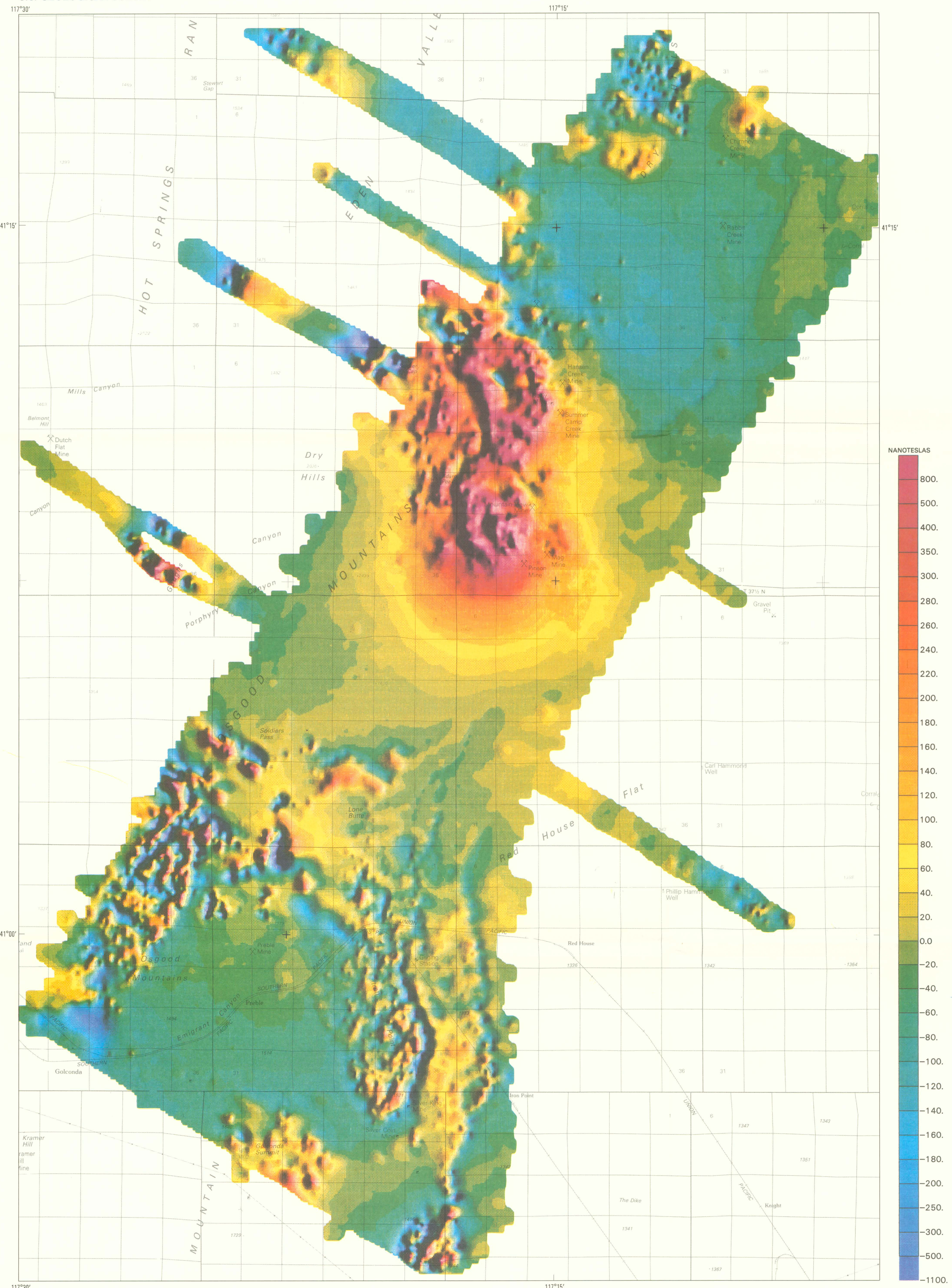
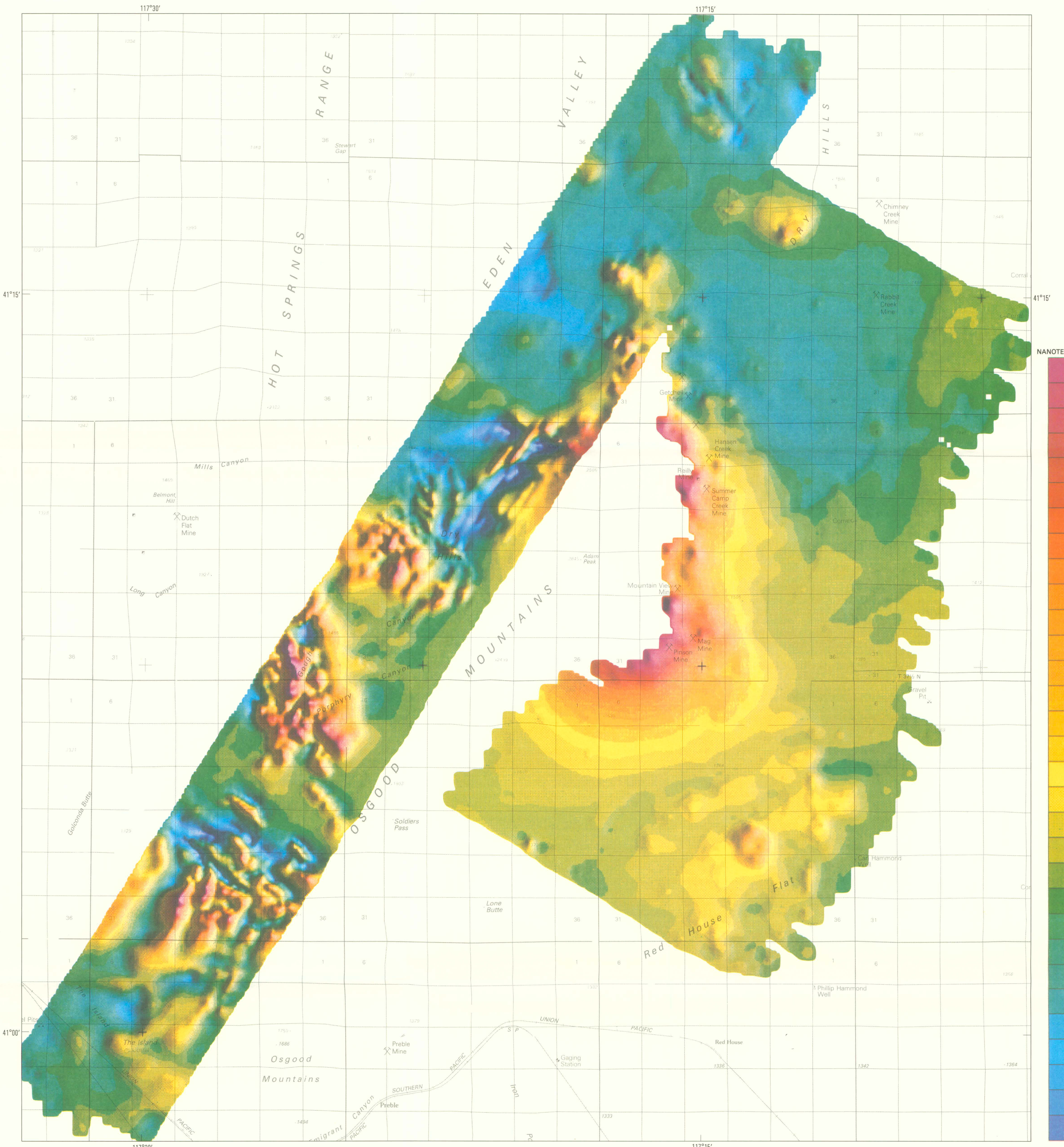
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

GEOPHYSICAL INVESTIGATIONS
MAP GP–1003–B (SHEET 1 OF 6)



MAP A. CONTRACT SURVEY TOTAL-FIELD MAGNETIC ANOMALY MAP



Base modified from U.S. Geological Survey
Osgood Mountains, 1985;
Winnemucca, 1986

MAP B. IN-HOUSE SURVEY TOTAL-FIELD MAGNETIC ANOMALY MAP

Edited by F. Craig Brunstein
Color design by Virginia D. Scott
Graphic design by Thomas L. Loesch
Cartography by Michael Kirtley
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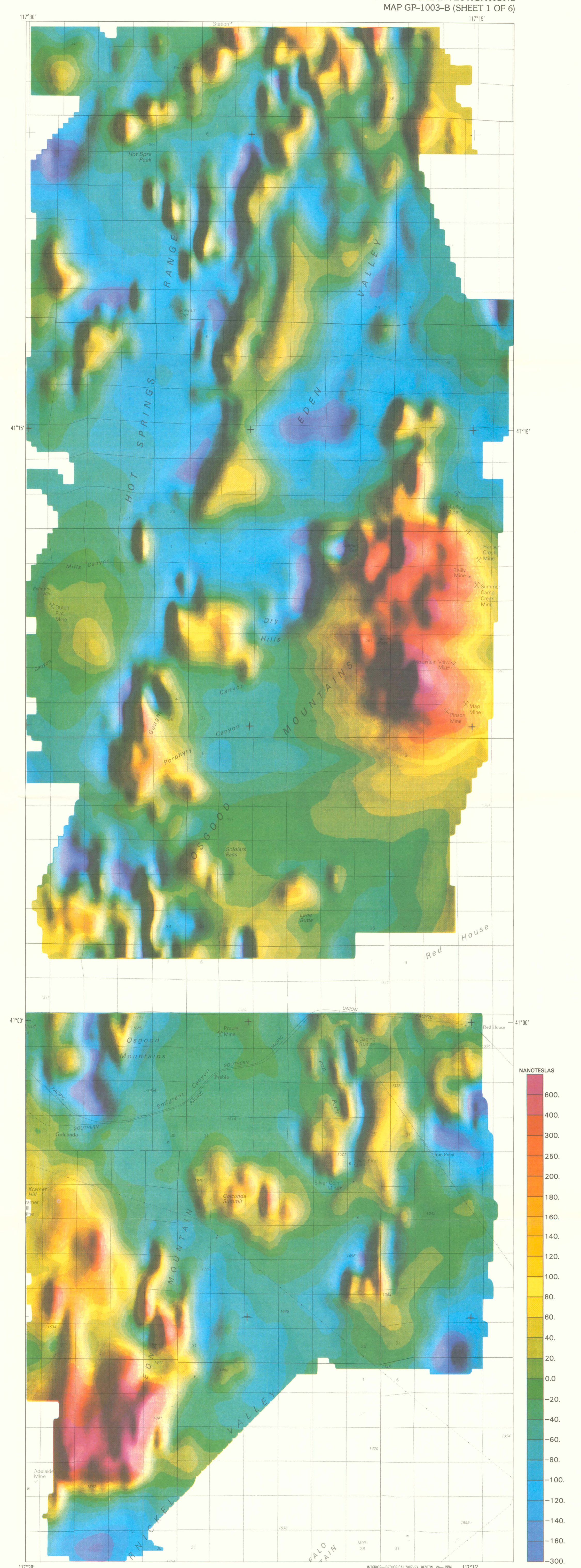

MAP C. IRON POINT SURVEY TOTAL-FIELD MAGNETIC ANOMALY MAP

INTRODUCTION

In 1988, the U.S. Geological Survey (USGS) initiated an integrated airborne geophysical program in the area of the Getchell gold trend, a northeasterly alignment of six sediment-hosted disseminated gold deposits along the eastern side of the Osgood Mountains in Humboldt County, Nevada (Fig. 1). The purpose of the program is to test the usefulness of various airborne geophysical methods in mineral deposit studies. To that end, aeromagnetic, gamma-ray, electromagnetic (EM), and 64-channel visible and near-infrared remote-sensing data were acquired in the summer and fall of 1988. Aeromagnetic data, which are the subject of this map, were acquired during two of the surveys. In addition, Continental Oil Company (Conoco) released contour maps to the USGS of an aeromagnetic survey flown in 1973 by their now defunct Minerals Department. These maps were subsequently digitized. Maps of low-resolution, regional surveys are already available for the Osgood Mountains (USGS, 1968a) and vicinity (USGS, 1968b; USGS, 1972; see Erwin and others, 1980 for survey boundaries).

This publication presents total-field residual aeromagnetic data from the 1973 and 1988 surveys, associated flight-line locations, terrain clearance where known, digital topography, reduced-to-pole magnetic maps, and horizontal-gradient magnitude maps derived from pseudogravity. In addition, we present a map of data merged from the two 1988 surveys and the associated reduced-to-pole and horizontal-gradient magnitude derivations in order to provide a coherent view of the high-resolution aeromagnetic data across the Osgood Mountains.

SIGNIFICANCE OF AEROMAGNETIC DATA

Aeromagnetic measurements represent variations in the strength and direction of the Earth's magnetic field that are produced by rocks containing significant amounts of magnetic minerals (commonly magnetite). Study of magnetic anomalies, the variations that cannot be explained by the Earth's main magnetic field, can lead to a better understanding of subsurface geology. This information is crucial to an understanding of the three-dimensional geologic setting of gold deposits.

The shape and magnitude of an anomaly produced by one body of rock is complexly related to the body's shape and total magnetization. Total magnetization is a vector quantity related to the strength and direction of the magnetic field produced in the rock body. It is the vector sum of two components of magnetization: induced and remanent magnetizations. Induced magnetization aligns with the direction of the Earth's magnetic field and is proportional to the magnetic susceptibility of the rock, which roughly corresponds to the concentration of magnetic minerals. Remanent magnetization, the subject of paleomagnetic studies, is the vector sum of all permanent magnetizations acquired since the formation of the rock. The types, strengths, and directions of the permanent magnetizations are determined by a variety of factors, including initial rock chemistry, emplacement and cooling history, later hydrothermal alteration, and the status of the Earth's field during the rock's history. In the northern hemisphere, if remanent magnetization has a positive inclination (directed downward relative to horizontal), the rocks are normally magnetized; if it has a negative inclination, the rocks are reversely magnetized.

Anomalies caused by igneous and metamorphic rocks generally dominate aeromagnetic maps because these rocks ordinarily are more magnetic than other rock types (Nettleton, 1971). Moreover, remanent magnetization is commonly smaller than or generally aligned with the induced magnetization so that the total magnetization has a positive inclination. However, significant exceptions occur in volcanic rocks where the remanent component can dominate the total magnetization and considerably affect aeromagnetic interpretation (Grauch, 1987).

Typically, an isolated rock body in the Northern Hemisphere having a total magnetization with positive inclination produces a magnetic anomaly which is shifted off center from the body to the south and accompanied by a weak low on the northern side, called a polarity low. In practice, anomalies are not isolated from each other. Groups of overlapping anomalies are commonly viewed as patterns, where differences between patterns generally express structural, topographic, and lithologic variations. Discrimination of individual magnetic sources from the patterns can be very difficult because the signals of all the sources may interfere with each other. In these cases, resolving magnetic differences that are produced by geologic features takes considerable study. Interpretation can be immensely aided by transforming the data into different forms that result in the enhancement of certain features over others. Several of these kinds of transformations are described in this report.

The depth to which magnetic rocks can be detected is primarily a function of the magnetization strength and size of the rock bodies, and the resolution of the aerial survey. Large, strongly magnetic sources can be detected by most surveys at great depths, but smaller, weaker sources may only be detected at near-surface depths by high-resolution surveys.

DATA DESCRIPTIONS

Maps A–C show total-field residual magnetic data for three aerial surveys of the Osgood Mountains area: one flown by helicopter in 1988 by DIGHEM, Inc., another flown by fixed-wing aircraft in 1988 by the USGS, and an exploration survey (the Iron Point project) flown by the Minerals Department of Conoco in 1973. For brevity, these henceforth will be called the *contract*, *in-house*, and *Iron Point surveys*, respectively. The specifications of these surveys are summarized in Table 1; their areas of coverage are shown in figure 2. Specifications for the regional USGS survey covering this area, which is part of the Norths Ranch quadrangle, (USGS, 1968a) are listed in Table 1 for comparison.

Due to the different specifications, each survey has a different degree and type of resolution. The resolving power of an aeromagnetic survey is determined primarily by flight-line spacing and height above magnetic sources. The closer the flight lines are to the ground, the better is the resolution of magnetic sources below the lines, especially if the sources are near the surface. The closer the flight lines are together, the better is the resolution of magnetic sources in between lines. A survey with flight lines spaced twice as wide as their height above ground resolves the magnetic sources between and below the flight lines equally, giving the most reliable contour maps (Reid, 1980). Most surveys, including the ones for the Getchell trend area, have flight lines spaced wider than twice the height above ground to cut costs or to accommodate the requirements of other geophysical instruments on board. In addition, magnetic sources that have linear strikes, such as dikes and faults, are best resolved by flying perpendicular to strike. In the Getchell trend area, geologic strike is generally north-south to northeast-southwest.

The regional USGS survey has the lowest resolution due to its wide flight-line spacing (Table 1) and considerable height, averaging about 5,100 ft (1,550 m) above the ground. The Iron Point survey data has better resolution than the regional survey, due to narrower flight-line spacing and lower height above ground. The contract survey has the best resolution along flight lines because the flight height is the lowest, and the in-house survey has the best resolution for making reliable contour maps because the flight-line spacings are closest to twice the flight height. In practice, the contract survey best resolves detailed geologic features, in spite of the inadequate resolution between flight lines.

All three survey data sets are presented as color-shaded relief maps. This type of presentation, which enhances detailed features of the map without subduing broad features, treats the magnetic values as though they were topographic elevations shadowed by the sun. For maps A–C, the illumination direction is from the east, which subdues east-west-trending features and enhances features aligned in other directions. In addition, the colors display the range of magnetic values and bring out broader features.

CONTRACT SURVEY

The contract survey data (map A) were acquired by helicopter over the Getchell trend area by DIGHEM, Inc., in October 1988 on contract to the USGS. The flight lines were directed NW-SE and spaced 1/4 mi (400 m) apart except over the vicinity of known gold deposits where they were spaced 1/8 mi (200 m) apart (map D). Several extended flights across the area (map D; the arm-like colored areas on map A) are for future magnetic modeling purposes.

The survey was designed primarily for acquiring EM data, which are presented by Wojniak and others (1993) and Taylor (1990). The EM instrument and the magnetometer were towed 100 ft (30 m) and 130 ft (40 m) above ground, respectively. Map G presents terrain clearance of the magnetometer, which is derived from radar altimeter measurements. Note that abrupt, linear changes in elevation occur over power lines, where increased ground clearance was needed. These sudden changes in elevation have negligible qualitative effect on magnetic anomaly values (map A), but they must be taken into account in quantitative modeling.

The contractors corrected the flight-line data for positioning using a transponder network, and the data were also checked visually. They also removed diurnal and other time-dependent variations that had been monitored at a ground-base magnetometer during the time of the survey. The resulting total-field data from the contractor, already positioned in UTM coordinates (base latitude 0°; central meridian 117°W), were interpolated onto a grid having equally spaced intervals of 0.1 km (330 ft) using the minimum-curvature gridding program of Webring (1981). Finally, the 1985 International Geomagnetic Reference Field (IGRF; Langel, 1988) extrapolated to 1988 was evaluated at the flight elevations of the survey (Sweeney, 1990) and removed from the data to account for the effects of the Earth's main magnetic field.

Because the flight height is much less than half of even the closest flight-line spacing (table 1), the magnetic field in between flight lines is not adequately sampled. As a result, the gridding program tends to produce anomalies that look like "beads" strung along flight lines. In map A, the "beads" give a pimply appearance, especially in the southern part of the map. The contractors applied a decorrugation filter (Urquhart, 1989) to counteract this effect (Richard Taylor, oral commun., 1989). The filter works well to smooth leveling differences between flight lines, but when applied to such widely spaced lines, the filtering tends to artificially elongate anomalies perpendicular to the flight direction. After inspection of filtered and unfiltered grids, the unfiltered grid (map A) was considered preferable for interpretation purposes, despite the pimpled appearance in many areas of the map caused by the "beading" effect. Both unfiltered and filtered versions (the latter before and after removal of the IGRF) as well as the flight-line data are available on magnetic tape from the National Geophysical Data Center, NOAA, Boulder, Colo. A map of the filtered version (after IGRF removal) at 1:100,000 scale can be viewed at USGS Mineral Information Offices in the unpublished "Getchell Trend Map Folio;" the map is also published as a page-size figure in Taylor (1990). The "Getchell Trend Map Folio" was distributed prior to regridding by the USGS.

IN-HOUSE SURVEY

The in-house survey data (map B) were acquired in two pieces in October 1988 using a fixed-wing Porter aircraft operated by the Branch of Geophysics of the USGS. Three geophysical instruments were onboard: a proton magnetometer and a 60-Hz EM instrument placed on the wing tips and a ring-core vector magnetometer placed in a tail stinger. The EM instrument and ring-core magnetometer were experimental; no reliable results were obtained. The flight crew consisted of Charles Thompson (pilot), Robert Krizman (instrumentation), Richard Sneddon (navigator and copilot), Robert Bracken (ground operations), and Charles Mitchell (party chief).

The flight lines for the western half of the in-house survey were flown NE-SW and spaced 1/8 mi (200 m) apart; the lines for the eastern half were flown NW-SE and spaced 1/4 mi (400 m) apart (map E). Even though the flight lines for the western half generally follow geologic strike, they also tend to follow topographic contours, which facilitated flying the fixed-wing aircraft close to the ground. To compensate for flying parallel to geologic strike, the flight lines were spaced closer than twice the flight height.

Surveys of the western and eastern halves were at nominal altitudes of 450 ft (140 m) and 300 ft (90 m) above ground, respectively. However, as an experiment, individual flight lines were flown considerably smoother than in ordinary draped surveys. In theory, the smoothing helps reconcile the difference between the aircraft's angle of climb up a topographic slope and its angle of descent down the same slope when it is heading the opposite direction along an adjacent line. Tempering the angle of descent to equal the angle of climb gives adjacent lines with similar heights, thus facilitating later gridding. In practice, however, the lines were individually smoothed, but heights of adjacent lines were inconsistent. These elevation disparities were produced by difficulties in estimating vertical position during flight and are manifested as stripes in the terrain clearance values on map H, especially on the western side where topography is more rugged. Problems produced by these elevation differences also appear as stripes in the magnetic data (map B). In the north where the flight lines of the two survey halves overlap, lower terrain clearance values along lines of the eastern survey appear as linear indentations on map H. The elevation differences produce minor stripes in the magnetic data (map B). No filters were applied to correct these problems in order to preserve the resolution of the original magnetic data.

The raw magnetic data were reduced to residual total-field values by Robert Bracken. Position was determined by a radio-frequency transponding guidance system using UTM coordinates (base latitude 0°, central meridian 117°). Time-varying magnetic field effects were monitored at a base station during the survey and subtracted from the flight-line data, which served as a leveling procedure. Next, Bracken removed the 1985 IGRF (Langel, 1988), extrapolated to 1988 and evaluated at the flight elevations of the survey (Sweeney, 1990), to account for the effects of the Earth's main magnetic field. The final, reduced flight-line data for both survey halves were merged and interpolated onto a grid (Webring, 1981) having equally spaced intervals of 0.10 km (300 ft). Magnetic tapes of the gridded data are available from National Geophysical Data Center, NOAA, Boulder, Colo.

IRON POINT SURVEY

The Iron Point survey data (map C) were released from Conoco to the USGS in 1988 in the form of contour maps because the digital recording of the survey could not be found. The contour lines on the maps were subsequently digitized by Esther Castellanos. The digitized map faithfully reproduces problems in the original contour map and cannot gain the uncontoured detail that would have been available on the digital tapes. The problems with the original contour map become evident after comparing the survey flight-line locations (map F) to the magnetic map (map C). For example, positional misadjustments of adjacent flight lines produce a herring-bone pattern on the magnetic map, which is especially noticeable as wiggles on the western side of the major positive anomaly along longitude 117°22'30" between latitudes 41°7'30" and 41°15'0". Other areas on the original contour map that were problems due to inadequate flight-line coverage have been masked.

After digitization, the data were projected into UTM coordinates (base latitude 0°; central meridian 117°W) using the computer program PRJREC (USGS, 1989). The projected data were then interpolated onto a grid having equally spaced intervals of 0.25 km (820 ft) using the minimum-curvature gridding program of Webring (1981). Finally, the Definitive Geomagnetic Reference Field (DGRF) was subtracted from the gridded data to remove the effects of the Earth's main magnetic field. Unlike the IGRF model, which is extrapolated into the future from recent geomagnetic measurements, the DGRF for 1973 is interpolated between models derived from past measurements (Langel, 1988). In order to best approximate the values of the Earth's field when and where the survey was flown, the DGRF was evaluated 500 ft (150 m) above the digital topographic surface (map I) using the computer program of Sweeney (1990). This procedure is negligibly affected by problems in the digital topographic data, evident as stripes and mismatches along 41° latitude on map I. The gridded data (before DGRF removal) are available on magnetic tape from National Geophysical Data Center, NOAA, Boulder, Colo.

REDUCED-TO-POLE MAPS

Southward shifts of magnetic anomalies over their sources and accompanying polarity lows on the north are intrinsic in the magnetic anomaly maps (maps A–C). As introduced earlier, these shifts or polarity effects occur because the measured magnetic field is not directed vertically at this location. The shifts can be removed through a mathematical transformation called "reduction-to-the-pole" or "reduction-to-pole". Reduction-to-pole recasts the data as though the magnetic field had been measured at the magnetic north pole, where the Earth's magnetic field is vertical. Reduced-to-pole data were computed for the Getchell trend data by means of the fast Fourier transform (Hildenbrand, 1983) and results are shown on maps J–L.

Reduction-to-pole requires an assumption about the directions of magnetization of the magnetic sources. Generally, it is assumed that the total magnetizations of most rocks in the area align parallel or anti-parallel to the Earth's main field (declination=16°, inclination=66° for the Getchell trend area). This is probably a good assumption for much of the study area, especially for the granodiorite pluton that produces the prominent, hour-glass shaped anomaly (Grauch and Bankey, 1991) apparent at least in part in all three survey maps (maps A–C). For reference, it is located in the center of the contract survey (map A). The northern, elongate lobe of the anomaly is much more apparent on the reduced-to-pole maps (maps J–L) than on the total-field maps (maps A–C).

However, magnetic anomalies in many parts of the southern extremes of all three surveys are caused by volcanic rocks that may not have total magnetizations aligned with the Earth's field (V.J.S. Grauch, unpublished modelling, 1990). In these areas, the reduced-to-pole maps may be in error.

HORIZONTAL-GRADIENT MAGNITUDE MAPS

Magnetization boundaries are boundaries between rock units of contrasting magnetic properties and such boundaries commonly occur at faults and other geologic contacts. Locating magnetization boundaries from aeromagnetic data helps delineate buried geologic contacts. Moreover, magnetic sources are more easily delineated from magnetization boundaries than from anomalies because anomalies have unclear edges and are offset from their sources due to polarity effects. The locations of these boundaries can be estimated from aeromagnetic data by applying the horizontal-gradient method of Cordell and Grauch (1985). The method exploits the similarity between gravity and magnetic field equations and the mathematical properties of the gravity field over steeply dipping boundaries.

The mathematical properties of the gravity field to be exploited are illustrated in figure 3, which shows a plot of the gravity field over a simple near-vertical boundary between homogeneous materials having contrasting densities. The slope of the gravity curve is steepest directly over the top edge of the boundary. The steepness of the slope can be computed by taking the first derivative with respect to the horizontal direction, and its magnitude will peak where the gravity curve is steepest, right over the contact. In map form, the derivative takes the form of the two-dimensional horizontal gradient. Analogous to the one-dimensional case in figure 3, the horizontal-gradient magnitude (HGM) has local maxima along ridges of a HGM map. These maxima can be located automatically by computer (Blakely and Simpson, 1986) and plotted as symbols. The sizes of the symbols can be varied to indicate the sizes of the HGM, which in turn is related to the amount of contrast in physical properties across the boundaries, thickness of the rock masses, and depth of burial.

A plot of the magnetic field over a simple vertical boundary is not as straightforward as the gravity field (fig. 3). However, by first transforming the magnetic data so they have the same mathematical properties as gravity data, the HGM can be utilized to find magnetization boundaries in the same way it was used to find density boundaries from gravity data. The transformation relies on similarities between the mathematical equations that describe gravity and magnetic fields and is called the pseudogravity transformation (Baranov, 1957). Pseudogravity maps look like gravity maps, but reflect information solely about the *magnetic*, not density, properties of rocks. Like reduction-to-pole, the pseudogravity transformation requires an assumption about the magnetization directions of the rocks.

The logarithms of the HGM's of the pseudogravity for each survey are shown on maps M–O. Logarithms of the HGM's are used to enhance subtle gradients. Maxima of the HGM of the pseudogravity were computed for each survey (Blakely and Simpson, 1986) and are plotted on maps M–O as x's that are proportional in size to the amplitude of the HGM. The x's form discontinuous lines because the input data are located at discrete grid points. They must be aligned by eye to estimate the locations of continuous magnetization boundaries.

The accuracies of the locations of HGM maxima over real magnetization boundaries are determined primarily by how well the boundaries approximate steeply dipping planes, terrain effects, data control, interference from neighboring anomalies, boundary dip, (Grauch and Cordell, 1987), or choice of magnetization direction in the pseudogravity transformation. Several of these factors may be affecting the location of HGM maxima in the Getchell trend area; they are discussed in the following paragraphs.

First, many of the large maxima in the pseudogravity HGM in the southwestern parts of the contract and in-house (west half) surveys are influenced primarily by the steep edges of topography rather than by differences in magnetization (compare maps I, M, and N). In addition, as mentioned previously, magnetization directions are probably not aligned with the Earth's main field in this area, which would shift maxima off magnetization boundaries.

Second, lack of data control probably explains some discrepancies between the locations of maxima between the three surveys. For example, the locations of maxima, plotted as x's on maps M–O, do not match between surveys along the northern, eastern, and southern sides of the most prominent anomaly produced by the granodiorite pluton. The maxima determined from the in-house survey are controlled only by data near the ends of the flight lines, if at all (map E). These data may not be sufficient to define the proper gradient after pseudogravity transformation. On the other hand, the original Iron Point survey data are presumably adequately controlled by flight lines over the edges of the anomaly. Instead, the offsets between the locations of the maxima determined from the Iron Point and contract survey data, generally ranging from 250 to 500 m, may be due to one or a combination of the following factors: (1) loss of resolution during digitization of the Iron Point survey maps and subsequent gridding at a coarse interval of 0.25 km; (2) effects of draping the surveys; or (3) difference in height above ground between the two surveys coupled with the magnetic effects produced by the sloping, magnetized terrain surface. We deduce the latter as a possible factor because the highly magnetic granodiorite that makes up steeply sloping terrain in this area is comparable to the theoretical subsurface dipping boundary examined by Grauch and Cordell (1987). They found that HGM maxima in the theoretical situation are offset downdip an amount dependant on the dip of the boundary and the height of the observation level. Thus by analogy, the larger terrain clearances of the Iron Point survey would produce greater offsets in maxima locations.

Finally, interference from the granodiorite anomaly after pseudogravity transformation may prevent the recognition of subtle HGM maxima around its perimeter. The best example is the subtle change in magnetic values caused by a northeast-trending magnetization boundary evident on the contract magnetic map (map A) at about 41°11'15"N, 117°11'15"W. It may be related to a similar boundary trending more northerly and running from about 41°13'N, 117°12'W to 41°16'N, 117°7'5"W. The northern boundary is well defined by the HGM maxima (map M) but the southern boundary is not. Plots of the pseudogravity (not shown) indicate that the gradient due to the granodiorite anomaly may overwhelm such subtle gradients as far as 10 km from the center of the anomaly.

MERGED MAGNETIC MAP

In order to simplify inspection and interpretation of the magnetic maps, data from the in-house and contract surveys were digitally merged. The Iron Point data were excluded from merging because the resolution of detailed patterns are comparatively poor.

First, each of the gridded data sets for the two surveys were continued analytically to a smooth surface nominally 300 ft (90 m) above ground by the method of Cordell (1985). The surface was constructed from the digital terrain data (map I) after smoothing by running averages. Mild low-pass filtering was applied to the in-house data during downward continuation in order to subdue amplification of short-wavelength noise. Next, 126 nT were added to the in-house data to reconcile a constant shift between values of the two surveys. Finally, the data from the two surveys were splined together using program MAGMRG (USGS, 1989), favoring the contract survey in areas of overlap. Maps of the merged data, reduced-to-pole merged data, and the log of the HGM of pseudogravity are shown on maps P–R.

FINAL NOTE

Prior to 1988 the sole aeromagnetic data set publically available for the Getchell Trend area (USGS, 1968a) showed only the most prominent granodiorite anomaly, which appeared as a somewhat elongated bull's eye with no hint of the hour-glass shape evident in maps A–C. In contrast, the maps of the two surveys flown in 1988 (maps A and B) superbly display detail in anomaly patterns that clearly change in character across the maps, corresponding primarily to different lithologic units (Grauch and Bankey, 1991). Even the Iron Point survey, which was flown for mineral-deposit reconnaissance and is typical of surveys flown for general geophysical studies, lacks the resolution necessary to easily distinguish the different anomaly patterns apparent on maps A and B. For example, the pear-shaped anomaly centered at about latitude 41°7'30"N, longitude 117°25'15"W, on the Iron Point magnetic map (map C) does not display the change in character from a smooth coherent shape in the northeastern part to tightly spaced, isolated small anomalies in the southwestern part that is obvious on the in-house magnetic map (map B). In addition, fine structures and trends of anomalies abundantly clear in the extreme southwestern part of the merged magnetic map (map P) are almost entirely absent on the Iron Point magnetic map.

The comparisons between the Iron Point survey (map C) and maps A and B attest to the value of lower and more closely spaced flight lines in aeromagnetic surveys. Moreover, the recent discovery in the northern part of the in-house and contract survey areas of a subtle magnetic anomaly that is associated with an ultramafic ore host at the Rabbit Creek gold deposit (V.J.S. Grauch, unpub. data, 1990) shows that high-resolution aeromagnetic surveys should be an integral part of mineral exploration and resource assessment work.

ACKNOWLEDGMENTS

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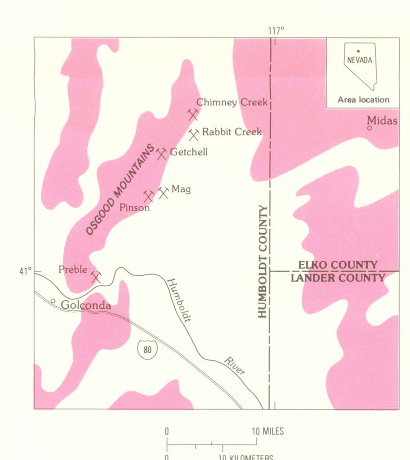

Figure 1. Map showing location of gold deposits that define the Getchell gold trend along the eastern edge of the Osgood Mountains. Red areas are topographic ranges.

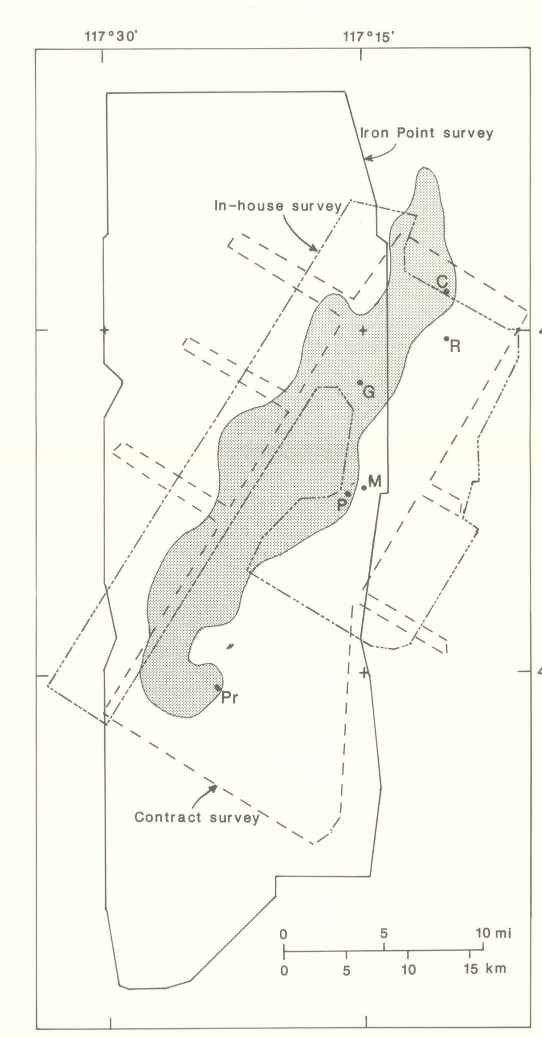

Figure 2. Locations of the three aeromagnetic surveys for the Getchell trend presented in this publication. Stippled area represents the Osgood Mountains. C, Chimney Creek deposit; G, Getchell deposit; M, Mag deposit; P, Pinson deposit; Pr, Preble deposit; R, Rabbit Creek deposit.

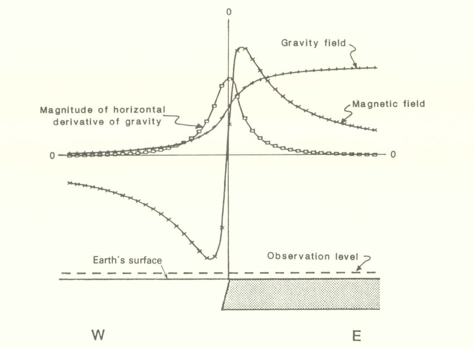

Figure 3. Gravity and magnetic fields over a simple, near-vertical boundary between homogeneous materials having contrasting density and magnetic properties. Stippling indicates higher density and magnetization than neighboring material. The gravity curve is steepest directly over the contact of the boundary. Because steepness is measured mathematically by the horizontal derivative, the magnitude of the horizontal derivative is maximum right over the contact. These principles can be extended to map data by using the two-dimensional horizontal-gradient magnitude (HGM). The properties of the horizontal derivative of gravity data can be exploited in the magnetic case by first transforming the magnetic data to pseudogravity data (see text).

TABLE 1. *Specifications of aeromagnetic surveys over the Getchell trend area*

SURVEY NAME	SURVEY AFFILIATION AND AIRCRAFT TYPE	YEAR FLOWN	MAGNETOMETER TYPE	FLIGHT-LINE SPECIFICATIONS	ALTITUDE	DATA TYPE
Southern part, Norths Ranch quadrangle	USGS, fixed wing (USGS, 1968a)	1967	Fluxgate	1 mi (1.6 km) E-W	9000 ft (2740 m) above sea level	Digitized contour map
Iron Point Project	Minerals Dept., Conoco, fixed wing	1973	?	1/2 mi (800 m) E-W	500 ft (150 m) above ground	Digitized contour map
In-house survey	USGS, fixed wing	1988	Proton	WEST HALF: 1/8 mi (200 m) NE-SW EAST HALF: 1/4 mi (400 m) NW-SE	WEST HALF: 450 ft (140 m) above ground* EAST HALF: 300 ft (90 m) above ground*	Digital flight-line data
Contract survey	DIGHEM, Inc., helicopter	1988	Cesium vapor	1/4 mi (400 m) with 1/8 mi (200 m) over deposits NW-SE	130 ft (40 m) above ground	Digital flight-line data

*Individual flight lines were flown smoother than in normal draped surveys

SCALE 1:100 000
5 0 5 MILES
5 0 5 10 KILOMETERS

AEROMAGNETIC AND RELATED MAPS OF THE GETCHELL GOLD TREND, OSGOOD MOUNTAINS, NORTH-CENTRAL NEVADA

By
V.J.S. Grauch and Viki Bankey
1994

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