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PRELIMINARY INVESTIGATIONS OF THE EXTENT OF RIO GRANDE RIFT IN THE NORTHERN PORTION OF THE STATE OF CHIHUAHUA

(Communication)

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INTRODUCTION

During the past decade, the Río Grande rift has been recognized as one of the major Cenozoic continental rift systems. The other widely recognized rift systems are the East African rift, the Rhine graben, and Lake Baikal. A series of special publications (Riecker, 1979; Baldridge *et al.*, 1984; Keller, 1986) have drawn the attention of the international scientific community to the Río Grande rift. Early studies suggested this rift might only extend as far south as the Socorro, New Mexico region which is about 300 km north of El Paso/Juárez. However, more recent geological (Seager and Morgan, 1979) and geophysical (Daggett *et al.*, 1986; Sinno *et al.*, 1986; Keller *et al.*, 1988) studies document that the rift can be differentiated from the Basin and Range province and extends for a significant distance into the State of Chihuahua.

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GEOLOGICAL AND GEOPHYSICAL STUDIES

There is a significant body of geological data that suggests the Río Grande rift is present in Chihuahua (Seager and Morgan, 1979). First of all, the rift seems to be associated with asymmetrical grabens which contain over 1 km of sedimentary fill. Drilling and gravity data indicate that the Mimbres, Los Muertos, Mesilla, Hueco,

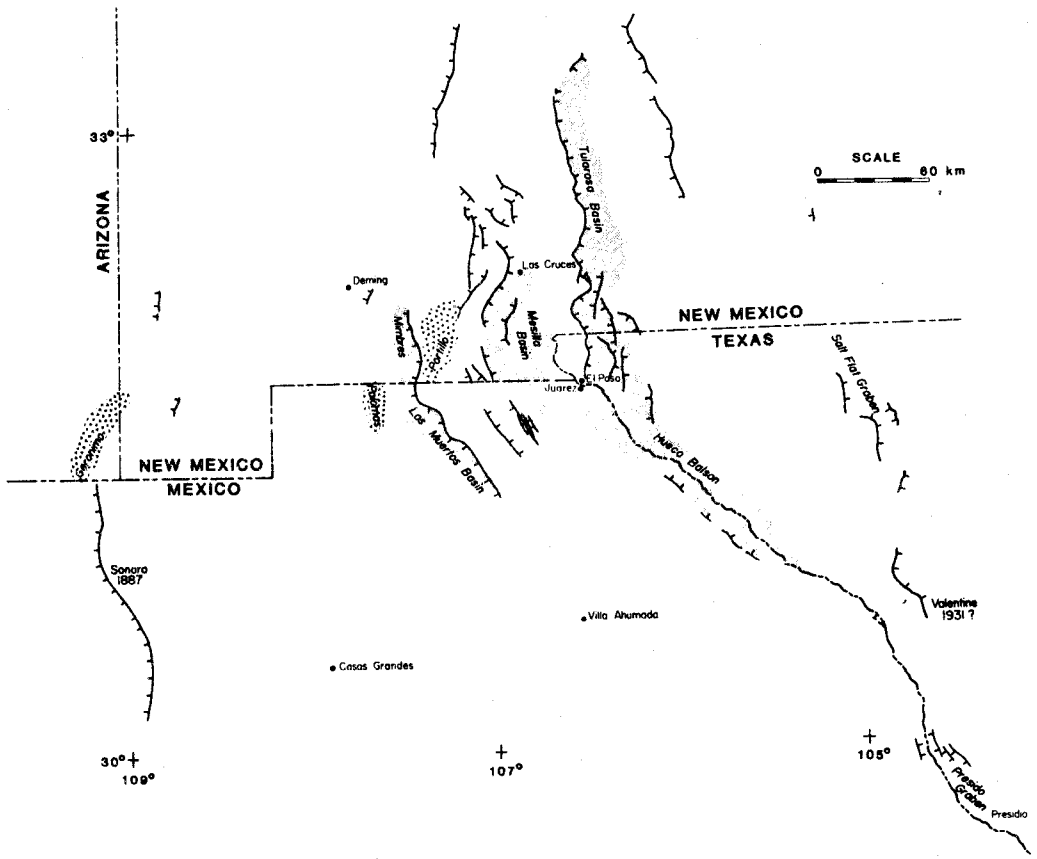

Fig. 1. Index map showing volcanic fields (Potrillo, Palomas and Gerónimo), faults with Quaternary displacement (dark lines), and deep basins (stippled pattern) in the southern Río Grande rift area.

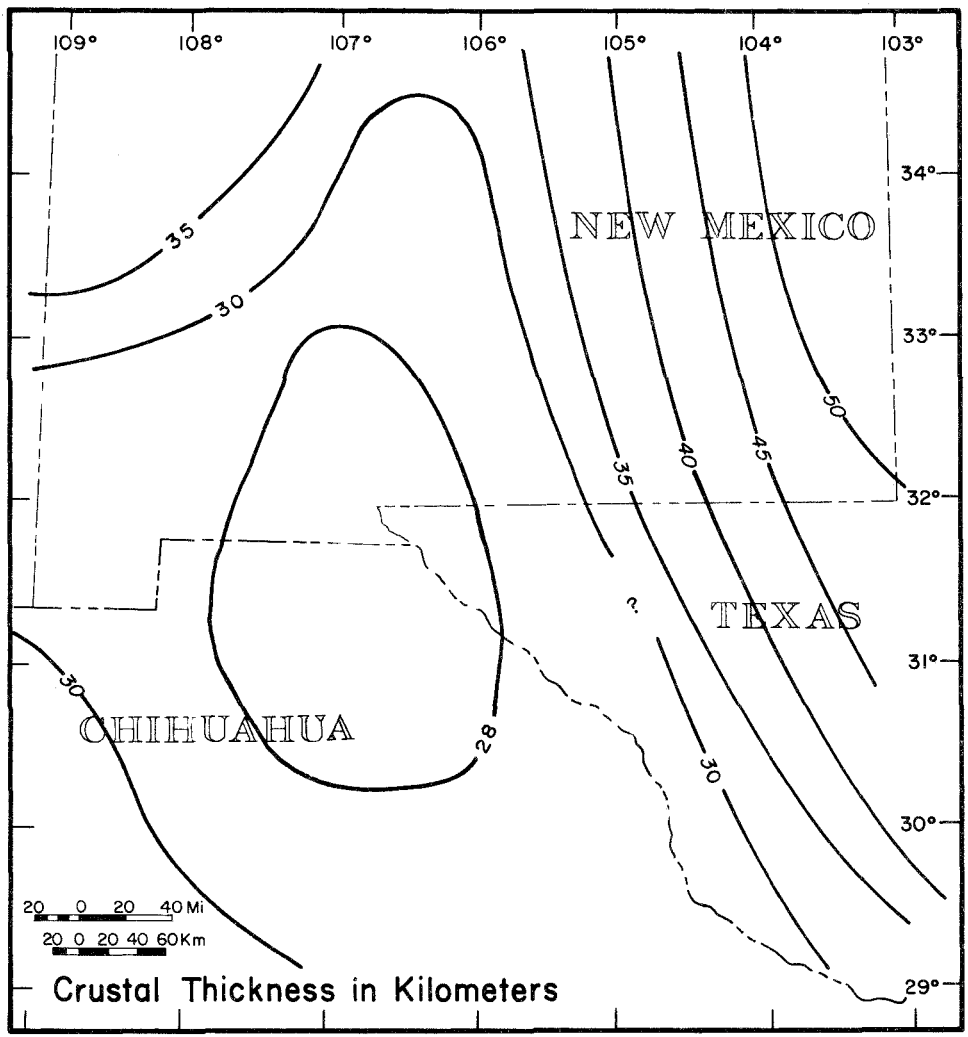

Fig. 2. Contours of crustal thickness (kilometers) in the southern Río Grande rift (from Keller *et al.*, 1988).

and Presidio basins (Fig. 1) all contain sediments which attain this thickness. Another consideration is that these same basins are bounded at least in part by faults which have been active during the Quaternary (Fig. 1). The Basin and Range province in central and southern Arizona and northern Sonora seems to have been relatively inactive since the late Quaternary (Menges, 1983). Thus, the Río Grande rift appears to be an active tectonic province separated from the Great Basin (Nevada and western Utah) by a less active area. The great Sonora earthquake of 1887 which occurred near the boundary between Sonora and Chihuahua (Fig. 1) created a fault scarp approximately 80 km long with a maximum offset of 8.5 m (Aguilera, 1920). This area could be the western-most extent of Río Grande rift related tectonic activity. Although volcanic activity in the area is of limited extent, three significant basalt fields exist, the Potrillo (Hoffer, 1976), the Gerónimo (*e.g.* Menzies *et al.*, 1985) and the Palomas (*e.g.* Frantes, 1981). All these fields contain a number of Late Pliocene and Quaternary basaltic volcanoes and extend into Mexico. The Palomas field is located primarily in Chihuahua along the Los Muertos Basin. Hoffer *et al.*, (1983) have shown that basalts along the Río Grande valley in southern New Mexico are alkali and show little to no differentiation whereas those outside the valley include both alkali and highly differentiated volcanic units. Chemically, the valley basalts are predominantly nepheline normative and become hypersthene normative west and east of the valley (Hoffer and Hoffer, 1984). In the Palomas field nepheline normative basalts rest on top of hypersthene normative units.

A good data base of gravity readings has been compiled for the southern Río Grande rift area (*e.g.* Aiken *et al.*, 1981; Daggett *et al.*, 1986). These data along with recently acquired seismic refraction data in southwestern New Mexico delineate a crustal structure anomaly which is associated with the Río Grande rift. The consistency of the gravity and seismic results in southwestern New Mexico suggest this anomaly is simple crustal thinning which extends well into Chihuahua (Fig. 2). The filtered gravity map shown in Figure 3 indicates the approximate extent of the rift as best we can determine from presently available data. However, crustal scale seismic data are badly needed in northern Mexico.

FUTURE STUDIES

Many questions remain in regard to the southern termination of the Río Grande rift. The map shown in Figure 2 is interpretive and assumes that the pattern of regional gravity anomalies (Fig. 3) is due primarily to crustal thinning. We can only be sure

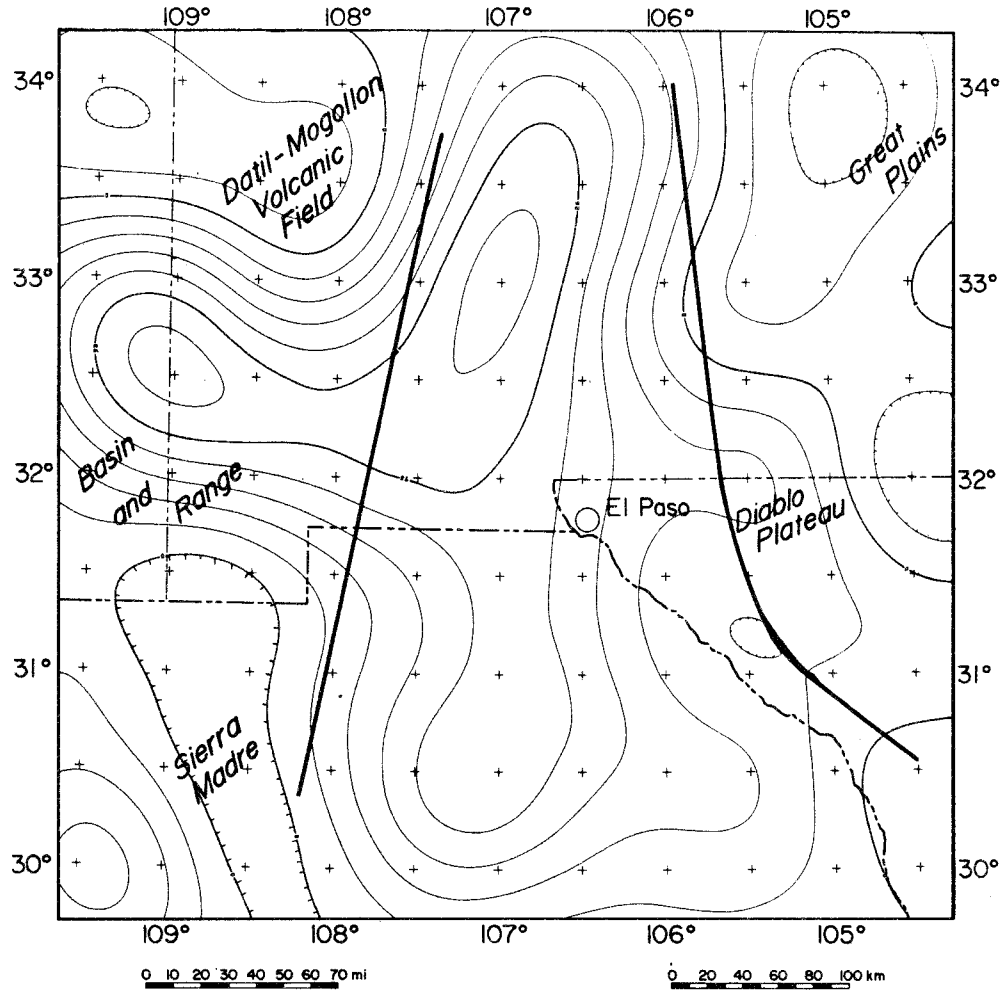

Fig. 3. Map of low-pass filtered (150 km cutoff) residual gravity anomalies in the southern Río Grande rift area. Contour interval -5 milligals. Heavy lines indicate the usually accepted boundaries of the rift.

that this is true in southwestern New Mexico. The extent of faulting and young volcanism is incompletely known in northern Mexico, further limiting our ability to delineate the rift. The East African rift appears to die out in northern Tanzania only

to appear again in Malawi. Perhaps the Río Grande rift dies out near the city of Chihuahua and reappears in southern Chihuahua and northern Durango. In any case, this rift is a major lithospheric structure in northern Mexico which warrants much more study.

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