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Geologic Setting of the East Antelope Basin, with emphasis on fissuring on Rogers Lake, Edwards AFB, Mojave Desert, California

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GEOLOGIC SETTING OF EAST ANTELOPE BASIN, WITH EMPHASIS ON FISSURING ON ROGERS LAKE, EDWARDS AFB, MOJAVE DESERT, CALIFORNIA.

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In the early spring of 1991, a large earth fissure opened at the south-east end of Rogers Dry Lake at Edwards Air Force Base. Much insight was gained regarding theorigin of the fissure through the integration of information obtained from recent regional and detailed geologic mapping (Dixon and Ward, 1993a, b; Ward and Dixon, 1993a, b), geophysical, and hydrologic studies. Pertinent questions are whether the fissure is tectonic or hydrologic in origin and whether future occurrences are likely. In addition to addressing these questions, our ongoing studies are refining the regional late Tertiary and Quaternary geologic history of the East Antelope Basin, a depocenter for upper Tertiary and lower Quaternary sediments.

Local rock units in the area include tuffs, lava flows, and sediments of the Tertiary Tropico Formation, Tertiary fanglomerates, Tertiary intrusive rhyolites and dacites, and deeply weathered Mesozoic granitic rocks. Exposed Quaternary geologic units include sandy alluvium, playa clay, and beach deposits. These are late Quaternary in age and related to pluvial Lake Thompson.

Maybey's (1960) first recognized the East Antelope Basin from a 40-mgal gravity low and suggested that the steep gravity gradients may be fault controlled. The gravity signature

suggests that this is a northeast-trending basin (fig. 1), which is deepest just southwest of Rosamond Lake and shallows to the northeast. We confirm this as a faulted basin not only from gravity data (fig. 2), but also from a series of resistivity anomalies (Zohdy, 1990), subtle surface escarpments, alignment of historical spring discharge mounds trending N30-45E, and steep hydrologic gradients. The southeast boundary of the basin is less apparent, however, but is definable from field observations and geophysics.

During mid-Quaternary time, a drainage reversal occurred in the regionas a result of uplift of the San Gabriel Mountains and activity along northwest-trending faults, thus blocking the southwest flow of water out of the basin and creating Lake Thompson. As the climate became more arid, water sources were depleted; today remnants of Lake Thompson remain in the form of Rogers, Buckhorn, and Rosamond playas.

Hydrologically, the East Antelope Basin is part of the Lancaster groundwater sub-basin and is a source for agricultural, municipal, and industrial ground water for the Antelope Valley and the primary source of water for Edwards Air Force Base.

The March, 1991 earth fissure on Rogers Lake (Fig. 1) is approximately is about 1-2 m wide, 1.16 km long, and extends to an unknown depth. Although somewhat sinuous, its average trend is within a few degrees of north. Known and inferred faults in the immediate area trend northwest; e.g. the El Mirage fault of Dibblee (1967) probably extends beneath south

Rogers Lake near the fissure and continues northwest, connecting with the Bissell Hills fault.

The fissure occurs near the bottom of a local gravity low (fig. 2), which defines the northeastern sub-basin of the East Antelope Basin; we infer the sub-basin to be more than 600 m deep. The shape of the basement beneath this sediment-filled sub-basin is reflected in the gravity contours that bound the gravity low. These trend at angles of 45° or more from the trend of the fissure. Based on the trends of the major faults in the area and the trends of thegravity contours that define the local sub-basin beneath the fissure, and the interpretation that the fissure occurs over a deep part of the sub-basin, we reject afault-controlled origin for the fissure. We consider that the fissure was caused by differential compaction of Quaternary sediments on a downsloping erosional bedrock surface, rather than by extensional strain on sediments on a convex-upward basement surface.

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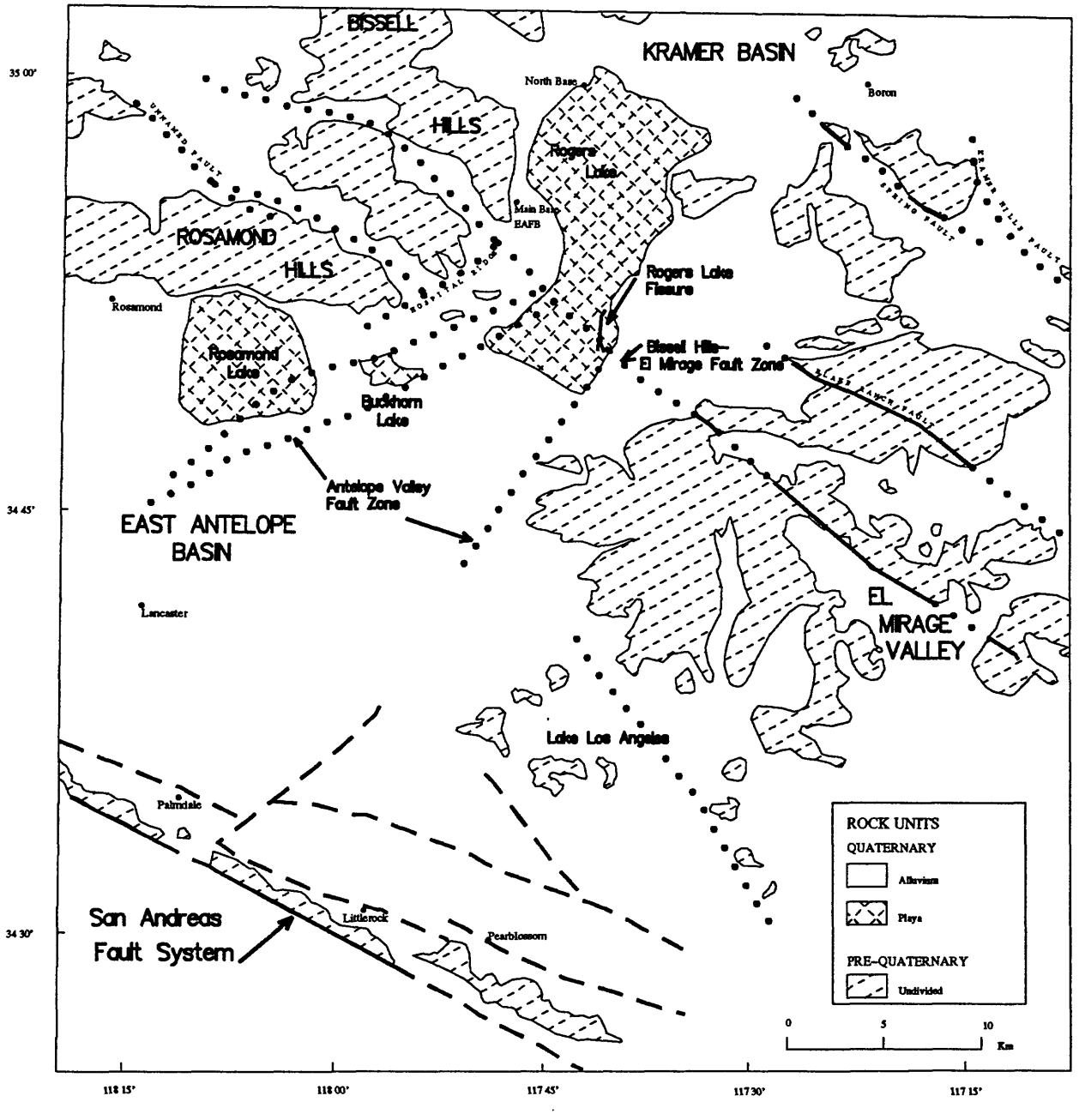
Figures:

Figure 1. Generalized geologic map of the East Antelope Basin area.

Figure 2. Isostatic residual gravity map of the East Antelope Basin area.



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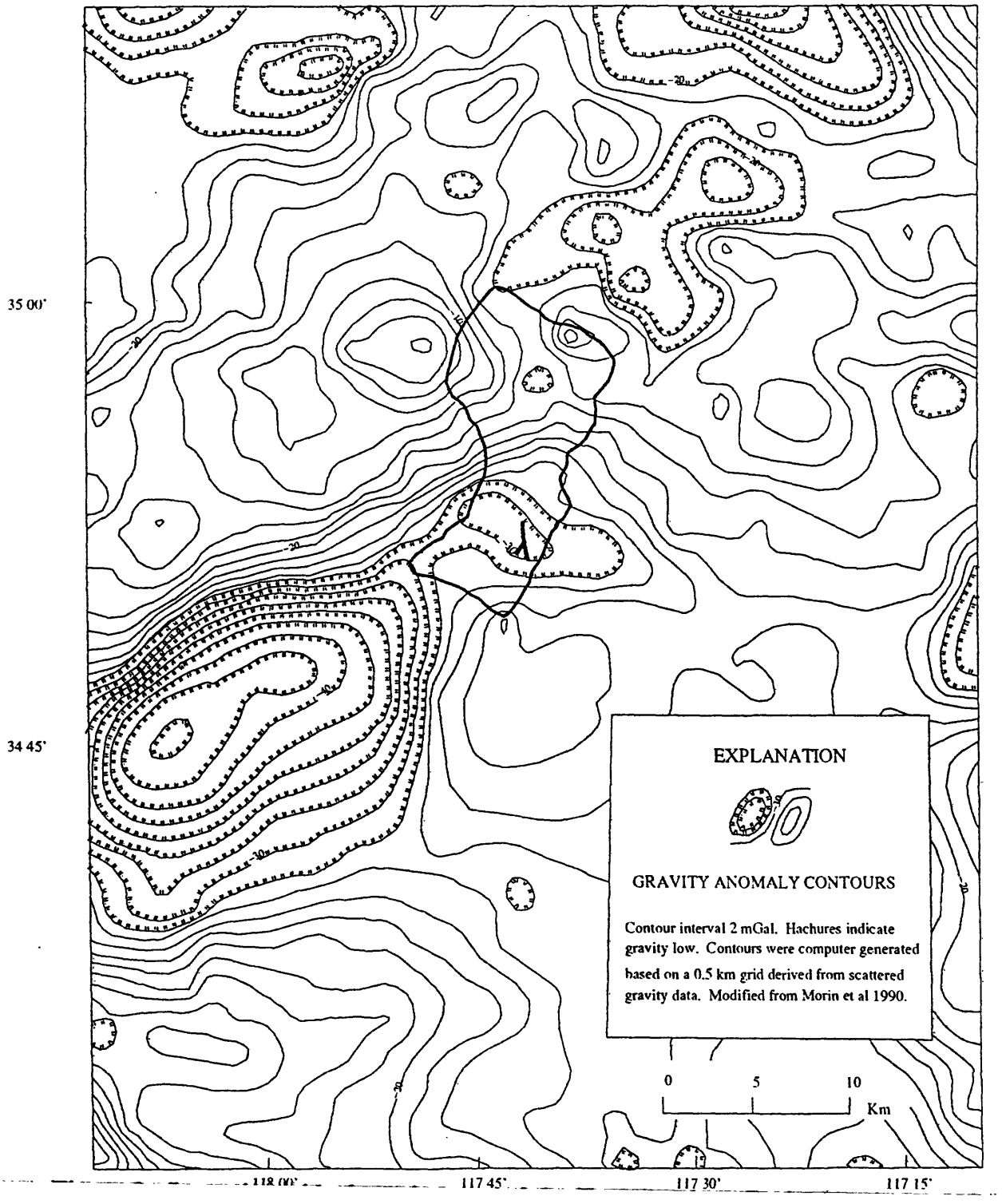

Figure 2. Isostatic residual gravity map of the East Antelope Basin Area.