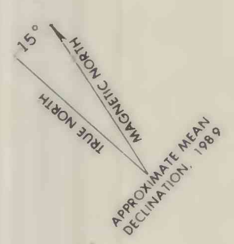
Base from U.S. Geological Survey, Bakersfield, 1971; Fresno, 1971; Monterey, 1976; San Luis Obispo, 1969. Scale 1:250,000. Transverse Mercator Projection, central meridian at 120.5°W.



SCALE 1:250 000

5 0 5 10 15 20 MILES

5 0 5 10 15 20 25 30 KILOMETERS

TOTAL-FIELD MAGNETIC CONTOUR INTERVAL 20 NT
BASE TOPOGRAPHY CONTOUR INTERVAL 200 FEET

COMPOSITE AEROMAGNETIC MAP, PARKFIELD REGION

Composite Total-Field Aeromagnetic Map

Explanation

Three separate aeromagnetic surveys were combined to produce the composite map shown here (Hanna, 1970; U.S. Geological Survey, 1974; U.S. Geological Survey, 1987). The dates and specifications for the three surveys are shown in table 1.

We did not attempt to mathematically merge the surveys by adjusting them to a common elevation because of the great differences in data quality and survey specifications. For example, the low-elevation survey, flown in draped mode at a constant (nominal) elevation of 1000 ft (300 m) above the ground surface, cannot be mathematically upward-continued without losing a great deal of its finer detail. The two high-elevation surveys, flown at a constant barometric elevation of 6500 ft (1980 m) above sea level, cannot be mathematically downward-continued very far without greatly enhancing artifacts and noise in the data. We did subtract constant values of 2700 nT and 900 nT (1 nT = 1 gamma) from the 1970 and 1974 surveys, respectively, in order to improve the match of contour levels at the survey boundaries.

Total-field magnetic intensity values were adjusted in two surveys (1974 and 1987) by subtracting the International Geomagnetic Reference Field (IGRF) to remove long-wavelength anomalies caused largely by sources in the Earth's core. A linear regional gradient was removed from the 1970 survey.

The aeromagnetic anomalies seen on the map are primarily caused by magnetic rock-forming minerals, most commonly magnetite. For example, many of the magnetic high anomalies in the upper left corner of the map can be attributed to bodies of serpentinite or to sedimentary rocks containing serpentinite detritus. Serpentinite is an ultramafic rock which contains abundant magnetite grains. Hanna and others (1972) discuss the magnetic properties of rocks exposed in part of the map area.

The shapes of the magnetic anomalies are influenced by both the strength and distribution of magnetic sources and by a number of geometric factors. These factors include the distance and direction of the magnetometer from the sources, the inclination and declination of the magnetization direction in the sources, and the inclination and declination of the local geomagnetic field. The anomalies of greatest geologic interest are those caused by spatial variations in the amount of magnetic material present and by variations in the direction of rock magnetization. However, because of the geometric factors involved, anomalies can also be caused by changes in the airplane's elevation as it flies over the sources and by topographic features such as hills and valleys. A narrow valley may show up as a magnetic low because of the absence of magnetic material in the valley relative to the valley walls (air is not very magnetic). Because the formation of topographic features is often controlled by the distribution of geologic units and structures, it is not always easy to separate purely topographic effects from geologic effects in the interpretation of aeromagnetic maps.

At the latitude of the study area, even relatively simple sources can produce complex anomalies. For example, a point source magnetized parallel to the present geomagnetic field yields a high-low polarization pair of anomalies with the high centered somewhat to the south of the point source and the low, of lesser amplitude than the high, located on the north side. Because aeromagnetic anomalies are not necessarily centered over their causative bodies, care must be taken in interpreting the nature of the sources. Hanna and others (1972) have shown that the large elliptical high anomaly in the right half of the map can be explained almost completely by a magnetic source body confined to the northeast side of the San Andreas fault, even though the anomaly appears to be squarely centered on the fault.

References Cited

Hanna, W.F., 1970, Aeromagnetic and gravity features of the western Franciscan and Salinian basement terranes between Cape San Martin and San Luis Obispo, California: U.S. Geological Survey Professional Paper 700-B, p. 66-77.

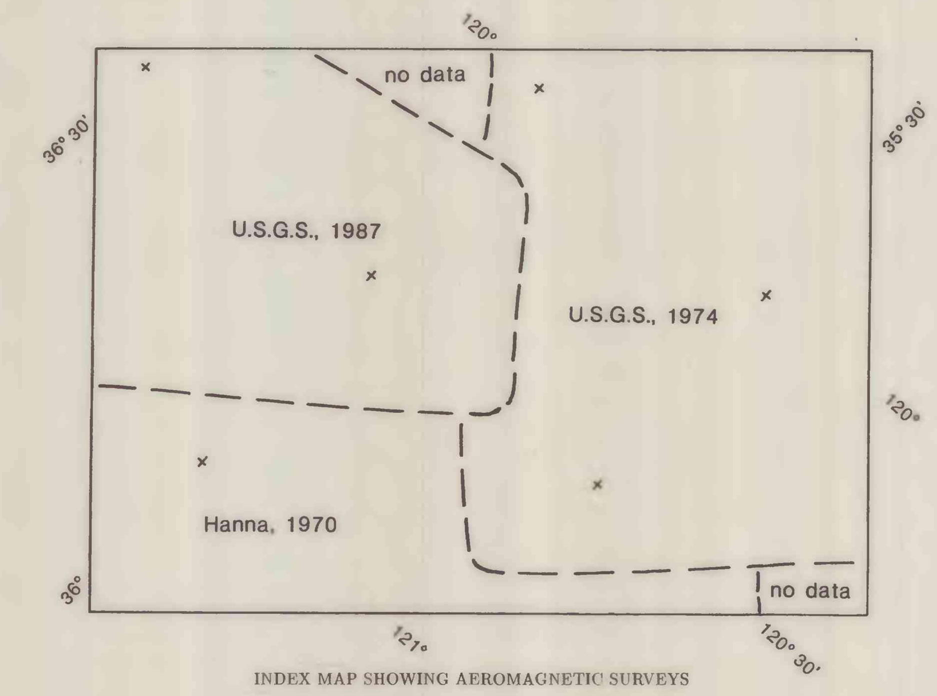
Hanna, W.F., Burch, S.H., and Dibblee, Jr., T.W., 1972, Gravity, magnetics, and geology of the San Andreas fault area near Cholame, California: U.S. Geological Survey Professional Paper 646-C, p. C1-C29.

U.S. Geological Survey, 1974, Aeromagnetic map of the Cholame-Taft area, southwestern California: U.S. Geological Survey Open-File Report 74-008, scale 1:125,000.

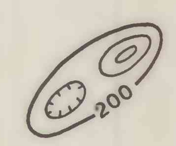
U.S. Geological Survey, 1987, Aeromagnetic map of the Hernandez-Parkfield area, southwestern California: U.S. Geological Survey Open-File Report 87-092, scale 1:250,000.

Table 1 – Aeromagnetic Survey Specifications

Survey Name	Date Flown	Elevation	Flight Line Direction	Flight Line Spacing	Regional Removed	Reference
San Luis Obispo–Cape San Martin	pre–1970	6500' above sea level	NE–SW	1 mi	gradient of 9γ/mi in N.16E. direction	*Hanna* (1970)
Cholame–Taft	9/73	6500' above sea level	NE–SW	1 mi	IGRF	*U.S.G.S.* (1974)
Parkfield	2/86	1000' above ground level	NE–SW	0.5 mi	IGRF	*U.S.G.S.* (1987)



INDEX MAP SHOWING AEROMAGNETIC SURVEYS



Magnetic Anomaly Contours

Contours show total residual magnetic intensity of the Earth's field in nanoteslas (nT). Contour interval is 20 nT, with darker index contours at 100 nT interval. Hachures point in direction of decreasing magnetic intensity within closed magnetic lows.

LOCATION MAP

AVERAGE TOPOGRAPHY, ISOSTATIC RESIDUAL GRAVITY, AND AEROMAGNETIC MAPS OF THE PARKFIELD REGION, CALIFORNIA

By

R.W. Simpson, R.C. Jachens, C.M. Wentworth

1989