Field sampling for indicator minerals: How to choose and locate the correct medium and avoid anthropogenic contamination

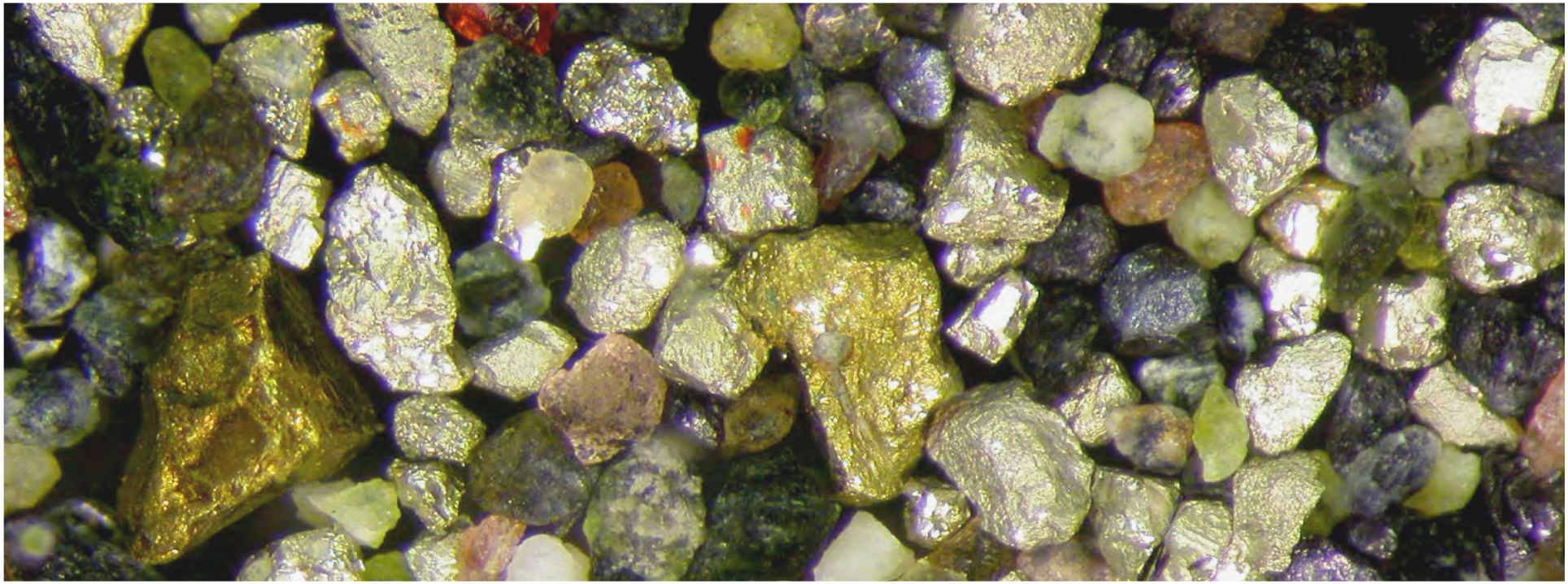
Michael Michaud, David Hozjan & Stuart Averill

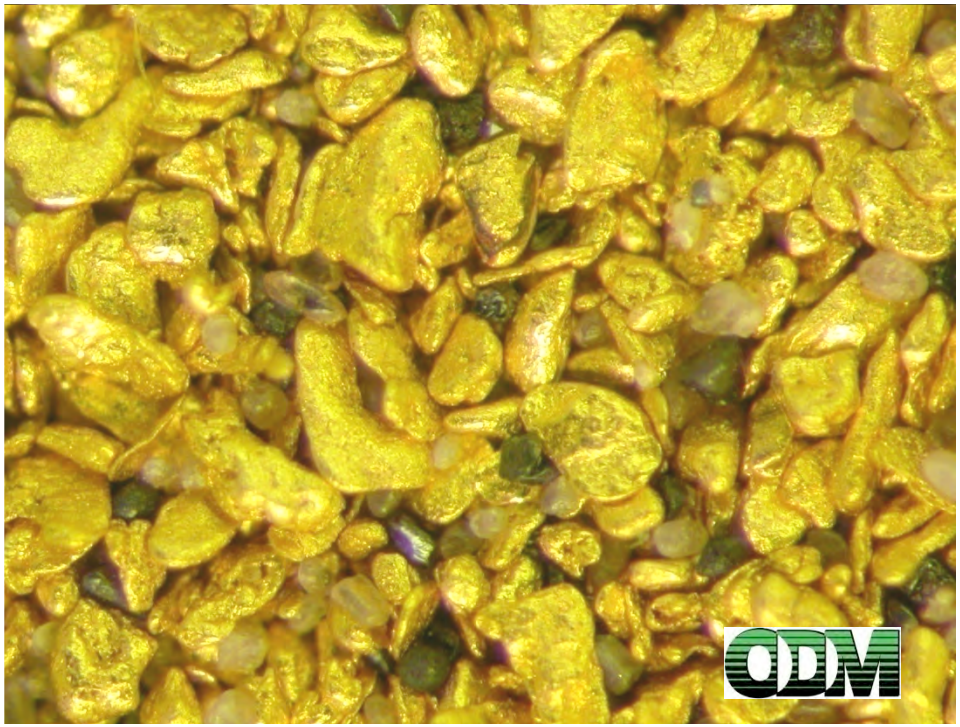
Overburden Drilling Management Limited
Ottawa, Ontario

Exploration 2007
Workshop No. 3: Indicator Mineral Methods in Mineral Exploration

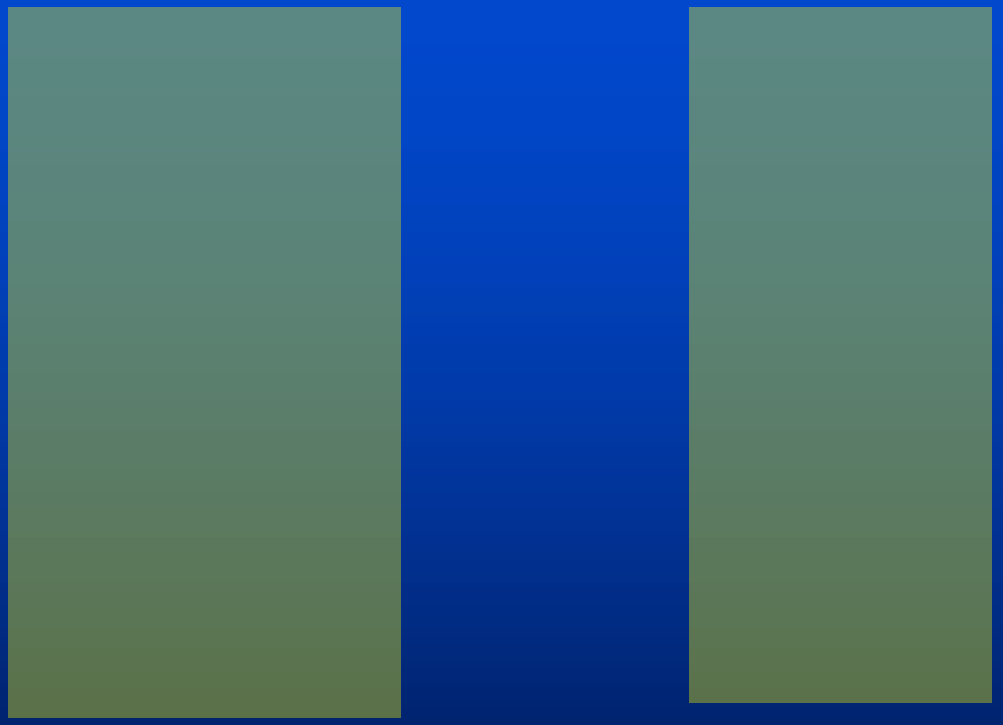
Exploration07

ODM




ODM

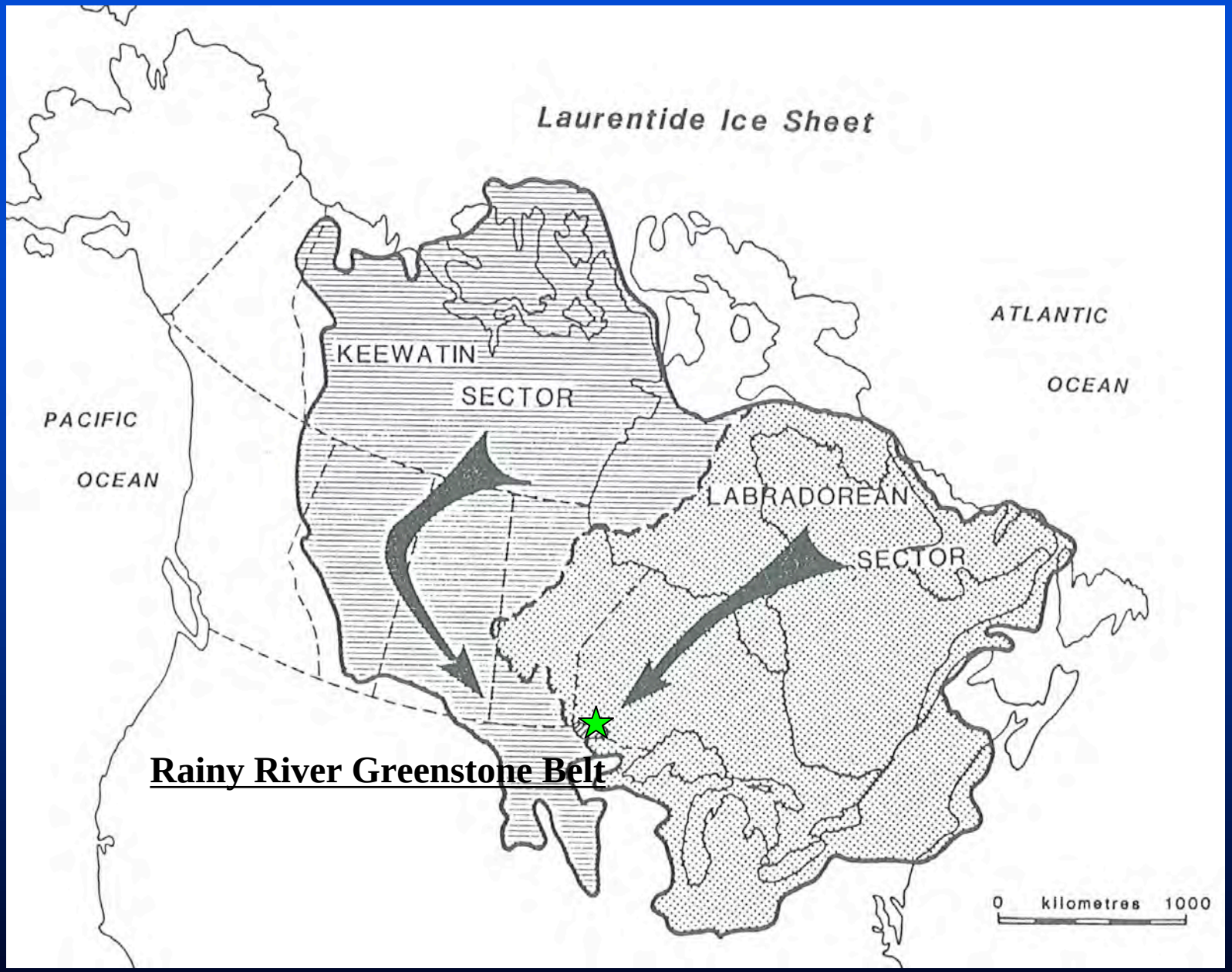
Gold Grain Dispersal Train Lengths and Gold Grain Diameters



Positive Characteristics of Glacial Till for Gold Grain Sampling

1. Unsorted with a large silt-sized component.

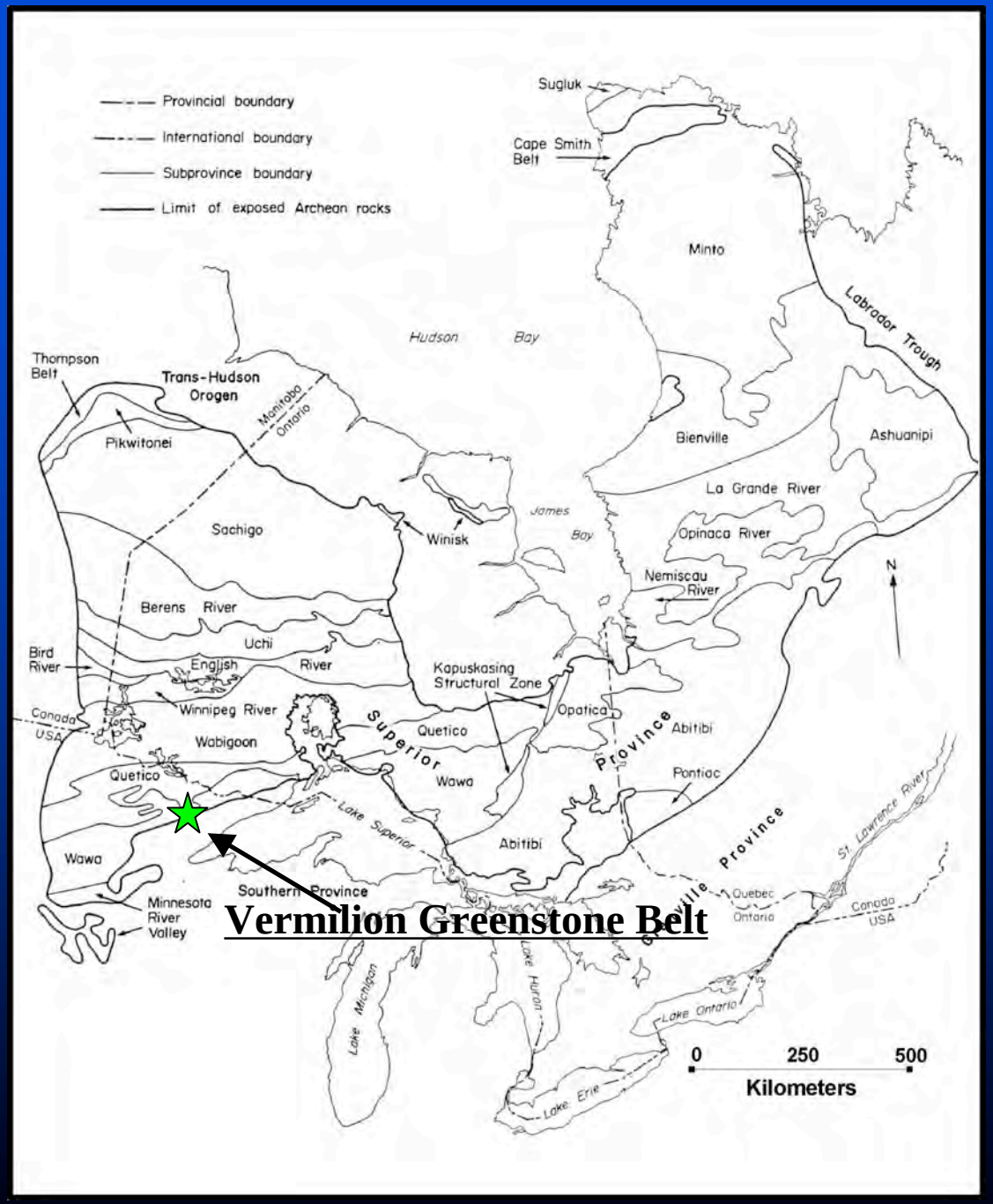
2. Abundant and can be of local provenance.


Laurentide Ice Sheet
KEEWATIN
SECTOR
LABRADOREAN
SECTOR
PACIFIC
OCEAN
ATLANTIC
OCEAN
Rainy River Greenstone Belt
0 kilometres 1000

Map: OGS.

Till Overlying the Rainy River Greenstone Belt, Ontario

Reverse Circulation Drilling


Provincial boundary
International boundary
Subprovince boundary
Limit of exposed Archean rocks
Sugluk
Cape Smith Belt
Minto
Labrador Trough
Hudson Bay
Thompson Belt
Trans-Hudson Orogen
Manitoba
Ontario
Pikwitonei
Bienville
Ashuanipi
La Grande River
James Bay
Sachigo
Winisk
Opinaca River
Nemiscau River
N
Berens River
Uchi
Bird River
English River
Kapuskasing Structural Zone
Winnipeg River
Canada
USA
Opatica
Superior Province
Abitibi
Wabigoon
Quetico
Wawa
Pontiac
Lake Superior
Abitibi
Grenville Province
St. Lawrence River
Wawa
Southern Province
Minnesota River Valley
Quebec
Ontario
Canada
USA
Vermilion Greenstone Belt
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
0
250
500
Kilometers

Map: OGS.

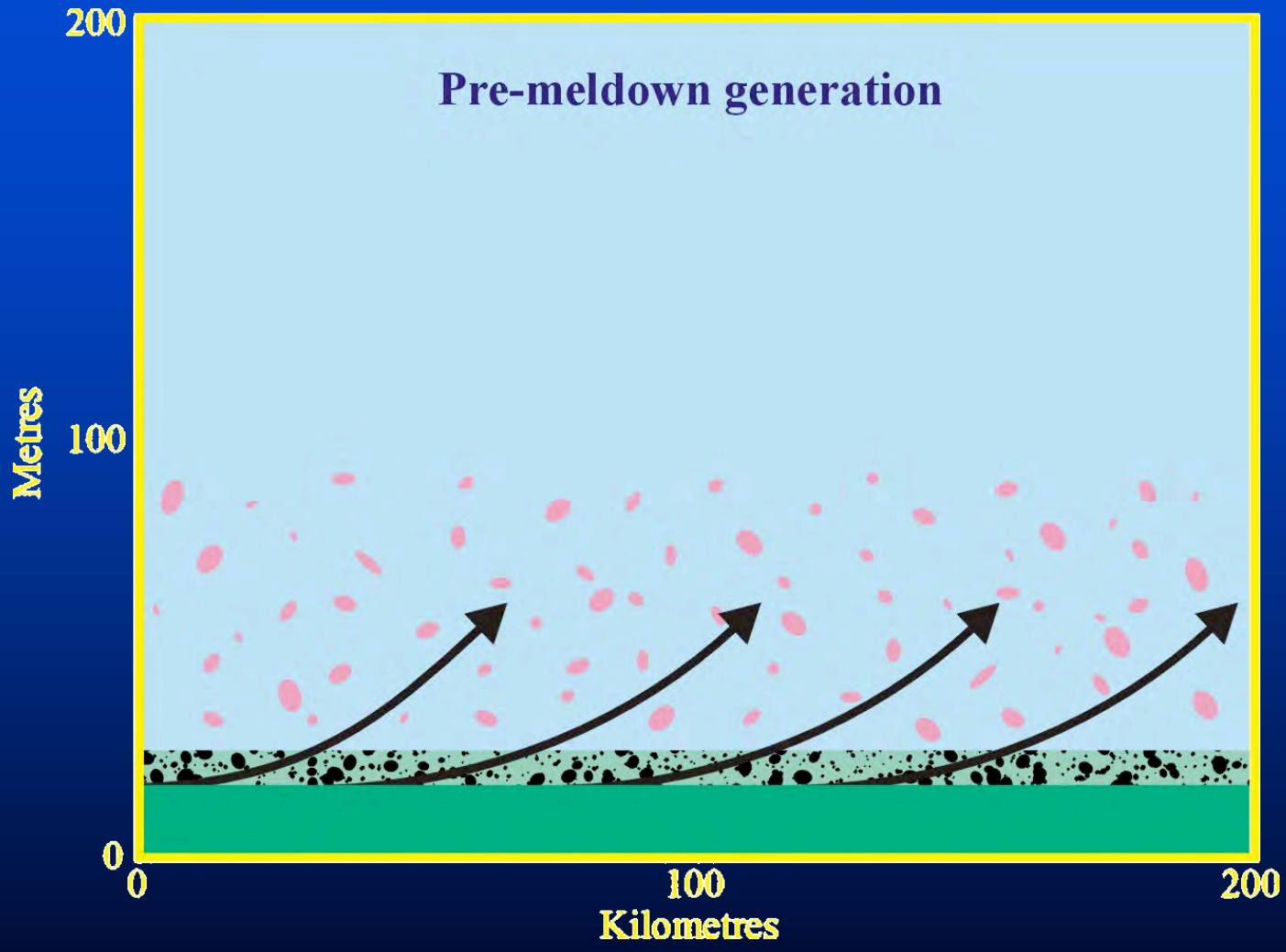
MDNR Descriptions of Till Units

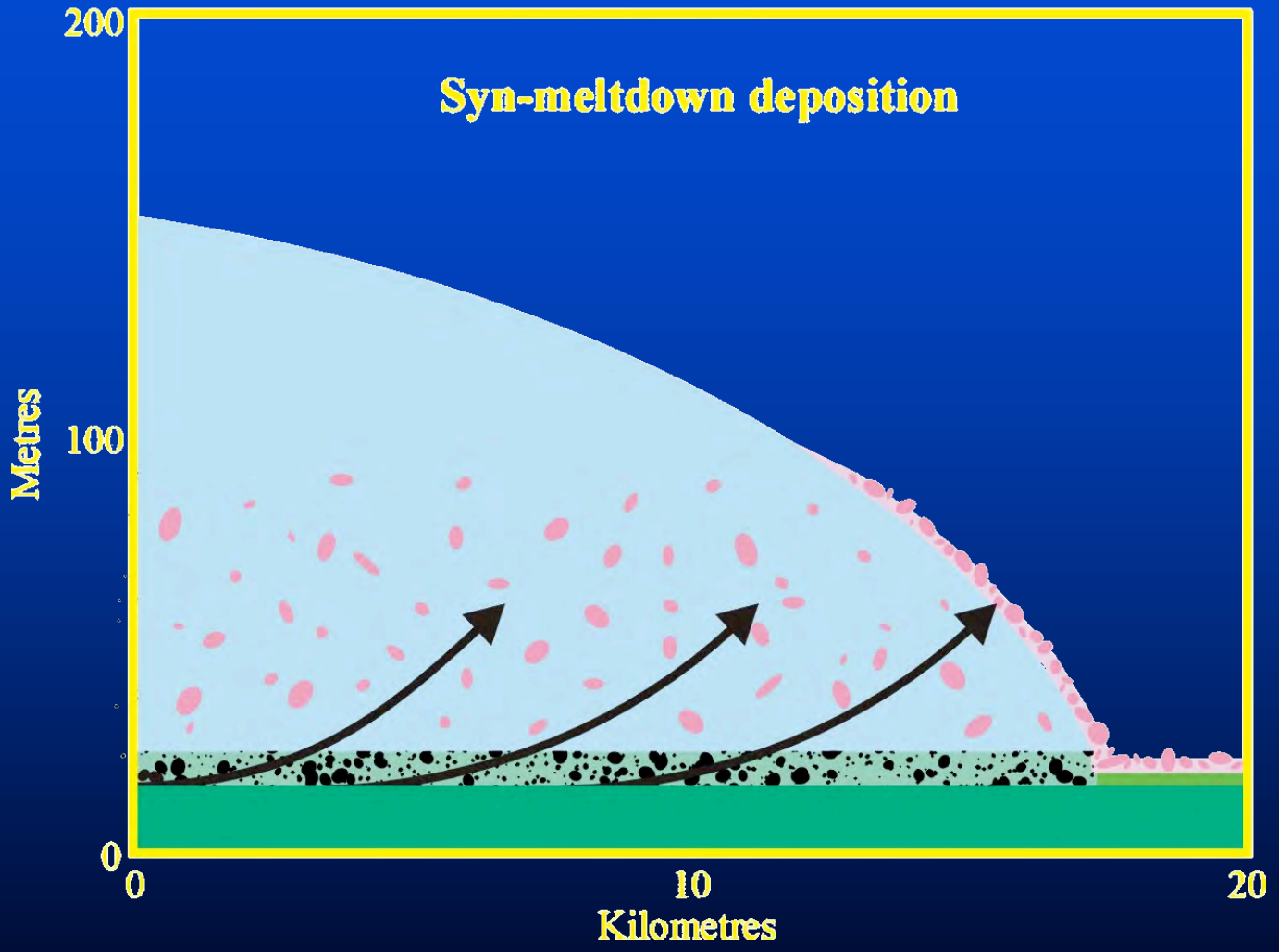
Meltout till: … *contains numerous well-rounded, coarse-grained cobble-to-boulder sized clasts of gneiss and granitoid.*

Basal till: … *lies beneath the meltout till and (contains) an abundance of sharply angular clasts, mostly of supracrustal lithologies, contained in a clayey- to clay-loam rich, often dark coloured matrix.*

Meltout till = Supraglacial till

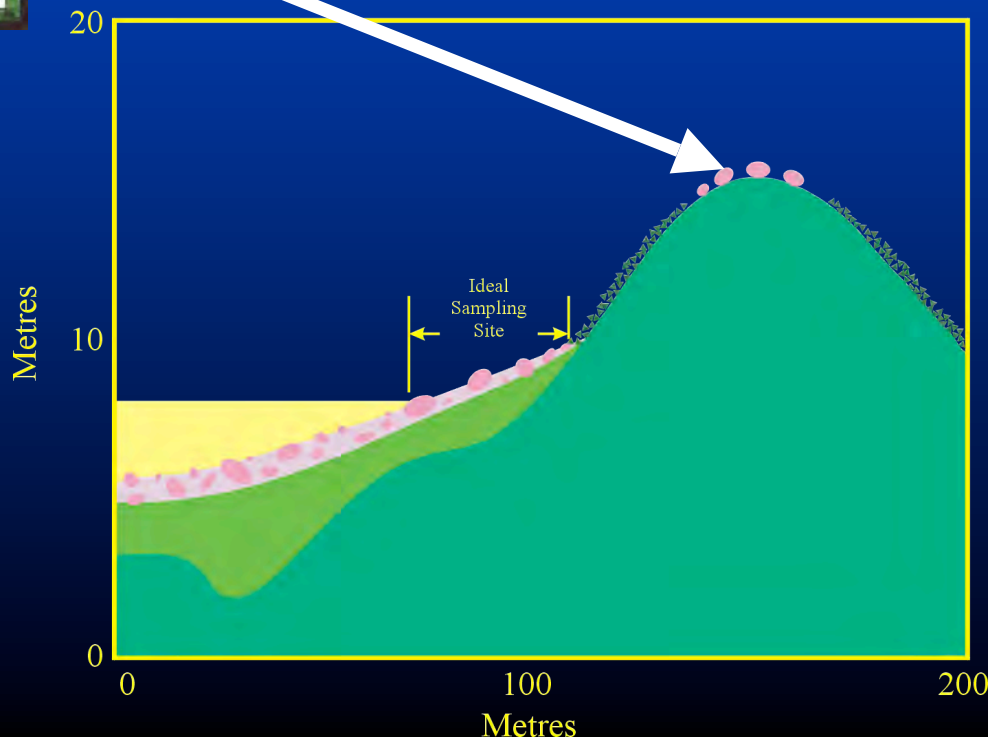
Basal till = Subglacial till


Pre-meldown generation
200
100
0
Metres
0
100
200
Kilometres


Syn-meltdown deposition
200
100
0
Metres
0
10
20
Kilometres

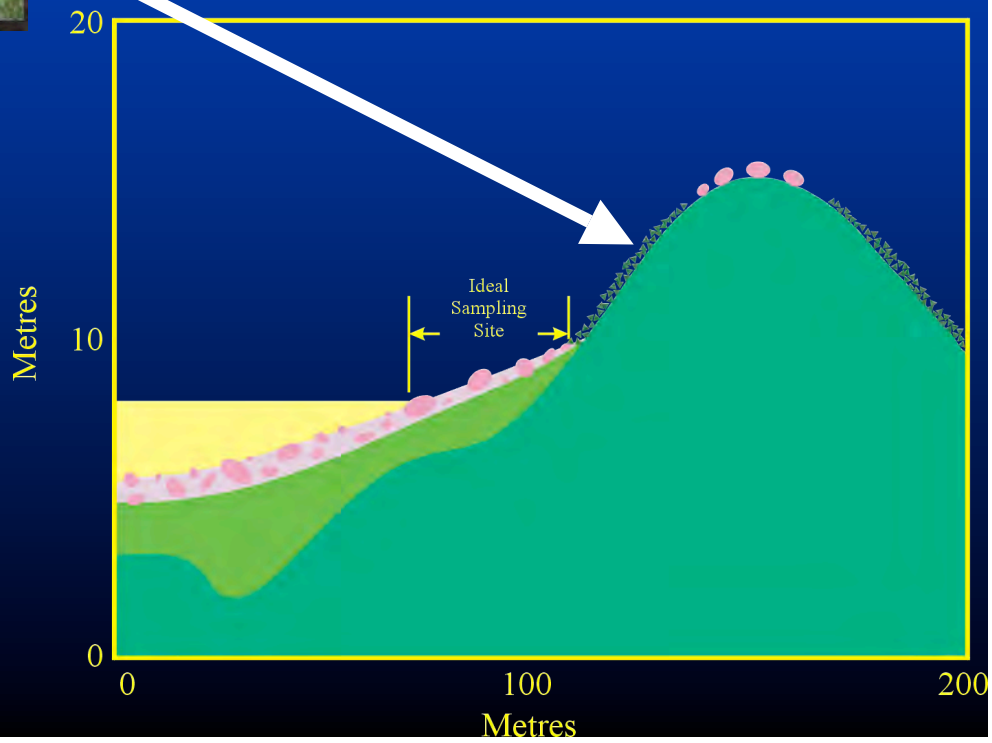
Boulder Lag on Exposed Bedrock High

Photo: Minnesota DNR.



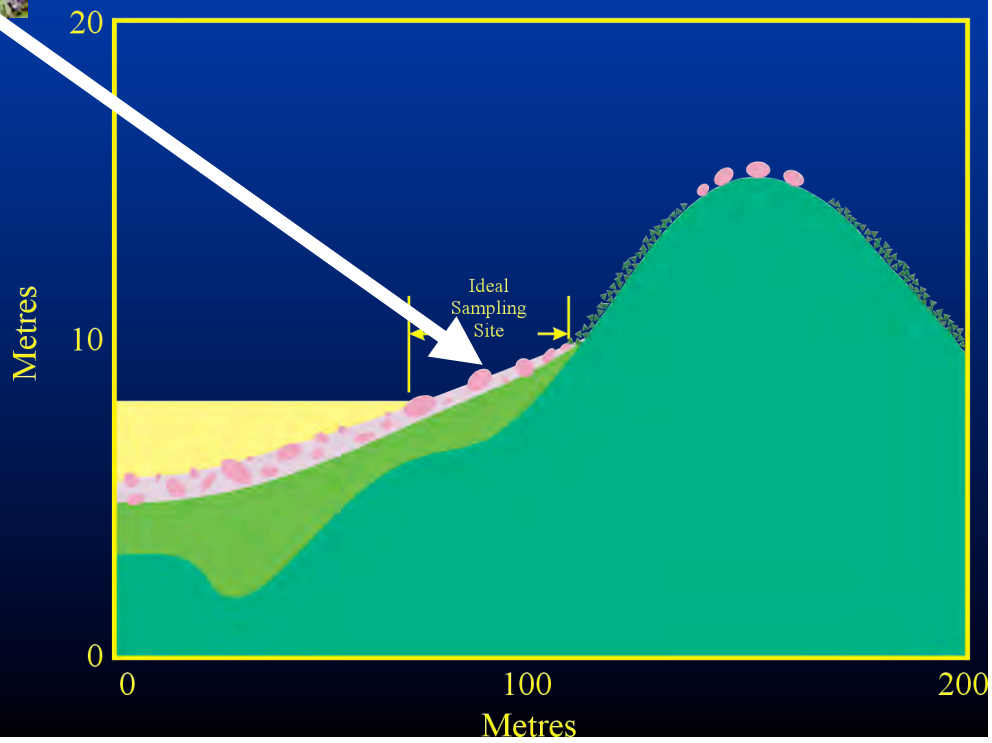
Bedrock Rubble on Steep Slope of Bedrock High

Photo: Minnesota DNR.



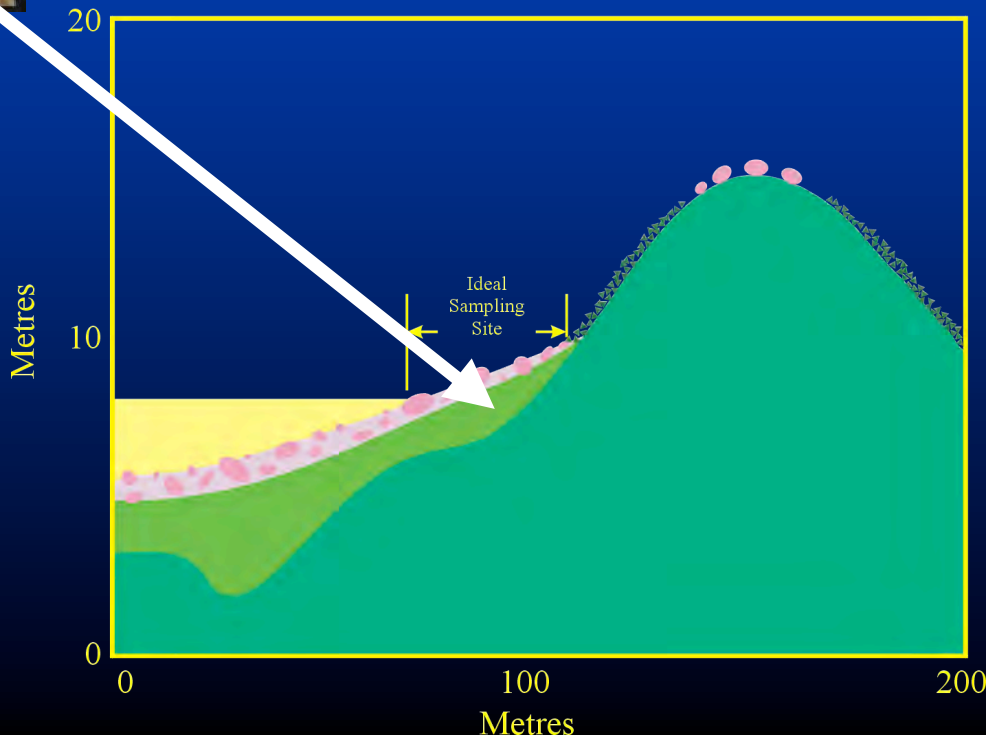
Supraglacial Till

Photo: Rainy River Resources.



Desired Subglacial Till

Photo: Minnesota DNR.



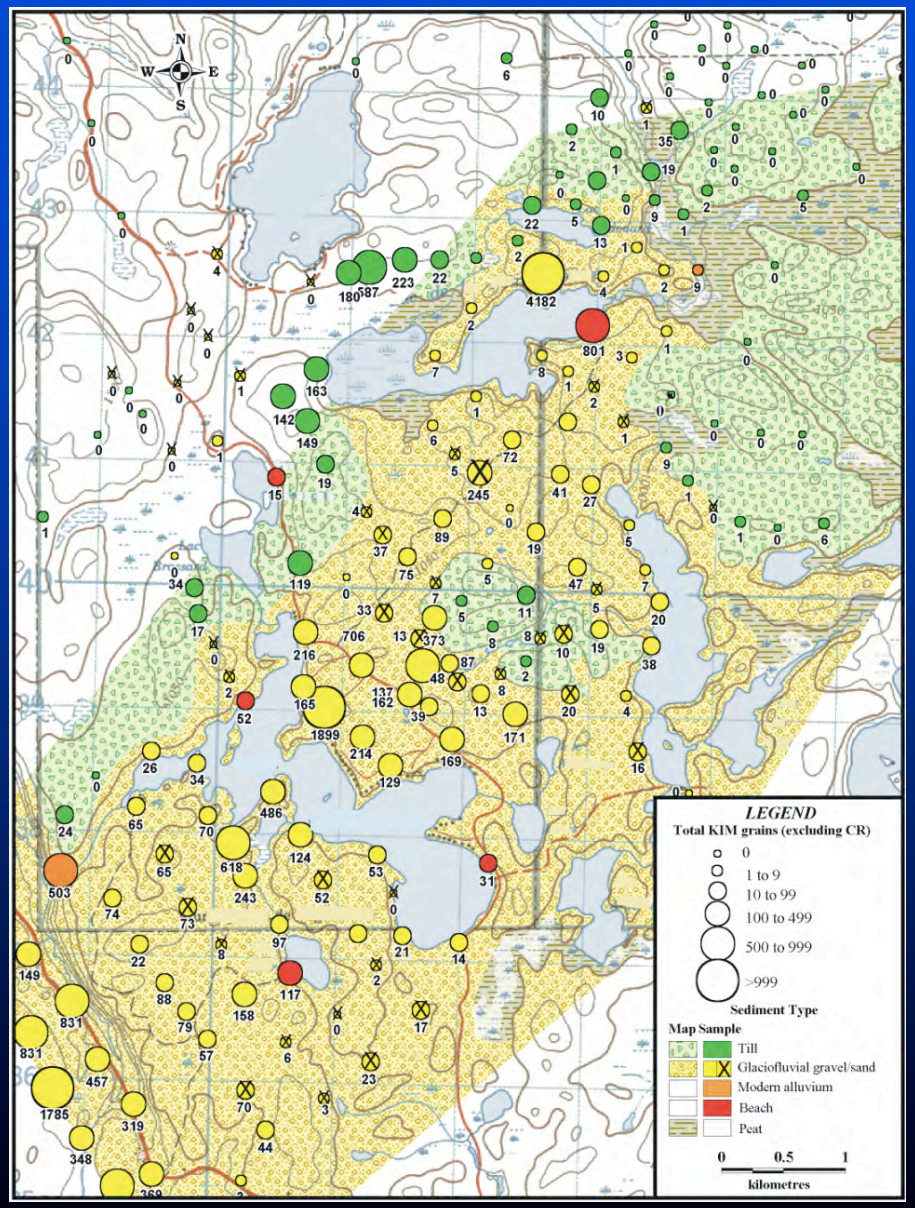
Survey	Dominant Sample Medium	Gold Grain Counts*
MDNR	Supraglacial till	0-2
RRR	Subglacial till	7-10

* Constitutes background average; grains/sample normalized to 10 kg.

Grain Sizes of Indicator Mineral Suites

Commodity/ Rock Type	Indicator Minerals	Dominant Grain Size
Gold	Gold grains	<0.063 mm
Kimberlite	KIMs	0.25-1.0 mm
Base metals	Sulphides, silicates, oxides, phosphates	0.25-1.0 mm

Kimberlite Indicators Recovered from Various Sample Types



Options if Desired Material is Not Present

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1. Move the sample site to the closest location with the desired medium.

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Options if Desired Material is Not Present

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2. Take the poor quality sample anyway.
3. Don’t take the sample.

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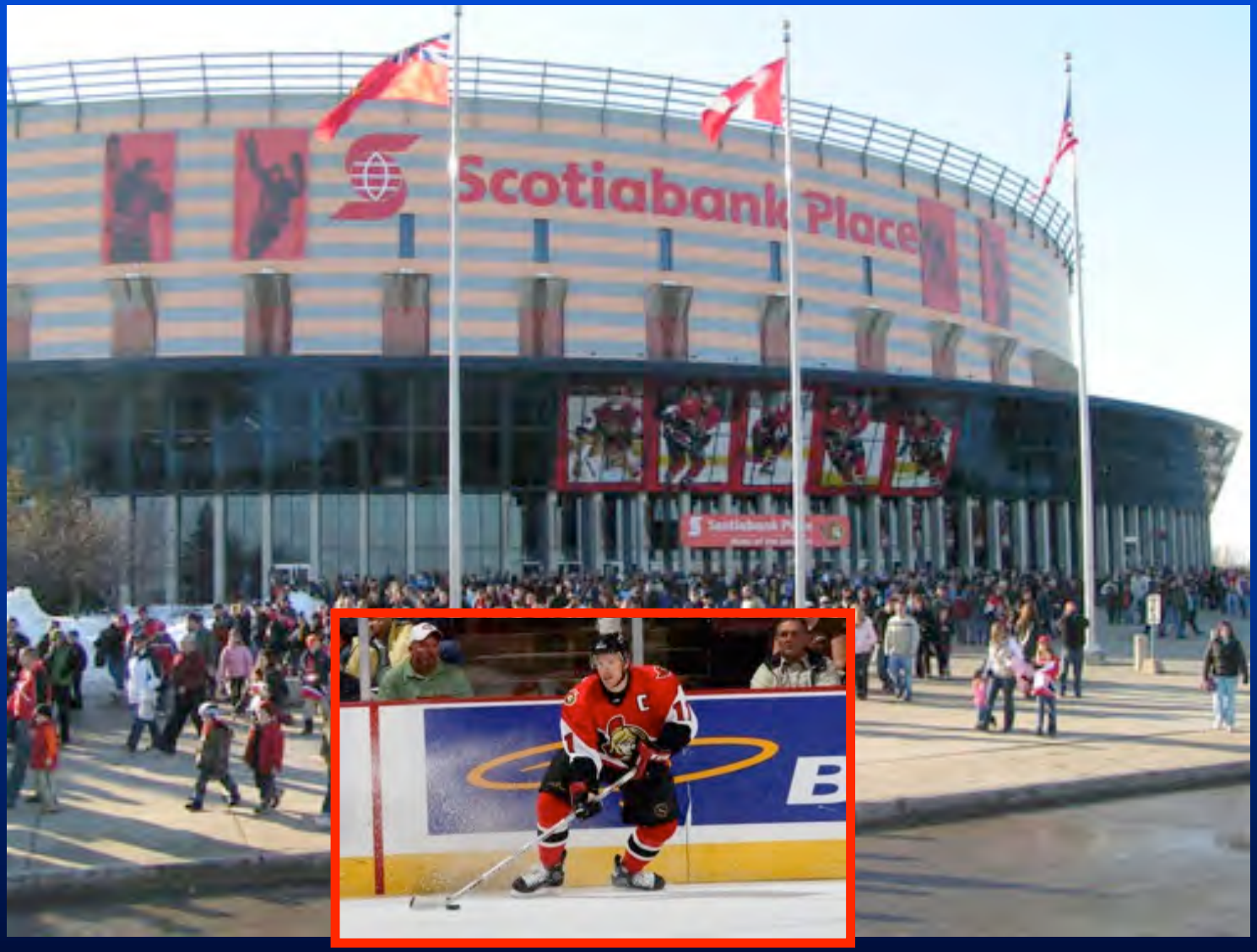
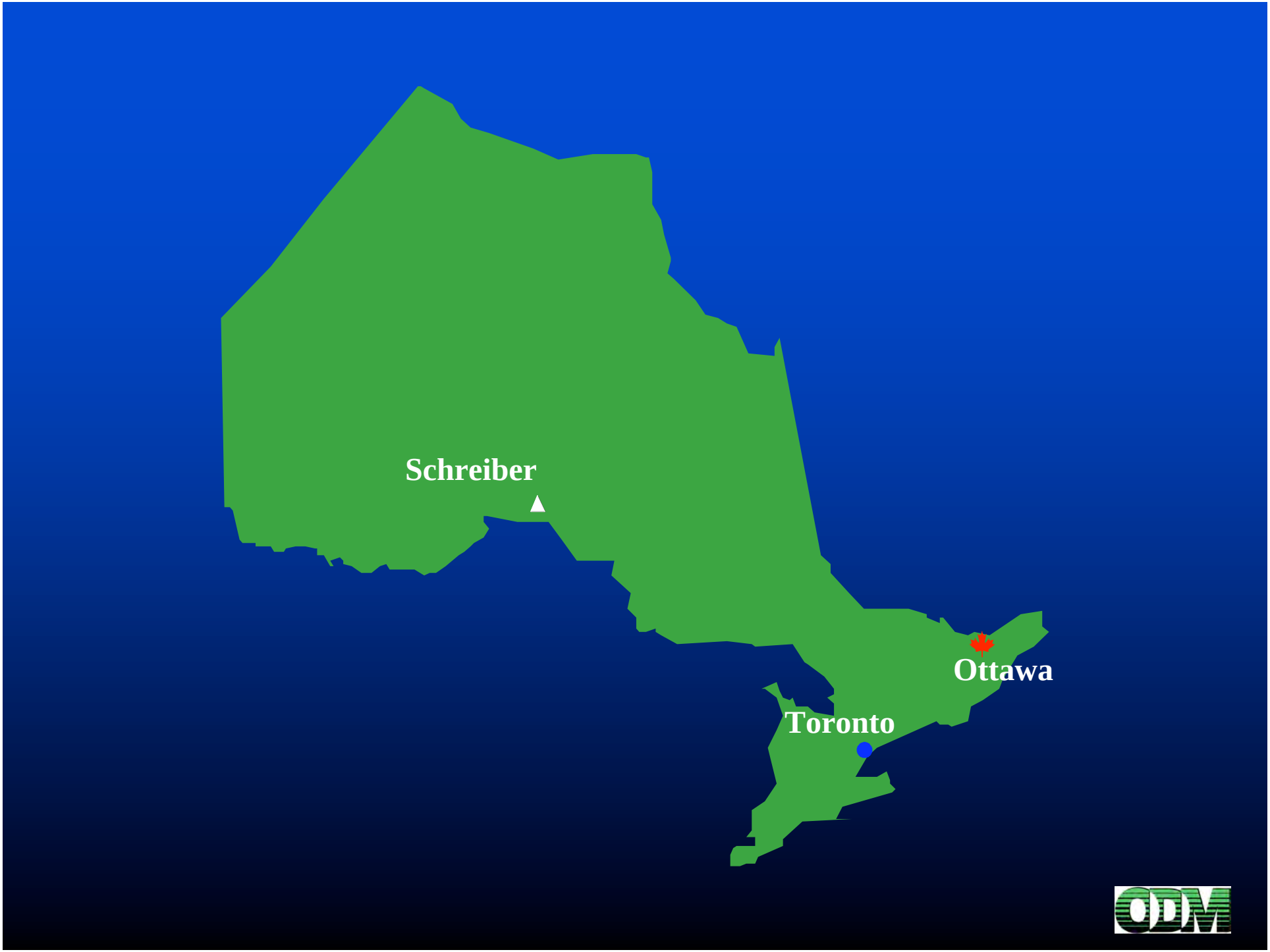
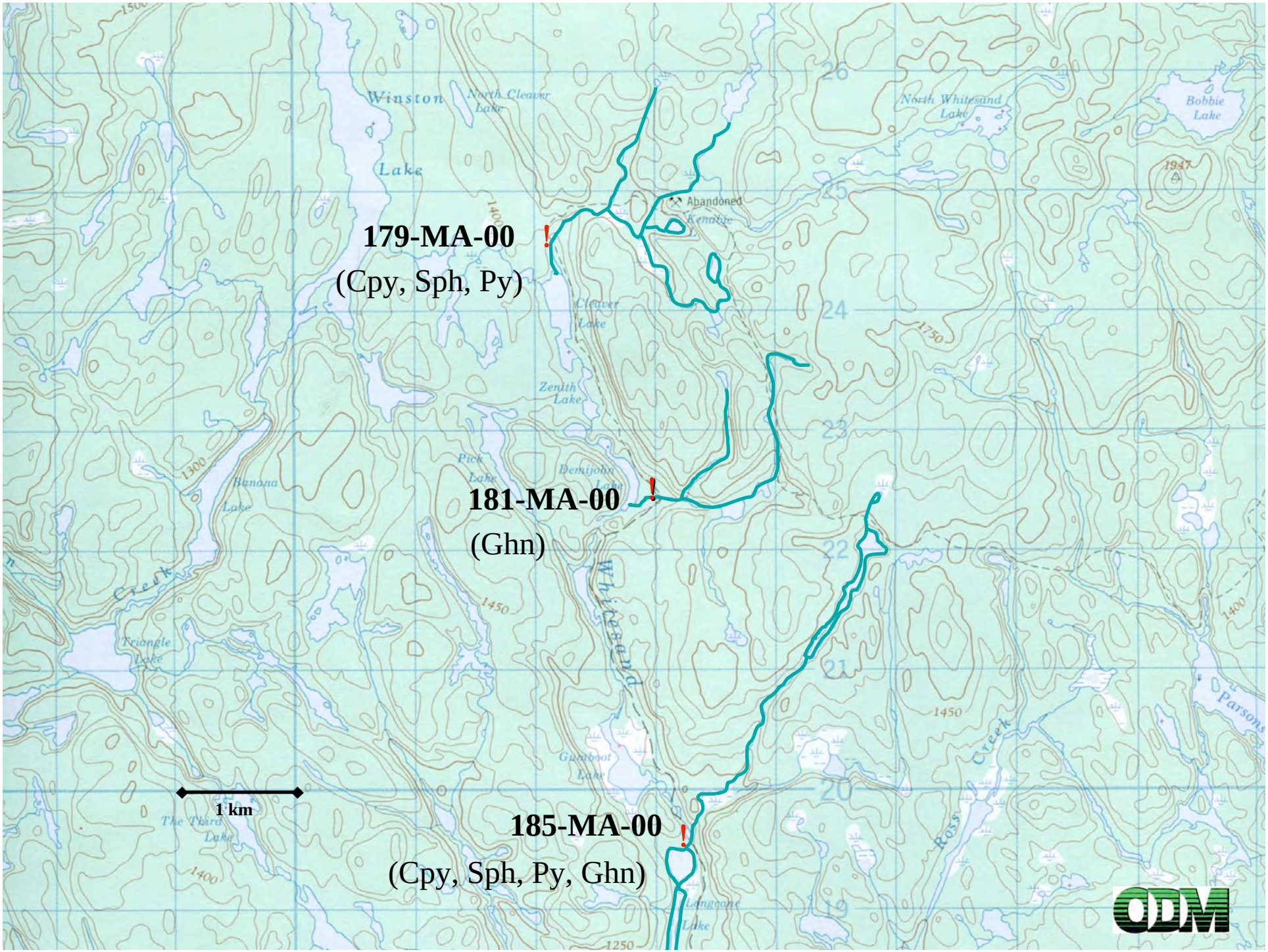
©Ron Niebrugge


Scotiabank Place

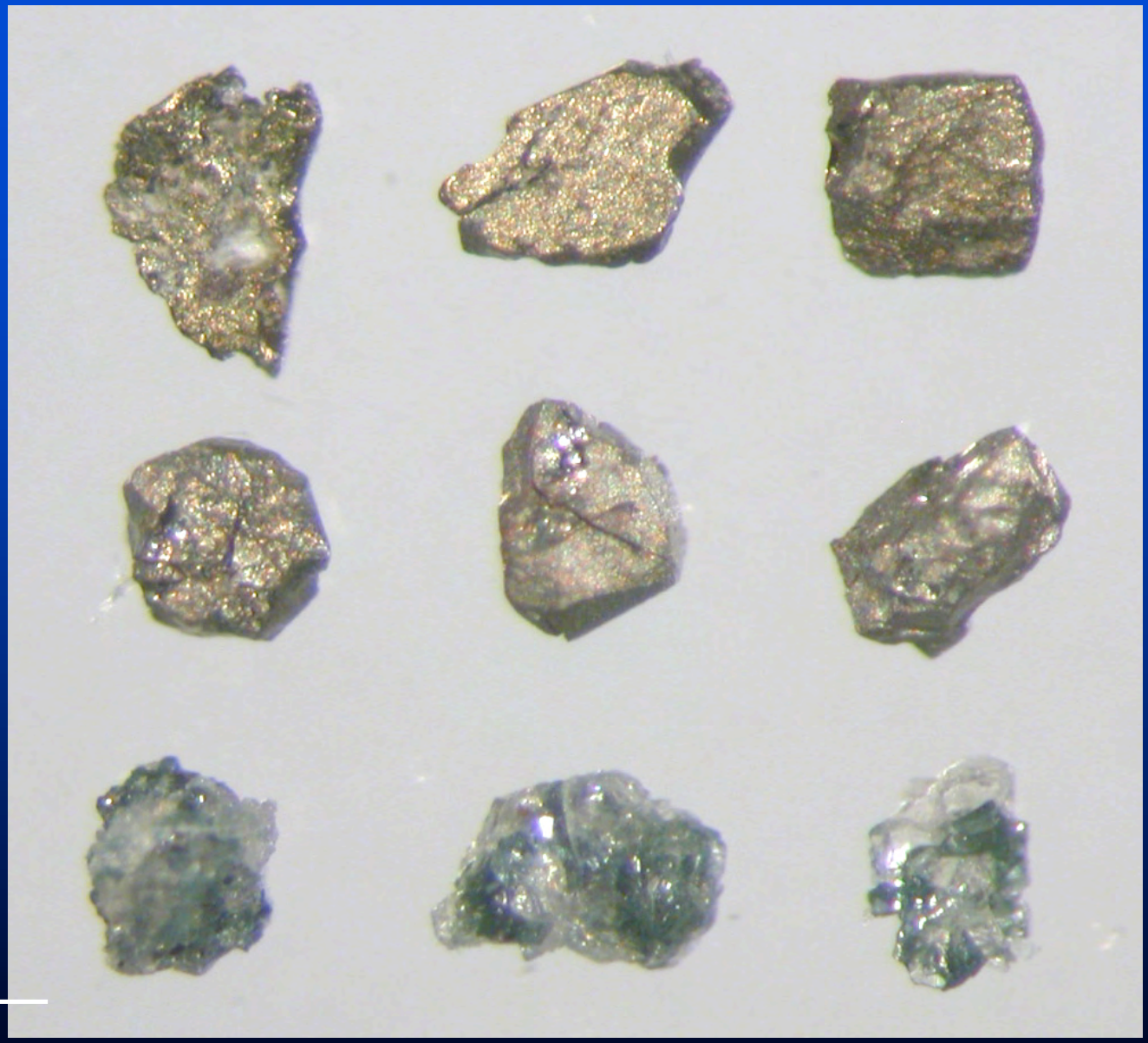
Sources of Contamination to Indicator Mineral Sampling

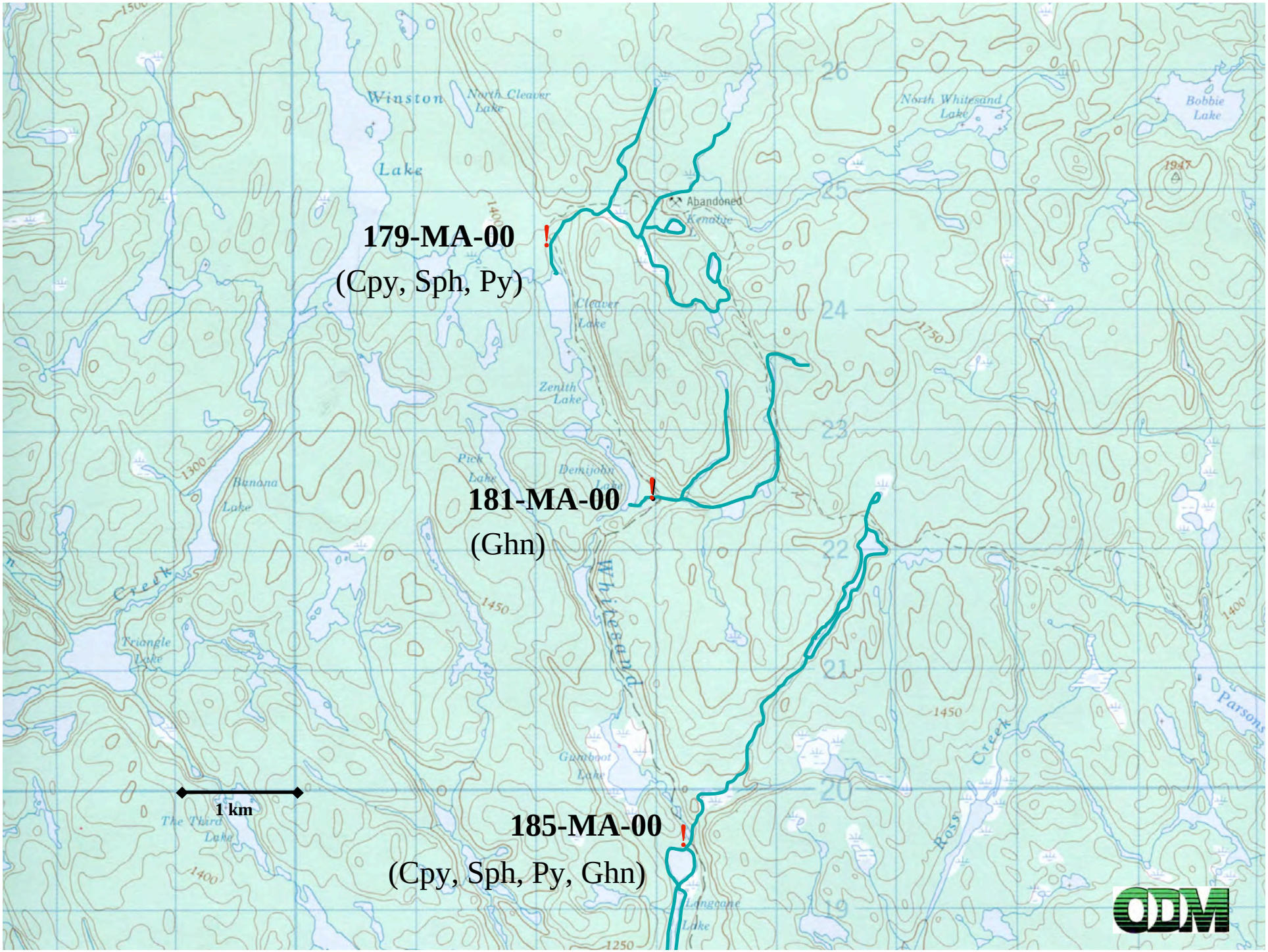
- Mining related infrastructure and operations (tailings, waste dumps, smelters)
- roads
- railways
- bridges


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
North Whitesand Lake
Bobbie Lake
Abandoned Kenaite
Whitesand
Ross Creek
Parsons
1947
1750
1450
1400
1300
1250

VMS Indicator Mineral Contamination




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
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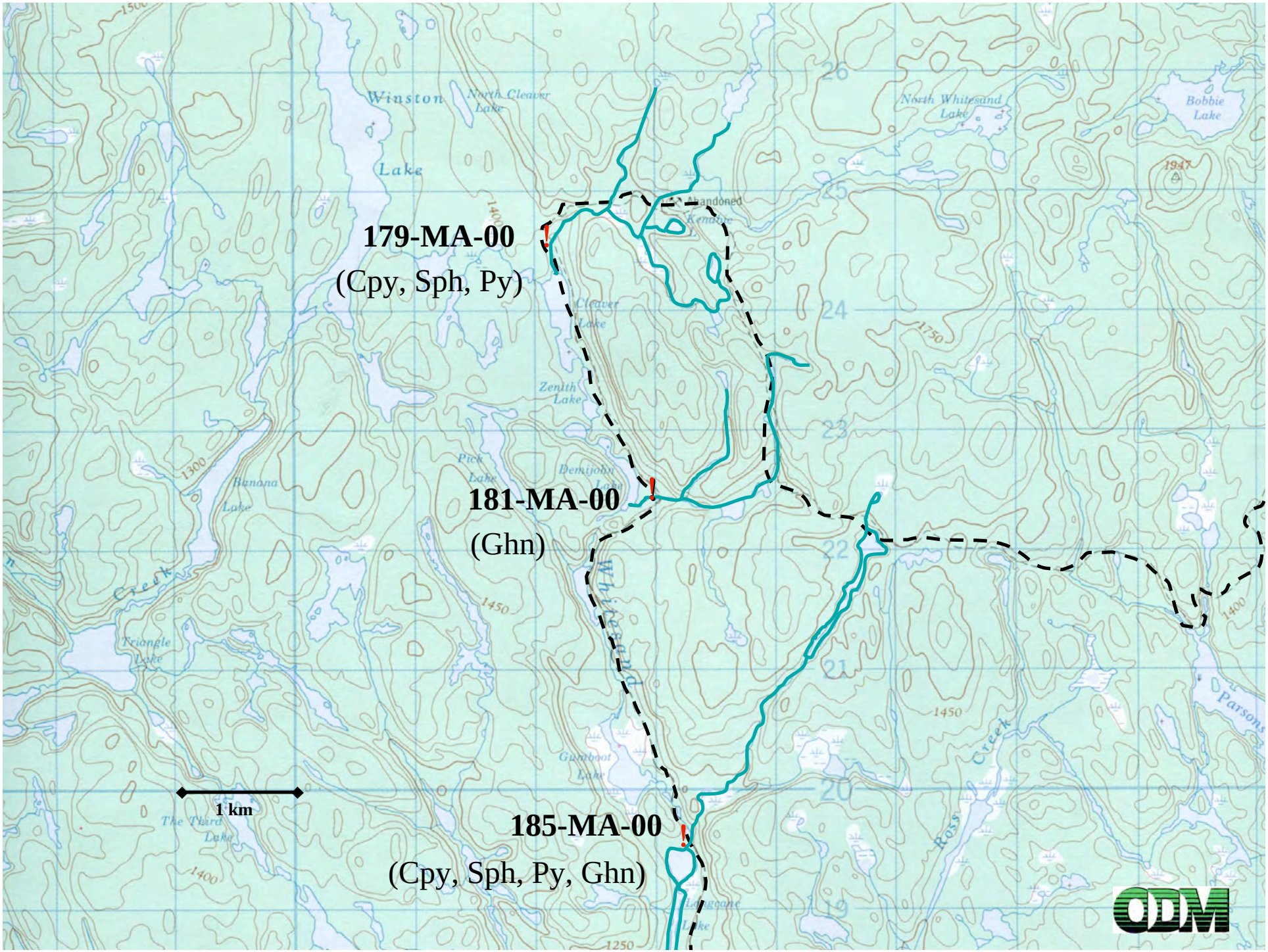
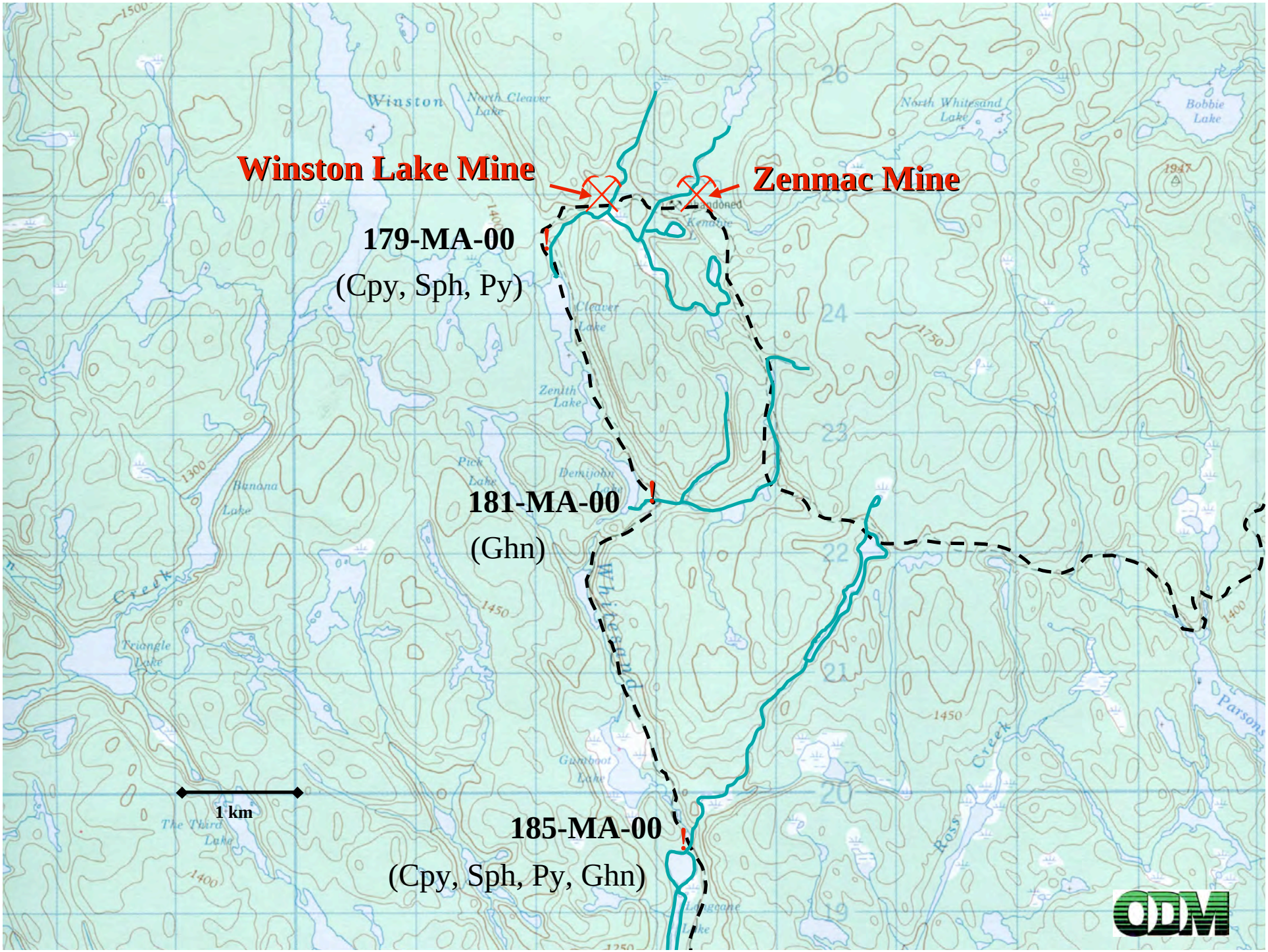
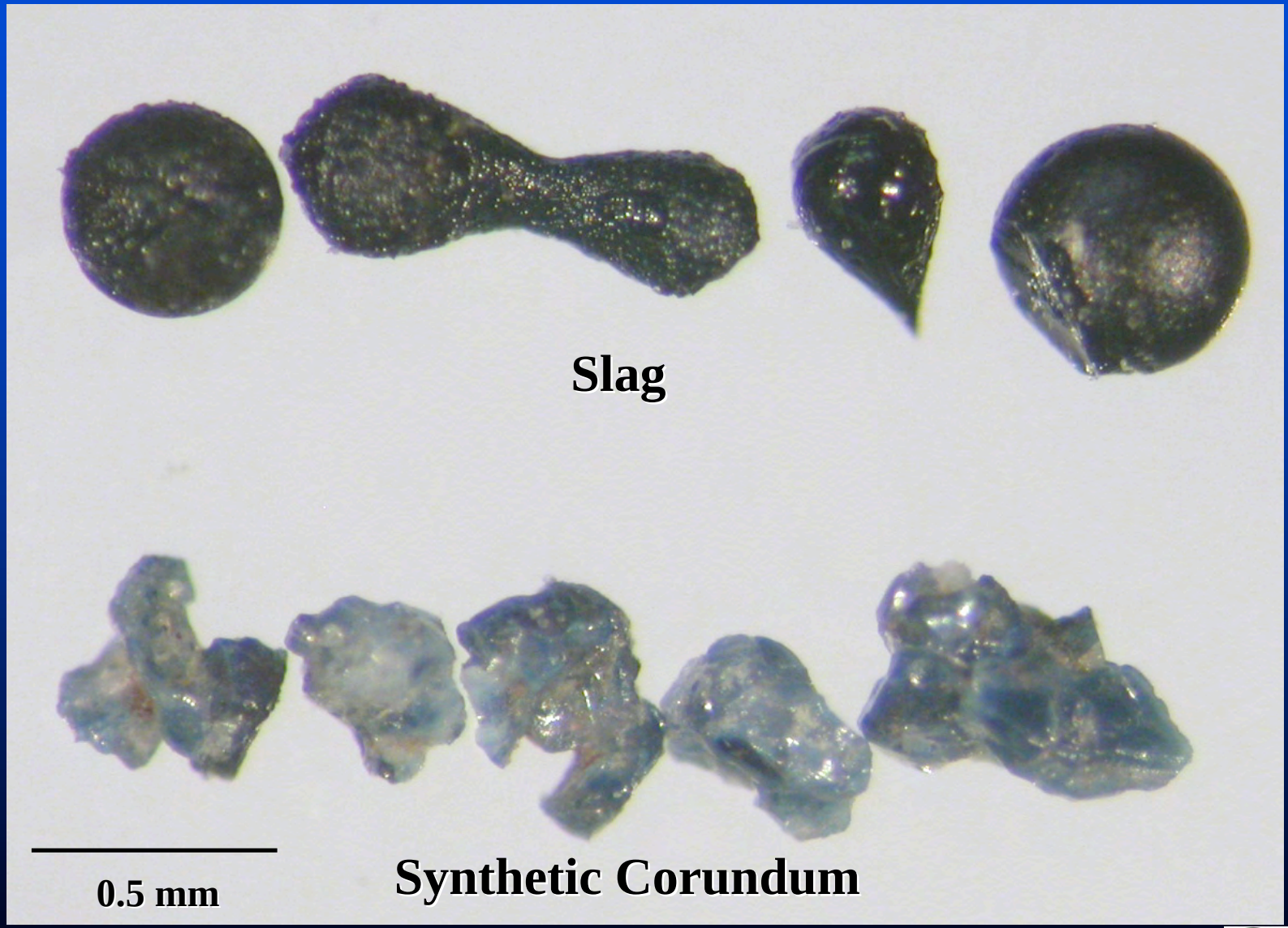
Bobbie Lake
Abandoned Kenaite
Whitesand
Ross Creek
Parsons
1947
1750
1450
1400
1300
1250


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
North Whitesand Lake
Bobbie Lake
Whitesand
Ross Creek
Parsons
1947
1750
1450
1400
1300
1250
ODM


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
Gumboot Lake
Ross Creek
Parsons
The Third Lake
1500
1450
1400
1300
1750
1250
1947
ODM

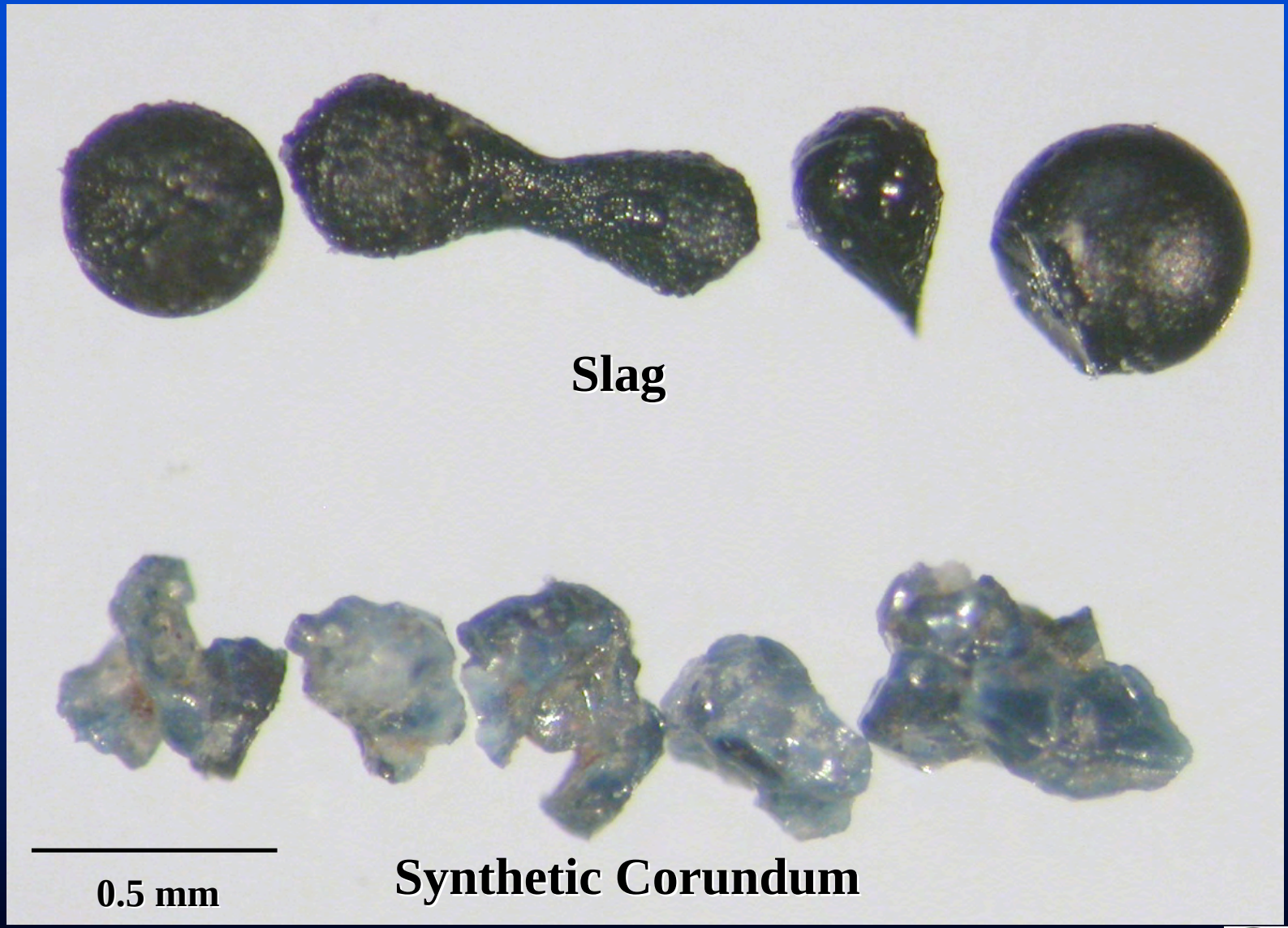

Ottawa
Tweed
Toronto

Examples of Contamination in Ontario Alluvial Sediment Samples



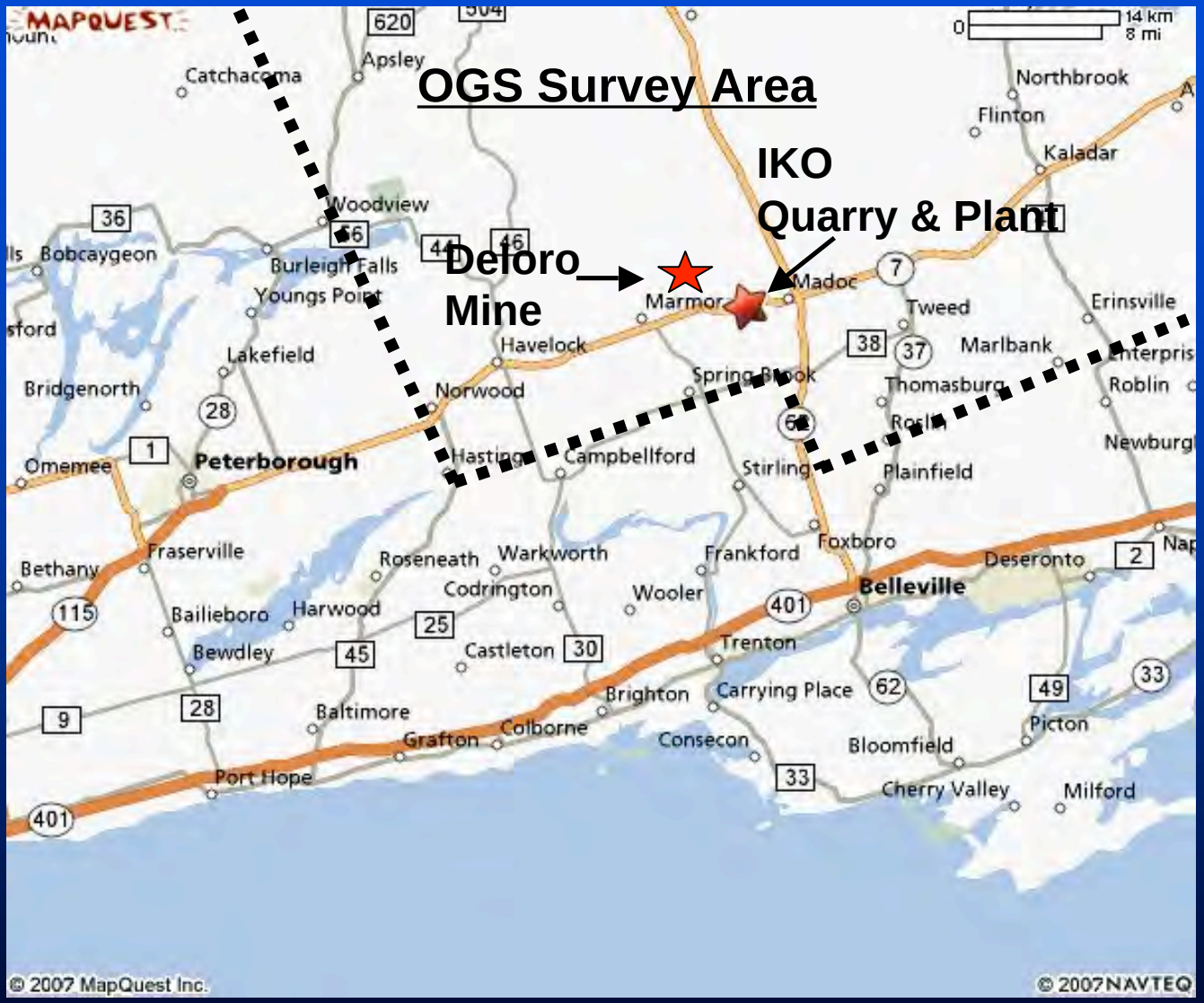
Ontario Railway Bridge – Contamination Source

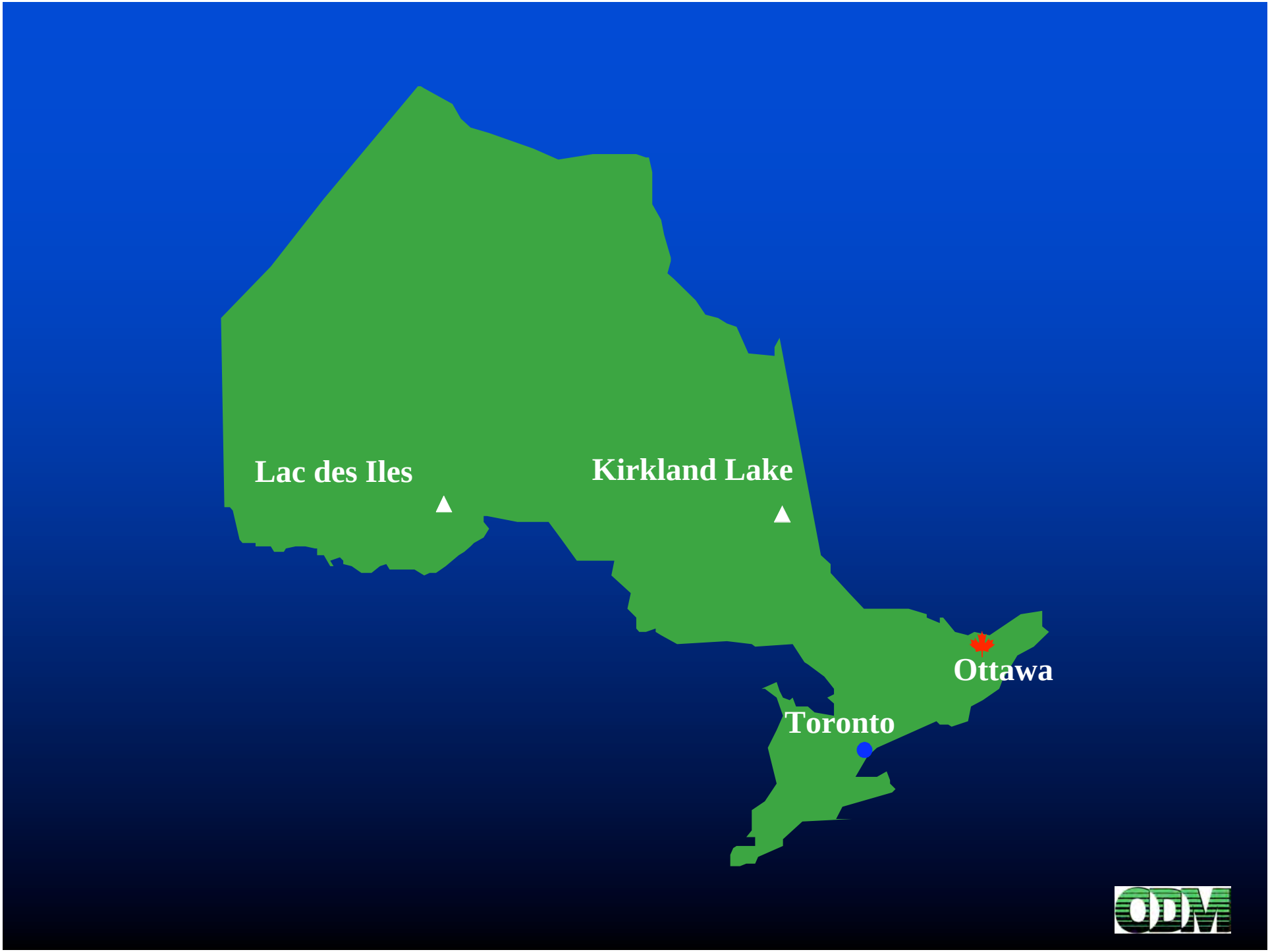
Examples of Contamination in Ontario Alluvial Sediment Samples



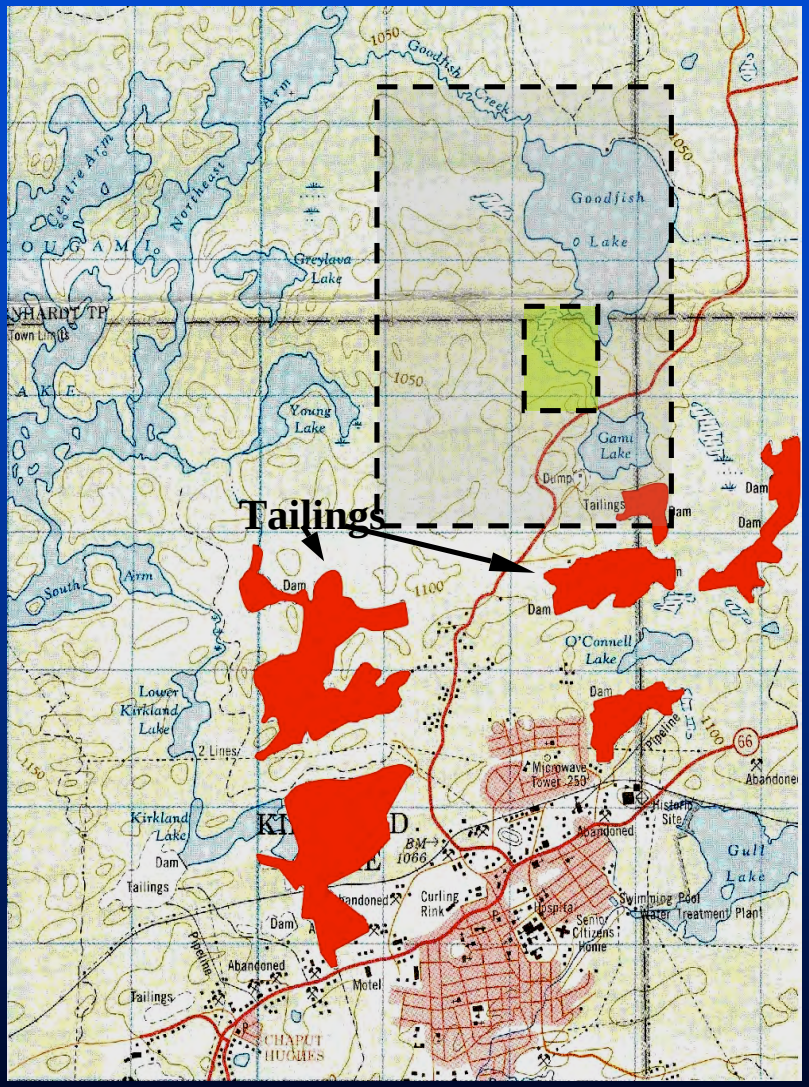
Paint and Ceramic Coated Shingle Granules

Contamination Sources in OGS Survey Area

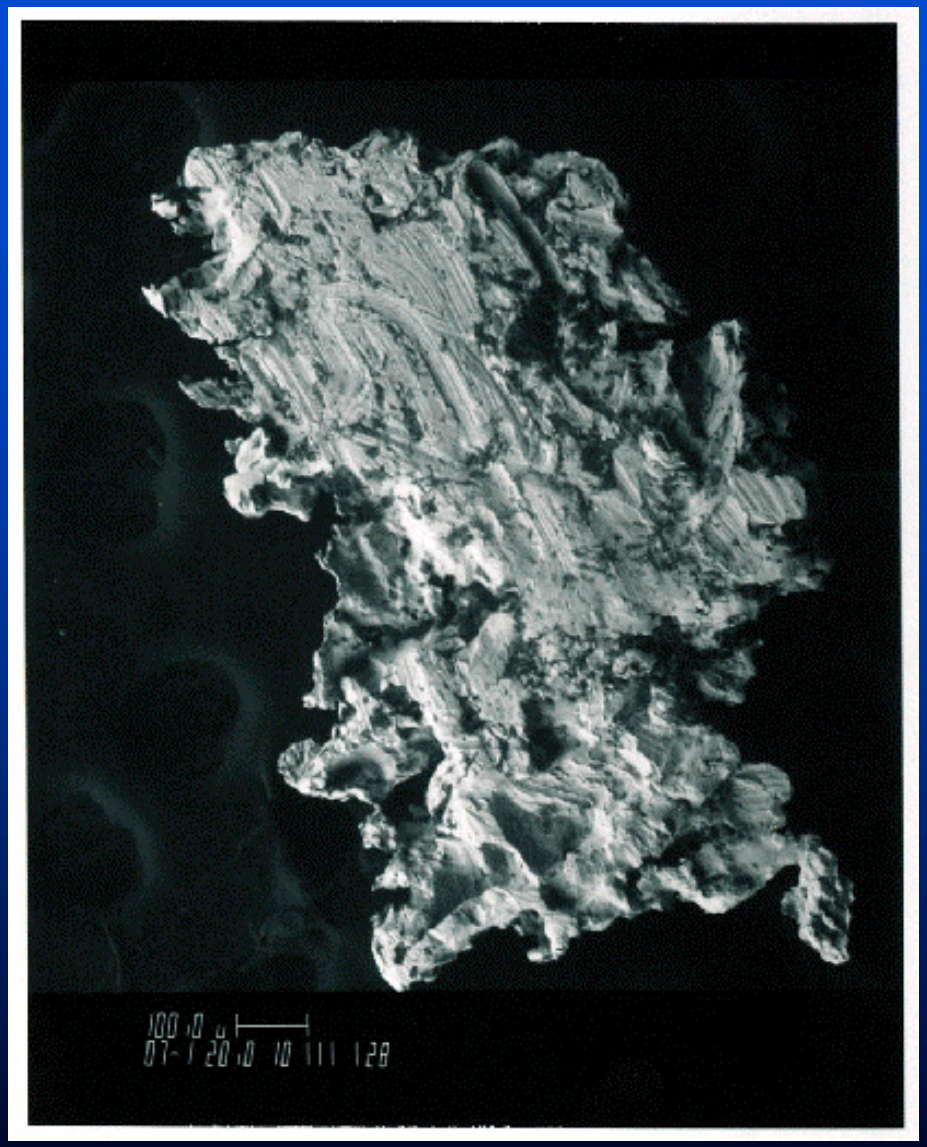



Lac des Iles
Kirkland Lake
Ottawa
Toronto

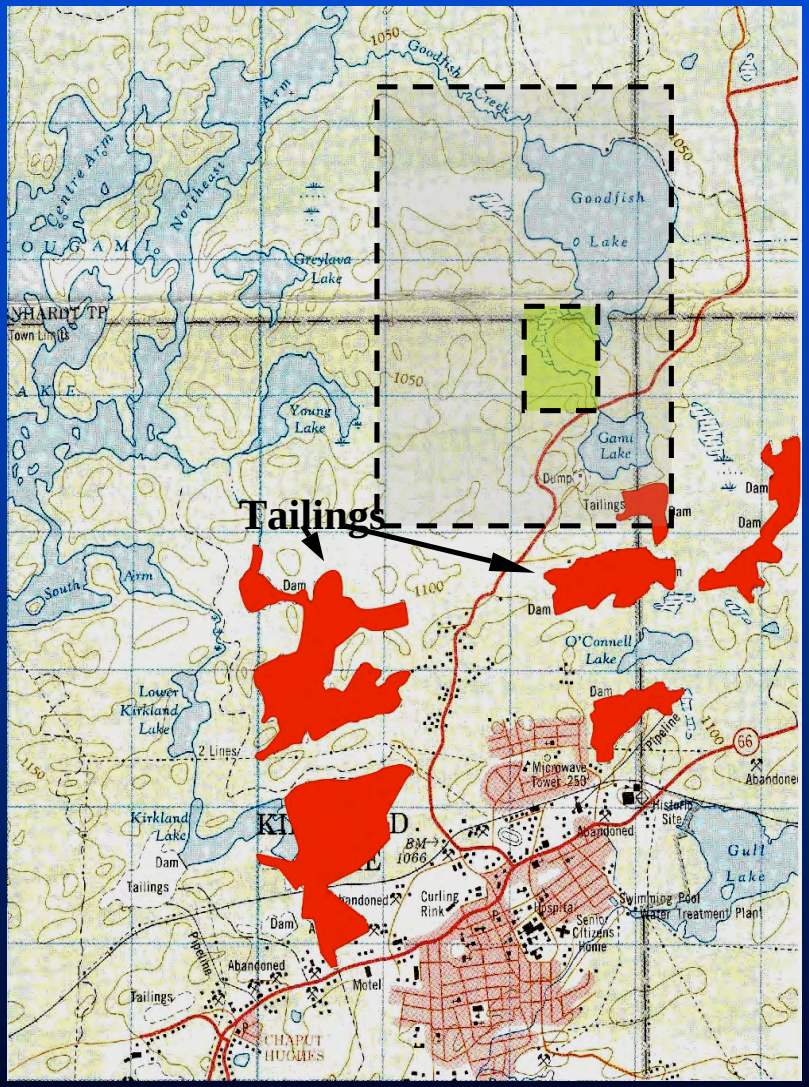
Location of Gold-in-Humus Anomaly and Proximal Tailings Ponds, Kirkland Lake, Ontario



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.

Bullet Recovered from Basil Till Sample

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