

TOK ELECTROMAGNETIC AND MAGNETIC AIRBORNE GEOPHYSICAL SURVEY DATA COMPILATION

Emond, A.M., CGG, Burns, L.E., Graham, G.R.C., and CGG Land (US) Inc.

Geophysical Report 2015-2

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



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2015, Tok electromagnetic and magnetic airborne geophysical
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Surveys Geophysical Report 2015-2. <https://doi.org/10.14509/29347>



TOK ELECTROMAGNETIC AND MAGNETIC AIRBORNE GEOPHYSICAL SURVEY DATA COMPILATION

Emond, A.M.¹, CGG, Burns, L.E.¹, Graham, G.R.C.¹, and CGG Land (US) Inc.²

ABSTRACT

The Tok geophysical survey is located in eastern interior Alaska. The Tok survey area is roughly centered about 35 miles west-southwest of Tok. Almost all the area is in the Tok mining district; with a minor amount in the Chistochina mining district. Frequency domain electromagnetic and magnetic data were collected with the DIGHEMV system from August 21, 2014 to November 13, 2014. A total of 7338.7 line kilometers were collected covering 2597.4 square kilometers. Line spacing was 400 meters (m). Data were collected with an average ground surface clearance 52.55 m from a helicopter towed sensor platform (“bird”) on a 30 m long line.

PURPOSE

The purpose of this airborne survey was to map the magnetic and conductive properties of the Tok survey area, and to detect zones of conductive mineralization. The survey area contains many copper, gold, and gold-silver-copper prospects. These data will assist future geological mapping in the region.

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 under the Strategic and Critical Minerals Assessment Capital Improvement Project.

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

AVAILABLE DATA

Data Type	Provider	Description
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 supporting 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. Includes a geographically registered pdf (GeoPDF) for use with mobile devices such as GPS enabled smartphones and tablets, other devices, and programs.
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.
resistivity_models	USGS	Resistivity models created by USGS from the electromagnetic data. Not available at time of publication. Contact USGS for publication status.
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.

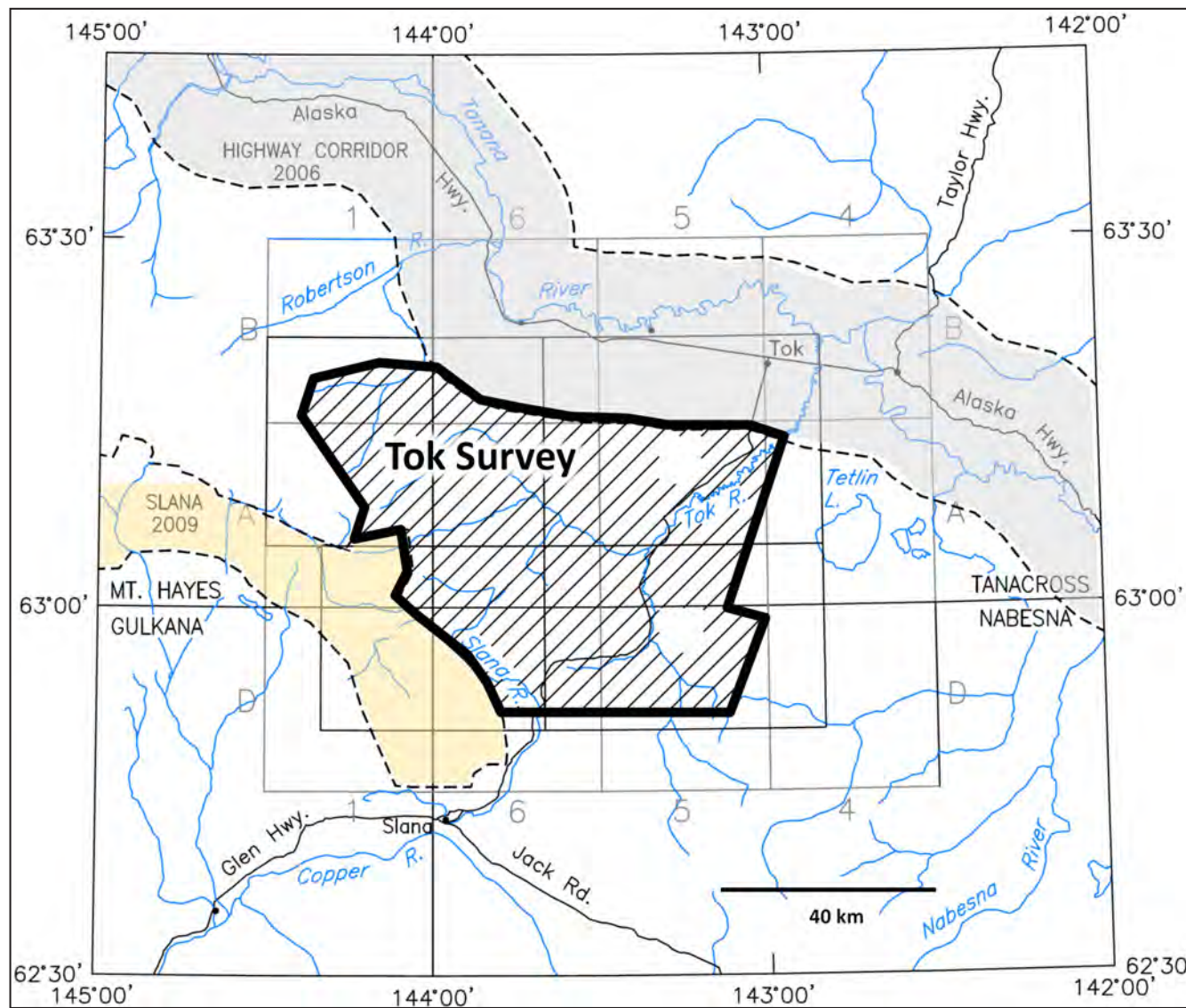
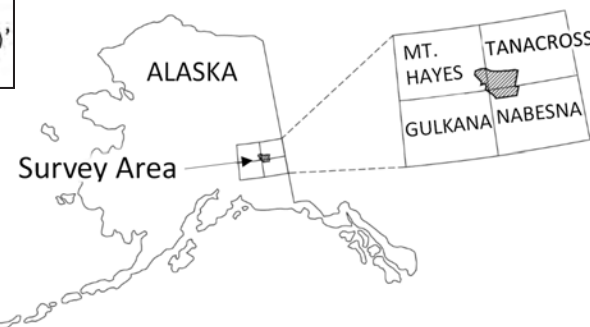


Figure 1. Tok magnetic and electromagnetic airborne geophysical survey location shown in eastern interior Alaska (right). Survey area shown with landmarks, relevant 1:250,000-scale quadrangle boundaries, major roads, and rivers.



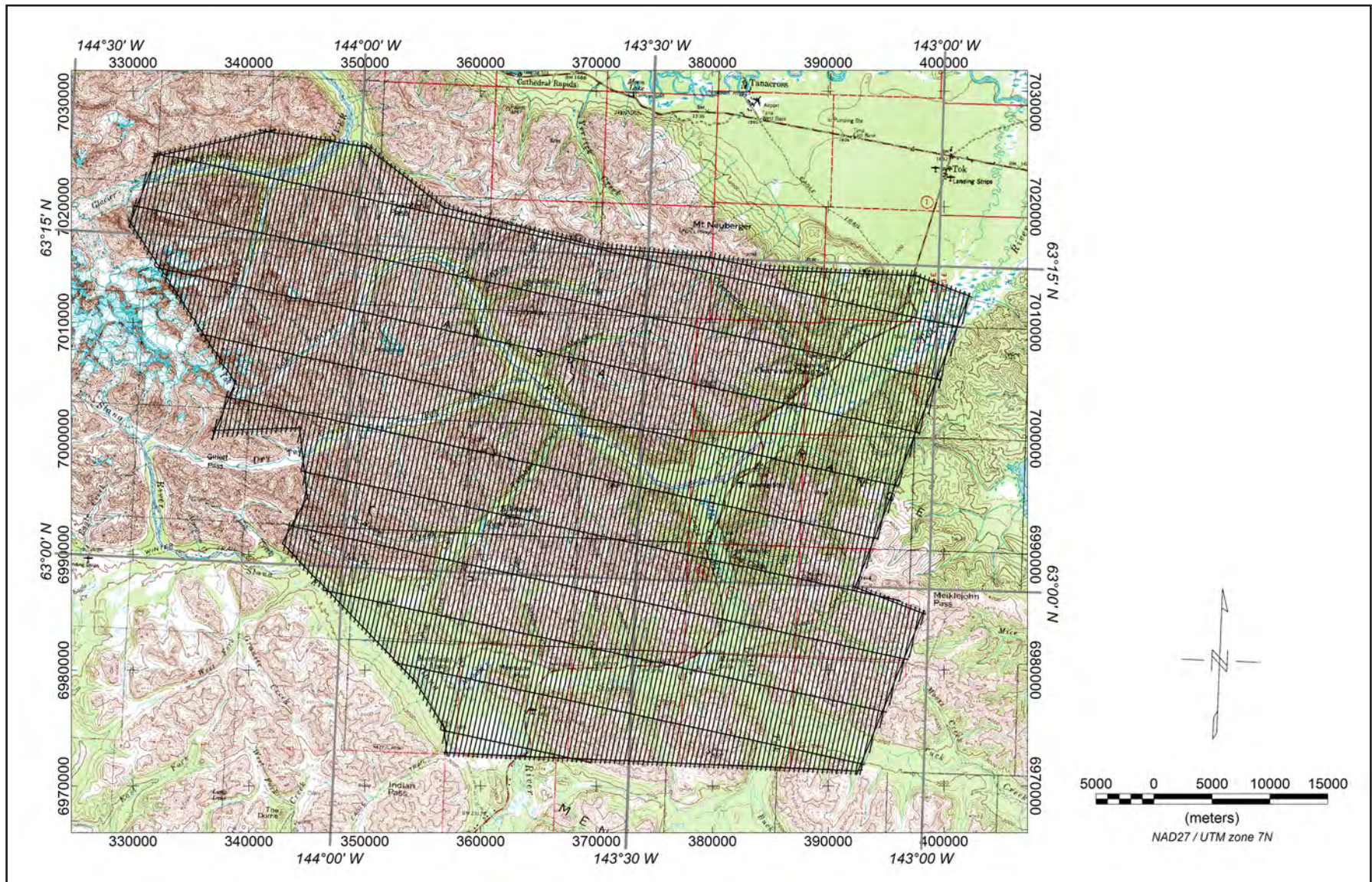


Figure 2. Flight path with topographic basemap.

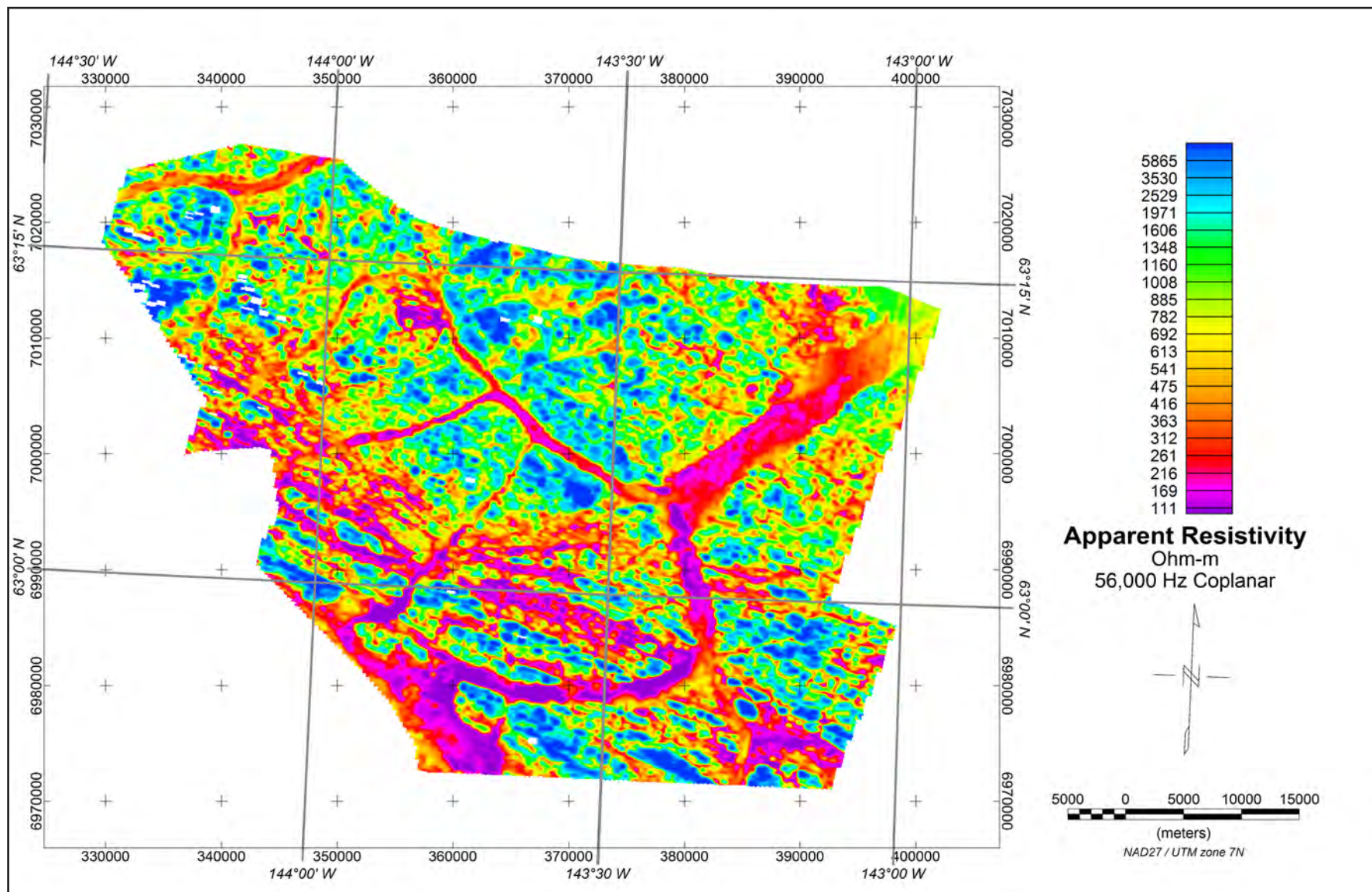


Figure 3. 56,000 Hz apparent resistivity grid.

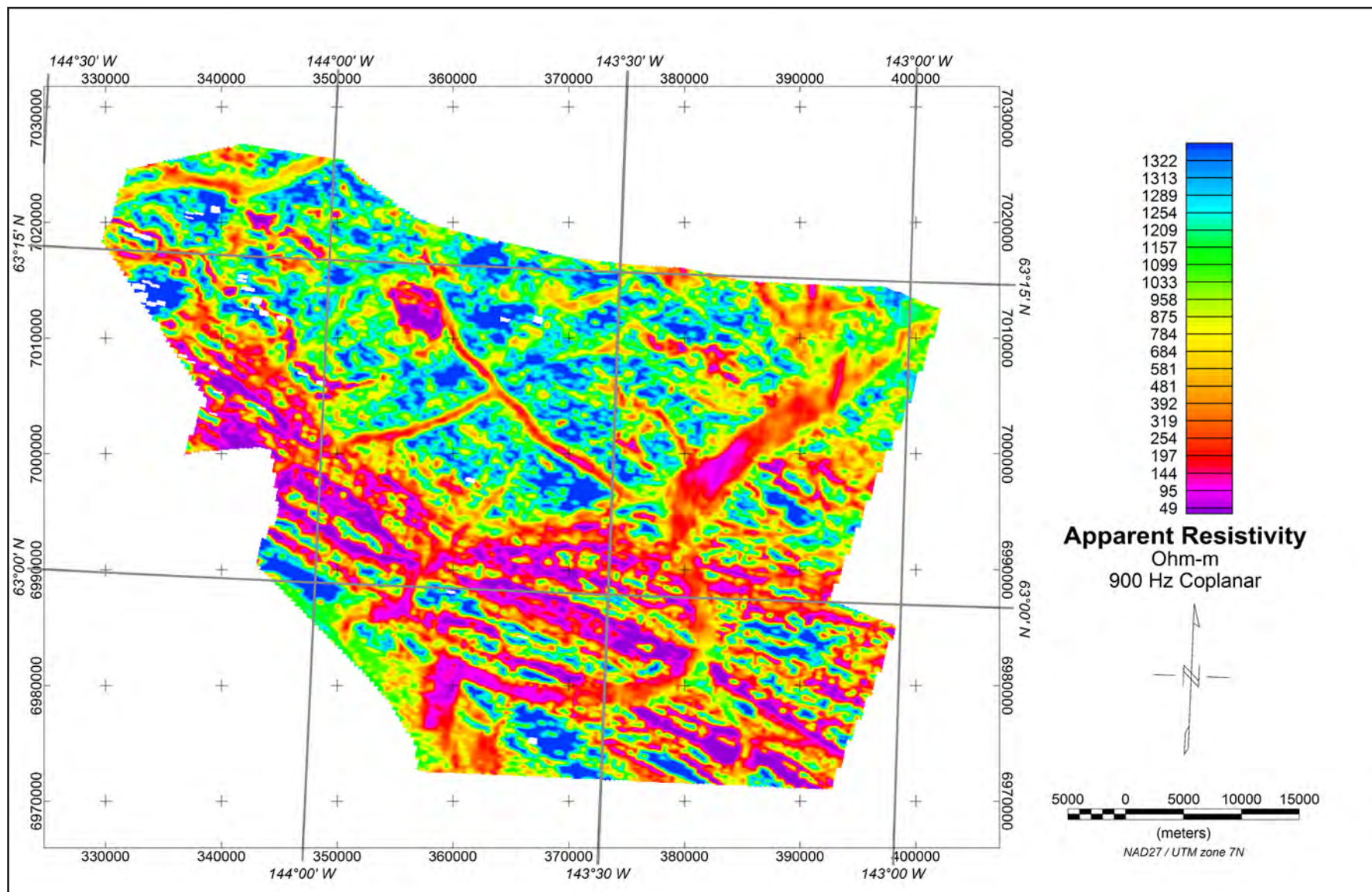


Figure 4. 900 Hz apparent resistivity grid.

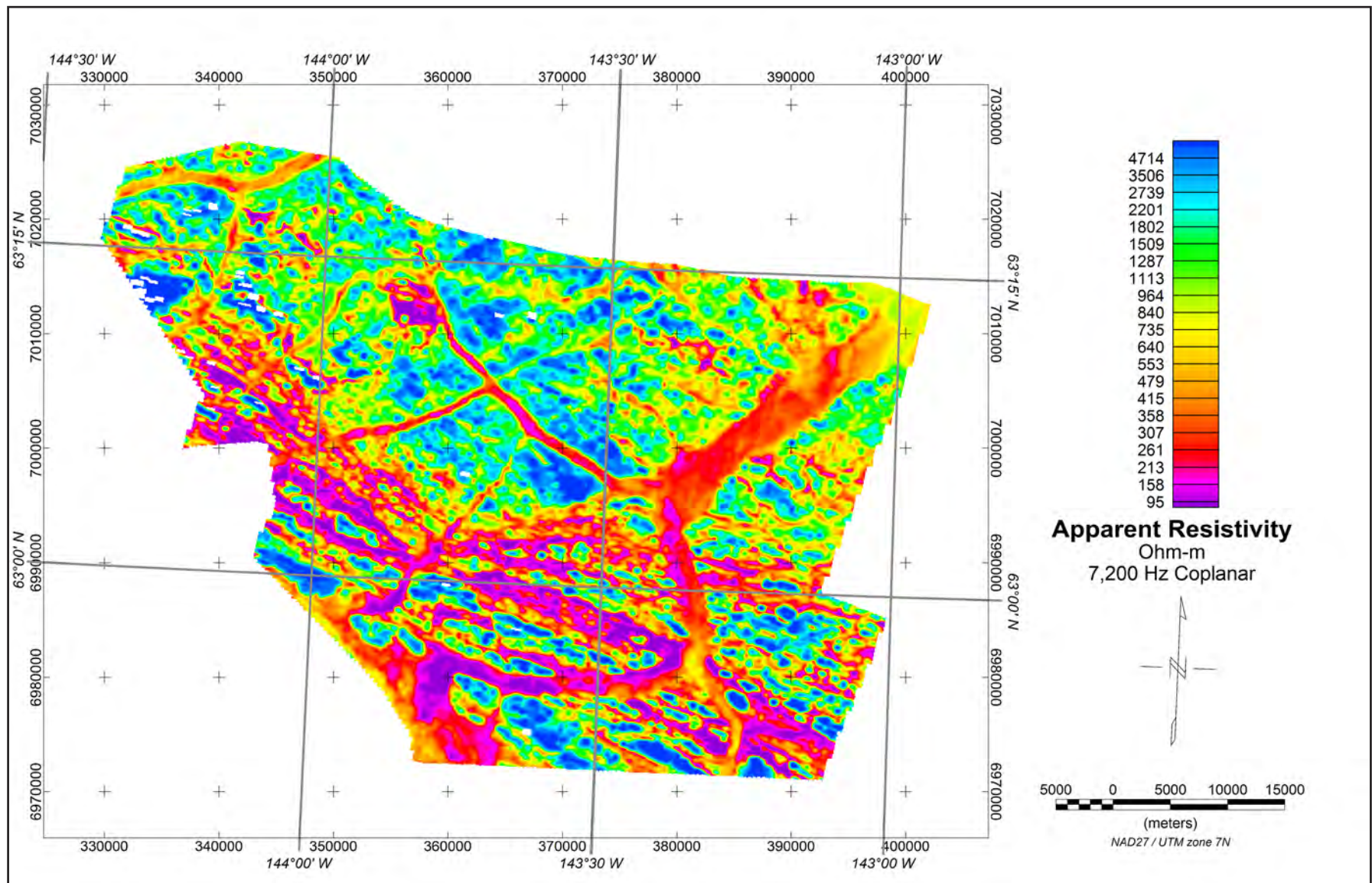


Figure 5. 7,200 Hz apparent resistivity grid.

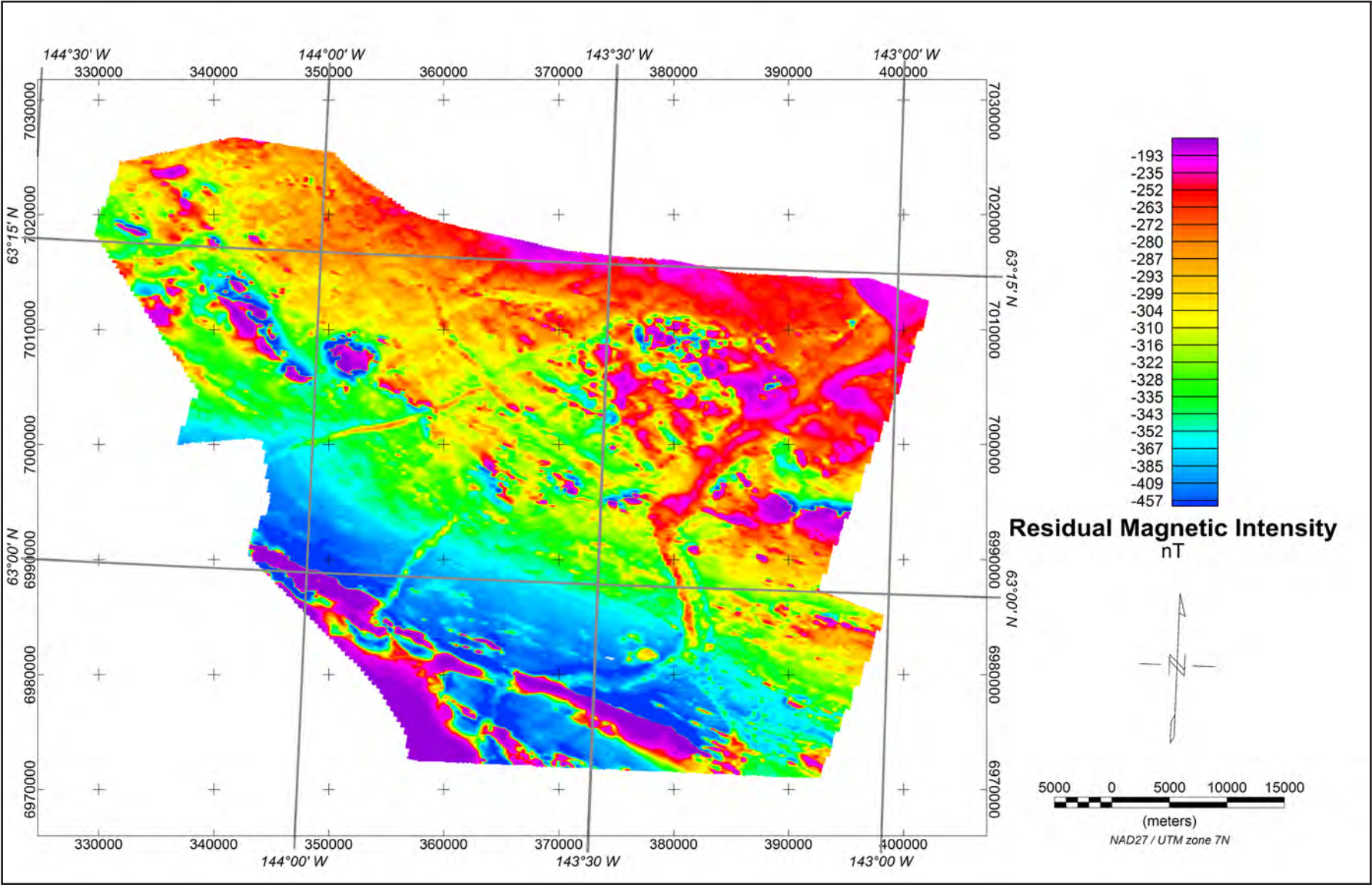


Figure 6. Residual magnetic intensity grid.

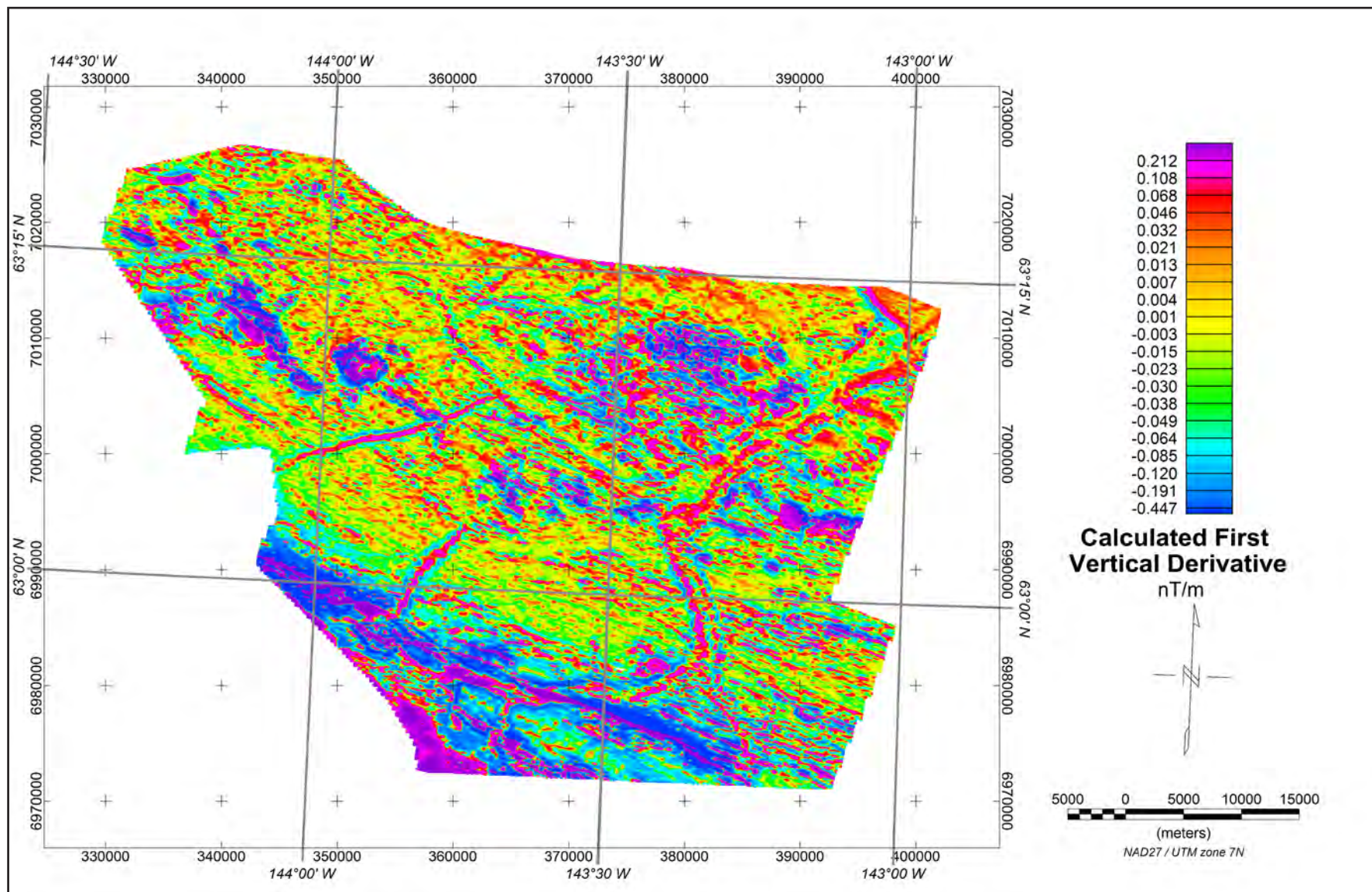


Figure 7. Magnetic calculated first vertical derivative grid.

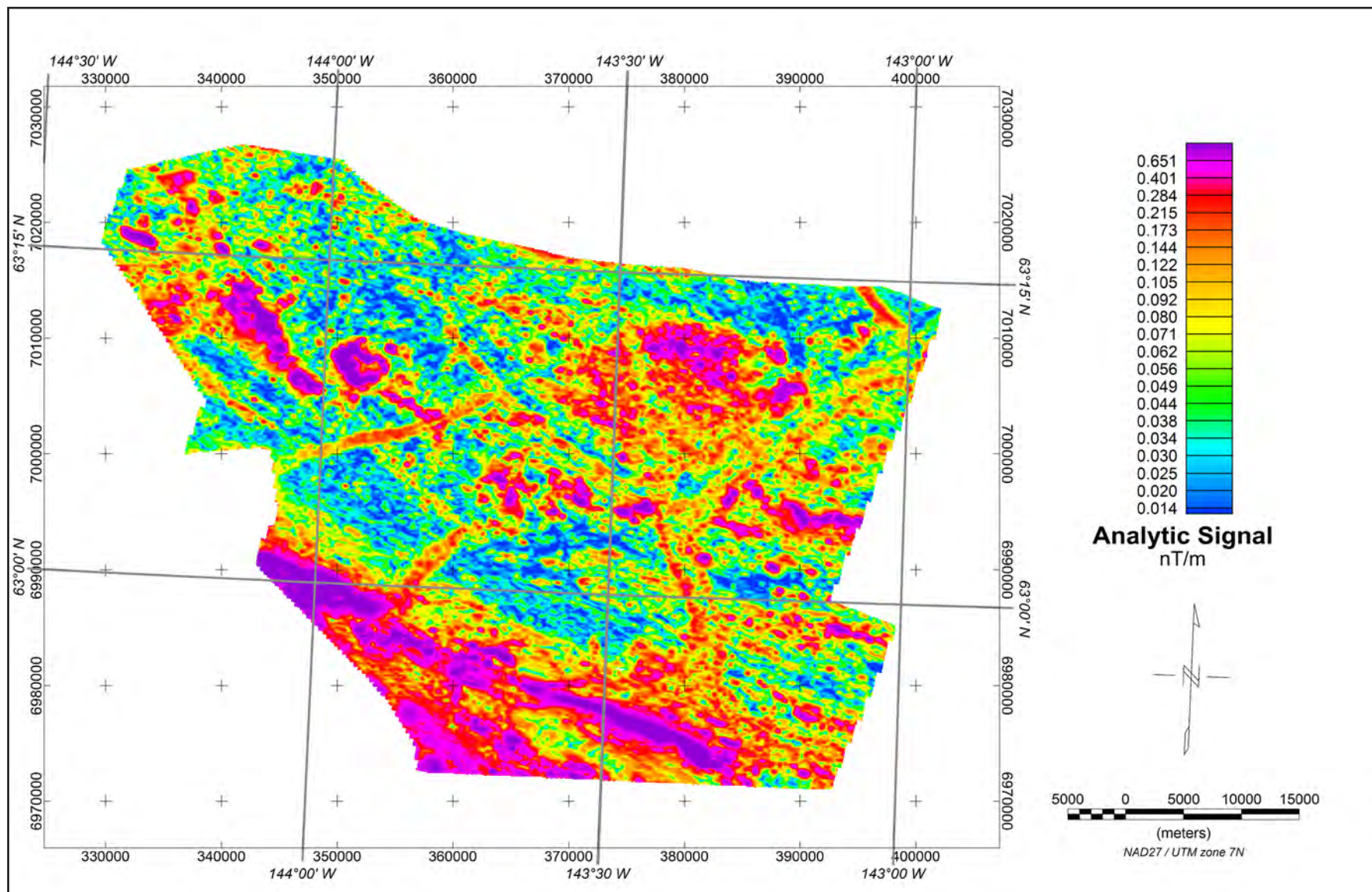


Figure 8. Magnetic analytic signal grid.

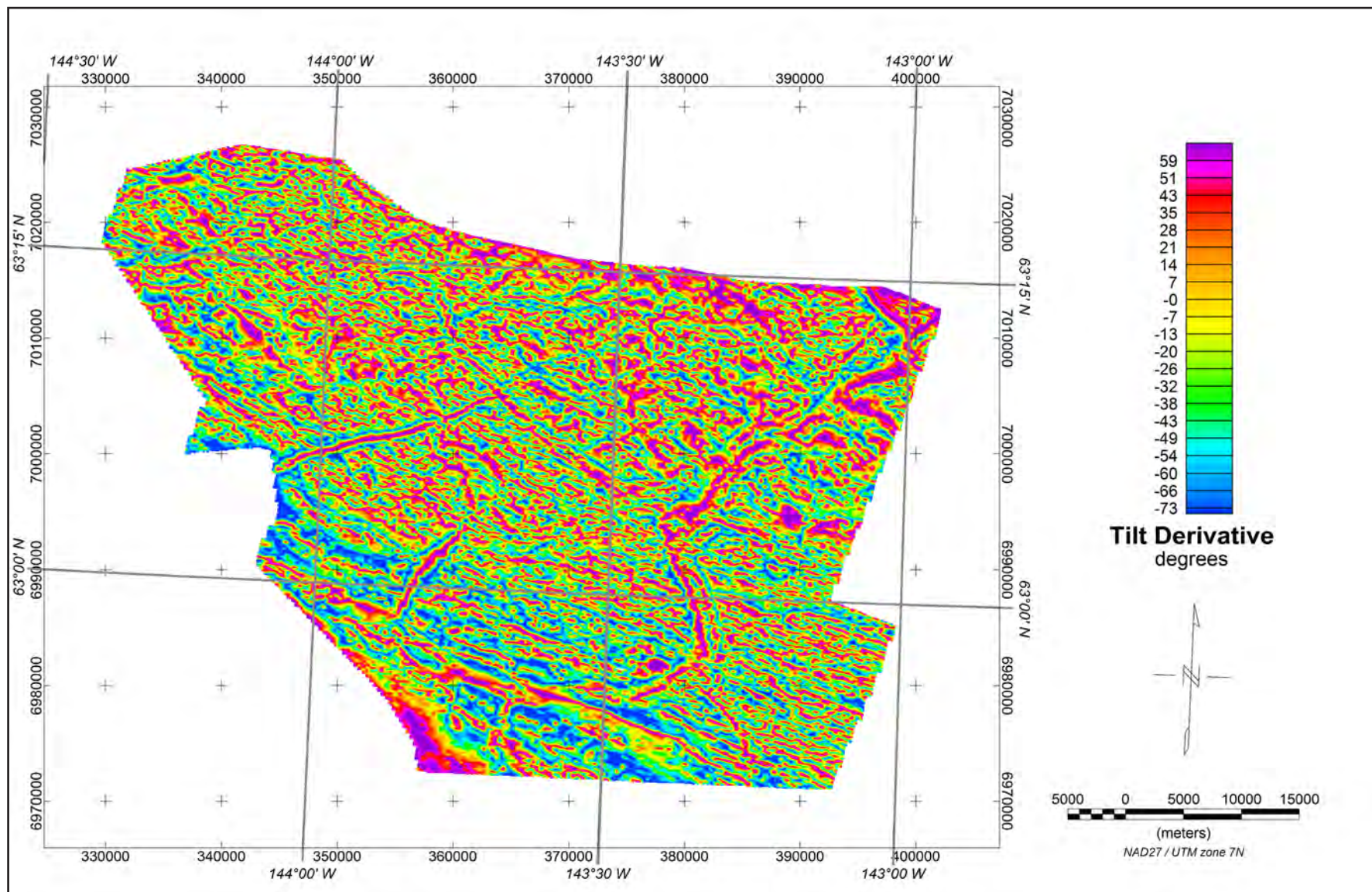


Figure 9. Magnetic tilt derivative grid.

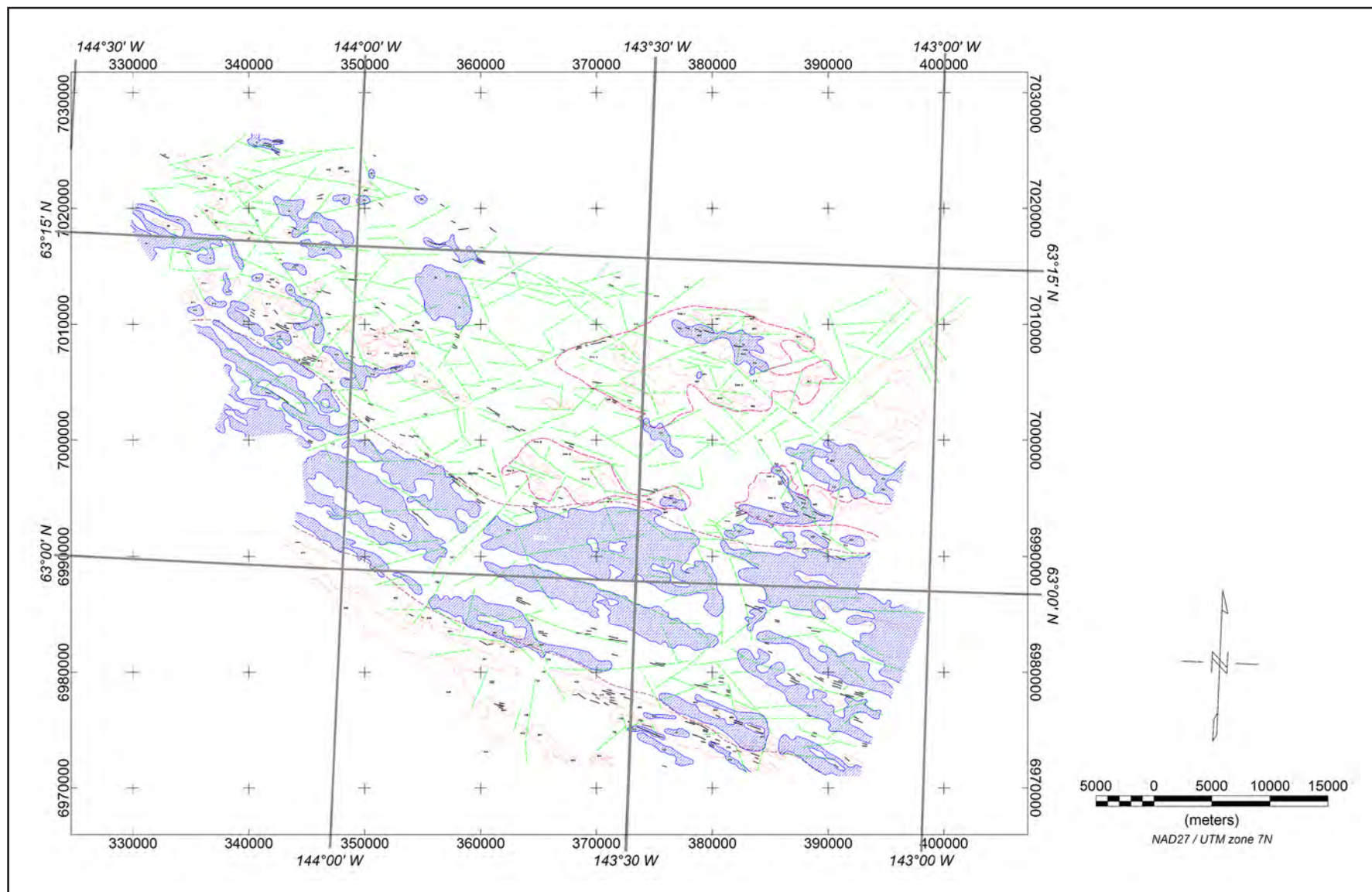
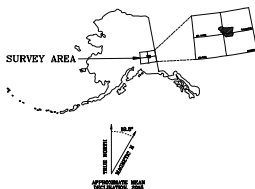


Figure 10. Magnetic and electromagnetic interpretation by the contractor.

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: <https://doi.org/10.14509/29347>

Pages	Map No.	Grid Shown	With
1:63,360-scale maps			
14–17	GPR2015-2, sheet 1a–d	Residual magnetic intensity, IGRF removed	Topography
18–21	GPR2015-2, sheet 2a–d	Residual magnetic intensity, IGRF removed	Magnetic contours
22–25	GPR2015-2, sheet 3a–d	First vertical derivative of the RMI	Topography
26–29	GPR2015-2, sheet 4a–d	Analytic Signal of the RMI	Topography
30–33	GPR2015-2, sheet 5a–d	Analytic Signal of the RMI	Analytic signal contours
34–37	GPR2015-2, sheet 6a–d	Tilt Derivative of the RMI	Tilt Derivative contours
38–41	GPR2015-2, sheet 7a–d	Shadowed RMI	Topography and Tilt Derivative contours
42–45	GPR2015-2, sheet 8a–d	56K Hz coplanar apparent resistivity	Topography
46–49	GPR2015-2, sheet 9a–d	56K Hz coplanar apparent resistivity	56K contours
50–53	GPR2015-2, sheet 10a–d	7200 Hz coplanar apparent resistivity	Topography
54–57	GPR2015-2, sheet 11a–d	7200 Hz coplanar apparent resistivity	7200 contours
58–61	GPR2015-2, sheet 12a–d	900 Hz coplanar apparent resistivity	Topography
62–65	GPR2015-2, sheet 13a–d	900 Hz coplanar apparent resistivity	900 contours
66–69	GPR2015-2, sheet 14a–d	Flight path	Topography
82–85	GPR2015-2, sheet 16a–d	Electromagnetic and magnetic interpretation	Township, range, and section
86–89	GPR2015-2, sheet 17a–d	EM and magnetic interpretation, residual magnetic intensity	Township, range, and section
1:31,680-scale maps			
70–81	GPR2015-2, sheet 15a–l	Detailed EM anomalies, residual magnetic data grid	Topography



**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

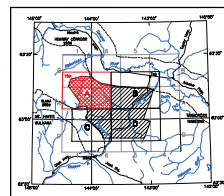
by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018

RESIDUAL MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a COG D134-4 magnetometer with a 100 mHz cut-off frequency. 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 1980), updated for dates of flight and ground control variations), (3) leveled to the tie line data, and (4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

¹ Aising, 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.

LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGs), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014. All project work was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggs@alaska.gov).

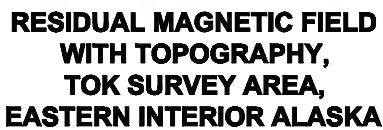
DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 scalar magnetometer with a Sinterex CS3 sensor, and the EM and magnetic data were collected at a depth of 1 m and a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 single helicopter at a mean terrain clearance of 60 m along E-W (D12) survey flight lines with a spacing of 100 m. The lines were flown parallel to the coast to the flight lines at intervals of approximately 4,800 m.

A Novatel OEMS-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.



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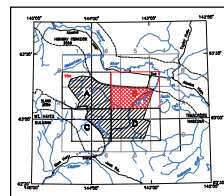
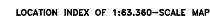


**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018

The magnetic total field data were processed using digitally recorded data from a CGO D134 magnetometer with a Sincrotr CS3 cesium 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 magnetic data, (2) IGRF corrected (IGRF 1990, 2010), updated for secular variation, and (3) detimed (variations), (3) leveled to the tie line data, and (4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

¹ Aizma, 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.



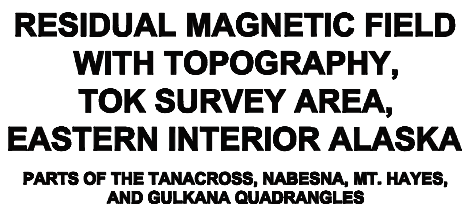
This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG Land (U.S.) Inc. under contract to the State of Alaska by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Program.

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The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition, the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.



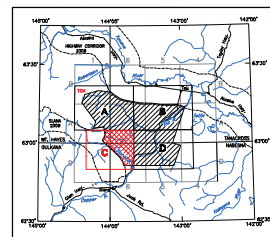
by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2015

RESIDUAL MAGNETIC FIELD

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¹ 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.

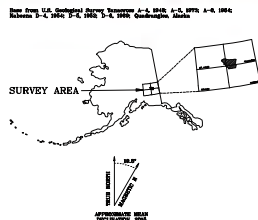
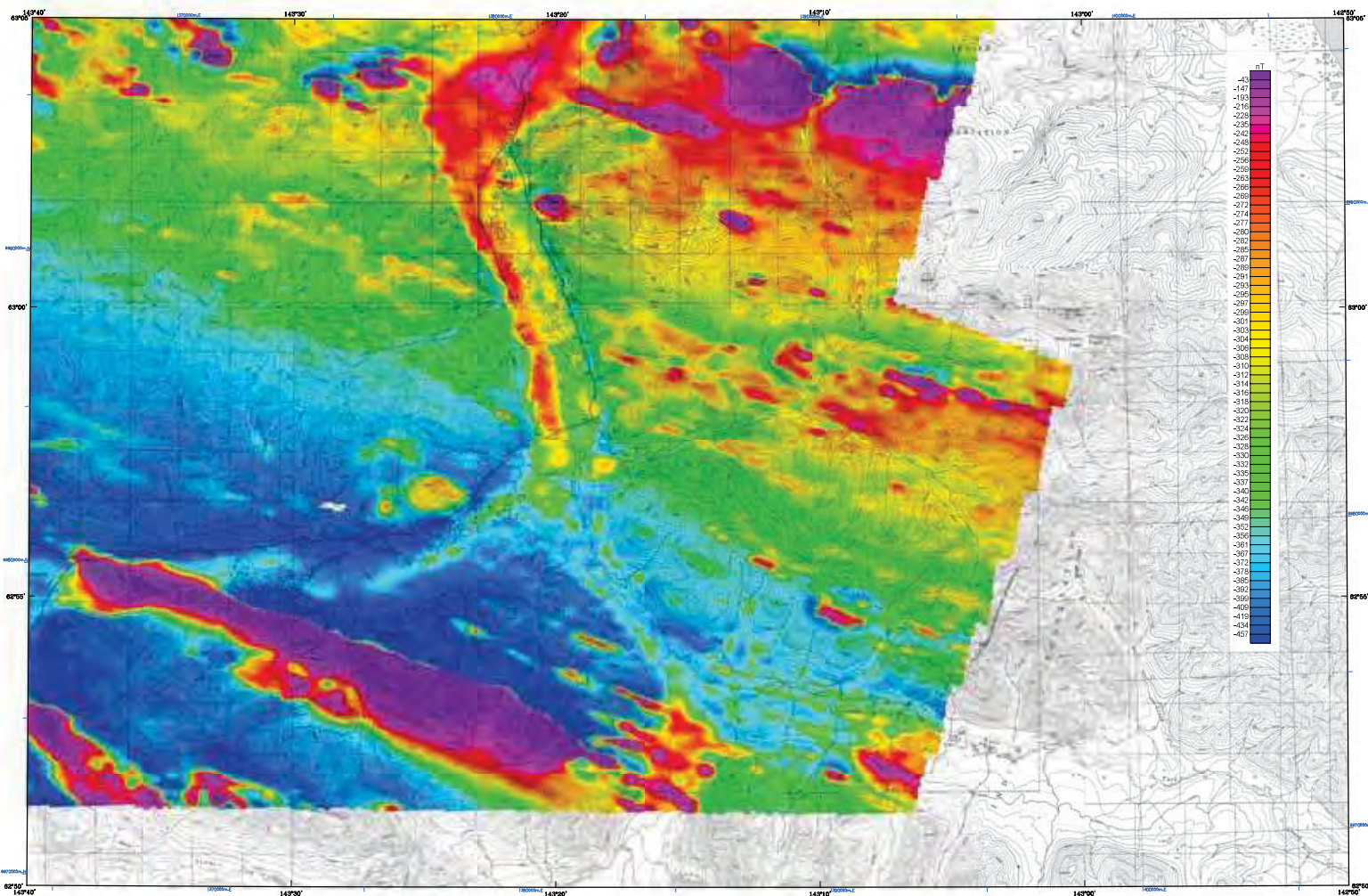
LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

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RESIDUAL MAGNETIC FIELD WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Emond, CGO, and CGO Land (U.S.) Inc.
2015

RESIDUAL MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a CGO D1-344 magnetometer with a Sinterex CS3 cesium 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 2010, 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 Adams (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

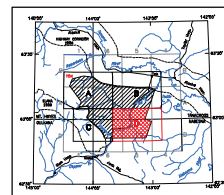
¹ Adams, M., 1970, A new method of interpolation and analog curve fitting based on local averages, *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

DESCRIPTIVE NOTES

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A Novatel OEM5-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.2 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141° 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.

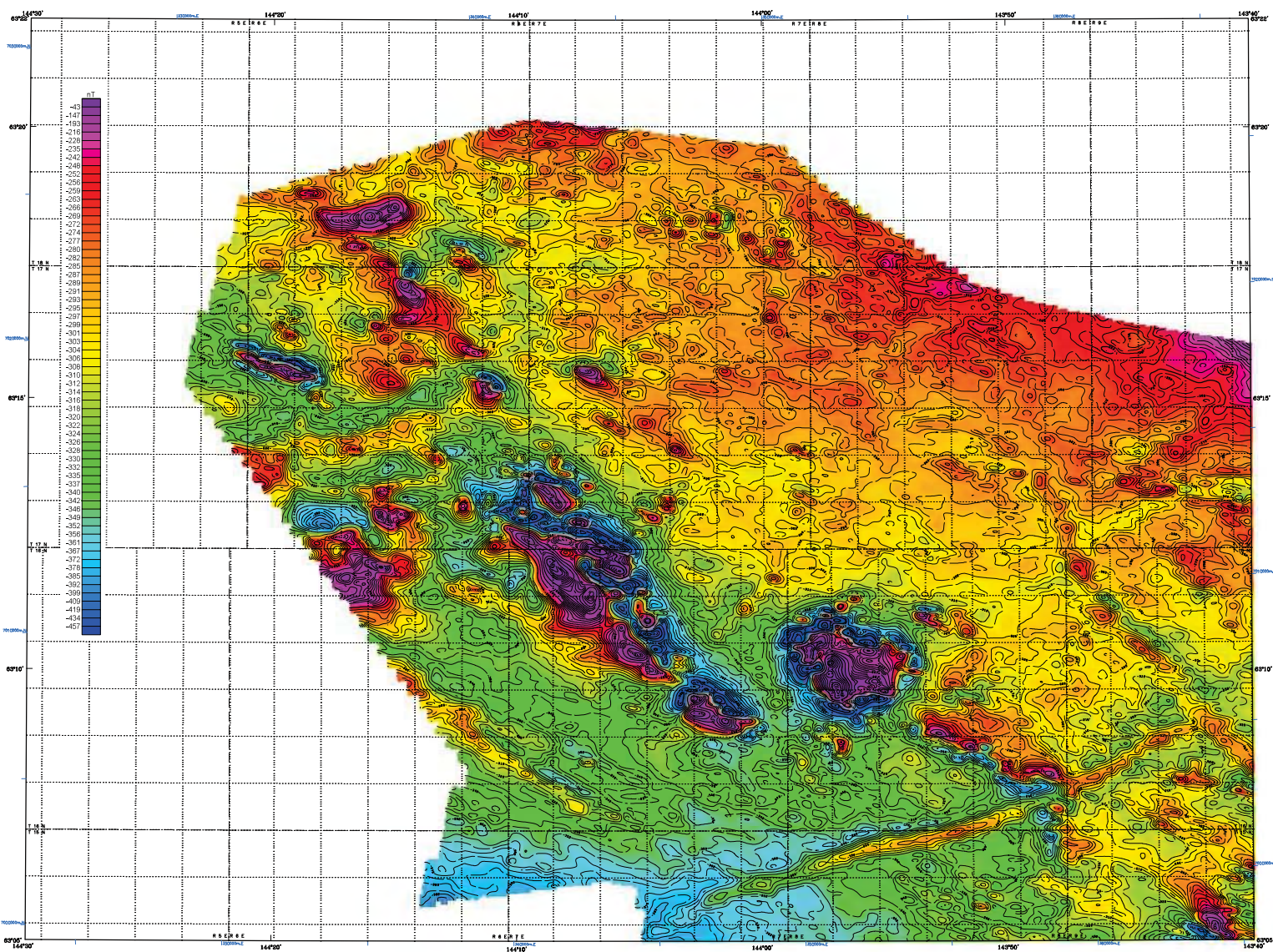
LOCATION INDEX OF 1:63,360-SCALE MAP



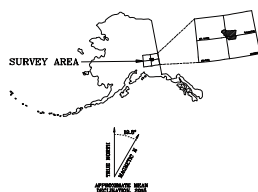
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Surveyed within the U.S. Geological Survey M. Ryan A-1, 1970; B-1, 1985.
 Revisited in 1994, 2004, 2010, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025.



RESIDUAL MAGNETIC FIELD WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
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by
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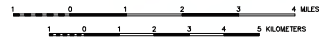
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RESIDUAL MAGNETIC FIELD

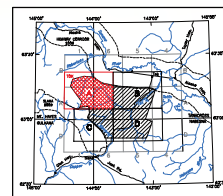
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¹ Akima, H., 1970, A new method of interpolation and smooth curve
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SCALE 1:63,360



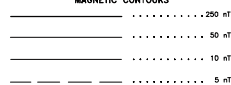
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 (www.dggs.alaska.gov/pubs/geophysics). Products are
 also available in digital format and maps are available
 on paper for a nominal fee from the DGGS office,
 3354 College Road, Fairbanks, Alaska, 99709-1707 (phone
 907-451-5020; email dggs@alaska.gov).

MAGNETIC CONTOURS





The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and CGO D134 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean ground speed of 50 km/h. The EM survey was flown in a series of parallel lines in the SE-NW (012°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEMS-GZL 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 7) spheroid, 1927 North American datum using a Clarke meridional arc length constant of 0.001 and an east constant of 500,000. Positional accuracy of the presented data is better than 10 m with respect to the UTM grid.

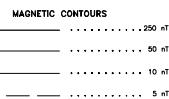
The magnetic total field data from a CCGS D1344 magnetometer with a Sinterex CS3 cesium sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base magnetic field, (2) leveled to the geoid (IGR 1980), (3) updated for date of flight and altimeter variations, (4) leveled to the tie line data, and (4) interpolated onto a regular 80 m grid using a modified Alma (1970) technique. All grids were then resampled from a 10 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

¹ 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.

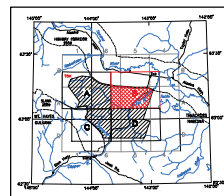
RESIDUAL MAGNETIC FIELD WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018



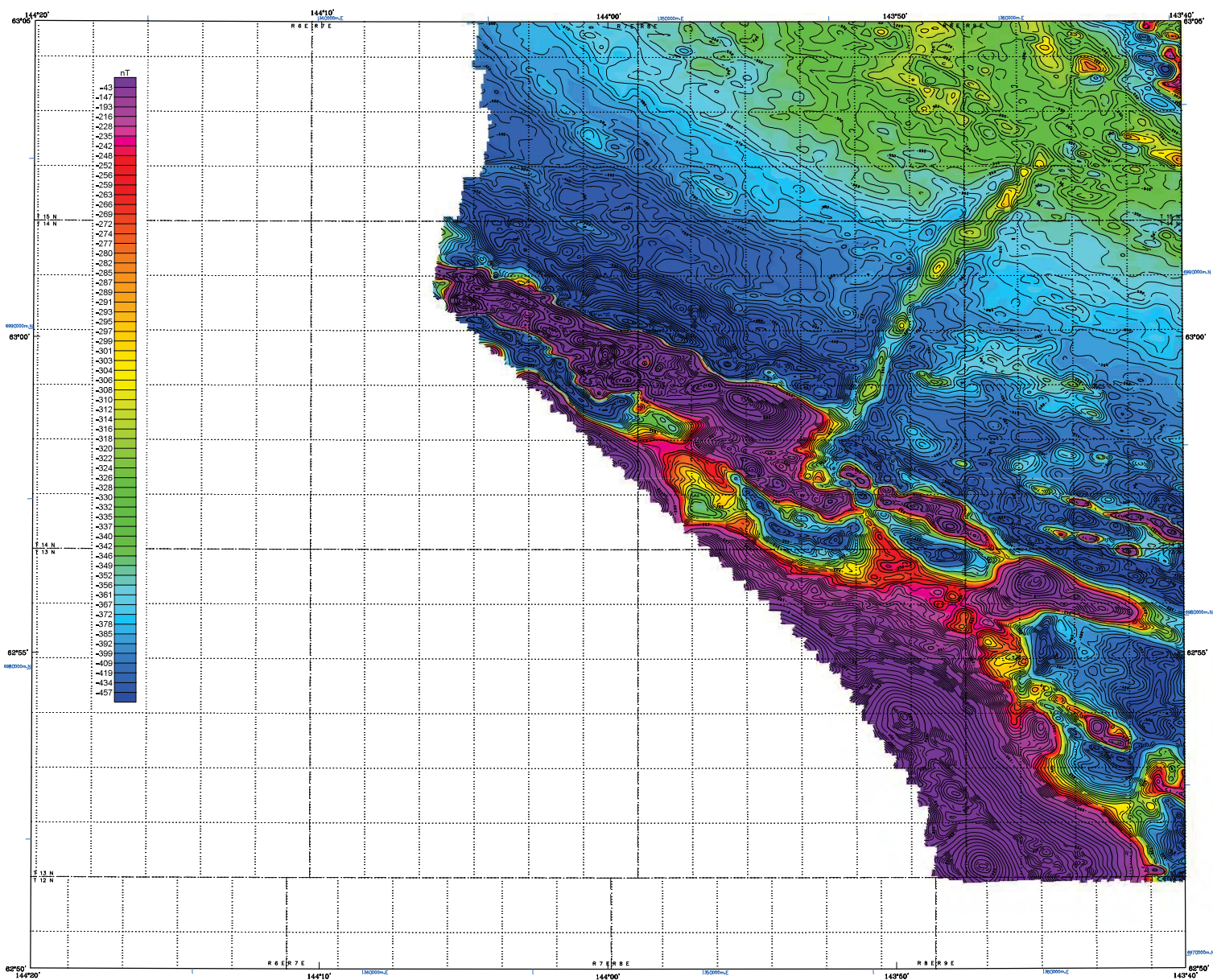
LOCATION INDEX OF 1:63,360-SCALE MAP



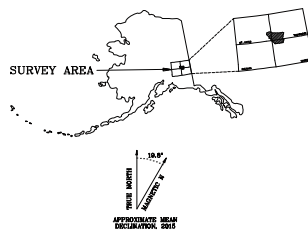
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG Land (U.S.) Inc. under contract to the State of Alaska by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Program.

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Section outlines from U.S. Geological Survey Topographic A-5, 1964; Johnson D-5, 1966; Collins D-1, 1976; St. Hayes A-1, 1976; Gulkana, Alaska.



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

RESIDUAL MAGNETIC FIELD WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Ermond, CGG, and CGG Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

RESIDUAL MAGNETIC FIELD

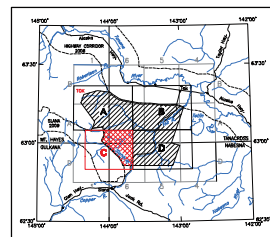
The magnetic total field data were processed using digitally recorded data from a CGG D1344 magnetometer with a Scintrex CS3 cesium sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2010, 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. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

¹ 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 CONTOURS

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

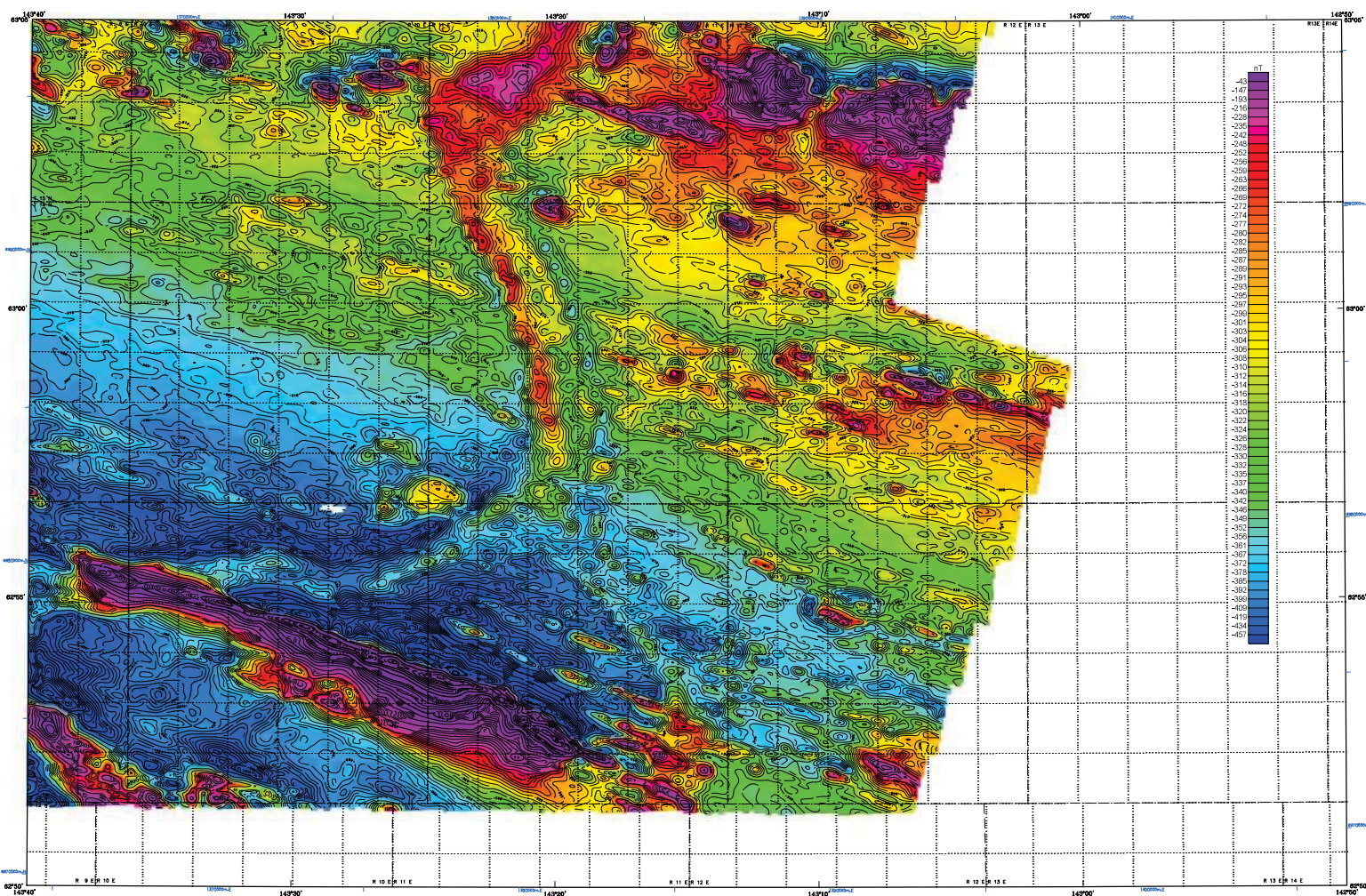
LOCATION INDEX OF 1:63,360-SCALE MAP



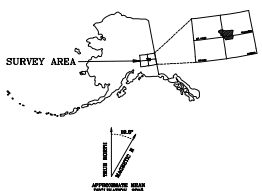
SURVEY HISTORY

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Survey Area, Part 2, of Geological Survey Report 2015-2, Sheet 2D, 2015. Alaska Division of Geological & Geophysical Surveys, 2015.



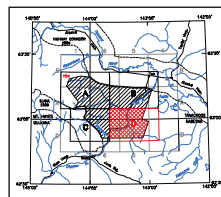
SCALE 1:63,360
0 1 2 3 4 MILES
0 1 2 3 4 KILOMETERS

RESIDUAL MAGNETIC FIELD WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Emond, COG, and COG Land (U.S.) Inc.
2015

LOCATION INDEX OF 1:63,360-SCALE MAP



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a COG D1344 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the right lines at intervals of approximately 4,800 m.

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 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141° and a north constant of 0 and an east constant of 900,000. Positional accuracy of the presented data is better than 10 m with respect to the UTM grid.

RESIDUAL MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a COG D1344 magnetometer with a Sinterex CS3 cesium 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) GMR corrected (GMR model 2010, 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 Adams (1975) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

¹ Adams, 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. 589-605.

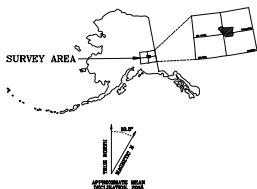
MAGNETIC CONTOURS

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

SURVEY HISTORY

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**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a GGG D1344 cesium magnetometer with a Schintec CS3 cesium gradiometer. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m above the terrain (102' survey flight lines with a 100 m spacing). Flights were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEMS-G2L Global Positioning System was used for navigation. The helicopter position was determined at a second ground station using differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, a north constant of 1000 and a scale constant of 1000. Positional accuracy of the projected data is better than 10 m with respect to the UTM grid.

COLOR BAR HISTOGRAM

Approximately 98% of the first vertical derivative of the magnetic field for the Tok Survey Area dataset lie within the range displayed on the color bar. Data values actually range from $-16,363$ nT/m (dark blue) to about $21,049$ nT/m (magenta).

FIRST VERTICAL DERIVATIVE OF THE MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a CCGG D13444 magnetometer with a Selenia C53 column sensor. Data were collected at a sampling rate of 100 Hz. The magnetic data were (1) corrected for diurnal variations by subtracting the digitally recorded station magnetic data, (2) IGRF corrected (IGRF model 2010), (3) corrected for crustal magnetic anomalies (2010), (4) leveled to the tie line data, and (4a) interpolated onto a regular 80 m grid using a modified Akima (1970)'s technique. All grids were then resampled to a regular 10 m grid. The grids were then used to produce the maps and final grids in this publication. The first vertical derivative grid was calculated using the first vertical derivative of the magnetic field using FFT base frequency domain filtering algorithm. The resulting first vertical derivative grid provides better definition and resolution of near-surface magnetic units.

¹ Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedure. *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG Land (U.S.) Inc. under contract to the State of Alaska by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with Sinterex CS3 cesium sensor. The EM and magnetic data were collected at a flight height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and a video camera. Flights were performed with an AS-350-B3 Alouette helicopter at a mean terrain clearance of 60 m along E-W (12°) survey flight lines with a spacing of 100 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

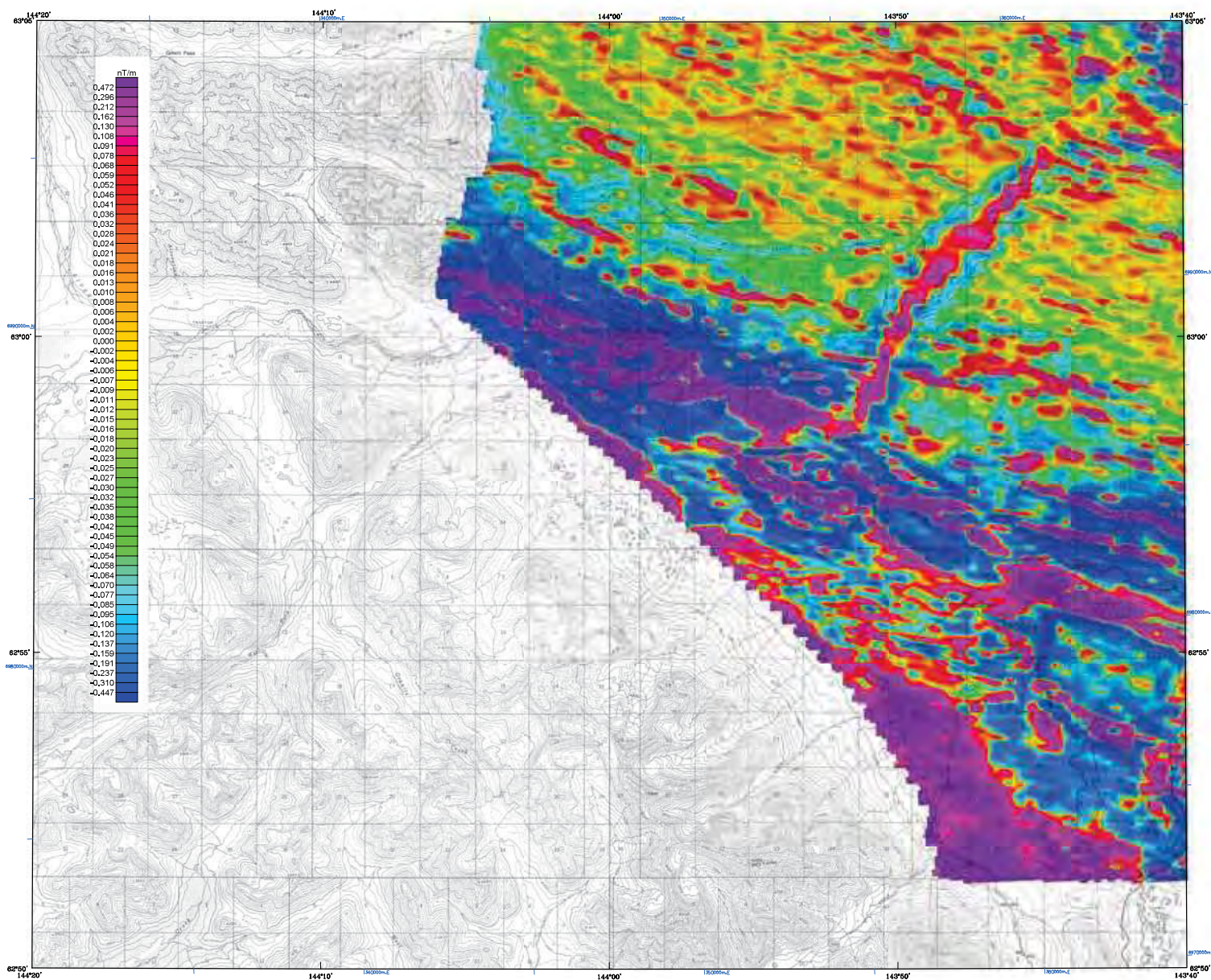
A Novatel OEMS-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

Approximately 98% of the first vertical derivative of the magnetic field for the Tok Survey Area dataset lie within the range displayed on the color bar. Data values actually range from -16.363 nT/m (dark blue) to about 21.049 nT/m (magenta).

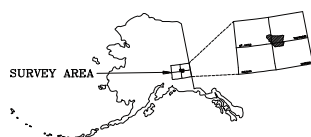
The magnetic total field data were processed using digitally recorded data from a CCG 131444 magnetometer with a Sincrus CS3 cosmic sensor. Data were collected at a rate of 100 samples per second. The magnetic data were (1) corrected for diurnal variations by subtracting the digitally recorded station magnetic data, (2) IGRF corrected (IGRF model 1990), (3) corrected for magnetic declination (20 variations), (3) leveled to the tie line data, and (4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique. All grids were then resampled to a regular 10 m grid. The grids were then processed using the methods and final grids in this publication. The first vertical derivative grid was calculated using the first vertical derivative of the magnetic field FFT base frequency domain filtering algorithm. The resulting first vertical derivative grid provides better resolution of the results and is more useful in helping to identify weak magnetic features that may

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Der. from US Geological Survey Topographic A-C, 1964; Release D-E, 1966;
Culture D-E, 1976; B, Baye A-C, 1976; Olenok, Alaska



FIRST VERTICAL DERIVATIVE OF THE MAGNETIC FIELD WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Emmond, CGG, and CGG Land (U.S.) Inc.
2015

FIRST VERTICAL DERIVATIVE OF THE MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium 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 2010, updated for date of flight and altitude variations), (3) leveled to the tie line data, and (4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication. The first vertical derivative grid was calculated from the processed total magnetic field grid using an 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.

¹ 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. 588-592.

COLOR BAR HISTOGRAM

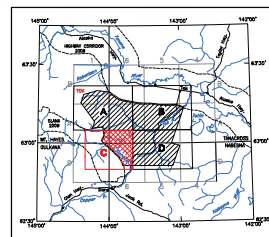
Approximately 98% of the first vertical derivative of the magnetic field for the Tok Survey Area dataset lie within the range displayed on the color bar. Data values actually range from -16.363 nT/m (dark blue) to about 21.049 nT/m (magenta).

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

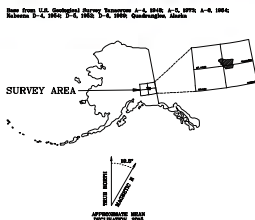
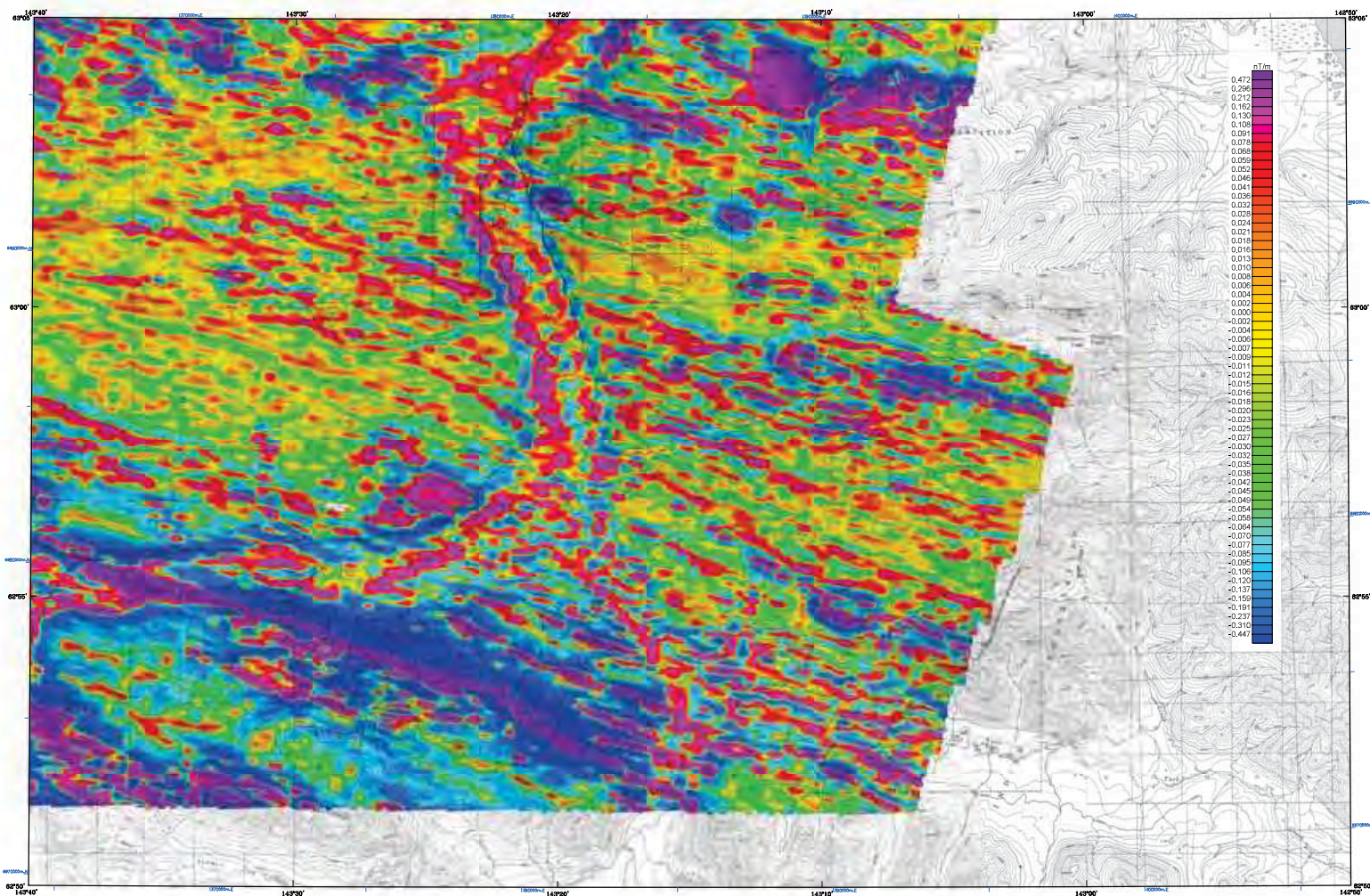
LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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FIRST VERTICAL DERIVATIVE OF THE MAGNETIC FIELD WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES, AND GULKANA QUADRANGLES

by
Abraham M. Emond, CGO, and CGO Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a CGO D1344 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM4-C2L Global Positioning System was used for navigation. The helicopter position was derived every 0.2 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141° 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.

COLOR BAR HISTOGRAM

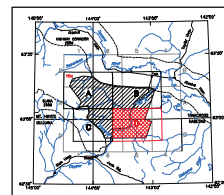
Approximately 98% of the first vertical derivative of the magnetic field for the Tok Survey Area dataset lie within the range displayed on the color bar. Data values actually range from -16.363 nT/m (dark blue) to about 21.949 nT/m (magenta).

FIRST VERTICAL DERIVATIVE OF THE MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a CGO D1344 magnetometer with a Sinterex CS3 cesium 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 2010, 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 Adina (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication. The first vertical derivative grid was calculated from the processed total magnetic field grid using an 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.

¹Adina, 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. 589-593.

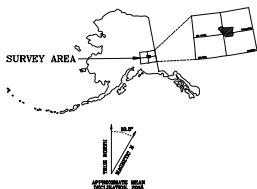
LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

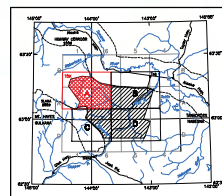
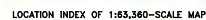
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AND GULKANA QUADRANGLES**

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and cesium magnetometer were flown at an altitude of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and a video camera. Flights were performed with an AS-350-B3 Airbus helicopter at a mean terrain clearance of 60 m along NE-SW [012°] survey flight lines with a spacing of 400 m. The lines were flown approximately perpendicular to the flight lines at intervals of approximately 4,800 m.

A NovAtel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

ANALYTIC SIGNAL

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.

SURVEY HISTORY

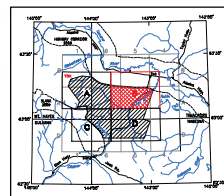
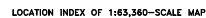
This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska Department of Natural Resources as part of the Alaska Airborne Geological and Geophysical Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment/Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggs@alaska.gov).



**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer (EM Sciences). CS3 cesium sensors. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Sikorski helicopter at a mean terrain clearance of 60 m above the ground. The survey flight was at a speed of 400 m. The line lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 1886 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

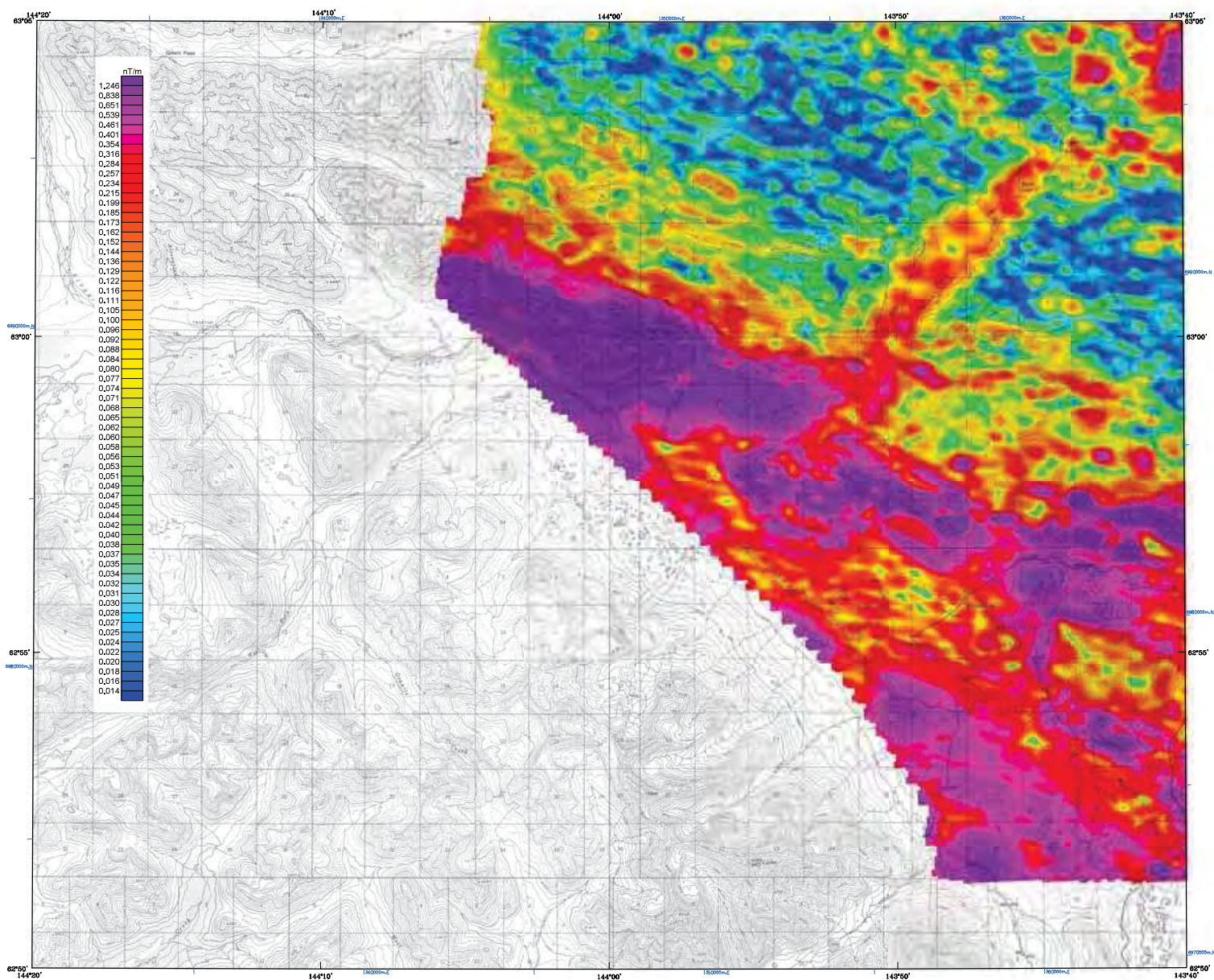
ANALYTIC SIGNAL

ANALYTIC SIGNAL
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.

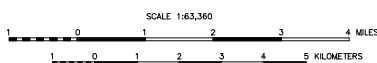
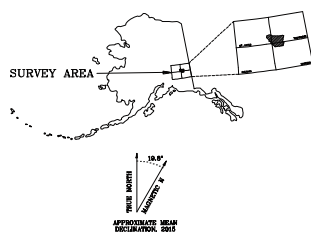
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 at 200 m resolution. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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Base from U.S. Geological Survey Topographic A-5, 1964; Release D-5, 1966;
Culture D-1, 1976; B-1, 1976; and C-1, 1976; Oronokuk, Alaska.



ANALYTIC SIGNAL WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Ermond, CGG, and CGG Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

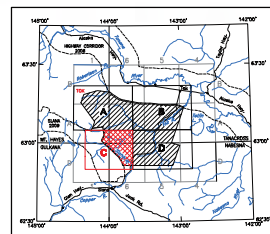
The geophysical data were acquired with a DIGHEM V Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

ANALYTIC SIGNAL

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.

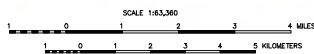
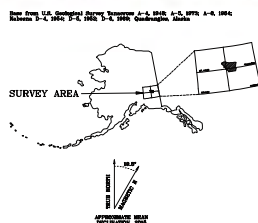
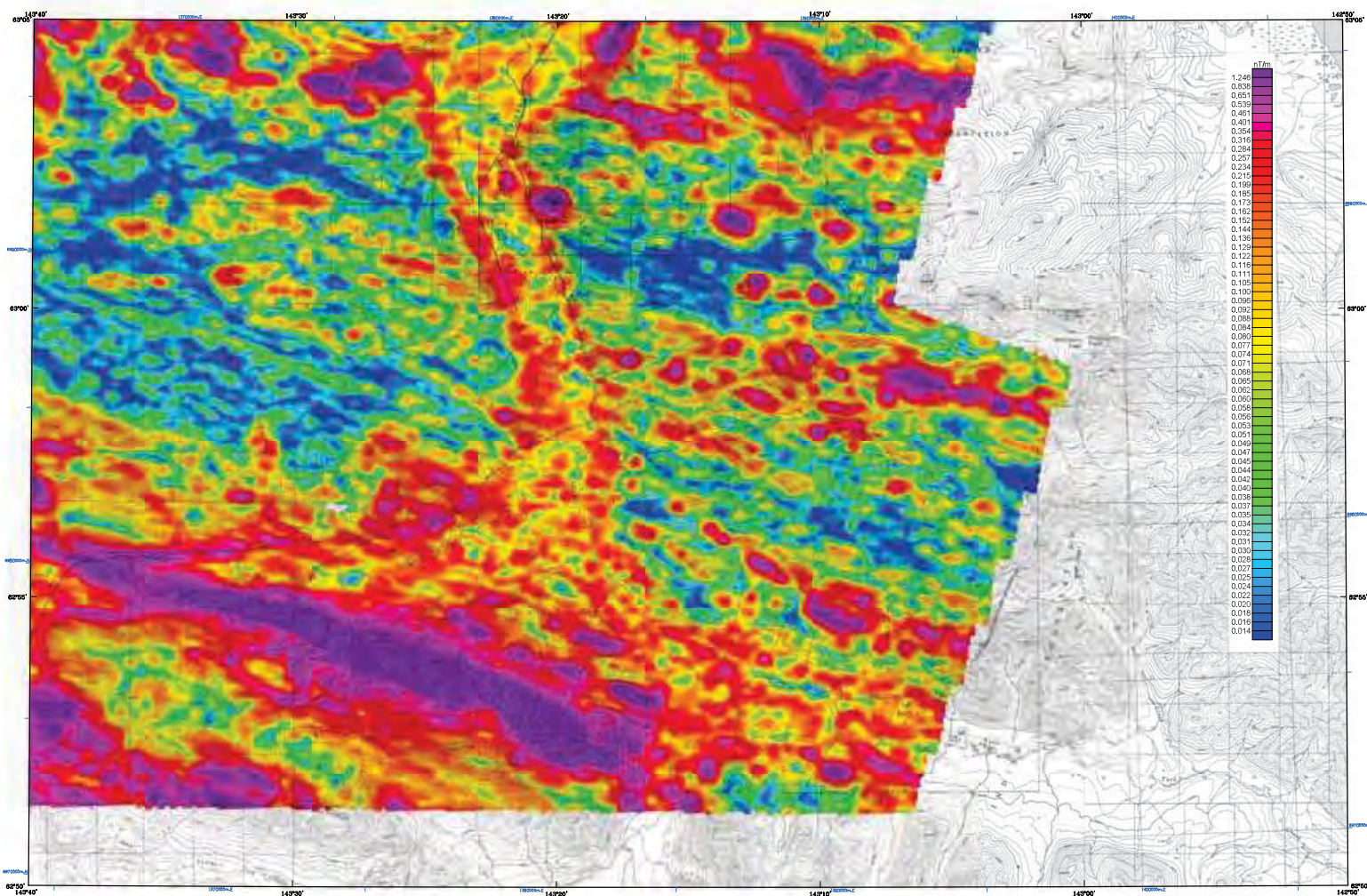
LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGs), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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ANALYTIC SIGNAL WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Emond, CGO, and CGO Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

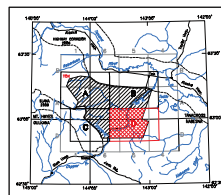
The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGO D1344 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

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 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141° 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.

ANALYTIC SIGNAL

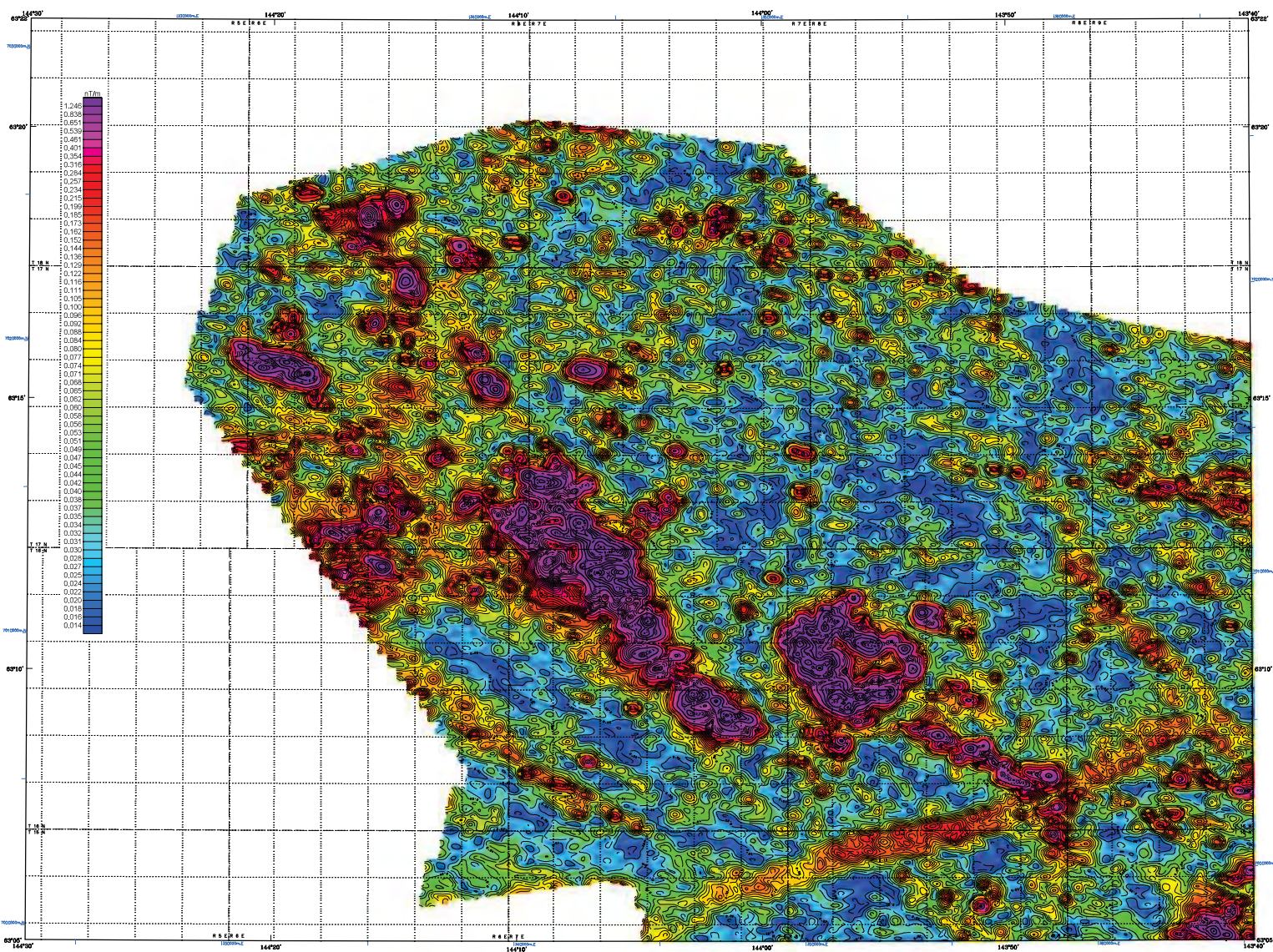
Analytic signal is the total amplitude of all directions of magnetic gradient calculated from the sum of the squares of the three orthogonal gradients. Mapped highs in the calculated analytic signal of magnetic parameter locate the anomalous source body edges and corners (such as contacts, fault/shear 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.

LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGGS), and CGO Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGO in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project. All data and maps produced to date from this survey are downloadable for free from the DGGGS website (www.dgggs.alaska.gov/Pubs/geophysical/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email aggs@pubs.alaska.gov).



Surveyed by the U.S. Geological Survey, M. Ryan, A.L. 1970, B.L. 1985.
 Revisited by the U.S. Geological Survey, M. Ryan, A.L. 1970, B.L. 1985.



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGO D1344 cesium magnetometer with a Sinterex C53 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video cameras. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°; 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.

ANALYTIC SIGNAL

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 remnant magnetizations.

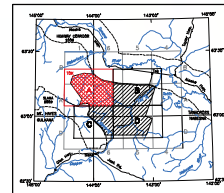
SCALE 1:63,360
 1 2 3 4 MILES
 1 2 3 4 KILOMETERS

ANALYTIC SIGNAL WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
 AND GULKANA QUADRANGLES

by
 Abraham H. Emond, CGO, and CGO Land (U.S.) Inc.
 2015

LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGO Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGO in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project. All data and maps produced to date from this survey are downloadable for free from this survey (www.dggs.alaska.gov/pubs/geophysics). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3364 College Road, Fairbanks, Alaska, 99709-1707 (phone 907-451-5020; email dggs@alaska.gov).

ANALYTIC SIGNAL CONTOURS

.....	0.50 nT/metre
.....	0.10 nT/metre
.....	0.02 nT/metre
.....	0.01 nT/metre

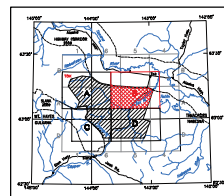
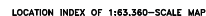


The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG DI344 cesium magnetometer with a Sinterex C53 cesium sensor. The EM and magnetometer systems were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and a video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (102°) survey flight lines with a spacing of 400 m. The flight lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEMS-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential GPS. Resulting horizontal accuracy is better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, a north constant of 0 and an east constant of 500,000. Positional accuracy of the G2L is better than 10 m with respect to the UTM grid.

**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

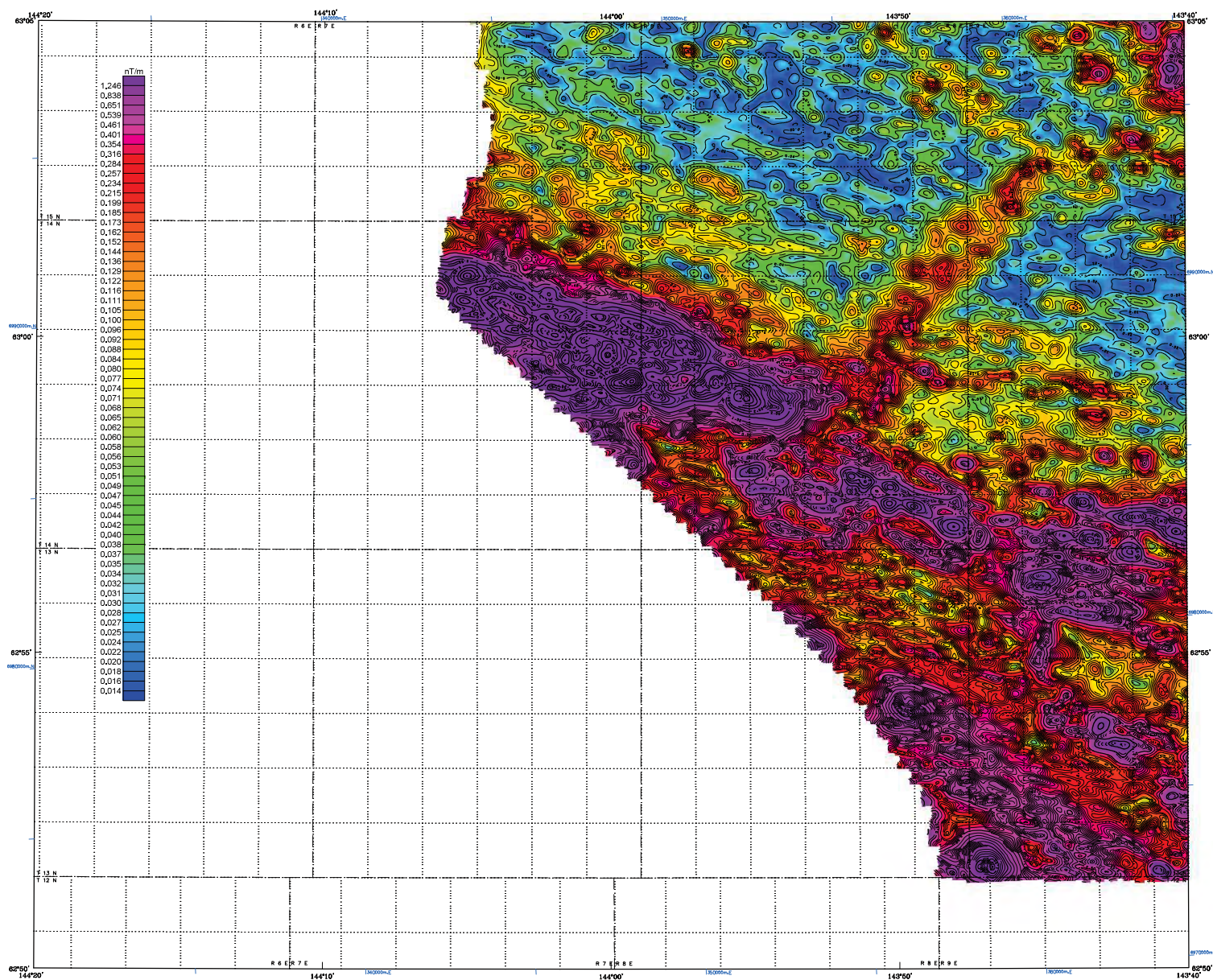
by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018



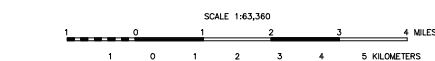
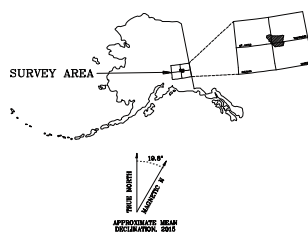
SURVEY HISTORY

This map was compiled and drawn under contract from the State Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG Land and CGG. This project was funded by the Alaska State Legislature and is part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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Section outlines from U.S. Geological Survey Topographic A-6, 1964; Johnson D-6, 1966; Collins S-1, 1976; St. Hayes A-1, 1976; Gulkana, Alaska.



ANALYTIC SIGNAL WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Ermond, CGG, and CGG Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM V Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

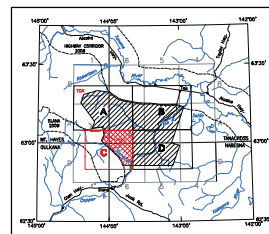
ANALYTIC SIGNAL

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.

ANALYTIC SIGNAL CONTOURS

.....	0.50 nT/metre
.....	0.10 nT/metre
.....	0.02 nT/metre
.....	0.01 nT/metre

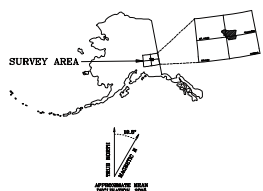
LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

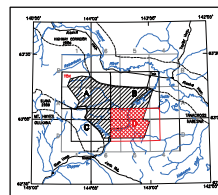
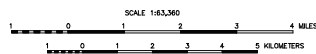
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**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Ermond, CGG, and CGG Land (U.S.) Inc.
2015



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a CQG D134 cesium magnetometer with Scintrex CS3 cesium sensors. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and 83 channels. Flights were performed with an AS-350B3 Sikorsky helicopter. The survey was flown along NE-SW (T12) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEMS-GZL Global Positioning System was used for navigation. The helicopter position was surveyed 20 times 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, a north constant of 10,000,000 and a scale factor of 0.999 999 96. The accuracy of the presented data is better than 10 m with respect to the UTM grid.

ANALYTIC SIGNAL

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.

ANALYTIC SIGNAL CONTOURS

ANALYTIC SIGNAL CONTROLS

_____	0.50 nT/metre
_____	0.10 nT/metre
_____	0.02 nT/metre
_____	0.01 nT/metre

SURVEY HISTORY

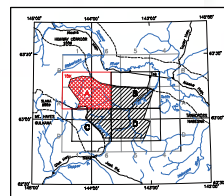
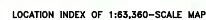
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AND GULKANA QUADRANGLES**

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018



DESCRIPTIVE NOTES

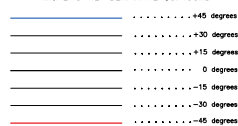
The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Sinter SX CS3 cesium sensor. The EM and magnetic surveys were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m above ground level (AGL). The survey was flown at a speed of 400 m. The flight lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

MAGNETIC TILT DERIVATIVE

The tilt derivative is the angle between the horizontal gradient and the total gradient, which can be used for identifying the depth and type of source. The tilt angle is positive over the source, crosses through zero at, or near the edge of a vertical sided source, and is negative outside the source region. The tilt derivative has the added advantage of responding equally well to shallow and deep sources and is able to resolve deeper sources that may be masked by larger responses from shallower sources.

MAGNETIC TILT DERIVATIVE CONTOURS



SURVEY HISTORY

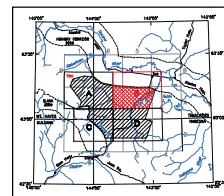
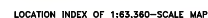
This map was compiled and drawn under contract between the State of Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys (DGG&S), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG Land (U.S.) Inc. in 1997 and 1998, and approved by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Program. Copyright 1999 by CGG Land (U.S.) Inc.

All data and maps produced to date from this survey are downloadable for free from the DGG&S website (www.dggs.alaska.gov/pubs/geophysics/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGG&S office, 3330 Airport Road, Anchorage, Alaska 99512 (phone 907-451-5020; email dggs@alaska.gov).



**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018



DESCRIPTIVE NOTES

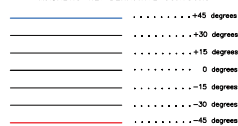
The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer[®] with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 helicopter at a mean terrain clearance of 60 m above the SW (left) side of the ridge. The flight track consisted of 400 m tie lines. The tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

MAGNETIC TILT DERIVATIVE

The tilt derivative is the angle between the horizontal gradient and the total gradient, which can be used for identifying the depth and type of source. The tilt angle is positive over the source, crosses through zero at, or near, the edge of a vertical sided source, and is negative outside the source region. The tilt derivative has the added advantage of responding equally well to shallow and deep sources and is able to resolve deeper sources that may be masked by larger responses from shallower sources.

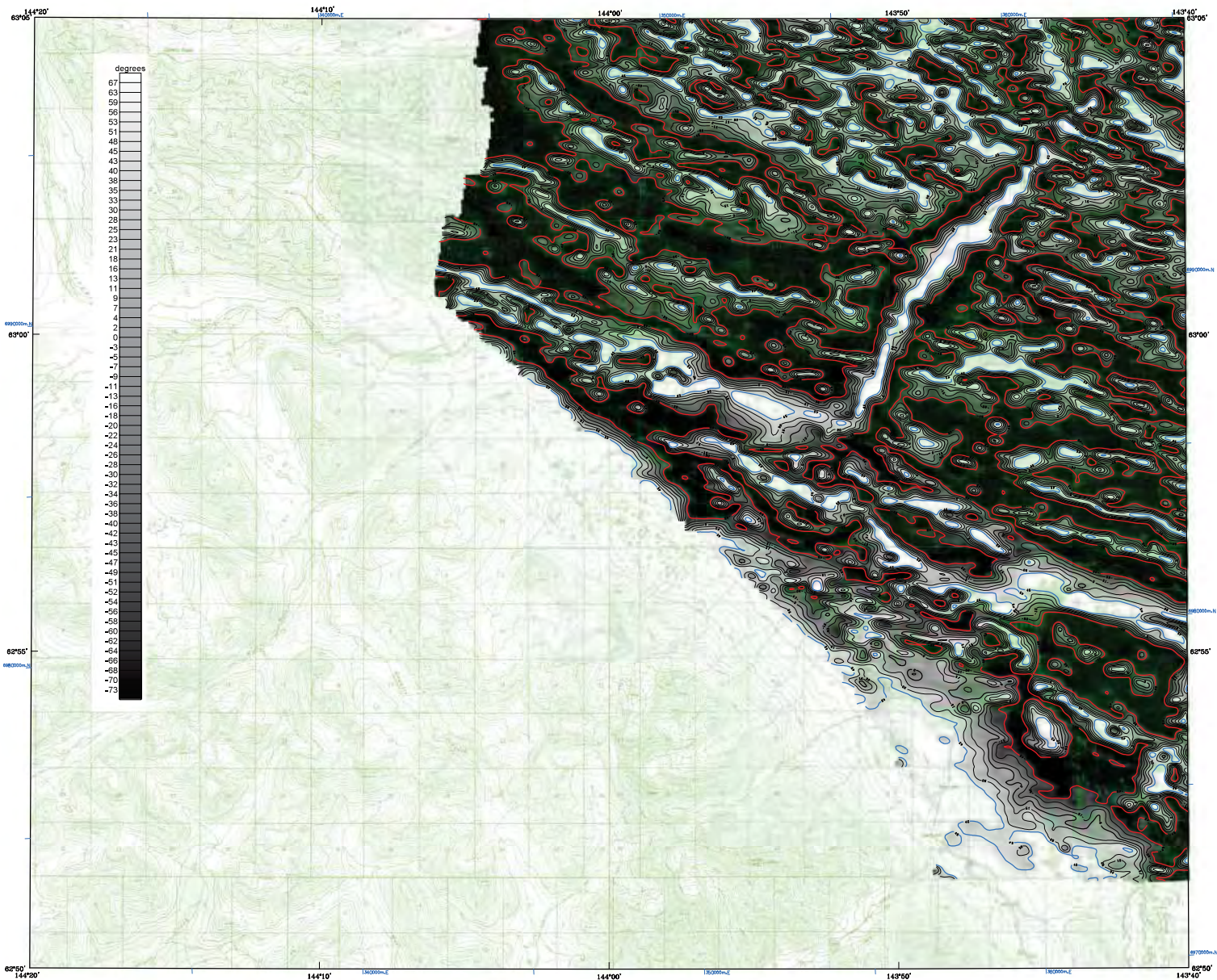
MAGNETIC TILT DERIVATIVE CONTOURS



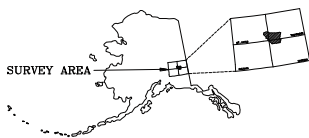
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGs), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 at 200 m resolution. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggsdgs@alaska.gov).



Base from US Geological Survey Topographic A-5, 1964; Release D-5, 1966;
Culture D-1, 1970; St. Hayes A-1, 1970; Olenokpuk, Alaska



1:10,000
APPROXIMATE MEAN
ELEVATION, 2015

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

MAGNETIC TILT DERIVATIVE WITH TOPOGRAPHY AND DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Ermond, CGG, and CGG Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

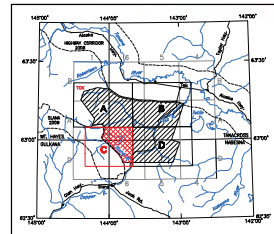
The geophysical data were acquired with a DIGHEM V Electromagnetic (EM) system and a CGG 01344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

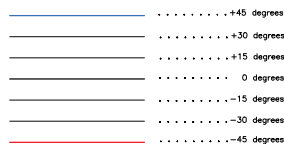
MAGNETIC TILT DERIVATIVE

The tilt derivative is the angle between the horizontal gradient and the total gradient, which can be used for identifying the depth and type of source. The tilt angle is positive over the source, crosses through zero at, or near, the edge of a vertical sided source, and is negative outside the source region. The tilt derivative has the added advantage of responding equally well to shallow and deep sources and is able to resolve deeper sources that may be masked by larger responses from shallower sources.

LOCATION INDEX OF 1:63,360-SCALE MAP



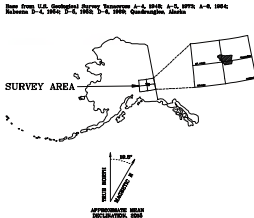
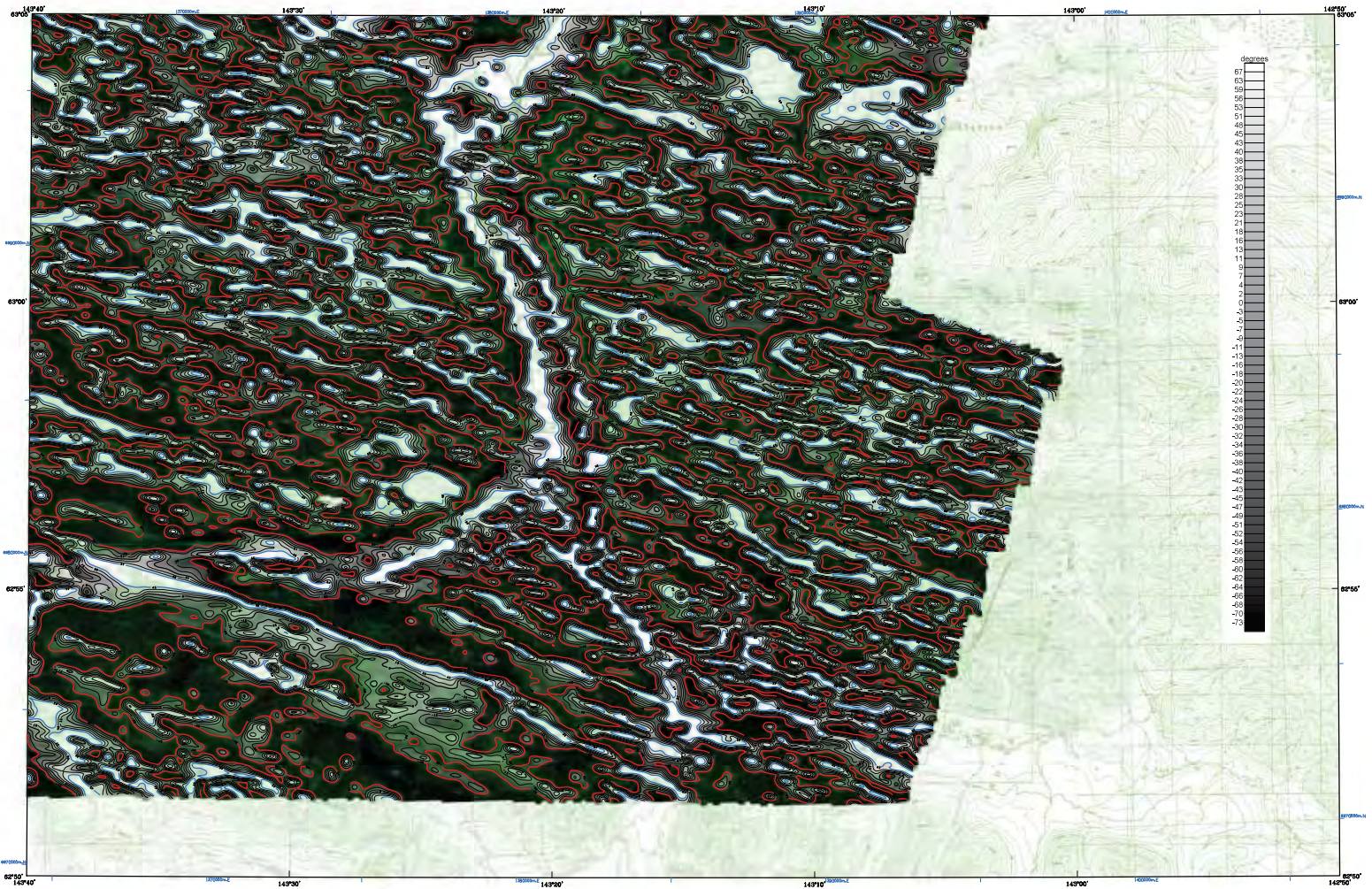
MAGNETIC TILT DERIVATIVE CONTOURS



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGs), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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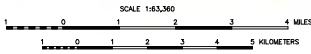
DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a CGG 01544 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM4-C2L Global Positioning System was used for navigation. The helicopter position was recorded 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141° 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.

MAGNETIC TILT DERIVATIVE

The tilt derivative is the angle between the horizontal gradient and the total gradient, which can be used for identifying the depth and type of source. The tilt angle is positive over the source, crosses through zero at, or near, the edge of a vertical sided source, and is negative outside the source region. The tilt derivative has the added advantage of responding equally well to shallow and deep sources and is able to resolve deeper sources that may be masked by larger responses from shallower sources.

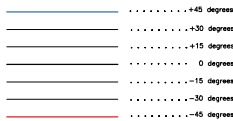


**MAGNETIC TILT DERIVATIVE
WITH TOPOGRAPHY AND DATA CONTOURS,
TOK SURVEY AREA,
EASTERN INTERIOR ALASKA**

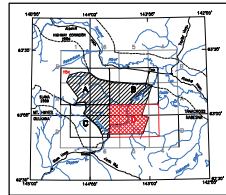
**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Emond, COG, and COG Land (U.S.) Inc.
2015

MAGNETIC TILT DERIVATIVE CONTOURS

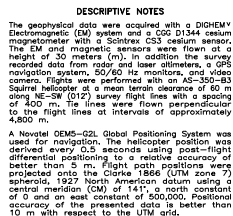


LOCATION INDEX OF 1:63,360-SCALE MAP



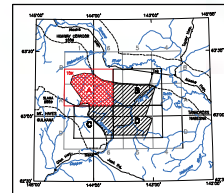
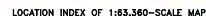
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and COG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by COG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project. All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysical/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggspublic@alaska.gov).



**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018



The magnetic total field data from a CCGS were processed using digitally recorded data from a GEOM D1344 magnetometer with a Scribner CS3 cesium 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 magnetic data, (2) corrected for (IGRF) magnetic variations, (3) leveled for drift (diurnal 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. All grids were then resampled from a 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

The tilt derivative is the angle between the horizontal gradient and the total gradient, which can be used for identifying the depth and type of source. The tilt angle is positive over the source, crosses through zero at, or near, the edge of a vertical sided source, and is negative outside the source region. The tilt derivative has the added advantage of responding equally well to shallow and deep sources and is able to resolve deeper sources that may be masked by larger responses from shallower sources.

.....+45 degrees
.....+30 degrees
.....+15 degrees
..... 0 degrees
.....-15 degrees
.....-30 degrees
.....-45 degrees

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG Land (U.S.) Inc. under contract to the State of Alaska by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment and Mapping Improved Project.

All data and maps produced under this survey are available for downloading free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 1000 West 10th Avenue, Anchorage, Alaska 99567 (phone 907-451-5020; email dggs@alaska.gov).

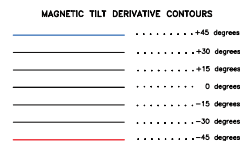


A Novatel OEMS-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, a north constant of 1000000 m, and a scale factor of 0.9996. Positional accuracy of the presented data is better than 10 m with respect to the UTM grid.

The magnetic total field data were processed using digitally recorded data from a CGG D1344 magnetometer with a Sinterrex CS3 cesium 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 magnetic field, (2) leveled to the datum of 1 January 2010, updated for data 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. All grids were then resampled to 1 m cells and then down to a 25 m cell size to produce the maps and final grids contained in this publication.

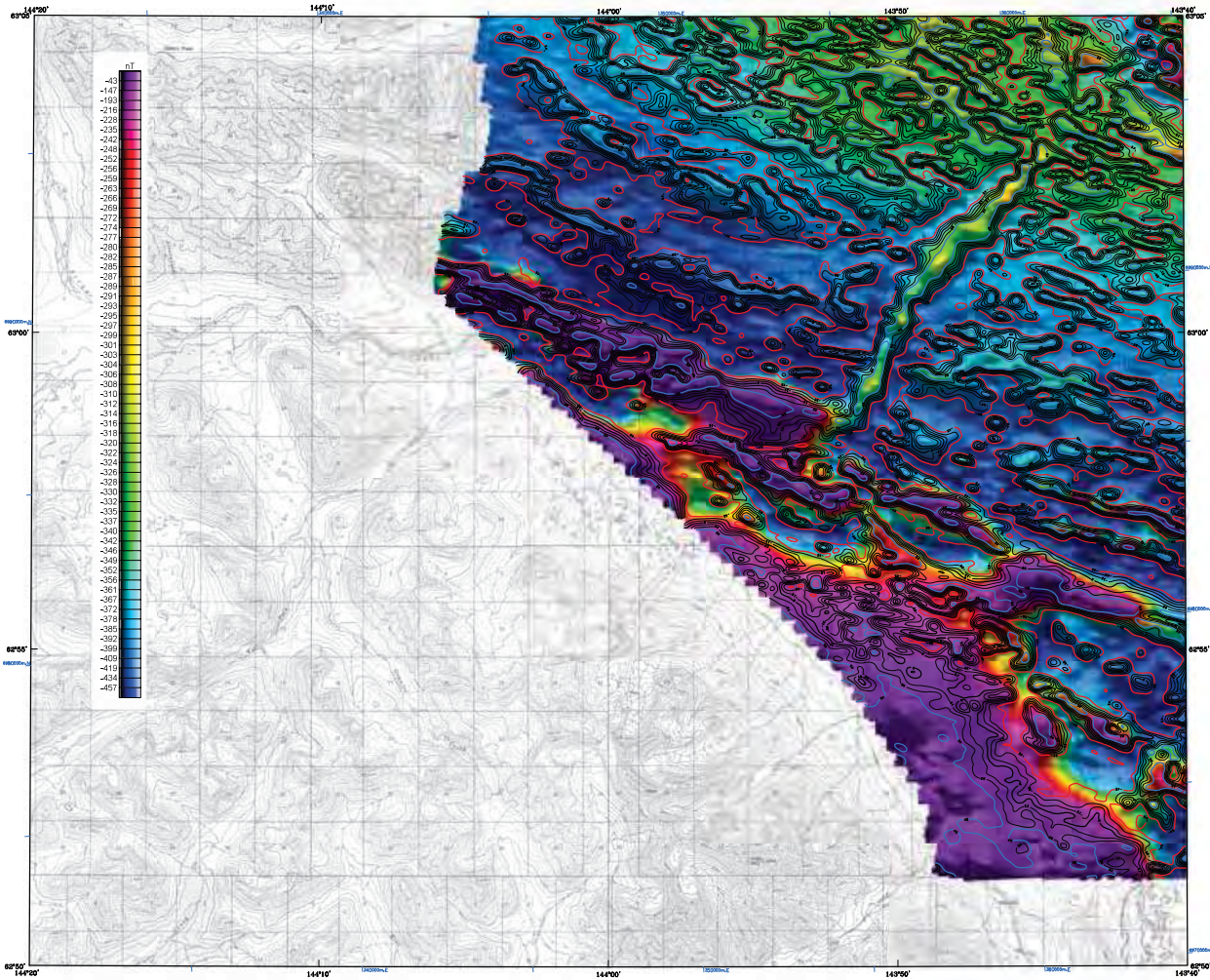
¹ Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures: *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

The tilt derivative is the angle between the horizontal gradient and the total gradient, which can be used for identifying the depth and type of source. The tilt angle is positive over the source, crosses through zero at, or near, the edge of a vertical sided source, and is negative outside the source region. The tilt derivative has the added advantage of responding equally well to shallow and deep sources and is able to resolve deeper sources that may be masked by larger responses from shallower sources.

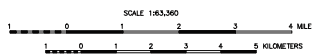
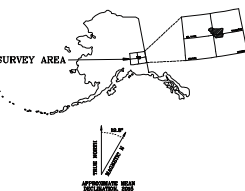


This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGGS), and CGG Land (U.S.) Inc. Airborne geophysical data were collected by CGG Land (U.S.) Inc. and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Program. Copyright © 2015 CGG Land (U.S.) Inc.

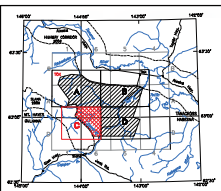
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Base Map: U.S. Geological Survey, 1:63,360, Release 2-5, 1985
Colors: U.S. GPO, 1975, Washington, D.C.



LOCATION INDEX OF 1:63,360-SCALE MAP



COLOR SHADOW RESIDUAL MAGNETIC FIELD WITH MAGNETIC TILT DERIVATIVE DATA CONTOURS TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m), in addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM-72L Global Positioning System was used for navigation. The helicopter position was derived every 0.2 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 7) meridian, 1927 North American datum using a central meridian (CM) of 141° 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.

RESIDUAL MAGNETIC FIELD

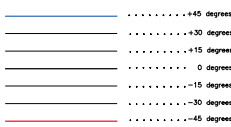
The magnetic total field data were processed using digitally recorded data from a CGG D1344 magnetometer with a Sinterex CS3 cesium sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) IGR corrected (IGRF model 2010, 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 (1970¹) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

¹ Akima, 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. 589-602.

MAGNETIC TILT DERIVATIVE

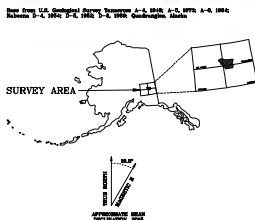
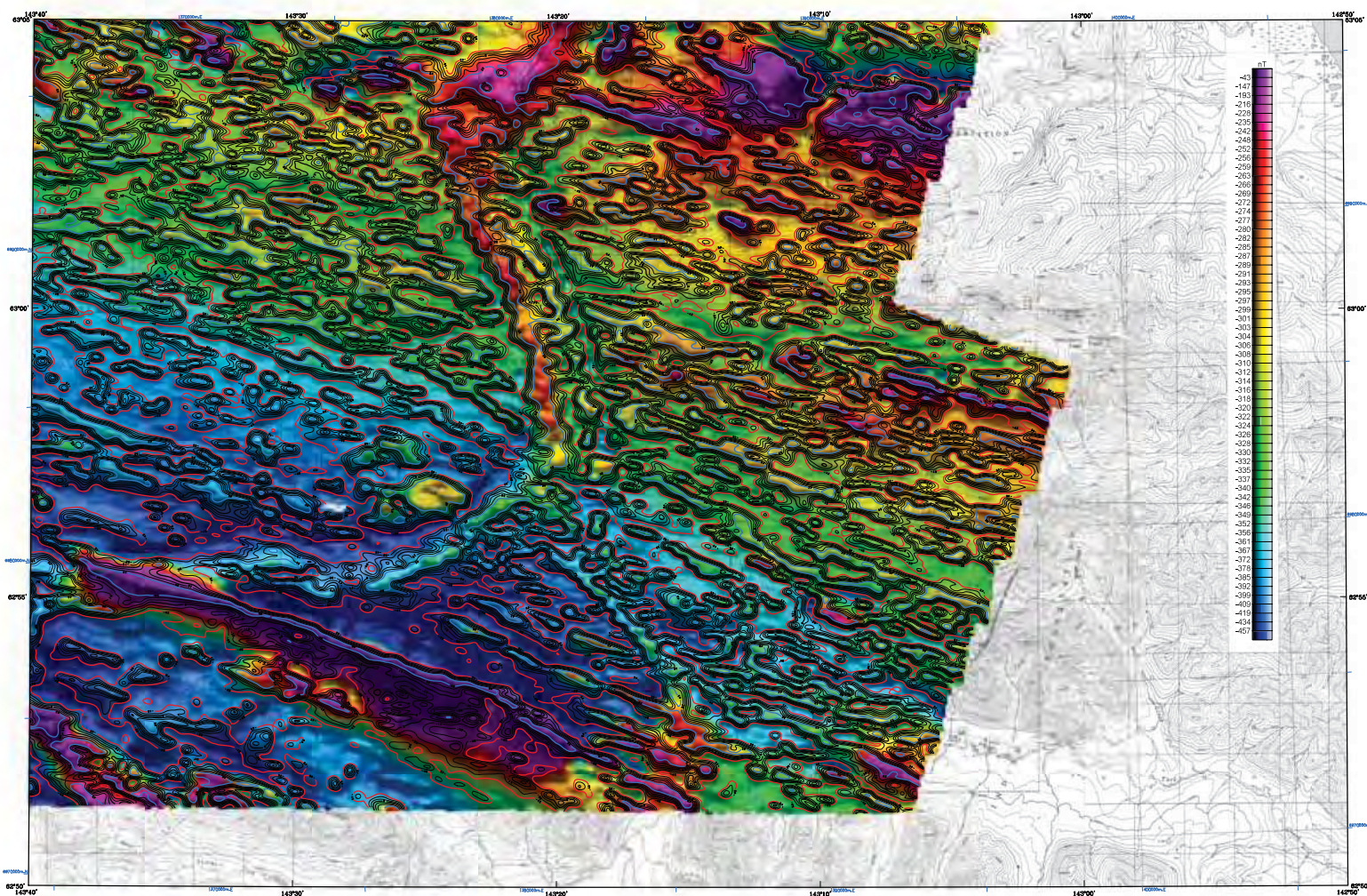
The tilt derivative is the angle between the horizontal gradient and the total gradient, which can be used for identifying the depth and type of source. The tilt angle is positive over the source, crosses through zero at, or near, the edge of a vertical sided source, and is negative outside the source region. The tilt derivative has the added advantage of responding equally well to shallow and deep sources and is able to resolve deeper sources that may be masked by larger responses from shallower sources.

MAGNETIC TILT DERIVATIVE CONTOURS



SURVEY HISTORY

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

COLOR SHADOW RESIDUAL MAGNETIC FIELD WITH MAGNETIC TILT DERIVATIVE DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
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2015

DESCRIPTIVE NOTES

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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 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°1' 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.

RESIDUAL MAGNETIC FIELD

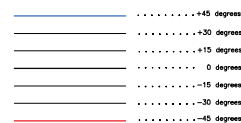
The magnetic total field data were processed using digitally recorded data from a CGO D1344 magnetometer with a Sinterex CS3 cesium sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2010, 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. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

¹ Akima, 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. 589-602.

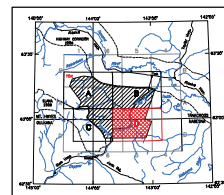
MAGNETIC TILT DERIVATIVE

The tilt derivative is the angle between the horizontal gradient and the total gradient, which can be used for identifying the depth and type of source. The tilt angle is positive over the source, crosses through zero at, or near, the edge of a vertical sided source, and is negative outside the source region. The tilt derivative has the added advantage of responding equally well to shallow and deep sources and is able to resolve deeper sources that may be masked by larger responses from shallower sources.

MAGNETIC TILT DERIVATIVE CONTOURS



LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGGS), and COG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by COG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project. All data and maps produced to date from this survey are downloadable for free from the DGGGS website (www.dgggs.alaska.gov/pubs/geophysical/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggspubs@alaska.gov).



The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a GGG D1344 cesium magnetometer with a Schintec CS3 cesium gradiometer. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m above the terrain (102'). Survey flight lines with a spacing of 400 m. Flights were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEMS-G2L Global Positioning System was used for navigation. The helicopter position was determined at a second ground station using differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, a north constant of 100,000 and a false easting of 500,000. Positional accuracy of the projected data is better than 10 m with respect to the UTM grid.

RESISTIVITY

The DIGHEM™ EM system measured in-phase and quadrature components at five frequencies. The vertical coaxial 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 s sampling intervals. The EM system responds to both conductive and resistive overburden structures. Apparent resistivity is generated from the in-phase and quadrature component of the coplanar 56,000 Hz using the pseudo-layer half-space model. The data were processed using the "1D-100" technique (Aking, 1970) and the "1D-100" technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹ 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.

z COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

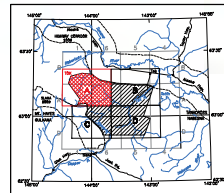
**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018

RESISTIVITY ALTITUDE LIMITS

in areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.

LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.). Airborne geophysical data for the area was acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggs@alaska.gov).



The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a GGG D13 cesium magnetometer with a Scintrex CS3 cesium gradiometer. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along a 100 m wide survey flight lines spaced at 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatek OEMS-G2L Global Positioning System was used for navigation. The height 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, a north constant of 100,000 m and a scale factor of 0.999 999. Positions and their associated error data are better than 10 m with respect to the UTM grid.

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

56,000 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018

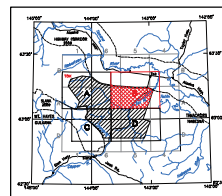
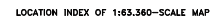
RESISTIVITY

The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. Two vertical electrodes were spaced 100 m apart and connected to 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 in-phase and quadrature components 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. All grids were then resampled from the 80 m cell size down to a 25 m cell size to

¹Aikma, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures. *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

RESISTIVITY ALTITUDE LIMITS

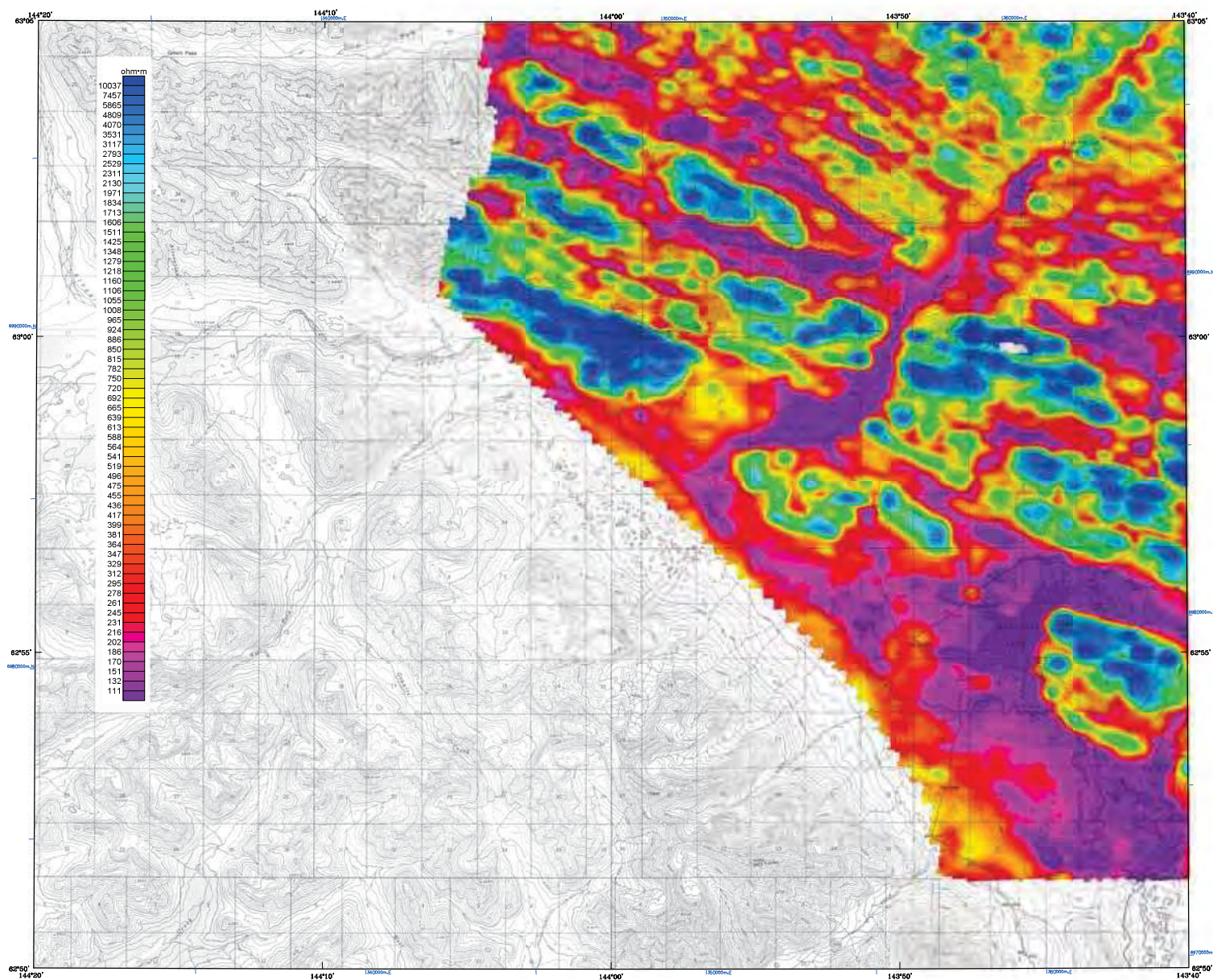
in areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.



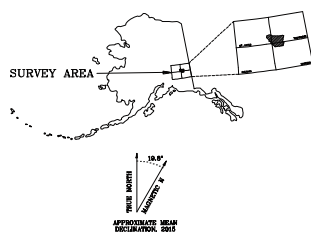
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Department of Natural Resources, Alaska Airborne Geological and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment/Capital Improvement Project.

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Base from US Geological Survey Topographic A-6, 1964; Release D-6, 1966;
 Release D-7, 1970; St. Boye J-1, 1970; Olenok, Alaska



56,000 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
 AND GULKANA QUADRANGLES

by
 Abraham M. Ermond, CGG, and CGG Land (U.S.) Inc.
 2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (112) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

RESISTIVITY

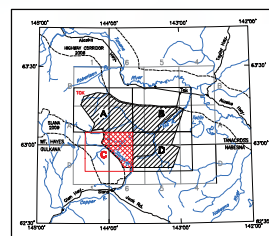
The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. Two vertical coaxial coil pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil pairs operated at 300, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase 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. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹ Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures, Journal of the Association of Computing Machinery, v. 17, no. 4, p. 589-602.

RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.

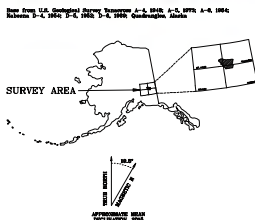
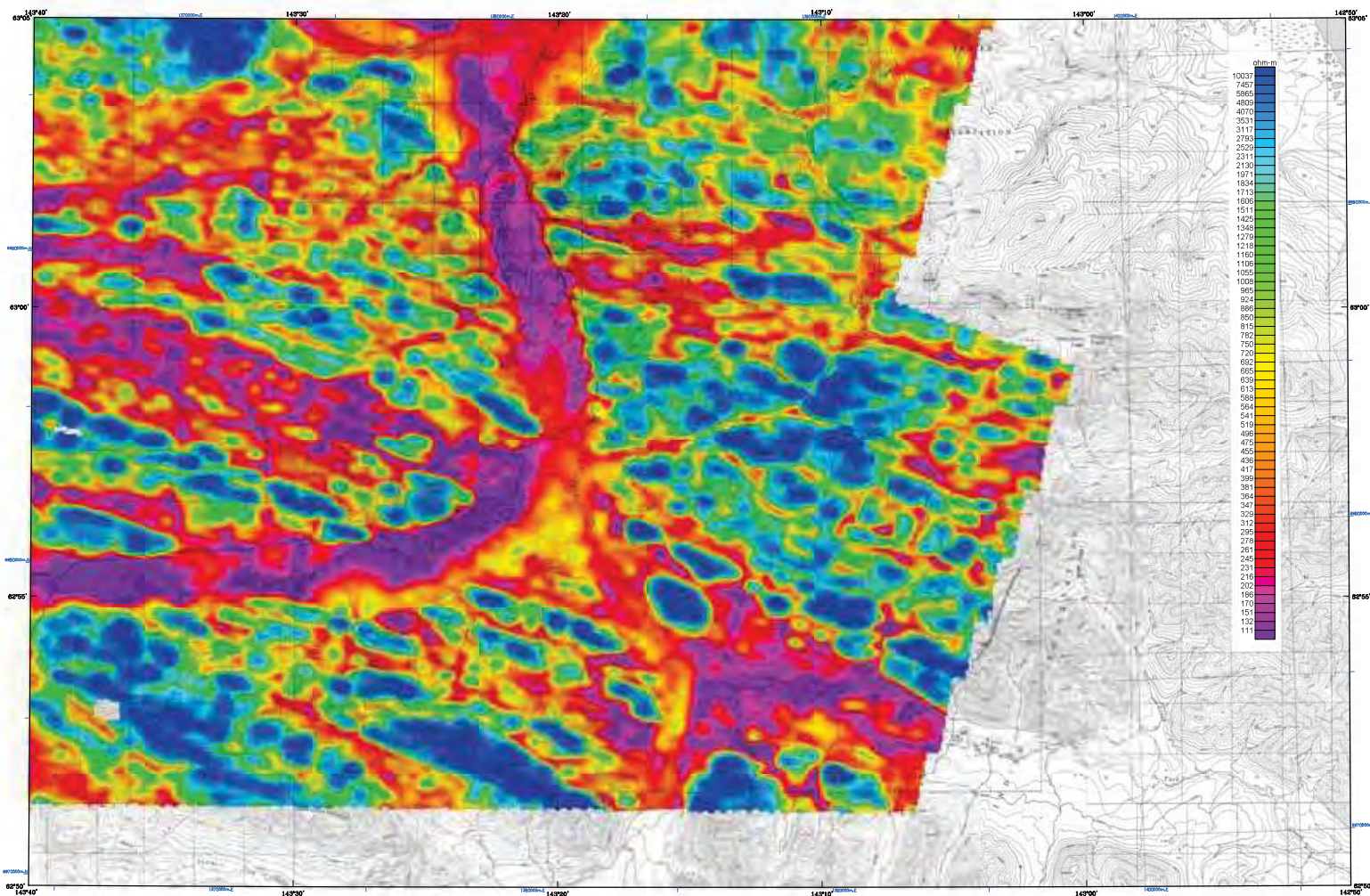
LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGs), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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56,000 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Emond, CGO, and CGO Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGO D1544 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM4-C2L Global Positioning System was used for navigation. The helicopter position was derived every 0.2 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141° 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.

RESISTIVITY

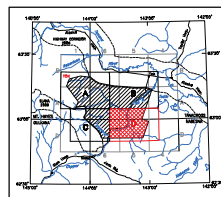
The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies, two vertical coplanar coil pairs operated at 1000 and 3500 Hz while three horizontal coplanar coil pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase 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 (1970¹) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹ Akima, 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. 589-602.

RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.

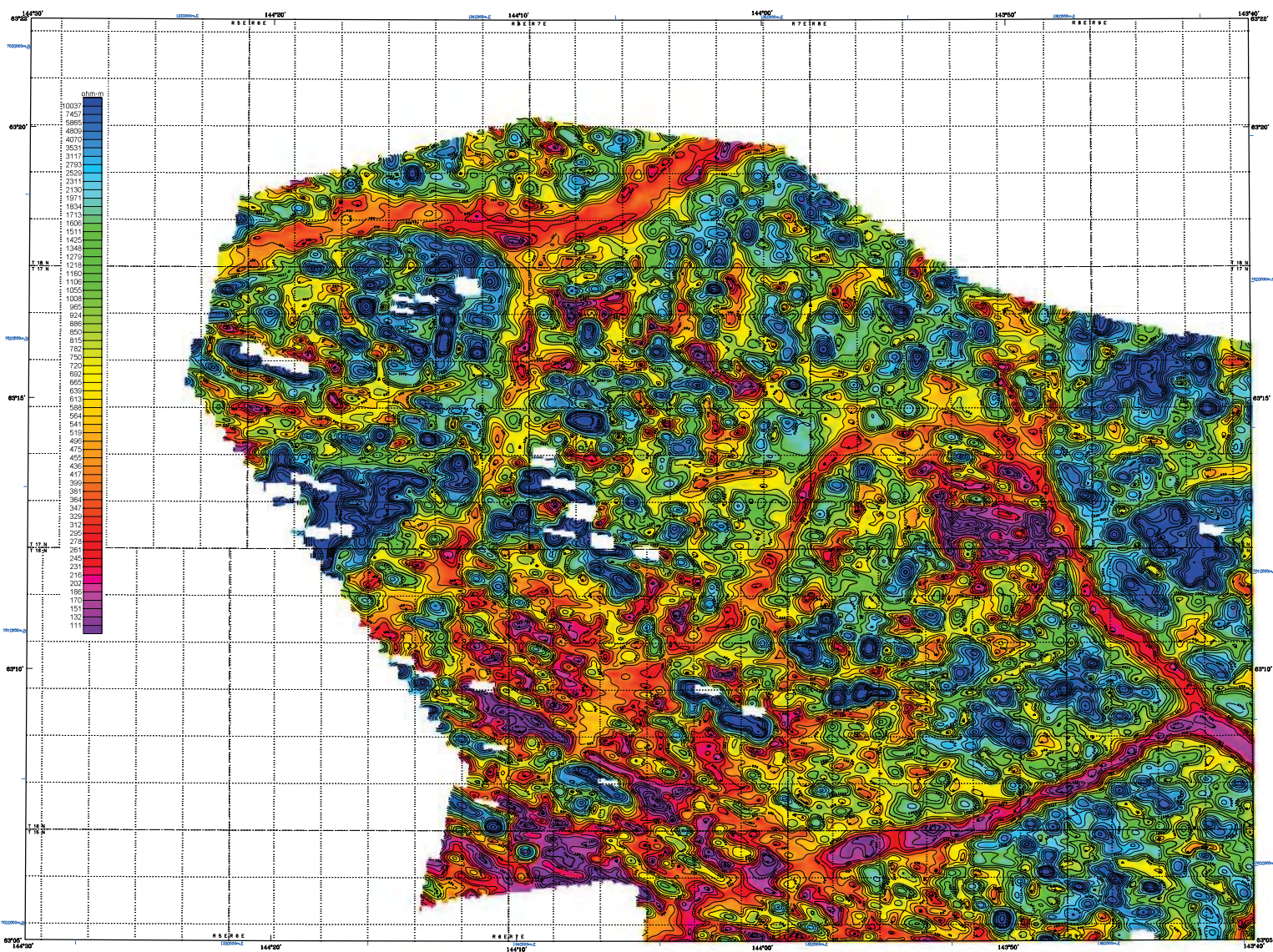
LOCATION INDEX OF 1:63,360-SCALE MAP



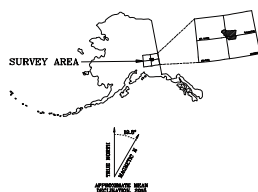
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGO Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGO in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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Source: Survey Data U.S. Geological Survey, M. Ryan A-1, 1970; B-1, 1982.
 Modified: A-1, 1990; B-1, 1990; Quadrange, Alaska.

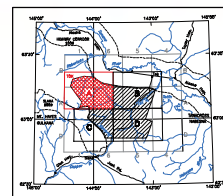


56,000 Hz COPLANAR APPARENT RESISTIVITY WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham H. Emard, CGG and CGG Land (U.S.) Inc.
2015

LOCATION INDEX OF 1:63,360-SCALE MAP



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Schlumberger C33 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video cameras. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (017°) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the right lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a geoid of 141.7 m 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.

RESISTIVITY

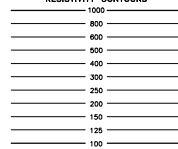
The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. Two vertical coplanar coil pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase and quadrature component of the coplanar 56,000 Hz using the Alkna (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹Alkna, H. 1970, A new method of interpretation and smooth curve fitting based on least principles, *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

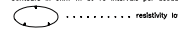
RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying corrected over more than one survey line.

RESISTIVITY CONTOURS



Contours in ohm-m at 10 intervals per decade



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m (200 ft) (1012) survey flight lines with a spacing of 400 m. The flight lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatek OEMS-G2L Global Positioning System was used for navigation. The height position was derived every 0.2 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, a north constant of 100,000 m and a scale factor of 0.999 999. Positions and their associated error data have a better than 10 m with respect to the UTM grid.

**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

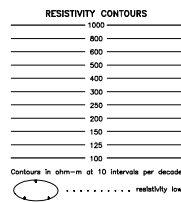
by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018

RESISTIVITY

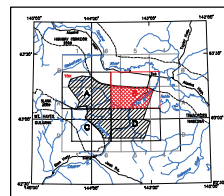
The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. Two vertical coplanar coil pairs operated at 1000 and 4500 Hz, while three horizontal coplanar coil pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductance and resistivity. The in-phase component of the apparent resistivity is generated from the in-phase and quadrature component of the coplanar 56,000 Hz using the pseudo-layer-half-space model. The data were linearized using the logarithmic transformation of Aluma (1979) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.



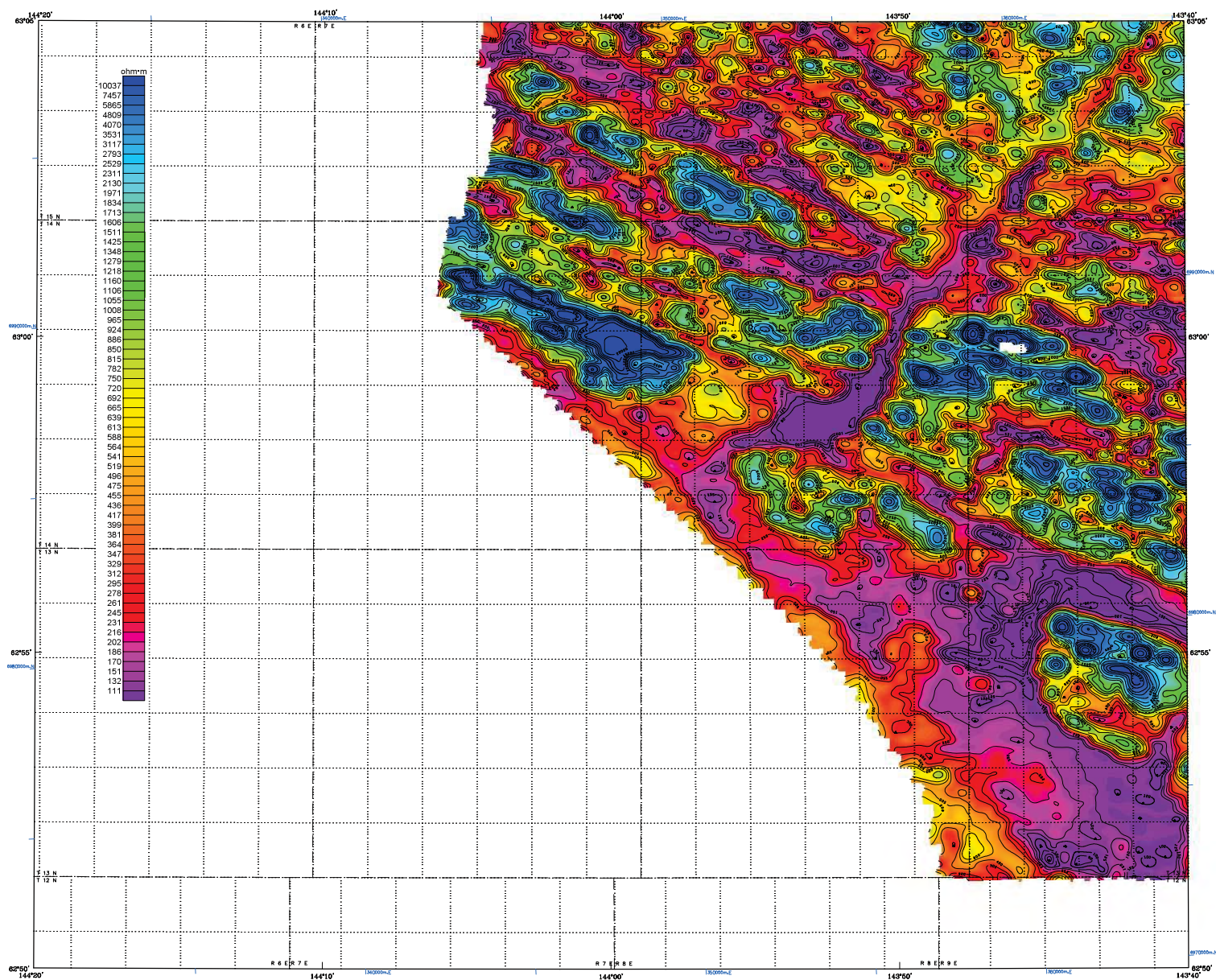
LOCATION INDEX OF 1:63,360-SCALE MAP



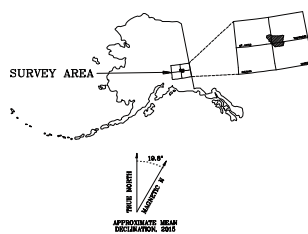
SURVEY HISTORY

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Section outlines from U.S. Geological Survey Transverse A-6, 1964; Johnson D-6, 1966
 Collins S-1, 1976; St. Boyer A-1, 1976; Goughman, Alaska



56,000 Hz COPLANAR APPARENT RESISTIVITY WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
 AND GULKANA QUADRANGLES

by
 Abraham M. Emmond, CGG, and CGG Land (U.S.) Inc.
 2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

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RESISTIVITY

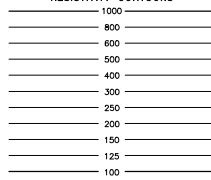
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¹ Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures, *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

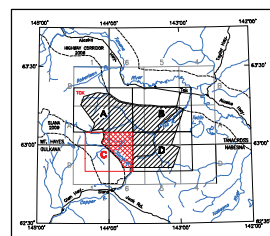
RESISTIVITY ALTITUDE LIMITS

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RESISTIVITY CONTOURS

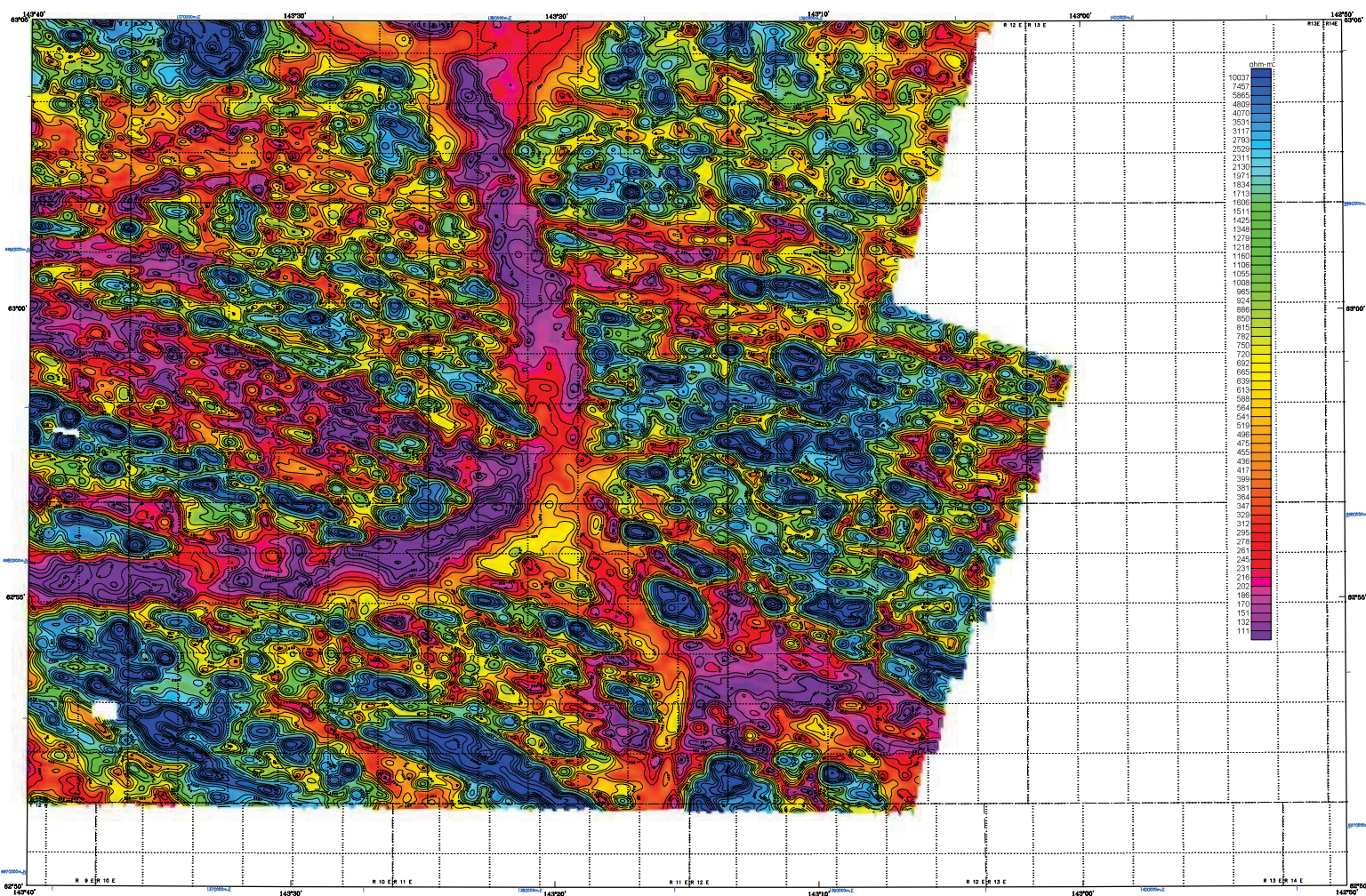


LOCATION INDEX OF 1:63,360-SCALE MAP

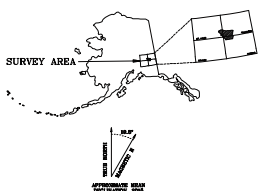


SURVEY HISTORY

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Survey area, Tok, Alaska, showing the location of the survey area within the Tanacross, Nabesna, Mt. Hayes, and Gulkana quadrangles.



56,000 Hz COPLANAR APPARENT RESISTIVITY WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

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by
Abraham M. Emond, COG, and COG Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG 0154M cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition to the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

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 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141° 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.

RESISTIVITY

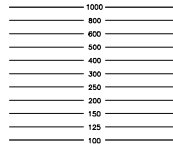
The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. Two vertical coiled coil pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase 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. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹ Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures, *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small depths where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.

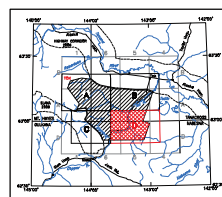
RESISTIVITY CONTOURS



Contour in ohm-m at 10 intervals per decade

..... resistivity low

LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and COG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by COG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysical/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email aggs@dggs.alaska.gov).



The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a GGC D1344 cesium magnetometer system, a Scripps CS3 cesium gradiometer. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m above the ground. The survey flight lines were spaced at 400 m. The flight lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.2 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, a north constant of 630,000 m and a scale factor of 0.999 96. Positions are presented to the nearest 0.1 m. The accuracy of the presented data is better than 10 m with respect to the UTM grid.

**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

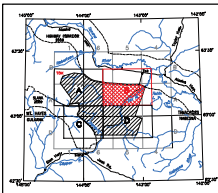
by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018

RESISTIVITY

The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. Two vertical coplanar coils, 100 and 1000 ft apart, and three horizontal coplanar coils at 1000 and 5000 and 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock and claystone, coal, sandstone, and shales, to white and black sandstone, and to lignite and coal. Apparent resistivity is generated from the in-phase and quadrature component of the coplanar 7200 Hz using the pseudo-layer half-space model. The data were processed using the computer program and software Alkma (1970-71) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

RESISTIVITY ALTITUDE LIMITS

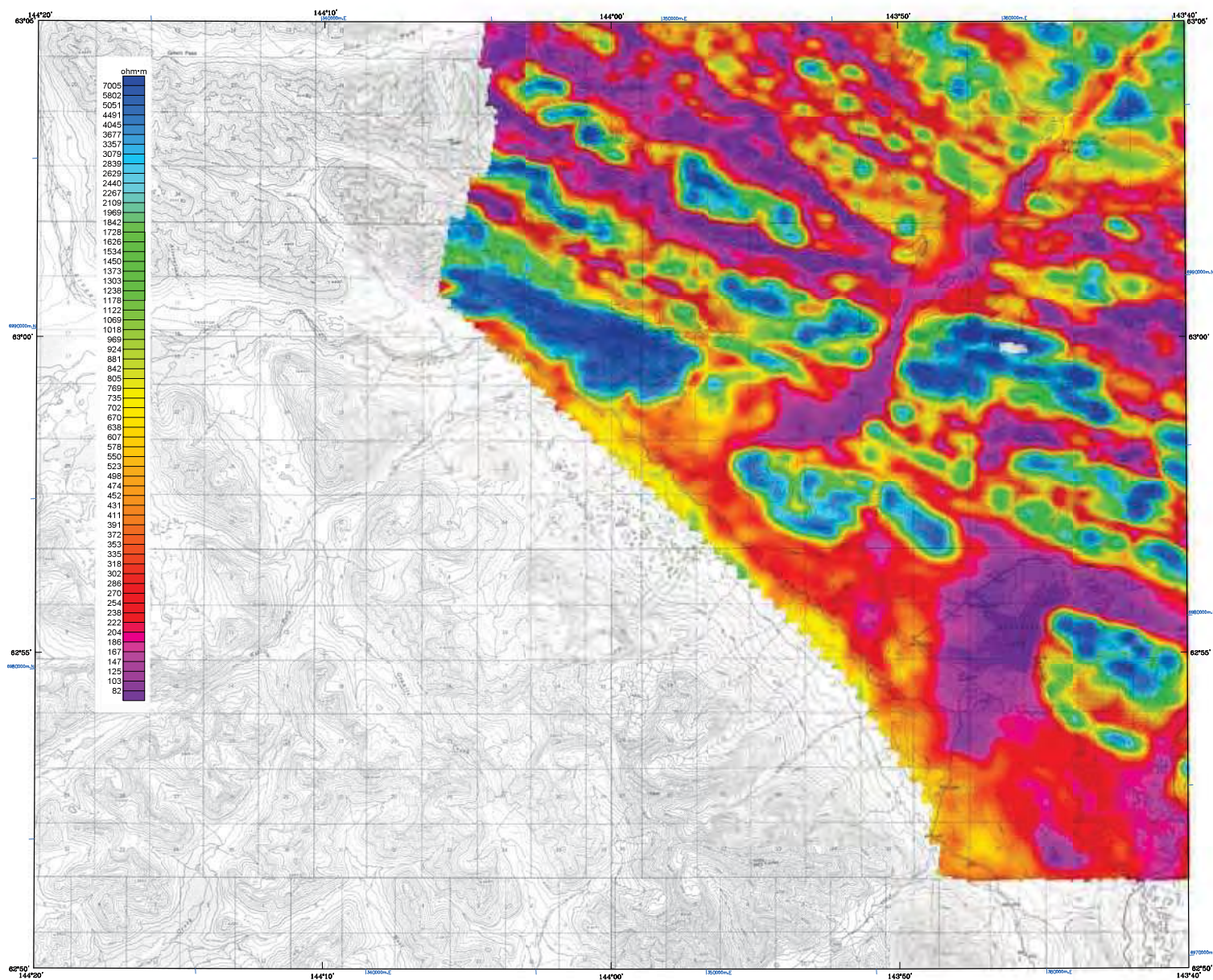
in areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.



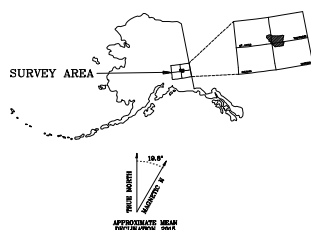
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGG&S), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG Land (U.S.) Inc. under contract to the State of Alaska by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data maps produced and data from this survey are downloadable (free) from the DGG&S website (www.dogs.alaska.gov/pubs/geophysics/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGG&S office, 1000 West 8th Avenue, Anchorage, Alaska 99561-3707. Phone 907-451-5000, email dogs@alaska.gov.



Base from U.S. Geological Survey Topographic A-6, 1964; Release D-6, 1966;
Columbia D-1, 1970; H. Bayne J-1, 1970; Olenokwaga, Alaska



7200 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Ermond, CGG, and CGG Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (112) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

RESISTIVITY

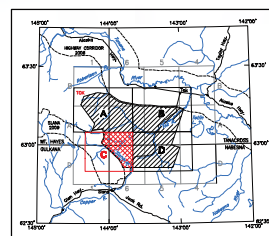
The DIGHEM[®] EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase 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 Akima (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹ Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures: Journal of the Association of Computing Machinery, v. 17, no. 4, p. 589-602.

RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.

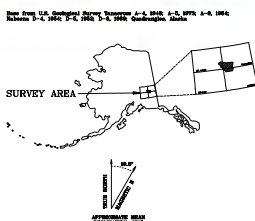
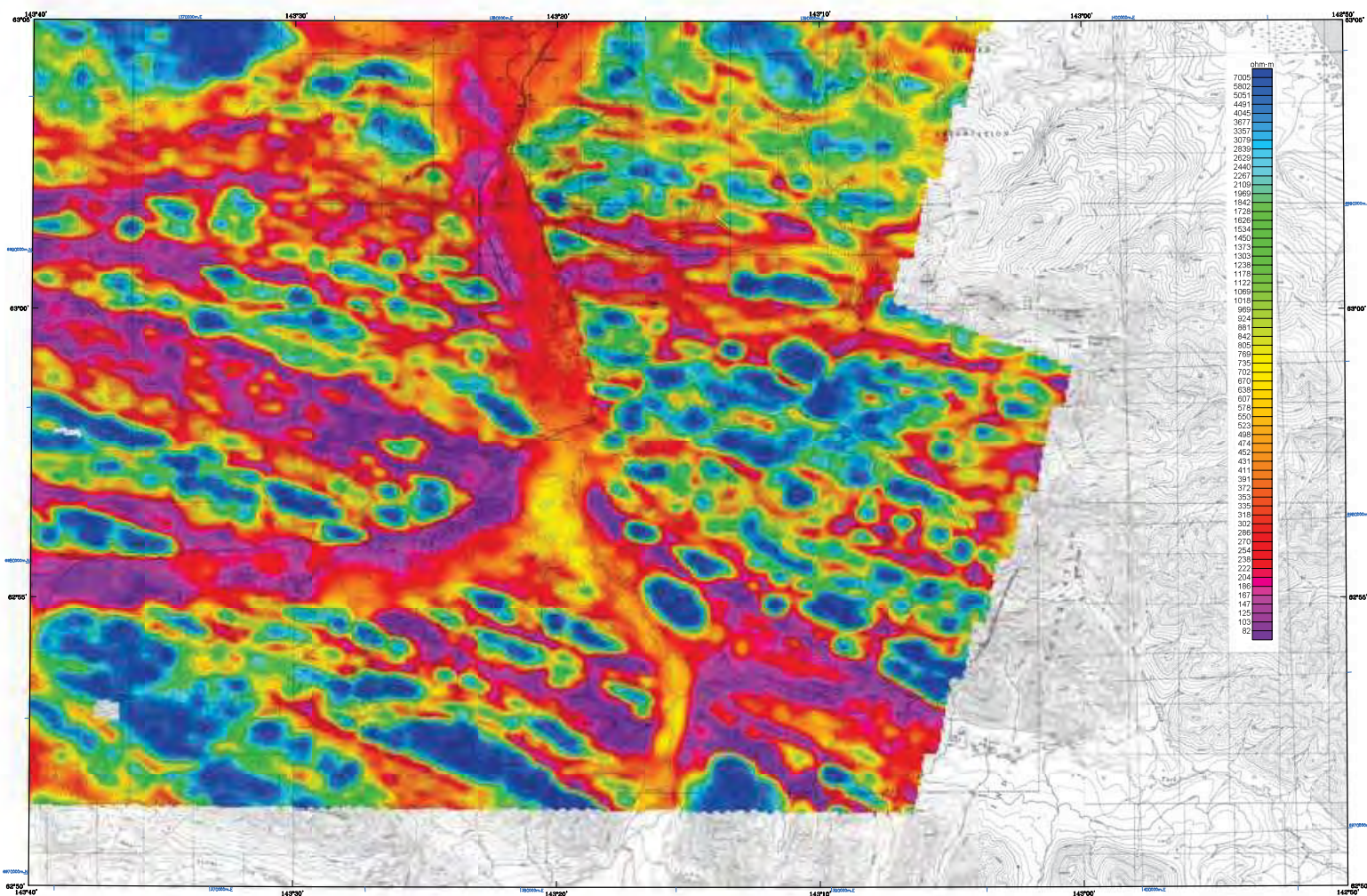
LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggs@alaska.gov).



7200 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Emond, CGO, and CGO Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGO D1544 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM4-C2L Global Positioning System was used for navigation. The helicopter position was derived every 0.2 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 7) meridian, 1927 North American datum using a central meridian (CM) of 141° 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.

RESISTIVITY

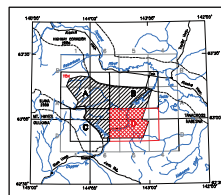
The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. Two vertical coplanar coil pairs operated at 1000 and 3500 Hz while three horizontal coplanar coil pairs operated at 900, 7200 and 56,200 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductance, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase and quadrature components 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 Akima (1970)¹ technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹ Akima, 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. 589-602.

RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.

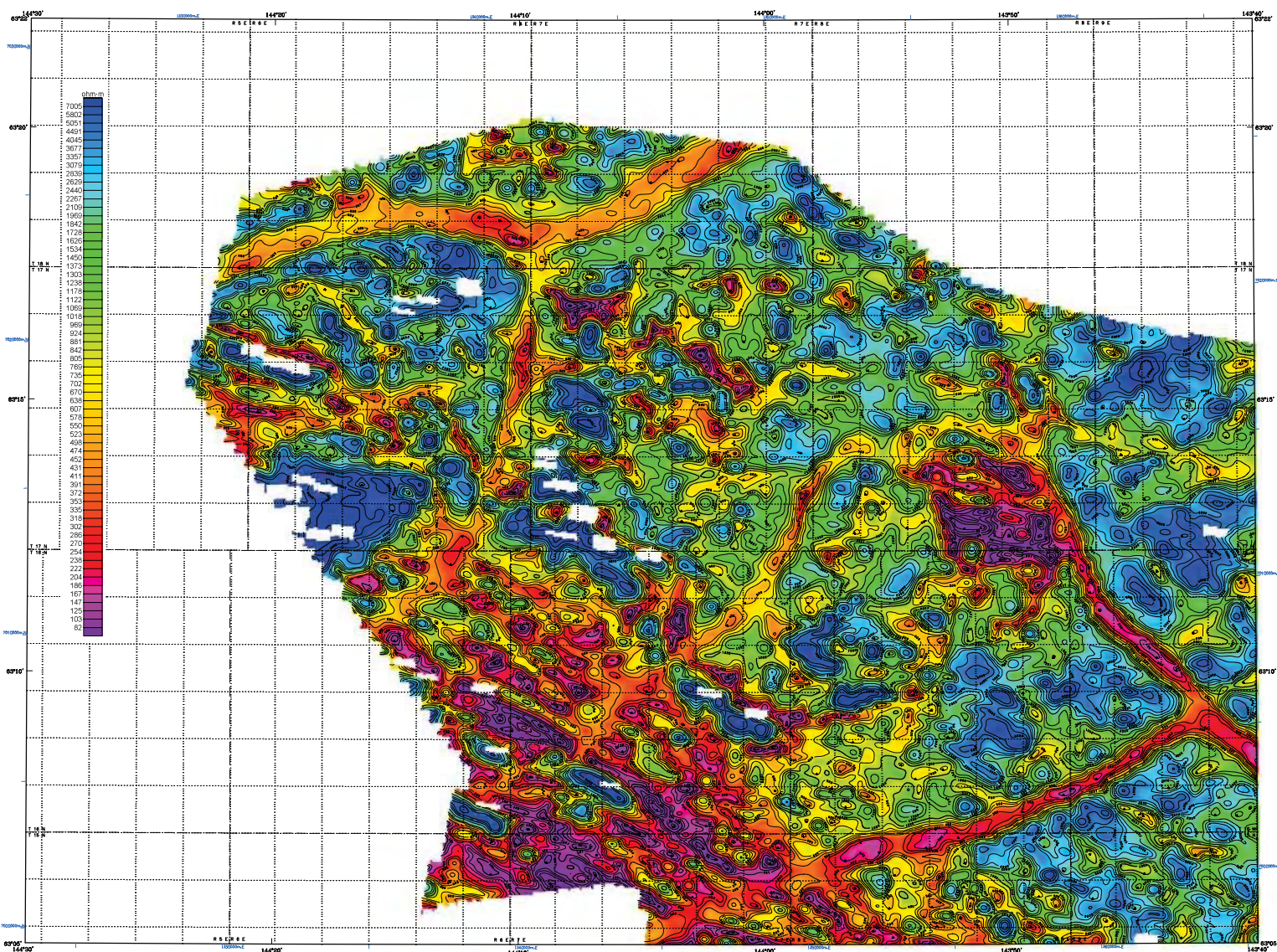
LOCATION INDEX OF 1:63,360-SCALE MAP



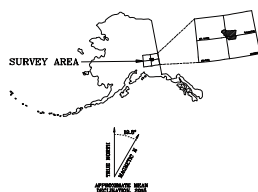
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGO Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGO in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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Surveyed by the U.S. Geological Survey, M. Ryan, A. L. 1970, B. L. 1982.
 Reprinted with permission from the U.S. Geological Survey, M. Ryan, A. L. 1970, B. L. 1982.

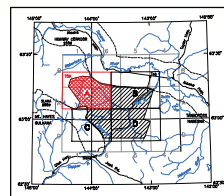


7200 Hz COPLANAR APPARENT RESISTIVITY WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
 AND GULKANA QUADRANGLES

by
 Abraham H. Emard, CGG and CGG Land (U.S.) Inc.
 2015

LOCATION INDEX OF 1:63,360-SCALE MAP



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Schlumberger C33 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video cameras. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (017°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a projected meridian (CM) of 141° 30' 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.

RESISTIVITY

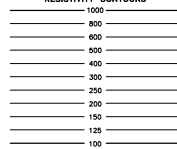
The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. Two vertical coplanar coil pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase 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 Akima (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹ Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local principles, *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

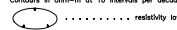
RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying corrected over more than one survey line.

RESISTIVITY CONTOURS



Contours in ohm-m at 10 intervals per decade



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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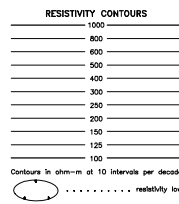
A Novatel OEMS-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a Clarke 1866 spheroid and a Clarke 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.

The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. The vertical coaxial 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 m intervals. The EM system was equipped with shielded conductors, conductive overdrain, and cultural surveys. Apparent resistivity is generated from the in-phase and quadrature component of the coplanar 7200 Hz using the pseudo-layer-half-space model. The data were interpreted using the Schlumberger and Schlumberger (1940) and Alkema (1970) techniques. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹ Akima, H., 1970, A new method of interpolation and smoothing based on local procedures, *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

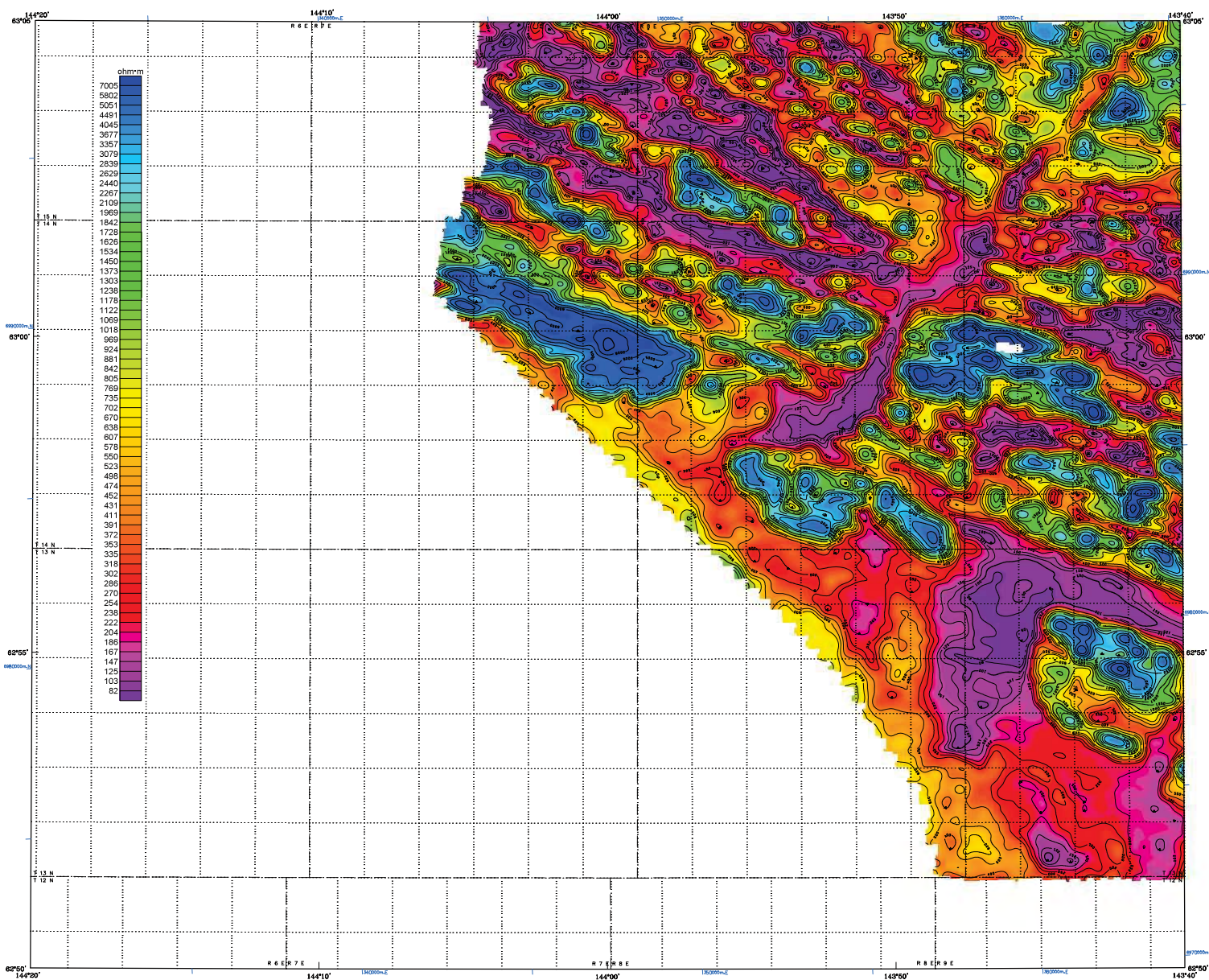
RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.

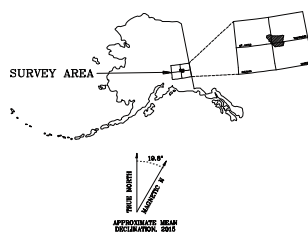


This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG Land (U.S.) Inc. under contract to the State of Alaska by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Program.

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Section outlines from U.S. Geological Survey Topographic A-5, 1864; Johnson D-5, 1866; Collins S-1, 1876; St. Boyer A-1, 1876; Goughman, Alaska.



7200 Hz COPLANAR APPARENT RESISTIVITY WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Ermond, CGG, and CGG Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

RESISTIVITY

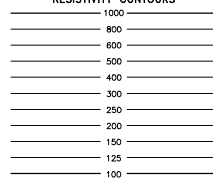
The DIGHEM[®] EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil pairs operated at 800, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase 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 Akima (1972) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹ Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures, *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

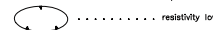
RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.

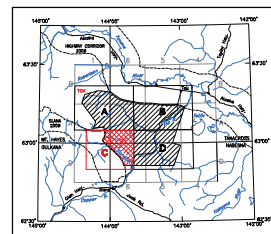
RESISTIVITY CONTOURS



Contours in ohm-m at 10 intervals per decade

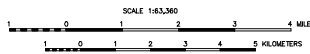


LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

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**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Ermond, CGG, and CGG Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIHEMY Electromagnetic (EM) system and a CGO D14 cesium magnetometer with a Scintrex CS3 cesium magnetometer. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 helicopter. The magnetic survey was flown in a grid along NE-SW (012°) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

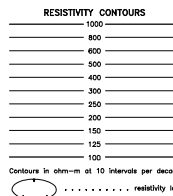
A Novatel OEM5-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian of $114^{\circ} 41'$. The constant of one of the axes is 6300000 m. The constant accuracy of the presented data is better than 10 m with respect to the UTM grid.

RESISTIVITY

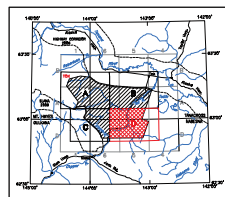
The DIGEM[®] EM system measured in-phase and quadrature component frequencies. The vertical coaxial coil pairs operated at 1000 and 3500 Hz while three horizontal coplanar coil pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock contrast in magnetic susceptibility. The in-phase component of the EM signal is generated from the in-phase and quadrature component of the coplanar 7200 Hz using the quadrature-layer half-space model. The data were interpreted using the computer program of A. D. Aldred (1970) technique. The grids were resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.



LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and CGG Ltd (U.S.) Inc. Airborne geophysical data for the area was acquired and processed by CGG in 2014 and 2015. This project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGS website (www.dggs.alaska.gov/pubs/geophysics). Products are also available in digital format and maps are available on paper for a nominal fee from the DGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggsdgs@alaska.gov).



The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a GGG D1344 cesium magnetometer with a Schintec CS3 cesium gradiometer. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m above the terrain (102' survey flight lines with a 100 m spacing). Flights were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEMS-G2L Global Positioning System was used for navigation. The helicopter position was determined at a second ground station using differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, a north constant of 100,000 and a false easting of 500,000. Positional accuracy of the projected data is better than 10 m with respect to the UTM grid.

**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

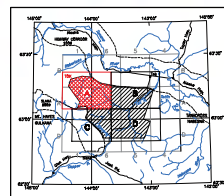
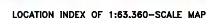
by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018

RESISTIVITY

The DIGHEM[®] 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, 7200 and 56,000 Hz. EM data were sampled at 0.1 m intervals. EM data were processed by computer using conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase and quadrature component of the coplanar 900 Hz using the pseudo-layer half space model. The data were then processed to produce resistivity maps. The resistivity maps were processed using the resistivity to conductivity conversion algorithm (Alding, 1970) technique. All grids were then sampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

RESISTIVITY ALTITUDE LIMITS

in areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data were collected and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Program.

All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 1000 W. Road 12, Fairbanks, Alaska 99707 (phone 907-451-5020, email dggs@alaska.gov).



The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a GGC D1344 cesium magnetometer system, a Scripps CS3 cesium gradiometer. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m above the ground. The survey flight lines were spaced at 400 m. The flight lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.2 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, a north constant of 1000 and a false easting of 1000. Positions are given in the UTM zone 7 projection. The accuracy of the presented data is better than 10 m with respect to the UTM grid.

**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

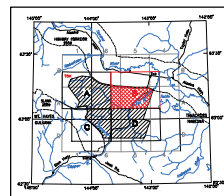
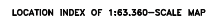
by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018

RESISTIVITY

The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. The vertical coaxial 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 m intervals. The EM system was designed to minimize conductor, collective overvoltage, and cultural sources. Apparent resistivity is generated from the in-phase and quadrature component of the coplanar 900 Hz using the pseudo-layer half-space model. The data were processed using the *RESOLVE* (1970) computer program (Alkema 1970-71) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

RESISTIVITY ALTITUDE LIMITS

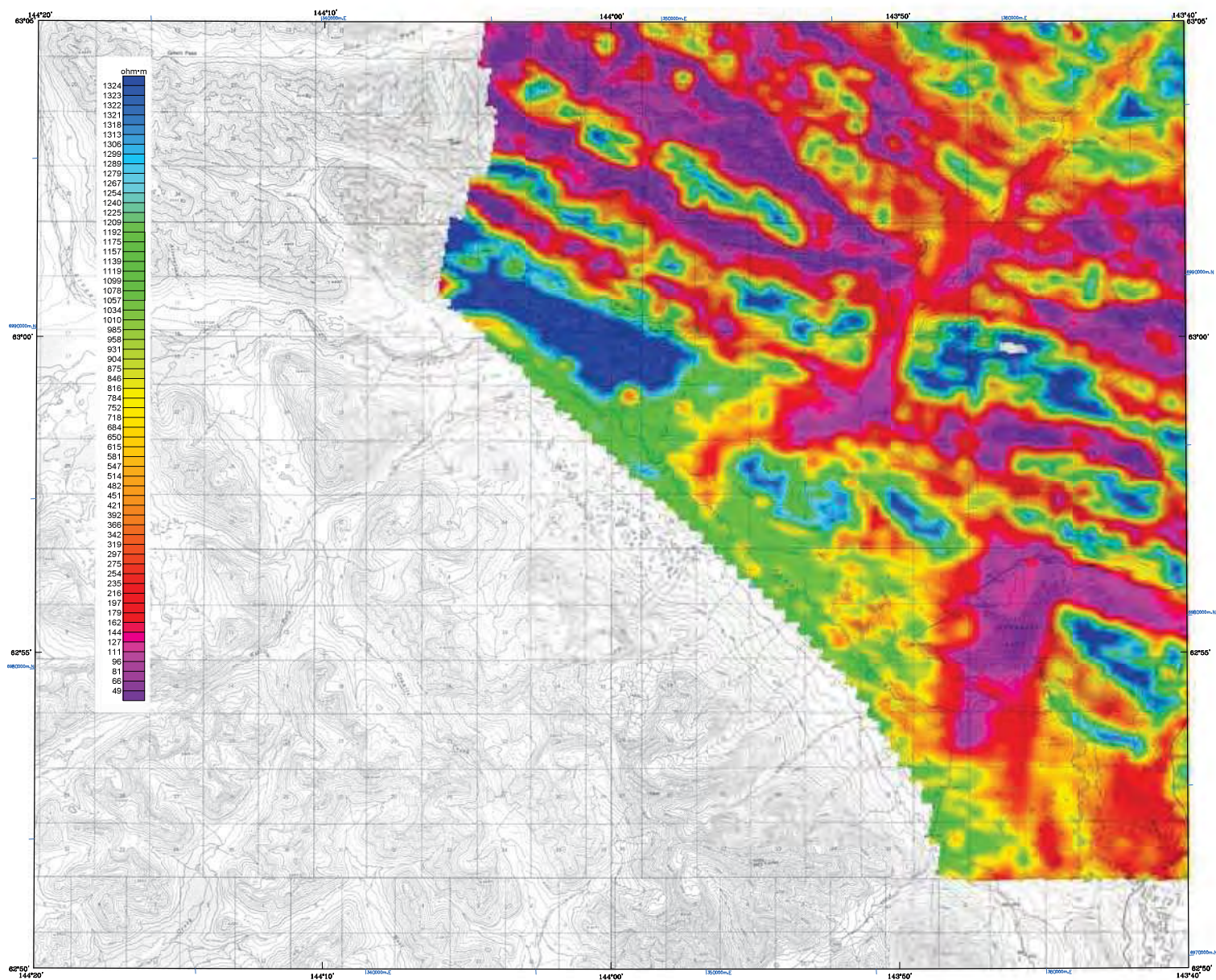
in areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.



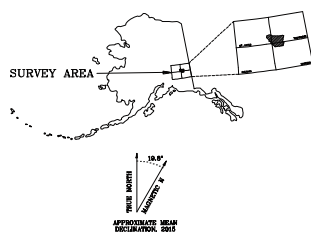
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geology and Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG Land (U.S.) Inc. under contract to the State of Alaska by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

The data and maps posted on this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 1000 W. Road 12, Anchorage, Alaska 99507 (phone 907-451-5020, email dggs@dnr.state.alaska.gov).



Base from U.S. Geological Survey Topographic A-6, 1964; Release D-6, 1966;
Colburn D-1, 1970; B. Boye J-1, 1970; Olenikovich, Alaska



900 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Ermond, CGG, and CGG Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (112) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

RESISTIVITY

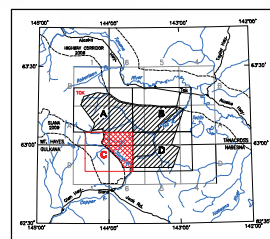
The DIGHEM[®] EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase 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. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹ Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures: Journal of the Association of Computing Machinery, v. 17, no. 4, p. 589-602.

RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.

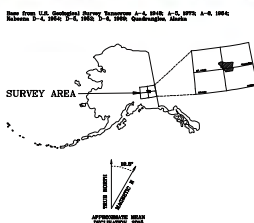
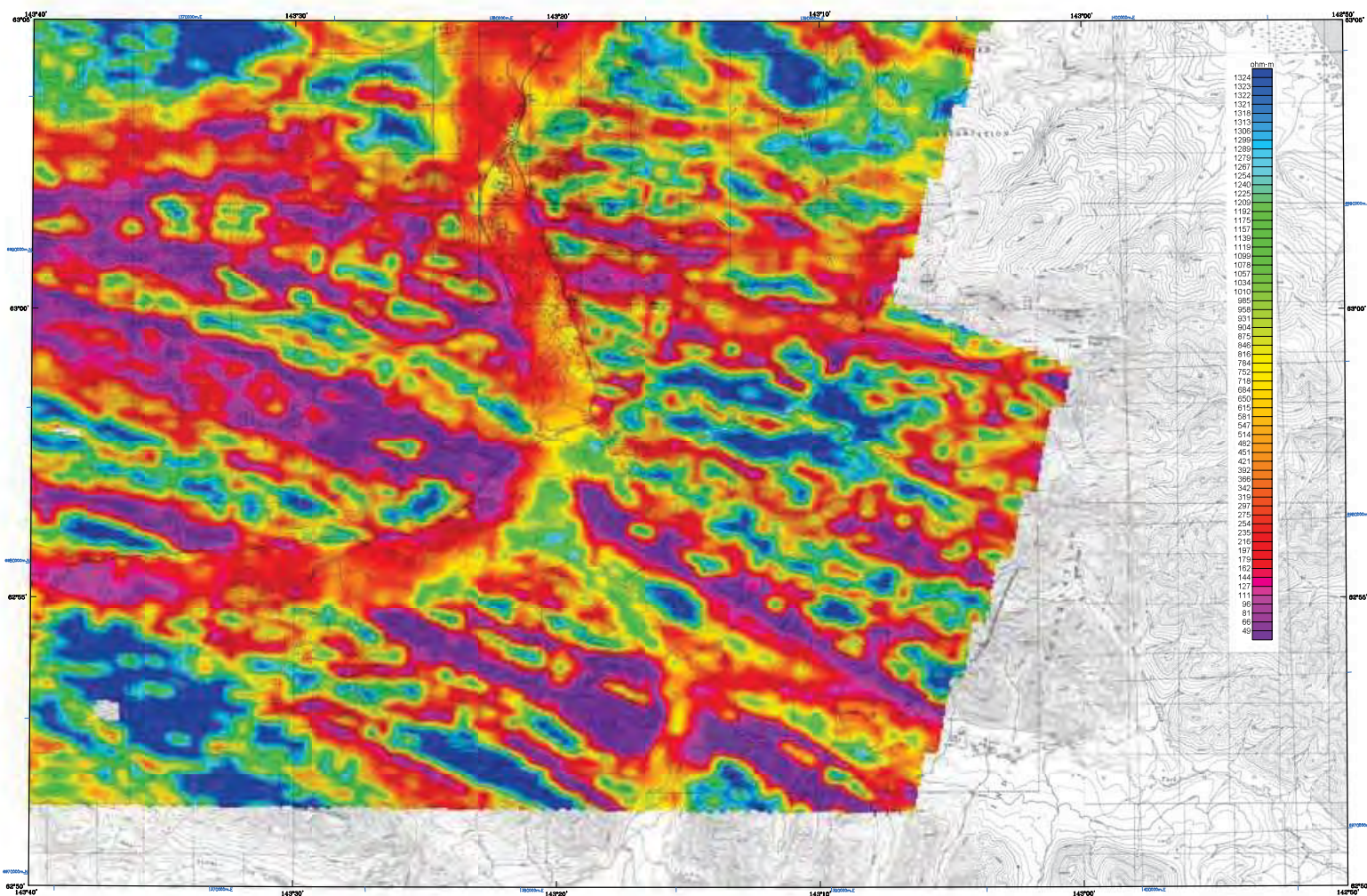
LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggspublic@alaska.gov).



900 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Emond, CGO, and CGO Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGO D1544 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM4-C2L Global Positioning System was used for navigation. The helicopter position was derived every 0.2 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141° 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.

RESISTIVITY

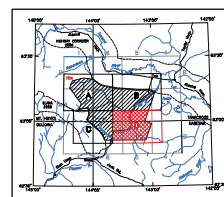
The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. Two vertical coplanar coil pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil pairs operated at 900, 7200 and 56,200 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductance, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase 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)¹ technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹ Akima, 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. 589-602.

RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.

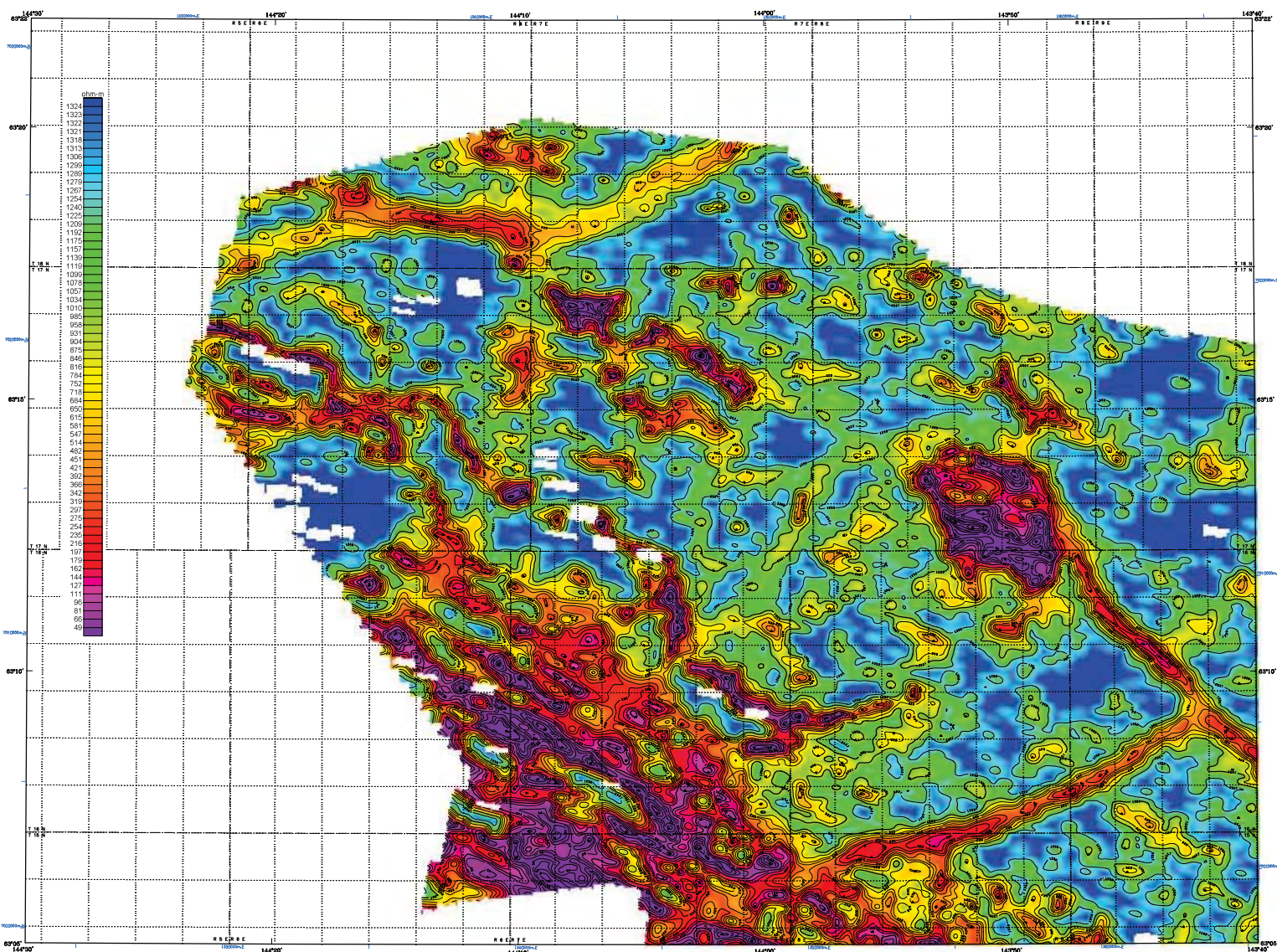
LOCATION INDEX OF 1:63,360-SCALE MAP



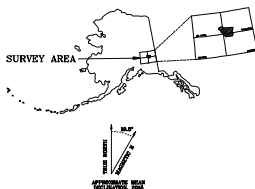
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGO Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGO in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysical). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggs@alaska.gov).



Source: Modified from U.S. Geological Survey, M. Ryan et al., 1970, B-1, 1985.
 Reprinted with permission from the U.S. Geological Survey, 1985.

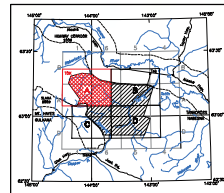


900 Hz COPLANAR APPARENT RESISTIVITY WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham H. Emard, CGG and CGG Land (U.S.) Inc.
2015

LOCATION INDEX OF 1:63,360-SCALE MAP



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Sinterex C53 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video cameras. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (017°) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the right lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a 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.

RESISTIVITY

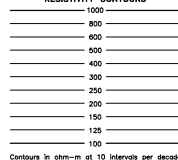
The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. Two vertical coplanar coil pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase 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. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹ Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local principles, *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

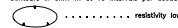
RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying corrected over more than one survey line.

RESISTIVITY CONTOURS



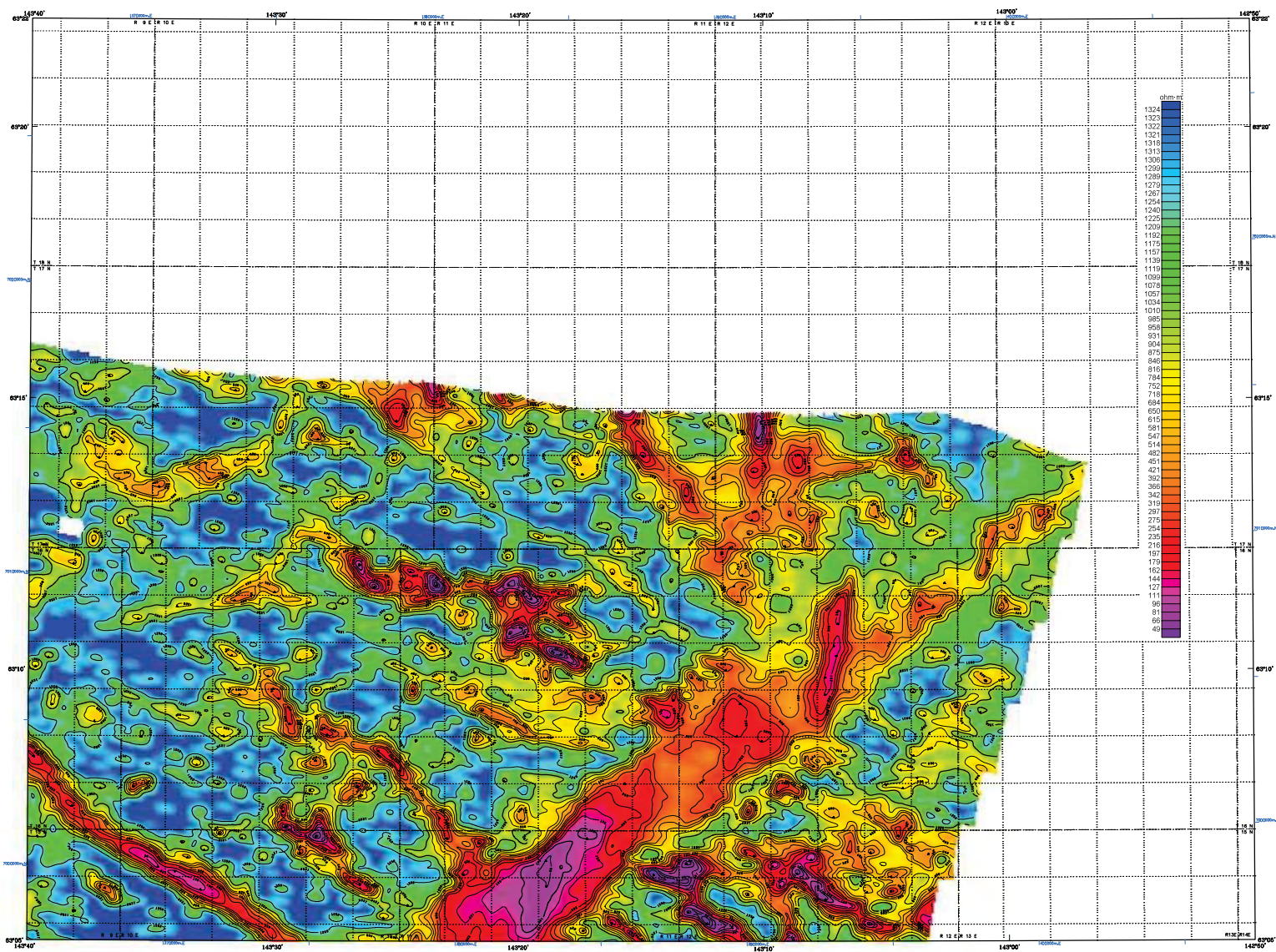
Contours in ohm-m at 10 intervals per decade



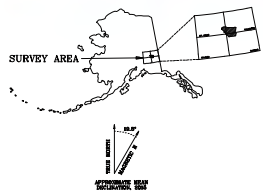
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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Surveys collected from U.S. Geological Survey Resources A-1, 1946; A-2, 1975; A-3, 1984; P-1, 1946; P-2, 1954; P-3, 1970. Coordinates, UTM.



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

900 Hz COPLANAR APPARENT RESISTIVITY WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Emard, CGG and CGG Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Slichter CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 145° 1' 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.

RESISTIVITY

The DIGHEM[®] EM system measured in-phase and quadrature components at five frequencies. Two vertical coil pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil pairs operated at 900, 7200 and 58,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductive, conductive overburden, and cultural sources. Apparent resistivity is generated from the in-phase and quadrature component of the coplanar 900 Hz using the Alame (1970)¹ technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

¹Alme, H., 1970, A new method of interpretation and smooth curve fitting based on local principles, *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 588-602.

RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying corrected over more than one survey line.

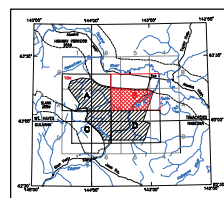
RESISTIVITY CONTOURS

1000
800
600
500
400
300
250
200
150
125
100

Contours in ohm-m at 10 intervals per decade

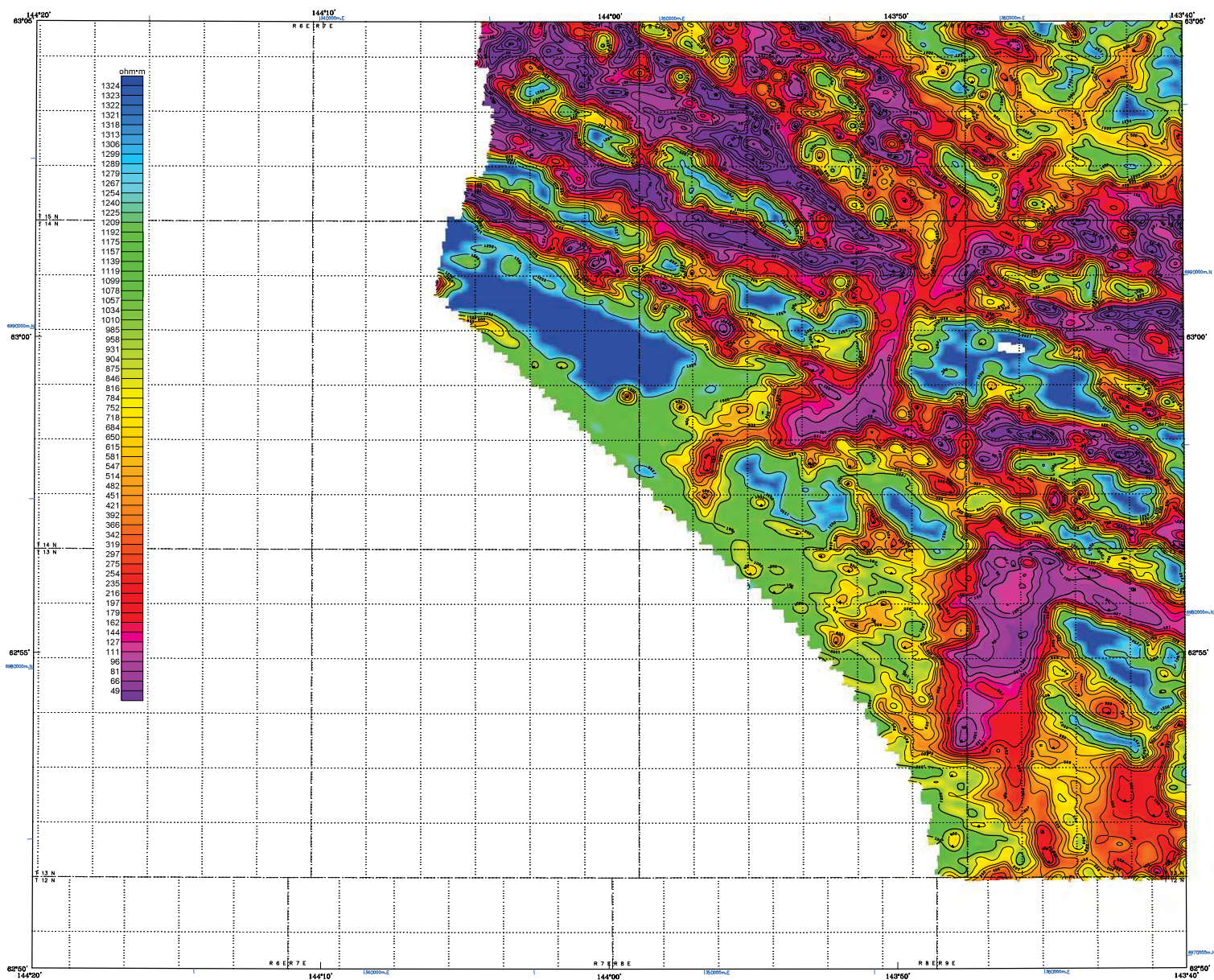
..... resistivity low

LOCATION INDEX OF 1:63,360-SCALE MAP

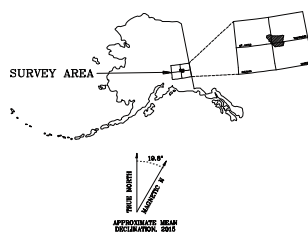


SURVEY HISTORY

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Section outlines from U.S. Geological Survey Transverse A-6, 1964; Johnson D-6, 1966
 Collins S-1, 1976; St. Boyer A-1, 1976; Goughman, Alaska



900 Hz COPLANAR APPARENT RESISTIVITY WITH DATA CONTOURS, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
 AND GULKANA QUADRANGLES

by
 Abraham M. Ermond, CGG, and CGG Land (U.S.) Inc.
 2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Sinterex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

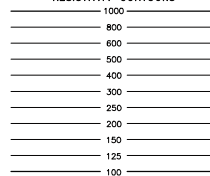
A Novatel OEM5-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

RESISTIVITY
 The DIGHEM[®] 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 800, 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 in-phase 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 (1972) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication. Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures, *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

RESISTIVITY ALTITUDE LIMITS

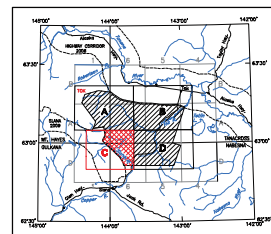
In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.

RESISTIVITY CONTOURS



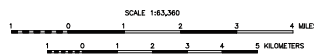
Contours in ohm-m at 10 intervals per decade
 resistivity low

LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project. All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggs@alaska.gov).



**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

by
Abraham M. Emond, CGO, and CGO Land (U.S.) Inc.
2015

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a CQG D134 cesium magnetometer with Scintrex CS3 cesium sensors. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and 83 channels. Flights were performed with an AS-350B3 Sikorsky helicopter. The survey was flown along NE-SW (T12) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

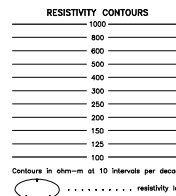
A Novatel OEM5-G2L Global Positioning System was used for navigation. The horizontal position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a constant meridian arc length of 111,320 m and a constant of 0.000001 or less constant of 500,000. Positional accuracy of the presented data is better than 10 m with respect to the UTM grid.

RESISTIVITY

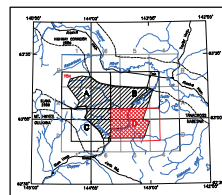
The DIGHEM[®] EM system measured in-phase and quadrature component frequencies. The vertical coaxial coil pairs operated at 1000 and 3500 Hz while three horizontal coplanar coil pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock contrast in magnetic susceptibility. The in-phase component of the EM signal is generated from the in-phase and quadrature component of the coplanar 900 Hz using the pseudo-layer-half-space model. The data were interpreted using the computer program of A. D. Alkema (1970) technique. The grids were resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids in this publication.

RESISTIVITY ALTITUDE LIMITS

In areas where the EM bird height exceeded 150 m, resistivity was not calculated to avoid meaningless resistivity calculations for small signals where the helicopter flew higher to avoid cultural objects or for safety reasons. Blank areas in the grids were created where zones of high flying correlated over more than one survey line.



LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

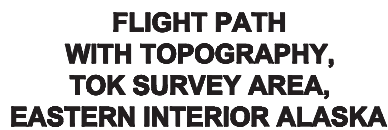
This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area was acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGGs website (www.dggs.alaska.gov/pubs/geophysics). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGs office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggsdgs@alaska.gov).



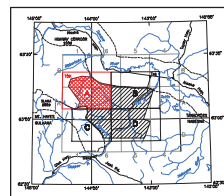
The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Sointrex CS3 cesium sensor. The EM and the cesium magnetometer were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and a video camera. Flights were performed with an AS-350-B3 helicopter at a mean terrain clearance of 60 m along the E-SW [012°] survey flight lines with a spacing of 1,400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEMS-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential corrections to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, a north constant of 0 and an east constant of 500,000. Positional accuracy of the UTM grid is better than 10 m with respect to the UTM grid.



**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

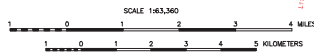
by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018



SURVEY HISTORY

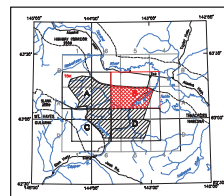
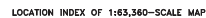
This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGs), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014. All project work was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggs@alaska.gov).



**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

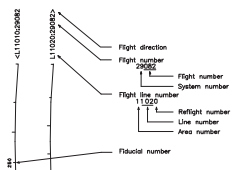
by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2018



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer (EM Sciences). Scintrex CS3 cesium sensors. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Sikorski helicopter at a mean terrain clearance of 60 m above the ground. The survey flight was with a speed of 400 m. The line lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

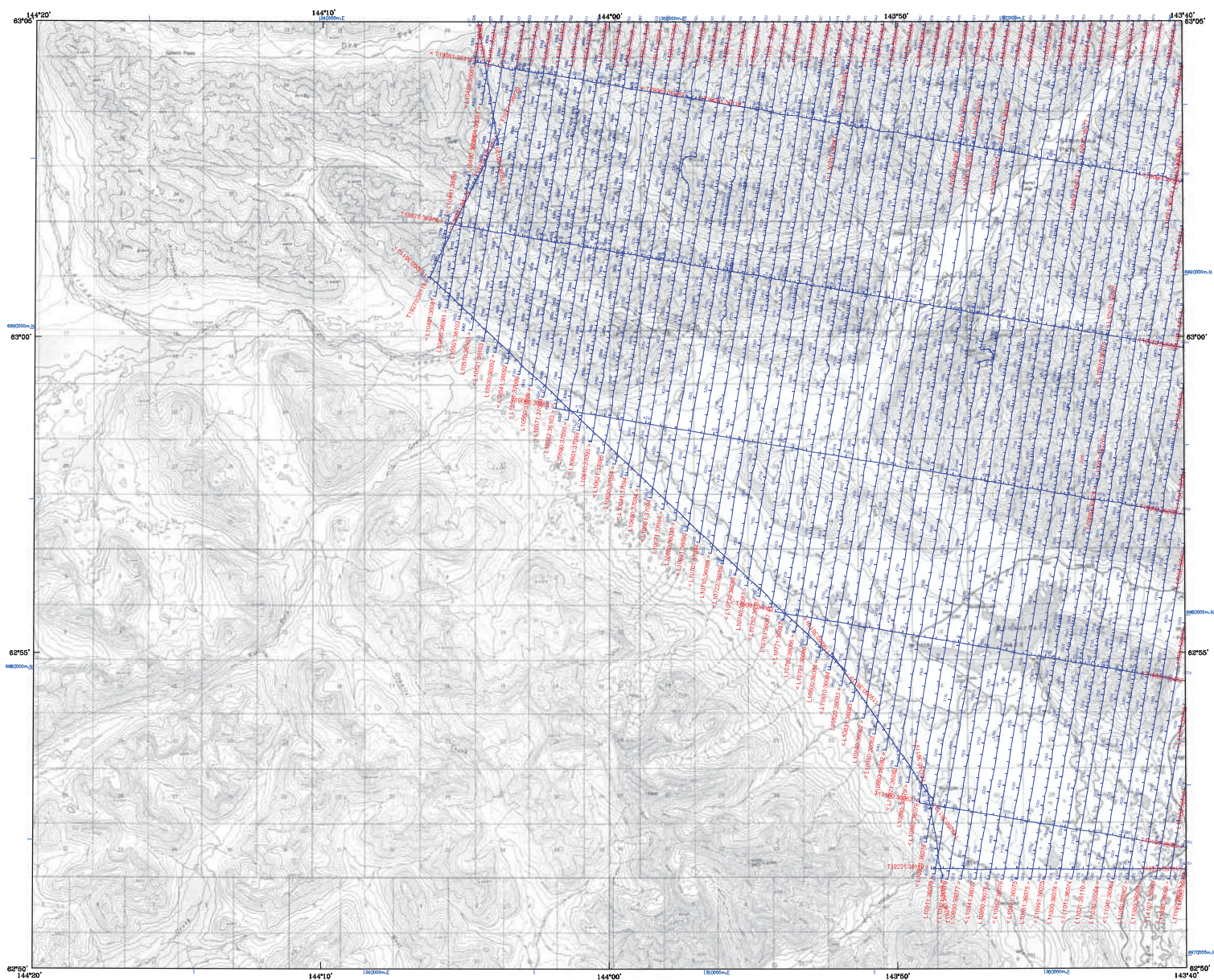
A Novatel OEM5-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1886 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.



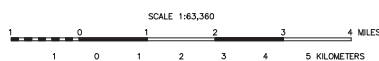
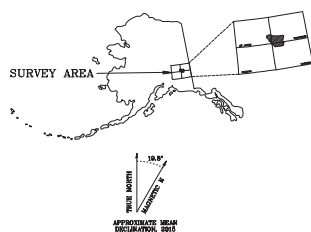
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 at 200 m resolution. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggspubs@alaska.gov).



Derive from US Geological Survey Topographic A-5, 1984; Release D-5, 1986;
Colburn D-1, 1976; St. Boye A-1, 1976; Olenokvok, Alaska



FLIGHT PATH WITH TOPOGRAPHY, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

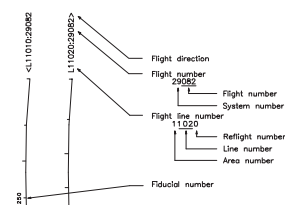
PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

by
Abraham M. Ermond, CGG, and CGG Land (U.S.) Inc.
2015

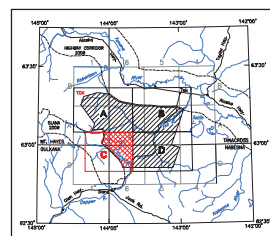
DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM V Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.



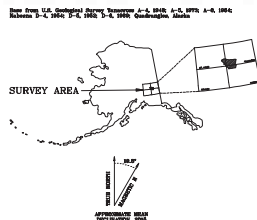
LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

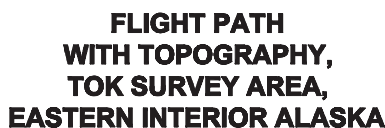
This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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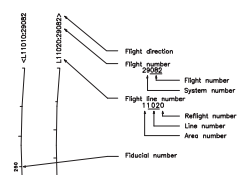
The geophysical data were acquired with a DIGHEM Electromagnetic (EM) system and a CGG D1344 cesium magnetometer (CGG, St. John's, Canada) cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along the SW (112°) survey flight lines with a spacing of 400 m. The flight lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian of 120°W. The constant of the ellipsoid is one quarter of 500,000. Positional accuracy of the presented data is better than 10 m with respect to the UTM grid.



**PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES**

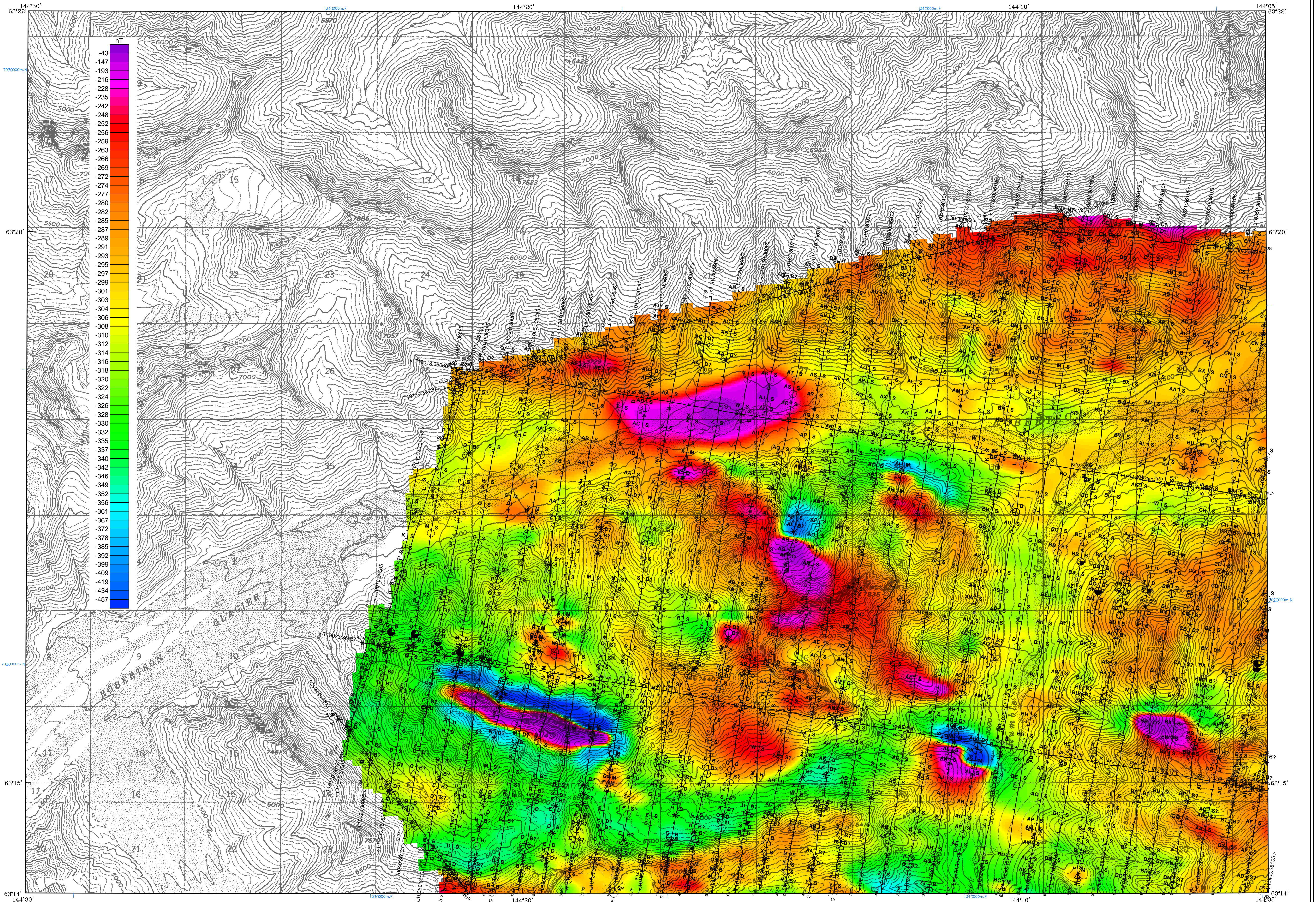
by
Abraham M. Emond, CGO, and CGO Land (U.S.) Inc.
2015



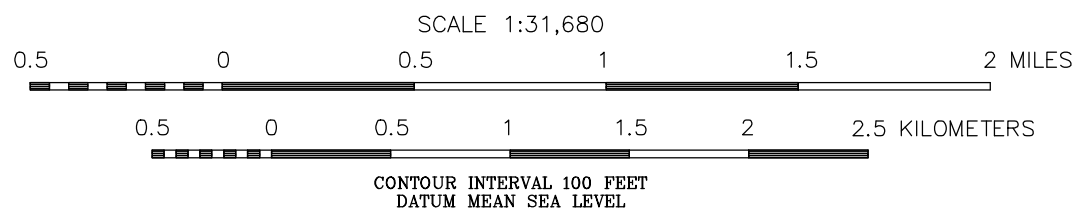
The map shows the northern Adriatic Sea with the Italian coastline to the west and south. Major cities labeled include Trieste, Udine, Gorizia, and Trieste. The map includes latitude and longitude coordinates. Four sampling stations are marked: A (hatched area), B (dotted area), C (white area), and D (red area). The map also shows the location of the 'GRANDI PORTI' and 'GRANDI PORTI'.

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGG&G) and CGA Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. This project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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Base from U.S. Geological Survey Mt. Hayes A-1, 1975; B-1, 1982; Quadrangles, Alaska



RESIDUAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES WITH TOPOGRAPHY OF THE TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS of MT. HAYES A-1 and B-1
QUADRANGLES

by
Abraham M. Emond, CCG, and CGG Land (U.S.) Inc.
2015

RESIDUAL MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a CGG D1344 magnetometer with a Scintrex CS3 cesium 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 2010, 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. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

¹ 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.

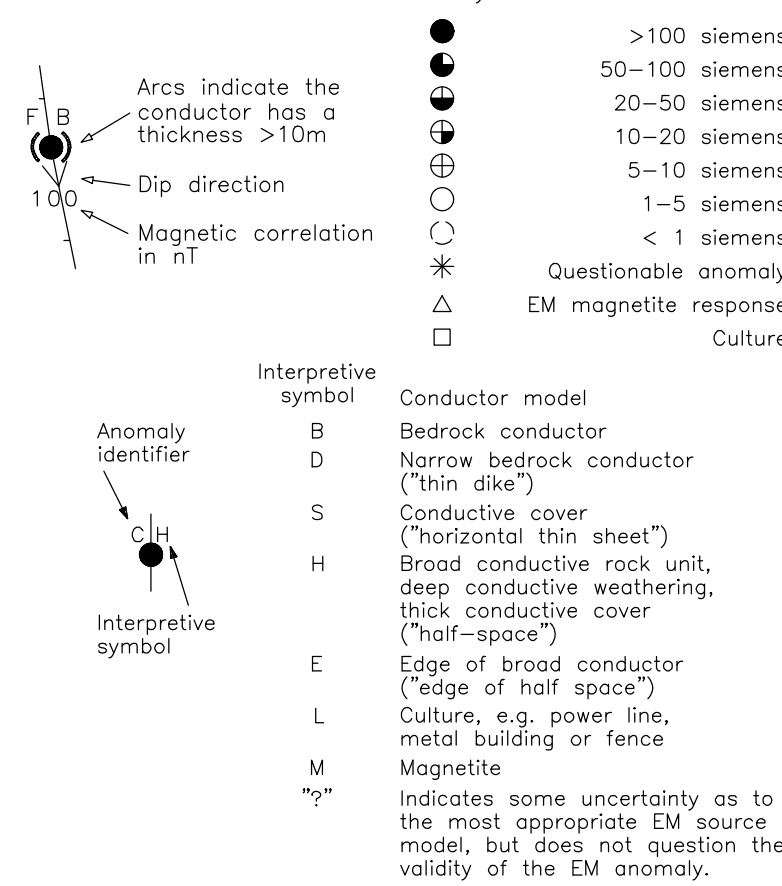
SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGs), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project. All data and maps produced to date from this survey are downloadable for free from the DGGs website (www.dggs.alaska.gov/pubs/geophysics/). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGs office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggs@alaska.gov).

ELECTROMAGNETICS

To determine the location of EM anomalies or their boundaries, the DIGHEM[®] 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, 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.

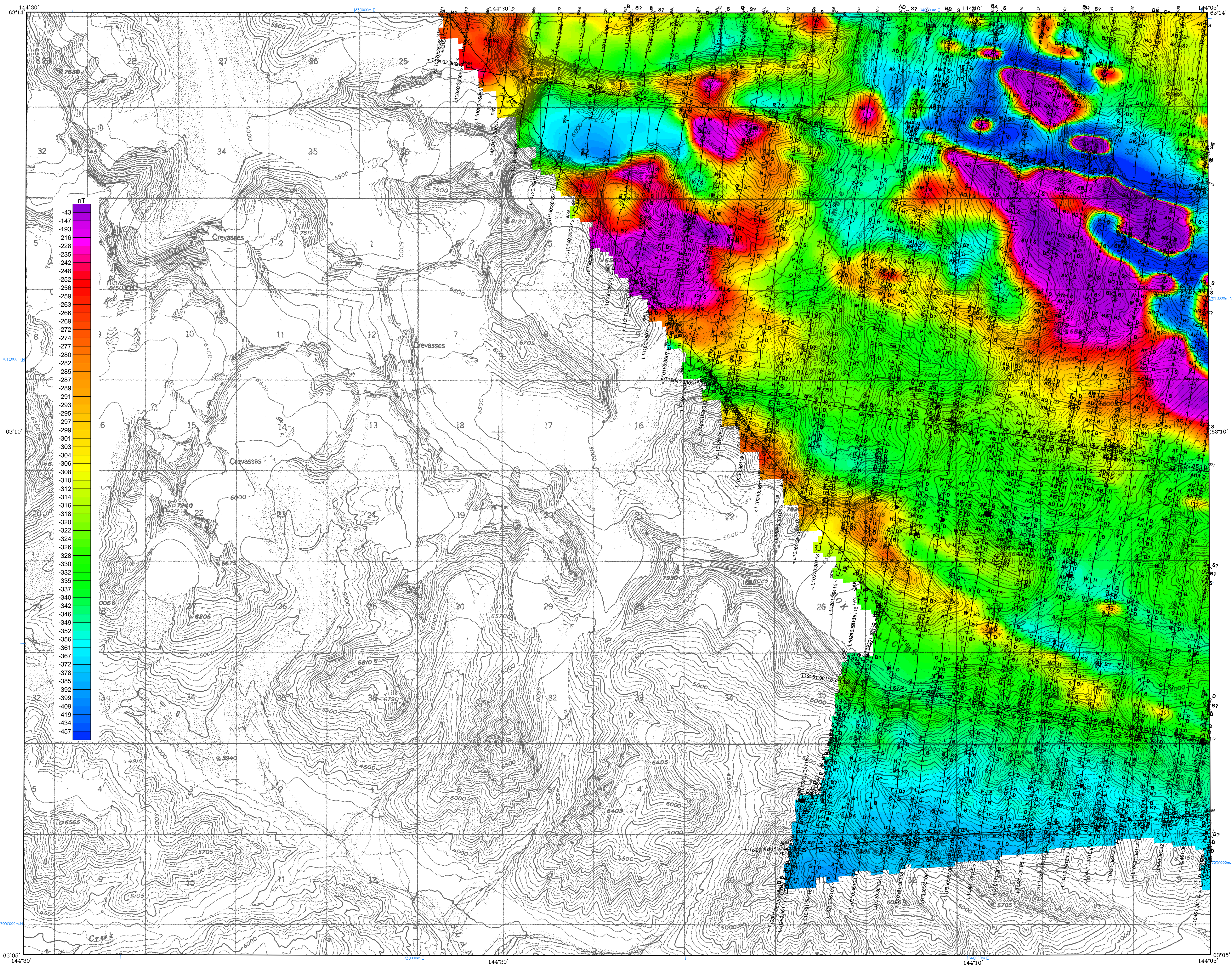
ELECTROMAGNETIC ANOMALIES



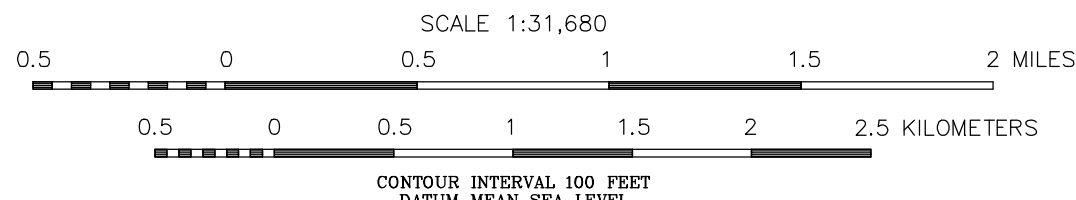
DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.



Base from U.S. Geological Survey Mt. Hayes A-1, 1975, Quadrangle, Alaska



RESIDUAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES WITH TOPOGRAPHY OF THE TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PART of MT. HAYES A-1
QUADRANGLE

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2015

ELECTROMAGNETICS

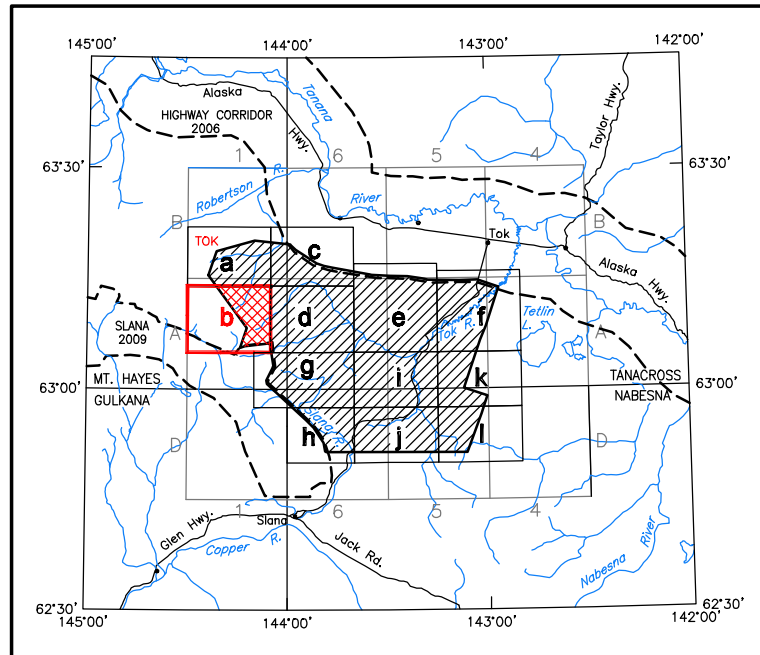
To determine the location of EM anomalies or their boundaries, the DIGHEM EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial-coil pairs operated at 1000 and 5500 Hz while three horizontal coplanar-coil pairs operated at 90, 7200, and 56,000 Hz. EM data were 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.

RESIDUAL MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a CGG D1344 magnetometer with a Scintrex CS3 cesium 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 2010, 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. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

¹ 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.

LOCATION INDEX OF 1:31,680-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

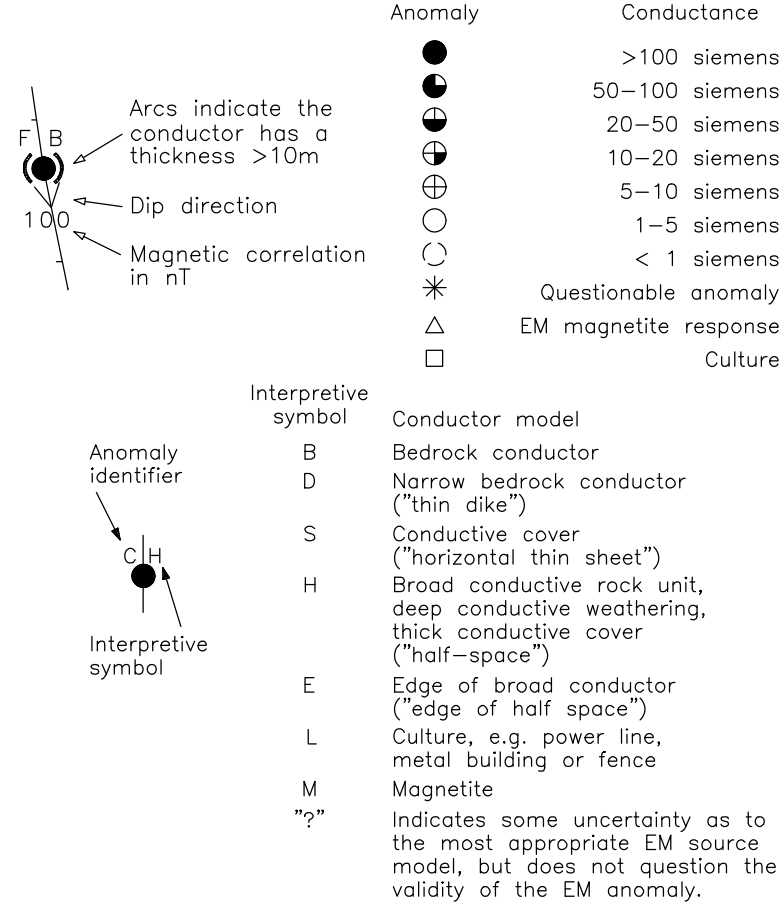
All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggsdgs@alaska.gov).

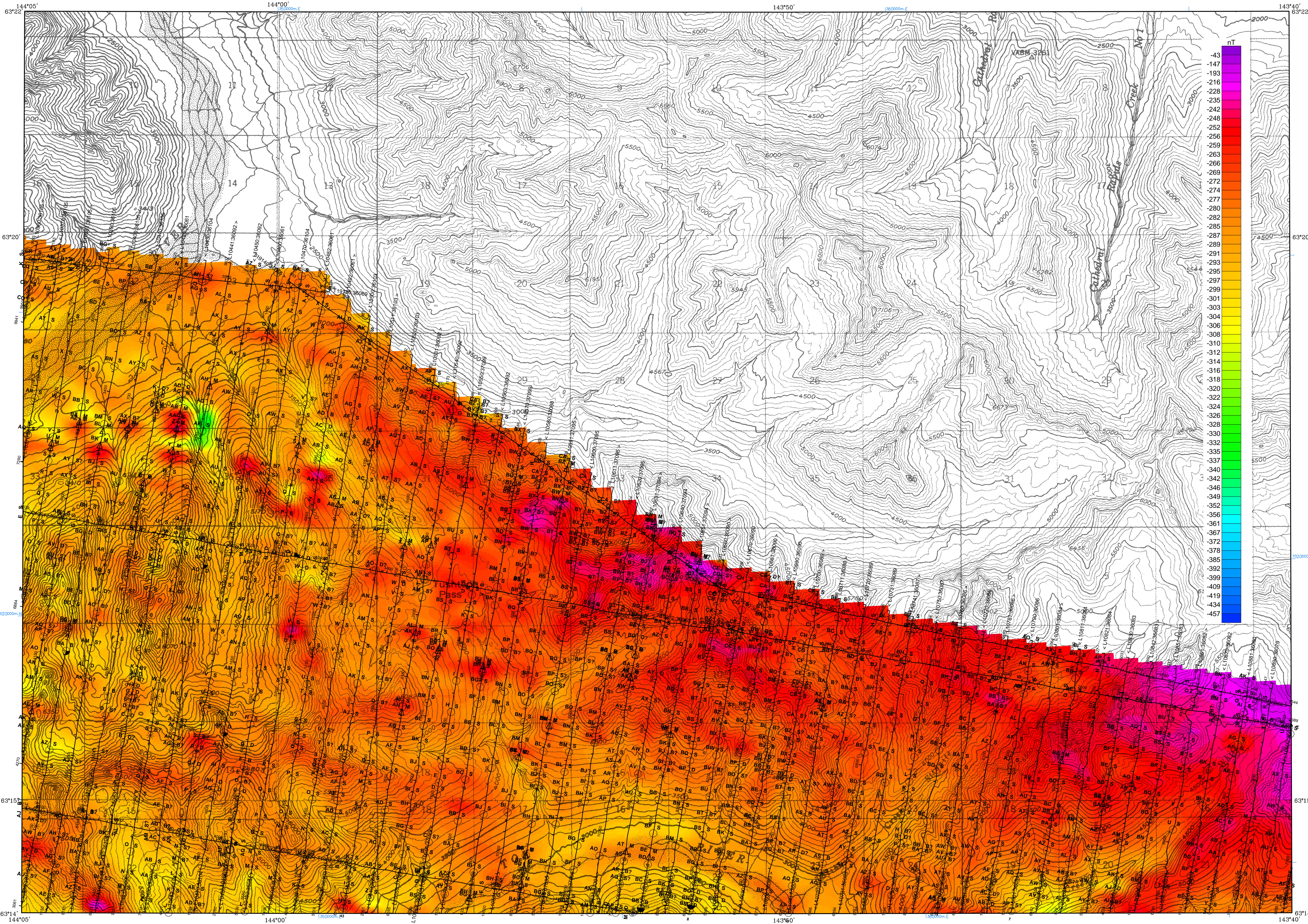
DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM V Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

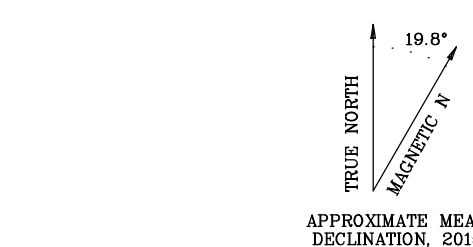
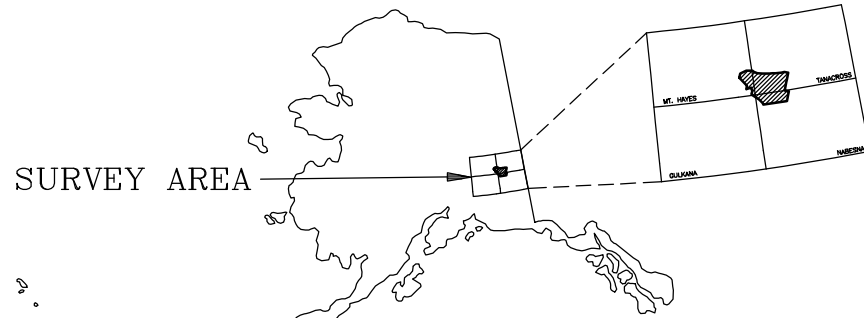
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ELECTROMAGNETIC ANOMALIES





Base from U.S. Geological Survey MT. Hayes A-1, 1975; B-1, 1982;
Tanacross A-6, 1964; B-6, 1970, Quadrangles, Alaska

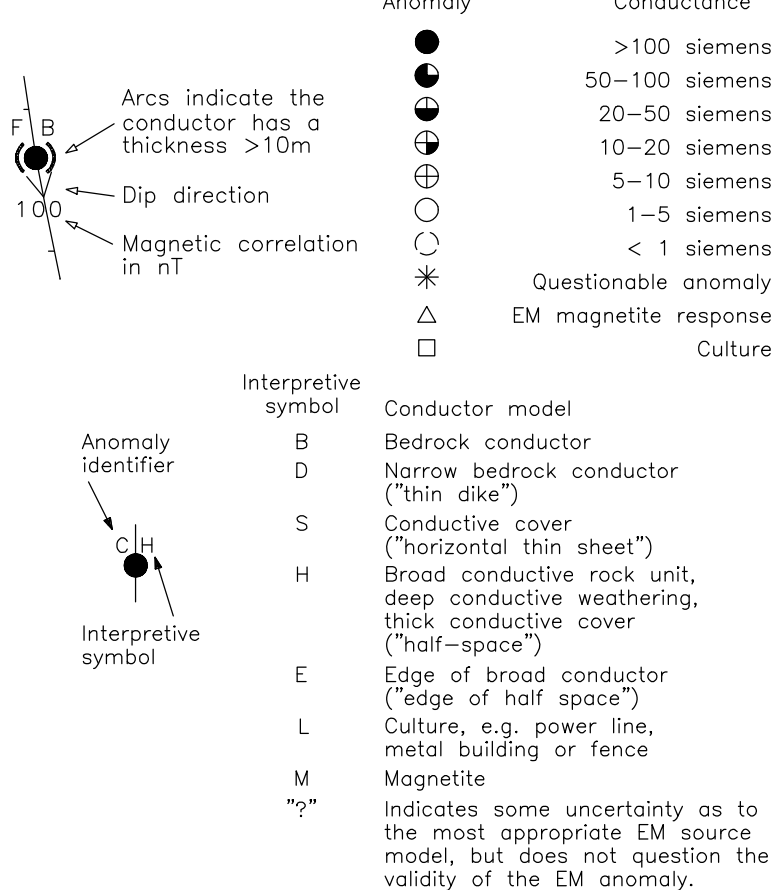


DESCRIPTIVE NOTES

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ELECTROMAGNETIC ANOMALIES



RESIDUAL MAGNETIC FIELD AND
DETAILED ELECTROMAGNETIC ANOMALIES
WITH TOPOGRAPHY
OF THE TOK SURVEY AREA,
EASTERN INTERIOR ALASKA

PARTS of TANACROSS A-6, B-6,
MT. HAYES A-1 and B-1 QUADRANGLES
by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2015

ELECTROMAGNETICS

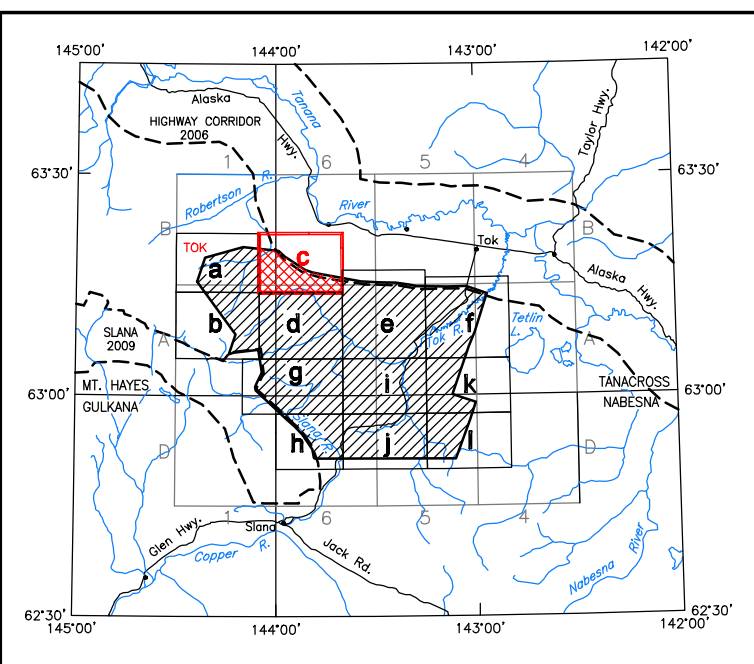
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¹ Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures: Journal of the Association of Computing Machinery, v. 17, no. 4, p. 589-602.

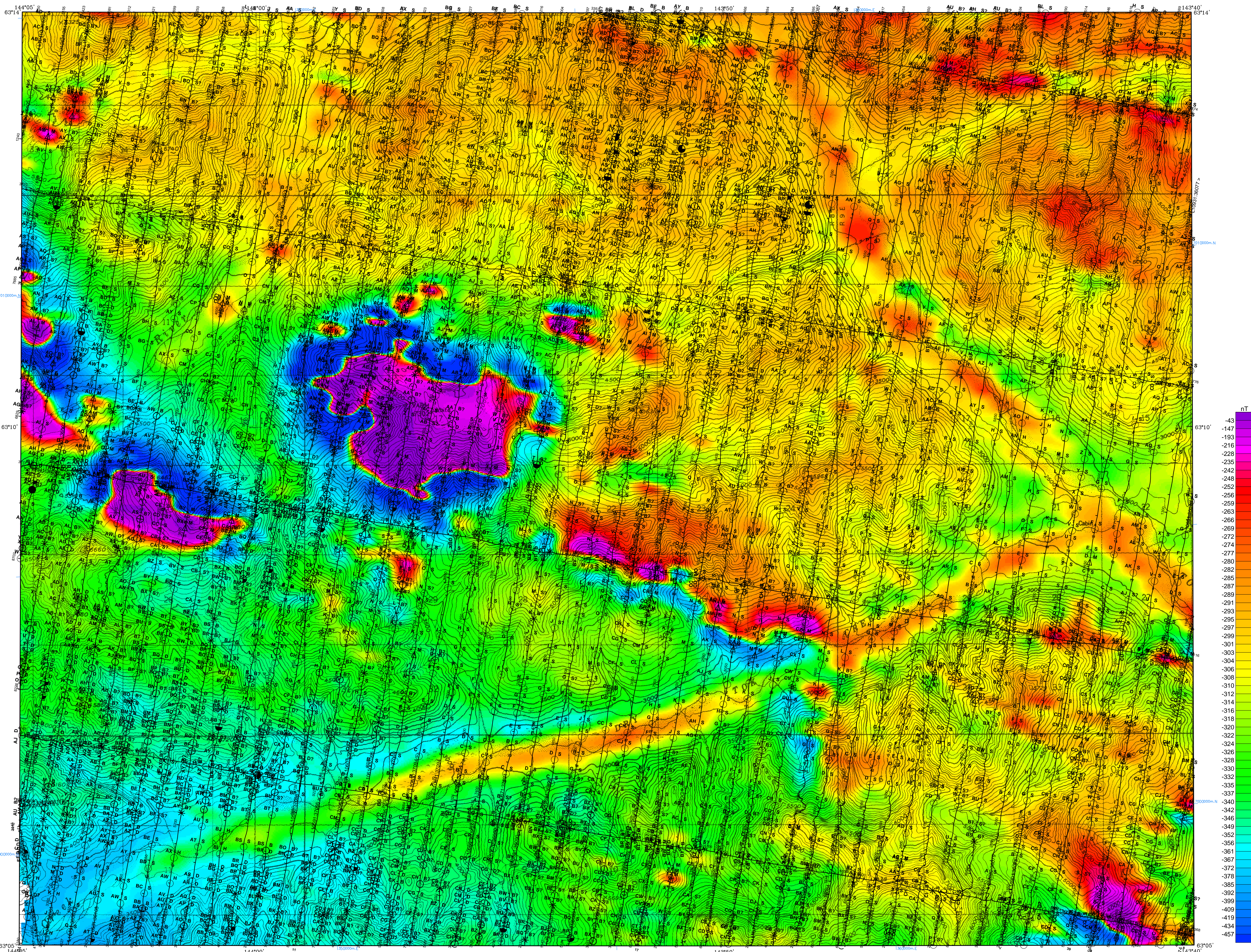
LOCATION INDEX OF 1:31,680-SCALE MAP



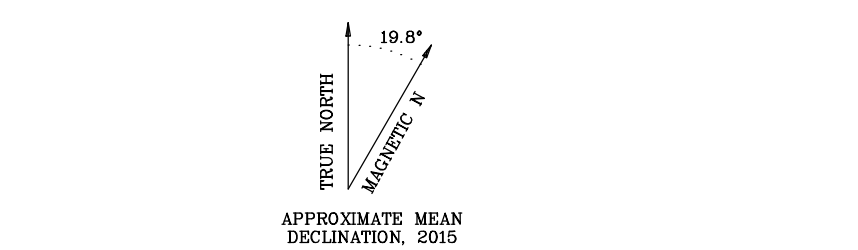
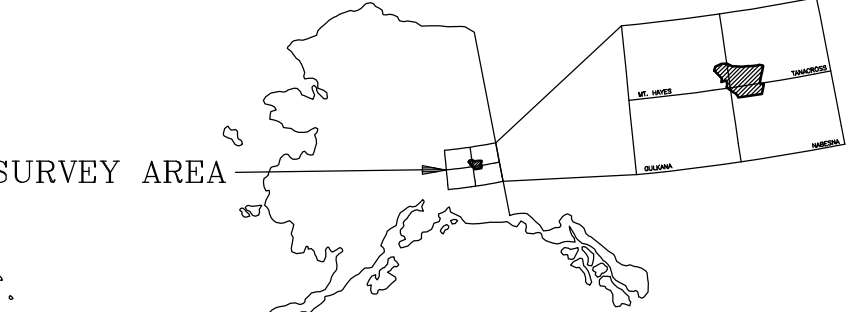
SURVEY HISTORY

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Base from U.S. Geological Survey Mt. Hayes A-1, 1975; Tanacross A-6, 1964, quadrangles, Alaska.



DESCRIPTIVE NOTES

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ELECTROMAGNETIC ANOMALIES

Anomaly

- >100 siemens
- 50-100 siemens
- 20-50 siemens
- 10-20 siemens
- 5-10 siemens
- 1-5 siemens
- < 1 siemens
- Questionable anomaly
- △ EM magnetite response
- Culture

Conductance

Interpretive symbol

- B Bedrock conductor
- D Narrow bedrock conductor ("thin dike")
- S Conductive cover ("horizontal thin sheet")
- H Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half-space")
- E Edge of broad conductor ("edge of half space")
- L Culture, e.g. power line, metal building or fence
- M Magnetite
- 7" Indicates some uncertainty as to the most appropriate EM source model, but does not question the validity of the EM anomaly.

Anomaly identifier

Interpretive symbol

-
-
- △
-
- 7"

RESIDUAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF THE TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS of TANACROSS A-6 and MT. HAYES A-1 QUADRANGLES

by Abraham M. Emond, CGG, and CGG Land (U.S.) Inc. 2015

ELECTROMAGNETICS

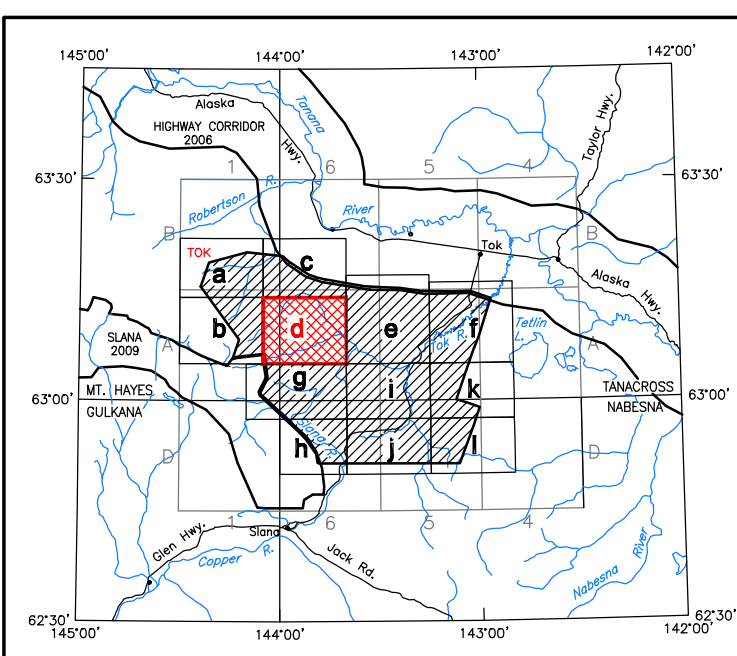
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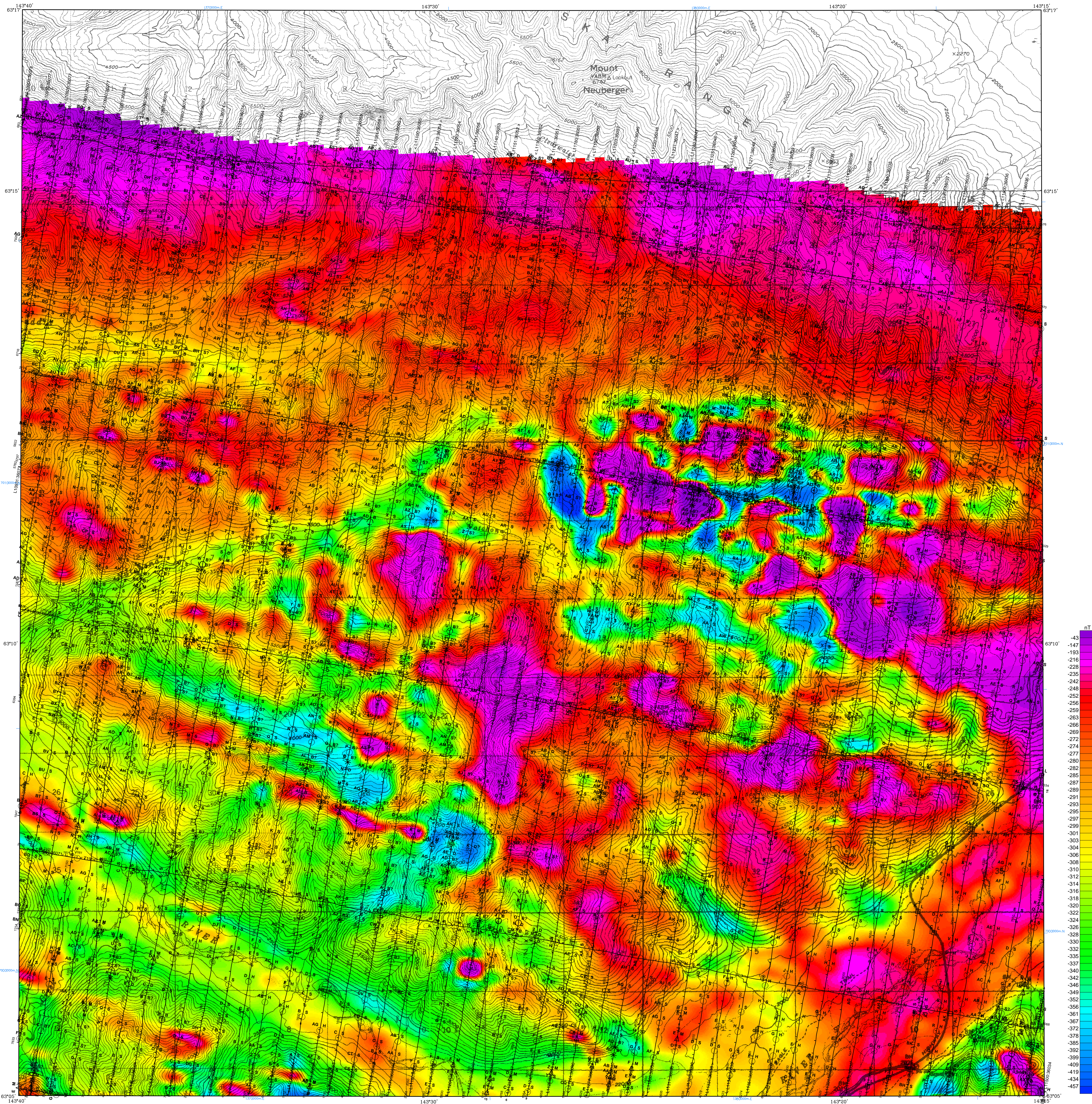
LOCATION INDEX OF 1:31,680-SCALE MAP



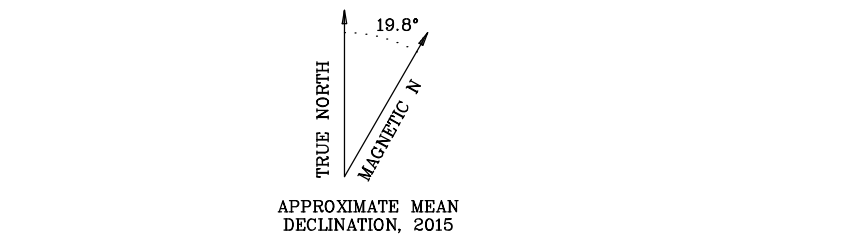
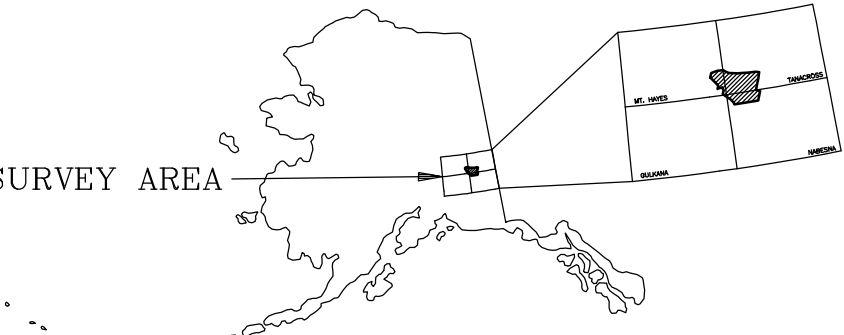
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Base from U.S. Geological Survey Tanacross A-5, 1972; A-6, 1984; B-5, 1984; B-6, 1970; Quadrangles, Alaska



DESCRIPTIVE NOTES

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Questionable anomaly

EM magnetite response

Culture

Interpretive symbol

Conductor model

Bedrock conductor

Narrow bedrock conductor ("thin dike")

Conductive cover ("horizontal thin sheet")

Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half-space")

Edge of broad conductor ("edge of half space")

Culture, e.g. power line, metal building or fence

Magnetite

M

Indicates some uncertainty as to the most appropriate EM source model, but does not question the validity of the EM anomaly.

RESIDUAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES WITH TOPOGRAPHY OF THE TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS of TANACROSS A-5, A-6, B-5, and B-6 QUADRANGLES
by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2015

ELECTROMAGNETICS

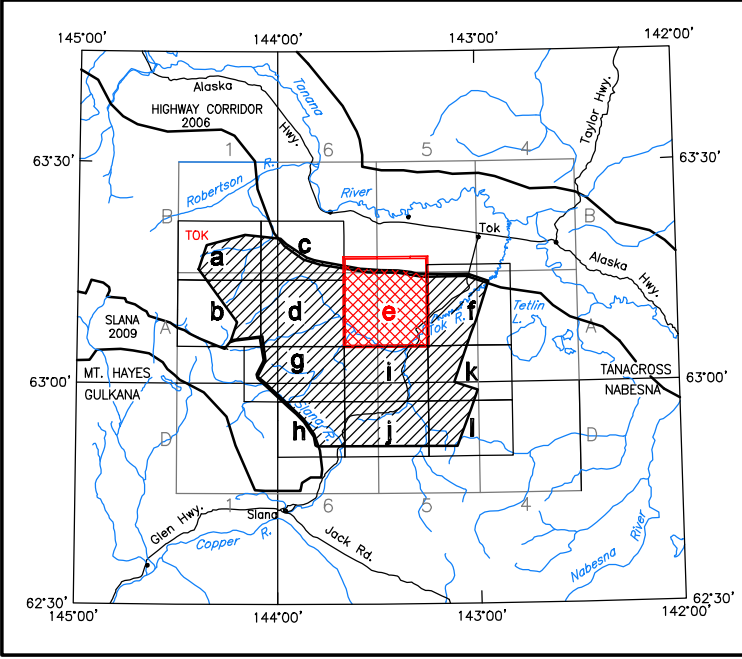
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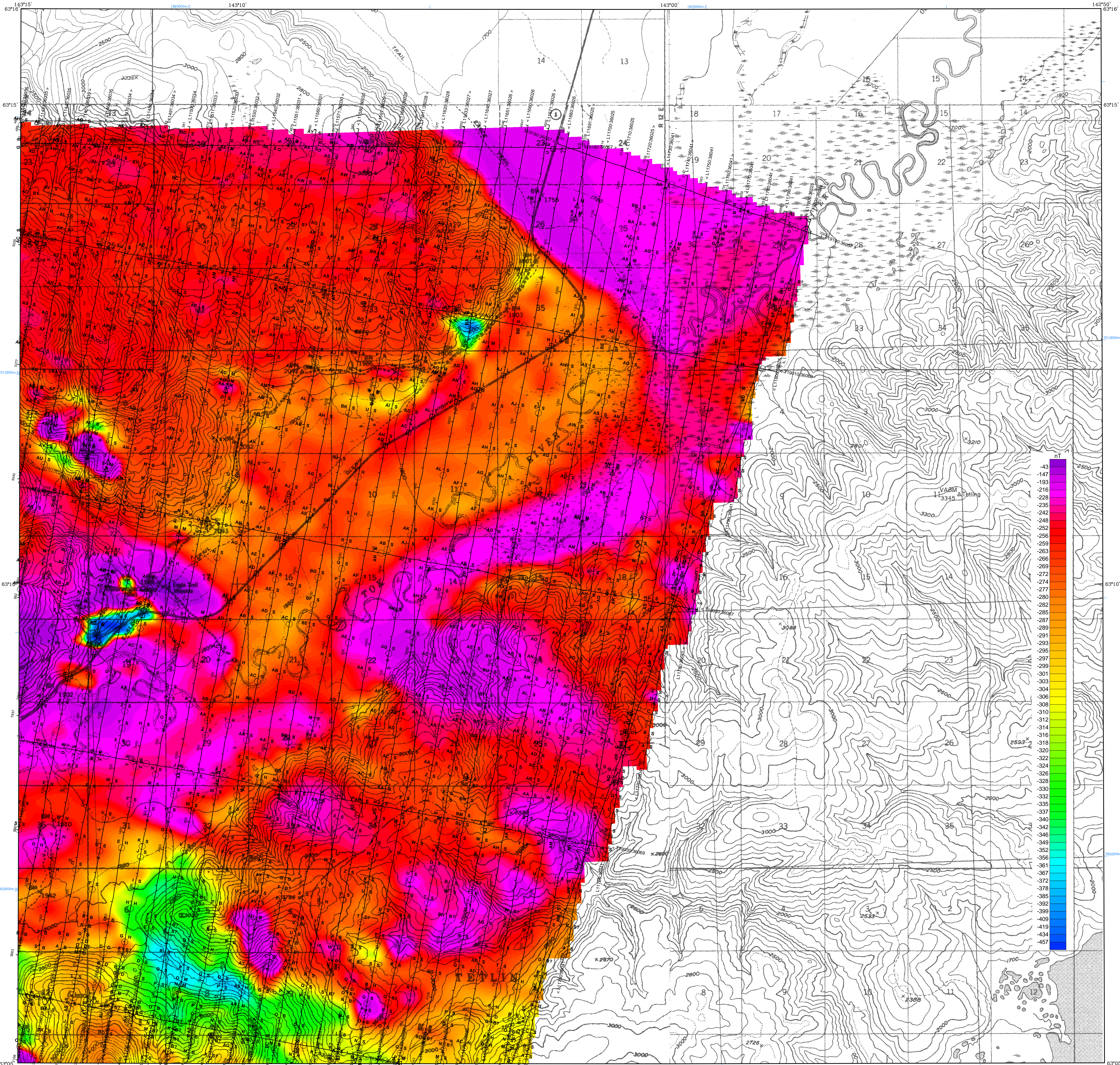
LOCATION INDEX OF 1:31,680-SCALE MAP



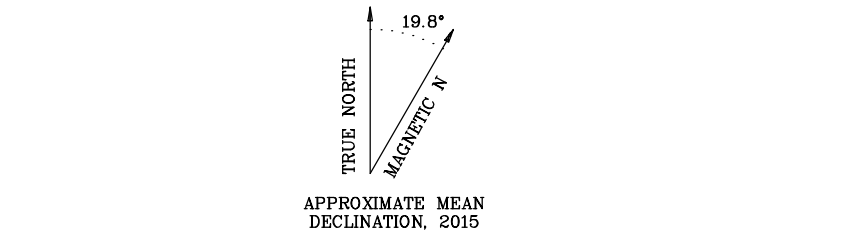
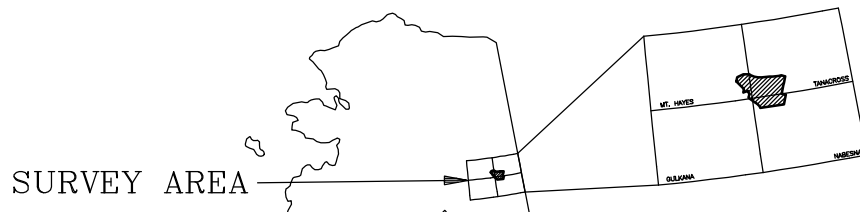
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Base from U.S. Geological Survey Tanacross A-4, 1948, A-5, 1973, B-4, 1949, B-5, 1965, Quadrangles, Alaska

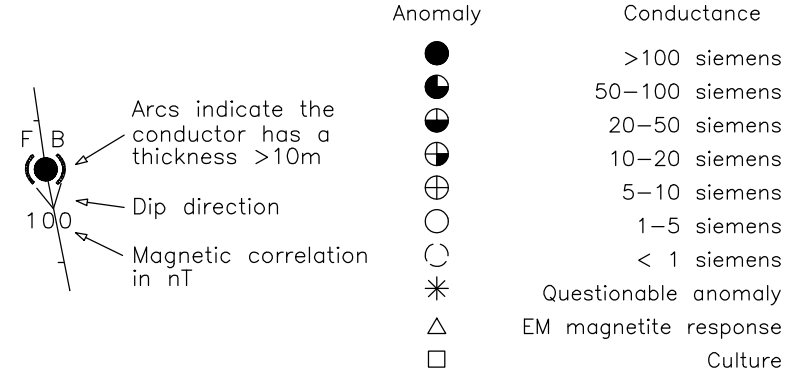


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PARTS of TANACROSS A-4, A-5,
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by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2015

ELECTROMAGNETICS

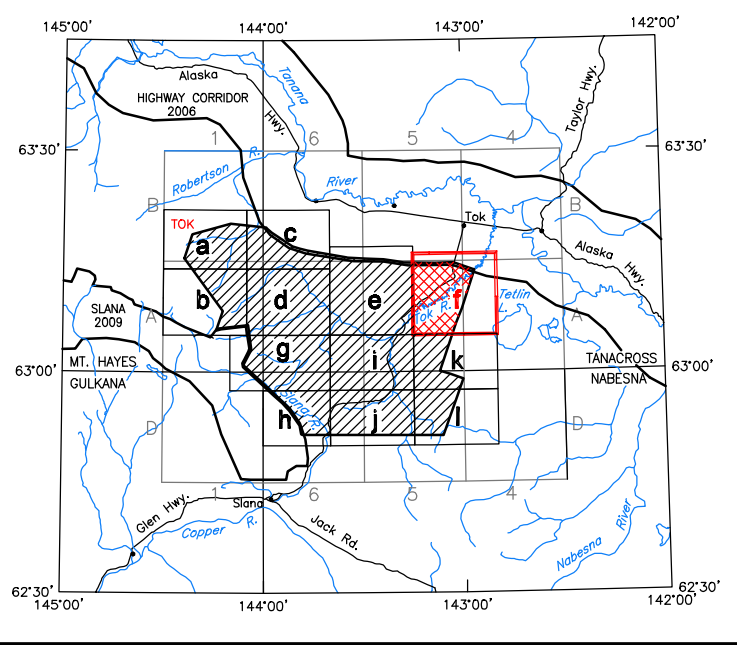
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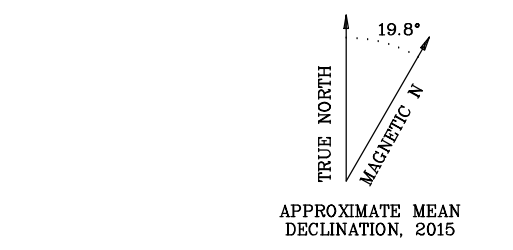
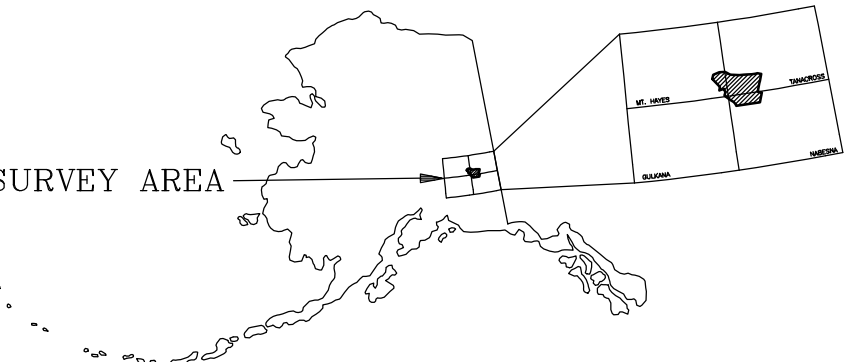
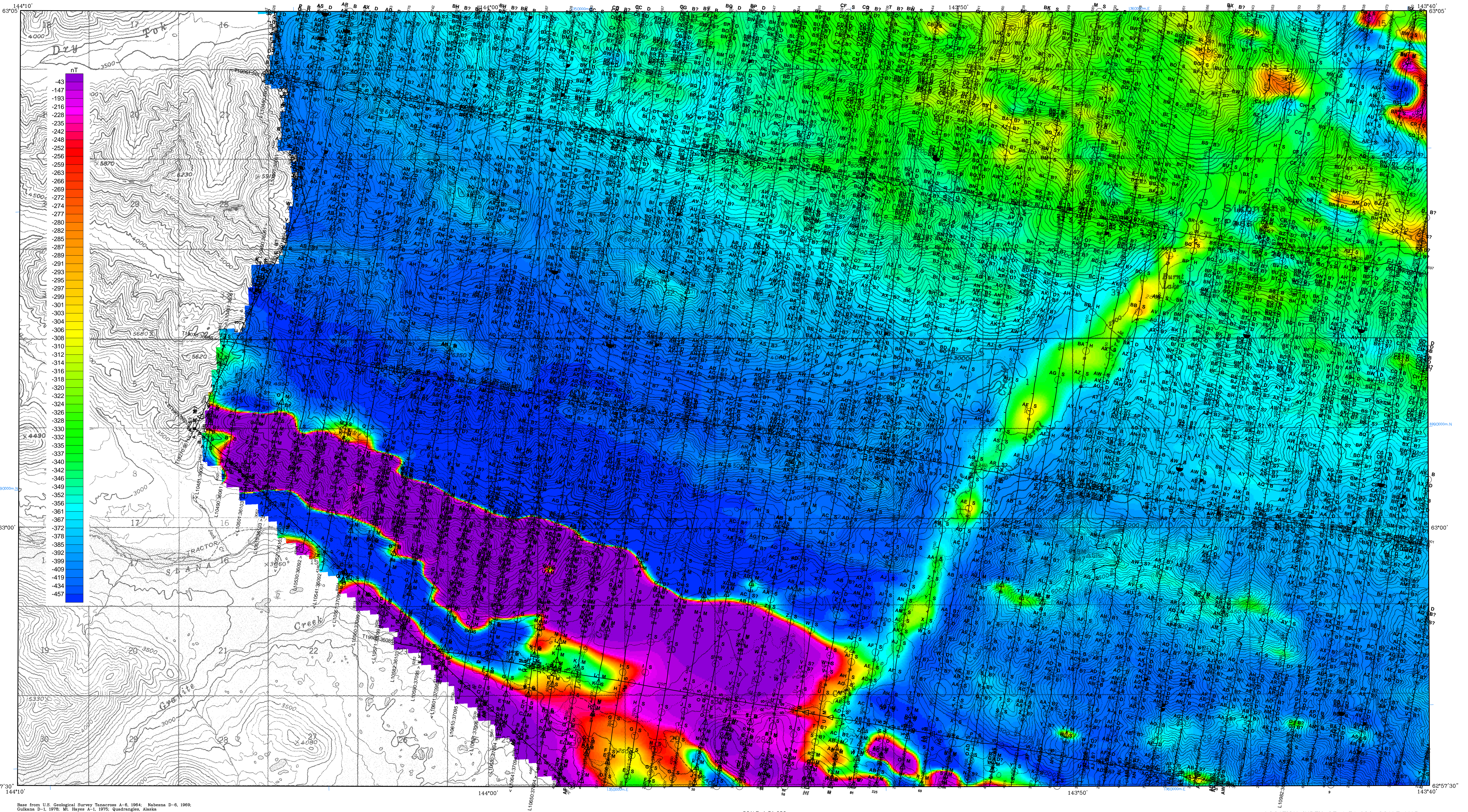
LOCATION INDEX OF 1:31,680-SCALE MAP



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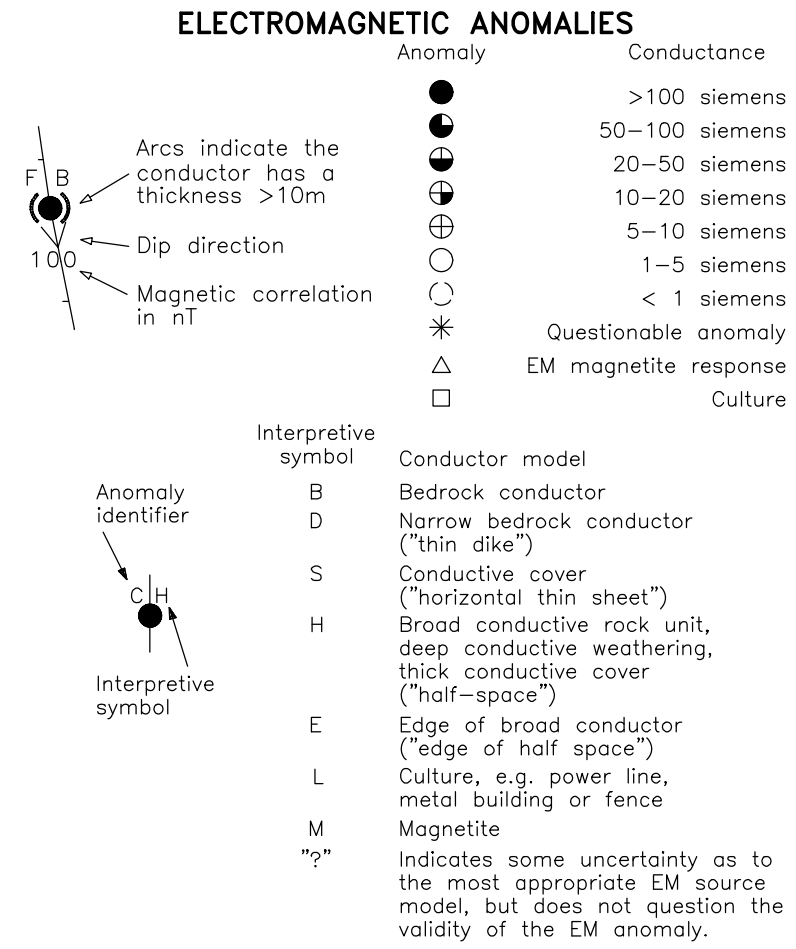
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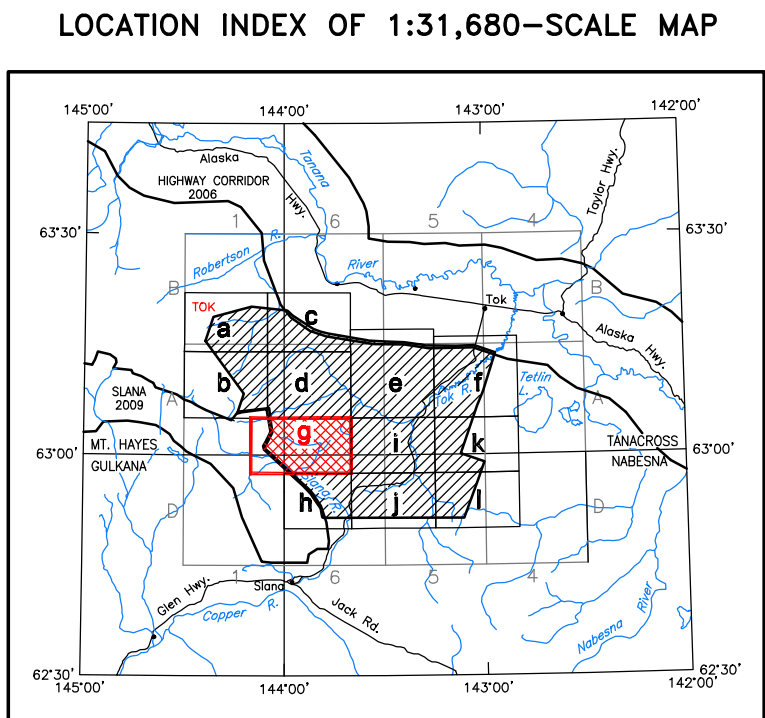
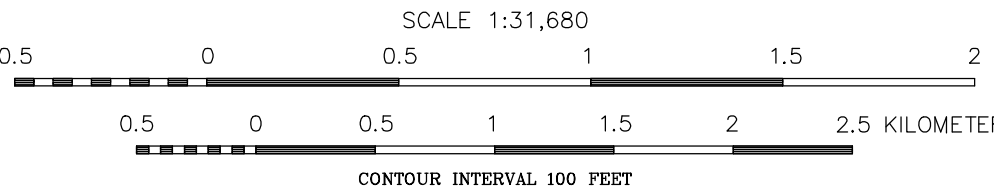
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RESIDUAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF THE TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS of TANACROSS A-6, NABESNA D-6, GULKANA D-1, and MT. HAYES A-1 QUADRANGLES

by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc. 2015



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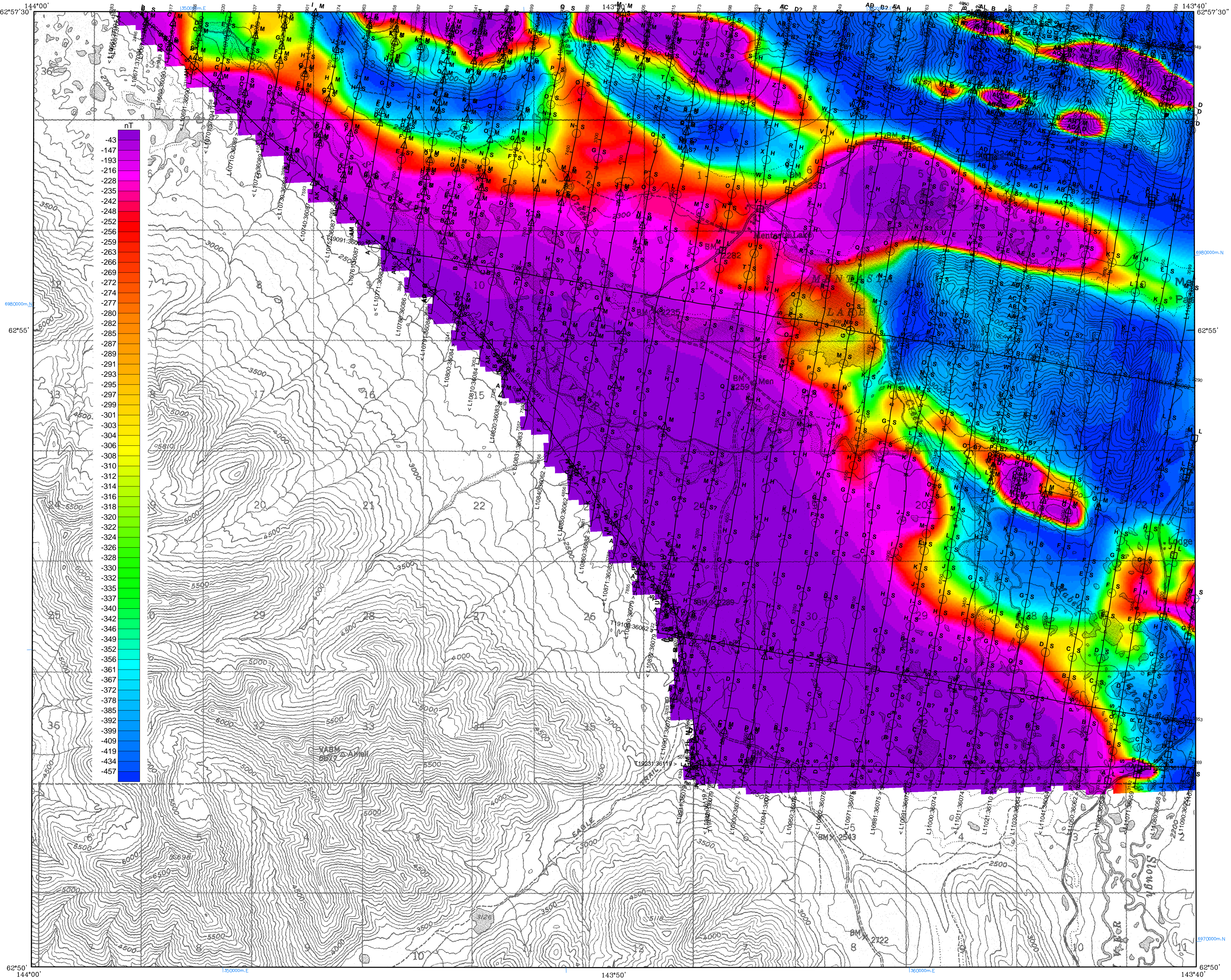
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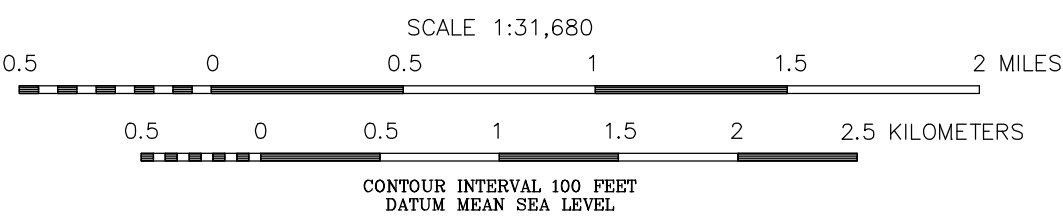
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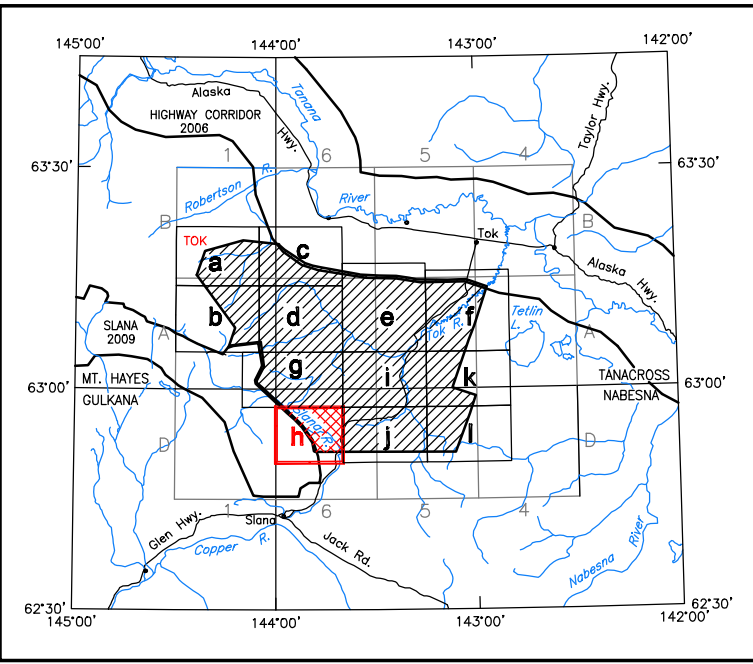
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Base from U.S. Geological Survey Nabesna D-6, 1969; Quadrangle, Alaska



LOCATION INDEX OF 1:31,680-SCALE MAP



RESIDUAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES WITH TOPOGRAPHY OF THE TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PART of NABESNA D-6 QUADRANGLE

by
Abraham M. Emmond, CGG, and CGG Land (U.S.) Inc.
2015

ELECTROMAGNETICS

To determine the location of EM anomalies or their boundaries, the DIGHEM™ 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, 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.

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¹ 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

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DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM™ Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

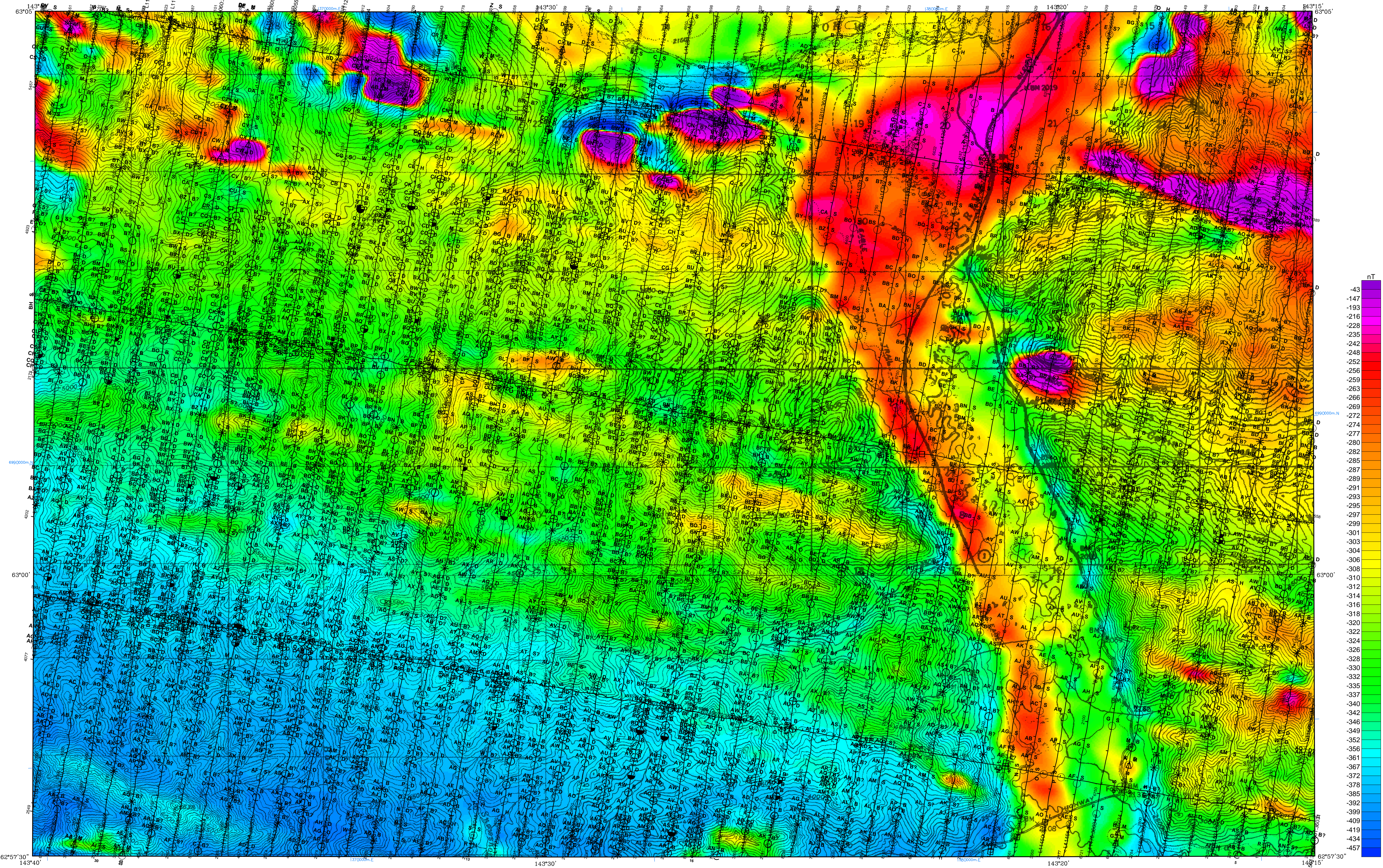
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ELECTROMAGNETIC ANOMALIES

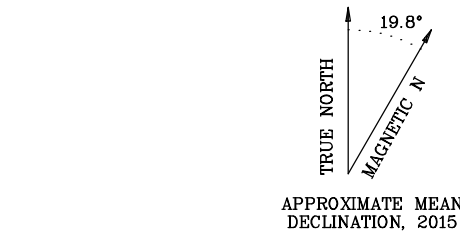
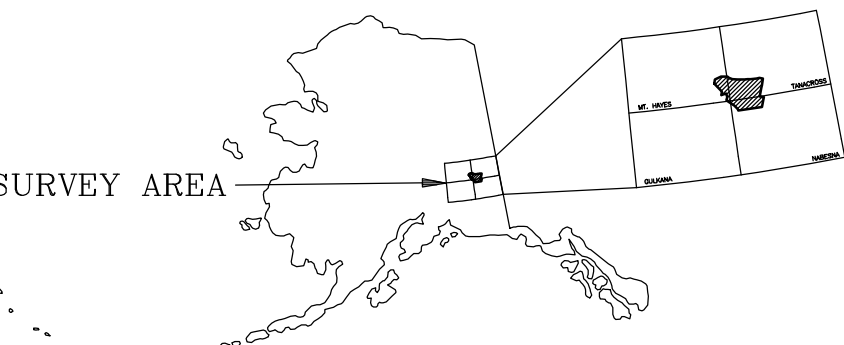
Anomaly	Conductance
●	>100 siemens
●	50-100 siemens
●	20-50 siemens
●	10-20 siemens
●	5-10 siemens
●	1-5 siemens
●	< 1 siemens
*	Questionable anomaly
△	EM magnetic response
□	Culture

Interpretive symbol	Conductor model
B	Bedrock conductor
D	Narrow bedrock conductor ("thin dike")
S	Conductive cover ("horizontal thin sheet")
H	Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half-space")
E	Edge of broad conductor ("edge of half space")
L	Culture, e.g. power line, metal building or fence
M	Magnetite
"?"	Indicates some uncertainty as to the most appropriate EM source model, but does not question the validity of the EM anomaly.

F B	Arcs indicate the conductor has a thickness >10m
100	Dip direction
100	Magnetic correlation in nT
CH	Anomaly identifier
Interpretive symbol	



Base from U.S. Geological Survey Tanacross A-5, 1973; A-6, 1964; Nabesna D-5, 1952; D-6, 1969; Quadrangles, Alaska.

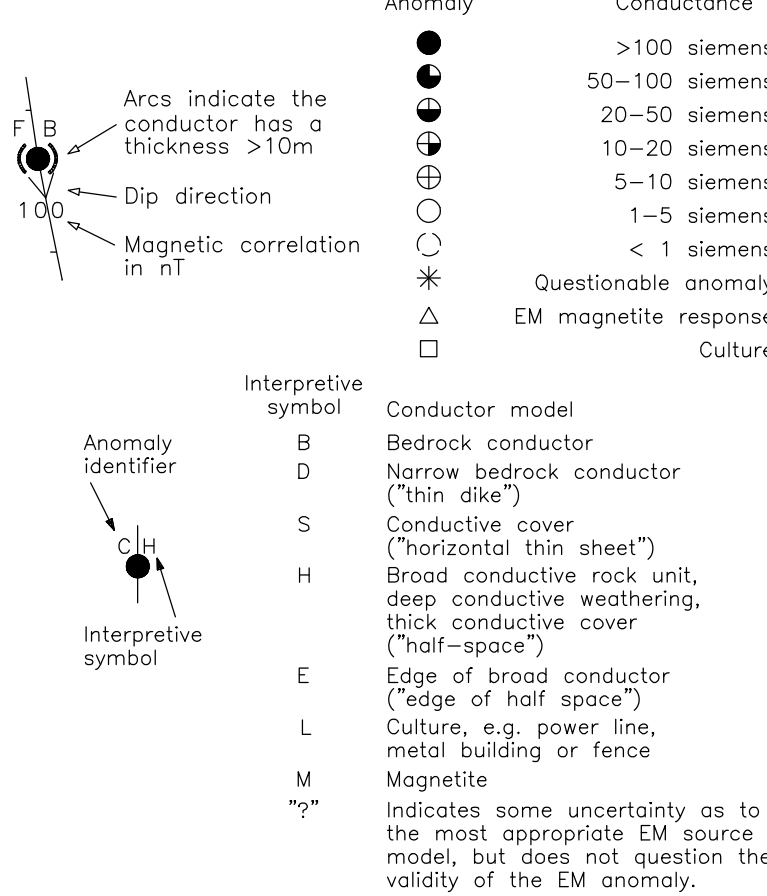


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PARTS of TANACROSS A-5, A-6,
NABESNA D-5, and D-6 QUADRANGLES

by
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2015

ELECTROMAGNETICS

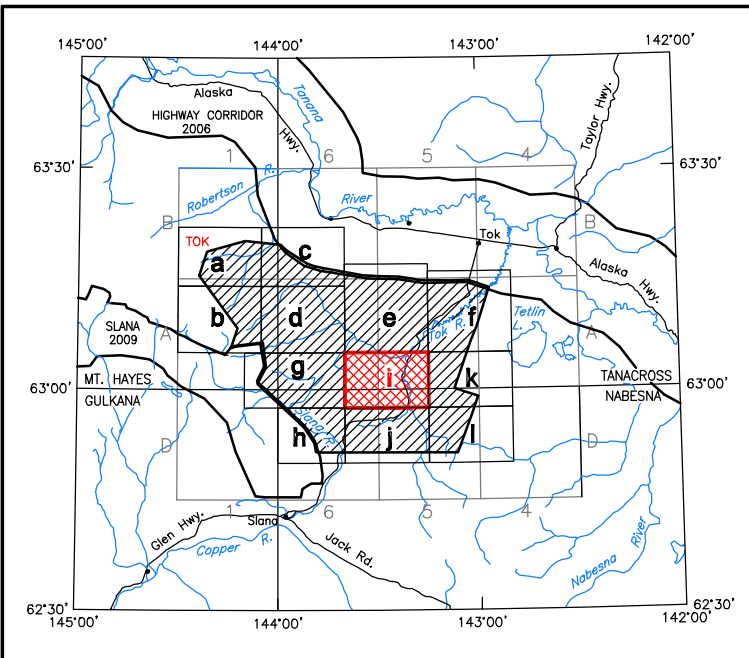
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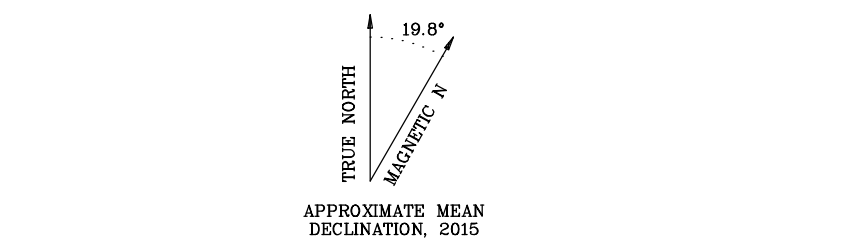
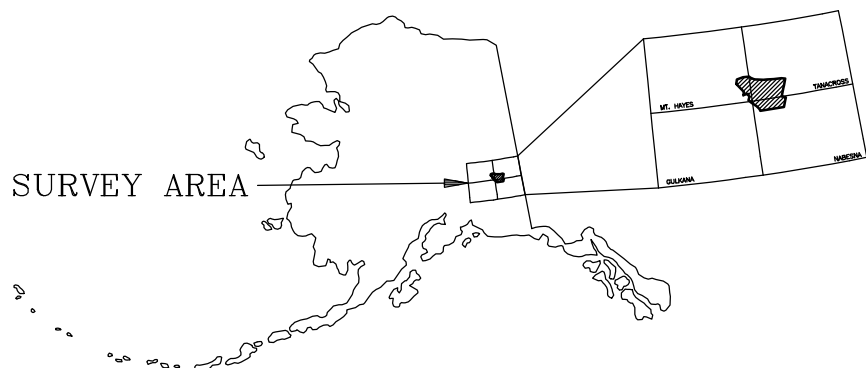
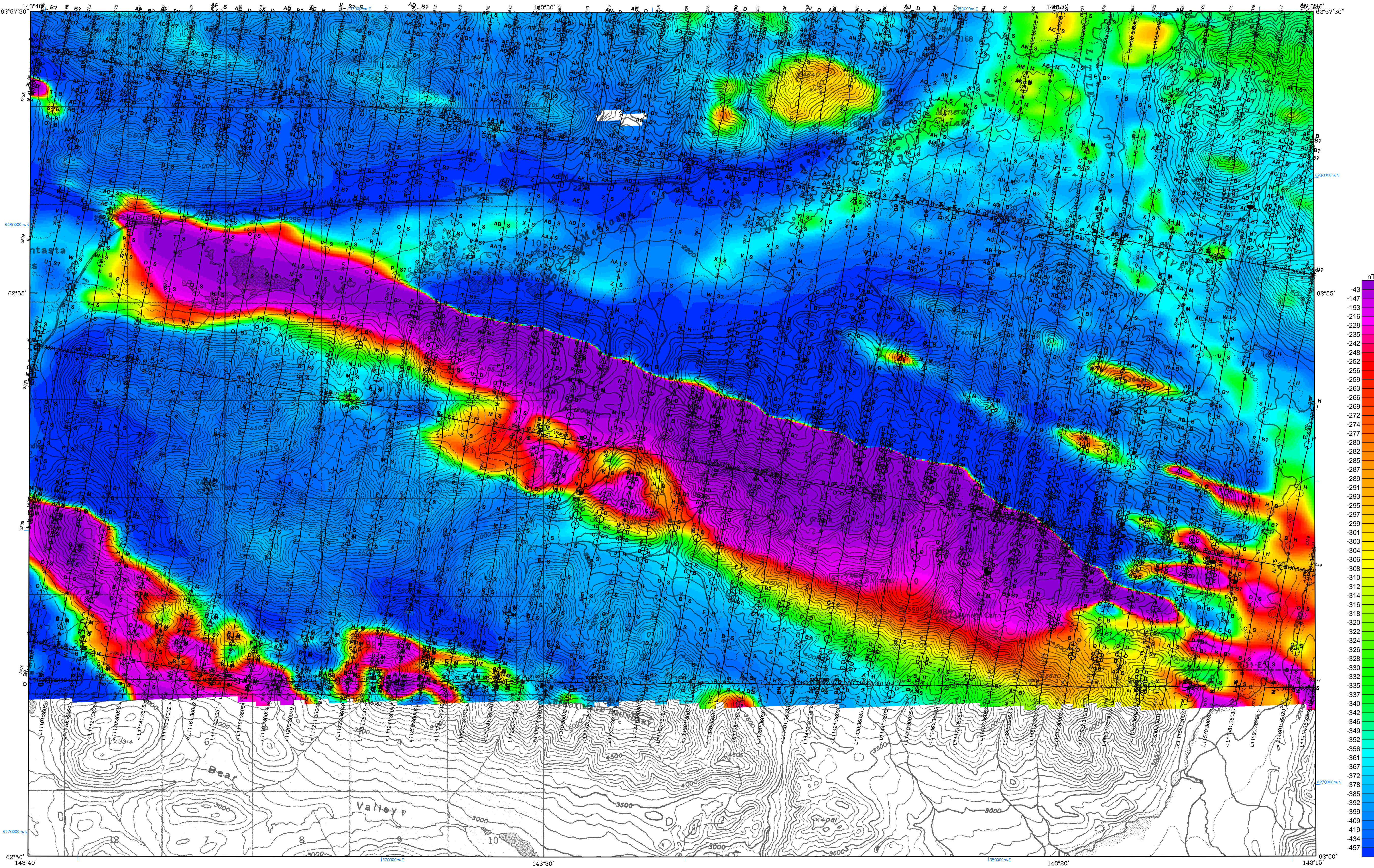
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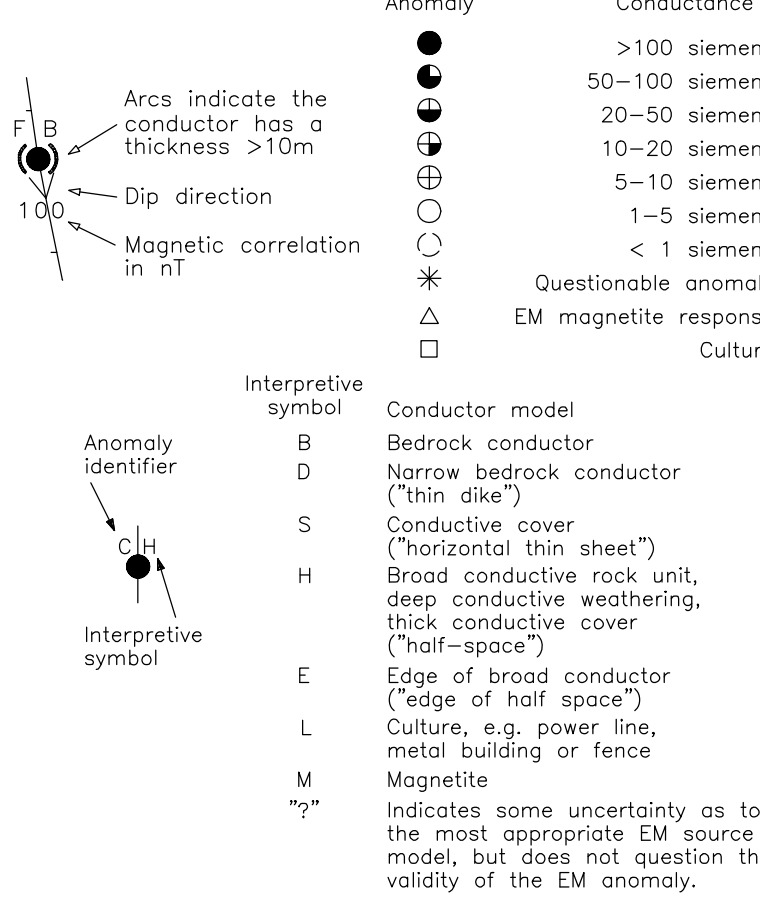


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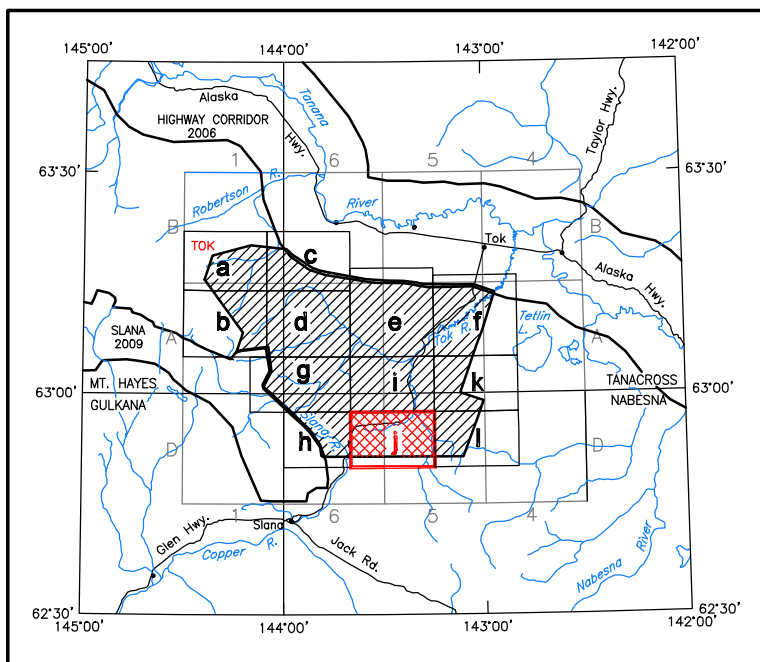
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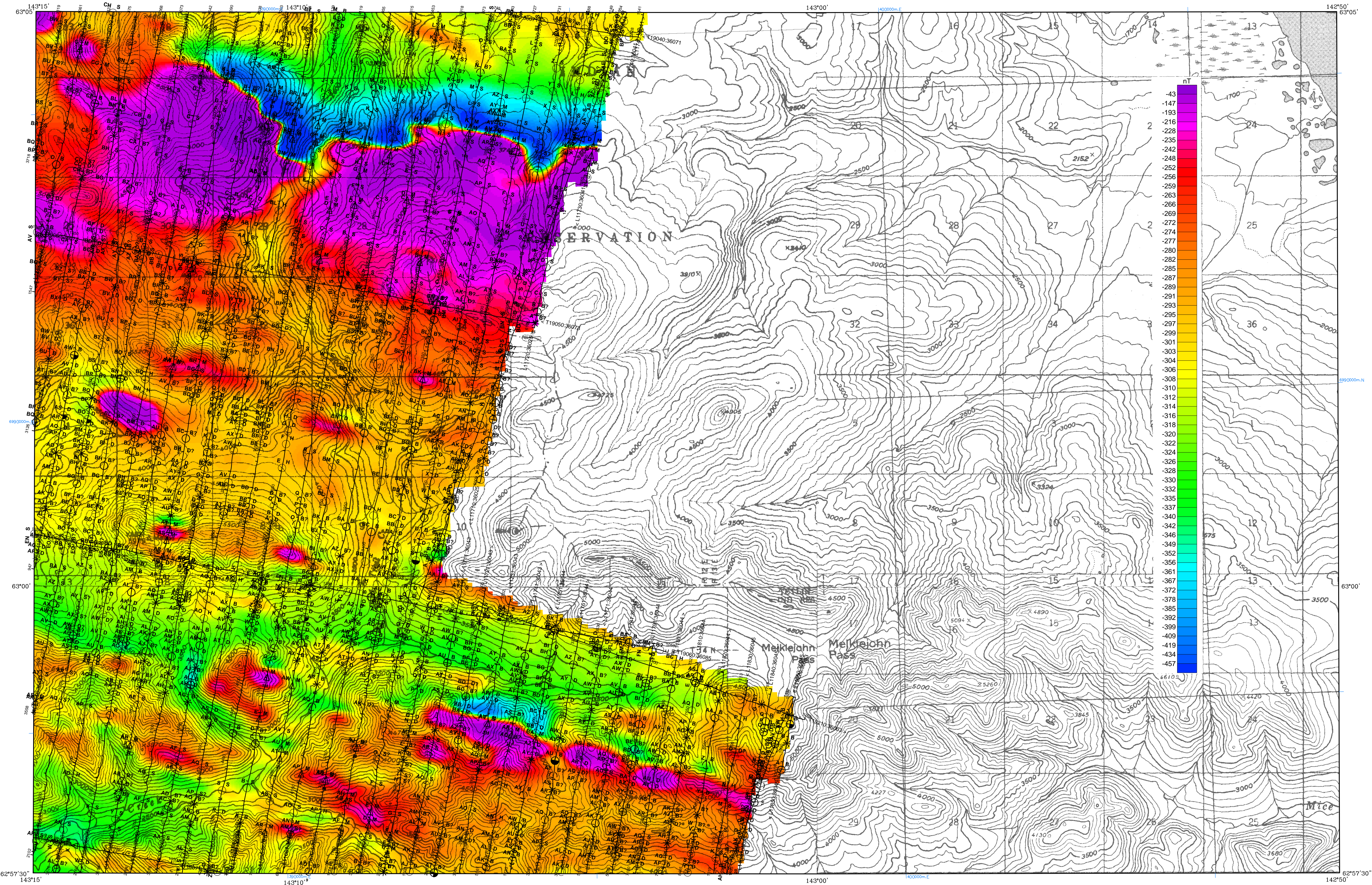
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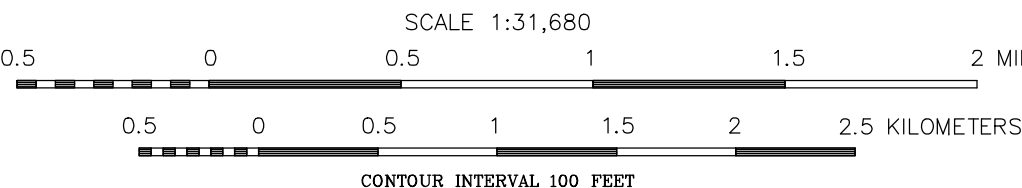
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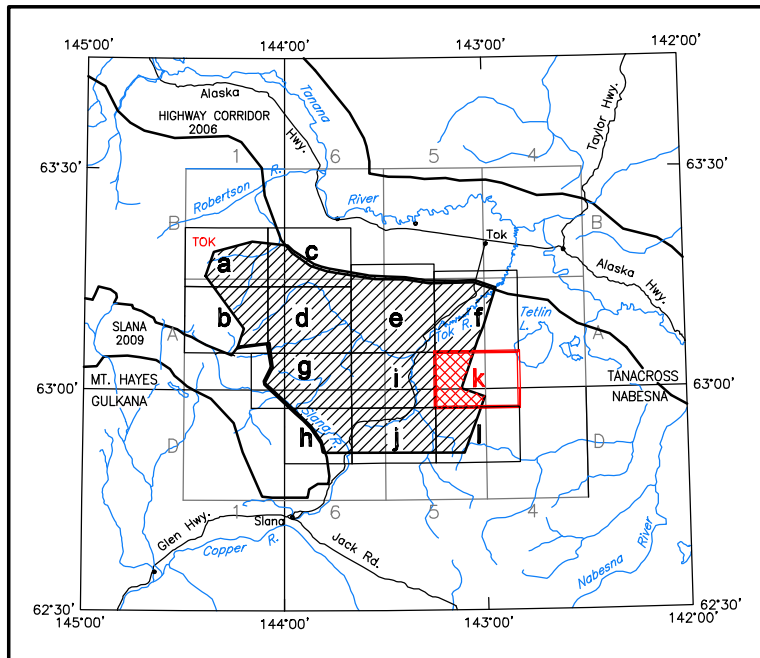
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Base from U.S. Geological Survey Tanacross A-4, 1948; A-5, 1973; Nabesna D-4, 1954; D-5, 1952; Quadrangles, Alaska



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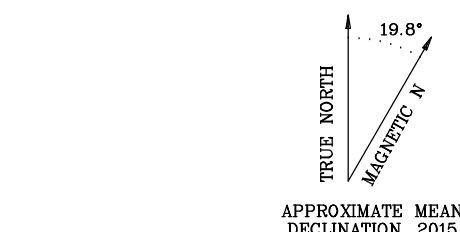
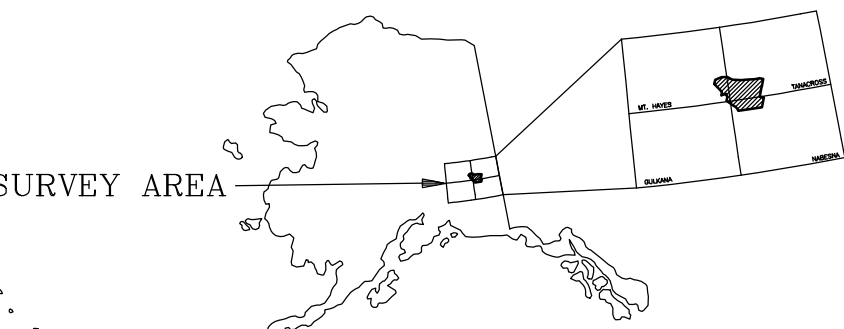
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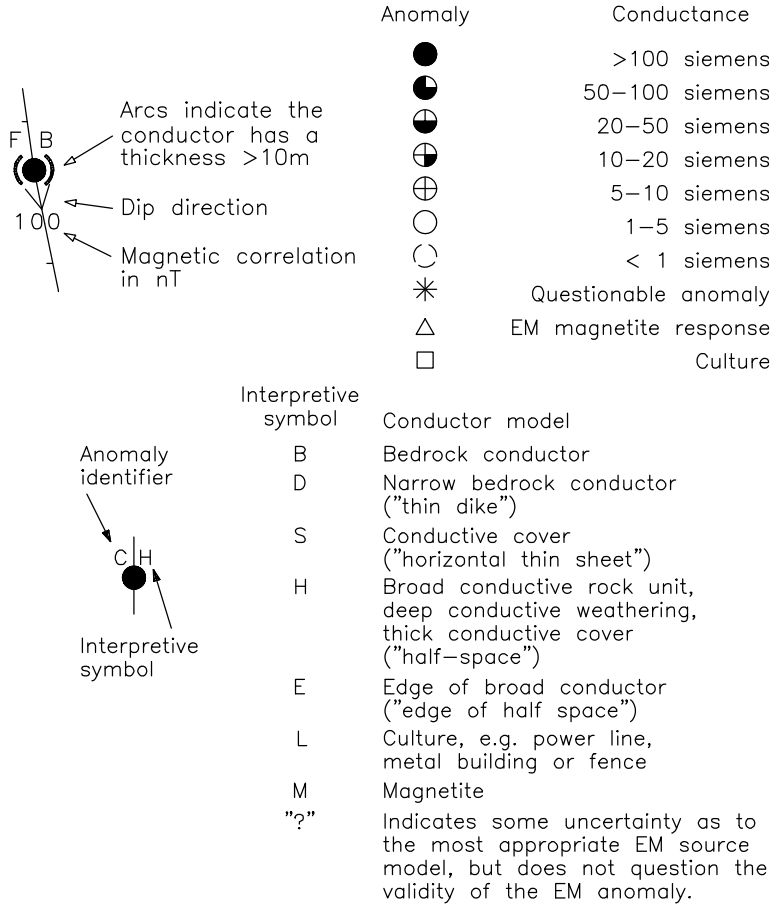


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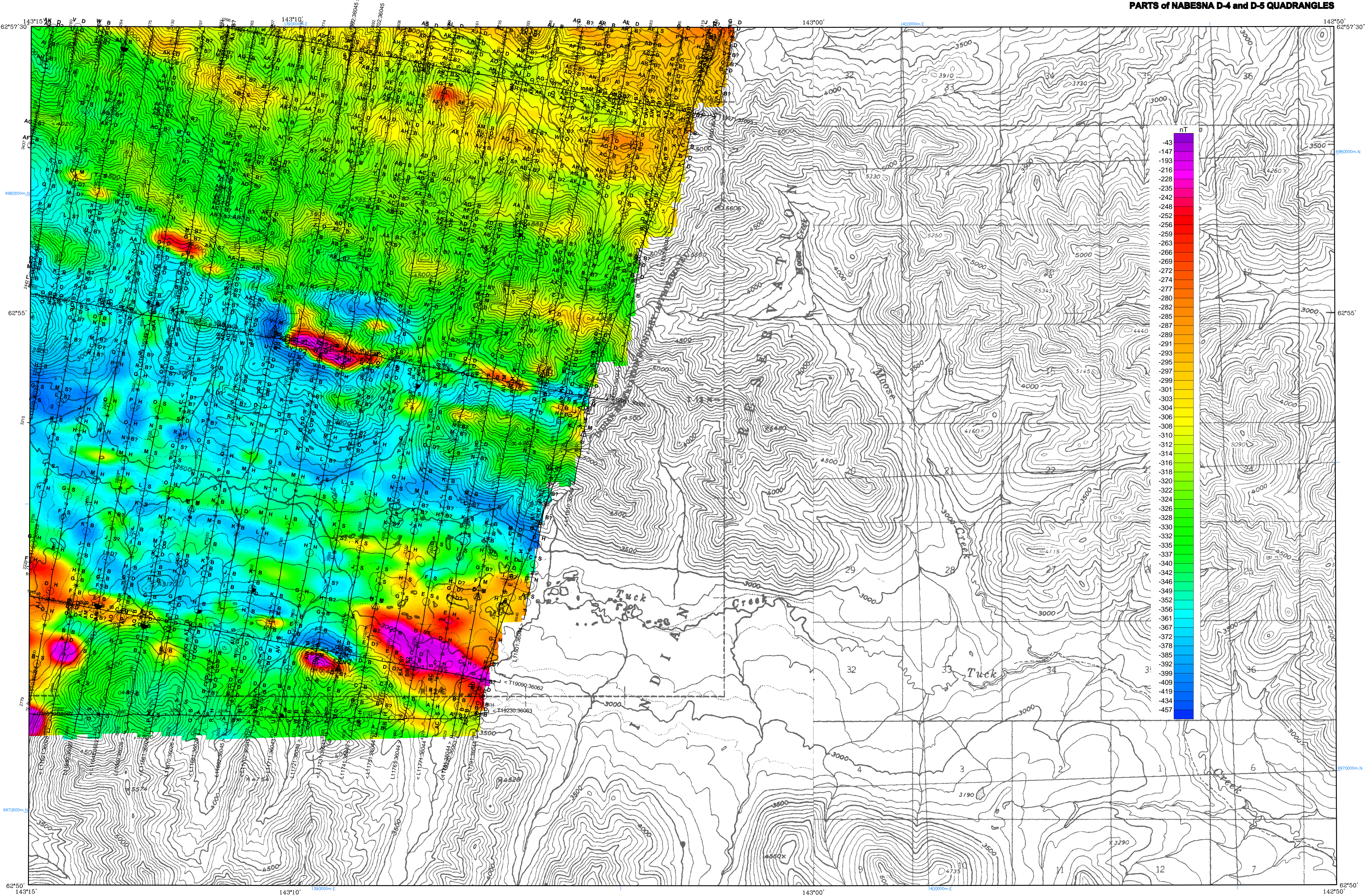
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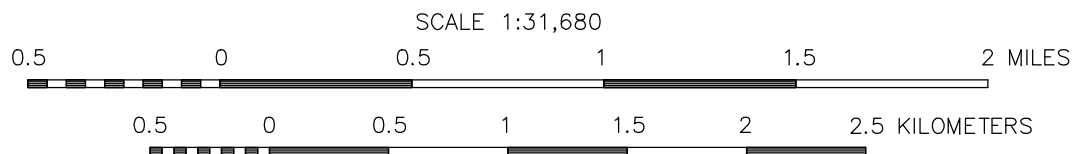


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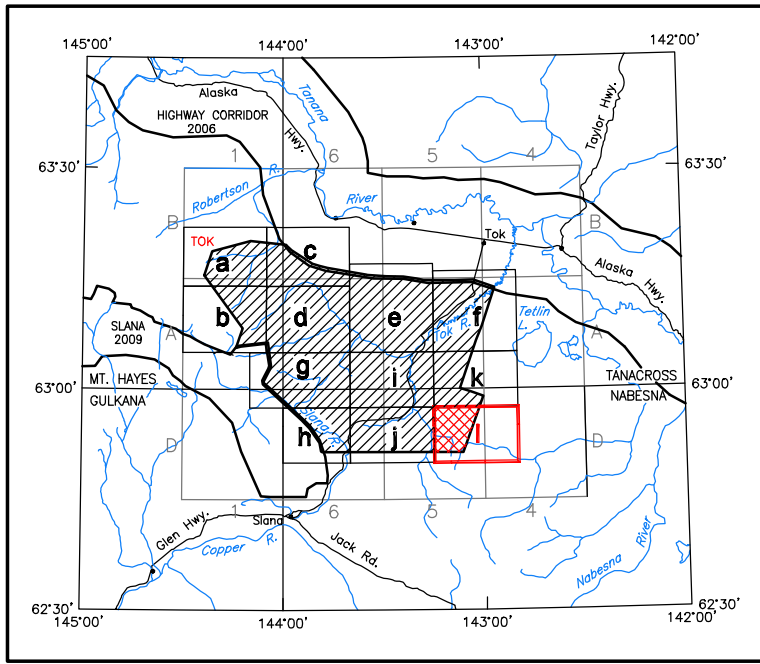


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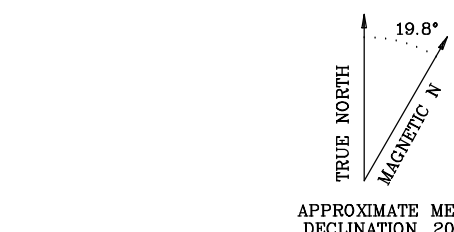
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SURVEY AREA

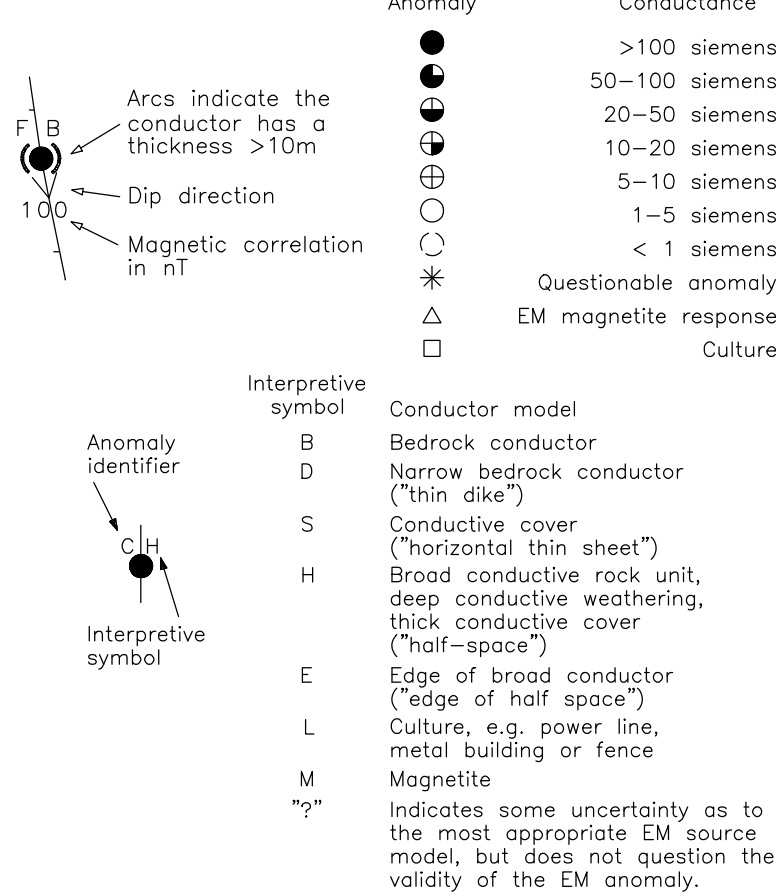


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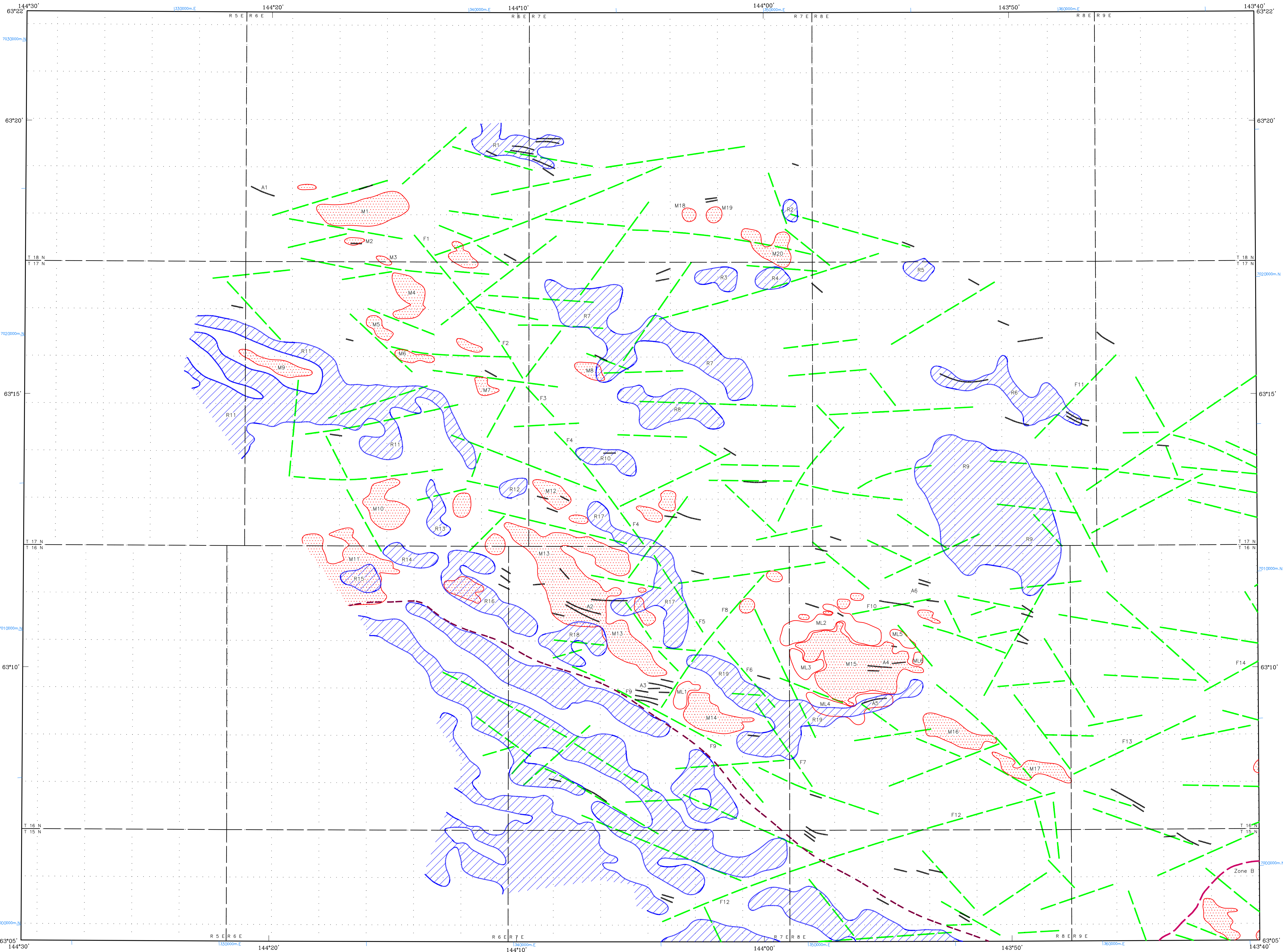
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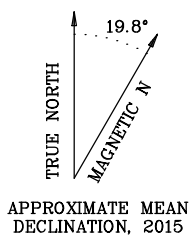
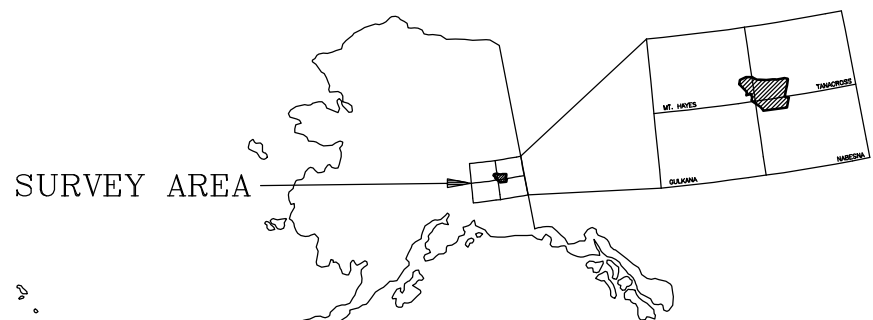
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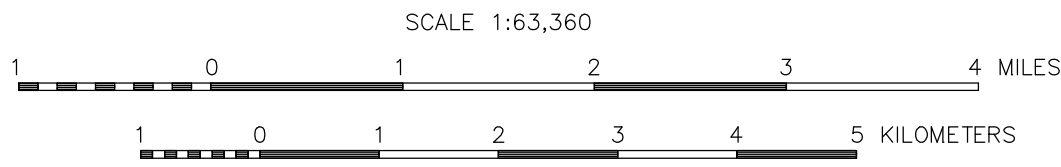
Section outlines from U.S. Geological Survey Mt. Hayes A-1, 1976; B-1, 1982; Tanacross A-6, 1984; B-6, 1970; Quadrangles, Alaska



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INTERPRETATION MAP,
TOK SURVEY AREA,
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PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
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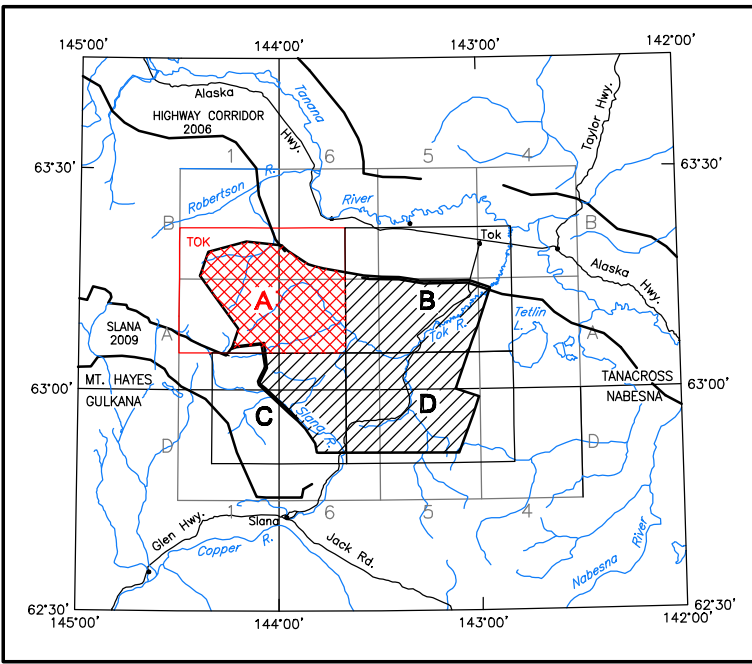
Interpretation by CGG
2015

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

LEGEND

- F1 Inferred Structural Break
- A1 EM Conductor, or group of EM Conductors
- Possible Folded Unit
- Highly conductive zone boundary associated with a geologic unit
- Magnetic Zone
- M1 Magnetic Low
- R1 Highly Conductive Zone
- Zone A Approximate outline of broad magnetic zone defined by a change in magnetic texture

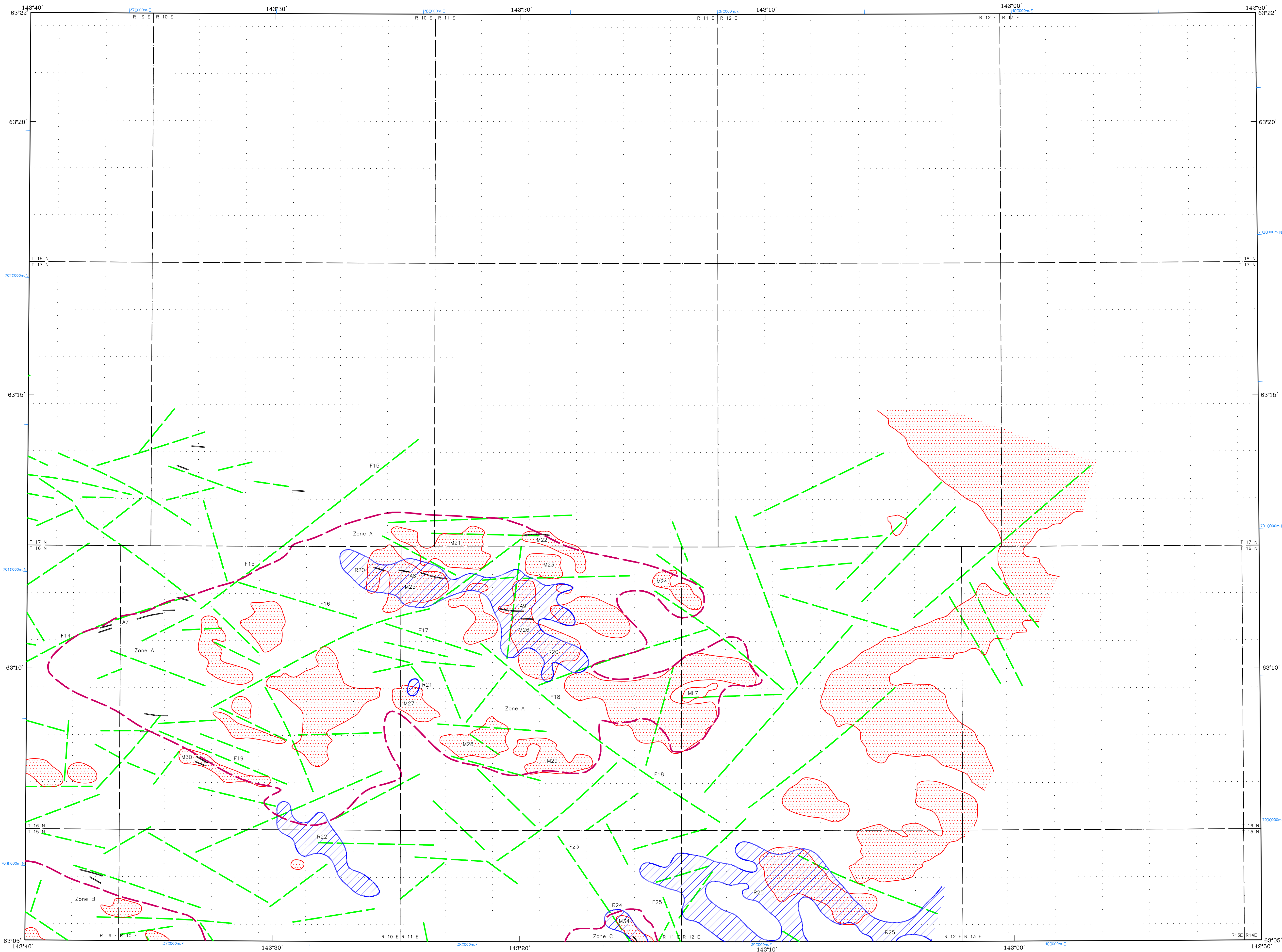
LOCATION INDEX OF 1:63,360-SCALE MAP



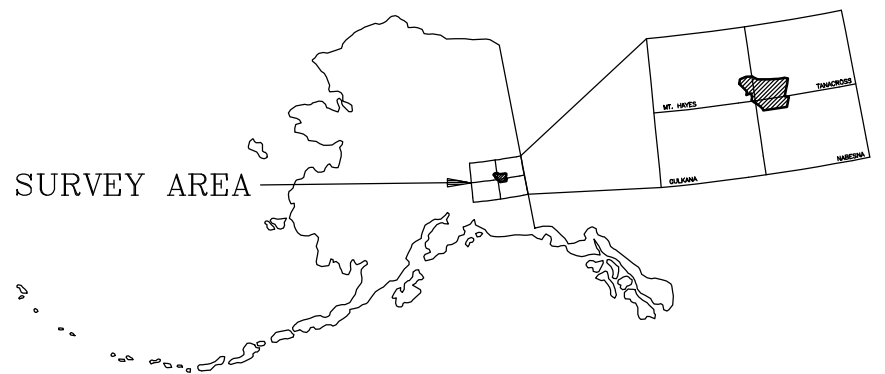
SURVEY HISTORY

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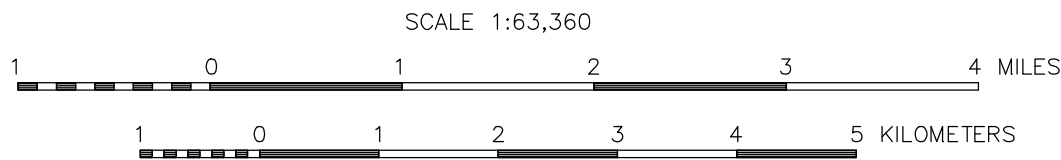
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Section outlines from U.S. Geological Survey Tanacross A-4, 1948; A-5, 1973; A-6, 1964; B-4, 1949; B-5, 1994; B-6, 1970; Quadrangles, Alaska



TRUE NORTH
MAGNETIC N
APPROXIMATE MEAN DECLINATION, 2015



INTERPRETATION MAP, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

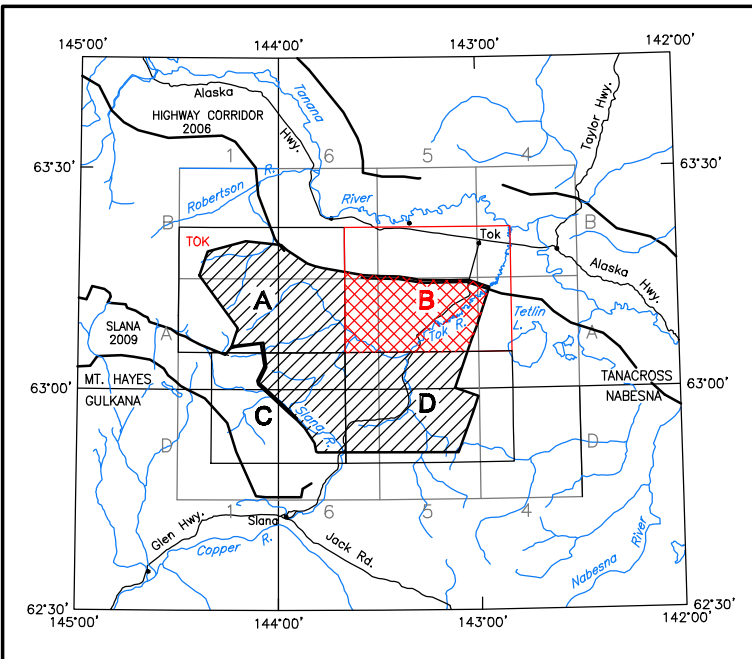
Interpretation by CGG
2015

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

LEGEND

- F1 Inferred Structural Break
- A1 EM Conductor, or group of EM Conductors
- Possible Folded Unit
- Highly conductive zone boundary associated with a geologic unit
- M1 Magnetic Zone
- ML1 Magnetic Low
- R1 Highly Conductive Zone
- Zone A Approximate outline of broad magnetic zone defined by a change in magnetic texture

LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

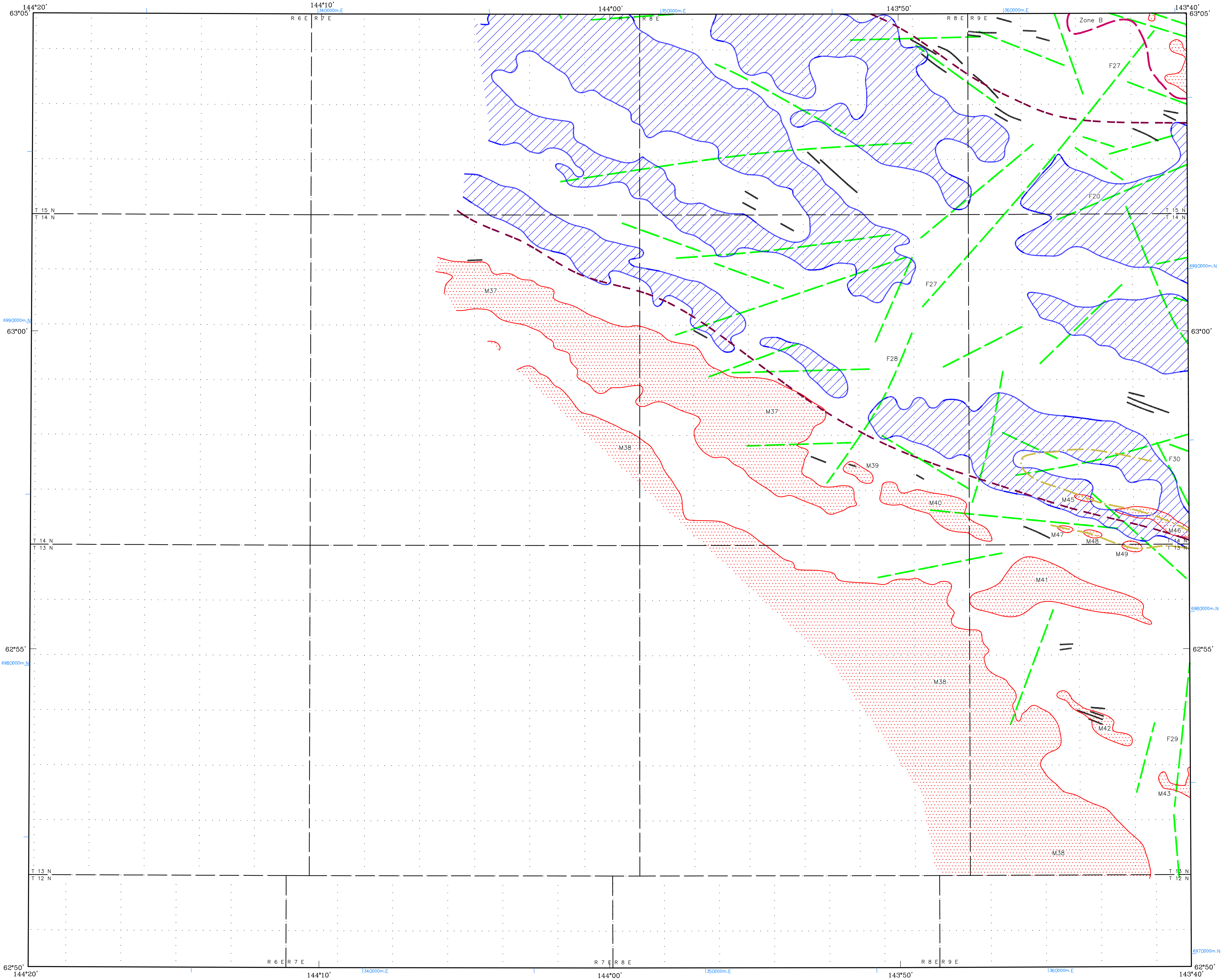
This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGs), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

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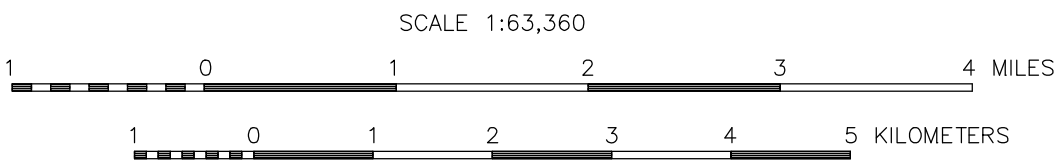
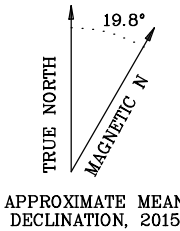
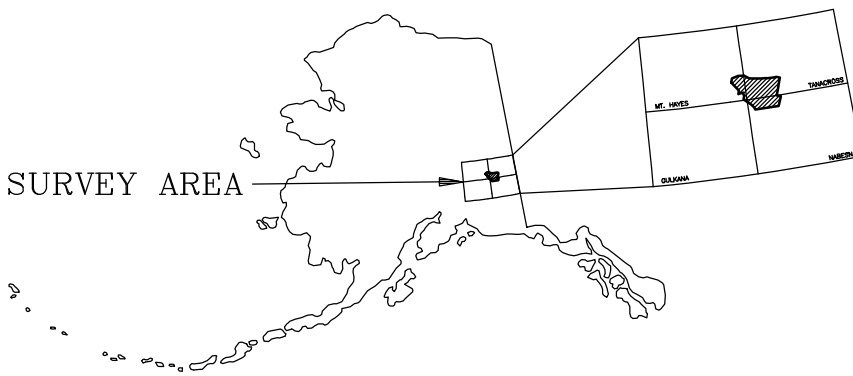
DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM V Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. The lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.



Section outlines from U.S. Geological Survey Tanacross A-6, 1964; Nabesna D-6, 1969; Gulkana D-1, 1978; Mt. Hayes A-1, 1975; Quadrangles, Alaska



INTERPETATION MAP, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES, AND GULKANA QUADRANGLES

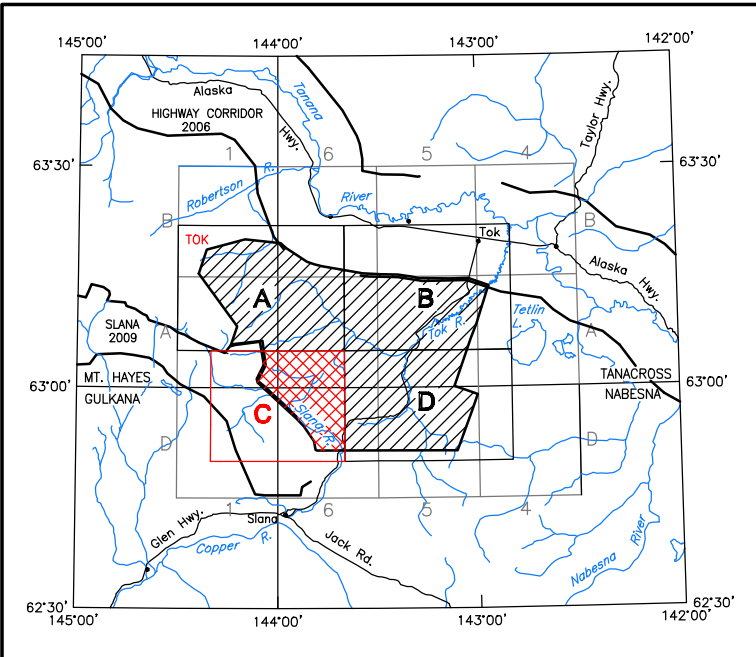
Interpretation by CGG
2015

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LEGEND

- F1 Inferred Structural Break
- A1 EM Conductor, or group of EM Conductors
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- Magnetic Zone
- Magnetic Low
- Highly Conductive Zone
- Approximate outline of broad magnetic zone defined by a change in magnetic texture

LOCATION INDEX OF 1:63,360—SCALE MAP



DESCRIPTIVE NOTES

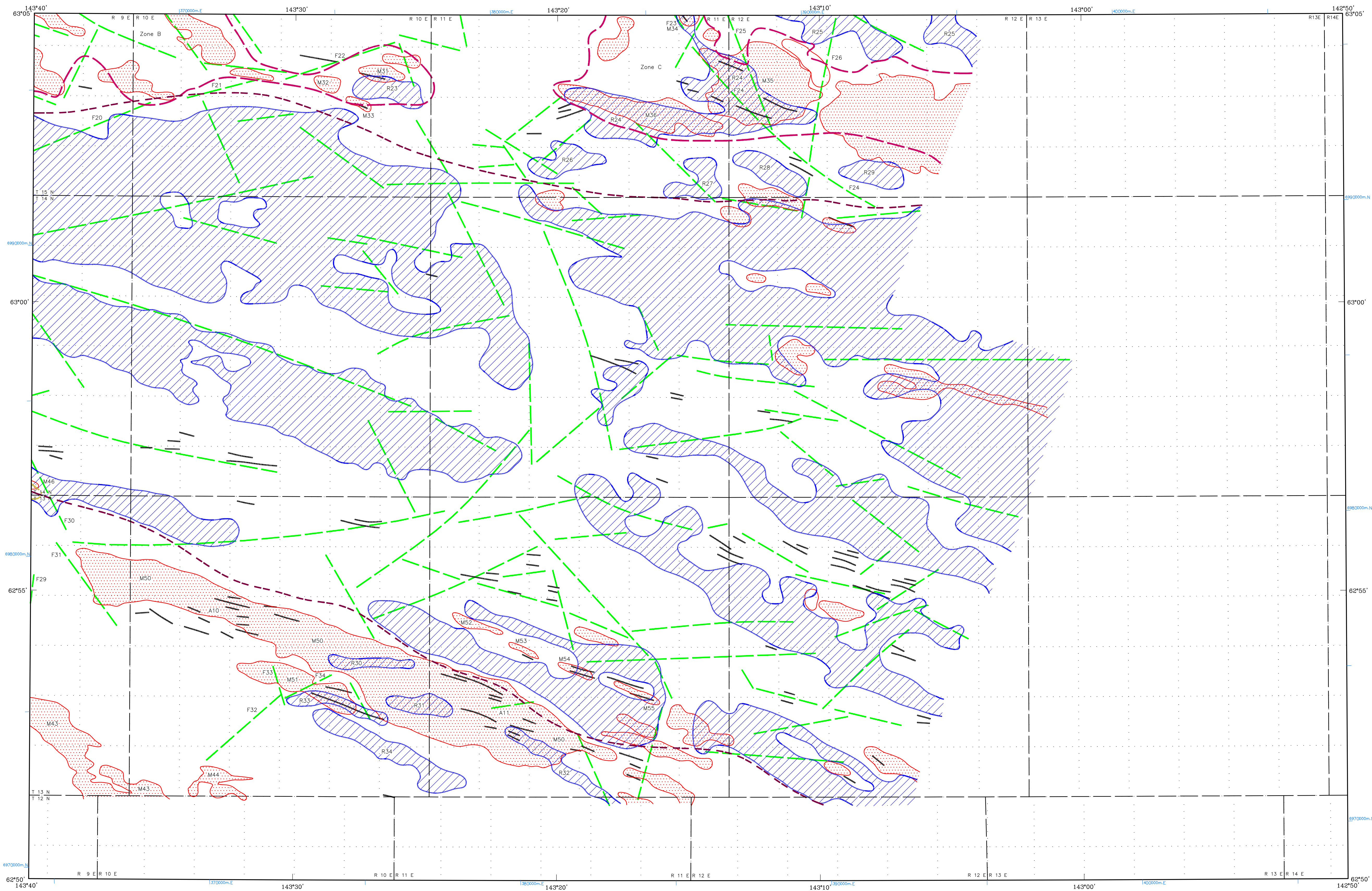
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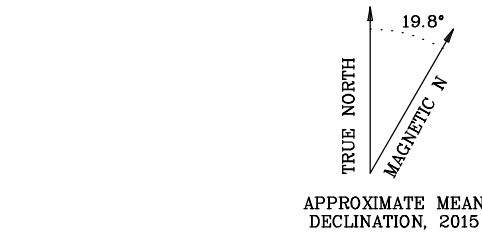
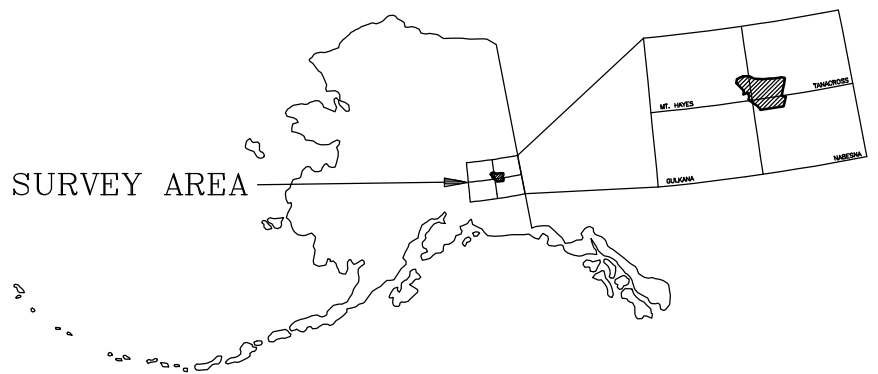
SURVEY HISTORY

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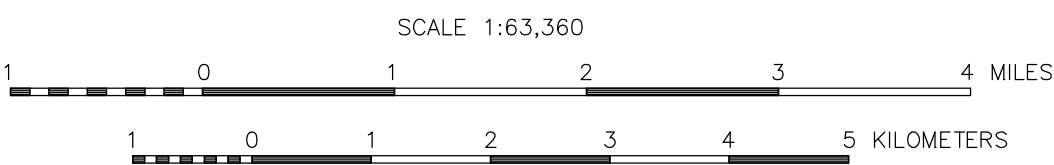
Section outlines from U.S. Geological Survey Tanacross A-4, 1948; A-5, 1973; A-6, 1964; Nabesna D-4, 1954; D-5, 1952; D-6, 1969; Quadrangles, Alaska



DESCRIPTIVE NOTES

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INTERPRETATION MAP,
TOK SURVEY AREA,
EASTERN INTERIOR ALASKA
PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

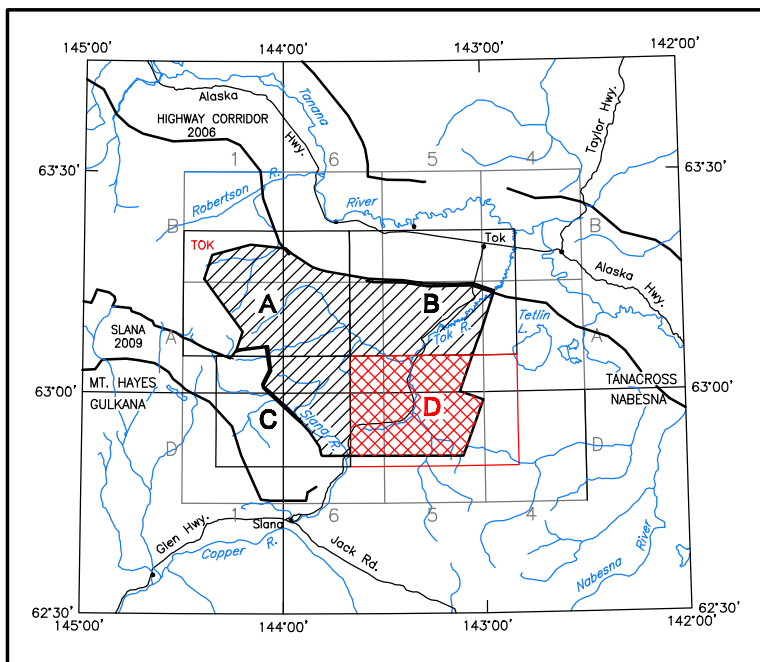
Interpretation by CGG
2015

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

LEGEND

- F1 Inferred Structural Break
- A1 EM Conductor, or group of EM Conductors
- Possible Folded Unit
- Highly conductive zone boundary associated with a geologic unit
- Magnetic Zone
- M1 Magnetic Low
- ML1 Magnetic Low
- R1 Highly Conductive Zone
- Zone A Approximate outline of broad magnetic zone defined by a change in magnetic texture

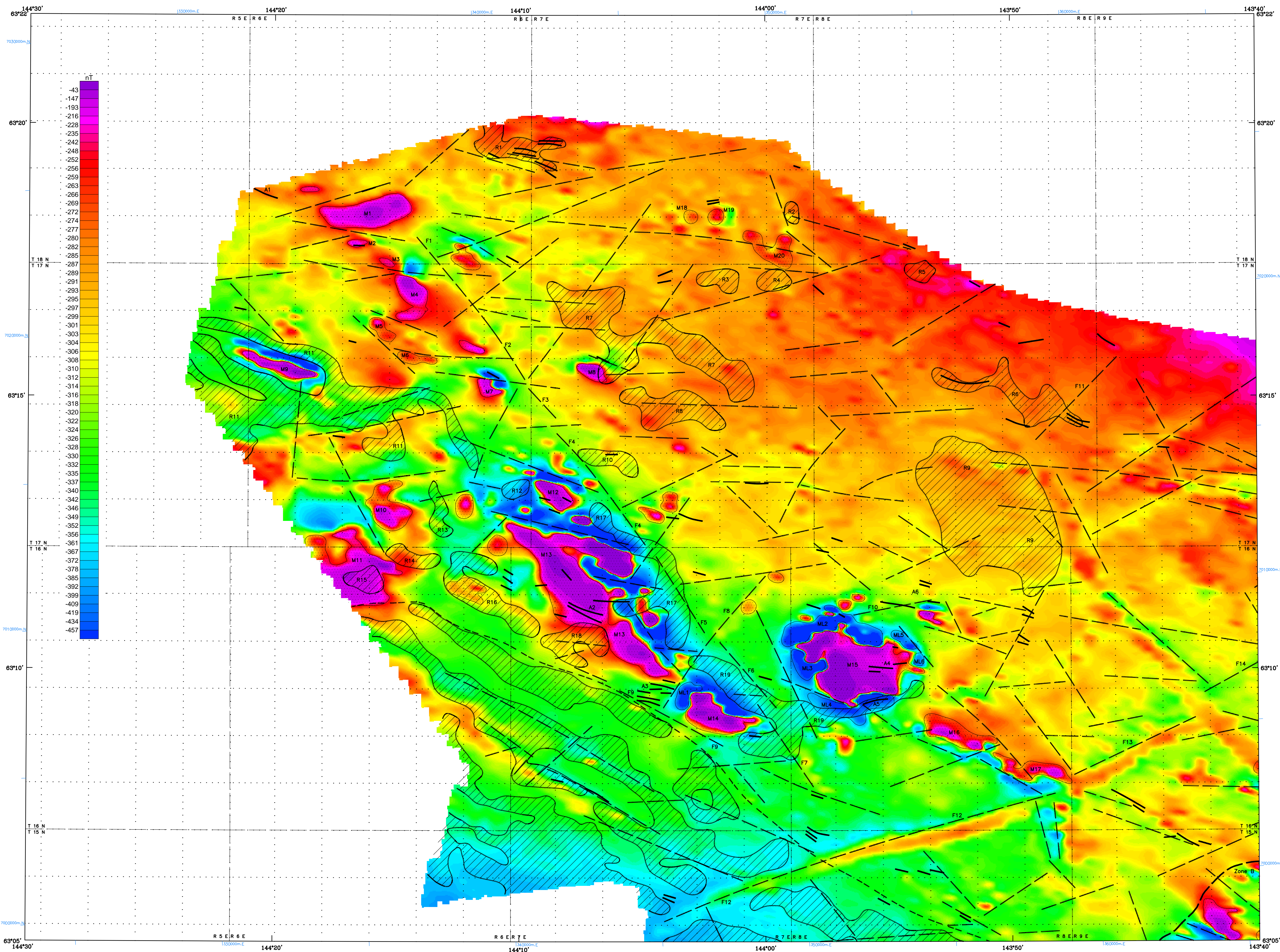
LOCATION INDEX OF 1:63,360-SCALE MAP



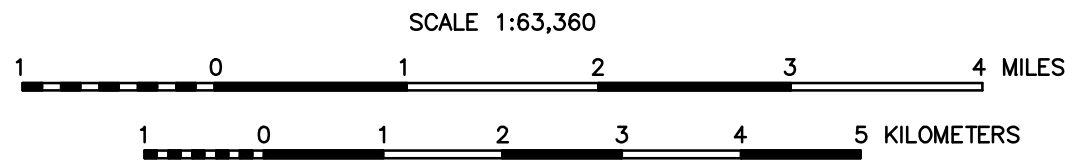
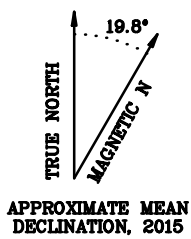
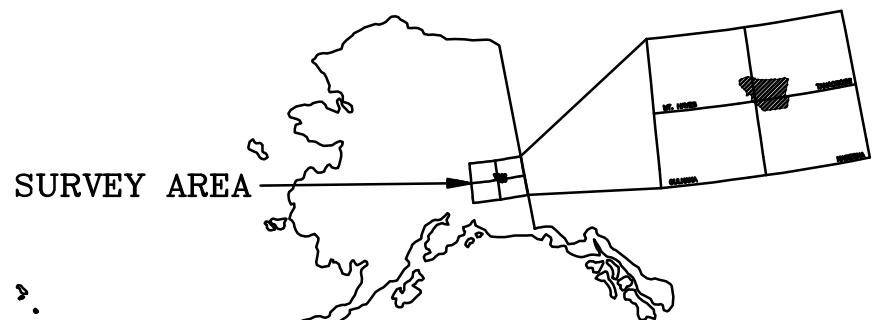
SURVEY HISTORY

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Section outlines from U.S. Geological Survey Mt. Hayes A-1, 1976; B-1, 1982; Tanacross A-6, 1984; B-6, 1970; Quadrangle, Alaska.



INTERPRETATION MAP WITH RESIDUAL MAGNETIC FIELD, TOK SURVEY AREA, EASTERN INTERIOR ALASKA PARTS OF THE TANACROSS, NABESNA, MT. HAYES, AND GULKANA QUADRANGLES

Interpretation by CCG
2015

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

RESIDUAL MAGNETIC FIELD

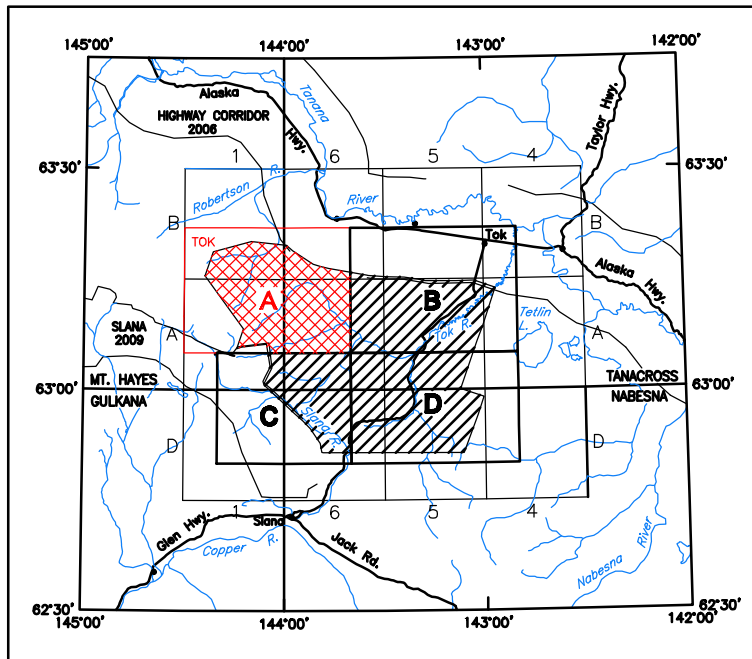
The magnetic total field data were processed using digitally recorded data from a CCG D1344 magnetometer with a Scintrex CS3 cesium sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2010, 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. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

¹ 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.

LEGEND

- F1
A1
Possible Folded Unit
Highly conductive zone boundary associated with a geologic unit
- M1
ML1
R1
Zone A
- Inferred Structural Break
EM Conductor, or group of EM Conductors
Magnetic Zone
Magnetic Low
Highly Conductive Zone

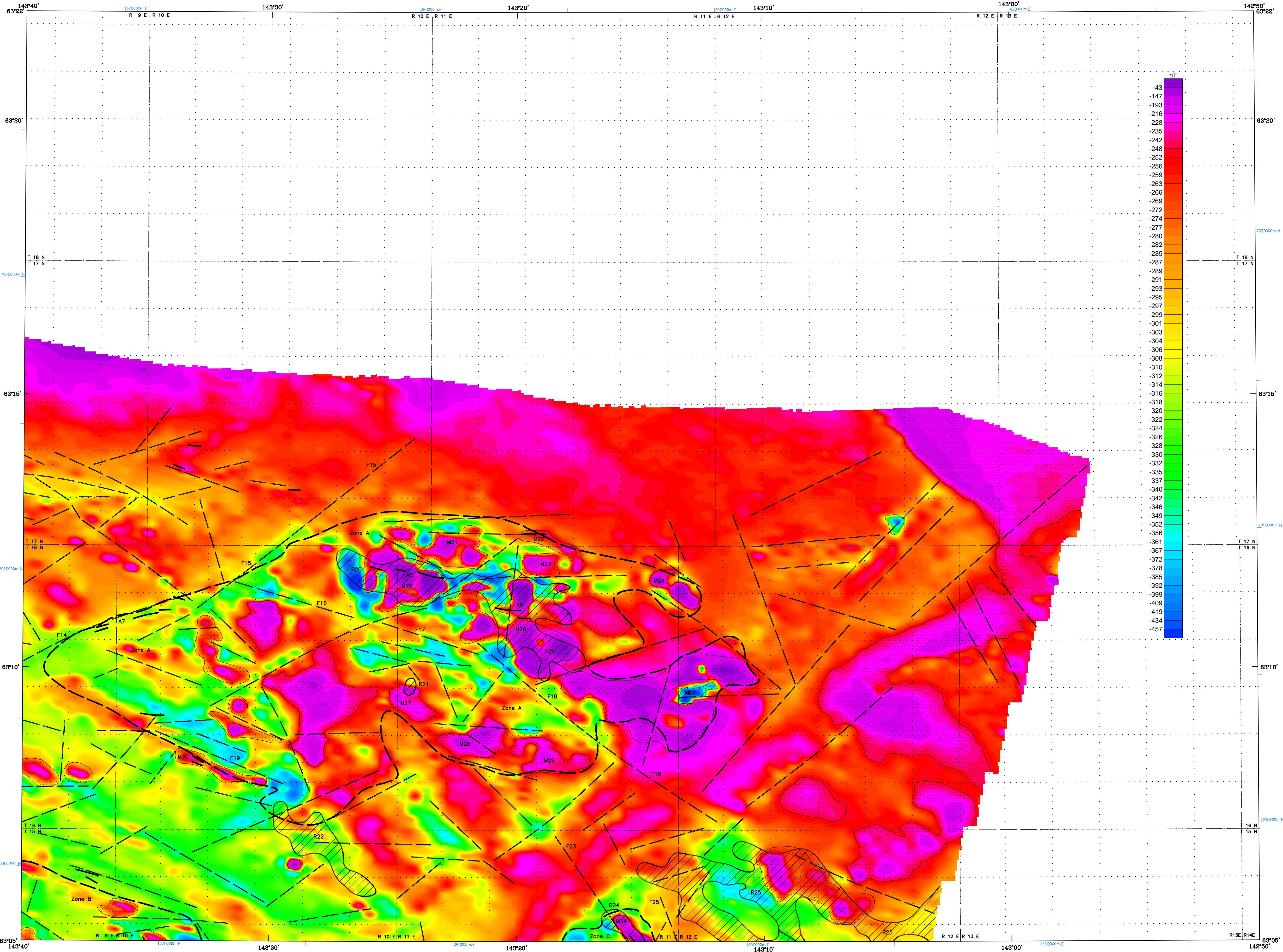
LOCATION INDEX OF 1:63,360-SCALE MAP



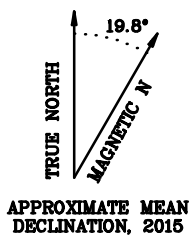
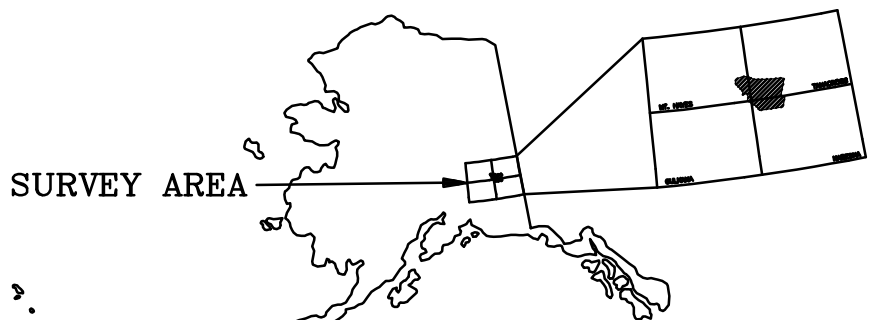
SURVEY HISTORY

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Section outlines from U.S. Geological Survey Tanacross A-4, 1946; A-5, 1972; A-6, 1964; B-4, 1946; B-5, 1964; B-6, 1970; Quadrangles, Alaska



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a CGG D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 30 meters (m). In addition the survey recorded data from radar and laser altimeters, a GPS navigation system, 50/60 Hz monitors, and video camera. Flights were performed with an AS-350-B3 Squirrel helicopter at a mean terrain clearance of 60 m along NE-SW (012°) survey flight lines with a spacing of 400 m. Tie lines were flown perpendicular to the flight lines at intervals of approximately 4,800 m.

A Novatel OEM5-G2L 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 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

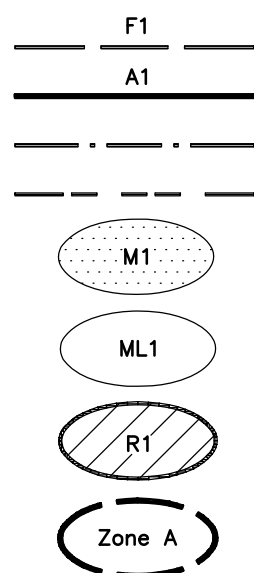
RESIDUAL MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a CGG D1344 magnetometer with a Scintrex CS3 cesium 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) ISRF corrected (ISRF model 2010, 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)¹ technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

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Interpretation by CGG
2015

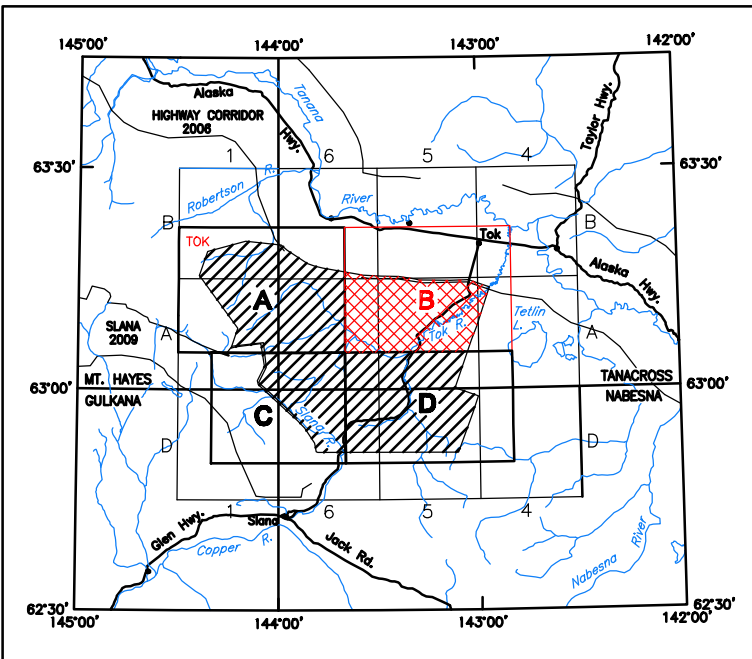
The interpretation is based on the geophysical parameters with reference to geological maps, which were supplied by the State of Alaska.



LEGEND

Inferred Structural Break
EM Conductor, or group of EM Conductors
Possible Folded Unit
Highly conductive zone boundary associated with a geologic unit
Magnetic Zone
Magnetic Low
Highly Conductive Zone
Approximate outline of broad magnetic zone defined by a change in magnetic texture

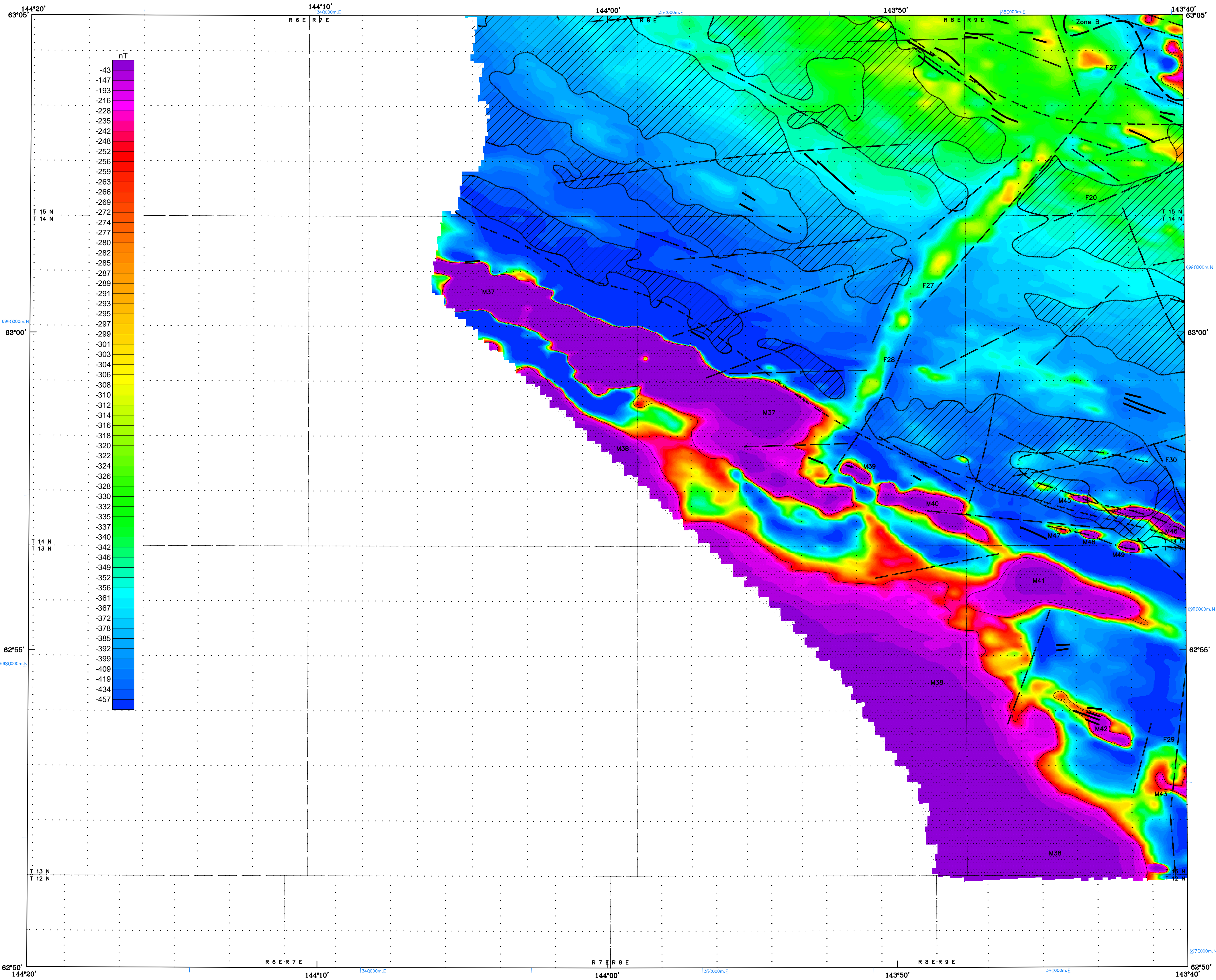
LOCATION INDEX OF 1:63,360-SCALE MAP



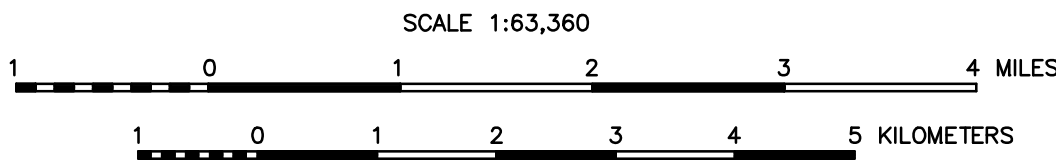
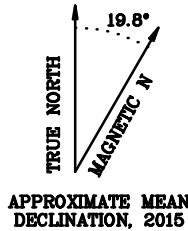
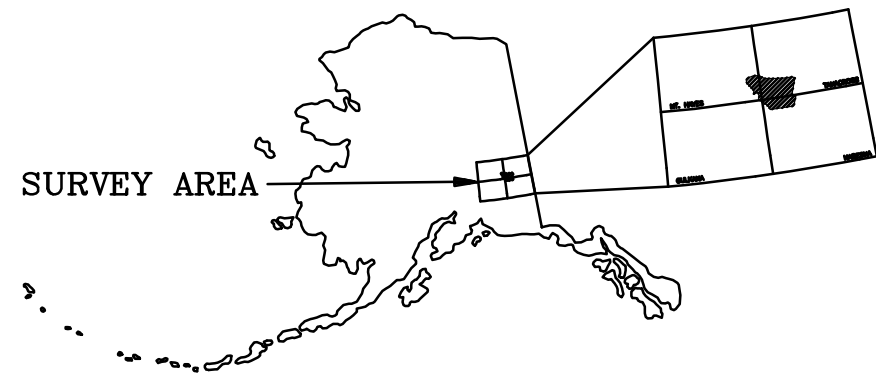
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Section outlines from U.S. Geological Survey Tanacross A-6, 1964; Nabesna D-6, 1969; Gulkana D-1, 1978; Mt. Hayes A-1, 1976; Quadrangles, Alaska



INTERPETATION MAP WITH RESIDUAL MAGNETIC FIELD, TOK SURVEY AREA, EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

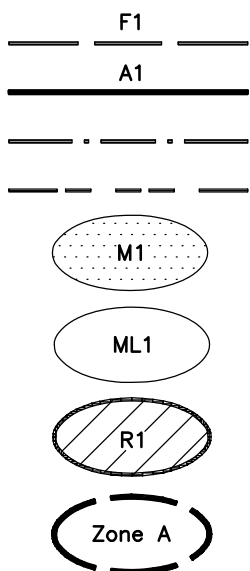
Interpretation by CGG
2015

RESIDUAL MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a CGG D1344 magnetometer with a Scintrex CS3 cesium 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 2010, 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 (1970¹) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

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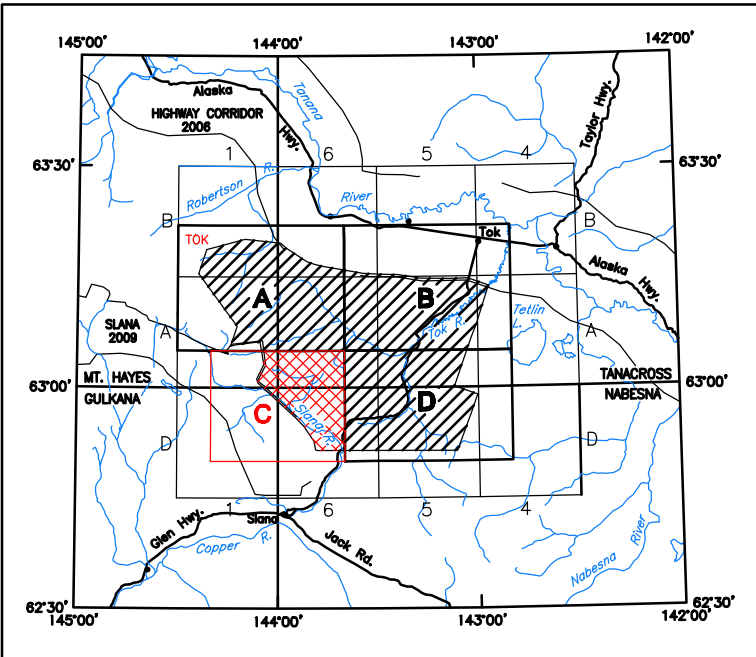
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LEGEND

- Inferred Structural Break
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- Magnetic Low
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LOCATION INDEX OF 1:63,360-SCALE MAP



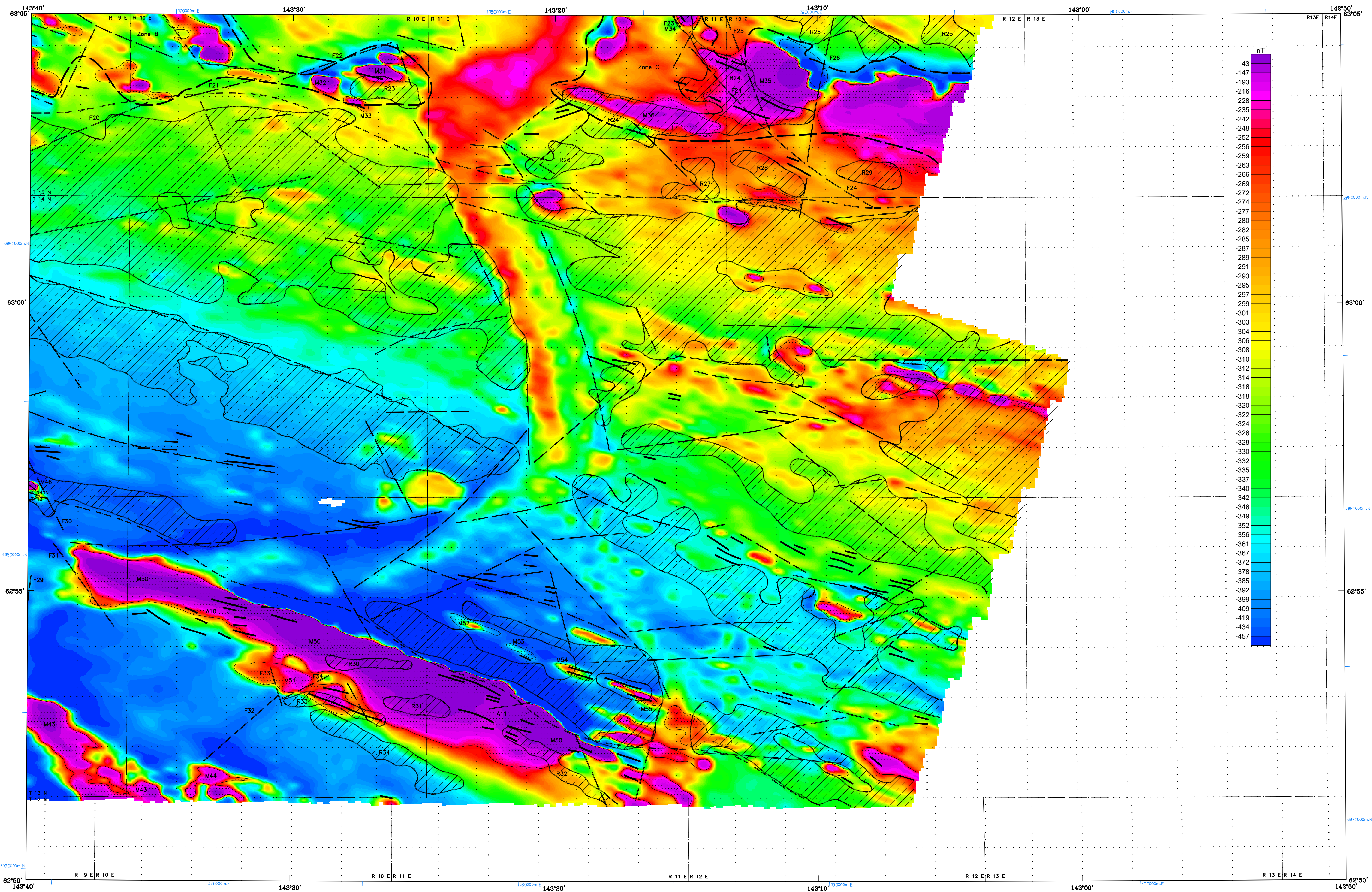
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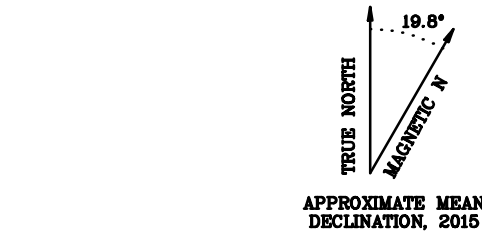
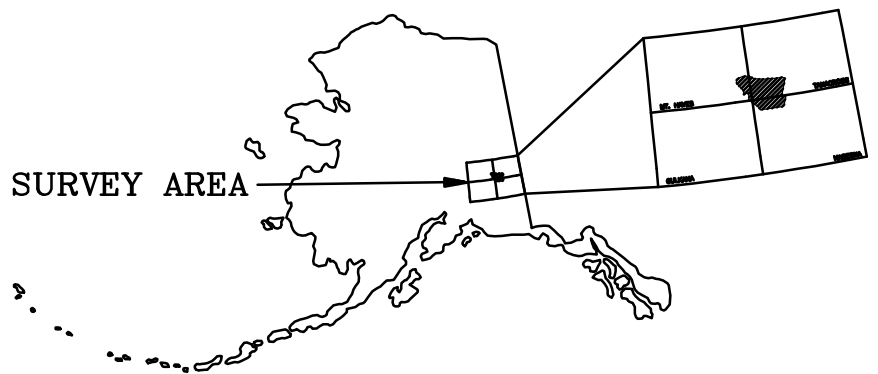
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DESCRIPTIVE NOTES

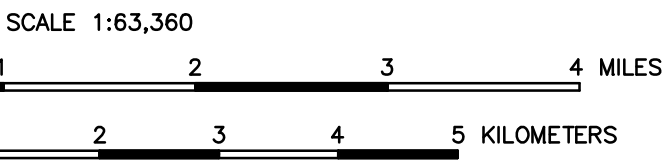
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A Novatel OEM5-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 7) spheroid, 1927 North American datum using a central meridian (CM) of 141°, 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.

RESIDUAL MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a CGG D1344 magnetometer with a Scintrex CS3 cesium 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 2010, 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 (1970¹) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

¹ 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.



INTERPRETATION MAP
WITH MAGNETIC RESIDUAL FIELD,
TOK SURVEY AREA,
EASTERN INTERIOR ALASKA

PARTS OF THE TANACROSS, NABESNA, MT. HAYES,
AND GULKANA QUADRANGLES

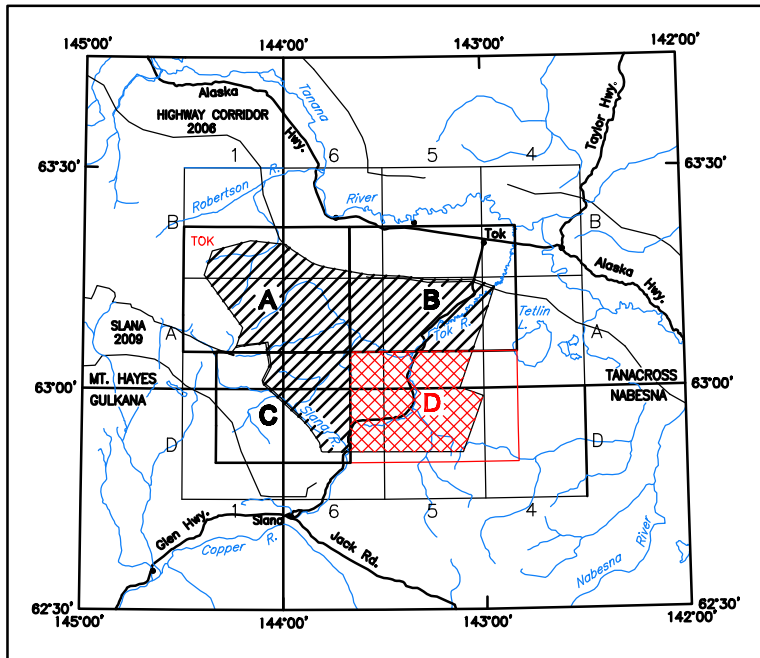
Interpretation by CGG
2015

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

LEGEND

- F1 — Inferred Structural Break
- A1 — EM Conductor, or group of EM Conductors
- Possible Folded Unit
- - - Highly conductive zone boundary associated with a geologic unit
- M1 — Magnetic Zone
- ML1 — Magnetic Low
- R1 — Highly Conductive Zone
- Zone A — Approximate outline of broad magnetic zone defined by a change in magnetic texture

LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

This map was compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and CGG Land (U.S.) Inc. Airborne geophysical data for the area were acquired and processed by CGG in 2014 and 2015. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program and the Alaska Strategic and Critical Minerals Assessment Capital Improvement Project.

All data and maps produced to date from this survey are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs/geophysics). Products are also available in digital format and maps are available on paper for a nominal fee from the DGGS office, 3354 College Road, Fairbanks, Alaska, 99709-3707 (phone 907-451-5020; email dggs@alaska.gov).