DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT
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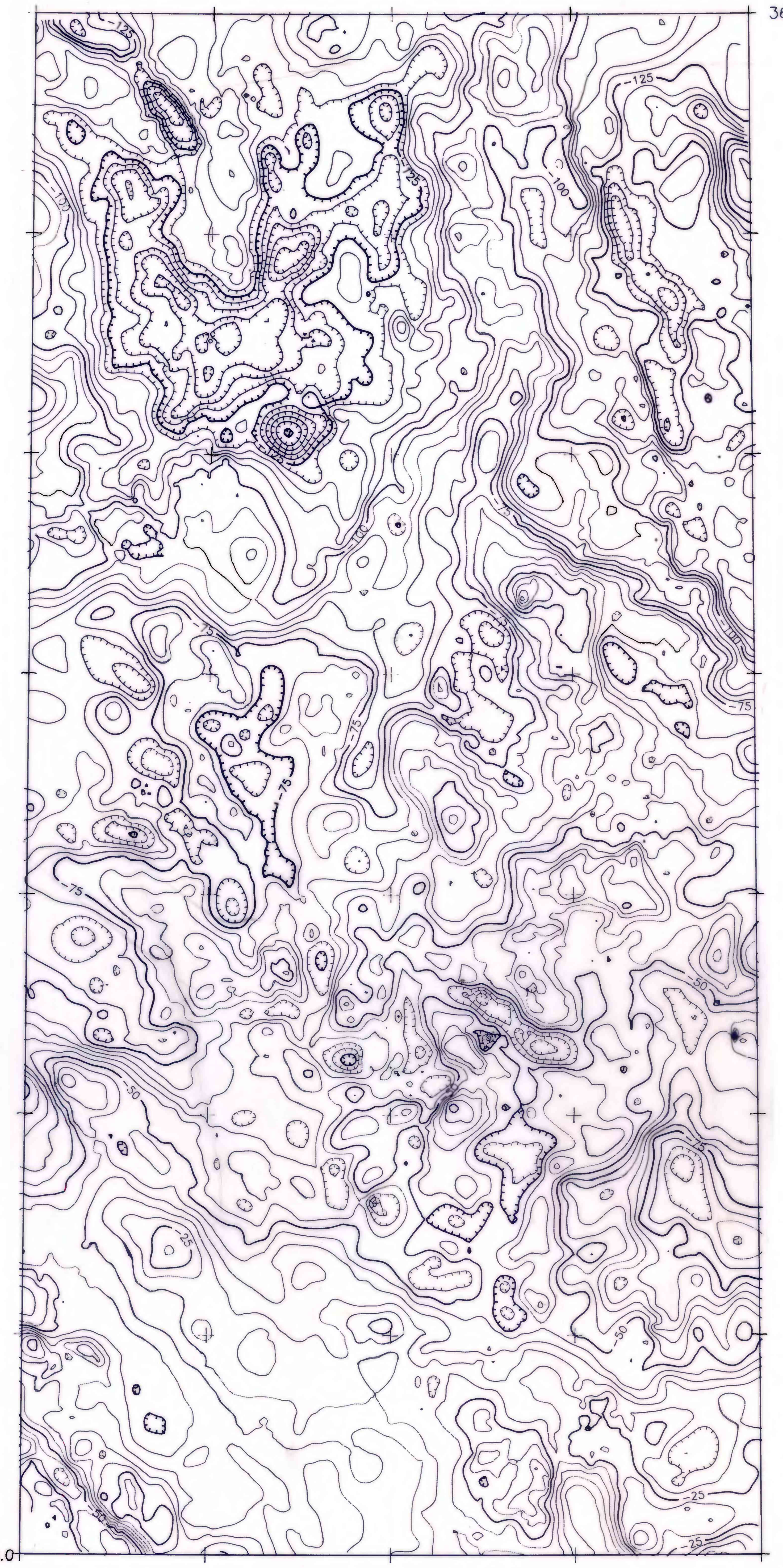
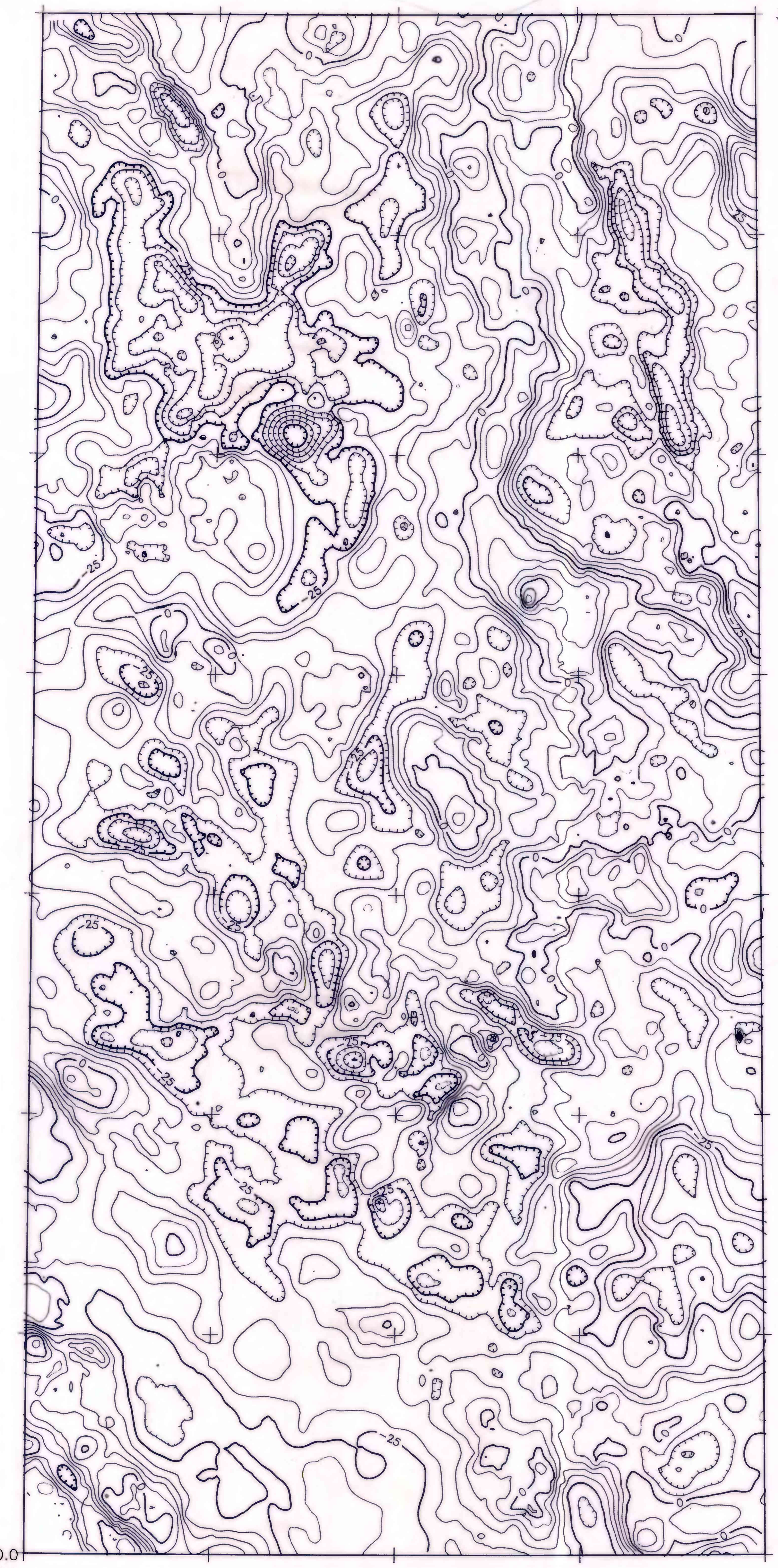
SHEET 7 OF 7



BOUGUER GRAVITY MAP

TRANSVERSE MERCATOR PROJECTION



This map is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards

ISOSTATIC RESIDUAL GRAVITY MAP

SCALE 1:750 000
10 0 10 20 30 40 MILES
10 0 10 20 30 40 50 60 KILOMETERS

Explanation

The principal gravity data set compiled for this map was generated by various projects of the U.S. Geological Survey. This set was then supplemented with data received from the Defense Mapping Agency Gravity Library. The observed gravity data, based on the International Gravity Standardization Net (IGSN71) datum (Morelli, 1974), were reduced to free air gravity anomalies by using the Geodetic Reference System 1967 formula (GRS67) for the theoretical value of gravity at sea level (International Association of Geodesy, 1971, p. 60) and Swick's (1942, p. 65) formula for the free air correction. Bouguer, curvature, and terrain corrections (out to a distance of 166.7 km from the station) at a standard reduction density of 2.67 g/cm^3 were added to the free-air anomaly at each station to determine complete Bouguer gravity anomalies.

Editing of data involved examination and subsequent deletion of stations which produced large anomalies not supported by values at neighboring stations. This procedure probably was successful in eliminating gross errors in areas with dense gravity coverage but incorrect values may still exist in areas of sparse coverage.

The bulk of the inconsistencies remaining within this data set probably stem from observed gravity values based on a datum other than IGSN71 and from errors in terrain corrections. Because the gravity data came from a variety of different sources, some datum problems were unavoidable. However, based on comparisons of redundant observations from different sources, datum inconsistencies are believed to be less than 1 mGal. Terrain corrections (within .895 km of the site of observation) were applied by hand only to some of the U.S. Geological Survey data and generated by computer for the rest of the data set. The error introduced at this stage probably is less then 1 mGal for most stations but could be larger for stations in areas of extreme topographic relief. In view of these problems, the data are believed, in general, to be accurate to within 2 mGals.

The Bouguer gravity field over the western United States reflects both shallow crustal density variations and deep-seated density distributions, many of which are directly related to isostatic support of topography (Simpson and others, 1985). In an attempt to emphasize the gravity anomalies caused by shallow density distributions (those most readily correlated with the results of geologic mapping) the isostatic residual gravity map was constructed from the Bouguer gravity data by removing a regional gravity field based on a simplified model for isostatic compensation of topography. Extensive tests on similar maps from California (Jachens and Griscom, 1985) and the conterminous United States (Simpson and others, 1985) indicate that anomalies on isostatic residual gravity maps primarily reflect lateral density variations in the mid- to upper-crust.

Isostatic corrections were calculated assuming complete local compensation according to the Airy-Heiskanen system. Calculations were performed by computer (Jachens and Roberts, 1981) out to a radius of 166.7 km from each station using formulas of Heiskanen and Vening Meinesz (1958, p. 136 and 182) modified to incorporate station elevations. Thickness of the model crust was calculated from topography averaged over 3 x 3 minute compartments (Robbins and others, 1973) assuming density of topography, 2.67 g/cm^3, sealevel crustal thickness, 25 km, and density contrast across the base of the model crust, 0.40 g/cm^3. For the region beyond 166.7 km, combined terrain and isostatic corrections were taken from published topographic-isostatic reduction maps (Karki and others, 1961).

Contouring by computer with 1000 meter grid size.

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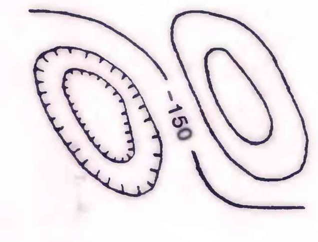
LOCATION DIAGRAM

BOUGUER AND ISOSTATIC RESIDUAL GRAVITY MAPS OF THE COLORADO RIVER REGION, INCLUDING THE KINGMAN, NEEDLES, SALTON SEA, AND EL CENTRO QUADRANGLES

by

John Mariano, M. G. Helferty, and T. B. Gage

1986



Gravity Anomaly Contours

Contour interval is 2 mGal. Hachured contours indicate closed gravity lows.