Division of Geological & Geophysical Surveys

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PORTFOLIO OF AEROMAGNETIC AND RESISTIVITY MAPS OF THE IRON CREEK AREA, SOUTHCENTRAL ALASKA

by

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and

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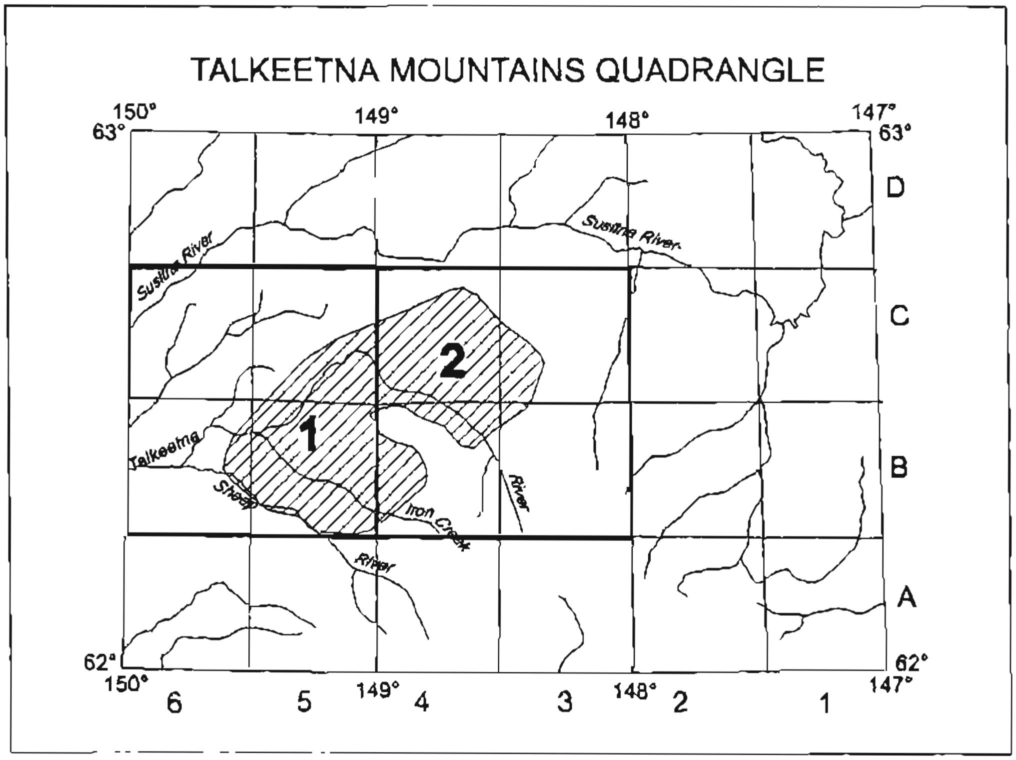
PORTFOLIO OF AEROMAGNETIC AND RESISTIVITY MAPS OF THE IRON CREEK AREA, SOUTHCENTRAL ALASKA

In the summer of 1997, the Alaska Division of Geologic and Geophysical Surveys acquired airborne geophysical data over about 690 square miles in the Talkeetna Mountains Quadrangle (figure 1). The data acquired were aeromagnetic and resistivity data at several frequencies. The data were released in January 1998. This Public-Data File (PDF) contains generalized information on data acquisition, data interpretation, and publications and data formats available for the Iron Creek survey area. Another report, PDF 98-7, gives a more detailed interpretation of the data and a more complete description of the processing.



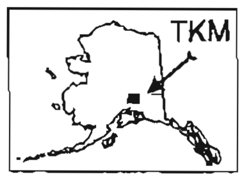


Figure 1. Index map for aeromagnetic and resistivity maps that are available at 1:63,360 scale.

This report also shows some of the data as page-size color maps and black-and-white shadow maps, and includes an acetate overlay of the topography. The acetate topography included as figure 8 in this portfolio should be used only for generalized locations. For accurate locations, the large-scale geophysical maps or the computer files should be used. Clients can request any color map from this portfolio at scale of 1:63,360 (1 inch = 1 mile) from the Alaska Division of Geological & Geophysical Surveys, 794 University Avenue, Suite 200, Fairbanks, Alaska, 99709-3645. Phone: (907) 451-5020. Fax: (907) 451-5050. These maps are already prepared and are listed at the end of this sheet. Custom plots of variations of the data can be made at any scale at the DGGS office for a reasonable fee.

The area surveyed includes parts of Talkeetna Mountains B-3, B-4, B-5, B-6, C-3, C-4, C-5 quadrangles. The maps produced at a scale of 1:63,360 (1 inch = 1 mile) cover the entire survey area shown in figure 1. Maps sold at a scale of 1:31,680 (1 inch = ½ mile) are labeled as in figure 2.

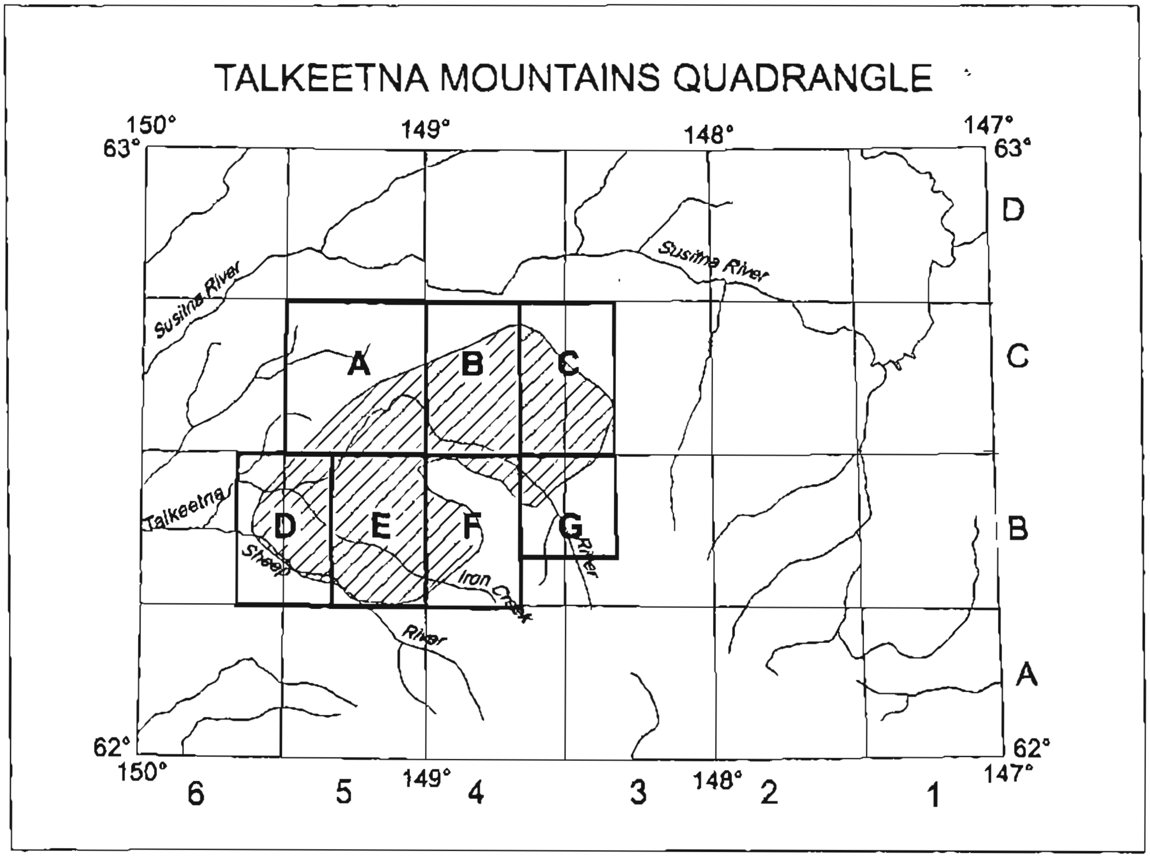


Figure 2. Index map for aeromagnetic maps available at 1:31,680 scale. Only aeromagnetic maps are available at this scale. These contain are photographic topography, magnetic contours, and detailed EM anomalies with a symbol denoting signal strength and an interpretation as to what is causing the EM anomaly.

Survey history, instrumentation, and data processing

The following indented section describing the instrumentation and processing is from the maps produced by WGM and Geoterrex-Dighem, the contractor and subcontractor, in conjunction with DGGS.

> The airborne geophysical data for the Iron Creek area were compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys, and WGM, Mining and Geological Consultants, Inc. Airborne geophysical data for the area were acquired in 1997 by Geoterrex-Dighem, a division of CGG Canada Ltd.
>
> Geophysical data were acquired with a Geoterrex-Dighem Electromagnetic (EM)

system, a Scintrex cesium magnetometer, and a Herz VLF system installed in an AS350B-2 Squirrel helicopter. In addition, the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz monitors, and a video camera. Flights were performed at a mean terrain clearance of 200 feet along survey flight lines with a spacing of a quarter of a mile. Tie lines were flown perpendicular to the flight lines at intervals of approximately three miles.

A Sercel Real-Time Differential Global Positioning System (RT-DGPS) was used for both navigation and flight path recovery. The helicopter position was derived every 0.5 seconds using both real-time differential positioning to a relative accuracy of less than 10 m. Flight path positions were projected onto the Clark 1866 (UTM) spheroid, 1927 North American datum using a central meridian (CM) of 147 degrees, a north constant of 0 and an east constant of 500,000. Positional accuracy of the presented data is better than 10 m with respect to the UTM grid.

Total Field Magnetics:
The magnetic total field contours were produced using digitally recorded data from a Scintrex cesium magnetometer, with a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) leveled to the tie line data, and (3) interpolated onto a regular 100 m grid using a modified Akima (1970) technique. The regional variation (or IGRF gradient, 1985 updated to August 1997) was removed from the leveled magnetic data.

Resistivity:
The Dighem^V EM system measured inphase and quadrature components at four frequencies. Two vertical coaxial coil-pairs operated at 900 and 5000 Hz while three horizontal coplanar coil-pairs operated at 900, 7200, and 56,000 Hz. EM data were sampled at 0.1 second intervals. For the 900 and 7200 Hz resistivity maps, the resistivity is generated from the inphase and quadrature component of the coplanar 900 and 7200 Hz respectively using the pseudo-layer half space model. The data were interpolated onto a regular 25 m grid using a modified Akima (1970) technique.

Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures: Journal of the Association of Computing Machinery, v. 17, no. 4, p. 589-602.

Magnetic data

The magnetometer is a passive instrument that measures the earth's magnetic field in nanoteslas (nT). Rocks with high magnetic susceptibilities (measured in SI units) locally attenuate or dampen these magnetic signals producing the relative highs and lows. Iron-rich magnetic minerals such as magnetite, ilmenite, and pyrrhotite have the highest magnetic susceptibility. These minerals commonly occur in mafic volcanic rocks (such as basalt), mafic and ultramafic plutonic rocks (such as serpentinite, clinopyroxenite, and gabbro), some skarns, and in some other geologic units. Rocks with low to no iron tend to produce little variation in the magnetic signal. These include silicic volcanic rocks (rhyolites), silicic plutonic rocks (granites), and most sedimentary rocks (for example, limestone, sandstone, and shale). Some iron-rich minerals—such as pyrite—are not magnetic and do not produce a magnetic signal.

Different types of ore deposits have different magnetic signatures. A bedrock gold deposit associated with the top of a granitic pluton would likely be an aeromagnetic low whereas a magnetite-bearing gold skarn would be an aeromagnetic high. A gold deposit hosted by a low-angle (thrust) fault has a different signature than one hosted by a high-angle fault.

Figure 3 shows the aeromagnetic data for the Iron Creek area. The high values (in nanoteslas) are purple and orange and indicate appreciably magnetic rocks. The low values are the blues and greens. A gradual change in color indicates a gradual change in the magnetic field strength. This can be caused by either a gradual change in magnetic susceptibility of rocks near the surface, the gradual burial of a rock unit of relatively constant magnetic susceptibility, or the introduction of a new unit at depth. Conversely, an abrupt change in color indicates an abrupt change in the magnetic susceptibility. This is caused by juxtaposing two rock units with very different magnetic susceptibilities such as is the case with faults, volcanic dikes, or some mineralized zones. Faults can be inferred on aeromagnetic maps from linear or curvilinear features composed of discontinuous aeromagnetic highs or lows.

Figures 4 and 5 show the aeromagnetic data presented as "shadow" maps. These three-dimensional maps simulate a light source shining on the data. The higher values appear bright like the mountain tops struck by sunlight. The light source can be rotated in a complete circle with 0° (north) clockwise to 180° (south) and back to 360° (north). Figure 4 shows azimuth 27° (apparent light source in the northeast), and figure 5 shows azimuth 303° (apparent light source in the northwest). Shadow maps can enhance structures, such as faults, intrusions, and the trend of stratigraphic layers.

<u>Resistivity data</u>

The electromagnetic (EM) system is an active instrument that measures the resistivity of the rocks below it by sending out electromagnetic signals at different frequencies and recording the signals that are returned from the earth. The high values (measured in ohm-m) are indicative of resistive (low conductivity) rocks, such as quartzite. Low resistivity (high conductivity) values are present for bedrock conductors (water-saturated clays, graphite, concentrations of certain sulfides, some alteration halos), conductive overburden (water-saturated zones), and cultural sources (e.g. powerlines). The main conductive minerals are graphite, most sulfides, (but not sphalerite), and water-saturated clays. Rocks hydrothermally altered to clay minerals also are conductive. Some faults will show up very well on the resistivity maps, because they either offer a conduit for ground water or they separate rocks with markedly different resistivities.

The EM instrument (bird) contains 5 or more transmitting coils in front and 5 matching (paired) receiver coils in the rear. Three of these pairs are coplanar—the axes of the coils are perpendicular to the long axis of the bird. Two of these pairs are coaxial—the axes of the coils are parallel to the long axis of the bird. These two major geometric configurations, coplanar and coaxial, record different information about the conductivity of the rocks below. Coplanar coils emphasize horizontal and flat lying conductive units. Coaxial coils emphasize vertical to near vertical conductive units.

The EM coplanar coil pairs are processed to produce resistivity maps, shown in figures 6 and 7. Since ground penetration correlates inversely with frequency, the 7200 Hz reflects near surface rocks and the 900 Hz adds the influence of deeper rocks in general. However, the depth of penetration is variable depending on the resistivity of the rocks the signal is passing through. Although the color bars in these figures differ, each figure has the most conductive rocks shown as purple and orange.

The information derived from the coaxial electromagnetic pairs emphasizes vertically- or near-vertically-dipping "discrete" bedrock conductors. These anomalies are shown generally as circular symbols along flight lines with some of the aeromagnetic maps. The 1 inch = 1 mile scale maps show anomaly symbols denoting strength of the signal, those caused by a concentration of magnetite, and those interpreted to have formed from cultural sources. More detailed interpretations for the electromagnetic anomalies are shown on the aeromagnetic maps produced at the 1:31,680 scale. This information is also available on the CD-ROM. PDF 98-8 gives a more detailed discussion of these EM anomalies.

Description of selected products

Three maps are in full color, the aeromagnetic data (RI 98-1), the 900 Hz coplanar resistivity data (RI 98-2), and the 7200 Hz coplanar resistivity data (RI 98-3). All three have scanned topography at a scale of 1:63,360 (inch to a mile). The data contours, electromagnetic anomaly symbols, and flight lines are not included in any of these maps.

The blueline format for the aeromagnetic data (PDF 98-3), the 900 Hz coplanar resistivity data (PDF 98-5), and the 7200 Hz coplanar resistivity data (PDF 98-5) contain data contours and section lines, but do not show topography. An addition, the aeromagnetic maps show simplified electromagnetic anomaly symbols (discussed above) along the flight lines. This aeromagnetic map is also available on diazo (PDF 98-2).

The flight line maps (PDF 98-1) contain photographically-produced topography, which is clearer than the scanned topography.

The CD-ROM (PDF 98-9) contains profile data, gridded data, and location information. The CD-ROM is useful for someone who would like to view the original processed data or take out different mathematical trends. The zip-disk (PDF 98-8) contains gridded files in Geosoft format. A computer program capable of viewing these files in Geosoft format or converting files to another format is necessary to view the files. If you need assistance, please contact our office.

DGGS PUBLICATIONS PRODUCED FOR THE IRON CREEK AREA SURVEY

AEROMAGNETIC MAPS

RI 98-1. Total field magnetics of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 2 sheets, scale 1:63,360. Topography included. Full color plot from electronic file, 400 dpi. Made on request.

PDF 98-2. Total field magnetics and electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 2 sheets, scale 1:63,360. Clear diazo film. Magnetic contours and section lines included. Made on request.

PDF 98-3. Total field magnetics and electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 2 sheets, scale 1:63,360. Blueline. Magnetic contours and section lines included.

PDF 98-18a. Total field magnetics and detailed electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 7 sheets, scale 1:31,680 (part of C-5 quadrangle). Blue ine.

PDF 98-18b. Total field magnetics and detailed electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 7 sheets, scale 1:31,680 (part of C-4 quadrangle). Blue line.

PDF 98-18c. Total field magnetics and detailed electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 7 sheets, scale 1:31,680 (part of C-3 and C-4 quadrangle). Blue line.

PDF 98-18d. Total field magnetics and detailed electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 7 sheets, scale 1:31,680 (part of B-5 and B-6 quadrangle). Blue line.

PDF 98-18e. Total field magnetics and detailed electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 7 sheets, scale 1:31,680 (part of B-5 quadrangle). Blue line.

PDF 98-18f. Total field magnetics and detailed electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 7 sheets, scale 1:31,680 (part of B-4 quadrangle). Blue line.

PDF 98-18g. Total field magnetics and detailed electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 7 sheets, scale 1:31,680 (part of B-3 and B-4 quadrangle). Blue line.

RESISTIVITY MAPS

RI 98-2. 900 Hz coplanar resistivity of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 2 sheets, scale 1:63,360. Topography included. Full color plot from electronic file, 400 dpi. Made on request.

RI 98-3. 7200 Hz coplanar resistivity of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 2 sheets, scale 1:63,360. Topography included. Full color plot from electronic file, 400 dpi. Made on request.

PDF 98-4. 900 Hz coplanar resistivity of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 2 sheets, scale 1:63,360. Blue line. Resistivity contours and section lines included.

PDF 98-5. 7200 Hz coplanar resistivity of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 2 sheets, scale 1:63,360. Blue line. Resistivity contours and section lines included.

DIGITAL FILES, PROJECT REPORT, PORTFOLIO, AND FLIGHT LINES

PDF 98-1. Flight lines of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 2 sheets, scale 1:63,360. Blue line. Topography included.

PDF 98-6. Portfolio of aeromagnetic and resistivity maps of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska, 16 p. Includes color and shadow maps. Maps fit 8½" x 11" sheet.

PDF 98-7. Project report of the 1997 geophysical survey data for Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska.

PDF 98-8. Zip disk containing gridded files and section lines of 1997 geophysical survey data for Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska. Gridded files in GeoSoft format.

PDF 98-9. CD-ROM containing profile and gridded data and section lines of 1997 geophysical survey data for Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska.

SOME AVAILABLE REFERENCES ON THE IRON CREEK AREA TALKEETNA MOUNTAINS QUADRANGLE

Anderson, R.E., 1969, Geology and geochemistry, Diana Lakes area, western Talkeetna Mountains, Alaska: Alaska Division of Mines and Minerals, Geologic Report 34, 27 p., scale 1:48,000, 1 sheet.

Csejtey, Bela Jr., Nelson, W.H., Jones, D.L., Silberling, N.J., Dean, R.M., Morris, M.S., Lanphere, M.A., Smith, J.G., and Silberman, M.L., 1978, Reconnaissance geologic map and geochronology, Talkeetna Mountains quadrangle, northern part of Anchorage quadrangle, and southwest corner of Healy quadrangle, Alaska: U. S. Geological Survey Open-File Report 78-558-A, 62 p., 1 sheet, scale 1:250,000.

Grantz, A., 1960, Geologic map of the Talkeetna Mountains (A-2) quadrangle Alaska, and the contiguous area to the north and northwest: U. S. Geological Survey Miscellaneous Investigations Series Map I-313, 1 sheet, scale 1:48,000.

Hackett, S.W., 1978, Simple bouguer gravity map of Talkeetna-Kashwitna River area: Alaska Division of Geological and Geophysical Surveys, Alaska Open-File Report 107G, scale 1:63,360, 1 sheet.

Hackett, S.W., 1978, Aeromagnetic map of Talkeetna-Kashwitna River area: Alaska Division of Geological and Geophysical Surveys, Alaska Open-File Report 107H, scale 1:63,360, 1 sheet.

Hackett, S.W., 1979, Provisional geophysical interpretation of simple bouguer gravity map, Talkeetna-Kashwitna River area: Alaska Division of Geological and Geophysical Surveys, Alaska Open-File Report 107I, scale 1:63,360, 1 sheet.

Hackett, S.W., 1979, Preliminary geological interpretation (basement complex) of aeromagnetic map, Talkeetna-Kashwitna River area: Alaska Division of Geological and Geophysical Surveys, Alaska Open-File Report 107J, scale 1:63,360, 1 sheet.

Hudson, Travis, 1979, Calc-alkaline plutonism along the Pacific rim of southern Alaska: U. S. Geological Survey, Open-file Report 79-953, 31 p.

Kachadoorian, R., 1974, Geology of the Devil Canyon dam site, Alaska: U. S. Geological Survey Open-File Report 74-40, 24 p., 1 sheet, scale 1:63,360.

Kaufman, M.A., 1963, Copper occurrences and hydrothermal alteration at Sheep Mountain: AK Territorial Dept. of Mines, Miscellaneous Report 85-2, 3 p.

Kline, J.T., 1978, Slope map of the Talkeetna-Kashwitna area, Susitna River Basin: Alaska Division of Geological and Geophysical Surveys, Alaska Open-File Report 107C, scale 1:63,360, 1 sheet.

McGee, D.L., 1978, Bedrock geology and coal occurrences, Talkeetna-Kashwitna area, Susitna River Basin: Alaska Division of Geological and Geophysical Surveys, Alaska Open-File Report 107E, scale 1:63,360, 1 sheet.

Miller, Thomas P., 1994, Pre-Cenozoic plutonic rocks in mainland Alaska: in Plafker, George, and Berg, Henry C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America, The Geology of North America, vol. G-1, p. 535-554.

Moll-Stalcup, E.J., 1990, Latest Cretaceous and Cenozoic magmatism in mainland Alaska: U.S. Geological Survey Open-file Report 90-84, 79 p.

Moll-Stalcup, Elizabeth J., 1994, Latest Cretaceous and Cenozoic magmatism in mainland Alaska: in Plafker, George, and Berg, Henry C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America, The Geology of North America, vol. G-1, p. 589-620.

Nokleberg, W.J., and Plafker, George, 1994, Geology of south-central Alaska: in Plafker, George, and Berg, Henry C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America, The Geology of North America, vol. G-1, p. 311-366.

Reger, R.D., 1978, Reconnaissance geology of the Talkeetna-Kashwitna area, Susitna River Basin: Alaska Division of Geological and Geophysical Surveys, Alaska Open-File Report 107A, scale 1:63,360, 1 sheet.

Reger, R.D., and Carver, C.L., 1978, Reconnaissance map of geologic materials, Talkeetna-

Kashwitna area, Susitna River Basin: Alaska Division of Geological and Geophysical Surveys, Alaska Open-File Report 107B, scale 1:63,360, 1 sheet.

Rose, A.W., 1967, Geology of an area on the upper Talkeetna River, Talkeetna Mountains Quadrangle, Alaska: Alaska Division of Mines and Minerals, Geologic Report 32, 9 p., scale 1:63,360, 1 sheet.

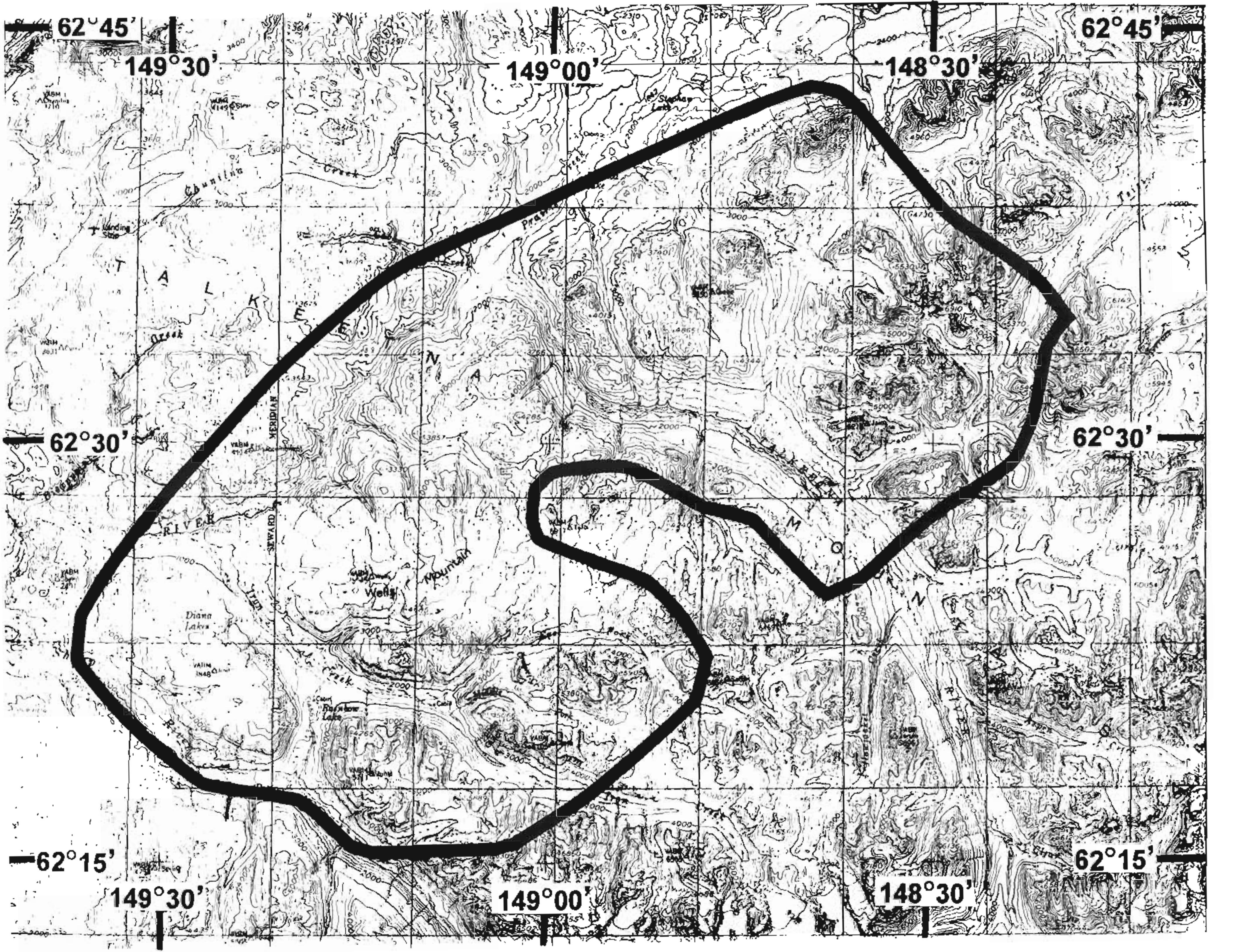
Staff, 1973, Aeromagnetic map, Talkeetna Mountains Quadrangle: Alaska Division of Geological & Geophysical Surveys, Alaska Open-File Report 20, 5 p., scale 1:250,000, 1 sheet.

Turner, D.L., Grybeck, D.G., and Wilson, F.H., 1975, Radiometric dates from Alaska: A 1975 compilation: Alaska Division of Geological and Geophysical Surveys, Special Report 10, 64 p.

Williams, J.A., 1952, Possible future mining operations as potential consumers of Susitna power from the proposed Susitna Basin power project: AK Territorial Dept. of Mines, Miscellaneous Reports 195-32, 5 p.

Wiltse, M.A., 1991, National uranium resource evaluation (NURE) geochemical data for stream and lake sediment samples, Alaska, Talkeetna Mountains Quadrangle: Alaska Division of Geological & Geophysical Surveys, Public-data File 91-22kk, 33 p. of data along with one 5-1/4" diskette.

Wiltse, M.A., Clautice, K.H., Burns, L.E., Gilbert, W.G., March, G.D., Tam, J., Pessel, G.H., Smith, T.E., Bundtzen, T.K., Robinson, M.S., Bakke, A.A., Duce, P., Fogel, E., Colter, G., and Moddrow, C., 1988, Mineral potential of Alaska mental health trust and replacement pool lands: Alaska Division of Geological & Geophysical Surveys, Public-data File 88-4, 40 p., 49 sheets, scale 1:250,000.



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Creek
Prairie
Stephan Lake
Landing Strip
RIVER
SEWARD MERIDIAN
Wells
Mountain
Diana Lakes
Rainbow Lake

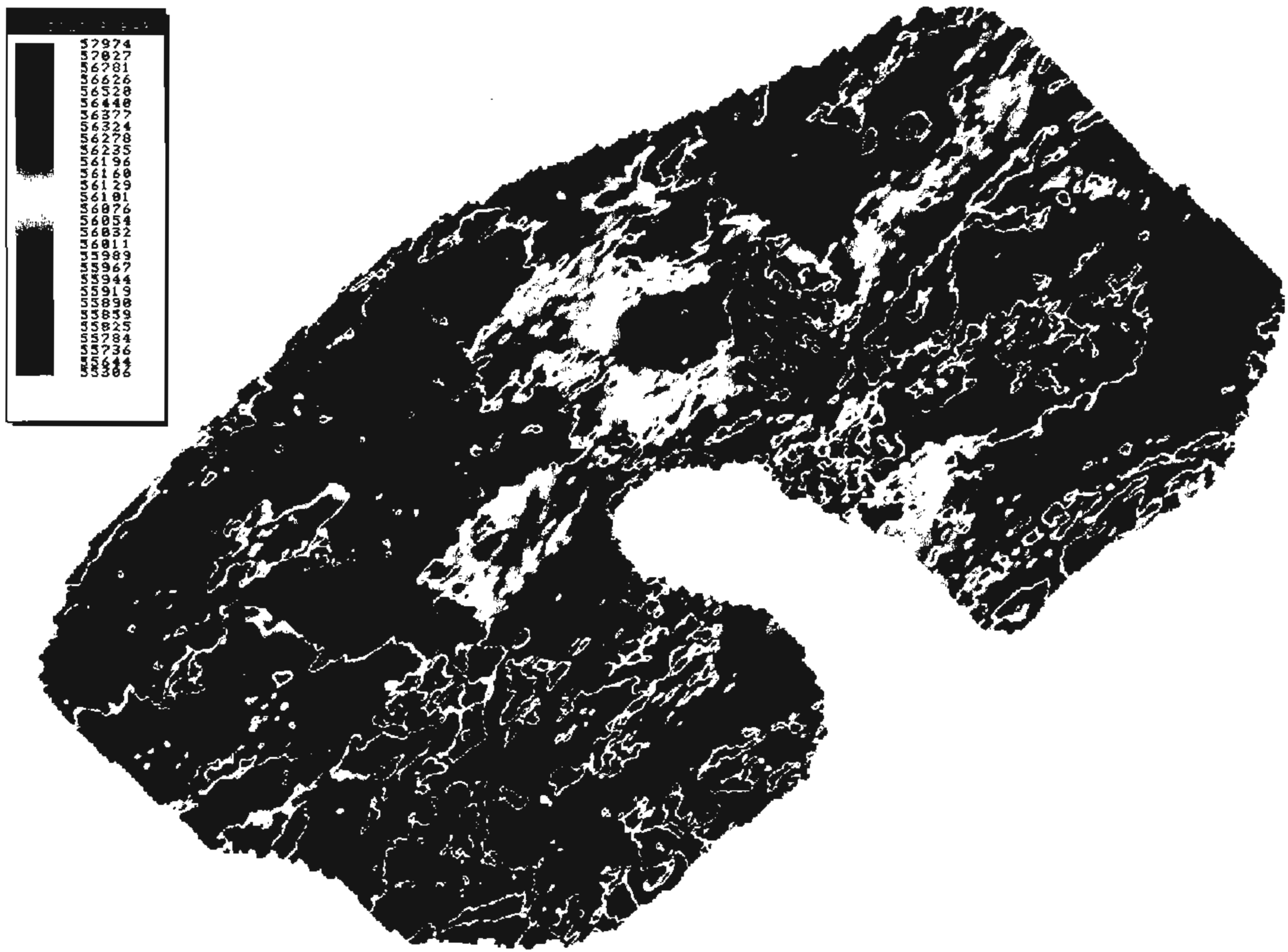

Figure 3: Total field magnetics of the Iron Creek area. Magnetic units are in nT.

Figure 4: Shadow map of the aeromagnetic data from the Iron Creek area, Alaska. Illumination source is at 27 degrees. High magnetic values appear like the tops of mountains that are hit by sunlight.

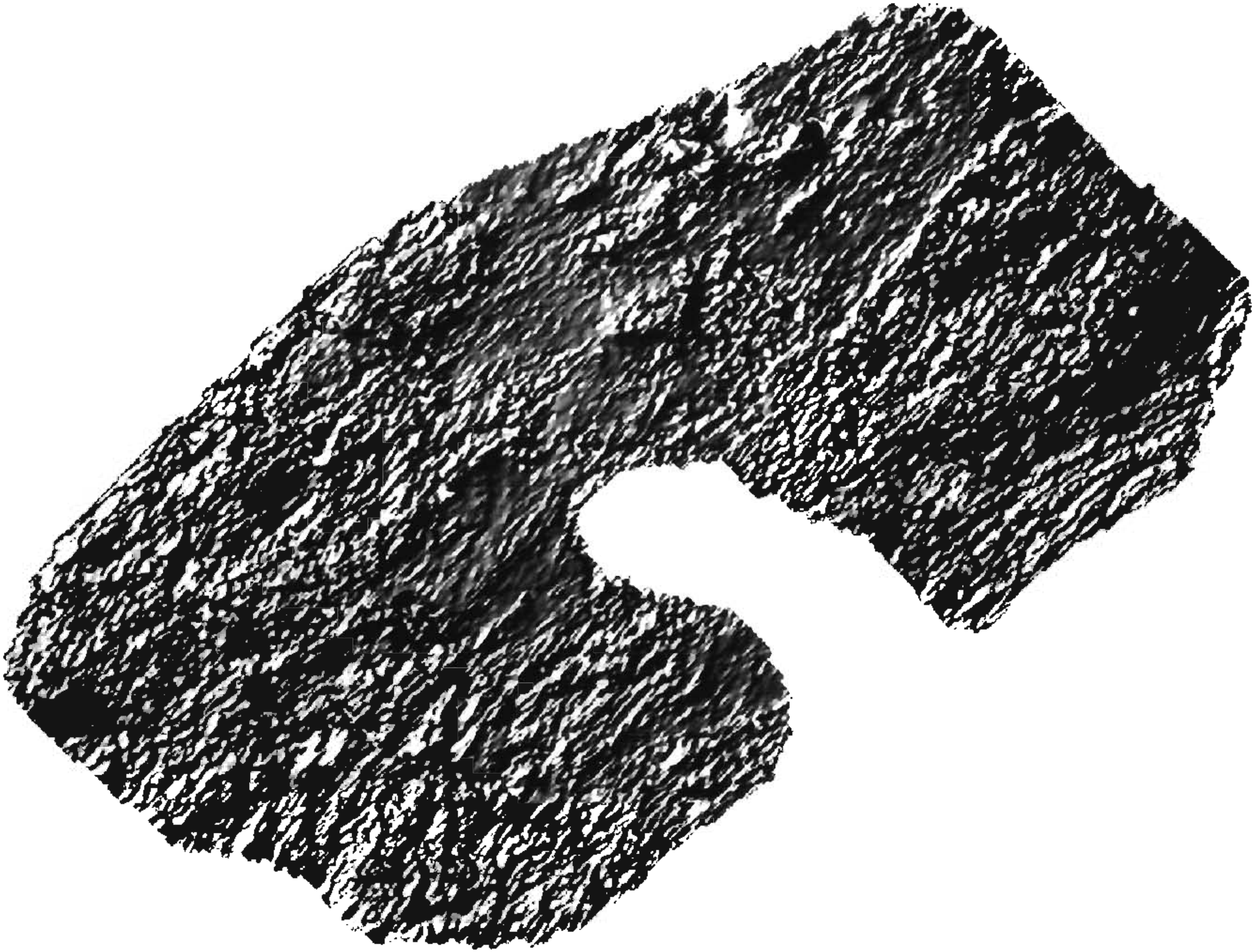

Figure 5: Shadow map of the aeromagnetic data from the Iron Creek area, Alaska. Illumination source is at 303 degrees. High magnetic values appear like the tops of mountains that are hit by sunlight.

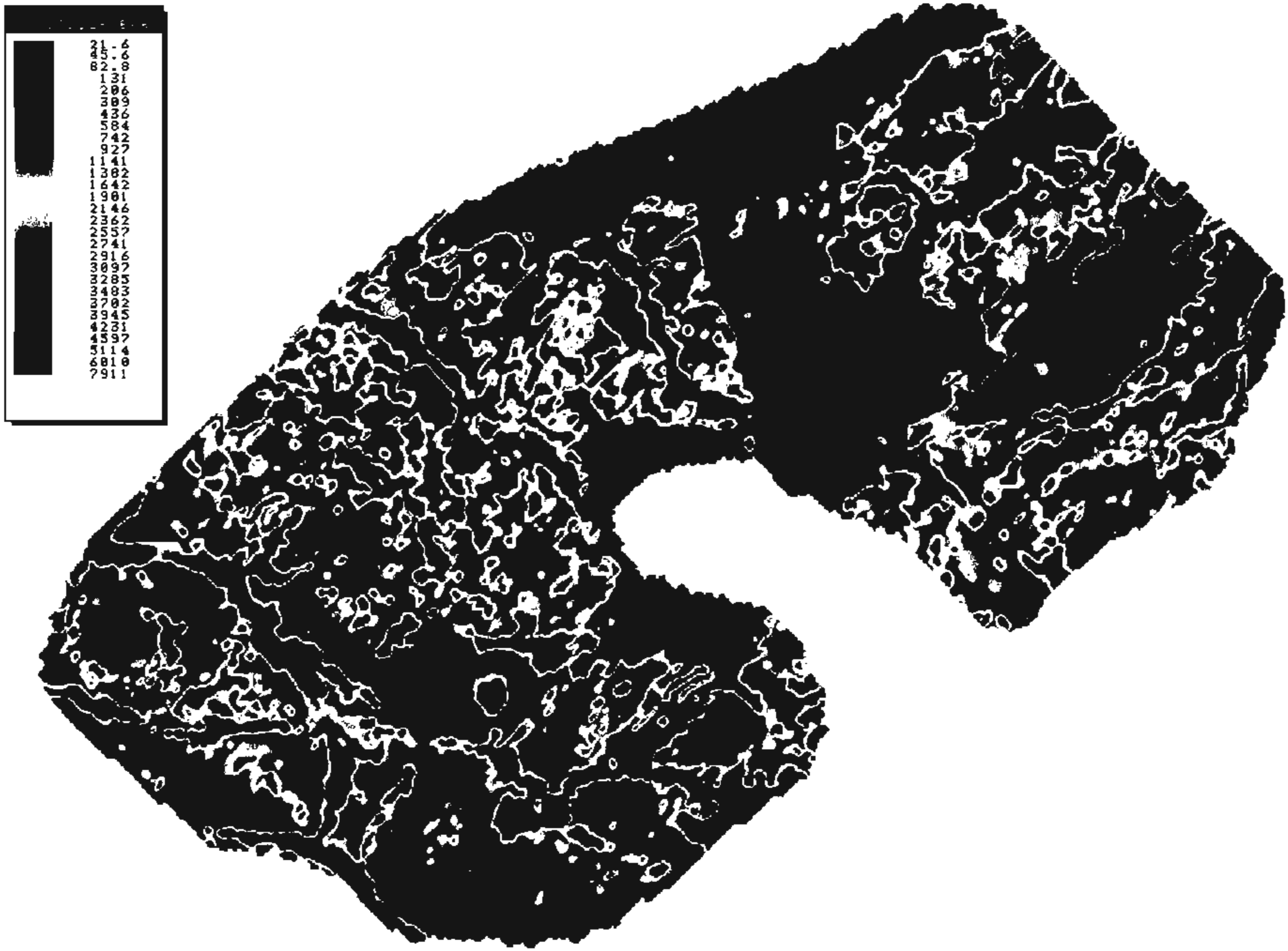

Figure 6: 7200 Hz resistivity map of the Iron Creek area, Talkeetna Mountains Quadrangle. Resistivity values in ohm-m. Conductive units have low numbers and are shown in purple and orange on this map.

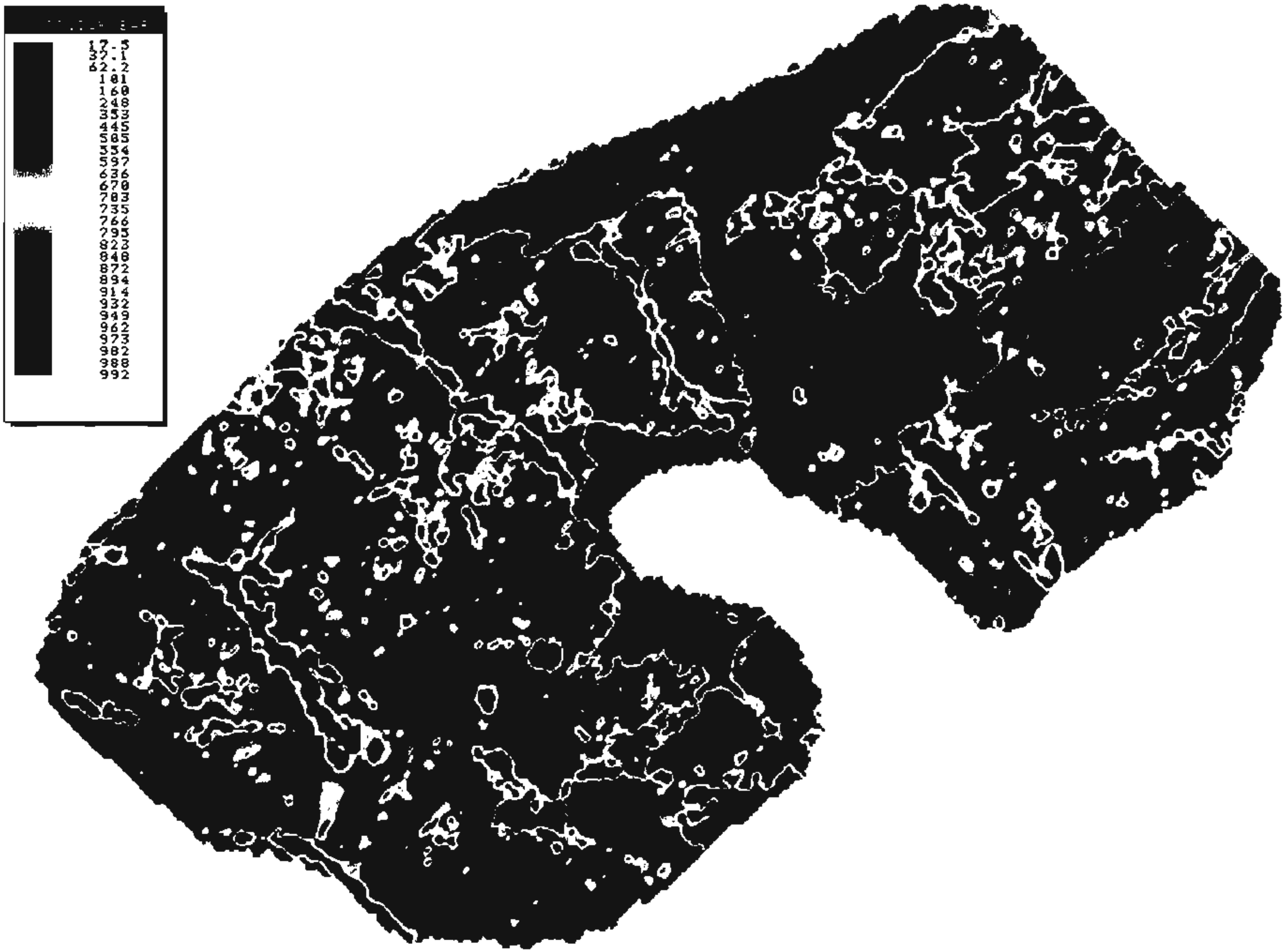

Figure 7: 900 Hz resistivity map of the Iron Creek area, Talkeetna Mountains Quadrangle. Resistivity values in ohm-m. Conductive units have low numbers and are shown in purple and orange on this map.