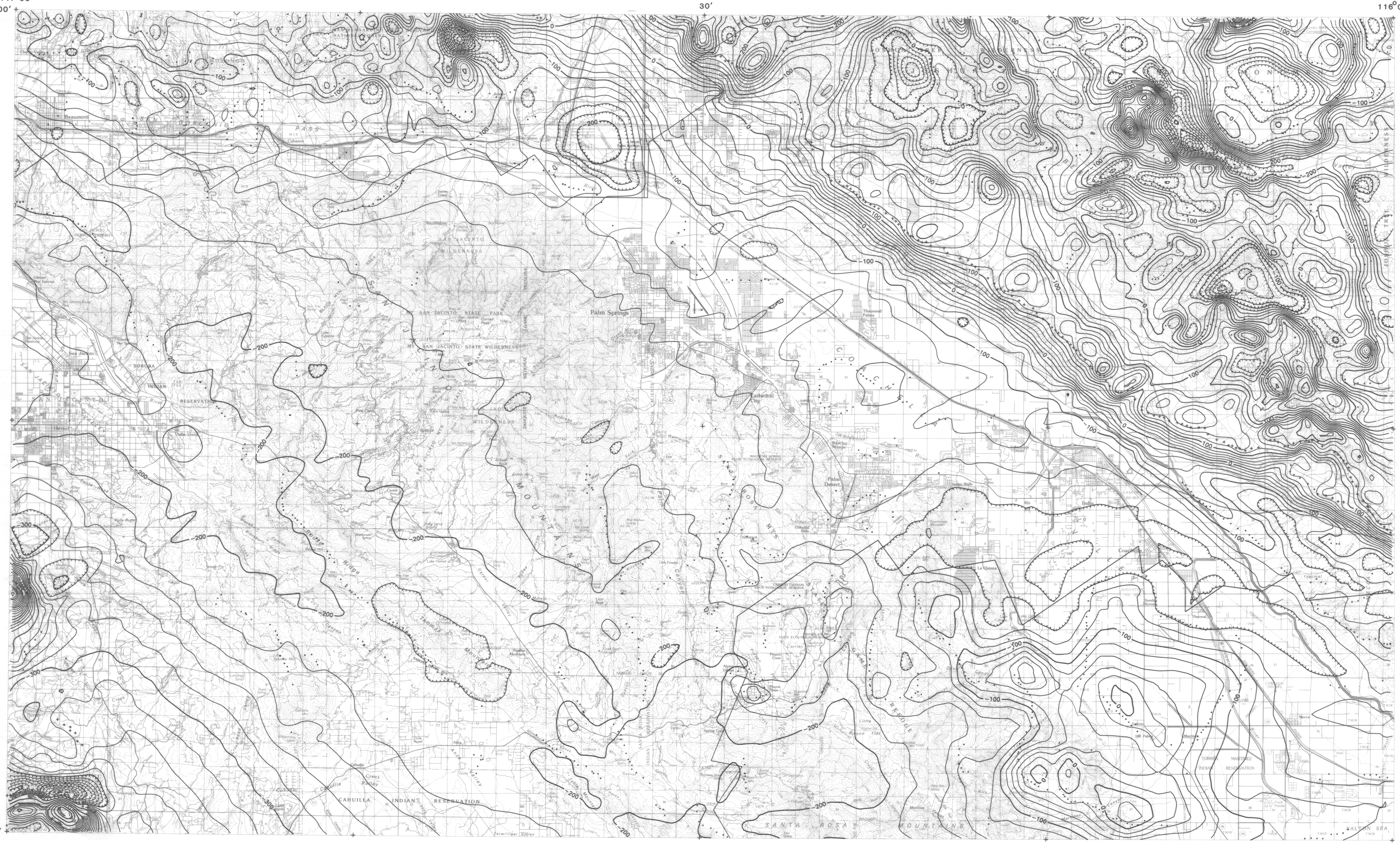
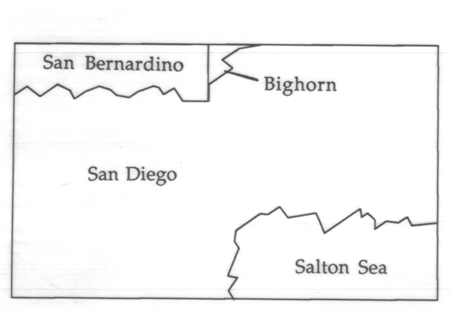
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT
92-549



BASE MAP FROM U.S. GEOLOGICAL SURVEY
TOPOGRAPHIC SERIES 1:100,000
PALM SPRINGS 1984



Index map of aeromagnetic survey boundaries

SCALE 1:100 000

Topographic Contour Interval 50 meters

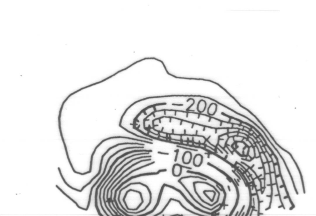
AEROMAGNETIC MAP OF THE PALM SPRINGS 1:100,000 SCALE QUADRANGLE, CALIFORNIA

By

Robert C. Jachens

1992

Quadrangle Location



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

INTRODUCTION

The accompanying aeromagnetic map is part of the Southern California Areal Mapping Project (SCAMP) and is intended to promote further understanding of the geology in the Palm Springs 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. In many cases the volume content of magnetic minerals can be related to rock type, and abrupt spatial changes in the amount of magnetic minerals commonly mark lithologic boundaries. 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.

Within the Palm Springs quadrangle the most magnetic rocks occur in the San Bernardino and Little San Bernardino Mountains in the northern and northeastern parts of the map (Rogers, 1965). These ranges are lithologically complex, containing Precambrian gneissic rocks, Precambrian and Paleozoic metasedimentary rocks, and Mesozoic granitoid rocks of various kinds. Near the southwestern corner of the map, two strong magnetic anomalies indicate the locations of magnetite-rich plutons characteristic of the western part of the Peninsular Ranges batholith (Jachens and others, 1986; Gastil and others, 1990). The general lack of large magnetic anomalies in the central part of the map indicates (San Jacinto Mountains, Santa Rosa Mountains, and the Coachella Valley) that within the map area igneous and metamorphic rocks in the eastern Peninsular Ranges are at most weakly magnetic. An exception occurs near the southeastern corner of the map where a 15-20 km-wide magnetic high delineates a magnetic pluton that is partly exposed in the Santa Rosa Mountains but mostly concealed beneath sedimentary deposits in the Coachella Valley.

Most magnetic anomalies on this map bear a direct and somewhat intuitive relationship to the rocks directly beneath them, e.g., the broad magnetic high near the southeast corner of the map mentioned above or the transition from intense magnetic anomalies in the northeast part of the map to an area of low-amplitude anomalies in the center which marks the south edge of a huge magnetic block of crust truncated at the Mission Creek strand of the San Andreas fault. Two other anomalies or features of the map bear a less direct relationship to the underlying rocks and, therefore, warrant some explanation. First, the pattern of evenly-spaced, northwest-trending contours present in the southwest corner of the map (indicating an increase in magnetic field value toward the northeast) actually reflects the presence of a large mass of highly magnetic rock located mostly south and west of the map area rather than a spatial variation of the magnetic properties in the rocks beneath this part of the map (U.S. Geological Survey, 1990). In the northern hemisphere, local magnetic anomalies induced by the Earth's main field (the types of anomalies present on this map) are not symmetrical, but instead display highs that typically occur over the southern parts of magnetic bodies and lows that lie to the north of the bodies. The contours in the southwest corner represent the northeast side of such a low. Second, the rippled pattern of the contours in the central part of the map (the "chevron" pattern that points NE-SW along the direction of the flight-lines) also does not reflect the magnetic properties of the underlying rocks, but is caused by the inability of the survey aircraft to maintain a constant ground clearance on adjacent flight-lines. In order to safely clear the high escarpment of the Little San Bernardino Mountains on the northeast side of the Salton Trough, the survey aircraft was forced to begin climbing well to the southwest of the escarpment on northeast directed flight-lines. In contrast, on southwest directed flight-lines, the aircraft was able to dive more quickly than it was able to climb on the adjacent flight-line, thus maintaining a flight path closer to the ground and the sources of the magnetic anomalies. Because the magnetic field strength decreases with increasing distance from the source, the survey aircraft was actually measuring a different part of the earth's field on successive passes, thus resulting in the characteristic ripple-pattern in the contours.

DATA SOURCES AND REDUCTIONS

Total-field magnetic data from four separate surveys (table 1, index map) were used to construct the aeromagnetic map of the Palm Springs quadrangle.

TABLE 1

Survey	Year Flown	Flight Elevation (Above ground surface)	Flight Line Spacing	Flight Line Direction
Bighorn (U.S. Geological Survey, 1982)	1981	305 m	0.8 km	N/S
Salton Sea (U.S. Geological Survey, 1983)	1981	305 m	0.8 km	E/W
San Bernardino (U.S. Geological Survey, 1979)	1979	305 m	0.8 km	N/S
San Diego (U.S. Geological Survey, 1990)	1989	305 m	0.8 km	NE/SW

Data from the four surveys were taken directly from original digital tapes provided by the contractors. 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.

Data from all surveys were transformed to a Universal 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). Because all four surveys were flown at a nominal height of 305 m above the ground surface (305 m drape), only the magnetic base levels of the various surveys were adjusted to bring them into 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).

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 therefore the procedure described above can be used to locate these boundaries.

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