



EXPLANATION

Isostatic gravity anomaly contour—Contour interval 2 mGal. Hatchures indicate closed lows. Contours were computer generated based on an 800 m by 800 m grid derived from scattered data. Although the data have been edited, caution should be exercised when interpreting anomalies controlled by only a single gravity station.

Gravity station

INTRODUCTION

This isostatic gravity map is part of the Southern California Areal Mapping Project (SCAMP) and is intended to promote further understanding of the geology in the Victorville 1:100,000-scale quadrangle, California, by serving as a basis for geophysical interpretations and by supporting both geological mapping and topical, SCAMP-related studies. Local spatial variations in the Earth's gravity field (after various corrections for elevation, terrain, and deep crustal structure explained below) reflect the distribution of densities in the mid- to upper crust. Densities often can be related to rock type, and abrupt spatial changes in density commonly mark lithologic boundaries.

High-density basement rocks exposed within the Victorville quadrangle generally include metamorphic rocks and Mesozoic plutonic rocks present in the mountainous areas of the quadrangle. Plutonic bodies of mafic composition, such as gabbro or diorite, are usually responsible for gravity highs whereas felsic plutons where juxtaposed against denser metamorphic or igneous rocks commonly cause local gravity lows. Alluvial sediments, usually located in the valleys, and Tertiary sedimentary rocks are characterized by low densities. However, with increasing depth of burial and age, the densities of these rocks may become indistinguishable from those of basement rocks.

The lowest isostatic gravity values within the Victorville quadrangle are about -42 mGal over sedimentary basins near George Air Force Base and the southwest corner of Edwards Air Force Base. The highest isostatic gravity values are along an "L" shaped anomaly that runs from Iron Mountain to north of Barstow. This anomaly ranges from about -10 to -2 mGal.

DATA SOURCES, REDUCTIONS, AND ACCURACIES

Gravity data in the Victorville 1:100,000-scale quadrangle include 2031 gravity stations. The data of Morin (1992) and Langenheim (written commun., 1993) was added to the data set of Tang and Ponce (1982). The datum of observed gravity for this map is the International Gravity Standardization Net of 1971 (IGSN 71) as described by Morelli (1974, p. 16); the reference ellipsoid used is the Geodetic Reference System 1967 (GRS67; International Association of Geodesy, 1971).

The observed gravity data were reduced to free-air anomalies using standard formulas (Telford and others, 1976). Bouguer, curvature, and terrain corrections, to a radial distance of 166.7 km (Plouff, 1977), were applied to the free-air anomaly at each station to determine the complete Bouguer anomalies at a standard reduction density of 2.67 g/cm³. An isostatic correction was then applied to remove the long-wavelength effect of deep crustal and (or) upper mantle masses that isostatically support regional topography. The isostatic correction assumes an Airy-Heiskanen model of isostatic compensation (Heiskanen and Vening-Meinesz, 1958). Compensation is achieved by varying the depth of the model crust-mantle interface using the following parameters: a sea-level crustal thickness of 25 km, a crust-mantle density contrast of 0.40 g/cm³, and a crustal density of 2.67 g/cm³ for the topographic load. These parameters were used because (1) they produce a model crustal geometry that agrees with seismically determined values of crustal thickness for central California, (2) they are consistent with model parameters used for isostatic corrections computed for the rest of California (Roberts and others, 1990), and (3) changing the model parameters does not significantly affect the resulting isostatic anomaly (Jachens and Griscom, 1985). 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 and thus calculating the isostatic correction; the resulting isostatic gravity values should reflect lateral variations of density within the mid- to upper crust.

The main sources of error are inaccurate elevations and inaccurate terrain corrections. Errors associated with terrain corrections may be 5 to 10 percent of the value of the total terrain correction. The average error based on the average terrain correction (0.34 mGal) is thus about 0.03 mGal, but in the Leuhman Ridge area, the individual errors may be as large as 0.6 mGal. Errors resulting from elevation uncertainties are probably less than 0.5 mGal for most of the data because the majority of the stations are at or near bench marks and spot and surveyed elevations, which are accurate to about 0.2 to 3 m. Measurements for which elevations were controlled by contour interpolation are expected to have errors of up to 1.2 mGal. In general, the total uncertainties for the data shown on the map are estimated to be less than 2 mGal (or one contour interval), although in many areas the data are considerably more accurate.

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ISOSTATIC GRAVITY MAP OF THE VICTORVILLE 1:100,000 SCALE QUADRANGLE, CALIFORNIA

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