

**SLATE CREEK – SLANA RIVER ELECTROMAGNETIC AND MAGNETIC AIRBORNE  
GEOPHYSICAL SURVEY DATA COMPILATION**

Burns, L.E., Barefoot, J.D., Naibert, T.J., Fugro Airborne Surveys Corp., and Stevens  
Exploration Management Corp.

**Geophysical Report 2018-9**

2019  
STATE OF ALASKA  
DEPARTMENT OF NATURAL RESOURCES  
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS



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# **SLATE CREEK – SLANA RIVER ELECTROMAGNETIC AND MAGNETIC AIRBORNE GEOPHYSICAL SURVEY DATA COMPILATION**

Burns, L.E.<sup>1</sup>, Barefoot, J.D.<sup>1</sup>, Naibert, T.J.<sup>1</sup>, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp

## **ABSTRACT**

This geophysical survey is located in interior Alaska in the Chistochina mining district, about 225 kilometers southeast of Fairbanks. Frequency domain electromagnetic and magnetic data were collected with the DIGHEMV system from September to October 2008. A total of 3367.1 line kilometers were collected covering 1151.9 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. Mineral prospects in the survey area include Golden Range, Grubstake, Judy, and POW. 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 Alaska State Legislature as part of the DGGS Airborne Geophysical/Geological Mineral Inventory (AGGMI) program.

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

**AVAILABLE DATA**

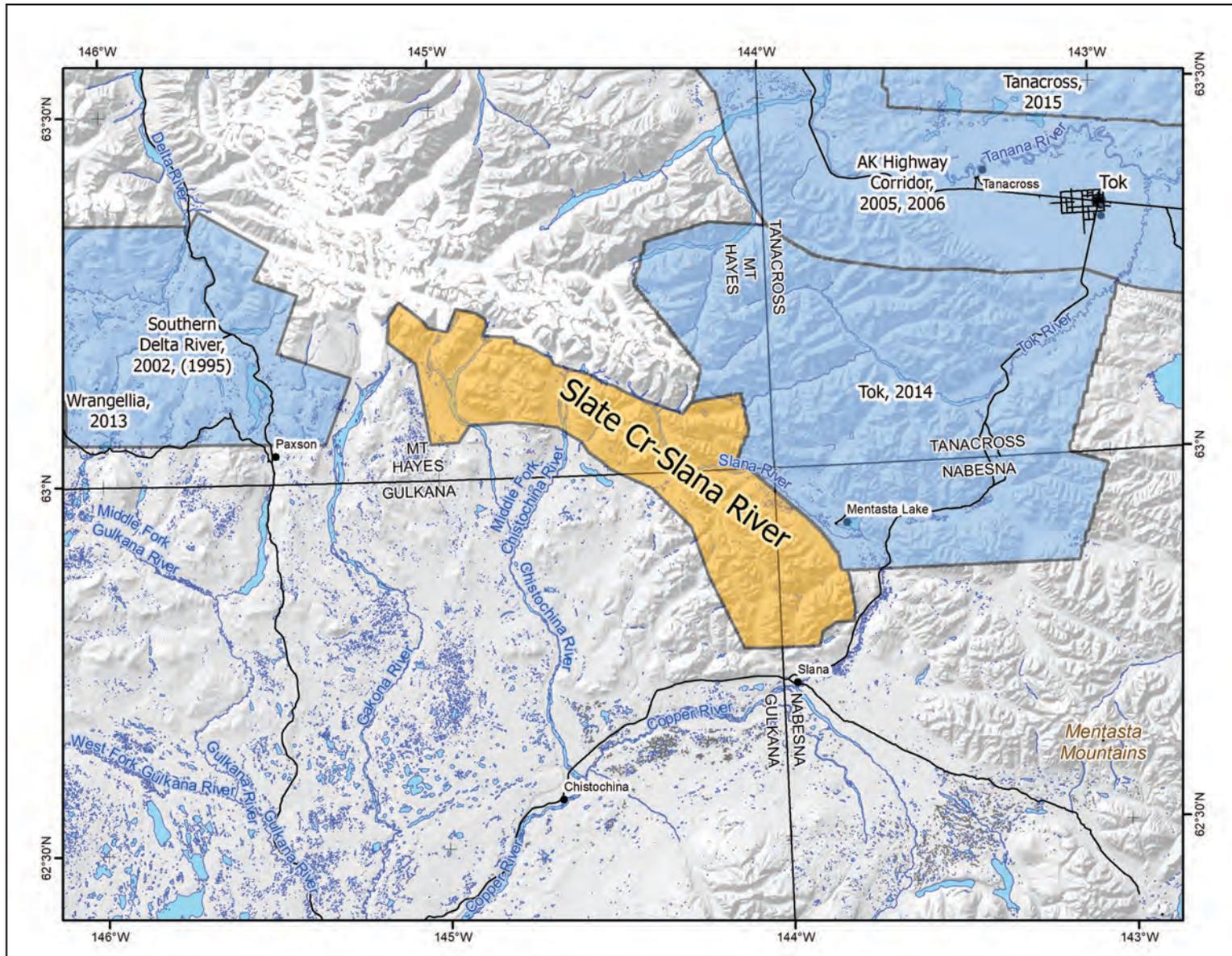
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ascii_data	contractor	ASCII format line data, other ASCII data
databases_geosoft	contractor	Geosoft format database of final line data, other Geosoft format databases
documents	contractor and DGGS	Project and field reports, survey background information, gridded data explanations, other documentation
grids_ermapper	contractor	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	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**

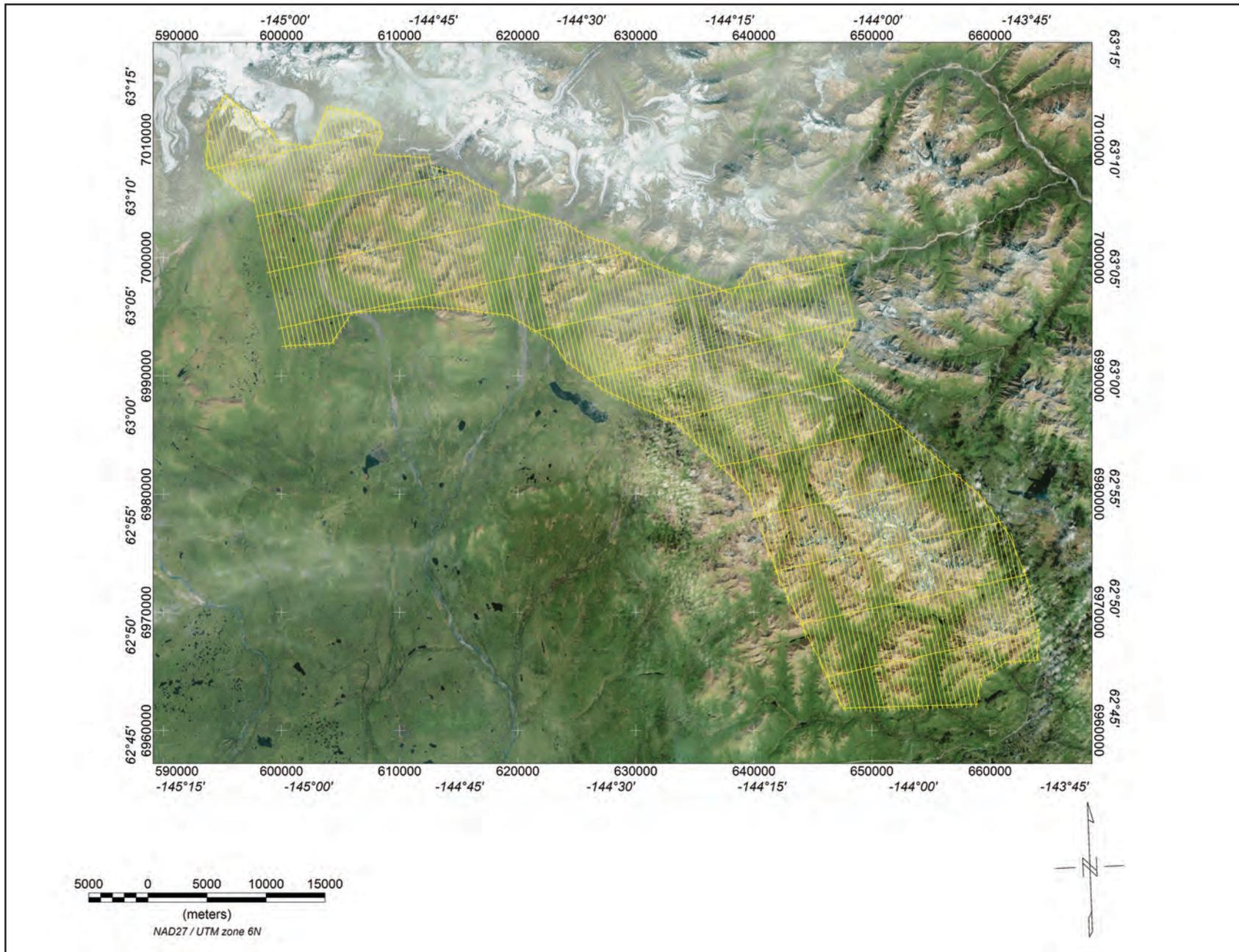
Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures:

Journal of the Association of Computing Machinery, v. 17, n. 4, p. 589–602.

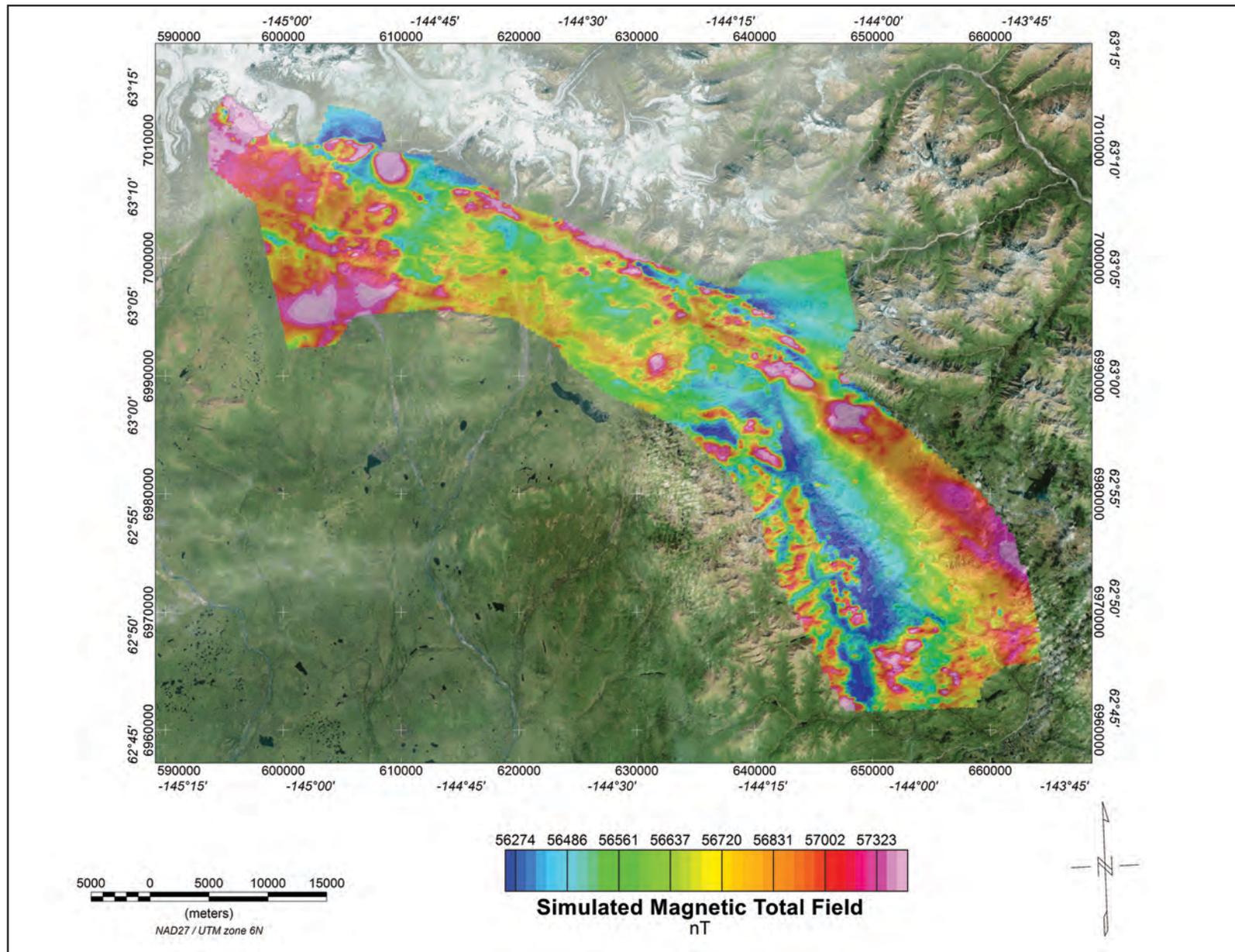
Burns, L.E., Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2009, Line, grid, and vector data, and maps for the airborne geophysical survey of the Slate Creek-Slana River Survey, Chistochina mining district, south-central Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2009-1, 18 sheets, scale 1:63,360, 1 DVD. [doi.org/10.14509/19621](https://doi.org/10.14509/19621)



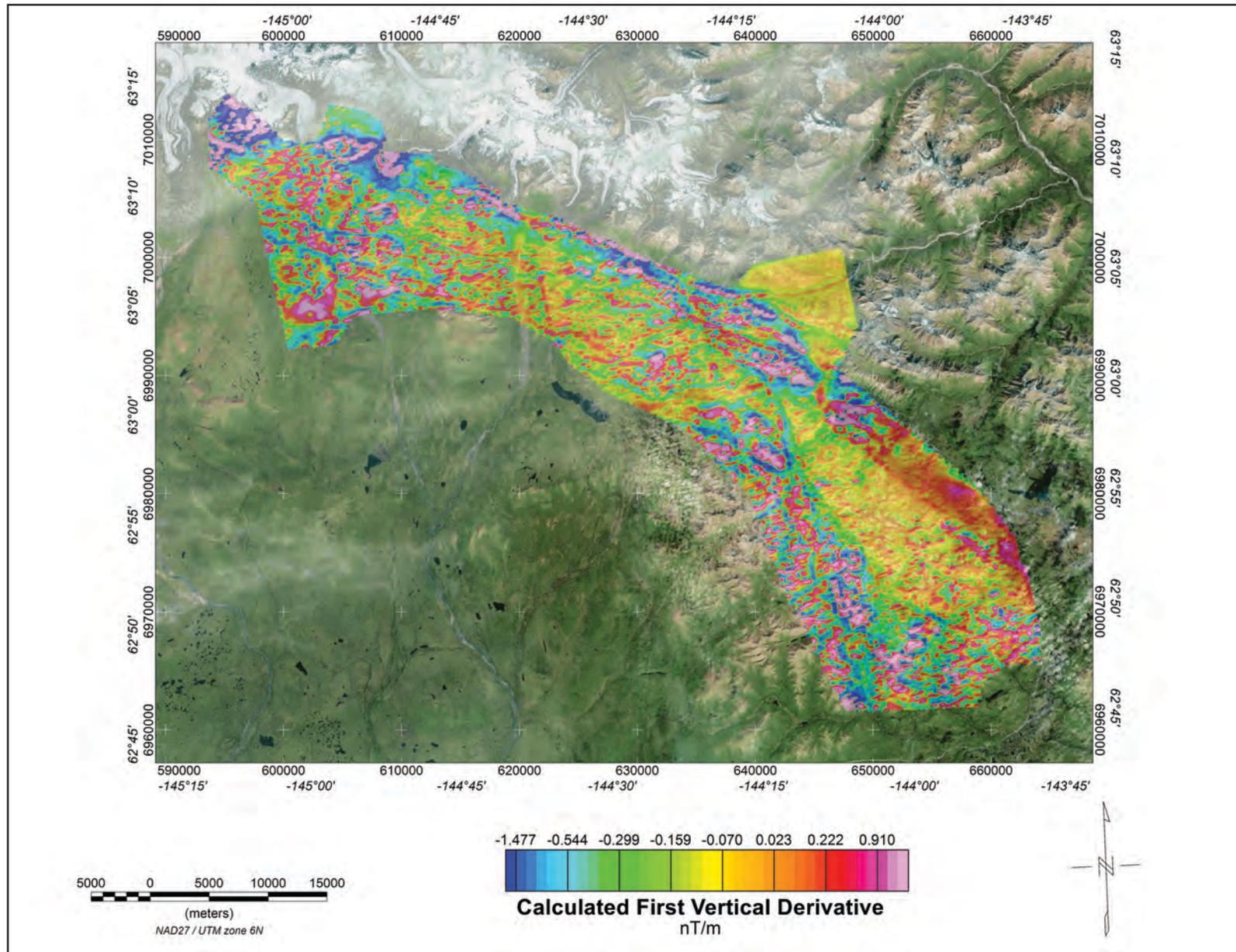
**Figure 1.** Slate Creek–Slana River electromagnetic and magnetic airborne geophysical survey location in Alaska (inset). Slate Creek–Slana River survey area shown with adjacent DGGS geophysical surveys, landmarks, relevant 1:250,000-scale quadrangle boundaries, mountain ranges, rivers, glaciers, and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



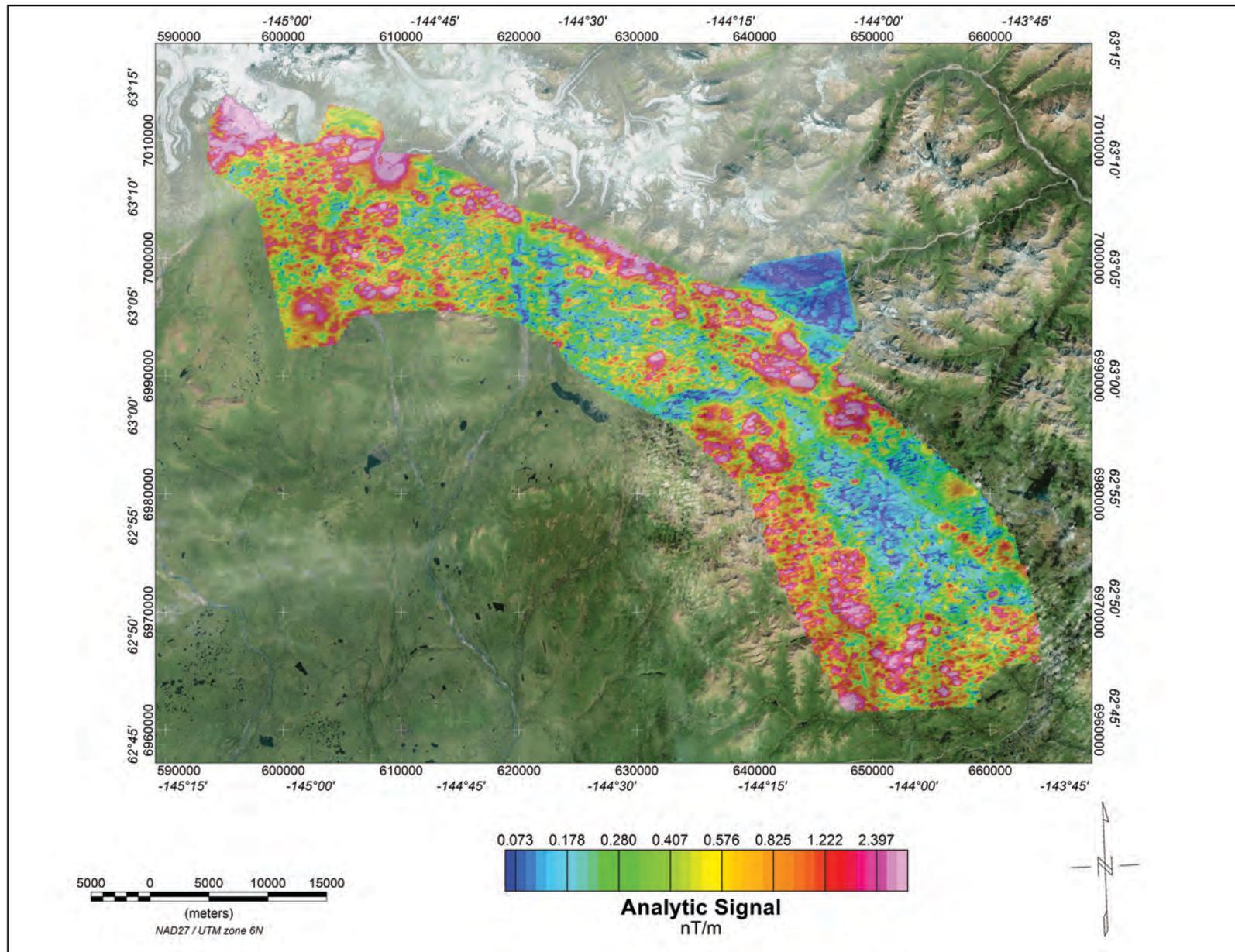
**Figure 2.** Flight path with orthometric image.



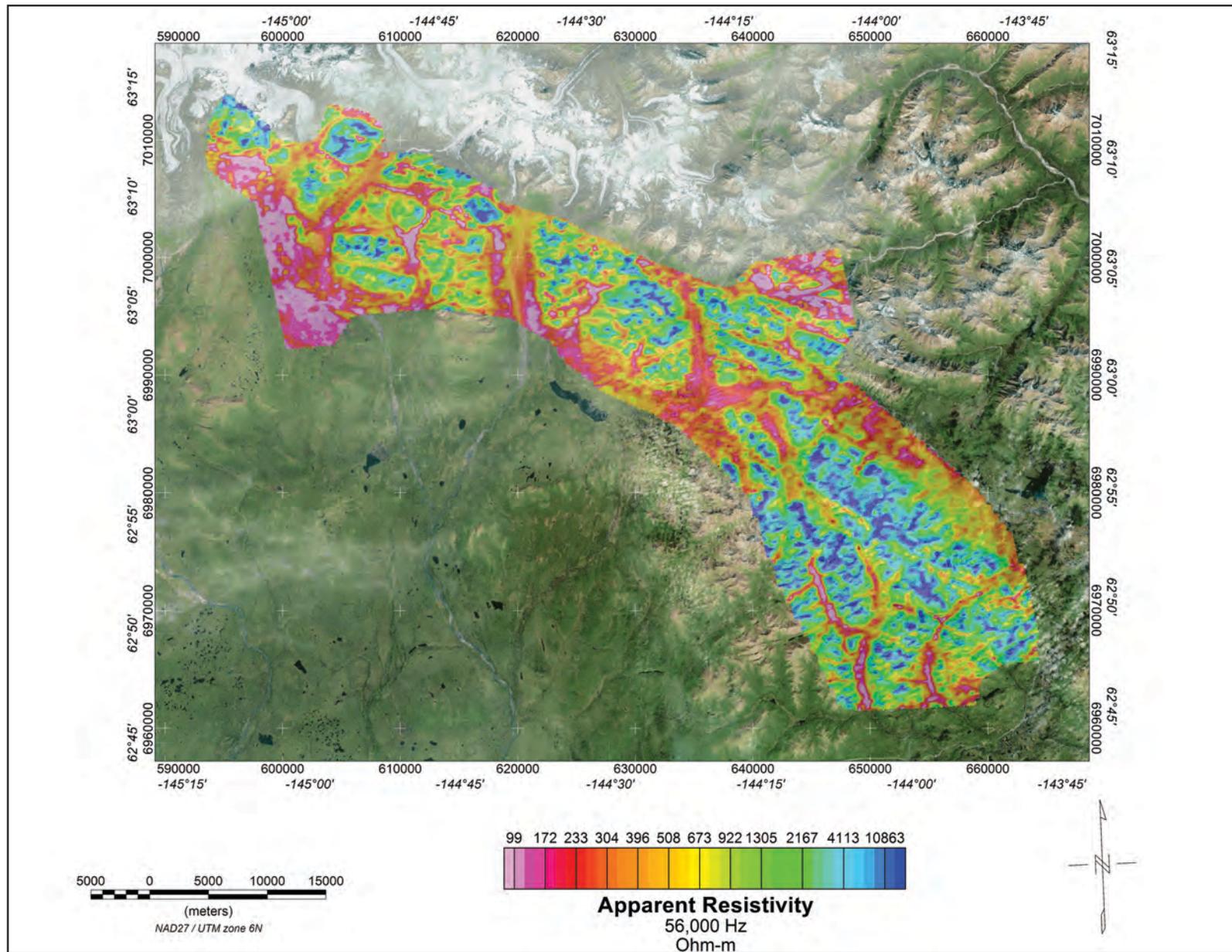
**Figure 3.** The simulated magnetic total field data were created using digitally recorded data from a Fugro D1344 cesium magnetometer with a Scintrex CS3 sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtracting the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2005, updated for date of flight and altimeter variations), (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 80 m grid using a modified Akima (1970) technique.



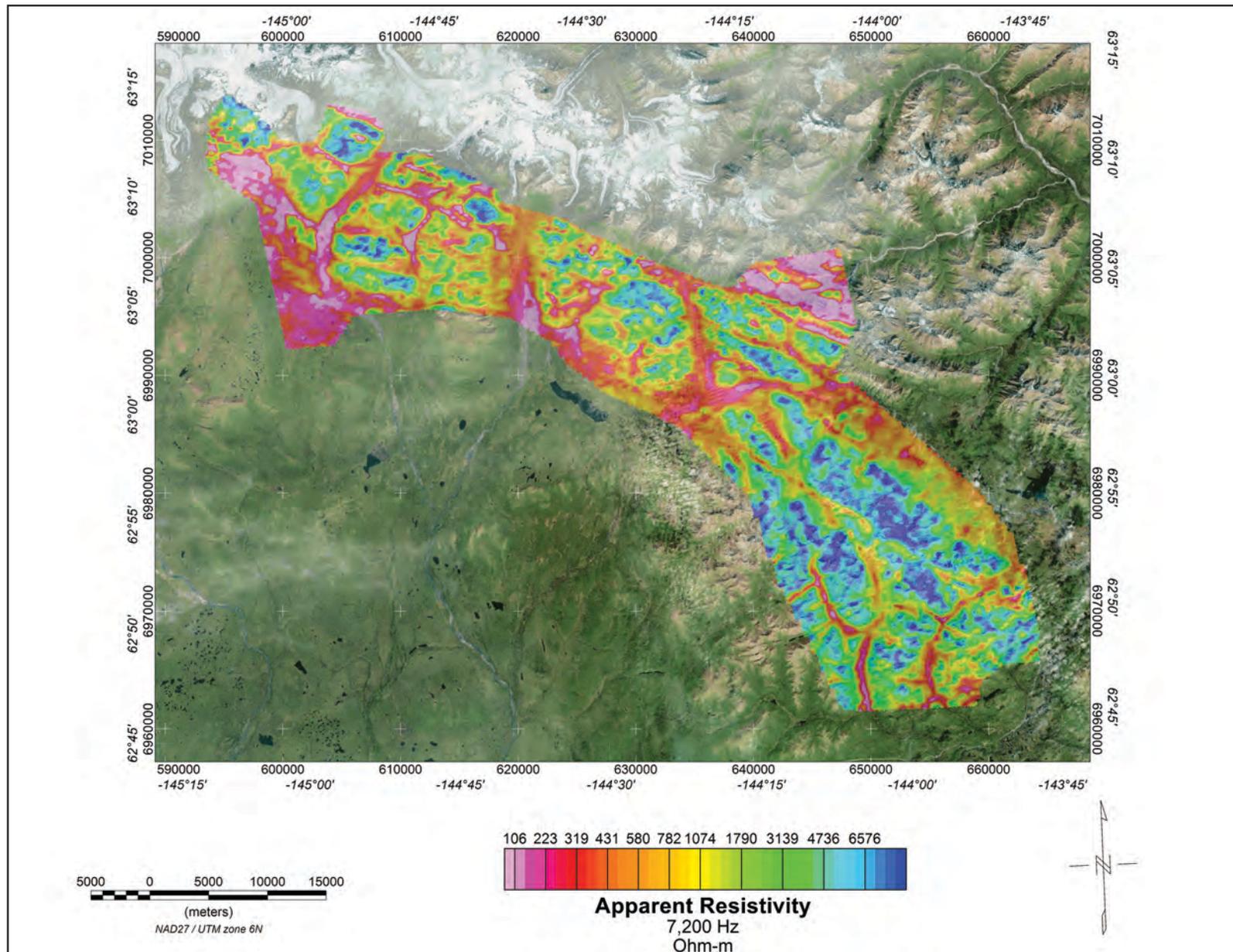
**Figure 4.** The first vertical derivative grid was calculated from the diurnally-corrected, IGRF-corrected total magnetic field grid using a FFT base frequency domain filtering algorithm. The resulting first vertical derivative grid provides better definition and resolution of near-surface magnetic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



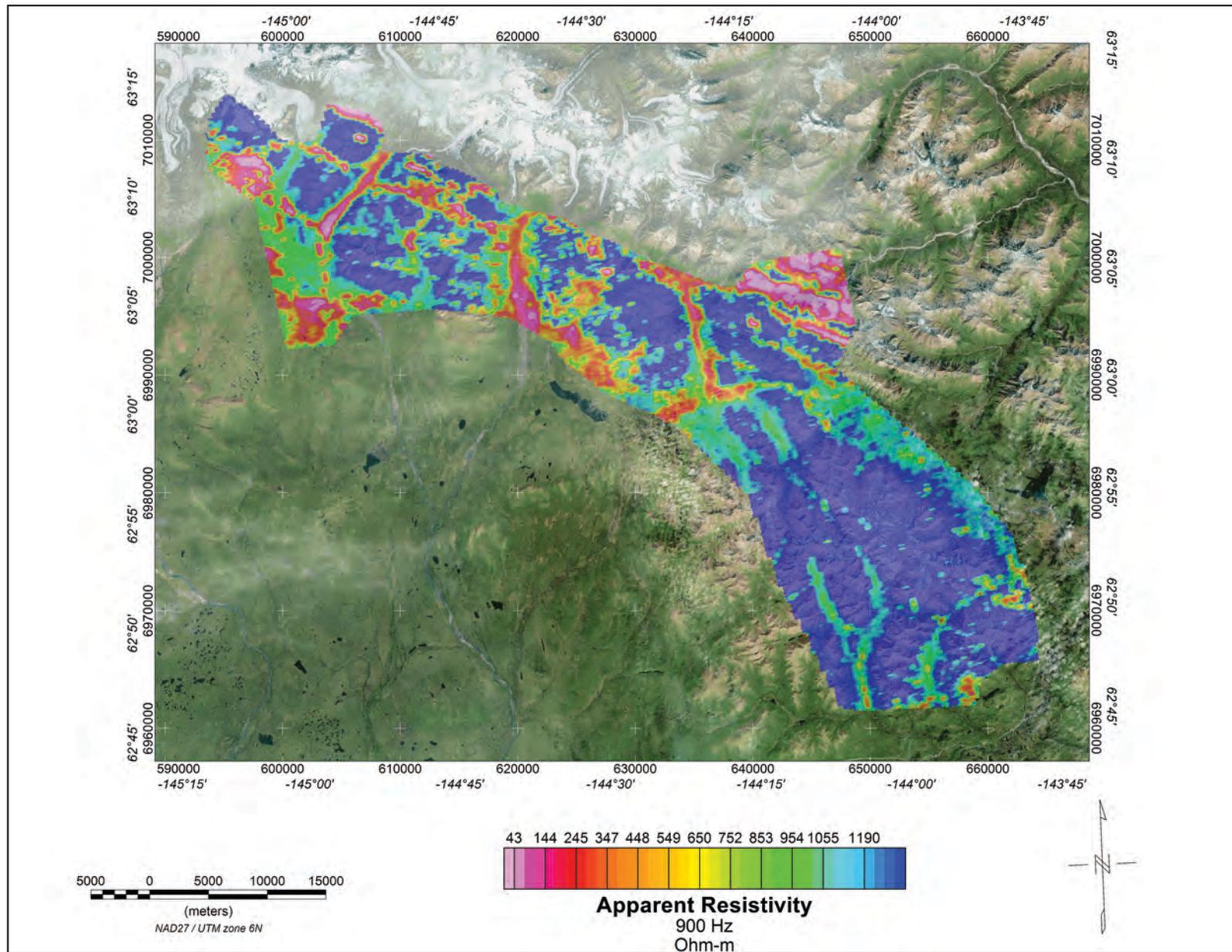
**Figure 5.** Analytic signal is the total amplitude of all directions of magnetic gradient calculated from the sum of the squares of the three orthogonal gradients. Mapped highs in the calculated analytic signal of magnetic parameter locate the anomalous source body edges and corners (such as contacts, 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.** The DIGHEM<sup>Y</sup> EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1000 and 5500 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 80 m grid using a modified Akima (1970) technique.



**Figure 7.** The DIGHEM<sup>Y</sup> EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1000 and 5500 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 80 m grid using a modified Akima (1970) technique.

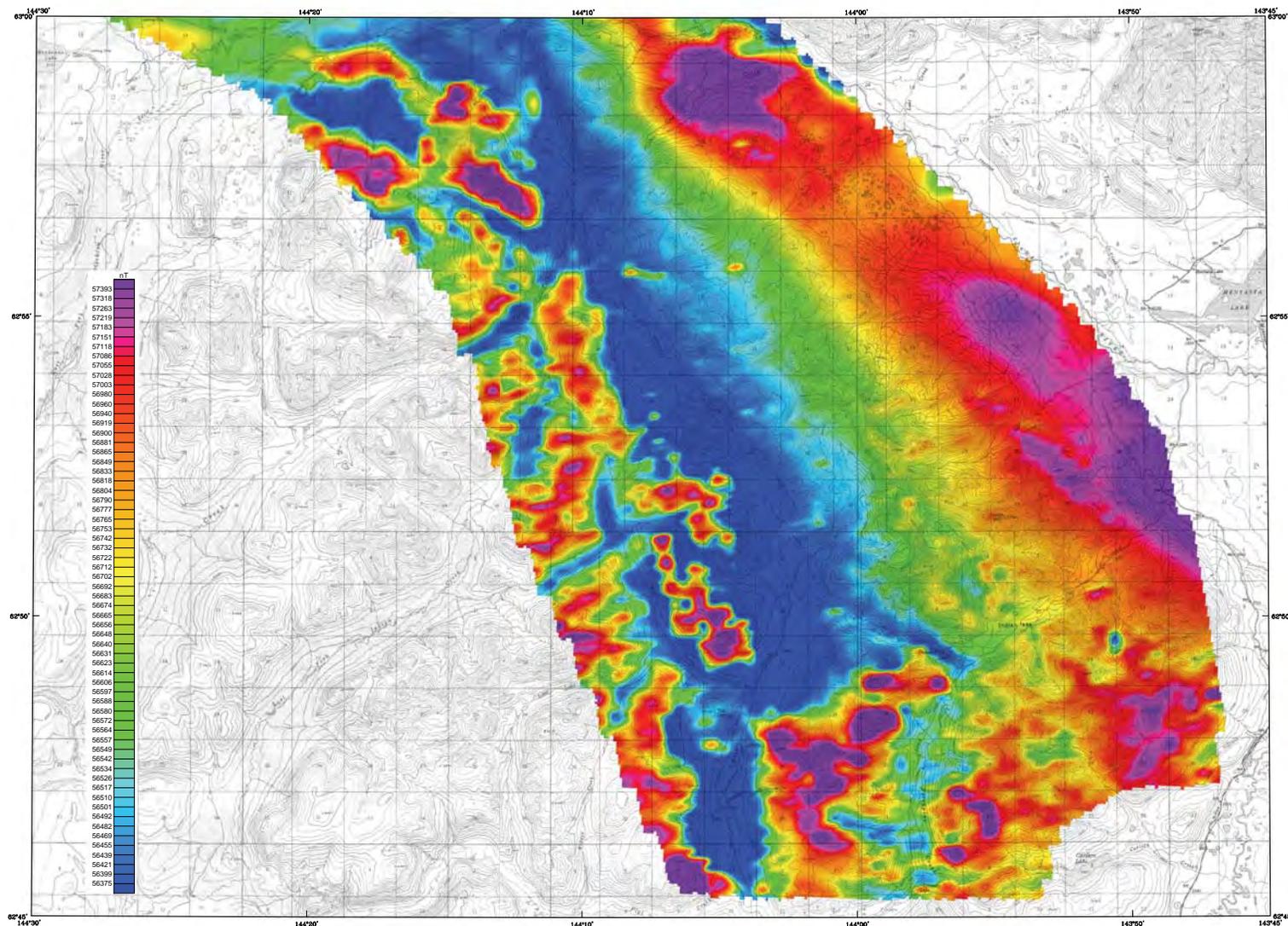


**Figure 8.** The DIGHEM<sup>Y</sup> EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil-pairs operated at 900, 7,200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bed-rock 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 80 m grid using a modified Akima (1970) technique.

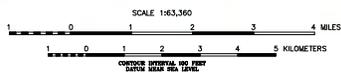
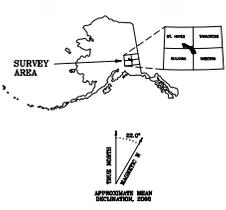
**Table 1.** Copies of the following maps are included at the end of this booklet. The low-resolution, page-size maps included in this booklet are intended to be used as a search tool and are not the final product. Large-scale, full-resolution versions of each map are available to download on this publication's citation page: <http://doi.org/10.14509/29852>.

Map Title	Description
slatecreek_slana_sim_magtf_topo_map_a.pdf	simulated total magnetic field grid with topographic base map
slatecreek_slana_sim_magtf_topo_map_b.pdf	simulated total magnetic field grid with topographic base map
slatecreek_slana_sim_magtf_contours_plss_map_a.pdf	simulated total magnetic field grid with contours and public land survey system base layer
slatecreek_slana_sim_magtf_contours_plss_map_b.pdf	simulated total magnetic field grid with contours and public land survey system base layer
slatecreek_slana_calculated1vd_topo_map_a.pdf	calculated first vertical derivative grid of the diurnally-corrected, IGRF-corrected magnetic data with topographic base map
slatecreek_slana_calculated1vd_topo_map_b.pdf	calculated first vertical derivative grid of the diurnally-corrected, IGRF-corrected magnetic data with topographic base map
slatecreek_slana_res56khz_topo_map_a.pdf	56,000 Hz coplanar apparent resistivity grid with topographic base map
slatecreek_slana_res56khz_topo_map_b.pdf	56,000 Hz coplanar apparent resistivity grid with topographic base map
slatecreek_slana_res56khz_contours_plss_map_a.pdf	56,000 Hz coplanar apparent resistivity grid with contours and public land survey system base layer
slatecreek_slana_res56khz_contours_plss_map_b.pdf	56,000 Hz coplanar apparent resistivity grid with contours and public land survey system base layer
slatecreek_slana_res7200hz_topo_map_a.pdf	7,200 Hz coplanar apparent resistivity grid with topographic base map
slatecreek_slana_res7200hz_topo_map_b.pdf	7,200 Hz coplanar apparent resistivity grid with topographic base map
slatecreek_slana_res7200hz_contours_plss_map_a.pdf	7,200 Hz coplanar apparent resistivity grid with contours and public land survey system base layer
slatecreek_slana_res7200hz_contours_plss_map_b.pdf	7,200 Hz coplanar apparent resistivity grid with contours and public land survey system base layer
slatecreek_slana_res900hz_topo_map_a.pdf	900 Hz coplanar apparent resistivity grid with topographic base map
slatecreek_slana_res900hz_topo_map_b.pdf	900 Hz coplanar apparent resistivity grid with topographic base map
slatecreek_slana_res900hz_contours_plss_map_a.pdf	900 Hz coplanar apparent resistivity grid with contours and public land survey system base layer
slatecreek_slana_res900hz_contours_plss_map_b.pdf	900 Hz coplanar apparent resistivity grid with contours and public land survey system base layer
slatecreek_slana_emanomalies_sim_magtf_detailed_topo_map_a.pdf	detailed electromagnetic anomalies with simulated total magnetic field grid and topographic base map
slatecreek_slana_emanomalies_sim_magtf_detailed_topo_map_b.pdf	detailed electromagnetic anomalies with simulated total magnetic field grid and topographic base map
slatecreek_slana_emanomalies_sim_magtf_detailed_topo_map_c.pdf	detailed electromagnetic anomalies with simulated total magnetic field grid and topographic base map
slatecreek_slana_emanomalies_sim_magtf_detailed_topo_map_d.pdf	detailed electromagnetic anomalies with simulated total magnetic field grid and topographic base map
slatecreek_slana_emanomalies_sim_magtf_detailed_topo_map_e.pdf	detailed electromagnetic anomalies with simulated total magnetic field grid and topographic base map
slatecreek_slana_interpretation_plss_map_a.pdf	interpretation of the geophysical data with public land survey system base layer
slatecreek_slana_interpretation_plss_map_b.pdf	interpretation of the geophysical data with public land survey system base layer





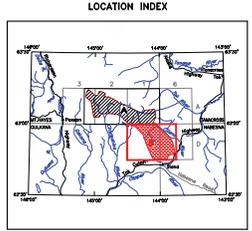
New Survey U.S. Geographical Survey Database D-1-1976  
 flown at a 100m Geophysical scale.



## TOTAL MAGNETIC FIELD OF THE SLATE CREEK - SLANA RIVER AREA, CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA

PARTS OF GULKANA and NABESNA QUADRANGLES

by  
 Laurel E. Burns, Fugro Airborne Surveys Corp. and Stevens Exploration Management Corp.  
 2008



**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex C53 cesium sensor. The EM and magnetic sensors 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-3 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (350°) 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.

A Novatel OEM4-C2L 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 5m. Flight path positions were projected onto the Clarke 1866 (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 10m with respect to the UTM grid.

**TOTAL MAGNETIC FIELD**

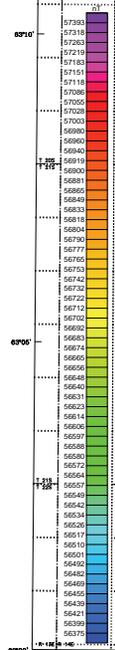
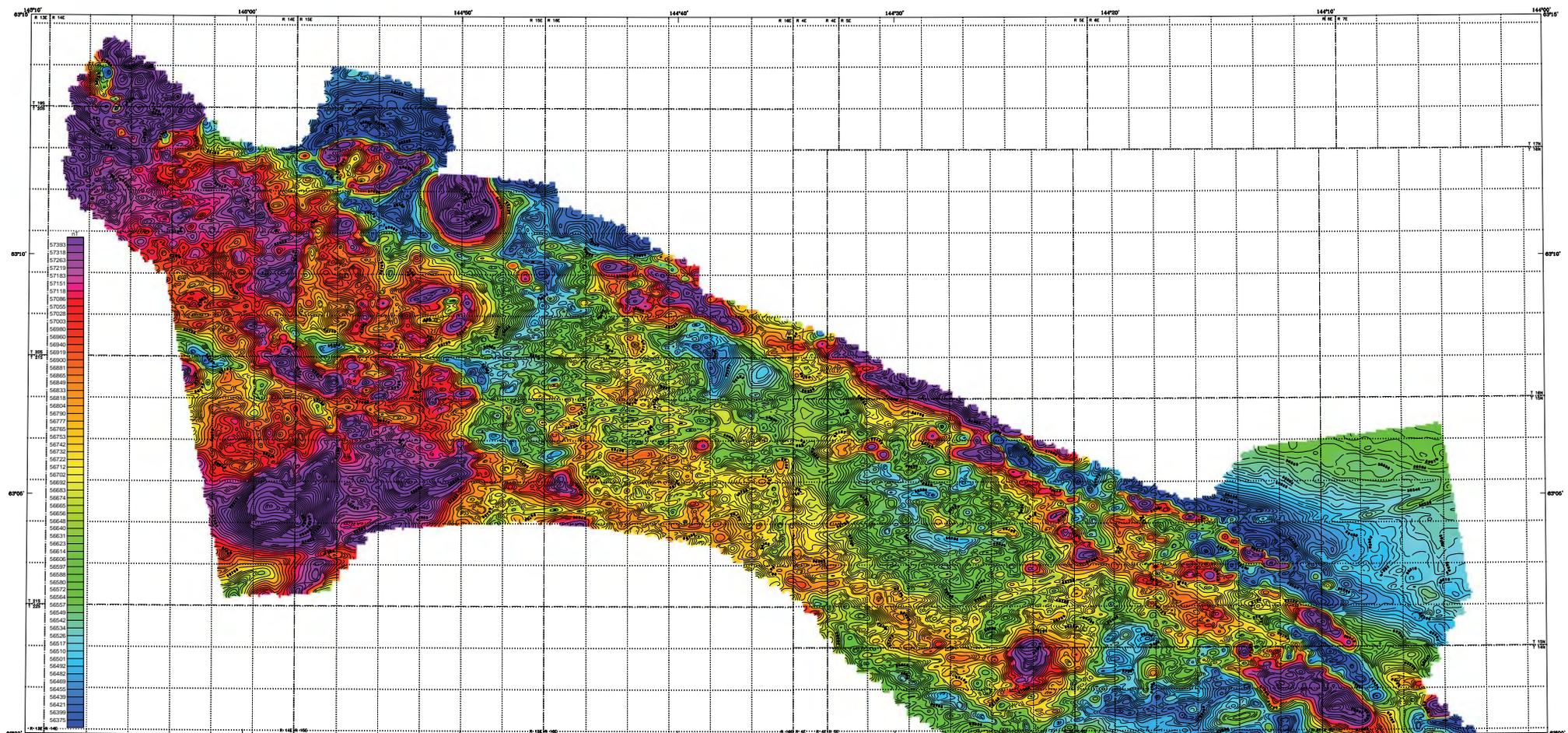
The magnetic total field data were processed using digitally recorded data from a Fugro D1344 cesium magnetometer with a Scintrex C53 sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2005, updated for date of flight and altimeter variations), (3) leveled to the tie line data, and (4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

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

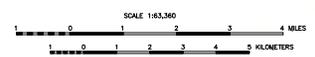
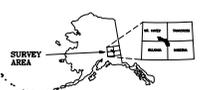
**SURVEY HISTORY**

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 Corp. Airborne geophysical data for the area were acquired and processed by Fugro Airborne Surveys Corp. in 2006 and 2009. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geological & Geophysical Mineral Inventory Program.

This map and other products from this survey are available by mail order, or in person, from DGGGS, 3354 College Road, Fairbanks, Alaska, 99709-3707. Published maps are also available for viewing or downloading as Adobe Acrobat Files (.pdf) on our Web site (<http://www.dgggs.dnr.state.ak.us/pubs/>).

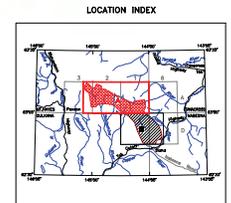


Source: Modified from U.S. Geological Survey M. Howe et al. 1995, A-4, 1976  
 U.S. Geological Survey, Seattle



**TOTAL MAGNETIC FIELD  
 OF THE SLATE CREEK - SLANA RIVER AREA,  
 CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA**  
 PART OF MT. HAYES QUADRANGLE

by  
 Laurel E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.  
 2009

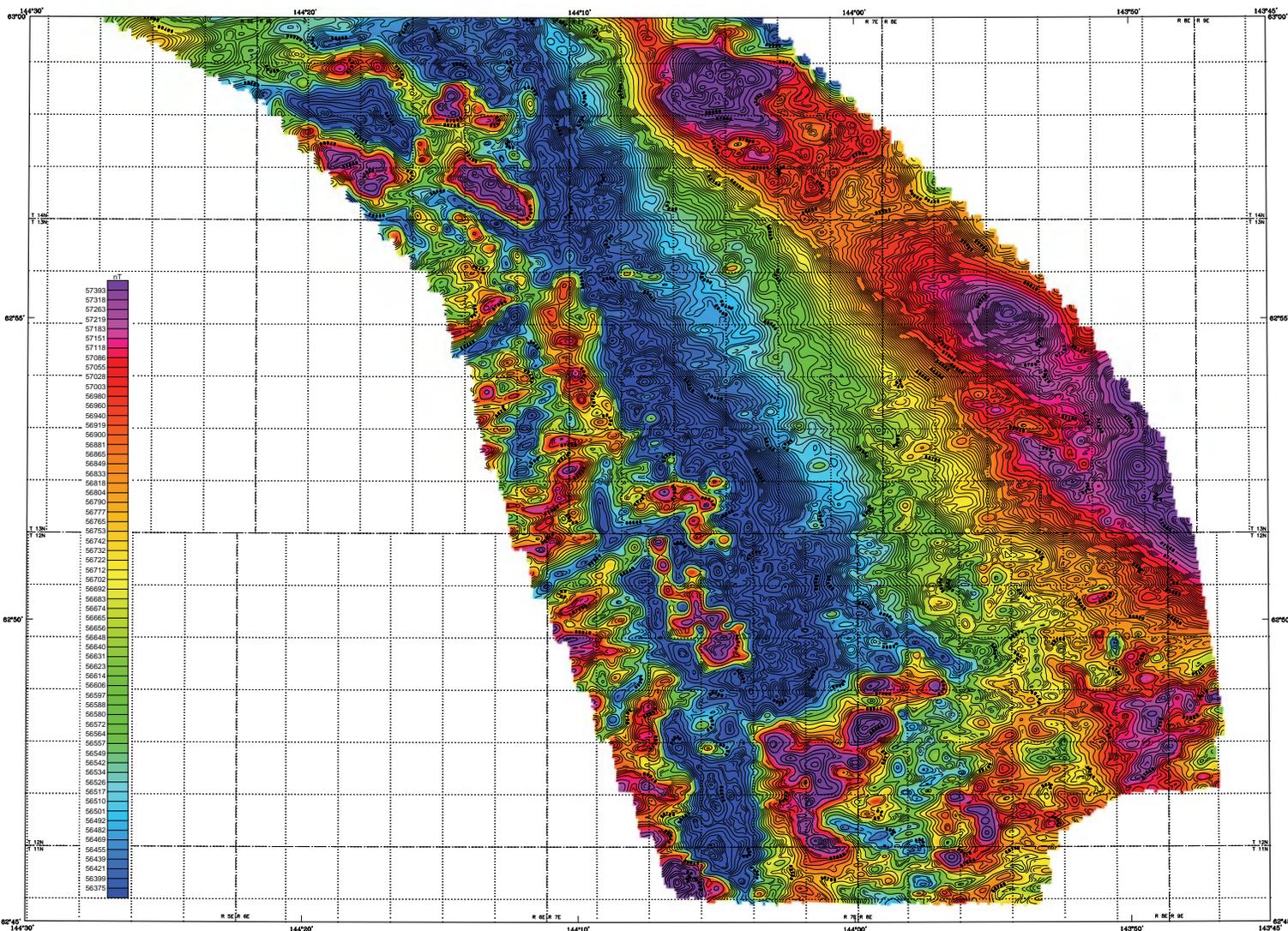


**DESCRIPTIVE NOTES**  
 The geophysical data were acquired with a DIGHEMV Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz manila and video camera. Flights were performed with an AS350B-3 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (350°) 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.  
 A Novatel OEM-422 Global Positioning System was used for navigation. The helicopter position was derived from EM and magnetic sensors. 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 10m with respect to the UTM grid.

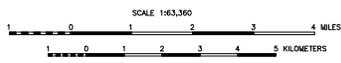
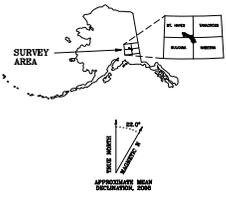
**TOTAL MAGNETIC FIELD**  
 The magnetic total field data were processed using digitally recorded data from a Fugro D1344 cesium magnetometer with a Scintrex CS3 sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2005, updated for date of flight and diurnal variations), (3) leveled to the tie line data, and (4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique.  
Alkima, 1970, A new method of interpolation and smooth curve fitting, in: Proc. of the 1970th Annual Meeting of the Association of Computing Machinery, p. 171-176, N. J. p. 588-602.

**MAGNETIC CONTOUR INTERVAL**

.....	250 nT
.....	50 nT
.....	10 nT
.....	5 nT



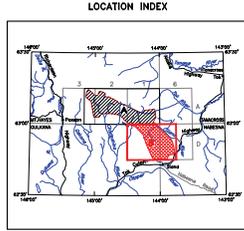
Position outlines from U.S. Geological Survey Database D-1, 1976; flown at a height of 100 feet.



# TOTAL MAGNETIC FIELD OF THE SLATE CREEK - SLANA RIVER AREA, CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA

PARTS OF GULKANA and NABESNA QUADRANGLES

by  
Laurel E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.  
2008



**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DIGEMV Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex C33 cesium sensor. The EM and magnetic sensors 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-3 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (350°) 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.

A Novatel OEM4-C21 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 5m. 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 10m with respect to the UTM grid.

**TOTAL MAGNETIC FIELD**

The magnetic total field data were processed using digitally recorded data from a Fugro D1344 cesium magnetometer with a Scintrex C33 sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2005, updated for date of flight and altimeter variations), (3) leveled to the tie line data, and (4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

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

**MAGNETIC CONTOUR INTERVAL**

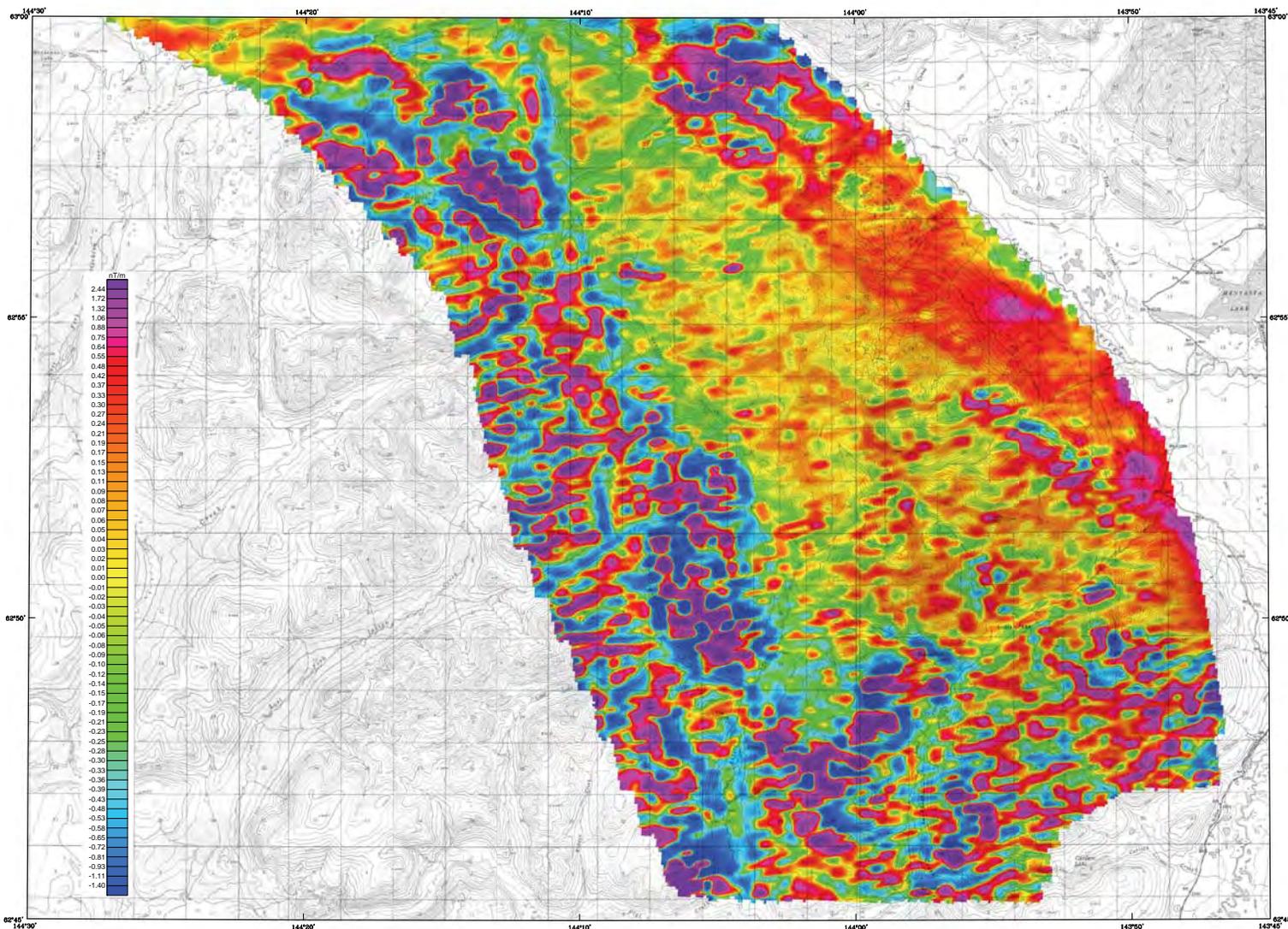
- ..... 250 mT
- ..... 50 mT
- ..... 10 mT
- ..... 5 mT

**SURVEY HISTORY**

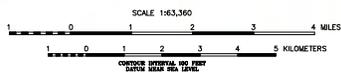
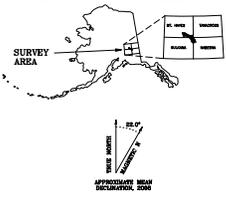
This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGGS), and Stevens Exploration Management Corp. Airborne geophysical data for the area were acquired and processed by Fugro Airborne Surveys Corp. in 2008 and 2009. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geological & Geophysical Mineral Inventory Program.

This map and other products from this survey are available by mail order, or in person, from DGGGS, 4354 College Road, Fairbanks, Alaska, 99709-3707. Published maps are also available for viewing or downloading as Adobe Acrobat Files (.pdf) on our Web site (<http://www.dgggs.dnr.state.ak.us/pubs/>).





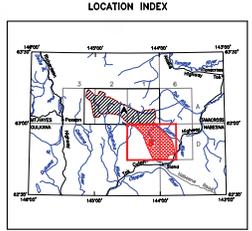
New Survey U.S. Geological Survey Database D-1, 1976  
 Brown & Green, U.S. Geological Survey



## FIRST VERTICAL DERIVATIVE OF THE MAGNETIC FIELD OF THE SLATE CREEK - SLANA RIVER AREA, CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA

PARTS OF GULKANA and NABESNA QUADRANGLES

by  
 Laurel E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.  
 2008



**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DIGHEM Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors 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-3 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (350°) 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.

A Novatel OEM4-C2L 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 5m. 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 10m with respect to the UTM grid.

**COLOR BAR HISTOGRAM**

Approximately 99% of the first vertical derivative of the magnetic field for the Western Fortymile Mining District dataset lie within the range displayed on the color bar. Data values actually range from -13.68 nT/m (dark blue) to about 41.10 nT/m (magenta).

**FIRST VERTICAL DERIVATIVE OF THE MAGNETIC FIELD**

The magnetic total field data were processed using digitally recorded data from a Fugro D1344 cesium magnetometer with a Scintrex CS3 sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2005, updated for date of flight and altimeter variations), a modified Akima (1970) technique. The first vertical derivative grid was calculated from the processed 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.

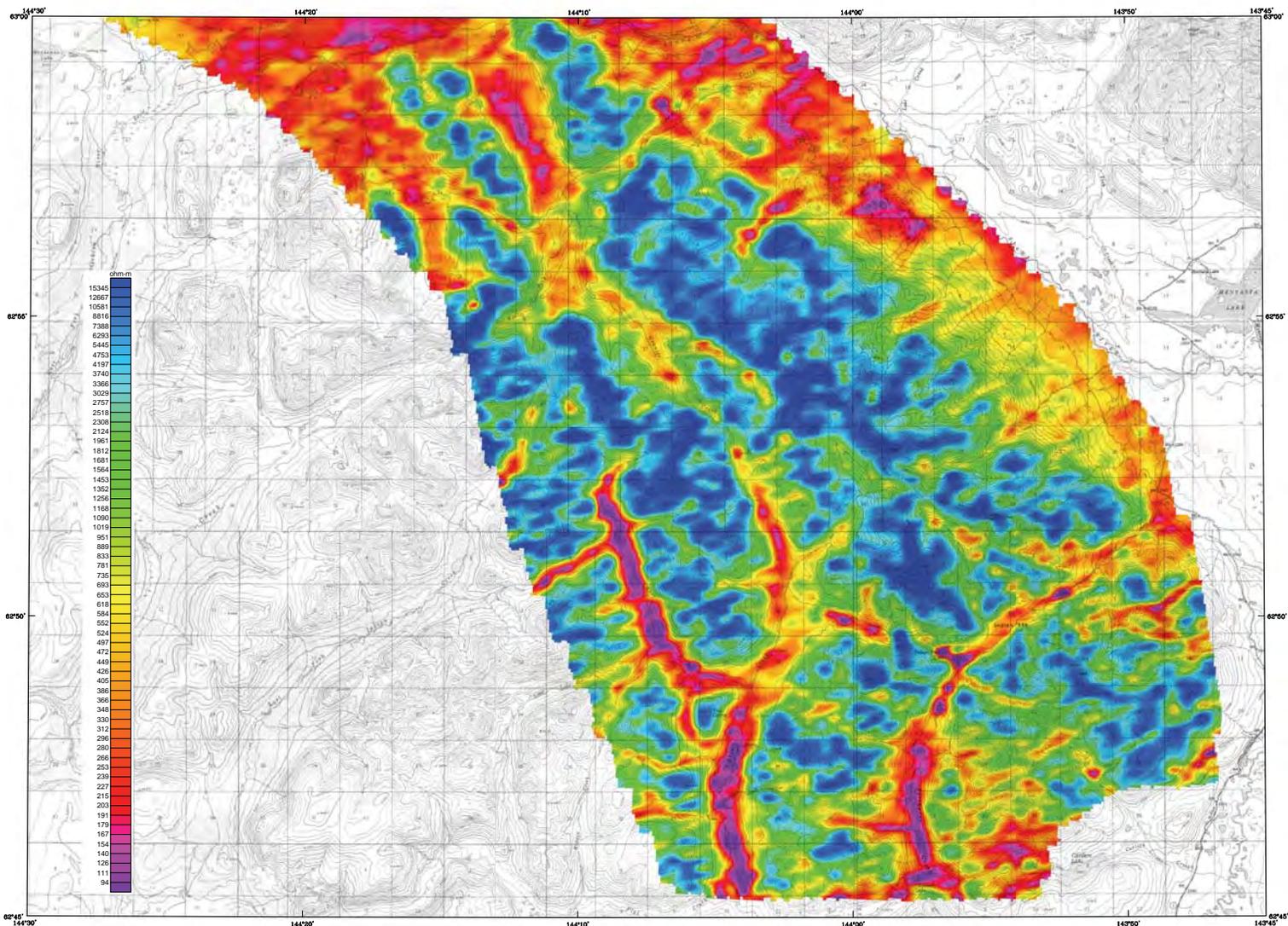
Alkma, H., 1970. A new method of interpolation and smooth curve fitting based on local polynomial regression of the Association of Computing Machinery, v. 17, no. 4, p. 589-602.

**SURVEY HISTORY**

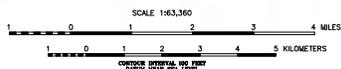
This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (2002), and Stevens Exploration Management Corp. Airborne geophysical data for the area were acquired and processed by Fugro Airborne Surveys Corp. in 2006 and 2009. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geological & Geophysical Mineral Inventory Program.

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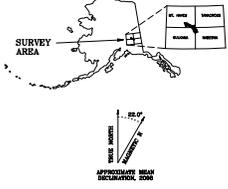
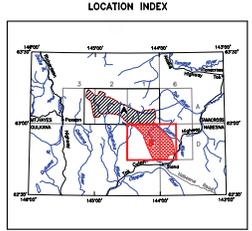
Base from U.S. Geological Survey Database D-1-1976  
 flown at 100 ft. Contour interval 100 ft.



## 56,000 Hz COPLANAR APPARENT RESISTIVITY OF THE SLATE CREEK - SLANA RIVER AREA, CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA

PARTS OF GULKANA and NABESNA QUADRANGLES

by  
 Laurel E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.  
 2008



**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DIGHEM Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex C33 cesium sensor. The EM and magnetic sensors 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-3 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (350°) 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.

A Novatel OEM4-C2L 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 5m. Flight path positions were projected onto the Clarke 1866 (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 10m with respect to the UTM grid.

**RESISTIVITY**

The DIGHEM™ EM system measured inphase and quadrature components at five frequencies. Two vertical coplanar coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar 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. 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 80 m grid using a modified Alma (1970) technique.

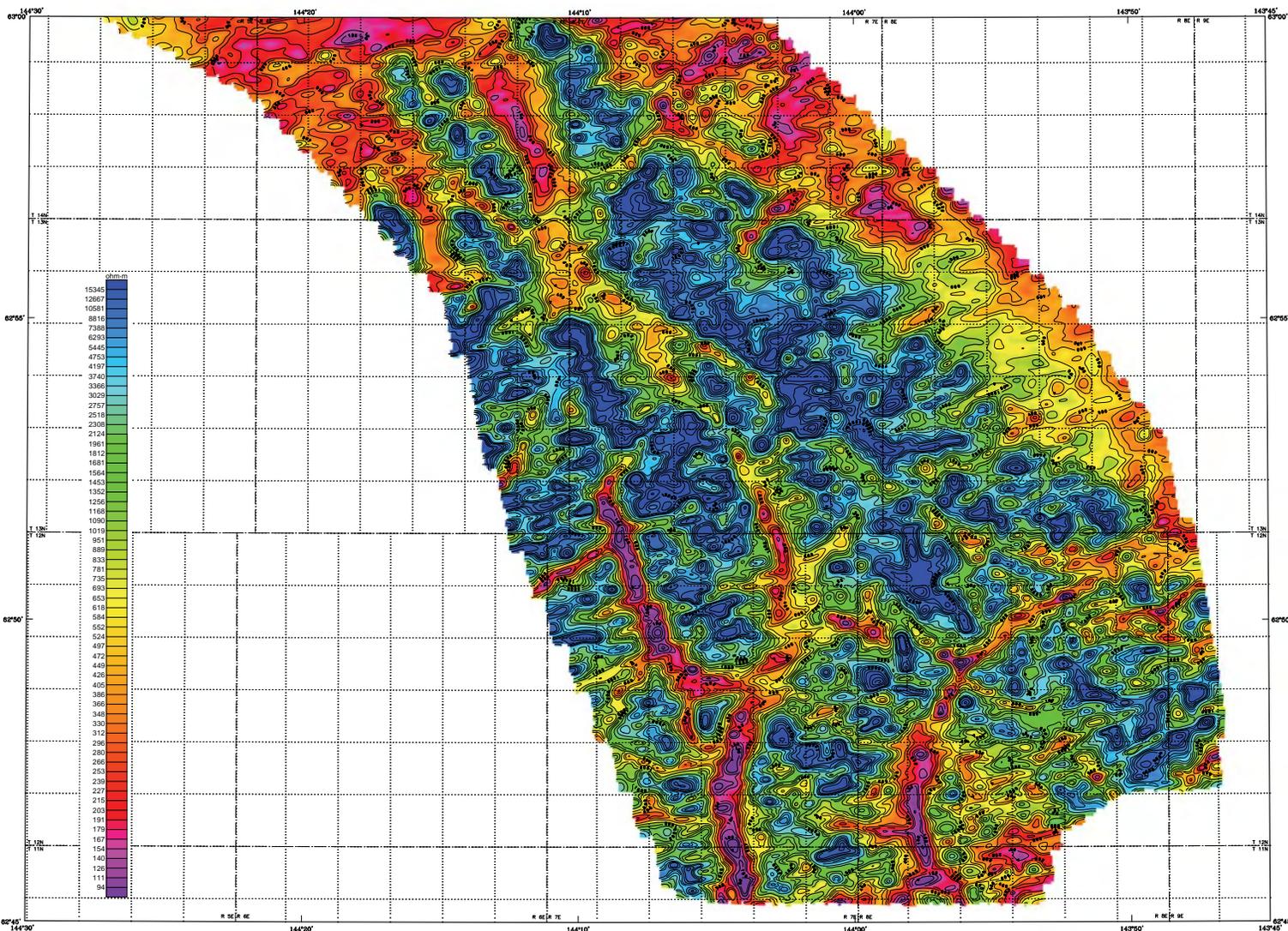
Alma, H., 1970. A new method of interpolation and smooth curve fitting based on local procedures. Journal of the Association of Computing Machinery, v. 17, no. 4, p.589-602.

**SURVEY HISTORY**

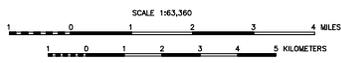
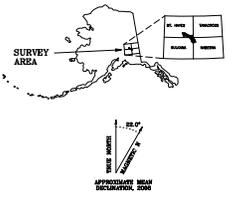
This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGGS), and Stevens Exploration Management Corp. Airborne geophysical data for the area were acquired and processed by Fugro Airborne Surveys Corp. in 2008 and 2009. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geological & Geophysical Mineral Inventory Program.

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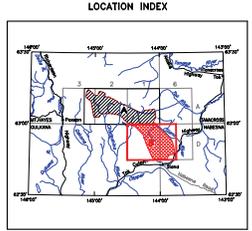
Resistivity contours from U.S. Geological Survey Database D-1, 1976; flown at 100 feet, Chistochina, Alaska.



## 56,000 Hz COPLANAR APPARENT RESISTIVITY OF THE SLATE CREEK - SLANA RIVER AREA, CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA

PARTS OF GULKANA and NABESNA QUADRANGLES

by  
Laurel E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.  
2008



**DESCRIPTIVE NOTES**

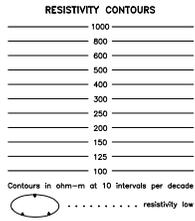
The geophysical data were acquired with a DIGHEM Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex C33 cesium sensor. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS350B-3 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (350°) 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.

A Novatel OEM4-C2 Global Positioning System differential positioning to a relative accuracy of better than 5m. 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 10m with respect to the UTM grid.

**RESISTIVITY**

The DIGHEM EM system measured inphase and quadrature components at five frequencies: two vertical coplanar coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar 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. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 56,000 Hz using the pseudo-true half space model. The data were interpolated onto a regular 80 m grid using a modified Alms (1970) technique.

Alms, H., 1970. A new method of interpolation and smooth curve fitting based on the least squares method. *Journal of the Association of Computing Machinery*, v. 17, no. 4, p.889-902.

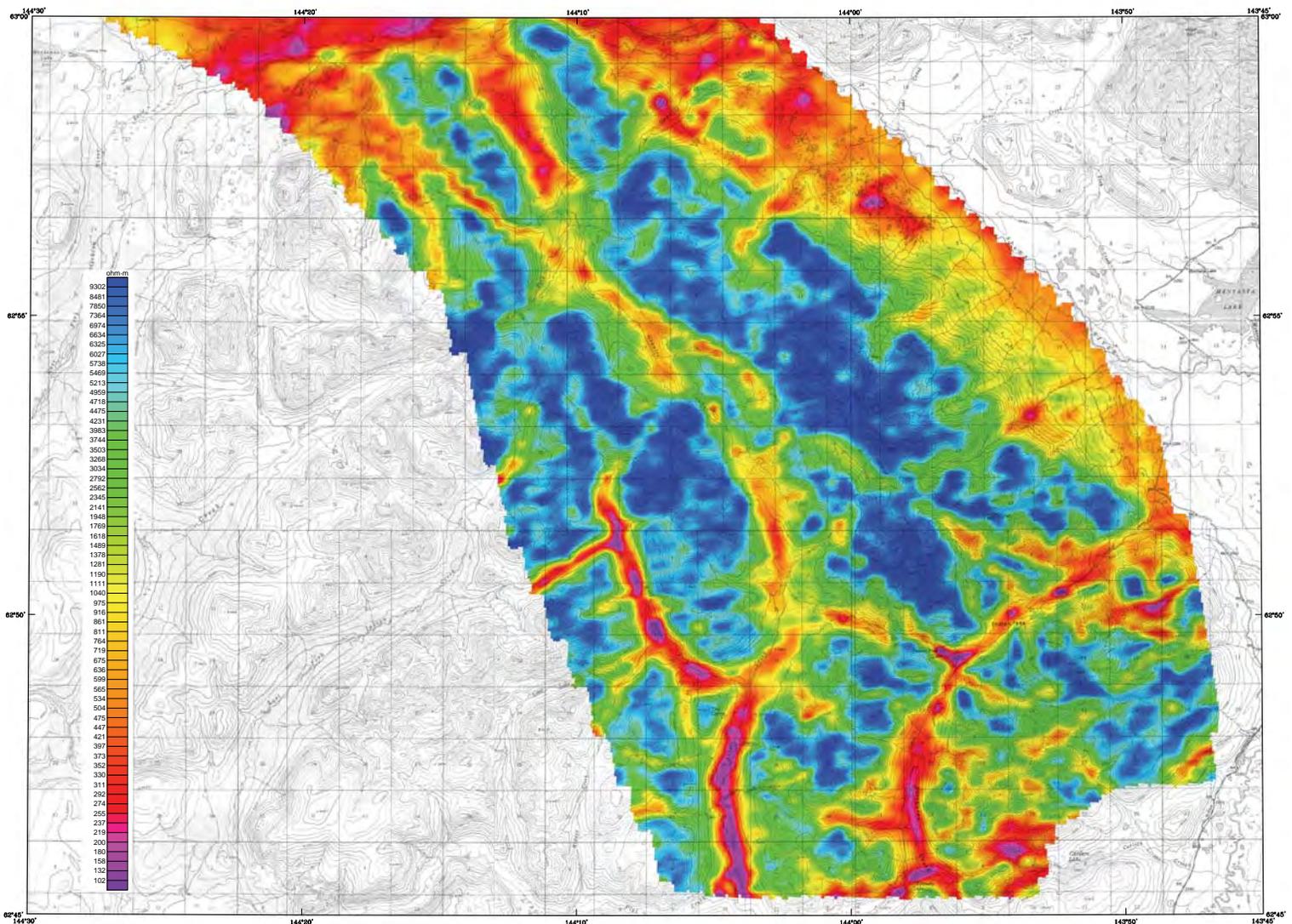


**SURVEY HISTORY**

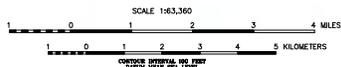
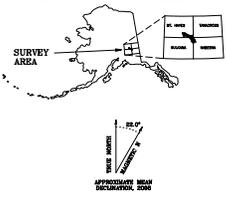
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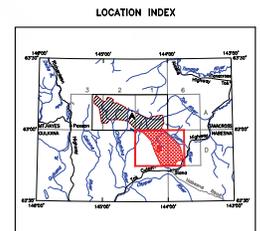
New Survey U.S. Geographical Survey Database D-1-1976  
 flown at 100m Geophysical data.



## 7200 Hz COPLANAR APPARENT RESISTIVITY OF THE SLATE CREEK - SLANA RIVER AREA, CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA

PARTS OF GULKANA and NABESNA QUADRANGLES

by  
 Laurel E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.  
 2008



**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DIGHEM Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex C33 cesium sensor. The EM and magnetic sensors 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-3 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (350°) 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.

A Novatel OEM4-C2L 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 5m. Flight path positions were projected onto the Clarke 1866 (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 10m with respect to the UTM grid.

**RESISTIVITY**

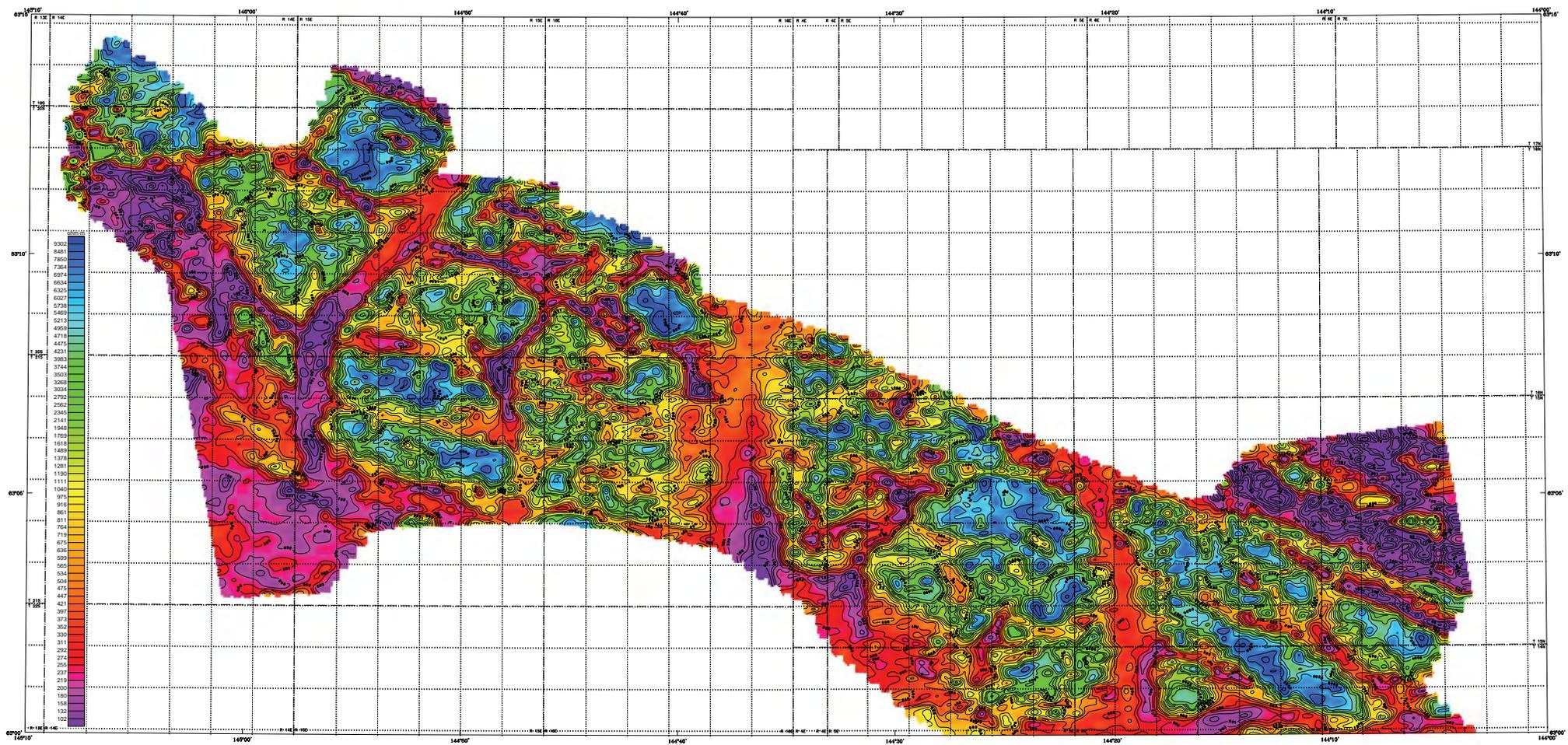
The DIGHEM™ EM system measured inphase and quadrature components at five frequencies. Two vertical coplanar coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil-pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 7200 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 80 m grid using a modified Alma (1970) technique.

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

**SURVEY HISTORY**

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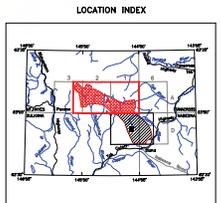


Source: Modified from U.S. Geological Survey, 1:500,000-scale map, A-4, 1976, and 1:250,000-scale map, A-4, 1976.



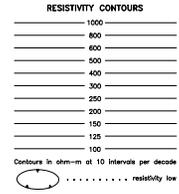
**7200 Hz COPLANAR APPARENT RESISTIVITY  
OF THE SLATE CREEK - SLANA RIVER AREA,  
CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA**  
PART OF MT. HAYES QUADRANGLE

by  
**Laurel E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2009**

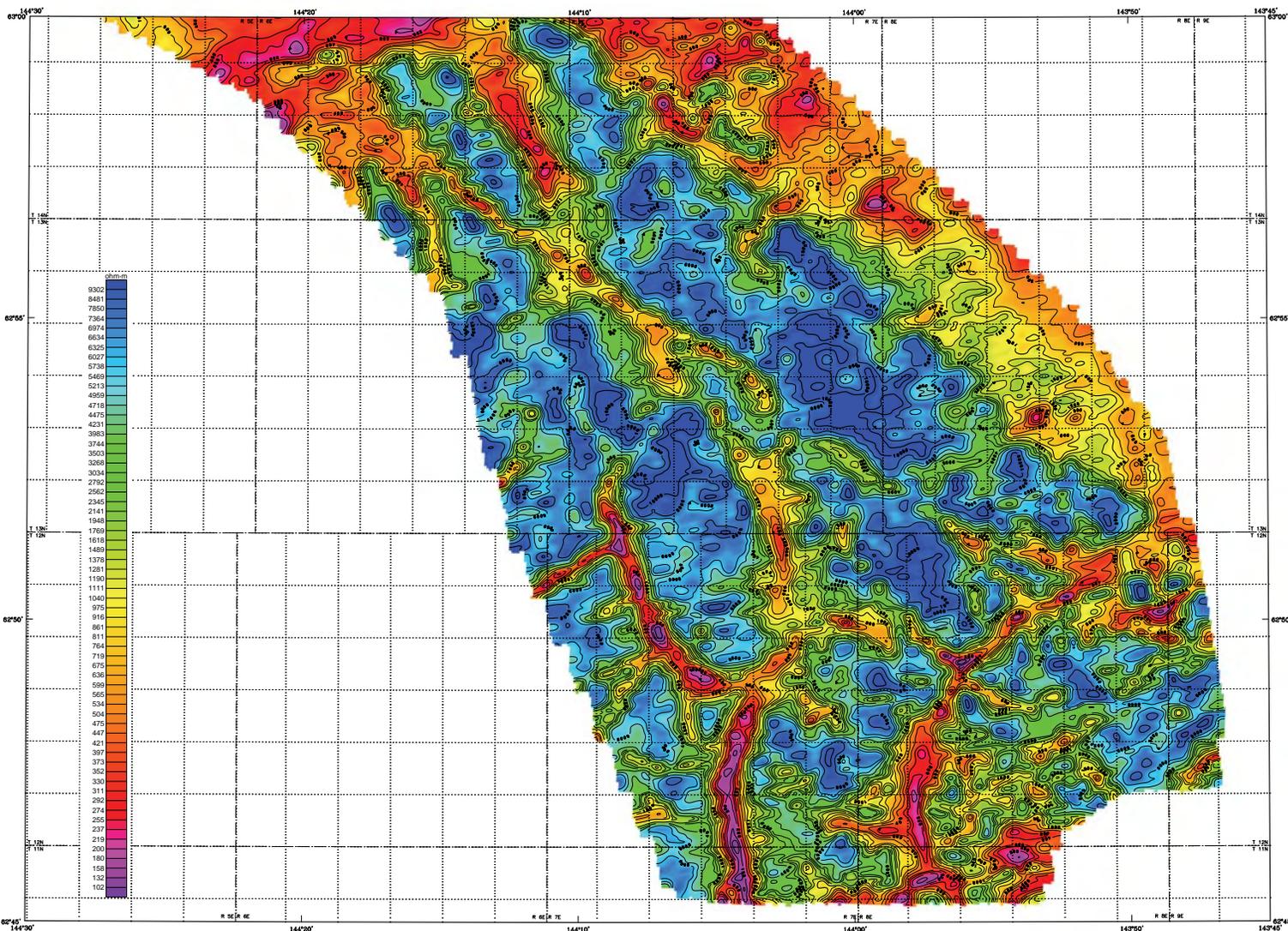


**DESCRIPTIVE NOTES**  
The geophysical data were acquired with a DIGHEM Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Schlumberger CG3 medium sensitivity EM on magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz manlana and video camera. Flights were performed with an AS350B-3 Squirrel helicopter at a mean terrain clearance of 500 feet along NW-SE (350°) 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.  
A Novatel OEM-22L Global Positioning System was used for navigation. The helicopter position and derived EM on magnetic sensors 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 10m with respect to the UTM grid.

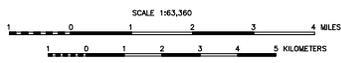
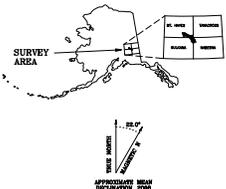
**RESISTIVITY**  
The DIGHEM EM system measured inphase and quadrature components of five frequencies. The vertical coplanar coil-pole operated at 1000 and 5500 Hz while three horizontal coplanar coil-pole operated at 90, 700 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 7200 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 50 m grid using a modified Akima (1970) technique.  
Atmos. H-1970. A new method of processing EM data using computer technology. p. 11, 164, 308B-309.



**SURVEY HISTORY**  
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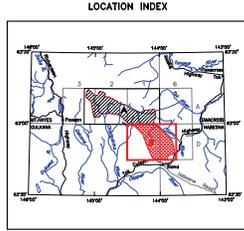
Positioning system from U.S. Geological Survey Database D-1, 1976; datum is North American datum.



## 7200 Hz COPLANAR APPARENT RESISTIVITY OF THE SLATE CREEK - SLANA RIVER AREA, CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA

PARTS OF GULKANA and NABESNA QUADRANGLES

by  
Laurel E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.  
2008



**DESCRIPTIVE NOTES**

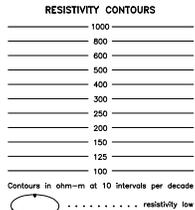
The geophysical data were acquired with a DIGHEM<sup>®</sup> Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex C33 cesium sensor. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS350B-3 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (350°) 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.

A Novatel OEM4-C21 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 5m. 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 10m with respect to the UTM grid.

**RESISTIVITY**

The DIGHEM<sup>®</sup> EM system measured inphase and quadrature components at five frequencies: two vertical coplanar coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar 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. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 7200 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 80 m grid using a modified Aluma (1970) technique.

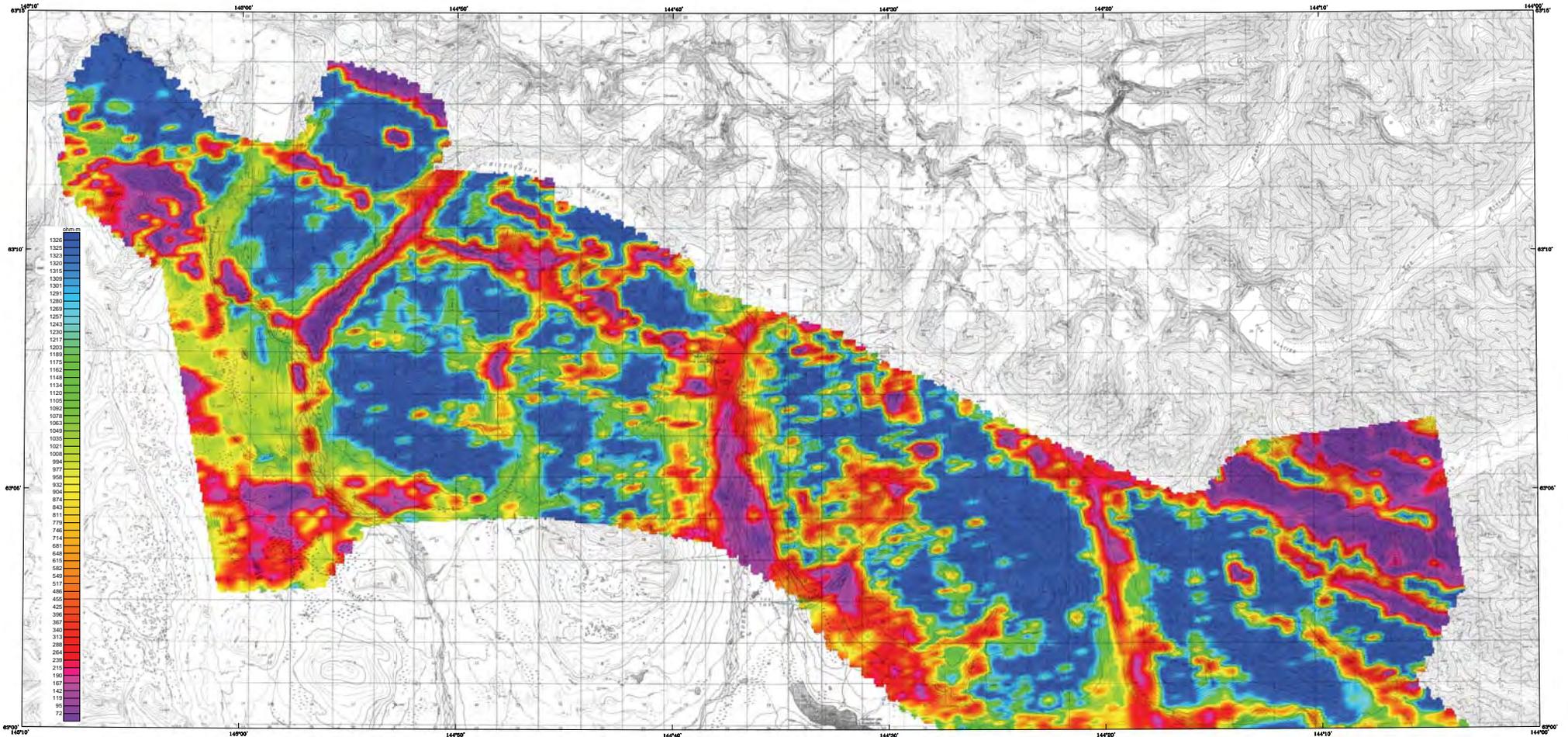
Aluma, H., 1970. A new method of interpolation and smooth curve fitting based on total procedures. *Journal of the Association of Computing Machinery*, v. 17, no. 4, p.889-902.



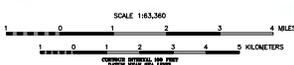
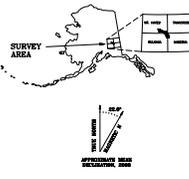
**SURVEY HISTORY**

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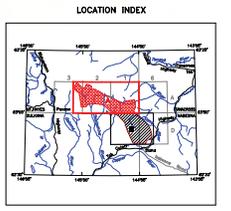
Base Data: U.S. Geological Survey 10, 10000 4-L, 10000 4-R, 10000 4-S, 10000 4-T, 10000 4-U, 10000 4-V, 10000 4-W, 10000 4-X, 10000 4-Y, 10000 4-Z, 10000 4-AA, 10000 4-AB, 10000 4-AC, 10000 4-AD, 10000 4-AE, 10000 4-AF, 10000 4-AG, 10000 4-AH, 10000 4-AI, 10000 4-AJ, 10000 4-AK, 10000 4-AL, 10000 4-AM, 10000 4-AN, 10000 4-AO, 10000 4-AP, 10000 4-AQ, 10000 4-AR, 10000 4-AS, 10000 4-AT, 10000 4-AU, 10000 4-AV, 10000 4-AW, 10000 4-AX, 10000 4-AY, 10000 4-AZ, 10000 4-BA, 10000 4-BB, 10000 4-BC, 10000 4-BD, 10000 4-BE, 10000 4-BF, 10000 4-BG, 10000 4-BH, 10000 4-BI, 10000 4-BJ, 10000 4-BK, 10000 4-BL, 10000 4-BM, 10000 4-BN, 10000 4-BO, 10000 4-BP, 10000 4-BQ, 10000 4-BR, 10000 4-BS, 10000 4-BT, 10000 4-BU, 10000 4-BV, 10000 4-BW, 10000 4-BX, 10000 4-BY, 10000 4-BZ, 10000 4-CA, 10000 4-CB, 10000 4-CC, 10000 4-CD, 10000 4-CE, 10000 4-CF, 10000 4-CG, 10000 4-CH, 10000 4-CI, 10000 4-CJ, 10000 4-CK, 10000 4-CL, 10000 4-CM, 10000 4-CN, 10000 4-CO, 10000 4-CP, 10000 4-CQ, 10000 4-CR, 10000 4-CS, 10000 4-CT, 10000 4-CU, 10000 4-CV, 10000 4-CW, 10000 4-CX, 10000 4-CY, 10000 4-CZ, 10000 4-DA, 10000 4-DB, 10000 4-DC, 10000 4-DD, 10000 4-DE, 10000 4-DF, 10000 4-DG, 10000 4-DH, 10000 4-DI, 10000 4-DJ, 10000 4-DK, 10000 4-DL, 10000 4-DM, 10000 4-DN, 10000 4-DO, 10000 4-DP, 10000 4-DQ, 10000 4-DR, 10000 4-DS, 10000 4-DT, 10000 4-DU, 10000 4-DV, 10000 4-DW, 10000 4-DX, 10000 4-DY, 10000 4-DZ, 10000 4-EA, 10000 4-EB, 10000 4-EC, 10000 4-ED, 10000 4-EE, 10000 4-EF, 10000 4-EG, 10000 4-EH, 10000 4-EI, 10000 4-EJ, 10000 4-EK, 10000 4-EL, 10000 4-EM, 10000 4-EN, 10000 4-EO, 10000 4-EP, 10000 4-EQ, 10000 4-ER, 10000 4-ES, 10000 4-ET, 10000 4-EU, 10000 4-EV, 10000 4-EW, 10000 4-EX, 10000 4-EY, 10000 4-EZ, 10000 4-FA, 10000 4-FB, 10000 4-FC, 10000 4-FD, 10000 4-FE, 10000 4-FF, 10000 4-FG, 10000 4-FH, 10000 4-FI, 10000 4-FJ, 10000 4-FK, 10000 4-FL, 10000 4-FM, 10000 4-FN, 10000 4-FO, 10000 4-FP, 10000 4-FQ, 10000 4-FR, 10000 4-FS, 10000 4-FT, 10000 4-FU, 10000 4-FV, 10000 4-FW, 10000 4-FX, 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## 900 Hz COPLANAR APPARENT RESISTIVITY OF THE SLATE CREEK - SLANA RIVER AREA, CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA

PART OF MT. HAYES QUADRANGLE

by  
**Laurel E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.**  
2009



**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DIGHEM V Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Schöberl C33 cesium gradiometer. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from a real-time GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS350B-3 Squirrel helicopter at a mean terrain clearance of 500 feet along NW-SE (350°) 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.

A Novatel OEM-722L Global Positioning System was used for navigation. The helicopter position and derived EM and magnetic sensors were differential positioned to a relative accuracy of better than 5 m with a north constant of 0 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 10m with respect to the UTM grid.

**RESISTIVITY**

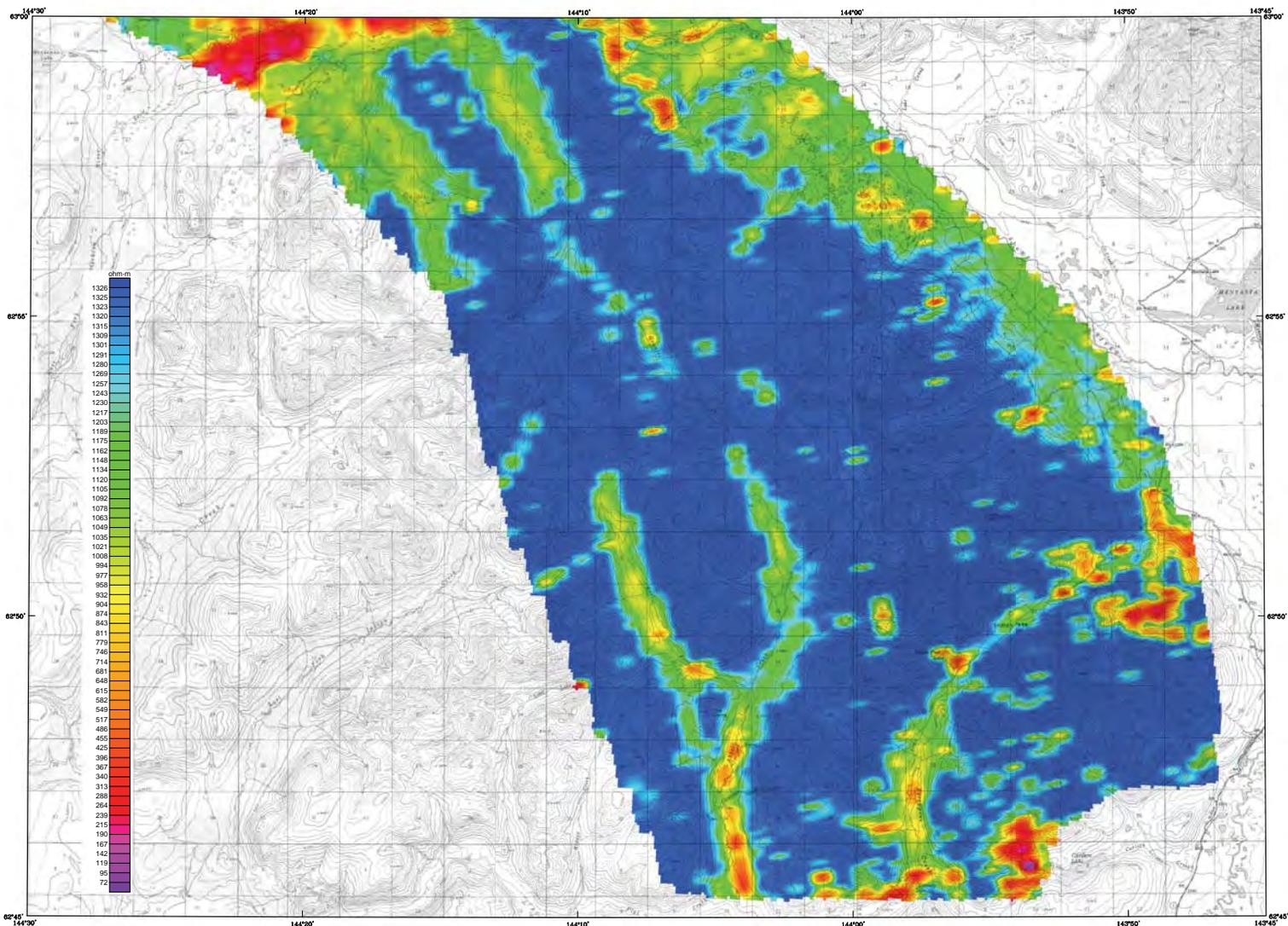
The DIGHEM V EM system measured inphase and quadrature components of five frequencies: the vertical coplanar coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil-pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. 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 50 m grid using a modified Akima (1970) technique.

AKIMA, H. (1970). A new method of interpolation of irregularly spaced data. Computing, Westbury, N.Y., vol. 1, pp. 310-312.

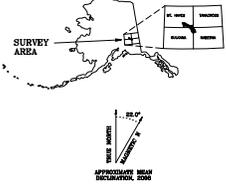
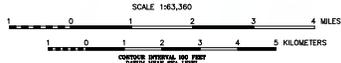
**SURVEY HISTORY**

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 area were acquired and processed by Fugro Airborne Surveys Corp. in 2008 and 2009. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geological & Geophysical Mineral Inventory Program.

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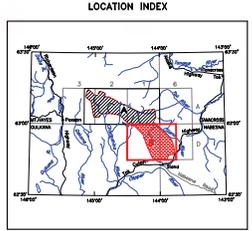
New Survey U.S. Geographical Survey Database D-1, 1976.  
 Datum is 1983 Geodetic datum.



## 900 Hz COPLANAR APPARENT RESISTIVITY OF THE SLATE CREEK - SLANA RIVER AREA, CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA

PARTS OF GULKANA and NABESNA QUADRANGLES

by  
 Laurel E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.  
 2008



**DESCRIPTIVE NOTES**

The geophysical data were acquired with a DIGHEM Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex C33 cesium sensor. The EM and magnetic sensors 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-3 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (350°) 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.

A Novatel OEM4-C2L 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 5m. Flight path positions were projected onto the Clarke 1866 (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 10m with respect to the UTM grid.

**RESISTIVITY**

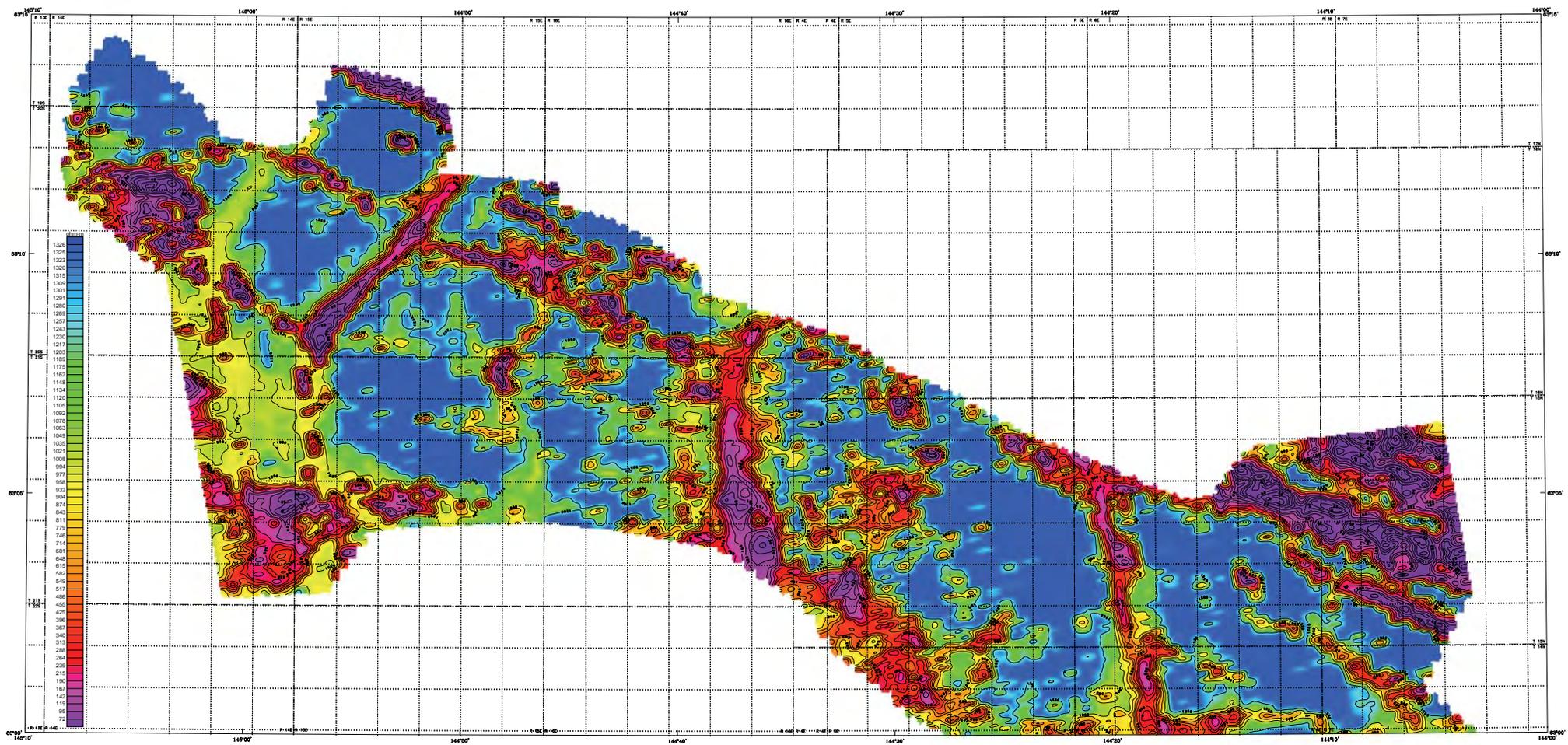
The DIGHEM™ EM system measured inphase and quadrature components at five frequencies. Two vertical coplanar coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil-pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. 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 80 m grid using a modified Alma (1970) technique.

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

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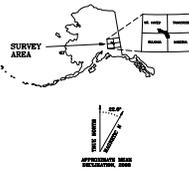
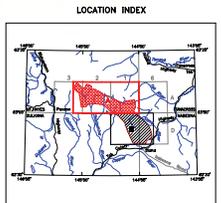


Section within Strip U.S. Geological Survey M. Zone 4-1, 1983, 4-1, 1983  
 U.S. Geological Survey, Seattle



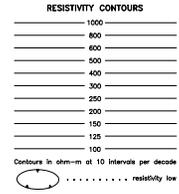
**900 Hz COPLANAR APPARENT RESISTIVITY  
 OF THE SLATE CREEK - SLANA RIVER AREA,  
 CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA**  
 PART OF MT. HAYES QUADRANGLE

by  
 Laurel E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.  
 2009

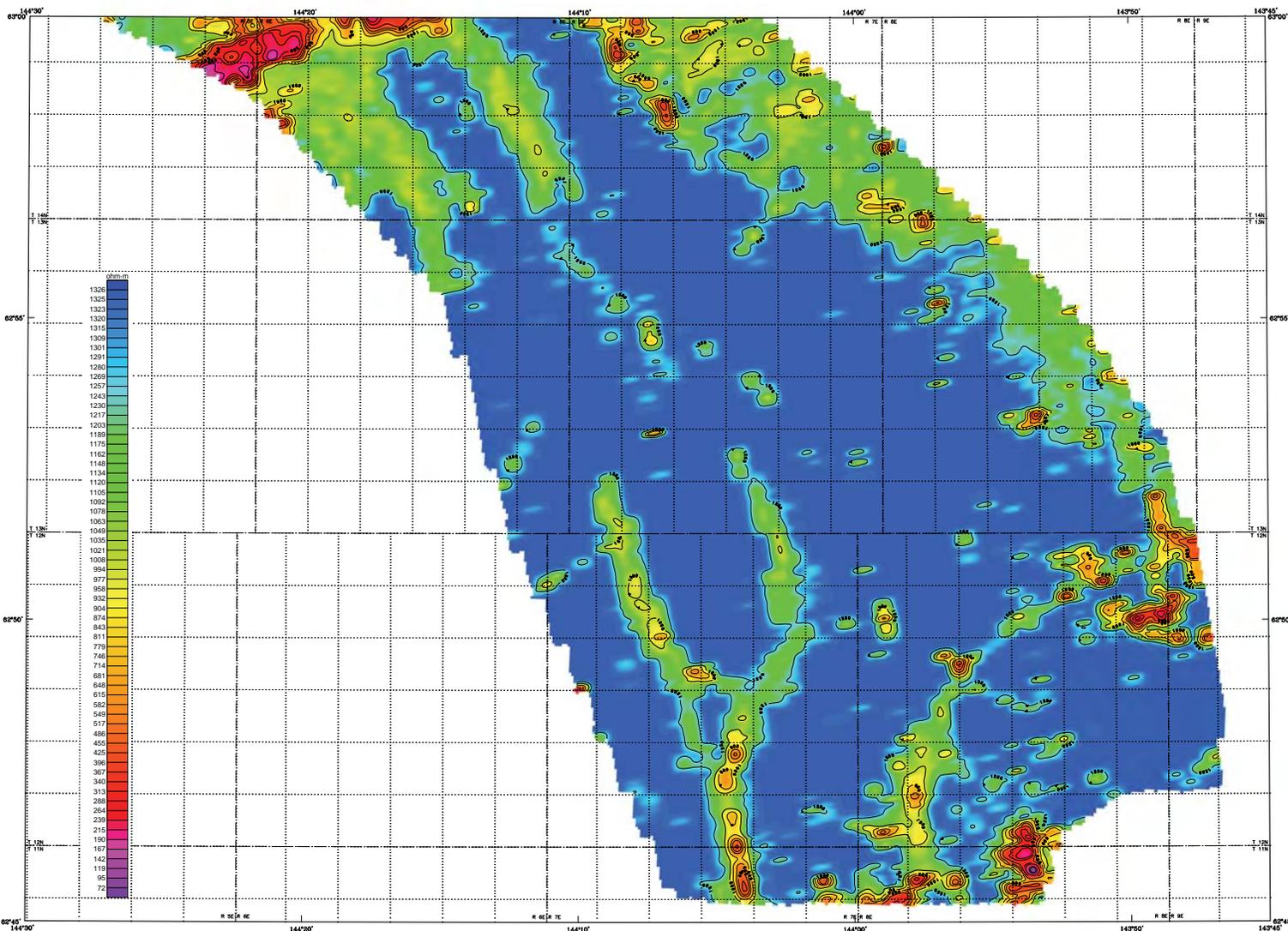


**DESCRIPTIVE NOTES**  
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 A Novatel OEM-42L Global Positioning System was used for navigation. The helicopter position and derived EM and magnetic sensors were projected onto the Clarke 1866 (UTM zone 6) spheroid, 1927 North American datum using a central 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 10m with respect to the UTM grid.

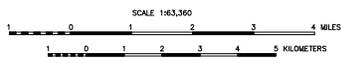
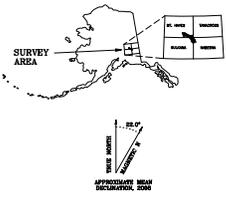
**RESISTIVITY**  
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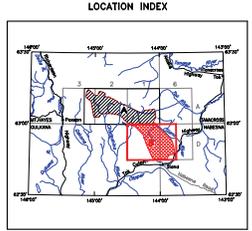
Position outlines from U.S. Geological Survey Database D-1, 1976.  
 Boundaries of Park, Chugach, and Denali.



## 900 Hz COPLANAR APPARENT RESISTIVITY OF THE SLATE CREEK - SLANA RIVER AREA, CHISTOCHINA MINING DISTRICT, SOUTHCENTRAL ALASKA

**PARTS OF GULKANA and NABESNA QUADRANGLES**

by  
**Laurel E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.**  
 2008



**DESCRIPTIVE NOTES**

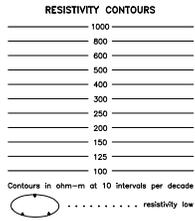
The geophysical data were acquired with a DIGHEM<sup>®</sup> Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex C33 cesium sensor. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS350B-3 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (350°) 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.

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**RESISTIVITY**

The DIGHEM<sup>®</sup> EM system measured inphase and quadrature components at five frequencies: two vertical coplanar coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar 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. 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 80 m grid using a modified Alms (1970) technique.

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**INTERPRETATION MAP  
OF THE SLATE CREEK - SLANA RIVER AREA,  
CHISTOCHINA MINING DISTRICT,  
SOUTHCENTRAL ALASKA**

PART OF BT. NUMBER 064888000-01  
Interpretation by Ruth Pleshch  
Figure Alaska Surveys Dept.  
2009

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

SCALE 1:63,360  
0 1 2 3 4 5 MILES  
0 1 2 3 4 5 KILOMETERS

**LEGEND**

- F1 Fault
- DF-1 Normal Fault
- A1 EM Conductor
- M1 Magnetic Zone
- A Approximate outline of broad magnetic zone defined by a change in magnetic texture
- M2 Magnetic Zone
- H1 Highly Conductive Zone

