Metal Leaching and Acid Rock Drainage Prediction, Prevention and Mitigation at the Brucejack Gold Mine

Colleen Atherton and Alison Shaw

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Brucejack Mine

Located in Northwest BC
Mine Site Surface Layout

- WZ Portal
- Camp Creek
- Contact Water Pond
- Waste Rock Pad
- Mill
- VOK Portal
- Phase II Camp
- Phase I Camp

Brucejack Lake

Scale: 500 m
RECEIVING ENVIRONMENT

Mitchell Ck.

Sulphurets Ck.

Mine Site
ARD Potential

- Volcanic arc-related epithermal vein deposit
- Large gossan
- Low pH observed seasonally in local creeks
- ABA analysis from previous operator indicated waste rock was PAG (MEND, 2005)
Metal Leaching/ Acid Rock Drainage Management Plan

- Water Quality model developed to predict effects
- Minimize bedrock disturbance
- Confirm and document geochemical assumptions
- Triggers for further investigation
ARD Prevention

- Mine designed and constructed to prevent/minimize ARD generation
  - Core infrastructure platforms ~30 ha.

- Management strategies
  - Minimize surface excavation
  - No PAG rock permitted for use in surface construction
  - Place all waste rock under permanent water cover
Surface and Underground Waste Rock Deposition Schedule

- Surface WR to Lake
- UG WR to Lake
- Total WR to Lake

Waste Rock Deposition

September 2018
Contact Water Management
Water Treatment Plant

- Designed to treat maximum predicted concentrations
- Designed to removed TSS and targeted metals and adjust pH
- Will operate as long as necessary to mitigate impact of ARD from underground workings and surface disturbance
Water quality model developed from preliminary data

Updates required every five years

Includes a variety of data sources from each lithology:
- Static testing (> 500 samples)
- Humidity cells (46)
- Saturated columns (15)
- Field Bins (14)
- Wall washing stations (5)

ML/ ARD Mgmt Plan identifies triggers for additional investigation or review of model
Ongoing Characterization
Underground Waste Rock Static Test Results

- **Conglomerate (S3)** – Heterolithic boulder to coarse cobble conglomerate with sandstone
- **Fragmental (V12)** – Hornblende and/ or feldspar phric latite to andesite fragmental volcanic rocks and subordinate flows with minor ash and lapilli tuff
- **Volcanic Sedimentary Facies (VSF)** – Volcanically derived siltstone and sandstone with minor arenite and pebble conglomerate
Ongoing Characterization
Humidity Cell Tests

Active Conglomerate Tests

Active Fragmental Tests

Active VSF Tests

pH

Weeks
### Geochemical Assessment of Impact

<table>
<thead>
<tr>
<th>Geological Model Unit</th>
<th>Relative % of Underground Waste Rock</th>
<th>HCT Time Until CaNP Depletion (years)</th>
<th>Field Bin ID</th>
<th>Field Bin Time Until CaNP Depletion (years)</th>
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<td>Upper Case</td>
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<td>Volcanic Sedimentary Facies (VSF)</td>
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<td>Bridge P1</td>
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</table>

- Calculated NP depletion times are >> 2 years
- Loads accumulated during the first 2 years of exposure, based on lithology-specific field bin data and estimated exposed volumes were incorporated into the water quality model
- Loads associated with exposed waste rock are insignificant and result in insignificant change to lake water quality (e.g., a change of < 0.4 mg/L SO4, < 1ng/L As, < 1ng/L Zn)
Ongoing Studies

- Kinetic tests ongoing
  - Behaviour of waste in lake and UG mine
  - Behaviour following flooding

- Wall Washing
  - Evolution of mine wall geochemistry
  - Planning for closure

- Results used to refine site WQ model
References
