Lava Caving Areas in New Mexico

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The complex geological history of New Mexico includes a number of episodes of active volcanic eruption and lava flow, some particularly recent. This has left throughout the state a number of significant lava fields called malpais (Spanish for badlands). Some of these malpais areas are noted for an abundance of lava tubes while other areas have geological, mineralogical, biological, and paleontological features that make them worthy of study.

Although there are many lava flow areas throughout New Mexico, three malpais areas are of special interest. El Malpais near Grants, the Valley of Fires near Carrizozo, and the Aden Crater area near Las Cruces (Figure 1) have significant vulcanospeleological resources while being accessible to the general public and popular with the local caving community. It is our intention to provide just enough information about these areas to spur interest towards further study of the vulcanospeleological resources in this region of the United States.

Figure 1 – Selected lava caving areas in New Mexico.

El Malpais

Recently designated a national monument, the El Malpais flow (170 square miles) contains the most extensive lava tube systems in the state. El Malpais National Monument is located in Cibola County, southwest of Grants, New Mexico (Figure 2). The monument ranges in elevation from 6,500 feet (1,980 meters) to the 8,372-foot (2,552-meter) summit of Cerro Bandera, on the Continental Divide. The predominant vegetation on the malpais includes sage, juniper, pinon, and ponderosa pines, with stands of aspen along the flow margins. Because of the high elevation, year-round ice is found in over 100 of the lava caves and crevices, perhaps more here than in any other lava flow area in the country.

Nearly a dozen major lava flows within the monument have been ordered chronologically by

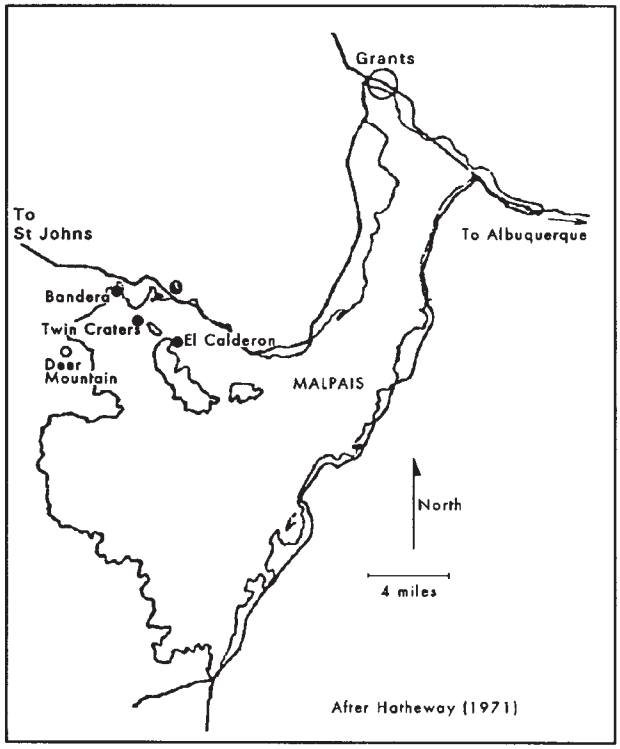

Figure 2 – The El Malpais Lava Flow.

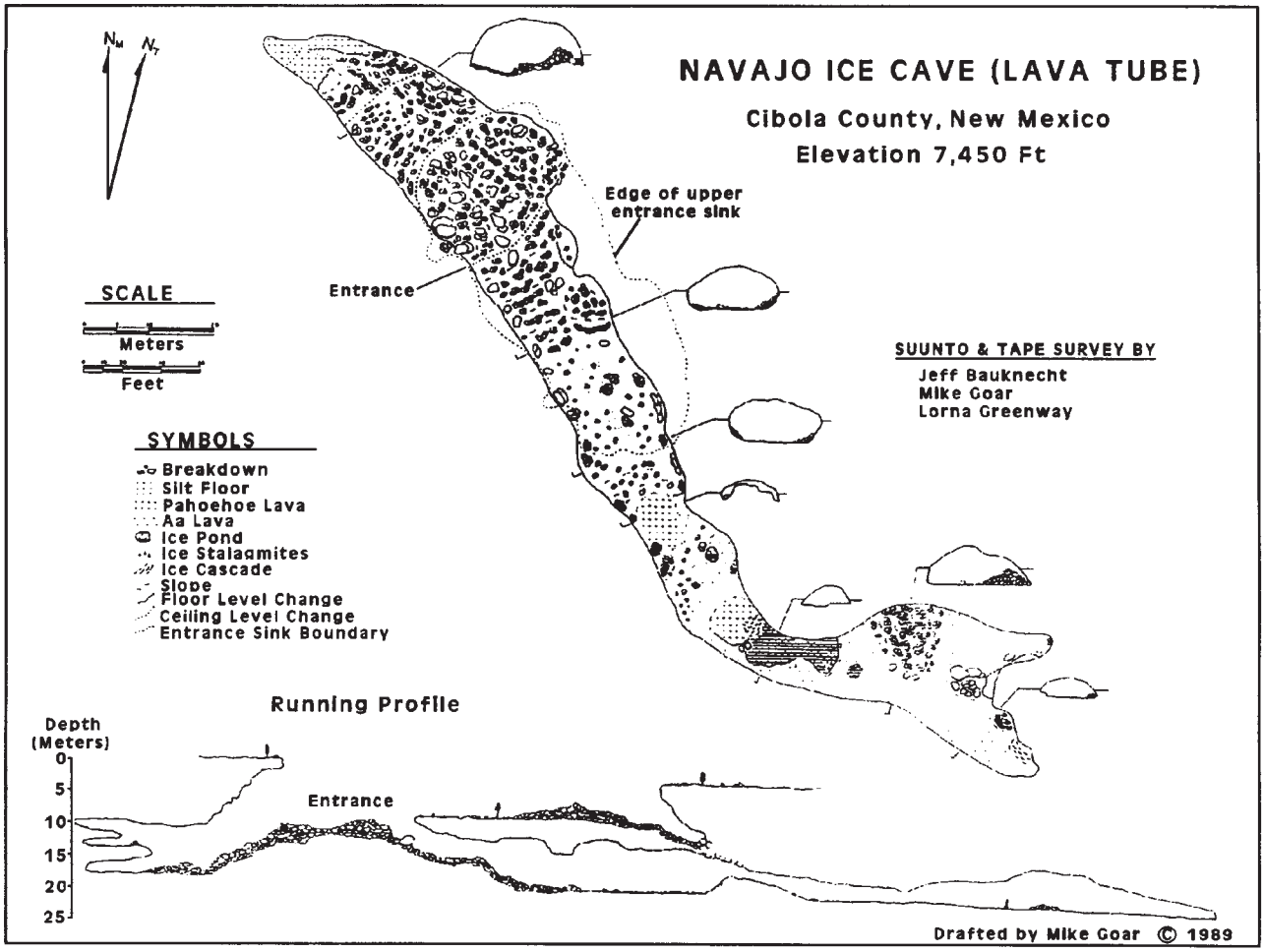

Figure 3—Map of Navajo Ice Cave.

Hatheway (1971) according to stratigraphic position and surface characteristics. The oldest flow is Tertiary and originates from the Cerro Encierro cone. Laughlin and West (1976) approximate an age of 188,000 years to an early flow at the base of Bandera Crater, but it is now thought that the main flows from Bandera Crater may be as recent as 10,000 years before present (Laughlin *et al.*, 1982). The McCartys flow may be as recent as 400 to 1,000 years before present (Maxwell, 1986).

Of the many lava features in the monument, especially striking are collapse structures, spatter cones, and tree molds. Classic examples of pahoehoe, aa, and blocky flows frequently occur adjacent to each other. El Malpais lava tubes feature colorfully banded walls and ceilings, lava, and other secondary speleothems including spectacular ice formations. Ceiling skylights are common; parallel tubes are sometimes interconnected by windows forming "braids"; tubes may be "stacked," intersecting at different levels. Floor subsidence in some tubes has left elevated shelves, "curbs," or "sidewalks," along the passage walls.

Only a few of the flows within the El Malpais National Monument occurred under conditions favorable for lava tube development. The most prominent of these, the Bandera Crater Flow, produced a tube system which can be traced for over 16 miles (Hatheway, 1970). A survey by Kent Carlton in 1988 revealed nearly 20% of the system uncollapsed. The lava caves of the Bandera tube system can be quite large (50 feet to 70 feet in cross section) and contain abundant year round ice. Navajo, Brewers, and Classic caves were recently surveyed in the Bandera system.

Ice formations in Navajo Ice Cave (Figure 3) include frozen ponds, ice needles (up to three centimeters long), and large (four to seven centimeters in diameter) hexagonal crystals. Lava straws can be observed in the cave as well as thick charcoal

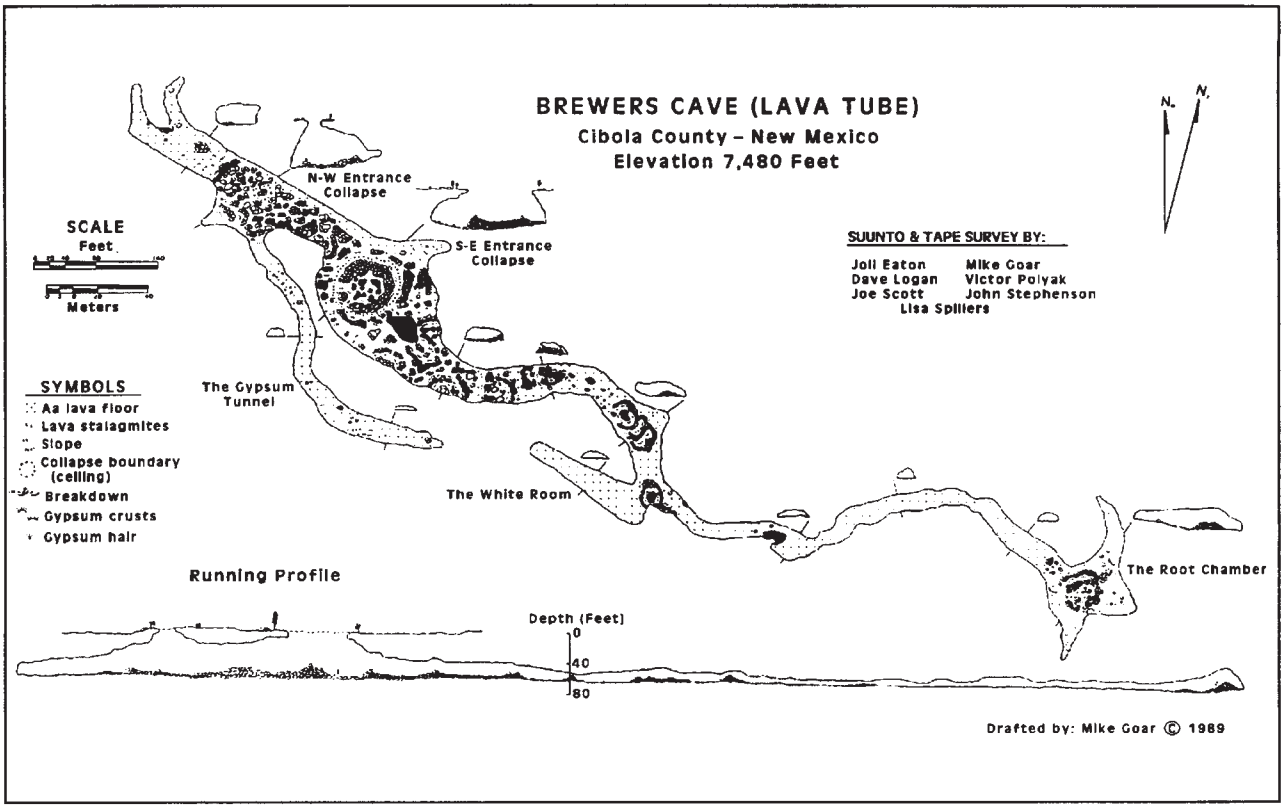

Figure 4—Map of Brewers Cave.

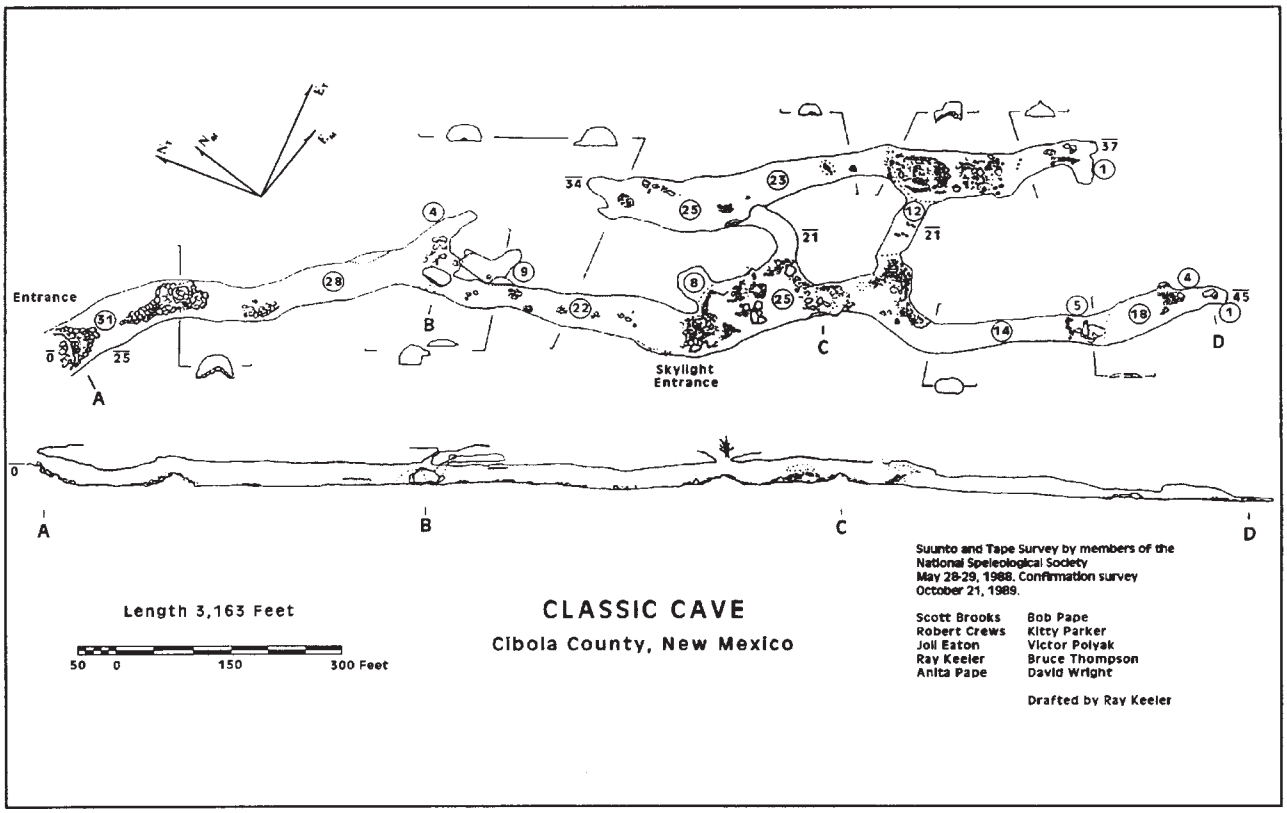

Figure 5—Map of Classic Cave.

floor deposits. Thin lava blisters, some forming honeycombs, occur on the walls in the back of the cave. Associated with these blisters are lava coralloids, some fully developed into lava popcorn. In some areas, the same material composing the coralloids occurs in the form of thin (0.5-centimeter) crusts.

Brewers Cave (Figure 4) is representative of the impressive size that is attained by many of the tubes in the Bandera system. Two collapse entrances, one 10 feet in diameter and the other over 50 feet in diameter, dramatically light the northern end of the tube which has a 50- by 70-foot cross section. Unusual secondary mineral deposits are found in Brewers Cave. A coarsely crystalline snow-like mineral on the floor of a side passage is easily soluble in water, bitter to taste, and yet effervesces with hydrochloric acid. A transparent white efflorescence with hairs up to one centimeter long covers a 0.5-meter by 0.5-meter area of wall and floor in one location. From site observations, it is thought that it may be mirabilite or epsomite. Bats were observed in the cave during our visit and we noted several bat skeletons and decomposing bodies on the floor.

Elsewhere in Brewers Cave, moist, white pasty moonmilk deposits occur on, between, and under pieces of floor aa in association with deposits of bat guano. Further moist moonmilk deposits, up to 1.5 centimeter thick, occur on a 4.5-meter by 1-meter area of wall associated with carbonate popcorn and frost work. The texture of this moonmilk is cotton-like to cottage cheese-like with a pearly to satin-like luster. Like the floor deposits, it is white except where it has been stained locally to colorful hues of blue, red, and orange. Hundreds of water droplets glisten from speleothems and rock surfaces at this locality.

Another large lava tube, Classic Cave (Figure 5), has a walk-in entrance as well as a skylight midway to the back. Near these two entrances the cave has moss, lichen, fern, and plant communities. Parallel passages in this tube are connected in two places by smaller tunnels.

An outstanding example of interconnecting passageways can be also found in Braided Cave which is part of the Hoya de Cibola flow further to the south. This appropriately named lava tube is one of the longest in the national monument and is currently being surveyed. Braided Cave is noted for its beautiful mineral stained walls, banded with "ribs" of color. It also contains a profusion of lava formations, including lava helictites. Secondary speleothems of unidentified mineralogy occur from the tips of, or as crusts over, some of the lava formations.

To the east of the Bandera flow is the El Calderon flow. One of the lava tubes in this flow, Junction Cave (Figure 6), dips more steeply (7°) than is

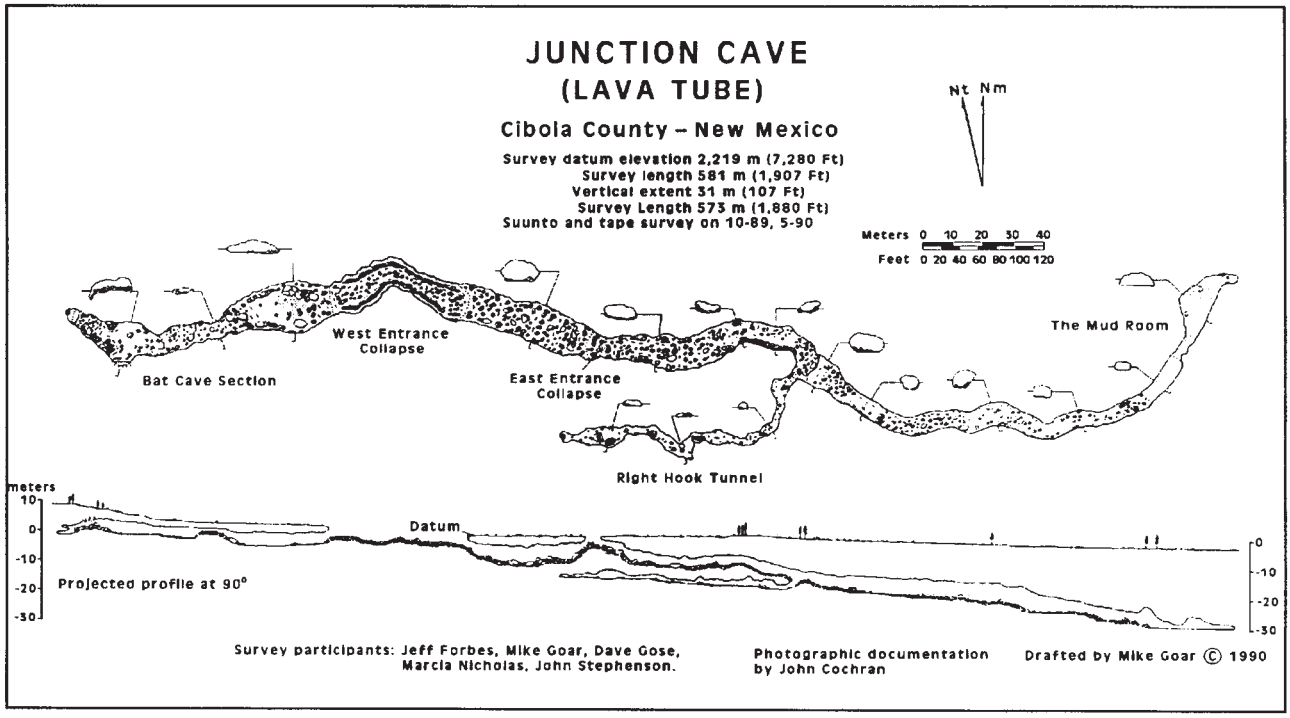

Figure 6—Map of Junction Cave.

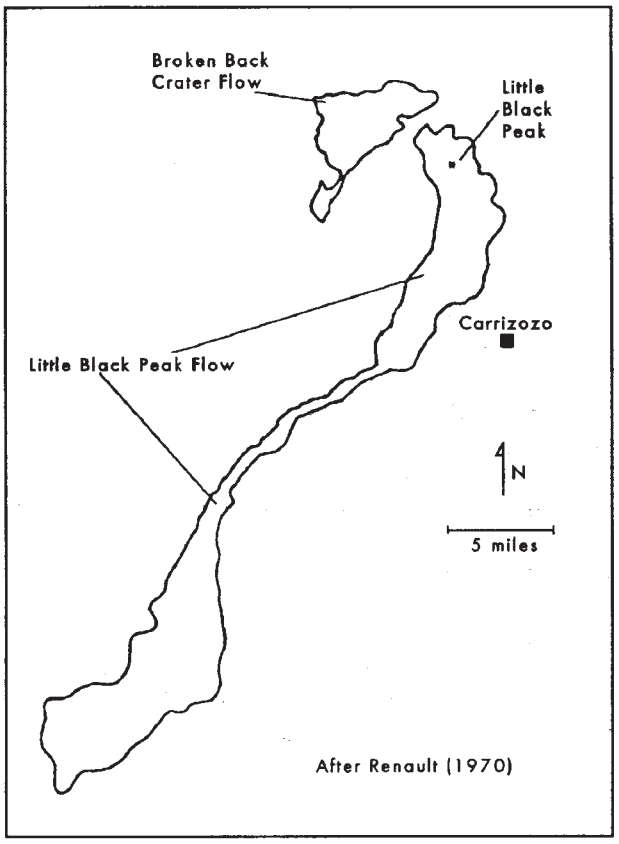

Figure 7—The Carrizozo Lava Flow.

typical of most of the lava tubes in the monument and is the only lava tube in the area known to have occasionally been flooded by water. A remnant water line can be seen along the walls midway back in the tube. Here, the breakdown floor dips 100 feet below the entrance level to a termination in a mud floored room. The shallower eastern end of Junction Cave is the roost for a summer colony of bats. There is also a colony of thousands of Mexican Freetail bats in Bat Cave, another lava tube of the El Calderon flow, which lies to the east of Junction Cave.

Carrizozo Malpais

The Carrizozo lava flow covers an area of 127 square miles of western Lincoln County, just west of Carrizozo, New Mexico (Figure 7). The flow lies on the northern end of the Tularosa Basin in a transition zone between the upper Chihuahuan Desert and dry northern grasslands at an elevation of 5,250 feet. Part of the flow is included in the Valley of Fires State Park.

The Carrizozo lava flow originated from two major sources, Broken Back Crater and Little Black Peak. The older flow, from Broken Back Crater, is overlain by the much more recent flow from Little Black Peak. The Little Black Peak flow, which extends to the south for a distance of 44 miles, occurred 1,500 to 2,000 years ago (Weber, 1979). It was the result of the most recent of a number of explosive episodes which interrupted periods of fluid lava eruption. The Little Black Peak cinder cone is 85 feet high with

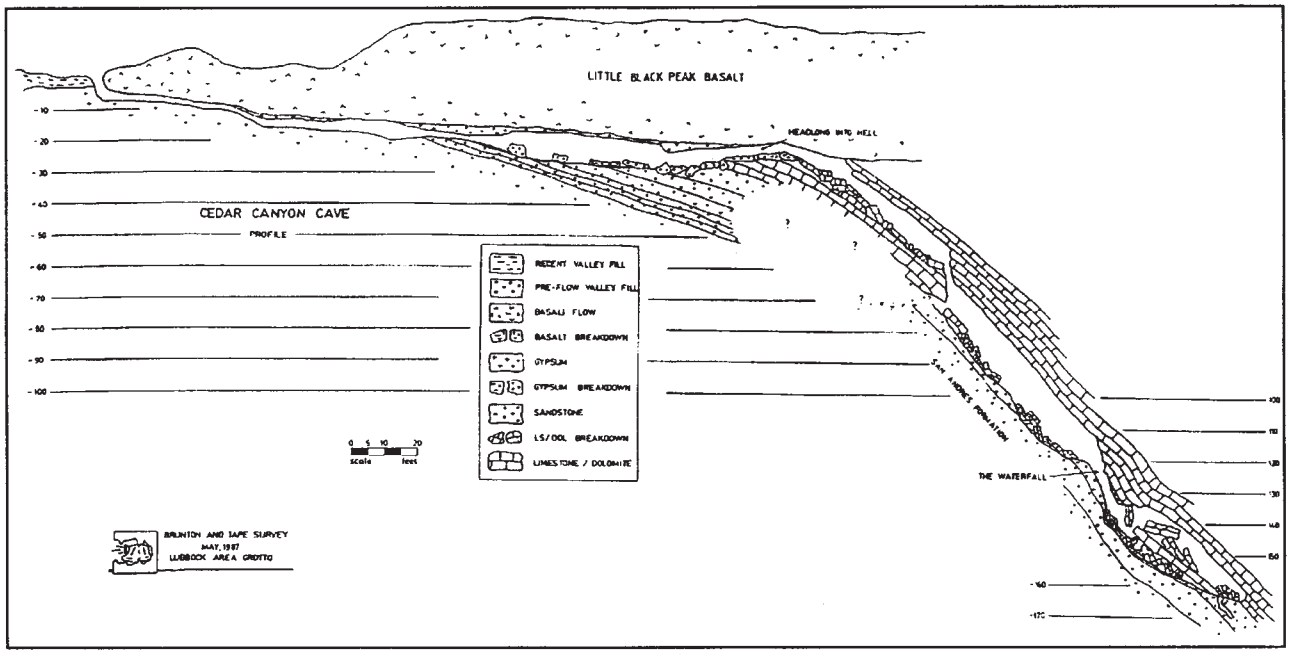

Figure 8—Map of Cedar Canyon Cave.

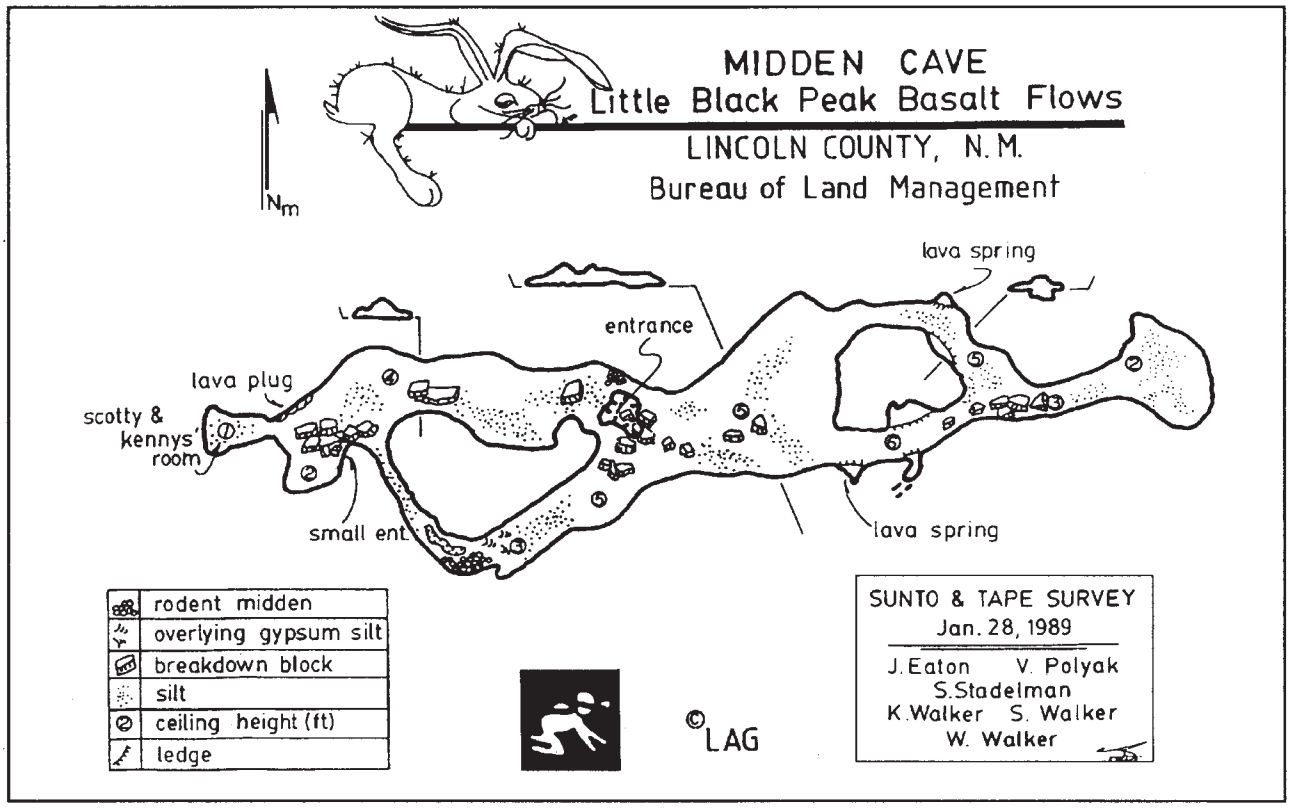

Figure 9—Map of Midden Cave.

an interior crater 32 feet in depth. Weber estimated that there is approximately one cubic mile of olivine basalt contained in the total volume of the flow.

The Carrizozo lava flow covers the Permian Yeso and San Andres Formations, which have been contorted by solution collapse and folding, and vary in thickness up to 160 feet (Weber, 1979). At the margins of the flow there are several known caves: Cedar Canyon (Figure 8), Crocketts, and Milrace Caves, which follow the contact between the Permian formations and the basalt. The caves dip steeply, attaining depths greater than in other caves known elsewhere in the Yeso and San Andres formations. Milrace Cave is one of the deepest (110 meters) gypsum caves in the world.

The Carrizozo lava flow has excellent examples of pressure ridges and a number of deep collapse structures. The ropy lava corrugations, some of which are braided, are prominent over much of the flow surface. Although the flow has not been fully explored for lava tubes, several in the vicinity of Little Black Peak have been found and surveyed, including Midden Cave (Figure 9) and Metate Cave (Figure 10). These caves occur in the Little Black Peak flow unit. The Carrizozo lava tubes discovered thus far are fewer and smaller than those in the El Malpais flow.

Aden Crater

The Aden lava field is located in southwestern Dona Ana County, about 23 miles southwest of Las Cruces, New Mexico (Figure 11). The flow covers about 25 square miles of high Chihuahuan Desert at an elevation of 4,300 feet (1,310 meters). A portion of the flow is part of a Wilderness Study Area being managed by the Bureau of Land Management, while the remainder is leased public land.

The source of the flow is Aden Crater, a 50-foot high basaltic shield volcano, situated in the northwestern part of the flow. The volcano is estimated to be 100,000 years old (Burnsom, 1991) and once held a lake of lava, which later withdrew down the primary vent to leave a number of collapse pits in the center, some as deep as 100 feet (Hoffer, 1975). Tension cracks and pressure ridges are common within the crater and a number of small lava tubes a few feet in diameter can be found beneath the pressure ridges (McMillan, 1991).

Features of the Aden lava flow include explosive craters with rims three to ten meters high, and small lava tubes 0.3 to 0.6 meters in diameter which are as long as 100 meters (Hoffer, 1975). Horseshoe shaped lava ridges called "herraduras,"

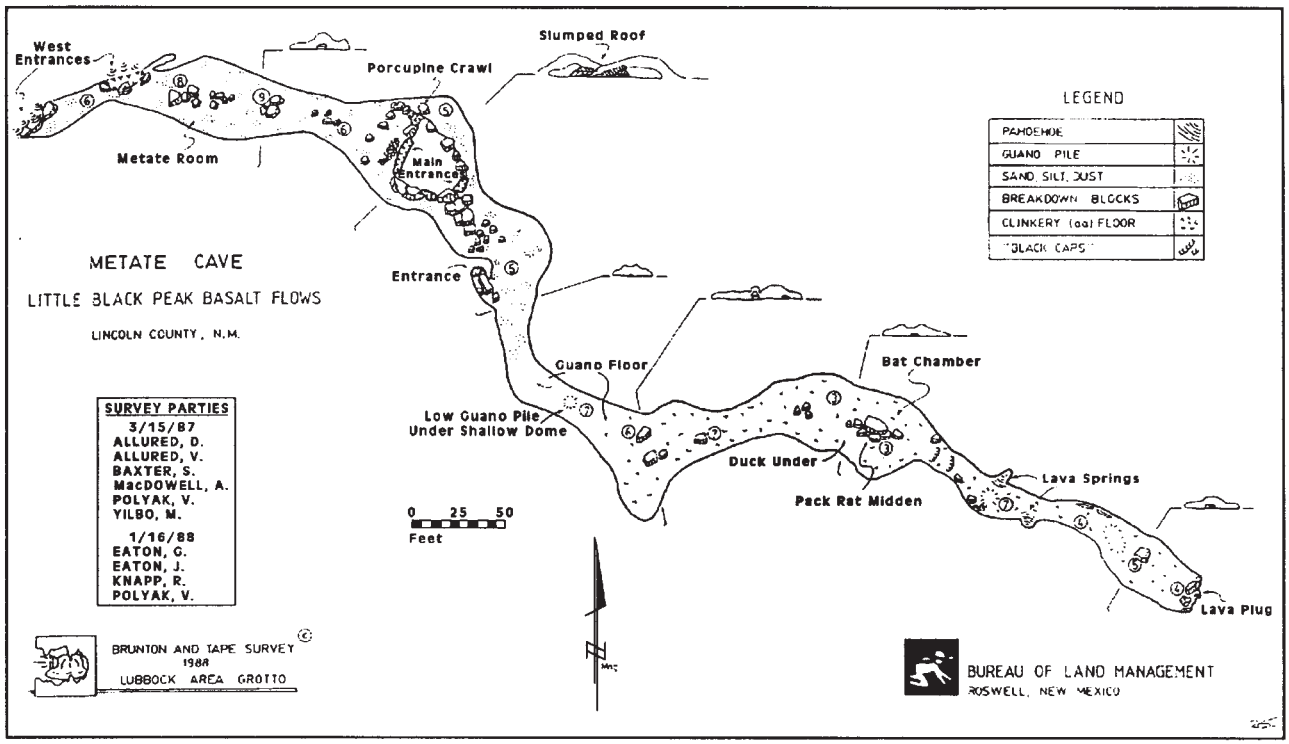

Figure 10—Map of Metate Cave.

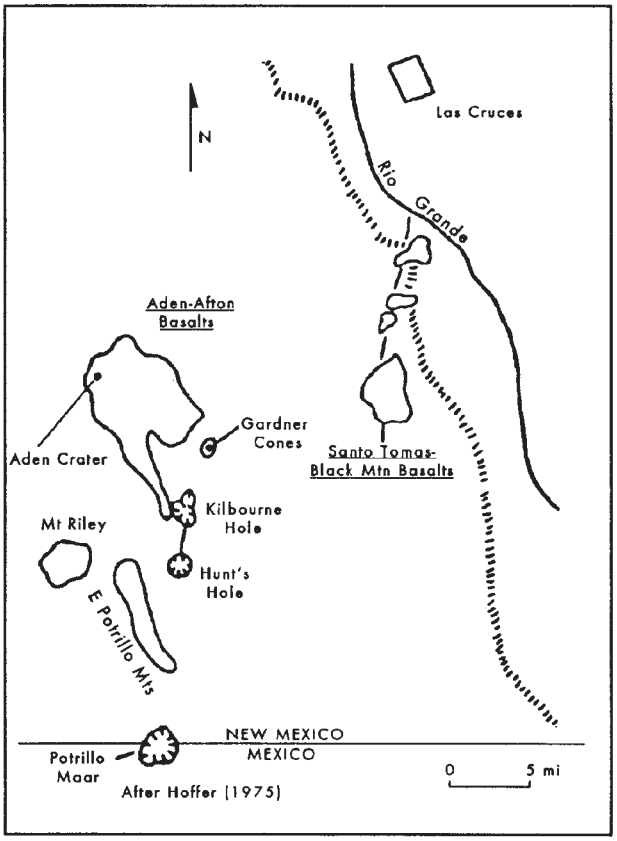

Figure 11—The Aden Crater Lava Flow.

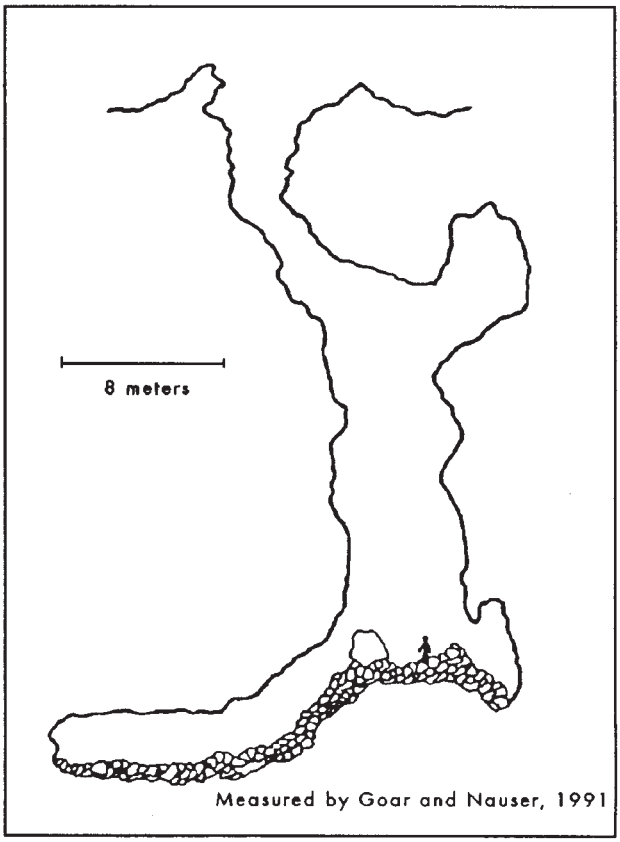

Figure 12—Profile View of the Aden Crater Fumarole.

which occur where cracks in the upper crust of the flow are perpendicular to the flow direction, have been identified by Hoffer at Aden Crater. The Aden flows are highly vesicular olivine basalts in layers 0.5 to 5 meters thick (Hoffer, 1975).

One interesting feature of Aden Crater is a 37-meter deep fumarole (Figure 12) located on the east rim. Used today by local cavers for practicing single rope technique, it was the site of the discovery of a late Pleistocene ground sloth (*Nothrotherium shastense*) in 1928 (Simons and Alexander, 1964). The exceptionally well preserved sloth was unearthed from beneath bat guano deposits at the bottom of the fumarole. Much of the soft tissues and hair taken from the specimen was desiccated but still intact. The ground sloth was dated at 11,000 years before present.

Summary

Even though there are many malpais areas in New Mexico, the El Malpais, Valley of Fires, and Aden Crater areas possess a wealth of vulcanospeleological resources for researchers, cavers, and the general public. In addition to being sources of scientific interest, these areas are rich in scenic beauty and are easily accessible to visitors, making them a marvelous living laboratory in which to study many of the natural processes which have shaped the southwestern United States.

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