DGGS Geologic and Mineral-Resource Assessment of the Western Wrangellia Terrane, Central Alaska: Initial Progress Report

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Why are we interested in PGEs?

(PGEs = Platinum-group elements: Pt, Pd, Rh, Ir, Os, Ru)

Strategic & Critical Minerals
PGEs essential as catalysts
- Automotive
- Chemical industry
- Your woodstove?

Heavy dependence on foreign sources:
- US Net import reliance: 91% of Pt, 56% of Pd¹
- Mine production:
  - South Africa + Russia = 92% of Pt, 77% of Pd¹

¹USGS 2013 Commodity summary for Platinum-Group Metals
2013 Project Goals

1) Re-analyze available USGS stream sediment pulps with modern techniques:
   - Fire assay Pt, Pd, Au; multi-element ICP

2) Collect additional airborne magnetics and EM data over western Wrangellia

3) Field data collection to evaluate potential of W. Wrangellia for magmatic Ni-Cu-PGE
Part 1: Reanalysis of archived pulps

Existing geochemical data coverage (AGDB + DGGS Webgeochem + BLM):

- Semi-quantitative emission-spectroscopy analyses (blue)
- Other (better) analytical methods (gold)
- Wrangellia geochem re-analysis area (black line)
Example: Platinum in stream sediments

Major data gap in western Wrangellia
Part 2: Geophysical Surveys

2013 Wrangellia Survey
Late January target release date
1400 square miles

Valdez Creek (1994)
Slate Creek (2009)
Iron Creek (1998)
Part 3: Geologic Evaluation

- Compile existing data and develop targets for follow-up fieldwork

- **Potential PGE hosts:** Known and suspect Late Triassic mafic-ultramafic intrusions
  - Previous mapping and reporting
  - Stream sediment anomalies (e.g. Cr, Ni)
  - Appropriately shaped magnetic highs

- Other important units (e.g. Nikolai Gnst)

- Identify areas that would benefit from a detailed mapping project in 2014
Wrangellia: what is it, and why is it important?

Modified from Colpron and Nelson, 2011
Metallogenesis of Wrangellia

Late Triassic **Mafic to ultramafic** intrusions:
- Interpreted as feeders to Nikolai flood basalts
- Dunite-CPXite-gabbro
- Host magmatic Ni-Cu-PGE

Adapted from Kluane M-UM Complex (Hulbert 1995, GSC OF3057)
Metallogenesis of Wrangellia

Nikolai Greenstone:
- Oceanic flood basalt
- ~3000m thick
- Late Triassic
- Metalliferous: numerous basaltic copper occurrences

Adapted from Kluane M-UM Complex (Hulbert 1995, GSC OF3057)
Metallogenesis of Wrangellia

**Chitistone and Nizina Limestones:**
- Conformably overlies Trn
- Hosts of the high grade Kennecott Copper deposit
- Linked to L. Jr-K orogeny

Adapted from Kluane M-UM Complex (Hulbert 1995, GSC OF3057)
Jurassic-Cretaceous flysch

Triassic Nikolai flood basalts (Wrangellia)

Penn-Perm. sediments ± volcanic rocks (Wrangellia)*

Tertiary volcanics

Cretaceous and Tertiary plutonic rocks

Geology after Wilson and others, 1998
Industry Activity in the Project Area

- Millrock Resources
- Pure Nickel
- Corvus
- Lichen (Alaska Ventures Inc.)
- Caribou Dome
- Valdez Ck
- Proposed Su Dam
- MMG USA Exploration

Legend:
- State Mining Claims
- State Patent or TA
- State Selected
- Native Selected
- Native Patent or IC
- Bureau of Land Management
- National Park Service
Previous agency work in the area

- 2007 BLM Delta River
- 1992 USBM Valdez Creek
- USGS Talkeetna Mountains Transect (1999-2007)
Published detailed geologic mapping

Data gaps in western Wrangellia

Partial coverage from pending USGS 1:125,000 mapping

Coming soon via DGGS: inch-to-mile maps by Warren Nokleberg (Mt Hayes, Gulkana, Nabesna, and Tanacross quadrangles)
2013 Field Program (3 weeks)

- Rock samples for multi-element and PGE analysis, lithogeochemistry
- 137 stream sediment samples for multielement geochemistry indicator mineralogy
- Magnetic susceptibility
- Gravity profiles (39km)
- Petrologic and stratigraphic studies
Field observations

~1000’-thick multi-phase (or layered?) gabbroic complex:
Olivine cumulate rocks, previously mapped as seds
Initial results: XRF geochemistry

The DGGS uses direct XRF at UAF to get quick, economical major-oxide and trace element analyses of fine-grained rocks. These results support map interpretations and unit descriptions (especially important for volcanics) and will be published as a Raw Data File through DGGS.

After Le Maitre and others (1989)
XRF results: Nikolai Greenstone

- **Groups B, C (Hi Ti):** Nikolai Greenstone Plume-related flood basalts
  → Enriched mantle source

- **Group D (Lo Ti):** Lower Nikolai and/or Upper Paleozoic arc volcs
  → Depleted mantle source

Nikolai data from Greene and others, (2008), diagram after Meshede (1986)
Mafic-Ultramafic intrusions
Normative mineralogy from XRF results:

- Gabbroic: troctolite, olivine gabbro
- Ultramafics: harzburgite, dunite
- Olivine gabbro
- Gabbro, gabbronorite, olivine gabbro
Gravity profile results

Isostatic gravity anomaly:
- 100mGal
- 50
- 0
- -100

Magnetic anomaly >500nT

Long-wavelength signal = Deep (3km+) source

Pre-2013 data and reduction tools from USGS DS264 (Saltus and others, 2006)
Proposed 2014 STATEMAP Project: Talkeetna Mountains C-4

- 1:50,000
- Bedrock & surficial maps
- Structural history
- Ni-Cu-PGE potential

Geology after Wilson and others, 1998
Stay tuned…

- Early 2014 releases:
  - 2013 program geochemistry
  - USGS/USBM reanalysis data
  - Wrangellia geophysical survey

- Spring 2014 releases:
  - Mineralogical data
  - Physical properties data
  - Preliminary interpretive report

- Summer 2014:
  - 1:50,000-scale geologic mapping project in the Talkeetna Mountains (publication spring 2015)
REFERENCES CITED


