Alaska Division of Geological & Geophysical Surveys

New Pogo Area Airborne Magnetic and Radiometric Data and DGGS Yukon-Tanana Uplands Update

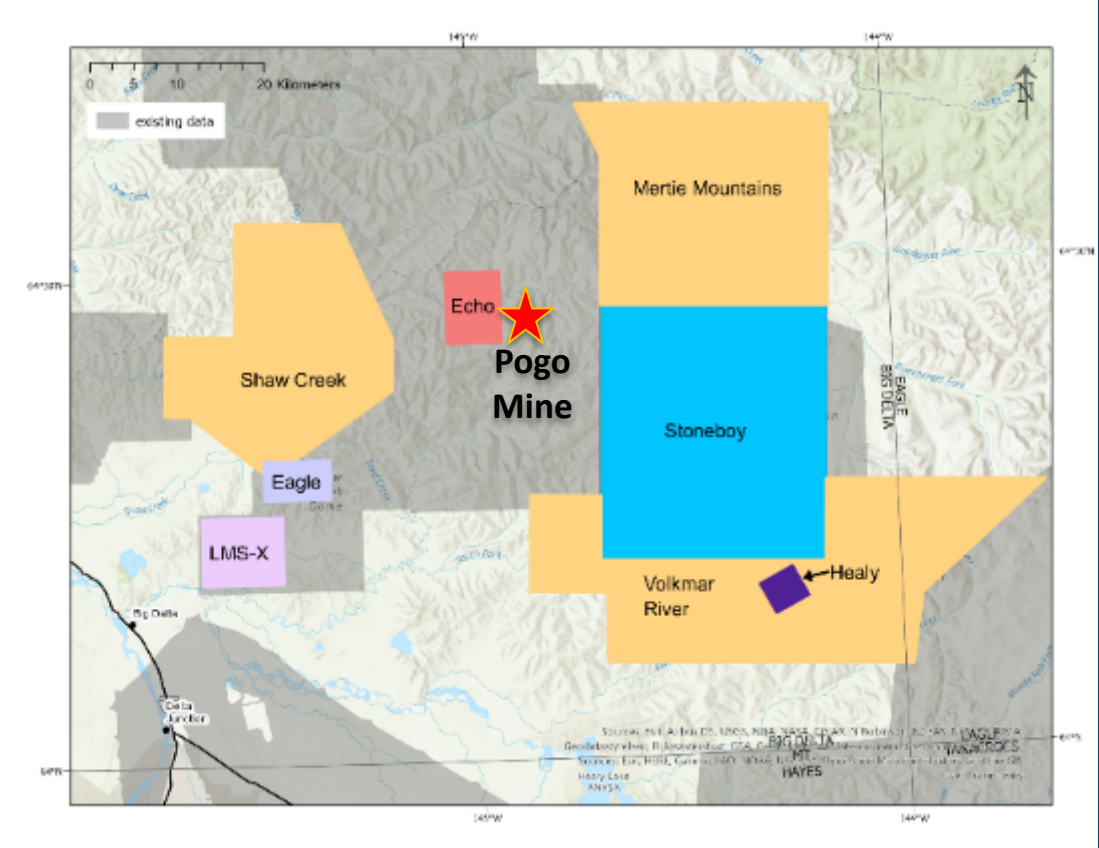
by Abraham Emond, Evan Twelker, and Melanie Werdon

Alaska Miners Association Annual Convention
Tuesday, November 3, 2020

Outline

- New Shaw Creek-Shawnee Peak Geophysics Data
- Geophysics Program Update
- Geologic Mapping Update

State-Industry FY2020 Geophysical Survey



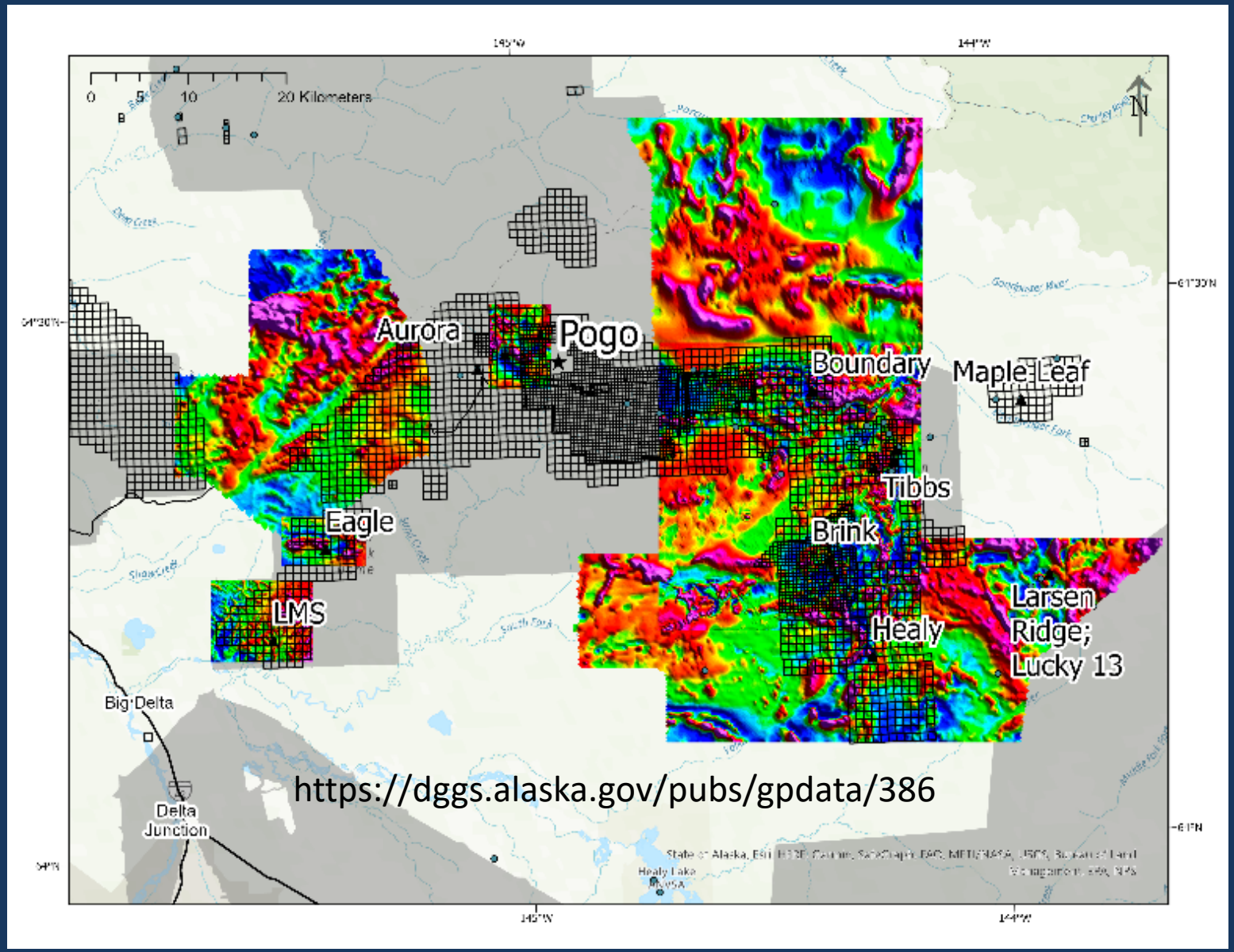
- Funding
  - Industry: $305,000 - THANK YOU Northern Star (Pogo), Millrock Resources, and Northway-Kenorland!
  - State: $250,000
- Regional and detailed helicopter-based magnetic & radiometric data
  - 2,600 km^2 in Big Delta Quadrangle
- Ties together magnetic data coverage of region
- Industry contributions lowered DGGS cost by 20%
- Increased DGGS data collection of detailed data
- It will enable DGGS to improve region's geologic mapping in future projects

STATUS:

- Survey completed in late July 2020
- Preliminary data published in early August to benefit industry exploration programs
- Final data scheduled to be published mid-November 2020

Shaw Creek and Shawnee Peak Survey

State-Industry FY2020 Geophysical Survey



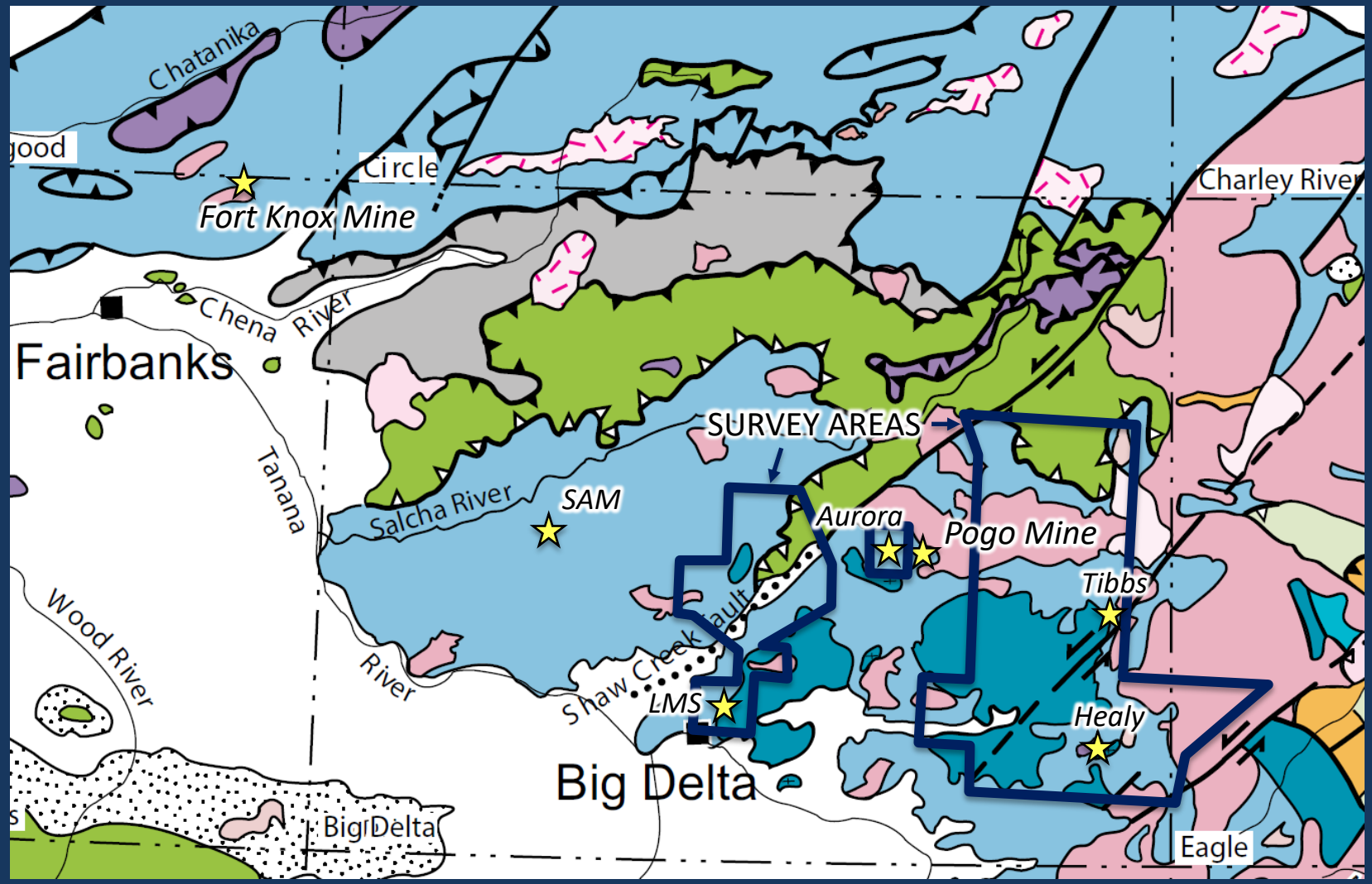
Magnetic data,
claim blocks, Pogo mine,
& major prospects

Regional Geology

Legend

- Cretaceous intrusions
- Seventymile, etc. (oceanic rocks)
- Butte assemblage (greenschist grade)
- Blackshell, Dan Ck. (carbonaceous units)
- Lake George assmblg.: (amphibolite grade)

- Thrust fault
- Low-angle normal fault

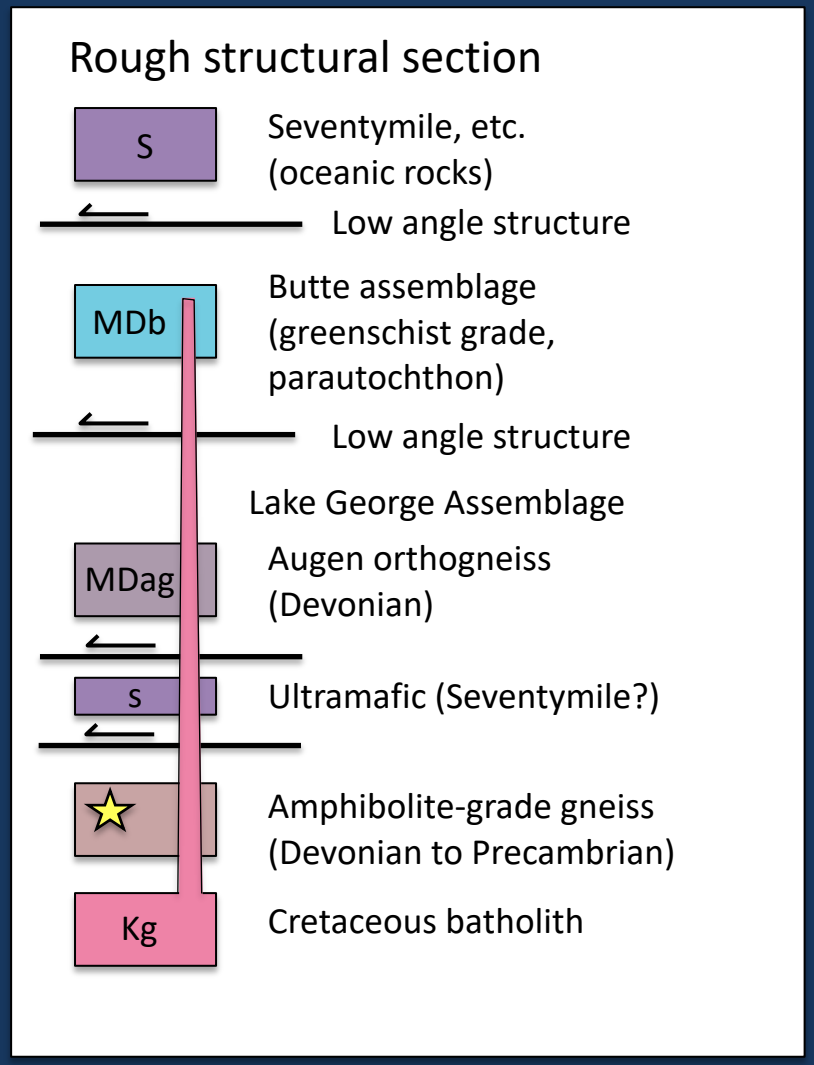


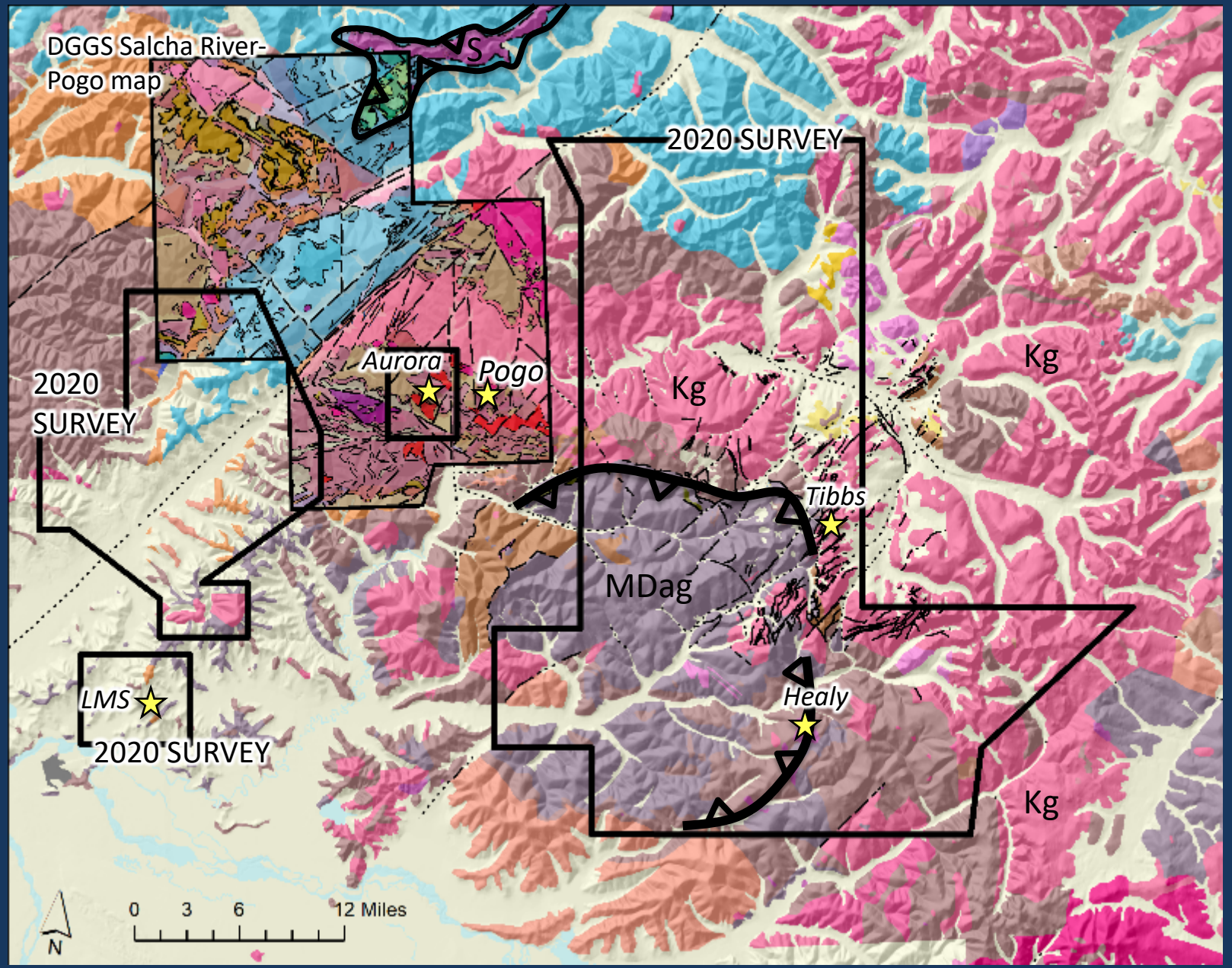
after Dusel-Bacon and others (2017)

Generalized Timeline:

Precambrian-Mississippian Protolith deposition	Early Cretaceous Peak metamorphism	~ 112 Ma Extension, exhumation, metamorphic cooling	~ 105 Ma Magmatism Pogo	~ 90 Ma Magmatism Ft Knox	~ 55 Ma Extensional magmatism

Area geology: Low-angle features





after Wilson and others (2015) and Werdon and others (2004)

Geophysics: Low-angle features

Total magnetic field:

- Arcuate belts of fault-bound serpentinite bodies
- A geophysical expression of regional shear zones
- Association with gold prospects; direct control in some places

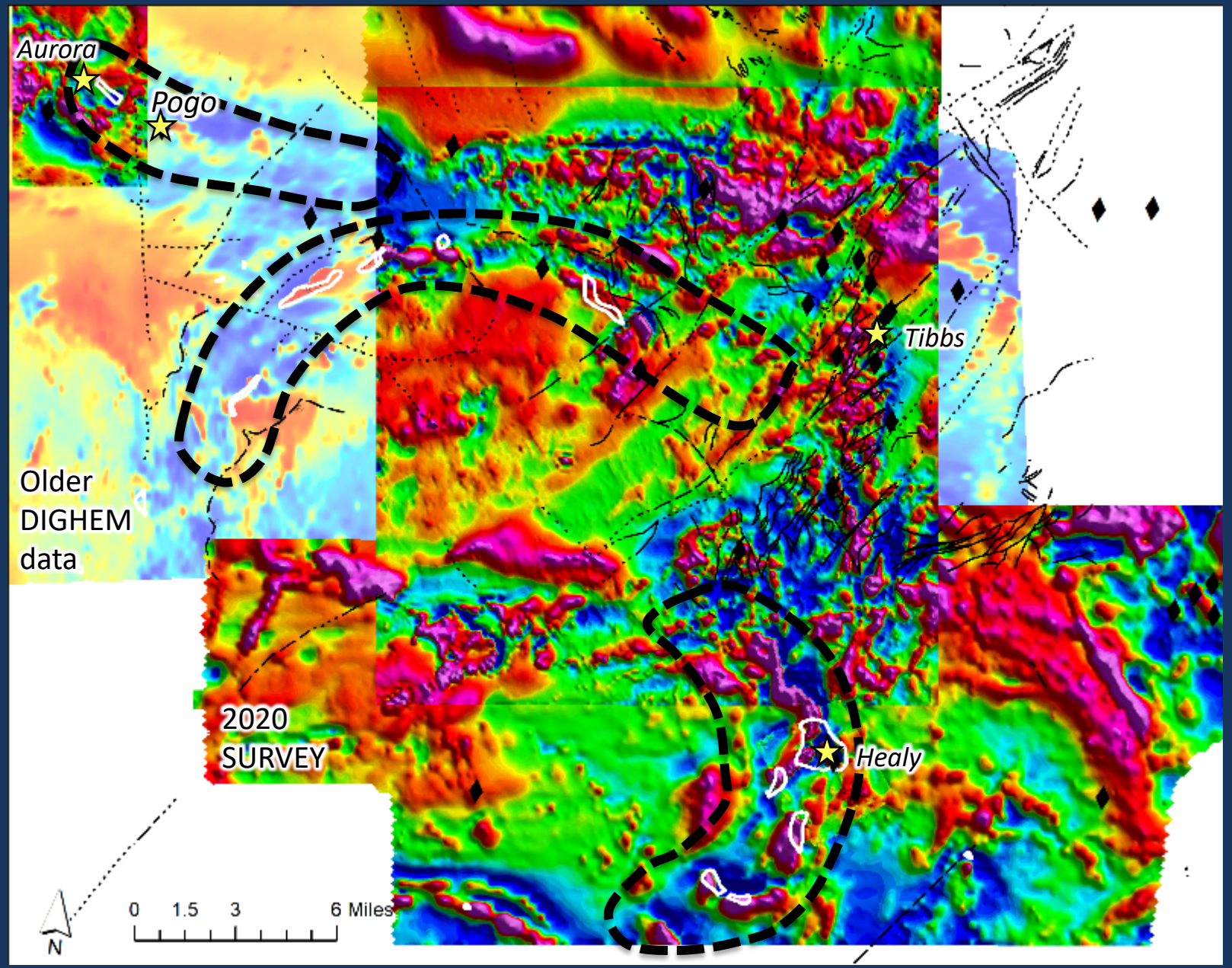
Map legend:

Serpentinite/metamorphosed mafic-ultramafic rocks

Mapped faults

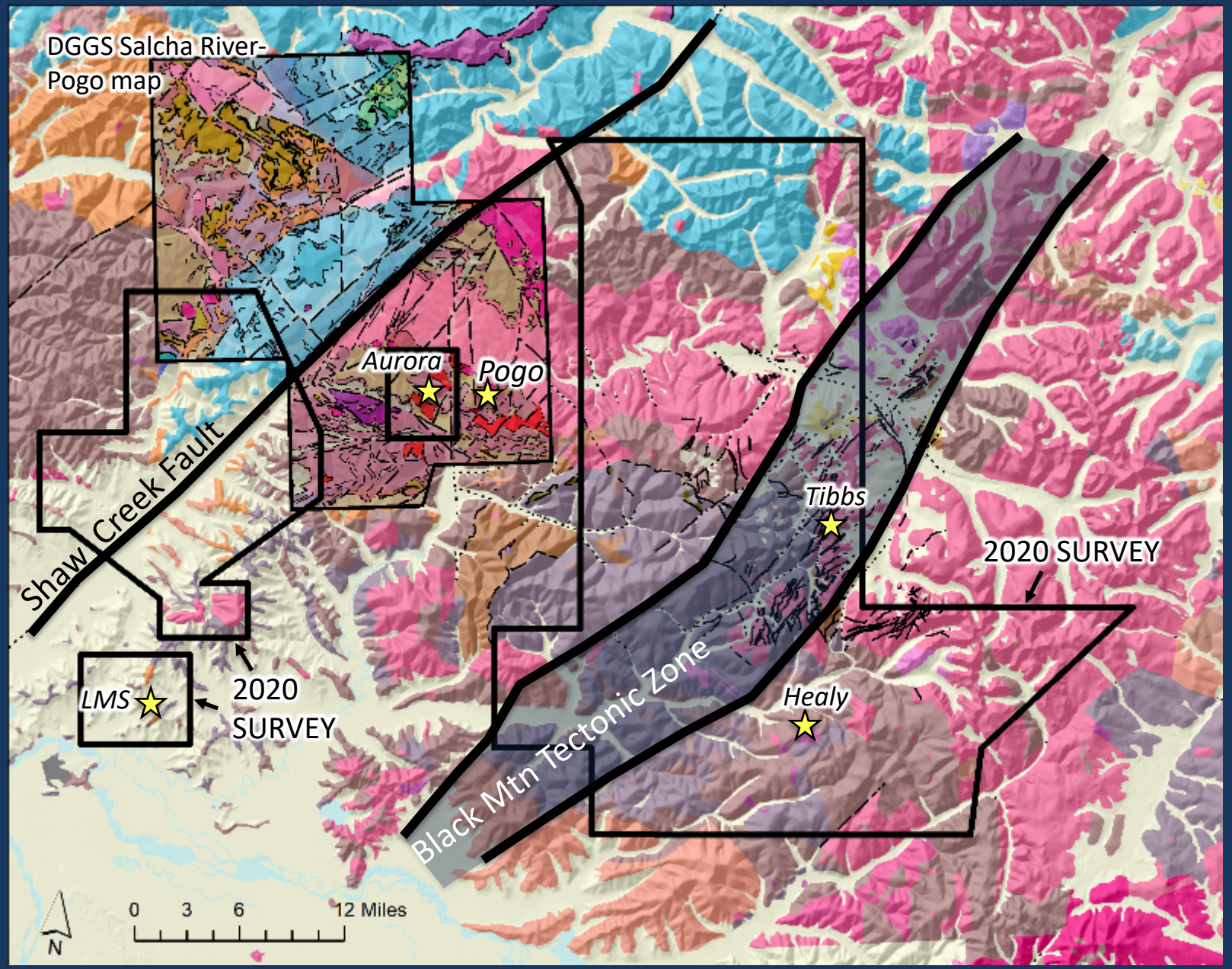
Alaska Resource Data File prospect

(geology from Wilson and others, 2015)



Area geology: High-angle features

- Survey area cut by two regional, northeast-trending fault zones
- Shaw Creek Fault
- Black Mtn. Tectonic Zone
  - Active mid-Cretaceous through Quaternary
  - Localizes mid-Cretaceous intrusions
- Numerous other similar faults
- Controls some gold mineralization



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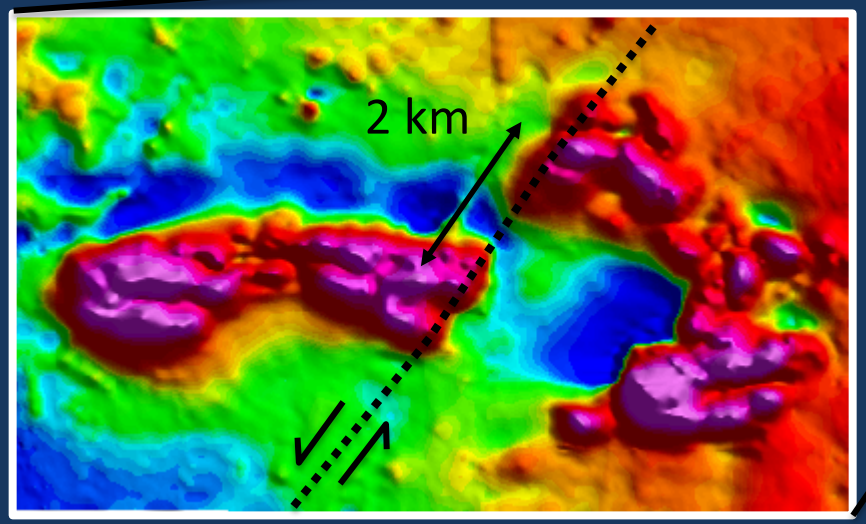
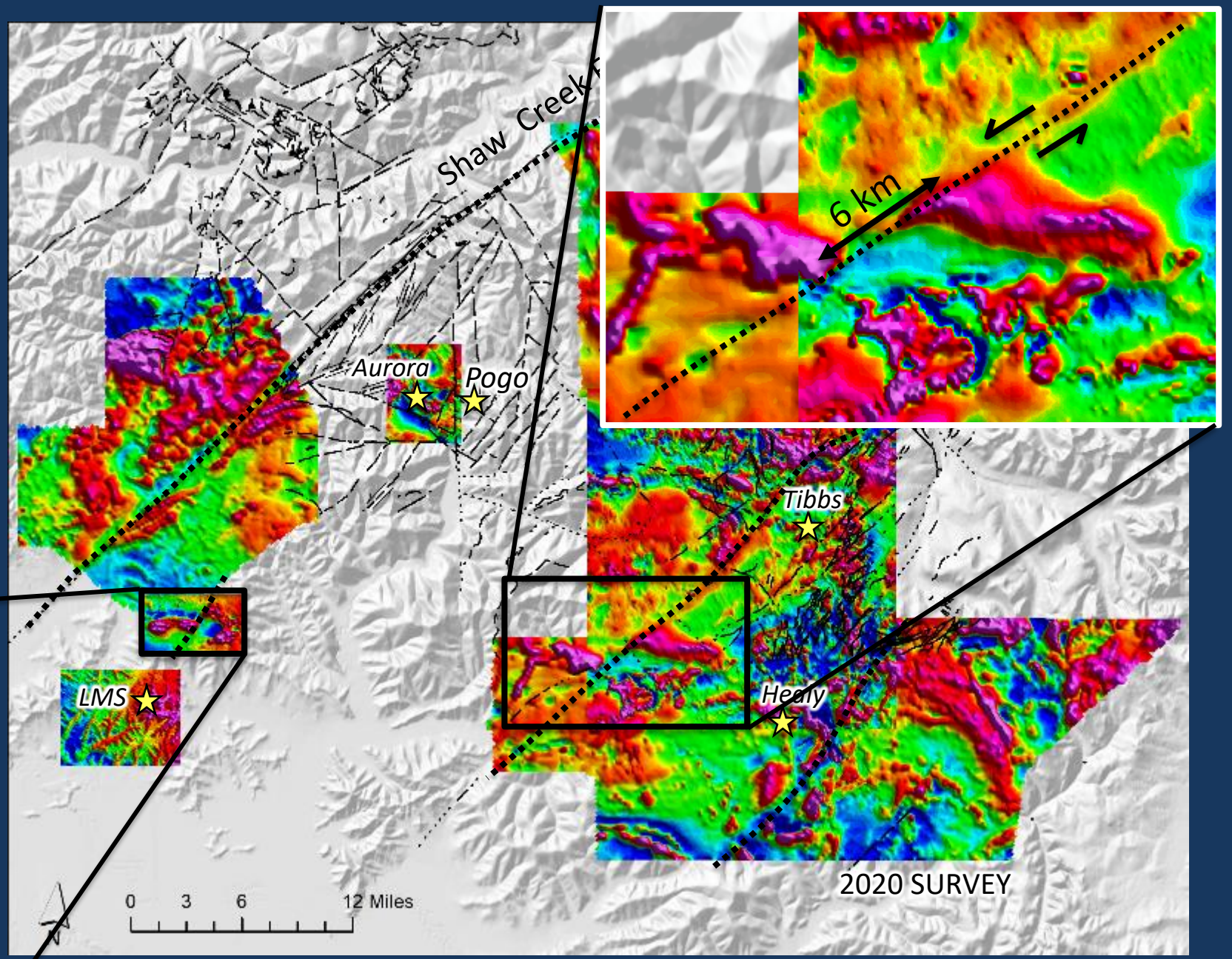
Geophysics: High-angle features

Total magnetic field

- Left-lateral apparent displacements visible
- Numerous intricacies yet to be mapped out

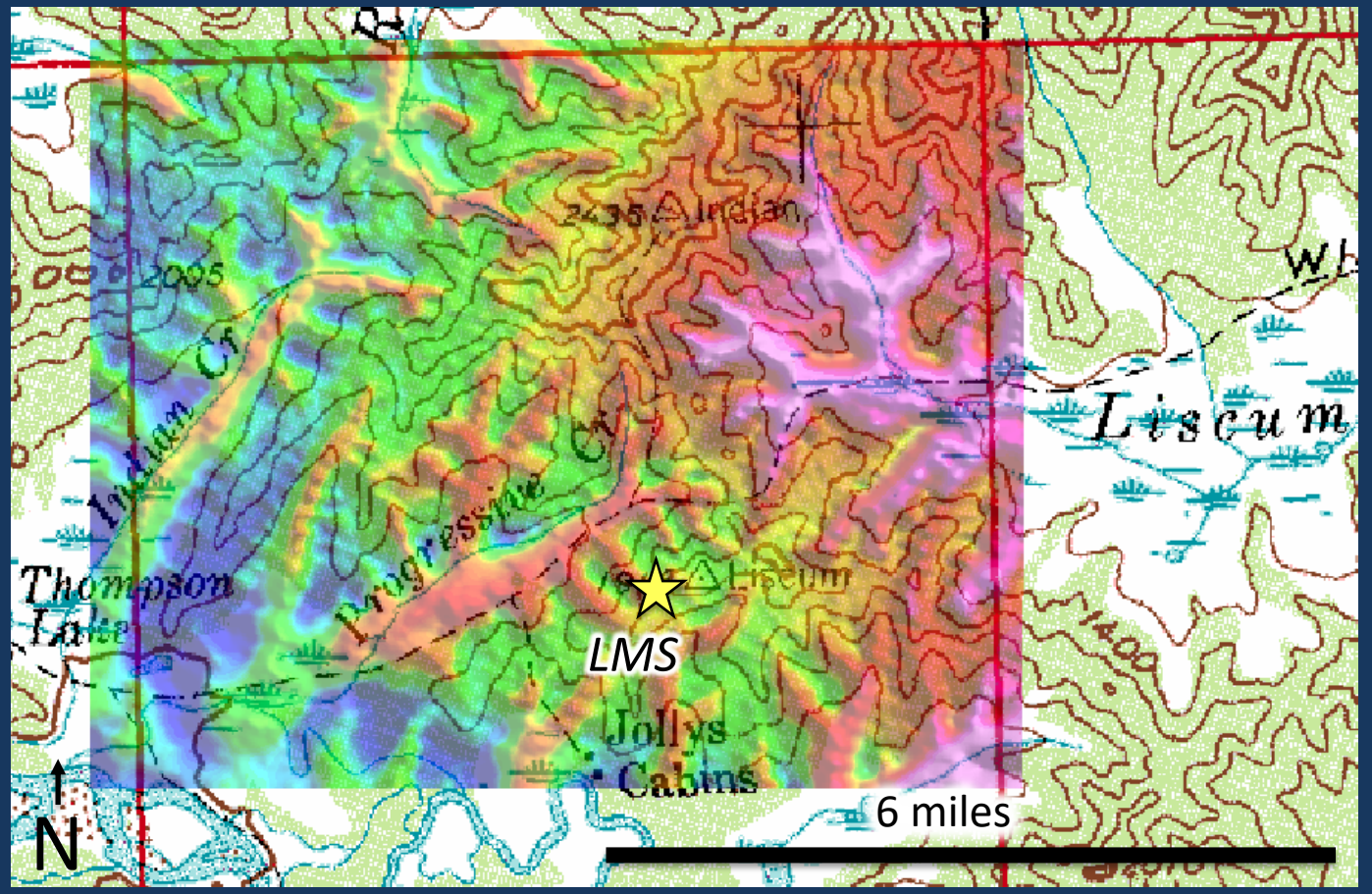




after Wilson and others (2015) and Werdon and others (2004)

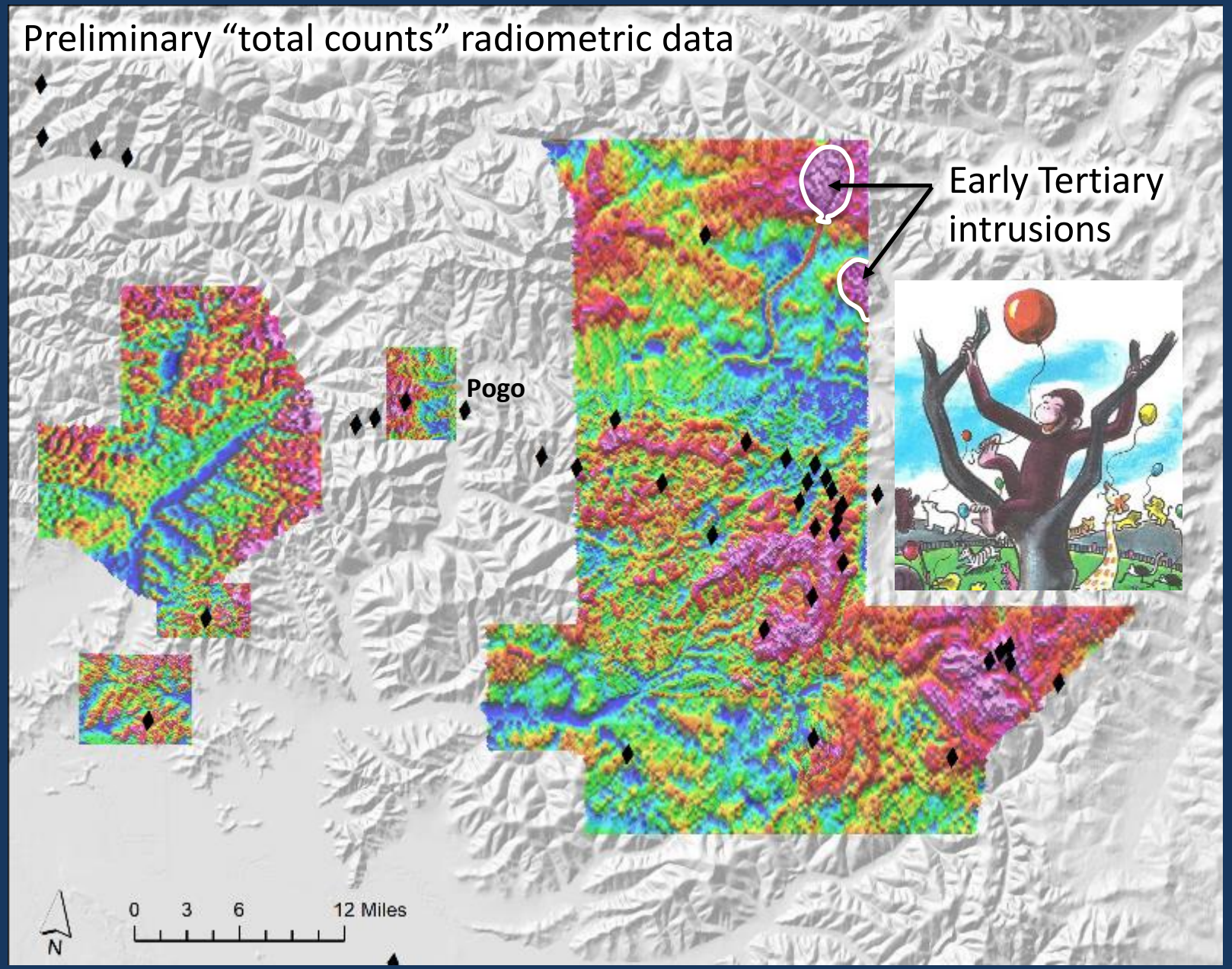
Effects of Quaternary geology

- The southwestern-most survey, the LMS block, is dominated by dendritic magnetic highs coincident with valley bottoms
- Likely explanation: magnetite-rich glacial drift from the Alaska Range (mafic-ultramafic rocks) and/or magnetite lag deposits, as documented at Quartz Lake by Reger and Pewe, 2002



“Opportunistic” Radiometrics

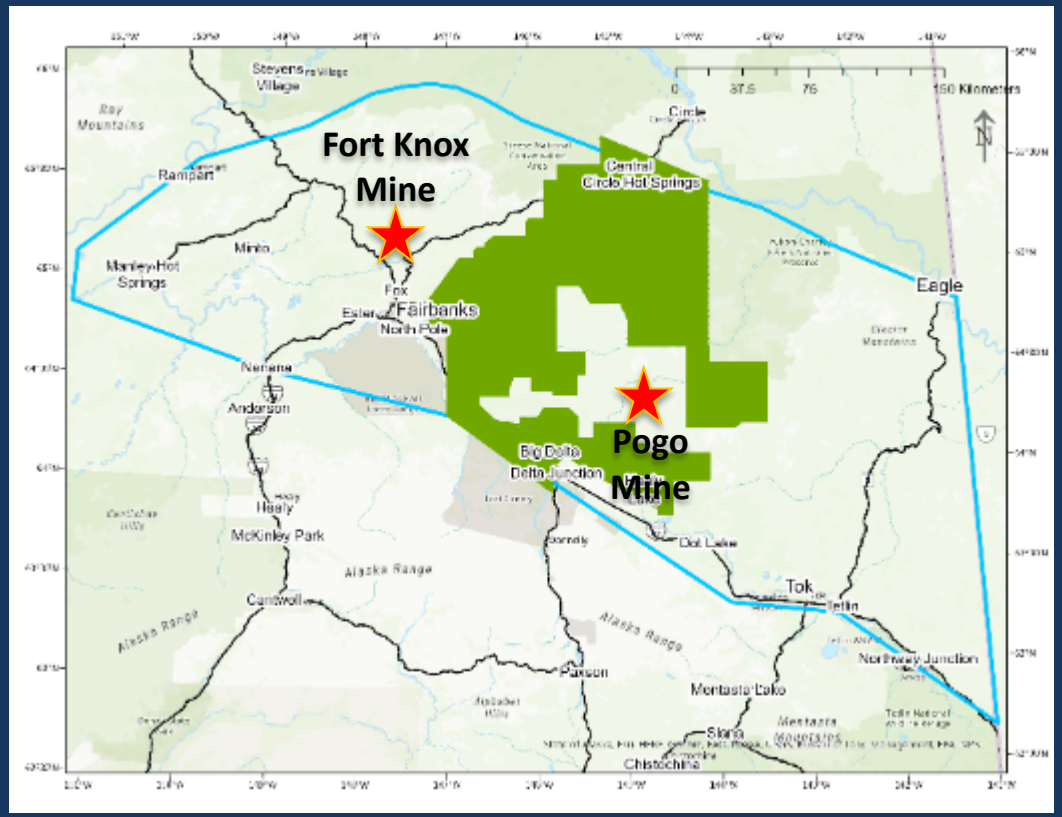
- Preliminary “total counts” data
- Need final data for QC and more nuanced interpretation
- Early Tertiary (55-61 Ma) intrusions stand out in Total Counts



Current DGGS Geophysics Projects

- Earth MRI FFY2019 Geophysical Survey
- Earth MRI FFY2020 Geophysical Survey
- Airborne Geophysical Data Maintenance

Earth MRI FFY2019 Geophysical Survey

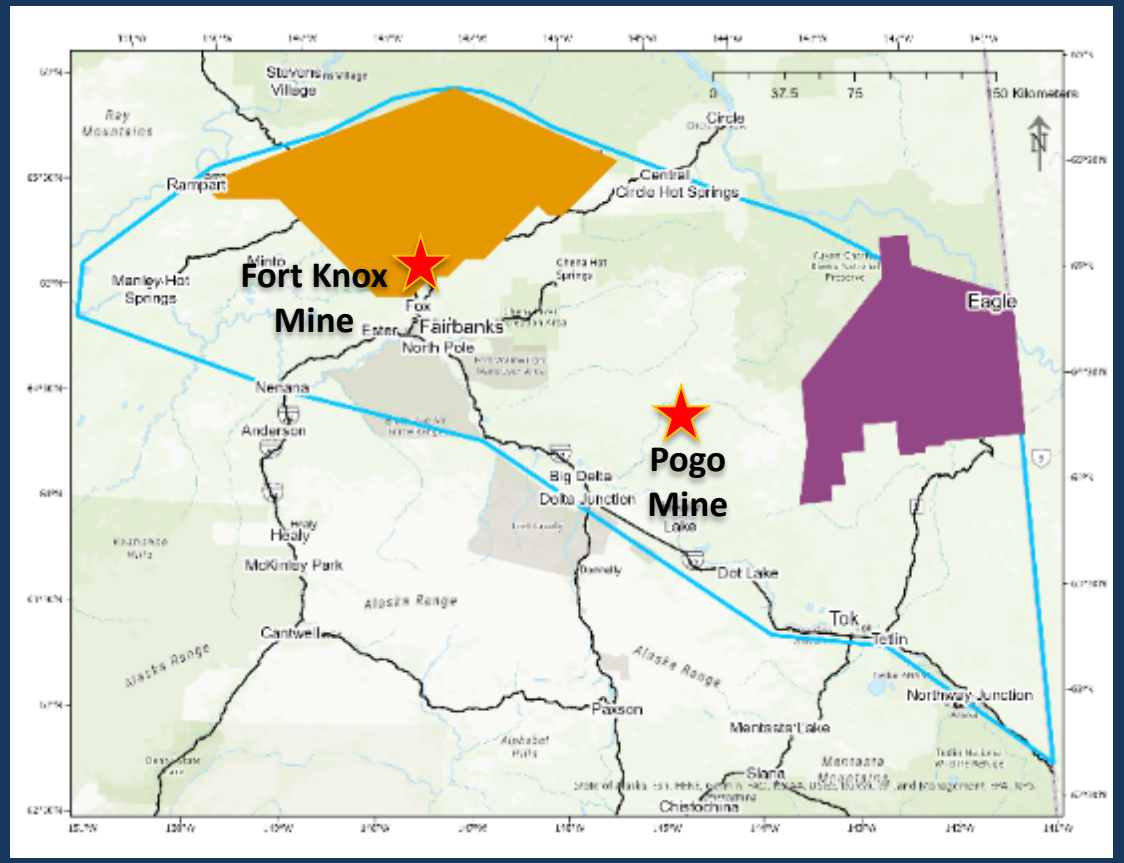


- Funding
  - USGS: $500,000 ($475K contractual / $25K salaries)
  - State: $25,000 contractual + salaries and IT
- Regional airborne magnetic & radiometric data
  - Located in central Yukon Tanana Uplands
  - 18,000 km^2 fixed-wing
- Completes magnetic data coverage of region
- Promotes resource exploration
- Will enable DGGS to improve region's geologic mapping

STATUS:

- Survey designed and final flight path approved
- Survey rescheduled for May 2021
  - Delayed due to Corona Virus

Earth MRI FFY2020 Geophysical Survey

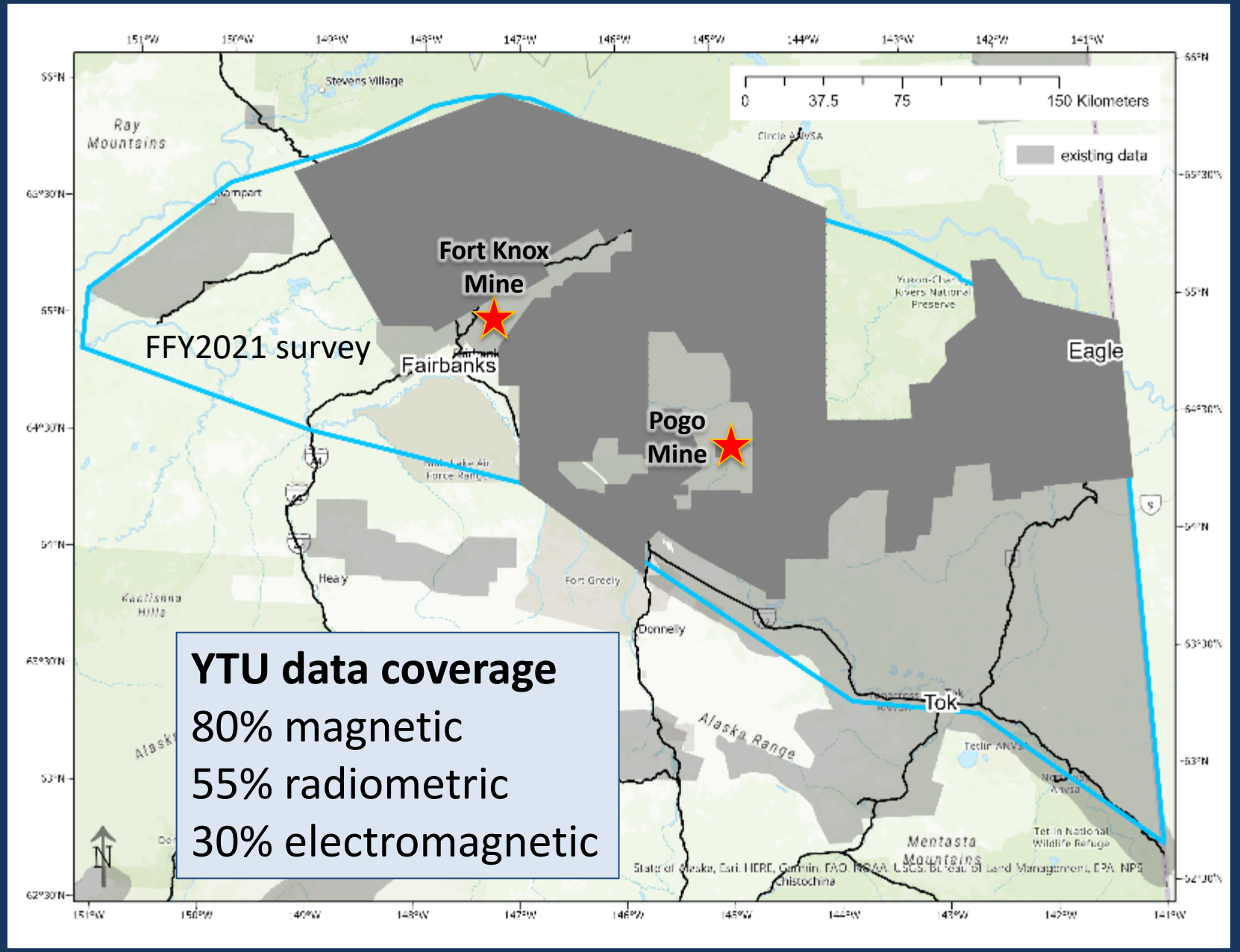


- Funding
  - USGS: $500,000 ($400K contractual / $100K salaries)
  - BLM: $175,000 ($160K contractual / $15K salaries)
  - State: salaries as needed and IT infrastructure
- Regional airborne magnetic & radiometric data
  - Surveys located in the eastern and western Yukon Tanana Uplands
  - 22,000 km^2 fixed-wing
- Completes magnetic data coverage of region
- Promotes resource exploration
- Will enable DGGS to improve region's geologic mapping

STATUS:

- Eastern YTU portion designed and final flight path approved
- Western YTU portion in design phase
- Scheduled for May 2021

Anticipated YTU magnetic data coverage 2021



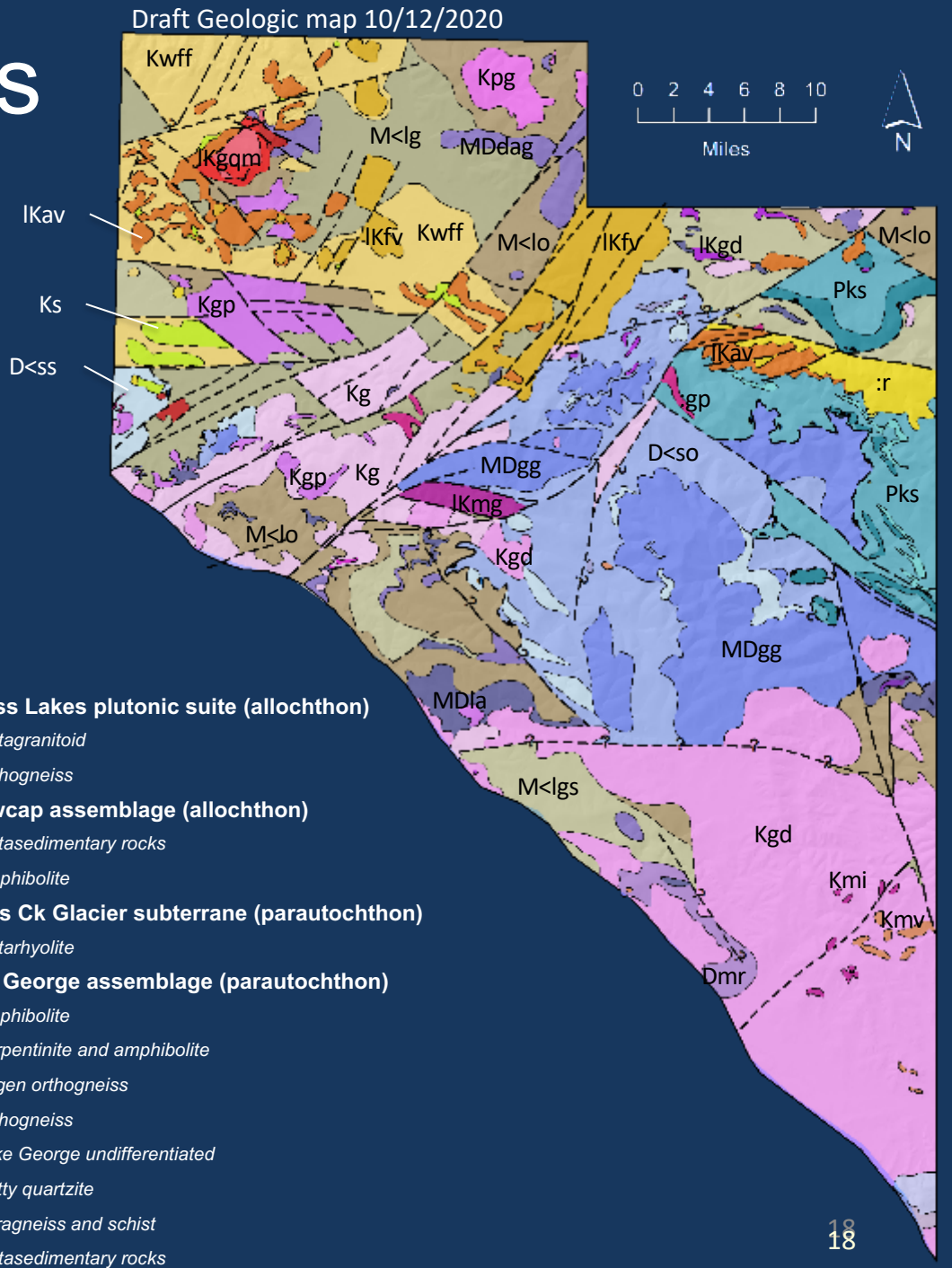
Airborne Geophysical Data Maintenance

- All DGGS “modern” airborne geophysical surveys available online: https://dggs.alaska.gov/pubs/geophysics
  - More accessible to public
  - Securely archived
  - Reduced custom data requests
- New interactive map and GIS services
  - Scheduled for year-end 2020 launch
  - Map-based search tool for users to locate data
  - ESRI Arc Portal based and a GIS service
  - Should reduce custom requests for survey footprints

Yukon Tanana Uplands Geology Update

Earth MRI - Eastern Tanacross

- 1,900 mi^2 new 1:100k-scale geologic map
- Lots of new information on the economically important Cretaceous intrusions and volcanics
- Published detailed petrology and REE potential report on the Mt. Fairplay alkaline intrusions
- Geochemistry published; U-Pb zircon ages are pending, Ar/Ar dates are in process



Legend

Paleogene volcanic and sedimentary rocks
- : r *Rhyolite*
- : s *Sedimentary rocks*

Paleogene intrusive rocks
- : gp *Granite porphyry*

Late Cretaceous volcanic rocks
- lKav *Alkaline volcanic rocks*
- lKfv *Felsic volcanic rocks*

Late Cretaceous intrusive rocks
- lKgd *Granodiorite*
- lKmg *Monzogranite*

Late Cretaceous Mt. Fairplay intrusive complex
- lKafs *Alkali feldspar syenite*
- lKm *Monzonite*
- Ksy *Syenite*
- lKgqm *Granite and quartz monzonite*

Mid-Cretaceous volcanic rocks
- Ks *Sedimentary rocks*
- Kwff *West Fork felsic tuff*
- Kmv *Volcanic rocks of McArthur Creek area*

Mid-Cretaceous intrusive rocks
- Kmi *Intermediate to felsic dikes of McArthur Creek area*
- Kgp *Granite porphyry*
- Kgb *Gabbro to diorite*
- Kgd *Granodiorite*
- Kg *Granite*
- Kpg *Peraluminous granite*

Permian Klondike assemblage (allochthon)
- Pkmb *Metabasite*
- Pks *Schist*
- Pkgs *Graphitic schist*

Dev.-Miss. Grass Lakes plutonic suite (allochthon)
- MDgg *Metagranitoid*
- D<so *Orthogneiss*

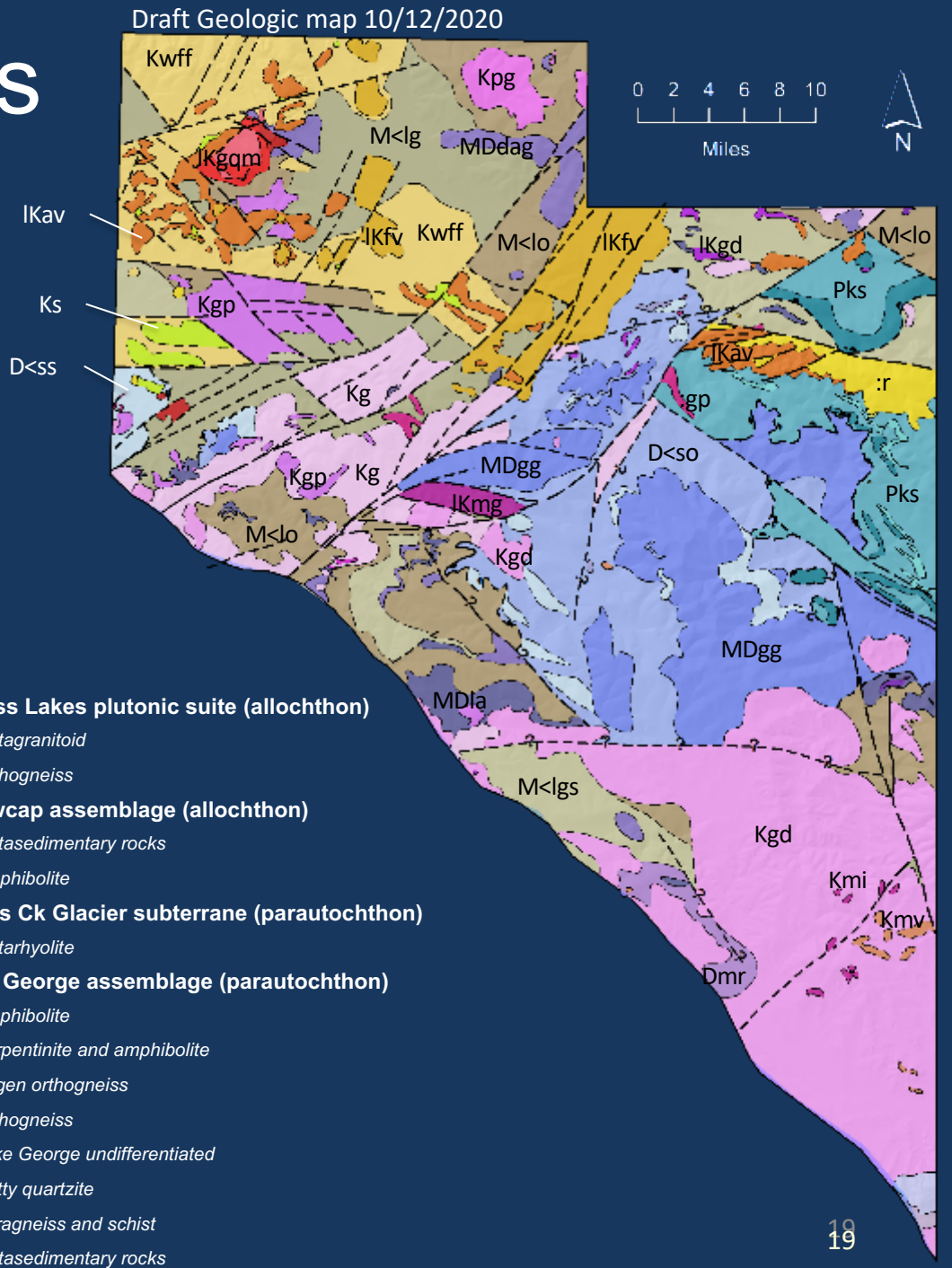
Pre-Miss. Snowcap assemblage (allochthon)
- D<ss *Metasedimentary rocks*
- D<sa *Amphibolite*

Devonian Jarvis Ck Glacier subterrane (parautochthon)
- Dmr *Metarhyolite*

Pre-Miss. Lake George assemblage (parautochthon)
- MDla *Amphibolite*
- MDlau *Serpentinite and amphibolite*
- MDdag *Augen orthogneiss*
- M<lo *Orthogneiss*
- M<lg *Lake George undifferentiated*
- D<gq *Gritty quartzite*
- pMlp *Paragneiss and schist*
- M<lgs *Metasedimentary rocks*

Earth MRI - Eastern Tanacross

- Major refinements to distribution of the fundamental metamorphic terranes of interior Alaska :
  - Klondike Assemblage
  - Ladue River unit (= Yukon's Snowcap & Grass Lakes?)
  - Mapped new outcrops of terrane-bounding shear zone
- Working on reconciliation with Yukon, adjacent maps
- On track to deliver map by July 2021 to USGS, the primary funding agency for this work; lesser SOA funds.



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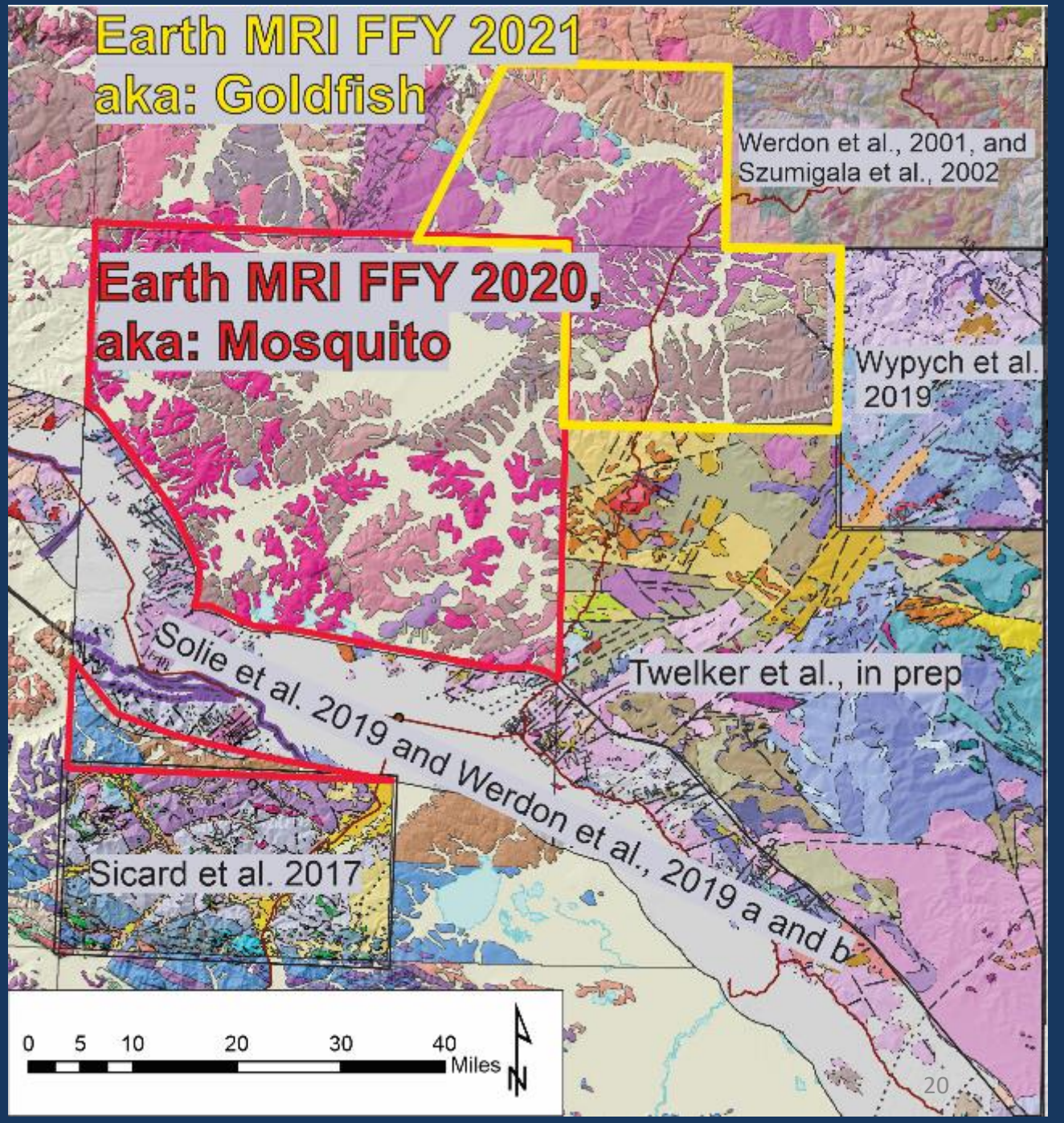
Earth MRI FFY 2020 and FFY2021

- Summer 2021:
  - 7-week field program:
    - 4-5 weeks for Mosquito project area mapping, 2-3 weeks for Goldfish project area mapping
  - 7-geologist field crew, rotation schedule
  - Work based from Cathedral Creeks B&B and Chicken
  - Total area to be mapped: 2,440 square miles



Earth MRI – USGS stream sediment geochemical reanalyses

- 2,453 samples reanalyzed
  - 2,453 ICP data including major and trace elements
  - 2,187 aqua regia data for metals
  - 370 fire assay for gold and PGE – more to come!