Caves of the Inter-American Highway

NUEVO LAREDO, TAMAULIPAS

to TAMAZUNCHALE, SAN LUIS POTOSI

BULLETIN 1

of the

Association for Mexican Cave Studies

EDITED BY

WILLIAM H. RUSSELL and TERRY W. RAINES

REPRINT

Frontispiece: View from one of the many caves in Huasteca Canyon.
Photo by Jim McLane

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Austin, Texas, U.S.A.

July 1967

FOREWORD TO THE REPRINT EDITION

This classic work, long out of print, was the first introduction to the spectacular caves and karst of Mexico to most of the world. The Association for Mexican Cave Studies was founded, initially as the Speleological Survey of Mexico, in 1962. By the time this Bulletin 1 was published, there had been two volumes of the *Association for Mexican Cave Studies Newsletter,* but *Caves of the Inter-American Highway* was its first major publication. This is a facsimile reprint of the original edition.

In the nearly thirty-five years since the publication of this book, much has changed in Mexico and in caving. Spectacular finds have continued to be made in the area in northeastern Mexico that it covers, and additional important caving areas have been found in other parts of the country. Records of length and depth have been broken repeatedly. But the caves described here are still some of the most interesting in Mexico.

The road logs and details about access to the caves may well, of course, have become obsolete. The reader planning to visit caves in Mexico should request up-to-date information from those who are active in the area today, or at least while seeking proper local permission to visit the caves.

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INTRODUCTION

The ASSOCIATION FOR MEXICAN CAVE STUDIES was founded in 1962 as the SPELEOLOGICAL SURVEY OF MEXICO, and has as its purpose the advancement of knowledge of caves and related features in Mexico. This Bulletin compiles the results of numerous trips into the area served by Mexican Highway 85 — the Inter-American Highway. It is intended as a guide to the areas easily accessible from this Highway, and as an introduction to geology, cave biology, and speleogenesis in Northeastern Mexico. Along the Inter-American Highway are some of the outstanding caves and karst in North America.

Caves in Mexico, along with all other underground resources, are government property and permission should be obtained both from the local authorities and the landowner before visiting caves not frequently visited. Courtesy and conservation are most important in Mexico, where North Americans are not only strangers, but also foreigners. A glossary of Spanish geological and biological terms is included at the end of this Bulletin. More detailed and current information on many of the caves and areas mentioned in this Bulletin frequently can be found in the AMCS NEWSLETTER, or can by obtained directly from the ASSOCIATION FOR MEXICAN CAVE STUDIES, P.O. Box 7672, University Station, Austin, Texas, 78712.

ACKNOWLEDGMENTS

The editors wish to acknowledge the valuable assistance of many people and organizations. Most helpful were the geologic guidebooks published by the Corpus Christi and South Texas Geological Societies. These were extensively revised for this Bulletin; much new material was added and some names were changed to correspond to more recent usage. The editors assume responsibility for the content of the road logs as well as the interpretations expressed in the geology and speleogenesis sections. But the greatest acknowledgment should be extended to the members of the University of Texas Speleological Society who made this Bulletin possible. They spent literally thousands of hours in gathering the basic field data and then processing the results in the form of reports and maps. Special thanks go to Orion Knox, A. Richard Smith, and Danny Evans for drafting the multicolored maps. A. Richard Smith is also to be recognized for his technical assistance. James Reddell is primarily responsible for the compilation of all biological information contained in this Bulletin. And not to be forgotten is Carol Westmoreland for her critical reading of the manuscript.

TO ENTER MEXICO

To enter Mexico a United States citizen need have only proof of citizenship (voters registration, birth certificate, passport, or notarized affidavit), car title, and a smallpox vaccination certificate of an internationally recognized type. The vaccination is usually not checked when entering Mexico but is needed to avoid having a revaccination when re-entering the United States. If the owner of the car is not present it is necessary to have, in addition to the title, a notarized release from the owner to bring the car into Mexico. These papers are needed even if a visa has been obtained before crossing the border. Insurance is advisable as those involved in accidents are frequently detained until all claims are settled. Permits are needed for biological collections and for geological work. Removal of minerals and artifacts from Mexico is not permitted. As cavers are frequently suspected of these activities, it is best to emphasize the recreational aspects of the trip and any other activity, such as mountain climbing, that may be planned. While government officials in any country can be a problem, as is frequently discovered upon reaching United States customs, the unselfish cooperation of local officials and people living in the cave areas can be one of the most gratifying aspects of caving in Mexico.

"Bienvenidos a México"

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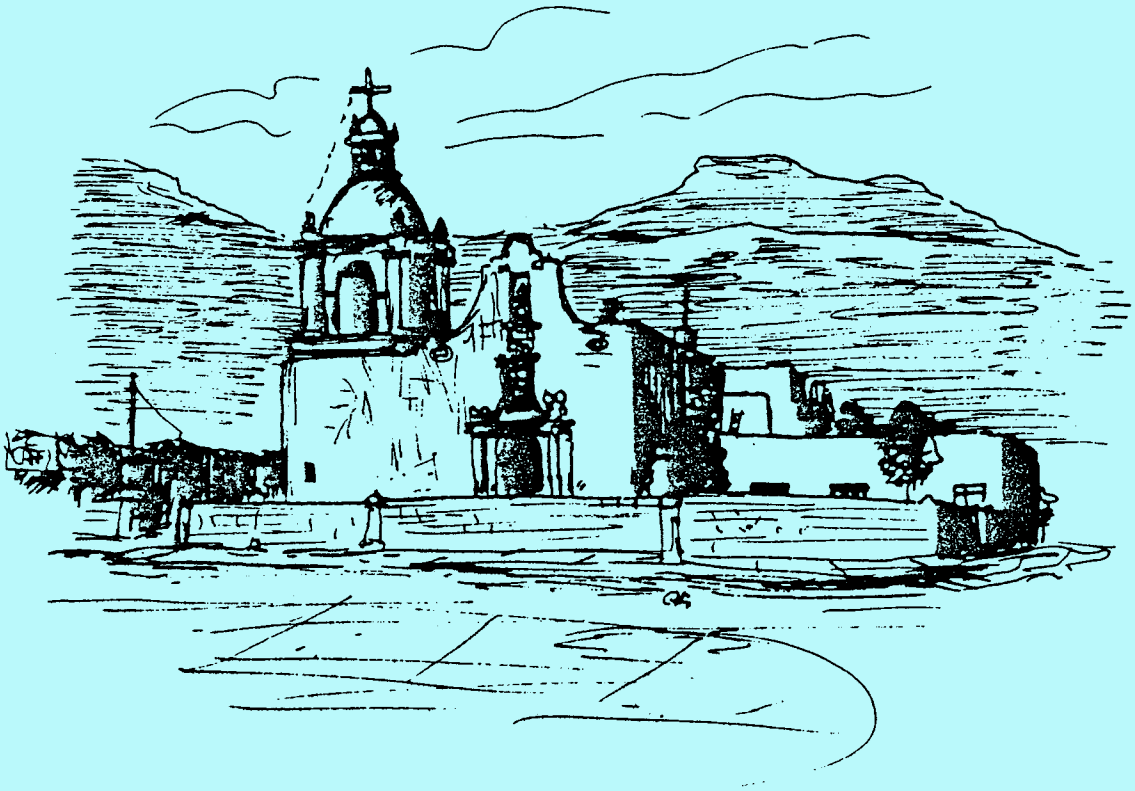
PART ONE

NUEVO LAREDO – MONTERREY



ROAD LOG: NUEVO LAREDO – MONTERREY

From Nuevo Laredo to Sabinas Hidalgo the highway crosses the semi-desert flats of the Río Grande Embayment, an extension of the coastal plain up the Río Grande Valley. A few low limestone hills near Vallecillo and views of the mountains to the west break the monotony. From Sabinas Hidalgo a paved side road leads west through the mountains to the town to Bustamante and the impressive Gruta del Palmito. South of Sabinas Hidalgo the main highway follows the mountains southward to Monterrey, climbing between two ranges through Mamulique Pass. West of Monterrey is the commercially operated Grutas de Villa de García and the geologically scenic Huasteca Canyon.

Kilo Post	Total Miles	Partial Miles	
	00.0	00.0	International Bridge—enter Mexico. The Río Grande, called the Río Bravo in Mexico, is the largest river between Laredo and Mexico City. Sedimentary rocks over four miles thick underlie this point.
	0.1	0.1	Keep right into customs (MIGRACION) and park at far right side of building to obtain tourist card and car permit, and then return to car for baggage inspection and car decal. Then go left around building and right onto main street leading south from bridge.
	2.2	2.1	Monument to Benito Juárez, Indian president of Mexico. Continue around monument and into center road.
	3.8	1.6	Monument to Founding Fathers of Nuevo Laredo. Inscription reads in part: "with the signing of the Treaties of Guadalupe, 118 patriot families, with the ashes of their ancestors, crossed the Río Bravo and founded Nuevo Laredo so they could continue their life under the protection of the flag of Mexico." The Treaties of Guadalupe moved the boundary of the United States from the Nueces River south to the Río Grande.
1194	15.0	11.2	Road east to Reynosa. Radio relay tower to east.
1190	17.0	2.0	Customs checkpoint. STOP. Have papers ready.
1178	24.0	7.0	Piedras Pintas (Painted Rocks). Rocks in this area are brown sandstones and yellow shales of Tertiary age. These rocks dip to the north, away from the Salado Arch.
1172	27.7	3.7	Leave Tamaulipas and enter Nuevo Leon. Texans frequently believe the narrow strip of Tamaulipas that separates Texas from Nuevo Leon was established to prevent Nuevo Leon from joining Texas in its revolution. However, this boundary is much older than the Texas Revolution. This is the approximate Cretaceous-Tertiary contact. The road continues south over upper Cretaceous shales dipping away from the Salado Arch.
1168	29.1	2.4	Flats developed on the Méndez (Taylor) Shale. This is the approximate crest of the Salado Arch, an anticlinal structure with little topographic expression as it has not exposed the more resistant lower Cretaceous rocks.

Kilo Post	Total Miles	Partial Miles	
1145	43.7	14.6	Hill top. View of mountains to right. First ridge is the Vallecillo Hills, the second, the Sierra de Lampazos—Sierra de Iguana, also called the Sierra de Lampazos—Sabinas.
1143	45.7	2.0	Road west to Anáhuac.
1141	47.2	1.5	Cross Río Salado. The Río Salado joins the Río Grande at Falcon Lake. Much of the flow of this river comes from large springs in the vicinity of Múzquiz.
1116	63.7	16.5	Méndez Shale near road. Vallecillo Hills to the right of road. These hills were formed by the marly Upper Cretaceous limestones exposed along the crest of the Vallecillo Arch.
1114	65.5	1.8	Dumps of the old Dolores Mine, which produced lead, zinc, and silver.
1112	66.0	1.5	Vallecillo, once an important mining town. Mines is this area produced much of the lead for the South during the Civil War.
1110	67.4	1.4	To the right 0.2 mi. are calcite veins carrying lead and silver. The flaggy limestone is the San Felipe formation exposed along the crest of the Vallecillo Arch. No igneous rocks are known in the vicinity.
1107	69.2	1.8	One—half mile to the right is the site of the old Jesús María Mine. Water broke into this mine at about the 500—foot level, possibly when they mined into a water—filled cave, drowning several hundred miners.
1096	76.2	7.0	El Canelo (the cinnamon tree). The Sierra de Iguana to the west and the Sierra de Lampazos to the north—west form a continuous range, mostly composed of Lower Cretaceous Limestone. In this range is the famous La Pachona (lazy woman) mine that produced from 15 to 20 million dollars of lead—silver ore. Much of this ore was in the form of clays (cave fill?) that was shoveled into railroad cars and shipped directly to the smelter.
1087	82.0	5.8	Enter Sabinas Hidalgo. Population (1960) was 15,425, most of whom were engaged in ranching. There is some manufacturing of brooms and children's clothing.
1085	82.4	1.4	Bridge across the Río Sabinas. Road to right just before bridge leads to Villaldama and Bustamante (26 mi.). This paved road leads west through the Sabinas Canyon to the town of Bustamante, where a side road leads a short distance to the impressive Gruta del Palmito. (See the Bustamante — Carrizal road log.) Along the Río Sabinas are many large cypress trees (Sabina is Spanish for cypress). Near Bustamante the Río Sabinas is sometimes called the Río Tlaxcala.

Kilo Post	Total Miles	Partial Miles	
1082	84.7	2.3	To the west is the Sierra Santa Clara, separated from the Sierra de Iguana to the north by the Cañón de Sabinas.
1077	88.3	3.6	View of the Sierra de Los Picachos to the southwest. These mountains are formed by a relatively broad domal anticline that has been intruded by igneous rocks, which form the higher peaks. The massive rightmost peak nearest the highway is Pico Nueces. The higher pointed peaks to the west are the Picos de Sombretillo. No caves are presently known in these mountains.
1050	107.0	19.7	Cuesta de Mamulique (Mamulique Hill). The deep road cuts are in the flaggy San Felipe formation. Landslides and slumping have closed this new section of highway for several months at a time.
1047	108.5	1.5	Customs checkpoint. Sometimes not in operation. The road ahead is over gravel-covered San Felipe formation. This gravel supports a thick growth of Joshua trees.
1020	121.3	12.8	The view ahead is of the mountains near Monterrey. Ahead are several chicken farms that supply Monterrey.
911	126.8	5.5	Town of Ciénaga de Flores (Marsh of Flowers). At the south edge of town is the Río Salinas.
900	133.7	7.1	Monterrey airport. Jagged peaks slightly to right of road are the Sierra de Mitras. Mountains to west are the Sierra del Fraile (location of the Grutas de Villa de García) and the Sierra Mulata. To the northwest is the Sierra de Minas Viejas. Slightly to the left of the highway is the Cerro de la Silla (Saddle Mountain).
899	134.3	0.6	Road to the right leads to Salinas Victoria.
882	138.3	4.0	Road to the right leads to Hidalgo, Mina, and Monclova.
	143.5	5.2	Monterrey city limits. Population 862,500. Monterrey is the largest city of northern Mexico, with large steel mills and other heavy industry.
	144.3	0.8	University of Nuevo Leon to the right.
	144.8	0.5	Large military post to the right was headquarters for the soldiers who built the original Pan American Highway from Monterrey to Nuevo Laredo.
	145.8	1.0	Turn right for Saltillo, Grutas de Villa de García, Huasteca Canyon, and fastest route to Mexico City.
	147.0	1.2	Monument to Cuauhtémoc, an Aztec emperor who was captured and tortured by the conquistadors.
	147.2	0.2	Independence Arch. End of log. To continue south to Montemorelos and Ciudad Victoria, continue straight around end of arch and on to divided Pino Suarez St., and start the Monterrey – Ciudad Victoria log.

ROAD LOG: SABINAS HIDALGO – BUSTAMANTE – CARRIZAL

Total Miles	Partial Miles	
0.0	0.0	Proceed west from the north end of the bridge that crosses the Río Sabinas in Sabinas Hidalgo.
0.3	0.3	Turn left just before school behind wall on left.
0.5	0.2	Turn right and follow sign: Villaldama 28, Ojo de Agua 8.
2.5	2.0	Camping along river to left. The 'quarry' on the mountain to the right of road contains a water tank. Note steep dips to the east along flank of mountains. Ahead enter the Cañón de Sabinas. To the north is the Sierra de Iguana and to the south, the Sierra de Santa Clara.
3.4	1.9	Cross dry river channel. Vado means ford or low water crossing. Road left to Ojo de Agua (literally, Eye of Water), a large spring that supplies the entire normal flow of the Río Sabinas. Surrounding the spring is a park with swimming pool, refreshments, and camping area.
4.1	0.7	Three caves on cliff to right of road. Westmost cave is about 150 feet long with dug tunnel continuing along approximate trend of cave for about 200 feet. Tunnel is probably a phosphate prospect as phosphates are frequently associated with caves in this area. Cave in center is reported small and cave to the east is a bat cave with one medium-sized room and several smaller passages near the cliff face. The cave is in general dry; the guano contains the fungus histoplasmosis which can cause serious illness.
5.0	0.9	Mina Mercedes is located about 1.5 kilometers to the north along the Cañón de Rancherías. The mine is on the left of the canyon about 150 meters above the valley floor. This mine produced phosphate rock for use in the preparation of fertilizer. The rock mined is cave fill, the phosphate being derived from guano deposited with the fill. The fill is probably of late Tertiary age as it is cut by faults.
10.1	5.1	Caves in cliff face above road to left. Several fissures open on the face, many of which are connected by cross passages. Canyons like that of Sabinas are common in northern Mexico, and indicate that a previous drainage pattern has been superimposed upon the present topography. This drainage developed on a relatively flat, probably low-lying surface. Following the general uplift of the area during the Tertiary, the rivers rapidly began to remove the poorly resistant Upper Cretaceous shales and marls, forming wide valleys except where they encountered narrow belts of folded, more resistant Lower Cretaceous limestone. Through these limestone belts the rivers cut narrow canyons. Further erosion removed more shale, leaving the folded limestones to form long, narrow, isolated mountains cut by deep canyons.
14.4	4.4	Road to San Isabel.
17.6	3.2	Enter Villaldama. Río Sabinas is on the left.

Total Miles	Partial Miles	
18.4	0.8	Town plaza. Turn right, then left around plaza.
18.75	0.35	Cross Río Sabinas.
19.2	0.45	Turn right on road to Bustamante. Road ahead leads to Villaldama railroad station.
19.7	0.5	Cross Río Sabinas.
21.7	2.0	Cross grade of old narrow-gauge railroad to La Pachona Mine. Mountains to the west are the Sierra de Gomas. High point west northwest is the Cabeza de León (Lion's Head).
23.05	1.35	Turn left to Bustamante. Road ahead leads to Lampazos, Anáhuac, Carrizal, and, via Candela, to Monclova. Much of the road is unpaved and is passable only during dry periods. To the north are two volcanic peaks; La Candela (The Candle) is the lower sharp peak, and just behind is the higher El Carrizal. At its base is Gruta de Carrizal.
23.6	0.55	Cross Monterrey – Nuevo Laredo railroad. Bustamante railroad station is to the right.
25.6	2.0	Enter Bustamante.
25.9	0.3	Traffic light (frequently not in operation). Turn left. Road ahead leads through Cañón de Bustamante and via rough dry-weather road to Monclova. Excellent camping is found 1.6 miles ahead along river in canyon.
26.3	0.4	Bustamante plaza. Presidencia Municipal (Municipal Building) to left. Refreshment stand (beer, cold drinks) on right. To reach Gruta del Palmito turn right at far side of plaza, go one block, and then turn left at church. Follow this street through town. At edge of town is a relatively new cement-block clinic. Follow the best dirt road on the right side of the clinic and cross a low levee. Continue along bulldozed road. (It is sometines easier to reach the clinic by continuing straight ahead at the plaza and watching for the clinic one block to the west, as this street is usually in better repair.)
26.7	0.4	Cross arroyo. Lime kilns to the left of road.
27.7	1.0	Parking lot. Stop. Follow foot trail to cave. Trail continues west along the main canyon for about one-half mile, staying on the south side about 100 feet from the bottom. Just past rock bluff to the left, the trail climbs steeply up the south side of the canyon (about 72 switchbacks) to cave. The cave is about 1200 feet above the parking lot. The Gruta del Palmito is one of the more impressive North American caves and should be visited by all that have the opportunity.

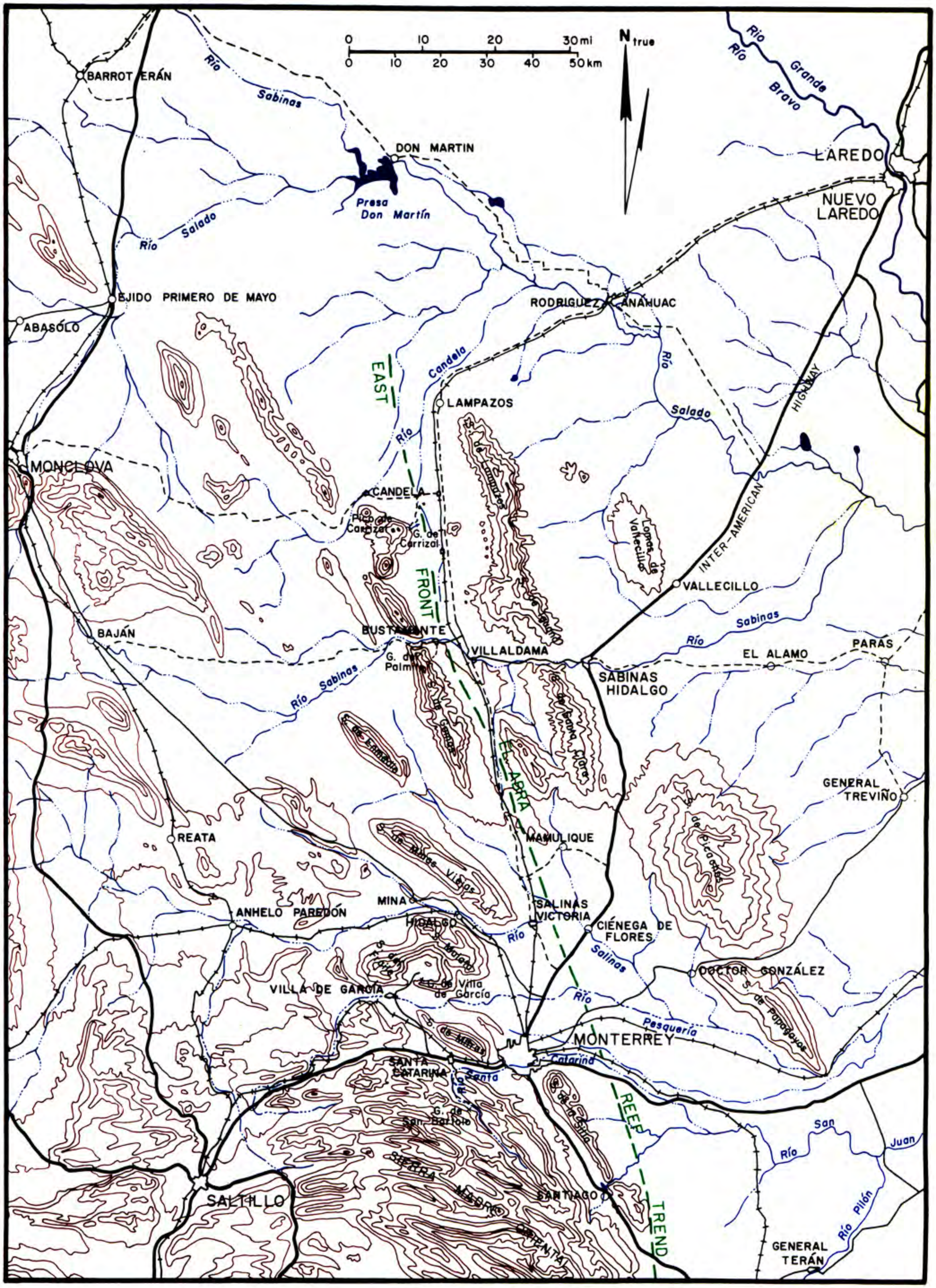
Total Miles	Partial Miles	
0.0	0.0	Start north on paved road that leaves the Sabinas Hidalgo—Bustamante road 0.5 miles east of the Bustamante railroad station. Road is paved for several miles, but beyond it is passable only during dry periods.
13.0	13.0	Golondrinas railroad station to left. A railroad spur leads to the Golondrinas Mine on the east side of the mountain.
15.0	2.0	Divide, with drainage south into Río Sabinas and north into the Río Candela, a tributary of the Río Salado. Volcanic mountains are to the northeast. These are volcanic intrusions which are part of an east—west volcanic zone that includes the Carrizal uplift and extends westward.
20.3	5.3	Turn left. Sign: A Candela — 20 k. Road ahead leads to Lampazos and Anáhuac.
21.0	0.7	The fort—like Candela railroad station was built by the Mexican government to help hold the railroad during the time when the revolutionaries under Pancho Villa were active in the area--around 1913. Facing the railroad is a completely blank dedication stone. Local workmen sympathetic to Villa installed the stone on the front of the building with the inscription facing inward.
22.0	1.0	Small igneous hill to the left.
23.6	1.6	Cement bridge. Turn left and continue 0.1 mile. Keep to the extreme left and do not turn right on main road to Candela. Follow narrow dirt road to the south.
24.3	0.7	Gate — please close. Follow main road south to Hacienda Carrizal. Gruta de Carrizal is located at the base of the mountain ahead, just under the mine which is barely visible as a streak low on the side of the mountain.
27.95	3.65	Hacienda Carrizal. The hacienda is mostly in ruins, with only a caretaker living there. The stream from the cave flows through the hacienda. To reach Gruta de Carrizal follow the road around to the right just before the hacienda.
28.5	0.55	Crest of pass. Note steep dip of thin—bedded limestone away from the intrusion.
28.7	0.2	Pens and hut.
28.8	0.1	End of road. Lower wet entrance to cave is about 30 feet behind spring. Trail leads to upper entrance. The house near these entrances was built when the mine above the cave was in operation.

ROAD LOG: MONTERREY — HUASTECA CANYON

Total Miles	Partial Miles	
0.00	—	Constitution Avenue and Pino Suárez in Monterrey. Proceed west along Río Santa Catarina on Constitution Avenue (Saltillo Highway).
4.4	4.4	Sierra de Mitras to right. Quarries produce limestone used for flux by steel mills in the Monterrey area. Note steep dips typical of the sharp uplifts in this area.
6.1	1.7	Narrow bridge. Industrial suburbs of Monterrey ahead. To the left across the Río Santa Catarina are the jagged summits of the north end of the Sierra Madre Oriental.
9.8	3.7	Enter town of Santa Catarina.
10.2	0.4	Edge of plaza, turn left to Huasteca Canyon. Ahead start road log to Grutas de Villa de García.
12.0	1.8	Entrance to Huasteca Canyon. Vertical bedding in Aurora Limestone. Canyon is formed where the Río Santa Catarina has cut through resistant rocks sharply uplifted by the Los Muertos Anticline. The Sierra Madre lies to the east and the Sierra de los Muertos to the west. Huasteca Canyon cuts through the entire Cretaceous section, and the underlying Jurassic rocks are exposed in valleys along the crest of the anticline. The stream that until recently flowed through the canyon has been diverted to supply water to Monterrey.
12.9	0.9	Two caves high on cliff to right. Upper cave is about 150 feet long and goes completely through a narrow ridge. The frontispiece of this Bulletin is a view from the entrance of this cave. The lower cave is about 40 feet long. Both caves are developed in thick-bedded vertical Cupido Limestone and are possibly associated with reef zones.
13.4	0.5	Keep left.
15.1	1.7	Enter canyon, cliff to left. Note recent rock fall.
15.9	0.8	Keep left.
17.4	1.5	Arroyo flows from gorge through mountains on right.
18.2	0.8	Ridge of shale extends to left side of road, with small house at end of ridge. Road right leads to dug well and trail to Grutas de San Bartolo. Trail to caves starts about 100 yards east of well, and follows the east side of the arroyo into the steep canyon to the south. The caves are on the right (west) side of the canyon just before a steep cliff crosses the canyon. The north (upper) cave has about 1500 feet of dry dusty formationless passages that contain several bat colonies. The south (lower) cave contains about 600 feet of damp, formation-decorated passages.

ROAD LOG: SANTA CATARINA — GRUTAS DE VILLA DE GARCIA

Total Miles	Partial Miles	
0.00	—	Plaza in Santa Catarina, continue west on Saltillo Highway.
3.9	3.9	Turn right to Villa de García and Grutas de Villa de García. Highway ahead leads to Saltillo and Mexico City.
10.0	6.1	Large chemical plant of Industria de Álcali, S. A.
14.4	4.4	Villa de García. Follow main highway.
16.6	2.2	Mountains ahead are the Sierra del Fraile. The highest ridges are formed by nearly vertical Cupido Limestone, and the slopes near the road are formed by the Aurora Limestone. At the west end of the range is Pico del Fraile, and at the east end is Pico Oriente.
18.8	2.2	Enter García Canyon.
20.0	1.2	Enter typical potrero or hidden valley developed in the center of the Sierra del Fraile. These almost enclosed valleys are common in northeastern Mexico and develop where soft rocks exposed in the centers of the mountains are removed by erosion.
20.2	0.2	Grutas de villa de García parking lot. Pink mountain to the north is composed of Cretaceous Limestone that once formed part of the north side of the valley. These rocks slumped into their present position as the soft underlying shales and gypsum were removed by erosion. The Grutas de Villa de García are developed in a reef zone in the Cupido Limestone, and are reached by a cable car that takes visitors up 800 feet to the cavern.



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N true
Río Grande
Río Bravo
LAREDO
NUEVO LAREDO
BARROTERÁN
Río Sabinas
DON MARTIN
Presa Don Martín
Río Salado
EJIDO PRIMERO DE MAYO
ABASOLO
RODRIGUEZ
ANAHUAC
Río Salado
Río Candela
LAMPAZOS
EAST
FRONT
EL ABRA
REEF
TREND
MONCLOVA
CANDELA
Pico de Carrizal
G. de Carrizal
Lomas de Vallecillo
VALLECILLO
INTER-AMERICAN HIGHWAY
Río Sabinas
BAJÁN
BUSTAMANTE
VILLALDAMA
EL ALAMO
PARAS
SABINAS HIDALGO
G. de Palmito
Río Sabinas
GENERAL TREVIÑO
REATA
MAMULIQUE
S. de Picachos
MINA
ANHELO
PAREDON
SALINAS VICTORIA
HIDALGO
CIÉNEGA DE FLORES
Río Salinas
DOCTOR GONZÁLEZ
S. de Papagayos
VILLA DE GARCIA
G. de Villa de García
Río Pesquería
MONTERREY
SANTA CATARINA
Río Santa Catarina
G. de San Bartolo
SIERRA MADRE ORIENTAL
Río San Juan
SALTILLO
SANTIAGO
Río Pilón
GENERAL TERÁN

GEOLOGY: NUEVO LAREDO – MONTERREY

The Gulf Coastal Plain of northeastern Mexico is a southern continuation of the Texas Gulf Coastal Plain. It is an area of low relief developed on relatively undeformed Upper Cretaceous and Tertiary clastic marine sediments that dip gently toward the Gulf of Mexico. These sediments are capped by Recent and Quaternary sands and gravels that form terraces along the larger streams and low mesas along the divides. The Rio Grande Embayment is a broad extension of the coastal plain up the Rio Grande Valley. This wide wedge of Tertiary and Upper Cretaceous sediment extends up the Rio Grande past Piedras Negras, and forms the area of low relief that is crossed by the Inter–American Highway between Nuevo Laredo and Sabinas Hidalgo.

The western edge of the coastal plain is formed by a series of long, narrow anticlinal uplifts. The eastmost of these uplifts is the Salado Arch that extends southeast from the Serranínas del Burro. This arch has almost no topographic expression in the Nuevo Laredo – Monterrey area as it exposes only poorly resistant Upper Cretaceous shales. Just to the west of the Salado Arch is the Vallecillo Arch that has exposed the Upper Cretaceous marly limestones that form the Vallecillo Hills. Immediately to the west of the town of Sabinas Hidalgo a north–south trending anticline has exposed the resistant Lower Cretaceous limestones forming a series of ranges called the Sierra de Lampazos to the north, the Sierra de Iguana near Sabinas Hidalgo, and the Sierra de Santa Clara south of Sabinas Hidalgo. This group of ranges is separated by a wide alluvial valley from the most prominent range of the area, the Sierra de Gomas. The Sierra de Gomas passes just to the west of the town of Bustamante and trends slightly to the west of north. In this range a sharp uplift has exposed the mountain–forming Lower Cretaceous limestones. The northern part of the range is moderately dissected, but preserves the form of the original uplift, while to the south the anticline has been breached and an interior valley has developed on the less resistant Upper Jurassic rocks. The Sierra de Picachos southeast of Sabinas Hidalgo was formed by a broad domal anticline, but this also has a general north–south alignment.

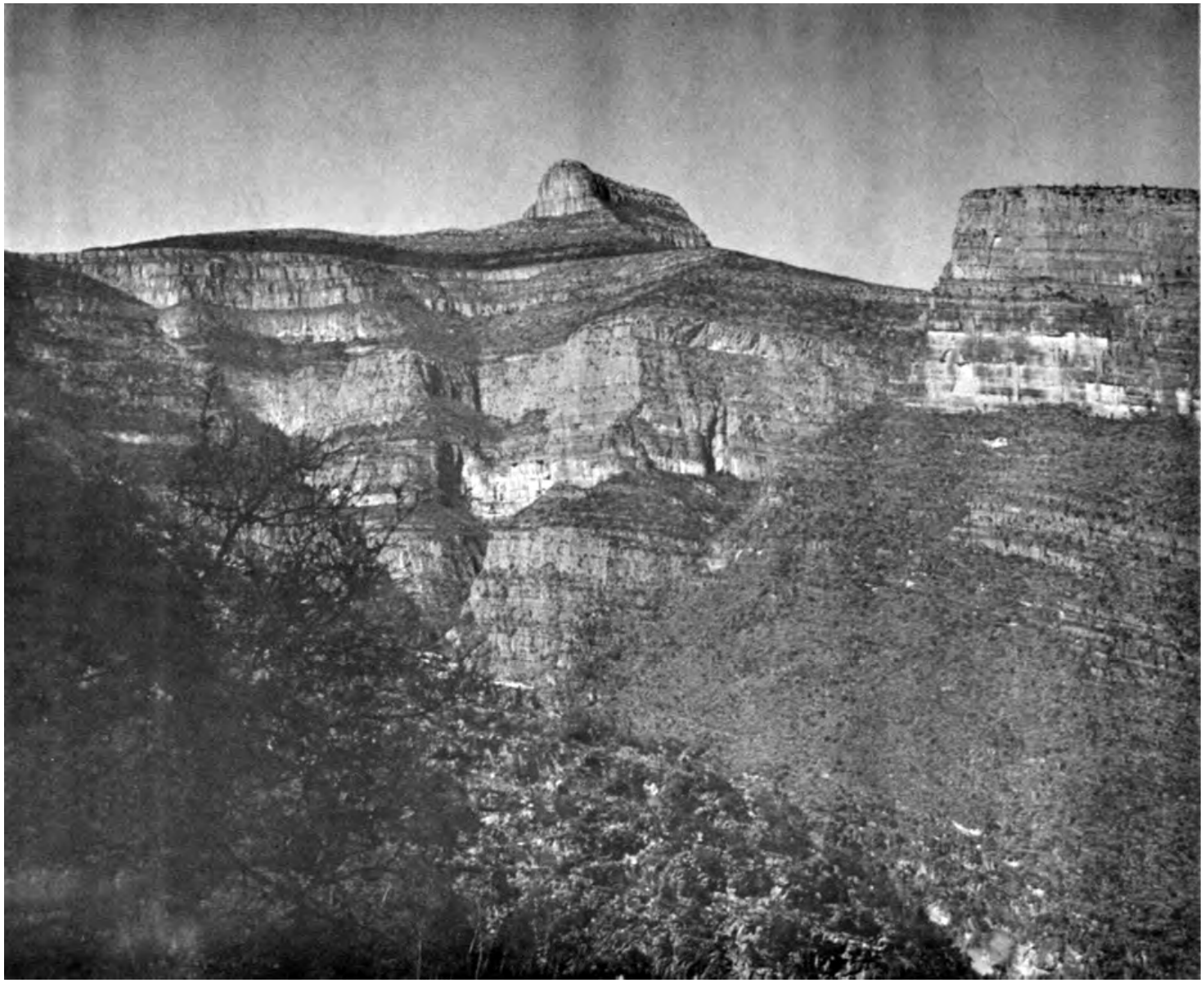
These anticlinal structures originated during the Laramide Orogeny and resulted from the same compressional forces that formed the Rocky Mountains to the north and the Sierra Madre Oriental to the south. Folding was less intense in the area north of Monterrey as this area was protected by a platform of shallow basement rocks that are resistant to deformation. The original structure of many of the mountains has been considerably modified by Tertiary intrusions. These intrusions resulted in both a general uplift of the area and intensive deformation and metamorphism near the centers of intrusion. Igneous activity was especially prominent in the Sierra de Picachos and in a zone that included part of the Sierra de Lampazos and extended west to Pico de Carrizal and beyond. Associated with this zone are the mines northwest of Sabinas Hidalgo and the Golondrinas mine north of Bustamante.

The oldest rocks exposed in the Nuevo Laredo – Monterrey area are the poorly–resistant Upper Jurassic shales, sandstones, limestones, and gypsum. These rocks were deposited in a shallow sea that received sediment from the adjacent land. At the end of the Jurassic the sea ceased to receive large amounts of clastic material, and deposition of the Lower Cretaceous limestones began. The basin gradually subsided while deposition continued, until about 6000 feet of shallow–water limestones had accumulated. At this time large amounts of clastic material again began to enter the basin and the Upper Cretaceous impure limestones, marles, and shales were deposited.

The Lower Cretaceous limestones of the area have been divided into seven formations. The lowermost is the Taraises Formation which consists of about 1400 feet of dark limestone with interbedded shale and marl. This

formation, along with the even less resistant Upper Jurassic rocks, often forms potreros or hidden valleys along the centers of uplift where the anticlines have been breached. These formations have only limited exposures and are not known to contain caves. Above the Taraises Formation lies the thick Cupido Limestone, consisting of about 3000 feet of thin-to-thick-bedded limestone. This limestone is the principal cave-forming limestone, with both the Gruta del Palmito and the Grutas de Villa de García being developed in reef zones in this formation. This limestone was deposited in a shallow, relatively clear sea and contains numerous small reefs and shell banks in the western part of the area. Above the Cupido lie about 450 feet of marly limestone of the La Peña Formation. This formation is not known to contain caves. Overlying the La Peña is the Aurora Formation, composed of up to 1500 feet of thick-to-massive-bedded limestone. This formation, like the Cupido, is a prominent cliff former. Recent work has divided the Aurora into the Tamaulipas Formation to the east, and the restricted Aurora to the west. The division is an inferred reef trend that follows the valley east of the Sierra de Gomas. This reef zone is also present in the La Peña, Cuesta del Cura, and Cupido Formations. This zone developed along the eastern edge of a shallow bank, with deeper water to the east. This reef zone is important speleologically, as to the west of this reef trend conditions are much more favorable for the development of large caves.

Above the Aurora is the Sombretillo Formation, about 35 feet of clayey limestone. Above this is the Cuesta del Cura Formation, composed of about 400 feet of chert bearing limestone. Above the Cuesta del Cura lie about 1000 feet of Upper Cretaceous limestones and marls of the Agua Nueva and San Felipe Formations. These formations grade into the sandstones and thick shales of the Mendez Formation that was deposited during the late Cretaceous.



View to the west from the entrance of Gruta del Palmito.
Prominent peak is Cabeza de León. Photo by Mills Tandy.

LA GRUTA DE CARRIZAL

La Gruta de Carrizal is located about 15 miles north of the town of Bustamante at the base of the impressive peak, Cerro Carrizal, an eroded core of a Tertiary intrusion. Here, resistant igneous rock have formed a peak rising 5140 feet above the surrounding plain. Around this intrusive mountain is a ring of much lower hills developed along the outcrop of the resistant Lower Creataceous Limestones. These limestones have been sharply uplifted and dip steeply away from the mountain, and are thus in a favorable position to absorb much of the runoff from the impervious higher areas of the mountain. La Gruta de Carrizal has formed at a low point on the outer edge of the limestone outcrop where the flow has been concentrated. A large and complex cave system has developed with major passages at two levels. These levels probably developed during periods of equilibrium in the erosion of the valley east of the cave. The ceiling of the main upper level passage just west of the upper entrance is almost perfectly horizontal even though the passage runs at right angles to the strike and crosses several beds with obvious differences in composition. This suggests that the passage was closely related to a previous water level. Solution was active before this water level was established and has formed a three-dimensional maze, some passages of which extend along the dip slope above the upper level. Main passages in both the upper and lower level slope downward away from the entrances. The main upper level passage ends in fill about 400 feet from the upper entrance, and both lower level passages eventually siphon. These passages appear to decrease only slightly in size away from the entrance, but the down ward slope of the passages has, in general, resulted in increasing amounts of fill. This fill could not be removed as the streams flowing in the main passages never achieved enough velocity to carry fill material up the passage slope and out the entrance. This fill, mostly a fine sand composed of limestone and igneous material, was apparently carried into the cave from the surface by small streams. Pits dug in the upper level of the cave reveal up to 15 feet of bedded fill, with several coarse layers near the bottom. Deposits of fine clay are visible in both lower level stream passages and presumably resulted from the original solution. The Warm River Passage has not been filled with sediment and contains only clay deposits. The ceiling of this passage goes below water level at the far end of the Baño Caliente, rises briefly to form a small room, then slopes steeply downward, the passage continuing as a water filled tunnel. The water temperature in the Baño Caliente is 88F°, about 10F° above the mean temperature of the area. There are at least three possible sources for the heat that warms the water. It could come from deep circulation, but this is unlikely as the Carrizal area is near a major divide. The water almost certainly originates from the nearby mountain, and it is unlikely that the water reaches great depth in such a small distance. It is also possible, as there are several mines in the area, including one on the mountain above the cave, that the oxidation of ore bodies is producing heat. However, ore deposits large enough to produce the necessary heat do not appear to be present, and no unusual concentrations of trace minerals were discovered in analysis of the cave water. The air and rock temperature in isolated rooms of the cave is also abnormally high. Thus it seems probable that the heat is a result of the relatively recent igneous activity, and that the rock temperature of the whole Carrizal-Golondrinas area is above normal. Futher measurements should be made to outline the area of this geothermal abnormality.

Recently, prospect pits weredug in the upper level of the cave, where the fill apparently contain an appreciable amount of phosphates. Preparations were made to mine the fill but these operations were abandoned. Phosphate-rich stream-deposited fill has been mined from several caves in the area; the phosphates are the result of the leaching of guanno.

This cave is one of the few containing passages following both the dip and strike as well as horizontal passages cutting the bedding. These features, together with the warm streams and complex fill, make the cave of unusual geologic interest. The oasis at the base of the mountain created by the cave stream flowing into the desert is, in itself, reward for the trip to the cave.

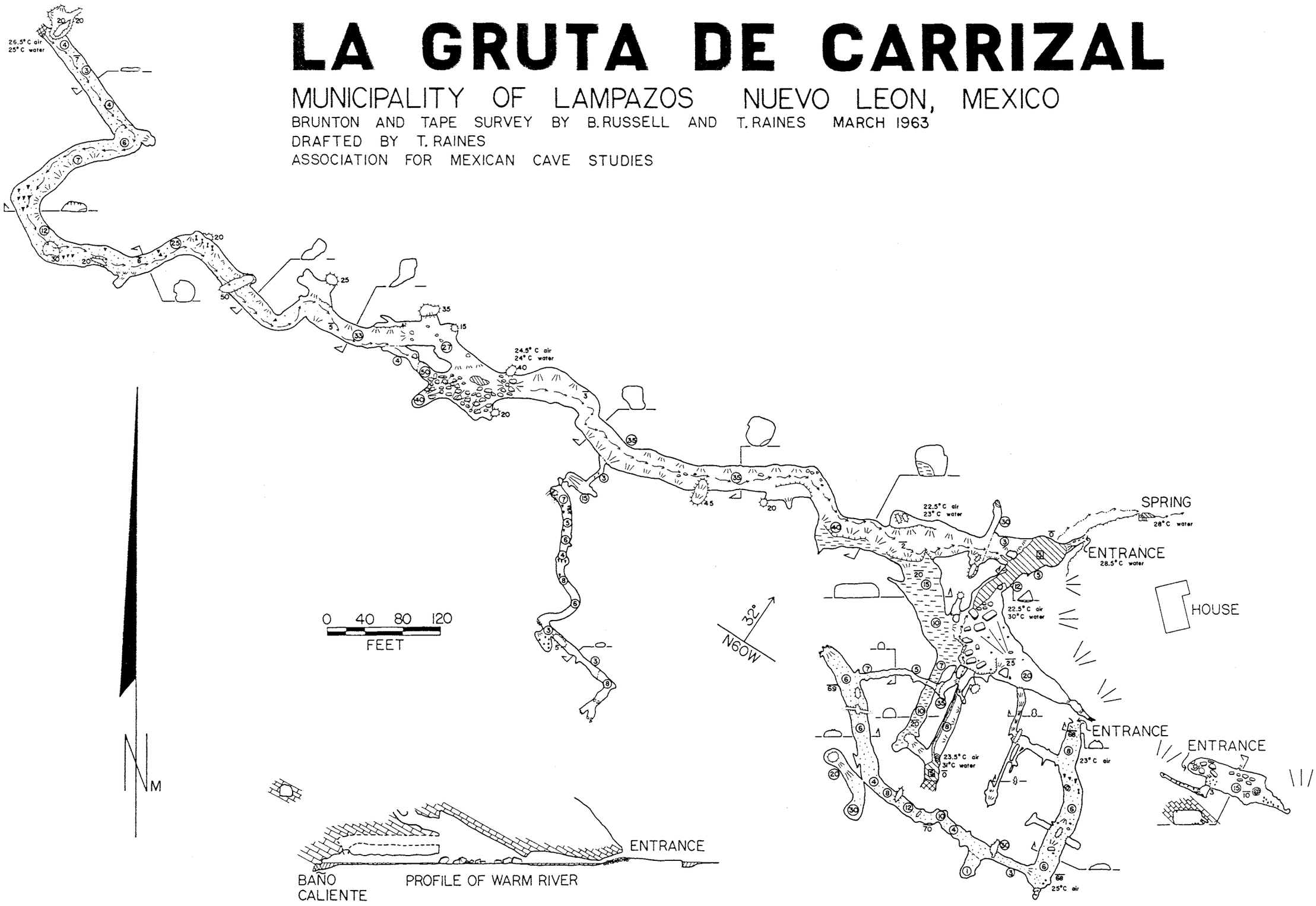
LA GRUTA DE CARRIZAL

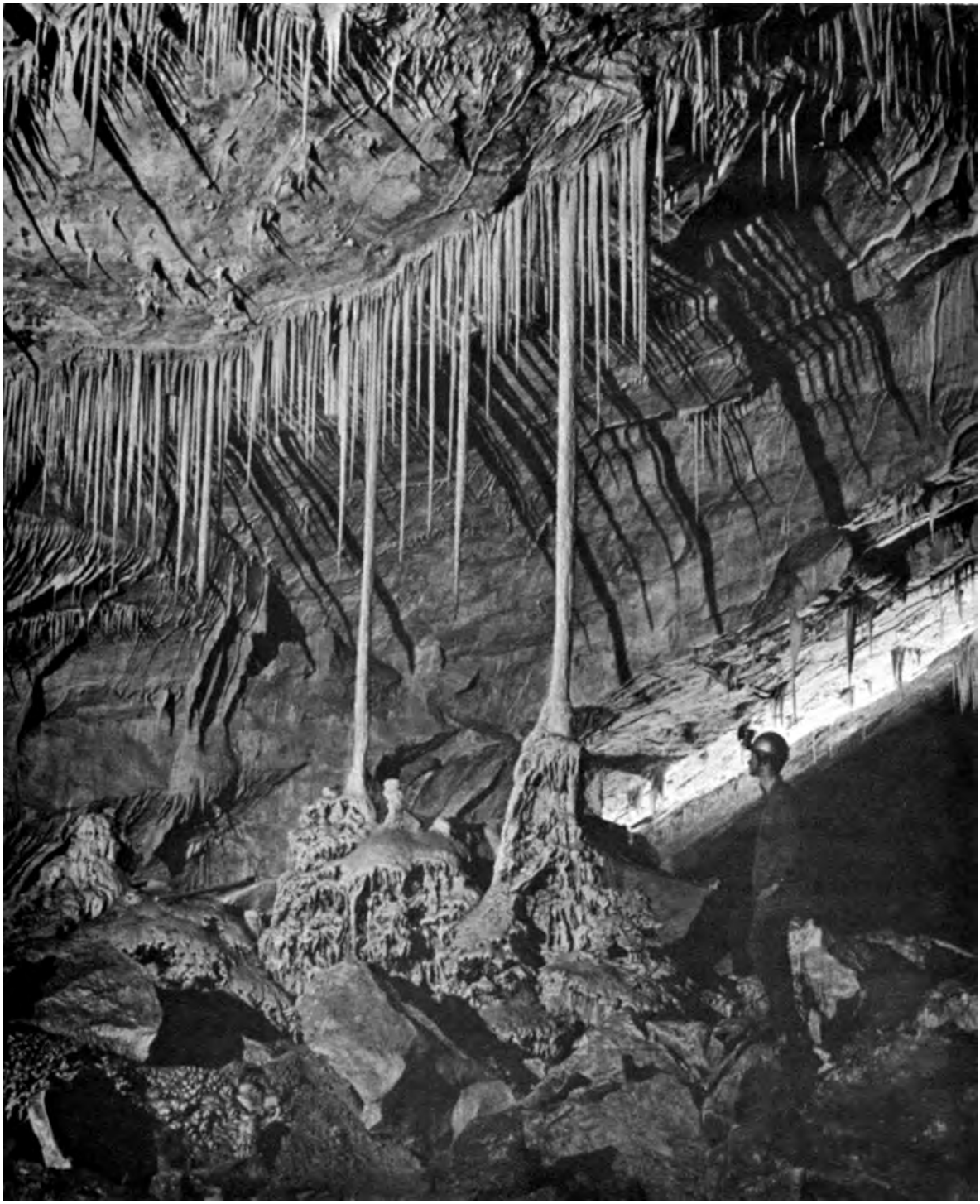
MUNICIPALITY OF LAMPAZOS NUEVO LEON, MEXICO

BRUNTON AND TAPE SURVEY BY B. RUSSELL AND T. RAINES MARCH 1963

DRAFTED BY T. RAINES

ASSOCIATION FOR MEXICAN CAVE STUDIES





One of the many groups of formations in Gruta del Palmito.
Photo by Mills Tandy

GRUTA DEL PALMITO

Gruta del Palmito is located in the Sierra de Gomas about two miles southwest of the town of Bustamante in the state of Nuevo León. The almost hidden entrance to the cave is on the south side of a deep canyon about 1000 feet above the canyon floor and 1500 feet above the wide valley to the east of the range. The cave is essentially two large chambers: an entrance room 300 feet wide, 600 feet long, and 60 feet high, and a main room 1700 feet long, 300 feet wide, and 100 feet high. This room compares in size and spaciousness with the Big Room in Carlsbad Caverns. Large and impressive formations decorate many sections, frequently forming massive columns over 60 feet high. The floor of the cave descends in several irregular steps to a depth of 667 feet, making it the deepest cave in northern Mexico.

The entrance to the cave is a relatively small passage through the talus that forms one end of the entrance room. This talus, originating from the cliff above the entrance, formed after erosion destroyed a section of the cave to the north of the present entrance. Except for the numerous formations and the end that has been cut by erosion, the entrance room is little changed from its phreatic state. There is little breakdown and the floor is composed of thin deposits of clay and secondary calcite development along bedrock. The bedrock is visible in a fissure that has formed along the west wall of the inner part of the entrance room. This fissure, about 50 feet wide and partly filled with breakdown, continues south beyond the end of the entrance room to the main part of the cave, forming a passage about 200 feet long, 200 feet high, 50 feet wide, and tilted about 20 degrees from the vertical. The trail called Paso de la Muerte leads along the side of this fissure, starting at the level of the entrance room. From the end of the Paso de la Muerte a breakdown slope leads downward 250 feet to a level, clay-floored area that marks the start of the larger part of the cavern. To the south large formations have almost enclosed several areas, forming the Hall of the Giants, the Cathedral, and other smaller rooms. Except for the formation areas along the west wall and near the south end, the main section of the cave is floored with large masses of breakdown. The known cave ends in a series of short drops, flowstone slopes, and small rooms. Although there are persistent rumors of a large continuation with a deep pit, exploration by AMCS members has so far failed to find it.

The cave is developed in the upper part of the Cupido Limestone, and is located where a relatively soluable reef zone is crossed by a zone of fracturing. This north-south zone of fracturing extends along the east side of the Sierra de Gomas and follows an inflection in the dip. To the east the rocks dip steeply eastward, while to the west they rise more gently toward the crest of the anticline. The fracturing appears to be the dominant influence in the development of the cave, as the cave is aligned with this zone. The permeability and solubility of the reef apparently controlled the depth and size of the rooms. The cave is developed at right angles to a relatively narrow ridge, and cannot extend far to the south unless it descends much below its presently known depth. It has been proposed that the present cave is a result of collapse into a void left by the solution of gypsum at a lower level. This theory is hardly tenable, as there is obvious evidence of much solution at the present cave level, much of the cave is underlain by bedrock, and the closest gypsum is several thousand feet below the cave.

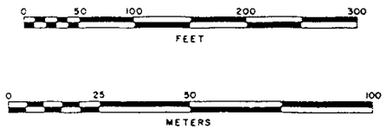
Elk and sloth bones found in the cave indicate a cave entrance predating historic records, but the cave was apparently not frequented by man until modern times. Local folklore holds that the cave was used as a camp by a general and his army, who left the pencil-sized wire that is strung throughout the cave. It is also said that an attempt was made to develop the cave as a tourist attraction and at this time the trail to the cave and the dirt platform at the entrance were constructed. Recent proposals to develop the cavern commercially have been abandoned after calculating the cost of development and the probable number of tourists that could be expected. The cave, one of the most impressive in North America, deserves to be developed, although it will be some time before it will be commercially profitable. Until that time, efforts should be made to preserve the cave from the all-too-numerous formation collectors and wall-defacers.

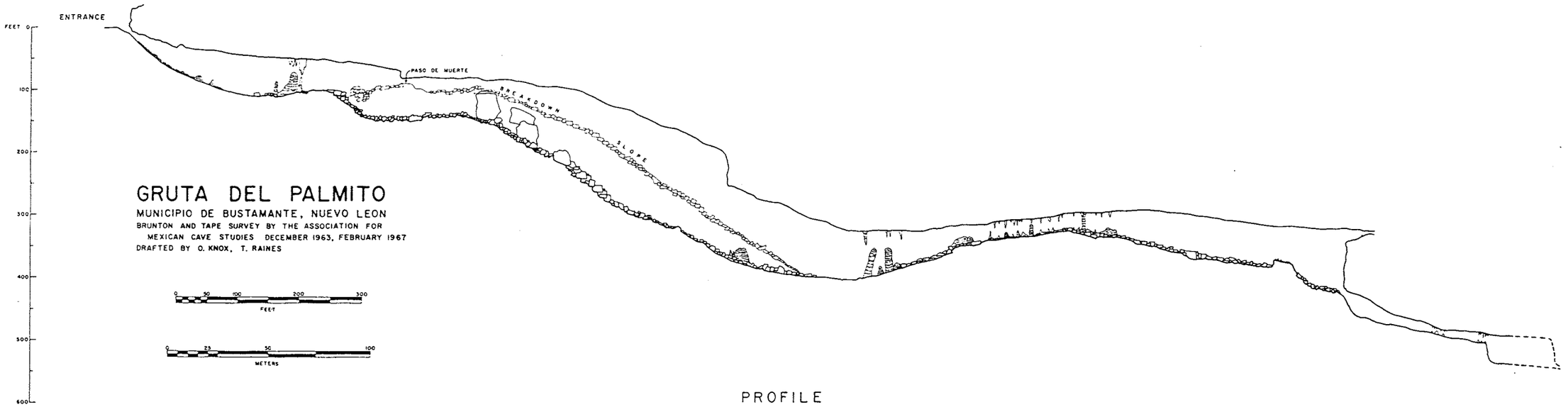
GRUTA DEL PALMITO

MUNICIPIO DE BUSTAMANTE, NUEVO LEON

BRUNTON AND TAPE SURVEY BY THE ASSOCIATION FOR MEXICAN CAVE STUDIES DECEMBER 1963, FEBRUARY 1967

DRAFTED BY O. KNOX, T. RAINES




ENTRANCE
FEET 0
100
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PASO DE MUERTE
BREAKDOWN
SLOPE
GRUTA DEL PALMITO
MUNICIPIO DE BUSTAMANTE, NUEVO LEON
BRUNTON AND TAPE SURVEY BY THE ASSOCIATION FOR
MEXICAN CAVE STUDIES DECEMBER 1963, FEBRUARY 1967
DRAFTED BY O. KNOX, T. RAINES
0 50 100 200 300
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PROFILE

GRUTAS DE VILLA DE GARCIA

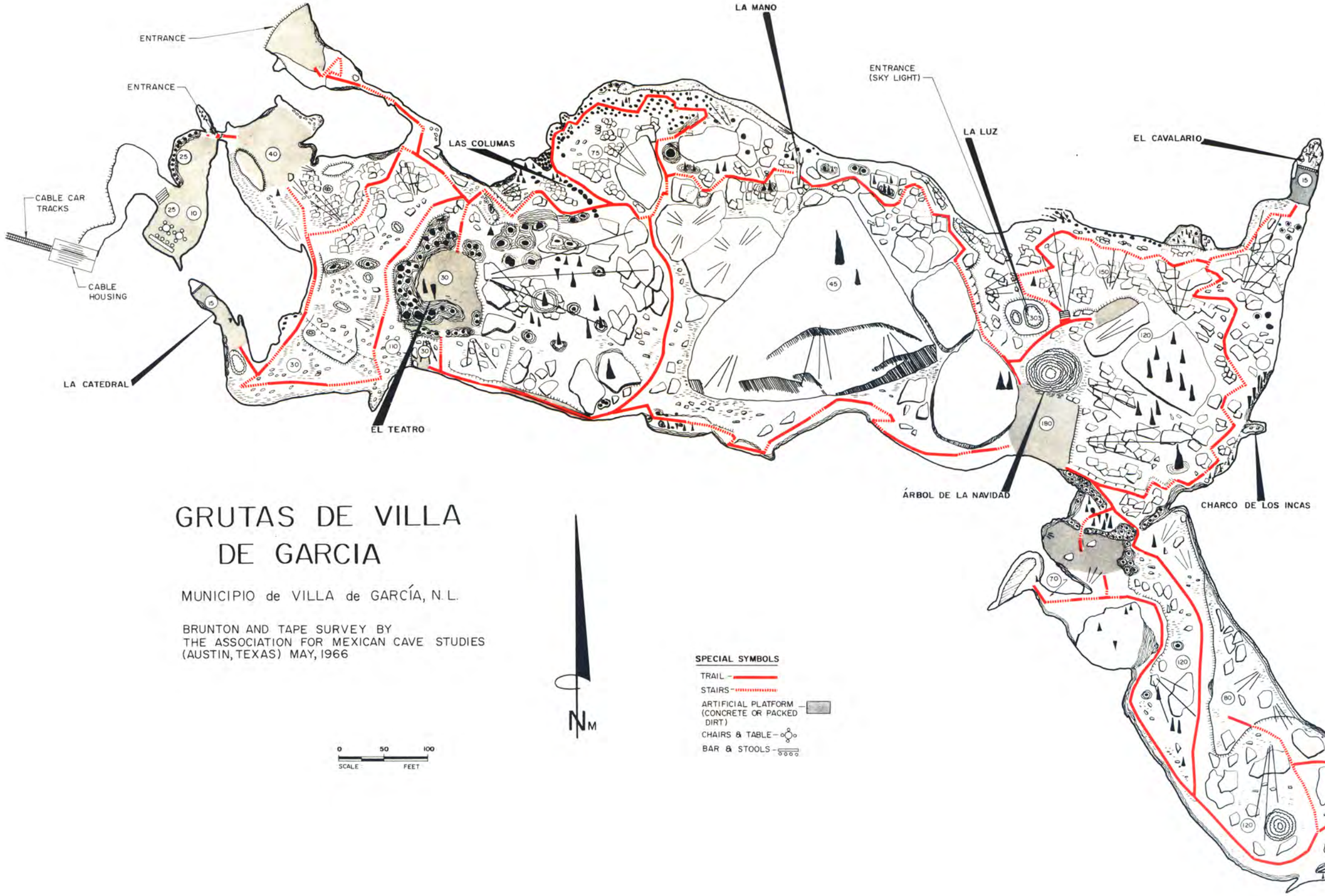
This cave is located in the Sierra del Fraile about 20 miles west of Monterrey, and is reached by a paved road leading northeast from the town of Villa de García. The cave has been operated as a tourist attraction by the Lions Club of Monterrey since 1936. According to their information the cave was discovered by Father Juan Antonio Sobiervilla in 1842. From that time until its development by the lions Club, the cave was visited by numerous groups who unfortunately left ample evidence of their visits. The cavern is presently reached by a cable car that takes visitors up 800 feet to the entrance.

Grutas de Villa de García is developed in a reef zone in the almost vertical Cupido Limestone. The limestone in the area of the cave has been sharply uplifted along the south flank of the Sierra del Fraile anticline. The cave itself consists primarily of one almost rectangular room about 630 feet long, up to 240 feet wide, and 170 feet high. Two small passages lead from the west end of the main room. One connects with a sheltered entrance area just west of the main room and the other leads southwest to a balcony on the cliff face overlooking the valley. At the east end of the main room there is a smaller room to the south and a fissure extending to the north, apparently developed along joints at approximately right angles to the vertical bedding. These joints have resulted in the formation of a skylight near the east end of the main room. This shaft is a relatively recent feature, and was formed by water entering the cave along the joints and fractures. The main rooms of the cave were probably formed during the late Tertiary, and in any case the cave predates the present topography. Water slowly circulating through joints in the limestone far below the surface removed the more easily dissolved reef material, forming the presently existing rooms. These rooms have since been modified by breakdown and the development of numerous formations. Most of these formations are now inactive and there is very little water present in the cavern.

The cave was visited on Sunday, May 28, 1950, by delegates to the World Congress of Speleology in Monterrey, and at this time the first descent of the skylight was attempted. This descent has been described in the National Speleological Society NEWS by Burton Faust who reported:

> The opening is 105 meters or approximately 325 feet above the floor of the big room. All but about 75 feet of this distance is vertical free space drop, and the remaining 75 feet is approximately 80° slope... All preparations finally being completed, Robert Flack was tied in the harness of the rope and started over the edge on his way down. It took approximately 20 minutes to make the descent down the 75 feet of 80° slope and into free space. From then on approximately 225 feet of vertical drop. I had suggested to Pedro Wood previously that he instruct the band that was playing from time to time in the caverns that when Bob was practically on the bottom that they give them a big roll of drums. Everyone took that as a signal to cheer, shout, and clap hands over the success of the first descent into García Caverns through the upper entrance ever made by any person. After taking pictures of Bob hanging on the rope 20 to 25 feet above the floor we let him on down, removed the rope from him, thus completing this particular project.
>
> Señorita Frazia García, daughter of General Rubin García, was awaiting at the top to make the descent and thus have the honor of being the first girl to make the descent into the big room of García Caverns. The rope was pulled back to the top and the Señorita came down without any trouble, difficulty, or mishap, and received the same sort of greeting that had been tendered Flack.

The ride up the cable car alone is worth the admission price, and though the cavern tour is rather long, there are several remarkable views of the valley below the cave, the skylight, and formations silhouetted across the cavern.



GRUTAS DE VILLA DE GARCIA

MUNICIPIO de VILLA de GARCÍA, N. L.

BRUNTON AND TAPE SURVEY BY
THE ASSOCIATION FOR MEXICAN CAVE STUDIES
(AUSTIN, TEXAS) MAY, 1966

NM

0 50 100
SCALE FEET

SPECIAL SYMBOLS

TRAIL –
STAIRS –
ARTIFICIAL PLATFORM (CONCRETE OR PACKED DIRT) –
CHAIRS & TABLE –
BAR & STOOLS –

OTHER CAVES IN THE NUEVO LAREDO — MONTERREY AREA

Grutas de San Bartolo There are two separate caves known by the name of San Bartolo. The uppermost (north) of the two caves, which are located in a side canyon off the main Huasteca Canyon, has about 1500 feet of dry, dusty, mostly walking-size passage. See map on next page. The cave slopes upward from the entrance and has been reasonably well explored, except for a dome at the end of the northmost passage. It is possible that this dome may lead to horizontal passages at a higher level as there is a prominent, inaccessible cave entrance just north and above the entrance to Gruta de San Bartolo (south). Several test pits in the main passage reveal at least fifteen feet of complex fill. This fill is, in general, composed of very fine material and consists in part of a varved clay. The cave predates the canyon and an extension of the cave across the canyon can apparently be reached only with difficulty. Bats inhabit the cave and guano has been intermittently mined.

The other San Bartolo cave (south) is about 800 feet long and slopes downward from the entrance. From just inside the entrance a low crawl leads to a large, decorated passage floored with damp clay. This passage continues through several formation areas, and the last part of the cave can be reached only by climbing through a mass of formations.

Other Caves in Huasteca Canyon A cave can be reached by following the bulldozed right fork of the road at 5.5 miles from the plaza in Santa Catarina. This road ends at a mine and the cave is located on a hill to the right of the road about one-quarter of a mile before the mine. The cave has been partially explored for about 100 feet through two breakdown rooms. Another cave is reported near Rancho de Agua Blanca. This ranch is 32 miles from Santa Catarina and can be reached by following the right forks of the road at 20.1 and 31.1 miles.

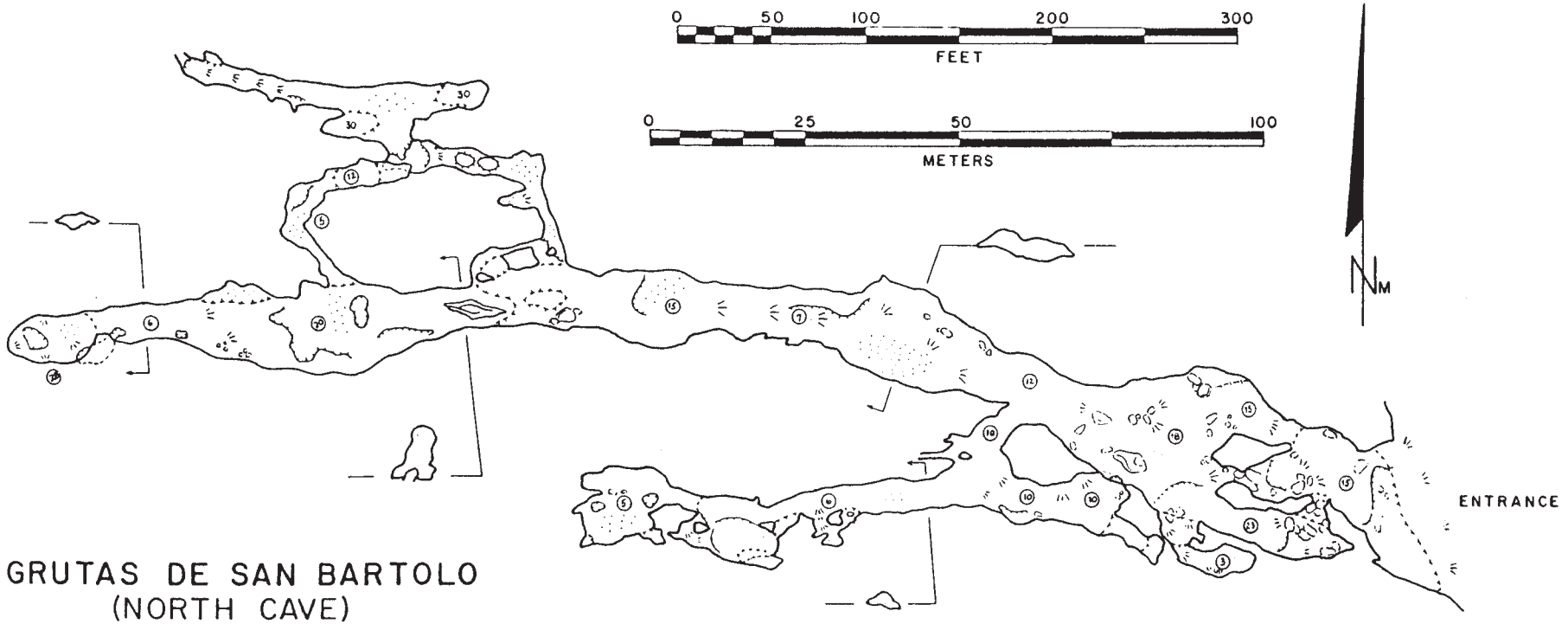
Cueva de El Rincón de la Virgen This cave is a medium-sized bat cave located in the west end of the Sierra del Fraile 6.8 km. north of the town of Villa de García, and approximately 25 miles northwest of Monterrey.

Caves in Sabinas Canyon: Cueva del Diablo This cave is mentioned on page 4 in the road logs but not by name. The west-facing entrance to the cave is visible from the Sabinas Hidalgo-Villaldama Highway 4.1 miles from Sabinas Hidalgo and just west of the road to Ojo de Agua. It is the eastmost of three caves visible from the highway and is approximately 700 feet above the road. The cave consists of a large entrance room about 40 feet wide, 60 feet long, and 50 feet high. From the interior of this room crawlways on three levels extend to the east and another passage extends to the south. None of these passages are over 200 feet in length and they are mostly dry. The cave contains the fungus histoplasmosis that can infect the lungs of humans. During mining operations 20 persons became ill and 8 died.

Two other caves are visible just to the west of Cueva del Diablo and at about the same elevation. The eastmost of these caves has not been visited but is reported to be only a shelter. The westmost cave is mainly a single passage about 150 feet long, 40 feet wide, and 30 feet high. Extensive mining operations in and near this cave are apparently phosphate prospects.

Cueva de la Fisuras is located just above and south of the highway about six miles west of Cueva del Diablo. Several of the entrances are visible from the road when traveling east. The cave is composed of several interconnected fissures opening at the base of a cliff about 100 feet above the road. These fissure passages, averaging about 100 feet long are connected by crawlways at right angles to the fissures.

Caves near Bustamante: Volcán de Bustamante This pit is reported to be located on the west side of the Sierra de Gomas just west of the town of Bustamante. Hot air is said to blow from the entrance. Caves are also reported in the Sierra de Gomas near the town of El Alamo, about 20 miles south of Bustamante. There are at least six fissures located northwest across the canyon from Gruta del Palmito, the deepest being 240 feet. These fissures are apparently of solutional origin. The Boca del Diablo is a reported cave on the south side of the Cañón de Bustamante. The entrance is on a cliff said to resemble the face of the devil, with the cave forming the mouth. Several large caves are reported to have been encountered in the Golondrinas mines about 15 miles north of Bustamante.



GRUTAS DE SAN BARTOLO
(NORTH CAVE)

MUNICIPIO DE SANTA CATARINA, NUEVO LEON

BRUNTON AND TAPE SURVEY BY D. MCKENZIE, M. MEREDITH, W. RUSSELL, C. WESTMORELAND 5 FEBRUARY 1966

DRAFTED BY C. WESTMORELAND, T. RAINES

ASSOCIATION FOR MEXICAN CAVE STUDIES

SPELEOGENESIS: NUEVO LAREDO – MONTERREY

In most areas the greatest amount of cavern development occurs at a relatively shallow depth along a generally horizontal zone where ground water movement is concentrated. However, in the Nuevo Laredo – Monterrey area this pattern of development has not been followed and it is probable that, in general, such 'shallow phreatic' enlargement is only of local importance in most arid mountains. This lack of a well-defined zone of horizontal cavern development is due to several factors. Water entering the limestone mass follows fractured and permeable zones throughout the thick limestone rather than forming a relatively thin zone of circulation. Also, the complex structure, high local relief, and long distances generally traversed by ground water all tend to channel the flow of water into favorable zones, which can extend to depths of several thousand feet. Another factor is that water movement is slow and solution tends to be selective, with large rooms frequently being connected by very small tunnels.

Under the above conditions the relatively uniform tunnels and multiple levels typical of 'shallow phreatic' enlargement have developed in only a few local areas. In the area northwest of Sabinas Hidalgo there is evidence of numerous large horizontal tunnels developed at a relatively shallow depth. These tunnels bear no relation to the existing topography and have been cut by faults probably related to Tertiary volcanic activity. These caves have been extensively studied (Pérez Martínez and Wiggin, 1953) as the stream deposits that almost completely fill these caves are rich in phosphates, and several of these caves have been mined. The phosphate-rich fill was deposited by shallow streams that carried gravel and volcanic material into the cave and mixed these sediments with guano. Leaching has concentrated the phosphates along the lower part of the filled passage. These basal concentrations have been mined, with large sections of the deposits averaging over 20% P_2O_5. Most of these caves are completely filled except for a space, usually only a few inches high, caused by settling and leaching, and a few rooms that were domes in the original cave. These filled cave tunnels range from less than a meter in diameter to over fifty meters in width. These were evidently formed during the more humid climate that existed in the Tertiary. Only small sections of these tunnels have been preserved, many of them extending through ridges. If similar tunnels developed in the Sierra de Gomas to the west, they have probably been entirely removed by erosion as there is much greater local relief in the Sierra de Gomas than in the mountains northwest of Sabinas Hidalgo.

In the area west of the reef trend that extends along the valley east of the Sierra de Gomas, conditions were favorable for the formation of large rooms at relatively great depth. These rooms were formed along local zones of porosity surrounding fossil reefs, and in zones of fracturing. The largest cave in the area, Gruta del Palmito, was formed where a zone of fracturing crossed a reef zone, and the cave has areas that have their maximum enlargement along fractures and others that are enlarged along the reef zones. Grutas de Villa de García is formed in a reef zone with only minor joint control. Gruta de Carrizal is the outlet channel for waters entering a ring of limestone surrounding the igneous intrusion of Pico de Carrizal. This cave has two well developed levels that probably were controlled by the level of the valley floor to the east. The large passages, complex fills, and lack of relation to the present topography all indicate that this cave is probably also of Tertiary age. All these caves predate the present topography and probably received their maximum development at the same time that the shallow caves to the east were formed. It would appear that the larger caves of the area formed at depth and are relics of a more humid Tertiary climate. A somewhat similar history has been proposed (Bretz, 1949) for the Carlsbad area, and it is probable that most presently accessible large caves in arid mountains were formed at relatively great depth. This would explain the general lack of integrated horizontal systems and the relative importance of large rooms in the western United States and northern Mexico.

CAVE BIOLOGY OF THE MONTERREY AREA

The invertebrate cave fauna of northern Mexico is of special interest for the relationship which it bears to the faunal assemblages of Texas to the north and to the main mass of the Sierra Madre Oriental to the south. The epigean environment is more closely similar to that of southern and western Texas than it is to the more tropical region to the south. Geologically, however, it is a northern extension of the Sierra Madre Oriental.

Although only a few caves in this area have been studied two are among the best-known caves of Mexico. Various collections have been made over the past thirty years in Grutas de Villa de García and Gruta del Palmito with the result that they are much better known biologically than any other caves in the area. Most of the caves of northern Mexico are quite dry, but the entrance room of Gruta del Palmito contains an abundance of organic material and is exceptionally moist; this has resulted in the presence of rich fauna.

Generally speaking the area is relatively poor in troglobites, especially when compared with the much better known fauna of the Edwards Plateau of Texas. There are, however, several interesting and unique troglobites present. These include one milliped (Ceuthauxus palmitensis, known only from Gruta del Palmito), one opilionid (Chinquipellobunus osorioi, known from Gruta del Palmito, Grutas de Villa de García, and Gruta de Carrizal), two pseudoscorpions (Leucohya heterodonta from Gruta del Palmito and an undescribed genus and species from Gruta del Carrizal), two diplurans (Parallocampa cavernicola and Paratachycampa boneti, both known only from Grutas de Villa de García), a centipede (Garcibius osorioi, known only from Grutas de Villa de García), a trichoniscid isopod (Protrichoniscus palmitensis, known only from Gruta del Palmito), a collembolan (Pararrhopalites anops, known only from Gruta del Palmito), and a trechinid beetle (Mexaphaenops prietoi, known only from Gruta del Palmito). One aquatic cavernicole is known. Conilera stygia, a cirolanid isopod, was described in 1900 from a single specimen found in a well in Monterrey. It has not been found since that time.

When this list of troglobites is compared with lists of forms from the caving regions to the north and the south it is at once apparent that it is much more closely related to the faunas of more southern Mexico than to Texas. Only one genus (Protrichoniscus, an isopod) is represented both in Texas and in southern Mexico. The milliped genus, Ceuthauxus, has cave representatives as far south as the state of Guerrero. The blind beetle, Mexaphaenops prietoi, is a member of the carabid tribe Trechini. This tribe is abundant in caves of the eastern United States but is absent from Texas caves. Two additional blind species of this tribe have recently been collected in caves west of Xilitla, San Luis Potosí, indicating that it may be an abundantly occurring group throughout the Sierra Madre Oriental. The cirolanid isopod, Conilera stygia, is suspected to belong to the genus Speocirolana rather than to Conilera or to the Texas Cirolanides. The species is too poorly described for it to be definitely assigned to any genus. The other genera have no cave representatives in areas other than those listed above. This may indicate isolation resulting from dissection of this region into several isolated mountain ranges.

An examination of troglophilic forms indicates a fusion of the fauna of the two regions, with the northern groups dominating. The carabid beetle genus Rhadine is found in two caves in this area. Rhadine araizai is known from Gruta del Palmito; two different subspecies of this species are known from Texas caves. R. pelaezi is known only from Grutas de Villa de García. Other species of Rhadine appear in caves farther to the

west. Rhadine boneti, described from Cueva de La Boca, probably belongs in a distinct undescribed genus also found in Gruta del Palmito and in caves in Val Verde County, Texas. The catopid species, Ptomaphagus (Adelops) cavernicola, is found in Gruta del Palmito as well as in caves in Texas. The staphylinid beetle, Belonuchus sp. nr. moquinus, is common in Texas caves and appears also in Gruta del Palmito. It reaches the southern limit of its known range in Crystal Cave, Tamaulipas. The spider, Physocyclus hoogstraali, is known from Grutas de San Bartolo, Grutas de Villa de García, Cueva de Las Animas, and a bat cave at Sabinas Hidalgo. Although the genus is known also from caves in more southern Mexico it is most abundant in desert regions and one species is found in caves of New Mexico and west Texas. The large spiders of the genus, Ctenus, and whip-scorpions of the genus, Tarantula, are rarely found in Texas caves but appear in caves in Mexico as far south as Xilitla and Yucatan respectively. The camel cricket subfamily Rhaphidophorinae is abundant in Texas caves, as well as in many caves of northern Mexico and the Mexican Plateau. It appears to be absent from the caves of the Sierra de El Abra and in areas of the Sierra Madre Oriental along the eastern front of the range. The genus Ceuthophilus is abundant in Texas caves and also appears in Gruta del Palmito and Gruta del Carrizal. A related genus has been found in Cueva del Camino, near Sabinas Hidalgo, and in Gruta del Palmito.

Several genera which inhabit caves in this area are either exclusively Mexican and reach their northern range limit in this area or else are more closely allied to the more southern forms than to the fauna to the north. The small whip-scorpion, Schizomus., belongs to a genus common in caves as far south as Yucatan. One epigean species has been found in the extreme southern tip of Texas. In this part of Mexico it is known only from Grutas de San Bartolo. Three undescribed species of the spider genus, Metagonia, are found in this area. These are known from one cave each (Grutas de Villa de García, Cueva de La Boca, and Gruta del Carrizal). Two species of the spider genus, Modisimus, are found in this area (Cueva de La Boca and Grutas de Villa de García). The true crickets are represented in caves in this area by the species, Paracophus apterus, found in several caves. All of these species are known only from caves and conceivably are troglobites, although they show little or no adaptation for the cave existence. It might be better to consider them "incipient" troglobites.

From this listing it can be seen that the area is most intimately related to the more southern part of Mexico with respect to its troglobitic and "incipient" troglobitic fauna. This probably reflects conditions in the area prior to dissection and the isolation of the area into several dry mountain ranges. The troglobitic fauna probably represents remnants of surface groups now absent from the area. The troglophilic and trogloxenic species represent, in most instances, fauna typical of cave faunas of the much drier portions of Mexico and Texas and presumably have invaded the caves much more recently.

PART TWO

MONTERREY - CD. VICTORIA

ROAD LOG: MONTERREY – CIUDAD VICTORIA

Southward from Monterrey on Highway 85, one travels between two mountain ranges through pleasant Huajuco Canyon, then across more open country, spotted with orchards to Montemorelos. Accessible from the highway are Cueva de La Boca and Horsetail Falls. From just south of Montemorelos, a road follows the scenic canyon of the Río Pilón to Rayones. The main highway crosses more level country to Linares, where a winding road leads west across the mountains to Galeana and Highway 57. From Linares south to Ciudad Victoria the front range of the Sierra Madre Oriental forms a majestic backdrop to the west.

Kilo Post	Total Miles	Partial Miles	
	00.0	00.0	From Independence Arch in Monterrey, go south on Pino Suarez for 1.5 miles to the Río Santa Catarina bridge. Turn left just before bridge onto expressway. Follow expressway east along river past the Zaragoza Street bridge and then turn right across the river on the Felix U. Gómez bridge, 2.9 miles from the arch.
	4.2	4.2	Leaving Monterrey on Highway 85 south to Ciudad Victoria. Technical Institute of Monterrey on left. Mountain behind Institute is Cerro de la Silla (Saddle Mountain), 1792 meters. Ahead enter Huajuco Canyon with the Cerro de la Silla to the left and the Sierra de los Amargos, part of the Sierra Madre Oriental, to the right.
974	8.6	4.4	Río Elizondo
974	8.8	0.2	Gravel road west to El Diente. El Diente (The Tooth) is an impressive spike of limestone with a sheer face rising about 1500 feet. Nearby are several caves and mines. To reach this area follow gravel road west, keep right at 1.7 miles, go left around mine dump at 3.9 miles, and reach El Diente mine at 4.6 miles. Several cave entrances are visible from the mine. One cave, about 1000 feet up the slope to the south, has mine shafts which apparently connect with the El Diente mine. Mines of this area are a part of Los Minerales de San Pedro, San Pablo, which produce lead and zinc.
972	9.9	1.1	Arroyo Calabozo
962	15.8	5.9	Arroyo Las Palmas
954	20.6	4.8	Gravel road east to Presa (dam) de La Boca, Cañón Garrapatas, and Cueva de La Boca (Gruta de Santiago). The view of the entrance to Cueva de La Boca alone is worth the drive. To reach the cave, follow the road east and cross a river at 0.5 miles, pass dam (Presa de La Boca, used to store water for Monterrey) at 4.0 miles, and reach the river below the 100 foot by 100 foot cave entrance at 5.4 miles. The cave is about 800 feet above the road and is reached by a steep trail. It is essentially one large room about 800 feet long, with ceiling heights of over 400 feet. At the rear of the cave a tower leads upward 110 feet to where miners are presently quarrying phosphate rock. Mining operations frequently hinder exploration of the cave.
952	22.1	1.5	Street on right to main plaza of Villa Santiago.

Kilo Post	Total Miles	Partial Miles	
948	24.3	2.2	El Cercado
947	24.8	0.5	Road west to Cola de Caballo (Horsetail Falls). The winding road leads four miles to the hotel (there is a charge of three pesos per person) and the falls are reached by a footpath from the hotel. Caves are reported in this area; inquire locally.
931	34.9	10.1	Altamira
925	39.1	4.2	Río Ramos
918	43.6	4.5	Río Blanquillo
910	48.1	4.5	Dissected pediment forms ridge in foreground. These ridges are capped by coarse gravel washed from the mountains when the area was at a higher elevation. Erosion has cut into the soft shale below the gravel, leaving the gravel capping flat-topped hills.
906	50.8	2.7	Enter Montemorelos, center of a large citrus-growing area. Population is about 80,000. Ahead 0.6 miles is junction with Highway 89 to McAllen and Reynosa.
904	52.0	1.2	Río Pilón, also called Río Mante and Río Montemorelos.
902	53.5	1.5	Road west to Rayones. This road follows the scenic canyon of the Río Pilón to the town of Rayones (or Rayón). Road is rough in parts but can be negotiated by most cars. (See Montemorelos – Rayones road log.) Ridges ahead are capped by gravel from the mountains. Note the constant slope away from the mountains, characteristic of pediments.
879	67.3	13.8	Río Cabezones
868	84.3	7.0	Arroyo La Laja
865	86.5	2.2	Road west to Hualahuises, 0.3 miles.
855	92.7	6.5	Río Camacho
853	93.9	1.2	Linares, population 23,000. Road west to Galeana, Zaragoza, and Highway 57. Good paved road, winding in places. See Linares – Galeana – Zaragoza road log.
851	94.1	1.2	Río Pablillos
841	100.8	6.7	Arroyo El Muerto
826	110.1	9.3	Pico Pilón (Sugar Loaf) ahead.
825	110.3	0.2	Arroyo Anecaro. Leave Nuevo León and enter Tamaulipas.
817	115.1	4.8	Río El Pilón. Maguey plants beside road. These plants are cultivated for the production of sisal fiber, used to make rope and binders' twine. From a plant of this same type are produced pulque, mezcal, and tequila. Pulque is a whitish drink of low alcoholic content, produced by cutting out the centers of the maguey plant and fermenting the sap (aguamiel) that collects. Mezcal is a clear liquor fermented from the steamed hearts of the plants. Tequila is

Kilo Post	Total Miles	Partial Miles	
			distilled from pulque. These drinks are considered traditional; pulque has a history dating back to pre-Conquest times, although it is now being replaced by soft drinks and bottled beer.
814	117.3	2.2	Arroyo San José
809	120.6	3.3	Arroyo La Tinaja
804	123.4	2.8	Arroyo and village of Villagrán
800	126.0	2.6	Rosina
799	126.9	0.9	Viveros
794	127.2	3.3	Arroyo El Meco
793	127.8	0.6	Cuesta El Salero
775	139.1	11.3	Hidalgo (Miguel Hidalgo). Road west to El Chorrito and cave of the Virgin, a small cave that is a shrine to the Virgin of Guadalupe. Entrance to the cave is through a church and up the steps behind the altar. The cave is about 200 feet long and contains a large accumulation of casts and crutches discarded by those who have visited the shrine. From Hidalgo an excellent gravel road leads to La Mesa (11.5 miles). Just before La Mesa are ruins of a large sugar mill abandoned during the Revolution (about 1920). Beyond La Mesa continue ahead on the road which climbs steeply up a large travertine terrace (several million cubic meters) to El Chorrito and cave of the Virgin, at road's end.
762	147.6	8.5	Arroyo El Guardado and village of San Isidro
756	151.6	4.0	Road west to Palo Alto
752	153.9	2.3	Ejido Oyama
747	156.8	2.9	Cross Monterrey – Tampico Railroad.
737	163.2	6.4	Barretal
736	163.6	0.4	Río Purificación. This large river begins in the Escondidos–Zaragoza area and flows east through a low pass. Road to right, Hacienda del Carmen, 0.8 miles.
724	170.5	6.9	Río Corona (Río San Pedro). Drains La Boca canyon.
717	174.6	4.1	Río Caballeros
711	178.8	4.2	Arroyo La Presa. Drains Peregrina (La Presa) Canyon.
707	181.8	2.3	Road west to Caballero, 10 kilometers.
698	186.4	5.3	Enter Ciudad Victoria, capitol of Tamaulipas.
	187.5	1.1	Plaza. Large theater to right, federal office building to left. Road west to Tula is presently under construction, but is passable with difficulty by car. End of Log.

ROAD LOG: MONTEMORELOS — RAYONES

Total Miles	Partial Miles	
00.0	00.0	Turn west off Highway 85 on gravel road 1.7 miles south of the Río Pilón bridge in Montemorelos. Ahead, cross flats which are developed on steeply dipping Upper Cretaceous shales.
8.0	8.0	Cliff to the left is of coarse gravel that at one time formed a continuous layer sloping gently away from the mountains. Note large rounded boulders up to several feet in diameter. Ahead, climb onto pediment surface. A pediment is a plain, frequently gravel-covered, that slopes gradually away from the mountains. The pediment in this area has been dissected by later erosion. Kilometer 13 just ahead.
10.7	2.7	Descend from the pediment to the present river level.
11.0	1.3	La Puerta de la Boca — store and houses. Mountain to the south overlooking valley is Cerro de la Boca.
13.0	2.0	Spring and shrine to left. About 150 feet before the shrine (east), the trail to Cueva de Chorros de Agua leaves road, leads above spring, then zig-zags up to the cave. The entrance room of the cave is about 40 feet wide, 60 feet long, and is filled partially with breakdown. A short stoopway to the right leads to a dome about 10 feet wide, 40 feet long, and 30 feet high. From the road 0.2 miles on beyond the shrine, a primitive lumber road leads upward to a high limestone area near the top of Cerro de la Boca. Ahead to the right, what appears to be a large cave entrance is visible about halfway up the mountain.
17.1	4.1	Road crosses flow from large spring, probably a subterranean meander cutoff of the Río Pilón. The river flows around a sharp curve and is only about 100 feet west of the spring. Vertically bedded limestone forms a narrow canyon at this point.
17.6	0.5	Rough side road across river and up canyon to right. Divided road ahead, keep right.
19.2	1.6	Chevron folding to north of road. Ahead, leave canyon and start good raod to Rayones.
25.1	5.9	Shelter caves in mountain north of road. Impressive limestone peak ahead.
27.1	2.0	Road junction. Road left to Rayones. Road ahead to Barroal and El Becerro.
27.5	0.4	Rayones (Rayón). Main plaza. A rough jeep road leads from here to Galeana.

ROAD LOG: LINARES — GALEANA JUNCTION

Total Miles	Partial Miles	
00.0	00.0	Intersection of Highway 85 and Highway 60 to Galeana in Linares. Leave town and cross plains developed on Upper Cretaceous shales and marls.
11.3	11.3	Enter foothills of the Sierra Madre Oriental.
12.0	0.7	Orientale
14.0	2.0	Enter Cañón de Santa Rosa
18.3	4.3	El Ebanito
20.3	2.0	Los Pinos
21.3	1.0	Mural to left of road carved in vertically bedded limestone by Frederico Canto features an allegorical representation of modern Mexico, including figures of various engineers, patriotic figures, and a large goddess of abundance. Dedicated by President Lopez Mateos in 1961.
25.0	3.7	Possible cave entrance on north side of valley, high above.
25.9	0.9	Keep left on bypass; road to right loops into Iturbide.
29.3	3.4	Iturbide to right.
30.5	1.2	La Colorada
33.6	3.1	Puesta de los Encinos
34.5	0.9	Enter wide valley typical of the plateau area. Several high peaks are visible to the west. Highest is Cerro Potosí, 3635 meters (11,902 feet). There is frequent disagreement as to peak elevations in this area.
36.2	1.7	El Barrial
38.9	2.7	Galeana junction. Right to Galeana and Pozo de Gavilán; left to the Escondida—Zaragoza area and San Luis Potosí.

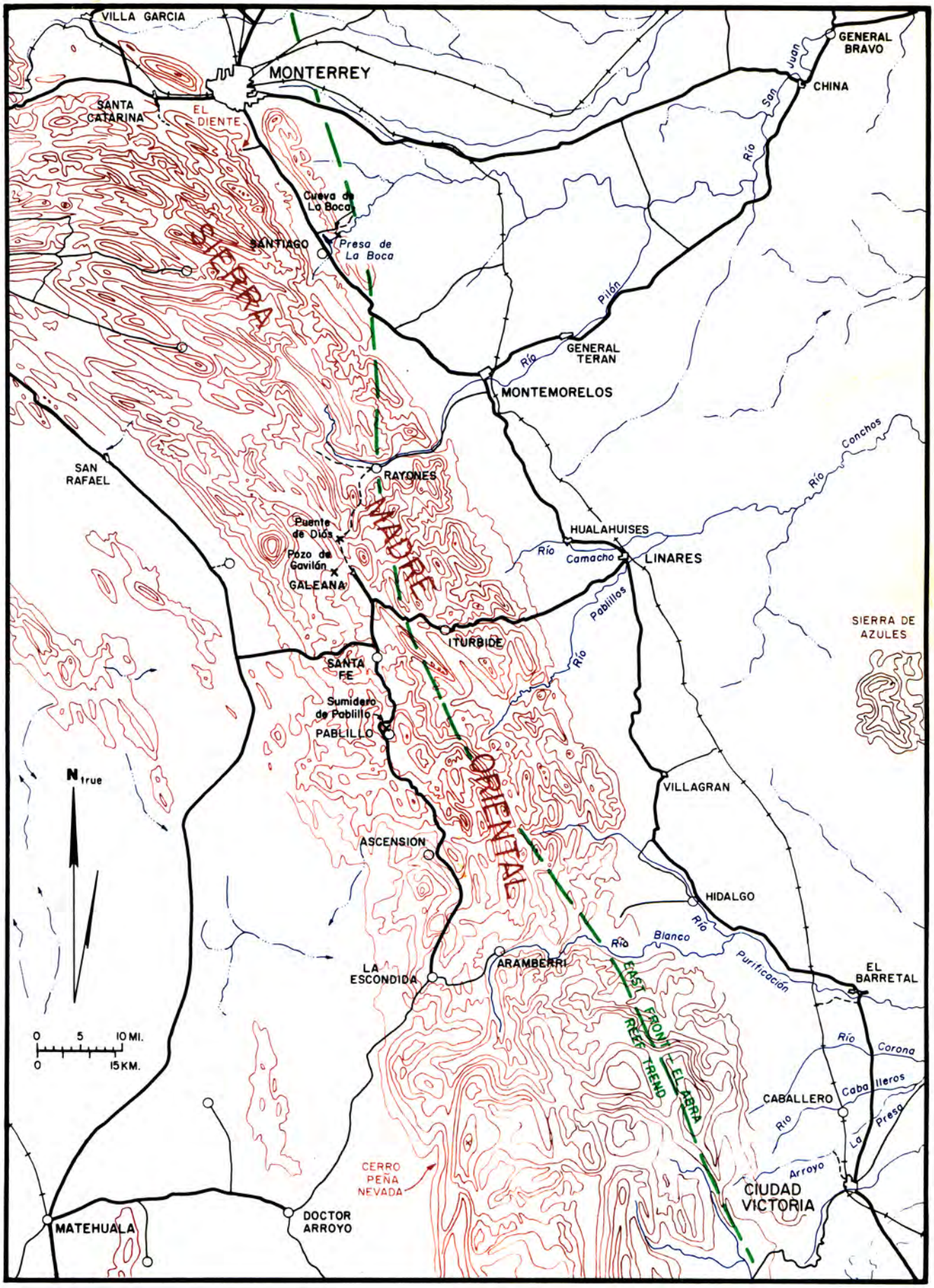
ROAD LOG: GALEANA JUNCTION — POZO DE GAVILAN

00.0	00.0	Galeana junction. Right to Galeana and Pozo de Gavilán.
3.4	3.4	Galeana. Cathedral across plaza. Road to Pozo de Gavilán to left; road to Puente de Dios and Rayones to right. To reach Puente de Dios go two blocks right, then turn left. Puente de Dios is a large natural bridge about 5 miles north of Galeana, and has a span of about 50 feet, is over 100 feet wide and 40 feet thick. The center is about 90 feet above the river. The bridge is developed in cemented talus derived from two ridges above the river which apparently filled the river canyon, the bridge forming as the river enlarged a subterranean channel. In Mexico the name Puente de Dios is so commonly applied to natural bridges as to be almost a synonym. The road crosses the bridge and continues as a rough jeep road to Rayones.
6.2	2.8	Small settlement: Barrio de Jalisco.

Total Miles	Partial Miles	
7.0	0.8	Settlement. Take left (worse) fork for 1.1 miles, then bear left along fence to left of pond. Cut sharply left across field at fence corner 0.5 miles beyond junction by pond. Follow road left by fence corner and out into field for 0.3 miles. Pozo de Gavilán is about 100 yards to the left (south). If the field is not planted, it is possible to drive around the head of a small draw to the edge of the pit. Pozo de Gavilán is about 200 feet in diameter and 325 feet deep, with almost sheer walls. At the bottom a short slope leads to a water-filled room. The pit is developed in gypsum of the Jurassic Olvido formation, the upper fifty feet of which have weathered to gypsite. (See map of Pozo de Gavilán on page 38.)

ROAD LOG: GALEANA JUNCTION — ESCONDIDA — ZARAGOZA AREA

00.0	00.0	Galeana junction. Left to San Roberto junction, Ascensión, and Zaragoza.
3.5	3.5	Highway junction. Road west to San Roberto junction on Highway 57 and San Luis Potosí. South to Ascensión, Escondida, Aramberri, and Zaragoza. The road south follows a valley developed on relatively soft Olvido gypsum exposed along the crest of the Galeana Anticline. Cretaceous rocks from the Taraíses to the Méndez formations are exposed in the complexly folded mountains to the east.
4.8	1.3	Santa Fe. Ahead lie numerous sinks, mostly to the west of the road. These sinks are developed in gypsum and overlying gypsite. Characteristically they are about 30 feet deep and about 80 feet in diameter. In many of them smaller vertical shafts have developed, some reaching depths of 150 to 200 feet. The deepest explored was about 15 feet in diameter and led to water at an estimated depth of 250 feet. The gypsite is about 100 feet thick and the upper parts are very loose and crumbly. (See picture on page 39.)
13.1	8.3	Pablillo. Large flat valleys to the north and northeast drain into the gypsum cave of Sumidero de Pablillo at the north end of the valley. A large gully leads into the cave, which after about 300 feet constricts to three feet in height. Poor air halted exploration. (See picture on page 39 and map on page 40.)
21.3	8.2	Puerto de Cieneguillas. Kilometer 29.
36.8	15.5	Entronque (Junction) La Rondada.
39.6	2.8	Ascensión junction. Ascensión is about one mile to right.
57.2	17.6	Escondida junction. Turn left into Escondida. Road ahead leads to Dr. Arroyo then by several gypsum caves to Matehuala.
66.5	9.3	Aramberri
74.8	8.3	Turnoff to Cueva de Cuesta Blanca just beyond top of hill. Follow dim road for about 300 yards; cave is on right at end of large gully. The cave is in gypsum, about 150 feet deep, and needs no equipment. Other small caves in area.
78.4	3.6	Zaragoza. Three limestone sinks about 70 feet deep are found east of town at the base of mountain. To the southwest near the small town of Encantada is a high (8400 foot) karst area with numerous small sinks; the deepest so far, 110 feet. Exploration of the Zaragoza area has only begun.


VILLA GARCIA
MONTERREY
SANTA CATARINA
EL DIENTE
SIERRA MADRE ORIENTAL
GENERAL BRAVO
CHINA
San Juan
Río
Cueva de La Boca
SANTIAGO
Presa de La Boca
Pilón
Río
GENERAL TERAN
MONTEMORELOS
SAN RAFAEL
RAYONES
Río Conchos
Puente de Dios
Pozo de Gavilán
GALEANA
HUALAHUISES
Río Camacho
LINARES
Pablillos
Río
SIERRA DE AZULES
ITURBIDE
SANTA FE
Sumidero de Pablillo
PABLILLO
VILLAGRAN
ASCENSION
HIDALGO
Río Blanco
Río Purificación
LA ESCONDIDA
ARAMBERRI
EAST FRONT REEF TREND
EL ABRA
EL BARRETAL
Río Corona
CABALLERO
Caballeros
Río La Presa
Arroyo
CIUDAD VICTORIA
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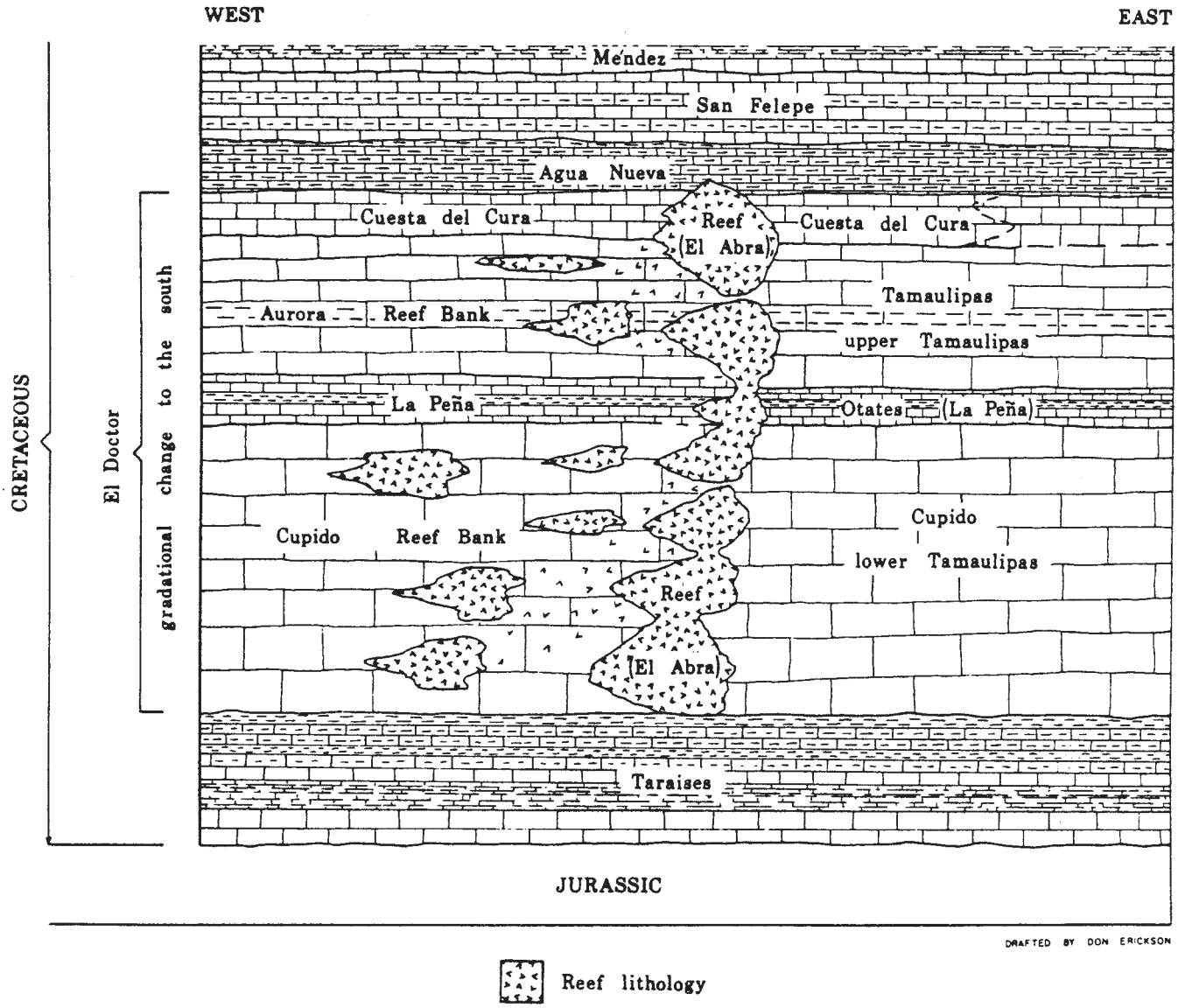
GEOLOGY: MONTERREY — CIUDAD VICTORIA

Between Monterrey and Ciudad Victoria the geology and landscape are dominated by the rugged Sierra Madre Oriental, with peaks rising over ten thousand feet above the coastal plain below. In these mountains large thicknesses of sediment have been complexly crumpled and overturned to form some of the sharpest large-scale folding on the North American continent. The Sierra Madre trends north-northwest from Ciudad Victoria into the Monterrey area, where the ranges curve sharply to the west. Most geologists feel that the abrupt change in the direction of folding is due to buried structural elements. Areas of relatively high basement rock have tended to protect the region north of Monterrey from intense folding and to deflect the trend of the ranges to the west. The intense crumpling commonly seen in folds in the Monterrey area is probably due in part to gypsum which was plasticly intruded into the folds as they were formed. Jurassic intrusive gypsum has been found in contact with Cretaceous rocks in several sharp anticlines near Monterrey. More extensive gypsum outcrops occur along the centers of anticlines in the Galeana-Zaragoza area on the western slopes of the Sierra Madre.

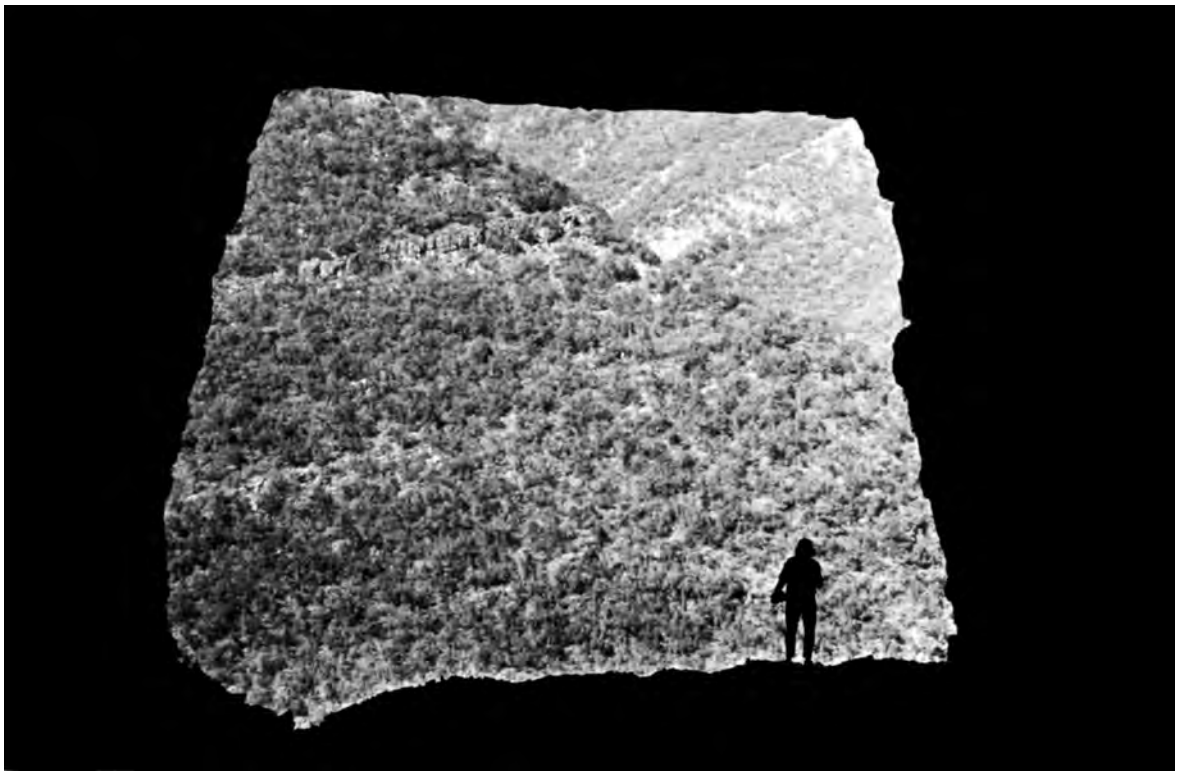
Structurally the northern Sierra Madre Oriental can be divided into two areas, a zone of tightly-folded Cretaceous and Jurassic rocks north of the Río Purificación, and the Huizachal-Peregrina area near Ciudad Victoria, where Paleozoic and older rocks are exposed in the centers of relatively broad anticlines. In both areas the thick Cretaceous limestones are very seldom faulted, although they are tightly folded and overturned. Where they are exposed, Paleozoic and older rocks are extensively faulted, but this faulting was related to orogenic and magmatic activity during the Paleozoic and has had little direct effect on the Cretaceous rocks. Before the end of the Cretaceous, the lower Cretaceous limestones were probably deeply buried and thus tended to undergo plastic deformation rather than faulting. The folds that now form the Sierra Madre developed principally during the Laramide Orogeny that began at the end of the Cretaceous and reached its culmination in the Eocene. The intense plastic deformation probably does not favor the development of caves, for instead of fracturing the rock it tends to close any existing porosity. Striking examples of such complex folding can be seen in Huasteca Canyon west of Monterrey, in the canyon of the Río Pilón along the road between Montemorelos and Rayones, and canyons just northwest of Ciudad Victoria, where rocks as old as Precambrian are exposed in the center of the Huizachal-Peregrina Anticlinorium.

Southward from Monterrey the amount of limestone in the lower Cretaceous section begins to increase, and a few miles south of Ciudad Victoria much of the lower Cretaceous section can be grouped into one formation, the El Doctor Limestone. The formation names used north of Monterrey are retained in the Monterrey — Ciudad Victoria area, although the Cupido Limestone is frequently referred to as the lower Tamaulipas Formation. It is separated from the Tamaulipas proper (called the upper Tamaulipas) by the Otates Formation, which is equivalent to the La Peña, but much thinner (5 to 20 meters). The Cuesta del Cura is also sometimes grouped into the upper Tamaulipas. There is much confusion in the use of the name Tamaulipas, but its most logical application, and the one that seems most nearly the original, would be to use the name east of the El Abra reef trend only. This reef trend is an extension of the subsurface Edwards reef trend of Texas, and is a zone of reefs that developed along the Gulf Coast during mid-Cretaceous time. East of the reef the name Tamaulipas can be applied only to the seaward equivalent of the Aurora, or it can be applied to both the Aurora equivalent, upper Tamaulipas, and the Cupido equivalent, lower Tamaulipas. The reef trend is marked by a series of discontinuous patch reefs flanked by shell and lime mudbanks; typical reef sequences occur in the Galeana area west of Linares. As conditions are more favorable for cave formation west of the reef trend, few caves are known in the east face of the Sierra Madre Oriental.



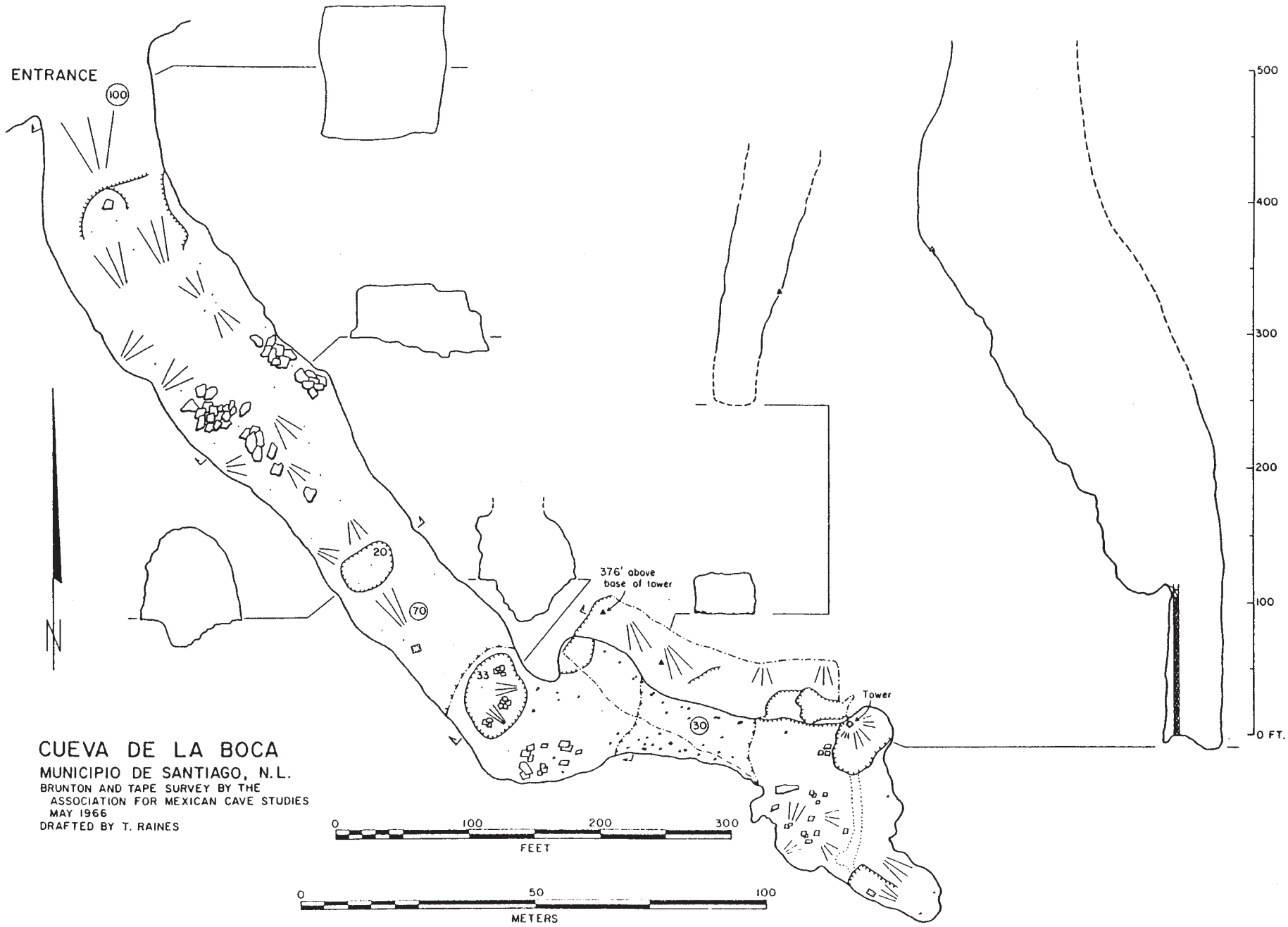
GENERALIZED CORRELATIONS ACROSS EL ABRA REEF TREND

NORTHEASTERN MEXICO



View from Cueva de La Boca. Photo by Terry Raines

The large passage of Cueva de La Boca. Note Jeep road and scaffolding over test pit. Photo by Terry Raines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CUEVA DE LA BOCA
MUNICIPIO DE SANTIAGO, N.L.
BRUNTON AND TAPE SURVEY BY THE ASSOCIATION FOR MEXICAN CAVE STUDIES MAY 1966
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METERS

CUEVA DE LA BOCA

The large entrance to Cueva de La Boca opens on the south side of Cañón Garrapatas 1.4 miles east of Presa de La Boca. The cave is developed in massively bedded, almost horizontal Cupido Limestone along the crest of a narrow anticlinal range that extends south from Cerro de la Silla, the famous saddle mountain that overlooks Monterrey. The valley just to the west of this range drains east through Cañón Garrapatas. The stream that cut the canyon was probably flowing in its present location before the soft Méndez Shale covering the mountains had been removed. As the surface of the land was lowered by erosion the stream was able to form a wide valley to the west of the mountains but was only able to cut a narrow canyon through the resistant limestone. The limestone exposed by this erosion was a well-fractured reef limestone. Unlike other areas, where solution was primarily localized in a zone along and near the water table, there was no zone of concentrated ground water movement in this region. Instead, throughout the entire limestone mass the ground water was able to flow freely and there was extensive removal of material in areas favorable to solution. Continued down-cutting has exposed one of these voids formed by deep solution. This void, Cueva de La Boca is essentially a single chamber 900 feet long and varying in width at the present floor level from 45 to 100 feet. The cave trends approximately northeast-southwest, but it is not strongly joint controlled. Near the entrance the ceiling is almost flat. The most remarkable feature of the cave is two large domes near the interior end of the cave. These domes are as wide or wider than the lower part of the cave and extend upward over 400 feet from the floor of the cave. They are inclined slightly from the vertical and with the aid of a 110 foot tower it is possible to climb the steeply sloping northeast wall to a point 376 feet above the floor. The light from several flashlights would not reach the top of the domes from this point. The canyon wall slopes steeply upward above the entrance and there is probably over 300 feet of limestone above the highest point in the dome that is visible. The two domes are separated by a natural bridge about 100 feet above the floor and form one large dome above the bridge.

The tower has been built to the ledge above the natural bridge to facilitate the mining of phosphates that have accumulated above the bridge and on the steeply sloping walls. The phosphate minerals, apparently leached from guano, have permeated several feet into the rock and this mineralized rock is now mined, then dropped to the floor below. Here a jeep road has been built to carry the rock to the cave entrance where an aerial tramway carries the ore in buckets across the canyon to the road below. Several prospect pits have been dug in the unconsolidated material that forms the floor of the cave. Apparently no deposits of economic value have been found as none of this material has been removed. This fill is composed of large breakdown blocks intermixed with guano and various substances that appear to be formed by the weathering of limestone blocks and guano. This fill ranges in depth from 10 to 34 feet.

The cave resembles many of the large caves of northeastern Mexico except that it has a much greater vertical range than others of comparable length. This is probably due to the local vertical homogeneity of the limestone but it is also possible that water moving downward into the limestone from beneath the river could have formed the large vertical domes. Further exploration of the higher parts of the domes should indicate whether or not the domes are the result of solution along favorable areas, as along a vertical joint, or if the domes are part of a continuous passage.

At present (1966) exploration of the cave is limited to Sundays and holidays as mining operations drop large amounts of rock into the main cave from high in the ceiling, and to prevent injury, exploration is not allowed. The stream below the cave is a popular camping and swimming area and during weekends and holidays large numbers of people come from Monterrey to camp, swim, and visit the cave, though the steep trail to the entrance discourages most casual visiting.

OTHER CAVES IN THE MONTERREY – CIUDAD VICTORIA AREA

Cueva de Chorros de Agua is located west of Montemorelos in the canyon of the Río Pilón and is just above the road to Rayones (see road log on page 29). The cave is about 100 feet above a large spring and is developed near the edge of a limestone outcrop. It consists of two rooms. An entrance room is about 40 feet wide, 60 feet long, and up to 30 feet high. This room is partially filled by debris from a now-closed upper entrance. A short stoopway to the west of the entrance leads to a dome room about 40 feet long, 8 feet wide and 30 feet high. A small amount of guano is present in this room.

Cueva de la Virgen is located west of the town of Hidalgo (see road log on page 28). The cave is a shrine to the Virgin of Guadalupe and is entered through a church. The cave is approximately 200 feet long and is composed of two irregular rooms; an entrance room about 75 feet long, 30 feet wide, and 15 feet high and a smaller room to the east. The cave is about 100 yards east of a large spring that has deposited a very large travertine terrace that fills the valley northeast of the cave.

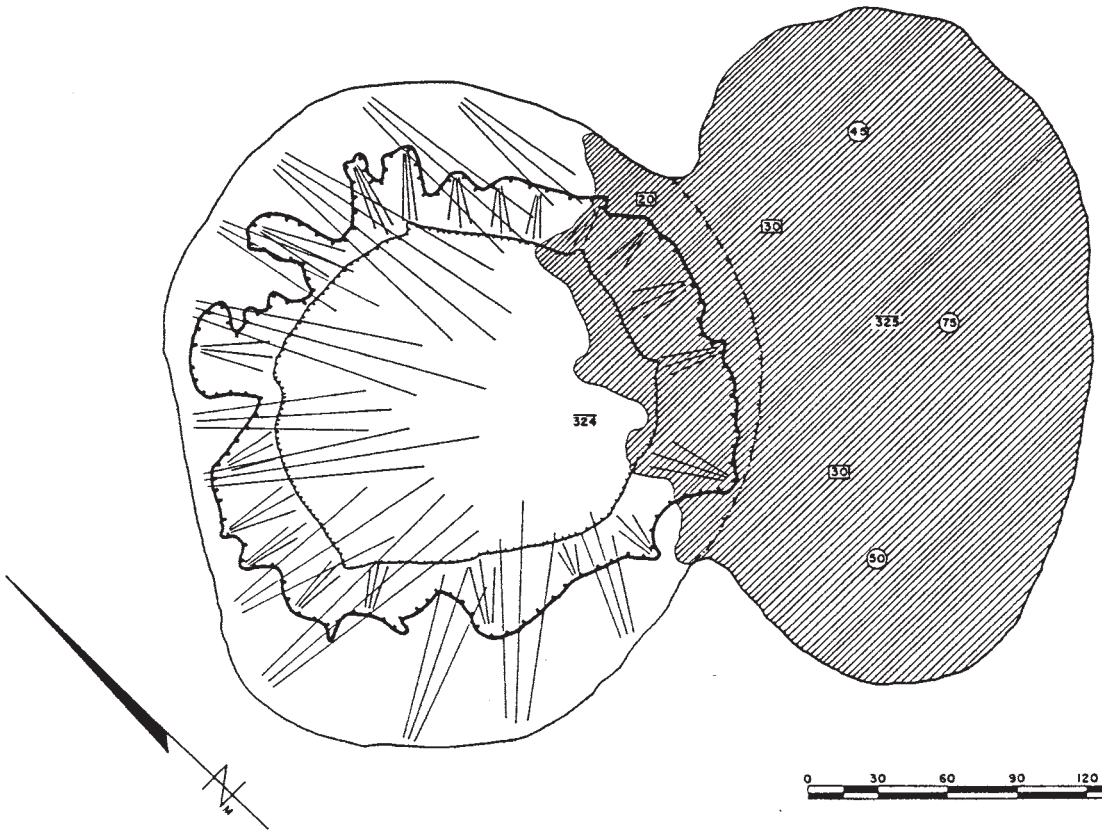
Caves in the Galeana Area: These caves are all developed in Jurassic gypsum or in the soft gypsum-cemented alluvium that covers the gypsum. Pozo de Gavilán, the most spectacular of these caves, is a vertically walled pit 200 feet in diameter that drops 325 feet to a deep lake (see map on page 40). The upper 35 to 40 feet of this sink is developed in the soft alluvium, and below the alluvium the walls are slightly undercut. The shortest drop into the pit is 285 feet, to where a talus slope leads to the lake. The pit probably formed as the result of the collapse of a nearly water filled room. Drainage from the surrounding area flows into Laguna de Laboradores, a lake developed on a now mostly filled sink. There are several small caves and fissures nearby. South from Galeana are the Santa Fé Sinks, a group of sinks located near the small town of Santa Fé. These sinks extend for several miles along the road from just south of the Galeana junction to just north of Pablillo (see road log on page 31). Some of these sinks are unusually large and straight-sided even though they are developed in the soft, crumbly, gypsum-cemented alluvium. One of the larger sinks is 70 feet in diameter and 120 feet deep. Another is 50 feet in diameter for the first 40 feet and then opens into a room 50 feet high. The deepest sink ends in water 227 feet below the surface. There are probably about 50 sinks from 20 to 80 feet in diameter and 20 to 50 feet deep, most of them climbable. Most of these pits appear to be the result of collapse, though some are more complex. Sumidero de Pablillo is located at the end of a wide draw that drains a large valley. Two cave passages extend from the end of the draw (see map on page 41). One is reached by climbing down about 15 feet through breakdown and the other extends horizontally for about 100 feet to where it joins the lower passage. From this point a passage continues for about 300 more feet before becoming a low, silt floored crawl containing poor air. The cave receives water from a large area and local inquiries should be made about the location of possible resurgences. The large natural bridge, Puente de Dios, is located 9 kilometers north of Galeana by road (see road log on page 30). It is not formed in gypsum, but instead it is developed in cemented landslide material that the river has tunneled through.

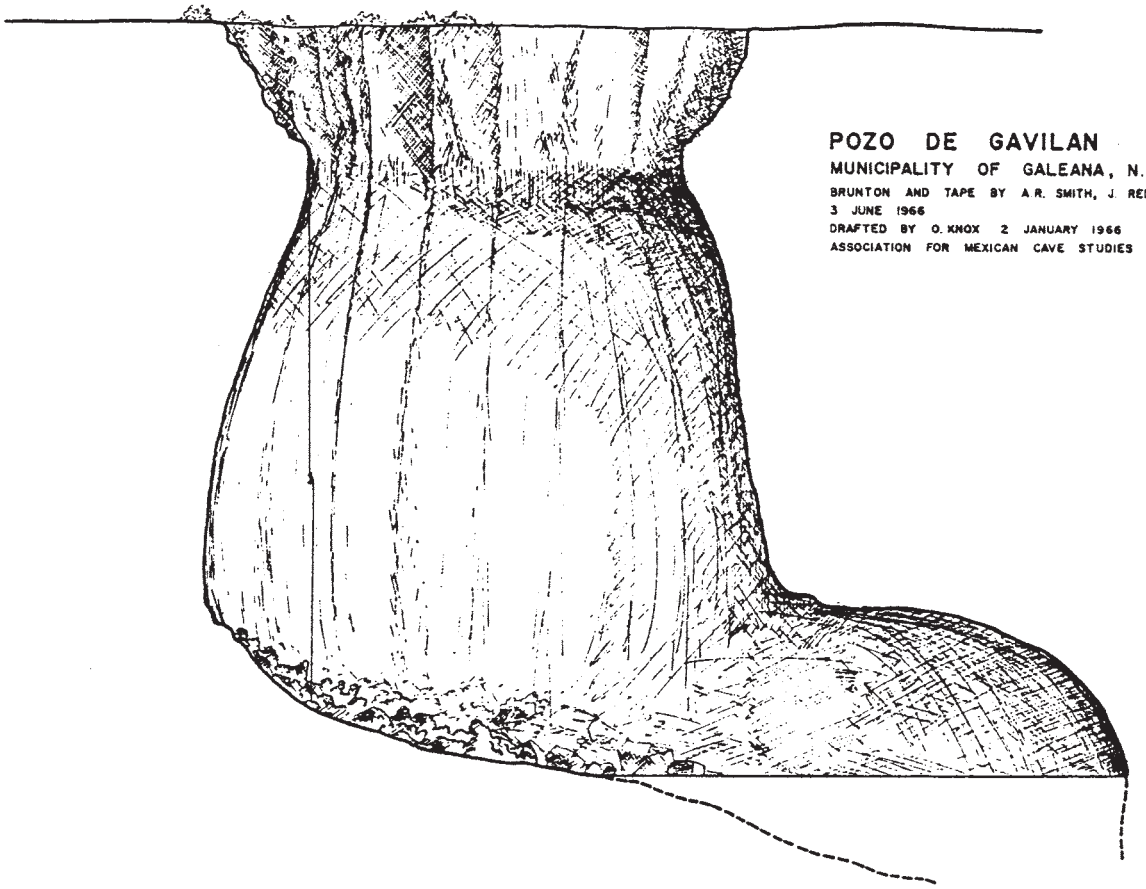
Cueva de Cuesta Blanca is located in a low hill about two miles west of Zaragoza and is formed in gypsum. The cave is apparently of vadose origin as flood waters from a large arroyo which enters the cave have enlarged the original small openings. From the entrance a passage six feet wide and ten feet high leads 200 feet to a series of pits dropping to a depth of 151 feet, at which point the passage becomes too small to follow. Nearby are numerous fissures and small caves, as well as Sótano de Cuesta Blanca, a collapse sink about 40 feet deep. It is possible to work through breadkown at the bottom of this sink for an additional 40 feet.

Zaragoza Area: Several unexplored limestone sinks about 70 feet deep are located a few miles east of Zaragoza. Southwest of Zaragoza near the small town of Encantada several sinks have been visited in a high limestone area (about 9300 feet). The deepest of these sinks was about 130 feet, but exploration of this area has only just begun.

One of the many Santa Fe dirt sinks located to the south of Galeana. Photo by Orion Knox

The large depression surrounding the entrance to Sumidero de Pablillo. Photo by Orion Knox

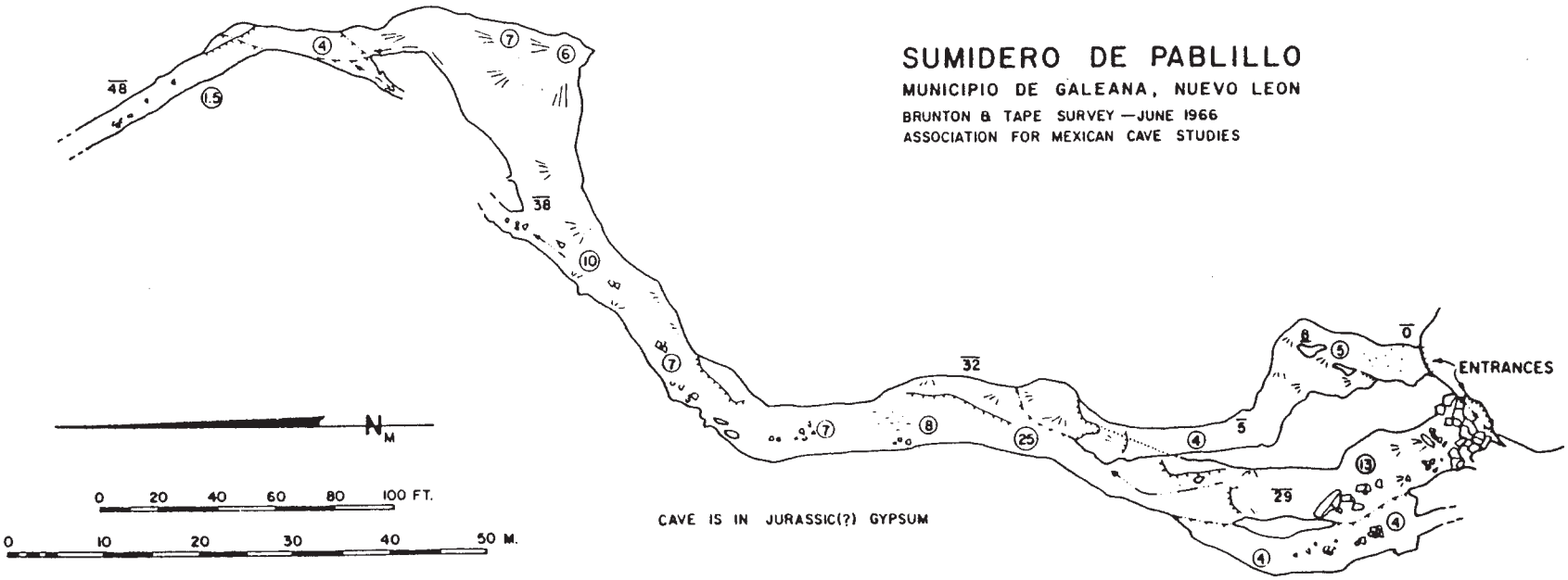




POZO DE GAVILAN

MUNICIPALITY OF GALEANA, N.L.

BRUNTON AND TAPE BY A.R. SMITH, J. REDDELL, O. KNOX
3 JUNE 1966
DRAFTED BY O. KNOX 2 JANUARY 1966
ASSOCIATION FOR MEXICAN CAVE STUDIES


SUMIDERO DE PABLILLO
MUNICIPIO DE GALEANA, NUEVO LEON
BRUNTON & TAPE SURVEY —JUNE 1966
ASSOCIATION FOR MEXICAN CAVE STUDIES
ENTRANCES
CAVE IS IN JURASSIC(?) GYPSUM
N M
0 20 40 60 80 100 FT.
0 10 20 30 40 50 M.

PART THREE

CD. VICTORIA – CD. MANTE

ROAD LOG: CIUDAD VICTORIA — CIUDAD MANTE

From Ciudad Victoria south to the Río Guayalejo the Inter-American Highway crosses low volcanic hills to the east of the Sierra Madre Oriental. Beyond the Río Guayalejo the highway passes through the foothills of the Sierra de Guatemala, a massive limestone range rising to elevations of over 2000 meters. The Sierra de Guatemala extends south almost to the Río Frío. Southward from the Río Fríothe highway parallels the much lower Sierra de El Abra through a prosperous sugar growing area into Ciudad Mante.

Kilo Post	Total Miles	Partial Miles	
699	0.0	0.0	Plaza in Ciudad Victoria. Proceed south on Highway 85 and cross the Río San Marcos at 0.4 miles from plaza.
694	3.3	3.3	Cross Monterrey-Tampico Railroad
690	5.6	2.3	Arroyo Juan Capitán (Arroyo Sarnoso)
680	11.3	5.7	El Sisal. Henequén plantation to left. Henequén is the cactus-like plant and is used to make binder's twine, rope, and bags. The range to the west is the Sierra de la Boca. The Huizachal Anticline lies behind this range and has exposed rocks from Triassic to upper Cretaceous in age.
659	24.4	13.1	Tropic of Cancer. The northern limit of the area in which the sun passes directly overhead. The sun is directly overhead at this point once each year, every 21 or 22 June.
649	30.6	6.2	To the west of the road are hills extending from the Mesa de Llera and to the east is the Mesa de Sandía.
645	33.1	2.5	Mesa de Llera, elevation 1772 feet. This mesa is capped by Tertiary basaltic lava flows. To the south-east is a panoramic view of volcanic necks and lava-capped mesas. In the foreground is the volcanic neck of Bernal de la Purísima. Behind is the Bernal de Clementina. To the east is the Mesa de Tigre or Mesa de Méndez, and to the south is the Mesa de la Caja.
640	36.2	3.1	Río Guayalejo. This river drains a large area of desert to the west and flows through the Sierra Madre in an impressive canyon that forms the north end of the Sierra de Guatemala.
638	37.5	1.3	Road right to Llera, 1 kilometer. Ahead lies an area of tropical vegetation.
625	45.6	8.1	Ejido de Felipe Angeles. An ejido is a government land grant given to a group of farmers. Much of the land involved in these grants was purchased from the large land owners. Exposures of the thin bedded San Felipe Limestone which underlies the Méndez shale and marl. The Sierra de Prieta lies just to the west of the road.
621	48.1	2.5	Galeana
619	49.7	1.6	El Guayabo

Kilo Post	Total Miles	Partial Miles	
613	53.7	4.0	El Encino. A lumber road from this small town provides access to the northern part of the Sierra de Guatemala. This road, passable only by large trucks and four-wheel drive vehicles, leads to the lumber camps of Julilo, La Perra, La Cueva, and the town of Joya de Salas (see road log on page 45). The roads traverse heavily forested limestone mountain several thousand feet above the base of the range. Supply trucks regularly travel to Julilo and La Perra, and infrequently to Joya de Salas. These trucks will carry passangers and baggage. There is almost no surface drainage on the east face of the range and water is usually obtained from cisterns filled by rainfall or is carried in by truck. Some areas on the east face receive almost 90 inches of rain a year, mostly during the rainy season from the end of June to the first of September. Water falling on the range sinks into the limestone and emerges in large springs that form the Río Sabinas and the Río Frío. Only a few small areas near the roads have been well investigated. The numerous pits so far located indicate that the total number of caves and pits in the Sierra de Guatemala must be quite large. Indians in these mountains resisted conquest by the Spaniards for over 200 years and were not pacified until 1747.
600	61.4	7.7	Río Sabinas. This river flows from a large spring about 15 miles to the northwest at the base of the Sierra de Guatemala.
592	66.3	4.9	Road west to Gomez Farías and Nacimiento del Río Frío Gomez Farías, about 10.5 miles from Highway 85, is reached by an excellent new road. Just before Gomez Farías is Sótano de Gomez Farías, a complex system of rooms, pits, and passages reaching a depth of about 400 feet. The entrance is visible on the south side of the road in a field at the bottom of the hill just before a sign reading: Bienvenidos a Gomez Farías. Sótano de El Molino, a 250 foot pit is located just west of town. Rough lumber roads from Gomez Farías provide access to the southern part of the Sierra de Guatemala. From a junction high on the range one road leads northwest to Rancho del Cielo and another west to the lumber camps of San José, La Gloria, and Cuevacillas (see road log on page 45). To reach the Nacimiento del Río Frío and the nearby cave turn left off the Gomez Farías road about 2 miles from Highway 85, where the main road to Gomez Farías turns north, and reach the Río Frío 2 miles from the Gomez Farías road. Follow the irrigation canal to the main springs. Cueva del Nacimiento del Río Frío is above and just beyond the spring. See cave description on page 53.
590	67.7	1.4	Poblado 601 and canal from Nacimiento del Río Frío. The town was at kilometer marker 601 before the highway was shortened.

Kilo Post	Total Miles	Partial Miles	
587	69.5	1.8	Road east to Xicoténcatl, a sugar processing center. To the east can be seen the low pass that separates the Sierra de El Abra from the Sierra de Guatemala.
577	75.7	6.2	Río Frío bridge. The Río Boquilla drains a large area to the west in the vicinity of Ocampo, cuts through the Sierra de El Abra in a narrow pass, and joins the Río Frío just west of the bridge.
576	76.1	0.4	Road west to Chamal and Ocampo. The road first crosses the Río Boquilla and then climbs to the crest of the El Abra range. It then leads just south of Chamal and then on to Ocampo. From Chamal a road leads north to "Bee Cave", entered by a 350 foot pit that drops into a large, 400 foot long passage.
575	76.9	0.8	El Limón
572	78.7	1.8	Road west to San Rafael de los Castros and Cueva de San Rafael de los Castros.
565	80.4	1.7	Río Mante. The river flows from a nacimiento at the base of the Sierra de El Abra. Most of the normal flow is used for irrigation.
564	83.7	3.3	Railroad crossing. Ahead enter Ciudad Mante, population – 55,000, elevation – 272 feet.
563	84.1	0.4	End of log. See Ciudad Mante – Ciudad Valles Road Log for continuation south.

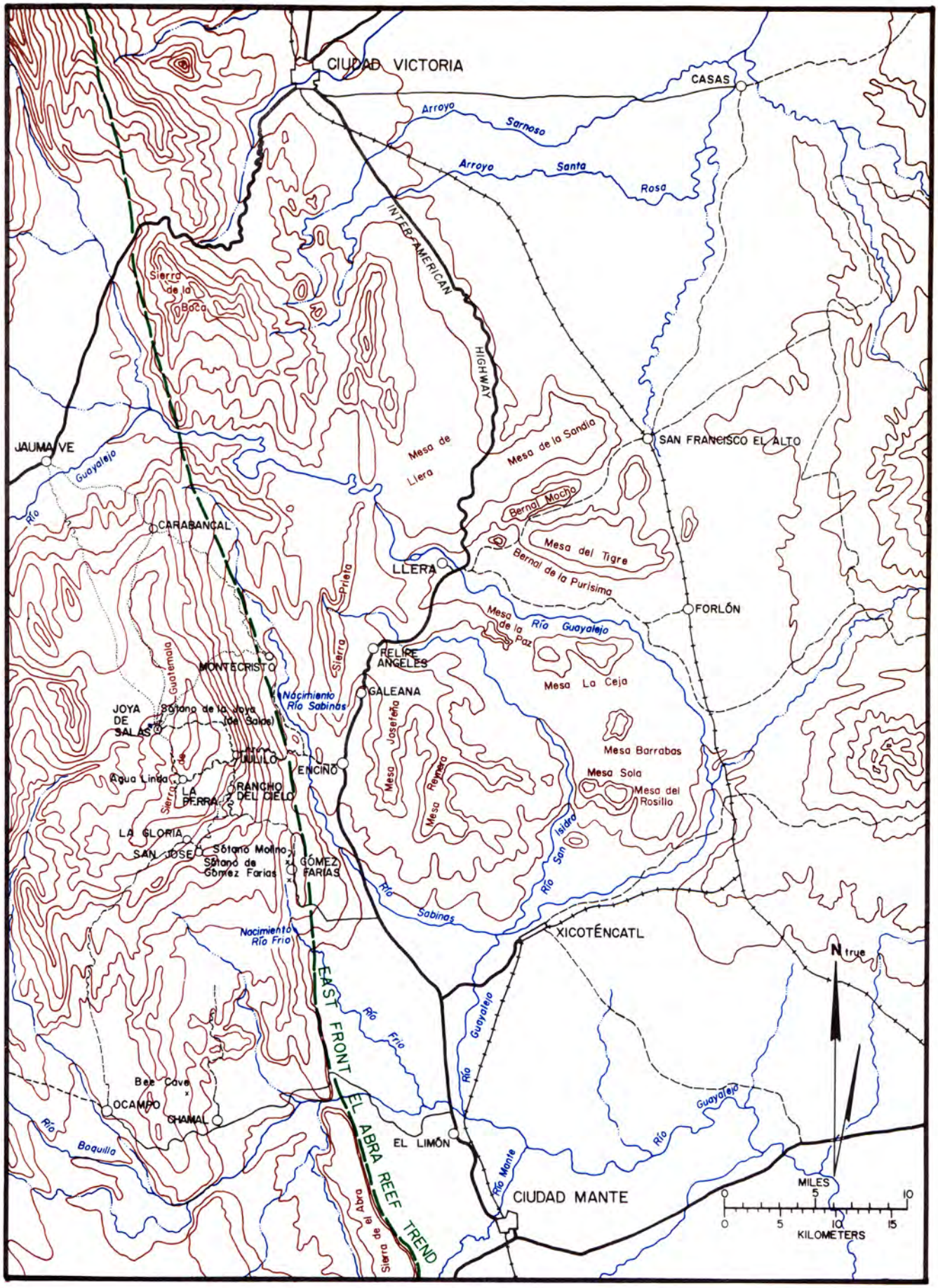
ROAD LOG: SIERRA DE GUATEMALA

Encino – Julilo – Joya de Salas

Encino – turn west from highway at stores. 0.6 miles – road to right and cemetary to left. 3.1 miles – cross Río Sabinas and take left fork. Beyond the Río Sabinas the road climbs steeply into the Sierra de Guatemala. 6.2 miles – 30 foot pit on right shoulder halfway down switchback. 7.7 miles – Sótano de Santa María, 180 feet deep, on left. 8.2 miles – fenced spring. 10.0 miles – logging road to left. 10.7 miles – cave about 150 feet long to right. 11.5 miles – one road to right and two roads to left. 11.6 miles – road to right. 12.1 miles – lumber camp of Julilo. Julilo is at an elevation of about 1800 meters and is 2 3/4 hours by truck from Encino. From Julilo a road leads south 4.4 miles to Rancho del Cielo, but the ranch is usually reached by a somewhat better road from Gómez Farías. The road south to Rancho del Cielo forks at the edge of Julilo. The right fork leads to La Perra, a lumber camp at an elevation of about 1800 meters, and then continues south to Agua Linda. The road north from Julilo to Joya de Salas (keep right through Julilo) forks 0.1 miles from Julilo, keep right. Road forks again at 0.9 miles, take left; right to La Cueva? Keep right at 1.1 miles and 1.6 miles, pit on right, take road to right. 2.9 miles – road to right. 3.1 miles – road to left. 3.5 miles – keep right at large sink. 3.9 miles – top of ridge. 5.4 miles – 50 foot pit to left. 6.1 miles – keep right. 9.1 miles – enter Joya de Salas (21.2 miles from Encino). Sótano de la Joya de Salas is 0.8 miles ahead beyond school house to right. This pit has a 246 foot entrance drop and has been explored to a depth of 892 feet.

Gómez Farías – Rancho del Cielo – San José – La Gloria – Ocampo

0.0 miles – Gómez Farías plaza. 1.2 miles – El Paraíso, keep left. Descend into canyon of Río Frío. The road from here is recommended for four-wheel drive vehicles only. 2.5 miles – begin ascent. 3.7 miles – Intersection, keep right for Rancho del Cielo. Tree by road has large yellow paint splotch to mark turn. On the road to Rancho del Cielo, reach pole gate 0.7 miles from intersection; keep right at 3.0 miles; reach Rancho del Cielo 3.8 miles from intersection. Facilities have been constructed here by Southmost College of Brownsville, Texas, for conducting biological research. The ranch was established by Frank Harrison about 1935; his interest and enthusiam in the unique flora and fauna of the area attracted many biologists to the ranch. Since his death in 1966 the ranch has been operated by Southmost College. There are many caves and pits in the area of the ranch; although most are small, the pits attain depths of up to 400 feet. 4.5 miles – enter long valley with many dead-end sinks. 5.2 miles – obscure road to right. 7.8 miles – intersection; road to right goes eventually to Julilo, take left road. 8.8 miles – gate. 9.4 miles – San José. This lumber camp lies in a closed valley with many dead-end sinks; truck graveyard on left, trail leads from here to Cueva del Infierno. 10.0 miles – intersection; take right road to La Gloria. 10.4 miles – La Gloria; sótano reported 1 1/2 hour walk from here. 11.6 miles – gate. 12.5 miles – intersection; road right leads to a lumber camp, Manantiales, where sótanos are reported; take dim left road across pasture to Cuevacillas and Ocampo. 13.6 miles – intersection; take right road. 15.2 miles – dim road on right. 16.0 miles – cross main ridge. 16.9 miles – dim road on left. Main road continues down steep slope over very bad road. 17.9 miles – intersection; left road goes to Cuevacillas where two caves are reported; right road goes to Ocampo. 18.2 miles – Clearing with stacked lumber. 19.7 miles – cross main ridge. 20.7 miles – small, unexplored caves on right side. 22.6 miles – El Refugio; ranch located among cleared pastures; obtain guide to Sótano de El Refugio. 23.0 miles – pasture; trail on far left side leads to Sótano de El Refugio, a 470 foot deep, 180 by 100 foot in diameter pit. 24.6 miles – top of ridge, begin descent to western flatlands. 25.9 miles – several houses. 26.4 miles – gate. 27.2 miles – gate. 28.8 miles – enter flatlands, gate. 29.4 miles – fence. 29.9 miles – sink on left 50 feet in diameter, 20 feet deep. 30.3 miles – intersection, take left fork, passing through cleared fields. 31.5 miles – gate, Ejido de El Tigre. 33.8 miles – gate. 36.5 miles – square in Ocampo, pavement.


CIUDAD VICTORIA
CASAS
Arroyo Sarnoso
Arroyo Santa Rosa
INTER-AMERICAN HIGHWAY
Sierra de la Boca
JAUMAVE
Río Guayalejo
Mesa de Llera
Mesa de la Sandia
SAN FRANCISCO EL ALTO
Bernal Mocho
Mesa del Tigre
Bernal de la Purísima
CARABANCAL
LLERA
Sierra Prieta
FORLÓN
Mesa de la Paz
Río Guayalejo
RELIPE ANGELES
MONTECRISTO
Sierra de Guatemala
Nacimiento Río Sabinas
GALEANA
Mesa La Ceja
JOYA DE SALAS
Sótano de la Joya (de Salas)
Mesa Josefeña
Mesa Barrabas
Mesa Sola
Mesa del Rosillo
ENCINO
Agua Linda
Sierra de
LA PERRA
RANCHO DEL CIELO
Mesa Reynosa
Río San Isidro
LA GLORIA
SAN JOSE
Sótano Molino
Sótano de Gómez Farías
GÓMEZ FARÍAS
Río Sabinas
Nacimiento Río Frío
XICOTÉNCATL
EAST FRONT EL ABRA REEF TREND
Río Frío
Río Guayalejo
Bee Cave
OCAMPO
SHAMAL
Río Baquilla
EL LIMÓN
Río Mante
CIUDAD MANTE
Sierra de el Abra
Río Guayalejo
N true
MILES
0 5 10
0 5 10 15
KILOMETERS

GEOLOGY: CIUDAD VICTORIA — CIUDAD MANTE

Southward from Ciudad Victoria the Sierra Madre Oriental is characterized by a series of long, north–south, anticlinal ridges and ranges. Near Victoria the larger anticlines have valleys developed along their axes, but to the south, due to the increasing thickness of resistant limestone in the section, the anticlines form mountains closely related to the structure of the original uplift. Just south of Ciudad Victoria lies the Huizachal Anticline, where erosion has exposed rocks as old as Triassic. This anticline does not front directly on the coastal plain, but is separated from it by several lower ranges, the most notable being the Sierra de la Boca. The Huizachal Anticline plunges to the south and disappears near the Tropic of Cancer. South of the Tropic of Cancer the main range of the Sierra Madre Oriental is formed by the Carabanchel Anticline. This anticline is cut near its northern end by the canyon of the Río Guayalejo and the portion of the anticline to the south of the canyon forms the Sierra de Guatemala. This massive limestone range extends from the Río Guayalejo just west of Llera south to the Chamal–Ocampo road, and in places reaches elevations of over 6000 feet. Southward from Llera the low frontal ranges begin to disappear and at Gómez Farías there is only one ridge separating the Sierra de Guatemala from the coastal plain. Between Gómez Farías and Ocampo the Sierra de Guatemala breaks up into a series of small, comparatively low, north–south ranges, the most notable being the Sierra de El Abra to the east and the Sierra de Nicolás Pérez to the west. Though the ranges of the Sierra Madre Oriental south of Victoria are anticlinal in form there are areas of local structural complications, crumpling and mineralization. The structural relations that caused the pronounced low sections of the Sierra Madre south of the Sierra de Guatemala are not known.

Of great stratigraphic significance is the southward increase in the amount of limestone in the Cretaceous section. In the vicinity of Ciudad Victoria the Cuesta del Cura has been mapped as the upper member of the upper Tamaulipas, as in this area it closely resembles the massive limestones of the upper Tamaulipas. South of the Tropic of Cancer the Cretaceous formations from the base of the Cupido to the top of the Cuesta del Cura have merged to form one formation called, to the west of the reef trend, the El Doctor Limestone. This very thick formation is exposed in the Sierra de Guatemala and over a large area to the south, the type locality being the El Doctor mining district in the vicinity of Zimapán, Hidalgo. This limestone is separated from the Tamaulipas limestone to the east by the El Abra Reef Trend. This reef trend is exposed in the Sierra de El Abra just west of Ciudad Mante and continues northward, passing just east of Gómez Farías, then north–northwest through the Sierra de Guatemala, then along the west flank of the Huizachal Anticline. North of the Sierra de El Abra the reef limestones are not usually mapped as a separate formation (the El Abra Formation) but are included in the El Doctor. Areas to the east (seaward side) of the reef trend are not known to contain large caves, as do the reef and back reef limestones of the El Doctor formation, which are apparently more favorable to solution.

The present mountain landforms represent an essentially structural surface. The soft upper Cretaceous shales were removed soon after the area was uplifted, and mechanical erosion has not been effective on the massive limestones. The relatively rapid lowering of the area surrounding the limestone mountains has concentrated most of the horizontal solution in a zone near the level of the present resurgences. Since early in the history of the ranges, water has tended to descend to near the present base level before traveling horizontally. For this reason there should be relatively few large horizontal passages at high elevations.

SOTANO DE LA JOYA DE SALAS

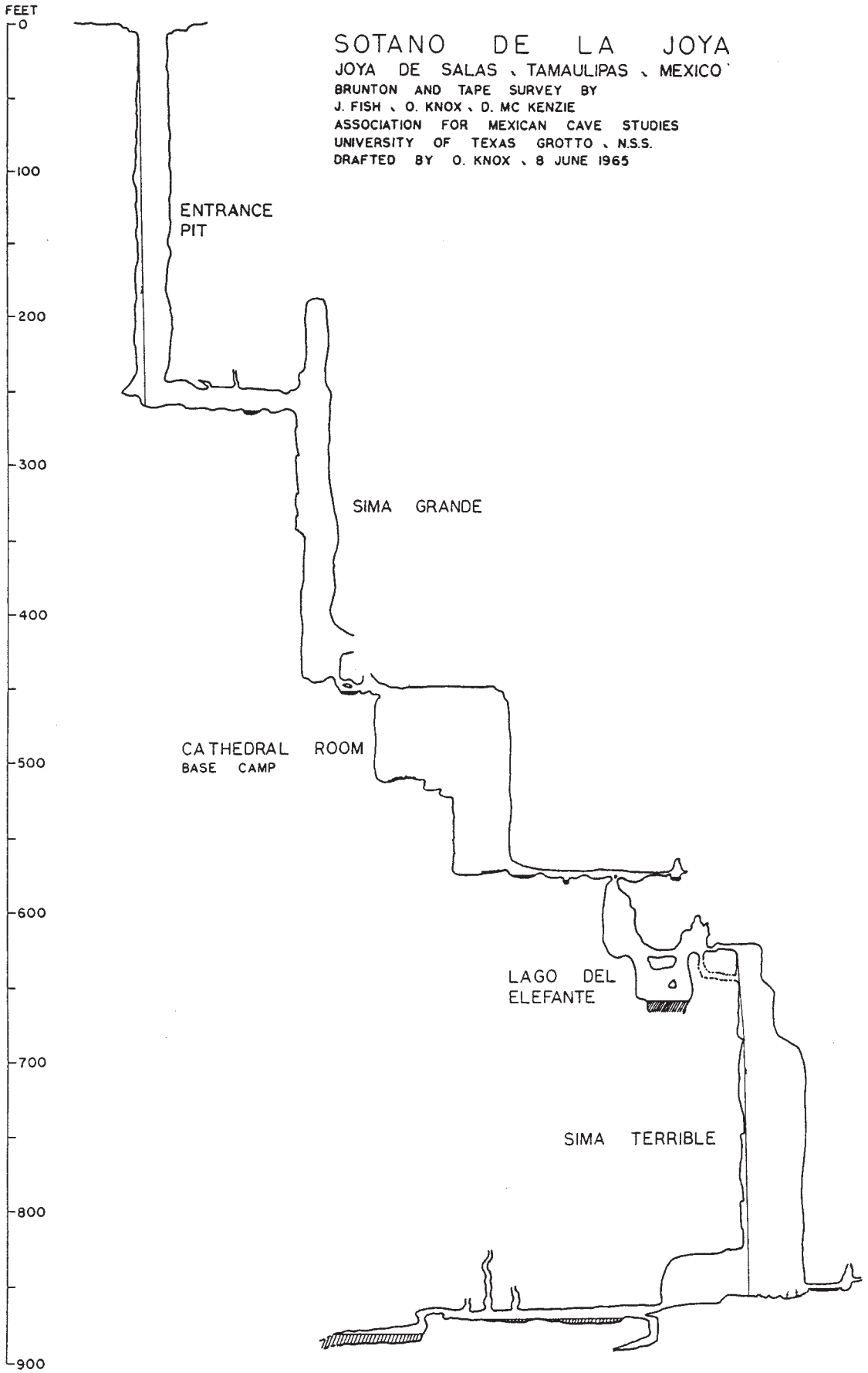
Sótano de la Joya de Salas is located in a closed valley near the town of Joya de Salas at an elevation of approximately 1500 meters. Most of the drainage in the area is subsurface through numerous small sinkholes. The runoff that does occur forms a lake in the lowest part of the valley. Located a short distance from this lake and at a slightly higher elevation is the entrance to Sótano de la Joya de Salas, which in times of heavy rainfall receives overflow from the lake. The entrance is a fissure measuring 115 feet by 24 feet and drops 246 feet to the floor below. At one end of the fissure is a ledge 85 feet down which can be used as an intermediate stop on the descent. The floor at the bottom of the entrance drop is composed of rocks and dirt from the surface. Two passages extend from the bottom of the entrance at right angles to the entrance fissure. One is a narrow, muddy passage that leads to an unchecked drop and the other is a water-scoured passage about 9 feet in diameter. This passage leads about 100 feet to a domepit about 25 feet in diameter and an estimated 270 feet from top to bottom. The passage from the entrance intersects the domepit 177 feet above its base. The walls of this pit, the Sima Grande, are fluted and covered with a thin layer of reddish-brown flowstone. At the bottom a fissure about 15 feet wide leads around a bend to a 6 foot drop into a low, narrow passage. At the end of this passage is a 64 foot drop into the Cathedral Room, a high arched and fluted room about 50 feet long and 15 feet wide. The floor of this room, 525 feet below the entrance, is relatively dry, level, and suitable for camping. At the edge of this room a 12 foot chimney leads to a 40 foot drop into a 120 foot high fissure. Its walls are covered with a thin red flowstone much like that found in the Sima Grande. From this fissure a low crawl near the entrance drop goes for about 60 feet to where it becomes small and barely passable. Across the length of the room is a second passage about 5 feet in diameter which leads for about 100 feet to a small dead-end room. Just before the room are two slots in the floor which drop 79 feet into a lake about 30 feet long and 6 feet wide. This room contains several formations that partly block passage into the next room, a roughly elliptical room with a maximum dimension of about 30 feet. From this room several holes in the floor lead to the Sima Terrible, a pit about 40 feet across and 230 feet deep, with a small ledge 59 feet from the top. At the bottom of this drop is an oval-shaped room and from the upper end of this room a 3 foot in diameter passage extends for about 20 feet to a 60 foot high dome room, and then divides into two small crawlways which narrow to impassibility. From the lower end of the oval room a passage slopes down to a small pit that drops 15 feet to the deepest point yet reached in the cave, 892 feet below the entrance. A trickle of water flows from a small passage into this pit, which ends in a muddy pool. The passage beyond the pit divides, a small unchecked crawl leading ahead and a larger passage leading to the right. This right passage goes beneath three small domes and over and through formations to a short drop into a passage with several feet of water on the floor. This passage has only been entered on a trip in November 1966, soon after the cave had received heavy runoff following a hurricane, and at that time the ceiling of the passage met the water after about 50 feet. Apparently the passage carries much water during floods. It is possible that during dry periods the water level will be low enough to permit further exploration, as this passage is several feet above the lowest explored point in the cave. If the water from this level does not seep into lower levels it might be possible to lower the water level artificially.

The exploration of deep caves located far from the resurgences should provide evidence as to the type of ground water circulation. So far, Sótano de la Joya de Salas appears to indicate that the water descends almost vertically to a level near the level of the resurgences and then flows horizontally. It is possible for Sótano de la Joya de Salas to be over 1000 meters deep, and as the cave has been explored to a depth of only 272 meters, there is still a chance that the cave could intersect several horizontal levels. Not enough work has yet been done in the Sierra de Guatemala to fully determine the types of ground water circulation and speleogenesis.

View of entrance to Sótano de la Joya de Salas. After heavy rains the lake (left center) overflows into the sótano.
Photos by Orion Knox

Passage leading from entrance drop. Note logs wedged in passage.

Sima Terrible, total drop 230 feet.


FEET
0
100
200
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700
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900
SOTANO DE LA JOYA
JOYA DE SALAS , TAMAULIPAS , MEXICO
BRUNTON AND TAPE SURVEY BY
J. FISH , O. KNOX , D. MC KENZIE
ASSOCIATION FOR MEXICAN CAVE STUDIES
UNIVERSITY OF TEXAS GROTTO , N.S.S.
DRAFTED BY O. KNOX , 8 JUNE 1965
ENTRANCE
PIT
SIMA GRANDE
CATHEDRAL ROOM
BASE CAMP
LAGO DEL
ELEFANTE
SIMA TERRIBLE

OTHER CAVES IN THE SIERRA DE GUATEMALA

Caves west of Encino Several small caves have been discovered along the road leading west from Encino. Sótano de Santa María is located 7.7 miles west of Encino just to the left of the road. A vertical shaft about 130 feet deep leads into a small room. A talus slope extends from below the entrance down to the end of the room. The total depth of the cave is about 180 feet. Cave 10.7 miles west of Encino. The entrance to this cave is a sink to the left of the road. From the entrance the cave slopes steeply downward for a distance of 150 feet, reaching a depth of about 80 feet. Several caves are reported near Julilo and a large horizontal cave is reported in the vicinity of Agua Linda.

Caves in the vicinity of Joya de Salas: Sótano de los Pinos is located one-half mile east of the low divide just east of the town of Joya de Salas. The entrance to the pit is about five feet in diameter and is in a shallow arroyo on the flat valley floor. The pit drops 40 feet to a ledge and then drops 40 more feet to a dirt-covered bottom. Cueva de los Leones is a steeply slanting fissure passage near the town of Joya de Salas that has been explored to a depth of about 100 feet.

Sótano de Gómez Farías The entrance to Sótano de Gómez Farías is located in a field on the south side of the road to Gómez Farías just before a sign reading "Bienvenidos a Gómez Farías". The entrance measures 30 feet in diameter and is 50 feet deep. From the bottom of the entrance two shallow pits lead to the first level of the cave. The cave has at least three levels, all of which are interconnected by numerous pits. The first two levels are made up primarily of passages averaging 10 feet high and 15 feet wide which are floored with small breakdown and contain few formations. One exception is a well-decorated room on the first level. This room is approximately 15 feet high, 30 feet wide, and over 100 feet long and contains several large formations as well as a pit that drops over 200 feet to the lowest level. This lower level consists of one main passage, floored with silt, averaging about 10 feet high, 30 feet wide, and 1000 feet long. This passage ends in a small hole at a depth of close to 400 feet. The cave is quite complex with many pits and interconnecting levels and is well worth visiting.

Sótano de El Molino The cave is located in the upper end of the valley that parallels the ridge upon which the town of Gómez Farías is located. To reach the cave follow the trail leading west from the road at the north end of Gómez Farías down into the valley. Near the valley bottom a small arroyo crosses the trail and eventually empties into the sótano. The entrance pit is an oval about 15 feet wide and 30 feet long. It drops about 250 feet to a shallow pool of water which almost covers the bottom. From the edge of the pool a slope leads down about 15 feet over small breakdown to a horizontal passage. This passage averages only 4 feet high and 10 feet wide and continues about 150 feet to where the passage siphons. The floor is composed of a mixture of sand and mud with a large percentage of water; the mixture is almost quicksand. The lower level of this pit is not much higher in elevation than the Nacimiento del Río Frío, the probably emerging point for the water.

Sótano de Harrison The cave is located about one mile north of Rancho del Cielo near the top of a hill. Because of the many intersections and misleading trails in the dense rainforest, a guide is needed. Situated about 25 yards east of a trail (machete marks have been chopped on several trees at this spot) the entrance is surrounded by trees and small plants. This vegetation conceals the entrance but is not thick enough to otherwise hinder the caver. The entrance is about 15 feet in diameter and drops 175 to 200 feet to a very narrow ledge. From this ledge flowstone extends another 200 feet to the bottom of the pit. The bottom is level and is covered with small rocks, possibly thrown in, and there are no leads. Like the entrance, the floor is about 15 feet in diameter. The pit entrance receives no drainage from the surface.

Sotanito de Harrison The entrance to this pit is located about 100 yards south of Sótano de Harrison, and about 25 yards east of the trail. More machete marks indicate the location along the trail. The Sotanito lies on top of the same hill as the Sótano de Harrison. The dense vegetation and limestone outcroppings make the entrance relatively hard to locate. From the 10 foot in diameter entrance the pit drops about 80 feet to a small ledge and then drops another 160 feet to a mud floor. The pit narrows to about 5 feet in diameter at the ledge but soon widens again to 10 feet for the remainder of the way down. There are no leads from the bottom. The pit receives no surface runoff and only insignificant amounts of ground water seepage.

Other caves in the Rancho del Cielo area: There are several small caves in the area. Most of these are shallow and do not exceed 40 feet in depth, with the exception of Harrison Sinkhole which is 180 feet deep. The largest of the caves is Crystal Cave. It has one room 40 feet long, 30 feet wide, and 25 feet high and is filled with intricate speleothems and abundant cave life. Other small caves in this area of mainly biological interest are Wet Cave and Cueva de Rancho del Cielo Núm. 3 and 7.

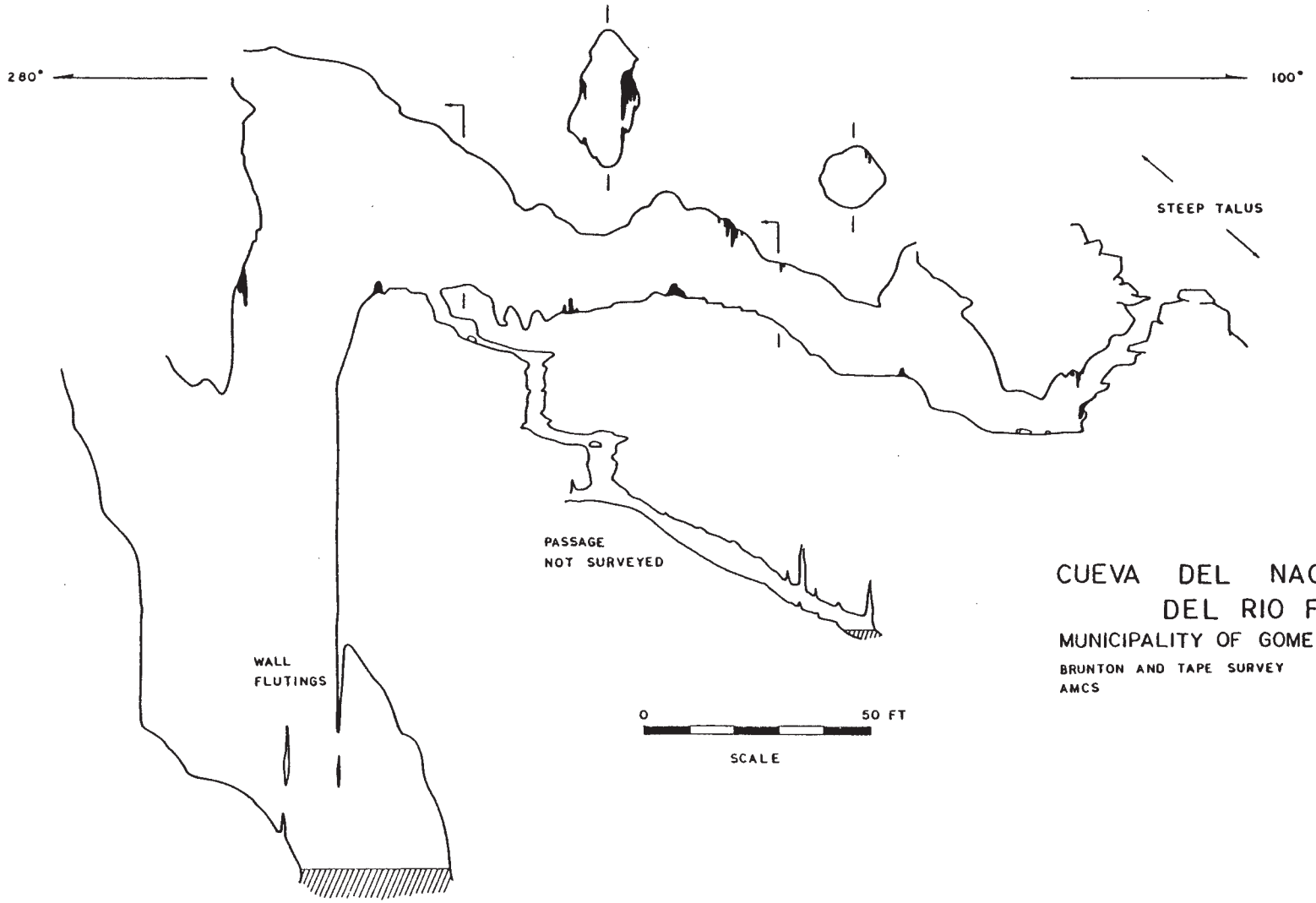
Cueva de El Infierno This cave is large and about a 20 minute walk from San José. The local people frequently visit the cave but vandalism has been minor. The entrance to the cave is about 30 feet wide and 20 feet high, and leads directly into the main room of the cave. This main room is 200 feet across and 80 feet high. From the entrance a breakdown slope leads down to the lowest part of the entrance room where along the left wall there is a large, cold lake with no apparent life. At the far end of the room is a very large flowstone deposit that rises to the ceiling and forms the entire far wall. Around this flowstone to the right are two large passages about 100 feet long. The total length of the cave is close to 500 feet.

Cuevacillas Núm. 1 (Cave on the right) This cave is located to the right of the road from Gómez Farías just past the Cuevacillas saw mill. The entrance leads into a passage about 20 feet high, 40 feet wide and about 200 feet long. The last 100 feet of this passage has a flowstone slope on the right side. This flowstone has almost filled the large room and there is now only 2 to 7 feet of space above the flowstone.

Cuevacillas Núm. 2 (Cave on the left) This cave is located across the road from Cuevacillas Núm. 1. From the entrance a passage leads for about 75 feet to a second entrance. From this point the passages enlarges and turns to the left and continues for about 300 feet. There is much life in the cave, including bats, millipeds, and snails.

Bee Cave This large cave is located in the extreme southern part of the Sierra de Guatemala about 8 kilometers north of the town of Chamal. The road toward the cave is passable for about 4 kilometers by car, and it is possible to drive within 200 yards of the entrance with a four-wheel drive vehicle. The entrance to the cave is a large oval pit about 170 feet by 90 feet. It opens on the side of a low hill and receives no surface drainage. The drop from the edge of the pit to the lowest point on the bottom is about 350 feet, but from the edge to the top of a talus mound is about 280 feet and this drop is broken by several steeply sloping ledges. From the southern edge of the pit a large passage extends south. This passage is about 30 feet high and leads over large mud banks for about 300 feet to a room about 100 feet in diameter and 50 feet in height. At the far end of this room is a small intermittent pool that when full contains blind fish. Blind fish have not previously been noted north of Cueva del Pachón, but the Sierra de El Abra merges with the Sierra de Guatemala with no break that would hinder the migration of the fish. The strata in the vicinity of Bee Cave dip steeply (75°) toward the east along the east flank of the Sierra de Guatemala. The name Bee Cave is used by several English-speaking ranchers who live in the area and it is not known if the cave has a local Spanish name.

Cueva del Nacimiento del Río Frío To reach the small inconspicous entrance to the cave drive southwest from the road to Gómez Farías (see road log) to the large springs at the head of the Río Frío. Cross the stream and follow the dry arroyo and water tunnel upstream to the diversion dam. Then follow the arroyo upstream past several springs to where a dry channel is reached. Keep to the far left of this channel until it ends. The cave entrance is located above the end of the dry channel about half-way up and along the left side of a talus slope. The small entrance to the cave leads down over breakdown for about 30 feet to a dirt floor (see map). From here a slope over flowstone leads through an attractively decorated passage up almost to the level of the entrance. About 150 feet beyond the entrance a small pit is found in the floor, and about 20 feet past this small pit a large domepit is encountered. This last pit is about 40 feet in diameter and drops 130 feet to a deep lake. The most distinctive thing about this pit is that one wall is deeply fluted forming thin, knife-like projections that extend from the cave wall for several feet. The smaller pit was at first not large enough to enter, but excavation uncovered a small passage leading down over slopes and small drops to a shallow pool. This passage contains very fine, well-sorted sand and is marked by deep, sliver-like flutings. The cave is an attractive cave, not having been entered before being discovered by AMCS members, and visitors are urged not to attract local people to the cave as they do not have any conservation policy.



CUEVA DEL NACIMIENTO DEL RIO FRIO

MUNICIPALITY OF GOMEZ FARIAS, TAMPS.

BRUNTON AND TAPE SURVEY APRIL 18, 1965

AMCS

CAVE BIOLOGY OF THE SIERRA DE GUATEMALA

The fauna of the caves of the Sierra de Guatemala is very poorly known, with few caves having been adequately sampled and only a small percentage of species known having been described. With few exceptions the fauna in the area is most closely allied to that of the Xilitla region. Both areas are closely related geologically and both are higher mountain regions with temperate climates and high rainfall. Most of the genera containing troglobites which are present in the Sierra de Guatemala are also present in the Xilitla region, but with specific differences. These two regions are thus distinct from the dry desert regions of northern Mexico and the lowland Sierra de El Abra. The Sierra de Guatemala is particularly interesting in that caves have been sampled from an elevation of 150 m. on the eastern side of the range to the top of the range at 2000 m. to about 1100 m. on the western side. This allows us an opportunity to determine the influence which surface fauna has on the composition of the total cave fauna.

Although only one aquatic troglobite is known in this region, the terrestrial fauna is very rich in troglobites. Blind fish (Anoptichthys sp.) have been found in Bee Cave. The terrestrial fauna includes one beetle (Mexisphodrus profundus, known from Sótano de la Joya de Salas and a sinkhole at Rancho del Cielo), one pseudoscorpion (Paravachonium sp., known only from Sótano de Gomez Farías), two true crickets (Paracophus sp. A, known only from Sótano de la Joya de Salas; and Paracophus sp. B, known from Harrison Sinkhole, Cueva del Nacimiento del Río Frío, Sótano de El Molino, and Sótano de los Pinos), and four millipeds (Mexicambala russelli subsp., known from Crystal Cave, Cueva del Nacimiento del Río Frío, Sótano de Gomez Farías, Harrison Sinkhole, Sótano de la Joya de Salas, and Cueva de los Leones; Glomeroides promiscus, described from Sótano de Gomez Farías and Cuevas de Rancho del Cielo n. 3 and n. 7; Sphaeriodesmus sp., known from Crystal Cave, Wet Cave, Sótano de Gomez Farías, and Cuevas de Rancho del Cielo n. 3 and n. 7; and a probable new genus and species, known from Crystal Cave, Wet Cave, Cuevas de Rancho del Cielo n. 3 and n. 7, Sótano de Gomez Farías, Harrison Sinkhole, and Sótano de El Molino). Still unidentified are troglobitic isopods, diplurans, and collembolans. Of the above genera, all except Paravachonium and Anoptichthys are represented by distinct species (or subspecies in the case of Mexicambala russelli) in the caves of the Xilitla region. The only members of the area to be also represented by troglobites in the El Abra range are Paravachonium and Anoptichthys; a troglobitic species of Paravachonium has been described from Grutas de Quintero, while an unidentified species of Anoptichthys has been taken in Bee Cave.

As is to be expected, the troglophilic fauna is somewhat more closely related to other areas than are the troglobites. Space will only allow mention of a few of the more obvious examples, but many other examples could also be used to demonstrate these similarities. The staphylinid beetle, Belonuchus sp. nr. moquinus, is a common troglophile in Texas caves and has also been found in northern Mexico. It may reach its southern range limit here. An undescribed species of the spider genus Leptoneta has been taken in Wet Cave; this genus is represented by troglobitic members in Texas and by a possible troglophile in Grutas de Villa de García. The large spiders of the genus Ctenus are also found in Texas and northern Mexico as well as in caves of the Sierra de Guatemala and Sierra de El Abra. The spider genera Modisimus and Metagonia are also present in this region, as well as in other parts of Mexico. A new species of the spider genus Psilochorus has been taken in Cueva del Río Frío. This genus is frequently found in caves of western Mexico and the western Plateau, but has not been found in either the Sierra de El Abra or the Xilitla region. The cricket species, Paracophus apterus, is a common troglophile in caves of the Sierra de Guatemala, and is also found in the Sierra de El Abra and the Xilitla region. An undescribed genus and species of the milliped family Stylodesmidae has been taken in the two lower elevation caves, Sótano de Gomez

Farías and Cueva del Río Frío. A second species of the same genus is known from caves of the Sierra de El Abra.

In the caves near the top of the range and on the western slopes crickets of the subfamily Rhaphidophorinae appear. This is an undescribed genus and species representative of a group of allied species inhabiting caves of the Mexican Plateau and northern Mexico, but which is apparently absent from the Sierra de El Abra and Xilitla region. It does appear west of Xilitla in an area not covered by this report. This is a group most frequently found in drier situations and its appearance in these caves reflects the drier nature of the western slopes of the mountains.

In summary, this area is interesting in demonstrating the northern limit of several genera present in the caves of the Xilitla region. It is also interesting to note that, although species are found at elevations as low as or lower than in the El Abra range and with tropical surface vegetation and fauna, the same species are present as appear in the caves at higher elevations. It is presumed that these ranges result from invasion via subsurface routes from the higher caves. It is generally believed that true terrestrial troglobites occur only rarely, if at all, in tropical areas; although the Sierra de El Abra is not truly tropical, it posseses a reduced terrestrial troglobitic fauna correspondent to its tropical affinities. The appearance of blind fish in Bee Cave is of interest in that it is the most northern locality for the genus. Changes in climate would have been more severe in the higher portions of the Sierra Madre Oriental, giving rise to invasions into the caves by animals already "preadapted" to the cave environment.

PART FOUR

CD. MANTE – CD. VALLES

ROAD LOG: CIUDAD MANTE — CIUDAD VALLES

Southward from Ciudad Mante the Inter-American Highway crosses the plains to the east of the Sierra de El Abra, then climbs through El Abra pass and into a broad valley to the west. The highway follows this valley south to Antiguo Morelos where Highway 80 leads west to El Salto (falls) and, via Huizache junction, to San Luis Potosí. The Inter-American Highway continues south from Antiguo Morelos along the west edge of the Sierra de El Abra into the state of San Luis Potosí and on to Ciudad Valles. From Valles Highway 110 leads east through the Sierra de El Abra to Tampico and Highway 86 leads west across several ranges to San Luis Potosí. The Sierra de El Abra contains some of the longest caves in Mexico, and many of them are easily accessible.

Kilo Post	Total Miles	Partial Miles	
563	00.0	00.0	Ciudad Mante — population 55,000, elevation 272 feet. Commercial center for prosperous farming area. Much of the irrigation water comes from resurgences at the base of the Sierra de El Abra.
561	1.6	1.6	Highway 80 east to Tampico, 151 kilometers or 94 miles. The mountains to the west and southwest are the Sierra de El Abra.
559	2.6	1.0	Canal and road west to Nacimiento (birthplace) del Río Mante. The water that flows from this large spring has been diverted by a dam at Nuevo Veracruz, about one mile east of the spring, and is used to irrigate an extensive area. The river appears to flow from a large underwater cave, and there are two other small caves in the vicinity, a fissure cave just to the south of the underwater entrance, and a medium-sized room about 200 feet above the water level.
550	8.1	5.5	Road right to Quintero and Grutas de Quintero. To reach the cave drive to the center of town and turn left at the sign. The cave is about one mile south of town. Grutas de Quintero is a spacious cave, with several nice formations and is easily traversed except for a shallow pit near the end. A tourist agency has built a stone stairway from the road to the cave.
546	11.1	3.0	Town of El Abra. The highway curves upward and into a pass through the Sierra de El Abra. Several miles to the south the range reaches its highest point, about 450 meters or 1400 feet, and at this point the almost vertical east face drops over 900 feet to the plains below. There are two passes through the Sierra de El Abra, both named El Abra (the mountain pass), and both have towns in them named El Abra. The part of the Sierra de El Abra north of this pass is sometimes called the Sierra de Cucharas.
544	12.1	1.0	El Abra pass and Cueva de El Abra. This pass is the abandoned valley of a stream that at one time crossed the range and drained the large valley to the west. However, arroyos flowing northward into the Río Boquilla could downcut much faster in the soft Méndez Shale and have since captured the drainage. To the north and above the highway just after it enters the pass is the 70 foot high, 60 foot wide entrance to Cueva de El Abra. About 600 feet into the cave the large entrance passage intersects a domepit that drops 89 feet into a lower level and opens to the surface high above. See map on page 67.

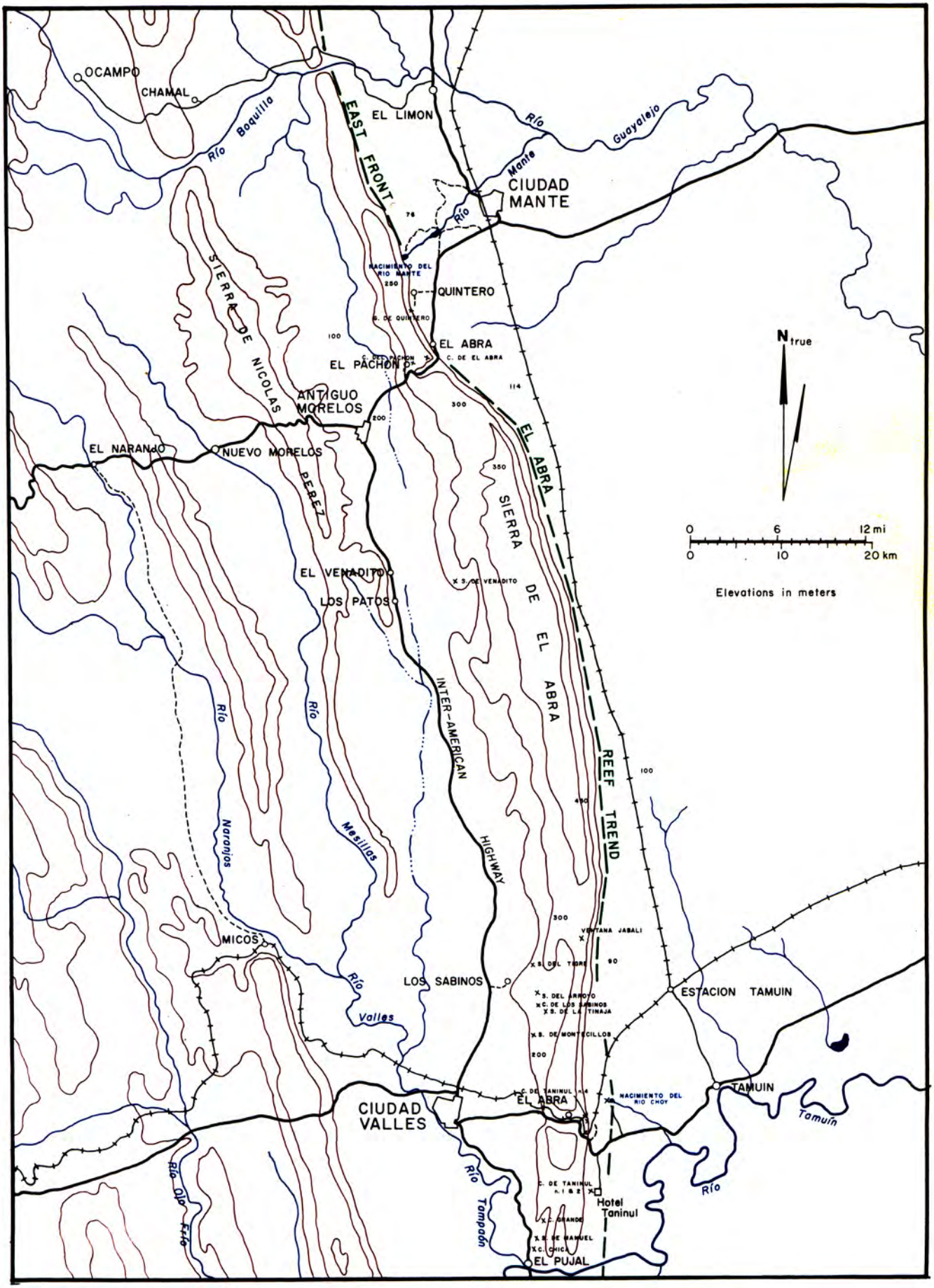
Kilo Post	Total Miles	Partial Miles	
540	14.2	2.1	Road to village of Pachón and Cueva del Pachón. This rough road leads about one mile to the small village of Pachón. Cueva de Pachón is about 100 yards from town and is the type locality for the blind fish Anoptichthys antrobius. The cave is about 900 feet long and contains several large pools (see map). About one mile north of Pachón is Cueva La Florida, a large horizontal cave only partly explored. Also, Sótano de Pachón is located about 2.5 miles northeast of Pachón and is reported to connect with a large stream passage.
538	15.4	1.2	Arroyo El Lagarto (Arroyo Torrencito)
534	18.4	3.0	Antiguo Morelos, elevation 683 feet. Highway 80 leads west to El Salto (falls), Ciudad del Maíz, and Huizache junction. From Antiguo Morelos south the Inter-American Highway follows the valley between the Sierra de El Abra to the east and the Sierra de Nicolás Pérez to the west. The Sierra de El Abra has a steep east-facing slope and a much more gentle westward slope.
530	20.4	2.0	Las Conchas
529	21.3	0.9	El Edén
524	24.6	3.3	Las Flores
520	26.6	2.0	El Venadito. Road east to Sótano de Venadito and Rancho de la Noria. Sótano de Venadito is to the south and downhill from the end of the right fork of the road. The left fork leads to Rancho de la Noria and several pits. Sótano de Venadito is a series of pits that drop about 200 feet to an unexplored drop. About two miles to the south of the village of El Venadito is the San Luis Potosí-Tamaulipas boundary. The area east of the road between El Venadito and Los Sabinos is potentially the best caving area in the Sierra de El Abra
483	49.8	23.2	Arroyo El Limoncito
479	52.2	2.4	Thatched shelter to right of highway and road east to the village of Los Sabinos. Sótano del Arroyo, Sótano del Tigre, Cueva de Los Sabinos, and Cueva Pinta are accessible from this village. Sótano del Arroyo is reached by continuing east through the village of Los Sabinos to the end of the road. A short distance east of the end of the road is an arroyo that drains into Sótano del Arroyo after about one mile. The cave has slightly over one mile of mapped passage with a large downstream passage as yet unexplored. The broad valley to the north and east of Los Sabinos drains into the cave.
476	53.8	1.6	Loma Dura. Road east to Sótano (Cueva) de la Tinaja. To reach Sótano de la Tinaja walk east from cattle pens (at the end of the road) for a short distance to an arroyo that drains into the cave. Over two miles of large passages have been mapped and most of the cave can be explored with only one 40 foot rope. The gate at the highway is usually locked and permission and key must be obtained from Sr. Luis Martínez in Valles.

Kilo Post	Total Miles	Partial Miles	
473	55.1	1.3	Road east to the village of Montecillos. Sótano and Sotanito de Montecillos, both large and only partly explored, are located to the east of this village. The Sotanito has a 110 foot entrance drop that leads into a large system of horizontal passages. The Sótano is located at the end of a large arroyo. The main horizontal passage is reached by a 45 and a 150 foot drop.
467	59.0	3.9	Railroad underpass. Ahead Highway 86 leads west across several limestone mountain ranges to San Luis Potosí. Several large sinkholes are visible from the highway and just east of San Luis Potosí is Valle de los Fantasmos, a high mountain karst area.
465	60.2	1.2	Ciudad Valles, elevation 184 feet. Commercial center of a large farming and ranching area. Just west of the town plaza is the Río Valles. From Ciudad Valles Highway 110 leads east through the Sierra de El Abra to Tamuín and Tampico while the Inter-American Highway continues south toward Tamazunchale.

ROAD LOG: CIUDAD VALLES – TANINUL – TAMUIN – VENTANA JABALI

0	0.0	0.0	Road log begins at Highway 110 and Highway 85 intersection just south of Ciudad Valles. Proceed east on Highway 110.
8	4.7	4.7	Village of San Felipe, type locality of the San Felipe Formation. Ahead the road crosses the Sierra de El Abra through the El Abra Pass. The pass through the Sierra de El Abra between Antiguo Morelos and Ciudad Mante is also called the El Abra Pass, and to prevent confusion the pass east of Valles will be referred as the Valles Pass.
9	5.8	1.1	Village of El Abra, altitude 574 feet. The quarry is the type locality of the El Abra Formation. Here a back reef lime mud facies is exposed.
10	6.1	0.3	Quarry of Ferrocarriles Nacionales to left. Here the highway crosses the approximate crest of the El Abra Anticline and the bedding is almost horizontal.
12	7.7	1.6	Quarry, elevation 509 feet. Much of the limestone in this area is composed of material that once formed the centers of the reef masses.
13	8.3	0.6	Exposure of a reef center. On the north side of the pass is the Taninul Tunnel which has been cut through limestone that once formed a reef core. A trail about 300 feet west of the tunnel leads to Cueva de Taninul n. 4. This cave is about 500 feet long and can be explored without artificial light, as there are at least 10 skylight entrances. A pit is located across the pass from the cave.

Kilo Post	Total Miles	Partial Miles	
14	8.5	0.2	Side road north to Quarry. Along this road are exposures of what appear to be San Felipe Formation overlain by El Abra. This relation indicates a possible fault along the east face of the range. As large faults do not appear to be present elsewhere, this relationship should be more closely examined.
14	8.8	0.3	Road right to Hotel Taninul. Directly behind the hotel is Cueva de Taninul n. 1. The entrance room of this cave has been converted into a dance floor and bar. Just north of Cueva de Taninul n. 1 is Cueva de Taninul n. 2 which has been explored to a fissure that stopped exploration about 200 feet from the entrance.
15	9.2	0.4	Private road north to Nacimiento del Río Choy. This road leads north 2.2 miles to the large cave spring at the head of the Río Choy. The river flows from a passage 25 feet high and 30 feet wide that reportedly soon syphons. The cave is in a private resort operated by Hotel Taninul and permission to enter should be obtained from the Hotel.
35	21.0	11.8	Town of Tamuín. Highway 110 ahead leads east to Tampico. Side road leads north 6.2 miles to Estación Tamuín and then on to Ventana Jabalí. To reach Ventana Jabalí continue north from the Estación, following the dirt road beside the unused railroad track until the large oval entrance of the cave is visible. Soon a side road will be encountered which will lead to the base of the range and a trail up to the cave. Ventana Jabalí is a single large solution tunnel 1200 feet long and containing several skylights, the highest dropping free for 503 feet into the center of the passage. Further to the north the entrance to Cueva de la Ceiba and several others can be seen from the road, but these caves remain unexplored.


OCAMPO
CHAMAL
Río Boquillo
EAST FRONT
EL LIMON
Río Guayalejo
Río Mante
CIUDAD MANTE
Río
NACIMIENTO DEL RIO MANTE
250
QUINTERO
S. DE QUINTERO
100
EL ABRA
C. DE EL ABRA
EL PACHON
C. DEL PACHON
SIERRA DE NICOLAS PEREZ
ANTIGUO MORELOS
200
300
114
EL ABRA REEF TREND
EL NARANJO
NUEVO MORELOS
350
SIERRA DE EL ABRA
EL VENADITO
S. DE VENADITO
LOS PATOS
INTER-AMERICAN HIGHWAY
Río Naranjos
Río Mesillas
100
490
300
VENTANA JABALI
S. DEL TIGRE
90
MICOS
LOS SABINOS
S. DEL ARROYO
C. DE LOS SABINOS
S. DE LA TINAJA
ESTACION TAMUIN
Río Valles
S. DE MONTECILLOS
200
C. DE TANINUL
EL ABRA
NACIMIENTO DEL RIO CHOY
TAMUIN
Tamuín
CIUDAD VALLES
Río Tampaón
C. DE TANINUL
Hotel Taninul
Río
Río Olo Frío
C. GRANDE
S. DE MANUEL
C. CHICA
EL PUJAL
N true
0 6 12 mi
0 10 20 km
Elevations in meters

GEOLOGY OF THE SIERRA DE EL ABRA

The Sierra de El Abra is a cuesta-like range of mountains extending in a generally north-south direction from northwest of Ciudad Mante to southeast of Ciudad Valles. To the north the range merges with the Sierra de Guatemala while to the south it gradually declines, disappearing just east of El Pujal. The west side of the range slopes gently toward the wide valley that separates it from the Sierra de Nicolás Pérez, but to the east an almost vertical escarpment, in places over 900 feet high, drops sharply to the coastal plain. The highest part of the range, along the San Luis Potosí-Tamazunchale border is slightly over 1480 feet in elevation, while the plain just below is at less than 300 feet. The Sierra de El Abra is about 75 miles long and from 2 to 10 miles wide.

Structurally the range appears to be an asymmetrical, elongate anticline, as the rocks dip gently to the west and steeply to the east away from the crest of the range. However, the uplift due to this anticline is not enough to account for the present topographic prominence, and some geologists have postulated a fault along the steep east face. It seems more likely that most of the relief not accounted for by uplift is due to the removal of the surrounding soft shales and marls away from a large body of resistant limestone. The limestones of the Sierra de El Abra represent a reef deposit that at one time stood several hundred feet above the sea floor to the east. Later the low areas around the reef were filled with shale and other poorly-resistant sediments. Following the uplift of the area the removal of this soft sediment left the range in its present elevated position.

The thick massive reef limestones exposed in the Sierra de El Abra have been named the El Abra Limestone after the outcrops in the El Abra pass east of Ciudad Valles. This reef limestone was not deposited as one large solid mass, but as a large number of individual shell reefs that existed at different times and localities. These reefs were from 20 to 150 feet thick and several hundred yards long. The reefs along with reef debris and interreef lime mud formed a complex that has been called a 'calcareous bank'. The El Abra Limestone represents one of the largest of these banks and one that contains a relatively large amount of reef material. Many other reefs and limestone banks existed along and to the west of the El Abra Reef Trend, but these either contain less reef material or are too small to be mapped individually and are included in the El Doctor Limestone. To the east or seaward from the El Abra reef is the Tamaulipas Limestone that was deposited at the same time as the El Abra Limestone but in deeper water. To the west the El Abra Limestone merges with the El Doctor Limestone. The El Abra Limestone is also exposed in the Tantobal Dome, a broad uplift immediately to the south of the Sierra de El Abra.

The El Abra Limestone was deposited during approximately the middle third of the Cretaceous and after the end of the El Abra deposition shales and marly limestone of the San Felipe Formation were deposited against, but not over, the reef deposits. Then during the late Cretaceous a thick sequence of shales and marls was deposited in the area surrounding the El Abra reef, but these formations only thinly covered the reef. The El Abra reef has been exposed to chemical weathering for long periods of time and has not been subjected to the physical and chemical effects of deep burial.

During the late Cretaceous and early Tertiary orogenic movements related to the Laramide Orogeny downwarped the areas west and east of the reef, while the entire area underwent several hundred feet of uplift. These movements cracked and fractured the limestone, and when post-Tertiary erosion exposed the El Abra Limestone, ground water was able to enter along these joints. This limestone proved to be particularly susceptible to solution, probably due more to the lack of adverse changes that accompany deep burial than to an increase of porosity by Cretaceous solution. As more of the surrounding material was removed surface drainage on the limestone disappeared and erosion is at present mainly chemical.

CAVES OF THE SIERRA DE EL ABRA

INTRODUCTION

The Sierra de El Abra is a narrow limestone mountain range that contains some of the longest, most interesting, and complex caves in Mexico. Although the range rises almost vertically from the coastal plain to the east, the caves remain relatively accessible because the west side is much less steep. The floor of the valley to the west is only three to four hundred feet below the crest of the highest part of the range. Through this valley runs the Inter-American Highway. It parallels the main section of the range and provides access to the caves by means of rough but passable side roads. Though the Sierra de El Abra is one of the most studied of the Mexican cave areas, a large amount of work still remains to be done. Most of the range has not been investigated, including the promising high area along the San Luis Potosí-Tamaulipas border. It is likely that caves in this area will reach depths of around 1000 feet.

The city of Valles receives about 30 inches of rainfall a year, most of it during the summer months. The higher parts of the range probably receive slightly more rainfall. The average temperature is about 76 degrees. Only during infrequent northers does the temperature drop below freezing. The rainfall is enough to support a dense growth of brush at the lower levels which becomes almost impenetrable at the higher elevations. The dense vegetation and the effects of solution have almost eliminated surface runoff from most of the range. It is estimated that 1155 million cubic meters of water flow yearly from springs at the base of the range.

The caves of the Sierra de El Abra appear to have formed in two stages. The first stage was of phreatic solution during which ground water velocities were low. Two types of caves developed under these conditions: large rooms in especially favorable areas and long linear passages that were apparently phreatic conduits. These two types grade into each other. For example, some of the large voids developed where a phreatic conduit crossed an easily dissolved area, but most of these voids were apparently not connected by large passages. Ventana Jabalí and Cueva de El Abra are examples of this type of solution. Grutas de Quintero appear to be a phreatic tunnel. The second stage of cavern development occurred when arroyos invaded the, in general, poorly connected phreatic voids. The main effect of this invasion was the integration of the voids into large systems. This integration is effective both above and below the water table. Caves such as Sótano del Arroyo, Tinaja, and Venadito probably represent several poorly connected phreatic voids that have been combined. There are probably many caves in the Sierra de El Abra that could not be integrated and these caves will have been filled with sediment. In many areas caves reach their maximum length while at or near the water table and the development of surface valleys and formations tends to fragment these cave systems. In the Sierra de El Abra, as in many karst areas, the water table is not a stable surface. Most of the caves in the lower part of the range near the village of Los Sabinos appear to fill completely with water after heavy rains. In effect, the water table rises several hundred feet. This type of rapid fluctuation of the water table appears to be common in areas of internal drainage.

The Sierra de El Abra, with its miles of easily accessible cave passage, provides a natural laboratory to study the effects of the invasion of surface water, as well as ground water movement and cavern development in general. The study of the caves of this region could result in the more efficient use of the ground water, both by providing means for the underground storage of water until it is needed for irrigation and by providing sources of water for irrigation and livestock in areas where it is now not available.

Nacimiento del Río Mante

The Río Mante flows from beneath a cliff at the base of the Sierra de El Abra about 4 miles west of Ciudad Mante. The Nacimiento is a popular picnic and swimming area and can be reached by following the signs from the highway south of Mante. A large cavern system must be present to supply the amount of water that flows from this spring. Unfortunately this water flows from a completely water filled passage. The water level has been raised by a dam used to divert the Río Mante into irrigation canals, but it does not appear that the cave could have been entered before the dam was constructed as the water at the entrance is only a few feet deep.

A small cave on the south side of the Nacimiento is developed along a prominent joint. The cave is a high, partially breakdown-filled fissure about 300 feet long. About 50 feet from the entrance a skylight opens to the surface. Several pits on back in the cave lead to deep water. The cave appears to be inhabited at times by bats.

Cueva de los Fósiles

This cave, located about one mile southwest of the Nacimiento del Río Mante, has an entrance room about 100 feet long from which large amounts of fill have been removed. Near the end of this room a passage leads to the left for about 150 feet. At the end of this passage is a high skylight.

Another small cave exists about one-half mile from the Nacimiento del Río Mante. This cave is a small, steeply sloping, breakdown-floored passage that ends in a syphon after about 100 feet.

Grutas de Quintero

Grutas de Quintero are located a mile south of the town of Quintero. Signs point the way to the cave and stone steps have been built from the road up to the mouth of the cave. The cave is entered through a passage about 5 feet wide and 6 feet high. This soon opens into a large tunnel 30 feet wide and 20 feet high. About 50 feet from the entrance two small passages to the right lead into a high fissure that forms a loop and connects back into the main passage. About 150 feet from the entrance there is a succession of large travertine dams and flowstone slopes. One hundred feet beyond the travertine dams is a skylight. A short distance beyond the skylight the cave turns sharply to the northwest for about 300 feet to where the passage turns west. Ahead at this point a passage leads down to an alcove, at the end of which it is possible to climb over ten foot high travertine dams filled with water. The passage continues beyond this point but has not been explored. After turning west the main passage extends about 200 feet to where a second alcove to the right leads down to an area of lakes which have not been explored. From this second alcove the main passage leads up into a large room about 150 feet long, 50 feet wide, and 40 feet high. A sloping passage on the right leads to a large lake, while a passage on the left leads up to a dead end. A notable formation, a white stalagmite about 15 feet high and 10 feet in diameter is located in this room. The main passage from the room extends for about 800 feet to a somewhat smaller, mud-floored passage that ends in a 40 foot pit. The portion of the cave before the pit is frequently visited and has suffered from heavy traffic and the thoughtless acts of some of the visitors. Beyond the pit the passage narrows to an average size of about 15 feet wide and 10 feet high and continues for an estimated 2000 feet. From the large room on to the end of the cave much mud and water is encountered.

Cueva de El Abra

This frequently visited cave is located just above the Inter-American Highway at kilometer post 544, and to the northbound traffic the 70 foot high by 60 foot wide entrance provides an impressive sight. From this large opening on the steep north side of the El Abra Pass the passage increases in height until it is about 140 feet high. At this point, 600 feet from the entrance, a domepit intersects the passage. This shaft extends downward from the surface and was triangulated to be about 245 feet above the floor of the entrance passage. From this passage an 89 foot drop leads to the bottom of the domepit and the lower section of the cave. This lower section is a high fissure parallel to the entrance passage and extending in both directions from the domepit. To the northwest the passage leads steeply up over a flowstone slope and continues for about 200 feet. Several large and beautiful formations are encountered at the top of the flowstone slope but the last 100 feet of the passage is floored with dry, dusty guano. The other half of this lower section of the cave, to the southeast of the domepit, slopes steeply down over loose breakdown blocks. At the bottom of this slope the deepest point in the cave is reached in a dirt-floored room, 389 feet below the entrance. Total length of the cave is 1460 feet.

Cueva del Pachón

The entrance to this cave is located on the western side of the Sierra de El Abra a short distance uphill from the village of Pachón. The cave measures 20 feet wide and 8 feet high at the entrance, but quickly enlarges to an average height of 15 feet and a width of 30 feet. The passage continues for 600 feet before ending. There are only a few minor side passages. Most of the cave floor is covered with black soil, apparently washed in. Just before the end of the cave is a lake, 140 feet long and over 6 feet deep. At the far end of the lake a mud slope leads up into the terminal room of the cave.

Sótano del Pachón

Sótano del Pachón is located about 3 miles north of Pachón. This pit has not been entered by AMCS members but is reported to be about 50 feet in diameter at the entrance and about 150 feet in depth. Mexican exploration groups have also reported a large river that can be reached by following a passage from the base of the pit.

Cuevacita del Pachón

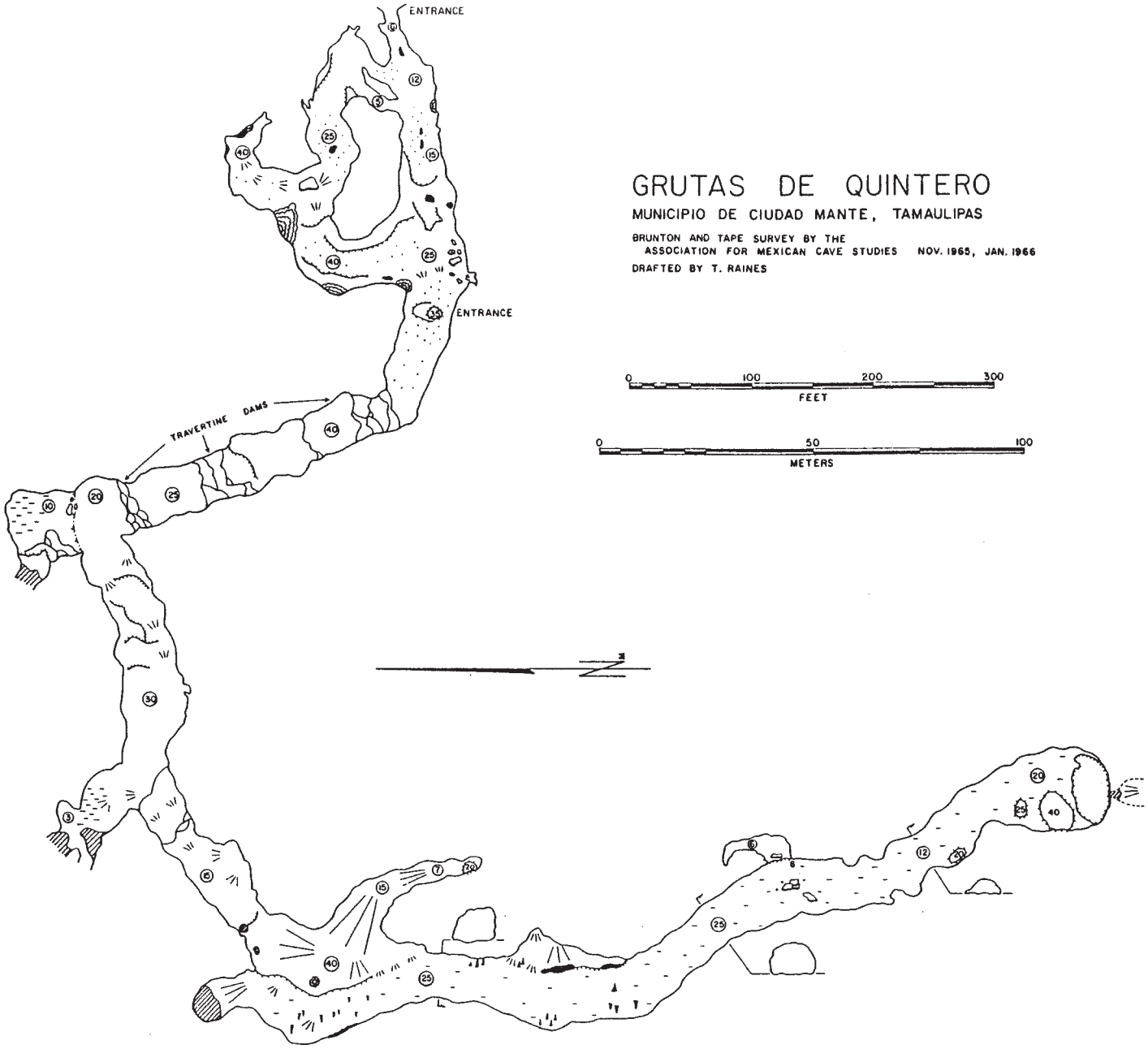
This small cave is located about two miles from Pachón along the road. The cave is about 250 feet long and is primarily of biological interest.

Cueva La Florida

This large cave is located about one mile north of Pachón. The entrance is about ten feet by ten feet, and the passage immediately splits into two apparently separate systems. This cave is only partly explored and has an estimated mile of large passage with ceiling heights in places of 75 feet. The cave has several levels and appears to be an essentially unmodified phreatic cave, as no water enters through the entrance.

Sótano de la Noria

This complex pit is located about one mile north of the ranch house at Rancho de la Noria. The entrance to the pit is an irregular hole about five feet in diameter at the end of a shallow draw that carries runoff from the surrounding fields. The entrance drops 20 feet to a ledge, where another 20 foot drop leads to a natural bridge. The pit beneath the bridge leads to a high fissure, the end of which is blocked by debris. Total depth is about 120 feet. Considerable time would be required to clear the fissure.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MUNICIPIO DE CIUDAD MANTE, TAMAULIPAS
BRUNTON AND TAPE SURVEY BY THE
ASSOCIATION FOR MEXICAN CAVE STUDIES NOV. 1965, JAN. 1966
DRAFTED BY T. RAINES
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METERS

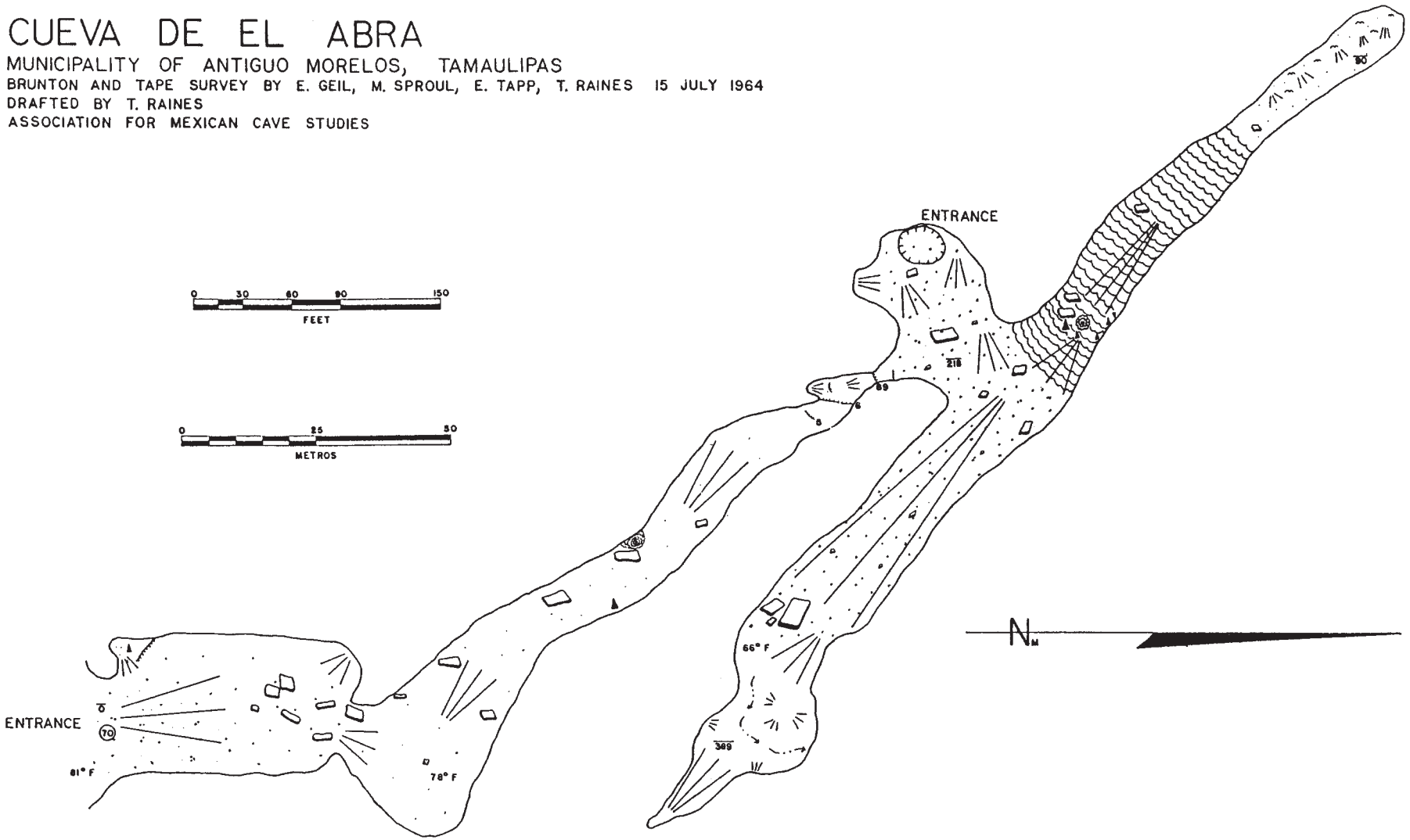
CUEVA DE EL ABRA

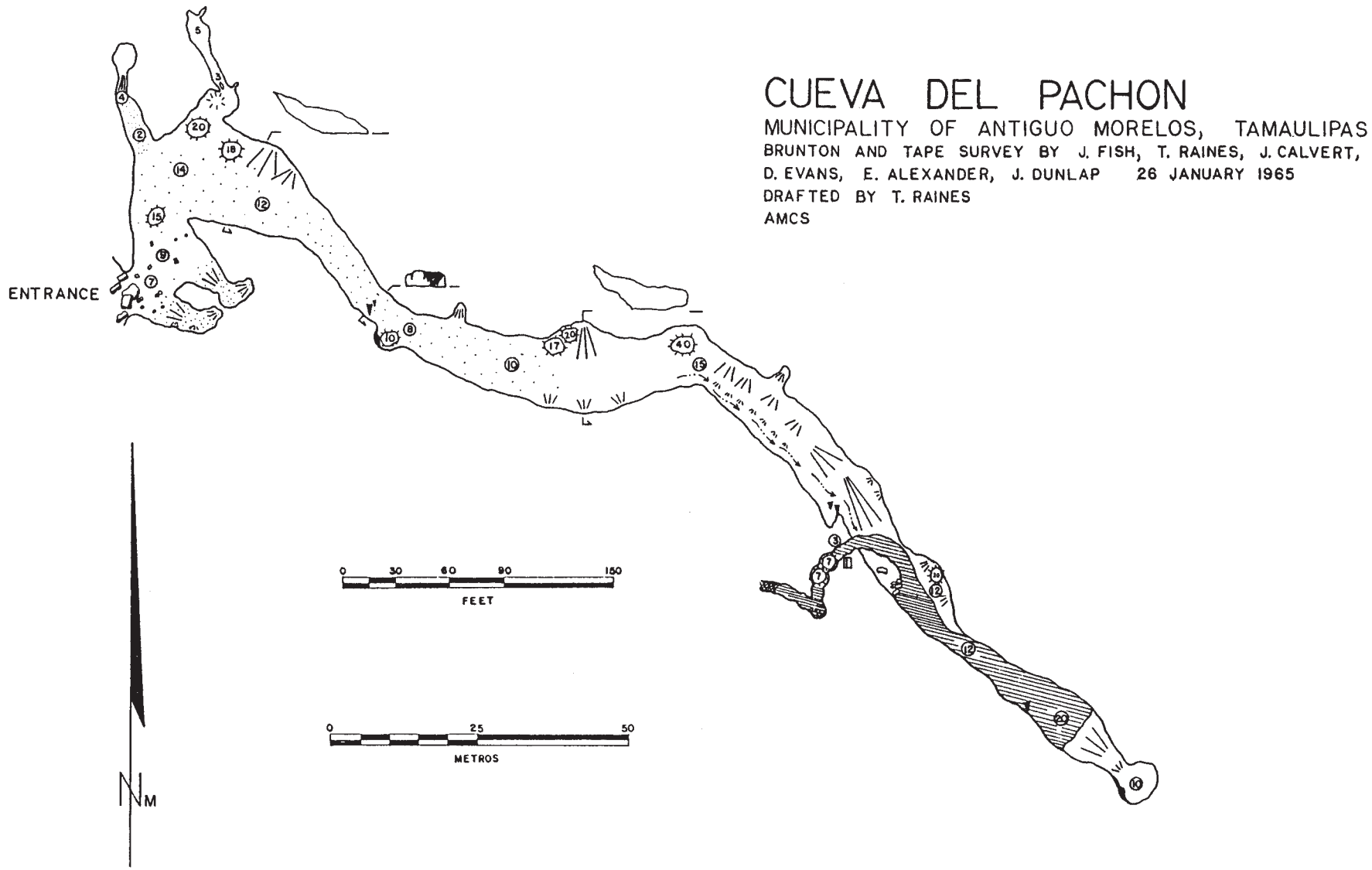
MUNICIPALITY OF ANTIGUO MORELOS, TAMAULIPAS

BRUNTON AND TAPE SURVEY BY E. GEIL, M. SPROUL, E. TAPP, T. RAINES 15 JULY 1964

DRAFTED BY T. RAINES

ASSOCIATION FOR MEXICAN CAVE STUDIES




CUEVA DEL PACHON
MUNICIPALITY OF ANTIGUO MORELOS, TAMAULIPAS
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D. EVANS, E. ALEXANDER, J. DUNLAP 26 JANUARY 1965
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Sótano de Venadito

Like many of the caves in the Sierra de El Abra the entrance to this cave is located at the end of an arroyo and receives much runoff after heavy rains. The pit entrance measures 20 by 40 feet and drops 152 feet with a ledge at the 49 foot level. At the bottom are several large, deep plunge pools. Just beyond the entrance the passage divides, one passage being a 7 foot in diameter tube that cuts back sharply to the left, while the other is a larger passage, 15 feet wide and 20 feet high, that continues ahead. About 200 feet from the entrance down this large passage a flowstone-lined pit is encountered. The pit is 100 feet deep and has no passages leading from the bottom. Following the tube passage from the entrance, it divides after about 200 feet. The right branch leads up to a 50 foot high dome where it ends. The left branch leads to a 60 foot pit. Beyond this pit the passage again divides. The left passage circles back to the 100 foot flowstone-lined pit, entering the pit at a lower level than the large passage from the entrance. The right passage from the 60 foot pit carries much flood water and averages 25 feet high and 8 feet wide. After only a few hundred feet a 40 foot pit is encountered, the walls and bottom of which are quite muddy. At the pit's bottom a stagnant pool almost forms a siphon. But the passage continues past the pool for several hundred more feet to a drop estimated to be 50 feet deep and at which point exploration stopped because of lack of equipment. Estimated distances in the cave were: total explored length about 2000 feet and depth from entrance to top of last pit between 300 and 350 feet.

Sótano del Tigre

This sótano is located about 4 kilometers by road and trail northeast of Los Sabinos. It has been entered only once by AMCS members, and also it is reported to have been entered by the president of the Municipio de Ciudad Valles who found it unsuitable as a source of water. The entrance is located at the end of a canyon not as large as those entering Sótano del Arroyo or Tinaja, but still providing an impressive approach. The entrance drop is sheer, with dimensions averaging 50 by 25 feet, and drops 190 feet to a plunge pool. A short offset leads to a 110 foot drop into a high gallery trending perpendicular to the arroyo. Just opposite the drop, a scoured, tube-like passage averaging only 5 feet high extends about 200 feet to an unentered domepit perhaps 60 feet deep. The main gallery leads north from the entrance, for about 300 feet to an 80 foot drop into a large domepit that also remains unexplored.

Cueva de Los Sabinos

The entrance to Cueva de Los Sabinos is located about 4 kilometers east of the village of Los Sabinos at an elevation of about 560 feet. This cave has not been visited by AMCS members, the information in this report obtained from a description and map published by the American Museum of Natural History. The entrance to the cave is about 100 feet high and 50 feet wide and leads into a room about 200 feet long and up to 100 feet wide. From this room a large passage extends north and east for about 200 feet. Southwest from the entrance room a 20 by 20 foot passage leads for 200 feet to a 110 foot drop at the bottom of which is a passage of the same size and direction. After 100 feet this passage enlarges to form a series of rooms that extend for 500 feet to where the passage appears to end in a pool. Two hundred feet from the drop there is another passage leading to the southeast that soon turns and leads back almost under the entrance. This passage is about 20 feet wide and high with much of the floor being covered by deep pools. From near the entrance this passage turns north after 500 feet and drops 50 feet into a room. The passage leading from this room is at an elevation of 235 feet which is 325 feet below the entrance and very near the level of the resumidero at Taninul. The passage at this level is very nearly filled with water and the total length of the passages mapped by the Museum was about 3000 feet. The purpose of the Museum's visit to the cave was to investigate the biology, especially the blind fish.

Sótano del Arroyo

The entrance to this sótano is located about three miles east of the Inter-American Highway southeast of the village of Los Sabinos. The cave can be reached by traveling east from Los Sabinos for about one mile and then following the normally dry arroyo south to the cave. Near Los Sabinos the arroyo has low dirt banks, but before it reaches the cave the arroyo has cut deeply into solid rock. The entrance is a rectangular slot almost 200 feet deep except on the north end where the arroyo drops 60 feet to the main level of the cave. Two passages lead from the entrance. Thirty feet above the floor and below the arroyo a passage averaging about 8 feet in diameter goes west for about 800 feet to where it is almost blocked by flowstone. Water appears to enter this passage during floods, indicating that flood water must almost fill the entrance area. The main passage leaves the south end of the entrance slot and continues for about 1000 feet to a 50 foot drop. This section of the cave averages about 20 feet wide and 30 feet high and shows signs of violent flooding. About 500 feet from the entrance a right branch, the Water Passage, leads from the base of a small drop behind a curtain of formations. This passage extends for about 200 feet to a right turn through a small hole into a deep lake. This lake is about 200 feet long with 3 to 4 feet of clearance. At the end of the lake the passage goes over a series of travertine dams and drops into a larger passage that extends for an estimated 1500 feet to where it reduces to a small crawlway.

The first drop in the main passage, 50 feet, leads over polished limestone into a larger section of the cave. From the base of the drop a passage 30 feet wide and 60 feet high extends to a large triangular room about 200 feet on a side. The room slopes steeply downward to where the main passage enters a lake. Across the lake is a low section of passage with only a few feet of air space. This passage then enlarges and leads to a drop of about 30 feet into a second lake. A passage appears to lead from the base of the drop but it has not been checked.

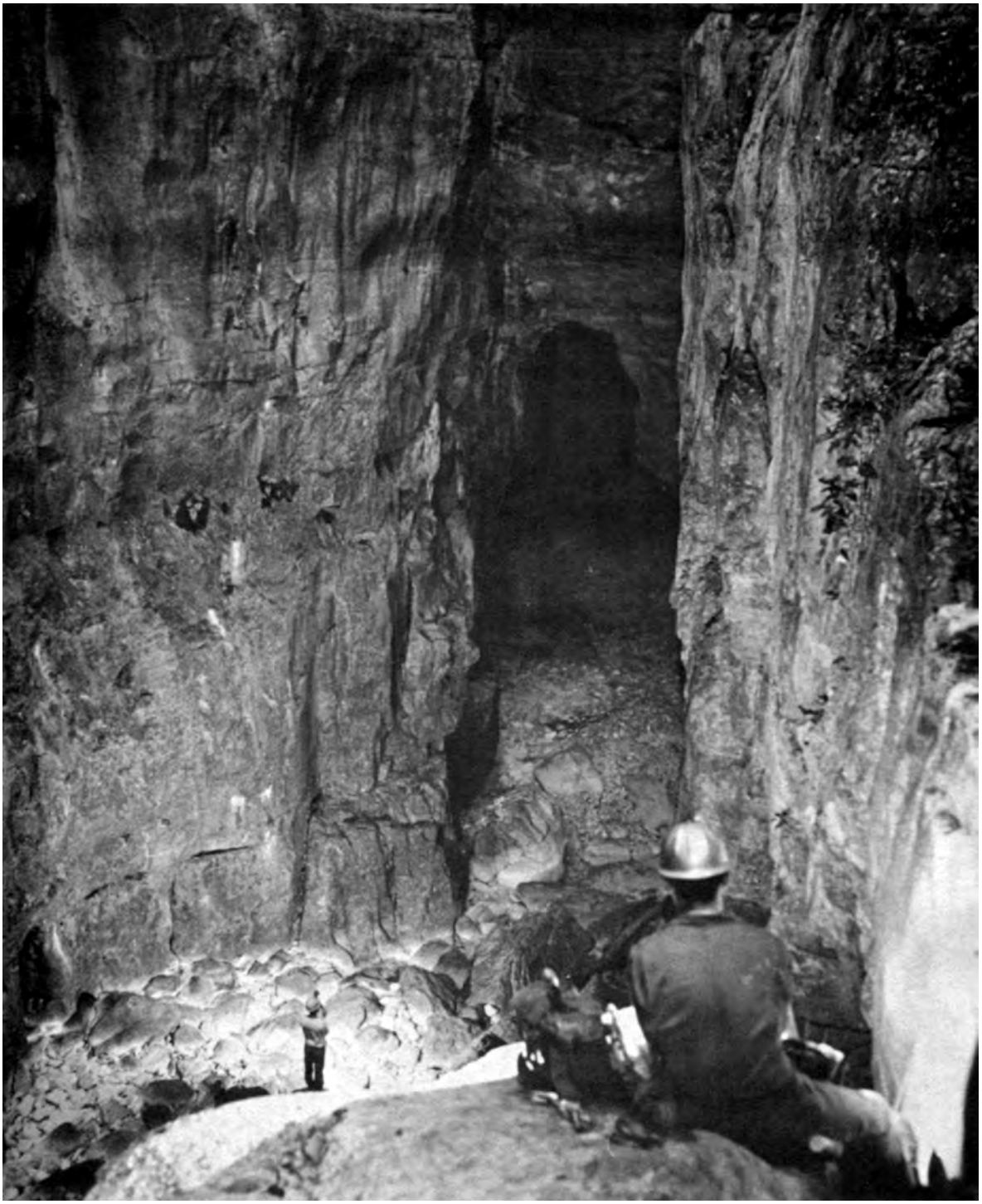
There is another passage that leads north from the base of the drop just before the triangular room. This passage leads up a slope to the level of the entrance passage, makes a right turn, and continues averaging 15 feet wide and 10 feet high. By making a right turn and climbing through formations it is possible to reach a room about 10 feet high and 100 feet in diameter. From this room a passage 10 feet high and 20 feet wide leads for 300 feet to a lake that forms the end of the passage. This cave is one of the best known of the large caves of the Sierra de El Abra, with over one mile of surveyed passage. The cave appears to flood about every two years after exceptionally heavy rains.

Sótano (Cueva) de la Tinaja

Sótano de la Tinaja is approached by following a canyon-like arroyo to its end where the surrounding walls are nearly 200 feet high. The drops in the arroyo into the cave are climbable. A descending passage extends east from the entrance and averages 30 feet wide and 15 feet high. Five hundred feet from the entrance it abruptly enlarges and attains widths and heights exceeding 75 feet. The floor consists of large smooth boulders often covered with slippery vampire bat guano. This passage contains a deep lake that can be bypassed and just beyond the lake, 1826 feet from the entrance, is an unclimbable 27 foot drop. The cave had been mapped to this point by the zoologists from the American Museum of Natural History in 1947.

Beyond the drop the 25 foot wide, 50 foot high, Sandy-floored Passage leads to the northwest, while the east-trending entrance passage becomes high and narrow and appears to be blocked by flowstone about 360 feet from the 27 foot drop. There is a narrow side passage up on this flowstone that leads to a pit from which no leads are presently known.

The Sandy-floored Passage continues a few hundred feet to the main intersection. Previous to this intersection is the stoopway entrance to

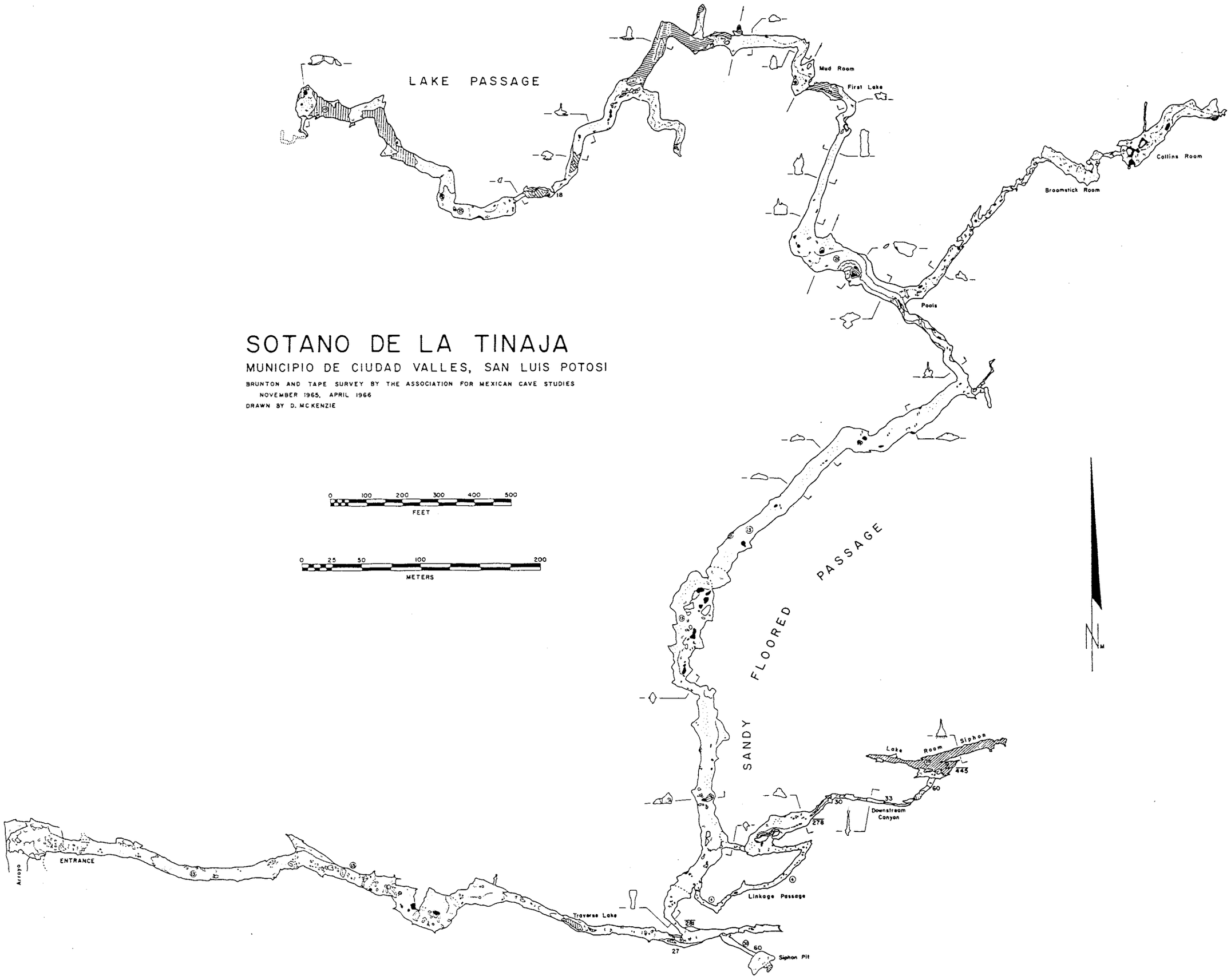


The entrance of Sótano del Arroyo.
Photo by Mills Tandy

SOTANO DE LA TINAJA

MUNICIPIO DE CIUDAD VALLES, SAN LUIS POTOSI

BRUNTON AND TAPE SURVEY BY THE ASSOCIATION FOR MEXICAN CAVE STUDIES
NOVEMBER 1965, APRIL 1966
DRAWN BY D. MCKENZIE



Entrance passage in Sótano del Arroyo. Note log vertically wedged by flood waters. Photo by Orion Knox

Passage in Sótano de Montecillos. Photo by Don Erickson

Sandy-floored Passage in Sótano de la Tinaja. Photo by David McKenzie

the 500 foot long linkage passage, some parts of which are attractively decorated. At the main intersection the large Sandy-floored Passage continues to the north, while to the east a narrow passage through formations soon reaches a room to which the Linkage Passage connects. This passage continues east several hundred feet to a 30 foot drop. The muddy debris-covered floor indicates that it is a major course for flood water. This passage descends rapidly beyond the first 30 foot drop. It is very high and usually less than 10 feet wide at the bottom. The passage ends at a 60 foot drop into a lake that is oriented at right angles to the passage. This lake room is about 350 feet long, 30 feet wide, and 100 feet high with no passages known to lead from the room. The level of the lake is 445 feet below the entrance which is about the level of the Nacimiento del Río Choy.

Extending north from the junction, the Sandy-floored passage constitutes the largest and most spectacular portion of the cave. This broad, meandering gallery, commonly 50 feet wide and 25 feet high, has been followed for about 4000 feet. The floor is a stream bed, usually dry, with many sand and gravel bars forming undulations. Large columns and flowstone deposits are numerous and often quite colorful. About 2000 feet from the intersection is a narrow section of the passage with deep travertine pools. Here a side passage has been explored through a series of rooms for about 600 feet. About 1000 feet beyond the pools a lake is encountered which is about 200 feet long and 40 feet wide. The main passage continues an additional 1000 feet to another lake where progress is made difficult by a broad natural bridge. Just beyond these lakes the main passage comes into a room with a pool of water and an apparent upper level passage. This upper level soon ends.

Another major passage is a relatively obscure passage extending northwestward from a point 150 feet from the cave entrance. Its approach is through a 100 foot long slot, with the passage dropping down through large boulders at the end. The passage continues as a low, 40 foot wide crawl over smooth rocks, but soon shallow pools of water and mud are encountered. There are noticeable air currents in this passage and much of the arroyo's water appears to flow through the passage. This system of small crawlways and pits has been explored for about 2000 feet, with all large leads having been checked. Over 13,300 feet of the cave have been surveyed, making it the longest known cave in the Sierra de El Abra.

Sotanito de Montecillos

The entrance to this cave is located in the floor of the arroyo that flows into Sótano de Montecillos. This entrance, 1260 feet upstream from the Sótano, is a vertical well about 110 feet deep. The 8 by 5 foot opening is partially covered by a thick limestone slab. From the bottom of the bell-shaped shaft a high irregular passage averaging 15 feet wide and dropping occasionally leads to the south. After about 300 feet a cross-passage is reached. To the right it extends to an unexplored water crawl. But to the left, past a large flowstone curtain, is the passage through which the flood-water is directed. It is a large meandering stream channel averaging 20 feet by 20 feet with several high domes. The cross-sections are interesting, as in places a narrow slot has been cut into the floor. The passage meanders so greatly that in one place a cutoff has formed. One can bypass a loop by climbing through a hole in the thin passage wall. This passage was explored to a lake where flotation gear was necessary. The passage was still large at this point.

Back near the main intersection a steep climb on flowstone leads to a small side passage directed north. This shortly opens into a large irregular gallery containing formations. The passage descends fairly rapidly, soon reaching a depth well below that of the water channel. Further exploration of this cave should find a connection with the Sótano de Montecillos.

Sótano de Montecillos

Typical of many of the large caves in this area, the entrance to Sótano de Montecillos is situated at the end of a large arroyo. Just before the entrance the arroyo drops over a 20 foot climbable drop and then drops 45 feet into the cave. The entrance pit is about 75 feet wide and 50 feet across, with the east wall rising about 150 feet above the arroyo. There are two passages leading from the bottom of the entrance drop. The flood water follows a passage 20 feet wide and 45 feet high that goes eastward for about 100 feet to a 140 foot drop. Directly across from this passage a 25 foot high and 30 foot wide passage leads back under the arroyo. This passage remains large for about 200 feet. It then becomes much smaller, the width being 10 feet and the height varying from 5 to 10 feet. This passage has been explored past a low area for 400 feet to a water crawl. From the bottom of the 140 foot pit a passage about 30 feet wide and 15 feet high leads northwest. This passage has been explored for about 300 feet through several large pools and continues beyond the end of exploration. The entrance to Sotanito de Montecillos is 94 feet above the entrance to the Sótano, making the main passage level in the Sotanito slightly above the level of the upper passages in the Sótano, an indication of the possibility of a connection.

Ventana Jabalí

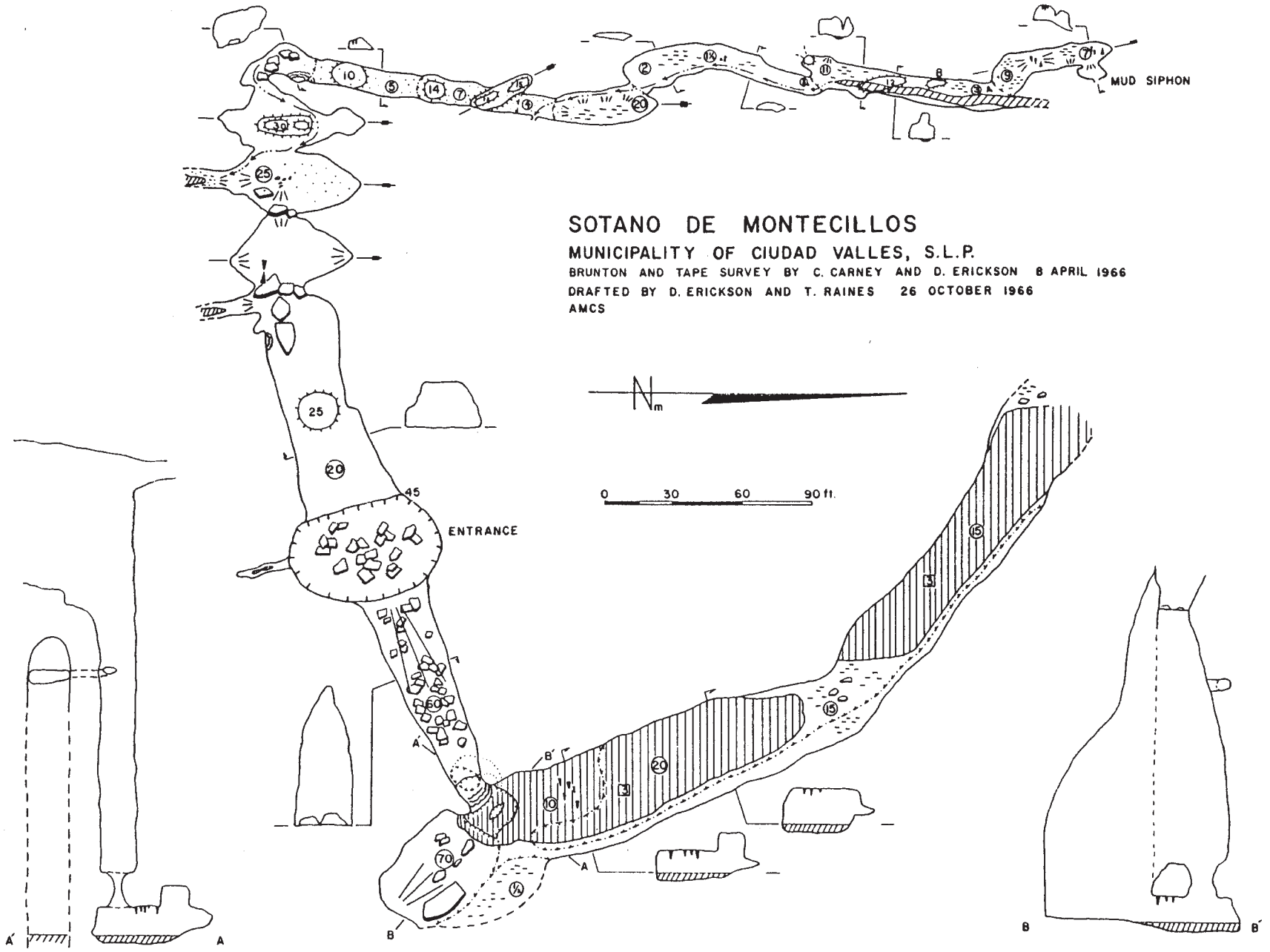
The large oval entrance of Ventana Jabalí becomes clearly visible as one drives north of the Tamuín railroad station along an unused track that parallels the eastern face of the Sierra de El Abra. Situated one-third of the way below the crest of the range, the cave is approached by a narrow road that zig-zags up to the cave. The road once facilitated the mining of nitrates from the cave but is now overgrown and hardly recognizable.

The cave consists of a single 1200 foot long solution tunnel whose outstanding features are its large dimensions and spectacular skylights. At floor level the passage is from 40 to 90 feet wide and the ceiling, when visible, allows for only crude estimations of its height. Broad arches extend to below 150 feet, but the passage is commonly much higher. At one point the ceiling soars to two skylights measured at 503 feet above the floor. The floor area throughout has been altered by mining operations and marks of previous levels on the walls indicate that a very large amount of fill has been removed. While perhaps conforming to the anticlinal structure of the range, the floor undergoes a rise of 170 feet. Toward the end of the cave is a peculiar limestone partition of solutional origin. A small hole in this 20 foot high wall gives access to a 50 foot in diameter room with the ceiling well out of sight.

There are at least five skylight entrances to the cave. Besides the two mentioned which are 500 feet from the entrance, there is a faint light visible another 300 feet beyond. Though very high, this entrance would not allow for an entirely free drop. The others are about 130 feet high and situated only a short distance within the cave.

Nacimiento del Río Choy (Nacimiento de Taninul)

This large resurgence is developed as an attraction for guests of Hotel Taninul. The Río Choy swiftly emerges from a passage 25 feet high above the water and 30 feet wide. The water is 10 to 15 feet deep. A walk constructed above the water ends at a small balcony slightly within the mouth. From here a series of small rapids is visible. These rapids are illuminated by a 170 foot high skylight. The passage beyond appears high but the attendant at the hotel implied that it soon siphoned. The cave is not to be confused with Cueva del Nacimiento del Río Coy, a cave 20 miles south of Ciudad Valles, near Rincón Grande.


MUD SIPHON
SOTANO DE MONTECILLOS
MUNICIPALITY OF CIUDAD VALLES, S.L.P.
BRUNTON AND TAPE SURVEY BY C. CARNEY AND D. ERICKSON 8 APRIL 1966
DRAFTED BY D. ERICKSON AND T. RAINES 26 OCTOBER 1966
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ENTRANCE
A
A'
B
B'

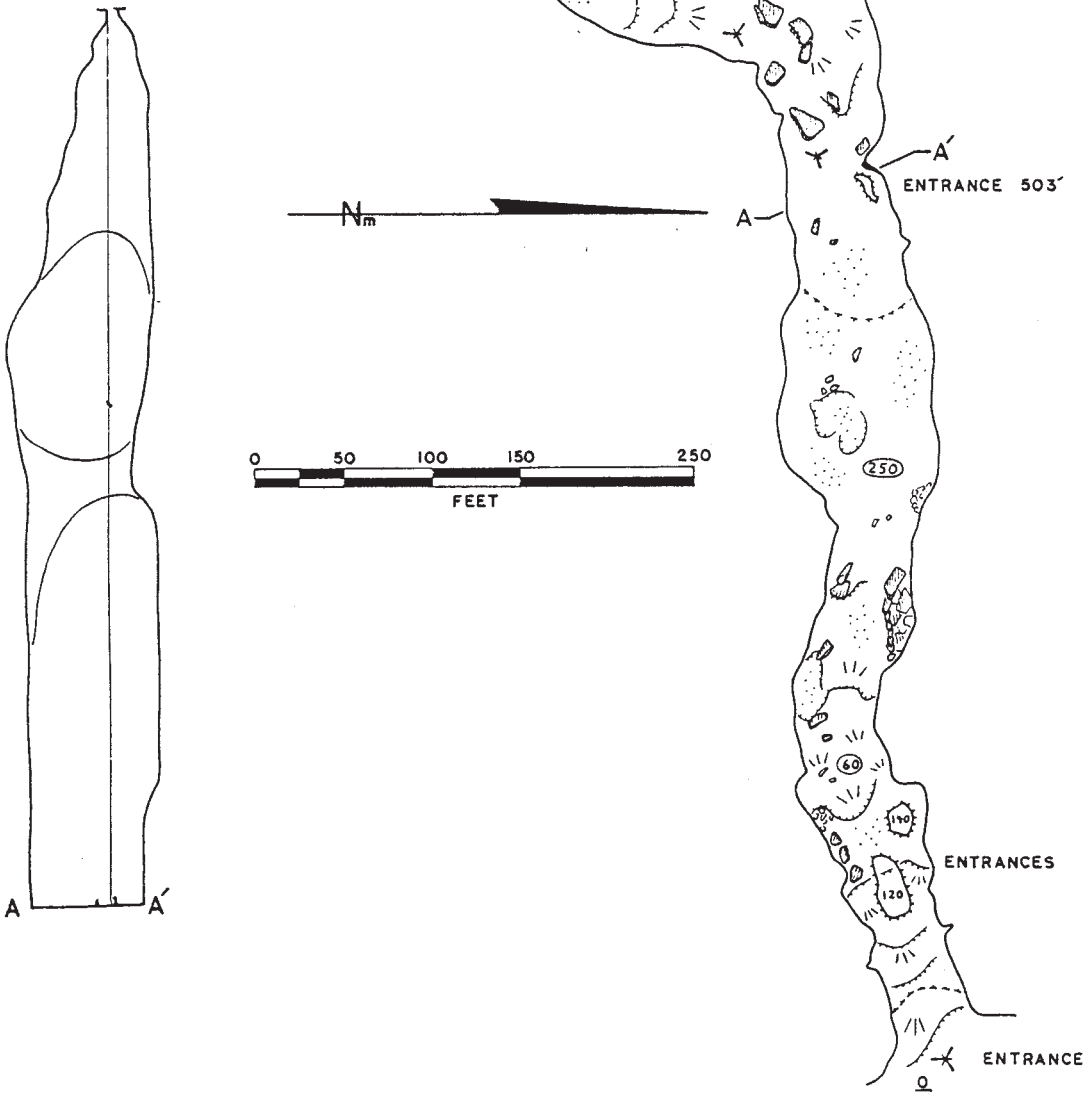
VENTANA JABALI

MUNICIPALITY OF TAMUIN, S.L.P.

BRUNTON AND TAPE SURVEY BY T. RAINES, B. BELL, D. MCKENZIE APRIL 1964

DRAWN BY D. MCKENZIE

AMCS



Cueva de Taninul n. 4

The main entrance to this cave can be seen from the Ciudad Valles–Tampico highway near the east end of the Valles Pass. The entrance is situated about 300 feet west of a railroad tunnel and 75 feet above the track. The cave is frequently visited and there are steps that extend up the slope. In addition to the three cliff entrances there are at least nine skylights that illuminate the cave passage. They are well distributed and the 500 foot long cave can be explored without artificial light. The passage of the cave is generally 10 to 15 feet high and as much as 60 feet wide. The flat silt floors are free of breakdown except at the entrances.

Cueva de Taninul n. 2

The small sink entrance to this cave is located about 300 feet north of Taninul n. 1 and 250 feet above the foot of the abrupt hillside. The cave consists of two passages that intersect near the entrance. The larger passage trends north, parallel to the contour of the hillside, and is generally 15 feet high and wide. This passage continues north to an 8 foot wide slot in the floor that must be bridged to continue exploration. A narrow fissure extends west from near the entrance and requires a handline to enter. The floors of this cave are of dry silt. Dr. F. Bonet recorded a 23.0° C temperature and a 69% relative humidity.

Cueva de Taninul n. 1

This cave is situated directly behind the Hotel Taninul and only a few feet from a swimming pool fed by a nearby sulfur spring. The entrance room has been converted into a dance floor with tables and a bar. A 12 foot high natural bridge accomodates a bandstand. The unaltered portion of the cave begins 150 feet from the entrance where an upper level leads to a constriction covered by a wire gate. By crawling underneath one can continue west for about 300 feet through a narrow, irregular passage that finally becomes too small to follow. Dr. F. Bonet records a late November temperature of 26.6° C and a relative humidity of 96%.

Cueva Grande

This is the larger of the caves in the lower portion of the Sierra de El Abra to the south of the Valles Pass. It is located about 5 kilometers north–northeast of the small town of El Pujal. The 25 foot wide by 15 foot high entrance is situated in a steep, brush covered slope and is difficult to locate without a guide. A talus slope extends from the entrance to a 40 foot wide by 150 foot long entrance room with a crawlway leading from its end. The left wall of this room is a partition that divides the cave into two major parts.

The crawlway from the end of the entrance room is an elliptical solution tube whose major trend is eastward. It often enlarges to stoopway dimensions or greater and there are occasional domes and small rooms that contain bats. The rock floor is quite damp, but other than a scattering of guano there is little or no fill. The air in this section is often uncomfortably warm, and the measurement by Dr. Bonet of a temperature of 25° C and a relative humidity of 91% was probably made in this section.

The passage leading north from the cave entrance is large and well ventilated. Two skylights exist near the middle of this passage, and several large aerial roots extend 60 feet to the floor. Initially this passage is wide and irregular with a few large flowstone formations, but eventually it becomes fissure–like, being up to 50 feet high and 10 feet or less in width. A 30 foot drop over flowstone requires a handline to descend, and the passage soon ends in a breakdown fill.

Sótano de Manuel

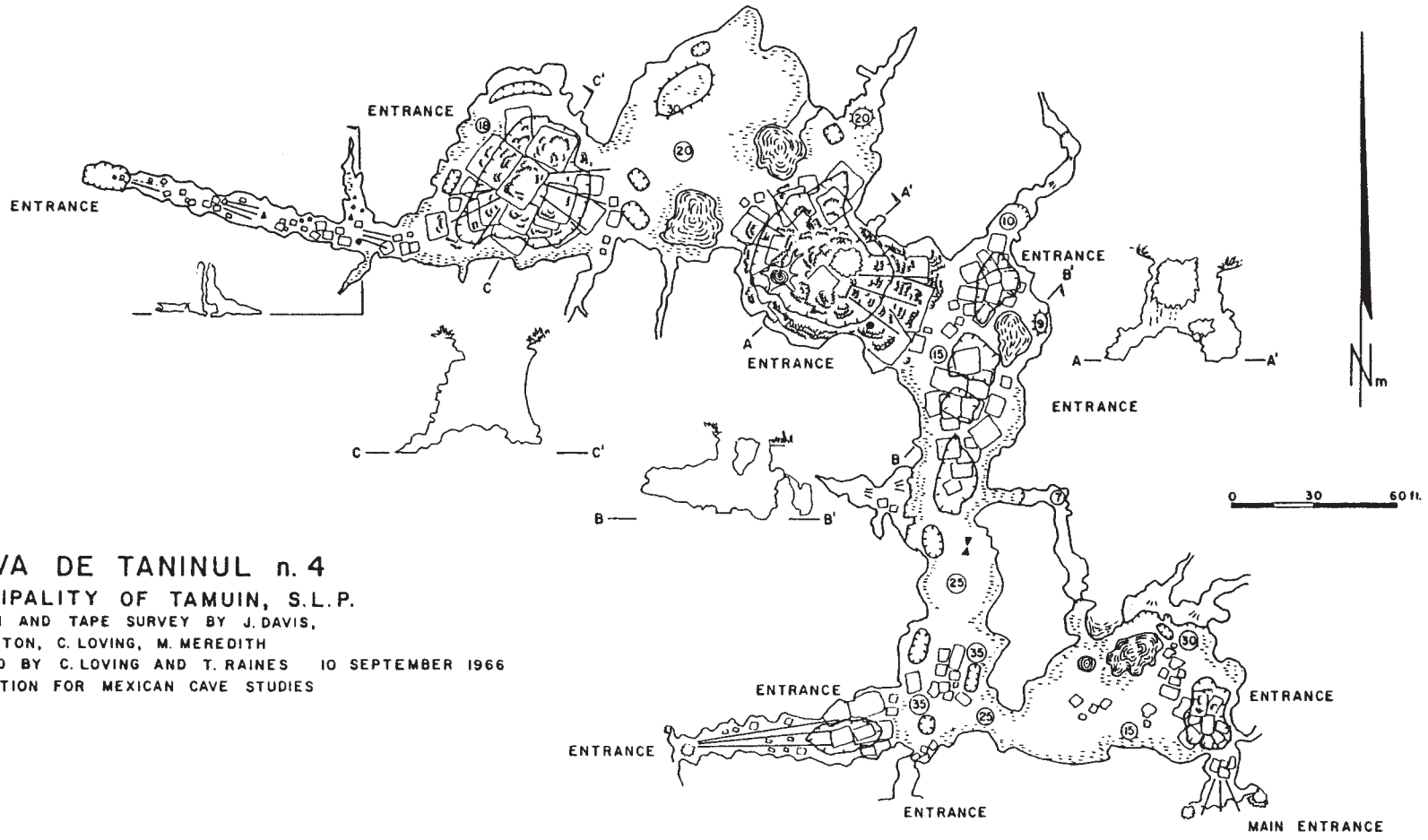
Near El Pujal, the lower cultivated areas adjoining the escarpment of the Sierra de El Abra are characterized by scattered sinks and depressions. This cave, visited because of its proximity to Cueva Chica, is one of many small caves that doubtless exist in the area. It is situated within the shallow, indistinct course of an arroyo which winds south to eventually enter Cueva Chica, about 2 kilometers distant. Although locally termed a sótano, the 15 foot sink entrance is easily climbable, and the two passages which total approximately 1000 feet never exceed a depth of about 35 feet.

From the 10 foot by 25 foot entrance room the most obvious lead extends to the east as a silt-floored crawl and stoopway sometimes reaching 15 feet to 20 feet in width. The passage terminates in fill from an apparent surface sink. At the north end of the entrance room, a hole in the breakdown floor enters a small crawlway which, in an irregular fashion, leads to the larger portion of the cave. This sinuous gallery features a few dry flowstone deposits and several attractive domes.

Cueva Chica

Cueva Chica is certainly the best known of the many small caves in the vicinity of El Pujal. Located about one-half kilometer from the Inter-American Highway, it serves as a water source. A gasoline engine installed 300 feet within the cave is used to pump water from a deep, permanent pool.

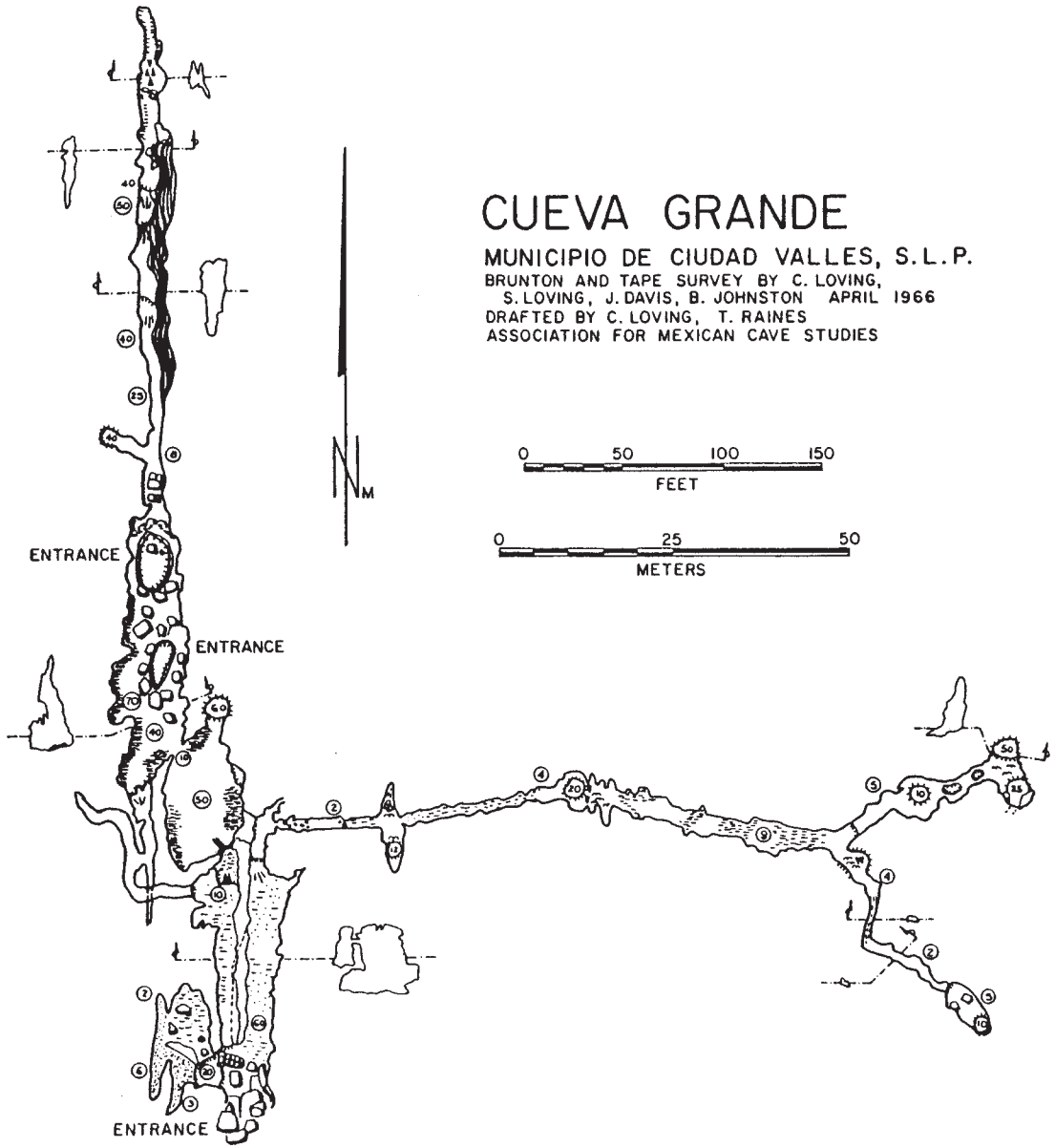
The 20 foot wide by 4 foot high entrance receives the drainage of a shallow but lengthy arroyo. The cave is irregular at first, with large rocks covering the floor. Trending south, it soon becomes 25 feet wide by 10 feet high with a scoured rock floor. At 350 feet from the entrance is the first deep pool that must be crossed. Beyond, the passage narrows and increases in ceiling height. At the foot of a 75 foot long series of travertine pools is a second deep pool, about 50 feet long, 30 feet wide, and 10 to 15 feet deep. Beyond this pool is a narrow 60 foot high dome inhabited by bats. From this dome a low arch leads into the terminal room, a 40 foot in diamter dome above the siphon pool. Total length of the cave is about 750 feet. Few Mexican caves have received attention such as that given to Cueva Chica. The discovery of the blind fish Anoptichthys jordani in this cave inspired much additional collecting and these collections have received a rich fauna.



CUEVA DE TANINUL n. 4

MUNICIPALITY OF TAMUIN, S.L.P.

BRUNTON AND TAPE SURVEY BY J. DAVIS,
B. JOHNSTON, C. LOVING, M. MEREDITH
DRAFTED BY C. LOVING AND T. RAINES 10 SEPTEMBER 1966
ASSOCIATION FOR MEXICAN CAVE STUDIES


CUEVA GRANDE
MUNICIPIO DE CIUDAD VALLES, S.L.P.
BRUNTON AND TAPE SURVEY BY C. LOVING,
S. LOVING, J. DAVIS, B. JOHNSTON APRIL 1966
DRAFTED BY C. LOVING, T. RAINES
ASSOCIATION FOR MEXICAN CAVE STUDIES
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CAVE BIOLOGY OF THE SIERRA DE EL ABRA

The Sierra de El Abra is unique among the regions under discussion in this bulletin in its possession of a rich troglobitic aquatic fauna. Only in the Yucatan Peninsula is the Mexican cave fauna of a comparable interest. Terrestrial troglobites, on the other hand, are rare and lack the variety of the Sierra de Guatemala or the Xilitla region.

Only two unquestionably troglobitic terrestrial species have been found in the Sierra de El Abra. One is an isopod, Protrichoniscus bridgesi, which has been collected in Sótano del Arroyo, Sótano del Tigre, Sótano de la Tinaja, Cueva de Los Sabinos, Cueva Chica, Ventana Jabalí, Cueva del Pachón, and Grutas de Quintero. This genus of isopod ranges north into Texas and south to Veracruz. The second terrestrial troglobite is a small trichopetalid milliped, Mexiterpes sabinus, known only from Sótano del Arroyo. This rare species is known only by two specimens. The family is otherwise unknown in Mexico, but has numerous cave representatives in the United States. Possible troglobites include the small whip-scorpion, Schizomus sp., known from several caves in the area; the dipluran, Campodea (Campodea) chica, known only from Cueva Chica; and undescribed thysanurans of the family Nicoletiidae.

The aquatic troglobites are of great interest for zoogeographic and evolutionary reasons. Included among these are three species of blind fish (Anoptichthys jordani, known only from Cueva Chica; A. hubbsi, known only from Cueva de Los Sabinos; and A. antrobius, known only from Cueva del Pachón). Blind fish have also been found in Sótano de la Tinaja, Sótano del Tigre, Sótano de Montecillos, and Bee Cave. Because of considerable confusion in the taxonomic position of these fish it is impractical to assign these to a given species. These fish have been the subject of intensive study by Charles Breder and his co-workers over a period of thirty years. They appear to interbreed with the river fish, Astyanax mexicanus, in Cueva Chica. They have presumably evolved from this species, been separated from it, and as the river has intersected cave passages river fish have been re-admitted into the cave systems. Other troglobites in the area include two large cirolanid isopods (Speocirolana pelaezi, known from Sótano del Arroyo, Sótano de Montecillos, Cueva del Pachón, Grutas de Quintero, Cueva de Los Sabinos, Sótano de la Tinaja, Sótano de Ferrocarril, and Cueva de la Lagunita; and S. bolivari, known only from Grutas de Quintero), a mysidacean (Speleomysis quinterensis, known from Sótano de la Tinaja and Grutas de Quintero), a shrimp (Troglocubanus sp., known only from Sótano de la Tinaja), and two ostracods (Sphaeromicola cirolanae, taken from Speocirolana pelaezi in Cueva de Los Sabinos, Cueva del Pachón, and Grutas de Quintero and from Speocirolana bolivari in Grutas de Quintero; and Sphaeromicola sp., taken from Speocirolana pelaezi in Sótano del Arroyo).

The troglophilic fauna of the Sierra de El Abra, although possessing some elements of other areas, is in many ways unique. Perhaps the most exciting members of the troglophilic fauna are the ricinuleids, Cryptocellus osorioi and Cryptocellus sp. The first species has been found in Cueva de Los Sabinos, Cueva de Taninul n. 1, and Sótano de Venadito. The second species is known only from Cueva de Taninul n. 1. This rare order of arachnids is very poorly represented both by species and by specimens and the appearance of a single specimen is of interest. The group does not appear in any of the other areas covered by this bulletin, but it has been found in caves in Yucatan, Guerrero, and Durango. Other species of interest include new species of the spider genera, Modisimus and Metagonia. Both of these genera are represented by other species in the other areas covered by this report. The spider genus, Ctenus, is also represented in other areas by other species. One species of collembolan, Acherontiella sabina, has been reported from caves in northern Mexico, the Sierra de El Abra, and the Xilitla region. Once identifications of collembola from the Sierra de Guatemala have been made, it may very possibly appear there as well. The cricket species, Paracophus apterus, is abundant in most of the caves of the Sierra de El Abra as well as being found in other parts of Mexico. The

catopid genus, Ptomaphagus, is represented in this area by two or possibly three undescribed species related to P. cavernicola. The staphylinid beetle, Stilicolina condei, is found in this area as well as in the Xilitla region; it is a common troglophile in Texas caves. A milliped of the family Stylodesmidae, representative of a probable new genus and species, is present in several caves of the range; a species of the same genus is present in lower elevation caves of the Sierra de Guatemala. The only other troglophilic milliped of this area is Bolivaresmus sabinus, which is known only from the Sierra de El Abra. One species of considerable interest is the tenebrionid beetle, Zophobas atratus, previously recorded in Cueva Ricardo Suloaga, Venezuela. In the Sierra de El Abra it is a guanophile in Ventana Jabalí. The hemipteran species, Pangaeus docilis, also found in Ventana Jabalí, was previously recorded in the Chilibrillo Cave, Panama. The carabid beetle genus, Pachyteles urrutai, known only from Cueva de Los Sabinos, is a member of a tribe not usually found in caves. Many other examples of troglophilic groups could be cited but these should be sufficient to indicate the nature of the fauna of the area.

The caves of the Sierra de El Abra appear to be inhabited primarily by strictly tropical species or species which reach the limits of their range in the caves of the Sierra de El Abra. Several troglophilic species are known only from caves and appear to be restricted to the Sierra de El Abra. The aquatic cavernicoles are generally of marine origin and are closely related to species inhabiting the caves of the Yucatan Peninsula and West Indies. The scarcity of terrestrial troglobites is possibly related to the tropical nature of the area. There is very little relationship to the cave faunas of the higher mountains.

PART FIVE

CD. VALLES - TAMAZUNCHALE

ROAD LOG: CIUDAD VALLES — TAMAZUNCHALE

From Ciudad Valles the Inter-American Highway follows the Río Tampaón southward until it joins the Río Tamuín at El Pujal. South from El Pujal the highway approaches the steep limestone ranges of the Sierra Madre Oriental, until just south of Aquismón the highway passes through a narrow valley with low rounded hills to the east and the steep escarpment of the Sierra Madre to the west. Beyond the road to Xilitla the valley widens and the highway winds through the hills to Tamazunchale. The mountains west of the highway in the Ciudad Valles — Tamazunchale area contain some of the most spectacular karst and caves in North America.

Kilo Post	Total Miles	Partial Miles	
465	00.0	00.0	Begin road log at intersection of Highway 85 and 110 at the south edge of Ciudad Valles. Highway 110 leads east to Tamuín and Tampico (see road log, page 44). Proceed south on Highway 85.
459	2.5	2.5	Birmanía. View to the right of Río Tampaón (Río Valles).
452	6.9	4.4	View to the west of Paso Real del Choy, a deep canyon cut by the Río Tamuín. This river, known to the west as the Río Santa María, has its headwaters near the city of San Luis Potosí.
447	10.7	3.8	Dirt road east, just past crest of hill, to Cueva Grande. This cave has about 2000 feet of passage and is the largest yet found in the El Pujal area.
446	11.0	.3	Dirt road east to Cueva Chica. Go to second gate by hut and then follow path east to arroyo that leads to the cave entrance. The cave is about 750 feet long with several lakes. The blind fish, Anoptichthys jordani, of the Sierra de El Abra were first discovered in this cave, which is the type locality of these fish.
445	11.7	.7	El Pujal, formerly Alvaro Obregón. Ahead cross the Río Tamuín just downstream from its junction with the Río Tampaón.
441	14.2	2.5	Exposures of the El Abra Limestone on the flank of the Tantabol Dome. This structural dome, located to the south of the Sierra de El Abra, has exposed the El Abra Limestone over an area of about five square miles, mostly to the east of the highway. One cave, Cueva del Nilo, is reported from this area. Other caves are probably present and it will be interesting to see if blind fish are to be found in this area, which is not connected on the surface with the Sierra de El Abra.
433	19.8	5.6	Bridge over Río Coy and settlement of El Nacimiento.
418	29.5	9.7	Crucero. Paved road to Aquismón, 4 kilometers. Limestone mountains to the west are the Sierra de Tampamochl. Six hours walk to the west of Aquismón and about 2000 feet above the town is Sótano de las Golondrinas. This pit is about 200 feet in diameter at

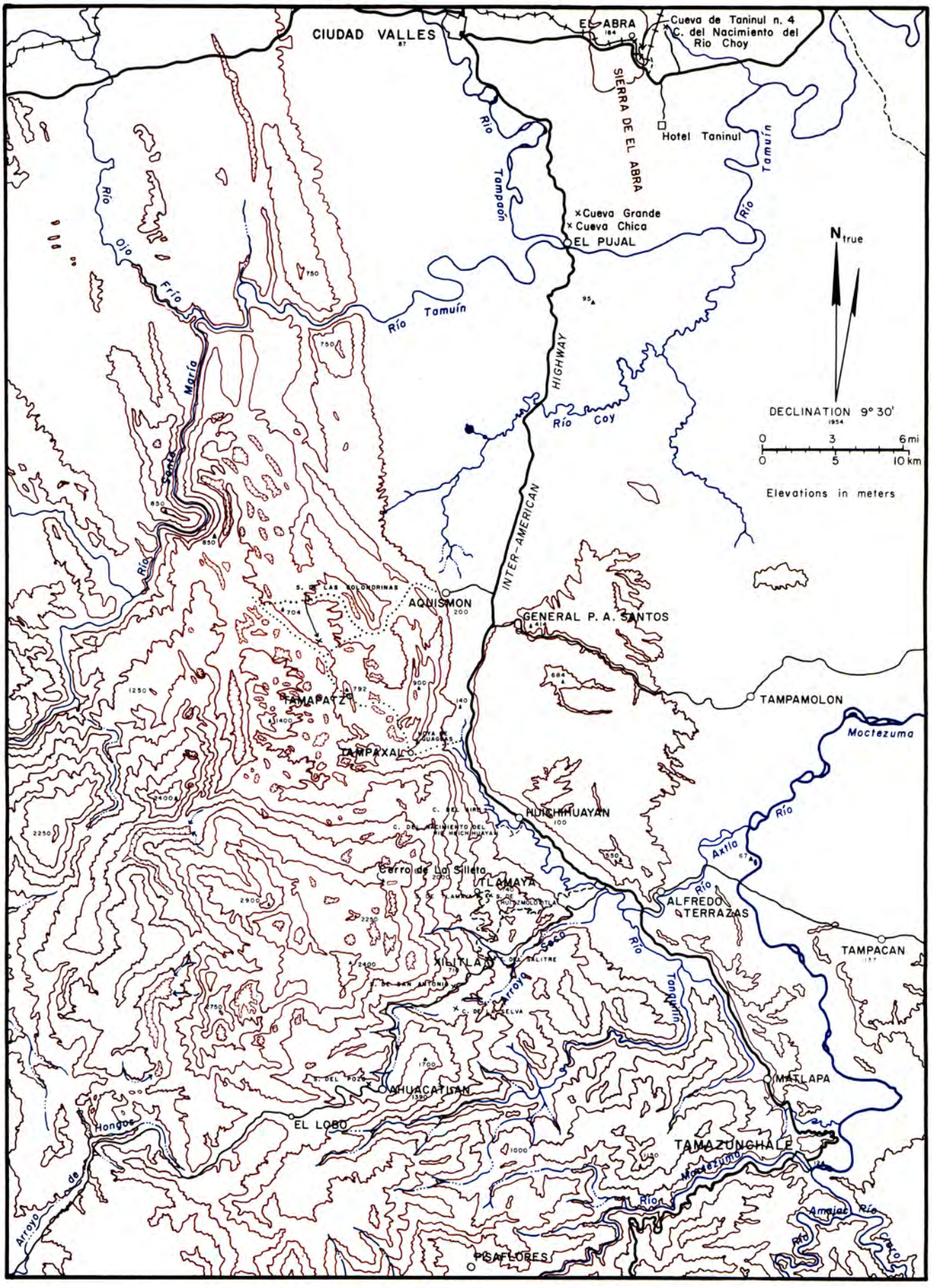
Kilo Post	Total Miles	Partial Miles	
			the top and widens to about 1000 feet by 400 feet at the bottom. From the lowest point around the entrance the vertical, free-fall drop to the floor of the pit is 1094 feet; from the high side the free drop is 1220 feet. Other large pits and caves are undoubtedly located in this area. One pit, Sótano de Guaguas, has an entrance drop of 480 feet to a steep slope descending to a presently unentered drop estimated at about 400 feet.
415	31.8	2.3	Xolol. Paved road east to Ciudad Santos, 4 kilometers.
411	34.4	2.6	Puerto los Sabinos. Highway passes through a narrow valley in which vertically dipping El Doctor Limestone forms the valley wall to the west.
409	35.4	1.0	El Limoncito. Mountains just to the west rise over 600 meters or about 2000 feet above the highway. A rugged karst area extends for over 20 kilometers west to the Río Santa María.
400	41.4	6.0	Huichihuayán. Dirt road west from town leads to El Nacimiento del Río Huichihuayán. Cross river just southwest of town and follow road west as far as possible, then walk west to the base of mountains where the Río Huichihuayán flows from Cueva del Nacimiento del Río Huichihuayán. This cave has not been completely explored, but like most well-known caves it is reported to be large. In the mountains above is Cueva de la Mujer del Agua.
394	45.0	3.6	Old road to Xilitla. This road traverses karsted jungle-covered mountains. Both this road and the new road cross the karst area, but the karst is better developed along the old road. See Highway 85 – Xilitla road log on next page.
393	45.8	.8	New road to Xilitla. This road follows the edge of the deep valley of Arroyo Seco with unchecked caves along both sides of the road. This road will soon be paved through Jalpan and Pinal de Amoles to Highway 57. See Highway 85 – Xilitla road log on next page.
392	46.8	1.0	Río Huichihuayán to right of highway.
389	48.8	2.0	Comoco. Road left to Alfredo Terrazas (Axtla). Ahead cross Río Axtla and leave Comoco.
366	64.3	15.5	View of Río Moctezuma valley ahead.
362	66.7	2.4	El Sol Courts (abandoned). Tourist trade has suffered since the building of Highway 57, a much faster route to Mexico City.
359	68.4	1.7	Río Moctezuma and Tamazunchale. Moctezuma (Montezuma) is the name of the Aztec emperor at the time of the Cortez invasion. Southwest from Tamazunchale the Inter-American Highway climbs through the Sierra Madre Oriental and on to the Central Plateau. The mountains crossed by the highway are very complexly folded, unlike the simply folded linear ranges present to the north. Many sinks and depressions are visible from the highway, some of them several thousand feet above the river. Local inquiry would probably produce numerous caves.
		Note:	Those attempting to use the road log from south to north are urged to read all geology sections from north to south as geologic names are introduced in this order.

ROAD LOG: HIGHWAY 85 — XILITLA (OLD ROAD)

0.0 miles, Highway 85 — store and gravel road west to Xilitla. 0.4 miles — ferry over Río Huichihuayán. This deep, clear river flows from several springs at the east edge of the Sierra Madre. The largest is the Nacimiento del Río Huichihuayán. 1.9 miles — side road south to new Xilitla road. 2.6 miles — cross large arroyo. 3.1 miles — limestone beds dip steeply to the east at 57°. 4.5 miles — small sótano immediately to the left. 5.1 miles — Cueva de El Jobo. The entrance to this cave is immediately to the right and leads to a walking-size tunnel about 200 feet long. 5.3 miles — town of El Jobo. 6.4 miles — circling Dolina de El Jobo, with several pits visible in the bottom. 6.6 miles — large entrance to shelter cave above road. 8.0 miles — Dolina de Tlahuilapa, with sótano in middle of field. 8.3 miles — circling Dolina de la Hondura. 9.1 miles — village of Los Cajones. 10.0 miles — Dolina de Cajones n. 2. This dolina contains many prominent karst features, a 30 foot deep sótano, and a cave 100 feet long. 10.1 miles — tunnel through karst pinnacle. 10.6 miles — circling Uvala de Buena Vista. 10.8 miles — Turnoff to Tlamaya (3.5 miles to spring above Sótano de Huitzmolotitla, 3.7 miles to Rancho de Huitzmolotitla, 4.2 miles to trail to Sótano de Tlamaya, 4.5 miles to village of Tlamaya). Ahead to Xilitla. 11.2 miles — unusual house, Las Conchas. 11.3 miles — cross stream, waterfall to right. 12.6 miles — cross-over to new road. 13.2 — Xilitla.

ROAD LOG: HIGHWAY 85 — XILITLA (NEW ROAD) — AHUACATLAN — JALPAN — PINAL DE AMOLES — TEJAMANIL

0.0 miles — Highway 85 at 0.8 miles south of old road to Xilitla. Road west to Xilitla, Jalpan, and on to Highway 57 will soon be paved. 0.8 miles — Puente Huichihuayán across the Río Huichihuayán. Water from the limestone mountains flows from several large springs to form this river. 5.8 miles — opening on right in road cut and canyon of Arroyo Seco to left. El Doctor Formation exposed in road cut. 7.0 miles — possible cave across Arroyo Seco valley. 7.4 miles — grotto on right in road cut. The large entrance of Cueva del Salitre can be seen across canyon. 8.2 miles — Puente Los Conchas, cross tributary of Arroyo Seco. 9.3 miles — Cross-over from old road intersects from right. Take this road to enter Xilitla. 9.9 miles — new road intersects old road. 10.0 miles — "gas station" on right has 20 foot deep sótano and larger sótano is reported uphill. 10.3 miles — leave Xilitla. 11.8 miles — Sótano de San Antonio, a 386 foot blind pit located in a clump of brush just above road. 12.4 miles — Escuela Miguel Alvarez Acosta. 13.8 miles — waterfall to right. 17.3 miles — El Balcón and deep valley of Arroyo Seco to left. 19.4 miles — Ahuacatlán plaza and church. Cueva de Iglesia is located across plaza and above the church to the left of the plaza. 20.2 miles — Sótano del Pozo, a slope leading to a 376 foot drop reaching a total depth of 502 feet, is located about 100 yards to the right of road. Sótano de las Hoyas is located 360 feet to the southwest. 23.3 miles — Blowing cave on right in road cut. Explored for 50 feet to a depth of 25 feet through bad breakdown. Much air flow. 25.0 miles — Possible sótanos at end of uvala to left. 25.4 miles — El Lobo, several houses and a small store; gas may be bought here. 26.7-27.5 miles — Rancho El Madroño. Several sinks and dolinas along road. Cueva del Madroño located about 2 km. to the left. 28.5 miles — Laguna Colorado. Two small caves, Cueva de las Tablas and Cueva del Niño on left. 29.2 miles — Small cemetary on right. Sótano de Camposantos on right of road just before reaching cemetary. Many sinks throughout this area. 39.4 miles — Rancho Nuevo. 42.2 miles — Lagunita, several caves reported in surrounding hills. 48.8 miles — Landa de Matamoros. 51.6 miles — Mazacintla. 57.7 miles — Tancama. 63.0 miles — Puente Jalpan. 63.7 miles — Jalpan plaza, no gas in Jalpan. 68.2 miles — Puerto Animas. Trail leads left from here to Puente de Dios, located above the upper entrance to Cueva del Río Jalpan, a 3 km. long underground course of the Río Jalpan.. Cueva de los Riscos is about 2 miles upstream. 72.4 miles — Aguacatlán. 75.1 miles — Cross Río Jalpan. 76.6 miles — Waterfall on right. 80.2 miles — Road cut and waterfall on left, Barranca Grande on right. 88.3 miles — 100 foot long cave in road cut to left formed along axis of chevron fold. 88.8 miles — The several entrances in road cut on left may be mines. 90.5 miles — Chruch at Pinal de Amoles. 92.9 miles — Puerto del Pino. 93.4 miles — Sótano de Tejamanil on right, Cueva de Tejamanil below road on left; inquire. 93.5 miles — Tejamanil.


CIUDAD VALLES
EL ABRA
Cueva de Taninul n. 4
C. del Nacimiento del Río Choy
SIERRA DE EL ABRA
Hotel Taninul
Río Tampaón
Río Tamuín
Cueva Grande
Cueva Chica
EL PUJAL
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Río Santa María
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HUICHIHUAYAN
Río Axtla
Cerro de La Silleta
LAMAYA
ALFREDO TERRAZAS
Río Seco
Río Tanquián
TAMPACAN
XILITLA
Arroyo
MATLAPA
AHUACATLAN
Hongos
EL LOBO
TAMAZUNCHALE
Río Moctezuma
Río Amajac
Río Calabozo
Arroyo de
PISAFLORES

View north along valley of the Inter-American Highway. The Xilitla-area caves are located in the mountains to the left (west).

The Tlamaya solution valley, about one kilometer across, with the prominent peak of La Silleta in the background; view looking west.

GEOLOGY OF THE XILITLA AREA

Southwest from Ciudad Valles the ranges of the Sierra Madre Oriental gradually increase in height and structural complexity. Just west of Valles the crests of the front range are below 500 meters or 1600 feet, while west of Xilitla, 65 kilometers to the south, there are several peaks over 2500 meters or 8200 feet and large areas above 2000 meters or 6500 feet. Near Valles the ranges are formed along linear anticlines with only minor structural complications. These anticlinal ridges increase in number and height until about 10 kilometers north of Aquismón where they are intersected by a series of NNW–SSE trending ridges. These two trends merge, forming a broad dome to the southwest of Aquismón. There are doubtless many local structural complexities in this area, but they tend to be obscured by the thick limestone sequence.

Most of the anticlines from the Sierra de Guatemala southward are more steeply folded on the east side. This tendency increases toward the south with the mountains in the Xilitla area having very steeply dipping or overturned rocks along the east face. And north of Xilitla a thick sequence of El Doctor Limestone has been overthrust for several kilometers toward the east. The needle–like peak, La Silleta, is the east edge of this overthrust. Near Xilitla the structure is cut by several faults, causing it to break into a number of southeast–plunging anticlines. South of Xilitla the structure becomes very complex and almost all traces of the previously dominent north–south alignment disappear. Locally the structures are so complexly crumpled, overturned, and contorted that the weathering of the mountains proceeds as if they were of uniform composition. The synclinal valleys present to the north are absent. This intense deformation does not appear to be favorable to the development of large caves, but numerous sinkholes are developed along the narrow divides.

The karst of the Xilitla area is developed on the El Doctor Limestone, which exceeds 1000 meters in thickness in this area. This limestone is a reef sequence that has been named the Jacala Bank. These reef deposits probably reach a thickness of about 1200 meters west of Xilitla. The bank extends west from Xilitla for about 30 kilometers to just east of Jalpan, about 15 kilometers to the north, and for over 60 kilometers to the southwest. North and west of Xilitla the reef deposits form the higher mountains as they are highly resistant to mechanical erosion. This thick system of reef limestone is especially favorable to the formation of large cave systems. An exception is in a few local areas of intense crumpling, such as along the plane of the Xilitla overthrust, where cave development is hindered. All of the drainage from a very large area north of Xilitla is underground through caves and cracks in the limestone, the water reappearing from large springs at the base of the range. It is likely that caves much deeper than any now known exist in the high mountains north of Xilitla. West of Jalpan, away from the Jacala Bank, the El Doctor is much thinner, being about 200 to 300 meters thick at Pinal de Amoles, and less than 30 meters thick further to the west and northwest. However, the steep folding creates a much larger effective thickness. Only the general outline of the geology is known for much of the area north of Xilitla as the area is very difficult to traverse, and there are few key beds in the thick reef limestones. The sequences exposed in the caves of these areas will be of great help to the understanding of the geology.

CAVES OF THE XILITLA AREA

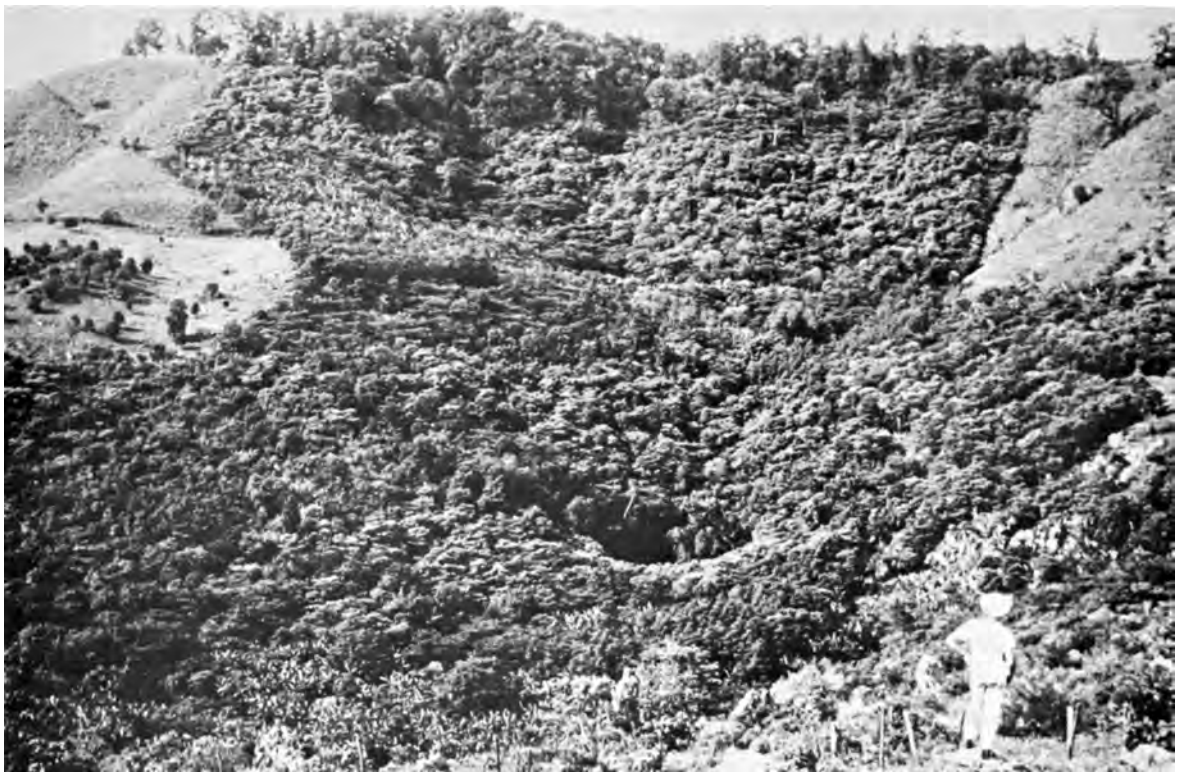
Sótano de Huitzmolotitla

Sótano de Huitzmolotitla is located 250 feet below the Xilitla–Tlamaya road about one mile from Tlamaya and 0.2 miles before the Rancho de Huitzmolotitla. The entrance is a large pit about 200 feet in diameter and 364 feet deep (see photograph on next page). The sides of the pit near the top are covered with dense vegetation except on the west side where a normally dry arroyo enters the pit. The floor of the pit is flat and is covered with breakdown except directly below the surface arroyo where there is a pool about 30 feet in diameter. Out of this pool a small stream flows to a second drop of 156 feet. This drop is located at the south edge of the entrance pit and is a slot, at the top about 15 feet wide and 40 feet long, that drops into one end of a large fissure. Beneath this drop is another plunge pool, and from this pool a stream follows a high narrow fissure averaging 8 to 10 feet wide and at least 40 to 50 feet high. The stream flows on the gravel floor and is generally shallow, though in places there are pools up to 10 feet deep. This fissure continues for about 1800 feet to a large flowstone deposit that almost blocks the passage. The stream siphons beneath the block while a slippery climb over the flowstone leads to a continuation of the fissure passage. About 9000 feet from the entrance the passage opens into a high dome room about 200 feet long and 125 feet wide, containing a great mud mountain. From the far side of this room the passage continues, except that the cross section is now more of an ellipse than a fissure and the ceiling height decreases and the walls are covered with mud. The passage finally ends in a muddy siphon 9850 feet from the entrance and 804 feet below the top of the entrance pit. The general trend of the cave is south, the terminal siphon being a direct distance of 4600 feet in a direction of S10E from the entrance. The first mile of the cave was explored and surveyed by T. R. Evans and T. Raines on November 21, 1962, and a final survey of the cave was made by Bill Bell, Tom Philips, Terry Plemons and Terry Raines on January 28, 1964.

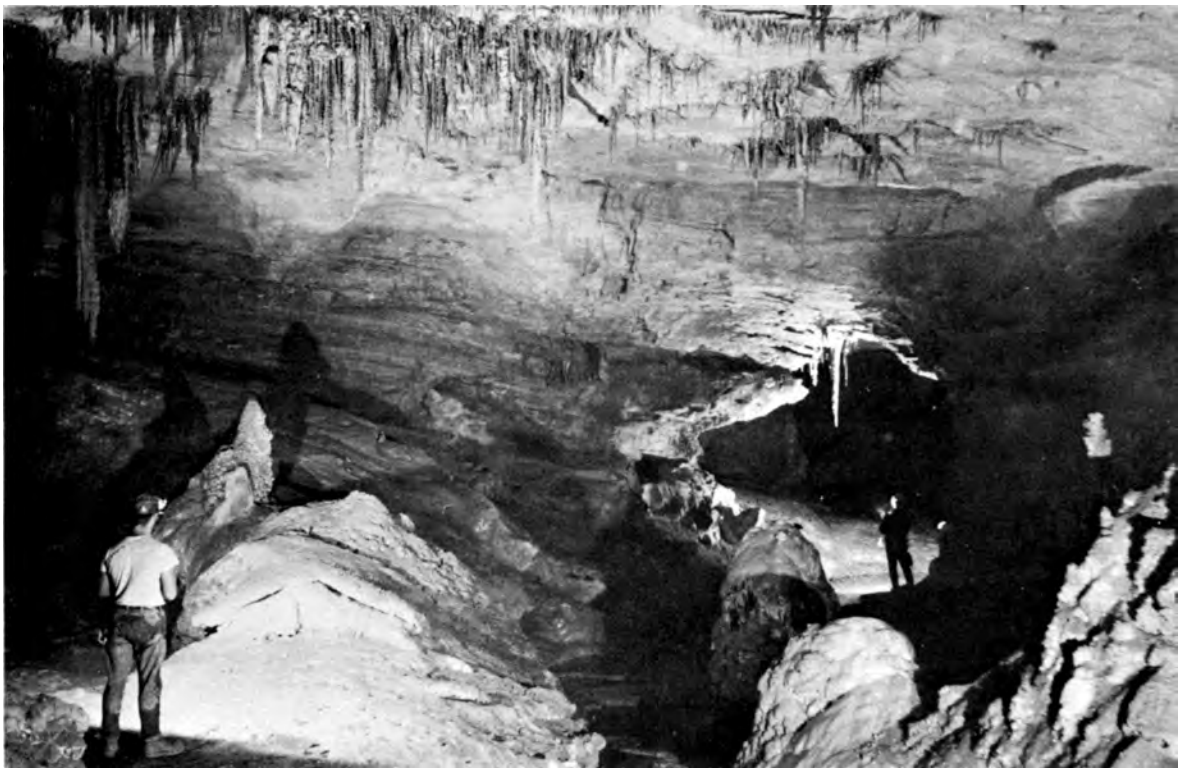
Sótano de Tlamaya

The entrance to Sótano de Tlamaya is located about 300 yards to the southwest of the Xilitla–Tlamaya road, about 0.7 mile past the Rancho de Huitzmolotitla. A trail leads to the entrance which is located about 30 feet above the relatively flat floor of the Tlamaya solution valley. The main or Lower Entrance consists of two separate pits. The smaller one is 15 feet in diameter and drops free for 279 feet. The other is 20 feet away, 30 feet in diameter, and drops about 150 feet before slanting toward the smaller pit and intersecting it. Both entrances are located in the bottom of an arroyo and now pirate floodwater that once ran into the valley. From 279 feet below the small entrance drop a steep slope with drops of 73 feet and 76 feet descends to the Entrance Room, 475 feet below the entrance. This room, essentially the bottom of the entrance pit, is about 30 feet in diameter with a small stream flowing through a passage about 5 feet wide and 25 feet high that runs tangent to the room. The upstream section of this passage narrows and continues for about 200 feet to a high dome with the small stream descending from the top. Downstream the passage immediately drops 12 feet and continues as a fissure for about 150 feet to the 100 foot drop, Junction Pit. From the bottom of this pit the water divides. Some of the water enters an unexplored pit while the rest follows a passage to a 209 foot drop, Fossil Pit. From Fossil Pit the main passage continues to the Big Room, which measures 200 feet long, 50 feet wide, and 80 feet high. The stream that has followed the cave since the Entrance Room siphons at one end of the Big Room. The Upper Entrance to the cave, 71 feet higher than the main entrance, leads to a series of generally smaller pits that connect with the main system at the Junction Pit.

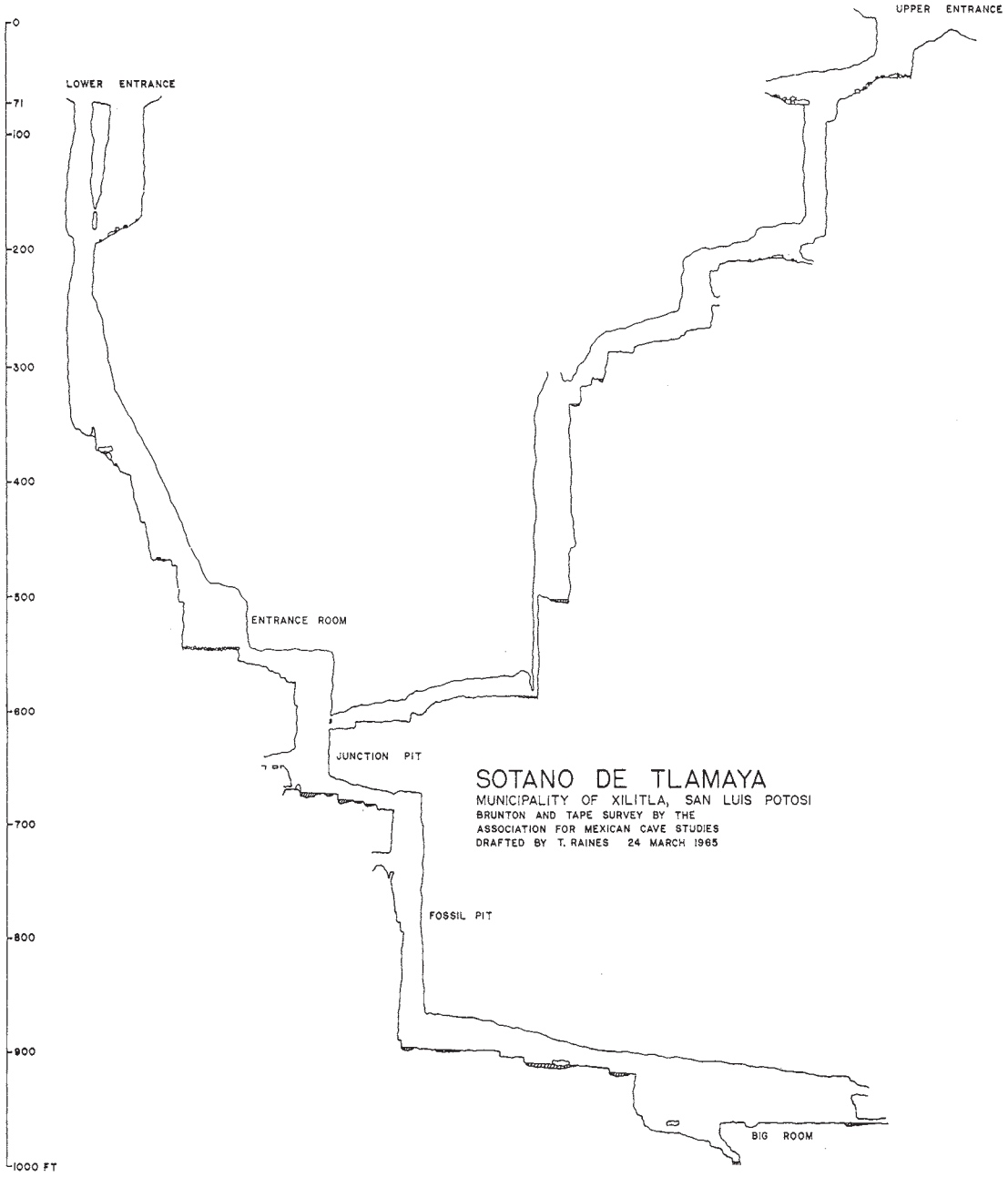
A stream flows across the far side of the Big Room, which may be followed in both directions. Upstream the water flows between banks of black dirt through an elliptical passage about 20 feet high and 25 feet wide. About 470 feet from the Big Room this passage is almost blocked by formations, but a small hole leads to a continuation going to a large room. A



Entrance to Sótano de Huitzmolotitla, 150 feet to 200 feet in diameter and 364 feet deep. Photo by Terry Raines



Upstream Passage in Sótano de Tlamaya near its junction with the Big Room. Photo by Terry Raines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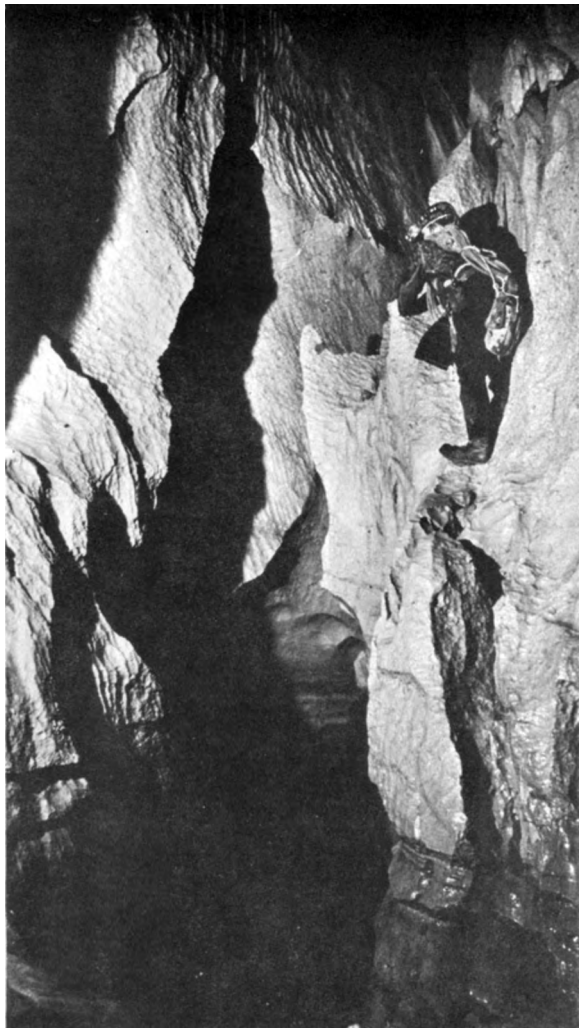
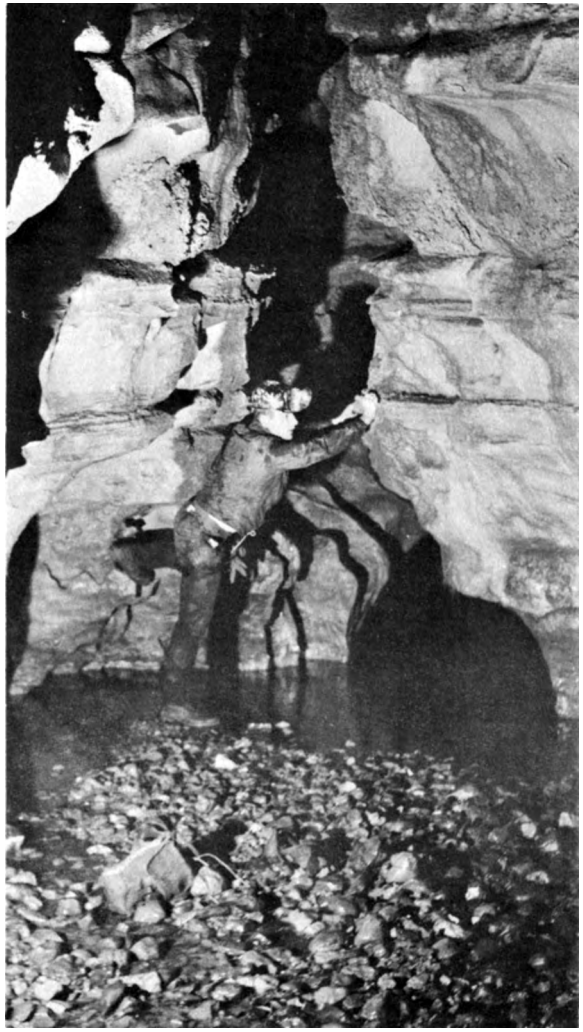
ENTRANCE ROOM
JUNCTION PIT
FOSSIL PIT
BIG ROOM
SOTANO DE TLAMAYA
MUNICIPALITY OF XILITLA, SAN LUIS POTOSI
BRUNTON AND TAPE SURVEY BY THE
ASSOCIATION FOR MEXICAN CAVE STUDIES
DRAFTED BY T. RAINES 24 MARCH 1965

Typical fissure passages in Sótano de Tlamaya. Photos by Terry Raines



Bottom of Junction Pit.

Between Fossil Pit and Big Room.



Downstream from the Big Room.

passage leads from this room and then divides, both large branches soon ending in breakdown. A strong air current flows through the small hole in the formation block. Downstream from the Big Room the stream flows through numerous pools along a fissure about 10 feet wide. This passage continues across several short drops to the Pinnacle Drop, 2717 feet from the Big Room, where the passage drops 97 feet into a large room. From here a generally high fissure leads over several short drops to the terminal siphon, 1488 feet below the Upper Entrance. During periods of very heavy rains the water table appears to rise almost 150 feet. This and the deposits of mud toward the end of the cave indicate that the cave does not connect directly with the large resurgences, but that the water probably filters through small passages and bedding planes. The general trend of the cave is south and it almost passes beneath the stream passage in Sótano de Huitzmolotitla, but at a depth about 500 feet below. This again indicates a poorly integrated system. It is possible that the water from both Sótano de Tlamaya and Huitzmolotitla flows south and feeds springs in the vicinity of Arroyo Seco.

Sótano de la Gorra (Porra)

This large pit is located above the southwest end of the Tlamaya solution valley. The entrance to the pit is about 40 feet in diameter. From the entrance the pit drops free for 360 feet, enlarging with depth to form a room about 200 feet long and 60 feet wide. The floor is composed of small rocks and breakdown piles. The cave receives essentially no surface drainage. The name of the pit was originally understood to be Sótano de la Porra, but recent explorers have been told that the name is Sótano de la Gorra, so both names are listed.

Cueva de la Gorra

This cave is located about three-fourths of a mile up the hill to the west-northwest of Rancho de Huitzmolotitla at the edge of a large jungle-filled sinkhole. The entrance to the cave is a small vine-covered hole on the side of the sink near the bottom. A series of irregular, small rooms and fissures lead about 50 feet to a stream passage. To the right from this junction a passage 100 feet long contains several domes with vampire bats. In this downstream passage the stream sinks, but upstream, to the left, the passage can be followed until it is necessary to crawl and where exploration stopped. The name of this cave is the same as the name of the sótano.

Cueva de Tlamaya

This cave is located in the village of Tlamaya on the floor of the Tlamaya valley. From the entrance a slope descends into a room about 100 feet long with a pit at the far end. This pit drops 140 feet to a series of small pits that finally reach a depth of 316 feet below the entrance (see map on page 96). The only other cave explored in the floor of the Tlamaya valley is located just north of Tlamaya in the middle of the valley. It is a blind, 80 foot pit named Sótano de los Plátanos.

Other Pits in the Tlamaya Area

Like the other areas of the Sierra Madre, the Tlamaya area has many pits that are small, blind, and of little depth. In this area the small amount of reconnaissance and exploration that has been accomplished has been concentrated in only two localities. One is on either side of a ridge that separates the Tlamaya valley from the valley in which Sótano de Huitzmolotitla is located. The other is the land owned by Rancho de Suchallo, the ranch immediately to the south of Rancho de Huitzmolotitla, which includes a hillside and part of a small, closed valley.

At the present time nine pits have been discovered and explored along the ridge that forms the southern boundary of the Tlamaya valley. This is excluding Sótano de la Gorra and Sótano de Tlamaya which are mentioned above. The pits range in depth from 260 feet to 50 feet, with six of them

measuring less than 100 feet deep. They average 10 to 15 feet in diameter and none have any extensive passages whatsoever. Most of these pits vary from elliptical shafts to elongate fissures and most of them terminate in dirt fill and small rocks, but a few continue as holes too small to follow.

In the small area covered by Rancho de Suchallo, eight pits have been explored, with an average depth of 160 feet. Although the average depth is more than that of the pits in the ridge, the diameters of the pits average about the same. Sótano de Suchallo is one of the largest pits on the ranch, measuring 15 feet by 20 feet and dropping sheer for 205 feet to a flat dirt floor.

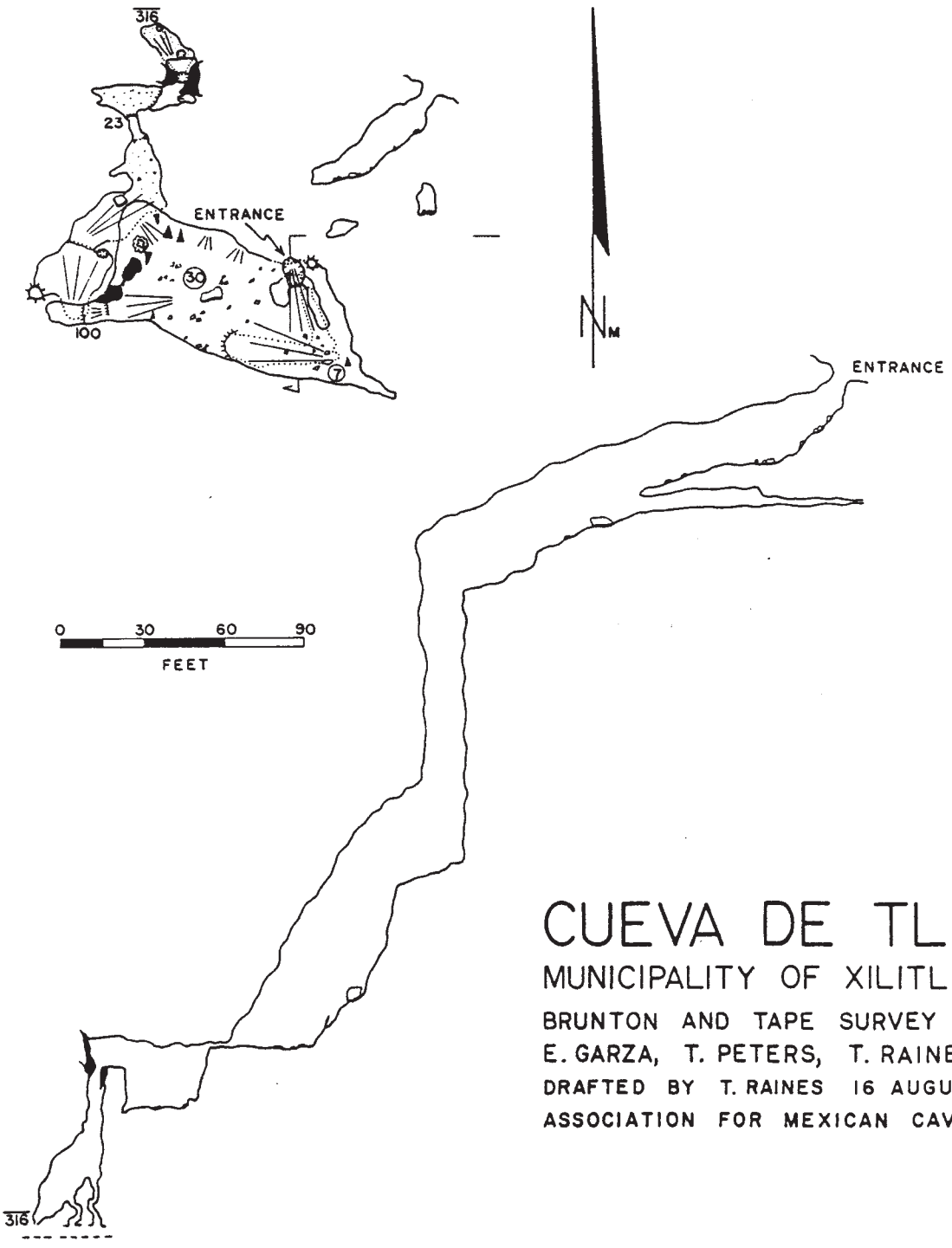
The only other pit, besides the ones mentioned above, that has been entered in the entire Tlamaya area is Sótano de La Silleta. It is located at the base of the peak of La Silleta (see photograph on page 88) and has been explored to a depth of about 500 feet. Judging from the number of pits that are presently known in such small, localized areas, the Tlamaya area as a whole should produce literally hundreds of more pits after enough time has been spent in reconnaissance. Although most will be small and of seemingly little importance, their significance will become apparent when a detailed study is made of the speleogenesis of the area.

Sótano de San Antonio

The entrance to this pit is located on a hillside about 50 feet above the Xilitla–Ahuacatlán road, 1.5 miles past the west edge of Xilitla, and just above a small quarry for road material. The entrance, which is almost covered with undergrowth, is 20 feet in diameter. The pit remains this size to a depth of about 100 feet, at which point it widens to about 80 feet in diameter. It then slowly tapers to 40 feet in diameter at the bottom, 386 feet below the entrance. The flat floor is covered by small rocks, black soil, and twigs. At the north side of the pit, about 30 feet above the floor, a passage seems to lead off but exploration proved it to be filled with dirt and loose rocks which have formed a slide to the floor. A large east–west joint is very prominent about one–half way down the pit, which appears to be formed along it. See map on page 97.

Cueva del Salitre

Cueva del Salitre is located just to the east and below the town of Xilitla. The tremendous entrance, almost 200 feet wide and over 100 feet high, is visible from both roads to Xilitla. The two large rooms that compose the cave have ceiling heights of well over 100 feet and measure up to 400 feet between opposite walls. In the entrance room, thick vegetation covers the steep breakdown slope as far as sunlight penetrates into the cave. At the end of a short passage that connects the two rooms is an 86 foot drop into the second room. This drop can be climbed without the use of equipment by descending along the right wall. The second room is almost as large as the entrance room, and like the entrance room most of the floor is a steep talus slope. At the upper end of this room a short passage leads to a 66 foot free drop into a small room. See map on page 98.



CUEVA DE TLAMAYA

MUNICIPALITY OF XILITLA, S.L.P.

BRUNTON AND TAPE SURVEY BY B. BURNETT, E. GARZA, T. PETERS, T. RAINES 9 APRIL 1966

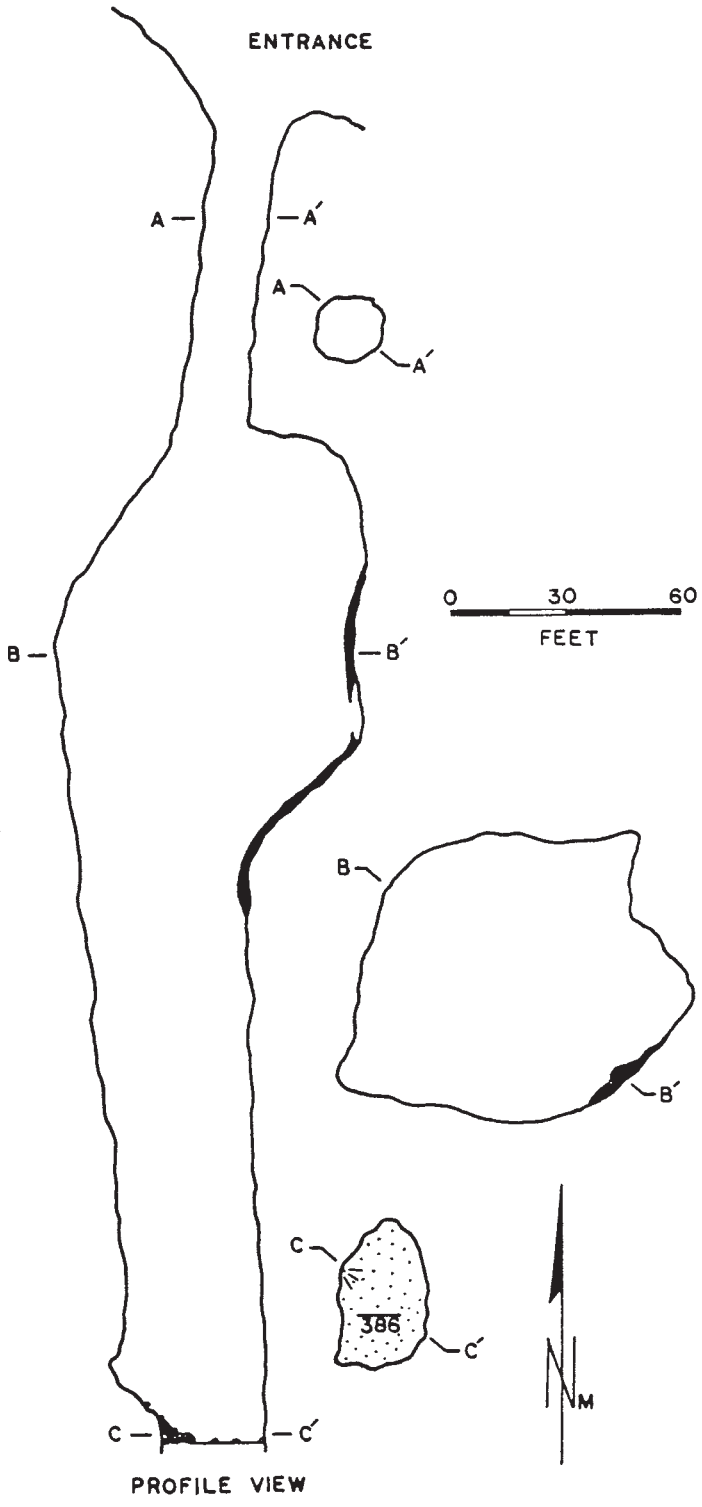
DRAFTED BY T. RAINES 16 AUGUST 1966

ASSOCIATION FOR MEXICAN CAVE STUDIES

SOTANO DE SAN ANTONIO

MUNICIPALITY OF XILITLA, S.L.P.

BRUNTON AND TAPE SURVEY BY
B. BELL, T. RAINES, M. ROE 29 NOVEMBER 1963
DRAFTED BY T. RAINES 4 DECEMBER 1963
AMCS



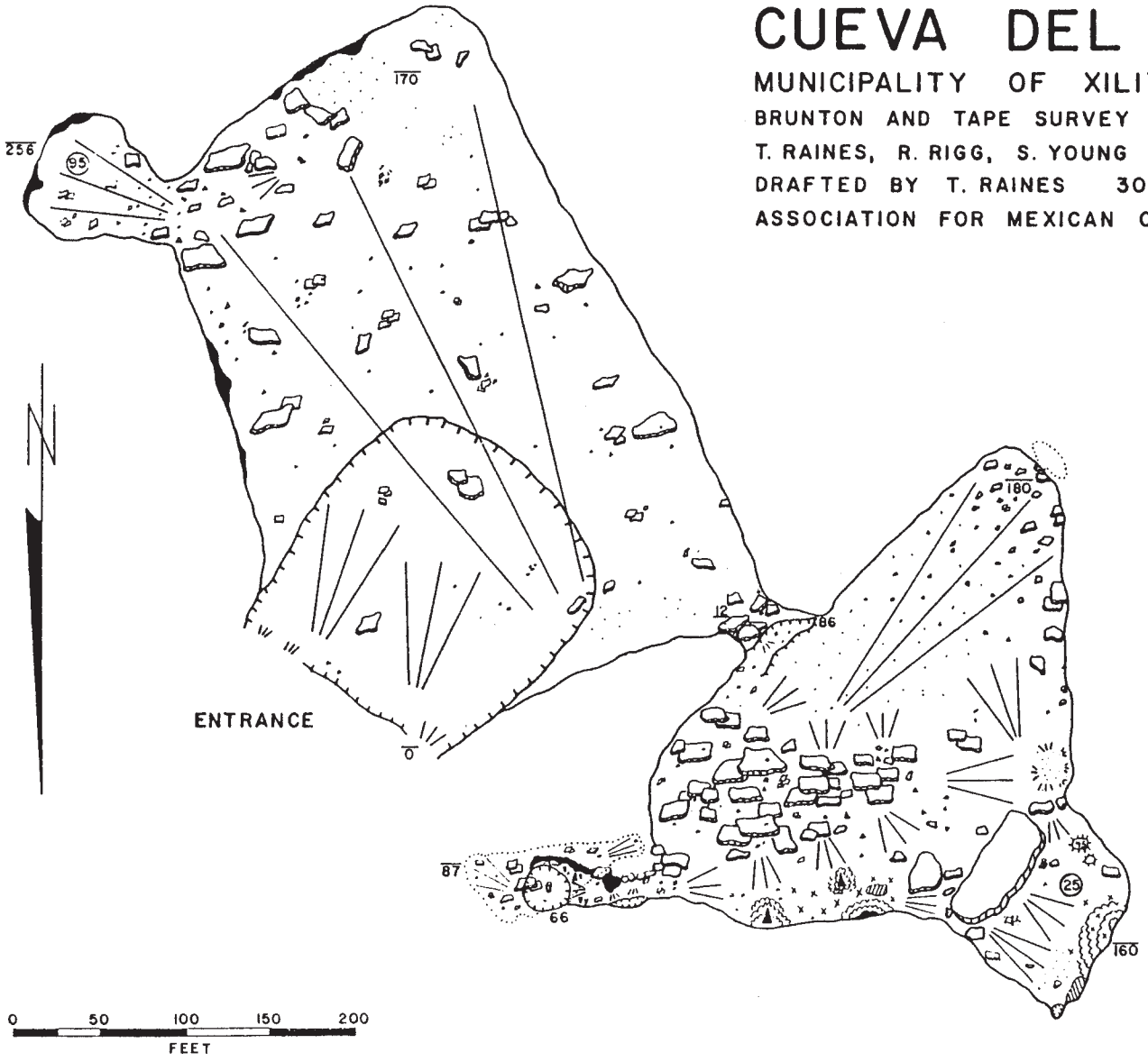
CUEVA DEL SALITRE

MUNICIPALITY OF XILITLA, S.L.P.

BRUNTON AND TAPE SURVEY BY E. GARZA, T. PETERS, T. RAINES, R. RIGG, S. YOUNG 7 JULY 1966

DRAFTED BY T. RAINES 30 AUGUST 1966

ASSOCIATION FOR MEXICAN CAVE STUDIES



Cueva de la Selva

The entrance to this large cave is located in the bottom of the Arroyo Seco valley just down the mountainside from Sótano de San Antonio. The Main Entrance is at one end of a large depression and is 150 feet wide and an estimated 80 feet high. From the entrance a passage slopes steeply downward to form one large room 500 feet long, 200 feet wide, and over 100 feet high. Just inside the entrance the first side passage slopes upward to the bottom of the Upper Entrance, a 77 foot drop. On the east wall of this passage is a flowstone 'waterfall' approximately 70 feet high, at the top of which is a small passage that ends shortly. The local people collect water from rimstone pools below this 'waterfall'. When this water is not available they are forced to follow a trail down the steep entrance slope to another pool.

The second side passage leaving the main entrance room has its entrance on the north wall at the bottom of the entrance slope. This passage appears to be one of the downstream branches of an intermittent stream that issues from breakdown beneath the south wall of the entrance room. The other branch of this wet-weather stream runs to the back of the entrance room where it sinks into the floor. The north passage ends in a small mud siphon. There is also an upper level crawlway that soon becomes too small to negotiate.

From the main entrance to the second side passage the floor is composed of small rocks and soil with a few large boulders. The dense vegetation near the entrance thins out into the cave, and past the second side passage there is no vegetation, only large mounds of black topsoil.

At the back of the entrance room is a second flowstone 'waterfall'. It is about 60 feet high with a small room at the top. Also at the back of the entrance room is another side passage that was explored but not mapped. This passage averages between three and ten feet wide for about 100 feet to a fork. The right fork ends shortly in a siphon, while the left fork narrows to a low, wide crawlway and then fills with gravel. Air was noted blowing out of the gravel at the end of the passage. Pools through this section contain white worms and isopods. Evidently, when it rains, water from the main room sinks through breakdown and enters these passages. Dr. F. Bonet mentions, with no description, Cueva de Chalcoayo, reached by a one-half hour walk from the highway to Ahuacatlán at a point two kilometers from Xilitla. It is not known if these are the same caves. See map on page 101.

Sótano del Pozo

Sótano del Pozo is located about 100 yards up a mountain called Sierra del Calvario from a point on the road 0.8 miles southwest of Ahuacatlán. The same distance from the road and 360 feet to the southwest is Sótano de las Hoyas. The entrance to Sótano del Pozo is a sink 60 feet by 25 feet, in which it is possible to descend to a depth of 118 feet by means of a steeply sloping path. The path follows the steep slope of soil, rocks, and decaying vegetable matter to a room. Consuming most of the floor area of this room is a pit or well (pozo) 40 feet by 20 feet and 376 feet deep. Two small pools at the top of the pit are used as a water source. Just above the rock-covered floor, the pit is spanned by a natural bridge. The only lead from the bottom is a small passage developed along a joint which soon becomes too small to negotiate. The total depth to this lowest point is 502 feet. The temperature at the top of the pit was 64° F in the air and 61.5° F in the water, while at the bottom of the pit the temperature was 60° F in the air and 59° F in the water. See map on page 102.

Sótano de las Hoyas

Sótano de las Hoyas is located just to the southwest of Sótano del Pozo and at the same elevation. The entrance is oval shaped, 35 by 50 feet, and drops 170 feet to a floor of small breakdown. About one-half way down on the north side is a pit 25 feet in diameter into which it is possible to swing, but it remains unexplored. From the bottom of the entrance pit a short crawl leads to a five foot wide walkway that provides access to several pits and domes. These pits lead to a second level of the cave 60 feet below the floor of the entrance pit. This level continues to a 20 foot and a 60 foot drop. From this last drop the passage is too small to follow.

Cueva del Nacimiento del Río Huichihuayán

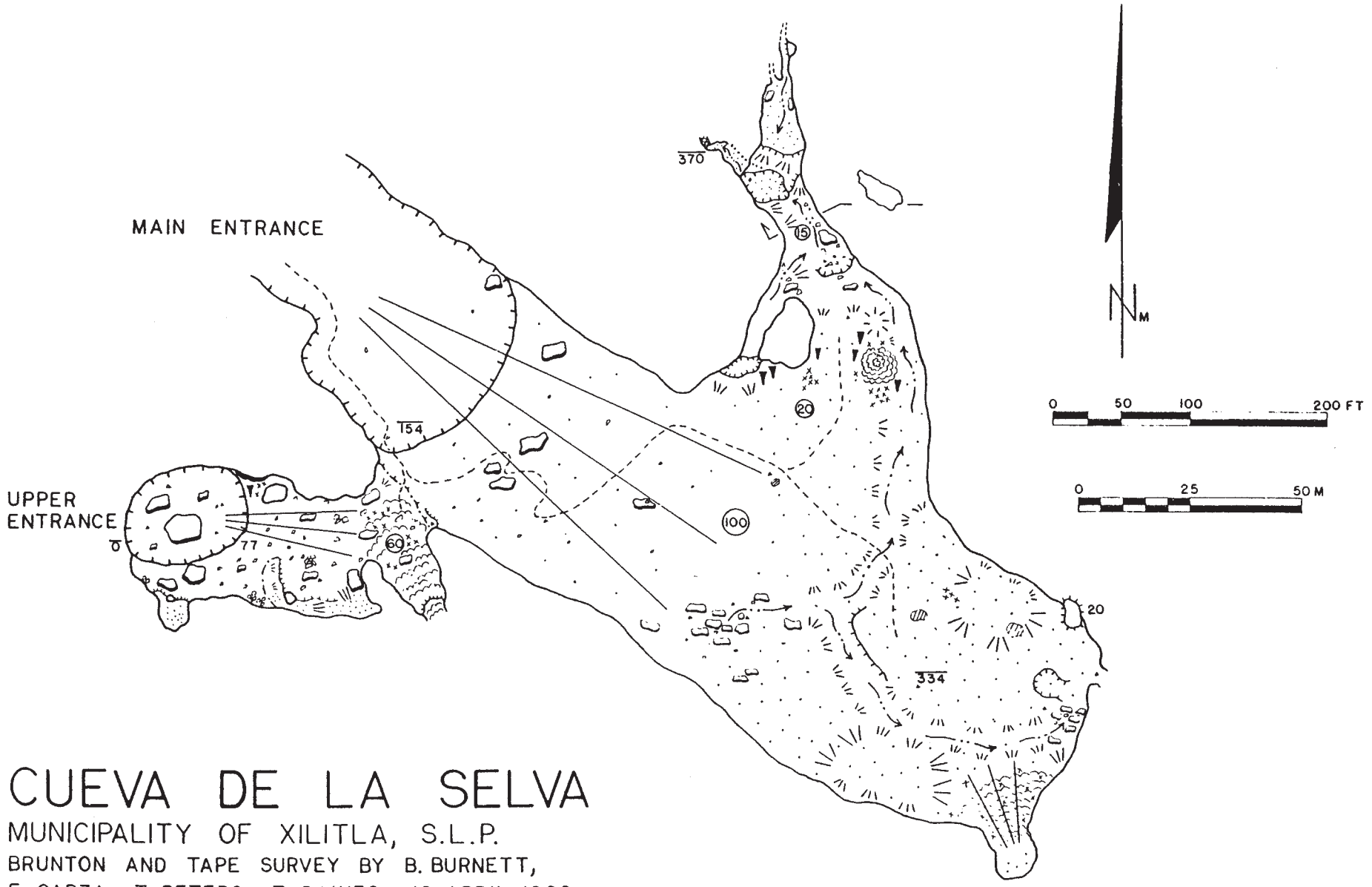
This cave is located about 1.5 miles southwest of the town of Huichihuayán, and during dry periods most of this distance can be driven. The entrance to the cave is at an elevation measured by Dr. F. Bonet to be 110 meters. From the entrance a large amount of water flows into a lagoon to form the Río Huichihuayán. To the north of the cave is a large, flat meadow from which rise limestone cliffs. This meadow is probably of solutional origin. The entrance to the cave is in a relatively low ridge that extends east from the main range. It measures about 30 feet wide and 10 feet high and immediately opens into a large room mostly filled with very large breakdown blocks. The cave has at least two other entrances, one a climbable pit that leads into the back of the entrance room. The cave has not been explored beyond the entrance area, but local people report that a passage can be explored for several hours to where boats are necessary. This is one of the major resurgences and should be explored to determine if large, horizontal passages exist near the base level of the mountains to the west.

Cueva del Aire

This cave has not been visited by AMCS members but was partly explored by Dr. F. Bonet. The cave is located 1,780 meters S 85° W from the church in Huichihuayán on the east face of the mountains at an elevation of 190 meters. The low (75 cm) entrance to the cave leads into a room 10 to 25 feet high and very irregular. From this room a passage averaging about 10 feet wide and from 3 to 12 feet high leads downward for a distance of about 120 feet to the end of exploration. A very strong current of air flows from the entrance, especially during periods of cold weather, which indicates that this cave is the upper entrance to a larger system.

Cueva de la Mujer del Agua

This cave has not been visited by AMCS members but was partly explored by Dr. F. Bonet. The cave is located 85 meters southwest of Cueva del Aire at an elevation of 245 meters. To reach the cave from Huichihuayán cross the river and travel west to the large spring of Mujer del Agua; the cave is located above the spring to the west. The entrance is on a steep bluff and is difficult to reach without rope. It is partly obscured by large blocks of breakdown and an artificial wall. The small entrance leads into a small room with a skylight, and this room leads into a larger room about 60 feet across and 6 to 10 feet high. From the end of this room a steep slope descends toward the south but remains unexplored.



CUEVA DE LA SELVA

MUNICIPALITY OF XILITLA, S.L.P.

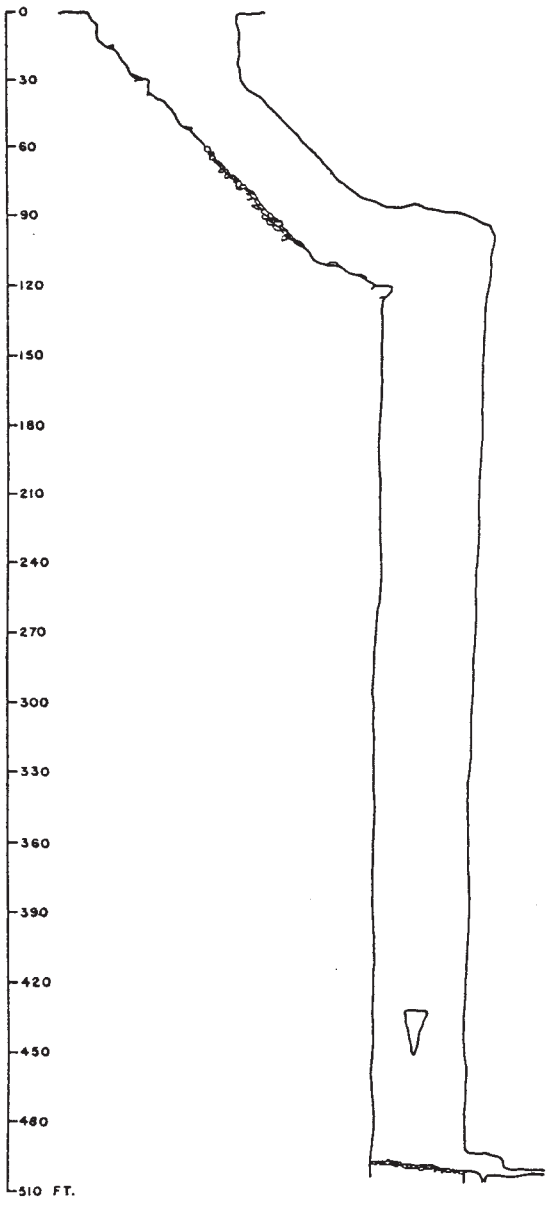
BRUNTON AND TAPE SURVEY BY B. BURNETT,
E. GARZA, T. PETERS, T. RAINES 10 APRIL 1966

DRAFTED BY T. RAINES

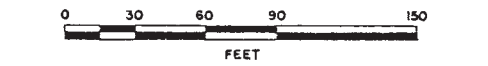
ASSOCIATION FOR MEXICAN CAVE STUDIES

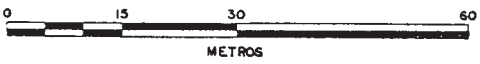
SOTANO DEL POZO

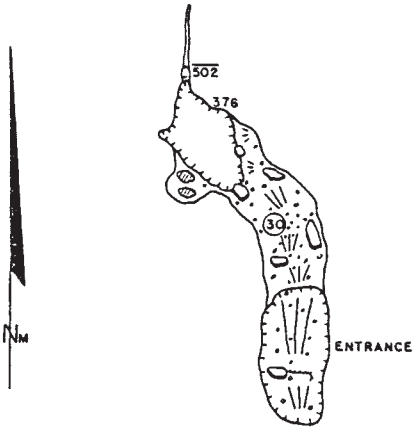
MUNICIPALITY OF XILITLA, S.L.P.
BRUNTON AND TAPE SURVEY BY
E. TAPP, T. RAINES, E. GEIL, AND
M. SPROUL 26 JUNE 1964
DRAFTED BY T. RAINES
ASSOCIATION FOR MEXICAN CAVE STUDIES



LONGITUDINAL PROFILE







PLAN

Sótano de las Golondrinas

Sótano de las Golondrinas is located about 10 miles west of the town of Aquismón and 15 miles north of Xilitla. This pit is thus far the deepest, and by far the largest vertical shaft yet discovered in the entire world. Sótano de Las Golondrinas was discovered by T. R. Evans, Charles Borland, and Randy Sterns on 27 December 1966, although it was known locally before that time. The pit can be reached by trail, and it is about a six hour hike uphill from Aquismón. It is situated at the base of a mountain at an elevation of about 2500 feet. The entrance is surrounded by a small local area of rough karren and is elliptical in shape, measuring 160 feet by 205 feet. The entrance is undercut around its entire perimeter, the walls sloping away to form a room 995 feet long and 440 feet wide. The floor of this room has considerable relief, the deepest point being 1306 feet below the highest point around the entrance. From the lowest point around the entrance there is a vertical free drop of 1094 feet to the floor below; from the highest point around the entrance there is a vertical free drop of 1220 feet. Between the high and low points of the entrance there is 109 feet of relief and the floor slopes downward from the area beneath the low point.

Sótano de las Golondrinas apparently was formed by the collapse of a large room. The floor of this room was probably several hundred feet below the present floor level. As solution increased the size of the room, the span was unable to support itself and blocks fell from the ceiling. These blocks, being more fragmented than the massive limestone walls, were more easily dissolved. As collapse enlarged the room upward, the debris was removed by solution at the bottom. This solutional removal of the collapse material probably accounts for most of the present depth of the cave. Such solution is apparently still continuing, as slumping has produced a trough along one wall of the pit where removal has been concentrated. One wall of the trough is formed by the wall of the pit, developed in this area along a prominent joint, and the other wall is a 100 foot cliff of cemented collapse breccia. The floor of the pit is smooth and composed mostly of weathered material with only a few large limestone blocks. This weathered floor indicates the cave is relatively stable and is only slowly being deepened by solution and slumping.

Detailed explanation of the formation of Sótano de las Golondrinas will have to await a more thorough examination of the local geology and exploration of the other caves and pits in the area. The pit is developed along a fault of undetermined throw. This fault is possibly related to the mountain to the west of the cave, and might have been a factor in channeling water through the collapse debris. Exploration of the area west of Aquismón has only begun and this area promises to contain numerous deep caves and pits.

Hoya de Guaguas

This deep pit is located about 10 miles southeast of Sótano de las Golondrinas at a somewhat lower elevation. The south side of a prominent pass in which the sótano is located is visible from the Inter-American Highway just before Puerto Los Sabinos. The pit is locally known and is about a three hour walk uphill from the highway. The entrance is about 150 feet by 100 feet. From the lowest point around the entrance it is a 470 foot free drop to the top of a steep slope. This slope is about 250 by 500 feet and leads back under the far side of the entrance to a second drop, estimated to be 400 feet deep. This drop has not yet been descended. The vertical drop from the high side of the entrance to the floor below is about 700 feet. The total depth of the cave will be over 1000 feet, making it one of the deepest caves in North America.

SPELEOGENESIS

The karst of the Xilitla area is the most pronounced of the areas covered by this Bulletin. Many of the major landforms such as the long valleys west of Aquismón are solely of solutional origin. The surface throughout much of the area has been lowered at least several hundred feet by solution, and the more soluble areas now form valleys and depressions. Dolinas, haystack hills, and solutional valleys are well developed and cover most of the east slope of the Sierra Madre, while to the west sinkholes are confined mostly to the relatively flat areas along the divides. The rainfall over large areas on the east slope exceeds 100 inches per year, and there is no surface drainage. Instead the water sinks, to reappear in large springs at much lower elevations. Yet, despite this large amount of solutional activity, most of the cave investigated appear to be only small segments of a large but poorly integrated subsurface drainage system.

The apparent reason for the lack of large, integrated cave systems such as exist in the Sierra de El Abra to the north is that phreatic or near phreatic conditions did not exist for a long period of time in most of the Xilitla area. Relatively soon after the uplift of the mountains the soft surrounding rock was removed and ground water was able to flow from the limestone at a low elevation. Limited phreatic enlargement in the higher areas has resulted primarily in the enlargement of joints to form fissures, with a few rooms developed in especially favorable areas. This is typical of the Tlamaya area where the several miles of fissure passage in Sótano de Tlamaya and Sótano de Huitzmolotitla intersect only two or three rooms. The large rooms such as Cueva del Salitre and Cueva de la Selva are situated at a somewhat lower elevation where phreatic enlargement was more effective. Surface water descending along vertical joints appears to have large solvent powers, resulting in numerous vertical shafts. The water that enters the more horizontal fissures has had, in general, little effect on the passages as the gradients and volumes of water are usually small.

The area west of Aquismón is not yet well known. Two very deep pits, Sótano de las Golondrinas and Hoya de Guaguas have been entered. Sótano de las Golondrinas appears to be a vertical shaft formed by the solutional removal of collapse debris, and little is known about the origin of Hoya de Guaguas. These pits and a large cave near Tamapatz indicate the area is promising. Further to the west are several long, linear solutional valleys. These have developed where the predominent north-south trending structures are crossed by northwest-southeast trending uplifts. The resultant crumpling forms an area that is easily dissolved.

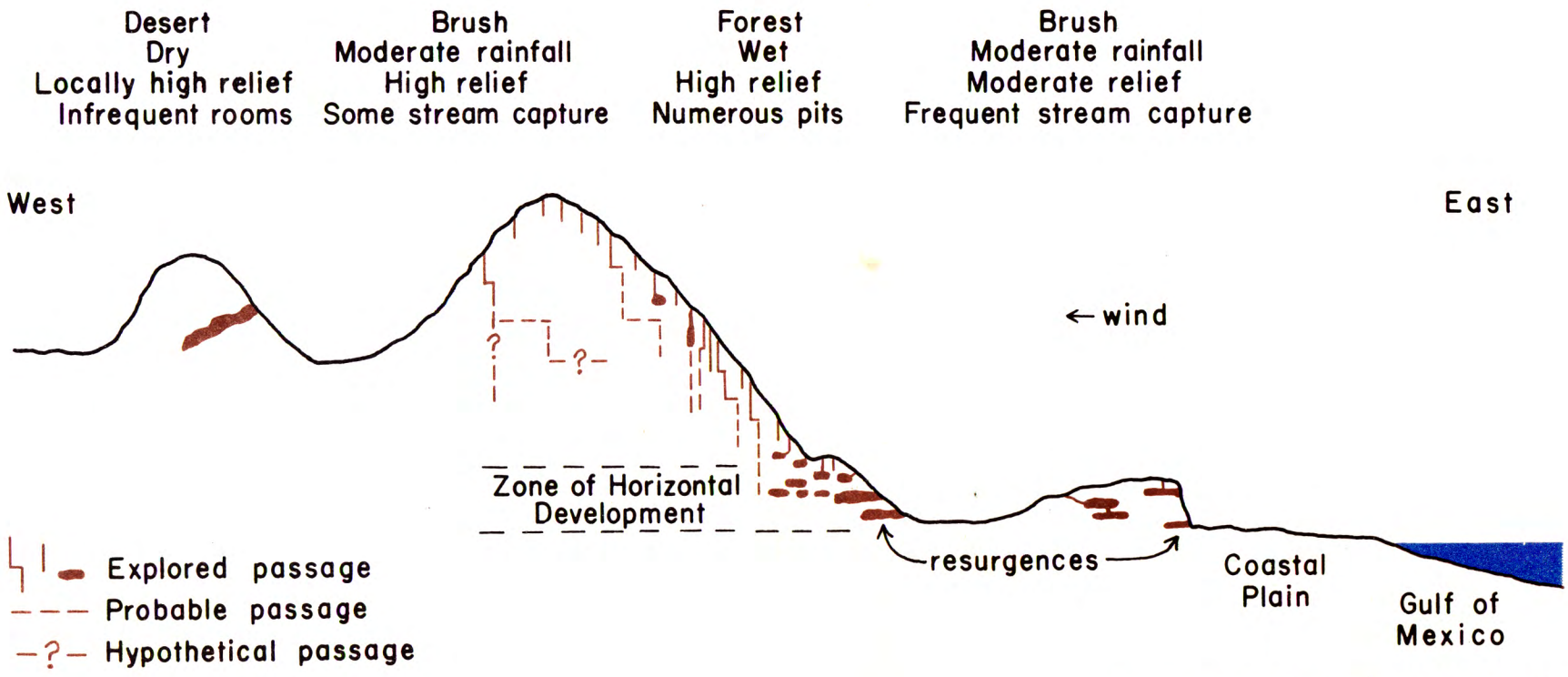
The area lying near the present resurgences at elevations from 110 to about 300 meters should be investigated as it is likely that large horizontal passages have developed in this zone. Cueva del Nacimiento del Río Huichihuayán should be explored, and the surrounding area, as well as the east face of the range near the resurgence of Mujer del Agua and the Nacimiento del Río Tocomón. It is possible that some of the horizontal passages are under the present water level, but the large amount of water flowing from individual springs indicates that these springs receive water from an extensive area.

The diagram on the following page summarizes speleogenesis in northeastern Mexico. The lower foothills lie almost entirely in the zone of horizontal ground water movement, and the rainfall that enters these ranges is quite effective in forming large cave systems. The higher mountains to the west have a high rainfall and are characterized by the development of karren, haystack hills, and numerous vertical pits. Many caves in this area are probably destroyed, as large volumes of rock are dissolved to form valley sinks and dolinas. The water falling on these ranges descends vertically and forms large cavern systems near the level of the resurgences. Across the mountains to the west the number of caves decreases. Many of these western caves are large rooms unrelated to the present topography and were formed in the deep phreatic zone during the Pliocene. The probably more numerous caves that once existed have been destroyed by rapid mechanical erosion. The exact routes of ground water movement in this area are not yet known.

GENERALIZED RELATION BETWEEN VEGETATION, RAINFALL, TOPOGRAPHY, AND SPELEOGENESIS

of the

SIERRA MADRE ORIENTAL, NORTHEASTERN MEXICO



ASSOCIATION FOR MEXICAN CAVE STUDIES

CAVE BIOLOGY OF THE XILITLA REGION

Although fifteen caves in the Xilitla region have been biologically investigated, either by Dr. F. Bonet or by members of the Association for Mexican Cave Studies, the fauna of the area is very inadequately known. The only caves which have been intensively studied are the deep systems, Sótano de Huitzmolotitla and Sótano de Tlamaya. These contain an interesting accumulation of troglobitic and troglophilic species. A few caves to the west of Xilitla have been recently visited and collections made, but most of this fauna has not yet been identified. Indications are, however, that the same genera are present, but with specific differences. This region will not be covered at all by this report. Caves at the base of the range near Huichihuayán have not been studied, so it is not possible to determine if the same type of situation is present here as is in the Sierra de Guatemala.

No aquatic troglobites have yet been found in this area, but the terrestrial fauna is quite interesting. Troglobitic forms include three isopods (Xilitloniscus laevis, known from Cueva de la Selva, Cueva de la Hoya, and Cueva de la Gorra; Mexiconiscus tlamayaensis, known only from Sótano de Huitzmolotitla; and Trichorhina boneti, known only from Cueva del Ahuate Núm. 2), one collembolan (Acherontides potosinus, known from Cueva del Salitre, Cueva de la Hoya, Cueva de los Cuchos, Cueva del Aire, and Cueva de El Jobo), three millipeds (Mexicambala russelli, known from Cueva del Salitre, Cueva del Ahuate Núm. 2, Sótano de Tlamaya, and Cueva de la Gorra; Glomeroides caecus, known from Sótano de Huitzmolotitla and Sótano de Tlamaya; and an undescribed genus and species of polydesmoid, known from Sótano de Huitzmolotitla and Sótano de Tlamaya), a spider (Metagonia sp., known only from Sótano de Tlamaya), and a true cricket (Paracophus sp., known from Sótano del Pozo and Sótano de Tlamaya). The small whip-scorpion, Schizomus sp., has been found in Sótano de Huitzmolotitla, and is a possible troglobite.

The troglophiles of this area reveal interesting correlations to the fauna of the Sierra de Guatemala and, to a lesser degree, the Sierra de El Abra. Two troglophilic crickets, Paracophus apterus and Paracophus sp., have been found in the caves of the area. The first is, of course, also known from the Sierra de Guatemala and the Sierra de El Abra, but the second appears to be restricted to the Xilitla region. Two beetles have been identified to species from this area. The first is a carabid, Mexisphodrus tlamayaensis, known only from the lower levels of Sótano de Tlamaya. An undescribed troglophile of this genus is known from caves to the west of the Xilitla region proper. The second species is the staphylinid, Stilicolina condei, which has already been discussed. Other troglophilic beetles of the genera, Tachys, Colpodes, and Ardistomis, have been found in caves of the region. These are widespread genera and have been found in caves in other parts of Mexico. Troglophilic spiders of the genera, Ctenus and Maymena, are also known from the caves in this and other regions covered by this Bulletin. The most interesting animal present in the caves of the area is a remarkable earthworm of the genus, Eodrilus. The species is apparently undescribed and has been found only in dripstone pools at the 950-foot level of Sótano de Tlamaya. Although it is essentially transparent, there is no way to determine if it is a true troglobite or not. The genus, Eodrilus, also has cave representatives in Yucatán.

What has already been said of the cave fauna of the Sierra de Guatemala can to a certain extent be said of the fauna of the Xilitla region. One definite difference appears to be a slight increase in the predominance of the more southern fauna. This is illustrated by the presence of the tropical earthworm, Eodrilus, in the area. In analyzing preliminary collections to the west of Xilitla, it is noted that Rhaphidophorine crickets appear, just as they appeared in the more western caves of the Sierra de Guatemala. Also of great interest is the discovery of two blind species of beetles of the tribe Trechini in Sótano de Tejamanil, to the west of Xilitla. This group is possibly represented in the Xilitla region as well, and great care should be taken to determine if this is so.

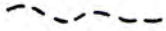
In summary, it can be stated only that study of the four regions covered by this Bulletin indicate that the cave faunas of the Sierra Madre Oriental are composed primarily of forms more closely related to tropical groups than to northern groups. In the northern part of Mexico, a few troglophiles and trogloxenes related to the Texas fauna are common in the caves; a few of these appear in caves as far south as Xilitla. The fauna of the Sierra de El Abra is only incidentally related to the fauna of the higher mountain regions and can best be considered separately. Further study of the western slopes of the Sierra Madre Oriental and an extension of the area of study farther to the south will serve to clarify problems of the source of certain aspects of the fauna. Finally, it must be emphasized that even the "well-known" caves produce new taxa with each collection and every visit to a new area offers almost unlimited opportunities for discovery.

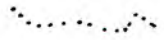
ASSOCIATION FOR MEXICAN CAVE STUDIES

AREA MAP LEGEND


Main road


Good secondary road


Poor secondary road


Trail


Railroad

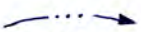

City or large town


Small town


Cave locations

Permanent stream

Intermittent stream


Intermittent stream (no outlet)


Lake


Topographic form line (not contour line)

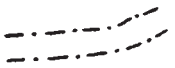

El Abra Reef Trend, east front

ASSOCIATION FOR MEXICAN CAVE STUDIES

STANDARD CAVE MAP LEGEND


Passage outlines


Lower level passage


Upper level passage


Unsurveyed passage


Survey station


Ceiling height (above floor or water)


Depth below beginning point, usually entrance


Height above beginning point

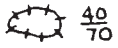

Sharp drop in floor level in hachured direction (vertical distance in feet)

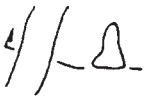

Slope, down in splayed direction


Sharp drop in ceiling; hachures point toward low ceiling


Pit, with depth in feet; if so indicated, pit entrance


Dome, with height in feet


Domepit, with height over depth in feet


Cross section of cave viewed in the direction shown by half-barbed arrow (cross section rotated to the horizontal)

Profile trace


Direction and course of water flow in permanent stream (air flow, if so marked)

Direction and course of intermittent stream


Standing water; lakes or pools


Siphon (cross-hatched)

Water depth


Rimstone dams


Flowstone on floor


Masses of flowstone on walls, or flowstone partitions

Flowstone column


Stalactites


Stalagmites


Soda straws


Loose crystalline floor deposits


Clay


Sand, silt, or dirt


Mud (if differentiated from clay or silt)


Gravel


Very small breakdown


Masses of breakdown


Large individual mapped blocks of breakdown


Guano


Ladder


Steps

Strike and dip of strata (dip in degrees)


Vertical joint

Dipping joint, dips toward side with block (dip in degrees)

Fault, D side moved down relative to U side

Special symbols indicated on individual maps

GLOSSARY OF MEXICAN SPELEOLOGY — ESPELEOLOGÍA

This glossary is designed to provide colloquial Mexican speleo—terminology for general caving. Scientific Mexican speleology often uses other terms from the Spanish literature in place of Mexican terms. Terms and usages may vary from place to place in Mexico.

PHYSIOGRAPHY

actun (Mayan) — cave (used in Yucatán)

carso — karst

caverna — cavern or cave; used like gruta

cenote (tzonot, Mayan) — vertical shaft, usually large, often water filled at the bottom; "sacrificial well"

cueva — cave; frequently used for a cave of small extent

dolina — sink; sinkhole; shallow to deep closed depression of moderate size

fuente voclusiano — vauclusian spring

gruta — grotto or cave; used for a large, often decorated cave

hoya — pit; hole

manantial — spring, commonly lake-like

nacimiento — resurgence of a river

ojo de agua — gravity spring, usually large

pozo — well

resumidero — large sumidero

sima — vertical shaft; rarely used; synonym for sótano

sótano — cave with a pit—like, vertical, usually unclimbable entrance

sumidero — shallow hole; sink at end of stream course

torca — sink; small closed depression

torcal — area of sinks

uvala — two or more dolinas that have coalesced

valle cerrado — closed valley

SPELEOGENS

boca — mouth or entrance

cámara — room

chiminea — chimney

claraboya — skylight

corte a pico — vertical drop

cúpula — dome

declive — slope

entrada — entrance

fisura — fissure

galería — galery

pared — wall

pasaje — passage

pendiente fuerte — steep slope

piso – floor
sala – room
sumidero – sink or pit in a cave
techo – ceiling

SPELEOTHEMS

columna – column
estalactita – stalactite
estalactita excéntrica – helictite
estalactita isotubular – soda straw
estlagmita – stalagmite
macizo estalagmítico – large stalagmitic mass
pared incrustada – incrusted wall

CLASTIC MATERIALS AND WATER

agua – water
agua corriente – running water; stream
arcilla – clay
arena – sand
barro – mud
cascada – waterfall
grava – gravel
lago – lake
piedras – rocks, usually small
rocas – rocks, usually large; breakdown

GEOLOGY

caliza – limestone
falla – fault
grieta – joint
plano de estratificación – bedding plane
yeso – gypsum

FAUNA

insecto – insect
murciélago – bat
pez – fish
pez ciego – blind fish
vampiro – vampire bat
víbora – snake

DEEP CAVES (OVER 200 METERS) OF THE WESTERN HEMISPHERE

Cave Name	Location	Depth	
		meters	feet
Sótano de San Agustín (Bottom not yet reached)	Oaxaca, Mexico	449	1472 (+250 est. of next pit)
Sótano de Tlamaya	S.L.P., Mexico	454	1488
Sótano de las Golondrinas (Longest free drop: 1220 feet)	S.L.P., Mexico	398	1306
Pozo Prieto	Cuba	380	1247
Neff Canyon Cave	Utah, USA	357	1170
Carlsbad Caverns	N. Mexico, USA	308	1013
Sótano de la Joya de Salas	Tamps., Mexico	272	892
Cueva Juara	Cuba	267	876
Dunn's Hole	Jamaica	250	820
Sótano de Huitzmolotitla	S.L.P., Mexico	245	804
Bull Cave	Tenn., USA	242	794
Ape Cave	Wash., USA	214	702
Spanish Cave	Colorado, USA	204	670

Recent work in Mexico continues to result in new depth records for caves in the Western Hemisphere. This list has been revised to show these changes from the list published in the AMCS NEWSLETTER, Vol. II, No. 1 (Jan–Feb 1966). Major differences are the addition of Sótano de San Agustín—which has not yet been completely explored—and Sótano de las Golondrinas, and the deletion of Gruta del Palmito which a resurvey showed to be substantially less than 200 meters deep. Conflicting depth reports for deep caves in the United States and the present difficulty in obtaining information from Cuba may necessitate further changes in this list. Some information included was taken from the admittedly incomplete list of the deepest caves of the world edited by H. Trimmel at the IV International Congress of Speleology in December 1965. Only 6% of the world's caves known to be over 200 meters in depth are in the Western Hemisphere.

DESCENT OF DEEP PITS

The discovery of the world record breaking Sótano de las Golondrinas and the nearly as awesome Hoya de Guaguas signifies a new era in pit caving. Descents into these pits should not be taken lightly and should only be attempted by qualified persons. It is the purpose of this article to briefly discuss the techniques and equipment used by AMCS members who have descended long drops.

ROPE Goldline climbing lay and other similar nylon ropes having several ravelled strands should not be used for long drops. When weight is added to this type of rope two things occur: 1) The rope stretches 10% to 15% of its entire length. (A prusiker in Golondrinas would have more than 100 feet of slack to overcome before leaving the floor.) 2) The rope begins to spin rapidly. A man prusiking from 1000 feet down may rotate at several revolutions per second for many minutes. Eventually a state of rotational equilibrium will be attained, but most climbers would not be able to withstand the spinning before this state is reached.

It is recommended that only braided ropes such as those sold by Samson Cordage Works in 7/16" and 1/2" sizes be used. This type of rope 1) does not spin, 2) only stretches about 3% when a person's weight is added, and 3) averages about 20% stronger than lay type ropes. Using this rope, it is common practice to have two persons prusik out at a time.

RAPPELLING A section of 1/2" braided rope 1000 feet long weighs about 65 pounds. Therefore, a person rappelling into Golondrinas (1094 feet) will find a change of 70 pounds down to 0 pounds of tension acting on his rappel device as he goes from top to bottom. For this reason a rappel device that easily allows change of friction while on rappel is highly desirable. Probably the most successful device has been a "rappel rack" such as the one designed by John Cole of Huntsville, Alabama, (see NSS NEWS, Vol. 24, No. 6, June 1966). Several cavers, however, have successfully used carabiner and brake bar rappels into Golondrinas. Starting with two brake bars (one brake bar runs much too fast), it is necessary to feed the rope for several hundred feet. Near the bottom a third brake bar may be necessary, depending on the size and newness of the rope, the condition of the brake bars, and the weight of the person. Single brake bar rappels should never be used except under very special circumstances, such as when a fast rappel down a short drop is desired to avoid a waterfall. The rappel rack is better adapted to incremental force changes, and thus is more desirable for long drops.

It is highly recommended that a person on rappel have a safety Jumar Ascender ready for instant clamping onto the rope in case of trouble. Most experienced pit explorers follow this policy for all drops. Also, it is pointed out that the optimum safe rappel into Golondrinas should take at least 25 minutes. This is based on the accepted practice of never moving faster than about 40 feet per minute, a figure that applies to all drops. This reduces the damage to the rope and any chances of losing control.

PRUSIKING A 1000 foot prusik is a rather formidable undertaking. The average time required to prusik out of Golondrinas is 2 1/2 hours. The most reasonable prusik is obtained by moving at 10 feet per minute. The mark of a good prusiker is not how fast he can move but how rested he is when he reaches the top. On a short drop such as 200 feet a man should reach the top in 20 minutes and be so rested that he could easily do the same prusik immediately over again. On a long drop, 1000 feet or more, one should reach the top with enough spare energy left to go at least several hundred feet more. This extra energy is needed as a safety factor is case of trouble. For example, you may have to back down the drop to help an injured friend.

Be sure to carry enough water with you. Almost everybody drank a full canteen while prusiking out of Golondrinas last April 1967 when the temperature was about 80° F.

Serious consideration must be given to the amount of equipment carried while prusiking. After a thousand feet even a hard hat feels like it weighs a ton. Keep the weight distributed around your hips so you will have a low center of gravity. Spare equipment should be tied onto the end of the rope and hauled up later.

All persons making a long prusik are urged to use the prusiking system with which they are most familiar and experienced. A long drop is no place to test experimental methods. Whether to use Jumar Ascenders in place of prusik knots or to use an entirely different knot such as the RBS is something the individual must find out for himself by experimentation. While prusiking, rest often to conserve energy and enjoy the fabulous views. Most people find they cannot rest comfortably using only a chest sling to hold their weight. For this reason, a good, tight-fitting seat sling or a seat sling-chest sling combination is recommended.

NOTES ON SOTANO DE TLAMAYA

The exploration of Sótano de Tlamaya has become somewhat simplified now, since the stage of pure exploration and mapping has been past. On previous trips the exploration party would carry up to 500 feet of extra rope, expecting to come upon some deep drop in the far reaches of the cave. Now, with the cave totally explored, it is known exactly what lengths of rope to carry and where they will be used.

The purpose of this article is to give an idea of the exact nature of Sótano de Tlamaya and what one should expect on a trip through the cave. Also, because so many of the deep cave systems in Mexico are basicly similar, the ideas and techniques contained below will prove helpful in the exploration of all deep caves.

Drops and Equipment

Most of the drops that require equipment are located before the Big Room, (see profile map on page 92). The few exceptions are located along the downstream passage, the furthest being the Pinnacle Drop 2717 feet from the Big Room. There are several things to keep in mind concerning the rope work. The list below shows only the drops where equipment is absolutely necessary. Throughout the cave much chimneying is required with several difficult climbs necessary to avoid the deep pools of water. For this reason it would be advisable to carry a couple of 20 to 30 foot handlines. Another aid is to have someone block the flow of water down the drop by standing in the water at the top edge of the waterfall. In this manner the water is stopped long enough to provide a chance for another person to rappel down and stay relatively dry.

In the past the rope most often used has been 7/16 inch Goldline. No problems have been encountered with this rope, and the same holds true for 1/2 inch and 7/16 inch Du Pont 707 Nylon, the only other type of rope used in this cave. Personal equipment is carried in one small side pack and held to a minimum. It usually includes a seat sling, two brake bars and carabiners, two Jumar Ascenders (one for the seat sling loop and the other for one foot loop), two baby bottles of carbide, flashlight, hard candy and several small cans of food, and sometimes an extra shirt or light jacket which is worn while resting or after falling into a pool of water. Any special equipment, which is determined by the purpose of the trip, can be divided among the group. All above equipment can be fitted into an army side pack, which leaves the explorer's arms and legs free for climbing.

Drops in Sótano de Tlamaya

Actual depth	Minimum rope needed	Comments
279', 73', 76'	520'	Entrance drops, rope tied at all drops to eliminate slack.
100'	120'	Junction Pit, tieoff to solution hole 25' from drop; loop rope over projections on right wall to avoid waterfall.
209'	250' or 90' & 100'	Tieoff to solution pocket 27' from drop, which can be rigged in two parts with climb-down between.
42'	50'	Last drop before Big Room.
25'	30'	Used as a handline down a steep flowstone waterfall.
40'	50'	Stream drops through narrow channel for 25'; avoid it by climbing up to left to top of a "wall" then rappel down; tieoff in solution pocket just back from top.

32'	45'	Short drop immediately before Pinnacle Drop.
97'	115'	Pinnacle Drop, is rigged from "window" to left of waterfall; rappel 20', traverse ledge to pinnacle overhanging center of pit, loop rope over, and rappel on to bottom.

Water Conditions

The cave as a whole is very wet but the water poses no great problem to exploration. Along the passages there are many deep pools which make several tricky traverses necessary to avoid the water. An arroyo runs in the entrance, but it is dry except during the heaviest of rains. The first real stream in the cave issues from a small side passage in the Entrance Room, 475 feet below the Lower Entrance, and continues on down the various drops to a point just before the Big Room where it siphons. The other stream in the cave is encountered at the far end of the Big Room. It begins in a large section of the cave, flows past the Big Room, and on to the end of the cave. Groups have been in the cave while it has rained three and four inches during the night and they have noted only a small increase in flow of both streams. This is probably due to the fact that there are so many sinkholes and passageways in the limestone of the Tlamaya area that no one system carries a very large percentage of the water. From all signs observed in the cave on previous trips, the streams never reach a really high level or become raging torrents, even during very heavy rainfalls. This was proven in June, 1966, when a group visited the cave after nearly a week of continuous rain. They found that objects that could be easily moved by even a small stream (empty Clorox bottles, cans, clothing) remained in the places where they were left, some only a few feet above the normal low level of the water. One consideration, that is of great interest, is that after the week-long rain the whole water table in the area rose and flooded the last 130 to 150 vertical feet of the cave. This was the first rainfall of such magnitude in several years. The normal rainy season is during the summer months. During this period the level of the streams does rise somewhat and may cause flooding in a small section of the cave near the end. The best time to explore the cave is between Christmas and Easter.

Sótano de Tlamaya is no "easy" cave. Even though, in view of the information above, exploration seems simple and clear cut, there are many unseen dangers that could mean the difference between success and death. Perhaps the greatest danger is from fatigue. It may seem easy going in, but after the bottom is reached the real work begins. It's a long prusik our and many a stout caver has sworn he wasn't going to make it. One also has to keep in mind that an average trip through the cave takes between 25 and 35 hours of steady caving. In addition, the air temperature of 68° F and the water temperature of 64° F can cause great discomfort as well as a pronounced loss of energy to a wet caver, increasing the effects of fatigue to the danger point. Another unavoidable hazard is an accident. The only precaution one can take is just to be careful and make sure his equipment is in good condition. Even the most minor accident could be fatal, for the nearest people who could render any aid are here in Austin, 800 miles away. It is suggested that anyone planning a trip to Mexico first contact the AMCS. Here they can learn of the latest developments in the area or caves they plan to visit, but most important, they can let someone who can help know where they will be in case there is an emergency.

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