SOUTHERN NPRA ELECTROMAGNETIC AND MAGNETIC AIRBORNE GEOPHYSICAL SURVEY DATA COMPILATION

Laurel E. Burns, Gina R.C. Graham, John D. Barefoot, Fugro Airborne Surveys Corp., and Stevens Exploration Management

Geophysical Report 2020-10

2020
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DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

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SOUTHERN NPRA ELECTROMAGNETIC AND MAGNETIC AIRBORNE GEOPHYSICAL SURVEY DATA COMPILATION

Laurel E. Burns[1], Gina R.C. Graham[1], John D. Barefoot[1], Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.

ABSTRACT

The Southern NPRA electromagnetic and magnetic airborne geophysical survey is located in northwest Alaska in the southern National Petroleum Reserve-Alaska, about 320 kilometers south of the City of Utqiaġvik. Frequency domain electromagnetic and magnetic data were collected with the DIGHEM^{V} system from July to August 2005. A total of 11,115 line kilometers were collected covering 3,947.9 square kilometers. Line spacing was 400 meters (m) and 200 m over the Drenchwater area. Data were collected with an average ground clearance of 35 m from a helicopter towed sensor platform ("bird") on a 30-m-long line.

PURPOSE

This airborne geophysical survey is part of a program to acquire data on Alaska's most promising mineral belts and districts. The information acquired is aimed at catalyzing new private-sector exploration, discovery, and ultimate development and production. The purpose of the survey was to map the magnetic and conductive properties of the survey area. Drenchwater Creek is a Pb-Zn prospect in the western part of the survey area. Other gold and base-metal anomalies, altered zones, favorable lithologies, and structural zones are known to exist throughout the survey area.

SURVEY OVERVIEW DESCRIPTION

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

ACKNOWLEDGMENTS

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

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[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	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.
vector_data	contractor and DGGS	Line path, data contours, and survey boundary in ESRI shapefile (SHP) format, ESRI Geodatabase format, and/or AutoCAD dxf format
video_flightpath	contractor	Survey flight path downward facing video

REFERENCES

Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures: Journal of the Association of Computing Machinery, v. 17, n. 4, p. 589–602.

Burns, L.E., 2005, Project report and profile data of the southern National Petroleum Reserve-Alaska, northwest Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2006-2. http://doi.org/10.14509/14510

Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2006, Line, grid, and vector data and plot files for the airborne geophysical survey data of parts of the southern National Petroleum Reserve-Alaska, northwest Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2006-1, 43 sheets, 1 DVD. http://doi.org/10.14509/14501

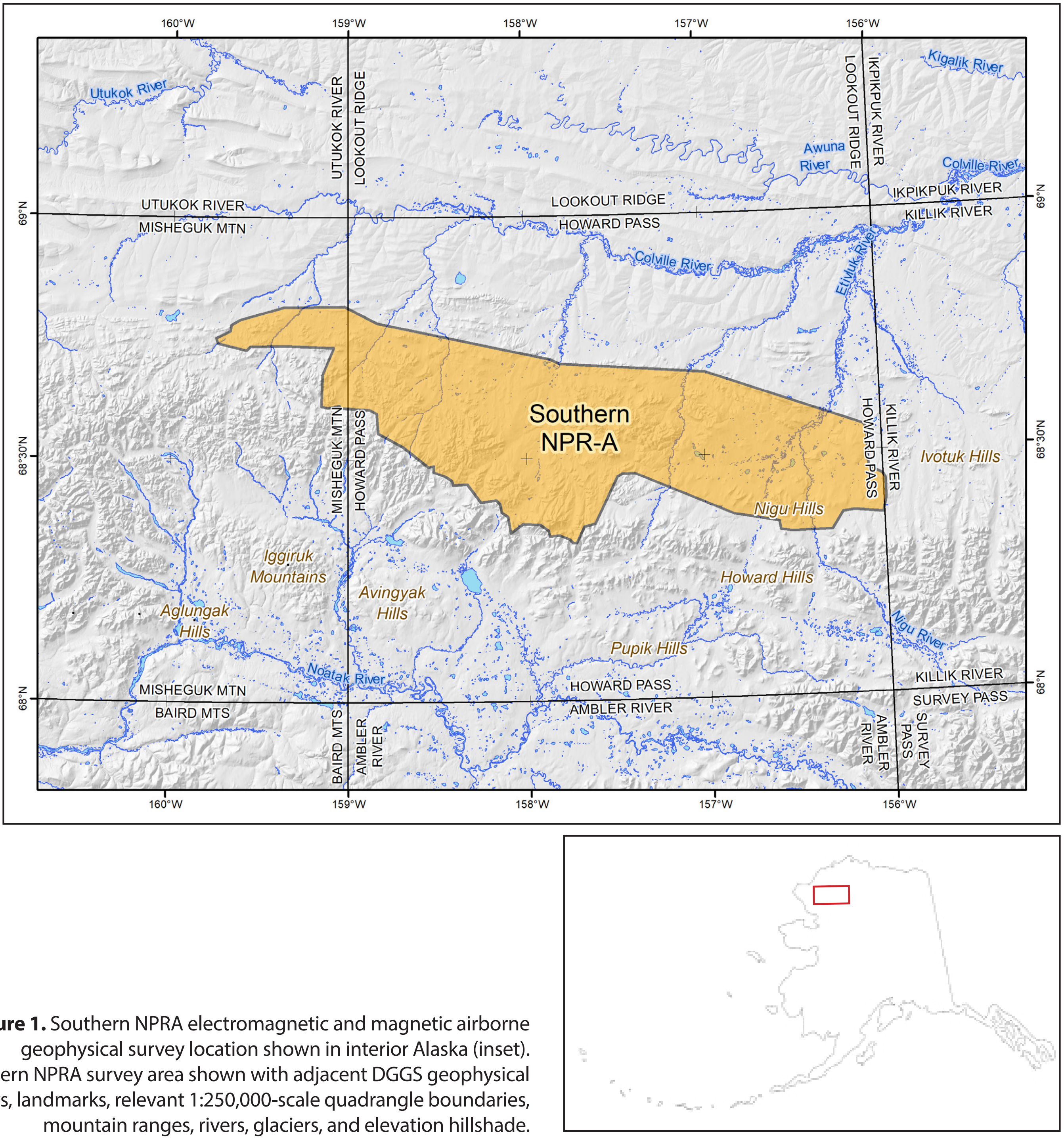

Figure 1. Southern NPRA electromagnetic and magnetic airborne geophysical survey location shown in interior Alaska (inset). Southern NPRA survey area shown with adjacent DGGS geophysical surveys, landmarks, relevant 1:250,000-scale quadrangle boundaries, mountain ranges, rivers, glaciers, and elevation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

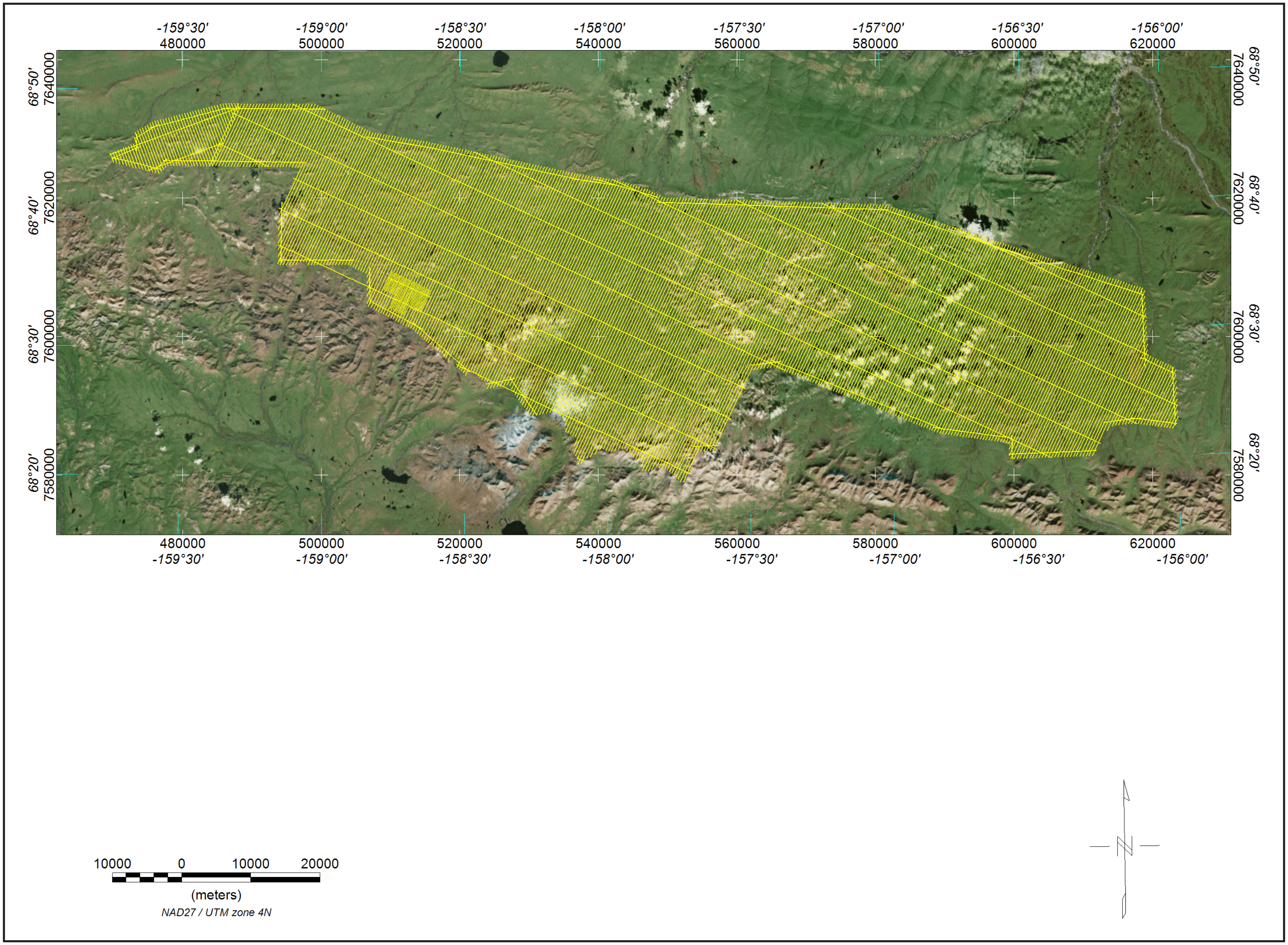

Figure 2. Flight path with orthometric image.

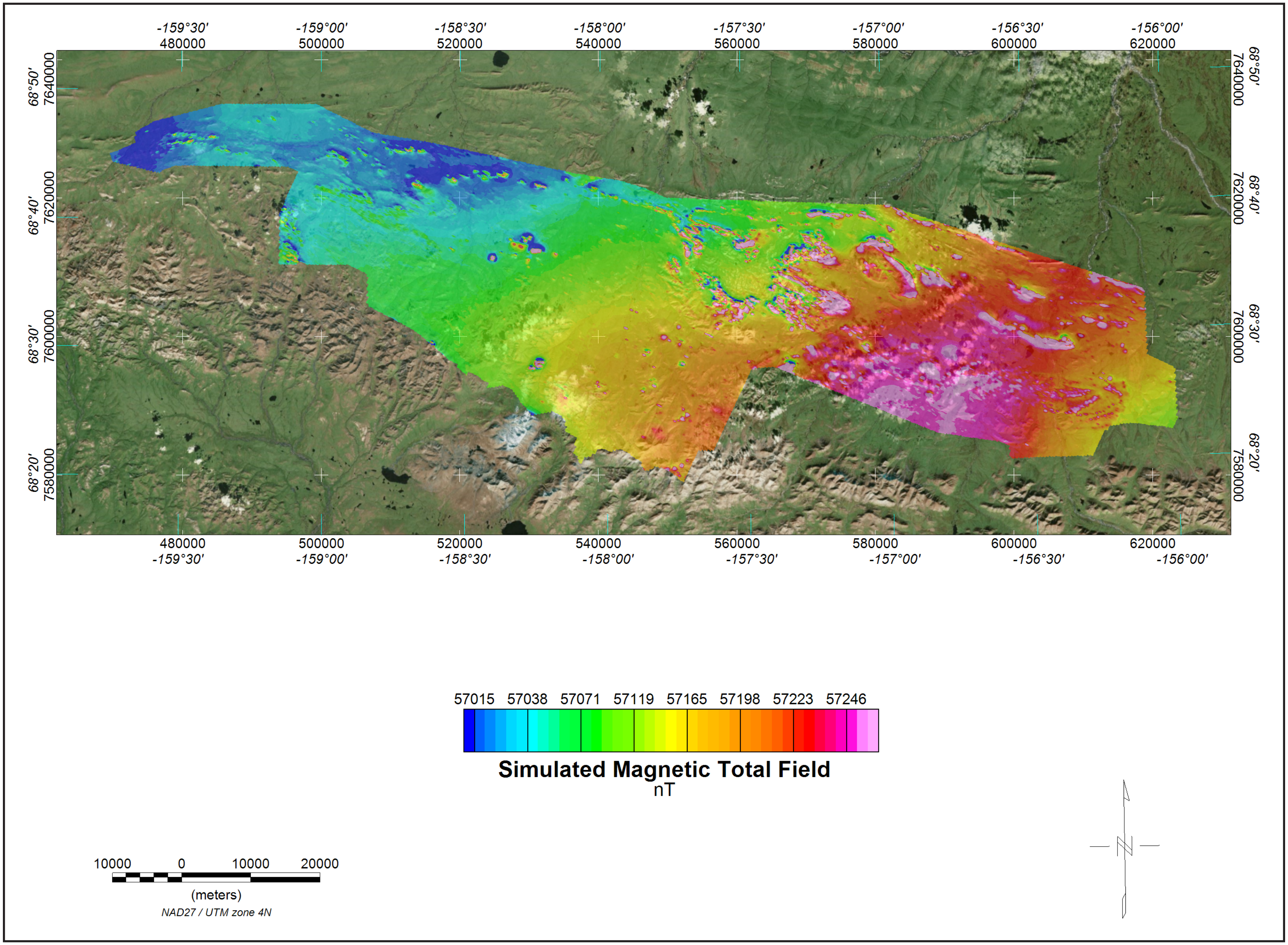

Figure 3. Simulated magnetic total field grid with orthometric image. The magnetic total field data were processed using digitally recorded data from a Scintrex CS2 cesium magnetometer. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtracting the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2005, updated to August 2005), (3) leveled to the tie line data, (4) a constant value of approximately 57,000 nT was added to all data, and (5) interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

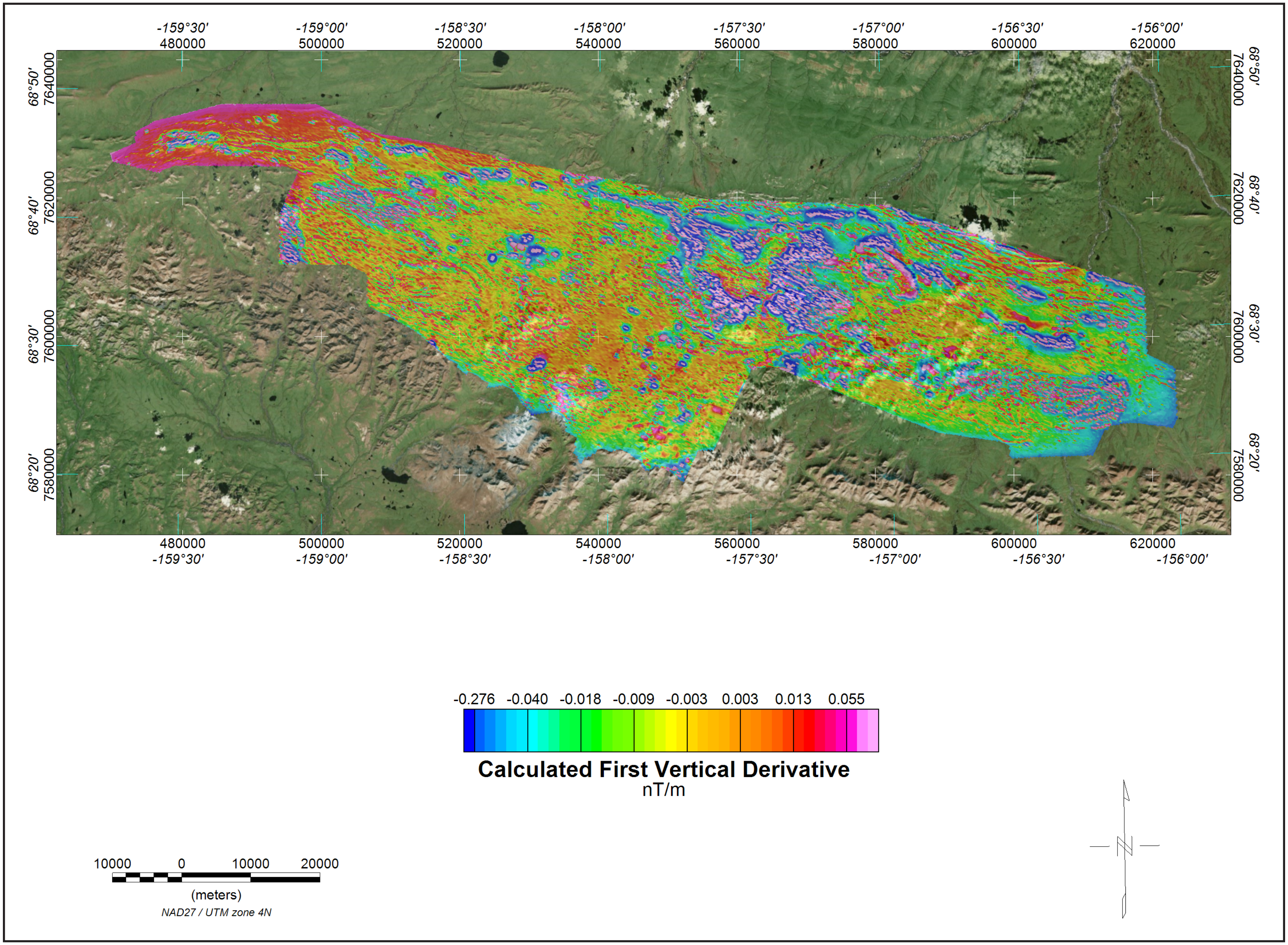

Figure 4. Calculated first vertical derivative grid with orthometric image. The first vertical derivative grid was calculated from the diurnally-corrected, IGRF-corrected total magnetic field grid using a FFT base frequency domain filtering algorithm. The resulting first vertical derivative grid provides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

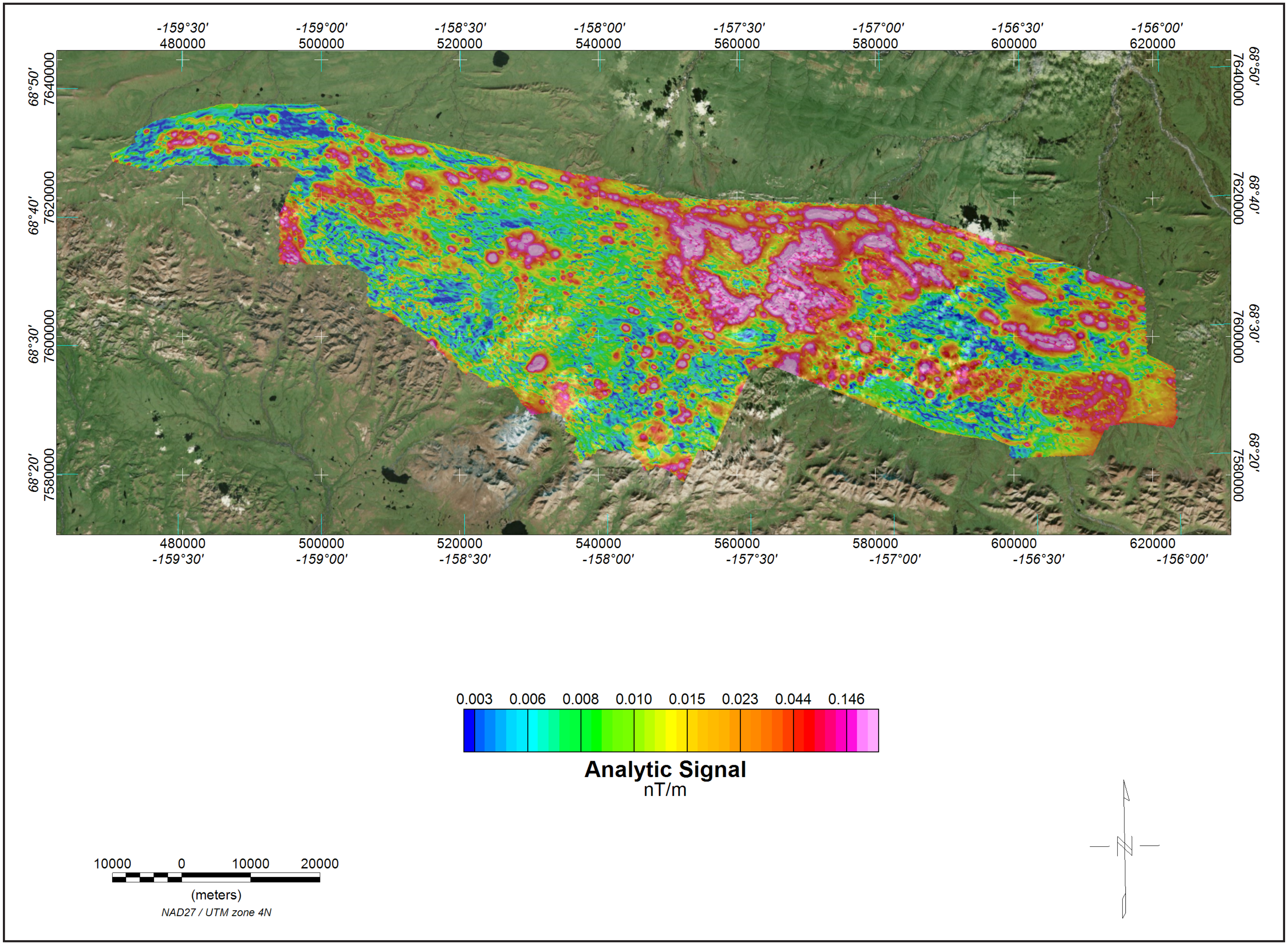

Figure 5. Analytic signal grid with orthometric image. Analytic signal is the total amplitude of all directions of magnetic gradient calculated from the sum of the squares of the three orthogonal gradients. Mapped highs in the calculated analytic signal of magnetic parameter locate the anomalous source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

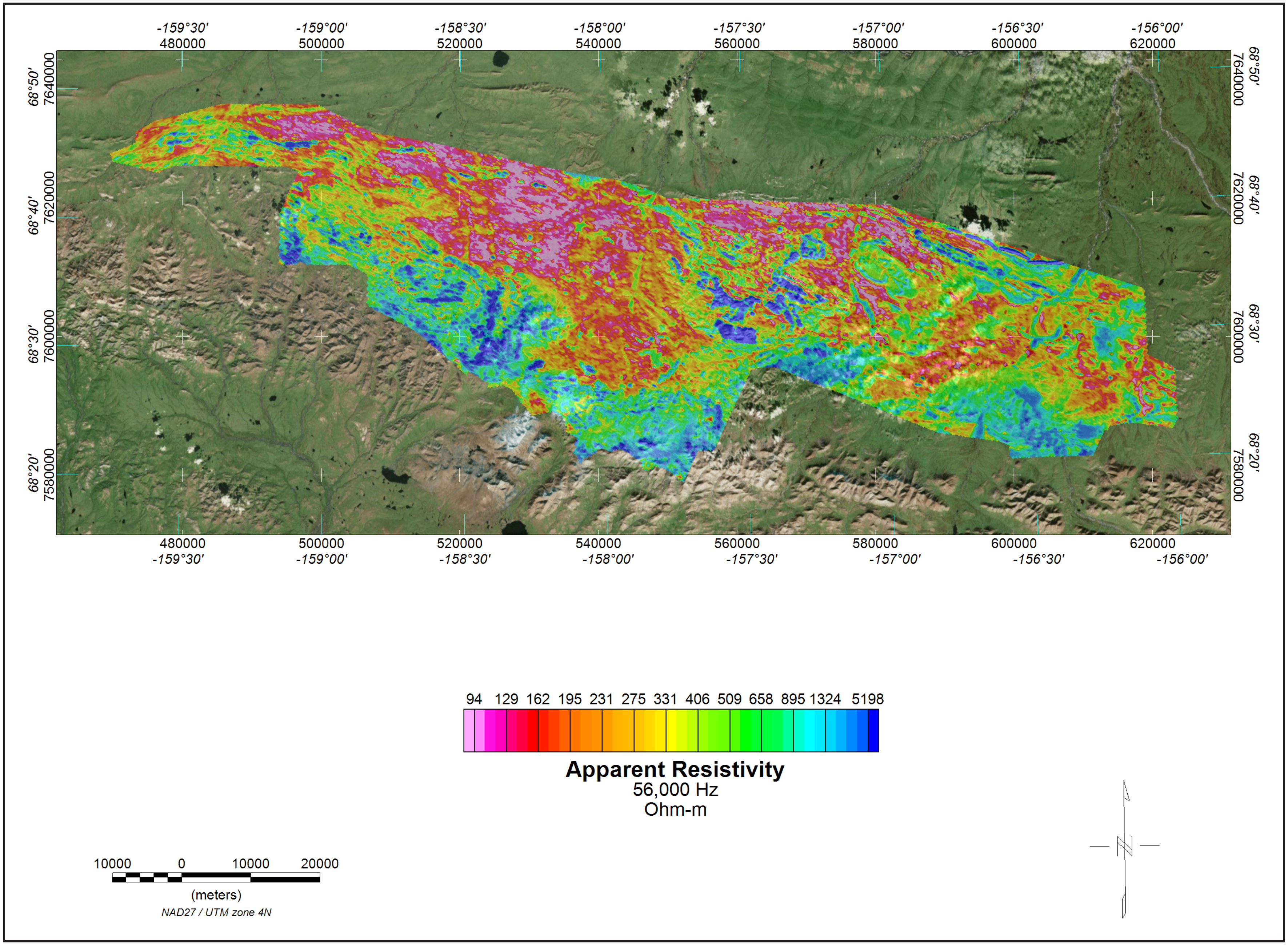

Figure 6. 56,000 Hz coplanar apparent resistivity grid with orthometric image. The DIGHEM^V EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1000 and 5000 Hz while three horizontal coplanar coil-pairs operated at 900, 7,200, and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 56,000 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

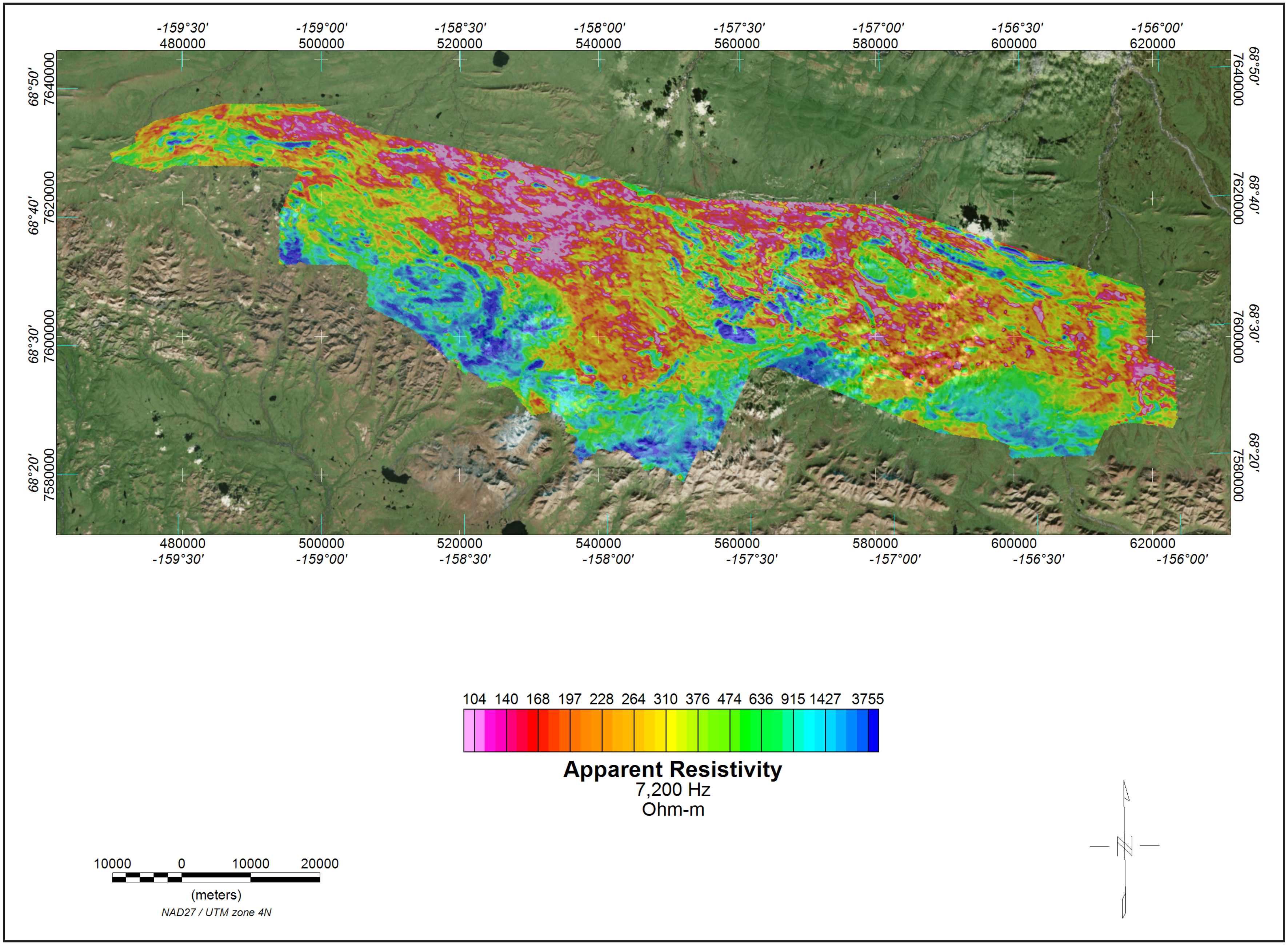

Figure 7. 7,200 Hz coplanar apparent resistivity grid with orthometric image. The DIGHEM^V EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1000 and 5000 Hz while three horizontal coplanar coil-pairs operated at 900, 7,200, and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 7,200 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

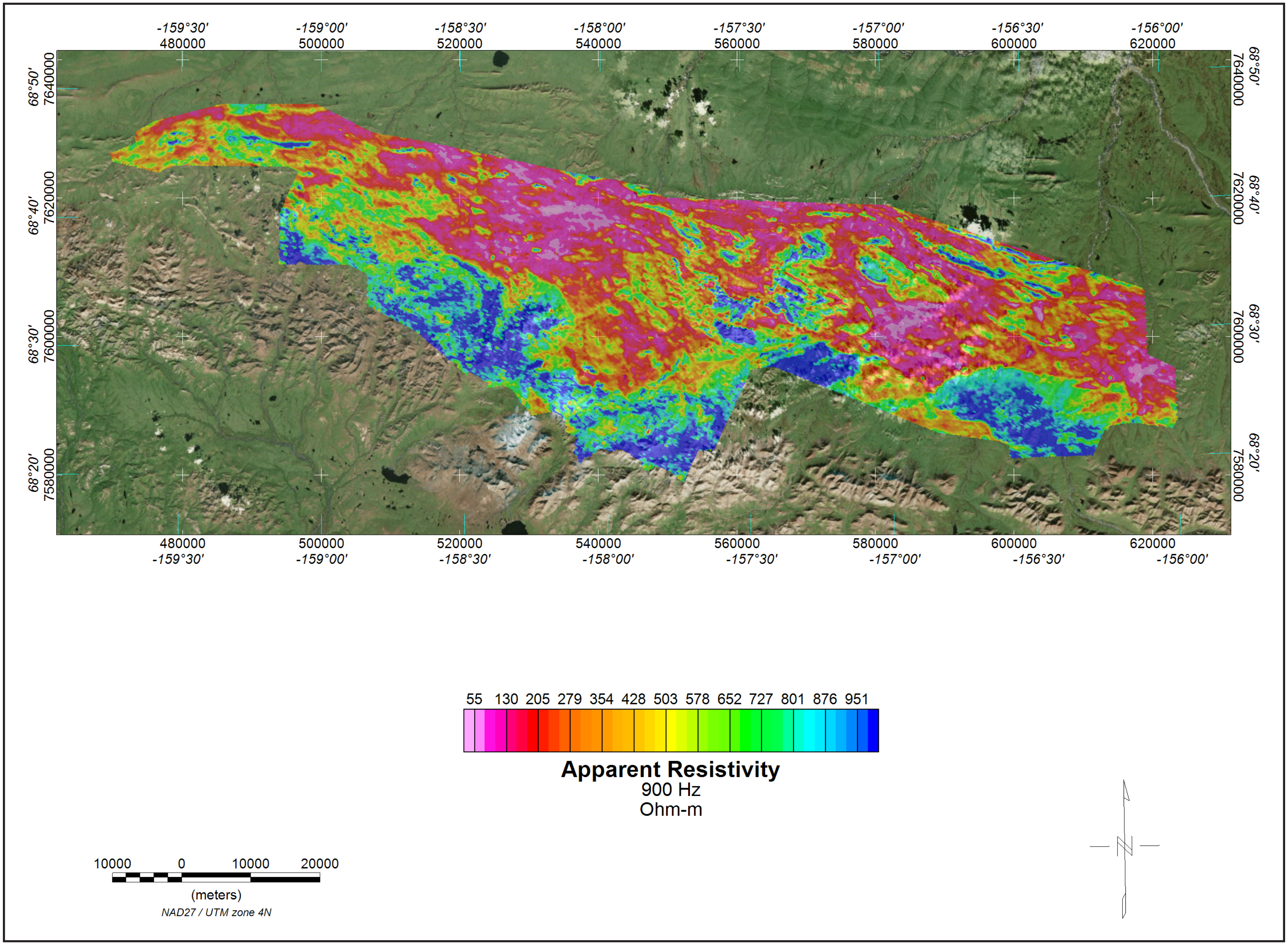

Figure 8. 900 Hz coplanar apparent resistivity grid with orthometric image. The DIGHEM^V EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1000 and 5000 Hz while three horizontal coplanar coil-pairs operated at 900, 7,200, and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 900 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

Table 1. Copies of the following maps are included at the end of this booklet. The low-resolution, page-size maps included in this booklet are intended to be used as a search tool and are not the final product. Large-scale, full-resolution versions of each map are available to download on this publication's citation page: http://doi.org/10.14509/30441

Map Title	Description
southernnpra_sim_magtf_topo_map_1of4.pdf	simulated magnetic total field grid with topographic base map
southernnpra_sim_magtf_topo_map_2of4.pdf	simulated magnetic total field grid with topographic base map
southernnpra_sim_magtf_topo_map_3of4.pdf	simulated magnetic total field grid with topographic base map
southernnpra_sim_magtf_topo_map_4of4.pdf	simulated magnetic total field grid with topographic base map
southernnpra_sim_magtf_contours_plss_map_1of4.pdf	simulated magnetic total field grid and contours with public land survey system base layer
southernnpra_sim_magtf_contours_plss_map_2of4.pdf	simulated magnetic total field grid and contours with public land survey system base layer
southernnpra_sim_magtf_contours_plss_map_3of4.pdf	simulated magnetic total field grid and contours with public land survey system base layer
southernnpra_sim_magtf_contours_plss_map_4of4.pdf	simulated magnetic total field grid and contours with public land survey system base layer
southernnpra_res7200hz_topo_map_1of4.pdf	7,200 Hz apparent resistivity grid with topographic base map
southernnpra_res7200hz_topo_map_2of4.pdf	7,200 Hz apparent resistivity grid with topographic base map
southernnpra_res7200hz_topo_map_3of4.pdf	7,200 Hz apparent resistivity grid with topographic base map
southernnpra_res7200hz_topo_map_4of4.pdf	7,200 Hz apparent resistivity grid with topographic base map
southernnpra_res7200hz_contours_plss_map_1of4.pdf	7,200 Hz apparent resistivity grid with contours and public land survey system base layer
southernnpra_res7200hz_contours_plss_map_2of4.pdf	7,200 Hz apparent resistivity grid with contours and public land survey system base layer
southernnpra_res7200hz_contours_plss_map_3of4.pdf	7,200 Hz apparent resistivity grid with contours and public land survey system base layer
southernnpra_res7200hz_contours_plss_map_4of4.pdf	7,200 Hz apparent resistivity grid with contours and public land survey system base layer
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southernnpra_res900hz_topo_map_2of4.pdf	900 Hz apparent resistivity grid with topographic base map
southernnpra_res900hz_topo_map_3of4.pdf	900 Hz apparent resistivity grid with topographic base map
southernnpra_res900hz_topo_map_4of4.pdf	900 Hz apparent resistivity grid with topographic base map
southernnpra_res900hz_contours_plss_map_1of4.pdf	900 Hz apparent resistivity grid with contours and public land survey system base layer
southernnpra_res900hz_contours_plss_map_2of4.pdf	900 Hz apparent resistivity grid with contours and public land survey system base layer
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southernnpra_res900hz_contours_plss_map_4of4.pdf	900 Hz apparent resistivity grid with contours and public land survey system base layer
southernnpra_emanomalies_sim_magtf_contours_detailed_topo_map_01of11.pdf	electromagnetic anomaly map with simulated magnetic total field grid contours and topographic base map
southernnpra_emanomalies_sim_magtf_contours_detailed_topo_map_02of11.pdf	electromagnetic anomaly map with simulated magnetic total field grid contours and topographic base map

Table 1, continued. Copies of the following maps are included at the end of this booklet. The low-resolution, page-size maps included in this booklet are intended to be used as a search tool and are not the final product. Large-scale, full-resolution versions of each map are available to download on this publication's citation page: http://doi.org/10.14509/30441

Map Title	Description
southernnpra_emanomalies_sim_magtf_contours_detailed_topo_map_03of11.pdf	electromagnetic anomaly map with simulated magnetic total field grid contours and topographic base map
southernnpra_emanomalies_sim_magtf_contours_detailed_topo_map_04of11.pdf	electromagnetic anomaly map with simulated magnetic total field grid contours and topographic base map
southernnpra_emanomalies_sim_magtf_contours_detailed_topo_map_05of11.pdf	electromagnetic anomaly map with simulated magnetic total field grid contours and topographic base map
southernnpra_emanomalies_sim_magtf_contours_detailed_topo_map_06of11.pdf	electromagnetic anomaly map with simulated magnetic total field grid contours and topographic base map
southernnpra_emanomalies_sim_magtf_contours_detailed_topo_map_07of11.pdf	electromagnetic anomaly map with simulated magnetic total field grid contours and topographic base map
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southernnpra_res56khz_contours_plss_map_4of4.pdf	56,000 Hz apparent resistivity grid with contours and public land survey system base layer
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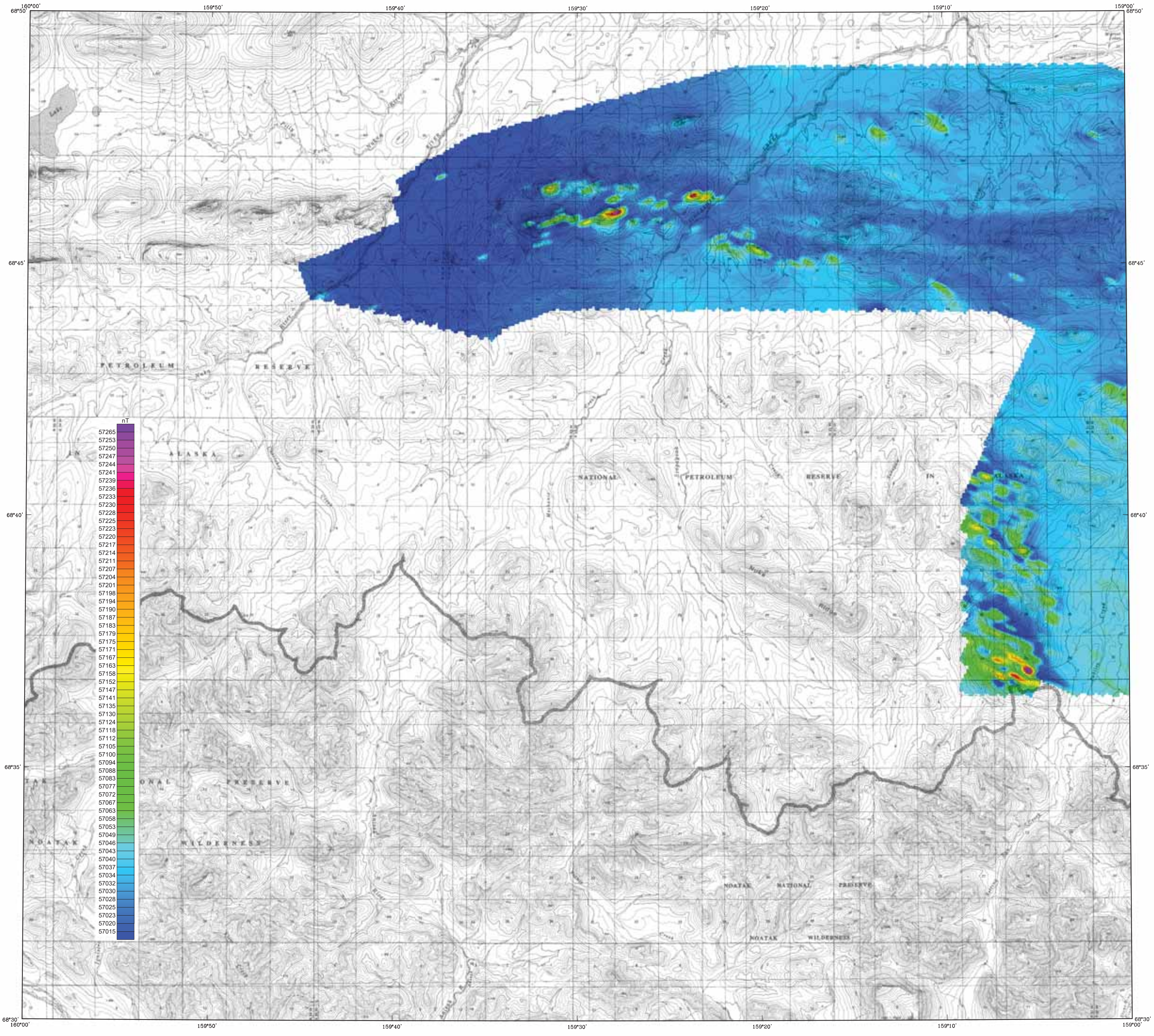
southernnpra_interpretation_plss_map_4of4.pdf	interpretation based on geophysical data with public land survey system base layer

ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
IN COOPERATION WITH THE U.S. BUREAU OF LAND MANAGEMENT

GEOPHYSICAL REPORT 2006-1-1a
Sheet 1 of 4



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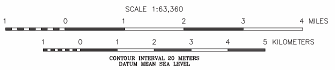

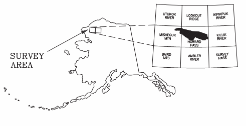

TOTAL MAGNETIC FIELD OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS OF HOWARD PASS AND MISHEGUK MOUNTAIN QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.
2006

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM^{V} Electromagnetic (EM) system and a Scintrex cesium magnetometer. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS350B-2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (340°) survey flight lines west of the red line shown on the location index and NE-SW (25°) survey flight lines east of the red line. Flight lines were spaced a quarter of a mile with the exception of the Drenchwater Creek area (red area in the location index), where flight lines were spaced one eighth of a mile. Tie lines were flown perpendicular to the flight line intervals of approximately 3 miles except for the Drenchwater Creek areas, where the flight interval was 1.5 miles.

An Ashtech GG24 NAVSTAR / GLONASS Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 4) spheroid, 1927 North American datum using a central meridian (CM) of 159°, 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.

TOTAL MAGNETIC FIELD

The magnetic total field contours were produced using digitally recorded data from a Scintrex cesium CS2 magnetometer, with 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) adjusted for regional variations (or IGRF gradient, 2005, updated to August 2005) using altimeter adjusted IGRF, (3) leveled to the tie line data, and 4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

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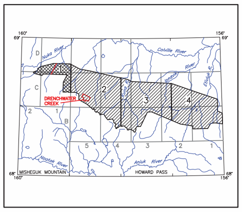
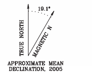
LOCATION INDEX

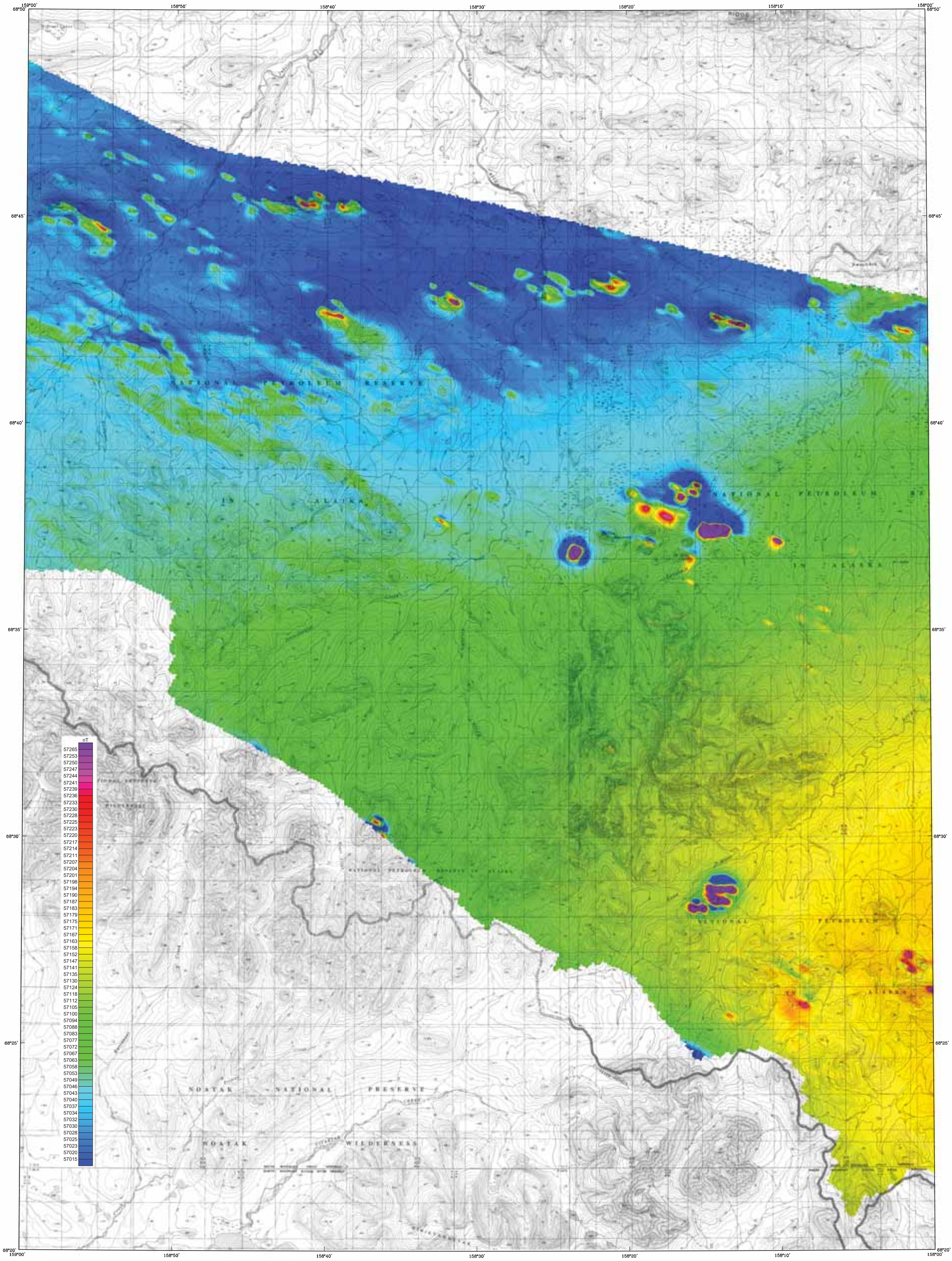




SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and Stevens Exploration Management Corp. Airborne geophysical data for the area were acquired and processed by Fugro Airborne Surveys Corp. in 2005. Funding for the project was provided by the U.S. Department of the Interior, Bureau of Land Management (BLM).

This map and other products from this survey are available by mail order in person from DGGS, 3354 College Road, Fairbanks, Alaska, 99709-3707. Published maps are also available for viewing or downloading as Adobe Acrobat Files (*.pdf) on our Web site (http://www.dggs.dnr.state.ak.us/pubs/). Some products are also available for viewing at the BLM Alaska State Office, 222 W. 7th Avenue, Anchorage, AK 99513.



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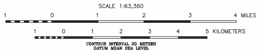

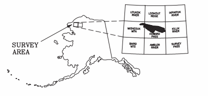

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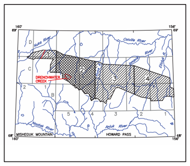

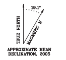

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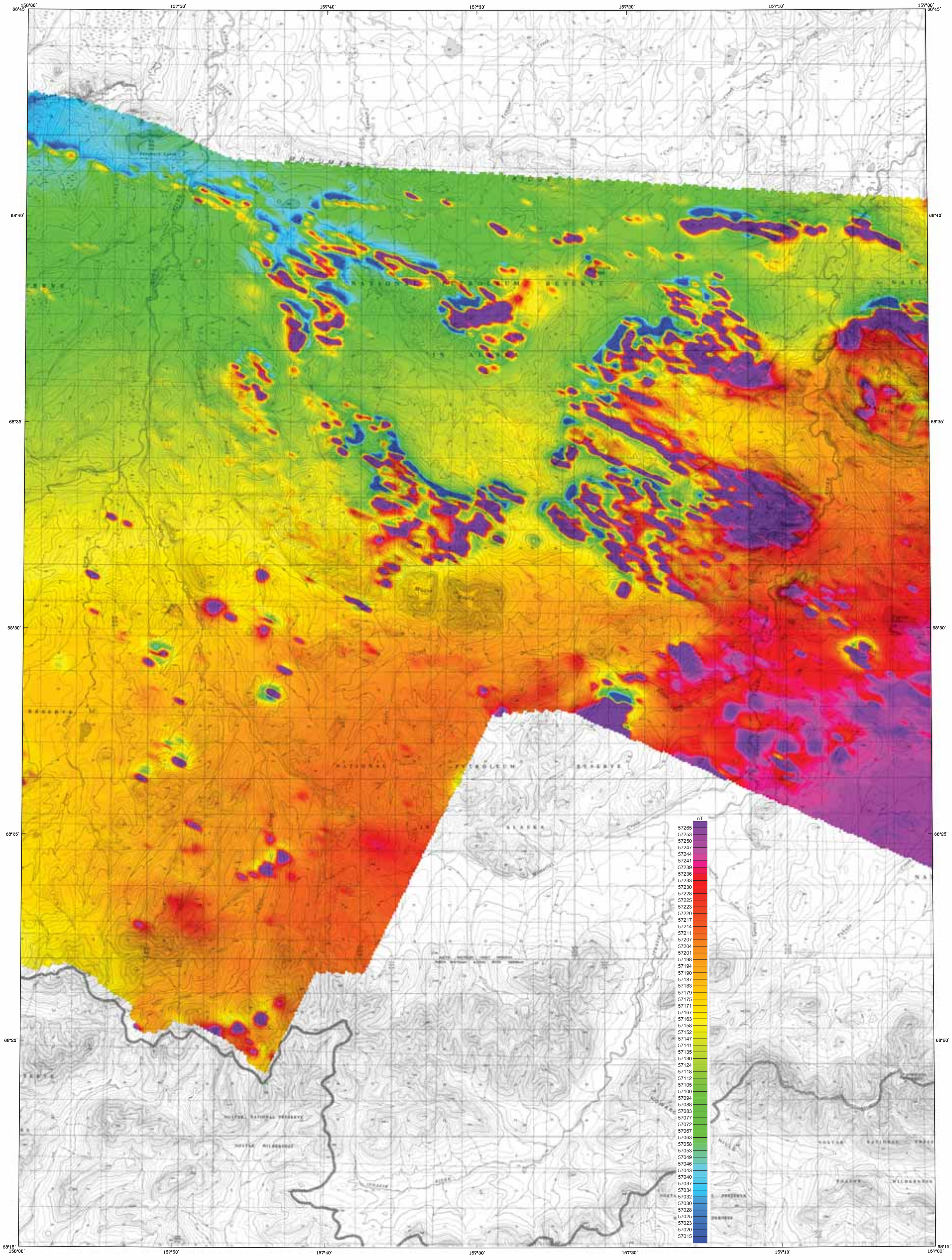
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
IN COOPERATION WITH THE U.S. BUREAU OF LAND MANAGEMENT

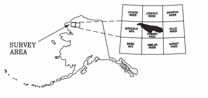
GEOPHYSICAL REPORT 2006-1-1a
Sheet 3 of 4



Base from U.S. Geological Survey Howard Pass B-2, 1984; B-3, 1984; B-4, 1984; C-2, 1984; C-3, 1984; C-4, 1984; Quadrangles, Alaska

SCALE 1:63,360

CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL

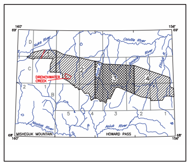


TOTAL MAGNETIC FIELD
OF PARTS OF
SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA,
NORTHWEST ALASKA

PARTS OF HOWARD PASS AND MISHEGUK MOUNTAIN QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.
2006

LOCATION INDEX



APPROXIMATE MEAN
DECLINATION, 2005

DESCRIPTIVE NOTES

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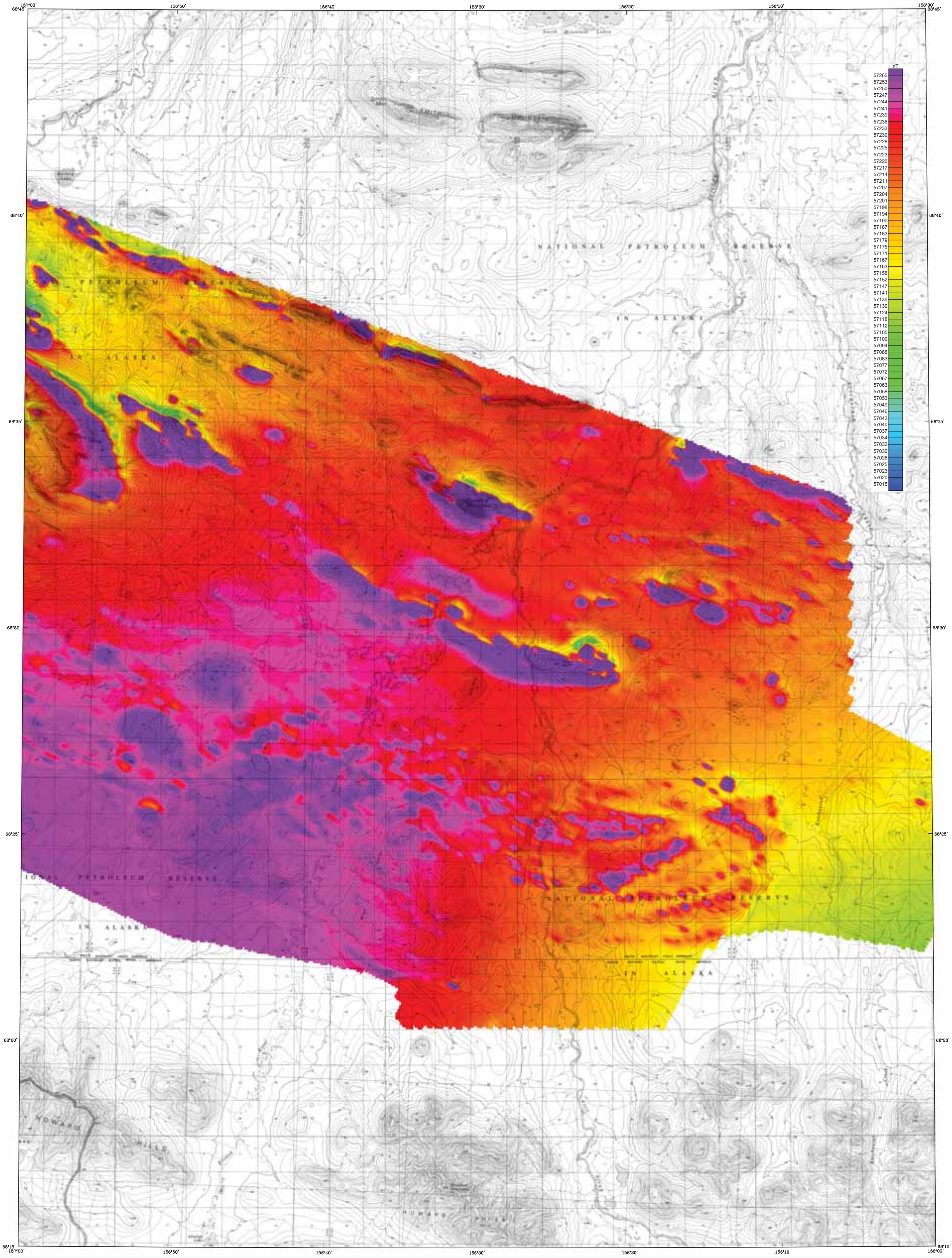


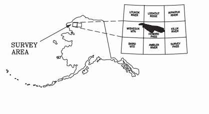
Base from U.S. Geological Survey Howard Pass B-1, 1984; B-2, 1984; C-1, 1984; C-2, 1984; Quadrangles, Alaska

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL



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by
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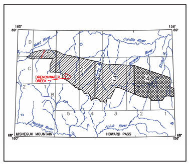

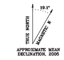

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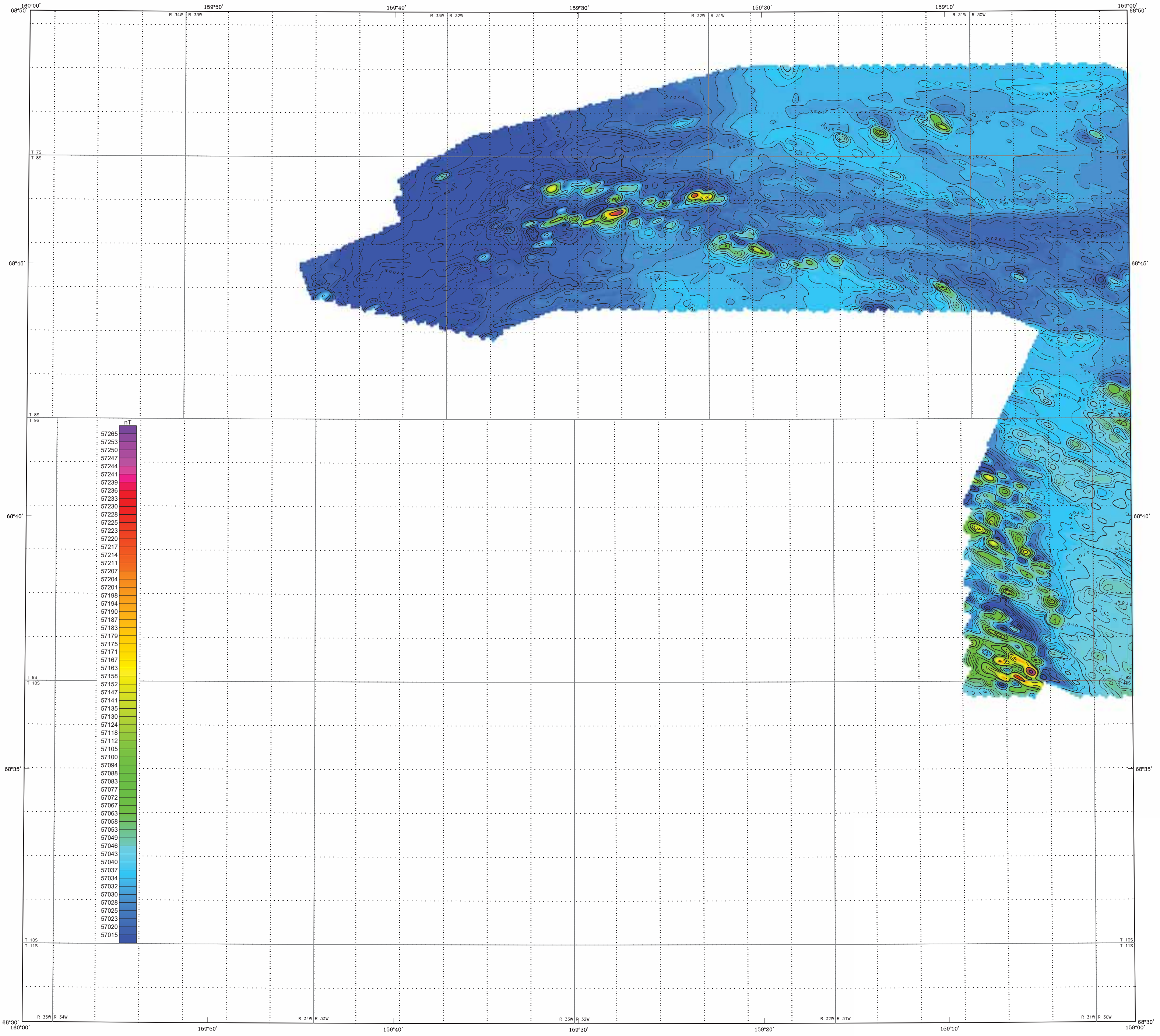
GEOPHYSICAL REPORT 2006-1-1b
Sheet 1 of 4

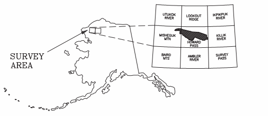


Section outlines from U.S. Geological Survey Misheguk Mountain C-1, 1984; C-2, 1984; D-1, 1984; D-2, 1984; Quadrangles, Alaska

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS



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NORTHWEST ALASKA

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Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.

2006

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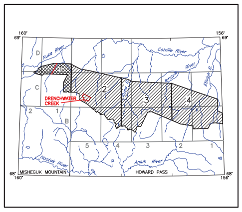

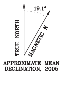

APPROXIMATE MEAN
DECLINATION, 2005

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MAGNETIC CONTOUR INTERVAL

▬	100 nT
―	20 nT
─	4 nT
— — — —	2 nT

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GEOPHYSICAL REPORT 2006-1-1b
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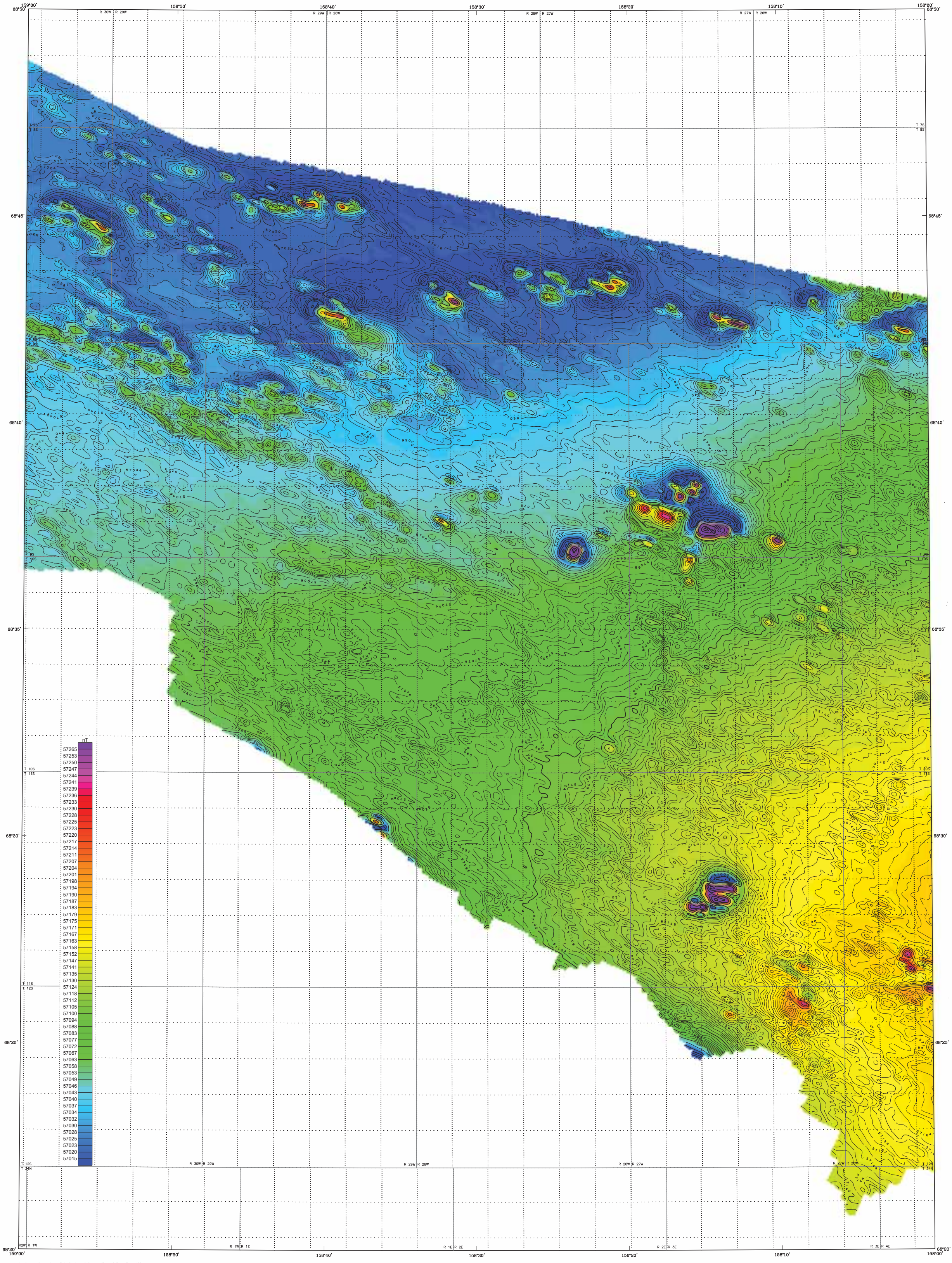
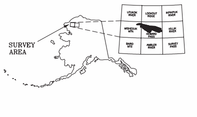


Section outlines from U.S. Geological Survey Howard Pass B-4, 1984; B-5, 1984; C-4, 1984; C-5, 1984; D-4, 1984; D-5, 1984; Quadrangles, Alaska

SCALE 1:63,360



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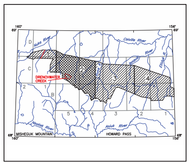

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MAGNETIC CONTOUR INTERVAL

━━━━━━	. . . . .100 nT
──────	. . . . 20 nT
──────	. . . . 4 nT
— — — —	. . . . 2 nT

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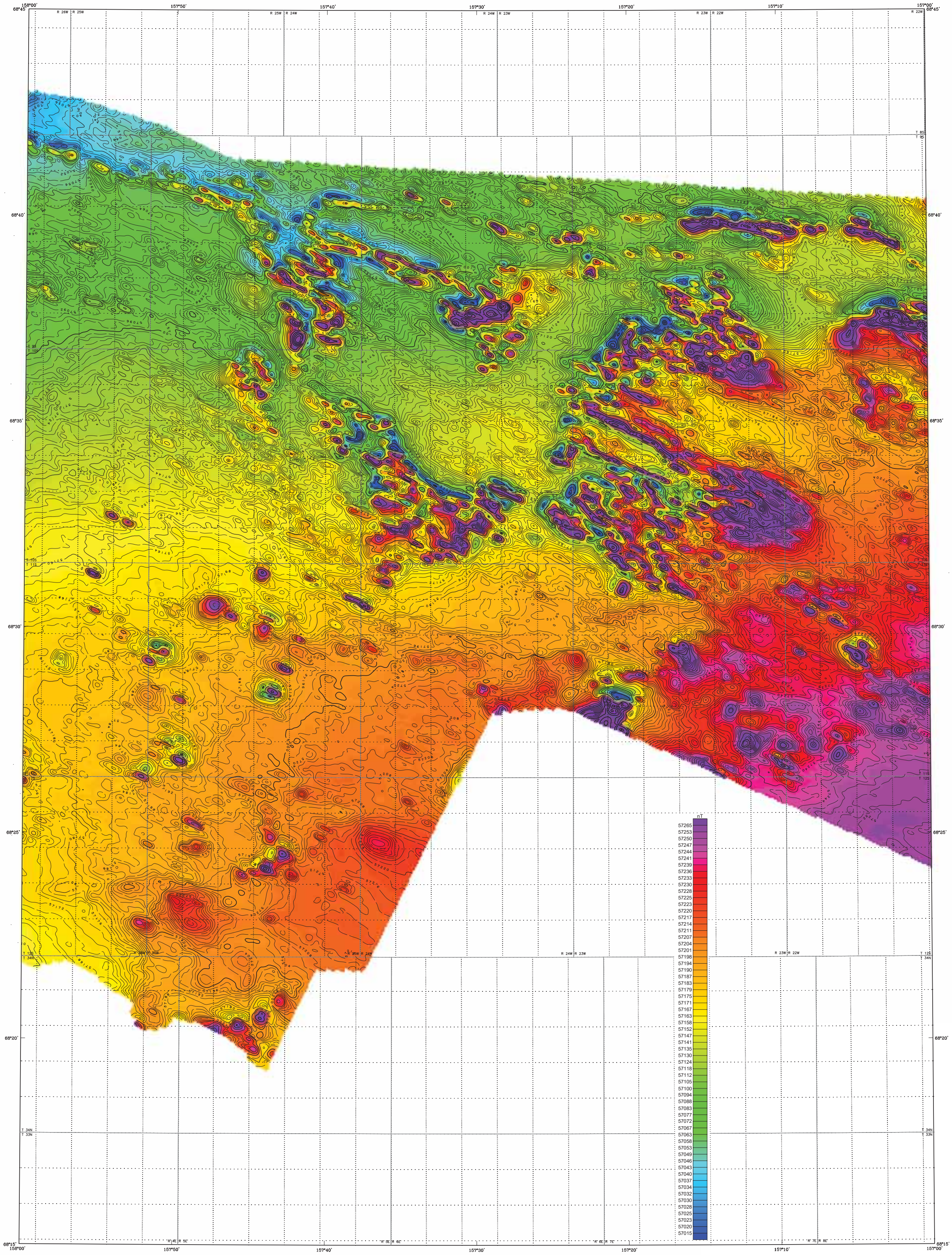
GEOPHYSICAL REPORT 2006-1-1b
Sheet 3 of 4



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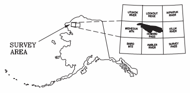
1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS



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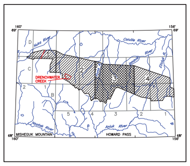

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———————— . . . . .100 nT
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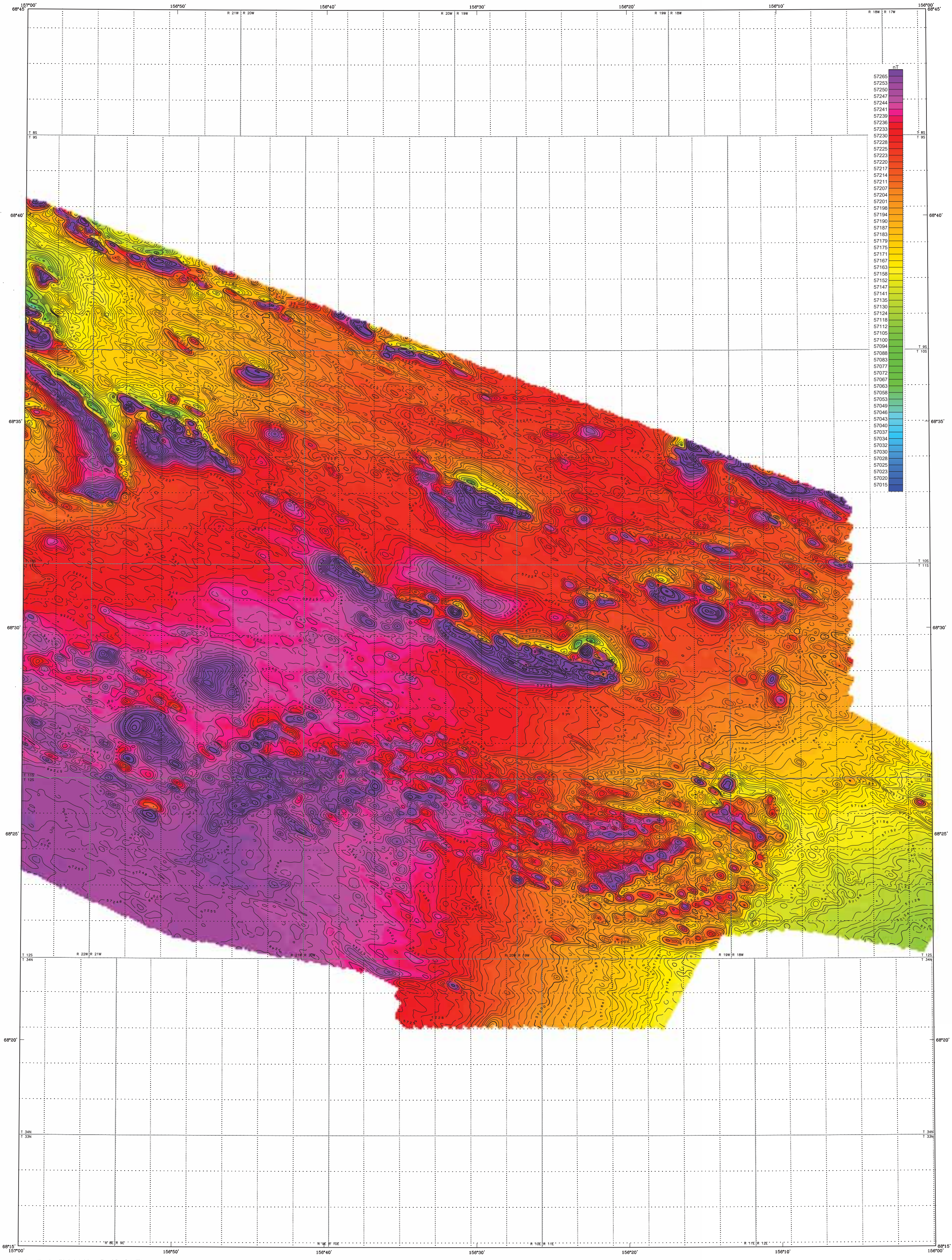

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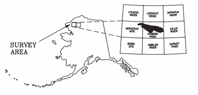

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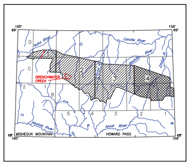

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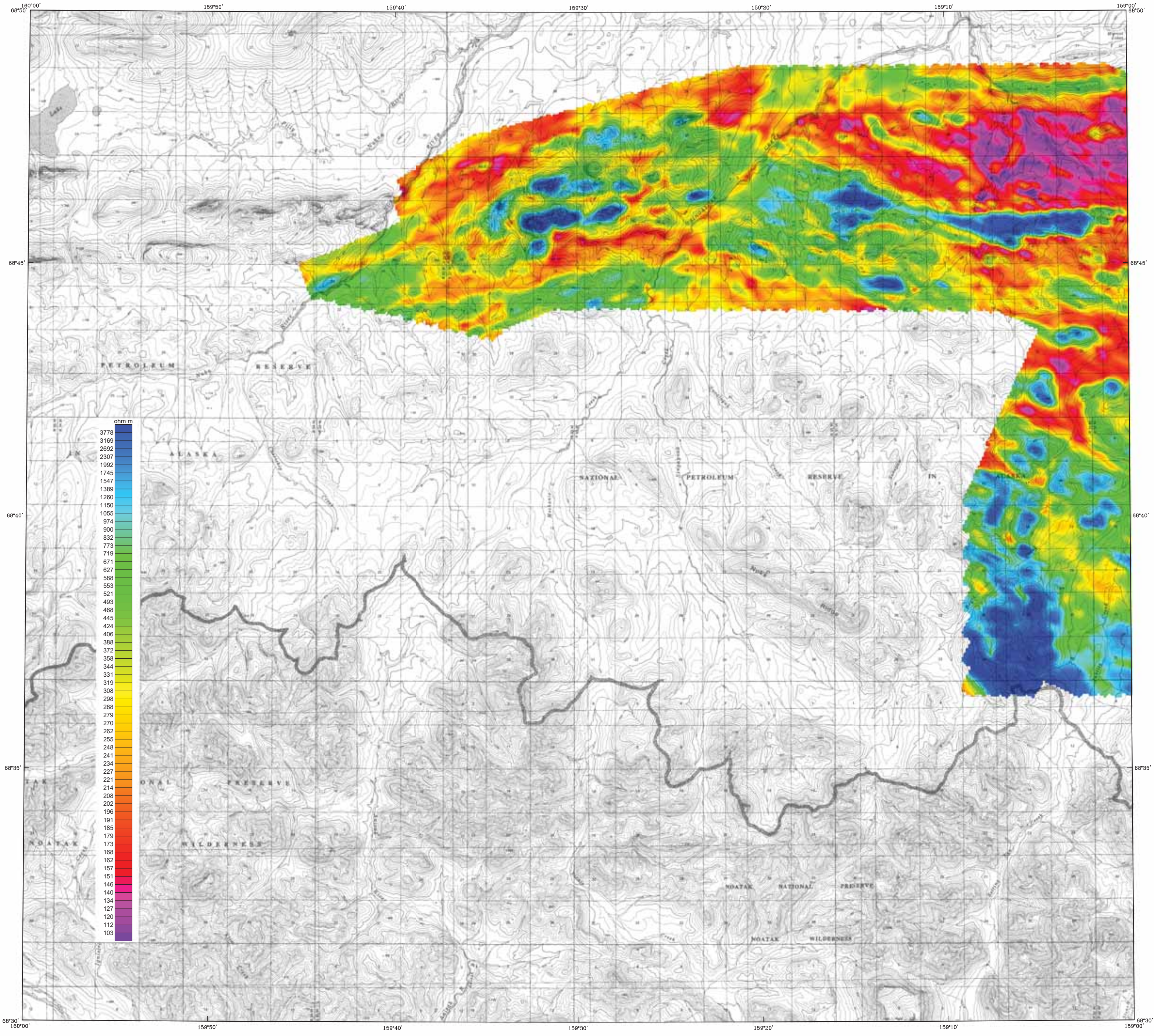
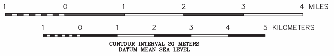
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
IN COOPERATION WITH THE U.S. BUREAU OF LAND MANAGEMENT

GEOPHYSICAL REPORT 2006-1-2a
Sheet 1 of 4

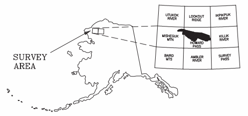


Base from U.S. Geological Survey Misheguk Mountain C-1, 1984;
C-2, 1984; D-1, 1984; D-2, 1984; Quadrangles, Alaska

SCALE 1:63,360



CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL

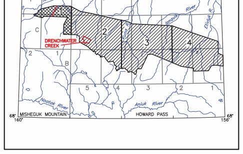


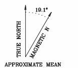
7200 Hz COPLANAR APPARENT RESISTIVITY OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS OF HOWARD PASS AND MISHEGUK MOUNTAIN QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.
2006

LOCATION INDEX





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DECLINATION, 2005

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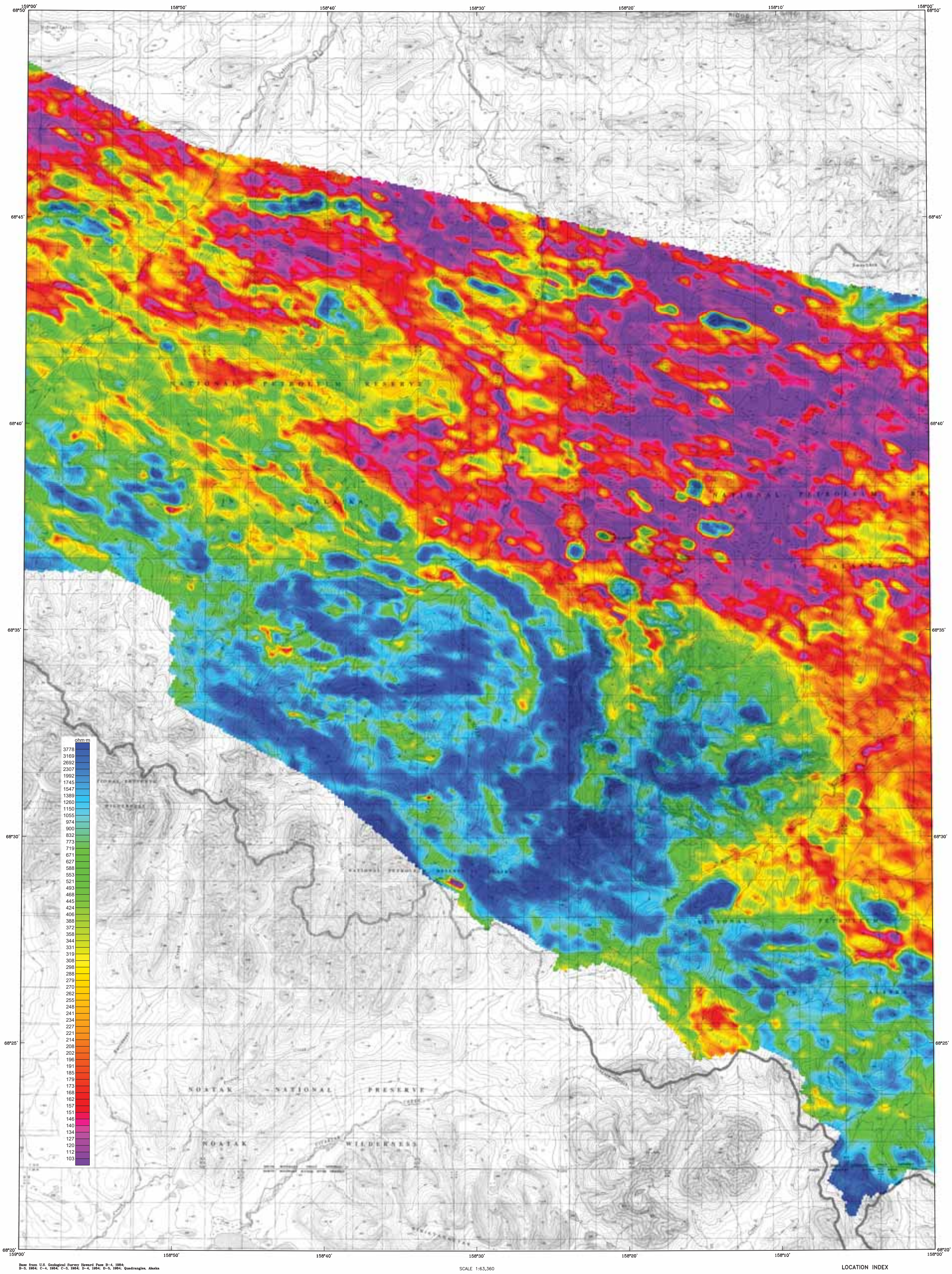


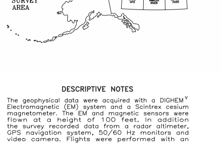
Base from U.S. Geological Survey Howard Pass B-4, 1984; B-5, 1984; C-4, 1984; C-5, 1984; D-4, 1984; D-5, 1984; Quadrangles, Alaska

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL



7200 Hz COPLANAR APPARENT RESISTIVITY
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NORTHWEST ALASKA

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2006

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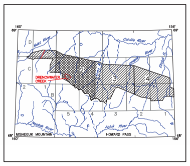

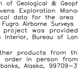

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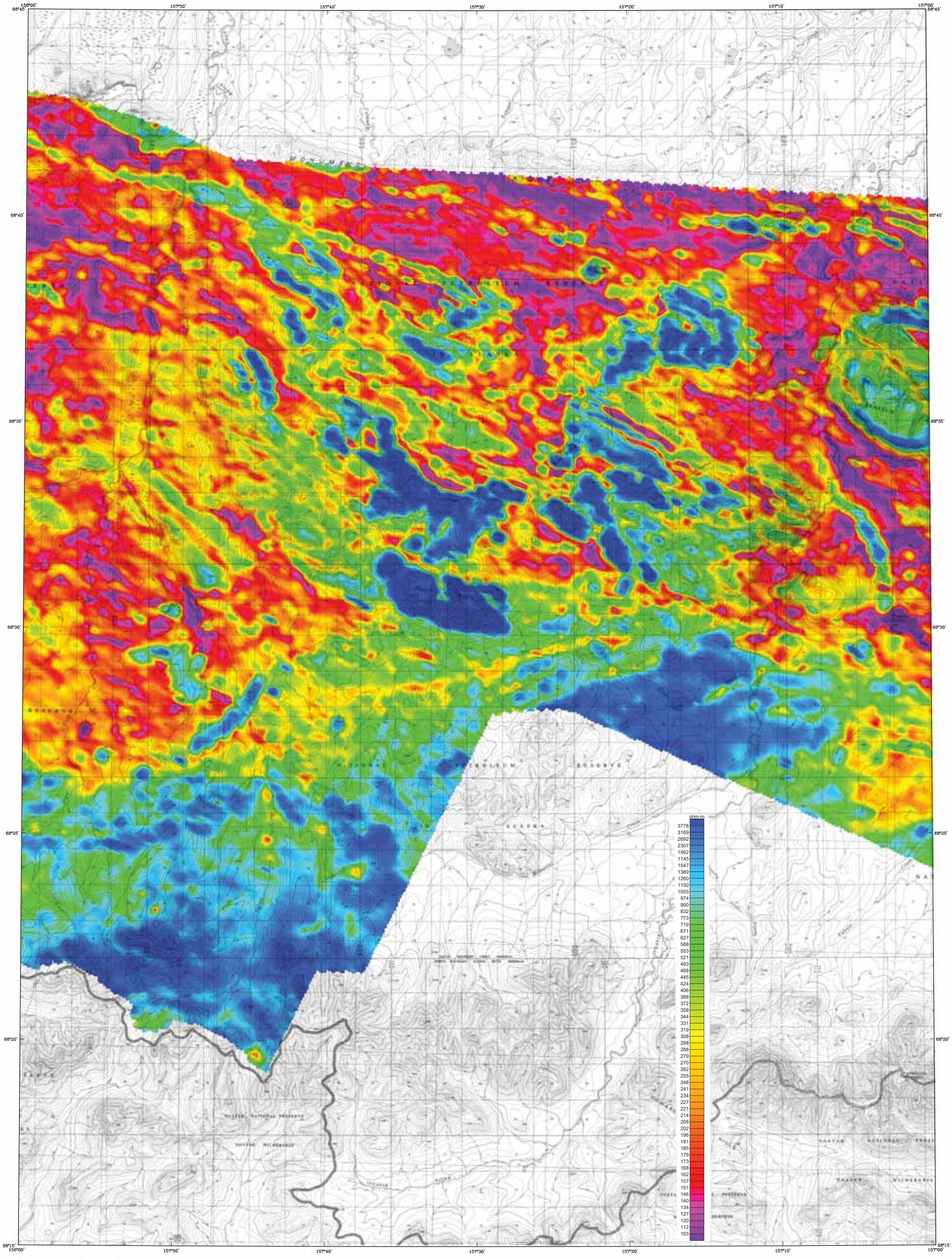
GEOPHYSICAL REPORT 2006-1-2a
Sheet 3 of 4



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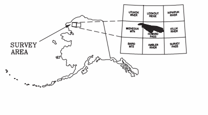
CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL



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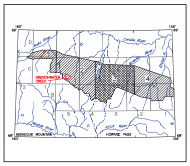

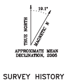

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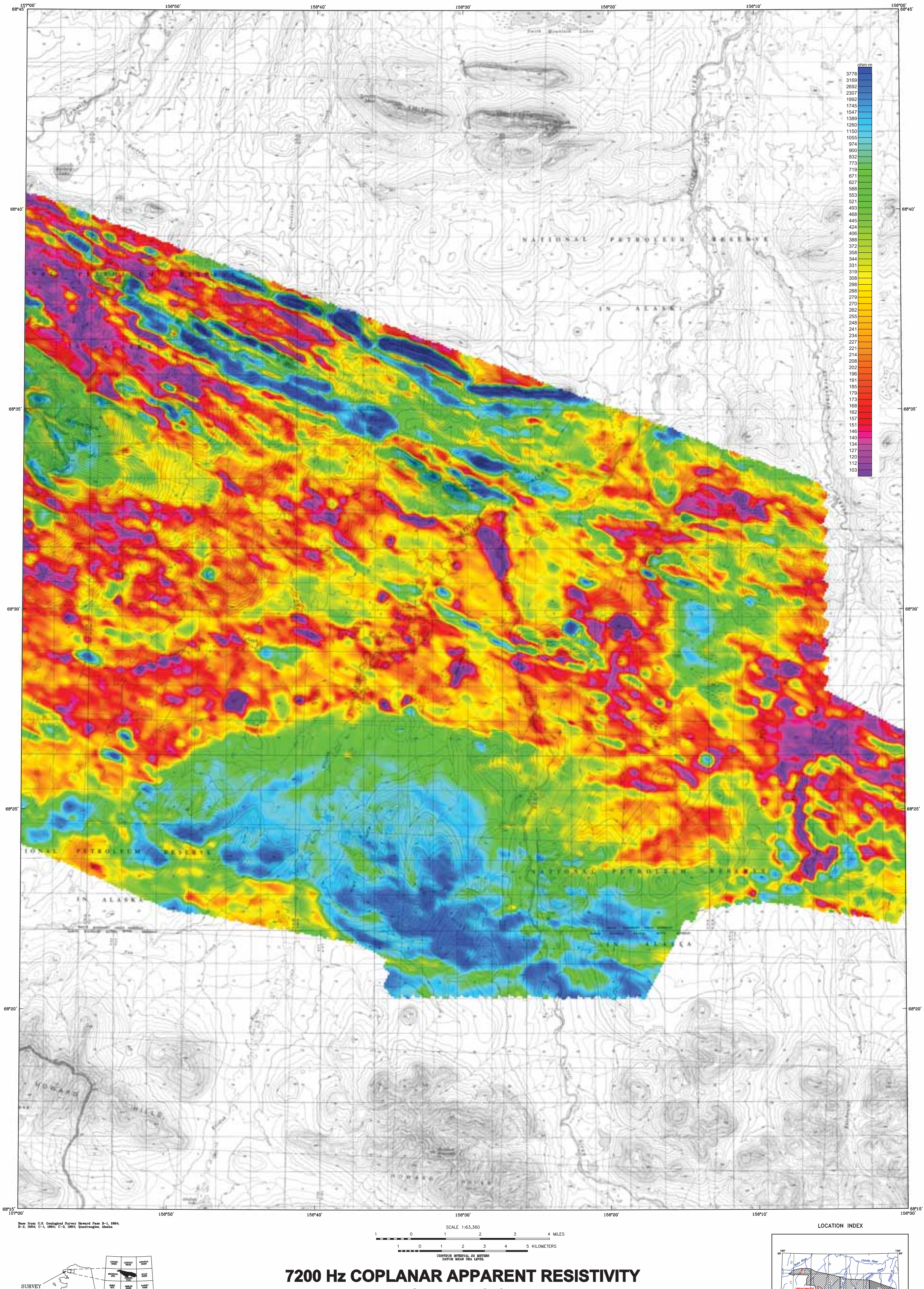
GEOPHYSICAL REPORT 2006-1-2a
Sheet 4 of 4



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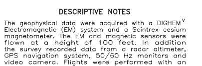
CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL



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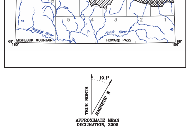

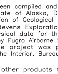

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DECLINATION, 2005

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GEOPHYSICAL REPORT 2006-1-2b
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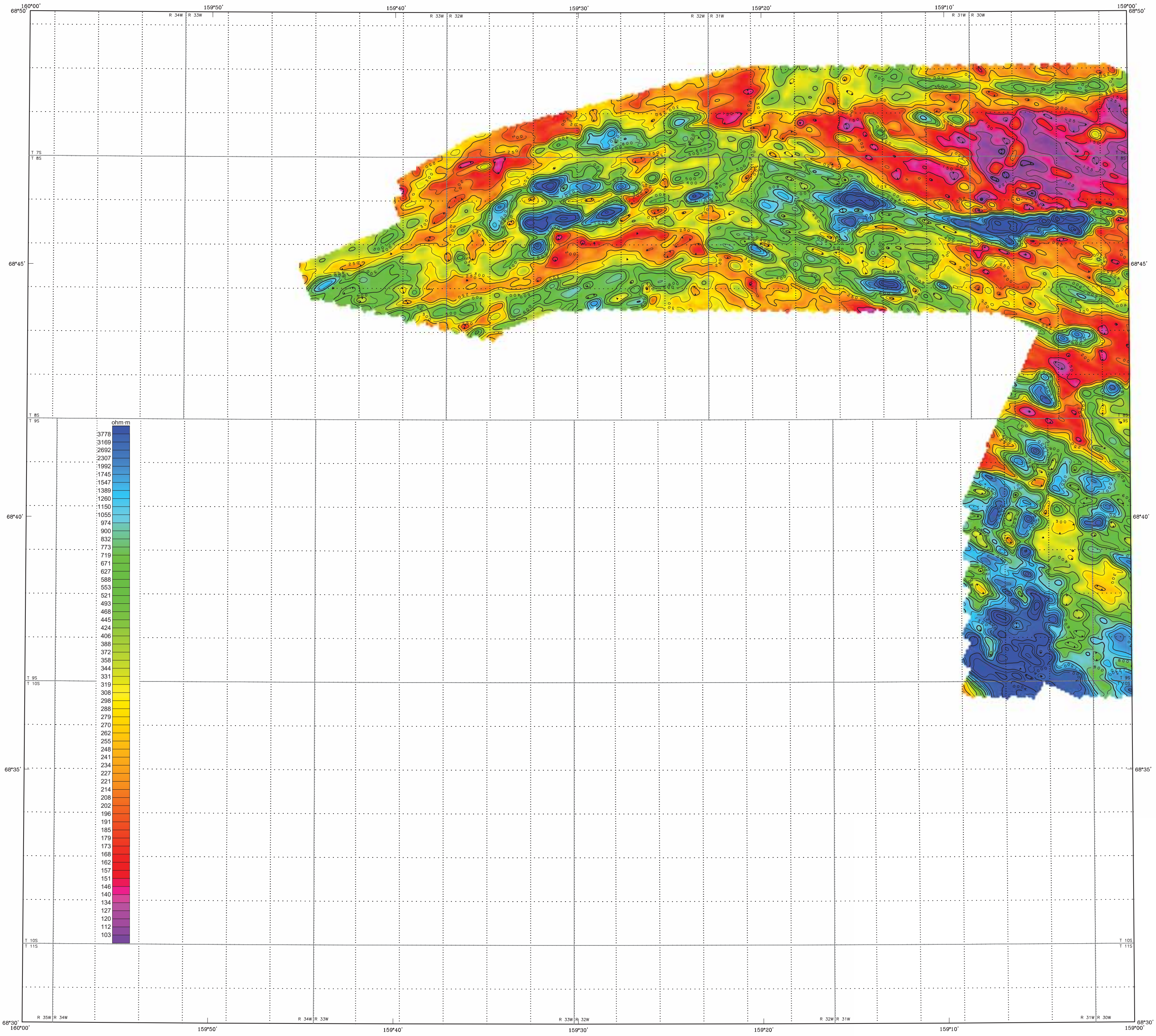

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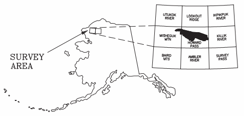

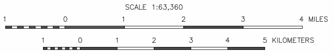

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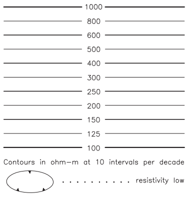
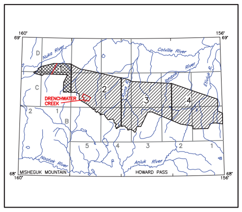
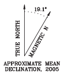
RESISTIVITY CONTOURS



LOCATION INDEX





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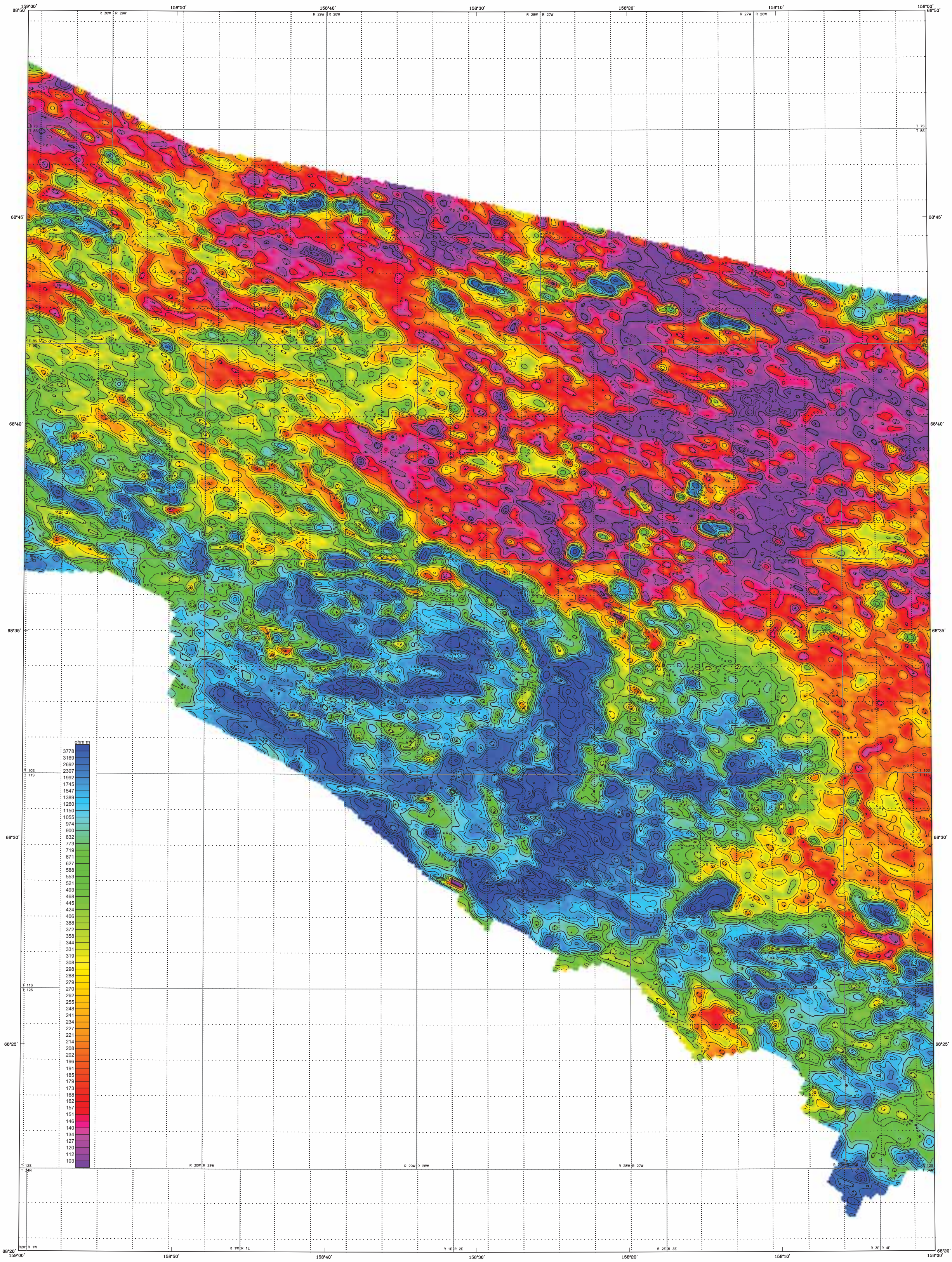

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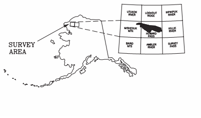

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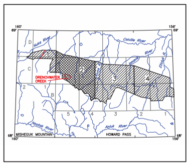

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APPROXIMATE MEAN DECLINATION, 2005

DESCRIPTIVE NOTES

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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

SURVEY HISTORY

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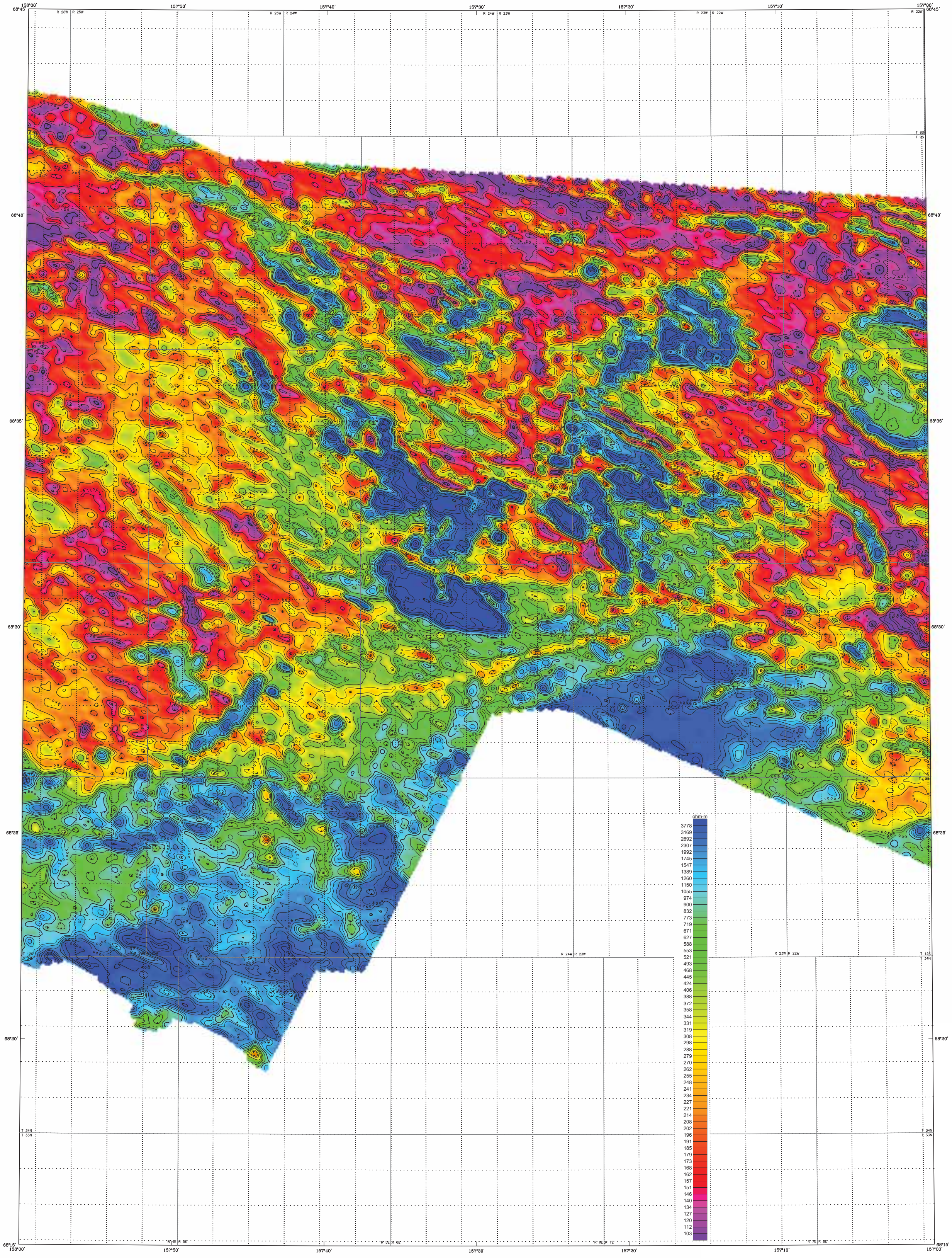
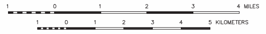
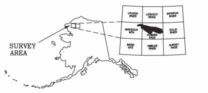
GEOPHYSICAL REPORT 2006-1-2b
Sheet 3 of 4



Section outlines from U.S. Geological Survey Howard Pass B-2, 1984; B-3, 1984; B-4, 1984; C-2, 1984; C-3, 1984; C-4, 1984; Quadrangles, Alaska

SCALE 1:63,360





7200 Hz COPLANAR APPARENT RESISTIVITY
OF PARTS OF
SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA,
NORTHWEST ALASKA

PARTS OF HOWARD PASS AND MISHEGUK MOUNTAIN QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.
2006

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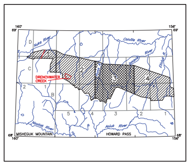

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Contours in ohm-m at 10 intervals per decade

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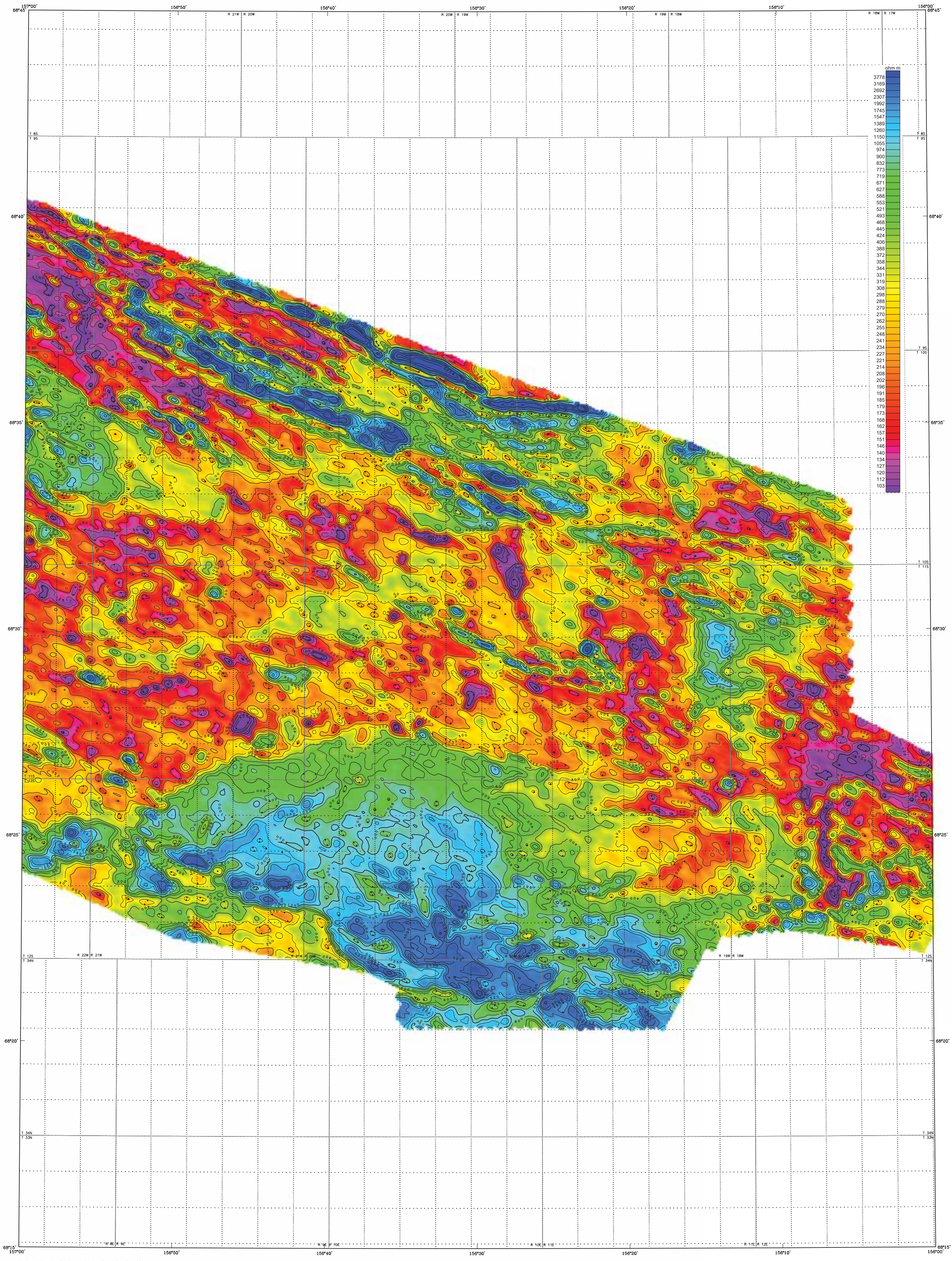
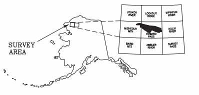


Section outlines from U.S. Geological Survey Howard Pass B-1, 1984; B-2, 1984; C-1, 1984; C-2, 1984; Quadrangles, Alaska

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS



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by

Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.

2006

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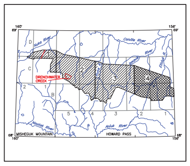

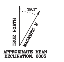

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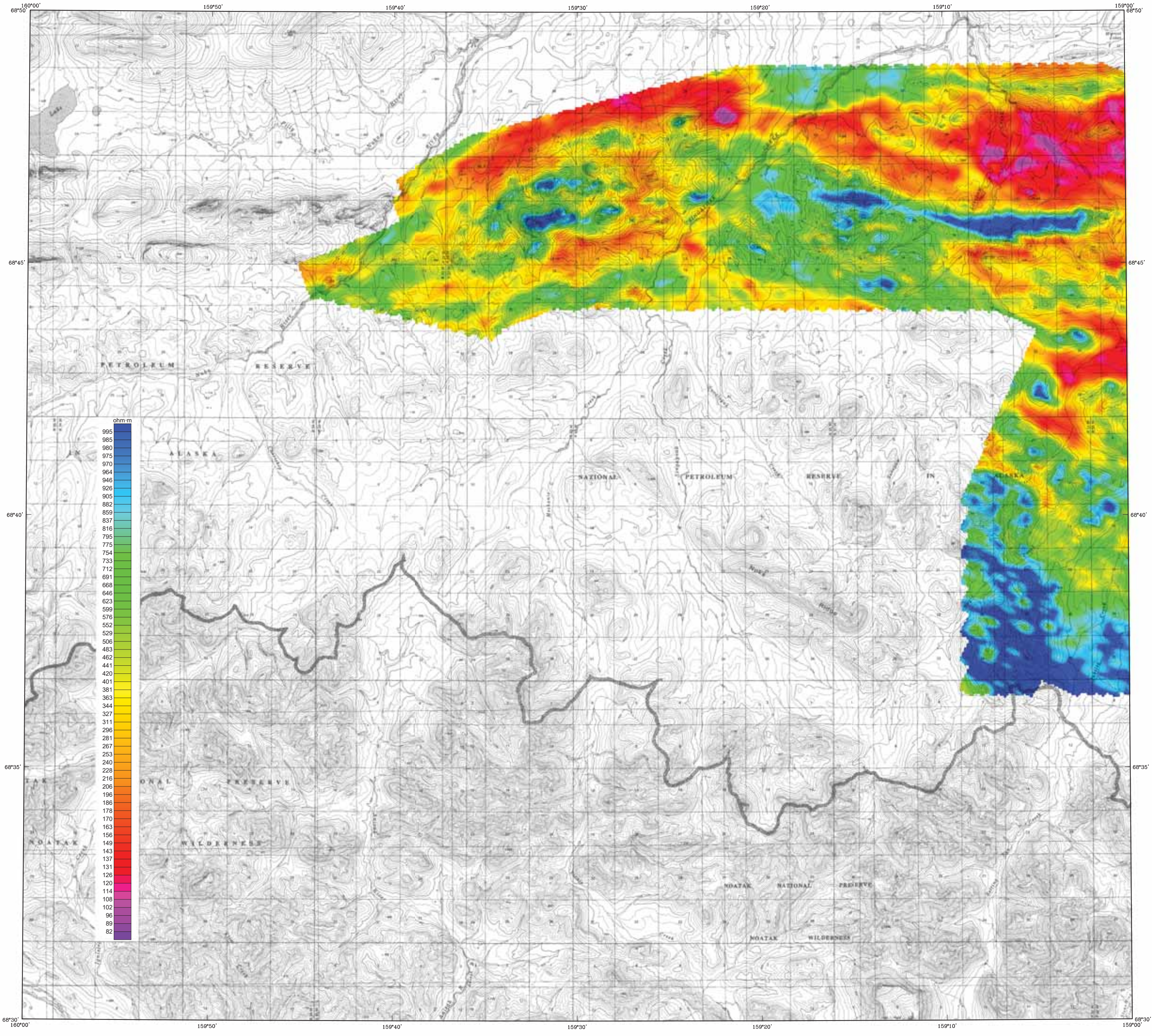
GEOPHYSICAL REPORT 2006-1-3a
Sheet 1 of 4



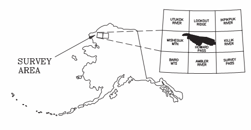
Base from U.S. Geological Survey Misheguk Mountain C–1, 1984;
C–2, 1984; D–1, 1984; D–2, 1984; Quadrangles, Alaska

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL



900 Hz COPLANAR APPARENT RESISTIVITY OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

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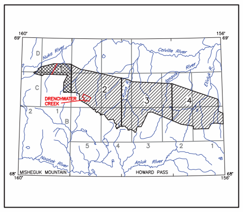

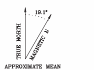

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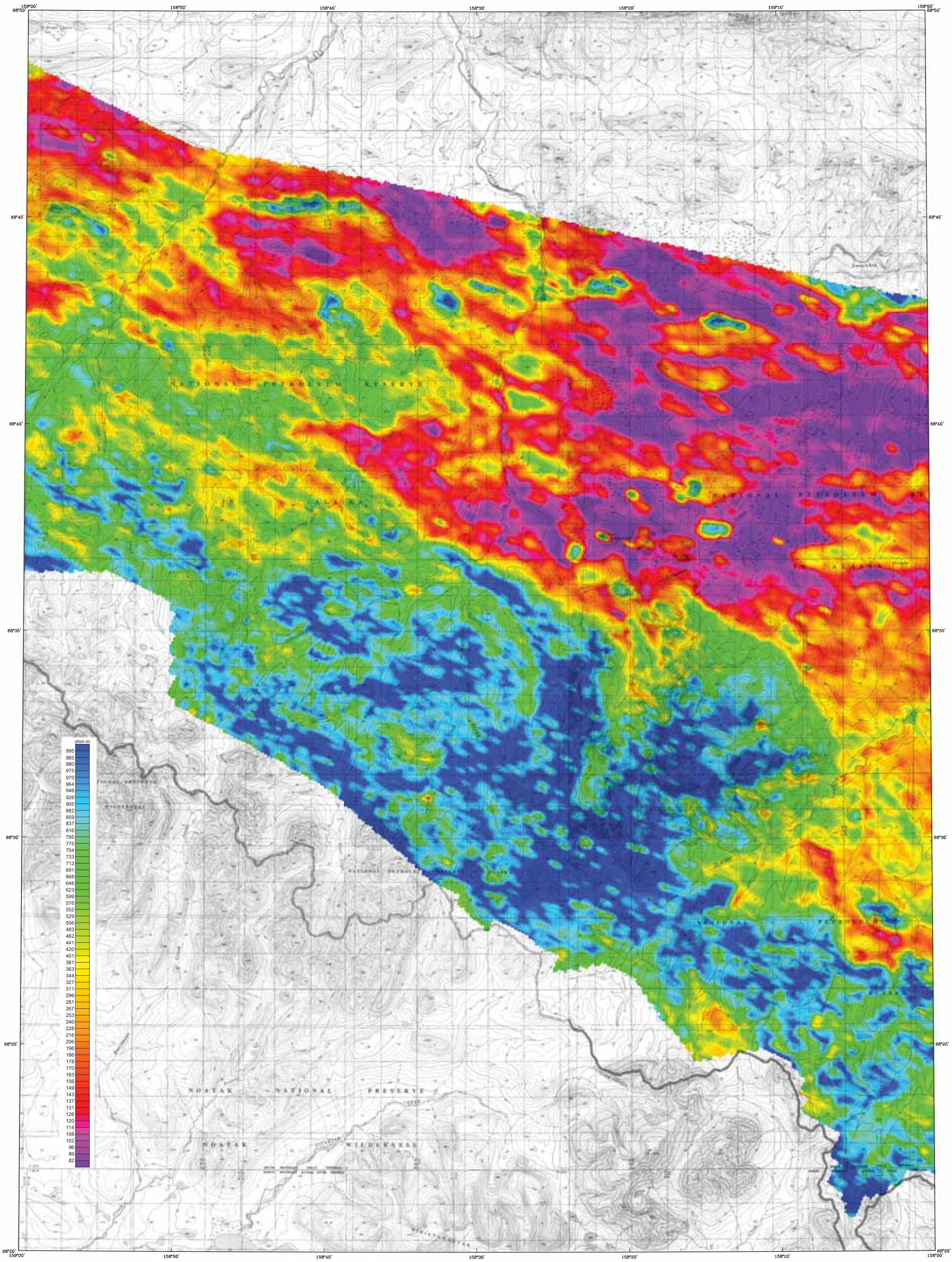

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1 0 1 2 3 4 MILES

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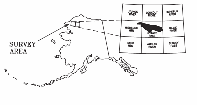
CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL



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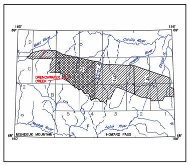

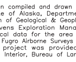

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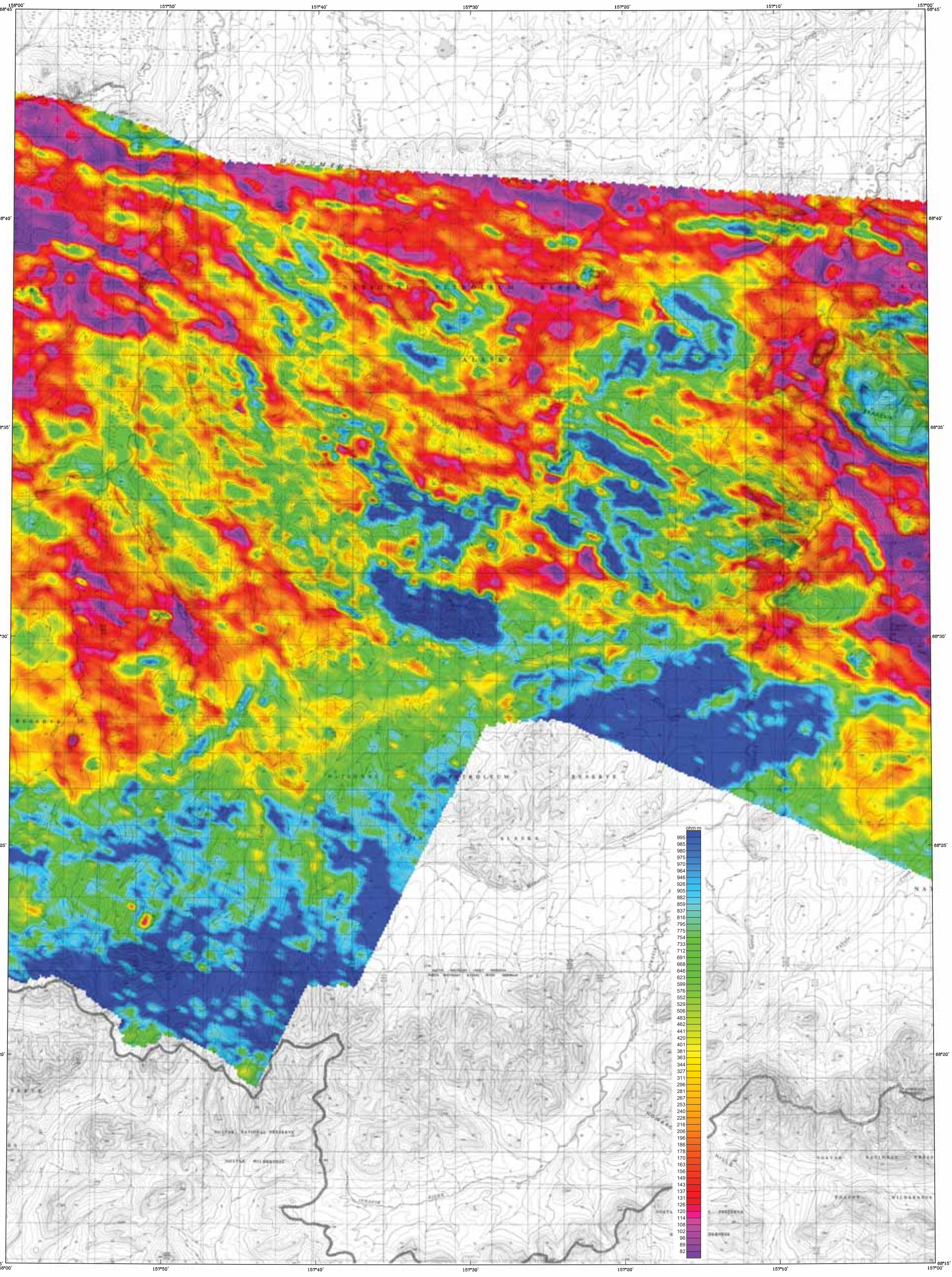

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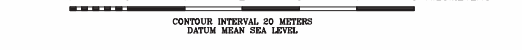

CONTOUR INTERVAL 20 METERS
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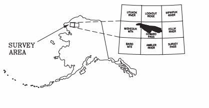

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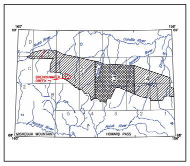

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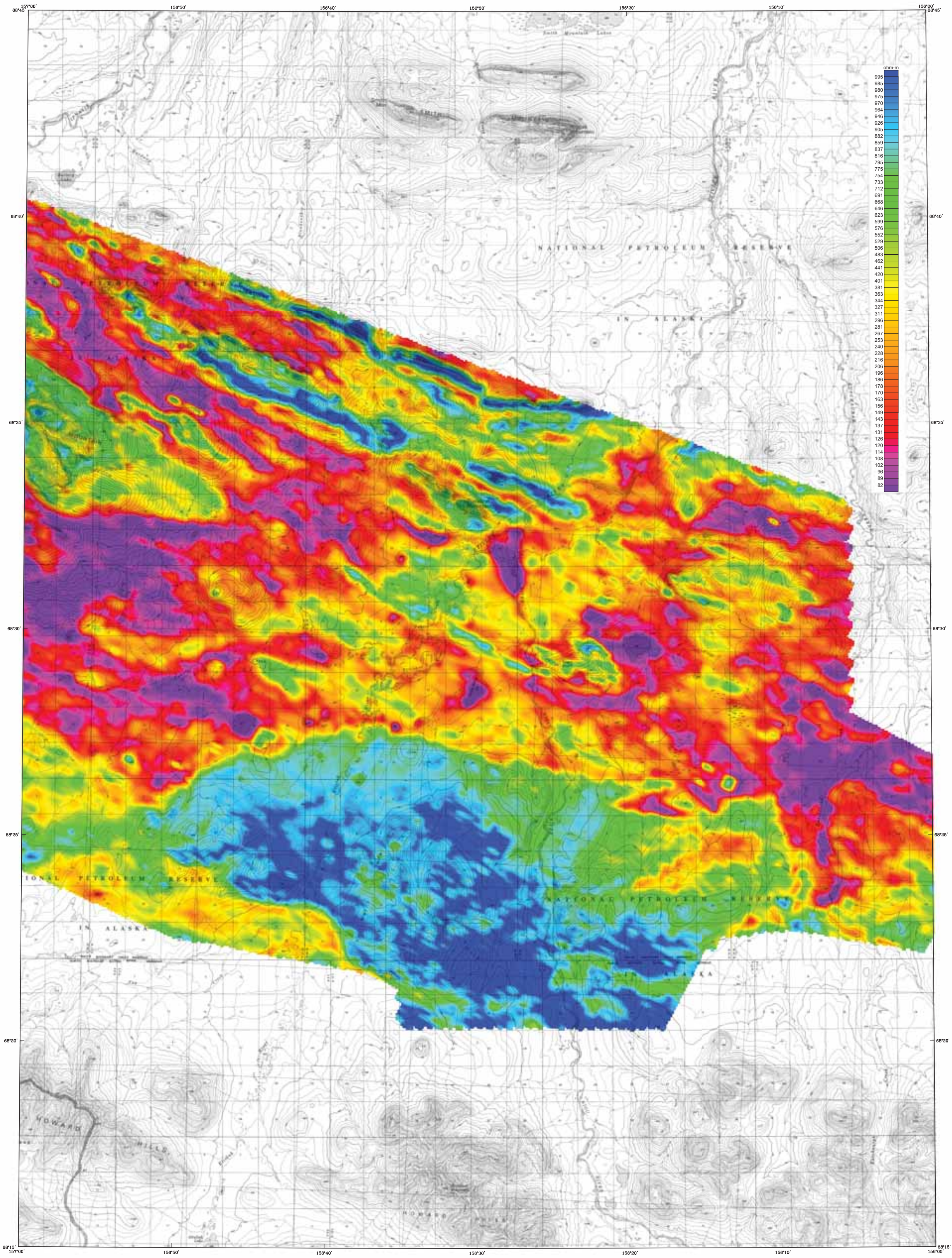
IN COOPERATION WITH THE U.S. BUREAU OF LAND MANAGEMENT

GEOPHYSICAL REPORT 2006-1-3a
Sheet 4 of 4



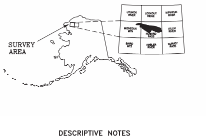
Base from U.S. Geological Survey Howard Pass B-1, 1984;
B-2, 1984; C-1, 1984; C-2, 1984; Quadrangles, Alaska

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL

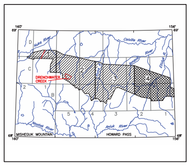


900 Hz COPLANAR APPARENT RESISTIVITY
OF PARTS OF
SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA,
NORTHWEST ALASKA

PARTS OF HOWARD PASS AND MISHEGUK MOUNTAIN QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.
2006

LOCATION INDEX



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APPROXIMATE MEAN
DECLINATION, 2005

SURVEY HISTORY

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ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
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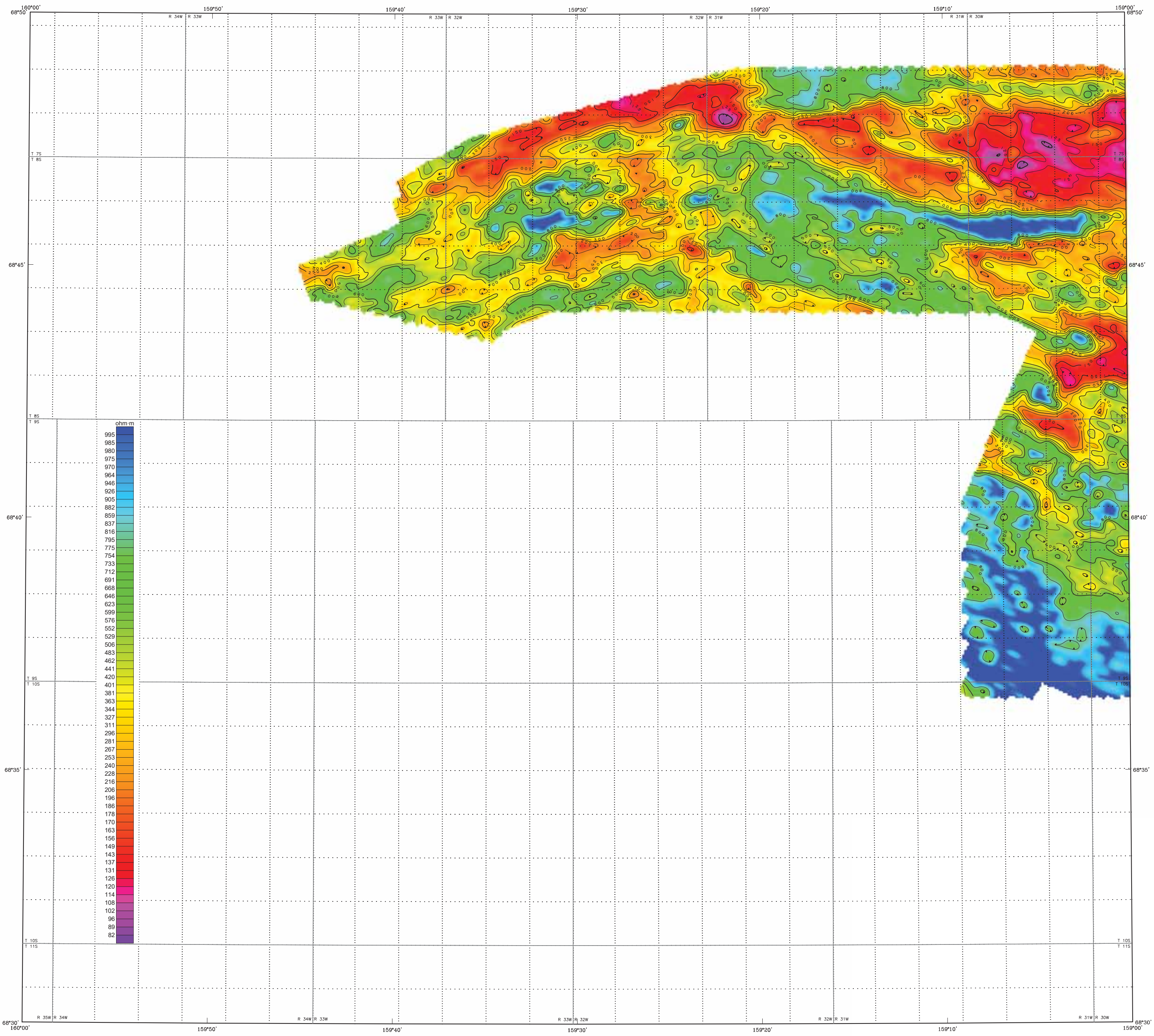
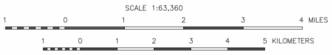
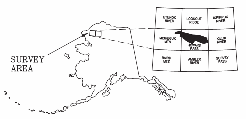
GEOPHYSICAL REPORT 2006-1-3b
Sheet 1 of 4



Section outlines from U.S. Geological Survey Misheguk Mountain C-1, 1984; C-2, 1984; D-1, 1984; D-2, 1984; Quadrangles, Alaska



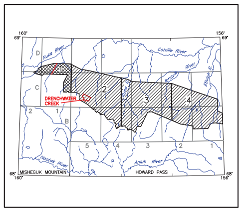


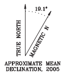
900 Hz COPLANAR APPARENT RESISTIVITY OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS OF HOWARD PASS AND MISHEGUK MOUNTAIN QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.
2006

LOCATION INDEX





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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

SURVEY HISTORY

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ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
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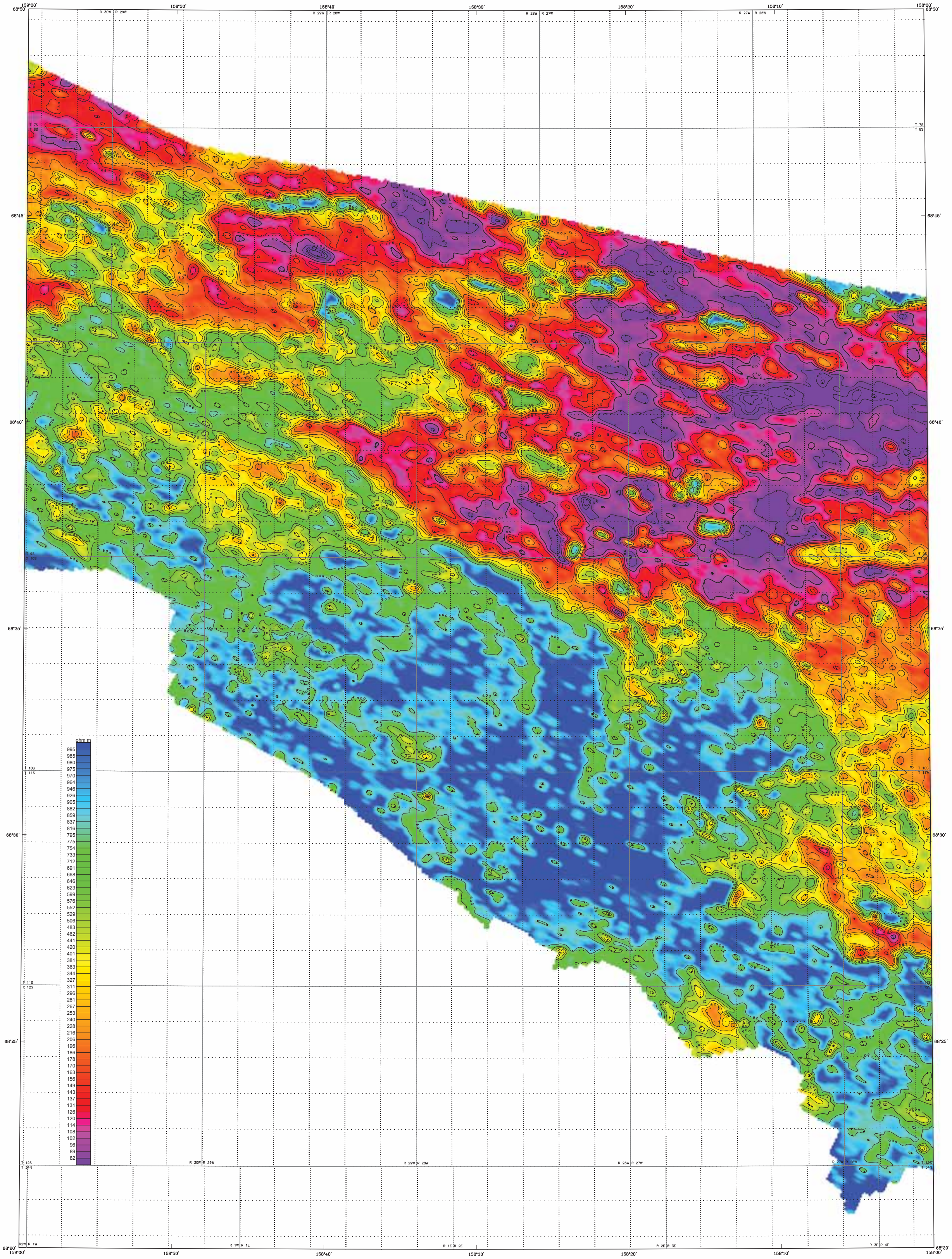
GEOPHYSICAL REPORT 2006-1-3b
Sheet 2 of 4

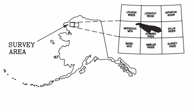


Section outlines from U.S. Geological Survey Howard Pass B-4, 1984; B-5, 1984; C-4, 1984; C-5, 1984; D-4, 1984; D-5, 1984; Quadrangles, Alaska

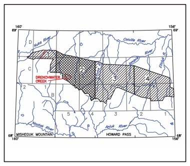
SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS



LOCATION INDEX



900 Hz COPLANAR APPARENT RESISTIVITY OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS OF HOWARD PASS AND MISHEGUK MOUNTAIN QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.
2006

APPROXIMATE MEAN DECLINATION, 2005

DESCRIPTIVE NOTES

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1000
800
600
500
400
300
250
200
150
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100

Contours in ohm–m at 10 intervals per decade

. . . . resistivity low

SURVEY HISTORY

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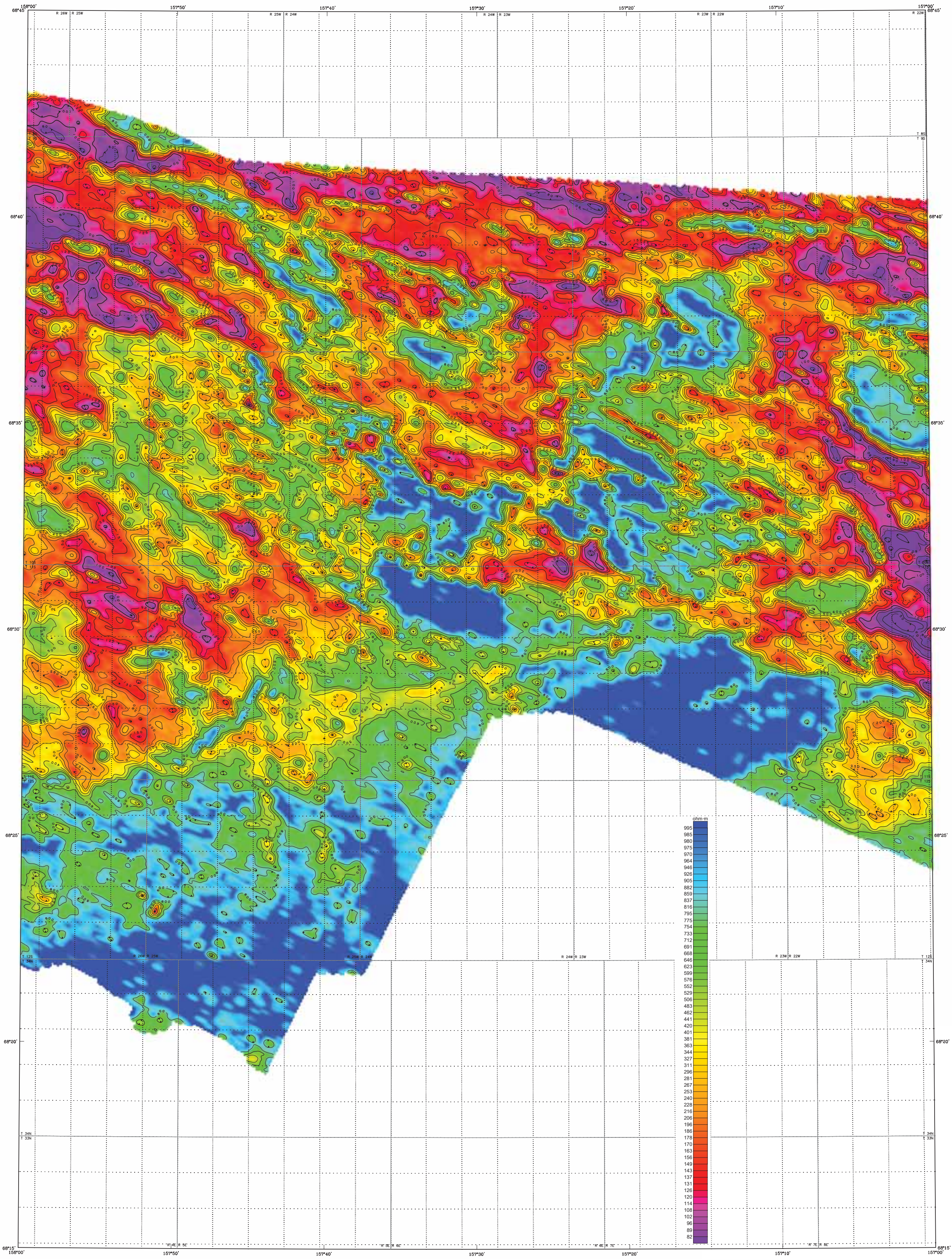
GEOPHYSICAL REPORT 2006-1-3b
Sheet 3 of 4

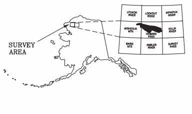


Section outlines from U.S. Geological Survey Howard Pass B-2, 1984; B-3, 1984; B-4, 1984; C-2, 1984; C-3, 1984; C-4, 1984; Quadrangles, Alaska

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS



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2006

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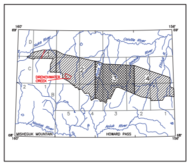

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Contours in ohm-m at 10 intervals per decade

. . . . resistivity low

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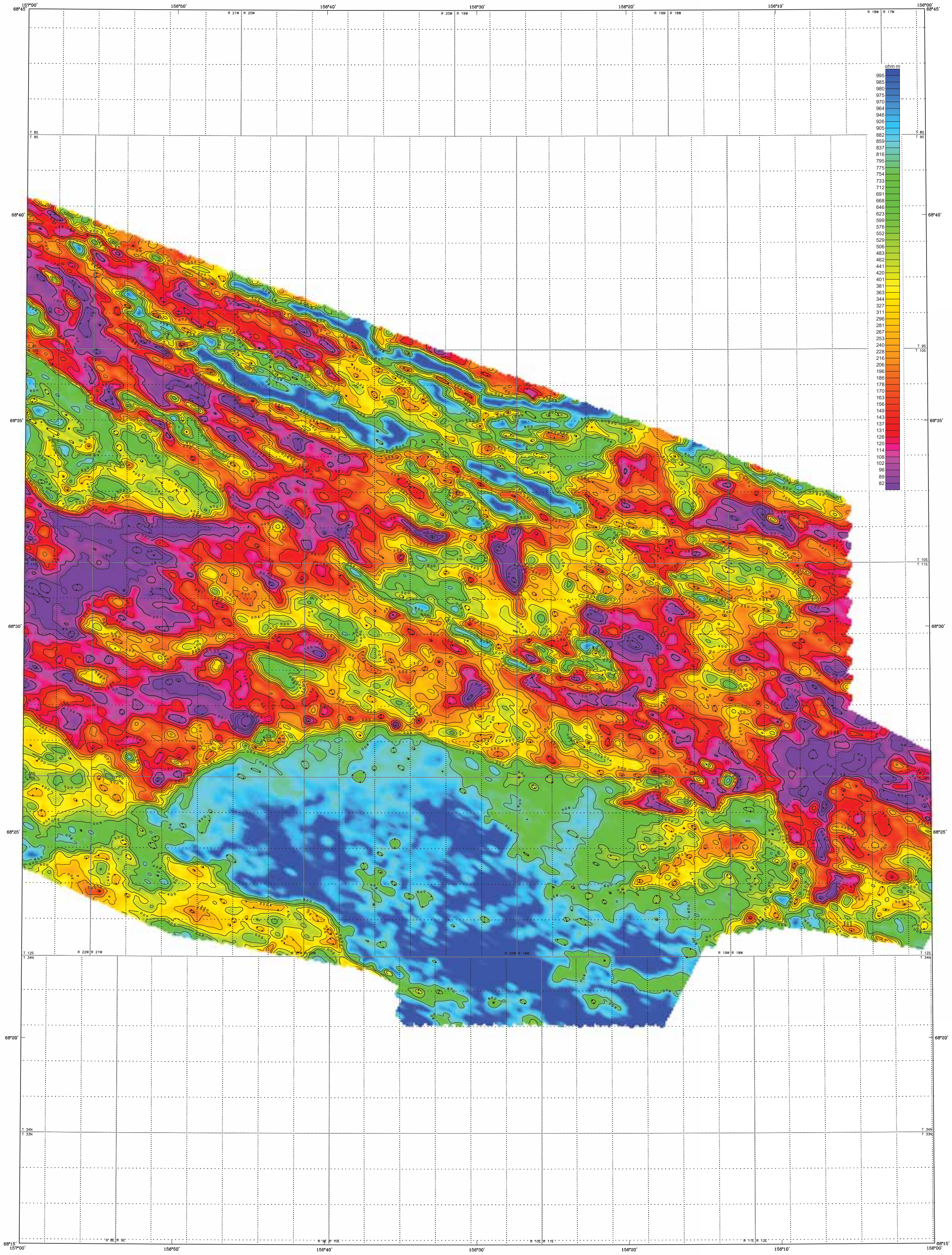

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1 0 1 2 3 4 MILES

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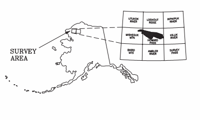

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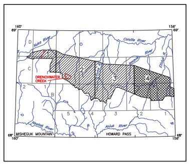

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Contours in ohm-m at 10 intervals per decade

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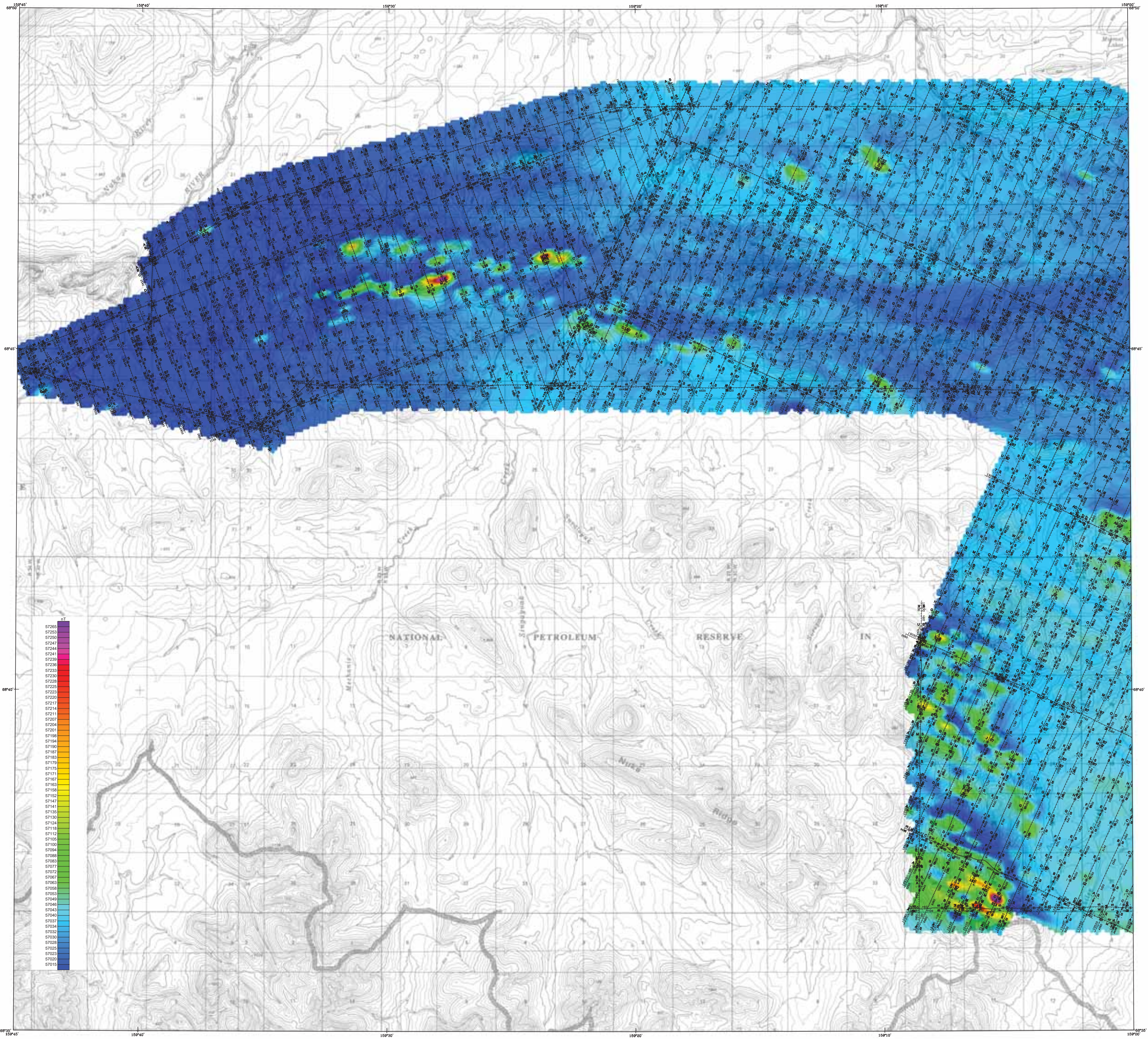
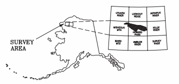
GEOPHYSICAL REPORT 2006-1-4a
PARTS of MISHEGUK MOUNTAIN C-1, C-2, D-1 and D-2 QUADRANGLES



Base from U.S. Geological Survey Misheguk Mountain C-1, 1984; C-2, 1984; D-1, 1984; D-2, 1984; 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 20 METERS
DATUM MEAN SEA LEVEL



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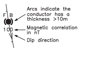
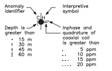
ELECTROMAGNETICS

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



Anomaly	Conductance
●	>100 siemens
◕	50–100 siemens
◒	20–50 siemens
◍	10–20 siemens
⊕	5–10 siemens
○	1–5 siemens
◌	< 1 siemens
✳	Questionable anomaly
△^{M}	EM magnetite response



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

TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS of MISHEGUK MOUNTAIN C-1, C-2, D-1 and D-2 QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp.,
and Stevens Exploration Management Corp.
2006

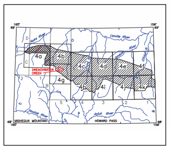
APPROXIMATE MEAN DECLINATION, 2005

TOTAL MAGNETIC FIELD

The magnetic total field contours were produced using digitally recorded data from a Scintrex cesium CS2 magnetometer, with 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) adjusted for regional variations (or IGRF gradient, 2005, updated to August 2005) using altimeter adjusted IGRF, (3) leveled to the tie line data, and 4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

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

LOCATION INDEX FOR SCALE 1:31,680



SURVEY HISTORY

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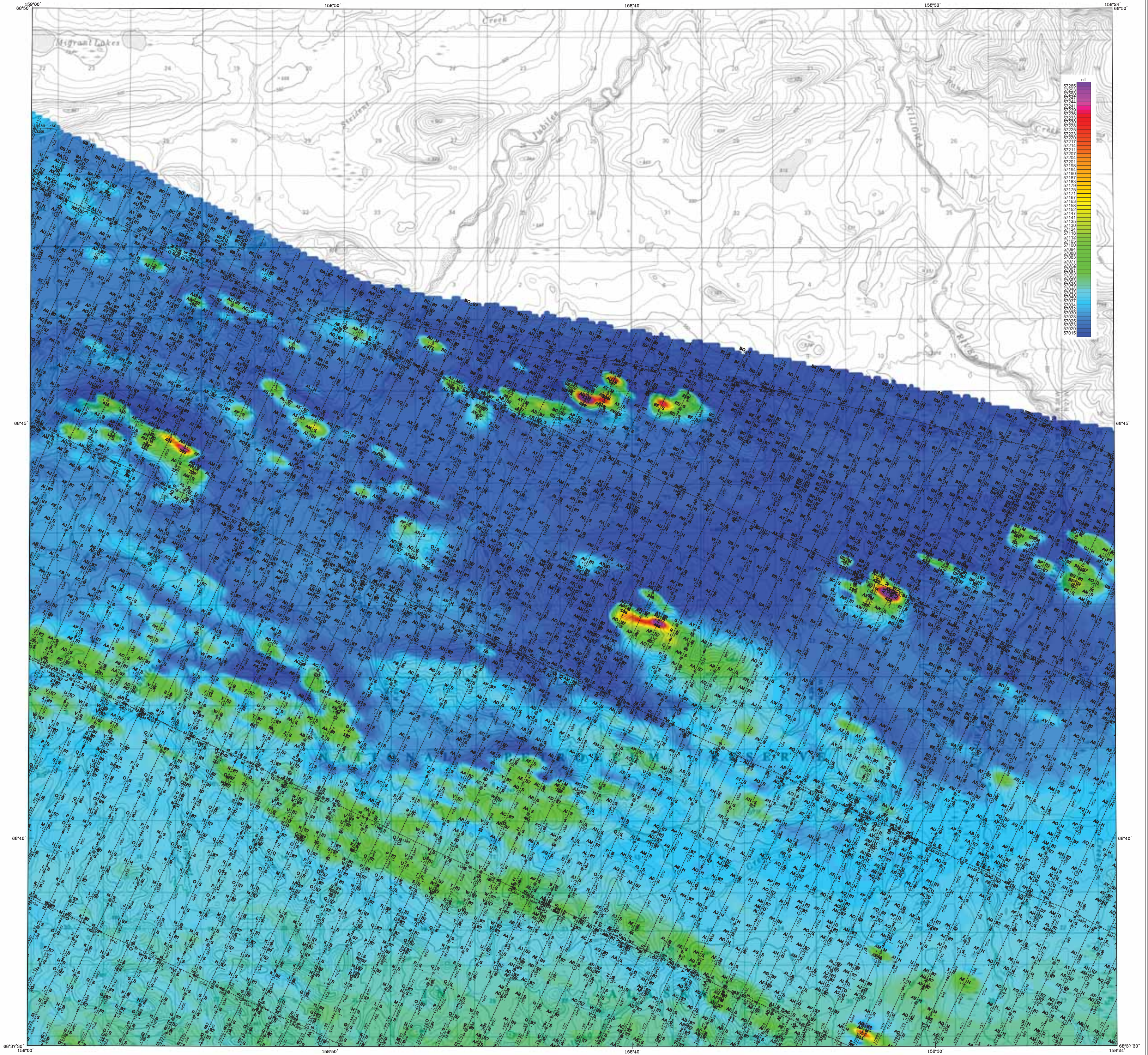
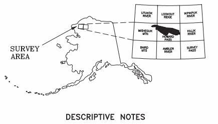
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
IN COOPERATION WITH THE U.S. BUREAU OF LAND MANAGEMENT

GEOPHYSICAL REPORT 2006-1-4b
PARTS of HOWARD PASS C-5 and D-5 QUADRANGLES



Base from U.S. Geological Survey Howard Pass C-5, 1984; D-5, 1984; Quadrangles, Alaska



DESCRIPTIVE NOTES

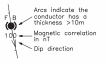
The geophysical data were acquired with a DIGHEM^V Electromagnetic (EM) system and a Scintrex cesium magnetometer. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS350B–2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW–SE (340°) survey flight lines west of the red line shown on the location index and NE–SW (25°) survey flight lines east of the red line. Flight lines were spaced a quarter of a mile with the exception of the Drenchwater Creek area (red area in the location index), where flight lines were spaced one eighth of a mile. Tie lines were flown perpendicular to the flight line intervals of approximately 3 miles except for the Drenchwater Creek areas, where the flight interval was 1.5 miles.

An Ashtech GG24 NAVSTAR / GLONASS Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post–flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 4) spheroid, 1927 North American datum using a central meridian (CM) of 159°, 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.

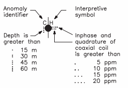
ELECTROMAGNETICS

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



Anomaly	Conductance
●	>100 siemens
◕	50–100 siemens
◒	20–50 siemens
⊕	10–20 siemens
⊕	5–10 siemens
○	1–5 siemens
◌	< 1 siemens
✳	Questionable anomaly
$\triangle^M$	EM magnetite response



Interpretive symbol	Conductor ("model")
B	Bedrock conductor
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S	Conductive cover ("horizontal thin sheet")
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E	Edge of broad conductor ("edge of half space")
L	Culture, e.g., power line, metal building or fence

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 20 METERS
DATUM MEAN SEA LEVEL

TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS of HOWARD PASS C-5 and D-5 QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp.,
and Stevens Exploration Management Corp.
2006

APPROXIMATE MEAN DECLINATION, 2005

TOTAL MAGNETIC FIELD

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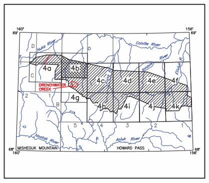
Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures: Journal of the Association of Computing Machinery, v. 17, no. 4, p. 589–602.

LOCATION INDEX FOR SCALE 1:31,680



SURVEY HISTORY

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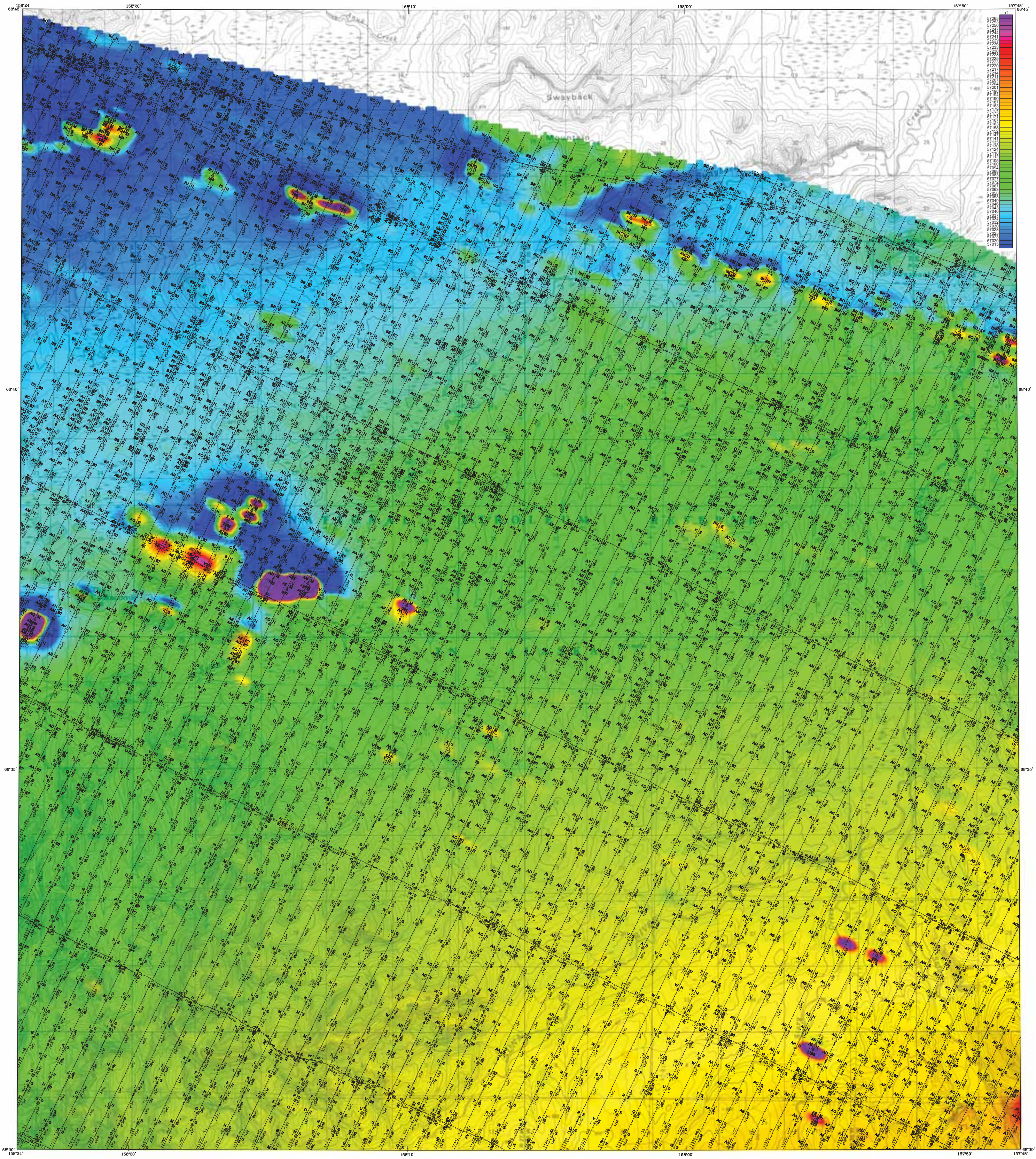
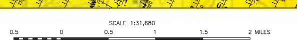
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
IN COOPERATION WITH THE U.S. BUREAU OF LAND MANAGEMENT

GEOPHYSICAL REPORT 2006-1-4c
PARTS of HOWARD PASS C-4 QUADRANGLE

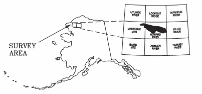


Base from U.S. Geological Survey Howard Pass C-4, 1984; Quadrangle, Alaska

SCALE 1:31,680



CONTOUR INTERVAL 10 METERS
DATUM MEAN SEA LEVEL



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM^V Electromagnetic (EM) system and a Scintrex cesium magnetometer. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS350B-2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (340°) survey flight lines west of the red line shown on the location index and NE-SW (25°) survey flight lines east of the red line. Flight lines were spaced a quarter of a mile with the exception of the Drenchwater Creek area (red area in the location index), where flight lines were spaced one eighth of a mile. Tie lines were flown perpendicular to the flight line intervals of approximately 3 miles except for the Drenchwater Creek areas, where the flight interval was 1.5 miles.

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ELECTROMAGNETICS

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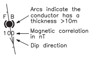
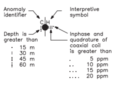
ELECTROMAGNETIC ANOMALIES



Anomaly	Conductance
●	>100 siemens
◕	50–100 siemens
◒	20–50 siemens
⊕	10–20 siemens
⊕	5–10 siemens
○	1–5 siemens
◌	< 1 siemens
✳	Questionable anomaly
△ᴹ	EM magnetite response



Depth is greater than	
·	15 m
:	30 m
⋮	45 m
⁞	60 m

Inphase and quadrature of coaxial coil is greater than	
.	5 ppm
..	10 ppm
...	15 ppm
....	20 ppm

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

TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS of HOWARD PASS C-4 QUADRANGLE

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp.,
and Stevens Exploration Management Corp.
2006

APPROXIMATE MEAN DECLINATION, 2005

TOTAL MAGNETIC FIELD

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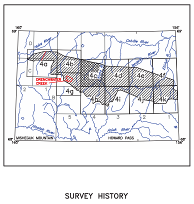
Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures: Journal of the Association of Computing Machinery, v. 17, no. 4, p. 589-602.

LOCATION INDEX FOR SCALE 1:31,680



SURVEY HISTORY

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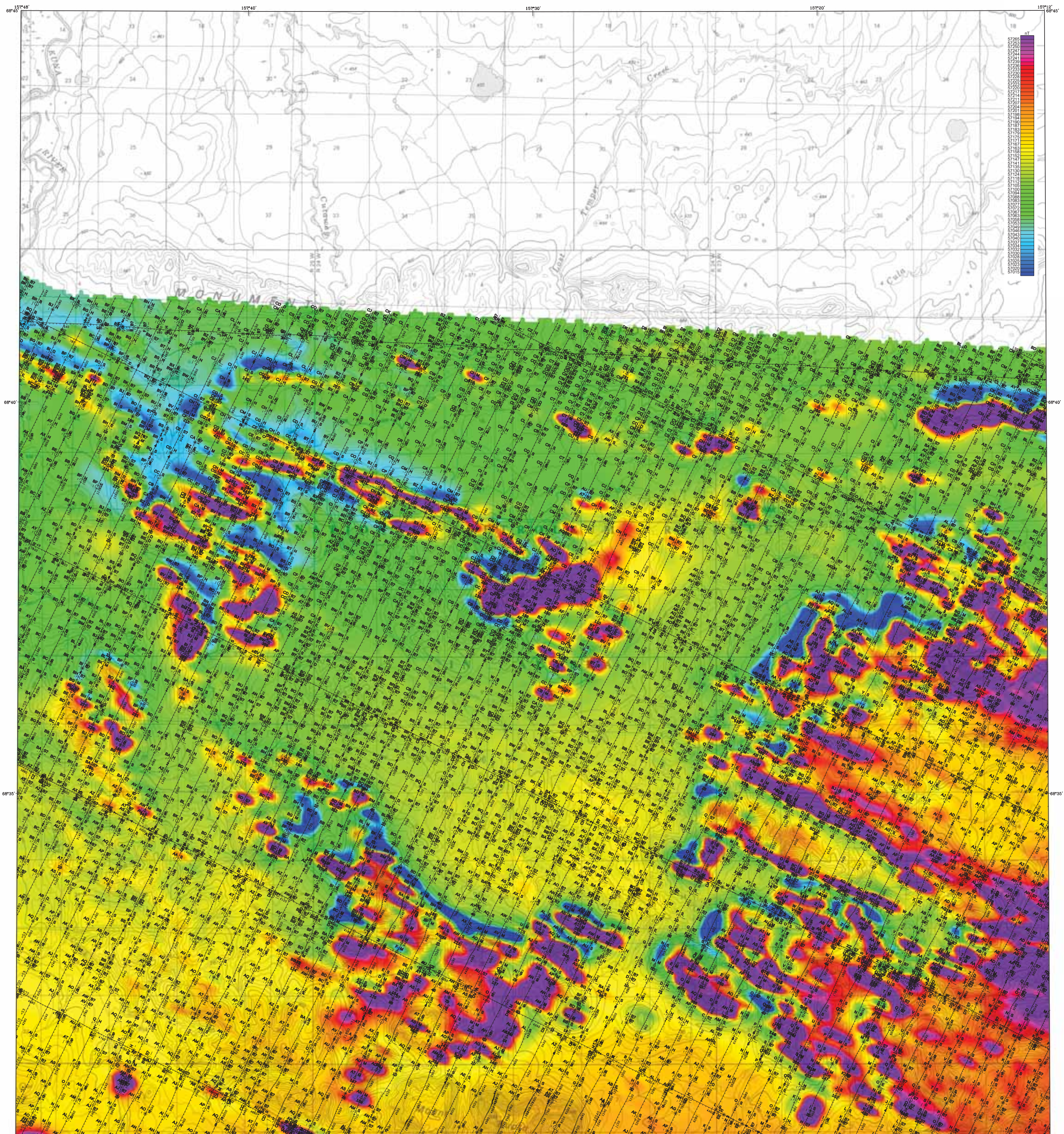
GEOPHYSICAL REPORT 2006-1-4d
PARTS of HOWARD PASS C-3 QUADRANGLE



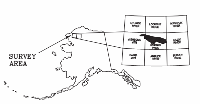
Base from U.S. Geological Survey Howard Pass C-3, 1984; Quadrangle, Alaska

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 20 METERS
DATUM MEAN SEA LEVEL



DESCRIPTIVE NOTES

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ELECTROMAGNETICS

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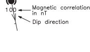
ELECTROMAGNETIC ANOMALIES



Anomaly	Conductance
●	>100 siemens
◕	50–100 siemens
◒	20–50 siemens
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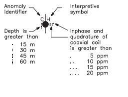


·	15 m
:	30 m
⁝	45 m
⁞	60 m

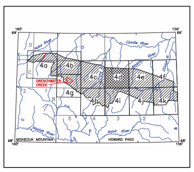
.	5 ppm
..	10 ppm
...	15 ppm
....	20 ppm

TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS of HOWARD PASS C-3 QUADRANGLE

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp.,
and Stevens Exploration Management Corp.
2006

LOCATION INDEX FOR SCALE 1:31,680



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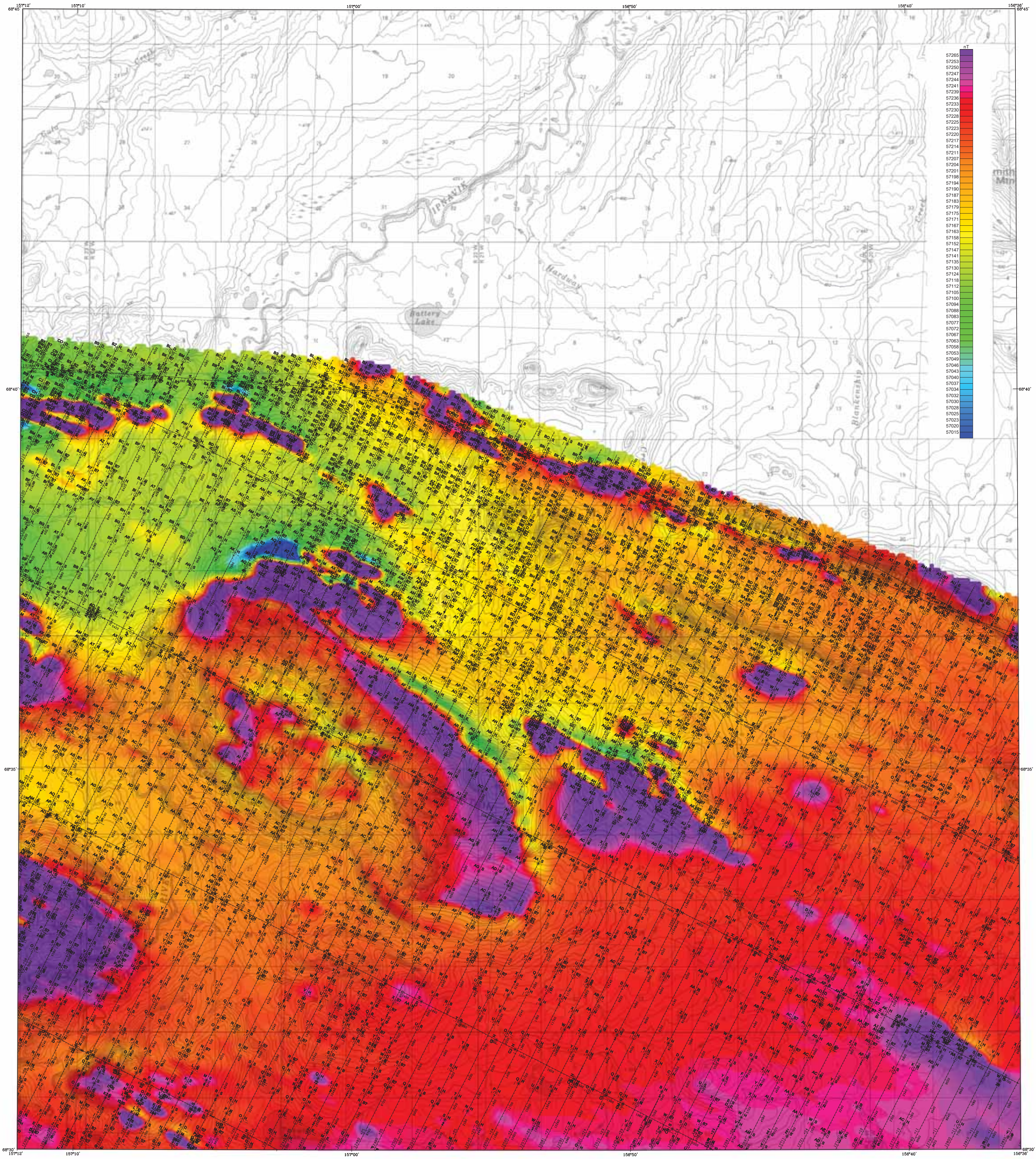
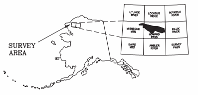
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
IN COOPERATION WITH THE U.S. BUREAU OF LAND MANAGEMENT

GEOPHYSICAL REPORT 2006-1-4e
PARTS of HOWARD PASS C-2 QUADRANGLE



Base from U.S. Geological Survey Howard Pass C-2, 1984; Quadrangle, 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 10 METERS
DATUM MEAN SEA LEVEL



DESCRIPTIVE NOTES

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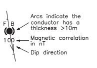

Anomaly	Conductance
●	>100 siemens
◕	50–100 siemens
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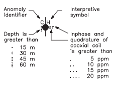
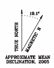


Interpretive symbol	Conductor ("model")
B	Bedrock conductor
D	Narrow bedrock conductor ("thin dike")
S	Conductive cover ("horizontal thin sheet")
H	Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half space")
E	Edge of broad conductor ("edge of half space")
L	Culture, e.g., power line, metal building or fence

TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS of HOWARD PASS C-2 QUADRANGLE

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp.,
and Stevens Exploration Management Corp.
2006



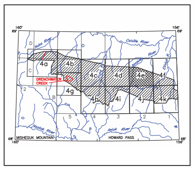
APPROXIMATE MEAN
DECLINATION, 2005

TOTAL MAGNETIC FIELD

The magnetic total field contours were produced using digitally recorded data from a Scintrex cesium CS2 magnetometer, with 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) adjusted for regional variations (or IGRF gradient, 2005, updated to August 2005) using altimeter adjusted IGRF, (3) leveled to the tie line data, and 4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

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

LOCATION INDEX FOR SCALE 1:31,680



SURVEY HISTORY

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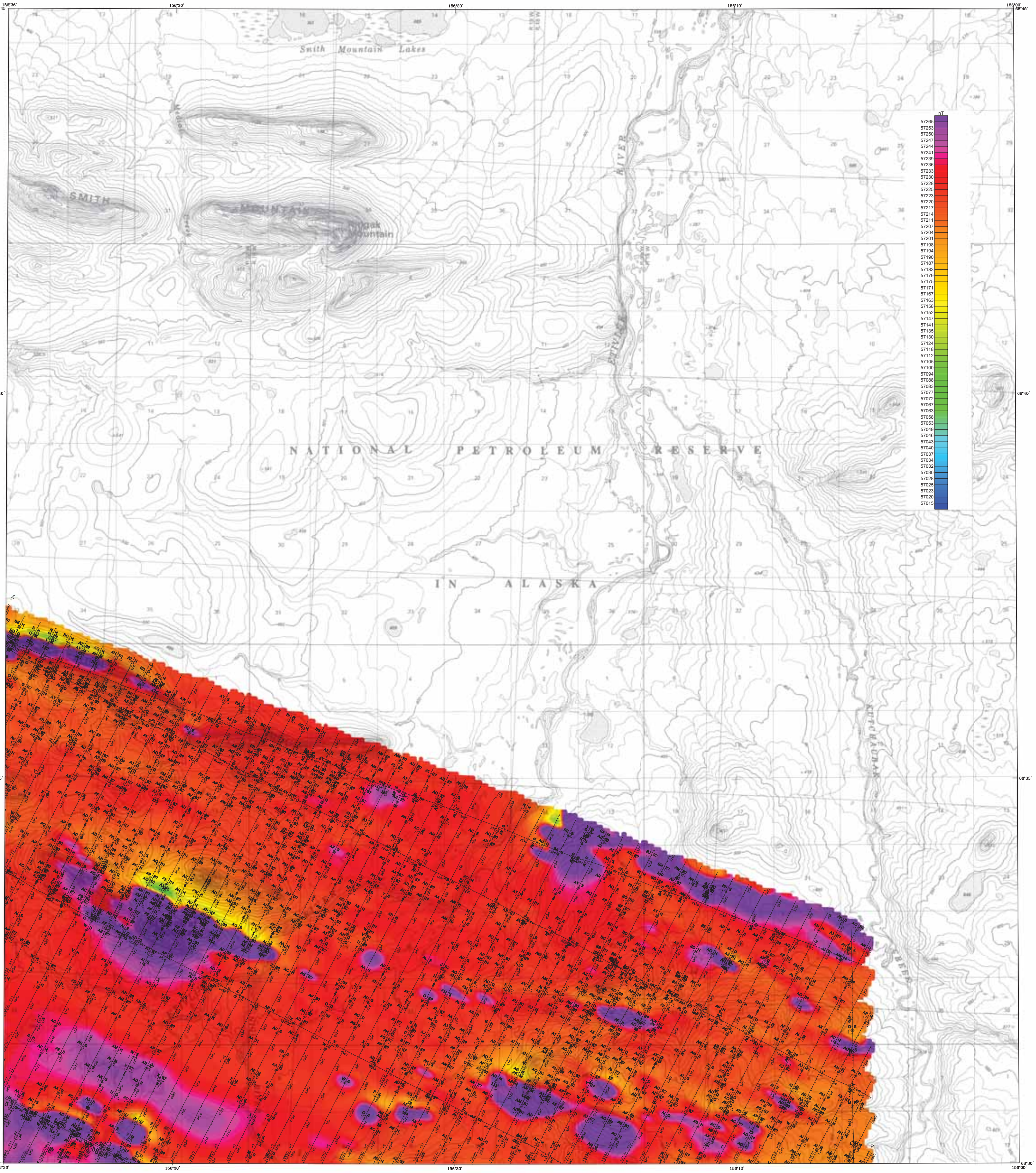
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
IN COOPERATION WITH THE U.S. BUREAU OF LAND MANAGEMENT

GEOPHYSICAL REPORT 2006-1-4f
PARTS of HOWARD PASS C-1 QUADRANGLE



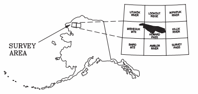
Base from U.S. Geological Survey Howard Pass C-1, 1984; Quadrangle, Alaska

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 10 METERS
DATUM MEAN SEA LEVEL



TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS of HOWARD PASS C-1 QUADRANGLE

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp.,
and Stevens Exploration Management Corp.
2006

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM^{V} Electromagnetic (EM) system and a Scintrex cesium magnetometer. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS350B−2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW−SE (340°) survey flight lines west of the red line shown on the location index and NE−SW (25°) survey flight lines east of the red line. Flight lines were spaced a quarter of a mile with the exception of the Drenchwater Creek area (red area in the location index), where flight lines were spaced one eighth of a mile. Tie lines were flown perpendicular to the flight line intervals of approximately 3 miles except for the Drenchwater Creek areas, where the flight interval was 1.5 miles.

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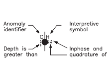
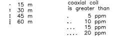
ELECTROMAGNETICS

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



Anomaly	Conductance
●	>100 siemens
◕	50−100 siemens
◒	20−50 siemens
⊕	10−20 siemens
⊕	5−10 siemens
○	1−5 siemens
◌	< 1 siemens
✳	Questionable anomaly
△ M	EM magnetite response



Depth is greater than
· 15 m
: 30 m
⋮ 45 m
⁞ 60 m

Inphase and quadrature of coaxial coil is greater than
. 5 ppm
.. 10 ppm
... 15 ppm
.... 20 ppm

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")
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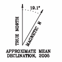

APPROXIMATE MEAN DECLINATION, 2005

TOTAL MAGNETIC FIELD

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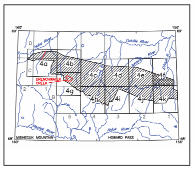
LOCATION INDEX FOR SCALE 1:31,680



SURVEY HISTORY

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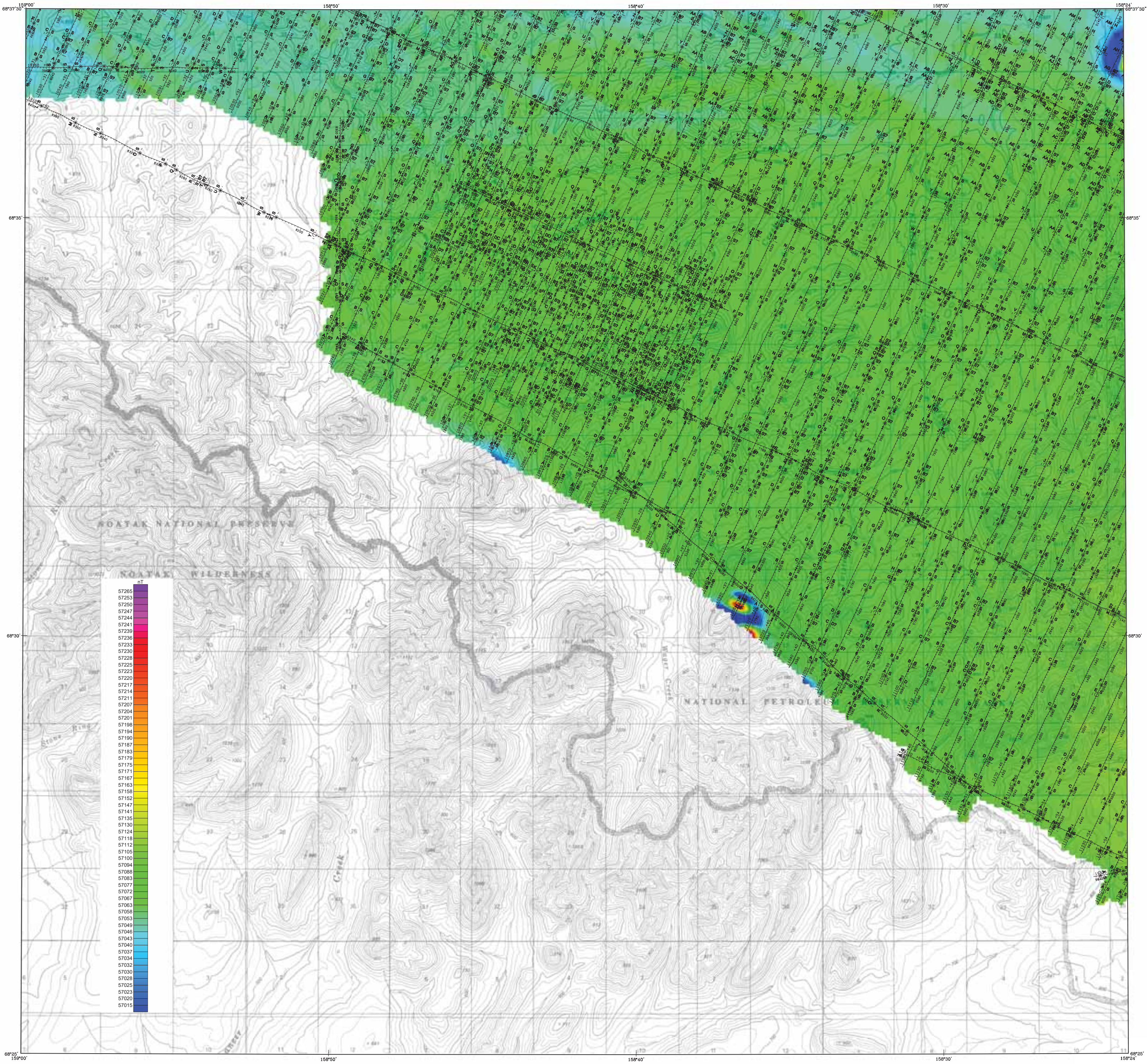
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
IN COOPERATION WITH THE U.S. BUREAU OF LAND MANAGEMENT

GEOPHYSICAL REPORT 2006-1-4g
PARTS of HOWARD PASS B-5 and C-5 QUADRANGLES



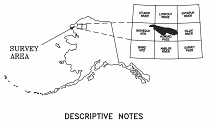
Base from U.S. Geological Survey Howard Pass B-5, 1984; C-5, 1984; Quadrangles, Alaska

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 20 METERS
DATUM MEAN SEA LEVEL



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM^V Electromagnetic (EM) system and a Scintrex cesium magnetometer. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS350B-2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (340°) survey flight lines west of the red line shown on the location index and NE-SW (25°) survey flight lines east of the red line. Flight lines were spaced a quarter of a mile with the exception of the Drenchwater Creek area (red area in the location index), where flight lines were spaced one eighth of a mile. Tie lines were flown perpendicular to the flight line intervals of approximately 3 miles except for the Drenchwater Creek areas, where the flight interval was 1.5 miles.

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ELECTROMAGNETICS

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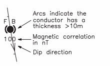
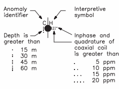
ELECTROMAGNETIC ANOMALIES



Anomaly	Conductance
●	>100 siemens
◕	50–100 siemens
◒	20–50 siemens
⊕	10–20 siemens
⊕	5–10 siemens
○	1–5 siemens
◌	< 1 siemens
✳	Questionable anomaly
△ M	EM magnetite response



Interpretive symbol	Conductor ("model")
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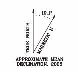
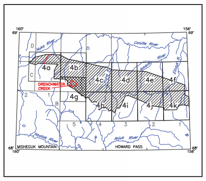
PARTS of HOWARD PASS B-5 and C-5 QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp.,
and Stevens Exploration Management Corp.
2006



LOCATION INDEX FOR SCALE 1:31,680



TOTAL MAGNETIC FIELD

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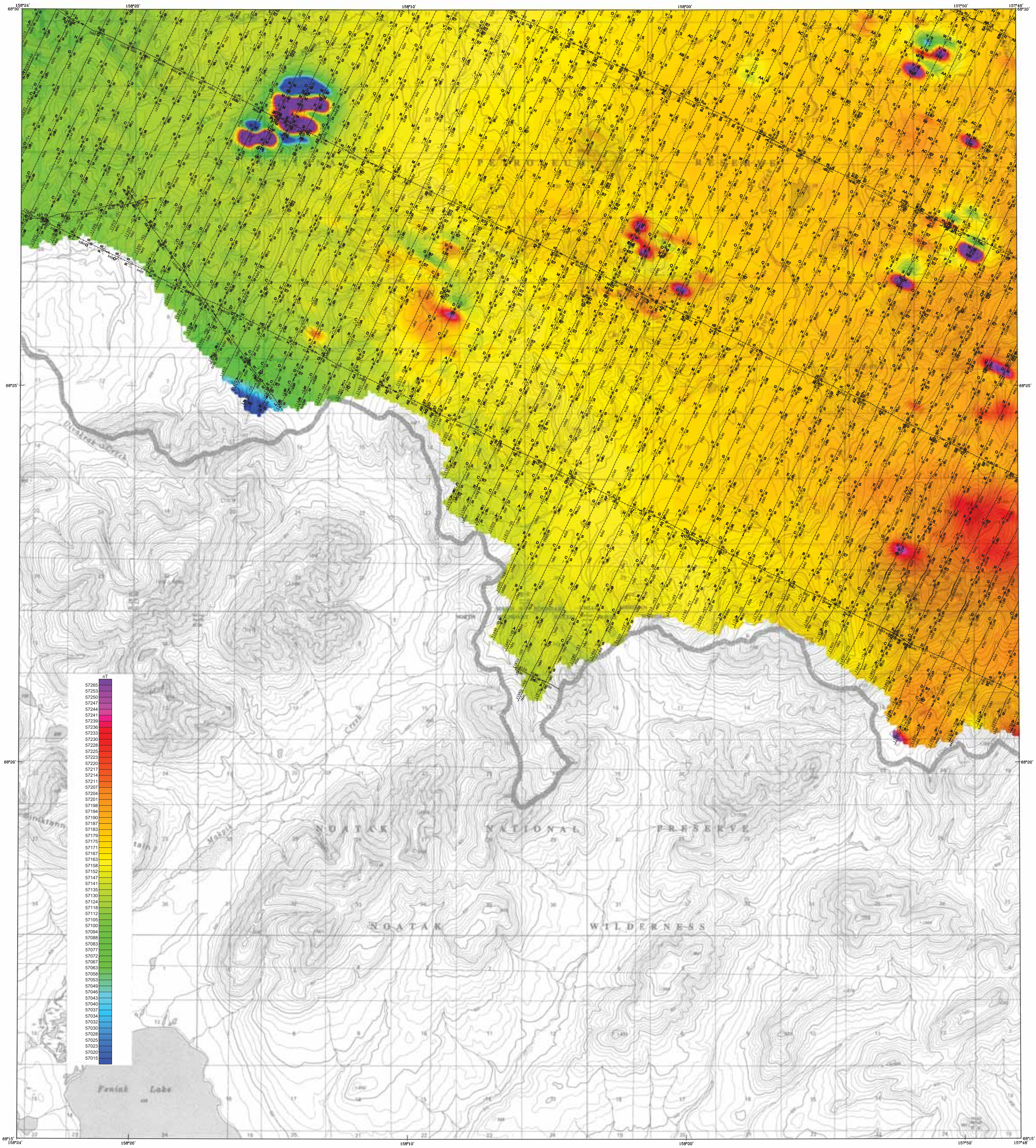
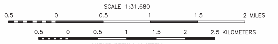
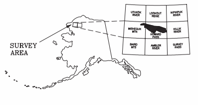


Base from U.S. Geological Survey Howard Pass B-4, 1984; Quadrangle, Alaska



CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL



DESCRIPTIVE NOTES

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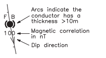
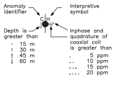
ELECTROMAGNETIC ANOMALIES



Anomaly	Conductance
●	>100 siemens
◕	50–100 siemens
◒	20–50 siemens
⊕	10–20 siemens
⊕	5–10 siemens
○	1–5 siemens
◌	< 1 siemens
✳	Questionable anomaly
△ᴹ	EM magnetite response



Interpretive symbol	Conductor ("model")
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TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS of HOWARD PASS B-4 QUADRANGLE

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp.,
and Stevens Exploration Management Corp.
2006

APPROXIMATE MEAN
DECLINATION, 2005

TOTAL MAGNETIC FIELD

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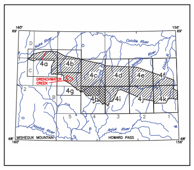
LOCATION INDEX FOR SCALE 1:31,680



SURVEY HISTORY

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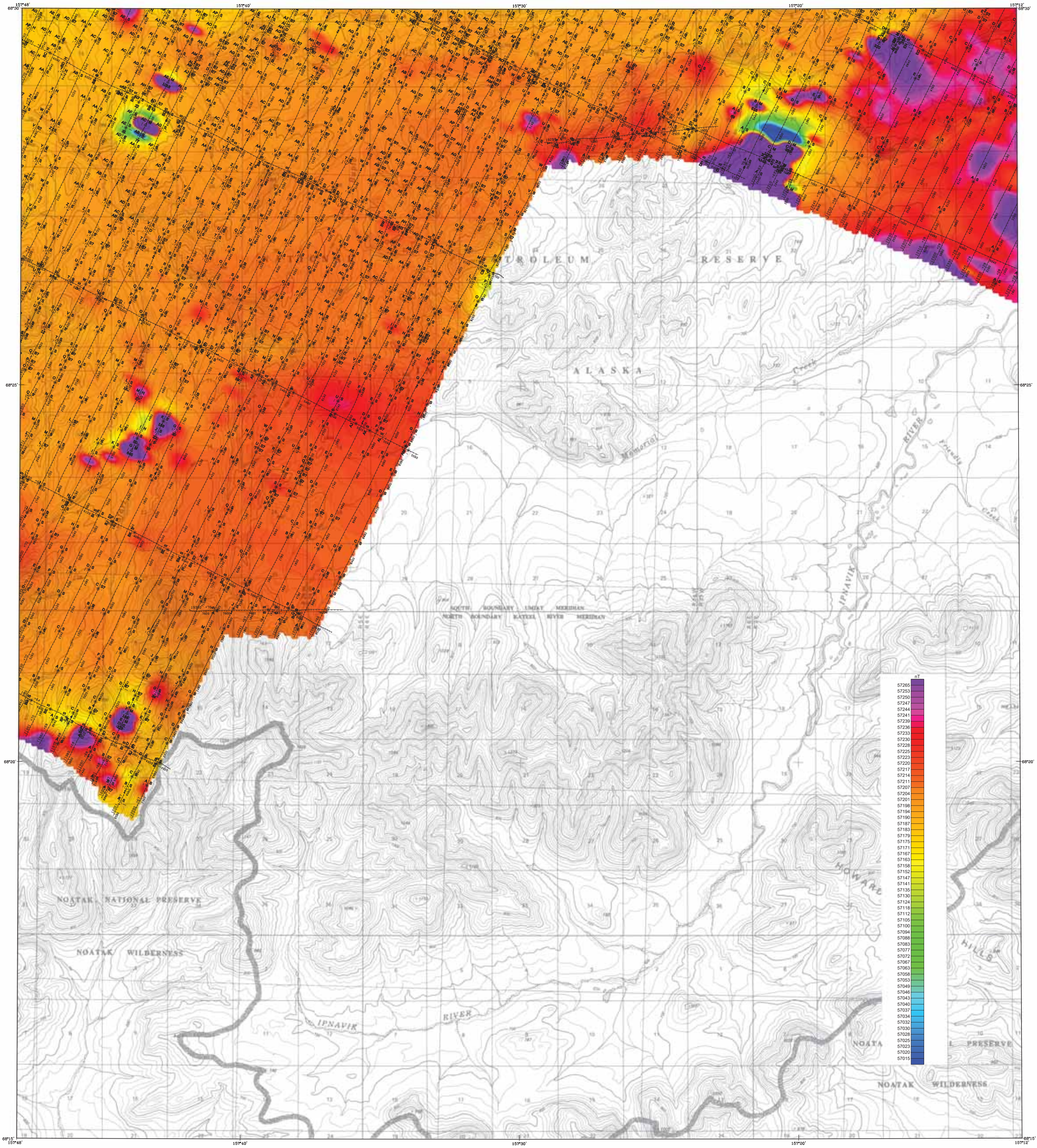
IN COOPERATION WITH THE U.S. BUREAU OF LAND MANAGEMENT

GEOPHYSICAL REPORT 2006-1-4i
PARTS of HOWARD PASS B-3 QUADRANGLE



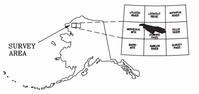
Base from U.S. Geological Survey Howard Pass B-3, 1984; Quadrangle, Alaska

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 20 METERS
DATUM MEAN SEA LEVEL



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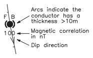
ELECTROMAGNETIC ANOMALIES



Anomaly	Conductance
●	>100 siemens
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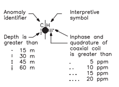


Interpretive symbol	Conductor ("model")
B	Bedrock conductor
D	Narrow bedrock conductor ("thin dike")
S	Conductive cover ("horizontal thin sheet")
H	Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half space")
E	Edge of broad conductor ("edge of half space")
L	Culture, e.g., power line, metal building or fence

TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS of HOWARD PASS B-3 QUADRANGLE

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp.,
and Stevens Exploration Management Corp.
2006

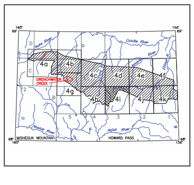
APPROXIMATE MEAN DECLINATION, 2005

TOTAL MAGNETIC FIELD

The magnetic total field contours were produced using digitally recorded data from a Scintrex cesium CS2 magnetometer, with 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) adjusted for regional variations (or IGRF gradient, 2005, updated to August 2005) using altimeter adjusted IGRF, (3) leveled to the tie line data, and 4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

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

LOCATION INDEX FOR SCALE 1:31,680



SURVEY HISTORY

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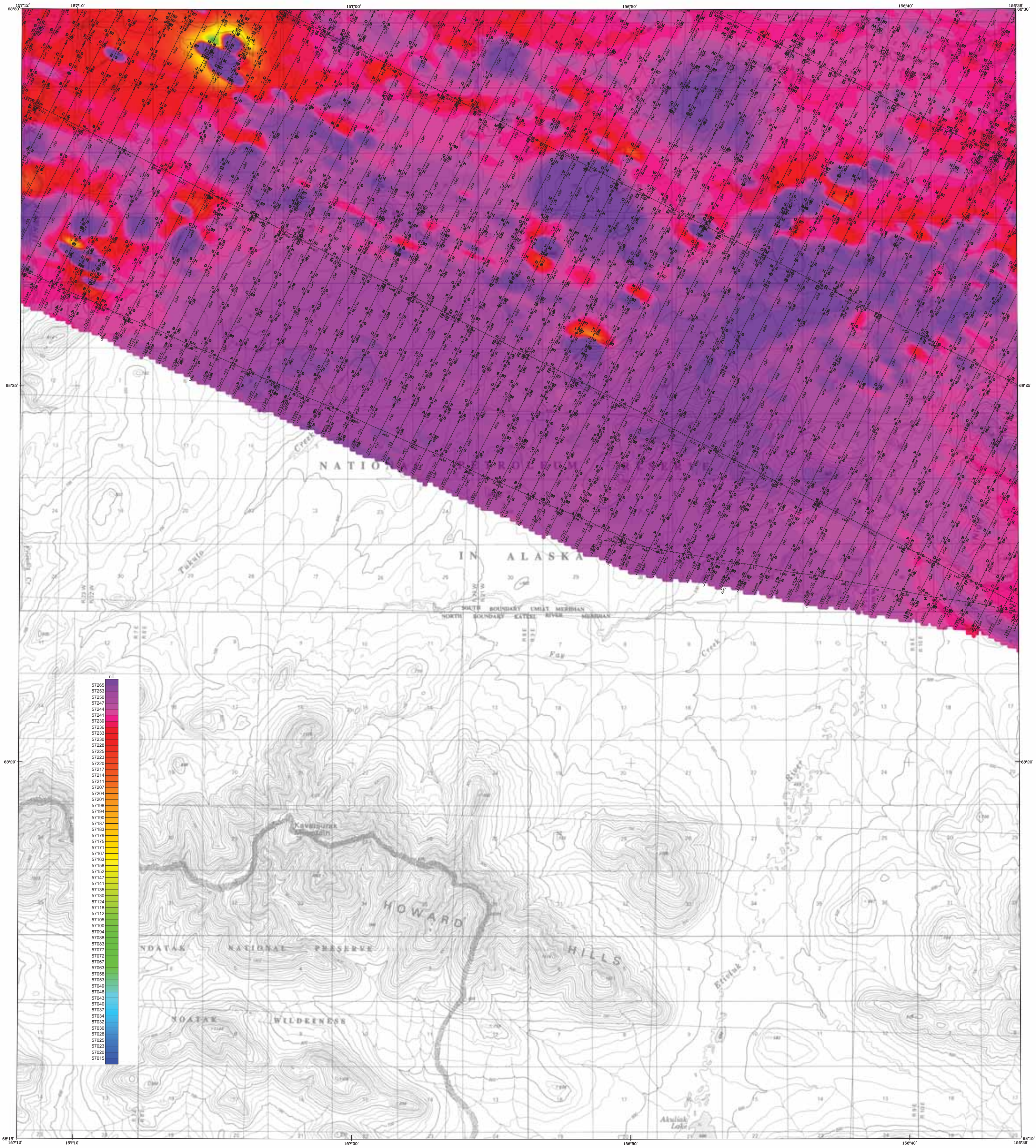
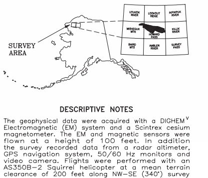
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
IN COOPERATION WITH THE U.S. BUREAU OF LAND MANAGEMENT

GEOPHYSICAL REPORT 2006-1-4j
PARTS of HOWARD PASS B-2 QUADRANGLE



Base from U.S. Geological Survey Howard Pass B-2, 1984; Quadrangle, Alaska



DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM^{V} Electromagnetic (EM) system and a Scintrex cesium magnetometer. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from a radar altimeter, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS350B-2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (340°) survey flight lines west of the red line shown on the location index and NE-SW (25°) survey flight lines east of the red line. Flight lines were spaced a quarter of a mile with the exception of the Drenchwater Creek area (red area in the location index), where flight lines were spaced one eighth of a mile. Tie lines were flown perpendicular to the flight line intervals of approximately 3 miles except for the Drenchwater Creek areas, where the flight interval was 1.5 miles.

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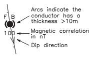
ELECTROMAGNETICS

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



Anomaly	Conductance
●	>100 siemens
◕	50-100 siemens
◒	20-50 siemens
⊕	10-20 siemens
⊕	5-10 siemens
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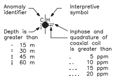
△M	EM magnetite response



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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 20 METERS
DATUM MEAN SEA LEVEL

TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS of HOWARD PASS B-2 QUADRANGLE

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp.,
and Stevens Exploration Management Corp.
2006

APPROXIMATE MEAN DECLINATION, 2005

TOTAL MAGNETIC FIELD

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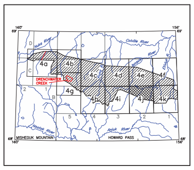
LOCATION INDEX FOR SCALE 1:31,680



SURVEY HISTORY

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ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
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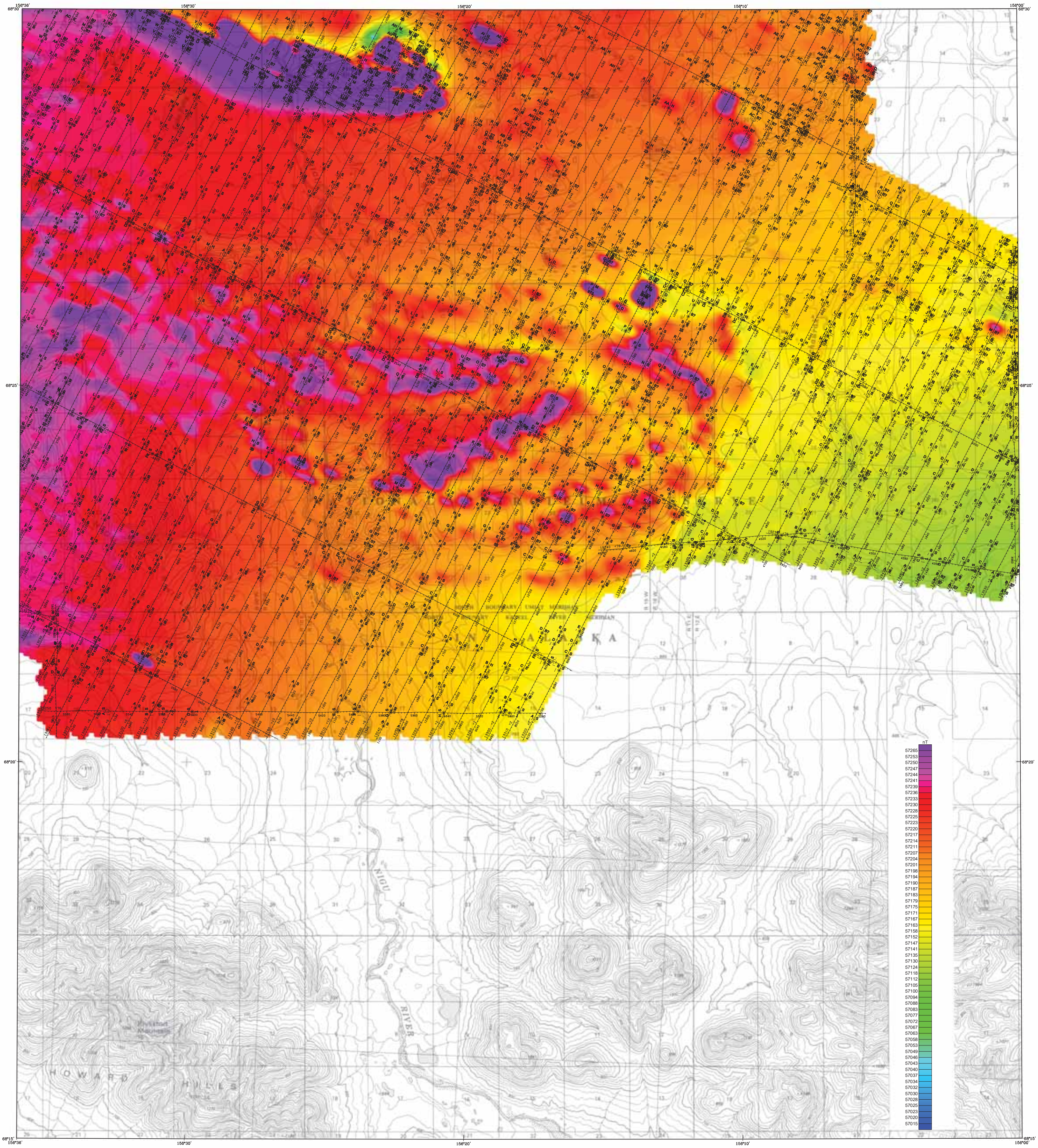
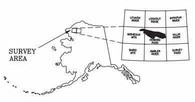
GEOPHYSICAL REPORT 2006-1-4k
PARTS of HOWARD PASS B-1 QUADRANGLE



Base from U.S. Geological Survey Howard Pass B-1, 1984; Quadrangle, Alaska



DESCRIPTIVE NOTES

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ELECTROMAGNETICS

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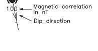

Anomaly	Conductance
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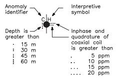

Depth is greater than
- · 15 m
- : 30 m
- ⋮ 45 m
- ⁞ 60 m

Inphase and quadrature of coaxial coil is greater than
- . 5 ppm
- .. 10 ppm
- ... 15 ppm
- .... 20 ppm

Interpretive symbol	Conductor ("model")
B	Bedrock conductor
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L	Culture, e.g., power line, metal building or fence

156°20'

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 20 METERS
DATUM MEAN SEA LEVEL

TOTAL MAGNETIC FIELD AND DETAILED ELECTROMAGNETIC ANOMALIES OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS of HOWARD PASS B-1 QUADRANGLE

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp.,
and Stevens Exploration Management Corp.
2006

APPROXIMATE MEAN DECLINATION, 2005

TOTAL MAGNETIC FIELD

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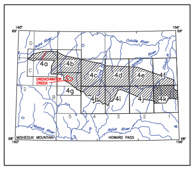
LOCATION INDEX FOR SCALE 1:31,680



SURVEY HISTORY

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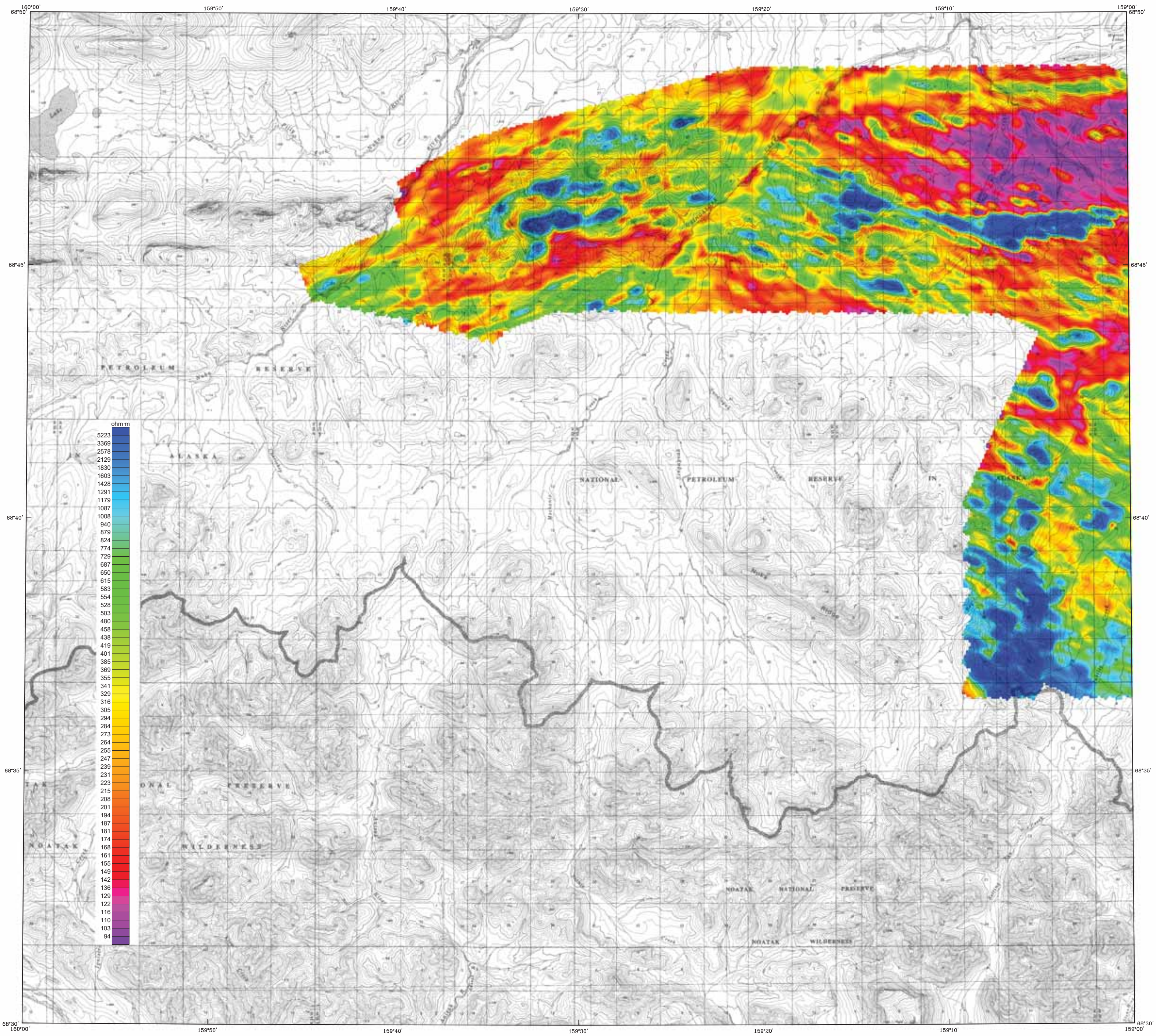
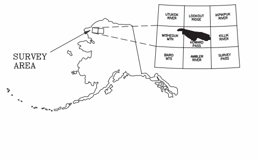
GEOPHYSICAL REPORT 2006-1-5a
Sheet 1 of 4



Base from U.S. Geological Survey Misheguk Mountain C-1, 1984; C-2, 1984; D-1, 1984; D-2, 1984; Quadrangles, Alaska

SCALE 1:63,360
1 0 1 2 3 4 MILES
1 0 1 2 3 4 5 KILOMETERS
CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL

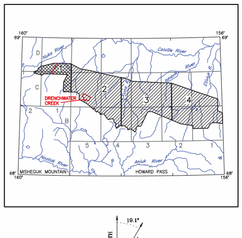


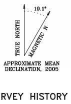
56,000 Hz COPLANAR APPARENT RESISTIVITY OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS OF HOWARD PASS AND MISHEGUK MOUNTAIN QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.
2006

LOCATION INDEX





APPROXIMATE MEAN
DECLINATION, 2005

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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 5000 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.

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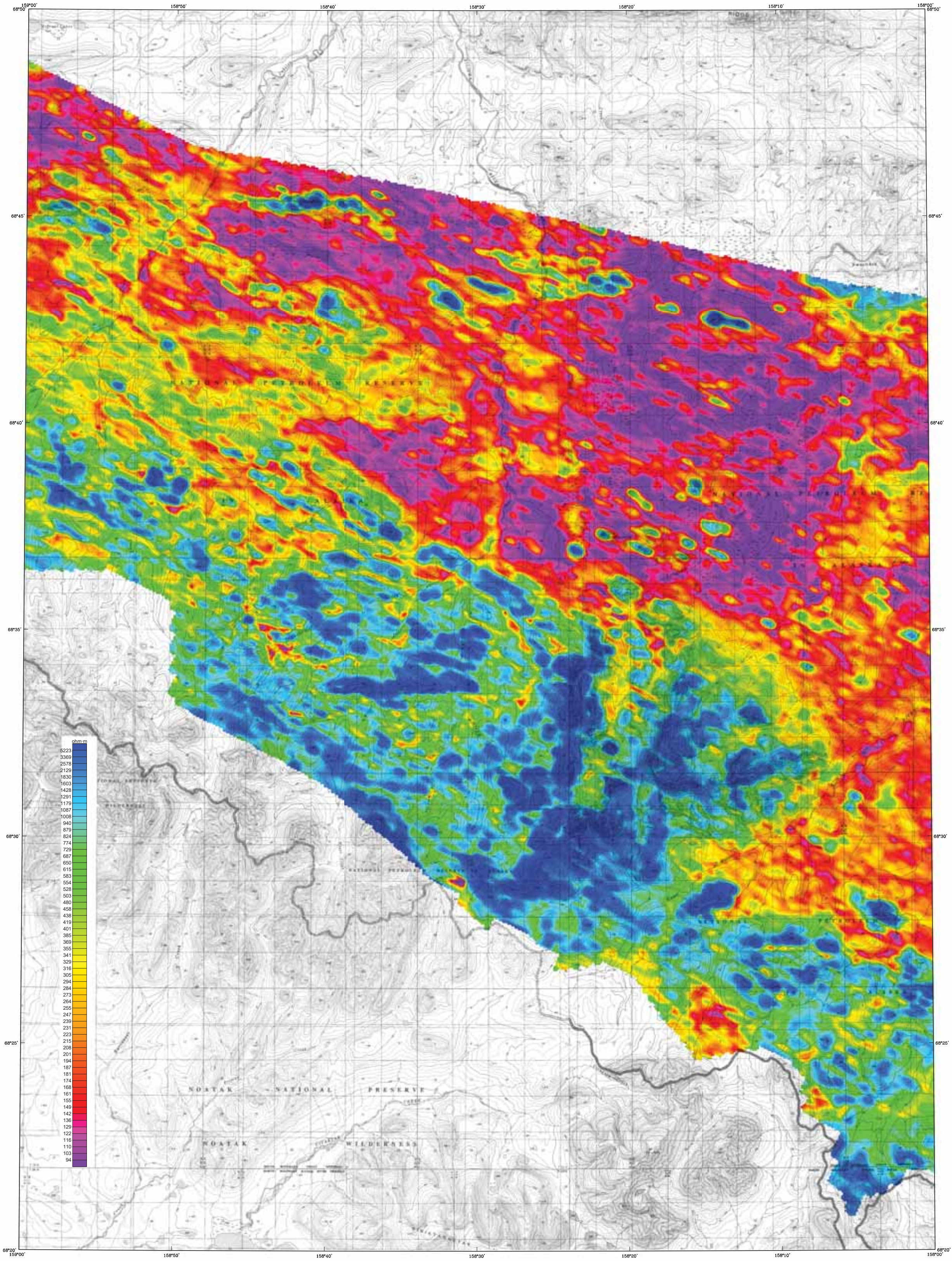
GEOPHYSICAL REPORT 2006-1-5a
Sheet 2 of 4



Base from U.S. Geological Survey Howard Pass B-4, 1984; B-5, 1984; C-4, 1984; C-5, 1984; D-4, 1984; D-5, 1984; Quadrangles, Alaska

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL

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PARTS OF HOWARD PASS AND MISHEGUK MOUNTAIN QUADRANGLES

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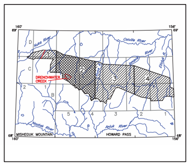
LOCATION INDEX



APPROXIMATE MEAN DECLINATION, 2005

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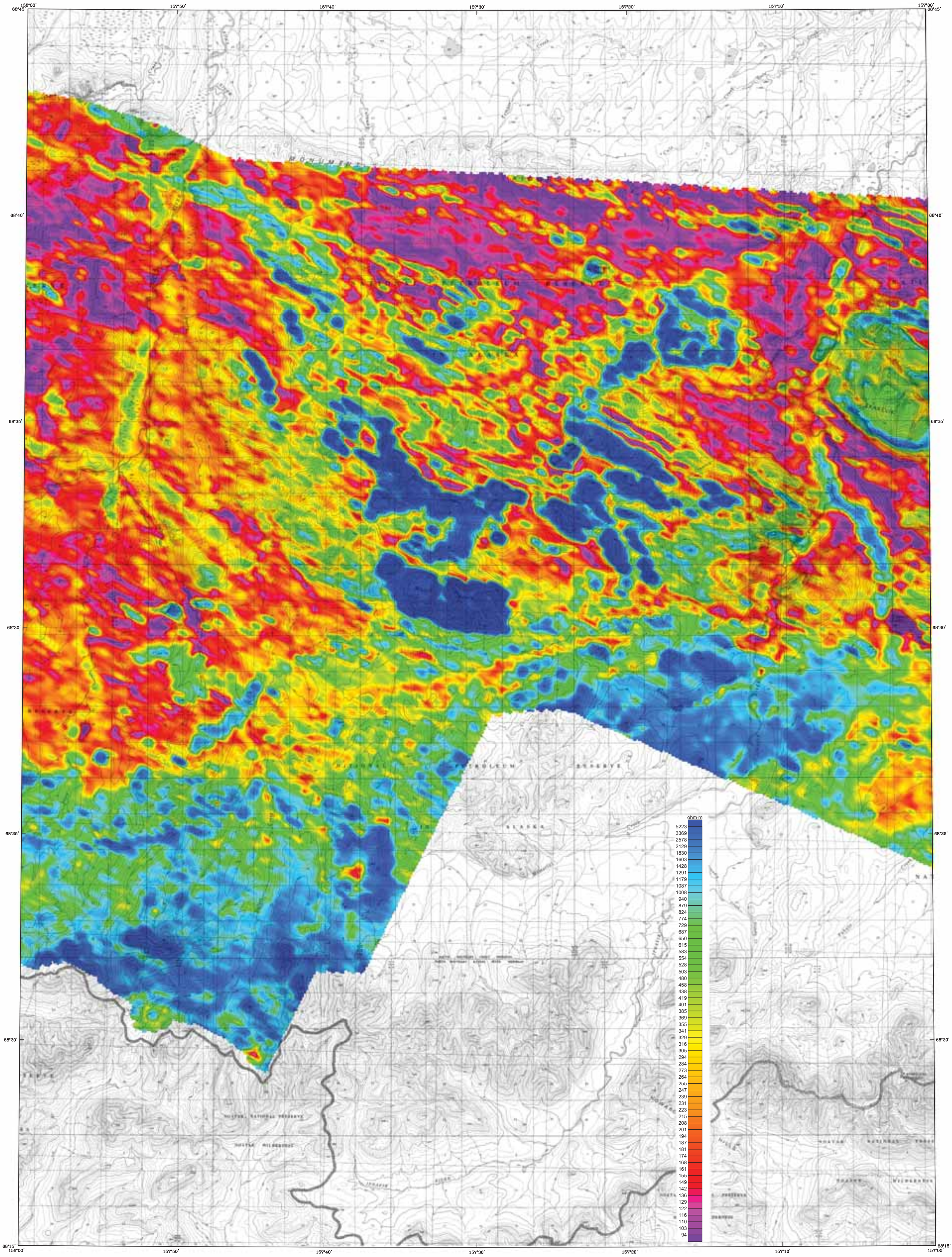
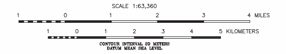
GEOPHYSICAL REPORT 2006-1-5a
Sheet 3 of 4

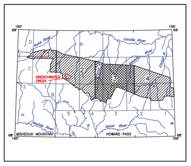


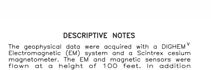
Base from U.S. Geological Survey Howard Pass B-2, 1984; B-3, 1984; B-4, 1984; C-2, 1984; C-3, 1984; C-4, 1984; Quadrangles, Alaska



CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL

LOCATION INDEX





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2006

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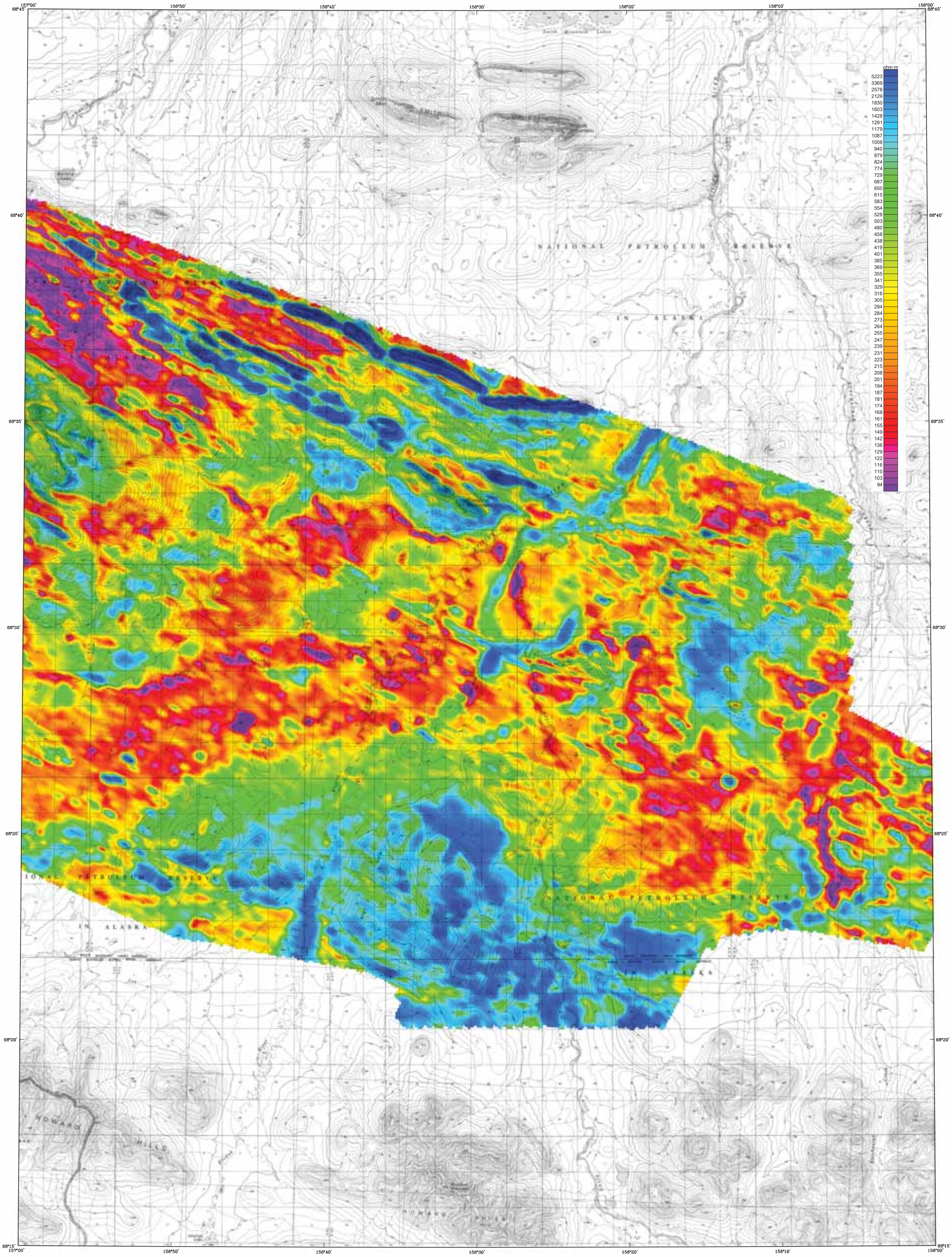
GEOPHYSICAL REPORT 2006-1-5a
Sheet 4 of 4



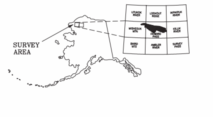
Base from U.S. Geological Survey Howard Pass B-1, 1984; B-2, 1984; C-1, 1984; C-2, 1984; Quadrangles, Alaska

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 20 METERS
DATUM MEAN SEA LEVEL

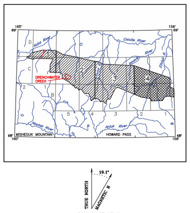


56,000 Hz COPLANAR APPARENT RESISTIVITY OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS OF HOWARD PASS AND MISHEGUK MOUNTAIN QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp.
2006

LOCATION INDEX



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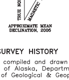

APPROXIMATE MEAN
DECLINATION, 2005

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GEOPHYSICAL REPORT 2006-1-5b
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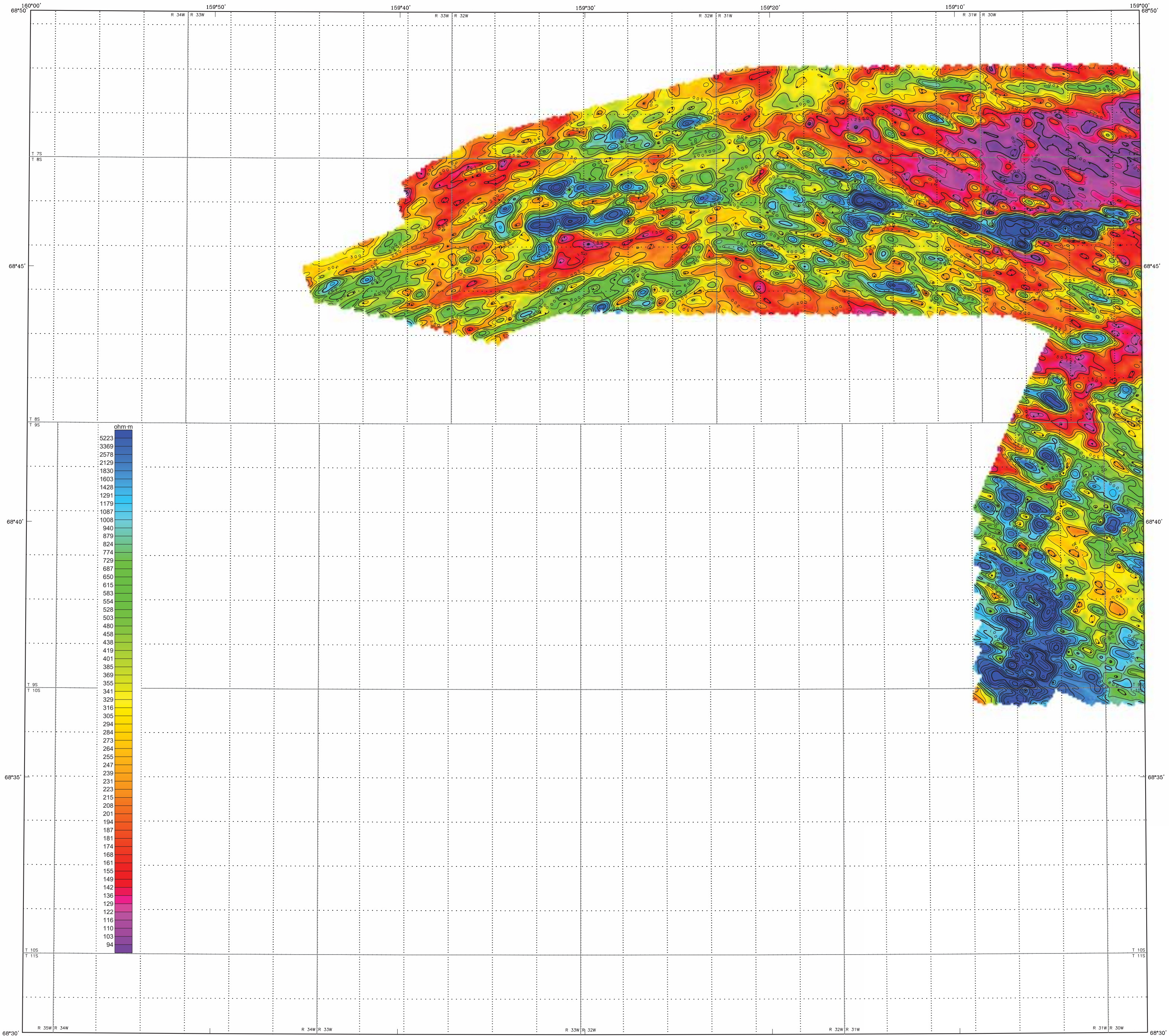
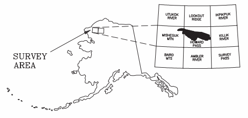


Section outlines from U.S. Geological Survey Misheguk Mountain C-1, 1984; C-2, 1984; D-1, 1984; D-2, 1984; Quadrangles, Alaska

SCALE 1:63,360



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by

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2006

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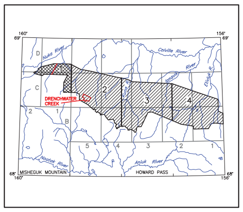

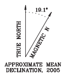

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DECLINATION, 2005

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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

SURVEY HISTORY

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GEOPHYSICAL REPORT 2006-1-5b
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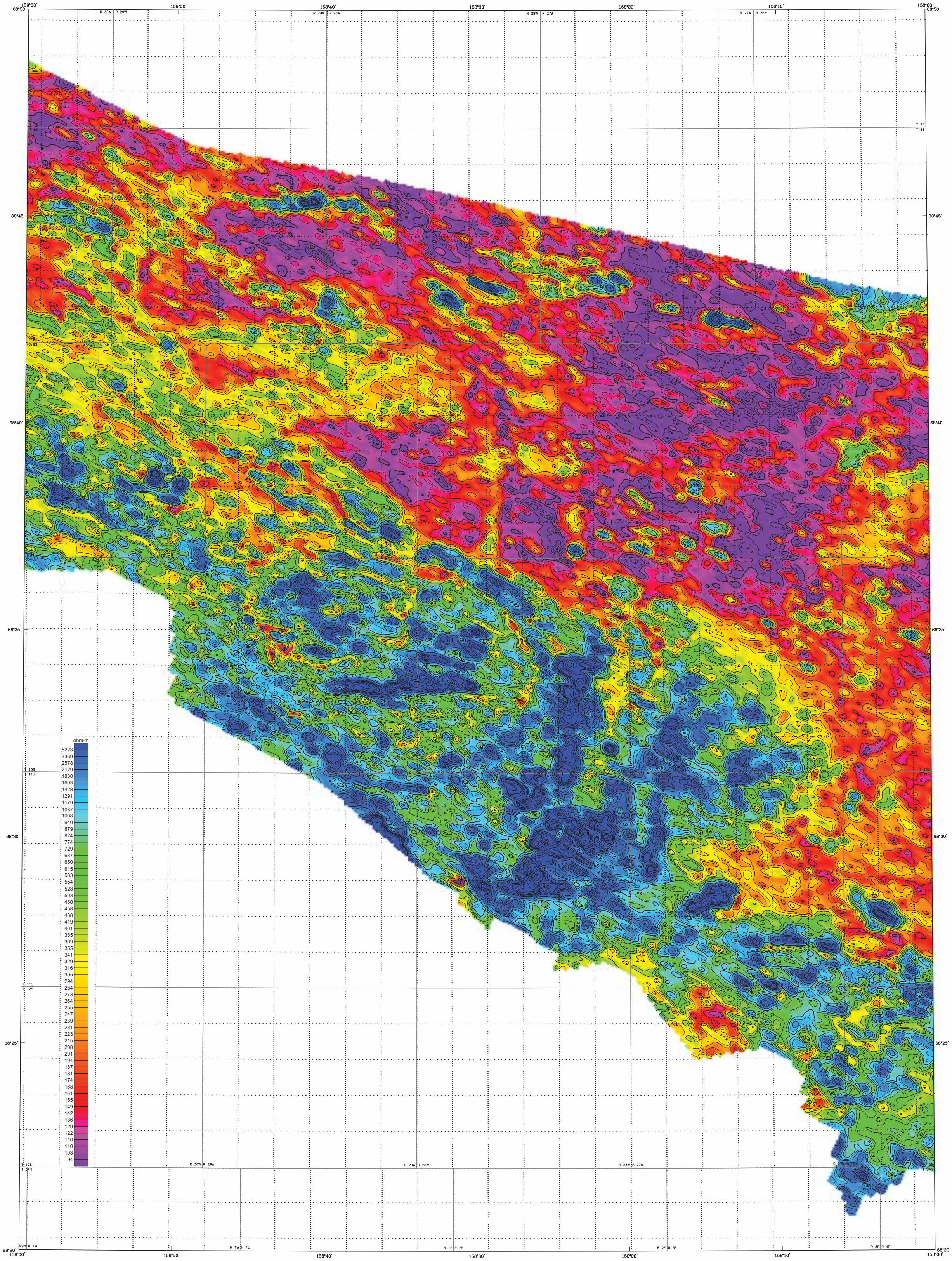
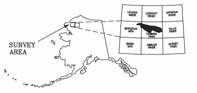


Section outlines from U.S. Geological Survey Howard Pass B-4, 1984; B-5, 1984; C-4, 1984; C-5, 1984; D-4, 1984; D-5, 1984; Quadrangles, Alaska

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS



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2006

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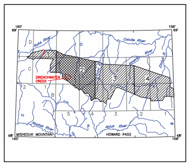

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1000
800
600
500
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125
100

Contours in ohm-m at 10 intervals per decade

. . . . resistivity low

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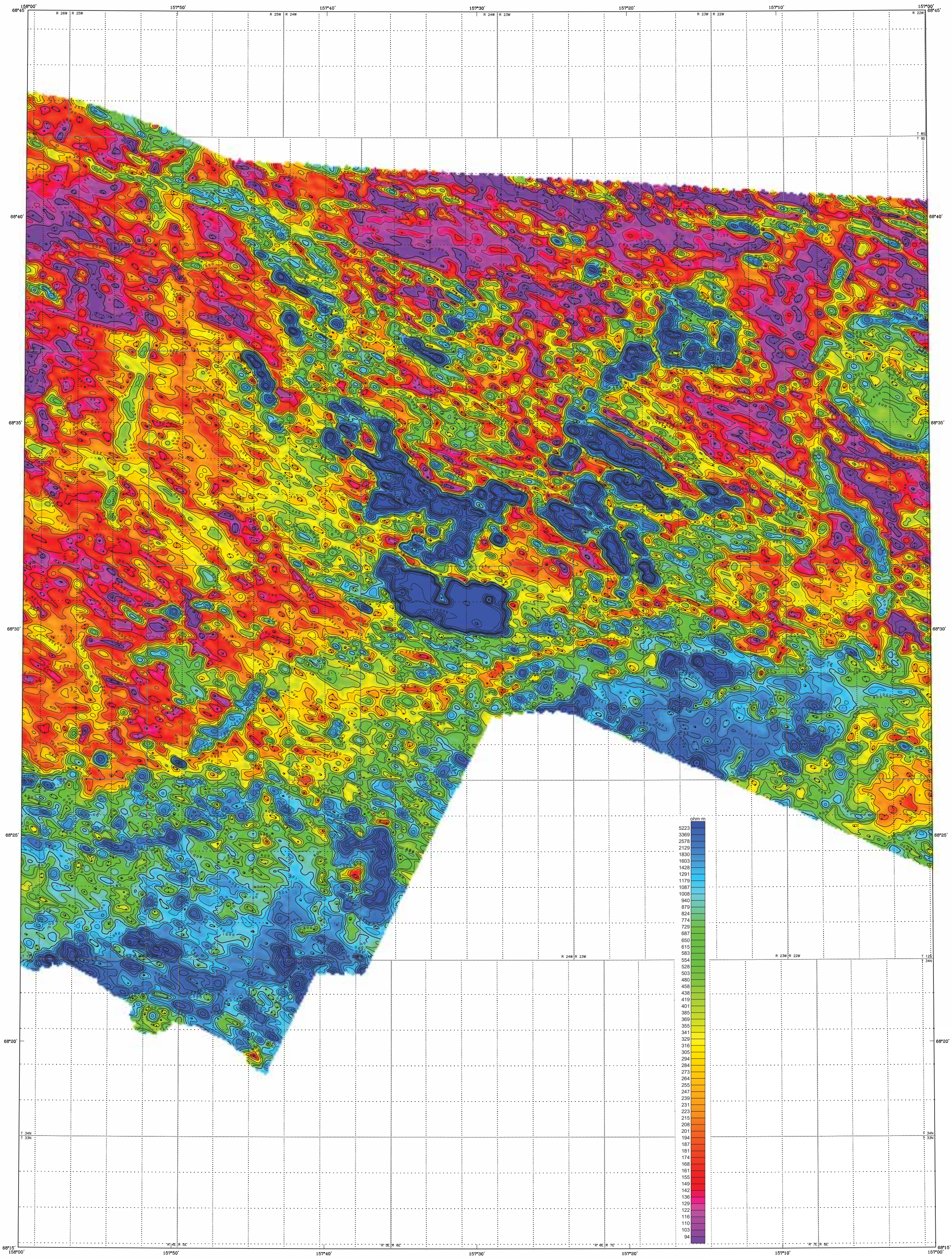
GEOPHYSICAL REPORT 2006-1-5b
Sheet 3 of 4



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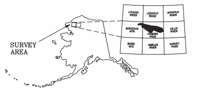
SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS



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OF PARTS OF
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NORTHWEST ALASKA

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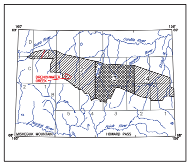

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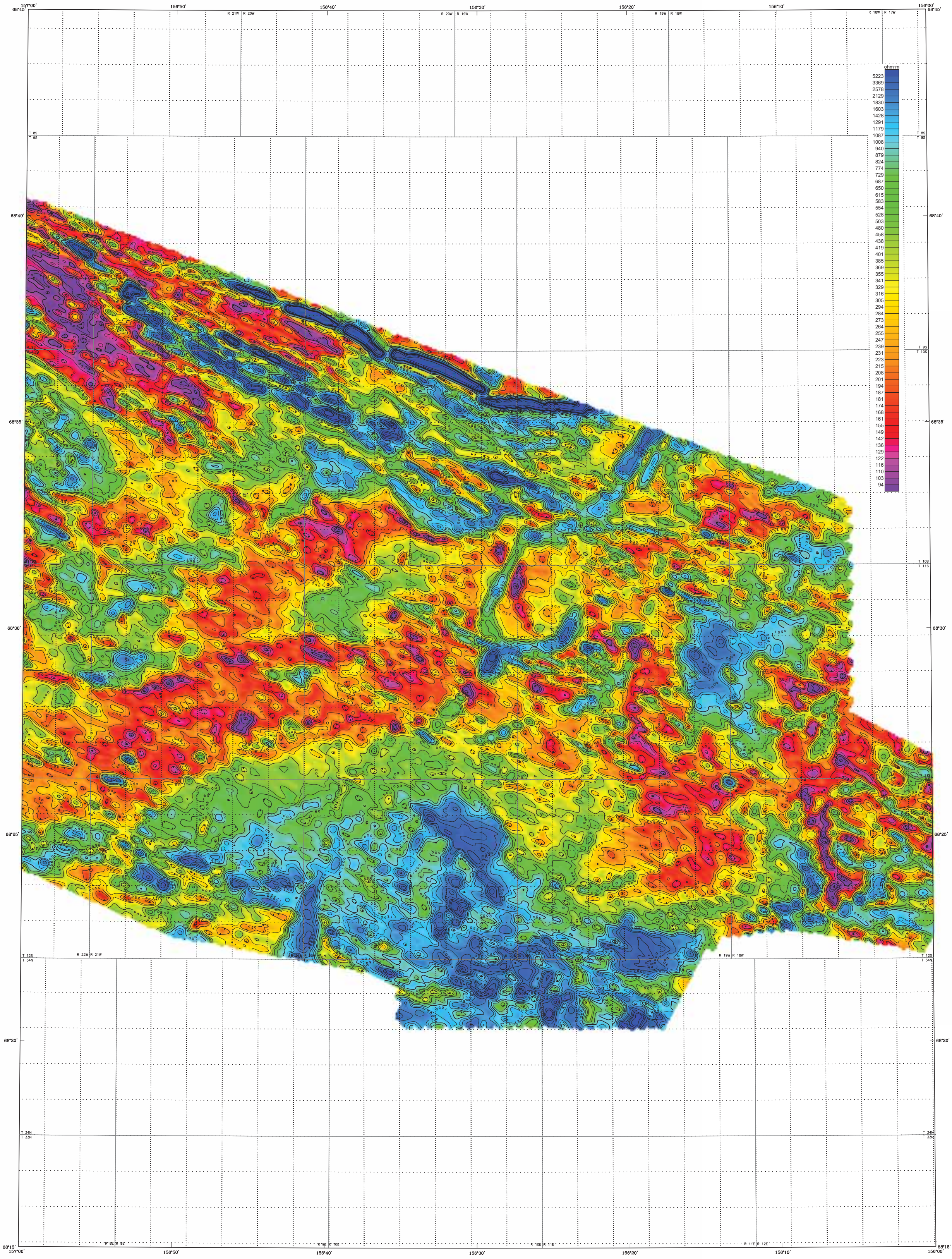

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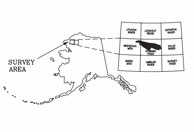

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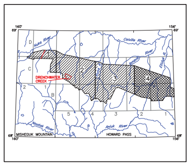

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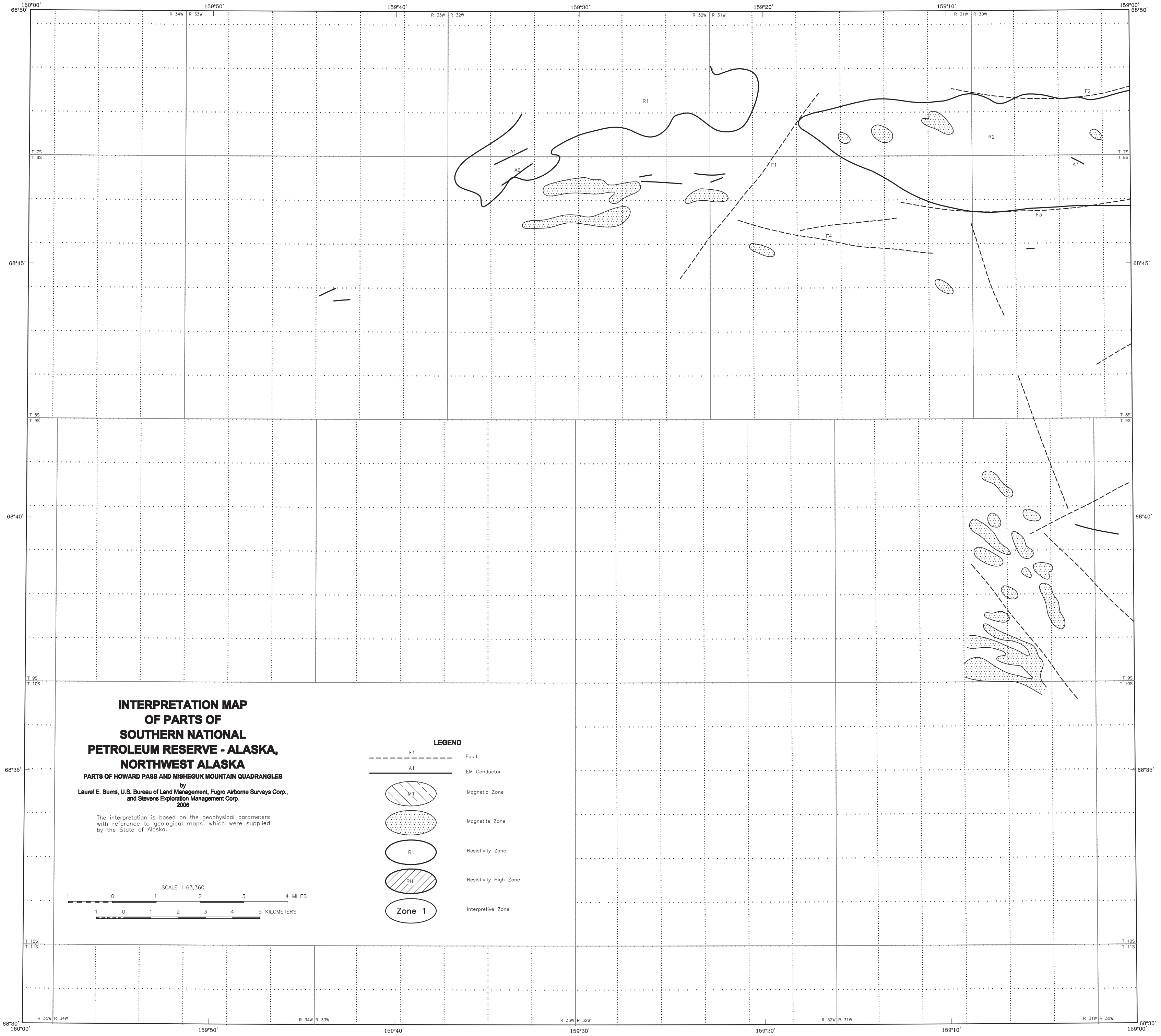
GEOPHYSICAL REPORT 2006-2-1
Sheet 1 of 4



INTERPRETATION MAP OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

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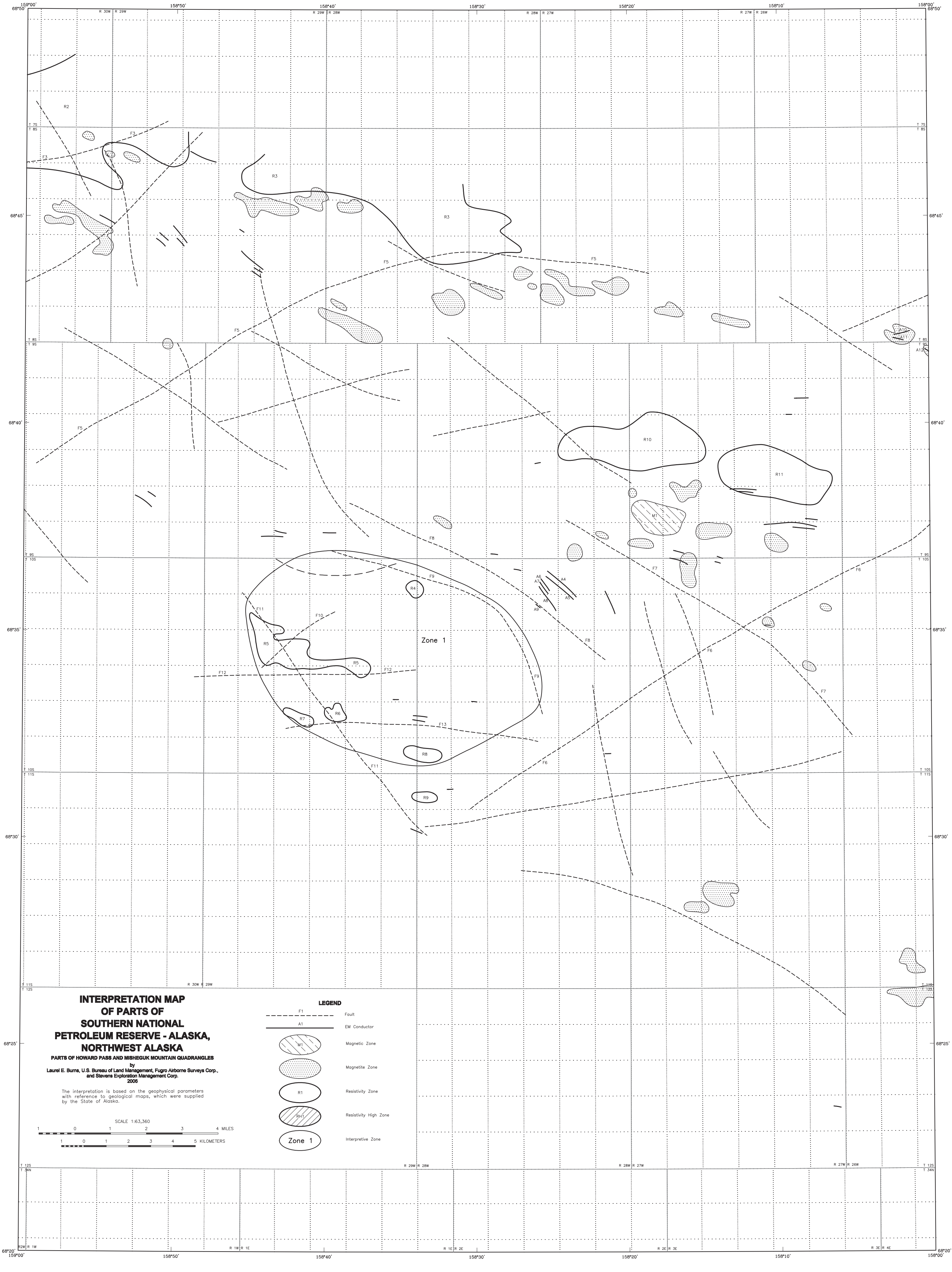
The interpretation is based on the geophysical parameters with reference to geological maps, which were supplied by the State of Alaska.

SCALE 1:63,360

LEGEND

Fault
EM Conductor
Magnetic Zone
Magnetite Zone
Resistivity Zone
Resistivity High Zone
Interpretive Zone



INTERPRETATION MAP OF PARTS OF SOUTHERN NATIONAL PETROLEUM RESERVE - ALASKA, NORTHWEST ALASKA

PARTS OF HOWARD PASS AND MISHEGUK MOUNTAIN QUADRANGLES

by
Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp.,
and Stevens Exploration Management Corp.
2006

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

SCALE 1:63,360

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

LEGEND

F1	Fault
A1	EM Conductor
M1	Magnetic Zone
▒	Magnetite Zone
R1	Resistivity Zone
RH1	Resistivity High Zone
Zone 1	Interpretive Zone

ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
IN COOPERATION WITH THE U.S. BUREAU OF LAND MANAGEMENT

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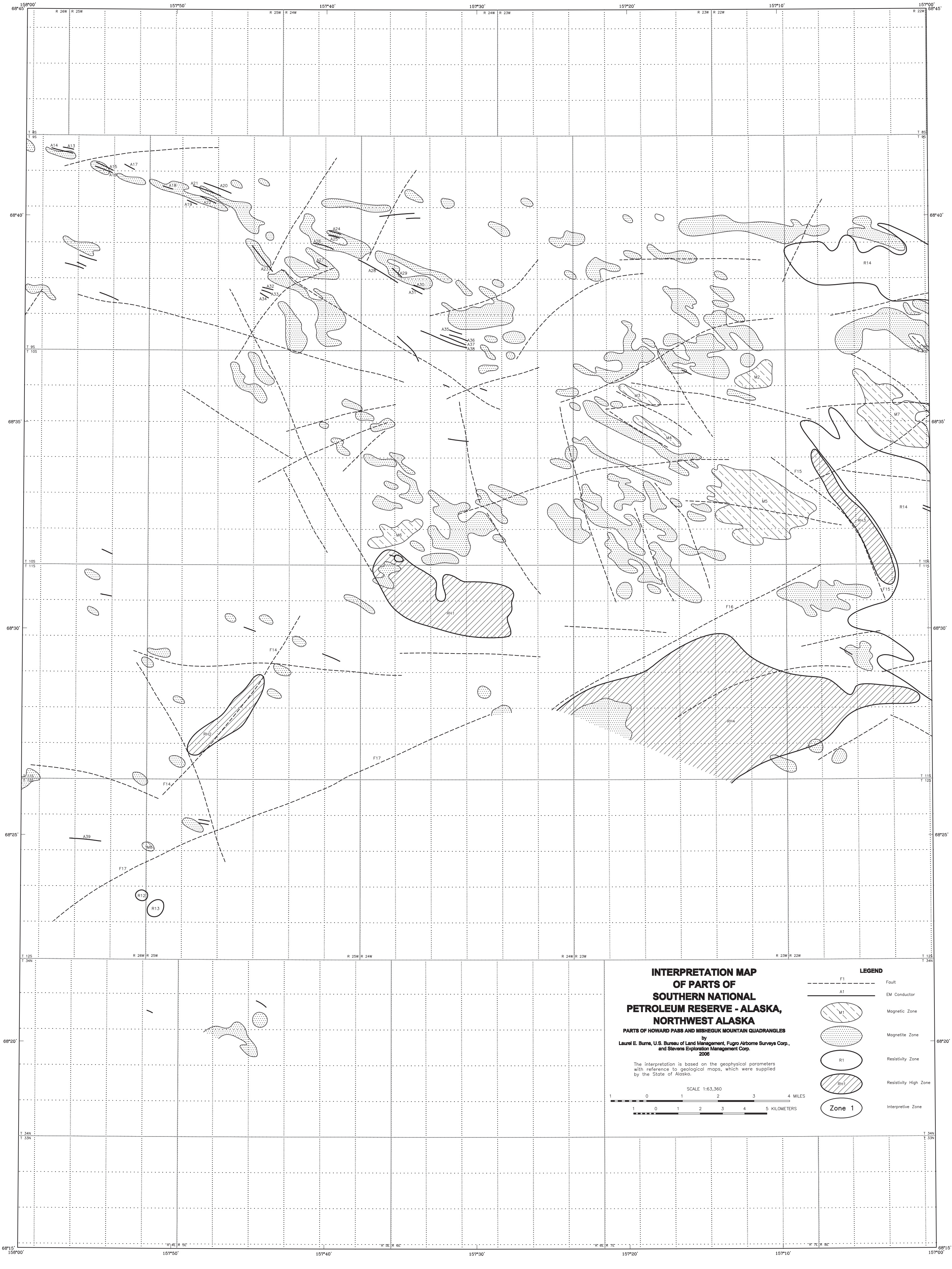

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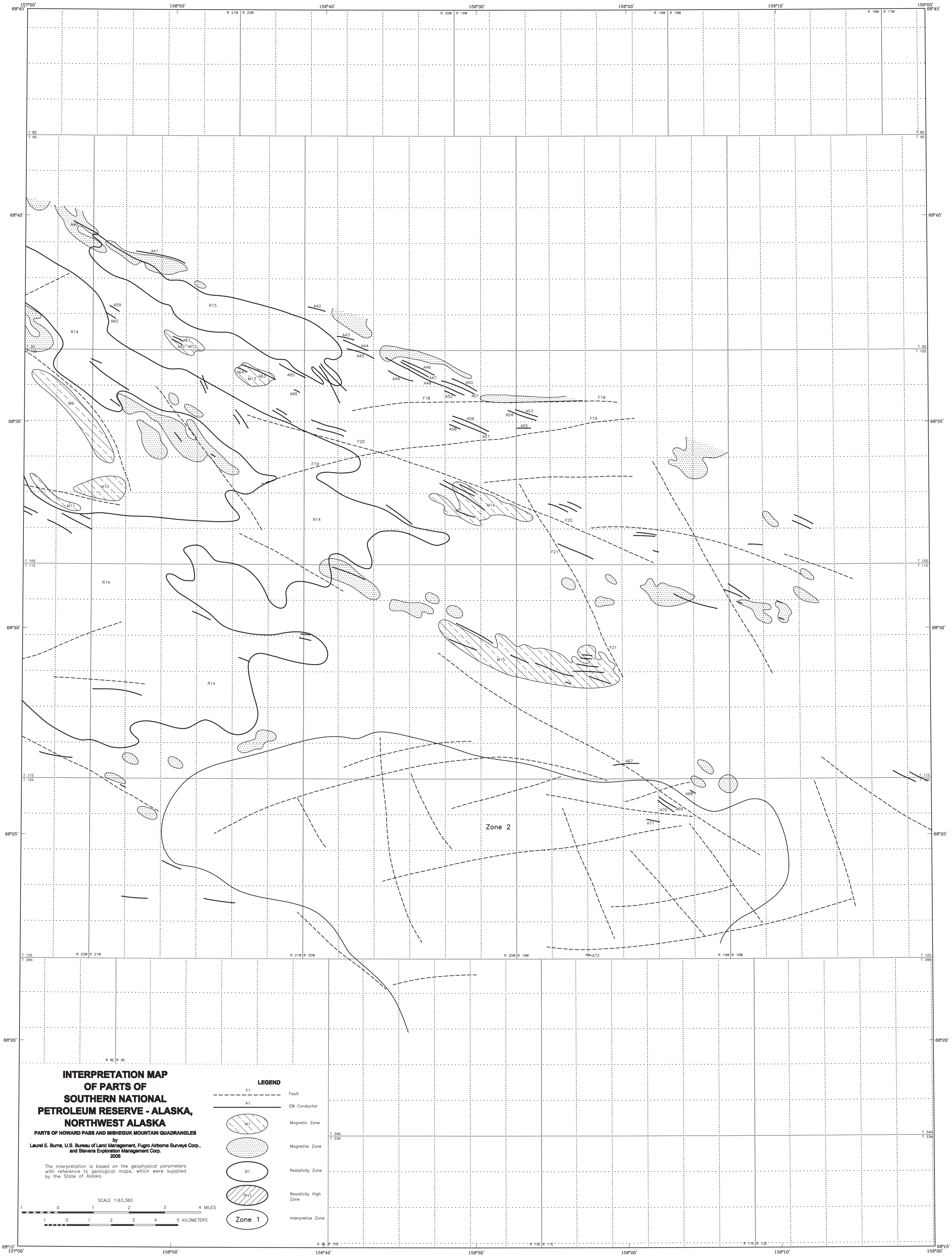
LEGEND

F1 - - - - -	Fault
A1 ——	EM Conductor
M1 ▨	Magnetic Zone
⬭ (dotted)	Magnetite Zone
R1 ⬭	Resistivity Zone
RH1 ▨	Resistivity High Zone
Zone 1	Interpretive Zone



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1 0 1 2 3 4 MILES

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LEGEND

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