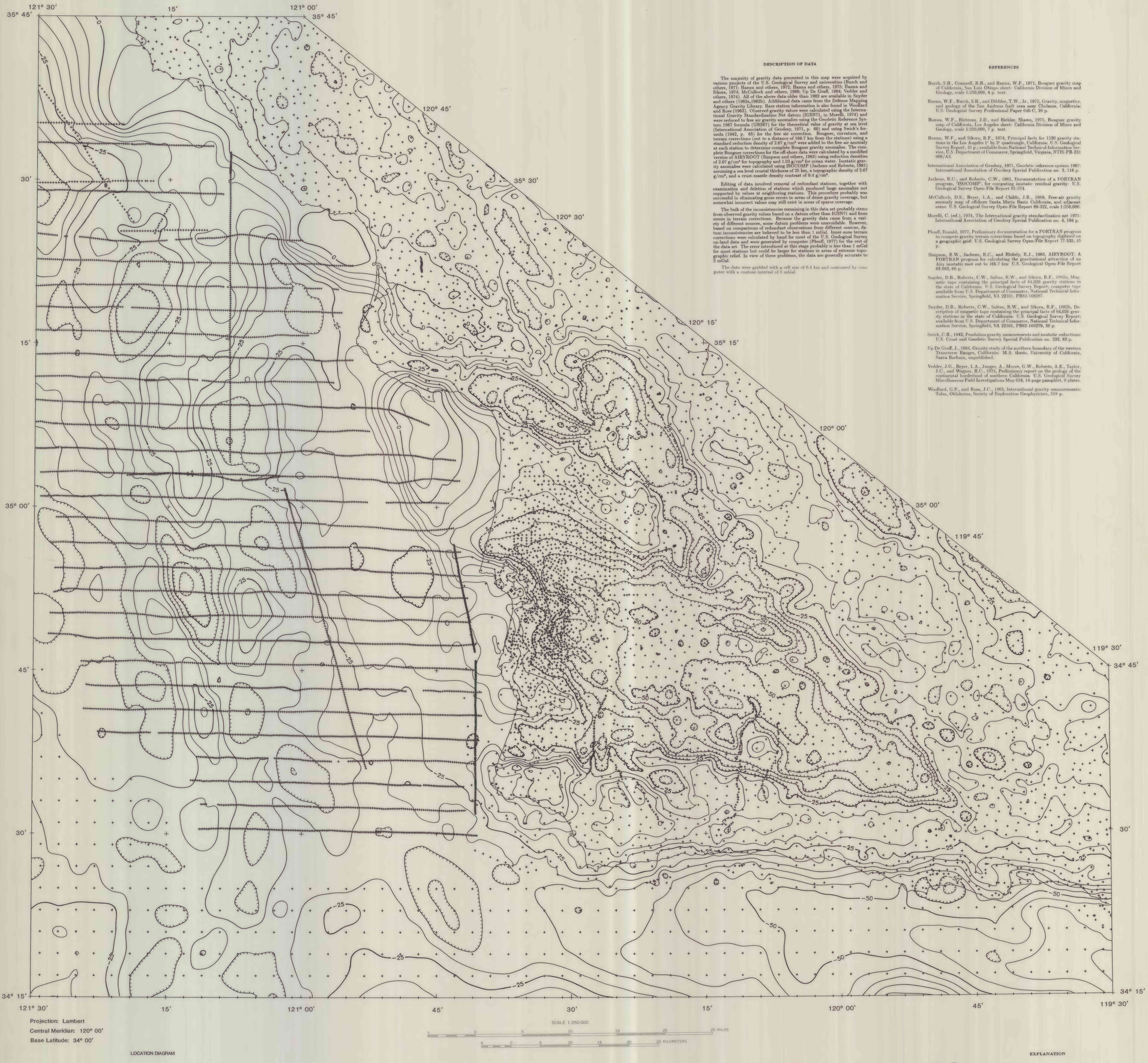
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT 90-308
SHEET 1 OF 2



Projection: Lambert
Central Meridian: 120° 00′
Base Latitude: 34° 00′

SCALE 1:250 000

0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

LOCATION DIAGRAM

ISOSTATIC RESIDUAL GRAVITY AND AEROMAGNETIC MAPS OF THE SANTA MARIA PROVINCE INCLUDING PORTIONS OF THE SANTA MARIA, SAN LUIS OBISPO, LOS ANGELES, AND BAKERSFIELD QUADRANGLES AND ADJACENT OFF-SHORE AREAS, CALIFORNIA

ISOSTATIC RESIDUAL GRAVITY MAP OF THE SANTA MARIA PROVINCE

by

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DESCRIPTION OF DATA

The majority of gravity data presented in this map were acquired by various projects of the U.S. Geological Survey and universities (Burch and others, 1971; Hanna and others, 1972; Hanna and others, 1975; Hanna and Sikora, 1974; McCulloch and others, 1989; Up De Graff, 1984; Vedder and others, 1974). All of the above data older than 1982 are available in Snyder and others (1982a,1982b). Additional data came from the Defense Mapping Agency Gravity Library. Base station information is also found in Woollard and Rose (1963). Observed gravity values were calculated using the International Gravity Standardization Net datum (IGSN71, in Morelli, 1974) and were reduced to free air gravity anomalies 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 using Swick's formula (1942, p. 65) for the free air correction. Bouguer, curvature, and terrain corrections (out to a distance of 166.7 km from the stations) using a standard reduction density of 2.67 g/cm³ were added to the free air anomaly at each station to determine complete Bouguer gravity anomalies. The complete Bouguer corrections for the off-shore data were calculated by a modified version of AIRYROOT (Simpson and others, 1983) using reduction densities of 2.67 g/cm³ for topography and 1.03 g/cm³ for ocean water. Isostatic gravity anomalies were calculated using ISOCOMP (Jachens and Roberts, 1981) assuming a sea level crustal thickness of 25 km, a topographic density of 2.67 g/cm³, and a crust-mantle density contrast of 0.4 g/cm³.

Editing of data involved removal of redundant stations, together with examination and 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 of dense gravity coverage, but somewhat incorrect values may still exist in areas of sparse coverage.

The bulk of the inconsistencies remaining in this data set probably stems 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. Inner-zone terrain corrections were calculated by hand for most of the U.S. Geological Survey on-land data and were generated by computer (Plouff, 1977) for the rest of the data set. The error introduced at this stage probably is less than 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 generally accurate to 2 mGal.

The data were gridded with a cell size of 0.4 km and contoured by computer with a contour interval of 5 mGal.

REFERENCES

Burch, S.H., Grannell, R.B., and Hanna, W.F., 1971, Bouguer gravity map of California, San Luis Obispo sheet: California Division of Mines and Geology, scale 1:250,000, 4 p. text.

Hanna, W.F., Burch, S.H., and Dibblee, T.W., Jr., 1972, Gravity, magnetics, and geology of the San Andreas fault area near Cholame, California: U.S. Geological Survey Professional Paper 646-C, 29 p.

Hanna, W.F., Rietman, J.D., and Biehler, Shawn, 1975, Bouguer gravity map of California, Los Angeles sheet: California Division of Mines and Geology, scale 1:250,000, 7 p. text.

Hanna, W.F., and Sikora, R.F., 1974, Principal facts for 1230 gravity stations in the Los Angeles 1° by 2° quadrangle, California: U.S. Geological Survey Report, 45 p.; available from National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia, NTIS-PB-231 909/AS.

International Association of Geodesy, 1971, Geodetic reference system 1967: International Association of Geodesy Special Publication no. 3, 116 p.

Jachens, R.C., and Roberts, C.W., 1981, Documentation of a FORTRAN program, 'ISOCOMP', for computing isostatic residual gravity: U.S. Geological Survey Open-File Report 81-574.

McCulloch, D.S., Beyer, L.A., and Childs, J.R., 1989, Free-air gravity anomaly map of offshore Santa Maria Basin California, and adjacent areas: U.S. Geological Survey Open-File Report 89-322, scale 1:250,000.

Morelli, C. (ed.), 1974, The International gravity standardization net 1971: International Association of Geodesy Special Publication no. 4, 194 p.

Plouff, Donald, 1977, Preliminary documentation for a FORTRAN program to compute gravity terrain corrections based on topography digitized on a geographic grid: U.S. Geological Survey Open-File Report 77-535, 45 p.

Simpson, R.W., Jachens, R.C., and Blakely, R.J., 1983, AIRYROOT: A FORTRAN program for calculating the gravitational attraction of an Airy isostatic root out to 166.7 km: U.S. Geological Open-File Report 83-883, 66 p.

Snyder, D.B., Roberts, C.W., Saltus, R.W., and Sikora, R.F., 1982a, Magnetic tape containing the principal facts of 64,026 gravity stations in the state of California: U.S. Geological Survey Report; computer tape available from U.S. Department of Commerce, National Technical Information Service, Springfield, VA 22161, PB82-168287.

Snyder, D.B., Roberts, C.W., Saltus, R.W., and Sikora, R.F., 1982b, Description of magnetic tape containing the principal facts of 64,026 gravity stations in the state of California: U.S. Geological Survey Report; available from U.S. Department of Commerce, National Technical Information Service, Springfield, VA 22161, PB82-168279, 30 p.

Swick, C.H., 1942, Pendulum gravity measurements and isostatic reductions: U.S. Coast and Geodetic Survey Special Publication no. 232, 82 p.

Up De Graff, J., 1984, Gravity study of the northern boundary of the western Transverse Ranges, California: M.A. thesis, University of California, Santa Barbara, unpublished.

Vedder, J.G., Beyer, L.A., Junger, A., Moore, G.W., Roberts, A.E., Taylor, J.C., and Wagner, H.C., 1974, Preliminary report on the geology of the continental borderland of southern California: U.S. Geological Survey Miscellaneous Field Investigations Map 624, 14-page pamphlet, 9 plates.

Woollard, G.P., and Rose, J.C., 1963, International gravity measurements: Tulsa, Oklahoma, Society of Exploration Geophysicists, 518 p.

EXPLANATION

Contours showing isostatic residual gravity in milligals. Contour inverval 5 and 25 mGal. Hachures indicate gravity lows. Grid cell size is 0.4 km.

Gravity station.

Shoreline.