Division of Geological & Geophysical Surveys

GEOPHYSICAL REPORT 2002_5

PORTFOLIO OF AEROMAGNETIC AND RESISTIVITY MAPS OF THE SOUTHEAST EXTENSION OF SALCHA RIVER - POGO SURVEY, CENTRAL ALASKA

by

Laurel E. Burns

March 2002

THIS REPORT HAS NOT BEEN REVIEWED FOR TECHNICAL CONTENT (EXCEPT AS NOTED IN TEXT) OR FOR CONFORMITY TO THE EDITORIAL STANDARDS OF DGGS.

Released by

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
Division of Geological & Geophysical Surveys
794 University Avenue, Suite 200
Fairbanks, Alaska 99709-3645

PORTFOLIO OF AEROMAGNETIC AND RESISTIVITY MAPS OF THE SOUTHEAST EXTENSION OF SALCHA RIVER - POGO SURVEY, CENTRAL ALASKA

In the summer of 2001, the Alaska Division of Geologic & Geophysical Surveys acquired airborne geophysical data over 91 square miles in the Big Delta Quadrangle (figure 1). The data were acquired and processed under contract by Stevens Exploration Management, Corp. and their subcontractor, Fugro Airborne Surveys. Aeromagnetic and electromagnetic data were collected in September of 2001. The data were merged with the Salcha River—Pogo airborne geophysical survey (Burns and others, 2000) acquired by DGGS in summer 1999 northwest of the current survey. The new data were released March 2002 in the forms of maps and digital files.

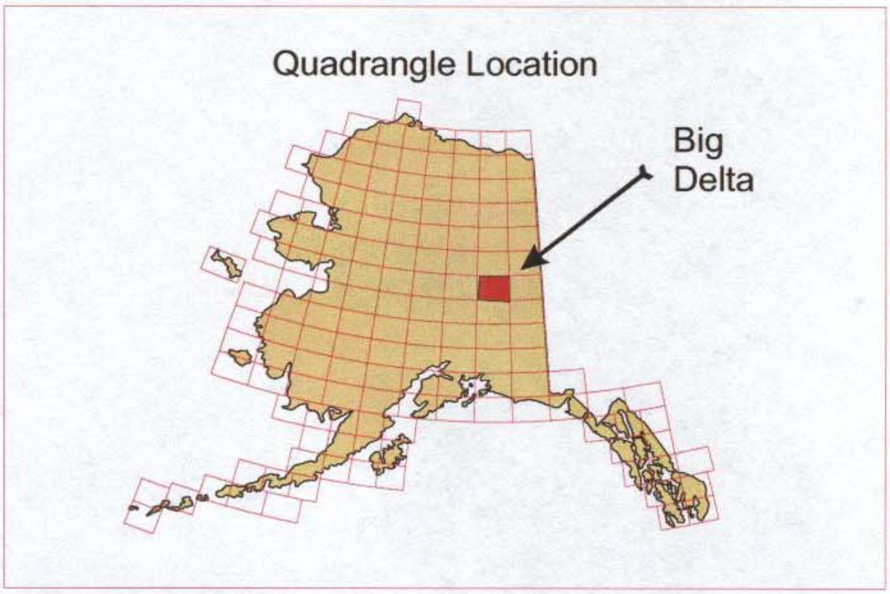


Figure 1. Location of Big Delta quadrangle.

This Geophysical Report (GPR) contains generalized information on data acquisition, data interpretation, publications, and data formats available for the southeast extension of the Salcha River - Pogo survey. Page-size color maps of most of the data are also included. The contractor's report, GPR 2002_4, gives a more detailed interpretation of the data and a more complete description of the processing.

The acetate topography included with this portfolio should be used only for generalized locations. For accurate locations, the large scale geophysical maps or the computer files should be used. The area surveyed in 2001 includes parts of the Big Delta B-1 and B-2 quadrangles and in 1999 included parts of the Big Delta B-2, B-3, B-4, C-2, C-3, C-4, D-2, D-3, and D-4 quadrangles.

Clients can request maps from this geophysical survey from the Alaska Division of Geological & Geophysical Surveys. Ordering information and available maps are listed at the end of this portfolio. Some of the products are available at DNR's Public Information Center in Anchorage. Most of the maps in this portfolio are available from DGGS. Custom plots of variations of the data can be made at any scale at the DGGS office for a reasonable fee.

Products available from this survey

Maps are available of the aeromagnetic, 7200 Hz coplanar resistivity data, and 900 Hz coplanar resistivity data. Most of the maps for the southeast extension of the Salcha River - Pogo survey were produced at 1:63,360 scale (1 inch = 1 mile, fig. 2). Aeromagnetic maps with electromagnetic (EM) anomalies were produced at 1:63,360-scale with simplified EM symbols and 1:31,680-scale (1 inch = ½ mile; fig. 3) with detailed EM symbols (1 inch = ½ mile; fig. 3). One sheet was needed to cover the area at the 1:63,360-scale and two sheets were needed to cover the area at the 1:31,680-scale. The southern sheet of the 31,680 map contains only a small amount of data.

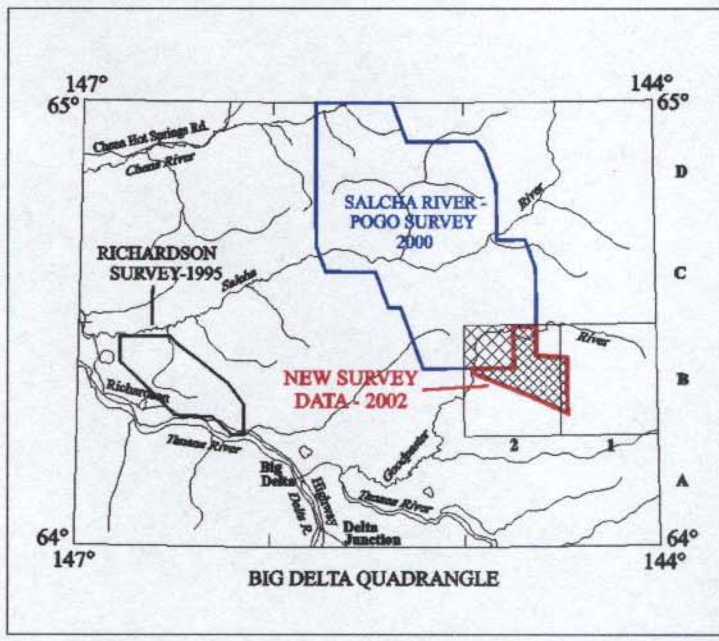


Figure 2. Index map showing area of new data acquisition (red outline) and older survey areas (blue and black outline). Data for hachured area included on the map sheets.

Gridded and vector magnetic and electromagnetic data included on the CD-ROM publications GPR 2002_2 and GPR 2002_3 included data for the old and new Pogo surveys (2000 and 2002). Line data included on GPR 2002_2 includes only the new data. All 63,360-scale maps fit on one sheet.

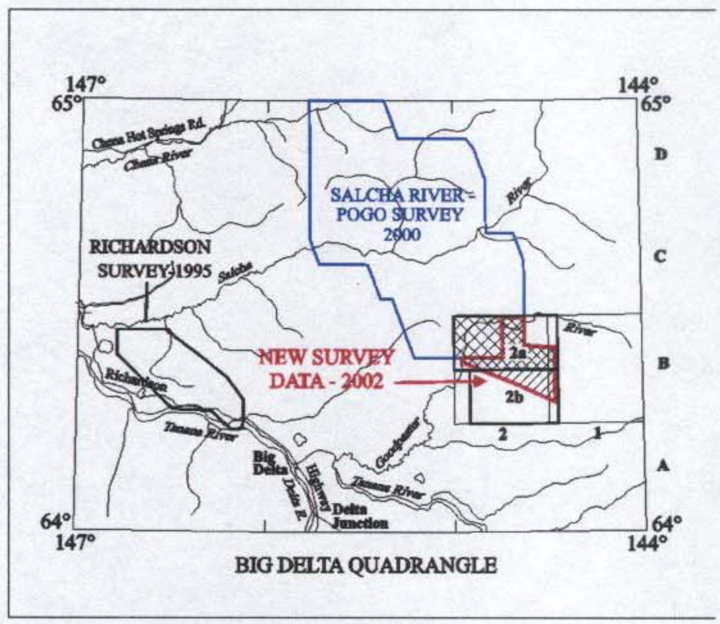


Figure 3. Index map for aeromagnetic maps available at 1:31,680 (1 inch = ½ mile) scale. Only aeromagnetic maps with detailed EM anomalies are available at this scale. New survey area (red outline) shows area of new data acquisition. Two map sheets (marked 2a and 2b) are used to cover the area at 31,680-scale.

Three CD-ROMS were produced for this survey. GPR 2002_1 contains plot files in HPGL/2 format of the 13 maps produced from this survey. The plot files were produced with Hewlett Packard Designjet 2500 printer driver version 4.61. GPR 2002_2 contains the processed line data, gridded data (magnetic data, 900 Hz, 7200 Hz, and 56,000 Hz coplanar apparent resistivity data, and a digital terrain model) with associated data contour files, and detailed electromagnetic anomalies. The processed line data is in Geosoft Ascii format, the gridded data are in both Geosoft Ascii and Geosoft binary format, and the vector files are in Autocad version 14 dxf files. GPR 2002_3 contains the gridded data in Geosoft binary format only and associated data contour files, and detailed electromagnetic anomalies.

Survey history, instrumentation, & data processing

The following indented section describing the instrumentation and processing is modified from the metadata included on the CD-ROMS.

The 2002 airborne geophysical data were acquired with a DIGHEM(V) Electromagnetic (EM) system and a Scintrex cesium magnetometer. Both were flown at a height of 100 feet. In addition, the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS350B-2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (340 degrees) survey flight lines with a spacing of one quarter mile. Tie lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

An Ashtech GG24 NAVSTAR/GLONASS Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 6) 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.

Total Field Magnetics:

The total magnetic field data were acquired with a sampling interval of 0.1 seconds, and 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, 2000, updated to August 2001) was removed from the leveled magnetic data. The aeromagnetic data were then merged with the IGRF-corrected aeromagnetic data from the Salcha River-Pogo survey (published 2000) using the line data. The merged aeromagnetic data are interpolated onto a regular 100 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.

Resistivity:

The EM inphase and quadrature data are drift corrected using base level data collected at high altitude (areas of no signal). Along-line filters are applied to the data to remove spheric spikes. The data are inspected for variations in phase, and a phase correction is applied to the data if necessary. Resistivities are then calculated from the inphase and quadrature data for all frequencies based on a pseudo-layer half-space model. Manual leveling of the inphase and quadrature of each coil pair, based on the resistivity data and comparisons to the data from the other frequencies, is performed. Automated micro-leveling is carried out in areas of low signal. The resistivity data were then merged with the resistivity data from the Salcha River-Pogo survey released (published 2000) using the line data. The resistivity data are then interpolated onto a regular 100 m grid using a modified Akima (1970) technique. The resulting grids are subjected to a 3x3 hanning filter before contouring and map production. 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. Fraser, D.C., 1978, Resistivity mapping with an airborne multicoil electromagnetic system: Geophysics, v. 43, p.144-172.

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.

Generalized information about aeromagnetic, electromagnetic, and radiometric data

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.

Figures 4a-d show the aeromagnetic data for the survey area. The high values (in nT) are purple and orange and indicate appreciably magnetic rocks. The low values are the blues and greens. Although figures 4a and 4b are both colored with purple for high values and blue for low, the number of points colored a given color varies for these figures. Variations in color schemes are used to see subtle features in the data.

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 4c and 4d show the aeromagnetic data presented respectively as "color shadow" maps where a simulated light source is shown on the three-dimensional data. The higher values appear bright like mountaintops 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). Shadow maps can enhance structures, such as faults, intrusions, and the trend of stratigraphic layers.

Resistivity data

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 coplanar resistivity data are shown in Figures 5-7. The resistivity maps are produced from the EM coplanar coil pairs, and emphasize horizontal or near horizontal units and structures. Since ground penetration correlates inversely with frequency, the 56,000 Hz reflects very near surface rocks and the 900 Hz adds the influence of deeper rocks in general. The 7200 Hz in general reflects rocks between the two extremes. However, the depth of penetration is variable depending on the resistivity of the rocks the signal is passing through.

EM anomalies are shown with both the 1:63,360 and 1:31,680 scale magnetic maps. EM anomalies are derived from the coaxial coil pairs, which emphasize vertically- or near-vertically-dipping "discrete" bedrock conductors. These EM anomalies are shown as circular symbols along flight lines with the aeromagnetic contours. On the 1:63,360 scale maps, anomalies are subdivided into those with 1) a signal strength greater than 50 siemens, 2) a signal strength less than 50 siemens, and 3) weak conductivity associated with an EM magnetite response. Questionable (or possible) anomalies are also noted.

More detailed interpretations for the electromagnetic anomalies are shown on the 1:31,680 scale aeromagnetic maps. In these maps, the EM anomaly is shown as a symbol that denotes more information about signal strength and the anomaly source than on the 1:63,360 maps. Instead of two signal strengths (greater than or less than 50 siemens) shown on the 1:63,360 maps, signal strength on the 1:31,680 maps is broken into seven subdivisions (e.g. 5-10 siemens, 1-5 siemens, etc). In addition, potential sources shown for each symbol include 1) bedrock conductors, 2) narrow bedrock conductors ("thin dike"), 3) conductive covers ("horizontal thin sheet"), 4) combination including broad conductive rock units, deep conductive weathering, and thick conductive cover, 5) edge of broad conductor, and 6) culture. This information is also available on the CD-ROMS. The project report, GPR 2002-4, gives a more detailed discussion of these EM anomalies.

DGGS PUBLICATIONS PRODUCED FOR THE SOUTHEAST EXTENSION OF THE SALCHA RIVER - POGO SURVEY

Bold font is used below to highlight the differences between the maps.

AEROMAGNETIC MAPS

GPR 2002_1_1a. Total magnetic field of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:63,360. Topography included. Full-color plot** from electronic file, 600 dpi.

GPR 2002_1_1b. Total magnetic field of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:63,360. Magnetic contours and section lines included. Full-color plot** from electronic file, 600 dpi.

GPR 2002_1_1c. Color shadow magnetic map of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:63,360. Full-color plot** from electronic file, 600 dpi.

GPR 2002_1_1d. Total magnetic field and electromagnetic anomalies of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:63,360. Magnetic contours, simplified electromagnetic anomalies, and section lines**

included. **Black and white plot** from electronic file, 600 dpi.

GPR 2002_1_2a. Total magnetic field and detailed electromagnetic anomalies of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:31,680 (parts of Big Delta B-1 and B-2 quadrangles). Magnetic contours, detailed electromagnetic anomalies, and topography included. Black and white plot** from electronic file, 600 dpi.

GPR 2002_1_2b. Total magnetic field and detailed electromagnetic anomalies of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:31,680 (parts of Big Delta B-1 and B-2 quadrangles). Magnetic contours, detailed electromagnetic anomalies, and topography included. Black and white plot** from electronic file, 600 dpi.

RESISTIVITY MAPS

GPR 2002_1_3a. 7200 Hz coplanar resistivity of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:63,360. Topography included. Full-color plot** from electronic file, 600 dpi.

GPR 2002_1_3b. 7200 Hz coplanar resistivity of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:63,360. Resistivity contours and section lines included**. **Full-color plot** from electronic file, 600 dpi.

GPR 2002_1_3c. 7200 Hz coplanar resistivity of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:63,360. Resistivity contours and section lines included. Black and white plot** from electronic file, 600 dpi

GPR 2002_1_4a. 900 Hz coplanar resistivity of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:63,360. Topography included. Full-color plot** from electronic file, 600 dpi.

GPR 2002_1_4b. 900 Hz coplanar resistivity of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:63,360. Resistivity contours and section lines included**. **Full-color plot** from electronic file, 600 dpi.

GPR 2002_1_4c. 900 Hz coplanar resistivity of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:63,360. Resistivity contours and section lines included. Black and white plot** from electronic file, 600 dpi.

DIGITAL FILES, PROJECT REPORT, PORTFOLIO, AND FLIGHT LINES

GPR 2002_1_5a. Flight lines of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska, 1 sheet, **scale 1:63,360. Topography included. Black and white plot** from electronic file, 600 dpi.

GPR 2002_1. Plot files of the airborne geophysical survey data of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska. **1 CD-ROM set**. **Contains 13 maps** listed below as GPR2002_1_xy in **prn printer file format** made with an **HP Designjet 2500 HPGL/2 printer driver v4.61. Check for printer compatability.**

GPR 2002_2. Line, gridded, and vector data of airborne geophysical survey data for the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska. **2 CD-ROM set. Line data in ASCII format; gridded data in Geosoft format; vector files in Autocad 14 dxf files.**

GPR 2002_3. Gridded and vector data of airborne geophysical survey data for the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska. **1 CD-ROM set. Gridded data in Geosoft format; vector files in Autocad 14 dxf files.**

GPR 2002_4. Project report of the airborne geophysical survey of the Salcha-River–Pogo mining area, central Alaska, by Ruth Pritchard, Fugro Airborne Surveys, 2002, scale 1:63,360.

GPR 2002_5. Portfolio of aeromagnetic and resistivity maps of the southeastern extension of Salcha River—Pogo survey, Goodpaster mining district, east-central Alaska**. Includes color and shadow maps. Maps fit 8½" x 11" sheet.**

SELECTED REFERENCES FOR THE SALCHA RIVER - POGO GEOPHYSICAL SURVEY AND NEARBY AREA

Current links to online data are provided. DGGS data is either in PDF format for reports or Mr. SID format for maps.

GEOPHYSICAL DATA

Alaska Geologic Survey, 1975, Aeromagnetic map, Big Delta Quadrangle: Alaska Division of Geological & Geophysical Surveys, Alaska Open File Report 73:
http://wwwdggs.dnr.state.ak.us/scan1/aof/text/AOF073.PDF , Report, 5 p., 128 KB.
http://wwwdggs.dnr.state.ak.us/scan1/aof/oversized/AOF073-SH1.SID Map, 1538 KB.

Barnes, David F., 1977, Preliminary Bouguer gravity map of central Alaska, U.S. Geological Survey Open-File Report, 77-0168-C.

Burns, L.E., Division of Geologic & Geophysical Surveys, CGG Geoterrex-Dighem, and Stevens Exploration Management Corp., 2000, Profile, gridded data, and section lines of 2000 geophysical survey data for the Salcha River–Pogo mining area, central Alaska: Alaska Division of Geological & Geophysical Surveys, Geophysical Report GPR 2000-21. CD-ROM. Many individual magnetic, resistivity, and radiometric maps are published by DGGS for this survey and are not repeated here.

Division of Geologic & Geophysical Surveys, Dighem, and W.G.M., Inc., 1995, CD-ROM digital archive files of 1994 survey data for Fairbanks and Richardson mining districts: Alaska Division of Geological & Geophysical Surveys, Public Data File 95-11. CD-ROM.

McConnell, Douglas L., Division of Geological & Geophysical Surveys., Dighem, and W.G.M., Inc. 1995, Project report of the Fairbanks and Richardson mining districts: Alaska Division of Geological & Geophysical Surveys, Public Data File 95-12:
http://wwwdggs.dnr.state.ak.us/scan2/pdf95/text/PDF95-12.PDF 178 p., 3944 KB.
http://wwwdggs.dnr.state.ak.us/scan2/pdf95/oversized/PDF95-12-SH1.SID Figure 4-1, Interpretation map of the Fairbanks Mining District - West Fairbanks, scale 1:63,360, 1267 KB.

Saltus, R.W., and Simmons, G.C., 1997, Composite and Merged Aeromagnetic Data for Alaska: A Website for Distribution of Gridded Data and Plot Files: U.S. Geological Survey Open File Report OFR 97-520.
http://greenwood.cr.usgs.gov/pub/open-file-reports/ofr-97-0520/alaskamag.html

GEOLOGIC INFORMATION

Bundtzen, T.K., Reger, R.D., 1977, The Richardson lineament - a structural control for gold deposits in the Richardson mining district, interior Alaska: in Short Notes on Alaskan Geology - 1977: Alaska Division of Geological & Geophysical Surveys, Geologic Report 55G:
http://wwwdggs.dnr.state.ak.us/scan1/gr/text/GR55.PDF , Report, 50 p., 1659 KB.

Burns, L.E., Newberry, R.J., Solie, D.N., 1991, Quartz normative plutonic rocks of interior Alaska and their favorability for association with gold: Alaska Division of Geological & Geophysical Surveys, Report of Investigation 91-03:
http://wwwdggs.dnr.state.ak.us/scan1/ri/text/RI91-03.PDF , Report, 71 p., 1516 KB.

http://wwwdggs.dnr.state.ak.us/scan1/ri/oversized/RI91-03-SH1.SID , Sheet 1, Plutons and sample locations, Interior Alaska scale 1:412,500, 4231 KB.
http://wwwdggs.dnr.state.ak.us/scan1/ri/oversized/RI91-03-SH2.SID Sheet 2, Calculated favorability for non-porphyry Gold, Interior Alaska, scale 1:412,500, 5348 KB.

Burns, L.E., Solie, D.N., Newberry, R.J., 1993, Digital files of geochemical analyses of plutonic rocks in east-central interior Alaska: Alaska Division of Geological & Geophysical Surveys, Public Data File 93-44: http://wwwdggs.dnr.state.ak.us/scan2/pdf93/text/PDF93-44.PDF, 58 p., 1071 KB.

Dusel-Bacon, Cynthia, and Aleinikoff, John N., 1985, Petrology and tectonic significance of augen gneiss from a belt of Mississippian granitoids in the Yukon-Tanana terrane, east-central Alaska, Geological Society of America Bulletin, vol. 96, No. 4, p. 411-425.

Dusel-Bacon, Cynthia, and Bacon, Charles R., 1984, Concordant bands of augen gneiss within metasedimentary rocks in the Big Delta C-2 Quadrangle, east-central Alaska, in Coonrad, Warren L., and Elliott, Raymond L., editors, The U.S. Geological Survey in Alaska; accomplishments during 1981: U.S. Geological Survey Circular 0868, p. 48-50.

Joesting, H.R., 1938, Mining and prospecting in the Goodpaster region: Alaska Territorial Department of Mines, Miscellaneous Report 59-02:
http://wwwdggs.dnr.state.ak.us/scan1/mr/text/MR059-02.PDF ,2 p., 395 KB.
http://wwwdggs.dnr.state.ak.us/scan1/mr/oversized/MR059-02-SH1.SID Planetable map of claims, Goodpaster Camp Fairbanks District, Alaska, scale 1:500, 2492 KB.

Liss, S.A., Wiltse, M.A., 1993, United States Geological Survey Alaska Mineral Resource Appraisal Program (AMRAP) geochemical data for Big Delta Quadrangle, Alaska: Alaska Division of Geological & Geophysical Surveys, Public Data File 93-39F:
http://wwwdggs.dnr.state.ak.us/scan2/pdf93/text/PDF93-39F.PDF 6 p., 140 KB.

Newberry, R.J., Solie, D.N, 1995, Data for plutonic rocks and associated gold deposits in Interior Alaska: Alaska Division of Geological & Geophysical Surveys, Public Data File 95-25:
http://wwwdggs.dnr.state.ak.us/scan2/pdf95/text/PDF95-25.PDF 62 p., 2479 KB.

Reed, Irving, 1937, Brief report on the Goodpaster quartz lode mining at the head of Johnson and Boulder Creeks: Alaska Territorial Department of Mines, Miscellaneous Report 59-01:
http://wwwdggs.dnr.state.ak.us/scan1/mr/text/MR059-01.PDF 1 p., 138 KB.

Rombach, Cameron, 1999, The Alaska Resource Data Files, Big Delta Quadrangle, U.S. Geological Survey Open-File Report 99-354. http://ardf.wr.usgs.gov/quads/html/BigDelta.html

Smith, T.E., Robinson, M.S., Weber, F.R., Waythomas, C.F., Reifenstuhl, R.R., 1994, Geologic map of the Upper Chena River area, eastern interior Alaska: Alaska Division of Geological & Geophysical Surveys, Professional Report 115:
http://wwwdggs.dnr.state.ak.us/scan1/pr/text/PR115.PDF 19 p., 595 KB.
http://wwwdggs.dnr.state.ak.us/scan1/pr/oversized/PR115-SH1.SID Geologic map of the Upper Chena River Area, Eastern Interior Alaska, scale 1:63,360, 12913 KB.

Solie, D.N., Burns, L.E., Newberry, R.J., 1990, Gold favorability in the Big Delta Quadrangle, Alaska, as predicted by discriminant analysis for non-porphyry granitic rocks: Alaska Division of Geological & Geophysical Surveys, Public Data File 90-13:
http://wwwdggs.dnr.state.ak.us/scan2/pdf90/text/PDF90-13.PDF 16 p., 321 KB.
http://wwwdggs.dnr.state.ak.us/scan2/pdf90/text/PDF90-13.PDF Plate 1, Map showing plutons, sample locations and K-AR ages, Big Delta Quadrangle Alaska, scale 1:250,000, 2598 KB.
http://wwwdggs.dnr.state.ak.us/scan2/pdf90/oversized/PDF90-13-SH2.SID Plate 2, Calculated Gold favorability of the Big Delta Quadrangle, Alaska, scale 1:250,000, 1342 KB.

Szumigala, D.J., 1999, Map of prospective mineral areas and significant mineral resources of Alaska: Alaska Division of Geological & Geophysical Surveys Miscellaneous Publication 38, 1 sheet, scale 1:2,500,000.

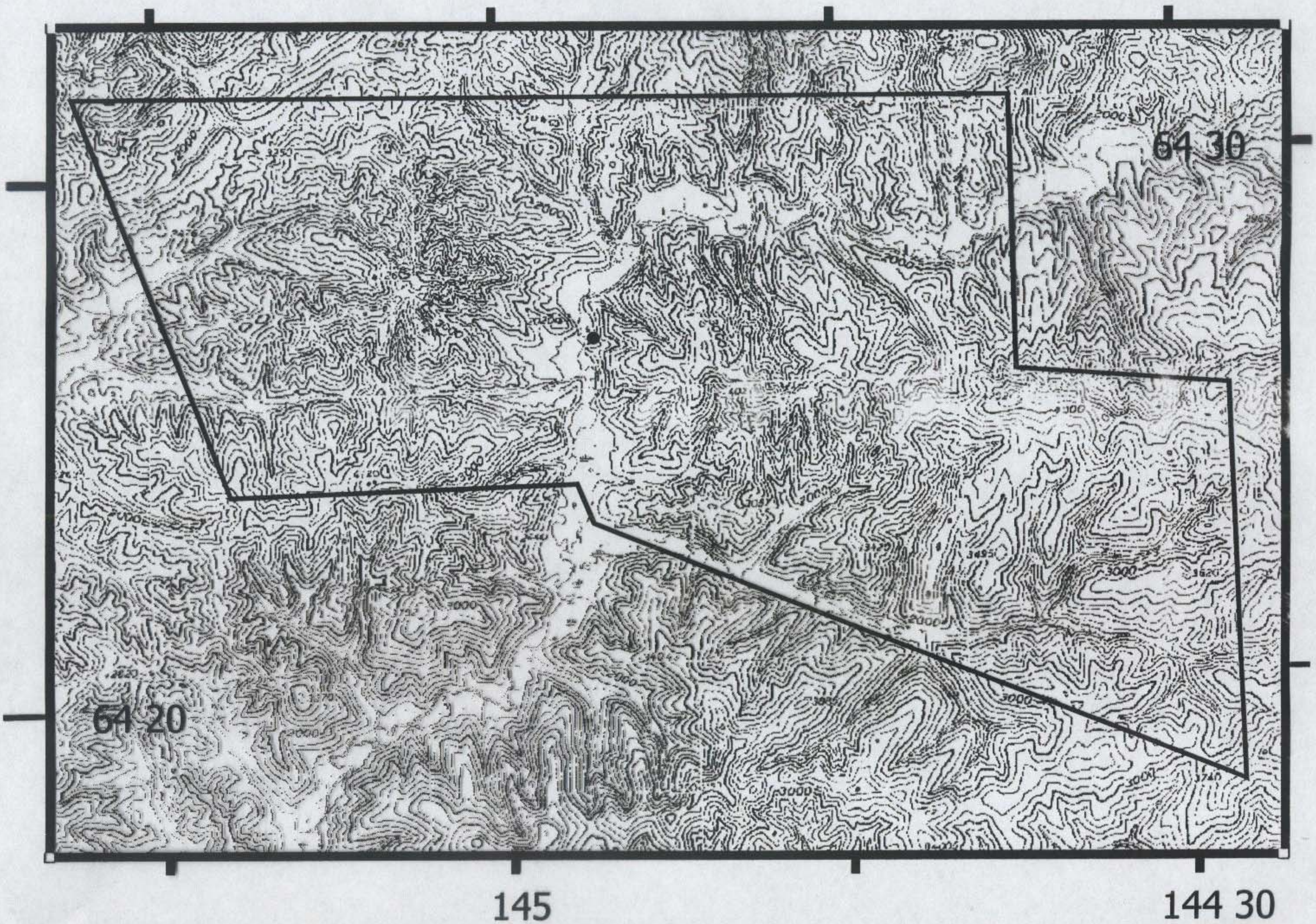
Szumigala, D.J., and Swainbank, R.C., 1998, Map of selected mines, coalfields, and significant mineral resources of Alaska: Alaska Division of Geological & Geophysical Surveys Miscellaneous Publication 33, 1 sheet, scale 1:250,000.

Werdon, M.B., Newberry, R.J., Szumigala, D.J., and Burns, L.E., 2001, Reconnaissance bedrock geology of the Pogo area, Big Delta B-2 and B-3 Quadrangles, Alaska: Alaska Division of Geological & Geophysical Surveys Preliminary Investigative Report PIR 2001-5, 1 sheet, scale 63,360.

Wiltse, M.A., 1991, National uranium resource evaluation (NURE) geochemical data for stream and lake sediment samples, Alaska, Big Delta Quadrangle: Alaska Division of Geological & Geophysical Surveys, Public Data File 91-22G: http://wwwdggs.dnr.state.ak.us/scan2/pdf91/text/PDF91-22G.PDF 33 p., 613 KB.

Wilson, Frederic H., Dover, James H. , Bradley, Dwight C. , Weber, Florence R., Bundtzen, Thomas K. , and J. Haeussler. Peter J., 1998, Geologic Map of Central (Interior) Alaska: U.S. Geological Survey Open-File Report OF 98-133-A. http://wrgis.wr.usgs.gov/open-file/of98-133-a/

THIS PAGE INTENDED TO BE PRINTED ON CLEAR ACETATE/MYLAR



Topography for GPR2002_5. This topography is to only be used as a general reference. Outline shows approximate area of figures. Black dot shows the location of the Pogo mine.

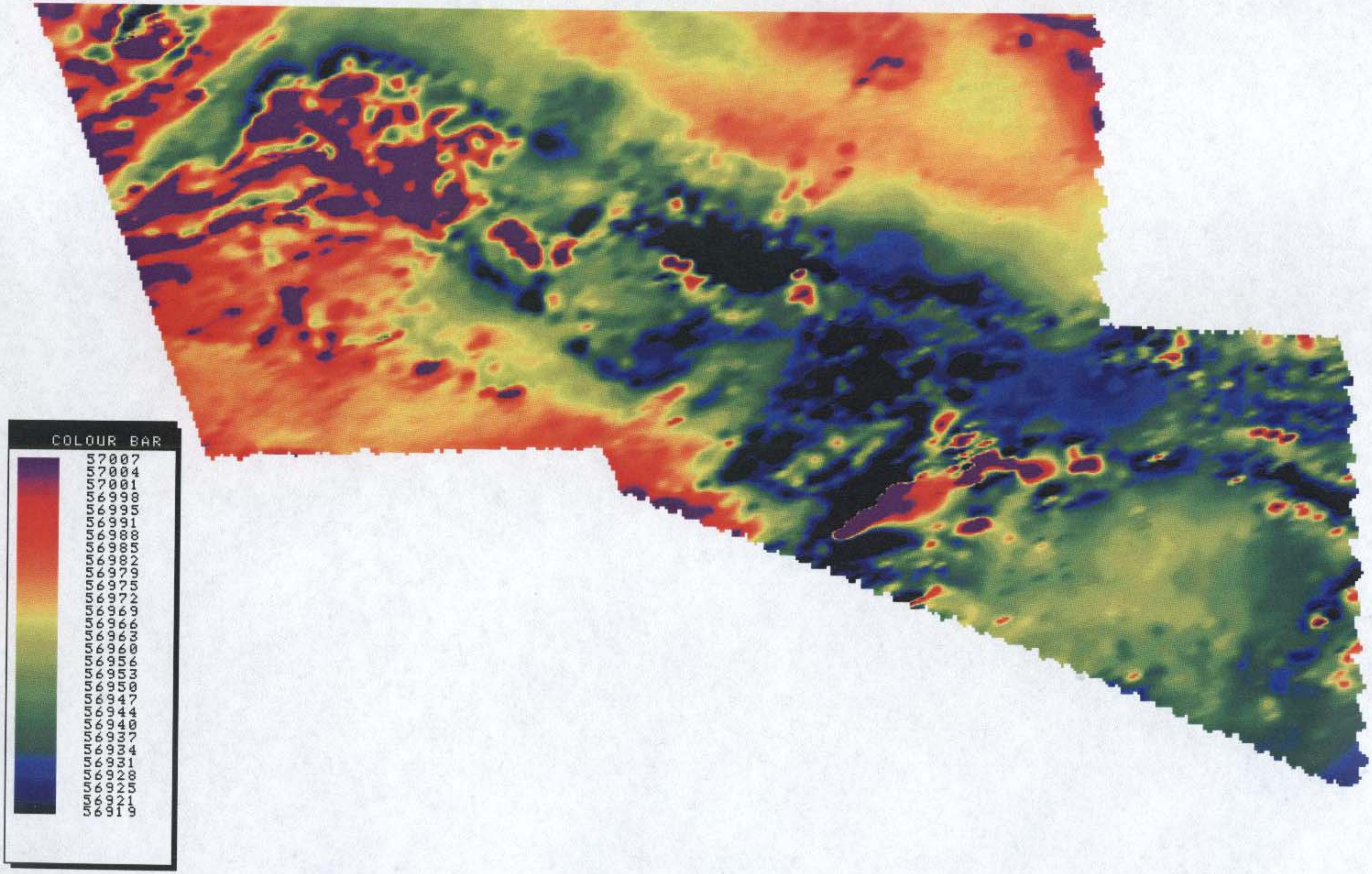


Figure 4a. Total field magnetics of the southeastern extension of the Salcha River-Pogo survey area, Goodpaster mining district. Magnetic units are in nT. Color scheme is a linear distribution except that five percent of the values at both the high and low ends of the data are assigned to the highest and lowest color respectively. The data range of the intermediate ninety percent of the values is equally divided by the number of remaining colors.

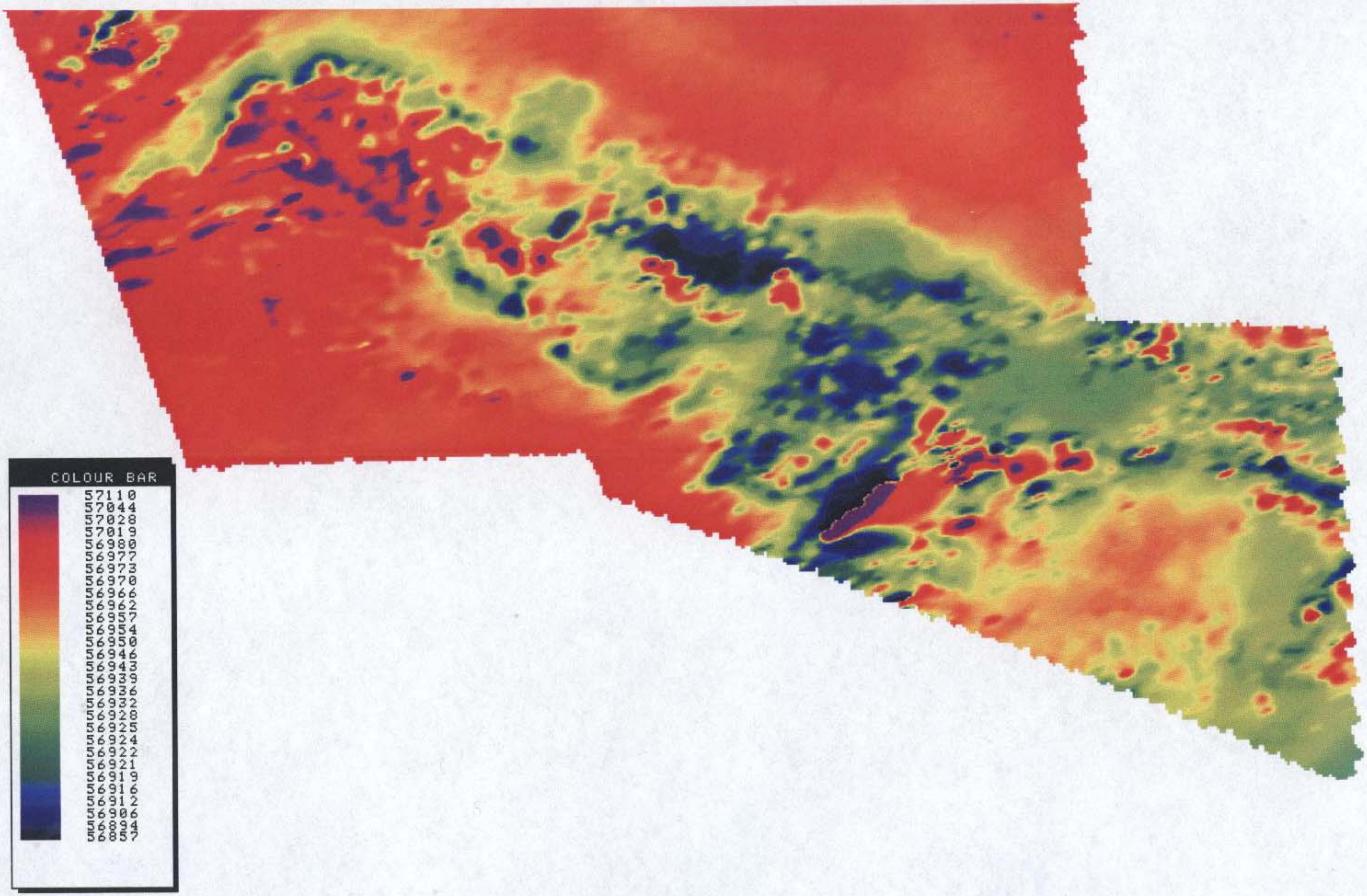


Figure 4b. Total field magnetics of the southeastern extension of the Salcha River-Pogo survey area, Goodpaster mining district. Magnetic units are in nT. Color scheme is an equal area distribution. In this techniques the image contains equal or nearly equal areas of each color. Unfortunately the software available to display the figure for publication may not show all subtleties of the colors.

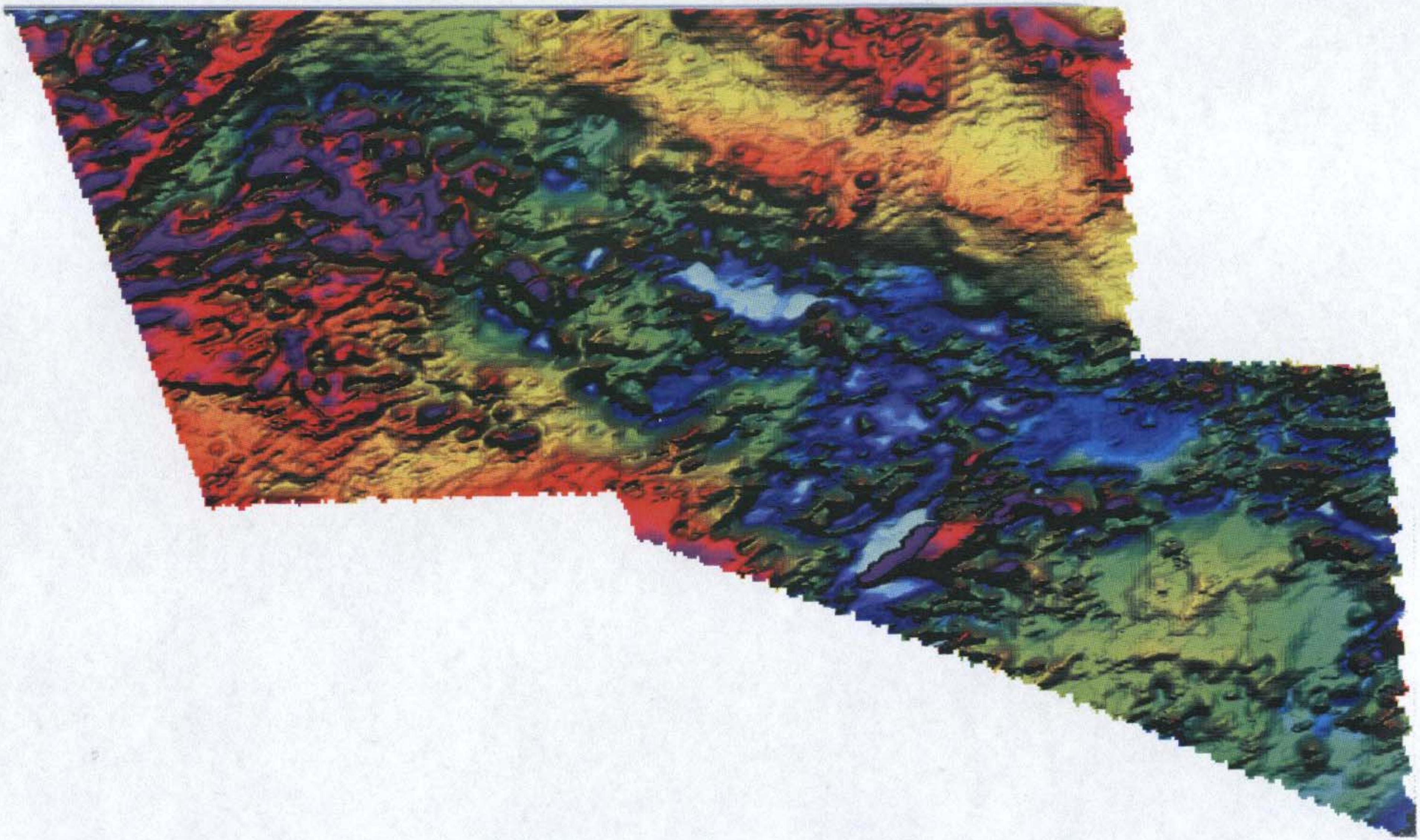


Figure 4c. Color shadow map of the total field magnetics of the southeastern extension of the Salcha River-Pogo survey area, Goodpaster mining district. Illumination is from the north. The northern boundary of this image is further north than that shown in most of the other figures.

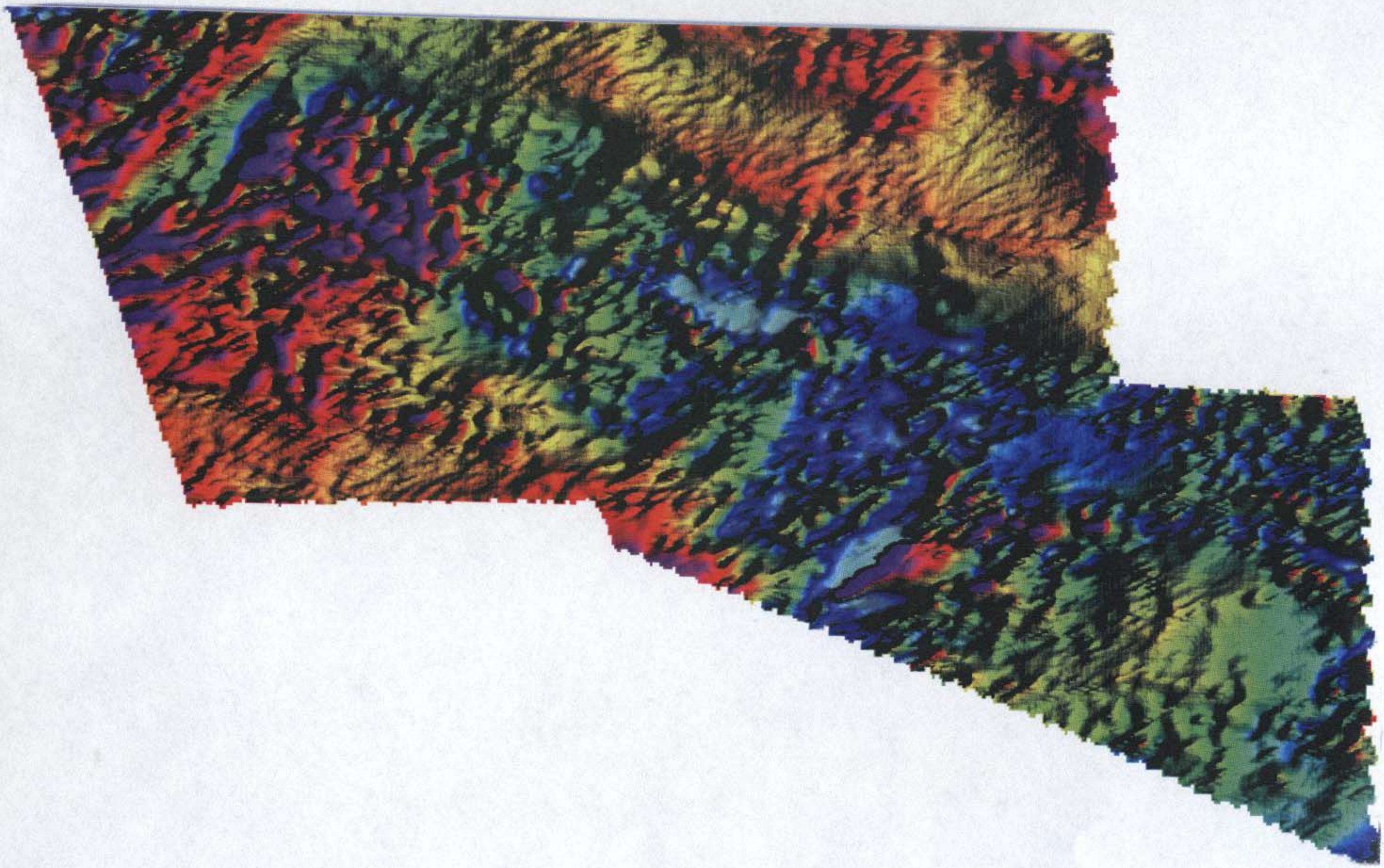


Figure 4d. Color shadow map of the total field magnetics of the southeastern extension of the Salcha River-Pogo survey area, Goodpaster mining district. Illumination is from the east. The northern boundary of this image is further north than that shown in most of the other figures.

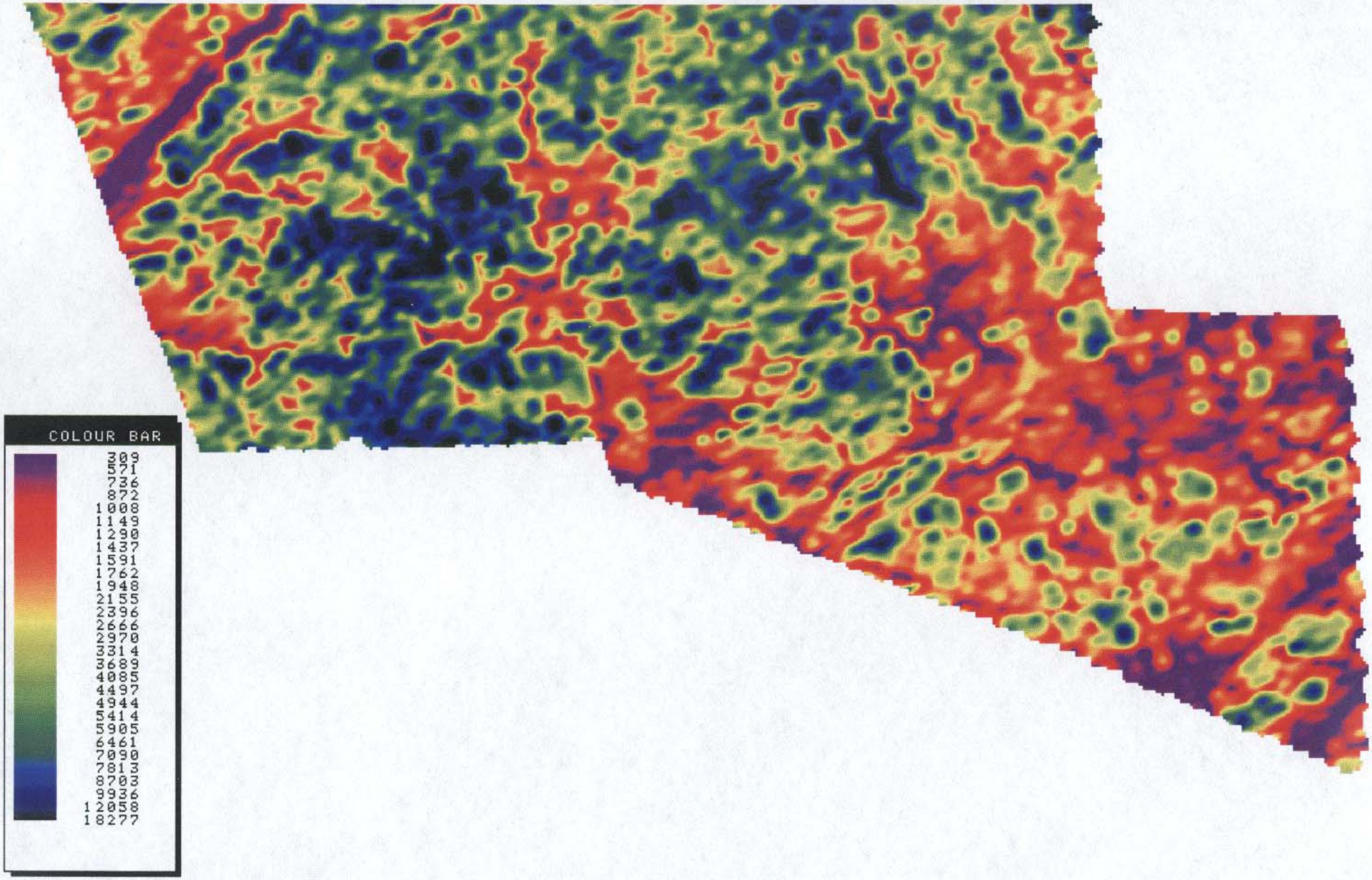


Figure 5. 56,000 Hz coplanar resistivity of the southeastern extension of the Salcha River-Pogo survey area, Goodpaster mining district. Resistivity units in ohm-m. Conductive units have low numbers and are shown in purple and orange on this map. An equal area color scheme is used.

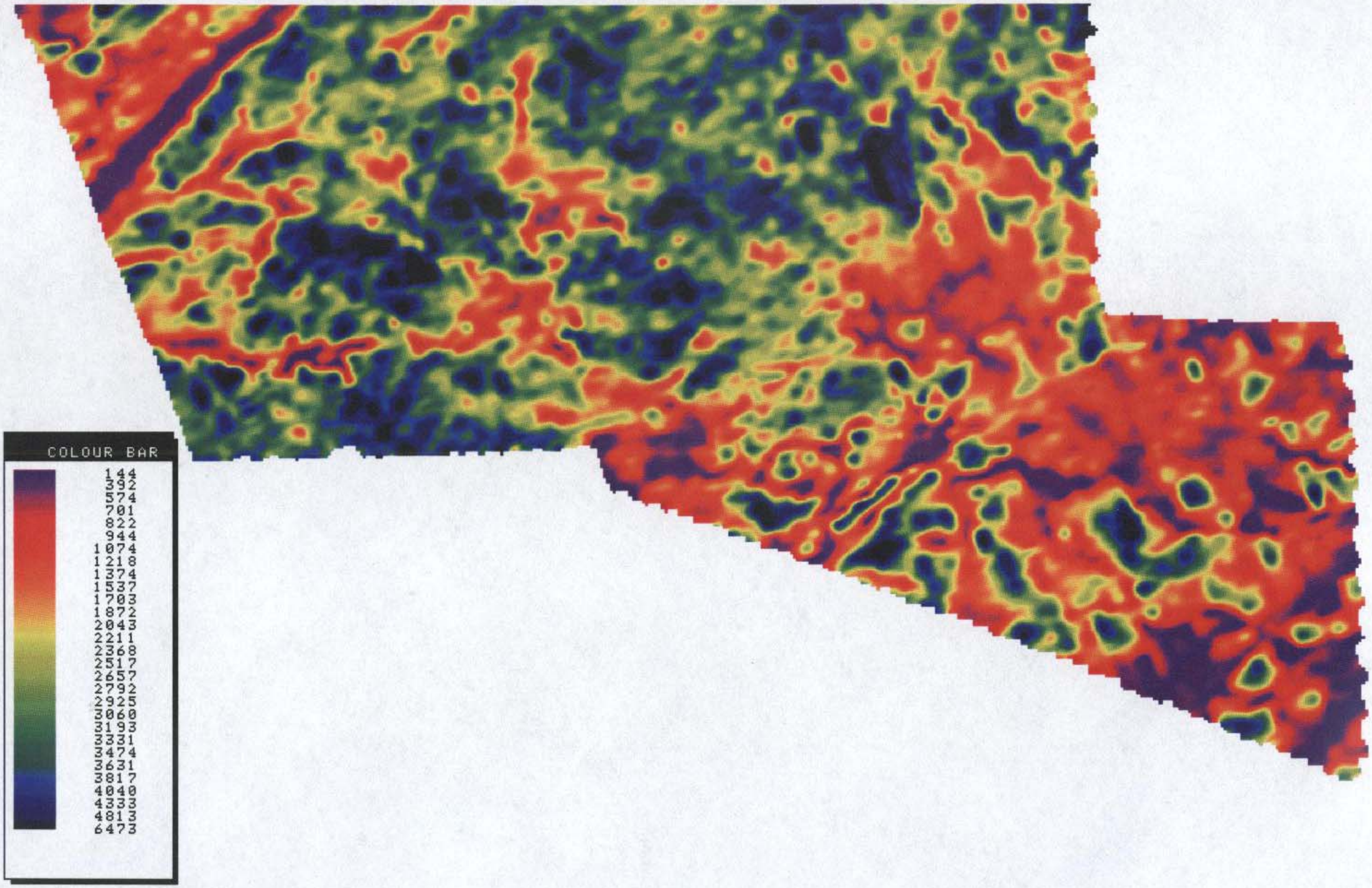


Figure 6. 7,200 Hz coplanar resistivity of the southeastern extension of the Salcha River-Pogo survey area, Goodpaster mining district. Resistivity units in ohm-m. Conductive units have low numbers and are shown in purple and orange on this map. An equal area color scheme is used.

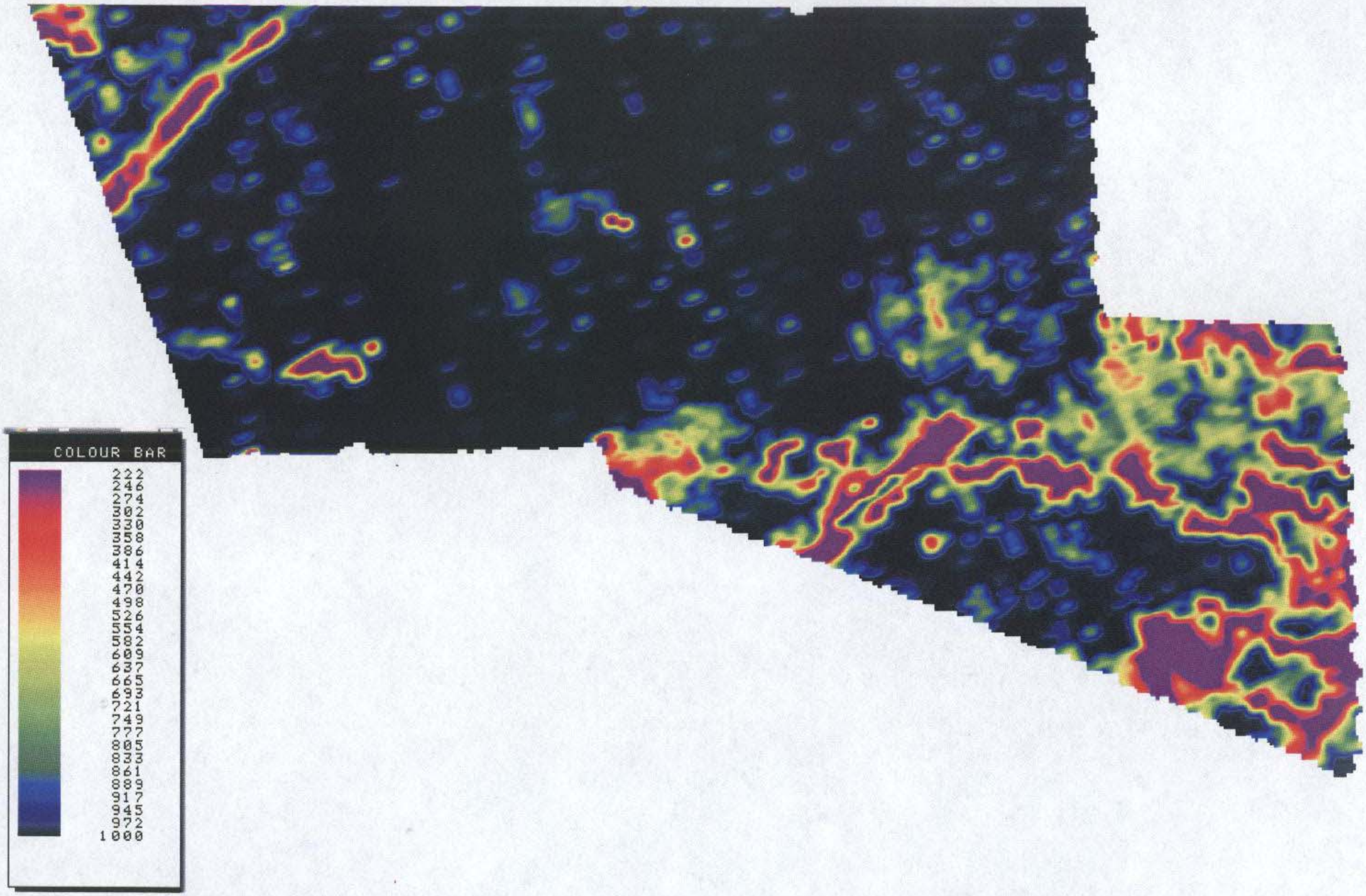


Figure 7. 900 Hz coplanar resistivity of the southeastern extension of the Salcha River-Pogo survey area, Goodpaster mining district. Resistivity units in ohm-m. Conductive units have low numbers and are shown in purple and orange on this map. A linear color scheme with five percent saturation in both high and low is used. See Figure 4b for more color scheme explanation.