TONSINA 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 2015-1

2021
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

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Suggested citation:
Emond, A.M., CGG, Burns, L.E., Graham, G.R.C., and CGG Land (US) Inc., 2015, Tonsina electromagnetic and magnetic airborne geophysical survey data compilation: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2015-1. https://doi.org/10.14509/29169

TONSINA 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 Tonsina electromagnetic and magnetic airborne geophysical survey is located in Tonsia approximately 50 kilometers south of Glennallen, Alaska. Frequency domain electromagnetic and magnetic data were collected with the DIGHEMV system from July 25 to August 20, 2014. A total of 1998 line kilometers were collected covering 705 square kilometers (km). Line spacing was 400 meters (m). Data were collected an average of 44 m above the ground surface from a helicopter towed sensor platform ("bird") on a 30 m long line.

PURPOSE

The Tonsina survey data was conducted to assist and promote mineral exoplortion in the Nelchina mining district. Mineral occurrences within the survey area include: Jurassic, mafic-ultramafic-rock-hosted, PGE-bearing, chromite and Ni-Cu sulfides at the base of the Talkeetna Arc crustal section; Metamorphic-related, Late Cretaceous to Tertiary age, lowsulfide, gold-bearing quartz veins in the Chugach terrane; and placer gold minor scheelite in Holocene alluvial gravels. The data were collected to aid geologic mapping of 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.

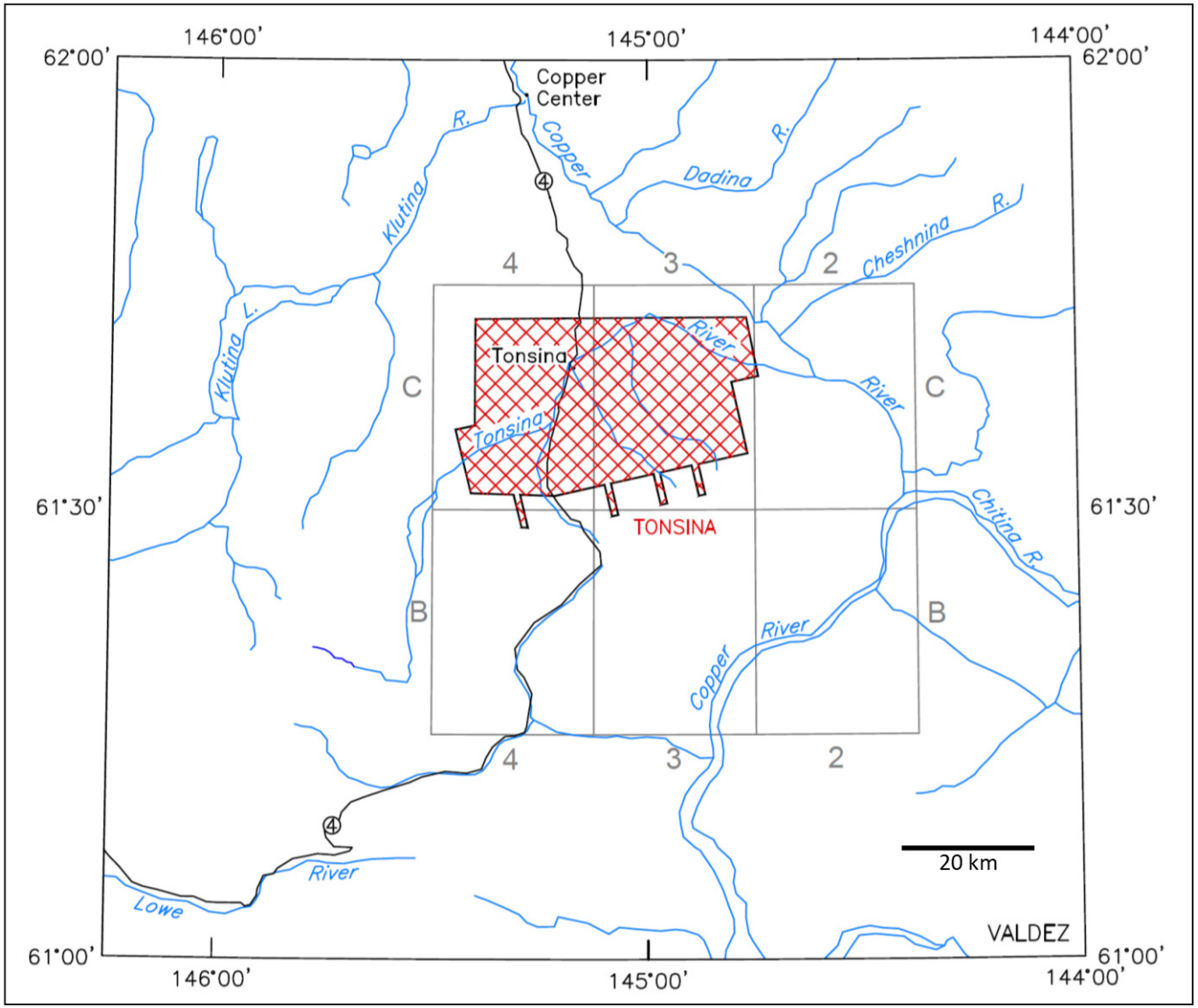
ACKNOWLEDGMENTS

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 final line data with readme files; note: these data are provided in both UTM NAD27 and Geopgraphic WGS84 projections.
databases_geosoft	contractor	Geosoft format database of final line data with readme files; note: these data are provided in both UTM NAD27 and Geopgraphic WGS84 projections.
documents	contractor	Field operations report, gridded data explanations, survey background information, processor notes.
grids_ermapper	contractor	Geographically registered gridded data, ER Mapper ERS format.
grids_geosoft	contractor	Geosoft-format grids, these grids can be viewed in ESRI ArcMap using a free plugin from Geosoft or the free viewer available from Geosoft.
kmz	contractor	Google Earth kmz files of of all gridded data; note: these files use the WGS84 datum.
images_registered	contractor	GeoTiff format images of all gridded data.
maps_pdf_format	contractor	Print format maps in pdf format.
maps_prn_format	contractor	Printable maps in HPGL/2 printer file format with extension .prn.
vector_data	contractor	Line path, data contours, and survey boundary in ESRI shape file (SHP) and Autocad (2000) DXF formats.
video_flightpath	contractor and DGGS	Downward looking video to verify position and record ground conditions. Video synchronized with data.
profiles_stacked	contractor	Electromagnetic and magnetic data profiles with EM anomalies.



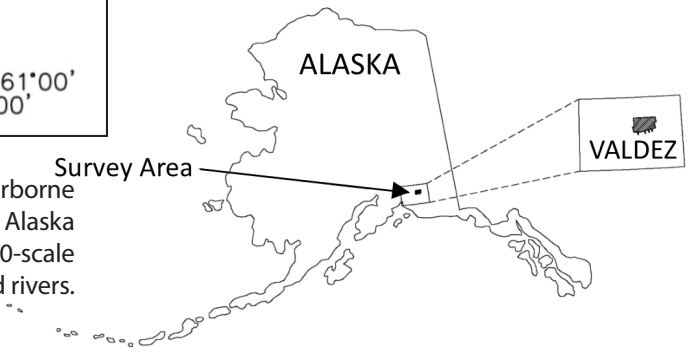


Figure 1. Tonsina magnetic and electromagnetic airborne geophysical survey location shown in eastern interior Alaska (right). Survey area shown with landmarks, relevant 1:250,000-scale quadrangle boundaries, major roads, and rivers.

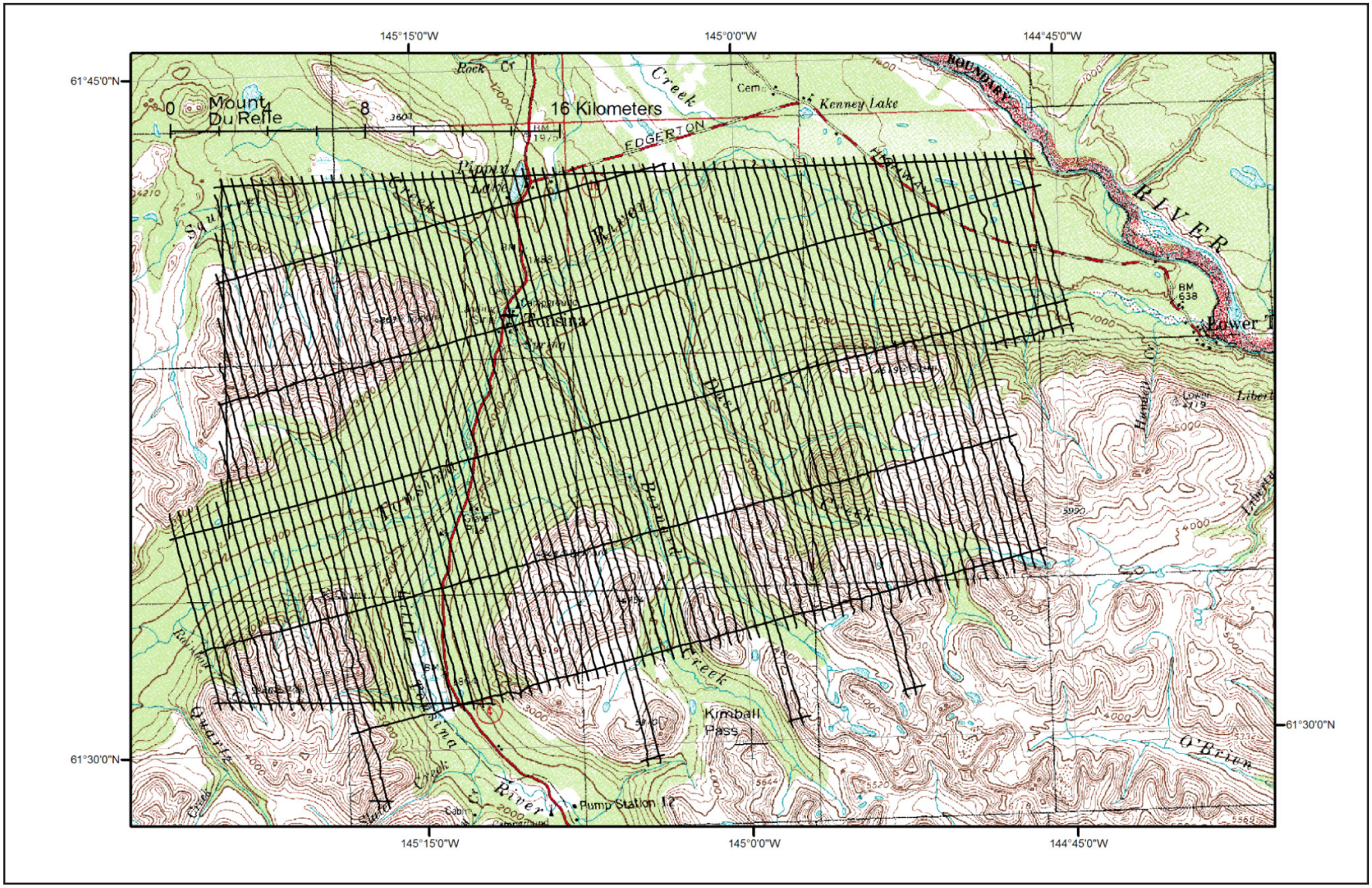


Figure 2. Flight path with topographic basemap.

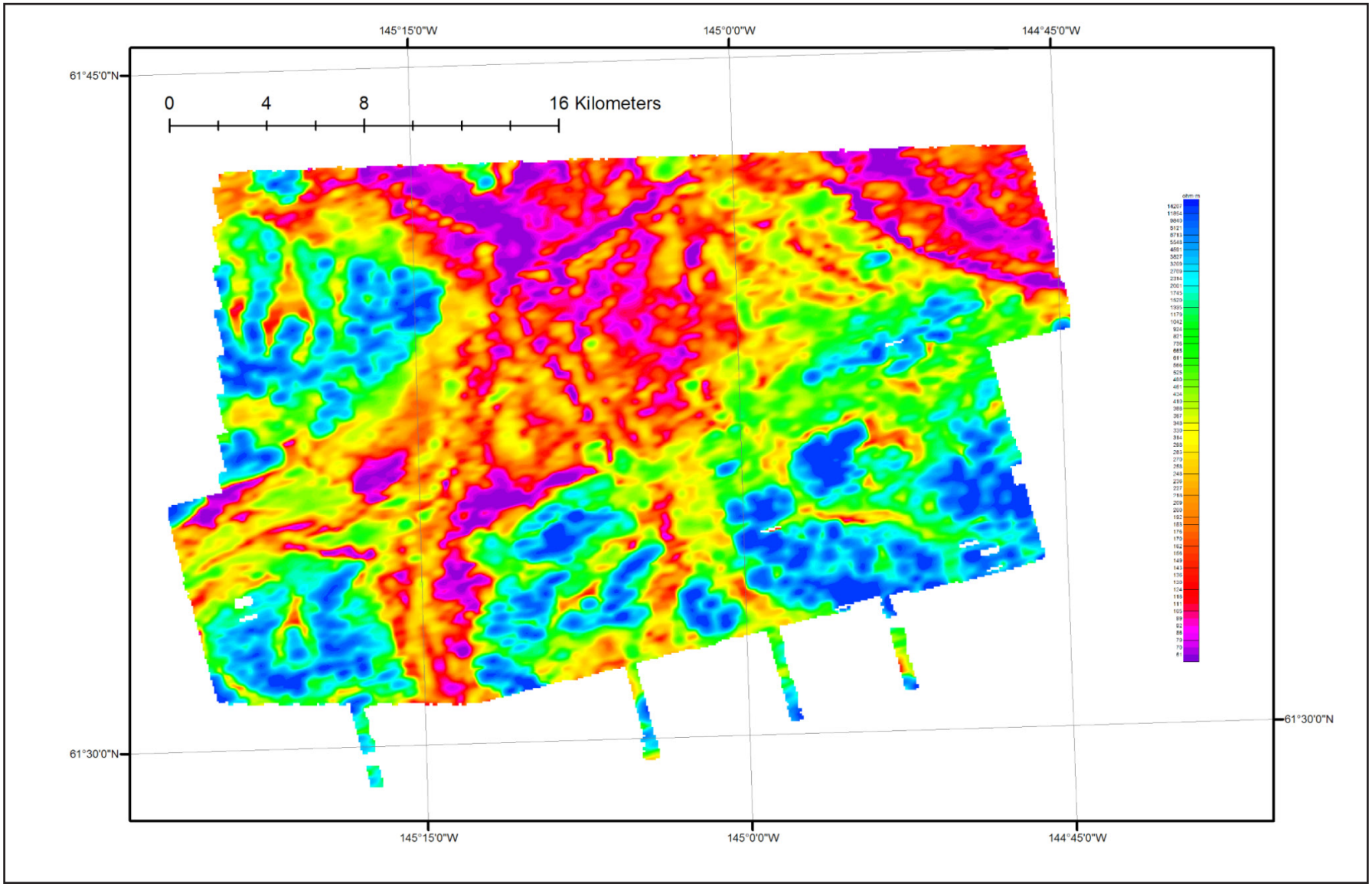


Figure 3. 56,000 Hz apparent resistivity grid.

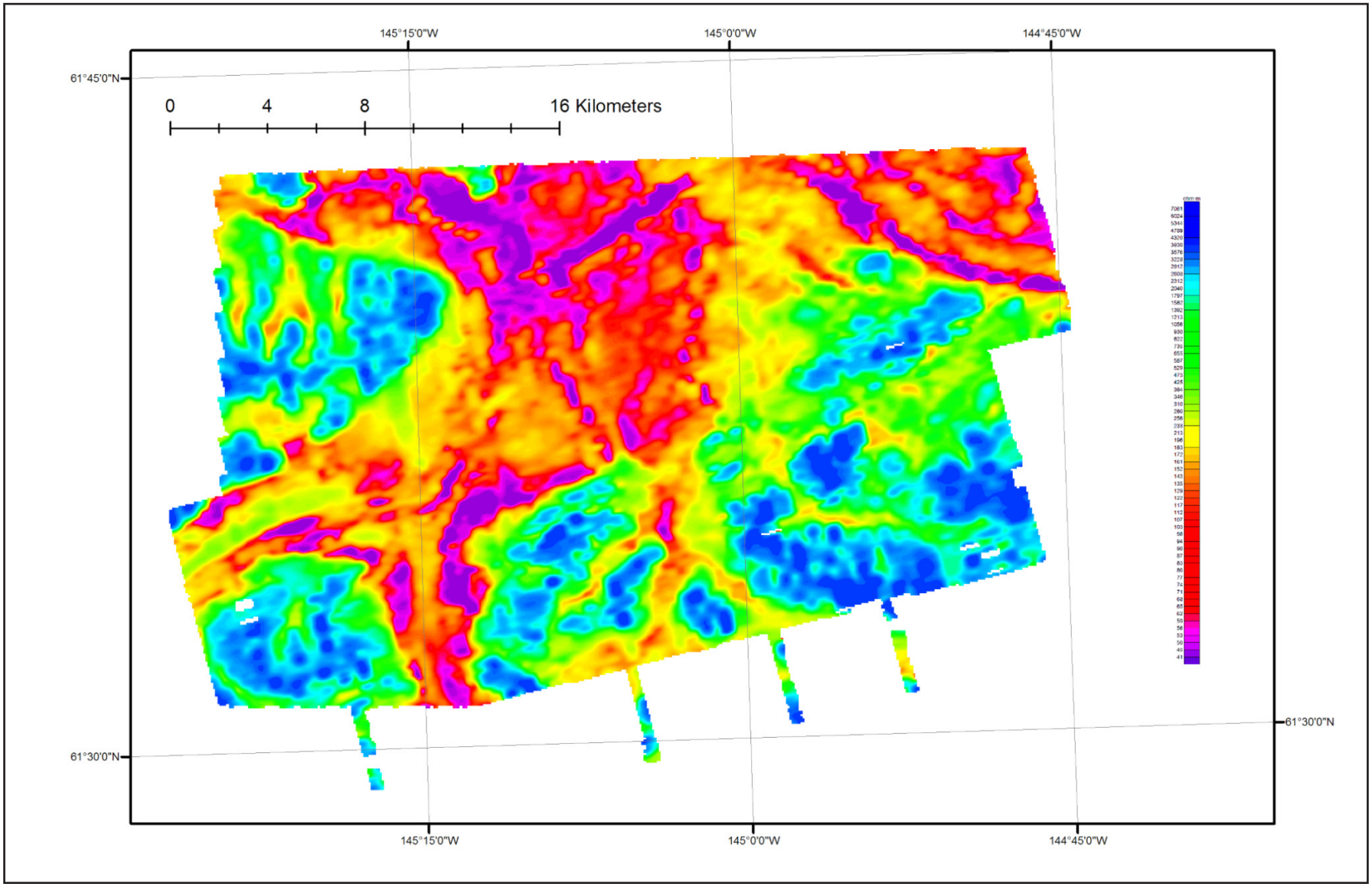


Figure 4. 7,200 Hz apparent resistivity grid.

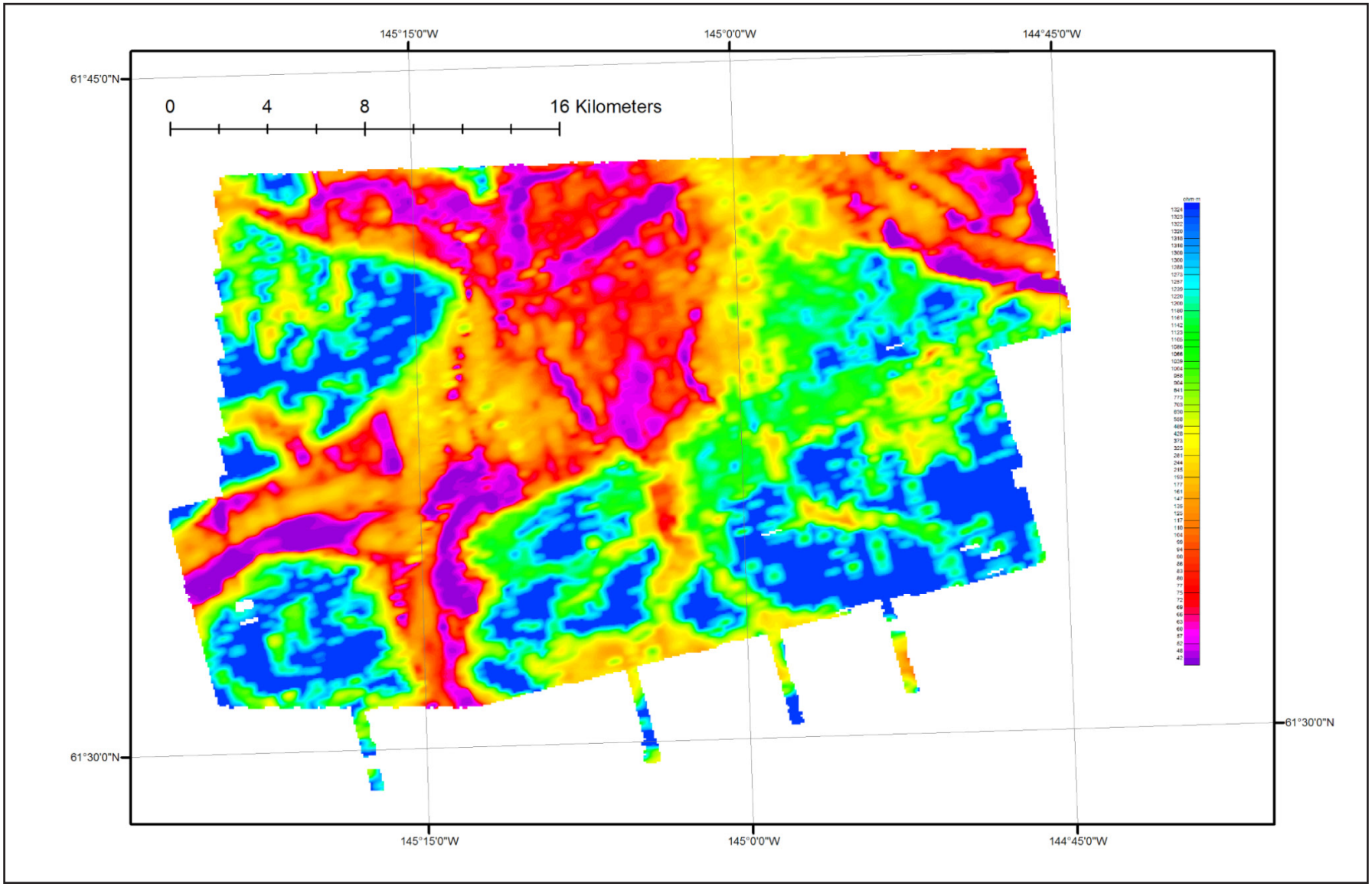


Figure 5. 900 Hz apparent resistivity grid.

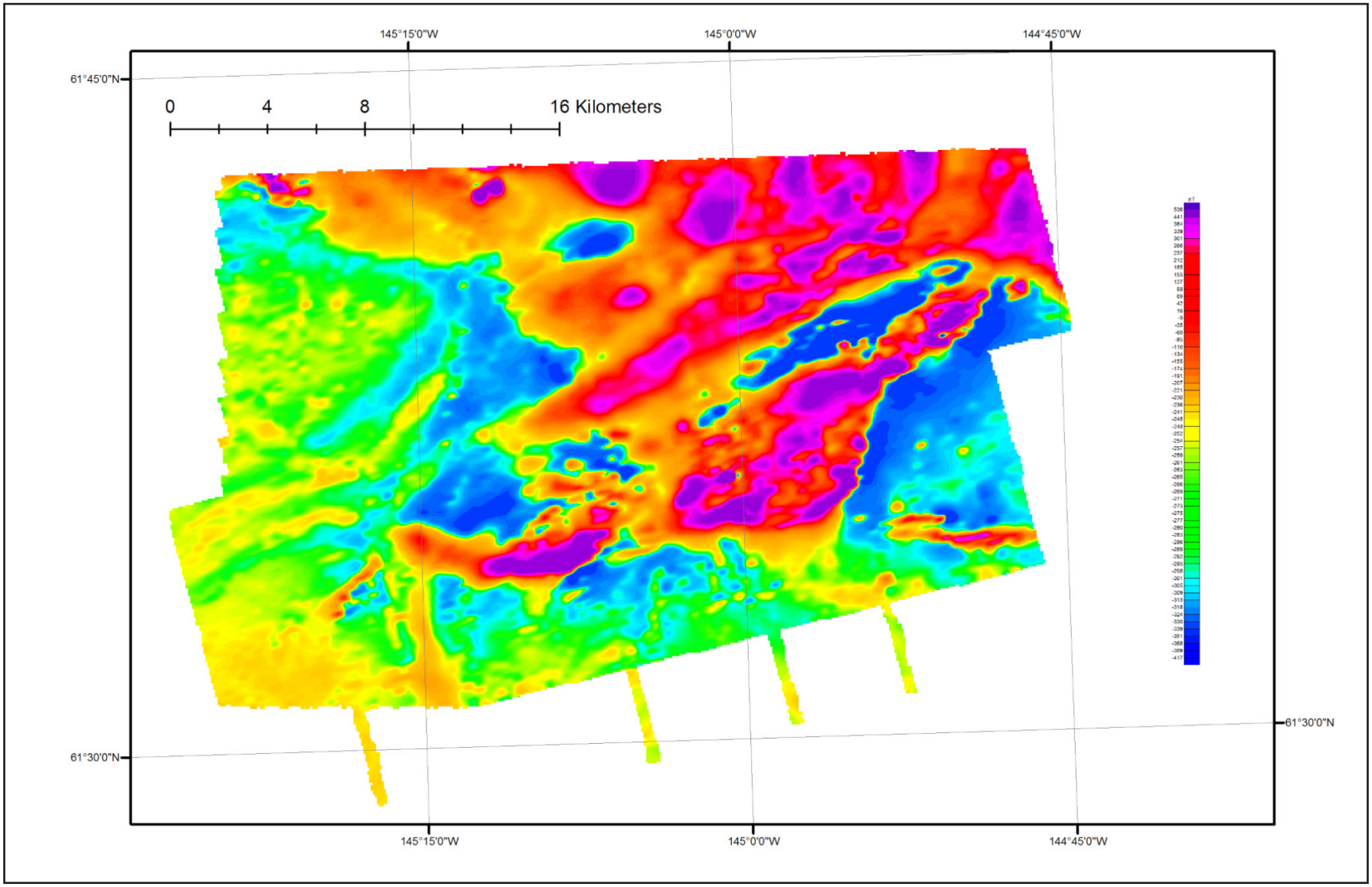


Figure 6. Residual magnetic intensity grid.

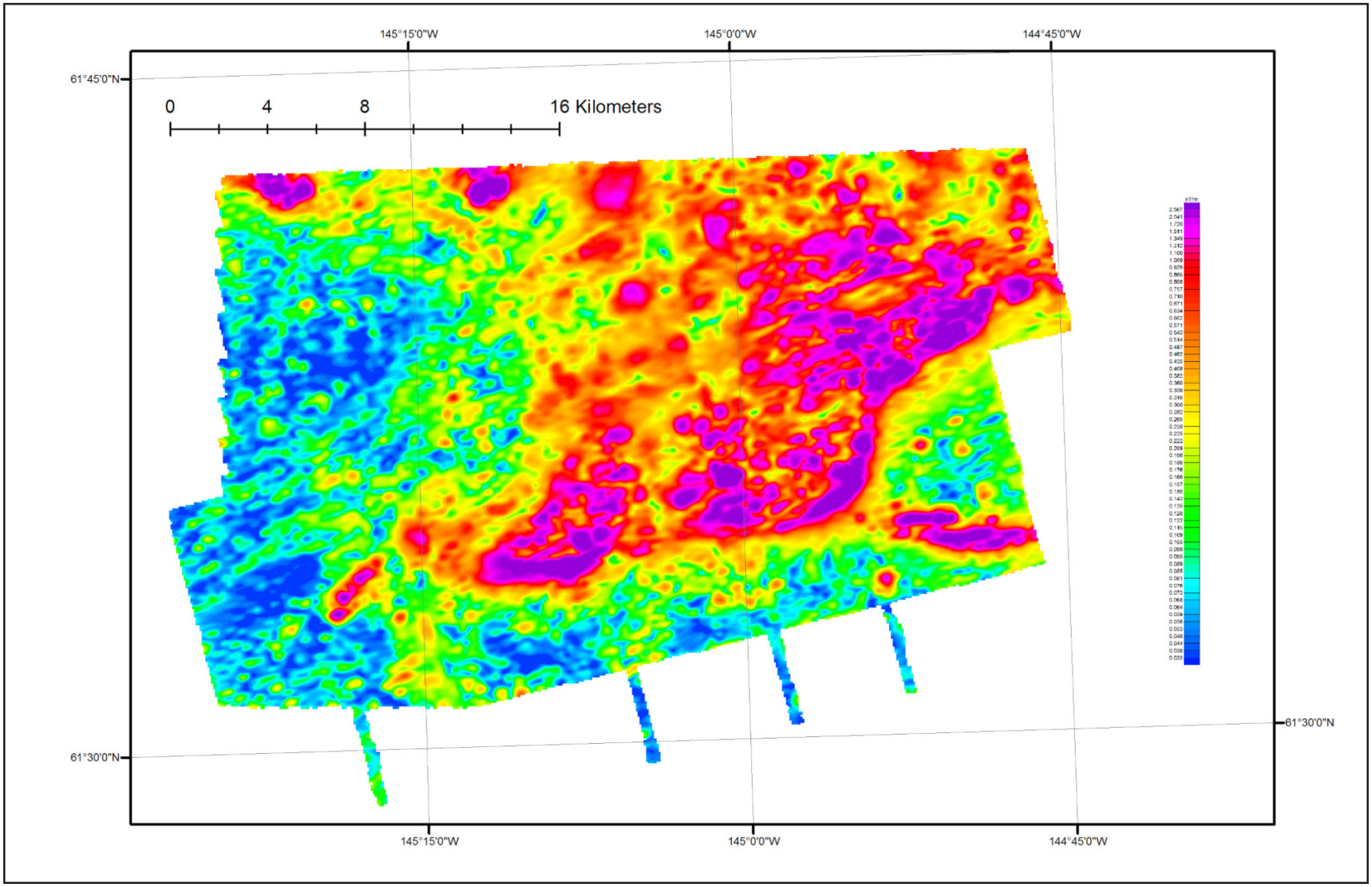


Figure 7. Magnetic analytic signal grid.

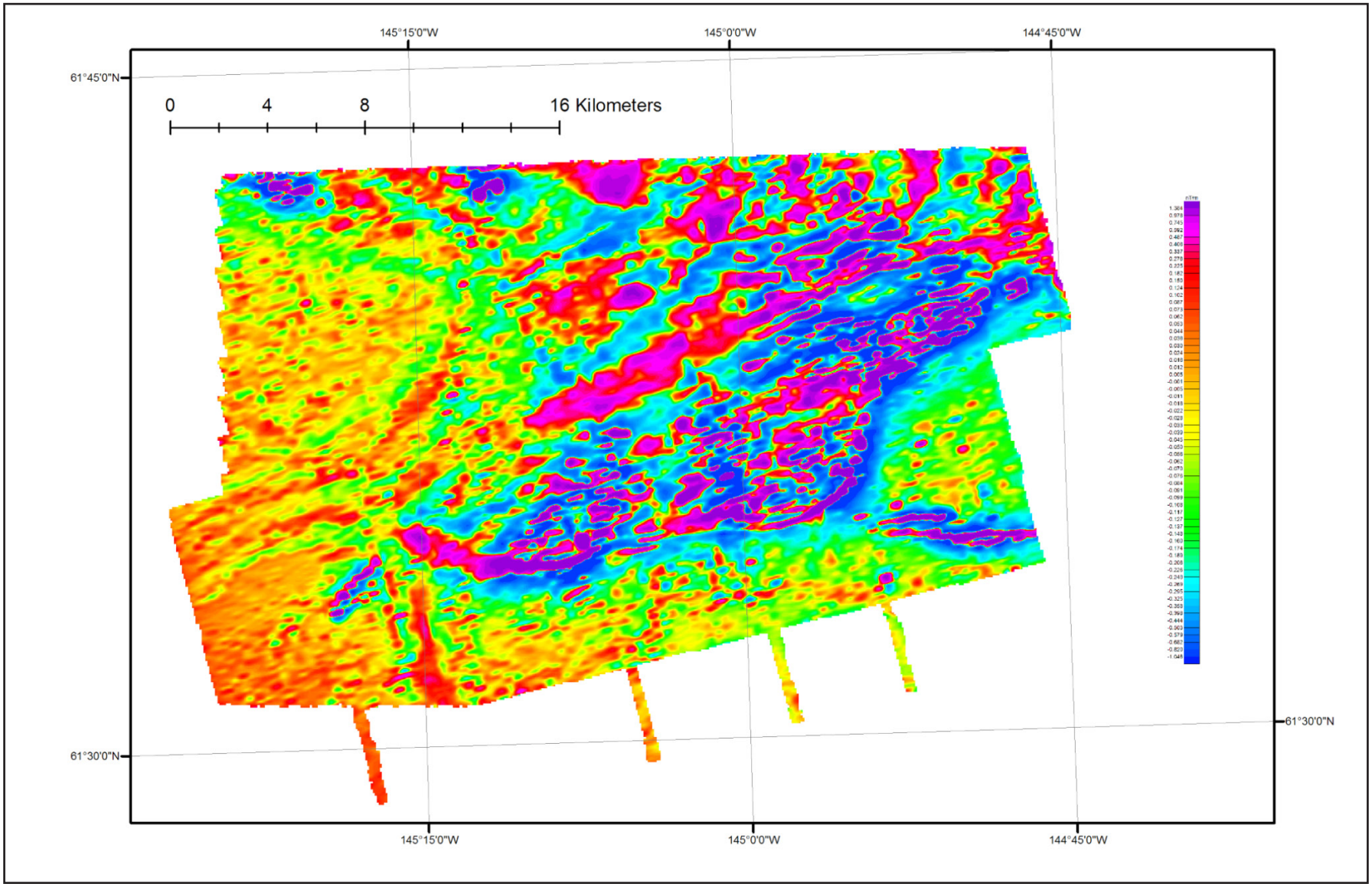


Figure 8. Magnetic calculated first vertical derivative grid.

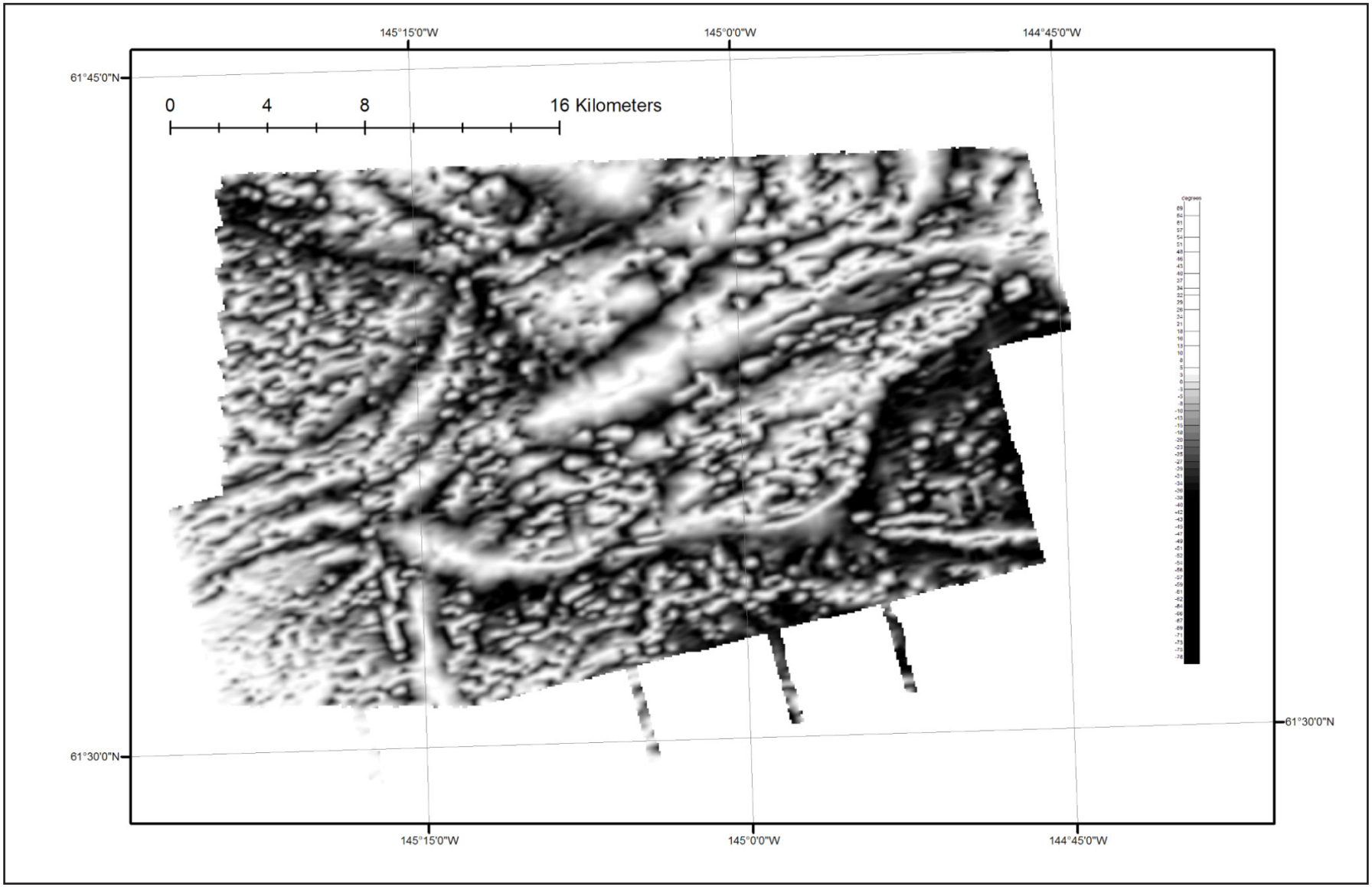


Figure 9. Magnetic tilt derivative grid.

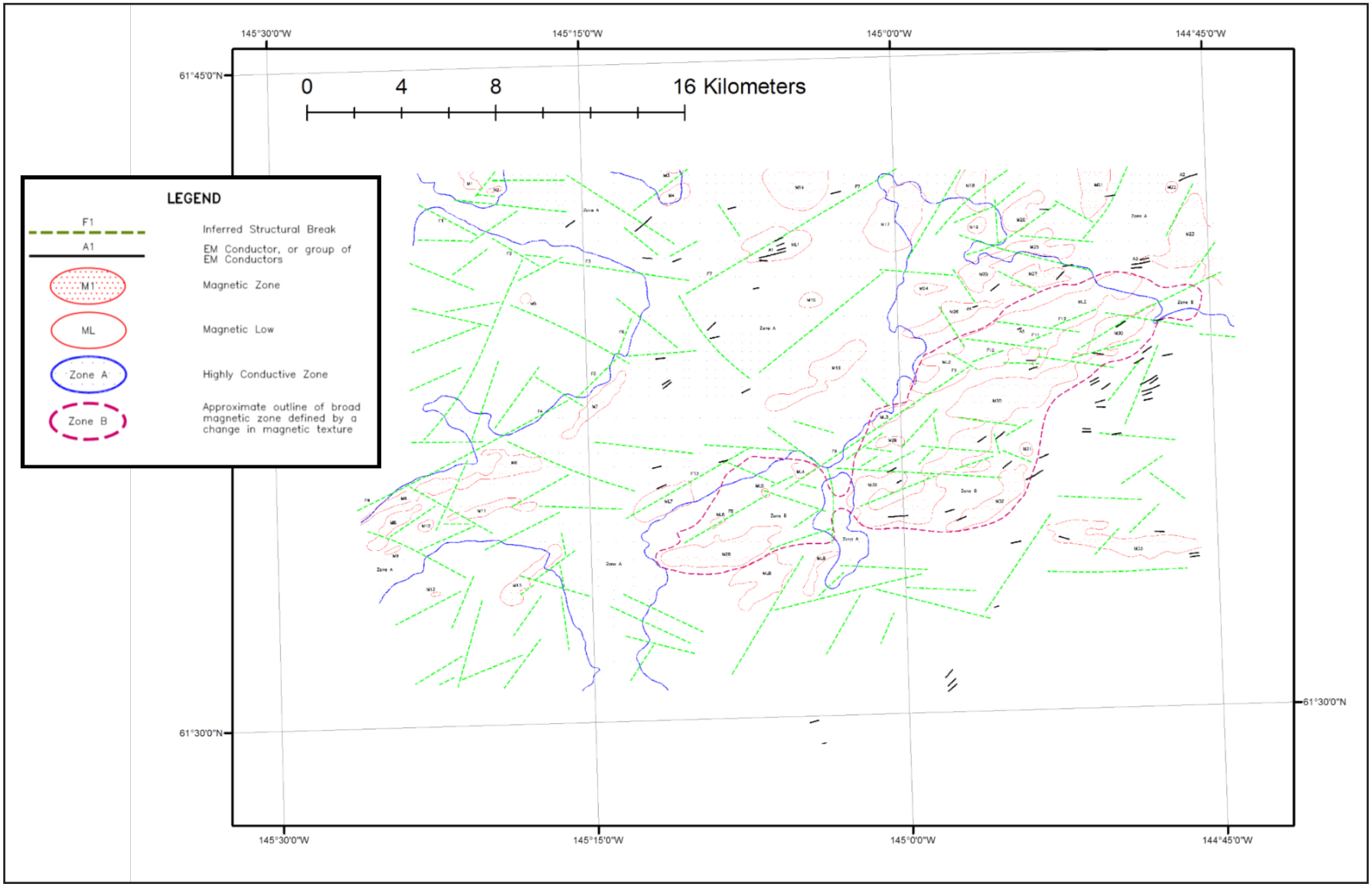
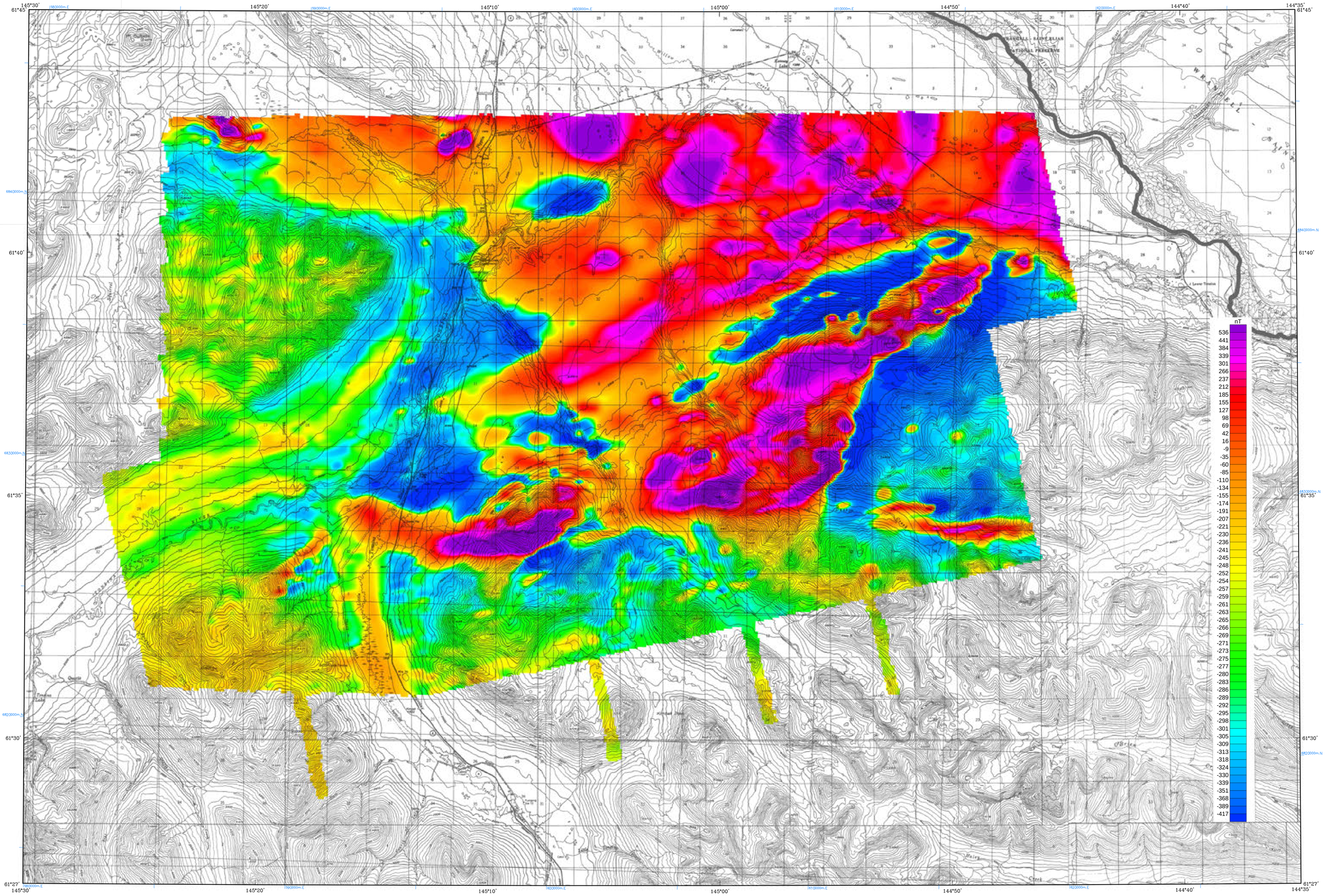


Figure 10. Contractor-provided magnetic and electromagnetic data interpretation of survey area.

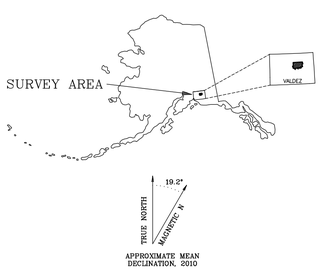
Figure 11. Example of contractor-provided stacked profile.

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	
15	GPR2015-1, sheet 1	Residual magnetic intensity (RMI), IGRF removed	Topography
16	GPR2015-1, sheet 2	Residual magnetic intensity, IGRF removed	Magnetic contours
17	GPR2015-1, sheet 3	First vertical derivative of the RMI	Topography
18	GPR2015-1, sheet 4	Analytic Signal of the RMI	Topography
19	GPR2015-1, sheet 5	Analytic Signal of the RMI	Analytic signal contours
20	GPR2015-1, sheet 6	Tilt Derivative of the RMI	Topography and Tilt Derivative contours
21	GPR2015-1, sheet 7	Shadowed RMI	Topography and Tilt Derivative contours
22	GPR2015-1, sheet 8	56K Hz coplanar apparent resistivity	Topography
23	GPR2015-1, sheet 9	56K Hz coplanar apparent resistivity	56K apparent resistivity contours
24	GPR2015-1, sheet 10	7200 Hz coplanar apparent resistivity	Topography
25	GPR2015-1, sheet 11	7200 Hz coplanar apparent resistivity	7200 Hz apparent resistivity contours
26	GPR2015-1, sheet 12	900 Hz coplanar apparent resistivity	Topography
27	GPR2015-1, sheet 13	900 Hz coplanar apparent resistivity	900 Hz apparent resistivity contours
28	GPR2015-1, sheet 14	Flight path	Topography
29	GPR2015-1, sheet 16	Electromagnetic and magnetic interpretation	Township, range, and section
30	GPR2015-1, sheet 17	EM and magnetic interpretation, residual magnetic intensity	Township, range, and section
		1:31,680-scale maps	
31–34	GPR2015-1, sheet 15a-d	Detailed EM anomalies, residual magnetic data grid	Topography



Base from U.S. Geological Survey Valdez B–2, 1972; B–3, 1995; B–4, 1994; Valdez C–2, 1996; C–3, 1996; C–4, 1996; Quadrangles, Alaska



SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

RESIDUAL MAGNETIC FIELD WITH TOPOGRAPHY, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

PART OF THE VALDEZ QUADRANGLE

by
Abraham M. Emond, 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, 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 NW–SE (345°) 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.

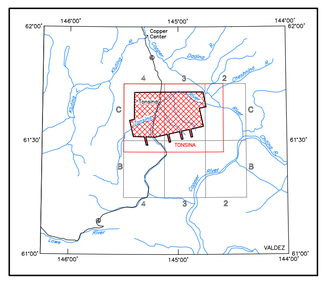
A Novatel OEM5–G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post–flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 6) spheroid, 1927 North American datum using a central meridian (CM) of 147°, a north constant of 0 and an east constant of 500,000. Positional accuracy of the presented data is better than 10 m with respect to the UTM grid.

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.

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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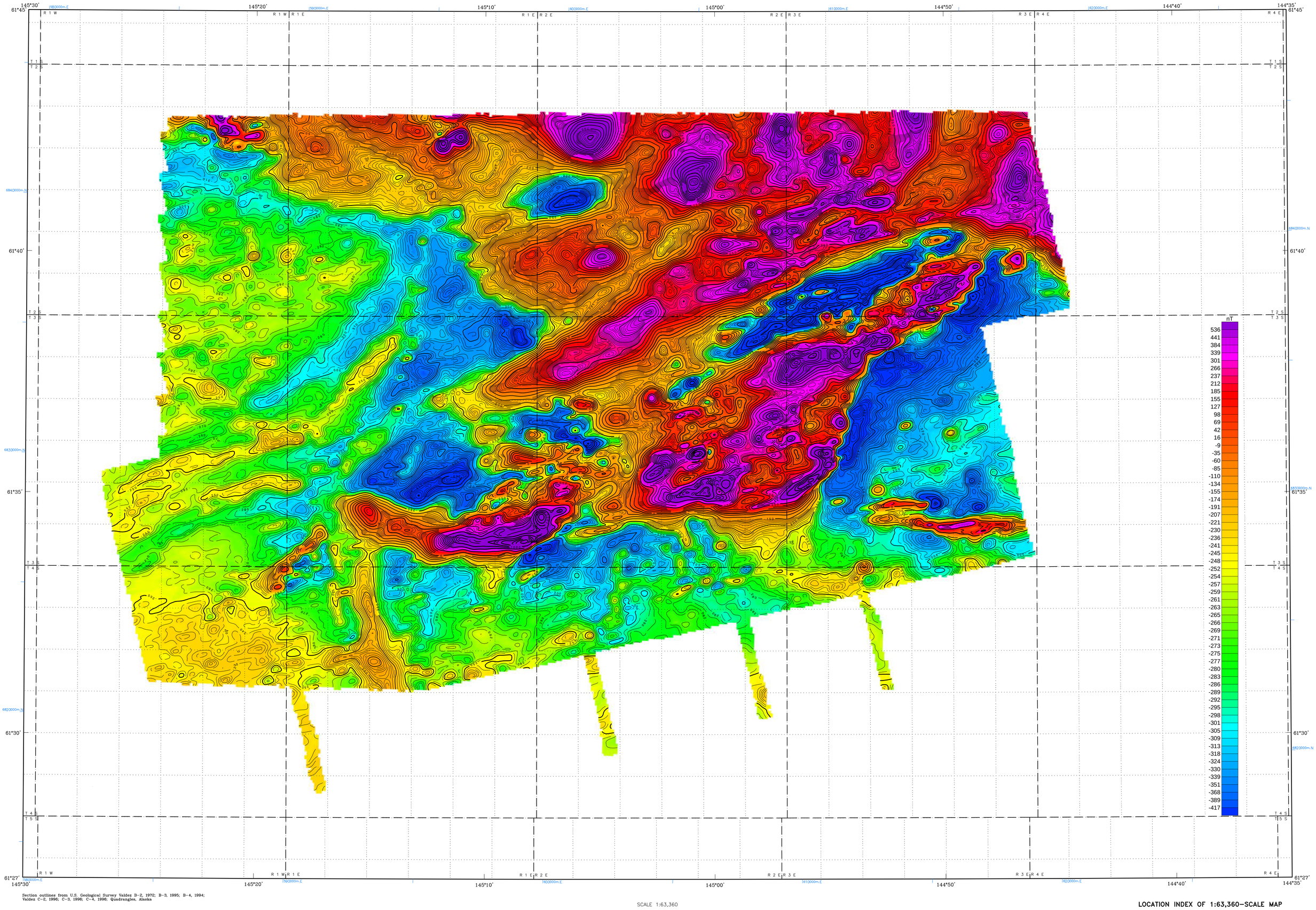
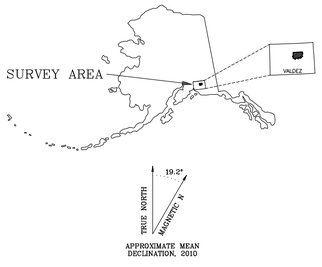


Section outlines from U.S. Geological Survey Valdez B-2, 1972; B-3, 1995; B-4, 1994; Valdez C-2, 1996; C-3, 1996; C-4, 1996; Quadrangles, Alaska



SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

RESIDUAL MAGNETIC FIELD WITH DATA CONTOURS, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

PART OF THE VALDEZ QUADRANGLE

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

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MAGNETIC CONTOURS

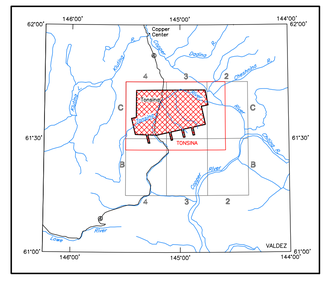
250 nT

50 nT

10 nT

5 nT

LOCATION INDEX OF 1:63,360–SCALE MAP



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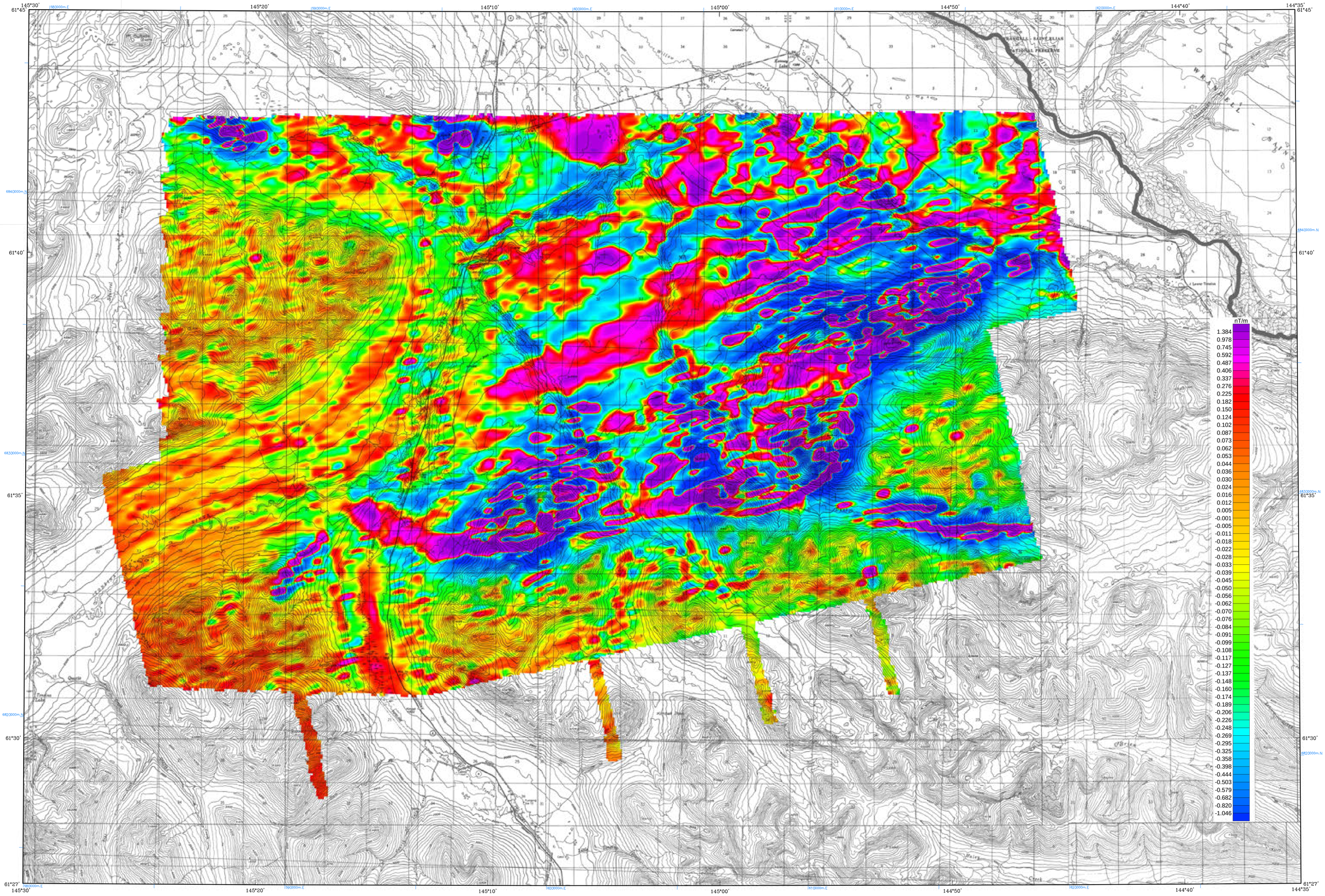

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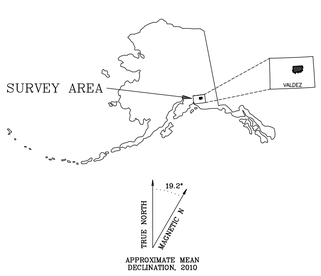


SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

FIRST VERTICAL DERIVATIVE OF THE MAGNETIC FIELD WITH TOPOGRAPHY, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

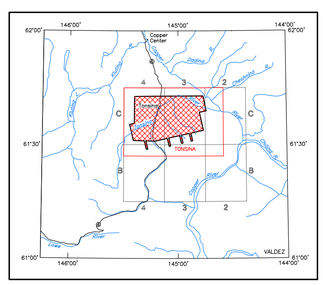
PART OF THE VALDEZ QUADRANGLE

by

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

2015

LOCATION INDEX OF 1:63,360–SCALE MAP



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COLOR BAR HISTOGRAM

Approximately 98% of the first vertical derivative of the magnetic field for the Tonsina Survey Area dataset lie within the range displayed on the color bar. Data values actually range from –17.549 nT/m (dark blue) to about 83.029 nT/m (magenta).

FIRST VERTICAL DERIVATIVE OF THE 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. The first vertical derivative grid was calculated from the processed total magnetic field grid using a FFT base frequency domain filtering algorithm. The resulting first veritical 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.

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.

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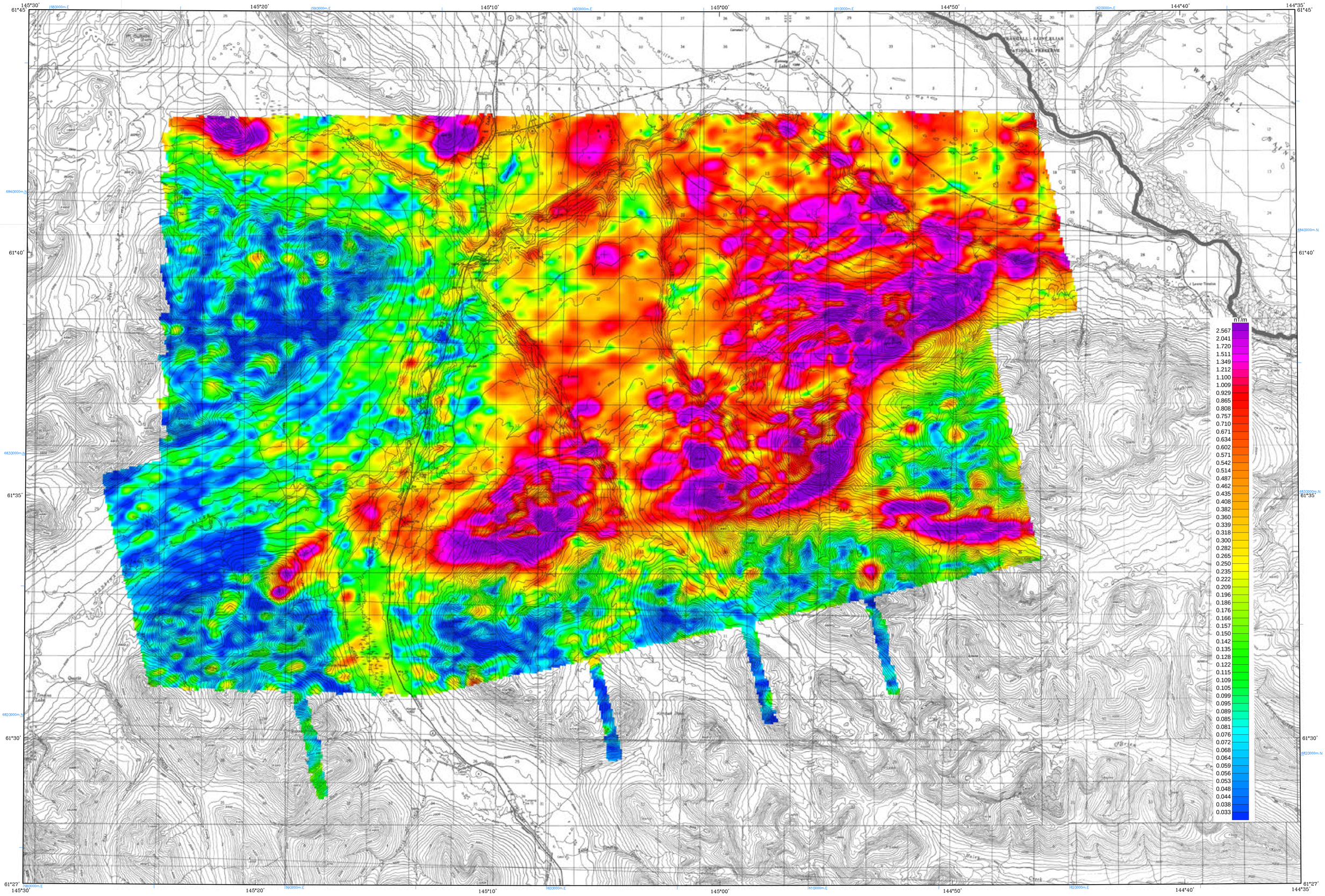
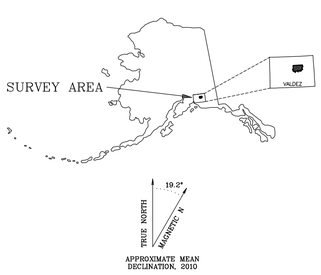


Base from U.S. Geological Survey Valdez B–2, 1972; B–3, 1995; B–4, 1994; Valdez C–2, 1996; C–3, 1996; C–4, 1996; Quadrangles, Alaska



APPROXIMATE MEAN DECLINATION, 2010

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

ANALYTIC SIGNAL WITH TOPOGRAPHY, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

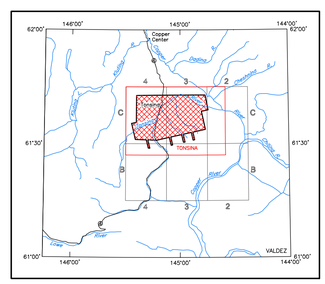
PART OF THE VALDEZ QUADRANGLE

by

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

2015

LOCATION INDEX OF 1:63,360–SCALE MAP



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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 (e.g., contacts, fault/shear zones, etc.). Analytic signal maxima are located directly over faults and contacts, regardless of structural dip, and independently of the direction of the induced and/or remanent magnetizations.

SURVEY HISTORY

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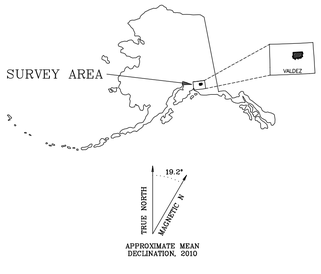
Section outlines from U.S. Geological Survey Valdez B-2, 1972; B-3, 1995; B-4, 1994; Valdez C-2, 1996; C-3, 1996; C-4, 1996; Quadrangles, Alaska



SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

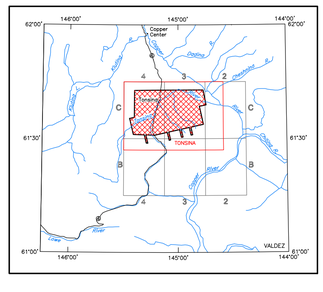
ANALYTIC SIGNAL WITH DATA CONTOURS, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

PART OF THE VALDEZ QUADRANGLE

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

nT/m
2.567
2.041
1.720
1.511
1.349
1.212
1.100
1.009
0.929
0.865
0.808
0.757
0.710
0.671
0.634
0.602
0.571
0.542
0.514
0.487
0.462
0.435
0.408
0.382
0.360
0.339
0.318
0.300
0.282
0.265
0.250
0.235
0.222
0.209
0.196
0.186
0.176
0.166
0.157
0.150
0.142
0.135
0.128
0.122
0.115
0.109
0.105
0.099
0.095
0.089
0.085
0.081
0.076
0.072
0.068
0.064
0.059
0.056
0.053
0.048
0.044
0.038
0.033

LOCATION INDEX OF 1:63,360-SCALE MAP



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ANALYTIC SIGNAL CONTOURS

2.50 nT/metre

0.50 nT/metre

0.10 nT/metre

0.05 nT/metre

SURVEY HISTORY

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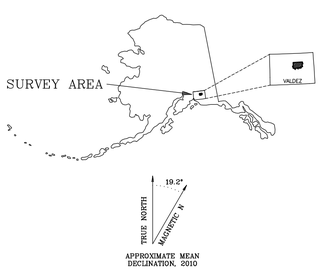

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

MAGNETIC TILT DERIVATIVE WITH TOPOGRAPHY AND DATA CONTOURS, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

PART OF THE VALDEZ QUADRANGLE

by
Abraham M. Emond, 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, 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 NW-SE (345°) 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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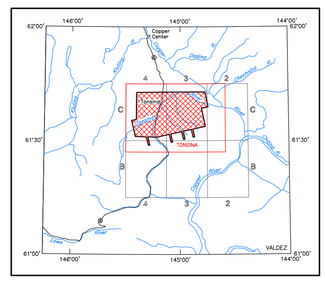
MAGNETIC TILT DERIVATIVE

The tilt derivative is the angle between the horizontal gradient & the total gradient, which is useful for identifying the depth & 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. It 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

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

LOCATION INDEX OF 1:63,360-SCALE MAP



SURVEY HISTORY

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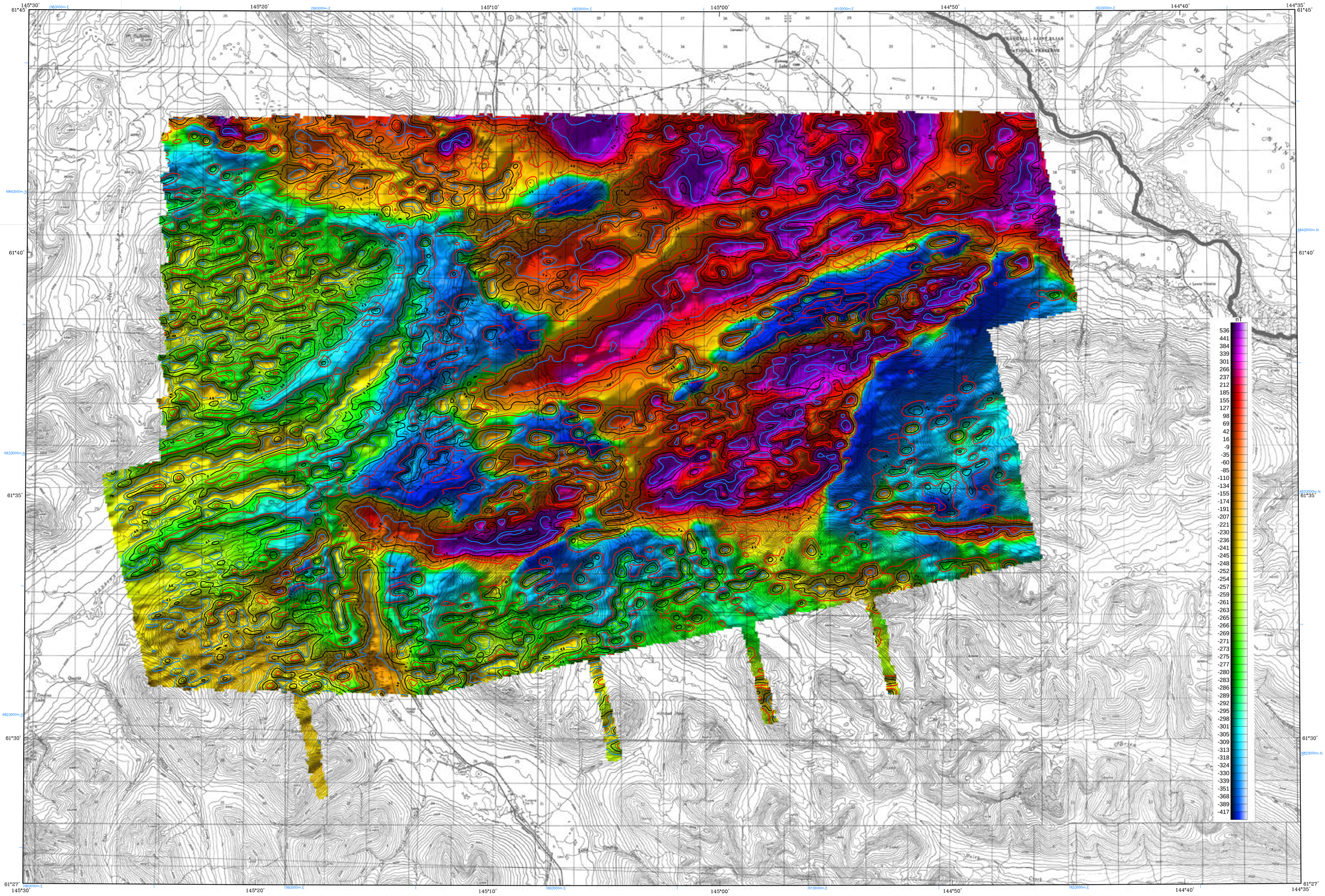

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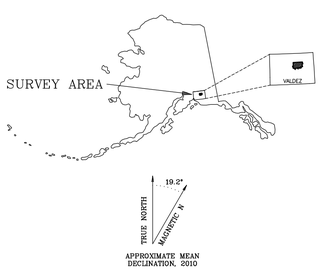


SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

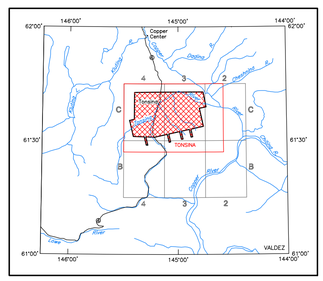
COLOR SHADOW RESIDUAL MAGNETIC FIELD WITH MAGNETIC TILT DERIVATIVE DATA CONTOURS, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

PART OF THE VALDEZ QUADRANGLE

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

Sun Azimuth: 0 degrees; Sun Inclination: 45 degrees

LOCATION INDEX OF 1:63,360–SCALE MAP



DESCRIPTIVE NOTES

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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.

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.

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MAGNETIC TILT DERIVATIVE CONTOURS

- +45 degrees
- +30 degrees
- +15 degrees
- 0 degrees
- −15 degrees
- −30 degrees
- −45 degrees

SURVEY HISTORY

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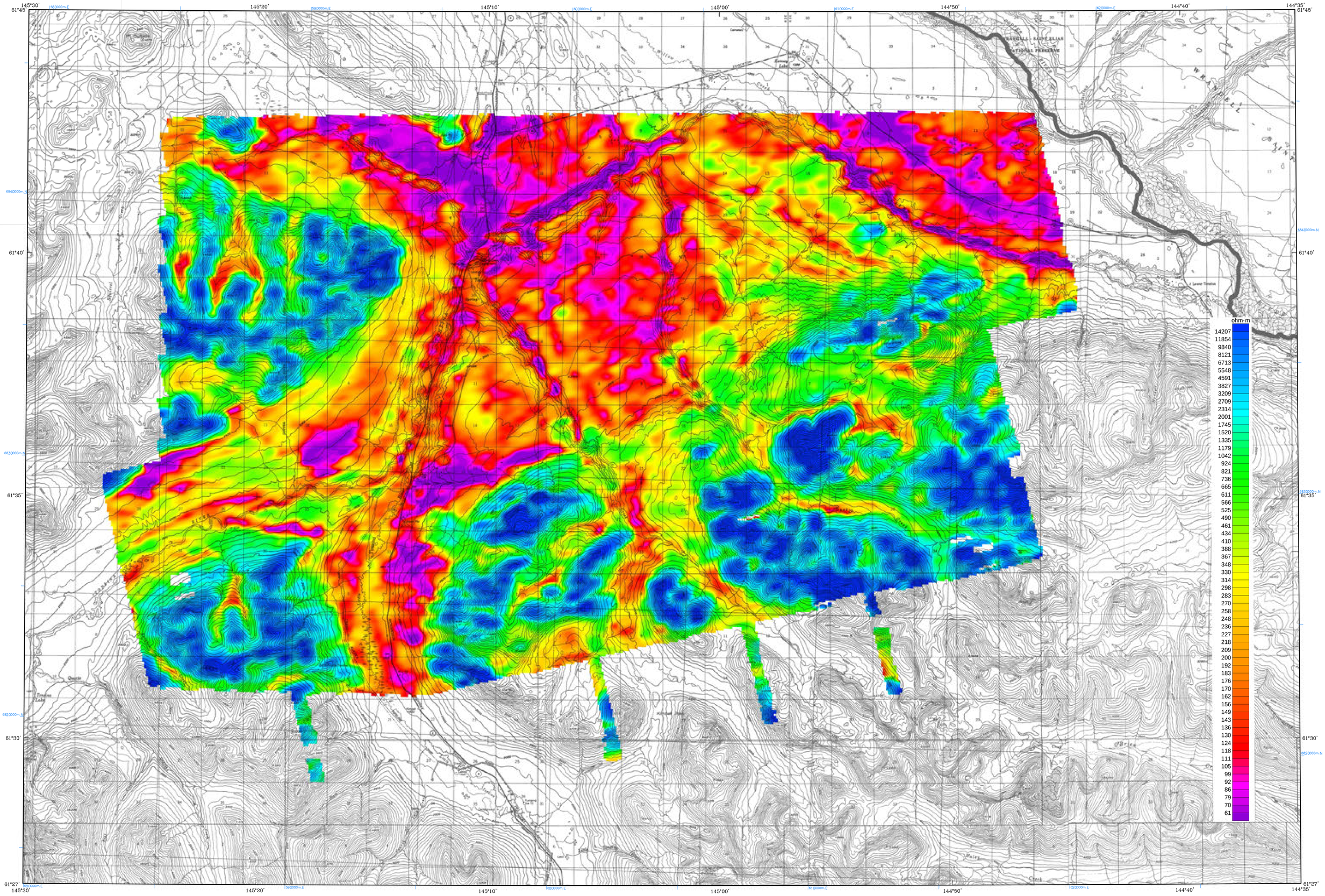

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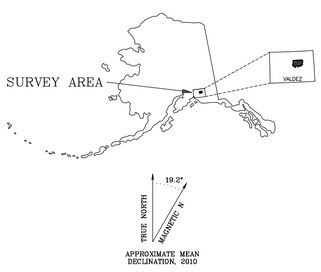
SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS



APPROXIMATE MEAN DECLINATION, 2010

56,000 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

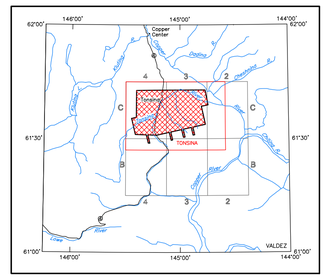
PART OF THE VALDEZ QUADRANGLE

by

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

2015

LOCATION INDEX OF 1:63,360–SCALE MAP



DESCRIPTIVE NOTES

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RESISTIVITY

The DIGHEM^V 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 inphase and quadrature component of the coplanar 56,000 Hz using the pseudo–layer half space model. The data were interpolated onto a regular 80 m grid using a modified Akima (1970) technique. 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.

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. This avoids meaningless resistivity calculations due to 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.

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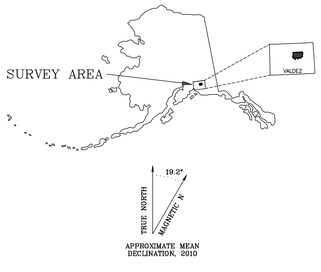

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

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by

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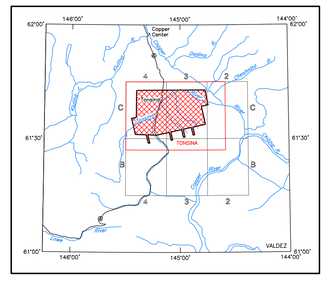
RESISTIVITY CONTOURS

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



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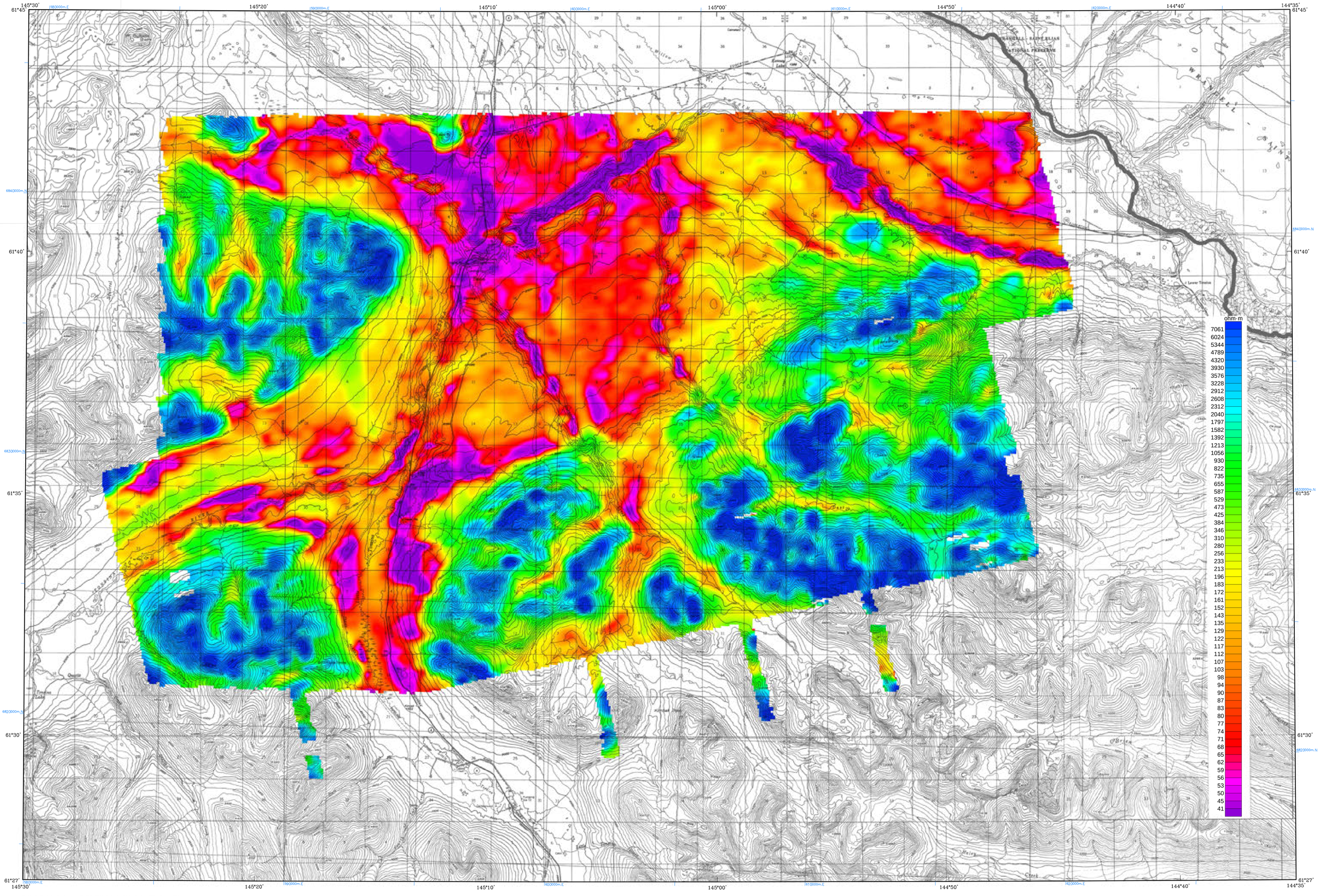

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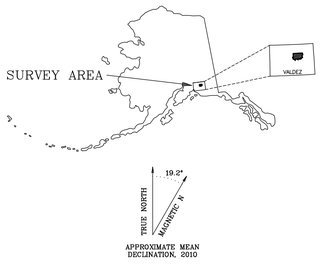
SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

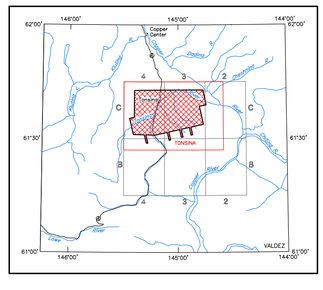


7200 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

PART OF THE VALDEZ QUADRANGLE

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

LOCATION INDEX OF 1:63,360–SCALE MAP



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In areas where the EM bird height exceeded 150 m, resistivity was not calculated. This avoids meaningless resistivity calculations due to 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

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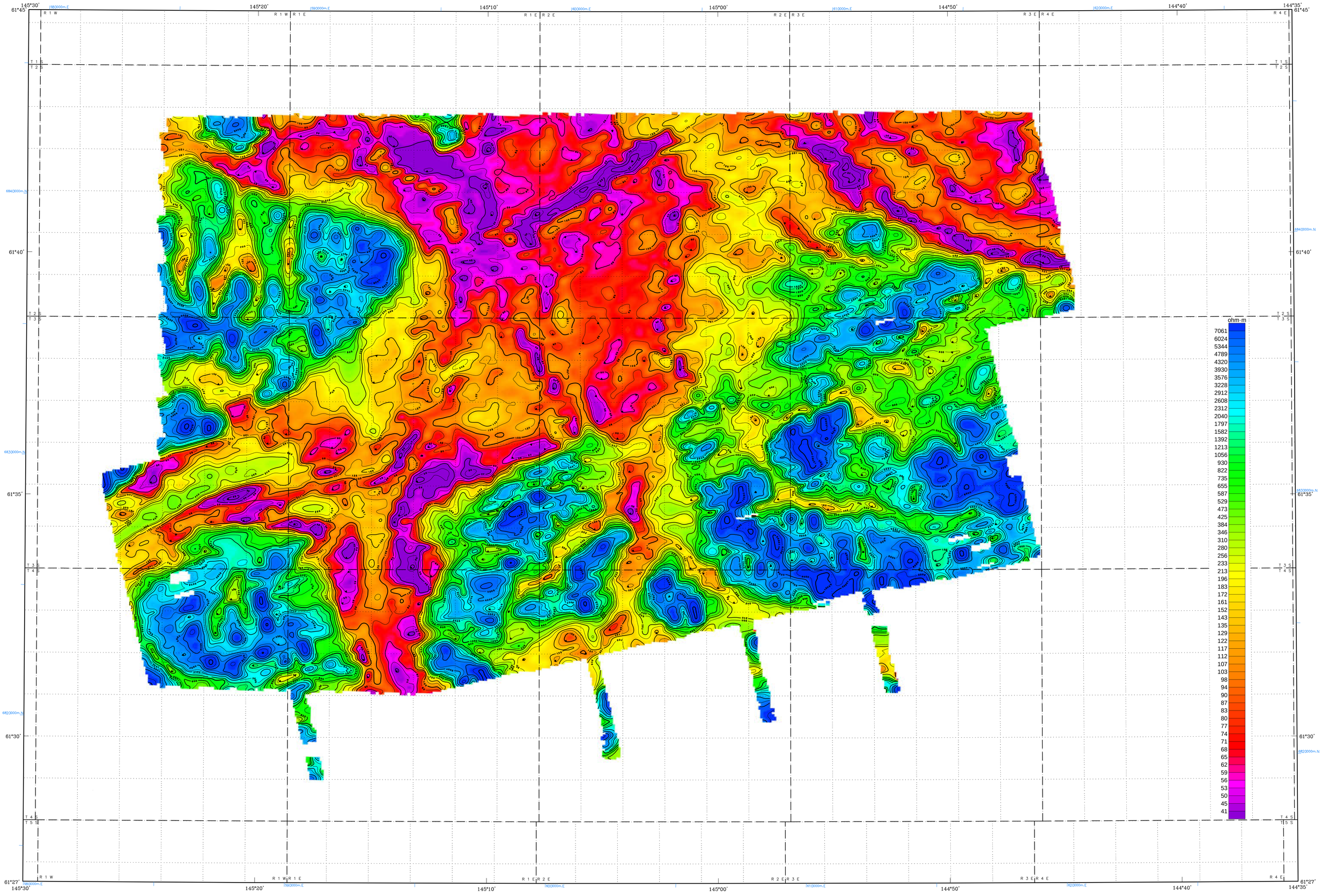
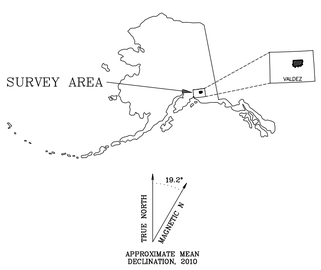


Section outlines from U.S. Geological Survey Valdez B–2, 1972; B–3, 1995; B–4, 1994; Valdez C–2, 1996; C–3, 1996; C–4, 1996; Quadrangles, Alaska



APPROXIMATE MEAN DECLINATION, 2010

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

7200 Hz COPLANAR APPARENT RESISTIVITY WITH DATA CONTOURS, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

PART OF THE VALDEZ QUADRANGLE

by

Abraham M. Emond, 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, 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 NW–SE (345°) 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 6) spheroid, 1927 North American datum using a central meridian (CM) of 147°, a north constant of 0 and an east constant of 500,000. Positional accuracy of the presented data is better than 10 m with respect to the UTM grid.

RESISTIVITY

The DIGHEM^V 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 inphase and quadrature component of the coplanar 7,200 Hz using the pseudo–layer half space model. The data were interpolated onto a regular 80 m grid using a modified Akima (1970) technique. 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.

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.

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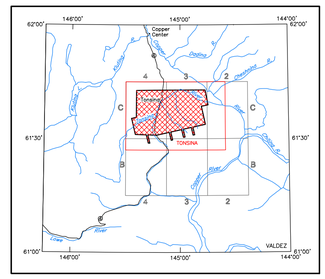
RESISTIVITY CONTOURS

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



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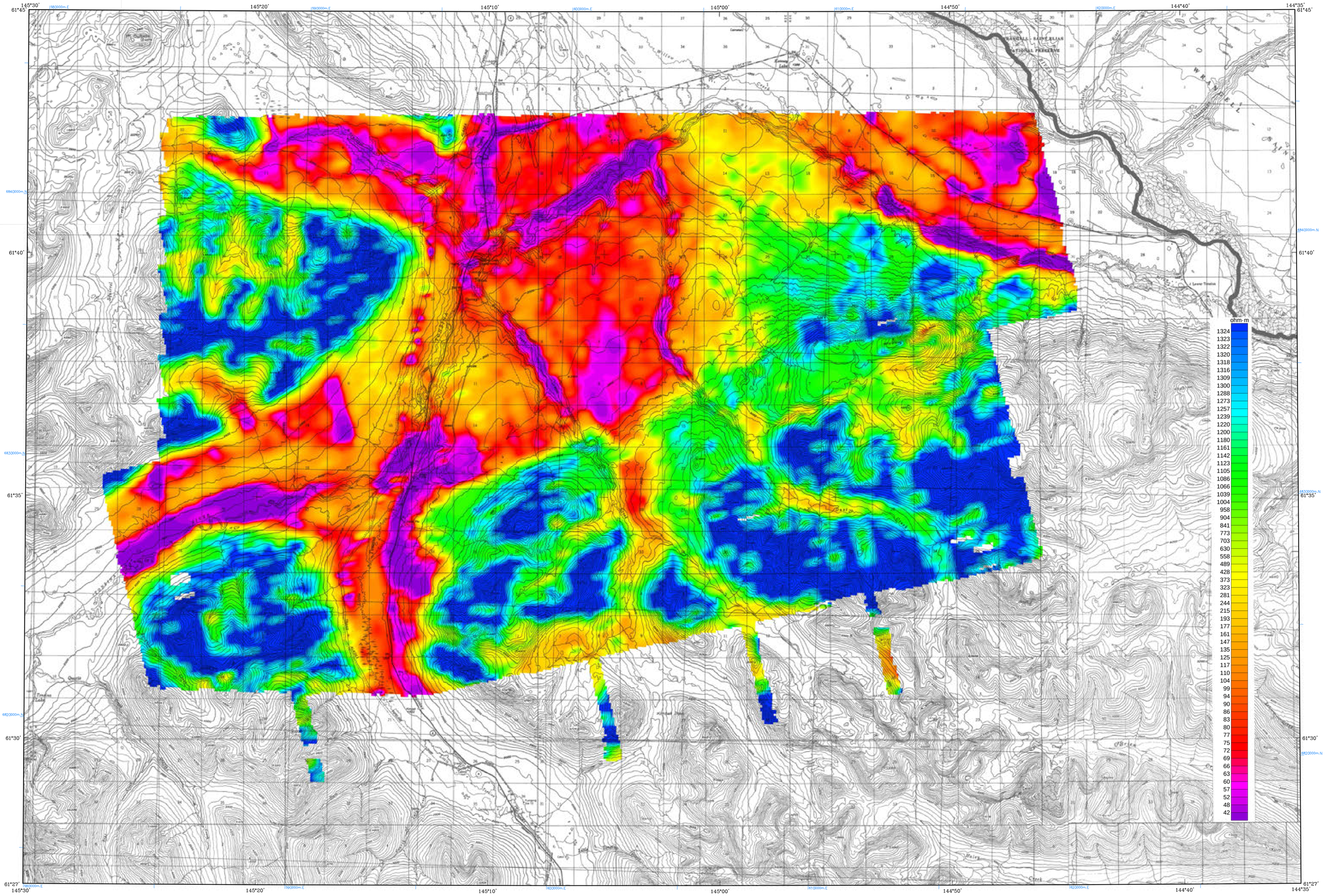

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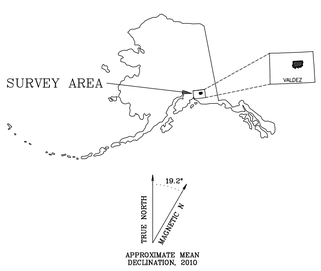


SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

900 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

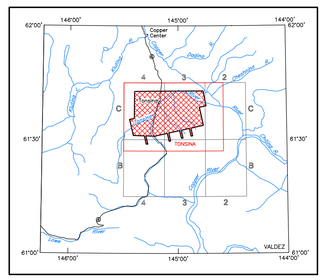
PART OF THE VALDEZ QUADRANGLE

by

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

2015

LOCATION INDEX OF 1:63,360–SCALE MAP



DESCRIPTIVE NOTES

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RESISTIVITY

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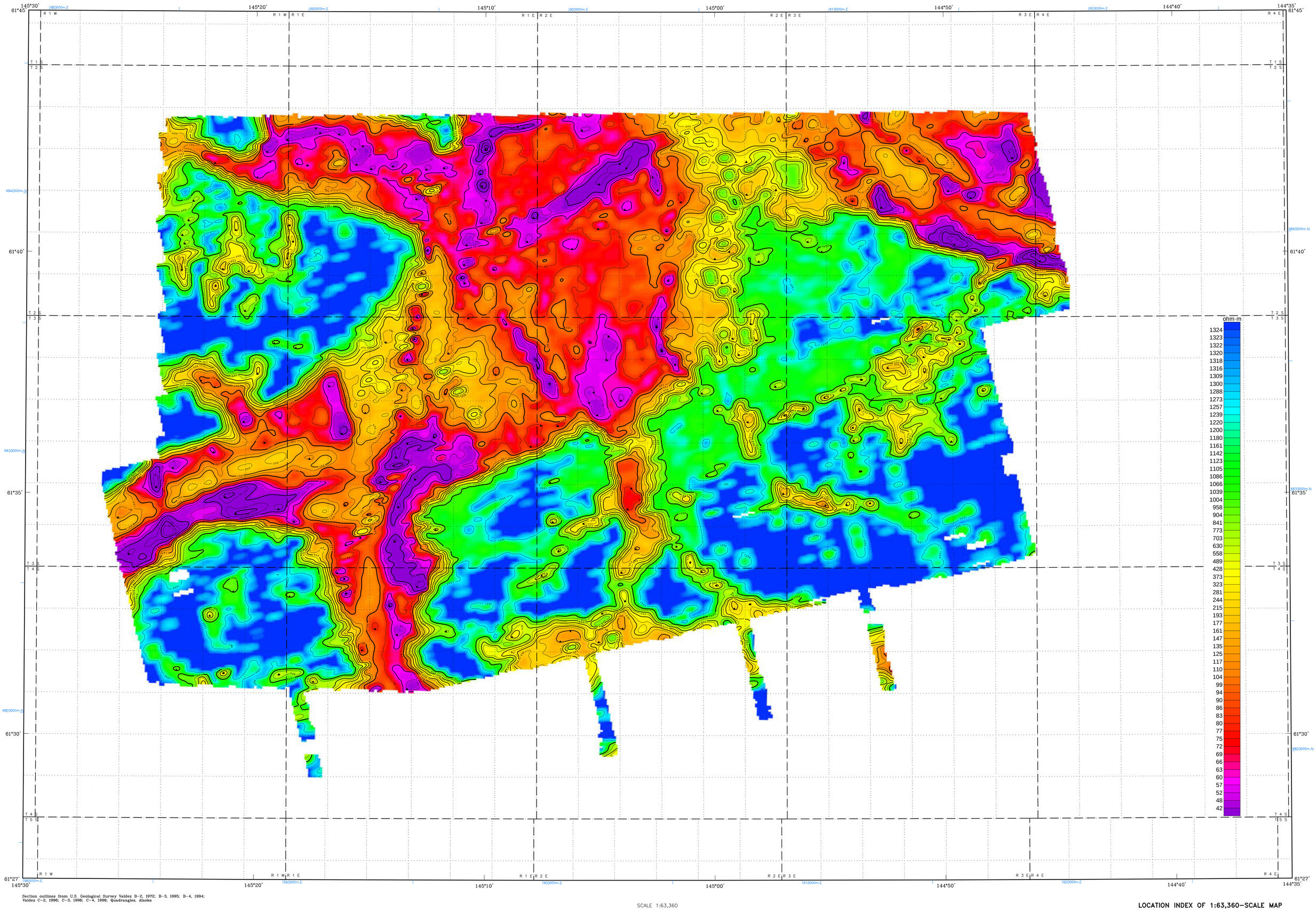

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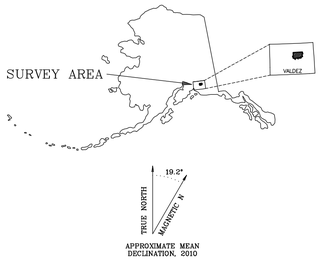

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

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by

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

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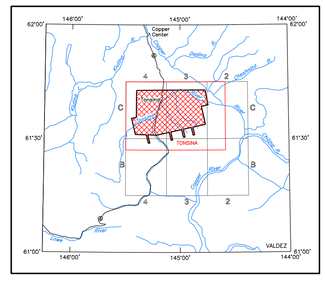
RESISTIVITY CONTOURS

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



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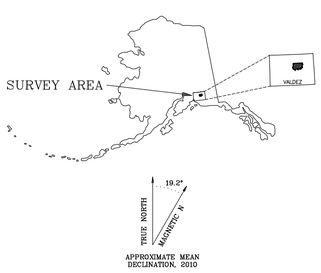


SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

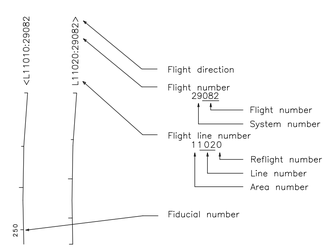
FLIGHT PATH WITH TOPOGRAPHY, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

PART OF THE VALDEZ QUADRANGLE

by

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

2015



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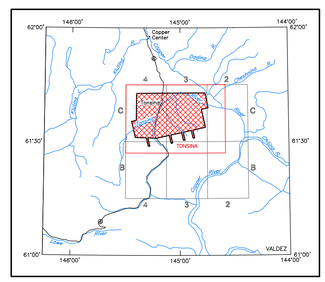
LOCATION INDEX OF 1:63,360–SCALE MAP



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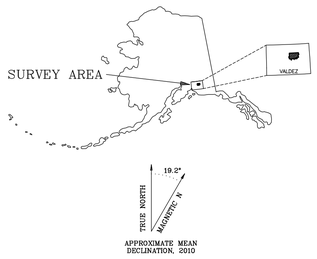

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

INTERPRETATION MAP, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

PART OF THE VALDEZ QUADRANGLE

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
M1	Magnetic Zone
ML	Magnetic Low
Zone A	Highly Conductive Zone
Zone B	Approximate outline of broad magnetic zone defined by a change in magnetic texture

DESCRIPTIVE NOTES

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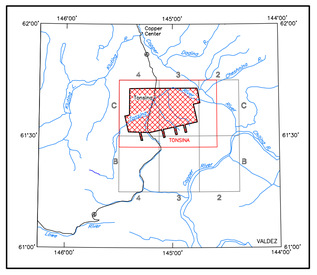

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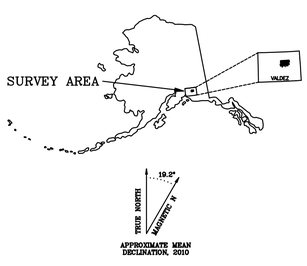

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

INTERPRETATION MAP WITH RESIDUAL MAGNETIC FIELD, TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

PART OF THE VALDEZ QUADRANGLE

Interpretation by CGG
2015

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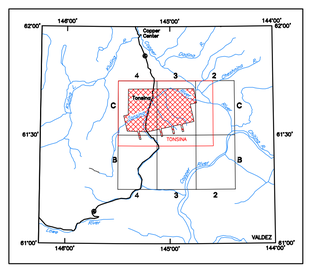

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RESIDUAL MAGNETIC FIELD

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.

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LEGEND

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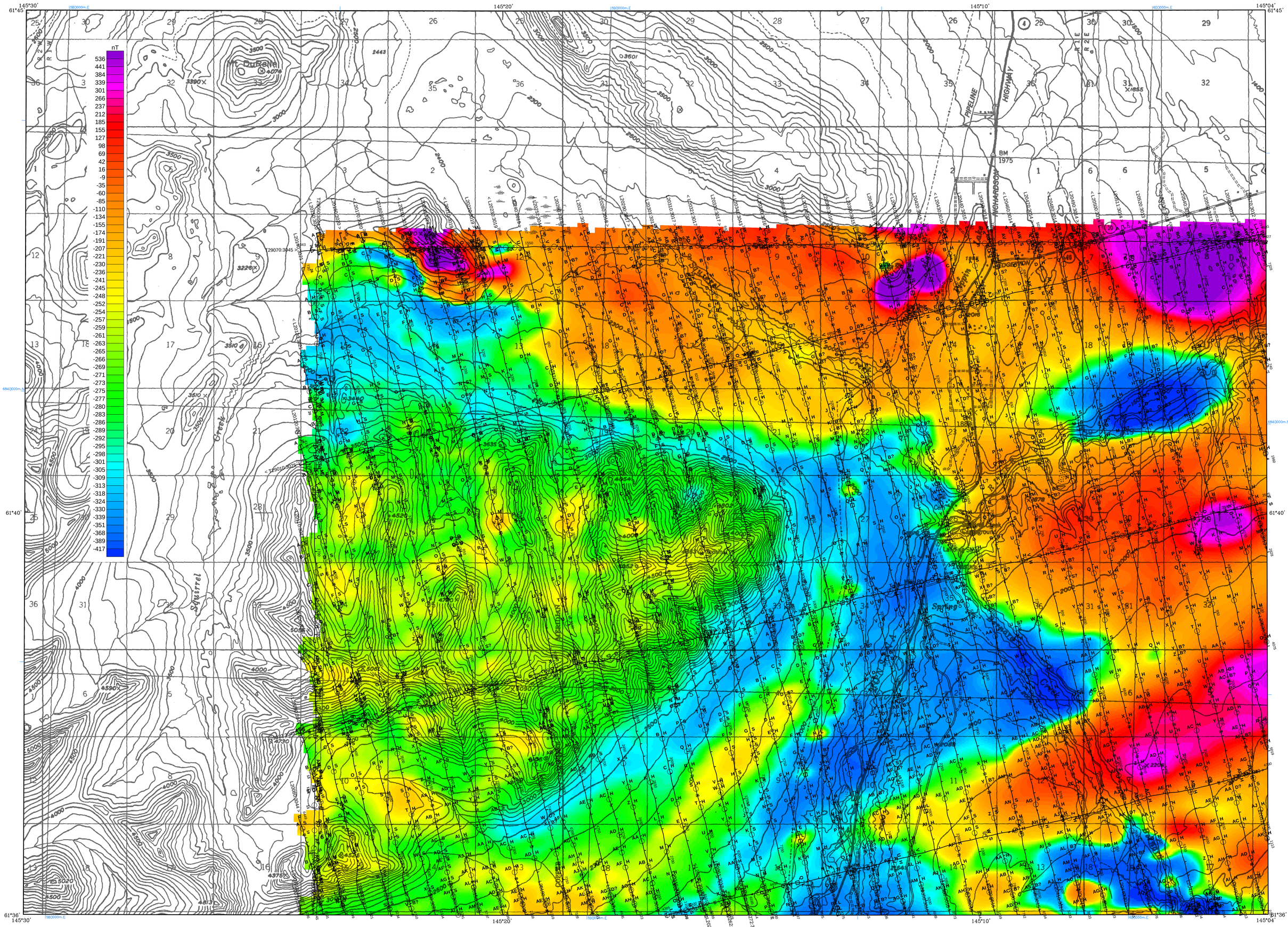


Base from U.S. Geological Survey Valdez C-3, 1996; C-4, 1996; Quadrangles, Alaska

SCALE 1:31,680

0.5 0 0.5 1 1.5 2 MILES

0.5 0 0.5 1 1.5 2 2.5 KILOMETERS

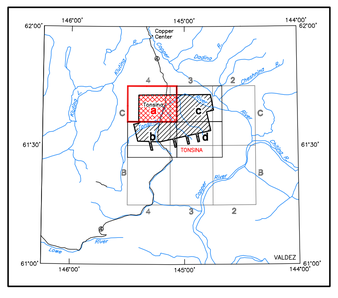
CONTOUR INTERVAL 100 FEET
DATUM MEAN SEA LEVEL

RESIDUAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES WITH TOPOGRAPHY OF THE TONSINA SURVEY AREA, SOUTH-CENTRAL ALASKA

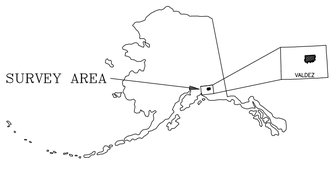
PARTS of VALDEZ B-3, B-4, C-2 C-3, and C-4 QUADRANGLES

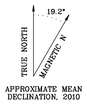
by
Abraham M. Emond, CGG, and CGG Land (U.S.) Inc.
2015

LOCATION INDEX OF 1:31,680–SCALE MAP



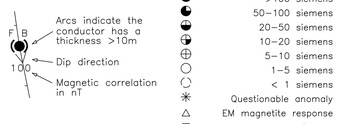
SURVEY AREA





APPROXIMATE MEAN DECLINATION, 2010

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 magnetite response
□	Culture

Anomaly identifier C|H Interpretive symbol	Interpretive symbol	Conductor model
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	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
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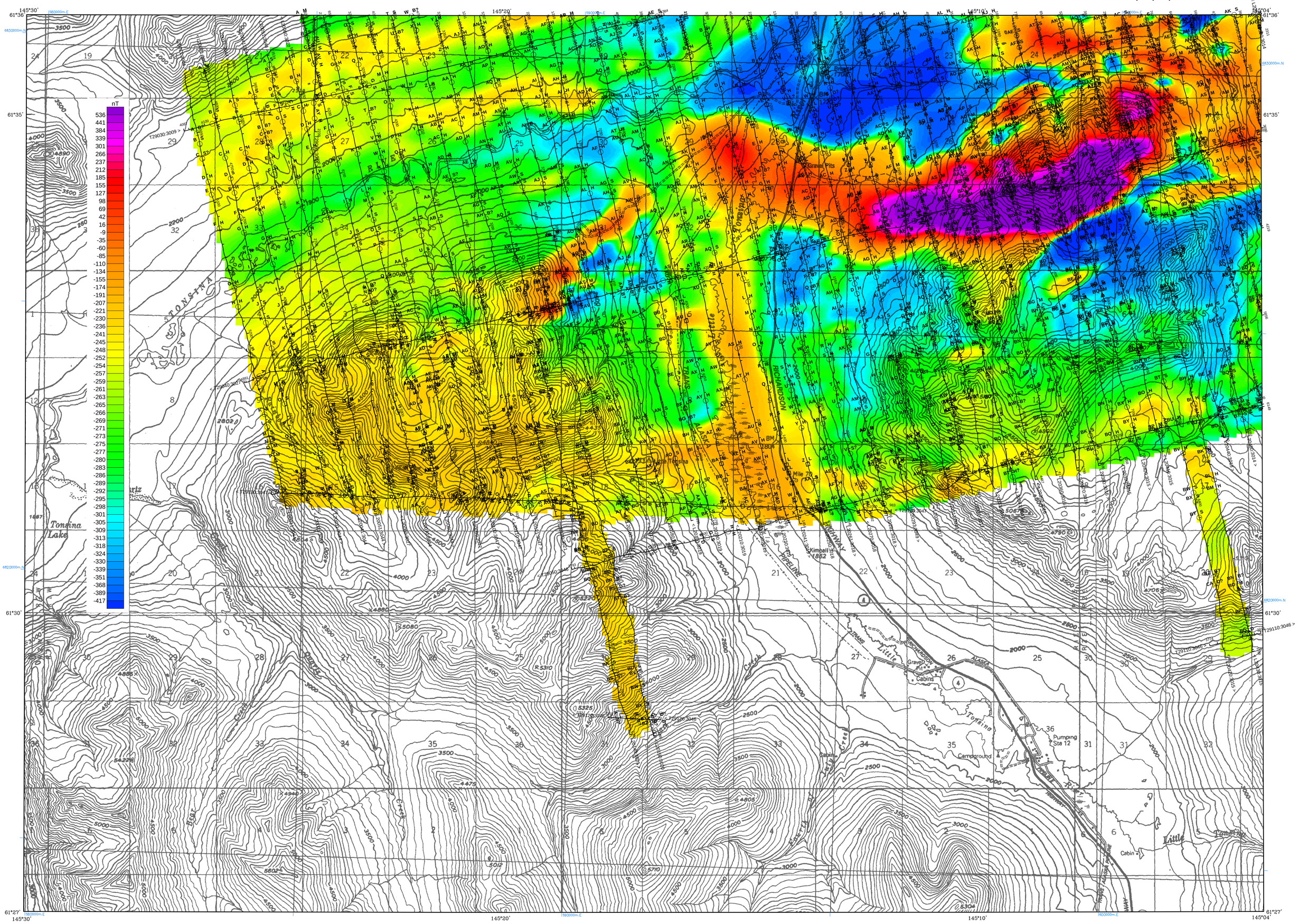


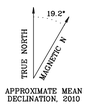
Base from U.S. Geological Survey Valdez B-3, 1995; B-4, 1994; C-3, 1996; C-4, 1996; Quadrangles, Alaska

SCALE 1:31,680

0.5 0 0.5 1 1.5 2 MILES

0.5 0 0.5 1 1.5 2 2.5 KILOMETERS

CONTOUR INTERVAL 100 FEET
DATUM MEAN SEA LEVEL



APPROXIMATE MEAN DECLINATION, 2010

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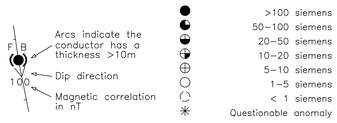
PARTS of VALDEZ B-3, B-4, C-2 C-3, and C-4 QUADRANGLES

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

ELECTROMAGNETIC ANOMALIES



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◒	20–50 siemens
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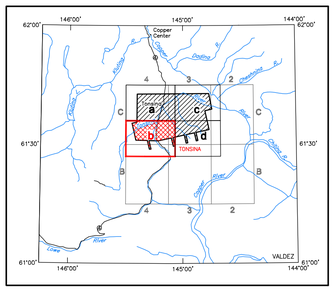

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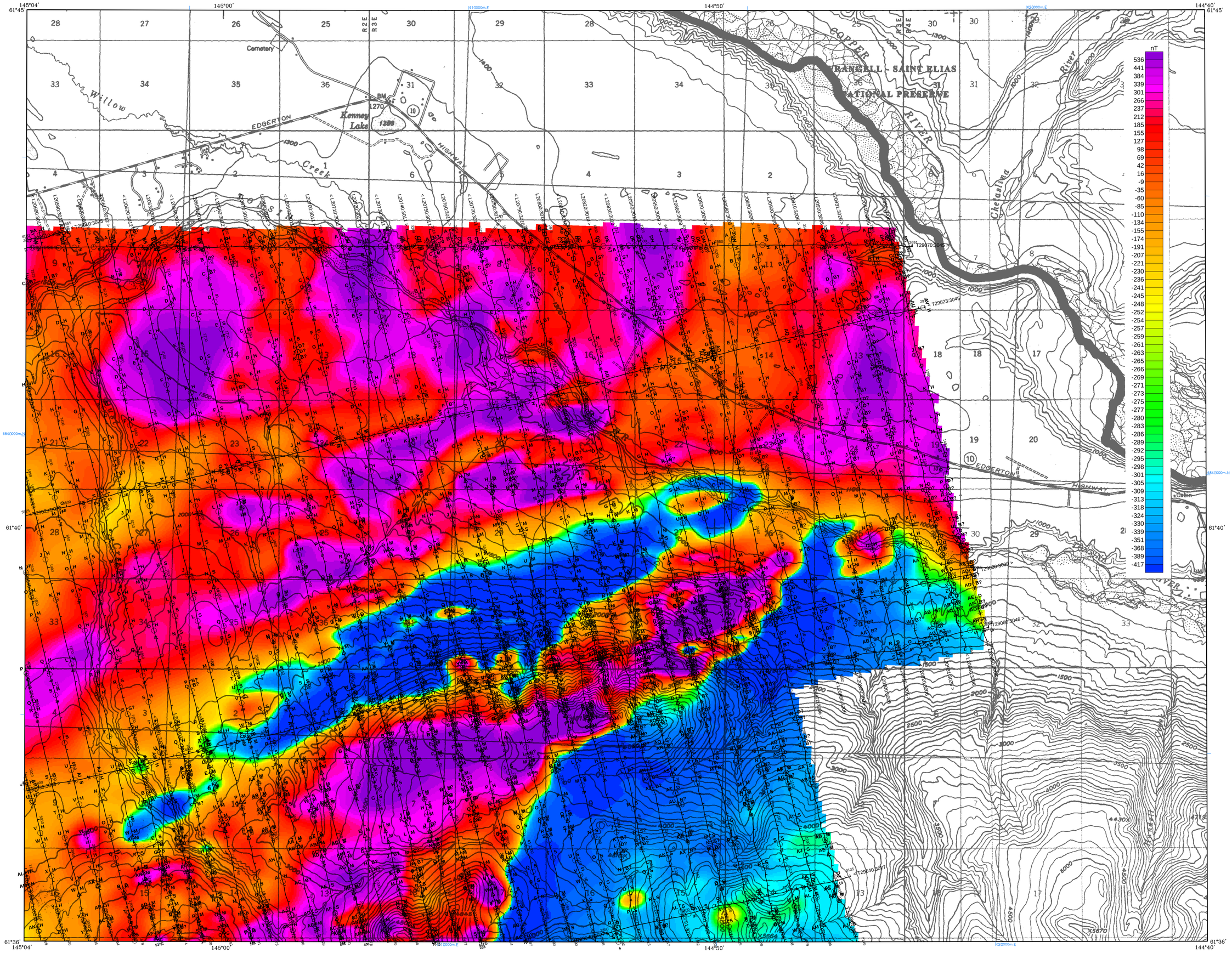

Base from U.S. Geological Survey Valdez C-2, 1996; C-3, 1996; Quadrangles, Alaska

SCALE 1:31,680

0.5 0 0.5 1 1.5 2 MILES

0.5 0 0.5 1 1.5 2 2.5 KILOMETERS

CONTOUR INTERVAL 100 FEET
DATUM MEAN SEA LEVEL

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

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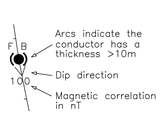

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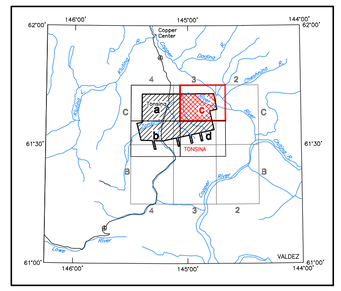

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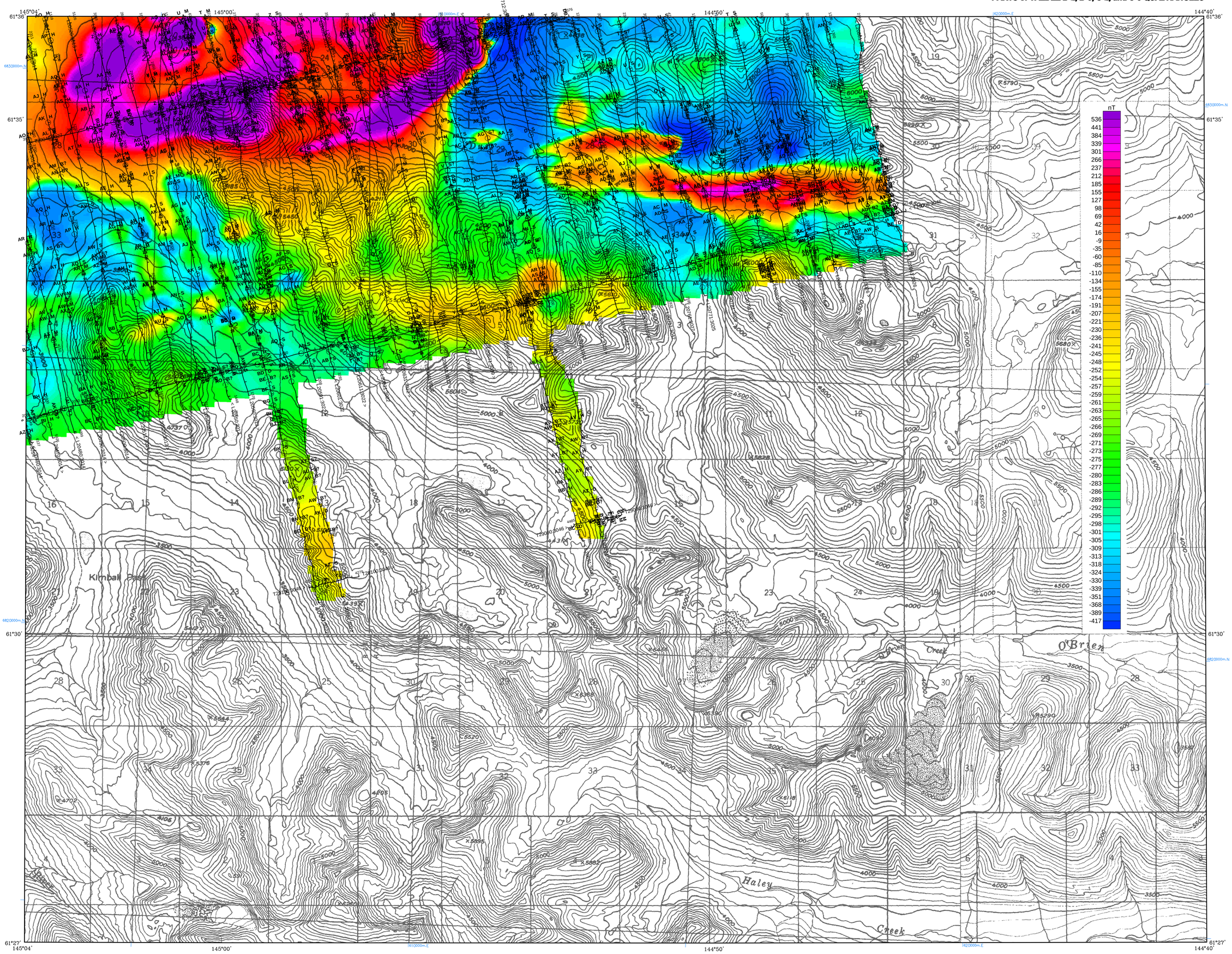

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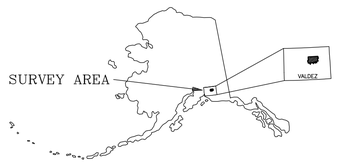

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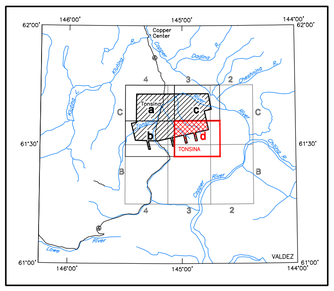

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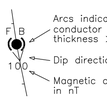

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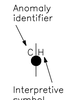

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