DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT
89-322

EXPLANATION

GRAVITY OBSERVATIONS

Gravity was measured using a stabilized platform LaCoste and Romberg shipborne gravity meter (No. S-53) aboard the R/V S.P. LEE during a 1979 (U.S. Geological Survey L4-79-NC) seismic-reflection survey of the offshore Santa Maria basin. Survey lines were designed for the reflection survey, and hence, there are fewer tie-lines than customary on a gravity-dedicated survey. Ship navigation was controlled by ranging to a shore-based transponder network.

The gravity observations were adjusted for instrument drift based on repeated occupation of harbor base stations, and for ship speed and heading (Eötvös correction). Free-air gravity anomalies were calculated with the Geodetic Reference System (International Association of Geodesy, 1967) and the International Gravity Standardization Net (Morelli et al., 1971).

The offshore free-air gravity is contoured at a 5 mgal interval, with supplemental 2.5 mgal contours. The distribution of crossing errors is shown in Figure 1. Onshore Bouguer gravity anomaly contours are from Reitman and Beyer (1982).

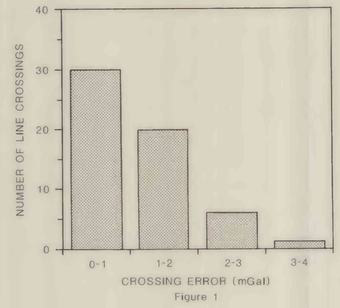

Figure 1

GEOLOGY

This marine gravity survey covers the southern part of the offshore Santa Maria basin, a late Tertiary shelf basin containing late Cenozoic strata of Oligocene(?) and younger age that rest unconformably on basement rocks thought to belong to the Franciscan assemblage. To a large extent, the free-air gravity anomaly pattern appears to be governed by the structural relief on the underlying Cretaceous basement rocks and the thickness of the less dense overlying late Cenozoic strata (Figure 2) as delineated by interpretation of the seismic-reflection data (McCulloch, 1987). The western side of the basin is bounded by a physiographic and structural high, the Santa Lucia bank, on which Franciscan rocks lie at or near the sea floor. The northeastern edge of the high is bounded by the Santa Lucia bank fault, along which there is vertical down-to-basin (east) separation of basement rocks. Relatively high free-air gravity anomaly values occur over Santa Lucia bank, and a north-northwest-trending, almost linear free-air gradient of 15 to 20 mgals coincides with the Santa Lucia bank fault. Similarly, on the northeast side of the basin, the Hosgri fault along which there is also vertical down-to-basin (west) separation of basement rocks, separates the offshore basin from the northwesterly structural trends of the onshore geology. The mapped trace of the Hosgri fault, also coincides with a prominent north-northwest-trending free-air gravity anomaly gradient of 15 to 25 mgal that extends southward to the vicinity of Point Sal.

Within the offshore basin, deformation of the Cretaceous basement has produced north-trending, doubly-plunging en echelon structural highs. The structural highs developed through the late Tertiary (possibly until 3-5 Ma) and accumulating sedimentary strata filled the intervening structural lows. The gravity anomaly lows that lie between the structural highs reflect these locally controlled depocenters within the offshore basin.

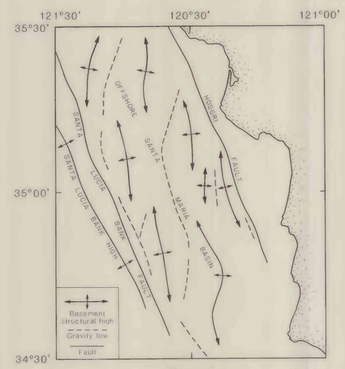

Figure 2

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International Association of Geodesy, 1971, Geodetic reference system 1967: Bulletin Geodesique Special Publications, 116 p.

McCulloch, D.S., 1987, Regional geology and petroleum potential of offshore central California, in D.W. Scholl, A. Grantz, and J.G. Vedder, Eds., Geology and resource potential of the continental margin of western North America and adjacent ocean basins--Beaufort Sea to Baja California: Circum-Pacific Council for Energy and Mineral Resources, Earth Science Series, Houston, Texas.

Morelli, C., Gantar, C., Hondasalo, T., McConnell, R.K., Tanner, I.D., Szabo, B., Uotila, U., and Whalen, C.T., 1971, The international gravity standardization net 1971: International Association of Geodesy, Special Publication 4, 194 p.

Rietman, J.D., and Beyer, L.A., 1982, Bouger gravity map of California, Santa Maria sheet: California Division of Mines Geology, 1 sheet, scale 1:250,000, 4 p.

122° 30′ 121° 30′ 120°

Base map from U.S.G. & G.S. map 1306N-20
Universal Transverse Mercator
Bathymetric contour intervals: 10 meters to the 200 meters depth, 50 meters to maximum depth.

FREE-AIR GRAVITY ANOMALY MAP OF OFFSHORE SANTA MARIA BASIN CALIFORNIA, AND ADJACENT AREAS

by

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1989

Scale 1:250,000

5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometers
5 0 5 10 15 Nautical Miles