Preliminary results from 2014 geologic mapping in the Talkeetna Mountains, Alaska

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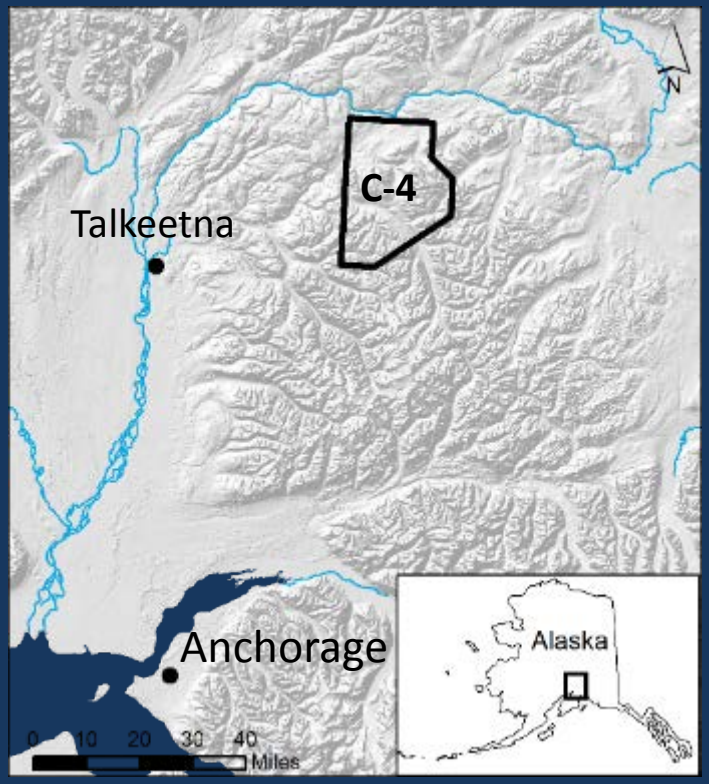
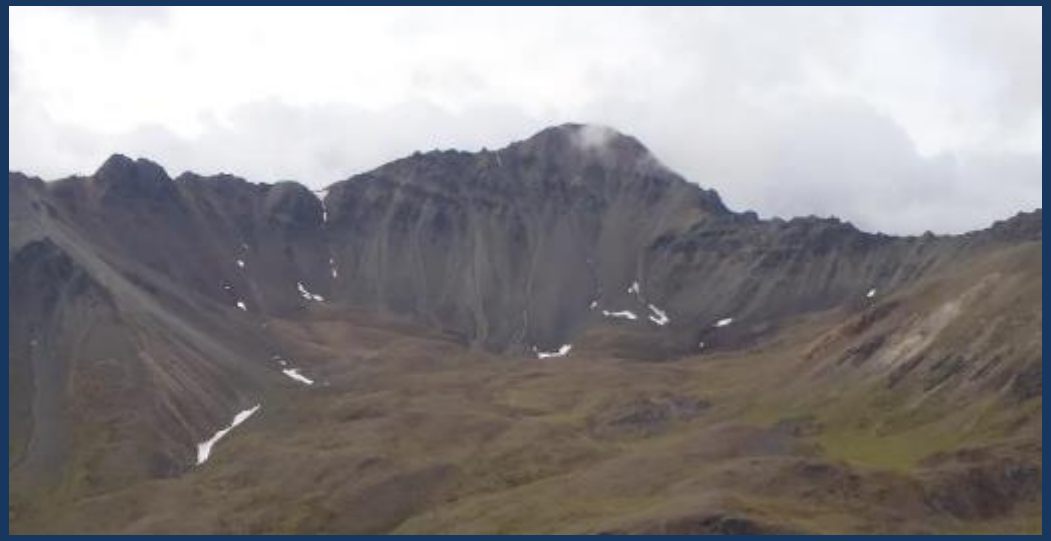
Please Note:

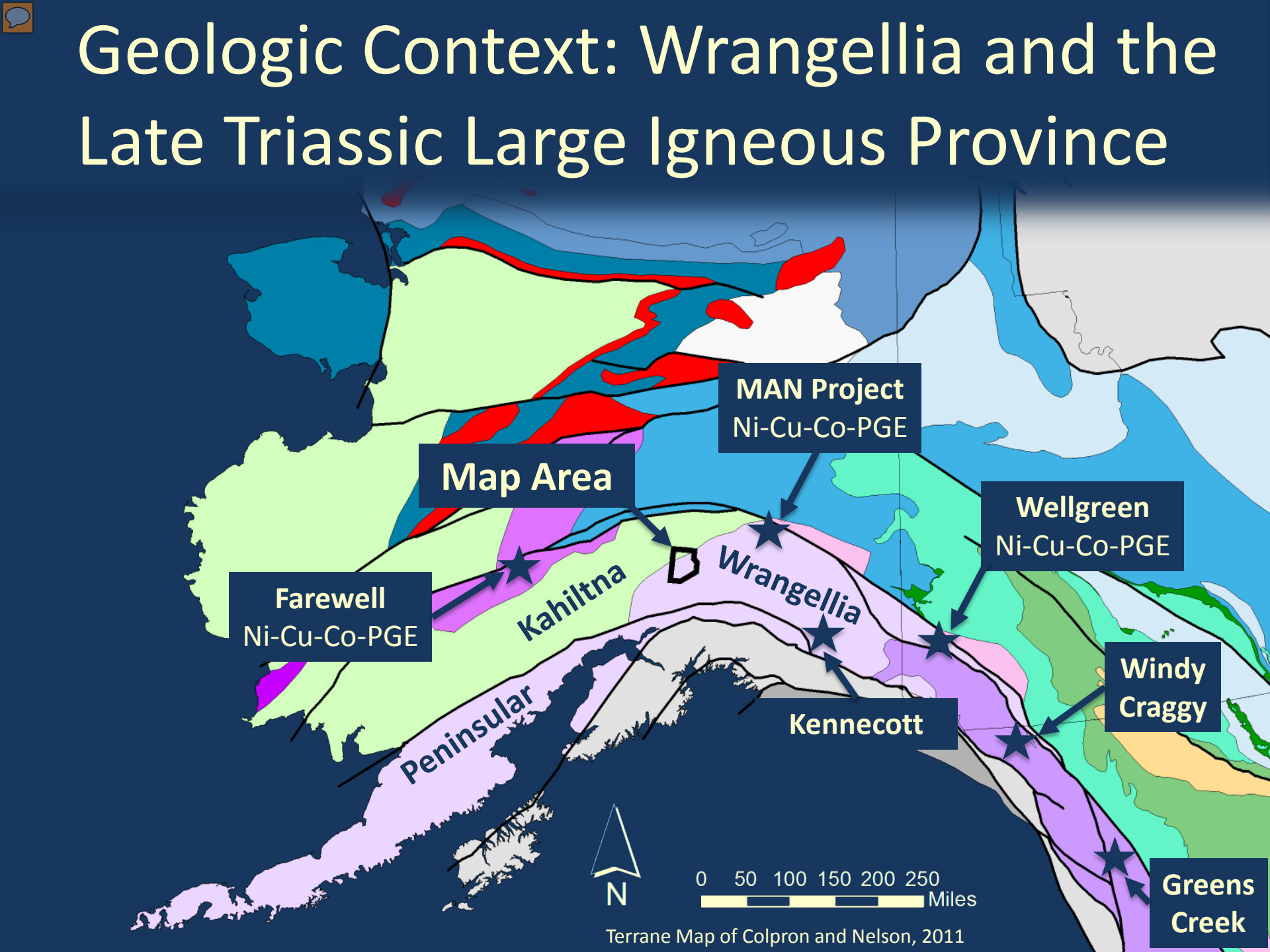
1. The map area has complex mineral and surface estate ownership including State of Alaska, Federal Bureau of Land Management, Cook Inlet Region Inc. (CIRI) and associated village corporations, as well as other private land owners. The user of this data is responsible for all land status research and for obtaining appropriate access and operating permissions prior to completing any follow-up field work.
2. This is a presentation of preliminary results and an early draft of the 2014 Talkeetna Mountains C-4 bedrock geologic map. Neither the draft map nor the presentation have been reviewed for technical content or for conformity to the editorial standards of the DGGS

Location: Talkeetna Mountains C-4 (+)



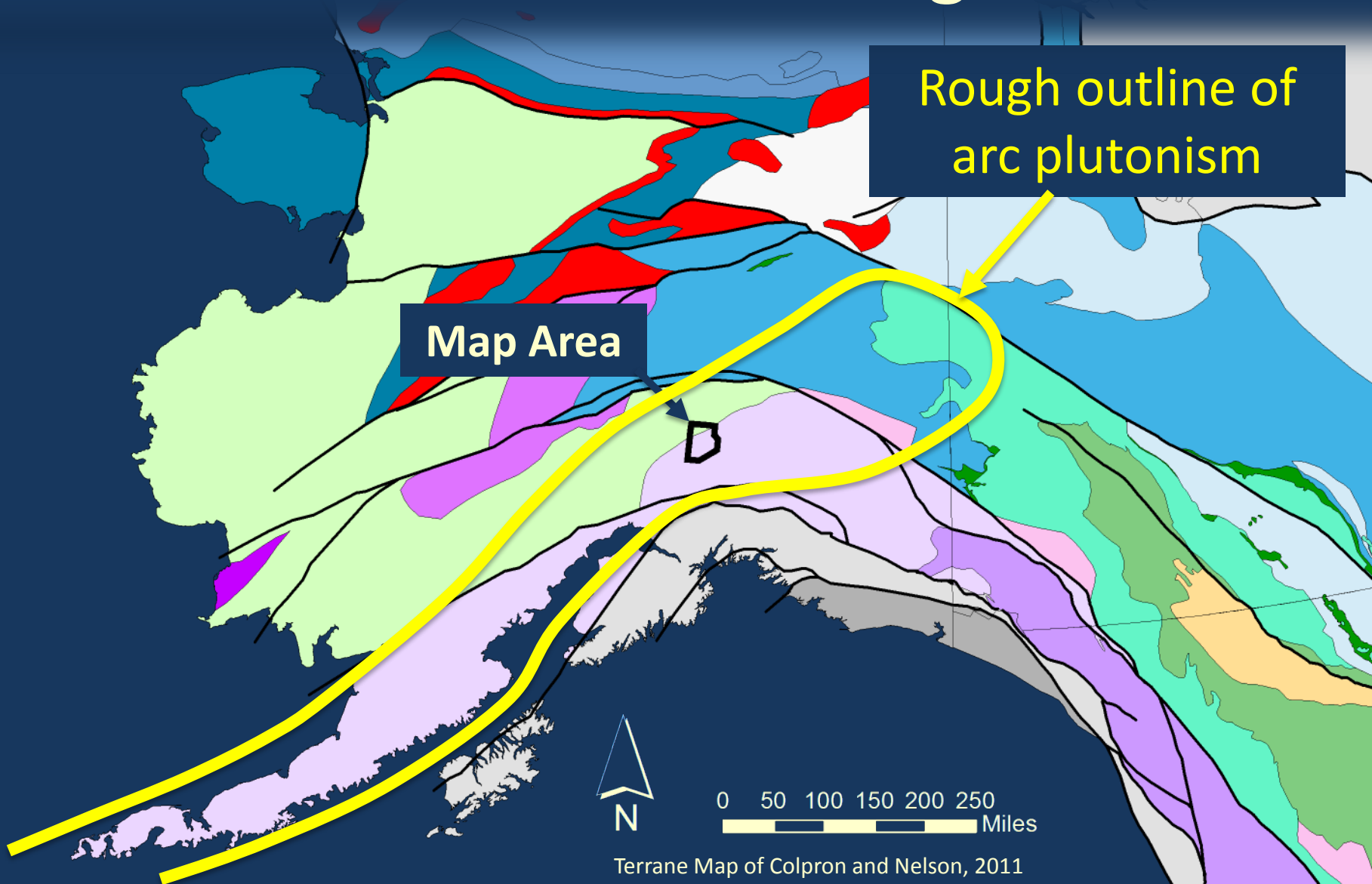


Geologic Context: Wrangellia and the Late Triassic Large Igneous Province



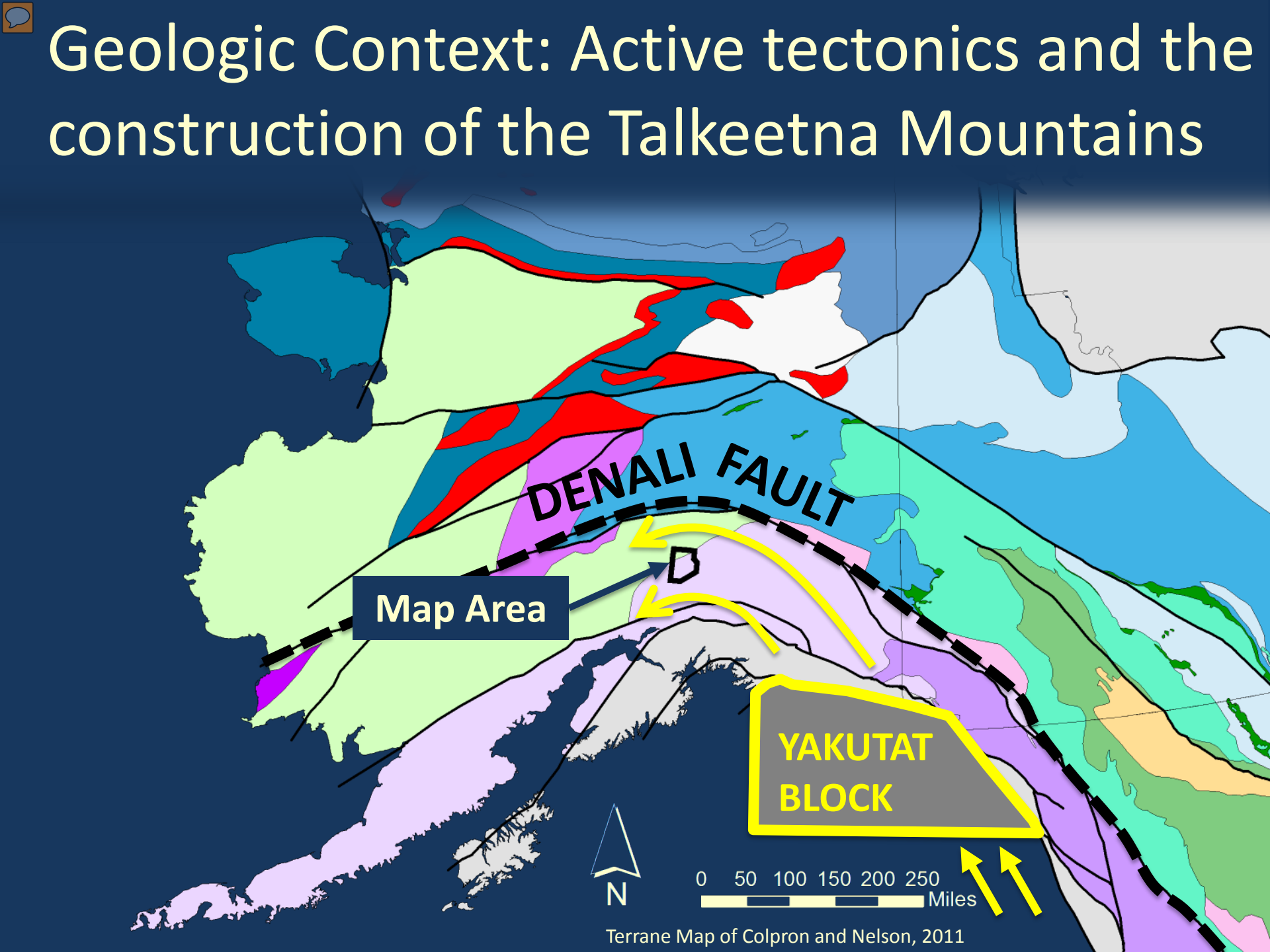
Terrane Map of Colpron and Nelson, 2011

Geologic Context:
Jurassic to Present Arc Magmatism



Terrane Map of Colpron and Nelson, 2011

Geologic Context: Active tectonics and the construction of the Talkeetna Mountains

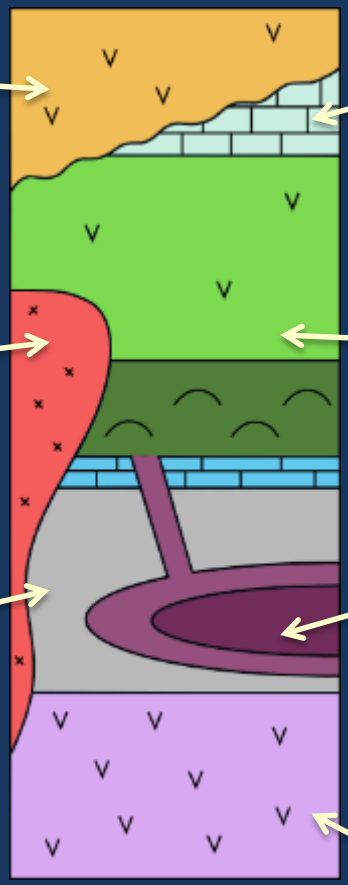


Basic Map Area Geologic Units and Potential Mineralization

Tertiary volcanics:
Epithermal Gold

Jurassic to Tertiary intrusions:
Porphyry and skarn Cu-Au-Mo

Pennsylvanian to Triassic sediments

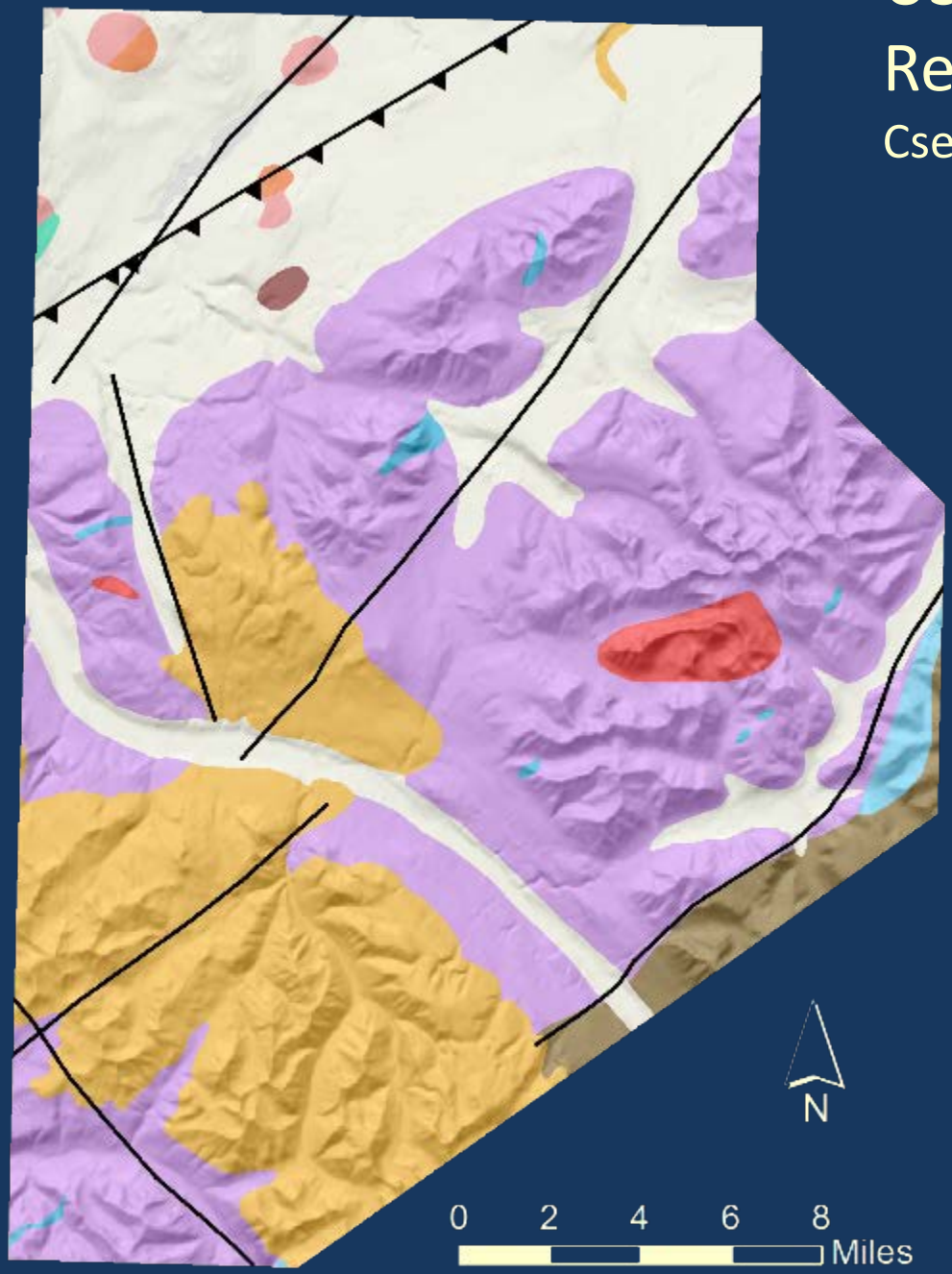


Late Triassic Carbonates:
Sediment-hosted Cu

Late Triassic Nikolai Greenstone LIP
Basalt-hosted Copper

Late Triassic Mafic-Ultramafic intrusions:
Magmatic Ni-Cu-PGE

Pennsylvanian to Permian Volcanics
Porphyry and VMS



Geology after Wilson and others, 1998

USGS 1:250,000 Reconnaissance-scale mapping

Csejtey et al., 1978

Tertiary Volcanics

- Basalt
- Undifferentiated volcanics

Cretaceous-Tertiary Plutons

- T granodiorite
- T-K quartz monzonite
- T-K granodiorite
- Jurassic gneiss

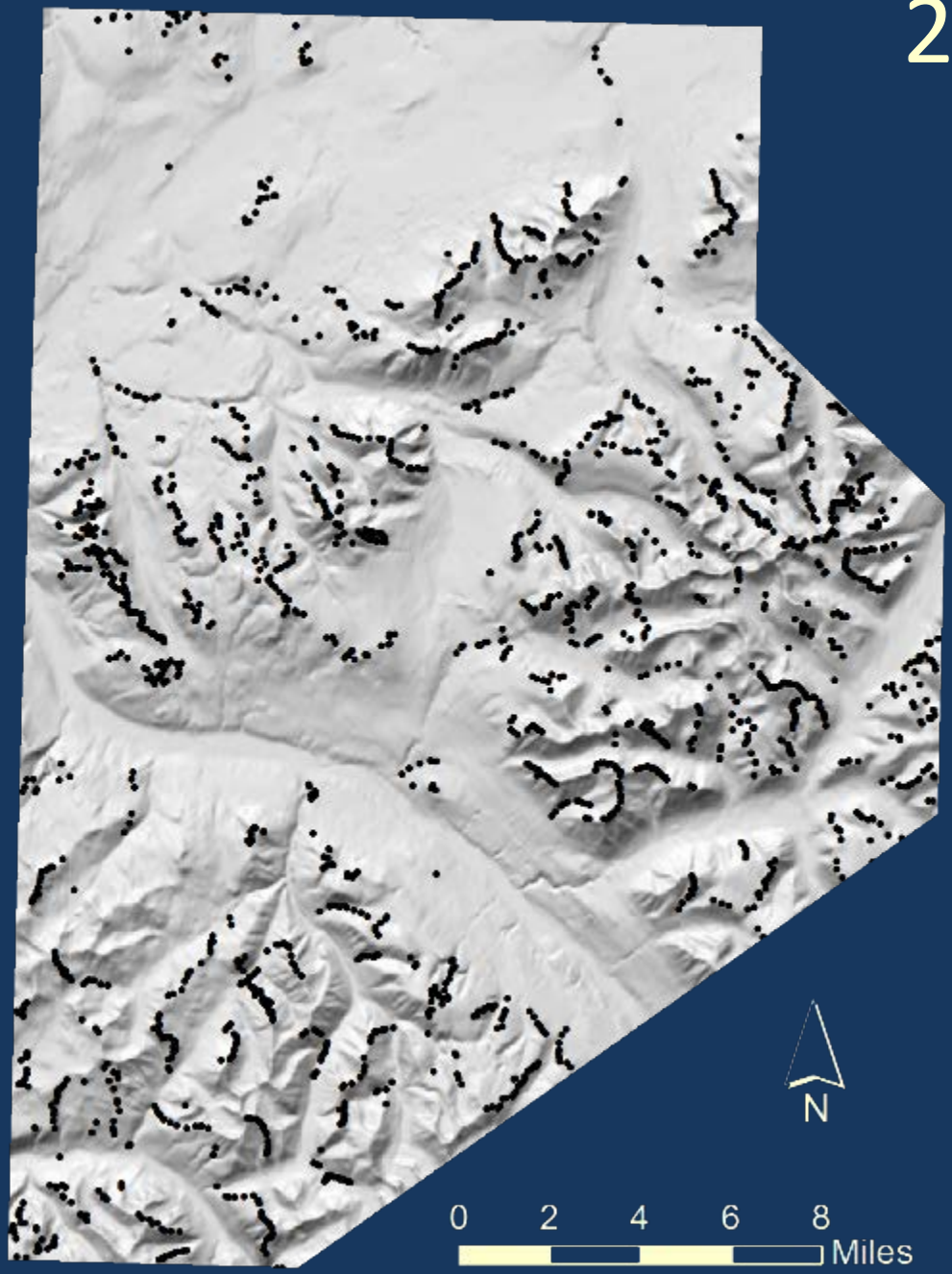
Kahiltna Assemblage

- Flysch

Wrangellia Terrane

- Permian limestone
- Volcanics

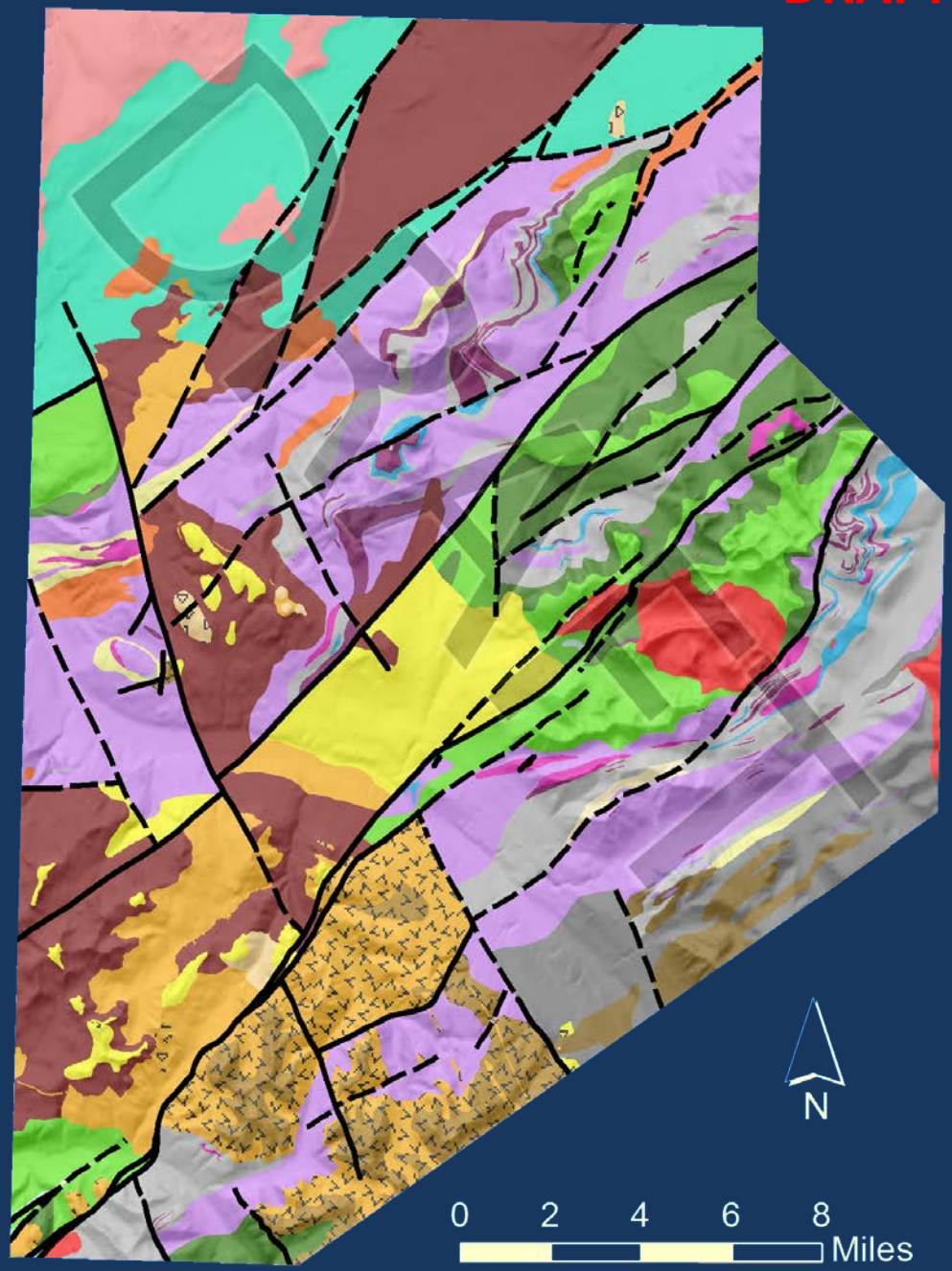
→ No Nikolai LIP mapped



2014 Field Program

- 6 weeks; crew of 7
- 2400 field stations
- Digital data collection
- Geochemistry
- Petrography
- Geochronology

DRAFT DGGS Bedrock Geology 1:50,000



Tertiary Volcanics

- Mafic-intermediate volcaniclastic
- Rhyolitic volcaniclastic
- Andesite
- Basalt
- Rhyolite

Mesozoic Arc Plutonism

- ± Quartz-monzodiorite (K to T?)
- Hornblende gabbro (mid-K)
- Tonalite to granodiorite (Jurassic)
- Tonalite orthogneiss (Jurassic)
- Paragneiss (Paleozoic protolith?)

Kahiltna Assemblage

- Fine sandstone to argillite

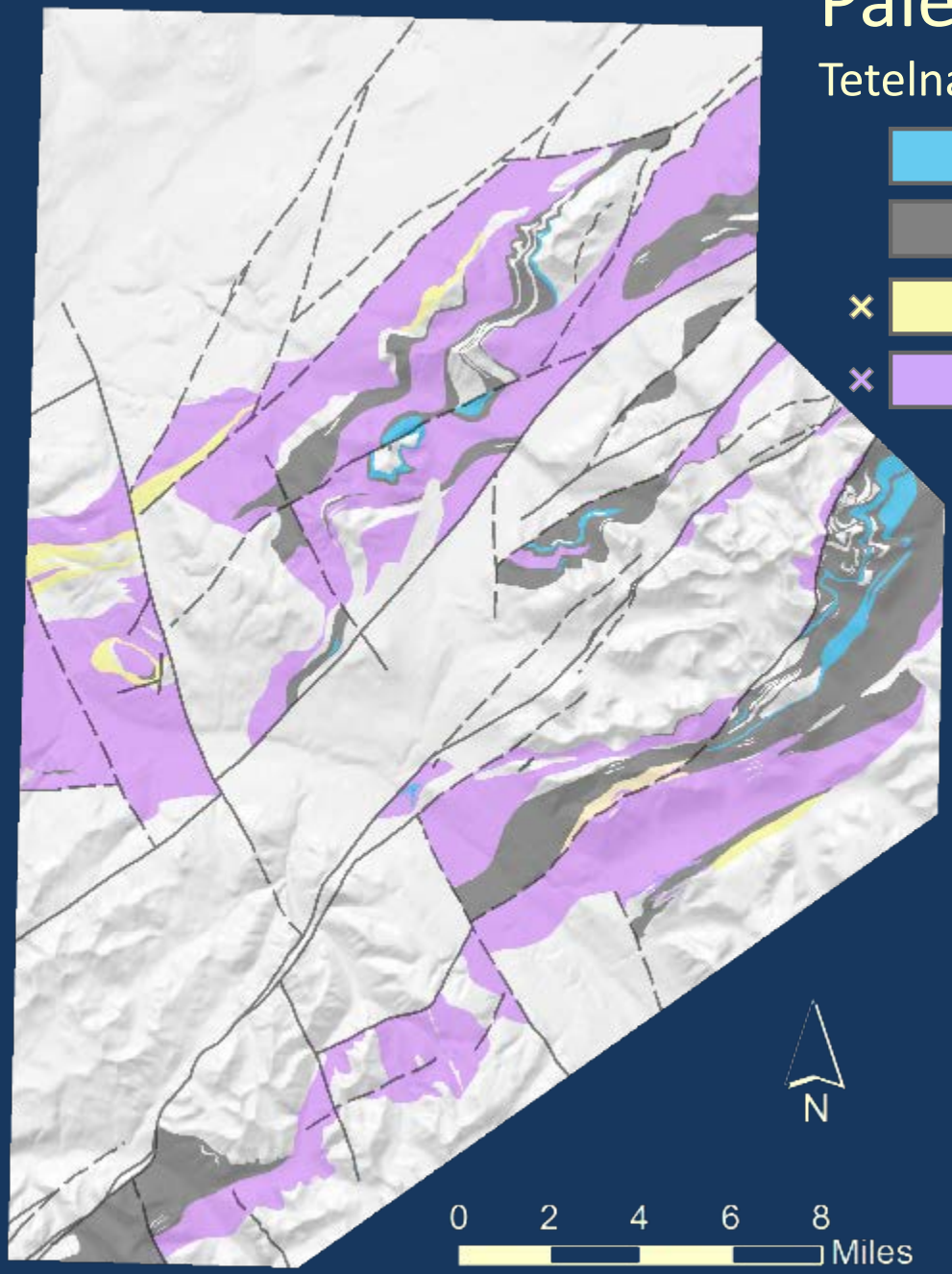
Wrangellia Terrane

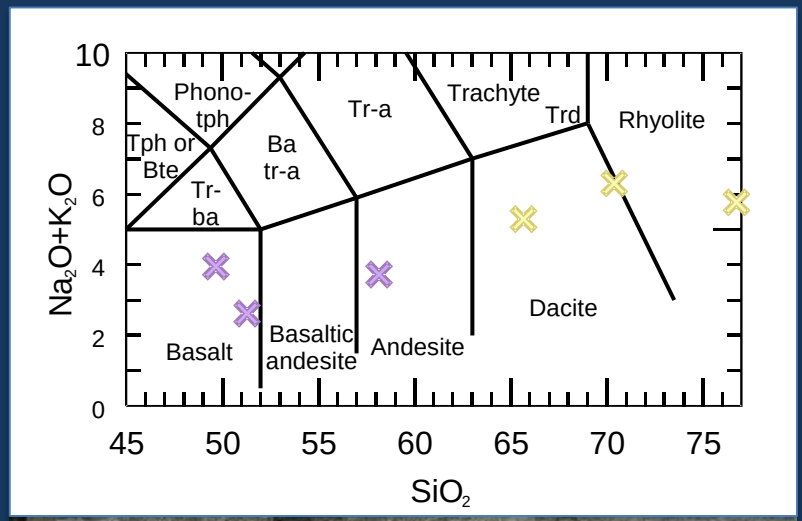
- Late Triassic limestone
- Late Triassic Nikolai Greenstone
- Nikolai-equivalent gabbro sills
- Permian limestone
- Sandstone, siltstone, chert
- Rhyolitic volcanics
- Mafic-intermediate volcaniclastic

Paleozoic Wrangellia:

Tetelna, Slana Spur, Eagle Creek Fm Equivalents

- Permian limestone
- Sandstone, siltstone
- Rhyolitic volcanics
- Mafic to int. volcaniclastics





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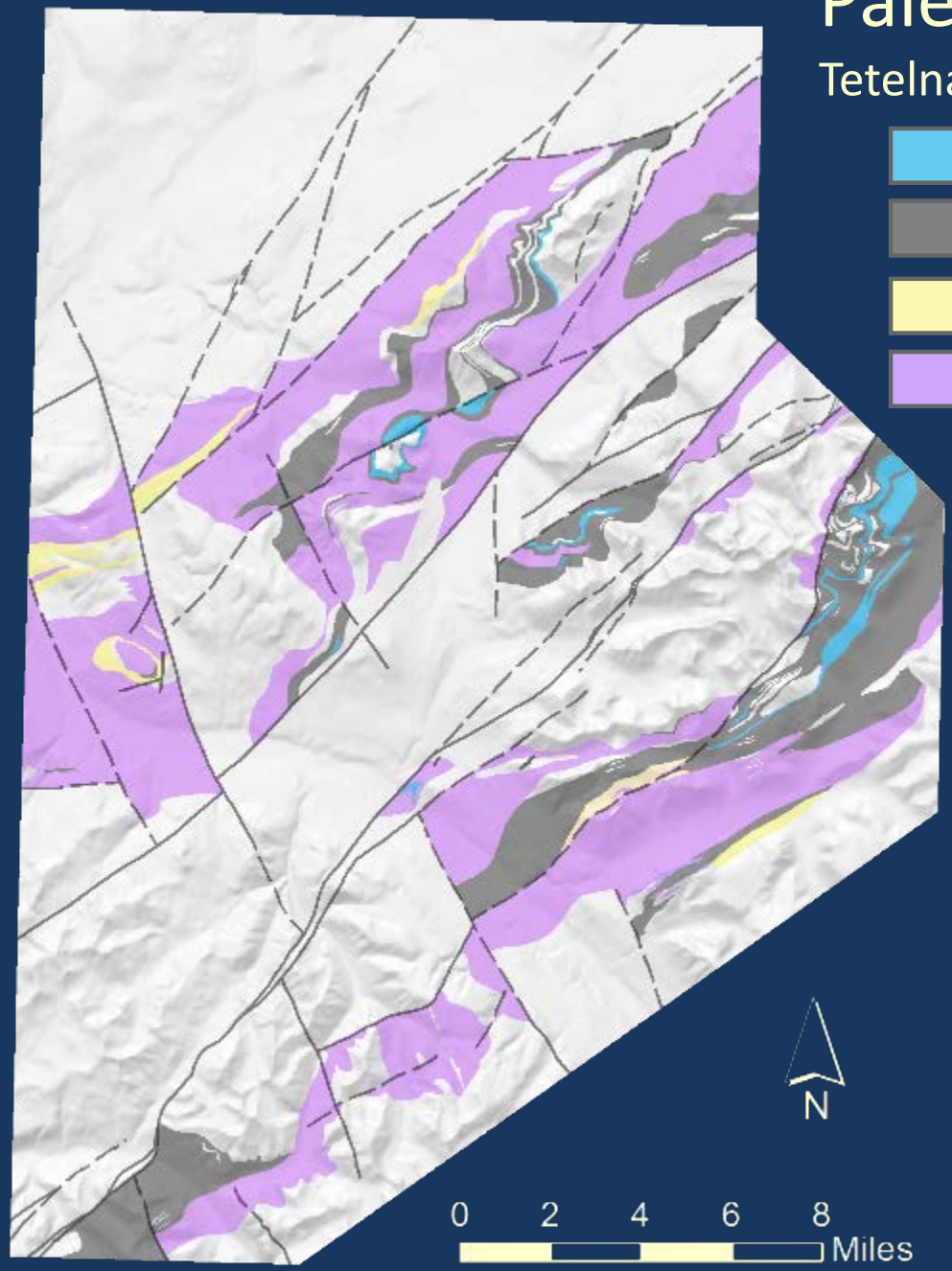
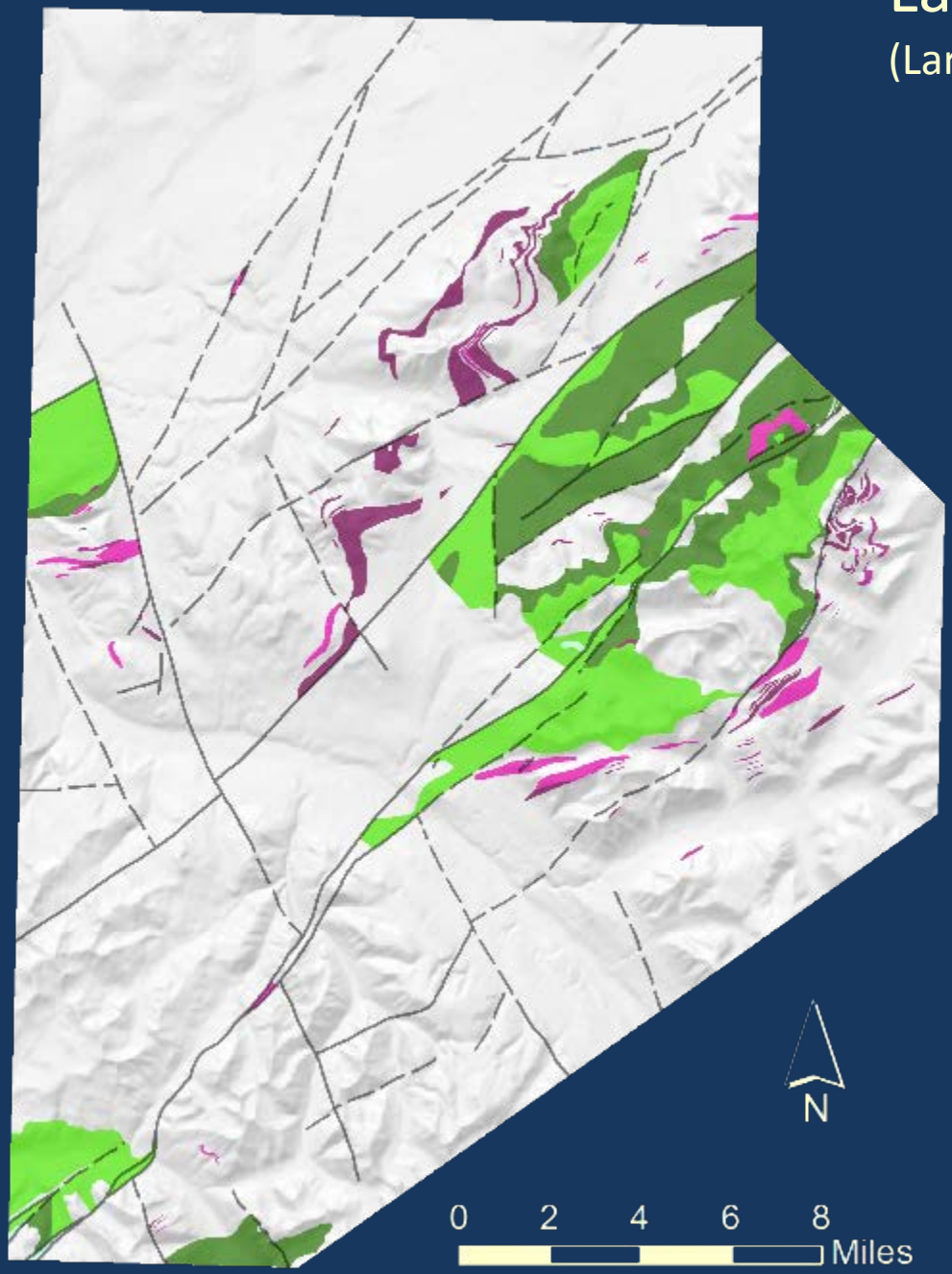
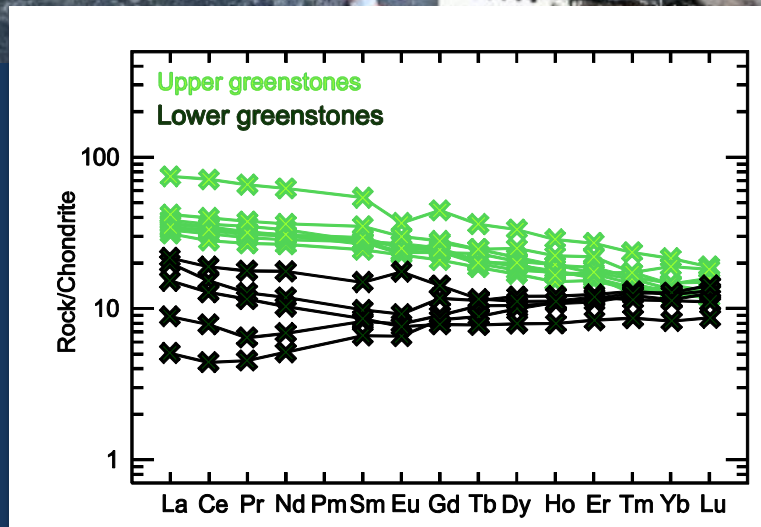


Late Triassic Nikolai LIP

(Large Igneous Province)

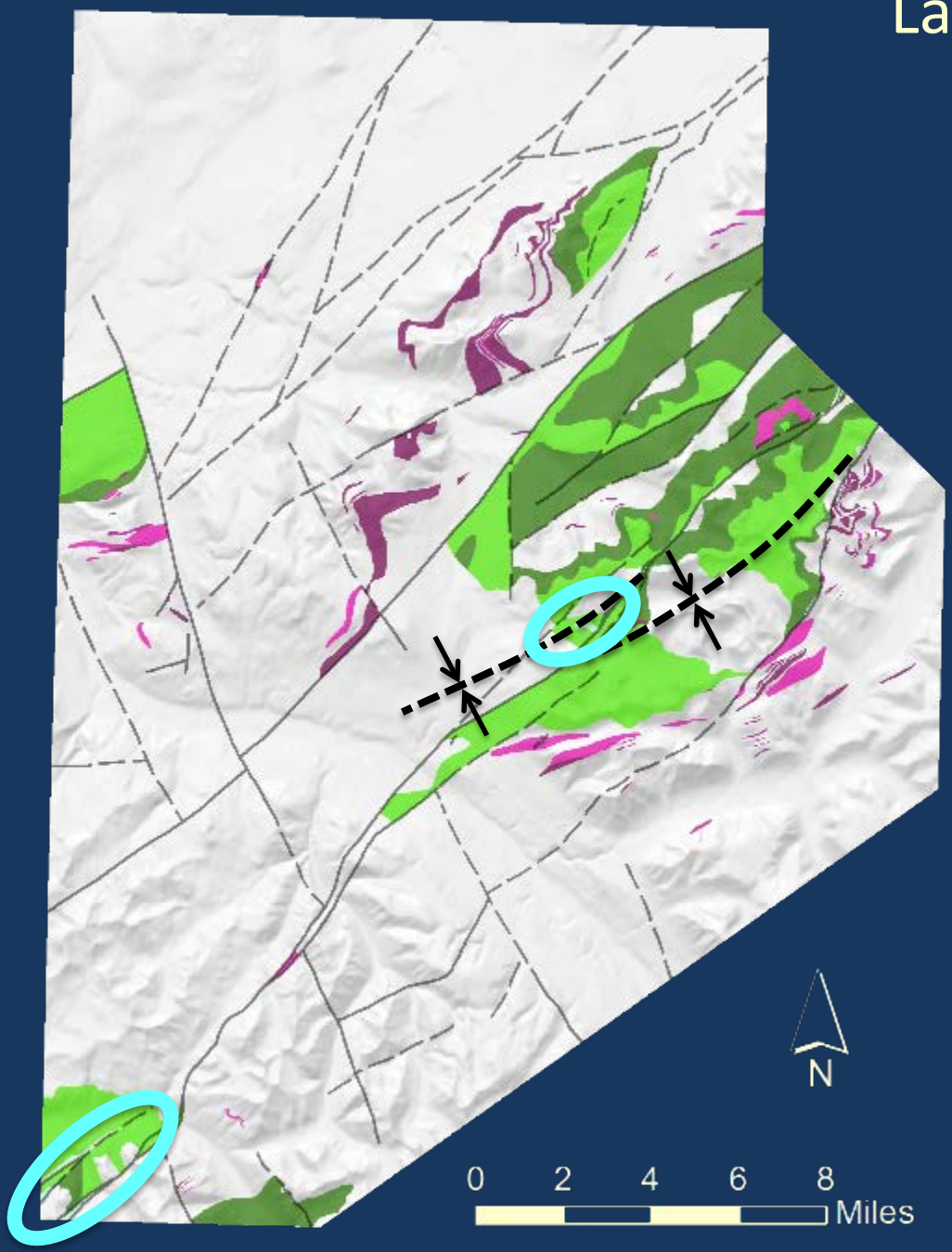
- Nikolai Greenstone (upper)
- Nikolai Greenstone (lower)
- Gabbro Sills (high TiO2)
- Gabbro Sills (low TiO2)





Late Triassic Stratigraphy

- Late Triassic (?) Limestone
  - Possible Chitistone Limestone equivalent?
- Nikolai Greenstone (upper)
- Nikolai Greenstone (lower)
- Gabbro Sills (high TiO2)
- Gabbro Sills (low TiO2)



Mesozoic Arc Plutonism

- Quartz-monzodiorite (K to T?)
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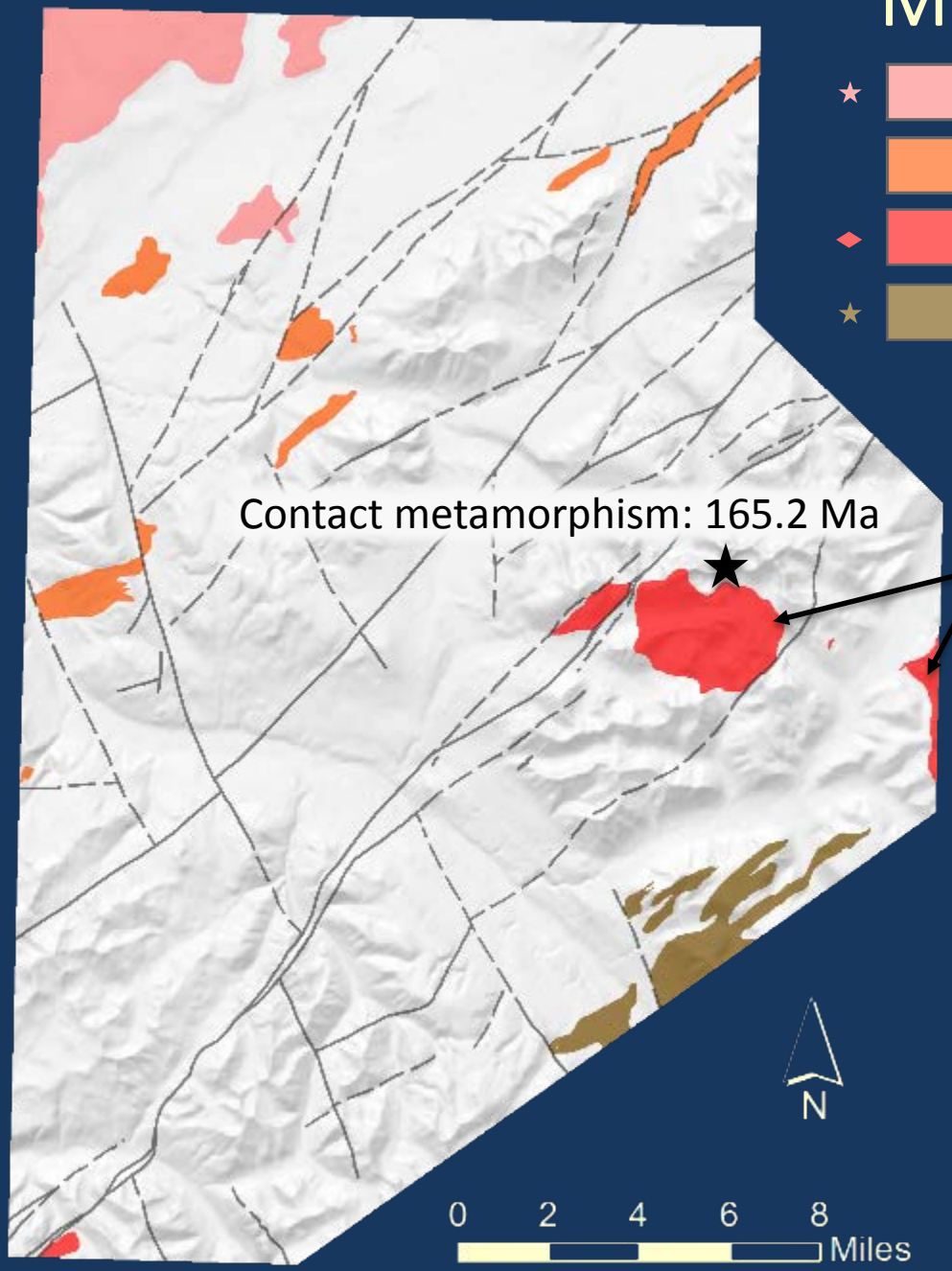
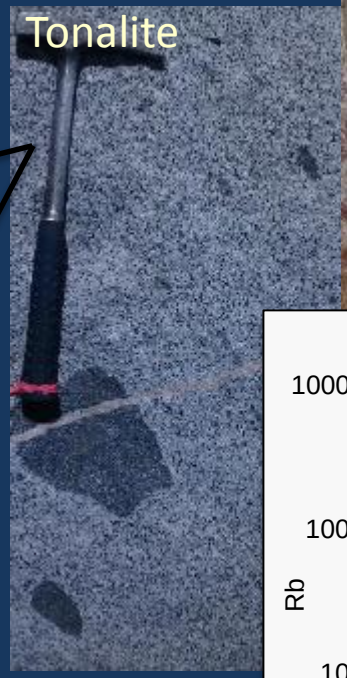
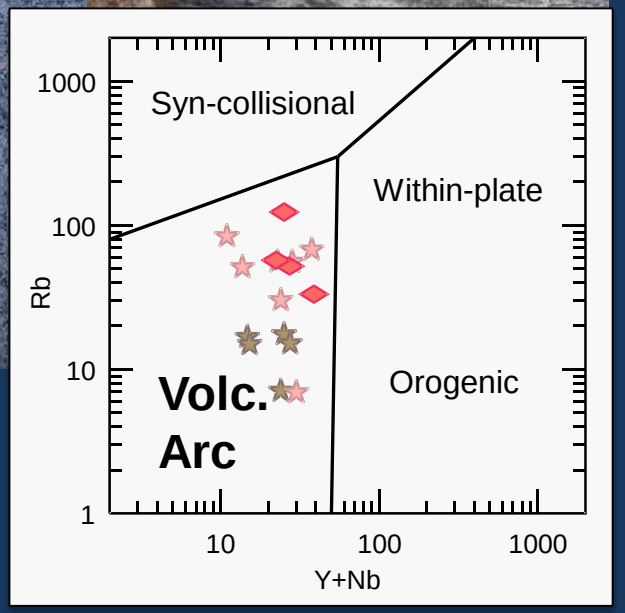


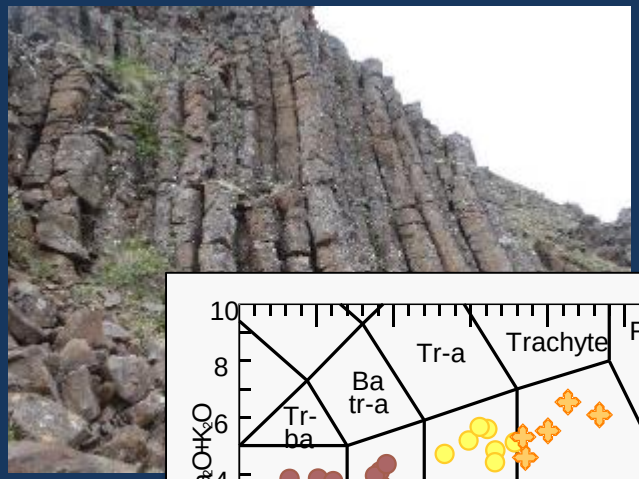


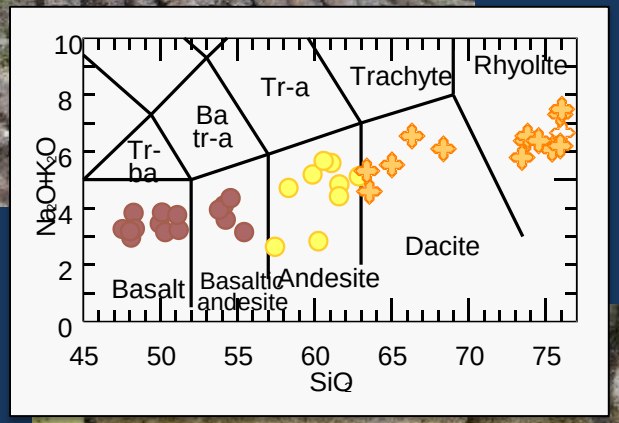


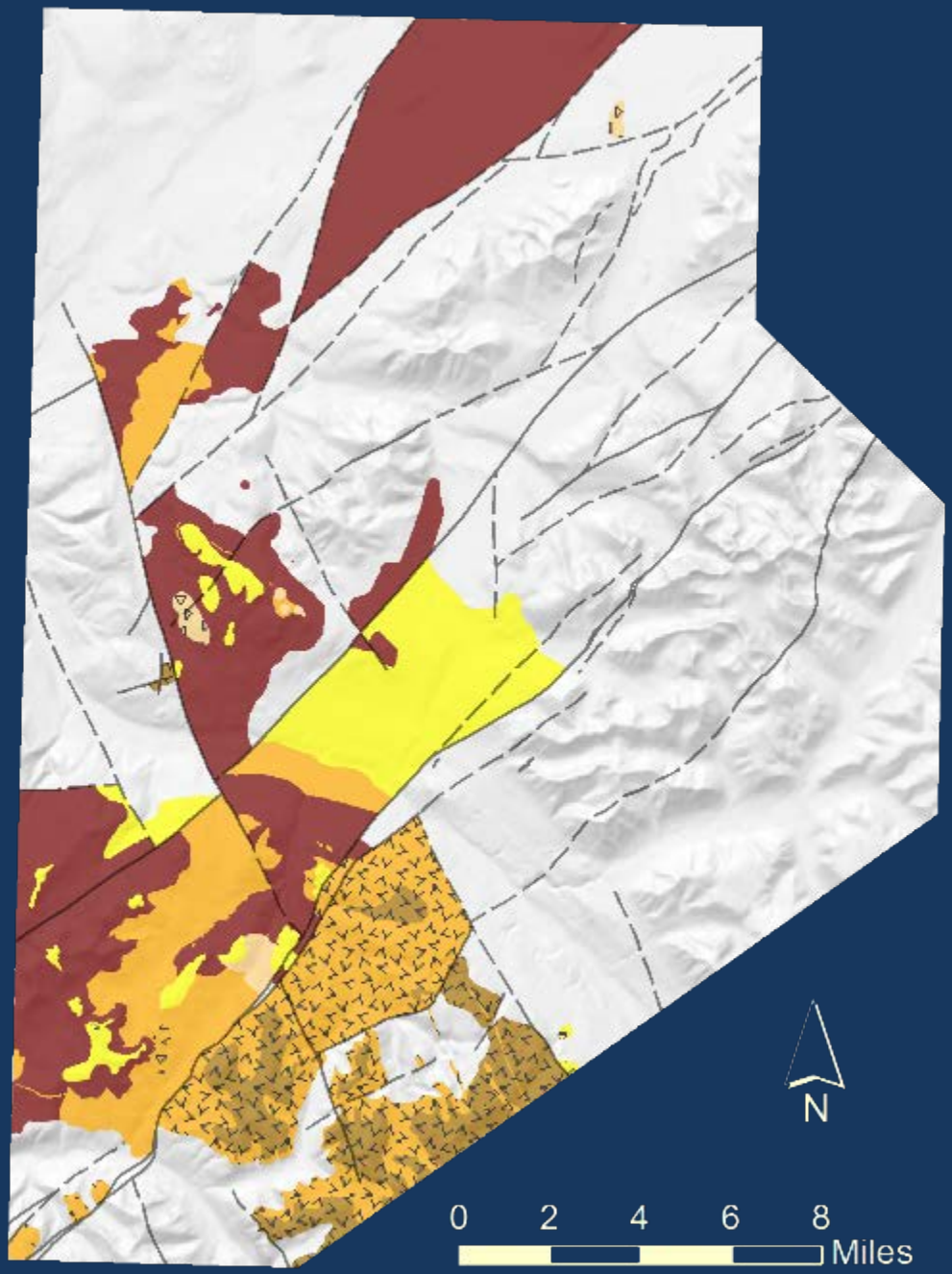
New DGGS $^{40}Ar/^{39}Ar$ Data (Benowitz et al, 2014)

Tertiary Volcanics

- Mafic-intermediate volcaniclastic
- Rhyolitic volcaniclastic
- Andesite
- Basalt
- Rhyolite







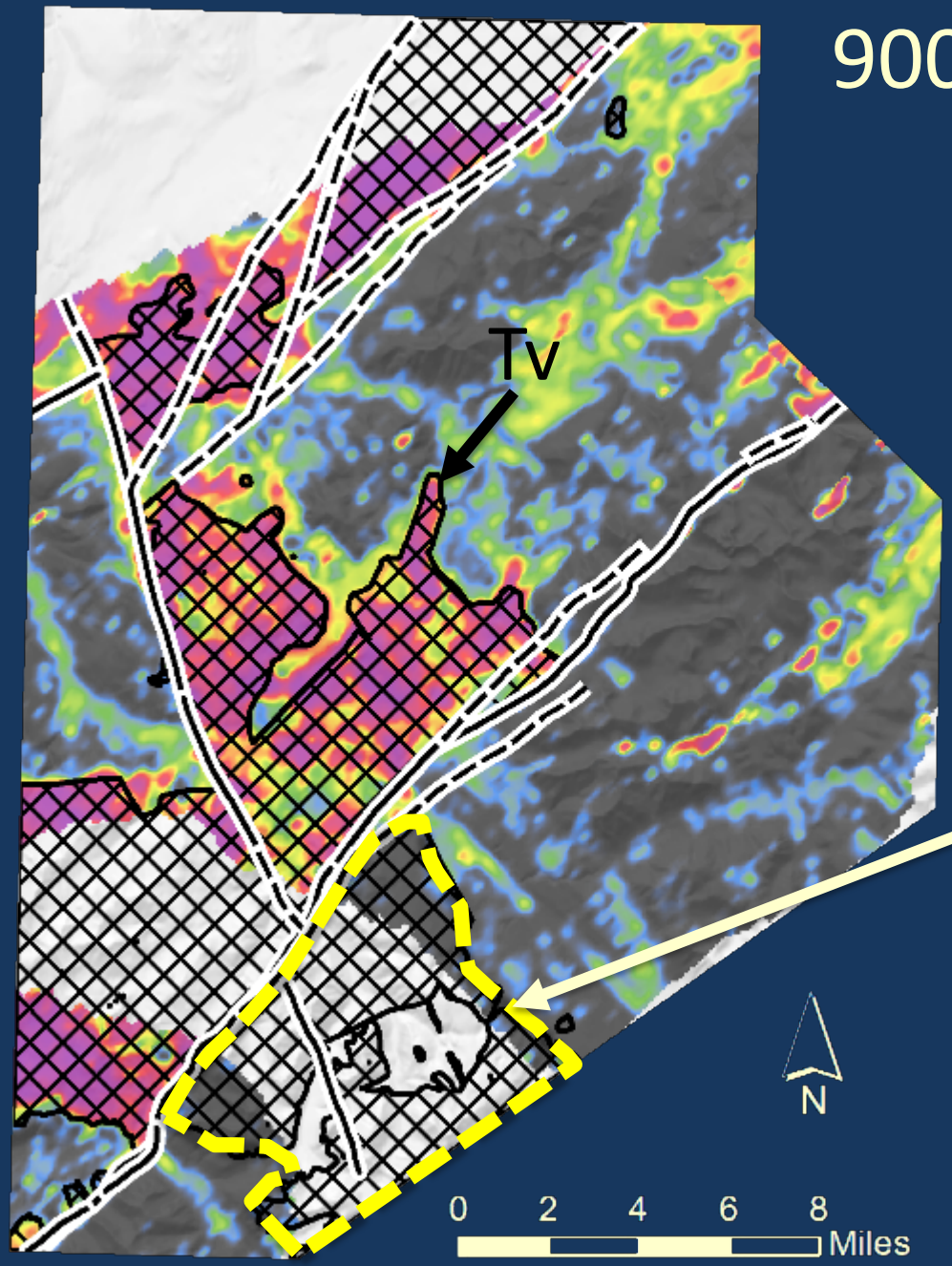
900 Hz Electromagnetics

1998 Iron Creek (Burns and Liss, 1998)
2013 Wrangellia (Burns et al., 2014)

Major breaks are faults

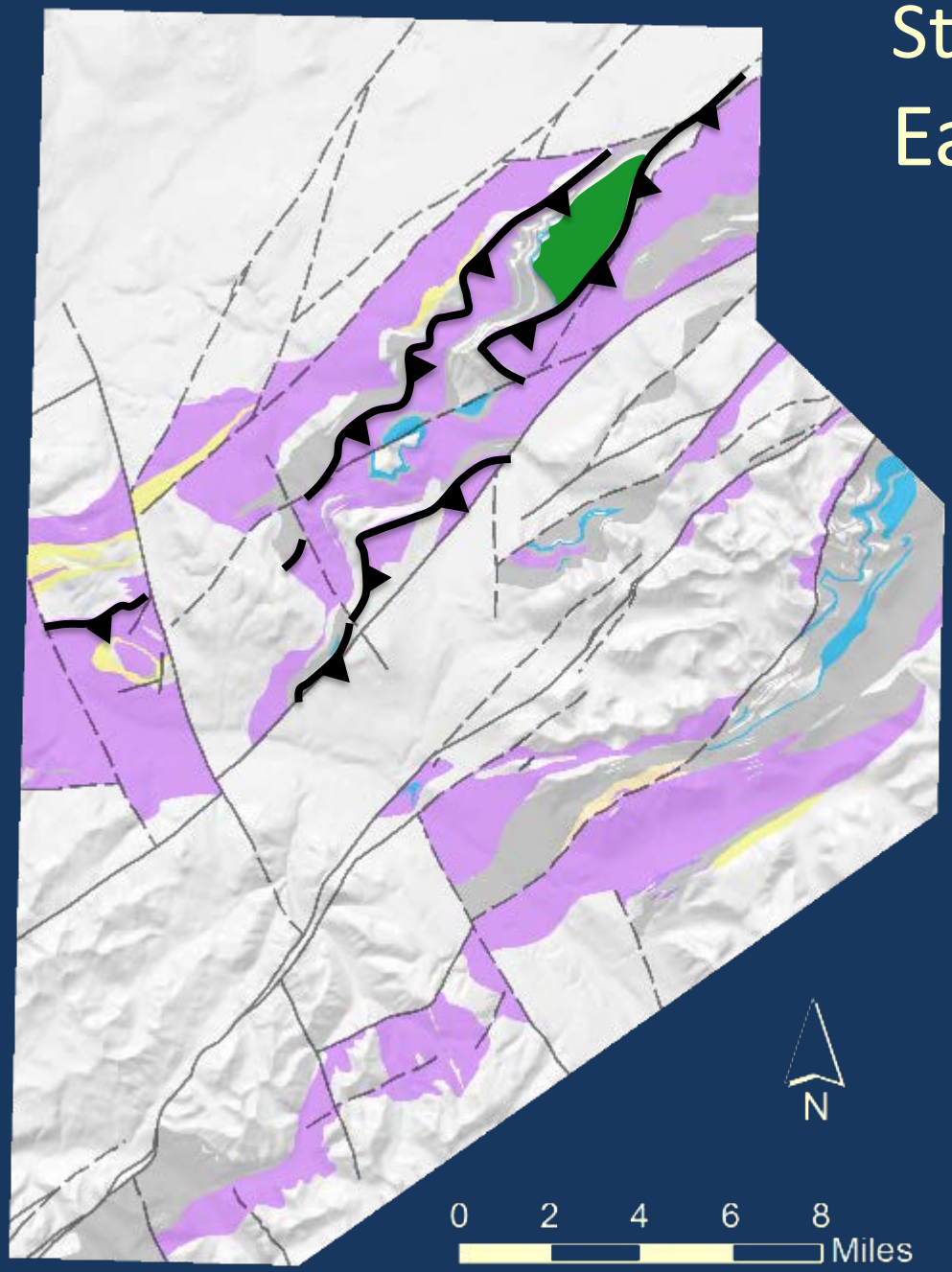
Low resistivity =
Tertiary volcanics*
(black hatch pattern)

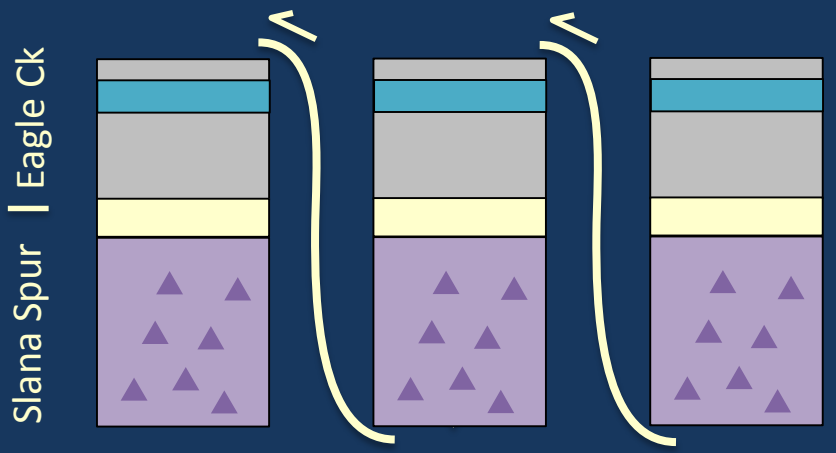
*Dominantly volcaniclastic rocks in the southeast have 'normal' resistivities



Structural geology:
Early Thrust Faulting?

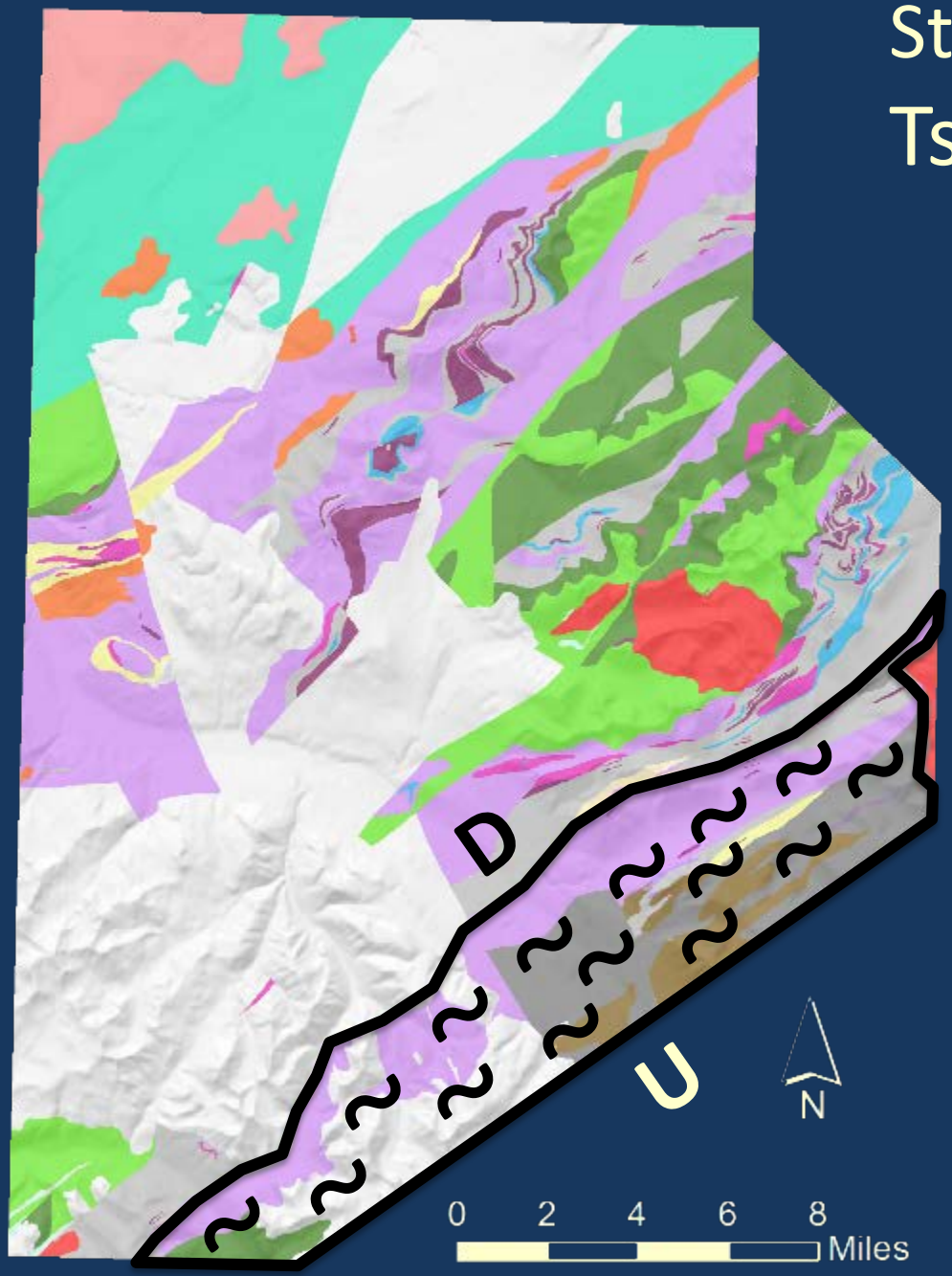
- Paleozoic section is THICK
  - > 5 km as mapped
- Regionally: ± 2 km thick
- Stratigraphic repetition?
- Jurassic to Tertiary timing (cuts Nikolai Greenstone)
- Accretion of Wrangellia?

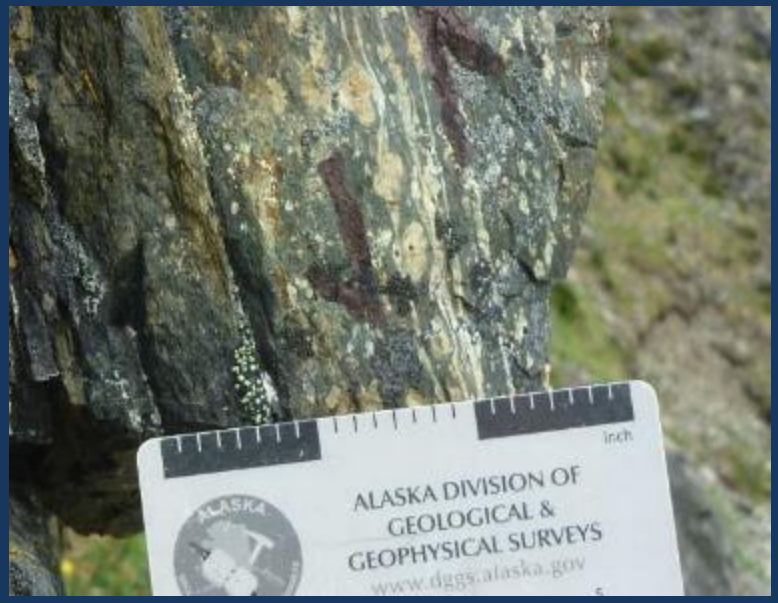


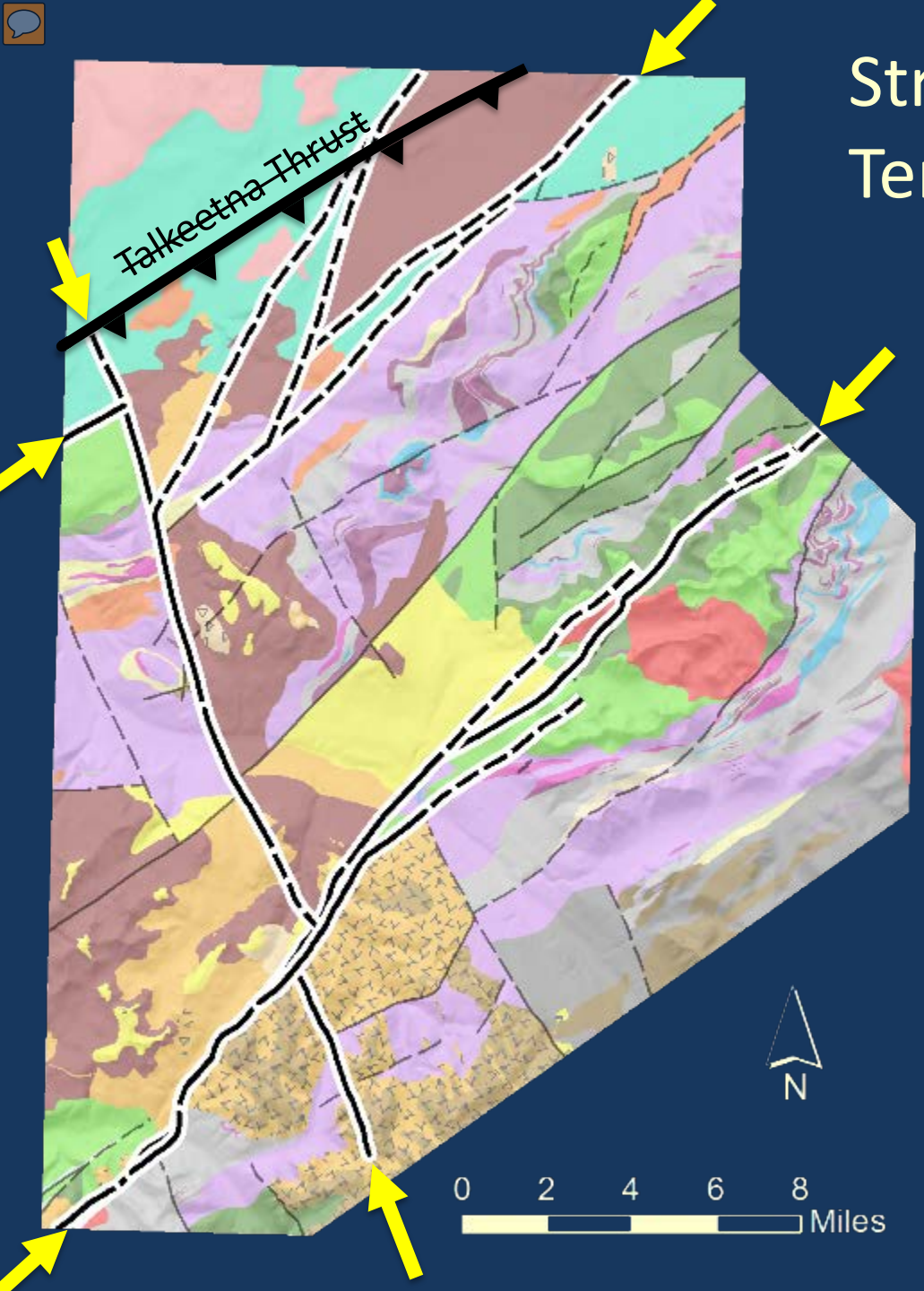


Structural geology:
Tsisi Creek Shear Zone

- Zone of distributed strain
- SE side up (generally)
- Southern Boundary of Wrangellia
- Cut by and deforming Jurassic (?) intrusions





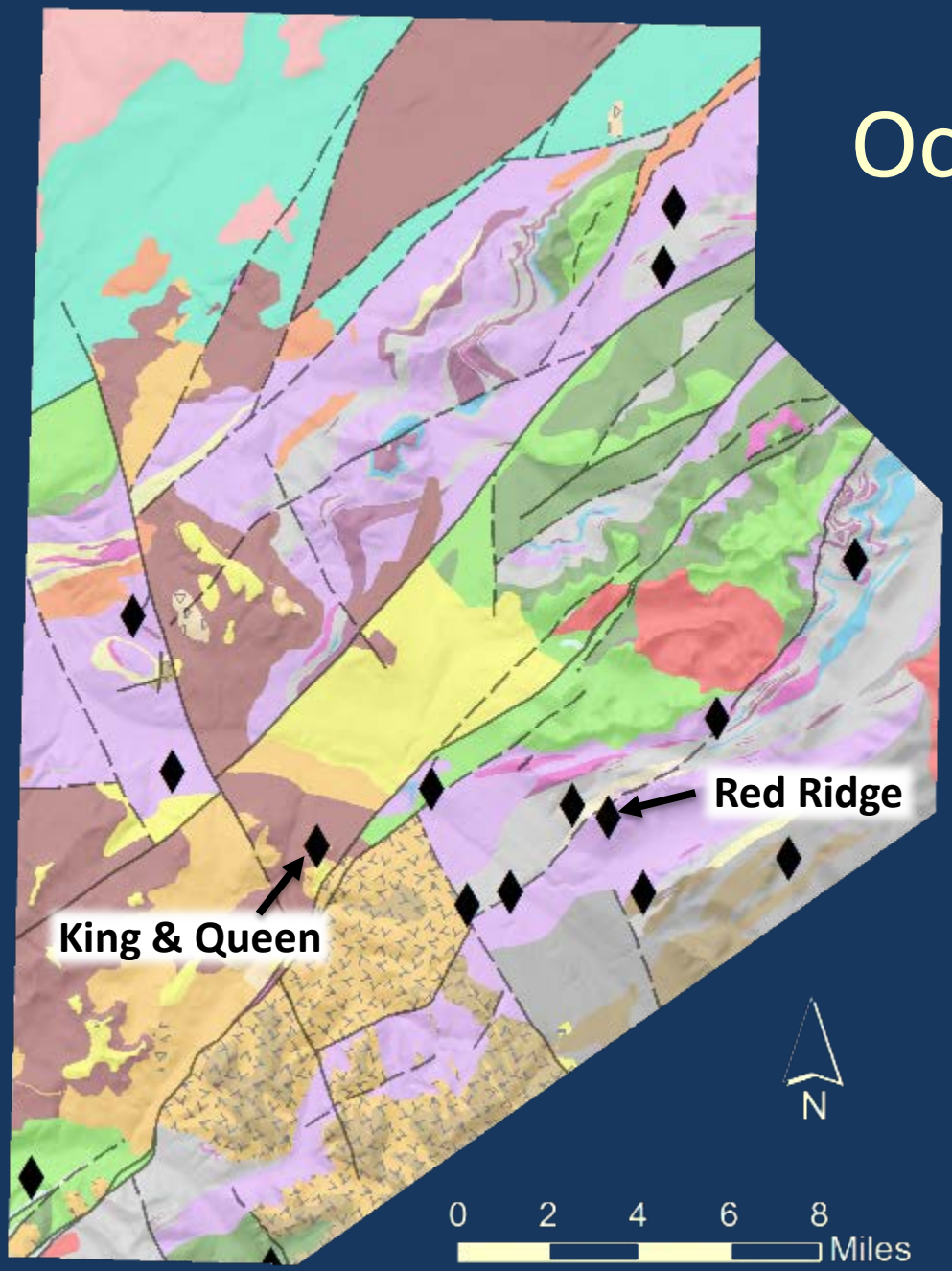


Structural geology: Tertiary to Present Faulting

- "Talkeetna Thrust" not identified
- Fog Lakes Graben—just one of a series of high angle NE-trending faults
- 'Central Raingellia Fault':
  - Oblique kinematics
  → Complex strike-slip setting
- NNW-trending faults
  - Crosscuts Fog Lakes Graben
  - Offset by the CRF

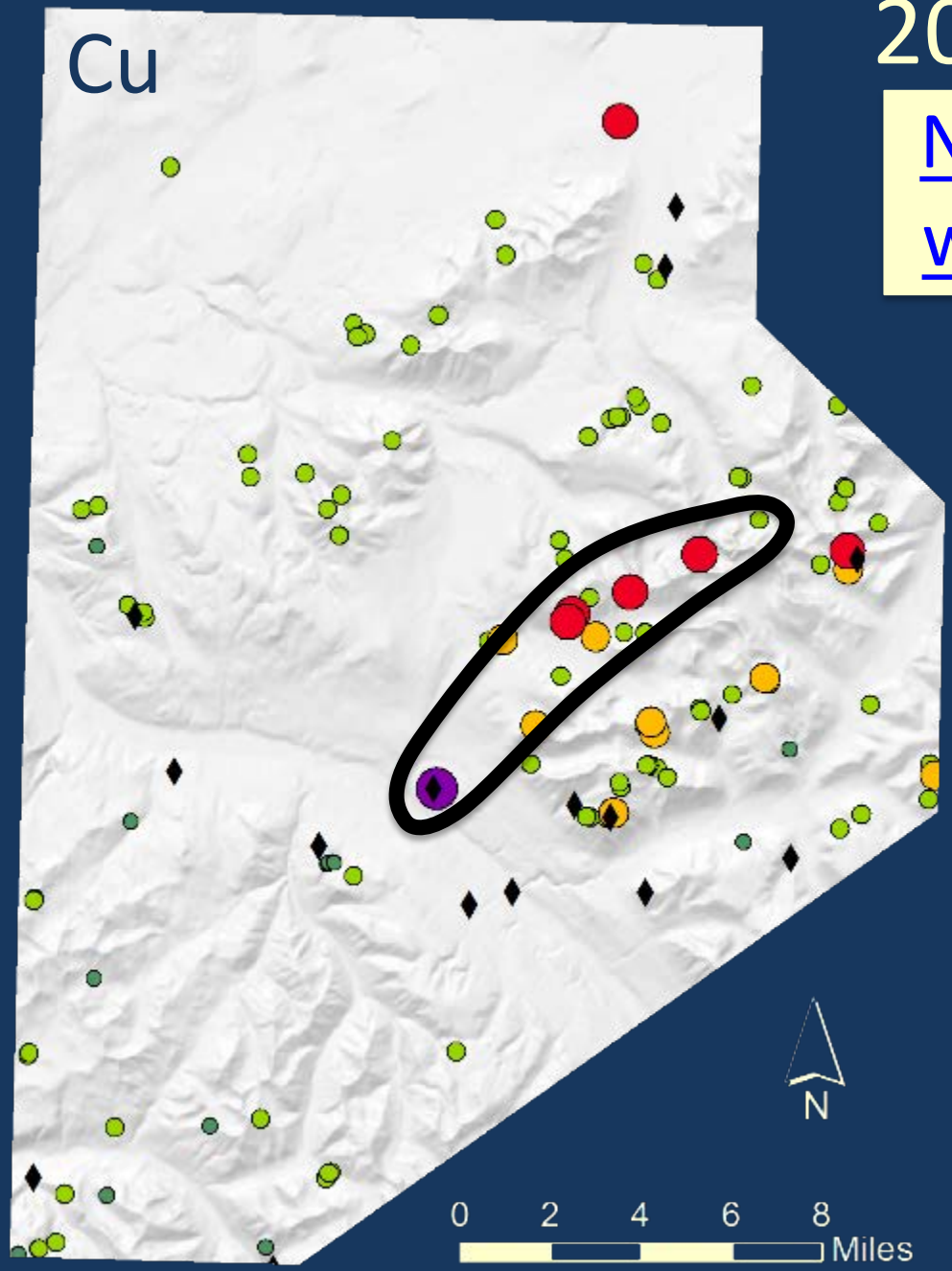
Known Mineral Occurrences (ARDF*)

- Relatively few
  - Only two named sites
- Basaltic Copper type
  - Structurally controlled
- Low sulfide quartz veins




Gossan at Red Ridge

*Alaska Resource Data File occurrences (black diamonds) from Rogers and Schmidt (2003)



2014 Geochemistry

[Now available online:
www.dggs.alaska.gov]

About these plots:

Data are log transformed

$$\text{Z-score} = \frac{\text{value - mean}}{\text{std dev}}$$

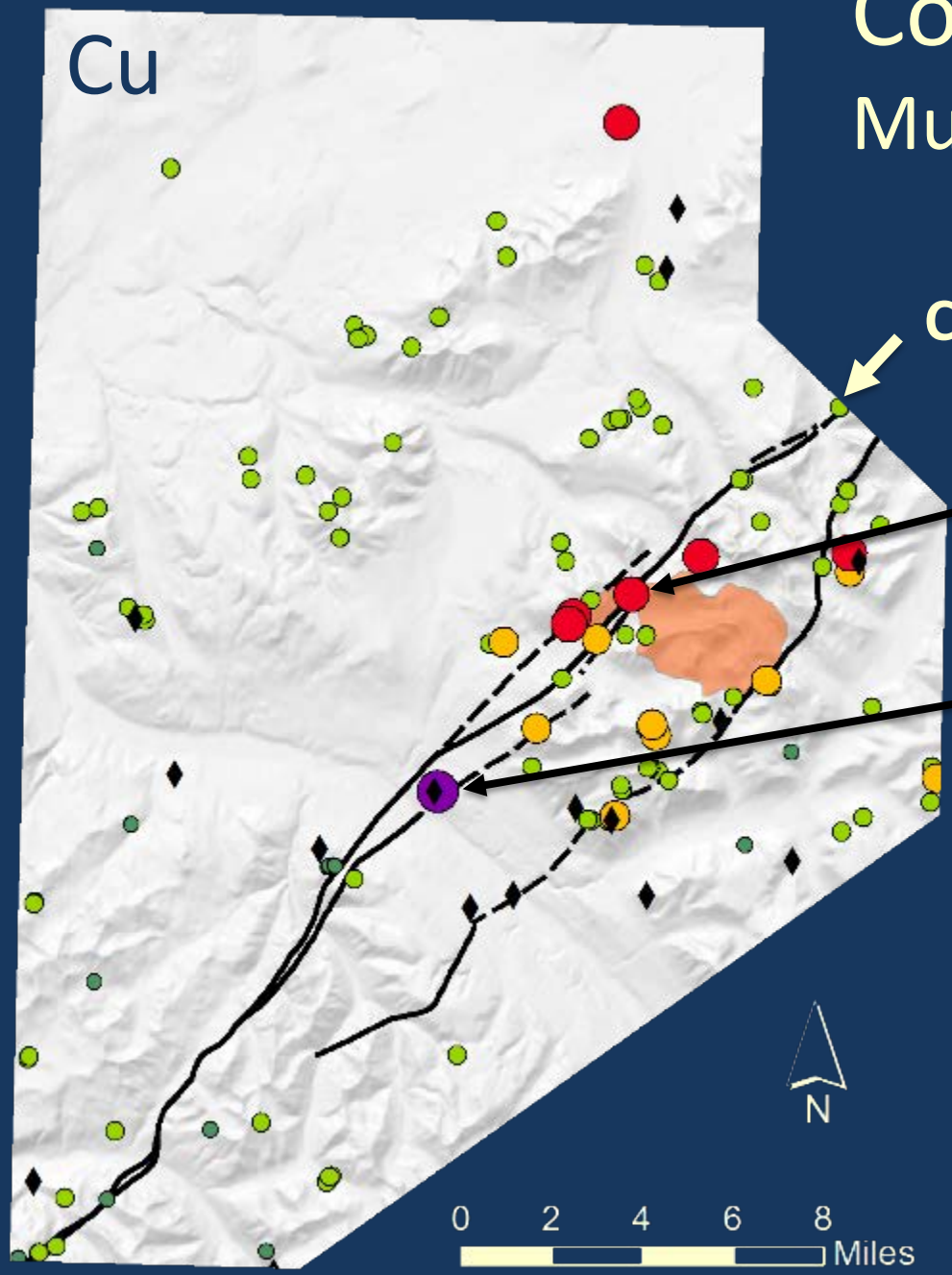
"anomaly maps"
(no economic threshold implied)

Z-score
(log-transformed)

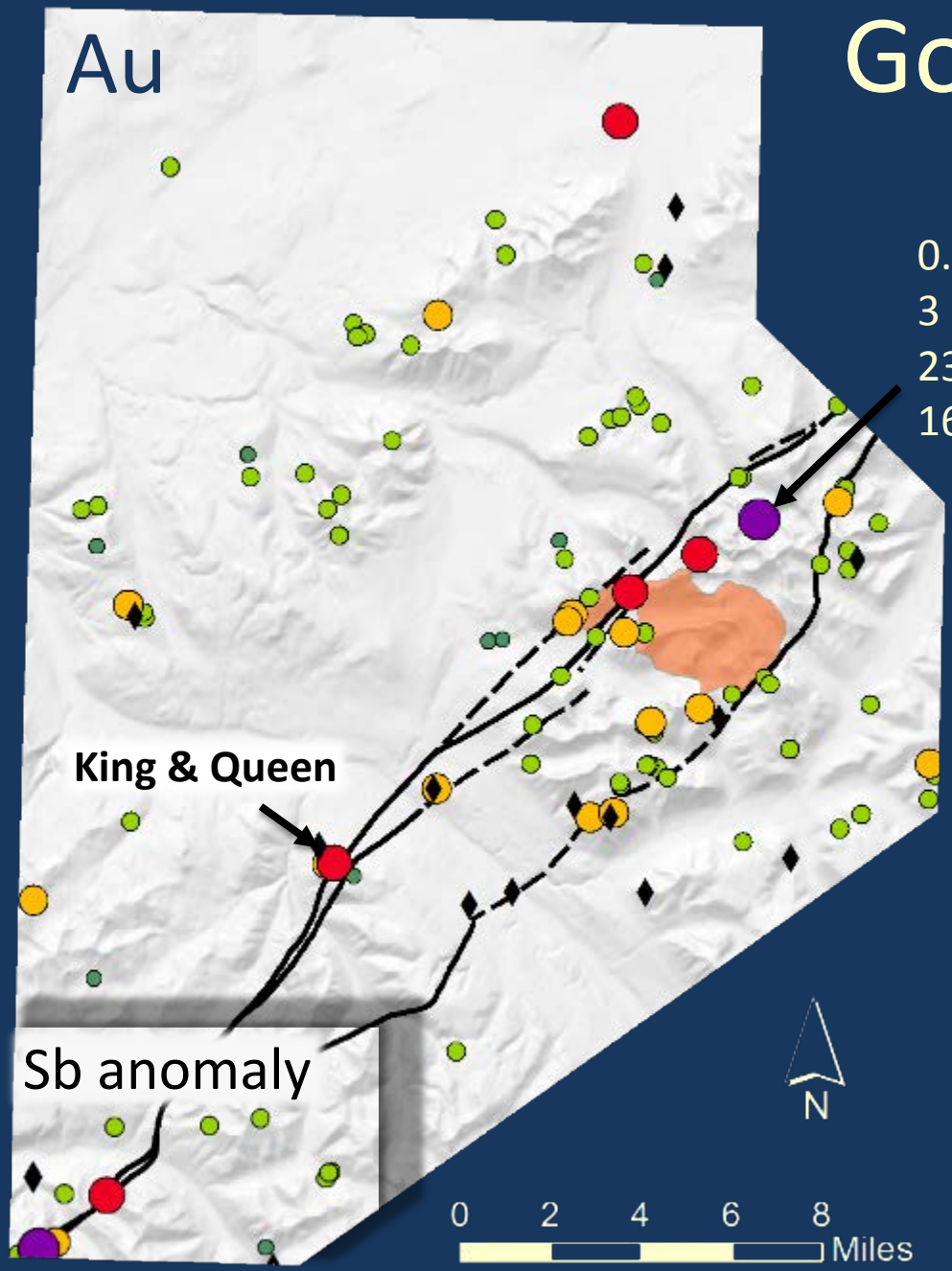
- < -3
- -3 to -2
- -2 to -1
- -1 to 1
- 1 to 2
- 2 to 3
- > 3

Copper Mineralization

Multiple styles observed



Gold Mineralization

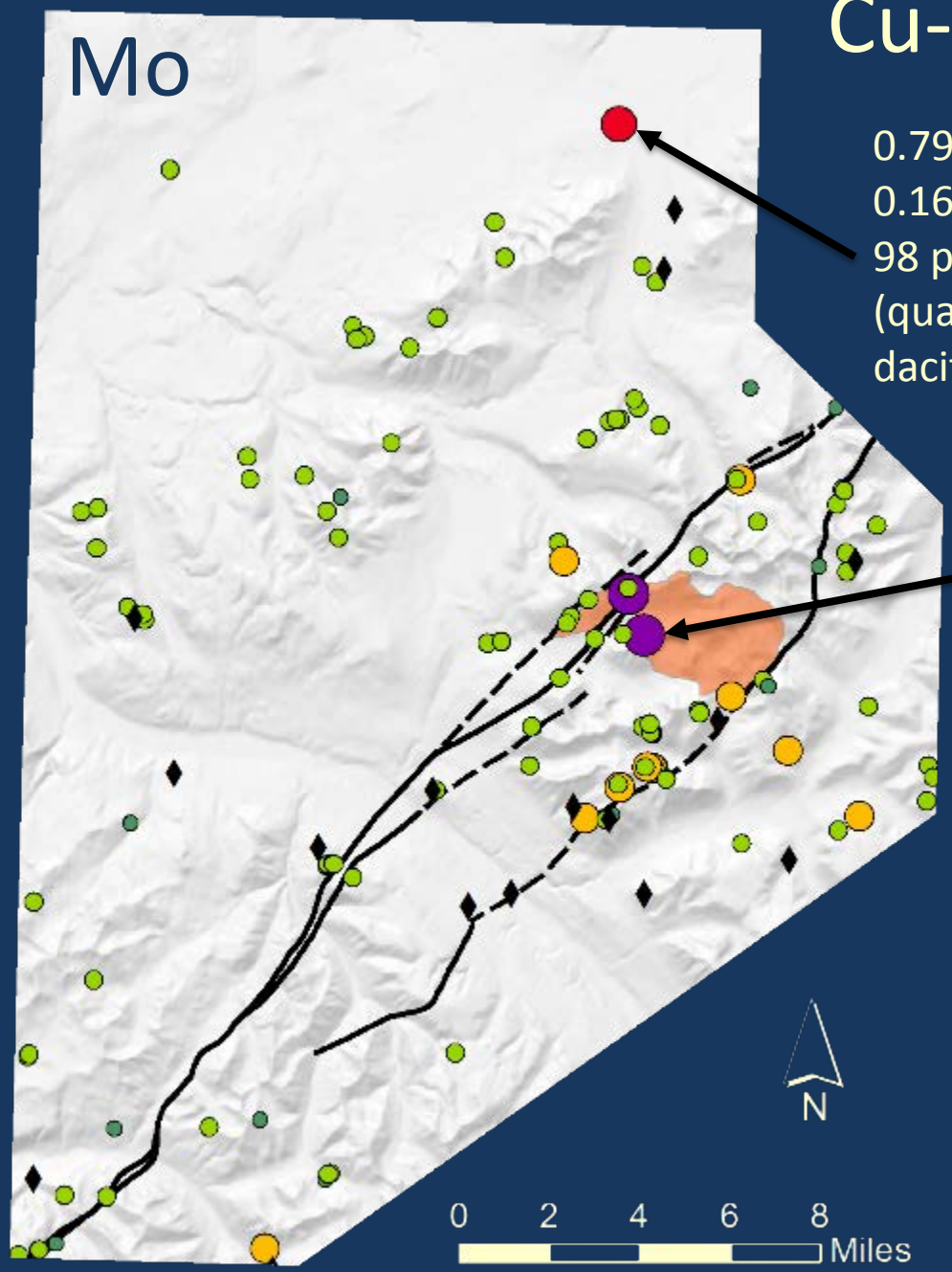


0.875 ppm Au
3 ppm As
23 ppm Bi
16 ppm Te

Z-score
(log-transformed)
- < -3
- -3 to -2
- -2 to -1
- -1 to 1
- 1 to 2
- 2 to 3
- > 3

Selected geology
- Fault
- Granodiorite

Cu-Au-Mo Mineralization



0.79 % Cu
0.164 ppm Au
98 ppm Mo
(quartz veining in dacite porphyry)

1.18 % Cu
0.52 ppm Au
757 ppm Mo
(quartz veining at pluton margin)

Z-score
(log-transformed)
- < -3
- -3 to -2
- -2 to -1
- -1 to 1
- 1 to 2
- 2 to 3
- > 3

Selected geology
- Fault
- Granodiorite

Ongoing Investigations

- $^{40}Ar/^{39}Ar$ and U-Pb ages for igneous rocks and mineralization
- Paleontologic and detrital zircon ages for Paleozoic section
- Petrographic work and map unit descriptions
- Structural analysis of brittle and ductile deformation
- Surficial geology in progress; comprehensive geologic map due late spring 2015

Acknowledgements

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- ALS Minerals
- Peter Oswald, Jeanine Schmidt, Ben Porterfield for discussions
- Robert Blodgett for paleontological work
- Behind-the-scenes work by the DGGS staff

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