

DGGS Completes Yukon-Tanana Upland Earth MRI Airborne Geophysics Program

Planning Underway for CY2023 Magnetic, Radiometric,
and Electromagnetic Data-Acquisition

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Alaska Division of Geological & Geophysical Surveys



Alaska Miners Association Annual Convention

November 8, 2022

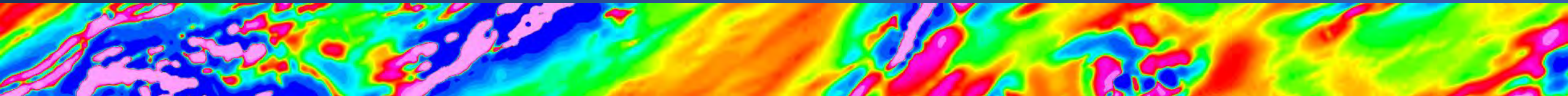
Acknowledgments

- MPX Geophysics Ltd.
- DGGS Staff, especially Melanie Werdon, Simone Montayne, Kristen Janssen, Felisa Childress, and former Director Steve Masterman
- USGS staff, including Warren Day, Jamey Jones, Doug Kreiner, Ben Drenth
- Primary funding provided by U.S. Geological Survey Earth Mapping Resources Initiative (Earth MRI) cooperative agreements G19AC00263, G20AC00160, G21AC10326, G22AC00475
- Additional funding for Yukon Tanana Uplands surveys from the State of Alaska, U.S. Bureau of Land Management, Northern Star Pogo, Millrock Resources, Inc., and Northway (Kenorland) Resources



New emphasis on Alaska's mineral potential

- High interest in Critical Minerals
- Our program is looking at Critical Mineral belts
- Earth Mapping Resources Initiative (Earth MRI)
 - U.S. Geological Survey program to understand framework geoscience for the purposes of Critical Mineral resources
 - Funding increased by Infrastructure Investment and Jobs Act
 - Earth MRI base Alaska geophysics funding \$0.5M per year → \$5M for FFY2022
 - Three-fold increase in magnetic survey line-kilometers
- State of Alaska funding through Capital Improvement Project

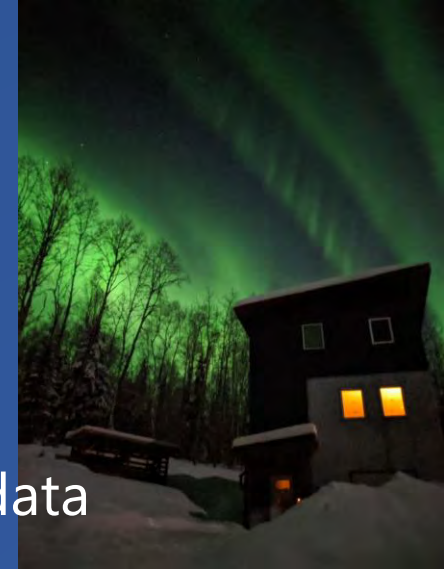


Program Management Updates

- Contracting
 - Master agreement task order process since 2019
 - New master agreements expected December 2022
 - Mag
 - 6 vendors
 - EM
 - 5 vendors, 11 active source EM systems
 - Quantifying Depth of Investigation and near-surface sensitivity of each system
 - We will be using both Time Domain and Frequency Domain systems, as appropriate
- Partnerships
 - DGGS has a long history of industry, ANCSA corp., federal agency partnerships
 - Helicopter mag + rad – favorable interest
 - EM surveys – favorable interest
 - Fixed-wing – low interest so far

Magnetic Data Management Changes

- Survey design—optimizing for high latitudes
 - High diurnal magnetic variation, long distances from base station
 - Solution: level against tie lines
 - Goal of 30 seconds between tie lines (3 crossings in 60 seconds)
 - fixed-wing = 2,400-m tie lines
 - Helicopter = 1,200-m tie lines
- Processing
 - GSC leveling guidelines, diurnal not used, tie lines are part of final data
- Data management
 - Consistent file naming and structure
 - Standard channel names (new for 2022)
- QC: Developing standard process, scripts, and database views



New Geophysics Web App and Services

The screenshot displays the 'Geophysical Surveys Web App' interface. The top navigation bar includes 'BETA', 'Alaska Geophysics Program', 'Alaska Seismic and Well Data', and 'Geophysics Data Portal Group'. On the left, a 'Filter Survey Grid Rasters' panel is active, showing filters for 'Survey Name(s)', 'Survey Type', and 'Survey Product'. The main map area shows a map of Alaska with various survey boundaries and data layers. A circular inset provides a detailed view of a specific survey area, showing gridded data. A pop-up window for 'Tonsina' provides detailed survey information.

Annotations:

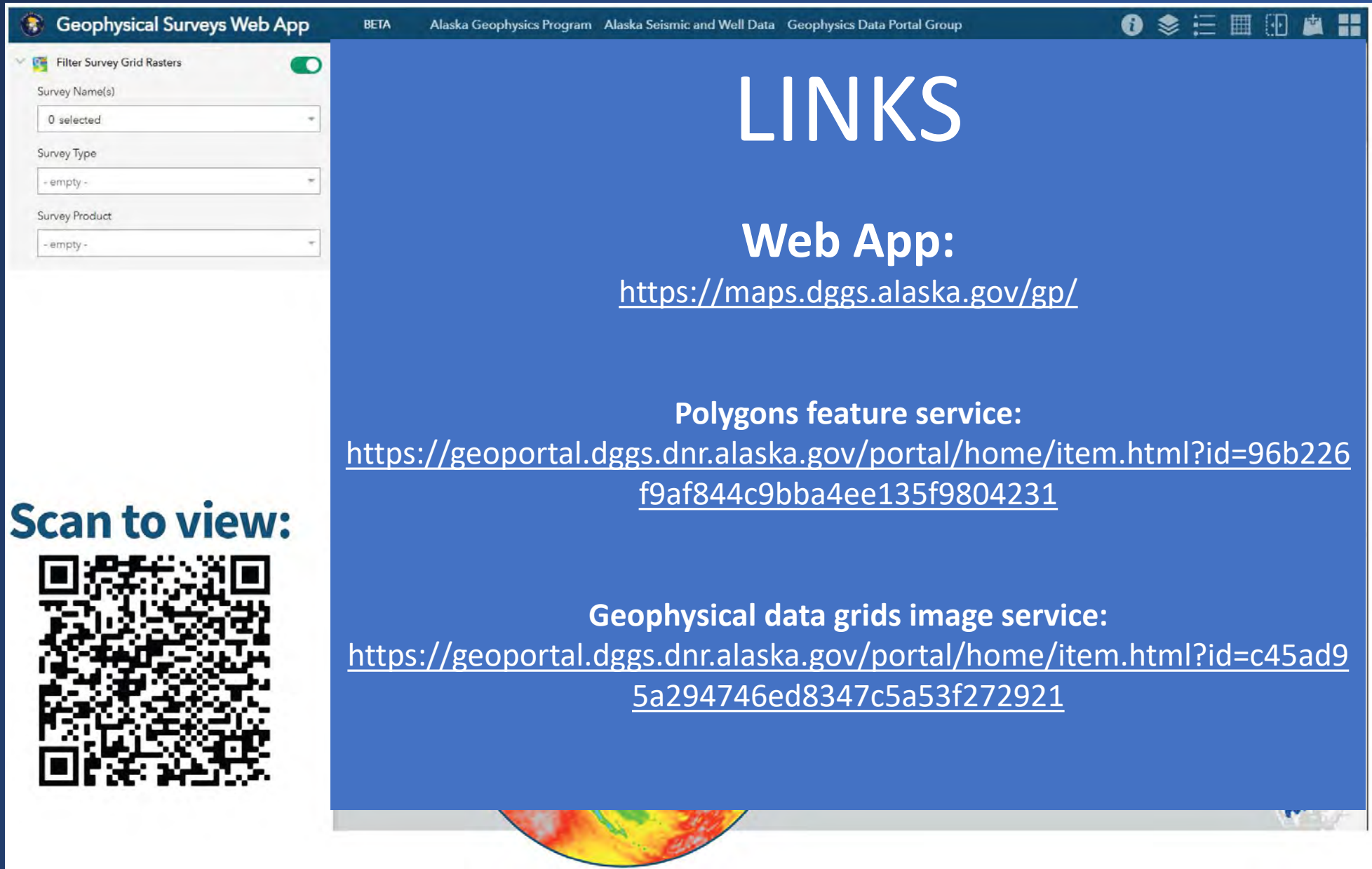
- GIS layer service links
- survey boundaries, survey information, download links from new feature service
- changeable data layers and display filters
- upcoming surveys
- gridded data from new image service

Scan to view:

Tonsina

Survey ID	336
nickname	tonsina_2014
Survey Name	Tonsina
Status	available
type	original
Citation ID	29169
Citation Link	More info
Collection Method	helicopter
Start Date	7/21/2014
End Date	8/21/2014
Collection Dates(s)	7/22/2014 to 8/22/2014
Collection Year(s)	
Zoom to	...

New Geophysics Web App and Services



Geophysical Surveys Web App BETA Alaska Geophysics Program Alaska Seismic and Well Data Geophysics Data Portal Group

Filter Survey Grid Rasters

Survey Name(s)
0 selected

Survey Type
- empty -

Survey Product
- empty -


LINKS

Web App:
<https://maps.dggs.alaska.gov/gp/>

Polygons feature service:
<https://geoportal.dggs.dnr.alaska.gov/portal/home/item.html?id=96b226f9af844c9bba4ee135f9804231>

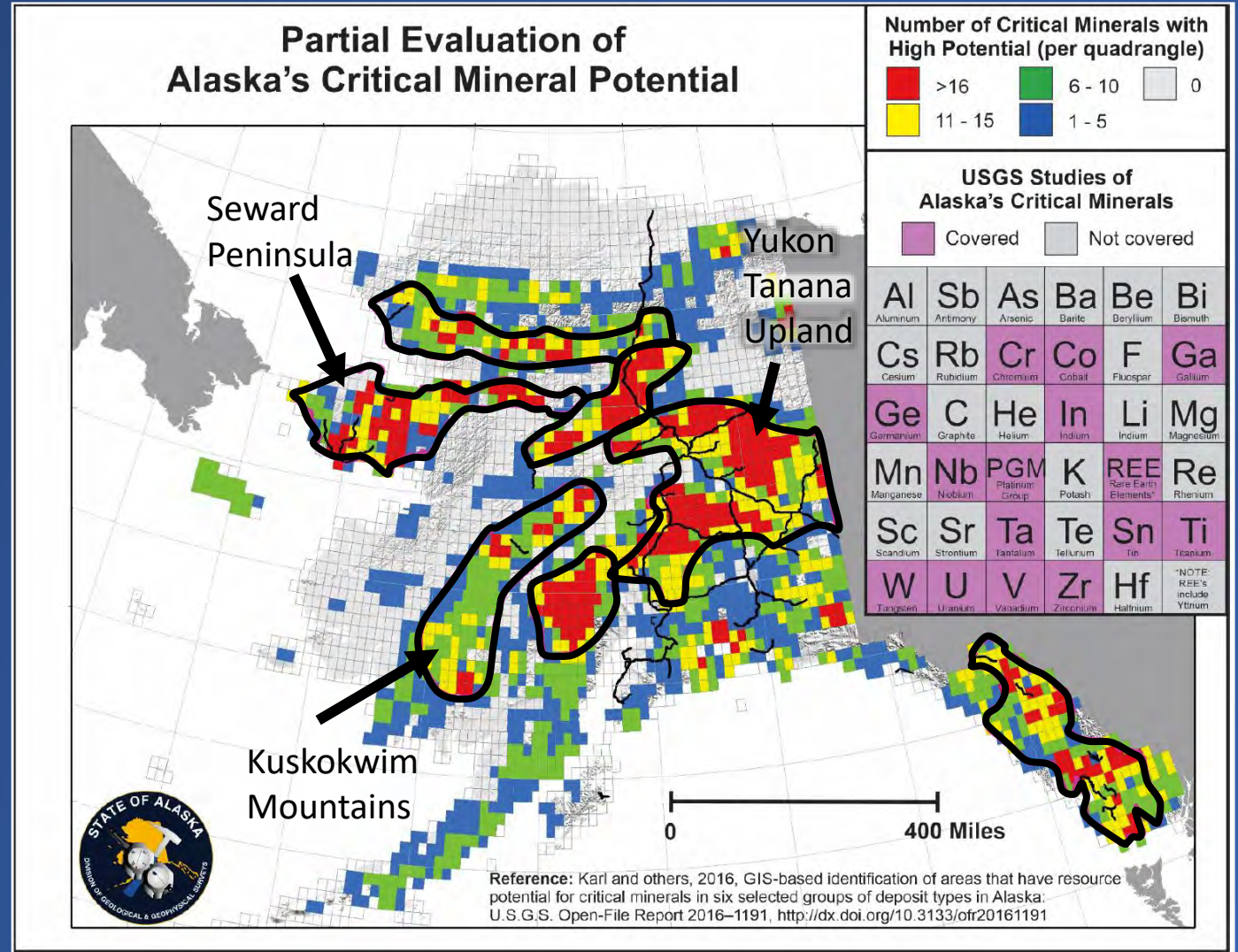
Geophysical data grids image service:
<https://geoportal.dggs.dnr.alaska.gov/portal/home/item.html?id=c45ad95a294746ed8347c5a53f272921>

Scan to view:



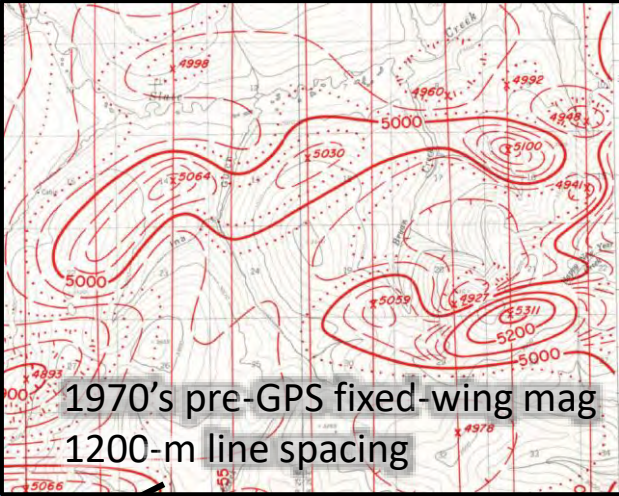
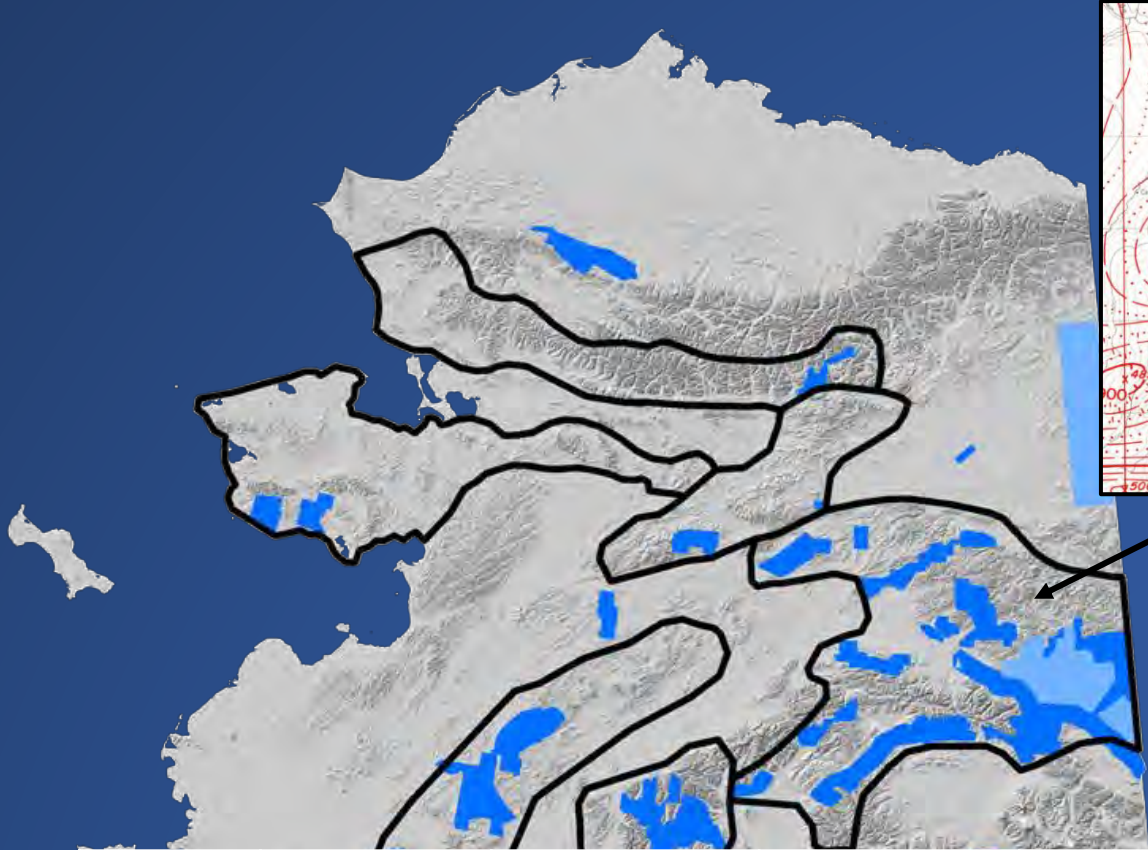
Geophysical Focus Areas

- Earth MRI and State of Alaska funding both have a **Critical Minerals (CM)** emphasis
- The USGS & DGGs have used existing geoscience datasets to evaluate Alaska's CM potential and identify CM hotspots (Karl *et al.*, 2016)
- General agreement between Alaska's high-prospectivity Critical Mineral belts and conventional precious- and base-metal mineral belts



Magnetic data coverage 2019 (pre-Earth MRI)

-  Critical mineral belts
-  TIER II magnetic data
-  TIER III magnetic data



USGS Magnetic Rank	Terrain clearance	Line spacing/terrain clearance ratio	Approx. line spacing	Data in DGGs collection
TIER I	< 150 m	< 2	< 300 m	Detailed helicopter mag surveys
TIER II	< 150 m	2 – 3	300 to 450 m	Helicopter-borne Earth MRI magnetic surveys
TIER II	150 - 300 m	< 2	< 621 m	Most Earth MRI fixed-wing magnetic surveys
TIER III	< 150 m	3 to 6	300 to 450 m	Most DGGs helicopter based mag-EM surveys

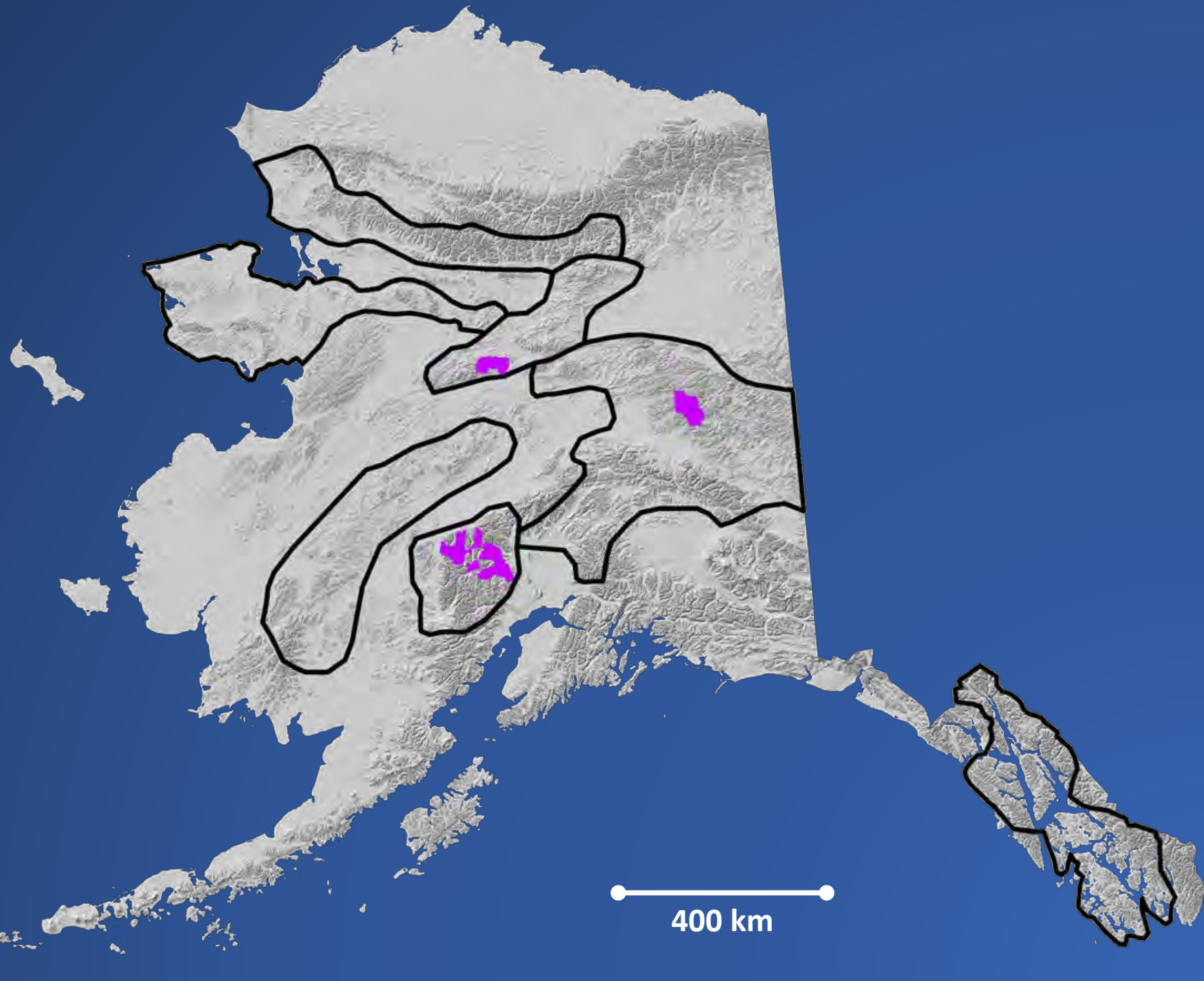
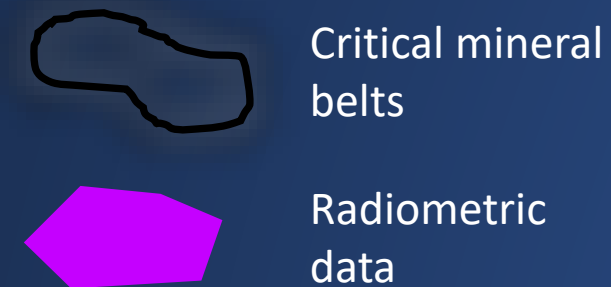
Anticipated magnetic data coverage after completion of FFY2022 program



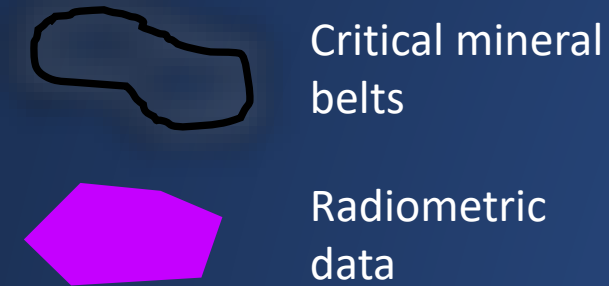
Yukon-Tanana Uplands (YTU) focus area, FFY2019, 20, 21 data collection complete and data are published

400 km

Radiometric data coverage 2019 (pre-Earth MRI)



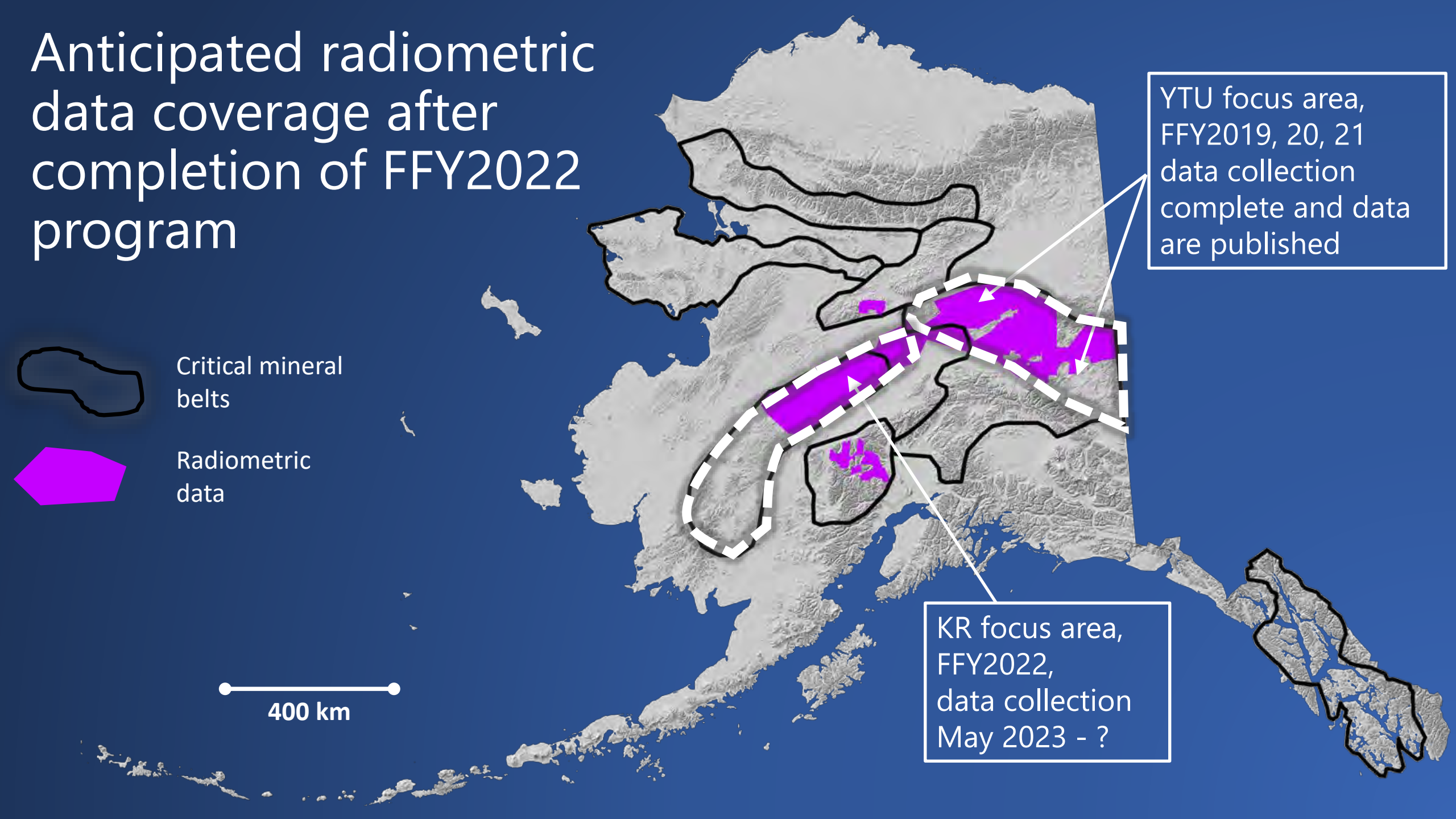
Anticipated radiometric data coverage after completion of FFY2022 program



400 km

YTU focus area,
FFY2019, 20, 21
data collection
complete and data
are published

KR focus area,
FFY2022,
data collection
May 2023 - ?



Yukon Tanana Uplands pre-Earth MRI



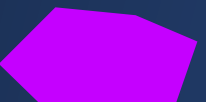
YTU focus area



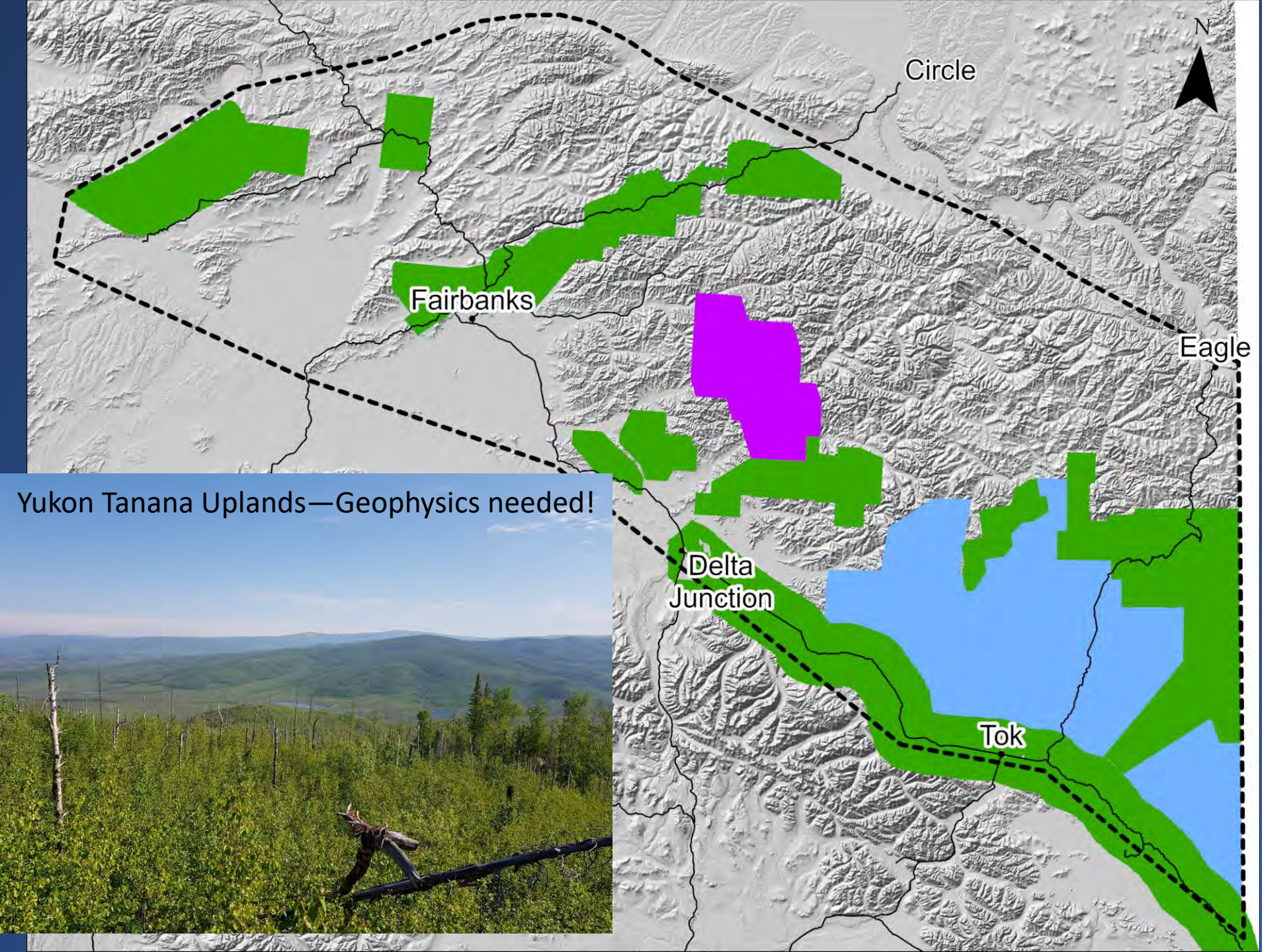
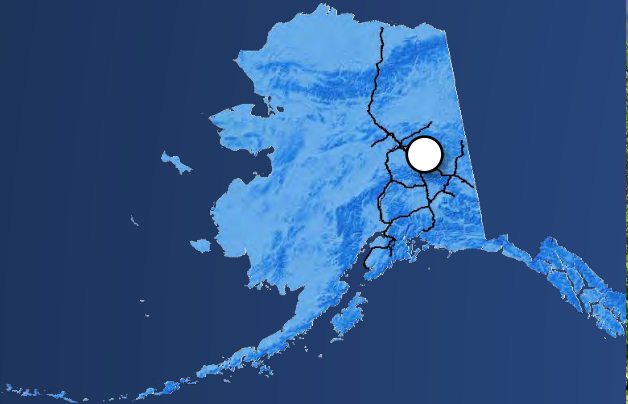
TIER II
magnetic data



EM and TIER III
magnetic data



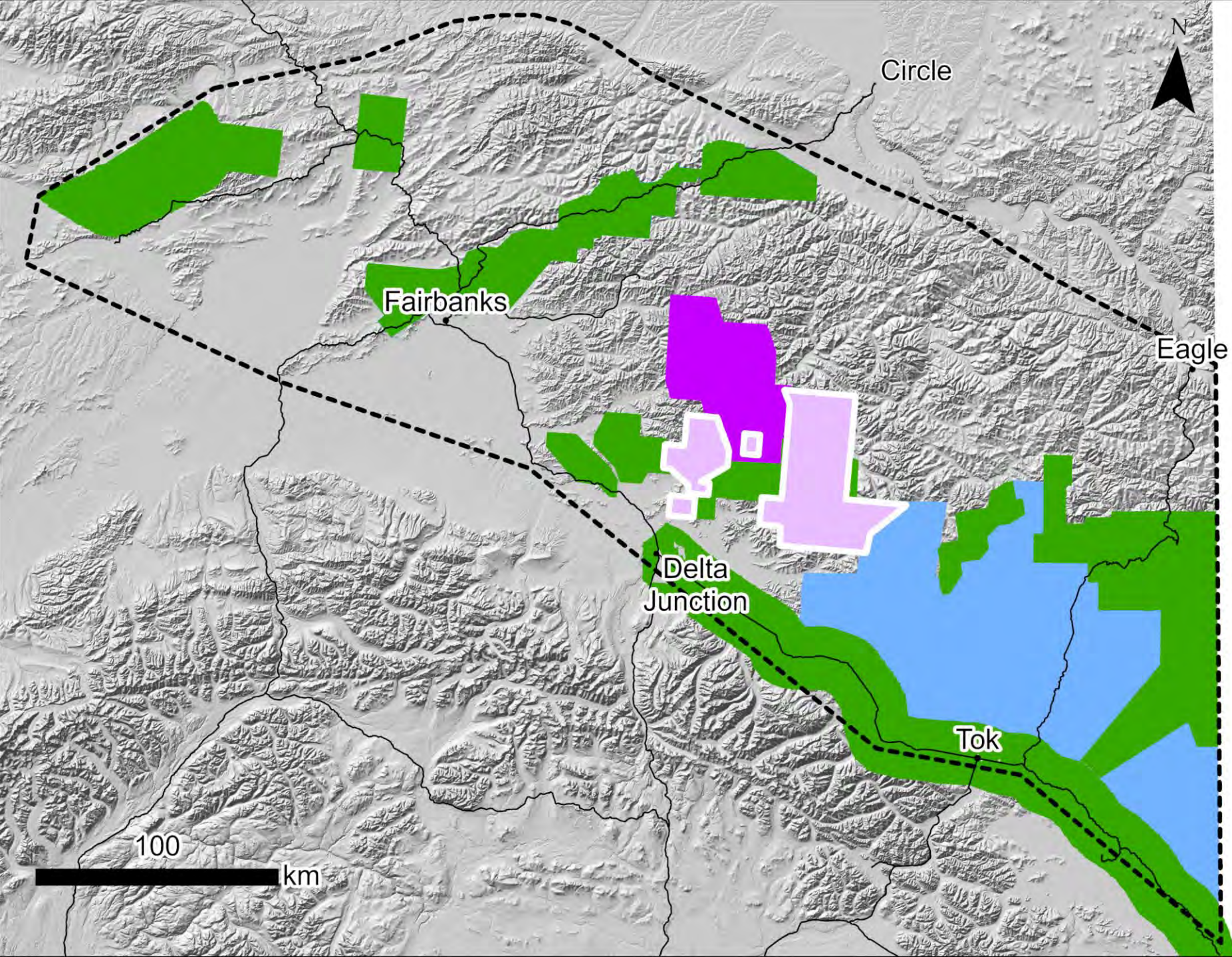
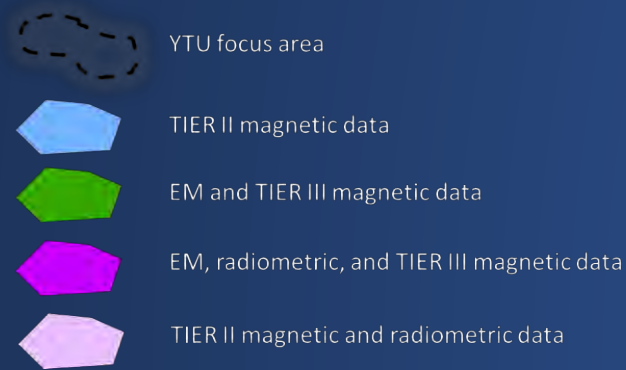
EM, radiometric,
and TIER III
magnetic data



Yukon Tanana Uplands—Geophysics needed!

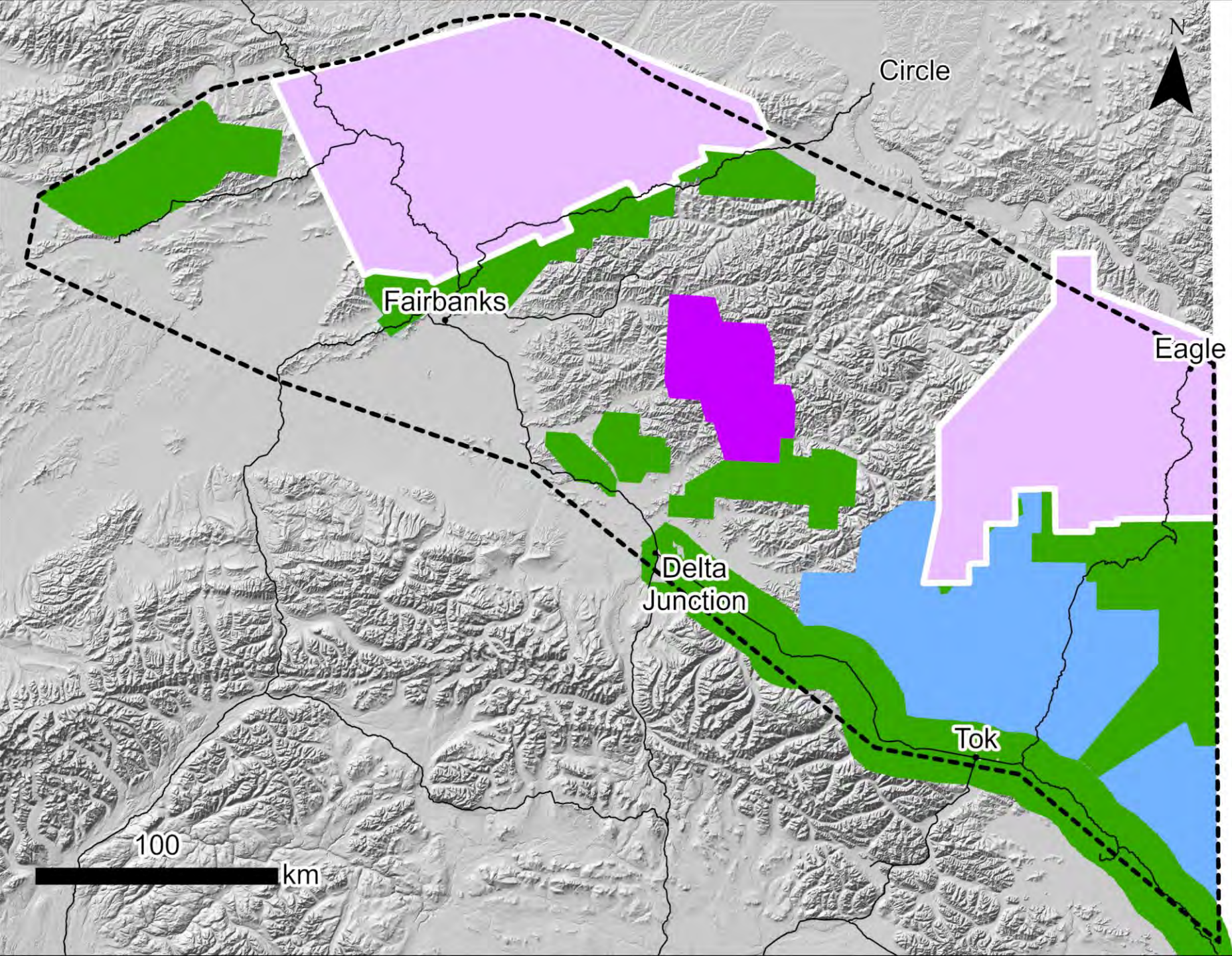
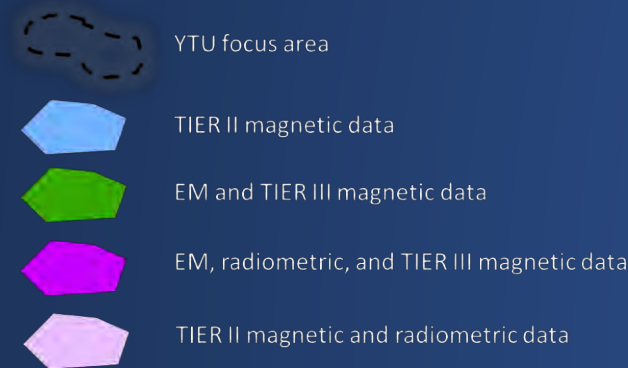
2020 State and Industry Funded Survey

- TIER I and II magnetic + radiometric
- Helicopter
- 100 m - 400 m line spacing
- 3,000 sq km
- > 50% funded by industry
- All industry funded data is public



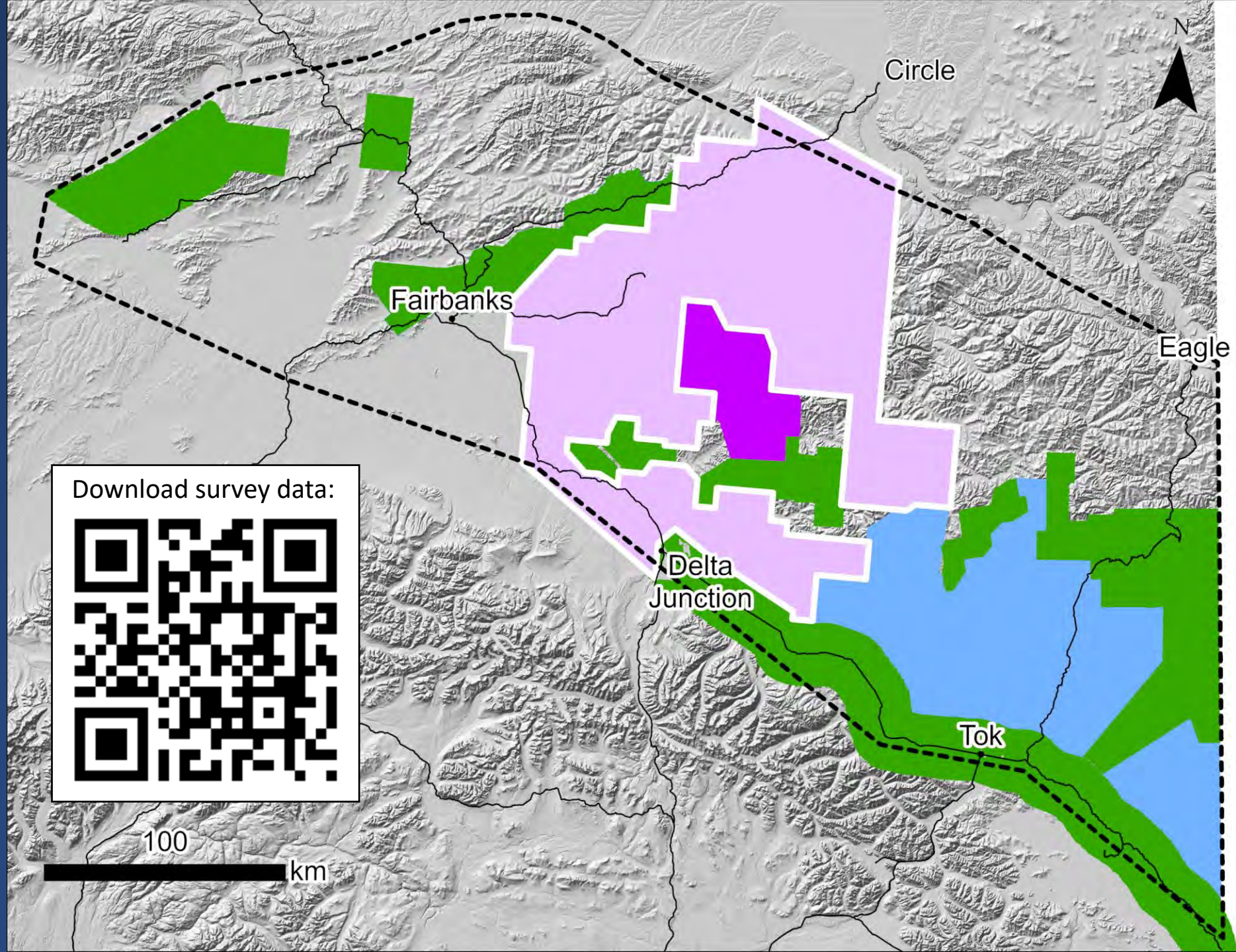
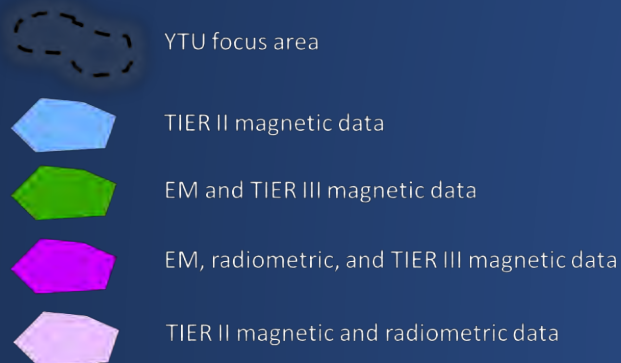
Yukon Tanana Uplands 2021 Surveys

- USGS EMRI + US BLM funded
- TIER II magnetic + radiometric
- Fixed Wing
- 400-m line spacing
- 23,000 sq km
- Published December 2020



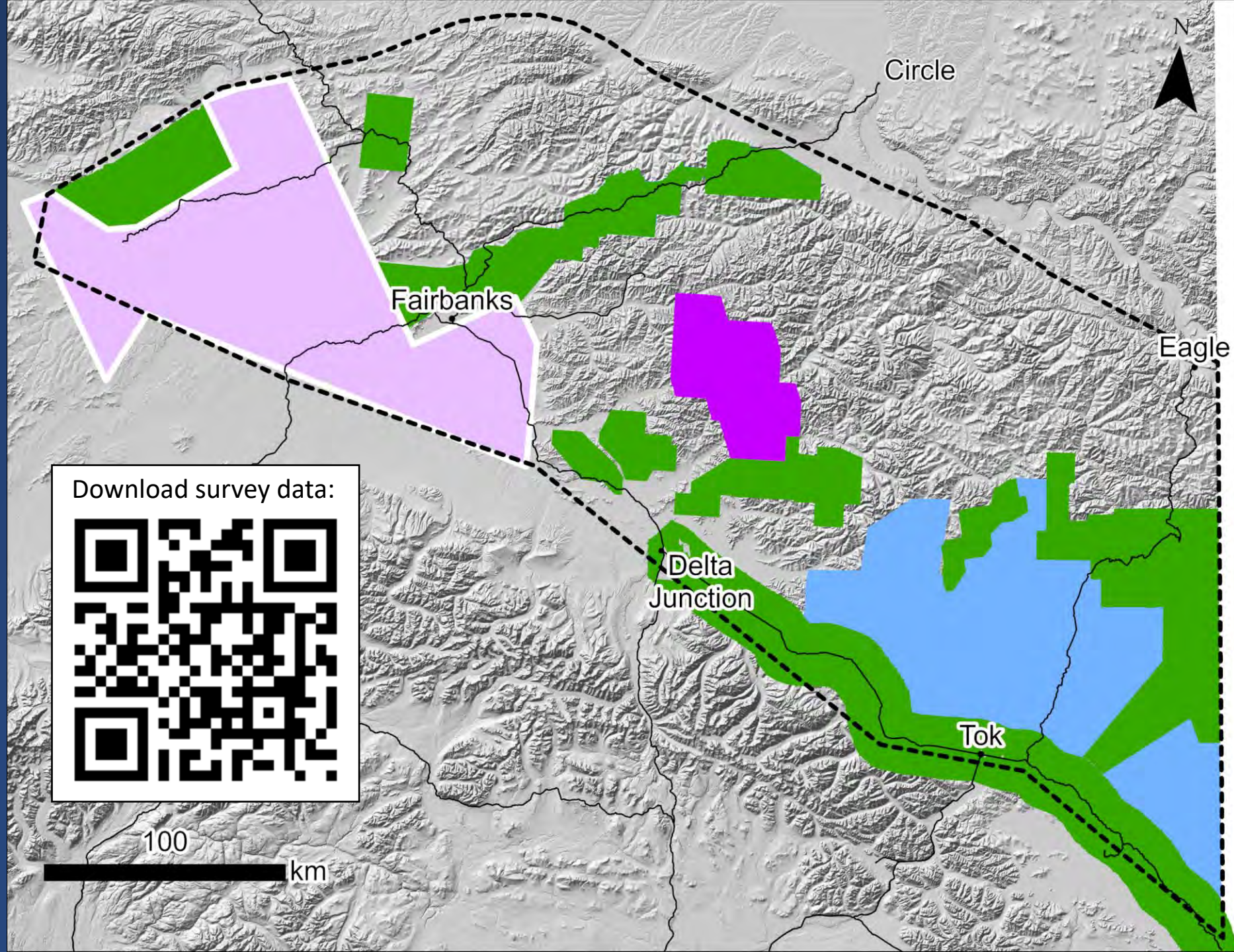
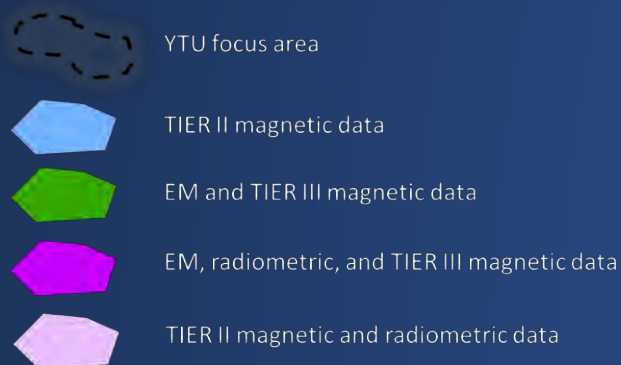
Yukon Tanana Uplands FFY2019 Survey Flown 2022

- TIER II magnetic + radiometric
- Fixed-wing
- 400-m line spacing
- 19,000 sq km
- Data collection completed August 2022
- **Now published**
- <https://dggs.alaska.gov/pubs/id/30899>



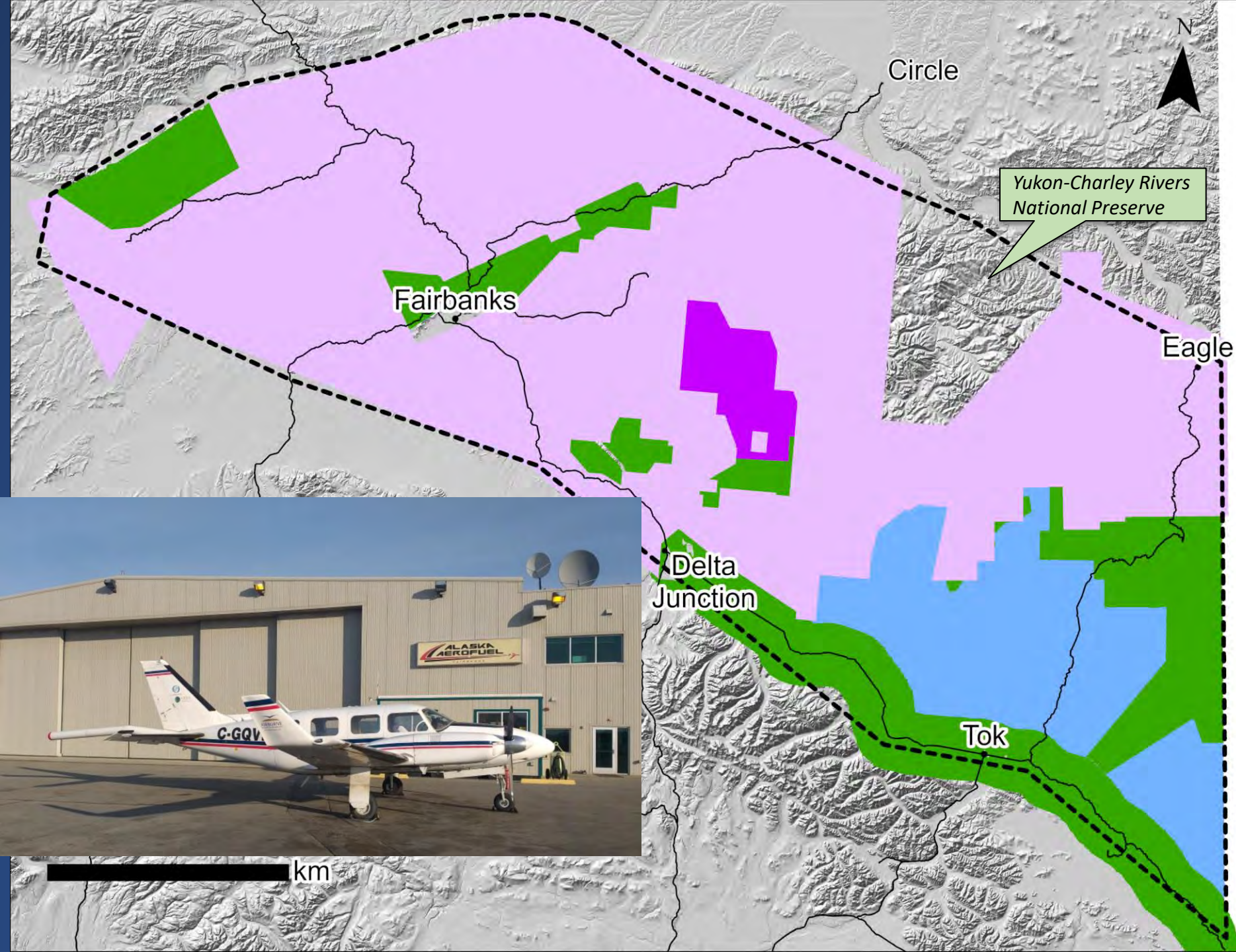
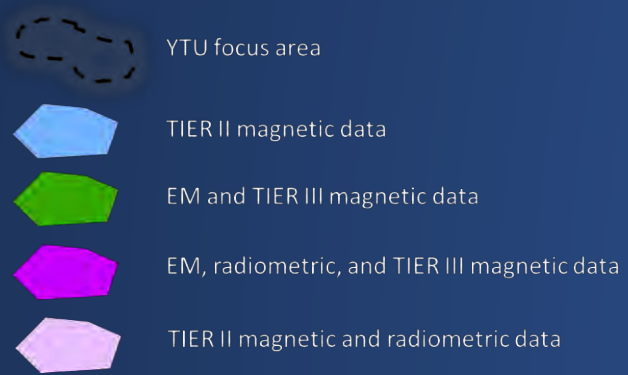
Yukon Tanana Uplands FFY2021 Survey Flown 2022

- TIER II magnetic + radiometric
- Fixed Wing
- 400-m line spacing
- 13,000 sq km
- Data collection completed August 2022
- **Now published**
- <https://dggs.alaska.gov/pubs/id/30899>



Yukon Tanana Uplands Magnetics Complete

- ~60,000 sq km of new data!
- TIER II magnetic + radiometric
- Primarily fixed-wing
- Excluded Yukon-Charley Rivers National Preserve
- Final publications November 2022

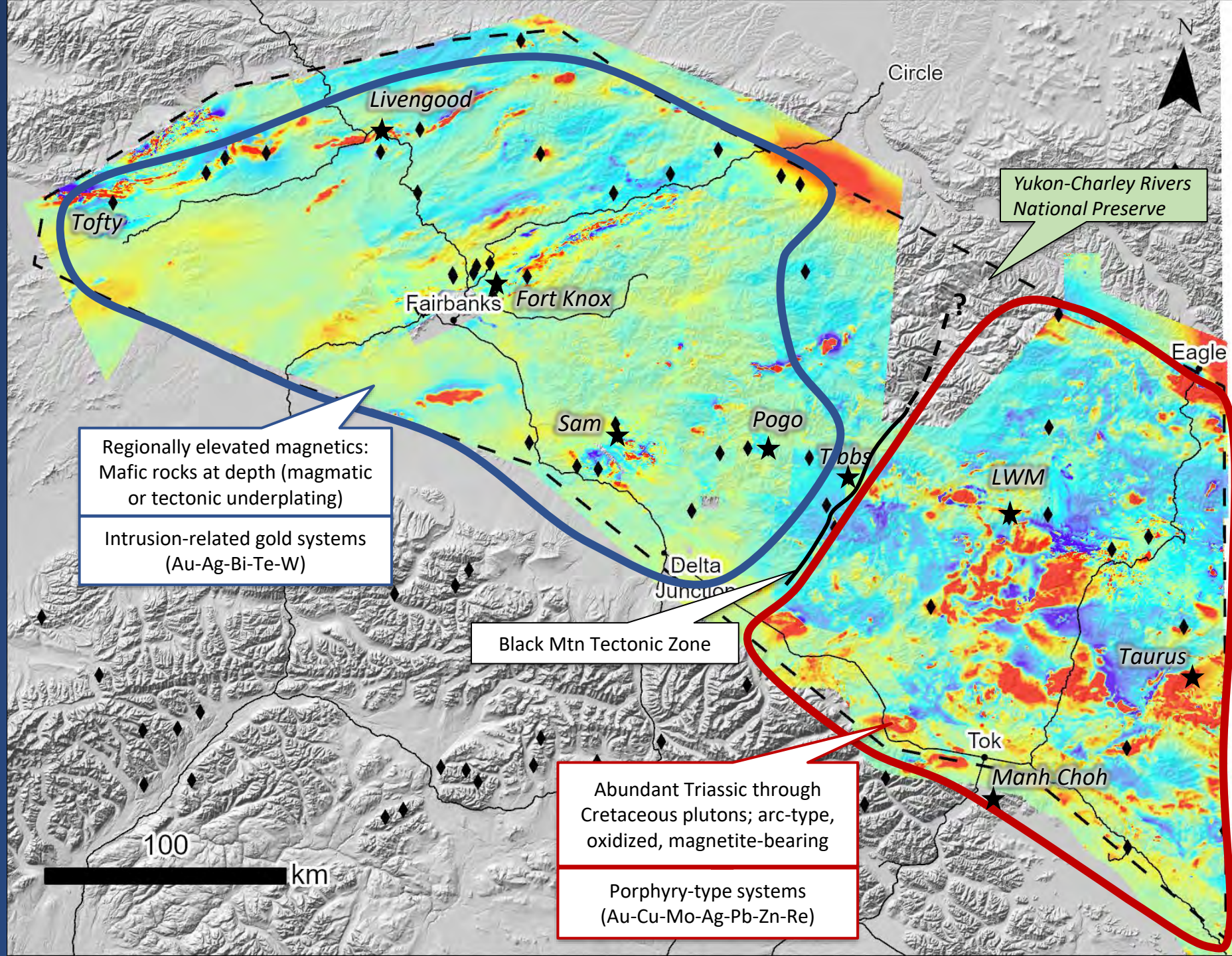
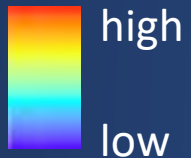


Yukon Tanana Uplands

Magnetics

- Modern dataset completed
- Visually merged
- True merged data grids are planned

Residual magnetic field

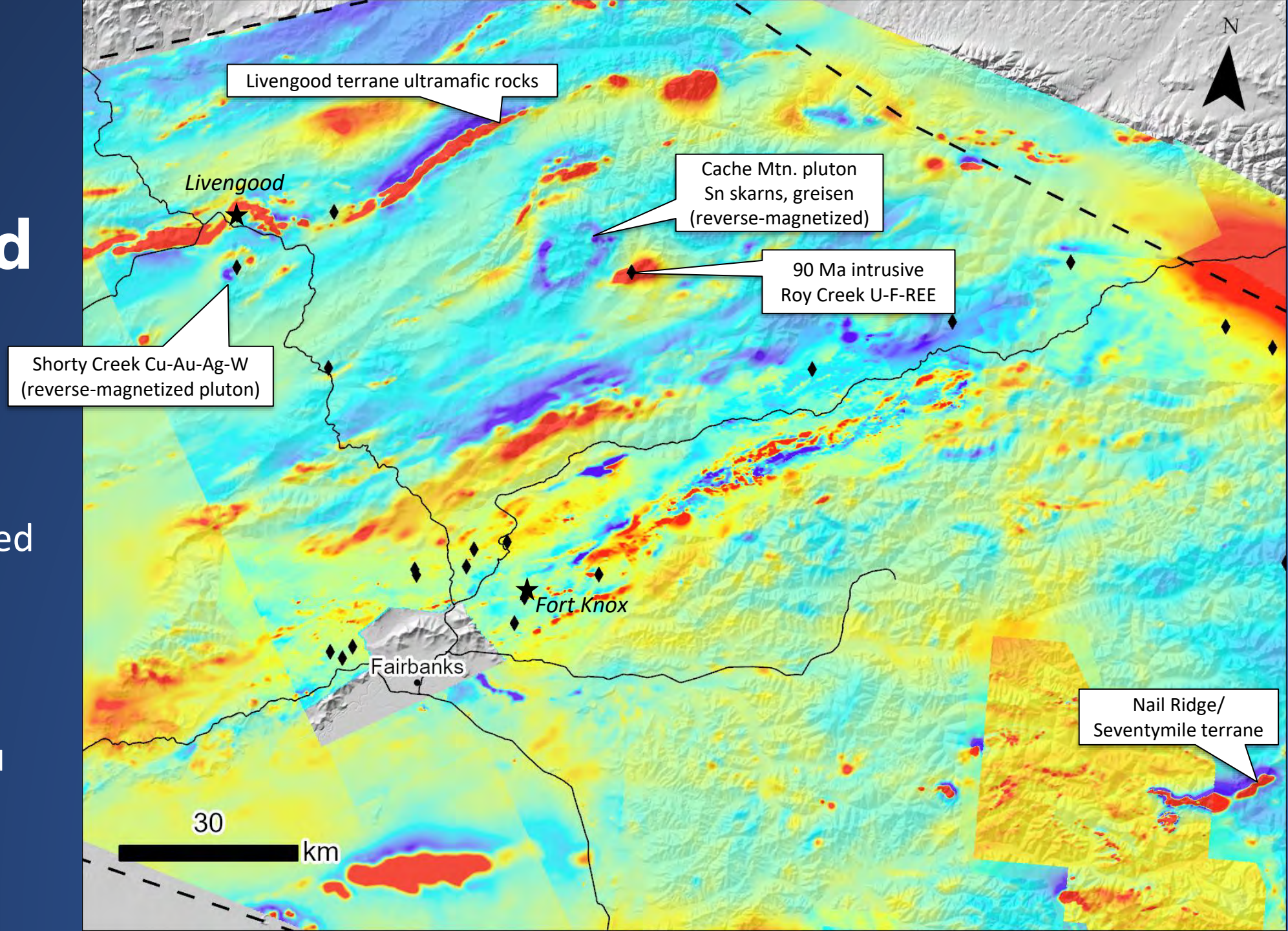
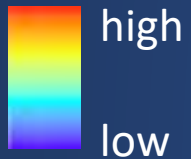


Fairbanks-White Mountains area

Magnetics —total field

- Mafic terranes:
 - Seventymile
 - Livengood
- Plutons with reverse-magnetized contacts, skarns

Residual magnetic field

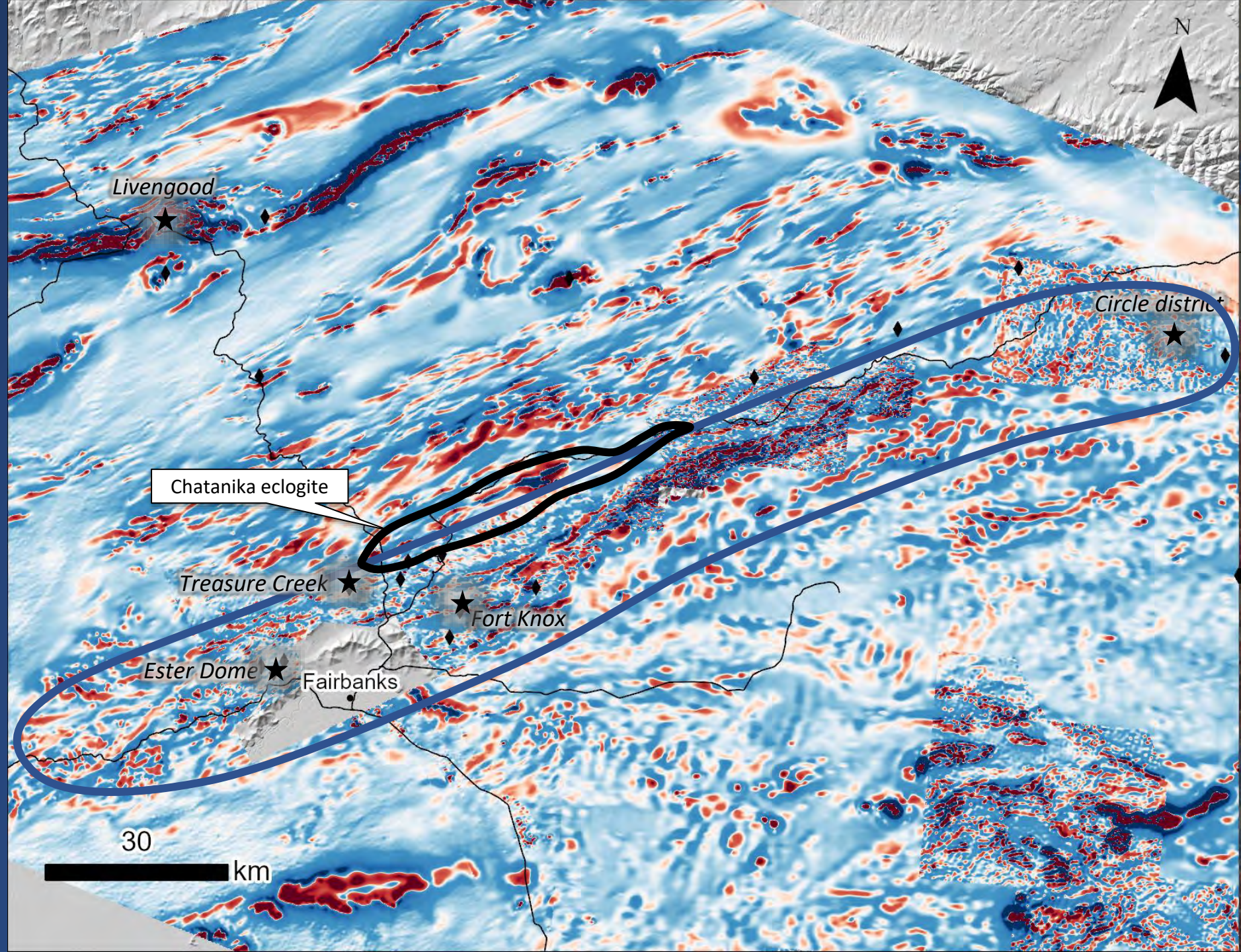


Fairbanks-White Mountains area

Magnetics— calc. 1st vertical derivative

- High-frequency mag highs connect Fairbanks and Circle districts: “Structural grain”
- Mapped in the Fairbanks area as amphibolite bodies
- Parallels Chatanika eclogite
- New survey data highlight differences with region to the southeast

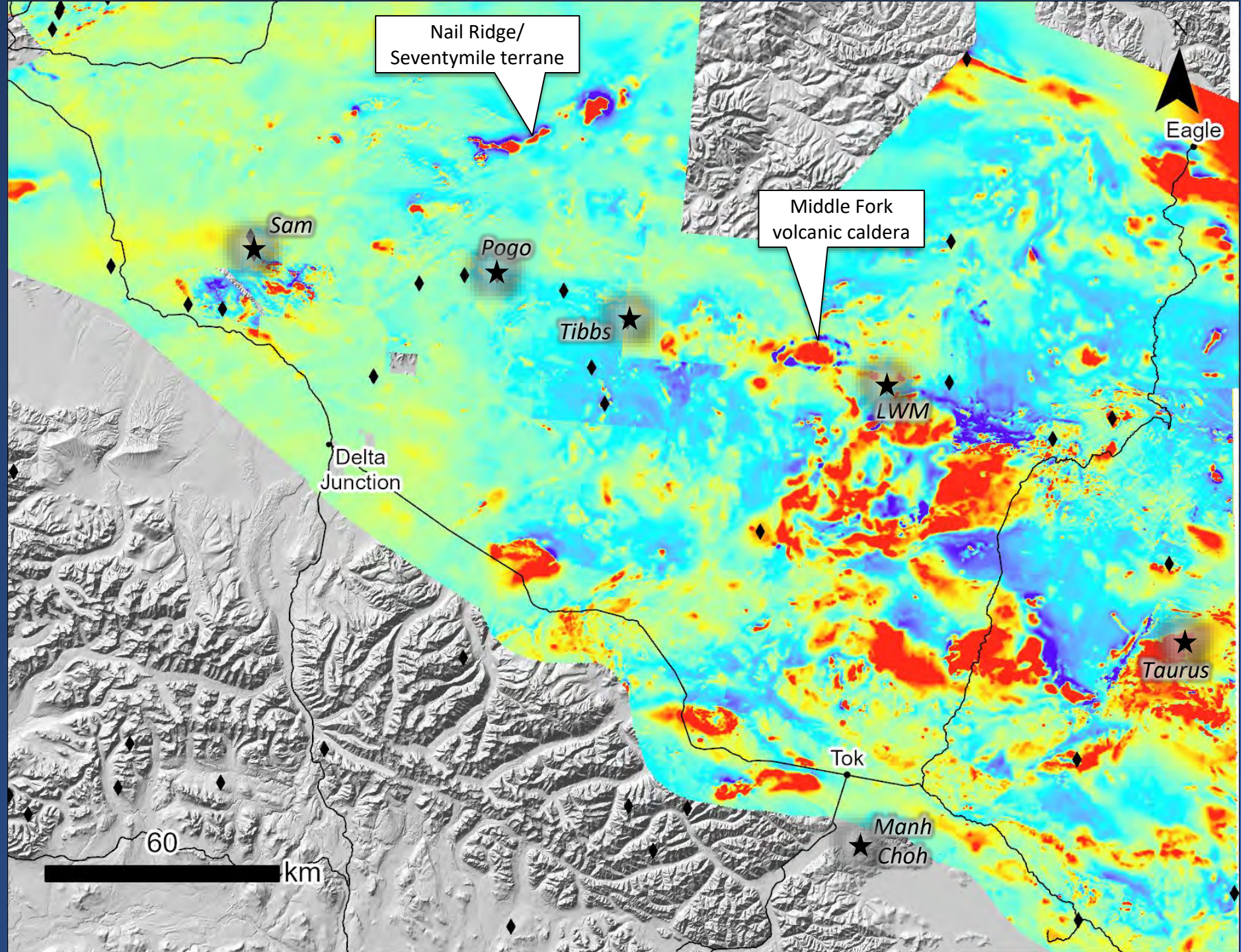
Calc. vertical derivative



Eastern Interior Alaska

Magnetics —total field

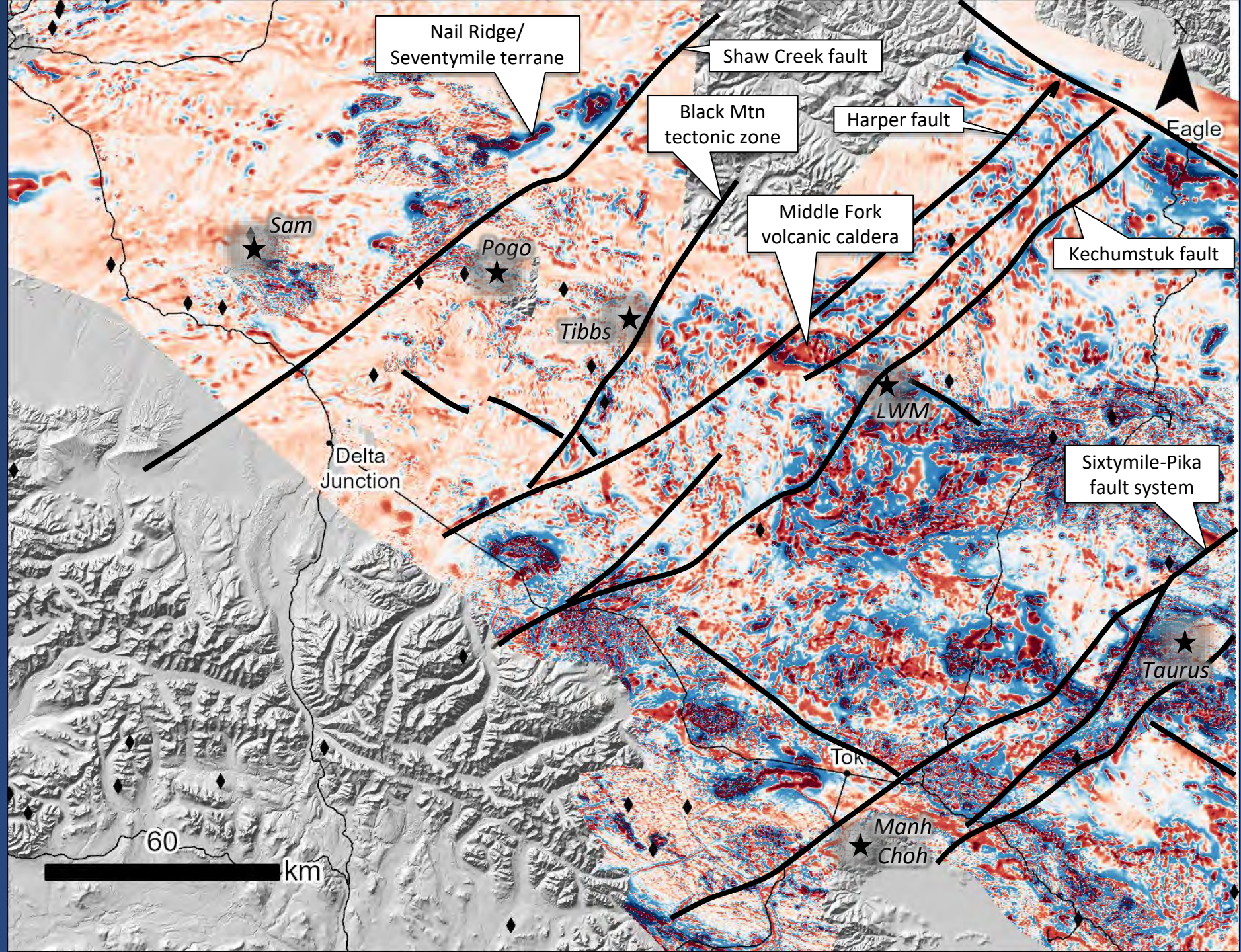
- Busy magnetics due to assortment of magnetite and non-magnetite-bearing plutons and volcanic rocks
- Triassic through Paleogene



Eastern Interior Alaska

Magnetics— calc. 1st vertical derivative

- Geophysical survey coverage highlights major structures
- Identifies areas where mapped faults probably don't have large displacement

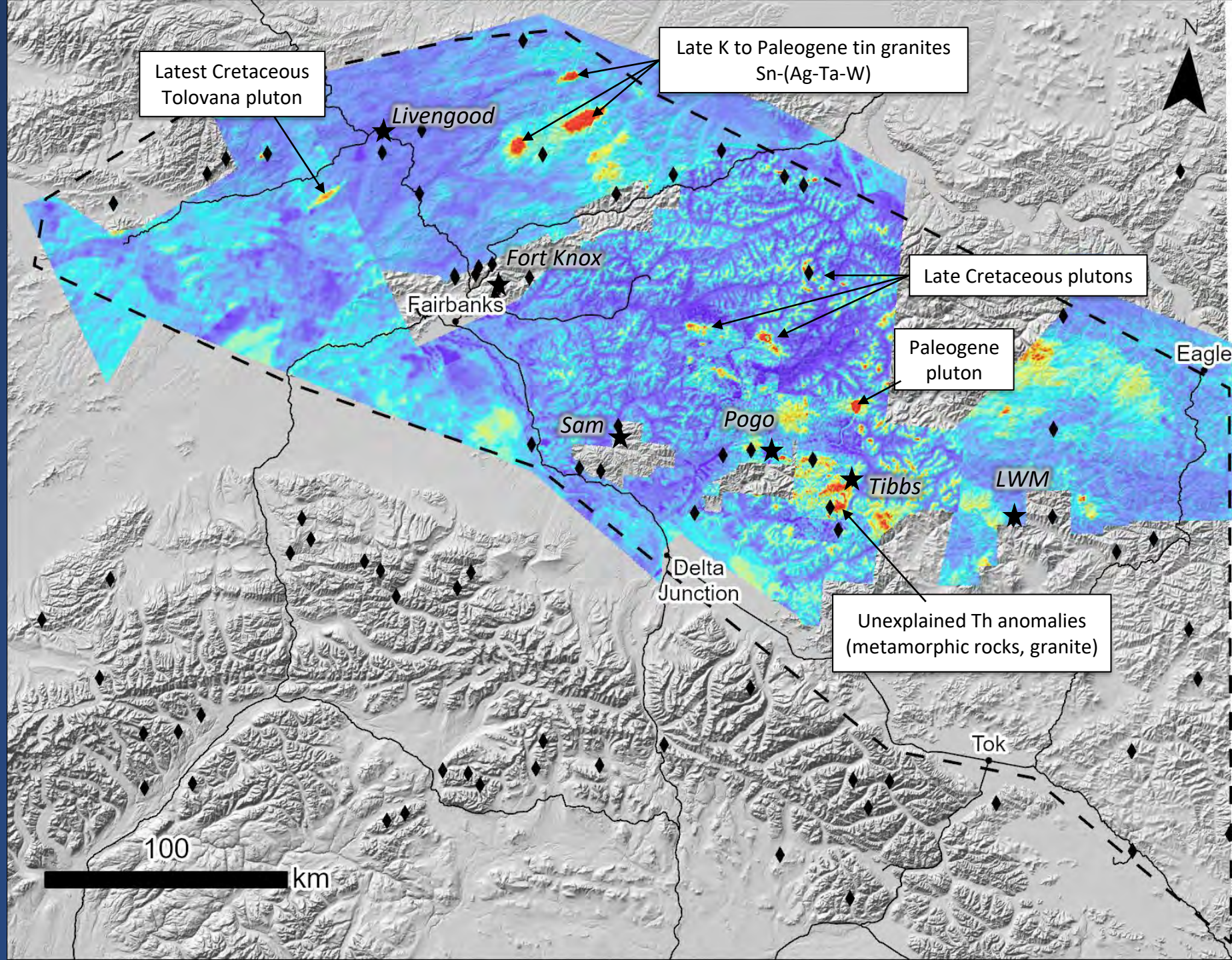
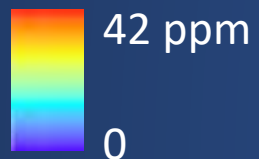


Yukon Tanana Upland Surveys

Radiometrics

- “Opportunistic” meaning the surveys were not optimized for radiometric data collection
- Area is partially covered/vegetated, resulting in some noise, topo signal
- Late Cretaceous-Paleogene plutonic suites are clearly mapped, especially by Thorium

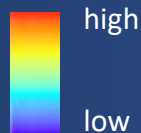
Th equivalent



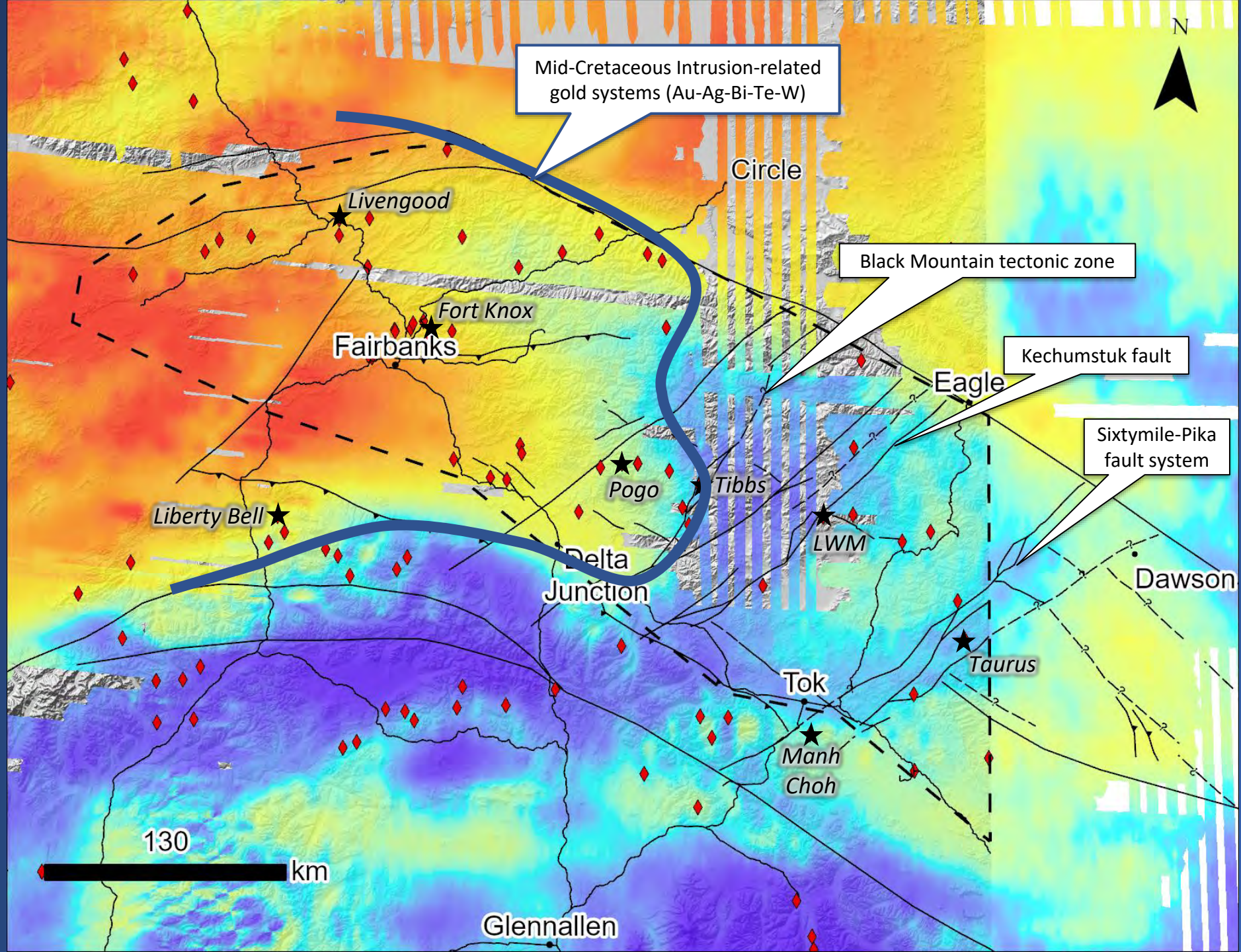
Yukon Tanana Uplands Airborne Gravity

- NOAA GRAV-D survey
 - Airborne; 2009-present
- Refine geoid and vertical datum for flood modeling
- NOAA distributes Free-Air product
- Shown at right: Draft internal Complete Bouguer Anomaly (CBA)
- DGGs hopes to process and release gravity products for industry use
- <https://www.ngs.noaa.gov/GRAV-D/index.shtml>

Gravity: CBA



YTU focus area



Looking Ahead: Magnetic/radiometric acquisition moves to the Kuskokwim Mineral Belt

-  Critical mineral belts
-  TIER II magnetic data
-  TIER III magnetic data

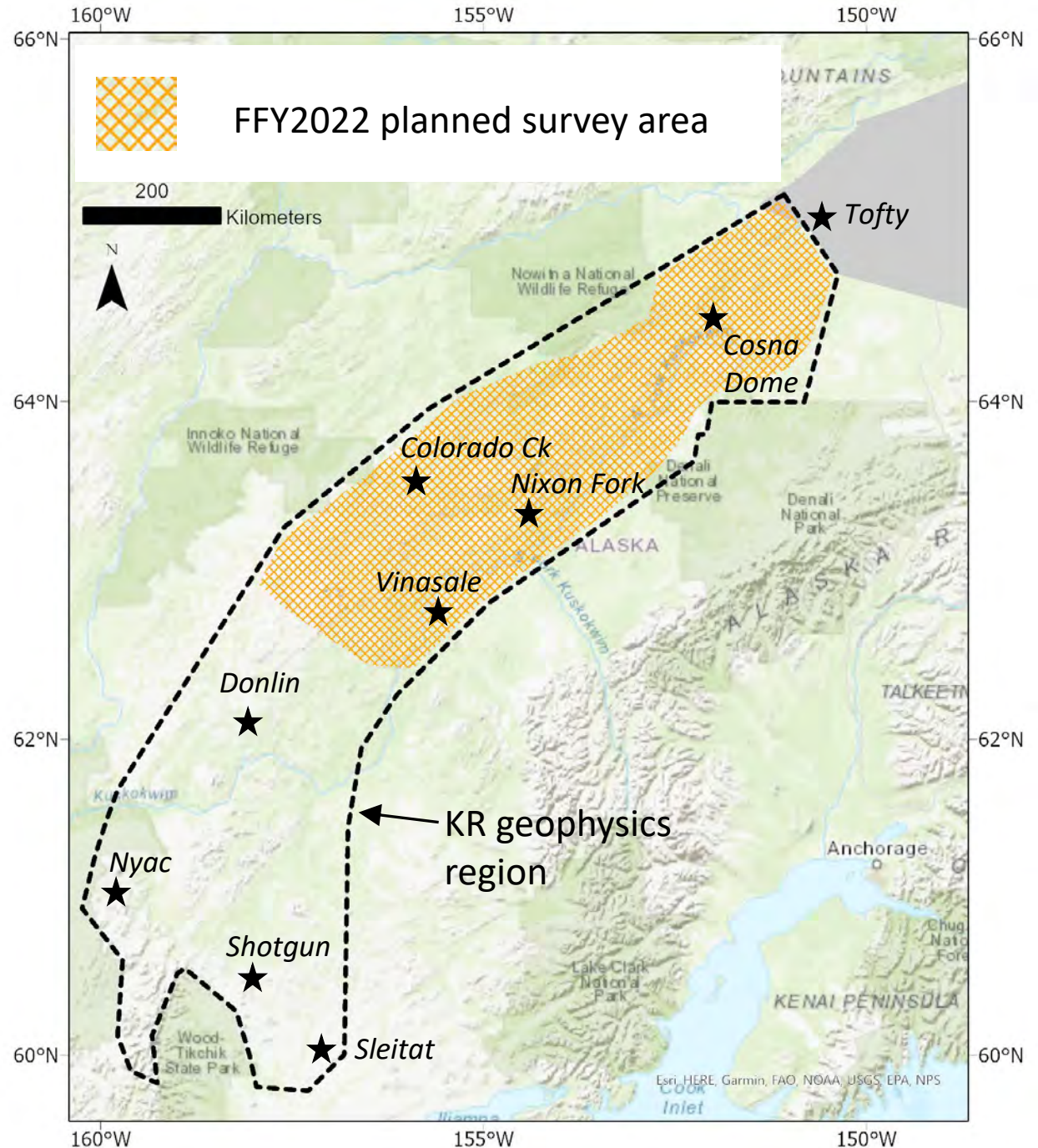

400 km



Kuskokwim River (KR) focus
area, FFY2022,
data collection May 2023 - ?

FFY2022 Kuskokwim River Program

- TIER II magnetic + radiometric
- 75% fixed-wing 25% helicopter
- 40,000 to 50,000 sq km
 - 3x typical annual program
 - Multiple vendors
- Data collection begins May 2023



Electromagnetic data coverage 2019 (pre-Earth MRI)



critical mineral belts



electromagnetic data

400 km

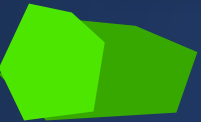
400 km



Anticipated electromagnetic data coverage after completion of FFY2022 program

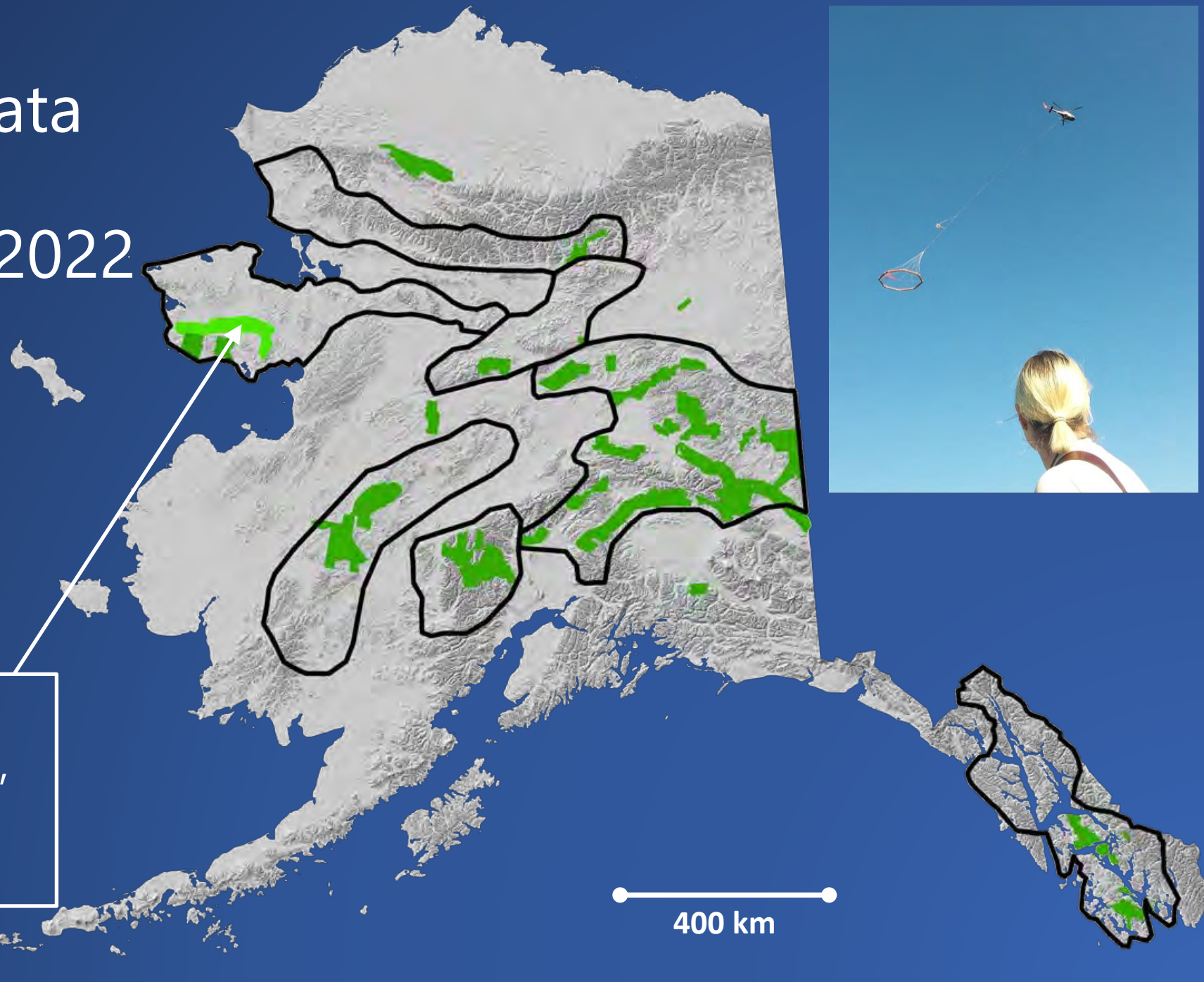


critical mineral
belts



electromagnetic
data

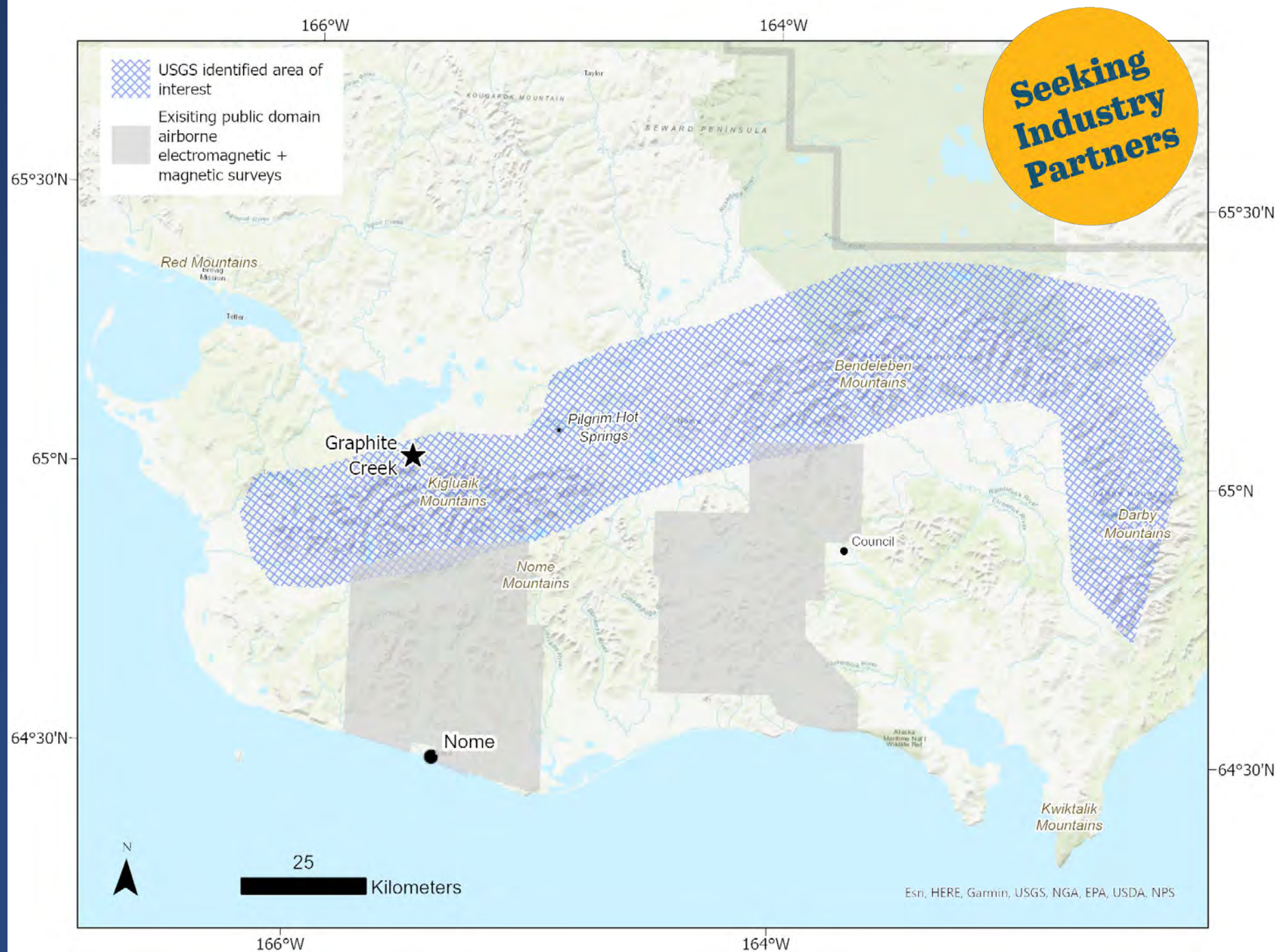
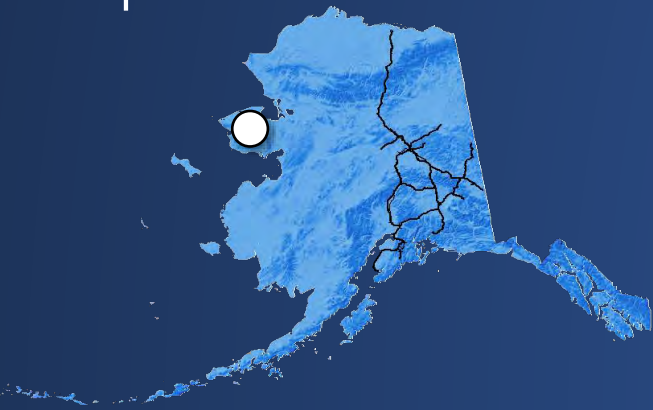
Seward Peninsula (SP)
graphite area, FFY2022,
data collection Feb –
May 2023



400 km

FFY2022 Seward Peninsula Program

- Electromagnetic data
- Time domain system
- Helicopter
- 1,000 to 3,000 sq km
- Data collection Feb - May 2023
- Industry participation expected



Finally...join us!

Now hiring: DGGS Geophysicist

- Lead, manage, & implement a very dynamic regional airborne geophysical program
- Closes November 16
- See job posting on Workplace Alaska:
<https://www.governmentjobs.com/careers/alaska/jobs/3779550-0/>



photo by: Gina Graham

Participate in upcoming geophysical Surveys

- Improve data quality over areas of interest
 - Closer line spacing
 - Helicopter survey over areas planned for fixed-wings
- Upcoming areas:
 - Kuskokwim Mineral Belt
 - Seward Peninsula
- Cost synergy
- Data become public
- Contact Melanie Werdon for details
melanie.werdon@alaska.gov