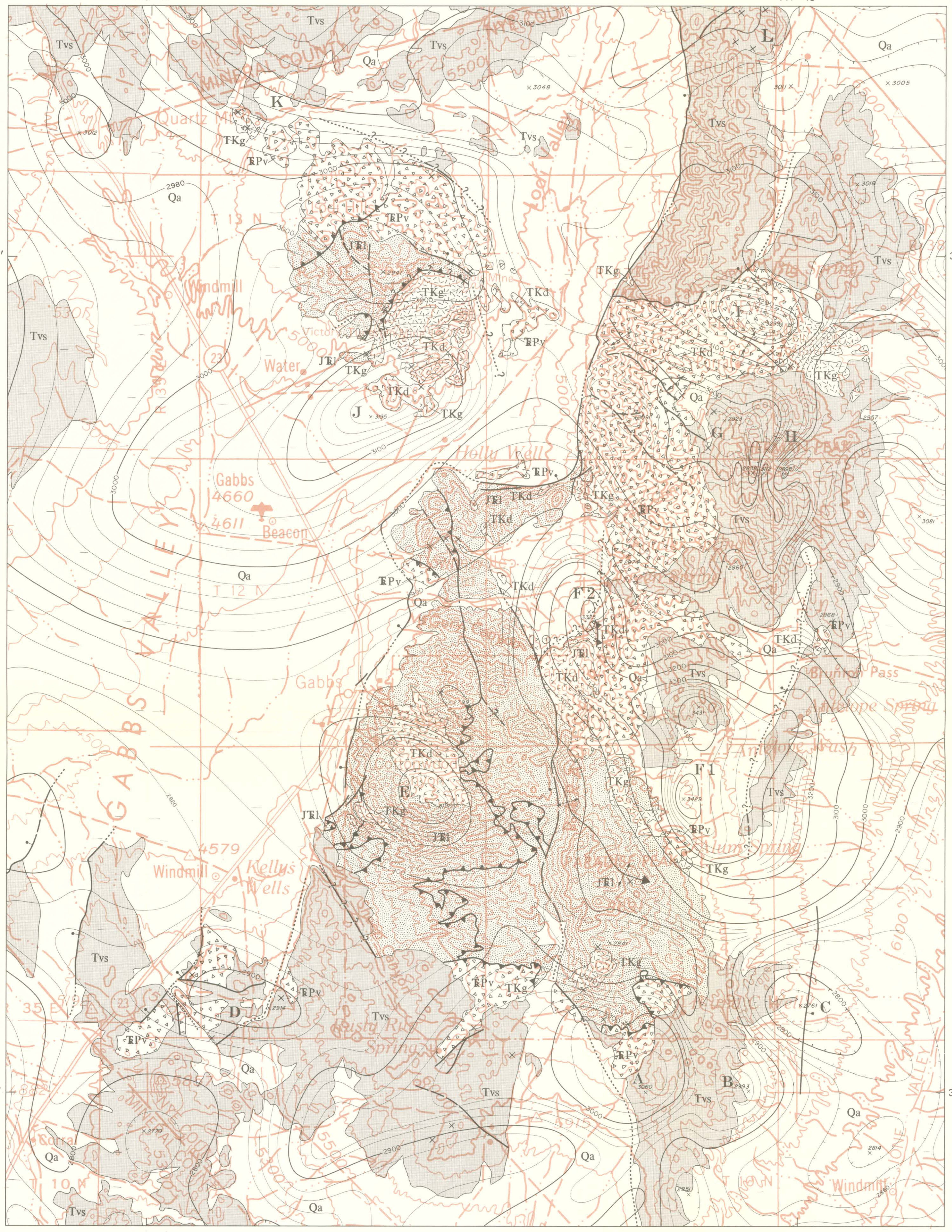
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

GEOPHYSICAL INVESTIGATIONS
MAP GP–926



118° 00′ 117° 45′

Base from U.S. Geological Survey 1:250 000
Reno, 1957; Tonopah, 1962; Millett, 1955;
Walker Lake, 1957

Author revisions as of 1978

16½°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1979

SCALE 1:125 000

2 1 0 1 2 3 4 5 MILES

2 1 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 200 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

☆ Interior—Geological Survey, Reston, Va.—1979—G78167

Geology generalized from maps and reports by Vitaliano, Callaghan, and Silberling (1957), Vitaliano and Callaghan (1963), and from unpublished data by F. J. Kleinhampl and J. I. Ziony

Aeromagnetic data from U.S. Geological Survey (1971)

EXPLANATION

Qa	Quaternary alluvium, fanglomerate, and other unconsolidated deposits
Tvs	Tertiary volcanic and sedimentary rocks
TKd	Cretaceous or Tertiary dioritic rocks
TKg	Cretaceous or Tertiary granitic rocks
JŦl	Triassic and Jurassic limestone, dolomite, and shale
ŦPv	Permian(?) and Triassic(?) volcanic rocks. Pyroclastic rocks and silicic to basic flows. May contain some Jurassic strata

Contact

High-angle fault—Dashed where approximately located, dotted where concealed. Bar and ball on downthrown side

Thrust fault—Dotted where concealed; queried where location uncertain. Sawteeth on upper plate

Axis of anticline, showing plunge

× Group of mines

Magnetic contours, showing total intensity magnetic field of the earth in gammas relative to arbitrary datum. Hachures indicate closed areas of lower magnetic intensity. Contour interval 20 and 100 gammas

A Magnetic anomaly referred to in text

INTRODUCTION

The Paradise Range area, lying mostly within the northwestern part of Nye County, Nev., includes, besides the Paradise Range, the Lodi Hills and intervening Lodi Valley and is bordered by Gabbs Valley on the west and Ione Valley on the east. Gabbs, a town noted for its nearby large magnesite and brucite deposits, is located along the west-central front of the Paradise Range. Throughout most of the northward-trending, moderately rugged range, crestal altitudes are above 2,100 m, with Sherman and Paradise Peaks reaching nearly 2,700 m above sea level. Lodi and Gabbs Valleys are about 450 to 600 m below the approximately 2,000-m-high Ione Valley on the east side of the range. The 60-km^2 circular upland of the Lodi Hills in the northwestern part of the area rises to more than 300 m above the adjacent valleys and is considered to be a spur of the Desatoya Range to the north.

Pre-Tertiary and Tertiary rocks crop out within the mountains and adjoining hills. The pre-Tertiary rocks include dolomite, limestone, siltstone, shale, sandstone, quartzite, and conglomerate of Triassic and Jurassic age; pyroclastic rocks and altered silicic to basic flows of presumed Permian and Triassic age; and associated intercalated and spatially related fine-grained volcanic sedimentary strata derived from the Mesozoic volcanic rocks. Most of these sedimentary and volcanic rocks are mildly metamorphosed and have been intruded by Cretaceous or Tertiary dikes, sills, and stocks that range in composition from diorite to granite and from andesite to rhyolite. The pre-Tertiary rocks are strongly folded, primarily along northwest-trending axes, and are commonly displaced along several major thrust faults of Mesozoic age and by post-Mesozoic normal faults. Tertiary volcanic rocks, chiefly pyroclastic deposits and flows, cover the northern and southern slopes and the high east-central part of the Paradise Range. The Tertiary rocks are less complexly faulted than the older rocks, except in the vicinity of small volcanic centers, and are affected mainly by high-angle normal faults, the most conspicuous of which are basin-and-range structures of Tertiary and Quaternary age.

Besides the major magnesite and brucite deposits near Gabbs, the area has been economically important for a variety of scattered metallic mineral deposits, such as gold, silver, lead, tungsten, and iron (Kral, 1951). The Fallon-Manhattan mineral belt hypothesized by Roberts (1966) transects the area.

In order to facilitate further study of mineral potential, a total intensity aeromagnetic survey was conducted to better define igneous rock masses and to determine their proximity and relation to known ore deposits. The survey was made with a continuously recording Gulf Mark III fluxgate magnetometer installed in a fixed-wing aircraft. Total intensity magnetic data were obtained along east-west flight lines about 1.6 km apart and flown at an average barometric elevation of 2,740 m above sea level. Topographic maps were used for guidance, and the flight paths were recorded by a 35-mm camera. Ground clearance ranged from less than 300 m over the crest of the mountains to as much as 1,370 m over the lowlands.

MAGNETIC FEATURES AND INTERPRETATION

The magnetic map shows positive anomalies of low amplitude over the southern and northern parts of the range, prominent magnetic highs near Gabbs and over the central mountains, and a broad positive anomaly over the southern Lodi Hills. The anomalies are augmented by topography and are superimposed on a regional magnetic gradient of about 9.7 gammas per 1.6 km northeastward. Interpretation of magnetic features is based on results of geologic mapping and general knowledge of the magnetic properties of rocks involved. Intensities of magnetization in igneous rocks are inferred from results of laboratory examination of sparse samples collected in anomalous localities. The sedimentary rocks and unconsolidated deposits generally possess relatively low magnetic susceptibility and negligible remanent magnetization and are considered to be nonmagnetic.

A broad magnetic high (A) of low amplitude occurs over volcanic rocks and bordering alluvium in the southern part of the range. The high is attributed mostly to Tertiary andesite flows that form extensive outcrops in the area. Samples of these rocks from near the magnetic maximum show a remanent magnetization of 1.55×10^{-3} emu/cm^3 that probably is the main source of the anomaly, but Mesozoic greenstone and hypabyssal intrusive rocks may also contribute to the magnetic pattern. East of the main maximum is a small positive closure (B) that lies over part of the Tertiary andesite flows. The closure may represent a concealed hypabyssal intrusive body. Several mineral prospects occur near granophyric dikes in the Tertiary rocks and in older metavolcanic rocks along the crest of the main anomaly.

The zone of low magnetic intensity (C) along the southeast front of the range lies primarily over Quaternary fanglomerates. These rocks partly conceal a thick accumulation of inversely polarized Tertiary andesite flows that are coincident with a pronounced minimum in the western part of the zone. A north-trending fault lies beneath this minimum but does not seem to be expressed elsewhere in the anomaly pattern.

A weak magnetic high (D) associated with Tertiary andesitic flows and pre-Tertiary metasedimentary and metavolcanic rocks lies south of Kellys Wells in the southwest part of the map area. The anomaly is probably caused mostly by remanent magnetization of the Tertiary rocks, but the older rocks may also contribute to it. Gold deposits occur in the pre-Tertiary rocks on the flank of the high.

Southeast of Gabbs, a positive anomaly (E), bordered on the north by a related low, lies over granodiorite and sedimentary rocks. The anomaly has an amplitude of about 300 gammas and is attributed to a large granodiorite pluton. Samples of the granodiorite from Cottonwood Canyon have an induced magnetization of about 1.10×10^{-3} emu/cm^3 and negligible remanent magnetization. The related magnetic low occurs over sedimentary rocks that contain the large magnesite and brucite deposits of Gabbs.

A broad, high-gradient anomaly (F1) with twin maximums having amplitudes of approximately 500 gammas occurs over Tertiary welded tuff adjacent to Ione Valley. Magnetic characteristics of these Tertiary volcanic rocks are expressed prominently in the magnetic pattern: samples of welded tuff collected near the largest magnetic maximum and near Antelope Spring to the east have an average remanent magnetization of about 4.04×10^{-3} emu/cm^3. The strong remanent intensity suggests that thick accumulations of these rocks could account for much of the eastern part of the anomaly. Granitic rocks have intruded pre-Tertiary sedimentary rocks near the southern magnetic maximum, but the granite, and similar granitic masses elsewhere in the mapped area, lacks notable magnetic expression. Granite exposed near anomaly F1, however, could be remnants of a mass engulfed at depth by more strongly magnetic plutonic rocks of more mafic composition. Such mafic rocks crop out farther northwest as a northwest-trending chain of plutons on the flank of the anomaly.

A narrow part of the anomalous zone extends northwest across the range and partly coincides with sedimentary strata and metavolcanic rocks as well as the plutonic rocks. The magnetic pattern appears to be only weakly influenced by the one large mass of granodiorite near the northwesternmost magnetic maximum (F2). This magnetic maximum lies over the Phelps Stokes iron deposit (Reeves and others, 1958, p. 38–44) near the mouth of Bell Canyon. Although about 500,000 tons of ore has been mined, sufficient disseminated magnetite and pyrrhotite apparently remain to account for the high magnetic intensity. A consideration of the F1 and F2 anomalies leads us to believe that iron-bearing metavolcanic rocks may extend southeastward from F2 toward F1 beneath the Tertiary volcanic rocks and Quaternary alluvium. Thus the main part of the magnetic anomaly (F1) may represent the additive effects of iron-bearing metavolcanic rocks and previously described Tertiary welded tuff with strong remanent magnetization. Along the north side of the major magnetic high of anomalies F1 and F2 is a related belt of low magnetic intensity.

An area of low magnetic intensity (G) lies over the mountain crest and slopes north and east of Sherman Peak. This feature is probably caused by remanent magnetization in the Tertiary volcanic rocks. Several mines in the western part of the zone produced gold and silver from quartz stringers in sheared and highly altered Tertiary volcanic rocks.

Along the east side of the low-intensity zone is a narrow positive anomaly (H) that lies over some of the lower mountain peaks and may be caused by intrusive rocks. The locality was not visited, but the anomaly is characteristic of a narrow, near-surface dikelike mass. The high could represent a northward-trending dike swarm consisting of shallowly buried hypabyssal intrusive rocks.

Farther east, minor variations in magnetic intensity form extensive low-gradient positive and negative anomalies that are associated with different parts of the Tertiary volcanic rock sequence.

A positive anomaly (I) occurs over pre-Tertiary andesitic rocks near Fairview Peak northwest of Ellsworth (site). Samples of these rocks have strong remanent magnetization of 2.12×10^{-3} to 3.38×10^{-3} emu/cm^3 that probably causes the anomaly. Exposures of granite in this part of the area are highly weathered and do not seem to be expressed in the magnetic pattern. Gold and silver deposits occur in the metavolcanic rocks near Ellsworth (site). A silver-bearing vein also cuts a reported thrust fault between granite and limestone (Kral, 1951, p. 111), and tungsten deposits occur in quartz veins in granitic rocks.

The positive anomaly (J) over the southern part of the Lodi Hills is ascribed to dioritic parts of a partly concealed plutonic complex of granitic to dioritic composition. The extent and amplitude of the anomaly (J) suggest that dioritic rocks form a large body beneath the alluvium along the southwest and southern margins of the hills. A large mass of granitic rocks nearby appears not to have affected the magnetic pattern and, in this regard, bears a similarity to the magnetic expression of granite near Ellsworth (site). Effects of intense hydrothermal alteration and contact metamorphism are widespread in the vicinity of the granitic plutons. Several authors have suggested movement along low-angle faults coincident with the contacts of some of the bodies (Kral, 1951, p. 96–97 and Humphrey and Wyatt, 1958, p. 40–43). Silver, lead, and small quantities of gold were produced from mines (Illinois mine) in limestone that borders the granitic stock, whereas major scheelite deposits occurred chiefly in the plutonic rocks of the southern Lodi Hills (Victory tungsten mine). The old lead-silver mines at nearby Downeyville are also in carbonate strata on the southeast flank of the broad positive anomaly.

Lead and silver deposits at Quartz Mountain in the northwest corner of Lodi Hills are associated with faulted Mesozoic carbonate strata that have been intruded by a small granitic body. A large northwest-striking fault probably drops Tertiary volcanic rocks down on the north against the Mesozoic strata and may also cut off the ore bodies. The mining district lies on the southern flank of a broad magnetic high. Steep magnetic gradients (K) correspond to the trend of the fault, but otherwise the anomaly exhibits no distinctive details that correspond with the geology of the district.

In the northeast part of the area, a small magnetic high (L) indicated by contour undulations occurs over Tertiary volcanic rocks underlying the Bruner mining district. These rocks consist of numerous rhyolitic flows and domes and minor tuffaceous sedimentary strata, ash-flows tuffs, and andesitic dikes. The district yielded about $1.5 million in gold and silver between 1924 and 1940.

POSSIBLE TARGET AREAS FOR MINERAL EXPLORATION

The coincidence of mineral deposits and magnetically anomalous parts of the surveyed area suggests that untested favorable exploration targets may yet exist. Target localities where parts of igneous rock masses and adjacent sedimentary strata are marked by magnetic anomalies include:

(1) Pre-Tertiary sedimentary and metavolcanic rocks beneath the flank of the positive anomaly (A) south of Paradise Peak.
(2) Triassic and Jurassic sedimentary rocks beneath the southern flank of the positive anomaly (E) southeast of Gabbs.
(3) Jurassic volcanic and clastic rocks and Cretaceous or Tertiary granodiorite plutons near the east maximums of the major magnetic high (F1). Iron deposits may be concealed here.
(4) Tertiary volcanic rocks and Jurassic volcanic and clastic rocks adjacent to the magnetic low (G) near Sherman Peak.
(5) Triassic and Jurassic sedimentary rocks adjacent to and beneath alluvium along the northwest and southeast flanks of the positive anomaly (J) over the southern Lodi Hills, and the possible southwestward extension of the plutonic complex beneath the valley alluvium.

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AEROMAGNETIC AND GENERALIZED GEOLOGIC MAP OF THE PARADISE RANGE AREA, NEVADA

By

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1979

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