Base from U.S. Geological Survey, 1954
Revised 1970
10,000-meter Universal Transverse Mercator grid, zone 12
100,000-foot grid ticks based on New Mexico coordinate system, west zone and Arizona coordinate system, east zone

SCALE 1:250 000

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1987—G84496

Geology by J. R. Cooper, Harald Drewes, T. L. Finnell, D. C. Hedlund, R. M. Hernon, B. B. Houser, W. R. Jones, V. A. Lawrence, S. L. Moore, R. B. Morrison, W. P. Pratt, D. H. Richter, and C. H. Thorman, U.S. Geological Survey; M. Shafiqullah, and P. E. Damon, University of Arizona; E. G. Deal, Eastern Kentucky University; W. E. Elston, University of New Mexico; J. E. Cunningham, Western New Mexico State University. Compiled 1979

Aeromagnetic data for each survey area processed by QEB Incorporated, Lakewood, Colorado

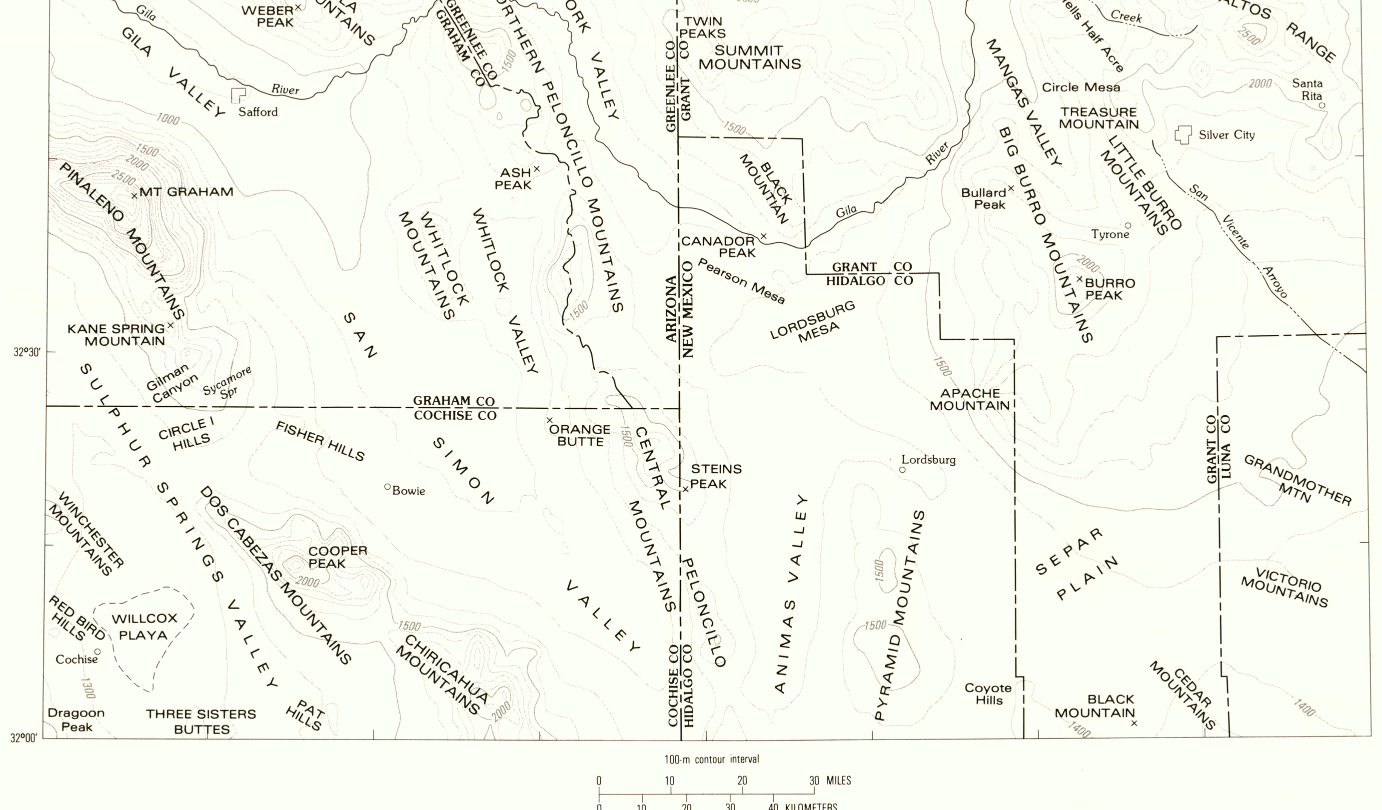


Figure 1.—GENERALIZED TOPOGRAPHY OF THE SILVER CITY 1° x 2° QUADRANGLE. This map was computer contoured using digital terrain data.

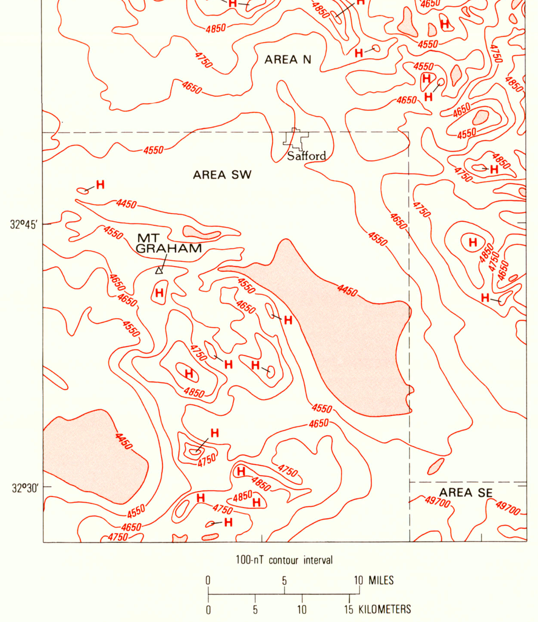
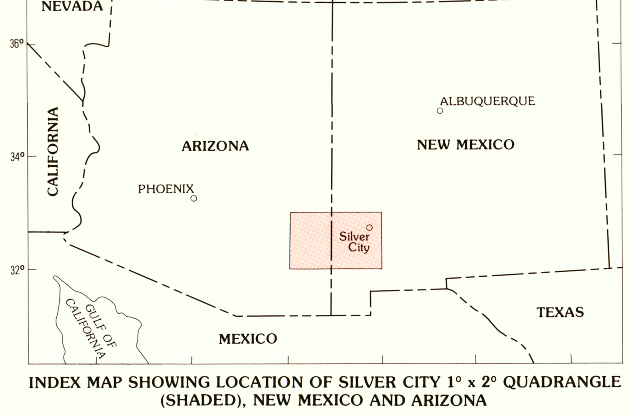
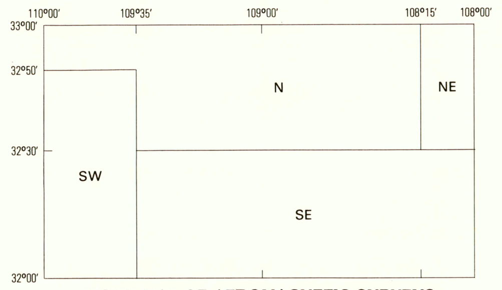


Figure 2.—ORIGINAL AEROMAGNETIC CONTOURS ON THE NORTH FLANK OF THE PINALENO MOUNTAINS. These data include only the contours at 100-nT intervals, whereas the published maps are contoured at intervals of 10 nT (U.S. Geological Survey, 1979). These data, obtained at a nominal elevation of 457 m above ground level, are not upward-continued, whereas the larger map shows the data reprocessed to represent the field at an elevation 2 km above the mean elevation at which they were acquired. Area SE is on a different datum and is contoured independently of areas N and SW, hence the truncated contours and inconsistent contour value.



INDEX MAP SHOWING LOCATION OF SILVER CITY 1° x 2° QUADRANGLE (SHADED), NEW MEXICO AND ARIZONA



INDEX MAP OF AEROMAGNETIC SURVEYS

CONTACT

FAULT—Dotted where concealed

STRIKE AND DIP OF BEDS
Inclined
Vertical

STRIKE AND DIP OF FOLIATION—Includes primary flow foliation of volcanic rocks and secondary metamorphic foliation of metamorphic rocks
Inclined
Vertical

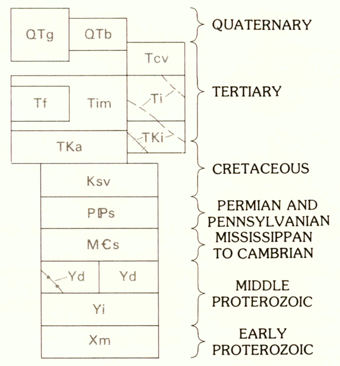
MAGNETIC CONTOURS—Showing total intensity magnetic field of the Earth in nT (nanoTesla: 1 nT is 1 gamma) at 3,500-m mean elevation relative to the International Geomagnetic Reference Field 1975 datum. Red tint indicates closed areas of lower magnetic intensity. Areas of relative magnetic highs are indicated by **H**. Contour intervals 25 and 100 nT

SPECIFICATIONS OF AEROMAGNETIC SURVEYS

Area	Date flown	Elevation[1]	Flight-line direction	Flight-line spacing	Reference
NE	1973	3,048 m (10,000 ft) CBA	East-west	1.6 km (1.0 mi)	U.S. Geological Survey, 1974
N	1979	457 m (1,500 ft) MTC	East-west	1.0 km (0.62 mi)	U.S. Geological Survey, 1979
SW	1979	457 m (1,500 ft) MTC	North-south	1.6 km (1.0 mi)	U.S. Geological Survey, 1979
SE	1980	152 m (500 ft) MTC	East-west	1.0 km (0.62 mi)	U.S. Geological Survey, 1980[2]

[1]Abbreviations are CBA for constant barometric elevation and MTC for mean terrain clearance.
[2]The flight line elevation given in the reference as 1,500 ft MTC is in error and is shown correctly above.

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

- QTg — GRAVEL, SAND, SILT, AND CLAY (QUATERNARY AND TERTIARY)—Mainly alluvium on stream terraces, fan aprons, and pediments; colluvium on hill slopes; and lacustrine and eolian deposits in basins
- QTb — BASALT (QUATERNARY AND TERTIARY)—Basalt and basaltic andesite flows and small intrusions
- Tcv — CONGLOMERATE AND VOLCANIC ROCKS (TERTIARY)—Mainly coarse conglomerate with intercalated mafic to intermediate flows and felsic tuffs
- Tim — INTERMEDIATE TO MAFIC VOLCANIC ROCKS (TERTIARY)—Mainly flows, scoria cones, domes, and small intrusions. Locally includes small units of felsic volcanic rocks and volcaniclastic rocks
- Tf — FELSIC VOLCANIC ROCKS (TERTIARY)—Mainly flows, domes, and pyroclastic deposits. Locally includes small units of more mafic volcanic rocks and volcaniclastic rocks
- Ti — INTRUSIVE ROCKS (TERTIARY)—Includes granitic rocks in plutons and aphanitic and porphyritic rocks in plugs and dikes
- TKi — INTRUSIVE ROCKS (TERTIARY AND CRETACEOUS)—Includes granitic rocks, commonly porphyritic, in plutons and porphyritic rocks and breccias in dikes, plugs and small stocks
- TKa — ANDESITIC ROCKS (TERTIARY AND CRETACEOUS)—Flows and small intrusions. Locally includes small units of sedimentary rocks.
- Ksv — SEDIMENTARY AND VOLCANIC ROCKS (CRETACEOUS)—Mainly shale, siltstone, sandstone and conglomerate; includes some limestone and felsic to intermediate volcanic rocks. Mainly Lower Cretaceous Bisbee Group to the southwest and Upper Cretaceous Colorado Shale to the northeast. Includes Jurassic and Triassic rocks in extreme southwest corner of quadrangle
- PIPs — SEDIMENTARY ROCKS (PERMIAN AND PENNSYLVANIAN)—Mainly limestone; includes some dolomite and sandstone. Chiefly Naco Group
- M€s — SEDIMENTARY ROCKS (MISSISSIPPIAN TO CAMBRIAN)—Mainly limestone, dolomite, shale, quartzite, and sandstone; includes some conglomerate and arkose sandstone
- Yd — DIABASE (MIDDLE PROTEROZOIC)—Includes gabbro, and metadiorite in sills, dikes and irregular masses
- Yi — INTRUSIVE ROCKS (MIDDLE PROTEROZOIC)—Granitic rocks, commonly porphyritic or porphyroblastic, in plutons
- Xm — METASEDIMENTARY AND METAIGNEOUS ROCKS (EARLY PROTEROZOIC)—Includes Pinal Schist and unnamed gneisses

INTRODUCTION

This map is part of a folio of maps of the Silver City 1° x 2° quadrangle, New Mexico and Arizona, prepared under the Conterminous United States Mineral Assessment Program. Other publications in this folio include U.S. Geological Survey Miscellaneous Investigations Maps I-1310-A, I-1310-B, I-1310-C, and I-1310-F. Interpretation of the present data is planned to be incorporated in a later map of this folio.

DESCRIPTION OF THE AEROMAGNETIC MAP

Four aeromagnetic surveys over the Silver City quadrangle have been analytically processed to provide a common representation of the different data sets and merged to form the present map. The original data (U.S. Geological Survey, 1974, 1979, 1980) were flown with different flight-line parameters (see: Specifications of Aeromagnetic Surveys). The original contour maps of these data are unsuitable for a combined mosaic at a scale of 1:250,000 because of their different specifications, and because extensive areas in the Silver City quadrangle show large amplitude magnetic changes over relatively short distances that would be blurred at small scale. The areas that show these patterns of spatially dense anomalies are generally those that are predominantly covered by exposed Cretaceous through Tertiary volcanic rocks.

Analytical processing of the data has smoothed the magnetic field representation and has effectively removed magnetic anomalies having horizontal dimensions less than about 2 km (1.2 mi; this dimension refers to the half-width of an anomaly, Grant and West, 1965, p. 345-346). The data smoothing is effective primarily over areas of exposed bedrock where anomalies of small horizontal dimensions can be related largely to the relatively small distance between the magnetic source rock and the sensor. In the original contour maps, magnetic intensity over much of the terrane covered by alluvium shows small amplitude variations, presumably resulting from deeply buried source rock. The present map is not greatly altered from the originals for the areas over these alluvial basins. Because of the field smoothing, the present map is missing much of the resolution that can be useful for detailed scrutiny of specific magnetic anomalies located over exposed bedrock; however, the generally uninteresting and interfering effects of magnetic topography are also greatly reduced. The map is considered to represent, in a general sense, the magnetic contrasts due to structure and lithology in the bedrock beneath alluvium and volcanic rock cover, as well as in the core of the mountain ranges.

The analytical continuation of the data (Grant and West, p. 311-316) was based on the concept of a surface (S) of equivalent magnetization, calculated as described by Bhattacharyya and Chan (1977). The data processed for all areas except NE (see Index Map of Aeromagnetic Surveys) were original digital flight-line data corrected for the International Geomagnetic Reference Field 1975 (International Association of Geomagnetism and Aeronomy Division 1 Study Group, 1976) updated to the date flown. These data are on magnetic tapes supplied by USGS contractors. Data for the area NE was digitized from a contour map (U.S. Geological Survey, 1974) at the points of intersection between the contours and the flight-line paths. The data of the area NE were simply recontoured by computer without being reprocessed.

The data for areas N, SW, and SE were filtered prior to the construction of the surface S in order to remove small-dimension magnetic variations that would alias the magnetic field when sampled at 0.5 km (0.32 mi) for gridding. The surface S was established at an elevation corresponding to the original surface of data acquisition (flight elevation) as defined by adding the digital topographic data (compiled by the USGS; available from National Geophysical Data Center, Boulder, Colorado 80303) to the digital altimeter data. The latter was available in the aeromagnetic flight-line data tapes. The distribution of artificial magnetic dipoles on S, calculated so as to provide an equivalent source for the observed fields (Bhattacharyya and Chan, 1977), was used to upward continue the data from survey areas N, NW, SE to a level 2 km above the mean level of surface S. Elevations in area SE (flown nominally at 152 m above the ground) range from about 1,100 m in the San Simon Valley to 2,100 m in the Chiracahua Mountains with the predominant elevation being in the range of 1,200-1,400 m (fig. 1). Elevations in area SW (flown nominally at 457 m above the ground) range from about 900 m near Safford to 3,000 m in the Pinaleno Mountains with the predominant elevations ranging from 1,100 to 1,300 m. Elevations in area N (flown nominally at 457 m above the ground) range from about 900 m near Safford to 2,100 m in the northern Summit Mountains with the predominant elevations ranging from 1,200 to 1,400 m. Thus, the upward-continued surface ranges from about 3,450 m for area SE, to 3,650 m for area SW, to 3,750 m for area N. These levels compare to constant 3,000-m elevation for data acquired in area NE. The data, gridded at 0.5 km intervals in both north-south and east-west directions were separately contoured by machine and manually joined.

The effects of survey boundaries and ground elevation variations are reduced but probably not eliminated by the data processing. The 15- to 25- percent greater upward-continued elevation datums of areas SE, SW, and N as compared to area N, are not expected to produce serious boundary distortion, but anomalies along the boundaries should be analyzed carefully prior to making conclusions on their geologic significance. Discrepancies at the joins between merged data sets were less than 25 nT. These discrepancies were partly caused by the lack of overlap between the different surveys except for that between areas SW and SE. The outmost border contours of the map, in a zone about 4 km (2.5 mi) wide, were hand drawn from the edge of computer contouring to the edge of the map. The hand-drawn contour continuations were based on the trends seen in the original data maps, but this outmost border zone is considered only approximately reliable. It should further be borne in mind that anomalies over areas of higher elevation will remain enhanced in gradient and amplitude relative to those over areas of lower elevation because of sensor-source distance relationships.

The northern Pinaleno Mountains is an area where the present data processing resulted in a significant difference in the anomaly pattern when compared to the general patterns evident in the original contour maps. Figure 2 shows the original contours for this area (U.S. Geological Survey, 1979) that can be compared to the newly processed data. The explanation for this difference is elusive, but is believed to reflect the extreme effects that steep elevation gradients can have on draped aeromagnetic data. This discrepancy is on the north flank of the steepest topography in the study area.

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AEROMAGNETIC MAP OF THE SILVER CITY 1° x 2° QUADRANGLE, NEW MEXICO AND ARIZONA

By
Douglas P. Klein
1987

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