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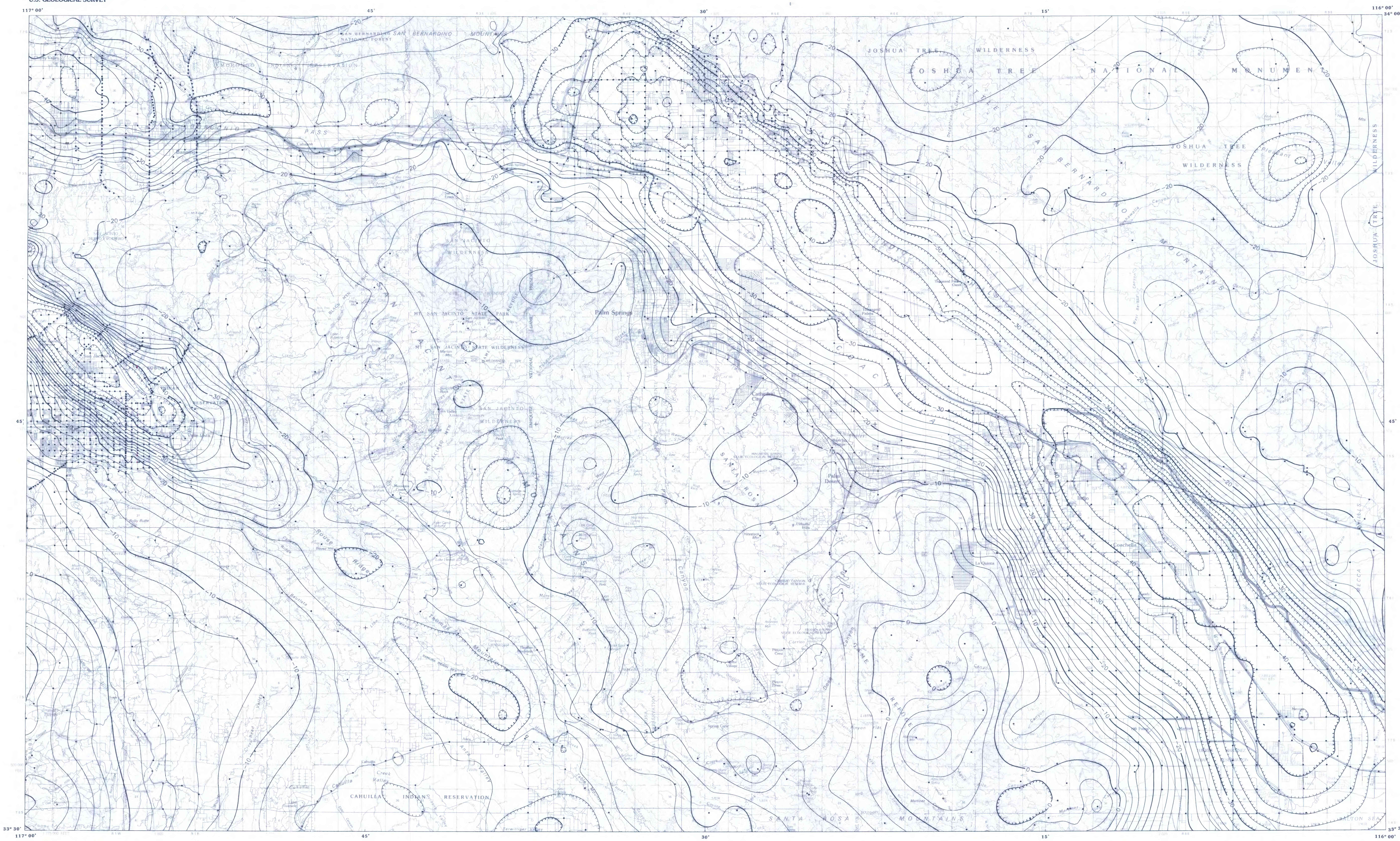


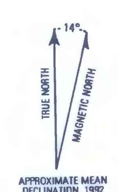

Base from U.S. Geological Survey, 1984
Universal Transverse Mercator Projection

SCALE 1:100 000

KILOMETERS

MILES

FEET



CONTOUR INTERVAL 50 METERS

QUADRANGLE LOCATION

# ISOTATIC RESIDUAL GRAVITY MAP OF THE PALM SPRINGS 1:100,000-SCALE QUADRANGLE, CALIFORNIA

By

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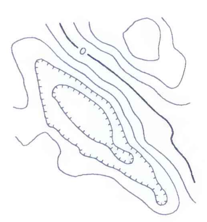
1992

EXPLANATION



Gravity contours---showing isostatic residual gravity. Contour intervals are 2 and 10 milligals (mGal). Hachures indicate gravity low. Contours were computer generated using a 400-m grid derived from scattered gravity data.

DATA

An isostatic gravity map of the Palm Springs 1:100,000-scale quadrangle was derived from complete Bouguer gravity data (Biehler and others, 1992) as an aid to geophysical and geological studies of southern California. Observed gravity values were referenced to the International Gravity Standardization Net 1971 gravity datum described by Morelli (1974). Data were reduced using the Geodetic Reference System 1967 formula for theoretical gravity on the ellipsoid (International Association of Geodesy, 1971). Standard gravity corrections with a reduction density of 2.67 $g/cm^3$ were used to derive complete Bouguer gravity anomalies. An isostatic correction was applied using a procedure by Jachens and Roberts (1981) based on an Airy-Heiskanen model of local compensation with a sea-level crustal thickness of 25 km, an upper-crustal density of 2.67 $g/cm^3$, and a density contrast between the lower-crust and upper-mantle of 0.4 $g/cm^3$. Isostatic corrections are intended to remove the effects of long-wavelength anomalies related to topography and their compensating masses and thus, enhance short- to moderate-wavelength anomalies caused by mid- to upper-crustal features.

DISCUSSION

Isostatic gravity anomalies within the Palm Springs quadrangle range from about -46 mGal near the west edge of the quadrangle in San Jacinto Valley to about +10 mGal in an area from Black Mountain to Black Hills along the west edge of the quadrangle. In general, gravity lows are associated with thick alluvial basin deposits, broad gravity highs occur over mountain ranges composed of pre-Cenozoic rocks, and steep gravity gradients correlate with major fault zones within the quadrangle.

A prominent gravity low with an amplitude of about 25 mGal is associated with San Jacinto Valley on the west edge of the quadrangle. Fett (1968) and Cordell (1973) estimated a minimum depth to basement of 2.4 km, consistent with that determined from seismic refraction data. Gravity lows of 25 mGal are associated with Coachella Valley and the Salton Trough in the eastern-part of the quadrangle. Biehler (1964) indicated that the maximum depth to basement in Coachella Valley is about 4.7 km in the vicinity of Mecca and that the basin is asymmetrical with the thickest part on the northeast side of the valley. Both these pull-apart basins are of similar shape; San Jacinto Valley is about 35 km long and 6 km wide, while Coachella Valley is about 70 km long and 12 km wide. San Jacinto Valley is located between parallel faults within the San Jacinto fault zone, whereas only the northeast border of Coachella Valley coincides with a mapped fault--the Banning-Mission Creek fault. A gravity low of about 8 to 12 mGal occurs between the San Jacinto and San Bernardino Mountains along San Gorgonio Pass that merges with the Coachella Valley and Salton Trough gravity lows; the northern border of the gravity low correlates with the Banning fault.

In the southwest corner of the quadrangle a broad gravity high partly overlies Black Mountain and Black Hills that is associated with Mesozoic basic intrusive rocks at Bachelor Mountain (Rogers, 1965), just beyond the west edge of the quadrangle. In the northeast part of the quadrangle a broad gravity high overlies the Little San Bernardino Mountains. Although gravity data are sparse, this gravity high probably reflects Proterozoic gneiss and pre-Cenozoic granitic rocks (Rogers, 1965). In addition this anomaly is interrupted by east-west trending gravity contours that approximately correlate to the Dillon shear zone (Rogers, 1965).

The San Jacinto and Santa Rosa Mountains are located between the San Jacinto and Coachella Valleys and are the highest mountains in the eastern part of the Peninsular Range province reaching an elevation of 3,293 m (10,804 ft) at San Jacinto Peak. The San Jacinto Mountains, predominantly composed of Mesozoic felsic plutonic rocks and Paleozoic metasedimentary rocks (Rogers, 1965), are characterized by a broad gravity high with superimposed local highs of about 6 to 8 mGal. Although gravity data coverage is sparse, these local highs probably reflect both exposed and buried metasedimentary rocks that are generally more dense than the surrounding granitic rocks (Ponce and others, 1992). In the eastern part of the San Jacinto Mountains a prominent north-south trending gravity low is associated with the Palm Canyon fault and a mylonitic zone of shearing (Rogers, 1965).

REFERENCES

Biehler, Shawn, 1964, Geophysical study of the Salton trough of southern California: Ph.D. dissertation, California Institute of Technology, 139 p.

Biehler, Shawn, Langenheim, V.E., Sikora, R.F., Chapman, R.H., and Beyer, L.A., 1992, Complete Bouguer gravity anomaly map of the Santa Ana 1° by 2° quadrangle: U.S. Geological Survey Open-File Report 92-279, scale 1:250,000.

Cordell, Lindreth, 1973, Gravity analysis using an exponential density-depth function--San Jacinto graben, California: Geophysics, v. 38, no. 4, p. 684-690.

Fett, J.D., 1968, Geophysical investigation of the San Jacinto Valley, Riverside County, California: University of California, Riverside, unpublished thesis, 87 p.

International Association of Geodesy, 1971, Geodetic Reference System 1967: International Association of Geodesy Special Publication no. 3, 166 p.

Jachens, R.C., and Roberts, C.W., 1981, Documentation of a FORTRAN program, 'isocomp', for computing isostatic residual gravity: U.S. Geological Open-File Report 81-574, 26 p.

Morelli, C. (Ed.), 1974, The International Gravity Standardization Net, 1971: International Association of Geodesy Special Publication no. 4, 194 p.

Ponce, D.A., Hanna, W.F., Kingston, Marguerite, Simpson, S.L., and Snyder, S.L., 1992, Geophysics of the San Bernardino National Forest, in Calzia, J.P., ed., Mineral resource assessment of the San Bernardino National Forest: U.S. Geological Survey Bulletin.

Rogers, T.H., compiler, 1965, Geologic map of California, Santa Ana sheet: California Division of Mines and Geology Map, scale 1:250,000.