AIRBORNE MAGNETIC AND GEOPHYSICAL SURVEY OF THE BETHEL BASIN, ALASKA, DATA COMPILATION

Laurel E. Burns, Abraham M. Emond, GEONEX Aero Service, and Sanders Geophysics Ltd.

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DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

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AIRBORNE MAGNETIC GEOPHYSICAL SURVEY OF THE BETHEL BASIN, ALASKA, DATA COMPILATION

Laura E. Burns[1], Emond, A.M.[1], GEONEX Aero Service, and Sanders Geophysics Ltd.

ABSTRACT

The airborne magnetic geophysical survey of the Bethel Basin, Alaska is located in the Bethel, Baird Inlet, Russian Mission, and Marshall quadrangles near the town of Bethel in southwest Alaska. Magnetic data were collected during October 1996 by Sanders Geophysics Ltd. and August 1994 by GEONEX Aero Service and its subsidiaries. A total of 20,915 line kilometers were collected covering 14,953 square kilometers. Line spacing was 800 meters (m). Data were collected using a fixed-wing aircraft with a median ground clearance of 90 m.

PURPOSE

These data were collected to assist the state in assessing the Bethel basin for natural gas potential. The aeromagnetic data were intended to be interpreted and integrated with available gravity, seismic, and geological information to recommend sites for subsequent drill testing of potential natural gas accumulations.

SURVEY OVERVIEW DESCRIPTION

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

ACKNOWLEDGMENTS

Funding was provided by the Alaska State Legislature.

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

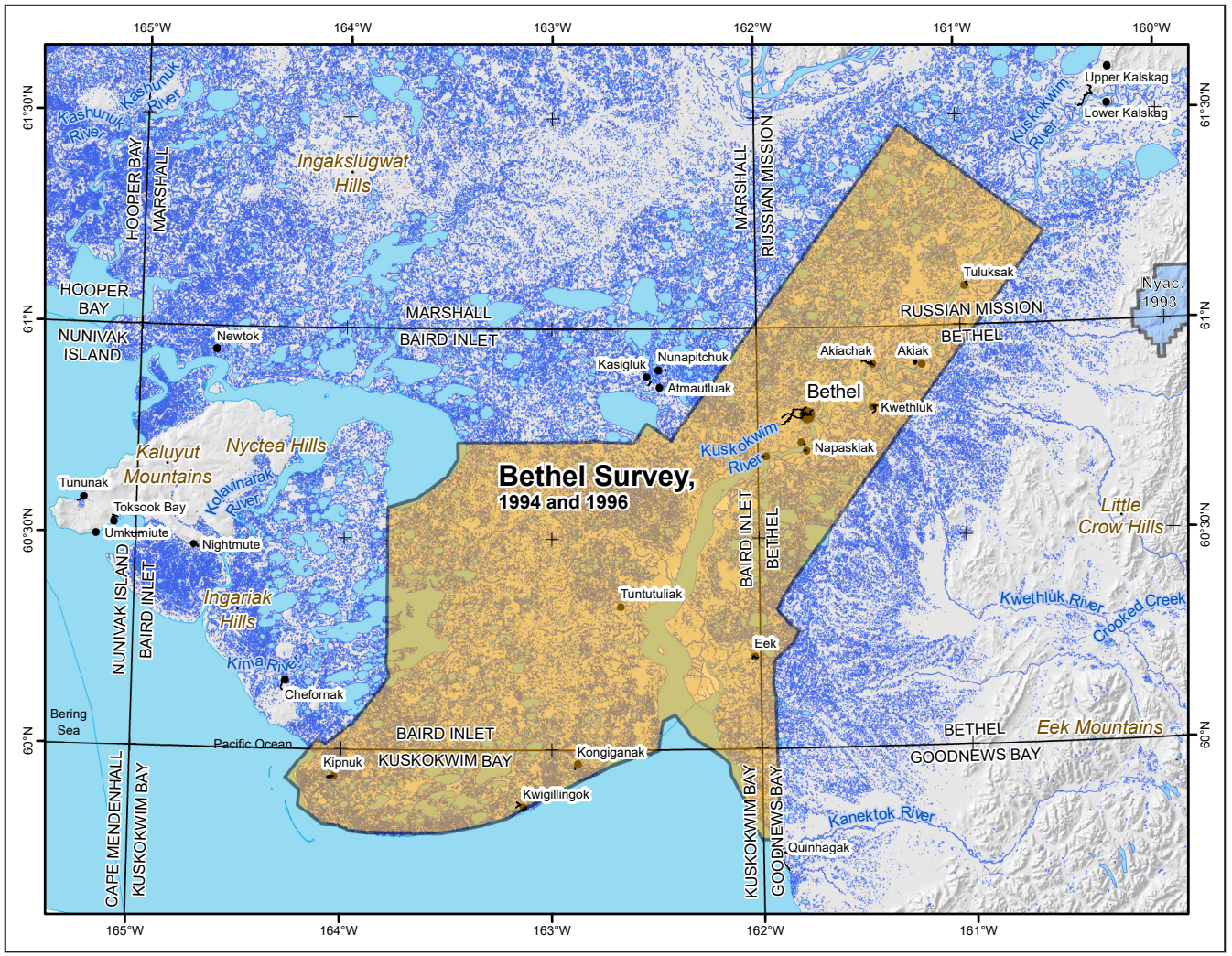
AVAILABLE DATA

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 documentation
grids_ermapper	contractor	Geographically registered gridded data, ER Mapper ERS format
grids_geosoft	DGGS	Geosoft-format grids, these grids can be viewed in ESRI ArcMap using a free plugin from Geosoft or the free viewer available from Geosoft
images_registered	DGGS	GeoTiff format images of all gridded data
kmz	DGGS	keyhole markup language (kml) kmz archive files of project data. Viewable in Google Earth and other compatible programs
maps_pdf_format	contractor and DGGS	Printable maps in pdf format. Includes a geographically registered pdf (GeoPDF) for use with mobile devices such as GPS enabled smartphones and tablets, other devices, and programs
vector_data	DGGS	Line path, data contours, and survey boundary in ESRI shapefile (SHP) format
video_flightpath	contractor	Survey flight path downward facing video

REFERENCES

DGGS Staff, and Sanders Geophysics Ltd., 1997, Total field magnetics of the southeastern Bethel basin, Alaska: Alaska Division of Geological & Geophysical Surveys Public Data File 97-27, 6 sheets, scale 1:125,000. http://doi.org/10.14509/1776

Sander, S.D., 1997, Aeromagnetic survey, southwestern Bethel basin, Bethel, Alaska: Alaska Division of Geological & Geophysical Surveys Public Data File 97-28, 32 p., 6 sheets, scale 1:125,000. http://doi.org/10.14509/1777



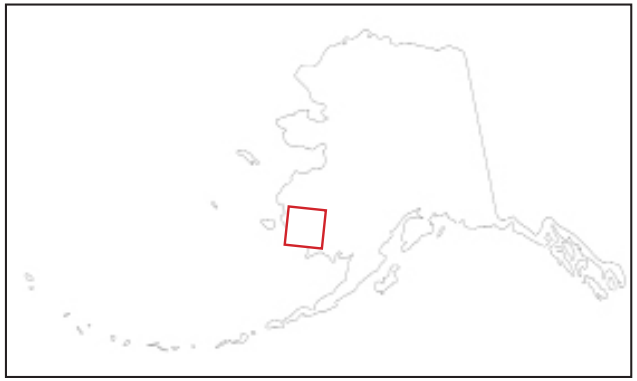


Figure 1. Bethel electromagnetic and magnetic airborne geophysical survey location shown in interior Alaska (inset). Bethel survey area shown with adjacent DGGS geophysical surveys, landmarks, relevant 1:250,000-scale quadrangle boundaries, mountain ranges, rivers, glaciers, and elevation hillshade.

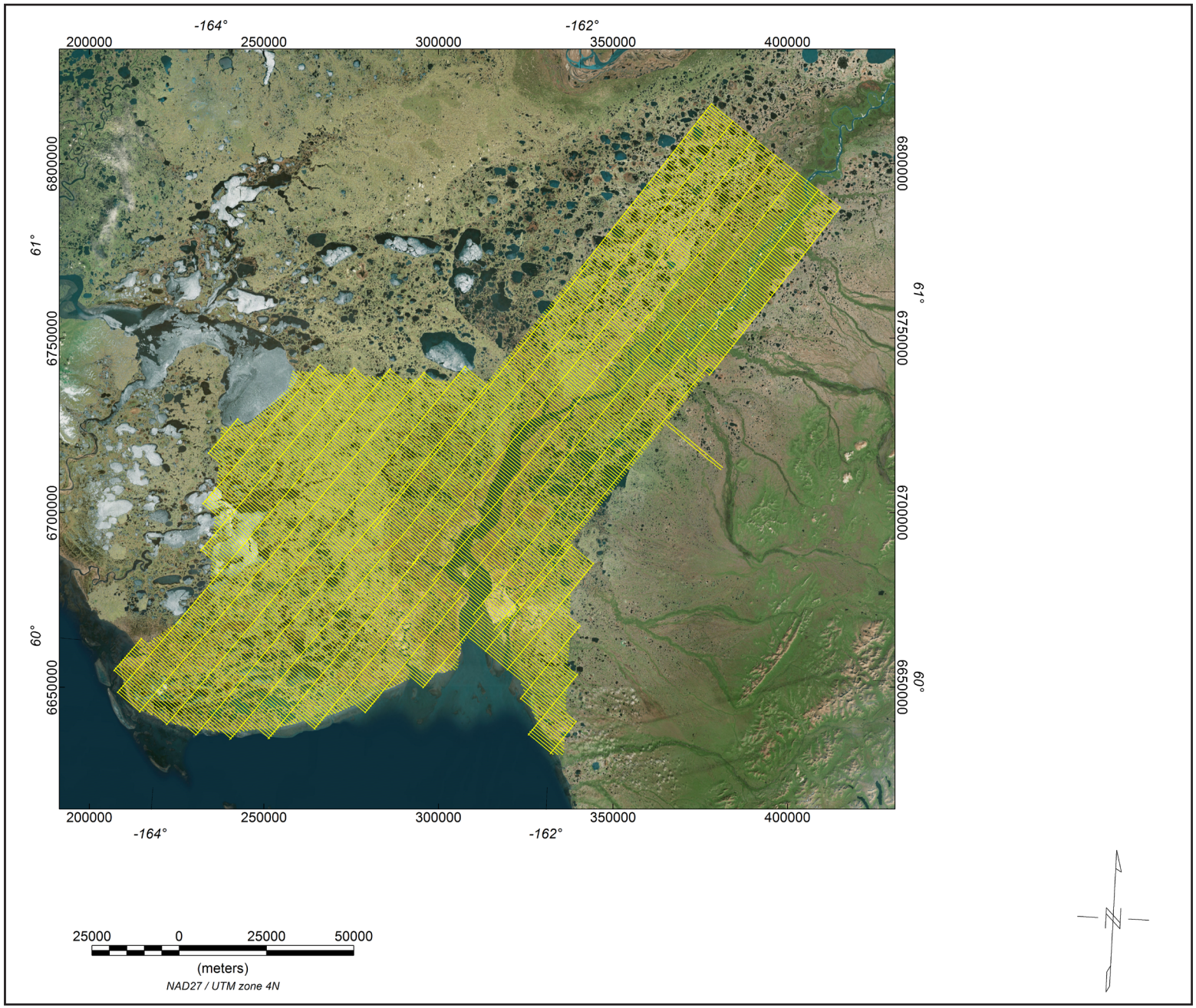


Figure 2. Flight path with orthometric image.

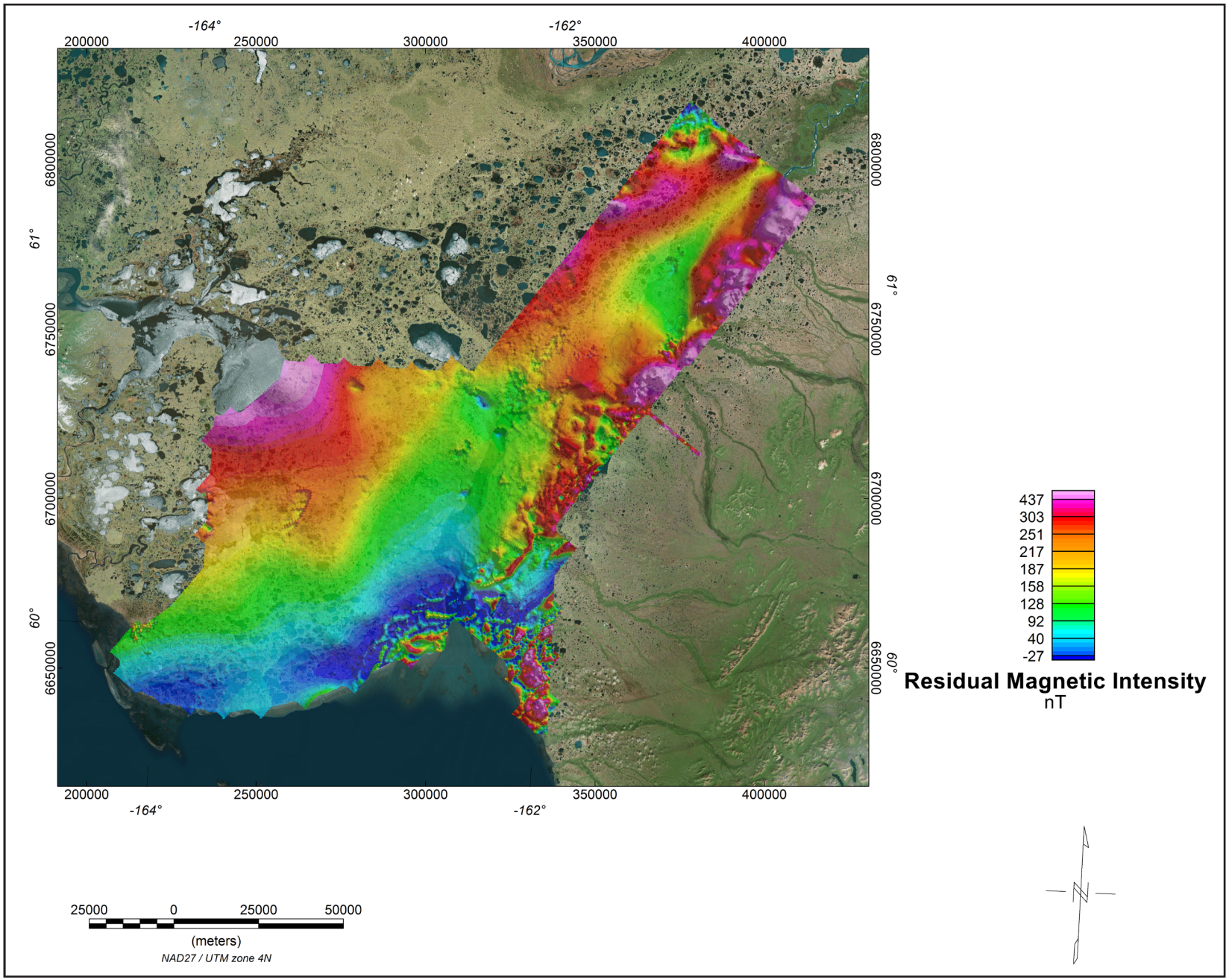


Figure 3. Residual magnetic intensity grid with orthometric image. The residual magnetic intensity data were produced using digitally recorded data from a Scintrex CS-2 cesium vapor magnetometer with a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) corrected for regional variation by subtracting the IGRF 1990 updated to October 1996 and August 1994.

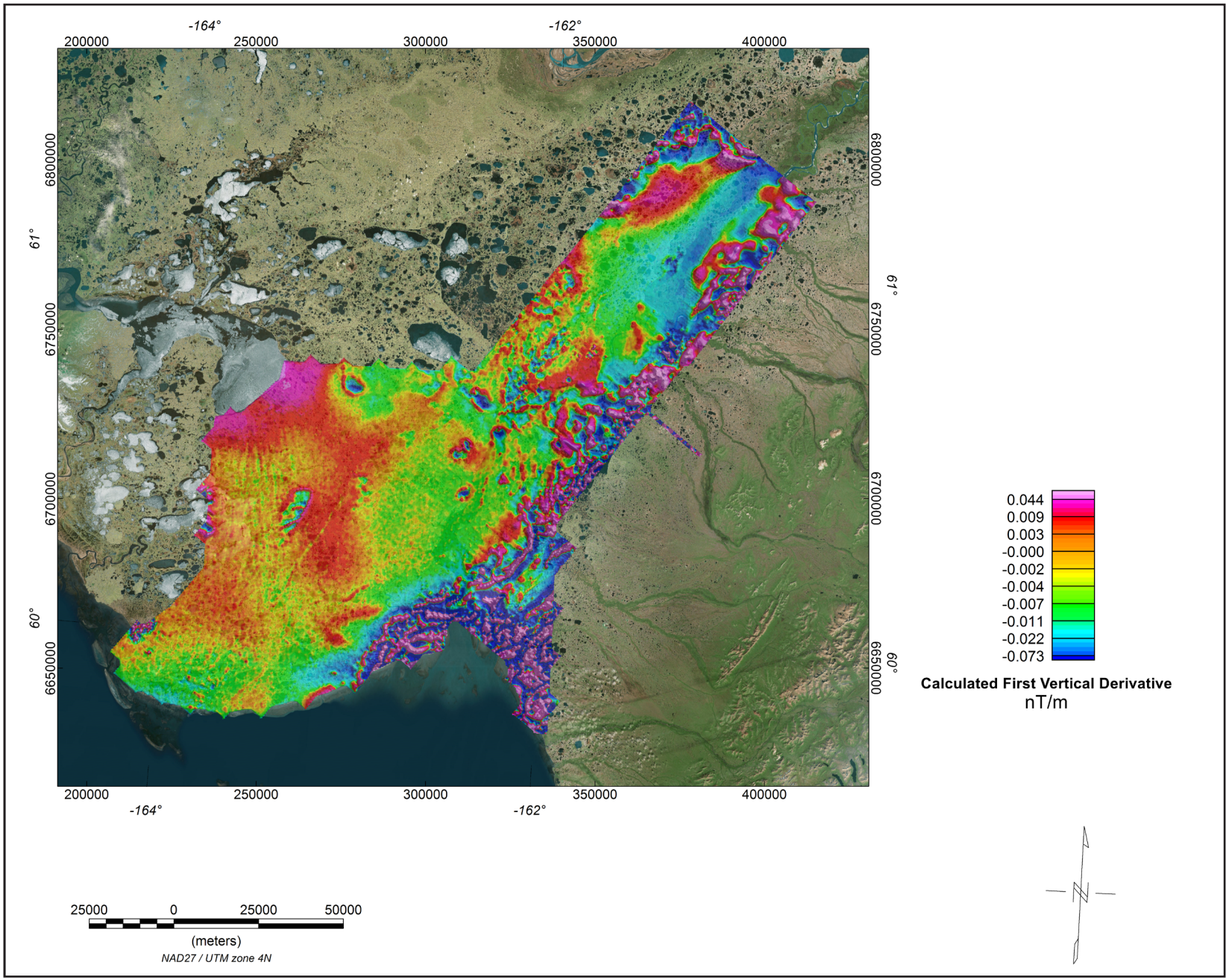


Figure 4. Calculated first vertical derivative grid with orthometric image. The first vertical derivative grid was calculated from the diurnally-corrected, IGRF-corrected total magnetic field grid using a FFT base frequency domain filtering algorithm. The resulting first vertical derivative grid provides 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.

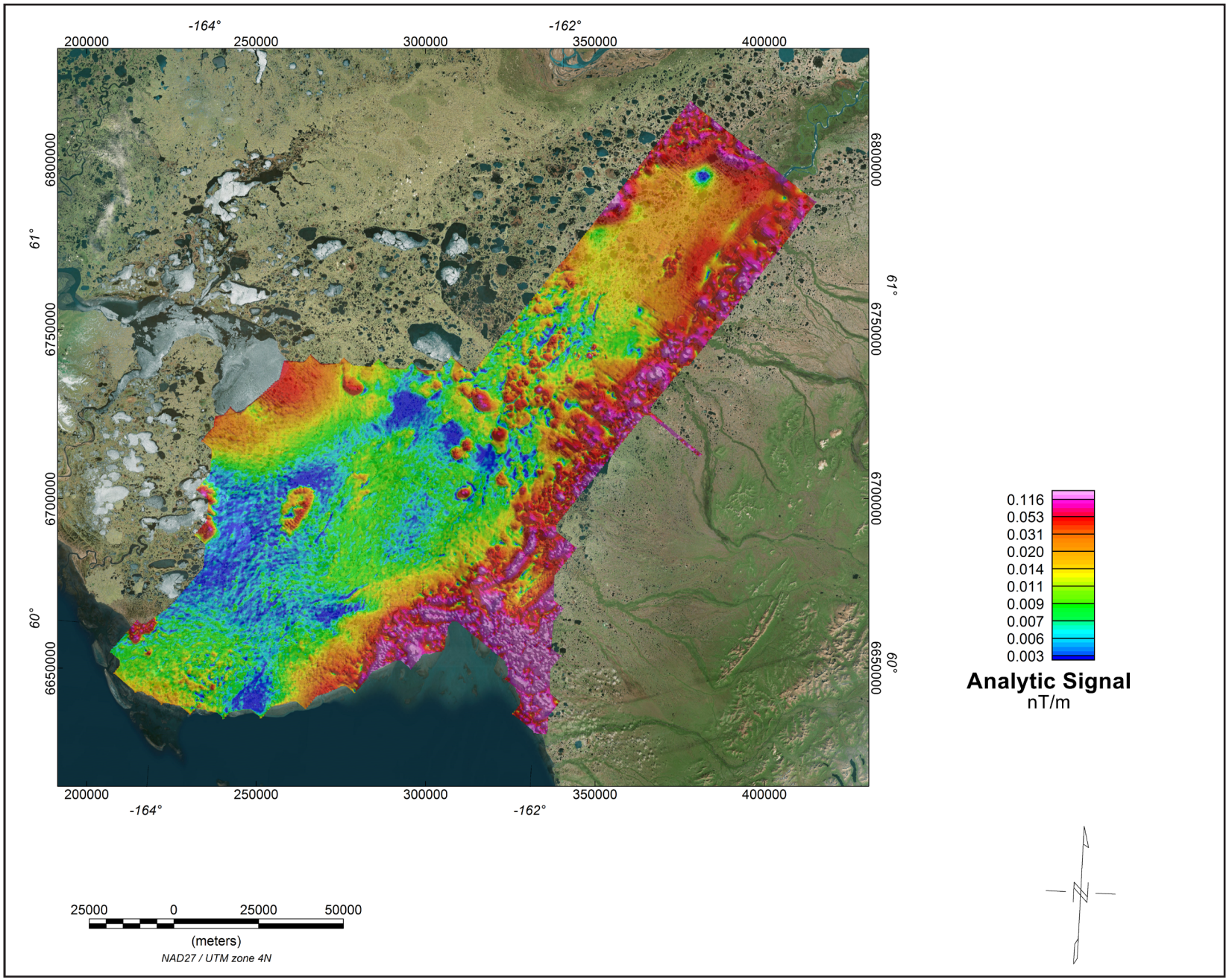
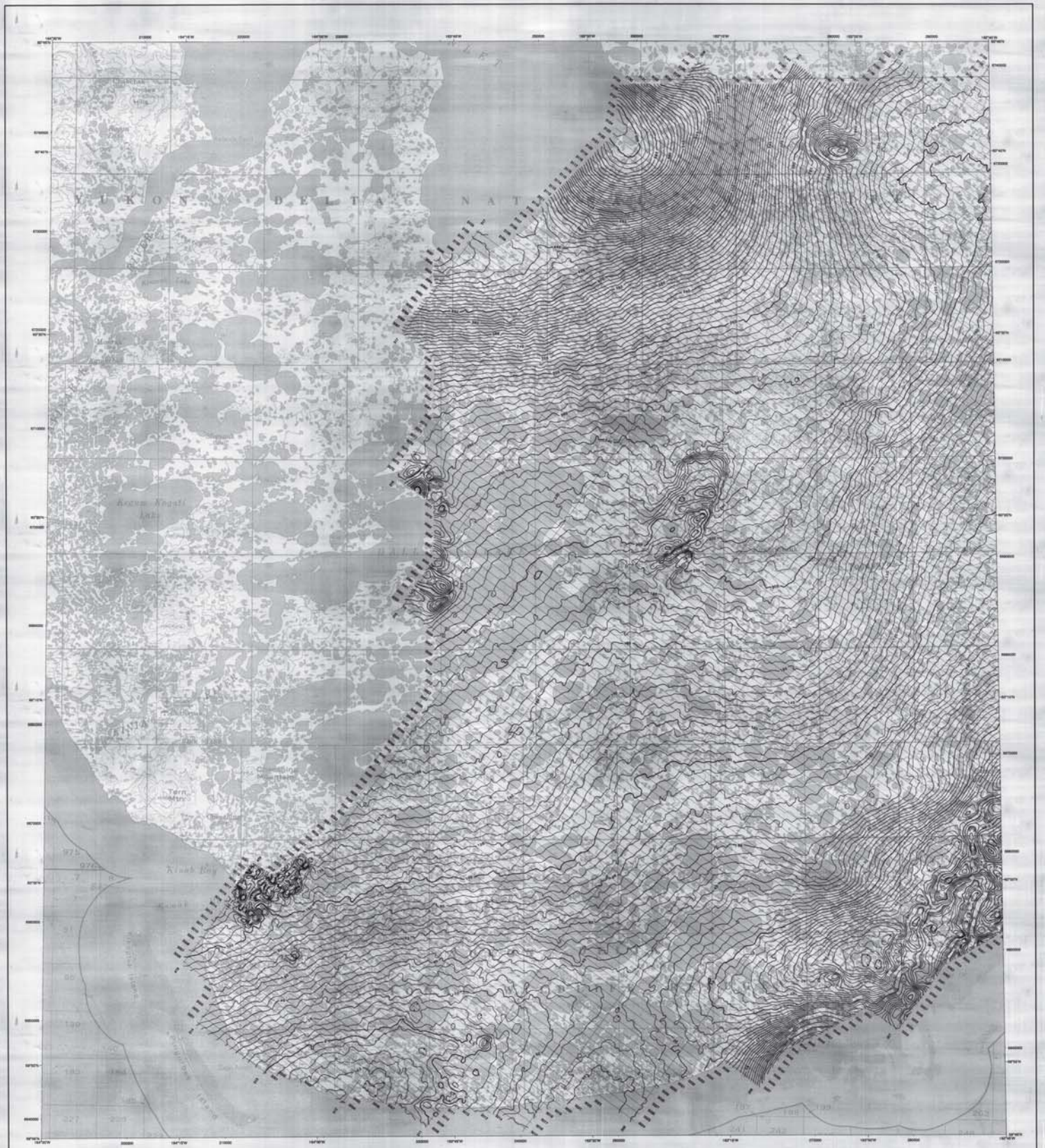


Figure 5. Analytic signal grid with orthometric image. Analytic signal is the total amplitude of all directions of magnetic gradient calculated from the sum of the squares of the three orthogonal gradients. Mapped highs in the calculated analytic signal of magnetic parameter locate the anomalous source 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.

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/10.14509/30458

Map Title	Description
bethel_residualmag_topo_map_1of3.pdf	residual magnetic intensity contours with topographic base map
bethel_residualmag_topo_map_2of3.pdf	residual magnetic intensity contours with topographic base map
bethel_residualmag_topo_map_3of3.pdf	residual magnetic intensity contours with topographic base map
bethel_flightpath_topo_map_1of3.pdf	flightlines with topographic base map
bethel_flightpath_topo_map_2of3.pdf	flightlines with topographic base map
bethel_flightpath_topo_map_3of3.pdf	flightlines with topographic base map
bethel_geological_interpretation_map_1of3.pdf	geologic interpretation from magnetic data
bethel_geological_interpretation_map_2of3.pdf	geologic interpretation from magnetic data
bethel_geological_interpretation_map_3of3.pdf	geologic interpretation from magnetic data
bethel_regional_interpretation_map_1of3.pdf	regional interpretation
bethel_regional_interpretation_map_2of3.pdf	regional interpretation
bethel_regional_interpretation_map_3of3.pdf	regional interpretation
bethel_interpretation_pdf_95_2_map.pdf	geologic interpretation from 1994 magnetic data



Base modified from U.S. Geological Survey 1:250,000 Series
Baird Inlet (1980) and Kuskokwim Bay (1980).

Scale 1 : 125 000



MAP A

TOTAL FIELD MAGNETICS OF THE SOUTHEASTERN BETHEL BASIN, ALASKA

DESCRIPTIVE NOTES

The aeromagnetic data were acquired using a Scintrex CS-2 cesium vapor magnetometer and an RMS AADC-4 Mk II automatic compensator installed in a Beechcraft Queenair fixed wing aircraft. In addition, the Sander ASAT digital acquisition system recorded data from both radar and barometric altimeters, from the GPS navigation/positioning system and a video camera. Differential post-processing of the GPS data resulted in a relative positional accuracy of 10 meters or better.

Surveyed	October 1996
Average Sensor Elevation	328 feet above terrain
Clarke 1866 Spheroid	UTM Projection Zone 4
Datum	NAD27
Inclination at 60°30'N, 164°00'W	71.6° North
Declination at 60°30W, 164°00'W	16.1° East
Inclination at 60°30'N, 161°00'W	72.0° North
Declination at 60°30'N, 161°00'W	17.5° East
Intensity	54230 nT
Contour Interval	5, 20, 100 nT
Traverse Interval	0.5 mile
Tie Line Interval	8.0 miles

TOTAL FIELD MAGNETICS

The total field magnetic contours were produced using digitally recorded data from a Scintrex CS-2 cesium vapor 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) corrected for regional variation by subtracting the IGRF 1990 updated to October 1996 and adding a bias of 54230 nT, (3) leveled to the tie line data, and (4) interpolated onto a regular 100 m grid.

MAGNETIC CONTOUR INTERVAL (nT)

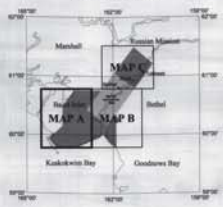
5 .....

20 .....

100 .....

Depression .....

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, and Sander Geophysics Limited. The airborne magnetic data were acquired by Sander Geophysics Limited in October, 1996 and merged with data acquired by Geonex Aeroservice in August, 1994. This and other products from this survey are available from the Alaska Division of Geological & Geophysical Surveys, 794 University Ave., Suite 200, Fairbanks, Alaska, 99709.



Base modified from U.S. Geological Survey 1:250,000 Series Saint Inlet (1980), Goodnews Bay (1979), Bethel (1960) and Kuskokwim Bay (1980).

DESCRIPTIVE NOTES

The aeromagnetic data were acquired using a Scintrex CS-2 cesium vapor magnetometer and an RMS AADC-4 Mk II automatic compensator installed in a Beechcraft Queenair fixed wing aircraft. In addition, the Sander ASAT digital acquisition system recorded data from both radar and barometric altimeters, from the GPS navigation/positioning system and a video camera. Differential post-processing of the GPS data resulted in a relative positional accuracy of 10 meters or better.

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Inclination at 60°30'N, 161°00'W	72.0° North
Declination at 60°30'N, 161°00'W	17.3° East
Intensity	54230 nT
Contour Interval	5, 20, 100 nT
Traverse Interval	0.5 mile
Tie Line Interval	5.0 miles

TOTAL FIELD MAGNETICS

The total field magnetic contours were produced using digitally recorded data from a Scintrex CS-2 cesium vapor 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) corrected for regional variation by subtracting the IGRF 1990 updated to October 1996 and adding a bias of 54230 nT, (3) leveled to the tie line data, and (4) interpolated onto a regular 100 m grid.



Scale 1 : 125 000

MAP B

TOTAL FIELD MAGNETICS OF THE SOUTHEASTERN BETHEL BASIN, ALASKA

MAGNETIC CONTOUR INTERVAL (nT)

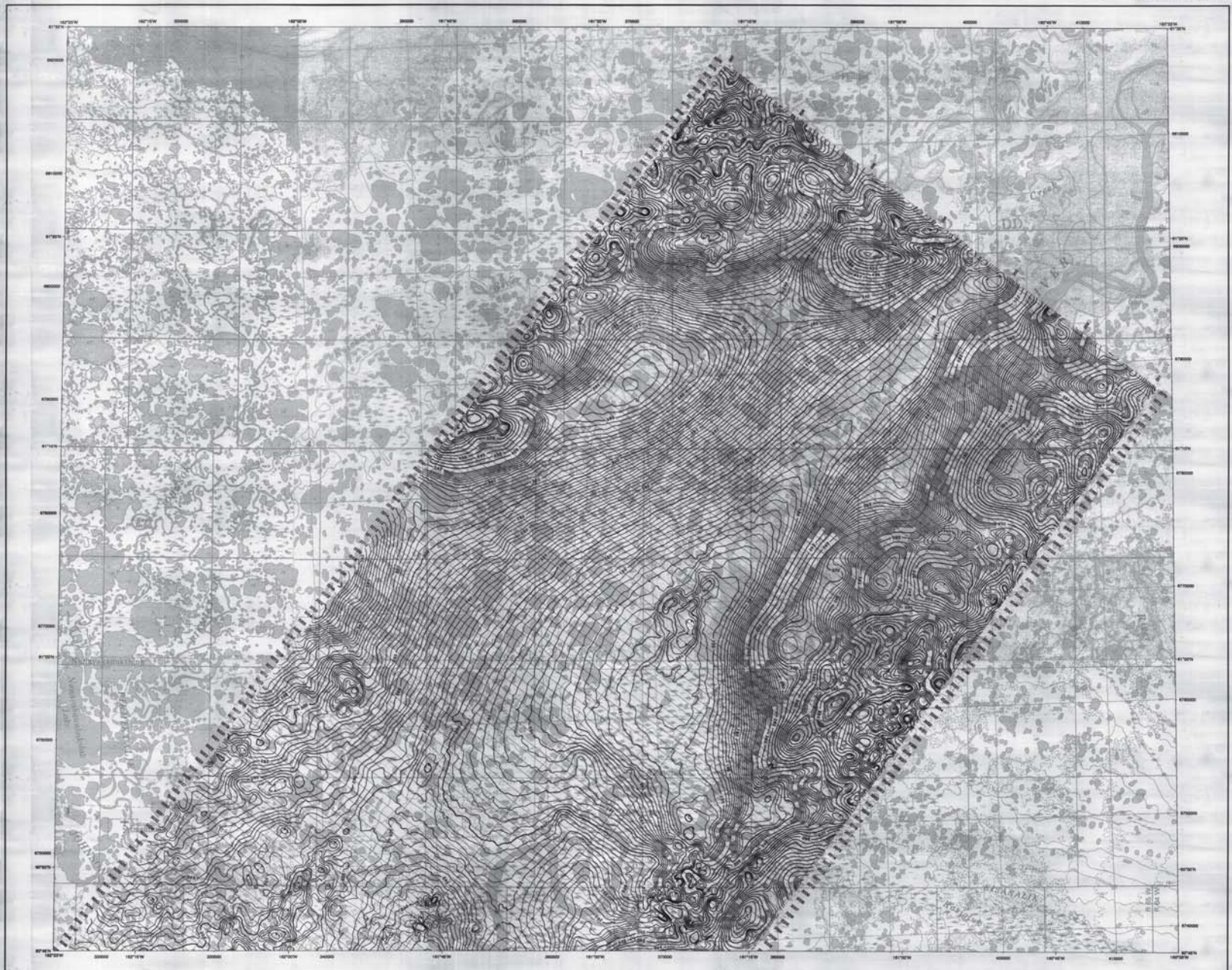
5 .....
20 .....
100 .....
Depression .....

LOCATION INDEX



SURVEY HISTORY

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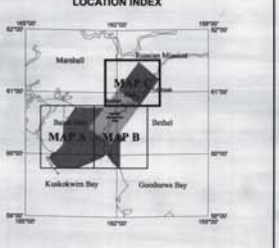


Base modified from U.S. Geological Survey 1:250,000 Series Marshall (1964), Russian Mission (1980), Baird Inlet (1980) and Bethel (1980).

Scale 1 : 125 000







LOCATION INDEX

MAP C

TOTAL FIELD MAGNETICS OF THE SOUTHEASTERN BETHEL BASIN, ALASKA

DESCRIPTIVE NOTES

The aeromagnetic data were acquired using a Scintrex CS-2 cesium vapor magnetometer and an RMS AADC-4 Mk II automatic compensator installed in a Beechcraft Queenair fixed wing aircraft. In addition, the Sander ASAT digital acquisition system recorded data from both radar and barometric altimeters, from the GPS navigation/positioning system and a video camera. Differential post-processing of the GPS data resulted in a relative positional accuracy of 10 meters or better.

Surveyed	October 1996
Average Sensor Elevation	328 feet above terrain
Clarke 1866 Spheroid	UTM Projection Zone 4
Datum	NAD27
Inclination at 60°30'N, 164°00'W	71.6° North
Declination at 60°30'N, 164°00'W	18.1° East
Inclination at 60°30'N, 161°00'W	72.0° North
Declination at 60°30'N, 161°00'W	17.8° East
Intensity	54230 nT
Contour Interval	5, 20, 100 nT
Traverse Interval	0.5 mile
Tie Line Interval	5.0 miles

TOTAL FIELD MAGNETICS

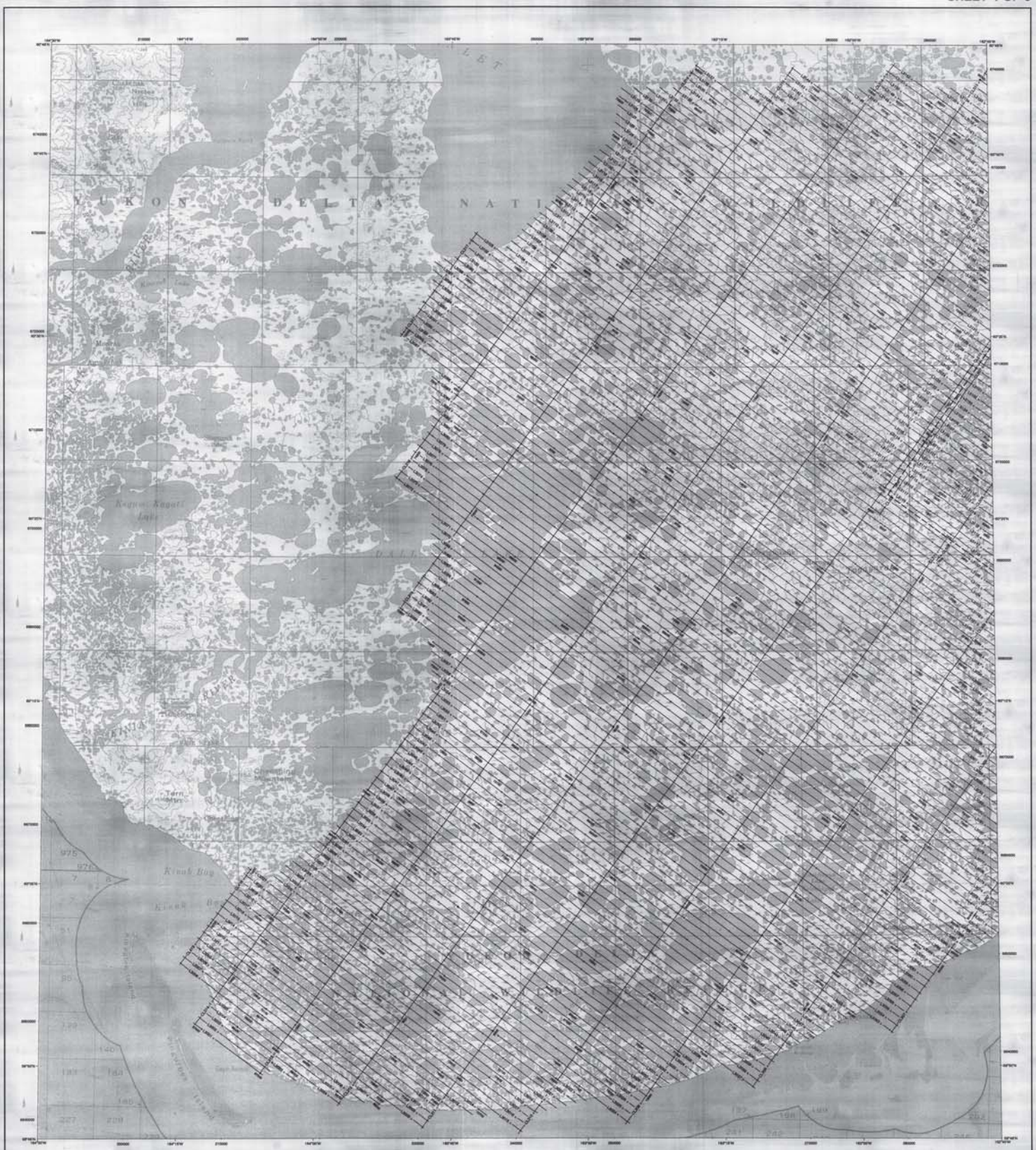
The total field magnetic contours were produced using digitally recorded data from a Scintrex CS-2 cesium vapor magnetometer with a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) corrected for regional variation by subtracting the IGRF 1990 updated to October 1996 and adding a bias of 54230 nT, (3) leveled to the tie line data, and (4) interpolated onto a regular 100 m grid.

MAGNETIC CONTOUR INTERVAL (nT)

5 .....
20 .....
100 .....
Depression .....

SURVEY HISTORY

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MAP A

TOTAL FIELD MAGNETICS OF THE SOUTHEASTERN BETHEL BASIN, ALASKA

FLIGHT LINES

DESCRIPTIVE NOTES

The aeromagnetic data were acquired using a Scintrex CS-2 cesium vapor magnetometer and an RMS AADC-4 Mk II automatic compensator installed in a Beechcraft Queenair fixed wing aircraft. In addition, the Sander A9AT digital acquisition system recorded data from both radar and barometric altimeters, from the GPS navigation/positioning system and a video camera. Differential post-processing of the GPS data resulted in a relative positional accuracy of 10 meters or better.

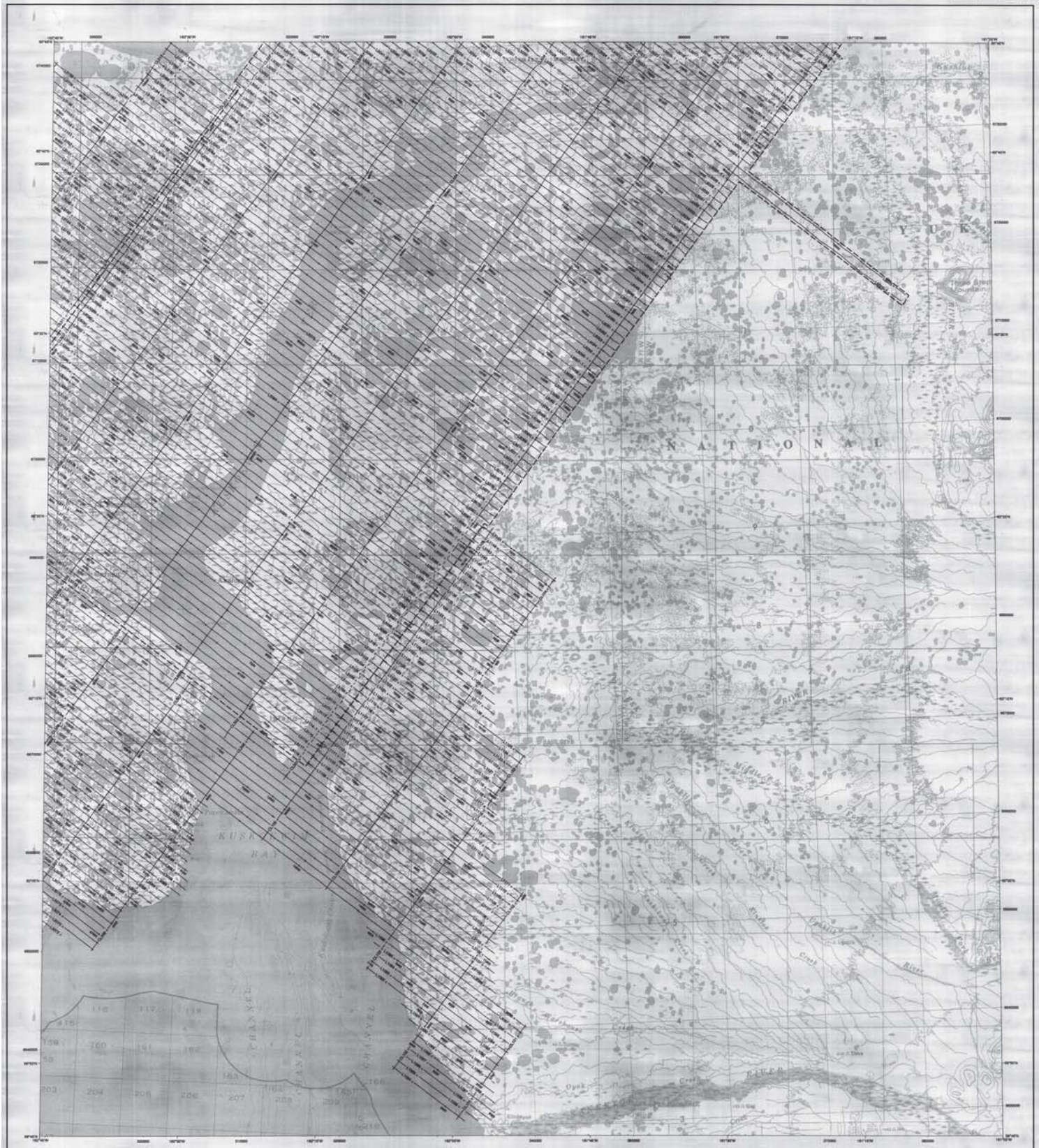
Surveyed	October 1996
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Datum	NAD27
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Inclination at 60°30'N, 161°00'W	72.0° North
Declination at 60°30'N, 161°00'W	17.8° East
Intensity	54230 nT
Contour Interval	5, 25, 100 nT
Traverse Interval	0.5 mile
Tie Line Interval	5.0 miles

TOTAL FIELD MAGNETICS

The total field magnetic contours were produced using digitally recorded data from a Scintrex CS-2 cesium vapor 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) corrected for regional variation by subtracting the IGRF 1990 updated to October 1996 and adding a bias of 54230 nT, (3) leveled to the tie line data, and (4) interpolated onto a regular 100 m grid.

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Base modified from U.S. Geological Survey 1:250,000 Series Baird Inlet (1980), Goodnews Bay (1979), Bethel (1980) and Kuskokwim Bay (1980).

DESCRIPTIVE NOTES

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Declination at 60°30'N, 161°00'W	17.8° East
Intensity	54230 nT
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Traverse Interval	0.5 mile
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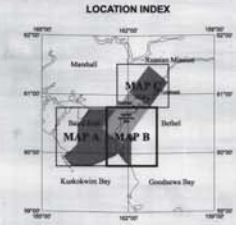


MAP B

TOTAL FIELD MAGNETICS OF THE SOUTHEASTERN BETHEL BASIN, ALASKA

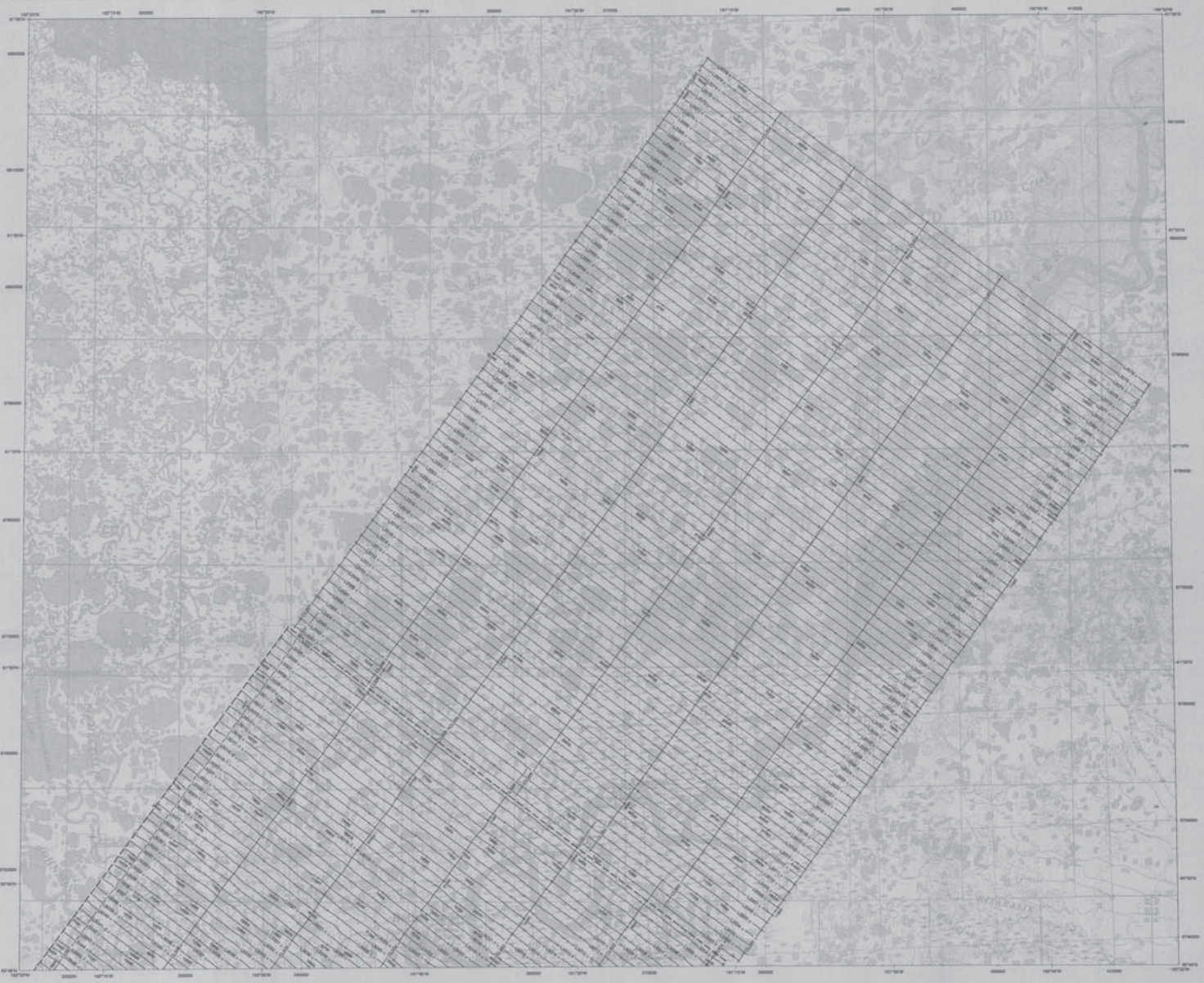
FLIGHT LINES

LOCATION INDEX



SURVEY HISTORY

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Base modified from U.S. Geological Survey 1:250,000 Series Marshall (1964), Russian Mission (1960), Baird Inlet (1960) and Bethel (1960).

Scale 1 : 125 000





MAP C

TOTAL FIELD MAGNETICS OF THE SOUTHEASTERN BETHEL BASIN, ALASKA

FLIGHT LINES

DESCRIPTIVE NOTES

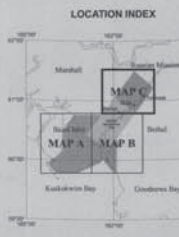
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Inclination at 60°30'N, 161°00'W	72.0° North
Declination at 60°30'N, 161°00'W	17.9° East
Intensity	54230 nT
Contour Interval	5, 20, 100 nT
Traverse Interval	0.5 mile
Tie Line Interval	5.0 miles

TOTAL FIELD MAGNETICS

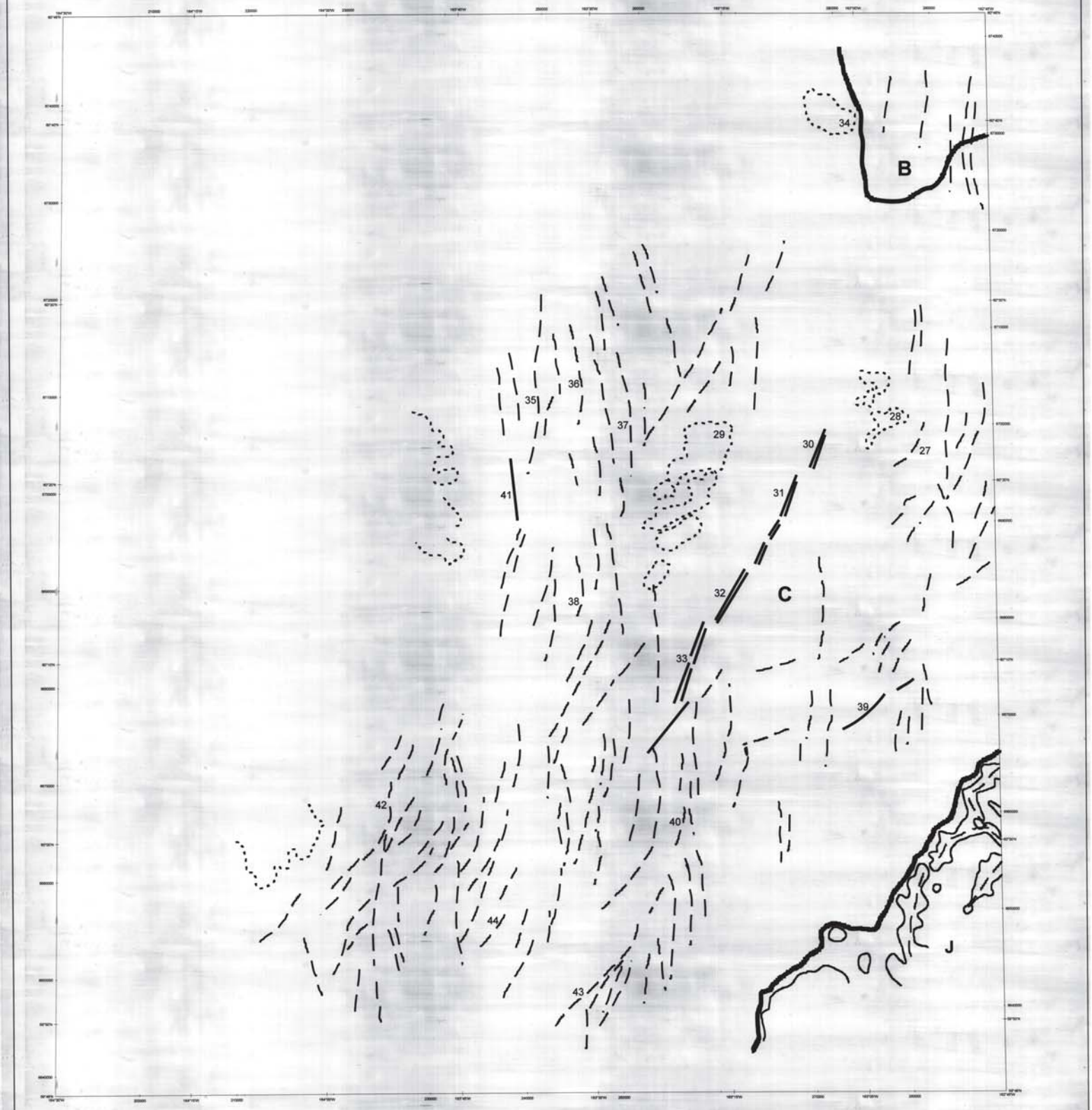
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LOCATION INDEX



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Scale 1 : 125 000



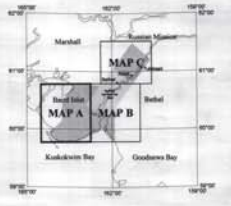
LEGEND

- INTRUSION
- ZONE BOUNDARY
- HIGH AMPLITUDE MAGNETIC ANOMALY
- LOW AMPLITUDE MAGNETIC ANOMALY
- INFERRED FAULT
- FAULT
- CULTURAL FEATURE — Culture
- ZONE DESIGNATION — A
- AEROMAGNETIC FEATURE NUMBER — 24

MAP A

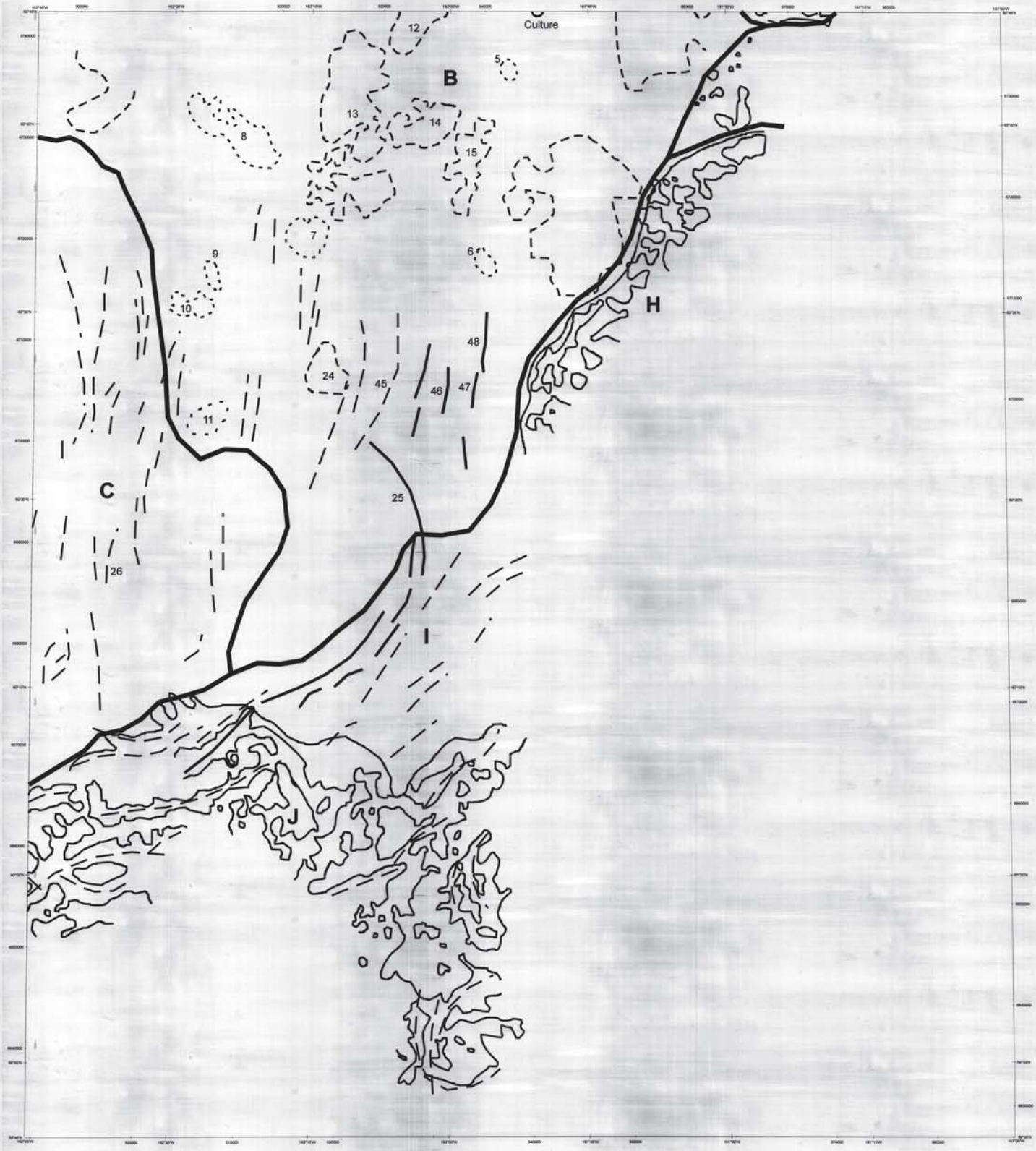
GEOLOGICAL INTERPRETATION OF THE SOUTHEASTERN BETHEL BASIN, ALASKA

LOCATION INDEX



SURVEY HISTORY

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Scale 1 : 125 000



LEGEND

INTRUSION .....

ZONE BOUNDARY .....

HIGH AMPLITUDE MAGNETIC ANOMALY .....

LOW AMPLITUDE MAGNETIC ANOMALY .....

INFERRED FAULT .....

FAULT .....

CULTURAL FEATURE ..... Culture

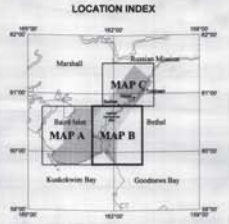
ZONE DESIGNATION ..... A

AEROMAGNETIC FEATURE NUMBER 24

MAP B

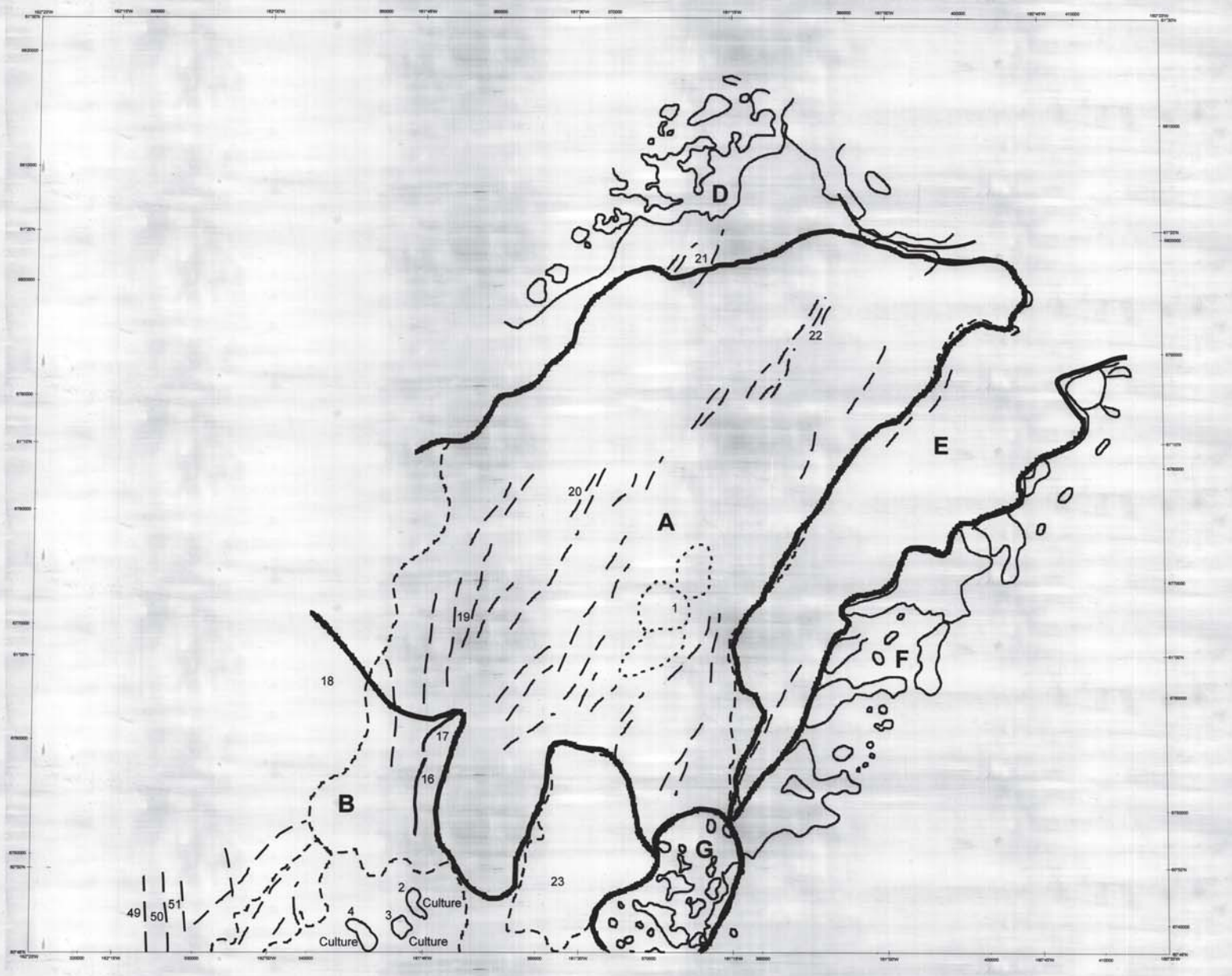
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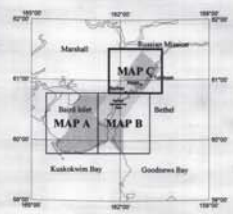
LEGEND

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- LOW AMPLITUDE MAGNETIC ANOMALY
- INFERRED FAULT
- FAULT
- CULTURAL FEATURE — Culture
- ZONE DESIGNATION — A
- AEROMAGNETIC FEATURE NUMBER — 24

MAP C

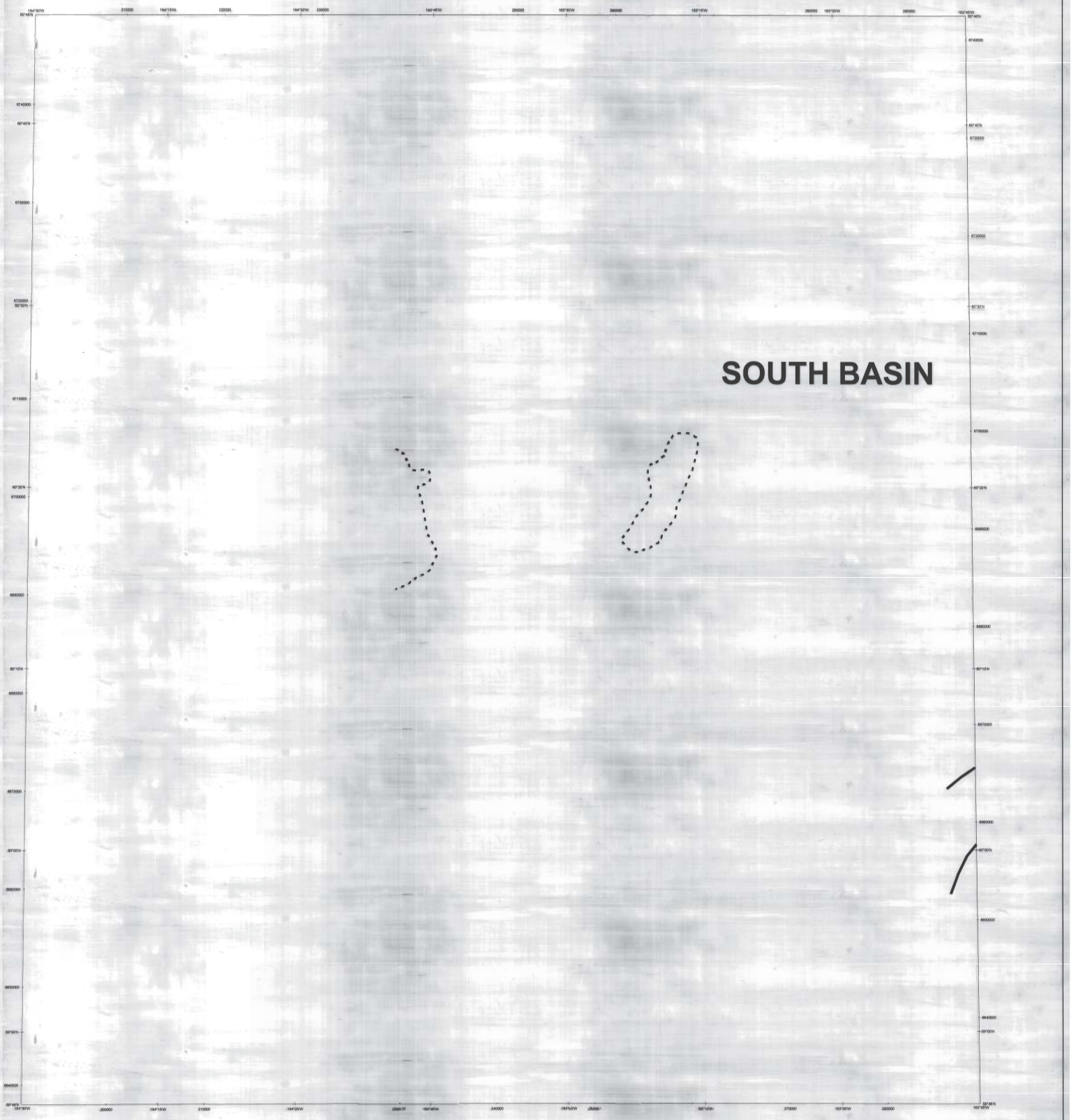
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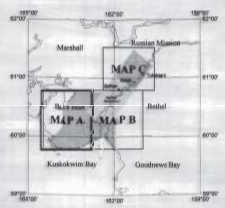
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MAP A

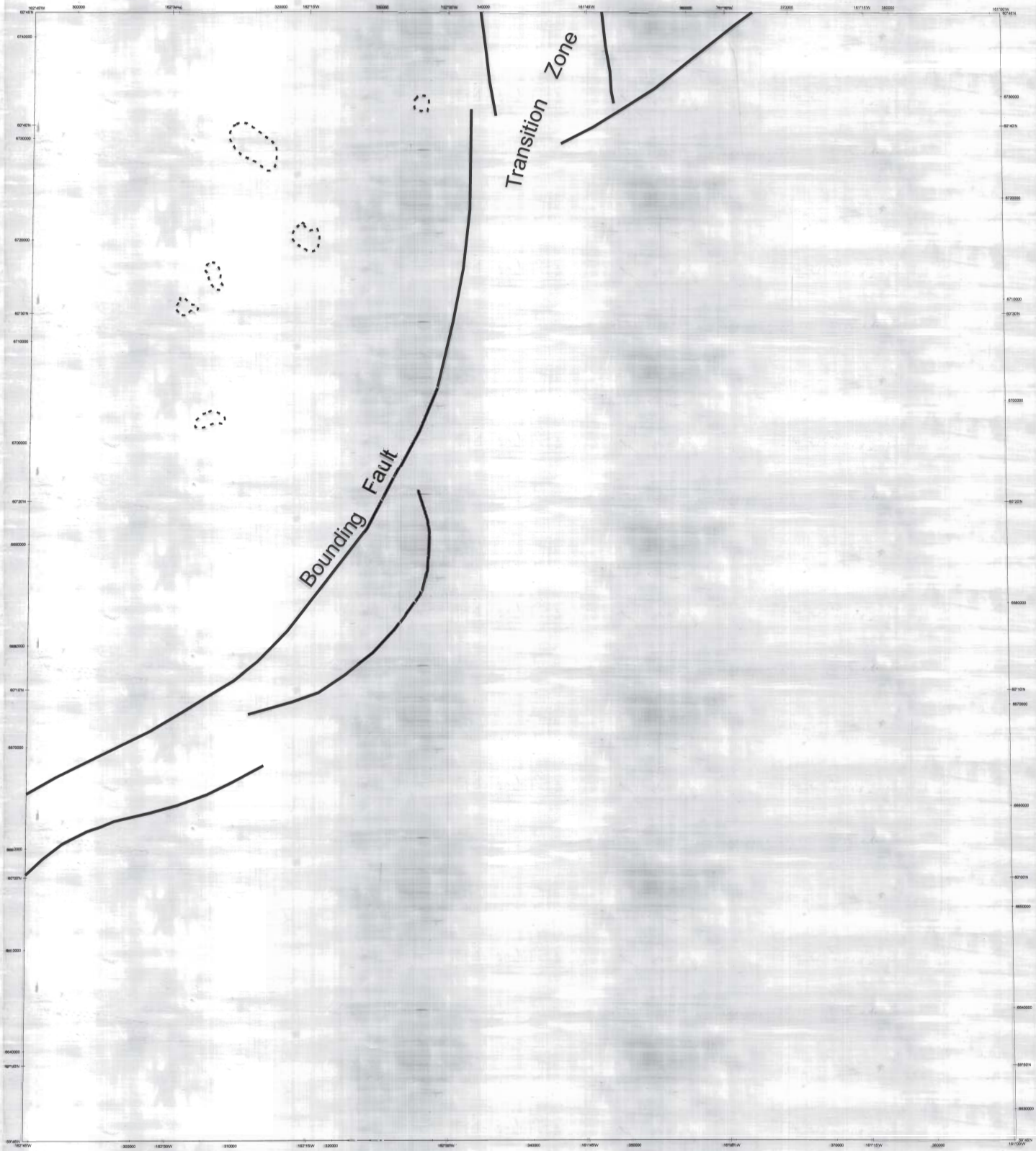
REGIONAL SCALE FEATURES OF THE SOUTHEASTERN BETHEL BASIN, ALASKA

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Scale 1 : 125 000



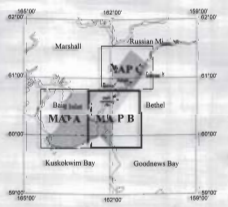
LEGEND

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MAP B

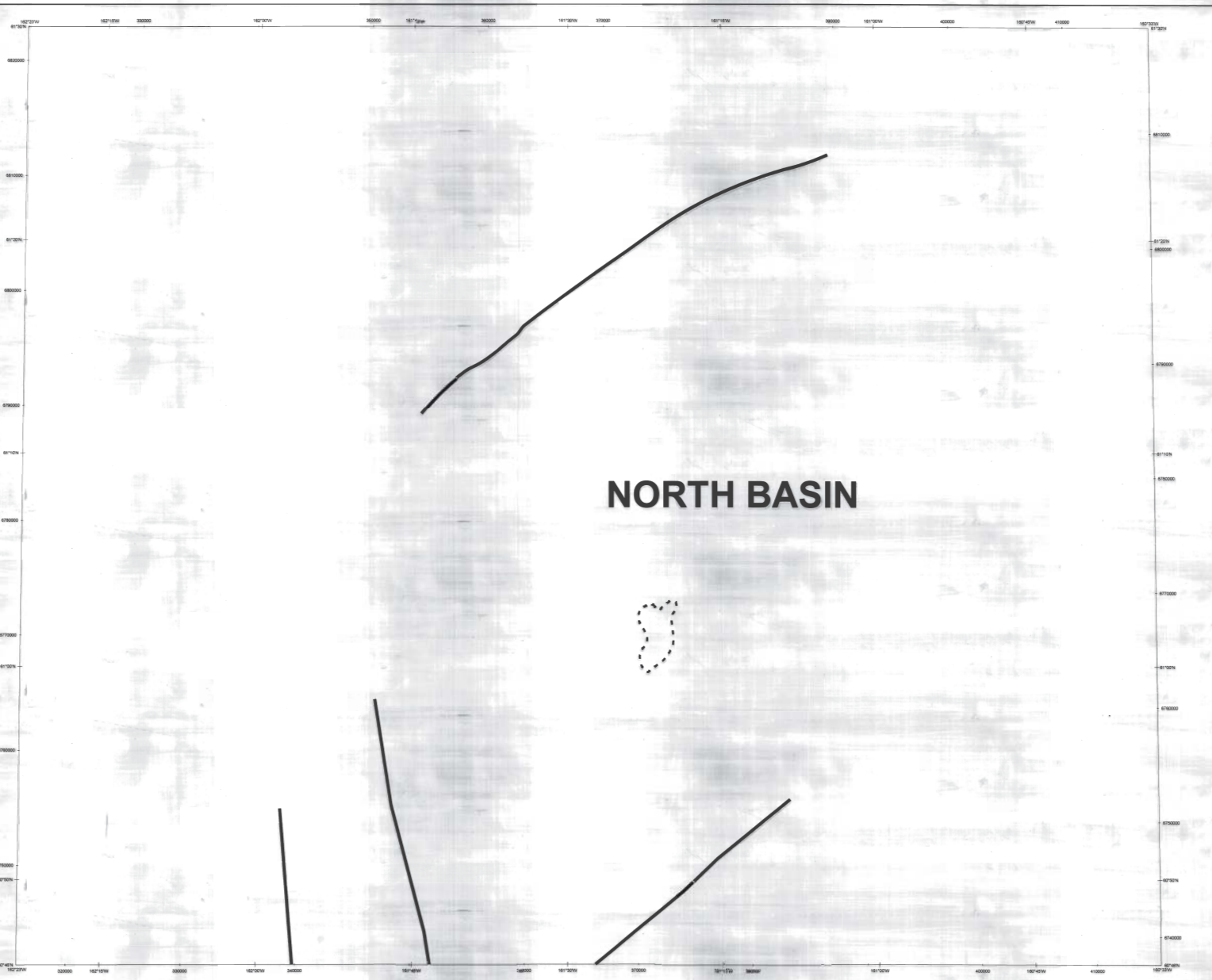
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Scale 1 : 125 000

km 2.5 0 5 10 km

mi 2.5 0 5 10 mi



LEGEND

INTRUSION

ZONE BOUNDARY

HIGH AMPLITUDE MAGNETIC ANOMALY

LOW AMPLITUDE MAGNETIC ANOMALY

INFERRED FAULT

FAULT

CULTURAL FEATURE — Culture

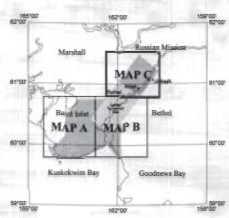
ZONE DESIGNATION — A

AEROMAGNETIC FEATURE NUMBER — 24

MAP C

REGIONAL SCALE FEATURES OF THE SOUTHEASTERN BETHEL BASIN, ALASKA

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Section outlines from U.S. Geological Survey topographic bmaps: Baird Inlet (1954); Bethel (1954); Marshall (1954); Russian Mission (1954); Goodnewsbay, Alaska

DESCRIPTIVE NOTES

The aeromagnetic data were acquired using a Scintrex H8 cesium vapor magnetometer and an EMS AADC-II automatic compensator mounted in the tail of a Cessna 404 twin-engined wing aircraft. In addition, the RMS DAS-9 digital acquisition system recorded data from both radar and barometric altimeters, from the GPS navigation/positioning system, the 60 Hz monitor and a video camera. Differential post-processing of the GPS data resulted in a relative positional accuracy of 10 meters or better.

LOCATION OF SURVEY AREA

SURVEYED	AUGUST 1994
AVERAGE SENSOR ELEVATION	300 FEET ABOVE TERRAIN
CLARKE 1866 SPHEROID	UTM PROJECTION ZONE 4
INCLINATION	71.9 DEGREES NORTH
DECLINATION	17.3 DEGREES EAST
INTENSITY	53875 nT
TRAVERSE INTERVAL	0.5 MILE
TIE LINE INTERVAL	5.0 MILES

SCALE 1:125000

SCALE 1:125000

EXPLANATION

20, 20, 207 — GRIDED DEPTH CALCULATIONS TO INTERPRETED MAGNETIC BASEMENT IN HUNDREDS OF FEET BELOW SEA LEVEL. UNDERLINED WHERE ESTIMATED, QUESTIONED WHERE UNCERTAIN. ONLY THESE DEPTHS ARE USED IN CONTOURING MAGNETIC BASEMENT SURFACE.

(2), (5), (57) — GRADED DEPTH CALCULATIONS TO MAGNETIC SOURCES IN HUNDREDS OF FEET BELOW SEA LEVEL SHALLOW THAN INTERPRETED BASEMENT SURFACE.

(10), (10), (10) — GRIDED DEPTH CALCULATIONS TO MAGNETIC SOURCES IN HUNDREDS OF FEET WHICH ARE BELIEVED TO ORIGINATE FROM VOLCANIC HORIZON.

A-1 — ANTICLINAL AXIS, DASHED WHERE INFERRED.

S-3 — SYNCLINAL AXIS, DASHED WHERE INFERRED.

F-2 U D — FAULT, SENSE OF DISPLACEMENT UNKNOWN, OR LITHOLOGIC CONTACT, DASHED WHERE INFERRED. DISPLACEMENTS WHERE SHOWN DO NOT NECESSARILY IMPLY NORMAL FAULTING.

1000 — CONTOURS ON MAGNETIC BASEMENT SURFACE IN FEET BELOW SEA LEVEL. DASHED WHERE INFERRED.

50 – 1 — STRUCTURAL DISTURBANCE.

S — MAGNETIC SOURCE AT OR NEAR SURFACE.

C — CULTURAL SOURCE.

I-5 — NORMALLY POLARIZED INTRUSIVE BODY.

I-6 — REVERSELY POLARIZED INTRUSIVE BODY.

D-2 — DIKE.

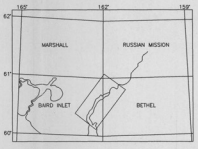
1860 — SUSCEPTIBILITY CONTRAST VALUES IN MICRO C.G.S. UNITS. ESTIMATED FROM AMP–2–M SOLUTIONS.

TD — TEST WELL TOTAL DEPTH: 14910' BELOW THE SURFACE.

BOUNDARY OF VOLCANICS/INTRUSIVES HORIZON (TOMAPOS SHADED SIDE).

FEATURES ARE NUMBERED FOR REFERENCE IN THE ACCOMPANYING PUBLIC–DATA FILE 95–2.

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