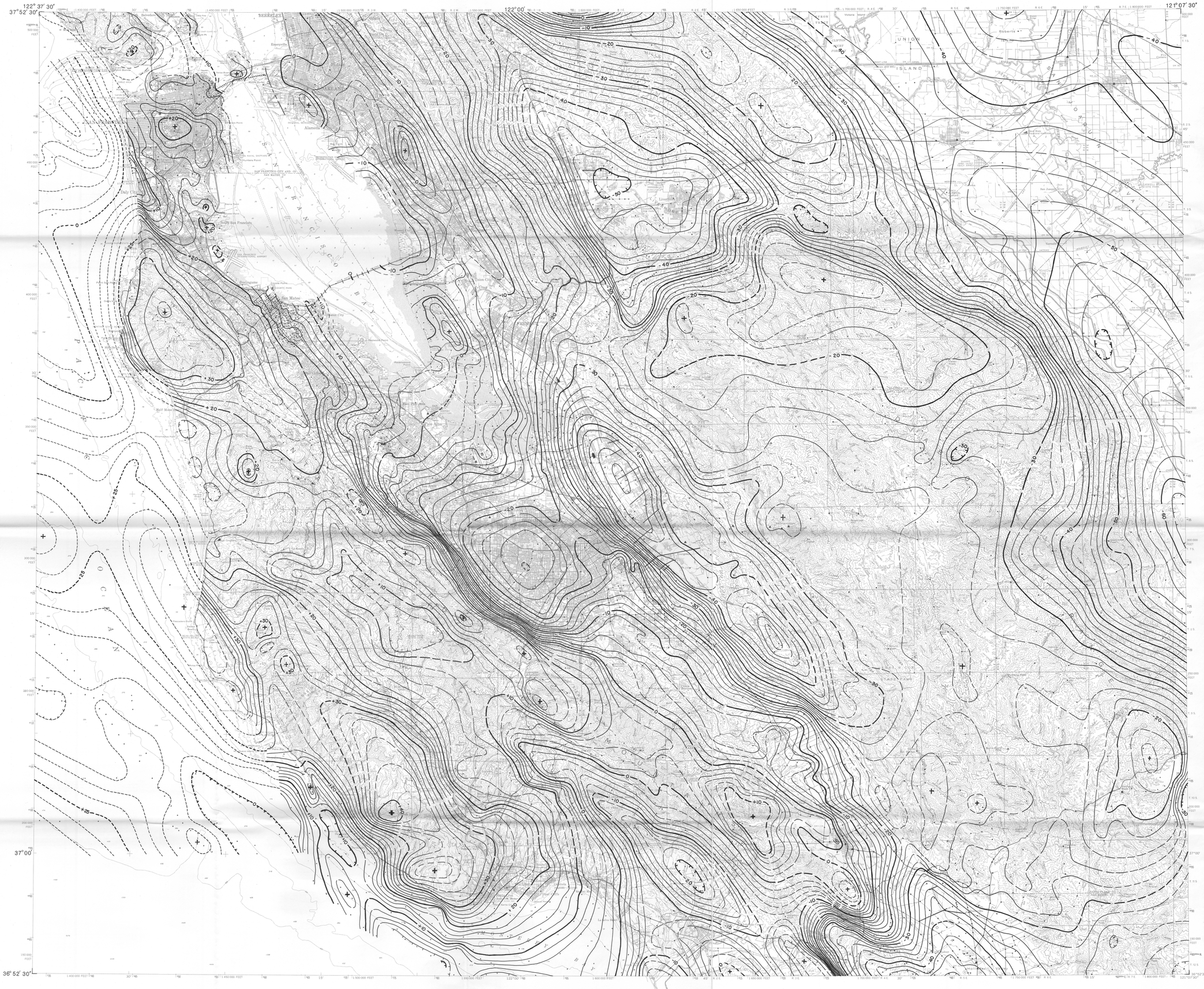
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF 780-C



Base from U.S. Geological Survey
San Francisco Bay Region, sheet
3 of 3, 1970

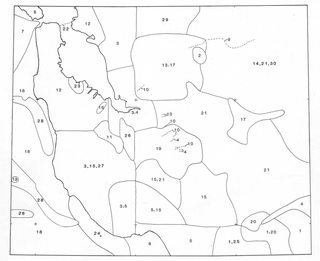
APPROXIMATE MEAN DECLINATION, 1982

SCALE 1:125 000

BOUGUER GRAVITY MAP OF SOUTHERN SAN FRANCISCO BAY REGION, CALIFORNIA

By
S.L. Robbins, C.W. Roberts, and R.H. Chapman

1982



GENERALIZED INDEX TO SOURCES OF GRAVITY DATA

Original sources of gravity data

1 C. C. Bishop and R. H. Chapman (1967)
2 R. H. Chapman (1966)
3 R. H. Chapman and C. C. Bishop (1968)
4 R. H. Chapman (written commun., 1976)
5 J. C. Clark and J. D. Nistman (1973)
6 M. G. Clement (1965)
7 R. H. Chapman (1968)
8 R. E. Crosby (1973)
9 J. F. Evernden (written commun., 1961)
10 John Fett (written commun., 1975)
11 R. J. Flach (unpublished data, 1967)
12 R. J. Fleck (1967)
13 R. D. Holmes (1976)
14 Humble Oil (written commun., 1975)
15 J. D. Johnson (written commun., 1975)
16 R. W. Oliver (in DiBlasio, 1966)
17 R. W. Oliver (written commun., 1966, 1968, 1962)
18 R. E. Pratt and R. R. Mills (1975)
19 R. L. Robbins (1971)
20 R. L. Robbins (written commun., 1976)
21 S. L. Robbins and others (1974)
22 S. L. Robbins and others (unpublished data, 1979)
23 F. J. Seidelman (1973)
24 C. R. Spikes (1973)
25 Standard Oil of California (written commun., 1967)
26 R. G. Taylor, Jr. (1956)
27 U.S. Navy (written commun., 1970)
28 U.S. Institute of Oceanography (1965, 1966)
29 L. C. Wood (1964)
30 G. P. Woollard and R. R. Joesting (1964)

Source data are available from the California Division of Mines and Geology, Sacramento, California.

Discussion

This gravity map covers the southern sheet (number 3) of the topographic map of the San Francisco Bay region and includes the eastern part of the San Francisco, the western part of the San Jose, and the northwestern part of the Monterey (formerly Santa Cruz) 1° x 2° quadrangles (scale 1:250,000).

Most of the gravity data utilized in compiling this map were previously shown on maps of parts of the San Francisco Bay region (Bishop and Chapman, 1968; Chapman, 1966; Chapman and Bishop, 1968; and Robbins and others, 1977). On the present map, the data from Bishop and Chapman (1968) and Chapman and Bishop (1968) have been slightly modified to bring all data to a common datum level and format (Robbins and others, 1974, p. 2-6). New data obtained by the U.S. Geological Survey in the intervening years have been added to the present map along with other new data from the following sources: Clark and Nistman (1973), Cooper (1971), Crosby (1973), John Fett (written commun., 1975), Holmes (1976), Pratt and Mills (1975), Seidelman (1973), and Spikes (1973). These data have also been adjusted in various ways to provide mutual consistency and to fit the existing data. The new sources are shown on the index figure and are keyed to the list of sources.

The observed gravity values from the various land surveys have been adjusted to a common datum by means of a local network of gravity base stations (Chapman, 1966). The network uses the datum of Behrendt and Woollard (1961) and ties to the station at the U.S. Naval Observatory in Washington. The base station at San Francisco airport (station WA 361). Oceanic data are referenced to base stations in San Francisco and Oakland (Lattimore and others, 1968), and in Monterey (Crosby, 1973, p. 22; Spikes, 1973, p. 33). The land surveys were made with either LaCoste and Romberg or Worden gravity meters, and the ship and boat surveys with LaCoste and Romberg shipboard gravity ranges (Barnes and others, 1965, p. 526-527). The marine surveys include both surface-ship and ocean-bottom data using LaCoste and Romberg meters.

All land data have been reduced to complete Bouguer anomalies for a density of 2.67 g/cm^3. The terrain corrections were generally made manually to a radius of 166.7 km using templates and the U.S. Geological Survey (Plouff, 1977) and the digital topographic model of California (Robbins and others, 1973). Terrain corrections are the main source of errors in the Bouguer anomalies, the errors being generally less than 0.1 mGal but as high as perhaps 1 mGal in extreme topography such as the top of Mount Hamilton. Ocean-bottom data have been reduced to free-air anomalies, and these are continuing have been reduced using Dodge Bouguer anomaly corrections: one for the crustal density of 2.67 g/cm^3 and one for the seawater density of 1.03 g/cm^3 (Crosby, 1973; Spikes, 1973). Terrain corrections were made to a radius of 166.7 km by hand using templates.

The values of observed gravity for surface-ship and ocean-bottom in the area of 5-mGal interval contouring were reduced to Bouguer anomalies using the difference between 2.67 g/cm^3 and the density of seawater, 1.03 g/cm^3. No terrain corrections were made for these data.

The values of observed gravity for ocean-bottom and land gravity measurements are tied to the local base station, and those for surface-ship are relative to the local base station. Many of the surface-ship data have errors of ±5 to ±5 mGal or more. Because of the errors in the surface-ship data, the contouring in the oceanic areas with 5-mGal contouring may locally be in error by one contour interval.

The main differences of this map over earlier versions (Bishop and Chapman, 1968; Chapman and Bishop, 1968; and Robbins and others, 1977), other than the change in scale from 1:250,000 to 1:125,000, are: 1) new data in some areas (Livermore Valley, oceanic areas, east side of Santa Clara Valley, and Hollister area); 2) better terrain corrections on the older data, and 3) a 2-mGal contour interval instead of a 5-mGal interval.

A tabulation of the principal facts for the gravity stations and a map showing station numbers and locations are available on request from the Sacramento District office of the California Division of Mines and Geology. Many of the data on the San Jose 1° x 2° quadrangle can be found in tabular form in Robbins and others (1977).

Discussions of the geologic significance of Bouguer anomalies in various parts of sheet 3 and tabulations of rock densities for certain rock units may be found in the following publications:

Santa Cruz (Monterey) sheet (south of 37° N.) - Bishop and Chapman (1968)
San Francisco sheet (east of 122° W.) - Chapman and Bishop (1968)
San Jose sheet (east of 122° W.) - Robbins and others (1977)
Santa Cruz Mountains and Gabilan Range - Clark and Nistman (1973)
San Mateo - Seidelman (1973)
San Jose area - Robbins (1971)

[1]Any use of trade names is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey.

References

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Behrendt, J. C., and Woollard, G. P., 1961, An evaluation of the gravity control network in North America: Geophysics, v. 26, no. 1, p. 57-76.
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Pratt, R. E., and Mills, R. R., 1975, Gravity data, offshore southern coast California shelf bottom gravity, Cape Flattery to Santa Cruz: NOAA ship MORTHAR; NOAA, NOS, Marine Geophysics Group Report, 52 p.
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EXPLANATION

Gravity field station

Gravity base station

Gravity contours - Showing Bouguer anomaly in milligals. Hachures indicate areas of low gravity. Reduction density 2.67 g/cm^3.

2-mGal contour interval - All land data and some offshore bottom data west of Santa Cruz for which terrain or curvature corrections have been made to a distance of 166.7 km. Contours are long dashed where poorly controlled.

5-mGal contour interval - Offshore surface ship data and some offshore bottom data for which no terrain or curvature corrections have been made. All contours short dashed.

Datum is 979,958.74 milligals at the U.S. Geological Survey, Menlo Park, California, California Division of Mines and Geology gravity base station No. 1721

Gravity high

Gravity low

Interior—Geological Survey, Reston, Va.—1982
For sale by Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225