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

Rough outline of arc plutonism

Map Area

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**
  - **Pennsylvanian to Triassic Mafic-Ultramafic intrusions:** Magmatic Ni-Cu-PGE
  - **Pennsylvanian to Permian Volcanics**
    - Porphyry and VMS
- **Late Triassic Carbonates:** Sediment-hosted Cu
- **Late Triassic Nikolai Greenstone LIP**
  - Basalt-hosted Copper
- **Late Triassic Mafic-Ultramafic intrusions:**
  - Magmatic Ni-Cu-PGE
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
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

Diagram showing the distribution of different rock types:

- **Na\(_2\)O+K\(_2\)O** vs. **SiO\(_2\)** plot
- Phono-
- Basalt andesite
- Andesite
- Dacite
- Basalt
- Trachyte
- Trd
- Rhyolite

Geological map with rock type symbols:

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

Legend:

- **N**
- **Miles**

Photograph of geological feature with a hammer for scale.
Paleozoic Wrangellia:
Tetelna, Slana Spur, Eagle Creek Fm Equivalents

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

Spiriferella
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?)
- Hornblende gabbro (mid-K)
- Tonalite to granodiorite (J)
- Tonalite orthogneiss (J)

Contact metamorphism: 165.2 Ma

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

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

Map showing the distribution of different volcanic rock types.
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

900 Hz Resistivity

- high
- low

Miles
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

*Alaska Resource Data File occurrences (black diamonds) from Rogers and Schmidt (2003)
Z-score = \frac{\text{value} - \text{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

Cu
Copper Mineralization

Multiple styles observed

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

Z-score
(log-transformed)

Selected geology

Granodiorite

19.7 % Cu
41.7 g/t Ag
1.18 % Cu
0.52 ppm Au
757 ppm Mo

Central Raingellia Fault

Cu
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

King & Queen
Sb anomaly

Au
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

[Map showing mineralization with location and concentration data]
Ongoing Investigations

• $^{40}\text{Ar}/^{39}\text{Ar}$ 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
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References Cited


