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THE BLACK MOUNTAIN FAULT

by

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Abstract

Information from a resistivity survey conducted in the summer of 1972 as well as published geologic, gravity, and aeromagnetic data indicates that a major structural feature passing near Black Mountain affects the earth's crust for a minimum distance of 33 miles (53 km). The data suggest that the structure is, in part, a hinged fault.

Previous Work

The Black Mountain fault or fault zone has been recognized by many workers. Heindl (1959) noted that faults trending N 60° E were present in the area of Black Mountain and that extrusive and hypabyssal rocks had been emplaced along this trend. A geologic study of the Del Bac Hills by Percious (1968) revealed that exposed N 60° E-trending faults in the area are high-angle normal faults and are downthrown to the south approximately 350 feet. Sumner (1965) mentioned an east-northeast-trending, steep gravity gradient that passes near Black Mountain which may be related to late Tertiary faulting. Ganus (1965) reported that the gravity trend continues into the Tucson Basin and referred to it as a basement fault that is downthrown to the south. He postulated that the reentrant between the Santa Catalina and Rincon Mountains may be an expression of the continuation of a structurally weak zone along this east-northeast trend. Davis (1967) stated that alluvial thicknesses in the Tucson Basin increase from approximately 3,000 feet north of the basement scarp to over 5,000 feet south of the scarp. An interpretation of aeromagnetic data (Sauck, Sumner, and Christensen, 1971) suggested that the structure is expressed magnetically and extends at least 2.5 miles (4 km) east-northeast of Tucson International Airport.

There are several geophysical surveys in the area that are available to the public and which show some indication of the Black Mountain fault or fault zone. These include the aeromagnetic map of the Twin Buttes area (Andreason and Pitkin, 1963), the aeromagnetic map of the northern part of the Tucson Basin (Sauck and others, 1971), the Bouguer gravity anomaly map of the Twin Buttes area (Plouff, 1962), and a simple Bouguer map of the Tucson Basin (Davis, 1967).

Resistivity Survey

During the summer of 1972, Cities Service Minerals Corporation conducted a resistivity survey in an area on the northwest flank of the Sierrita Mountains and west-southwest of Black Mountain (Fig. 1). The area was surveyed using a standard dipole-dipole electrode configuration.

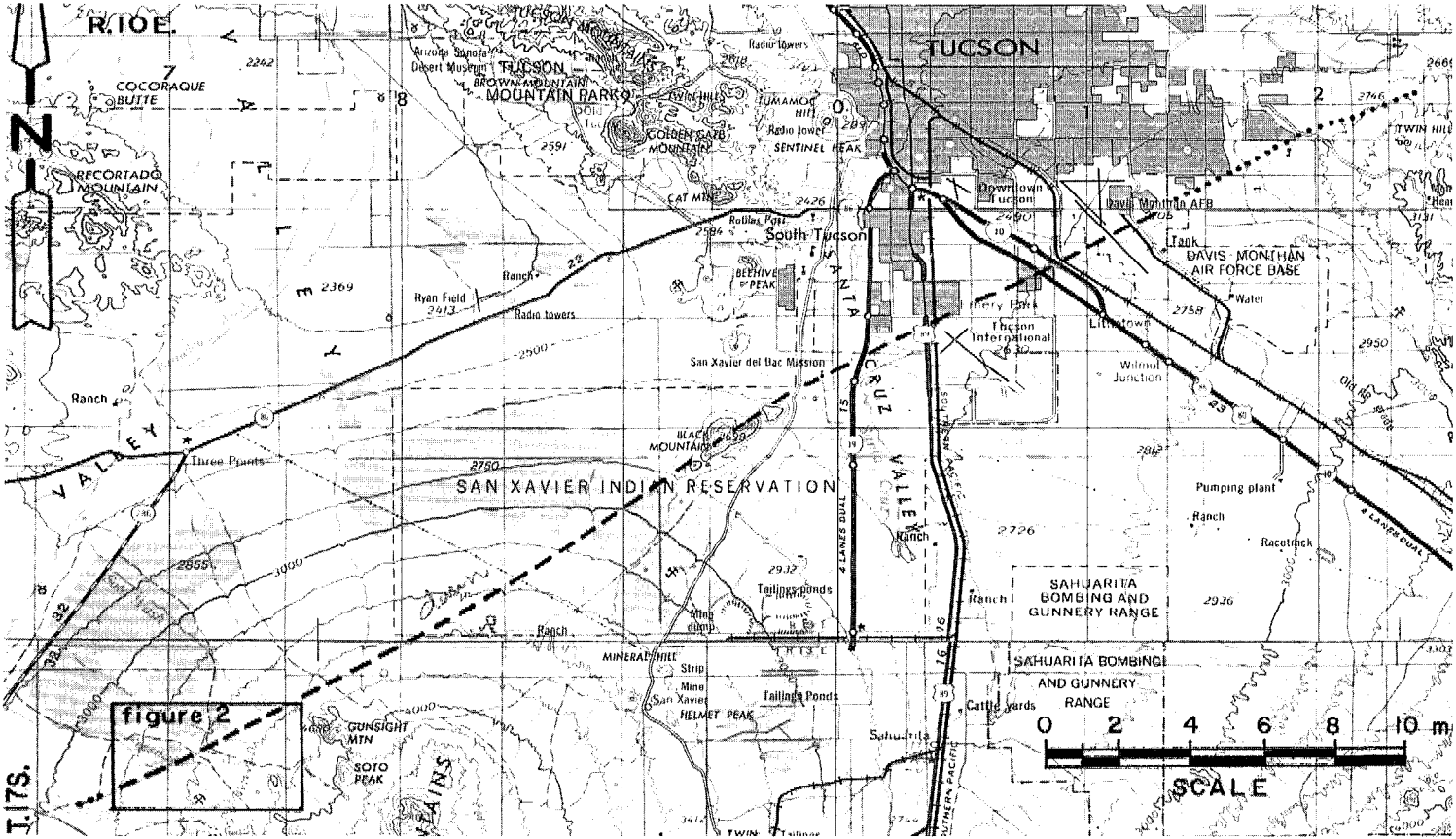

Figure 1. Location map showing the approximate position of the Black Mountain fault. Map base from U.S. Geological Survey 1:250,000 topographic series.

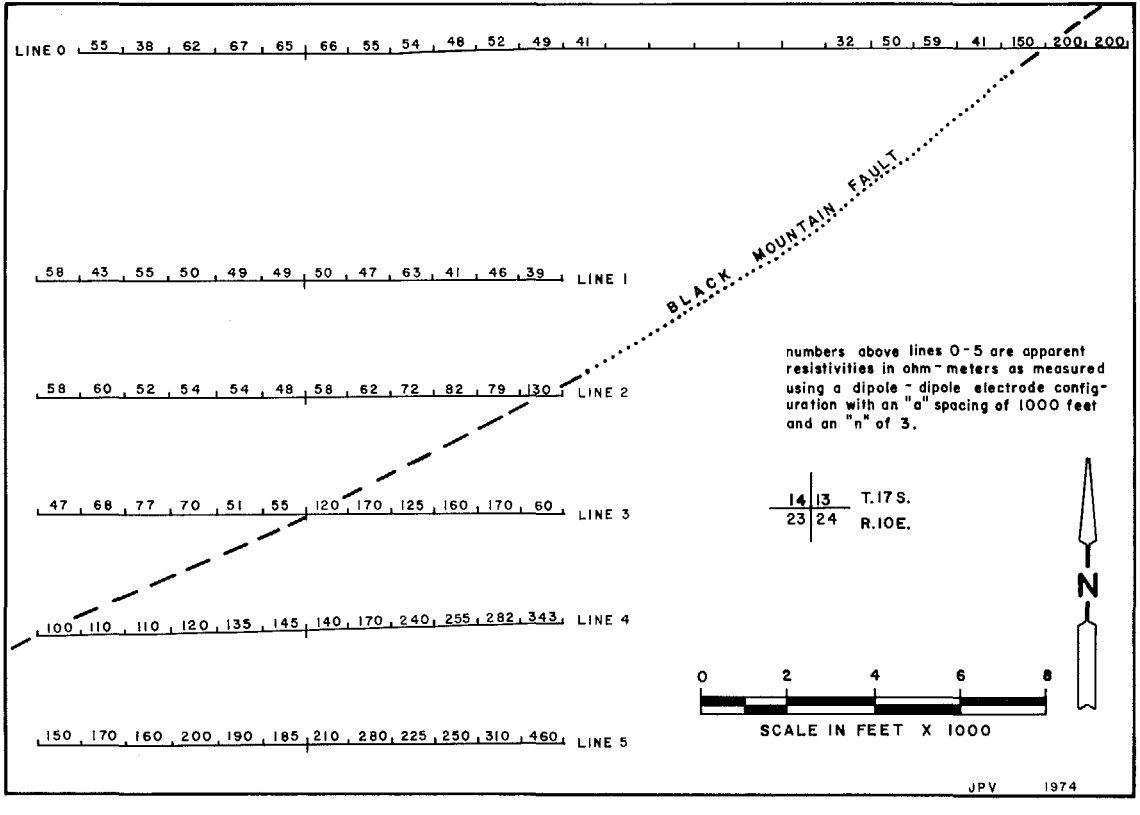

Figure 2. Map showing apparent resistivities measured in an area northwest of the Sierrita Mountains.

The distance between the two current electrodes and the distance between the two potential electrodes ("a" spacing) were kept constant at 1,000 feet. The distance between the near current electrode and the near potential electrode was varied from 1 to 6 times the "a" spacing ("n" = 1-6). Surface exposures in the entire area consist of unconsolidated sediments and alluvium.

The collected data reveal a sharp resistivity break extending west-southwesterly across the area. The resistivity break is apparent when the data are plotted in plan at an "n" of 3 (Fig. 2). Northwest of the break, alluvial material with an apparent resistivity of 40-80 ohm-meters extends to a depth greater than the effective depth of penetration of the method (± 2,000 feet). Southeast of the break, apparent resistivities increase rapidly in a southeasterly direction to 200-400 ohm-meters indicating thinning alluvial cover to the southeast. The west-southwest-trending resistivity break coincides with a steep gravity gradient of similar trend (Plouff, 1962). The gravity data indicate less dense material to the northwest and are suggestive of a normal fault downthrown to the northwest. The same trend, although more subtle, can be seen on the aeromagnetic map (Andreason and Pitkin, 1963). The geophysical data indicate that a major fault extends south-southwesterly from Black Mountain and is downthrown to the northwest.

Discussion

Accumulated geologic and geophysical data indicate that a major structural break extends east-northeast and south-southeast from the vicinity of Black Mountain. For a distance of ± 13 miles (21 km) northeast of Black Mountain, this structure probably is a normal fault or fault zone downthrown to the south. This northeast trend may continue to the area of Redington Pass or may be terminated by a northerly trending structure within the Tucson Basin. For a distance of ± 20 miles (32 km) southwest of Black Mountain, the structure probably is a normal fault or fault zone downthrown to the north. The southwest trend is most likely terminated by a northerly trending structure within the Altar Valley. The overall structure may best be described as a hinged fault with the hinge located in the vicinity of Black Mountains.

Permission by Cities Service Minerals Corporation to publish this note is gratefully acknowledged.

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