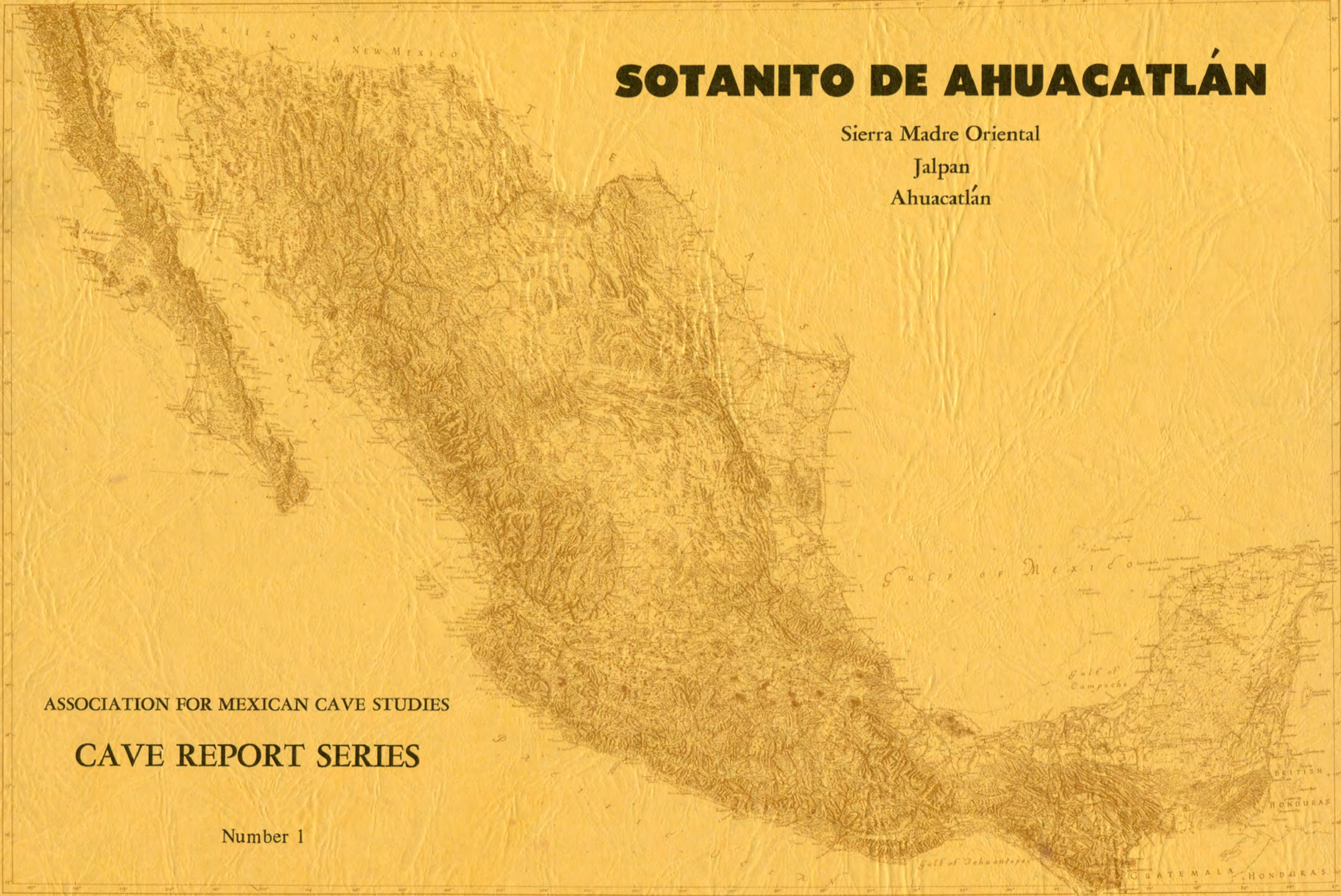
SOTANITO DE AHUACATLÁN

Sierra Madre Oriental

Jalpan

Ahuacatlán



ASSOCIATION FOR MEXICAN CAVE STUDIES

CAVE REPORT SERIES

Number 1

ASSOCIATION FOR MEXICAN CAVE STUDIES

CAVE REPORT SERIES

Number 1

SOTANITO DE AHUACATLAN

Sierra Madre Oriental; Jalpan; Ahuacatlán

by TERRY W. RAINES

The Speleo Press • Austin • 1972

The Association for Mexican Cave Studies is a non-profit, volunteer organization whose goals are the collection and dissemination of information concerning Mexican caves. The AMCS publishes a Newsletter, Bulletin, and Cave Report Series which are available to any sincerely interested, conservation-minded person. Prices are available by writing.

Some of the persons responsible for the continued success of the Association's endeavours are the following:

Publications Editor . . . . Terry W. Raines
Cave Files . . . . William H. Russell
Secretary-Treasurer . . . . Jan E. Lewis
Coordinating Biologist . . . . James R. Reddell
Photo Editor . . . . Carl E. Kunath
Production Manager . . . . Ronald G. Fieseler

ASSOCIATION FOR MEXICAN CAVE STUDIES
P. O. Box 7672, Austin, Texas 78712

Frontispiece: Craig Sainsott views the entrance of the 288.3 m (946 ft) drop within Sotanito de Ahuacatlán.

The Speleo Press P. O. Box 7037 Austin, Texas 78712

ASSOCIATION FOR MEXICAN CAVE STUDIES
P. O. Box 7672, University Station
Austin, Texas 78712 USA

Price of this issue – $2.50 US

INTRODUCTION

Of the 18 physiographic provinces in Mexico (Russell, 1969, *Assoc. Mex. Cave Stud. News.*, 3:27), the Sierra Madre Oriental has been the most productive in terms of caves and other karst features to date. For the past ten years the AMCS has been conducting field investigations in this rugged terrain of thick limestone sequences. The Sierra Madre is extensive, measuring roughly 200 km by 550 km, with few roads to allow access. These logistics problems, coupled with the lack of manpower, have limited extensive detailed exploration and certainly in many locations large caves only a few minutes' hike from the road have not been entered. As a result, AMCS cavers have directed their efforts from one area of concentrated karst development to another. Most recently initiated has been the Ahuacatlán Area, located within the Jalpan Region of the SMO Province. The Jalpan Region lies almost entirely within the state of Querétaro and to the northwest of Jalpan, Qro. The small town of Ahuacatlán gives its name to the Area, which consists primarily of the Cerro de la Tinaja north of the highway (see map, p. 7). It is within this area that Sotanito de Ahuacatlán is situated.

For the most part, volunteer manpower to produce this report was supplied by the ever-present, hard-core group of Austin cavers, with, of course, help from our friends. Persons who should be recognized are: Chuck Bryan, Arthur Cleaves, de de Esparza, Ronnie Fieseler, Blake Harrison, Roy Jameson, James Jasek, Orion Knox, Carl Kunath, Jan Lewis, Neal Morris, James Reddell, Olga Reyes, Jim and Julie Rodemaker, Bill and Carol Russell, Craig Sainsott, Joe Simo, Richard M. Smith, Bob Stockton, and Hugo Victoria. Undoubtedly, others will appear in the latter stages of production who can not be credited at this time.

GEOGRAPHY

Primary vehicular travel through the Ahuacatlán Area is via a hard-surfaced highway which borders the southern edge. Until the mid 1960's this right-of-way consisted solely of a single lane road paved with cobbles which was built in 1910. Branching off the highway at innumerable points is a complex network of both primary and secondary trails which provide the really basic means of travel. These trails date from the 1500's and even earlier, and can lead one to almost any point desired. Access to the Sotanito is by way of one of these primary routes that leaves Ahuacatlán and continues to the northwest indefinitely. Presently, this particular trail is being widened to road-size which will allow passage of trucks to Puerto Guilotla and then on to Santa Agueda, a small village west of the Area.

To reach the Sotanito, follow the main trail, which trends generally northwest, out of town. It roughly parallels the arroyo in the valley below but climbs continuously. Less than 1 km from Ahuacatlán the first hillside arroyo is crossed. Continue on, up over a broad ridge, until reaching a second arroyo. From this point the cave entrance is directly up the arroyo, requiring a steep, one hour hike. It would be impossible to describe exactly where the entrance can be found from here as it is so small and insignificant. The upper photograph on page 16 is a view from the cave which may give some aid. This field is crossed immediately before arrival at the entrance, located in an area of undergrowth. Also, the town of Ahuacatlán lies hidden in the main valley directly above the caver. The last leg of the journey is most comfortably traversed under the direction of a local guide, who would be more than willing to help out if approached in a friendly manner. The elevation gained between Ahuacatlán and the cave is about 400 m over a distance of 2.5 km. The weather is usually hot and the trail steepens as one nears the cave. There is absolutely no water once you get there, so be prepared.

As mentioned before, the Ahuacatlán Area and Cerro de la Tinaja are essentially one and the same. Extending to the north beyond the map, the range is ultimately terminated by the Río Ayutla. Total dimensions are 5 km by 20 km. To the southeast of the Sotanito, the greatest elevation difference is 500 to

600 m. It is measured between the crest of the Cerro de la Tinaja and the base level at Ahuacatlán. The crestal area is broad, giving way on the southwestern flank to a dip slope of 30°. In the vicinity of the linear peak a number of shallow stream courses head. These channels are in general oriented directly downslope and coalesce with a base level arroyo which is parallel to the range. Because of internal drainage, the channels very rarely carry water and are consequently poorly developed. On the other hand, the usually dry base level arroyos do flood after intensive summer rains, in this case conducting the torrent through Ahuacatlán into the Río Jalpan drainage system.

The climate of the Ahuacatlán Area is rather harsh on visitors as well as local residents. The winter and spring months are quite dry, receiving only 10% of the annual 600 mm rainfall. Then, during the summer months, heavy rains erode quantities of loose topsoil from bare corn fields. At all times good water for drinking can usually only be found along the base level arroyos because the above limestone terrain readily consumes all precipitation quickly.

GEOLOGY OF THE AHUACATLAN AREA

by Richard M. Smith

LOCATION

The author, aided by several other members of AMCS, mapped the area during 1971-1972. It should be noted that the mapping was reconnaissance in nature and because of the difficulty of access and poor exposures, much reliance was placed on the geologic map compiled by Segerstrom in 1961. The few minor errors found in the remarkable Segerstrom work were corrected on the included map.

LITHOSTRATIGRAPHIC UNITS

The rocks exposed in the Ahuacatlán area have been subdivided into formations on the basis of lithologic characteristics. Since these formations have a similar order of arrangement in different locations, but are not necessarily contemporaneous, they are said to be homotaxial, and therefore rock-stratigraphical units. However, on the basis of fossil evidence, certain time intervals can be assigned at specific locations.

LAS TRANCAS FORMATION

The lower-most formation exposed in the Ahuacatlán Area is a splintery-weathering, slightly phyllitic gray shale interbedded with a dark-gray argillaceous limestone. These thin beds contain small quartz grains and the formation has scattered beds of impure calcarenite.

The photograph on page 9 is a good example of the splintery-weathering exhibited by the Las Trancas formation, while on page 10 is illustrated the characteristic thin bedding. A small thrust fault can also be seen in this photograph with accompanying drag folds.

Fossil evidence found by Segerstrom 1961 indicates the Las Trancas formation in the immediate Ahuacatlán area is considered to be late Callovian to late Oxfordian age. These, of course, are stages of the Late Jurassic System.

EL DOCTOR FORMATION

The El Doctor is the principal rock unit exposed in the area. To the west of the region, the El Doctor overlies the Las Trancas with great disconformity, however, the exposed contact between these two formations near Ahuacatlán is extremely gradational as can be seen on page 11 . The lithologic characteristics change from slightly phyllitic gray shale and dark-gray argillaceous limestone in the upper Las Trancas to shaly limestone interstitially bedded with calcareous shales. These beds range from 15 cm to 20 cm thick.

In turn, these beds grade into a thick-bedded, fine grained, dove micrite. Further in the section, a rudistid facies appears turning the hitherto unfossiliferous micrite into a virtual coquina. The extent of this facies could not be determined, but certainly constitutes a major portion of the middle El Doctor.

The middle El Doctor quickly changes within a few feet from massive limestone to thin-bedded limestone with some interbeds of brown calcareous shale.

Along the highway, just south of Escanelilla, an attempt was made to measure a section through the El Doctor, but due to intensive parasitic folding and some faulting, the extent of repetition of the section could not be determined.

Again from fossil evidence gathered by Segerstrom 1961, the El Doctor formation, in the Ahuacatlán region ranges from early Albian age to early Cenomanian age, which places the formation in the Early Cretaceous System.

SOYATAL AND MEXCALA FORMATIONS UNDIFFERENTIATED

The El Doctor formation is conformably overlain by a thin-bedded, dove micrite with interbeds of yellow-weathering shale, mudstone and siltstone. The proportion of shale to limestone rapidly increases as one goes higher in the section. Once again, the boundary is gradational and difficult to define. The author based his decision on the first appearance of conspicuous shale beds and the disappearance of the thicker-bedded limestone. Although this procedure agrees with Segerstrom 1953, the field decision made by the author has displaced the previously drawn contact by several hundred meters in the vicinity of Joya del Durazno.

In places the Mexican farmers have removed most of the vegetation from the Soyatal-Mexcala for agricultural purposes, while leaving the vegetation on the El Doctor in its' natural state because topsoil is nonexistent. This has the effect of accentuating the contact between the El Doctor and Soyatal-Mexcala. This can be seen in the photograph on page 12 .

No fossils have been found in the Soyatal-Mexcala in this area, but fossil evidence from the north of the region indicates the formation is probably upper Turonian age at the base and early Maestrichtian age at the top.

STRUCTURE

The Cretaceous and Jurassic rocks in the area have by means of lateral compression been intensely folded with the axial plane trend from northwest to southeast. It is evident from lithologic considerations that the El Doctor is the competent unit while the Las Trancas and Soyatal-Mexcala act as the incompetent units. Parasitic folds, boudinage, tension fractures, shear zones and minor faulting are related to this folding episode.

All folding and related structures are a result of the Laramide orogeny. The major folds in the Ahuacatlán Area are overturned toward the northeast with axial planes inclined approximately 35° SW. From southwest to northeast, the area contains a breached overturned anticline of El Doctor with Las Trancas exposed in the center of the fold followed by a syncline of Soyatal-Mexcala and then another overturned anticline of El Doctor that precedes the final overturned syncline of Soyatal-Mexcala. All of these folds plunge at shallow angles toward the southeast. (See cross section on page 6. Also, the top photograph on page 16 is a southwest view along this cross-section from the Sotanito entrance).

All parts of the Las Trancas, lower and upper El Doctor and Soyatal-Mexcala formations exhibited parasitic folding. The thinner the beds, the more parasitic the folding. The Las Trancas and Soyatal-Mexcala exhibited small amplitude, densely spaced fold trains, while the more competent, thick-bedded El Doctor contained parasitic fold trains of relatively higher amplitude and less density. An example of this type of folding can be seen on page 13, which shows a fold in the lower El Doctor.

Due to the competency of the middle El Doctor, it does not show as much deformation as the other rock units. However, the presence of shear zones and minor thrust faults like the one shown on page 14 shows that the middle El Doctor did share the same stress field as the other units.

Some of the small folds did seem to be concentric in nature while the majority showed the definite thickening of the crest and thinning of the limbs that is indicative of similar folds. This can also be seen on page 13 . Such thickness changes are prevalent in incompetent strata and are accomplished by flowage.

All boudens observed were in the lower unit of the El Doctor. Boudens (sausage-shaped structures) are common on the limbs of folds where medium to thick limestone beds alternate with thin limestone beds. They probably formed at the time of folding since a tensional force was then exerted on the limbs of the folds causing the more plastic units to fracture and flow. The photograph on page 15 shows the result of flowage on the limbs of a fold in the El Doctor. Unfortunately, these features are not true boudens, but the author had no better photograph at his disposal.

Associated with the boudens and having a similar history are tension fractures. These fractures are most obvious in the more massive El Doctor and are recognizable as calcite veinlets or often as a network of en echelon fissures filled with calcite. The latter type of deformation was due to shearing, while the former was generally simple tension. As the tensional or shearing forces opened up the fractures, calcite was deposited in them.

Only a few small faults were mapped in the area. Because of the terrain, it was difficult to ascertain their lateral extent much less vertical displacement. Several zones were mapped that may or may not be faults but are definitely shear zones on a large scale.

Although jointing of the more massive El Doctor limestone was noted, a thorough investigation was not conducted. It was observed that the thick-bedded limestone had a pronounced vertical jointing pattern with a strike orientation parallel and perpendicular to the major fold trends. It is assumed by the author that this joint pattern provided the pathway for the water that formed the Sotanito.

GEOMORPHOLOGY

The Ahuacatlán Area is a combination of two geomorphic terrains. The Soyatal-Mexcala synclines that appear as topographic highs reflect the geomorphic patterns one generally finds on a shale formation. All drainage is above ground and parallels the fall line of the slope. Irregularities are few due to the homogeneity of the formation.

In contrast, the El Doctor anticlines pose a topography peculiar to and dependent upon underground solution and the diversion of surface waters to underground routes. The anticlines are a mature to old karst terrain. Although lapies are common, the most prominent karst feature visible in the area to the average person is sinkholes or dolinen. They are numerous in the region, occuring in two types of localities: in upland interfluvial areas and at the heads of arroyos. Both are areas of imminent integration of a surface drainage system. The two dolinen immediately to the west of the Sotanito are in an upland interfluvial area. The larger of the two is named Joya del Durazno (see photograph on page 12) and measures 500 m by 650 m. The sinkholes through the region were much more numerous in the past than they are now; their number has been reduced by headwater erosion of surface streams.

Between Ahuacatlán and Jalpan the Río Jalpan flows through a natural tunnel 1.5 km long and emerges at a place called Puente de Dios. The tunnel was formed by subterranean stream piracy, which diverted surface waters from about 1050 m above sea level on the west side of the limestone anticlinal ridge of El Doctor to about 900 m above sea level on the east side. A classical example of this sort of feature is the Natural Tunnel of Virginia.

GEOLOGIC HISTORY

Marine deposition of clastic materials took place during the latter part of Middle Jurassic or the early part of Late Jurassic time. The existing sedimentary and metamorphic rocks were eroded where there was local emergence. General submergence followed, and graywacke, arkose, chert, calcareous shale, and argillaceous limestone were deposited in the sea during the Callovian, Oxfordian, Kimmeridgian, and Portlandian stages of Late Jurassic time.

Owing to a withdrawal of the sea and to differential uplift, the Ahuacatlán area was only slightly underwater during much of Early Cretaceous time. The area to the west was a landmass and erosion in this part was so deep locally, as at Bernal, that the Las Trancas clastic beds and impure limestone were completely removed.

A general submergence began in the eastern part of the area probably in middle Albian time and progressed westward during late Albian time. The submergence continued probably into early Cenomanian time and was followed by uplift and emergence that lasted until late Turonian. Renewed submergence in late Turonian time continued into Maestrichtian. Toward the close of the Cretaceous period the entire region was uplifted and has continued to be emergent.

The Cenozoic history of the region began with the folding of all rocks that had been deposited in Cretaceous and earlier times. Folding continued until late Eocene time and was followed by minor faulting, erosion, and local terrestorial deposition. The deepening of the Río Jalpan valley has been the latest observable geologic change and this is still going on today.

REFERENCES

Segerstrom, Kenneth. 1961. "Geology of the Bernal-Jalpan Area, Estado de Querétaro, México." *Geol. Surv. Bull.*, 1104-B.

Johnson, Arvid. 1970. *Physical processes in geology*. Freeman, Cooper & Co.

Pettijohn, F. J. 1957. *Sedimentary rocks*. Harper & Row.

Thornberry, W. D. 1954. *Principals of geomorphology*. Wiley & Sons, Inc.

GEOLOGIC MAP AND SECTION OF THE AHUACATLAN AREA, QUERETARO, MEXICO

1972

EXPLANATION

Rock-Stratigraphic Units

Cretaceous

- Kms — Mescala and Soyatal formations undifferentiated
- Ked — El Doctor limestone

disconformity

Jurassic

- Jt — Las Trancas formation

Symbols

Contact; observed and inferred

A — A′

Cross section line

20

Strike and dip of beds, showing dip angle

20

Overturned beds

S — S

Sheer zone showing strike

? — ?

Fault, movement unknown

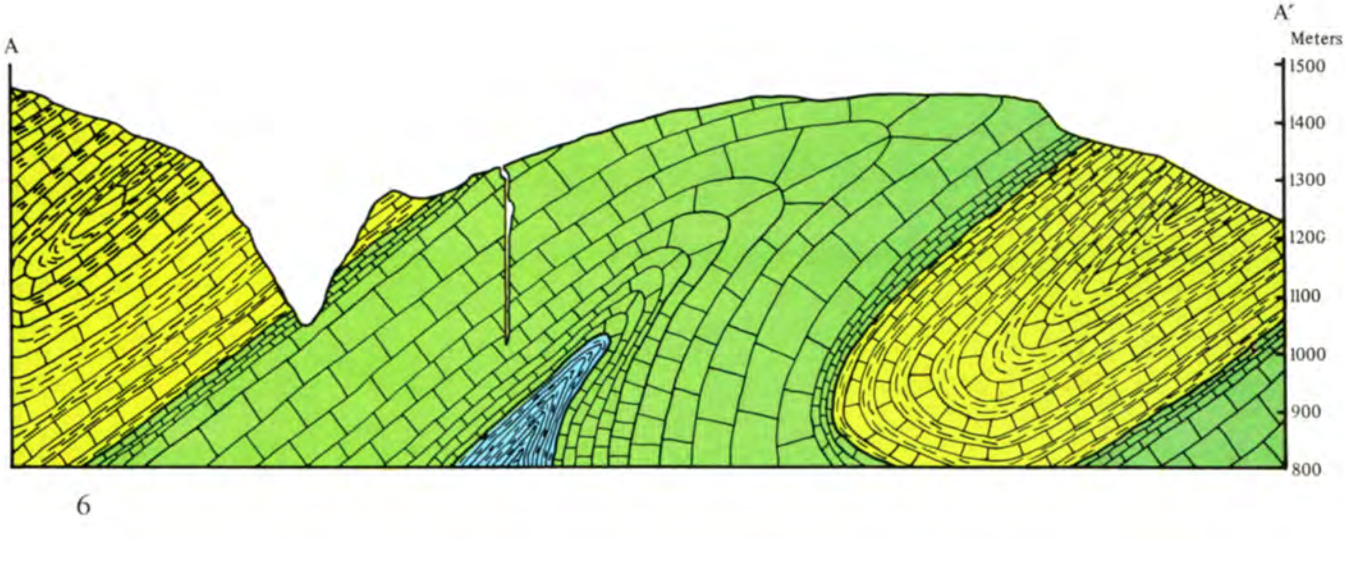
Boudinage

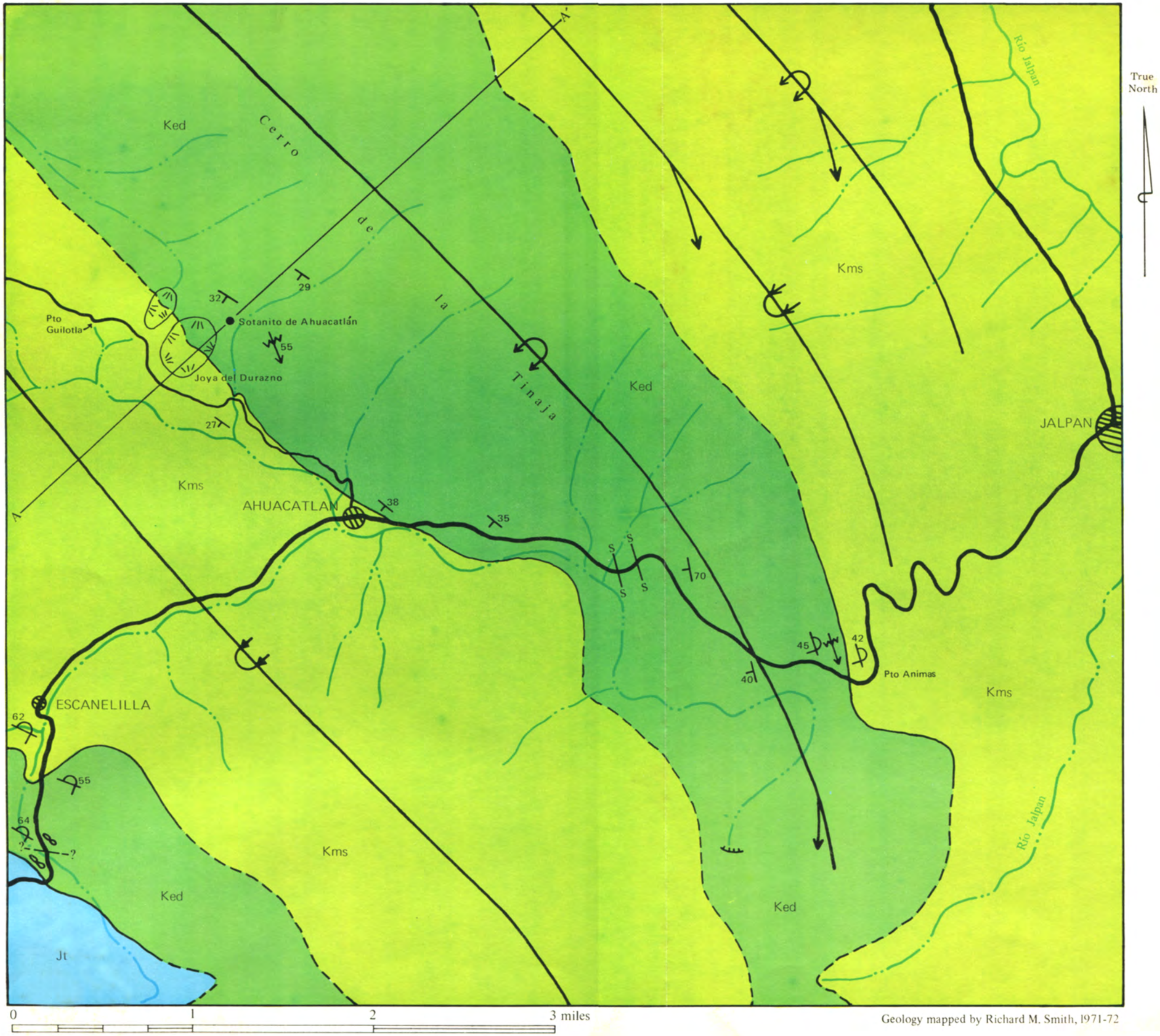
20

Parasitic fold showing angle of plunge

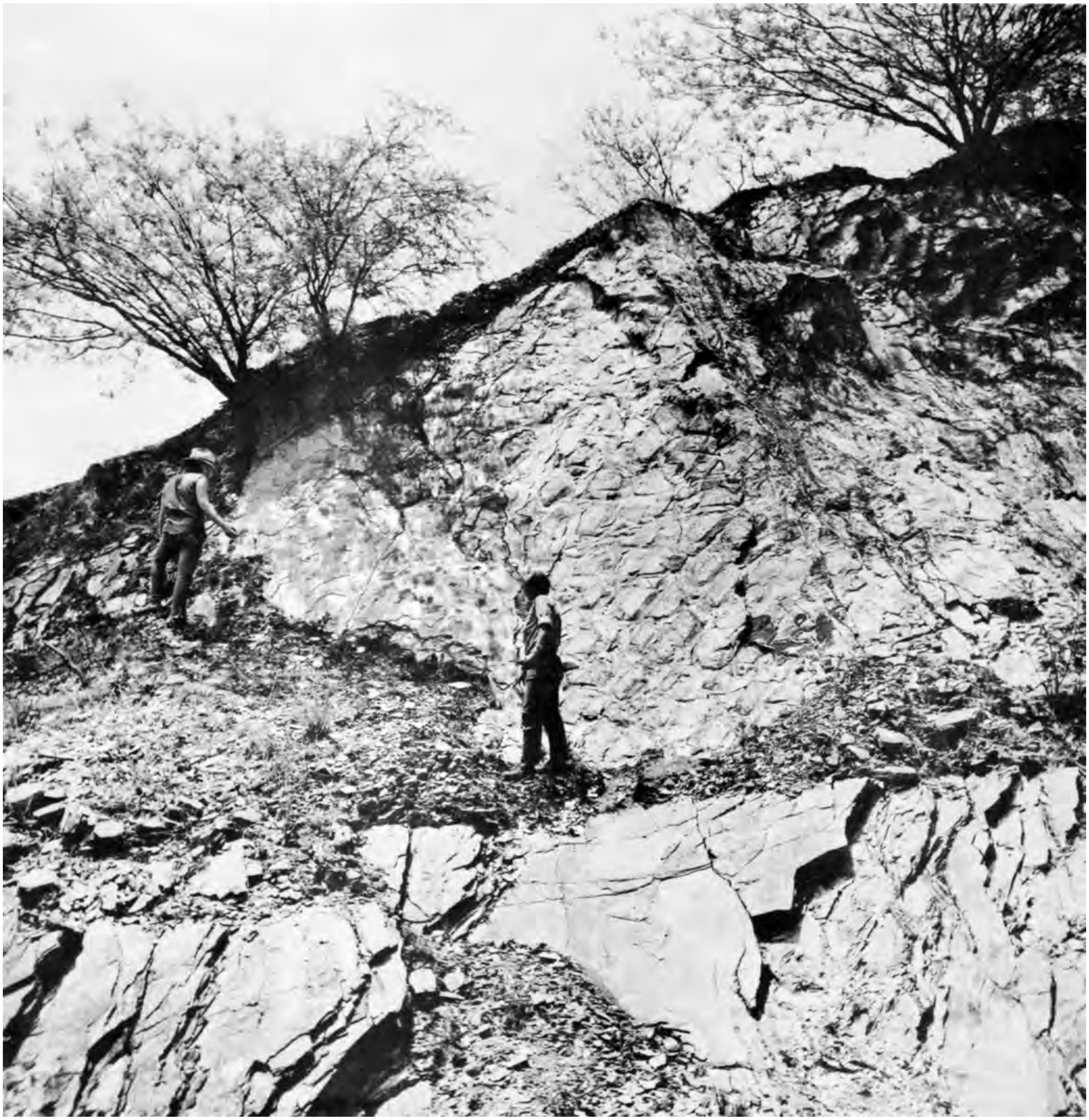
Overturned anticline, showing trace of hinge surface and direction of plunge

Overturned syncline, showing trace of hinge surface and direction of plunge





Geology mapped by Richard M. Smith, 1971-72



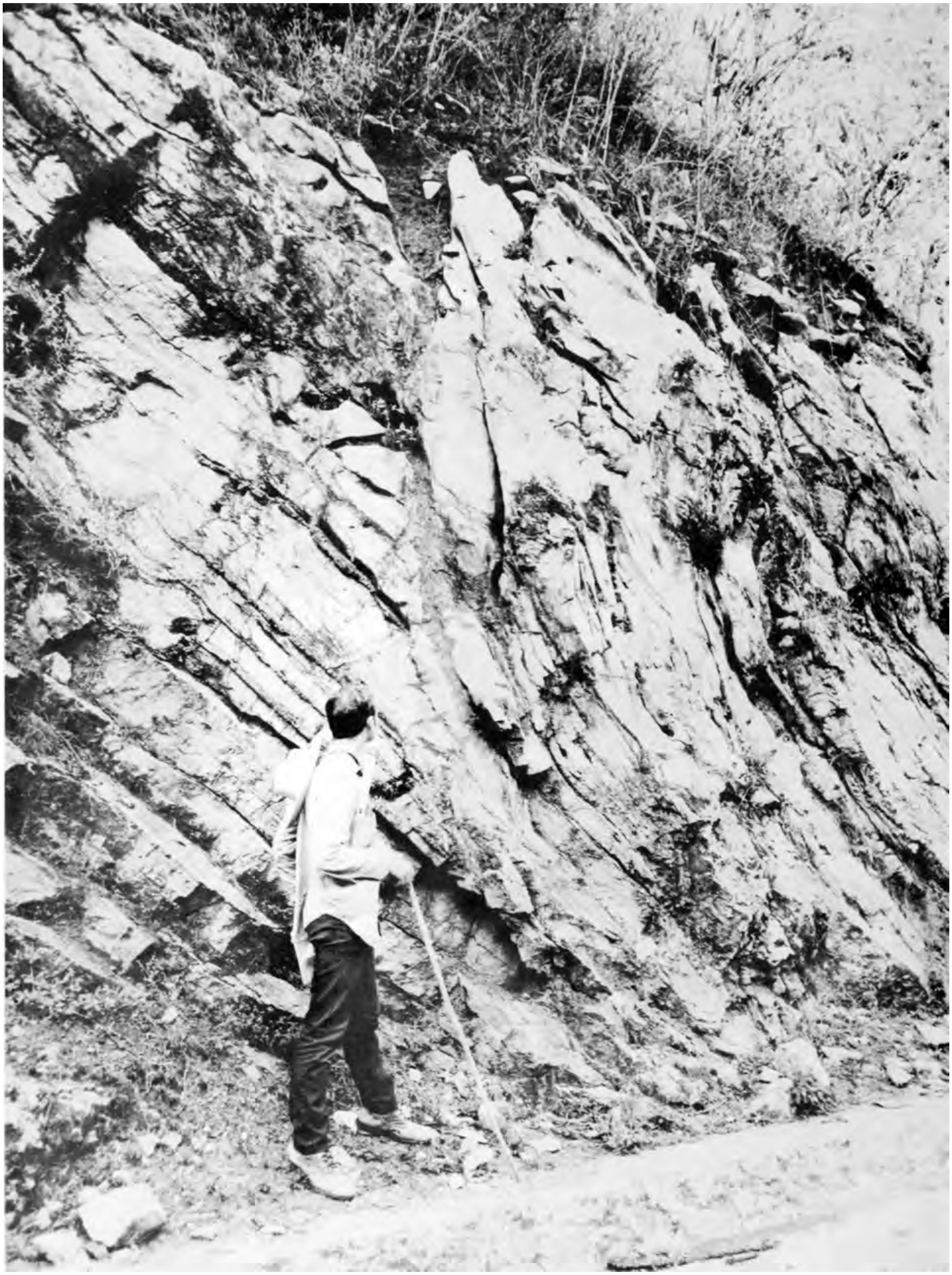
The middle section of the Las Trancas formation exposed in a road cut one-half way up Cuesta de Huasmazontla.

The upper Las Trancas formation near its contact with the El Doctor. This road cut is located at the west edge of the Ahuacatlán Area Map.

Contact between the Las Trancas formation and the El Doctor at a point 100 m to the right (east) of the previous photograph.

Joya del Durazno showing contact between El Doctor (right) and Soyatal-Mexcala formations.

Parasitic folding of the El Doctor limestone in a road cut at the top of Cuesta de Huasmazontla.



Minor thrust faulting and sheering in the El Doctor limestone just to the east of its contact with the Las Trancas formation near Escanelilla.

The El Doctor limestone showing fracturing and flowing on the limbs of an overturned anticline. Road cut is just west of Escanelilla.

CAVE DESCRIPTION

The term *sotanito* or little pit can well be applied to this cave. To even a native of the area the entrance could go unnoticed because of its size and obscurity. The photograph on the bottom left indicates how well a boulder conceals it from a nearby trail. Topographically, the cave entrance is located about 20 m above a shallow, poorly developed valley running perpendicular to the range and 150 m west of the usually dry channel. The slope above the cave rises to a hill, which marks a local high point between the valley and Joya del Durazno. To the northeast rises the main bulk of the range, while in the opposite direction the mountainside slopes steeply to the arroyo that forms the area base level.

Utilizing any of the nearby trees, the explorer rigs a 30 m rope to descend the initial 22 m (71 ft) drop. A slot 1 m in length provides access to the cave below. He must then pad the lip to protect the nylon from the sharp edge. Once this is done the caver quickly rigs on and descends to escape the noonday heat. It is still only March and the daily temperature rises to 92°F. As one rappels through the narrow opening, the walls slowly recede, then suddenly break away into a room 11 m in diameter and 15 m high. Here the temperature has dropped to 63.5°F. The walls in this portion of the cave are completely encrusted with flowstone and other calcite formations, which can be seen in the bottom right photograph. This view of the room also shows the entrance and 22 m drop.

The caver is now at the top of a 34° slope looking down upon a second pit (see frontispiece). This slope is composed of angular rocks which have fallen from the walls, ceiling, and entrance. They range in size from silt to boulders one meter in diameter, with an average size of 10-15 cm. One must closely follow the right wall to reach the second pit as other routes will surely dislodge rocks. Any motivated breakdown plunges directly into the pit, which means disaster after the rope has been rigged. Almost overhanging the pit is a portion of a large column which has fallen and now provides a nearby tieoff point. Other massive, as well as a few delicate formation displays are found on the surrounding walls.

A 300 m rope is not easily strung out in a room only 11 m in diameter. For this reason, fellow cavers are simultaneously spreading out the new coil of Goldline on the surface while the explorers below clear the slope of loose rocks. It is hard to believe that such a small pit will be so deep, but reports by earlier explorers are certainly reliable. The end is lowered down the first drop, then directed directly into the mouth of the second. Once in place, the rope is again padded where it passes over the pit edge. The caver is now ready to enter and he clips onto the taut rope (see upper left photo). The initial 50 m of rappel is slow even though only four bars are used because of the weight of rope below. Afterwards, descent becomes easier. Previous experience might indicate that under similar circumstances such a pit as this should end quickly or open up. But this is the exception. It remains a narrow tube for a great distance with a change limited to only one dimension at -100 m. Past this point the pit gradually narrows again to almost its entrance dimensions. As the explorer passes the -50 m level voice communication is lost and past -100 m no sounds are transmitted by the narrow pit. The rappel seems endless. At any moment one expects to encounter a room and perhaps arrive at a breakdown floor. But rather the narrow shaft continues with little variation. The first sign that the bottom is being approached is the appearance of several twisted loops in the Goldline. Suddenly all progress ceases as a tremendous entanglement is encountered. Only with much difficulty is the obstruction overcome, passed, and the pit bottom reached. More energy is required to unclip and be free of the rope. By this time the light is growing dim and it is time to recarbide (bottom photo).

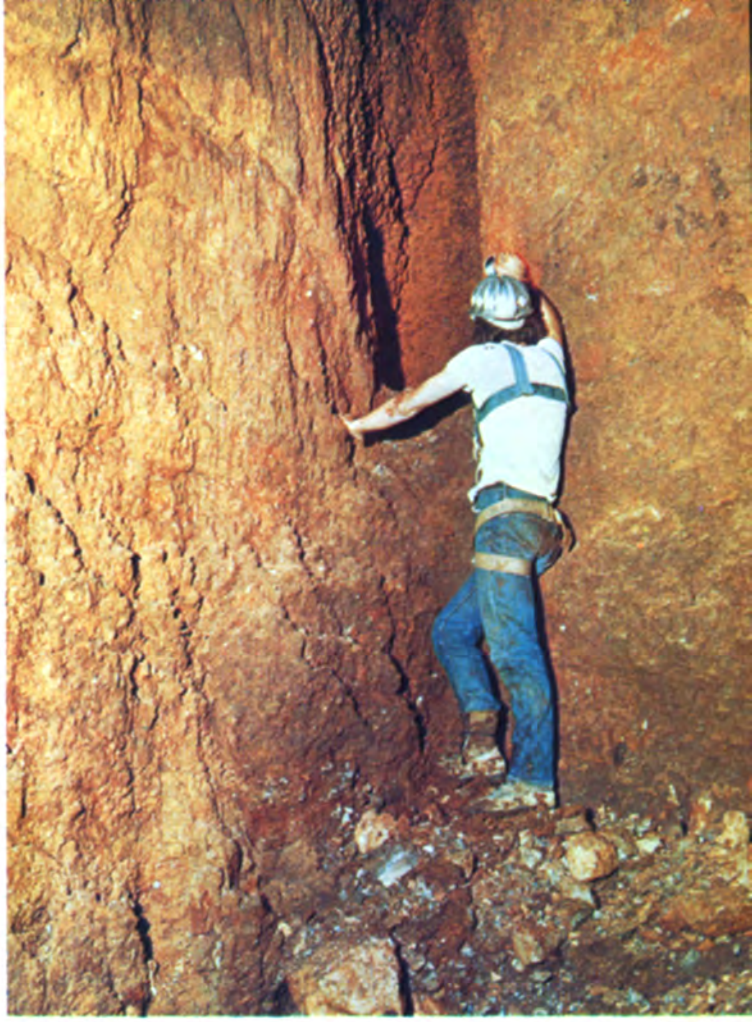
The detailed features of the cave are again visible and immediately the explorer questions the absence of the half-meter boulders which were used to sound the pit. He then realized that they have actually exploded into small pieces, most less than 10 cm, because of the great fall. In fact, many particles can be seen embedded in a thin veneer of clay that covers the walls. There is very little other debris at the bottom, which measures only 4 m in diameter. Looking up and remembering, the explorer can see that the last 40 to 50 m of the pit are encrusted with formations as was the entrance room, while in other sections of the pit the walls were bare. From the bottom exits only one possible lead (upper right photo), which is entered by climbing over a 1.5 m saddle. On the other side a narrow pit descends 4.6 m to water and the end of the cave. From altimeter readings, it is calculated that this pool is near the base level in the area and represents the watertable. The temperature here at the bottom is 67°F, which is 3.5° above that of the entrance room.

The necessary information has now been gathered in this part of the cave and it is time to leave. The long prusik out will provide a chance to make further observations of the pit walls. Above the encrusted zone the limestone is exposed. Beds are 0.5 to 1 m in thickness and cream colored. Higher up, about -200 m, long well-developed flutings begin to appear and are the dominant feature in this section. The pit becomes more and more fissure-like as one ascends, reaching its maximum length at -100 m. Here it is difficult to tell whether or not another pit system joins the Sotanito. If it does, it will probably be of little extent as the surface above would be the limiting factor. This questionable lead is estimated to be 20 m away from the rope and practically impossible to reach. Dim carbide lights illuminate few other details. Continuing the climb, the prusiker is aware of an immediate narrowing of the pit and a corresponding change in lithology. The medium bedded cream limestone gives way to a much darker, gray limestone that is more thinly bedded. The most striking feature here are the numerous fossils, primarily rudists, which have been etched from the wall and stand out in great relief. They are prominent throughout the remaining ascent. Common to all limestone beds in the cave is the dip. It is estimated to be 30° which is consistent with exact surface readings. The problem with the cave is that the few planes suitable for measurement are just not accessible while in rappel. The caver now emerges from the pit and makes the final measurements. The drop is 288 m (946 ft) deep with the rope hanging near the wall from top to bottom. Total depth of the cave at the pool is -320.4 m (1051 ft). As the dim light from the entrance fades, the caver quickly exits before nightfall.

PAST AND FUTURE EXPLORATION

The first members of organized speleology to visit the Region were David McKenzie, James Reddell, John Fish, and Richard M. Smith from the University of Texas Speleological Society. The caves they explored were located along the Río Jalpan just below Puerto Animas. On 8 August 1966 they made a reconnaissance of the upper entrance of the Puente de Dios cave system and two smaller caves on the natural bridge above. During the following days the four were shown several additional caves, the largest being Cueva de los Riscos. A complete report of their work may be found in *AMCS Newsletter,* Vol. II, No. 4, p. 84-87. As is true with most initial visits to a region, exploration was limited to an area immediately adjacent to the highway.

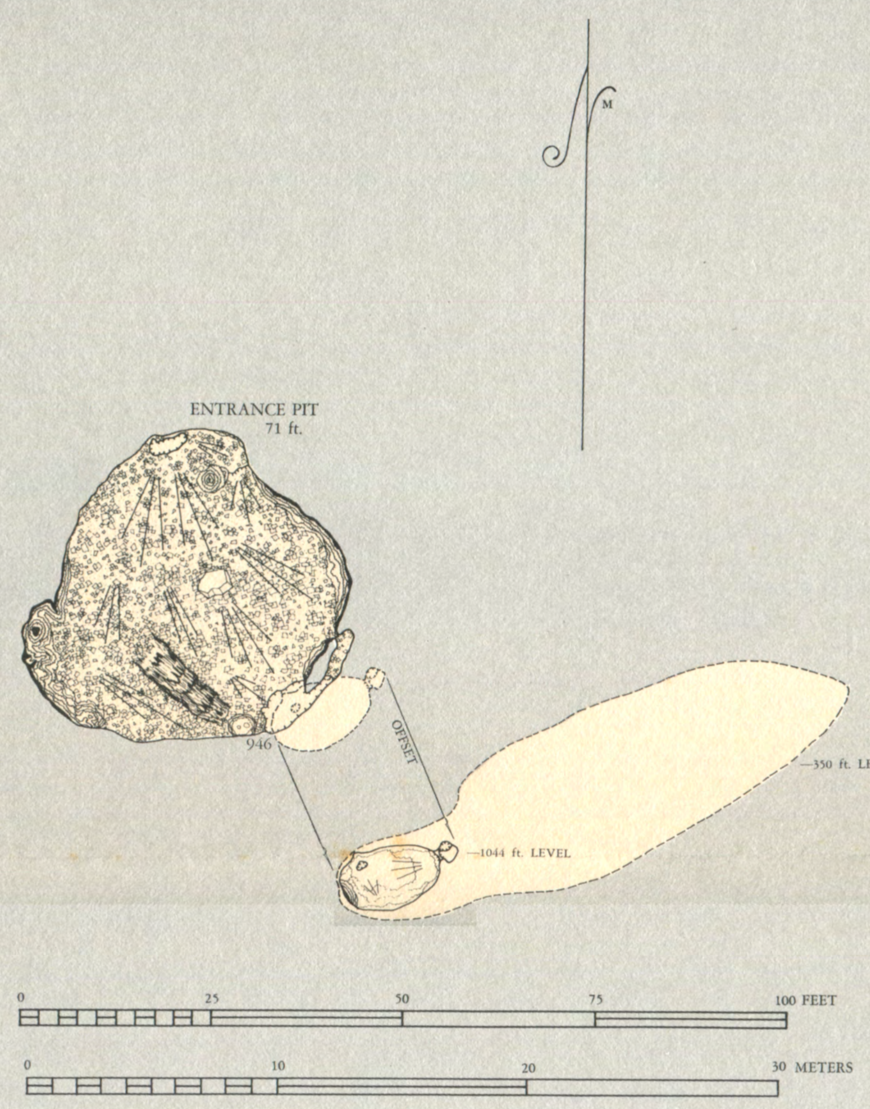
Several years passed before interest was activated in the Ahuacatlán Area. Pursuing reports of caves in the area above Ahuacatlán, 11 members of the Southwest Texas Grotto and two cavers from Illinois arrived in the town during March 1971 and began the hike into the mountains. During their stay in the Area, Grayson Knapp, Keith Heuss, and Scott Campbell made the initial descent and exploration of the Sotanito entrance room. They reported a second drop of over 200 ft. Blake Harrison then entered the pit, rigging it with a 365 ft rope. This proved entirely insufficient, as rocks could be dropped for four more seconds free from the rope's end. There was a day's delay in obtaining a 700 ft rope, but once it was rigged Logan McNatt entered the pit. All members of the group were amazed after Logan's 45 minute rappel and prusik when he reported 700 ft free and still going. Depleted of time and equipment, exploration was postponed until a future trip.



This trip materialized one week later when cavers from San Marcos and Austin, Texas, Carbondale, Illinois, and Monterrey, Nuevo León, returned to the Sotanito. This time they carried a 1200 ft rope and the hope of bottoming the cave. Blake Harrison, who had previously entered the pit to -365 ft now rappelled first. Because of the poor communication characteristics in the pit it was agreed that when the rope became slack Blake would be on bottom and Terry Raines would rappel in to aid with the survey. All went as planned and the pit termination was explored and mapped. The remaining problem was how to accurately measure the depth without a calibrated wire and only a 100 ft steel tape. Fortunately, it was observed that the wall was always close at hand. By prusiking in tandem, Blake, who was in the lead could mark a point on the wall every 100 ft with Terry measuring to the previous point. The system worked quite well and an accurate survey was the result. A day was required to make the exploration and gather information, after which the group returned. More exacting details of the above groups' explorations may be found in *AMCS Newsletter,* Vol. III, No. 3 & 4.

In the future, one can expect many caves to be located and explored in the Ahuacatlán Area. The potential for vertical development is over 300 m at most points and as indicated by the presently known caves, deep pit development will be favored. The caver with persistence and a love for hiking will be rewarded.

LONGITUDINAL PROFILE



PLAN

SOTANITO DE AHUACATLAN

Sierra Madre Oriental; Jalpan; Ahuacatlán

Municipio de Pinal de Amoles, Querétaro, México

Brunton and Tape Survey, 26 March 1971 by Blake Harrison and Terry Raines
Support Crew: Roy Jameson, Jim and Julie Rodemaker, Craig Sainsott, Hugo Victoria
Artwork by Orion Knox
Drafting by Terry Raines

Published by The Speleo Press
for the
Association for Mexican Cave Studies
Austin, Texas, USA
June, 1971