GEOLOGIC SETTING OF SYNGENETIC AND EPIGENETIC DEPOSITS IN THE EASTERN BONNIFIELD MINING DISTRICT, ALASKA

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Bonnifield Mining District -- AGGMI
Prior geologic studies

2007 Airborne Geophysical Survey

(Burns, et al, 2007)
Preliminary Bedrock Geologic Map
Eastern Bonnifield Mining District
Alaska
Healy schist

- Devonian (?) to Proterozoic
- Low conductivity and magnetic susceptibility
- Quartzite, metagrit, quartz schist, green and maroon phyllite, marble

![Graph showing relative age frequency vs. U-Pb age (Ma)]
Keevy Peak Formation

- Devonian (?) to Proterozoic
- Distinctly conductive
- Gray metagrit/quartzite, graphitic phyllite, quartz/chert pebble conglomerate
Totatlanika Schist subdivisions

**Previous mapping:**
- Sheep Creek Member
  - Epiclastic
  - Tuffaceous
  - Black carbonaceous phyllite
- Mystic Creek Member
- Chute Creek Member
- California Creek Member
- Moose Creek Member

**This study:**
- Quartzite-metagrit
- Green, gray, maroon phyllite/slate
- Meta-volcaniclastic rocks
- Peralkaline meta-rhyolite
- Meta-mafic rocks
- Meta-rhyodacite
- Meta-granite
- Meta-arkosic wacke
- Black graphitic phyllite/slate
Totatlanika Schist meta-sedimentary rocks
- Green metagrit
- Meta volcaniclastics
- Meta-arkosic wacke
- Graphitic phyllite
- Phyllite-slate
Totatlanika Schist Metamorphic rocks

- Tabular to lensoidal
- Contacts typically cleavage-parallel
- Local relict primary textures/structures
Metafelsic textural varieties

- Aphanitic - aphyric
- Porphyritic quartz/feldspar
- Megacrystic potassium feldspar-bearing
Totatlanika Schist

- Bimodal volcanism
- Alkali-basalt
- Rhyodacite/granite
- HFSE enriched peralkaline rhyolite

Zircon U/Pb (Dusel-Bacon et al, 2010)

Rb-Y-Nb variation (Pearce et al, 1984)

Nb/Y - Zr/TiO₂ plot (Winchester + Floyd 1977)
Cretaceous Plutons & Dikes
Eastern Bonnifield
Mining District
Alaska

Quartz Monzonite
92.3±0.5 Ma (biotite)

Granodiorite
93.1±0.6 Ma (biotite)
92.0±1.0 (hornblende)

Gabbro dike
102.5±0.6 Ma (whole rock)
Volcanogenic Massive Sulfide Prospects
Eastern Bonnifield Mining District
Alaska
Dry Creek (Red Mountain Creek)

DC North inferred resource:
- 2.9 million tonnes
- 4.4 % Zn, 1.9 % Pb, 0.2 % Cu
- 93.6 g/t Ag, 0.55 g/t Au

(Grayd, 1999)

Fosters Creek

(Grayd, 1998)
Inferred resource
- 2.8 million tonnes
- 6.0% Zn, 2.5% Pb, 0.1% Cu
- 178.2 g/t Ag and 0.9 g/t Au
(RAA via Grayd, 1999)
Rerun Prospect

- Sediment hosted, multiple horizons
- Symmetrical silicification halos
- Mineralization displaced from meta-rhyolites

**Totatlanika Schist**

- Meta-Sandstone
- Silicified Meta-Sandstone
- Green & Maroon Slate (Oxidized Layers)
- Gray Slate
- Black Graphitic Slate
- Siliceous Graphitic Slate
- Intergrown Quartz + Calcite
- Silica Rock
- Disseminated Sulfides
- Sulfide-bearing, foliation-parallel Quartz Veins
- Meta-Volcanic Package

**Legend**

- Silica Rock w/ Disseminated Pyrite
- Disseminated Pyrite
- Disseminated Pyrite + Chalcopyrite
- Disseminated Pyrite
- Disseminated Pyrite
- Silica rock w/ Sphalerite, Galena, Pyrite

43.1 ppm Ag
3930 ppm Cu
25.2 ppm Ag
3670 ppm Pb
East Bonnifield VMS

- Bimodal Volcanic suite continental arc/rift geochemistry
- YTT siliciclastic basement and cap
- Sediment & volcaniclastic hosted VMS
- Zn>Pb>Cu, significant silver values
- Hangingwall Ba anomalies
- Drill inferred resources
  - (5.7 million tonnes, 5.2 % Zn, 2.2 % Pb, 0.2 % Cu, 125.9 g/t Ag, 0.7 g/t Au – Grayd, 1999)
- Finlayson Lake district similarities
Epigenetic Vein Occurrences

East Bonnifield

Mining District

Alaska
Glory Creek

- Au-Ag-As-Pb-Sb veins
- Granodiorite stock $94.1 \pm 0.6$ Ma (biotite)
- Vein sericite $91.4 \pm 0.7$ Ma
- 11 samples, 7 > 1 g/t Au
Buzby Prospect

- Chalcopyrite lenses in phyllite
- Up to 19.8 % Cu, 233 g/t Ag

- Galena veins in trench
- Up to 12.9 % Pb, 304 g/t Ag
Opportunities?
References


Piercey, S.J., Peter, J.M., Mortensen, J.K., Paradis, S., Murphy, D.C., and Tucker, T.L., 2008, Petrology and U-Pb geochronology of footwall porphyritic rhyolites from the Wolverine volcanogenic massive sulfide deposit, Yukon, Canada: Implications for the genesis of massive sulfide deposits of continental margin environments: Economic Geology, v. 103, p. 5–33.

