

**SOUTHERN DELTA RIVER ELECTROMAGNETIC AND MAGNETIC AIRBORNE  
GEOPHYSICAL SURVEY DATA COMPILATION**

Burns, L.E., Graham, G.R.C., Barefoot, J.D., Fugro Airborne Surveys, and Stevens Exploration Management Corp.

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DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS



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# **SOUTHERN DELTA RIVER ELECTROMAGNETIC AND MAGNETIC AIRBORNE GEOPHYSICAL SURVEY DATA COMPILATION**

Burns, L.E.<sup>1</sup>, Graham, G.R.C.<sup>1</sup>, Barefoot, J.D.<sup>1</sup>, Fugro Airborne Surveys, and Stevens Exploration Management Corp.

## **ABSTRACT**

The Southern Delta River electromagnetic and magnetic airborne geophysical survey is located in interior Alaska in the Delta River mining district, about 200 kilometers southeast of Fairbanks. Frequency domain electromagnetic and magnetic data were collected with the DIGHEM<sup>V</sup> system from August to September 2002. A total of 2,902.8 line kilometers were collected covering 1001 square kilometers. Line spacing was 400 meters (m). Data were collected 30 m above the ground surface from a helicopter towed sensor platform (“bird”) on a 30 m long line.

## **PURPOSE**

This airborne geophysical survey is part of a program to acquire data on Alaska’s most promising mineral belts and districts. The information acquired is aimed at catalyzing new private-sector exploration, discovery, and ultimate development and production. The purpose of the survey was to map the magnetic and conductive properties of the survey area. The survey area contains prospects for lode gold, placer gold, and Ni-Cu-PGE deposits. Other gold and base-metal anomalies, altered zones, favorable lithologies, and structural zones are known to exist throughout the survey area.

## **SURVEY OVERVIEW DESCRIPTION**

This document provides an overview of the survey and includes text and figures of select primary and derivative products of this survey. A table of digital data packages available for download is provided to assist users in data selection. For reference, a catalog of the available maps is presented in reduced resolution. Please consult the metadata, project report, and digital data packages for more information and data.

## **ACKNOWLEDGMENTS**

Funding was provided by the U.S. Department of Interior Bureau of Land Management (BLM).

## **KNOWN PROBLEMS**

The digital data for this compilation is from the 2002 Southern Delta River survey by Fugro Airborne Surveys and Stevens Exploration Management Corp. However, the Southern Delta River contract specified that print maps sheets would also depict previously acquired data from the Nikolai airborne geophysical survey (1995 by Aerodat, Inc.). Merged data grids of several adjacent surveys in this region are available in DGGS publication DDS-12.

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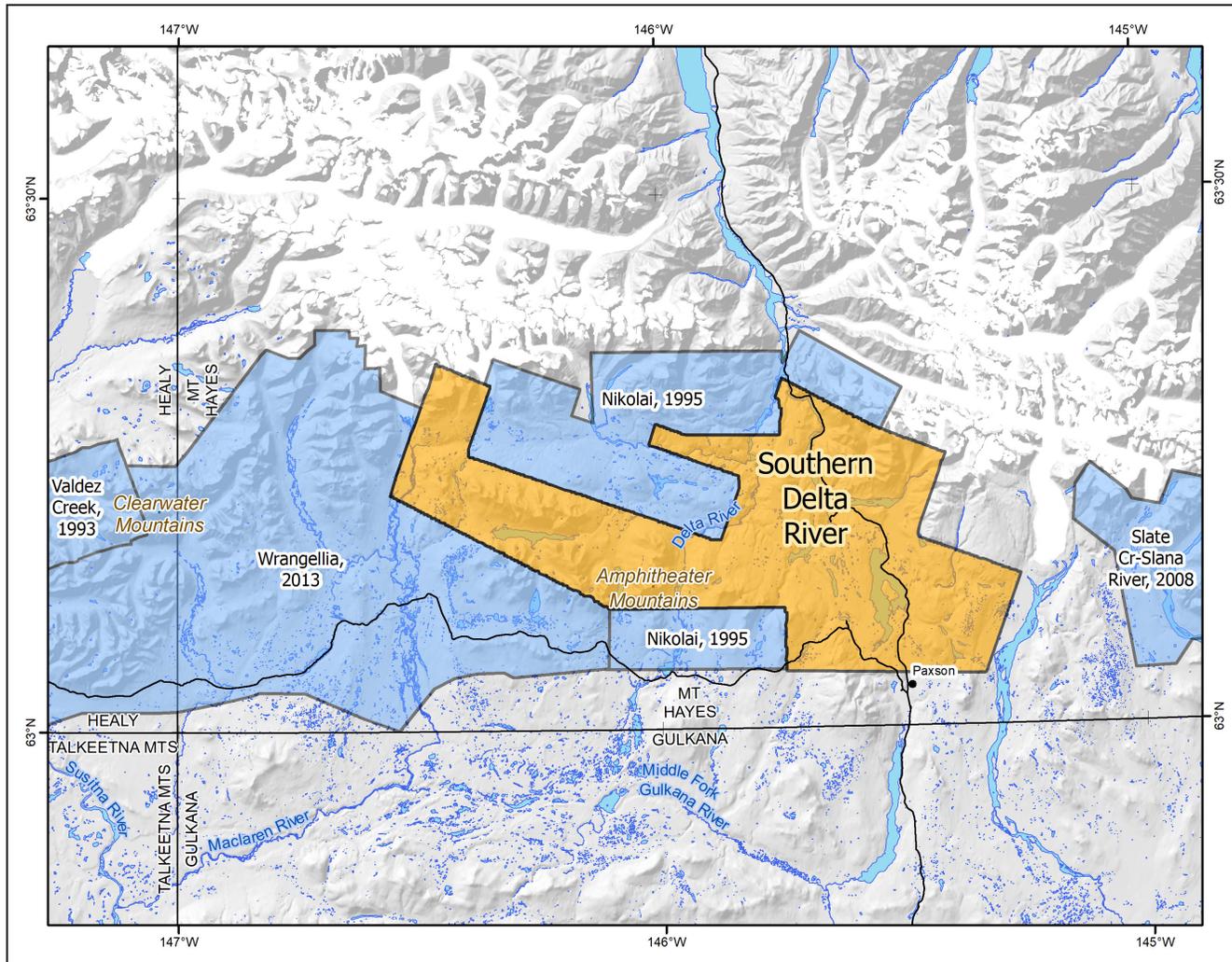
<sup>1</sup> Alaska Division of Geological & Geophysical Surveys, 3354 College Road, Fairbanks, Alaska 99709-3707

**AVAILABLE DATA**

<b>Data Type</b>	<b>Provider</b>	<b>Description</b>
ascii_data	contractor	ASCII format line data, other ASCII data
databases_geosoft	contractor	Geosoft format database of final line data, other Geosoft format databases
documents	contractor and DGGS	Project and field reports, survey background information, gridded data explanations, other documentation
grids_ermapper	contractor and DGGS	Geographically registered gridded data, ER Mapper ERS format
grids_geosoft	contractor and DGGS	Geosoft-format grids, these grids can be viewed in ESRI ArcMap using a free plugin from Geosoft or the free viewer available from Geosoft
images_registered	DGGS	GeoTiff format images of all gridded data
kmz	DGGS	keyhole markup language (kml) kmz archive files of project data. Viewable in Google Earth and other compatible programs
maps_pdf_format	contractor and DGGS	Printable maps in pdf format
maps_prn_format	contractor	Printable maps in HPGL/2 printer file format with extension .prn
profiles_stacked	contractor	Distance-based profiles of the digitally recorded geophysical data are generated and plotted at an appropriate scale. The profiles display electromagnetic anomalies with their respective interpretive symbols. Printable in pdf format
vector_data	contractor and DGGS	Line path, data contours, and survey boundary in ESRI shapefile (SHP) format, ESRI Geodatabase format, and/or AutoCAD dxf format
video_flightpath	contractor	Survey flight path downward facing video

**REFERENCES**

- 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, n. 4, p. 589–602.
- Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2003, Line, grid, and vector data of airborne geophysical survey data for the southern Delta River area, east-central Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2003-6, 1 DVD. <http://doi.org/10.14509/2973>
- Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2003, Plot files of the airborne geophysical survey data of the southern Delta River area, east-central Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2003-5, 1 DVD. <http://doi.org/10.14509/2904>
- Burns, L.E., and Clautice, K.H., 2003, Portfolio of aeromagnetic and resistivity maps of the southern Delta River area, east-central Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2003-8, 15 p. <http://doi.org/10.14509/2975>
- Fraser, D.C., 1978, Resistivity mapping with an airborne multicoil electromagnetic system: *Geophysics*, v. 43, p. 144-172.
- Pritchard, R.A., and Fugro Airborne Surveys, 2003, Project report of the airborne geophysical survey for the southern Delta River area, east-central Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2003-7, 252 p., 2 sheets, scale 1:63,360. <http://doi.org/10.14509/2974>



**Figure 1.** Southern Delta River electromagnetic and magnetic airborne geophysical survey location shown in interior Alaska (inset). Southern Delta River survey area shown with adjacent DGGs geophysical surveys, landmarks, relevant 1:250,000-scale quadrangle boundaries, mountain ranges, rivers, glaciers, and elevation hillshade.

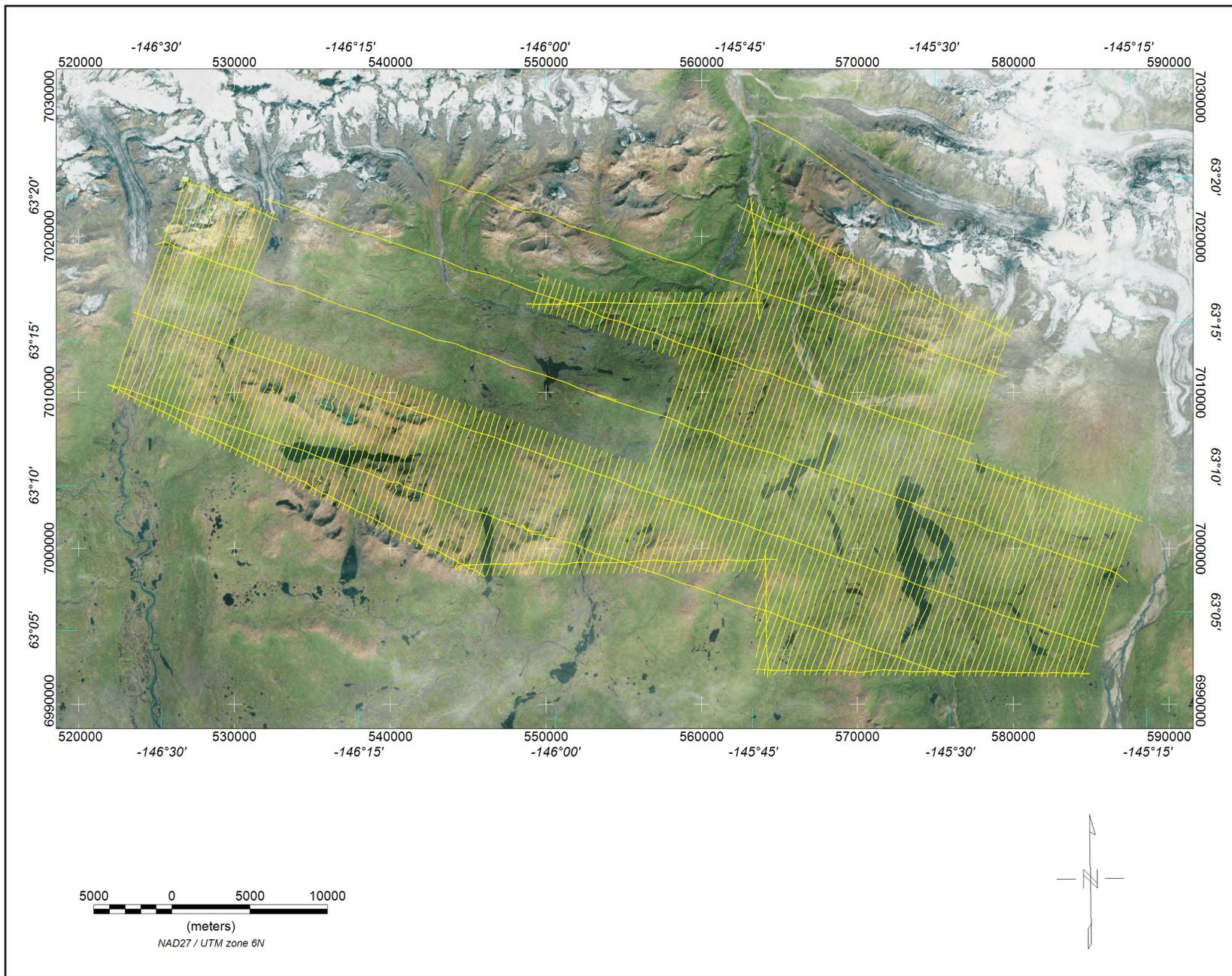
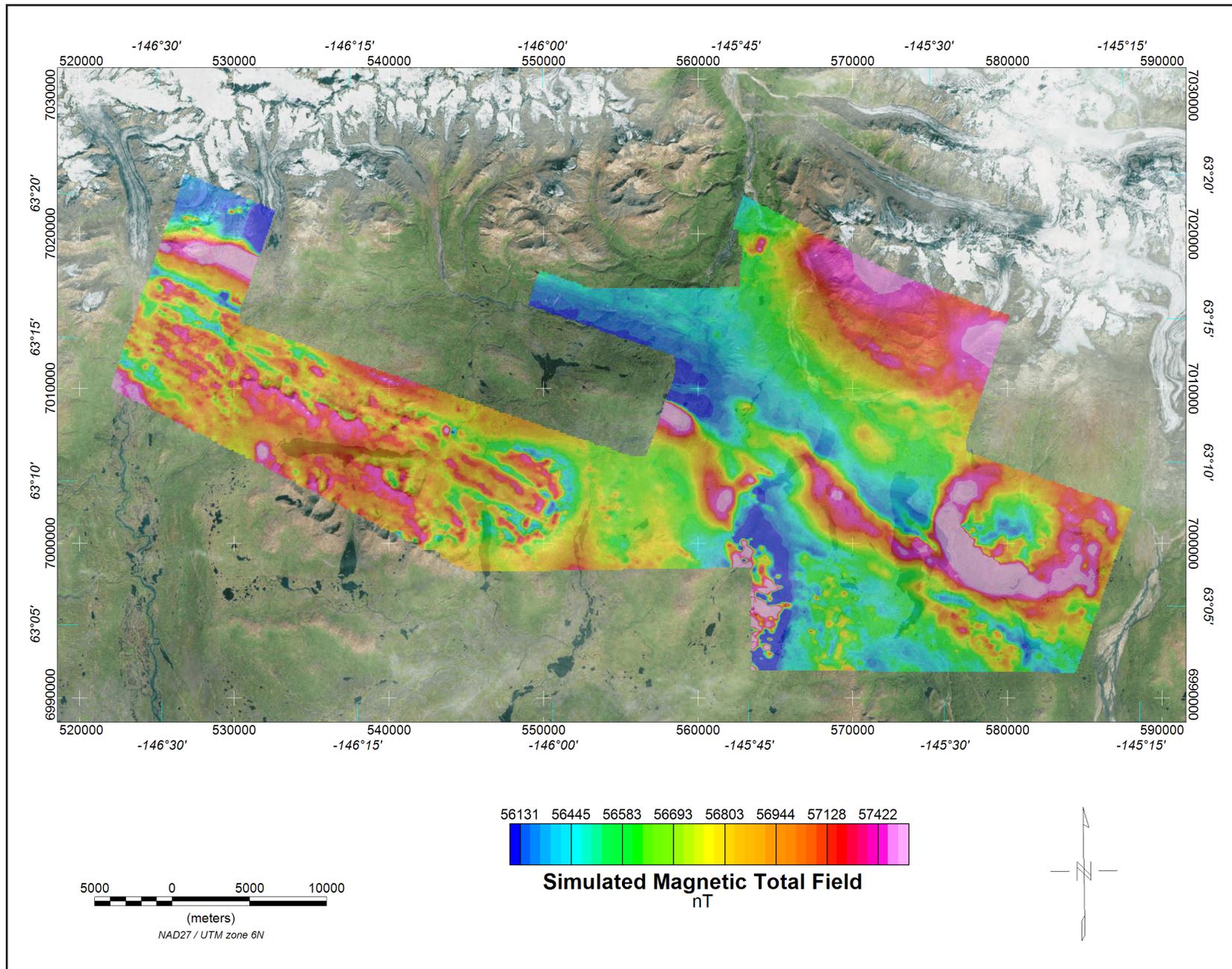
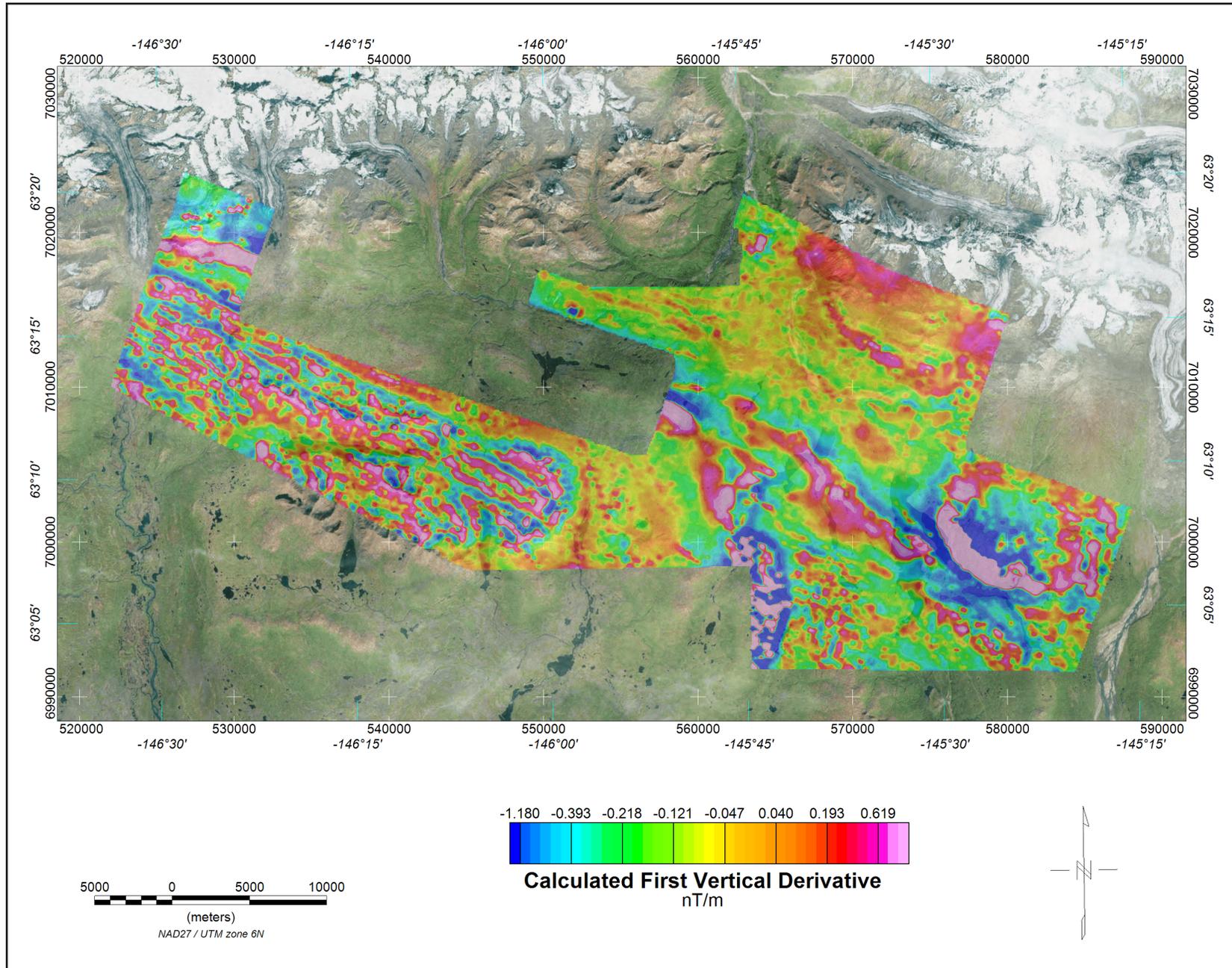


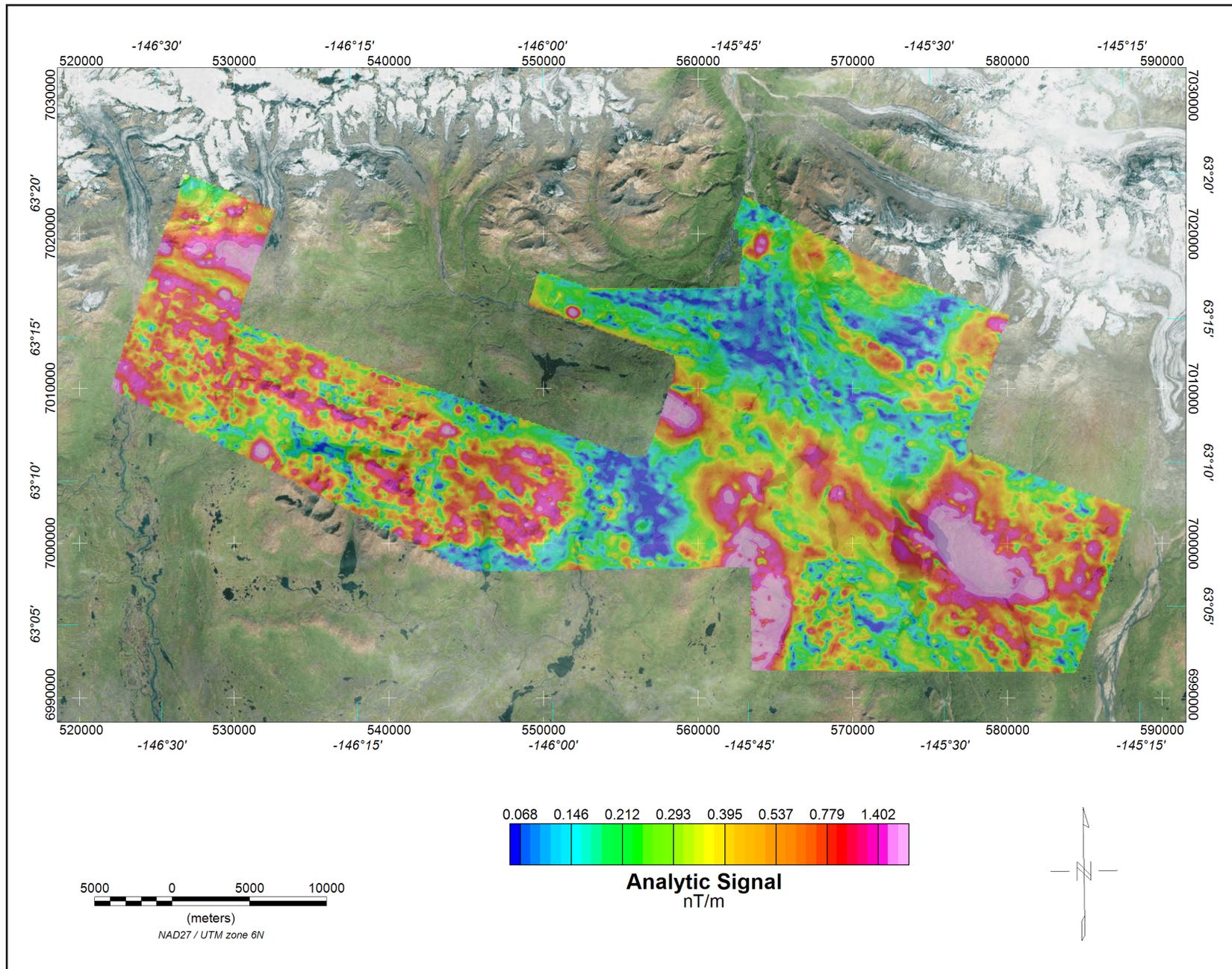
Figure 2. Flight path with orthometric image.



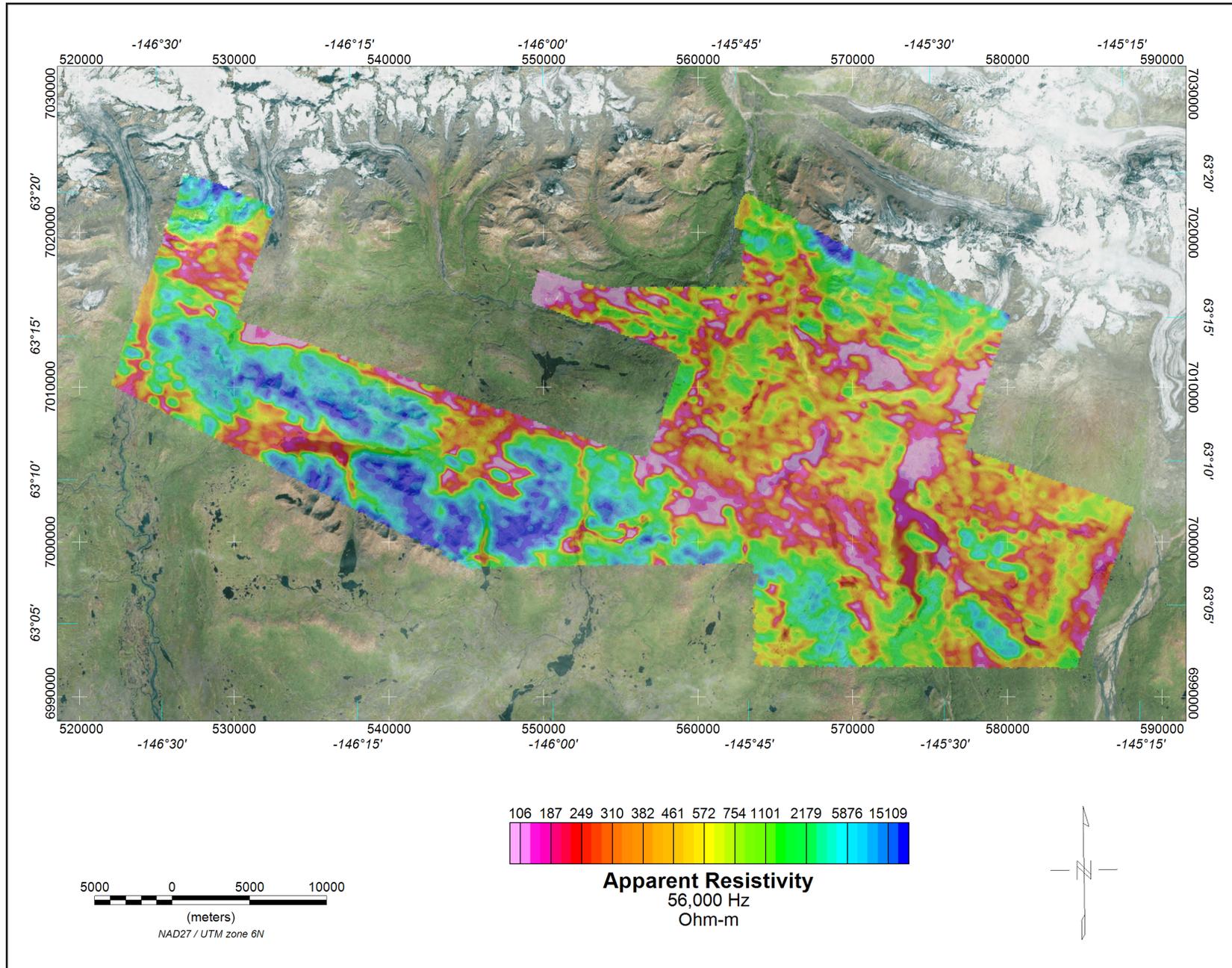
**Figure 3.** Simulated magnetic total field grid with orthometric image. The simulated magnetic total field data were created using digitally recorded data from a Scintrex cesium magnetometer. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtracting the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2000, updated to August 2002), (3) leveled to the tie line data, (4) a constant value of approximately 57,000 nT was added to all data, and (5) interpolated onto a regular 100 m grid using a modified Akima (1970) technique.



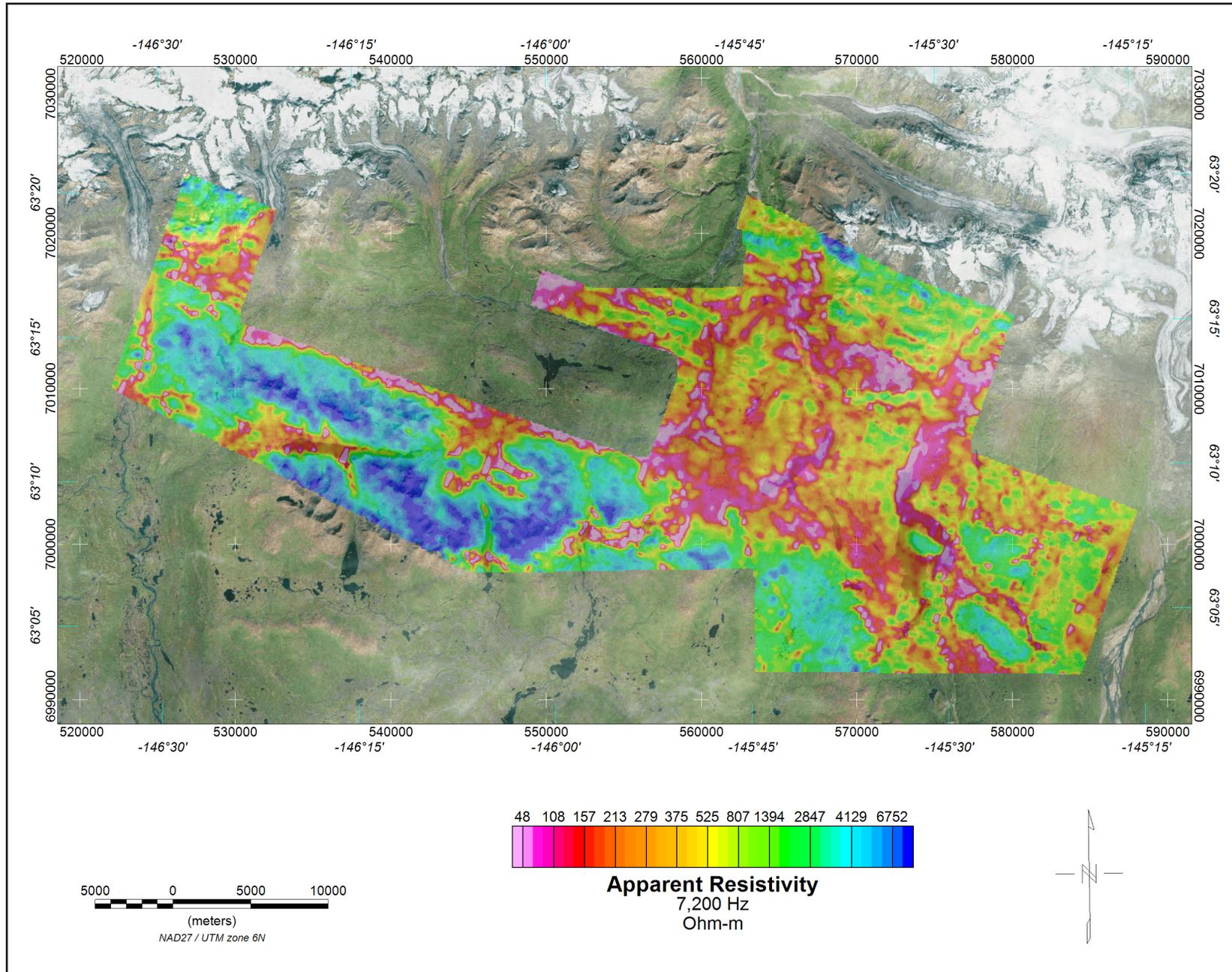
**Figure 4.** Calculated first vertical derivative grid with orthometric image. The first vertical derivative grid was calculated from the diurnally-corrected, IGRF-corrected total magnetic field grid using a FFT base frequency domain filtering algorithm. The resulting first vertical derivative grid provides better definition and resolution of near-surface magnetic units and helps to identify weak magnetic features that may not be evident on the total field data.



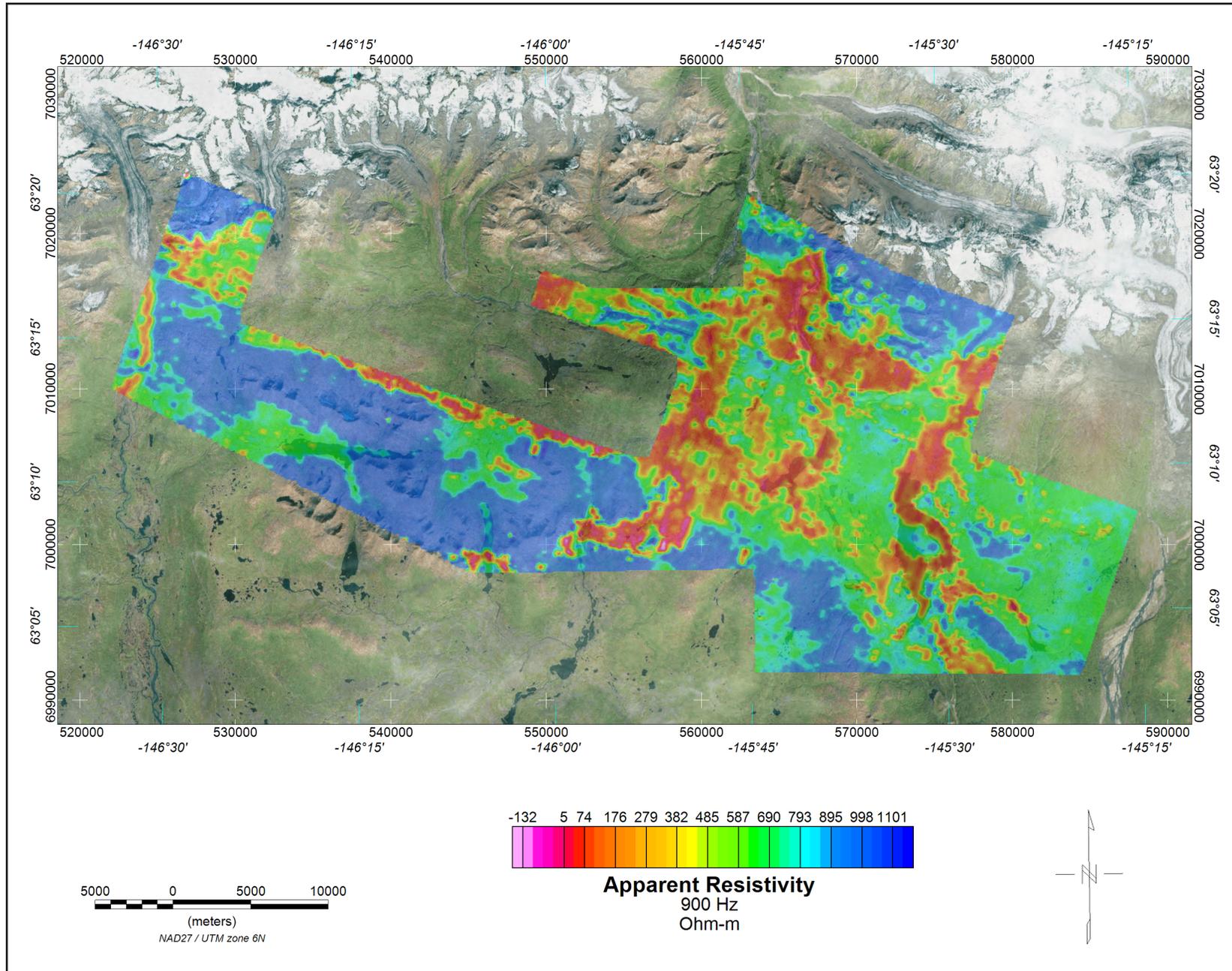
**Figure 5.** Analytic signal grid with orthometric image. Analytic signal is the total amplitude of all directions of magnetic gradient calculated from the sum of the squares of the three orthogonal gradients. Mapped highs in the calculated analytic signal of magnetic parameter locate the anomalous source body edges and corners (such as contacts, fault/shear zones, etc.). Analytic signal maxima are located directly over faults and contacts, regardless of structural dip, and independent of the direction of the induced and/or remanent magnetizations.



**Figure 6.** 56,000 Hz coplanar apparent resistivity grid with orthometric image. The DIGHEM<sup>V</sup> EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1,000 and 5,500 Hz while three horizontal coplanar coil-pairs operated at 900, 7,200, and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 56,000 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 100 m grid using a modified Akima (1970) technique.



**Figure 7.** 7,200 Hz coplanar apparent resistivity grid with orthometric image. The DIGHEM<sup>®</sup> EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1,000 and 5,500 Hz while three horizontal coplanar coil-pairs operated at 900, 7,200, and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 7,200 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 100 m grid using a modified Akima (1970) technique.



**Figure 8.** 900 Hz coplanar apparent resistivity grid with orthometric image. The DIGHEM<sup>Y</sup> EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1,000 and 5,500 Hz while three horizontal coplanar coil-pairs operated at 900, 7,200, and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 900 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 100 m grid using a modified Akima (1970) technique.

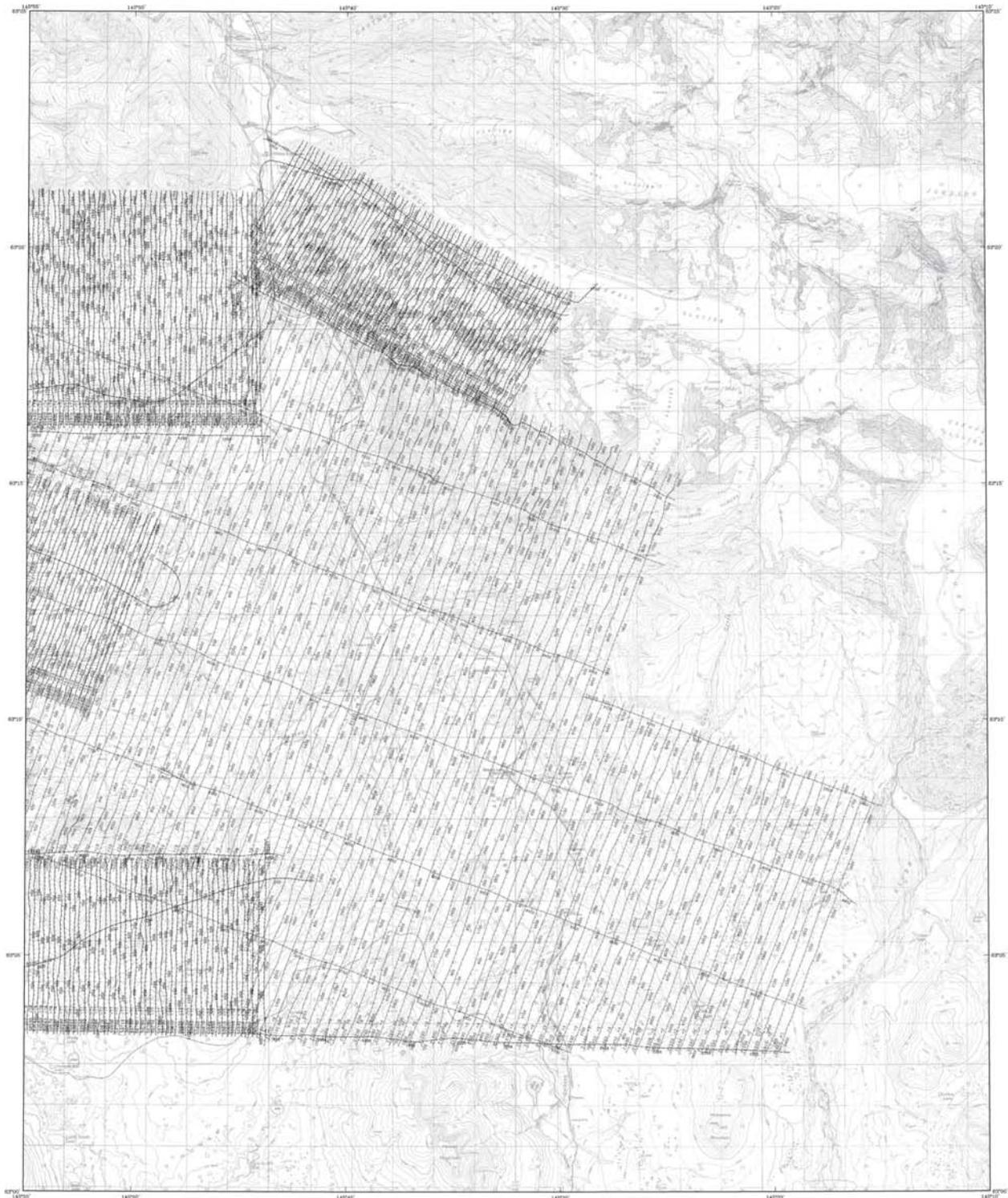
**Table 1.** Copies of the following maps are included at the end of this booklet. The low-resolution, page-size maps included in this booklet are intended to be used as a search tool and are not the final product. Large-scale, full-resolution versions of each map are available to download on this publication's citation page: <http://doi.org/10.14509/30229>

Map Title	Description
southerndeltariver_flightlines_topo_map_1of2.pdf	flightlines with topographic base map
southerndeltariver_flightlines_topo_map_2of2.pdf	flightlines with topographic base map
southerndeltariver_sim_magtf_topo_map_1of2.pdf	simulated magnetic total field grid with topographic base map
southerndeltariver_sim_magtf_topo_map_2of2.pdf	simulated magnetic total field grid with topographic base map
southerndeltariver_sim_magtf_contours_plss_map_1of2.pdf	simulated magnetic total field grid with data contours and public land survey system base layer
southerndeltariver_sim_magtf_contours_plss_map_2of2.pdf	simulated magnetic total field grid with data contours and public land survey system base layer
southerndeltariver_sim_magtf_shaded_plss_map_1of2.pdf	color shaded simulated total magnetic field grid with public land survey system base layer
southerndeltariver_sim_magtf_shaded_plss_map_2of2.pdf	color shaded simulated total magnetic field grid with public land survey system base layer
southerndeltariver_res7200hz_topo_map_1of2.pdf	7,200 Hz apparent resistivity grid with topographic base map
southerndeltariver_res7200hz_topo_map_2of2.pdf	7,200 Hz apparent resistivity grid with topographic base map
southerndeltariver_res7200hz_contours_plss_map_1of2.pdf	7,200 Hz apparent resistivity grid with data contours and public land survey system base layer
southerndeltariver_res7200hz_contours_plss_map_2of2.pdf	7,200 Hz apparent resistivity grid with data contours and public land survey system base layer
southerndeltariver_res7200hz_bw_contours_plss_map_1of2.pdf	black and white 7,200 Hz apparent resistivity grid with data contours and public land survey system base layer
southerndeltariver_res7200hz_bw_contours_plss_map_2of2.pdf	black and white 7,200 Hz apparent resistivity grid with data contours and public land survey system base layer
southerndeltariver_res900hz_topo_map_1of2.pdf	900 Hz apparent resistivity grid with topographic base map
southerndeltariver_res900hz_topo_map_2of2.pdf	901 Hz apparent resistivity grid with topographic base map
southerndeltariver_res900hz_contours_plss_map_1of2.pdf	900 Hz apparent resistivity grid with data contours and public land survey system base layer
southerndeltariver_res900hz_contours_plss_map_2of2.pdf	901 Hz apparent resistivity grid with data contours and public land survey system base layer

**Table 1, continued.** Copies of the following maps are included at the end of this booklet. The low-resolution, page-size maps included in this booklet are intended to be used as a search tool and are not the final product. Large-scale, full-resolution versions of each map are available to download on this publication's citation page: <http://doi.org/10.14509/30229>

Map Title	Description
southerndeltariver_res900hz_bw_contours_plss_map_1of2.pdf	black and white 900 Hz apparent resistivity grid with data contours and public land survey system base layer
southerndeltariver_res900hz_bw_contours_plss_map_2of2.pdf	black and white 900 Hz apparent resistivity grid with data contours and public land survey system base layer
southerndeltariver_emanomalies_sim_magtf_contours_plss_map_1of2.pdf	em anomalies with simulated total magnetic field grid data contours and public land survey system base layer
southerndeltariver_emanomalies_sim_magtf_contours_plss_map_2of2.pdf	em anomalies with simulated total magnetic field grid data contours and public land survey system base layer
southerndeltariver_emanomalies_sim_magtf_contours_detailed_topo_map_1of7.pdf	detailed em anomalies with simulated total magnetic field grid data contours and topographic base map
southerndeltariver_emanomalies_sim_magtf_contours_detailed_topo_map_2of7.pdf	detailed em anomalies with simulated total magnetic field grid data contours and topographic base map
southerndeltariver_emanomalies_sim_magtf_contours_detailed_topo_map_3of7.pdf	detailed em anomalies with simulated total magnetic field grid data contours and topographic base map
southerndeltariver_emanomalies_sim_magtf_contours_detailed_topo_map_4of7.pdf	detailed em anomalies with simulated total magnetic field grid data contours and topographic base map
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southerndeltariver_emanomalies_sim_magtf_contours_detailed_topo_map_6of7.pdf	detailed em anomalies with simulated total magnetic field grid data contours and topographic base map
southerndeltariver_emanomalies_sim_magtf_contours_detailed_topo_map_7of7.pdf	detailed em anomalies with simulated total magnetic field grid data contours and topographic base map
southerndeltariver_interpretation_plss_map_1of2.pdf	interpretation with public land survey system base layer
southerndeltariver_interpretation_plss_map_2of2.pdf	interpretation with public land survey system base layer
southerndeltariver_dem_contours_plss_map_1of2.pdf	digital elevation grid with contours and public land survey system base layer
southerndeltariver_dem_contours_plss_map_2of2.pdf	digital elevation grid with contours and public land survey system base layer

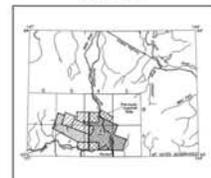




Base from U.S. Geological Survey Map No. 6-1085, 1:40,000  
U.S. GEOLOGICAL SURVEY



LOCATION INDEX



## FLIGHT LINES OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES QUADRANGLE  
2003

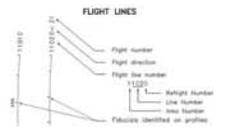
**DESCRIPTIVE NOTES**

The geophysical data were acquired with a GEODETIC Electromagnetic (EM) system and a Siblex dual magnetometer. Data were flown at a height of 100 feet above the terrain. The EM system consists of a Siblex dual magnetometer, GPS navigation system, 50/50 Hz receiver and transmitter. Flights were performed with an AS350B-2 Super helicopter at a mean terrain clearance of 200 feet above MDT. Survey flight lines with a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

An ARISTON Q224 INERTIAL / GYROSCOPE Oriented Positioning System was used for navigation. The helicopter was oriented every 2.5 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 10 westward, 1927 North American datum using a central meridian (CM) of 147° 00' 00" west longitude and an east constant of 500,000 meters. Accuracy of the projected data is better than 10 m with respect to the UTM grid.

**PREVIOUSLY SURVEYED AREAS**

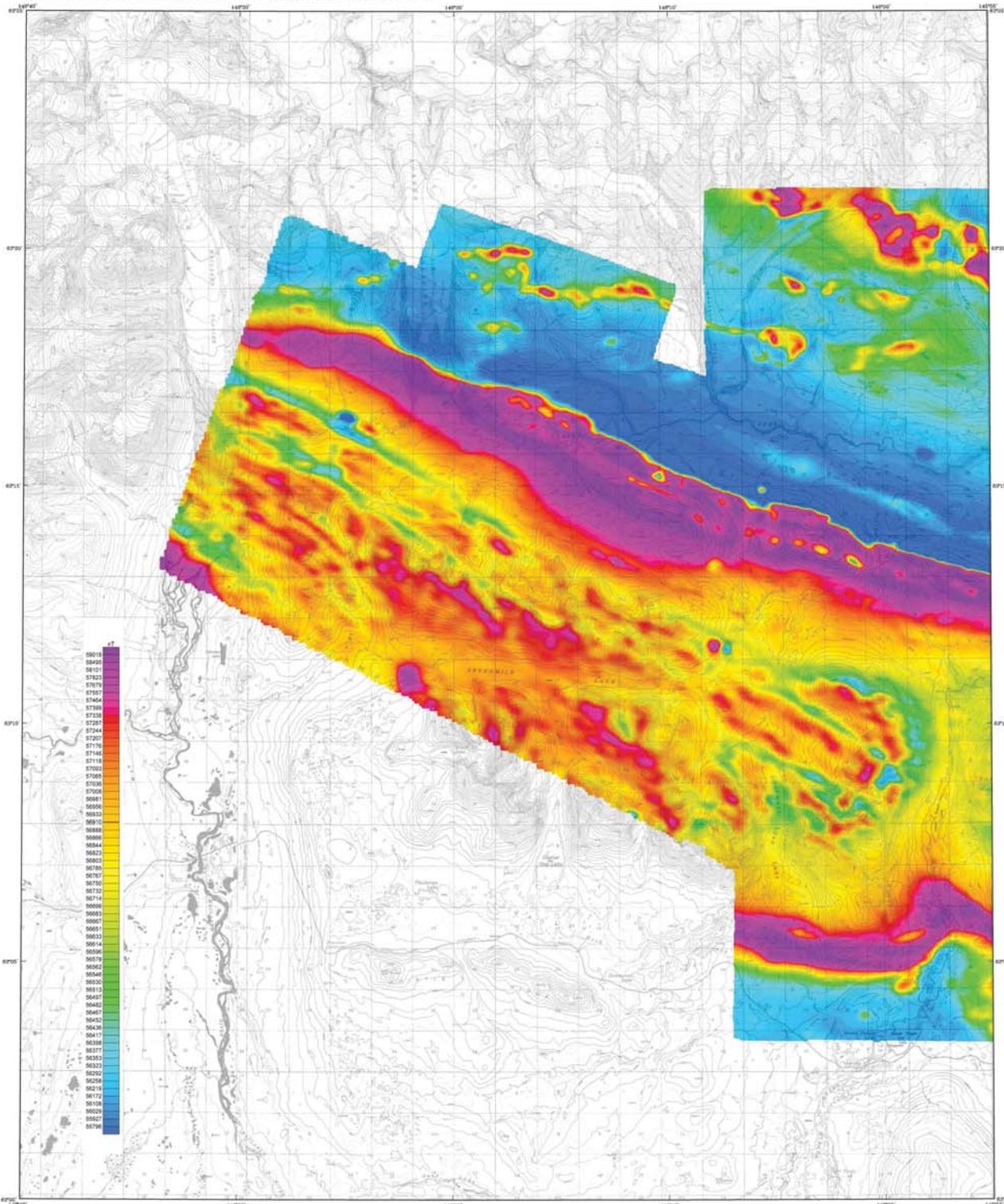
The previously acquired geophysical data were acquired with an aerial Geotek Geophysical (GG) system and a Siblex dual magnetometer. The electromagnetic system utilized four channel dual point at 840 Hz, 4.75 m and three channel dual point at 840 Hz, 4.75 m and 52,400 Hz. Mean terrain clearance for the magnetometer and EM system were slightly higher than 100 and 100 feet, respectively. In addition, the survey recorded data from a radar altimeter, GPS navigation system, 50 Hz receiver and transmitter. The GPS electronic positioning system operated in differential mode. The flight line location varies from south to north on the Delta River. The flight lines were flown with a 100 m spacing. The data were flown with a Siblex dual magnetometer.



**SURVEY HISTORY**

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Bureau of Geological & Geophysical Surveys (DGG), and Stevens Exploration Management Corporation. Geophysical data for the current survey were acquired and processed by Fugro Airborne Surveys in 2002. Additional geophysical data for the Central Delta, Fish Lake Basin and Tongue Lake areas were acquired in 1995 by Aerilog Inc. and were previously funded by the U.S. Department of Interior, Bureau of Land Management (BLM) and conducted as part of its mineral assessment program in the Delta River mining district. Labels Borne are the correct number for DGG.

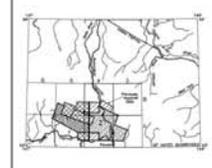
This map and other products from this survey are available by mail order or in person from DGG, 714 University Ave., Suite 205, Fairbanks, Alaska, 99701. Some products are also available in person only at the BLM's Junction Mining Information Center, 100 Seward Blvd., Bettendorf, Alaska, 99824.



Base Data: U.S. Geological Survey, 1:50,000 Scale, 1988, 1:50,000



LOCATION INDEX



## TOTAL MAGNETIC FIELD OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES QUADRANGLE  
2003

**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DINGEM<sup>®</sup> Electromagnetic (EM) system and a Sinterre cesium magnetometer. Both were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, DG/RO Hz magnetic and compass correction. Flights were performed with an AS350B-2 5000 feet gross weight helicopter at a mean terrain clearance of 200 feet using NAD83 survey flight lines with a spacing of a quarter mile. The lines were flown perpendicular to the flight lines at intervals of approximately 2 miles. An Ashtech DG24 NAVSTAR / GLOPASS Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a real-time accuracy of better than 2 m. Flight 8000 elevations were projected onto the Contour 188 (UTM zone 6) spheroid, 1927 North American datum using a central meridian of 147° 00' 00" west and a scale constant of 0 and an east constant of 500,000. Positional accuracy of the recorded data is better than 10 m with respect to the UTM grid.

**PREVIOUSLY SURVEYED AREAS**

The previously acquired geophysical data were acquired with an Aeromac Control Electromagnetic (EM) system and a Sinterre cesium magnetometer. The electromagnetic system used two line coils at 150 Hz and 4.476 Hz and three horizontal coil pairs at 849 Hz, 4,180 Hz and 32,460 Hz. These former operations for the magnetometer and EM system were slightly higher than 100 and 150 feet, respectively. In addition the survey recorded data from a radar altimeter, GPS navigation system, DG/RO Hz magnetic and compass correction. The GPS electronic positioning system consisted of differential mode. The flight line direction varies from north to south to the Contour 188 (UTM zone 6) spheroid, 1927 North American datum using a central meridian of 147° 00' 00" west and a scale constant of 0 and an east constant of 500,000. Positional accuracy of the recorded data is better than 10 m with respect to the UTM grid.

**TOTAL MAGNETIC FIELD**

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) windowed to the low end data, and (3) interpolated onto a regular 100 m grid using a modified spline (1970) technique. The regional variation (or IGRF gradient, 2000, updated to August 2002) was removed from the leveled magnetic data.

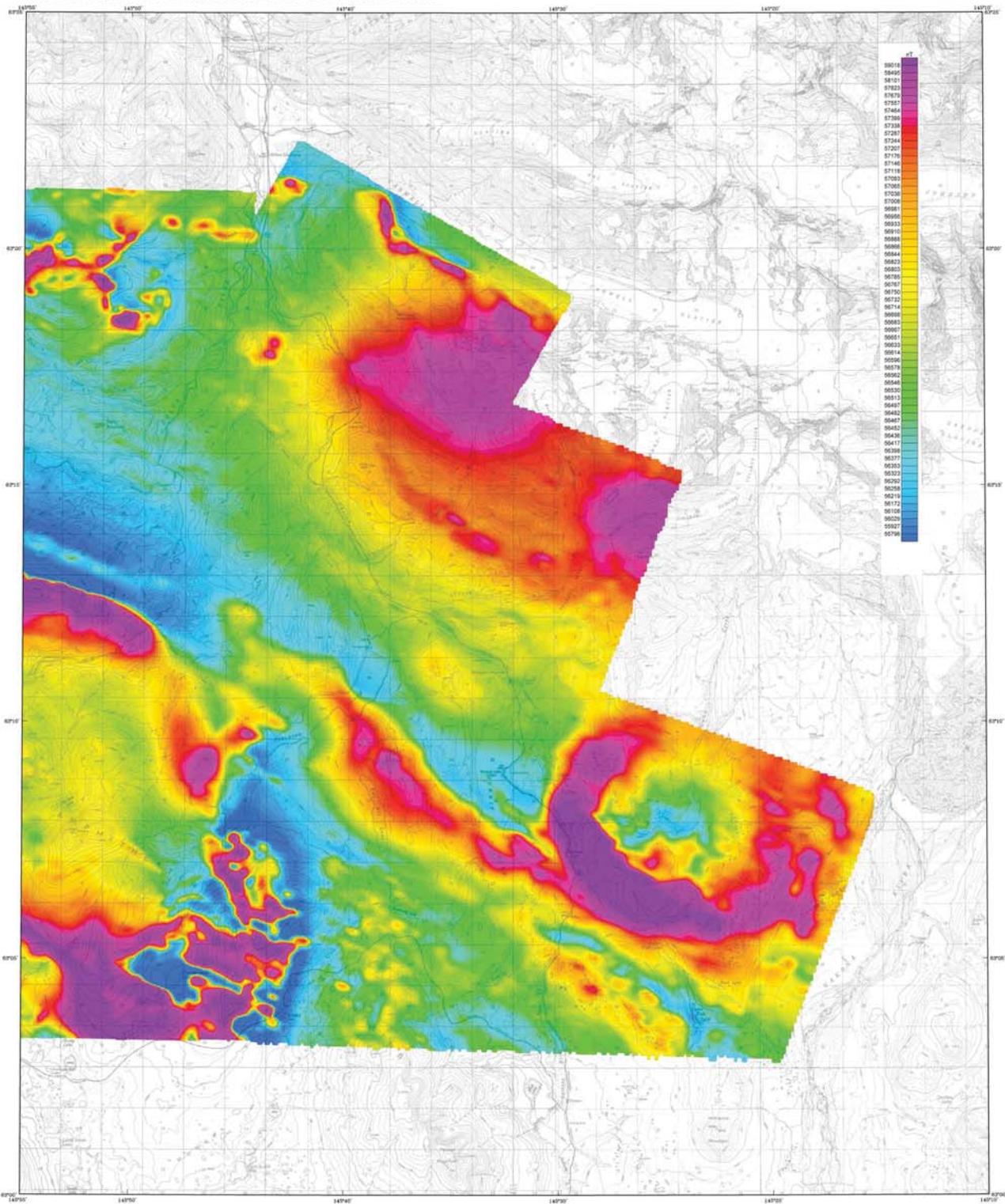
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS  
1000 North Steese Avenue, Fairbanks, Alaska 99709  
907-455-1100 (voice), 907-455-1101 (fax), 907-455-1102 (TDD)

**SURVEY HISTORY**

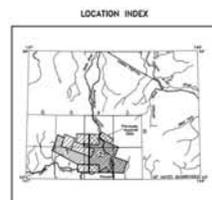
This map has been compiled and derived under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Survey (DGGG), and Stevens Exploration Management Corp. Airborne geophysical data for the current area were acquired and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Contour 188, Delta River Lake area were acquired and processed in 1995 by Aeromac Inc. and were provided for publication by the DGGG. The contract was funded by the U. S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Laurel Burns was the contract manager for DGGG.

This map and other products from this survey are available by mail order or in person from 2002, 794 University Ave., Suite 200, Fairbanks, Alaska 99709. Some products are also available in person only at the BLM's Juneau Mineral Information Center, 100 Barkley Road, Douglas, Alaska 99824.





Base Data: U.S. Geological Survey, 1:50,000 Scale, 1988



## TOTAL MAGNETIC FIELD OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA PARTS OF MT. HAYES QUADRANGLE 2003

**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DIGHEM<sup>®</sup> 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, 50/70 Hz magnetic and compass. Flight was performed with an AS350B-2 Superpuma helicopter at a mean terrain clearance of 200 feet along 120°E survey flight line with a spacing of a quarter of mile. The lines were flown perpendicular to the flight line at intervals of approximately 2 miles. An Ashtech DD24 NAVSTAR / GLOPASS 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 2 m. Flight 8000 elevations were projected onto the Contour 188 (UTM zone 6) sphere03, 1927 North American datum using a contour projection (300' of 147°) a north constant of 0 and an east constant of 500,000. Positional accuracy of the projected data is better than 10 m with respect to the UTM grid.

**PREVIOUSLY SURVEYED AREAS**

The previously acquired geophysical data were acquired with an Aeromagnetic Electromagnetic (EM) system and a Scintrex cesium magnetometer. The electromagnetic system used two vertical coil pairs at 4.5 Hz and 4.476 Hz and three horizontal coil pairs at 848 Hz, 4,180 Hz and 32,460 Hz. These former operations for the magnetometer and EM system were slightly higher than 100 and 150 feet, respectively. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50 Hz magnetic and video camera. The GPS electronic positioning system operated in differential mode. The flight line direction varies from north to south to roughly parallel 120°E. Lines at Fish Lake 120°E, and Rainy and Tongue Lake N-S. The flight lines were one-quarter mile apart. Extended by lines were flown with the current survey which cover both the 1905 and 2002 survey areas. The other survey was flown with a AS350B2 helicopter.

**TOTAL MAGNETIC FIELD**

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) windowed to the low end data, and (3) interpolated onto a regular 100 m grid using a modified spline (1970) technique. The regional variation (or IGRF gradient, 2000, updated to August 2002) was removed from the leveled magnetic data.

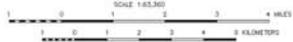
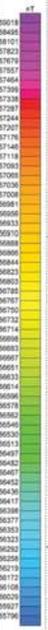
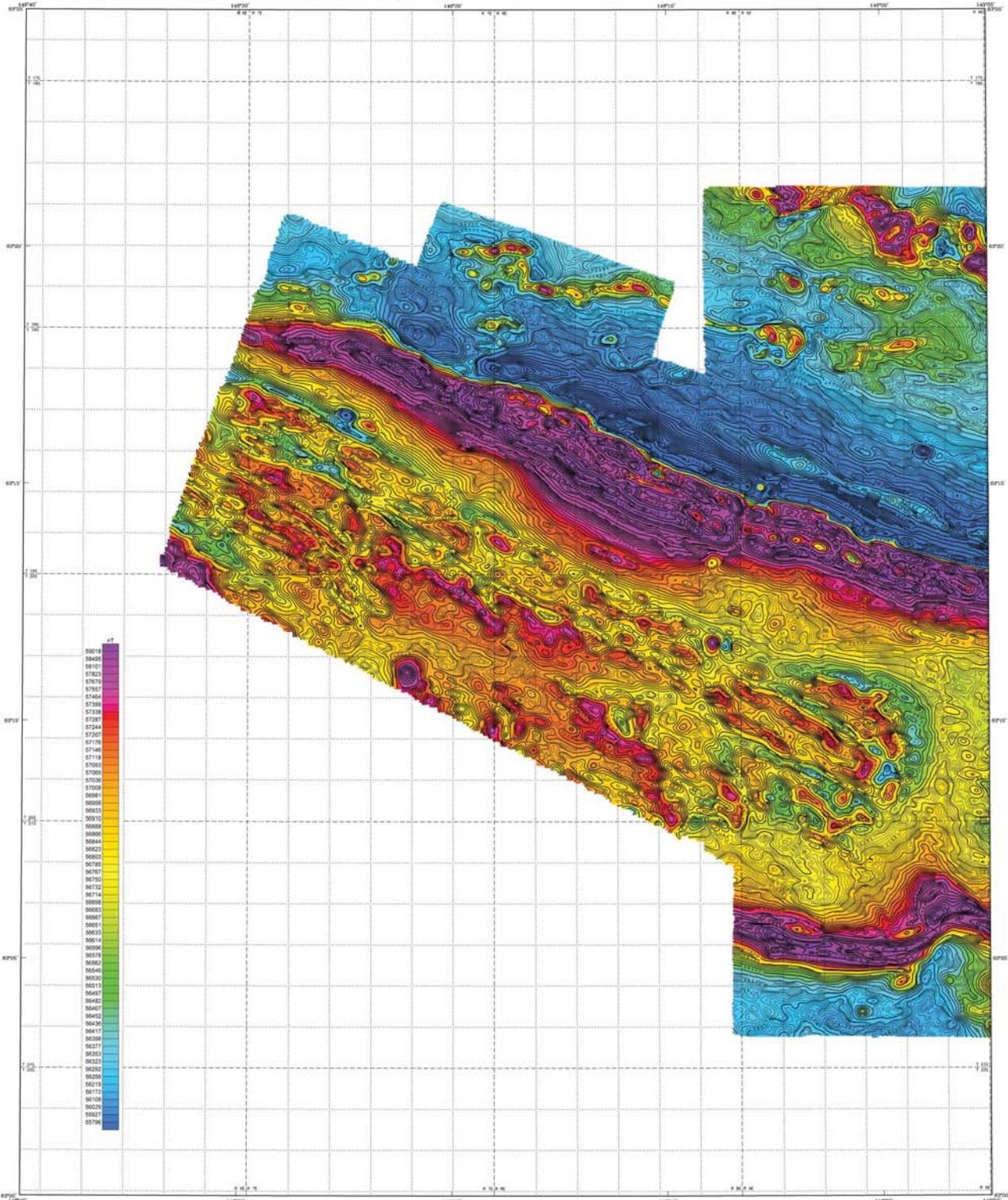
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**SURVEY HISTORY**

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and Stevens Exploration Management Corp. Archive geophysical data for the current area were acquired and processed by Fugro Airborne Surveys in 2002. Archive geophysical data for the Contour 188, Delta River, Fish Lake, and Tongue Lake areas were acquired in 1995 by Aeromag Inc. and were provided for publication by DGGG. The same data were funded by the U. S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Lower Basin was the contract manager for DGGG.

This map and other products from this survey are available by mail order or in person from DGGG, 794 University Ave., Suite 200, Fairbanks, Alaska, 99774. Some products are also available in person only at the BLM's Juneau Mineral Information Center, 100 Seward Road, Douglas, Alaska, 99824.





Geographic coordinates from U.S. Geological Survey, 6th Edition, 1:250,000, 4-4, 2000



## TOTAL MAGNETIC FIELD OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES QUADRANGLE  
2003

### DESCRIPTIVE NOTES

The geophysical data were acquired with a DINGEMAN® Electromagnetic (EM) system and a Geotek cesium magnetometer. Both were flown at a height of 100 feet. In addition to the survey, recorded data from a radar altimeter, GPS navigation system, 50/70 Hz monitors and video camera. Flights were performed with an AS350B-2 Squirrel helicopter at a mean terrain clearance of 200 feet using 4000Z hourly flight times with a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines at intervals of approximately 2 miles. An Ashtech 0224 NAVSTAR / GLONAVIS Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a real-time base station located within 2 miles. Flight elevations were projected onto the UTM zone 18Q (UTM zone 6) UTM zone 18Q2 North American datum using a contour interval of 100 feet. A north constant of 0 and an east constant of 500,000. Positional accuracy of the recorded data is better than 10 m with respect to the UTM grid.

### PREVIOUSLY SURVEYED AREAS

The previously acquired geophysical data were acquired with an Aeromagnetic (AM) system and a Geotek cesium magnetometer. Both were flown at a height of 100 feet. In addition to the survey, recorded data from a radar altimeter, GPS navigation system, 50/70 Hz monitors and video camera. The GPS navigation system recorded in differential mode. The flight line direction varies from north to south as follows: Canyon 100Z; Lakes and Fish Lake 100Z; and Rainy and Tongue Lake 100Z. The flight lines were flown with the current survey which cover both the 1995 and 2002 survey areas. The other survey was flown with a AS350B2 helicopter.

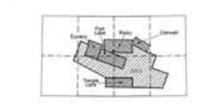
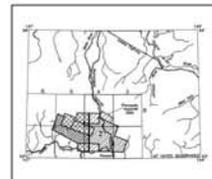
### TOTAL MAGNETIC FIELD

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) warped to the tie line data, and (3) interpolated onto a regular 100-m grid using a modified spline (1970) technique. The regional variation (or IGRF gradient, 2000, updated to August 2002) was removed from the leveled magnetic data.

ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS  
675 NORTH DIVISION AVENUE, SPOKANE, WYOMING 83401-1000  
PHONE: (307) 325-1500 FAX: (307) 325-1501



### LOCATION INDEX



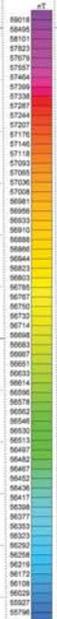
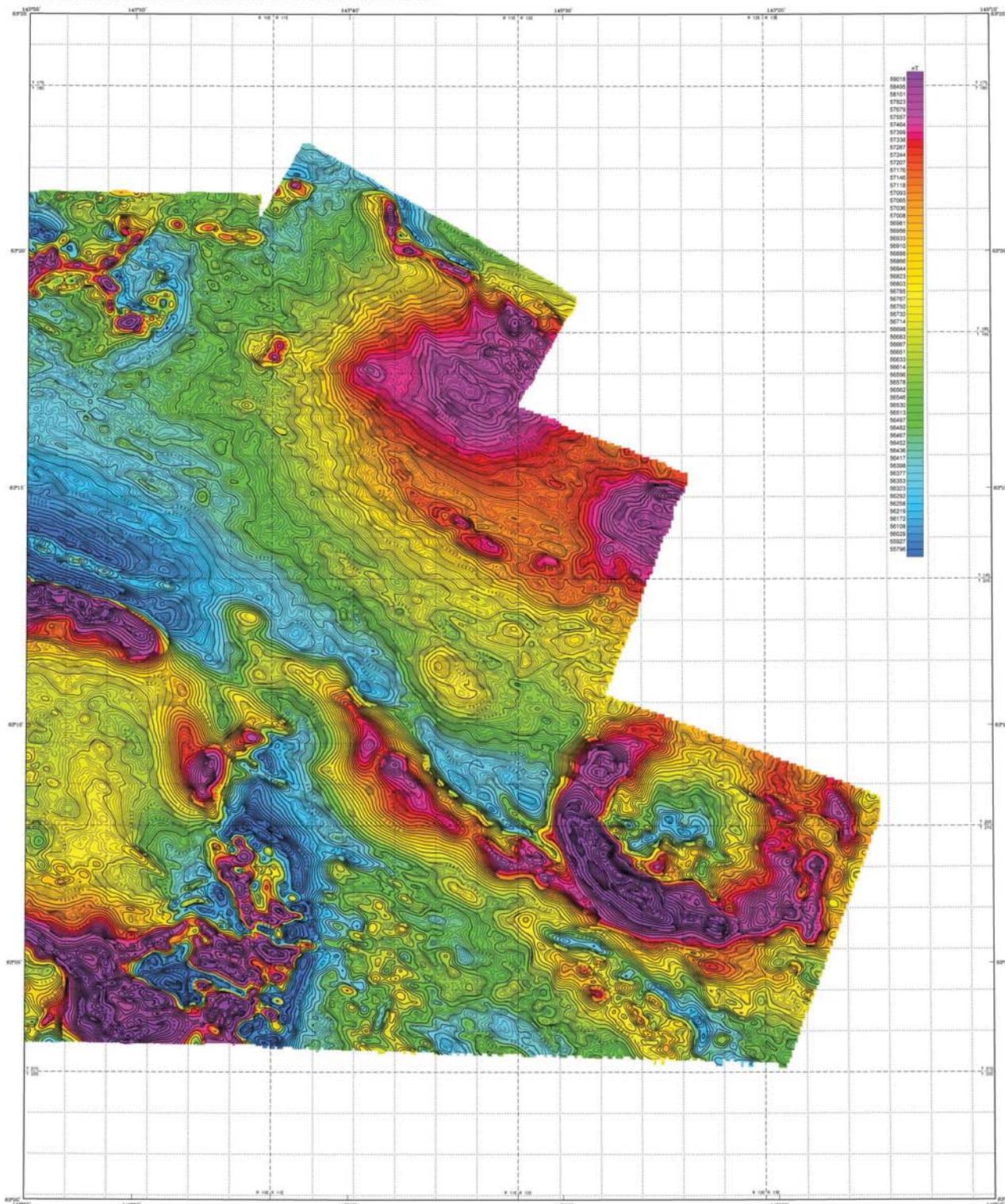
### SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Survey (DGGG), and Stevens Exploration Management Corp. Airborne geophysical data for the current area were acquired and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Canyon, Lakes, Fish Lake, Rainy and Tongue Lakes area were acquired in 1995 by Aerotech Inc. and were provided for publication by the DGGG. The current map was funded by the U. S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Laurel Burns was the contract manager for DGGG.

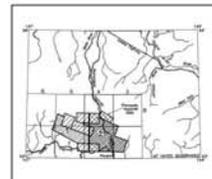
This map and other products from this survey are available by mail order or in person from DGGG, 794 University Ave., Suite 200, Fairbanks, Alaska, 99709. Some products are also available in person only at the BLM's Juneau Mineral Information Center, 100 Banks Road, Douglas, Alaska, 99824.

### MAGNETIC CONTOUR INTERVAL





Scale: 1:62,500. 0 1 2 3 4 KILOMETERS. 0 1 2 3 4 MILES.



## TOTAL MAGNETIC FIELD OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

### PARTS OF MT. HAYES QUADRANGLE

2003

**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DCHM™ 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, 50/70 Hz monitors and cable compass. Flights were performed with an AS350B-2 Squirrel helicopter at a mean terrain clearance of 200 feet along 1420'E survey flight lines with a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines at intervals of approximately 2 miles.

An Ashtech 0224 NAVSTAR / GLONAVIS Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a reference accuracy of better than 2 m. Flight 8000 elevations were projected onto the Clarke 1881 UTM zone 6 northern 1927 North American datum using a world meridian (WGS) of 147° 0 north constant of 0 and an east constant of 500,000. Positional accuracy of the projected data is better than 10 m with respect to the UTM grid.

**PREVIOUSLY SURVEYED AREAS**

The previously acquired geophysical data were acquired with an Amtek Counter Electromagnetic (CEM) system and a Scintrex cesium magnetometer. The electromagnetic system utilized two vertical coil pairs of 150 m and 4.476 m and three horizontal coil pairs of 849 m, 4.188 m and 32.640 m. These former operations for the magnetometer and EM system were slightly higher than 100 and 100 feet, respectively. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50 Hz monitor and cable compass.

The GPS electronic positioning system recorded in differential mode. The flight line direction varies from north to south as they cross 1420'E. Lines on Fish Lake 1420'E, and Rainy and Tongue Lake 1420'E. The flight lines were one-way, one shot. Extended to lines were flown with the current survey which cover both the 1955 and 2002 survey areas. The other survey was flown with a AS350B2 helicopter.

**TOTAL MAGNETIC FIELD**

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 (2) waves to the low end data, and (3) interpolated onto a regular 100 m grid using a modified spline (1970) technique. The regional variation (or IGRF gradient, 2000, updated to August 2002) was removed from the leveled magnetic data.

Notes: 1. 2003 - a new method of interpretation and analysis was used. 2. 1955 - a new method of interpretation and analysis was used. 3. 1955 - a new method of interpretation and analysis was used.

**MAGNETIC CONTOUR INTERVAL**

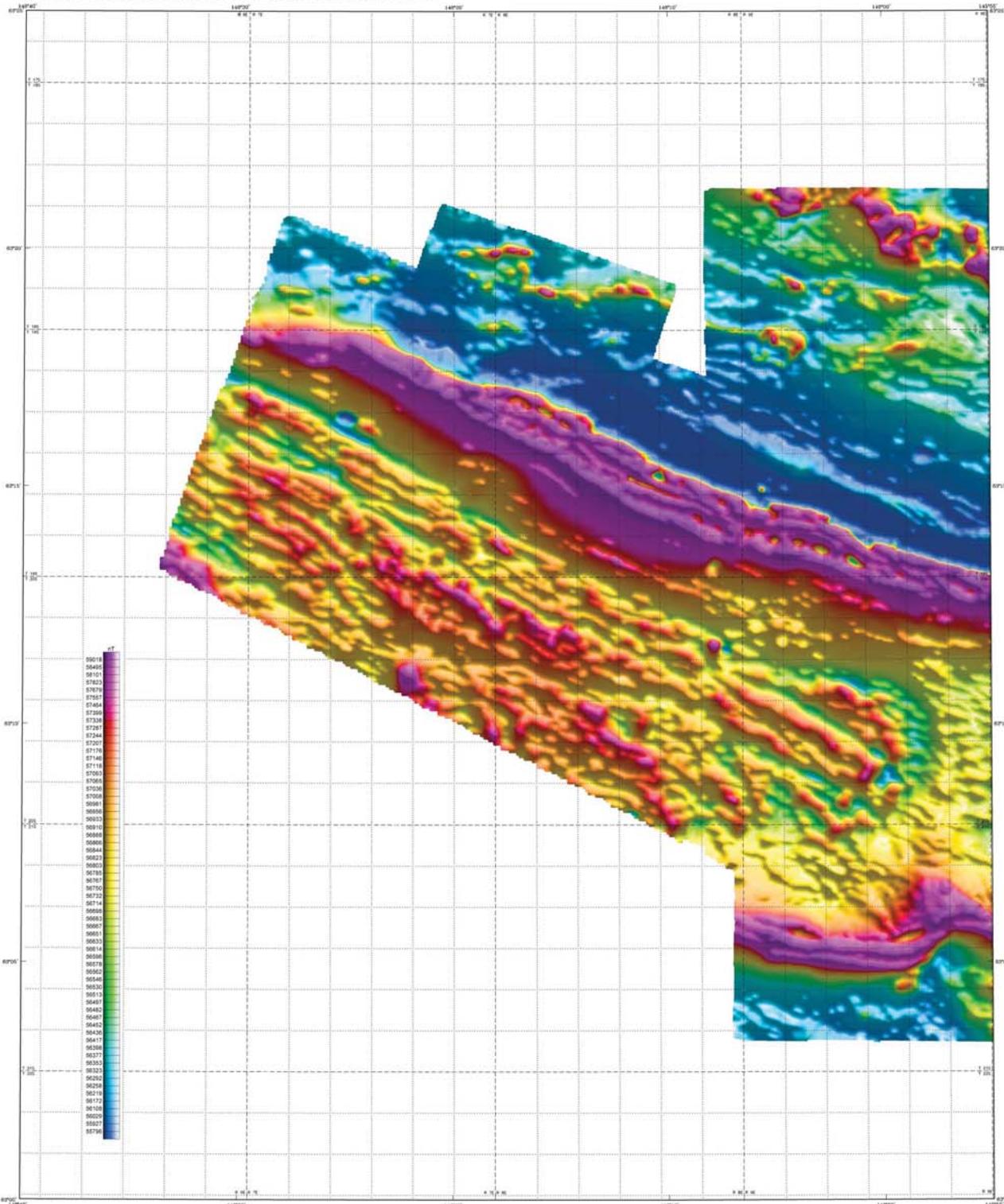
.....	250 of
.....	50 of
.....	10 of
.....	5 of

**SURVEY HISTORY**

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Survey (DGGS), and Stevens Exploration Management Corp. Airborne geophysical data for the current area were acquired and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Central, Eastern, Full Lake, and Upper Lake areas were acquired in 1955 by Aerotek Inc. and were provided for publication by DGGS. The current survey was funded by the U. S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Laurel Burns was the contract manager for DGGS.

This map and other products from this survey are available by mail order or in person from DGGS, 794 University Ave., Suite 200, Fairbanks, Alaska, 99776. Some products are also available in person only at the BLM's Bureau of Land Management Center, 100 Banks Road, Douglas, Alaska, 99824.

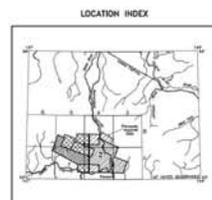




Geophysical Data were collected under contract with the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Central, Eastern, and Lower Delta River areas were collected in 1995 by Aerotek Inc. and were provided for publication by the BLM. The current survey was funded by the U. S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Laurel Burns was the contract manager for DGGG.



SCALE 1:63,300  
0 1 2 3 4 MILES  
0 1 2 3 4 KILOMETERS



## COLOR SHADOW TOTAL MAGNETIC FIELD OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES QUADRANGLE

2003

Sun Azimuth: 20 degrees  
Inclination: 30 degrees

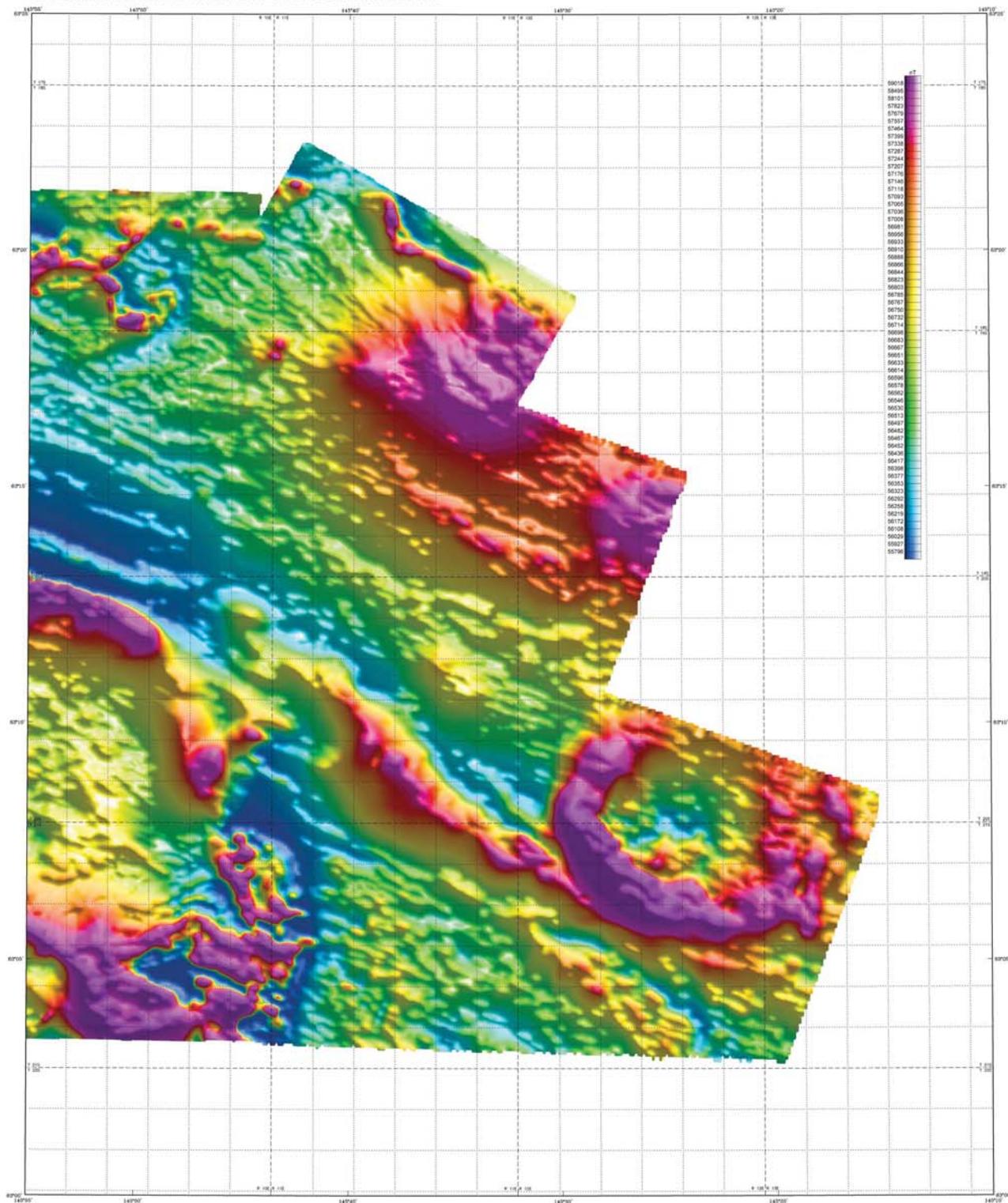
**DESCRIPTIVE NOTES**  
The geophysical data were acquired with a DIXHEM<sup>®</sup> Electromagnetic (EM) system and a Geotek cesium magnetometer. Both were flown at a height of 100 feet. In addition to the survey, recorded data from a radar altimeter, GPS navigation system, 50/70 Hz magnetic and video camera. Flights were performed with an AS350B-2 Squirrel helicopter at a mean terrain clearance of 200 feet using 420ZE survey flight lines with a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines at intervals of approximately 2 miles.  
An Ashtech 0224 NAVSTAR / GLONAVIS Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a reference station of better than 3 m. Flight 8000 elevations were projected onto the Clarke 1882 (UTM zone 6) spheroid, 1927 North American datum using a conformal projection (3) of 147° a north constant of 0 and an east constant of 500,000. Positional accuracy of the recorded data is better than 10 m with respect to the UTM grid.

**PREVIOUSLY SURVEYED AREAS**  
The previously acquired geophysical data were acquired with an Aerotek Cesium magnetometer (EM system) and a Geotek cesium magnetometer. The electromagnetic system used two vertical coils spaced at 3.0 Hz and 4.475 Hz and three horizontal coil pairs at 849 Hz, 4.188 Hz and 32.640 Hz. These three coils were used for the magnetometer and EM system were slightly higher than 100 and 100 feet, respectively. In addition to the survey, recorded data from a radar altimeter, GPS navigation system, 50 Hz magnetic and video camera. The GPS electronic positioning system recorded in differential mode. The flight line direction varies from north to south as shown on the map. Flights were flown over Fish Lake 420ZE, and Rainy and Tongue Lake N-2. The flight lines were one-quarter mile apart. Extended flight lines were flown with the current survey which cover both the 1995 and 2002 survey areas. The other survey was flown with a AS350B2 helicopter.

**TOTAL MAGNETIC FIELD**  
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) waded to the low tide data, and (3) interpolated onto a regular 100-m grid using a modified spline (1970) technique. The regional variation (or IGRF gradient, 2000, updated to August 2002) was removed from the leveled magnetic data.

**SURVEY HISTORY**  
This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Central, Eastern, and Lower Delta River areas were collected in 1995 by Aerotek Inc. and were provided for publication by the BLM. The current survey was funded by the U. S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Laurel Burns was the contract manager for DGGG.  
This map and other products from this survey are available by mail order or in person from DGGG, 794 University Ave., Suite 200, Fairbanks, Alaska, 99709. Some products are also available in person only at the BLM's Juneau Mineral Information Center, 100 Banks Road, Douglas, Alaska, 99824.

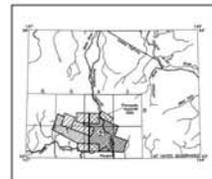




Source: Modified from U.S. Geological Survey, M. Peters et al., 2002, p. 4. URL: <http://www.gsi.gov>



LOCATION INDEX



## COLOR SHADOW TOTAL MAGNETIC FIELD OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES QUADRANGLE

2003

Sun Azimuth: 20 degrees

Inclination: 30 degrees

**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DINGHY<sup>®</sup> Electromagnetic (EM) system and a SICKER<sup>®</sup> cesium magnetometer. Both were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/70 Hz monitors and video camera. Flights were performed with an AS350B-2 Super helicopter at a mean terrain clearance of 200 feet along 1027E survey flight lines with a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines at intervals of approximately 2 miles. An Ashtech D224 NAVSTAR / GLONAVIS Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a reference station at better than 2 m. Flight path elevations were projected onto the Clarke 1880 UTM zone 6 (sphere), 1927 North American datum using a conformal projection (30) of 1470 = north constant of 0 and an east constant of 500,000. Positional accuracy of the projected data is better than 10 m with respect to the UTM grid.

**PREVIOUSLY SURVEYED AREAS**

The previously acquired geophysical data were acquired with an Ashtech D224 NAVSTAR (D2) system and a SICKER cesium magnetometer. The electromagnetic system utilized two vertical coil pairs at 840 Hz and 4475 Hz and three horizontal coil pairs at 840 Hz, 4180 Hz and 32,460 Hz. These former operations for the magnetometer and EM system were slightly higher than 100 and 100 feet, respectively. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50 Hz monitor and video camera. The GPS electronic positioning system consisted of differential mode. The flight line direction varies from north to track to follow Canyon 1027E, Lakes and Fish Lake 1027E, and Rainy and Tongue Lake 1027E. The flight lines were one-quarter mile apart. Extended to the lines were flown with the current survey which cover both the 1955 and 2002 survey areas. The other survey was flown with a AS350B2 helicopter.

**TOTAL MAGNETIC FIELD**

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 digital magnetic field, (2) reduced to the sea level datum, and (3) interpolated onto a regular 100 m grid using a modified spline (1970) technique. The regional variation (or ICF gradient), 2003, updated to August 2002, was removed from the reduced magnetic data.

Alaska, U.S. 2003, a free analysis of interpretation and possible cause of magnetic anomalies in the area of the study. URL: <http://www.gsi.gov>

**SURVEY HISTORY**

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Survey (DGGG), and Stevens Exploration Management Corp. Airborne geophysical data for the current area were acquired and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Central, Eastern, Fish Lake, and Tongue Lake areas were acquired in 1955 by Aerotek Inc. and were provided for publication by the DGGG. The current project was funded by the U.S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Laurel Burns was the contract manager for DGGG. This map and other products from this survey are available by mail order or in person from DGGG, 794 University Ave., Suite 200, Fairbanks, Alaska, 99776. Some products are also available in person only at the BLM's Juneau Mineral Information Center, 100 Banks Road, Douglas, Alaska, 99824.

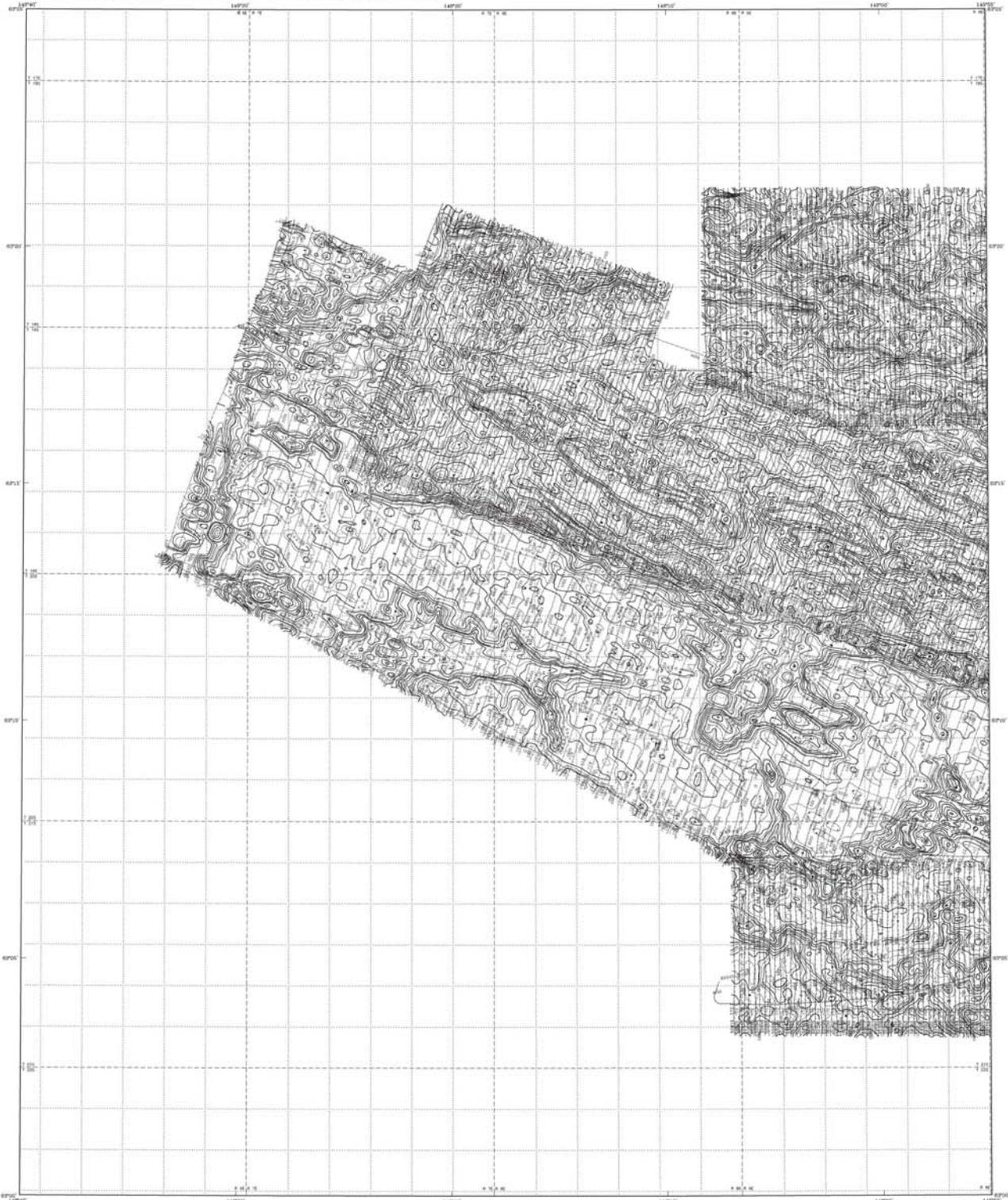




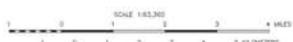








Approved for Release by NSA, National Security Agency, on 08-08-2014 pursuant to E.O. 13526



## 7200 Hz COPLANAR RESISTIVITY OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES QUADRANGLE

2003

### DESCRIPTIVE NOTES

The geophysical data were acquired with a DGHM<sup>®</sup> Electromagnetic (EM) system and a Solaire cesium magnetometer. Both were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/100 Hz magnetic and cesium compass. Flights were performed with an AS350B-2 Super helicopter at a mean airspeed of 200 feet along 120°E magnetic flight lines with a heading of a quarter mile. The lines were flown perpendicular to the flight lines at intervals of approximately 2 miles. An Ashtech G24 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 receiver accuracy of better than 0.5 m. Flight path positions were projected onto the UTM zone 188U (UTM zone 6) UTM zone 1827 North American datum using a conformal projection. The datum is a spheroid of 6378137 m and an axis constant of 500,000. Position accuracy of the recorded data is better than 10 m with respect to the UTM grid.

### PREVIOUSLY SURVEYED AREAS

The previously acquired geophysical data were acquired with an Aercon Center Electromagnetic (EM) system and a Solaire cesium magnetometer. The electromagnetic system utilized two vertical magnetic coil pairs at 150 Hz and 4.476 Hz and three horizontal coil pairs at 843 Hz, 4.188 Hz and 32.640 Hz. These former operations for the magnetometer and EM system were slightly higher than 100 and 150 feet, respectively. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50 Hz magnetic and cesium compass, differential mode. The flight line direction varies from north to south or between Cassin N20°E, Laska and Fish Lake N20°E, and Rinky and Tongue Lakes N-C. The flight lines were one-eight mile apart. Excepted to this area flown with the current survey which cover both the 1955 and 2002 survey areas, the other survey was flown with a AS350B2 helicopter.

### RESISTIVITY

The DGHM<sup>®</sup> EM system measured inphase and quadrature components of five frequencies. Two vertical coplanar coil pairs operated at 1000 and 5500 Hz while three horizontal coplanar pairs operated at 500, 1200, and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to subsurface conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature components of the inphase 7200 Hz using the pseudo-transfer half space model (Dey and Weidner 1976). The data were interpreted using the 7200 Hz apparent resistivity from the current survey. The 7200 Hz apparent resistivity from the current survey have been merged with the 1955 survey data from the previously surveyed areas. To facilitate the merge between data sets, the resistivity for the pre-instantly acquired 1955 Hz coplanar data was re-calculated using the pseudo-transfer half space model.

ASHTech, Inc. 1995, A new method of navigation and smooth curve fitting using GPS. *Geomatics Engineering*, v. 11, no. 4, p. 88-95.  
Dey, R.L., 1976, Resistivity mapping with an airborne coplanar electromagnetic system. *Geophysics*, v. 41, p. 144-172.

### LOCATION INDEX



### RESISTIVITY CONTOURS



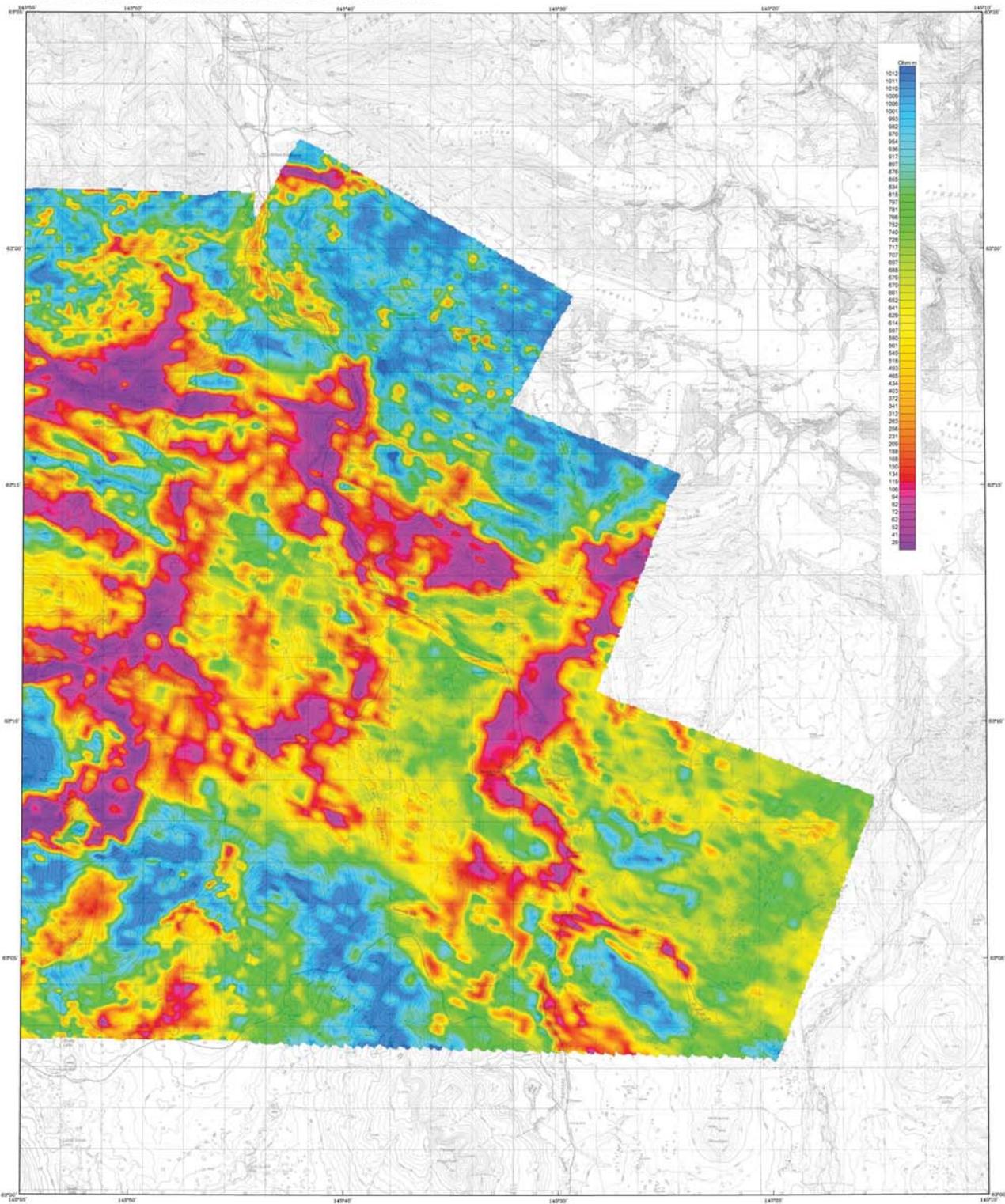
### SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Survey (DGGS), and Stevens Exploration Management Corp. Airborne geophysical data for the current area were acquired and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Cassin, Laska, Fish Lake, Rinky and Tongue Lakes area were acquired in 1955 by Aercon Inc. and were provided for publication by the BLM. The current survey was funded by the U. S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Loren Burns was the contract manager for DGGS.

This map and other products from this survey are available by mail order or in person from 2002, 794 University Ave., Suite 200, Fairbanks, Alaska 99709. Some products are also available in person only at the BLM's Juneau Mineral Information Center, 100 Banks Road, Douglas, Alaska 99824.



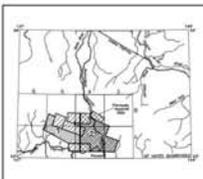




Base Data: U.S. Geological Survey, 1:50,000, 1:62,500, 1:125,000



LOCATION INDEX



## 900 Hz COPLANAR RESISTIVITY OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES QUADRANGLE  
2003

**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DIGHEM<sup>®</sup> 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, 50/70 Hz magnetic and compass correctors. Flights were performed with an AS350B-2 5000 feet class helicopter at a mean terrain clearance of 200 feet along 1420E survey flight line with a spacing of 0.25 quarter mile. The lines were flown perpendicular to the flight line at intervals of approximately 3 miles.

An Ashtech 0024 NAVSTAR / GLONAVSS 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 2 m. Flight 6000 elevations were projected onto the Contour 188 (UTM zone 6) spheroid, 1927 North American datum using a central meridian (CM) of 147° 00' north, constant of 0 and an east constant of 500,000. Positional accuracy of the projected data is better than 10 m with respect to the UTM grid.

**PREVIOUSLY SURVEYED AREAS**

The previously acquired geophysical data were acquired with an Aercon Counter Electromagnetic (EM) system and a Scintrex cesium magnetometer. The electromagnetic system utilized two vertical coil pairs at 145 Hz and 4.476 Hz and three horizontal coil pairs at 849 Hz, 4.18 Hz and 32.640 Hz. These former operations for the magnetometer and EM system were slightly higher than 100 and 150 feet, respectively. In addition, the survey recorded data from a radar altimeter, GPS navigation system, 50 Hz magnetic and compass correctors. The GPS electronic positioning system consisted of differential mode. The flight line direction varies from south to north to follow Contour 1420E, Turley and Fish Lake 1420E, and Rummy and Tongue Lake N-C. The flight lines were cross-flight, wide angle. Extended to lines were flown with the current survey which cover both the 1905 and 2002 survey areas. The other survey was flown with a AS350B2 helicopter.

**RESISTIVITY**

The DIGHEM<sup>®</sup> EM system measured inphase and quadrature components of five frequencies. Two vertical coplanar coil pairs operated at 1000 and 3500 Hz while three horizontal coplanar coil pairs operated at 500, 1700, and 5630 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to subsurface conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature components of the inductor 900 Hz using the pseudo-layer half space model (Freyer 1976). The data were interpreted using a The 900 Hz coplanar data from the current survey have been merged with the 900 Hz coplanar data from the previously surveyed areas. To facilitate the merge between data sets, the resistivity for the previously acquired 849 Hz coplanar data was reinterpreted using the pseudo-layer half space model.

ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS  
1700 N. P. 98-4000  
Finger, B.C., 1976. Resistivity mapping with an airborne electromagnetic system (Dighem), v. 41, p. 144-172

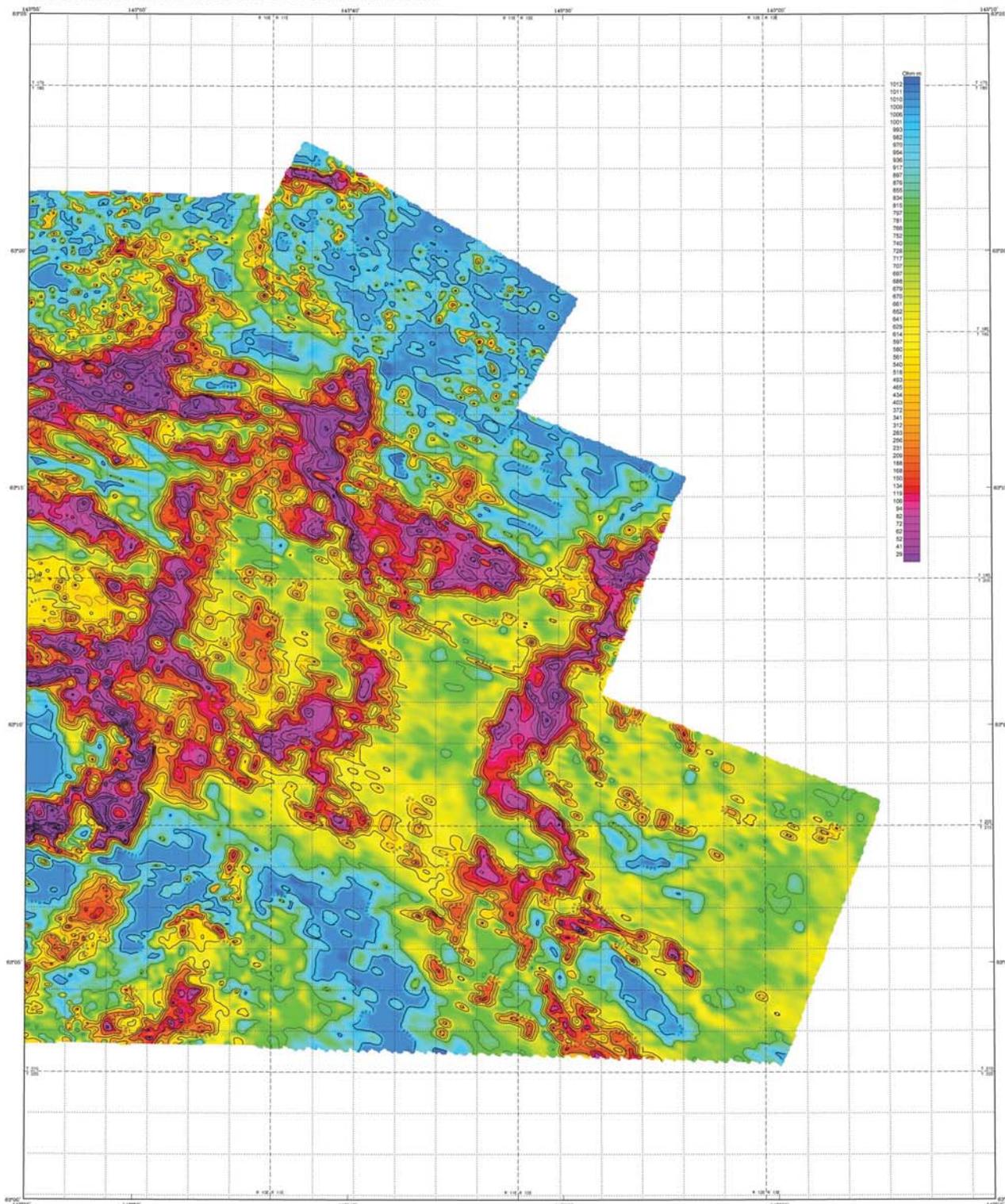
**SURVEY HISTORY**

This map has been compiled and derived under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and Stevens Exploration Management Corp. Airborne geophysical data for the current area were acquired and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Contour 188 area, Fish Lake area, and Rummy and Tongue Lake area, acquired in 1995 by Aercon Inc. and were provided for publication by the DGGG. The current survey was funded by the U. S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Loren Burns was the contract manager for DGGG.

This map and other products from this survey are available by mail order or in person from DGGG, 794 University Ave., Suite 200, Fairbanks, Alaska, 99704. Some products are also available in person only at the BLM's Juneau Mineral Information Center, 100 Seward Road, Douglas, Alaska, 99824.







Scale: 1:62,500  
North arrow: True N. Geographical N. True N. is 0.285° S. of G.N.

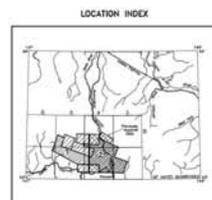


### 900 Hz COPLANAR RESISTIVITY OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA PARTS OF MT. HAYES QUADRANGLE 2003

**DESCRIPTIVE NOTES**  
The geophysical data were acquired with a DIGHEM<sup>®</sup> 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, 50/70 Hz magnetic and compass. Flights were performed with an AS350B-2 5000 feet gross weight helicopter at a mean terrain clearance of 2000 feet along N207E surveying flight lines with a spacing of 0.2 kilometer flight lines. The lines were flown perpendicular to the flight line at intervals of approximately 3 hours.  
An Ashtech D224 NAVSTAR / GLONAVSS Global Positioning System was used for navigation. The helicopter position was observed every 2.5 seconds using post-flight differential positioning to a relative accuracy of better than 2 m. Flight 8000 elevations were projected into the Contour 188 (UTM zone 6) spheroid, 1927 North American datum using a contour datum of 1987.00. The datum constant of 0 and an east constant of 500,000. Positional accuracy of the projected data is better than 10 m with respect to the UTM grid.

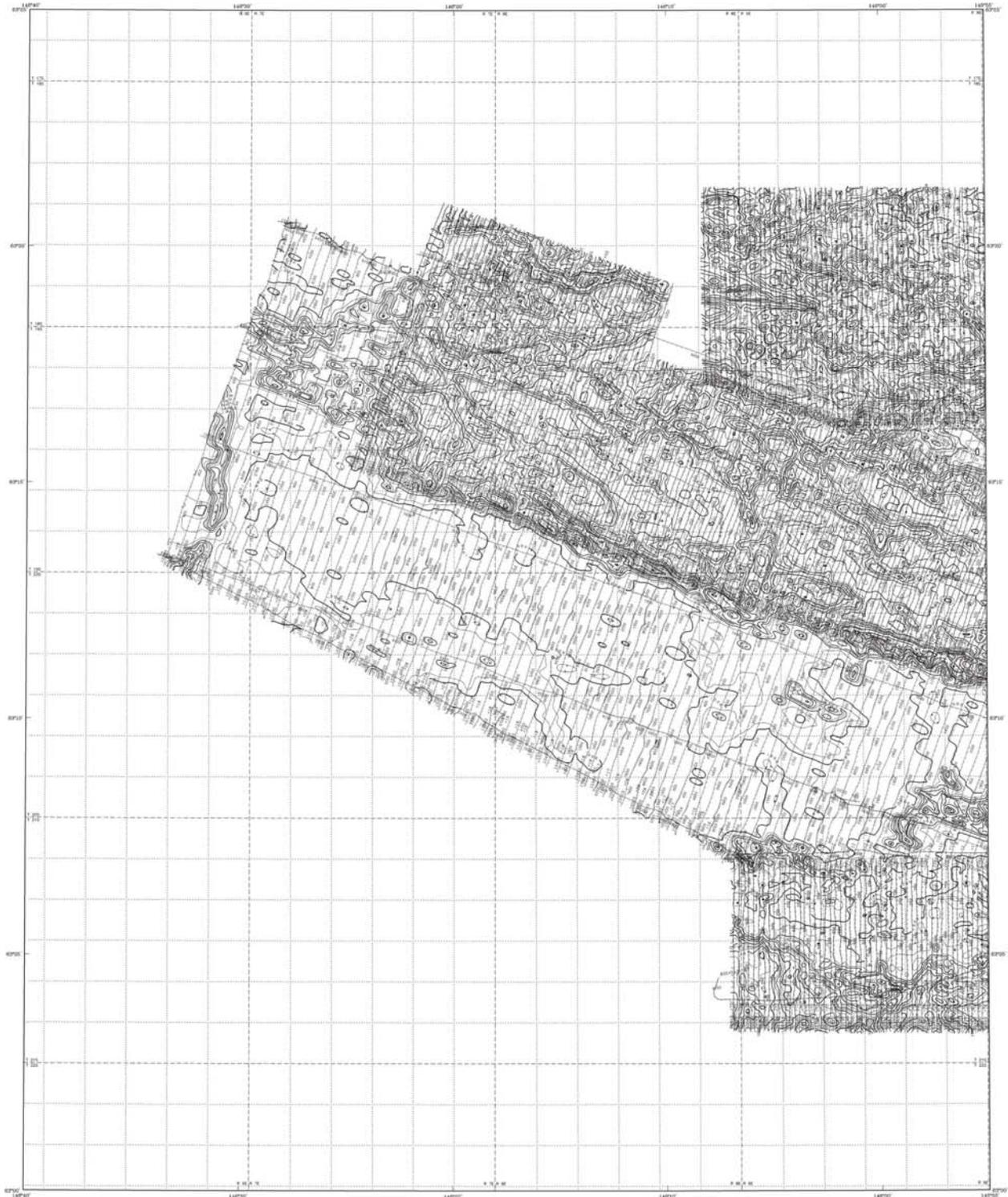
**PREVIOUSLY SURVEYED AREAS**  
The previously acquired geophysical data were acquired with an Aercon Counter Decimeter (CD) system and a Scintrex cesium magnetometer. The electromagnetic system utilized two horizontal coil pairs at 150 Hz and 4.476 Hz and three horizontal coil pairs at 849 Hz, 4.188 Hz and 52.640 Hz. These lines were flown with the magnetometer and EM system were slightly higher than 100 and 150 feet, respectively. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50 Hz magnetic and compass. The flight lines were flown perpendicular to the flight line at intervals of approximately 3 hours. The flight lines were flown with the current survey which cover both the 1985 and 2002 survey. The other survey was flown with a AS350B2 helicopter.

**RESISTIVITY**  
The DIGHEM<sup>®</sup> EM system measured in-phase and quadrature components of five frequencies. Two vertical coplanar coil pairs operated at 1000 and 5000 Hz with three horizontal coplanar coil pairs operated at 500, 1000, and 50,000 Hz. EM data were sampled at 0.1 second intervals. The EM system records in-phase and quadrature components of the in-phase 900 Hz using the pseudo-bay half space model (Freyer 1976). The data were interpreted using a regular 100 m grid using a modified semi-logarithmic scale. The 900 Hz coplanar data from the current survey have been merged with the data from the previously surveyed areas. To facilitate the merge between data sets, the resistivity for the previously acquired 849 Hz coplanar data was reinterpreted using the pseudo-bay half space model.  
Snoke, M., 1995, A new method of interpretation and smooth curve fitting of 900 Hz resistivity data. M.S. Thesis, University of Colorado, Boulder, CO. P. 110-111. P. 114-117.  
Freyer, G.C., 1976, Resistivity mapping using a pseudo-bay electromagnetic system. Geophysics, v. 41, p. 144-152.



**SURVEY HISTORY**  
This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and Stevens Exploration Management Corp. Airborne geophysical data for the current area were acquired and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Contour, Earth, Fish Lake, and Tongue Lake areas were acquired in 1995 by Aercon Inc. and were provided for publication by the BLM. The current survey was funded by the U. S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Laurel Burns was the contract manager for DGGG.  
This map and other products from this survey are available by mail order or in person from DGGG, 794 University Ave., Suite 200, Fairbanks, Alaska, 99774. Some products are also available in person only at the BLM's Juneau Mineral Information Center, 100 Seward Road, Douglas, Alaska, 99824.





Scale within 10% of original. Accuracy of 1:50,000. A-1, A-2, A-3, A-4, A-5, A-6, A-7, A-8, A-9, A-10, A-11, A-12, A-13, A-14, A-15, A-16, A-17, A-18, A-19, A-20, A-21, A-22, A-23, A-24, A-25, A-26, A-27, A-28, A-29, A-30, A-31, A-32, A-33, A-34, A-35, A-36, A-37, A-38, A-39, A-40, A-41, A-42, A-43, A-44, A-45, A-46, A-47, A-48, A-49, A-50, A-51, A-52, A-53, A-54, A-55, A-56, A-57, A-58, A-59, A-60, A-61, A-62, A-63, A-64, A-65, A-66, A-67, A-68, A-69, A-70, A-71, A-72, A-73, A-74, A-75, A-76, A-77, A-78, A-79, A-80, A-81, A-82, A-83, A-84, A-85, A-86, A-87, A-88, A-89, A-90, A-91, A-92, A-93, A-94, A-95, A-96, A-97, A-98, A-99, A-100.

SCALE 1:63,500  
0 1 2 3 4 KILOMETERS  
0 1 2 3 4 MILES



LOCATION INDEX



## 900 Hz COPLANAR RESISTIVITY OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES QUADRANGLE  
2003

**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DODEM<sup>®</sup> Electromagnetic (EM) system and a Trimble<sup>®</sup> differential GPS system. The survey was flown at a height of 100 feet. The DODEM EM system consisted of a 900 Hz radio transmitter, GPS navigation system, 50/100 Hz receiver and data logger. Flights were performed with an AS350B-2<sup>®</sup> Sikorski helicopter at a mean terrain clearance of 200 feet using 1000E survey flight lines with a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

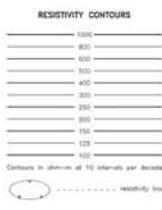
An ASPEN<sup>®</sup> G224 NAVSTAR<sup>®</sup> Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path locations were projected onto the Clarke 1866 UTM zone 18J universal, 1983 North American datum using a constant meridian (CM) of 141° 14' north-south and an east constant of 500,000. Planimetric accuracy of the ground data is better than 10 m with respect to the UTM grid.

**PREVIOUSLY SURVEYED AREAS**

The previously acquired geophysical data were acquired with a DODEM<sup>®</sup> EM system and a Trimble<sup>®</sup> differential GPS system. The survey was flown at a height of 100 feet. The DODEM EM system consisted of a 900 Hz radio transmitter, GPS navigation system, 50/100 Hz receiver and data logger. Flights were performed with an AS350B-2<sup>®</sup> Sikorski helicopter at a mean terrain clearance of 200 feet using 1000E survey flight lines with a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

**RESISTIVITY**

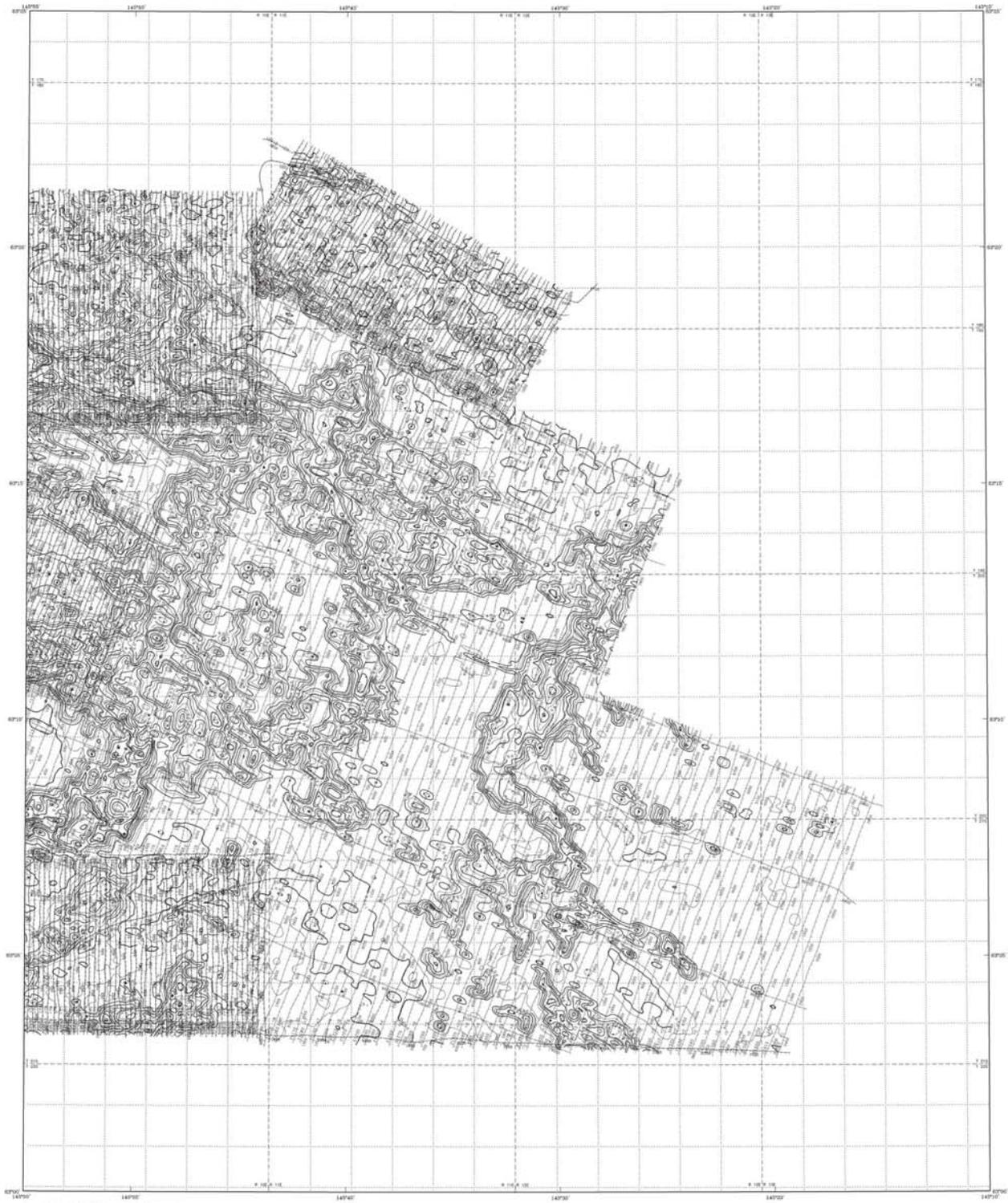
The DODEM<sup>®</sup> EM system measured in-phase and quadrature components of EM frequency. The in-phase component data were separated at 1000 and 5000 Hz, while three quadrature component pairs separated at 500, 1000, and 50,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to natural conductive, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase and quadrature components of the in-phase 900 Hz using the pseudo-layer half space model (Wenner 1973). The data were interpreted into a resistivity 100 m grid using a modified Wenner (1973) technique. The 900 Hz coplanar EM data from the current survey have been merged with the resistivity data from the previously acquired areas. To facilitate the merge between data sets, the resistivity for the previously acquired 900 Hz coplanar EM data was reclassified using the pseudo-layer half space model.



**SURVEY HISTORY**

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Bureau of Geological & Geophysical Surveys (DGG), and the Bureau of Land Management, Alaska Division (BLM/AD). The geophysical data for the current area were acquired and processed by Fugro Airborne Surveys in 2002. Additional geophysical data for the Colville Delta, Fish Lake Basin, and Tongue Lake areas were acquired in 1992 to 1994 and were previously used by the U.S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Later BLM use the contract number for DGG.

This map and other products from this survey are available by mail order or in person from DGG, 714 University Ave., Suite 205, Fairbanks, Alaska, 99701. Some products are also available in person only at the BLM's Bureau of Land Management, 100 South Bush, Seward, Alaska, 99624.



Scale: 1:63,360  
North arrow true to U.S. Geological Survey 80 North at 1:63,360 scale  
Fig. 1003-5-4c, 2003, Geological Survey



LOCATION INDEX



## 900 Hz COPLANAR RESISTIVITY OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES QUADRANGLE  
2003

**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DODEM<sup>®</sup> Electromagnetic (EM) system and a Solinst<sup>®</sup> dual-magnetometer. Data were flown at a height of 100 feet. In addition to the recorded data, a flight path, a radar altimeter, GPS navigation system, 50/100 Hz magnetic and video camera, flights were performed with an AS350B-2 Super helicopter at a mean terrain clearance of 200 feet above NAD83 survey flight lines with a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

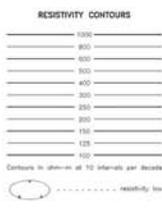
An ASPEN<sup>®</sup> Q224 Navigator<sup>®</sup> Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path locations were projected onto the Clarke 1866 UTM zone 11 westward, 1983 North American datum using a central meridian (CM) of 149° 00' 00" west longitude and an east constant of 500,000 meters. Relative accuracy of the recorded data is better than 10 m with respect to the UTM grid.

**PREVIOUSLY SURVEYED AREAS**

The previously acquired geophysical data were acquired with a Solinst<sup>®</sup> dual-magnetometer. The electromagnetic system utilized dual-magnetometer units at 845 Hz and 4475 Hz and three subsurface soil points at 845 Hz, 4150 Hz and 52,400 Hz. In addition to the recorded data, a radar altimeter, GPS navigation system, 50/100 Hz magnetic and video camera, flights were performed with an AS350B-2 Super helicopter at a mean terrain clearance of 200 feet above NAD83 survey flight lines with a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

**RESISTIVITY**

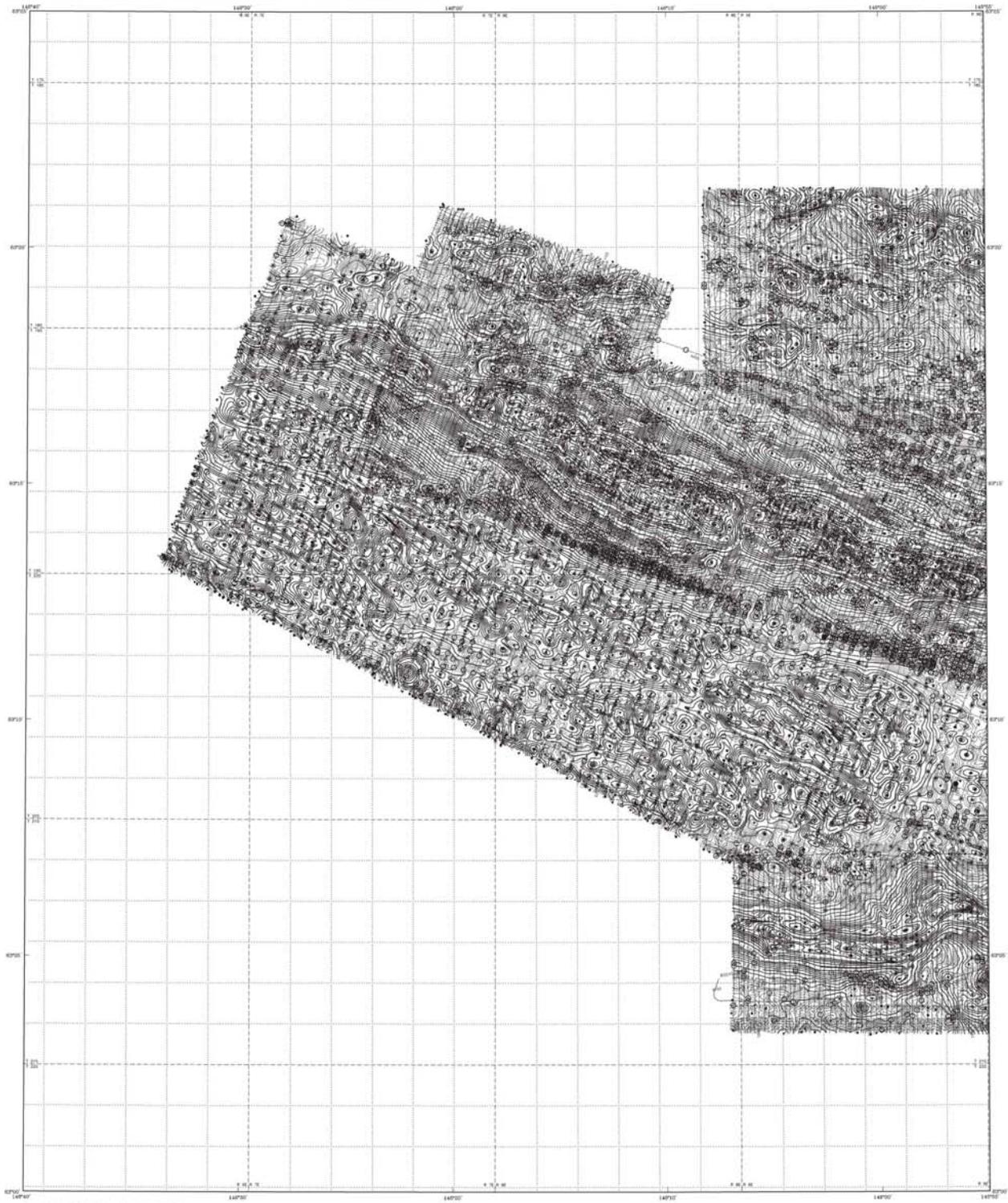
The DODEM<sup>®</sup> EM system measured in-phase and quadrature components of the magnetic field. The derived conductivity data were reported at 1000 and 5000 Hz, while three magnetic susceptibility data were reported at 300, 700, and 10,000 Hz. EM data were reported at 0.1 second intervals. The EM system responds to natural induction, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase and quadrature components of the apparent 900 Hz using the pseudo-layer half space model (Foster 1978). The data were interpreted onto a regular 100 m grid using a modified Area 11070 technique. The 900 Hz apparent resistivity data from the current survey have been merged with the resistivity data from the previously acquired 845 Hz coplanar EM data and re-interpreted using the pseudo-layer half space model.



**SURVEY HISTORY**

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Bureau of Geological & Geophysical Surveys (DGG), and the Bureau of Land Management, Geophysical Division (DGG), and the Bureau of Land Management, Geophysical Division (DGG). The geophysical data for this current area were acquired and processed by Fugro Airborne Surveys in 2002. Additional geophysical data for the Central Delta, Fish Lake Basin, and Tongue Lake areas were acquired in 1992 by the Bureau of Land Management, Geophysical Division (DGG) and conducted on behalf of the U.S. Department of Interior, Bureau of Land Management (BLM) and conducted on behalf of its mineral assessment program in the Delta River area. Land files are the correct source for DGG.

This map and other products from this survey are available by mail order or in person from DGG, 714 University Ave., Suite 205, Fairbanks, Alaska, 99701. Some products are also available in person only at the BLM's Alaska Mining Information Center, 100 Seward Street, Seward, Alaska, 99624.



Scale: 1:62,500. UTM Zone 18N, Datum: NAD 83, Spheroid: GRS 1980, Projection: UTM.



LOCATION INDEX



## TOTAL MAGNETIC FIELD AND ELECTROMAGNETIC ANOMALIES OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES QUADRANGLE  
2003

**DESCRIPTIVE NOTES**

The geophysical data were acquired with a GEODETIC Electromagnetic (EM) system and a Sinterex digital magnetometer. Data were flown at a height of 100 feet. The system flew a survey rectangle from a raster altimeter, GPS navigation system, 50/100 Hz monitors and video camera. Flights were performed with an AS350B-2 Super helicopter at a mean terrain clearance of 200 feet using ADS-1 survey flight lines with a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

an ASPEN/CGI24 HAZARDUS Global Positioning System and 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 locations were projected onto the Clarke 1866 UTM zone 18N datum, 1983 North American datum using a central meridian (CM) of 141° 14" north coordinate of 0 and an east constant of 500,000. Relative accuracy of the projected data is better than 10 m with respect to the UTM grid.

**PREVIOUSLY SURVEYED AREAS**

The previously acquired geophysical data were acquired with an aerial Geometric Electromagnetic (EM) system and a Sinterex digital magnetometer. The electromagnetic system utilized four modified composite coil pairs at 830 Hz and 8,470 Hz and three horizontal coil pairs at 840 Hz, 8,150 Hz and 52,450 Hz, respectively. In addition, the survey recorded data from a raster altimeter, GPS navigation system, 50 Hz monitor and video camera. The GPS electronic positioning system operated in differential mode. The flight line direction varies from north to south on routes 1002E, 1002F, 1002G and 1002H. The flight lines were approximately one mile apart. Estimated to have been flown with the current survey with error both for 1988 and 2002 survey areas. The older survey was flown with a AS350B2 helicopter.

**ELECTROMAGNETIC ANOMALIES**

- Conductivity
- Induction
- Spontaneous anomaly
- △ Area contoured associated with an EM magnetic response

**ELECTROMAGNETICS**

To determine the location of EM anomalies or their boundaries, the GEODETIC EM system measured primary and secondary components of EM frequency. Two vertical coil-pair sets oriented at 1000 and 5000 Hz and three horizontal magnetometer pairs oriented at 800, 2000, and 50,000 Hz. EM data were collected at 0.5 second intervals. The EM system responds to bedrock conductors, conductive pebbles, and cultural structures. The power line monitor and the flight track video were examined to locate cultural sources. The EM responses that are indicated are classified by conductivity.

**TOTAL MAGNETIC FIELD**

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 magnetic variation, (2) reduced to the base line data, and (3) interpolated with a regular 100 m grid using a smoothing spline (SPLINE) technique. The regional correction (or IGRF gradient, 2000, updated by Magnet 2002) was removed from the leveled magnetic data.

**MAGNETIC CONTOUR INTERVAL**

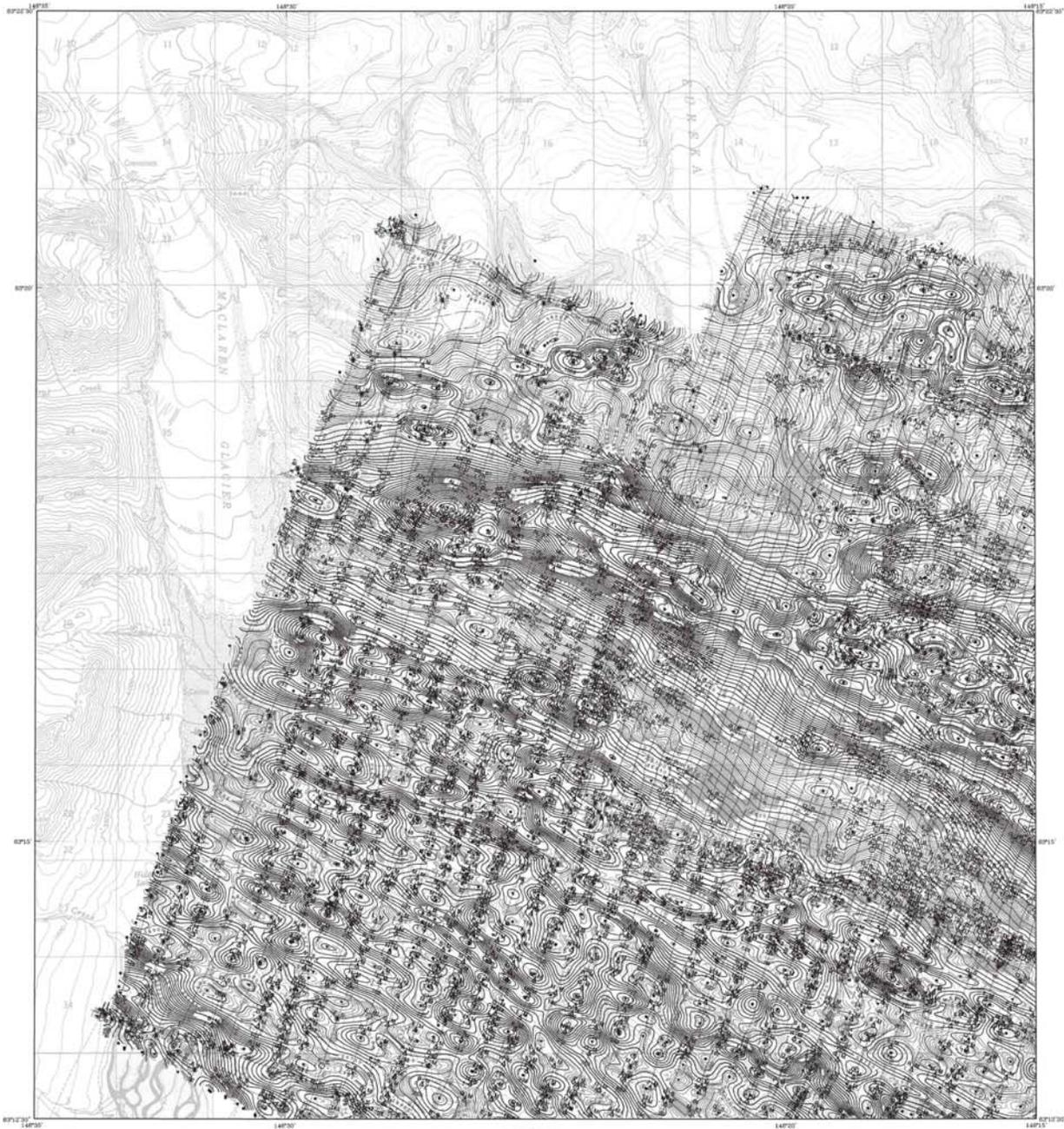
- ..... 100 mT
- ..... 50 mT
- ..... 10 mT
- ..... 5 mT
- ..... magnetic top
- ..... magnetic high

**SURVEY HISTORY**

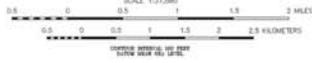
This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Bureau of Geological & Geophysical Surveys (DGGG), and Stevens Exploration Management Corporation geophysical data for the current area were acquired and processed by Fargo Airborne Surveys in 2002. Additional geophysical data for the Colville, Delta, Fish Lake, Klamath, and Tongue Lake areas were acquired in 1988 by the State of Alaska and were processed by the U.S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Later Bureau use the contract number for DGGG.

This map and other products from this survey are available by mail order or in person from DGGG, 714 University Ave., Suite 205, Fairbanks, Alaska, 99701. Some products are also available in person only at the BLM's Junction Mining Information Center, 150 Seward Street, Stearns, Alaska, 99824.





Base Data U.S. Geological Survey 40, Maps A-4, B-5, A-6, B-6  
S.T. 500 5-4, 5-5, 5-6, 5-7, 5-8, 5-9, 5-10, 5-11, 5-12



**DESCRIPTIVE NOTES**

The geophysical data were acquired with a GDEM<sup>®</sup> Electromagnetic (EM) system and a Scripps custom magnetometer. Both were flown at a height of 100 feet. In addition the survey recorded data from a radio altimeter, GPS navigation system, 500-foot magnetic and dip compass. Flights were performed with an A3550B-2 Squire helicopter at a mean terrain elevation of 200 feet above 1420° N survey lines with a spacing of a quarter of a mile. The lines are flown perpendicular to the flight lines at intervals of approximately 3 miles.

An Ashtech G24 NAVSTAR / GLOBALSTAR Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using postflight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the GCS NAD 83 (UTM zone 6) spheroid, 1927 North American datum using a central meridian (CM) of 147° 00' 00" west of G and an east constant of 500,000. Positional accuracy of the presented data is better than 10 m with respect to the UTM grid.

**PREVIOUSLY SURVEYED AREAS**

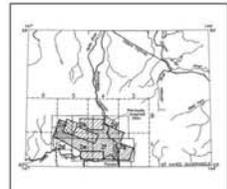
The previously acquired geophysical data were acquired with an aerial Corbis Electromagnetic (EM) system and a Scripps custom magnetometer. The electromagnetic system utilized two vertical coil pairs at 800 Hz and 4.747 kHz and two horizontal coil pairs at 800 Hz, 4.188 Hz and 33,490 Hz. Mean terrain elevations for the magnetometer and EM system were greater than 150 and 100 feet, respectively. In addition the survey recorded data from a radio altimeter, GPS navigation system, 80 Hz monitor and video camera. The GPS electronic positioning system operated in differential mode. The flight line direction curves from track to track are followed (except for 1420° N curves and Fish Lake 1420° E and 1420° W and Tongue Lake 1420° E and 1420° W). EM data were acquired at 0.1 second intervals. The EM system responds to bedrock conductors, conductive sediments, and cultural structures. The type of conductor is indicated on the geophysical map by the number of the magnetic response. Other magnetic responses of the EM system are based on EM anomaly shapes of the magnetic and resistivity responses. Together with conductor and magnetic patterns and topography, the map shows the magnetic and resistivity data were examined to locate cultural sources.

**ELECTROMAGNETICS**

To determine the location of EM anomalies of their boundaries the GDEM<sup>®</sup> EM system measured separate and quadrature components of five frequencies. Two vertical coil-pair pairs operated at 1000 and 2000 Hz while three horizontal coil-pair pairs operated at 300, 700, and 50,000 Hz. EM data were acquired at 0.1 second intervals. The EM system responds to bedrock conductors, conductive sediments, and cultural structures. The type of conductor is indicated on the geophysical map by the number of the magnetic response. Other magnetic responses of the EM system are based on EM anomaly shapes of the magnetic and resistivity responses. Together with conductor and magnetic patterns and topography, the map shows the magnetic and resistivity data were examined to locate cultural sources.

**TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA**  
PARTS OF MT. HAYES A-5, A-6, B-5 AND B-6 QUADRANGLES  
2003

LOCATION INDEX FOR SCALE 1:51,680



**SURVEY HISTORY**

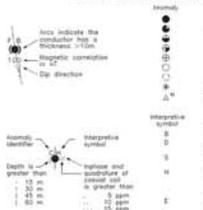
This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Bureau of Geological & Geophysical Surveys (BGGGS), and Geosens Exploration Management Corp. Airborne geophysical data for the current area were acquired and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Central, Exuma, Fish Lake, Rany and Tongue Lake areas were acquired in 1995 by an uncontracted party and were provided for publication by the BLM. The current survey was funded by the U.S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Laurel Burns was the contract manager for GDEM.

This map and other products from this survey are available by web order or in person from GDEM, 794 University Ave., Suite 200, Fairbanks, Alaska, 99709. Some products are also available in person only at the BLM's Alaska Mineral Information Center, 100 Seaska Road, Douglas, Alaska, 99524.

**TOTAL MAGNETIC FIELD**

The total magnetic field data were acquired with a sampling interval of 0.5 seconds. The data were (1) converted for datum operations by subtraction of the magnetic declination (magnetic declination), (2) leveled to the sea level datum, and (3) interpolated onto a regular 100 m grid using a modified spline (1970) technique. The regional correction (or IGRF gradient, 2000) is added to August, 2002) was removed from the leveled magnetic data.

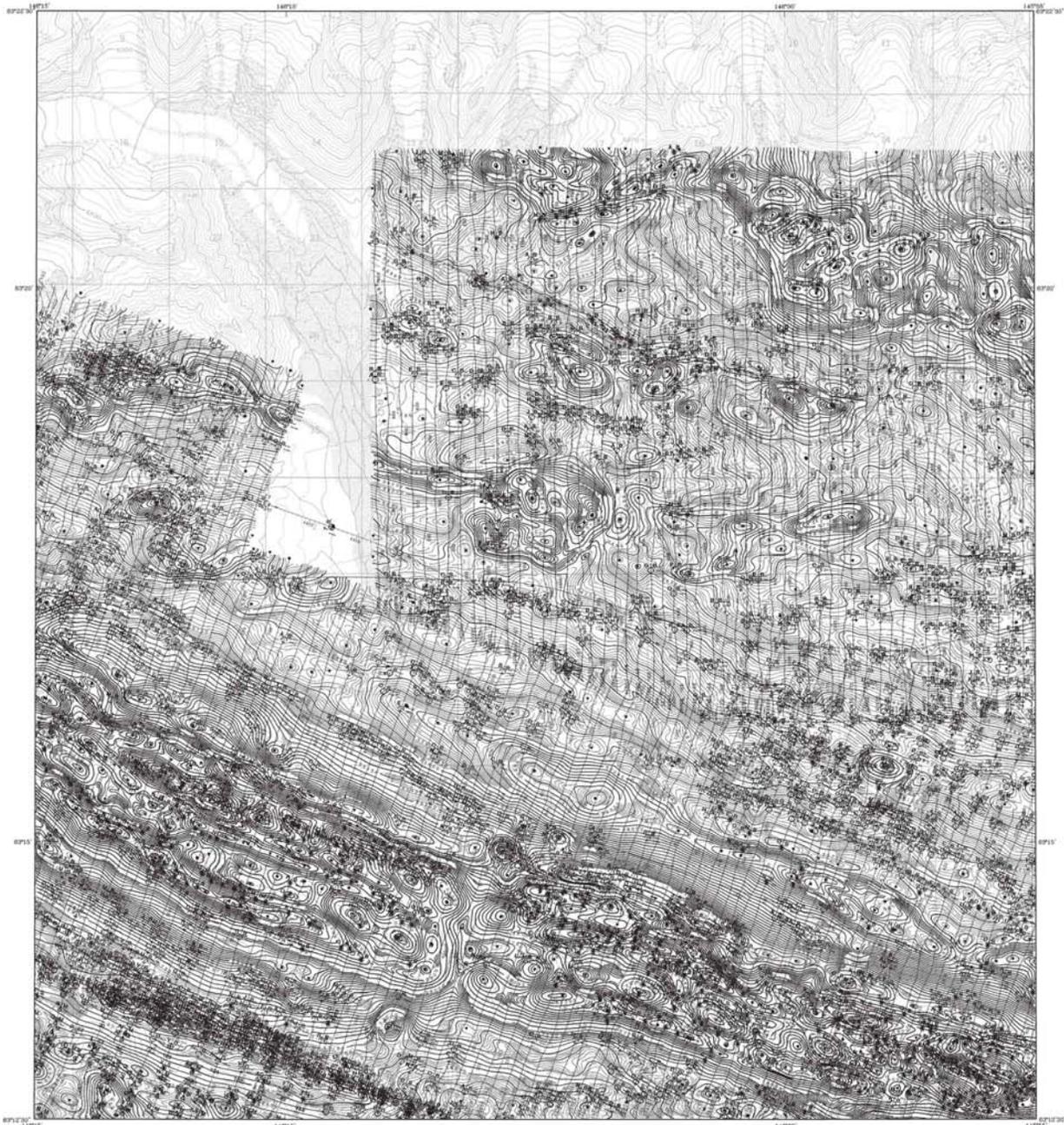
**ELECTROMAGNETIC ANOMALIES**



**MAGNETIC CONTOUR INTERVAL**



Hess, H., 1970. A new method of interpolation and smooth curve fitting based on the principle of least squares. *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-601.



Base Data US Geological Survey 48, Maps A-4, A-5, B-4, B-5  
U.S. GPO: 1978 O-378-708

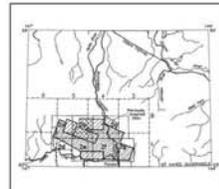


LOCATION INDEX FOR SCALE 1:51,680



## TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES A-4, A-5, B-4 AND B-5 QUADRANGLES  
2003



### DESCRIPTIVE NOTES

The geophysical data were acquired with a GOMEX<sup>®</sup> Electromagnetic (EM) system and a Scripps custom magnetometer. Both were flown at a height of 100 feet. In addition the survey recorded data from a radio altimeter, GPS navigation system, 500-foot retractor and line sensors. Flights were performed with an AC3082-2 Sycamore helicopter at mean terrain elevations of 200 feet above 1927 North American datum with a spacing of a quarter of a mile. The lines are flown perpendicular to the flight lines at intervals of approximately 3 miles. An AARtech GG24 NAVSTAR / GLOHASIS Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using postflight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the GRS80 (UTM zone 6) spheroid, 1927 North American datum using a central meridian (CM) of 147° 0 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.

### PREVIOUSLY SURVEYED AREAS

The previously acquired geophysical data were acquired with an Aerotec Geomagnetic (EM) system and a Scripps custom magnetometer. The electromagnetic system utilized two vertical coil pairs at 830 Hz and 1470 Hz and three horizontal coil pairs at 830 Hz, 4.185 Hz and 33,490 Hz. Mean terrain elevations for the magnetic lines were 100 feet, respectively. In addition the survey used a radio altimeter, GPS navigation system, 50 Hz monitor and video camera. The GPS electronic positioning system operated in differential mode. The flight line direction varied from track to track on following General 1927C, Curlew and Fish Lake 1927C, and Rainy and Tongue Lake 1927C. The flight lines were one-eighth mile apart. Excepted to lines were flown with the current survey which cover both the 1995 and 2002 survey areas. The older survey was flown with a AC3082 helicopter.

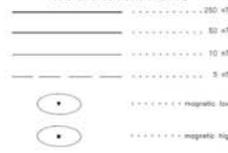
### ELECTROMAGNETICS

To determine the location of EM anomalies of their boundaries, the GOMEX EM system measured magnetic and quadrature components at five frequencies. Two vertical coil-pair pairs operated at 1000 and 2000 Hz and three horizontal coil-pair pairs operated at 300, 700, and 50,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive sediments, and cultural sources. The type of conductor is indicated on the composite map by the intensity of the response and quadrature response. Together with conductor and magnetic patterns and topography, the more the north-south and the right track view were examined to locate cultural sources.

### ELECTROMAGNETIC ANOMALIES



### MAGNETIC CONTOUR INTERVAL



### SURVEY HISTORY

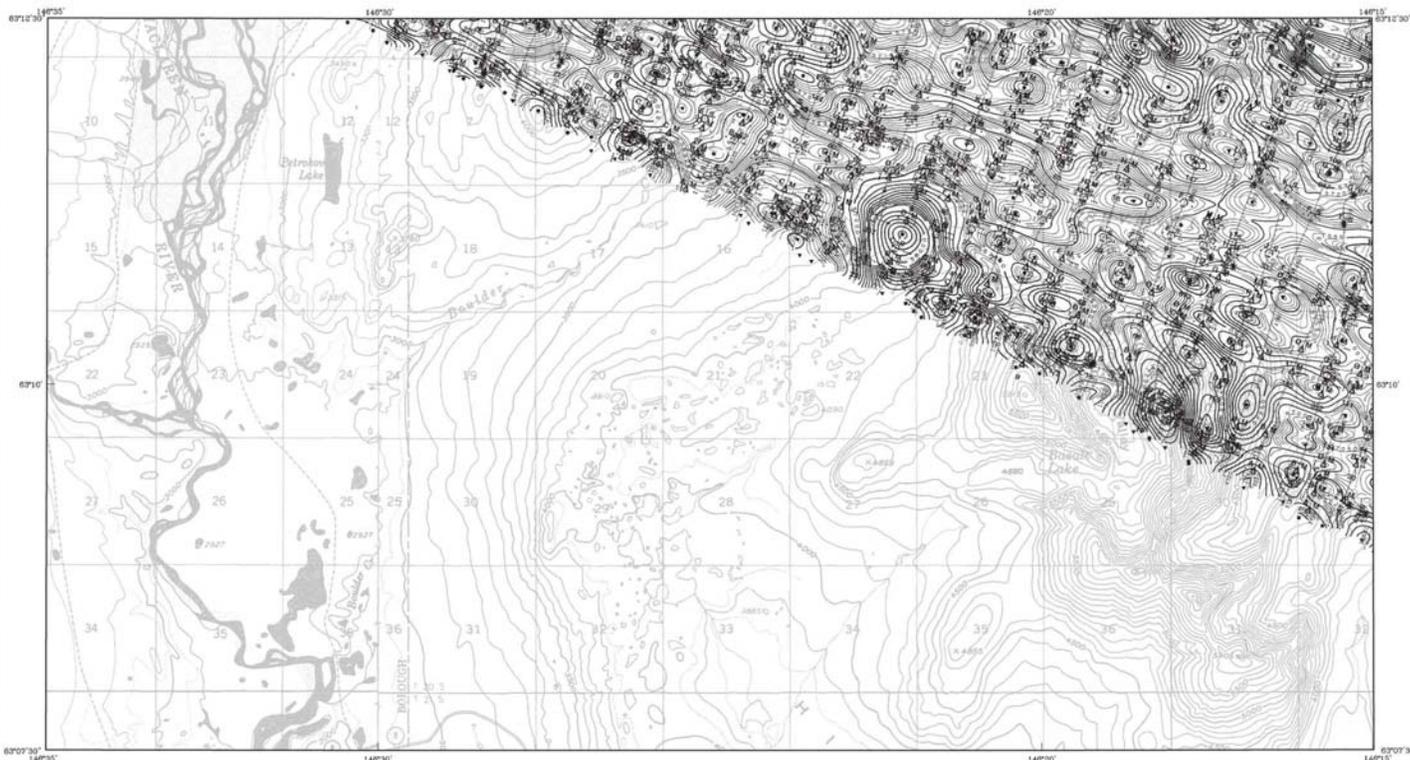
This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and Geomatics Exploration Management Corp. Airborne geophysical data for the current area were acquired and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Curlew, Excess, Fish Lake, Rainy and Tongue Lake areas were acquired in 1995 by a contract program of the Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Laurel Burns was the contract manager for DGGS.

### TOTAL MAGNETIC FIELD

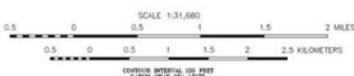
The total magnetic field data were acquired with a sampling interval of 0.1 second and were (1) converted for datum operations by subtraction of the magnetic north (magnetic declination), (2) leveled to the 56 one datum, and (3) interpolated onto a regular 100 m grid using the nearest-neighbor (1970) technique. The regional correction (or IGRF gradient, 2000, updated to August, 2002) was removed from the leveled magnetic data.

Hess, H., 1970. A new method of interpolation and smooth curve fitting based on area preservation. *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 588-592.

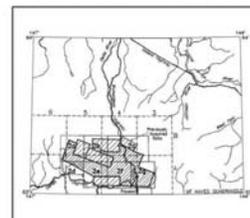




From U.S. Geological Survey W. Stone 4-6, 1978, 4-8, 1979, Geologic Map, Alaska



LOCATION INDEX FOR SCALE 1:31,680



## TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA PARTS OF MT. HAYES A-5 AND A-6 QUADRANGLES 2003

### DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM<sup>3</sup> 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 N207E survey flight lines with a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

An Aantech G024 NAVSTAR 7 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°, 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.

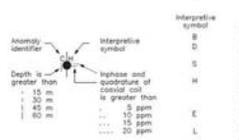
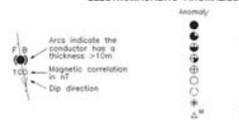
### PREVIOUSLY SURVEYED AREAS

The previously acquired geophysical data were acquired with an Aerodot Condor Electromagnetic (EM) system and a Scintrex cesium magnetometer. The electromagnetic system utilized two vertical coaxial coil pairs of 836 Hz and 4.416 Hz and three horizontal coil pairs of 849 Hz, 4.189 Hz and 32,490 Hz. Mean terrain clearance for the magnetometer and EM system were slightly higher than 150 and 100 feet, respectively. In addition the survey recorded data from a radar altimeter, GPS navigation system, 60 Hz monitor and video camera. The GPS electronic positioning system operated in differential mode. The flight line direction comes from block to block as follows: Conwell N207E, Eureka and Fish Lake N207E, and Rainy and Tongue Lake N45E. The flight lines were one-eighth mile apart. Extended tie lines were flown with the current survey which cover both the 1995 and 2002 survey areas. The older survey was flown with a AS350B2 helicopter.

### ELECTROMAGNETICS

To determine the location of EM anomalies or their boundaries, the DIGHEM<sup>3</sup> EM system measured phase and quadrature components of five frequencies. Two vertical coaxial-coil pairs operated at 1000 and 5500 Hz while three horizontal coaxial-coil pairs operated at 900, 7200, and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. The type of conductor is indicated on the aeromagnetic map by the interpretive symbol attached to each EM anomaly. Determination of the type of conductor is based on EM anomaly shapes of the coaxial- and coplanar-coil responses, together with conductor and magnetic patterns and topography. The power line monitor and the flight track video were examined to locate cultural sources.

### ELECTROMAGNETIC ANOMALIES



### SURVEY HISTORY

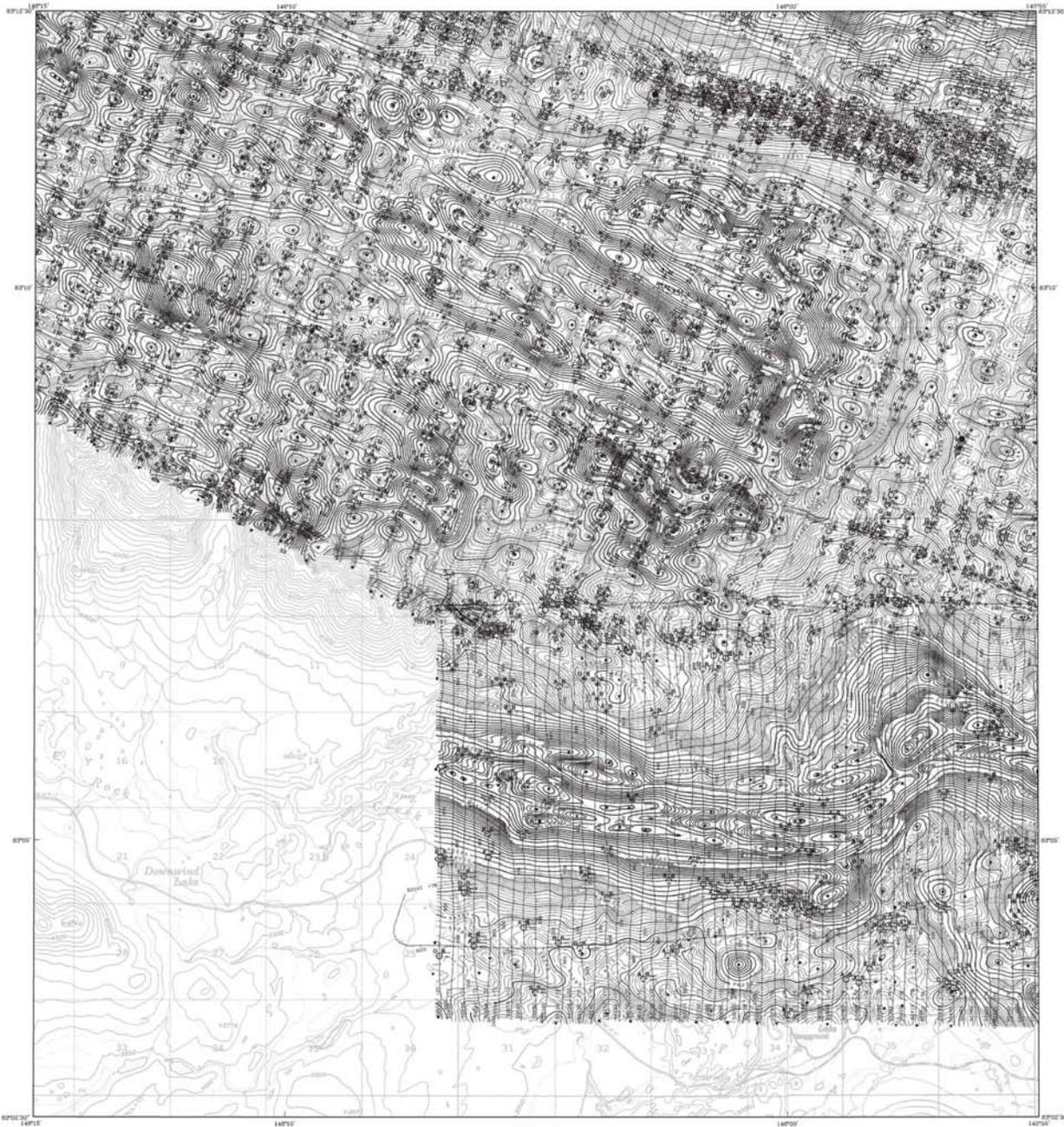
This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGG), and Stevens Exploration Management Corp. Airborne geophysical data for the current area were acquired and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Conwell, Eureka, Fish Lake, Rainy and Tongue Lake areas were acquired in 1995 by Aerodot Inc. and were provided for publication by the BLM. The current survey was funded by the U. S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Laurel Burns was the contract manager for DGG.

This map and other products from this survey are available by mail order or in person from DGG, 734 University Ave., Suite 200, Fairbanks, Alaska, 99709. Some products are also available in person only at the BLM's Juneau Mineral Information Center, 100 Svalikko Road, Douglas, Alaska, 99824.

### TOTAL MAGNETIC FIELD

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 Simpson (1970) technique. The regional variation (or IGRF gradient, 2000, updated to August, 2002) was removed from the leveled magnetic data.

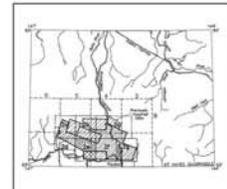
ALASKA, H. 1970. A new method of interpolation and smooth curve fitting based on least squares. *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.



From U.S. Geological Survey 60, 6000-1, 1995, and 60, 6000-2, 1995, Southgate, Alaska.



LOCATION INDEX FOR SCALE 1:31,880



## TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES A-4 AND A-5 QUADRANGLES  
2003



### DESCRIPTIVE NOTES

The geophysical data were acquired with a DIOHEM<sup>®</sup> Electromagnetic (EM) system and a Schriev casing magnetometer. Both were flown at a height of 100 feet. In addition the survey recorded data from a rotor antenna, GPS navigation system, 50/70 Hz bandpass and noise canceler. Flights were performed with an AC350B-2 Sikorski helicopter at a mean flight altitude of 200 feet using 1000 ft mean flight lines with a spacing of 0.25 miles. The lines are flown perpendicular to the flight lines at intervals of approximately 3 miles. An ashtech G24 NADSTAR / OLIVETTI 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 3 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 6) spheroid, 1927 North American datum using a control projection (CA) of 147.0 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.

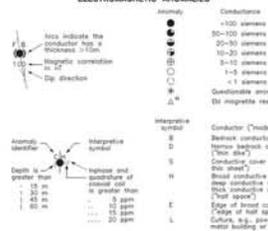
### PREVIOUSLY SURVEYED AREAS

The previously acquired geophysical data were acquired with an Aerovis Gamma Electromagnetic (EM) system and a Schriev casing magnetometer. The electromagnetic system utilized four vertical coil pairs at 840 Hz and 4.475 Hz and one horizontal coil pair at 840 Hz, 4.188 Hz and 32.490 Hz. Mean terrain elevations for the magnetic field EM system are generally higher than 100 and 100 feet, respectively. In addition the survey recorded data from a rotor antenna, GPS navigation system, 80 Hz monitor and noise canceler. The GPS navigation system operated in differential mode. The flight line direction varies from track to track on follow course 1527E, Kuruk and Fish Lake N207E and Rainy and Tangle Lake N1-S. The flight lines were one-way and Tangle Lake N1-S. The flight lines were the current survey which cover both the 1950 and 2003 survey areas. The older survey was flown with a 4233B2 Helicopter.

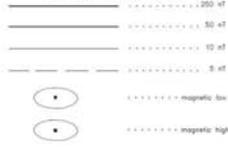
### ELECTROMAGNETICS

To determine the location of EM anomalies or their boundaries, the DIOHEM EM system measured phase and quadrature components of five frequencies. Two vertical coil-coil pairs operated at 1000 and 5000 Hz while three horizontal coil-coil pairs operated at 300, 700, and 6500 Hz. EM data were collected at 0.1 second intervals. The EM system responds to bedrock conductors, conductor anomalies, and cultural sources. The type of conductor is indicated on the geophysical map by the response curve attached to each EM anomaly. Determination of the type of conductor is based on EM response of the near-surface and deeper coil responses, together with conductor and magnetic patterns and topography. The near the monitor and the flight track lines were examined to locate cultural sources.

### ELECTROMAGNETIC ANOMALIES



### MAGNETIC CONTOUR INTERVAL



### SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Survey (DGGG), and Stevens Exploration Management Corporation geophysical data for the current area were acquired and processed by Tugis Alaska Surveys in 2002. Airborne geophysical data for the Curlew, Kuruk, Fish Lake, Rainy and Tangle Lake areas were acquired in 1950 by aerobatics and were provided for publication by the BLM. The current survey was funded by the U. S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of the mineral assessment program in the Delta River mining district. Laura Burns was the contract manager for DGGG.

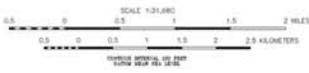
### TOTAL MAGNETIC FIELD

The total magnetic field data were acquired with an aerobatics system of 0.1 second pulse wave (1) corrected for diurnal variations by subtraction of the diurnal variation from the total field, (2) leveled to the sea datum, and (3) interpolated with a minimum 100 m grid using the digital filter (1970) technique. The regional variation (or IGF) gradient, 2000, obtained in August 2002, was removed from the leveled magnetic data.

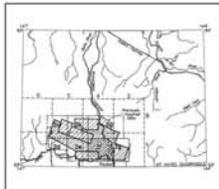
Hein, H., 1970. A new method of interpretation and smooth curve fitting based on time derivatives. Journal of the Association of Consulting Geologists, v. 17, no. 4, p. 88-92.



From U.S. Geological Survey 60, Mon. A-4, 1970, Washington, D.C.



LOCATION INDEX FOR SCALE 1:31,680



## TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PART OF MT. HAYES A-4 QUADRANGLE  
2003

**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DIOHEM<sup>®</sup> Electromagnetic (EM) system and a Schriev casing magnetometer. Both were flown at a height of 100 feet. In addition the survey recorded data from a color altimeter, GPS navigation system, 500/50 Hz monitors and odometer. Flights were performed with an AC308B-2 Sikorski helicopter at a mean terrain clearance of 200 feet above treetops. The flight lines with a spacing of 0.25 miles and a flight line interval of approximately 3 miles.

An Ashtech G24 HIKSTAR / OLIVETTI 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 3 m. Flight path positions were projected onto the Clarke 1860 (UTM zone 6) spheroid, 1927 North American datum using a control elevation (CA) of 147.0 m north constant of 0 and an east constant of 500,000. Positional accuracy of the oriented data is better than 10 m with respect to the UTM grid.

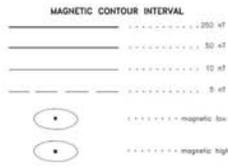
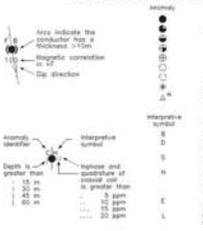
**PREVIOUSLY SURVEYED AREAS**

The previously acquired geophysical data were acquired with an Aerolex Electromagnetic (EM) system and a Schriev casing magnetometer. The aerolex 50 Hz and 4.175 Hz and one horizontal coil pair at 640 Hz, 4.175 Hz and one horizontal coil pair at 640 Hz, 4.175 Hz and 32,490 Hz. Mean terrain clearance for the aerolex EM system was greater than 100 and 100 feet, respectively. In addition the survey recorded data from a color altimeter, GPS navigation system, 80 Hz monitor and video camera. The GPS electronic positioning system operated in differential mode. The flight line direction varies from track to track on follow courses 1577E, Eureka and Fish Lake N207E and Rainy and Tangle Lake N-S. The flight lines were one-eighth mile apart. Extended to lines were flown with the current survey which cover both the 1950 and 2002 survey areas. The older survey was flown with a 4233B2 helicopter.

**ELECTROMAGNETICS**

To determine the location of EM anomalies or their boundaries, the DIOHEM EM system measured phase and quadrature components of five frequencies. Two vertical coil-coil pairs operated at 1000 and 2000 Hz while three horizontal coil-coil pairs operated at 300, 700, and 50,000 Hz. EM data were oriented at 0.1 second intervals. The EM system responds to bedrock conductors, conductive anomalies, and cultural structures. The type of conductor is indicated on the geophysical map by the response curves attached to each EM anomaly. These curves are based on the type of conductor based on EM response of the receiver and receiver coil response, together with conductor and magnetic patterns and frequency. The power the receiver and the flight track lines were examined to locate cultural sources.

**ELECTROMAGNETIC ANOMALIES**



**SURVEY HISTORY**

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGGS), and Stevens Exploration Management Corporation geophysical data for the current area were acquired and processed by Tugot Airborne Surveys in 2002. Airborne geophysical data for the Corvax, Eureka, Fish Lake, Rainy and Tangle Lake areas were acquired in 1950 by aerolex data and were processed for publication by the BLM. The current survey was funded by the U.S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Laurel Burns was the contract manager for DGGGS.

This map and other products from this survey are available to all users at no charge from DGGGS, The University, Suite 200, Fairbanks, Alaska, 99703. Some products are also available in paper only at the BLM's Alaska Mineral Information Center, 100 Seward Road, Douglas, Alaska, 99824.

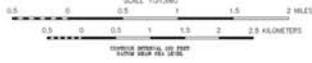
**TOTAL MAGNETIC FIELD**

The total magnetic field data were acquired with an aerolex system and were processed by the BLM. The data were (1) corrected for diurnal variations by subtraction of the diurnal variation from the total magnetic field, (2) leveled to the sea level, and (3) interpolated onto a regular grid using the minimum curvature (1970) technique. The regional variation (or IGRF gradient, 2000) was added in August 2002 and removed from the leveled magnetic data.

Amo, H., 1970. A new method of interpretation and smooth curve fitting based on least squares, Journal of the Association of Consulting Geometers, v. 17, no. 4, p. 94-102.



From U.S. Geological Survey 60, Sheet G-4, 1963, at 1:50,000, Santa Fe, Idaho

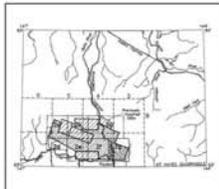


LOCATION INDEX FOR SCALE 1:31,880



## TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES A-3 AND A-4 QUADRANGLES  
2003



**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DIOHEM<sup>®</sup> Electromagnetic (EM) system and a Schriener cesium magnetometer. Both were fixed at a height of 100 feet. In addition the survey recorded data from a rotor antenna, GPS navigation system, 50/70 Hz ground and reference electrodes. Flights were performed with an AC350B-2 2000 ft helicopter at a mean airspeed of 120 ft/sec (36.6 m/sec). The flight lines were spaced at a quarter of a mile. The lines are shown approximately to the flight lines at intervals of approximately 3 miles.

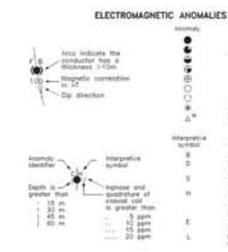
An Ashtech G24 NAVSTAR / OLONASIS Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 3 m. Flight path positions were projected onto the Clarke 1860 (UTM zone 6) spheroid, 1927 North American datum using a control elevation (CA) of 47.0 m, 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.

**PREVIOUSLY SURVEYED AREAS**

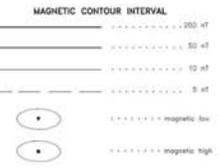
The previously acquired geophysical data were acquired with an Aerolex Electromagnetic (EM) system and a Schriener cesium magnetometer. The aerolex EM system utilized four vertical coil pairs at 640 Hz and 4.475 Hz and one horizontal coil pair at 640 Hz, 4.188 Hz and 32.490 Hz. Mean terrain elevations of the magnetic field EM system were greater than 100 and 100 feet, respectively. In addition the survey recorded data from a rotor antenna, GPS navigation system, 80 Hz monitor and video camera. The GPS electronic positioning system operated in differential mode. The flight line direction varies from track to track on follows contour lines. The flight lines were flown over the Fish Lake, Rainy and Tangle Lake (A-3, A-4) areas. The EM data were collected at 0.1 second intervals. The EM system responds to bedrock conductors, conductive anomalies, and cultural sources. The type of conductor is indicated on the geophysical map by the electrode array attached to each EM anomaly. The resolution of the type of conductor is based on EM images of the receiver and transmitter coil responses, together with conductor and magnetic patterns and topography. The power the receiver and the flight track lines were estimated to locate cultural sources.

**ELECTROMAGNETICS**

To determine the location of EM anomalies or their boundaries, the DIOHEM EM system measured magnetic and quadrature components of five frequencies. Two vertical coil-pair pairs operated at 1000 and 2000 Hz while three horizontal coil-pair pairs operated at 300, 700, and 50,000 Hz. EM data were collected at 0.1 second intervals. The EM system responds to bedrock conductors, conductive anomalies, and cultural sources. The type of conductor is indicated on the geophysical map by the electrode array attached to each EM anomaly. The resolution of the type of conductor is based on EM images of the receiver and transmitter coil responses, together with conductor and magnetic patterns and topography. The power the receiver and the flight track lines were estimated to locate cultural sources.



- ELECTROMAGNETIC ANOMALIES**
- Conductance
  - 1-100 siemens
  - 20-100 siemens
  - 10-20 siemens
  - 1-10 siemens
  - 1-5 siemens
  - <1 siemens
  - Geophysical anomaly
  - EM magnetic response
- Magnetic Variation**
- 0
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- Top Direction**
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**SURVEY HISTORY**

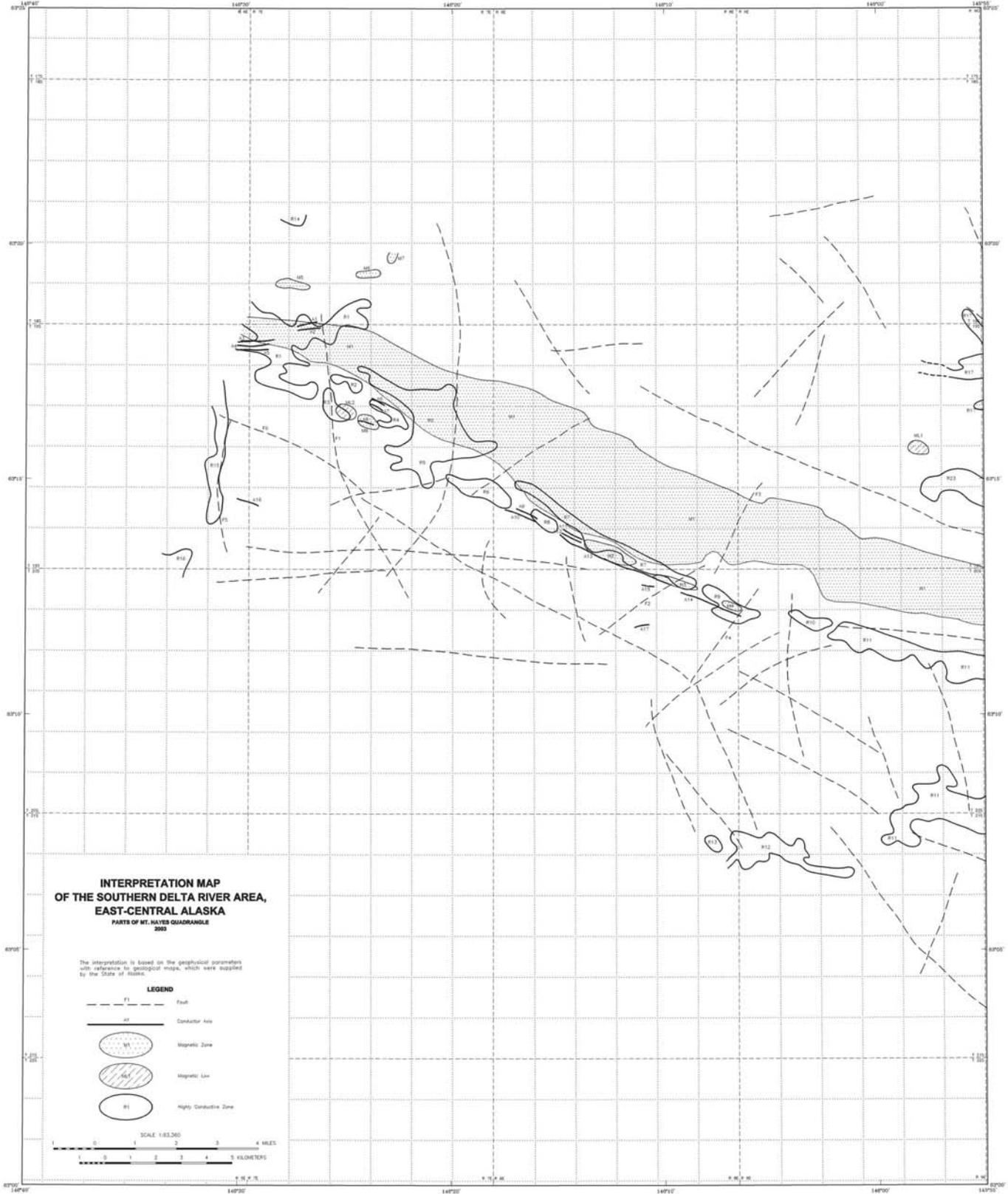
This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and Stevens Exploration Management Corporation geophysical data for the current area were acquired and processed by Tugot Alaska Surveys in 2002. Airborne geophysical data for the Corral, Eureka, Fish Lake, Rainy and Tangle Lake areas were acquired in 1993 by Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Laurie Burns was the contract manager for DGGG.

This map and other products from this survey are available by mail order or in person from DGGG, The University, S-1, Suite 200, Fairbanks, Alaska, 99709. Some products are also available in person only at the BLM's Alaska Mineral Information Center, 100 Saklino Road, Douglas, Alaska, 99824.

**TOTAL MAGNETIC FIELD**

The total magnetic field data were acquired with an aerolex EM system at 1000, 2000, 3000, and 50,000 Hz. The data were processed by subtraction of the aerolex recorded noise (station magnetic data), (2) leveled to the sea level data, and (3) interpolated onto a regular 100 m grid using a modified along (1970) technique. The regional variation (or IGRF gradient, 2000) obtained in August 2002 was removed from the leveled magnetic data.

Almeida, H., 1970. A new method of interpolation and smooth curve fitting based on local properties. *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 989-993.

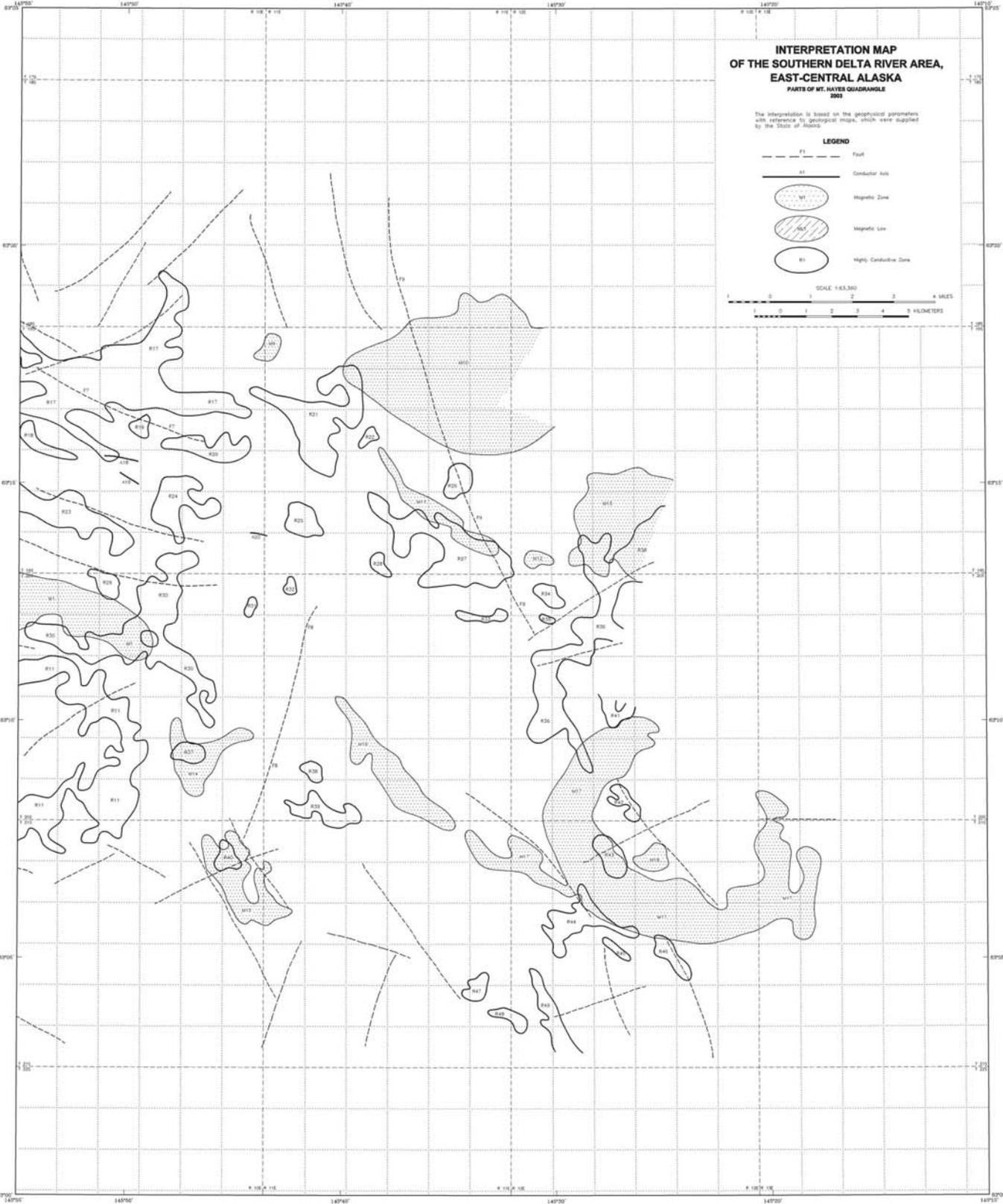


**INTERPRETATION MAP  
 OF THE SOUTHERN DELTA RIVER AREA,  
 EAST-CENTRAL ALASKA**  
 PARTS OF MT. HAYES QUADRANGLE  
 2003

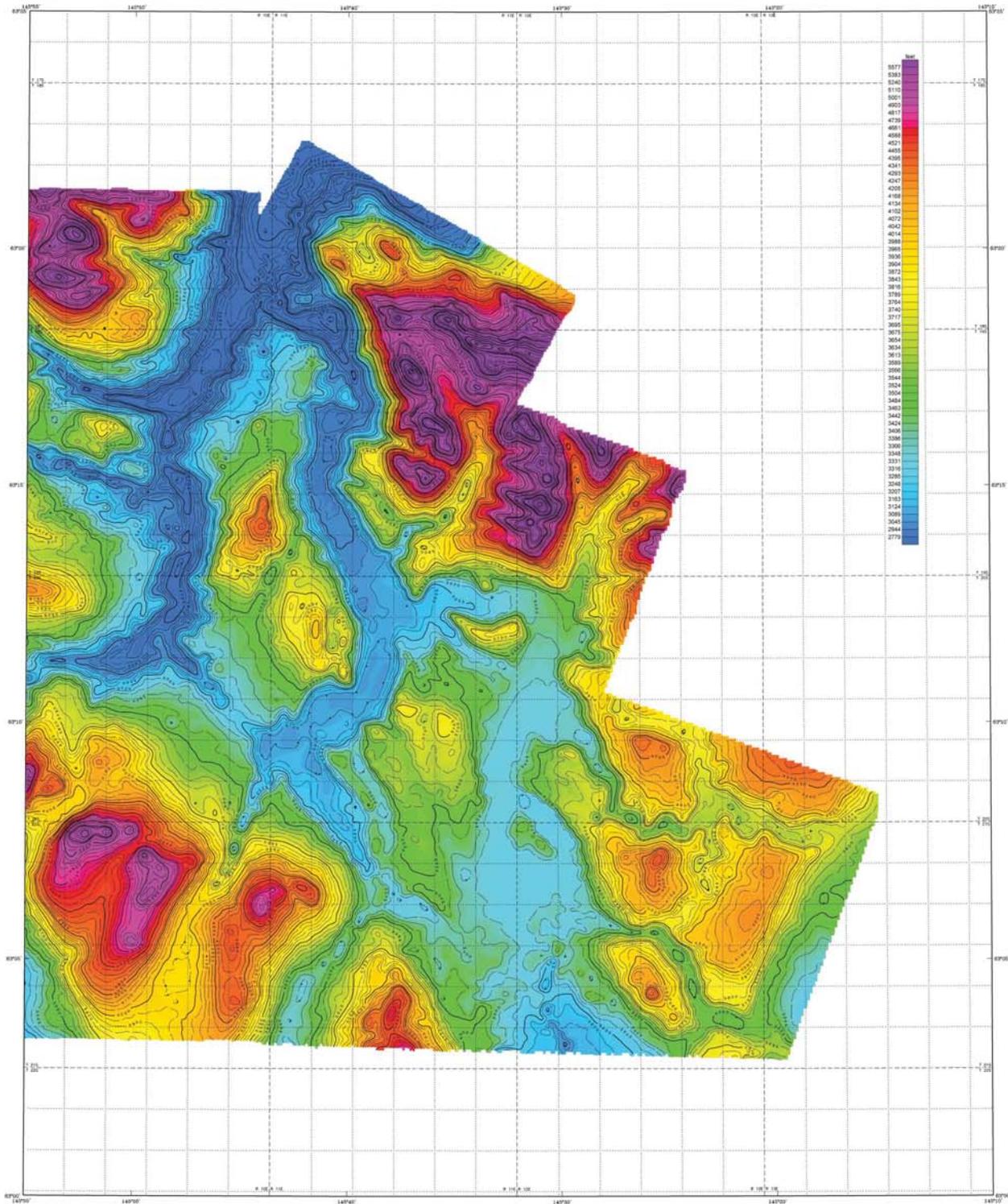
The interpretation is based on the geophysical parameters with reference to geological maps, which were supplied by the State of Alaska.

**LEGEND**

- F1 Fault
- CL Conductive Axis
- M1 Magnetic Zone
- M2 Magnetic Low
- H1 High Conductive Zone



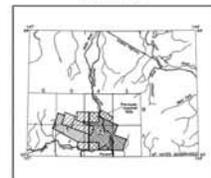




Scale within Area U.S. Geological Survey 60, Sheet 4-1, 600, 4-1, 600  
Fig. 1047, 6-1, 600, Washington, D.C.



LOCATION INDEX



## DIGITAL ELEVATION MODEL OF THE SOUTHERN DELTA RIVER AREA, EAST-CENTRAL ALASKA

PARTS OF MT. HAYES QUADRANGLE  
2003

**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DIMEH<sup>1</sup> Electromagnetic (EM) system and a Solinst<sup>2</sup> continuous magnetometer. Data were flown at a height of 100 feet. In addition, the survey recorded data from a radar altimeter, GPS navigation system, SSI/60 Hz monitors and video camera. Flights were performed with an AS350B-2 Squirrel helicopter at a mean terrain clearance of 200 feet above HADEL survey flight lines with a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines at intervals of approximately 3 miles, in a pattern 0224 NAD83/03 GROUNDSPIDER Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a receiver accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 18) datum, 1927 North American datum using a central meridian (CM) of 143° 30' north-south spacing of 3 and an east constant of 500,000. Relative accuracy of the elevation data is better than 10 m with respect to the UTM grid.

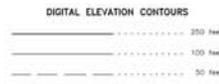
**PREVIOUSLY SURVEYED AREAS**

The previously acquired geophysical data were acquired with a Solinst<sup>2</sup> continuous magnetometer. The electromagnetic system used for the survey was a SSI/60 Hz and three SSI/60 Hz monitors and video camera. The survey recorded data from a radar altimeter, GPS navigation system, SSI/60 Hz monitors and video camera. The flight line direction varies from north to south on a 100-foot grid. The flight lines were flown with the current survey which cover both the 1983 and 2002 survey areas. The older survey was flown with an AS350B2 helicopter.

**DIGITAL ELEVATION MODEL**

This Digital Elevation Model (DEM) has been compiled from GPS-C values minus the ground altimeter data recorded during the course of a helicopter-borne geophysical survey. This is a contour of the ground at a quarter of a mile, azimuth 20 degrees. Elevation values have been interpolated/gridded between survey lines. Every effort has been made to make the model a useful general reference. No guarantee can be made that this model is a true representation of the height above sea level and it may contain minor elevation responses from buildings and in some instances dense timber. Users of the product should be aware of the topographic limitations mapped hereafter.

DO NOT USE THIS MAP FOR NAVIGATION PURPOSES



**SURVEY HISTORY**

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Bureau of Geological & Geophysical Surveys (DGG), and Shreve Exploration Management Corporation. Geophysical data for this area were acquired and processed by Fugro Airborne Surveys in 2002. Airborne geophysical data for the Colville, Kupuk, Fish Lake, Kulu, and Tongue Lake areas were acquired in 1992 for the project and were processed by the U.S. Department of Interior, Bureau of Land Management (BLM) and conducted in support of its mineral assessment program in the Delta River mining district. Lander Barnes was the contract manager for DGG.

This map and other products from this survey are available by mail order or in person from DGG, 734 University Ave., Suite 203, Fairbanks, Alaska, 99709. Some products are also available in person only at the BLM's Bureau Mineral Information Center, 100 Seward Road, Douglas, Alaska, 99624.