Introduced particles in indicator mineral processing: a) considerations in preparing test samples for QA/QC; and b) examples of anthropogenic contamination

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Workshop B: Indicator Mineral Exploration Technology
Introduced particles in indicator mineral processing: a) considerations in preparing test samples for QA/QC; and b) examples of anthropogenic contamination

Part 1
- Grain species used for spiking
- Mineral properties: density, size and shape
- Laser etched grains and synthetic tracers
- Base sample selection

Part 2
- Mine contamination of stream sediments
- Nuisance contamination of streams
- Airfall contamination of humus and till
- Ending with a ‘bang’
Part 1

“Considerations in preparing test samples for QA/QC”
Mineral Properties that Affect Recovery

1. Density
2. Size
3. Shape
Recovery versus Density

![Graph showing recovery versus density with categories CR, IM, GP, GO, DC, FO. Recovery values range from 0 to 100. Decreasing density is indicated by an arrow.]
<table>
<thead>
<tr>
<th>Mineral</th>
<th>Symbol</th>
<th>Specific Gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forsterite</td>
<td>FO</td>
<td>3.25</td>
</tr>
<tr>
<td>Cr-diopside</td>
<td>DC</td>
<td>3.3</td>
</tr>
<tr>
<td>Cr-poor pyrope</td>
<td>GO</td>
<td>3.7</td>
</tr>
<tr>
<td>Cr-pyrope</td>
<td>GP</td>
<td>3.8</td>
</tr>
<tr>
<td>Mg-ilmenite</td>
<td>IM</td>
<td>4.7</td>
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<tr>
<td>Chromite</td>
<td>CR</td>
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Why Size of Spike Grains Matters

• Stokes’ Law

• Most KIMs occur naturally between 0.25-2.0 mm

• There is no perfect gravity concentrating device
KIMs from 0.25-0.5 and 0.5-1.0 mm Fractions
Other Considerations for Spike Grain Selection

- Use only unequivocal KIMs that have been naturally transported
- Include both typical and atypical specimens
- Avoid structurally weak grains
- Avoid grains with dimensions close to upper and lower boundaries
- Avoid slightly magnetic grains (Mg-ilmenite) to prevent premature removal
Structurally Weak Cr-Diopside
Laser Etching

Photos: Sean Whiteford
Synthetic Density Tracers

- Different shape than KIMs
- If magnetic, removed by ferromagnetic separation
- If non-magnetic, contain Pb but variably paramagnetic
- Reshaped/resorbed by solvents such as acetone
Acceptable Base Samples

- Only natural sample material should be used
- Weight and mineralogy of the HMC matches that of the host project
- HMC is essentially KIM and pseudoKIM free
- Previously processed samples are ideal if all fractions are available to be re-combined
“Considerations in preparing test samples for QA/QC”

Spiked Grains
• Test range of densities
• Test range of sizes
• Laser etched grains are useful but expensive and possibly weakened
• Synthetic tracers should avoided

Sample Base
• Natural till or sand and gravel
• Quartz-sand bases enhance recovery
• Previously processed, KIM-free samples are ideal
Part 2

“Examples of anthropogenic contamination”
Sources of Contamination to Indicator Mineral Sampling

- Mining related infrastructure and operations (tailings, waste dumps, smelters)
- roads
- railways
- bridges
VMS Indicator Mineral Contamination

Chalcopyrite

Pyrite

Gahnite

0.5 mm
Winston Lake Mine

185-MA-00
(Cpy, Sph, Py, Ghn)

181-MA-00
(Ghn)

179-MA-00
(Cpy, Sph, Py)

Zenmac Mine
Examples of Contamination in Ontario Alluvial Sediment Samples
Ontario Railway Bridge – Contamination Source
Examples of Contamination in Ontario Alluvial Sediment Samples

Slag

Synthetic Corundum

0.5 mm
Paint and Ceramic Coated Shingle Granules
Contamination Sources in OGS Survey Area

OGS Survey Area

IKO Quarry & Plant

Delford Mine

Map: © 2007 MapQuest Inc.
Location of Gold-in-Humus Anomaly and Proximal Tailings Ponds, Kirkland Lake, Ontario
Mechanically Modified Gold Grain
Location of Gold-in-Humus Anomaly and Proximal Tailings Ponds, Kirkland Lake, Ontario
Dust Cloud from Lac des Iles Pd Mine

Photo: OGS.
Slag from Thompson Manitoba

Photo: B. McClenaghan
Bullet Recovered from Minnesota Till Sample