AMCS

ACTIVITIES NEWSLETTER

Number 41 June 2018

AMCS
ACTIVITIES NEWSLETTER
Number 41 June 2018

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 Yvonne Droms, Mark Minton, and Rodolfo "Fofo" Gonzalez.

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.

ASSOCIATION FOR
MEXICAN CAVE STUDIES
BOX 7672
AUSTIN, TEXAS 78713
www.mexicancaves.org

Front cover

Heather McCloskey diving in the Cenote Ochun part of Sistema Santuario de los Guerreros, Quintana Roo. Photo by Alexander Buëß.

Back cover

A caver descending the pitch just above Sump 4 in Cueva de la Peña Colorada, Oaxaca. Photo by Adam Haydock.

CONTENTS

NEWS

Andreas Klocker diving in the Huautla Resurgence, Oaxaca, Photo by Chris Jewell.

MEXICO NEWS

Compiled by Bill Mixon

NOTE ABOUT TINY URLs. Many web URLs are ridiculously long and very difficult to type from paper copy, when you can't just click on them. I have made tiny URLs (see tinyurl.com) that can be typed more easily. The full form of a tiny URL is, for example, https://tinyurl.com/abcd1234. Most browsers apparently don't need the https://, and I have not included that. Some, such as Safari and Chrome, default to .com; you may find that you can type them without it.

CHIAPAS

Chiapas 2018, more than twenty-five years of exploration. In the month of March 2018 a new expedition took place in Chiapas, Mexico, as part of a research activity that has been going on since 1990. Dozens of trips have given important results, both in terms of speleological knowledge and a general awareness of the karst phenomena of this region. This year we wanted to gain a bit of knowledge and evaluate whether to pull the oars on the boat or not, not so much for lack of things to do, but for the psychological exhaustion that always accompanies returns to the same places, however beautiful.

A good group was formed, eighteen people from Italy plus five Mexicans, who participated for about twenty days divided among several objectives. The first was a new descent of the La Venta canyon, which none of those present had done completely except me twenty years ago. The main purpose was to identify and locate all the resurgences, redetermine the locations of the known caves and look for new ones with the help of drones, and increase the number of people who know the canyon, its difficulties, and its potential. The two drones we took did not work well for reasons of magnetic interferences, probably related to the jutting walls, but apart from that everything went smoothly, with good surprises: at least four or five caves or new entrances of caves in the walls that we had never seen before. The tight schedule of the descent, which remains challenging if done with a lot of material, did not allow for new explorations, but no doubt the foundation has been laid for very promising future activities.

In parallel to the first part of the descent of the canyon, a second group made the through-trip of the Cueva del Río la Venta, so far the most important and most beautiful cave we have discovered here. Here it was also a matter of making it known to new people, in addition to improving the rigging of the most complex passage of the descent, the famous Chac Rapids. [See *AMCS Activities Newsletter* 34, pages 65–74, 2011.]

The adventure in the canyon was completed in six days and characterized by learning of the techniques, sometimes unique, necessary to face it, at the beginning with a lot of trouble, toward the end with fluidity. There were long swimming areas because the inflatable kayaks were only four, and they had to haul a good amount of material. In the final part of the canyon, just before arriving at Lake Malpaso, it was exciting to see a spider monkey family in the vegetation on the banks.

A short interlude allowed some to rest and others to explore a cave reported by the local Comisión Nacional Áreas Protegidas Natural. It took a few hours to survey over half a kilometer.

The second part of the expedition took place in another canyon, the Parque Nacional Sumidero, where several areas were left open. On the plateau on the orographic right of the Río Grijalva, in the area of the Triunfo Agrarista town, pits and caves were descended and explored that did not give remarkable results; the greatest depth was 70 meters. Nevertheless it is a further contribution of knowledge of the basin that feeds the great waterfall called the Árbol de Navidad, at this time practically dry.

In the bottom along the river, we

The La Venta team in the La Venta canyon. *Francesco Lo Mastro.*

made a base in the former Amikúu eco-park, and from there several groups started climbing walls and treacherous slopes under a scorching sun and a temperature above 30 degrees C. Three caves were reached, respectively at 100, 150, and 350 meters in height above the river; the last took three days to approach. But all proved to be of little development. At least now we know what's behind those dark and very difficult-to-reach portals. There remain many others, of course, and one in particular looks promising.

We took the opportunity to return to the Cueva del Águila, a beautiful 70-meter-high cave reached in February 1988 by Marco Topani, Marco Leonardi, Mario Pappacoda, and me. Just thirty years later, we once again appreciated its beauty and remapped the entire extent, which exceeds 500 meters. The cave presents a possible underwater continuation.

In the end everyone was definitely satisfied with the increase of knowledge and the sharing and strengthening of relations with local authorities who have supported us so much. Several people in the group, both members and not of the La Venta Esplorazione Geografiche, were struck by the beauty of the places and the potential that still exists in Chiapas. So, again, it was not the last expedition. . . .

Source: edited from http://www.laventa.it/en/blog/669-chiapas-2018-more-than-25-years-of-exploration (tinurl.com/y7mfey8x). This blog by Tullio Bernabei contains many photographs without captions.

CHIHUAHUA

Mummified Prehistoric Bird Head Discovered in Mexican Cave: The mummified head of a prehistoric bird was found back in 2016, the National Institute of Anthropology and History in Mexico has revealed. Researchers say the bird was unearthed in the Avendanos Cave in the state of Chihuahua, Mexico. The scientists believe they have identified the head of one of the oldest macaw mummies ever discovered.

"The first [thing] we noticed was the head of the macaw in perfect condition," Archaeologist Emiliano Gallaga told The National Geographic. The green color of the military macaw's plume is visible, and its beak is intact. The researchers determined that the bird dates back to about 2,000 years *[sic]* to AD 900, 800 years older than any other specimen from that region.

The scientist said that military macaws were not native to that region of the Central American country and as a result were likely brought there for religious purposes. Gallaga, who is the director of the School of Anthropology of the North of Mexico [Escuela de Antropología e Historia del Norte de México], said the species of parrot had been naturally mummified by the arid climate of the region.

"It's still 400 kilometers [250 miles] that someone has to take it and bring it to this site," Gallaga highlighted. "Not everybody can afford to bring a macaw from far away," explaining that the bird was probably owned by high-ranking members of society like merchants, shamans, and other elites.

"One of the reasons Gallaga's find is really, really exciting is because of the early date," Abigail Holeman, said. "It does speak to the antiquity of their ritual importance."

The parrot's head was found along with the skeleton of an infant and the lower half of a man.

Source: anonymous web post at https://www.telesurtv.net/english/news/Mummified-Prehistoric-Bird-Head-Discovered-in-Mexican-Cave-20180218-0004.html (tinyurl.com/ycb8aqma), called to our attention by Jerry Atkinson.

COAHUILA

Abstract: The Mexican Blindcat Project: New Discoveries and Future Efforts, by Andrew Gluesenkamp, Dean Hendrickson, and Peter Sprouse.

The endangered Mexican blindcat (*Prietella phreatophila*, Carranza 1954) is one of only four stygobitic ictalurid catfish in North America. Members of two monotypic genera (*Satan eurystomus* and *Trogloglanis pattersoni*) are known from the Edwards Aquifer in Texas and, until recently, *Prietella* (represented by *P. lundbergi* and *P. phreatophila*) was only known to occur in Mexico (northern Coahuila to southern Tamaulipas). The recent discovery of *P. phreatophila* in a cave on the Amistad National Recreation Area in Val Verde County, Texas is the result of decades of sporadic effort on both sides of the US/Mexican border and has stimulated a renewed effort to investigate the distribution, ecology, evolutionary history, and conservation status of this species. Collaborative efforts among the San Antonio Zoo, the University of Texas at Austin, Zara Environmental, and the National Park Service are currently focused on habitat surveys in Texas as well as captive husbandry and propagation. Future efforts will include collaborators from the Comisión Nacional de Áreas Naturales Protegidas, Área de Protección de Recursos Naturales Sabinas, and the Laboratorio de Genética para la Conservación, Centro de Investigaciones Biológicas del Noroeste, La Paz, to conduct expanded fieldwork in Mexico, hydrogeologic studies, and surveys using environmental DNA.

Source: 5th Astyanax International Meeting 2017 program and abstracts, https://www.stowers.org/sites/all/themes/aimfc/aim2017_prog.pdf, or http://www.mexicancaves.org/other/AIM2017.pdf, page 38.

GUERRERO

Two teenage sisters who went on a tour of an underground river were swept away by the current and died, authorities in southern Mexico said Sunday. Guerrero state security spokesman Roberto Álvarez said in a statement that the sisters, age 16 and 19, hailed from the state of México. They disappeared Saturday while on a cave tour in Cacahuamilpa National Park. Álvarez said they were among a group of nineteen visitors outfitted with life vests and accompanied by two guides. Both bodies were found Sunday [May 6].

Source: AP dispatch at https://apnews.com/4ac3d0ae3a3e4228aa416a3550a3c780 (tinyurl.com/ydxhqf9j), called to our attention by Geary Schindel. See also "Encientran muertas a jóvenes que se perdieron en las grutas de Cacahuamilpa, Guerrero," which identifies the cave as Chontalcoatlán, one of the Dos Bocas river caves below the show cave: http://surestesur.

com/encuentran-muertas-a-jovenes-que-se-perdieron-en-las-grutas-de-cacahuamilpa-guerrero/ (tinyurl.com/ybkvvkuk).

MÉXICO

Abstract: AD 550–600 Collapse at Teotihuacán: Testing Climatic Forcing from a 2400-Year Mesoamerican Rainfall Reconstruction, by Matthew S. Lachniet and Juan Pablo Bernal-Uruchurtu. In *Megadrought and Collapse: from Early Agriculture to Angkor,* edited by Harvey Weiss, Oxford University Press, 2017.

We analyze a 2400-year rainfall reconstruction from an ultra-high-resolution absolutely-dated stalagmite (JX-6) from southwestern Mexico (Lachniet et al., 2012). Oxygen isotope variations correlate strongly to rainfall amount in the Mexico City area since 1870 CE, and for the wider southwestern Mexico region since 1948, allowing us to quantitatively reconstruct rainfall variability for the Basin of Mexico and Sierra Madre del Sur for the past 2400 years. Because oxygen isotopes integrate rainfall variations over broad geographic regions, our data suggest substantial variations in Mesoamerican monsoon strength over the past two millennia. As a result of low age uncertainties (≤ 11 yr), our stalagmite paleoclimate reconstruction allows us to place robust ages on past rainfall variations with a resolution an order of magnitude more precise than archeological dates associated with societal change. We relate our new rainfall reconstruction to the sequence of events at Teotihuacán (Millon, 1967; Cowgill, 2015a) and to other pre-Colombian civilizations in Mesoamerica. We observe a centuries-long drying trend that culminated in peak drought conditions in ca. 750 CE related to a weakening monsoon, which may have been a stressor on Mesoamerican societies. Teotihuacán is an ideal location to test for links between climate change and society, because it was located in a semi-arid highland valley with limited permanent water sources that relied upon spring-fed irrigation to ensure a reliable maize harvest (Sanders, 1977). The city of Teotihuacán was one of the largest Mesoamerican cities, which apparently reached population sizes of 80,000 to 100,000 inhabitants by AD 300 (Cowgill, 1997; 2015a). Following the "Great Fire", which dates approximately to AD 550, population decreased to lower levels and many buildings were abandoned (Cowgill, 2015). Because of the apparent reliance on rainwater capture (Linné, 2003) and spring-fed agriculture in the Teotihuacán valley to ensure food security and drinking water, food production and domestic water supplies should have been sensitive to rainfall variations that recharge the surficial aquifer that sustained spring discharge prior to recent groundwater extraction.

Source: The full paper is at https://lachnietblog.files.wordpress.com/2017/11/lachniet-and-bernal-2017-teotihuacan-collapse-in-weiss-ed-2017-megadrought.pdf (tinyurl.com/y8bxtey8).

MICHOACÁN

Abstract: Morphological and mineralogical characterization of speleothems from the Chimalacatepec lava tube system, Central Mexico, by Rafael López-Martínez, Ricardo Barragán, Hugo Beraldi-Campesi, Tomáš Lánczos, Juan R. Vidal-Romaní, Roman Aubrecht, Juan P. Bernal Uruchurtu, Teresa Pi Puig, and Ramón Espinasa-Pereña.

Siliceous opal-A speleothems of the Chimalacatepec lava tube system in central Mexico [Michoacán] are characterized here for the first time. Morphologically, they can be classified into cylindrical and planar, and they display a wide array of shapes, inner textures, and locations within the lava tube. All speleothems analyzed here are composed of opal-A, and their pores are filled with calcite and monohydrocalcite. Microscopic examination reveals a variety of microbial-looking, silicified filaments and cell casts embedded within the microlamination of the structures. The abundance of biofilms in the Chimalacatepec lava tube may be similar to other volcanic caves elsewhere. The direct presence of such bimorphs in the microstructure of the speleothems suggests the biological mediation of these structures. Potential mechanisms include nucleation and sorption of silica on extracellular polymeric substances in the biofilms that, along with the SiO_2 saturation in the water film and evaporative effects, result in the formation of a speleothem. That said, the presence of microbes in these and other cave systems, or their inevitable interactions with the mineral phase of the speleothems, should not be surprising. In view of this, these structures can be most accurately described as biospeleothems. This study contributes to our understanding of the diversity of such structures in these types of cave systems and our ability to recognize the presence of microbes in these.

Source: *International Journal of Speleology*, volume 45, number 2, pages 111–122, 2016. Full paper at http://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=1927&context=ijs (tinyurl.com/y886u5jn).

NUEVO LEÓN

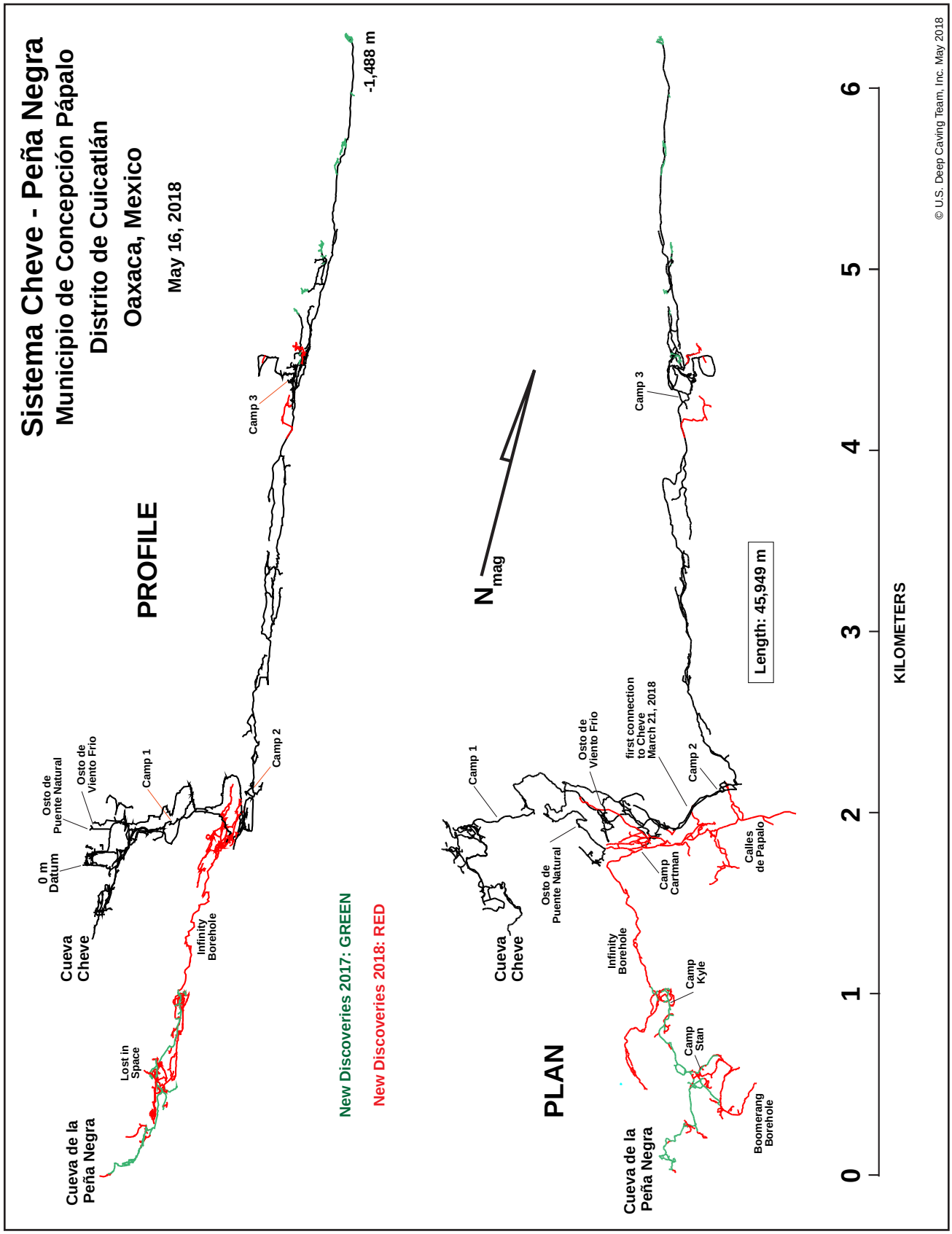
Abstract: Return to the Deep Desert: Renewed Exploration at Pozo de Montemayor. Fernando Hernandez and Morgan Smith.

Exploration and survey of Pozo de Montemayor; one of the deepest caves in northern Mexico, has been renewed. Pozo de Montemayor is located in the remote Minas Viejas region of the Sierra Madre Oriental in the state of Nuevo León. The current vertical extent of Pozo de Montemayor is 483 meters over a horizontal distance of 1,325 meters.

Source: 2017 NSS convention program book, page 62.

OAXACA

2018 Sistema Cheve Expedition. At the end of the 2017 Cheve expedition (see articles in this issue) an extraordinary discovery was made some 2 kilometers southeast of the main entrance to Cheve. The new find was initially dubbed CL6 by the recon team. Further discussions with locals in the municipality revealed that the place had a proper geographical name, so the new cave became Cueva de la Peña Negra, Cave of the Black Cliff. The final push in 2017 had turned around in 40-by-40-meter borehole with strong wind, so there was no question about whether to return. The 2018 lead team left Austin on February 25, and a team of forty


Sistema Cheve - Peña Negra
Municipio de Concepción Pápalo
Distrito de Cuicatlán
Oaxaca, Mexico
May 16, 2018
PROFILE
PLAN
N mag
Cueva de la Peña Negra
Cueva Cheve
Lost in Space
Infinity Borehole
0 m Datum
Osto de Puente Natural
Osto de Viento Frio
Camp 1
Camp 2
Camp 3
-1,488 m
Camp Kyle
Camp Stan
Boomerang Borehole
Camp Cartman
Calles de Papalo
first connection to Cheve March 21, 2018
Length: 45,949 m
New Discoveries 2017: GREEN
New Discoveries 2018: RED
KILOMETERS
0
1
2
3
4
5
6
© U.S. Deep Caving Team, Inc. May 2018

people from six countries participated. The final derig crew returned to Austin on April 30. Because of the equally important discovery in 2017 of a tunnel carrying strong wind near the bottom of Cheve, both caves were rigged in 2018, consuming some 8,000 meters of rope. A total of six underground camps were set, three in each cave, and it was not uncommon to have only three to five people in basecamp and the remainder of the team spread among three or more underground camps. All camps were linked to basecamp by a single-wire Michie phone system so that efforts could be coordinated daily. The result of this was that an extraordinary amount of cave was discovered and mapped in 2018. A total of 13.5 kilometers of new cave, the vast majority of which was borehole measuring 40 by 40 meters or larger, was added to the system, most of that in Peña Negra. The depth of Peña Negra reached 798 meters before not one but four widely separated connections were made to Cueva Cheve. The first connection was made near Camp 2 in Cheve just above the East Gorge in a fossil gallery first explored in 1988. With the connections the length of Sistema Cheve increased to 45,949 meters. The profile of the connected cave system now reveals clearly that the upper portion of Cheve, known for over thirty years now, is just a side passage to Peña Negra. The lower section of Cheve also saw intense exploration effort, with 1.1 kilometers of new cave discovered this year but no new depth.

Source: Bill Stone.

The Proyecto Espeleológico Sistema Huautla's month-long expedition April 4–May 4, 2018,was the fifth annual expedition of a goal of ten. Thirty-nine people from five countries, USA, Mexico, England, Costa Rica, and Canada, participated.

A connection of Sótano de Agua de Carrizo to Sistema Huautla was made that, combined

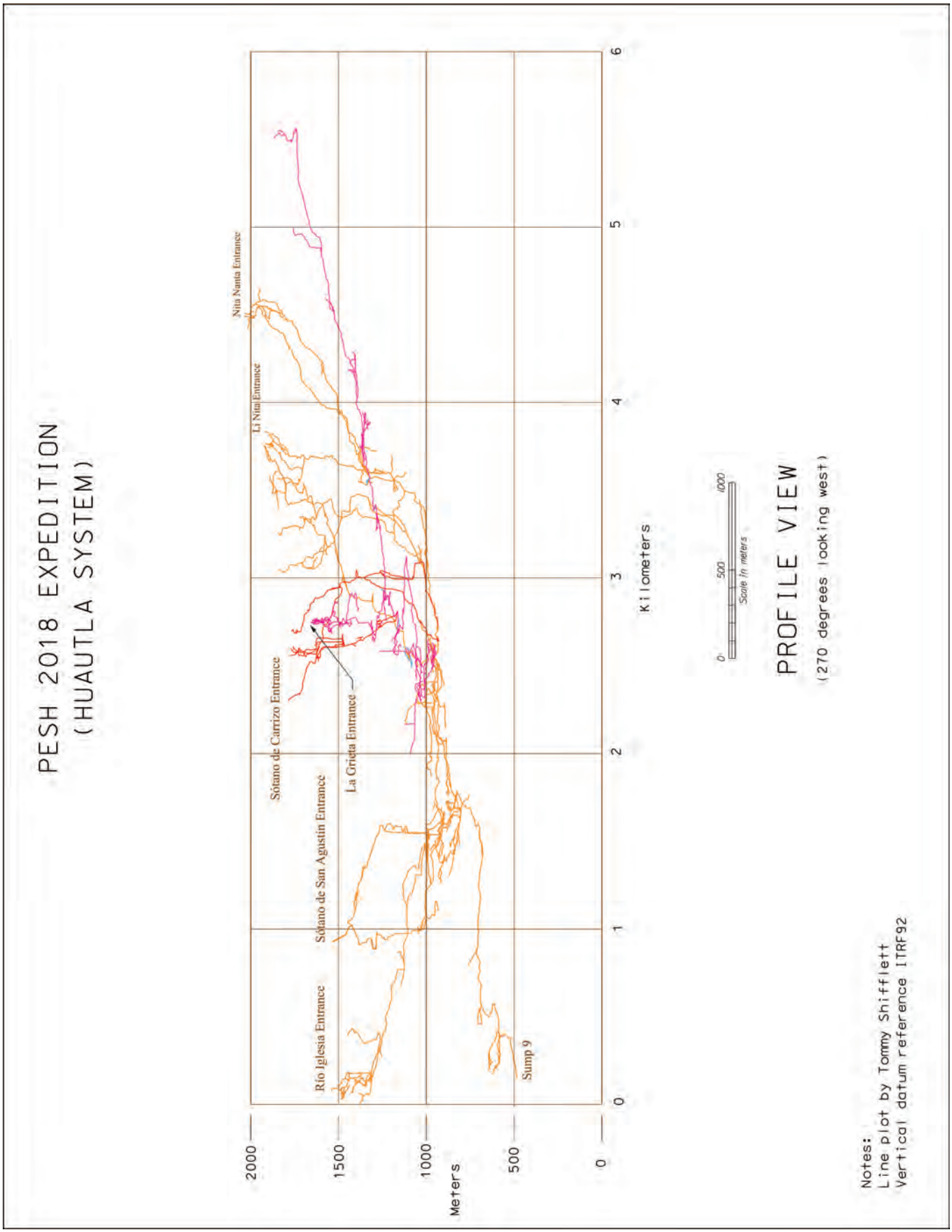
Cueva de la Peña Colorada:

Top: A passage just beyond Sump 3 known as Wrath of the Rimstone, one of the more challenging places when carrying heavy dive gear.

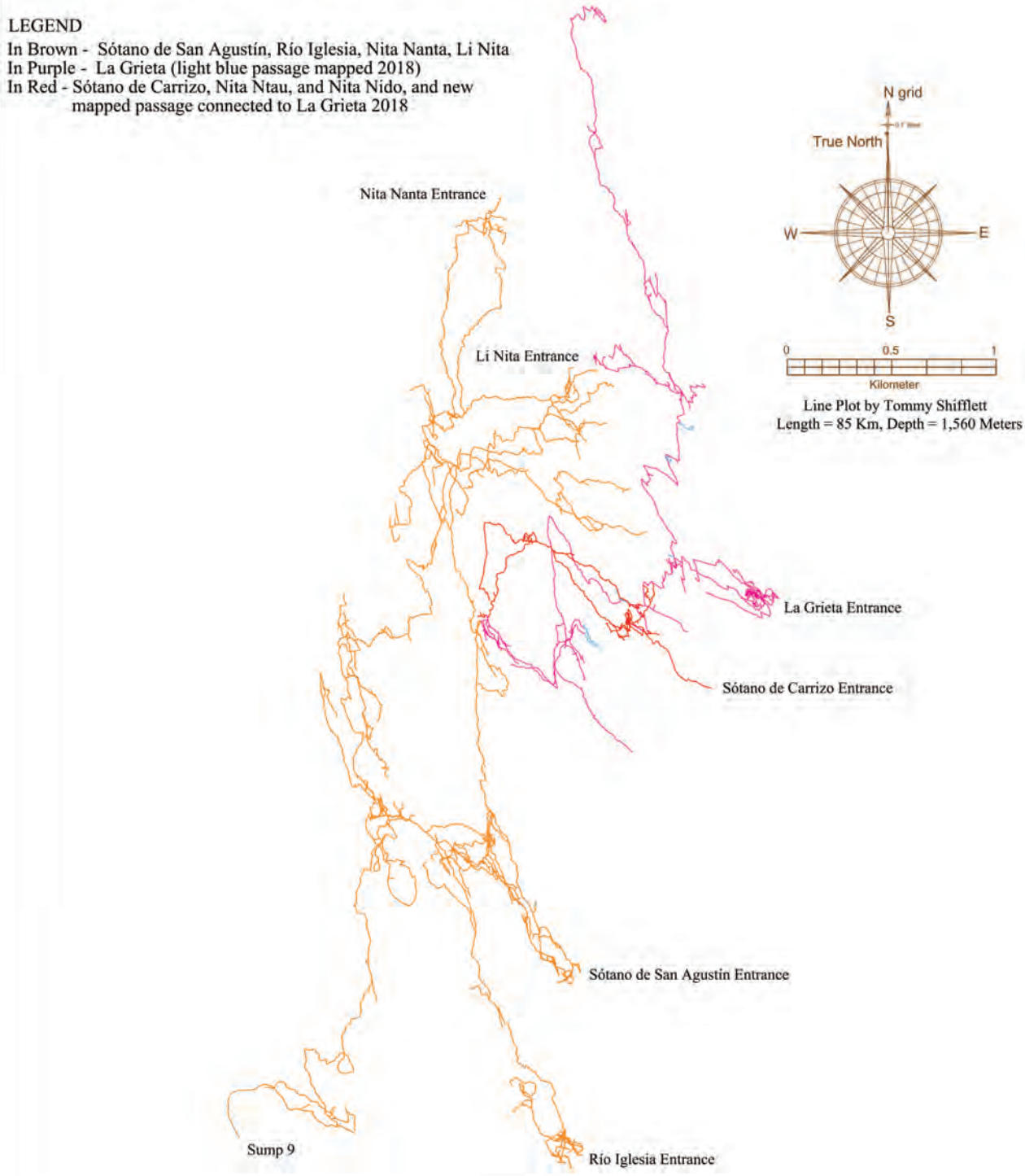
Middle: Gear hauling between Camp 1 and Sump 4 where most of the cave passage is huge with mud-covered walls.

Bottom: Cave passage on the way between Sump 3 and Camp 1. This passageway became sumped during the flood

Photos by Adam Haydock.


PESH 2018 EXPEDITION
(HUAUTLA SYSTEM)
Nita Nanta Entrance
Li Nita Entrance
Sótano de Carrizo Entrance
Sótano de San Agustin Entrance
La Grieta Entrance
Río Iglesia Entrance
Sump 9
2000
1500
1000
500
0
Meters
0
1
2
3
4
5
6
Kilometers
0
500
1000
Scale in meters
PROFILE VIEW
(270 degrees looking west)
Notes:
Line plot by Tommy Shifflett
Vertical datum reference ITRF92

PESH 2018 EXPEDITION
(HUAUTLA SYSTEM)



PLAN VIEW

with new passages discovered this year, added 9.2 kilometers and five more entrances to Sistema Huautla. The system now has twenty-five entrances, is 85.38 kilometers long (53.05 miles), and remains 1560 meters deep (5,117 feet), the deepest cave in the Western Hemisphere and the ninth-deepest cave in the world. The connection of Carrizo to Sistema Huautla was done by exploring a lead 100 meters deep in Carrizo that had been noted on a 1977 survey and was this year named Spirit of Schreiber. This led to the 160-meter-deep TAG Shaft in Nita Ntau. A tight crack off the bottom of this awesome shaft, one ofthe the deepest in Sistema Huautla, was pushed, leading to a descending shaft series that eventually connected in two places to the La Grieta section of Sistema Huautla near Camp 2, also known as Mazateca Shores. This route went 625 meters deep before connecting.

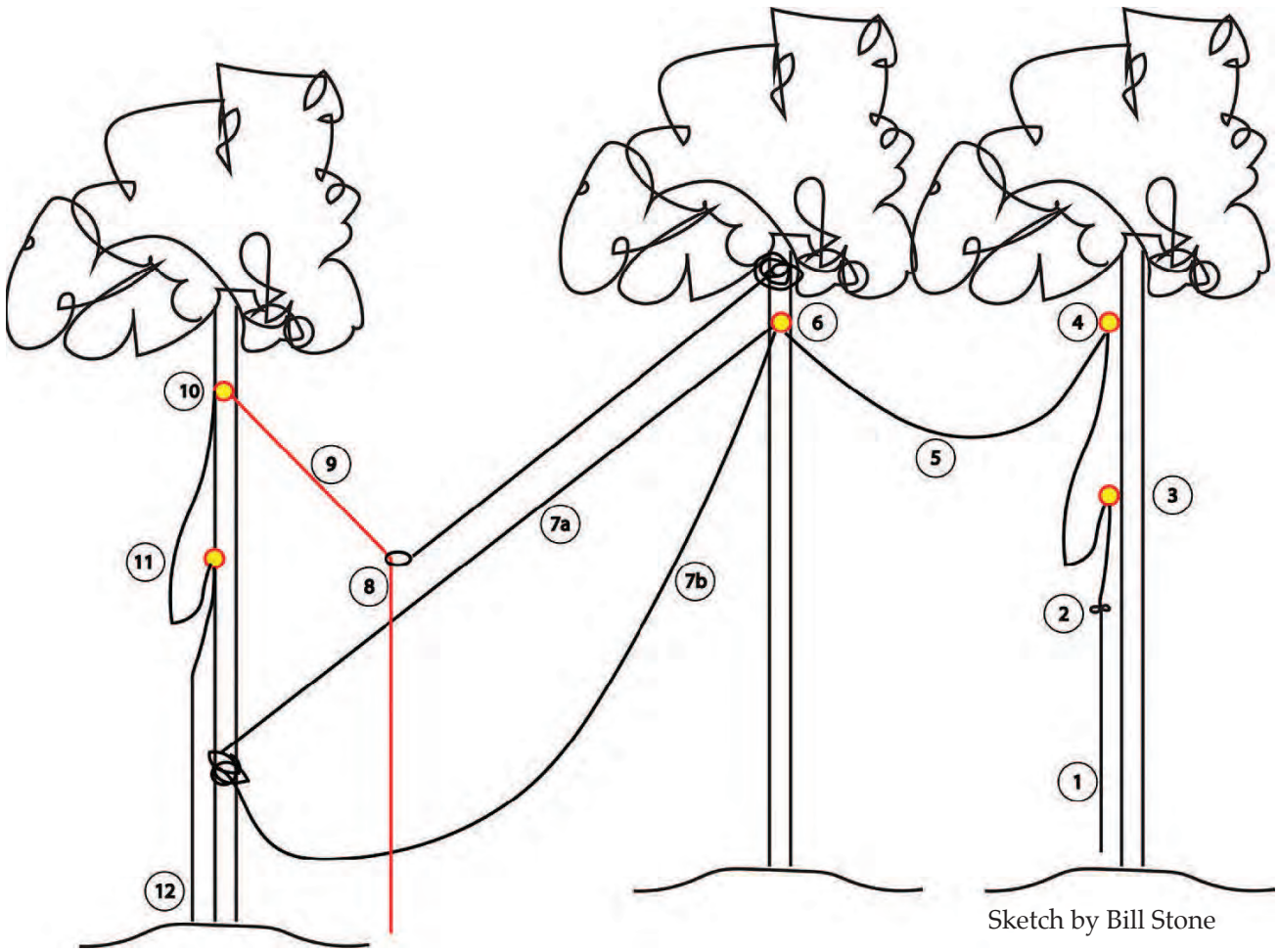
Four underground camps were used: the base of the TAG Shaft and Camps 1.5, 3, and 4 in La Grieta. Underground campers in Camp 4, 700 meters deep, were trapped for three days by an unexpected sump caused by a rain storm during this unseasonably wet April.

Success was also obtained in public relations and access to previously inaccessible areas. Informative presentations were given to school groups and the public at large.

Source: Bill Steele, PESH Co-Leader.

In 1984 a team led by Bill Stone explored Cueva de la Peña Colorada to Sump 7, about 5 kilometers into the cave and at the bottom of a 70-meter pitch. Sump 7 quickly went to a depth of approximately 45 meters. Due to the open-circuit diving gear used at the time, they soon hit their logistical limits and were forced to return. They reported the sump continued at a similar depth and noted a strong thermocline in the sump, leading to the hypothesis that Sump 7 might be part of the active Huautla System, hopefully intersecting between Sump 9 in San Agustín and the Huautla Resurgence.

Thirty-four years later an international team of twenty-four cave divers returned for a two-month-long expedition, this time with rebreathers, scooters, and mixed gases, to push Sump 7 toward Sump 9 in San Agustín. After weeks of gear hauling, Sump 7 finally saw its first divers in thirty-four years, who found only an impenetrable rock pile 20 meters beyond the 1984 limit. After several dives, no way on could be located. Together with the fine silt noticed within the sump, this pointed toward the absence of flow. The cave looked more like the water enters between Sump 7 and Sump 4 through surface percolation, suggesting that the cave is the drainage of the canyon above.



Sketch by Bill Stone

This theory became even more likely when toward the end of the expedition heavy rains led to a fast increase in the water level in the canyon, subsequently flooding the cave. This sudden flooding led to six of the team members escaping rising water levels in the Whacking Great Chamber, a chamber known to stay dry in floods. They were forced to wait for sixty-nine hours in their wetsuits, cut off from their camp until water levels receded enough to leave the cave. While luckily all the cavers escaped, most of the gear at Camp 1 was never seen again.

Source: Andreas Klocker.

Abstract: Proyecto Espeleológico Sistema Huautla 2017. Bill Steele and Alma Rodriguez Estrada.

In 2013 Tommy Shifflett and Bill Steele organized PESH with the main goal of conducting annual expeditions for a decade and continue exploring and studying Sistema Huautla, Huautla de Jiménez, Oaxaca, and all other non-integrated caves in the Huautla drainage basin. The 2017 expedition was the fourth of these. PESH goals include conducting all speleological studies: cartography, geology, hydrology, biology, paleontology, archaeology, and gear testing. PESH has an ongoing public-relations program to educate the local people about the caves beneath their homeland. Mexican cave scientists are welcome to participate and are supported. PESH has a steady record of published findings. PESH is an official project of both the NSS and the U.S. Deep Caving Team. Expeditions to date have carried the flag of the Explorers Club.

The presentation will briefly cover fifty-plus years of caving in the Huautla drainage basin, but mostly cover the results of the 2017 expedition. [See articles in this issue.] Prior to this year's expedition Sistema Huautla stood as the deepest cave in the Western Hemisphere, the eighth deepest cave in the world, the longest of the seventeen deepest caves in the world, 75.5 km long (47 miles) and 1560 m deep (5,117 feet). Most cavers who have seen it feel it is the world's greatest cave.[Update : After the 2017 expedition,the length was 78.3 kilometers.]

Source: 2017 NSS convention program book, page 61, "Mexico News," *AMCS Activities Newsletter* 40.

US Deep Caving Team Standard Rebelay Test

Must be completed in forty minutes or less.

1) Start of course
2) Pass the knot
3) Pass the rebelay
4) At rebelay switch to rappel on line 5
5) Rappel part way down line 5, then switch to ascent toward rebelay 6
6) Switch from ascent to rappel on line 7b

7a) Attach short cow's tail to line 7a
7b) Rappel line 7b (this is a "taught line, slack line" traverse—we use a lot of these)
8) Stop descent/traverse on 7a/7b just below redirect carabiner 8.
9) Switch to ascent on line 9 and pass redirect carabiner 8.
10) Switch from ascent to rappel
11) Pass the rebelay
12) Get completely off rope

Then, reverse the course back to point 1. The clock starts when you attach your first ascender at the start and the clock stops when you are completely disconnected from the rope at point 1.

Advance publicity pages on the web about the 2017 Sistema Cheve expedition are at http://www.usdct.org/sistemacheve_2017.php. They include summaries of the history of and plans for the project in both English and Spanish and a list of planned participants and their qualifications.

Oaxaca: Expedicionarios de los EEUU mapean el agua, petróleo y minerales en la Sierra Mazateca. Extensive material written by Renata Bessi posted in September 2017 at http://avispa.org/2017/09/11/sierra-mazateca/ addresses the relationship between cavers, mainly Americans, and the local Mazatec people in the Huautla, Oaxaca, area. It is up to date, containing material on spring 2017 expeditions that I had not yet seen. Based in large part on published information, the facts are mostly correct, although it says that Bill Stone is organizing the Huautla Resurgence Cave diving. It does not deny that the cavers are there mostly just for fun or that they gave proper permissions from authorities, but the text quotes various local people as saying they have not benefitted from the cavers' discoveries. Too much of the information has not been published in Spanish, and virtually none in Mazatec. (How many people in the village of San Agustín does the author think are *literate* in Mazatec?) Then the conspiracy theories begin. Caving publications have reported that there are shale layers at the base of caves in the area, so their explorations are really to benefit international oil companies that want to frack the shale. Conservation-minded cavers support groups like The Nature Conservancy, which accepts donations from evil corporations. Recent expeditions to the Huautla area have been partly sponsored by the National Speleological Society, which supplies cave data to the US Geological Survey, which collaborates with the US military—you get the idea. Basically the material serves as an outlet for a minority of less-assimilated, more-traditional locals. If you click on the English choice on the home page, you get links to lots of other articles. Clearly Avispa Media is dedicated entirely to claiming privileges for indigenous people throughout Latin America. *Source*: Comments by Bill Mixon. Mark Minton called this to our attention. These allegations were also addressed and refuted by Bill Steele, Alma Rodríguez, and others at a public forum in Huautla in early 2018. See newspaper article at https://www.facebook.com/PESH.mx/.

Abstract: Cave Access Challenges at Sistema Huautla, Mexico, by Charles William Steele.

Sistema Huautla is the deepest known cave in the Western Hemisphere. It is 1,560 meters deep, 75.5 kilometers long, with twenty integrated entrances. The discovery of the caves in the remote Sierra

Mazateca of the southern Mexico state of Oaxaca occurred in 1966. Since then, expeditions to the area have occurred nearly annually. For the past thirty-five years, cavers have unsuccessfully attempted to access cave entrances on the highest ground at the north end of the karst drainage basin. Large, deep, impressive sinkholes are there in abundance. The Mazatec Indians who live around them have spiritual beliefs about the caves and have not given permission for cavers to enter them. They have stated that they fear cavers might upset cave spirits residing in them, resulting in upsetting nature's equilibrium, causing dire things such as their children becoming ill or their corn not growing. With the restart of annual expeditions to the area in 2014, a new name of Proyecto Espeleológico Sistema Huautla (PESH) and a logo being adopted, PESH co-leader Bill Steele, a long time Huautla caver, devotes his time on the annual, month-long expeditions to addressing the challenge of gaining access to the highest entrances. Steps taken include a quality display about PESH's speleological work being installed in the area government building assemby room, the local newspaper has run articles, the local radio station has interviewed Steele, brochures about the project have been printed in Mazatec, and Steele has given many presentations to community groups and to school children. Also, at the urging of local govenment officials, a shaman was consulted and a spooky ritual was held, concluding the sacrifice of a live turkey by dropping it in a 70-meter shaft , one of the entrances to Sistema Huautla. While this action is taking place on the surface, deep underground cavers are camping long-term and ascending up-dip toward possible high entrances.

Source: *Proceedings of the 17th International Congress of Speleology, Sydney 2017*, volume 1, page 206.

Report on the arthropods collected in La Grieta, Sistema Huautla during the 2017 expedition: For me personally, the most important are two specimens of the scorpion *Alacran tartarus* Francke: one adult female taken at –150 meters 5 kilometers from the entrance, and a juvenile female taken at Camp 2, –519 meters. I had hoped for one of these highly troglomorphic scorpions from the first time my graduate students and I joined the cavers in San Agustín in 2013 and finally got two. One leg of the adult female has been donated to the American Museum of Natural History for DNA extraction and further phylogenetic studies.

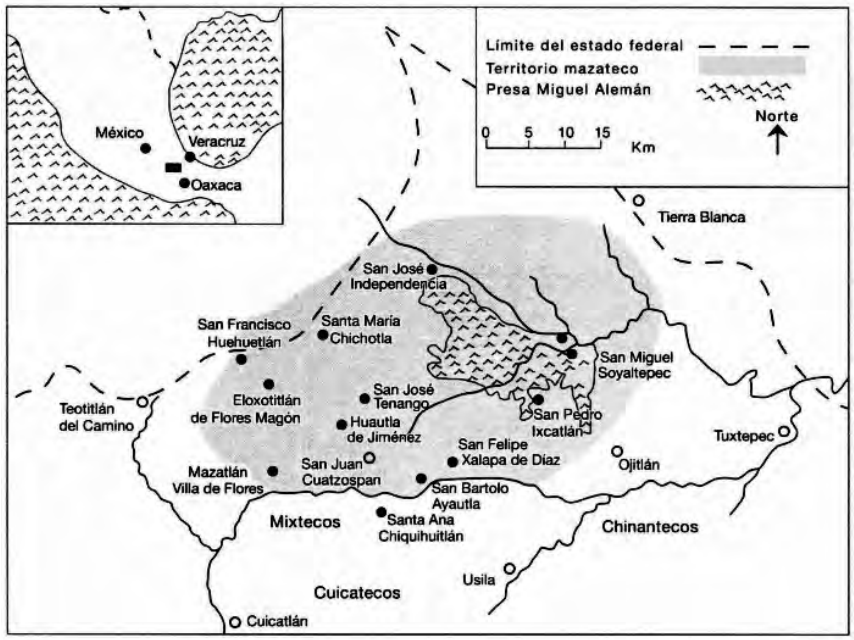
The only other arachnid collected in 2017 is a troglomorphic and blind harvestman of the family Stygnopsidae that belongs to a new genus and a new species, totally different from the yellowish-orange *Stygnopsis* that are fairly abundant throughout the system and that we had previously collected in several of the cave entrances we visited. This particular specimen was taken at –200 meters. Since it is new to science, it would be nice if the 2018 cavers can try to get some more; ideally we need at least one adult male and one adult female to do proper descriptions.

There is one millipede that was forwarded to the expert on the group, Dr. Julian Bueno at the Universidad Autónoma de Hidalgo. He identified it as belonging to the order Polydesmida, family Rhachodesmidae, genus *Acutangulus aff. alius*. This particular species has been previously reported from a cave in Veracruz by J. G.Palacios-Vargas and J. R. Reddell [2013,. Actualización del Inventario Cavernícola (Estigobionets, Estigófilos y Troglobios) de México; *Mundo Subterráneo*, 24:33–95 [PDF available at http://www.mexicancaves.org/other/mundos24.pdf]. There is also one centipede sent to the expert on the class, Dr. Fabio Cupul, at the Universidad de Guadalajara, Puerto Vallarta campus. A preliminary identification by Dr. Julian Bueno places it in the order Lithobiomorfa, family Lithobiidae, which have been previously reported only from caves in Nuevo León. Additional specimens will certainly be helpful for the description of this species.

Finally, there are two whole and two halves of a large troglomorphic silverfish or thysanuran, which will be sent to the expert on those insects, Dr. Luis Espinasa. I am sure Luis would also welcome additional specimens from La Grieta.

Thanks to all of the participants in the 2017 expedition for their efforts at collecting the specimens for our scientific studies!

Source: Oscar Francke, in the December 2017 *NSS News*, page. 19.



Abstract: The discovery and exploration of Sistema J2, Oaxaca, Mexico, by Matt Covington.

Sistema Cheve, located in the Sierra Juárez in the Mexican state of Oaxaca, is one of the deepest known karst hydrological systems in the world. This area has seen extensive exploration for the past thirty years.

In 2004, Cueva J2 was discovered during an effort to find a route into the yet-unexplored central portion of the Cheve system that lies between the current downstream terminus of Sistema Cheve and the upstream end of the resurgence cave Cueva de la Mano. Expeditions returned to continue exploration in J2 in 2005 and 2006, pushing the cave to a depth of 1210 meters, where a sump halted further exploration. Major diving expeditions in 2009 and 2013 pushed the cave beyond two sumps before reaching a seemingly final terminus. While this dashed the hopes of using J2 as a route into the middle Cheve system, J2 now stands as an impressive cave in its own right, with a depth of 1229 meters and a length of nearly 15 kilometers. In my presentation I will summarize the history of exploration and scientific research in J2.

Source: *23rd International Karstological School "Classical Karst" Program and . . . Abstracts*, 2015, page 107.

The Proyecto Espeleológico Sistema Huautla has a long list of expedition objectives for spring 2018. Top among them are to continue in the La Grieta section of Sistema Huautla, exploring and mapping farther from Camp 3, the northernmost part of the system, and Camp 4, over 600 meters deep. Good cave photographers have signed up to participate and will add to the growing collection of publishable photos for a planned coffee-table book at the conclusion of the project. Sótano de Agua de Carrizo will be rigged and re-explored for the first time in forty years. This 843-meter-deep cave is known to be very close to a section of Sistema Huautla, and a connection will be attempted both from this cave and by cavers in La Grieta at the same time. While relocating the entrance to Carrizo in 2017 to get an accurate GPS location, two other enticing entrances were discovered in its vicinity. These will be explored in 2018.

Other 2018 objectives include continuing with our community outreach with hopes of obtaining permission to enter caves in areas where the locals have spiritual beliefs about the caves. PESH also now has a Mexican social scientist onboard, Amalia Montoya, an anthropologist who is researching Mazatec beliefs about caves.

A Mexican biological collecting permit has been requested, and specimens collected will be sent to Dr. Oscar Francke, with whom we have worked for thirty-five years. Fernando Hernandez, a PESH caver originally from Monterrey, Mexico, is now in graduate school in geology and is planning to do his field research in Sistema Huautla.

Source: Bill Steele and Tommy Shifflett in *NSS News*, December 2017, page 21.

PUEBLA

Results of the GSAB 2018 Cascabel expedition to the Zoquitlán, Puebla, area.

Seventeen people participated in this expedition, setting up camp above Zoquitlán on February 25, 2018. In order to get acclimated, team members started out by working on scientific tasks. Water temperature and conductivity were measured in various places, such as in the two main resurgences, Coyolatl and Atlixicaya, as well as in OZ11 and Topitzatl, located deep in the canyon at the very bottom of the GSAB area. Many pictures were taken of places that had not been well documented. Accurate records of an archaeological site were made. Troglobitic fauna were collected in several caves, bringing to three the new species discovered in that area.

In 1989, Xantilco had been explored to a depth of 280 meters, ending at a sump. In 1997, a connection was made with a new entrance near the village of Oztopulco. The cave had been declared finished, but this year a new visit to the sump was made, resulting in the discovery of new passage, a tight meander clean-washed and full of fossils, that after 200 meters opened up into a large underground river as well as an upper phreatic level covered in 20-centimeter gypsum flowers. A few days later and 1.5 kilometers farther, a sump stopped the team. Later the survey revealed that their stopping point was very close to the sump in Topitzatl, at the bottom of the canyon. This was a big surprise, since Xantilco was expected to resurge in OZ9, farther downstream and directly below its entrance.

One of the 2018 objectives, TZ14, was well positioned to connect to Rosetta and had been explored to –240 meters. A windy lead at –80 meters was explored but reconnected lower down, so this cave was derigged.

Mosquito, which in 2016 had ended in a large room with leads at –320 meters 1 kilometer from the entrance, was painstakingly rerigged out of the water due to the rains. About 2 kilometers of new passage was then explored, ultimately ending in a downstream sump, but there was still good airflow in upstream leads.

Exploration of a new cave, Rosetta B, located only 30 meters from Rosetta, resulted in about 200 meters of nice-sized meandering passage, going in a straight line and perfectly perpendicular to Rosetta. A second push and survey brought the length of the cave to 350 meters. The team stopped at a large meandering river passage with spacious and windy leads, both upstream and downstream. Unfortunately the terrible rains did not allow them to pursue these leads.

A separate team, intending to explore leads in Rosetta, descended to the underground camp at –350 meters. All night long water thundered through the cave, causing the P50 that follows camp to become impossible to descend due to a raging waterfall. The team was forced to return to the surface, after a photo shoot to make the trip at least somewhat productive.

After more team members left, the rains stopped. Three of the last few decided to do a rush push to the deepest part of Rosetta before stage-derigging it. A few side leads to the main passage at the bottom of the system ended, but a few other leads were found. Finally, it appears that a connection with Akemati was found at the level of the P100 "Midnight Express," approximately where one crosses the –1000-meter level in Akemati. This, if confirmed, would change Sistema Oztotl's depth to a bit more than 1300 meters.

During the last few days of the expedition, a local boy led the team to the mountainside above

the village of Cruztitla, vertically above the system. They found a few interesting pits, in one of which they stopped at around –100 meters. The cave continues, with air, which will give them something more to do next year.

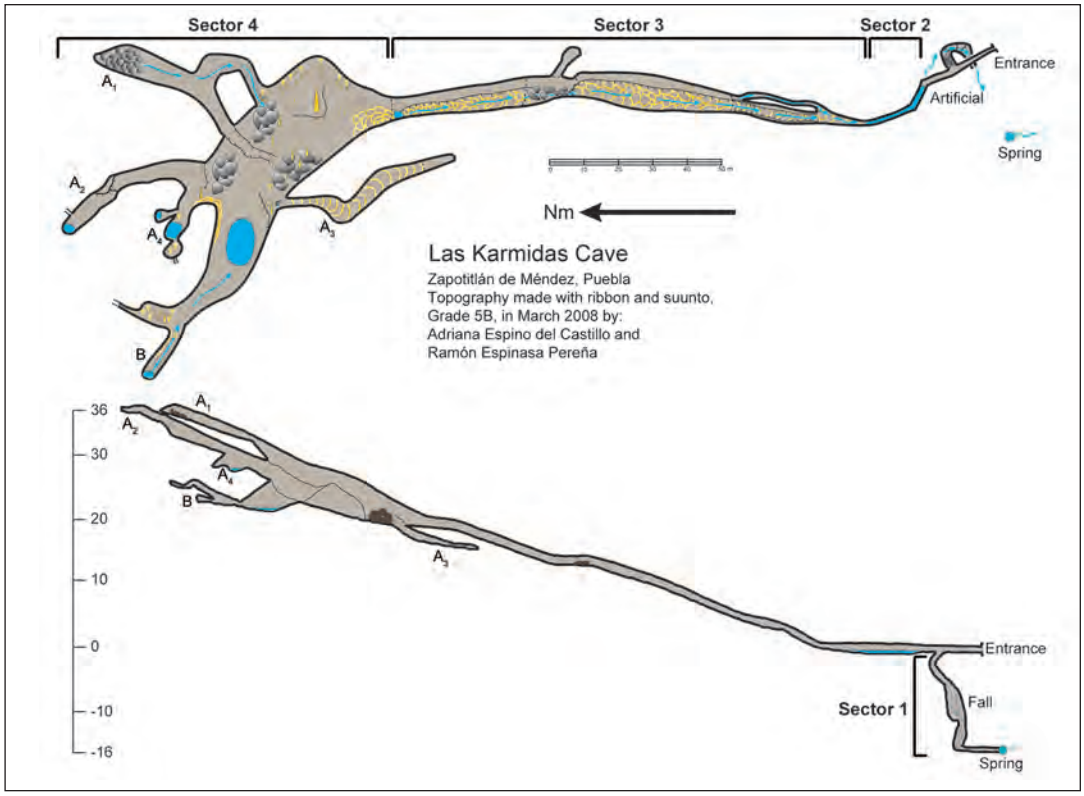
Source: Richard Grebeude, translated from French by Yvonne Droms.

Cascabel 2018, Thursday March 1, teams 3 and 4: Cueva Xantilco: In 1985 OZ1 (Xantilco) was the first cave explored in Oztopulco, based on a reconnaissance trip two years earlier. We had gone back in 1989 and again later, adding to the depth of the cave and also finding a second entrance. Its entrance is a huge arch followed by a long, steep, and equally impressive passage. Recently they were the subject of some photo shoots using natural light. One of the (too) many objectives this year was to do the same in the following large canyon using the talents of Gaëtan Rochez. With that in mind, I arranged a warm-up trip for a team willing to assist him. This would be a great opportunity for those who had not been there to view this extraordinary place. Dédé, Richard, Phil Soet, and Loran volunteered. In addition to some superb shots, they brought back some critters captured in the river, which also was the subject of temperature and conductivity measurements. We had decided to run these everywhere as a prelude to a more advanced hydrological study planned for 2019.

As for me, I was supposed to show them how to get there, and therefore I returned to the cave too. In 1985, Mamour and I had reached the depth of 160 meters, coming upon, at the bottom of a 20-meter drop we hastily descended, what we thought was a sump pool. This siphon was renamed Tombé du Ciel (fallen from the sky) when, during a push in 1989, the way on was discovered, bringing the depth to 280 meters. Now I had no recollection of having participated in this second exploration, even though there were only five of us on the 1989 trip, which explains my desire to rerig the system in order to go have a look. I had no problem convincing Ben and Nico, who had not yet been to Xantilco.

And so here we are, after rerigging out of the water, at the bottom of the "terminal" P20 of 1985. It's very wet, with a waterfall hitting the wall and crashing into a deep pool. Behind me is the vertical fissure that we had marked on the sketch as impassable. In reality, it's an obvious 6-meter downclimb that I hastily descend, assuming that's where the lead is. At the bottom, I encounter a long horizontal meander, relatively narrow, but nevertheless comfortable, just like in Belgium, but super clean and full of fossils. I cover almost 100 meters, encouraging my teammates to come along. A series of wet pits follows. Strange, there are no spits. Maybe we had used natural rigging? After some beautiful drops that require great efforts to rig, doubt settles in. At the bottom of a P20, we have to go under the waterfall and climb down to a shelf that tees into a big passage, with large leads beckoning upstream and downstream. We can't quite yet explain this mystery, but we are not in the 1989 system. We have just discovered the way on in Xantilco.

We return to the Tombé du Ciel, me by the way I had come and Ben by an alternate way in the meander that also led to the pool, meaning there had been two leads. It does not appear that all the water from the waterfall goes our way, and so the idea of passing behind the curtain



comes to my mind. And indeed, behind it, there is a third lead. I feel sure that this time it is the one we had followed in 1989. And sure enough, François S. later confirmed this, reminding me that during the 1989 push, he, Pierre C. and I myself (!) had named this passage the Temple du Soleil (as in the Tintin comics). Which goes to show that it may be good to have memory lapses.

Source: Jean-Claude "Jack" London on Facebook, tinyurl.com/yazkzbly or https://www.facebook.com/groups/1937458513240701/permalink/1986339595019259/, translated from French by Yvonne Droms.

Recent issues of *Regards*, magazine of the Union Belge de Spéléologie, are on the web at http://www.speleoubs.be/index.php/votre-documentation/le-regards-l-info-et-la-newsletter (tinyurl.com/y8y2ytec). Articles of interest are:

Poblanos 2014: Expédition GSAB Mexique, Municipio de Zoquitlán, Sierra Negra, Tehuacán, Puebla, by Richard Grebeude with photographs by Gaëtan Rochez. *Regards* 79, October 2014, pages 97–107.

Aperçu de la faune cavernicole d'une zone d'exploration spéléologique au sein de la Sierra Madre-Oriental, Mexique, by Gaëtan Rochez. *Regards* 80, first quarter 2015,pages 54–65.

Pasilla 2015: Expédition GSAB Mexique, Oztopulco, Municipio de Zoquitlan, Sierra Negra, Tehuacán, Puebla, by Richard Grebeude with photographs by Gustavo Vela Turcott. *Regards* 81, 2016, pages 114–124. A collection of photographs by Gustavo Vela from this expedition is in *AMCS Activities Newsletter* 38.

Tlamanicitli et la Muñeca Fea, Zoquitlán, Sierra Negra, Puebla, Mexico, by Richard Grebeude. *Regards* 83, 2017, pages 78–81. This article includes a description of the original discovery in 1999 of the huge room Muñeca Fea.

Ancho 2016: Expé GSAB Mexique, by Richard Grebeude. *Regards* 83, 2017, pages 70–77. An article by Gustavo Vela on this expedition appears in *AMCS Activities Newsletter* 39, pages 109–114.

Canica 2017: Expé GSAB Mexique, by Richard Grebeude. *Regards* 84, 2017, pages 66–79. A translated version of this article appears in this issue of the *AMCS Activities Newsletter*.

Abstract: Timing of Speleogenesis of Las Karmidas Cave (Mexico): First Description of Pseudokarst Developed in Ignimbrite, by María del Pilar Aliaga-Campuzano, et al.

Las Karmidas Cave (Puebla State, Mexico) is an unusual type of pseudokarstic cavity generated by piping and erosive processes within the contact of a diamicton and an overlying Quaternary ignimbrite. Morphological evidence suggests that the cave was developed in two stages: a phreatic stage and a vadose stage. The latter was characterized by the formation of carbonate speleothems. The absolute upper-age limit for the cave (168 +7.1/–7.5 ka) was established by U-Th dating of zircon grains extracted from the overlying ignimbrite, while a minimum age for the transition from a phreatic to vadose regime (95.6 ± 2.1 ka) was constrained by U-Th dating of carbonate speleothems within the cave. The geochronological results indicate a very rapid evolution of this pseudokarstic system and suggest that similar systems might evolve and degrade at a very fast pace, consequently, making them hard to be preserved. Despite this, and considering the rather common geological context in which this system was developed, it is likely that similar pseudokarstic systems are yet to be detected worldwide.

Source: *International Journal of Speleology*, volume 46, number 3, 2017, p. 331–343. Full article is at http://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=2097&context=ijs (tinyurl.com/y8qv6x7l).

Besides his article on La Muñeca in Cueva Tlamanictli in this issue, translated from México Desconocido, June 2017, (http://expediciones.mexicodesconocido.com.mx/muneca-fea-cueva-grande-america.html), the magazine has published the following articles of Gustavo's about caves in Puebla:

https://www.mexicodesconocido.com.mx/el-misterio-de-las-cuevas-profundas-akemabis.html

https://www.mexicodesconocido.com.mx/sistema-tepetzala-puebla.html

https://www.mexicodesconocido.com.mx/espeleologia-huizmaloc-puebla.html

There are YouTube videos on the large room la Muñeca, a chamber in the Tlamanictli-TZ1 cave at https://www.youtube.com/watch?v=n5AaPrraVpo (tinyurl.com/y8zd7c54, about 2 minutes) and youtube.com/watch?v=QhdCjxRfoTI (tinyurl.com/yb9cbbpk, about 4 minutes). The first, from *México Desconocido*, shows scenes from the scanning project, which is the subject of articles in *AMCS Activities Newsletter* 40 as well as this issue. The second consists of panning and zooming the resulting point cloud or solid model. *Source*: Gustavo Vela.

There is another web page on the big room La Muñeca in Tlamanictli cave at http://mexiconewsdaily.com/mexicolife/underground-chamber-worlds-fourth-largest/ (tinyurl.com/y9fat2bn). It includes a link to display the same YouTube video that is the second one listed in the previous item. The article is in English and was written by John Pint. It is similar to the article on the scanning by Tim Allen that appeared in *AMCS Activities Newsletter* 40. *Source*: Jerry Atkinson brought this to our attention.

The Tláloc Exploring Team was founded in 1998 and is made up of Italian and Mexican speleologists who have been exploring new areas together for the past twenty years. The exploration area of this year's project was located in the Sierra Negra, in the municipality of San Juan Cuautla [on the border with Oaxaca], where some recons carried out a few months before our arrival by Mexican friends had shown good potential. The base camp was placed at the village of Xochiapa, at about 1800 meters above sea level. In the upper part above the inhabited area, at over 1900 meters of elevation, almost a month of work recorded more than forty caves, some gigantic pits and very complex caves. Explorations were also conducted

along the Río Mazateco canyon, 400 meters below.

Our last day gave us an unexpected discovery. We found the skeleton of a giant sloth, whose height could exceed 2 meters, extinct about twenty thousand years ago. Naturally, it was communicated to the competent authority for all the necessary studies to be carried out.

For the images and in-depth information on the expedition, which benefited from, among others, the patronage of the Italian Speleological Society and the full support of the URION and UNAM speleological groups in Mexico City, who provided materials and logistics, see the Facebook page [https://www.facebook.com/Tláloc-Exploring-Team-351272908691964/ or tinyurl.com/ybg7224p, mainly unattributed photographs].

Source: Edited from Google translation of http://www.scintilena.com/resoconto-della-spedizione-tlaloc-2018-2/05/08/#sthash.s1AEpgHu.dpbs or tinyurl.com/y9pj7bhb, posted to an Italian site by Silvia Arrica, May 8, 2018. Yvonne Droms called this to our attention.

QUERÉTARO

The first Festival de las Cuevas was held October 19–22, 2017, in the Sierra Gorda of Querétaro to celebrate the fiftieth anniversary of the first descent of Sótano de las Golondrinas and the forty-fifth anniversaey of the discovery of El Sótano de El Barro. It was organized by the Sociedad Nacional de Exploradores and concluded with an opportunity to visit (but not descend) El Sótano.

The advance schedule of presentations follows. The poster listed some people who did not end up attending, and we do not know how many of the scheduled talks occurred.

Explorando los abismos más profundos de San Luis Potosí. Roberto Legaspi and Homero Reséndiz.

El Sótano de la Culebra y otros encuentros en la Sierra Gorda: exploraciones del Politécnico Nacional. Argelia Tiburcio and Alejandro Villagrán.

50 años de exploraciones en el Sistema Huautla, Oaxaca. Fernando Hernández.

37 años explorando en la Sierra Negra, Puebla: exploraciones del Grupo Espeleoalpino Belga (GSAB). Jean Claude London and Richard Grebeude.

Exploraciones de la Sociedad Quebequense de Espeleología en la Sierra Negra, Puebla. Guillaume Pelletier.

55 años de espeleología en Xilitla, San Luis Potosí. Peter Sprouse.

50 años de la primera exploración del Sótano de las Golondrinas. John Cole.

El Sistema Cheve, cueva de nivel mundial. Bill Stone.

45 años del descubrimiento del Sótano del Barro. Logan McNatt.

Treinta años de Exploraciones del Grupo La Venta. Tullio Bernabei.

Una vida dedicada a la exploración. Ramón Espinasa.

40 Años de espeleología en la UNAM. Manuel Casanova and Ángeles Verde.

Presentación del libro *El Mundo Subterráneo de Tabasco*. Roberto Porter.

La Espeleología, una forma de vida. Gustavo Vela.

Source: https://drive.google.com/file/d/0BzFQcdCj4yHnZTZQdmpGVmRxR1E/view (tinyurl.com/y8ruz5vc).

Sótano del [de El] Barro, Hogar de Guacamayas, Biodiversidad del Sótano del Barro, Arroyo Seco, Querétaro, by Robert Pedraza Ruiz.

No doubt it will be curious and interesting for many people to know that the steep and imposing mountains that today form the Sierra

Sótano de El Barro. *Rubén Navarrete.*

Gorda did not exist some millions of years ago, because they simply were part of the seabed. Some time later, about 50 million years ago, plate tectonics produced a powerful folding that lifted the seafloor, creating the great mountain range of the Sierra Madre Oriental, which can be generally regarded as an enormous mass of Mesozoic marine sediment. That is why the rocks of this sierra are mainly of calcareous nature, so in many areas it is characteristic to find typical karst topography composed of mogotes, peaks, sinkholes (closed basins with internal drainage), and a multitude of sótanos, that is, vertical caves, of which an important number have already been explored and mapped; they undoubtedly only represent a small fraction of the abysses that the sierra hides. This variety of formations have been originated basically by the dissolution of the limestone due to the physical and chemical action of water.

Our Sierra Gorda stands out even at an international level in terms of the deep vertical caves it holds inside, as the sótanos of Tilaco (649 meters of total depth) and Nogal (529 meters) are undoubtedly magnificent, and even more impressive are the successions of pits, but those are modest next to the Sótano de El Barro. This is an extraordinary geological formation located in the municipality of Arroyo Seco, within the lands of the ejido of Santa María Cocos. This cavity is located at a height of 1,860 meters, formed approximately 1.5 million years ago by a process of dissolution and fractures, which gave rise to its gigantic mouth that reaches 420 meters on its major axis and 200 in the smallest , a total depth of 455 meters and 410 freefall, which makes this one of the deepest in the world. Also this sótano stands out for being, together with the Cañada del Infiernillo, the nesting site of the colony of green macaws (*Ara militaris*) of approximately forty pairs located in the Sierra Gorda, that find refuge in small horizontal cavities in the sótano's walls, from where they go out daily in search of food, reaching long distances in a single day. The presence of the green macaws was a fundamental reason why, with the decree creating the reserve in 1997, the Sótano de El Barro was designated as a core area of the reserve, limiting the entrance of cavers to this cavity and the disturbance to these birds, which are threatened throughout their distribution area in the Mexican Republic and beyond.

Seeking to know thoroughly the flora and fauna of the sótano, which had only been studied briefly, staff of the Autonomous University of Querétaro under the direction of Dr. Luis Hernández Sandoval developed the study Biodiversity of the Sótano del Barro, both within as well as in the vicinity of it, which yielded interesting results. Basically they are in the outside forests of *encino*, *encinar* shrub and *rosetófilos* shrubs, in the walls *rupícolas* plants, and in the bottom of the cavity species rather like those of the *mesófilo* forest or medium forests, due to the climate that is formed in the environment of the chasm, including some large trees. Totals of 144 species of plants, 104 of animals, (54 insects, 23 mites, 12 arachnids, 3 species of amphibians, 4 reptiles, 6 birds, and 2 species of mammals) were recorded, and aspects such as soil, climate, temperature, and amount of light inside were studied.

Due to the fact that the Sótano del Barro is a core zone, we have worked with the ejido owners of Santa María Cocos to protect and give sustainable management to this cavity, which in turn constitutes a tourist attraction of the first order, which is why they now have a rustic lodge where they offer services of lodging, food, guides, and rent of horses to access the sótano. We extend a cordial invitation to visit this exceptional point of the geography of Querétaro, while benefiting the *comuneros* that are custodians of this pit.

Source: Edited from Google translation of a 2014 post at http://sierragorda.net/en/sotano-del-barro-hogar-de-guacamayas/(tinyurl.com/ybnak62r) called to our attention by Logan McNatt. The full 2003 paper appeared in the proceedings of the Primer Encuentro de Investigación sobre la Sierra Gorda, at San Juan de los Durán, Jalpan, Querétaro, Volume 1 as Biodiversidad del Sótano del Barro, Arroyo Seco, Querétaro, by Luis Hernández Sandoval, et al. It may be downloaded from https://www.researchgate.net/publication/306012649_Biodiversidad_del_Sotano_del_Barro_Arroyo_Seco_Queretaro (tinyurl.com/yb9bvbpy).

QUINTANA ROO

A team of experts from the National Institute of Anthropology and History has discovered a link between two systems of flooded caverns that together form the world's largest underwater cave.

The multidisciplinary team made the discovery during work on the

Great Mayan Aquifer project, in which archaeologists, biologists, underwater photographers, and cave divers are exploring, documenting, and mapping the extensive subterranean network of water features on the Yucatan Peninsula.

GAM project-director Guillermo de Anda told the newspaper *Milenio* that the discovery of the connection between the 263-kilometer-long Sac Actun system and the 84-kilometer Dos Ojos system in Tulum, Quintana Roo, was made on January 10 following ten months of intense work.

The interconnected system measures 347 kilometers and has an average depth of 20 meters, although in some sections it is as shallow as 2 meters and in others as deep as 100. In accordance with speleology conventions, the combined network will be named after the larger of the two systems: Sac Atun, which in the Yucatec Mayan language means the White Cave.

"Without a doubt, it's the most important submerged archaeological site in the world," de Anda said. "We've recorded more than one hundred archaeological elements: the remains of extinct fauna, early humans, Maya archaeology, ceramics, and Maya graves. It's also very significant that this discovery enables us to see the possible patterns of past settlement. From the Pleistocene through the ancient Maya and up to the colonial era, they developed parallel to this enormous flooded fresh-water cave," he added.

De Anda also said that within the underwater system there are dry and partially dry caves where the research team has documented age-old modifications that include walls and staircases and has discovered cave paintings and other signs of ancient human presence.

Documentation of the extensive cave system is a great achievement, as the aquifer represents one of the final frontiers of exploration, the underwater archaeologist said. "INAH authorities are conscious of the challenge represented by properly documenting, studying, and recording all the [different] elements and placing them under the same lens in order to stop seeing them in an isolated context, [but rather] make a comprehensive interpretation," de Anda said.

German explorer Robert Schmittner, who leads the diving team, said the discovery of the link between the two systems is the result of years of hard work and his team's dedication, passion, and desire to find it. "It's a titanic effort from the whole team. . . . I didn't rest for fourteen years until I found the interconnection," Schmittner explained.

However, de Anda said that there is still a lot of work to be done to better understand the value of the natural resources, the morphology of the Yucatan Peninsula subsoil, and the biodiversity of the subterranean cave networks.

Another challenge is finding whether any links exist between Sac Actun and three other nearby underwater cave systems. One located to the north of Sac Actun is considered "the mother" of the cenotes, or sinkholes, and until now at least, believed to be an independent system.

According to data from the Quintana Roo Speleological Survey, there are 358 underwater cave systems in the north of the state alone. Together, they are made up of around 1400 kilometers of underwater passages including the 270-kilometer-long Ox Bel Ha system located to the south of Tulum.

[Previous reports of a connection between the two caves were based on a large amount of "drip-line" surface survey. The initial underwater connection between Sac Actun and Dos Ojos reported here was just a "handshake connetion," but it has since been enlarged to allow human passage.]

Source: https://mexiconewsdaily.com/news/underwater-cave-is-worlds-biggest/ (tinyurl.com/y7g7q9hh) called to our attention by Jerry Atkinson.

The exploration group Gran Acuífero Maya (GAM) have connected two of the largest flooded cave systems in the world, Sac Actun and Dos Ojos in Tulum. The caves of Sac Actun and Dos Ojos have a tunnel that connects them, a discovery that makes up the largest flooded cave in the world. According to the world rules of speleology, the largest cave absorbs the small, so Dos Ojos becomes part of Sac Actun.

GAM released a statement detailing the extent of the 347-kilometer flooded cave, which displaces the largest on the planet from another in Tulum, Ox Bel Ha of 270 kilometers.

GAM exploration group also recorded a system with a length of 18 kilometers so far called "the mother of all the cenotes" north of Sac Actun whose maximum depth is 20 meters.

The importance of the finding is that it gives rise to and supports a great biodiversity and represents a large reserve of fresh water that has given life to this region of the Yucatan Peninsula.

GAM is a project directed by Guillermo de Anda, underwater archaeologist and explorer of National Geographic. The project is an initiative developed with the support of Aspen Institute Mexico, the National Institute of Anthropology and History (INAH), the Technological University of the Riviera Maya (UTRM), National Geographic, and the Development Bank of Latin America (CAF).

Source: January 16, 2018, post by Raul Alzaga, *Riviera Maya News*, https://www.riviera-maya-news.com.

The underwater caves in Quintana Roo longer than 15 kilometers and also some new caves in the QRSS database are listed below. Lengths are in meters. The second number is the number of cenotes that connect to the cave; this number is uncertain in some cases.

Sistema Sac Actun	352,920	226
Sistema Ox Bel Ha	270,174	143
Sistema K'oox Bal	93,622	56
Sistema Xunaan Ha	52,214	32
Sistema Toh Ha	47,072	20
Sistema Sand Crack	26,747	8
Sistema Nohoch Pek	25,161	8
Sistema Nohoch Kai	15,633	9
Entrada Caapechen	15,638	1
Sistema Ponderosa	15,210	19
Sistema MOAC	11,369	2
Sistema O'ho Tucha	5,969	2
Sistema de los Metates	5,758	4
Sistema Red Pool	3,982	8
Cenote Dagobah	1,601	1

The total length of the ninety-six underwater caves over 1.5 kilometers long in the database is 1,341,212 meters or 4,400,302 feet.

Source: Jim Coke, Quintana Roo Speleological Survey, May 1, 2018. The full list of long underwater caves is at http://caves.org/project/qrss/qrlong.htm. Other interesting material can be accessed from the QRSS home page at http://caves.org/project/qrss/.

Abstract: The blurred line between photic and aphotic environments: a large Mexican cave with almost no dark zone, by Luis M. Mejía-Ortíz, Tanja Pipan, David Culver, and Peter Sprouse.

Sistema Muévelo Rico is a 1.2-kilometer-long cave in Quintana Roo, less than 2 kilometers from the Caribbean Sea. We measured illuminance to a level of 0.1 lux, organic matter (weight loss on ignition), temperature, and relative humidity. The last two were measured at hourly intervals for nearly one year. Approximately one-third of the cave has illuminance values greater than 0.01 lux, and most of the rest of the cave has light as well. Temperature and relative humidity were relatively constant, but they showed a daily cycle at all stations, albeit with different strengths. Organic matter averaged 8%, intermediate in value between surface and aphotic zones. Both eyeless species and eyed predators occurred throughout the cave. Their occurrence can best be explained by their foraging for organic matter and incurring an increased risk of predation.

Source: *International Journal of Speleology*, volume 47, number 1, http://scholarcommons.usf.edu/ijs/vol47/iss1/6/, 2018. Full article at http://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=2155&context=ijs (tinyurl.com/yaqjr9pf).

Archaeologists exploring the world's biggest flooded cave in Mexico have discovered ancient human remains at least 9,000 years old and the bones of animals that roamed the earth during the last Ice Age.

A group of divers recently connected two underwater caverns in eastern Mexico to reveal what is believed to be the biggest flooded cave on the planet, a discovery that could help shed new light on the ancient Maya civilization.

The Yucatan Peninsula is studded with monumental relics of the Maya people, whose cities drew upon an extensive network of sinkholes linked to subterranean waters known as cenotes.

Researchers say they found 248 cenotes at the 347-kilometer (216-mile) cave system known as Sac Actun, near the beach resort of Tulum. Of the 200 archaeological sites they have discovered there, around 140 are Maya. Some cenotes acquired particular religious significance to the Maya, whose descendants continue to inhabit the region.

Apart from human remains, they also found bones of giant sloths, ancient elephants and extinct bears from the Pleistocene period, Mexico's Culture Ministry said in a statement.

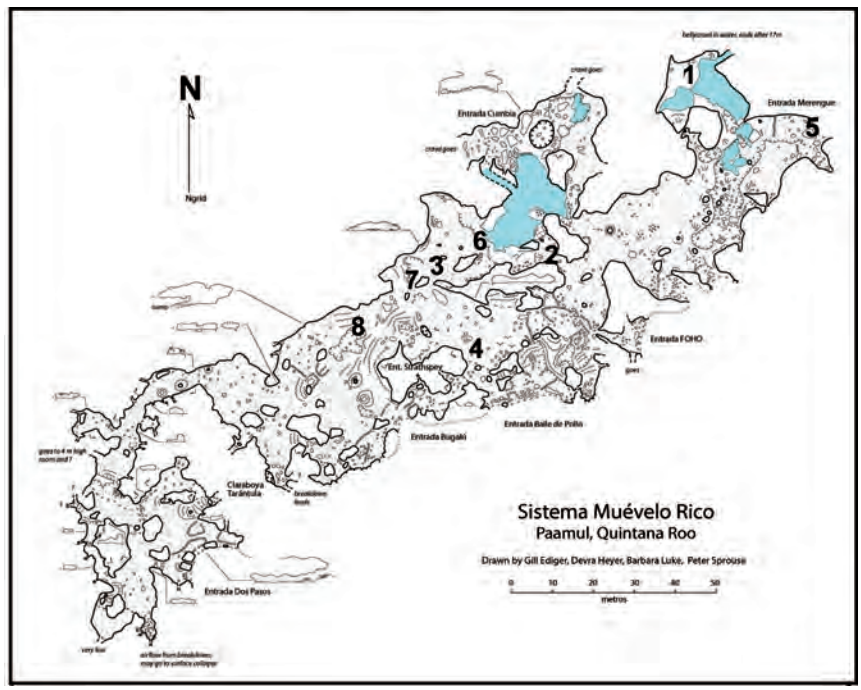
The cave's discovery has rocked the archeological world. "I think it's overwhelming. Without a doubt it's the most important underwater archaeological site in the world," said Guillermo de Anda, researcher at Mexico's National Anthropology and History Institute (INAH). De Anda is also director of the Gran Acuífero Maya (GAM), a project dedicated to the study and preservation of the subterranean waters of the Yucatan peninsula.

According to the INAH, water levels rose 100 meters at the end of the Ice Age, flooding the cave system and leading to "ideal conditions for the preservation of the remains of extinct megafauna from the Pleistocene." The Pleistocene geological epoch, the most recent Ice Age, began 2.6 million years ago and ended around 11,700 years ago.

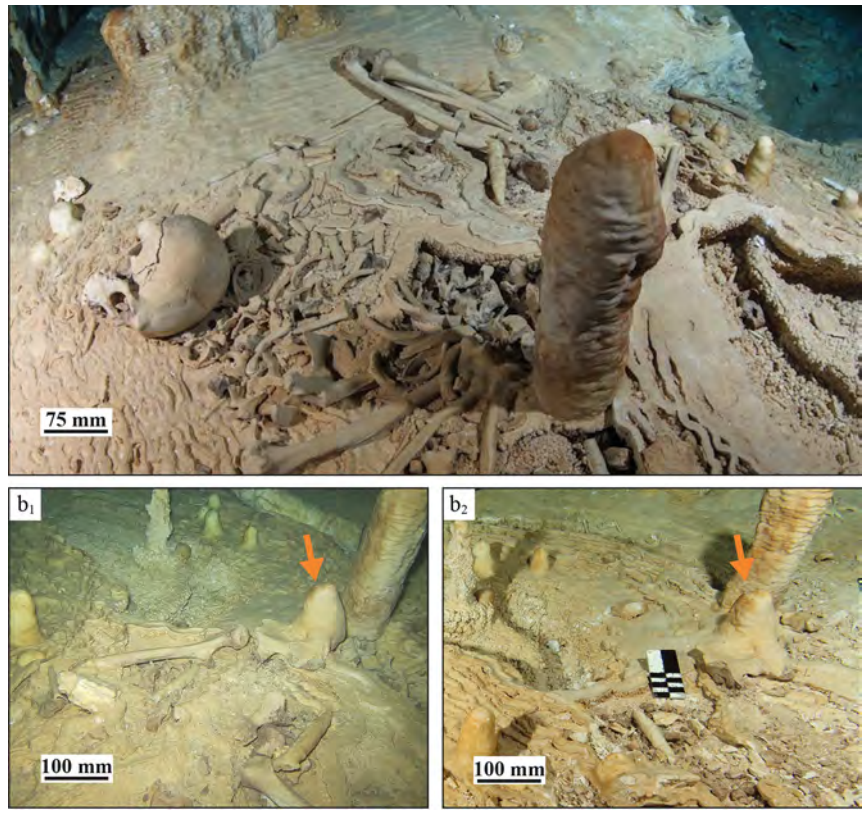
Source: anonymous post by Thomson Reuters to http://www.cbc.ca/news/technology/mexico-flooded-cave-1.4543416 (tinyurl.com/y7ef77op). The web page, called to our attention by Ron Ralph, includes a one-minute video.

Abstract: The Earliest Settlers of Mesoamerica Date back to the Late Pleistocene, by Wolfgang Stinnesbeck et al. (al. here being thirteen more alleged authors).

Preceramic human skeletal remains preserved in submerged caves near Tulum in the Mexican state of Quintana Roo, Mexico, reveal conflicting results regarding C dating. Here we use U-series techniques for dating a stalagmite overgrowing the pelvis of a human skeleton discovered in the submerged Chan Hol cave. The oldest closed-system U/Th age comes from around 21 mm above the pelvis defining the terminus *ante quem* for the pelvis to 11,311±370 y



Human skeletal remains in Chan Hol.



BP. However, the skeleton might be considerable older, probably as old as 13 ky BP as indicated by the speleothem stable-isotope data. The Chan Hol individual confirms a late Pleistocene settling of Mesoamerica and represents one of the oldest human osteological remains in America.

Source: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0183345 (tinyurl.com/y7zy3vzy), where the full paper can be found. Note that the skeleton mentioned is known as Chan Hol 2 and is not the same as the famous Naia found deep in the Hoyo Negro in Sistema Sac Actun. Most of this skeleton was removed from the cave by persons unknown shortly after it was reported, but the stalagmite on the pelvis was likely responsible for its remaining in place until it was removed for this study. The paper was called to our attention by Jim Coke.

Abstract: Santuario de los Guerreros—a Key Link in the Xpuha Puzzle. Peter Sprouse and Bill Mason.

Rancho Santuario de los Guerreros lies inland from Xpuha, an old Maya trading post on the Caribbean coast of Mexico. It occupies a central location among the explored cave systems that lie between Playa del Carmen and Akumal and is upstream of known underwater systems close to the coast. Recent exploration of under- and above-water cave passages in various adjacent caves shows progress toward consolidation into a large system. Sistema Dos Amores was connected to Sistema Santuario via an underwater passage that featured a dry crawlway through which tanks had to be hauled. And from the south, the dry maze cave Ruta de los Guerreros, several kilometers long, is close to connecting.

Source: 2017 NSS convention program book, page 62.

Cenote Tucan is a sinkhole with no diveable cave passageway. It's always a bit disappointing when we don't find going cave, but every time we jump into a new cenote, we learn a little more about the planet. It's never a waste. Cenote Tucan is visually stunning (and a bit spooky) with strong tannic-water layers, hydrogen sulfide, and a sharp halocline. We found a variety of bones and one pot on the debris cone, made a quick survey of the cavern walls, and took a little video.

The cenote has a maximum depth of about 60 feet/18 meters with an oval shape. The descent to the water is a sharp slope with the smooth walls typical of sinkholes, and getting out required a little vine climbing. The debris cone starts at 15 feet/5 meters and drops to about 40 feet/12 meters. The debris cone is covered with fallen branches and organic material. The cavern has no speleothems.

Source: From web post by Natalie Gibb, http://www.underthejungle.com/en/cenote-tucan-exploration/. There are also photos, more text, and a short video there.

Abstract: New Exploration in Underwater Cave Systems in Riviera Maya, Mexico, by Zdeněk Motyčka.

During two expeditions in 2014 and 2015 the members of Czech Speleological Society continued their project for exploration and documentation of underwater cave systems on the Yucatan Peninsula that has been running since 2003. They discovered three new cenotes northwest and southwest from the known parts of the K'oox Baal Cave system, which is now the fourth longest underwater cave in the world, 75 kilometers long. In the new cenote Shoot's Hool they discovered 589 meters of new passages and in the cenote Wa Ba'ax Yan a total of 1176 meters of new corridors. During an inspection dive in cenote Chak Ha, they discovered 354 meters of new passages and connected Chak Ha in to the cenote Zebra, which reached the total length of 2443 meters. In new area located about 4 kilometers northeast of the K'oox Baal Cave system they discovered eight new cenotes, and four of them were conected to one cave system Paachil Nah, which is now 5271 meters long.

Source: 23rd International Karstological School "Classical Karst" Program and . . . Abtracts, 2015, page 136. See next item for updates.

Xibalba 2016: In January and February 2016, three different groups of cavers from the Czech and Slovak

Speleological Society continued their long-term project in the exploration of underwater cave systems on the Yucatan Peninsula. During five weeks, new underwater tunnels were discovered in the Nah Baak cenote and also in the new Mariposa cenote. Altogether 5 kilometers of new passages were discovered, and all cenotes in the area were connected to a single system called Sac Kay [or Sac Kai]. The total length of the cave system is now 11,638 meters, with the Paachil Nah Cave being now a part of this system.

New corridors were also discovered in the Luuk Hoof cenote, which is now 872 meters long. A surprise was the discovery of two new dry caves—Xul In, 546 meters long, and ZBK, which is 753 meters long. In the last days of the expedition the team also

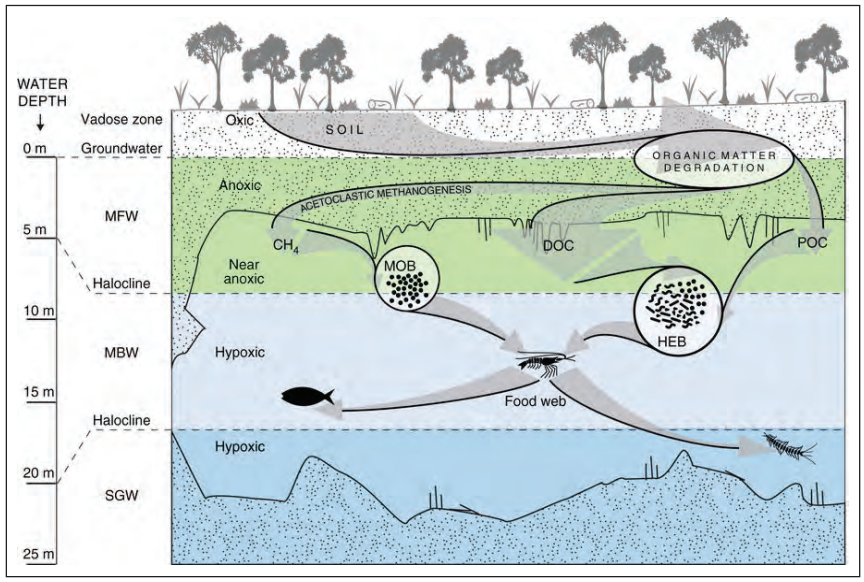
surveyed and mapped new passages in the K'oox Baal Cave system, which is now 90 kilometers long and presently ranks as the third longest underwater cave in the world.

Source: English summary of article by Zdeněk Motyčka and Daniel Hutňan, *Speleofórum* 36, 2017, pages 51–52. The Quintana Roo Speleological Survey web site gives 93,621 meters for the current (September 2017) length of K'oox Baal. See also the article on Sac Kay elsewhere in this issue.

An article with a similar abstract by Zdeněk Motyčka is in *Proceedings of the 17th International Congress of Speleology*, volume 1, pages 334–335.

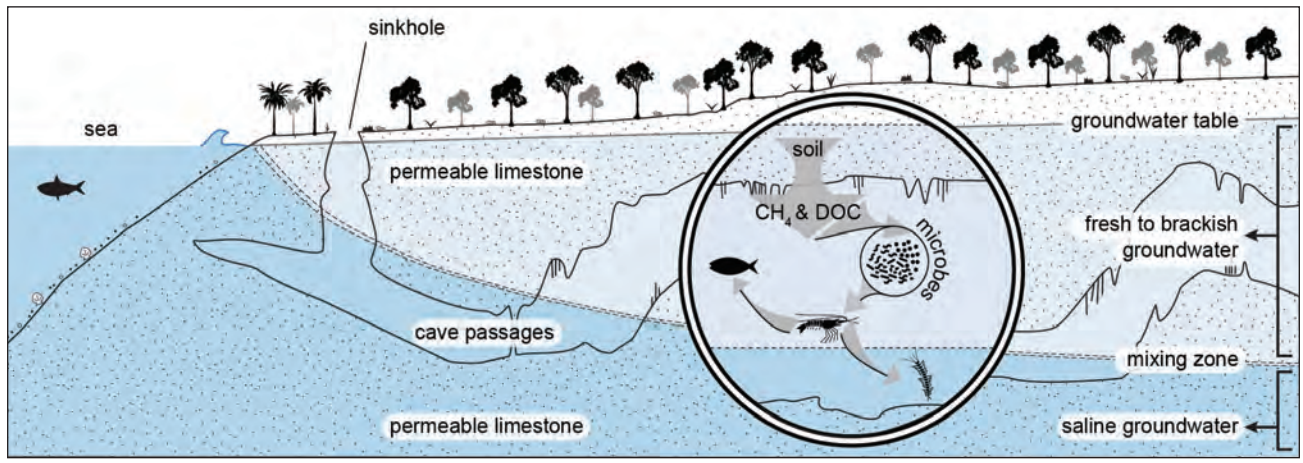
In the underground rivers and flooded caves of Mexico's Yucatan Peninsula, where Maya lore described a fantastical underworld, scientists have found a cryptic world in its own right. Here, methane and the bacteria that feed on it form the lynchpin of an ecosystem that is similar to what has been found in deep-ocean cold-seeps and some lakes, according to recent research by Texas A&M University at Galveston, the U.S. Geological Survey, and a team of collaborators from Mexico, the Netherlands, Switzerland, and other U.S. institutions.

The study was conducted in the Ox Bel Ha cave network of the northeastern Yucatan, which is described as a subterranean estuary because the flooded cave passages contain distinct water layers consisting of



Caves within a karst subterranean estuary are filled with separated fresh (green), brackish (gray) and saline (blue) waters. Within the subterranean estuary, methane (CH4) and other forms of dissolved organic carbon (DOC) created during the decomposition of soil from the overlying tropical forest sustain a complex cave-adapted ecosystem.

Conceptual model for a terrestrially influenced tropical karst subterranean estuary microbial loop. Dissolved organic carbon (DOC) and methane (CH4) produced from soil organic matter degradation within the shallow and anoxic saturated zone of the carbonate rock-matrix are transported into hypoxic cave conduits, where methane oxidizing bacteria (MOB) and heterotrophic bacteria (HEB) consume these reduced forms of organic carbon. Bacterial biomass is assimilated by filter-feeding crustaceans that are, in turn, preyed upon by higher trophic levels of the food web in this anchialine ecosystem.



freshwater fed by rainfall and salt water from the coastal ocean. This subterranean estuary complex covers an area approximately the size of Galveston Bay, the seventh largest surface estuary in the United States.

The freshwater portion of the caves and the sinkholes, which are used to access the caves and are referred to locally as cenotes, are important sources of freshwater for communities throughout the Yucatan. Methane in the caves forms naturally beneath the jungle floor and migrates downward, deeper into the water and caves; normally, all of the methane formed in soils migrates upward, toward the atmosphere. This sets the stage for the bacteria and other microbes that form the basis for the cave ecosystem. The microbes eat both the methane in the water and other dissolved organic material that the freshwater brought with it from the surface. The microbes then fuel a food web that is dominated by crustaceans, including a cave-adapted shrimp species that obtains about 21 percent of its nutrition from methane.

One surprising finding was how important the dissolved organic material like methane was to the caves' food web. Prior studies had assumed that the majority of organic material that feeds the microbes of caves came from vegetation and other detritus in the tropical forest that washed into the caves from the cenotes.

However, deep within the caves, where the study was conducted, there is very little of that surface debris, so the microbes depend on methane and the other dissolved organics percolating downward through the ceiling of the caves.

Source: Extracts from a USGS press release at www.sciencedaily.com/releases/2017/11/171128090945.htm. The journal article is D. Brankovits, J. W. Pohlman, H. Niemann, M. B. Leigh, M. C. Leewis, K. W. Becker, T. M. Iliffe, F. Alvarez, M. F. Lehmann, and B. Phillips, Methane- and Dissolved Organic Carbon-Fueled Microbial Loop Supports a Tropical Subterranean Estuary Ecosystem. *Nature Communications*, 2017; 8(1), available at https://www.nature.com/articles/s41467-017-01776-x (tinyurl.com/ya66h3st).

Other reports on the web based on the same information as the preceding item are at http://www.newsweek.com/cryptic-sunken-underworld-mexico-yucatan-peninsula-726091 (tinyurl.com/ycvy8258) and https://www.usgs.gov/news/mexico-s-yucatan-peninsula-reveals-a-cryptic-methane-fueled-ecosystem-flooded-caves (tinyurl.com/yaluya8n).

On February 7, 2018, NOVA TV presented a program "First Face in America" about the human skeleton found in Actun Hu, part of Sistema Sac Actun (http://www.pbs.org/wgbh/nova/evolution/first-face-america.html for one local station's video). It might be seen as repeats on local stations, or there is a DVD of the program to come out May 1. The videography is impressive, but there are some problems with the narration. For example, carbon-14 does not decay to nitrogen-14 by emitting a proton. From "Mexico News" in *AMCS Activities Newsletter* 37 (2014): 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.

Source: The program was called to our attention by Lee Skinner.

Abstract: Digital Preservation of Ancient Maya Cave Architecture: Recent Field Efforts in Quintana Roo, Mexico, by Domonique Rissolo, et al.

The presence of ancient Maya shrines in caves serves as unequivocal evidence for the ritual appropriation of these subterranean spaces and their significance with respect to Maya religious practice. Detailed study of the miniature masonry temples and altar features in the caves of Quintana Roo, Mexico, reveals a strong stylistic and likely functional correspondence between these structures and their terrestrial counterparts at Postclassic sites. The Proyecto Arquitectura Subterránea de Quintana Roo (coordinated by the Center of Interdisciplinary Science for Art, Architecture, and Archaeology, or CISA3, at the University of California, San Diego and in collaboration with the Instituto Nacional de Antropología e Historia in Mexico) is conducting a survey and program of digital documentation of both the pristine and impacted cave shrines of the region. Once an area is developed and populated, and access is opened to caves containing ancient architectural features, they are soon vandalized—often resulting in the complete obliteration of these rare miniature buildings and their diagnostic architectural elements. This emergent situation necessitates the use of rapid reality-capture tools; however, the physical challenges of working in caves requires researchers to adapt increasingly common architectural

Point cloud via structure-from-motion photogrammetry of the shrine in the cave known as Aluxes.

documentation methodologies to more adverse field conditions.

Source: *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Volume XLII-2/W5, 2017 26th International CIPA Symposium 2017, 28 August–01 September 2017, Ottawa, Canada, pages 613–616. https://www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XLII-2-W5/613/2017/isprs-archives-XLII-2-W5-613-2017.pdf or tinyurl.com/y7ol8p77.

A device to expedite recording distance and orientation of segments of cave-diving guidelines is being manufactured in Playa del Carmen. *Source*: http://arianesline.azurewebsites.net/Home/Mnemo, tracked down by Justin Shaw.

SAN LUIS POTOSÍ

The program and abstracts book for the 2017 Astyanax International Meeting in Juriquilla, Querétaro, March 12–14 is online at https://www.stowers.org/sites/all/themes/aimfc/aim2017_prog.pdf. or http://www.mexicancaves.org/other/AIM2017.pdf While the meeting was in Querétaro, the note appear here under San Luis Potosí because that is where many of the *Astyanax* blind-fish caves are located.

The following paragraphs are the abstracts on the first two chapters in the new book *Evolution in the Dark: Darwin's Loss without Selection*, by Horst Wilkens and Ulrike Strecker, Springer 2017, ISBN 978-3-662-54512-6 (e-book also available), 211 pages. About half of the book is specifically about the Mexican *Astyanax* blind cave fish.

Evolution is predominantly understood as a progressive process, and less attention is usually paid to those traits being reduced at the same time. Since Darwin, who was the first to expound what can be called "Darwin's loss," the main agents of regression have been under dispute.

Processes of regression and rudimentation are deeply involved in the evolution of life and are as important as constructive evolution. They occur in every taxonomic group and concern morphological, behavioural, as well as physiological traits. For example, whales have reduced their hind legs and the pelvic girdle. The ratite birds have convergently abandoned the ability to fly and exhibit reduced wings and sternal carina. In addition, the delicate feather structure is broken down. In the Pacific island of Tahiti, where no insectivore bats exist, noctuid moths have lost the acoustic startle response. Even the gustatory system may selectively lose taste components (e.g. sweet in cats; bitter, sweet, and umami in penguins; or umami in the giant panda) after changes in diets during evolution. However, from the view of human beings relying on sight as the dominant sense, the most bizarre and striking examples for rudimentation, often also characterized as degeneration or regression of traits, are provided by the loss of eyes and dark pigmentation in species living in the continuous absolute darkness of subterranean habitats like caves.

William Elliott's chapters in the book *Biology and Evolution of the Mexican Cavefish*, Academic Press , Amsterdam, 2015, are available online.

Chapter 1: Cave Exploration and Mapping in the Sierra de El Abra Region, http://cavelife.info/pdf/2015%20Elliott%20Mex%20Cavefish%20Chap%201r.pdf (tinyurl.com/ybowhswj).

Introduction: Here I explore the worlds of biology and caving, and summarize what is known about the Mexican cavefish and its habitat. I will discuss the history of discovery, exploration, and mapping of caves in the Sierra de El Abra region. Much of this fieldwork was driven by an interest in the cavefish by about two hundred biologists, geologists, and speleologists, who often worked together. Biologists and geologists made the first cavefish discoveries in the region. Only a few of the fish caves can be accessed on foot—vertical caving techniques and training are required in most. Many of the pit caves proved to be too challenging for academics. The cavers were younger explorers and adventurers, some of them graduate students excited by large, deep caves. Some of the professors became proficient in vertical caving, and some of the cavers became cave biologists. Americans, Canadians, Europeans, and Mexicans sometimes worked together in the field and laboratory. It also was a cultural phenomenon; the northerners learned more Spanish, fell in love with Mexico, and worked to create international goodwill. The teams found over two hundred caves in the El Abra region, but just twenty-nine of them are known to contain the Mexican cavefish.

Mexico is home to at least seven known species of cavefishes. These cavefishes have reduced or nearly absent eyes and pigment, and they have evolved from six families from widely separated areas: Characidae, Ictaluridae, Pimelodidae, Poeciliidae, Bythitidae, and Synbranchidae. In this book, we refer to cavefishes of the species *Astyanax mexicanus*, which include the obsolete genus, *Anoptichthys*, as the "Mexican cavefish." Whatever the Latin name may be, the Mexican cavefish is an evolving new species that is separating from its river form. The cave form can be purchased in aquarium shops and is easy to keep and breed. The aquarium breed came from La Cueva Chica; it is a hybrid between the river and cave forms.

Chapter 3: Cave Biodiversity and Ecology of the Sierra de El Abra Region, http://cavelife.info/pdf/2015%20Elliott%20Mex%20cavefish%20Chap%203%20Elsevier.pdf (tinyurl.com/ybkx2obv).

Introduction: I discuss the general ecology and biodiversity of fish caves in the Sierra de El Abra region and describe four important, but very different, caves within the El Abra region.

Source: Bill Elliott.

I have made a new *Astyanax* Cavefish Page on my website, http://cavelife.info/index.htm. You can download two versions of my *Astyanax* cavefish bibliography, listed by authors or by years. There are 800 references from 1936 through 2017, 81 years of work. This includes scientific publications and many cave reports on the original exploration, mapping, and fish-collecting. The biblio PDFs include graphs of

the publication rate, which is going exponential over the last few years. There have been booms like that before when new technologies were introduced, from classical taxonomy and genetics, anatomy, behavior, development, starch-gel electrophoresis, and genomics. So many papers are being published now that I probably missed a couple. Please send me the missing citations and pdfs at speodesmus@gmail.com.

Source: Bill Elliott.

Bill Elliott gave a presentation at a meeting of the Underground Texas Grotto on October 18 ,2017. The hour-long talk is on Periscope at https://www.periscope.tv/w/1YqKDLzEllvKV (tinyurl.com/yc98rqd4).

New book: Elliott, William R. 2018. The *Astyanax* Caves of Mexico. Cavefishes of Tamaulipas, San Luis Potosí, and Guerrero. Association for Mexican Cave Studies, Bulletin 26. Austin, Texas. 326 pp.

This well-illustrated book was many years in the making. It covers the Sierra de El Abra Region, one of the premier cave areas of Mexico. The book includes a lot of history, biology, hydrogeology, cave accounts, caver stories, and more—something for everyone. The book is 326 pages, with 14 chapters, 6 appendices, 18 tables, 15 area maps, 53 cave maps, 3 illustrations, 183 photos, 1001 references, 8 caver stories, many Spanish summaries, and acknowledgments of 282 cavers and scientists. A folded regional geologic/topographic map, 10 by 29 inches (25 by 74 centimeters), suitable for field work, is included in an envelope in the back cover.

There are now thirty-one known *Astyanax* cavefish sites in the El Abra Region, adding two more to the known count. More details about the book will be placed soon on Elliott's website, http://cavelife.info/.

The price of the book is $30.00. US addresses should add $4.00 for media mail for the first copy, and an additional $1.00 for each subsequent copy in the same container. Foreign addresses require higher postage; contact the AMCS to get the cost of postage. Some copies may be on sale at the 2018 NSS Convention in Helena, Montana, July 28–August 3, 2018. A limited supply of rolled El Abra Region maps (not folded) are available at $11.00 for two maps in a tube, minimum order via media mail in the US. There is a higher charge for foreign addresses (ask). These rolled maps are suitable for your wall (each book comes with a folded regional map anyway). An individual rolled map with a rubber band may be sold at meetings at $3.00 each.

Abstract: The Sierra de El Abra Region in Tamaulipas and San Luis Potosí, México, now has 31 known caves inhabited by the eyeless *Astyanax jordani*, the *Astyanax* cavefish or blind cave tetra. Many of these caves also contain hybrids between the cave form and the epigean *Astyanax mexicanus*. In Guerrero there is another population of evolving cavefishes in two caves, but descended from *Astyanax aeneus*, a different but closely related species. These cavefishes are of great interest to scientists in the study of evolution and genetics, and even in the development of blindness and craniofacial anomalies in humans.

The hydrogeology of the El Abra Region is explained based on previous studies and new information gleaned from new cave maps, publications, and INEGI geologic coverages relating to limestones, shales, and basalts. The relative ages of caves are not estimated easily because different parts of the region have been uplifted at different times. The Gómez Farías caves in the north cannot be old because the caves are morphologically young, and the area was covered by Neogene (Tertiary) basalts until relatively recently. These basalts delayed karst development until the basalts and the underlying shales could be eroded away, exposing limestone underneath. An age model of the caves and a hypothetical colonization sequence is presented.

A chapter on *Astyanax* cavefish biology summarizes their many known constructive and degenerative traits including anatomical, developmental, physiological, and behavioral traits. Their conservation and population estimates are discussed.

A large chapter on cave ecology and fauna provides details about ten important caves in the El Abra Region, and a species list of 306 species in many caves of the region, including caves with no fishes.

The history of exploration and mapping of fish caves in the El Abra Region is outlined, with details given in each cave description. At least 282 individuals and 862 significant events were reported in the El Abra fish caves from 1936 to 2018.

Descriptions of the fish caves are arranged by the following areas from north to south: Gómez Farías, Chamal-Ocampo, Northern El Abra, Yerbaniz Cluster, Los Sabinos, Southern El Abra, Micos and Tamasopo, and Guerrero. Many previously unpublished cave and area maps are shown, with photographs by dozens of contributors going back to 1961. Recent field work in the El Pujal, Tamasopo, and Chamal areas is included. Some caves without fishes are included in each area because they may contain fishes, or they explain the karst, or to document local caves that have been searched.

Appendices include a large, exhaustive bibliography; a glossary of Spanish and scientific terms; a list of cavers, local guides, and scientists; 40 important cave dives in nacimientos; how to obtain Mexican maps and GIS coverages; and an English translation of Federico Bonet's 1953 paper on caves of the El Abra Region.

Sources: William Elliott and the book's abstract.

SONORA

On January 14, 2017, members of the Grupo Pionero Espeleológico de Sonora visited the "most beautiful cave in Sonora," Cueva La Mora. Sergio Santana of the National Commission of Protected Natural Areas (CONANP) had visited the cave in 2011 and stated that it might be viable for ecotourism if suitable infrastructure was provided. Since then nothing had been done, and the G-PES wanted to survey the cave and corroborate Santana's information. New survey made the cave 300 meters long and 24 meters deep, and the author of the web post thinks it is indeed the most beautiful cave in

Sonora. *Source*: August 29, 2017, post at http://latinamericanscience.org/spanish/2017/08/la-cueva-mas-hermosa-de-sonora/ (tinyurl.com/ybwv4q8j)

Abstract: Faunal Diversity on Arid Lands Caves in the Sonoran Desert, Mexico, by M. C. Luis Omar Calva Pérez and Dra. Reyna A. Castillo-Gámez.

Biospeleological studies in Mexico are scarce, particularly ones to explain the interaction between species in caves, as well as the relationship with their physical environment. The Sonoran Desert is located in the northwest of Mexico and southwest of the USA, with most of this desert belonging to the state of Sonora. There is a shortage of knowledge of the biospeleology from Sonora, representing only 1.2 percent of Mexican speleological studies. The objective of this work was to determine biotic factors that have a role in the fauna diversity in two karst caves in the central region of Sonora. In order to accomplish the objective, we surveyed the Cueva de la Mariana and Cueva El Tigre for a year, April 2015–April 2016. Two sensors were placed in each cave in the transition zone and deep zone of the caves to determine the temperature and relative humidity, and the fauna (vertebrate and invertebrate) were collected and preserved through different methods. The climates of the caves were different, with a mean annual temperature of 26.5 °C and 52 % annual relative humidity for Cueva de la Mariana and for Cueva El Tigre 29.3 °C and 67 %. The fauna found in both caves were represented by twenty-three orders, thirty-eight families, fifty-one genera, and fifty-two species. This cave community depends on the guano produced by seven species of bats, the Mexican free-tailed bat (Molossidae: *Tadarida brasiliensis*) being the most important, with a population of a half-million in Cueva de la Mariana and a million individuals in Cueva El Tigre in summer. The alteration or elimination of the bat populations inside both caves could produce local extinction of 80 % of the species registered. This is the first biospeleological study on arid-lands caves from Mexico.

Source: *Proceedings of the 17th International Congress of Speleology, Sydney 2017, volume 1, pages 64–70.*

See also the announcement of the 2019 Congreso Mexicano de Espeleología under the General heading at the end of Mexico News.

TABASCO

Abstract: Caves of Tabasco Project—2016. Laura Rosales-Lagarde, Eladio Terreros, and Amelia Escobar Potenciano.

More than sixty caves have been mapped in Tabasco, southern Mexico. These caves have been explored by humans dating to at least 1,000 years BC as evident by the archaeological evidence found in at least twenty caves of the Tabasco mountain ranges. From 1,000 years BC until the Spaniards' arrival, members from the Zoque ethnicity deposited ceramic objects, blades made of obsidian and chert, as well as human burials between AD 700 and 1,500. For these earlier visitors, caves were sacred places. This cave conception persists today. The locals still use the caves to perform rituals with diverse purposes, from requests for rain, prosperous crops, an improvement of their economy, to witchcraft ceremonies. In 2016, two caves with archaeological remains were surveyed as part of the ongoing archaeological research by Eladio Terreros. Sima Arroyo Chispa is 12 meters deep and 25 meters long. Cueva Jonás Hernández–Fidencio López is 18 meters deep and 98 meters long. The description of the artifacts in these caves will provide a clearer picture of the Zoque's culture and their perception of caves.

Source: 2017 NSS convention program book, page 61.

Abstract: Isotopic evidence for the migration of thermogenic methane into a sulfidic cave, Cueva de Villa Luz, Tabasco, Mexico, by Kevin Webster, et al.

Methane (CH_4) is an economic resource and a greenhouse gas, but its migration through rocks is not immediately associated with speleogenesis. Sulfuric-acid speleogenesis is a cave-forming mechanism that has produced a variety of economically important oil fields and aquifers, and is theorized to be related to the oxidation of CH_4 and hydrocarbons. Despite hypotheses that the oxidation of CH_4 may provide a basis for the generation of sulfides during sulfuric-acid speleogenesis, evidence from active systems has not yet been obtained. In this study, we address how CH_4 influences the development of sulfidic cave systems by sampling the CH_4, H_2S, and CO_2 concentrations, as well as $\delta^{13}C$ CH_4, δ^2H CH_4, and $\delta^{13}C$ CO_2 values, in a cave currently forming by sulfuric-acid speleogenesis, Cueva de Villa Luz. CH_4, H_2S, and CO_2 concentrations were highest directly above springs in the cave, showing that all three gases enter by means of the spring water. The $\delta^{13}C$ CH_4 and δ^2H CH_4 in the air of CVL ranged

from –47.92 ± 0.15 to –35.47 ± 0.12 ‰ (VPDB) and –117 to –83 ‰ (VSMOW), respectively. Keeling plots suggest that CH_4 with $\delta^{13}C$ CH_4 = –24 ± 3 ‰ and $\delta^{2}H$ CH_4 = –40 ± 50 ‰ was outgassing from spring water. This stable-isotope signature does not fall within traditional published $\delta^{13}C$ CH_4 versus $\delta^{2}H$ CH_4 fields. Our data suggest that the CH_4 entering Cueva de Villa Luz is the remnant of a larger thermogenic CH_4 flux that is incompletely oxidized in the subsurface as it travels to Cueva de Villa Luz. Our data support links between the processes forming Cueva de Villa Luz and the proposed mechanisms for other caves associated with sulfuric acid.

Source: *Journal of Cave and Karst Studies*, volume 79, number 1, pages 24–34, 2017. Full paper is at https://caves.org/pub/journal/PDF/V79/cave-79-01-24.pdf.

TAMAULIPAS

Abstract: DNA Sequences of Troglobitic Nicoletiid Insects Support Sierra de El Abra and the Sierra de Guatemala as a Single Biogeographical Area: Implications for *Astyanax*, by Luis Espinasa, Nicole D. Bartolo, and Catherine E. Newkirk.

The blind Mexican tetra fish *Astyanax mexicanus* has become the most influential model for research on cave-adapted organisms. Many authors assume that the Sierra de Guatemala populations and the Sierra de El Abra populations are derived from two independent colonizations. This assumption arises in part from biogeography. The 100-meter-high, 100-meter-wide Servilleta Canyon of the Boquillas River separates the mountain ranges and is an apparent barrier for troglobite dispersion. *Anelpistina quinterensis* (Nicoletiidae, Zygentoma, Insecta) is one of the most troglomorphic nicoletiid silverfish insects ever described. 16S rRNA sequences support that this species migrated underground to reach both mountain ranges within less than 12,000 years. Furthermore, literature shows a plethora of aquatic and terrestrial cave-restricted species that inhabit both mountain ranges. Thus, the Servilleta canyon has not been an effective biological barrier that prevented underground migration of troglobites between the Sierra de Guatemala and the Sierra de El Abra. The Boquillas River has changed its course throughout time. Caves that in the past connected the two Sierras were only recently geologically truncated by the erosion of the new river-course. It is likely that, with the geological changes of the area and throughout the 2 to 8 million years of evolutionary history of cave *Astyanax*, there have been opportunities to migrate across the Servilleta canyon.

Source: Subterranean Biology 13, 2014, pages 35–44, https://subtbiol.pensoft.net/article/1317/.

When people find out I do research on cave deposits, they almost always ask me, "Do you go spelunking?" The short answer is yes, I do visit beautiful caves all over the world, but the longer answer is more complicated. If you saw our field team heading into a cave, we would look like extremely prepared rock climbers: plenty of rope, lots of bags, and helmets galore. But most of our gear bags, innocent though they may seem, are full of hammers, chisels, and duct tape on the way in, and stalagmites on the way out.

Stalagmites take hundreds or even thousands of years to grow, so each one is unique and extremely valuable for the record of environmental changes it contains. To get that environmental data, we have to cut the stalagmite out of a cave, slice it open with a tile saw, and remove tiny amounts of powder from the length of the stalagmite. In some cases, the stalagmite is barely recognizable by the time all the analyses are complete.

I do cave-based research because I'm excited to learn about how climate has changed in centuries and millennia past, but also because I care about the communities around my field sites. The findings from our research can be used in computer models of climate change that will help these communities adapt to the changing climate. By slicing up stalagmites, we learn about what controls the amount of rain in this region and, in some cases, even find out how frequently major storms occurred before instrumental records. This data helps climate scientists estimate how much water will be available as climate change progresses.

Many of the caves that we visit for research have signs prohibiting damage to the stalagmites that we pass by as we walk in with hammers. I know that our research is valuable, even though we are taking irreplaceable resources out of the cave. But I think it could be even more beneficial for everyone if we were more connected with the local communities near our caves.

The idea of relationship-centered work is not a new one; other research fields, like public health, emphasize the importance of community partnerships. There is no reason cave research should be any different. By strengthening the relationship between natural scientists and community members, we can better understand our field sites, create new learning opportunities, and improve environmental outcomes.

When I found out that I would be going to Tamaulipas and San Luis Potosí in northeast Mexico for more field work, I was determined to do *something* for the communities near the caves. Near one of our sites there is an amazing nature reserve called the Biosphere of "The Heavens" [Reserva de la Biosfera El Cielo] because of the cloud forest it encompasses, so my first idea was to create a museum display about our work. My adviser pushed me to think about what would actually benefit the community and the reserve, which has had steadily fewer visitors over the last few years, in part due to US travel warnings for the region. She was teaching me the difference between community outreach and engagement: outreach is done for a community, but engagement is done in cooperation with the people who form it.

The nature reserve's visitor center has plenty of informational displays—it only lacks people to visit them. My display idea, I realized, wasn't really trying to connect with people, I was trying to assuage my guilt. That moment helped me realize what it means to prioritize local needs over my own potential contribution. It might actually be

more helpful to write great reviews for the reserve on travel sites than to send a poster they don't need, even though making a poster might feel more familiar or active. I plan to ask the reserve staff what would most help them, and to take the time to fulfill their requests as best as I can, even if it means stepping out of my own comfort zone. I also plan to talk to locals about their knowledge of the cave systems, because they have been learning about the caves far longer than I have.

Back in the US, I make an effort to talk with people about how much I love traveling to Mexico and doing my field work. We can and should work to counteract stereotypes of Mexico that some Americans have, especially when people ask things like, "Isn't it dangerous to go to there?" I love showing pictures of my field sites and the stalagmites I am using, because it gives people a chance to reset their perspective of Mexico. But we can do a lot more than just providing another view of our field site.

Other research teams work with local communities from the very beginning of a new project, and prioritize community needs over pre-determined scientific goals. For example, UC Berkley and the Karuk Tribe have established collaborative project agreements governing research on Karuk ancestral lands and territory. They have worked together to study food systems and to increase access to healthy foods, an outcome that would have been far less successful without their community partnerships.

Community-focused measures don't counteract the potentially damaging effects of our research on the caves, but they're first steps that each of us can make toward doing more good, and toward mutual understanding and goals. Natural scientists should come together, think outside the box a little more, and practice listening to what communities really need. Engagement doesn't just involve starting a citizen-science project or making a poster. It takes real work. This is true for all field work and for local engagement in our own neighborhoods. We have a responsibility to work more collaboratively than we are now, and I think both researchers and community members will benefit.

Source: March 5, 2018, post by Gabriela Serrao Marks at https://massivesci.com/articles/cave-stalagmite-climate-change-community-research/ (tinyurl.com/yc2ypjy7), called to our attention by Jerry Atkinson.

See also the material on the Mexican cave-fish *Astyanax mexicanus* under San Luis Potosí.

YUCATÁN

Abstract: Spatial and temporal distribution of stygobiotic crustaceans: *Creaseria morleyi* and *Typhlatya* spp. in Yucatan cenotes, by Efraín Chávez-Solís, Maite Mascaró, and Nuno Simões.

Studying the distribution, population dynamics and behavior of stygofauna in their natural habitat may be difficult, technically challenging, and involves risks when cave diving is involved. Nevertheless, many different taxonomical groups have been found, described, and studied. Most of these studies focus on taxonomy, biogeographic studies, or evolutionary or genetic trends, allowing some behavioral and ecological questions to remain unanswered. The forty-two species of stygobiotic crustaceans living in underwater karst caves of the Yucatan peninsula of Mexico make them the most diverse group in this habitat.

The Palaemonid *Creaseria morleyi* and the Atyids *Typhlatya* spp. were monitored to evaluate the depth distribution during day and night in the light-transition zone of two cenotes (sinkholes) of Yucatan, Kankirixché and Tza-Itzá. These cenotes were monitored day and night every two months from February 2014 to February 2015 to study the distribution of organisms and changes in population size. The trophic interaction between these species was video-recorded with infrared devices in the laboratory.

Results indicate: 1) Higher densities of both genera are found in cenote Tza Itzá. 2) *C. morleyi* occurs more frequently during the night and is found only at night in the shallow areas that are otherwise illuminated during the day. 3) Beyond the open water surface of the cenotes where *Typhlatya* spp. are not found, it exhibits a decreasing density as the depth increases. 4) *Typhlatya* spp. maintain similar densities during day and night at each depth. 5) Population size of *C. morleyi* increases at the beginning of the rainy season of Yucatan, while the populations of *Typhlatya* spp. exhibit no significant change. 6) *C. morleyi* is capable of hunting, capturing and feeding on live *Typhlatya* spp.

The observed distribution pattern in *Typhlatya* spp. could be explained by the greater availability of allochthonous and photosynthetic material at the entrance of the cenote. The migration to the cenote entrance of *C. morleyi* could be explained by the trophic interactions with *Typhlatya* spp. revealed by this study and also other feeding sources such as Mysidae and allochtonous material.

Source: *23rd International Karstological School "Classical Karst" Program and . . . Abtracts*, 2015, page 103.

GENERAL

Abstract: The La Venta Associazione di Esplorazioni Geografiche was founded in 1991 with the aim of organizing and running geographical exploration projects with particular attention to the underground world. In twenty-five years of activity, La Venta has undertaken explorations in several countries, involving over one hundred speleologists and researchers. Such projects are carried out using a multidisciplinary approach, developing new ideas and using new research and documentation strategies. In more than one hundred expeditions, this association has documented some of the most unique underground environments around the world, such as the Naica Giant Crystal Cave, the quartzite karst of the tepuis of Venezuela and Brazil, glacier caves in the Alps, in Patagonia, and in Antarctica, tropical caves in Mexico, Myanmar, and the Philippines, halite caves in Chile, and high-altitude caves in Uzbekistan and Iran. One of the main goals of the projects carried out by the La Venta team is to promote the conservation of the areas in which the expeditions take place and to raise public

The exploration and study of the Giant Crystal Cave of Naica in Chihuahua remains one of the main milestones of La Venta. *P. Petrignani*/ La Venta.

awareness in the local inhabitants.

The La Venta members carry out caving activity in a true "geographical" way, trying to understand the archaeological, historical, anthropological, and physical aspects of caves, also involving partnerships with local institutions and UNESCO. The exploration results have allowed La Venta to be known and appreciated all over the world, through publications and films and collaborations and advisory activities with governments and cultural and scienti fic institutions. This article summarizes and discusses the main projects and results of La Venta during its twenty-five years of life, as well as the current frontiers of exploration projects in progress.

Source: La Venta Association, 25 Years of Exploration Projects and Discoveries, by Francisco Sauro, et al., *Proceedings of the 17th International Congress of Speleology*, volume 1, pages 361–365, includes brief descriptions of La Venta's work in Chiapas, Chihuahua, Coahuila, and Puebla. This work has been covered in various issues of the *AMCS Activities Newsletter* over the years, including reprints of some of La Venta's articles (Puebla, numbers 29 and 34, Coahuila number 30, Chiapas number 34). The full article here can be seen as part of the proceedings volume at https://www.speleo2017.com/proceedings/Proceedings-17th-ICS-Vol1-Ed2-screen.pdf (tinyurl.com/y7tjxc8o).

Mexico, Making Changes to Improve National Speleology:

1—New Executive Committee 2017–2019. The Mexican Union of Speleological Associations (UMAE, in Spanish) announces its new board of directors. The selection took place in the month of July 2017, when leaders of each association and honorary members who are affiliated to UMAE voted to select the new Executive Committee. The structure of this union is led by the following members: a president, a vice-president, one general secretary, one treasurer, and two assistants. President is Oscar Alvarado Machorro of Puebla, vice-president is Fátima del Rosario Tec Pool of Yucatán, secretary is Adrián Miguel Nieto of Cd. México, treasurer is Alicia Dávila García of Cd. México, and additional board members are Luis Omar Calva Pérez of Sonora and Rogelio Hernández Vergara of Guerrero.

The new committee is ready and willing to initiate activities, starting with the agreements and proposals that will help in the progress of our national speleology. Our objectives are to reactivate work groups focused on different disciplines, to create courses, workshops, and talks to encourage a better understanding and knowledge of this science, to continue coordinating the National Speleology Congresses, and to guide any foreign cavers about the way to explore and research in Mexico.

2—History of UMAE. Mexico is well-known around the world in the field of speleology because of its high diversity of caves. Our country has several of the most outstanding caves in the world. Sistema Huautla (the deepest cave on the Western Hemisphere), Sistema [Sac Actun] (the world's longest underwater cave), Sótano de las Golondrinas, Cueva de los Cristales de Naica, and Sistema Cheve, just to mention a few. This natural variety was the reason to establish an organization to represent all cavers of Mexico, here and around the world, and in 1990 the UMAE was born. The main objective of this union is to encourage and spread speleology in Mexico through the exploration and documentation of the subterranean environments in different aspects, scientific, technical, touristic, and sport.

UMAE supports the National Mexican Congress of Speleology. This event comes every two years and is manage by affiliate groups. The first congress was held in Mérida, Yucatán, on December 16–20, 1991, and operated by Espeleo-Grupo Yucatán, with the support of the Universidad Autónoma de Yucatán and the government of Yucatán. Since then, National Congresses have been held in different states, such as Guerrero (1993), Campeche (1995), Puebla (1998), Querétaro (2000), Chiapas (2003), Nuevo León (2005), Puebla (2007), Tabasco (2009), Puebla (2011), Yucatán (2013), Veracruz (2015), and Puebla (2017). As part of these congresses, we hold the General Assembly, where the Executive Committee and all the groups and honorary members discuss the situation and problems to be solved in relation to our speleology.

3—UMAE today. Almost thirty years have passed since its creation, and great progress was made, but there is more be done. At this moment, the Union is constituted of twenty-eight groups or associations

and more than 220 members. Also, UMAE is affiliated with the Union Internationale de Spéléologie (UIS) and the Federación Espeleológica de América Latina y del Caribe (FEALC). All members are working through different areas and making great progress in this science.

The UMAE also publishes *Mundos Subterráneos*, the official newsletter that talks about the activities of cavers from Mexico and any caver around the world. This publication has already published twenty-seven issues and is distributed to Zoological Records and UIS and FEALC libraries. [Available online on AMCS web site at http://www.mexicancaves.org/other/mundos.html.] UMAE is still coordinating the National Mexican Congress of Speleology, with a total of thirteen congresses so far, and is searching for the next host.

4—The 2017 National Mexican Congress of Speleology was held in Puebla, Mexico, in the town of Hueytamalco and was hosted by the Asociación de Espeleología del Estado de Puebla from February 3–6, 2017. Led by Alondra Fernández, president of the National Mexican Congress of Speleology Executive Committee 2017, and Alfredo Bravo Bonilla, president of Asociación de Espeleología del Estado de Puebla, more than two hundred cavers, students, teachers, and researchers from different states of Mexico and local people reunited. Not only cavers from Chiapas, Guerrero, Jalisco, Mexico City, Michoacán, Puebla, Quintana Roo, Sonora, Veracruz, and Yucatán gathered for this important event, but we also had the presence of cavers from different countries such as Brazil, Cuba, Japan, Puerto Rico, and United States. During the four days of the event, all participants shared their experiences about cave exploration and research. Over forty-five conferences and talks, workshops, and art and videos exhibits were held during this event, with topics of cave exploration, cave rescue, and new discoveries, as well as about biology, karstology, geology, conservation, and archaeological research.

The event also had excursions to the local caves. On this occasion, two caves in the Atepetaco Karst System, with different levels and structures, were selected depending on the experience of the crew. Cueva Las Cruces (show cave) and Cueva El Viento were the two caves where cavers spent a full day underground using different entrances and paths, sharing each other's knowledge and practicing their techniques. Last, but not less important, it included our General Assembly by UMAE, where new changes were decided on the future of the Mexican caves.

5—Coming to Mexico. Based on the UIS Code of Ethics for Cave Exploration and Science in Foreign Countries, the new Executive Committee invites any international caver (explorers or scientists) to follow the recommendations of UIS and to contact UMAE for any support and help with international activities in Mexico.

UMAE welcomes any cavers to Mexico. We are here to help any expedition that follows the UIS Code of Ethics for Cave Exploration and Science in Foreign Countries and our statements. We desire a collaborative participation between cavers from Mexico and any country, to learn from each other, and to make your stay easy. We also request sharing the information not only with us and the local cavers who accompanied you, but with the local authorities; and remember to add the acknowledgments in all related publications. For more information, visit our website www.umae.org.

6—Acknowledgements. Thanks to Adrián Miguel-Nieto, Alicia M. Dávila García, Fátima del Rosario Tec Pool, and Ana Aguilera García for comments and suggestions. Also, special thanks to Dr. José G. Palacios Vargas for the information for the sections History of UMAE and UMAE Today.

Source: Luis Omar Calva Pérez and Rogelio Hernández Vergara in *UIS Bulletin*, volume 59, number 2, pages 89–93, December 2017, http://www.uis-speleo.org/index.php?option=com_content&view=article&id=81&Itemid=408 (tinyurl.com/ydfsert5).

XIV Congreso Mexicano de Espeleología

Caves have made Mexico a great choice to visit and explore. International and national cavers have explored and still explore our country, contributing to new discoveries every year. Our country has several of the most outstanding caves in the world. Sistema Huautla, Sistema Sac Actun, Sótano de las Golondrinas, and Sistema Cheve, just to mention a few.

This natural variety was the reason to establish an organization to represent all cavers of Mexico, and in 1990 the Mexican Union of Speleological Associations (UMAE, in Spanish) was born. The main goals of UMAE are to encourage and spread the knowledge of Mexican speleology. Among its activities, UMAE supports the National Congress every two years, with a total of thirteen congresses so far, and next year's will be celebrated in the state of Sonora, for the first time in northwestern Mexico in such an iconic place as the Sonoran Desert.

The XIV Congreso Mexicano de Espeleología will be hosted by the Grupo Pionero Espeleológico de Sonora (gpes.sonora@gmail.com), led by Alejandra de la Torre, president of the Organizing Committee 2019 and coordinator with UMAE. The congress is scheduled to be held from February 1–4, 2019, in the city of Hermosillo, Sonora. The event will be held at Centro de las Artes of the University of Sonora.

We expect around 350 cavers from different states of Mexico and around the world. We will have at least eight special guest speakers on several topics and from other countries, also contributed talks, a poster section, workshops, art and video exhibitions, contests, field trips to caves, and more.

We will be glad to welcome all cavers in Sonora. Prepare your gear, your sunscreen and see you soon. For more information, visit our Facebook page Congreso Mexicano de Espeleología 2019.

Source: Alejandra de la Torre and Omar Calva, omarcalva13@gmail.com.


CNME
XIV
CONGRESO
NACIONAL
MEXICANO DE
ESPELEOLOGÍA
1-4 FEBRERO 2019
HERMOSILLO, SONORA
CENTRO DE LAS ARTES
UNIVERSIDAD DE SONORA
CONFERENCISTAS NACIONALES E INTERNACIONALES
EXCURSIONES / TALLERES / SPELEO-GAMES / CONCURSOS
EXHIBICIONES ARTÍSTICAS Y FOTOGRÁFICAS
Informes: @CNME2019
umae.org/congreso2019
cnme2019@gmail.com
UMAE
UES
HERMOSILLO

Mark Minton
June 2018
Length in meters

LONG CAVES OF MEXICO

For the first time, making this top-50 list requires being over 10 kilometers long.

1	Sistema Sac Actun (+Dos Ojos)	Quintana Roo	360459
2	Sistema Ox Bel Há	Quintana Roo	270174
3	Sistema Purificación	Tamaulipas	94889
4	Sistema K'oox Baal (+Tux Kupaxa)	Quintana Roo	94456
5	Sistema Huautla	Oaxaca	85000
6	Sistema Xunaan-Há (María Isabella, 3B) - Tixik K'una - Templo)	Quintana Roo	60445
7	Sistema Yok Ha' Hanil (Río Cristal, Pool Tunich, Río Secreto,....)	Quintana Roo	51911
8	Sistema Toh Há	Quintana Roo	47072
9	Sistema Cheve	Oaxaca	45949
10	Sistema Garra de Jaguar (Jaguar Claw)	Quintana Roo	44560
11	Cueva del Tecolote	Tamaulipas	40475
12	Sistema Cuetzalan (Chichicasapan+San Miguel)	Puebla	37676
13	Sistema Oztotl (Tepetzala)	Puebla	35000
14	Kijahe Xontjoa	Oaxaca	31373
15	Sistema Tepepa (Ehécatl+Niebla+Xalltégoxtli+Pozo 4)	Puebla	29401
16	Sistema Soconusco - Aire Fresco	Chiapas	27793
17	Sistema Sand Crack	Quintana Roo	26746
18	Sistema Nohoch Pek	Quintana Roo	25161
19	Sistema PonDeRosa (Pondazul, Edén)	Quintana Roo	22873
20	Sistema Coyolatl-Esperanza (TZ57)	Puebla	22221
21	Chjine Xjo (Xine Xao, Chine Xao)	Oaxaca	19515
21	Sistema Aerolito	Quintana Roo	18288
23	Sistema Nohoch Kai	Quintana Roo	15663
24	Entrada Caapechen (Cenote Manatí)	Quintana Roo	15638
25	Cueva de Alpazat	Puebla	15200
26	Sistema J2 (Ozto J2 (Faustino, Barbie) + Last Bash (Hija Puta))	Oaxaca	14840
27	Sistema Murena - Aak Kimin (Yal Ku Lagoon)	Quintana Roo	14269
28	Sistema Dos Pisos (Ka'p'el Nah)	Quintana Roo	14176
29	Sistema Doggi	Quintana Roo	13686
30	Sistema Sac Muul	Quintana Roo	13674
31	Sistema Caterpillar	Quintana Roo	13452
32	Sistema Camilo	Quintana Roo	13442
33	Sistema Zumpango (+ Sistema Texcoco)	Quintana Roo	12826
34	Sistema Chango Místico	Quintana Roo	12006
35	Pixan Bel	Quintana Roo	11899
36	Sistema Atepetaco (Miquizco + Viento + Mama Mia)	Puebla	11876
37	Sistema Sac Kai (Paachil Nah)	Quintana Roo	11844
38	Cueva Quebrada - Sistema Dos Coronas	Quintana Roo	11555
39	Entrada Boca Paila	Quintana Roo	11402
40	Sistema MOAC	Quintana Roo	11369
41	Sistema Cupul Ha	Quintana Roo	11153
41	Atlixicaya	Puebla	11120
43	Sistema Río La Venta	Chiapas	11020
44	Sistema San Andrés	Puebla	10988
45	Sistema Quijada de Jaguar (Jaguar Jaw)	Quintana Roo	10900
46	Cueva de la Mano	Oaxaca	10841
47	Sistema El Puente	Quintana Roo	10474
48	Actun Káua	Yucatán	10360
49	Sistema Zapote (Toucha-Há - Vaca Há)	Quintana Roo	10320
50	Grutas de Rancho Nuevo (San Cristóbal)	Chiapas	10218

Updates and corrections: Mark Minton, mminton@illinoisalumni.org

DEEP CAVES OF MEXICO

Mark Minton
June 2018
Depth in meters

1	Sistema Huautla	Oaxaca	1560
2	Sistema Cheve	Oaxaca	1488
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	Sistema Oztotl (Tepetzala)	Puebla	878
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+Tototzil 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 (TZ57)	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 Tío 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
June 2018
Depth in meters

DEEP PITS OF MEXICO

1	El Sótano (de El Barro)	Entrance drop	Querétaro	410
2	Sótano de las Golondrinas	Entrance drop	San Luis Potosí	376
3	Sótano de la Culebra	Entrance drop	Querétaro	336
4	El Zacatón (mostly underwater)	Entrance drop	Tamaulipas	335
5	Sótano de Tomasa Kiahua (Quiahua)	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	Sótano del Aire	Entrance drop	San Luis Potosí	233
15	Resumidero del Pozo Blanco	Entrance drop	Jalisco	233
17	Sistema Ocotempa (OC3)	Pozo Verde	Puebla	221
18	Live in Busch	Entrance drop	Oaxaca	220
18	Sistema Soconusco	Sima de la Pedrada	Chiapas	220
18	Sótano de Eladio Martínez (S-CHIC 1)	Entrance drop	Veracruz	220
18	Sótano de los Planos	Puits Tannant	Puebla	220
22	Sótano de los Coatimundis	Entrance drop	San Luis Potosí	219
23	Pozo del Cerro Grande	Entrance drop	Jalisco	218
24	Resumidero el Borbollón	Tiro Grande	San Luis Potosí	217
24	Sótano de Sendero	Entrance drop	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	Nita Gatziguin	Entrance drop	Oaxaca	200
33	Akemati-Akemasup	Gran Salto Acuatico y Barbaro	Puebla	200
33	Sistema de la Lucha	Entrance drop	Chiapas	200
33	Hard Rock Cave		Oaxaca	200
33	Fundillo de El Ocote	Entrance drop	Chiapas	200
33	Hueholvastempa	Entrance drop	Puebla	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
42	Sótano de Tepetlaxtli No. 1	Entrance drop	Puebla	190
42	Sótano de Alpupuluca	Entrance drop	Veracruz	190
42	Cueva de los Murmullos (Cueva del Tízar)	Tiro de los Murmullos	San Luis Potosí	190
45	Sótano de Puerto de los Lobos (Sótano Hondo)	Entrance drop	San Luis Potosí	189
46	Cuaubtempa	Pozo con Carne	Puebla	188
46	Hoya de la Luz	Entrance drop	San Luis Potosí	188
48	Sótano de Hermanos Peligrosos	Orgasmatron	Veracruz	186
49	Atlalaquía (Sótano) de Ahuihuitzcapa	Entrance drop	Veracruz	180
49	Sima de Veinte Casas	Entrance drop	Chiapas	180
49	Sistema Ocotempa (OC11)	Puits Analogue	Puebla	180
49	Sótano Cirque Cuauxipetstli	Entrance drop	Puebla	180
49	Croz 2	Entrance drop	Puebla	180

ARTICLES

Saknussemm's Well in Cueva Cheve, photographed by Chris Higgins during the 2017 Cheve Expedition.

2017 SISTEMA CHEVE EXPEDITION

Bill Stone

As of June of 2013 there were three known cave systems in northeastern Oaxaca's Sierra Juarez that had been explored to depths in excess of a kilometer since the discovery of the area by cave explorers in 1986: Cueva Cheve (1488 m), Cueva Charco (1286 m), and Sistema J2 (1229 m). It is known that the water entering these very extensive and geographically separated caves all leaves the mountain at the same location, a spring known as the Cueva de la Mano in the depths of the Santo Domingo gorge, some 2600 meters vertically below the highest known entrance of Cueva Cheve. Together, all of the known caves on the mountain presently comprise more than 80 kilometers of surveyed subterranean tunnels. The horizontal scale of this karst region, 20 kilometers long by 10 kilometers in width, is vast, and a cave system traversing that entire extent is almost certain to impose upon explorers scales of remoteness underground that have never before been confronted. If one were able to go into Cueva Cheve and reappear at the Cueva de la Mano it would be an epic journey without precedent. Underground travel is never in a straight line; caves weave east and west, up and down, creating traverse paths often four times that of straight line distance. Such a journey might be on the order of 60 to 80 kilometers in length and require a month or two underground to complete—if it could be completed, because at some point the logistical supply chain will break down. And, if achieved, it would signify the successful exploration of the world's deepest cave.

Despite the proven hydrological linkage confirmed by a dye trace in 1990, no one has yet come close to succeeding in following the water in person from the highest entrances to the springs. Less than 20 percent of the apparent puzzle is in place as surveyed, known terrain; the rest is an extrapolated guess. Cueva Charco notoriously ends at an enticing blue sump pool some 6 kilometers from its entrance in a nearly straight line. It would have been investigated by cave divers long ago, the last major exploration there having been in 2001, were it not for its diminutive cross-section. Cueva Charco is essentially a 6 kilometer-long crawl. The thorough investigation of Sistema J2 consumed nine years of time over the course of six significant international expeditions. It ended in 2013 beyond a 600-meter dive in Sump 4 beyond which the water entered into an air-filled canyon and then spilled into a 5-centimeter-wide crack that no human could ever follow.

Cueva Cheve had been last visited in 2003, when after eight weeks of work, four divers spent nineteen hours beyond Sump 1 , a 140-meter-long dive reaching a depth underwater of just 12 meters, and discovered a kilometer of new descending river canyon. That was followed by a 280-meter-long second dive and then, in air-filled passage on the downstream side, a breakdown collapse. The collapse was only inspected for a very brief time before the two-person lead team had to give up due to fatigue. Along the way out the survey party noted on the map the presence of several waterfalls that entered from high above the river passage between the sumps. These remained uninvestigated because the dives took place at the end of the expedition. Similarly, a labyrinth, euphemistically named Mazunte Beach, was discovered in a vertical fissure extending upward on the upstream side of Sump 1. Only a very tentative exploration of this zone was made before the expedition needed to leave the cave before the arrival of the rainy season.

During the years between 2003 and 2013, the discovery and exploration of Sistema J2 took precedence as a potentially more promising route into the core of the mountain in the hopes of discovering the central corridor that linked all of the major caves. With the end of work at J2, we had exhausted all of the obvious possibilities, and I began to think about what the next move should be in this game of 3D subterranean chess. From the 3D computer map that included the topography of the mountain and the known cave systems beneath it, it became apparent that most of the caves were developed on several levels, with each higher level representing a more ancient version of the cave. Cueva Cheve has three pronounced levels, the currently active river canyon, a labyrinthine middle layer approximately 40 to 80 meters above the river that often foreshadows difficult and complicated going, especially with a heavy haul sack, and a "fossil" or ancient, dry high level approximately 80 to 120 meters above the river. This latter level produced tunnels of extraordinary size, in some cases 20 to 30 meters wide by 20 to 40 meters tall, usually floored by rolling hills of collapsed rubble under arched ceilings of solid rock overhead. Cavers have a name for such large passage: *borehole*. It is the pursuit of borehole that serves as cheese to a mouse in motivating otherwise stolid individuals to perform extraordinary feats of subterranean exploration.

The tunnels we had discovered in Cheve in 2003 had been at the active river level. But there were a number of waterfalls entering this

stoneaerospace001@gmail.com

tunnel through the roof of the canyon, which was up to 20 meters tall in places. Waterfalls in a deep cave system, and especially in a fault-controlled cave like Cueva Cheve, are like drills: they bore through all layers of rock indiscriminately and patiently over millions of years. Thus, in theory, if one were to scale those waterfalls there was a good chance of finding upper-level boreholes. With J2 played out, scaling the waterfalls entering the river canyon between Sumps 1 and 2 in Cheve seemed like the last resort to continuing exploration in Sistema Cheve. It would require setting up a long-term presence beyond Sump 1 to effectively investigate the collapse beyond Sump 2 and to scale the waterfalls. A further remote bivouac would be needed above Sump 1 to investigate the labyrinth at Mazunte Beach.

During the years following the 2013 J2 expedition I had a number of discussions with Marcin Gala in Warsaw regarding likely candidates for the dive team that would work from Camp 4 in Cheve when the return took place. We both agreed that a four-person team should be stationed there for safety and efficiency of the operation, and we also knew that they would have to be very good multidisciplinary cave divers, aid climbers, vertical cavers, and cartographers. There were plenty of excellent technical divers in the world, but combining all of the requirements together limited the field considerably.

Over the next three years we identified thirteen candidates for the dive team: Oscar Berrones (Texas), James Brown (Texas), Witek Hoffman (Poland), Tomasz Kochanowicz (Canada), Jon Lillestolen (Virginia), Artur Nowak (Poland), Yuri Schwartz (Russia), Morgan Smith (Texas), Kasia Turzańska (Poland), Victor Ursu (Romania), Nick Vieira (Canada), Marcin, and me. Significant back stories could be written about each of these individuals, but, to summarize, each was extraordinarily talented and through various prior expeditions and projects had risen to prominence in the very esoteric and dangerous business of cave diving at the bottom of deep cave systems.

During 2015 and the early part of 2016 Brown, Hoffman, Gala, and I designed a standard expedition diving system that utilized common lightweight components based on 500-bar pressure carbon-epoxy tanks and allowed for standard open circuit side-mount cave diving procedures to be used, but that also could be rapidly converted into a fully closed circuit rebreather based on the Poseidon Se7eN system. Of the above thirteen, five individuals (Brown, Hoffman, Lillestolen, Gala, and I) were cross trained in closed-circuit diving procedures. This subgroup would be responsible for the majority of the equipment transport through Sump 1 to establish Camp 4, since the rebreathers were dramatically more efficient in their use of gas. Rehearsals for the divers were conducted over the latter half of 2016 and in January 2017 in Sardinia and in Texas, with simulated missions through Sump 1. The primary purpose of these simulations was to obtain an estimate of the maximum gas usage for each individual making an open-circuit round trip through Sump 1. Based on these simulations we determined that the entire project could be safely accomplished with pre-filled carbon tanks, including twenty-three tanks of compressed air and ten of oxygen to drive the rebreathers, and that we could leave the compressors in Texas. During the actual expedition these estimates proved surprisingly accurate: only eight 9-liter air tanks (at 500 bar pressure) and four 4.7-liter oxygen tanks (at 200 bar) were transported to Sump 1 for all the underwater operations conducted, which included a large number of equipment transport runs through Sumps 1 and 2 and nine divers working at various times from Camp 4.

The remaining 43 team members were an all-star cast of expeditionary vertical cavers from nine countries: Canada, Mexico, Poland, Romania, Russia, Slovenia, Sweden, Switzerland, and the US. Like the divers, they had been carefully recruited based on recommendations of prominent explorers in those respective countries. Their job was initially to rig the cave, establish the system of underground camps, run a phone line to all camps, stock the camps with food and equipment, and transport the significant amount of diving gear to outfit four divers for travel through Sump 1. Once that system was set up, there were secondary objectives to address, including aid climbs at the Mazunte Beach labyrinth. As of February of 2017 the underground logistics chain looked like tthe table below.The times listed are for individuals acclimated to the elevation (basecamp was at 2632 meters), familiar with the fully rigged route, and carrying a light pack. Times could be much longer for newly arrived personnel and those carrying heavier loads, particularly on the way up. The times beyond Sump 1 do not include the four to six hours needed to kit up, make the 140-meter-long dive, and de-kit on the downstream side. Camp 4 was located approximately halfway between Sump 1 and Sump 2. In general it was a hard day's trip from the entrance to Camp 2, an even longer trip from Camp 2 to Camp 3, and a full day to make a round trip from Camp 3 to Sump 1 and conduct useful work there. Camp 1 was used as an early rigging base, as a bailout option for those making their first deep trips into the cave and coming out from Camp 2, and

Cueva Cheve Traverse Segments	Length (meters)	Time (hours)
Entrance to Camp 1	1183	Down 1 to 3, Up 2 to 5
Camp 1 to Camp 2	2338	Down 3 to 5, Up 4 to 8
Camp 2 to Camp 3	2892	Down 5 to 10, Up 5 to 10
Camp 3 to Sump 1	1090	Down 2 to 3, Up 2 to 3
Sump 1 to end	1239	Down 1 to 2, Up 1 to 2
Total Length	8742	

as a derig base of operations at the end of the project.

From February 15 through May 8, 2017, an international team of fifty-six people from eight countries took part in this return expedition to Cueva Cheve in northeastern Oaxaca, Mexico. With a team of fifty-six total and with around thirty-five on the mountain at any given time, it is difficult to provide a clear narrative, because there were so many groups doing so many different things simultaneously. On any given day up to five teams might be underground in different locations within Cueva Cheve, each with significantly different objectives that day, but with all moving in concert to enable exploration at the farthest limits of the cave by whoever was on the lead team at that time. With the phone system installed, it was standard practice for all camps to call in at 9 a.m. and 9 p.m. daily to receive instructions from basecamp as to priorities as well as to report shortages at the camps and the status of exploration.

In addition, extensive surface reconnaissance took place in 2017 in search of new entrances that might provide an alternative route into the core of the mountain, and there were several notable forays in this regard, with one changing the course of the expedition. Below I will attempt to capture the high points of the siege assault on Cheve, while following up with a story of one particularly surprising recon discovery.

In late January 2017 Nikki Green came to Austin and spent a week purchasing and vacuum-compressing close to a ton of dried high-energy-density food for the underground camps in Cheve. More than twice that amount would be purchased in Oaxaca City and on the mountain in the towns of Cuicatlán and Concepcion Pápalo over the course of three months. While basecamp fare was a standard mix of dried food and some occasional fresh vegetables from infrequent trips to Pápalo and Cuicatlán, the food for underground camps had been carefully chosen for high protein and fat content, as experience in the past had taught us that an individual carrying a twenty-kilogram pack and working twelve to fourteen hours a day on rope underground would be burning well over five thousand calories a day. If this was not addressed carefully, it was easy to burn off all body fat and begin consuming muscle tissue, and he could actually end the expedition in worse physical condition, when logic said that he should be getting harder from all the workout. I had conversations on this subject with Lance Armstrong's nutritionist and many others over the years, and the first thing we did was to ditch traditional freeze-dried meals and begin crafting our own. This year's refined recipes looked like this:

Breakfast Mix

3 parts freeze-dried bulk scrambled eggs
2 parts freeze-dried bulk refried beans
2 parts dried powdered institutional potatoes
2 parts nuts (cashews)
1 part bulk pre-cooked diced bacon

Dinner Mix

3 parts raman or other fast-cook noodles for texture
2 parts dried powdered institutional potatoes
2 parts bulk dried broccoli-cheese soup
1 part bulk pre-cooked diced bacon (or jerky)
1 part nuts (cashews)

Initially these were mixed in stew pots, but as the expedition began to fully kick in with more personnel underground than in basecamp, we bulk-mixed it in eighty-liter tubs and then compressed it into four-liter Nalgene bottles for transport through the cave. This basic regimen was supplemented by a generous supply of durable cheese (mainly aged cheddar) and hard sausage, which also were the primary ingredients packed for day-travel food when not in camp. Additionally the underground camps were stocked with energy bars, chocolate, jerky, nuts, dried fruit, coffee, cocoa, tea, and a variety of Tang in flavors only available in Mexico, such as. horchata, mango, and tamarindo. Despite these preparations several team members still lost close to fifteen kilograms of weight over the course of the expedition.

Lead team members began arriving in Austin on February 15, and over the course of the following week four heavily loaded pickup trucks made their way to southern Mexico with team members John Harman, Vickie Siegel, Adam Byrd, Kristen Anderson, Fernando Hernández, Jon Lillestolen, James Brown, and me. A fifth pickup-load of equipment and food, driven by Oscar Berrones and Jordan Toles, arrived in basecamp at the end of March. In addition, Siegel made an extraordinary second round trip from southern Mexico to Texas and back to resupply basecamp. The total equipment and food load was in excess of four tons.

In Oaxaca City we met Wicho Díaz, our liaison to the Oaxacan government, and gave a lecture at City Hall on February 23. By February 24 all of the lead team was at basecamp in Llano Cheve. Two days later I gave a public lecture to some three hundred residents of the small town of Concepcion Pápalo, 15 kilometers away and the nearest outpost of civilization on the mountain. The questions asked afterwards were telling of a populace, who not only knew about Cueva Cheve but also held little in the way of fears about caves that is common in other parts of Oaxaca. Indeed, over the following three months large numbers of visitors from Pápalo and other towns on the mountain visited basecamp, not because we were there, but because with increasingly accessible transportation on the mountain it had become popular to picnic in Llano Cheve and popular for outsiders who tour the cave entrance, usually with an ecotourism guide from Pápalo, although none ever went farther than the top of the first rope drop.

With the permitting process resolved, we set about our work. Mike Frazier, Witek Hoffman, and others began rigging the cave and by March 1 had reached

Yuri Schwartz and Tomasz Kochanowicz at the entrance to Sump 1. *Kasia Biernacka* / kasiabiernacka.com.

CUEVA

The entrance passage to Cueva Cheve. *Chris Higgins.*

Jola Sikorska on the Flowstone Drop. *Kasia Biernacka.*

Morgan Smith rappels into Saknussem's Well. *Kasia Biernacka.*

CHEVE

Jordan Toles and Oscar Berrones in the Salmon Ladders, –650 meters. *Chris Higgins.*

Mimi Alexander and Yuri Schwartz in the Hall of the Restless Giants. *Kasia Biernacka.*

Saknussemm's Well at the –500-meter level. On March 2 Frazier was in the lead, rigging the Piston, one of the iconic pitches in the Turbines section of the cave at –700 meters, a very wet, windy, and hypothermic canyon,when a foothold gave way and he shock-loaded his right side in catching the fall, either severely pulling a muscle or breaking a few ribs in the process. Hoffman sprinted for help at Camp 1 after stabilizing Frazier on a sloping rock above the Turbines. A small team including Siegel, who is an EMT, and I descended to assist. Following a day of rest Frazier was able to climb out on his own to basecamp, much to the chagrin of the rescuers who were having a difficult time keeping up with him. Marcin Gala and Nick Vieira took over the rigging task and by March 10 had established Camp 2 and continued on 2 kilometers through the Low Rider Parkway to the beginning of the Swim Gym at the 1-kilometer depth level.

On March 12 a team of Nathan Roser, Adrián Miguel-Nieto, Jared Habiak, Rob Stone, Fernando Hernández, and I entered the cave for what would prove to be a two-week stay to complete the rigging to the sump. We were later joined in Camp 2 by Matt Covington and Katie Graham. By this time the entire team was mobilized, and there were multiple parties working throughout the cave, first moving in additional rigging tackle and food to fuel our lead team, and later to stock Camp 2 and begin moving in diving equipment. A general leapfrog system of depots was created at the bottom of Saknussemm's Well, at Camp 2, and at the end of the Hall of Restless Giants halfway to Camp 3. The location of this latter depot bounced about, its farthest point being the beginning of the Black Borehole, as teams operating out of Camp 2 and Camp 3 sought to balance the distance and time each had to travel to make a handoff of equipment. The rigging team initially bivouacked in hammocks at the end of HORG, and a temporary depot was established there while we moved on through the Black Borehole, the Looking Glass breakdown, and eventually the Arne Saknussemm Borehole on the way to Camp 3. In the process of doing this we ran out of rope twice on the way to Camp 3 and no less than three times on the way to the sump, despite having brought 3400 meters of new 9-millimeter Cancord rope. It was only thanks to the unexpected discovery of a substantial stockpile of 11-millimeter rope, tough as cable but suitable for rigging traverses,that had been left in the cave by other expeditions at the end of the 1990s that we were able to finally reach Sump 1 on March 21.

All during this effort Hernández and Graham had been running a phone line to the sump. The phone system was a single 26-gauge urethane-insulated multi-strand wire implementation of the original Australian Michie phone redesigned and improved by Dave Larson; it used Earth-return for the ground and eliminated half the weight of a traditional two-wire telephone system. It was possible to tap into the

Cheve Surprise Stream 2017
Salón de las Maravillas

Surprise Stream is a major infeeder that joins the Cheve stream not far inside the main entrance. While surveying upstream in that passage back in 1990 I climbed to an upper level and found a paleo borehole. One end of the borehole issued from a still higher level that would take a bolt climb to reach, but was never pursued as far as I knew. We finally decided to check it out in 2017.

Yvonne Droms and I did a recon trip to check the ropes and found them in surprisingly good shape. The main waterfall drop had the rope tied back to one side, which protected it during flood pulses. I had forgotten about the tremendous airflow, which is especially noticeable at a pinch above the waterfall. At the lead we found some webbing and a dynamic rope, but no evidence that it had been climbed. Apparently someone brought in gear to do it, but never followed through. It's amazing that such a good lead only 30 minutes into the cave sat idle for 27 years.

James Brown, Yvonne Droms, Adrián Miguel-Nieto and I returned a few days later, prepared to climb and survey. James and Yvonne conducted a survey back to a known station to provide a tie-in while Adrián belayed and I climbed. Bolts held well in spite of being in flowstone and I was soon at the top. I was in big passage, but could not go far because of a large hole where the floor had collapsed. The flowstone floor apparently covered loose fill which had been washed away, leaving dangerously thin ledges around the void.

While James and Yvonne brought up the survey, Adrián led a traverse along the right wall that got around the main void, but he soon encountered another. We used all of our rope, including the dynamic, to rig a series of traverses that went through a formation partition and climbed again to solid ground.

When we got off rope we were in large, horizontal passage 10 to 20 meters wide with massive formations. We called it Salón de las Maravillas. This passage went over a hundred meters before encountering massive breakdown. Along the way we passed another spot where the floor had collapsed, but we were able to climb around it. There were interesting formations on the floor in that area that looked like vermiculations and gypsum blisters.

The passage terminated beyond the breakdown at our level, although there was a dome that could be climbed in addition to lower levels that were not fully explored. Given the good airflow, I suspect that more passage will be relatively easily accessible. This was the first survey of the 2017 expedition and netted 142 meters of new survey. A photo trip followed ours, but as far as I know no additional exploration was done.—Mark Minton

system anywhere, which was put to good use on many occasions. With this system in place, Marcin Gala, now running basecamp, was able to coordinate with all of the underground camps and to the sump. By March 25 all dive equipment had arrived, been sorted, and hung at Sump 1 from gear ropes rigged to rock bolts across the river. It had taken nearly a month to prepare the cave for new exploration.

On March 28 the first push team of Lillestolen, Hoffman, Vieira, and Artur Nowak reached Camp 3. Lillestolen and Hoffman set up a bivouac with hammocks over the river entering Sump 1 on March 30 and remained camped there for two days conducting rebreather dives to place a 9-millimeter rope through Sump 1 as a haul line and, later, a phone line through the sump. Hoffman continued hauling equipment bags with the Poseidon rebreathers through the sump to a depot on the downstream side. The other divers and the remaining support team at Camp 3 continued to haul equipment to the sump for establishing Camp 4. By April 1 all equipment was through and all four divers moved into Camp 4. There is no dry land between Sumps 1 and 2, but Lillestolen located a 2-meter-wide section of the canyon where a prominent flat rock projected above the water in the middle of the stream to serve as a kitchen rock. They set hammocks from rock bolts in the walls and rigged the hammocks, Hennessy X-large ultralights, diagonally across the passage. A slip getting in or out meant a dunking in the river, and the roar of the water was constant. All of the divers used their Fourth Element Arctic drysuit fleece for in-camp living garments when not caving. Regular caving shell suits and base layer fleece went through Sump 1 wet inside the haul bags. We used four-liter and two-liter Nalgene bottles for all food, instruments, and clothing that had to get through dry. Everything arrived intact and the phone worked. It was eerie to be at basecamp receiving phone calls from this exceedingly remote place.

For the next ten days the main push of the expedition took place out of Camp 4. All of the waterfall domes shown on the 2003 map were scaled, mapped, and thoroughly pushed. Standard aid gear included PMI dynamic ropes, Petzl quick-draws, Yates etriers and adjustable daisys, DFS stainless rock bolts, ClimbTech hangers, and Hilti 36-volt hammer drills. A two-person team could easily scale a 30-meter shaft in a day. In each case what was hoped to be an open dome leading up to borehole eventually became an impassably tight fissure. This was the first hint that things might not go as we had hoped. The divers moved on to Plan B, which was for all four to transport rebreathers to the beginning of Sump 2 and for Lillestolen and Hoffman to recheck the tunnel collapses that began on the other side of that 280-meter-long dive. A total of two pushes were made beyond Sump 2 during which 278 meters of new passage was mapped. But this was largely passage among the stream boulders; no clear, open continuation to larger air filled tunnel was discovered. And there was no airflow to suggest that this section of the cave connected to something deeper. The only surprise was a discovery at the head of Sump 2 that had somehow gone unnoticed in 2003. There was an underwater spring, distinct from the main Cheve river, that was feeding water into the head of Sump 2. Hoffman used a Se7eN rebreather to explore it downward to a depth of 16 meters, going upstream, to where a fallen rock blocked the tunnel. A clear, blue void ran upstream beyond the boulder. This distraction did produce one unanticipated result; the underwater blockage in this upstream spring was 4 meters deeper than the previous deepest point in the cave halfway through Sump 2, thus increasing the depth to 1488 meters. This was of little consolation, given that more than 1100 meters of additional depth lay somewhere beyond where the water had poured freely into the impassable boulder pile on the other side of Sump 2.

On April 9, per prior agreement, Vieira and Nowak rotated out of Camp 4. The replacement crew was Yuri Schwartz and Tomasz Kochanowicz. They took over aid-climbs in the last few remaining high leads between Sumps 1 and 2. On April 11, following the final rebreather push to the other side of Sump 2, Lillestolen and Hoffman also rotated back to Camp 3, leaving Camp 4 with a two-person crew. Like the other leads in the ceiling, everything investigated by Schwartz and Kochanowicz ended in increasingly tight fissures. They dived out from Camp 4 on April 14, but there remained a substantial amount of equipment that needed to be retrieved from Camp 4. We had been keeping close track of the tank pressures all along, and there was sufficient gas remaining to permit three divers, Oscar Berrones, Kasia Turzańska, and Morgan Smith, to make equipment-removal dives to Camp 4 and back. With their safe return, diving and climbing operations beyond Sump 1 were brought to a close, and there began a two-week marathon effort to take all of the diving equipment out of the cave. In all, 678 meters of new cave were explored and mapped beyond Sump 1 in 2017 with 278 meters of that in the breakdown pile beyond Sump 2.

Meanwhile on April 5, a six-person team of Morgan Smith, Mimi Alexander, Kasia Biernacka, Bev Shade, Vickie Siegel, and me entered the cave intending to establish a bivouac at the Mazunte Beach labyrinth. The area upstream of this zone had already been extensively pushed by Katie Graham, Jared Habiak, Rob Stone, Klemen Mihalič, and Nathan Roser in a series of up-trending tunnels and aid-climbs that carried small drafts of air but eventually ended in impassable cracks. But the labyrinth above Sump 1 appeared to be the last stand for new cave in Cueva Cheve. Graham and crew were on their way out of the cave when Siegel tore an ACL ligament in her left knee while hauling gear through Sumplands, about an hour above Camp 2. I retrieved two sets of bivouac gear from Camp 2 while reporting the emergency to basecamp. Two of the haul-team carrying resupplies to the Saknussemm Borehole depot, Kasia Turzańska and Jordan Toles, had checked in with basecamp via the phone system at Camp 1 on their way down and

were apprised of the accident, and they picked up emergency camp equipment from Camp 1 and headed down to Sumplands. Turzańska was an emergency room physician, and between her and Siegel, an EMT, they diagnosed the problem and decided to wait a day camped at Sumplands before attempting an evacuation. As with Mike Frazier earlier, we were fortunate that Siegel was able to self-rescue with some assistance from Habiak and Mihalič up to Camp 1 and me from there to basecamp. The entire exit took two days from a depth of 740 meters, with Siegel climbing out on her own using her one good leg.

The four remaining members of the Mazunte Beach team continued on and were able to establish a hanging camp 60 meters vertically above Sump 1 with four hammocks bolted close together with vertical shafts on both sides of the cluster and a small flat space for a kitchen under the hammocks. Over the course of the next six days this group methodically pushed northward, higher into the labyrinth, and eventually well out over Sump 1. Several people traded in and out with the bivy team during this week, including Corey Hackley, Nathan Roser, and Jordan Toles. One unexpected result of this was that while forcing a tight fissure downward the team dropped through the ceiling of an airbell 50 meters into Sump 1. They had been hoping to completely bypass Sump 1 and surprise the divers by inhabiting their hammocks at Camp 4. The connection to the airbell, however, was not of much practical value, as it was far easier to dive out from there to the upstream side of Sump 1. Other than this odd success, the rest of the work had been grim, wet, muddy, cold, and unproductive. Clearly something was going on with the geology in this region that didn't match our model for the cave. We knew the water went down through the sumps, but the wind had been lost not far beyond Camp 3, and the wind was the one telltale clue that never lied. If there was wind then there was significant cave volume beyond, because it was barometric-pressure differences that drove the wind, and for that to have an effect there had to be a very large storage volume beyond the point where the wind was being detected. There was no wind anywhere in the Wet Dreams canyon other than that stirred up by waterfalls and zero wind beyond Sump 1. We had missed something somewhere.

The Mazunte Beach bivy was temporarily abandoned from April 17 to 20 while diving equipment was moved upward toward Camp 2 by a large crew consisting of Vieira, Hackley, Schwartz, Smith, Turzańska, and Roser working from Camp 3 and Berrones, Toles, and Satterfield from Camp 2. With an enormous pile of dive equipment now at the Hall of the Restless Giants depot, Hackley, Smith, and Schwartz requested additional supplies for a further week's push from Camp 3 in a desperate last-ditch search for a dry bypass to the sumps. On April 21 Hackley and Smith returned to Mazunte Beach for three days and they methodically scaled the largest waterfall in Wet Dreams to a height of 126 meters above the stream, where they discovered a small chamber with no apparent way onward. Somehow we had missed the expected upper-level cave. Or maybe it had never been there and we had hit an extraordinarily hard layer of limestone. Roser subsequently descended to help them derig the camp and the ropes in Wet Dreams canyon back to Camp 3.

On April 18 a three-person team of Marcin Gala, Hoffman, and Mihalič, descended to Camp 2 to begin the toughest stage of moving the dive gear out the final 5 kilometers and 800 vertical meters to the surface. Their self-styled Team Motivation had been relentlessly moving equipment for three days when Lillestolen and I dropped in for reinforcement on April 20. That same night Vieira joined the haul team coming up from Camp 3, and the assemblage became a juggernaut. For the next three days we moved a staggering pile of equipment upward. Vieira, Hoffman, and the others had discovered that they could bypass half the ropes in the cold, windy Salmon Ladders section below the Saknussemm Borehole by swimming the deep pools and climbing through the shorter waterfalls that we had carefully rigged around at the beginning of the expedition. Doing so, they cut transit times in half and were able to move much more equipment. But they were also pushing themselves into hypothermia. Vieira is one of the strongest cavers I have ever met. So I was surprised to see him at Camp 2 one night, hunched over holding his knees and shaking. He had asked for some "Vitamin I" (ibuprofen), as his knees had been hurting from the endless impacts from moving through the cave with heavy loads. Everyone gets ground down by this place, even superheroes.

On April 21 Hackley and Smith descended to the Mazunte Beach bivy for one last push on the big waterfall. Along the descent from Camp 3 they checked out one last hunch before resigning themselves to the waterfall climb. There was a small canyon passage that joined the main stream. It was not carrying water, and it was headed in the direction opposite that we needed to go. And there was no air. There was no good reason to go up this tunnel. But they did anyway and soon encountered a series of seriously exposed climbs leading steeply upward. They free-climbed four pitches up 55 meters vertically and were suddenly confronted with something completely unexpected: they had intersected a bedding-plane fault—a wide, horizontal fissure only a meter and a half tall—that was headed due east and descending. In a vertical cave, intuition would have had the climbs continue up an endless series of vertical shafts that ultimately would lead up to a nameless, obscure sinkhole on the surface over 1600 meters above. But that didn't happen. The rising tunnel had simply stopped going up and reversed direction. Hydrogeologists refer to this type of feature as a drainage divide. In this particular case it could also be called a phreatic lift tube. Hackley and Smith began descending, and as they did so they began noticing that other tunnels were joining the one they were in, like the exhaust manifold on a car engine. And each of these new tunnels was bringing something: wind. By the time they

got to their exploration limit there was a forcible breeze blowing in. That night by phone they informed Yuri Schwartz of their discovery and encouraged him to investigate further. Schwartz, along with all the others remaining at Camp 3, was still hauling gear to the HORG depot.

On April 23 Schwartz, Kasia Biernacka, and Nathan Roser returned to the curious passage Hackley had told them of by phone the previous night. Schwartz immediately decided to rig the first two pitches with rope, and they proceeded on to a restriction where the wind was now blowing ferociously. I was writing in my log at Camp 2 that night when the 9 p.m. phone tag-up time came. Yuri was on the line requesting an unusual direct camp to camp call in a few minutes. When I got on he said, "Bill, you have to come down here and see this lead." I was skeptical. These were desperate men trying to save a sinking ship. Not long before the phone call I had written in my log that quite likely the expedition was a complete failure and that we had wasted three months of our time, unless you counted getting in shape physically. Pulling a rabbit out of the hat at the eleventh hour was the stuff of movies, not expeditionary reality. "Is it really that good ?" I queried. He reiterated, "You need to come down here."

As we were kitting up at Camp 2 the following day I mentioned to Lillestolen that I had been having trouble the previous day tethering a haul-sack while climbing the Fuel Injector Bypass pitch during our final gear haul to the the Saknussemm Borehole. The harness D-ring was flopping up and down on each cycle, costing me energy. "The damn harness buckle must be slipping," I said to no one in particular, and I set about taking the harness off to tighten the strap. Lillestolen interrupted, "Those buckles never loosen on an MTDE harness." "You have another theory?" I asked. "Yeah," Jon said laughing, "You've lost weight!" So had we all. Later that afternoon there was a moment where everyone from Camp 3 and Camp 2 who was still in the cave met at the Hall of the Restless Giants depot, exchanged handshakes, and headed out with the last of the outbound equipment . . . except for Hackley, Smith, and me. We picked out a few days food at the depot and made our way back to Camp 3. Everyone else was headed completely out of the cave. As the three of us, soon to be the sole denizens of Sistema Cheve, sat cooking dinner that night I looked at Hackley and said, "This had better be worth it."

The following day found the three of us making our way up the mystery tunnel. There was something very strange about it that I could not place. Someone had been here

An Unexpected Discovery at the Bottom of Cheve

A team of Corey Hackley, Morgan Smith, Kasia Turzańska, Nathan Roser, and me were stationed at Camp 3 from April 13 till April 23, 2017, during the Cheve expedition. We were tasked with exploration of the lower levels of the cave and helping Nick Vieira and Matt Vinzant remove the diving equipment from Sump 1 upward toward Camp 2. Nick arrived around April 14 from basecamp, and he brought with him some computer line-plots of the surveys for the lower parts of the cave that we had requested from the surface. Looking at the line plots, Corey and I noticed that the ZB survey seemed to extend beyond the terminal breakdown at the downstream end of the AS borehole. But from the line plots it was hard to gauge at what depth the ZB passage was situated, so we got only moderately excited and initially concentrated on potential leads closer to Camp 3.

It was not until April 19, when on their way down to Mazunte Beach, that Corey and Morgan located the obscure ZB passage and checked how it ends. During the evening telephone communication between Camp 3 and the Mazunte Beach camp, Corey described to me what they had seen and urged me to check the ZB lead for myself. He also advised us to bring the bolt-climbing gear and static rope to rig the exposed chimneys that they boldly (or foolishly) had free-climbed.

The next day, April 20, Kasia, Nathan, and I went to the ZB area. I used two bolts to climb the top part of the first chimney and rigged both chimneys for subsequent descents and ascents. Nathan and I inspected the end of the ZB passage, while Kasia waited halfway back to the main tunnel. Both Nathan and I noticed very strong airflow sucking into a constriction. I felt that it would take a bit of work to get through. Nathan thought it was hopeless. On March 21 Kasia and I shuttled the gear from Camp 3 to the Flowstone Drop depot halfway to Camp 2 while Nathan helped Corey and Morgan derig the Mazunte Beach camp. The same day Adrián Miguel-Nieto and his friend Claudio Cruz García arrived from the surface with a food resupply.

On April 23 in the morning call to Camp 2, Corey, Morgan and I suggested to Bill Stone, the expedition leader, that he extend the stay for the team at Camp 3. We requested additional supplies from the surface for a push on the ZB lead. After extended negotiations over the phone with Bill, the plan was approved. The same day Corey and I went to ZB and spent a day moving loose rocks. We made much better progress than I expected. While we were digging, Morgan, Kasia, Adrián, Claudio, and Nathan shuttled gear from Camp 3 to the Flowstone Drop depot. On April 24 Kasia, Nathan, Adrián, Claudio, and I ascended to Camp 2 with the load of gear. Corey and Morgan accompanied us to the Flowstone Drop depot, where they met with Bill, who had come down from Camp 2 with additional supplies to join the digging crew. On March 25 and 26 Bill, Corey and Morgan worked at the ZB constriction. Although they made significant progress, one or two more days' effort will likely be required to get through the initial constriction. There is an echo in the distance.—*Yuri Schwartz*.

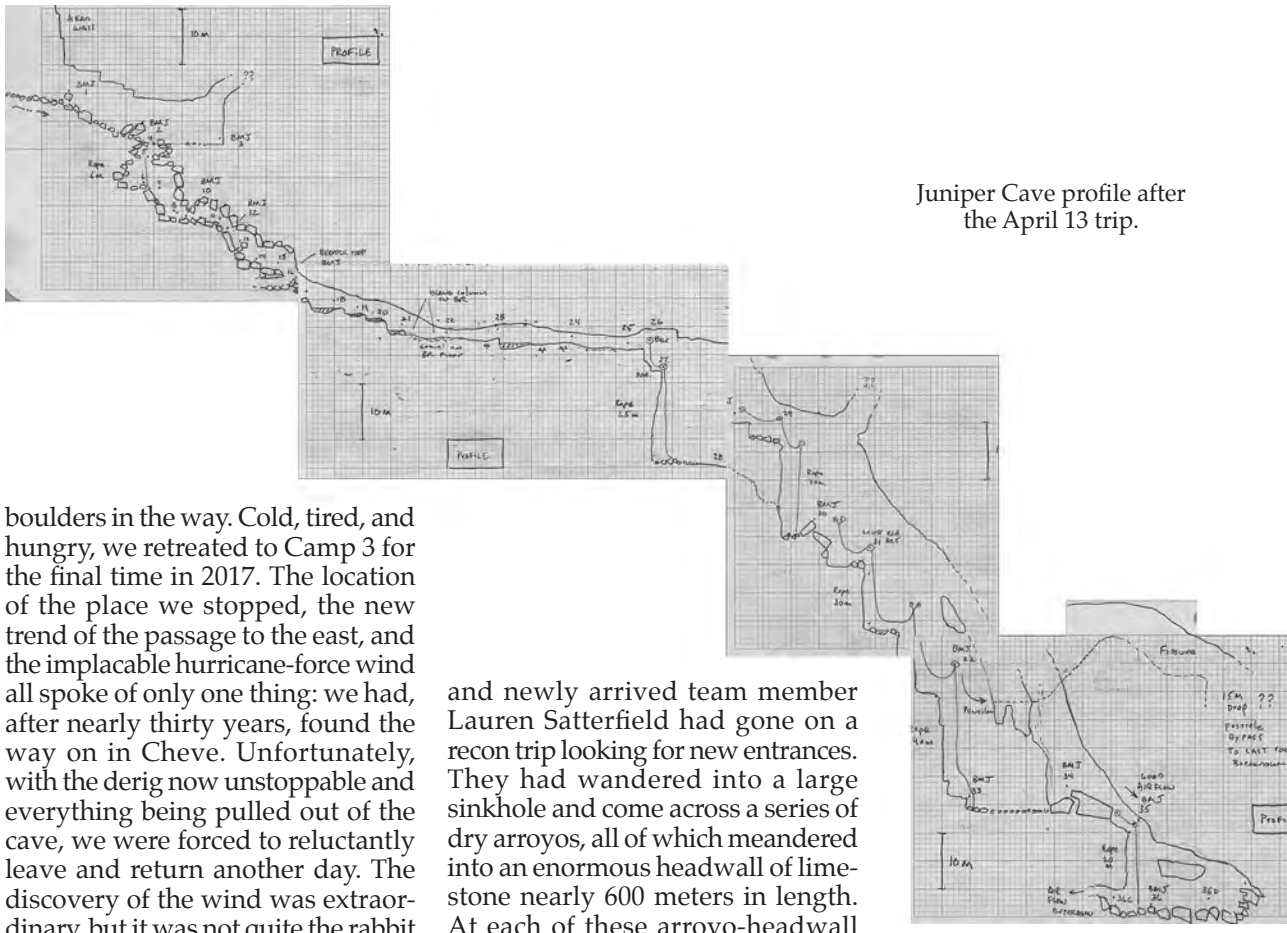
before, at least to parts of this tunnel. There were survey markers sparsely scattered here and there that had survived a very long time, as they were made with a carbide lamp. These were not from our team this year. As we got to the first rope that Yuri had rigged I looked up at the towering, exposed, overhung climb that had been done. It was standard operating practice when doing aid-climbs in deep caves to leave a fixed rappel line so that the next party did not have to do a dangerous recreation of the initial ascent. Now there were two ropes in place insisted upon by Yuri. But above those were two more unprotected pitches. I looked ruefully up a 15-meter overhung shaft and shook my head. Corey said, "It's not as bad as it looks. It's feature rich,"as if the presence of a handhold or two justified the exposure. A minor slip down here could turn into a major international rescue. It was now my turn to insist that we place two more fixed ropes for safety. As I climbed through the lift tube and began descending the fault plane I concluded that whoever originally climbed this stuff must have been mad men; not only had they free-climbed these shafts without rope, they had down-climbed them without rope. It was not until ten days later, back in basecamp, when I had a chance to look up the twenty-seven-year-old survey data. And there at the top of the file I found the original mad men listed. The first name on the list was Bill Stone. Hmmm. Three decades has a way of changing one's perspective on things, not to mention memory.

Despite having been the first people to this obscure place a long time ago, our team then had not been thorough. We had not seen everything, as Corey and Morgan had proven. Corey was living up to his reputation as a speleo bloodhound. And as we came to one obvious junction after another the wind continually picked up. I was increasingly amazed at the force of the breeze. Something very important was happening here. The rock was white, mostly crystalline, nearly marble. It had been tortured, ripped as only sections of this cave do when orogeny forces the cave to go a way it doesn't want to. When we reached the limit of exploration the wind had increased to gale force. Although the place did not have any dripping water or waterfall spray, it was clear that hypothermia was going to be an issue. Survey flagging held out was blowing horizontally and flapping wildly. As soon as we stopped moving the chill set in. The focus of the manifold was not a large tunnel, but more of a venturi, and it was choked with boulders forced in by some ancient flood event. We set about removing these, and ten hours later we could hear an echo in the distance. The wind continued, unabated. But there were still three

2017 Cheve Expedition Roster

Mimi Alexander (USA)
Kristen Anderson (USA)
Ryan Baker (USA)
Oscar Berrones (Mexico) *3*
Kasia Biernacka (Poland)
James Brown (USA) *4*
Adam Byrd (USA)
Sarah Cline (USA)
Matt Covington (USA)
Claudio Cruz García (Mexico)
Wicho Díaz (Mexico)
Yvonne Droms Switzerland
Mike Frazier (USA)
Marcin Gala (Co-Leader, Poland) *4*
Kathleen Graham (Canada)
Nikki Green (USA)
Jared Habiak (Canada)
Corey Hackley (USA)
John Harman (USA)
Fernando Hernández (Mexico)
Chris Higgins (USA)
Witold Hoffmann (Poland) *1*
Kathryn Huchton (USA)
Jake Kandl (USA)
James King (USA)
Tomasz Kochanowicz (Canada) *2*
Jason Lavender (USA)
Jon Lillestolen (USA) *1*
Adrián Miguel-Nieto (Mexico)
Klemen Mihalič (Slovenia)
Mark Minton (USA)
Ramsés-Alejandro Miranda-Gamboa (Mexico)
Gerardo Morril (Mexico)
Artur Nowak (Poland) *1*
Thomas Polson (USA)
Hector Hugo Rodríguez Torres (Mexico)
Nathan Roser (USA)
Lauren Satterfield (USA)
Yuri Schwartz (Sweden / Russia) *2*
Bev Shade (USA)
Vickie Siegel (USA)
Jolanta Sikorska (Poland)
Paweł Skoworodko (Poland)
Małgorzata Skowron-Suchodolska (Poland)
Morgan Smith (USA) *3*
Bill Stone (Co-Leader, USA) *4*
Rob Stone (USA)
Jordan Toles (USA)
Anuj Tomar (USA)
Katarzyna Turzańska (Poland) *3*
Victor Ursu (Romania) *4*
Angie Verde-Ramírez (Mexico)
Nicholaus Vieira (Canada) *1*
Matt Vinzant (USA)

1 on first dive, March 30–April 1
2 on second dive, April 9–April 14
3 on third dive, April 14
4 other members of dive team



Juniper Cave profile after the April 13 trip.

boulders in the way. Cold, tired, and hungry, we retreated to Camp 3 for the final time in 2017. The location of the place we stopped, the new trend of the passage to the east, and the implacable hurricane-force wind all spoke of only one thing: we had, after nearly thirty years, found the way on in Cheve. Unfortunately, with the derig now unstoppable and everything being pulled out of the cave, we were forced to reluctantly leave and return another day. The discovery of the wind was extraordinary, but it was not quite the rabbit having been pulled out of the hat to capstone the expedition.

On the day that Vickie Siegel left Cheve on one good leg, we met Corey Hackley at the entrance, on his way down to Mazunte Beach. It was April 9. The previous day Hackley and newly arrived team member Lauren Satterfield had gone on a recon trip looking for new entrances. They had wandered into a large sinkhole and come across a series of dry arroyos, all of which meandered into an enormous headwall of limestone nearly 600 meters in length. At each of these arroyo-headwall intersections it was obvious that a lot of water sank underground in the rainy season. Where there should have been entrances carved by this water there were enormous debris piles with tree trunks jammed up against the headwall. Hackley gave abbreviated names to each of these sites – CL1, CL2, . . . where the first two letters stood for the first letters of their first names. CL6 was somewhat different in that the arroyo actually dumped into a sizable cave entrance. That illusion of having found something going ended abruptly about 40 meters inside, where debris again piled up. It was obvious this was not a place to be hanging out in the rainy season. Corey was a sturdy twenty-five-year-old West Virginian with a peculiarly laconic manner of speech who was gifted with a gumshoe sense for finding cave passage, as he would later prove in Cheve. The tree trunks inside the entrance had been moved against the wall as if pushed there by a whirlpool. A whirlpool meant that water was going somewhere. He dug into the gravel at the low point. A half-hour later sand began falling into a small hole and a puff of air bellowed up. Another half-hour and he had a

Morgan Smith in the Juniper Tube. *Nick Vieira.*

Not the way on, but just a side passage off the Infinity Borehole that nobody has been in. *Nick Vieira.*

body-tight squeeze between the bedrock wall and the nearest tree trunk. He dropped through into a boulder maze. Eventually this opened into a 1-meter-high, 2-meter-wide polished-clean bedrock tunnel. In another hundred meters he was stopped at a 20-meter shaft, taking air. It was not Cheve in size, but it was situated far east of Cheve and might possibly drop into a fault that was hypothesized to exist between Cheve and J2. Word of this discovery spread rapidly through the team.

From April 12 to 15 there were three exploration pushes on CL6 involving Gala, Hoffman, Mihalič, Nowak, Lillestolen, Mark Vinzant, Jake Kandl, Yola Sikorska, me ,and Siegel, who, despite the ACL injury, bandaged up her knee and came to survey. Such was the draw of virgin territory. The cave descended rapidly to 140 meters depth in a series of open shafts, then suddenly terminated in a breakdown-floored chamber. Mihalič discovered a high fissure leading off two pitches

By April 24 Team Motivation of Gala, Hoffman, and Mihalič was out of Cheve and immediately returned to Juniper/CL6. One of their first acts was to follow an up-trending tunnel they had seen on the last trip that appeared to be heading under the 140-meter-level breakdown chamber. Their hunch played out, and by moving a few boulders they gained access to the large chamber. This now eliminated Mihalič's tight bypass fissure but not the Juniper Tube. Ahead they discovered another vertical fissure. It averaged about 2 to 3 meters in height and 20 centimeters in width; in some places it was more narrow and the fact that it was generally sloping downhill all the way guaranteed a struggle on the way out, as there was nothing but smooth, polished rock to pull against. It was claustrophobic as hell, and yet Mihalič forced his way through, risking the possibility that it might slowly get tighter as he descended. It continued for an unnerving 120 meters like this before opening to a balcony overlooking a 20-meter-wide, 30-meter-tall canyon. The presence of this canyon immediately fueled enthusiasm in basecamp. But countering that was the presence of the fissure. Interesting features in caves often acquire names. Hoffman, with a gleam in his eye, dubbed the fissure the White Rabbit, leaving no doubt as to the analogy to the infamous rabbit scene in "Monte Python and the Holy Grail." From that point forward this small stretch of passage in a still not significant cave gathered status each day until it reached the level of almost insurmountable legend. Many of us were convinced upon each retelling of Mihalič's struggle with the White Rabbit that it would filter out anyone larger than those on Team Motivation. Of course, it could have been an intentional plot on the part of Team Motivation to have the place to themselves. But no one going down that fissure for the first time had anything in their heart but dread.

Over the next three days the final derig of Cheve took place from the Salmon Ladders out to basecamp. So it was not until April 28 when Team Motivation plus Jordan Toles returned to Juniper/CL6. They mapped several hundred meters in the large canyon before it suddenly began ascending. Gala led two pitches and set fixed ropes, and they continued down the obvious canyon before them, exploring several hundred meters more. As the map evolved it was becoming clear that this was adding pieces to the puzzle of the area that had not been previously anticipated in thirty-one years of work on the mountain. On May 30 Berrones, Turzańska, Smith, Hackley, and Satterfield picked up where Team Motivation left off. For Hackley and Satterfield it was their first chance to really explore the cave they had discovered.

At the end of the 20-by-30-meter canyon explored by Team Motivation the team had established a kitchen of sorts with a stove and a supply of stores for making hot meals. This

was at the base of the first pitch subsequently scaled by Gala. From this point it is possible to look upward and see a vast black void overhead. It was this blackness that Gala had been aiming for on his climbs. But after two pitches they discovered going horizontal cave and had followed that. Now Hackley, from a perch at the top of the second pitch, looked upward again and saw that the yawning blackness was still there. They aid-climbed another 32 meters upward and suddenly were in the void. The extent of the chamber was such that there was no sense of direction; it opened up in every direction. So they moved to the nearest wall, split into two survey teams, and began surveying in opposite directions along the wall. Some ten hours later they rejoined, and it was not until the following day that it could be calculated that the chamber they had entered was 140 meters in diameter. They had not given it a name, but a day later Jon Lillestolen did: Lost in Space. In the enthusiasm of a last ditch effort—both Hackley and Satterfield were leaving the expedition the next morning—they had pushed their trip long and surfaced shortly before dawn on May 1. They had then gotten lost on the mountain during the long hike back to basecamp in the dark. At 6:15 a.m., with barely first light, Hoffman began waking up everyone in basecamp. Within fifteen minutes most of the team was sitting around the campfire circle, bleary-eyed and slugging coffee, while plans were laid down for rescue options. We had just agreed to split into two teams with one proceeding straight to the entrance and a second to fan out over the mountain when Hackley stumbled into the llano. He was halfway to the camp fire when everyone turned and noticed him. There was a full thirty seconds of silence before everyone ran to greet him. Between the relief of canceling the rescue and the news of the Lost in Space chamber there was a momentous breakfast discussion around the fire.

One of the biggest revelations from Team Lost in Space was the presence of large tunnels leading off from the big chamber in all directions and of a gigantic breakdown pile leading upward. We had been hoping that the large tunnels might proceed southward and intersect the big headwall, thus providing easy access to what was rapidly becoming an important new cave. Thus, on the morning of May 2, six of us (Hoffman, Smith, Miguel-Nieto, Lillestolen, Gerardo Morril, and I) entered Juniper/CL6 expecting a long trip. Hoffman had been incessantly teasing us about the White Rabbit, and indeed it was an unpleasant place. I had to strip off vertical gear and harness and was down to nothing but a jump-suit in order to get through by exhaling in places before I could move. But that was the price of admission. We assembled at the western limit of the vast Lost in Space chamber and looked at the huge breakdown pile leading upward. Hoffman, clearly the most energetic among us that day, scampered up to the roof at the top of the pile and began probing, then disappeared into the left corner. A short while later he returned and said, "We need to go this way; you'll see why." My survey crew shot a line up to the intersection of the collapse pile and the roof. There was a squeeze there, and Smith

The Total Perspective Vortex.
Nick Vieira.

took to it with a hammer for a few minutes before I could fit through. The others were all standing on the other side looking dazed. It took only a second to realize why: the entire view in front of us was black. Smith let out a loud yell. The echoes were still returning ten seconds later. As in the Lost in Space, we split into two teams and started in opposite directions in an effort to gauge the size of the place. We were using DISTOX laser-survey instruments, which turned out to be extremely effective today. We were getting 60-meter passage width shots and 60-meter heights to the ceiling, far overhead. It slowly dawned on us that it was not a simple chamber. It was a tunnel. And, mind bogglingly, it kept going and going and going. I had a name ready for this place, the Total Perspective Vortex, which, as in the Douglas Adams novel, left the occupants feeling small and insignificant. For the next twelve hours we surveyed down an endless talus pile in this enormous tunnel. We came across a stream, then lost it again as the tunnel climbed into a 60-meter-wide passage junction. Lillestolen's team had been in the lead then, and as we entered the junction they returned claiming that they were out of rope and looking down a 20-meter shaft into even larger passage. This is how expeditions were meant to end. Out of rope, in enormous going tunnel, with the wind blowing in.

We surfaced in the pre-dawn dark at the bottom of a cold sinkhole. But the first dim rays of sunlight became visible as we hiked up the mountain and homeward. The horizon glowed purple and deep blue, illuminating low-hanging clouds down in the coastal plain. We doggedly marched into basecamp at 6:30 a.m.. Everyone was still sleeping; we had warned them it would be a long trip to avoid a repeat of the rescue activation of yesterday. When we punched in the survey data Juniper/CL6 was found to be 426 meters deep where we ran out of rope and 3.5 kilometers long. This, plus what had been discovered in Cheve added up to 5.3 kilometers of new discoveries in 2017. We had not seen the major breakthrough beyond the sumps that we had been hoping for. But we had found the way onward. Had we known in advance what would happen at the bottom of Cheve we could have left all those tons of diving equipment at home, never set the painfully memorable Mazunte Beach bivouac, and focused everything on Hackley's new lead. But that is what exploration is about—the gradual revealing of the unknown. Sometimes you just have to invest a few years of your life and a three-month expedition to find out, but in the end it sure was

Cueva de la Peña Negra Cave Timeline
(new official name of Juniper/CL6)

April 8, 2017. Discovery of CL6/Juniper Cave during reconn trip. Corey Hackley, Lauren Satterfield.

April 12. First exploration push in Juniper Cave: Entrance passed and three pitches rigged. Marcin Gala, Klemen Mihalič, Mark Vinzant, Jake Kandl, Vickie Siegel (driving), Bill Stone.

April 13. Second exploration and mapping push in Juniper Cave/CL6: Team rigs several more vertical pitches and reaches a breakdown room at –140 meters; a potential bypass is discovered above the penultimate pit in a high fissure. Marcin Gala, Pwyvak Nowak, Jolanta Sikorska (rigging team); Bill Stone, Vickie Siegel, Klemen Mihalič (survey); Jake Kandl (trail chopping); Kasia Biernacka and Zusia Gala (hiking).

April 15. Third exploration and mapping push on Juniper Cave/CL6: The bypass fissure is mapped, and it leads to a series of very tight rappels that lead to some very tight crawls, later named the Juniper Tubes. A small room is discovered that appears to have a tunnel leading back toward the 140-meter-deep room discovered on the second push, but the way forward and down is exceedingly tight and unpromising, though it does carry wind.

April 24. Fourth exploration push on Juniper Cave/CL6: Team discovers and passes the Juniper Tubes, a 50-meter-long flat-out crawl in a bedrock tube with 5-centimeter-deep ponds on the floor, and the White Rabbit, a claustrophobic 120-meter-long stretch of vertical fissure averaging 20 centimeters wide, and comes to a balcony overlooking 20-by-30-meter tunnel. Klemen pioneers the route through the White Rabbit and is first to the balcony. Marcin Gala, Klemen Mihalič, Witek Hoffman.

April 28–29. Fifth push on Juniper/CL6: Team returns 2:30 a.m., having successfully mapped the main borehole to Kitchen Rock and to a sump; team climbs up two pitches and maps a new canyon. Marcin Gala, Witek Hoffman, Jordan Toles.

April 30–May 1. Sixth push on Juniper/CL6: Team scales the third and fourth vertical pitches above Kitchen Rock and discovers the Lost in Space Chamber 140 meters in diameter. they are late getting out, get lost in the karst, and return 6:30 a.m. to a rescue team being organized to find them. Happy ending. Corey Hackley, Morgan Smith, Katarzyna Turzańska, Lauren Satterfield, Oscar Berrones.

May 2–3. Seventh push on Juniper/CL6: Discovery of Total Perspective Vortex and Infinity Borehole; arrival at basecamp at 6:30 a.m. Depth: 426 meters; length 3.5 kilometers. Witek Hoffman, Gerardo Morril, Morgan Smith, Adrián Miguel-Nieto, Bill Stone, Jon Lillestolen.

May 5. Eighth (final) trip in Juniper/CL6: Photography to Total Perspective Vortex. Nick Vieira, Morgan Smith, Adrián Miguel-Nieto.

worth it. Juniper/CL6 is an anomaly. What we had originally thought of as a small infeeder to Cheve, or perhaps a gnarly, grim fissure cave like J2, had broken into something extraordinary, with passages larger than those in Cheve. Was Juniper/CL6 the master cave in the Sierra Juarez, waiting all these years to be ferreted out? We had gone into this project with a pervasive sense of someone playing solitaire where it appeared that all the cards had been played out, then suddenly being presented with two new cards that would change the outcome of the game. The 2017 Cheve expedition will perhaps be remembered not for the struggle of the first ten weeks, but for the astonishing two weeks that ended it. The doors opened on this expedition will occupy a decade or more of future exploration.

Expedición Sistema Cheve 2017

Recuento detallado de la Expedición Sistema Cheve 2017. El Sistema Cheve es el sistema hidrológico de mayor profundidad comprobada en el mundo, sin embargo se estima que una parte mayoritaria de las galerías subterráneas no han sido exploradas aún. El objetivo primario en 2017 fue colocar a un grupo de buzos más allá del Sifon 1 para escalar domos y continuar la exploración del Sifón 2 en busca de una continuación. Estas metas fueron logradas; no se encontraron pasajes subsiguientes, pero un buceo agregó 4 metros a la profundidad total de la cueva. Se ubicó un punto pequeño cerca del Campamento 3 que mueve una cantidad bastante grande de aire y es un candidato para agrandar el pasaje y podría resultar ser la continuación. Una cueva nueva llamada inicialmente CL6 o Cueva del Junípero (ahora Cueva de la Peña Negra) se convirtió en el objetivo principal hacia finales de la expedición y se paró la exploración a 3.5 kilómetros de longitud y 426 metros de profundidad, con corrientes de aire y galerías grandes que aún continúan.

CHEVE 2017: ENDURING CAMP FOUR

Jon Lillestolen

During the 2017 Sistema Cheve expedition, work had been long and slow to get the cave rigged and camps stocked. There were kilometers of rope to rig, food to carry down, fragile dive gear to prepare, and too many batteries to charge. Slow as it was, preparation finally approached a level around the end of March where we could begin setting up to dive Sump 1 and establish a new deep camp in the cave. The dive team assembled on the surface to make final preparations, packed the last bags of masks, hoods, food, and climbing gear, and left for Camp 3.

The dive-team rotation was still being decided, but we had a strong first round, Pływak Nowak (Poland), Nick Vieira(Canada), Witek Hoffman (Poland), and I (USA). Along with the rest of the expedition, we had all made a strong effort to rig the cave and get a mound of dive gear hauled to the sump.

With gear at the sump, there were several critical tasks that remained to be completed before Camp 4 could be established, so Witek and I decided to spend a couple of nights sleeping in hammocks at the sump to accomplish them. The first task was to take the mound of bags at the sump and carefully unpack them and assemble dive gear. We set up all the regulators, tanks, and rebreathers for a dive team of four, two of whom would use rebreathers. The next task was to find the correct route and make sure we had a continuous guideline through the sump. The sump has two obvious routes once you enter the water. Directly ahead lay the route taken by Schweyen in 1991 and behind a fin of rock to the right was the route the Brits found during the 2003 expedition [*AMCS Activities Newsletter* 27, pages 84–86]. Beyond the British route through the sump was the borehole where we planned to establish Camp 4. Fourteen years had passed since the Brits had laid the line through this tunnel, and we were unsure how much had been spared by the annual floods.

Witek and I entered the water with our Poseidon rebreathers and made our way along the British route. With a vague route description and a partially intact line, we quickly made our way to the downstream end of Sump 1, replacing remnants of the old line with new.

With this out of the way, we returned to the upstream end of the sump for hot drinks and a snack. On a second dive, to set up a 9-millimeter pull-rope through the sump, my rebreather failed to start, so Witek dutifully made a second dive and rigged rope for divers to use to pull themselves through with the heavy bags we needed for a camp. The final step would be to rig a phone line, which was rigged out of the way of the pull-line and partially along the Schweyen route through the sump, which connects with the British route about halfway along its length via a window in the floor of the passage.

The hard parts of setting up Sump 1 for travel were now out of the way, and we could now set up to trudge all the camp gear through the water. Diving rebreathers, drysuits, and carbon-fiber bottles didn't leave much lead for our lightweight camp gear. We tossed gear and a combination of lead and rocks into duffels, one at a time, to pass through the sump. We built an efficient train of people to accomplish this, with Nick and Pływak packing and weighting bags at the sump, Witek swimming them through, and me dumping them on the downstream side. Duffel bags and lead went both directions, since both came at a premium. Once all the camp gear made it through, the open-circuit divers put their dive gear on and made the journey through the sump.

Once through, Nick and Pływak promptly left to find a suitable camp spot. We had a few spots picked out from the 2003 survey, but they needed to be checked for suitability. In short order, they had found a better spot, and we shuttled all the gear there , set bolts for hammocks, and declared Camp 4 established.

We wasted no time before searching out some of the leads we'd be pursuing, checking the high leads nearest camp before spending the first night there. Over the next few days we picked off the leads left from the twenty-four-hour blitz trip in 2003. We were disappointed time and again, as each of the leads didn't produce any breakouts. Several of the high leads turned into high, pinched-off fissures when looked at under modern LED lights.

Nick Vieira preparing to dive Sump 1. *Rob Stone.*

jlillest@gmail.com

The staging area for the dives through Sump 1. *Rob Stone,*

We figured that the stress of the marathon push in 2003 had left them surveying passage so fast that they didn't have a chance to give each of the high leads a thorough look.

It became increasingly obvious that we had explored everything between Sumps 1 and 2, and so we discussed with the surface a plan to take another look at Sump 2. This had originally been a low-priority lead, but was now starting to be one of our best remaining leads. We began transporting dive gear to Sump 2 to make a dive, and in doing so noticed a significant infeeder coming out of the wall right at Sump 2. There was no indication of this in the 2003 notes, and when we stuck our head below water we noticed a nice descending tunnel with ripples in the sandy floor. This lead was the best one we had found yet despite needing dive gear to push it. We called it Sifon del Fuego.

Carrying enough dive gear for two rebreather divers between the sumps was a heavy chore, but we had a strong team of four and managed to do it quickly. Witek and I geared up to dive Sifon del Fuego and survey anything we found. Witek tied off a fresh reel of line and headed down into the infeeder. I was going to wait five minutes and then follow the line to survey it. I had barely started up my rebreather when we saw Witek's light returning. He had laid less than 50 meters of line, and it ended in a no-mount passage with gravel pouring down into an angle-of--repose slope with water coming out of it. Not wanting to risk the precious open-circuit gas or entrapment, I quickly surveyed it, and we moved on to Sump 2. We found out later that this sump would add a few meters of depth to the cave.

We swam through Sump 2 with Witek laying line, finding only one small section of old dive line. We left the water in the bottom of a giant breakdown pile, secured the dive gear, and left to explore the passage ahead in only our drysuits. We squirmed through every bit of passage that we could find that we were sure wouldn't put tears in our drysuits. We had found a good bit of passage, but knew we were limited by the fear that we'd tear a drysuit beyond two sumps, so we left and made plans to return with digging supplies, survey gear, and cave suits.

We took a rest day while Pływak and Nick finished up that last of the lead list between the sumps. In their effort to find any plausible lead, they managed to climb every piece of passage, either by free-climbing or by drilling, between the sumps, whether it looked like a good lead or not. After our rest day, all four of our team would dive. Nick and Pływak would depart through Sump 1, and Witek and I would dive Sump 2 to give the bottom of the cave one final push before we left. During a long day of exploration, Witek and I pushed every crack and crevice in the breakdown pile at the bottom of the cave Without drysuits to hold us back this time, we had the ability to really push everything we could find. Surveying all the possible leads produced around 300 meters of passage, but no real possibility of continuations. Our best guess is that the sump ends in a massive breakdown pile where the passage collapsed because of faulting action. If there's any chance of this going, it'll probably require digging to find a way to the top of the pile, much like was done in the Through the Looking Glass breakdown. Defeated by the cave, Witek and I retreated back to Camp 4 late at night to find our two new teammates, Yuri Schwartz (Russia) and Tomek Kochanowicz (Canada/Poland). Yuri and Tomek had traveled through Sump 1 while we were exploring beyond Sump 2. We awoke the next morning to swap tales and update them on the current state of the lead list. We spent the rest of the day moving dive gear from Sump 2 back to Sump 1 while showing Yuri and Tomek everything we had pushed downstream of camp. We began demobilization of camp the next day, pulling out two camp sets when Witek and I dove through Sump 1, taking multiple trips each to move duffels through the route. Yuri and Tomek demobilized the deep camp two days later when they determined the leads between the sumps weren't worth pushing and removed the remaining two camp sets.

Cheve 2017: Resistiendo en el Campamento Cuatro

Un recuento de los intentos por encontrar la continuación a través de los sifones en las profundidades del Sistema Cheve en 2017. El Campamento 4 fue establecido más allá del Sifón 1. Se inspeccionaron pasajes previamente no explorados en zonas altas entre los sifones, pero ninguno tuvo continuación. Una exploración final en el Sifón 2 encontró un poco más de pasaje, pero nada que continuara más allá de un colapso masivo. Se exploró un pequeño tributario, el cual agregó unos metros más a la profundidad del sistema, pero éste también terminó en un colapso.

CHEVE 2017: THE DISCOVERY OF CL6

Corey Hackley

The beginning of my stay on the Cheve 2017 expedition was an immersion experience. Three days before departing for Mexico, I had a PICC line, a valved silicone tube straight into the entry of my heart. But now, dragging my bags down the hill into basecamp, it was removed. The PICC enabled intravenous infusion of powerful antibiotics to treat Lyme disease and its co-infections, an increasingly common condition among cavers and ridge walkers of the eastern United States. But it also kept me from the kind of every-weekend caving I was accustomed to, and the result was that I arrived in Llano Cheve in high spirits, but relatively poor shape. The elevation did not help. Nonetheless, after passing the rebelay course in the rain, I hurled myself at the depths of Cheve for my warmup trip: a kilometer-plus long, 500 meter-deep yo-yo into the entrance series of one of the most spectacular caves I've ever encountered.

The trip left me enthralled but exhausted. I arrived back in the llano to a dark, misty night, ten hours or so after entering. Panting, my head throbbing, and nauseous, I vomited and went to sleep.

The next morning brought welcome sunshine and gastrointestinal improvements, but I was decidedly not going back into the cave that day. Despite how remarkable Cheve is, the surface is quite remarkable as well. The combination of the cloudless, 80-degree days, the clean mountain air, astonishing scenery, and limitless unchecked karst conspire to rob otherwise ambitious cavers of their motivation. It was these temptations that seduced me away from the call of the deep and toward a day of mostly lazing around in the sun.

By afternoon, however, this had grown boring, and I found my attention wandering to topographic maps of the area, and my thoughts wandering to the countless unentered cave entrances that no doubt surrounded me. Lauren Satterfield, with whom I had traveled to Mexico, was in a similar situation, having just been flung into the same deep end as me, and we decided a modest ridge walk was a worthy way to spend the remainder of the day. I picked an attainable target on the topographic map, near enough to reach and return from in a day's hiking, but far enough away to yield more than merely another entrance to Cheve, whose depths are no doubt accessed by dozens of inconspicuous caves and shaft complexes in the immediate vicinity. I took my half-baked plan to Marcin Gala, at this moment of the expedition acting in the role of basecamp manager. As it turned out, the llano I had set my sights on had already been visited by Yvonne Droms and Mark Minton earlier on this expedition, but rather than exhausting its possibilities, they had generated more, finding countless small entrances that deserved further investigation. Better yet from our perspective, they had been forced to abort when the ever-volatile weather of the Sierra Juárez had threatened to sock them in with fog, rain, or possibly worse. Basecamp had already weathered one hailstorm. Half of the llano stretched unchecked.

Moving significant distances through the terrain overlying Sistema Cheve is easier imagined than executed. A short distance from basecamp, Lauren and I had encountered the dreaded shrubbery, in this instance generally about navel-deep. Expedition veterans recall a time when these heinous flora were not present, but now they cover large expanses of the mountains, at a distance appearing like a rolling pasture, and in proximity manifesting itself as a kind of gray-green, leafed, bottomless quicksand that somehow cuts you to shreds as you sink into it. To make matters worse, the substrate of this plant life is an indescribably dangerous moonscape of fissured, unstable, knife-sharp limestone, the hidden breaks in which can be anywhere from a meter to tens of meters, if you're quite unlucky, deep. These factors conspire to make an ordinarily trivial hike into a dangerous, if comical, fiasco.

Nonetheless, after some struggle, Lauren and I emerged onto a crag of rock that offered us some reprieve and a breathtaking view of the enormous sinkhole we were gradually progressing toward. Not long afterward, we broke free of the shrubbery and found ourselves wandering an open pine forest, punctuated by tufts of grass and laced with countless ravines. As we wandered toward the looming limestone headwall, it dawned on me that each of these ravines plunged into the cliff ahead and together they carried at least as much, if not more, water than the modest stream we had been camped by over the hills that, along with some other minor infeeders, had been responsible for the creation of the behemoth cave called Cheve. If a little water could produce such grandiose results there, why not here?

The best of the leads Mark and Vonny had left for us was the site where one of these ravines slammed

clearsig@myactv.net

into the llano's wall and sank, but after some investigation it became clear that it sank not into a tunnel in the stone, but instead into an endless pile of enormous boulders, through the eons tumbled down from the cliffs above, blocking easy passage into the mountain for all but water. But this boulder pile let something escape from the mountain, drafts of unmistakably cool, damp cave air. Surely there was an entrance to a vast cave buried here, but without becoming one of the aforementioned fluids, we weren't going to get in or out through it.

This result repeated itself several times. I took GPS locations on each sink point, while Lauren dutifully recorded written notes about them. Mark and Vonny had noted some of these; others they had not, either because they escaped notice or simply weren't of great enough promise to record. Just where we entered the unchecked region of the long cliff, a particularly large arroyo, floored with well-rounded pebbles of quartz and metamorphic rocks, snaked off the gentle hill above and began to parallel the rock face. As Lauren finished her notes on the last feature, I couldn't help but run ahead, and I was immediately greeted by a gaping entrance. I gave a yell, and started scrambling down the talus slope to the passage beyond. I could feel I was descending into a pool of that familiar air, but just as I turned my light on, I was staring at a rock wall. The cave I had just mentally prepared myself to sprint into the unplumbed depths of had ended.

But air doesn't lie, nor do rivers of flood water grind to a confused halt, as I had. There was a way on, but systematically probing every crack in the wall of the shelter yielded nothing. At one point, I forced my way through a torturous series of chest-compressing fissures, meandering in all directions, only to eventually hear Lauren's voice proclaiming my labored grunts were coming out of a pile of boulders in the entrance room. Dejected, I extruded myself though said boulders, and we left the entrance as dead.

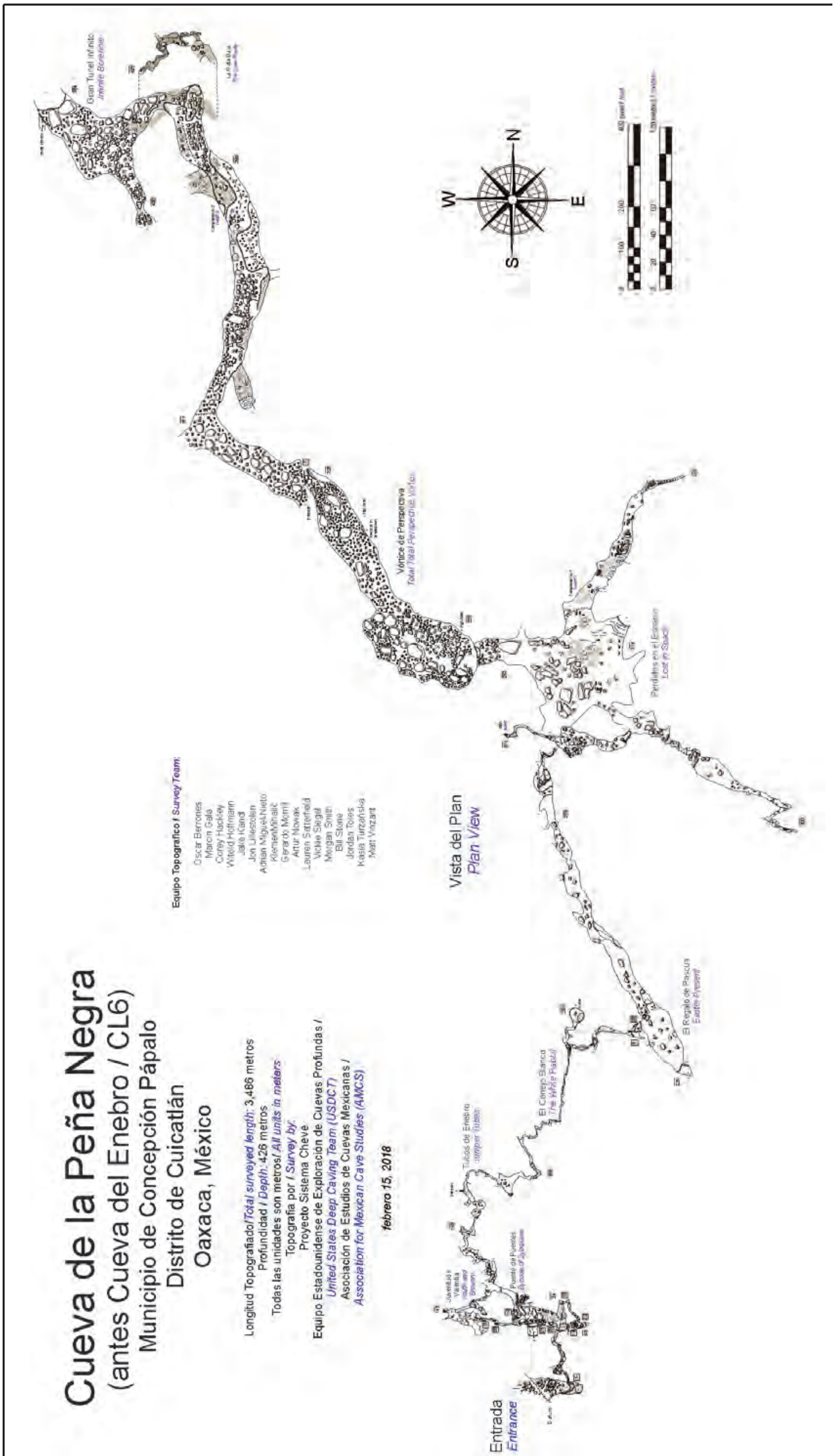
By this point, though, the day was waning, and we had investigated the entirety of the headwall. Walking up a rise, we saw another llano in the distance, likely holding as many secrets as the one we had just spent half of our day in. But common sense prevailed as the sunk sank and wafts of fog started to appear on the horizon. We turned and began our retreat toward basecamp.

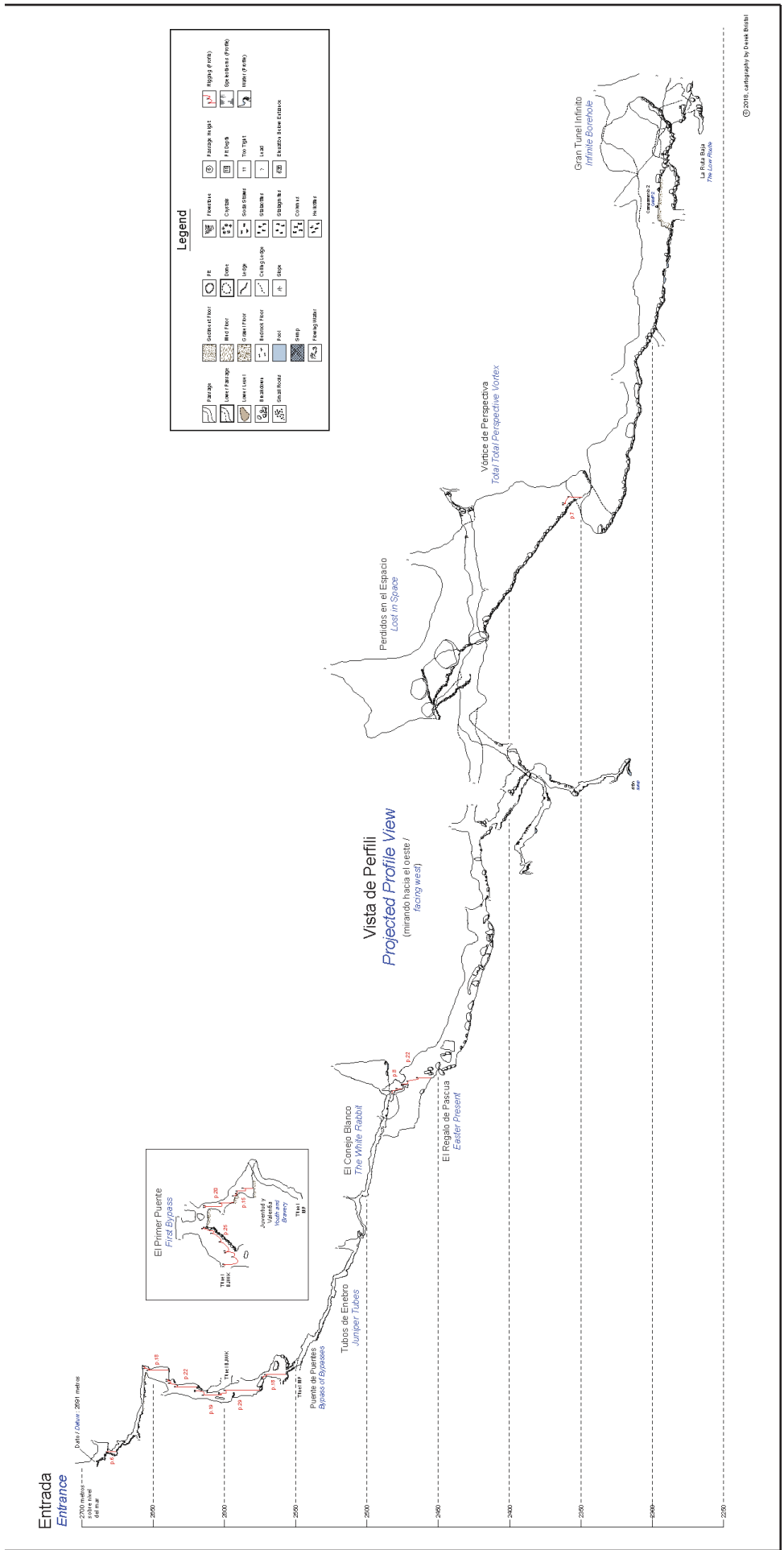
Common sense may have been on the verge of prevailing, but I wasn't ready to accept that the beckoning maw of CL6, the GPS label we had affixed to the entrance, simply went nowhere. Veering off-course and with thoughts of what a lovely basecamp the llano I was standing in would make, I once again bottomed the cave, at the formidable depth of around 7 meters. I had exhausted all the passages off of the room, such as they were, but I had not exhausted the floor. An uninspiring mix of rotting logs and gravel, this was, somehow, where the water must have gone during the terrifying floods of the wet season. From this perspective, the cave must not go left, right, or forward; it must go virtually straight down, under the deceptively solid floor I was standing on. After all, in mountains known worldwide for bottomless pits, why *wouldn't* it plummet downward as soon as possible? In the words of many a caver: "There was something down there." The geometry of the entrance room was such that it felt more like an obstructed horizontal tunnel than a pocket at the ceiling of a clogged-up drop. With solid walls, though, and proof of a way on in the form of heaps of flood detritus, the latter was the only remaining possibility.

It was in the course of staring at the hopeless mess of debris around me that I noticed something odd. In the masses of sticks and logs, plastered against each other in a direction normal to that of the water flow, here, by the wall of the cave, one stick stood vertically. Like a dowsing rod, it pointed straight down at the location where we were to dig. How else could it have arrived in this orientation, if not by some enormous current sucking its far end into a space below? It was only two or so inches in diameter, and I took hold of the protruding end and rent it from the ground. From the cavity left behind, a jet of cold air blasted into the surface world. By the grace of this single stick, we had been shown the way in.

It was not long before I had ripped out enough debris to slip between logs into the cave below. A little poking around revealed a spiraling path downward through breakdown, eventually emerging into a clean-washed tube of stooping height. Excitedly rushing down the tube, I soon found myself, unsurprisingly, at a drop requiring rigging. Though the lip was such that I couldn't see the bottom, a dropped rock showed me it was certainly not something I could free-climb. I retreated to find Lauren, who was napping somewhere along the headwall; I had

Prospecting in the karst.
Kasia Biernacka/kasiabiernacka.com


Cueva de la Peña Negra
(antes Cueva del Enebro / CL6)
Municipio de Concepción Pápalo
Distrito de Cuicatlán
Oaxaca, México
Longitud Topografiado/Total surveyed length: 3,486 metros
Profundidad / Depth: 426 metros
Todas las unidades son metros/ All units in meters
Topografía por / Survey by:
Proyecto Sistema Cheve
Equipo Estadounidense de Exploración de Cuevas Profundas /
United States Deep Caving Team (USDCT)
Asociación de Estudios de Cuevas Mexicanas /
Association for Mexican Cave Studies (AMCS)
febrero 15, 2018
Equipo Topografico / Survey Team:
Oscar Berrones
Marcin Gala
Corey Hackley
Witold Hoffmann
Jake Kandl
Jon Lillestolen
Adrian Miguel-Nieto
KlemenMihalič
Gerardo Morrill
Artur Nowak
Lauren Satterfield
Vickie Siegel
Morgan Smith
Bill Stone
Jordan Toles
Kasia Turzańska
Matt Vinzant
Vista del Plan
Plan View
Entrada
Entrance
Puente de Puentes
Tubos de Enebro
Juniper Tubes
El Conejo Blanco
The White Rabbit
El Regalo de Pascua
Easter Present
Perdidos en el Espacio
Lost in Space
Vórtice de Perspectiva
Total Total Perspective Vortex
Gran Tunel Infinito
Infinite Borehole
W
S
N
E


Legend
Entrada
Entrance
El Primer Puente
First Bypass
Puente de Puntes
Bypass of Bypasses
Tubos de Enebro
Juniper Tubes
El Conejo Blanco
The White Rabbit
El Regalo de Pascua
Easter Present
Perdidos en el Espacio
Lost In Space
Vórtice de Perspectiva
Total Total Perspective Vortex
Gran Tunel Infinito
Infinite Borehole
Vista de Perfili
Projected Profile View
(mirando hacia el oeste /
facing west)

Marcin Gala; Suzia Gala, and Kasia Biernacka at the entrance to Peña Negra. *Kasia Biernacka*.

now been engrossed in my last-ditch effort to find a continuation for some likely worrisome period of time. I shared the news with her, and we slipped down into CL6 once more, touring the find to the drop. Pausing, I noticed small scallops on the ceiling. For a considerable period of the year, this entrance tube, now slightly damp, was a horrifying natural drainpipe, conducting pressurized water into the ground with unspeakable force. With dusk fast approaching, and acres of unforgiving shrubbery between us and the camaraderie of basecamp, we made haste out of the llano.

In the coming weeks, CL6, since officially renamed Cueva de la Peña Negra, would be explored farther, but not by us. We were slated, the day after our ridgewalk, to enter Cheve for a stay of loosely specified purpose and duration. Both became clearer in the natural course of things. In the three weeks that followed, I would not see the sun at all; but topside the story of CL6 evolved as teams pushed the cave deeper and through ever-more disheartening obstacles. Finally, grueling trips of digging, surveying, and rigging later, our friends emerged as flies on the wall in an enormous tunnel, nearly 200 meters below the lip of the drop where Lauren and I had been forced to turn around. Though the cave's destiny in the annals of the exploration of the Sierra Juárez remains unclear, it has already rekindled inspiration: In a region as rich and dense in secrets as the mountains of Oaxaca, decades of exploration barely scratch the surface of countless hidden wonders. While some will require unfathomable work, others are a merely a stick away.

Cheve 2017: El Descubrimiento de CL6

Se reseña el descubrimiento de una cueva significativa llamada originalmente CL6 o Cueva del Junípero (ahora conocida como Cueva de la Peña Negra). Se convirtió en el foco de la exploración hacia finales de la expedición 2017 al Sistema Cheve y alcanzó rápidamente una extensión de 3.5 kilómetros y una profundidad de 426 metros, agregando una pieza más al rompecabezas de la Sierra Juárez.

NO ONE GETS OUT FOR FREE A GREENHORN'S ACCOUNT OF CHEVE 2017

Jordan Toles

If I rolled out of my hammock to the right, I risked falling 12 meters to my death. If I exited left, I might fall 6 meters down the latrine shaft and land in my own feces. Neither of these options was particularly enticing, but my current situation was entirely unsustainable, and I needed to get down, fast. I was camped out nearly 1200 meters beneath the surface of the earth in Cueva Cheve, the western hemisphere's second deepest cave, and I really had to pee.

This was a common dilemma for those of us at the Mazunte Beach bivy, which despite the attractive name was the antithesis of an actual beach. The bivy consisted of a series of four tightly spaced hammocks strung wall to wall across a 3-meter-wide fissure with our own excrement at the bottom of it. It was from here that we staged our eleventh-hour efforts to find the way on, a mythical borehole that we hoped lay at the other end of an impossibly tight congestion of mud-glazed squeezes. The Beach was a magically miserable place located very inconveniently on the frontier of modern exploration. We were packed into our nylon cocoons like sardines, which made getting out to use the bathroom during the night an unbelievably difficult process. To dismount from a hammock and urinate without careening down any one of the many deadly chasms below required snaking through the tight weave of bodies onto a narrow ledge, crawling underneath the suspended entourage to the edge of the designated pee pit, and, for the last act, balancing delicately over the precipice while strategically aiming to avoid splattering the nearby cookware. Simple as A-B-Cremnophobia (noun: a fear of precipices).

The repetitive nature of these drills usually made for restless nights, but eventually our watches would tell us that morning had come and it was time to start the day. Low-beam headlamps pierced the darkness; groans and curses served to greet our lithium sunrise. The weather forecast was always the same, dark and cold with a chance of drips. We stirred apprehensively in our hammocks for as long as our unsettled digestive tracts would allow. A synchronized urge to purge the previous night's dinner was the only real motivation we had to leave the warm solace of our synthetic-fill sleeping bags.

The stove hissed, and the aroma of stale coffee soon homogenized with the dull stench rising from the latrine. We huddled around the kitchen and glared at our soggy underwear hanging from the clothesline. I boiled a second pot of water while the team conducted another informative, if redundant, inventory of our gear, anything to stall the process of getting dressed for as long as possible. I forced myself to finish the last few unpalatable spoonfuls of rehydrated breakfast mix to buy a few extra seconds, all of which immediately ticked away. I slipped into my wet socks. *Uuuuggggghhh.* Only ten hours until I could take these off again. OK, now the boxers. With cave suit fully donned, I sat with my back against the wall and fastened the D-ring on my harness. One of my female companions used my shoulder to brace herself while she squatted over the ledge for a final time. "Jordan," I heard her say over my shoulder, "what if hell is real and God forces me to spend eternity surveying leads here at Mazunte Beach?"

"Don't worry," I assured her, "God doesn't know this place is here."

Kasia Biernacka, one of the expedition organizers, must not have known Mazunte Beach was there either, when she first told me about the 2017 Sistema Cheve Expedition. Or if she did, she certainly didn't lead with it. She enchanted me with accounts of Cheve's dizzyingly large caverns and powerful waterways surging down its dramatically scalloped canyons. I had such spectacular notions going in, but now that I was shielding my breakfast from stray flecks of urine in a room the size of a handicapped-bathroom stall, it all seemed a bit less glamorous. It was probably a good thing that I didn't know all of the details about Cheve when I first agreed to join the United States Deep Caving Team in Mexico for six weeks; otherwise I might have had second thoughts. Luckily, this was my first major expedition, so I had no idea what to expect. I knew that I had been recruited to help shuttle gear through one of Mexico's largest caves, but beyond that, I knew very little about what I was getting into. My gumption was resolute—and totally naive.

I was already irreversibly committed by the time I realized the gravity of the expedition. My first hint was a profile-view map of Cueva Cheve superimposed on a cross section of Mount Everest, deliberately contrasted to illustrate the similarity in scale. Reading further through the

jordan.toles@gmail.com

team letters, it became apparent that what I had volunteered for was no *asunto sin importancia*. On the contrary, this was to be one of the most significant and remote exploration projects of the decade.

Sistema Cheve was already known to be one of the deepest caves in the world, but the system's true prestige lies in its astounding depth potential. A scientific study conducted in the 1990s had dye-traced water entering the cave to a resurgence epevation 2,600 meters lower, making it the deepest hydrologic system on the planet. The ultimate goal of this expedition was to find a humanly passable connection from the established cave passage to the distant hydrologic resurgence. If successful, the depth of the linked system would dwarf that of any known cave system on Earth.

Reaching the farthest known point in Cheve, the current limit of exploration, had required the cumulative efforts of more than sixteen expeditions since 1986. The last teams had discovered a number of going passages, or leads, past a flooded section in the remote outer fringes of the cave. The current objective would be to establish a camp beyond this first sump with a small team of expert cave divers, systematically climb and survey the high inlet waterfalls that poured into the passage, and finally dive through the second sump to explore what lay beyond.

The challenge would be building a steady supply chain to support the exploration beyond the sump. Just to get to this point, almost 10 kilometers from the entrance, required rigging more than 3 kilometers of rope on countless vertical pitches nd horizontal traverses and establishing three subterranean camps to break up the immense travel times. Transporting all the necessary food and equipment would be a massive logistical undertaking. Team members would need to navigate raging waterfalls, massive borehole passages, and vertical jungle-gyms requiring an extraordinary amount of technical expertise, all while hauling forty- to fifty -pound packs.

An Olympic-caliber caving team had been assembled for the task. The 2017 USDCT roster was composed of nearly sixty individuals representing some of the most elite cavers from eight nations, and me. I was definitely in over my head, but I was committed nonetheless. I hadn't caved on all seven continents and the moon like some of these guys. (Just to clarify, no one has ever been caving on the moon.) But I felt strong. I had a few solid projects under my belt, a healthy spine, good for hauling bags, and a respectable amount of technical experience. I was part of a team now, right? I owed it to them to be at my best and perform.

Getting to Cheve presented a challenge of its own. I scoured the team roster for potential ride-share candidates and connected with an exceptionally experienced Mexican cave-diver living in Austin, Texas, named Oscar Berrones. He had more than thirty years of caving experience in his home mountains near the city of San Luis Potosí, and, perhaps most importantly, a family to come home to. His credentials as a gringo-chauffeur were impeccable. If anyone was qualified to get me through Mexico and back in one piece, it was Oscar.

Despite early skepticism of our ad hoc arrangement by both his wife and my grandmother, Oscar and I were soon to become an inseparable duo. We exchanged a few emails prior to the expedition, and the next thing I knew, we were buying tacos together through holes in a chain link fence along the Arco Norte highway near Mexico City. Our friendship progressed rapidly. I spoke no Spanish, so I typically followed Oscar's lead when it came to culinary matters. Over the next several weeks, I would trust him with much more than just dicey street food.

"There are going to be some hardcore cavers on this expedition." Oscar glanced over at me as we piled back in the truck, tacos in hand. "But remember," he paused briefly to recall the exact wording of the quote, "every corpse on Everest was once a highly motivated person." I laughed, but must have looked uneasy. He smiled. "Take it *slow*," he said, "and above all, be safe." A few days later, we departed the small village of Cuicatlan for the high mountain vistas of the Sierra de Juárez. My stomach churned with nervousness and perhaps the remnants of zesty fajita meat as we clambered up the steep switchbacks into the heart of what is known as the Himalaya of caving.

When Oscar and I arrived at base camp the first thing we noticed was the gargantuan limestone headwall with a *giant* black hole in it. "*Santa mierda. . . .* That's a big cave!" I exclaimed. Cueva Cheve was a sight to behold. The entrance was breathtakingly massive. Situated at the far edge of a large sinkhole, it looked like an atomic bomb had detonated and blasted open a gateway straight to hell. It would be no wonder if the locals believed that the cave was home to some dark, supernatural presence.

The second thing we noticed as we descended the steep trail down to camp was the complex network of ropes dangling between a cluster of tall ponderosa pines. "Ah, that must

Oscar Berrones on a short drop in Cueva Cheve. *Chris Higgins.*

Part of the rebelay course. *Kasia Biernacka* / kasiabiernacka.com.

be the re-belay course everyone was talking about."

The third thing we noticed was that the whole place was practically deserted. "Where is everyone?" We found that the main expedition leaders were out ridge-walking looking for new caves, and the other experienced folks were underground preparing for the dive, but we received a warm welcome from a few veterans of previous expeditions hanging out at camp.

"Hey dudes, *Bienvenido* to Cheve!"

Once we were settled, they gave us a very casual orientation to life in base camp. I was perplexed by the lack of any official matriculation, but thus far having no other direction, assumed that nothing was out of the ordinary.

The next thing on the docket was the rebelay course, designed to be a true test of a caver's technical skill, that everyone had to successfully complete in forty minutes or less before they were allowed to enter the cave. There were a few of us who had just arrived at base camp and needed to run through it . Since the management was on furlough, the basecamp sourdoughs graciously offered to group supervise our efforts. I was initially nervous because of the degree of technicality, but after watching the two other newcomers, Chris Higgins and Jason Lavender, execute all the maneuvers, I eased up a bit. I relaxed and completed the course somewhat quickly, which perhaps made me seem more experienced than I actually was. Oscar also finished under the time threshold, despite the inefficiency of his unique "Berrones" system, Oscar's own hybrid between a Mitchell and a Texas system, specially designed for climbing long ropes out of deep pits, on the complicated European-style rigging.

"Wow! Great job guys!" Our supervising committee greeted us once back on the ground with high-fives and large yellow haul bags. "You're obviously some hardcore cavers. Here, take these fifty-pound packs down to Camp 2. Good luck!." (I'm paraphrasing here, slightly). Pleased with our performances, we shouldered the packs and lumbered across the llano towards the gaping black catacomb looming just beyond camp. We were about to find out that the rebelay course might have been a good way to evaluate technical competency, but it was in no way representative of the immense ass-kicking that Cueva Cheve was capable of delivering. None of us had any idea of just how unprepared we were for this venture.

Walking into the entrance room of Cheve felt like taking the field in a large professional sports stadium, and we were on the away team. The bludgeoning silence was as daunting as the booing of an unwelcoming crowd. Oscar, Chris, Jason, and I huddled up to make a game plan. With no guide or map, we were left to call the plays. "Down," we agreed. The walls and ceiling fell away from us as we walked out of the sunlight and into the massive void of darkness.

From there it was a blur. The seemingly endless series of rappels melded together into a steady stream of cascading rope. I mechanically executed what felt like hundreds of rebelays. We passed from large, steeply sloping boreholes to narrow canyons carved by the relentless power of the active stream. We constantly switched between ascending and descending rope, climbing short stints out of the water only to plunge right back into the frigid stream. Our movements were encumbered under the weight of our absurdly heavy bags. Trudging through the thigh-deep water began to feel like wading through molasses. As the day dragged on and our stamina drained, we stumbled like drunkards down the black limestone gorges. After about fourteen hours, we finally reached Camp 2. Wet, unnerved and completely exhausted, we threw down our packs and collapsed.

The next morning we wiped the crust from our eyes and phoned into basecamp. "*Good morning! Glad you made it. Today we would like you to carry your bags to the depot between Camp 2 and Camp 3 and return with the loads that have been stashed there. It's already pretty late in the day, so get a move on!*" I felt like a clogged turd being mercilessly plunged farther down the toilet.

As a professional photographer, Chris was primarily there to take pictures, so he and Jason stayed behind to conduct their work while Oscar, our new friend Ryan, who we found living somewhat semi-permanently at Camp 2, and I set off for another day of brutally hard caving. After many long hours of aimless wandering, we managed to locate the depot and swap out our loads. We took an emotional moment to poach some bourbon from the supply stash before retracing our uncertain steps back to camp. The round trip journey took us about twelve hours. We woke up the next morning completely spent. Everything hurt. "I could really use a rest day," Oscar confided in me. "Me too!" I don't think either of us expected this level of intensity right out of the gate.

"*Sorry,*" the radio crackled, "*those bags from the depot need to come out ASAP.*"

At this point I was having serious doubts about whether I was cut out for this type of work. We set out again, thankfully moving slowly as Chris and Jason took pictures, but were still too fatigued to make it all the way out in one push. I was extremely tired and Oscar was having tremendous difficulty with his system. We spent a restless night at Camp 1 and slowly made our way back to the surface the next day.

We emerged to find our first view of the sun obstructed by the silhouetted figure of a very tall man. Squinting in the bright light, I made out the figure to be none other than the expedition leader, legendary cave explorer Bill Stone. He stood with his hands on his hips; a stern look canted his immaculately trimmed mustache. Here was a guy that was larger than life. He had been responsible for organizing and leading more than seventy expeditions over the last forty years. He was the big enchilada—or "*caca grande*" as Oscar often referred to him — and he looked it. Standing almost 2 meters tall, his imposing stature was as commanding as his sterling reputation. I was a bit star struck on this first meeting. I started to extend my hand, but Bill spoke before I could introduce myself. "You guys broke protocol," he firmly asserted. "We were seriously worried about you. Another few hours and we would have mounted a rescue."

We were taken aback. After what we had just been through, he might have well insulted our mothers. "PROTOCOL? *Qué chingados* protocol?"

As it turns out, there was definitely a system in place to prevent exactly what the four of us just did from happening. After the ropes course, cavers were expected to do a warmup trip to a point just past Camp 1 accompanied by an experienced caver and return within seven hours. They were then encouraged to go in for a one-night camp, again with a guide. Only then were they authorized to proceed past Camp 2 for any reason. All of this while carrying only what they deemed to be a reasonable load. *Oops*.

This was all news to us. We had managed to fly in under the radar in perfect conjunction with the management's absence and forego all formalities. When Bill returned from his ridge-walking trip and learned there were a handful of new guys coming out from a four day camp, he was deeply concerned. Someone had died in this cave under similar circumstances on a previous expedition. But after he heard our side of the story and saw that we were OK, he cut us some slack. He cracked a smile and we cracked some beers.

"Why don't you guys rest up for a couple of days and then we'll get you back underground for a proper warmup trip. There's a lot more to be done."

I was relieved to know our trip was a fluke. Maybe I could hang with this outfit after all. We said our goodbyes to Chris and Jason, who were off to photograph the nearby caving expedition happening on the Huautla plateau after a short tour of Oaxaca's beaches. With our responsibilities temporarily relinquished, Oscar and I loaded up with dive master James Brown to make the trip into the nearby village of Concepción Pápalo for some good food and locally distilled mountain liquor. We returned that evening to find that countless fliers outlining the FNG protocol had suddenly appeared all over basecamp. I still wonder if we had anything to do with that. . . .

After a few days of R&R and a thorough rearrangement of Oscar's Berrones system, we suited up once again and headed for the dark side of the dripline. Oscar and I were still drained from our previous misadventure, but we figured that we could handle a short trip. There was a group of six of us planning a quick jaunt to the bottom of Sacknussem's Well, a 155-meter pit a few hours into the cave. We were making good time and all was going well,until we called into basecamp from Camp 1. "*Camp I, this is basecamp. We have a situation.*" The voice of Marcin Gala, one of the expedition co-leaders, crackled through the radio in a crisp Polish accent. *"Vickie is injured, possible broken leg. She and Bill are bivouacked just past the Fuel Injector Bypass. We need you to respond."*

The mood became serious very quickly. Since I had been to this section of the cave before, albeit imprudently, I was instructed to escort the expedition doctor Kasia Turzanska down to the improvised bivy site. Bill had brought some sleeping bags and food up from Camp 2 and had requested that we bring a few extra bags down from Camp 1 for ourselves. Without dry camp clothes though, I anticipated this was going to be a very cold night. Our companions packed any extra warm layers and food they could spare into dry-bags while I finished up coordinating with the surface.

"*What we really need is for everyone to remain calm and rational."*

"Don't worry," I answered back, "we'll be cool as cucumbers."

There was a moment of silence. After a long pause the radio came back to life, "*OK then, guys, your codename is Cucumber Response Team."* Marcin and the other Polish cavers had never heard the expression before and were obviously amused. *"Take the phone and check in when you get there. Good luck*!" Without further adieu, we were dispatched down to the depths.

The borehole after Camp 1 ended in an abrupt drop. I rigged my rappel rack into the rope and looked down into the overwhelming darkness. The vertigo was astonishing. The sound of a waterfall crashing onto the rock somewhere far below gave the impression of astounding depth. I felt a lump in my throat. Not nearly enough time had passed for me to forget what lay in store for me down there.

So much for my short trip.

We found Bill and Vickie marooned on a sandy escarpment above the river a few hours later. "Glad you could make it," Bill said. We gave an affirmative smile, too tired from our journey to entertain a more flamboyant entrance. I was soaking wet and chilled to the bone. I felt more like a cucumber than a member of a rescue, but at least we were still a team. Kasia immediately got to work on her patient while I busied myself leveling out a dry place for us to sleep.

Kasia did a full assessment and determined that Vickie had a soft-tissue injury, likely a torn ACL, which a further diagnostic later confirmed. Thankfully not as serious as a broken leg, but this remote in the cave it was still no minor affair. She had slipped and fallen while traversing a section of smoothly scalloped limestone, which when wet has the equivalent surface friction of a bar of soap in a jar of olive oil. Falling here was just one of the inherent risks of caving. It could have happened to anyone. Despite her predicament, Vickie never lost her cheerful attitude. She might have been immobilized at the wrong end of a heinously twisted acrobatics course, but that didn't stop her from smiling and cracking jokes. We decided to lay over and give her a day to rest before attempting the journey out. With little else to do, we settled in and enjoyed each other's company.

It was during this time that I first got to know Bill Stone. Depending on how you look at it, Bill was either born at the wrong time or at exactly the right time. He was a high-caliber explorer, but with both poles claimed, the African interior mapped, and the high Himalayan peaks conquered, there were pretty much only two frontiers remaining: caves and space. Bill has the monopoly on both. In his professional life, he develops unmanned robotic vehicles for NASA with the aim of searching for extraterrestrial life on Jupiter's icy moons. He spends his personal time religiously searching for the world's deepest cave. One could justifiably compare him to a modern day Shackleton. On top of, or perhaps in spite of, all of his credentials, he also happens to be a super down-to-earth guy (no pun intended).

Bill beguiled us with stories for hours. He told us of how he'd flipped his truck on a Mexican highway back in the 70s and how one of his buddies once sacrificed a turkey by dropping it down a pit in order to gain access to a cave over on the Huautla plateau. It seemed that he had amassed more stories in his one lifetime than most people probably could in six. When we had talked all we cared to, we settled down in darkness and tried to catch some sleep.

Kasia and I were crammed next to each other on our small ledge. Lying mostly naked in the dark next to a beautiful young Polish doctor might have sounded much better if we weren't on an emergency bivouac 700 meters underground. I shivered with cold, not wearing anything but a thin polypro top inside my damp sleeping bag. Unable to sleep, I slurped some lukewarm dinner mix, Bill's special concoction of broccoli-cheddar soup, instant mashed potatoes, and ramen, from an old dried-mango bag and waited for the night to pass.

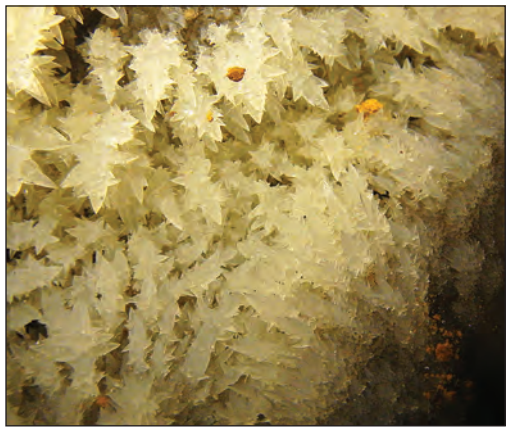
At precisely nine o'clock, the shimmering reflection of a distant LED headlamp alerted us that reinforcements had arrived from Camp 2. Bill had called upon Jerod Habiak and Klemen Mihalič, two exceptionally strong cavers, to assist Vickie to the surface by any means necessary. We were suited up and ready to go when they arrived. It was time to get moving.

Miraculously, Vickie was able to make it out of the cave under her own power. She climbed and crawled all over Jerod and Klemen, but she never once needed to be hauled or carried. Bill went with them while Kasia and I followed in the rear. We gave them a generous head start to avoid causing a rope jam, but we didn't see them again until Camp 1. Vickie was moving faster than I could keep up. Confident now that she could make the last leg unassisted, Bill and Vickie decided to stay at Camp 1 for the night while the rest of us took our leave.

Back on the surface, we were greeted with loud cheers and cold beers. Cucumber Response Team had delivered. Bill and Vickie made it out the next evening, and base camp turned into one big party. Bill broke out the good stuff he kept stashed in the gear tent for special occasions. The musically inclined serenaded us with guitars while bottles of mezcal and whisky orbited the fire. We drank and sang songs well into the night. Bill put down his guitar and passed me a bottle of Jameson. The fire danced shadows across his face. "There's a lot more to do down there," he said softly. "When are you guys going back in?" At the moment I felt more spry than I perhaps actually was. The alcohol did an excellent job of both masking my fatigue and impairing my judgment. I took another swig. "Hell, I'll go tomorrow," I blurted out. "Why not."

Bill was right, there was a lot more to do. The expedition was currently in crisis mode. The news coming back from beyond the sump was not good. Nothing was going. The small team of divers systematically checked every possible crack and crevice between Sump 1 and Sump

Morgan Smith in the Wet Dreams section of Cueva Cheve. *Kasia Biernacka.*



A display of crystals in Juniper Cave. *Nick Vieira.*

2 and confirmed them to be no more than just cracks and crevices. No passage. Their last task was to dive Sump 2 and check for leads on the other side, but since none had been found on the previous expedition, their prospects were already looking doubtful.

Efforts were beginning to be directed elsewhere. If burrowing straight down wasn't working, maybe there was a bypass into an older passage above the active streamway. After all, stream piracy by lower passages is common in large karst systems. Numerous other bypasses had been found in Cheve when the chances of continuation looked dismal, so why not this one?

The place to search was Mazunte Beach. It was geographically close to the sump and riddled with open leads. I was directed by the management to relieve members of the crew stationed there who had long past paid their dues. Three days of arduous travel later, I poked my head through an awkward fissure and locked eyes with Bev Shade. She, along with Mimi Alexander and Morgan Smith, had been at Mazunte Beach surveying hopelessly tight leads for a duration of time discernible only by the thickness of mud that coated each of their faces.

Lauren Satterfield, Corey Hackley, and I passed our packs down through the torsion of entrance holes and settled in. Technically, only Lauren and Corey settled in; I returned to Camp 3 that night and came back the next day so that Mimi could finish up the lead she was working on. I surveyed my new surroundings. Wow, what a shithole! I unpacked our provisions while Lauren and Bev discussed where to hang the fourth hammock. "Should we hang it over the kitchen or off in space over the death pit? It will give us a bit more room if we do it over there."

"Is this even a question?" I protested. "Of course we hang it over the kitchen. Sleeping over the death pit would be suicide." Lauren glanced over at the menacing drop. "Yeah," she agreed, "kitchen."

By now we had all heard the bad news. Sump 2 was dead. The lead divers were on their way out, presumably to a bar in Oaxaca. Oscar and two other divers had been tasked to derig Camp 4 between the sumps and haul equipment back across Sump 1. All exploration efforts were now focused solely on auxiliary leads. In the eyes of the management, Mazunte Beach was the expedition's last hope. And if a way on existed, Corey was the man to find it. Corey Hackley involuntarily held the position of Bill's secret weapon. "I made the mistake of finding borehole with Bill once," he told me, "now he expects me to find one every time." Corey had made a lot of exciting breakthroughs throughout the course of his caving career. He attributes his success to his thoroughness, but to anyone else, it might appear as if he could smell virgin cave. When Corey arrived at basecamp a few days earlier, it was like the second coming of Christ. The expedition was saved! If he didn't like this stigma, he certainly didn't do himself any favors when the first thing he did was go out ridge-walking with Lauren and find a significant new cave. They named it CL6, short for Cory and Lauren and the number of holes they checked that day. He was then given a choice by the management. "You can either continue to explore CL6, or you can go push leads at Mazunte Beach. This is the last chance for the expedition. It is up to you." Not much of a choice really.

Over the next few days, I tried my best to keep up with Corey. He practically floated over rock. On one occasion I tried to follow him across an exposed lip, only to find the rock was so rotten that I couldn't grasp a single hand hold without it breaking off. I tediously made my way across and finally found the spot he had disappeared into. There's just no way. It was impossibly small. I crawled in and got wedged. I could hear Bev and Lauren somewhere above. "Hey," I called out, "how did you guys do this?"

"I dunno," Bev replied, "you just kind of wiggle."

Nope. The squeeze precluded me from going any farther, but Corey had found a juicy lead just beyond that point. Bev and Lauren played rock-paper-scissors for who would follow him. Bev lost. Lauren and I left them to their own devices and turned back so that we could make the two-hour round trip down to the river to get water.

Several hours later our friends still hadn't returned, so we decided to head back toward their last known location. We found them pretty much where we had left them, but in a much altered state. They looked like they had just been through a war zone. They were soaking wet and caked in mud, cave suits in shambles. As Lauren described it later, their souls had been crushed. "How was it?" we asked. No answer. Bev finally broke the silence. "Maybe I can have a different hobby. Like stamp collecting. Or birdwatching. I could be a bird watcher!"

After we left, Corey and Bev had made their way to a room with a large waterfall. Before Bev could tell him that she didn't feel entirely comfortable climbing it unprotected, Corey was at the top and had disappeared into some tiny hole. With no other option, she followed. She emerged into a very small room and saw Corey digging away at what appeared to be a solid wall. Mud was being slung in her direction, and they were both getting sprayed with cold water. After a few minutes, Corey began squeezing his body into a ludicrously small crack. He later said that he could feel his pelvis

grinding against the rock. He fit, she didn't. Bev began chiseling away at the crack so that she could join her companion. Suddenly she was very alone. She sang in an effort to fill the void of silence. Meanwhile, Corey was in the midst of another exposed free climb somewhere up ahead. He reached the top and saw blackness through the cracks. "It goes!" But it was too tight. He would need to return with more digging equipment. He attempted to downclimb.

"Uh, Bev?" He could hear the sound of her chisel.

Tink tink "Yeah?"

"I'm going to need you to spot me down this climb."

"Oh, OK." *tink tink tink tink tink*

She worked double-time and finally made it through the crack. Corey thrust his rear end down upon her. A few awkward steps and he was back on the ground. They raced back through the passage down the way they had come. Unfortunately, this was still an open lead. Some poor soul would need to go back to this dreadful place and finish the job.

We relayed the find to basecamp. They wanted to know if it was worth staying down there for. "It's complicated," we said. It was good news, but not great news. Regardless, we were running low on food. That pretty much made the decision for us. Corey would stay; the rest of us would leave. Morgan Smith would return for his second shift at Mazunte Beach with supplies and help Corey dig open the lead. It was settled.

We spent our last evening together sipping hot cocoa and eavesdropping the inter-camp chatter on the phone line. Listening to Bill's rather blunt directives from the surface had us in stitches with laughter. *"Are those guys from Mazunte Beach coming out tomorrow? Make sure they're carrying bags. No one gets out for free!"* It came out rough, but we knew what he meant. There was still a lot more to do.

We crawled into our hammocks, and Bev began her nightly routine of rocking us to sleep. Swaying to and fro while suspended in mid air, our outfit resembled the rhythmic tossing of a ship at sea. The locations of the latrine and pee pit relative to our imaginary craft became the enterprise's motto. "Shit to port, piss to starboard!" Our sense of humor was the only thing that masked our malodorous musk. Laughter died and silence permeated the room as we stared up into the darkness. "No matter how terrible things get," Corey said before drifting off, "I always find solace in the fact that the swift current of time will inevitably sweep me far away from this place."

And sweep us away it did. Soon we, along with a large pile of dive gear, were back at Camp 3 and getting prepped for the long haul out. The expedition was now in its final stages. I sat on my sleeping pad and gazed out into space, the distant walls seeming to recede faster than my vision could follow. The spectacularly large borehole that housed Camp 3 was a nice change of scenery from the claustrophobic tunnels at Mazunte Beach.

"That headlamp is in the wrong spot." Lauren made the comment to no one in particular. "Whoever is at the latrine is slightly off center." Everyone looked. "Damnit, that was the rock I always put my foot on," Oscar responded "I've just about had it with whoever is taking these satellite shits.". The kitchen area resembled a slanted bobsled run with the latrine at the bottom, so it was hard not to notice these things. I turned my field of vision away from the perpetrator and looked over to the mound of bright yellow bags piled at the center of camp. Over the next few weeks it would all need to go out. The swift current of time. . . .

The mornings at Camp 3 started with Nathan Roser loudly announcing the cultivation status of his foot-fungus farm. "Gotta eat something," he would say. Now fully awake, but without much of an appetite, the crowd would migrate over to the kitchen area and watch the floating headlamps bob down the well trodden path to the ever-expanding latrine.

All hands were on deck for the gear hauling, which meant that the full spread of Cheve's swashbuckling crew was together at one place. The sport of caving is generally known to attract some unique personalities. If Cheve was the culmination of the sport, then the expedition's personnel were the embodiment of caving culture.

For instance, there was Nathan. Professionally, he was the manager of a shipping warehouse in New York whose primary export was phallic shaped gummy candies. Recreationally, he hauled loads on caving expeditions. Nathan would fly solo through the cave toting ridiculously heavy bags, purple cave suit open down to his bare naval, blasting rock-and-roll music from a small speaker as he went. At one point Nathan blazed past Lauren and me while shuttling bags. "Horse conch, coming through. Biggest conch in the world." We erupted into laughter, mistaking his "conch" for a similar, less appropriate word. "Wait . . . what!?" "*Conch*! Horse *conch*!" he said in a mortified tone, as if he would never have dreamed of saying anything else. "It's the largest conch in the world and it overtakes smaller conches because it's faster."

Nathan wasn't the only large conch overtaking us. We were often passed by Nick Vieira, who was indisputably the strongest caver on the expedition. He was a true force of nature. In the time it took the rest of us to do a single haul trip, he could easily do six. He could move through the cave like nothing I had ever seen, often carrying three or more bags. With his pronounced strong jawline-chin combination and defined six-pack that was visible even through his cave suit, I became convinced that he was actually Clark Kent turned from crime fighting to cave exploring. Before the expedition was over, he would spend over sixty days underground—a handsome contribution toward his average of two-hundred days underground per year. "How long would it take you to get out from here?" I asked him one night at Camp 2, which was a full day's travel from the surface. "Three hours," he replied. Jesus Christ.

There were definitely some superhuman personalities at play. Occasionally, they would join forces to create a tidal wave of infinite bag moving power. The aptly named Team Motivation, composed of our

eastern European counterparts Marcin Gala, Klemen Mihalič, and Witold Hoffmann, moved like a whirlwind through the cave, bringing large quantities of bags progressively closer to the surface. Oscar, Lauren, and I, self proclaimed Team Snail, leapfrogged with them until all bags had been delivered to Camp 2. With this task done, the three of us opted to leave the lion's share of shuttling through the most technical section of cave between Camps 2 and 1 to Team Motivation and folks like Nick and Nathan. I had been underground for eleven days, Oscar and Lauren more. We were low on both battery power and ibuprofen. It was time to head out.

Bill Stone, accompanied by one of the lead divers, Jon Lillestolen, passed us on their way in. Bill motioned us close so we could hear him over the torrent of the river. "Nice work you guys. Rest up and get back in, there are a lot more bags to come out."

Over the next several days, Oscar, Lauren and I, along with a few of our Mexican compadres who showed up for the last part of the expedition, staged out of basecamp and began shuttling loads from Camp 1 to the surface. I was finally in good enough shape to be effective. What took me four hours one way a month ago now only took me three hours round trip. As Marcin would say, "The holds begin to smile." I was getting to know my way around. Cruising up rope with bags hanging from my harness, flying through re-belays, I was feeling downright sexy.

Meanwhile, there was exciting news coming back from CL6. It was going big. Team Motivation, now repurposed, was conducting daily survey trips and had already found borehole equal in size to what was typically found much deeper in Cheve. With the looming prospect of a large new cave system, there was increasing pressure to begin derigging Cheve and redirect all efforts to the exploration of CL6.

The news coming back from Cheve was less promising. After maximum effort, the lead at Mazunte Beach yielded no results, but that didn't discourage Corey and Morgan from continuing exploration efforts. They cut their losses at Mazunte Beach and with the help of everyone still left in the cave began scouring the upper passages around Camp 3 for higher leads. If they were leaving Cheve, they were going to make damn sure that there was no reason to come back.

Meanwhile, some 1000 meters above, we kept pulling out more bags, Team Motivation surveyed swaths of virgin cave in CL6, and Bill sent updates on the "mission-critical" shortage of toilet paper remaining in the cave. Soon, whether the team at the bottom of the cave was ready not, Cheve was going to be finished. Bill had already written off Cheve for dead. The rainy season loomed just around the corner. Why waste what little time we had left on unpromising leads when there was a whole new cave to explore? Just when everyone was starting to get the impression that the guys down there should wrap things up, the team at the bottom came through with big news. They had almost accidentally stumbled upon a previously unnoticed lead with impressive airflow. "*This is where the cave goes,*" Corey radioed in. "*You need to get down here now.*" With limited time and hardly any food left, Bill joined Corey and Morgan while the rest of the crew headed out. "*If I had known about this lead from the beginning,*" Bill radioed in later that night, "*we wouldn't have even done the dive. There is hurricane-force wind blowing through here.*" It was enough to blow them sideways. The lead was screaming air.

Unfortunately, it wasn't low hanging fruit. The lead was going to require a substantial amount of modification before it could be passable. They worked hard and well to break through, but the supply chain was broken. With no external support, the isolated crew soon depleted their food and other material. A half-day more and they might have been through, but time had run out. Blackness loomed just beyond their reach. After nearly a month underground, Corey and Morgan were forced to retreat. They had no choice but to turn their backs on the dig.

The lead, and the mystery of the world's deepest cave, would have to wait.

Although Cheve had prudishly denied any further exploration, CL6 was exposing itself with gracious indecency. Team Motivation was generating as much as a kilometer of newly surveyed passage per trip. With Cheve officially finished, the expedition could now concentrate all efforts on deflowering the virgin system.

Marcin convinced me to take a break from gear-hauling and get in on the action. I was hesitant at first because of how tight some of the entrance sections were rumored to be, but Marcin was adamant that I participate. "I really think you should see this cave," he said. "It's like nothing you have ever seen."

"This is exactly like every other cave I've ever seen!" I yelled up

Morgan Smith in Juniper Cave. *Nick Vieira.*

passage at my friend Gerardo Morrill as I crawled on my stomach, face halfway submerged in a puddle. "Yeah, it's pretty tight." The acoustics of his reply reverberated harshly as he dragged his body through a tube with a diameter slightly bigger than that of a steering wheel. Watching his feet disappear ahead of me made me feel like an unborn baby following its twin brother out of the womb. The squeezes only got worse from there. Next was a 140-meter -ong vertical fissure named the White Rabbit that was never more, but often less, than 20 centimeters wide. My ribs made weird clicking sounds as I splayed out like mayonnaise spread between a flat rock sandwich. We made incremental forward progress by using body wedging techniques interspersed with fits of cursing. "When the hell does this thing open up!?"

Just as I was beginning to regret my decision of tagging along, the heinous fissure ended in a spectacular drop off at the edge of a cathedral-sized chamber. "Oh, wow." I stood bewildered for a moment at the edge of the balcony and gawked at the expanse. Not only was it enormous, but CL6 was as visually stunning a cave as I had ever seen. It was a geologic wonderland. Across the way I could see spectacularly exposed folds in the rock strata unfurled across the walls like an ancient mural, testament of some omnipotent power. The vista was so unexpected that it seemed as if it had reached out and slapped me.

Gerardo and I rappelled down off the balcony and caught up with Marcin and Witold. They were waiting for us at a survey station in a small constriction just down-passage. The airflow was so strong at this point that it caused the pink survey ribbon fixed to an overhang to hold a constant horizontal posture. Witold let the flagging flutter against his face as it blew rapidly in the wind. "It is doubtful that there is any cave back here." he joked. Smiling from ear to ear, he looked back at Gerardo and me. "Get ready for the best day of survey of your life."

From there we pushed forward and started scooping booty. With Marcin leading the way, we passed through large chambers and heavily decorated rooms as we chased the air. I would glance up at some extraordinary feature and immediately return my vision to the ground. We were the first humans to ever set foot here, so there was still an enormous amount of potential energy stored in the untrodden breakdown floor. We had to be careful—everything moved. When we had scouted what we deemed to be a reasonable amount, we broke out the survey gear and began to work backward toward the last surveyed point. Marcin handed me a Disto-X. "You're running backsights." By now I could hardly contain my excitement. CL6 was a mind-bending cave, and here I was getting to be a part of the survey. I was ecstatic.

"Wow! Dig this," I thought as I lit up the adjacent wall with splay shots from the Disto-X. "I'm surveying virgin passage in Mexico's next hot cave." I shot an arch of laser beams across the ceiling and sprinted to the next station with a big shit-eating grin on my face. I was letting it go to my head. For a moment I was invincible, nothing on earth could knock me off my high stool. But if there was one thing my mother always told me, it was that pride cometh before the . . . .

Crack. The rock below my feet broke in two. *Schwoosh, thud.* I fell about a meter and impacted rock with my right leg, hard. "GODDAMNIT! ARRRGH! GOD - DAMN - IT!"

"Are you ok?!" Marcin called back from the last station.

"I think . . . OW." I was in a lot of pain. I regained my composure and stood up. I slowly put pressure on the leg. It held. "It's not broken, but . . . ." I tried to walk. That sort of worked. I began to hobble down the passage back toward the staging area.

Gerardo took my bag. "You know," he said, "in Mexico, we say to always have a rock in your pack. That way if your buddy gets hurt, you can smash him in the head and get it over with." That turned my grimace to a grin. "Man, *amigo*, you might have to. I can hardly walk." I sat down to take some pressure off my leg.

"That's OK," Witold chimed in from behind, "You won't need to walk in the White Rabbit. I rested my face in my palms. "Gerardo, do you have that rock handy?"

Gerardo escorted me out while Witold and Marcin completed the survey. They would have plenty of time, as it was obvious that I wasn't going anywhere fast. I hobbled along at snail pace, using my good leg in the foot loop on my ascender to climb the series of ropes back towards the surface. Thrusting myself through the White Rabbit was very difficult this time through. My leg was pretty much useless, so I had to get creative with my body positioning. I was having substantially less fun than I was a few hours ago. Crawling back through the frigid water-filled tube, leg throbbing and bollocks fully retracted, I started contemplating the big questions; Why the hell am I here? Why do I cave? This is absolutely ridiculous. Of all things, why this?

The torment eventually ended. After several painstakingly long hours, we finally made it back to the surface. I fell on my face and practically kissed the ground. I was beyond thrilled to be out of the cave. Marcin and Witold had caught up with us by this point. We stripped off our wet cave suits and changed into dry clothes. "When you hit your leg, was it on a round rock or a sharp rock?" Witold asked me. I peeled off my thermals and revealed a 6-inch-long black gash on my left thigh. "OK," he said, "so it was a sharp rock." We piled in Gerardo's truck and let out a collective sigh. We could finally relax. Marcin reached into his pack and produced a sleeve of cheap Mexican cookies. A sweet aroma permeated the cab as he tore the foil wrapper and distributed its contents. I bit down into euphoric bliss. Nothing in the world could have tasted better at that moment. The flavor was intense, the texture sublime. I was so happy to be eating that cookie—just so happy to be alive.

"Why do we cave?" he posed the rhetorical question to everyone present. It was like he had read my mind and had been waiting until that moment to reveal the answer. "We cave for the technical challenge,

sure. We cave for the comradery that comes with doing these ridiculous things with others, absolutely. But perhaps most importantly, we cave for the taste of the cookies."

My caving was finished for the remainder of the expedition, but the exploration of CL6 continued. A few days later, Cory and Lauren returned to their namesake cave along with Morgan, Oscar, Kasia, Nick, and Team Motivation and discovered a room with a 140-meter diameter — almost large enough to house three 747 jet airliners tail to tail. In-feeder boreholes and large rooms intersected the main passage at numerous locations. Infinity Borehole, Lost in Space, Total Perspective Vortex—all names testament to their awesome sizes. There was too much cave to survey. This was going to take a few years.

Back at basecamp, we gathered together for a final group photo. I hobbled across the llano to join my friends as fast as my leg would allow. Strong bonds had formed between all of us; it was bittersweet to see everyone go. But as Bill had said time and time again, there was a lot more to do. We knew we'd be back.

I wandered over with my morning coffee to the entrance of Cheve to say a concluding goodbye to the cave. To my surprise, I found my friend Adrian Miguel-Nieto doing exactly the same thing. "It's so peaceful," he said. It absolutely was. We watched the swallows circle through the rising mist for what seemed like hours. I wanted to hang on to the moment forever. "Come on," Adrian gestured, "let's go help the others pack up." A final glance and the moment was gone. As we headed back up the trail toward camp, the trucks, and the rest of our lives, we were caught in the swift current of time, which inevitably swept us far away.

A huge thank you to Ellen Whittle and Emily Taylor for their punctilious editing, to Lauren Satterfield and Oscar Berrones for fact-checking, to the grammar savvy members of my family who provided literary critiques, and to all the great folks over at the Northern Rocky Mountain Grotto who supported me on this venture. I owe you all beers. Cheers!

Nadie Sale Gratis: La Reseña de un Novato de Cheve 2017

Descripción de la expedición 2017 al Sistema Cheve desde la perspectiva de un novato. Cheve se armó hasta el fondo, se bucearon los sifones y se escalaron los domos en búsqueda, infructuosa, de una continuación. Se descubrió una cueva de importancia, CL6 o Cueva del Junípero, ahora llamada Cueva de la Peña Negra, la cual se convirtió en el objetivo principal de la expedición. Se dejaron pendientes por explorar varios pasajes de buen tamaño para 2018.

THE WHITE-COLLARED SWIFTS AT SÓTANO DE LAS GOLONDRINAS

David Whitacre

I first visited Sótano de las Golondrinas and saw the swifts there over Christmas of 1967 or 1968, when my folks took us kids to Mexico over Christmas break from high school. I had heard of the pit and the swifts from my old snake-hunting buddy turned pit-caving buddy, Ted Wilson. I hired a local kid in Aquismón to guide me to the pit, and my folks picked me up in Aquismón two days later.

The sight of the thousands of white-collared Swifts *(Streptoprocne zonaris*) leaving and entering the pit captured my imagination. In the winter of 1975–76, I returned with some bird-watching pals, and we made our first approximate counts of the swifts. Then in January and February 1977 my first real studies of these swifts began: Devi Ukrain, Roger Skaggs, Kate Eberhardt, and I spent these two months living in Tamapatz and documenting swift populations and behavior at Golondrinas, Hoya de Guaguas, Hoya de Quilas, and a few other bird pits nearby. Our visual counts during these years estimated about twenty-five thousand swifts inhabiting Golondrinas and about fifteen thousand at Guaguas. These remain the largest known swift colonies in the Western Hemisphere, though some caves in Brazil housing the congeneric biscutate swift (*S. biscutata*) reportedly may rival them in population size.

I subsequently did my doctoral work at U.C. Davis on the foraging ecology of the two Mexican species of this genus—the white-collared swift *Streptoprocne zonaris* and the white-naped swift *S. semicollaris*. At about 180 grams weight, the white-naped is tied with a southeast Asian swift as the world's largest swift. The white-collared, at about 110 grams, is also among the world's larger swift species. The white-collared occurs throughout the American tropics at lowland to mid-elevations, from Mexico's northernmost tropics to northern Argentina. The very large white-naped, though similar in ecology and nesting habits to the white-collared, is curiously restricted to a relatively small area in southwestern Mexico, mainly in Guerrero, Morelos, and Michoacán. The third member of the genus, *S. biscutata*, is restricted to a portion of southeast Brazil and adjacent Argentina. Two smaller species have recently been transferred from the swift genus *Cypseloides* to the genus *Streptoprocne*—whether this change was merited waits to be seen.

Among the world's roughly ninety-two swift species, Mexico's two cave-nesting *Streptoprocne* species constitute an extreme in lifestyle or ecological strategy. While many swift species nest as single pairs in sites such as hollow trees, chimneys, or on tree trunks or plastered to palm leaves, the *Streptoprocne* swifts are highly colonial, living in year-round colonies within giant cave mouths and in cave-like situations and moist, mossy ledges associated with certain waterfalls. Colonies of these swifts generally number from five hundred to many thousands of birds. They nest on ledges or in potholes, usually in near-total darkness. When away from their colony site, these swifts are in constant flight; the swifts never perch anywhere except on vertical to overhanging rock walls at their colony sites. Unlike many swift species, these swifts often make use of soaring flight in rising air, no doubt saving much energy in this manner. When commuting to and from foraging locations, however, they often indulge heavily in powerful flapping flight.

All swifts feed exclusively on the "aerial plankton," flying insects and wind-borne spiders in the open sky. While all swifts are highly mobile, covering substantial ground as they forage, one factor largely determines how far they travel during a given foraging trip, at least during nesting. This predominant factor is the frequency with which they feed their young at the nest. On one extreme, many swifts, including the hollow-tree nesters, which often lay five or more eggs, feed their young every twenty minutes or so. As a result, these species forage mainly quite near the nest, and tend take a highly varied diet; while they will concentrate on swarms of ants and termites when available, they cannot travel widely enough to specialize in such a patchy food source.

At the other extreme, *Streptoprocne* swifts, along with their highly colonial cave-dwelling habit, are specialists at extreme long-distance foraging. Both of the Mexican *Streptoprocne* swifts lay a two-egg clutch. Adults take long shifts incubating the eggs, often a day-long stint. During most of the year these swifts make a single, many-hour foraging trip, covering distances of probably often hundreds of miles in a day. The only time they may make as many as three or four separate foraging trips in a day is when the nestlings are less than two weeks old and require more frequent feeding. Once chicks are two weeks old, they are fed only when the adults return to the nest at nightfall, and probably also during the night, with adults pumping up insects held in a large crop-like structure between the mouth and the stomach.

White-collared Swifts are often preyed upon by various birds of prey while they are leaving or entering their colony sites. At Sótano de las Golondrinas, a pair of peregrine falcons actually nests within the pit and feeds very often on the swifts. It

davewhitacre@gmail.com

is common to see a peregrine perched in a tree on the high side of the pit entrance and diving after swifts as they leave the pit. Short-tailed hawks, which specialize in hunting birds from a high, soaring flight, can also frequently be seen soaring above Golondrinas and occasionally diving after a swift.

The swifts at Golondrinas sometimes leave the pit in a single dense stream early in the morning. Sometimes there are two or more exit flights, with some swifts leaving in the very early dawn, and later flights occurring at any time up to noon or so. Why some swifts leave early and others later is not known. Perhaps those that leave early did not feed as well on the previous day, or else they are in the habit of foraging farther away from the pit, involving longer commuting flights.

Nesting occurs during the northern-hemisphere spring. Laying and hatching dates have not been precisely documented at Golondrinas, but colonies in Chiapas, Mexico, lay their eggs on average during the first week of May, and hatch, on average, at the end of May and beginning of June, with chicks fledging by mid-July. These swifts time their egg-laying such that eggs hatch at the onset of the rainy season, when insect populations increase dramatically. White-collared swifts in Chiapas, and presumably at Golondrinas as well, specialize in finding the richest feeding opportunities, those provided by winged mating swarms of ants and termites, which occur especially after rains early in the rainy season. These winged reproductives are crammed with fat in preparation for egg laying and founding of new colonies. These swifts' single day-long foraging trips seem to be an adaptation allowing them maximal opportunity to find and exploit such mating swarms of insects, which are unpredictable in time and space and short-lived. Once found, however, they are often huge, allowing swifts to quickly fill up and head back to the nest to feed their growing youngsters.

A white-collared swift photographed at the bottom of Golondrinas. *David Whitacre.*

The swift colony at Sótano de las Golondrinas has in recent years become a major tourist attraction, with usually dozens of tourists to be found waiting at the pit's rim in the morning to watch the exit flight and in the evening to view the entry flight. While exit flights are impressive to watch, the evening entry flights are even more so. Swifts arriving in late afternoon often spend a good deal of time milling and socializing in large flocks near the pit rim. Periodically a flock will pass near the pit mouth and a group will peel off, with much excited cheedling, and dive nearly vertically into the pit at impressive speeds. As darkness approaches, the entry flight becomes more continuous and dramatic, and the last-arriving swifts often come in at a high altitude and dive in directly, often unseen in the growing darkness, without any circling. These swifts make a sound like that of ripping cloth as they dive into the pit's yawning gape. The swifts of Golondrinas, together with the pit itself, are truly one of the wonders of nature and a patrimony of global significance.

In 2014, I began anew my studies of white-collared swifts, including those at Sótano de las Golondrinas. One goal was to make more accurate population counts than those I achieved during the 1970s and 1980s. I began to film entire exit flights using a GoPro video camera. I would then count the swifts individually as they crossed a computer screen, often playing back the video a single frame at a time. In the July 22, 2014, exit flight, I counted 49,539 swifts leaving the pit. This is a minimum, as a few swifts may well have escaped detection, but I believe it is very close to the true number on that date. I again filmed an entire exit flight on July 15, 2015, and I am still in the process of counting the swifts.

Compared to my counts of twenty to twenty-five thousand swifts at Golondrinas in the late 1970s, these current numbers indicate either that the population has increased, or, more likely, that my earlier counts were underestimates, being based solely on visual estimates, sometimes ticking off groups I believed to be twenty or fifty swifts. I believe the population of this pit has remained essentially constant over the four-decade interval—good news, considering that aerial insectivorous birds are widely believed to be in decline over at least portions of North America during the past couple decades.

I am in the process of creating an organization and website titled ProyectoVencejos.org that will be dedicated to the study, appreciation, and conservation of Mexico's cave-nesting swifts.

Los Vencejos de Cuello Blanco
en el Sótano de las Golondrinas

Reseña de la historia natural de los vencejos en Golondrinas y otros "pozos de pájaros" cerca de Aquismón. Estas son las colonias de vencejos más numerosas en el Hemisferio Occidental. El autor está iniciando una organización dedicada al estudio y conservación de los vencejos que anidan en cuevas en México.

HISTORY OF THE PROYECTO SIERRA MAZATECA

Marion Akers

After a Mazatec man caught me bathing by my camp, I travelled back to the main camp to tell everyone what had happened, and I had just finished telling the story when more men and dogs came up from their own trail up the hill from the south, fourteen in total, including police from San José Tenango. Horacio, the Security Agent, was leading the group and took his 9mm semi-automatic out of his holster, with the hammer pulled back, as Adam approached the group in greeting. Then he released the hammer when Adam smiled and voiced his greeting, holding an uneaten bowl of food in his hand. "¿Como Estas?*" How are you?*

"¿Que puedo te ayudar?*" How can I help you?*

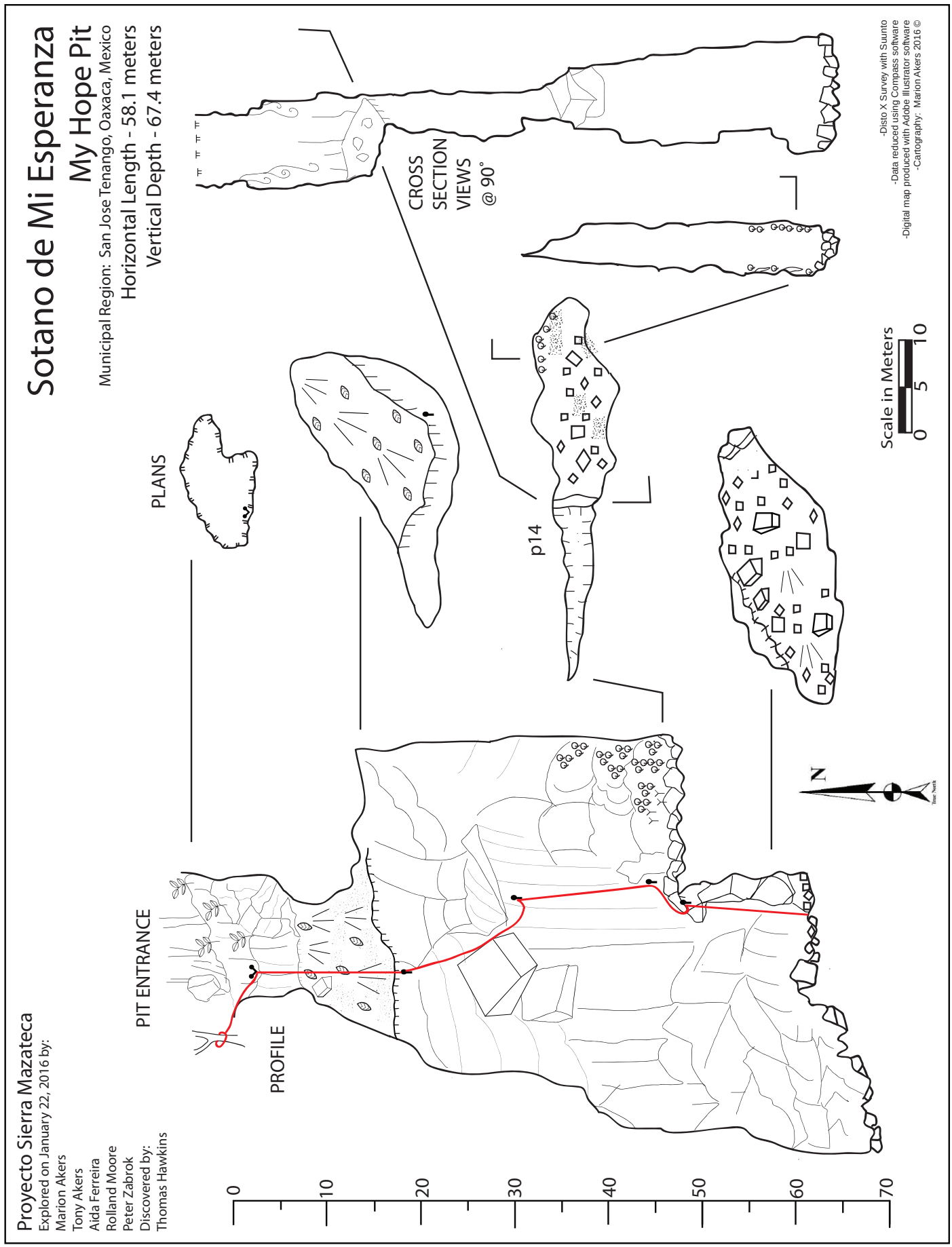
All available guns were pointed at him. There were several policemen in the group, but the majority of men were from Mina de Arena. The men were complaining that we had been in their territory and we had come to take from them. Horacio continued to be the mediator and told us that we had to go to San José Tenango to meet with the police in Centro and discuss the issue. He reassured us that we were not in trouble and not to worry, and that we could go back up in no time. Adam was great, being an excellent Spanish speaker and understanding the situation, friendly as well. Horacio was nice as well, and the conversation turned as I showed him photos from Thomas's album of orchids and plant IDs. Horacio did express that it was dangerous up here for other reasons, delinquents and robbers. Wow, and after the illegal logging that is going on, who can blame these guys for protecting themselves? We had our permission letter and gave them a list of names of all of us, plus GPS coordinates. They seemed impressed by the permission letter from the presidente *of San José Tenango, and we were glad of that. But Adam knew it was serious, that they had gone to a lot of trouble to find us, and we had better do what they said. We wondered what the meeting would hold for us.—Excerpt from the journal of Marion Akers, January 23, 2017.*

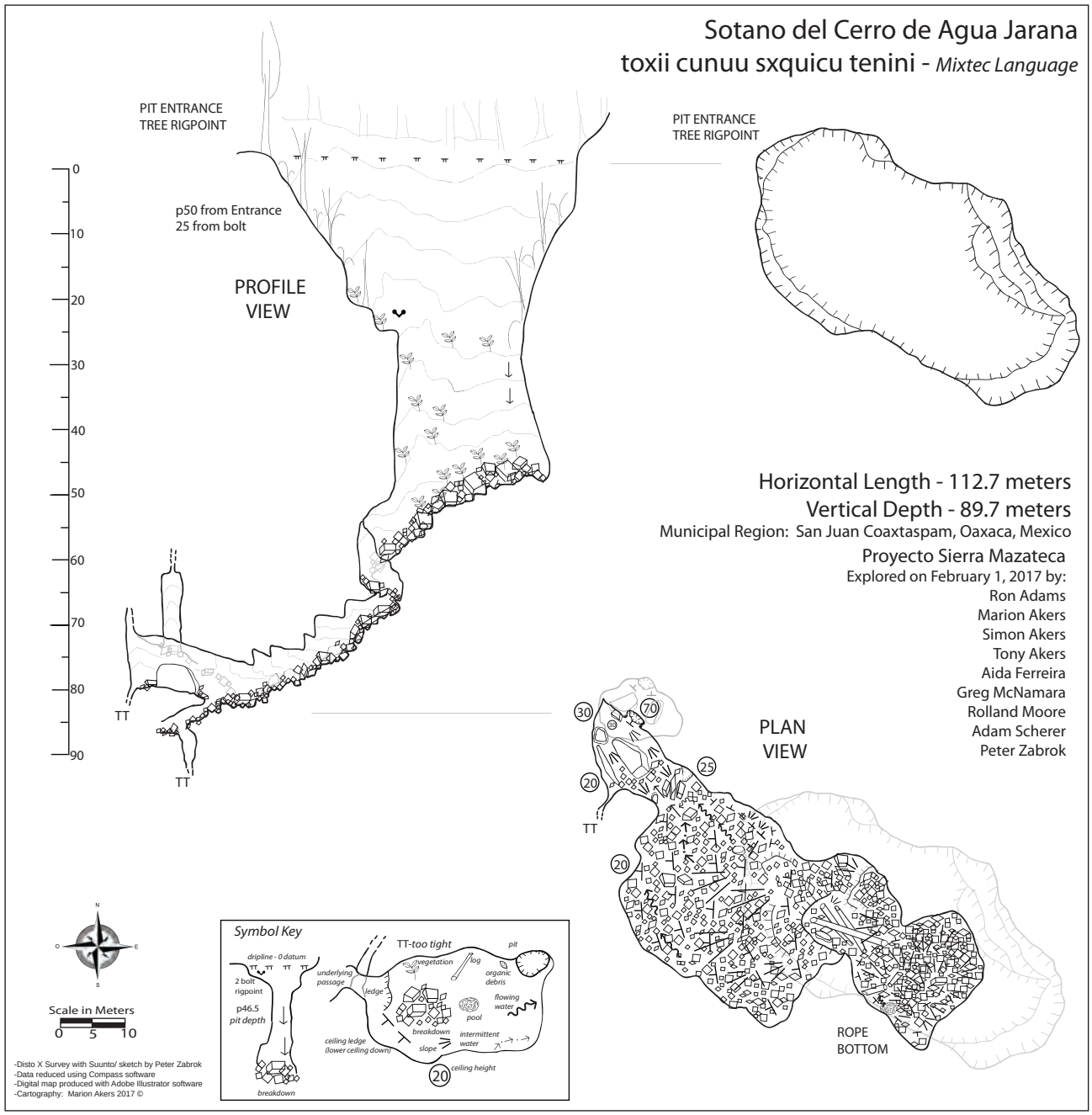
Long story made short: The meeting resulted in us being forced off of the mountain in one day. The local government could not stand up to this large local group, and regardless of our intentions we had to go.

Although the Proyecto Sierra Mazateca Corpor,ation officially started in 2012, the project itself stretches back to 1994, to a trip with just three people, Tony Akers, Joe Oliphant, and Tina Shirk, all Indiana cavers. They had read the published books about caves in Oaxaca by Swiss cavers, *Proyecto Cerro Rabón 1985–1989* and *Proyecto Cerro Rabón 1990–1994*. The Cerro Rabón escarpment was unexplored in many areas. This highland-karst environment, located in the northeast corner of the state of Oaxaca, houses some of the world's deepest cave systems, such as Sistema Huautla, currently at 1560 meters and Sistema Cheve at 1484 meters. The area gets huge amounts of rainfall, up to 5 meters per year, and is classified as a neotropical rainforest. As evidenced by resurgences such as that of the Río Uluapan and the lack of surface drainage, the underground water systems are huge. This magical cloud forest is called the Sierra Mazateca, where the Mazatecan people live. The Mazatecs' language and culture is a mixture of Spanish and Mazatec, and it is a truly unique indigenous culture with an interesting history. The population is growing rapidly with the onset of modern paved

Simon Akers, Adam Scherer, and Peter Zabrok in Sótano de Cerro de Agua Jarana. *Greg McNamara.*

marion@carlotagardens.com


Sotano de Mi Esperanza
My Hope Pit
Municipal Region: San Jose Tenango, Oaxaca, Mexico
Horizontal Length - 58.1 meters
Vertical Depth - 67.4 meters
Proyecto Sierra Mazateca
Explored on January 22, 2016 by:
Marion Akers
Tony Akers
Aida Ferreira
Rolland Moore
Peter Zabrok
Discovered by:
Thomas Hawkins
PIT ENTRANCE
PROFILE
PLANS
CROSS SECTION VIEWS @ 90˚
p14
Scale in Meters
0 5 10
0 10 20 30 40 50 60 70
N
-Disto X Survey with Suunto
-Data reduced using Compass software
-Digital map produced with Adobe Illustrator software
-Cartography: Marion Akers 2016 ©



From left: Thomas Hawkins, Simor Akers, Rand Heazlitt, and Greg McNamara. *Tony Akers*.

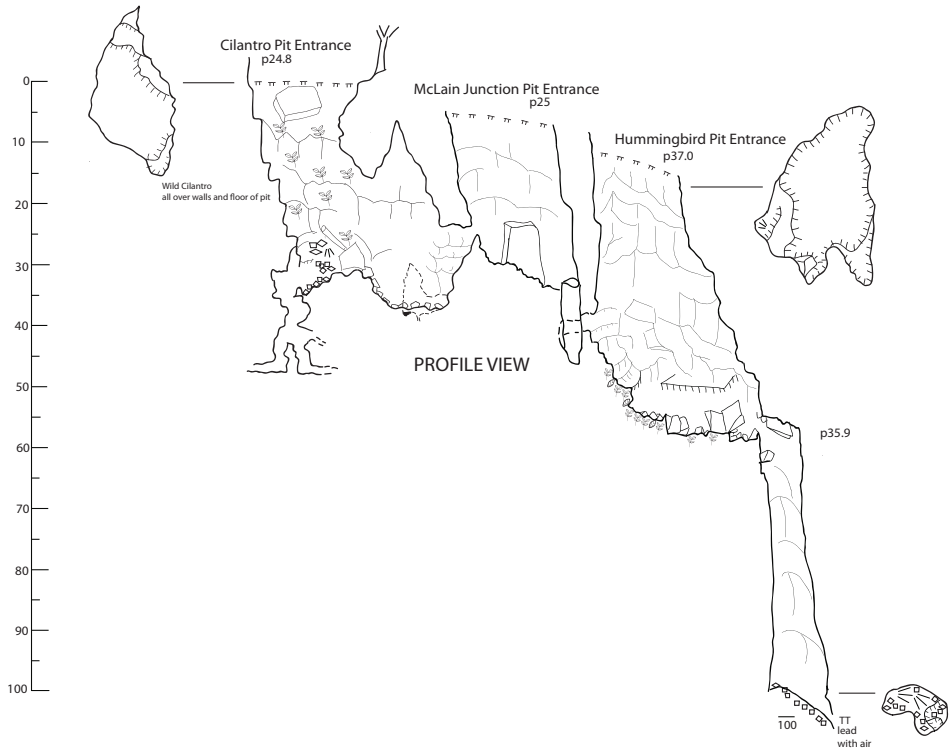
Sótano Espiritu de McLain
Spirit of McLain Pit

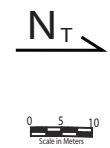
Proyecto Sierra Mazateca

Municipal Region: Huautla de Jiménez, Oaxaca, Mexico

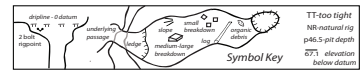
Horizontal Length - 216.9 meters
Vertical Depth - 100 meters

Explored on January 20, 2014 by:
Ron Adams
Marion Akers
Simon Akers
Tony Akers
Andy Armstrong
Rolland Moore
Paul Mozal
Coeli Velky





-Suunto and Disto Survey
-Data reduced using Compass software
-Digital map produced with Adobe Illustrator software
-Cartography: Marion Akers 2014 ©

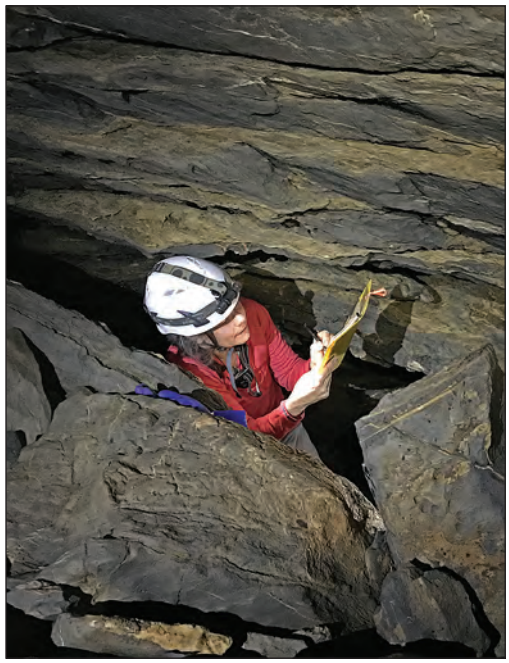


Spanish name	English name	Municipio	Length (meters)	Depth (meters)
1996–2002				
Nita Nindo Chank		San José Tenango	37.0	41.0
Cueva del Capsula de Tiempo	Time Capsule Cave	San José Tenango	8.5	4.0
Nita He Manincee	Three Brothers Pit	San José Tenango	30.0	61.0
Timbores de Oztotl	Drums of Oztotl	San José Tenango	4.9	51.6
Cueva Araña	Spider Cave	San José Tenango	24.0	18.0
Nita Sabertooth	Sabertooth Pit	San José Tenango	199.0	99.0
Sótano de Cerro Ocotal	Cerro Ocotal Pit	San José Tenango	106.0	65.0
Hálito de Oztotl	Breath of Oztotl	San José Tenango	230.2	277.8
Hoya Alta	High Jewel	San José Tenango		45.0
Sótano Vigilante	Vigilant Pit	San José Tenango		77.0
Sótano del Escondite	Hidden Pit	San José Tenango		44.0
Sótano de los Sueños Profundos	Deep Dreams Pit	San José Tenango		
Ojos Llorosos de Oztotl	Crying Eyes of Oztotl Pit	San José Tenango	50.4	100.5
Sótano de las Agujas de Pino Cayendo	Falling Pine Needle Pit	San José Tenango	79.4	212.7
El Sótano del Puma	Puma Pit	San José Tenango	352.3	166.5
Sótano del Escondite	Stash Pit	San José Tenango	16.2	43.5
Cueva del Pasadizo Con Falla	Faulted Breezeway Cave	San José Tenango	111.0	55.5
El Sótano del Galería de Tiro	Shooting Gallery Pit	San José Tenango	211.6	179.4
Cueva del Concha de Caracol	Snail Shell Cave	San José Tenango	249.0	54.2
Cueva Con Huesos y Viento	Windy Bone Cave	San José Tenango	70.0	10.8
Cueva de la Grieta	Rift Cave	San José Tenango	63.9	35.0
Totals			**1843.4**	**1641.5**
2004–2007				
Sótano de la Milpa	Cornfield Pit	San Bartolomé Ayautla	20.4	22.6
Sótano Agua Pajaritos		San Bartolomé Ayautla	4.1	13.0
Sótano del Besito		San Bartolomé Ayautla	19.7	29.4
Cueva del Cafetal Carlota		San Bartolomé Ayautla	116.	36.0
Totals			**160.2**	**101.**
December 2008–January 2009				
Sótano del Queso		San Miguel Huautepec	10.	11.0
Cueva Agua Golondrinas 2		San Miguel Huautepec	123.8	29.6
Cueva Agua Golondrinas 1		San Miguel Huautepec	106.3	28.9
Totals			**240.1**	**69.5**
December 2010–January 2011				
Sótano Trampa de Pluma		Huautla de Jiménez	15.	52.6
Cueva Rancho La Cuevita		San Bartolomé Ayautla	2.1	0.3
Sótano Cerro Abierto		Huautla de Jiménez	116.3	72.9
Sótano del Panadero		Huautla de Jiménez	16.5	70.3
Cueva de Loma Capital		Loma Naranjo	81.3	8.8
Cueva Rancho del Oro		Santa María Chilchotla	125.1	16.2
Cueva de la Malangar		San Bartolomé Ayautla	35.1	12.5
Cueva Santa Rosa		Santa María Chilchotla	352	155.2
Sótano Agua de Pluma		Huautla de Jiménez	20.4	89.9
Totals			**763.8**	**478.7**

Spanish name	English name	Municipio	Length (meters)	Depth (meters)
December 2011–February 2012				
Cueva de La Sorpresa Sección Mariano		La Sorpresa	961.8 1	4.4
Sótano de Las Ropas Sucias		Huautla de Jiménez	17.7	24.8
Sótano Cerro De Paloma		San Miguel Huautepec	0.	19.3
Sótano de las Ormigas		Huautla de Jiménez	6.4	31.9
Cueva de Arañas		San Miguel Huautepec	8.4	13.3
Sótano del Perro - Nita Nia		Huautla de Jiménez	9.4	43.7
Sótano de Lupita		San Bartolomé Ayautla	2.1	9.9
Cueva Cerro Frío		San Bartolomé Ayautla	26.	4 7.0
Totals			**1072.2**	**164.3**
December 2012–February 2013				
Cueva de la Sorda		Huautla de Jiménez	621.	75.9
Sotano Arriba de Río Santiago		Huautla de Jiménez	7.3	24.6
Sotano de Basurero		Huautla de Jiménez	0.	29.0
Sotano Motín Medianoche		Huautla de Jiménez	2.5	30.0
Sotano Bernardo		Huautla de Jiménez	22.7	72.9
Sotano Palo Gordo		San José Tenango	15.7	52.9
Sotano Corto Limpio		Huautla de Jiménez	4.3	27.5
Sotano Agua de Flor		San José Tenango	35.9	59.2
Sotano de Navidad		San Bartolomé Ayautla	3.	40.3
Totals			**712.4**	**412.3**
Janaury 2014				
Sótano de Archimedes	Archimedes Pit	San José Tenango	24.8	54.6
Sótano de Mariachi	Mariachi Pit	San José Tenango		27.0
Sótano de los Chivos Perdidos	Lost Goats Pit	San José Tenango	12.5	36.0
Cueva Agua Obscura	Obscure Water Cave	San José Tenango		
Ndá Xo'mii (Mazatec)	Water Spring Cave	Huautla de Jiménez	42.9	5.1
Cueva Viento Chico	Little Wind Cave	Huautla de Jiménez	13.7	7.9
Sótano de las Mariposas	Pit of The Butterflies	Huautla de Jiménez	6.1	43.8
Sótano Espíritu Mcclain	Spirit of Mcclain Pit (Mcclain's Connection)	Huautla de Jiménez		
Sótano Espíritu Mclain	Spirit of Mclain Pit (First Entrance - Cilantro)	Huautla de Jiménez	216.9	100.0
Sótano Espíritu Mcclain	Spirit of Mcclain Pit (Hummingbird Entrance)	Huautla de Jiménez		
Sótano Resbaloso	Slippery Pit	Huautla de Jiménez	32.	47.2
Sótano Diente Engancha	Snaggletooth Pit	Huautla de Jiménez	78.	67.1
Sótano de Cincuenta Pesos	50 Peso Pit	Huautla de Jiménez	37.5	40.0
Cueva de Calle	Road Cave	San José de Tenango	78.6	9.8
Cueva Margarita	Margarita Cave	Huautla de Jiménez	66.3	8.4
Sótano Sequia	Drought Pit	Huautla de Jiménez	16.8	12.5
Sótano de Arroyo Coyol		San Bartolomé Ayautla	3.	7.8
Totals			**629.1**	**467.2**

From left: Municipal official Jony Campos, Rand Heazlitt, Marion Akers, Tony Akers, *presidente* Arturo Carrera González, Rusty Riley, communal lands official Epifanio Flores, Greg McNamara, Simon Akers, Aida Ferreira. *Greg McNamara.*

Spanish name	English name	Municipio	Length (meters)	Depth (meters)
January 2015				
Campana de Eleazar	Eleazar's Bell	San Miguel Huatepec	0.	42.0
Sótano Marcelino	Marcelino's Pit	San Bartolomé Ayautla	9.8	46.4
Sótano de la Caléndula	Marigold Pit	San Miguel Huatepec	6.4	19.4
Sótano de las Siete Barras	Seven Bars Pit	San Miguel Huatepec	9.1	14.5
Sótano Huesos de Serpientes	Snake Bones Pit	Huautla de Jiménez	20.7	37.9
Sótano Ojo Jabalí	Boar's Eye Pit	Huautla de Jiménez	9.3	22.4
Sótano Trasero Jabalí	Boar's Butt Pit	Huautla de Jiménez	14.2	17.9
Sótano Bambú	Bamboo Pit	Huautla de Jiménez	0.	27.4
Hoyo Hundido de Mayo	Sinkhole de Mayo	Huautla de Jiménez	12.27	59.1
Cañón Shakedown	Shakedown Canyon	Huautla de Jiménez	53.	35.0
Sótano Pozo Triángulo	Triangle Shaft	Huautla de Jiménez	15.6	46.8
Sótano 45	Pit #45	Huautla de Jiménez	11.5	40.5
Sótano Milpiés Blanco	White Millipede Pit	Huautla de Jiménez	15.8	22.5
Hoyo Gusano de Seda	Silkworm Hole	Huautla de Jiménez	26.8	44.7
Sótano Hoyo Maíz	Cornhole	Huautla de Jiménez	42.1	85.1
Sótano Bravo	Family Bravo Pit	San Bartolomé Ayautla	0.	29.0
Sotano Boca Fea	Ugly Mouth Pit	San Bartolomé Ayautla	96.9	127.9
Totals			**453.9**	**718.5**
January–February 2016				
Sotano Boca Fea	Ugly Mouth Pit	San Bartolomé Ayautla	96.9	127.9
Sotano Mi Campamiento	My Camp Pit	San José Tenango	5.9	42.
Sotano de las Palmeras Undulantes	Blowing Palms Pit	San José Tenango	18.3	18.4
Cueva Que No Se Va	Cave That Doesn't Go	San José Tenango	35.7	22.2
Sotano Espíritu	Ghost Pit	San José Tenango	26.7	31.6
Caida Libre	Free Pit	San José Tenango	15.5	49.1
Sotano de Pared Cabeza	Head Wall Pit	San José Tenango	0.	16.
Sotano de Tres Ventanas -#1	Three Window Pit	San José Tenango	51.1	57.3
Sotano de Tres Ventanas -#2				26.5
Sotano de Dos Fondos	2 Bottom Pit	San José Tenango		22.
Sotano Serpiente	Snake Pit	San José Tenango	118.6	76.2
Sotano de Mi Esperanza	My Hope Pit	San José Tenango	58.1	67.4
Amor y Dolor	Love And Pain	San José Tenango	49.4	23.5
Totals			**476.2**	**580.1**
February 2017				
Sótano de Milk Dud	Milk Dud Hole	San José Tenango		
Sótano Viñedos Colgantes	Pit of the Dangling Vines	San José Tenango	2.8	13.1
Sótano de Tablones	Plank Pit	San José Tenango	10.9	38.2
Sótano de los Martínez	Martinez Pit	San José Tenango	187.7	116.9
Sótano de Jordan	Jordan Pit	La Placa	9.3	15.4
Cueva Agua de Ardilla	Squirrel Water Pit	San Juan Coatzospam	119.8	11.7
Toxii Cunuu Sxquiucu Tenini or Sótano del Cerro de la Agua Jarana	Mixtec Mountain Pit	San Juan Coatzospam	112.7	89.7
Sótano Dos Botellas	Two Bottle Pit	La Placa	3.8	7.7
Sótano Cafetal de Ambrosio	Ambrosia Coffee Plantation Pit	La Placa	5.2	20.6
Totals			**452.2**	**313.3**
Total			**6803.5**	**4946.4**



Marion Akers recording survey notes in Cueva Agua de Ardilla. *Greg McNamara*.

roads, and production of garbage and the threats of pollution and contamination of the water systems are growing quickly.

In 1994 they didn't go caving, but found their way into the Sierra Mazateca on the then four-wheel-drive roads, met the landowner Waldo Garcia of the Cafetal Carlota, and saw the huge potential for cave exploration. The next three years the group grew, and they backpacked their way into the cloud forest and found virgin cave, going in from Llano de Arnica, in the municipality of Jan José Tenango. It was Tony, Joe, and Tina still, along with twelve other people, some participants coming only one of the four years. During these years, the base was not the coffee plantation, but in a public place, close to the trails where they would ascend into the karst cloud forest and stay for as many weeks as they could, normally two to four weeks total. The political situation was sticky, and obtaining permission from the local authorities and landowners was always a challenge. We also began to experience the Mazatec people, their customs and food, learning slowly about their unique culture. The last expedition done in this manner was the one in December of 2001, with nine participants, exploring a high valley called the Lost City. This area looked like virgin cloud forest, with just one group of Swiss cavers known to be hiking there, but not able to explore any caves. Some great caves were explored and documented. Up to this point, twenty-one new pits or caves had been found, with totals of 1641 meters of depth and 1843 meters of horizontal passage. The deepest pit explored was 277.8 meters (911 feet) deep. The expeditions ceased for a number of years for various personal reasons, like children, changes of jobs and living locations, and businesses.

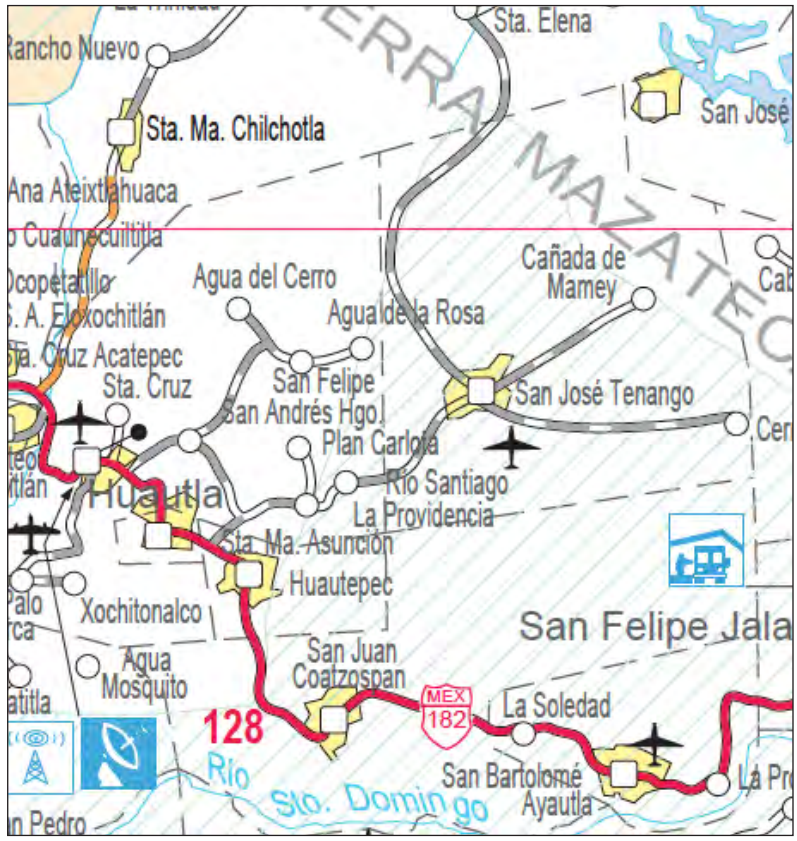
The next trip to the Sierra Mazateca was by Tony and Marion Akers in 2004. They had their son Simon with them and had been traveling around Mexico for business reasons. They had some extra time and went back to the Sierra Mazateca, especially to that coffee plantation in La Carlota. They were able to stay there for two weeks and begin exploration of the local caves and pits, as they would for the next three years.

Then larger groups began going again in 2008, and have been there almost every year since. The areas have varied, as permission and access have changed. Tony and Marion have an established field house that was once part of the historic coffee plantation called Cafetal Carlota. Mostly day trips were taken to explore caves. The top of the plateau from the ranch was also reached from the ranch by several groups, going from about 900 meters to 2000 meters. Short camps were set up and some trails were cleared.

In 2011, we began exploration in Río Santiago, in the municipality of Huautla de Jiménez. [An article on the winter 2010–2011 trip appears in *AMCS Activities Newsletter* 35, pages 103–110.] We explored and surveyed the area around Río Santiago on a yearly basis for the next three years and found some great pits and a couple of caves. We were invited to visit Rancho Arco Iris, a valley south of Río Santiago that was closer to the Lost City a higher elevation. In both 2014 and 2015, expeditions were made to Rancho Arco Iris by backpacks, burros, and porters, exploring for two to three weeks. Initially invited by the landowners, our base now was two cabins that had been abandoned and were no longer lived in. They functioned well, and we explored the valley for two years. We kept moving farther into unexplored areas higher up on the plateau.

The years 2016 and 2017 would bring us closer to the region explored in the 1990s, the precious valley called the Lost City, located in the municipality of San José Tenango. In 2016, the two weeks spent up in the cloud forest were fruitful and fun, complete with a jungle camping experience and an enthusiastic group of cavers. We explored areas at several elevations, established a new trail system, and a a water-catch system, and laid the groundwork for continued exploration. A total of 650 meters of vertical depth was both documented and photographed, utilizing experienced riggers and four different sketchers for the surveys. A new member, Thomas Hawkins, a botanist and horticulturalist, experienced and documented its botanical treasures with us, noting the rich biodiversity of the cloud forest at elevations up to 2100 meters. Some areas had been noticeably logged in the past but recovered, and other areas were being logged more by locals who now had chain saws, rather than the old hand-saws of days gone by. Even protected tree species, like the *ocote*, a pine tree, were being cut in very remote areas.

In 2017, we went back, but farther to the south, establishing a camp just below El Pico de Caballero, about 300 meters higher than we had been the year before and closer to the Lost City. The expedition was more of a cultural adventure than what we bargained for, having to change our two week camp and caving plans after only six days. Not only that, but a five-second pit was left indefinitely, because our presence in the Lost City threatened a small faction in one of the neighboring towns in that municipality that was carrying on



Tony Akers rigging Sótano de Mi Esperana, a 67-meter pit. *Marion Akers.*

illegal logging operations. Although we were defeated there, we left without getting arrested or hurt, and promptly changed gears and gained access to a neighboring municipality, San Juan Coatzospam, in an even-higher-elevation area where different indigenous people live, the Mixtecs. They welcomed our group with open arms, hoping we could offer them something back, maybe a new water source found underground. In just two days of exploration, we found a cave, a 90-meter jungle pit, and future potential for exploration and friendship in a brand-new area.

In 2017 we saw the harsh realities of the increasingly threatened cloud forest, the complex political and economic realities of unstable local governments and indigenous peoples in rapid evolution, and an anthropology study in action. Benjamin Feinberg, a professor of anthropology at Warren Wilson College in Asheville, North Carolina, has written *The Devil's Book of Culture: History, Mushrooms, and Caves in Southern Mexico*. He has come to the sierra continually since the early 1990s and currently interacts with us as well, seeing and studying our connection with the Mazatec people and our equal desire to explore and find deep caves.

So far, we have documented 4946 meters of vertical cave and 6803 meters of horizontal passage. In addition to cave exploration, other projects were begun along the way, promoting water conservation, cultural preservation, and reforestation efforts. We have received grants and donations from the National Speleological Society, the National Speleological Foundation, the Central Indiana Grotto, Highline Rope, the Southern Colorado Mountain Grotto, and various individual contributions. Despite the many challenges, we want to continue our karst-exploration efforts, continue documentation on the flora and wildlife of the region, and continue promotion of reforestation and conservation through educational projects within the local communities.

Historia del Proyecto Sierra Mazateca

El Proyecto Sierra Mazateca ha estado explorando cuevas en el noreste de Oaxaca desde 1994. Enfocados en la zona del altiplano del Cerro Rabón y sus alrededores, han documentado cerca de 7 kilómetros de galerías subterráneas, 5 kilómetros de los cuales son verticales. Además de la exploración de cuevas, han establecido una campaña de relaciones públicas y proyectos de conservación

CENOTE CANGREJO

Mauro Bordignon

During the last week of March 2018 I participated in an exploration with Peter Sprouse and his wild bunch of Paamul Grotto cavers. As usual we checked numerous sumps and a few cenotes, among them Cenote Cangrejo. The name means crab in Spanish; this was Peter's idea because there was a fresh-water blue crab in the cavern area. This is not the most remarkable cave in terms of extension or passage size, but it has quite interesting features. The cave has a small collapse entrance, and the cavern area is between 4 and 6 meters wide and about 25 meters long. From surface level you descend about 6 meters through the collapse to the water, where access is pretty easy and there is a considerable flow, at least by local standards.

The first dive was with Katy Fraser, and this was her first exploration dive in this kind of unstable and silty environment. To keep things simple, we decided that I would go first, laying line and surveying on the way back, and Katy agreed to leave her camera behind and just get familiar with a narrow and hostile cave. We decided to check downstream, knowing that, considering that flow, visibility would get compromised by diving the upstream first. We laid around 80 meters of line in a very low and crumbly bedding plane, with me checking every possible hole and Katy as a reference on the main line just laid. There was not much passage in this direction, as I would confirm by double checking the next day with Simon Velez, just lots of dead ends with water flow, reminding us that it is only divers that can't go through.

The upstream side is way more interesting, and going into the flow helps because the water stays clear instead of carrying your silt in front of you. The first 70 to 80 meters are very shallow with multiple air bells; there's pretty much just one single passage here. Tree roots, reaching for water from the jungle above, make it both spectacular and challenging because your gear is constantly getting caught in them and they carry lots of dirt and sediment, which doesn't help the visibility.

On day 1 we discovered what makes this cave so different. Rather than continuing shallow after the root section, I was attracted by a breakdown to the right possibly leading to a lower level, so I decided to go that way. Descending through a passage like this for the first time takes a bit of finesse—normally I go through passages quite excitedly and quickly when exploring, but experience taught me that this needed a slower approach. Divers' bubbles going up expand along the walls, and since the big boulders are covered with powdery silt, it starts snowing right away. We decided to go through quickly, breathing in as controlled a manner as possible and without touching the walls except for line tie-offs.

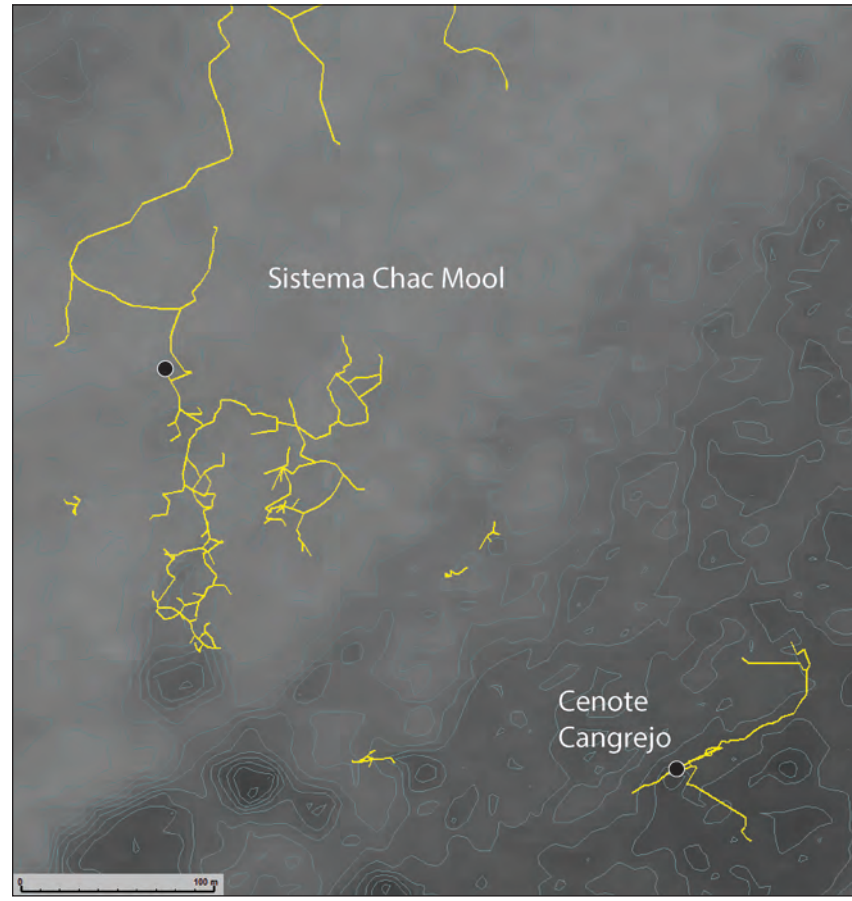
Luckily it worked, and when we passed from 4 to 16 meters, below the halocline, another passage opened, and after about 20 meters it turned into a tight vertical fracture. We were not far from our turning point, and we decided to check it quickly and then turn the dive. Katy held position on the reel, pointing her light at me while I would get sideways, as trim doesn't really count here. I went into the fracture for about 5 meters to see that it continued and, satisfied, I turned the dive. We surveyed on the way out, despite the water being the color of milk with coffee, knowing we would be back.

The next day, Katy was recruited for dry caving nearby in Chac Mool (see the article on Torre Fallecida in this issue), so I came back with Simon. We went to double-check downstream, and then headed upstream to The Crack. We tied our reel into the end of the line and started our sideways progression slowly. We extended it for about 70 or 80 meters, at an average depth of around 20 meters. The width of the

Simon Velez diving in Cenote Cangrejo. *Mauro Bordignon.*

maurocavediving@gmail.com

Peter helps Mauro prepare to dive in Cenote Cangrejo. *Katy Fraser.*



fracture kept changing from 1 meter to about 35 to 40 centimeters. What is amazing is the vertical extent of it. It goes from about 15 to at least 45 meters deep; we descended to 31 meters and could see down at least another 15 meters deeper.

Unfortunately, in the salt water at that depth the flow is completely gone, and the visibility turns to almost zero pretty quickly, limiting how far you can go in a narrow passage like this. The Crack keeps going, but exploring it means going back to add no more than 20 or 30 meters at a time, and since there is no other nearby cave to connect to, it is the kind of lead that you put on standby. In almost ten years of exploration here in the Yucatan Peninsula, though, I had never found a fracture so narrow and deep, and never heard of any. The closest thing to it is one in Murena (*AMCS Activities Newsletter* number 37), but despite going as deep at 60 meters it is not this narrow. Finding a passage like this makes the whole exploration effort worth it.

The following day Simon and I decided to go back upstream, and we found a bunch of shallow passages turning into wider rooms, with water again filtering through the pores of the limestone walls. Again the river runs through the rock where we cannot pass.

In three days of diving and a total dive time of about 6.5 hours, we explored 330 meters of new cave, reaching a depth of 35 meters and, best of all ,we surveyed a very different passage from most in the area. Thanks again to Peter's group for sharing their discoveries with us.

Cenote Cangrejo

Se describe la exploración subacuática del Cenote Cangrejo (Quintana Roo). El pasaje corriente abajo terminó a poca distancia, pero la sección corriente arriba siguiendo una fisura extraña, angosta y profunda, continúa. La exploración es difícil debido a la mala visibilidad en las profundidades.

ONE YEAR ABOVE AND BELOW THE TREE

Tullio Bernabei and Leonardo Colavita

Engaging systematically with Mexican territories is nothing new for our association, but the activity carried out in Chiapas between November 2014 and the end of 2015 was undoubtedly special, and innovative in many ways. The main protagonist was the Arbol de Navidad, or *Christmas Tree*, an extraordinary geological formation located in the Cañón del Sumidero, not far from the capital Tuxtla Gutiérrez. It's a waterfall of almost 180 meters that pours from a cave on the wall and that has created, over thousands of years a giant travertine structure covered by vegetation resembling the shape of a large Christmas tree. It is not only a natural phenomenon, but also a very important tourist attraction. The canyon, in fact, is visited annually by nearly half a million tourists, and the most exciting moment of the boat tour is precisely linked to the sight of the Arbol.

In recent years, a serious issue has been highlighted: the waterfall has less and less water, and during the dry season, January to April, the water flow can even cease completely, while up to a dozen years ago it was always active throughout the year. Therefore, the managers of the Sumidero National Park decided to contact the Association La Venta to analyze the situation and possibly find solutions.This choice was not due to a coincidence. In 1993 some members of the team had descended the high walls of the canyon and reached the cave where the waterfall pours out. The exploration was disappointing, because the cavity was small and ended after a few dozen meters, but the endeavor was truly remarkable for the times. This is why the local authorities decided to involve members of La Venta, the only ones who knew the situation and could reasonably say if something had changed inside the cave.

After a preliminary analysis, we formulated two hypotheses: first, a blockage might have occurred somewhere, gradually preventing water leakage, a bit like calcium obstructions in the pipes of washing machines or dish washers in our houses; second, a problem might have occurred in the feeding basin of the waterfall.

We thus decided to act on two fronts, to immediately inspect the cave again after twenty-two years and then to assess the hydrogeological situation on the plateau, an area subject to heavy deforestation in recent decades.

In November 2014 we organized an expedition aimed at descending the wall. A mixed group of about thirty people, Italian and Mexican, succeeded in the endeavor. At the beginning of December, after several days of difficult work and 500 meters of rope descent, the entrance of the cave was reached. This required eight hundred meters of rope, seventy-seven Raumer bolts, and many itching burns caused by a terrible plant strewn on the wall, the *cinco negritos*, *Comocladia guatemalensis*.

Inside the Cueva del Arbol the situation was worse than we had predicted. The massive presence of vegetation, especially roots, along with dirt and calcium carbonate deposits, had created a series of dams and obstructions that were not present in 1993 and that would close the cavity forever. There seemed to be at least two causes. The deforestation in the top part of the mountain had caused erosion of the soil and the arrival in the cave of large, abnormal amounts of dirt. The dense network of roots in the cave had blocked it, favoring the formation of carbonate deposits. Why so many roots? The cause is an exponential increase in the vegetation on the canyon walls,

Beyond the second threshold in Cueva del Arbol de Navidad. *Vittorio Crobu*.

KUR 22 2015, English version 2018, pages 9–12.
https://issuu.com/laventaesplorazionigeografiche/docs/kur22eng

Removing obstructing rock from the cave. *Tullio Bernabei*.

which can also be explained. The dam built in 1980 and the consequent formation of a huge lake may have increased the local humidity, essentially a micro-climate change both above and below,linked to human activity.

In three days of hard work the obstructions were almost completely removed, and the results were immediately evident. The water flow increased slightly, but, most notably, it once again poured out from the center of the waterfall, feeding the Arbol. Moreover, the cave no longer was at risk of suddenly sealing itself shut. A few years of life gained.

We also tried to reach the cave by an easier path, rigging a horizontal traverse running about 50 meters above the waterfall, but we had to give up due to the bad quality of the rock. However, the project is still ongoing. In the future,we plan to rig a sub-horizontal trail that will allow us to easily get to the cave to carry out studies and maintenance.

In April we took a complete speleological break. We went back to the cave of Rancho Nuevo, which opens at an altitude of 2,300 meters on the Altos de Chiapas, not far from the famous town of San Cristobal de las Casas. It is a vast underground system, reaching 500 meters of depth and 10 kilometers of length. It was explored by an expedition of the Circolo Speleologico Romano in 1987, and since: then no one had returned to look for leads due to the presence of a sump lake 1 kilometer from the entrance. In a small caving expedition we passed the sump and placed a safety line, opening the way for an expedition to be carried out in 2016, a door we opened after almost thirty years, and another new frontier to explore. But the attempt to reach the Sima Grande, a big pit spotted from a helicopter in an area close to the Cañón del Sumidero, did not succeed, not because we couldn't find the shaft, but because once we reached the area the residents refused to grant us the permission to explore it. This can happen in very isolated rural areas. It is a risk that we always take into account. The only thing to do is to withdraw and try again the following year, asking for all necessary permits and clarifying the aims of the mission well in advance.

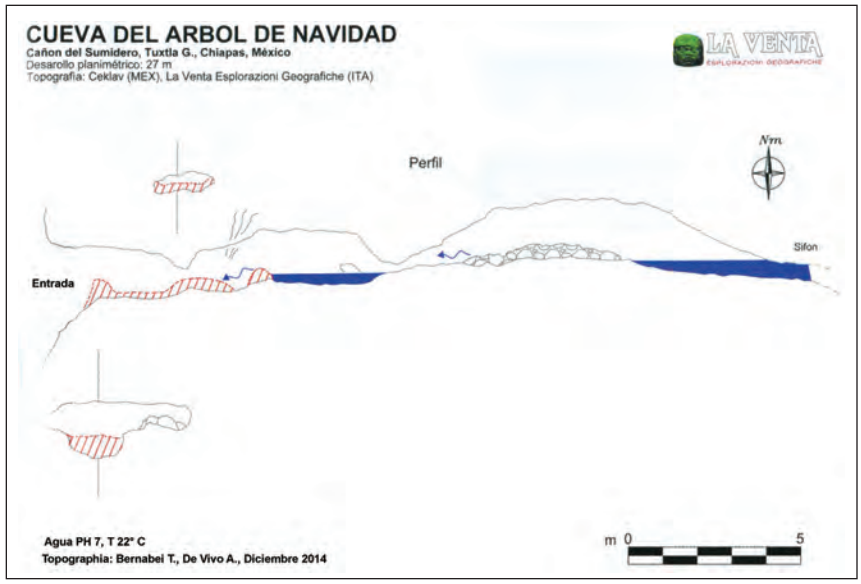
But let's go back to the Arbol de Navidad. The endeavor of December 2014 was greatly appreciated by the local community; we ended up on the pages of all the local newspapers and received countless expressions of esteem, but apparently this was not enough to assure all local access.

The big wall of the Arbol de Navidad. *Alessio Romeo*.

So we gave birth to a second phase, a new project named Guardianes del Arbol, the *Guardians of the Tree*. The first step was to study in depth the hydrological basin of the waterfall in order to understand what was really going on at the top, where the community of Triunfo Agrarista is located. A small loan provided by the Civil Protection of Chiapas allowed us to begin working in September 2015. After a few survey trips on the plateau, we understood that the situation was worse than we had imagined. About one hundred water-infiltration areas were identified, but 90 percent of them had been intentionally blocked by the locals, poor people who desperately search for water during the dry season and have tried to create small reservoirs where possible. The results are poor, but the consequences are even worse, because water does not go through karst conduits but infiltrates, disperses, or evaporates. In other words, it does not reach the waterfall.

Taking advantage of the rainy period, we carried out the first hydrogeological dye-tracing to understand which sinkholes are directly related to the waterfall, and at the same time we tried to talk to the local population and authorities to find mid- and long-term solutions.

It is very striking that below, along the river, a flow of relative wealth runs along thanks to tourist



sightseeing, but none of these economic benefits reach the top, where the true guardians of the waterfall live.The management plan of this entire area must be reviewed, finding socially, economically, and ecologically sustainable options. We are willing to give our contribution. but it is clear that a lot depends on local political policies.

The first results of the dye tracing, which have just arrived, comfort us with the possibility of finding solutions to restore the waterfall of the Arbol. It will take time, but we are optimistic. After all, only incurable optimists and dreamers can think of saving a waterfall and maybe even of succeeding.

Un Año Por Encima y Por Debajo del Árbol

El Árbol de Navidad es una atracción turística de travertino de 180 metros de alto en una cueva en las paredes de un cañón en Chiapas. Recientemente el flujo de agua ha disminuido y la vegetación ha crecido, amenazando con bloquear el acceso a la cueva y que la formación se seque. Se realizaron labores de remediación y se presentó a las autoridades un plan de manejo por parte del grupo La Venta.

CANICA 2017

Richard Grebeude

On this Monday, March 13, the base camp of the Groupe Spéléo Alpin Belge expedition is deserted, affording me a few moments of solitude and silence after much excitement in recent days through this morning. It feels strange to be absolutely alone suddenly, in the heart of the sierra, surrounded by unoccupied tents, as if a sudden cataclysm had erased all my companions. Yet barely forty-eight hours ago, we were no less than twenty-two people in this same spot, the highest number of participants of this Canica 2017 expedition, which this year turned out to be a very cosmopolitan expeditions since it included one Iranian, two French, four Mexicans, four Brits, and thirteen Belgians. An impressive number, for sure, but quite unusual in terms of effectiveness and productivity on the scale of the entire expedition. Indeed the group stayed this large for only a few days, and the crescendo and decrescendo of participants were rapid. The Brits stayed four days, two Mexicans and the Iranian one week, two other Mexicans from Saturday noon to the following Monday morning. Apart from their fleeting participations, it was thus mainly an expedition of Belgians with two French.

It all started on Saturday, February 25 at the Gare du Midi train station in Brussels, with Steph, Jack, Didier, Jean-Luc, Boulon, Benoît, and Etienne leaving for Roissy, France, on a Thalys train. As for Tom, Marie, Luis, Roger, Cédric, and Richard, they'd already been traveling around for some time all over Mexico on their own or in pairs. The seven who had left Brussels on that day were joined by Simon, collected at Roissy, and by Nico, who had left two days earlier and got picked up in Mexico City. Finally, Tom, Marie, Luis, Roger, and Cédric were waiting for the group in Tehuacán, a city at the foot of the sierra, where we do all the basic shopping before starting up the mountain.

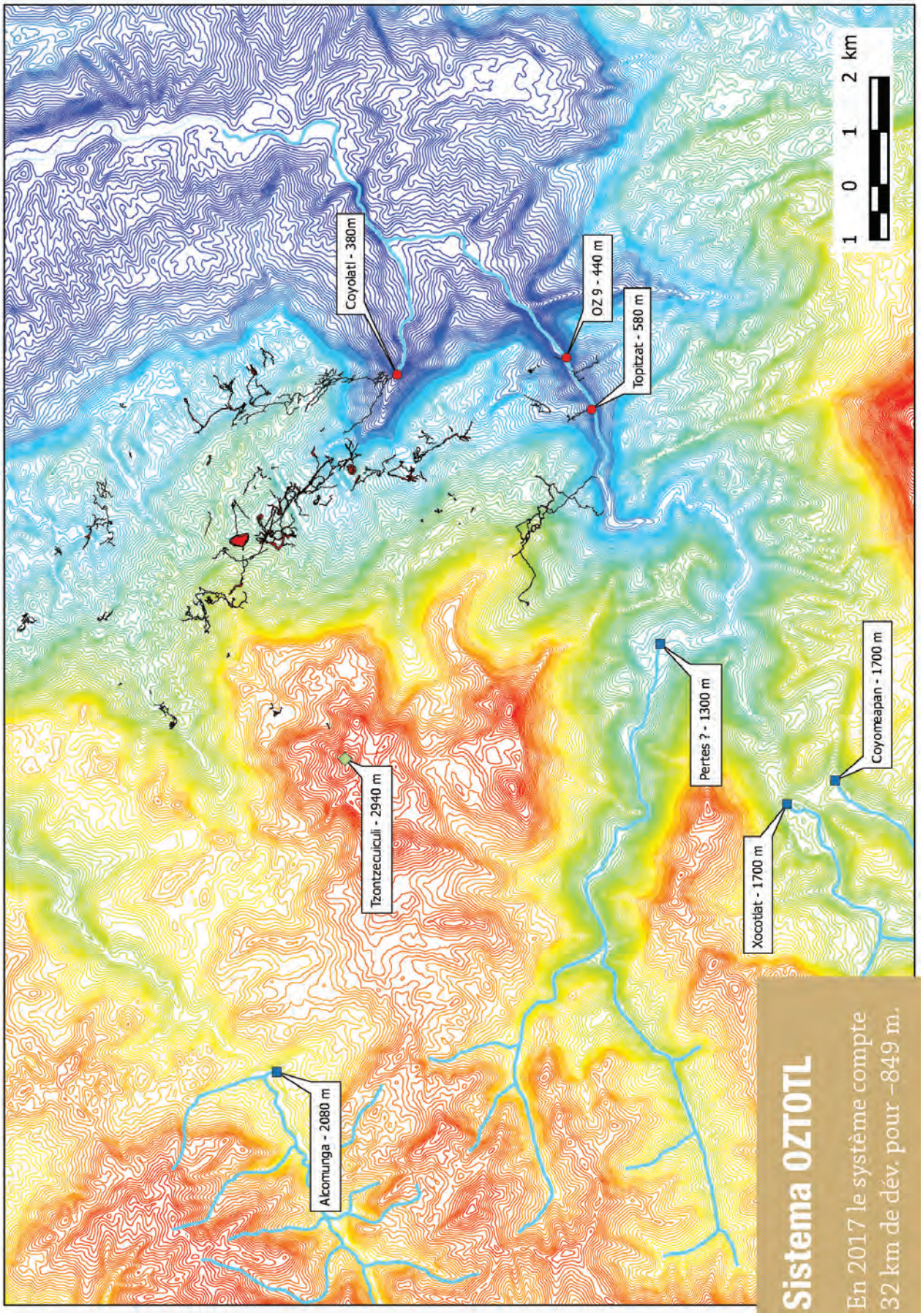
On the afternoon of Monday, February 27, this fourteen-person group started setting up base camp. Six days later, on March 4, Hugo, Gustavo, Nassirin, and Richard joined the team. They were followed two days later by the four Brits, Tim Allen, Andy Eavis, Pete Ward, and David Rose, who completed the team of twenty-two. When I arrived everything was going perfectly. My teammates had set up a comfortable basecamp with lots of common space under two large tarps, including areas for cooking, dishwashing, gear storage, an infirmary, two long tables and benches made of boards and logs, and a shower area outside—and a latrine, a bit farther away. I couldn't have asked for more.

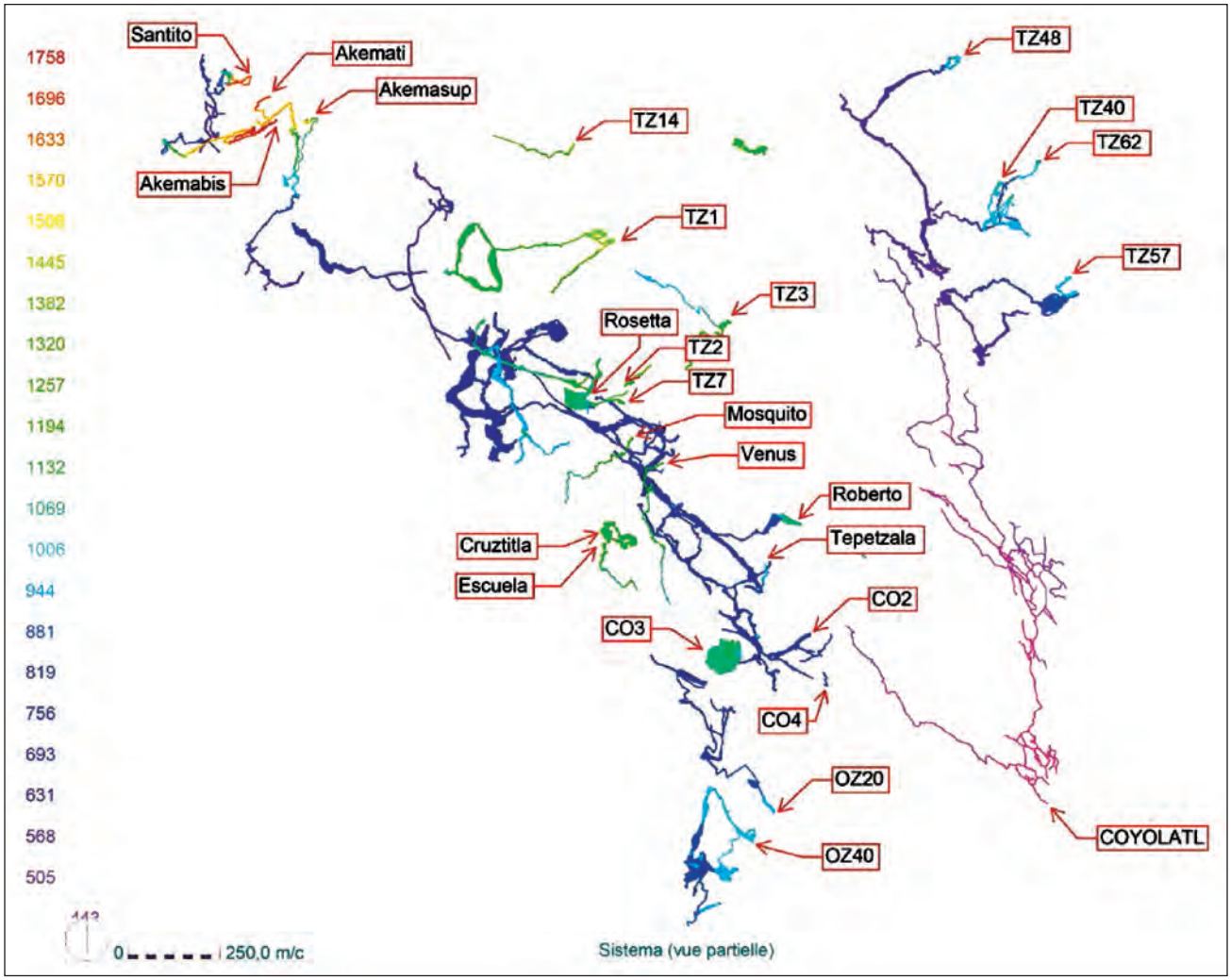
Our main objective, Rosetta, had not only been rerigged up to the previous end at –650 meters and a few kilometers from the entrance, but very promising trips had already taken place. Tlamanictli (TZ1), our second objective, was also fully rerigged down to its huge final room at –400 meters, la Muñeca Fea (the wicked doll or the ugly doll), after the name of a singing bar in Cordoba, Veracruz, and also the title of a traditional Mexican children's song. In this first part of the expedition the fourteen people had therefore not been idle, having done a great and productive job.

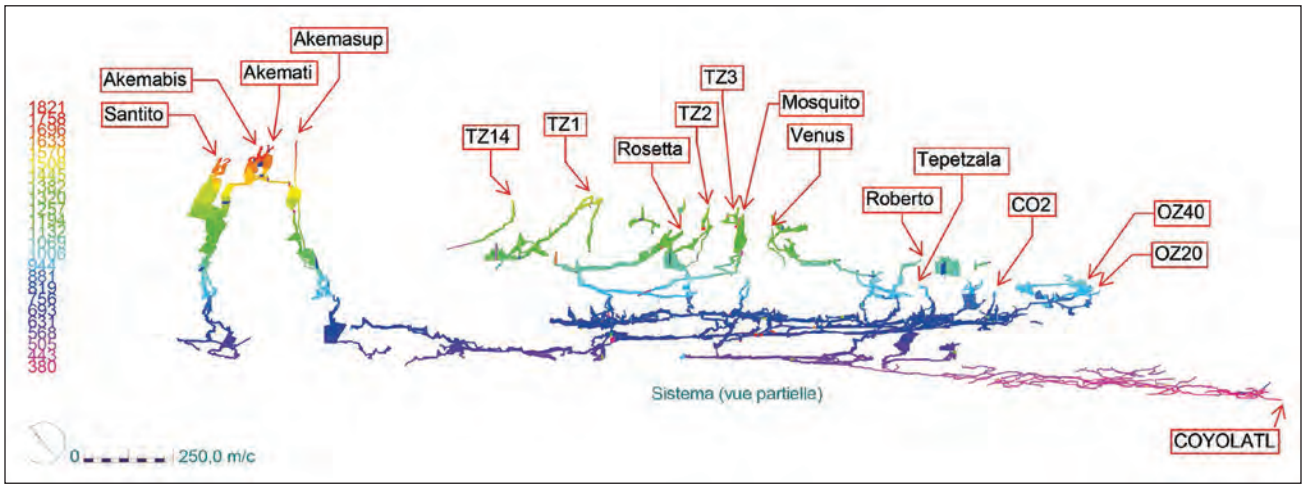
Rosetta, discovered in the second part of the Pasilla 2015 expedition and connected to Sistema Tepetzala during the Ancho 2016 expedition, immediately presented itself as a major cave, both in scale and potential. By the end of Ancho 2016, Rosetta was 5 kilometers long and 640 meters deep, and still went at the bottom, having burst through the section of sub-horizontal main passages in Tepetzala to continue on below. That's what was so interesting in our quest to connect this system with the resurgence of Coyolatl, way down at the bottom. Alas, at the downstream end we were temporarily stopped by a sump. But, surprise, in the direction that appeared to be going upstream at the end of 2016, the survey showed that we were just barely 500 meters away from Sistema Akemati, our –1,230-meter cave discovered and explored during the 1988 expedition. A connection became imaginable. It would bring the depth of the system, which we ended up naming Sistema Oztotl, to a little more than 1300 meters deep and more than 35 kilometers long, with ten entrances. With this potential connection and various leads at the bottom of Rosetta, the stakes for this cave were significant this year.

Regarding TZ1, Tlamanictli, its enormous terminal room is what led us to rerig it this year, and this for two reasons. The first and foremost is that we were contacted two and a half years ago by a British team who wanted to produce, as part of their Lidar project, a scan of ten to twelve of the largest rooms in the world, thanks to a budget funded by the publication of a major article in *National Geographic* about the largest rooms in the world. The scanning laser has a range of 700 meters with 10-millimeter accuracy. It makes it possible, through a series of stations scanning tens of thousands of points,

richardgrebeude@skynet.be
Regards 84, 2017, pages 66–79, http://www.speleoubs.be/images/regards/R84-Canica%202017-Expé%20GSAB%20Mexique.pdf. Translated from French by Yvonne Droms.


Coyolatl - 380m
OZ 9 - 440 m
Topitzat - 580 m
Pertes ? - 1300 m
Coyomeapan - 1700 m
Xocotlat - 1700 m
Tzontzecuiculi - 2940 m
Alcomunga - 2080 m
1 0 1 2 km
Sistema OZTOTL
En 2017 le système compte
32 km de dév. pour –849 m.


Santito
Akemati
Akemasup
Akemabis
TZ14
TZ1
TZ3
Rosetta
TZ2
TZ7
Mosquito
Venus
Roberto
Tepetzala
Cruztitla
Escuela
CO2
CO3
CO4
OZ20
OZ40
TZ48
TZ40
TZ62
TZ57
COYOLATL
1758
1696
1633
1570
1508
1445
1382
1320
1257
1194
1132
1069
1006
944
881
819
756
693
631
568
505
0
250,0 m/c
Sistema (vue partielle)


Akemasup
Akemabis
Akemati
Santito
TZ3
Mosquito
TZ2
TZ14
TZ1
Venus
Rosetta
Tepetzala
Roberto
CO2
OZ40
OZ20
Sistema (vue partielle)
COYOLATL
0
250,0 m/c

Towers of fairies and fir trees in the Muñeca Fea. *Stéphane Pire*.

to very accurately replicate the shape and volume of rooms, thereby establishing a new classification, no longer by floor area, but by volume—a big change ahead.

The Brits had contacted us because Muñeca Fea was ranked ninth in the world and was probably the largest room in the Americas, ahead of Belize Chamber in Belize. Since this year our respective schedules matched reasonably well, we proposed they come, promising them a fully rigged cave and that we would guide them and help them as best we could in their task, since they could only stay for four days.

The second reason that took us to TZ1 this year is that the cave was explored at the end of an expedition in 1999, and few trips went down. Carbide lights at that time could not compete with the power of the current Scurions, and so, without for a second putting in doubt the formidable accomplishments of the explorers of that time, this room deserved to be rechecked from top to bottom, and by the same token, to be resurveyed using the DistoX, so much more precise than our good old topofils. Lengthening Sistema Oztotl and connecting to this system the large room in TZ2-TZ7, relatively close to TZ1, were additional incentives for this project.

The day after the arrival of the Brits, a strong group consisting of three teams went to TZ1. First, a photo team composed of Gustavo, Hugo, Nassirin, Marie, Cédric, and Richard would attempt to capture on an image the enormous volume of the room; a second team, consisting of Jack, Luis, Ben, and Jean-Luc, would explore side passages and potential leads by finalizing some survey shots as far as the big room. The third team, our four Brits, would scan the room.

Everybody ended up in the big room at –350 meters, which made it possible, after everyone had scattered around, to see how gigantic this place was. We were all also amazed by the extraordinary echo. The walls are so far away that the echo lasts up to thirteen seconds. There is enough time to speak a sentence of several words without it being disturbed by the return of the echo, which only happens afterwards, and the sentence comes back to you in full. After a first session of measurements by Lidar and a series of photos, most returned to the surface and to basecamp. Jack, Ben, Jean-Luc, Luis, and Richard stayed in the cave to bivouac. I pointed out to my teammates that most likely never again in our lifetimes will we have the opportunity to sleep in such a large bedroom. It is indeed quite unusual to have a "bedroom" larger than 100,000 square meters with a ceiling taller than 200 meters. Even Louis XIV and Ceausescu did not, in spite of their immense palaces. Aside from this exceptional peculiarity, the team stayed there to search the room for possible leads that could have escaped the sharp eyes of the 1999 team. Another goal was to take a series of photos other than of the whole room, since various corners of it were super pretty, in particular large, perfectly flat areas covered with mud cracks, fields of clay cones, and a profusion of fairy chimneys. We also wanted to do a precise survey of the room by DistoX, staying as close as possible to the walls, in order to best define its shape. This painstaking task, begun the first evening, was continued the following day. It took no less than eight hours to complete the perimeter of the room, representing more than 1 kilometer of survey. After we processed the data, the closure error turned out to be only 7 meters, for an error of less than 0.7%. While some occupied themselves with this, the others went exploring, starting in a vast descending passage that was the deepest point in the cave. Despite the determination of our two friends, nothing new was found.

On the afternoon of the third day, as we were about to return to the surface and daylight, we ran into our Brits who were on their way to perform a second and final scanning session in the big room. The following day they left and we were back to eighteen participants after this brief peak of twenty-two.

The camp at –350 meters in Rosetta. *Stéphane Pire.*

Huge entrance gallery of Cueva Xantilco (Oztopulco). The three people show the scale. *Stéphane Pire*.

At Rosetta, things had progressed quite well since the beginning of the expedition. Those most involved there, by number of descents, were Cédric, Simon, Tom, Ben, Steph, and Jack, the others going there less, if at all, since they were busy elsewhere. After a few trips, exploration had progressed beyond the last push of 2016: What we thought was an upstream lead proved very quickly not to be the case, but soon new side leads both downstream and upstream were found. Around March 12, about two weeks after the start of the expedition, the area at the bottom of the cave had grown by 2.5 kilometers of additional passage. This consisted roughly of: a branch heading almost straight towards Akemati, with the last push stopping about 120 meters from a possible connection, and a second branch that appeared to be the main passage. This one climbs as a gentle slope over quite a distance in a nearly straight line. It is almost in line with the large, gradually deepening canyon that descends from the village of Huizmaloc—an area around which, in the second half of the 1980s, we had explored numerous caves between 430 and 753 meters deep and 2 to 6 kilometers long.

Sistema OZTOTL

En 2017 le système compte 32 km de dév. pour –849 m.

Ses orifices actuels sont:
- Tepetzala (CO1)
- Natitla (CO2)
- Tetonton (CO4)
- Roberto (TB1 ou TB14)
- TZ2 (point haut du système)
- TZ7
- Rosetta
- Anabel Flores

The large upstream passage, measuring on average 15 meters wide by 30 high and shaped like a cylinder that is wider on top, is most likely a major stream conduit that continues a long way upstream, perhaps going as far as the –500 and –700 meters depth in the Huizmaloc area. It is tempting to dream about this happening, but there is still a long way to go before we can envision new connections.

However, as of now, in view of the last push trips, the TZ14, which had been explored in 2000 to a dead end at approximately –200 meters but which revealed during the derig at the end of the expedition that it continued through parallel pits sucking strong air, proved to be already well placed to connect quite far upstream in this conduit. We had not been back since 2000, but this year it was part of our plans. However, with the weather in the second half of the expedition being very wet, with fewer participants, and with big goals still remaining, we again did not have time to return to TZ14.

Getting to the leads in Rosetta is no longer easy; it's becoming serious, since now from the Rosetta entrance we must negotiate a few kilometers of passage to get to –700 meters. We also have to descend a series of pits that are a little wet even when it is dry on the surface and that turn very wet when it rains. The 50-meter drop right after the cave camp becomes impossible during a flood, much to our disappointment. Past those obstacles, there are three deep pools to swim across, one 5 meters long, another 65 meters, and a third 160 meters with a low ceiling that sumps in a minor flood. We lose time putting on and taking off gear, and we lose calories too. Lead checking at the bottom is therefore not suitable to just anyone.

If I'm assessing the results of the 2017 explorations at the bottom of the system in mid-expedition, it's because afterwards persistently bad weather and lots of rain at night seriously affected push trips

The Topitzatl entrance, the resurgence at the bottom of the canyon. *Luis Álvarez.*

during a crucial week toward the end of the expedition, when we still had enough team members. A five-person push team who went in for three days had to wait in camp for the water level to go down in the P50 leading beyond to the bottom of the cave. This didn't happen, and the team came back empty-handed due to not being able to reach the leads to explore. Then several participants left the expedition, and there was no longer enough manpower to carry out effective push trips at the bottom. The weather in any case would not have allowed it.

In Tlamanictli, having finished the scan of the Muñeca Fea, its survey, and a thorough search for leads and having derigged the deep route to it, the expedition started exploring a new branch of the cave that started near the entrance and deviated noticeably from the main passage leading to the big room. This rather straight route turned out to be as spacious and steep as the main one, moving farther and farther away from the big room to drop rapidly within a few hundred meters to a depth of 350 meters. The 2017 exploration stopped there, at the same depth as the big room. If this passage continues past the big room, there is a small chance that Tlamanictli could connect to Sistema Oztotl.

If the second branch in Tlamanictli continues, a connection to the system is also conceivable. Push trips in the TZ14 should, if successful, give us a more direct route to the deep area of the main upstream passage discovered in Rosetta. Moreover, that main passage still goes, keeping its spacious shape and continuing straight upstream until Oztotl knows where. Finally, we need to return to Mosquito, explored for 1 kilometer to a depth of 250 meters in 2016. We turned around in a passage 80 meters high and almost as wide, going upstream and downstream, and which we had not even had the opportunity to revisit this year. There is therefore plenty to keep us busy and to dream about for the next few months, as usual.

As usual every year, the expedition leaves behind fantastic prospects for the next one. Cascabel 2018 will most likely give us a chance to connect with at least one of our three –1000-meter caves in the Ocotempa area, which would add new entrances and a few kilometers of length to the system, with a depth of over 1300 meters.

Our Mexico expeditions are very grateful to those who give their help to our project. The 2017 Canica expedition would like to warmly thank Petzl for its many years of sponsoring us with gear, especially Yannick Monnart, representative of Petzl for the Benelux. We thank our English friends for having "rolled out the carpet" to perform their scan of the big room, and in particular Pete Ward, who gave us 500 meters of English Braid, a brand of British rope of excellent quality. We would also like to thank the Union Belge de Spéléologie for the unwavering and substantial financial support it provided us via the Commission Explo. Finally, a huge thanks to our Mexican caver friend Franco Attolini, without whom the use of a vehicle on-site would have been much more expensive.

Canica 2017

Descripción de la expedición belga en 2017 al estado de Puebla. Los enfoques primarios fueron en la Cueva Rosetta y Tlamanictli. La primera de estas se había conectado al Sistema Tepetzala en 2016 y continuó, con potencial de conectar a otras cuevas de importancia en la zona. El nombre del sistema se cambió a Sistema Oztotl y alcanzó 32 kilómetros de longitud y 849 metros de profundidad al final de la expedición. El salón subterráneo Muñeca Fea en Tlamanictli fue topografiado de nuevo y escaneado usando LIDAR en cooperación con cueveros británicos. Se descubrió un ramal descendiente cerca de la entrada, el cual aún continúa.

THE RETURN TO THE HUAUTLA RESURGENCE

Andreas Klocker

During the 2016 expedition to the Huautla Resurgence (Klocker, 2017) we continued on from the farthest point reached by Jason Mallinson and Rick Stanton in 2001 (Shade and Stone, 2002) and managed to find a large fossil passage, now known as the Passage of the Cheeky Monkey. While this was a great find, this passage did not contain the active streamway we were hoping to explore that carried the water last seen in Sump 9 in Sistema Huautla, and hence we returned in 2017 to continue our exploration efforts.

On this trip the team and logistics changed. In 2017 Dave Bardi and Sandy Varin from Australia did not return, but instead we had Connor Roe and Maxwell Fisher from the UK and Matt Vinzant and Gilly Elor from the US join us. And since the push trips in 2016 to the end of the Passage of the Cheeky Monkey became very long, we planned to return to the Huautla Resurgence with small lithium-powered scooters and dry tubes and the intention of camping beyond Sump 2, increasing the amount of time available for exploration. This year Ernie Garza, Gilly, and I drove the truck from the US to Mexico, and everyone else arrived at varying times via public transport. Luckily this year no local politicians (we know of) had been shot, but instead we "enjoyed" Mexican corruption at its finest. This was particularly exciting on the US-Mexico border, where we were told by the senior border official that our truck was too heavy to be allowed into the country, but it would not be Mexico if not suddenly a Mexican turned up next to us with the words (in pretty good English) "I have heard you guys got a problem—I can fix it!". So several hours later, with additional US dollars in the pockets of both Mr Fix It and the border official, we continued on and finally made it back to the small town of Santa Ana Cuauhtémoc, which we had used as our base in 2016.

Since we knew the logistics from the previous year, we set up and relined the cave relatively quickly. The objective now was to do two three-day camping trips beyond Sump 2 to find the way on. The first team in the cave was Chris, Max, and I. Since we only had two scooters on this trip but three divers, we enjoyed quite an entertaining trip through Sump 2, with each of us being loaded with two large bailout tanks and one dry tube, and me towing Max through the deep part of the cave to avoid an unnecessarily long decompression. The trip became even more exciting when Chris was about to finish laying the line through the rift in Sump 2 and accidentally pushed the trigger on his scooter, resulting in the scooter wrapping up lots of the line and pinning him against the cave wall. Luckily we sorted out that mess without any further issues and emerged into the Passage of the Cheeky Monkey.

After leaving the sump, we stored our dive gear and set up a camp just a few meters up a sandy slope above where we left the water. Once this had been done, we explored a passage starting above a climb over the sump pools that seemed to head farther downstream. After a sketchy climb we found ourselves in a large fossil passage that was probably the downstream continuation of the Passage of the Cheeky Monkey and then after a few hundred meters stopped 10 meters above two sump pools. From Jason's descriptions of where he had surfaced in 2001 (Shade and Stone, 2002), it was clear that this was where he been, and looking at the muddy, steep walls around the

Andreas Klocker watches as the river appears from a flowstone restriction at the northern end of the cave.*Chris Jewell.*

andreas.klocker@utas.edu.au
cavesaustralia.com

Huautla Resurgence
Municipio de Mazatlán Villa de Flores
Oaxaca, Mexico

Original Exploration and Mapping by:

1982 Pena Colorada Recon Expedition:
Bill Stone, Pat Wiedeman, John Zumrick

1984 Pena Colorada Expedition:
Gary Storrick

1994 San Agustin Expediton:
Steve Porter, Noel Sloan, Bill Stone

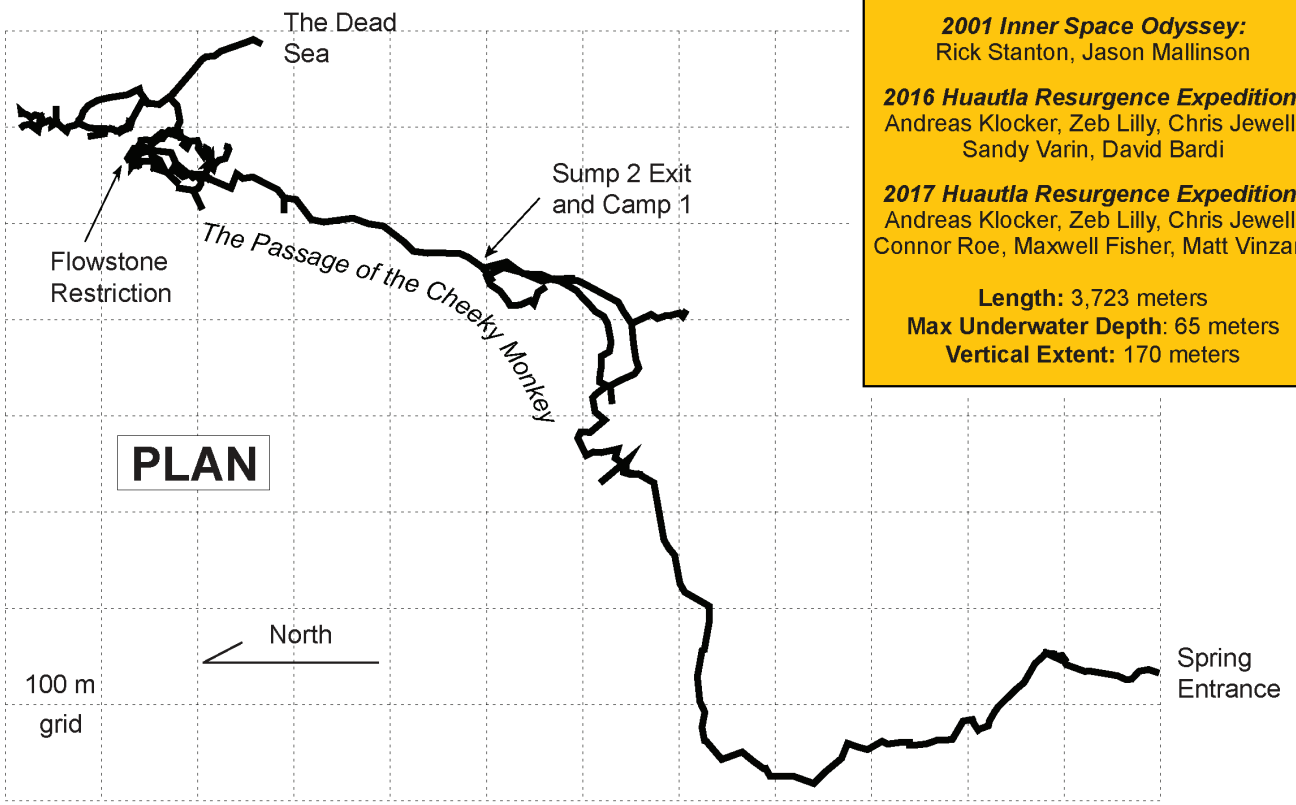
1995 Rio Tuerto Expedition:
Paul Heinerth, Jill Heinerth, Noel Sloan, Bill Stone, Barbara am Ende

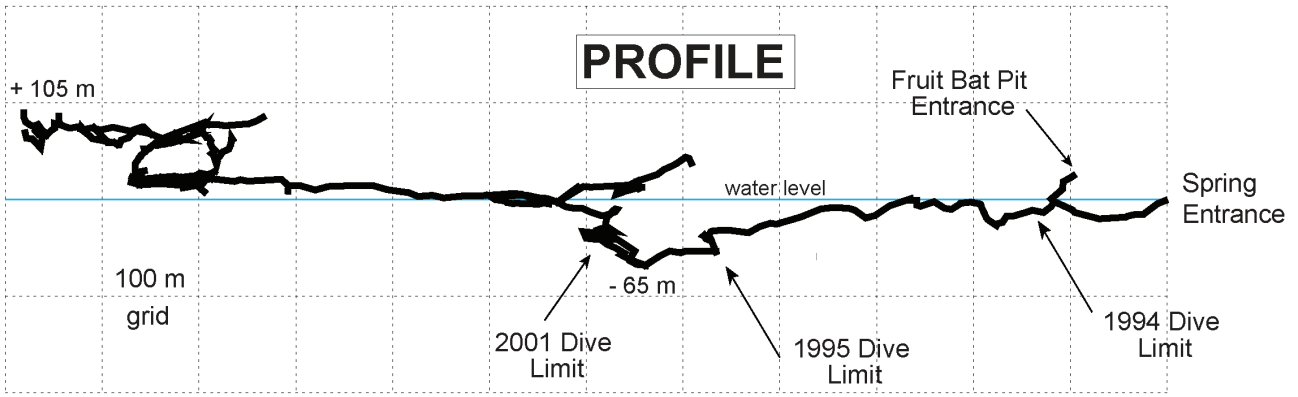
2001 Inner Space Odyssey:
Rick Stanton, Jason Mallinson

2016 Huautla Resurgence Expedition:
Andreas Klocker, Zeb Lilly, Chris Jewell, Sandy Varin, David Bardi

2017 Huautla Resurgence Expedition:
Andreas Klocker, Zeb Lilly, Chris Jewell, Connor Roe, Maxwell Fisher, Matt Vinzant

Length: 3,723 meters
Max Underwater Depth: 65 meters
Vertical Extent: 170 meters





Drafted by Bill Stone

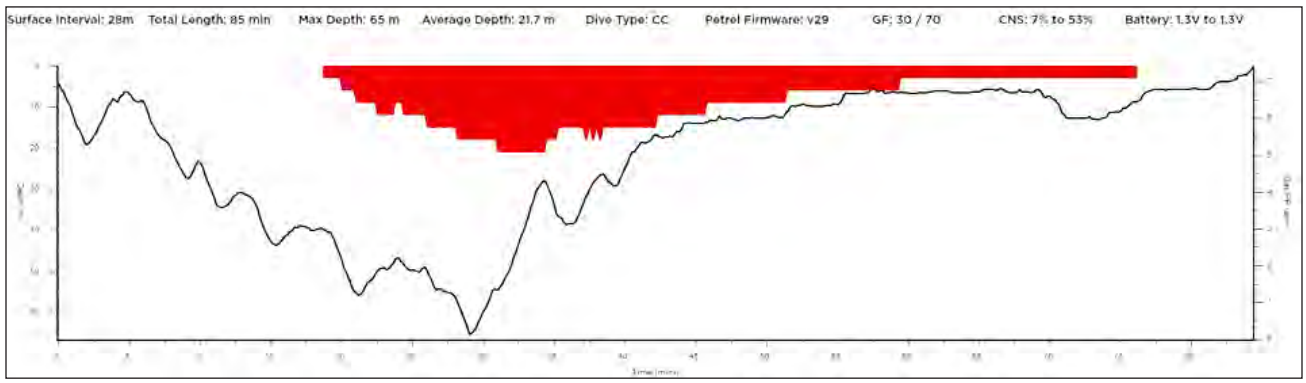
sump pools we were happy that we did not have to get out of the sump this way. The next day, after a good night of sleep, Chris and I dived part of Sump 2 again to see if we had missed any upstream leads along the main river. Most of our leads either ended or surfaced in a different place close to camp, but one lead at about 11 meters depth had flow coming out of it and continued, but at this point the reel jammed badly and we could not continue.

We then changed our focus back to the dry cave. While climbing around close to the upstream flowstone restriction, Chris suddenly called out that he had found a way on. What followed was some of the most amazing cave exploration I have been involved in, large fossil passages full of the funkiest flowstone decorations I have ever seen. In some parts the passage walls were covered all the way around, and in the farthest reaches of the main passage we found a large number of dead scorpions that must have been resting there for a very long time. After surveying all of this and marking the remaining leads for the next camping team, we returned to camp and after another night of sleep headed out. While the dive back went smoothly, our ride up the canyon to Santa Ana did not appear, and we finished off this big trip walking several hours up the steep canyon, meeting some funky snakes, scorpions, and spiders on the way. Shortly after reaching the top, the truck with everyone else came toward us, and we found out about several technical vehicle issues the others had had to deal with.

A few days later, the next team was going to head into the cave for another camping trip. On this trip the team was going to be Zeb, Matt, and Connor. Unfortunately on the way in Connor flooded his rebreather between the two sumps and had to bail, and so it was only Zeb and Matt making it to camp. Their trip went smoothly up to the last part of Sump 2, close to the surface, where Zeb managed to make contact with the sharp cave ceiling, resulting in a punctured breathing hose. Luckily they were close to surfacing, and a bit of remote field-repair resulted in a working rebreather. Zeb and Matt then spent their trip exploring and surveying more of the newly found dry cave. Toward the end of that camping trip, Matt also checked out one of the other sumps in the Passage of the Cheeky Monkey that we thought might bypass the flowstone restriction, but since he had only carried a 3-liter cylinder with him for this dive, he decided it needs a closer look with more gas.

Because the expedition was coming close to the end and we wanted to have another look at the sump close to the flowstone restriction, we decided to have a team go to the end on a day-trip, carry dive gear through the dry passage, and

Chris Jewell, Andreas Klocker, and Maxwell Fisher starting into sump 1 on the way to a camping trip beyond sump 2. *Gilly Elor.*



Profile of dive depth through Sump 2. The red area is forbidden to the diver because of his decompression obligation.

dive the sump. This was going to be done by Matt, Zeb, and Connor, but Zeb had difficulties equalizing and so Matt and Connor continued on. Connor then pushed the sump at the end, using his experience with tight caves gained in the UK, but even for him the sump became too small to continue. This was the end of this year's exploration, though we spent another few days cleaning up, but we all felt like we have missed something in this cave and that there must be more of an underwater continuation than the flowstone restriction at the northern end of the cave. It was hard to imagine that enough water could come through this restriction, even under flood conditions, to have destroyed all our previous year's guideline through both sumps. This cave definitely does not give up its secrets easily, and I guess we will have to plan another return to find the way on.

Since we struggled to find the way on in the Huautla resurgence in 2017, in 2018 we plan to shift our focus to the Cueva de la Peña Colorada. This cave is hypothesized to be the overflow resurgence to Sistema Huautla, and therefore it should connect into the main underwater river somewhere along its path from Sistema Huautla to the Huautla Resurgence. If we were to find this hypothesized junction, we could then explore both upstream toward Sistema Huautla and downstream toward the Huautla Resurgence. The current end of exploration is in Sump 7 at a water depth of 55 meters, with the sump starting at the bottom of a 55-meter-deep shaft with no land at the bottom to gear up on. The last expedition into Peña Colorada was led by Bill Stone in 1984, when the team had to turn due to the logistical limits of open-circuit gear (Stone, 1984). In 2018, thirty-four years later, we will return with rebreathers and mixed gases to push farther toward Sistema Huautla.

These trips would not have been possible without our great support by Alex and Ernie, who helped out with language barriers, local politics, and great cooking, and Bill Stone and the U. S. Deep Caving Team for lending us gear and helping with logistics. We were also supported by Damien Grigg from DKG drysuits, Shearwater Research, Otter drysuits, Stephen Fordyce from TFM

Crystal formations in the upper levels above the Passage of the Cheeky Monkey. *Maxwell Fisher.*

Andreas Klocker and Maxwell Fisher in the newly discovered area now known as the Dead Sea. *Chris Jewell.*

Andreas Klocker in front of a large flowstone wall in the upper levels above the Passage of the Cheeky Monkey. *Chris Jewell*.

Engineering, Highline ropes and Submerge Scooters. Thanks also to the National Speleological Society and the Ghar Parau Foundation for supporting us with grants! If you want to know more about our expeditions, past and future, follow us on www.beyondthesump.org or www.facebook.com/CaveDive.

Klocker, A., 2017, The Huautla Resurgence 2016 Expedition. *AMCS Activities Newsletter* 40:37–44.

Shade, B., and Stone, B., 2002, 2001 InnerSpace Odyssey Expedition. *AMCS Activities Newsletter* 25:53–71. http://www.mexicancaves.org/nl/25.pdf.

Stone, B., 1984, The Challenge of the Peña Colorada, *AMCS Activities Newsletter* 14:46–55.

El Retorno a la Resurgencia de Huautla

Se describe la continuación de la exploración de la Cueva de la Resurgencia de Huautla. La cueva ha sido confirmada mediante el uso de pigmento como la resurgencia del Sistema Huautla, que termina en un sifón muchos kilómetros arriba en la montaña. Espeleobuzos acamparon más allá del Sifón 2 y exploraron varias galerías de buen tamaño y muy decoradas, pero no se descubrió una continuación bajo el agua.

DAGOBAH EXPLORATION APRIL 2018

Natalie L. Gibb

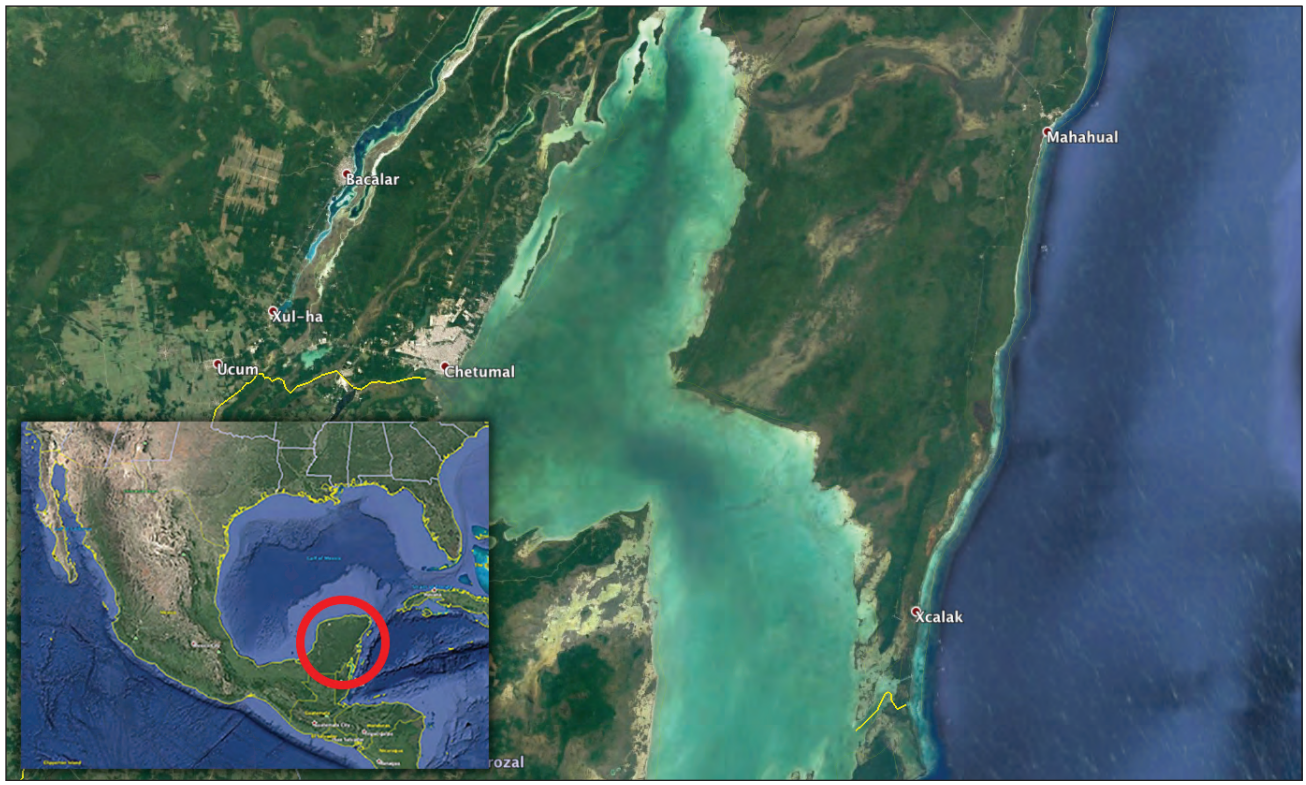
Looping my exploration line around my fingertips, I stretched the line forward and dropped it over a tie-off point. My chosen point disintegrated in a cloud of soft brown globs, white dust, and clay. At the same time, reddish flakes slid off the ceiling all around me, dropping the visibility to almost nothing as tiny rocks pattered down on my back. Oh no, I thought, not again.

These challenging exploration conditions are typical of flooded caves in the Pandora region, where Dagobah was discovered. The Pandora region begins on the Bay of Chetumal near the town of Xcalak and reaches northward towards Mahahual for a distance of about 40 kilometers. Our team has been working in the Pandora region since 2015, and while cave entrances are few and far between, the caves in the region are vast. We have reported and surveyed caves of Pandora, Melmak, Sea Cave 1, Sea Cave 2, Spooky Vent, and Vulcan. Every one of these caves is unstable and filled with unusual microbial growth. Microbial growth coats the ceilings in reticulated webs, it covers speleothems, and it has entirely blanketed the floor. We know the floor sediment is at least 1 meter deep, because we stuck a measuring stick into it. Microbial straws hang from the ceiling in low-flow regions; they drift and sway with water movement. Caves such as Vulcan, Sea Cave 1, and Sea Cave 2 that are closest to the ocean are home to marine life, including sponges, anemones, and mollusks. In Vulcan, the floor is composed of tiny shells layered on top of the microbial blanket. Caves that stretch farther inland do not typically have any sort of cave critters.

All the caves in the area are partially or entirely filled with hydrogen-sulfide-rich water. This dissolved toxic gas makes exploration difficult, but hints at the possibility of an interesting metabolic process for the microbes; perhaps the hydrogen sulfide is related to their metabolism in some way. Additionally, all the caves are relatively unstable, and the rock is brittle. It often shears off when wrapped with exploration line or falls from the ceiling when disturbed by exhaled bubbles. We wonder if the rock is being consumed by the microbes or dissolved by the hydrogen sulfide.

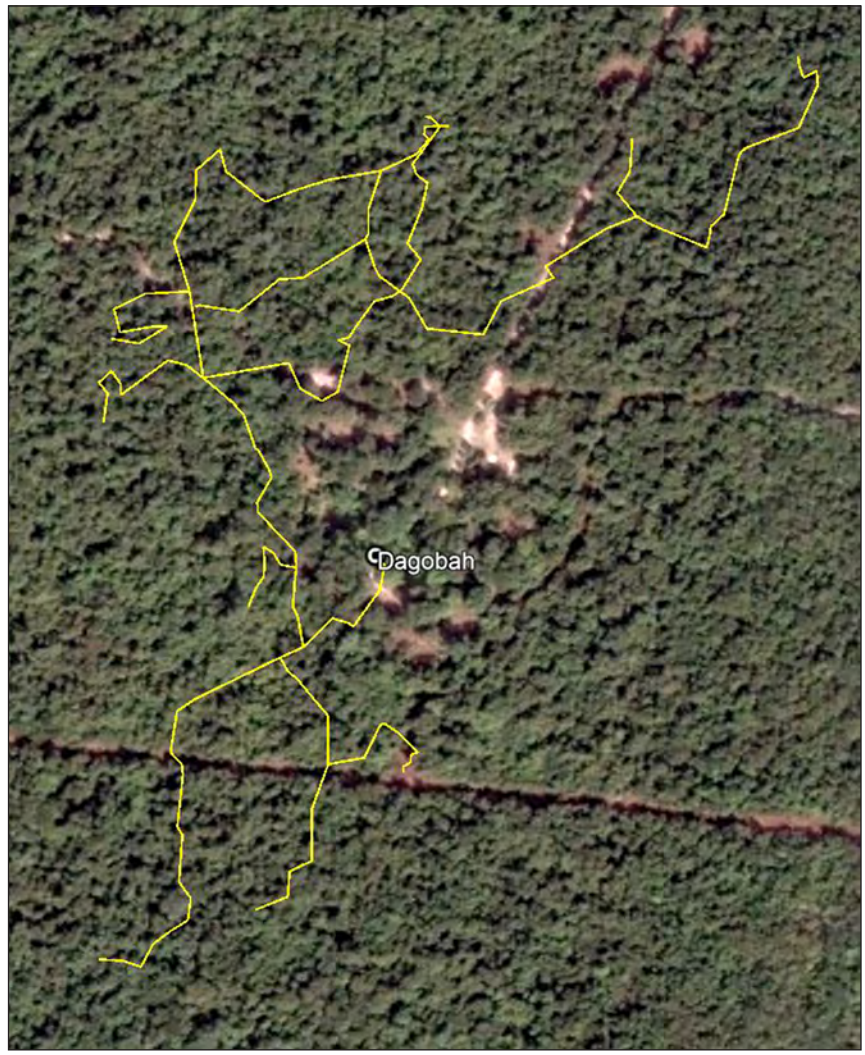
As of April 2018, we have found no caves above the water table in this region.

nat@underthejungle.com



Dagobah is located on a private ranch, approximately 38 kilometers from Sistema Pandora. The location is exciting, because the similarities between Dagobah and the Pandora region caves suggest a large subterranean aquifer extending throughout the Mahahual-Xcalak peninsula. Our team had been aware of the cenote for some years, but had been unable to gain permission to dive there. Peter Sprouse's group helped us gain initial permission to the site, and both the landowner and caretaker are enthusiastic to learn where their cave system goes.

The first dive led us down a steep, tight, and unstable slope into a room filled with sulfide-rich water. While the slope has now been dug out a bit, a sidemount equipment configuration is definitely preferable for this cave. The floor sediment in the entrance is lightly-packed microbial dust over bright orange clay and silts out visibility immediately. The clay stays suspended in the water for several days. At –15 meters, the cave opens into large chambers with diameters of 10 to20 meters. These chambers are filled with meters-long speleothems whose surface is covered with tiny bush-like spikes and fuzzy microbial growth. Hydrogen sulfide and tannic water fill all regions of the cave between depths of 8 and 21 meters. As in the other Pandora region caves, the speleothems are extremely fragile, and in some cases soft.



Over the course of four diving days, we surveyed 1.6 kilometers of cave at Dagobah, but the project is far from finished. It is a confusing place, with the cave running up and down over collapses and foggy rooms, and then dropping down into salt water with clear visibility below –22 meters. Some areas are very tight and unstable, and some are large and solid. The most exciting day of exploration was the discovery of The Crack. The Crack is a vertical fracture in the cave floor beginning at –18 meters and dropping to about –22 meters. Sliding sideways through The Crack, we found ourselves in clear salt water at –22 to –24 meters. The cave changes characteristics entirely; the speleothems are stable and solid, the water is perfectly clear, and the floor has either dark gray, clay-like sediment or no sediment at all. This deeper second level of the cave does eventually lead up over sediment piles to rooms filled with water containing hydrogen sulfide and tannins. The lower floor has

Marcelin Nebenhaus at a Fuzzy Wall. *Natalie Gibb*.

Vince Rouqette-Cathala in clear saltwater deep in Dagobah. *Natalie Gibb.*

many leads to check on our next expedition.

On the last day of the expedition, I ran upward from the deeper region, through a hydrogen-sulfide room, and up to very shallow water at –8 meters. Here I was surprised to find a distinct layer of clear, uncontaminated freshwater above the hydrogen-sulfide layer. It seems that freshwater is layered above hydrogen-sulfide water that is itself layered above saltier water.

Finally, unlike other caves in the Pandora region, cave shrimp of an unknown species were observed in the first chambers of Dagobah.

The exploration of Dagobah is far from finished. We have tunnels and leads to check in nearly every direction and hope to expand the cave far past the current 1.6 kilometers. We are working with scientists to analyze the microbial goop and geology of the area.

Exploración Dabogah Abril 2018

Se describe la exploración de las cuevas subacuáticas en la región de Pandora en Quintana Roo. Estas cuevas son inestables y contienen ácido sulfhídrico y aglomeraciones bacterianas. Hasta ahora se han topografiado 1.6 kilómetros de pasajes sumergidos y la cueva continúa.

HISTORY OF THE KIRKWOOD CAVING COMMUNITY

Frank Binney

Many factors contributed to the emergence of Austin's Kirkwood neighborhood as an internationally-known caver community in the 1970s. One major but often overlooked contributing influence can be found in the unusual characteristics and history of the available housing. This architectural uniqueness has since earned the Kirkwood neighborhood a listing in the National Register of Historic Places.

In the late 1940s, Texas Land Commissioner Bascom Giles saw financial opportunity in the national housing boom created by returning World War II GIs starting new families. In 1948 Giles built seventy-seven utilitarian duplexes on a tract of his family's pasture land north of 38½ Street in Austin, Texas, adjacent to the railroad tracks just east of East Avenue, Austin's north-south main artery, a "very pretty" divided four-lane city street with a manicured median featuring mature oak trees. Giles sited the duplexes along newly laid-out streets in a subdivision he labeled *Delwood, Section 3*. The new streets included Kirkwood Road, Maplewood Avenue, Ashwood Road, and Wrightwood Road.

Designed to be affordable by young white families of moderate income, Giles's boxy two-story duplexes were constructed of concrete masonry covered by white stucco, featured minimal decorative details, and varied little one from the other. Each offered approximately 860-square-foot apartments on the upper and lower floors, and most came with a detached concrete-block two-car garage.

Bascom Giles and his son Rogan Giles also developed a subdivision of relatively more upscale single-family homes on the other side of 38½ Street from his duplex development. At the time, both subdivisions were considered suburban, and both were well north of the area of East Austin segregated in the 1928 Austin City Plan as the City's "Negro District," just east of East Avenue and south of the City Cemetery.

When Missouri/California caver Frank Binney arrived in Austin in the fall of 1971 as part of a wave of cavers from throughout North America drawn to Austin as a jumping-off place for deep caving in Mexico, the Kirkwood area duplexes were in a state of general decline. The units' original target demographic young white families with moderate incomes, now found more desirable

frank@frankbinney.com

East Avenue, Austin's principal north-to-south roadway, circa 1950, looking south toward Brackenridge Hospital and downtown Austin. *Texas Department of Transportation.*

The original seventy-seven duplexes of the Kirkwood neighborhood (Bascom Giles's Delwood, Section 3 subdivision) viewed from the air in 1949. Note the concrete-block garages arranged along alleyways. The original caver house at 1307½ Kirkwood Road is visible on the left, at bottom right of the circle. It was one of the few duplexes in the development with a garage facing the street. The runways of Austin's main commercial airport from 1930 to 1999 are visible in the upper right. *Austin History Center, Austin Public Library.*

Bascom Giles helped ensure returning World War II servicemen could afford his duplexes by initiating and managing a 100-million-dollar state program that rewarded Texas's veterans with the ability to buy real estate at low interest rates subsidized by the taxpayers. A newspaper reporter won a Pulitzer Prize for investigative reporting when he uncovered fraud in Giles's management of the program. Giles lost his job as Texas Land Commissioner and served three years in prison on a bribery and corruption conviction.

1307½ Kirkwood, the original Kirkwood Caver House rented by Frank Binney in 1971, as it appeared in 2013. When cavers lived in the upper unit and in adjacent duplexes in the 1970s and 1980s, these and almost all the similar duplexes in the subdivision were painted the same shade of white. *Frank Binney.*

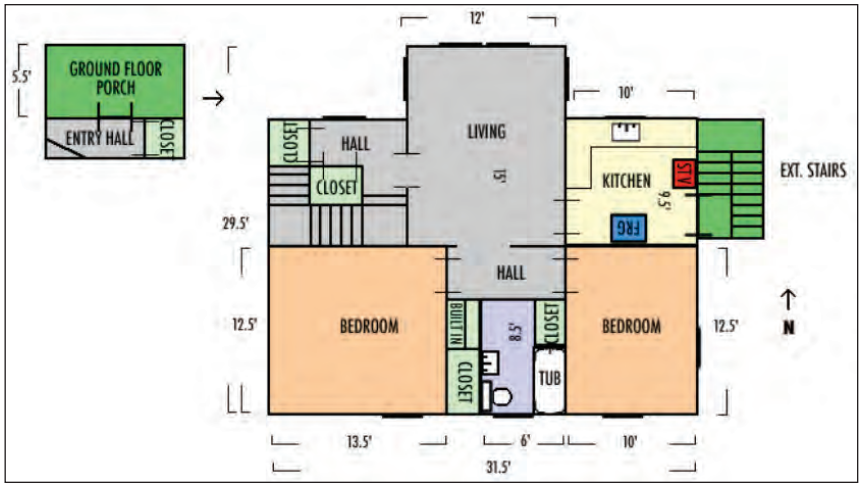
Examples of the minor variations in architecture between the Kirkwood neighborhood duplexes. In the 1970s and 1980s both of these styles were among those occupied by cavers. *Frank Binney.*

housing in new subdivisions farther out along Austin's ever-expanding suburban edges. A few units were still occupied by aging owners, but most had been acquired as income property by absentee landlords. Location negatives, including being beyond reasonable walking distance of the University of Texas, adjacent an active railroad, and within earshot of a major freeway (Interstate-35 had replaced idyllic East Avenue), limited the pool of potential renters to mostly bohemian types and UT students with vehicles. Tenant turnover was relatively high, rents were relatively low for Austin at the time, and most of the absentee landlords weren't choosy about tenants or overly concerned about tenant modifications to the run-down structures, all desirable conditions for 1970s "hippie caver" housing.

In addition, the neighborhood's unique concentration of nearly identical affordable units, many of which frequently became available, made it easy for the original 1307½ Kirkwood caver house to expand into a caver village. As Austin's reputation as a hub for international caving drew more cavers to the city from other regions, new

A number of cavers found work on the I-35 upper deck construction project. Pennsylvania-expatriate caver Charles "Squire" Lewis served as a project consultant, and former Southwest Texas State cavers Joe Sumbera, Jimmy Jarl, and Sam Billings hired on as laborers, along with California caver Walt Rosenthal, who was living at 1307½ Kirkwood in between Mexico caving trips. Walt died in 2006 while attempting to rescue two of his fellow ski patrollers who had fallen into a volcanic vent at California's Mammoth Ski Resort.

A number of former Kirkwood cavers reunited at the 2017 NSS Convention with two social scientists studying "caver villages". Left to right standing are anthropologist María Alejandra Pérez, Mark Minton, Preston Forsythe, Blake Harrison, Gill Ediger, Janet Fitzsimmons, Peter Sprouse, and sociologist John Wilson. Left to right sitting are Michael McEachern, Tom Byrd, Bill Steele, Frank Binney, and Dale Pate. *Frank Binney.*



Floor plan of 1307½ Kirkwood (upper unit), the original Kirkwood caver house rented by Frank Binney in 1971. Access to the unit was via an exterior wooden stairway off of the kitchen. The interior stairway was converted into caver bedrooms, as were the attic crawlspace, the detached garage, and the front balcony. As many as fourteen cavers occupied the premises at one time.

In 1962 the Interstate-35 freeway replaced-tree-lined East Avenue adjacent to the Kirkwood neighborhood. Concurrent with the early years of the Kirkwood caving village (1971–1975) upper decks were added to the freeway, further lessening the desirably of the neighborhood to upscale renters. Note the circled gas price (26⁹) on the left ,and on the right the sign on the original Academy Surplus store, the progenitor of today's Academy Sports and Outdoors chain. *Texas Department of Transportation.*

Historia de la Comunidad Cuevera de Kirkwood

Se describe la historia de la famosa comunidad cuevera de Kirkwood en Austin, Texas. Un estilo característico de alojamiento de bajo costo combinado con una mentalidad alternativa la convirtió en una villa cuevera conocida a nivel nacional en los 1970s.

arrivals often found housing in one of the many Kirkwood Road or adjacent-street duplexes.

The transition of Austin's maturing baby-boom cavers from renters to home owners, along with other sociologic and economic changes in the Austin caving community in late 1970s and early 1980s spelled the end of the Kirkwood caver village. Cavers found more desirable housing elsewhere in the growing Austin metropolitan area, and by about 1980 the lease for 1307½ Kirkwood had passed to non-caver tenants.

By the turn of the twenty-first century, Austin's growth and booming real estate market made the Kirkwood area popular among millennial fans of inner-city living. They dubbed the neighborhood "Duplex Nation". Young professionals began hiring urban architects to turn some of the duplexes into upscale owner-occupied single-family homes. While a number of the duplexes, 1307½ Kirkwood among them, remain as rental housing, all have been upgraded, and the once-white stucco exteriors are now painted in a variety of bright colors. Rents have risen from the $125 per month charged for 1307½ Kirkwood in 1971 to $1,550 per month for the same unit in 2016.

In 2011, the Kirkwood neighborhood achieved listing in the National Register of Historic Places as the *Delwood Duplex Historic District* in recognition of its importance to the history of Austin and Texas. The Texas Historical Commission press release for the listing explains, "The neighborhood illustrates post-war suburban development patterns fueled by the "baby boom," advances in building technology, federal incentives for home ownership, and trends in mass production and tract development occurring throughout the nation. Representative of national housing trends during the mid-twentieth century, it is the only concentration of duplex tract housing in Austin, and the city's first postwar neighborhood to be listed in the National Register." Shockingly, there is no mention of the neighborhood's immense importance to twentieth-century caving history.

CRYSTALS OF NAICA: FAREWELL FOREVER!

Giovanni Badino and Paolo Forti

Last October a brief notice appeared on a Mexican website announcing the permanent shutdown of a silver mine in the state of Chihuahua due to massive flooding that could not be countered in any way. At first glance, it might have looked like a communication of local interest. But for the world of speleology it was heartbreaking news. The mine in question was that of Naica, which hosted the most amazing caves in the world, with their giant gypsum crystals, by far the largest known to man. If possible, the news was even more shocking for our group La Venta Esplorazioni Geografiche. For five years from 2006 to 2010 we not only carried out the exploration and survey of these cavities, cooperating with C/Producciones from Mexico City for photographic documentation and the simultaneous production of a documentary and a film, but we also coordinated an interdisciplinary research group, consisting of about twenty scientists from various parts of the world, in order to study every aspect of these in credible caves.

We were deeply saddened by this news, even though, we must admit, we have always been aware that this "alien" world would be available to us only for a few years. In fact, the mine managers had clearly stated as early as 2002 that, within a maximum of about ten years, the ore would run out and the mine would consequently be closed, flooding the cavities underneath an insurmountable 170-meter-deep wall of hot water.

KUR 22 2015, English version 2018, pages 13–15.
https://issuu.com/laventaesplorazionigeografiche/docs/kur22eng

A BIT OF HISTORY

The mine of Naica became world-famous in 1910 when at the –120-meter level it encountered a natural cavity completely covered with gypsum crystals that measured up to 2 meters in length and that were by far the largest gypsum crystals ever discovered at the time. This cave, called Cueva de las Espadas, was immediately subjected to the extraction of the largest crystals, which were sent to the major mineralogical museums in the world, and then it was partially equipped for sightseeing. After World War II, thanks to the dewatering of over one thousand liters per second of water at 50 °C it was possible to deepen the mine well below the piezometric level.

In 2000, during the excavation of a mining tunnel 170 meters below that level, three cavities were intercepted in rapid succession. The largest is known as Cueva de los Cristales, and it contains giant gypsum crystals up to over 11 meters long and with diameters up to over 1 meter. But the environment was absolutely hellish. In this cave it was impossible to stay more than five or ten minutes without literally "steaming" to death.

At the invitation of the mine management, the first speleological visit was carried out in January 2001 by Mexican caver Carlos Lazcano, a member of La Venta, with his friends Claude Chabert and Nicky Boullier, two world-famous French speleologists. It was just a short visit, but it served to confirm the exceptional speleological and scientific significance of these cavities.

PROYECTO NAICA

La Venta began planning the exploration and documentation of these caves, where we were briefly admitted only in 2002 as guests of the mine, whose management simultaneously shut the door on any possible collaboration, gently but firmly. But in the following years we were lucky enough to meet C/Producciones from Mexico City, a company specialized in making nature documentaries, and thanks to their involvement we were able to have the Proyecto Naica accepted by the Peñoles Company, licensee of the mine.

That moment marked the beginning of what we believe to be by far the most important and complex activity ever undertaken by La Venta, both for the exceptional environment we were operating in and for the technological challenges constantly presented by this beautiful but hellish place. In fact, its deadly climate forced us to study and develop special suits and breathers before we could schedule any activities inside these caves. Without them, the times spent in Cristales would never have been sufficient to carry out exploration, documentation, and research activities. Despite this equipment and the development of careful security protocols, we really risked a lot on a few occasions.

The unfamiliarity of this environment and the uniqueness of the research that we would carry out led us to develop several other technological solutions. For documentation, we invented robotic instruments that could take pictures that didn't require the operator's presence inside the cave. For the studies on

The entrance to the Naica mine. *Paolo Petrignani.*

crystal growth, we designed a sort of "incubator" that could recreate, deep into the mine, the conditions existing in the cave before the dewatering had emptied it. This instrument was placed in lower levels of the mine, where native thermal water still flowed in an even more hostile environment than that of Cristales. In this way we have artificially grown in less than three years small gypsum crystals at the same rate at which the giant ones had formed naturally in hundreds of thousands of years.

During Proyecto Naica hundreds of thousands of photographs and dozens of hours of videos were shot, all the caves were surveyed, and in the Cueva de los Cristales we also made a partial 3D survey with a laser scanner.

The material of Proyecto Naica was used to make documentaries by National Geographic, the Discovery Channel, and the Japanese broadcaster NHK, to cite only the most famous producers, and a film screened in Mexico is being adapted for the Italian public.

During these years of intensive study, the caves of Naica have undoubtedly offered the greatest satisfaction in the scientific field. In fact, besides the giant gypsum crystals, these cavities have proved to be an almost inexhaustible source for many diverse research fields from mineralogy to physiology, from paleo-climatology to seismology, from micro-meteorology to astrobiology.

The environment of the Naica Caves has proved to be quite peculiar and in some ways almost extraterrestrial, to the point that even NASA wanted to participate in the project by testing analytical tools destined for Mars. . . .

Thanks to all these studies, about fifty scientific articles have been published since 2006, almost all of which have one or more La Venta members as authors. Papers will continue to be published as laboratory analyses of the samples collected over six years ago are being concluded. In fact the micro-meteorological analyses of Cristales have shown that this is only a small part of a larger underground complex extending north-east of the known cavity at least as far as the cave of Ojo de la Reina.

Unfortunately at the end of 2009, a year before its planned conclusion, Proyecto Naica was abruptly interrupted by a unilateral decision of the mine licensee, who feared that the increasing media visibility of this geological treasure would interfere with mineral extraction. **W**e were not even allowed to retrieve some automatic instruments that were still recording data inside Cristales.

CONSERVATION

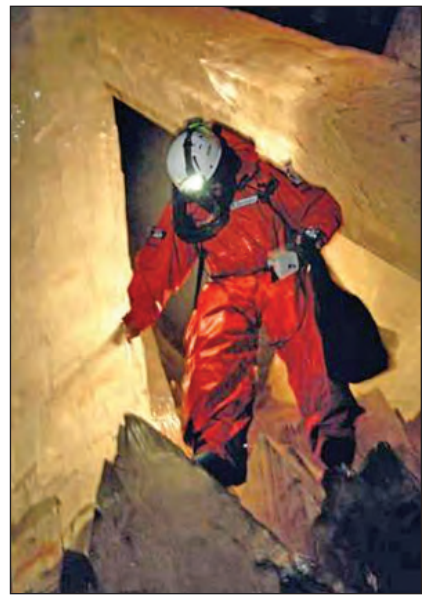
Since the beginning of Proyecto Naica, the safeguarding of these incredible and very delicate cave "jewel boxes" has always been the main concern for us. First of all, there was the issue of the progressive degradation of the crystals, which were exposed to an atmosphere very different from the soup in which they had grown for hundreds of thousands of years. In a few years, in fact, the condensation of water, aggressive and rich in carbon dioxide, had begun to transform them with calcium carbonate concretions. This process has been greatly slowed down, if not completely stopped, thanks to the placing of sealed doors at the entrances to the caves to eliminate air exchange with the mine galleries as far as possible. The watertight doors also performed the task of impeding the action of potential crystal thieves, who in fact, have not been able to access the caves any more after their installation.

Another fundamental problem was to guarantee the access of the caves over the time limits of the mining activity. To achieve this goal we reached out to everyone from the Peñoles company to the government of Chihuahua and from the federal government to UNESCO, presenting solutions that would guarantee, on the one hand, the partial economic sustainability of the project and, on the other hand, the possibility for the village of Naica to survive after the mine shutdown, thanks to tourism in the caves.

Our ideas have always been greatly appreciated, but only in theory. None of our interlocutors has ever proposed to move from project to operational implementation, and time has inexorably passed by.

THE END OF THE MINE

The mine operates below a local aquifer naturally located 130 meters below the entrance, and the pumping had lowered the water level about 750 meters. At the end of our operations in 2010, about 1,500 liters per second were being pumped from the bottom, with an annual consumption of about a thousand billion kilowatt hours. In these years the price of lead dropped about 20 percent and that of silver over 50 percent, which probably made mining unprofitable. It seems that, at the beginning of 2015, during the excavation of tunnels



In the Cueva de los Cristales. *Paolo Petrignani.*

toward potential ore deposits, an unexpected aquifer that flooded the deepest parts of the mine was intercepted. Pumping activities continued until last September, when the management of the mine ascertained that their efforts had limited the rising of water at –400 meters, without any further improvement, and thus decided to stop the pumps and, as it seems, to ask for permission to start a new mining activity in a different sector.

Despite our efforts, we have not been able to obtain more detailed information, but the level of the big caves of Naica is likely destined to be underwater again in a short amount of time.

CONCLUSIONS

We wish we could have at least greeted the crystals for the last time before they sank into thermal water, but it seems that we will not be allowed to do that, and that we will not be able to perform one last 3D survey to carefully preserve their memory. It's a pity, but we have already had the huge privilege to operate in an extraordinary environment, in close contact with this incredible forest of crystals, and to communicate the short-lived appearance of these treasures of the lands of the night to the rest of humankind. We are left with the consolation that now the crystals will feel better in their "amniotic" liquid, that they will start growing again, and, who knows, in a few hundreds or thousands of years somebody will be able to see them, larger and more beautiful than ever. We are left with the awareness that we have done everything we could to show the whole world the incredible jewel box of Naica, as well as its hidden treasures. The future generations, although deprived of the possibility of seeing directly these wonders of nature, will be able to remember Naica thanks, above all, to the publications that La Venta has already produced and will produce in the near future.

DEGOUTIN N., 1912 Les Grottes à cristaux de gypse de Naica (Mexique), La Nature, 1927

FORTI P., SANNA L., 2010 The Naica Project: a multidisciplinary study of the largest gypsum crystal of the world. Episodes 33, **1,** p.23–32

BADINO G., FORTI P., 2013, Naica caves: perhaps the most important mine caves of the world, *in* Memorie Instituto Italiano di Speleologia s.2, XXVIII, p. 29–40

Articles about the Cave of the Crystals and the Naica mine have appeared in three previous issues of the *AMCS Activities Newsletter*.

Cueva de los Cristales, by Carlos Lazcano Sahagún, number 25, 2002 pages 72–77. (The original caver visit.)

The Infernal Survey in the Crystal Paradise, by Giovanni Badino, number 30, 2007, pages 50–54.

The Selenite Caves of Naica, Mexico, by William F. Forshag (historical reprint), number 30, 2007, pages 155–156. (The Cave of the Swords.)

Shorter material appears in "Mexico News" in numbers 25, 30, and 33–40.

Cristales de Naica: ¡Adiós, por Siempre!

Breve reseña de la historia del descubrimiento de los cristales de yeso gigantes en la Cueva de los Cristales en la mina de plata de Naica. La extracción en la mina fue detenida recientemente debido a la caída de los precios del metal. Ya que los cristales están a una profundidad muy por debajo del nivel freático local, al detenerse las bombas de agua las galerías se han inundado de nuevo.

YUC 2016 EXPEDITION

Christian Thomas

The YUC 2016 expedition was the thirtieth expedition organized under the aegis of the French Federation of Speleology in Yucatan over twenty-one years. It took place in August 2016 over a period of three weeks. The participants were Odile Champart Curie, Fatima Tec Pol, Raul Manzanilla, Mario Novello, and Christian Thomas. On the Serrita de Ticul we explored in the state of Campeche the cave of Xcalumkin, and in the state of Yucatan the cave of Loltún near Oxkutzcab, Yaaxnik, Kiik, and several cavities in the area of Tekax. INAH gave us permission to explore the Loltún and Xcalumkin caves under their control.

In the eastern part of Yucatan, in the limestone plain west of the Holbox Fault, we finally found the Pitch Caves in Santa Rita and explored cavities in the nearby area of X-Can. We explored a total of fifteen cavities and surveyed 12,400 meters of caves. In general, the level of CO_2 in the caves was high. This was related to the rainy season. From a scientific point of view, we continued our search for clues from ancient sea levels and speleothem samples.

Numerous contacts have been made with the team of Peter Sprouse, with Fred Devos, and with German Mendoza to clarify elements integrated in the book we are preparing on the north-east of the peninsula.

Like every year, we had the pleasure of seeing Carlos Evia, professor of anthropology at the University of Mérida. We met for a short time José Ruiz Silva, director of the SEDUMA who holds a file of cenotes on the state of Yucatan with about three thousand references. He collects in particular the work of the American team of Kurt Bowen of *Advanced Diving Magazine*. We also met Helena Barba, who is responsible at INAH for exploring the caves in Campeche.

Finally, our work was presented at a conference organized in the INAH library in Mérida attended by some fifty academics. Two articles in the local newspapers echoed it.

christian.thomas@worldonline.fr

Xcalumkin Grande entance 20°10′13.38″N 90°0′33.89E″; Xcalcumkin Chico entrance 20°10′17.87″N 90°0′34.28″E. The caves of Xcalumkin open in the archaeological complex of the same name. Reddell in the 1970s wrote a description of Xcalumkin Chico and collected biological samples. [See AMCS bulletin 6, page 245.] No topography was then carried out. More recently, in the 2000s, Eric Baqueiro and Pablo Mex of Campeche SEMARNAP explored Xcalumkin Grande for over a hundred meters. They report the presence of carbon dioxide at a high concentration. In 2015, we made a rapid reconnaissance of the two entrances. We obtained authorization from INAH to explore them in 2016. The two caves open at elevation of 35 meters, and the passages are developed at 25 meters.

Xcalumkin Grande is a 7-meter pit that gives access to a passage leading 170 meters toward Xcalumkin Chico. This beautiful passage, 5 meters wide and 5 high, ends abruptly at a plug of clay. Traces of flow are visible, and a soil blockage is located 60 meters from the entrance.

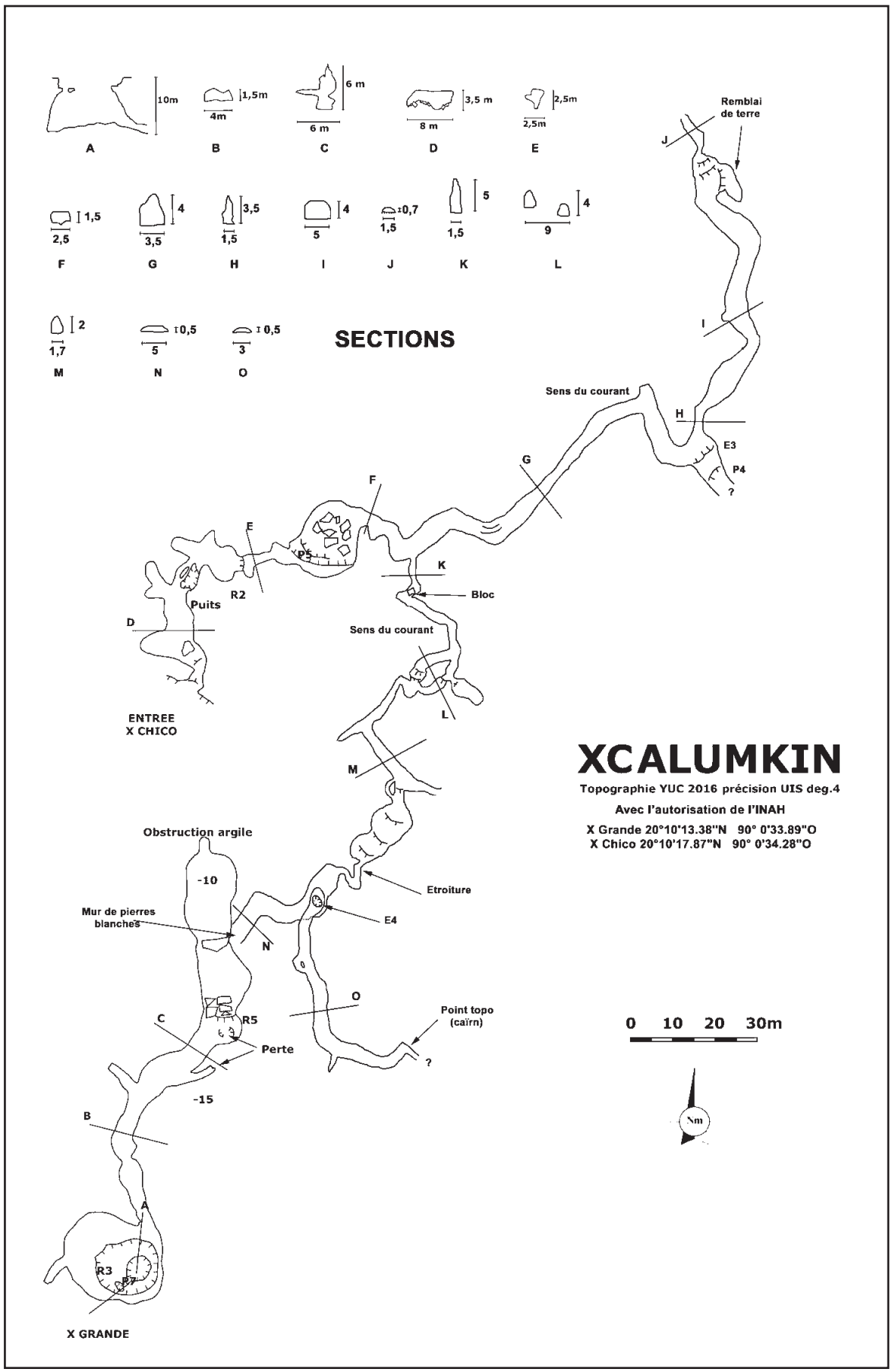
Xcalumkin Chico opens less than 30 meters from the end of Xcalumkin Grande. A small descending entrance gives access to a passage whose ground is covered with guano. A 6-meter drop located 40 meters from the entrance leads to a small network that we could not explore because of the high carbon dioxide (5%, with 16% oxygen).

This drop can be bypassed on the left to reach 30 meters farther to a 5-meter drop requiring a rope. A beautiful gallery 4 to 5 meters wide and 5 meters high follows this and heads northwest. Traces of flow and twigs show that this cavity is active during heavy thunderstorms and serves as a drain. After 200 meters the passage is partially obstructed and continues tight The presence of carbon dioxide did not allow us to advance.

Approximately 100 meters before the end, climbing on the west, right bank gives access to a side passage. A 4-meter drop that we did not descend gives, according to Reddell, access to a 150-meter-long network ending in a low and unexplored labyrinth.

Another 75 meters back from the end, a tributary gallery opens on the right bank. This more modest gallery, 1 to 2 meters wide and sometimes less than 1 meter high, is winding and runs generally toward the south. After 150 meters, a descent on sand gives access to a narrow lead. Traces of current are visible, and the twigs stuck to the ceiling show that this gallery operates as a sump. A bird corpse and some plastic waste brought by water show that the upstream source is sufficiently wide. The gallery ends 50 meters farther at a white stone wall. The map shows that we are under the downstream gallery of Xcalumkin Grande.

A small well that can easily be climbed overlooks the continuation south. We did not go through this gallery completely because of an excessive amount of carbon dioxide and anxiety aroused by the risks of thunderstorms in the rainy season. After 50 meters of progress we left a cairn-like survey point. Reddell


SECTIONS
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
Remblai de terre
Sens du courant
Bloc
Puits
R2
P5
ENTREE
X CHICO
Obstruction argile
-10
Mur de pierres blanches
Etroiture
E4
Point topo (caïrn)
R5
Perte
-15
R3
P7
X GRANDE
E3
P4
XCALUMKIN
Topographie YUC 2016 précision UIS deg.4
Avec l'autorisation de l'INAH
X Grande 20°10'13.38"N 90° 0'33.89"O
X Chico 20°10'17.87"N 90° 0'34.28"O
0 10 20 30m
Nm

indicates in his description that this route leads to an 11-meter pit located about 15 meters beyond our penetration. Is it a pit rising to an entrance or a descending well that has not been explored? We do not know. This cave currently totals 730 meters in length and could reach a kilometer. Flows come from both entrances and head north. Exploration should preferably be conducted in the dry season when flood risks and carbon dioxide levels are significantly lower.

Loltún. The cave of Loltún was described in the nineteenth century in the book *The Hill Caves of Yucatan* by H. C. Mercer. Since then, the cave has been the subject of excavations and studies carried out under the authority of INAH. The cave is open to tourism. Its access is regulated. We obtained the permit to visit and survey the cave of Loltún from INAH, which we thank. The aim was to study the fills in the cave in preparation for possible future sampling intended to date the traces of ancient sea levels.

The cavity was partially mapped in 1974 by McKenzie, Reddell, and Wiley. We verified by re-plotting a part of the cavity that their topography corresponds to the degree 4 precision of the International Union of Speleology. The north indicated on their map is a magnetic north. We have completed the survey and made a synthesis of the whole. (Our drawing has geographic north). Apart from short passages still to be studied, this map only lacks that part of the cavity protected by a lattice door located near the tourist exit that shelters bones of Pleistocene fauna. The drawing we have taken for this part comes from an unknown source. The length of the cave is 6300 meters. The depth is 31 meters, not 60 as often claimed.

The entrance is a vast collapse. A gently sloping descent leads at –15 meters at a large 30-meter-wide gallery heading west with a slightly downward slope to –30 meters. The floor is filled with red soil covered with a black film. Sporadic flows are drained and lost in a small passage to the south. In very large rainfall events, water accumulates 400 meters from the entrance in the lower point of the main route. It then takes several weeks to infiltrate. However, the volume of water draining into the cave is modest. It is therefore essentially a fossil cavity that no longer plays any hydrogeological role. Concretions have formed on the clay deposit, indicating that this backfill is old.

At 400 meters from the entrance the profile of the cave goes up. Indeed, a chaos of collapsed blocks imposes a rise of a few meters. This chaos leads us to a great crossroads. To the northwest, the Grand Canyon is a passage that resulted from the collapse of an upper passage into a lower one. The upper gallery contained a significant formation that was broken by the collapse. It should be possible to date these concretions in order to determine the age of this event. The upper gallery was about 10 meters above the lower one. The soil of the lower gallrout does not appear to have clay deposits. This could indicate that we are there at the level of the cave genesis. The sequence of events would then have been undermining of the upper gallery, collapse, and then clay backfill. That remains to be seen.

At the end of the large canyon, the cave turns to the left and regains its classic profile: horizontal and filled with dried red clay. Large formations have formed on this clay, indicating that the clay backfill is ancient. This leads to a large room 80 meters in diameter illuminated by two skylights. Massive formations are developed on the scree below the two domes. From this room a passage heads toward the southeast, parallel to the Grand Canyon, which connects to it. The soil is dry clay.

In the south, a second large room of comparable size has a depression in its central-eastern part. A large column is partly broken and shows that the soil has been undercut.

To the south of this room, one climbs a rocky chaos that leads to a another large room located 10 meters above the previous one. Several openings at the ceiling allow daylight to enter. The rest of the network develops on the same level, at the depth of 20 meters. It is made up of a gallery of more modest size,width 10 meters and height 5 to 10 meters, that ends at a laborinthine area of formations that we have not completely explored. We are here at the southwest end of the system.

Returning to the crossroads that gives access to the large canyon, we find the area to the south. A very labyrinthine and highly concreted area develops toward the east. This zone is disected by narrow passages between curtains of formations. The height of the ceiling rarely exceeds 6 meters. The network is horizontal and developed at a depth of 30 meters, and its floor is covered by a deposit of dried clay. In some places excavations are visible, witnesses of old clay mines. In several places, the clay was undermined, revealing the base of columns and showing that some of the formations predate the placement of the clay deposit.

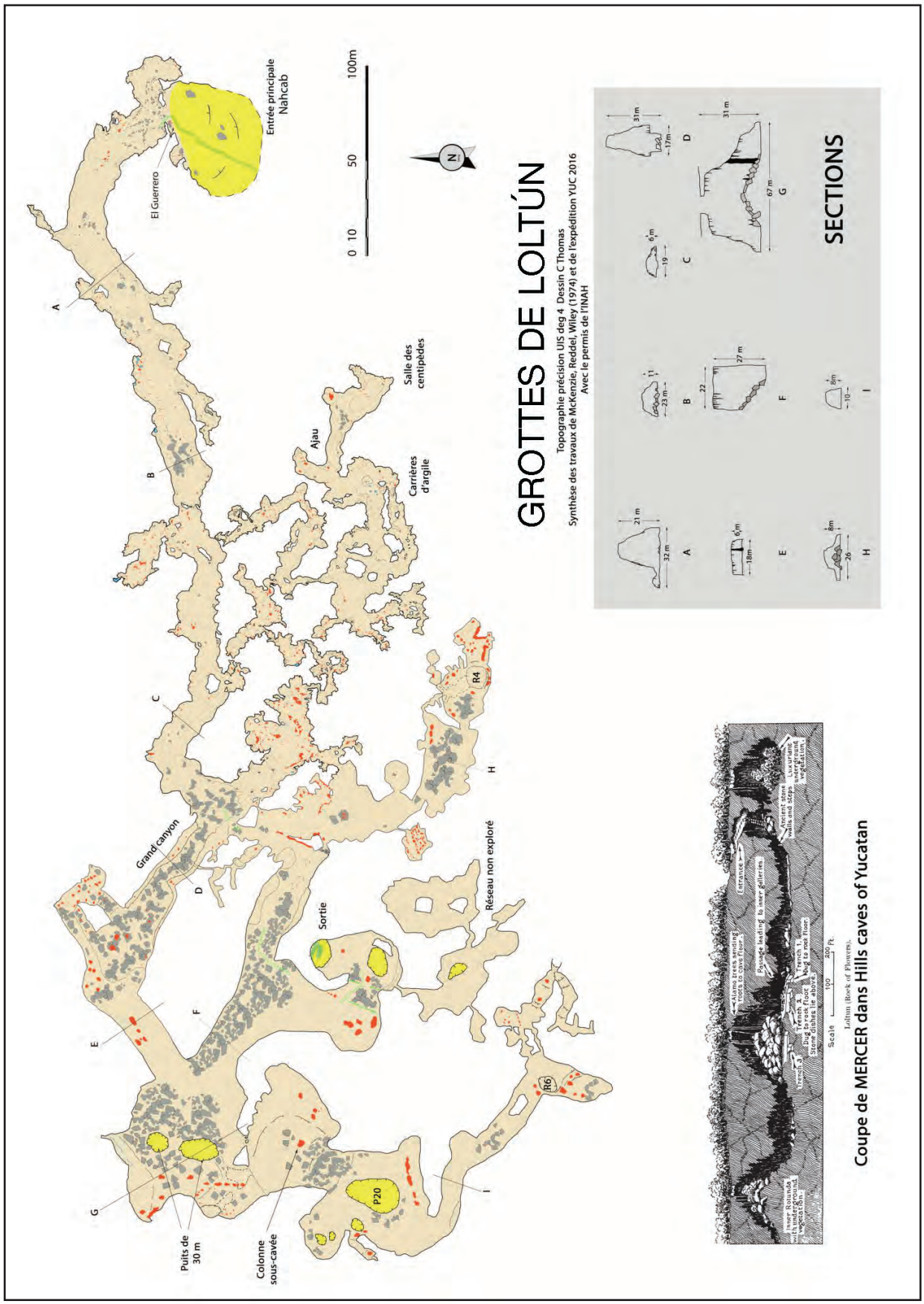
The western part of the labyrinth is taken by the tourist circuit. This takes us back to the big room that leads to the exit pits.

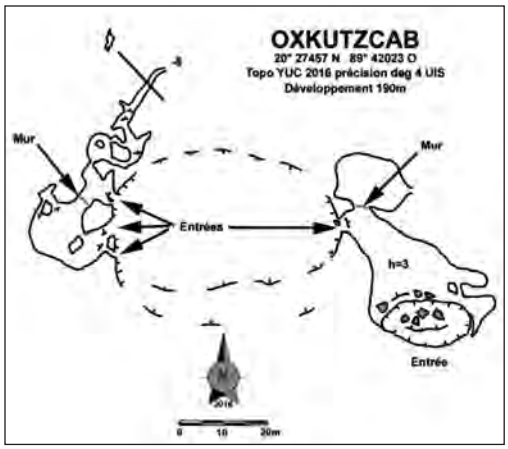
Close to the exit, a short climb leads to a network protected by a gate that we could not visit. In this part of the cave the Quaternary faunal bones were exhumed. This network develops at a depth of 20 meters.

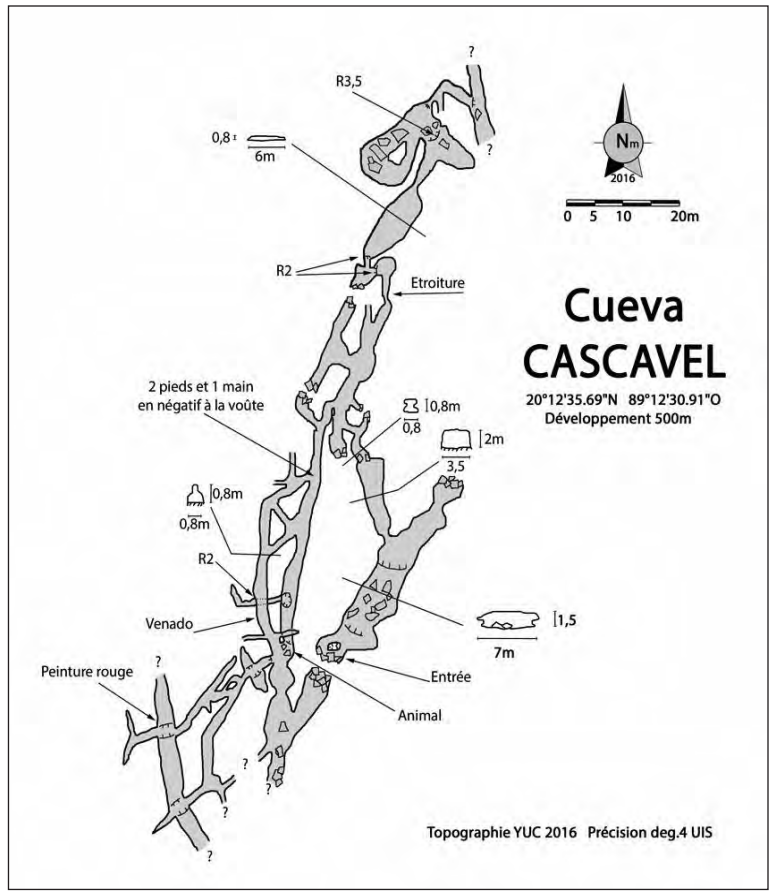
The main fracturingof the bedrock in the area is north-northeast to south-southwest and is parallel to the Ticul fracture. However, no faults are visible in the cave.

The generally labyrinthine form of the cave corresponds to a formation in the drowned regime of an anchialine cave. The formation of the Loltún Cave is most probably linked to an ancient sea level. The entrance to the cave is at an elevation of 92 meters. The main parts lie at a depth of 30 meters or at an elevation of 62 meters. This elevation corresponds to that of the polje located to the southwest of the cavity. The two phenomena are very probably contemporaneous and correspond to a relative sea level of +60 meters. The cave then evolved. One distinguishes a phase of old clay backfilling, followed by a concretion phase and then a undermining episode visible in several places in the cavity.

It may be possible to date the end of the backfill phase by removing the base of stalagmites that have formed


GROTTES DE LOLTÚN
Topographie précision UIS deg 4 Dessin C Thomas
Synthèse des travaux de McKenzie, Reddel, Wiley (1974) et de l'expédition YUC 2016
Avec le permis de l'INAH
Entrée principale
Nahcab
El Guerrero
0 10 50 100m
N
A
B
C
D
E
F
G
H
I
Salle des centipèdes
Carrières d'argile
Ajau
Grand canyon
Sortie
Réseau non exploré
R4
R6
P20
Puits de 30 m
Colonne sous-cavée
SECTIONS
Coupe de MERCER dans Hills caves of Yucatan



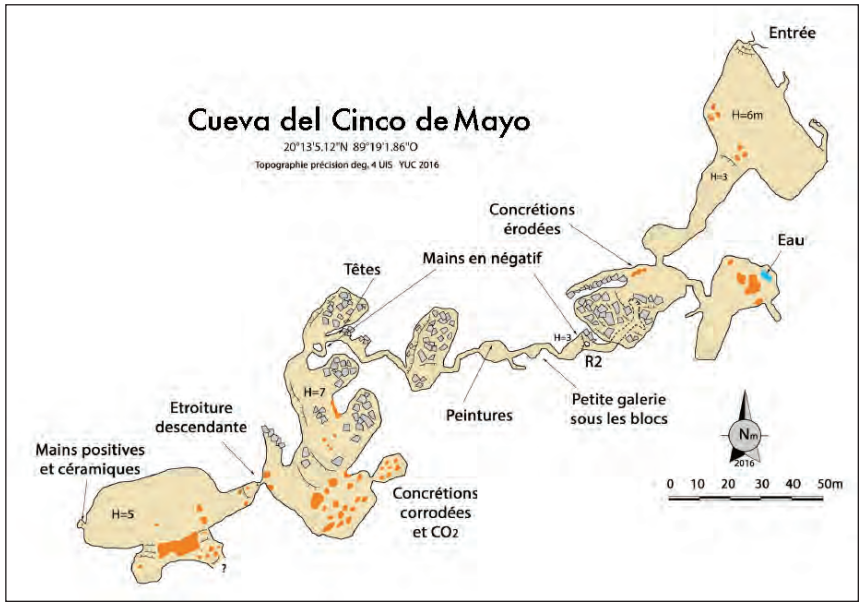


on the clay and have been undercut and subsequently dug up. Similarly, the stalagmitic mantle present on the cornices of the Grand Canyon and cut off at the time of the collapse of the upper gallery should give information on the age of this event.

Oxkutzcab; 20.27457°N 89.42023°E. Located two kilometers from Lotun, these two cavities open on the banks of a depression 100 meters in diameter located at an elevation of 70 meters. The complex includes 190 meters of galleries. A small, narrow descending gallery reaches a depth of 8 meters at the end of our visit. There is no air current, but the cavity continues.

Cinco de Mayo; 20°13′5.12″N 89°19′1.86″E. This cavity is located near Akil. It was discovered about a year ago. The people have made numerous excavations and looted archaeological objects.

The cave opens at the foot of the escarpment of the fault of Ticul. A dug entrance leads after a descent of a few meters into the cave. This is horizontal and extends over 850 meters. It is a string of large rooms separated by narrow spots located under collapses. Much remains to be explored in detail. Rooms are probably accessible by exploring the irregular blocks of breakdown that punctuate the cave. In our search for ancient sea levels this cave thus joins the cohort of caves that develop at the coast at +35 meters. Stalagmitic columns show traces of erosion due to water flows that are certainly conducive to sampling for dating purposes. On the archaeological level, some paintings, engravings, and negative hand printse are visible to several places in the cave.



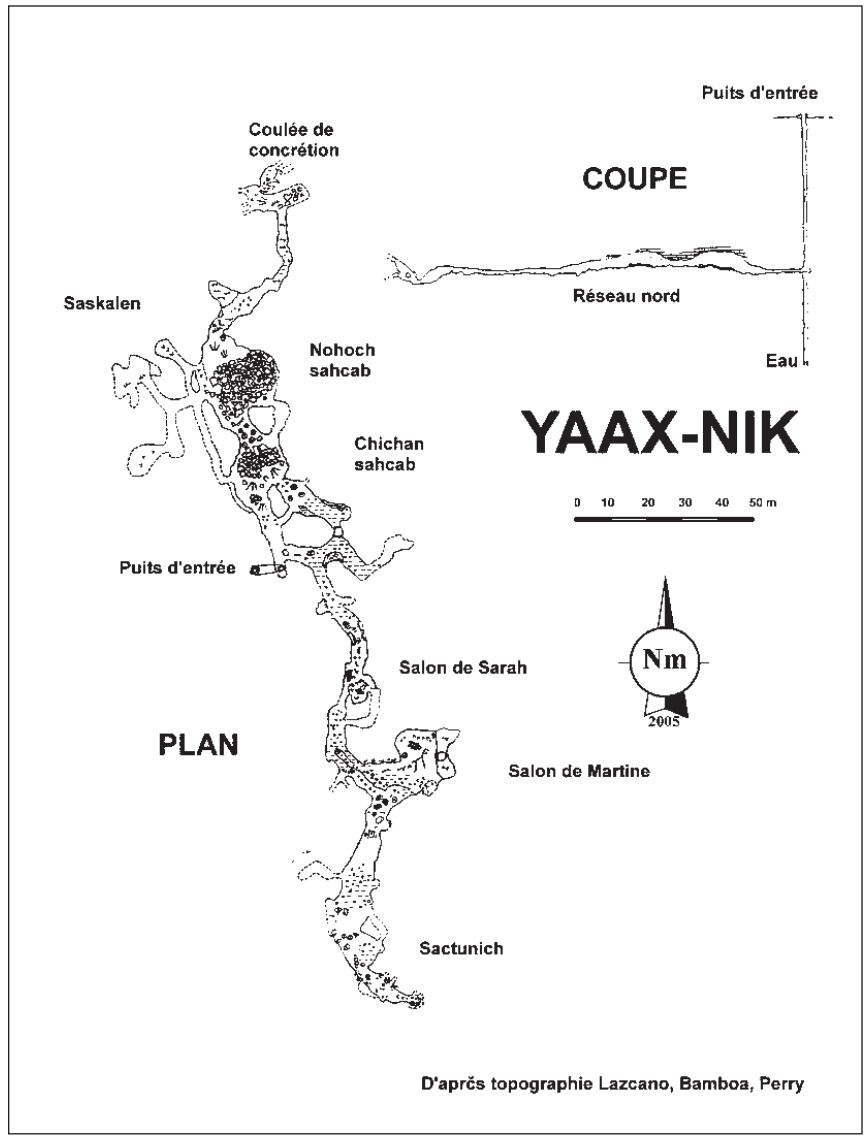
Cueva Cascavel; 20°12′35.69″N 89°12′30.91″E. The cavity is in the small wood behind the Tixcuytun cemetery. A small entrance of 1 meter in diameter protected by the remains of a gate opens on a descending corridor. The passage is 7 meters wide and 1.5 meters high. It stops at a collapse after about 40 meters. The continuation is on the left, where a short descent gives access to a narrow and labyrinthine network. Toward the north, the cave continues with intersections and narrowings

for nearly 150 meters. The passage is low,less than 1.2 meters high, and 2 to 7 meters wide. Exploration has been interrupted due to the high carbon dioxide content, but is worth pursuing.

In the south, the cave contains several Maya paintings and engravings. Recent markings fortunately spared the paintings. The passage intercepts the extension of the wide entrance gallery. A collapse, probably after Maya occupation, keeps the passage from connecting directly to the entrance. At this location the proximity of the entrance makes the air more breathable. The cavity continues south and deserves further exploration. The total surveyed topographic length is 500 meters. The morphology of the galleries shows that the cave was formed in a submerged regime near a shore. The area is at an elevaton of 35 meters.

Yaaxnik. The Yaaxnik cave was discovered in the 1980s accidentally during the digging of a well. It was explored and mapped by Carlos Lazcano et al. in 1986. [See *AMCS Activities Newsletter* 17,pages 150–154.] The cavity has since been visited sporadically by curious people who wanted to see the crystals. The looting described as catastrophic is actually quite limited and the beauty of the cavity overall preserved.

The cave opens at a depth of 50 meters, 29 meters above the level of the water table at the bottom of the well 33 meters above sea level. As such, its exploration interested us in our search for paleo-marine-level indices.



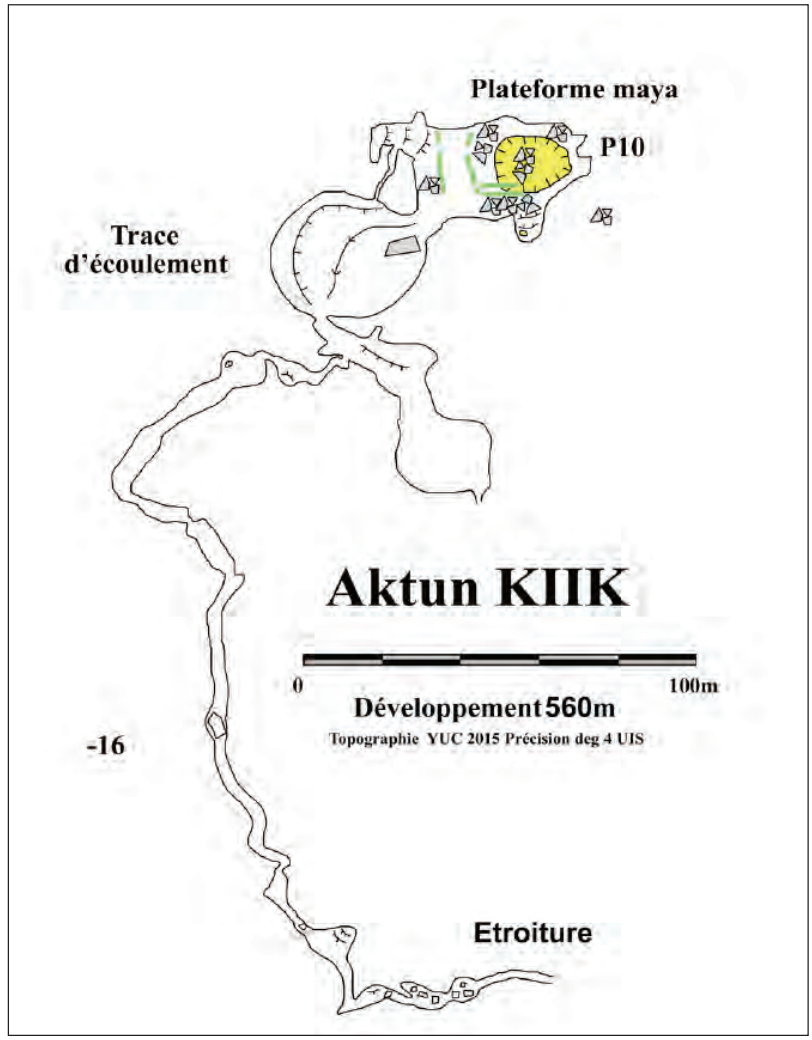
Two areas have surfaces of a few tens of square meters of dog-tooth spar and stalactites in the shape of a club characteristic of a partial flooding of the cave. Collapses and more recent formations certainly obscure other similar areas. In addition, dried clay benches with drying silts show the existence of old flows. Two

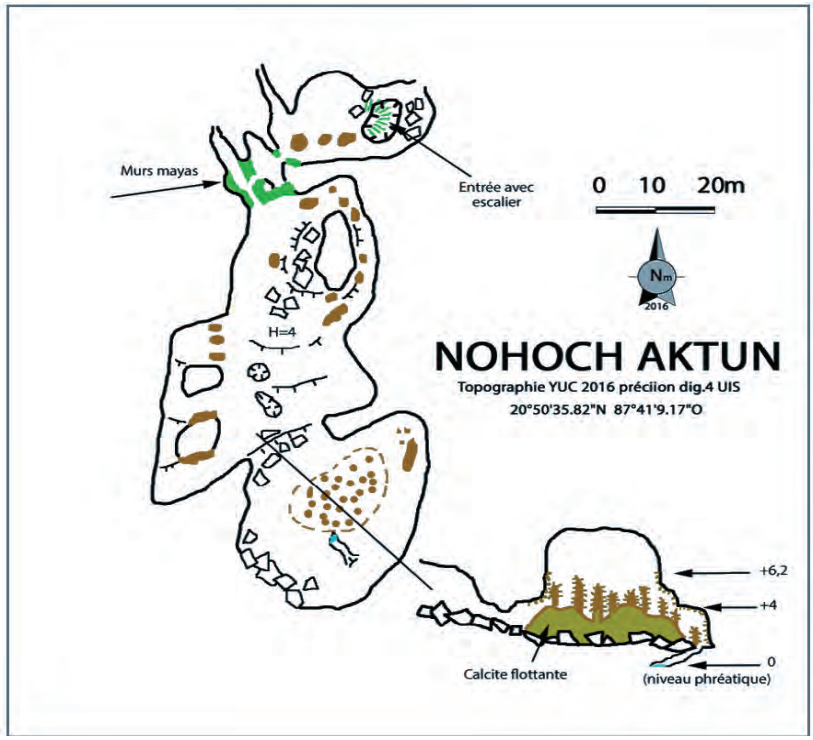
Yaaxnik.

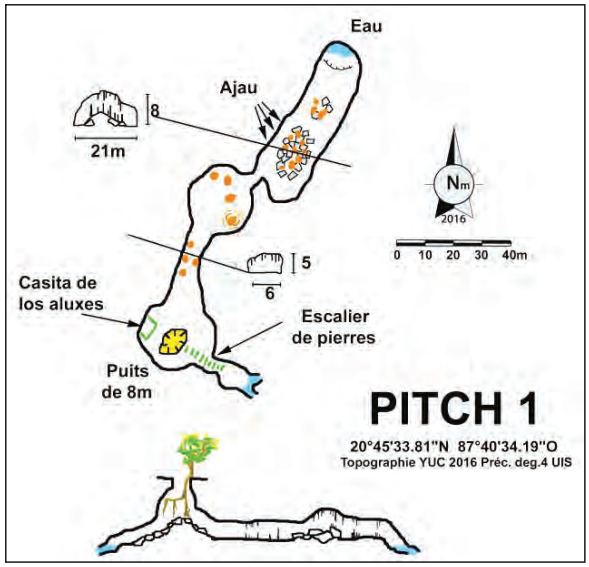
samples of calcite were taken from the spar to date. The dating gives 121 ± 1. 6 ka, which corresponds to the warm period of the Eemian but corresponds to the formation of our location above the paleo base-level of the time. The cave includes 650 meters of passage oriented north-south. A strong current of air runs through it, suggestin a continuation to the north, that is to say towards the fault of Ticul, where it is reasonable to postulate the exsurgence of the paleo-river.

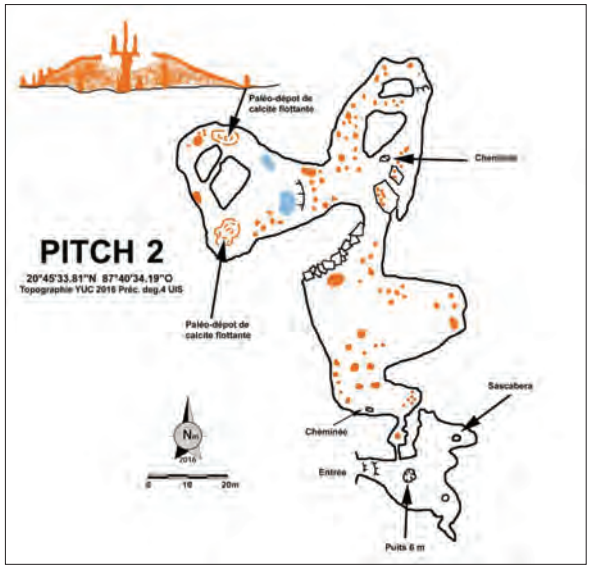
Aktun Kiik; 20°7′45.62″N 89°17′0.22″E. The cavity opens on the plateau of the serrita of Ticul about 7 kilometers as the crow flies in the south of Tekax. In 2015, we carried out a reconnaissance of this cave, which we surveyed in 2016. A pit 20 meters in diameter and 10 meters deep gives access to a platform and walls built by the ancient Maya. It is followed by a descent into the breakdown that leads to a room 20 meters in diameter. The trace of water flows is visible and forms the small dry river that is engulfed in a narrow, descending part backfilled by dirt. The continuation is a winding gallery of 2 to 6 meters wide, where one progresses most of the time bent in two. The passage ends in breakdown. Clearing would give easy access to more of the cave. Traces of flow are visible throughout the passage, which serves as collector during heavy rains. The presence of CO_2 makes exploration difficult. So far, the cave is 560 meters of long, with a depth of 16 meters. The elevation of the entrance is 90 meters.

Nohoch Actun; 20°50′35.82″N 87°41′9.17″E. The cavity is located about 2500 meters southeast of X'can. Nohoch Aktun means giant cave. In reality it is a cavity that does not exceed 300 meters of development. A small entrance opens onto a downstairs room 10 meters wide and less than 2 meters high. A chicane passage between several massive Maya walls leads to a large hall. The lower part of the room is interesting. Indeed, it has a filling consisting of, first, a layer of floating calcite debris forming a "sand" hill This formation assumes that the









room was occupied by a lake with a free surface. The hill is underneath the part of the room whose ceiling is at least 4 meters above the current water level accessible in the southern part of the room. The sand was dated at 111 ka ± 0.5. Above this "sand," a flowstone floor supports stalagmites. Some stalagmites have formed like fairy chimneys. Their heart is in sand. Their formation took place in the open air. This presupposes that the lake had disappeared. In addition, on these stalagmites and on the walls are bud-shaped concretions typical of underwater deposits. This means that the lake reformed. Access to the current water table makes it possible to accurately measure the height of this lake above the current level: 6.2 meters. Formations of this type are visible in the Multun Ha cenote located near Coba 7 meters above the water level. The fragment removed there was poor and gave an age of 170ka.

The interpretation is that these variations of the lake level are probably contemporaneous with the Eemian, 120 ka before our era. An episode of rising sea level, followed by a drop and a rise to +6 explains the formations visible in this room. This information is very consistent with Blanchon's work on the X-Caret corals. What is new is the existence of an episode of sea level fall between the two uplifts. This episode provides an explanation for the death of the corals of the outer barrier reported by Blanchon.

Pitch 1; 20°45'33.81"N 87°40'34.19"E. After ten years of tracking we finally managed to locate the Pitch caves. These are two small caves 150 meters apart without apparent link. Pitch 1 opens with a pit 8 meters dep and 5 meters in diameter. The cavity is obviosly frequented by the inhabitants of Durango, though it is located on the grounds of Santa Rita. A camera to study the movements of wildlife was recently placed there.

At the base of the pit, a small stone building made Don Juan, who accompanied us, say that it was the *casita de los aluxes*. This also explained why the bird Toh did not want to tell where the caves were. The rest of the day was spent in worried silence.

The cave continues on the one hand by a descent to the water by a staircase of stones and in the other direction by a passage 100 meters long ending in a lake. This passage measures 20 meters wide and 8 high. Heads (*ajau*) are painted on the walls. The total length is 170 meters.

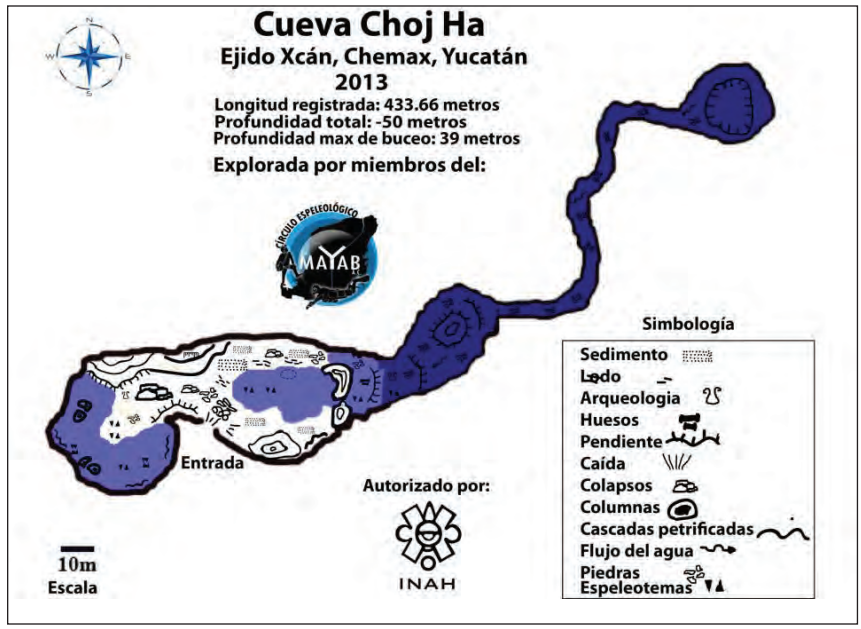
Pitch 2. Pitch 2 is located 150 meters east of Pitch 1. The entrance is a small descent overlooking a former quarry exploited for *sascab*, illuminated by a skylight. A narrow passage gives access to the rest of the cave. A string of three richly concreted rooms lead to the main curiosity in the cave. A deposit of sand formed by floating calcite is covered by a flowstone floor. Formations are partially buried in the sand, and one of them continued to grow above the floor, thus adopting the shape of a candelabra. The dropping of our camera 10 meters prevented us from taking a picture of this interesting concretion. We have not taken a sample, as the phenomenon is very localized and is not necessarily linked to a paleo-marine level. We have no access to the current water table, and the measurement of the absolute elevation of this is very uncertain.

The cave totals 350 meters of development.

Sascabera de X-Can; 20°51'30.79"N 87°40'1.81"E. The cavity opens into the garden of a small dwelling. A depression of 3 meters depth gives access to a narrow descent partly backfilled by plant debris. What follows is in fact an underground

quarry of *sascab*, lime made for mortar from limestone. The total length is 550 meters. The volume extracted is estimated at 1500 m^3.

Cenote Choj Ha. This tourist cave was revisited on 16 August. It had been dived and surveyed in 2013.



Expedición YUC 2016

Se exploraron varias cuevas principalmente secas en los estados de Campeche y Yucatán, incluyendo la cueva turística Loltún. Se topografiaron un total de 12.4 kilómetros. Muchas cuevas tenían niveles elevados de bióxido de carbono. Se realizaron estudios de niveles de los océanos antiguos.

POOL TUNICH AREA—NOVEMBER 2016

Text and photos by Chris Lloyd

After extending a number of other cave systems in the general area around Playa de Carmen in Quintana Roo, Peter Sprouse decided to once again return to the Cleoxxo jungle camp situated right over the Pool Tunich system. This would be the fourth straight Thanksgiving-week camp located here, and it had dual objectives of extending the Pool Tunich system from its current 40.55 kilometers and finding new caves that hopefully might be connected in the future. Most of the dry leads have been exhausted in Pool Tunich, so this year a number of cave divers were encouraged to come, and a bunch actually showed up, one even bringing his own compressor. Everything was in place for a successful trip.

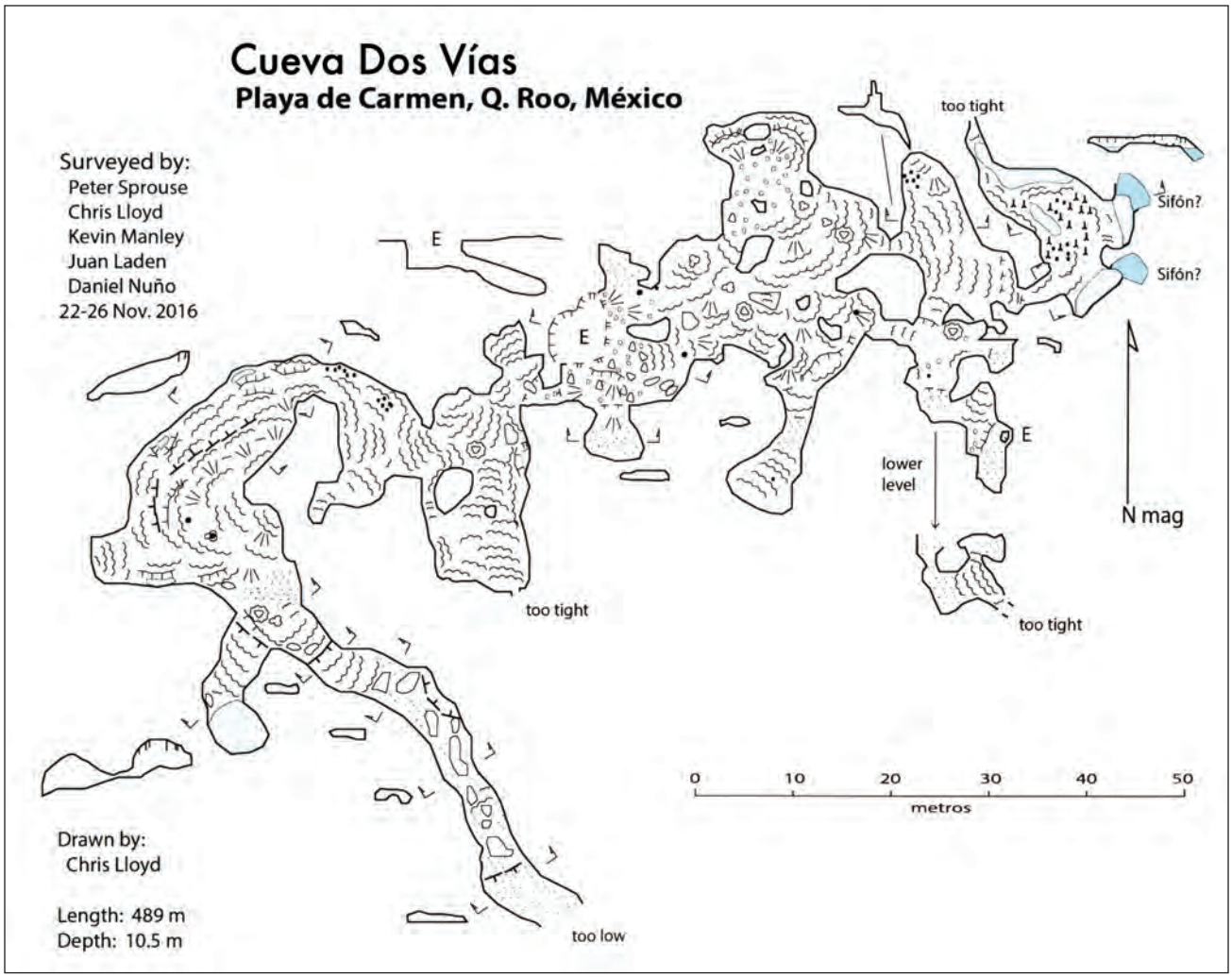
The early arrivals, Peter, Juan Laden, who drove his old Volvo down from Wyoming, Cyndie Walck, Henrick Nikander, a cave diver from Finland, American cave diver Bill Mason, and I headed into camp on Friday November 18, and after getting tents set up headed out to re-establish the tails out to our intended first dive leads in Laughing Grackle, part of Pool Tunich, and Chicleros, the hoped-for cave to connect to. Fortunately the chopping was light, as it had been only one year since we had cleared those trails. I took Bill into Laughing Grackle to get refamiliarised with the routes into the sumps that would be the first dive targets for Austrian cave diver Osama Gobora. After we cooled off swimming there, we did some jungle wandering, heading northwest from the entrance to see if we could find new entrances. We only came up with a couple of small holes, which Bill crawled into to confirm there were no continuing passages. Meanwhile Peter took Cyndie and Henrick out to Chicleros and also cut a trail into the Altar entrance because we had an archeologist scheduled who specializes in Maya altars coming on Saturday to see what we had. Back in camp additional arrivals trickled in, Bonny and Andy Armstrong along with Johanna Kovarik who had flown in that day and Elsi Lara and Joaquin Rivera who had driven over from Mérida for the weekend.

On Saturday I took Elsi, along with divers Osama Gobora and David Dusek back into Laughing Grackle Cave, helped them lower their first loads of dive gear down the vertical entrance, and took them to the first sump and back to the one across from it where Alan Formstone's dive-line came in. Once they were set up, Elsi and I set off jungle-chopping to the south-southeast to a set of shallow dolines located about 500 meters to the south that I had picked off the Lidar data. About half way to our target area, Elsi shouted out that she had found a drone. I replied that we were looking for entrances and what kind of an entrance was that? She keep going on about a drone, and I kept thinking that must be some kind of weird entrance, until I finally went over to where she was to see that she had in fact found a drone—of the camera-touting, four-rotors kind. And a top-of-the-line model with fancy camera included to boot The last photo showed an upside down view of the forest where it crashed. So of course the next small, going-nowhere holes we found became Drone Pit 1 and 2, and unfortunately they were the best things we managed to find all day, aside from the drone.

While we had been out doing our part to clean the jungle of discarded electronics, the others had been busy in various places. Henrick took in Dominique and Brian to do a preliminary study of the Maya altars in Cueva Chicleros and the Altar entrance of Pool Tunich, both of which were declared to be very interesting examples and worthy of further study. Andy, Bonny, Cyndie, Johanna, and Joaquin decided that they would have a go at chopping a trial to an entrance called Angry Wasps that had been described as a 15-meter-wide, 10-meter-deep shelter cave with no passage, but which happened to lie on the route to some other good-looking dolines a bit farther in. Unfortunately the cleared survey line they hoped for had not seen any traffic in some years, and the chopping was very

Daniel next to tree growing up through skylight entrance of Cueva Caraveo.

cjlloyd@prodigy.net.mx
Canadian Caver 85,winter 2018, pages 18-23.



slow going. They managed 400 meters, just making it to their first target, most of them coming back with bleeding blisters on their hands as well as various cases of *chechen*, a poison-ivy type rash, as they would find out the next day) But they were keen to return and get the job done. Bill Mason went into the Vasija Entrance of Pool Tunich to dive an old line of Formstone's. and do the underwater sketching. He made it about half way to Coati when he hit a constriction that Alan had squeezed through, and sketched his way back from there.

On Sunday I took Cyndi, Elsi, and Joaquin into the Tres Escalones entrance of Pool Tunich to check out a series of side leads that had been left back in 2012. The first few were just in from the entrance on the north side and went into low passage as short alcoves. We then splashed our way upstream past the spectacular Lost World entrance, which was sporting diverging sunbeams, to get to the Uch Ben Xol skylight entrance area and proceeded to work our way through five different side leads on the south side. Three of them turned out to be low, extended alcoves, while the fourth one went low and popped out at the entrance to the fifth, creating a short loop. With some time to kill, we decided to do a donut float trip downstream past the Tres Escalones entrance into the AT survey area, where I had connected that section with the north-bound survey back in 2012. It was quite a different experience not having to worry about avoiding swims to keep the survey book dry, and the large inflatable donuts along with plastic hand paddles—it would be interesting to know where these plastic hand paddles were developed . . . something special for the caves of Quintana Roo?—made progress quite easy and tourist-trip like. At least Elsi and Joaquin got to see something decent during their weekend trip.

Meanwhile Andy and Bonny decided to help Bill chop his way into House Cenote way out to the northwest of our area, only to find that someone was in the process of developing it into a tourist cenote, but wasn't there at the moment. They continued on a bit farther to the north to another cenote that also turned out to be developed as a tourist destination. So Andy and Bonny returned to their chop into the dolines they had been aiming for yesterday. Johanna and day-tripping Angelica Chimas went back to the Angry Wasps shelter cave only to find that it was actually a 50-meter-wide entrance,

slightly bigger than the Lord of the Rings Cave that it was immediately north of, and that after a short crawl in the back of the daylight zone, they popped into big stomping passage that they left still going at the end of the day. Peter took visiting Canadian cave diver Fred Davos into the southern portion of Pool Tunich along with Kevin Manley and Juan Laden to look for dive leads that might connect with Río Escondido. Fred came out quite happy with one of them, saying that he would return when he could. Osama and David laid line in from Laughing Grackle going from the first sump, closest to the entrance, and making progress toward Cueva Chicleros. Later in the evening, Bill and Henrick made a night dive into the Marvavilla entrance and went straight west, making it half way to connecting in with Pool Tunich. While the night team was out, Carol Vesley and Pati Kambesis arrived from the airport, adding to our already high numbers of sketchers.

On Monday, November 21, I went out with Peter and Kevin to cut a new trail into the Coati entrance so that Bill could go in from that end to complete the sketching of Alan's dive and Henrick could check out some of the other sumps there. On this trip we had excellent help from two of the kitchen helpers to sherpa in tanks, which was interesting to see, as they were barely taller than the tanks but really could move along those jungle trails. After we had the divers somewhat oriented and I had checked one of the outstanding dry leads, which turned out to be a sump at the back of a low alcove, we three dry cavers headed north to look for new stuff. Unfortunately this area is in the bad-Lidar-data area, so we were wandering aimlessly and after a bit came to Aimfull Wandering Cave, which has a nice 30-meter-wide, steeply descending entrance, but which quickly choked out, yielding only 55 meters of passage. There was one low spot in on the left side, northwest of the entrance, that had air blowing out from a boulder and stal blockage and an animal trail leading into it, but it was only big enough for said animals to squeeze through. As Kevin was asking me if it might be a good idea to look just up and over the edge of the steep doline we were in, Peter shouted out that he had another entrance,just up and over from Aimfull Wandering. This one was actually two passages heading off from a central doline collapse, one of which was heading back towards Aimfull Wandering and another blowing hole with an animal trail, but heading northeast, so not a direct route back to Aimfull. The northwest side of the collapse of Cueva Constitucional went into a small chamber with low stuff going back around both side of the collapse, but no onward passage. On our way back south we came across a small doline sink with a 6-meter-wide by 1-meter-high entrance that Peter quickly checked out and found to be going off in two directions, but we decided to leave Cueva Dos Vías till the next day.

Carol, Pati, and Juan decided to go have a look at Cueva Bajita, an old Gil Harmen find that I had relocated last the previousNovember and made a couple of survey shots into. As the name implies, it is not a walking cave to start with, but they made good progress mapping some 240.4 meters and getting to some places where one could indeed stand up. Angry Wasp Cave (Cueva Avispas Enojadas or Xuux Puja'an) took two teams, Cyndi and Johanna leap-fogging Andy and Bonny, and kept them busy all day in large passage, then low passage, then large again, which they left still going strong. Osama and David were joined by Italian cave diver Mauro Bordigon to continue placing and surveying line in Laughing Grackle Cave. Mauro went in the sump opposite from where Alan's old dive line came in from Pool Tunich and managed to get within 10 meters of the passage in Cueva Chicleros, while Osama came up in a chamber with bats, also very close, but he could not find any survey stations to confirm where he was.

On Tuesday I headed back toward Dos Vías with Kevin,heading northwest from the Chicleros trail to see if there might be other caves between those two. We only found one small entrance that went into low, sloping passage that Kevin was about to crawl into when I saw that there was a swarm of ants all over the dead palm leaf right about his head. There were so many of them it was the sound of their moving that alerted me. Kevin immediately noticed that they were also all over the ground beneath his feet, and he suddenly started the traditional Ants Up the Pants Dance and retreated. Once at the Dos Vías entrance we started in on the southwest side, which eventually swung back around to the southeast in passage that alternated between low crawls and nice large, decorated chambers. We left the end of the southwest branch still going in passage too low to crawl through but which appeared to be large enough for some bats to get through and which later plotted up not too far from the Ant Lair entrance we had found in the morning. On our way back to the

Geraldine looking for the sump in Cueva Chicleros.

Dos Vías entrance we came across an unusual formation that featured mini-rimstone dams spaced about 1 centimeter apart and with little vertical helictite or popcorn thingies all along the rim of the dams, basically low vertical pillars with a blob on the top about 3 to 4 millimeters across. I had never seen the like of it before and neglected to take a photo as the passage was not very wide. We then worked our way around to the southeastern side of cave, leaving a going crawlway and making it back to the entrance before dusk.

Andy, Bonny, and Juan continued the chop past Angry Wasp and made it to another of the old database leads (GE03), which was a small climb down entrance that led down into a sizable sloping chamber that was basically the space all around a central collapse. They left Cueva Alitas pretty much finished, except for a small, low crawl that Juan did not have a chance to check. Two teams went back into Angry Wasps; Carol and Pati plus Peter with day-tripping visitors Fernanda Lases and Alina Rotzinger. Peter was able to put his two remote slaves to good use in the big passage, capturing some nice photos. They stopped at a tight flowstone restriction blowing strong air. Cyndi and Johanna took a trip into the now touristic Vasija entrance of Pool Tunich and carried on to the Auditorium, checking and crossing off old leads along the way. The divers in Coati had a look at Alan's old line going south, but turned back shortly due to a tight constriction, and then laid 60 meters of new line in one of the other sumps. The three divers in Laughing Grackle worked on finishing surveying their lines there before pulling out all their gear. After plotting up their new lines they confirmed that they were within 10 meters of the sought connection to Chicleros, but they never saw just where it was.

On Wednesday, November 23, I headed out with Peter, Henrick, Carol, Linda Palit, and Daniel Nuñez to Cueva Caraveo, located out to the northwest of our area. This was a large pit-collapse entrance that had a 6-meter-long ladder leading down into it, where there had been one previous survey of the entrance area that we wanted to continue. We separated into three teams with Daniel and me starting off on the north side, Carol and Linda going to the northwest, and Peter and Henrick mopping up the entrance-area alcoves. My lead started off nicely, getting into a sizable chamber, but did not continue, so we then took another passage off the entrance collapse going to the southwest that got us down into exposed reef limestone of the very porous and fragile type, the kind that tends to break off just when you have all your body supported on one key piece, as happened to me when crawling back out of the end of that passage and narrowly avoiding a face-plant onto the jagged floor. Carol and Linda lucked out with the best lead, which they ended up leaving still going to the north.

Andy and Bonny continued chopping to their doline a bit south of Alitas, passing a nice entrance before they got there and finding nothing of interest in or around the actual doline. So they returned to the new find, which was a nice 6-meter-wide, 2-meter- high entrance sloping to the west and quickly hitting a Maya wall blocking most of the way on, with a doorway that was blowing strong, refreshingly cool air. A small plant under the drip line with two leaves helped name the cave, Cueva Dos *f*. They spent the day in big stomping passage and left it wide open going southwest, and they also noted a small entrance to the north of theirs at the other end of the entrance doline. Cyndi and Johanna headed back into Angry Wasp armed with a hammer and managed to enlarge the tiny blowing hole into a small blowing hole that only small cavers can fit through. The cave opened back up into large, very well decorated passage with nice pools to help cool them off. They also left their cave still going in large passage. Bill went back into the Coati entrance and sketched the 60 meters of line he had laid earlier, while Henrick tried to figure out old lines he found in one of the other sumps that he guessed must be additional lines from Alan Framstone.

The entrance to Cueva Caraveo.

On Thursday I headed out with Daniel to have a look at the small entrance about 50 meters northeast of Dos Hojitos, while Andy and Bonny continued with the survey in Dos Hojitos after dropping Pati and Henrick at a lead in that cave they suspected would come out in Alitas. Our entrance was only 1 meter across in a short headwall, but opened up into a nice chamber that we finished in eight survey shots. We called it Cueva Chipi for all the warblers we were hearing in the area. With that cave done we set off wandering to the north of that area, then came back around east, then south all the way back around the big doline Andy had already checked. The next area to check on the list was what we called the Horsehead doline, located about half way back to Angry Wasps, just south of the access trial. We were hard-pressed to find the actual doline there, not more than 1 meter deep, but just as we were about to head out, Daniel came across a 1-meter-wide pit that was blowing nice cool air. Below the 2-meter thickness of limestone roof we could see that the hole cut back on all sides, being a skylight in a big room that was 5 meters down to the closest floor and another 3 meters to the main floor. Considering the trend of Dos Hojitas, we figured it was likely a room Andy would be finding shortly, so we left a flagging tape down the hole, named Claraboya Acondicionada. Our last area to check was from the Angry Wasps

Carol Vesely near the Frog Belly entrance to Angry Wasps.

entrance to the south to check the area to the north end of Lord of the Rings Cave to see if there might be a way in from this side. No luck on that, so we headed back to camp a bit early. Andy and Bonny had a full day of surveying Dos Hojitos and left it still going in big passage without having seen our skylight. Pati and Henrick headed north within Dos Hojitas and did in fact connect back into Cueva Alitas, coming out in the small hole that Juan had left as the only lead. Henrick took advantage of having one the best cave surveyors ever as a teacher and took his first turn as sketcher, producing a very nice map.

Cyndie returned to Angry Wasp with Carol and continued on in generally big passage, though left it as it was starting to look like it might close down, being filled up with stal. Peter took Linda and Alan Cobb down to the south end of Pool Tunich to again try and fill the gap over to Río Escondido and found three small caves that they finished, but which did not connect to anything else. Bill packed up the last of his gear and entered the last of his data before heading off south to another project.

On Friday I headed out with Daniel, Juan, Peter, and visiting cave-guide Lara Martínez to help get French cave-diver Geraldine Solignac set up in Cueva Chicleros to see if she could manage to find the connection to the lines left by Osama, David, and Mauro in Laughing Grackle. The most likely sumps were in the southwest end of the cave and required walking, wading, crawling, and some swimming to get to with all the dive gear. Once Geraldine was set up and underwater, I took Daniel and Juan with me back to Cueva Dos Vías to continue on the east side of the entrance area, while Peter and Lara picked up some side leads in Chicleros and waited for Geraldine to surface. She first checked the north-trending sump out of the end of the cave, which went big with some current, but had no sign of the sought dive lines. So she went back and popped into a small sump on the south side just behind where she kitted up, and within six minutes she ran into line, making the connection to Laughing Grackle Cave. With all the new dive line and the old passage in Cueva Chicleros this would add about 4 kilometers of passage to the Pool Tunich System and achieve one of the main objectives of this expedition. It was very nice of Osama to lend his dive reel to Geraldine to get the job done.

Over in Cueva Dos Vías we continued east through some big passage and then, in typical form, some very small passage before dropping down into a low room thick with stalactites and stalagmites, so much so that we were continually squeezing between them to advance. A couple of small pools on the east side looked like they probably dropped into sumps, so we made sure to put survey stations right where a diver would be sure to see them from the water, as I knew we were right along the trend from the northern sump in Cueva Chicleros and getting to these sumps would be a lot easier from that direction than trying to haul tanks in through the crawls we had to pass getting into our sides of them.

The two Cueva Dos Hojitas teams returned there along with Linda and Alan, who were able to recognize a lot of Maya details in the entrance area that had been originally overlooked. The two survey teams pushed the cave to the southwest in branching big passage, with Pati and Henrick taking the south side and being the ones to discover the Claraboya Aconicionada from the inside. Both branches were left

Kevin Manley exploring in Cueva Dos Vías.

Elsi Lara floating near the Tres Escalones area in Pool Tunich.

going at the end of the day. Similarly Cyndi and Carol went to the end of Angry Wasps, and after some poking around in smaller stuff managed to find the way on into more big stuff, ending the day with a long shot to get over to the base of a skylight entrance that was almost choked up by large tree roots. They figured they could probably have climbed out of it if they really needed to, but then they would be faced with a good jungle thrash to get back to the road—much easier to return back through 2 kilometers of cave passage and use the existing trail back to the car.

Saturday November 26, saw some folks departing, so only two caves were visited. I went along with Cyndi, Carol, Henrick, and Daniel to chop a trail into the new skylight entrance at the end of Angry Wasps. It was about 400 meters in from the road and went quickly with five of us chopping, but when within 10 meters of the GPS coords I had taken off the Walls map I still could not see a hole or a big tree. But the GPS indicted it should be 10 meters south of me, so I walked 10 meters and there it was, a 4-meter-wide hole almost completely covered by wing roots of a tree that split into five different trunks, effectively disguising itself as a normal tree, not the big tree we were looking for. Looking down the pit had us thinking that Cyndi and Carol were *un poco loco* that they thought they could climb out unaided. So we set up the rope and rappelled down the 6-meter drop, popping out into a large room that we divided in half to survey. By the time we finished the room there was just time for a few pictures and a couple of survey shots into the northwestern continuation, which was left going.

Peter and Juan went back into Chicleros with Geraldine so she could do some sketching on the north-trending dive line, which she also extended somewhat. While Geraldine was under water Peter and Juan went back to nearby Cueva Dos Vías and finished off some leads that were left in the southeastern corner, finding another small entrance but no continuation. They also tidied up a gap in the survey in Coati between old stations and the new dive line, so that data could be tied into the system.

Sunday we packed up camp and headed out to the beach, with another successful trip having increased yet again the length of Pool Tunich, from the 40.558 kilometers when we arrived to 43.83, as well as adding 5.428 kilometers of new cave in the area to be connected in the future.

Área de Pool Tunich – Noviembre 2016

La continuación de la exploración agregó 3 kilómetros a la longitud del Sistema Pool Tunich y 5 kilómetros a otras cuevas en la zona de Playa del Carmen, Quintana Roo.

spéléo
Société québécoise de spéléologie

MEXPÉ 2014: THE ADVENTURE CONTINUES

Serge Olivier

The objective of the 2013 expedition was to explore a new area of the Sierra Negra, the high plateau of Tequixtepec at an elevation of 2100 to 2300 meters. During that expedition, two caves showed interesting potential, Chupa Pierna (–235 meters) and Mosca Busca Pez (–273 meters). These two caves are located southeast and northeast of camp, respectively. As for the high plateau, dubbed the Infernal Lapiaz and located southwest of camp, time and personnel proved quite insufficient for its exploration.

The goal of Mexpé 2014, consequently, was to continue where we had stopped in 2013, but with additional help. To achieve this, the length of the expedition was extended to four weeks, and the number of participants was raised to twenty-two cavers, including thirteen Quebecers, four Mexicans, two French, two western Canadians, and one Spaniard. In fact, arrival dates and length of stay were staggered between March 1 and April 1, so that we never had more than twenty-one cavers in camp. Naturally, the first days were dedicated to transporting food and gear, as well as setting up camp to accommodate so many cavers, which in itself was quite a challenge. We had to build tables and benches and set up a large tarp between two existing buildings, of which one would be used only as a kitchen and for storage of food.

MOSCA BUSCA PEZ

In 2013, we had pushed this cave, CT2-13-13, to a depth of 273 meters and a length of 693 meters, and we have high hopes that it will continue much deeper from its elevation of 1840 meters.

After a strong start on the day that Serge reopened the access trail, Nick, Christian, Catherine, and Cédric are off to rig the cave as far as the lead at –273. They make short work of it, but unfortunately cannot continue exploration for lack of a drill and bolting gear. We have to wait until the next day to find out where the cave goes and to discover that it finally ends at –299 meters in a huge room, 160 by 120 meters, filled with sediment. After touring the perimeter, we can't find any passable way on, in spite of hearing the sound of flowing water in certain places.

Although the cave ended too soon, the chamber is beautiful, with a profusion of colorful formations. Stalactites, stalagmites, soda straws, and helictites are highly concentrated, and we need to be careful in low spaces. After two years of working in this area, it's the first time we've discovered such a spectacularly decorated room. Most of the floor area is covered in sand banks of various heights, some quite tall. Surprisingly, it's hot in this large chamber, compared to the rest of the cave.

We derig the cave, and no doubt it won't be visited again by humans for many years. Results: we added 446 meters of length, mainly due to the size of the large room, and 26 meters of depth. As it turns out, we had almost reached the bottom in 2013.

CHUPA PIERNA

In 2013, we had stopped exploration of CT2-13-12 at a depth of 235 meters below the entrance at 1897 meters elevation and a length of 1011 meters after encountering sediment plugs, but several leads were noticed for the future. Thus a first team of Mathieu, Michael, and Diana rerig the pits explored in 2013, but once they arrive at the beginning of the presumed lead, Michael can not remember exactly where the last survey station was, so the day ended there. The following day, Michael, Guillaume, and Ramses return to the lead, intending to continue rigging deeper while surveying. They quickly arrive at a mysterious pit. While surveying, Guillaume and Michael think they recognize this spot. After having gone down the pit and explored the bottom, they are still convinced, among other reasons by watching the progress of the survey on Auriga, that they are at the base of the P45 seen in 2013. However, in the end, nothing seems the same as what was seen back then. Is it a survey problem? That would be rather surprising. A huge collapse? It crossed our minds! However, it turns out that Auriga was playing tricks on us by suggesting an imminent connection; the passages are indeed in two distinct sections of the same cave, certainly very close together, but without any physical connection.

In any case, exploration continues, and the team soon comes to a gigantic room that appears to be another dry lake similar to what has been found in other caves. The room is filled with sediment from which a few boulders emerge, with a ceiling height of 1 to 4 meters that makes it hard to appreciate its size.

serge.o@bell.net
Sous Terre, volume 26, number 1, pages 5–9, 2017. Translated from the French by Yvonne Droms.
Guillaume Pelletier helped prepare this article for *Sous Terre.*

After surveying the room, we could see that it measures about 140 by 40 meters. Several small passages, not very inspiring, are found in breakdown along the perimeter of the room. They are all explored without success, and only one of them seems promising, with a disappearing small stream and strong airflow blowing out toward the room. Through this passage, an upstream lead is found, and it still goes, but its exploration will be for the next team.

It's not till five days later that Michael, Eric, Martin, and Lucie continue following this passage upstream. It contains an active stream with strong flow. However, exploration soon stops due to the fact that the climbs become too risky. The team returns to the first P11 and explores another passage, which leads to a drop, then to another. The survey ends there, but Chupa Pierna is not finished, and its exploration will continue just to be certain by investigating the last question marks.

In conclusion, the exploration of the cave reached a depth of 249 meters, therefore only 14 more than in 2013, but 924 meters of length was added thanks to the discovery of a new passage.

THE INFERNAL LAPIAZ

During the 2013 expedition, the plateau at 2100 to 2300 meters proved to be a particularly difficult place to ridgewalk due to its extremely rugged terrain. It's composed in large part of a continual succession of blades of rock, ranging from 30 to 60 meters in height and with razor-sharp edges. The blades are separated by deep fissures, often covered in vegetation. Under the fissures there surely hides an immense underground system, but entrances are not easy to locate. Dubbed the Infernal Lapiaz, this plateau is aptly named.

Prospecting in this Infernal Lapiaz was the main objective of Mexpé 2014. To reach the area of exploration, two trails are created. The first continues what had been started in 2013, and it is named the Mirador Route. The second passes farther north and is named Route 66. Albeit more technical and longer, the latter proves to be faster than the first, and above all, much more interesting to traverse. In fact, it soon becomes the favorite for all. Some even keep track of their travel time and are able to reduce it each time. It has become a real obstacle course, where you have to traverse on the crests or the flanks of the rock blades by rappelling, then ascending, and so forth. This course requires full concentration and is, for many, the final pleasure after a hard day of exploration. In the end, as the Mirador Route seems less promising, we decide to connect it to Route 66, at a high point of the plateau, the Advance Camp, where we could rest a bit and even cache some gear.

In summary, more than thirty caves were inventoried. The majority of the caves are located in deep dolines and start with a pit, some as deep as 60 meters. We often had to return with more gear to rig these vertical caves. Carrying all this gear requires a lot of energy and adds a degree of difficulty to the trip. Unfortunately sediment plugs or rocks choked the bottoms of the pits every time. After eight days of intensive searching, none of the explored caves produce a potential entrance into

Roberto Rojo and Angeles Verde in a new 40-meter pit in Cueva Chupa Pierna. *Gustavo Vela.*

Roberto Rojo at the pool in Cueva Chupa Pierna. *Gustavo Vela.*

the underground system. Morale in the camp is low. Admittedly, a few promising entrances had been found, but they produced so little passage that we soon lose hope. Lots of action aboveground, but too little underground. Still, some continue searching in the Lapiaz, while others change course in the hopes of making the great discovery.

CUEVA DIPLOMATICA

The faster the days pass, the more the mad-mouse syndrome takes hold of the cavers—the mouse that keeps running in its treadmill, but doesn't move forward. Frustrated, it keeps going back to the wheel, convinced that it will find something at the end of the run. It gets better at it and feels more confident, and so accelerates the pace, but still it doesn't get any farther. The solution? Get off of the wheel! Some pray in their tents before falling asleep or develop a ritual of supplication to the Dios de la Cueva. Others, more realistic, try different searching methods in areas farther away from camp. A group took off toward Mosca and started exploring the dolines located beyond it. And that's where a perfect entrance materialized, Cueva Diplomatica. Finally, something to improve the troops' morale. But first, we need to settle a little diplomatic complication cleverly left to us by Gustavo and his team, the finders of the cave who have to leave the expedition soon. "We found you the most *chingona* cave of the expedition; we cannot explore it because we need to leave, but be aware that if you want to continue its exploration, the landowner is furious and demands an explanation. !*Hasta luego*!" In the end, the most difficult task is to find the owner, who lives in Tepepa; but after some discussions and explanations, he lets us explore "his" cave.

It had taken fifteen days for a team to find a promising entrance. This discovery, therefore, became the main attraction for the remainder of the expedition, and its exploration was spread over a period of nine days, to the great satisfaction of all. The huge entrance arch of the cave soon turns into a series of drops that quickly takes on water, including a P75. A first room at around –320 meters makes us fear the worst, because all the known caves in this area end around this depth. We always hope that one day we will be able to punch through this geological layer that causes us so many disappointments; and that was the case this time. While following one of the walls in this room, Eric finds a lead—a fossil passage that continues downward for another 120 meters of depth. Eventually, this initially dry passage becomes much more active, with several very wet drops, until it reaches the final room. All in all, with a length of 1475 meters and a depth of 450 meters, this is the deepest cave found in this area. Unfortunately, the bottom of the cave ended in sediment plugs and passages that were too tight.

Mexpé 2014: La Aventura Continúa

Continuación de la exploración de incógnitas no revisadas desde 2013 en la Sierra Negra. La Cueva Mosca Busca Pez terminó en una bóveda muy decorada a -299 metros. La Cueva Chupa Pierna también llegó a una bóveda grande pero con el techo a poca altura, y continúa. Una zona muy karstificada fue explorada pero no se encontraron incógnitas prometedoras. La Cueva Diplomática fue el mayor descubrimiento, pero terminó en -450 metros, la cueva más profunda en la zona.

MIDGES IN CUEVA DE VILLA LUZ, TACOTALPA, TABASCO, MEXICO

Kathleen Lavoie

Flying chironomids are small midges or nemtoceric dipters similar to mosquitoes found all across the world (Armitage et al., 1995). Pups and larvae are aquatic and form an important part of the aquatic biodiversity. Larvae are abundant in waters with low concentration of oxygen because they produce a type of hemoglobin that gives them a red color, thus being called blood worms. Adults are commonly found in big swarms. When these midges fly they are easy prey for other insects, birds, and insectivorous bats. For example, midges from Waimato Caves in New Zealand are prey for the luminescent worms (Baker and Merrit ,2003).

One of the most abundant organisms at Cueva de Villa Luz, Tabasco, is a non-biting midge, a small Chironomidae fly that looks like a mosquito. Midges are so numerous in this cave that two passages are named for their high numbers: the Buzzing Passage and the Other Buzzing Passage (Hose and Pisarowicz, 1999). Cavers are amused by making sounds and listening for a response as the midges change their pitch and volume.

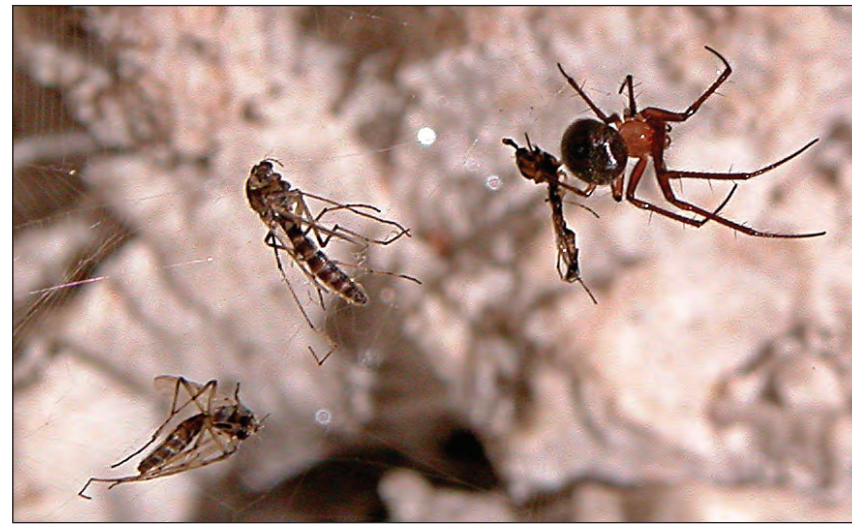
Adults lay abundant egg-cases that look like a pink slime just at the waterline. The location of the eggs is a real probem for the midges; too high and the eggs can dry out, but too deep into the water and the eggs-cases are eaten by the fish. The eggs hatch into tiny red larvae that live in the water and eat the abundant bacterial biofilm.When the larvae get big enough, they build a pupal case in which they go through a complete metamorphosis from a larva to an adult. After they pupate, the adult midges emerge from the water and crawl up on top of the nearest surface to dry out their new wings. Adults do not eat at all; their only function is reproduction and starting the cycle all over again by laying new eggs. Adult midges are initially red from larval hemoglobin, but change to a green color within twenty-four hours.

The midges are the primary way for energy to get from the aquatic ecosystem into the terrestrial ecosystem. The terrestrial and aquatic ecosystems in Cueva de Villa Luz are based on energy inputs of both organic material and sulfur (Langdecker et al. 1996). Sulfur bacteria in the stream are a major source of food for the larval stage of the midge. Capture of emerging midges shows a variable distribution, with productivity ranging from less than one per square meter per day in silt-bottomed areas of the cave to several hundred per square meter per day in riffle areas with fast-moving water.

Chironomid midges are an important link to transfer energy in the ecosystem of Cueva de Villa Luz. The hydrogen sulfide-oxidizing bacteria are eaten by the midge larvae in the aquatic environment. The larvae are either eaten by the *Poecilia mexicana* fish in the aquatic environment or they hatch to adult midges and are eaten by spiders in the terrestrial environment. Larvae and pups of the midges represent approximately 15 to 20 percent of the diet of *Poecilia* (Langdecker et al. 1996).

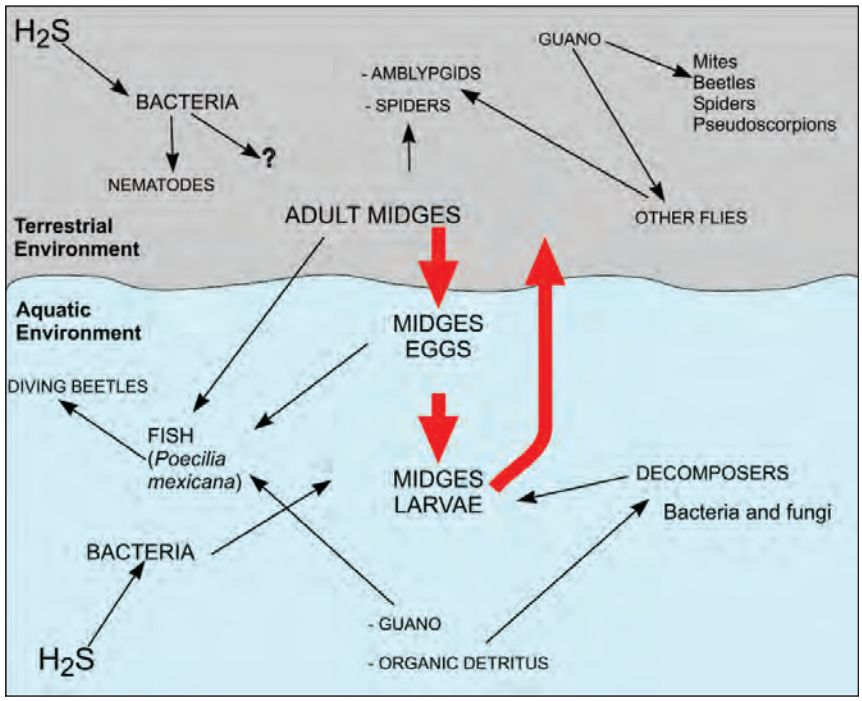
Thanks to Dr. Lenin Arias Rodríguez for his review of this document. Kenneth Ingham gave permission to use his photographs. Laura Rosales helped with editing.

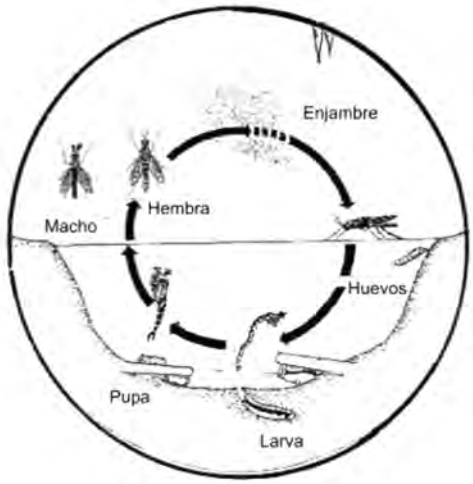
[continued on next page]



Three midges are wrapped by a spider at Cueva de Villa Luz. *Kenneth Ingham.*

lavoiekh@plattsburgh.edu





Top. Terrestrial and aquatic food webs showing the central role of the chironomid midge in bring nutrients from the aquatic environment to the terrestrial environment.

Middle.Life-cycle of chironomid midges. Modified from: Pinder (1986).

Bottom. Recently hatched adult chironomid midges drying their wings over a rock covered by green biofilm at the Sala Grande stream, Cueva de Villa Luz. *Kenneth Ingham.*

Armitage, P.D., Cranston P.S., Pinder L.C.V., eds., 1995. *The Chironomidae: Biology and Ecology of Non-Biting Midges*. London: Chapman & Hall. 572 pp. ISBN 0-412-45260-X. DOI 10.1007/978-94-011-0715-0.

Baker, C. H., and Merritt, D.J., 2003. Life cycle of an Australian glowworm *Arachnocampa flava* Harrison (Diptera: Keroplatidae: Arachnocampa). *Australian Entomologist*, 30(2)45–55.

Hose, L.D., and Pisarowicz, J.A., 1999. Cueva de Villa Luz, Tabasco, Mexico: Reconnaissance study of an active sulfur spring cave and ecosystem. *Journal of Cave and Karst Studies*, 61(1)13–21.

Langdecker, T.G., Wilkens, H., and Parzefall, J., 1996. Studies on the trophic structure of an energy-rich Mexican cave (Cueva de las Sardinas) containing sulfurous water. *Mémories de Biospéologie*, XXIII:121–125.

Pinder, L.C.V., 1986. Biology of freshwater Chironomidae. *Annual Review of Entomology*, 31:1–23.

Mosquitos en la Cueva de Villa Luz, Tacotalpa, Tabasco, México

Descripción de mosquitos encontrados en la Cueva de Villa Luz y sus importancia en la cadena alimenticia local.

EXPLORING PREHISTORY IN BAJA CALIFORNIA

Carlos Lazcano, Francesco Lo Mastro, and Natalino Russo

The Baja California peninsula stretches from north to south for 1300 kilometers. Almost all is a desert. This is one of the less populated areas of the country; a few more than three million people live on over 70,000 square kilometers, mostly concentrated in the north, near the border with the United States. Baja California is a magical place, characterized by immense areas where the eye can roam free for dozens of kilometers. The only real road is the Carretera Esratal 1 Transpeninsular, which goes from Tijuana to Los Cabos at the southern end of the peninsula. From the green northern hills, cloaked in vineyards, this road ventures into a progressively arid landscape until it enters the central desert. There it goes through immense expanses of dust and stones, wilderness, dark volcanic landscapes, and rocky deserts dotted with large cactuses. Occasionally, we meet trucks or surf described by explorer Jacques Cousteau. The importance of the sea is also endorsed by UNESCO, which declared it a World Heritage Site in 2005. Here, throughout the winter and into early spring, you can see the grey whale, watch the spectacular jumps of the humpback whale, and spot the blue whale.In addition, in Baja California surfers can find the right waves for their stunts.

But the peninsula is also known for the heritage left by those who lived there before the Spaniards arrived. The central desert was inhabited by the Cochimí and the Guachimí, who created thousands of paintings and rock carvings there. The ones in the southern part of the peninsula, belonging to the state of Baja California Sur, are widely known and studied. The Sierra de San Francisco, with over four hundred sites, was declared a UNESCO World Heritage Site. But many sites in the central region are still waiting to be discovered and catalogued. Geologist Carlos Lazcano, director of the Museo de Historia de Ensenada and member of La Verna, is working there.

We chose Cataviña, a village of less than a hundred inhabitants along the transpeninsular road, as our base camp. No phone, no Internet, like the whole wide central part of the peninsula. A few years ago there was a gas station here, but it has long since been closed. Fuel is sold in cans at the roadside, and Cataviña is a strategic point from which to explore the surroundings. Nathan Velasco, a nature photographer and Carlos Lazcano's friend, lives here. Together they have scoured the area and interviewed the last *rancheros*, the few farmers who still struggle in this hostile land. They know many cave sites or have heard of them from their parents or grandparents. In some cases, they remember the location well, but they often have only a vague idea. This precious information is transferred into a register that is being increased after every expedition with more accurate data, reports, and photographs.

In the surroundings of Cataviña we documented the site of La Bocana, where a few simple parietal paintings are immersed in a majestic and wild valley where the tall cactuses form a sort of forest. After two hours of riding we also reached the site called La Sirena, full of petroglyphs; its name is due to the form of one of the figures carved in the rock. It is a beautiful and lonely place, and it had never been documented before.

Other reconnaissance trips were carried out to the south, at the the 28° parallel, not far from the town of Guerrero Negro.With two hours of off-road travel we reached the old Jesuit mission of Santa Gertrudis, once very populated but now inhabited only by five people. From there we moved on horseback, following the barely recognizable Camino Real, a cattle track that linked the missions in the 1700s. One of the sites found in this area proved to be full of petroglyphs. At the base of another wall we found a long series of carvings.

The research project continues to produce results. In fact in November 2015 another group of Italians returned to Baja California to help with the research. This expedition took place once again in the Valle de los Cirios, among its warm desert colors ranging from the vibrant green of the cactuses to the black, ochre, and deep red shades of the rocks, the magical glitter of quartz sand, the immense expanses of dust and rock, and the rounded profile of the granite blocks. Once again the village of Cataviña served as a base to work on the documentation, including video, of the sites of La Bocana and La Bachata. We later moved to the Sierra de la Asamblea, a wilderness area with granitic mountains reaching 1600

KUR 22 2015, English version 2018, pages 17–18.
https://issuu.com/laventaesplorazionigeografiche/docs/kur22eng

meters of elevation, difficult to access and completely unexplored. Here, despite the low temperature due to the elevation, we discovered and documented many important sites. The first one is called La Pintada, a rocky slab along the dry bed of a stream, a large natural blackboard covered with petroglyphs.Then the sites of Las Pintaditas 1 and 2, where there are abundant cave paintings belonging to the Gran Mural style, typical of the Cochimí culture but previously unknown in this area.This discovery made it possible to link the sites of the Sierra de San Francisco to the south with those around the mission of San Borja to the north.

These expeditions have seemingly simple logistics, since the material can be transported by car and we usually rely on small villages, missions, and *ranchos* in the desert. But we have to face the difficulties of the geographic exploration of huge places, once inhabited but today almost forgotten. Sometimes the *rancheros* know the places because they have been there many years ago, often chasing a runaway horse. But their reports are often inaccurate, based on vague memories or stories of colored markings on the rocks. So we find ourselves wandering in the desert for a long time without any reference point in search of places like the Cueva Pintada, cited by many as a big cavity under a rock where the ancestors used as a shelter for horses.The walls of this cave are apparently completely covered by large and beautiful paintings. It is an almost mythological place, long sought and not yet found. The peninsula itself is a place on the border between myth and reality. The Jesuit missionaries had already realized that, naming the ancient inhabitants of the place *Californios*, a name derived from Califerne, an imaginary place mentioned in an eighth-century novel.

The research continues, and these charming places will be the subject of many other expeditions. This project, complex and far-sighted, has no records of sporting achievements, but is among the most fascinating by our La Venta group.

Paintings in the Cueva de Langosta. *Martino Frova.*

Participants in the 2015 expeditions. March: Umberto Fuerte, Carlos Lazcano, Natalino Russo, Alonso Salgado, Nathan Velasco. November: Martino Frova, Carlos Lazcano, Francesco Lo Mastro, Luca Massa, Nathan Velasco.

Explorando la Prehistoria en Baja California

Se estudia la prehistoria de la península de Baja California antes de la conquista española por parte del grupo La Venta. El área es en gran parte un desierto deshabitado. Se documentaron muchas cuevas de parapeto que contienen petroglifos y pictogramas.

LA MUÑECA FEA LARGEST CHAMBER IN THE AMERICAS

Gustavo Vela Turcott

In 1999, while hiking in the mountains near Huizmaloc, three explorers of the Groupe Spéléo Alpin Belge found a cave entrance of considerable size. They started in, gradually descending along a slope that soon turned into a pitch that they rigged, then rappelled down 15 meters. They continued on, rigging ropes and finding more and more water coming in from tributaries. They ran out of rope at –300 meters and so had to return to the surface and their camp.

On another day during the same expedition, they returned with more rope to continue exploring. They descended four more pits and various slopes. Just as it appeared that the cave was ending where the walls started coming together, the passage suddenly widened again and they came to a room at around –400 meters. As they climbed up a slope covered in rocks and mud, the room opened even more. They let out a shout to estimate the dimensions of the room. The echo lasted a long time, bouncing around in the immensity of the space. They were stunned by this incredible find. It took them a few hours to map a perimeter around the room so that they would not get lost. When they returned to the starting point where they had been that morning, it was afternoon, and seeing that the cave did not continue, they started back up the ropes. That's where the exploration ended for that year. They entered the data, which showed that the chamber measured about 400 meters in length and 200 in width. Due to the weak light of their carbide lamps, they had to estimate the height of the ceiling at 100 meters. They named the cave Tlamanictli, and the chamber La Muñeca Fea [the ugly doll].

A few years ago I heard stories about an underground room so large that two or three football stadiums such as the Azteca [Mexico's largest stadium] would fit into it. How could something so big created by nature exist underground? Since I couldn't quite believe it, some of my friends from the GSAB and I organized an expedition to the Sierra Negra in the south of the state of Puebla, with the objective of returning to Cueva Tlamanictli to measure the dimensions of La Muñeca Fea, as well as to photo-document it and to try to find a way somewhere to go deeper. A group of British explorers had a project to measure the fourteen largest rooms in the world, and La Muñeca Fea was the last one on their list. It was an excellent opportunity to work together to unravel the mystery of this enormous room. The team included Brits Jack London and Tim Allen and me as photographer. [See alsoTim Allen's article in *AMCS Activities Newsletter* 40, pages 59–61.]

Eighteen years after the initial discovery, we returned to La Muñeca Fea in order to accomplish our objectives. After shopping for food and other necessities in Tehuacán, we spent a few hours climbing up the steep and windy road that leads to Zoquitlán. From there we drove along a dilapidated road to Cosavicotla, a village that gave us use of a plot of land to set up our tents. We split up the chores; while some of us set up base camp with a kitchen and tarps, others dug a latrine, and still others went for water. Two days were spent turning our base camp into a cozy home. While we were setting up camp, a group went ahead to Cueva Tlamanictli to rig the necessary ropes. Since it usually rains in the mountainous areas of the Sierra Negra, it was imperative to rig the ropes meticulously out of the water, so that we could get out in case of a flood.

From base camp to the cave takes about thirty minutes of driving on a dirt road in a four-wheel-drive pickup truck. At the end of the road, you take a mainly ascending trail past a few very humble abodes that belong to the village of Cruztitla. There follows an exhausting, 1.5-hour uphill hike to reach the entrance of Tlamanictli. Little by little, we got geared up: polypro long underwear, Cordura suit, harness, vertical gear. We tested our main headlights and our emergency ones. We donned our helmets and one by one disappeared into the perpetual darkness of the cave. We progressed rapidly and smoothly down the ropes, and in a couple of hours we arrived at the bottom—we couldn't wait to see the large room. We were stunned: I let out a shout and the echo took thirteen seconds to fade away.

We climbed up the huge pile of breakdown, which made us feel tiny in comparison with the colossal size of some of the rocks—as big as a small house. We continued our ascent until we reached the highest part of the room. Our teammates who had remained below resembled little ants that wandered around in the distance, their conversation distorted into indecipherable sounds,

turmalinero@yahoo.com

Text from *México Desconocido* June 2017, http://expediciones.mexicodesconocido.com.mx/muneca-fea-cueva-grande-america.html, translated from Spanish by Yvonne Droms.

A sreen capture of YouTube video of assembled point cloud from scanning. Note the numerous places waterfalls hit the floor of the room.

their headlamps shining like powerful beams of light from distant fireflies, illuminating the walls and the ceiling. The six of us at the top marveled at the magnificence of this room—how could nature have created such a place, so immense, so remote, so majestic?

That evening, back at base camp, I wracked my brain, wondering how I could take a photograph that would properly represent this underground treasure. The scope of this task felt all-consuming and beyond me. I slept fitfully.

Two days later, we returned to the cave, this time accompanied by the Brits who were bringing a scanner that would take precise measurements of the entire room. Once there, they turned on the scanner, which started rotating and emitting a laser beam that measured the surrounding area. They turned it off, then moved it some 50 meters away and turned it on again. They repeated this maneuver time and time again.

Later my teammates arrived, and we could now get to work. My task was to direct them how and where to position themselves and when to turn on their lights, because, after having thought about it at length, I decided to take the photo with the shutter open, that is, to allow the light to paint the chamber for a few seconds. Although I had four radios to communicate with nine people, the situation was rather complicated because some spoke English, some French, and others Spanish. To make matters worse, one of the radios started to fail. With loud shouting, I ordered lights to be turned on. The chamber lit up, and we were all stunned to see its size. I had not estimated the volume correctly—the photo was too dark. I raised the ISO. They again turned on their lights: the photo turned out better, but some of the people were not well placed. They changed position, moved their light beams, and I pressed the shutter again: the photo improved. And so it went various times until I felt satisfied with the result. Exhausted and suffering from a headache, I declared the photo session a wrap.

In the meantime, six teammates were spending two days in the cave in order to make a new, more detailed map of the room and to search all nooks and crannies to find a way on to greater depth. That evening all our buddies appeared in base camp with the news that they had finished scanning and mapping the chamber. They had searched various areas but could not find a way on. We would not continue to the center of the earth.

Roger, Luis, and Nico waching the universe in Salon La Muñeca. *Gustavo Vela.*

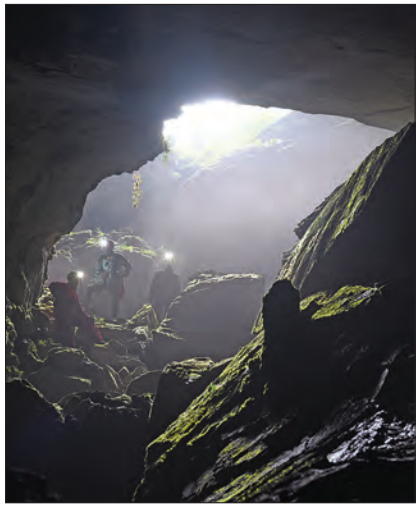
La Muñeca Fea: El Salón Subterráneo Más Grande en América

Historia del descubrimiento de la 4ª bóveda por tamaño en el mundo, La Muñeca Fea en la Cueva Tlamanictli. El salón fue escaneado recientemente usando LIDAR, lo que confirmó el tamaño. Mide 400 metros por 240 metros con 225 metros de altura.

The following day, we woke to a radiant, sunny day. All that was left to do was derig the ropes from the cave, but I saw it as another opportunity to take some final photos, and so we got ready to return to the cave. Once inside, progress was slow because I asked my teammates to pause and help me with the lighting. I got the camera out and took a couple of shots, then switched the mode to video and recorded my friends in action, rappelling down the ropes I put the camera away for my descent.

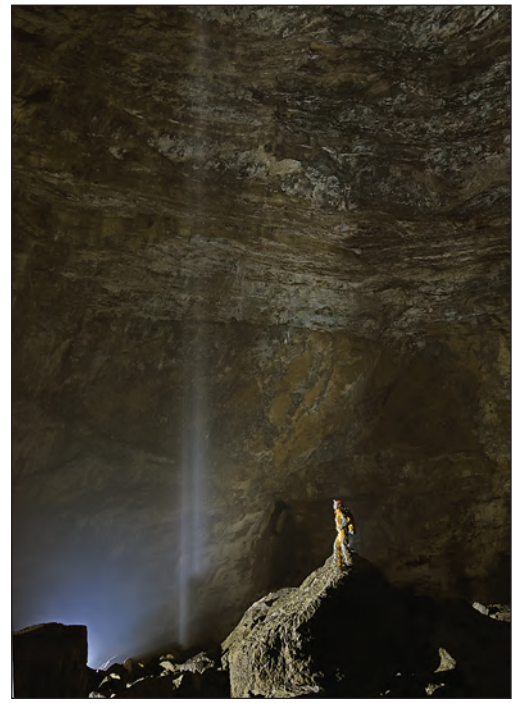
Later, I took it out again and took more photos. And thus passed the morning. Five hours later, we arrived at –400 meters. We toured the chamber one more time, without dallying. I took some additional photos, and finally I got some decent video footage [https://www.youtube.com/watch?v=n5AaPrraVpo]. I felt satisfied.

The entrance to Cueva Tlamanictli. *Gustavo Vela*.



La Muñeca Fea measures 396 meters in length and 242 meters in width. The height of the ceiling was estimated to be between 100 and 150 meters, but this was far from right, because the height is 225 meters. From this extremely detailed scan, we now know that the chamber's volume is 5.9 million cubic meters, with an area of almost 63,000 square meters, which means that six Azteca stadiums would fit in its interior. Six! It's hard to imagine the proportions of something so large, created by nature. La Muñeca Fea is considered the fourth-largest chamber in the world.

Hugo Salgodot near one of the waterfalls in La Muñeca Fea. *Gustavo Vela.*



OCHUN AND OGUN

Alexander Buëß

After being very busy teaching last year and almost not making it to Santuario de los Guerreros this year, I finally found time to get back and continue underwater exploration. I had not been very motivated to continue before for two reasons. First, the end of line was 1 kilometer from the entrance. And second, I had to pass a tiny dry-cave section that was simply a pain. Arriving there after 6 meters of swimming, I had to unclip all of my tanks and climb out of the water to move all my gear over a 3-meter-long section that is covered with a few short, thick stalagmites and a lot of clay. Unfortunately the air in the dry cave is not of very good quality and gave me a headache the first time I passed it, so I decided to leave my short-hose tank on and continue breathing from it. Moving tanks that way is not very easy on the slippery clay surface, but at least I could continue without a headache.

In the beginning of March 2018 I restarted exploration in the second sump in Ochun. I decided to go with three tanks and one DPV to help me arrive at the end of line less tired. It worked. Excluding the fifteen minutes I needed to pass the dry cave, it took me fifteen minutes of driving instead of forty-five minutes of swimming to get to the end of the line, where I started searching for leads. I was lucky to find one rather quickly. The new section was hidden behind a curtain of formations. Getting through there was not easy; I felt like the proverbial bull in the china shop, but luckily managed to pass without leaving a path of destruction behind. After this the cave got a little bigger, and I managed to explore 276 meters of new passage before it ended in a decorated chamber. I surveyed my work on the way out and drove my DPV home.

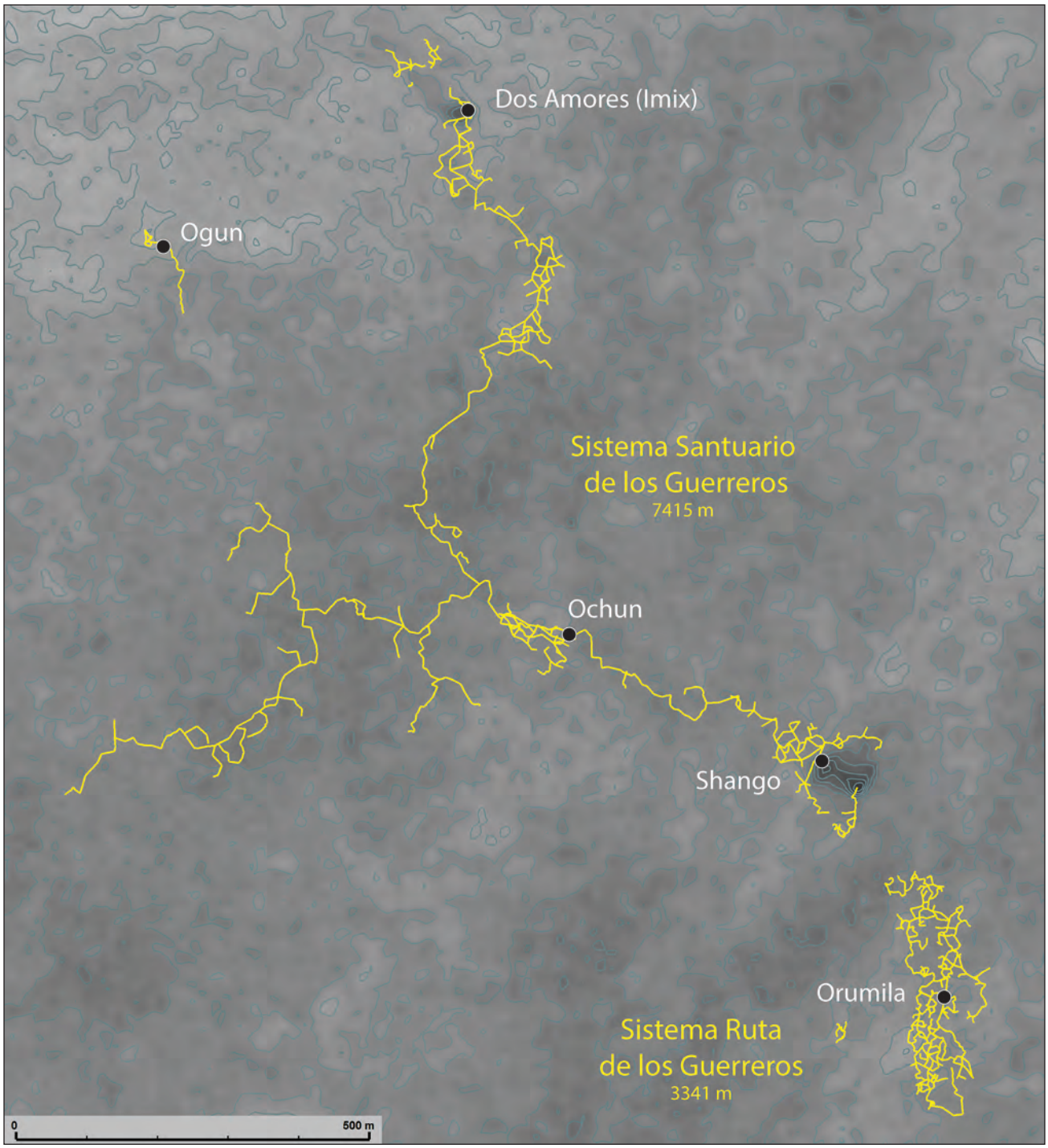
In the beginning of April I went back, this time to check other leads closer to the beginning of the second sump. To have more time I decided to take four tanks and a DPV. After passing the dry section I started checking leads right away. The first three led me into small dead ends and to zero-viz exits, but number four proved to be more interesting. After going through a restriction that forced me on my side, I came into a bigger chamber, which I passed only to find another one that seemed to be another dead end, but after taking a closer look I found a continuation. This repeated itself a few times. Every time after finding a restriction and thinking the cave would end, I came into another big room that gave me more options. I turned when facing a larger collapse I could not find a way around, and I explored two more side passages on the way out. All in all I explored and surveyed 422 meters of new passage. All I had left was about 35 meters of line on my backup exploration spool. Before passing the dry section on the way back, I checked once more to see if I could find a bypass for it, though I had tried several times before without finding one. As I had a very good feeling about it this day, I went for one last attempt. I tied into the main line and surprisingly managed to get to the end of my backup exploration spool's line. Looking ahead, I realized that I could see a line about 5 meters in front of me that looked like the line in the second sump. As I needed to know whether I had really found the bypass I had been looking for since the beginning of the exploration there, I pulled out my safety spool and connected the last meter. I went left and confirmed that I had actually made it—I had found a bypass. The bypass I found leads just around the collapse, connects

Divers' gear at the sump in Cenote Ochun, with light from the entrnace in the background. *Alexander Buëß.*

alex@dripstone-diving.com

again to the main line after 41 meters, and is big enough to pass with four tanks and a DPV. This will make future dives into this section way easier and more comfortable.

As my latest exploration had led north, I decided to start another project in a cenote close by, Ogun. The beginning of the underwater passage is located in a dry cave about 400 meters north of my end of line in Ochun. Heather McCloskey and I went to take a closer look, and found a hole in the ground we descended into using a rope and the wooden ladder in the entrance. The dry cave is a big room with sumps on all sides. Unfortunately all but one are dead ends, as I would find out later. I found one exploration line with a marker telling me that Ivo Kalushev had done an exploration dive in 2012. There was not much line to be found in the upstream section, and the downstream line was also rather short. As this one headed south in the direction of Ochun, I decided to ignore the upstream section and focus first on continuing the exploration downstream. On the first day I added 78 meters heading south, only to get stopped again by another



Stefanie Santschi and Heather McCloskey in Cenote Ochun. *Alexander Buëß.*

collapse. Two days later I tried finding a way around it, with limited success. I managed to push another 25 meters of line halfway around the collapse. Unfortunately this part is very small, and in the end I could no longer see a way ahead because of mediocre visibility, I could barely read my compass while surveying on the way back. Right now my two ends of line are 300 meters apart, so there is still a long way to go, but I believe I can pass the collapses that stopped me in both caves. The cave is staying interesting and I am very excited to go back soon.

Note: This article describes underwater exploration in the western part of the 7415-meter Sistema Santuario de los Guerreros, located at the Kool Ha adventure park. This system is a combination of dry and underwater passages, with exploration occurring as far back as 2001. A 2.3-kilometer-long system to the north, Dos Amores, was connected to it in December 2016. A 3.3 kilometer-long cave just to the southeast called Ruta de los Guerreros remains unconnected to the main system, due to a collapse at the principal Santuario de los Guerreros entrance (a.k.a. Shango).—Peter Sprouse

Ochun y Ogun

Se describe la exploración de cuevas bajo el agua en las inmediaciones del Sistema Santuario de los Guerreros (Quintana Roo). Se extendió la longitud de Ochun de una manera imporante y se exploró una cueva nueva, Ogun, en busca de una conexión potencial.

2017

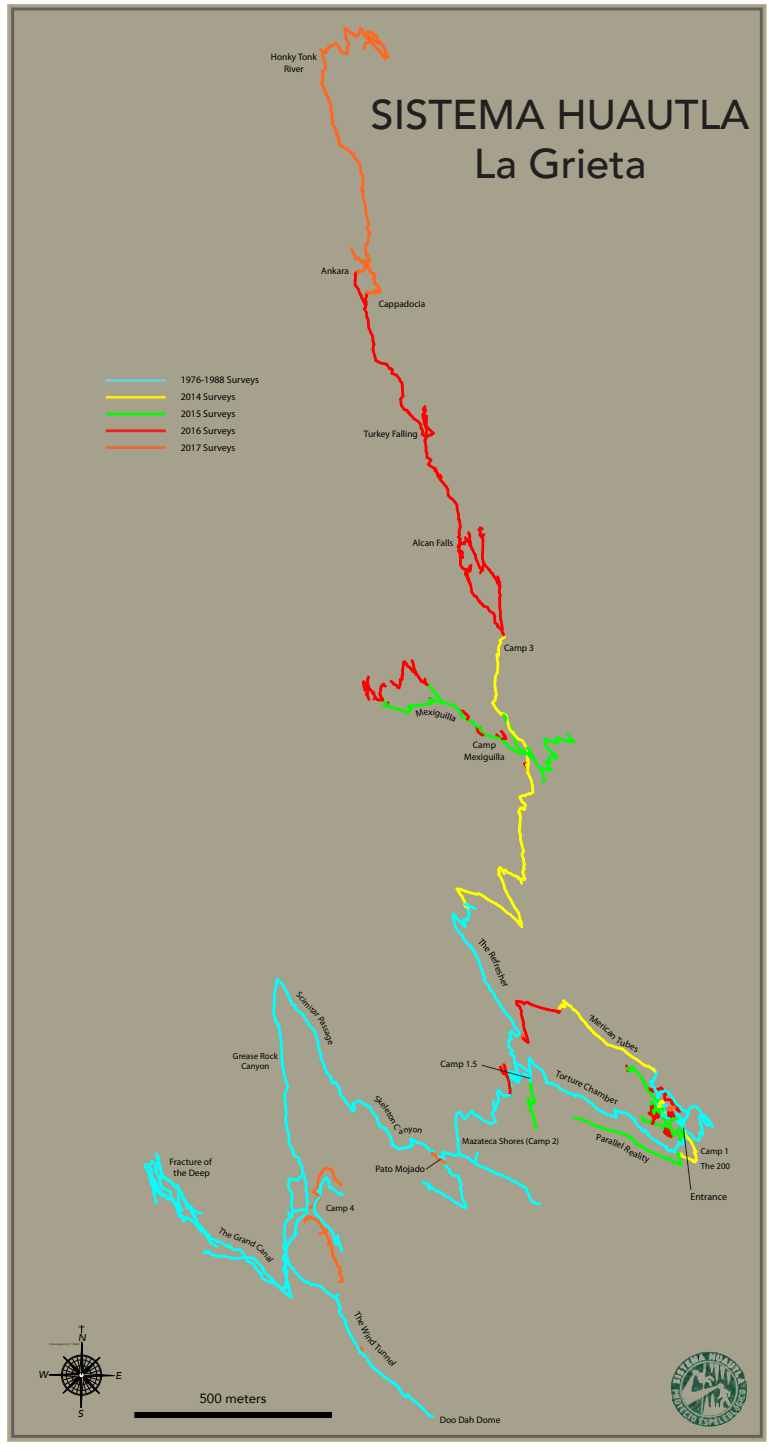
INTRODUCTION TO PESH 2017 AND PLANS FOR 2018

Bill Steele and Tommy Shifflett

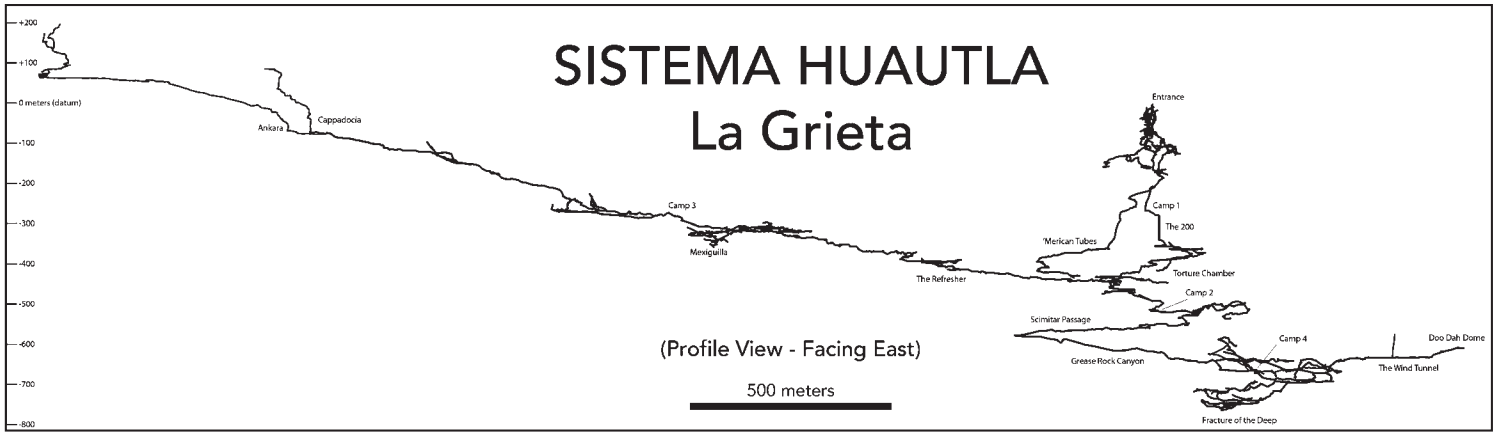
Proyecto Espeleológico Sistema Huautla (PESH) was launched in 2014 as the renewed speleological project in the caves of the Huautla subterranean drainage basin east of the city of Huautla de Jiménez, Oaxaca, Mexico. NSS cavers discovered the caves there in 1966. PESH is an official NSS Project, carries the flag of The Explorers Club on its expeditions, and publishes in the *Association for Mexican Cave Studies Activities Newsletter*, the *NSS News*, and *The Explorers Journal*. Cavers from many countries have participated in Huautla caving through the years, including: USA, Mexico, Canada, England, Australia, Poland, Romania, France, Germany, Netherlands, Switzerland, and more.

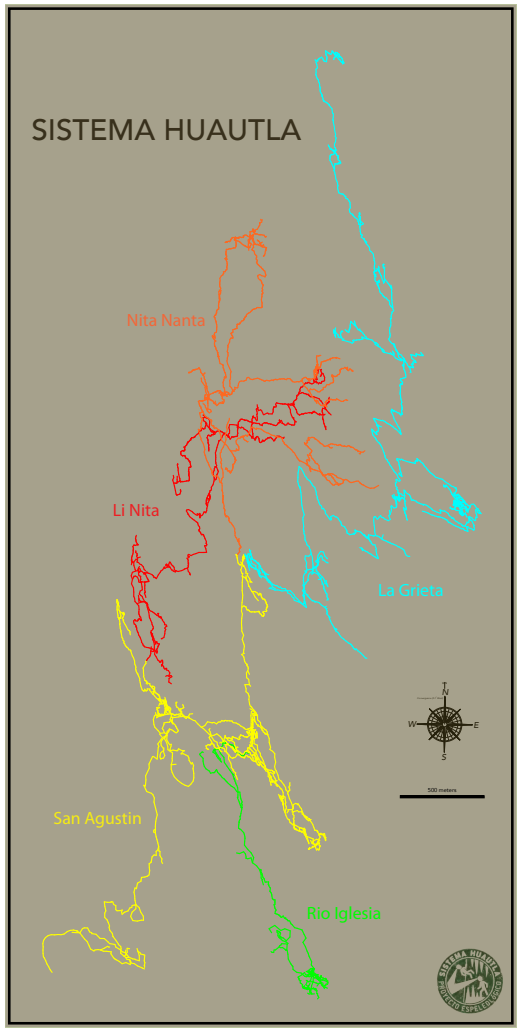
The 2017 expedition was the fourth annual expedition of a planned series of ten. All of our objectives were met. Sistema Huautla is now 78.3 kilometers (48.6 miles) long, 1560 meters deep (5,117 feet), ranks as the deepest cave in the Western Hemisphere, a distinction it has held off and on for fifty years, and is the ninth deepest cave the world. It was the eighth deepest cave in the world until recently, when a new cave, Veryovkina in Abkhazia, Republic of Georgia, was explored to a depth of 2204 meters, the new world's deepest cave. Several articles in this issue cover the 2017 expedition.

PESH has a long list of expedition objectives for spring 2018. Top among them are to continue in the La Grieta section of Sistema Huautla, exploring and mapping



speleosteele@aol.com
tommyshifflett@gmail.com
From December 2017 *NSS News* pages 2,21.





farther from Camp 3 in the northernmost part of the system and Camp 4, over 600 meters deep. Good cave photographers have signed up to participate and will add to the growing collection of publishable photos for a planned coffee-table-type book at the conclusion of the project. Sótano de Agua de Carrizo will be rigged and re-explored for the first time in forty years. This 843-meter-deep cave is known to lie very close to a section of Sistema Huautla, and a connection will be attempted both from this cave and by cavers in La Grieta at the same time. While relocating the entrance to Carrizo in 2017 to get an accurate GPS location, two other enticing entrances were discovered in its vicinity. These will be explored in 2018.

Other 2018 objectives include continuing with our community outreach with hopes of obtaining permission to enter caves in areas where the locals have spiritual beliefs about the caves. PESH also now has a Mexican social scientist onboard, Amalia Montoya, an anthropologist who is researching Mazatec beliefs about caves.

A Mexican biological collecting permit has been requested and specimens collected will be sent to Dr. Oscar Francke, with whom we have worked for thirty-five years. Fernando Hernandez, a PESH caver originally from Monterrey, Mexico, is now in graduate school in geology and is planning to do his field research in Sistema Huautla.

Introducción a PESH 2017 y Planes para 2018

Introducción y antecedentes del Proyecto Espeleológico Sistema Huautla. El Sistema Huautla es la cueva más profunda en el Hemisferio Occidental (y la novena más profunda en el mundo), con 1560 metros de profundidad y 78.3 kilómetros de longitud después de la expedición 2017. Recientemente la expedición se ha enfocado en la sección de La Grieta, donde se han realizado descubrimientos importantes. Los planes para el 2018 incluyen Sótano de Agua de Carrizo, con 843 metros de profundidad y no visitado desde 1978, y se buscará conectarlo con el sistema. Adicionalmente a la exploración se continuará con el contacto con la comunidad y proyectos científicos.

2017

LA GRIETA FROM THE BOTTOM UP

Derek Bristol, Gilly Elor, and Zeb Lilly

FIRST PUSH
UPSTREAM RE**FRESHER**

Gilly Elor—The 2016 push out of Camp 3 in the Upstream Refresher of the La Grieta part of Sistema Huautla by Zeb Lilly, Fernando Hernandez, Katie Graham, Bruce White, and me, known as Team Fat Turtle, added 2 kilometers of survey, established a new northernmost point for the whole system, and ended in two windy waterfall dome-climbs, Ankara the northernmost point of Sistema Huautla, and Cappadocia, which trended northeast. The locations of these climbs were such that they were well poised to potentially realize the dream that set in motion the renewed exploration of La Grieta back in 2014, when John Harman, Corey Hackley, Kasia Biernacka, Bill Stone, and I set out to push an infeeder at the –400-meter level We had hopes that this infeeder, upstream of the Refresher waterfall, would take us upward and northward, ultimately discovering new entrances in the highest karst of the Huautla plateau, a region where local permissions have always been tenuous. Now, after three expeditions, I felt we were positioned to finally realize—or kill—the dream. So as soon as we returned from Mexico in 2016, we began laying plans for what could be major bolt-climbing effort in 2017. We agreed on enough rope and hardware to potentially climb 500 meters, the estimated overburden at the 2016 limit of exploration, two complete bolt-climbing kits, and enough prepacked cave food and supplies to sustain two ten-to fourteen-day pushes of four to six people. Over the next year we raised money (thanks to all of you who contributed to our GoFundMe page) and started purchasing gear and supplies.

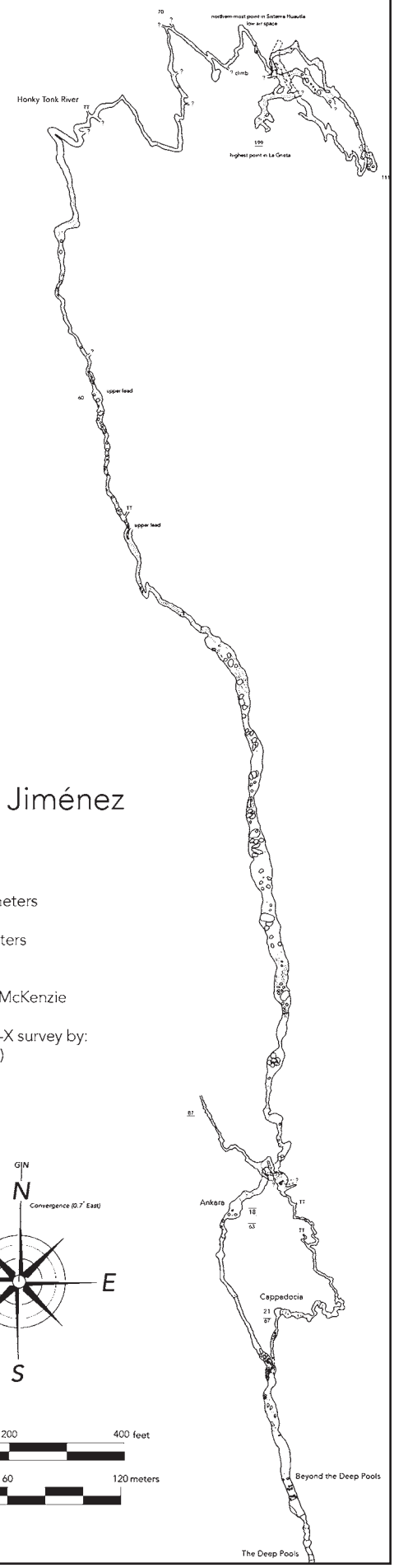
In March 2017, I flew to Austin to purchase and prepack the majority of the in-cave food and supplies needed for the Camp 3 push. Galen Falgout helped coordinate and let us use his house as a staging area. Additionally, many folks from the UT Grotto in Austin arrived to help us pack, thus allowing us to pull off the entire operation in 1.5 days. In the end we found ourselves with fifteen 32-liter haul bags – these we planned to transport to Mexico and ultimately to Plan Carlota in Ernie Garza's truck via a two-week detour to Santa Ana Cuauhtémoc, where the packs would live in the Huautla Resurgence Expedition field house until Ernie and I left for Huautla. After a series of several misadventures involving a nine-hour delay crossing the border into Mexico, multiple truck problems, and several bag recoveries after an incident when someone forgot to close the truck's back window, we rolled into Plan Carlota late on the evening of March 31.

In addition to Fernando, Katie, Zeb, and I of the the 2016 Fat Turtles, Derek Bristol of Mexiguilla fame and Andreas Klocker planned to join the 2017 push. As most people could only pull off a two-week commitment, I, perhaps foolishly, told everyone who couldn't come for a full month to try and come for the second push. The idea was by then all kinks in the expedition would have been sorted out and we should be primed for a big booty scoop. This ,however, left only Fernando and me for weeks one and two to climb two domes and haul fifteen bags. Fortunately we were able to get Adrian Miguel-Nieto, Gerardo (Gerry) Morrill, and Galen Falgout as last-minute recruits. Thus the first twelve-day camp commenced on April 1, 2017. Our first objective, as it usually is on this kind of expedition, was hauling bags. The goal was to get all or most of the bags to the Junction Room by Camp 1.5. This was a good staging area and allowed for any supplies not used up in the Refresher to be later dedicated to explorations in the lower levels. After a few days of shuttling bags and a few nights at Camp 1.5, we were finally ready to head to Camp 3 in the Upstream Refresher.

On the first day of exploration Gerry, Adrian, and Fernando headed upstream of Camp 3. Fernando would climb Ankara, which we believed was the more enticing of the two climbs both due to location and dimensions, while Gerry belayed and Adrian photographed. Meanwhile, Galen joined me for a run back to the Junction Room to pick up more food and the second drill. Galen and I had an uneventful trip to the Junction Roo and were able to get an update from Mike Green's team, who had begun exploring the lower levels. On the way back Galen had a close call with a rock, which rattled us a bit and led me to invent a song "Base Layer of Crud from the La Grieta Mud" to boost morale. Upon our return to Camp 3 we learned that Fernando had climbed Ankara, which turned out to be only 10 meters and relatively dry, and a short recon ahead had revealed a second aid-climb. As it was my turn to climb next, Fernando and Gerry informed me that I should

derekbistol@comcast.net
gelor84@gmail.com
zeblilly@gmail.com
From *NSS News*, December 2017, pages 4–9.

This map is a continuation of the detailed maps on pages 12–14 of *Activities Newsletter* 40. It is printed here in black-and-white to enhance the legibility of the small lettering. Water features in the original are not shown.

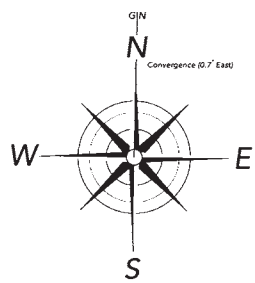


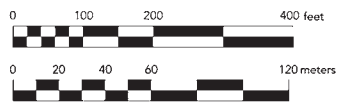
SISTEMA HUAUTLA

La Grieta

Plan Carlota, Municipio de Huautla de Jiménez
Oaxaca, México

Total surveyed length of Sistema Huautla: 78,020 meters
Total surveyed length of La Grieta: 20,804 meters
Total surveyed depth of Sistema Huautla: 1,560 meters
Total surveyed depth of La Grieta: 957 meters
All elevations and heights in meters
Data reduction and plotting: Walls v2 B8 by David McKenzie
Drafting: Adobe Illustrator CS6
Suunto compass and inclinometer, tape, and Disto-X survey by:
Proyecto Espeleológico Sistema Huautla (PESH)
United States Deep Caving Team (USDCT)
Association for Mexican Cave Studies (AMCS)





be prepared to "swim" across a pool with my climbing gear to get to the only place with good rock. The next morning Fernando and I headed north to the lead, while the others did a tourist trip to Mexiguilla. Upon reassessment of the climb I managed to stem around the pool to reach the good rock and avoid the swim. The climb was slow going; after the first couple bolts I ran out of good rock and found myself digging through a crust of mud in hopes of placing a bolt that would hold. Additionally I had the waterfall to contend with. Maybe it was actually, not such a good idea to send the person with glasses up the wettest climb, and at times I couldn't see more than a few feet above me. Nevertheless, I made my way toward a small unappealing crack the water was coming from. At this point I remember thinking, "That's it, we are done, I'm going to kill it, there can be nothing much up this thing." The rather gloomy mood I had gotten into, coupled with setbacks in the expedition as a whole,would later lead us to name this climb the Fall of Joy. After a final traverse that involved dropping clumps of mud of not negligible size on Fernando, I squeezed into the crack above. I set an anchor as fast as I could and headed back down to let a by-now- freezing Fernando clean the climb. With the route cleaned, Fernando and I headed into the crack to check it out, and it did not end.

In the past pushes upstream of Camp 3, we had employed a recon-type approach; once a climb was done, the climbing team would recon ahead to find the next climb. Then another team would bring the climbing gear to the lead while the first team surveyed the scoop. Usually the next climb was not too far ahead. Not this time. Fernando and I ran upstream through a canyon of large dimensions. We went on and on with no aid-climb in sight. Eventually the canyon narrowed and turned into a smaller stream passage that involved crawling at times. We noticed several climbing leads along the way, but the main route seemed to trend mostly horizontally upwards. Finally, after a rather long scoop, we decided to call it quits at a spot where the stream junctioned.

The remaining three days of exploration Fernando, Adrian, and I would spend surveying our scoop while Gerry and Galen began the climb up Cappadocia. Adrian proved to be an incredible sketcher, fast and efficient. Therefore Adrian sketched while Fernando shot the DistoX2 and I took point. This way Fernando could read the numbers off to Adrian, whose English isn't too fluent, in Spanish, and I simply played the role of a cat chasing the laser from the DistoX2 to set the next station. We designated the survey Ego-Fueled Mindset after the joking (or maybe not so joking) description Bill Stone had made of the free-climbing skills we had demonstrated on previous expeditions. The survey through the canyon portion was pleasant, and Fernando suggested naming it Diagon Alley from the Harry Potter books. Passages continued to take on such lighthearted names as Jiminy Cricket's Corner and The Crumbles. Clearly this is what happens when the adults let us kids run around the cave unsupervised. Once in the stream passage, which we named The Honky Tonk River, the survey slowed down, as the passage became more difficult to negotiate. Additionally, we were now frequently standing in waist-deep water and the cold was becoming a factor. The survey overall had been continuously trending northward toward the high karst exactly as we had hoped. Some would later point out that we were establishing a new northernmost point of the system with every survey shot. On the end of the third day of survey, after about 1 kilometer of new passage, we finally reached the junction that Fernando and I had scooped to. We decided to end the Push One survey there. Adrian was cold and hung behind to finish the sketch, while Fernando and I scouted ahead. Beyond the junction the passage character changed from trending directly northward to a more confusing corkscrew. We noted one drippy dome lead right after the junction and then followed the passage onward, passing through a later-much-dreaded low airspace, and not long after we discovered a dry aid-climb that Fernando, cave whisperer that he is, speculated was the way on.

On day twelve we left La Grieta. It was time for Adrian and Gerry to leave the expedition. Meanwhile Derek, Zeb, Katie, and Andreas were due to arrive in Plan Carlota to join us for Push Two. Upon plotting our survey data we learned that the limit of exploration beyond Ankara was now at a higher elevation than the La Grieta entrance. Additionally, Gerry and Galen had climbed the first couple pitches up Cappadocia into what turned out to be a nicely decorated area, stopping in a large formation room with an approximately 10-meter climb leading to a big hole in the ceiling. By the end of Push One we had climbed both dome leads, surveyed 1 kilometer of passage, established a new depth for La Grieta, not to mention another new northernmost point in the system, and hauled enough gear and supplies to Camp 3 to leave it ready for the second push. The northern leads we had left were arguably not too impressive, and the commute over 2 kilometers north of Camp 3 with nowhere dry enough to establish a new camp,and even a bivy was becoming nontrivial. But we were now, more than ever, at the very edge of the whole system. Also, the cave seemed different. It no longer felt like La Grieta; rather the passage resembled descriptions we had heard of the more miserable higher karst caves. Fernando and I had also noticed lots of trash, surface-adapted crickets, and spiders in the Honky Tonk: a hint that the surface might not be too far away. A sort of new kind of entrance fever was setting in, and I was optimistic about the possibility of finding an actual new entrance during the next push.

PUSH TWO, ANKARA

Derek Bristol—A new batch of cavers arrived from the US in mid-April. Derek Bristol, Steve Gladieux, and Johanna Kovarik came from Colorado and Idaho, while Kyle Lassiter, Adam McLeod, and Matt Tomlinson came from Georgia; all arriving the same day in Mexico City. Unfortunately they found bus tickets to Huautla de Jiménez to be sold-out due to increased travel for Semana Santa. They were able to

travel the following day and arrived to find that Gilly, Fernando, Adrian, Galen, and Gerry had left the cave to meet them. It was the end of the expedition for Adrian and Gerry, but Gilly was anxious to return to Camp 3 and continue the push north.

After a brief orientation and packing of a few supplies, Gilly, Derek, and Fernando headed back into La Grieta and returned to Camp 3. Fernando wasn't feeling well after six weeks of continuous caving that had included four weeks at Sistema Cheve before coming to Huautla, and possibly the typical in-town food concerns, so he opted for a rest day in camp while Gilly and Derek headed to the end of the Ego-Fueled Mindset survey to climb a pair of low domes that blocked further progress. Zeb, Katie, and Andreas had entered the cave a day earlier and spent the previous day completing the miserably wet survey from one of these domes back to the end of the EFM survey, starting the PPX designation, a reference to an unwelcome nickname given to Gilly, Pequeña Piedra. Station PPX8 is now the northernmost point in all of Sistema Huautla. Derek was able to free-climb the first of these domes for about 10 meters, placing two bolts for protection along the way, but found the top of the dome to be blind except for a too-tight crack with air. The rope was pulled, and they then headed to the other dome, which was on the far side of a low-airspace crawl. The second dome required about four bolts of direct aid and was 8 meters high, but a good walking-size stream passage was found at the top. They surveyed about 80 meters to a short waterfall before heading back to camp. A new survey, the EOR, was begun, named for a contentious e-mail prior to the expedition in which a team member was accused of having an "emotional overreaction." The travel time to the boundary of the cave was now getting to be well over two hours, with a significant amount of crawling at the northern end.

The following day Gilly, Derek, and Fernando returned to the short climb and continued the survey into a narrowing sinuous canyon beyond. After twenty short and unpleasant survey shots they arrived at the bottom of an 8-meter dome that blocked progress. Derek quickly climbed this with a mix of free and aid moves, only to find another 8-meter dome in the next room above. This was also quickly aided into a band of very loose rock and a narrow canyon that continued somewhat horizontally. The survey was ended here for the day, and the team returned to camp.

After a rest day in camp, the same team returned and the survey was continued through a canyon with loose rock, which soon emerged into a wider room with a pair of domes continuing above. Fernando was able to free-climb the second of these domes, which had a fair amount of exposure up very fractured rock, and the survey was continued into a narrow popcorn-lined fissure with a 20 centimeter vertical squeeze. On the far side of this constriction the passage opened up again and continued to climb steeply to another squeeze. Gilly and Fernando pushed through this and scouted the very tight ascending fissure beyond. Fernando found many signs of the surface, including rodent dung, roots, spider webs, and decaying vegetation, but airflow was dispersed and no opening to the surface could be located despite some very hard pushing. The team returned to camp excited that they were so close to the surface, but dejected that no opening was found.

The following day Fernando needed to leave the cave, and supplies of food and climbing gear were running low, so Zeb, Katie, and Andreas followed Fernando back to the Torture Chamber to retrieve some supplies that had been cached there. The draw of the surface proved to be too much, and after they traveled more than halfway out of the cave to retrieve the cache, the momentum carried the team the rest of the way to the surface. When the team didn't return to Camp 3, it didn't take Gilly and Derek long to realize what must have happened, and after some rationalization that included the safety implications of having an injury in the most remote part of La Grieta with only two people in the cave, they also decided to leave the cave and enjoy some better food and a shower.

Gilly, Derek, Zeb, Andreas, and Katie all returned to Camp 3 two days later. Katie joined Derek and Gilly in pushing the northern end of the cave. After another long and wet trip north they returned to the other dome left at the end of exploration. Gilly used direct aid to climb this 15-meter dome to a wide fissure that branched in many directions. With so many options, proximity to the surface, limited time left to survey, and few days left in the expedition, the team decided to split up and scout for a possible entrance. All the evidence is that this fissure rises up the inside of a large collapsed surface sink that is now plugged with sediment and breakdown. Every possible route was explored and pushed hard, but no entrance was located. Many of the same surface signs

Camp 3 in the Refresher in La Grieta. *Galen Falgout*.

Galen Falgout and Fernando Hernandez at the top of Ankara Falls. *Adrian Miguel-Nieto.*

that Fernando saw were observed again, such as roots, decaying leaves, surface-adapted insects, and even bits of green vegetation. The highest of these fissures was surveyed to a breakdown plug without airflow, where exploration was ended. A few side leads were checked on the way back to camp, and while a few potential leads still exist, none of them appears to be a major route on. There is strong airflow in many parts of the Refresher, but it mostly disappears when following the easiest travel route.

Meanwhile, Zeb and Andreas had also reached a too-tight termination to the Cappadocia dome area, and after a short discussion the team decided to end Camp 3 exploration for the year. Since there were still leads in a few areas, it was decided to not fully derig the camp, but all empty containers and packs were prepared for removal. Climbing gear, including a drill and batteries, had been left in Cappadocia, so the next day Gilly and Derek headed back to retrieve this while Zeb, Andreas, and Katie left the cave. Derek and Gilly followed about six hours later with heavy packs in tow. A couple of days later Steve, Derek, Katie, and Adam did a day trip to Camp 3 from the surface to carry out additional supplies, leaving just basic camp and cook gear behind for a future expedition.

The push north above the Ankara dome established a new high point for La Grieta that is 199 meters higher than the entrance, and extends the total depth of the that part of Sistema Hautla to 957 meters.

PUSH TWO CAPPADOCIA

Zeb Lilly—After a successful month-long expedition to the Huautla Resurgence, Andreas Klocker and I traveled to Cueva Cheve and picked up Katie Graham; she had been caving there for the previous month with the US Deep Caving Team expedition. We made our way to Huautla via the scenic route through the mountains and scouted out a few other potential cave leads in the area. We arrived in Plan Carlota to word that Gilly and her crew were due out the next day and we could get a report from the first push before starting the second push on the leads at the end of the Upstream Refresher. Gilly and her crew arrived on the surface and reported that they had a successful first push trip resulting in over a kilometer of cave explored and surveyed. Most of it was above the Ankara dome that was discovered last year. Instead of the anticipated tall dome, they had found the passage continuing upstream with occasional small domes that were easily climbed with bolting techniques. Gerry and Galen had focused their efforts on the Cappadocia dome, which had also been discovered last year. After a slightly longer bolt climb they had discovered passage continuing upstream with a small, crawly cross-section. Their efforts were rewarded with the discovery of a small chamber and 25-meter pitch. They reported that significant effort would be needed to pursue it due to the limited access afforded by the small passage. Having been brought up to speed by Gilly's team, Andreas, Katie, and I made preparations to enter the cave and start working, with Gilly's team planning to enter a day later and join us in camp. We made quick progress into the cave and arrived at Camp 3 to find that the previous team had spent some time creating a living-room area adjacent to the main cooking area. The living room had much better seating and a better central rock, and we made it our new kitchen area. The previous kitchen had been plagued by limited, unstable seating that left people sitting on the edge of a precipice, so the new kitchen was a welcome addition.

The next morning the three of us made our way to the new discoveries in the far northern part of the cave, choosing first to check out the passage they had discovered above the Ankara dome. We were impressed with the new passage and the work that thee others had done to survey it. These far-northern reaches of the cave were becoming smaller and smaller as the cave branched into tributaries, making exploration more difficult. Nearing the end of the Honky Tonk River, we were forced through a near duck-under and onto our sides to wiggle through a narrow fissure while lying in an increasingly cold cave stream. The temperature of the water, measured in the upper 50s F, was strikingly colder than the water we had been diving in at the Huautla Resurgence some 1700-plus vertical meters down the mountain. Finding the end of their survey, we briefly examined the climb above and decided that it would require a few bolts to adequately protect a climber on his way up, so we turned our attention to the adjacent horizontal lead. We explored ahead until arriving at another pitch requiring aid-climbing, as we had been doing so often in this cave, and surveyed back to tie into the previous team's survey. By this time we were all cold and ready to return to Camp 3, a four-plus-hour journey.

The next day we went to the Cappadocia dome and checked out

the climb that Gerry and Galen had completed on the previous trip. This dome has beautiful flowstone that meanders steeply down through tight, sculpted passage. Arriving at the the rigged drops, we were faced with the tight crawl that they had warned us about. We dropped our vertical gear and staged our packs to take a look, pressing forward with only survey gear with the plan of surveying out. An hour and a half of squeezing, squirming, and one brief wrong turn found us in the breakdown room they had described, and we soon located the next dome above. With our recon complete we started surveying out to tie in with last year's survey. This was a slow process with the average shot length being less than 2 meters, but we got it done before returning to camp.Our next trip to the Cappadocia area was to start the 25-meter bolt climb. On the way north we gathered gear from various depots: rope, quick-draws, and of course a drill. Arriving at the top of the rigged pitches we again stripped off our vertical gear and consolidated it into a pack to begin squeezing through the narrow bits ahead. After again squeezing and squirming and a few choice words, we found ourselves at the base of the dome gearing up for the climb. All set to go, I gave the drill a squeeze to set the first bolt and nothing happened. . . . Crap! The drill was dead. We tried the spare battery to the same disappointing result. I guessed we weren't bolt-climbing with this drill today. We put the drill in with our consolidated pack of vertical gear and started the long trip back through the squeeze. Once on the other side we discovered another battery staged with some of our equipment. Putting it on the drill, we found that it spruns to life. Maybe we were climbing today after all. We packed everything up and headed back through the squeeze, a trip of 1.5-plus hours each way. Arriving back at the dome we found that the drill wouldn't run again; apparently the drill had gotten damp and that is causing problems with the electronics. As a last resort, we tried warming and drying it in our cave suits, and it once again started to work, intermittently at first, but more reliably as it warmed up and dried out.

The climbing was fairly straightforward for the first 15 meters, if a bit overhung, which quickly wore me out. When I encountered a particularly overhung bit with bad rock all around I descended to the floor for a break, and Katie took the lead. Over the next hour she climbed the remaining 10 meters of flakey, chossy flowstone on bolts that could be easily pulled out of the rock by hand after they were unweighted. Somehow, though, she made it to the top and fixed a static rope for Andreas and me to ascend. Not surprisingly, at the top we found another dome leading upward with water cascading down.

Done for the day, we returned to camp.The next day we planned to make a run to the gear depot known as Camp 1.25, where additional rope had been stashed earlier in the expedition, as we were running low in Camp 3 and beyond. Katie, Andreas, and I volunteered for this task and took empty containers and trash out on our way. Fernando, who had been underground almost continuously for the last two months, decided that he was going to head out also. We arrived at Camp 1.25, which is about 1.5 hours from the surface, and the thought of tacos *al pastor* in Huautla got the better of us. We made the collective decision to go to the surface for a day of rest and relaxation. We easily reasoned that Gilly and Derek would know that we had gone to the surface if we didn't return to camp that night. This incident was afterward known as the Taco Rapture.

After our unplanned surface days, we returned to Camp 3 to continue our exploration. Andreas and I returned to the climb, and he took the lead, bolting up the next pitch. At the top we found an increasingly small meandering water passage, about 60 meters in total length, that ended in a tight pinch at stream level. It's unclear where the wind noted at the last vertical pitch goes, possibly into a multitude of narrow cracks. With the Cappadocia lead completed, we surveyed out.

LOOKING FORWARD

Gilly Elor—While records were set and a good time was had, the original dream, discovering a new high entrance of Sistema Huautla from the bottom up, was not realized in 2017. It might be fair to say that the area is more or less finished. However, leads remain. One climbing lead in particular right before the start of the Honky Tonk River looked particularly interesting. Derek and I toyed with the idea of climbing it on the way back to camp after the final day of exploration, when we had the bolting gear with us. However at 4 a.m. when you are wet and cold after a twenty-hour day, maybe an overhung bolt climb on rock that crumbles upon touch is not a good idea. Unappealing as this and other leads may sound, they may prove to be the way on. We will return to the north one more time to clean up, mop up, or possibly break out. Thanks to everyone who participated in the exploration of the Upstream Refresher over the last four years.

La Grieta de Abajo Hacia Arriba

Se describe la exploración de un tributario primario en La Grieta (Sistema Huautla). Este pasaje fue explorado corriente arriba hacia el norte por una buena distancia desde el Campamento 3 y se convirtió en el punto más al norte en el Sistema Huautla. Se acercó a la superficie, pero no se ubicó ninguna entrada. Éste aparenta ser el pasaje principal de La Grieta, y terminó 200 metros por arriba del nivel de la entrada.

HOO HAH DOME CLIMB AND OTHER ADVENTURES

2017

Johanna Kovarik

I had no plans for the 2017 Proyecto Espeleológico Sistem Huautla expedition. Or rather, I had plans to travel down to Oaxaca for two weeks to help with the project, but no goals or plans other than to lend a hand where needed. After hearing Bill Steele speak at conventions and his laughter and PESH stories booming out across the evening campfires, I was interested in joining the project—it sounded like an amazing place and a great group of cavers. My dissertation work had been in Mexico, but most of my time in that country had been in Chiapas. Now that I had graduated I was looking forward to seeing more of the karst development, especially in the Sierra Mazateca of Oaxaca.

Stephen Gladieux and I arrived in Plan Carlota the day before Easter in the back of a pickup truck driven by a group of Texas cavers. Gilly Elor was also in the back; we were lucky enough to get a ride up from Huautla de Jiménez because we'd arrived at the same time as Derek Bristol. Derek was planning to head into Camp 3 that evening with Gilly. Steve and I had heard via the caver grapevine that a team of TAG cavers had romped into the Camp 4 area, climbed a lead, and then departed, and so that climb needed both derigging and surveying. The pot was sweetened when it was mentioned that there was another climbing lead in the same area that had quite a bit of potential—and possibly, air.

Despite the temptation to get underground right away, Steve and I declined to rush into the cave with Gilly and Derek upon arrival in Plan Carlota. Unlike Camp 3, to which a large effort early in the expedition had focused on taking resources and supplies, Camp 4 was not as well outfitted or situated, and Steve and I knew nothing about the terrain between the entrance and camp. We had no climbing gear sorted, and no idea what other objectives were possible. Lee White, a caver from the TAG area as well, had been in Plan Carlota since the start of the expedition and was eager to talk aid-climbing and to join us on our mission to Camp 4. We cracked beers from the small store in Plan Carlota and began to organize and pack. Tommy Shifflett explained more about what the previous team in the Camp 4 area had accomplished, and we learned that swimming was involved. "Did you bring wetsuits?" said Jim Smith, "Because you are going to need them." Apparently the email from Steele about wetsuits had come a bit too late for Steve and me to see due to miscommunication on arrival dates. Fortunately, I was able to score a shortie from Shifflett, and Steve was able to borrow a neoprene vest from Bill.

We also learned that there were sleep sets of sleeping bag and air mattress in various places between the entrance and Camp 4 and three sets, one possibly damp, at Camp 4. Tommy was interested in our opinion on the new screws that the expedition was using for climbs, and we had a drill-and-driver combination packed for use at the climb, along with a mix of stainless and non-stainless screws, hangers, and a full complement of aid gear. There was no semistatic rope left at Camp 4, but a 60-meter dynamic. It was nice not to have to carry a sleep-set down in addition to the rigging gear. Not sure of the food situation, Steve and I had both brought along some of our own freeze-dried meals and cave food. The PESH kitchen, however, was well stocked with Epic bars, a variety of different items from which to make dinner mix, such as broccoli-cheese soup and ramen, and Clif Bars. We loaded up our gear goodies along with food. The plan was to spend five days underground, and we were packed and ready to head out by Saturday evening.

However, the next morning was Easter Sunday, and we were told that we could not go underground or be seen to be working on Easter. Our departure was delayed by one day. This afforded us an opportunity to visit the town of Huautla de Jiménez properly, and on Steve's birthday, no less. Bill had a presentation to give the community that day in the town center, and so we joined him and a great group of cavers in Bill's white speleo-van to bounce our way into town. This allowed a better view of the karst in the area. Bill filled in the details of the various caves over which we passed and their entrances. Fields were draped across steep slopes, and villages dotted ridgetops on our way to town. Another wave of cavers showed up from TAG, including Kyle Lassiter, Adam McLeod, and Matt Tomlinson.

The morning of April 17 dawned and we were ready to head underground. We got a ride up the hill to the cave entrance from Plan Carlota, and in no time Steve and I were swinging our way through rebelays down the entrance series and on into the 200 Series of ropes. Bottoming out at –348 meters, we continued into the streamway, but no cavers appeared behind us, and so we sat and waited. Our group had ballooned from a team of three to a team of six cavers with the arrival of the team from TAG, this had the

jkovarik@fs.fed.us
From December 2017 *NSS News*, pages 13–14.

unfortunate side-effect of slowing the group down, especially given that it was the first camp trip for half of the team. Eventually, the group began to catch up, and we continued on through the Torture Chamber toward Camp 2. On the way to Camp 2 there are some areas where you end up getting a bit wet, and by the time we reached Camp 2 I was soaked to mid-thigh. Many of the group began putting together food—twenty minutes turned into forty, and I had begun piling on neoprene while waiting for the others. The next obstacles were to swim through the Pato Mojado (Wet Duck) pseudo-sump and continue on through Skeleton Canyon and the Scimitar Passage. Finally, the suggestion was made that since we were getting on toward the wee hours perhaps it would be best to stay at Camp 2 and move on to Camp 4 in the morning. Some members thought it would be unsafe to split up into two groups; some had energy and didn't want to face the issue of only having four sets of sleeping gear. In the end, a high value was placed on group cohesion, and we all stayed at Camp 2. I worked my way out of the piles of neoprene into dry camp clothes. Unfortunately, being short two sets of camp gear was a problem. There were some dramatic declarations over who would and would not be happy without a full sleep set. I volunteered to go without a camp mattress. It turns out that four wetsuits with an emergency blanket over the pile insulates quite well. Lee had a hammock and didn't need a mattress, and other odds and ends were distributed to make sure all had some form of cover, and we all settled in next to Camp 2's lovely stream. Unfortunately, four of the team ate dinner out of a Nalgene left from the previous team in Camp 2 and spent much of the night in and out of the restroom. It was dubbed Elliot's Death Mix.

The rest of the trip out to Camp 4 the next day went smoothly. Steve, Adam, and I traveled together and, arriving near Camp 4 earlier than the second team, we investigated the previous team's setup. It was unsuitable. Under a dripping overhang, four cavers could cram together, but would have a damp bivy. There were many random items left over from the previous team, including a strange first-aid kit, a dumped pile of coffee grounds, and several water shoes. Additionally, an array of climbing gear had been left at the K Borehole gear depot. We decided to relocate Camp 4 back toward where the passage to Skeleton Canyon pops out, directly above the Black Slide. High above the streamway on top of some breakdown boulders now rests Mazatec Heights—a luxurious, dry camp with plenty of privacy and the lovely sound of rushing cave waters to drown out the sounds of your fellow explorers snoring.

The next day, Steve and I prepped for heading farther into the cave to investigate the climb. Lee unfortunately decided he needed to save his strength for the trip out of the cave, and so it was to be a romantic date of a trip to –630 meters to find the climbing lead. The other team opted to survey leads near the original Camp 4. Steve and I headed off with our camp packs full of climbing goods and survey kit. We were able to easily find the side passage off of the main borehole, but in short order the passage cut down to about the diameter of our fully loaded camp duffs. Steve doubted the veracity of many claims regarding the lead and our true location in the cave. After all, the map showed a 5-meter-wide passage with no floor detail. We stopped and dropped our packs to better scout in each direction for survey stations. We found one and soldiered on. To our surprise, we popped out of sandy crawling passage into a small room with a nicely drafting aven where we could stand. Beyond that room was reportedly the Glugs, which would require a fully wet crawl, and then the infamous Doo Dah Dome. Due to the team's taking two days to reach camp instead of one, we could either go derig and survey the previous team's work or do our climb. We did not want to waste the effort we invested in hauling rope, rigging, drill, and driver all the way here, and so we opted to begin the climb on our lead. Steve placed and replaced non-stainless screws, and we ran all of our 60 meters of semi static rope up the dome. It continued up with the same drip and draft as at the base. We surveyed back down what we had climbed, but were able to get another 20-meter shot into the ongoing aven, making well over 60 meters of height and going. We considered heading out to Doo Dah, retrieving the rope left, and then continuing on, but it was getting to be near three in the morning and we were out of food. Since our climb continued, someone would need to return to continue the climb, so we left it rigged cleanly and out of the wet-season flow as much as possible, with all stainless hardware. We headed back to our quarters in Mazatec Heights, talking through names for the dome as we shoved

Luxurious Camp 4. *Matt Tomlinson*.

Lee White in new passage near Camp 4. *Matt Tomlinson*.

our packs through crawlways and loped over boulders. I won out, and a team will be returning in 2018 to newly christened Hoo Hah Dome.

We had, unfortunately, only planned for a five-day trip, and so had to head out of the cave for supplies. The other part of the group had logged decent survey, but was tired and still unwell from the dinner mix at Camp 2. They did, however, report potential for an even nicer camp farther into the cave, near the stream and on flat, sandy ground. While Steve and I were game to stay for another night or two, the lack of food without gastrointestinal threat attached was a problem. We had arrived back at Mazatec Heights at around 5 a.m. and discussed plans with the rest of the team. It was decided that Adam would sleep in to get on our schedule. Lee, Kyle, and Matt would wake up at a normal hour and head to Camp 2; we would sleep later and then follow. We slept as much as we could, and then packed up our things, plus the items left behind by the previous team at Camp 4, and began our journey out to Camp 2 to meet up with the other team, arriving at the camp shortly after they did. We rounded up all that we could from the odd assortment at Camp 2 as well, and then Steve, Adam, and I made our way toward the surface. We popped out of La Grieta just at twilight in a world alight with fireflies, in plenty of time for beer and dinner.

The potential at Camp 4 for survey is great; borehole and climbing leads abound. For those relatively new to vertical, rebelays, more advanced rigging and cave camping, it is advised that a trip to Camp 2 would be a great objective, with plenty of survey and climbing leads to be done in close proximity to that camp as well. An experienced team should have no problem reaching Mazatec Heights in a single day, but there could still be value in staging some gear at Camp 2, as the trip is faster and can provide a good familiarization trips for new members. There are quite a few climbs past the Pato Mojado, so quite a bit of rigging gear will be needed. Many thanks to Bill Steele and Tommy Shifflett for their organization, hospitality, and all-around awesomeness!

Escalada del Domo Hoo Hah y Otras Aventuras

Usando un campamento recientemente establecido (Campamento 4, Alturas Mazatecas) en La Grieta (Sistema Huautla) se inició la escalada de el recientemente descubierto Domo Hoo Hah, que tiene una buena corriente de aire. El domo continuó más allá de los límites del equipo disponible (60 metros), sin tener final a la vista.

ONCE IN A LIFETIME TO CAMPTOWN RACES

2017

Brian Gindling

Mike: "How grim is the Wind Tunnel?"

Bill: "I remember it being wet and windy. Not grim, a delight."

Brian: "Soooo, how about here where it says The Glubs ('the sound one makes whilst drowning')?"

Bill, gurgling as he mimes an inch of airspace: "Though I would consider having swim goggles, and a wetsuit might be a good idea."

Brian: "I'll bring a snorkel."

And that is how we ended up standing in neck-deep water, pushing three ridiculously overstuffed cave packs through the scant space between one of the many body-height rimstone dams and the ceiling above with an endless mind-loop of Camptown Races slowly driving us mad. Over 3 kilometers from the entrance and 630 meters deep, we are nearing our goal. ♪May the gods end it now . . . Doo Dah, Doo Dah . . . may the cave gods end it now . . . oh Doo Dah day♪.

Doo Dah Dome had been last visited in December 1977 by Bill Steele, Bill Stone, and the late Richard Schreiber. Tales of a 50-meter-plus dome lurking beyond a passage tantalizingly named the Wind Tunnel had convinced the four of us,Mike Green, Brian Gindling, Elliot Stahl, and Damien Lebrun, to join the 2017 PESH expedition and try our hand at climbing it. The first night in Mexico as we debated plans in the mess hall, Mike was continuously pushing Bill Steele for more details, prodding him to remember forty years ago and why we should let him convince us to return to his lead, to which he vehemently replied, "Because of the air! It's called the friggin' Wind Tunnel."

Our plan was to camp at Mazateca Shores, Camp 2, for our first week underground. Goals were to find Pato Mojado (Wet Duck) Sump and see what we could do to either pass it or lower it. We were handed a photograph from the '70s, the last time anyone had gone through, showing two wide-eyed cavers grasping a line leading down to the water's surface and disappearing below a blank wall of rock. Not much had changed in the interim, and there still wasn't much that would lead anyone to believe that there was passage continuing beyond. Mike perched himself on a fin of rock, donned his ill-fitting goggles, and slid into the water, feeling with hands and feet for some sort of void that would allow us passage. After some flailing and theatrics, he bobbed up, grabbed a breath, and then dove, his light slowly fading out of sight. It wasn't long before he returned and said that the sump wasn't long and if you tried you could manage to keep at least one eyeball above water by holding your head in a narrow crack in the ceiling. That sounded great to me, so we dropped our packs into the water and with some effort relayed them through. After 5 meters or so of near-diving we emerged into nice swimming passage with a bedrock dam at the far side. Leaning over the edge, you could watch the water spew from holes in the dam and cascade down into the deep canyon beyond. Our first objective completed, we left our rigging gear and rope and traversed the sump again to meet up with Elliot and Damien, who were bringing the last bags from the surface.

There they explained that it had been raining heavily overnight and water levels were rising in the cave, which prompted Mike to enthusiastically proclaim, "That lake is so large I doubt it would ever completely sump." And yet when we returned to the shore it was visibly rising by the minute. Being both fresher and drier than we were, Damien and Elliot passed through to retrieve the rigging gear from the other side, since no one knew how long it would be shut. Meanwhile I went to check a small 10-meter crack to the left behind a breakdown block and discovered a thankfully dry, though tight, bypass of the sump. We had previously realized that the infamously inquisitive scorpions in our camp were also quite happy swimming around with their friends in the sump, so we named the bypass #No Scorpions, since it was one of the few places devoid of the troglobitic arachnids.

Now that we were no longer worried about being stuck on the far side of the sump, our next objectives lay open before us: traverse Skeleton Canyon, continue through Scimitar Passage, make a hard left and descend down Grease Rock Canyon to the Black Slide, and enter K Borehole. Bill was sure there were no ropes between Pato Mojado and Doo Dah Dome and that they had just bobbed like corks downstream back in the day. Having already noticed how quickly the water levels were fluctuating, we decided to rig any needed traverses or drops so that in the case of a flood, a dry way would be available to cavers in need of it. With 200 meters of Cancord rope split between the four of us, Mike led the way, rigging with DeWalt screw anchors as we fed him rope from our thankfully diminishing bags. Skeleton Canyon, a truly spectacular section of the cave, starts off tall and narrow, festooned with

karstnaut@gmail.com
NSSNews, December 2017, pages 10–12.

La Grieta scorpion. *Nikki Fox.*

Swiss-cheese bedrock; you either stay high or swim. Regardless, you are constantly pushed back into the water by the tightness of the canyon. Stroke-by-stroke we progressed downstream. As we rounded a corner, the Scimitar Passage appeared before us. Here, dropping into a small rotunda, you must balance on 2-meter-high bedrock blades solutioned into a palm-like cross section and damn near razor sharp. It was here that Bill Stone had such a blade removed, by Bill Steele no less, from his leg decades ago. Similar to an American Ninja Warrior course situated over a Punji-stake pit, this is some of the most surreal passage and one of my personal favorites. A number of infeeders spill into the main flow, and after some really fun swims through low tunnels, short duck-unders, and other aquatic adventures, the stream gradually sinks into the floor and the rift begins to widen as it reaches a 130-degree turn and the beginning of Grease Rock Canyon.

Our last hours of the trip were spent stumbling and sliding down 200 meters of greasy rock and then climbing up and up into the canyon as the floor dropped away and the water returned. We ended up standing on massive chockstones of breakdown, staring into the void below us and listening to the crescendo of water gaining speed as it rushed over the Black Slide down into K Borehole. We left everything we could high and dry and began our long haul back to the surface.

The look in Bill's eyes when we told him of our progress to the Black Slide bordered on comically incredulous, but he quickly changed tack and pontificated that, "You guys may not be as tough as we were back then. I bet you won't find the Wind Tunnel, let alone Doo Dah." This kind of cajoling was his way of keeping us motivated. No better way to convince someone to do something than to bet him he can't do it, and bet we did. A case of beer for each of us, of our choosing, upon our completion of the dome climb. Game on, Bill.

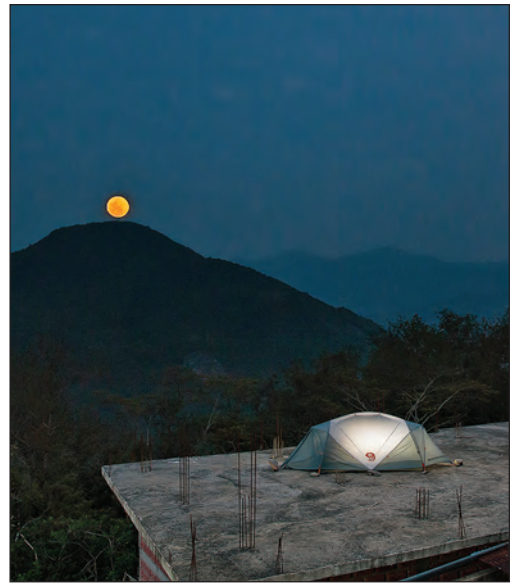
We still weren't really sure where we had gotten to at this point, and many hours and beverages were consumed while poring over maps and reading trip reports. This is the bread and butter of caver talk, debating where passages go, how deep something could be, and who ends up being right. The best we could figure was that we were still not to the Wind Tunnel and therefore had a lot more bags to haul down. One of the locals had apparently bought a conch shell in town that day, and his nighttime serenade continued on into our dreams and far too long into the morning, shutting down just as the chickens and turkeys began their morning rituals. It was time for us to go win that case of beer.

The following day Damien, Elliot, Mike, and I headed back into La Grieta. Somewhere in our shuttling of gear, Elliot suffered the first of a series of cuts and scrapes and, remembering a staph infection from a previous experience mucking about in the cave waters of Mexico, decided to embark on a herpetology excursion in the jungle. After receiving some bandages and TLC in Camp 1.5, he proceeded to rout in an orderly fashion. We got pretty spread out at this point, with Damien making sure that Elliot got out fine, Mike hauling bags from the entrance to meet me at Camp 2, and me muling the remaining bags to the sump and camp.

Upon reuniting, the three of us set out again back to the last drop, and from what we could gather from the map, there was borehole ahead. It didn't take long for Mike to have us rigged down into our last swim, and we ascended the breakdown shore and up onto an overlook of the Black Slide as it carried all the water down into the Grand Canal and off into the depths of La Grieta on its way to connect with Sistema Huautla proper. But this is where we exited stage left and began the hunt for the K Borehole, the Wind Tunnel, and hopefully our new home, Camp 4.

Here is where the map becomes crucial. The only map we had seen had passage widths only, plan view. With no ceiling heights, cross sections, or profile, it was interesting to finally see what we had been studying for months. I surmised from the map that there would be some nice flowstone floors, not too much breakdown, maybe some nice tranquil pools and level ground. That is exactly what we did not find. While the K Borehole was some of the largest I have seen, it is perched high above the water, completely floored with an astounding array of

Rooftop camping. J*osh Hydeman.*



breakdown, and devoid of anything resembling even the slightest hint of a campsite. We argued, we moved some rocks and tried to make a bed under, between, or atop the most comfortable boulders, and argued some more as we realized this was not going to work. Finally, Mike convinced us to hoist our packs again and follow him, promising us at least something, which was more than we had, so we couldn't really argue anymore. I may have been cursing his name as I saw him disappear into a tight squeeze in the floor, but all was forgotten as we dropped out of the ceiling and into comfortable walking passage. We had found our camp. It wasn't comparable to the beachside resort of Mazateca Shores, but we quickly moved enough sand around that the three of us could lie down side by side with at least our torsos on somewhat flat ground and mostly drip-free.

Now we were ready. Camptown Races was still fresh and fun in our minds as we whistled down the borehole looking for the Wind Tunnel, which from the map looked like a narrow infeeding passage. For months, I had envisioned this passage clean-washed, bedrock-floored, and similar in dimension to a small tunnel. It took us a number of hours to find it, and it did not look anything like what I had come to believe. About 25 meters up a very exposed, near vertical wall, a large rift intersected the borehole. At first, we doubted this was it, as it was not at all what we had expected and we had trouble picturing Bill and crew in wetsuits somehow scaling the wall. As Damien and I were sorting gear and counting screws, Mike volunteered to scout ahead and began to garden some enormous rocks off the ledges as we watched his progress from as far away as we could on the opposite wall. After he relayed back positive news, we had a rope quickly rigged up the wall and were finally on our way. Anticipation of the horrors ahead quieted us as we followed Mike through muddy rifts,and up, over, and down massive blocks as the passage narrowed and lowered. One name from the map kept going through my head, the Glubs, as I thought back to Bill miming gurgling and gasping for air. The grim image in my head and that damnable song repeated incessantly as we scraped and gurgled our way through, finally depositing our waterlogged selves at the base of Doo Dah Dome. It may have lookd like 50-plus meters if you were looking up with a carbide flame through the great amounts of steam pouring off your body, but with a good LED spot you could see it wasn't but 25 meters, with a large ledge halfway up and a visible passage at the top. It was quite astounding to see how fast Damien got up the wall and a bit anticlimactic after all our months of preparation. He followed the right wall, which curved up to the top of a chocolate-brown flowstone pillar that rose the whole 25 meters of the climb. Mike followed, removing the screws, and then we were off to virgin passage, gleefully discussing the different styles of beer our cases would contain. A picturesque clean-washed vadose canyon greeted us with a few more flowstone obstacles, one requiring another four screws to mount, and then about 50 meters of crawling on hands and knees to a flowstoned-shut end. Better put TT on the map here.

I'm not going to say there aren't some leads left there, but the air had left long ago, before Doo Dah Dome, and this was obviously not the way. As it happened, halfway back through the Wind Tunnel a pile of fresh breakdown creates a small beach in a dome that hadn't been given enough attention on our laser-focused inbound mission. The three of us sat there, Mike holding the last 10 meters of our rope, ways of retrieving the standing line in Doo Dah racing in my mind, and Damien illuminating what is easily a 50-plus-meter dome with the friggin' wind blasting up into the darkness. {See Hoo Hah Dome article by Johanna Kovarik.]

Oportunidades Únicas en los Campamentos

Descripción de la escalada del Domo Doo Dah en las profundidades de La Grieta (Sistema Huautla), que presentaba gran potencial. Se descubrió una alternativa al casi sifón Pato Mojado y se estableció un nuevo campamento (4). El domo fue escalado, pero no continuó. De salida se descubrió un nuevo domo (Hoo Hah) con mejor flujo de aire.

P.E.S.H. EXPLORATION OF CUEVA DE TIENZO (GOAT CAVE)

2017

Tommy Shifflett

Near the end of the 2014 Proyecto Espeleológico Sistema Huautla expedition a goat herder showed us a pit on his property. Two people, including me, descended the pit to check it out. This pit was difficult to rig because the slot leading into it was choked with debris of rock and dirt; but by stemming up high in the slot I was able to set two bolts, providing a free, unobstructed drop where no rocks and debris would come flying down the pit.

A 40-meter pit led down into a 14-meter-by-4-meter bottom with one very tight crevice leading down from the high end and no air movement. We considered the cave explored and headed back out toward the entrance. I was the last to climb back out. On my way out, at about 15 meters off the floor I noticed off the left side what looked like a possible lead. This required about a 4- to 5-meter pendulum to reach. The lead was a rain-well approximately 2 meters deep that I could rappel back down into.. At the bottom was a small room ,and leading out from it I could see a very narrow, 1-meter-high-by-150-centimeter-wide crack. Approaching this more closely to see if something larger could be seen beyond, I felt strong air blowing against the back of my neck and going into the crack. Thus began an effort I undertook during the 2015 and 2016 expeditions to widen the crack and follow the air. Several people helped in the digging, including Bill Steele, Mark Minton, Scott Wahlquist, Virginia del Rosario, Paul Winter, and, for the final breakthrough at the end of the 2016 expedition, Matt Tomlinson and Fernando Hernandez. The effort required widening the crack for more than 11 meters, ending at a very small space over a pit that also required widening for 2 meters vertically before reaching a point that became wide enough to easily rappel down.

tommyshifflett@gmail.com

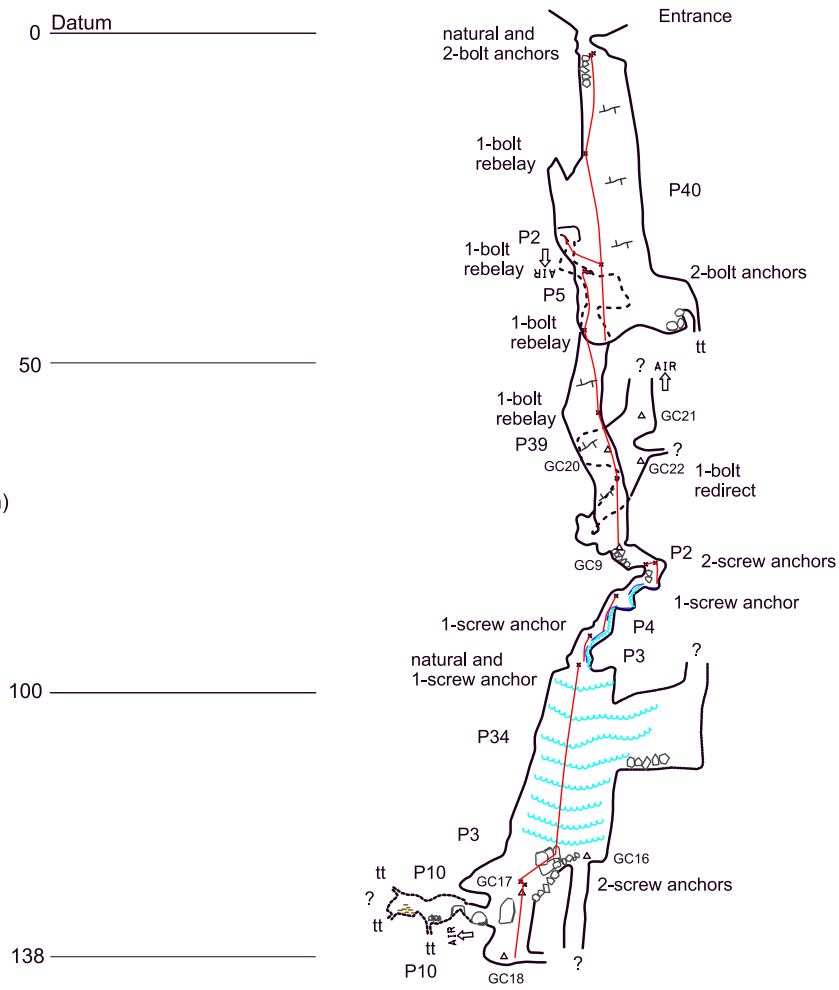
On the last trip of the 2016 expedition, Matt surveyed in solo, while Fernando and I headed to the last dig point with the expectation of finally getting through. We had to first widen the very small room just to be able to work on the beginning of a pit that made up the floor. It needed widening for 2 meters down to where the pit belled out to about 0.3 meters; beyond that it quickly belled out more to where we could see to the floor of a 2-meter-wide passage. This would be one very tight rappel for the first 2 meters, but easy beyond that point. A 5-meter drop led to yet another drop only a step away. I was the first down and immediately began moving much rock debris that had fallen down the pit. After clearing the ledge, I rigged a bolt and started rappelling down. It would take me nearly an hour to reach the bottom because of the need to remove loose rocks hanging on small ledges and the needs to set one rebelay and one redirect. Fernando soon followed behind me, and before he reached the bottom, Matt had caught up, stopping his survey on the ledge at the top of this deeper 39-meter pit. Following Fernando, Matt was only minutes before also being on the bottom, which was littered with much rock from the digging far above. We were quite elated and wondered which way we would follow the air. Under a ledge Fernando found a small hole looking into bigger passage going down, and the air was sucking strongly into it, but it was too small to get through on this trip.

Near the beginning of the 2017 expedition Bob Alderson, Nikki Fox, Chris Coates, and I returned to push the small hole taking the air. With us we brought survey gear and, for enlarging the restriction and rigging the cave, some rope and a new DeWalt drill that had been donated to the expedition. It was only minutes before Chris was the first to pass through the enlarged restriction. He entered a small room with a flowstone floor carrying a small trickle of stream, not quite what we had imagined after the breakthrough trip. From there the stream led down a series of five short flowstone drops varying from 2 to 6 meters. All of these drops were rigged with the new DeWalt-Powers Fasteners screw anchors that has been donated to PESH for testing for cave use. We were the first to use these in a cave during this expedition, and it didn't take us long to develop full confidence in them.

The last of this series of flowstone-lined pits led to a small room with a hands-and-knees crawl at the end leading to a much larger pit into what appeared to be a big canyon. This excited everyone, given that we were following some very good air into this small cave. Unfortunately, we had just two ropes left, and neither was long enough to reach the bottom. But we were all curious about what the cave was like on the bottom, so I went down on one rope to a narrow ledge that I could stand on. The flowstone seemed too old and soft to hold a screw, so I tied the other rope to the first and went the rest of the way down. On my way down, I could see a higher canyon coming into the canyon I was rappelling in, which I recorded in my

Legend

Main Passage
Lower Passage
Mid-Level Passage
Upper-Level Passage
Unexplored or Unmapped Passage
Breakdown
Small Rocks
Sand and Sediment Floor
Mud Floor
Sand and Gravel Floor
Bedrock Floor
Pool or Sump (as noted)
Stream
Pit
Dome
Ledge/Drop-off
Ceiling Ledge
Slope
Guano
Flowstone
Stalactites
Stalagmites
Columns
Soda Straws
Crystals
Helictites
6 Passage Height
15 Pit Depth (Plan)
tt Too Tight
? Lead
620 Depth Below Entrance
ABC15 Survey Station with Number
AIR Direction of Airflow
Rigging (Profile)
Speleothems (Profile)
Water (Profile)
Breakdown (Profile)
P15 Pit Depth (Profile)



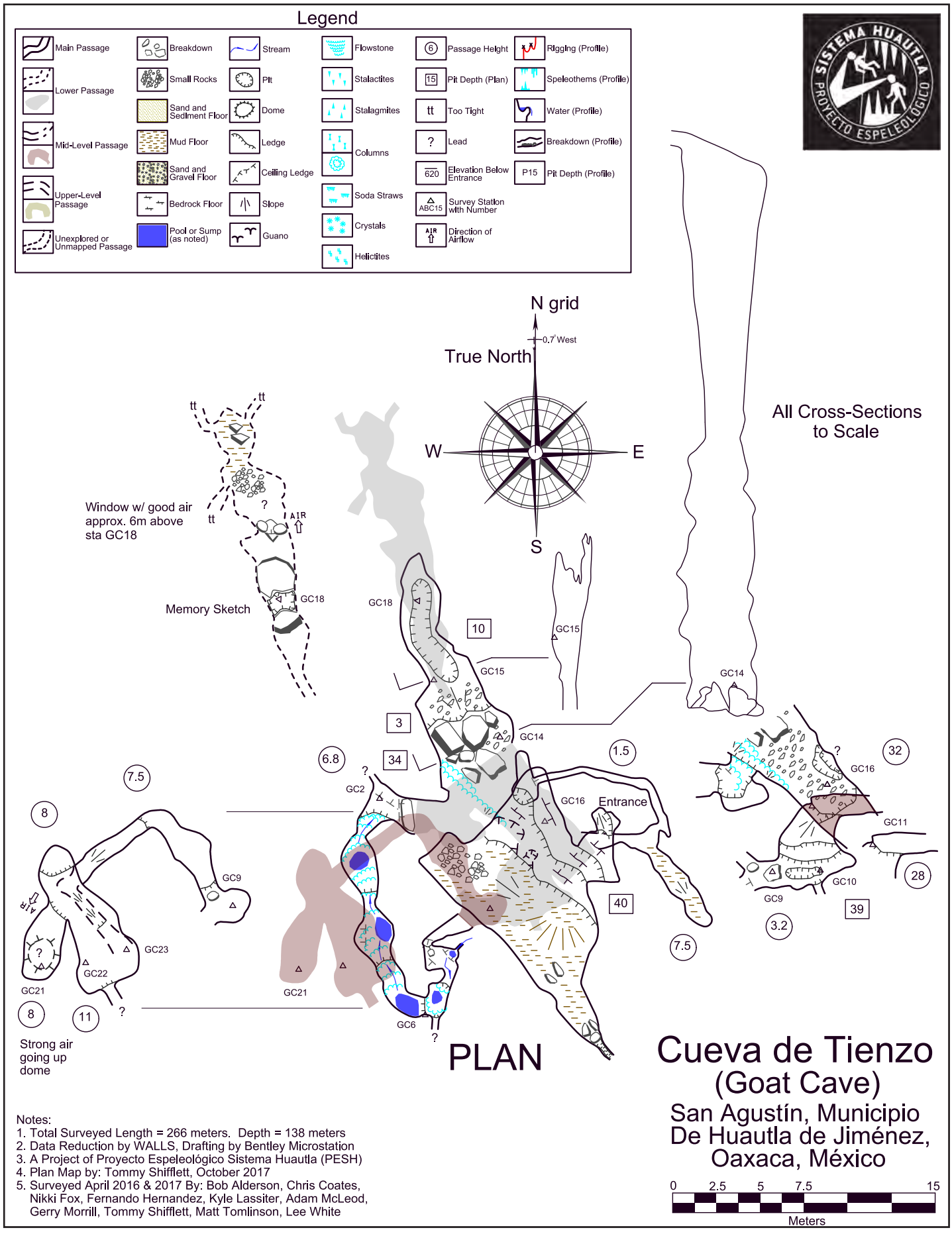
Profile View - 90 degrees (East)

PROFILE

Cueva de Tienzo
(Goat Cave)
San Agustín, Municipio De Huautla de Jiménez, Oaxaca, México

0 5 10 15 30
Meters

Notes:
1. Total Surveyed Length = 266 meters. Depth = 138 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. DeWalt-Powers Blue-Tipped SS 3/8" x 3" Screw Anchors used
5. Profile Map by: Tommy Shifflett, October 2017
6. Surveyed April 2016 & 2017 By: Bob Alderson, Chris Coates, Nikki Fox, Fernando Hernandez, Kyle Lassiter, Adam McLeod, Gerry Morrill, Tommy Shifflett, Matt Tomlinson, Lee White



Notes:
1. Total Surveyed Length = 266 meters. Depth = 138 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Plan Map by: Tommy Shifflett, October 2017
5. Surveyed April 2016 & 2017 By: Bob Alderson, Chris Coates, Nikki Fox, Fernando Hernandez, Kyle Lassiter, Adam McLeod, Gerry Morrill, Tommy Shifflett, Matt Tomlinson, Lee White

mind as a good lead. The second rope reached the bottom with just a few meters to spare. At the bottom, the canyon measured 4 to 5 meters wide and over 30 meters tall. Opposite the intersecting canyon, the passage dropped steeply down over a breakdown pile and then into what appeared to be another pit. The cave was looking good, and with that I climbed back to the others, and we surveyed out from the room at the top of the canyon.

For the next trip, I returned with Gerry Morrill, who lives in San Luis Potosí, Mexico. We returned with more screws and longer rope. From the last survey point in the cave we surveyed down into the canyon. We had replaced the two ropes with one single rope that was long enough to rig the steep slope over the breakdown pile to the next pit. Gerry did the rigging this time to provide another perspective on using the new DeWalt gear and screw anchors. This next pit led to a much narrower canyon. At the bottom Gerry looked for the air. While he was doing that, I rappelled down about halfway to a ledge that led upslope to a window looking into a small room. Climbing through the window, I could feel much air going in. Once in the room I could not determine where the air was going, as there was no passage I could fit into leading out of the room. At the end of the room is a dry mud-and-rock-pile collapse, and there were two tight leads heading off, one on the left side and the other on the right, but I could not detect any of the air entering them. There was also a too-tight lead midway along the room on the right going in.

After Gerry returned from the bottom of the pit I went down to continue the sketch. Gerry said he had felt air but the passage became too tight. I could not detect any air. Back at the bottom of the big canyon drop I noticed a tight pit leading down an estimated 10 to 15 meters against the back wall and not far from the base of the incoming canyon drop. Neither of us went down, so this lead remains unexplored. After I finished sketching what we had surveyed we headed out.

The last trip into Goat Cave would be to derig and check the incoming canyon lead and other leads to find the air. Adam McLeod, Kyle Lassiter, Lee White, and Fernando Hernandez were the team members for this trip. I was not able to attend because of a worsening shoulder issue. To reach the incoming canyon lead a double pendulum was required in the big canyon to reach a point where the team could rappel down and drop into this much higher canyon. This was accomplished, but no leads were found. The team then returned to the bottom of the breakout pit to survey a lead off the bottom. They first explored to a dome in passage climbing up toward the bottom of the entrance pit but offset from it. They reported that much air leads into this dome, and the survey notes indicate another high lead that will also require a bolt climb. These appear to be good leads.

With Goat Cave's strong airflow and remaining leads, I believe it will be worthwhile to return to attempt following the air. Goat is located not far south of San Agustín and Río Iglesia, and given that the cave has strongly sucked in air on every trip indicates that it is a high entrance, but not to the known Huautla System, as its entrance is just meters higher than Sótano de San Agustín, a low entrance. The cave is in a great location to find the Cueva de Agua Carlota and Río Iglesia streams, if it can be followed deep enough. The possibility of finding parts of the Huautla System beyond the deep terminal sump in San Agustín will indeed lure us back to follow the air.

Exploración de la Cueva de Tienzo por P.E.S.H.

Se describe la exploración de la Cueva de Tienzo. Ha sido difícil seguir la corriente de aire, y hasta ahora la cueva tiene una longitud de 266 metros y una profundidad de 138 metros. Sin embargo, su ubicación al sureste de los límites conocidos del Sistema Huautla la hace un objetivo primario para acceder a zonas aún no descubiertas del sistema.

2017

ADDITIONAL CAVE DISCOVERIES

Mark Minton

In addition to our main objectives in the La Grieta section of Sistema Huautla, several other caves were visited during the 2017 Proyecto Espeleológico Sistema Huautla expedition.

Cueva del Gran Viento (Big Wind Cave): One of the more exciting new cave discoveries of 2016 was Big Wind Cave. The cave is complex, with passages on several levels, all moving air. On the last trip that year, we found high-level passages heading southeast that looked like they might finally lead us away from the mazy entrance section. This year we followed up on those. The best lead was a popcorn-encrusted keyhole canyon accessible by an awkward climb to ceiling level near the southern end of the cave. This passage was difficult to traverse due to the necessity of chimneying over a bottomless floor slot while dodging formations and fighting aggressive directional popcorn that was pointing toward us on the way in. The passage was going upstream, which was not what we had hoped for, but near the end of the first survey we noticed a hole in the floor of the canyon where a small stream had been pirated to a lower level. The 9-meter pit was slightly too tight to enter, but there was air coming up the drop and it looked larger below.

On the second survey trip we followed the keyhole canyon to a point where it got physically too tight and there were signs that we were not far from an entrance, such as bat guano, crickets, and small bones. But we encountered a side passage with an upper level that looked completely different. It was phreatic, lacked the ubiquitous popcorn, and began sloping down away from the way we had come. Shortly we encountered a 4-meter pit with airflow, once again slightly too tight at the top, but with better-looking passage headed north at the bottom. It looked like a classic Huautla drainage divide.

Although they will require widening to enter, the two pit leads still hold out hope for Big Wind Cave to connect with nearby Nita Nanta. Since Big Wind is located higher than any known entrance to Nanta, it would add depth to Sistema Huautla. Unusually for a Huautla cave, it currently requires no vertical work to explore, although that will surely change if one of the pit leads goes. The cave is currently 569 meters long and 38 meters deep.

Wrench-Eater Traverse (Entrance Pit in La Grieta): Although not in a new cave, Wrench-Eater Traverse was a fortuitous bit of exploration that had gone unaddressed for forty years. While helping to shuttle camp packs into and out of La Grieta during the last couple of expeditions, I had noticed a major ledge partway down the 50-meter entrance shaft. It looked like there could be significant passage at the far end, so I envisioned a bolt traverse. In 2017 we finally accomplished it.

The ledge was relatively easily attained by a straightforward bolt traverse but simply led back to known cave where the Hobbit Hole passage joins the main La Grieta entrance shaft. However, from the ledge a window was visible on the opposite side of the entrance shaft, and it seemed to open into passage beyond. This window was not visible from the usual route down the pit or from the Hobbit Hole route, so it had very likely never been seen previously. We immediately saw an opportunity to lasso a projection and create a J-hang to get us over to the opposite wall without a prolonged climb. Bob Alderson threw a rope across and I parlayed it into position. Bob tied a slip-knot and drew it up tight. With Yvonne Droms belaying, he gently made his way across and set a bolt. From there, a relatively straightforward traverse up to and along a low ledge got him to the lead. It led almost immediately to a drop with another pit beckoning beyond another short traverse.

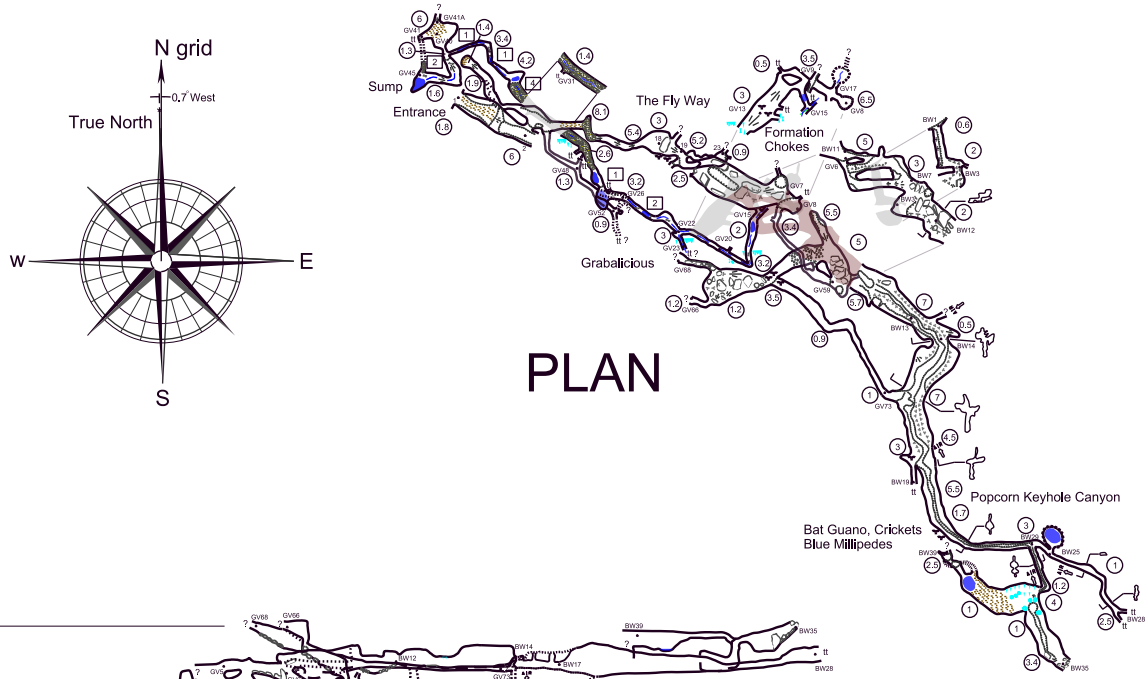
We explored a series of short drops that ultimately either got too tight or reconnected with the La Grieta entrance shaft farther down. Although not the hoped-for independent route deeper into the cave, it was nonetheless interesting exploration that adds still more complexity to the entrance area of La Grieta. A side benefit of this exploration was the fortuitous observation of a beam of sunlight that shined directly down the entrance shaft for about an hour in midday. Josh Hydeman and Rich Zarria joined us for a photo shoot, and Josh captured a spectacular image of the sunbeam.

Nita Nashi Arriba: While prospecting around the community of Plan de Arena, we were shown a walk-in cave with a metal gate across the entrance and a dysfunctional water system not far inside. The location matched closely with that for Nita Nashi, a 641-meter-deep cave explored back in 1982 but not connected to Sistema Huautla. (See *AMCS Activities Newsletter* 23 [1999].) However, none of the current infrastructure had been present back in the 80s, and as we had seen recently in the vicinity of Nita Nanta, land

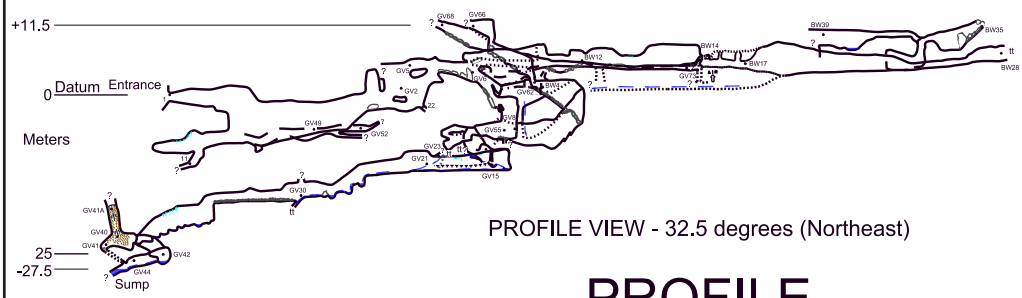
mminton@caver.net
Reprinted from *NSS News*, December 2017, pages 20–-21.

Legend

Main Passage
Lower Passage
Mid-Level Passage
Upper-Level Passage
Unexplored or Unmapped Passage
Breakdown
Small Rocks
Sand and Sediment Floor
Mud Floor
Sand and Gravel Floor
Bedrock Floor
Pool or Sump (as noted)
Stream
Pit
Dome
Ledge/Drop-off
Ceiling Ledge
Slope
Guano
Flowstone
Stalactites
Stalagmites
Columns
Soda Straws
Crystals
Helictites
Passage Height
Pit Depth (Plan)
Too Tight
Lead
Depth Below Entrance
Survey Station with Number
Direction of Airflow
Rigging (Profile)
Speleothems (Profile)
Water (Profile)
Breakdown (Profile)
P15 Pit Depth (Profile)



PLAN



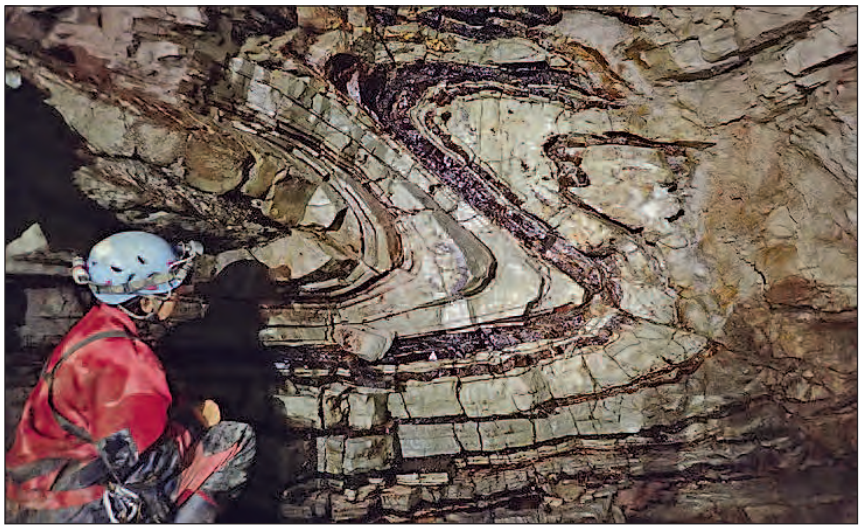
PROFILE VIEW - 32.5 degrees (Northeast)

PROFILE

CUEVA DEL GRAN VIENTO
(BIG WIND CAVE)
San Andrés, Municipio de Huautla de Jiménez, Oaxaca, México

0 10 20 30 60
Meters

Notes:
1. Total Surveyed Length = 639 meters. Depth = 39 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, October 2017
5. Surveyed April 2016 & 2017 By: Bob Alderson, Andy Chapman, Yvonne Droms, Adrian Miguel, Mark Minton, Eric Pelkey, Tommy Shifflett, Jim Smith,Paul Winter



Yvonne Droms views tightly folded bedding in Nita Nashi Arriba. *Mark Minton.*

use in the area had also changed, making positive identification difficult. As the only member of the 2017 expedition who had been to Nita Nashi, I visited the cave and confirmed its identity when I discovered an old self-drive bolt at the top of the first drop.

There are still leads in Nita Nashi, but more immediately interesting to us was another walk-in entrance slightly above and to the left of the gated entrance. Although only a few meters away, this entrance had surprisingly never been noticed in the past, probably because it had been hidden by thick vegetation. A strong breeze beckoned, and a brief recon led quickly to a window into the bottom of a large open-air pit that was also unknown to us.

We returned to the new cave, provisionally named Nita Nashi Arriba, with survey and photo teams a couple of days later. We felt certain that we would connect with Nashi proper, adding a few meters of depth to the latter. The short drop into the open-air pit was marginally free-climbable, but we rigged a traverse to the talus slope instead. Some fantastic folds were exposed in the walls of the lower end of the open pit, but all leads at the bottom ended in fill.

Surprisingly, a side passage near the top of the talus slope had very good airflow and led to a drop with large passage also visible on the opposite side. The passage across the pit was accessible by swinging over to a ledge, but it quickly led to a cliff entrance obscured by vegetation. The bottom of the pit intersected another small cave we had recently visited in the sinkhole below Nita Nashi. It quickly ended in collapse and fill.

That was the end of Nita Nashi Arriba. It unexpectedly headed away from Nita Nashi and did not connect in spite of its proximity. We surveyed a total of 213 meters to a depth of 33 meters, with four entrances. The fact that there were so many previously unknown entrances so close to a major cave indicates that there is still much to be discovered.

Descubrimientos Adicionales de Cuevas

Descripción de cuevas menores exploradas durante la expedición Huautla 2017. Las más importantes fueron la Cueva del Gran Viento y Nita Nashi Arriba.

2017

WATER IS MORE VALUABLE THAN GOLD

Josh Hydeman

Mike Green, Tennessee, and Brian Gindling, Montana, excitedly pack their PVC packs with space food, two hand drills, hundreds of feet of 9-millimeter static rope, and synthetic sleeping bags to go into La Grieta. Their plan changes every fifteen minutes, and every hour that goes by their entry time gets delayed. Their goal is to climb Doo Dah Dome, past a near-sump called the Pato Mojado, miles into this limestone crack in the mountains of Mexico's Sierra Mazateca. If they make it to the top of this dome they are into unchartered territory. It is hard to know what to pack when you don't really know where you are going. I join them to sherpa some of this gear to their camp while scouting the cave for locations for a photography trip I plan in a few days.

Our crew enters the cave around 5:00 p.m. We rappel down 300 vertical feet, passing technical rebelays and short traverse lines along the way. One rope after another, we keep descending. Then, we go even deeper. The number of ropes starts to seem almost comical to me."Wow . . . another rope!" I am just starting to realize what deep caving is all about. We just don't have caves like this one back home in Oregon. Occasionally I hear Brian yell out *yahoo* to the sound of his rappel rack whizzing down the rope. For just a few minutes Mike and Brian wait until Tommy and I catch up. Tommy Shifflett is co-leader of the Proyecto Espeleológico Sistema Huautla expedition, which is a team of around fifty cavers exploring for the month of April. I ask Mike, "Are we about to do some horizontal caving?" He looks to me for a just a moment, loading his rappel rack into yet another rope and says, "We are about to do some vertical caving." Before he is even finished speaking, he starts descending down, and his last words echo into the void below.

After another twenty rope drops or so we enter a narrow canyon floored with beautiful azure-blue water. Up ahead I hear Brian yell out another *yahoo* as I scramble along, trying to keep up, my PVC pack filled with drills and a hammer. We stem across water-filled canyons and work our way through tight passages. The canyon widens, and it is no longer possible to stay high and dry above the water. We walk neck-deep in cold water to the next section of cave,the Torture Chamber. I clip a safety lanyard tethered to my seat harness into a rope on the right side of the wall. Looking down below the crack, I hang from the rope and see another 6 meters below me. My pack, which is tethered to my seat harness, hangs low below me, scraping along the canyon walls as I pull myself across the traverse line.

Tommy gives me some rookie advice. "Don't bother trying to think about what you are going to do fifteen minutes from now. Only think about your next step. If you get caught up worrying about the summit you can miss your footing and make a fatal error." I take his advice seriously and stem across the slippery canyon, pushing against the adjacent walls. My confidence goes down when my climbing gear gets caught on horns and sharp blades protruding from below and from the sides; it's a very frustrating feeling to lose your momentum. It reminds me of having to fix a crampon that's coming undone while hiking up a steep, icy section of a mountain.

The canyon turns into a squeezing slot. I hoist myself up and push my pack ahead of me, hoping to push it far enough that it doesn't block my body as I try and crawl through. The cave goes left, then goes right. I climb up a 5-meter rope, stem 6 meters or so, and then rappel 12meters and enter a crawlway. I start realizing that the map we have, where the text is so small that even if I squint I can barely read it, might not help much in navigating through this jagged maze. I can, however, follow orange flagging tape and listen for the sounds of the others ahead of me. I hear their packs scrape across the walls, resonating with big echoes and splashes as they jump into pools of water.

We follow a creek until we reach a junction room. We stop and rest, chugging down water and eating snacks. And then it all hits me at once. We have descended 450 meters, deeper that I have ever been in a cave. I start thinking about the route back out and wonder how long it would take to do it. Rappelling fifty fixed ropes may only take five hours, but climbing back out will take much longer. And much greater effort. I remember Tommy's advice and try to push this idea as far out of my mind as possible. Focus on what is here now.

In 2016 an objective of the PESH expedition was to establish Camp 4 in the La Grieta section of Sistema Huautla, 600 meters deep and beyond the short sump named Pato Mojado (Wet Duck in Spanish), an area not seen since 1977. The main purpose was to climb Doo Dah Dome and look for other unexplored

joshhydeman@gmail.com
Reprinted from December 2017 *NSS News,* pages 15–17.

passages. But when cavers reached the area of Pato Mojado they weren't certain if they were at the right place and did not get past it.

Mike and Brian pull out the map and start scheming their next move. They don't include Tommy and me in their discussion. Tommy is on this leg of the trip for the free dive of the Pato Mojado. He has brought along a pair of goggles to help with that. Mike, Brian, and I are all under the impression that Tommy knows where the Pato Mojado is and has been there before, but in fact he has not.

"What time is it?" Mike asks. "10:30," Brian responds after looking at his watch.Being down here in the blackness of the Junction Room there really is no way to know what time is it.

"Let's eat real quick and then get going to look at the sump," Mike says in a combination of enthusiasm and frustration. Mike wishes we were already past the sump. If the route to the sump were rigged, which it is not, the travel time to the sump would be about three hours with ten or so rappels, ten traverses, and a Tyrolean traverse. Rigging this underground ropes course is going to take a lot of time and it will be a long night if we carry on. We move from the Junction Room to camp, set down our packs, and turn on a stove to prepare dinner. After eating a few spoonfuls of freeze-dried potatoes mixed with ramen and broccoli, Mike and Brian calm down a bit and decide to call it a day. They'll have a look at the sump in the morning.

Tommy forgot a change of dry clothing. He keeps reminding all of us that he has dealt with this issue before and it's no problem. Honestly, it sounded horrible. Imagine standing there in wet clothes trying to dry out before getting in a sleeping bag with wet clothes. Tommy's eyes light up as he tells us about camping on a wet, muddy ledge next to a deafening waterfall in a cave. I guess we have it pretty good here in Camp 1.5 with its mostly dried-mud floor and the faint sound of a creek just around the next bend. I realize that Tommy might actually enjoy the fact that he forgot dry clothes as he explains in detail sufferfest after sufferfest. Tommy was trapped in a Virginia cave behind a sump for a week wearing a wetsuit and without food. Which sounds like the most horrible thing ever and grounds for quitting caving altogether. The funny thing is that the day before, Yvonne Droms, another veteran Huautla caver, told me almost an identical story about getting trapped behind a sump for several days in West Virginia.

I'm relieved to change into the dry clothes I had not forgotten and get into a Mountain Hardwear sleeping bag. I lie next to Gerry Morrill of San Luis Potosí, another caver who was camping at 1.5 and who is moving on to Camp 3 tomorrow. Gerry tells me stories about a six-month deep-caving project he worked on in San Luis Potosí last year. His stories of crawling through super-tight passages with oxygen tanks because of dangerous CO_2 levels make La Grieta seem like child's play. It dawns on me that Gerry and I are in different leagues.

Gerry says goodnight, and I lie there listening to the creek flowing in the distance. Every time I shut my eyes, I think I'm hearing voices. I can't sleep. I rest my head on a 4-liter Nalgene bottle, and I think about how we got here. There is so much water; it's the water that led us here.

The city of Huautla de Jiménez, where La Grieta is located, supports about 31,000 people, which is almost unbelievable if you think about it. Surrounding Huautla de Jiménez is the Sierra Mazateca, a huge karst area. The terrain simply cannot support lakes or rivers or creeks because all water drains through it. But all water must drain somewhere, right?

Because water is so inaccessible to the people of Huautla, they are extremely conservative with what they have. During the wet season, which usually lasts from May to November, rainwater is collected in cisterns. But in the dry season, when water is scarce, it is trucked in from neighboring areas. Part of the beauty of having natural watersheds above ground such as rivers and lakes is that they not only collect water, but they also store it during drier seasons. Think of the storage capacity of a lake versus a few cisterns in your backyard. What the people of Huautla can't collect and store, they

Lee White and Adam Haydock try to stay dry while following a series of ropes in a steep, wet canyon in La Grieta. *Josh Hydeman*.

Richard Zarria rappelling through beams of sunlight in the entrance of La Grieta. *Josh Hydeman*.

have to purchase. And as the climate grows warmer and warmer each year, they find themselves spending more and more on a basic necessity for life.

And water doesn't just quench thirst, it also grows food. Because the rainy season has been shortening year-to-year, it means less water for farmers and a less predictable harvest. The local Mazatecs grow corn, coffee, and sugar cane, which supports their economy and thus their ability to truck in water. It's a fragile, cyclical system that is entirely dependent on one critical resource—water is more valuable than gold.

The most interesting thing about all of this is that these people are literally sitting on a gold mine. There is a vast amount of water in this area; it just happens to be 1000 meters below ground in a cave. The fifty years of mapping the caves in the Huautla region has been an incredible achievement for the local population, so they can one day build the infrastructure they need to sustain their way of life. Maybe one day this won't be a city of 30,000 but a city of 100,000 or larger.

During PESH's first expedition in 2014, the local government sent a staff member to talk with co-leader Bill Steele to ask for advice on what they could do to address a growing shortage of water in the Sierra Mazateca. Their population steadily grows, and being in the tropics, they have a rainy season and a dry season, six months each. Steele told me, "I told this person that we know where large reservoirs of water are in Sistema Huautla, that they are perpetually full, with one being surveyed at 800 meters deep. We can tell them precisely on the surface where a well could be drilled to access these large reservoirs of water. However, they are over 1,000 meters below the surface, so it would be both technically challenging and expensive, but possible."

Not only are cavers exploring these caves from the high entrances in the mountains, they are also seeking connections and pushing into the system from the bottom, exploring the water-filled resurgence in the canyon from the south. The Huautla Resurgence Cave Diving Team dives through the water-filled portions and climbs in the air-filled sections, approaching the Huautla caves from below. Hydrologist James Smith from Georgia conducted dye-traces in the '80s to study the water's path. Knowing where the water traveled led cavers to where they need to explore to make connections.

When people think of expeditions, they're immediately drawn to epic views from atop 8000-meter peaks. So why do the opposite and descend into utter darkness? In essence, what is all this expedition caving about? It's hard not to think of Gregory Mallory's brash comment about his motivation for climbing Everest. "Because it's there," he said. In fact, summiting Everest and bottoming-out the Huautla caves are pretty similar, with a few exceptions. But where Mallory falls short, I think Steve Knutson, a veteran Huautla caver, puts it well. He says, "Setting depth records and such is just a bit of fallout from what's really important—the experience, the happening, the doing. The feelings you experience as you are in the doing of such things is priceless. And there is no way to get it without going out to the cutting edge." It wasn't just the water that led us there; it was a thirst for the cutting edge.

Mike and Brian, along with Damien LeBrun-Grandié, who had joined them, eventually did successfully climb Doo Dah Dome about six days later and earned themselves a case of beer each from Bill Steele. Camp 4 was established and another, more promising dome named Hoo Hah Dome was discovered, with a plan to climb it in 2018. Each caver on the expedition contributed in different ways, and over 2 kilometers of passage was added to the map. One caver demanded everyone on his mapping trip stay in the cave as long as possible to continue surveying because "I want to be done mapping La Grieta this year." Another caver commented, "That's not how it works. Caves don't just end." This is where you realize why fifty years of exploring this cave system are not enough.

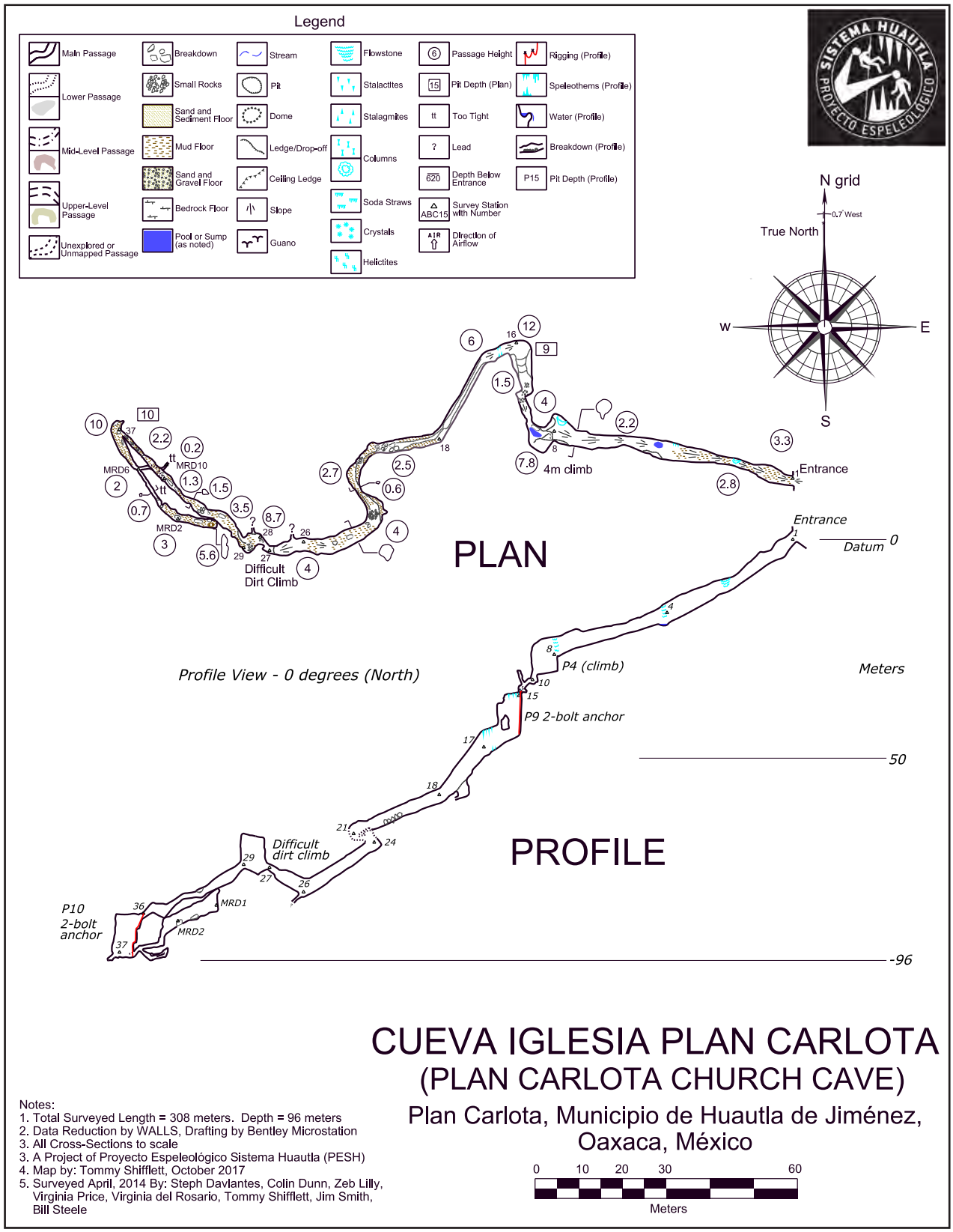
The cave keeps going.

El Agua es Más Valiosa que el Oro

Reflexiones durante un campamento en las profundidades de La Grieta (Sistema Huautla), desde el punto de vista de un novato. Hay mucha agua en las cuevas, lo cual puede ser problemático para los cueveros, pero podría ser un recurso muy valioso para los habitantes de la zona en la época de secas.

SMALL CAVES IN THE P.E.S.H. AREA

Cartography by Tommy Shifflett



CUEVA IGLESIA PLAN CARLOTA

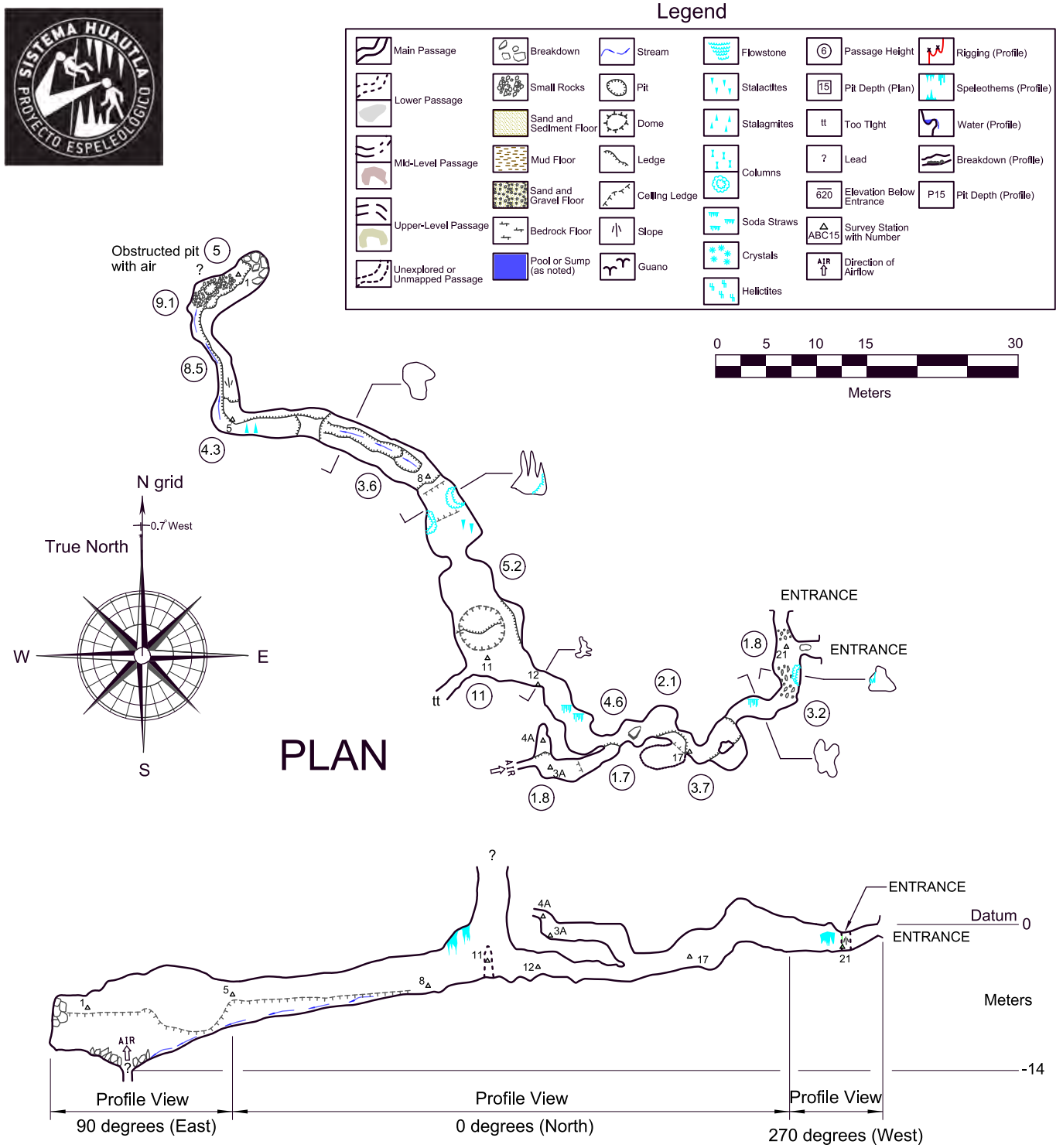
(PLAN CARLOTA CHURCH CAVE)

Plan Carlota, Municipio de Huautla de Jiménez, Oaxaca, México

Notes:
1. Total Surveyed Length = 308 meters. Depth = 96 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. All Cross-Sections to scale
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, October 2017
5. Surveyed April, 2014 By: Steph Davlantes, Colin Dunn, Zeb Lilly, Virginia Price, Virginia del Rosario, Tommy Shifflett, Jim Smith, Bill Steele

0 10 20 30 60
Meters

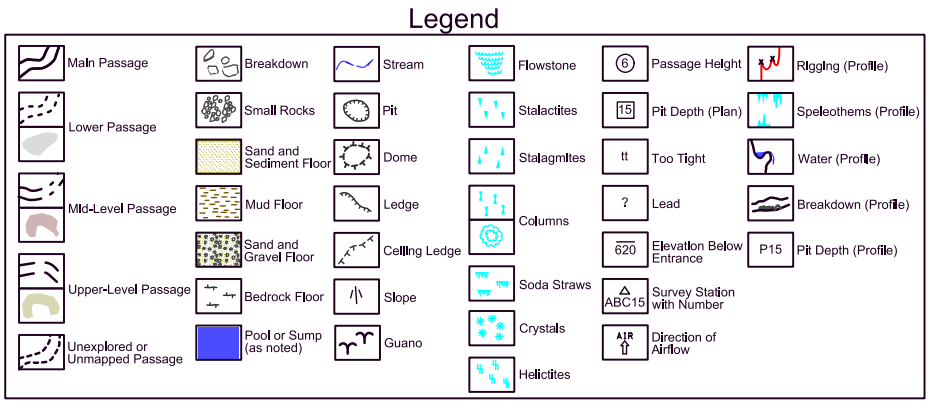
tommyshifflett@gmail.com

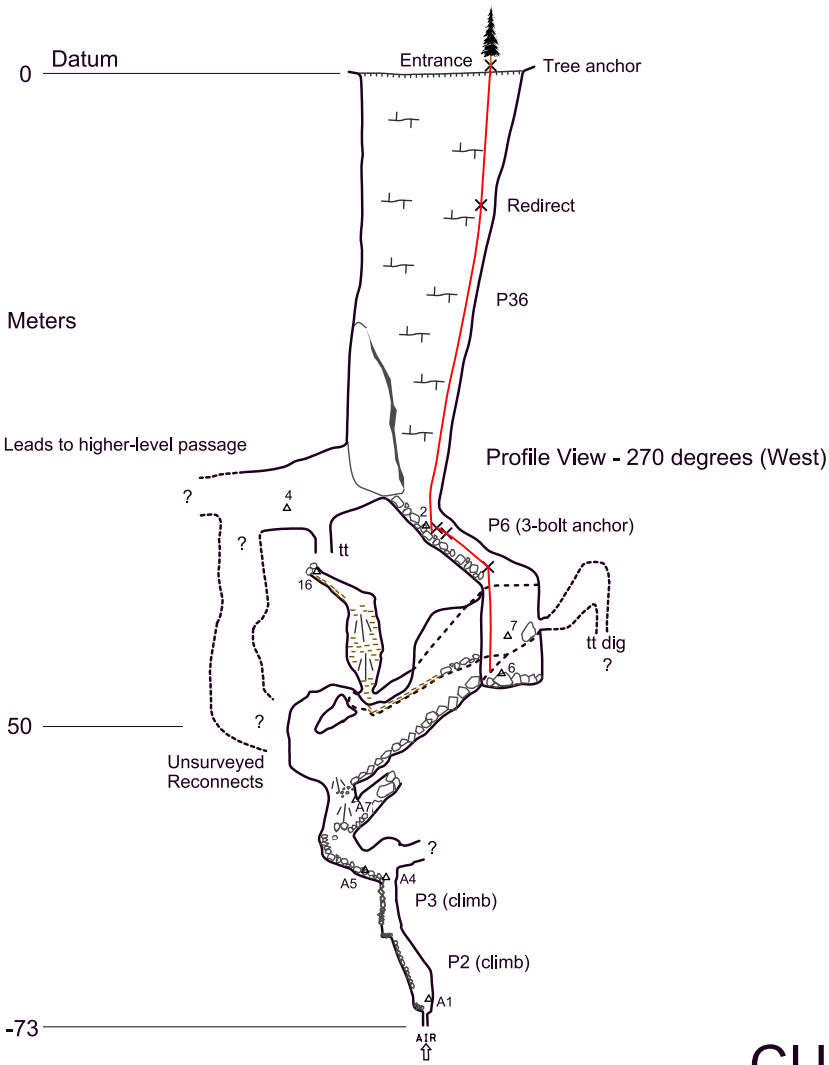


Notes:
1. Total Surveyed Length = 126 meters. Depth = 14 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. All Cross-Sections to scale
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, December 2017
5. Surveyed April, 2015 By: Yvonne Droms, Chris Higgins, Mark Minton, Jim Smith, Bill Steele

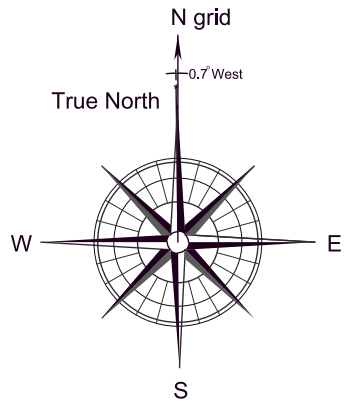
CUEVA DE AGUA DE CUERNO

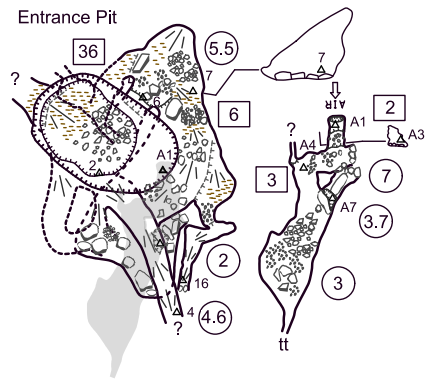
Plan Carlota,
Municipio de Huautla de Jiménez,
Oaxaca, México





PROFILE

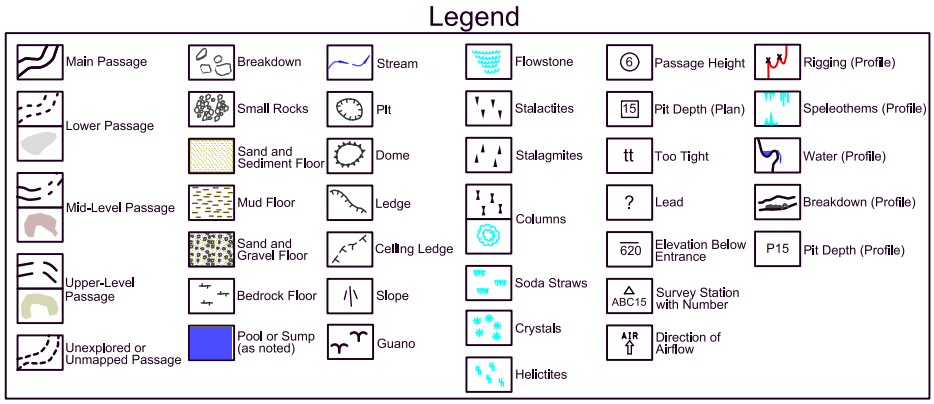


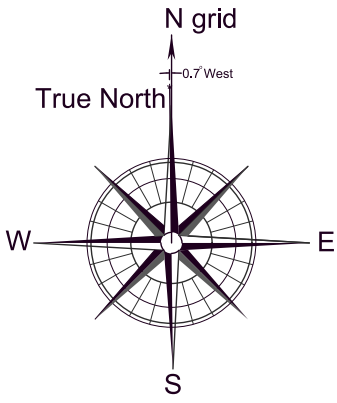


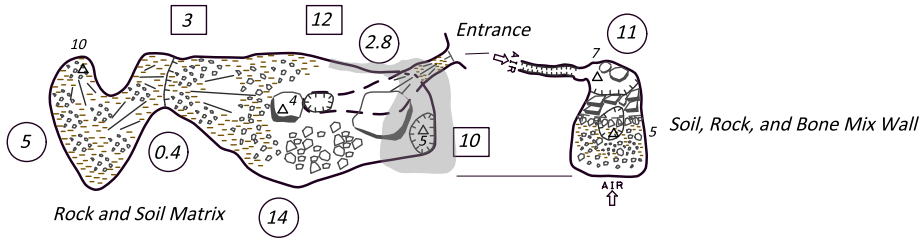
PLAN

CUEVA BALONCESTO
(BASKETBALL CAVE)
Plan Carlota,
Municipio de Huautla de Jiménez,
Oaxaca, México

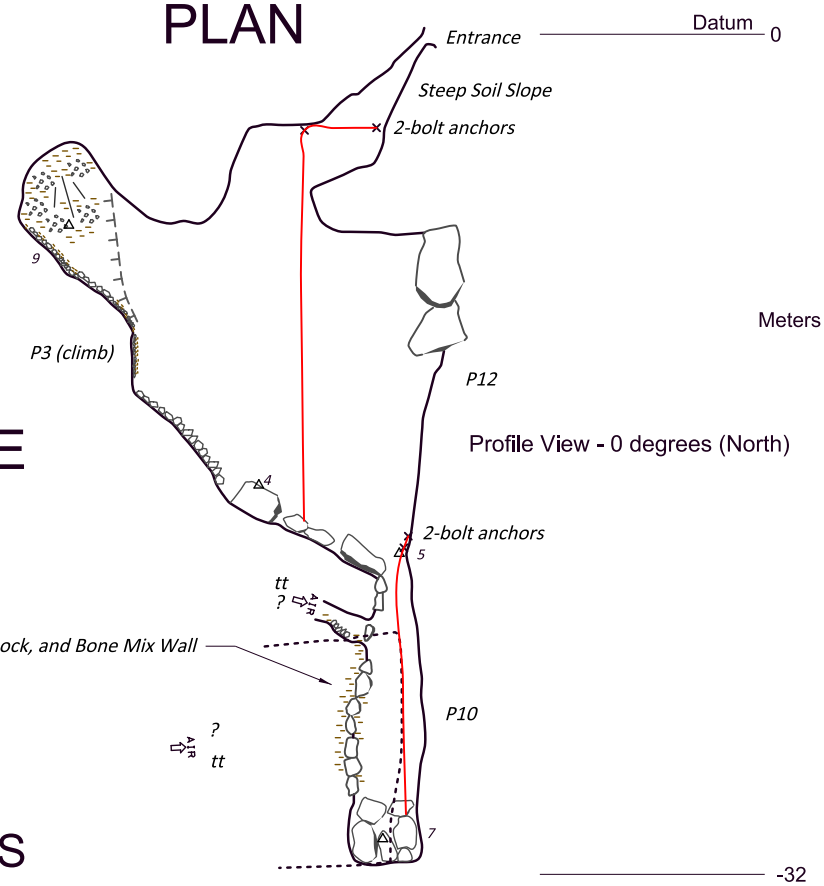
Notes:
1. Total Surveyed Length = 136 meters. Depth = 73 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. All Cross-Sections to scale
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, October 2017
5. Surveyed April, 2014 By: Virginia del Rosario, Tommy Shifflett Jim Smith, Scott Wahlquist







PLAN

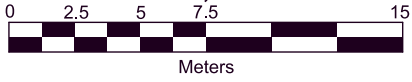


PROFILE

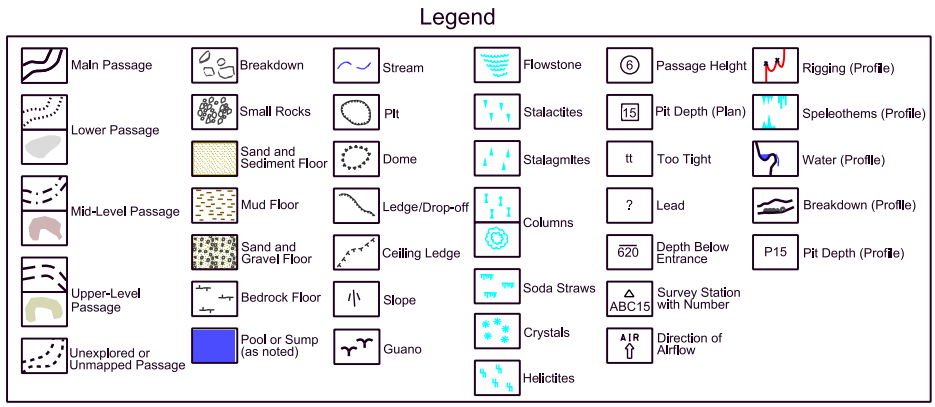
Profile View - 0 degrees (North)

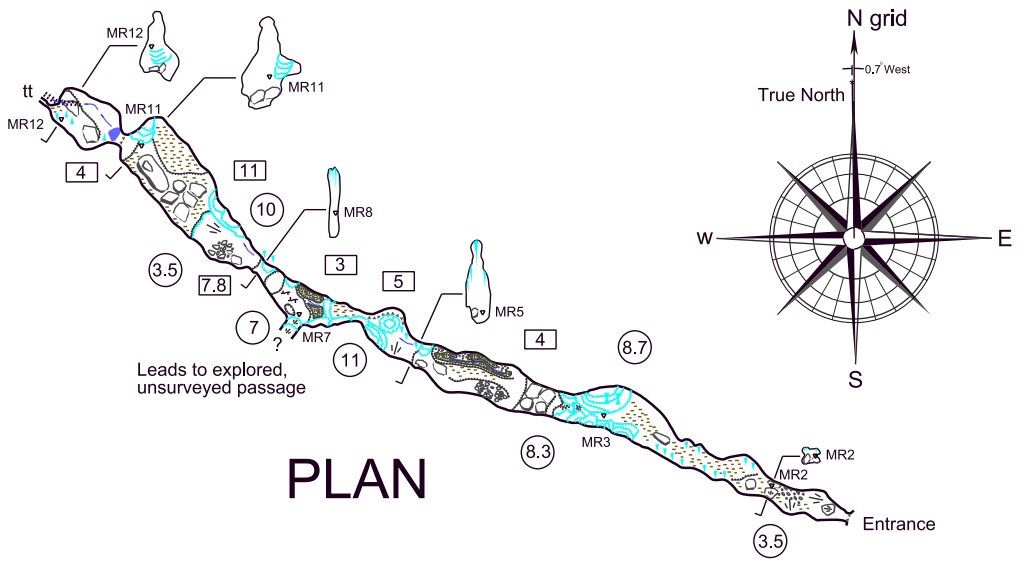
CUEVA de la PARED de HUESOS (Bone Wall Cave)

Plan Carlota, Municipio de Huautla de Jiménez, Oaxaca, México

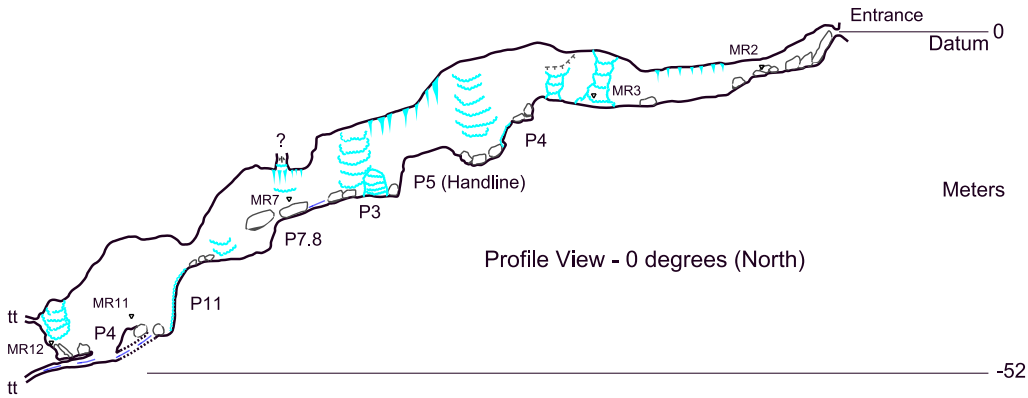


Notes:
1. Total Surveyed Length = 53 meters. Depth = 32 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, November 2017
5. Surveyed April 2016 By: Yvonne Droms, Mark Minton, Tommy Shifflett, Jim Smith





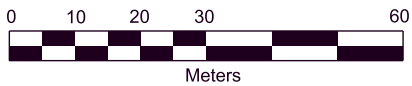
PLAN

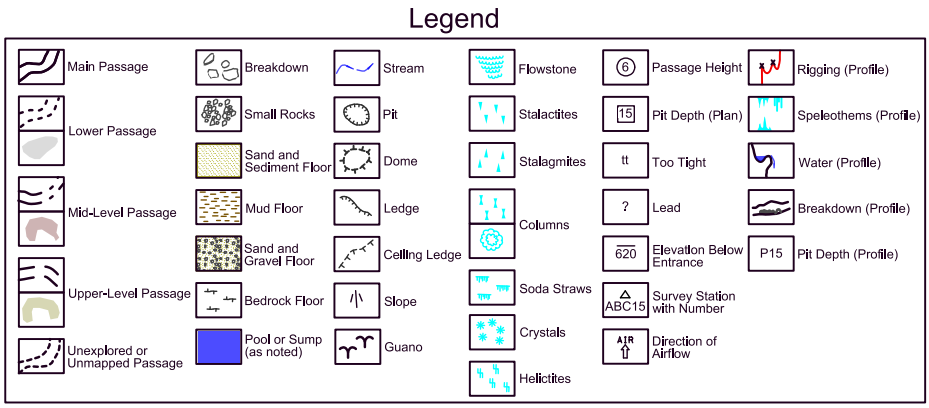


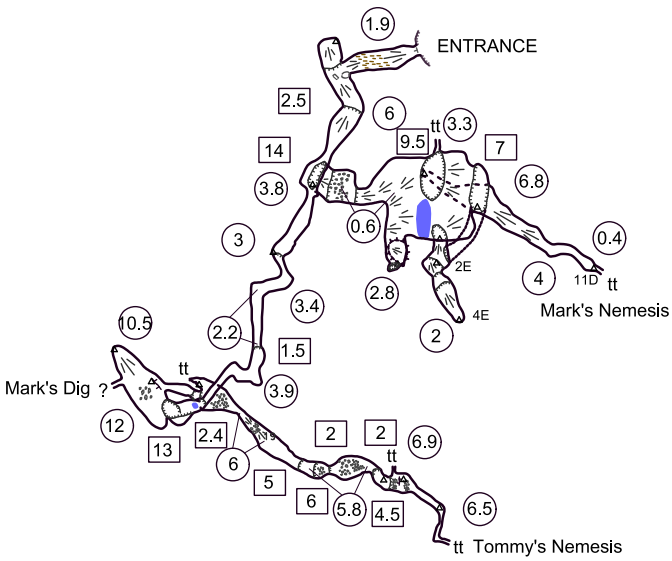
PROFILE

CUEVA DE EDUARDO
(EDUARDO CAVE)
San Agustín,
Municipio de Huautla de Jiménez,
Oaxaca, México

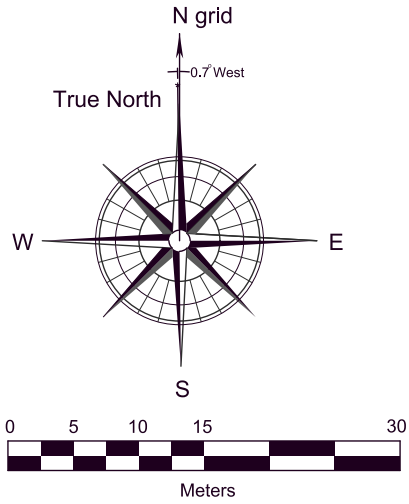
Notes:
1. Total Surveyed Length = 152.5 meters. Depth = 52 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. All Cross-Sections to scale
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, November 2017
5. Surveyed April, 2015 By: Corey Hackley, Katelyn Mahoney, Liz Rogers, Zeb Lilly

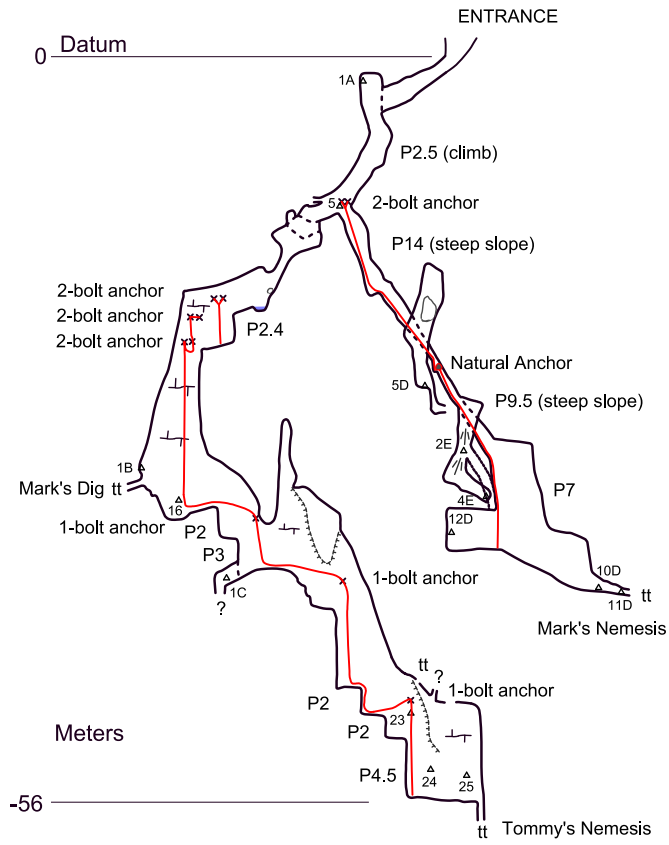






PLAN





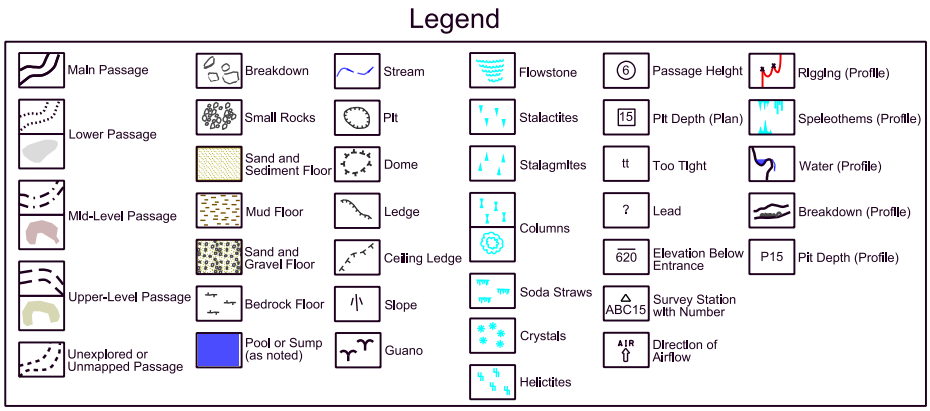
Profile View - 0 degrees (North)

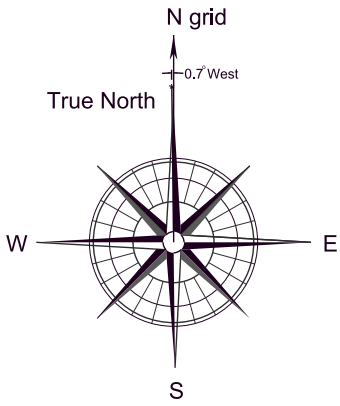
PROFILE

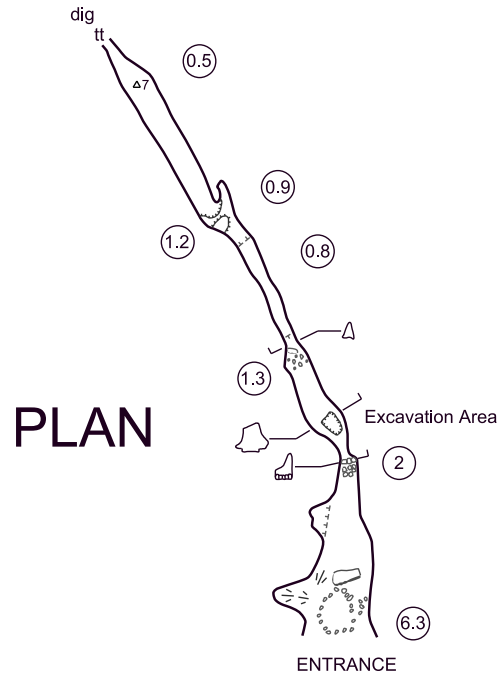
CUEVA DEL CEMENTERIO DE LAS CABRAS
(GOAT CEMETERY CAVE)

Plan Carlota,
Municipio de Huautla de Jiménez,
Oaxaca, México

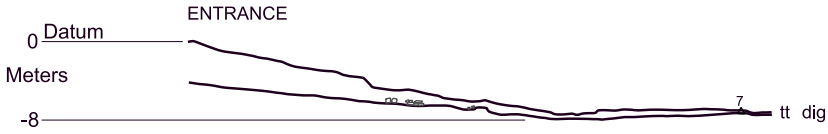
Notes:
1. Total Surveyed Length = 179 meters. Depth = 56 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. All Cross-Sections to scale
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, December 2017
5. Surveyed April, 2016 By: Mark Minton, Tommy Shifflett, Jim Smith, Scott Wahlquist







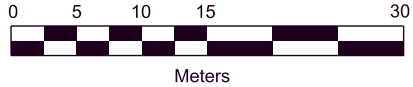
PLAN



Profile View - 270 degrees (West)

PROFILE

CUEVA DE ESCALERA
(LADDER CAVE)
San Andrés, Municipio de Huautla de Jiménez, Oaxaca, México

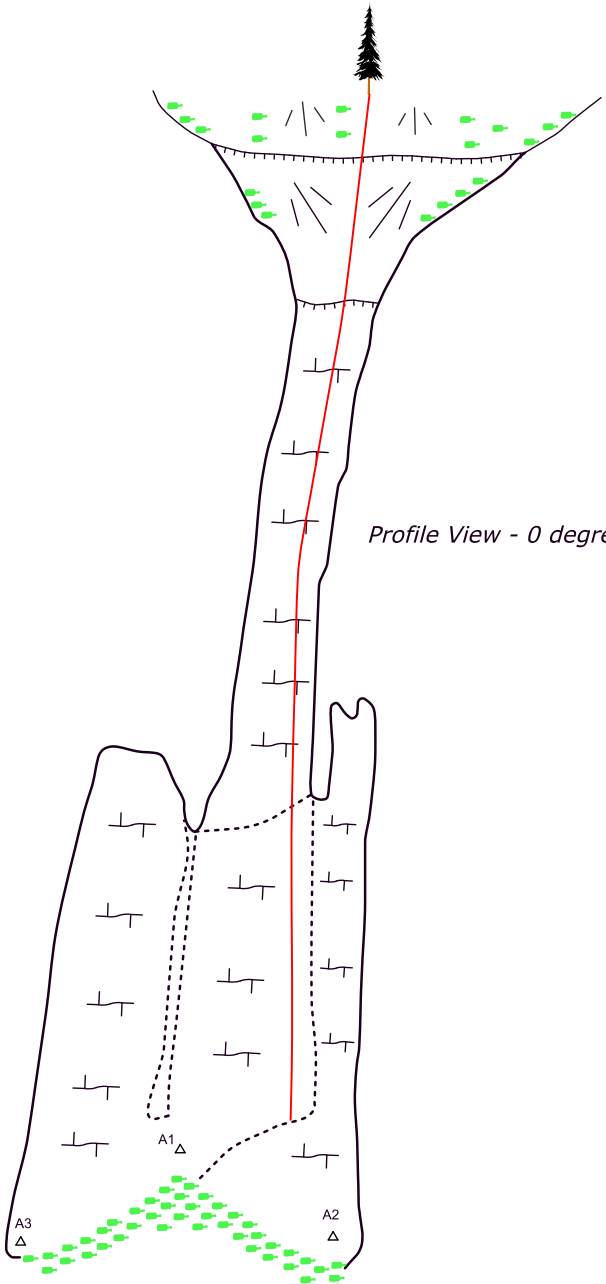


Notes:
1. Total Surveyed Length = 49 meters. Depth = 8 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, December 2017
5. Surveyed April, 2015 By: Yvonne Droms, Chris Higgins, Mark Minton, Jim Smith, Bill Steele

Legend

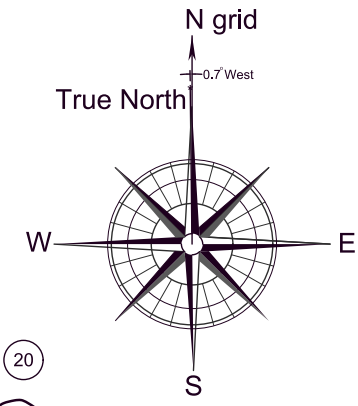
Main Passage
Lower Passage
Mid-Level Passage
Upper-Level Passage
Unexplored or Unmapped Passage
Breakdown
Small Rocks
Sand and Sediment Floor
Mud Floor
Sand and Gravel Floor
Bedrock Floor
Pool or Sump (as noted)
Stream
Pit
Dome
Ledge
Ceiling Ledge
Slope
Guano
Flowstone
Stalactites
Stalagmites
Columns
Soda Straws
Crystals
Helictites
6 Passage Height
15 Pit Depth (Plan)
tt Too Tight
? Lead
620 Elevation Below Entrance
ABC15 Survey Station with Number
AIR Direction of Airflow
Rigging (Profile)
Speleothems (Profile)
Water (Profile)
Breakdown (Profile)
P15 Pit Depth (Profile)

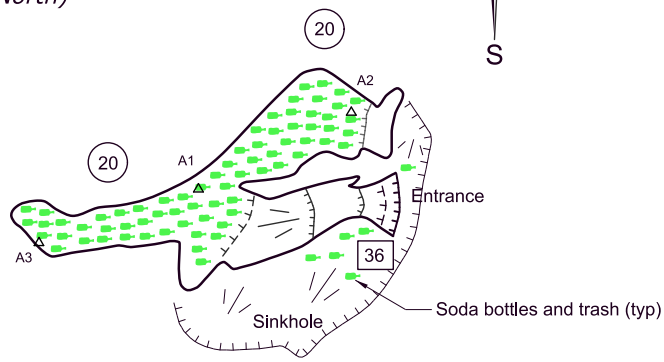
Notes:
1. Total Surveyed Length = 56 meters. Depth = 46 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, October 2017
5. Surveyed April, 2014 By: Tommy Shifflett, Scott Wahlquist



Profile View - 0 degrees (North)

PROFILE



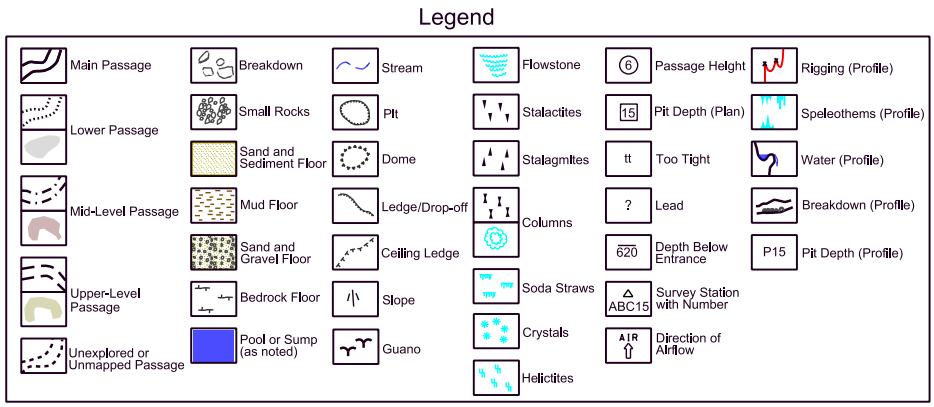


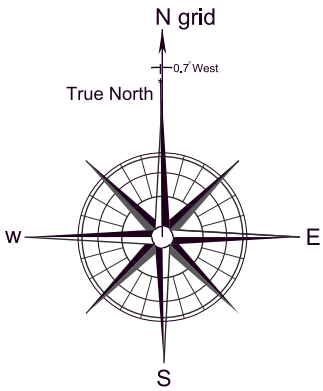
PLAN

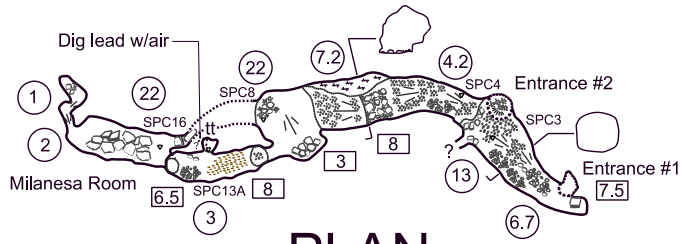
SÓTANO BASURA DE PLAN CARLOTA
(Plan Carlota Trash Pit)

Plan Carlota,
Municipio de Huautla de Jiménez,
Oaxaca, México

0 2.5 5 7.5 15
Meters

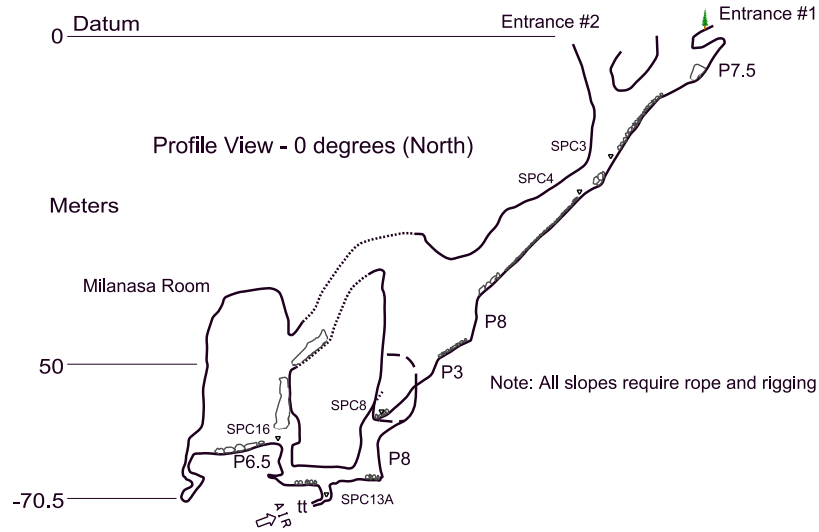






PLAN

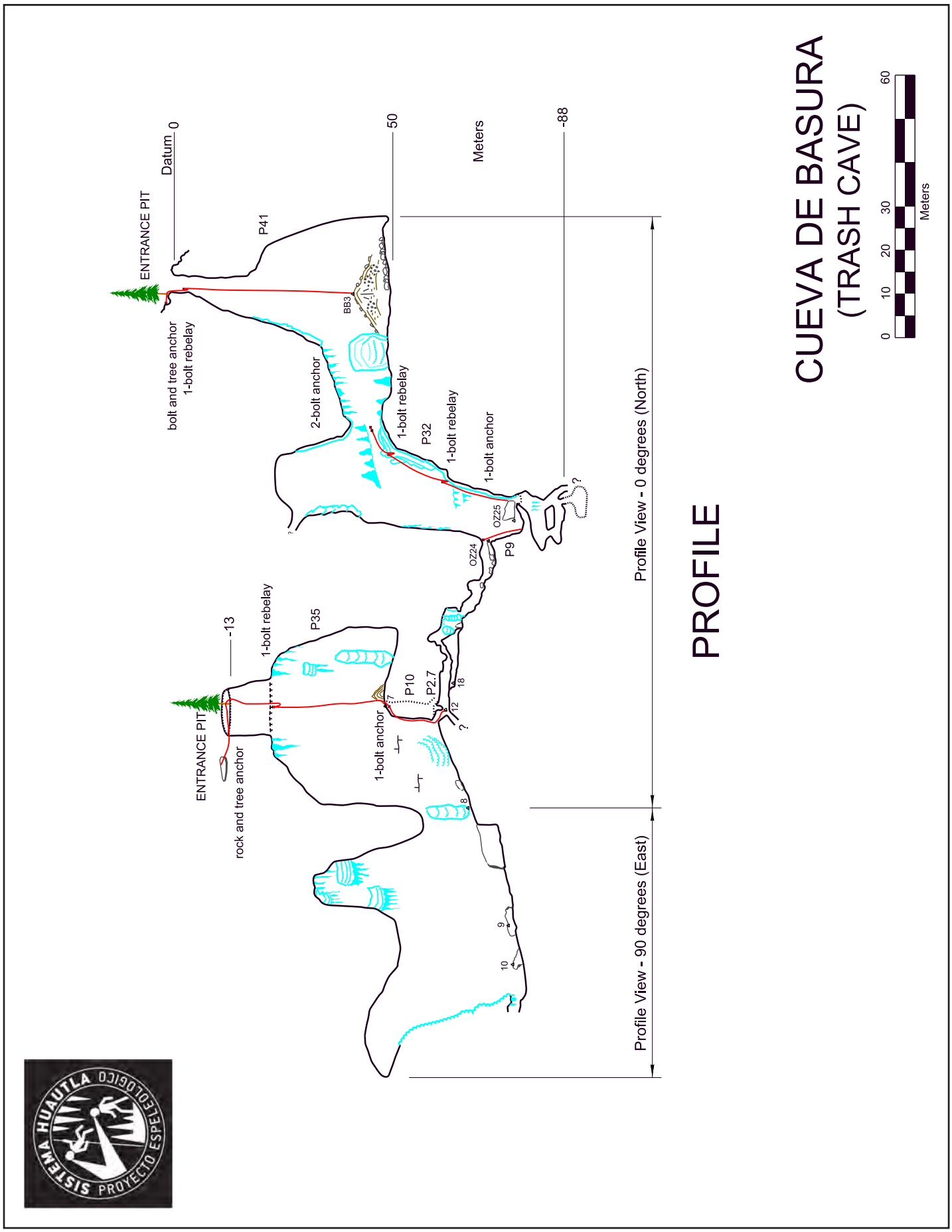
PROFILE

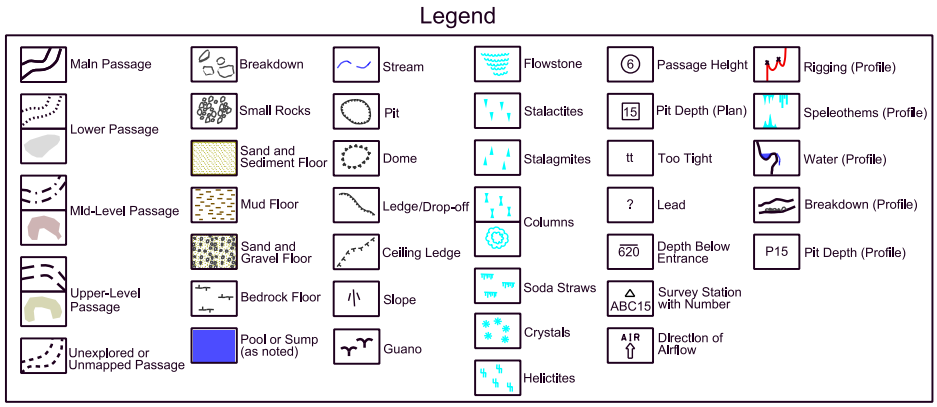


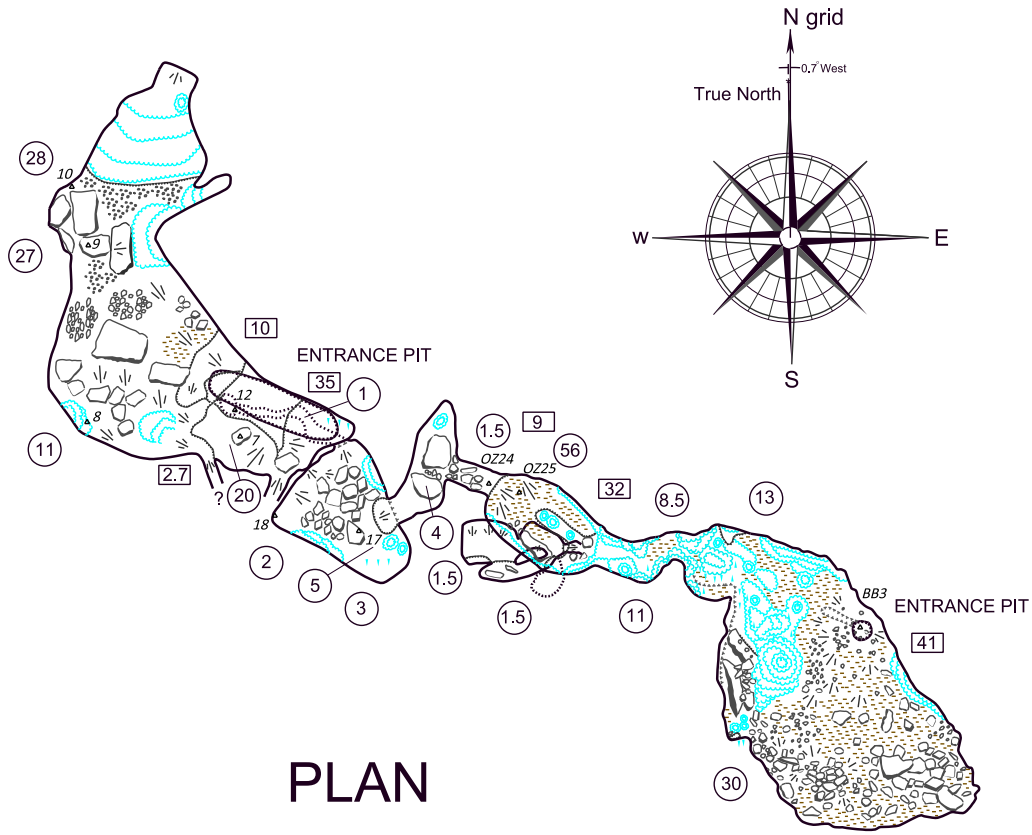
SOTANO PLAN CARLOTA
(PLAN CARLOTA PIT)
Plan Carlota,
Municipio de Huautla de Jiménez,
Oaxaca, México

0 10 20 30 60
Meters

Notes:
1. Total Surveyed Length = 157 meters. Depth = 70.5 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. All Cross-Sections to scale
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, October 2017
5. Surveyed April, 2014 By: Steph Davlantes, Vonny Droms, Mark Minton, Tommy Shifflett, Bill Steele


CUEVA DE BASURA
(TRASH CAVE)
0
10
20
30
60
Meters
PROFILE
Datum 0
-13
-50
-88
Meters
ENTRANCE PIT
bolt and tree anchor
1-bolt rebelay
P41
BB3
2-bolt anchor
1-bolt rebelay
P32
1-bolt rebelay
1-bolt anchor
OZ25
OZ24
P9
ENTRANCE PIT
rock and tree anchor
1-bolt rebelay
P35
1-bolt anchor
P10
P2.7
Profile View - 0 degrees (North)
Profile View - 90 degrees (East)
SISTEMA HUAUTLA
PROYECTO ESPELEOLOGICO





CUEVA DE BASURA
(TRASH CAVE)
San Agustín,
Municipio de Huautla de Jiménez,
Oaxaca, México

0 10 20 30 60
Meters

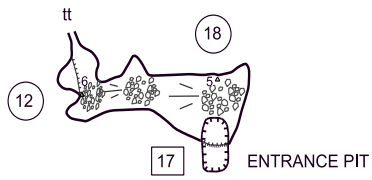
Notes:
1. Total Surveyed Length = 542 meters. Depth = 88 meters.
2. Data Reduction by WALLS, Drafting by Bentley Microstation.
3. All Cross-Sections to scale.
4. Map by: Tommy Shifflett, November 2017.
5. Surveyed April 2015 & 2016 by: Iván Alarcón, Mike Green, Chris Higgins, Chris Lafferty, Jason Lavender, Jim Smith, Matt Tomlinson

Legend

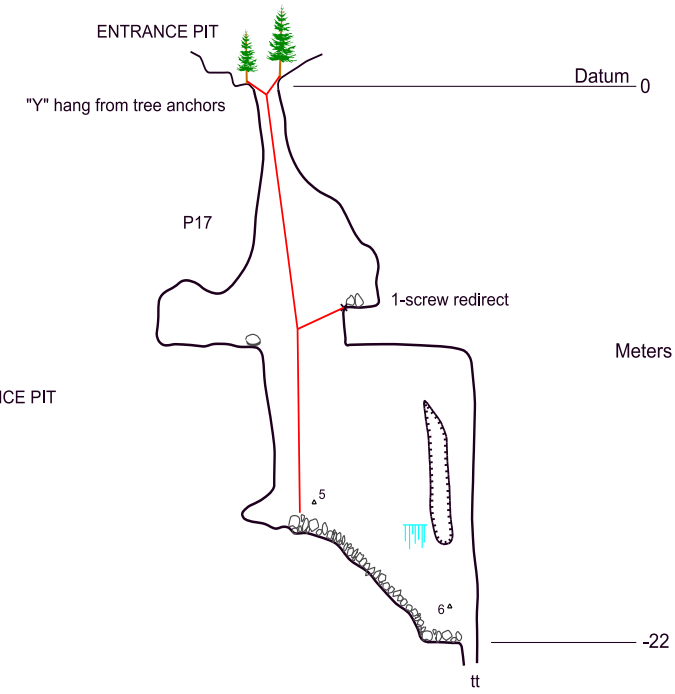
Main Passage
Lower Passage
Mid-Level Passage
Upper-Level Passage
Unexplored or Unmapped Passage
Breakdown
Small Rocks
Sand and Sediment Floor
Mud Floor
Sand and Gravel Floor
Bedrock Floor
Pool or Sump (as noted)
Stream
Pit
Dome
Ledge
Ceiling Ledge
Slope
Guano
Flowstone
Stalactites
Stalagmites
Columns
Soda Straws
Crystals
Helictites
Passage Height
Pit Depth (Plan)
Too Tight
Lead
Elevation Below Entrance
Survey Station with Number
Direction of Airflow
Rigging (Profile)
Speleothems (Profile)
Water (Profile)
Breakdown (Profile)
Pit Depth (Profile)

N grid
0.7° West
True North
W
E
S

SISTEMA HUAUTLA
PROYECTO ESPELEOLÓGICO



PLAN



Profile View - Extended East and North

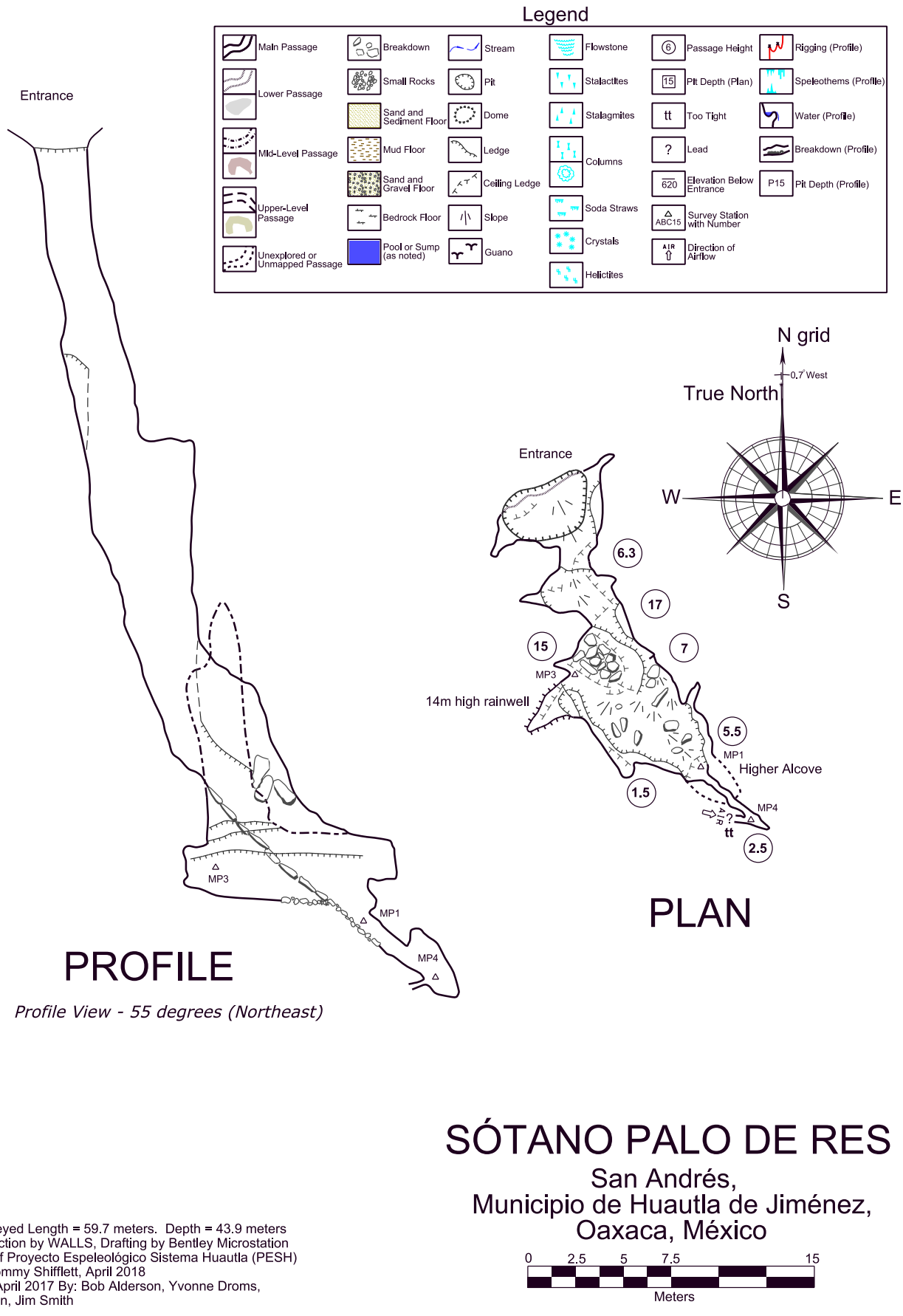
PROFILE

SÓTANO DE LA ARAÑA PATONA

Plan Carlota,
Municipio de Huautla de Jiménez,
Oaxaca, México

0 2.5 5 7.5 15
Meters

Notes:
1. Total Surveyed Length = 23 meters. Depth = 22 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, January 2018
5. Surveyed April, 2017 By: Stephen Gladieux, Johanna Kovarik, Alan Nieves

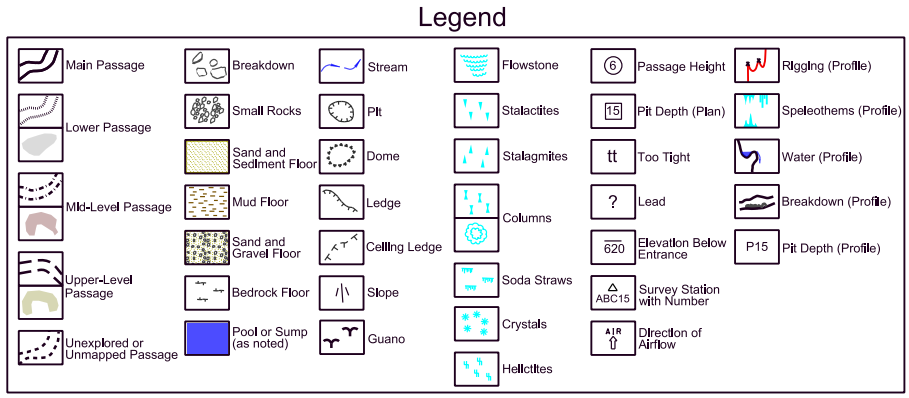


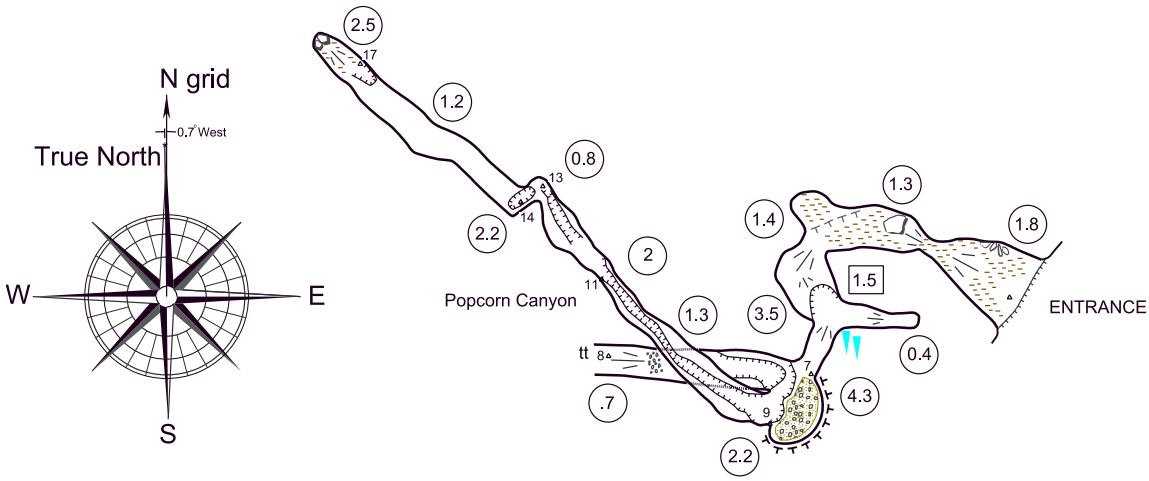
SÓTANO PALO DE RES

San Andrés,
Municipio de Huautla de Jiménez,
Oaxaca, México

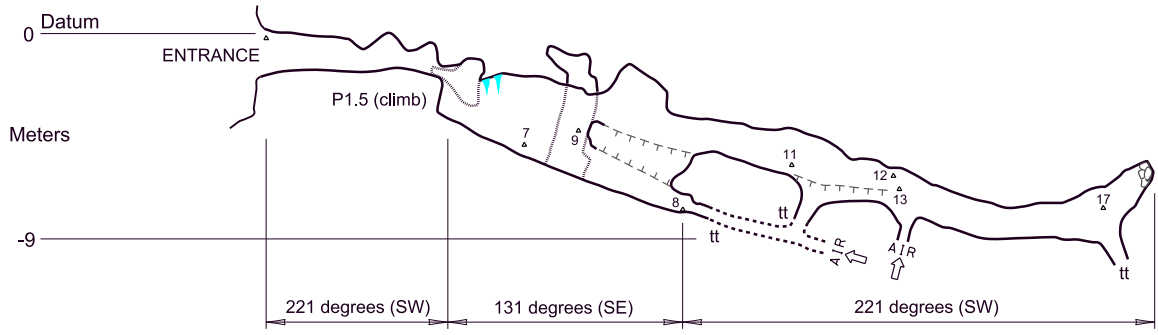
0 2.5 5 7.5 15
Meters

Notes:
1. Total Surveyed Length = 59.7 meters. Depth = 43.9 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, April 2018
5. Surveyed April 2017 By: Bob Alderson, Yvonne Droms, Mark Minton, Jim Smith





PLAN

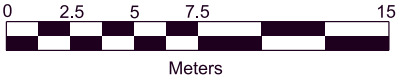


Profile Views - As noted

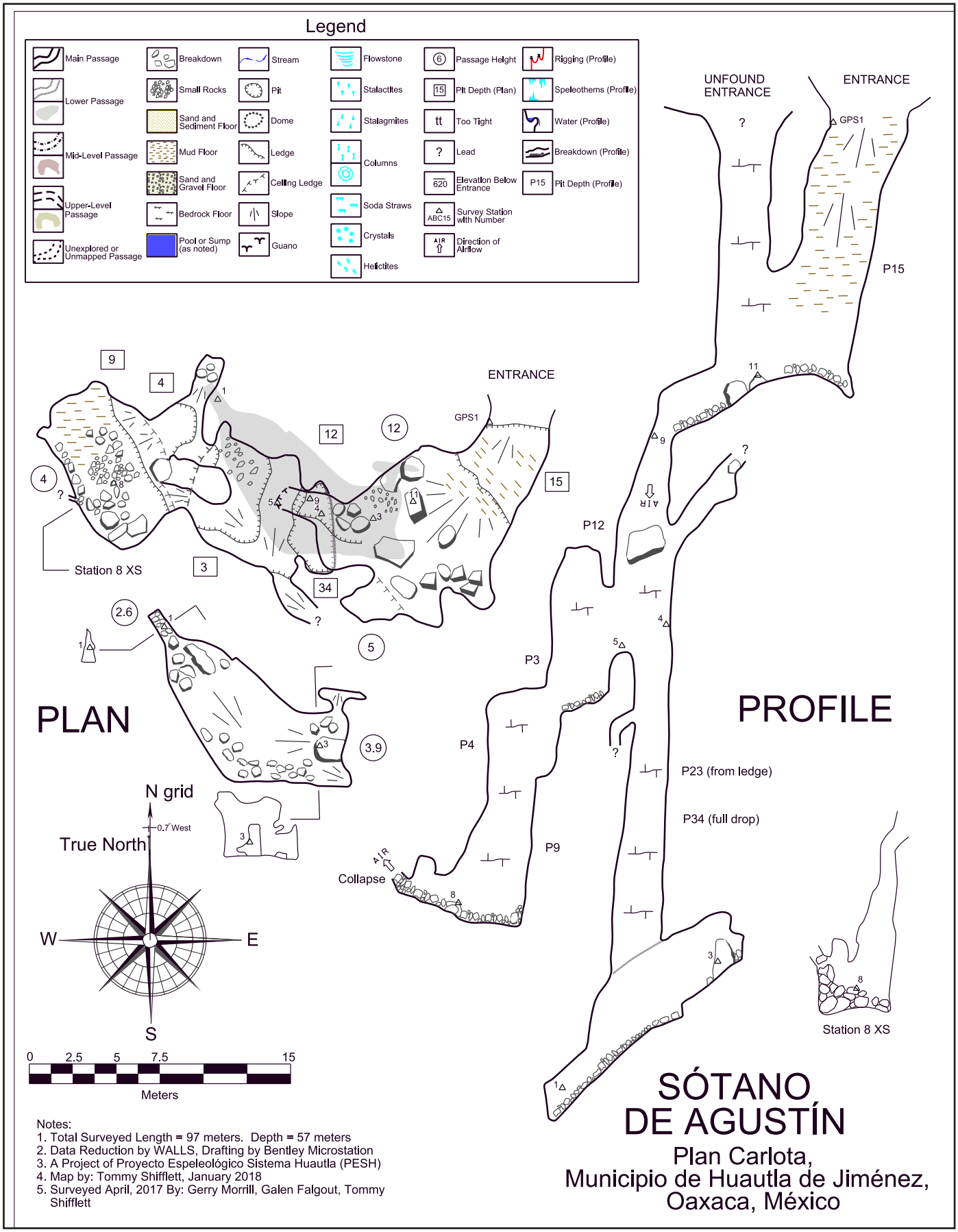
PROFILE

NITA GRIPE

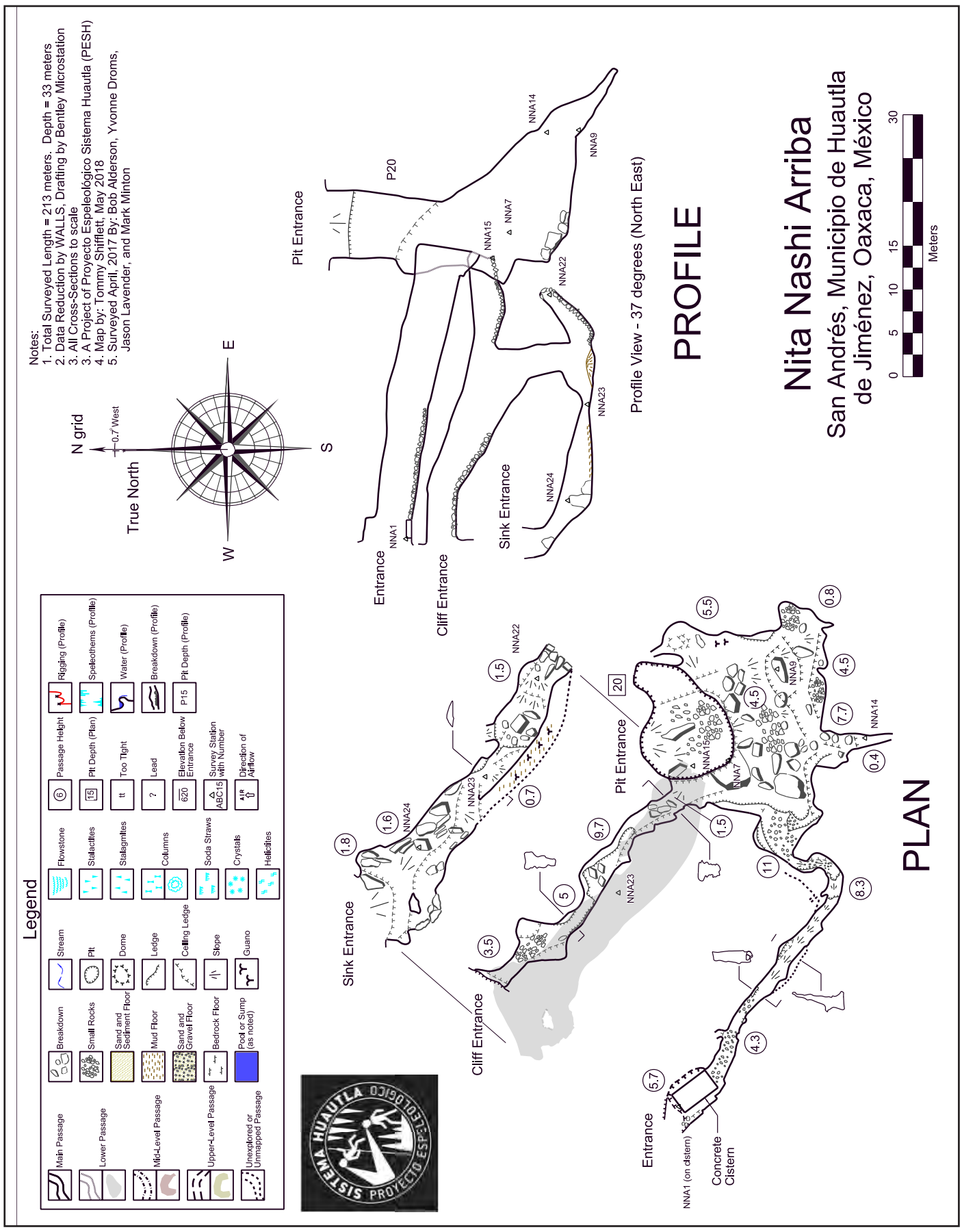
San Andrés,
Municipio de Huautla de Jiménez,
Oaxaca, México

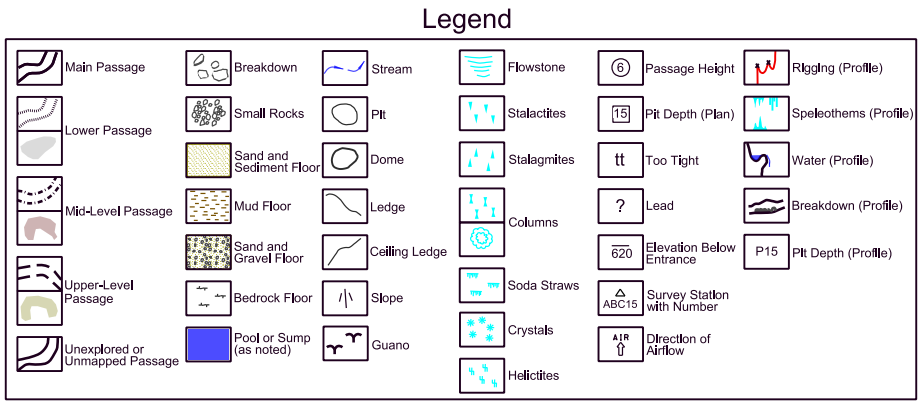


Notes:
1. Total Surveyed Length = 54 meters. Depth = 9 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, November 2017
5. Surveyed April, 2017 By: Alma K. Estrada, Tommy Shifflett, Jim Smith

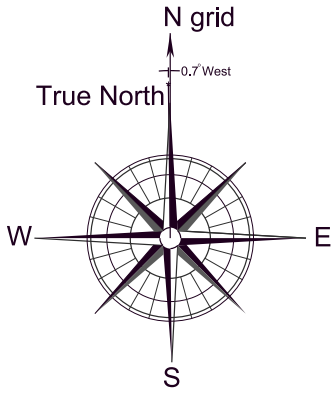


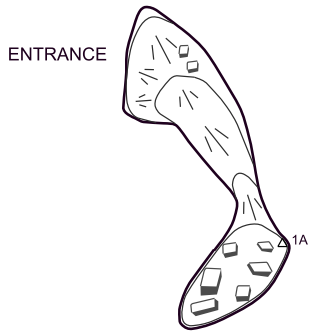
Notes:
1. Total Surveyed Length = 97 meters. Depth = 57 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, January 2018
5. Surveyed April, 2017 By: Gerry Morrill, Galen Falgout, Tommy Shifflett


Notes:
1. Total Surveyed Length = 213 meters. Depth = 33 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. All Cross-Sections to scale
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, May 2018
5. Surveyed April, 2017 By: Bob Alderson, Yvonne Droms, Jason Lavender, and Mark Minton
N grid
0.7° West
True North
W
E
S
Legend
Main Passage
Lower Passage
Mid-Level Passage
Upper-Level Passage
Unexplored or Unmapped Passage
Breakdown
Small Rocks
Sand and Sediment Floor
Mud Floor
Sand and Gravel Floor
Bedrock Floor
Pool or Sump (as noted)
Stream
Pit
Dome
Ledge
Ceiling Ledge
Slope
Guano
Flowstone
Stalactites
Stalagmites
Columns
Soda Straws
Crystals
Helictites
Passage Height
Pit Depth (Plan)
Too Tight
Lead
Elevation Below Entrance
Survey Station with Number
Direction of Airflow
Rigging (Profile)
Speleothems (Profile)
Water (Profile)
Breakdown (Profile)
Pit Depth (Profile)
Pit Entrance
P20
NNA14
NNA9
NNA15
NNA7
NNA22
NNA23
NNA24
Entrance
NNA1
Cliff Entrance
Sink Entrance
Profile View - 37 degrees (North East)
PROFILE
Nita Nashi Arriba
San Andrés, Municipio de Huautla
de Jiménez, Oaxaca, México
0
5
10
15
30
Meters
Sink Entrance
Cliff Entrance
Pit Entrance
Entrance
NNA1 (on dstern)
Concrete Cistern
PLAN
SISTEMA HUAUTLA
PROYECTO ESPELEOLOGICO

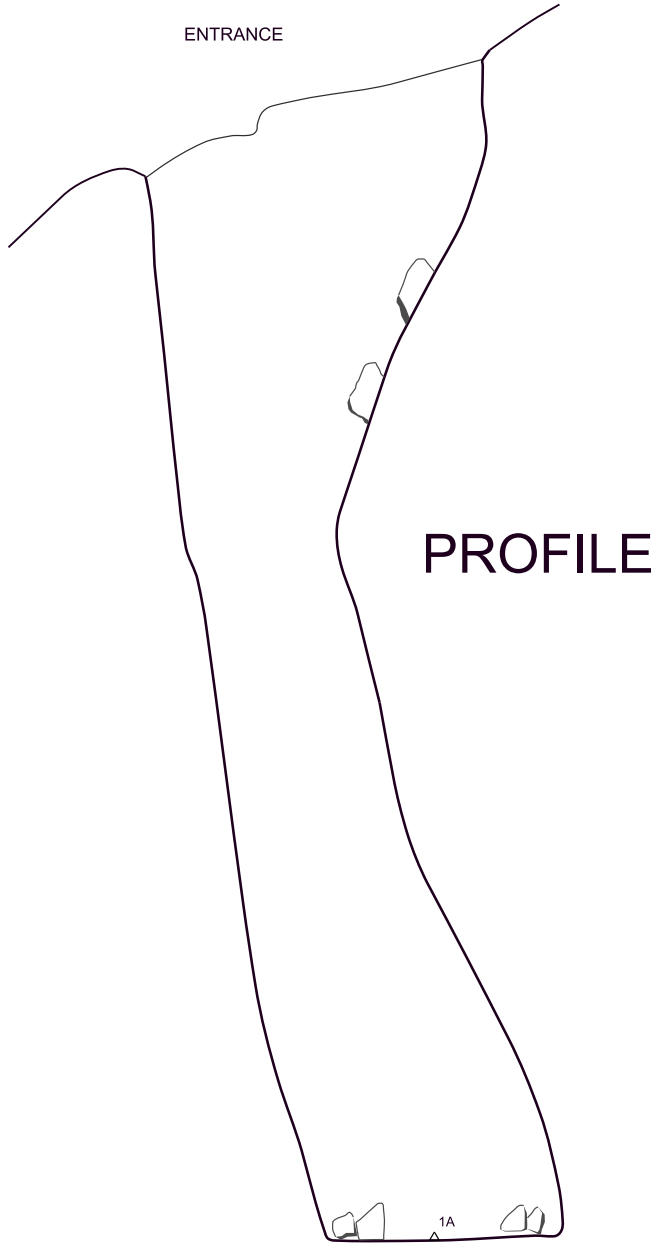


Notes:
1. Total Surveyed Length = 45 meters, Depth = 44 meters
2. Data Reduction by WALLS, Drafting by Bentley Microstation
3. A Project of Proyecto Espeleológico Sistema Huautla (PESH)
4. Map by: Tommy Shifflett, May 2018
5. Surveyed April, 2017 By: Kyle Lassiter and Lee White





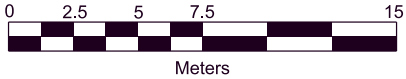
PLAN



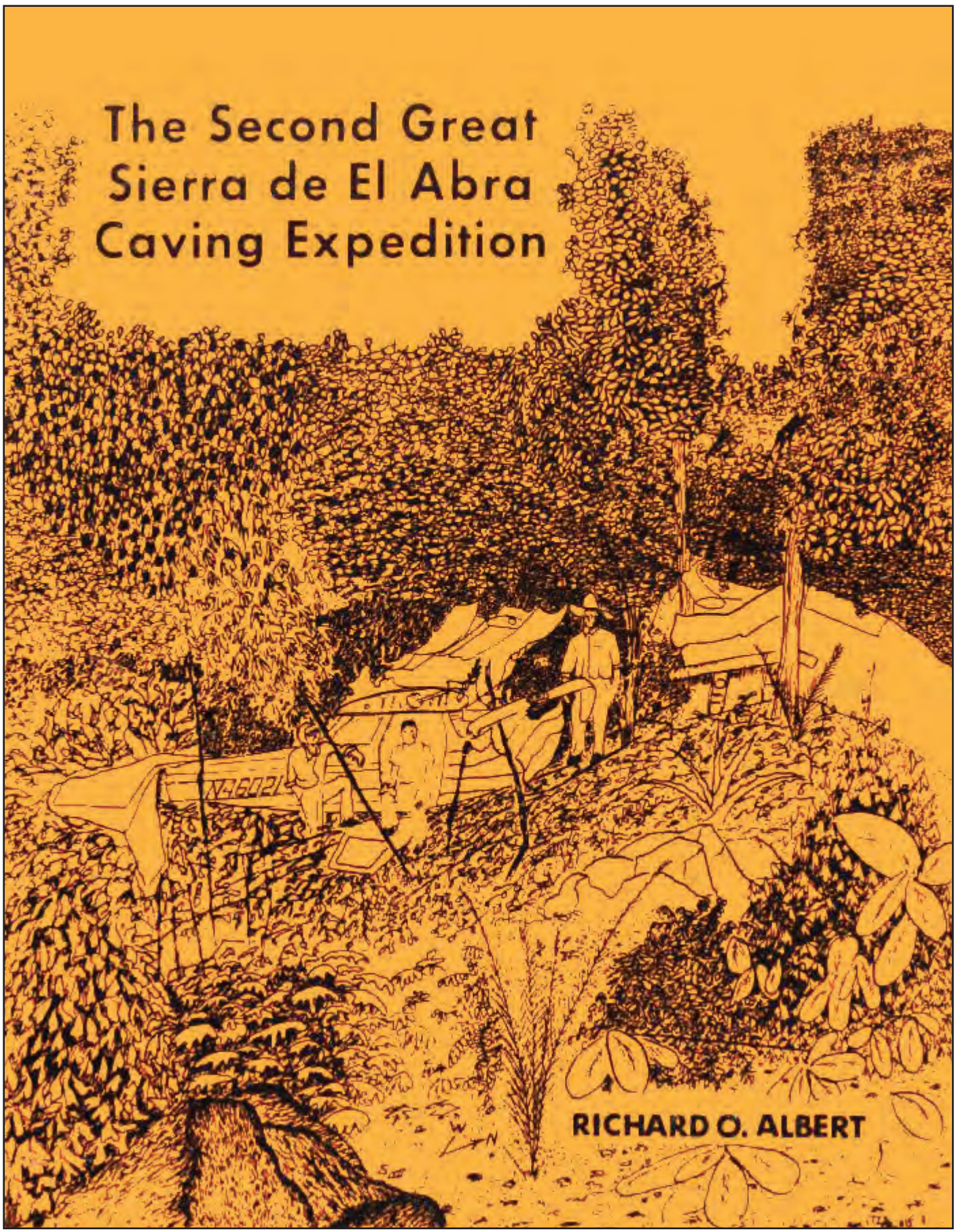
PROFILE

Perro's Plunge

Plan Carlota,
Municipio de Huautla de Jiménez,
Oaxaca, México



Profile View - 48 degrees (Northeast)


The Second Great
Sierra de El Abra
Caving Expedition
N4602L
RICHARD O. ALBERT

HISTORY

THE SECOND GREAT SIERRA DE EL ABRA CAVING EXPEDITION

Richard O. Albert

Notes on Richard O. Albert

Richard O. Albert, MD (September 10, 1920–March 10, 1990) was a surgeon, naturalist, pilot, caver, adventure traveller, and writer from Alice, Texas. He met his wife, Catherine Perkins Albert, while in the Navy in WW II; her nickname was Perky Wench or Perk. Their sons, Thomas R. Albert, a well-known caver, and David A. Albert, were part of this adventure story.

Richard went caving with Robert W. Mitchell and his associates in search of cavefishes of the genus *Astyanax* in San Luís Potosí and Tamaulipas, Mexico. He piloted a Cessna 172 airplane for a total of forty-eight hours on many flights in January-February and May-June 1969. They discovered many new caves that were soon explored and mapped and from which cavefishes were collected for science. We have records of twenty-five significant tasks done by Richard on these trips, including piloting the plane and co-discovering six new fish caves, Sótanos del Caballo Moro, Japonés, Matapalma, Palma Seca, Piedras, and Yerbaniz. Richard helped collect cavefishes in some of these caves. He and others also sighted significant new sótanos in the Sierra de Guatemala, Tamaulipas, and in the Sótano de las Golondrinas area near Aquismón, San Luis Potosí. Richard recounted the January 1969 trip in *AMCS Activities Newsletter* 29, 2006, and this second account completes his 1969 story. Later he made six trips in difficult terrain to find Sótano del Malpaís, which he had discovered from the air in 1969 and which he located and explored solo in 1972 (*AMCS Activities Newsletter* 40, 2017).

We hope that cavers will enjoy this colorful story. We have edited Richard O. Albert's manuscript to reconcile cave and place names with current caving and geographic terminology. Richard spoke and wrote Spanish fluently, but we have changed some Spanish words to more familiar ones. A few inadvertant errors and omissions have been corrected for clarity.

—William Elliott and Steve Bittinger

The original manuscript for this long article was found and scanned by Steve Bittinger. It was 71,000 words long. I have reduced it to half that length by deleting less interesting material such as visits to a local fair and an extensive discusion of difficulties, such as with the insurance company about the plane, that occurred after the return to civilization following the plane crash.—editor

This expedition began quite similarly to the first ["The Great Sierra de El Abra Caving Expedition", *AMCS Activities Newsletter* 29, pages 132–143], with Tommy Albert and Bill Russell coming down from the University of Texas Friday evening, and Bob Mitchell and Kenneth John arriving later that night. All spent the night in our home at 1800 Newell Street, Alice, Texas.

Robert W. Mitchell, Professor of Biology at Texas Tech University in Lubbock, was the leader of this expedition to study the caves of the Sierra de El Abra area near Ciudad Valles, San Luis Potosí. Bob had been at this project for several years, not only doing a great deal of research himself, but doing a grand job of coordinating the efforts of others as well. I had been engaged as pilot for the group in an expedition in January 1969 and now was going again to fly them for additional aerial reconnaissance to do photography, mapmaking, and searching for new caves. I had been looking forward to this second expedition, as I enjoyed the work and the companionship of the biologists.

Saturday, 5-24-69. Bob and Ken left in the Carryall towing the Jeep, as it would take them nearly all day to drive down to Ciudad Valles. Bill, Tommy, and I drove down to the Kleberg County Airport at Kingsville and rented the same little Cessna 172, N46021, put our gear aboard, and took off. It was rather pleasant flying, and we flew down low over the coastal oak forests and beautiful sand dunes, which we had not realized were so extensive, and saw quite a few wild turkeys. Then we landed at the Matamoros Airport, where we had to clear customs and immigration, get visas, plane clearance, etc. They didn't want me to file a flight plan to Ciudad Valles, since they said it was already too late and I would never get there before dark, so they made me file a flight plan for Tampico. However, they said that when I got close enough I would be able to contact Tampico by radio and cancel my flight plan if I saw that I could make it to Ciudad Valles all right.

We took off, heading in a south-southwesterly direction, crossing broad expanses of coastal prairie. It really seemed somewhat monotonous flying along here, and not as enjoyable as some other flights we had been on. Here we were flying along at about 2,000 feet, and not just above the treetops as we had back in Texas. Soon the relief became greater, and we reached the north side of the Sierra de Tamaulipas. It was a mature mountain system, as it had been quite cut up by ravines and canyons already, and the streambeds

were just beginning to meander and widen their canyons. When the canyons had been widened to greatly reduce the peaks and ridges between them, then the mountains would be old.

Tommy was flying along here, but he didn't seem to want to fly any higher, and higher we must fly if we were to go over the peaks, so I took over again. It really didn't look too good right here, since the sierra was covered by a mass of clouds, so it appeared that we would not get to see these mountains as we had hoped. We went higher and higher, and still the tops of the clouds went higher and higher, too. I wondered just how this was going to work out, as if we did get over the mountains above the clouds all right, we then might find the clouds extended all the way over to Tampico and down to an unknown distance above the ground. If that were the case, we might really be in bad shape, and have to turn around to fly back over to the north side of the sierra again and perhaps try to fly underneath the clouds. Maybe we might even have to land at Ciudad Victoria to spend the night, and we did not relish the thought of that.

The plane was not climbing as fast as the clouds were, and we found ourselves sailing along in deep troughs in high cumulus clouds that provided a practically solid cover underneath us. It did appear that we were sort of approaching the top of a cloud mountain, and as it turned out, we did. On the other side we began to descend somewhat from the nearly 9,000 feet to which we had climbed, and then to our relief the clouds did thin out to become only a widely scattered layer underneath, so most of the ground was visible. We had indeed left the Sierra de Tamaulipas far behind now and were crossing a rather broad, flat plain as we continued to the southwest.

It appeared that we would be able to make Ciudad Valles all right, and if not that at least the airport at Tamuín. I called the airport at Tampico, was able to raise them right away, and cancelled our flight plan to Tampico. It was getting rather late and the visibility was decreasing somewhat, but after a time we could see the Sierra de El Abra in the distance to the west of us. We then saw the cement factory just off the east face of the El Abra, and we decided to fly in along that fence about five miles north of the factory to see if we could see the two new sótanos on the top of the El Abra, nearly at the east edge. We flew right in along over what we thought was the right fence, and, sure enough, saw both of these sótanos that had been discovered on our last trip as we flew right over them. It was not too difficult to find the light grassy patch of the Hotel Covadonga airstrip, as it stood out sharply from the surrounding dark groves of orange trees. We put the plane down and rolled up to a stop, and the first leg of our journey was complete. We had flown exactly 5 hours.

We walked across the highway to El Bañito directly in front of the hotel, and began hitchhiking the five miles or so into Ciudad Valles. Eventually we got a ride in the back of a pickup, and he took us right to downtown Valles. We walked about half a mile westward to the **H**otel Condesa, where we were supposed to stay.

To our surprise, there stood Bob and Ken. We started reaming them out for not having come down to pick us up or at least to see if we had arrived, but they said they had only just arrived themselves. And Bob said there was no room in the inn, and there was no room to be had anywhere in town. The fair was in town, had just started yesterday and was due to run until next Saturday night, and the town was full. We'd just have to curl up on the sidewalk somewhere, and sleep for the night. We discussed this some more with the man in the Hotel Condesa, and he said no, there was absolutely no room tonight, but tomorrow, positively, we would have a room.

Sunday, 5-25-69. This morning we would go to Cueva Chica, a very famous cave to the south of us, near the town of El Pujal. Just north of the town we turned east and drove perhaps half a mile over a quite bumpy jeep road to cross the land of a man named Terán, almost up to the mouth of the cave. Señor Terán was there, he said that the engine in the cave was going, as he was pumping water out. This was their source of water, and the engine was down in the cave somewhere, but we could not hear it outside. We took several pictures here, including one of some strange little ferns growing out of the green moss on a rock in the streambed.

As we went in, we stooped low but almost immediately had to crawl on our hands and knees for a short distance, after which we were able to stand up again and move on quite comfortably. We now heard the gasoline engine running inside, and we saw a fair amount of smoke in the air, so we knew it was indeed running. I wondered about how many

The steep east face of the Sierra de El Abra. January 1969 photo. *Richard Albert.*

of us were going to be asphyxiated by carbon monoxide in this closed space, and it didn't smell too good, but Bob said he had been in here before with the engine running and he had survived. About 150 feet in we passed the engine, making some noise but not as much as I would have expected in this situation. After a short time the engine stopped, and then all seemed very quiet. Hopefully the air would soon clear.

We began to find more water now, and a short distance beyond was a small pool over on the right-hand side of the cave. It was only about thirty feet across, but Bob said it had been measured to a depth of thirty meters, so it certainly was deep. There were several cave fish swimming around in the clear water.

This cave was a very important cave from several standpoints. Historically, this was one of the first caves discovered and explored in this area, and it is well-known the world over in speleological circles. The first blind fish were collected here in 1936 and described, and of course this was something of great interest biologically [*AMCS Activities Newsletter* 37, pages 68–79]. It is said that two or three dozen of the fish collected here in Cueva Chica were taken to an aquarium where they were raised and thus became the ancestors of all the blind cave fish that have been sold in pet stores and tropical fish centers over the world. People have come here from all over North America to see this famous cave, and it has even been the object of expeditions from such faraway places as Germany and France. So we were treading on almost hallowed ground, speleologically speaking.

Tommy helped me take a picture of some white threads of fungus growing out of an old piece of the stem of a sabal-palm leaf, and then we climbed over a little ridge where we took some pictures of some reddish grasshopper-looking things that were true crickets, but were only partially cave-adapted. There was a slope of deep mud right on the edge of a rather large pool of water. Here were a number of round seeds about half an inch in diameter, seeds that had been washed in by the rains and yhat had now sprouted in the moisture. There were roots in the mud, and the sprouts had gone straight up to a height of six or some even ten inches into the darkness searching for the light that they would never find. They looked quite a bit like the pale saprophytic Indian pipes I had seen in the northern forests. These seeds had responded to the stimulus of moisture and had sprouted just as Mother Nature had intended, but soon they would wither and die, their death a forgone conclusion.

There was some flowstone on the walls here, and in many places where it came down to a sharp edge, it was very saw-toothed due to a series of very-tiny travertine pools along its edge. One of the actively growing stalagmites was also covered with a number of exquisitely made tiny travertine pools along the side, each a little lower than the other and in terraced fashion, each filled with crystal-clear water and each only about an inch in length. Many of the rocks in this cave as well as the flowstone were rather translucent and sort of amber in color. Two species of crawfish have been described from this cave, and one of these was very common around the mud of this pool. They looked almost exactly like our crawfish in south Texas and were not cave-adapted. We saw many of these as we walked along in the cave.

It was rather difficult moving around here, since we were anywhere from ankle-deep to knee-deep in mud in this area. We waded hip-deep in water and mud across the pool to the other side, where the going was much less muddy. Bob and Ken went on up ahead, while Tommy and I stayed behind to look around more leisurely and do some photography. A little farther along the crawfish were all smaller and white in color, probably the second species.

The passages were amply large, heading downward in a southeasterly direction, and the walls were made of rather smooth limestone in most places, although there were stalagmites and stalactites and flowstone in some places. At one point the smooth structure of the limestone wall was broken by a three-foot chunk of sharply stratified rock imbedded in it. It looked rather odd here, and I leaned over to look at it better. In one of the cracks between the thin strata, I saw some long legs moving, but I could not see what they belonged to. Right at that moment my light flickered and went out, and I could not get it going again. (I later determined that the bulb had burned out.) That left Tommy and me in a somewhat unfortunate predicament. He had not had a light to start with, and now mine had gone out, so we were right where Moses was when the lights went out, in total darkness. Bob and Ken were way up ahead somewhere, and we could not see their light nor hear their voices. There was nothing we could do but just stand there where we were and wait for our companions to rescue us.

Bob and Ken had gone on up ahead for some distance looking in pool after pool at the cave fish and other things. Ken John, a Professor of Biology at Franklin and Marshall in Lancaster, Pennsylvania, was a specialist in fish behavior, and he had done considerable work on these cave fish, but this was his first time to see them in their native habitat. He was going to do studies on the sense organs of the fish in the different caves, and thus would complement and enlarge the work that Bob was doing. They came to some large, deep pools that they could not cross, so they took off all their clothes and just swam across. Ken said that the sharp black crystals imbedded in some of these rocks were hard on his bare feet, but that he especially didn't like walking through the bat guano and feel it squishing up between his toes.

Bob caught a cichlid and a large prawn back in the cave. This was of some significance, since these were both from the surface. Rather obviously, Cueva Chica must have a subterranean connection somewhere with the Río Tampaón, as these could have gotten in no other way. Bob was bringing them both out, but then he dropped the cichlid and it got away. Along about here Bob's light went out, but Ken's was still working all right. However, this appeared to be somewhat precarious, because while Ken was swimming back across

some of the pools, lying flat on his back so he could hold the light up, he couldn't see very well where he was going and he swam smack into the rock wall. However, he managed to keep from dunking the light, so it continued to function well.

It was at this point that they returned to find us, Tommy standing on the bare rock but me standing in a pool of water, right where I was when the lights went out. Bob quickly identified the long legs in the finely stratified rock as those of an amblypygid, a whip-scorpion-like animal that is very secretive and is found in caves and other places down in this country. Then we turned and headed for the entrance, but the going was rather slow since there was only one light among the four of us. We really would have been in a fix down there without any light at all, but as it was, it did not take us long to find our way on out of the entrance and back up to the Jeep again.

We drove on down to El Pujal, where Bill had gone walking around to see what he could find in the way of holes or water. We found him there on the main street—the only street—of the town. I bought a couple of delicious *raspas* from a street vendor and thought they were just exactly what the doctor ordered on a day as hot as this. Then we went to look at the things Bill had found. The first of these was a hole or well where people came to get water. It was about 300 yards east, and was a hole in the flat limestone around which a one-foot raised concrete wall had been built so that it would be easier to get water. Several Mexicans came here while we were looking into the hole and dipped water out in buckets with a rope about 30 feet long. This they then put in buckets or five-gallon cans, one on each end of a pole across their shoulders, and walked away with it. One very small boy with very large buckets rather staggered under the load, but went bravely on. Another water carrier, a rather old man with a bent right leg that had been broken years ago and had healed badly, had two five-gallon cans of water on his pole that looked as though they ought to break his bent leg, but didn't.

Next was a small sink directly on the east side of this well that water was obviously pumped out of at times. Then some distance to the east just on the north side of the road going east there was another small mud sink about thirty feet in diameter, where a man was getting water for his horses. A short distance farther along the road there was a large sink several hundred yards off to the right, a sink perhaps one hundred feet across, with very large trees growing around it. These strangler figs were huge trees, surely some of the largest in Mexico. One of these had a trunk about twenty feet in diameter in one direction and about ten feet in diameter in the other direction. There were two kinds of climbing cactus growing in them, one a *Hylocereus*, and the other a rather large-stemmed *Selenicereus*, both night-blooming species, and both of which had just bloomed the previous night, with what were large and rather spectacular flowers. I broke off a piece of this *Selenicereus* to take back with me for my cactus collection.

Back in El Pujal, we walked out onto the bridge across the Río Tampaón and just looked around for a time. Several kiskadee flycatchers and tropical kingbirds were calling from the large trees along the river's edge, and a number of Mexican crows were making their odd guttural sounds nearby. These crows didn't seem to like us gringos too much, because they dived down on us, sometimes coming close enough to actually touch. They may have had nests around there somewhere, but we looked the bridge over and could not find any.

We drove back to Ciudad Valles to the Palma Motel, where we had gotten Room 16 this morning.

Monday, 5-26-69. Bob and Ken and I went flying this morning, but it wasn't good at all because the air was so very rough. It was very hot, and apparently it was the thermals that were bothering us. They were bouncing us around so much that I felt we were sort of wasting our time. We were up over the sótanos in the Los Sabinos area. "Let's go home!" said Bob. "I'm sick!" And I knew that he must be, because he gets seasick rather easily, and this was so rough it would make almost anybody seasick. So, after only 0.7 hours flying time, we returned to the Hotel Covadonga and landed on the rough grass strip.

Bob climbed out of the plane as soon as it stopped rolling, went directly to the shade of the nearest tree, and lay down flat on his back to recuperate. I felt sorry for him, because I knew he was sick, and anybody that is very seasick is really very sick.

I learned a lot more about Ken John today. As a specialist in fish behavior he had studied the cave fish, but he had also done lots of work on fish other than cave fish. He was engaged in studying the sense organs of fish to show relationships and differences between species or populations, and it was because of this that he and Bob Mitchell had gotten together, since these studies would complement and supplement the work Bob was doing. Ken would soak the fish in various different solutions, and this would make the sense organs stand out conspicuously wherever they were located on the fish. These could then be counted and otherwise studied, and the fish from the different caves shown to be either closely or not closely related.

Meantime, Bill and Tommy had gone to Sótano de Jos, one of a group of three, together with Sótano de la Palma Seca and Sótano de las Piedras, that we had discovered in January. This one had a smaller opening, but it went down a right respectable distance. They had only the 140-foot rope,and went down to the end of it at about the –100-foot level. They found two little ledges, and at one of these was a large boulder wedged into a crack. The hole went on down still farther, so they climbed back out, walked back to the Jeep, drove back to town, got another length of rope, drove back out there, walked out to the sótano, went in again, then tied the second rope off to the large boulder wedged into the crack and went on down. The bottom was 170 feet down, where they walked along some passages and then found water. A-number of cave fish were collected in jars of

formaldehyde, and they came back out. This was the first time anyone had ever entered this sótano.

The *pinolillos* were thick out in that area, and while they were not so thick as they had been in January, they were there in respectable numbers, waiting on twigs or leaves to get onto any passing animal. At one point there was a little dead twig sticking up on one side of the trail, and at the base of it were two little leaves loaded with *pinolillos* on the underside. Tommy broke off the twig and dunked the leaves in a little vial of alcohol, and about 75 percent of the *pinolillos* came off. This left a layer of the little critters about an eighth of an inch thick on the bottom of the vial of alcohol that must have numbered in the thousands of individuals. From only two leaves. How many billions and trillions must there have been in that forest?

Tuesday, 5-27-69. I went flying. First we went over toward the west, through the water gap of the Río Santa María in the Sierra de la Colmena, where we again saw the Puente de Dios, that strange natural bridge at the bottom of the canyon under which the river flowed. Just west of the water gap and the ridge was a valley with the village of Tanchachín. Just north of the village the Río Santa María made a long bend to the north, and there it was joined by the Río Tanchachín. We entered the gap-in the mountain directly to the west, and shortly there was the beautiful waterfall we had found in January. This was the Cascada de Tamul, and it was so sad, because now this spectacular fall was dry, and not a bit of water fell into the Río Santa María directly below the cliff. The canyon wall opposite the fall, which had been a bright verdant velvet from the growth of moss in the constant spray, was now a lifeless brown. Yes, it was sad.

We flew on up towards the north, going up the Río Gallinas (or was it the Río Ojo Frío?) that formed the fall. There were a few pools of green water here and there, and then as we continued on these became more numerous, until there was a little flowing water. This was then very pretty, and a few palm-thatched huts appeared, and farther to the north was a little village with several flaming red royal poinciana trees in full bloom.

Then we moved slightly to the east and turned around, now going south directly on the west side of the Sierra de la Colmena. At first this country was a little rough, but after a few miles it developed into a little valley where it had been partially cleared. There on the left we saw a *nacimiento*, the birth of the Río Tanchachín, and now there was a nice little stream in the valley. It was a very pretty green valley, with the meandering stream and the Mexican sabal palms growing singly and in cluster and several oxbow lakes where a meander of the stream had been cut off. Farther down was a grassy swamp, the Ciénega de Tanchachín, where the stream lost itself in flat vegetation that was devoid of trees. Farther down, a little hill chanced to rise above the swamp and was all covered with green trees, like an island. Beyond that, the stream reformed, and then it joined the northward bend of the Río Santa María.

Aerial shot of Sótano de Venadito taken January 1, 1969. *Richard Albert.*

We now turned north again and climbed up to go over the Sierra de la Colmena, going to the northeast to the vicinity of Los Sabinos. We went flying along more or less steadily while Bill sketched maps of the surface drainage of the area. This was rather important, since we wanted to know how much of an area drained into each of these sótanos. Then we went on up to the Sótano de El Venadito, just east of the little town of El Venadito, a sótano that emptied into the side of a hill and which was said to be very impressive. This was an important sótano, as only about two or three months ago, three fish were caught in the very difficult depths of this cave, and those three had been lost on the way back to Austin. Thus while there was a record of fish for the cave, the fish were not in existence and could not be studied, and it was very important for this study project to have fish from this cave, especially since it was considerably farther north, about 30 miles, than the fish caves of the Los Sabinos area. There was another sótano supposed to be somewhere in this vicinity, the Sótano de la Noria, but we searched for it for a time in vain.

Bob, Ken, and Tommy had gone to a new sótano that they had discovered in January, the one some peon had pointed out to them on the Cueva Pinta trail. They had asked him about sótanos, and he said there were sótanos all around, and promptly led them to one only about 400 yards south of the trail. Since this one had no name and it was in a forest of soyate trees, they planned on naming it the Sótano del Soyate.

The sótano was a deep one all right. Bob and Tommy tied one end of the rope off to a big old tree root and then threw 400 feet of rope down into the hole. Bob rappelled down, and after 300 feet found himself standing on a small ledge, about twenty feet long and only about six feet wide. Bob hollered back up that they couldn't go on down, but that it sure was pretty where he was, so Tommy descended too. He said that was the first time he had ever gone down 300 feet of rope just to

look at a hole. Together they stood on the ledge and peered over the edge down into the abyss, seeing the remaining 100 feet of rope hanging straight down, with nothing but blackness on beyond the end. They threw rocks down, and it seemed a long time before the clattering stopped very far below. They figured that it must be another 400 feet down to the bottom, so this sótano was one of the deepest in all of the El Abra. They had some more rope up on top, but not enough to reach down that far, so they turned around and climbed back out.

Ken had stayed up on top, so had a long wait while the boys went down and then climbed back up. He said that for a long time nothing happened, and then he saw the rope shaking a little all the time. Then from far down in the pit came Bob's voice, still a hundred feet below the surface, hollering, "There a canteen up there?" In due time a wild-eyed specter climbed up out of the slimy depths of the earth and looked around, its tongue hanging out. It unhooked itself from the caving gear, mumbled something rather irrationally, and took off running into the brush, in what appeared to be just a random direction. The purpose of this was not a first apparent, but then it appeared that Bob was looking for the Jeep, and he didn't know where it was. He began running around the sótano in an ever-increasing circle, hollering back at intervals so he wouldn't get lost. Finally he found the Jeep, and sure enough, there was a canteen, but having set out in the sun all day, it was almost scalding hot. However, it was wet, so it at least helped a little bit. When found, the specter was lying flat on his back in the meager shade of a desert tree, his tongue still hanging out, his eyes still with a glassy stare.

It had taken Bob only twenty-nine minutes to climb that 300 feet of rope, probably because he was in such a hurry to get to the water. It took Tommy thirty-three minutes to make that ascent.

Tonight Bob wanted to go seining in the Río Tampaón, but then he decided it would be insane to go splashing around in the unknown waters in total darkness. Instead, we went north along the highway, stopping at every little culvert to see if we could catch some fish. At the first culvert, there were some pools of water that did yield some fish that looked just exactly like cave fish, except that they were sort of fish-colored dark and had eyes. This was the *Astyanax mexicanus*, the surface form of the same fish that made the cave fish. Ages ago the ancestors of these fish had gotten washed down into the caves by the floods, and then, being completely isolated from light, in due time lost all the need of color or eyes, so these atrophied and the blind cave fish resulted.

At kilometer 485 we stopped again, right on the Japonés arroyo. Here we found a small pool of water directly under the culvert, but seining yielded no fish. We did see a tiny, dark salamander about three inches long in the water, but could not catch it. There were several leopard frogs hopping around here, and we caught several of another species of frog that superficially resembled a leopard frog, but was smaller and had a rather oddly shaped nose. We also caught fish in the Yerbaníz arroyo, both the north and south branches of it cross the highway very close together and join just a short distance to the west. At the north branch of the Yerbaníz, Tommy was standing on the bridge looking down with his light and saw a snake. He thought it looked like a long-nosed snake, but whatever it was, he wanted to catch it, and went as fast as he could down into the arroyo to see. Lo and behold, it was a cat-eyed snake, a rather unusual species that extends northward just over the border into extreme southern Texas. It was captured and placed in a sack for future reference. This was at kilometer. 489.

We stopped once more where another arroyo, name unknown, crossed the highway, and we knew it very shortly emptied into a large man-made lake that filled this portion of the valley. Seining yielded a lot of fish here, including a cichlid and another one that was positively the largest *Astyanax* any of us had ever seen—a good four inches long. Here at the water's edge I saw the shining eyes of a small animal like an opossum or a kinkajou.

Wednesday, 5-28-69. After the weather cleared somewhat, Bill and I went flying again, going along over the Sierra de El Abra and up north to beyond Ciudad Mante. The Río Comandante cut a water gap across the El Abra, and just beyond that there was a lowest point in the ridge where it again began to rise into the rather large, rough mass of the Sierra de Guatemala. Here we went west and over Bee Cave, looking right down into the black depths and a flock of bright green parakeets flying around just within the entrance. Just northeast of Bee Cave we flew over the appallingly forbidding grunge or karren that we had found so fascinating before. It was even more fascinating now, and looked even more appalling and forbidding than it did then. It looked as though it were from another world with the criss-cross of the labyrinthine passages around the very sharp pinnacles of rock, covered with no plants in most areas but in some places with these strange-looking *Hechtias* and cycads and the *mala mujer*. Then we flew over the Sótano del Grunge (now Sótano del Malpaís) that had been found in this grunge, and flew over it several more times so we would know exactly where it was. This one could have been named el Sótano de Mala Mujer, from the large bad nettles that grew there. Bob had given us strict orders to find a way to get to this sótano, but we flew around and looked and there just didn't appear to be a way in. There was a dry water-gap slightly north of a spot directly east from the sótano, but this deep gash in the ridge appeared too forbidding to permit penetration. It appeared equally forbidding to climb over the ridge on the east, while approach from the west over the grunge seemed totally impossible. To the north was the jumbled mass of the Sierra de Guatemala.[The original ground search for Sótano del Malpaís is the subject of an article in *AMCS Activities Newsletter* 40, pages 96–101.]

Then I noticed a couple of white cows grazing in an area just about a quarter of a mile east of the sótano, and here there were then also cow trails. Therefore, I reasoned, the

cattle must have a way out of here, and if they did, surely that would be the path of least resistance. We followed the cow trail south, watching it carefully below the trees through a little pass over the hills, and found that it led for about two miles or so down to a little ranch where began the fields and cultivation of the flat floor of the valley beyond. This, then, had to be the way in, although it would be a long walk. Probably it would be possible to have a burro or something carry the rope and other caving gear in for us when the time came. The air sure did get bumpy just before reaching the little ranch, and the plane bucked around quite a bit.

We flew around over Bee Cave area some more, Bill marking out the drainage system on his sketch maps. This was not so easy like it sounds, as it didn't seem too well defined. There was a very little valley just north of Bee Cave. It just seemed to sort of wind around and lose itself, but after careful looking and sketching it was seen to go down west of Bee Cave toward the south. It passed between a high peak on the east and a hill on the west and then entered the broad plain of the valley that stretched for a hundred miles to the south. This is a somewhat oversimplified version of it. Actually, the drainage just north of the sótano really did lose itself just to the west, and it is very doubtful if any water ever flowed on out into the valley. The "channel" south of there appeared to be an old prehistoric channel, unused for centuries, and probably could not have been identified from the ground at all.

Perhaps this north end of the valley should be described a little better. The high and conspicuous peak just east of this drainage channel was just a few hundred yards southeast of Sótano de las Abeja, and just east of that was the saddle over which came the cow trail from the Sótano del Malpaís down to the little ranch. Just east of this saddle was the ridge that sloped slightly as it went south a short distance before it began to rise as the Sierra de El Abra, between the valley and the coastal plain east of it. This highest and most conspicuous peak was just to the east of the channel, and was called El Chamalito. Just west of it was a rather long east-west hill, beyond that a couple of small hills, and then the high precipitous cliffs of the ragged ridge that went straight south as the Sierra de Nicolás Pérez, parallel to the El Abra and about eight or ten miles west of it. This was the north end of this long valley, and the hills that started here went quickly on to form the very rugged Sierra de Guatemala. The little town of Chamal was only about three miles south of the hills, about halfway between the two ridges. The highway from Chamal went east across the Sierra de El Abra to El Limón just north of Ciudad Mante, and west across the Sierra de Nicolás Pérez to Ocampo and on to Tula.

Next we went over the town of Gómez Farías near the east side of the Sierra de Guatemala, and just north of that followed a little jeep trail through a very narrow pass into the higher mountains to the west, where we found a beautiful little patch of several small green fields nestling right among the high peaks of the Sierra de Guatemala. Directly to the north of this little nest were some very rugged stone peaks sticking up out of the impenetrable green, peaks of broken pinnacles that looked just like the karren we had been flying over earlier, but here it formed the peaks of the mountains. Bill looked at all this wilderness, and said that if we were to crash here in the Sierra de Guatemala, we might as well head it right straight into the ground, as it would be totally impossible for, anyone to get out of here, ever. We followed the little jeep trail still farther to the west and then to the south, where there was finally a tiny ranch in another green valley that seemed like the bottom of a cup. This was San José, and another one like it nearby was La Gloria.

Bill kept pointing higher up into the mountains, so we kept climbing higher and higher. Soon we were at 5,000 feet, and still the main mass of the Sierra de Guatemala towered above us. On up to 6,000 feet, 7,000 feet, and 8,000 feet, until we were finally above the highest peaks of the mass of the Sierra de Guatemala. We levelled off at 8,500 feet, and then, as we were now on the north and northwest side of the mountain mass, we saw to the northwest a very broad and relatively flat valley, the valley of Jaumave. We circled on around the Sierra de Guatemala and found two sótanos, one on the north side and one on the west side just above a little sawmill that was built high up on the rugged slopes. About here we flew into a little rain, enough to wash the windshield.

Our work completed here, we now flew on south, to the west of the Sierra de Nicolás Pérez. This range of mountains extended southward from the main mass of the Sierra de Guatemala and paralleled the Sierra de El Abra but was some ten miles to the west, gradually getting lower and lower until it lost itself in the floor of the valley some miles north of Ciudad Valles. Soon we were over the town of Ocampo, and beyond that, just opposite Antiguo Morelos on the east side of the Sierra de Nicolás Pérez, we were over the town of Nuevo Morelos, and from that we could see the highway going on west across the next ridge and to the town of El Naranjo in the next valley. This was of interest to us, because just a few miles north of El Naranjo was the very beautiful waterfall Salto de Tamoquén, which we had visited in the past.

We flew on southward, over the end of the disappearing Sierra de Nicolás Pérez, and were at about 6,000 feet altitude when we reached the Hotel Covadonga. Here I throttled the engine back to idle, and wanted to see if I could land without the use of any engine at all. I had my flaps down, and sort of slowly fell out of the sky, at times losing 2,000 feet per minute as I circled but staying very nearly over the end of the airstrip. Finally there came the time when I felt I did not have enough altitude to make another complete circle but was still too high to land, so I turned from side to side several times to take up flying time and lose elevation. As luck would have it, I did get down to the airstrip just fine and landed without any difficulty at all. We had flown 3.9 hours today, and the gas tanks were practically empty.

Bob, Ken, and Tommy had gone to Sótano del Japonés and found a beautiful sótano entrance at the end

of a little arroyo. All three of them went down, and it marked Ken's first descent into a sótano. They said he did very well, and since he managed to get out, that confirmed it. Actually, it was not a very good ascent for a first ascent. The 140 feet wasn't so bad, but it went over a number of rocks and ledges that were somewhat difficult. Tommy caught an iguana down in the sótano. This was rather surprising, but there it was, on a log jam down not too far away from the entrance drop. It was a dark lizard with a very rough tail, and about sixteen inches or so in length. He brought it home with him.

Francis Abernethy arrived tonight, and moved in with us. He was Professor of English at Stephen F. Austin College in Nacogdoches, Texas, and taught Greek literature. He had taken a bus to Houston, a plane to Tampico, and a bus on to Ciudad Valles. He was an old caving buddy of Bob's, and in fact, these two, together with some other character named Dusty, had been the first people to descend into the great Sótano de Huitzmolotitla, down near Xilitla, and measured the entrance drop to a depth of 360 feet, at that time the deepest known in the western hemisphere. I was glad to meet Ab, as I had heard Bob speak of him often.

Last night Bob had said it would be insane to go down to the Río Tampaón and go splashing around in that unknown water in the dark. Well, tonight they did just that—at 1:00 a.m. yet. They caught some *Astyanax*, which was what they were after.

Thursday, 5-29-69. Today Ken came with Bill and me as we went flying, heading up over some of the caves in the Los Sabinos area and then on up northward. We flew up over the village of El Pachón so Ken could see a cave that he knew about, the Cueva de El Pachón, where it was possible to walk in only a short distance and find cave fish. This little village was nestled down on the west side of the Sierra de El Abra, just north of the point where the highway between Ciudad Mante and Antiguo Morelos came through the water gap. Along about here we flew up into what appeared to be rain, but when we got there we found it was just haze in the shade of some rather high, thick clouds. Right here, as we were cruising along in level flight, the engine coughed once, real hard, but then went purring along just as though nothing had happened. It startled us. Several miles beyond it was again lighter, so we went on and showed Ken the spectacular grunge, and then we flew over Bee Cave. He seemed duly impressed with the black pit underneath us.

We were cruising on farther west, nearly at the side of the high precipitous cliffs of the next ridge, which went south as the Sierra de Nicolás Pérez, when I noticed a little depression just on the west side of the last little peak before the cliffs. "Hey, fellas, look here. What's that?" I asked, and as I turned and made a bank to the left over it, the sides dropped away more and more until we looked down into an enormous green pit, with a flock of green parakeets or *quilas* flying around inside. It was a great pit, but we could not be sure that it went anywhere. We could see broken rocks down on the bottom far below, but on the northwest side of the bottom the wall appeared to be undercut some and could possibly lead into some passages. We made several passes over this spot, but never could determine this for sure. There was a jeep trail just south of this sótano, and we followed it to a little ranchito, and then on to another larger ranch slightly to the south, and then on to the southeast to the town of Chamal, so we would know how to get to it from the ground.

Then we cruised around north of the new green pit, over what was truly lush rain forest. There were impenetrable jungles of graceful and beautiful bamboo, and other trees were all covered with vines. It was indeed unusual to see the ground in any area, and it was very, very beautiful here, but we wondered if anyone could possibly walk along the ground. Several miles to the north, higher up in the mountains behind a little ridge, we found some little *ranchitos*, so there were people here to enjoy this beauty. These little *ranchitos* looked so nice, snuggled down in the bottoms of some little cup-like hollows that had been cleared. Especially noticeable was a little footpath bordered by green grass, a nice friendly little path that looked like it would be so nice to walk along.

We searched the northern portion of the El Abra some more, and found several new caves and sótanos. Bill was very busy sketching and having me follow roads out to some place so he could pinpoint these new finds. Just south of the highway crossing, we looked at the surface of the mountain range, and then

William Russell and Richard Albert refueling the ill-fated N46021. *Robert Mitchell.*

not too far beyond that came upon the enormous sink, the grandaddy of all sinks, the Caldera, in the top of the El Abra. As we circled here, we saw several parrots, the brilliant red, blue, green, and yellow military macaws, flying around in the south end of the sink. We flew off over the east face of the range part of the time, looking at things we could find there.

Then we noticed that up ahead it was raining. The large cloud that had made the shadow on the haze under it up near Bee Cave had apparently moved down to the southeast and had grown up into a rainstorm that was progressing along quite well down there. We flew along in it for a time, but then when it began to get too thick, we decided we had better go up over the crest of the Sierra de El Abra so that we would know that we would be above the mountain and not accidently fly into it. The disturbance did not appear to be a full-blown thunderstorm, but we could see some lightning up ahead and to the left when we decided to go up over the crest. We cruised along and everything seemed to be going all right.

When the rain slacked up a little, there up above us and slightly to the left was a sort of hole in the clouds, with ragged irregular edges that looked quite pretty. I took a picture of it. Then we saw that we had been blown off course, rather far over to the west. We now aimed the plane over toward the east instead of heading due south, and we found that even heading on a course of 120 degrees, we were making good a course of about 180 degrees or so, so strong was the force of the wind. Of course, I was not going along at the usual cruising speed of about 110 miles an hour, but had my flaps down and was not at full throttle so was making only about 60 miles per hour indicated air speed, but even so, that was certainly a strong wind. We could see it bending large trees down below us, but it did not feel particularly rough and the plane did not bounce around much. The rain had started on the east side of the El Abra, but now it had crossed over, and it was raining just as much over here, too.

By the time we reached the latitude of Ciudad Valles, we were south of the main part of the storm, and things were considerably clearer. We flew down over the south end of the El Abra to the Río Tampaón at El Pujal, where we again looked at Cueva Chica from the air. Then we turned back toward the north and landed at the Hotel Covadonga, having flown 3.8 hours today.

Bob, Ab, and Tommy had set out today for the Sótano de Matapalma, and they had said that they would be back late. As we were flying through this heavy rain today, we thought about how it was drenching all the very thirsty plants on the Sierra de El Abra, and how much of this water would now find its way into the many subterranean passages of the mountain mass. But I was also thinking of how heavy rains would make the arroyos run, and when the arroyos run, then there is a flood in the sótanos and their caves, and there were Bob, Ab, and Tommy down in the Sótano de Matapalma. How much water would there be flowing into this sótano? Would there be a flood? If so, the boys would be in real danger, and a really big flood would carry them down into the depths of the earth somewhere and they would never be heard of again. Not a very happy thought, but on all probability it would not rain that much.

At the Restaurant Condesa, we found two other cavers in town—University of Texas students Joseph Cepeda of Del Río and. Don Broussard of Houston. Both were quite experienced cavers and had been down in Mexico a number of times caving. When we had finished supper, these two newcomers shouldered their packs and prepared to walk out of town. They said they were going to go into Sótano de Matapalma tonight. That was about ten miles away, so we drove them up there in the Carryall. We told them about our boys being down in Matapalma now, and thought it would really be a joke if the two groups should meet down in the depths of the sótano. They would probably think they were meeting ghosts, or devils, or something. However, we predicted that what would probably happen would be that both groups would get lost, and they would chance to meet out somewhere in that horrible brush, and one group would say where is the sótano?, and the other group would say where is the highway? We thought that would be just real funny.

We let Joe and Don out on the highway where we found our Jeep parked, and they took off through the darkness. It was 10 p.m. They said they hoped to get to the sótano soon, and would sleep there beside it since they had their sleeping bags. It still looked very much like rain, but they said they had ponchos that would protect them. They planned to go down into the sótano in the morning, and then come back into town that night. They were really avid cavers. In addition to their loaded pack frames on their backs, they were carrying a sea-bag containing 225 feet of rope.

Up into the wee small hours, our group of three intrepid cavers had not returned. Had something happened to them? Had they fallen and been killed, or broken a few legs? No, that would not be too likely with three good and experienced cavers such as these. Had the flood gotten them? We didn't think it had rained that much. Had they decided to spend the night down in the sótano? That was possible, but not likely. Had they gotten lost? That was quite likely, and we decided that this probably had occurred.

Friday, 5-30-69. This morning our three intrepid *sotaneros* were not back yet from Matapalma, but then they finally came dragging in at 10 o'clock, looking thoroughly beat. This was only the second group to go into this sótano since our discovery of it in January; a group from Southwest Texas State University in San Marcos had been down to Ciudad Valles at Easter and had been the first group in. They found blind fish down there all right, and were collecting some when lo and behold one that had eyes swam right by Bob. Bob managed to catch it, and it did have eyes—maybe not functional, but eyes. This was sort of a throwback in evolution.

There was one slight misadventure in the climb out of the Sótano de Matapalma. Bob was ascending,

and was some distance up above the floor when he looked up and saw that his rope was caught on a little protuberance on the face of the rock and was in a quite unstable position. He hollered down and told the other two about it, that he knew that the rope would soon slip off of there, and then he would go swinging out across space, and there wasn't a doggone thing he or anybody else could do about it. Sure enough, in a little while the rope came loose, and there Bob went swinging forty feet across the shaft of the sótano to crash backwards into a fissure in the rock on the opposite wall. It jarred him considerably and he bumped his elbow pretty hard, but it didn't really hurt him too much. All he really got out of it was a few bumps and bruises.

They had goten out of Matapalma at about 1:00 a.m. and then started back for the car. As we had anticipated, they had gotten lost while crashing through that brush, and about three or four o'clock in the morning, when they were crawling on their hands and knees through all that thorny brush, they got so tired out they just lay down and tried to sleep. However, it was so cold they couldn't sleep, so Tommy gathered a little wood and built a fire with the acetylene torch from his carbide light, and that helped a little. They said they slept very fitfully for about an hour, and then when it got light enough, they could see better where to go and came on out.

As we had predicted, they found the party of Joseph Cepeda and Don Broussard, who were looking for Matapalma.

Right at that moment the two boys were not lost, although they certainly had been They had crashed around there in the brush, going for three solid hours before they suddenly found themselves back on the highline, having made a complete circle. They then decided to just sleep there and try again in the morning. Things had worked out almost exactly as we had predicted—both groups got lost, then the two chanced to meet, and they asked each other, "Where is the sótano?" "Where is the highway?"

Today Bill Russell went walking down in the Sótano de la Palma Seca,-Sótano de las Piedras area, making observations and correcting and filling out his map-making project. Also he walked from the highway straight east in a number places, to see how far he would have to go from the highway in order to find the limestone outcropping beginning to show up. As in January, the natives had associated him somehow with the plane that they had seen flying over. In January they had always thought he was looking for the plane that had crashed, but this time they just asked him if it had crashed. They seemed to expect it to crash, as it was always flying around rather low and then disappearing over the next hill or ridge, and they never saw it come up again.

After Bob and Ab had slept for a few hours and rested, they decided to go flying. We flew over the caves in the Los Sabinos area again, looking and making various observations. Then Bob remembered that Monday, when he had gotten so sick from the rough air, he had seen some sort of little hole in a creek but he had forgotten all about it till now. We looked for it, and sure enough, only a mile or so north of the edge of town, there in the middle of the bare rock of the creek bed was a little square concrete construction that had been put around a hole in the rock below, obviously a place to get water. Then just a couple of miles to the east, we found two more holes that we didn't know about, small holes but holes that might possibly go down to something. Here we had flown only 1.1 hours and already had found three new sótanos.

Saturday, 5-31-69. This morning Bob, Ab, and I went flying around again. We flew in front of the Nacimiento del Río Choy where it came out of the side of the El Abra under the railroad bridge in front of the cave, and then on up over the crest of the Sierra de El Abra northward and looked over the great Caldera that was so impressive. We continued on upward over the El Abra to the foot of the Sierra de Guatemala, then slightly east over a little valley and over the very pretty little town of Gómez Farías. Then we turned back southwest from there and flew over the grunge or karren that we had found so very impressive. I showed Bob the trail that Bill and I had decided he should take if he were going to Sótano del Malpaís**.** I said we had checked it out and felt this was the only way possible, but Bob said he just didn't believe that. No, that's too long; there's bound to be another way. So we flew over Bee Cave and looked for a path from that side, but the grunge was so bad over in that direction, it looked completely out of the question.

"Richard, why does the motor sound like it's trying to quit?" asked Bob as we were cruising around over Bee Cave, and indeed, I had just been wondering that very same thing myself. I had already headed the plane to the south where we could at least land in a field if necessary. Then I realized the gasoline mixture was too lean for this sort of maneuvering and was making the motor sputter, and when I made it richer, the engine ran just as pretty as pie.

I showed Bob the new Sótano Verde (now Sótano del Caballo Moro), as I had dubbed the very green) sótano on the little hill over to the west, but Bob didn't seem much impressed. He said he didn't think it went anywhere, but we never had actually seen the northwest side of the bottom yet. Then we went back south over Sótano de El Venadito, and on this one the sun was just right and we got two very excellent looks right down the green shaft of the pit, with the sunlight going all the way down to the bottom. We were here at just the right time of the day for this. We went down over Sótano del Tigre and Sótano de la Tinaja, then landed at the Hotel Covadonga again to get a drink and refuel.

Bob and I took off again, and Ben went with us for this flight. We flew down to the town of Aquismón, then went across the mountains there into a rather broad valley to the magnificent Sótano de las Golondrinas. They were most impressed by this great hole in the earth. We made several passes over the sótano in the direction I had learned before, going directly by the bell tower in the tiny village of San Rafael and heading south-southeast to go right over the gaping wound that was the

sótano entrance. We saw a lot of these white-throated swifts flying around in the vicinity, and as we approached a flock of these birds, the entire flock dived down to escape the plane, even though some of them were at a much higher level than we were.

Then we went on up the canyon of the Río Santa María, since Ben and Dee Dee had been talking about taking a river float trip, possibly on the Río Santa María. However, it did not look like a good river for a float trip now, as there was not sufficient water. Ben ran out of film just as we were over the Río Santa María, so did not get to take many pictures. We flew by the dry waterfall again, and then on east across the next little valley through the top of the water gap and back to the Hotel Covadonga. We had flown exactly 1 hour this time, making a total of 3.9 hours for the day. This was a total of 21.4 hours for this expedition so far, and was the last that we would fly, except for the trip home.

Bill, Ken, and Tommy had gone to the three new little sótanos we had found yesterday. Bill and Ken checked out the square concrete box while Tommy stayed with the Jeep, since it was in a rather conspicuous spot. They reported that the little square concrete box in the middle of the arroyo bed just led down to a small hole that did contain water, but it didn't seem to go anywhere else. Then they went to the other two holes we had discovered and found these were just little hand-dug holes in the ground and weren't anything interesting at all. However, in talking to the natives of the area, they discovered that there was another hole very nearby, Cueva de la Curva, where fish had been reported. Bill and Tommy went into this one to see. Tom went down into the cave to look around. It didn't seem to go anywhere much, and it angled down to the bottom, where it ended in a very low place with barely room to crawl, with mud and maybe an inch of water on the floor. He saw no point in wriggling around in all that mess where there were only a few cupfuls of water anyway, so he turned and came back out. When Bill learned that there was a little bit of moisture down there, he went down himself to look it over. He did enter that very low crawiway and did wriggle around in all that mess—and found cave fish. He caught one of the fish and carried it back out in his hand. Tommy said it just showed that Bill had that something extra that it took to succeed where others failed. Now they had come back, and were telling Bob about it. Bill showed him a very beat-up, dirty dead fish; ostensibly from the cave. Bob didn't want to believe it, and said it was just some old dried-up fish that had jumped out of one of our fish tanks and then been picked up off the floor. However, Bill insisted that it really had come from the cave.

Joseph and Don returned this afternoon from their survey of the Sótano de Matapalma, the third party ever to enter that hole. As related above, they had crashed around for three hours the night that we took them out to the trail, and then had spent the night back at the highline, where they had met our party coming out the next morning. Then they had started out for it in daylight, but apparently had gotten lost again, because they found the embers of our party's campfire, when they certainly had been lost. Anyway, they finally got to the sótano and went in to look around. Don had a small inflatable life raft that they had intended to use to float across the deep pool, which started as a water-filled passage that one could wade along for a time, but then suddenly the bottom dropped out, though the water-filled passage continued apparently uninterrupted. However, they never did find this passage, so they left the life raft down there, in case they should return sometime and want to use it. It is rather interesting that down there they found a small hand-drawn map showing very explicitly how to get to Sótano del Japonés. They got out of Matapalma about dark, so they decided to just spend the night and sleep there at the edge of the sótano. Today they marched out, but somehow went over the ridge to the Yerbaniz arroyo and then followed this over to Sótano de Yerbaniz, where they got some water from a little pool at the edge of the entrance. Then they came back into town.

Now they moved in with us. We wondered what the people here at the Palma Motel must think about us, because every day there were more of us. They had probably never had anyone like us before, all just as scroungy as could be, our room just as scroungy as could be and piled so high with junk that one could hardly move around inside. Really it was a wonder that we ever found anything at all, and sometimes it really was a chore. In view of this situation, it was not surprising that we spent a lot of time outside of the room, in the carport, as there we could at least move. Bob, Ab, Joseph, and Don always slept outside on the ground or on the concrete.

It was really a fine bunch of fellows, though, and I was very happy for the opportunity and the privilege of being one of them. Bob was a good leader, and we all admired him for his drive and energy, his vast knowledge and the facts at his fingertips, his ability to get things done and to lead others and to coordinate all their efforts in the study of the many different aspects of caves. He worked very hard at it; in fact, maybe too hard. Somebody said that Bob had driven himself so hard and so long that he was just about at the end of his rope, and was living just on frayed nerve endings. Perhaps that was true, since he was rather irritable, much more so than in January, but no one could deny that he was doing a tremendous job in the study of the caves of the Sierra de El Abra, a subject very dear to his heart.

Bob, Ab, Bill, and I went to Cueva de la Curva tonight to catch some of the fish that Bill had said were there. Bill had a very good sense of direction and such and was able to lead us through some almost trackless brush along invisible jeep trails to the railroad track, where we walked along the curve whence the cave got its name and then went down to the cave. It was a rather large opening at the foot of a cliff, but it narrowed down some inside, and then, some distance in, sure enough, there was a little water. The passage led along for several hundred feet, but was only low crawling-height or in places just wriggling height with the bottom full of two to four inches of water a foot

or two wide and considerable mud. Bob and Bill went back in and caught a number of cave fish, and Bob said this was important since this was the easternmost site for cave fish. I went into the crawlway only a short distance before coming back out again, since I couldn't do any good anyway and wasn't needed. Ab waited at the entrance of the crawlway, and then we both went outside of the cave to look around a bit. As we emerged some animal, maybe an armadillo, went running off away from us. Just to the right of the cave, only about thirty or forty feet away, was the entrance to another cave, and inside with the light we saw an animal like possibly a large rat. Then we went back up on the railroad track to await the coming of the others, and when they came we all returned to town.

Sunday, 6-1-69. Today was the day for the assault on Sótano del Tigre, a sótano that is well-known now but which has been visited for only about four years. Four of us went—Bob, Ab, Tom, and I—and at about kilometers 478 we turned off the highway and went east. We paused a moment at the little village of Los Sabinos and picked up a guide to take us down there, a nice man named Salustiano Herrera whom some of the others had met in January. He showed us a green parrot he had taken from a nest near the sótano. After a few minutes we left the village, driving east on a very rough jeep trail, and when it got so rough that even Bob wouldn't go on it any more, we got out and walked. Salustiano had his machete along and hacked off a few limbs across the trail as we walked along. Keeping a trail open is a never-ending chore, and anyone who goes along a trail routinely chops a little as he goes, so a trail is sort of continually being more or less cleared.

We walked about two kilometers through ever denser jungle until we went down into the arroyo itself. There the jungle was not so dense, but the boulders were quite large and made the going somewhat difficult. After about 200 yards of this we found the magnificent yawning pit of Tigre, with three sides bounded by high cliffs crisscrossed by the large clinging roots of strangler figs. There was a large rock right beside the entrance, and there on this rock, a couple of years ago, some cavers had actually seen a *tigre* (jaguar) and Michael Collin had photographed it, so this sótano was aptly named. One of those John-shit-on-himself doves flew away just as we arrived at the entrance. Tom caught a lizard here on a root on the side of the cliff, a xantusid lizard, a strange-looking very dark job that Bob said was very rare. He had caught some up around Cueva de El Pachón, and only a very few specimens of this strange little clade were in existence. We put it in a sack to keep until we came back out and laid it on a ledge where it was pretty well protected.

A large root was clinging tightly to the face of the cliff, and Bob tied off to this large root, which he said he had used before, and it certainly looked substantial enough. However, I noticed he used two bowlines to tie the rope off with—I guess the deeper the pit, the more bowlines one uses. He threw the long section of rope down into the pit and then went on in. I was next and didn't dare to look down, so I hooked my descenders onto the line and then backed down. Once over the edge I looked down and found myself hanging at the top of a deep, straight shaft about twenty feet in diameter and extending down what seemed like a long long ways to a bottom that was just barely visible. Maybe it was a good thing I hadn't lookd first. It was a good pit, most impressive from inside as well as from the entrance, and it was a real pleasure to descend down this spectacular shaft into ever-darkening gloom. I held the rope at my hip with my right hand to control the descent and went down rather rapidly to join Bob on a ledge about 160 feet down. I touched the carabiners as I was unhooking from the rope, and they burned my hand, so hot were they after that descent.

Shortly we were joined by Ab, so then there were three of us on that ledge. Most of the rope was lying in the plunge pool that was down about 30 feet below us, a nice round pool that caught the water when it flowed down into the sótano. This pool was about ten or twelve feet in diameter, and on the opposite side of it was a black hole that extended into a large room that was a lot deeper than we were. This was rather a peculiar arrangement, because the opening went sideways, like a door, and the edge of the plunge pool extended into it as a threshold, but then the threshold stopped and the space dropped down vertically. Bob coiled up the extra rope that lay down in the plunge pool, and threw it over the pool through the open door. His aim was good, and the line went sliding down over the threshold and into the room below. He said he would go on down, and he said that after he had descended, Ab should reach out and get the rope with an old tree limb that he had used before for that purpose, pull the rope over toward the ledge till he could reach it, and then hook on and come on down. I would then do the same.

Bob went down, having to swing a few times to get across and keep from dropping into the plunge pool, and disappeared over the threshold. When he hollered "Okay!" from somewhere down in the depths of the earth, Ab took the tree limb, reached out, and caught the rope. Snap went the tree limb and broke into three pieces, and splash went the biggest piece as it fell into the plunge pool Ab looked kind of surprised standing there with just a short piece of stick in his hand. Maybe that limb had worked fine for Bob, but that had been some time ago, and it had rotted more in the meantime in the cave's dampness and now had left us out on the ledge.

There was no other stick around, and this one was awfully short and felt quite rotten and limber, as though it could break again just any second. Ab leaned out over the ledge and reached out for the rope. Luckily, he was just able to reach it and very gingerly pulled it over and got it in his hand. He suggested we tie it off there somewhere so I would have it when I wanted to come on down, as if I later found I couldn't reach it, then I'd just have to stay there on that ledge until they came back up, and miss going into the cave. However, I wanted to take some pictures of Tom coming down the rope, so I

elected to take that risk and stay on the ledge. Ab went on down.

When Ab hollered he was clear of the rope, I relayed the message on up to Tom, still at the pit entrance, and told him to come on down, which he did. In a minute he was coming on down along that little thread. It was real neat to see him way up that shaft, a little hazy from the little clouds of moisture that were hanging in the air, with the branches of the jungle trees leaning out over the entrance and silhouetted in the light, and I took a picture of it. Tom came on down, and I took another picture of him hanging on the rope as he passed me. He never set foot on the ledge I was on but went on down, having to swing a little to get over the plunge pool to the threshold, and continued on down, a distance of about 310 feet in a single drop.

When he hollered "Off rope!" I made preparations to go on down, too. I picked up that rotten stick, and it felt even rottener than before. It was soft to the touch and quite limber, so I was afraid to shake it lest it would fall to pieces. It seemed like such a long eight feet over to that rope. I stood right where Ab had stood and reached for it, but I couldn't reach it. Either the rope wasn't in exactly the same place it had been before, or Ab had a lot longer arms than I did, or Ab hadn't been so afraid and had leaned farther out over the edge of that ledge than I did, or perhaps some of all three. But I very distinctly didn't want to spend the rest of the day there on that ledge, so I thought about it a moment. The ledge curved somewhat, and perhaps another portion of it was closer to that rope. But the footing over there was more precarious, and the ledge was narrower. There was nothing else to do, so I took the several steps over to that spot, and found I could just almost reach that rope. Almost was not good enough, so I leaned some more in that rather precarious situation, more than my senses told me was safe, and then just barely got the tip of that branch around the rope. As luck would have it, there was a little bump on the end of that stick, the rounded smooth bump several millimeters high where a twig had once been, and that bump had enabled Ab and now me to pull that rope over. It seemed sure that the limb would break, but it didn't, and I gave a sigh of relief as I finally grasped that rope. It only took a minute to hook my carabiner descenders on and start down. In a few seconds I was down to the plunge pool, and then I worried about getting across it. The idea was to push out suddenly on the near wall above the water, swing out across the pool, and slack off suddenly to land on the threshold on the other side. It sounded easy, but I guess I was clumsier than the others because it took me more kicks and swings to do the trick, but when I finally made it, it didn't seem difficult at all.

The threshold really was just that; a curved edge to the plunge pool, rough white flowstone that reached from the water out a foot or two to drop straight down into the blackness in a large room with a ceiling that was rather high above. I eased on down over the edge, and found myself in what seemed to me to be one of the most spectacular places I had ever been. For the next sixty feet or so I was going down right on the side of a bulging mass of flowstone, sort of columnar like the curved edge of the threshold up above, a vertical column bulging out from the cave wall. The surface was clean and white and covered with thousands of micro-terraces less than an inch in length. This was fascinating, so high above the floor of the room and so beautiful, it seemed almost sacrilegious to touch the pure flowstone with my boots and get it dirty. This splendid column ended suddenly in some roughly draped edges, and then the wall was far away in all directions.

The rest of the descent was free, and about another sixty feet down I joined Tom on the boulder-strewn floor of a big room. The ceiling was so high we practically couldn't see it, but we could dimly see the great column of flowstone that had so impressed me. The rope hung down in just about the middle of this floor onto a mass of soft debris.

From this rather large long room we now went toward the right, following the passage around until not far away there was another place where we had to use the rope, going down over a series of large boulders and flowstone for perhaps a hundred feet or so. The course of the entire drop let us down at about a 60-degree angle and down around a little curve, to land on a beautiful example of flowstone with many tiny terraced travertine pools on its sides. Here, in a couple of little pools of water about six and twelve inches long, we .found two of the large cave isopods a little more than an inch long and very broad, looking very much like huge white pillbugs. We went downward some over a series of rocks that were climbable but just barely, and then we turned to the right from the main passage and went along for another distance, then down in another drop that was 35 feet to the bottom, where I managed to swing across into a wall and break the plastic case on my battery. There we landed in a mess of mud, but here were large beautiful pools with large beautiful cave fish. We photographed and collected a number of these, and looked at others all around. We were about 410 feet down.

Then we went in a tunnel to the right, a tunnel that required crawling at first but then opened up into a fine passageway, only there was quite a bit of mud on the bottom. Here lived many ricinuleids, so this was called Ricinuleid Tunnel, but the spelunkers, being a somewhat irreverent bunch, called it Rice 'n' Noodles Tunnel. Ricinuleids are small, reddish, spider-like animals with a body about an eighth to a quarter of an inch in length with long legs, and we collected a number of these to take along for study. Bob said these were real nice little creatures to work with, since they looked so neat, were so unusual, and had a body that was firm enough it didn't crush easily on being handled. Also, there was the greatest number of millipedes in this tunnel that I had ever seen anywhere. Surely they must number in the thousands, and were crawling around just all over the place, large brown-looking jobs with alternating circles of dark and light brown on them at each segment. We found a number of other inhabitants here, too. There were little tiny, almost

microscopic white springtails, some white sow bugs, and a schizomid that went along in little rapid jerks. Bob turned over a rock and found a ricinuleid eating a white sow bug.

There were a number of bats in this tunnel, and a lot of them were now flying around. I didn't recognize them, but they were not vampires. There were also some ticks on the floor, and Bob said these, plus the millipedes and some of the other creatures, are always directly associated with a certain species of bat, so that particular bat must live in this cave.

I thought I was really out of shape, because I was having to breathe so hard back in this tunnel that I seemed to be just panting all the time. Then Bob said that the air in this tunnel was very low in oxygen content, so that is why everybody that came in here felt oxygen hunger. That made me feel better.

In times of flood, there must really be a lot of wild unharnessed energy all over the place down here. There were sticks and debris everywhere, but over by the fish pools, at the start of Ricinuleid Tunnel, there was a huge log, a tree trunk 25 feet long, leaning upright against the wall. It seemed almost impossible that something this large could be carried down here by water in cataract that would enable such a log to float over all the boulders and around all the corners of the crooked passages to a point so far away from the entrance to the sótano.

Tom had already started up, so I now followed him. That first thirty-five-foot climb was easy, of course, but I found myself very thirsty when I reached the top. It seemed like I was always very thirsty, as the humidity down there must have been at least 100 percent, and our clothes were always dripping with sweat, so we were losing a lot of body fluids. Anyway, I found a little pool of water to slake my thirst, but yuk, it was bitter as could be. It looked perfectly clear, but it was completely undrinkable. Another little pool about five feet away was sweet, so I quenched my thirst there. I looked at the first pool again, but still could see no difference between it and the others around it. I surmised that perhaps the bitter taste came because some caver had emptied his carbide light out there, or perhaps it only came from bat guano.

Bob and Ab caught up with me just after I had climbed up over the almost unclimbable rocks and had started up the rope for the next ascent. It was most fortunate for me that they did, because I was clumsy enough to get myself into trouble. I hung onto the rope with my ascenders and climbed till I got all the slack out, and then started on up, shortly reaching the edge of the flowstone about nine feet up. This was a sloping edge or surface that was somewhat difficult to get up over, and the first thing I knew I had my left index finger caught behind the rope and against the very sharp rough edges of the many tiny travertine pools. And I couldn't get it out. All my weight was hanging on that rope, of course, and hence my finger smarted considerably. I pulled on it, but the rough rock was like a bunch of hooks holding very securely to the skin and would not let go. I tried to push and pull in some direction to move the rope away from the rock a little, but I just couldn't budge it. In fact, all I did was jiggle another inch of slack out of the rope, and it slid down over my finger, rolling it like you roll a snake on the road when you slide over it with the brakes on. It smarted some more.

"Bob," I called, "can you lift up on me a little, or something? I've got my finger caught behind the rope and . . . ."

"You've got your finger caught behind the rope?" asked Bob.

"Yeah," I replied. "If you can still reach me and can lift a little . . . ."

"Well, why don't you say so!!" exclaimed Bob. "Don't be so bashful—holler it out!" And he sprang to the rescue. Fortunately he could

Richard Albert.

still reach my legs, and he grabbed theme and pushed up all he could. It wasn't much, but it was enough to lessen the load on my poor finger, and I was able to pull it out with a minimum of lost hide. Then I felt a lot better, but still embarrassed because I had let myself get into such a fix.

The climb up was not the easiest climb I had ever made. It led on up over the flowstone, and then over a series of huge boulders and rock outcroppings where the rope hung and slipped into cracks and in general was quite troublesome. Eventually this was negotiated, and I found Tom up there waiting for me. We walked on along the passage while Bob and Ab climbed on up over the boulder area—a sixty-five-foot climb.

Soon we were up at the foot of the entrance drop, 310 feet below the surface, in the rather large long room with a very high ceiling. I looked down on the floor, and lo and behold, there was a cat-eyed snake crawling along on the litter between some of the smaller rocks. It looked to be a twin brother to the one Tom had caught in the north branch of the Yerbaniz arroyo. I caught it, but then had no place to put it, so I took my sock off and put it in that. This worked all right after Tom tied off a small hole in the big-toe area. Also down here were a number of small frogs about an inch and a half long, so the cat-eyed snake probably had something to eat. On the wall, about five feet above the ground, there perched a large tree toad, right near a little dark stratum in the rock. Some thoughtless cavers had left some tin cans over near the far wall, so we gathered these up and put them in our packs to carry back up and properly dispose of them.

I hooked onto the rope with my ascenders, and began to climb. This was going to be a rather long one, a single shot of 310 feet to the surface, and I wondered how long it would take me. In the climb up the completely free area I spun a little as the rope unwound, but nothing at all seríous. Then I reached the edge of the flowstone up above, and again was greatly impressed with this massive formation as I slowly worked my way up it. Over the edge of the beautiful flowstone that marked the beginning of the fall from the plunge pool to the bottom, I paused for a moment to drink some of the water from the pool. I noticed it was very full of tiny water snails, so I pickled a bunch of these in a small vial of alcohol. I also noticed a vine snake coiled up on some dead leaves just to the right of the plunge pool, so I told Tom to catch it when he came up.

I had been wondering just how it would work when I reached this plunge pool, as I felt that surely I would lose some of the stretch of the rope when I reached the threshold and then when I began to climb better again the streatch would return and dunk me right into the pool. I did the best I could, but when I swung over I got dunked in the water halfway up to my knees before I could get to climbing on out.

The ascent up the 190 feet now began in earnest, and I worked my way on up, stopping after every few efforts to just hang there a moment and rest. I felt I was moving quite slowly, and I guess I was, though I tried to hurry as much as I could. With this long a stretch of rope above me, the stretch was quite noticeable, so that with each effort, I would bounce up and down a foot or so. As I hung on the rope and rested at intervals, I became aware of a strange something that I could not at first identify. In fact, it was so almost imperceptible that for a time I wasn't sure it was there at all. It was so uncertain, so subtle, so subdued, so ethereal, but yet I seemed to sense it, though I could not at first say with which of my senses it was that I became aware of it. It seemed like a movement somewhere perhaps, but what was there down here to move? Then again it seemed like it might be the movement of air, but all I could hear for certain was the constant slow drip, drip, drip of water, and there wasn't supposed to be any wind down here anyway, and I wouldn't feel any. But what was that?—a breath of air on my face, and then it was gone. Finally it dawned on me what this was. Night had come, and somehow the bats down in the depths of this cave knew it, too, and now they were flying, as nightly they go out to forage for food. What I was feeling was actually the sound of thousands of pairs of bat wings beating the air One pair I could not hear, but thousands I could, a very strange and fluttery sound somewhat like a wind but yet different, so soft that it could easily pass unnoticed. All these bats had to pass me on their way out, and I watched them come out of the passages, at times flying full speed through a crack only eight inches wide and never touching the side; their radar must really be working well. Sometimes I could see many of them in the beam of my headlight, and I often felt the movement of air on my face as a bat flew close to me, and there were some very high-pitched squeaks audible, but just barely. After a time the bat flight had largely passed, and only a few stragglers came by.

At one of my pauses halfway out of the pit, I looked into a little hole in the rock right beside me, and there was a little pinkish-looking frog about an inch long, crawling around in his little grotto that was no more than about six inches big. What a peculiar place for a frog to be living, on a sheer cliff about ninety-five feet from the top and ninety-five feet from the bottom. How would he ever find a mate?

Eventually I reached the top and crawled out. It was so nice to lie down there on the ground beside the pit and rest, as I was rather tired. All was blackness save for a few stars visible up through some small holes in the canopy overhead. A pauraque called several times far away, and several insects chirped nearby. I had been down into El Tigre and had gotten out again, an experience I considered myself most fortunate to have had the opportunity and the privilege to enjoy. Yes, God had been most kind to me, and I thought about these things as I enjoyed the solitude of the tropic night. Some animal squalled nearby up on the cliff, and I thought it was probably a cat of some sort. Later, I heard it again, but farther away.

When Bob came out he said he was very tired, and he seemed quite irritable tonight. I guess he was sore at me because I had taken so long to climb up that rope, and indeed

it had been a long time, a time during which everybody else could do nothing but just sit down there and wait on me. It had taken me an hour and a half of work to make those 310 feet. It seemed like an awfully long time to me, and I guess it was, because Tom and Bob each made the last 160 feet in sixteen minutes, so it had taken me about three times as long as it did them. I guessed I was just slow. I wondered about it for a while, and then decided that maybe my method of climbing was at fault. I was still climbing like they had told me on my first ascent, over in Sótano de Yerbaniz, with only one foot in the ascender sling, and I just wasn't strong enough to climb up 310 feet using only one leg. If I ever climbed out of another sótano, I would use both feet in the sling, and thus would have a great deal more strength. Yes, I decided that was it; I would have to climb better, and using two legs would be the way to do it, and then maybe I wouldn't take three times longer than anybody else to climb out of a hole.

After all of us were out of the sótano, we weren't through yet, because now we had to pull up all of our gear that was tied onto the end of the rope. There were the packs, Bob's cameras, other ropes, and so on, and we all now caught hold of the rope and pulled and pulled. The total amount of stuff seemed quite heavy, and we had to stop and pant several times before we got it up to the top. And then it caught on a ledge a short distance below the top, and Bob had to go over the edge to unhook it before we could get it on out.

Right at the edge here was a loose rock, and Bob jiggled it as he was unhooking our gear. Every one of us had discovered this rock on our climb out of the pit, and it hadn't helped our peace of mind any to be climbing in such a situation 190 feet above the plunge pool and then to catch hold of a rock that was about to fall. I thought it would be a good idea to lift or pry out that rock and drop it into the hole so that any future cavers would not be endangered or at least not have their confidence shaken by it and get an extra shot of adrenalin into their veins, but Bob didn't want to take the time and didn't feel it was necessary, so we hadn't.

Bill, Ken, Joseph, and Don had spent the day going down to near the Hotel Covadonga area, where they investigated reports of a couple of sótanos lying one or two kilometers or so to the east and southeast of the hotel. One of these was directly to the east, and was the Sótano del Toro, a fissure about four feet wide and fifteen feet long. It was only about fifteen feet deep, down to a pool of water about four by twelve feet in size but so deep that they could not see the bottom at all. To their great surprise, there, in practically broad daylight, were some cave fish swimming around, clearly visible without any artificial light at all. They counted eight fish in that pool. The second sótano they investigated was about a mile south of Toro, and turned out to be not a sótano at all but only a quite small crack in an arroyo bed with some *Gambusia* in it.

Bob was happy to get this record of Sótano del Toro, as it was the seventeenth record now of caves with cave fish. This was quite remarkable, as in the world literature up to now there were only five records of these caves with cave fish, and now we knew of seventeen, most of which had been discovered only this year. Yes, the knowledge gained in the research he was spearheading was certainly accumulating rapidly.

Monday, 6-2-69. Don Broussard had asked if he could fly back with us, and we figured we had room for him and his gear. Joseph was also leaving, but would take a bus back to Del Río. This morning Don got a haircut at the friendly neighborhood barber shop, and then also went down to the market to look around. He was especially interested in machetes, and considered getting one for use in the summer when he would be back in the Ciudad Valles area to map some of the Sierra de El Abra caves. He thought about waiting till summer to get his machete, but then he saw one that he liked, so he went ahead and bought it.

We loaded up the plane and shoved off, I certainly wish they'd fix that runway, because it sure was rough, and it took quite a long run to get the plane airborne. In fact, we used up just about every bit of the runway and just missed the orange trees. Perhaps it was the heat and air density, or maybe the plane wasn't working quite right. We wondered about it, but the motor sounded all right, so we went on.

Finally we were off the ground, and headed north. We looked at some of the sótanos in the Los Sabinos area, and Don was most interested in seeing them, because he had been in most of them but had never seen them from the air. We saw Sótanos de la Palmaca, Piedras, Jos, Pichijumo, Arroyo, Tinaja, Tigre, Yerbaniz, Matapalma, and Japonés, and Cueva de Los Sabinos. Then we went right over the Rancho San Ricardo airstrip and saw the little wilderness church up near the top of the Sierra de El Abra and the cave beside it. Not far beyond that, Don was astounded at the magnitude of the Caldera, and as we circled it we again saw a number of brilliantly colored military macaws and two yellow-headed parrots flying around over the jungle on its floor.

Before long we passed the ancient water gap that carried the Ciudad Mante–Antiguo Morelos highway, and soon we went over the lowest part of the ridge and then over the beginning of the Sierra de Guatemala. We marveled at the spectacular karren and saw the Sótano del Malpaís, and then passed over Bee Cave, which again had a flock of quilas flying around in it. A short distance to the west we looked at the new sótano we had found just four days before, the one I called Sótano Verde because it was so green. I had flown over it twice now and had looked clear down to the boulder-strewn bottom, but had never been able to see the northwest part of the bottom, because there was sort of an overhang. This time we made a pass over it from the south and then banked to the left, and sure enough, there in the northwest corner of the bottom was a huge fissure, its black interior indicating that it probably went down a considerable distance. That was good, and something had been accomplished by this flight, because Bob and Bill would be most interested to learn that this pit went

somewhere and didn't just end at the bottom of that rocky green hole.

Then we cruised northward, gaining altitude, as we were going to fly over part of the Sierra de Guatemala. About a couple of miles north of the Sótano del Caballo Moro were the areas of the large feathery bamboo that were so pretty. North of that was a little, low east-west ridge, and beyond that was the very delightful little village that had so fascinated me on previous flights over it. Tom and Don also seemed to be impressed by it. There were six or eight little thatched huts and several very small flat-bottomed valleys, each just large enough to hold a single little *ranchito*. Every time I saw this place I had the desire to go there sometime, as it looked so pretty down there in the green mountains, and I especially wanted to walk along the little footpath through the tall trees with very green grass along the sides of it.

As we continued northward, we looked at the bright green jungle beneath us and thought how it looked almost impossible to traverse by either man or beast. In one place there were many vines stretching from the trees to the brush, and in all areas there were some large trees and much smaller brush, so that usually it was impossible to see the ground anywhere.

We were enjoying all this, but then we seemed to be closer than I wanted to be to the trees. I looked up ahead at the very rugged mountains that we had to cross and noted that the ridges were just about level with us. We could easily climb a little and go over them, so that was no problem. I raised the nose of the plane to climb, and reached over to give it full throttle for the added effort that would be necessary. It was already at full throttle. That puzzled me. A quick check of the air-speed indicator alarmed me a little, as it read just slightly over 70 miles per hour. How could that be? Why didn't it read 110, as it ought to? The near horizon up ahead was just about as high as we were, and the plane seemed to be working hard trying to climb. Why should it, when there was so little elevation we needed to gain? Maybe the plane wasn't functioning properly, but the engine sounded good. Then I realized what the trouble was—or I thought I did. Maybe it was an illusion; maybe the ridges of the near horizon up ahead were actually quite a bit higher than we were. That would explain the slow air-speed since the plane would be in a rather marked nose-high attitude. If this was true, and I had to assume that it was, though it didn't look like it to me, then we were in trouble, and I had to turn around, but fast, before everything closed up on us.

I went over to the peaks on the right as close as I could, since I was already below the tops there, and then made a sharp turn to the left to head back toward the south. Right away things didn't seem to be going too well. The engine sounded a little funny as we started this turn. I couldn't tell what the problem might be, or even if there was a problem for sure, but the sound was somewhat different than it had been. But I didn't have time to worry about that very much. There was a ridge on the left, and as we approached in our sharp turn, it appeared that we might not clear it, that it was too near to complete the turn on this side of it. A treetop was coming uncomfortably close, and then I heard and felt a clug that told me we had hit it with the right wheel. I felt a little drag on the plane at the impact, but hoped that all would go well and we could clear the rest. However, the uppermost trees on the ridge were just a little bit too high, and the left wing, being down, was what touched next. Suddenly there were more clugs. As we continued on and the drag on the plane was very bad, we turned around to the left so that the plane was now facing north but we were moving south—actually flying backwards. Then the nose began to drop, and we were diving straight down for the top of the ridge, but the plane was still moving south, so it was in a vertical position and moving south, bellywards. No one said a word.

Then I began to wonder why the plane wouldn't stop, as it kept crashing through the trees making such a gosh-awful racket, and all I could see was a swirl of green before the windshield. It seemed to be taking such a long time, and I wondered golly, how long can this go on? Then suddenly the nose hit the ground, and it didn't really seem like such a great impact. That stopped the descent, but since the tail was still moving southward, the plane flopped down on its belly and then stopped. And all seemed suddenly so quiet.

Tom was also thinking as we were crashing. It didn't occur to him that we might survive. He just wondered from which direction it was coming. Would it be from the front where a rock would come up and crush him? Would it be from the side, when a tree limb would come in and stab him? Would it be from the bottom, when a tree trunk would come in through the floor and run him through? And he waited for it, to see from where it would come. He felt all the blows on the plane and heard all the racket, but he saw nothing since he closed his eyes and did not open them again until we had come to a complete stop. "Are you all right?" asked Tom as he looked at -me. "Yeah," I replied, looking at him. "Are you?"

"Yeah," he said, "I'm all right." I could see that he had a small cut under his left eye.

Then we asked Don in the back seat how he was, and he answered in a slow deliberate, quiet, typical Don Broussard voice, "Who, me? Oh, I am perfectly all right." Don had realized something was wrong when we hit the top of that first tree. As we then went crashing through the jungle, part of his impression was just like mine—green, everything green. However, he heard no sound; all was silence to him, which was in marked contrast to the loud crashing thundering racket that was so penetrating to my senses. After we stopped and all was really silence, then he was aware of the whine of the instrument gyros running down for the last time.

Good! At least we were alive and well.

"Wait a minute, Richard," said Tom, a note of concern in his voice. "I'm not sure now if I'm all right or not. I'm bleeding from somewhere. Look here! There's blood running

down." Then I saw Tom was holding the top of his head near the front, and sure enough, he was bleeding, and he had blood running down the front of his face and spotting his T-shirt. I looked at the top of his head in the hair just above the forehead, and there was a small cut, but it appeared to be not all the way through the scalp, and it was only about an inch long, so I wasn't too worried about that. I also wasn't worried about the one on his cheek, because while it was all the way through the skin, it did not go on down to the bone, but was about an inch long transversely and was gaping open about a quarter of an inch.

"I'm sorry, fellows," I said. "Gosh, I'm sorry!" I really felt very badly about it, as I felt it was all my fault. Only a short time ago we had been up there flying along with not a care in the world, and here now only seconds later all that had changed in the twinkling of an eye and we were on foot in the trackless jungle. I was the pilot, and I felt terrible, but that didn't help the situation any.

We got out to survey the damage, and there was considerable. In fact, the plane was completely and totally demolished. The left wing had been torn off about in the middle, and the part that remained was all torn with the skin full of holes and pieces bent in all directions. The right wing had been torn off directly adjacent to the fuselage, with not even a little fragment remaining. The windshield was broken to pieces, and the rear Plexiglass also was in pieces. The fuselage extended on back to the tail, but it was bent some to the left, with the tail or empennage twisted around about 60 degrees to the left, and all portions thereof were badly bent and destroyed. The propeller was positioned transversely right on top of where the engine was, with the right blade of the propeller sheared off at its tip, and the left blade of the propeller had been bent double in its distal 20 percent. The left door was still shut, but the right door, which actually seemed intact, was lying as though it had just fallen out and lay down, with the bottom of the door still against the plane and lying flat on some trees that had been bent down, giving us a very neat and convenient platform to step out on. Looking forward from the plane, we could see a nice hole through the trees that the plane had made in its path down. Directly in front of the nose of the plane, about 10 feet or so away, was a tree trunk about four feet high and about four or five inches in diameter, with the top very thoroughly splintered.

Actually, things had worked out very well. We had hit the trees right up on top of the little ridge, and then our momentum had carried us on over to the south slope. We had been diving straight down for the hard rocks on the ridge top, with the wings east-west, moving southward at a considerable rate of speed flat towards the belly side, and that actually had been a very convenient position. The plane was falling downward, but as blind luck would have it, the south side of the ridge we were over was also rapidly sloping downward towards the south, so the rate of convergence of the two was not as great as might be expected. As the plane went crashing through the trees southward, it hit many of them, and this slowed its passage down considerably. Then, it went right through between two trees, each about a foot in diameter. The left tree was slightly up the slope by about eight feet or so, and it hit the left wing at about the outer third or so and broke it off right at the attachment of the wing strut. This then rolled the plane slightly to the right, or clockwise, on its longitudinal axis, so that when the right tree trunk hit the plane, it just missed the wheel, but then hit the wing strut about a foot from the fuselage and tore loose that attachment, folded up the strut at the base practically touching the fuselage, and knocked the wing completely off the plane. The hinges of the right door, which protruded about an eighth of an inch or so above the skin, were sheared off right even with the skin by the end of the wing strut, so the door had fallen neatly outward when the plane stopped.

These two trees were about ten feet apart, and if we had hit either one with the belly of the plane, surely the story would have been different, as we all would have been squashed. But luck was on our side, and we went between. However, we would not have gone between if the left tree had not been a little upslope from the right one, thus allowing the left wing to hit first, which had rolled the plane so that when the right tree hit the right wing, the fuselage had moved slightly to the left so that the tree, which had been aimed for the bottom of the right side of the fuselage, now struck the slightly angled plane and thus missed the fuselage completely, struck the wing strut near the fuselage, and took the wing off right at the fuselage, about six inches from Tom's head. About then the nose of the plane had hit, too, and since the ground was sloping down sharply and thus receding rapidly, this blow of impact was not nearly what it would have been on a level ground, and so it was not enough to do much damage to us, but just bent the nose and the engine up some, leaving the propeller aimed up, right across the top of the engine mount. The entire engine mount was kinked upward somewhat.

It was unbelievable. Here we had been in a small aircraft crash in which the plane was totally and completely demolished, had been in a vertical nose dive right into the ground with full power on since it had never occurred to me to pull back on the throttle, but yet none of us had been hurt except for Tom's little cuts. It was truly miraculous the way things went, and it just must not have been our time to go, because no one, but no one, could walk away from a plane crash such as this, and especially not all three of us, 100 percent. It was incredible. I broke out my camera, changed to a new roll of film, and took a number of pictures of the plane from different angles and positions, and felt I would probably have a good record to remember the occasion by.

Now that Tom had pretty well stopped bleeding, I pulled his cheek cut together somewhat with a bandaid from Don's first aid kit, and I felt he was taken care of. We had no water, so we could not wash the blood off his face and he stayed exactly like he was. I would have liked to put some stitches in that cut on his cheek, but we didn't have a

needle of any kind at all. I thought of sticking thin cactus spines through the edges of the skin and then wrapping thread or some kind of fiber around behind the thorn ends to pull the skin edges together, but there wasn't any cactus growing here. I remembered how in Africa some of the native tribes close lacerations by holding a certain species of ant up so it will bite to catch both edges of the skin in the mandibles, at which point they break off the ant's head, and this leaves the ant head grimly attached holding the laceration closed until it heals. Pretty slick, but we didn't see any ants that looked like they might cooperate in such a venture.

As I was walking and climbing around, I began to notice that every now and then I would experience a very sharp and rather severe pain in the middle of my chest in front, right at the sternum or breastbone. I felt and pressed there and could feel only a slight soreness, so I didn't think it could be broken, as even on pressure it wasn't really tender, but when it decided to hurt, it really hurt. I had to be quite careful when I put my weight on my hands, as it didn't take but a very short while to learn that it was this that brought on the pain, especially when I was sitting and then tried to push up with my hands. However, since I seemed to be getting along all right, I dismissed it from my mind except at such times when it forcibly intruded itself into my consciousness.

The crash had occurred right at 3:00 p.m., the altimeter read 3,620 feet above mean sea level, and the hour meter read 349.0 hours, so we had flown exactly 1.2 hours since taking off from the Hotel Covadonga. The weather was fair, with a few clouds here and there.

But we couldn't stand around all day looking at the plane; we had to decide on a course of action. We could stay with the plane, but in the vast primitive mountain mass, surely no one had seen us fall, so no one would be coming to us. The general rule is that survivors should stay with the wreckage after a crash, but we sort of felt that the general rule might not apply here. I thought we should travel, and I thought I knew where we had to go—back there to those little *ranchitos* nestled down in the little valleys with the pretty green footpath leading down to them. Just how far away that was I didn't know, but it was somewhere to the south, so we would head south.

We were going to leave the plane, and since we couldn't take all our things with us, we thought that when we got down out of here we could send a Mexican or two with a burro or two back to get our stuff and haul it down. However, the boys were getting ready to pack some things to take along, and I very quickly realized that they were right. We had to take some things along with us, and prepare for a hike which might be rather long. We took only what we thought we would need on the hike, since we would send a Mexican with a burro up to get the rest. Our first consideration was clothing, of which we had some extra along, so we put in some extra shirts and trousers, and put on two pairs of socks. Tom and I were both wearing low, soft shoes, so we changed to our boots. Don had a poncho and a ground cloth, so those were put in. Tom had a quart canteen that was about one-fourth full of water, so we took that. Don had a similar canteen, but he had emptied it just before leaving Ciudad Valles in order to lighten the load, so we debated about that briefly, but then decided to take it with us anyway.

I went through my suitcase to see what I should take along. There was the jar full of millipedes from Rice ›'n' Noodles Tunnel in Sótano del Tigre, and there was the vial of snails from the plunge pool, but they could stay with the plane, since a few days being left alone wouldn't hurt them any, and if we took them along, they would be heavy and breakable. There were three rolls of film I had exposed on this expedition, some flying around Ciudad Valles and vicinity and some down in the Sótano del Tigre. I almost left them there, but then I thought that perhaps it might get very hot in the cabin of the plane and this would certainly not be good for the pictures, so I took them along. My little IBM 224 dictating machine was small, but it was rather heavy, and I debated about taking it for a time, but then I took it since Don said there was room in the pack for it. There were a number of belts for it that I had already dictated, as well as some undictated belts, and I took those along since they were small and light. I just could not bear to leave those for someone to come and get. The camera of course I would take, but I took the binoculars only after debating about it for a time, as I really probably wouldn't have a great deal of use for them on this hike.

I looked in my handbag, the nice bag given me by Jerry Hebert of the Roselawn Pharmacy in Alice, and found several things there that I wanted to take. That handbag was always so full of junk that I could hardly ever find anything in it, but I always wanted to have that junk along, just in case I should need it. There were many pieces of string of all lengths and sizes, and I took all of those along, since string might really come in handy on this hike. There was my little ditty bag, a little blue cloth bag with a drawstring at the top and two other strings so that it could be tied around the waist that had been given me by the Red Cross when I went overseas in the Navy in World War II. I had used this ever since to carry little toilet articles, and it was somewhat worn, and Perk had even patched it a couple of times with red and yellow cloth, and I was rather attached to it. However, I would not take it, since the Mexican with the burro could get that very well. Inside the bag was my razor, a little safety razor that I had turned down on a lathe so that everything would all fit very neatly into a thin compact plastic box that I had I had made up when I went on my trip around the world about two years before. Again, I did not take this razor, although I was also somewhat attached to it, as I would not need it on this hike. There were also three pocket knives in there, and these I took, since we would then each have a knife. I smiled as I remembered the big fuss the Communists back in Brazzaville in the Congo had made about those knives when they threw me into jail for two weeks on charges of international espionage. There was also a very fine Swiss Army officer's knife with many blades of different

kinds. I looked at it and thought it was a little too good to take along, I wouldn't need that much with me, so I left it for the burro. There were also various medicines in the bag, such as antibiotics, antihistamines, and various other things, but I really didn't think that we would need too much of this, so all that I took was a small vial of Upjohn's PAC tablets for minor aches and pain or headache.

There were several other things that we also had to decide on. There was Don's new machete that he had bought just before we left Ciudad Valles and that we knew immediately that we wanted to take along. We couldn't find it at first, as it had gotten displaced somewhere in the crash, but then we found it on the floor underneath the front seat. In the plane there was something that looked like a small fish net and a piece of plastic. We didn't know what it was, but we took it along since it looked like it might come in handy for something or other.

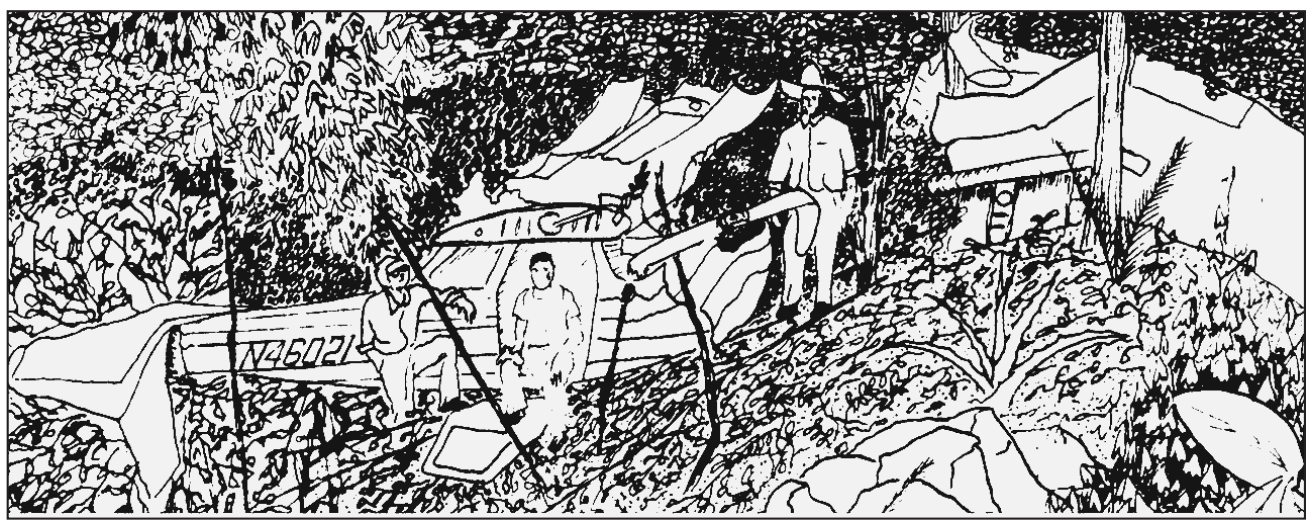
The magnetic compass had been attached on the top of the instrument panel, but it had been broken off in the crash and we found it lying on the floor of the cabin. This item was quite heavy even though it was fairly small, but we took it along anyway, since a compass might be very useful to us. Don already had a compass, but he said that it didn't work and was not at all reliable, so we were very glad to have the plane compass. It had a crack in the glass on the front of it, but it still seemed to work. Also on the floor of the plane I found the small plastic label carrying the plane's identification number, N46021, which had been attached to the instrument panel but had been knocked loose in the crash, so I stuck that in my pocket as sort of a souvenir. There was the heavy canvas sea bag filled with the 225 feet of Goldline nylon rope, but that we of course left with the plane, since we weren't about to carry that out.

My straw hat was found on the floor in the back of the plane. It had been a right decent-looking hat before the crash, but now it had assumed a number of most interesting shapes and kinks and bends. It still fit, so I put it on to wear down out of the sierra. Tom had his $2 hardhat and Don had his $15 hardhat, but both of them decided to leave their hats in the plane. Along with the hats on the floor of the cabin Tom found his translucent rock from Cueva Chica, but it stayed where it was, since he certainly wasn't in the mood for carrying that heavy rock along for ballast now. The burro could carry it a lot better than he could.

I checked in the plastic briefcase in which I carried my aeronautical charts, calculator, and other pilot's equipment, though I didn't think there was anything in there that I wanted. Those charts certainly would not help us on this hike, so I saw no point in taking them. However, in there I found two items that I thought I would take, my pilot's log book and my parachutist's log book, since they were important to me and were both small, flat, and light.

We checked once more, to see if there were anything else that we maybe should take. I saw the telephoto lens for my camera, and decided perhaps we could take that along, since it was rather light and had a strap to sling over the shoulder. We looked around some more on the floor of the plane among the persimmons—we must have crashed through a lot of persimmon trees, because green persimmons about an inch and a half or two inches in diameter were rolling around all over the floor. We saw an old white paper bag on the floor of the cabin, and on investigating we found that it contained some very old and very dead doughnuts that Perkie Wench had bought for our breakfast the day we left Alice about ten days before and had given us those left over to take along. This was food, so we certainly took that, although the doughnuts were just as hard and dry as could be. Don had had a very small amount of food in his pack, which we of course left in, as well as his small aluminum one-cup measuring cup. We also had a two-cell flashlight with very weak batteries in it, but we had eight extra batteries for it, so we were in pretty good shape as far as that was concerned. Tom was also taking along his carbide light and an eight-ounce plastic baby bottle full of carbide, and Don and I each also had a small two-cell pen light, so we should have plenty of light for our purposes. "You know," said Don, as we were just about ready to go, "I can't think

Richard Albert.



of any two guys that I would rather be doing this with than you." That was a very nice thing for him to say, and we appreciated it.

"By the way," said Don, as we left, "I am a diabetic."

That was a nice little surprise. It was really bad news, because that could complicate the picture no end. He said he had his insulin along, and alcohol and several syringes, so he could give himself shots when he needed them; but still, things can go so wrong with a diabetic. We had such a small amount of food along, and we didn't know how long we would be on the trail. If complications did set in; we couldn't handle them.

We had gone only perhaps a hundred yards when Don remembered a $50 traveler's check that he had left in the plane. He went back to get it, and so he was the last one of us to see the plane.

Since we were on a little ridge, I thought we should follow that ridge toward the east as far as it went, to where it disappeared down at the confluence of the two arroyos that it was between, and then we would follow that arroyo on south. However, it didn't seem to work out that way, since the going was very rocky and brushy and exceedingly rough. We weren't sure about the crest of the ridge because we were unable to see out anywhere, so we thought that perhaps we had better go down the south slope of the ridge to that arroyo, where we were pretty sure we could at least tell which way was downhill. In due time we reached the arroyo, but it was not very easy going at all. In fact; it was miserable. There was much tangle of vegetation, and there were green rocks all covered with moss that made them rather slippery, so we had to be careful how we walked. Sometimes an arroyo can be easier traveling than up on the ridge, but here it was quite bad in both places, with the canyon sides so steep and rocky that we couldn't very well travel over them anyway. We had to stay in the arroyo, but it was very difficult.

We were in the cloud forest of the Sierra de Guatemala, a disjunct segment of the Sierra Madre Oriental. This was a cloud forest in which most everything was wet all the time, but where there was no standing water. The vegetation grew lushly, and in some places there were patches of *Heliconia*, plants that looked like small banana trees. Actually, they really were members of the banana family, but they bore no edible fruit, but were blooming with quite interesting and pretty yellow and blue and red flowers that somewhat resembled bird-of-paradise flowers. One good thing about them was that they were easy to cut with the machete, so they did not impede progress so much as did some of the other vegetation.

After a time the bottom of the arroyo was not so bad as it had been, as now in some areas there were large tangles of the *Heliconia*. I thought of the traveler's palm of Madagascar, which is a member of the banana family also, and in which rain water collects on the leaves, runs down the leaf petioles to be stored in a hollow space down at the stem of the plant and from which travelers can get water. I looked in several of these *Heliconia*s, but found no water.

We were getting pretty thirsty, but allowed ourselves only a couple of swallows of water. We hoped we would find some somewhere, but it did not appear. We wondered where else we might get some fluid, and then found some more of that strange, slender climbing cactus the *Selenicereus*. I ate about a foot of it, as it certainly was very succulent, but it wasn't too good, just sort of neutral in taste and a little slimy in the pulp. Tom and Don tasted it but didn't seem impressed by it either.

We continued on gradually downhill, getting through the brush with varying difficulty, sometimes considerable. We would go as far as we could in daylight, as we felt it would be totally impossible to try to travel by night. Even though we had the flashlight and Tom had his carbide light, we would not be able to tell very well just what we were doing, and in the tangle of brush it would be next to impossible. Anyway, we couldn't use the carbide light, since that required water, and we certainly couldn't possibly spare any now.

The arroyo didn't seem to be too hard to stay in, as the canyon sides were so steep. Not cliffs, but just steep. Of course we could follow it downhill—but at just about dusk there came a time when we couldn't. It seemed sort of ridiculous, but we couldn't find which way was downhill. We thrashed around in the particularly thick brush here for a time, but couldn't get anywhere—it seemed like everywhere was up. Finally Don and I sat down to rest and sent Tom out to scout around. He climbed a little ridge to the southeast, and we kept hollering back and forth so he wouldn't get lost from us. After a time he returned and announced that it looked like we would have to cross that little ridge, so we climbed up over it and found the arroyo, or at least an arroyo, going on down. Apparently there had been a little cross-ridge blocking the arroyo, which seemed rather strange. It showed that there sure wasn't much rainwater accumulating up here, or the cross ridge would have been eroded through or a little lake would have formed on the upstream side of it. Or maybe the rocks here were so porous that the water just flowed right on through, like into a sótano somewhere.

We traveled until 8:00 p.m., by which time it was rather dark. We probably could have gone on a little farther, but it was now dark enough to where we couldn't tell whether we were stepping into a hole or not, or even into a sótano, so we decided to stop in a little flat area with the ground covered with a thick layer of leaves. Don had a small packet of one and a half ounces of instant oatmeal for supper, but Tom and I ate nothing, since we didn't feel that we really needed it yet, whereas Don did. Well, actually, Tom and I did have some supper, too. He found a small measuring worm which he swallowed whole, and I found a medium-sized grasshopper that I caught and ate, crunching it up between my teeth. It wasn't bad, but there just wasn't enough of it.

We were all very thirsty, and since we had only that quarter of a canteen of water that we were hoarding so carefully, we needed water badly. We hoped it would rain, but if it did, we needed something to catch it in, so we worked on that. Don had

a quite thin plastic ground cloth in his pack, so we now spread that out on the ground in an area that looked slightly more open. We chopped an opening in the *Heliconia* plants, and tied the edges of the cloth up about four inches to the stalks of the *Heliconia*s or to sticks we stuck in the ground. We used some of the string I had salvaged from my handbag, and thus made a nice catch basin that we hoped would hold water—if it should rain.

The boys were talking about what a survival hike this was turning into. "And it's for real, too," added Tom.

"Gosh, yes, it's for real!" answered Don. "You can't go and tell your Scoutmaster you're tired and you want to go home. It's the real thing."

We made camp right beside a forest giant of a tree with a trunk at least four feet in diameter, leaning about 15 degrees toward the southeast. There was a log about a foot and a half in diameter lying almost on the ground, so we could put our things under this log for a little protection. We put on three shirts apiece so that the chill of the night air would not bother us too much, but it was rather warm, so that at first it seemed a little too warm. I now for the first time looked at the thermometer that Tom had just given me back at the plane, and saw it was 78 degrees. We lay down under the shelter side of this great tree, under the leaning side. We covered ourselves with the poncho, the edges of which we also tied up all around the foot section, so it too would hold water.

However, we did not go to sleep right away. In a few minutes we arose again and got down on bended knee, while I said a little prayer of thanks to God for having watched over us this day and having been so good to us and preserving our health. We prayed that He would watch over us and guide us in the days ahead, and that if it were His will, to let it rain tonight. And then in unison we recited the Lord's Prayer.

We by now realized that everything we had left in the plane was completely and irretrievably lost, as it was totally impossible that anyone could ever get up near that plane, and if they did, they couldn't find it in that dense jungle, and a burro would never be able to make it at all. We talked for a time about whether we should have stayed with the plane or whether we were wise in trying to walk out. If we had stayed with the plane, when would anyone have missed us? Bob and the others wouldn't miss us, as we had left them to go home, so as far as they knew, we were home.

There was no airport in the Ciudad Valles area where we could file a flight plan, and the Hotel Covadonga didn't even have a telephone so we could have called one in somewhere, so there was no flight plan, and the Mexican aviation authorities would not miss us and would not come looking for us. And even if anyone were to look for us, they wouldn't know where to look, and if they did know where to look, they'd never find us down in this jungle.

Cliff, the plane's owner, wouldn't miss us right away, as our return had been somewhat indefinite. And if he did miss us and try to find us, all he could do would be to call my home, and he could get no information there. He didn't know where to reach us in Mexico.

And again, certainly no one had seen us crash, as no one lived up here, and no one could possibly be out in this trackless wilderness but us. We firmly believed that this was a completely virgin jungle that we were in, never before trod by the foot of man. No, there was no one anywhere who could possibly help us except the Good Lord himself, and he had already helped us tremendously. Yes, we felt that we had done the right thing in trying to walk out; there was really no other choice.

We wondered if it would rain. Right after the crash, we had heard a little rumble of distant thunder, but from our position we had not been able to see any weather anywhere. As we now looked up through the dense canopy of foliage above us, we could see tiny patches of sky, and in some of these patches we could see stars. The prospects for rain were not good. Then we heard a few tiny droplets of rain falling in the leaves high overhead, but none of them ever reached the ground, and still we could see a few stars high overhead. This went on for several hours, occasionally a little sprinkle would come that we could hear on the leaves high overhead, and once in a while we could even feel a little droplet down where we were, and we could see a few drops of moisture on our raincatcher, but that was all. Sometimes the stars were covered by clouds, but then they reappeared. This would probably go on all night, just teasing us enough to make us think it might rain, and then not doing so. And we were so badly in need of water; our tongues were sticking to the roofs of our mouths. I had planned to dictate some tonight, but I didn't do so because I couldn't talk very well with my mouth so dry, and also I felt I would lose more moisture that way with talking with my mouth open, and I wanted to conserve every drop that I possibly could. I couldn't even sleep, the thirst bothered me so.

Just at midnight came another sprinkle, and this increased to where it seemed as though it might be something. I went out to our raincatcher, and sure enough, there was already almost a teaspoonful of water in the bottom of the plastic cloth. This was very encouraging. I looked around and saw that some of the broad *Heliconia* leaves had drops of water on them, so I went around licking them, getting at least enough to wet my tongue that way, which was quite refreshing.

That little ground cloth looked so small, i wondered how it could ever possibly catch enough water to do any good. Then I had an idea. Hurriedly I built a little roof or leanto on two sides of the cloth, using the broad *Heliconia* leaves as thatching, so that the water that fell on these leaves would also be diverted into the ground cloth. This more than doubled the catch-basin area and hence would provide double the amount of water.

"How is it working?" asked my companions, who had: awakened. Of course they were glad to know that it was raining slightly now, and that a little water was beginning to collect. After a time a bit of water had collected, so they gave me Don's empty canteen to fill. It was filled completely, and still there was more water in the ground cloth. Tom

and Don had meanwhile drunk all the water out of the other canteen, so I now began to fill it from the ground cloth. The ground cloth was empty when the canteen was about two-thirds full, so I filled the rest of it from the top of the poncho that we had also rigged as a catch-basin. However, this water was not very good, as it had a rather strong poncho flavor. There was about three-fourths of a cup left on the poncho then, so we now divided that among ourselves. After a short time the sprinkle stopped, though we certainly wished it would continue. We were feeling better than we had been, as now we could at least talk a little, but our thirst was far from slaked. Once more during the night I got up to check on things, and found nearly a cupful of water in the pool. I drank half of it, and then took the other half in the cup up to our tree, where I set it next to the tree trunk. My companions were asleep now, but they would be happy to have it in the morning.

Tuesday 6-3-69. It had gotten cooler during the night, and at dawn our thermometer read 68 degrees. Our three shirts felt good this morning, but we took off all except one long-sleeved shirt as we made ready for the trail.

Don injected hypodermically into his right thigh 54 units of NPH U-80 insulin. He said he usually took 58 units per day, but when he was caving or doing other strenuous exercise he cut it down to 56 units. However, today he cut it down to 54 units, since he would be exercising a lot and there would be very little food. He ate a one-and-a-half-ounce packet of oatmeal for breakfast and had a teaspoonful of sugar and a doughnut. I found a fat juicy measuring worm about an inch and a half long that I swallowed whole, and Tom swallowed a small millipede about an inch long.

I asked Don something about his diabetes. He said he had been a diabetic about thirteen years now and had always seemed to get along rather well with it. However, about a year ago he had had a seríous reaction due to too much insulin, as his roommate had found him in convulsions one morning, and he had spent a week in the hospital recuperating. That news didn't make me happy at all, as we were treading on very thin ice with a diabetic out in a situation such as we were in now. If he had any sort of trouble out here, we could never handle it at all, and that would be very bad.

There was about a cup of water in the raincatcher this morning, but we increased that slightly by carefully picking up each leaf of the thatching on the leanto and shaking it over the cloth, thus salvaging several drops of precious water from each one. We gathered this very carefully, dipping it up out of the raincatcher with a teaspoon until we could not get another drop. We had also spread out the very small piece of plastic that had come with the net in the back of the plane, and we now dipped about a teaspoonful of water out of that to add to our drink for this morning. We shared this and then broke camp and were on our way.

As we were going down over the rocks, I found that the middle of my chest would hurt a great deal every once in a while. I could carry the pack all right, but I sure had to be careful when I helped myself down over the rocks, as that would really set me off. The boys said maybe I should x-ray it when I got back, but I felt myself, and since it wasn't tender to pressure, I replied that no, I didn't think I would, because if one of my patients had this pain and wasn't tender on pressure, I'd say it was just a bruise and not a fracture, so that's what I'd say it was in me, too.

We walked on, moving ever downstream, which was sort of toward the south. Every time we paused to collect a meager water supply, welcome though that small bit might be, we were losing valuable marching time, and we felt we must keep moving. We did not know how far we had to go, but there was a possibility that we might be able to get out of here today. If not, then tomorrow, we hoped. At times, the going was quite easy, marching along through the *Heliconia* on a floor of soft forest litter. At times we had to hack our way with some difficulty through tangles of underbrush and vines that just did not seem to want to let us through at all. At first the going had seemed easier than yesterday, but then it became worse again.

We stopped for dinner somewhere along the way. Don opened a can of Spam, and ate it along with two of the dead doughnuts. Tom and I had nothing, and this made Don feel so bad that he insisted we take half of his can of Spam. However, we knew he needed it a lot worse than we did, so we insisted even more strongly that he eat it all. Tom and I each wound up eating a little cube about three-quarters-of an inch in size, and Don ate the rest. Rather surprisingly, we didn't really feel hungry, as the sensation of thirst was overpowering everything else.

We litterbugged a little here. The can from the Spam was left lying on the bottom of the arroyo, in plain view. This was something we certainly should never do, arid we would ordinarily have put the empty can in the pack and carried it out. However, we felt this was a special circumstance. We did not want to burden ourselves down with any unnecessary items, and besides, the dampness of the cloud forest would soon rust it into oblivion. Certainly no one would ever see it here in a thousand years.

"Guess what?" said Tom. "I'm supposed to be registering for classes at the University of Texas today. And I won't be there." No, he sure wouldn't.

We kept hoping we would find a pond of water somewhere. On a number of occasions we found some little sinks or holes, and I went down into them to see what could be found. Always it was the same—I would dig a little, finding lots of decaying leaves just wet with moisture, but no standing water at all, and not enough to squeeze out of the leaves.

"Let's try to move along as much as we can," said Don. "I think maybe it would be better if we kept going and didn't stop so much."

We took turns carrying Don's pack frame, which was the largest and heaviest, and we also took turns in front with the machete. However, as it turned out today, I was the hatchet man most of the time. Many trees

and shrubs had limbs that would cut off fairly easily, but some wouldn't. One tree in particular was a small tree, with a trunk only about four or five inches in diameter, and it often had little branches three feet long across the trail. I learned very quickly that unless I hit them a good solid lick right against the trunk, I couldn't cut them at all, even though they were no larger in diameter than a pencil. They sure were tough. There were some kapok trees, with trunks solidly covered with short, fat conical spines, and we had to be careful not to bump against them. And of course, there was the ever-present *mala mujer*, a plant that looked like a castor bean, but it was a nettle that really could bite. In the litter on the forest floor we would find some large acorn cups, maybe two inches in diameter, and Tom remembered that these same cups could be found at Tansosob, up above Sótano de las Golondrinas.

A little farther along, Tom found another tiny puddle of water, in the cracks of a large rock forming the bed of the arroyo at this point. At first it tasted fairly good, but then as we began to get close to the bottom, we got closer and closer to the rotten leaves in it, and it got ranker and ranker, until it was hard to force down any more. We each got a little more than half a cupful of water here. I salvaged another three or four teaspoonfuls from a six-inch hole nearby, depressing the mud and leaves until a small amount of liquid flowed over the edges of the spoon. We managed to get a little more moisture in other ways, too. In some places we found more *Selenicreus*, so we ate some of that, as the water content was high. In these low places grew a plant with very juicy soft succulent stems up to perhaps half an inch in diameter, and we ate some of these stems, too, although they had a rather gooey consistency and they didn't look good at all, but they didn't taste so bad. Also, we ate the hearts out of some of the insides of the *Heliconia* plants, which gave a white crisp salad the taste of which was quite satisfactory. But we didn't want to eat too much of these other things, since we didn't know if they might have some other bad effects on us like vomiting or diarrhea, which would make things very much worse. Then Tom spotted a little *Rhipsalis*, another very strange cactus that grows as an epiphyte on the side of the trunk of a tree, looking very much like little mistletoe. We also ate some of this, but it didn't taste good at all, so we didn't eat very much.

Then our arroyo sort of seemed to play out. There seemed to be a maze of arroyos, and we could not tell which one to follow since we couldn't tell which one went downhill. We headed up in several different directions, but then it always seemed to go wrong, so we didn't continue. Along about here, we no longer had any sense of direction. We checked our two compasses, and they both always agreed as to which way was south, and we'd go a few steps in that direction, and then it would appear that they were now pointing 90 degrees off or perhaps even in the opposite direction from what they had been. However, both compasses always agreed, so we had to believe them.

This was a rather difficult situation here. Perhaps there was no water drainage out of this area. Once before we had had to climb a ridge across the arroyo, and here it again seemed like that, only more so. We couldn't see anything, as we were always in such dense jungle that we almost never could see the mountains around us. It was like being in a room, and we'd walk and walk and walk, and never seemed to get anywhere, because we were still in the same or very similar jungle.

These two boys really were good traveling companions. They didn't complain one bit, and seemed to trust me implicitly. While stumbling around down here in this maze trying to decide which way to go, I turned in many directions and reversed myself frequently, but Don and Tom always followed me right away, with never a question raised about whether they agreed with me or not. They were trusting me to get them out of this mess, and it was so heartwarming and gratifying to me to see the faith that they had. And it was I who had gotten them into this mess in the first place.

As fate and coincidence would have it, all three of us were Eagle Scouts, and thus more or less used to roughing it and camping in the outdoors. We had never been lost in a Mexican cloud forest before, but our Scouting experience and training was certainly of great benefit to us now that we were lost in such a forest, and we were all three much better equipped to handle the situation.

We didn't know which way to go, and we were losing very valuable time. We knew we wanted to go south, but south lay right over a ridge we sure didn't want to climb since we were so very hot and dry and thirsty, and we didn't like that idea at all. We lay down for a minute on the soft dark brown forest litter, and wished we could just lie there eternally. It was so nice to just lie there and relax, but we were far from comfortable, since we were so thirsty. It was all beautiful, very beautiful, just like Tom said, but it was hell to get out of. It might have been a very enjoyable hike, under other circumstances.

"Let's kind of move along," said Don. "Let's don't stop anymore if we can keep from it, because I don't know how much longer I can keep going." Poor Don. He felt that time was running out on him, and it was. To us it seemed like a time bomb waiting to go off, set for an unknown time to detonate.

A little farther along we stopped at another grove of *Heliconia* plants, and here Don himself suggested that we stop and try to get some water. This time we didn't try to cut the whole plant of and quickly hold it over a cup, because we always seemed to lose so much that way. Instead, each of us cut a little slit with his pocket knife and quickly reached down and sucked. This was a very productive stop, and I bet I got at least a cupful of water this way. On one really juicy plant I got several good swallows, and they came so fast I could hardly swallow fast enough. As soon as the water was all gone, we would suck air, so we knew when to quit. On the last plant I got a couple of good swallows of water and was sucking real hard when very suddenly the good water ended and I got a mouthful

of the foulest, rottenest water I had ever had the misfortune to have in my mouth. It almost made me retch, and I spit it out at once.

If we were going to go south, we had to go over a fairly high ridge; something that we very emphatically did not want to do. However, we weren't getting anywhere the way we were, and time was flying by, and we had to do something. It would be so nice just to sit here and rest and do nothing, but we simply must move on. We began to climb the ridge to the south of us, and right away it looked bad. It was a series of rock cliffs or steps, each from five to ten feet in height, over which the ascent was sometimes most difficult. Everything was covered with a dense growth of underbrush that had to be cut before we could proceed, and the pace was exceedingly hot, exceedingly slow, and exceedingly tedious, and our heart just wasn't in it. The going was really rough and rugged up here, and it was grueling work. On this slope we found some small palms growing, quite slender feather palms with eight-foot-long bamboo-like stems no more than an inch in diameter at the most. We split the tops of some of these with the machete, and ate the growing tip out of each one. This heart of palm is called swamp cabbage in some places, and really tasted very good, similar to but considerably better than the growing hearts of the *Heliconia* that we had eaten. We didn't see why there couldn't be some of the large Mexican sabal palms in this area, since they were so numerous down around Ciudad Valles. One of those had enough heart to give a man a good meal.

There was also some *Tradescantia* or spiderwort growing here, a quite succulent grass just like that I had brought back from El Salto de Tamoquén several years ago and that I now had growing in my back yard at home. These stems were very juicy, and we ate some of them since we figured grass probably wouldn't be poisonous. It had sort of a neutral taste.

"Say, Richard," asked Tom, as we were making our way up approaching the top of the ridge,"what do gorillas eat?" On the face of it, it sounded like an awfully foolish and stupid question to be asking out here at a time like this, but almost instantly I knew that we would eat a lot of *Heliconia*s the next time we came across them. The wheels had been turning in Tom's head, and he vaguely remembered that gorillas ate bananas. When he asked that question, the wheels started spinning in my head, too, and right away I saw what he was driving at. Yes, gorillas ate bananas, and not just the fruit—they did a lot of damage to banana groves in Africa by tearing open the large plants and eating the hearts out of them. That was just what some gorillas were doing not long ago in Río Muni, a tiny Spanish colony on the west coast of Africa. The owner of the banana grove came out and shot a large gorilla, and then it was discovered that she had a baby, a little albino gorilla, the first the world had ever seen. This had been featured in an article in the *National Geographic Magazine*, and the little white gorilla, now named Snowflake, had been pictured on the cover. Anyway, these gorillas had been eating the insides of the banana plants, and *Heliconia*s were members of the banana family, so therefore we could eat the insides of the *Heliconia*s with impunity. The next time we found any, we would eat them without fear and thus could eat much more than we had before.

We struggled on, rather discouraged at this very slow progress we were making, but we had to move. I was getting more tired now, and my aim with the machete wasn't so good and I didn't care so much any more, so I was more frequently now hitting rocks with my machete, making sparks fly and making nicks in the edge of the blade. When we reached the top of the ridge, we really couldn't tell we had reached it, because it rounded off so gradually without any sharp ridge, all a mass of jumbled broken flat-topped rocks and an immense tangle of underbrush and vines. We struggled to the base of an old dead tree trunk standing up above everything. For some strange reason everything was not so thoroughly overgrown right at this point, and we could see a rather good area of clear sky. Almost all of the limbs were off this old tree, and the bark and even some of the wood were coming off in large slabs. It had some buttress-type roots, and probably had at one time been a kapok tree.

Now for the first time it was possible for us to see a little bit out of the jungle and beyond our immediate vicinity, to see a mountain range in the distance. The compass said this was to the southwest, and it was so far away that it looked blue in the distance, and this led down to some hills below it, but I couldn't see a great deal and never could make out anything very definite. From their position to the southwest, I judged that these mountains were probably the upper end of the Sierra de Nicolás Pérez, and from the appearance of the east slope, it also resembled the Sierra de Nicolás Pérez, as it appeared to have the same rock cliffs. I asked Don to hand me the binoculars out of the case he was carrying, and he said "Okay" in sort of a smart-alecky way, which wasn't like him. He handed them to me all right, but then made some little remark that just didn't seem quite right.

We paused at the foot of this tree sitting down for a short time on the soft mass of rotting vegetation and bark on the south side of it and leaning up against some rocks. The climb up the north side of this rather high and very steep ridge had been a hard one, tiring us out and making us thirstier than ever, if that were possible. But we had to conserve our water as much as possible, as we had no idea when we could get any more. It was gratifying to see how Don and Tom went along with this, and drank just as little as possible. In fact, I did not have to mention this to them at all; they did it on their own, and they did it to the extent that I thought they were almost overdoing it.

The boys here now thought they could relax somewhat their tight hold on the water supply, and we had a drink. We had developed sort of a ritual that we went through for this. Don's little measuring cup was marked into quarters, and since there were three of us, we always filled it to the three-quarter cup mark when we allowed ourselves the luxury of a

drink. One of us would start out the drink by first looking at the water and sort of admiring it for a moment, and then he would take a sip of the precious elixir of life. His ration was only a quarter of a cup, 60 cc, and he could easily have downed it in one swallow, but it was never done that way. Tom was first this time, and after looking at the water and admiring it, he took just a sip, and moved it around in his mouth from side to side to wet all of his tongue, and then swallowed it. The second sip he held in his mouth a little longer, and swished it around a little more, trying to moisten all of his teeth, and he tilted his head momentarily to one side as though to say, "Boy! Is that ever deliciou." Then-a third sip, and a fourth, each held in the mouth and moved, around so as to savor fully every single drop. And so on until his quarter of a cup was exhausted, when he passed the cup on to Don.

Don did exactly the same way, enjoying his quarter of a cup to the fullest. After he had finished, I then followed the same ritual in the drinking of my ration of water, enjoying it as much as I thought anybody could possibly enjoy a little drink of water. A drink such as this was exceedingly enjoyable while we were in the process of drinking it, but it didn't really quench our thirst at all, as in a few minutes we felt just about as bad as we did before. I thought of the two large Pepsi-Colas I had drunk yesterday at the Hotel Covadonga just before leaving on our final flight, and would have given a considerable sum to have one of those here now.

We finished our little rest stop and started down. I had been hatchet man most of the day after carrying the pack for about two hours this morning, so I went on down the south slope first.

"Come on, Don, let's go," said Tom as he started to follow me.

"Okay," answered Don, but he made no move to get up.

"Are you all right, Don?" asked Tom, but Don didn't answer.

"Don!" called Tom.

"What?" answered Don.

"Are you all right?" repeated Tom, growing concerned.

"Yeah," answered Don.

"Well, come on, then, let's go," urged Tom.

"Okay," answered Don, very amiably, but he still made no move to get up.

"Hey, Richard, he's not coming," Tom called down to me.

This was it. Apparently our time bomb had gone off. I climbed back up to see Don, and he was just sitting there on the ground looking vacantly around, with his glasses far down towards the tip of his nose, and his lower lip curled out, making rather purposeless and useless movements with his hands. Tom gave him a little water in the cup, and he drank it all right, then grasped the empty cup firmly and resolutely in his left hand, turned it around counterclockwise till the handle touched his knuckle just so, and sat there tightly holding that cup, looking at it. It was just 4 p.m.

This was bad. In fact, it was terrible. Here we were lost in this completely trackless mountain vastness, and one of us was very sick. I of course knew that this had something to do with his diabetes, but which way was it, diabetic coma or insulin shock? I had no way of knowing. It was true that I was a doctor of medicine and had studied about diabetes, but I was a specialist, a general surgeon, and as such I did not treat diabetes at all and had forgotten just about everything I had ever learned about it. He could be having a reaction from either too much insulin or too little insulin, and the treatments for these two conditions were exactly opposites—assuming that there was something I could do about it and if I would know what it was.

I really thought about this problem. It could be insulin shock from too much insulin, which would result if he had his insulin shot this morning, which he had, but did not get enough food to eat during the day, which he might not have. On the other hand, it could be diabetic coma, from too little insulin or too much food. It could hardly be from too much food, but this morning he had taken less than his very least usual dose of insulin, so maybe he had cut down too much. How could this be determined? Very easily—by taking a sample of blood and checking the blood sugar level in a laboratory. Only thing, there was no laboratory available around here. Yes, this was a real problem. I weighed the probabilities, and after due consideration, it seemed that the most likely bet would be that it was an insulin reaction or shock. Don sure hadn't eaten much, and that would be the most likely cause of his trouble. It was true that he had taken less insulin this morning so it could also be a diabetic coma, but this seemed less likely, as he probably hadn't cut his insulin down that much. It seemed to me that under these circumstances that we had here and all, that the most likely bet was insulin shock, and I would gamble that that's what it was.

Tom also diagnosed it the same way, since he had a roommate who went into insulin shock at times, and he said a Coke would fix him up real nice. But we had no Coke. I looked in Don's pack to see what we had, and found the two old, very dead doughnuts, two of the doughnuts that we had brought from Alice about ten days before that were now very hard and dry. I handed one to Don and told him to eat it, and he took it, looked at it oddly, and then began to munch it. After that one was down I gave him the other one to eat, too, which he did, obediently but very slowly doing what I told him. I asked him if he wanted a teaspoonful of sugar which he had along, and he said "Yeah," but I doubted that he knew what he was saying. Anyway, we gave him three teaspoons of sugar and a little water to wash it down with, and he looked around just as blank and uncomprehending as before. We sure hoped that it was insulin shock, because if it wasn't, we were doing exactly the wrong thing for him. We were in a very bad fix. We realized that if he did not recover completely, he certainly could not go on. We were completely lost up here in goodness knows where, and had no idea how long we would remain lost. Under these circumstances, we could not see that it would benefit Don any to have us both stay here with him, as we could do nothing for him—he needed food, water, and care, none of which we could furnish him. If

Tom and I both stayed here with Don, we would not help him any, and we would of course be hurting ourselves. If Tom stayed with him and I went on, it would mean that there would be two starving men instead of one up on the mountain, and Tom couldn't help him anyway. Similarly, if I stayed with him and Tom went on, it would be the same thing. If we both left and Don remained there alone, his chances of rescue seemed slim indeed.

It would have to be done by helicopter, and where in Mexico could one find one of those? Monterrey, perhaps, but of course we didn't know. If it came to that, I would. try to contact the Mexican Army some way, and failing that, I would call the Corpus Christi Naval Air Station where I knew helicopters were available. However, that was several hundred miles away, and one was needed here right now. Exposure to the elements would not be very much of a problem for Don, since it probably would not be so cold, and we could dress him with extra clothing before we left. We could leave him all the food and the canteen half full of water, but then there would be nobody there to tell him to eat it, and he might not or probably would not do it himself. The big question, of course, was: When could we get a helicopter? No one could say, since we did not now how long it would take to get out of here, and after being out, we did not know how long it would take us to get a helicopter, or if we could get one at all.

Anyway we looked at it, it was very very bad. I had gotten us all into this mess, and the boys had been looking to me to get them out of it, but now it looked as though I wouldn't. Had our lives and limbs been spared, just to trek these miles through the wilderness and now have one of us fall by the wayside? It was sad, very, very, very sad, and my heart ached. I thought of poor Don's father and mother, and how they would feel, and what I could possibly say to try to explain this to them. Actually, it would be something that would be unexplainable. I felt responsible for all this, and the responsibility weighed very heavily on my shoulders, very heavily indeed. If this trip ended in tragedy, it would leave its scar on many hearts for life.

We waited around for a time, but nothing seemed to be happening. We took out one of the shirts and put it on Don. We waited some more, and it seemed that if the food were going to help Don, it should have done so by now. Maybe his problem was diabetic coma, in which case we couldn't help him at all. We waited and thought about it, and wondered just what we should do. I also considered, what if this were my own son here? Would I do things differently? I tried to look at things in cold, practical logic, and wondered if that would make any difference in the way we handled it.

Don was such a nice guy, a fine, clean, upstanding young man. I had not known him till this expedition, but Tom had known him for quite a long time. Both Tom and Don were students at the University of Texas and were members of the National Speleological Society grotto there, and had been caving together on a number of occasions. The way Tom talked, it was easy to see that he liked Don a lot.

"What happened?" asked Don, looking around. He no longer had the very blank look on his face, his glasses were up where they were supposed to be, and his lower lip was no longer stuck out. "I mean, did I convulse or something? I don't remember." Thank God, he was all right. It had taken the sugar and dead doughnuts a long time to act, but now they were obviously in his system and were taking care of the excess insulin, so he was all right. This was indeed a relief. It seemed as though just about the biggest weight I had ever known had been lifted from my shoulders.

We sat there for a while longer, and then discussed the situation with Don, since he was now perfectly rational. We pointed out the pros and cons of everything, about leaving him there and taking him with us, but he wanted to come with us. We discussed this for a time, and though he said that he thought he could make it on now, we pointed out that if he could not make it, he would be much better off here by this tall dead tree trunk, which stood out way above the other treetops and could probably be found by helicopter. If he got down into the jungle and then discovered he couldn't make it any more, there would be no earthly way for a helicopter to find him then, and we could certainly guide no one to him. We pointed out to him the uncertainty of our arriving at any point where help might be obtained by any definite time, and also then the uncertainty as to where or if a helicopter might be obtained.

"Yes, sir, I understand, but I want to come with you. I know I had a reaction, but I feel better now, and if it's all the same to you, I don't want to stay here. I'd a lot rather come along with you."

And I was with him all the way. I felt sure that now that he had gotten some food or at least some calories into him to counteract the excess insulin, that he would in all probability be all right, at least for a time. Don had a small jar of dry rice, so I now opened that and gave him two teaspoonsful of it, while Tom and I each had one teaspoonful. This didn't chew very well because it was so hard and dry, but we washed it down with a swallow of water. Don tried to eat some noodles, but they were too dry and he couldn't eat them. He did eat a small packet of one-and-a-half ounces of oatmeal.

While here, we made the decision to lighten our load. Tom threw away his carbide light with the eight-ounce plastic baby bottle full of carbide, which was quite heavy. He also threw away a pair of strong white dungaree pants with a belt. He had his two caving ascenders along, and he looked at them longingly but could not part with them. Besides that, they cost $27 . He did take out his knife and cut off all the nylon rope and belt that was attached to them, which halved their weight. In his pack Don had a stronger pair of pants than the ones he was wearing, a pair better able to withstand the rough treatment we were giving them, so he changed to those and discarded the pair he had been wearing. I threw away a pair of slacks I had along, which would not be any good in the brush anyway since they would not withstand the

abuse. I kept another pair of kahki pants, because the pair I was wearing now was already showing some torn spots, and before long it might be torn clean off of me, and I might need another pair. Tom found my black belt that had been given to me by my crew of Explorer Scouts that I had taken on a canoe trip up into Canada, and I really didn't want to throw it away. Tom solved the problem by taking it apart and throwing the belt away, keeping the buckle with the emblem on it. We also threw away the piece of plastic with the netting that had been in the back of the plane. I also threw away my Blake's *Birds of Mexico*, a book that I parted with most reluctantly, but it was a heavy item, so I threw it on the ground beside the tree trunk. I considered throwing away Peterson's *Field Guide to the Birds of Texas*, but this was rather precious to me since he had autographed it when he gave it to me, and I could not bear to part with it just yet. I had three other heavy items, my camera, my binoculars, and my IBM recorder, and I considered discarding one or all three of those. I could take the film out of my camera and then still would have a picture record of the plane crash, but I felt I would carry them a while longer yet. I thought of discarding my telephoto lens, but Tom said that this was not a very heavy item, so we kept it. Our large poncho was a quite heavy item, but we certainly could not discard that, as we might need it to catch more rain. When we finished, we had quite a pile of stuff on the ground beside that tree trunk, all things that we reluctantly left behind.

We started out again, Don taking the smallest pack and Tom the large pack. I went ahead with the machete, endeavoring to clear a way through the inhospitable countryside, but the going was so slow. We came to a series of small cliffs, but we were able to find our way down them without too much difficulty. We never were able to see anything again, only having had that small glimpse of the distant mountain from up by the dead kapok tree.

Things got worse, much worse. The going got so bad that at times we were stopped completely, with no possibility even of hacking through the tangle of stuff. We had to get down on our hands and knees and crawl, sometimes even flat on our belly, in order to gradually wriggle our way through. And if you think it isn't hard to try to cut a path with a machete when you're lying flat on your belly, just try it sometime. It was pretty grim. The vegetation was positively unbelievable and indescribable. Here we were crawling through this stuff, just barely going at a snail's pace, going we knew not where—just south, crawling south.

As we were crawling wriggling like snakes through this gosh-awful mess, just heading south, it was very discouraging, and I got to thinking of all sorts of things could have discarded back there to lighten the load. My camera and binoculars and IBM recorder were all insured, so it wouldn't really cost me anything anyway, and I came within an inch of throwing all of them away. However, I held on for a while longer, just to see what would develop. After several hundred yards of this, it opened up a little, to where sometimes we could walk, then it got to where we could walk practically all the time. This was much better, and we were making a little headway now.

But no, there was yet another obstacle for us. We ran into a bamboo forest, not large bamboo, but with stems only about a quarter of an inch in diameter. These were very long, reaching up and interlacing and intertwining as though braided together. Getting through this was something else again, and I'm sure nobody wanted my job as hatchet man. In fact, it really didn't do me too much good to have the machete, because with these hard stems it had to be a good blow-to severe them, and with the limberness and resilience of the stems, it was impossible to get a good hard lick, so all a machete blow would do was to just bend them and me. Crashing through them didn't do much good, because there were so many of them and they were so tightly braided together that little progress was made. However, we had to get through somehow, so we just worried our way through, doing some crashing and some hacking occasionally when a stem got our necks, arms, ankles, legs or anything else, and sometimes also crawling again. When these stems were bent sharply enough they split longitudinally but did not break transversely, so then we had a bunch of sharp, limber knives in our hands, and we did cut some gashes in our fingers with them.

One thing here, we were headed straight south, and that is just where we wanted to go. But what other obstacles would we be required to overcome? It was just like the seven labors of Hercules, each time he overcame one insurmountable obstacle, another yet more formidable one was placed in his way. It seemed to be just what was happening to us. And still we didn't know where we were or where we were going, just headed south. I felt so doggone beat I could hardly move, and I really didn't care whether I cut a trail or not. We all had to force ourselves to keep going south. If only we didn't run into some other insurmountable obstacle.

Much of this vegetation was not thorny, just bothersome and in the way. Some of it cut very easily, especially the *Heliconia* and some others, but some was very hard and tough, and we learned to try to go around that if possible. Some of it was downright mean, as a number of vines like greenbriars with hooked thorns. Another one was called wait-a-bit, and with that one we certainly did have to wait until we got untangled from its grip. It looked like *Pisonia aculeata* from the Río Grande Valley. Some trees, probably small kapok trees, had thorns along the trunk, and there was also another variety that had thorns along its small trunk. There was a vine that looked like a dewberry, but it wasn't, only its thorns were very much like it. There were several species of nettles, like the large herbaceous *mala mujer*, which really stung the unwary hand or arm. The greenbriars were especially difficult as they were so resilient and so loosely hung that they gave with every movement, and it was hard to get through them. We heard the whistling call of the olive sparrow, and then we saw one perched in the

brush not far away.

In some areas there were downed trees to climb over or under, and these could be difficult, too. These were numerous enough, but thank goodness not as numerous as some places I had seen. We began to see one of these tree stumps once in a while that was quite straight across at the top, as though it might have been cut, but if so, that must have been fifty years ago, as the down trees had sure been lying there a very long time.

Later, we began to see a machete cut occasionally. This was the first sign of any man that we had seen, and it was unmistakable, although by the degree of regrowth of these cut plants, we guessed they had been made one or two years before. There was no trail at all, only an occasional machete cut to indicate that a human being had ever been anywhere near this area at all.

Suddenly, the going seemed easier. We were still in this sorry old bamboo, but the going was easier, no doubt about it. It sort of had the semblance of a trail, but there were still some vines and *mala mujer* and bamboo in the way at times, but not nearly what there had been. Yes, there were machete marks along the trail, showing that it had been cut. Very old machete marks, maybe even a year old, but fresher than the others we had seen, which perhaps might be significant. It was a faint trail and we kept losing it at times, but it was a trail more or less, so we would follow it wherever it went. We were quite sure we were not following it backwards. And it was going straight south, too, and downhill. We couldn't hardly beat that.

Now we saw things in an entirely different light. The going was quite good now, comparatively speaking, and in an hour we traversed what previously would have taken us ten. We were so glad we hadn't thrown away more stuff than we had, and especially I still had my camera, binoculars, and talking machine. As we went merrily on our way, we noticed some vegetation changes. At one place was a *mala mujer* plant, or rather it had been there, as the plant had been cut down, but a stump eight inches in diameter remained, with about ten feet of new growth sprouts growing out of it. We had had no idea that a *mala mujer* would get that big, but here it was—or had been. Then we saw some young *orejón* trees and had to cut a couple of these limbs from the trail. Then we found another night-blooming cactus, the *Acanthocereus pentagonus*, which required a more arid habitat. We cut the spines off of some of the freshly growing tips of these stems and ate them, as they were certainly full of moisture. They weren't real good, but they weren't bad, either.

The trail began to get better all the time, and we now saw progressively fresher and fresher machete cuts. We descended more and more, and now saw tracks in the trail in some places where it was not too rocky—small horse or mule tracks. Then some distance farther along we met two horses and two mules on the trail, but no one was with them. They were very nice animals, and Tom said that if they were any judge of the quality of the place that we were approaching, it was good. Still farther down we found a gate made of cut poles across the trail, a gate that would not open. It all appeared to be so old that we wondered if it were ever opened, but then we realized that the poles in the portion directly across the trail had been tied together across the middle with a very old rope, which gave it the appearance of having been there a long time. When the rope was untied, the poles could be lifted out of their place, and the gate was open. Somehow these horses had to have water, so either they had some water available somewhere, or someone came to them rather frequently. It was probably the latter.

We crossed the gate, and continued on down. Some distance farther, we passed another gate that was closed across the trail, but a trail had been worn around the west side of it, so we went down that. Right at this gate we found one of the small-tree prickly pears that abounds in Mexico, as we had now gotten down to a low enough and dry enough area where it could grow. It had several tunas on it, one of which was somewhat red in color, so I brushed off all the spines and ate it. It was very good. None of the other tunas were red, so I did not try them, and I also did not try peeling and eating some of the leaves (pads), since we were almost surely coming to some sort of habitation soon. Otherwise, we certainly would have eaten them.

We were now getting down out of the cloud forest, and we were now getting to where the brush was so low that in places we could almost see over it, and in the near distance we could see some banana trees. These were real banana trees, and not the *Heliconia*, so we must be approaching humans. Then suddenly we broke out of the brush and were at the northwest corner of a small recently plowed field, at the opposite end of which were a number of banana trees. The beautiful loud ringing call of the canyon wren sounded a welcome for us just as we reached the field. Sure enough, there in the grove of banana plants we glimpsed part of a thatched hut. Surely there were people here, or at least very nearby. Then we heard the sound of an ax chopping wood, so we knew we were now safe. We were not out of the mountains yet by any means, but we were now safe—if the natives were friendly.

We went around the end of the field to where the thatched but was, and found it to be old and tumble down, abandoned. The trail turned east here, along the south side of the little field, with trees along both sides. The ax chops came from up ahead somewhere, about thirty yards to the left. There the woodchopper was at work—a human being.

"*¡Muy buenas tardes!*" I hollered to him, and he answered, "*¡Buenas tardes!*." We had thought he might speak Indian or something, but no, it was Spanish. It was just 6:00 p.m. This man was Mariano Garcia, a man that we were very happy to see. The little palm-thatched house here was his home, and he lived here all alone. We asked if he had water, and yes, plenty, and he showed us two square five-gallon tin cans that had formerly contained cooking oil, but which now were filled with the clearest, sparklingest, wettest, beautifullest water we had ever

seen. He handed me a metal cup with which to drink, a cup about .three or four times as large as the little one of Don's in which we had been measuring our meager rations, and told me to drink up. I filled the cup with the cool, sparkling water, looked at it longingly and admiringly for a moment, and then passed it to Don, to let him have the first drink. We felt that he needed it the most.

We drank and drank, until we could hold no more. Actually, we still had a whole canteen full and the other one was about a quarter full, so we had not been not completely out of water. We had been voluntarily rationing ourselves quite strictly , as we never knew how long it was going to have to last, so we had been very frugal with it. Each of us probably could have drunk at least five of those canteens full of water during the day's march today, but we had had only one-fourth of a canteen each. Fortunately, now we did not need to conserve it anymore, but we were glad we had done it the way we did. I would have thought I could have drunk the whole five gallons in one of those cans, but now as I looked at it, after several of those large cups of water, I felt differently, and I didn't think I could finish the tin of water.

"This is it, boys," I said. "This is the little *ranchito* that I was heading for, and now here we are. Remember that little footpath I told you about, the one lined with such bright green grass on each side? Well, that path is right over there. I pointed to the southeast. We'll be walking along it. But now we're here. We're so lucky!" And they agreed.

Mariano seemed to be burning with curíosity, and asked several little oblique questions to see what we were doing here or where we had come from or what. We told him about the plane crash, and he asked if it were the plane that had come flying low over here yesterday. He didn't seem too surprised and didn't show much emotion one way or the other. We suspected that maybe he didn't believe us, as maybe he felt that was too wild a tale to be true. He looked at Tom's bloody face with the bandage on it, but didn't say whether or not that had convinced him.

We asked if there were anything to eat, and Mariano said yes, tortillas; he would make some right away. He had already boiled the corn, so he now put it in a grinder and ground it into masa, then he made this into little flat patties with his hands and cooked them over a wood fire on the dirt floor of the little one-room shack. Everything inside was black from smoke, but most of the smoke could get out, since the walls of the house were made of vertical wooden poles with no chinking in between at all, so there was adequate cross-ventilation.

While waiting for the tortillas, Mariano remembered some bananas he had, so he brought out a stalk for us. It was a very tired stalk, and had only five bananas left on it, all very old and completely black and appearing to be just about completely dead. They were rather large, and were the *plátano macho* or cooking plantain, not the sweet or eating banana. They looked rotten, but these look like that when they get old, and were actually fairly firm yet and quite edible. We each ate one.

He made a lot of tortillas, and served them to us with a sauce that he said contained onions, cheese, and pepper, but we were willing to bet that it was by far mostly pepper—99.9 percent. It was hotter than heck, both from the fire and from the pepper, and me with the left side of my mouth all out of shape from trying to eat that aroid, I just couldn't take it. Even without the sauce my mouth felt as though it already had the sauce in it all the time, and then with the sauce in it too, that was just simply more than I could stand. I ate very little of it, though I ate a couple of the tortillas. I was just not hungry. In need of food, maybe, but not hungry.

But what was so very good was *aguacate* tea that he made for us. He pulled some leaves off the avocado tree in front of the house, put them in boiling water, and presto, there we had avocado-leaf tea, and better tea I had never tasted. It was very good. He had a small can of dirty brown sugar with which to sweeten it.

Two other Mexicans led a couple of horses along the trail about 100 feet from the house, and they saw that Mariano had visitors. In a short time they were back, to see what was going on, as surely there could not be many visitors ever in this very isolated little community. They all remembered having seen the airplane go over the day before, and Mariano remembered having seen it go over two or three days before that, too, which I'm sure he had. I asked him if he had greeted us, and he said sure, he'd hollered "*¡Adios!*" as loudly as he could. These two visitors invited us over for breakfast in the morning, since we had eaten supper here already, and Mariano had invited us to spend a "bad night" here with him. Mariano acted as though he didn't want us to go over to the other hut in the morning.

This was a very peaceful little spot, with a few papaya trees on the south side of the house away from the bananas, and an avocado tree and a mango tree in front of the house, with several young trees of other better kinds of mangos planted a short distance away. The entire little bowl was surrounded by green hills, especially here in the southeast corner of the depression, where there were large trees covered with epiphytes. On the north side of the little depression, from whence we had come, the vegetation appeared smaller and more desert-like. Numbers of large parrots were flying across this little depression here almost constantly, as at almost any moment one could look up and see several parrots in the air, giving their loud raucous cries.

We learned that this place was called El Ejido de la Joya de los Manantiales, Municipio de Ocampo, Tamaulipas, Mexico. What a long name for such a small place. Mariano said only four people lived here, but we saw more than four people, so we wondered just what the situation was. Apparently it was partly a matter of definition, because some people farmed here but apparently didn't live here permanently, just came here to work once in a while or stay a few days, so he did not consider then as living here. Others apparently stayed here more of the time but spent part of the time in town. We never could get a good answer, but we learned there was only one woman in the entire

settlement, and she lived in a hut up near a sótano where they got their water. That water sure was good. We drank till we couldn't hold any more, but before long we had to drink some more. We were really dehydrated, so dried out that all day I'd urinated only once, and I really didn't have to go then, but went just for something to do. Our bodies had been making a gallant effort to conserve as much water as possible.

We found a number of ticks on us here. Ticks had really not been a problem before, and Tom was sure we had gotten them from the little bit of grass on the ground here on the south side of Mariano's house, probably where that sorry dog had left them. Maybe we had gotten them along the lower part of the trail, where they could have come from the horses and other livestock. Maybe there were more wild animals down here, too, for the ticks to feed on.

We were all so very very glad Don was down here now, and not up there by that dead kapok tree on that ridge. As it had turned out, we had gotten down here in only two hours after leaving the tree. We learned we were still eighteen kilometers from Chamal, the nearest town, so if Don had remained up there, Tom and I could have walked on into Chamal tonight and contacted the Corpus Christi Naval Air Station tonight or maybe tomorrow morning, and maybe had a helicopter here by evening. Then, if we could find the dead tree and if Don hadn't wandered off somewhere, and if-he were still all right, and a lot of other ifs, then everything might have come out all right. However, we were certainly happy the way it was.

Mariano prepared us places to sleep in his humble abode. There was one room to the house that served as bedroom, kitchen, living room, and barn. He slept on a little table-like platform of boards on the south side of the middle of this room, and there was another similar rack of boards on the north side directly opposite him. This is where I was to sleep, so he took all his stuff off of it and put a folded piece of heavy canvas down on it for me to sleep on. I lay down there, and of course it was just about like lying on bare boards, but I certainly didn't mind that. It was a bit inconvenient that the rack had been made for a five-foot Mexican, but my gringo feet and lower legs sticking out a foot beyond the edge really didn't make too much difference. The boys had a similar rack under the little roof that extended out from the front of the house, where they were to sleep. It was also about a foot too short for them, but their feet couldn't hang over the edge since there was an upright board crossways at the end of the rack, so they wound up sleeping most of the time with their feet propped up on top of the board.

Wednesday, 6-4-69. It rained most of the night last night, and it seemed such a pity to have nothing out there to catch it. All that good water going to waste. When we awoke this morning, it was just beginning daylight. The great numbers of parrots were already making their usual harsh, loud screeches. Mariano was already stirring around, building up the fire in the middle of the floor and making ready for breakfast.

"Reheated tortillas are very delicious," he said, as he warmed them over the glowing coals. He had a few beans this morning, and they were good with the very delicious reheated tortillas. And of course, the aguacate tea was again much appreciated.

We packed all our stuff and were ready to go, as soon as it seemed that the rain had about quit. We walked on over about 200 feet or so to the second-nearest human habitation to the plane crash, the home of the two other men whom we had met last night and who had invited us over for breakfast this morning. They invited us in, and offered us some corn tortillas that they were baking on the circle of tin cut from the top of an oil drum, some beans, hot sauce, and a small amount of scrambled eggs. These must have been affluent people, since they were dining so well. Mariano had come with us, but he sulked when we stopped at this hut, and obviously was jealous of us. Human emotions are strange things, and this was so plain to see.

One of the men said he was going to town today, too, and he packed up two bales of small palm leaves and tied one on each side of a saddled mule. Then he threw Don's red pack on top of the mule, too, and of course we were glad to see this happen. The man would drive the mule to town with the load, sell the palm leaves, and then have a saddled mule to ride back on.

It was interesting for us to see two small cuts on the side of the mule's left shoulder at the base of the neck, each just about half an inch long, and a small trickle of blood had run down for several inches from each one. This was the work of vampire bats. We could also see several older already healed scars where this had happened to this mule before.

I tried to find out something about Sótano del Caballo Moro, the large new pit we had found, but they

Sign at the entrance to Joya de Mantaniales said by the locals to be on a piece of the airplane.
Jean Louis Lacaille Múzquiz.

didn't seem to know anything about it, although they seemed to realize that it probably was there. They agreed that the little *ranchito* right next to it was the Rancho Coahuila, but didn't know anything else about it. Sótano del Caballo Moro probably is near Los Manantiales. Sótano del Caballo Moro is near Coahuila.

We started out, walking along the little footpath with borders of bright green grass on each side. This was what I had seen from the air, and had wished to walk along that path some day. Little did I know that it would be so soon.

We had gone only a short distance, when the mule skinner asked us if we wanted to see the sótano. Of course we did, so he led us down a little side-path that I had also seen from the air for perhaps a hundred yards, past a house where we saw two men and a woman. Directly across the trail from this house was a patch of rather large elephant ears growing, large aroids which might be an edible variety such as taro. However, I doubted that this was actually used as food, because I had not heard of its being used for that in Mexico.

Then we were definitely going down a very short little arroyo, and it ran into a large crack in the rock, where we disappeared into the misty greeness of the sótano entrance. The path led downwards slightly and then stopped, but the man said that the water was still about sixty meters away, angling down about forty-five degrees. A wire had been set up here, with an attachment so that a bucket could be slid down this wire to the water below and then brought back up by pulling on a rope.

I asked about cave fish here, and he, like Mariano earlier, was sure that no sort of cave fish had ever been caught in a bucket here. I questioned him carefully about this area, and I was satisfied that it was a true sótano, although it was not a straight drop. In times of heavy rains, the little arroyo would rise and the water would run into the hole, but never filled it up, and the water always stayed at the same level. In only half a day or so after a heavy rain, the water was always clear again.

I had questioned about other sótanos around here, and was told that yes, there were two or three, but nobody seemed to know where they were or anything about them. This man had heard of some blind cave fish about a foot or so long that had been caught in a sótano just south of Ciudad Mante at El Abra, fish that were white or reddish and said to have no eyes.

As we left, a rather light-complected man about fifty-five years of age came from the house where the woman had been, and asked specifically about where the airplane was. We told him as best we could, indicating that it was up in the sierra to the north, but we doubted if anyone could find it. He just looked like the type of guy that would go to great lengths to try to get something for nothing. Of course, anyone that could get to the plane and get the stuff was welcome to it. We had told Mariano that up in the plane there were some clothing and a length of rope 225 feet long, but we doubted very seríously that anyone would ever get it.

Our driver was having a little trouble with the mule, as it kept wandering from the path. He said that the mule didn't want to go because the rocks were hurting his feet, as he had lost his shoes about a week before. If so, I certainly didn't blame him, as there were innumerable rocks around to hurt anybody's tender feet.

We wondered if Bob Mitchell would want to come in to check this sótano for fish. It was an extremely rough trail in places, but we bet that Bob could drive his Jeep in, although it might tear it up a bit. Then we realized that we had no name for the sótano, and the mule driver said it had no name, so we informed him that henceforth it would be called the Sótano de los Manantiales, now locallycalled Cueva del Ojo de Agua de Manantiales. He agreed that that was a good name.

Our mule skinner also told us more about the palm leaves after I questioned him. Then he told us his name was Ramón Carrillo López. I asked Ramón if very many gringos ever came to visit the Ejido de la Joya de los Manantiales, as it seemed like such an out-of-the-way place. No, said Ramón, gringos hardly ever came here at all. In fact, we were only the third group of gringos to come here, ever. How interesting! One of these, said Ramón, was a single man that stayed there for several days one time, maybe several years ago, he didn't really remember. The second time was when a group came, several people, and they looked around and went into the sótano and caught snakes and insects and things to take back with them. This was a year or two before, he thought. And we were the third. No, that place certainly was not on the beaten path.

We didn't know it then, but we learned later that we knew that second group of visitors. We were very surprised to find out that it was none other than Robert Mitchell, William (Dub) Rhodes, Francis Abernethy, and James Reddell. James was one of the cavers from Texas Tech who had been down at Ciudad Valles with us in January. Bob had driven his Jeep in, and they had gone down to the water in the cave but not beyond it, since it was deep and blocked all passage. They had stayed only a few hours, caught a few specimens, and gone back out that same day.

There were no steep grades along this trail, just a rather easy though rocky walk. We figured that Bob Mitchell could drive his Jeep along here if he had a mind to, and he might do it sometime if he wanted to check out the Sótano de los Manantiales. It was quite rough and rocky, but for us it seemed just like the Los Angeles Freeway.

Soon we passed a stone corral by a gate, and then some distance beyond that found a barbed-wire fence, sure signs of approaching civilization. The vegetation changed markedly as it became much dryer, and now we began to see semi-desert plants such as black brush and other thorny shrubs. White-eyed vireos were calling from the scrub, several bobwhites whistled in the distance, a couple of olive sparrows announced their presence with their clear rapid whistle, and we heard the wild ringing call of the canyon wren again. Mexican crows appeared, still sounding as though they had a frog stuck in their throats.

Suddenly we were at a little settlement called Rancho Nuevo, a settlement with people and a little school with kids and everything, And there was a Volkswagen, so we were getting out of the remoteness. We had now walked fourteen kilometers, and it was another four kilometers on down to Chamal.

This was right at the edge of the hills, and we were now coming out onto the plains of the valley floor. A couple of kids on a motorbike were coming up the road from Chamal, which was a rather straight road coming from almost due south. Looking directly west now, we could see the hill on the west side of which we knew was Sótano del Caballo Moro. Looking to the east we saw Cerro El Chamalito, the highest peak at the end of this little valley, and we knew that just northwest of that was Bee Cave, and just northeast of it was all that grunge. In short order we had reached the small town of Chamal, where we hoped we could get transportation out. However, we had to stop at a joint on the corner, where we had some very delicious cold drinks. Ramón left his mule and came with us, and I had Tom take a photograph of him and me together. In only a short time we caught a bus just east over the Sierra de El Abra to the town of El Limón, on the Inter-American Highway, where we were again left standing on the street.

La Segunda Gran Expedición a la Sierra de El Abra

Un recuento histórico de una salida de 1969 en busca de cuevas y peces de cueva en la Sierra de El Abra y la Sierra de Guatemala. Varias cuevas de importancia fueron descubiertas y se hicieron muchas anotaciones de historia natural. Una buena parte de este viaje fue por avioneta, la cual se estrelló en medio de la selva con lo que inició una aventura de supervivencia.

NEW EXPLORATION IN UNDERWATER CAVE SYSTEMS IN THE RIVIERA MAYA

Zdeněk Motyčka

In February 2014 members of Czech Speleological Society continued their Project Xibalba for exploration and documentation of underwater cave systems on the Yucatan Peninsula. Project Xibalba has been running since 2003. The area of interest is located in Mexican state of Quintana Roo, north of Tulum, near the village of Akumal. In 2014 over fourteen days they discovered two new cenotes northwest and southwest of the known parts of the K´oox Baal Cave system, which they had explored starting in 2006 to become the fourth longest underwater cave system in the world in 2012. In the new cenote Shoot's Hool they discovered 589 meters of new passage and in the cenote Wa Ba'ax Yan total of 1176 m of new corridors. During an inspection dive in cenote Chak Ha, they discovered 354 meters of new passage and connected Chak Ha to the cenote Zebra, discovered in 2015), which reached the total length of 2443 meters. The main result of this expedition was the reconnaissance of a new area, located about 4 kilometers northeast of K´oox Baal. Here they discovered eight new cenotes with 2 kilometers of new corridors that had potential for connection to a larger system.

BEHIND THE GATE OF DREAMS

In February 2015 project members focused their exploration in the new cenotes discovered in 2014, which are located about 4 kilometers northeast of the K'oox Baal Cave system. Over two weeks they discovered 3,2 kilometers of new corridors and connected cenote Tu, cenote Nautilostotl, cenote Paachil Nah, and cenote Beh et Óox Ha into one system with total length 5271 meters Two more cenotes were separately explored in the area. The first of them, Ash Puk, is 650 meters long, and the second, named Carita, is 350 meters long.

SAC KAY

In January and February 2016 three groups of cavers from the Czech and the Slovak Speleological Society continued the project for exporation of underwater cave systems on Yucatan Peninsula. Over five weeks they discovered new underwater tunnels in cenote Nah Baak and the new cenote Mariposa. Altogether they discovered 5 kilometers of new passage and connected most of cenotes in the area to one system called Sac Kay [or Sac Kai]. The total length of the system is now 11,844 meters. They also discovered new corridors in cenote Luuk Hool, which is now 872 meters long. A surprise for them was the discovery of two new dry caves; Xul In, 546 meters, long and ZBK which is 753 meters long. In the last days of expedition they also surveyed and mapped new passages in the K´oox Baal Cave system, which is now 90 kilometers long and the third longest underwater cave in the world.

SUMMARY

Sac Kay is a new underwater cave system on Yucatan Peninsula discovered, explored and surveyed by members of Czech and Slovak Speleological Society from 2014 through 2016. The total length of the system is now 11,638 meters. During three expeditions a total of 17.5 kilometers of new passage was discovered and documented in the area. The people who participated are Daniel Hutnan, Radek Jancar, Vit Kaman, Karol Kyska, Rafal Krzewinski, Miroslav Manhart, Pavol Malik, Tomas Mokry, Zdenek Motyčka, Jan Sirotek, Martin Vacek and Martin Vrabel.

Acknowledgements

Special thanks to Bil Phillips, Jim Coke, Jorge Gonzales Pacheco, Jacobo Pacheco, Robbie Schmittner, Nadia Berni, and David Sieff for their support, help, and friendship.

Journal Papers

[Papers in *Speleofórum* are in Czech with English summaries.]

Motyčka Z, 2004. Phenomenon of Underwater Caves of Riviera Maya, Mexico. 3rd. NSK. Brno

Motyčka Z, 2007. Xibalba 2006. *Speleofórum* 2007 . Brno

Motyčka Z, 2008. Xibalba 2007. *Speleofórum* 2008 . Brno

Motyčka Z, 2009. Xibalba 2008. *Speleofórum* 2009 . Brno

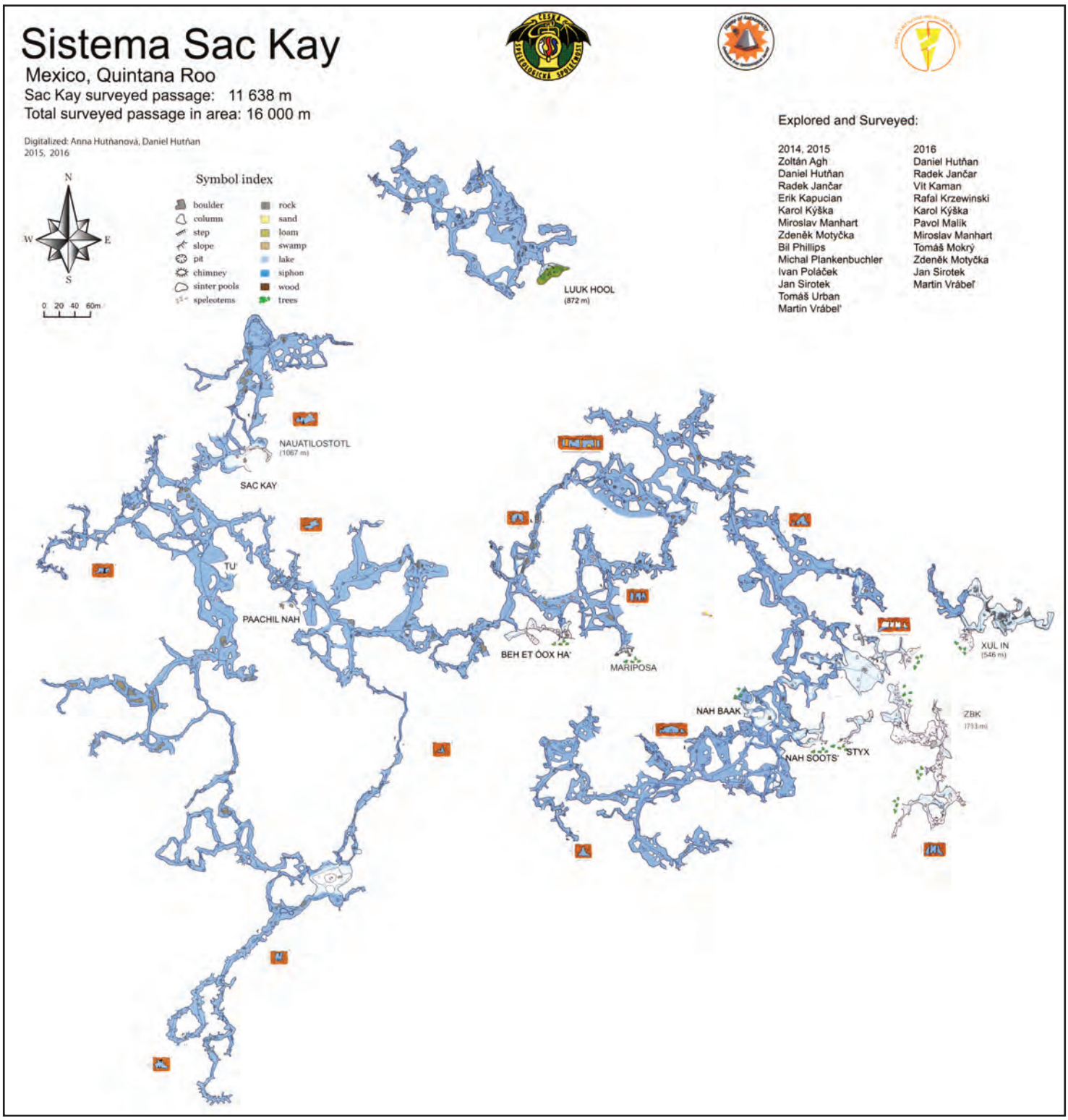
Hutnan D, 2010. Mexico – Following the Footsteps of Mastodonts. *Speleofórum* 2010 . Brno

Motyčka Z, andHutnan D., 2011. Xibalba 2010—K'oox Baal Cave System is 30 km long. *Speleofórum* 2011 . Brno

Motyčka Z, and Hutnan, D., 2013.

z. Motyčka@mediform.cz

From *Proceedings of the 17th International Congress of Speleology*, volume 1, pages 334–335, 2017.


Sistema Sac Kay
Mexico, Quintana Roo
Sac Kay surveyed passage: 11 638 m
Total surveyed passage in area: 16 000 m
Digitalized: Anna Hutňanová, Daniel Hutňan
2015, 2016
Symbol index
boulder
column
step
slope
pit
chimney
sinter pools
speleotems
rock
sand
loam
swamp
lake
siphon
wood
trees
0 20 40 60m
Explored and Surveyed:
2014, 2015
Zoltán Agh
Daniel Hutňan
Radek Jančar
Erik Kapucian
Karol Kýška
Miroslav Manhart
Zdeněk Motyčka
Bil Phillips
Michal Plankenbuchler
Ivan Poláček
Jan Sirotek
Tomáš Urban
Martin Vrábeľ
2016
Daniel Hutňan
Radek Jančar
Vít Kaman
Rafal Krzewinski
Karol Kýška
Pavol Malík
Miroslav Manhart
Tomáš Mokrý
Zdeněk Motyčka
Jan Sirotek
Martin Vrábeľ
LUUK HOOL
(872 m)
NAUATILOSTOTL
(1067 m)
SAC KAY
TU'
PAACHIL NAH
BEH ET ÒOX HA'
MARIPOSA
XUL IN
(546 m)
NAH BAAK
NAH SOOTS'
STYX
ZBK
(733 m)

Decorated passage in K'oox Baal Cave system, Mexico. *Radoslav Husak.*

Xilbaba 2012—K´oox Baal is more than 70 Kilometers Long. *Speleofórum* 2013 . Brno

Motyčka Z, and Hutnan, D., 2015. Xilbalba 2014. *Speleofórum* 2015 . Brno

Motyčka Z, and Hutnan, D., 2016. Xilbalba 2015. *Speleofórum* 2016 . Brno

Motyčka Z, and Hutnan, D., 2017. Xibalba 2016. *Speleóforum* 2017 . Brno

Monograph

Motyčka Z, et al. 2013. *A Quest for the Secrets of Xibalba* , Brno, Czech Republic

Conference proceedings papers

Motyčka Z, 2009. New Discoveries in Underwater Cave Systems in Riviera Maya, Mexico. Proceeding of 15th ICS , Kerrville, USA [reprinted *AMCS Activities Newsletter* 33, pages 91–93]

Motyčka Z, 2013. K'oox Baal—4th Longest Underwater Cave System in the World, Proceedings of 16th ICS , Brno, Czech Republic [reprinted *AMCS Activities Newsletter* 37, pages 149–155]

Nuevas Exploraciones en Sistemas Subacuáticos en la Riviera Maya

Reseña de exploraciones recientes en Quintana Roo por parte del Proyecto Xibalba de la Sociedad Espeleológica Checa. Un descubrimiento primario fue Sac Kay, con más de 11 kilómetros de longitud.

CAVE-CAMPING TECHNIQUES

Vickie Siegel

INTRODUCTION

In 1978, Bill Stone wrote an AMCS article detailing the status of cave camping in that era. (*AMCS Activities Newsletter* 8: http://www.mexicancaves.org/nl/08.html.) Over the last forty years, however, many things have changed to enable different camp strategies. Camping gear has gotten lighter and more advanced. Food options have changed (and, it seems, so have the myriad of dietary restrictions among team members). Other technological advances have been made, such as better caving lights, high performance fabrics, in-cave battery recharge, and reliable communication with the surface. I make no claim that the strategies listed here are the only, or the best, way to run cave camps. This article is intended to be a snapshot of how cave camps have been run on United States Deep Caving Team (http://www.usdct.org) expeditions in Oaxaca over the last decade or so. It's based on what I've seen and worked on starting with my first cave-camping experiences at J2 in 2006. Specifically, it includes information acquired from J2 (2006, 2009, 2013), Río Iglesia (2007), Cheve (2017), and La Grieta (as part of PESH 2016, Proyecto Espeleológico Sistema Huautla: http://www.peshcaving.org.).

The whole point of setting camps is to avoid having to do extremely long-duration trips from the surface. As a team explores farther and farther into a new cave, it spends more and more time traveling from the entrance to the known edge of exploration and a smaller percentage of its time underground is available to advance the exploration front. At some point the distance, the depth, and the nature of the passage all combine to create an endurance barrier. One has to carefully examine how each task adds up: traveling to the edge of exploration; surveying for eight or ten hours; traveling back out of the newly explored passage; and *then* traveling the previously known passage all the way to the entrance. If that total number of hours exceeds eighteen to twenty-four hours, you will reach a level of fatigue that is neither fun nor safe. Camps provide a way to remove a lot of that time and energy expenditure. They also provide an additional safety net by serving as stable locations stocked with food and supplies that can be used in unanticipated situations like a sudden change in the weather on the surface that produces a flood underground, logistics delays, or injuries.

SITE SELECTION

Several factors go into selecting a cave-camp site. The first criteria is travel time from the entrance or a previous camp. It works well if a camp is approximately a full day of travel, approximately eight to ten hours, from the starting point.This "full day of travel" estimate should be gauged to be a full day of travel for a slower or less experienced caver carrying a full cave pack of twenty-five to fifty pounds. This means that some more experienced or less laden cavers can reach a camp in a fraction of the time. Skipping camps is not uncommon, but should not be counted on. Even if a camp is frequently skipped, it is still a valuable resource as a staging point, an emergency resource, or just a place to take a break before continuing on.

Once it's decided that a camp is needed in an area, it is a question of finding the best spot. The most comfortable camps spots tend to be flat, spacious, sandy, dry but with a water source nearby, and without wind. At the other end of the spectrum are camps that are cold, drippy, windy perches on jagged rocks or over a river. Most camps fall somewhere in between. Typically a camp will need to accommodate at least four people, and some of the larger camps may hold eight to ten on occasion.

Matt Covington at Camp 3 in J2, –1,100 meters. This site, at the bottom of a small depression, is the only place for kilometers where there is a flat place to sleep. *Kasia Biernacka*/ kasiabiernacka.com..

vsiegel12@gmail.com

CAMP CLOTHES

Many people elect to bring dedicated camp clothes into the cave in a 6-liter Darren drum or 4-liter Nalgene bottle. Camp clothes are dry, warm clothes that you wear only in camp. It requires additional effort to carry this extra weight into and out of the cave, but there are some benefits to this approach. It is not uncommon to arrive at a camp at the end of a day underground soaking wet from head to toe. While it is possible to stay warm while wet by moving through the cave, you will quickly become uncomfortably chilly when you arrive at a camp and stop moving. This is when it is nice to have some dry clothes to change into while cooking, eating, and sleeping in camp. Camp clothes, like caving base-layers, should be synthetic or wool fabric, not cotton. Some cavers will bring an entire outfit, others will bring only elements like a shirt and warm socks. Another benefit of bringing camp clothes is that you can pack other small personal items like a toothbrush, special treats,or contact lenses or glasses into your camp-clothes drum. Some people opt not to bring camp clothes; they attempt to dry out their caving base layers by wearing them around camp. Regardless of the approach chosen, it is bad etiquette to climb into a camp sleeping bag that others will one day use with wet clothes. Once wet, it is difficult to dry sleeping bags out in the cave, and others who pass through that camp will have to deal with a wet, cold bag because of someone else's lack of consideration. As with sleeping bags, it is critical to stow your dry camp clothes back into the drum when you leave camp for a day's work in order to keep them dry.

SLEEPING KITS

Cave camps in the Cheve and Huautla project areas, both in northeastern Oaxaca but at significantly different elevations, range in temperature from 47°F to 64°F (8°C to 18°C). Sleeping well—warm and comfortable—is obviously a big deal. Once a sleeping spot has been cleared or flattened or assembled from vaguely flat rocks, the first piece that goes down is a space blanket. A space blanket is an especially low-weight, low-bulk layer made of heat-reflective thin plastic sheeting, usually aluminized polyimide. The impermeable barrier provided by the space blanket protects the sleeping pad and sleeping bag from moisture in the ground. The disadvantage is that it will also collect and pool any drips. The blanket also protects the sleeping pad from sharp rocks or gravel that could puncture it and provides a nice clean place to change clothes. In general it seems worthwhile to pay for the slightly more expensive space blankets, as they will hold up better over the course of an expedition.

We generally use inflatable sleeping pads from Thermarest. There are two basic types of inflatable pads now, with different pros and cons. The older style Thermarest has compressible foam inside. This makes it a little heavier and bulkier than the new style that is purely air-filled, but the benefit is that when the foam-based pad gets a hole, as happens frequently, you at least have that little bit of foam to provide some sort of insulation from the cold ground until you can find and patch the hole. Take a patch kit! The newer NeoAir and related styles are more compact, but when they deflate you have zero cushion or insulation. Different pads get used different places. For the most part we have been using the older style, internal-foam-style pads because their failure is less catastrophic and the extra weight and bulk aren't that significant. Camps that are established beyond sumps, however, often use the NeoAir style because weight, volume, and, importantly, buoyancy are all reduced.

We aim to use sleeping bags that are comfort rated to 32°F (0°C), are made of synthetic material, and will fit, with some effort, into a 4-liter Nalgene bottle for transport. Most recently we used the Mountain Hardwear Ultralamina 32 and the similar Lamina Z Spark 34, both of which have now been discontinued, but similar successors exist online. These bags have seen extensive use in Sistema Huautla and Sistema Cheve and maintain warmth when wet even after repeated compression and general abuse. It is worth mentioning that it is particularly effective to use "group gear" sleeping kits in a cave like Cueva Cheve or J2, where there are up to four

Typical clothing worn at underground camp in Sistema Cheve; all clothing is synthetic fleece (not cotton): 1) expedition-weight long-sleeve shirt; 2) optional vest; 3) expedition weight pants; 4) balaclava; 5) flexible ski or diving cap; 6) heavy-weight socks. *Bill Stone.*

Hammocks for a team of five, suspended from rock bolts at a biouac camp in the hall of the restless giants at –800 meters in Cueva Cheve during the 2017 expedition. *Matt Covington*.

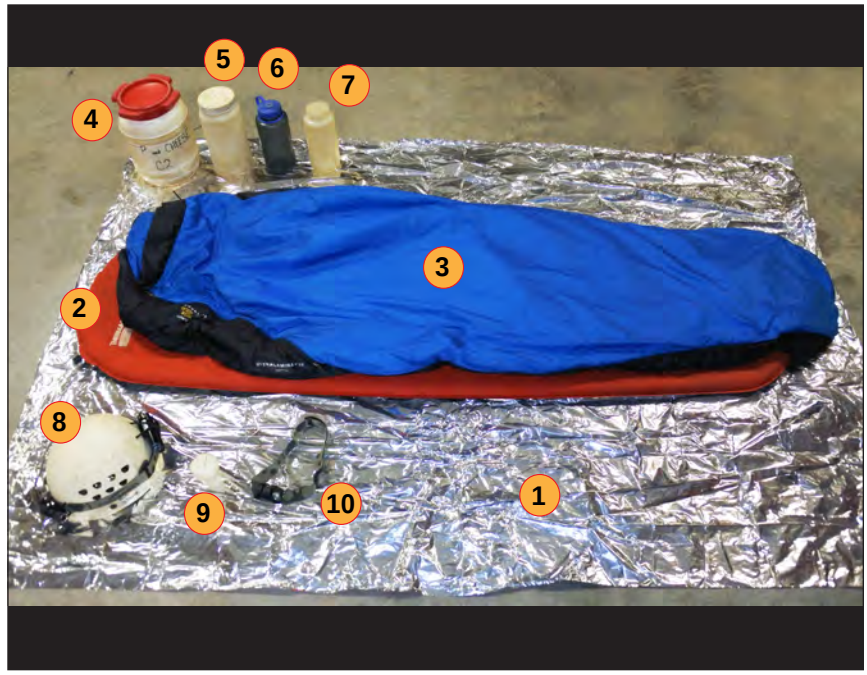
underground camps and many teams moving throughout the cave at any time. Once a sleeping bag is wet underground the best way to dry it out is to sleep in it, which can be quite unpleasant. The general procedure before leaving camp for the day is to stuff sleeping bags into a plastic trash bag to keep them safe from drips and absorbing ambient moisture while people are away.

One trick to retain warmth, especially in a windy camp where you can group several sleeping spaces close together, is to use a tent. In J2 we had two small tents, 2.2 by 2.6 meters custom made from silkweight jacket-liner material. These tents had very simple geometry and could accommodate six people sleeping side by side. They were rigged up by tying parachute cord to small loops in the corners. The entrance closures on each end were long, vertical continuous strips of Velcro. There were thus none of the traditional supporting tubes that add to the weight of a backpacking tent, and the silk is extremely light. The tent blocks the wind and mitigates small drips. With a few people inside the temperature will rise 3 to 5°C. The tent design we used fit into a 4-liter Nalgene bottle. Tents for cave camping should not be made from any kind of coated nylon, as this material will not breathe and will instead collect and drip condensation onto the sleeping bags inside.

When there aren't enough flat spots to be had on the ground you can always rig hammocks. This has was done with some notoriety in Cueva Charco, where cavers had to rig hammocks to rock bolts in a narrow fissure at the –1,000 meter level.(*AMCS Activities Newsletter* 30, pages 25–32, http://www.mexicancaves.org/nl/30.html). In some cases there are vertical drops of 10 meters or more below the hammocks. We have used lightweight backpacking hammocks. Several of these will fit into a 6-liter Darren drum. There is a fundamental problem with sleeping in a hammock in a cave, especially if wind is present. When you get into the sleeping bag you compress the insulation beneath you, and since there is open air below you, the heat will radiate away rapidly, leaving you quite cold. The way to fix this is to put a sleeping pad (an uninflated foam-filled old-style Thermarest works well) in the hammock first and sleep on top of the pad. Many find this arrangement makes it possible to sleep in the hammock when they couldn't otherwise. We've rigged hammocks either to natural anchors or to rigging bolts placed specially for that purpose. Some camps set exclusively using hammocks, such as Camp 4 in Cheve in 2017, actually have the cave stream running under the hammock. We have recently standardized on the large-capacity Hennessey hammocks, minus the insect netting and rain fly.

TRANSPORT

Much of the equipment and food we're transporting to camps needs to stay dry in transit and be kept dry in camp. Even in an apparently "dry" passage the humidity is 100%,



Typical sleep kit for underground camping: 1) space blanket used for ground tarp;, 2) inflatable sleeping pad (typically Thermarest brand);,3) synthetic sleeping bag rated for 0°C, 4) 6-liter waterproof container for camp clothes, 5) 2-liter waterproof container for personal items such as toothbrush, spare batteries; 6) 1-liter water bottle, 7) 1-liter pee bottle, 8) caving helmet with lights, 9) candle to save battery power when in camp, 10) emergency LED light. *Bill Stone*.

and things will eventually become soaked. And there is no easy way to dry things out underground, short of generating body heat through exercise and wearing the wet clothes until they dry. We generally use 0.5-liter, 1-liter, 2-liter, and 4-liter Nalgene bottles and 6-liter Darren drums to pack items that need to stay dry. These containers don't leak if sealed properly, and they can handle a lot of abuse. Nalgene bottles have been proven to be waterproof to 70 meters underwater and can be used for transporting sleeping bags, food, and clothing through sumps, as we did in Cheve in 2017. Since nearly everything gets packed into these protective containers, the cave packs we use to haul equipment can be pretty simple. We have been using 22, 35, and 55-liter capacity Kotarba PVC packs from Poland; the 35-liter size has been the standard haul sack in Cheve. They have two shoulder straps and a simple drawstring closure at the top. A pack like this works well for expedition caving. But it is not the best if you have many small items tossed loosely into the pack; they will fall out of the drawstring closure at the top. When carrying the Nalgene and Darren containers, however, they work great. The unsealed drawstring top and grommet holes on the bottom allow the bag to drain quickly, which is a nice feature when swimming in places like the Salmon Ladders in Cheve, where you are in and out of the river constantly.

FIRST AID

We have a general-purpose first aid kit in a 2-liter Nalgene bottle stationed at each underground camp. The first-aid kit used in the last few years has been adapted from the NOLS Wilderness Medicine Handbook (https://www.amazon.com/NOLS-Wilderness-Medicine-5th-Library/dp/0811711935). The goal has been to make a kit that can fix or stabilize mild to moderate traumatic injuries and medical issues underground. Significant injuries or medical problems require assistance from or transport to the surface, and the kit is not meant to fully address those more serious issue; there is a much more elaborate kit, including rescue litters and trauma equipment, in basecamp for this purpose. The least used and bulkier items and rolled gauze get packed into the bottom of the bottle and the more commonly used items on top. This way the entire kit doesn't get dumped out into the dirt every time someone wants an ibuprofen tablet for a muscle ache. The pills are sorted into 30-cc bottles or small Ziploc bags, and these are labeled with what the medication is and how many milligrams are in the pill. Sometimes it's undesirable to carry a full 2-liter-bottle kit to a temporary bivouac, through a sump, or to some waypoint that only sees limited traffic. For those situations, we've packed reduced kits in 1-liter bottles. The first-aid bottle is well-labeled so that it's easy to pick out from a pile of dirty containers when someone needs to get to it in a hurry. Of course not everyone on the team speaks English as a first language, so I also draw first-aid crosses (the big plus signs) on the bottles in addition to writing FIRST AID on the lid and sides.

FOOD

Food is one of the most hotly-debated topics in planning for a large expedition, and the best approach, should you find yourself in charge of planning food, is to simply accept that this is one of those jobs where you cannot make everyone happy. You can only make sure they are well fed. It is up to them to stop whining. It is important to check with everyone on the expedition regarding their known food allergies.

Since there is generally plenty of water in the cave, it is preferable to avoid hauling the weight of water in the cave-camp foods. This drives our decision to mainly use dried and freeze-dried foods. It also makes sense to minimize the amount of volume that the food takes up as you haul it in, so this leads to the search for high-density dried foods. These dried, high-density foods have to be palatable (I did not say "tasty") and

Cave Camp First Aid Kit		
Item	Quantity in 2 L Kit	Quantity in 1 L Kit
SAM Splint	1	--
10 X 10 cm Gauze	2	1
5 x 7.5 cm Gauze	2	2
Burn Dressing ("Second Skin")	1	--
Triangle Bandage (aka cravat)	2	2
Elastic Bandage (aka Ace Wrap)	1	--
Sterile Scrub Brush	1	
Pair Gloves	3	2
Wound Kit: Contains 2 Vials Benzoin tincture, 2 packs of steri-strips, loose gauze, 1 lg and 1 sm transparent dressing	1	--
Roll Cloth Tape	1	1
Aspirin (325 mg)	22	10
Acetaminophen (650 mg)	15	10
Bag/bottle Ibuprofen (200 mg)	30	20
Advil PM (200 mg ibuprofen, 38 mg diphenylhydramine)	12	8
Pepto Bismol	40	40
Benadryl (25 mg)	4	2
Triple Antibiotic Ointment packets (1/32 oz ea)	4	3
Burn Gel Packets	2	1
Roll Gauze	1	--
Bag Assorted Bandaids	1	1
Liquid Bandage ("New Skin", optional)	1	--
Sudafed (**for sump-diving camps, to clear sinuses, 30 mg)	6	--

Breakfast Mix:

Parts:	
3	Freeze dried bulk scrambled eggs
2	Freeze dried bulk refried beans
2	Dried powdered institutional potatoes
2	Nuts (cashews)
1	Bulk pre-cooked diced bacon

Dinner Mix:

Parts:	
3	Raman or other fast-cook noodles (orzo, cous cous) for texture
2	Dried powdered institutional potatoes
1	Bulk pre-cooked diced bacon (or jerky)
1	Nuts (cashews)
2	Bulk dried broccoli cheese soup

have to provide complete nutrition for cavers who are expending more than 5000 calories per day caving hard. The meal should be easily prepared using a minimal amount of stove fuel. Finally, the entire food system works most efficiently if everyone will and can eat the same foods. For all of these reasons we have moved to a system of custom-designed meal mixes that continue to evolve each year.

These mixes are prepared in large quantities on the surface in a 20-liter bucket or large tub and then scooped into 4-liter bottles for transport into the cave. To prepare the meal in the cave each individual pours some mix into his personal bowl and then stirs in boiling water. The meal is then covered, left to sit for five minutes or so, and then eaten. This system means that the group pot stays clean, since it is only used for boiling water. Each individual keeps his bowl as clean as he prefers, and no single person is stuck cleaning all of the dishes (and using lots of precious water) after each meal.

While we cook breakfast and dinner in the camps, we generally do not take stoves with us during the day. Instead, for lunch we carry foods that are easy to carry in a pack or pocket and eat them cold. Lunches and snacks: cheese, jerky, nuts, candy, energy or granola bars, tuna packets. Beverages: tea, cocoa, instant coffee, Tang or Gatorade, ethanol.

A load for one person to carry to Camp 2 in Cueva Cheve, 2013. Each 4-liter bottle (lower right) contained twelve person-meals. *Bill Stone.*

Generally it is easy to find water throughout the cave, though it may not always be conveniently close to a campsite. Before drinking or cooking with the water we treat it with Microdyn, a water treatment and vegetable disinfectant that can be purchased in Mexican grocery markets and pharmacies. The concentration sometimes varies, but generally one drop of Microdyn is added to each liter of water and then left for fifteen minutes. This treatment has been effective for avoiding gastrointestinal distress. The cave is cold, and plain drinking water does not always seem very appealing. But maintaining adequate hydration is of course important. We take various drink mixes and teas to prepare hot or cold to make it easier to drink adequate amounts of water. Ethanol has been a traditional cave camp after-dinner drink. We ration it at one-half liter per week per six-person team. Usually a 1-liter bottle of water is made up with two caps of ethanol and some flavor of powdered Tang (mango is quite popular) and often with warm water, and this is passed around the team before going to bed. Liquor, of any type, is generally not carried underground because it is 60% or more water, and that would be carrying useless mass.

COOKING

We have been using MSR Pocket Rocket brand stoves with 230-gram isobutane fuel canisters. The Pocket Rockets seem to offer a good compromise between weight, size, price, efficacy, durability, and general robustness. I am not aware of one failing in a cave camp. In each camp we have one or two simple MSR stainless pots (1.5 L and 2 L) and a pot gripper (which, I have been informed, is more properly referred to as a "spondonicle"). The main downfall of this system is that when it is all assembled and there is a 2 liter pot of boiling water on top it is a little unstable and easy to knock over. We haven't used heat-exchanger-based products like Jetboil because they are too delicate to reliably withstand the abuse of transportation into the cave. Empty fuel canisters can be flattened with a hammer to reduce volume. We carry all trash out of the cave.

LATRINES

In the large, deep, active caves of Oaxaca we use latrines in cave camps to contain human waste. When planned and used properly, these latrines do not appear to have a significant impact on the cave ecosystem. Several factors go into choosing a latrine site. First, a latrine should be as far as possible from any active stream or water source. This is to avoid contaminating the drinking water at the local camp and that of any camp downstream. Second, it is desirable to choose a latrine location with some degree of privacy if possible, and it is nice to have the latrine downwind of camp. Third, the ideal latrine is dug in an area of deep sand or clay. This won't be an option at every camp, sometimes a deep crack between two rocks is the only spot available. Once the site is chosen the next important matter is ease of use. It has to be immediately obvious to all users how a person should position his body and where

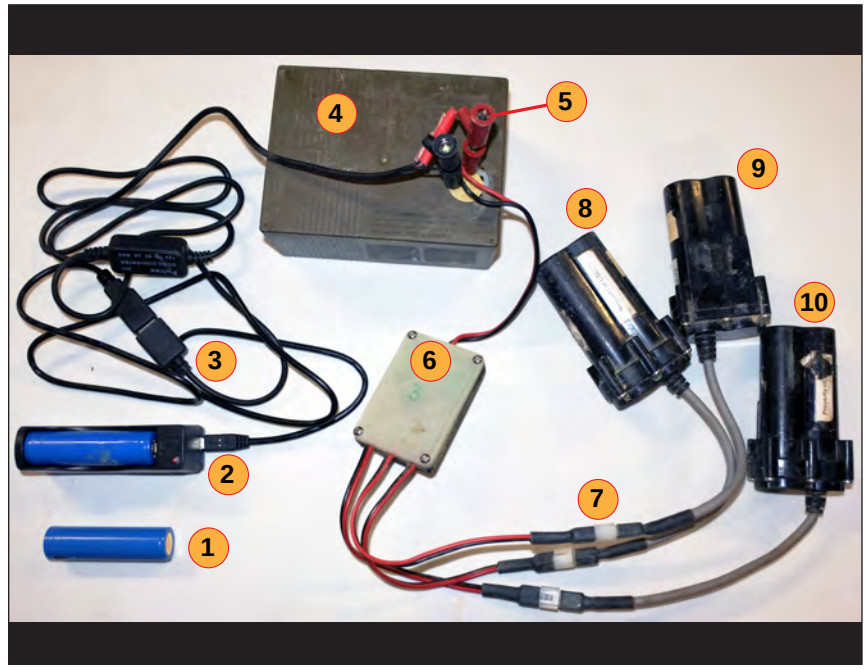
the exact target of the latrine is. If there is not a narrowly-defined and obvious procedure, the result will be many different and unforeseeable interpretations of what is considered the latrine target, and the result will be an unsanitary latrine with an ever-expanding radius. To be quite specific: it should be obvious or clearly labeled where each foot should go. A long, deep, narrow trench (perhaps 1 by 0.5 by 0.25 meters) with vertical (not sloping!) walls is easiest and most fool-proof. One foot goes on each side and all waste lands in the trench. By contrast, a round hole is ambiguous and difficult to straddle. The edges tend to crumble inward over time, leading to a sloping crater that is increasingly difficult to use. We bring toilet paper into the cave in 6-liter Darren drum; five rolls will fit in one drum, and we estimate one roll per person per week. Used toilet paper goes into the latrine. Wet wipe products should not be used in lieu of toilet paper because they are not biodegradable. At the end of the expedition, the latrine is filled in with dirt. It is important to recognize that in caving areas like Huautla and Cheve microbes in the soil will consume and process the waste over time. Generally it is possible to use the same latrine site two years later.

SANITATION AND HYGIENE

Despite the desire to go as lightly and quickly as possible, it's still important to bring in supplies that make it possible to have a cleaner camp. We bring in 30-cc bottles of alcohol-based hand sanitizer. One bottle goes near the kitchen space and one bottle goes near the latrine. In recent years we have started to bring small bottles of Dr. Bronner's brand or other highly-concentrated biodegradable soap into camps as well. Hand sanitizer is better than nothing, but it does not take the place of proper hand-washing with soap and water. In the past there has been a persistent problem with minor cuts and scrapes, particularly on the hands and fingers. These minor cuts become painfully infected after a few days in the cave. There is no exposure to ultraviolet light when living underground, and your hands spend most of the day in wet, dirty gloves. So minor scrapes easily become infected. A conscious effort to fully wash hands in camp has reduced this problem. People who are in a cave camp for over a week will sometimes choose to heat water and do a full soap and water sponge bath to get the grime off. The Dr. Bronner's soap can also be used for cleaning clothes; socks, gloves, and underwear are the biggest sources of infection and also the easiest to wash in the cave. Recently, some people have also taken the step of further sanitizing their gloves and socks with Steramine, a quaternary amine biocide. Finally, team members generally bring a toothbrush and small toothpaste tube in with their camp clothes.

RECHARGING BATTERIES

Another resource to manage in cave camps is power. Battery power is needed for recharging headlamps' batteries, powering cave phones, and recharging miscellaneous electronic gadgets and dive gear. For the most part we try to standardize the entire team on using either Sten or Scurion lights, which use rechargeable lithium-ion batteries, so that we can all use the same chargers underground. Over the years there have been several attempts to develop and use small hydroelectric turbines in cave streams. These projects have been unsuccessful for a number of reasons that are beyond the scope of this article. In 2013 we experimented with using methanol fuel cells, but the hardware was not robust enough for in-cave use. In the end we always return to using primary $LiSO_2$ batteries for our source of recharging current. The reason for this is that



Standard system for recharging batteries at underground camps for Sistema Cheve: (1) most cavers today use 18650 lithium-ion rechargeable batteries and LED lights. However, the power density of these batteries is low, by a factor of more than 3, compared to a lithium-SO_2 primary battery (4). We therefore use lithium-SO_2 batteries to recharge our batteries at underground camps. A single lithium-SO_2 pack (4) will recharge ten standard STEN primary LED light batteries (8,9,10), each of which provides light for two and a half days. A special charger circuit (6) converts 14.4 volts to 8.4 volts and allows three connections (7) at a time. It takes about eight hours to recharge a STEN battery. A USB converter (3) can enable a single-cell charger (2) to charge twenty single 18650 batteries; each takes eight hours to charge). All of the chargers connect to the SO_2 battery using "bananna"-type electrical plugs that can stack to allow more than one battery to be charged at a time. *Bill Stone.*

primary batteries can carry three to four times the energy density of the rechargeable batteries. We do not use primary batteries for our main LED lights simply because they are usually too bulky to place on a helmet. But the use of $LiSO_2$ batteries to recharge batteries has been well proven over the past ten years. We have been using surplus mil-spec BA-5598/U batteries. These provide 9 amp-hours at 14.4 volts. Anecdotally, a single "mil battery" will recharge ten dead Sten batteries or twenty single standard 18650 rechargeable batteries to full charge. The mil batteries are generally transported into the cave in a Darren drum and removed as trash once depleted.

CAVE PHONES

We have been using single-wire, earth-conducting-ground phones called Michie Phones in caves regularly since 2006. This phone line allows communication between people in the cave and those on the surface, as well as between one cave camp and another. We use the phone line to coordinate teams moving equipment, to track food and equipment inventory in camps, to relay new survey data up to the surface, and to communicate in the case of an emergency. There is extra time and effort expended to install and troubleshoot the phone line, but the argument can be made that this work is paid back in the greater efficiency that comes with real-time communication and better coordination.

A single insulated wire (26 AWG) is run from the surface basecamp into the cave. If the expedition has a diving objective such as a push on a sump at the limit of exploration, phone wire will be run from basecamp, through each cave camp, and all the way to the sump. A base station phone is set up at basecamp and an in-cave phone is permanently stationed at each cave camp. To use an in-cave phone, the user grasps the phone, pressing his bare palm onto the phone's aluminum backplate. The other bare hand is pressed against (in the best case scenario) solid bedrock. This completes the circuit using the bare rock as the ground. The in-cave user presses the button on the phone to ring up to the surface. The basecamp phone is attached to an external speaker so that the ring can be heard from a distance, in case no one is sitting by the phone station. From there, the two parties can converse using the push-to-talk style buttons on the phones. It is also possible to connect a phone into the system at any point along the wire; this is particularly useful in special cases like rescue efforts. The phones are far from perfect, and individual units seem to vary widely in the quality of signal they produce. Conversations can come across incredibly clear or faint and garbled. The best-quality signal happens between in-cave phones close to the entrance and the more powerful basecamp phone. Communication between cave camps is possible, but the signal is usually much fainter and relies upon both teams being in their respective camps with their phones turned on to establish contact.

Generally, we end up running several kilometers of wire, all carefully strung out of the main path of travel so that cavers don't damage the wire while passing through. When one spool of wire runs out it is attached to the next using a wire nut and electrical tape or sealed with putty. It is important to keep bare wire dry and isolated, so places where the insulation has been cut away to temporarily connect are subsequently covered with electrical tape, and an attempt is made to place the wire so that it will not contact a wall or other surface. Grounding the system is very important, and good grounding really improves signal strength. At basecamp, a large metal stake is driven deep into damp earth and connected to the phone wire. At each camp, a permanent phone station is set by creating a strong ground. Since you have to work with the conditions present at the camp, these grounds are of varying quality and take various forms. In some cases it is possible, for instance, to bury a metal tent stake in damp sand, or to wrap stripped wire around a rock and place the rock into a stream. Others have tied bare wire into a bolt installed in bedrock. Generally a short section of wire comes off of the ground and is tied into the main through-cave wire and the phone is attached at this point using alligator clips. Each phone requires a battery, and theyhave been designed to accept Sten batteries.

At 9 a.m. in the morning at Camp 3 in Cueva Cheve, Kathleen Graham calls basecamp for the daily meeting to coordinate activities. *Rob Stone.*

CLOSING THOUGHTS

Planning and implementing cave camps on large-scale expeditions requires a different approach than camp projects that involve fewer participants or shorter timescales. One of the most notable differences is that with dozens of participants it is impossible to bring everyone up to speed on the nuances of any kind of equipment that requires special treatment or is not intuitive to use. Things are done differently for group communal gear, and it's important to keep that in mind. There is an anonymity that comes with camps where many people are passing through. People simply and truly cannot be relied on to treat expedition gear with the same reverence and care that they might show to their personal equipment. Is that new coated-down sleeping bag warmer and lighter than a synthetic bag? Would it work well for a dry, sandy camp in the cave? Yes and sure. But does it require some special attention to keep it from getting soaked and losing its insulating properties? Maybe so. Is a down,

high-maintenance bag the best solution for a wet, super muddy camp? Maybe not. The same principle applies to heat-exchanger-style camp stoves. Furthermore, even with the best intentions on the part of the cavers, cave packs traveling deep into the cave receive rough treatment. All packs look identical, and they are often staged at a depot by one team and moved farther along by a different team, so the idea that everyone can be expected to treat one specific pack as "the pack that needs delicate handling" is unrealistic. It is better to find and use gear that performs reasonably well in any one of several possible scenarios and that requires the least special treatment or maintenance. Simple, robust, and interchangeable is the name of the game.

Técnicas para Acampar en Cuevas

Una reseña detallada de diversas técnicas para acampar en una cueva para exploraciones de larga estadía. Se cubren temas como selección de la ubicación, ropa para el campamento, equipo para dormir, transporte del material, primeros auxilios, comida, instrumentos para cocinar, sanidad, higiene, recarga de baterías y teléfonos de cueva.

A Memorable River Trip with David McKenzie

In the mid 1980s, Frank Endres (Phlex), David McKenzie, and I decided to run an approximately 64-mile section of the "upper" Santa Maria river in Mexico. We had read about the river in an account of a raft trip in a *National Geographic* Mexican edition. The rafting group had comprised Mexican boaters and a Houston boater, Wayne Walls, whom we were somewhat familiar with. The lower half of this trip had been run somewhat frequently by recreational boaters and is far less demanding than the first part, which to our best knowledge had only been run by the group from Mexico. After our trip we found that at least two other groups that had preceded us, the first run apparently by the CanoAndes group from Poland in 1979 and the second by US kayakers shortly before our trip. The Mexican group had encountered significant difficulties trying to take rafts down the upper stretch, and we imagined that inflatable kayaks might provide easier passage. We may very well have had a less difficult time than the rafters, but in no way would I describe our trip as easy. Expert kayakers have subsequently run this section much more quickly than we were able to. Tom Robey describes the trip in *A Gringo's Guide to Mexican Whitewater* as "one of the most unusual rivers in the world."

David had been enticed to go on the trip in part by the walls of karst that rise steeply at least 3000 feet from the river in several of its upper canyons, probably harboring unexplored cave entrances. We wound up being totally absorbed in the problem of simply making our way to our planned takeout without going too many days after we exhausted our food supplies, something we were contemplating after our ridiculously slow progress the first few days of the trip. The river literally disappeared in some places, leaving us to somehow determine how to drag our boats around or through arenas packed with giant boulders. Fortunately I did not have to deal with companions who complained other than making jokes about our shared misery. And as anyone who ever traveled with David knows, there never was any question about his willingness to shoulder more than a fair share of the load. Most of the upper section involved as much or more portaging than actual river-running. I don't remember if we encountered any stretch of river in the first two or three days where we were able to paddle more than 100 yards without having to portage or at least stop and scout. Thoughts of climbing to cave entrances rapidly disappeared. Ultimately the obstructions diminished and our progress accelerated until we got to the Cascada Tamul, a 315-foot waterfall that crashes down on the Río Santa Maria with water from the Río Gallinas. In drier parts of the year folks can boat past the waterfall; in wetter times it is difficult or impossible. Our trip was in a wetter season. Through a series of miscalculations on our part we managed to get divided, with me on the downstream side of the waterfall and Phlex and David on the upstream side. Ultimately we were able to reunite, but not until both sides of our divided party had contemplated having to write the parents of our companions about our friend's demise. Fortunately no such letters had to be written. The sound of any large waterfall was not one of my most pleasant sensory experiences for some years after this trip, but ultimately that discomfort faded. The quality of my buddies on this trip is a positive memory that endures.—Paul Reavley

[Cascada Tamul is remarkable as a karst-related geological feature. Normally waterfalls migrate upstream by erosion. This waterfall actually protrudes into the Río Santa Maria enough to force it into a bend. This is because of the large amount of dissolved limestone in the Río Gallinas that is deposited from the falling water.]

PIXAN BEL

Jessica Gordon

This is the story of seventeen cavers venturing into the jungle during a tropical storm to spend a week mapping a recently discovered cave in the Yucatan Peninsula. Peter Sprouse has been leading expeditions to map caves in Quintana Roo for seven years. Through his expeditions, about 250 kilometers of passages have been mapped in various cave systems. In August 2017, Peter Sprouse's team traveled through the 44-kilometer-long Jaguar Claw cave system to map Pixan Bel (Lucky Way). This cave had been discovered earlier in the year by cavers from the Paamul Grotto, including Alan Formstone, Roberto Ghisolfi, and Kevin McPeak, but only one day of mapping had taken place. Due to the remoteness of the cave, a camp would be needed to complete the map.

We began our journey on the morning on August 6, 2017. We started the day with tacos and smoothies, then headed into the jungle to camp in the recently-discovered cave for five nights. Allen Cobb and Linda Palit drove Leah Hill, Ben Hutchins, Sean Lewis, Rory O'Keefe, Benjamin Schwartz, Peter Sprouse, and me to the Jaguar trailhead. I was surprised how much the area had changed since the previous year. This wild jungle is rapidly being transformed. Río Secreto, a Mexican-owned ecotourism organization, is in the process of developing the Jaguar cave complex for adventure tours. They have built bathrooms and showers at the trailhead. Our smooth path on the-developed trail quickly led into rugged jungle. To get to Pixan Bel we hiked for several hours in the jungle and through six caves: Jaguar Paw, Jaguar Jaw, Jaguar Claw, Timid Tepescuintle, Mapa Ché, and Uts Kalkal. We were eager to take any and every opportunity to get out of the hot jungle and into a cool cave. We were all drenched in sweat from head to toe. We cooled off in Uts Kalkal as we waded in water up to our waists. We carefully held our gear above the waterlevel to try to keep everything dry.

After a last hike through the jungle, we made it to the Horno (Oven) entrance to Pixan Bel, which we would call home for the next week. There were many great campsites to choose from in the twilight zone. Peter set up his tent, then returned to Paamul to greet additional cavers. After the rest of us set up camp and enjoyed a snack break, Sean focused on DistoX calibration while the rest of us went to the water's edge and eagerly blew up our tubes and expedition boats. Sean wasn't feeling well, possibly dehydrated from the hike, so he and Leah stayed at camp. Benjamin and Rory started mapping the water passage, while Ben and I jumped ahead to map a large dry room and the surrounding water passage. Benjamin and Rory tied in to our survey and leapfrogged ahead to start surveying a large collapsed sinkhole, the first entrance past the Horno camp.

On the way back to camp, Benjamin noticed two scorpions on a little island, later to become known as Scorpion Island. The smaller one was a bark scorpion, genus *Centruroides*, and the larger one was a spinysting scorpion, *Diplocentrus taibeli*. The bark scorpion had died recently. We thought that it might have been stung by the spinysting scorpion. When we reached camp, we picked a spot to set up our camp kitchen and made dinner. Tropical storm Franklin brought rain our way, with more to come. We had had a good first day and looked forward to exploring and mapping more of the cave throughout the week.

The next morning we put on our gear to get ready to continue our cave-mapping adventure. Ben and I left a note for Peter and the others to let them know they should wait to inflate their tubes and boats because the part of the cave that had been mapped thus far did not have any deep water and inflated tubes would not fit through the low-airspace crawlway the cavers would encounter on the way to deep

Rory O'Keefe standing in one of the collapsed-sinkhole entrances of Pixan Bel. *Benjamin Schwartz.*

jdgordon512@gmail.com

water. Ben and I continued mapping the first large dry room, while Benjamin and Rory continued mapping the second entrance. Sean and Leah ventured onward and started mapping another collapsed sinkhole, the third. Intermittent rains from Tropical Storm Franklin continued throughout the day.

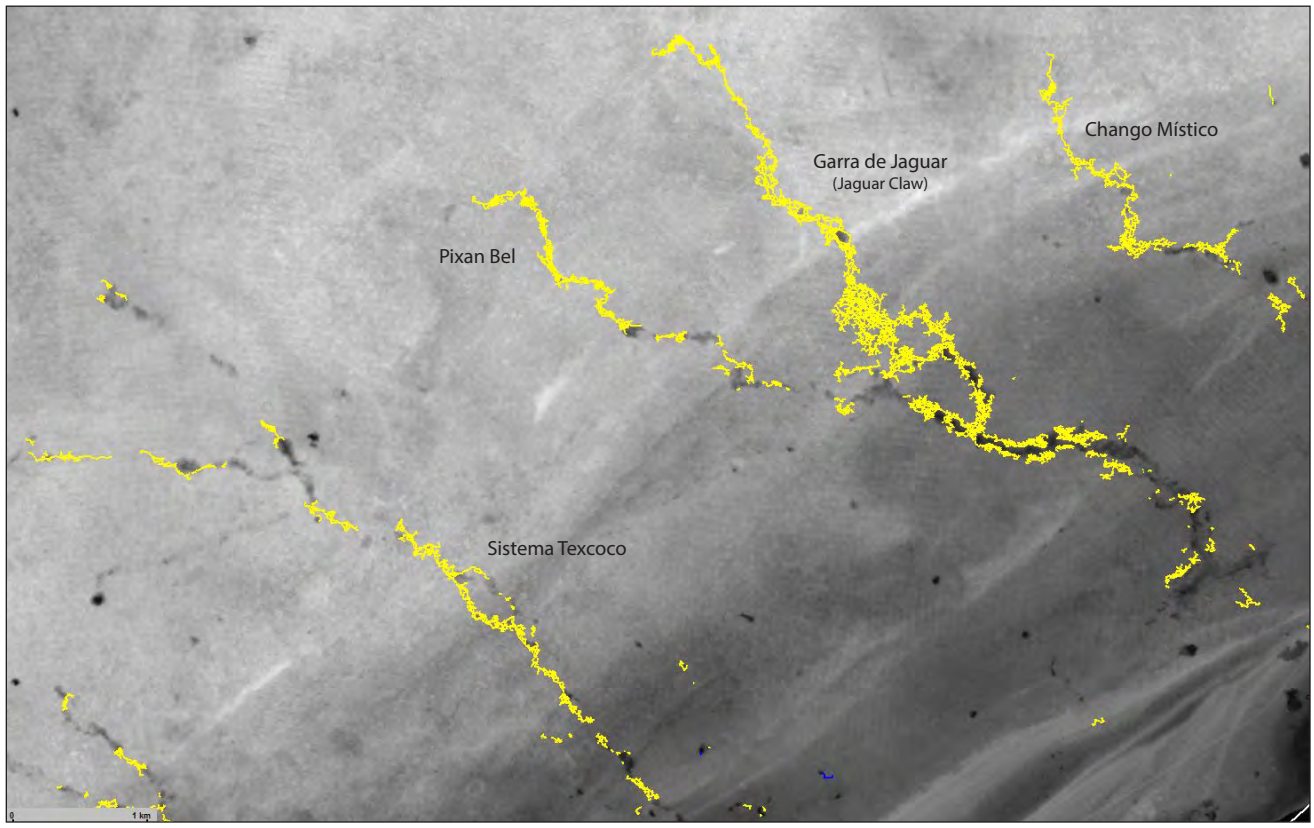
When Ben and I had finished mapping our room and tied into Benjamin and Rory's survey, we went ahead to join Sean and Leah and decide where we should start mapping next. Ben and I started near a passage with low airspace. We left our tubes on the land before the low airspace, then belly-crawled in the water over the sharp calcite rafts while navigating through the maze of stalactites in the low-airspace passage. This quickly opened up into a large room. Ben and I mapped the large island and surrounding water passages. Benjamin and Rory eventually passed us, went through a belly-crawl on dry land, and started mapping where the guideline ended.

Meanwhile, Peter led Amy Morton, Andy Edwards, Bev Shade, Crit Salaz, Chad Pedigo, Dror "Lucky" Benary, Kristen Levy, Mary Hicks, Patrick Roberson, and Rachel Adams through the rainy jungle to Pixan Bel. After they set up their camp, some of them helped Sean and Leah finish mapping their area, while the other teams went to fill in the gap between where Ben and I and Benjamin and Rory were mapping.

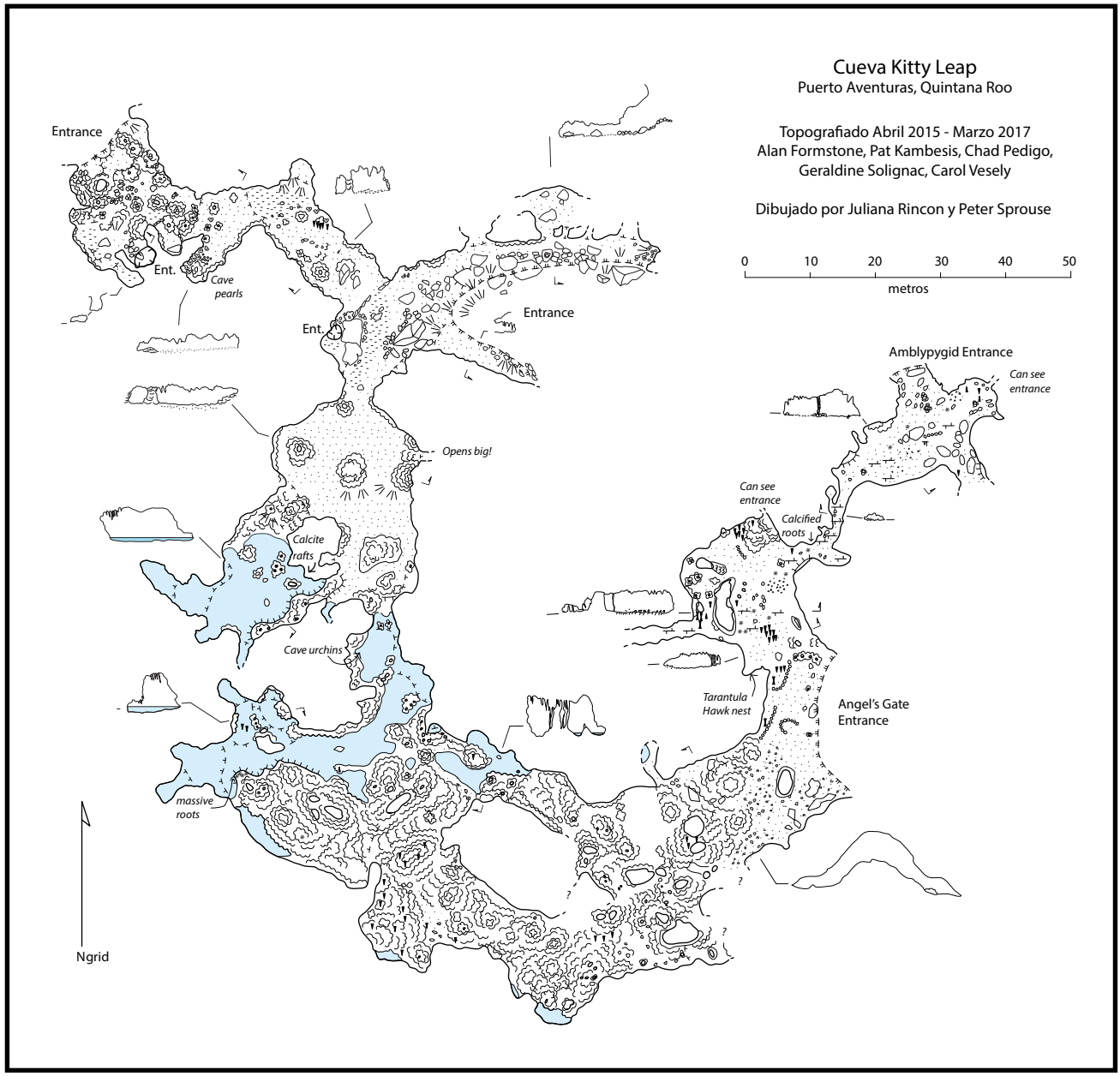
We returned to the Horno camp for dinner. Our one camp kitchen had multiplied into three so no one had to wait long for hot water. The rain from Tropical Storm Franklin had created many drips into the cave that enabled us to collect fresh rainwater for drinking and cooking.

The next day Rachel Adams, a Texas A&M University PhD student, sampled tree roots in Pixan Bel and six other caves in the area.

Jessica Gordon navigating through the stunning formations in Pixan Bel. *Sean Lewis.*



Paamul area caves in March 2018



A small cave in the jungle on the way to Pixan Bel.

Cavers make their way into Pixan Bel from the Horno entrance. *Peter Sprouse.*

The tree roots will undergo DNA analysis to determine which species have the ability to send roots deep into cave systems. She documented variations in root growth and morphology inside the caves. In surface plots directly above the cave passages, Rachel assessed tree abundances and biomass, as well as sampling stems for stable-isotope analysis. Water extracted from the stems will be compared with rainwater, soil water, and groundwater to determine the water source of individual trees. These data contribute to her dissertation research, which seeks to uncover the relationship between groundwater access and forest composition, hydraulic fluxes, and above- and below-ground biomass.

While Rachel conducted her research in her study plots in the jungle, the other teams continued mapping Pixan Bel. We mapped to the fourth, fifth, and sixth entrances, which were connected by several large, dry passages with spacious rooms and interconnected mazes. A couple of groups ventured beyond the sixth entrance to Skylight #42. This feature had been originally randomly named Skylight #4, but it was determined the name caused too much confusion, since we used the order of the entrances for navigation and reference points. The skylight was renamed Skylight #42, the answer to the ultimate question of life, the universe, and everything.

Rain continued throughout the day. We wondered how high the water level would rise and whether we would still be able to navigate through the passage with low airspace. Fortunately, the water level had risen the perfect amount—the level was still low enough for us to safely breath air and was high enough to make it easier to float through the low airspace rather than crawl over the sharp calcite rafts. Between the second and third entrances there was a nice spot to observe water flow; it looked like the water level had risen about 4 inches. Scorpion Island was now completely submersed, but the scorpion was still there, crawling on the ground underneath the surface of the water. After returning to camp, Mary, Sean, I enjoyed showering in an underground waterfall that had formed from the recent rains.

The next day most teams returned to where they had stopped mapping the day before to continue until their sections were fully tied in to other survey stations. There were four teams near the sixth entrance: Bev and Dror, Peter and I, Chad, Crit, and Patrick, and Ben and Mary. Three of the teams finished around the same time and headed deeper into the cave, while Ben and Mary continued mapping side passages near the fifth entrance. The other three teams made their way past Benjamin and Rory and Andy and Kristen, then started selecting good areas to map next. Bev and Dror floated on their tubes to map some deep-water passages. The other two groups continued onward. While swimming through deep-water passage, Chad realized that he had dropped the machete he had been carrying in case it was needed to make a path through the jungle. He took note of where he dropped it and said he would try to dive for it on his way back to camp. After we made our way through the water passage, we reached a large room that became known as Chetumal Hall, named after the capital of Quintana Roo. We climbed up a large mound of stalagmites to an overlook of El Grito (the Scream), the seventh entrance. Chad, Crit, and Patrick climbed down to map the water passage, while Peter and I mapped Chetumal Hall. The two groups were able to tie in to each others' surveys and map back toward Bev and Dror. Bev told the rest of the team that they had found a machete and that Dror had dove down 3 to 4 meters to retrieve it. Chad was glad that the machete had been recovered.

After breakfast the next morning, most of the teams returned to finish mapping the areas they had been working on the previous day. From El Grito, I showed Ben, Amy, and Leah where to connect to where she and Peter had mapped in Chetumal Hall and also the water passage mapped by Patrick, Chad, and Crit. Sean and I explored the main passage beyond El Grito. There was a long section of deep water. Sean and I were thrilled about the opportunity

Benjamin Schwartz sketching cave formations in Pixan Bel. *Rory O'Keefe.*

to use our boat and tube. Mapping deep-water passage in a cave is exciting, but it poses many challenges such as trying to remain still while floating on the water in order to get a steady shot at the target with the DistoX and making sure to carefully navigate around many sharp stalactites in order to prevent the popping of your floating transportation device. Eventually Benjamin and Rory passed Sean and I and reached the last large room in the back of the cave. Sean and I continued mapping the water-passage until we made it to where Benjamin and Rory had docked our boats at the edge of the large room. We marked our last station and a couple of leads to follow up on the next day. Then we paddled, swam, crawled, and hiked a couple of hours back to camp.

The next morning, we took a group photo at the Horno camp. Then Amy, Andy, Ben, Crit, Chad, Dror, Kristen, and Patrick returned to civilization. Bev, Benjamin, and Mary headed to the back of the cave to continue mapping. Rachel went to El Grito to work on her tree investigations. Peter and I stopped by El Grito for Peter to take some photographs, and we climbed out the entrance to get a GPS point in the jungle. Sean, Rory, and Leah focused on another photo session. After Peter took some photos near El Grito, he and I proceeded to the back of the cave. Bev, Benjamin, Mary, Peter, and I all worked together, as three teams, to map the last large island in the cave. It was in a huge room with stunning formations surrounded by crystal-clear water full of calcite rafts. Peter found a large crab claw. We all wondered how old it was and what the cave environment was like when it got there. We alternated climbing up and down a mountain of stalagmites and plunging into the water to map the room. Benjamin hopped into his expedition boat and Mary onto her tube to follow the water leads. Peter and I finished mapping our part of the room, then we helped Bev follow a few water-passage leads. There was a solid calcite raft across the surface of the water. Bev and I wondered how long it took to form such a large calcite raft. After the first lead pinched out, we followed up on a couple of the leads that Sean and I had seen the day before. One of the leads, located near the large room the group had been mapping, curved to connect to passage that Bev had been mapping earlier in the day. Bev and I got on our tubes to follow the last lead. Peter hadn't blown up his tube, so Bev shared her luxurious tube, which had ample room for the two of them. After singing a few songs while paddling, we docked at a small island and followed the flagging to the lead. From our first station, our lead split into two. Which way should we go first? Both options required getting low and slowly navigating through a maze of stalactites. It turned out that it didn't matter which way we went; our two leads connected via a loop.

It was getting late. We were hungry and looking forward to having our dinner back at camp, but we hadn't seen Benjamin and Mary go by. Could they have passed by while we were following one of our leads? In an attempt to check on Benjamin and Mary, we paddled back to the large island, hiked over the stalagmite mountain and down to the water's edge to the last place we had last seen them. Peter called out several times, but we heard no responses and saw no signs of their whereabouts, so we proceeded with our long journey back to camp. Along the way, Bev, Peter, and I searched for potential clues as to whether Benjamin and Mary were ahead of or behind us. There were several ambiguous signs. The first one we looked for was whether or not Rory and Sean's expedition boats were at the launching point. They had left them there the day before. If the boats were still there, we would know that Benjamin and Mary had not been by there yet, because Benjamin had told Rory he would get his boat for him if he had not made it that far into the cave. However, if the boats were not there, it did not necessarily mean that they had been by, because it could just indicate that Sean and Rory had picked up their own boats. The other sign we planned to look for was whether or not Rachel was still at El Grito. If she was still there, we would know that Benjamin and Mary had not been by, but if she was not there it

Bev Shade and Dror Benary float in Pixan Bel.*Benjamin Schwartz.*

Spinysting scorpion fluorescence in UV light. *Benjamin Schwartz.*

could indicate that she had gone back with Benjamin and Mary or that Sean and Rory had made it to that part of the cave and she had gone back with them. The boats were not at the launch point and Rachel was not at El Grito, so it was still unclear whether or not Benjamin and Mary were ahead of or behind us. We found a surprise sign, but we were not sure how to interpret its meaning—a kneepad hanging from the ceiling. What did that indicate? We weren't sure, so Peter took the kneepad, and we continued hiking through the water. Bev and I paused to admire a katydid laying eggs in a stick in the moonlight shining down through the sixth entrance. As we got closer to camp, we started making bets about whether or not Benjamin and Rory were back at camp. Bev was almost bound to lose, for we bet Tootsie Pops and she was the only one with Tootsie Pops to lose.

Bev, Peter, and I finally made it back to camp around 11 p.m. Some of the crew were already sleeping, but Benjamin and Mary had not made it back yet. Peter took that as implying the good news that their lead had continued farther than expected. Benjamin and Mary came strolling in around midnight to tell the tales of their adventures mapping the water passages and the sump at the end of their lead, where the cave continued as underwater passage.

August 12 was our last day in Pixan Bel. After breakfast, Peter, Benjamin, Bev, Leah, Mary, Rachel, Rory, Sean, and I packed up and started our return hike through the caves and jungle. Fortunately, the tropical storm had brought cooler weather, so our hike out was not as hot as our hike in. That being said, the hikes through the jungle were still quite hot, and we looked forward to the cooler portions of our hike in the caves. We had a nice lunch break in one of the caves, then continued our trek through the jungle. We didn't want to leave the cave, but thoughts of having ceviche and beer upon our return inspired us to continue onward. Allen and Linda were waiting at the trailhead with a cooler full of ice-cold beer. They informed us that the landowner had invited us to his house. We took the opportunity to use the newly built showers at the trailhead to rinse off the layer of calcite and cave mud that had accumulated on our bodies throughout the week.

Alberto, Crit, Chad, Kristen, and Patrick greeted us with drinks and delicious pulled-pork tacos with spicy homemade salsa. We devoured two towers of tortillas and platefuls of meat and washed it down with beer. It was an excellent way to be welcomed back into civilization.

Overall, it was a spectacular trip. We mapped 11,899 meters in Pixan Bel. The cave ended in a sump that looked promising for the cave's continuation underwater. We left the cave with some bruises, rashes, and bites, but no major injuries. As we reminisced about the expedition, everyone talked about how great it was to be in a cave camp with such a wonderful group of people that worked so well together.

Pixan Bel

Pixan Bel, una cueva "seca" descubierta recientemente en Quintana Roo, fue explorada desde un campamento remoto. Simplemente llegar a la cueva representó varias horas de caminata por la selva y a través de seis cuevas. La cueva es compleja, con varias entradas, lagos y muchas formaciones. Terminó en un sifón después de 11.9 kilómetros de topografía.

TORRE FALLECIDA

Rory O'Keefe

Torre Fallecida, or Fallen Tower, is a small cave entrance located in the development of Taema in the Puerto Aventuras area of Quintana Roo. The survey of this cave took place in early April 2018, when a combination of dry and underwater passages was discovered. This report will focus on the underwater sections of Torre Fallecida and its subsequent connection to Sistema Chac Mol. While I was exploring the underwater sections, teams of dry cavers explored several caves that connected into Torre Fallecida.

Torre Fallecida begins with a 6-meter drop that leads to a dry chamber bordered by a pool along its northern edge. I found a sump within this pool that headed upstream (north) for 80 meters and ended in an air dome approximately 3 meters in diameter. Turning around, I checked a western lead through a wide bedding plane for about 60 meters and connected to an old dive line. I began a short resurvey of this line before turning to complete my survey back to the entrance. Day one concluded with a total of 139 meters of new underwater passage. A review of the new data indicated that the closest known underwater passage was in Sistema Chac Mol. Unfortunately available data for that system is lacking, and we were unable to confirm a connection with Torre Fallecida. For this reason, it was decided that I would return the following morning to resurvey the old line as far as possible and hopefully correlate it with existing data.

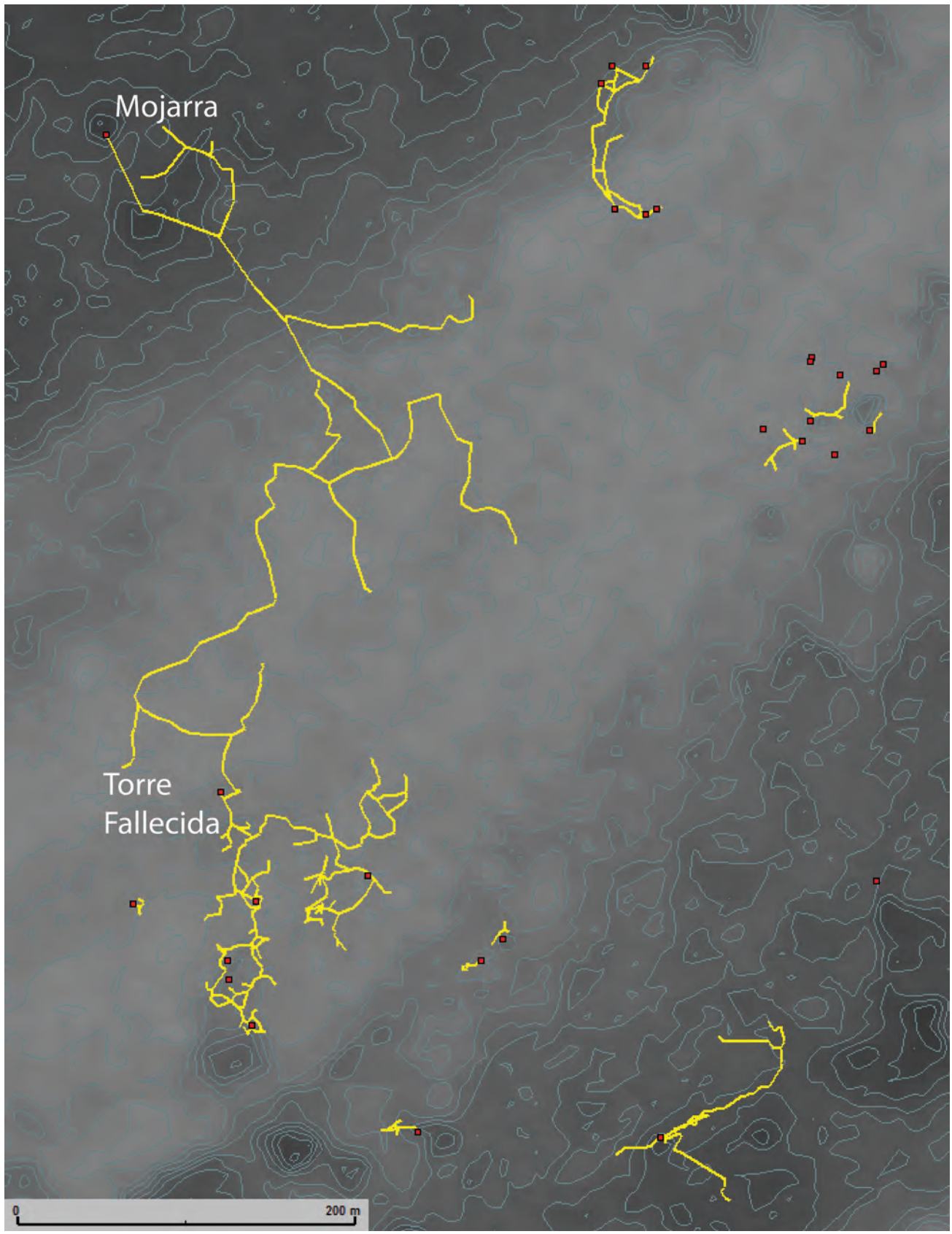
Sistema Chac Mol runs north of Torre Fallecida, and it was in this direction I focused my resurvey. Upstream there was a noticeable increase of hydrogen sulfide, and three air domes were left without inspection as a result of this. Along the way I observed a small blind eel with a length of approximately 10 centimeters. The cave passage continued at a consistent depth of 3 meters, and numerous leads were passed. Eventually I reached the end of the dive line at 280 meters and jumped east to another passage, which turned sharply northwest. At this point the cave passage became very large, and permanent markers signifying side passages were frequently encountered. The end of this line was reached at a picturesque cenote with light beams dancing through the water column. It was in this cenote that I turned my dive and began my exit. Day two concluded with a tally of 651 meters of underwater survey. A comparison of the line survey with the map of Sistema Chac Mol indicated that I had connected to a downstream branch known as the Flat Dreams section and had ultimately ended up in Cenote Mojarra. (The map of Sistema Chac Mol can be found at http://www.mexicancaves.org/maps/3521.pdf.) A unique line arrow found in this last passage turned out to be from local diver Alan Formstone, and we were then able to confirm our connection to Sistema Chac Mol using Alan's survey of the area.

The underwater passage of Torre Fallecida is coated in its entirety with a loose, dark brown bacteria. This bacteria falls from the ceiling after each exhalation and repeatedly reduces visibility to below 30 centimeters. Beneath this bacteria the cave ceiling is a bright white limestone with limited discoloration. The old dive line

Alina Rotzinger surveying in Torre Fallecida. *Peter Sprouse.*

Joaquín Rivera at the entrance to Torre Fallecida. *Peter Sprouse.*

okeefer@live.ca


Mojarra
Torre
Fallecida
0
200 m

and markers of Sistema Chac Mol were also coated with a finger-width thickness and had to be wiped clean to resurvey. It is important to note that these conditions are not typical of underwater caves in Quintana Roo, and it is only within the past few years that this bacteria has appeared in the once clear waters of Sistema Chac Mol.

At the conclusion of my two days in Torre Fallecida, a total of 901 meters of underwater passage was surveyed with 139 meters of new underwater passage added. Along with the 1240 meters of dry survey in Torre Fallecida, that brings Sistema Chac Mool to a current length of 10,811 meters.

Torre Fallecida

Se exploró una cueva nueva en Quintana Roo que tiene tanto pasajes secos como sumergidos. La cueva contiene depósitos bacterianos inusuales y ácido sulfhídrico. Se conectó con el Sistema Chac Mool, con lo cual la longitud total del sistema alcanzó 10,098 metros.

BOOK REVIEW

Cenotes of the Riviera Maya 2016, by Steve Penn Gerrard. Page Publishing, New York , 2015. 6 by 9 inches, 642 pages. Hardbound $40.95, softbound ISBN 978-1-68213-401-6 $26.95, Kindle ISBN ISBN 978-1-68213-402-3 $9.99.

The data on the size and page-count are from Amazon's web page about this book. I have only the Kindle version, which has no page numbers. Kindle.app and ebook readers in general allow the user to change font size, page size, and other parameters, and that makes it impossible to display page numbers, since the amount of material displayed on each page is variable. There are also other anomalies, such as captions not on the same page as the figures and headlines at the bottom of columns. I think a genuine Kindle would download the whole book, but the app fetches pages from the cloud on demand, so, for instance, you couldn't read the Kindle book with your pad or laptop in the Quintana Roo jungle. All the photos in the Kindle version are black-and-white; I don't know about the paper version.

Of course you can move forward and backward through pages one at a time in an obvious way, and the app does have links on the contents page to the beginnings of the chapters. It also has a slider the move to a particular "location", of which there are roughly 25 per page (out of 8606) using the display settings I have, as well as the percentage of the way through the book from 0 to 100. The table of chapter lengths below is calculated from the percentages. Perhaps because of the lack of page numbers, there is no index of the numerous cenote names; maybe the paper edition does have one. But the software for reading the Kindle version does have a *Find* function that will locate a name for you.

There are eleven chapters and three appendices. Most of the chapters are short, occupying only a few percent of the book, but the real meat of the book is the guide to cenotes on the Caribbean coast of Quintana Roo that are suitable for recreational snorkeling or cave-diving. These are described and sometimes illustrated by photos and occasionally by maps. Most descriptions include coordinate locations, either as decimal degrees or, less often, UTM coordinates. The second-longest chapter includes summaries of major exploration projects in the area over the past thirty years and probably provides the most interesting reading for those not seeking information on particular cenotes. The third-longest is about visiting the area, with lots of advice about customs and immigration and local accommodations and transportation that would be useful even to non-diving cavers visiting the area.

The main sections of the book, preceded by the approximate percentages they occupy, are

1	The Riviera Maya
3	The Environment
6	Geologic Introduction to the Cave Systems
2	How to Safely Snorkel in the Riviera Maya
2	Safe Cenote Diving
31	The Dive Sites
6	Accident Analyses
4	Techniques
17	Cave Diving Exploration
2	Protecting the Fragile Environment
9	How to Plan and Pack for Your Adventure
16	Glossary

My review of the earlier edition of this book, published in 2000, appeared in the *NSS News* in April 2000 and the *AMCS Activities Newsletter* 24, 2001.—Bill Mixon

RANCHO SAN GRACIANO, COAHUILA

Ken Demarest, Jessica Gordon, and Cait McCann

The Sierra del Burro, also known as Serranías del Burro, is a broad mountain range in northern Coahuila. Peter Sprouse had spent significant time in this range in years past and had several leads in mind for this trip. He had mapped caves in surrounding ranches and had arranged access to Rancho San Graciano in the northern part of the Burros. Old reports from Jean Krejca's visit to a *noria* (well) in the area showed promise of finding blind catfish. Our area included San Pedro, Pilas Cuates, and San Graciano.

Dylan Beeler, Ken Demarest, Jessica Gordon, Fernando Hernandez, and Cait McCann gathered at Peter's house on July 21, 2017, to organize and consolidate camping gear, caving gear, food, and water for five days of adventure. The six of us loaded up in Peter's Toyota Sequoia and headed southward. About thirty minutes into our trip, Peter asked Ken, "Do you have your passport?" Ken looked like a deer stunned in headlights. When he responded that he didn't have it, we all thought he must be joking. Then we realize that Ken was being serious. He had forgotten his passport. Ken immediately started looking into the possibility of FedExing his passport to Del Rio. Peter offered to turn around to retrieve the passport and suggested that Ken call his wife to see if she would meet us halfway. Ken called his dear wife, Sweet Pea, to see if she would meet us south of Austin. We met off of I-35 at Onion Creek Parkway. Ken said it felt like he was breaking the law by having a passport handoff exchange on the side of the road. When we were near New Braunfels, we heard the sound of straps hitting the roof of the vehicle. Peter left the highway so we could assess the situation. Most of the little bungee cords holding the tarp over our gear on his roof rack had broken. Fortunately he had extras, and we were able to secure the tarp. We continued onward.

Our first night we camped at Amistad National Recreation Area. We found a nice spot near the water with a beautiful view, a nice breeze, and ample room for everyone's tents. Everyone except Ken, that is. It seems that during the tarp-flapping near New Braunfels the tent he'd had for many years had fallen off the roof rack. Ken thinks this might be passport-related karma. He cheerfully resigned himself to a night under the stars. After everyone else set up their tents, we went for a refreshing swim in Lake Amistad and savored chilled watermelon;. Ken honored Jessica with the status of genius for thinking to bring such a succulent appetizer to share. The swimmers enjoyed investigating intricate patterns of spiderwebs that decorated the underside of the dock and glimmered in the setting sun. Jessica made pesto pasta for dinner. It was a good first night.

The next day, we entered Mexico via Ciudad Acuña. Tales of a spring coming out of a cave summoned us. Peter gave Fernando a copy of *Lower Cretaceous Stratigraphy of Northern Coahuila*, a report of investigations by Charles Isaac Smith in 1970. Fernando used the travel time to eagerly study the geology of the area, which is covered by a vast amount of limestone. We would search for caves and springs in the Glen Rose Formation. We all watched for a tractor tire that would mark our turn toward El Bonito. When we made the turn, we saw a cumulonimbus cloud forming over the mountains in the distance. We stopped to explore Arroyo la Zorra to look for caves in the cliffsides. We were excited to encounter one within the first five minutes of our search. Cait, Fernando, and Ken explored Cueva de la Zorra Seca while Dylan, Jessica, and Peter continued to search for other karst features. Thunderstorms loomed on the horizon.

We continued driving to the ranch, where Peter had made arrangements for us to stay. We were greeted by Tomás, Jorge, and Tomás's dog. It seemed they had not been informed to expect our arrival. As we waited for Tomás to talk to his boss on the radio, we took the opportunity to refill water and admire the beautiful ranch. We could see rain in the distance, and the rumbling thunder sounded like it was getting close.

After talking with his boss on the radio, Tomás told us to drive back to the red gate. He said he would ride his mule and meet us there to show us where we could camp and point out the trails for two known caves on the property. When we got there, we found a large pond. We were starting to follow some pipes feeding the pond to find out where the water was coming from when Tomás and Jorge showed up on a motorcycle. We joked about liking his mule. We went through another red gate, and then they showed where we could set up camp near an old ranch house next to an antiquated goat corral.

As we hiked toward the mountains behind the ranch house, they showed us where to turn the water spigot on or off. We continued hiking to the first cave, which was tucked away in a little ravine. We had heard about this cave, which sometimes has a spring flowing out if it. Tomás and Jorge called this Cueva el Sotol. After a preliminary inspection of the cave, we continued hiking to

ken.demarest@gmail.com
jdgordon512@gmail.com
caitmccann@gmail.com

another cave on the flank of the Sierra el Novillo. We snacked on some deliciously ripe persimmons as we hiked. Eventually we arrived at our destination, and Tomás and Jorge pointed out a potential cave high on the mountain, which later was named Cueva Trono de Oso.

Then we went back to set up camp. Tomás and Jorge headed off on the motorcycle to see if they could get us access to a nearby spring and a cave with pictographs. They returned to let us know that the landowners were not home, but they were going to try a nearby relative. Tomás and Peter negotiated a start time for the following morning. Tomás suggested he could come by at 7 a.m., Peter said 10 a.m., and eventually it was decided that we'd meet Tomás and set out between 8 and 9.

For an appetizer that evening, we snacked on sweet orange berries growing on a shrub called *granjeno*. For dinner, Ken made his famous chili. Just as it was getting dark, Cait encountered a large rattlesnake. That night we saw glowing click beetles searching for mates. The stars were stunningly beautiful. The Milky Way was shining brightly. We enjoyed the opportunity to be in one of the darkest places in North America, far away from civilization and flight paths. Dylan, who had a four-man tent, generously offered Ken a place to take refuge so he did not get devoured by ticks and other critters of the Chihuahuan Desert.

The next morning, the group geared up for caving after a quick breakfast so we would be ready for the arrival of Tomás. However, Tomás did not arrive when expected. The hastily-fed group waited and waited for Tomás, telling stories to pass the time. After an hour, the group devoured some dinner leftovers for their second breakfast and made a new plan: Peter, Cait, Dylan, and Jessica would map Cueva el Sotol, while Fernando and Ken would hike up to Cueva Trono de Oso. The Sotol team made the short hike up a hill and down the creekbed to the entrance, with its beautiful flowstone surrounding the drop in the entrance room. Interesting patterns in the rimstone dams and flowstone indicated that water flowed both into and out of the cave. It was a classic "J-tube" resurgence. Jessica searched for karst invertebrates while Peter guided Cait and Dylan in surveying and sketched while he collected harvestmen for study at the National Autonomous University of Mexico. Jessica found a wide variety of spiders, harvestmen, beetles, cave crickets, millipedes, and other invertebrates. Dylan patiently battled with an uncooperative paint pen to mark stations while listening to the sounds of a cliff chirping frog. From the entrance room, they climbed down the drop, past several small alcoves and columns and to the lower level with a small bat roost, a breakdown pile over a sump, and a loop along the wall that followed a large chert band. Cait's eye injury of the previous week meant a little extra squinting at the DistoX target, and as she shot to point 14, she heard Dylan giggling from the passage off the lower room. He reported that the bats flying around as he held the station were tickling him. Twenty-four stations were set in total. The cave is 14 meters deep.

Fernando approaches the entrance to Cueva de la Zorra Chica. *Peter Sprouse.*

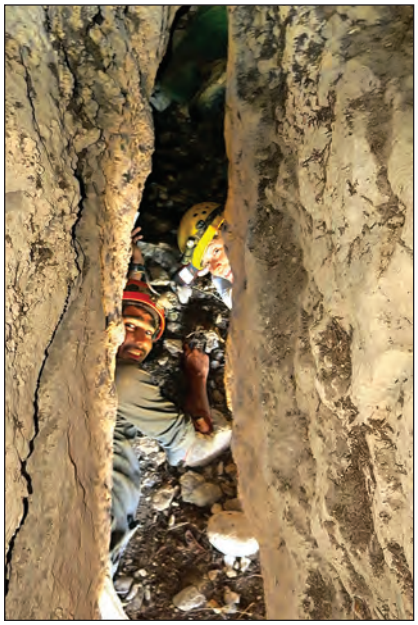
Jessica sat just above the sump to look for life there, hoping to spot a blind catfish. She squished stink bait into several of the rock cracks just under the water's surface, but after an hour of observation by her and, later, Cait, only a beetle and a decaying, floating cricket with a few mites were found. Jessica thinks she spotted an aquatic isopod, but was not able to collect it for verification.

The crack of thunder outside and sounds of a coming storm were concerning, since it was clear how much water the cave could take. The mark of a pool level in the cave was at least 5 meters up on the wall from the current sump, and the dry -tream entrance to the cave was a departure from the surrounding brush-covered hills and mountains. Jessica checked the surface and found the storm was in the distance, and it was not raining outside the cave. The water level in the sump didn't change, but every ten to fifteen minutes a gurgle could be heard from within the rock there. Jessica and Cait maneuvered around breakdown to shed a layer of muddy cave clothes and take turns going into the sump for a closer look. Jess donned a mask and ZebraLight before the visibility was too impacted by silt and saw what seemed to be a good dive lead for the future.

What were Fernando and Ken doing during this time? They had set out to check a cave higher in the mountainside. They drove Peter's vehicle as far as they could. The day before, Tomás was skeptical that they would be able to successfully drive on the precarious road, but they were able to move some rocks to make a portion of the road drivable. Ken said that Fernando leapt like a gazelle up the hillside while he scrambled up the steep slope, wearing gloves to protect his hands from the many thorns in the Chihuahuan Desert. When they made it to the entrance of the cave, they were excited to discover that it was indeed a mappable cave. It went back and to the left. It was about 7 meters in diameter. In the back of the cave they found a stovepipe-shaped lead that turned back to where the original entrance was. Ken fit only halfway into the

stovepipe. Fortunately, Fernando was able to fit. There was a ledge about 1 meter tall that resembled a throne. Gracing the entrance of the cave was black bear scat. Hence the cave was named Cueva Trono de Oso (Bear Throne Cave). In a little room to the left, there were juvenile grass sprouts in rows that looked like someone had planted them. This was Ken's first real cave-mapping experience as a sketcher. He said it was super fun but a little nerve-racking because he knew he wouldn't do it perfectly, but with feedback from Peter later in camp, it came together.

The view out the front of the cave was spectacular. Ken said, "If you were king of the mesa, that is where you would live." As Ken and Fernando looked out from the cave, they searched the landscape for other potential caves. They scouted to the left and right of the cave entrance, but didn't see any leads, so they climbed to the top of the mesa. Unfortunately, most of the cliffs they looked down upon did not look like they would have caves. As they were hiking down, they did discover some interesting sea-creature fossils: lots of mussels, a few snails, and an intact clam. They went down to the main river channel and up a tributary, but they did not find any more caves. This was during the baking heat of the day. Ken had not planned enough water for the extended trip. He was thankful that Fernando shared his water with him so de did not succumb to heatstroke. The blue water-cubes in truck were a welcome site. As they drove back, they added more pinstripes to the Sequoia.

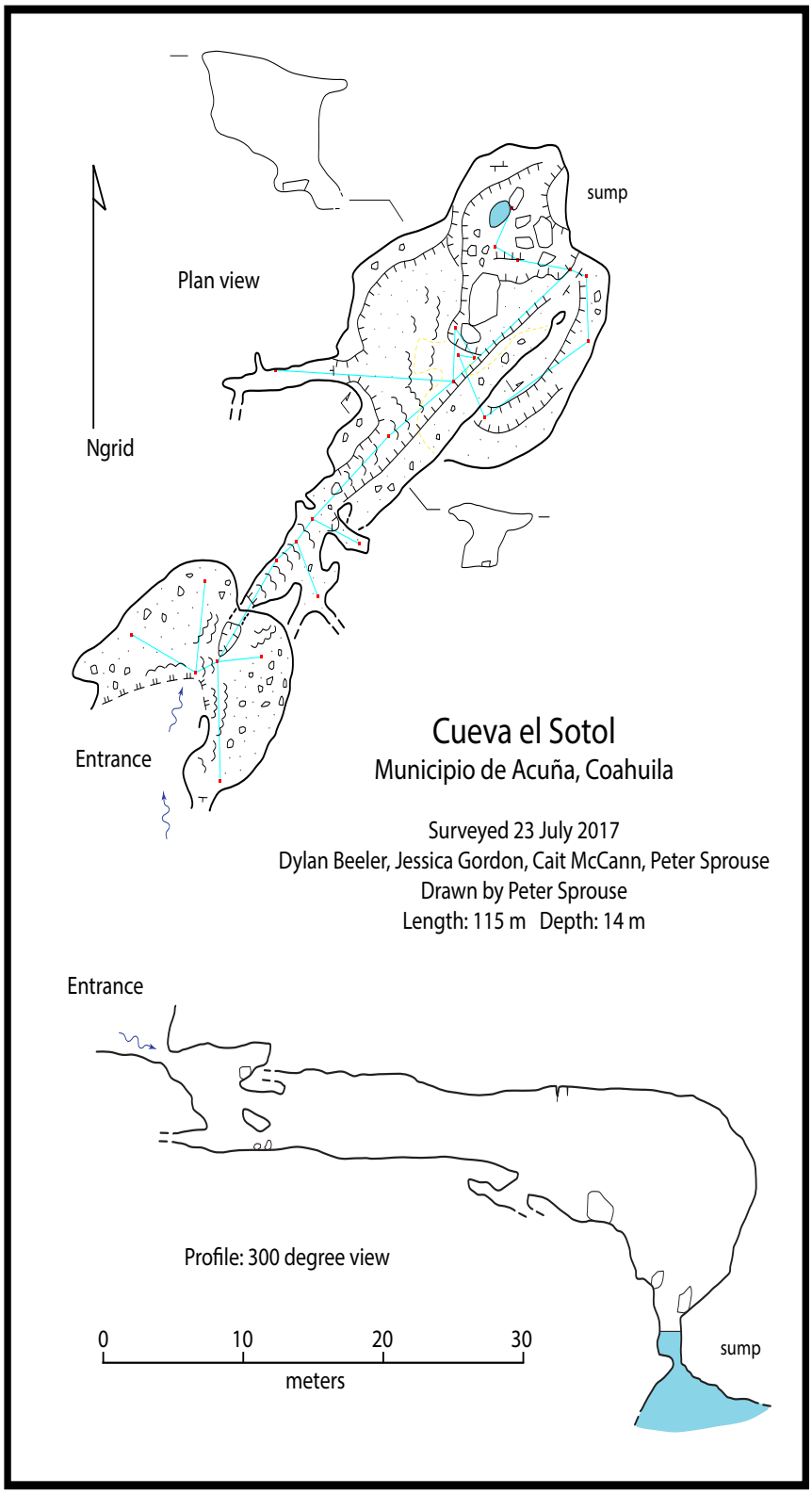


Fernando and Cait mapping Cueva de la Zorra Seca. *Jessica Gordon.*

Back at the road from Cueva el Sotol, Cait, Dylan, Jessica, and Peter wondered how things were going for Fernando and Ken. Taking a seat in the little bit of shade, we sat and talked awhile until Peter heard a vehicle coming down the road. The road wasn't visible from camp. It was beyond the tents, the pond, and a small gate. The soundscape was usually dominated by the sound of insects, raucous birds, and the occasional bellowing moo from a far-off cow, making any motor noise conspicuous. Peter went out to the road and chatted with Juan Manuel Rodriguez, "El Gallo," to ask about other caves nearby. El Gallo owned land farther up the canyon and rented a ranch close to the one we were staying on. He had worked on these mountains for twenty-three years. He suggested the group visit the *ojo de agua* past the ranch at San Graciano, saying it was a beautiful place and that we should take lots of pictures. El Gallo's son was with him and said that he'd lived in Austin for a while and didn't like it at all. He missed the ranch. They exchanged contact info with Peter, and El Gallo explained that he "likes people who do good things like exploring" and doesn't like "people who do bad things." Since we fell into the first of those categories, he suggested we visit the Noria de San Pedro, a spring coming out of a well just one ranch over. Then he continued down the road. After leaving a hasty note to Ken and Fernando, the group started walking to the noria. We crossed the Arroyo la Zorra through an impressive expanse of limestone cobbles, indicating that on occasion a lot of water can flow through the usually bone-dry area. The walk was hot, but along level roads. We were hoping to catch a glimpse of wildlife near the noria since we weren't traveling in a noisy vehicle. That plan was dashed—happily—as we saw Ken and Fernando slowly coming down the road toward us and the spring. They'd made it back from the mountain and didn't want to miss out on swimming. Cait hopped into the Sequoia and Dylan, Jessica, and Peter stood on the back bumper.

As we all stumbled out of the truck or off the back bumper, the spring seemed like an oasis in the dry landscape and was very different from the steep hike up to Trono del Oso through spikey plants. The water was beautiful, and it flowed out of the limestone structure that had been built around the spring in 1918, topped by an Aeromotor windmill, at an impressive rate. But just how impressive? We decided to give it our best estimate. Cait pulled three limes out of the vehicle that could be used for a timed float, and the distance was estimated based on Fernando's body length. The hope was that he would be tall enough for timing. It turned out he was almost a second long. Ken calculated an estimate of about 4.5 cubic feet per second. After taking turns sliding down the short chute coming out of the limestone structure, we started downstream to explore a little more. The cow patties from the surrounding ranch were concentrated, like the cows, close to the wide, ephemeral creek, and the water quality quickly degraded as we moved downstream. Although Dylan shed his shoes so they wouldn't get wet, he managed to keep up with the group barefoot while juggling cobbles along the way.

We returned to the campground refreshed, ate chicken tostadas, and marveled at the juvenile round-tailed horned lizard found by Dylan. After dinner, we went for a short hike in search of crepuscular fauna. We found several scorpions and watched them fluoresce in the UV light, saw a bat swoop down to eat one of the many glowing click beetles, and watched Fernando find a Texas banded gecko and coax a vinegaroon into his hands. We collected a couple of scorpions and saw a black widow spider, camel spiders, and wolf spiders, and we probably could have continued finding cool creatures all night. Our collections were bound for the Institute of Biology at UNAM.



We awoke to find just one scorpion in the collection bag. The large scorpion had killed and eaten the small scorpion. Cait and Fernando made the team a delicious breakfast. They had planned to make chilaquiles, but Fernando did not approve of Cait's chip and salsa selections. Peter was eager to cook sausage, so they decided to make a sausage-and-egg scramble with chips and salsa on the side.

The group then headed south to find a spring at San Graciano that El Gallo and others had mentioned. We turned right out of the gate, following the only road. When we stopped at a ranch along the way to make sure hadn't gone too far, we were surprised to be greeted at the gate by Tomás. He and the ranch keeper he was helping that morning stopped what they were doing and followed us by mule and horse down the road farther to the San Graciano ranch, providing an introduction to the several ranch workers there.

This ranch had a *pila*, a large, round water reservoir with walls 1 meter thick and 2 meters tall. The pila had been built about one hundred years ago, according to the ranch manager, and neatly whitewashed. We followed Tomás on a trail that passed the pila and continued to the left of the ranch house. We hike a few kilometers, gradually making our way up along karst limestone and lush plants, how the Barton Creek Greenbelt in Austin might look without invasive species and thousands of visitors each summer day beating down a path. We made our way to the *ojo de agua*, which had a small concrete spring-box built surrounding the spring's opening. This small, steady spring in the West Nueces and Fredericksburg geological members is the sole water source for ranches in this valley of the Sierra del Burro through a long plastic pipe that makes its way downhill.

Each person set to work. Peter gravitated toward the spring, Jessica pulled out her dip net, Fernando immediately climbed straight up the cliff face over the spring, Ken found a side path up the cliff, Cait began sifting through spring samples, and Dylan kicked off his shoes and found the perfect place to sit, observe,

and lend a hand to help everyone else. Ken's initial walk up the path along the cliff yielded no caves, so he headed left of the spring next. He found a cave but didn't have a light with him. When he went back to get his light, Fernando joined him. The cave entrance was too small for Ken, but Fernando was able to squeeze through the tight little cave. Fernando mapped Cueva Harvestmanhattan, home to more harvestmen than he had ever seen in one place. They fell onto his neck and book as he sketched. Ken continued on, exploring two rock layers that had the potential to have caves. In a rock layer about 5 meters above Cueva Harvestmanhattan he found one cave about 5 meters deep, but it had many stone columns blocking the entrance, so he could not enter the cave. A wasp stung him on his arm, then more showed up and told him it was time to turn around and head back.

Peter, Cait, and Jessica collected invertebrates, working their way from the main spring down to other pools in the ribbon of water down the hill through the karst terrain. The group admired neon skimmer dragonflies defending their territories, abundant damselfly larvae, caddisfly larvae, a blue turquoise lizard holed up in a boulder next to a toad, an orange millipede with an appealing smell, and a "skinkamander," which fled before it was verified whether it was a skink or a salamander. Among the limestone and igneous intrusions that characterized the riparian area, Dylan found a long black millipede and Peter managed to find and collect a pseudoscorpion. A small weir held back a small pool of the cool water downstream, and as the invertebrate-collecting came to a close, Cait and Jess waded in to cool off and see what else could be found. The result was water boatmen, striders, and whirligig beetles that gave off a sweet scent when we caught them. Under the surface of the water was a collection of caddisfly larvae clinging to a rock, each with intricate leaf camouflage.

As collecting and surveying wrapped up, the ranch manager came to check on us. As we hiked back toward the ranch, he explained that the ruins of a house along the path had been torn apart by people looking for treasure hidden in it. Of course, the supposed treasure was never found. It was unfortunate that the well-built little stone house was destroyed "because it even had a chimney" according to the ranch manager. Along the hike we enjoyed the stunning views of the surrounding mountains and spotting a black grasshopper with yellow and white stripes.

We wound down another road on the way back to camp, stopping at a goat ranch to talk to someone working on a truck. Jorge, whom we had met with Tomás earlier, was there helping. We asked about a cave with indigenous drawings on the walls that Jorge had mentioned when we first visited Cueva el Sotol. The rancher asked, somewhat angrily, who we heard about that from. We said Tomás, and Jorge was quiet. The rancher's indignance faded as we continued to ask about water, the noria, and caves. He reported that the spring at San Pedro had only been flowing for a few days, which meant we had come at the right time to see and swim in it. It could continue to flow for months after it begins. He didn't know where the water came from, just that it probably rains somewhere else, but he's not sure where. He assured us that fish do come out of the spring, although we never saw any. He also supported a report from other ranchers we had flagged down on the road the day before. Under the mountain with three pyramid-like peaks at the top, called la Centinela, there's a small cave that crosses from one side of the top of the steep mountain to the other in a short through-route.

Dylan in the entrance passage in Cueva el Sotol. Note the redissolving flowstone on the floor. *Peter Sprouse.*

We returned to the Noria de San Pedro, hoping to maintain our goal of swimming every day of the trip. We spoke with two more locals there, including the property leasee. She smiled when she heard that it had been our friends who had visited over twenty years before, remembering a visit by Jean Krejca and others. According to that trip report, the water in the noria was not flowing, and the team had to rappel 25 meters down the well shaft to reach water. We were happy to have permission to swim again, and amused by the wide variation in accounts from locals about the size and color of the fish in the spring. Some said grey, others green, catfish, sardines, and so on

During this relaxing swim, several of us entered the limestone structure hoping to get a better look. Were there any fish to be seen? Ken decided to do a vertical free dive against the flow. His ZebraLight started flashing when he reached a depth that he guessed to be about 10 meters. That wouldn't do, so he decided that putting a Zebra in a Nalgene bottle with water to keep it from floating to relieve some of the water pressure on it. That worked like a charm, and it enabled Ken to go 12 meters deep hand-over-hand

Rainstorm over the Sierra del Burro. *Jessica Gordon.*

down the windmill shaft. We gave him a measuring tape to verify his maximum depth. His dinner was well earned that night! Peter made a spaghetti feast for all, with many sous chefs helping cook sausage, saute veggies, heat the sauce, and provide appetizers.

On the last morning of the trip, we awoke to find that a dog had adopted us and was guarding camp. Jessica had seen a javelina right outside of her tent. She had been wondering what was making loud chomping and clanking noises. We packed up camp and headed north, back down Arroyo la Zorra. Peter and Dylan explored the area for karst features while Fernando, Cait, and Ken mapped Cueva de la Zorra Seca and Jessica collected cave invertebrates. We mostly belly-crawled in the cave, but erosion along a fault gave an opportunity to stand. Along the fault, there was flood debris way overhead, all the way up to the ceiling of the cave. The cave is about 12 meters long.

As we started to drive back toward civilization, we decided to make one more exploratory stop in an arroyo. In order to divide and conquer, we headed off to cliffs in two different directions. Both groups returned with reports of awesome ammonite fossils and a potential collection of dinosaur footprints in the bedrock. Ken and Jessica might have spotted a golden eagle. They did not get a good enough view to say for certain, but it was a brown, majestic predatory bird with an enormous wingspan. It was a fitting ending to our time in Sierra del Burro.

We had had a wonderful and productive trip to the Sierra del Burro in northern Coahuila. We mapped four caves, Cueva el Sotol, Cueva Trono de Oso, Cueva Harvest-manhattan, and Cueva de la Zorra Seca. One of the caves, Cueva el Sotol, has a sump that is worthy of future exploration. We investigated and swam in two springs, Noria de San Pedro and Ojo de Agua en San Graciano. Everyone we met was friendly and helpful. We established contacts and leads, including a cave that goes through the mountain and the everlasting hope of finding a blind catfish.

Rancho San Graciano, Coahuila

Se exploraron cañones y pequeñas cuevas en la Sierra del Burro en el norte de Coahuila. La zona es desértica, pero algunos manantiales forman pequeñas pozas adecuadas para nadar. Se realizaron también algunas colectas biológicas.

PALOS MARIAS, MICHUACÁN 2016 AND 2018

Peter Ruplinger

My 2016 trip was my thirty-fifth extended trip to Mexico and my ninth cave mapping expedition to the costal area near the border of Colima and Michuacán. Each trip has been a rewarding experience. We have mapped several caves in the area, including Cueva Cara de Tigre, which has one pit about 150 meters deep deep and Cueva de la Baranca Verde, which has several large rooms and is the home to tens of thousands of bats. Regrettably in recent ventures we have found it difficult to find additional virgin caves.

A dear friend Manuel Anguilano promised to take us to an "immense and notable cave" near the top of Peña Blanca. We prepared equipment and provisions for a four-day hike and mapping project. Several young men from Palos Marías enthusiastically offered to help with mules to carry our ropes and equipment. Each young man proudly toted a pistol or rifle. They hoped to shoot a deer or at least a *tejón (*coati) for dinner. It is a beautiful, heavily wooded area inhabited with herds of deer. Four varieties of pumas or jaguars are also reported. Mike Washburn and I had lightweight sleeping bags and ground cloths. The young men each had a hammock, which seemed more practical in an area with rattlesnakes,tarantulas, and deadly scorpions.

After a day of rough hiking, Manuel set off on his own to find the cave. He returned dejected. He couldn't find it. That's not surprising. Before the advent of GPS, I've been in the same embarrassing predicament. It's often difficult to relocate a cave. Manuel explained that the cave likely contains gold. Magical powers enable it to disappear at will. He could be right. Who knows?

Local farmers near Palos Marías were pleased to take us to several other small caves. Most amounted to little more than shelters. One cave was sufficiently large to merit mapping. It was high in the mountains east of Palos Marías. The entrance was guarded by an legion of large black ants. They had fiery bites. A confident young man, Miguel, quickly stepped forward. "Not to worry", he said. "I know how to protect us. I'm an expert at this sort of thing. I'll smoke them out!" The ants had their own strategy. While Miguel was making a fire several crawled up his pants. This caused him to jump and shout in agony. No one laughed, but I saw a few sly smiles.

The property owner, Joel Verduzco, said the cave didn't have a name, so we named it Cueva de las Hormigas Malditas (Cave of the Evil Ants). It had numerous formations and a pool of water near the bottom. Mike swam across the pool to see if the passage went beyond an obstacle.

In subsequent months Manuel relocated to an area near Villa Victoria, Michuacán. He reported that there were three unexplored caves in that vicinity. This gave us hope for a return visit.

In 2018, with renewed hopes for finding virgin caves Mike Washburn and I planned a subsequent expedition. Chris Hirschi and his thirteen-year-old son Mason offered to join us. We picked them up at the Manzanillo airport. This worked out well, saving them six days of travel. They missed out, however, on touring northwest Mexico.

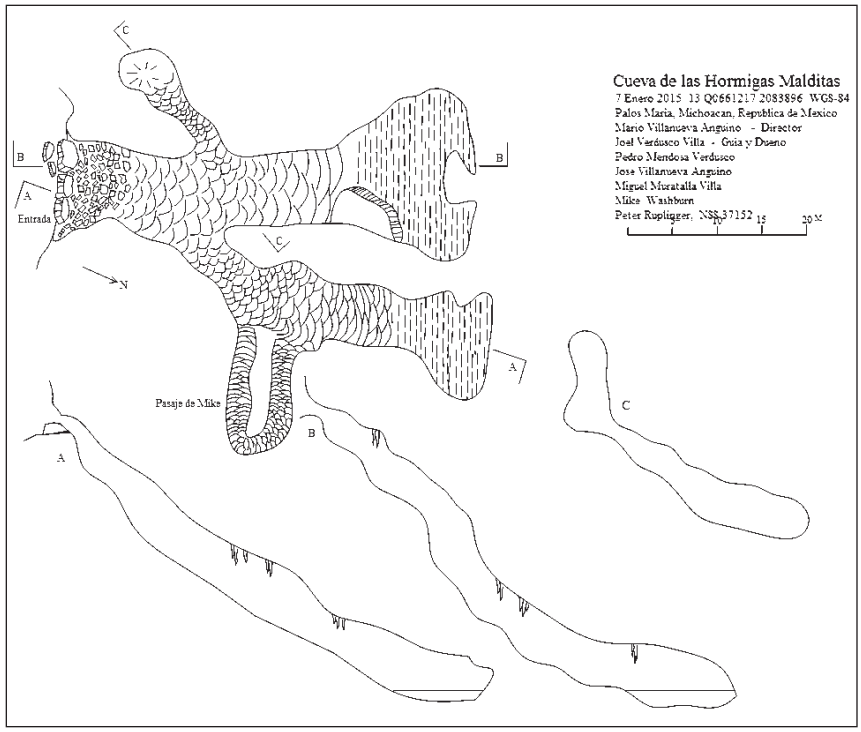
I drove most of the time. Mike and Chris rested on luggage in the truck bed. Naturally it was crowded with all our ropes and supplies. We even had the largest kitchen pot I have ever seen. Manuel Anguilano's sister-in-law lives near me. She asked me to take it to her mother in Mexico, who has the peculiar hobby of collecting pots. The pot was filled with clothing and kitchen appliances. Immediately upon arriving in Palos Marías we were pleased to get rid of the pot. María placed it on top of her kitchen roof with numerous pots almost as large. Soon several neighboring youths joined us for a dinner of *tejón* and iguana tacos.

We revisited two of the especially nice caves in the area, and new friend Valentín Castro Rodríguez took us to two new caves. They were small, but virgin. They were well decorated with numerous tooth-edged draperies. Chris mapped them. That evening Valentín with his wife and two adorable little daughters joined us for dinner.

The next day we drove high

Chris Hirschi among the toothed draperies in Cueva de los Dientes. *Peter Ruplinger.*

peter.r@ruplinger.com



into the mountains to the small town of Salitre de Copala. Manuel Anguilano was waiting for us. He took us farther into the mountains. The three caves were exactly as he had described them. Cueva La Angostura was close to a jeep trail in a narrow canyon with high walls. Much of the trail transversed a swift stream. Manuel said that summer rains often made travel impossible for weeks on end. Mike scrambled to the top of the steep gorge. There he found the other two caves. They were little more than rock shelters. Chris mapped Cueva La Angostura.

On a previous trip I had encountered a promising area northeast of Villa Victoria, Michoacán. It was clearly good karst terrain. Randomly spaced rocks protruded from the soil like tombstones. Desiring official permission, we visited the municipality of Villa Victoria to speak with the mayor. Presidente Adalberto Espindola Mendoza is a sharp young man. He was proud to say that prior to his election, he served as a cartographer and had heard of our speleocartography near San Gabriel, Colima. Presidente Espindola cordially suggested that we begin our explorations in a nearby community to the southwest. We drove there that afternoon and spoke with local farmers. They enthusiastically showed us one small cave. It contains numerous broken pots. It may possibly be of interest to archeologist. It looked like a large rock may have fallen from the ceiling, crushing the pots. We were careful not to disturb anything while prudently mapping. Mason named the cave Cueva de los Jaros Quebrados. Chris mapped it.

The local farmers say there are several other caves nearby. We plan to visit and map them in January of 2019. We also hope to investigate the area northeast of Villa Victoria.

The stream that leads to the entrance to Cueva La Angostura is frequently impassible during the rainy season. *Peter Ruplinger*

Palos Marías, Michoacán, 2016 y 2018

Varias cuevas pequeñas cerca de Palos Marías, Michoacán, fueron exploradas y topografiadas en dos expediciones en 2016 y 2018. Se planea regresar a la zona en 2019.

WILLIAM "BIL" A. PHILLIPS

Bil Phillips was a well-respected underwater cave explorer, cave-diving instructor, and knowledgeable mentor to cave divers and underwater explorers for over twenty-five years. He made his home and caving business in Tulum, Mexico, nearest to the caves and the people he cared for most. An unexpected and short battle with cancer brought his long and distinguished career to an unfortunate end in November 2017. His death took all of his friends and colleagues by complete surprise.

As a native of Vancouver, Canada, Bil worked for a refuse-removal service. In time he became known as a successful heavy-construction contractor. With the contracting business growing, Bil grew quite fond of offshore SCUBA diving in the Vancouver area. His experience in coldwater diving, limited visibility, and diving in remote coastal and island areas attracted a circle of some of his closest friends, who would eventually look to his expert diving counsel. This comradery challenged Bil personally. Diving as a hobby would soon develop into commitment to a lifelong professional career.

Bil explored the breadth of the Pacific Ocean as a SCUBA Instructor, experiencing many of this ocean's most virgin and appealing reef environments. He moved to Thailand to be near their remote reefs. Summer temperatures would soar in Thailand, encouraging Bil to plan diving vacations to other world-class diving destinations. Eventually he found Belize, and then Quintana Roo to be to his new choice as a home. He left Thailand to embark on a new business on what was called the Costa Turquesa. Always keen to improve his skills, Bil became a cave diver. His commitment to cave diving and cave-diver training established his presence during the infancy of the Quintana Roo cave-diving industry.

After a period of time as an employee in an Aventuras Akumal dive facility, Bil moved a few kilometers south to build a new adventure in Chemuyil. As the new owner of Speleotech, he hung his shingle as an expert and seasoned cave-diving instructor and guide. His spirits soared in Chemuyil at this time. He made many friends from around the world and taught many students. I don't believe Bil was ever happier or more content and productive than during this period in his life.

Bil would come to join a small team to explore the world's longest underwater cave in the world. Early explorations in sections of Ox Bel Ha were the result of yearly multiple-week exploration camps in the jungle. These projects focused the team on exploring and surveying specific areas in the Ox Bel Ha cave. Helicopters, compressors, human porters, horses, living arrangements, and personal commitment enhanced both the team effort and the length of the cave. As a member of the Explorers Club, Bil was also rewarded by carrying an Expedition Flag during a Sistema Ox Bel Ha expedition.

Bil Phillips in Tulum. *Gary Walten.*

My guess is that a number of the remote areas of Ox Bel Ha have not been visited by divers since. Unfortunately personal disagreements and philosophies surfaced among the original team members. Team explorations and team cohesion faltered, dividing the core team into autonomous efforts. All members continue to explore this intricate cave maze. It is also remains a cave of many personalities. The exploration of Ox Bel Ha continues to this day. Bil still owes me some survey data.

Around 2010 Bil moved from Chemuyil to Tulum after constructing a larger dive and hotel complex in Tulum. The new Speleotech dive center was a grand, yet bothersome labor for him. Bil had been hesitant to make this move. But he felt the move into the mainstream of a growing local dive industry was key to Speleotech's future. The transition to the larger dive center demanded much from him.

Bil still ranged far into the Quintana Roo jungle searching for new cave to explore, especially if the cave might connect to Sistema Ox Bel Ha or Sistema Sac Actun. He welcomed all his friends to help, explore, and survey with him. He taught them the rudiments of survey and opened areas not often open to the occasional gringo. Bil insisted that all his team respect the new cave environment and its conservation.

Bil remained a loyal Explorers Club member for many years. Aside from his Flag Expeditions in Sistema Ox Bel Ha, he participated in the 2000 Explorers Club Flag Expedition Project Aguakan in Quintana Roo. Bil was also a member of the History Channel documentary "Magellan's Lost Fleet" filmed in Patagonia. This too was an Explorers Club Flag Expedition.

Bil developed an interest as an underwater cave cartographer. He

was always a surveyor; he produced maps and sketched from Cuba, Belize, and Quintana Roo caves. Bil and I managed to do a map or two together as well. He also served as a committed director for the Quintana Roo Speleological Survey. He supported the QRSS initiative for nearly two decades. He saw the importance of complete underwater cave maps, as opposed to line plots. He understood that with maps in the right hands, cave maps are training aids and a means to teach students to know the cave and not follow the guideline blindly. Complete cave maps were also the best media for cave divers to plan their forays. He also understood the need to archive cave explorations in Quintana Roo as best as we could in the QRSS.

Bil was instrumental in the history of cave exploration and cave diving training in Quintana Roo. His voice for caution, a strong call for cave conservation, and his devotion to mentoring cave-diver training will be sorely missed. His past students will miss him, while new cave divers will discover a legacy of his explorations in many remote cave areas.

—Jim Coke

SERGIO ZAMBRANO

It has been almost a year now since my good friend Sergio Zambrano, born in 1948, died on November 12, 2016, in a tragic traffic accident while driving to Sótano de las Golondrinas. It is difficult to accept that he is gone. I knew Sergio for nearly thirty-seven years. Most of that time, to his delight, I referred to him as *Chótanai*, the Devil in Mazatec.

I had heard of Sergio Zambrano García as early as 1979. Rumors had begun to spread of a team of cavers from Mexico City who had explored a deep cave in Queretaro. It was called Sótano de Tilaco. At that time there were not many caves in Mexico that were much deeper than Tilaco. It was an impressive accomplishment, more so because there were not many Mexican cavers at that time. Through Peter Sprouse I began corresponding with the original explorer of the place, Sergio Zambrano.

In the spring of 1980 I had just made the connection between Li Nita and Sótano de San Agustin in Huautla by diving a series of short sumps. It turned out that Sergio was also beginning to pursue cave diving, and he was training with a north-Florida cave diving instructor named Paul Heinerth. By the spring of 1981 we had discovered the Cueva de la Peña Colorada, the fossil resurgence for Sistema Huautla, and I began training in the esoteric art of stage-diving, the practice of carrying additional tanks that were dropped as they were used to increase range. By this time Sergio had also become interested in stage-diving, and we agreed to meet and train together over Thanksgiving of 1981. Sergio and his life-long friend Ángel Soto Porrua, along with Paul Heinerth, were at Peacock Springs in north Florida. Paul had never met me, so Sergio instructed him how to introduce himself in Spanish. Thus the first time I met Paul he shook my hand enthusiastically and said "*¡hola cabron!*" Sergio and Ángel were behind him laughing hysterically. Paul was trying to figure what he did wrong.

It is hard to imagine any of the projects I was involved with in the 1980s and 1990s in Huautla happening without Sergio's help. In 1984 we spent three memorable months together in the jungle of a remote canyon just south of Huautla in an attempt to dive from the Huautla resurgence to Sótano de San Agustin. Sergio had helped with federal permits that allowed us to bring eight tons of cave-diving equipment to Huautla. Our team of eleven, including Sergio and Ángel, mapped nearly 10 kilometers of cave that spring. There were seven sumps, and 25 percent of that cave length was underwater. We set the first underground camps beyond sumps on that project. Sergio and Ángel filmed the underwater work. It was an extraordinary push to a very remote place. It has been

thirty-four years since anyone has attempted to go farther.

Two anecdotes about Sergio leap out when I think of that expedition. Sergio and I were the first modern humans to explore Altar Cave, a gigantic 40-by-40-meter tunnel high on the 500-meter-high wall of the Peña Colorada canyon. The only way in was to rappel 120 meters over the edge and pendulum inside. We were warned by local Mazatecs not to go in there. When asked why they warned us that *Chotanai* was in there. The level of spookiness increased when we discovered two huge circular altars inside the entrance. The site must have been fifteen hundred years old, or older. How on earth had they gotten in here and how could they have built these massive altars? This was mysterious and weird. I asked Sergio if this bothered him. He said, "No". I asked why. He said, with a wicked smile, "because I am Chótanai!"

A few weeks later Sergio and I were scouting for cave entrances in a remote side-canyon. We were ascending steeply along a very old trail when we came across a man sitting in the trail. He had a machete, not unusual in these parts. Sergio said quietly to me, in English, "let me handle this." He then said, diplomatically and politely in Spanish, "We are cavers looking for caves. May we pass ?" The man said, "Wait!" He disappeared up the trail and returned some time later, saying, "You may pass". We soon hiked up into an opening that had been laboriously cleared from the jungle. It was on an extremely steep slope halfway up the canyon wall. And there were twenty men there working in this field, digging and planting. Sergio explained our quest to the man who was obviously in charge—he had an automatic pistol on his hip, not something you commonly see in the Sierra Mazateca. "There are no caves here," said the man with the pistol. Segio said, "This is a lot of hard work you are doing to farm in this canyon. What are you growing?" "Beans," said the man with the gun. Then he said, "and who are you?" Without hesitation Sergio responded "Chótanai." The man with the gun laughed and indicated it was time for us to leave, back down into the canyon. To this day I do not think that encounter would have gone as well had Sergio not been there with me.

Some time later Sergio was having coffee one morning in base camp when twenty-six Mazatecs armed with machetes marched into camp. They explained that the Cueva de la Peña Colorada was actually in the Municipio de Mazatlán and they wanted an official letter from the government stating that we had permission to be there. Sergio went back to Mexico City. A few days later a twin-engine plane flew low through the canyon, an extraordinary feat of flying given the narrowness of the walls. A small parachute dropped from the plane. We scrambled to find out what it was. To everyone's stunned surprise it carried a container of ice cream. For those of us who had been sweating for months in the heat it was like a gift from heaven. Several hours later Sergio and Ángel walked down the trail into camp bearing the letter for Mazatlán. "How was the ice cream?" Sergio said with a grin. Yes, he was the acrobatic pilot of that barnstorming plane. A true Renaissance man.

We went on to work together on many other projects together: the 1987 cave-diving expedition to Wakulla Springs in Florida, the 1994 Huautla expedition, the 1999 Wakulla Springs expedition, the 2003 Cheve expedition, and the 2009 J2 expedition. Sergio, to me, seemed like the consummate statesman who always knew exactly what phrase, mannerism, and nuance was needed when negotiating with anyone. He was an extraordinary human being. Aside from his caving, diving, and flying, he was also the long-standing president of the Mexican Alpine Association, and he had climbed high–elevation peaks around the world. He had personally saved the lives of fellow mountaineers on Denali following a massive avalanche.

This past spring I asked Sergio's son Oscar if there was something that he could give us to commemorate Sergio's significant contributions to exploration. Oscar had a plaque created and sent me one of Sergio's first Jumar ascenders. Our team at Cueva Cheve in 2017 took these to Camp 3, at a depth of 1,100 meters, and held a small ceremony there in honor of our fallen comrade. It is a remote place, perhaps seen by fewer than fifty people. It is a fitting tribute to a man who lived an amazing, adventurous life. Adios, Chótanai!

—Bill Stone