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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Ottawa, Ontario

International Applied Geochemistry Symposium
Workshop B: Indicator Mineral Exploration Technology

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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

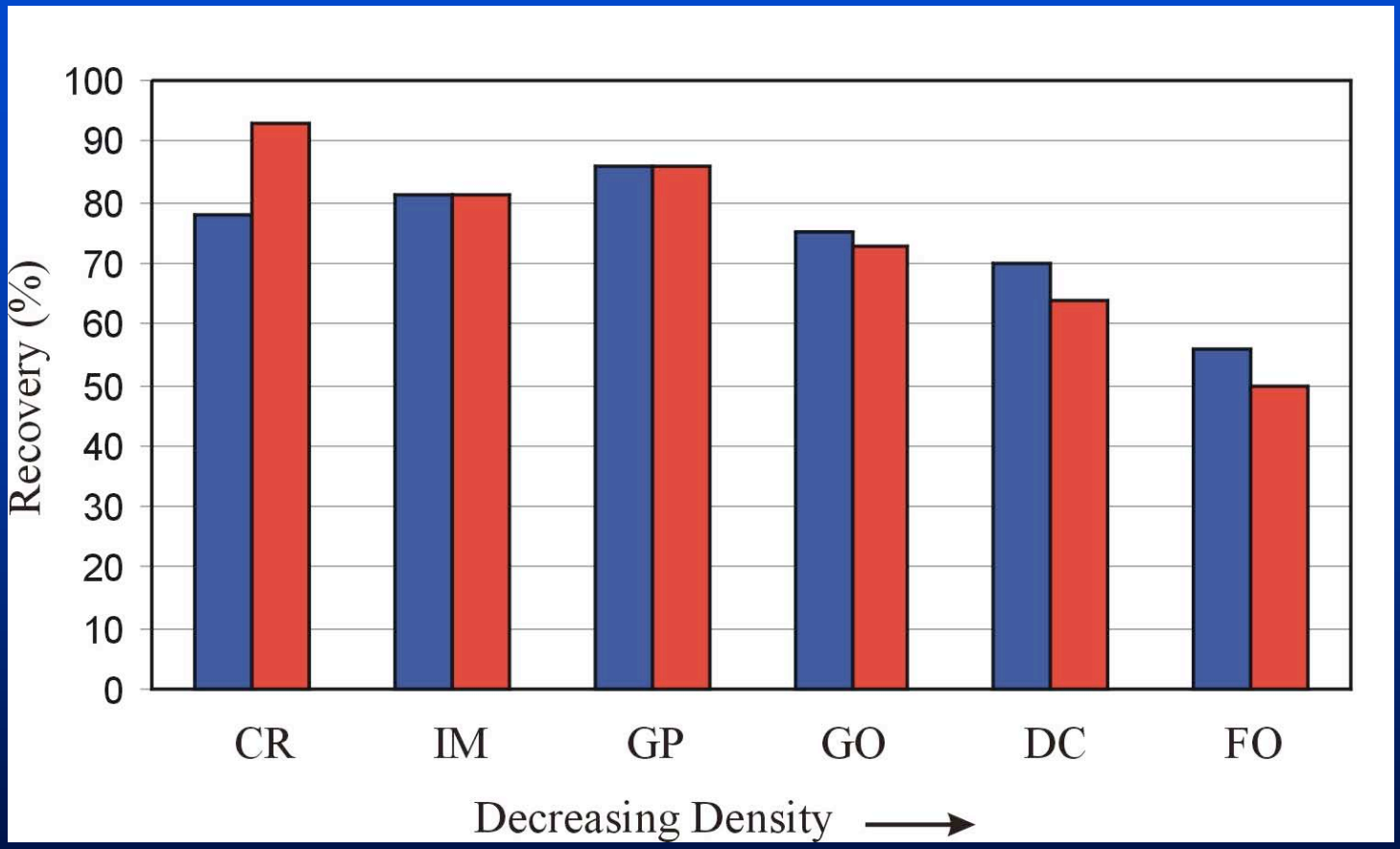
1. Density
2. Size
3. Shape

Photo: Mineral Services Canada

Photo: M. Lehtonen

Photo: P. Sarala

Recovery versus Density



Mineral	Symbol	Specific Gravity
Forsterite	FO	3.25
Cr-diopside	DC	3.3
Cr-poor pyrope	GO	3.7
Cr-pyrope	GP	3.8
Mg-ilmenite	IM	4.7
Chromite	CR	5.1

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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

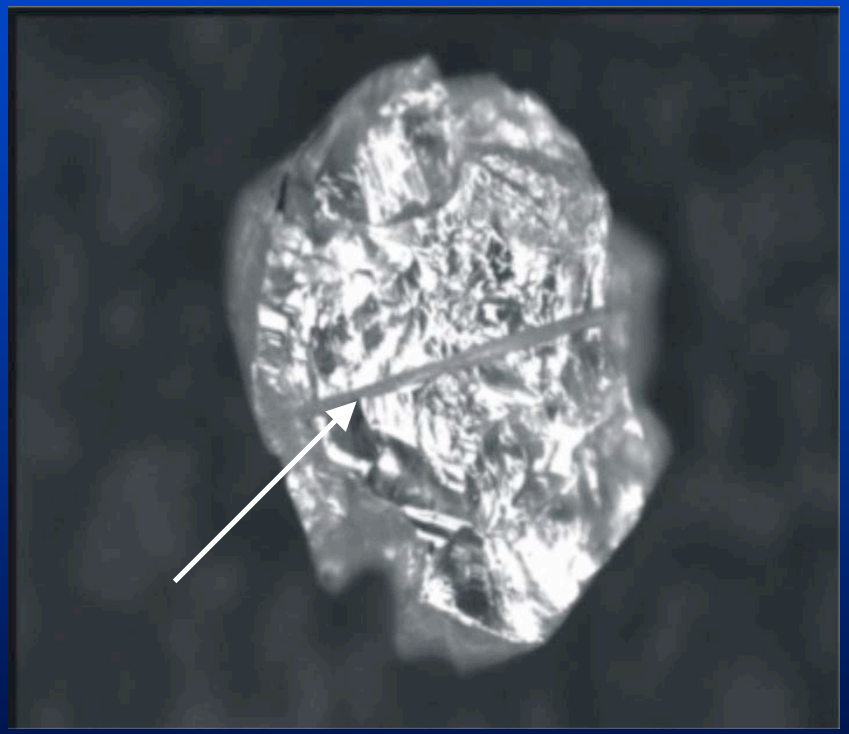
KIMs from 0.25-0.5 and 0.5-1.0 mm Fractions

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

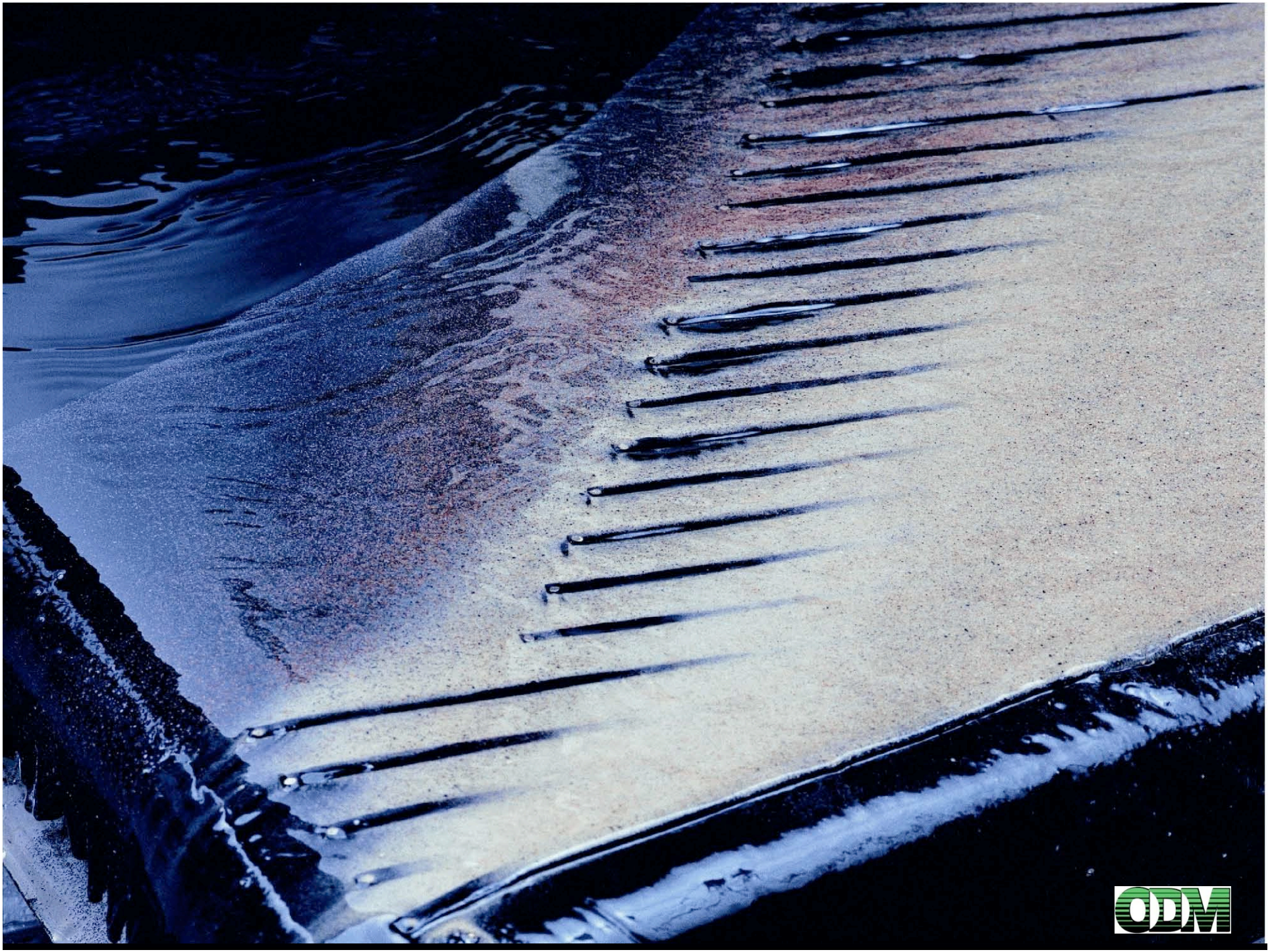
Photo: Bateman Engineering N.V.

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

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"<u>Considerations</u> 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

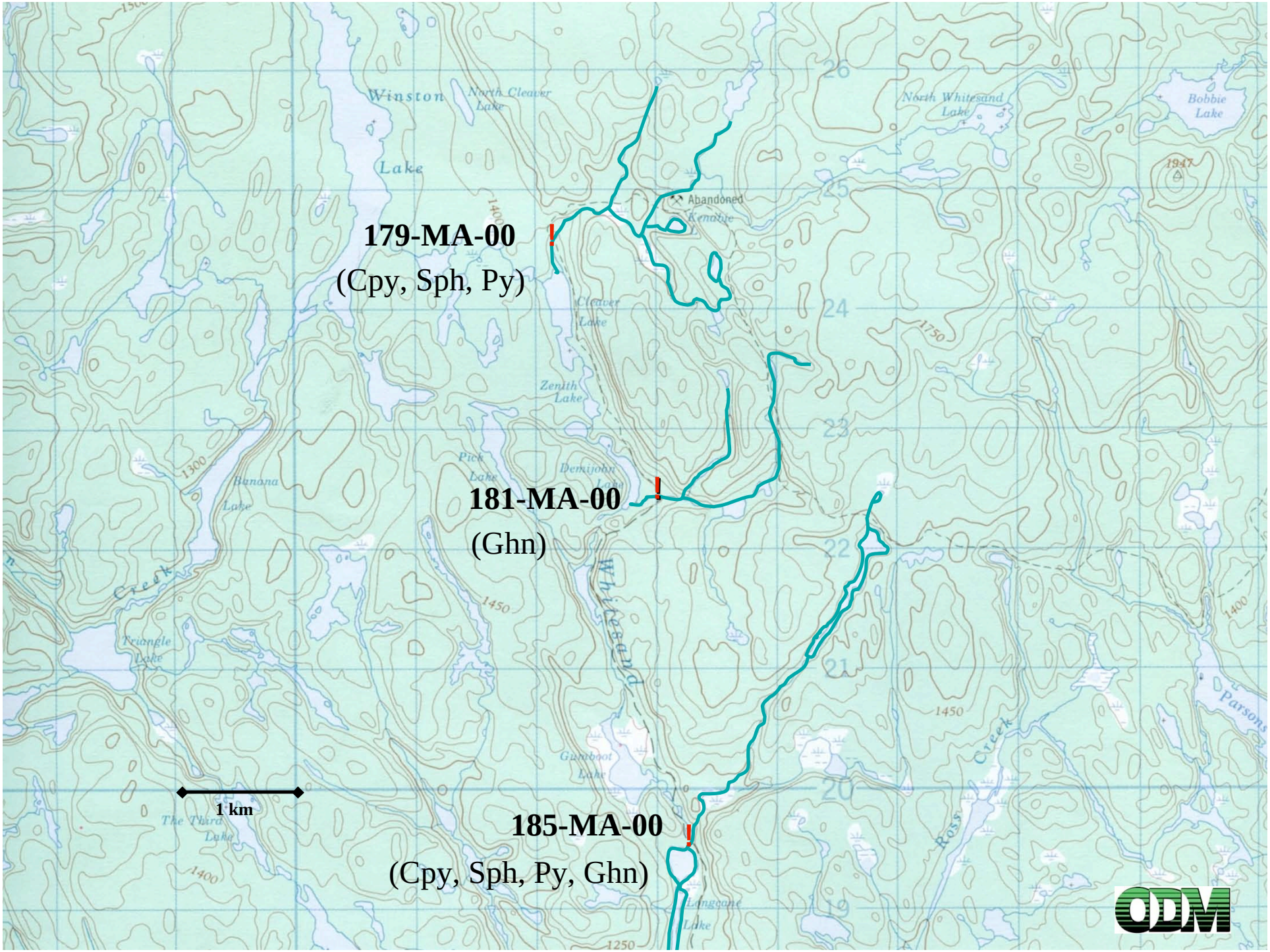
Part 2

“Examples of anthropogenic contamination”

Sources of Contamination to Indicator Mineral Sampling

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


Schreiber
Ottawa
Toronto

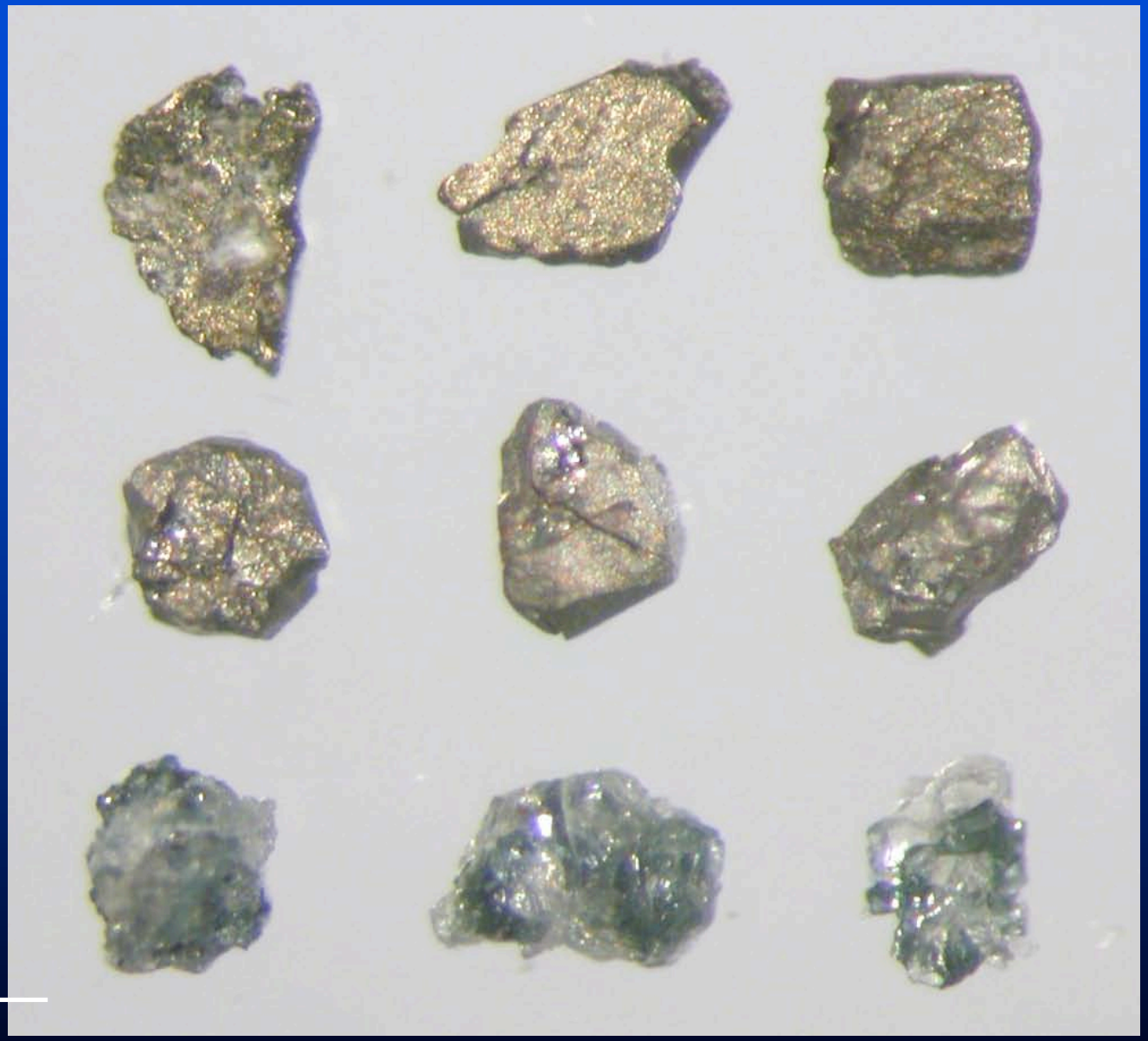

179-MA-00
(Cpy, Sph, Py)
181-MA-00
(Ghn)
185-MA-00
(Cpy, Sph, Py, Ghn)
1 km
Winston Lake
North Cleaver Lake
Cleaver Lake
Zenith Lake
Pick Lake
Demijohn Lake
Banana Lake
Triangle Lake
The Third Lake
Gunboot Lake
Langcane Lake
Whitesand
Creek
Ross Creek
Parsons
North Whitesand Lake
Bobbie Lake
Abandoned Kenotie
1947
1750
1450
1400
1300
1250
26
25
24
23
22
21
20
19

VMS Indicator Mineral Contamination

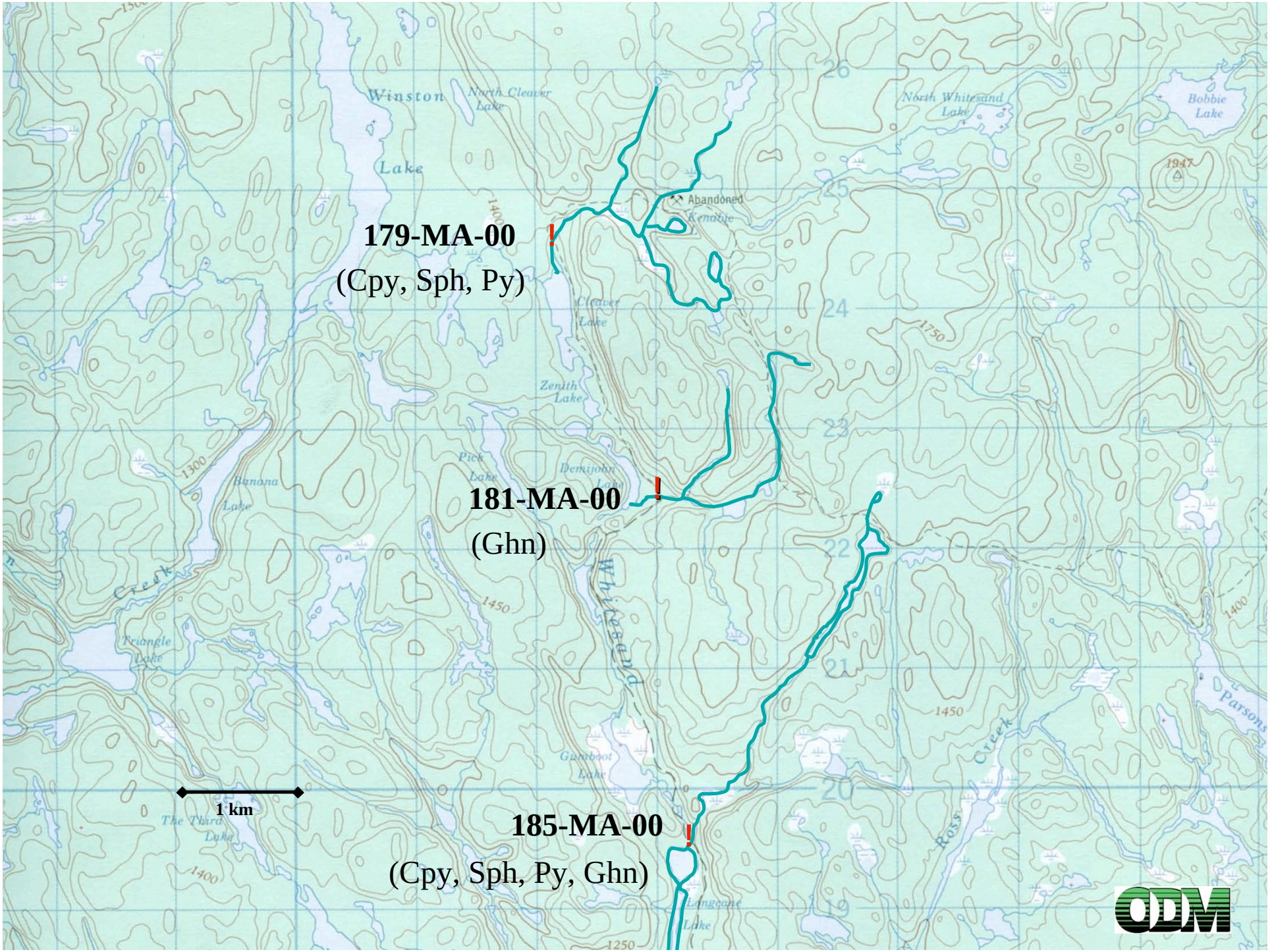
Chalcopyrite

Pyrite

Gahnite



0.5 mm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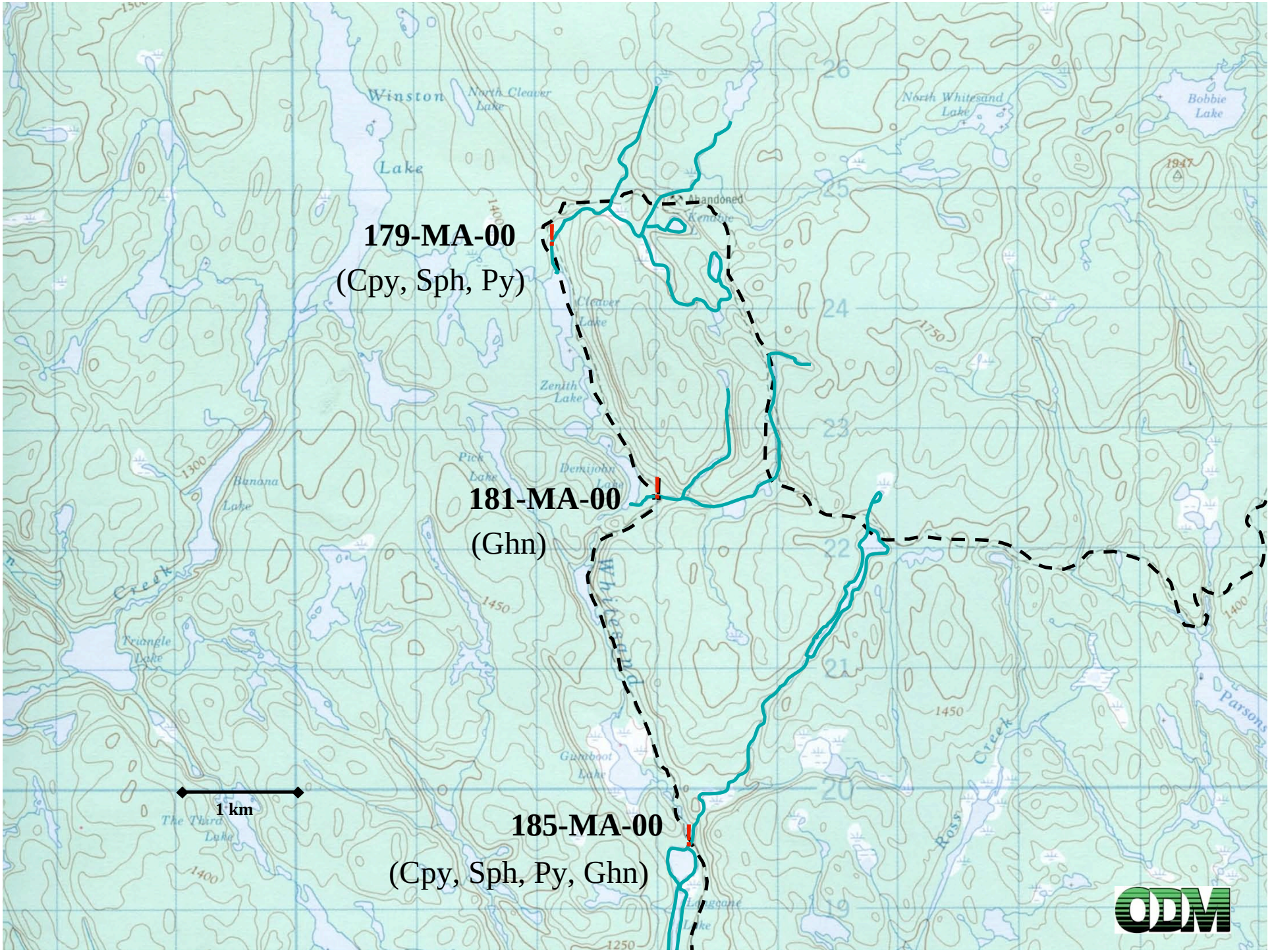
179-MA-00
(Cpy, Sph, Py)
181-MA-00
(Ghn)
185-MA-00
(Cpy, Sph, Py, Ghn)
1 km
Winston
Lake
North Cleaver Lake
North Whitesand Lake
Bobbie Lake
Abandoned
Kendrick
Cleaver Lake
Zenith Lake
Pick Lake
Demijohn Lake
Banana Lake
Triangle Lake
Whitesand
Gunboot Lake
The Third Lake
Ross Creek
Parsons
1300
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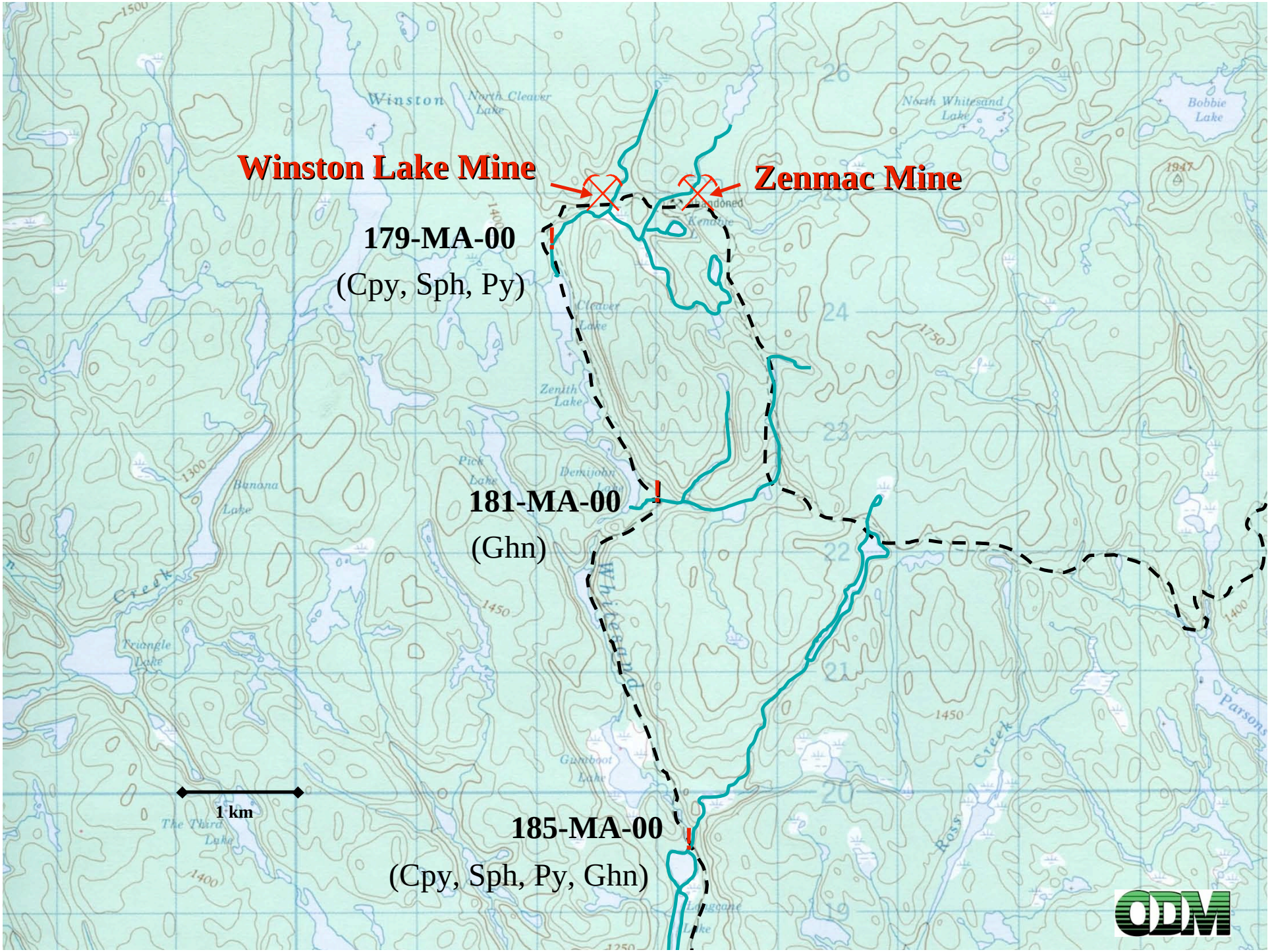
Winston Lake Mine
Zenmac Mine
179-MA-00
(Cpy, Sph, Py)
181-MA-00
(Ghn)
185-MA-00
(Cpy, Sph, Py, Ghn)
1 km
Winston
North Cleaver Lake
North Whitesand Lake
Bobbie Lake
Cleaver Lake
Zenith Lake
Pick Lake
Demijohn Lake
Banana Lake
Triangle Lake
Gunboot Lake
The Third Lake
Parsons Creek
Ross Creek
Whitesand
1500
1400
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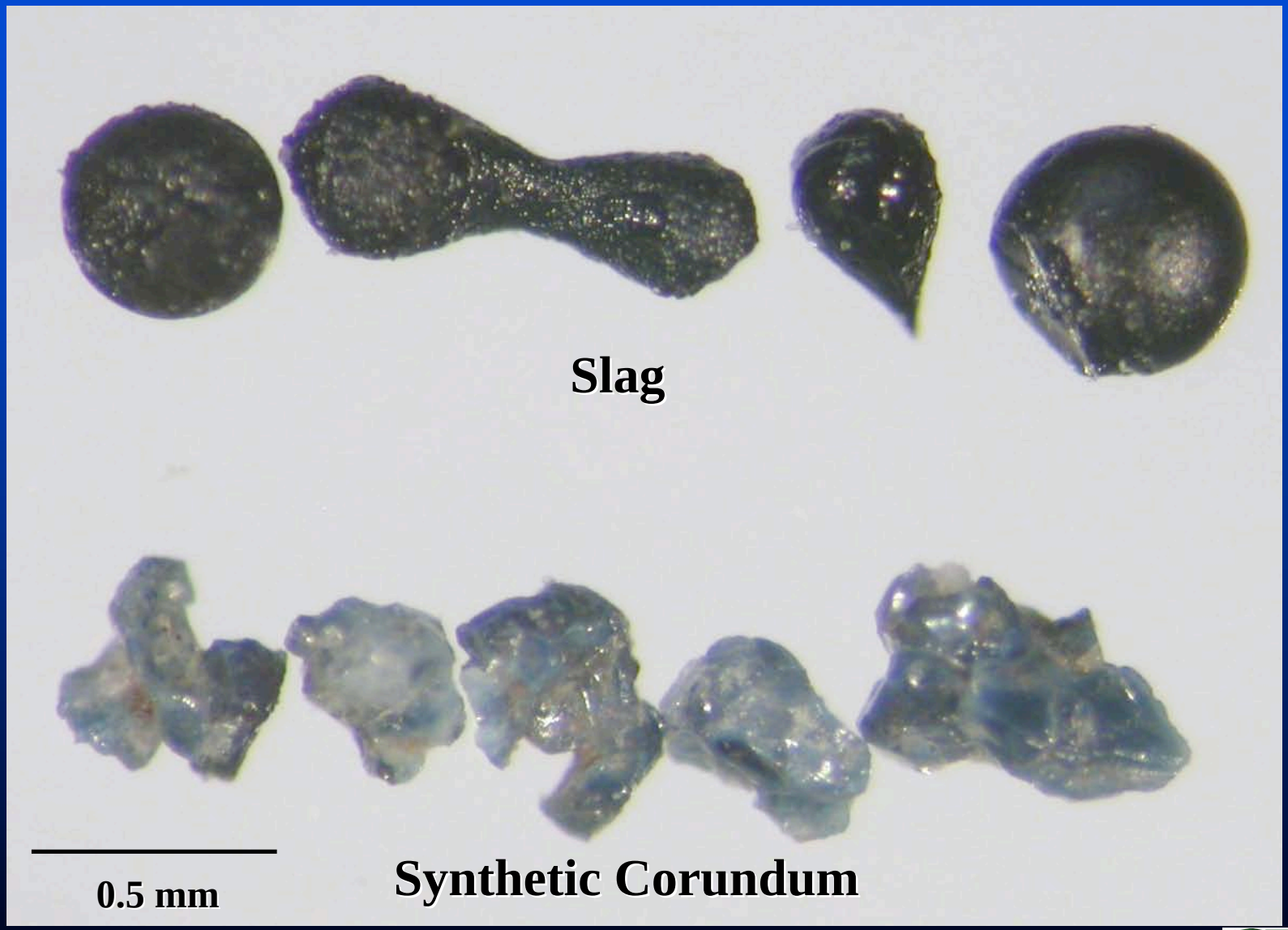
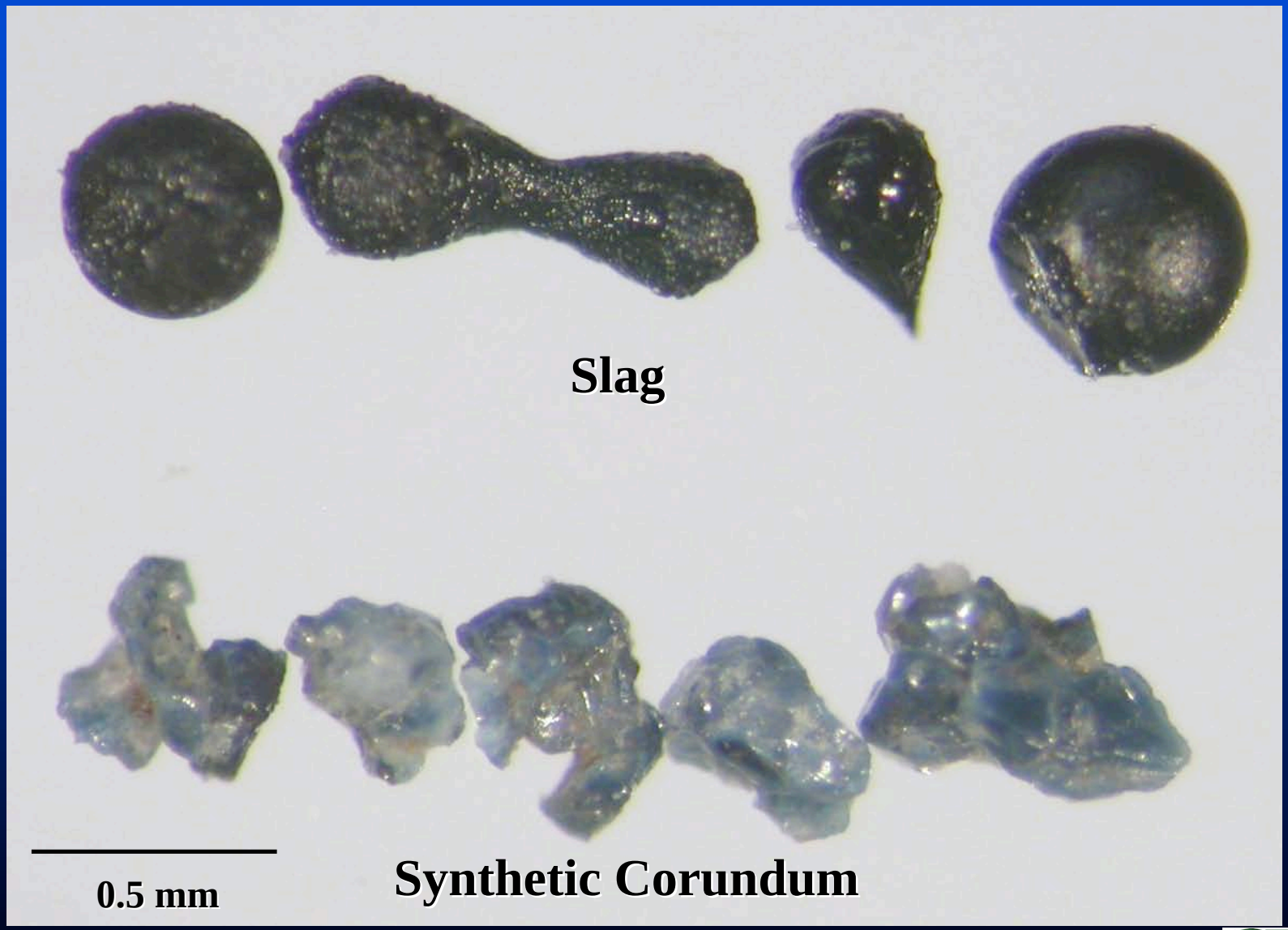
Ottawa
Tweed
Toronto

Examples of Contamination in Ontario Alluvial Sediment Samples



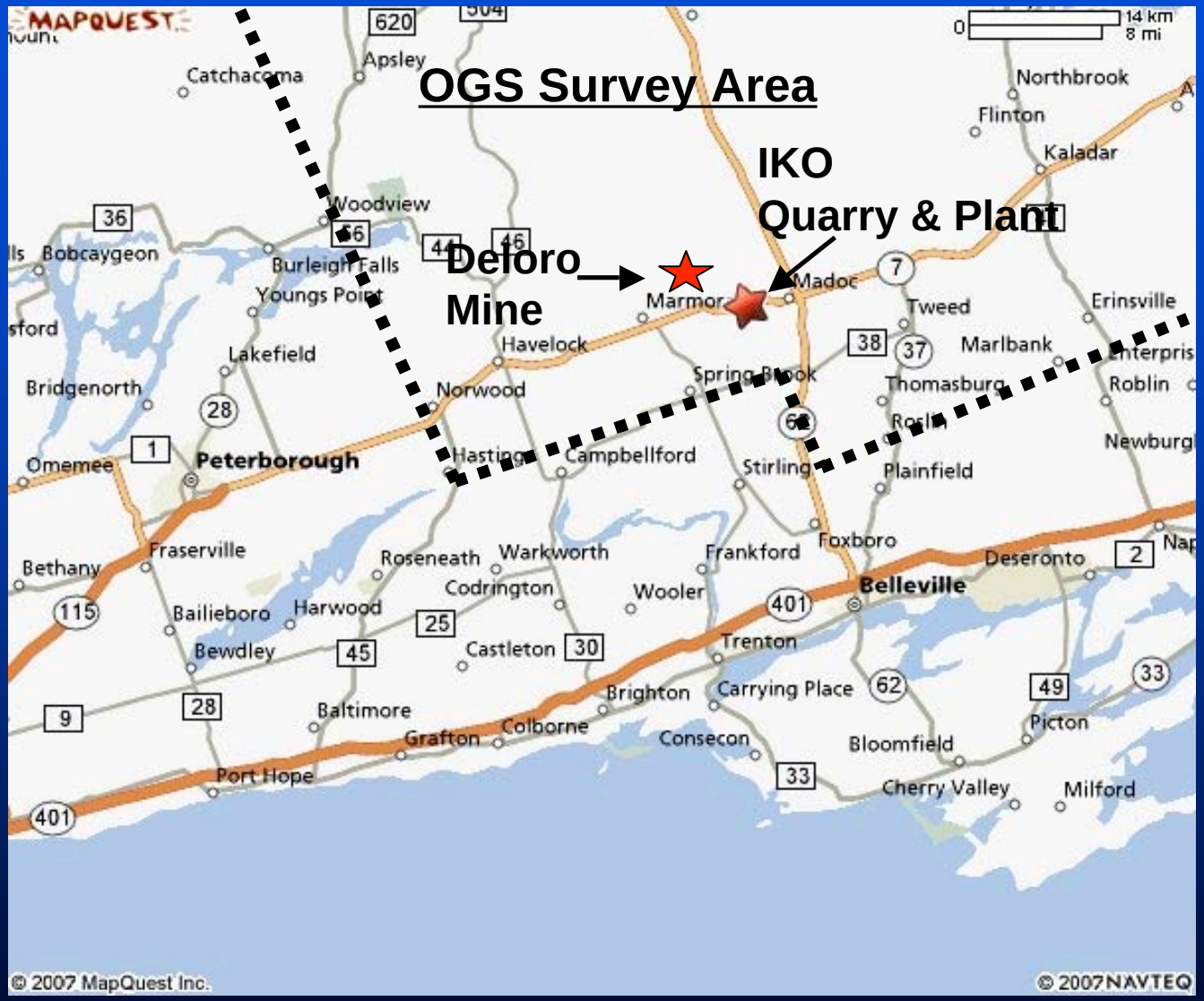
Ontario Railway Bridge – Contamination Source

Examples of Contamination in Ontario Alluvial Sediment Samples



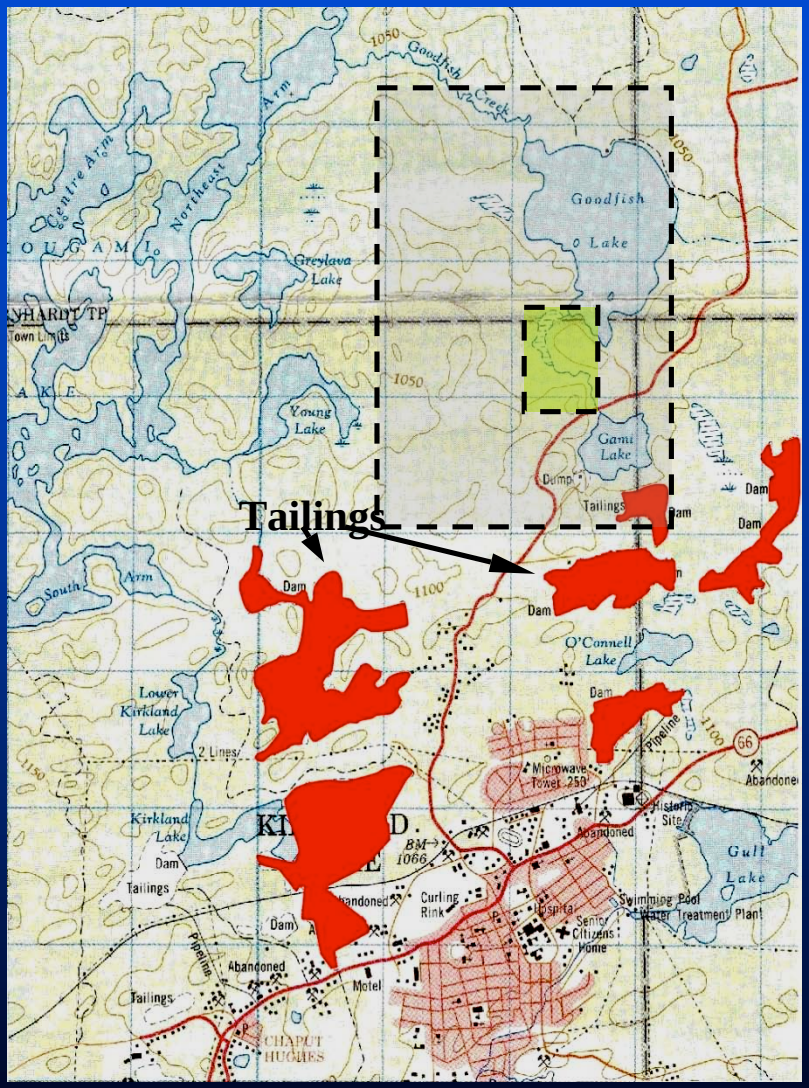
Paint and Ceramic Coated Shingle Granules

Contamination Sources in OGS Survey Area

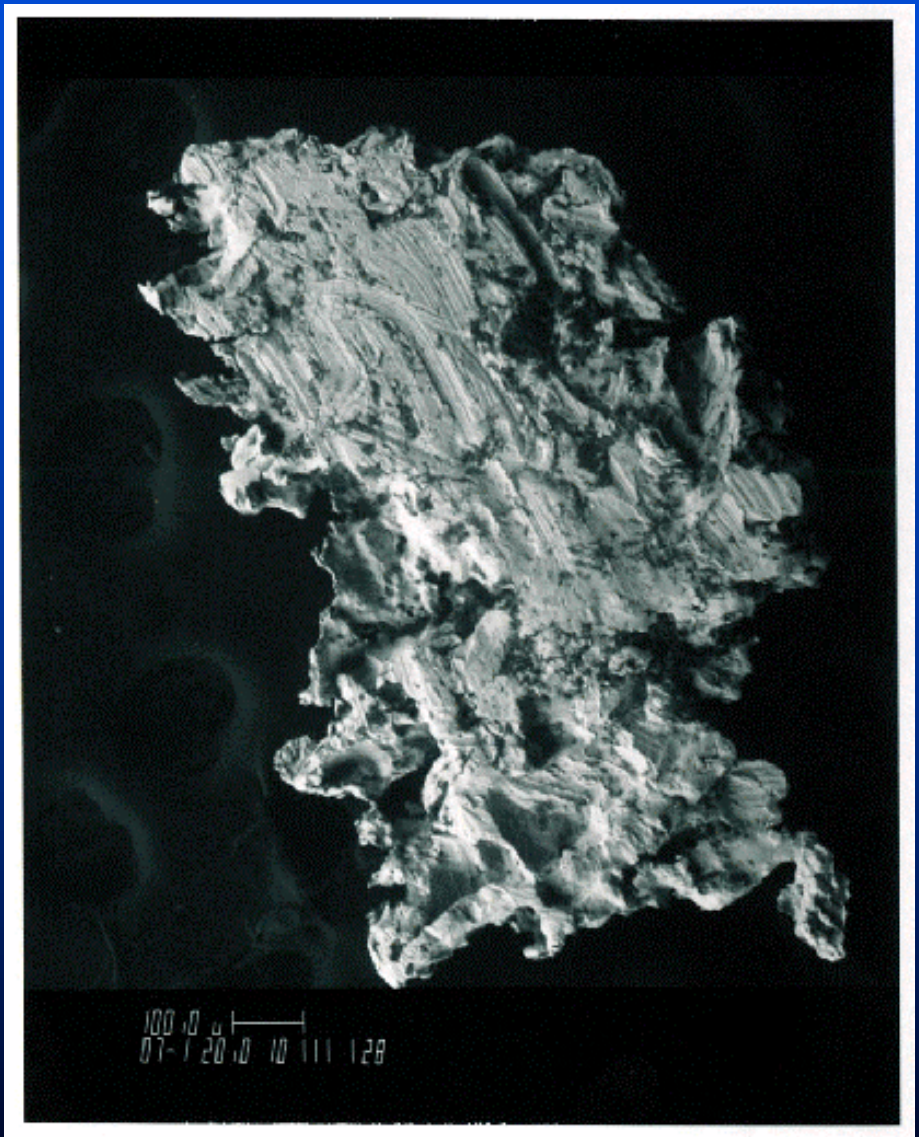



Lac des Iles
Kirkland Lake
Ottawa
Toronto

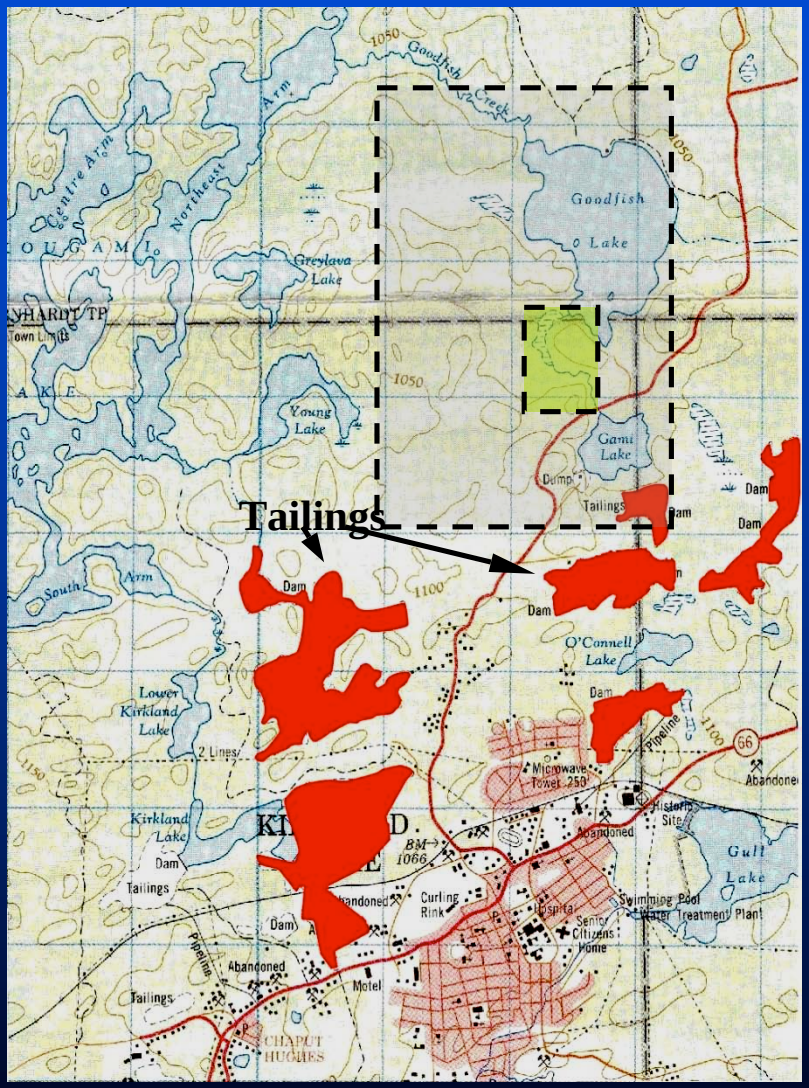
Location of Gold-in-Humus Anomaly and Proximal Tailings Ponds, Kirkland Lake, Ontario



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.

Smelter, Thompson, Manitoba

Photo: B. McClenaghan

Slag from Thompson Manitoba

Photo: B. McClenaghan

Bullet Recovered from Minnesota Till Sample