

KUSKOKWIM AIRBORNE ELECTROMAGNETIC AND MAGNETIC SURVEY, NORTHERN KUSKOKWIM MOUNTAINS

Emond, A.M., and MPX Geophysics LTD

Geophysical Report 2023-1

2023
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS



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KUSKOKWIM AIRBORNE ELECTROMAGNETIC AND MAGNETIC SURVEY, NORTHERN KUSKOKWIM MOUNTAINS

Emond, A.M.¹, and MPX Geophysics LTD

ABSTRACT

This publication covers parts of the Tanana, Norton Bay, Nulato, Ruby, Kantishna River, Medfra, and Mt. McKinley quadrangles west of Nenana, Alaska (fig. 1). Magnetic and radiometric data were collected with a fixed-wing aircraft from May 14 to August 31, 2023, by MPX Geophysics LTD. The survey contains a single block. A total of 86,712 line-kilometers were collected. The block covers 29,361 km². The magnetometer was mounted to a rear-facing fixed boom (“tail stinger”). The radiometric crystals were located in the cabin of the aircraft. The block was flown with a line spacing of 400 m. The mean ground clearance is 184 m.

PURPOSE

The data from the Kuskokwim airborne magnetic and radiometric survey, northern Kuskokwim Mountains geophysical survey will be used to improve the understanding of the area’s geology and mineral potential and promote resource exploration. This survey will also be a part of planned continuous regional magnetic data coverage of the greater Kuskokwim Mountains region.

SURVEY OVERVIEW DESCRIPTION

This publication 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 at <https://doi.org/10.14509/31087>.

ACKNOWLEDGMENTS

This work was primarily supported by the U.S. Geological Survey’s Earth MRI program grant G22AC00475 and secondary support was provided by State of Alaska Capital Funds. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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	Project report and other supporting files.
grids_geosoft	contractor	Oasis montaj Geosoft GRD format gridded data.
grids_tif	DGGS	Geographically registered data value rasters of gridded data, GeoTiff format.
kmz	contractor	Keyhole markup language (kml) kmz archive files of project data. Viewable in Google Earth and other compatible programs.
maps_pdf_format	contractor	Printable and geographically registered maps in pdf format. Compatible with mobile device navigation and desktop mapping applications.
maps_geosoft_format	contractor	Maps as Geosoft packed map files.
maps_jpg_format	contractor	Printable and geographically registered maps in jpg format.
vector_data	contractor	Line path and survey boundary in ESRI shapefile (SHP) format

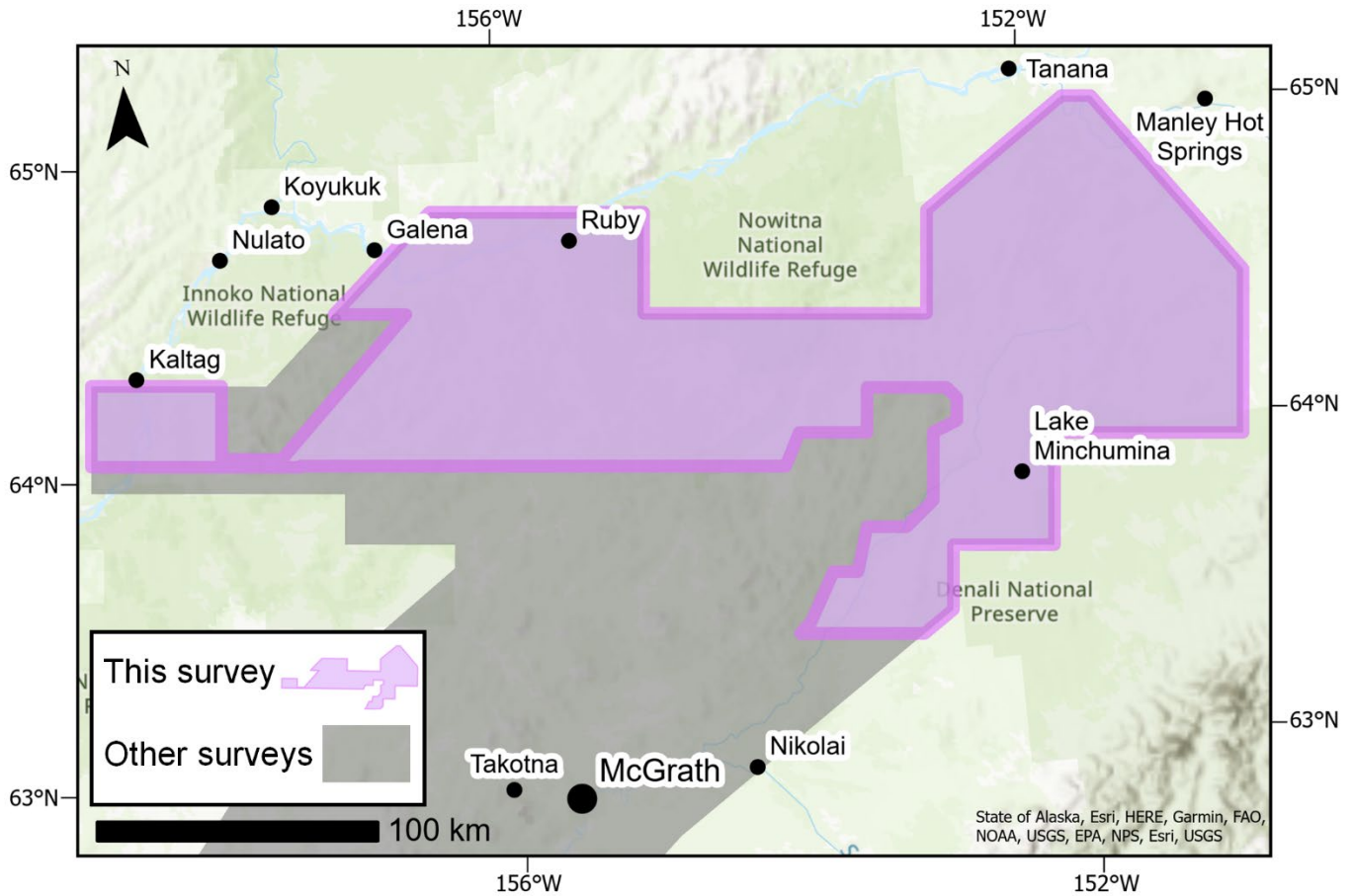


Figure 1. Top. The Kuskokwim airborne magnetic and radiometric survey, northern Kuskokwim Mountains geophysical survey location map with towns. Other existing in-progress and planned DGGs surveys shown in gray. **Right.** Survey location shown in Interior Alaska with relevant 1:250,000-scale quadrangles.

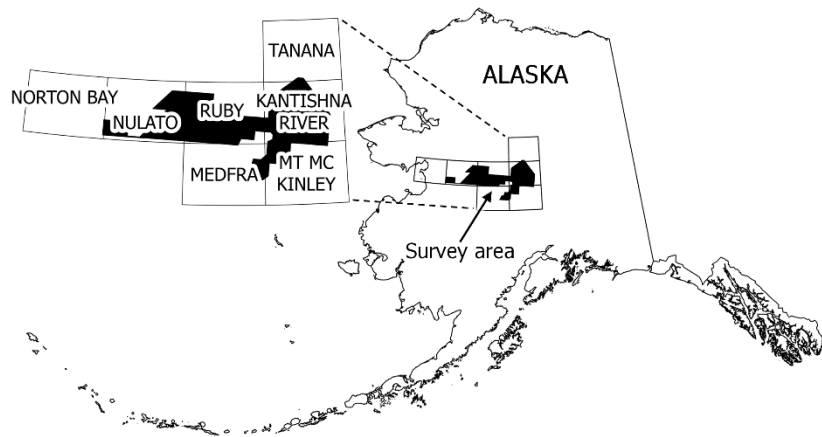


Table 1. The contractor-provided maps are made available as Geosoft Packed Map (*.map), Joint Photographic Experts Group (*.jpeg), and Portable Document Format (*.pdf) formats at a resolution of 400 dpi. All use WGS84 datum and UTM zone 4N projection. Copies of the following maps are included at the end of this booklet. The low-resolution, page-size maps included in this booklet are intended to be used as a search tool and are not the final product. Large-scale, full-resolution versions of each map are available to download on this publication's citation page: <https://doi.org/10.14509/31087>. All maps have a U.S. Geological Survey topographic basemap.

Flown flight path map

Magnetics

Total Magnetic Intensity, International Geomagnetic Reference Field (IGRF) removed (TMI-IGRF) - nT

Calculated analytic signal of the residual magnetic field - nT/m

Computed 1st vertical derivative of the residual magnetic field - nT/m

Radiometrics

Total Air Absorbed Dose Rate - nGy/h

Equivalent concentration of Potassium - %K

Equivalent concentration of Thorium - eqTh ppm

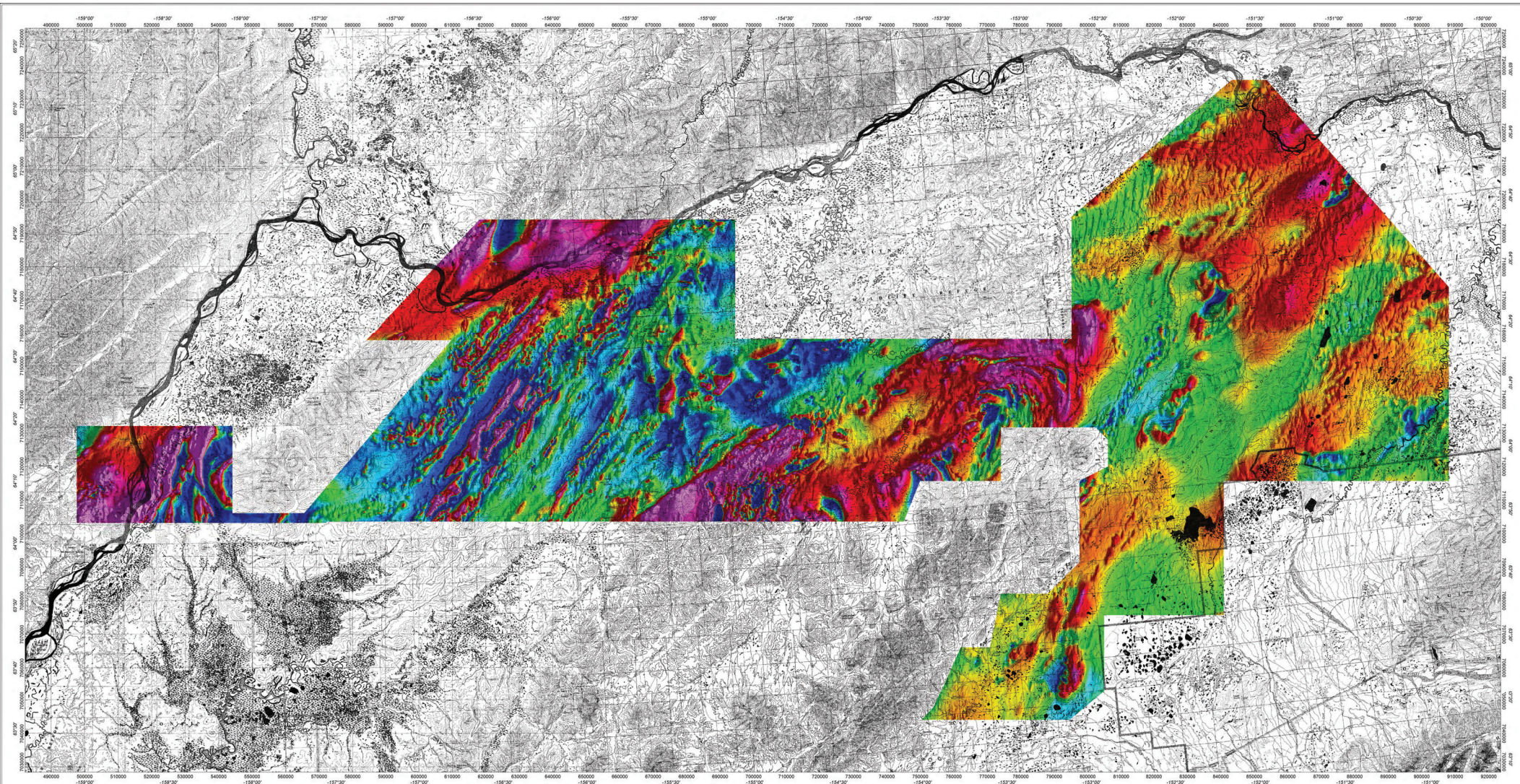
Equivalent concentration of Uranium - eqU ppm

U/Th Ratio (eqU ppm / eqTh ppm)

Th/K Ratio (eqTh ppm / %K)

U/K Ratio (eqU ppm / %K)

Ternary - %K-eqU-eqTh – RGB



AIRBORNE SYSTEMS:

MAGNETOMETER: Scintrex CS-3
Configuration: Tail-Stinger
Sampling Rate: 20 readings/second
Sensitivity: 0.01 nT

NAVIGATION: Novatel L1/L2 GPS
Real-time differentially corrected
Sampling Rate: 10 readings/second

ALTIMETERS:
Setta 276 Pressure Transducer

GAMMA-RAY SPECTROMETER:
RSX-3 multi-channel NaI sensors with
13.6 L "downwards looking" and 8.4 L
"upwards looking".
Sampling Rate: 1 reading/second

BASE STATION MAGNETOMETER:
GEM GS4-19TW
Sampling Rate: 1 reading/second
Sensitivity: 0.022 nT

SURVEY DATE: May–September 2023
Fixed-Wing Aircraft Type: Piper Navajo PA31
Registration: C-QQVP

SURVEY PARAMETERS:
Altitude Survey Mode:
Traverse Line Direction/Spacing:
Control Line Direction/Spacing:
Drage 3D computed at 100 m
90°(E-W) / 400 m
180°(N-S) / 2400 m

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Residual Magnetic Intensity
(nT)

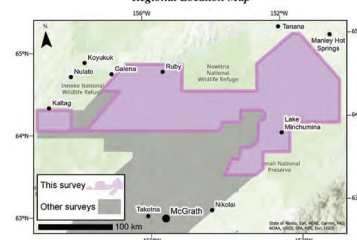
-1158 -78 -67 -59 -52 -47 -43 -39 -34 -30 -26 -21 -16 -8 2 815 35 72 1941

Base map: USGS 1:250,000-scale topographic map

Location of the northern Kuskokwim Mountains survey area in Alaska
and in relation to the USGS 1:250,000-scale quadrangles



Regional Location Map

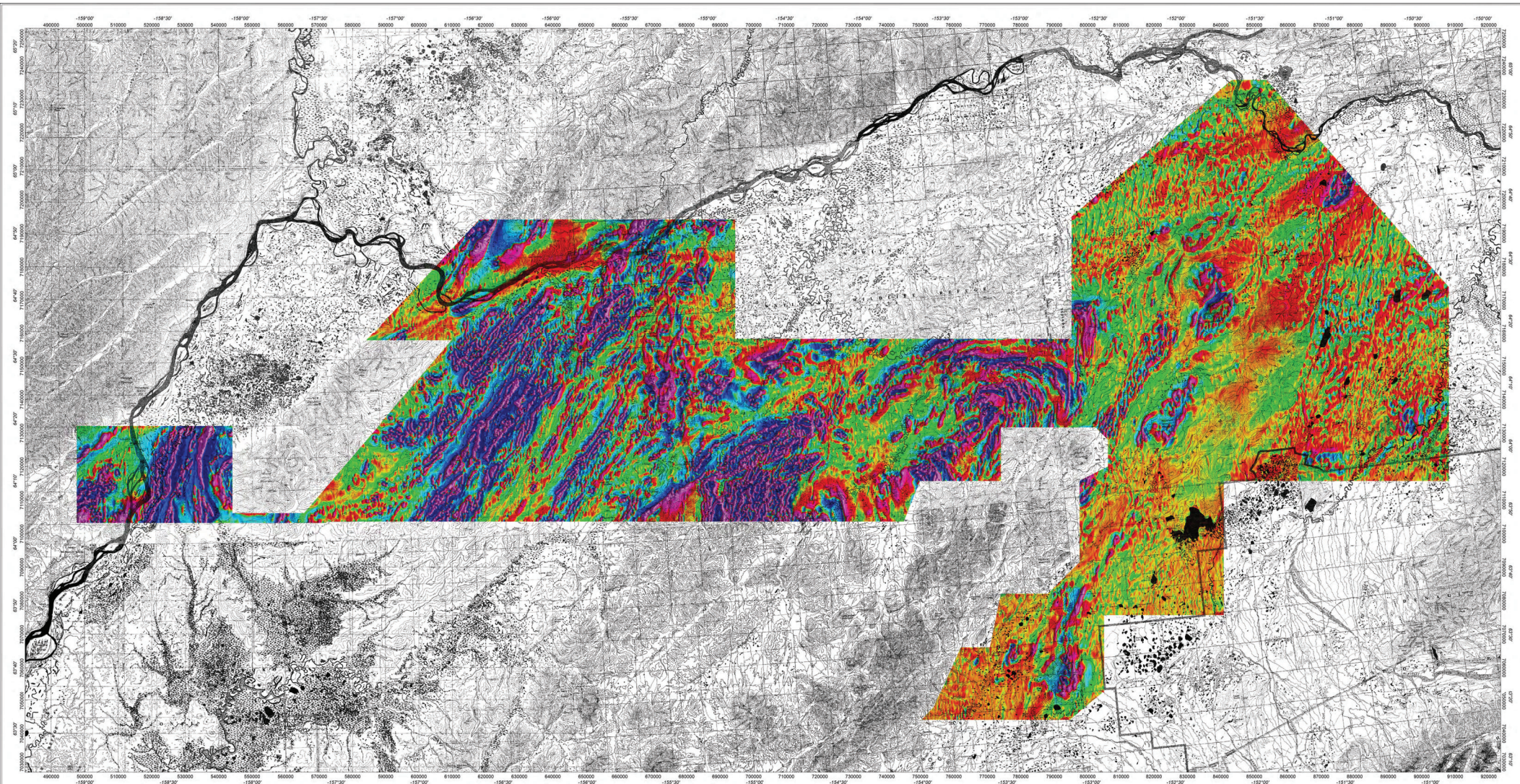


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Kuskokwim airborne magnetic and radiometric survey,
northern Kuskokwim Mountains

Residual Magnetic Intensity Map

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SURVEY PARAMETERS:
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Control Line Direction/Spacing: 180°(N-S) / 2400 m

MAGNETOMETER: Scintrex CS-3
Configuration: Tail-Stinger
Sampling Rate: 20 readings/second
Sensitivity: 0.01 nT

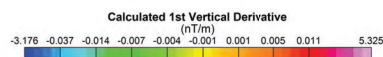
NAVIGATION: Novatel L1/L2 GPS
Real-time differentially corrected
Sampling Rate: 10 readings/second

GAMMA-RAY SPECTROMETER:
RSX-5 multi-channel NaI sensors with
33.6 L “downwards looking” and 8.4 L
“upwards looking”
Sampling Rate: 1 reading/second

ALTIMETERS:
Setra 276 Pressure Transducer

Sampling Rate: 10 readings/second
Radar: Bendix King KRA-10A
Sampling Rate: 20 readings/second

BASE STATION MAGNETOMETER:
GEM GSN4-19TW
Sampling Rate: 1 reading/second
Sensitivity: 0.022 nT

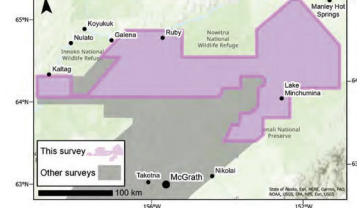


Base map: USGS 1:250,000-scale topographic map

Location of the northern Kuskokwim Mountains survey area in Alaska
and in relation to the USGS 1:250,000-scale quadrangles



Regional Location Map



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Kuskokwim airborne magnetic and radiometric survey,
northern Kuskokwim Mountains

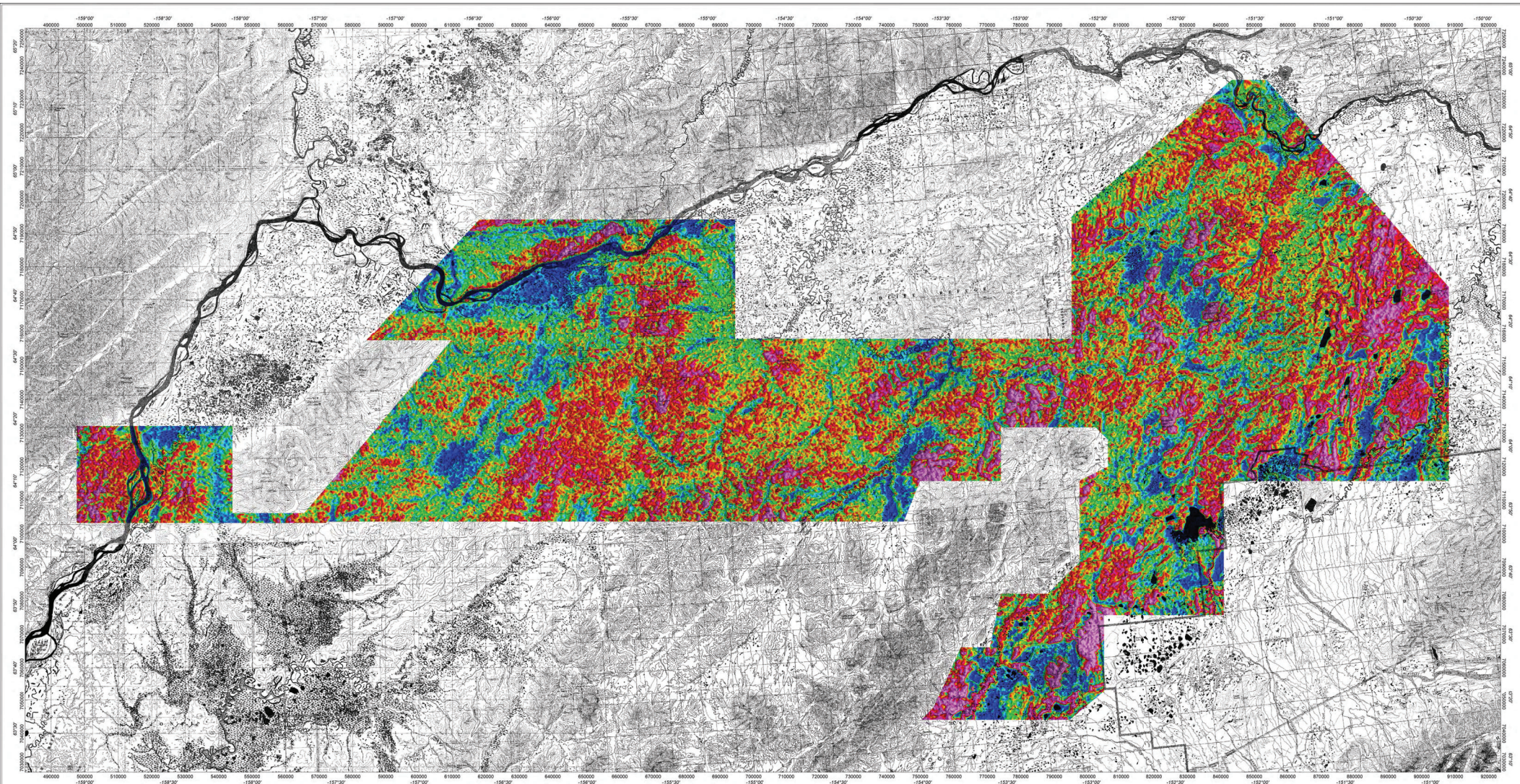
Calculated 1st Vertical Derivative Map

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Registration: C-GQVP

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Control Line Direction/Spacing: 180°(N-S) / 2400 m

MAGNETOMETER: Scintrex CS-3
Configuration: Tail-Stinger
Sampling Rate: 20 readings/second
Sensitivity: 0.01 nT

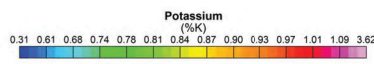
NAVIGATION: Novatel L1/L2 GPS
Real-time differentially corrected
Sampling Rate: 10 readings/second

GAMMA-RAY SPECTROMETER: RSX-5 multi-channel NaI sensors with 33.6 L “downwards looking” and 8.4 L “upwards looking”
Sampling Rate: 1 reading/second

ALTIMETERS: Setra 276 Pressure Transducer

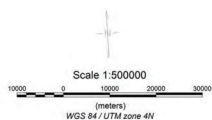
Sampling Rate: 10 readings/second
Radar: Bendix King KRA-10A
Sampling Rate: 20 readings/second

BASE STATION MAGNETOMETER: GEM GSNA-19TW
Sampling Rate: 1 reading/second
Sensitivity: 0.022 nT

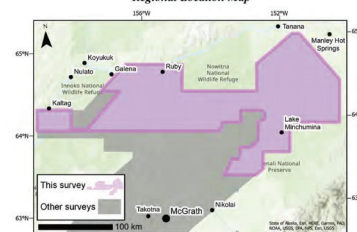


Base map: USGS 1:250,000-scale topographic map

Location of the northern Kuskokwim Mountains survey area in Alaska and in relation to the USGS 1:250,000-scale quadrangles



Regional Location Map



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Kuskokwim airborne magnetic and radiometric survey,
northern Kuskokwim Mountains

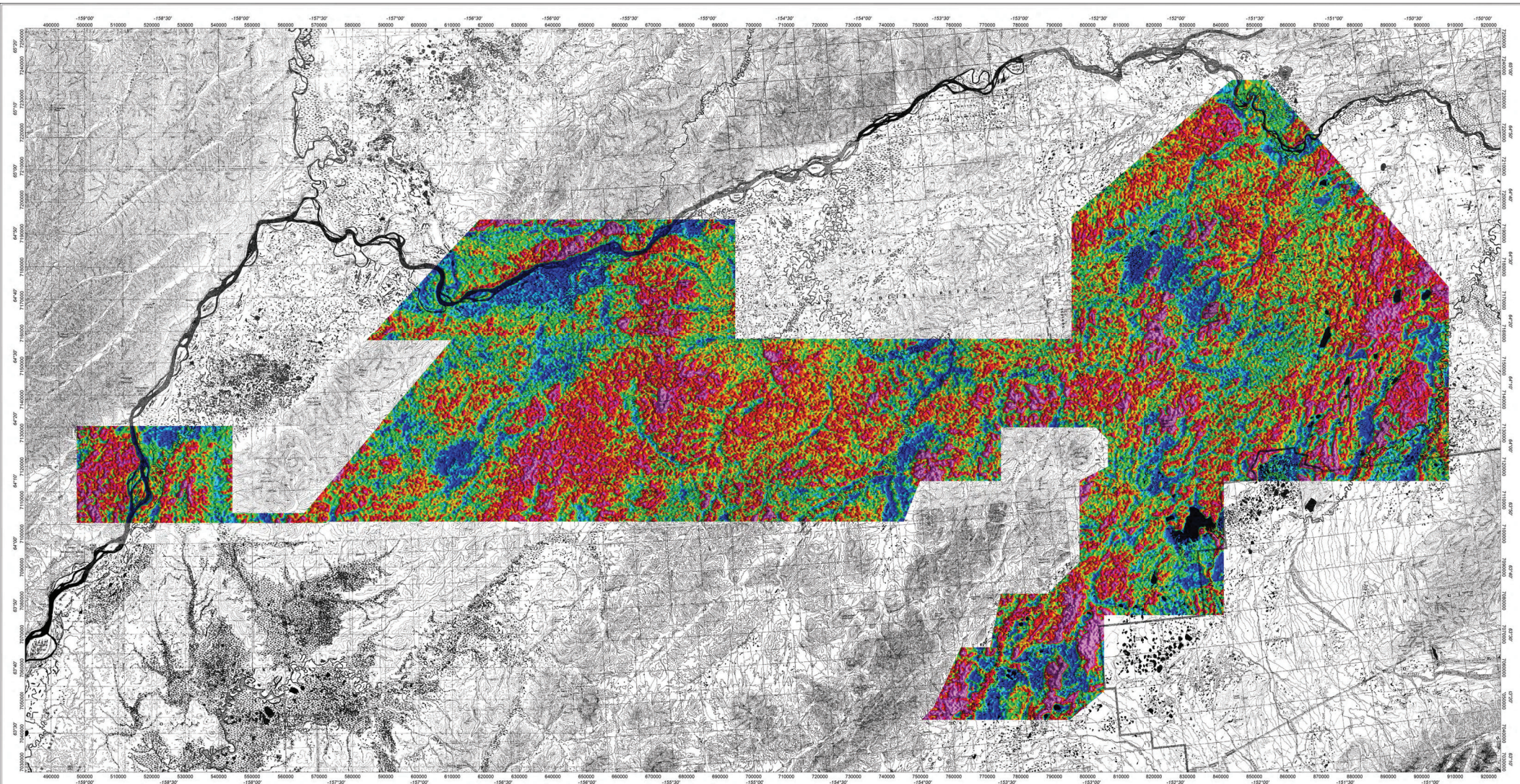
Potassium Map

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AIRBORNE SYSTEMS:

MAGNETOMETER: Scintrex CS-3
Configuration: Tail-Stinger
Sampling Rate: 20 readings/second
Sensitivity: 0.01 nT

NAVIGATION: Novatel L1/L2 GPS
Real-time differentially corrected
Sampling Rate: 10 readings/second

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GAMMA-RAY SPECTROMETER: RSX-5 multi-channel NaI sensors with 13.6 L "downwards looking" and 8.4 L "upwards looking".
Sampling Rate: 1 reading/second

ALTIMETERS: Setra 276 Pressure Transducer

BASE STATION MAGNETOMETER: GEM GSN4-19TW
Sampling Rate: 1 reading/second
Sensitivity: 0.022 nT

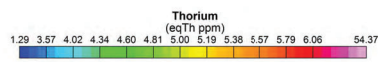
Survey Date: May–September 2023
Fixed-Wing Aircraft Type: Piper Navajo PA31
Registration: C-QQVP

Survey Parameters

Altitude Survey Mode: Drone 3D computed at 100 m
Traverse Line Direction/Spacing: 90°(E-W) / 400 m
Control Line Direction/Spacing: 180°(N-S) / 2400 m

Scale: 1:500,000
WGS 84 / UTM zone 4N

Scale 1:500,000
(meters)
WGS 84 / UTM zone 4N

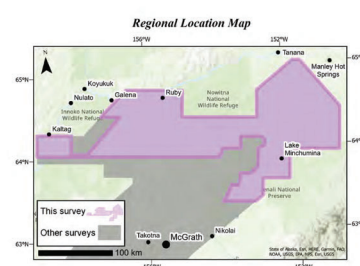


Base map: USGS 1:250,000-scale topographic map

Location of the northern Kuskokwim Mountains survey area in Alaska and in relation to the USGS 1:250,000-scale quadrangles



Regional Location Map

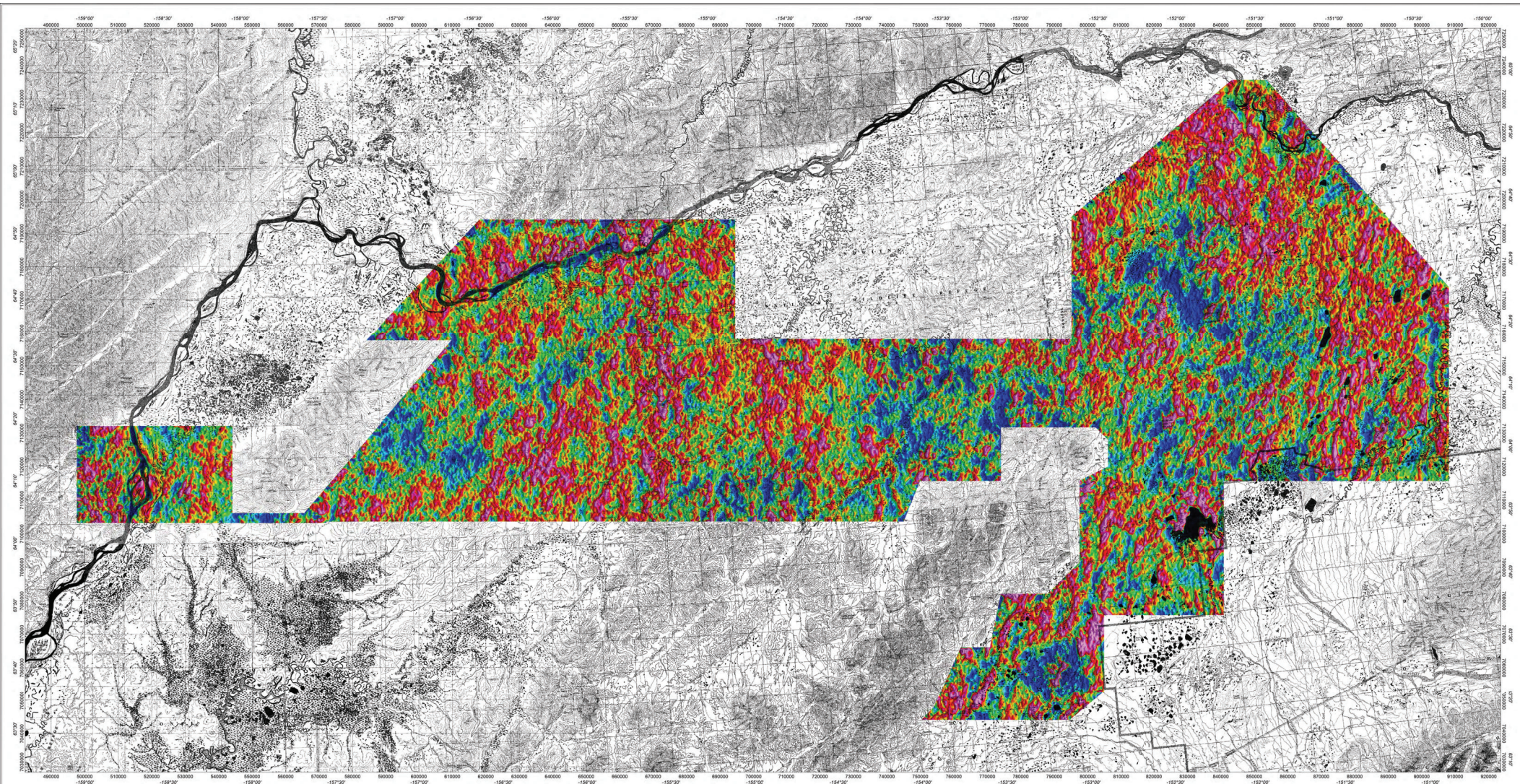


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Kuskokwim airborne magnetic and radiometric survey,
northern Kuskokwim Mountains

Thorium Map

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AIRBORNE SYSTEMS:

MAGNETOMETER: Scintrex CS-3
Configuration: Tail-Stinger
Sampling Rate: 20 readings/second
Sensitivity: 0.01 nT

NAVIGATION: Novatel L1/L2 GPS
Real-time differentially corrected
Sampling Rate: 10 readings/second

ALTIMETERS:
Setta 276 Pressure Transducer

GAMMA-RAY SPECTROMETER:
RSX-5 multi-channel NaI sensors with
13.6 L "downwards looking" and 8.4 L
"upwards looking".
Sampling Rate: 1 reading/second

Survey Date: May–September 2023
Fixed-Wing Aircraft Type: Piper Navajo PA31
Registration: C-GQVP

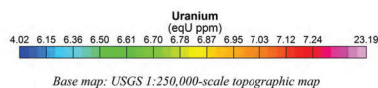
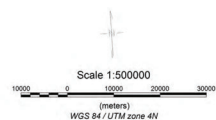
BASE STATION MAGNETOMETER:
GEM GS4-19TW
Sampling Rate: 1 reading/second
Sensitivity: 0.022 nT

SURVEY PARAMETERS:
Altitude Survey Mode:
Traverse Line Direction/Spacing:
Control Line Direction/Spacing:

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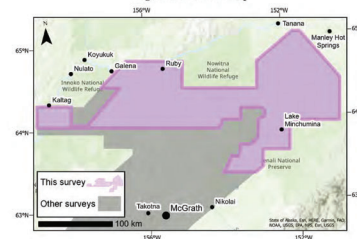


Base map: USGS 1:250,000-scale topographic map

Location of the northern Kuskokwim Mountains survey area in Alaska
and in relation to the USGS 1:250,000-scale quadrangles



Regional Location Map

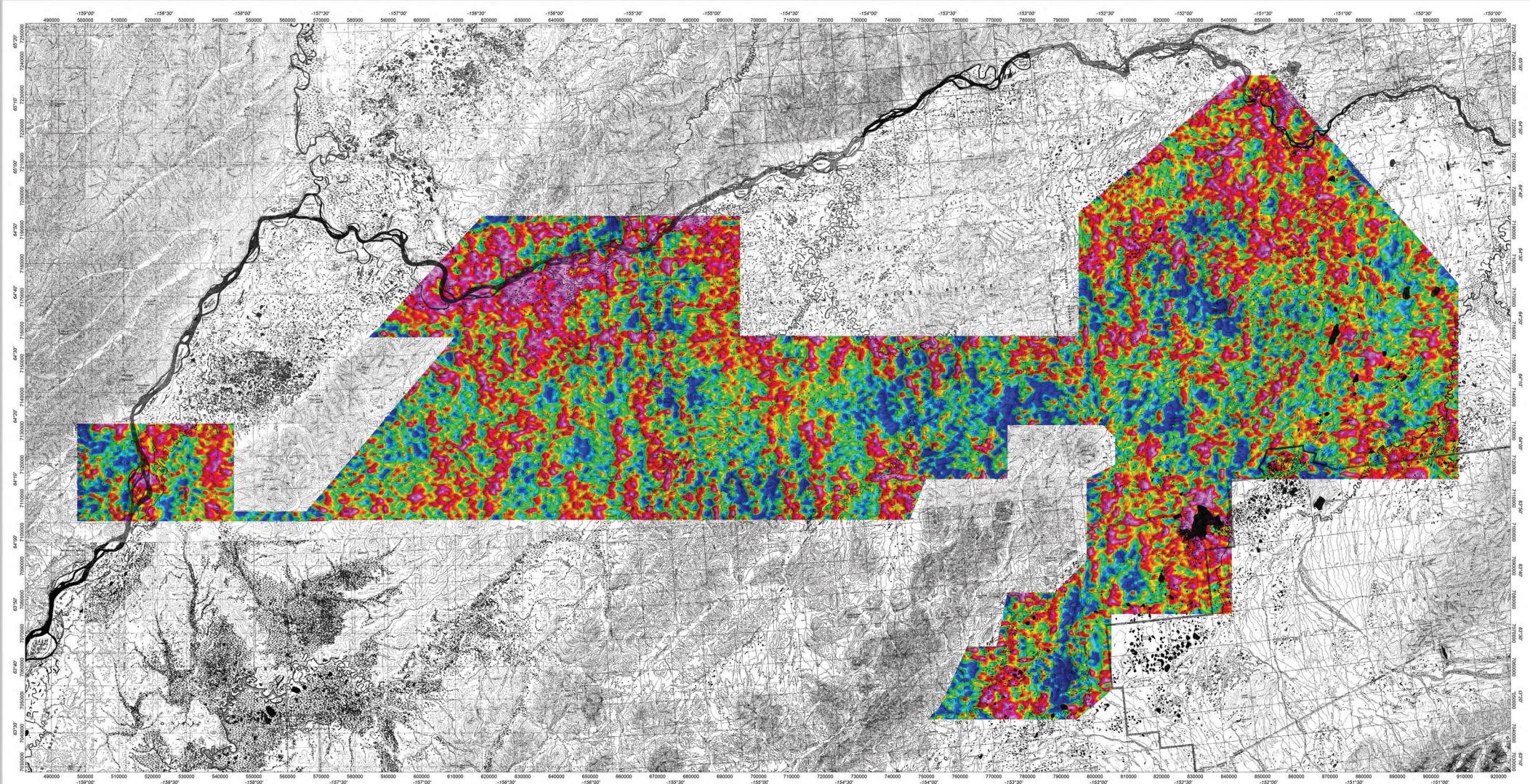


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*Kuskokwim airborne magnetic and radiometric survey,
northern Kuskokwim Mountains*

Uranium Map

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AIRBORNE SYSTEMS:

MAGNETOMETER: Scintrex CS-3
Configuration: Tail-Stringer
Sampling Rate: 20 readings/second
Sensitivity: 0.01 nT

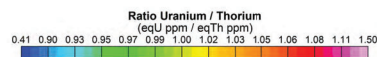
NAVIGATION: Novatel L1/L2 GPS
Real-time differentially corrected
Sampling Rate: 10 readings/second

ALTIMETERS:
Setta 276 Pressure Transducer

GAMMA-RAY SPECTROMETER:
RSX-3 multi-channel NaI sensors with
23.6 L "downwards looking" and 8.4 L
"upwards looking".
Sampling Rate: 1 reading/second

BASE STATION MAGNETOMETER:
GEM GSN-19TW
Sampling Rate: 1 reading/second
Sensitivity: 0.022 nT

Other surveys:

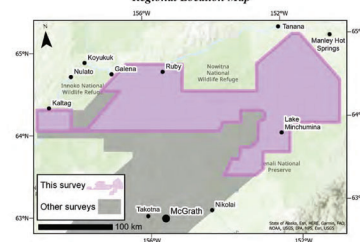


Base map: USGS 1:250,000-scale topographic map

Location of the northern Kuskokwim Mountains survey area in Alaska
and in relation to the U.S.G.S 1:250,000-scale quadrangles



Regional Location Map



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Kuskokwim airborne magnetic and radiometric survey,
northern Kuskokwim Mountains

Ratio Uranium / Thorium Map

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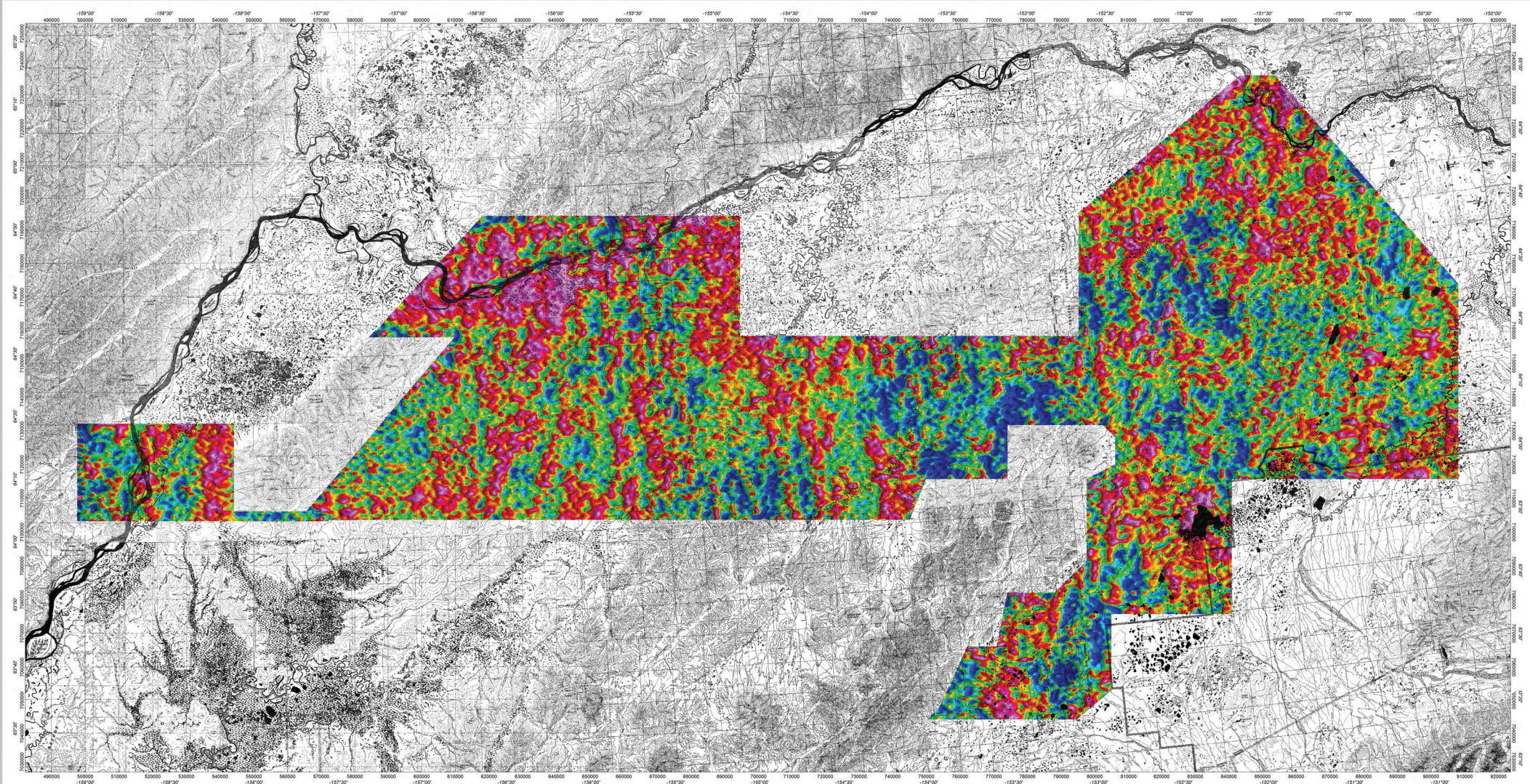
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Registration: C-GQVP

SURVEY PARAMETERS:
Altitude Survey Mode: Drone 3D computed at 100 m
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Control Line Direction/Spacing: 180°(N-S) / 2400 m

MAGNETOMETER: Scintrex CS-3
Configuration: Tail-Stringer
Sampling Rate: 20 readings/second
Sensitivity: 0.01 nT

NAVIGATION: Novatel L1/L2 GPS
Real-time differentially corrected
Sampling Rate: 10 readings/second

GAMMA-RAY SPECTROMETER:
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“upwards looking”
Sampling Rate: 1 reading/second

ALTIMETERS:
Setta 276 Pressure Transducer

Sampling Rate: 10 readings/second
Radar: Bendix King KRA-10A
Sampling Rate: 20 readings/second

BASE STATION MAGNETOMETER:
GEM GSN4-19TW
Sampling Rate: 1 reading/second
Sensitivity: 0.022 nT

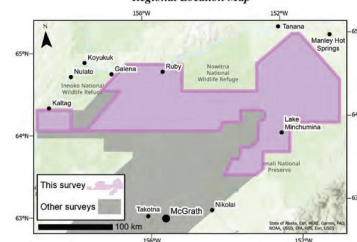
Ratio Uranium / Potassium
(eqU ppm / %K)
0.43 0.89 0.93 0.95 0.97 0.99 1.00 1.02 1.03 1.05 1.07 1.09 1.12 1.94

Base map: USGS 1:250,000-scale topographic map

Location of the northern Kuskokwim Mountains survey area in Alaska
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Regional Location Map



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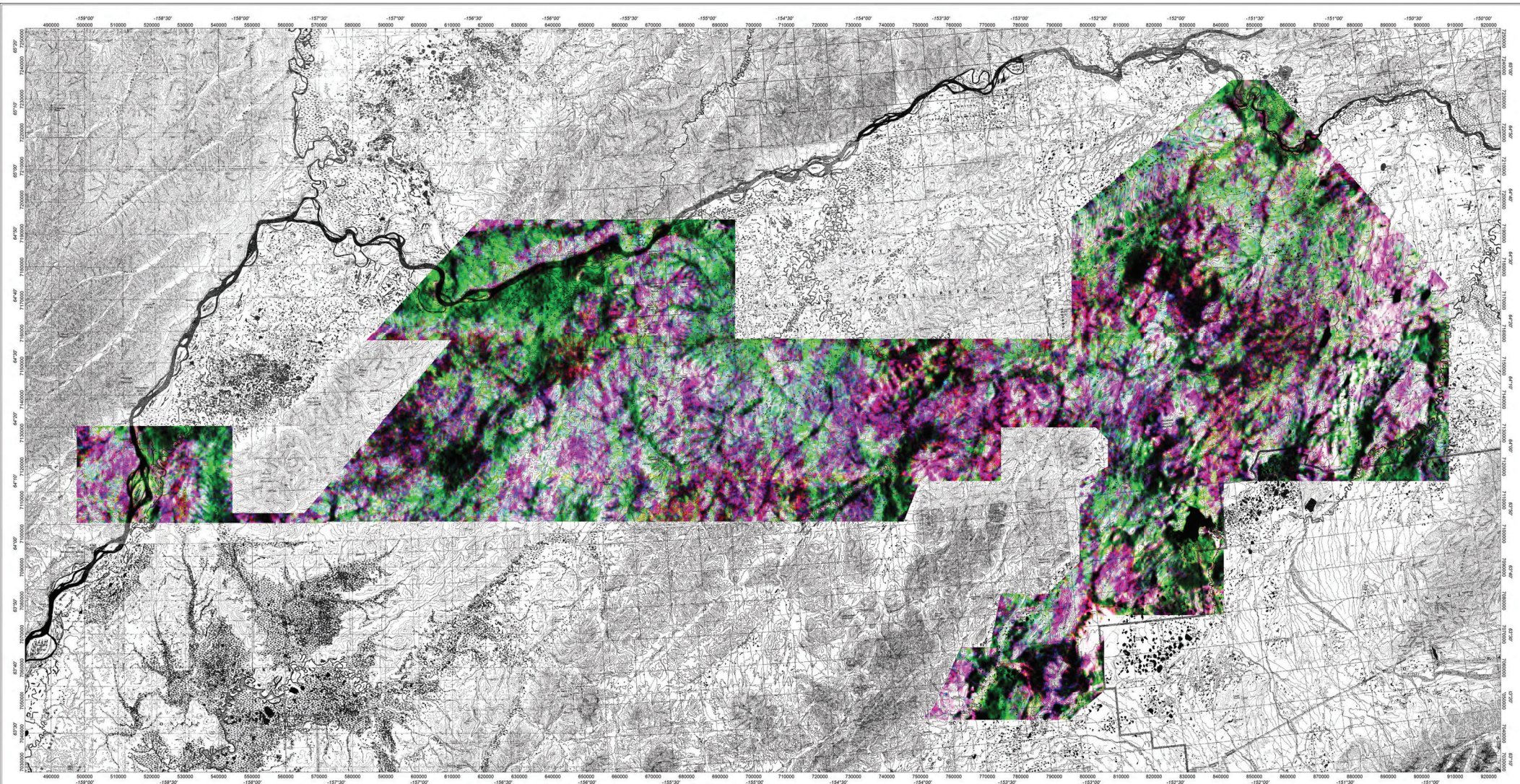
Ratio Uranium / Potassium Map

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Phone: +1 907-451-5000
Website: <https://dgg.alaska.gov/>

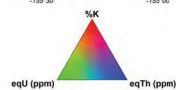


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Emond, A.M., and MPX Geophysics LTD, 2023, Kuskokwim airborne magnetic and radiometric geophysical survey, northern Kuskokwim Mountains: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2023-1, <https://doi.org/10.14509/31087>

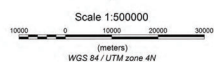
Sampling Rate: 10 readings/second
Radar: Bendix King KRA-10A
Sampling Rate: 20 readings/second

BASE STATION MAGNETOMETER:
GEM GSN4-19TW
Sampling Rate: 1 reading/second
Sensitivity: 0.022 nT

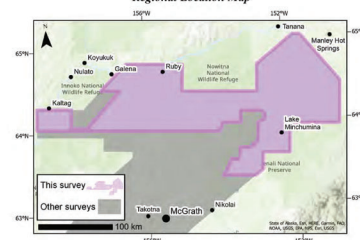


Base map: USGS 1:250,000-scale topographic map

Location of the northern Kuskokwim Mountains survey area in Alaska and in relation to the USGS 1:250,000-scale quadrangles



Regional Location Map



ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

Kuskokwim airborne magnetic and radiometric survey,
northern Kuskokwim Mountains

Ternary Map

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