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# Geology and paleontology of Tortugas Mountain, Doña Ana County, New Mexico

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Tortugas Mountain, an exposed tip of a large subsurface horst block (King and others, 1971), is located in southern Doña Ana County, approximately 3 mi east of the southern limit of Las Cruces. The visible part of this block occupies about 1 sq mi in secs. 23 and 24, T. 23 S., R. 2 E. Known locally as "A" Mountain, it has a total relief of 650 ft with the highest point at an elevation of 4,931 ft. Fluorite deposits have been mined extensively on the eastern side of the mountain.

### Structural geology

The bounding faults of Tortugas Mountain give a triangular horizontal pattern to the structure. Although the postulated large normal faults on the east and west sides cannot be seen, they undoubtedly formed the mountain. The mountain block has been tilted to the west; the southwestern face of the mountain closely approximates a dip slope (cross sections A–A′ and B–B′, fig. 1).

Tortugas Mountain is but one surface expression of the northwest-southeast-trending horst that includes the Doña Ana Mountains, 12 mi northwest, and Bishop Cap, 9 mi southeast. Classified gravity work gathered by oil companies documents the existence of the horst; water-well drilling records (King and others, 1971) also lend support. The western boundary of this horst is along a buried fault that marks the eastern boundary of the Mesilla Basin. Geothermally oriented geophysical work now in progress in the area may define the location and magnitude of the fault(s).

Within the mountain block, numerous faults have been identified and mapped (fig. 1). Faults trend either due north or N. 30° W. Although these faults are assumed to be normal, true movement is difficult to determine because of the alteration of the rocks along the faults and the absence of suitable marker beds.

The Tortugas fault, trending north-south across the eastern side of the mountain, has been mineralized by a fluorite-calcite vein up to 10 ft thick; the vein has been mined to a depth of 530 ft (Rothrock and others, 1946).

Most faults on the accompanying geologic map seem to be small fault zones rather than individual, distinct faults. These zones may account for the extensive silicification in fault areas.

The average strike of the beds is N. 15-30° W. The average dip of beds is 22° SW. Probably because of differential movement along faults, the dip of beds (cross section B–B′) along a canyon on the south-central part of the mountain increases to 45°.

### Stratigraphy

The block is composed primarily of limestone, dolomitic limestone, and shale and is surrounded by Pliocene through Holocene deposits of relatively unconsolidated sediments.

Because of extensive silicification and dolomitization of the limestones, bedding is difficult to discern. The limestones are generally gray, tan, or dark brown, thin, extremely hard and resistant, and devoid of recognizable fossils. Very poorly preserved fusulinids have been found in one locality. ☞

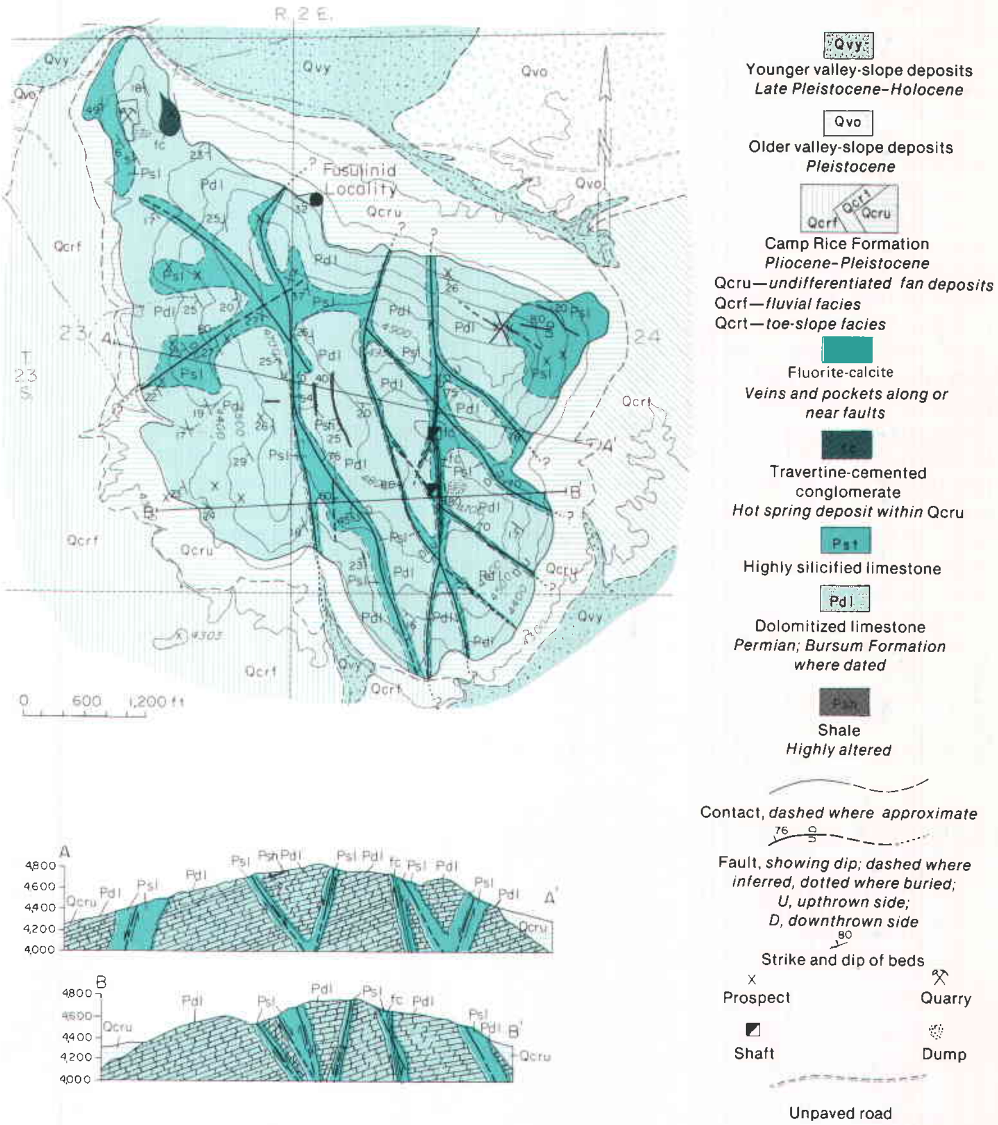


FIGURE 1—GEOLOGIC MAP AND CROSS SECTIONS, TORTUGAS MOUNTAIN.

A discontinuous shale bed to 15 ft thick crops out near the summit. Varying in color from red to pale yellow to deep maroon, this bed is heavily fractured and nonfossiliferous.

On the flanks of the mountain are Tertiary to Holocene sands, gravels, and conglomerates. The oldest of these deposits, the Camp Rice Formation (Qcrf) of Pliocene-Pleistocene age, is the uppermost member of the Santa Fe Group. The Camp Rice Formation is divided into three intertonguing facies: the undifferentiated piedmont slope or fan, the piedmont toe slope, and the fluvial (Gile and others, 1970).

The undifferentiated piedmont-slope or fan facies (Qcru) consists of a basal boulder-to-pebble conglomerate cemented by calcium carbonate and overlain by younger, less consolidated sand, sandy-gravel fan deposits, and a piedmont-toe-slope facies (Qcrt) of distinctively buff-colored sandy to loamy deposits. The fluvial facies (Qcrf), deposited by the ancestral Rio Grande, comprises fine to coarse sands and rounded gravels of varying rock types that are usually not locally derived.

A small outcrop of travertine near the base of the northern part of the mountain seems to have been derived from a hot spring. Rocks immediately surrounding the mouth of the spring are highly altered, with fractures filled by travertine, apparently formed during early Camp Rice time. These rocks are extensively stained with manganese.

Two distinct fan and arroyo alluvial deposits are present below the level of the Camp Rice Formation. The older of the two (Qvo) is associated with surfaces graded to the late Pleistocene levels of the Rio Grande floodplain. The younger deposit (Qvy) is found on surfaces graded to the present Rio Grande floodplain or to base levels slightly above the floodplain. Both units are silty to gravelly sediments (Gile and others, 1970).

Numerous prospect pits and trenches, most occurring in the outcropping rocks of Tortugas Mountain (fig. 1), have revealed fluorite, calcite, or—most commonly—a combination of both. The fluorite-calcite mineralization occurs as pockets or veins of massive material, frequently in proximity to faults (Johnston, 1928, and Dunham, 1935). Most of the veins are too small to be shown at the scale of the accompanying map. The calcite is massive, white and cleavable; the colorless, green, or purple fluorite is usually massive. The age of the mineralization is probably Miocene and may have been contemporaneous with the faulting.

Recent investigations by Macer (1978) suggest that the mineralization is related to late Tertiary Rio Grande rift faulting episodes, rather than to Oligocene volcanic activity.

McAnulty (1975) also has noted the abundance of fluorspar occurrences within or along the margins of the Rio Grande rift system and has stated his belief that the Rio Grande rift has had little or nothing to do with formation and localization of fluorspar deposits of the rift zone.

## Paleontology

Fusulinids were collected at one locality on the northeastern side of the mountain (fig. 1). Although preservation of these fossils is extremely poor, they are representative of the early Wolfcampian, for they seem to correlate with fusulinids of the Bursum Formation (Pb) of Abo Canyon, the Sacramento and Oscura Mountains, and the Bursum equivalents in the Robledo Mountains. Fusulinid studies by Thompson (1954) from areas in southern New Mexico reveal species and assemblages decidedly similar to the Tortugas Mountain material.

Although we made a number of thin sections, most were useless because extensive dolomitization has obliterated the wall structure of the fusulinids. To facilitate examination by micropaleontologists and to remove personal bias, the fusulinids were illustrated as they occur in the rock matrix (without trimming). The specimens have been measured as accurately as possible for such poorly preserved material. Consequently, we have chosen to note merely the affinities of these fusulinids with described species.

Specimens 1 and 2 (fig. 2) have affinities with *Leptotriticites hughesensis* (Thompson) and are found in the Bursum Formation(?) of the Robledo Mountains of Doña Ana County (Thompson, 1954). Specimen 2 is interpreted to be a juvenile form of *L. hughesensis* (Skinner and Wilde, 1965). The species is also found in the Hughes Creek Shale of Kansas and the Oquirrh Formation of Utah.

Specimens 3 and 4 (fig. 2), although of rather poor quality, have certain affinities with *Triticites creekensis* Thompson, especially those specimens from Fresnal Canyon in his New Mexico section 1, bed 133. They do not have as many volutions as the Sacramento Mountain specimens illustrated by Thompson (1954). This species is found in the Bursum Formation of the Los Pinos and Oscura Mountains of New Mexico, the Camp Creek Shale of Texas (Thompson, 1954), and the Earp Formation of southeastern Arizona (Sabins and Ross, 1963).

Specimen 5 (fig. 2) bears definite affinities with *Leptotriticites eoextenta* (Thompson), also found in the Bursum Formation of Abo Canyon, New Mexico (Skinner and Wilde, 1965). Other occurrences of *L. eoextenta* are in the Waldrip No. 1 Limestone of central Texas and in the Americus Limestone of Kansas.

Specimen 6 (fig. 2) is a tangential section designated *Triticites* sp. because the thin section does not yield sufficient information to determine species. This photograph is included to further illustrate the stage of evolution of the Tortugas Mountain fusulinid specimens.

The limestones and shales of Tortugas Mountain have been variously assigned to the Magdalena Formation (Johnston, 1928) and the Hueco Formation (Kottlowski, 1953, 1960). On the basis of the fusulinids, the lowermost beds of the Tortugas Mountain limestone sequence appear to be Bursum in age. We relied most heavily on specimens 1 and 5 (fig. 2), *Leptotriticites* aff. *hughesensis* and *Leptotriticites* aff. *eoextenta* in concluding that the fusulinid fauna is correlative with faunas of the Bursum Formation or its equivalents. Beds higher in the section are possibly correlative with the Hueco Formation, but fusulinids have not been found in the higher beds.

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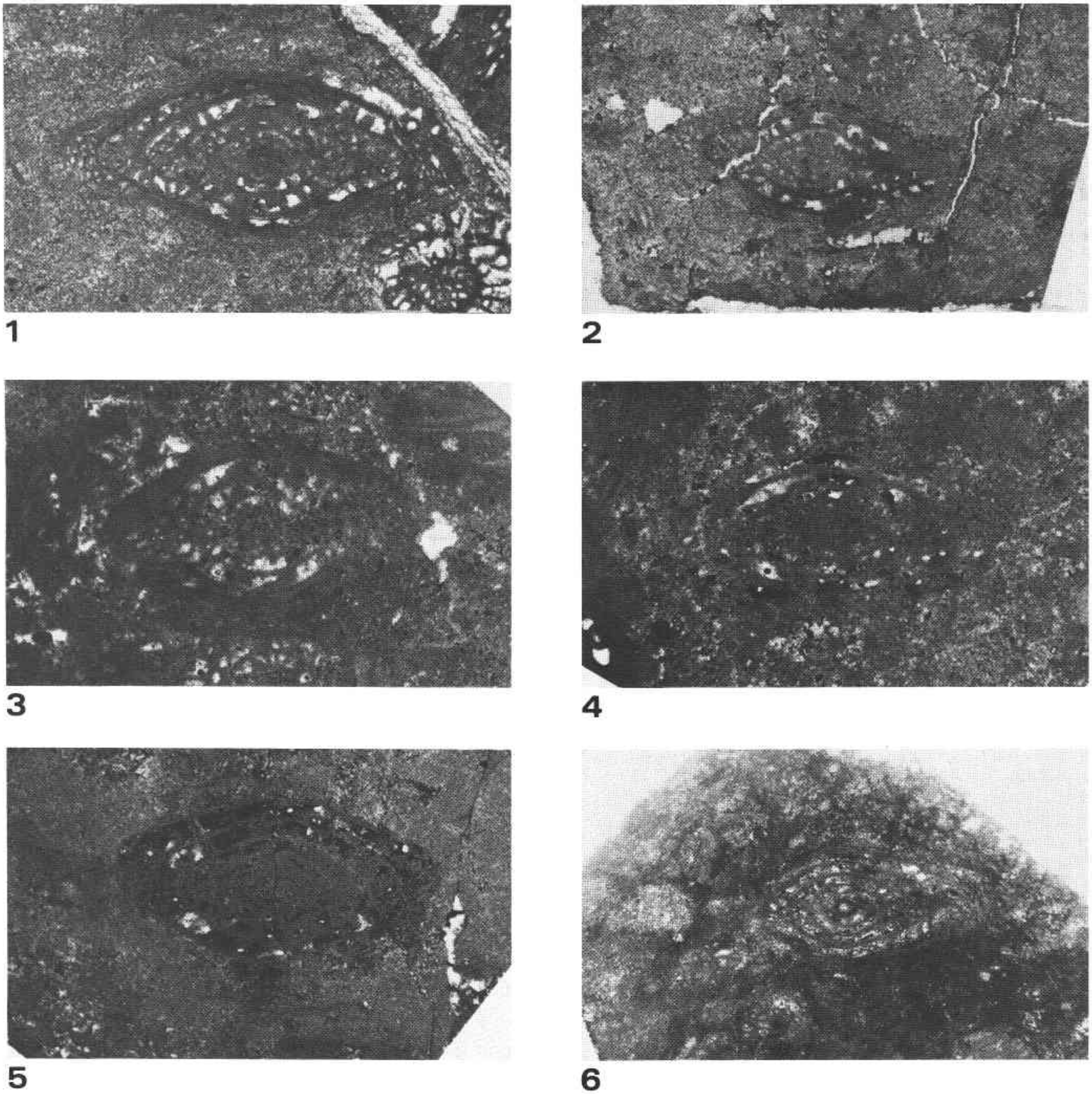

FIGURE 2—SPECIMENS **1, 2**—*Leptotriticites* aff. *hughesensis* (Thompson) 1954; **3, 4**—*Triticites* aff. *creekensis;* **5**—*Leptotriticites* aff. *eoextenta* (Thompson), 1954; **6**—*Triticites* sp. All figures x 10.


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