U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

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INTRODUCTION

The accompanying total-field aeromagnetic map is part of the Southern California areal mapping project (SCAMP) and is intended to promote further understanding of the geology in the Santa Ana 1:100,000-scale quadrangle, California by serving as a basis for geophysical interpretations and by supporting both geological mapping and topical, SCAMP-related studies. Local spatial variations in the Earth's magnetic field (evident as anomalies on aeromagnetic maps) reflect the distribution of magnetic minerals, primarily magnetite, in the underlying rocks. The volume content of magnetic minerals often can be related to rock type, and abrupt spatial changes in the amount of magnetic minerals commonly mark lithologic boundaries.

Within the Santa Ana quadrangle magnetic minerals mainly are confined to the Mesozoic plutonic rocks of the Peninsular Ranges batholith and their associated volcanic rocks. Bodies of gabbroic or dioritic composition tend to produce the most intense magnetic anomalies, but such generalizations must be applied with caution because rocks with more felsic compositions also are capable of causing measurable magnetic anomalies. Many of the plutons and most of the sedimentary rocks within the quadrangle appear to be effectively non-magnetic (i.e., they do not produce noticeable anomalies on the aeromagnetic map.) Magnetic anomalies over the sedimentary deposits of the Los Angeles basin are primarily caused by igneous rocks that make up the basement beneath the sedimentary fill, but some of the narrowest anomalies may reflect the combined effect of numerous steel well-casings concentrated in oil fields.

DATA SOURCES AND REDUCTIONS

Total-field magnetic data from three separate surveys (Table 1, figure 1) were used to construct the aeromagnetic map of the Santa Ana quadrangle.

TABLE 1

Survey	Year	Flight Elev. (Above ground surface)	Flight Line Spacing	Flight Line Direction
Los Angeles (Andreason and others, 1964a,b)	1959	154 m	1.6 km	N/S
San Bernardino (U.S. Geological Survey, 1979)	1979	309 m	0.8 km	N/S
San Diego (U.S. Geological Survey, 1990)	1989	309 m	0.8 km	NE/SW

Data from the San Bernardino and San Diego surveys were taken directly from original digital tapes provided by the contractors. The Los Angeles survey was recorded on an analogue device and no digital data were available; the contour maps (scale 1:48,000) of the original survey were hand digitized along flight lines to produce a digital data set. The International Geomagnetic Reference Field, updated to the dates that the individual surveys were flown, was subtracted from each survey to yield a residual magnetic field.

Both the San Bernardino and San Diego Surveys were flown at a nominal height of 309 m above the ground surface (309 m drape) whereas the Los Angeles survey was flown at a nominal height of 154 m above the ground surface. To insure compatibility of all three surveys during the final merging process, the Los Angeles survey data were analytically continued upward (Grant and West, 1965) to an effective height of 309 m above the ground surface. Data from all three surveys were transformed to a Transverse Mercator Projection (Base Latitude 0°, Central Meridian -117°) and interpolated to a square grid (grid interval = 0.4 km) by means of a routine based on the principal of minimum curvature (Briggs, 1974). The three survey grids were merged by smooth interpolation across a one-kilometer-wide buffer zone along survey boundaries and contoured at an interval of 20 nanoTesla (nT).

The small "plus" symbols indicate possible locations of abrupt lateral changes in magnetization and may represent lithologic boundaries. Their locations were determined as follows:

1) The total-field anomaly data were mathematically transformed into pseudogravity anomalies (Baranov, 1957); this procedure effectively converts the magnetic field to the "gravity" field that would be produced if all the magnetic material were replaced by proportionately dense material.

2) The horizontal gradient of the pseudogravity field was calculated everywhere by numerical differentiation.

3) Locations of locally steepest horizontal gradient ("plus" symbols) were determined by numerically searching for maxima in the horizontal gradient grid.

Boundaries between bodies having different densities are characterized by steep gradients in the gravity field they produce and if the boundaries have moderate-to-steep dips (>45°), locally the maximum horizontal gradients will be located over the surface traces of the boundaries (Blakely and Simpson, 1986). Similarly, boundaries between bodies having different magnetizations are characterized by steep gradients in the pseudogravity field and so the procedure described above can be used to locate these boundaries.

REFERENCES

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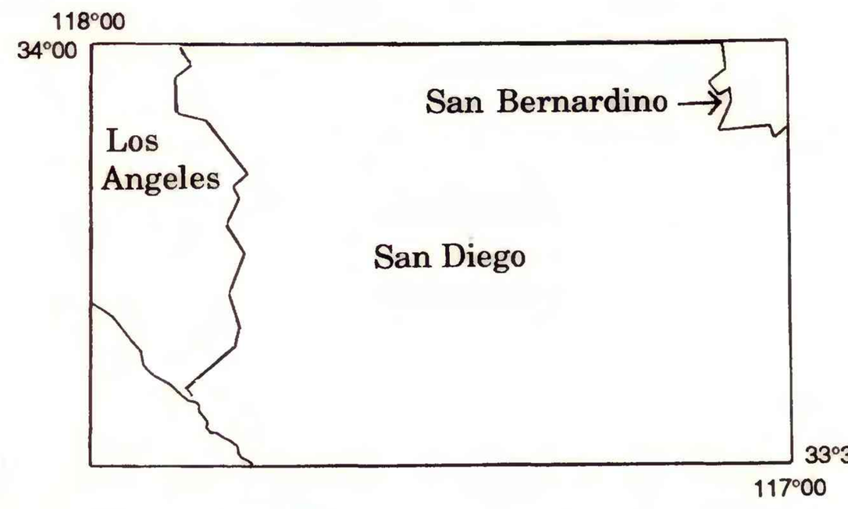
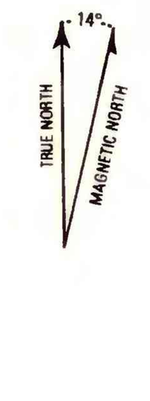
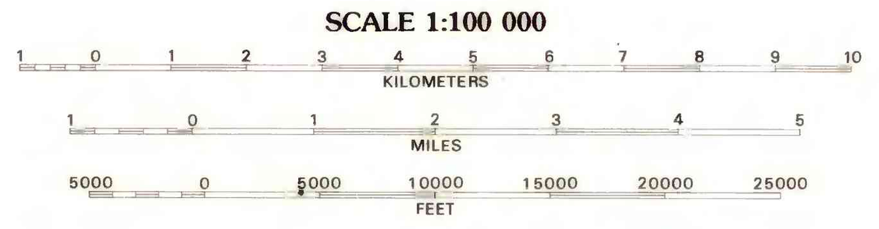
BASE MAP FROM U.S. GEOLOGICAL SURVEY
TOPOGRAPHIC SERIES 1:100,000
SANTA ANA 1983

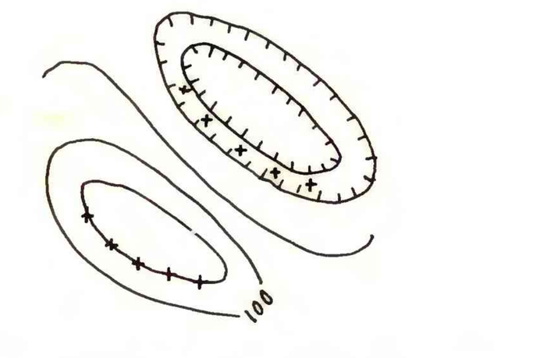


Bold lines indicate survey boundaries for the Los Angeles, San Diego, and San Bernardino surveys.





Contour Interval of base is 50 meters



Contours of total magnetic field intensity relative to the International Geomagnetic Reference Field. Contour interval is 20nT. Hachured contours indicate closed magnetic lows. Small "plus" signs indicate possible locations of boundaries between regions of different magnetizations (see accompanying text for explanation).

AEROMAGNETIC MAP OF THE SANTA ANA 1:100,000 SCALE QUADRANGLE, CALIFORNIA

By

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