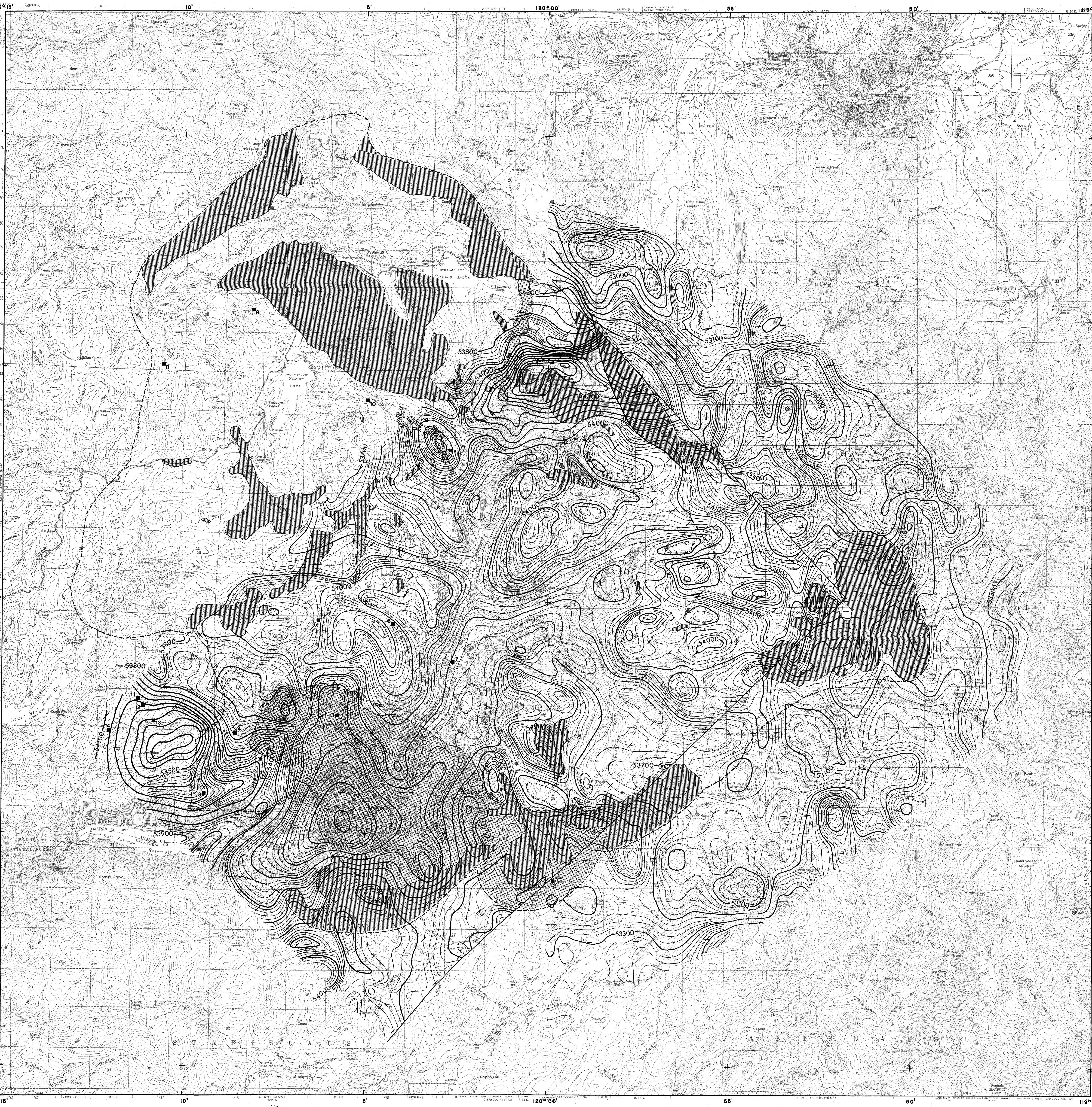
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF — 1201-B



Base from U.S. Geological Survey
Fallen Leaf Lake, 1955; Big Meadow, Dardanelles Cone, Freel Peak, Markleeville, Silver Lake, 1956

APPROXIMATE MEAN DECLINATION, 1980

SCALE 1:62 500

1 ½ 0 1 2 3 4 5 MILES

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

AREA OF MAP

Geology mapped in 1979

Aeromagnetic survey flown and compiled by Litton Aero Service, Texas, 1978; and LKB Resources, Inc., Pennsylvania, 1978-79

AEROMAGNETIC MAP OF THE MOKELUMNE WILDERNESS AND CONTIGUOUS RARE II FURTHER PLANNING AREAS, CENTRAL SIERRA NEVADA, CALIFORNIA

By
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1981

EXPLANATION

Andesitic, volcanic, hypabyssal, and tuffaceous sedimentary rocks } TERTIARY

Granodiorite and quartz diorite plutonic rocks } CRETACEOUS

Metamorphic rocks
Includes granitic gneiss, mica schist, metadiorite, metagabbro, and calc-silicate hornfels } CRETACEOUS AND (OR) JURASSIC

Contact--Dashed where approximately located; dotted where inferred

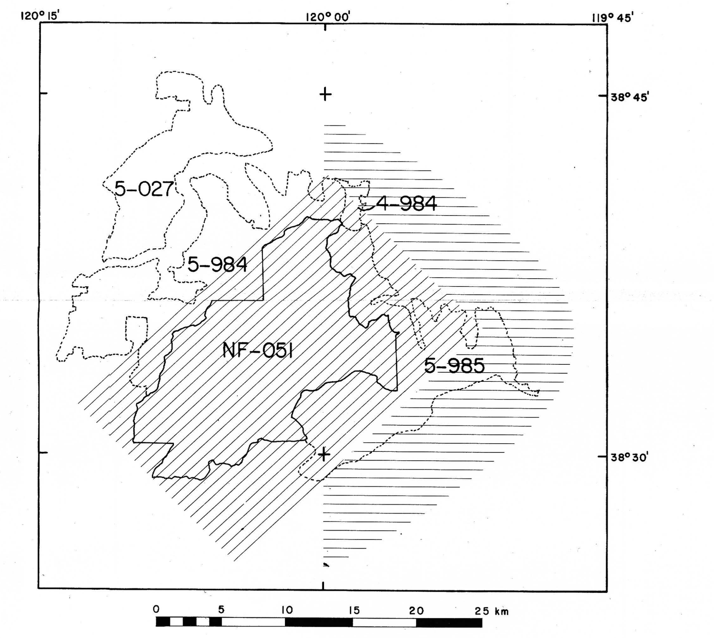
Fault

Limit of geologic mapping

Sample locality--Number refers to table 1

Magnetic contours--Showing residual magnetic intensity of Earth's magnetic field in nanoteslas (gammas). Regional fields removed are arbitrary datums and IGRF 1975 updated to the months flown. Hachured to indicate closed areas of lower magnetic intensity. Contour intervals 20 and 100 nanoteslas

Flight path--Showing location and spacing of data



Index of Wilderness and RARE II Further Planning areas

NF-051 Mokelumne Wilderness
5-027 Caples Creek RARE II Further Planning area
4-984 Tragedy-Elephants Back RARE II Further Planning area; part in Toiyabe National Forest
5-984 Tragedy-Elephants Back RARE II Further planning area; part in Eldorado National Forest
5-985 Raymond Peak RARE II Further Planning area

Shaded areas indicate aeromagnetic coverage:

From U.S. Geological Survey (1979a)

From U.S. Geological Survey (1979b)

Studies Related to Wilderness

The Wilderness Act (Public Law 88-577, September 3, 1964) and related Acts, require the Geological Survey and the Bureau of Mines to survey certain areas on Federal lands to determine their mineral resource potential. Results must be made available to the public and be submitted to the Administration and the Congress. These maps and reports present the results of a geological and mineral survey of the Mokelumne Wilderness and contiguous U.S. Forest Service RARE II Further Planning Areas, central Sierra Nevada, California.

INTERPRETATION OF AEROMAGNETIC MAP

INTRODUCTION

The aeromagnetic map consists of parts of two surveys flown at an altitude of 300 m above the average ground surface. One survey (west part of the map) centered over the Mokelumne Wilderness was flown in a northeast-southwest direction along flight lines spaced at a horizontal interval of about 800 m (U.S. Geological Survey, 1979b). The survey to the east is part of a regional survey flown in an east-west direction along flight lines spaced at an interval of about 1,600 m (U.S. Geological Survey, 1979a). The join of the aeromagnetic contours along the border between the two surveys is generally conformable. The contour datum of the eastern regional survey, however, is about 650 nT (nanotesla) lower than the Mokelumne Wilderness survey because of differences in data reduction.

The aeromagnetic pattern reflects variations of magnetization within the underlying rocks, but the pattern is complicated by strong topographic effects. That is, magnetic anomaly maxima tend to occur over ridges and hilltops and minima over canyons and depressions. The topographic effect exists mostly because a constant ground clearance could not be maintained at normal aircraft speeds in this area of rugged topographic relief. The recorded flight altitude varied from 30 m to nearly 1,500 m above the ground with local changes that approach 1,000 m in distances of less than 5,000 m.

Four magnetic anomalies that can be related to geologic features are discussed. Magnetic highs or lows caused by topography are not discussed.

PROMINENT MAGNETIC ANOMALIES

A prominent magnetic maximum about 4 km southeast of Caples Lake (northern part of the map) is centered over the north edge of Round Top peak. This strong positive anomaly is probably due to a combination of 1,000 m relief of Round Top peak and the andesitic rock that forms the peak and extends beneath it. Andesites in the area are dark hornblende-bearing rocks with abundant magnetite as small grains or dispersed throughout the glassy phases. The andesites tend to produce a strong magnetic effect if they are thick. Geologic mapping (McKee and Howe, 1980) indicates that Round Top peak is a small volcano including a number of lava flows near its top and flanks and intrusive rock extending beneath the peak to an unknown depth. At least 1,000 m of andesite is exposed on the dissected south side of the peak in Summit City canyon. The amplitude, shape, and width of the magnetic anomaly indicate that the magnetic rocks of this volcano extend substantially more than the 1,000 m of vertical exposure in the volcanic center. Quantitative interpretation, however, was not attempted because of the unknown distribution of magnetization within this complex volcanic center and the variable effects of surrounding magnetic rocks.

A second magnetic maximum about 5 km southeast of Silver Lake is centered over the ridge between Silver Lake and Summit City canyon. This positive anomaly is partly due to the steep relief of the north side of Summit City canyon and partly due to the presence of magnetite-rich hornblende-biotite gneiss that occurs as a series of tabular, elongate northwest-trending bodies that cross the ridge. The amplitude and the extent of the gradients at the edge of the magnetic anomaly indicate that these metamorphic rocks extend as much as 1,000 m below the surface.

The largest and geologically most significant magnetic anomaly is the minimum centered about 3 km south of Mokelumne Peak near the south edge of the area. This prominent magnetic low partly results from the increased flight altitude over Mokelumne canyon but is mostly attributed to the large body of metamorphic rocks that constitutes the Mokelumne Peak roof pendant. The underlying metamorphic rocks have low magnetization. Negligible magnetization was measured for a representative gneiss (sample 1) compared to the magnetizations of the surrounding plutonic rocks. The magnetic minimum includes a large area southwest of the outcrops of metamorphic rock. This extension of the magnetic anomaly possibly is a result of metamorphic rocks of the Mokelumne Peak roof pendant that plunge to the southwest beneath the granitic rocks. A smaller magnetic minimum to the northwest of the major minimum is related to the 1,000-nT magnetic maximum near the west edge of the magnetic map and is not an effect of concealed metamorphic rocks.

A magnetic maximum about 5 km west of Mokelumne Peak is caused partly by topography and partly by the occurrence of rocks of relatively high magnetization. The magnetic susceptibilities of samples 11-14 (table 1) collected near the magnetic maximum average 22 ± 5 siu and are nearly the same as an average of 19 ± 6 siu for the susceptibilities of plutonic rocks (samples 2-10, table 1) in other parts of the area. The measured values of the remanent magnetization for samples 11-14, however, average 1.56 ± 1.38 amperes per meter (A/m) and greatly exceed that of the other plutonic rocks (samples 2-10), which average 0.08 ± 0.05 A/m. The width of the steep magnetic gradients at the edge of the anomaly indicates that the underlying magnetic body may extend to about 1 km beneath the surface.

REFERENCES

McKee, E. H., and Howe, R. A., 1980, Geologic map of the Mokelumne Wilderness and contiguous RARE II Further Planning Areas, central Sierra Nevada, California: U.S. Geological Survey Miscellaneous Field Studies Map MF 1201-A, scale 1:62,500.

U.S. Geological Survey, 1979a, Aeromagnetic map of the Hoover-Walker Lake area, California: U.S. Geological Survey Open-File Report 79-1194, scale 1:250,000.

U.S. Geological Survey, 1979b, Aeromagnetic map of the Mokelumne area, California: U.S. Geological Survey Open-File Report 79-1233, scale 1:62,500.

Table 1.--Magnetization of rock samples
[The values of magnetic susceptibility were converted to induced magnetization by multiplying them by 43 A/m (equivalent to 0.54 oersted), the approximate intensity of the Earth's magnetic field.]

Sample number	Rock type	Magnetic susceptibility (siu) ($\times 10^{-3}$)	Magnetization Induced (A/m)	Magnetization Remanent (A/m)
1	gneiss	0.6	0.03	0.00
2	granitic rock	20.5	.88	.05
3	do.	17.4	.75	.08
4	do.	12.0	.51	.18
5	do.	25.6	1.10	.04
6	do.	29.1	1.25	.08
7	do.	11.6	.50	.05
8	do.	16.0	.69	.13
9	do.	19.3	.83	.01
10	do.	19.0	.81	.11
11A	do.	28.1	1.21	1.43
11B	do.	22.8	.98	1.20
12	do.	25.9	1.11	1.04
13	do.	15.8	.68	.23
14	do.	17.7	.76	3.88

Interior—Geological Survey, Reston, Va.—1981

For sale by Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225