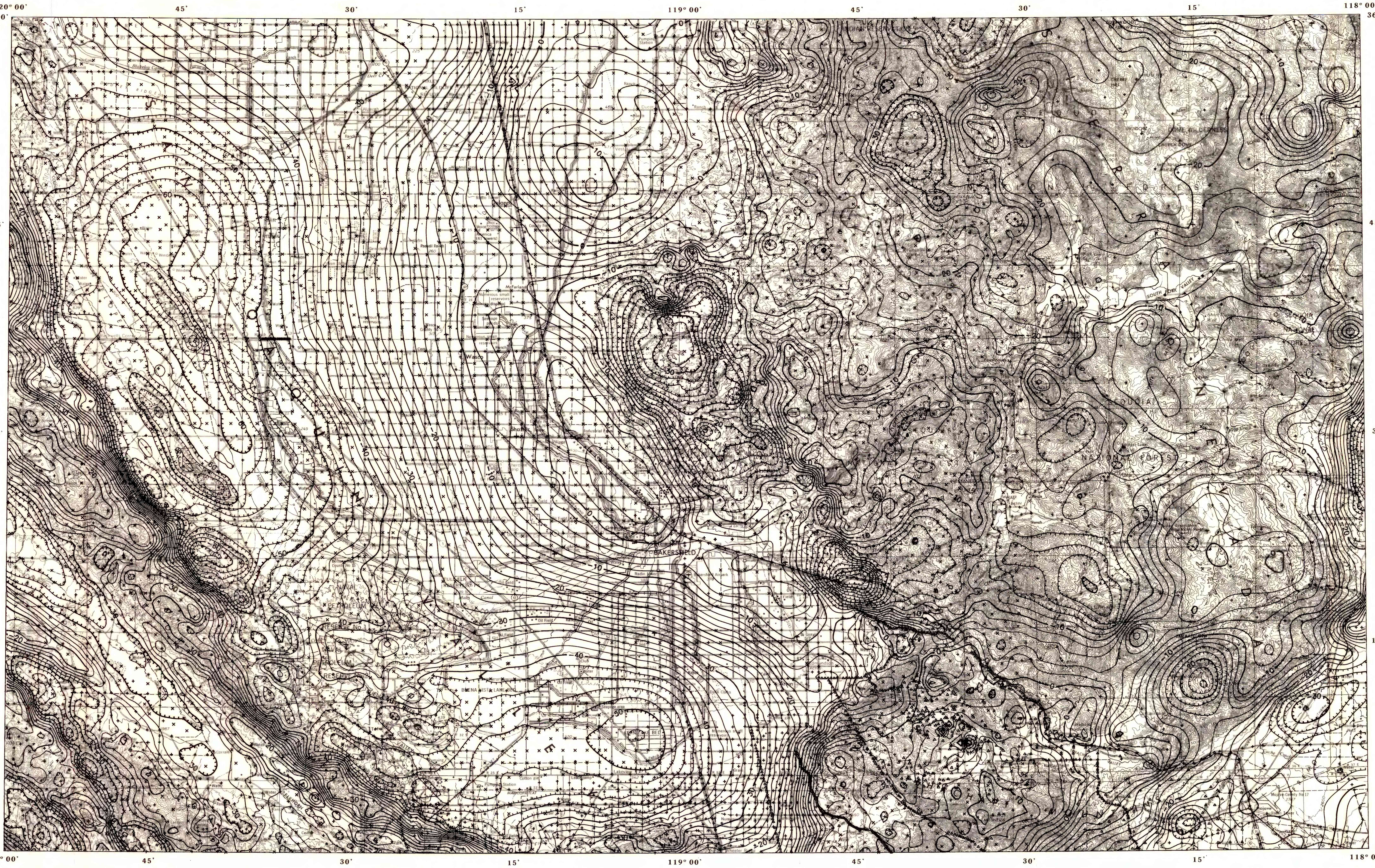
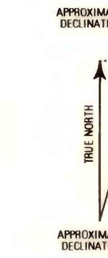
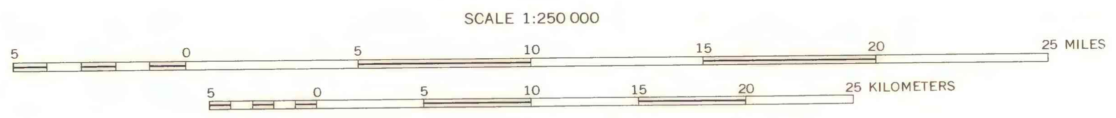
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT
91-554
SHEET 2 OF 2

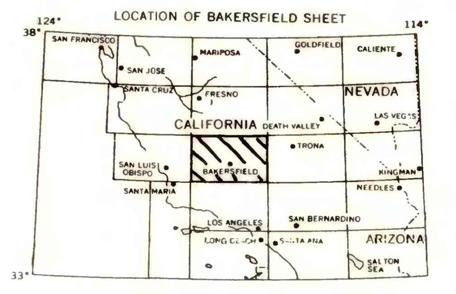


Topographic base from U.S. Geological Survey
Bakersfield (1962; revised 1968) at 1:250,000
Universal Transverse Mercator projection





Contour interval of base 200 feet
with supplementary contours at 100 ft intervals



COMPLETE BOUGUER GRAVITY ANOMALY AND ISOSTATIC RESIDUAL GRAVITY MAPS OF THE BAKERSFIELD 1° BY 2° QUADRANGLE, CALIFORNIA

ISOSTATIC RESIDUAL GRAVITY MAP

By

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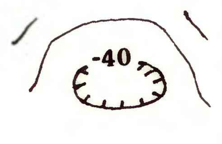
1991

EXPLANATION



Gravity anomaly contours. Contour interval 2 mGal. Hachures indicate gravity low. Contours were computer generated based on a 800-meter grid derived from scattered gravity data. Although the data have been edited, caution should be exercised when interpreting anomalies controlled by only a single gravity station.

+ Gravity station collected by USGS (see Langenheim and Plescia, 1991).

× Gravity station obtained from Defense Mapping Agency.

Δ Gravity station obtained from unpublished thesis by Plescia (1985).

ISOSTATIC CORRECTION

The isostatic correction approximately removes the long-wavelength effect of deep crustal and/or upper mantle masses that isostatically compensate regional topography. The isostatic correction used for this map is based on an Airy-Heiskanen model (Heiskanen and Vening Meinesz, 1958) of isostatic compensation; compensation is achieved by undulations of the crust-mantle interface. Model parameters used for this map are a sea-level crustal thickness of 25 km, a crust-mantle density contrast of 0.40 g/cm^3, and a crustal density of 2.67 g/cm^3 for the topographic load. These model parameters were used because (1) they agree with seismically determined values of crustal thickness for central California and crust-mantle density contrast, (2) changing the model parameters does not significantly affect the resulting isostatic anomaly (Oliver, 1973; Jachens and Griscom, 1985) and (3) they are consistent with model parameters used for isostatic corrections computed for the rest of California (Roberts and others, 1990). The computer program ISOCOMP (Jachens and Roberts, 1981) directly calculates the attraction of an Airy-Heiskanen root by summing the attraction of individual mass prisms making up the root.

The isostatic residual gravity map (Sheet 2) differs markedly from the complete Bouguer gravity map (Sheet 1). The amplitude of the average isostatic residual gravity is significantly reduced from the average complete Bouguer anomaly value, from -81 ± 24 (1σ) to -22 ± 18 mGal as compared with a reduction of -125 to -11 mGal for all of California (Oliver and others, 1982). This reduction in average amplitude in the Bakersfield quadrangle suggests that the isostatic correction removes most of the negative gravitational effect of the Sierra Nevadan root. The isostatic residual gravity values should therefore reflect lateral variations of density within the mid- to upper crust. Isostatic residual gravity values ranges from about -66 mGal along the western margin of the San Joaquin Valley to about +13 mGal in the Tehachapi Mountains and northern Sierra Nevada foothills. The gravity low in the San Joaquin Valley is caused by low-density sedimentary rocks that thicken to the west. Gravity highs are associated with dense crystalline rocks exposed in the Tehachapi Mountains and ultramafic rocks exposed in the Sierra Nevada foothills.

The removal of the large gravitational gradient across the Sierra Nevada batholith leaves a pattern of rounded, local gravity highs and lows associated with plutons and roof pendants. For example, the gravity low centered about 30 km east of Bakersfield corresponds with the mapped extent of a biotite tonalite pluton (Dibblee and Chesterman, 1953; Ross, 1989). Another gravity low centered near Pine Mountain about 55 km east of Delano coincides with the mapped boundary of the granodiorite of Pine Flat (Ross, 1990). Measurements by Ross (1987, 1988) indicate a density contrast of 0.05 to 0.10 g/cm^3 between the pluton and surrounding rocks. Assuming that this density contrast is constant with increasing depth, the granodiorite of Pine Flat extends 2 to 6 km below the surface in order to account for the gravity anomaly. These depth estimates, based on a two-dimensional model, are somewhat consistent with depth extents estimated for other plutons in the western Sierra Nevada (5-8 km from Oliver and others, 1986).

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