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

OPEN-FILE REPORT
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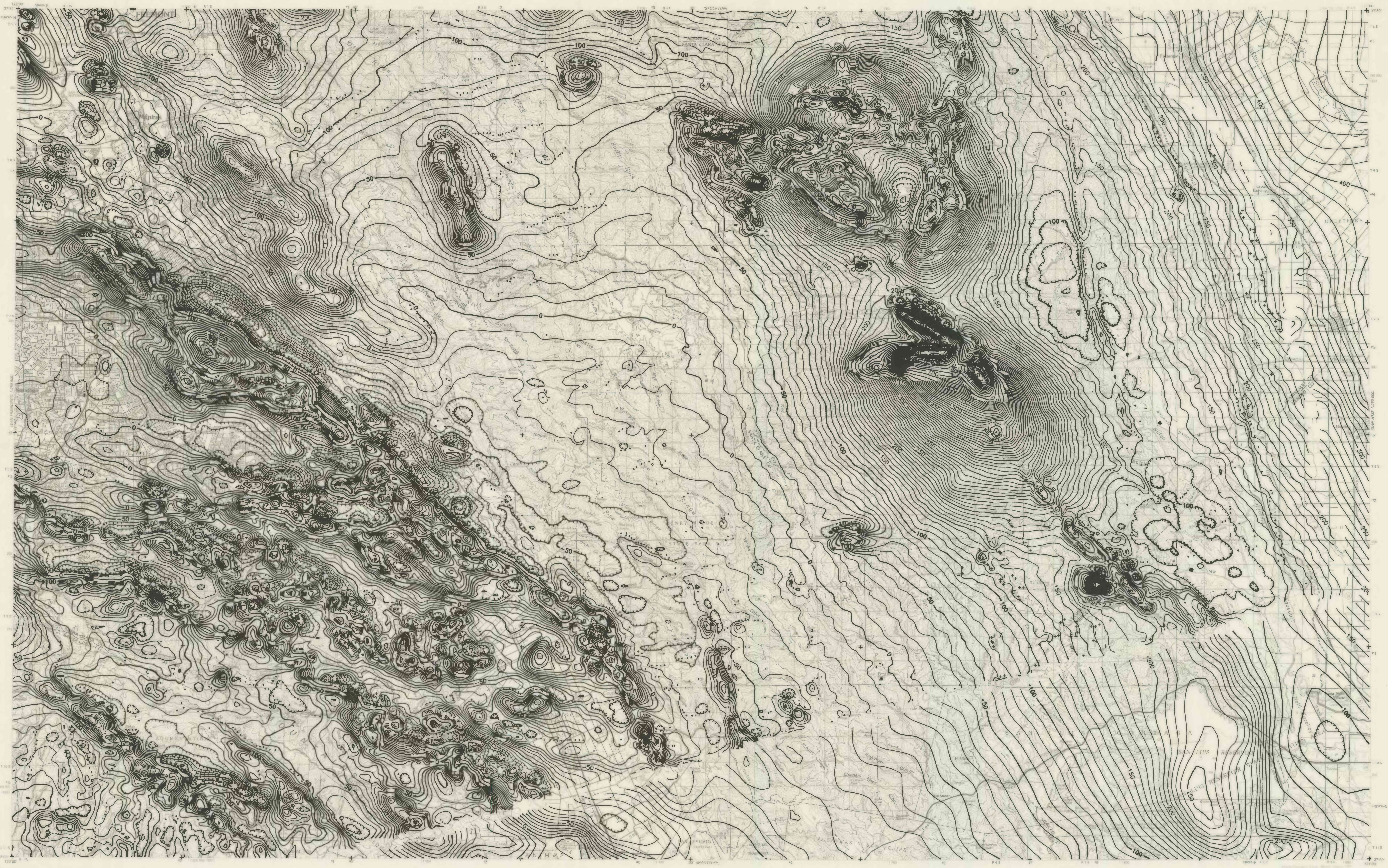

INTRODUCTION

The accompanying aeromagnetic map is part of the San Francisco Bay area National Geologic Mapping Project and is intended to promote further understanding of the geology in the San Jose 1:100,000-scale quadrangle, California, by serving as a basis for geophysical interpretations and by supporting geological mapping, mineral resource investigations, and topical 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. Bodies having mafic or ultramafic composition tend to produce the most intense magnetic anomalies, but such a generalization must be applied with caution because rocks with more felsic compositions also are capable of causing measurable magnetic anomalies.

Within the San Jose quadrangle, most of the large-amplitude magnetic anomalies are caused by tabular bodies of serpentinite and associated mafic rocks of the Coast Range Ophiolite (Brabb and Hanna, 1981; Jachens and Griscom, in press). Local exceptions are 1) the 5-km-wide magnetic high that occurs along the western edge of the map at 37° 7.5' N (only the eastern tip of this anomaly is seen on the map), probably caused by a thick slab of Logan Gabbro that floors the La Honda basin (Hanna and others, 1972; Jachens and Griscom, in press); 2) a narrow, 2 km-wide linear anomaly that extends from the south edge of the Logan Gabbro anomaly east-southeast across the entire corner of the map, caused by a thick section of magnetic sedimentary rocks of the Purisima Formation contained in the Glenwood syncline; and 3) the narrow, north-northwest-trending series of magnetic highs and lows centered on Coyote Lake (lat. 37° 5' N., long. 121° 33' W.), at least partly caused by strongly magnetic Tertiary basaltic flows. A narrow linear north-trending anomaly 20-40 nT in amplitude located about 13 km west of Crows Landing (at ~long. 121° 15' W) reflects an unusual magnetic bed within the generally non-magnetic Great Valley Sequence.

At the scale of this map, most magnetic anomalies bear a direct relationship to the rocks beneath them, i.e., magnetic highs are associated with magnetic rock bodies. In detail, however, because the Earth's main magnetic field is not vertical at the latitude of the San Jose quadrangle (field inclination ~63° north) and because almost all of the anomalies on this map are induced by the Earth's main field, the precise relationship between a magnetic body and its associated anomaly is complex. Typically, each magnetic body will generate a magnetic anomaly composed of a high and a low, with the high lying over the southern part of the body and the low lying just north of the northern edge of the body.

Two types of anomalies on this map are somewhat different from those described in the previous paragraph and therefore warrant additional explanation. First, the smooth magnetic gradient that covers a 20 km-wide strip of the northeast corner of the map (represented by the evenly spaced, generally north-northwest-trending, eastward increasing contours) is the southwest flank of a huge magnetic high that is centered to the east of the San Jose sheet (Meuschke and others, 1966; Jachens and Roberts, in press). This high is interpreted to be caused by an ophiolite slab obducted onto the continent in Jurassic time (Griscom, 1982). Second, in the extreme southwest corner of the map, the magnetic field is characterized by a magnetic pattern of low-amplitude, generally north-trending highs and lows. In this area, magnetic sedimentary rocks of the Purisima Formation make up the topography. Because the survey aircraft was unable to maintain a constant terrain clearance in areas of high relief, the magnetometer passed closer to the ridge tops than to the floors of the intervening valleys. The resulting magnetic pattern is one of highs over the ridge crests and lows over the valleys.

DATA SOURCES AND REDUCTIONS

Total-field magnetic data from five separate surveys (table 1, index map) were used to construct the aeromagnetic map of the San Jose quadrangle. Data from all surveys except the Sacramento survey are from original digital tapes provided by the contractors. No primary digital data were available for the Sacramento survey, so digital values were obtained from the contour map at locations where the contours intersected the flight lines. 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.

TABLE 1

Survey (reference)	Year Flown	Flight Elevation (above ground surface) m	Flight Line Spacing km	Flight Line Direction
Livermore (U.S. Geological Survey, 1992)	1991	240-305	0.5	N 60° E
NURE (U.S. Department of Energy, 1981)	1979-1980	120	4.8	EW
Sacramento (Meuschke and others, 1966)	1958-1959	150	1.6	N50°E
San Francisco Bay Area (U.S. Geological Survey, 1974)	1973	915 [1]	1.6	N 45° E
San Jose (Abrams and others, 1991)	1989	305	0.4	N 75° E

[1] survey flown at constant barometric elevation

Data from the Livermore and San Jose surveys were transformed to a Universal Transverse Mercator Projection (Base Latitude 0°, Central Meridian -123°) and interpolated to a square grid (grid interval = 0.25 km) by means of a routine based on the principal of minimum curvature (Briggs, 1974). Because these two surveys were flown at approximately the same nominal height above the ground surface, only the magnetic base levels of the surveys were adjusted to bring them onto a common datum. The survey grids were then merged by smooth interpolation across a one-kilometer-wide buffer zone along survey boundaries and contoured at an interval of 20 nanoteslas (nT).

Magnetic data from the other three surveys were collected at heights and line spacings significantly different from those of the Livermore and San Jose surveys. Because magnetic measurements taken in these other surveys in general were either farther above or closer to the magnetic sources than in the Livermore and San Jose, they could not be merged directly with the other two. Furthermore, the wide flightline spacing results in less detail between flight lines. Therefore, the data from these three surveys were transformed to a Universal Transverse Mercator Projection (Base Latitude 0°, Central Meridian -123°) and interpolated to a square grid (grid interval=1.0 km). The gridded data were either upward or downward continued numerically onto an irregular surface located 305 m above the ground surface, following the techniques of Cordell (1985). These data were then merged with the other three surveys using the procedures described in the previous paragraph. Because these surveys are substantially less detailed than the Livermore and San Jose surveys, we have left a narrow buffer zone on the map between areas covered by these surveys and those covered by the more detailed surveys.

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. If the boundaries are shallow and have moderate-to-steep dips (>45°), the maximum horizontal gradients will be approximately 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 therefore the procedure described above can be used to locate these boundaries.

We have included the possible boundary locations only in areas covered by the detailed surveys. The other surveys were judged to be too coarse to give reliable locations at a scale of 1:100,000.

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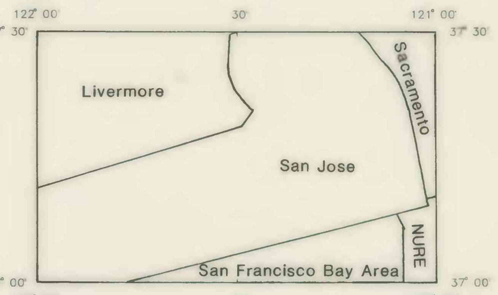
U.S. Geological Survey, 1992, Aeromagnetic map of Livermore and vicinity, California: U.S. Geological Survey Open-File Report 92-531, 1 scale 1:250,000.

Base from U.S. Geological Survey
topographic series 1:100,000, San Jose 1978
Universal Transverse Mercator projection



Index to aeromagnetic surveys
(See table 1 in text)

SCALE 1:100 000

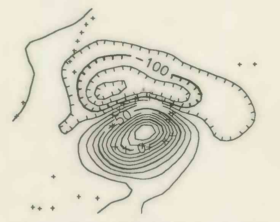
1 0 1 2 3 4 5 6 7 8 9 10 KILOMETERS

1 0 1 2 3 4 5 MILES

5000 0 5000 10000 15000 20000 25000 FEET

TOPOGRAPHIC CONTOUR INTERVAL 10 AND 50 METERS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Quadrangle location



Contours of total magnetic field intensity relative to the International Geomagnetic Reference Field. Datum is arbitrary. Contour intervals are 10 and 50 nanoteslas (nT). Hachured contours indicate closed magnetic lows. Small "plus" signs indicate possible locations of boundaries between regions of different magnitizations (see accompanying text for explanation).

AEROMAGNETIC MAP OF THE SAN JOSE 1:100,000 SCALE QUADRANGLE, CALIFORNIA

by

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1993