In the summer of 1980, *Texas Highways* published my feature article dealing with the caves of Texas. This came about after they had published one of my cave pictures on the cover of an earlier issue. There was some favorable public response to this picture and I was encouraged by the Assistant Editor, Bob Parvin, to develop a more detailed article. Oddly, they did not give me the cover of this issue; instead gave space to a purple iris.

They did a reasonably good job with photo reproduction and made only a couple of errors: On page, 17 Glenda is misnamed as "Linda" and on page 18, the bottom right photo is upside down.

Nevertheless, the article is something of a landmark and, nearly thirty years later, it remains as the sole example of such coverage in a Texas magazine.

NOTE: To see the photo page spread on pages 12-13, select

VIEW>PAGE DISPLAY>TWO-UP from the Acrobat menu bar.

Texas
THE OFFICIAL STATE TRAVEL MAGAZINE **HIGHWAYS**

July 1980—Vol. 27 No. 7

Texas Highways (USPS 385-770) is published monthly to promote energy conservation through more efficient recreational travel planning, and to inform its readers about public parks, recreational opportunities, scenic places, historic accounts, and other subjects concerning the State of Texas that are of interest and value to the general public.

Published monthly by Travel and Information Division

Tom Taylor	Division Director
Herman Kelly	Media Director
Frank Lively	Editor
Bob Parvin	Assistant Editor
Tommie Pinkard	Associate Editor
Ernest Jordan	Art Editor

Texas Highways is available on a subscription basis at $7 annually, or $1 per copy (price includes state sales tax). Write *Texas Highways* Circulation, Attention Mike Talley, PO Box 5016, Austin, Texas 78763, or call 512/475-7263.

Inquiries, manuscripts and other material should be directed to *Texas Highways*, 11th & Brazos Streets, Austin, Texas 78701. Phone 512/475-5954.

Second Class Postage paid at Austin, Texas, and additional mailing offices. Postmaster: Send notification (Form 3579) regarding undeliverable magazines to Texas Highways Circulation, P. O. Box 5016, Austin, Texas 78763.

Page 9

Page 26

ABOUT OUR COVERS

Front—Purple iris, cinnamon fern and dwarf palmetto palms, native American plants more commonly found in eastern climates, are among the 600-odd plant species that find ideal growing conditions in the terrarium-like environment of Palmetto State Park in dry south Central Texas. The lush, almost tropical setting comes as a surprise to the traveler. Turn to page 4 and take a look. Photograph by Bob Parvin

Back—Wonders seldom seen await the caver who slips into the crystalline world of the thousands of noncommercial caverns of Texas. (See page 12.) Elbert Bassham of Alpine pauses to admire the translucence of stalactites hanging in the depths of Caverns of Sonora. Photograph by Carl Kunath

Exploring new worlds below the Texas sun

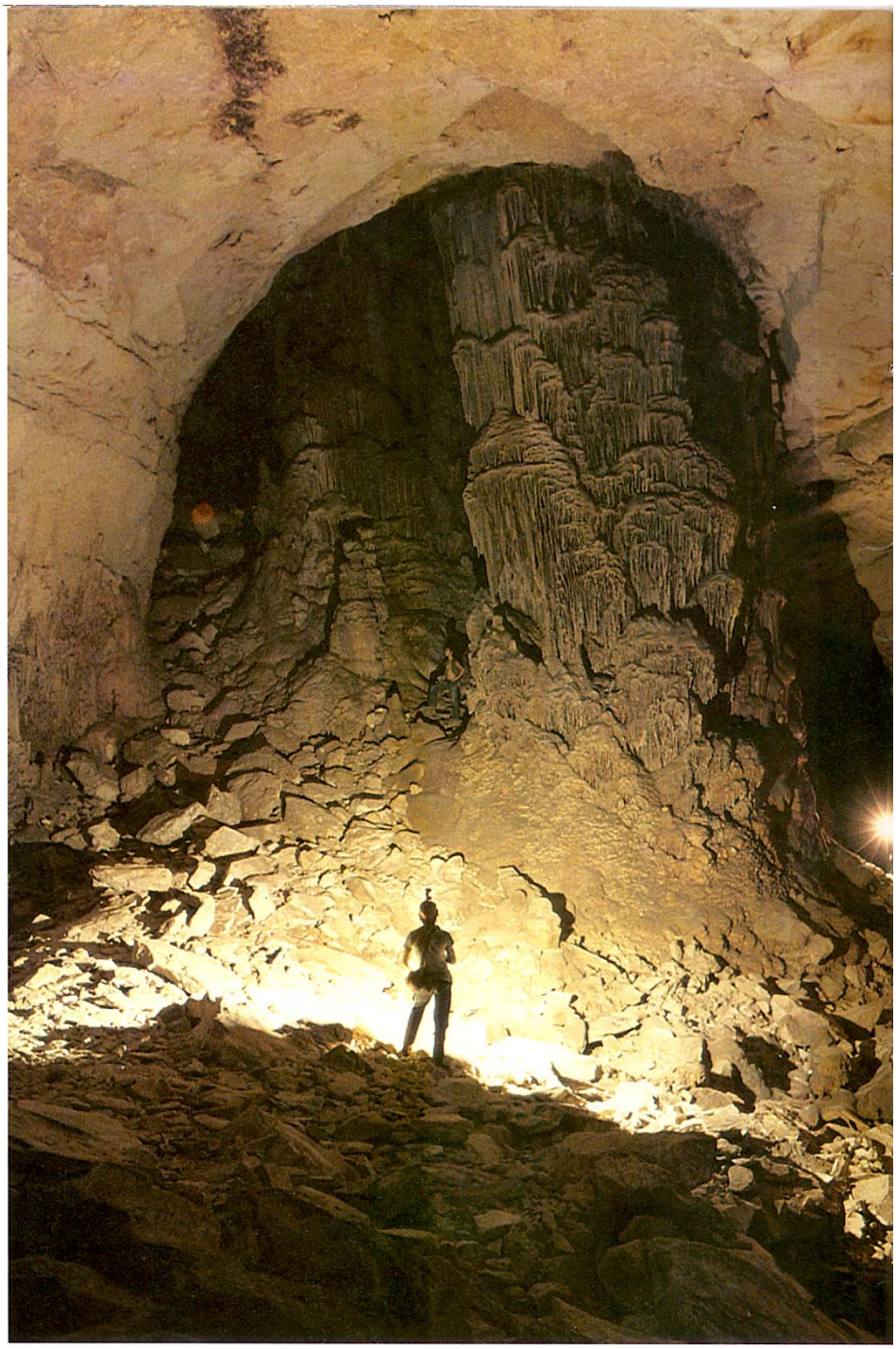
WHAT'S DOWN THERE?

Story and photographs
By Carl Kunath

IMAGINE A mountaineer examining a photograph of a peak he intends to conquer. Noting obstacles and problem areas, he carefully plans a route to the crest. Now suppose his photo was made as clouds veiled the upper portion of the mountain. The goal, with its attendant problems, is only vaguely sensed, not sharply etched as before.

So it is with the cave explorer (spelunker). Will the cave he is about to enter be large or small, easy or difficult? Will it be dry or dripping wet? Will it be clogged with mud or filled with splendid decorations? Cave exploring is a journey through the unknown with a surprise ending.

Thousands of caverns with decorated rooms like Real County's Cave of the Lakes (noncommercial) await the Texas spelunker. Ground water slowly reclaims the treasures of this chamber, decorated when it stood above the phreatic zone.



Kickapoo Cave's large volume accommodates a 60-foot stalagmite, thought to be the tallest in Texas' underworld. Someday this Kinney County cavern may be open to the public.

What Texas may lack in challenging mountains she more than makes up in her caves. Other states may have more caves, deeper or longer ones, but Texas takes the prize for the beauty of her caves and their diverse, often unique, animal life.

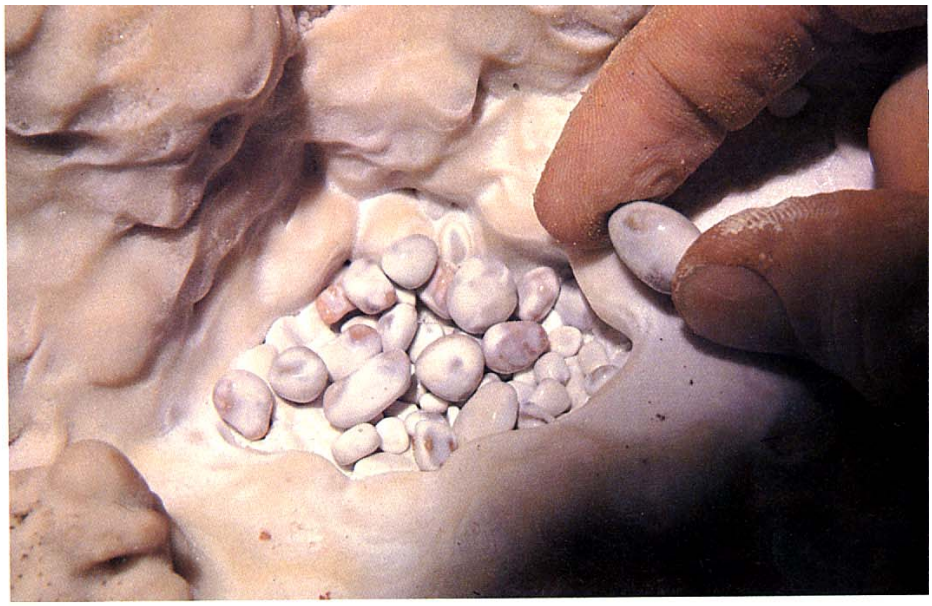
Only in recent years have the state's cave resources begun to be studied seriously. Since 1960, the Texas Speleological Survey (TSS) has collected information about more than 2,000 caves in 74 counties. Speleologists expect hundreds more caverns to be found. Consider the example of San Saba County. In 1962, TSS cataloged 82 caves of varied types and sizes. By 1973, the cave count for San Saba County had increased to 177.

Even a well-established caving area may yield surprises at any time, occasionally in rather unexpected ways. In 1963, highway construction crews assumed they were on solid ground as they sank test holes for the footings of an overpass on Interstate 35 near Georgetown. But again and again their drills fell into subsurface voids. A man-sized hole was bored through 33 feet of rock and explorers were lowered into an incredible cave, sealed from daylight for thousands of years. In room after room, they discovered an "Inner Space" of crystalline beauty. They also found an accumulation of fossil bones where once, thousands of years before, the cave had a trap opening to the surface. (Many speleologists believe that most caves have no entrance. Perhaps this is Nature's way of conserving her fragile underground resources.)

An informal group of 200 to 300 spelunkers from all walks of life carry forward cave exploration in Texas. Taking advantage of long weekends and holidays, the cavers slip into the underground for various reasons. A few are involved in the scientific aspects of caving; most simply enjoy the caving experience for the sport it offers.

You need not be the intrepid adventurer type to enjoy Texas' caves. Your curiosity may be satisfied by a visit to a commercial cave with its well-lighted paths and knowledgeable guides. Once that first tour is behind you, you may feel the desire to visit a "wild" cave. Done safely, a visit to a noncommercial cave should be an exhilarating experience and a step into a new world. You may stand where no man has stood before.

What are caves? Where are they found? How are they formed? The answers to these questions may not be as obvious as you think. Caves

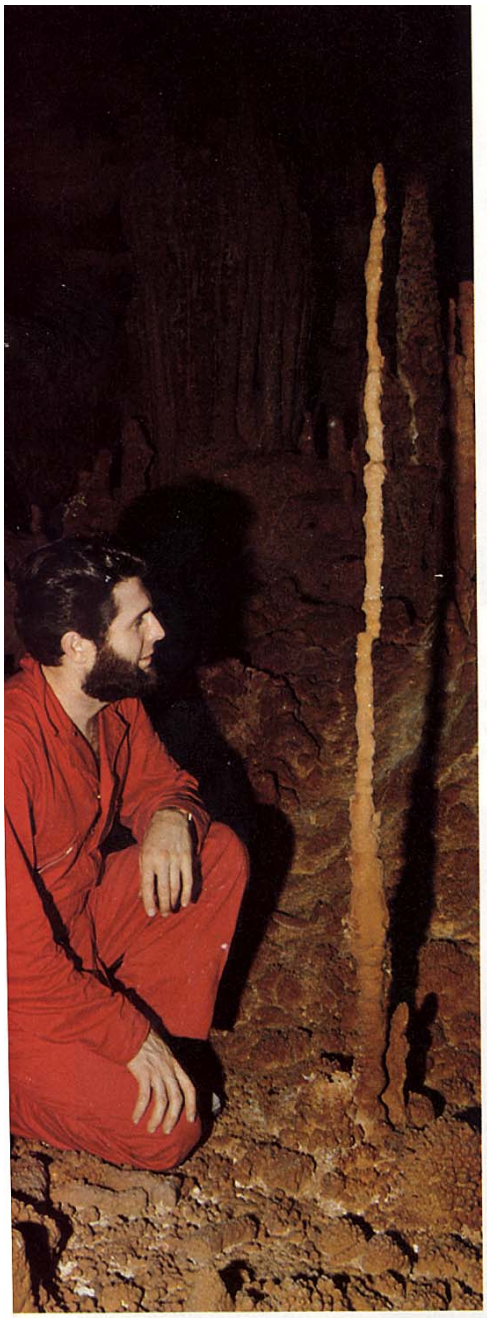


Concentric bands of calcite harden into soda straw formations (left), unless the hollow passage is blocked and water finds an alternate route. Drippage outside the walls of the tube results in thickening (below left). Hydrostatic pressure and chemical changes in water cause helictites (below) seemingly to defy gravity. "Cave pearls" (above), are accumulations of calcite left by steadily dripping water.

are the voids remaining when rock is removed by natural causes, usually in solution by slowly moving water at or slightly below the water table in an area called the phreatic zone. Actually, the whole process begins up in the clouds. Rain sinking through the humic soil layers picks up carbon dioxide. Carbon dioxide and water mix to become carbonic acid, a chemical that dissolves limestone, leaving an ever-enlarging maze of cavities in the rock.

Later, as the land rises or the water table drops, the voids fill with air instead of water. With the water pressure removed, the ceiling may not be able to support its own weight and will collapse until structural equilibrium is achieved. Thereafter, invading surface water tends to deposit material rather than remove it.

Most Texas caves have been formed in limestone, although many are found in gypsum and rare examples are in sandstone and granite. In Texas' predominant Cretaceous limestone regions, caves are believed to have required from 50,000 to 250,000 years to form. Although limestone is natu-



Caver George Yeary of Irving studies the "Toothpick," an Edwards County cave formation noted for its exceptional slimness and offset alignment, possibly the result of a shift in the overhead water source.

rally porous, water movement is only a few feet per year, unless it follows weak areas such as faults or joints.

Concentrated in a band 100 miles wide, caves can be found from Austin westward to El Paso, with emphasis in the Edwards Plateau region of Central Texas. Here, carbonate rocks of Cretaceous Age (about 100 million years ago) have been exposed by a great uplift. Along the eastern and southern edges of the uplift, an area called the Balcones Fault Zone, the rocks have been greatly fractured, creating ideal conditions where caves can form.

How do the caves of Texas compare with those of other areas? Two common measurements are "long" and "deep." The longest cave in the world is the Flint-Mammoth System in Kentucky where more than 214 miles have been surveyed. Texas' longest cave is Powell's Cave in Menard County at 10.6 miles. The low ceilings in Powell's have earned it the nickname of "World's Longest Crawlway."

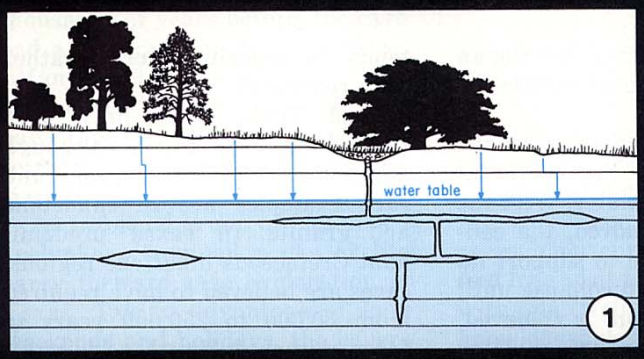
The deepest cave in the U.S., Big Foot Cave in Siskiyou County, California, descends to 1,205 feet. Texas' deepest cave is Adam's (Sorcerer's) Cave in Terrell County, recently surveyed to 548 feet.

Volume provides another interesting comparison. Fern Cave in Val Verde County has only 3,400 feet of passages, but they average 30 feet high and 100 feet wide. That is the equivalent of a corridor 10 feet wide, 10 feet high and more than 19 miles long. Contrast this with Airman's Cave in Travis County. Airman's passages extend for 11,200 feet, but are seldom high enough to allow its visitors to stand.

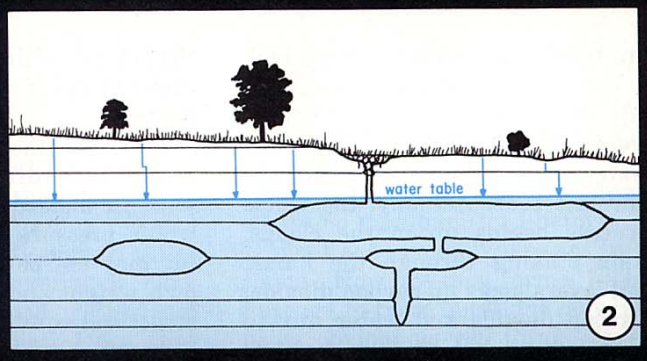
Texas has some of the most beautiful caves in the world. Conditions have often been right for the growth of extraordinary cave decorations (speleothems). Pure limestone dissolved in pure water results in nearly transparent deposits of calcium carbonate in crystalline form (calcite). Add a trace of iron to the solution and shades of orange occur. Manganese will produce gray coloration, and so on. Even the slightest change in water flow or chemical content will alter the shape and color of cave decorations.

A droplet of calcium-laden water may appear at a crack in the ceiling, hover for a time, perhaps sparkling in the light from a caver's lamp, then fall, splashing on the floor below. Above and below, crystals of calcite are left behind from which stalactites

Illustration by W. R. Elliott & Carl Kunath



Speleogenesis, the evolution of a cavern, takes tens of thousands of years. Surface water bearing limestone-eating chemicals invades through sinkholes, cracks and fault zones.



In response to a drying climate, the water table slowly subsides and seep water from the surface continues to deteriorate the limestone into widening passages.

Linda Kunath, wife of the author, squeezes through the "Diamond Horseshoe," a lopsided stalagmite found off the beaten trails at Caverns of Sonora.

(hanging from the ceiling) and stalagmites (rising from the floor) begin to reach toward each other. The rate of growth is slow by human standards, perhaps building at the rate of 1/250-inch per year, about the thickness of one page of this magazine.

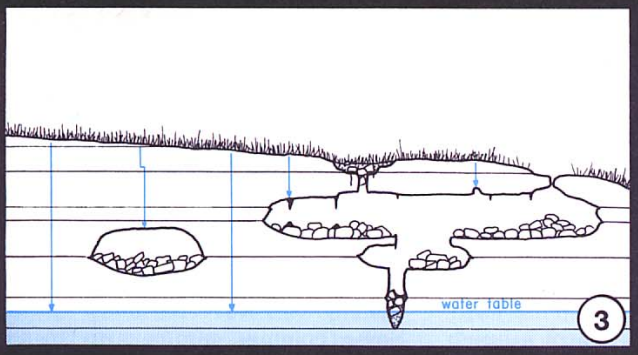
Stalactites begin as rings of calcite left on the ceiling and elongate into hollow, tube-like formations. If conditions are stable and the water is pure, the central canal never becomes blocked and these delicate "soda straws" may grow several feet long. However, if the central canal is plugged, water may escape higher up on the thin wall and flow down the sides, resulting in the common carrot-shaped stalactite. If chemical-laden water favors one side of the stalactite, lateral enlargement known as a drapery occurs.

Nature's repertory of spelean delights doesn't end with stalactites and stalagmites. In quiet pools saturated with calcite, huge crystals may cluster in striking perfection. Elsewhere, nests of smoothly rounded cave "pearls" can occur as small particles are agitated by constant dripping and acquire an even coating of calcite.

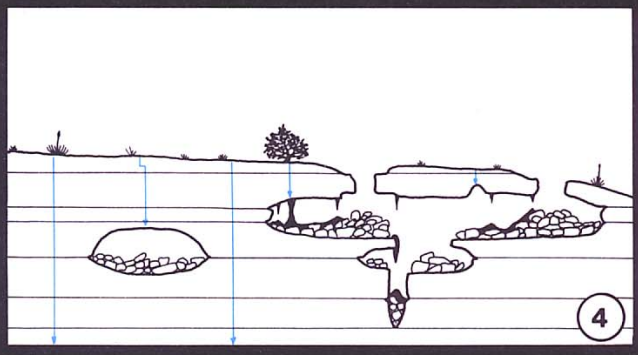
Speleologists do not fully agree on the genesis of helictites. These crazy tangles of crystal confusion defy the gravity which binds mere mortals. They grow in all directions, moving water upward and around by hydrostatic pressure or capillary action. Their contortions are thought to be the result of changes in the crystal structure at the "living" tip of the formation.

Massive pillars of calcite towering far overhead are easily appreciated. However, if you look closely, even the smallest drop of water may reveal a world that can sway your imagination. Hanging from a lacy bit of calcite for a second, an hour or a day in the breathless void of a cave, these translucent visions magnify the blending of physics and chemistry with time—the result is a cave decor of overwhelming beauty.

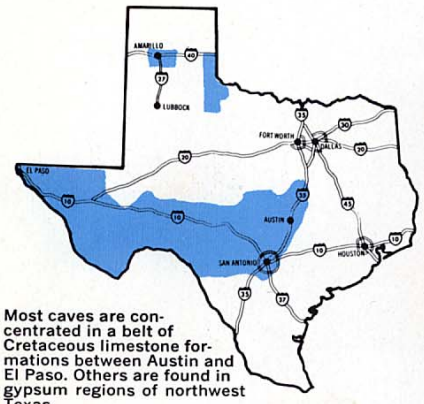
The biological world of Texas caves contains even more miracles. Some authorities rate Texas aquatic cave life as the most diverse in the world. More than 100 species of troglobites (creatures living *only* in caves) are presently known from Texas caves. These descendants of former surface dwellers have adapted so completely to cave environment they can no longer survive beyond it. Loss of pigmentation, absence of eyes, slender and elongated appendages and a generally lower metabolism are special



Lowering the watertable removes the bouyant pressure needed to support large chambers. Structural equilibrium is achieved by ceiling collapse.

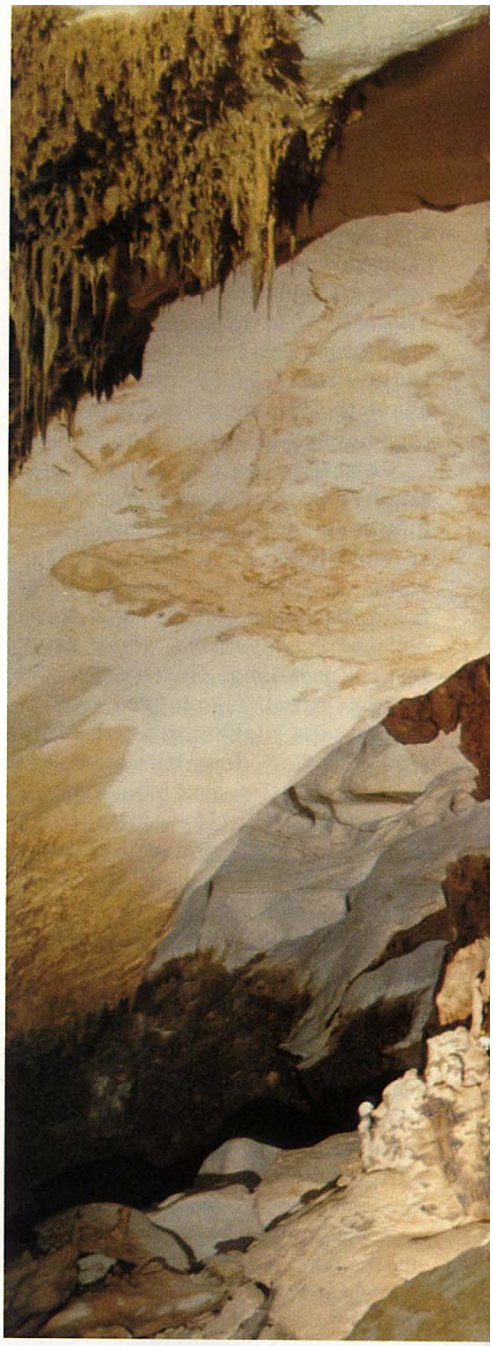


Left high and dry, cave rooms now become decorated with formations as surface water enters the air-filled cave, leaving behind deposits of calcium carbonate in crystalline form (calcite).



Most caves are concentrated in a belt of Cretaceous limestone formations between Austin and El Paso. Others are found in gypsum regions of northwest Texas.

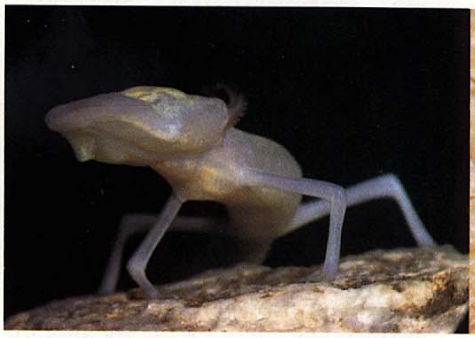
Mike Moody of Mount Pleasant crawls out of a Kerr County cavern.



When . . . Where . . . How

If you are interested in exploring caves, contact the Texas Speleological Association, 1019 Melrose Drive, Waco 76710, or the National Speleological Society, Cave Ave., Huntsville, Alabama 35810 for information on local caving clubs (grottoes) and their activities. Never attempt cave exploration without experienced partners. Always leave word of your destination and expected time of return with a responsible person. In case of emergency, call the "Rescue Hotline" (512/686-0234) for assistance. Take along at least three light sources for each member and use special care not to litter or disturb animal life or sensitive cave formations. Several beautiful caves on private land have been closed because of careless practices by visitors. If you discover new caves or if you have new information about known caves, Texas Speleological Survey, Box 5672, Austin 78763 will be grateful for the information. Commercial caverns include Cascade Caverns, Boerne; Caverns of Sonora, Sonora; Century Caverns (Cave Without A Name), Boerne; Inner Space Caverns, Georgetown; Longhorn Caverns, Burnet; Natural Bridge Caverns, New Braunfels, and Wonder Cave at San Marcos.

Robert W. Mitchell



Robert W. Mitchell

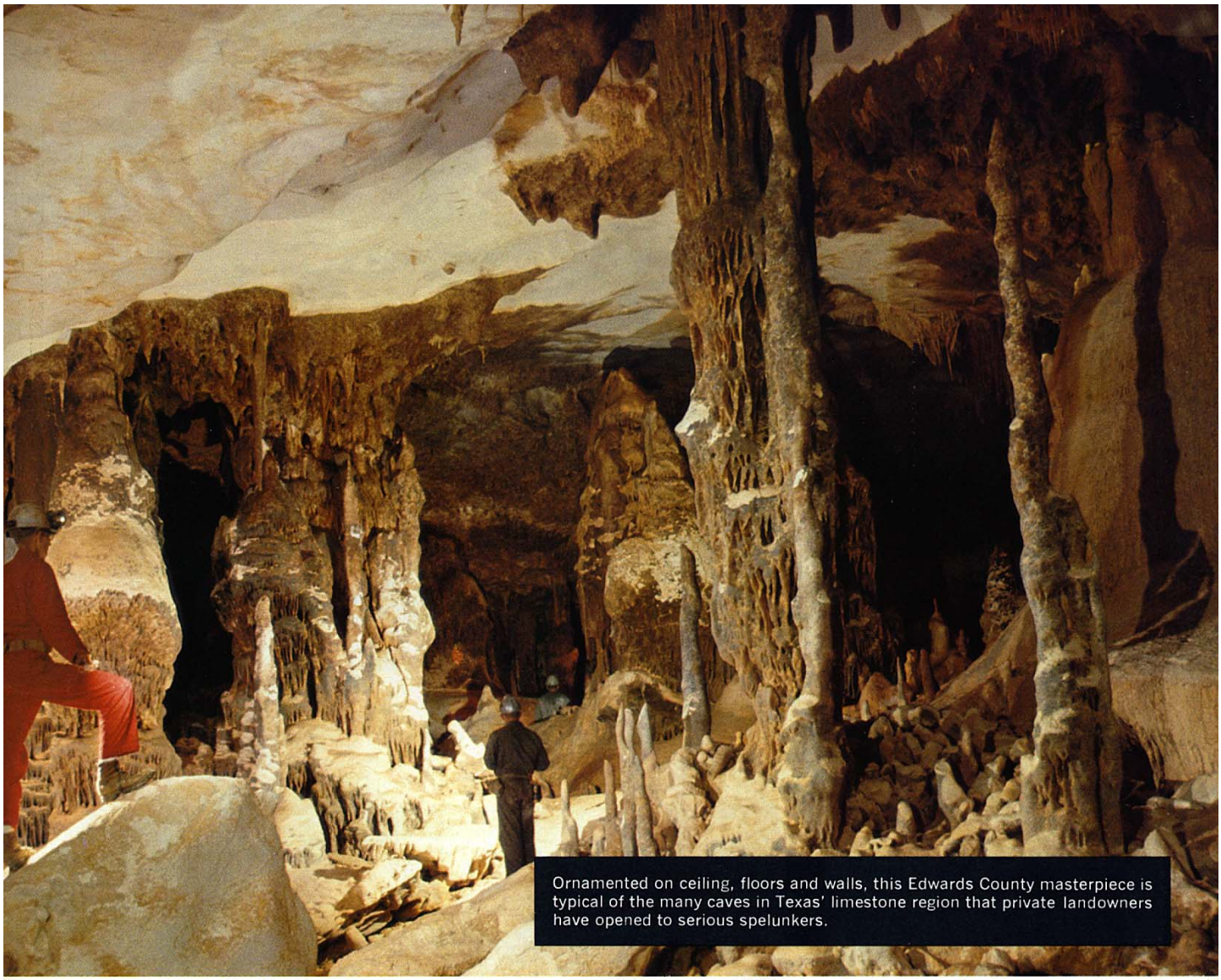
Creatures of the underworld, like the salamander and cave beetle, are noted by elongated appendages, lack of eyes and pigmentation.

features common to troglobites.

You have only to view the bizarre salamander, *Typhlomolge rathbuni*, to appreciate the extent to which these animals may adapt to their darkened world. The beetle, *Rhadine subterranea*, is eyeless and survives by foraging for eggs that cave crickets deposit in the silty cave floor. Its body is slim and well adapted to the task, while its more robust-bodied kin, *Rhadine howdeni*, has eyes and may be found on the surface as well as underground (this makes him a troglophile).

The fate of these animals is delicately balanced. Disruption of the food chain or pollution of their environment might have disastrous consequences. The cave cricket, *Ceuthophilus cunicularis*, eats the *Rhadine* beetle that feeds on the droppings of the bats. Bats eat the mosquitoes that plague us on summer evenings. What happens to the cricket when we spray the mosquito larvae with insecticide? What happens to the delicate life in a quiet cave pool when spent carbide from a thoughtless caver's lamp is added to the water? We are hard pressed for pleasant answers to such questions.

During the summer, an awesome spectacle begins at twilight when millions of bats emerge from certain Texas caves for their nightly feeding foray. First, a few "scouts" flutter out. Then, if all is well, the main group will follow, rising in the sky as a wavering black spiral. Some colonies number up to 20



Ornamented on ceiling, floors and walls, this Edwards County masterpiece is typical of the many caves in Texas' limestone region that private landowners have opened to serious spelunkers.

million and require as long as six hours to exit a cave. Hours later, gorged with insects, they return to their roost and sleep until the next evening. Caves such as Ney in Medina County, Frio in Uvalde County, and Bracken in Comal County harbor colonies of *Tadarida brasiliensis mexicana*, the Mexican free-tail bat.

Man has been a troglophile for thousands of years. Shelter caves served as homes for the earliest inhabitants of the state. During the bomb scare in the 1960s, some caves figured in the Civil Defense plan. Today, you might spot a cache of rusting barrels and rotting food crates on a tour of one of Texas' commercial caves.

Caves are also beginning to prove valuable as scientific laboratories when isolation and constant humidity and temperature conditions are required. In 1972, Michel Siffre, a Frenchman, made headlines as he settled into Midnight Cave in Edwards County for a six-month experiment in human isolation. His objective was to learn how the human mind and body might react when released from the traditional 24-hour cycle to which surface dwellers are bound.

To man, for scientific endeavor or as a recreational resource, the underground world of Texas supplies ample opportunity for fulfillment. As they come to be better understood, caves will reveal much about the inner workings of Mother Nature.