



**GEOLOGICAL SURVEY OF CANADA
OPEN FILE 7410**

**Operation GEM South Rae:
Reconnaissance geology of the most poorly known
part of the Churchill Province,
Northwest Territories and Nunavut**

**S.J. Pehrsson, J.A. Percival, W.J. Davis, M.W. McCurdy, R.G. Berman,
E.M. Hilary, F. Kiss, A. MacKinnon, C.W. Jefferson**

2014



Natural Resources
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GEM

**Operation GEM South Rae:
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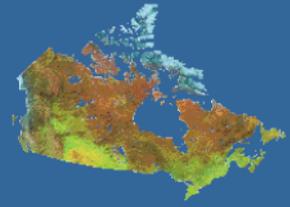
**Sally Pehrsson, John Percival, Bill Davis, Martin McCurdy,
Rob Berman, Beth Hilary, Frank Kiss, Alex MacKinnon, Charlie Jefferson
Geological Survey of Canada**



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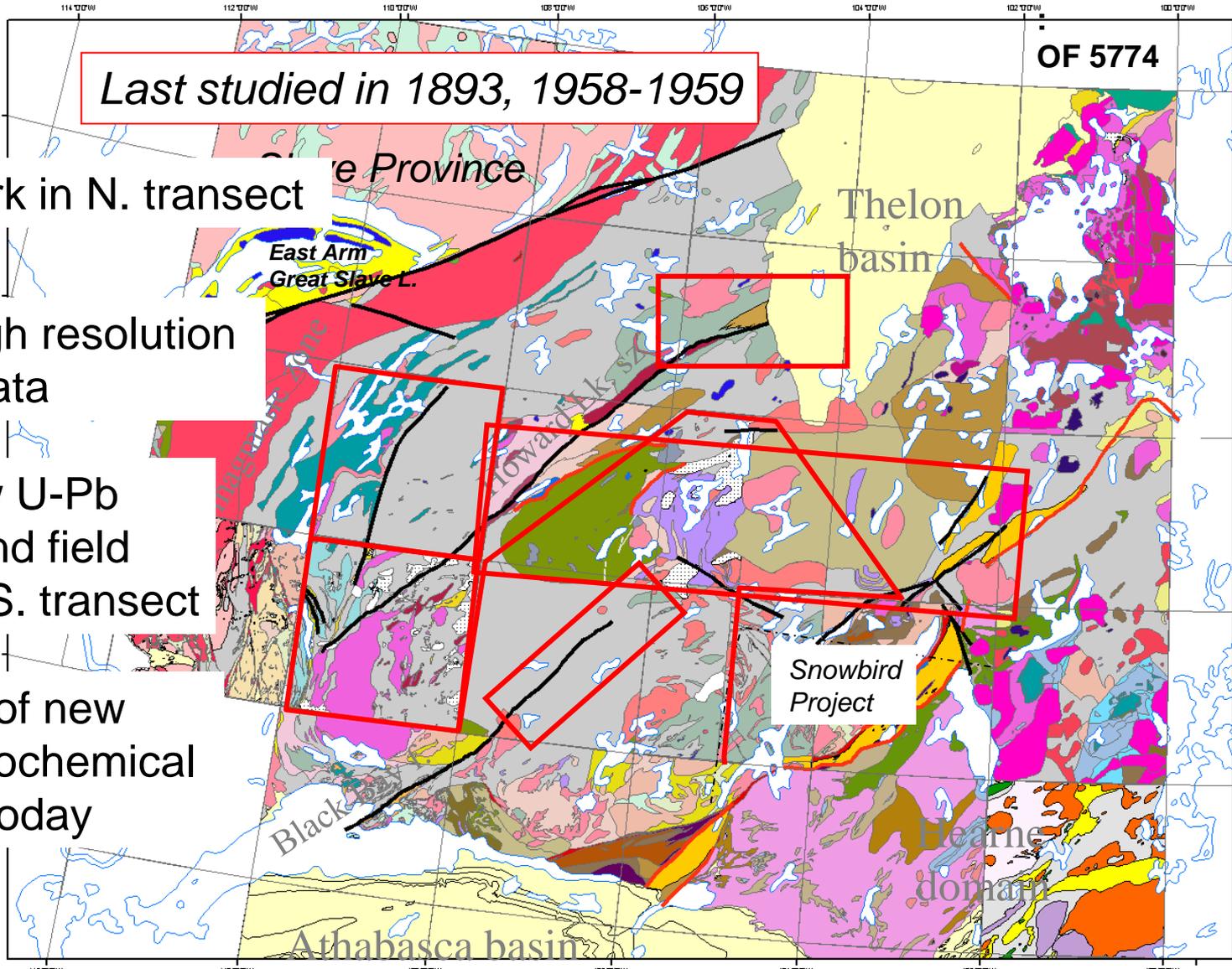
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Last studied in 1893, 1958-1959

OF 5774



➤ Outline field work in N. transect

➤ Present new high resolution aeromagnetic data

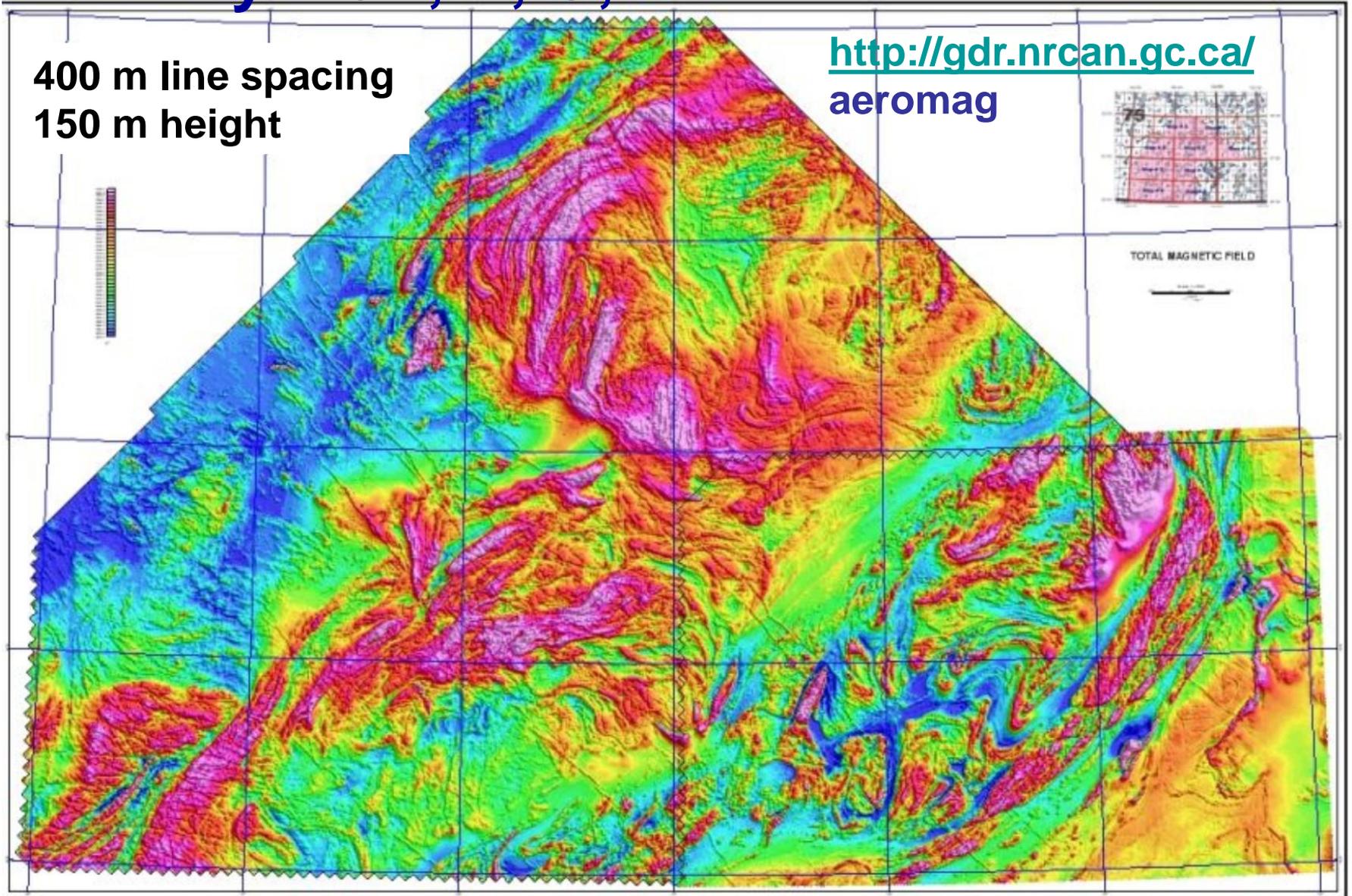
➤ Summarize new U-Pb geochronology and field observations for S. transect

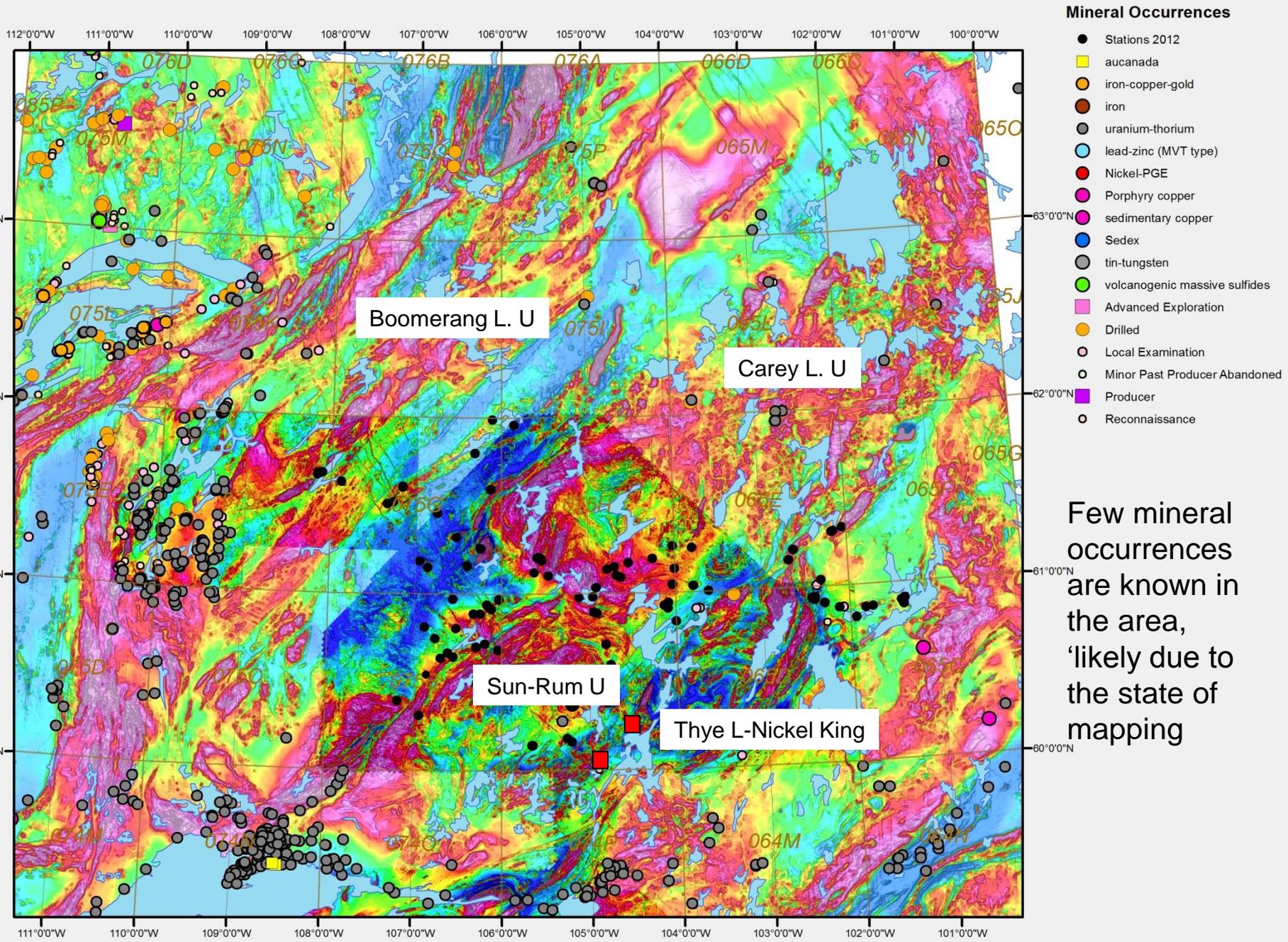
➤ Present results of new lake sediment geochemical survey released today

New high resolution aeromagnetic survey: 75A, B, G, H

400 m line spacing
150 m height

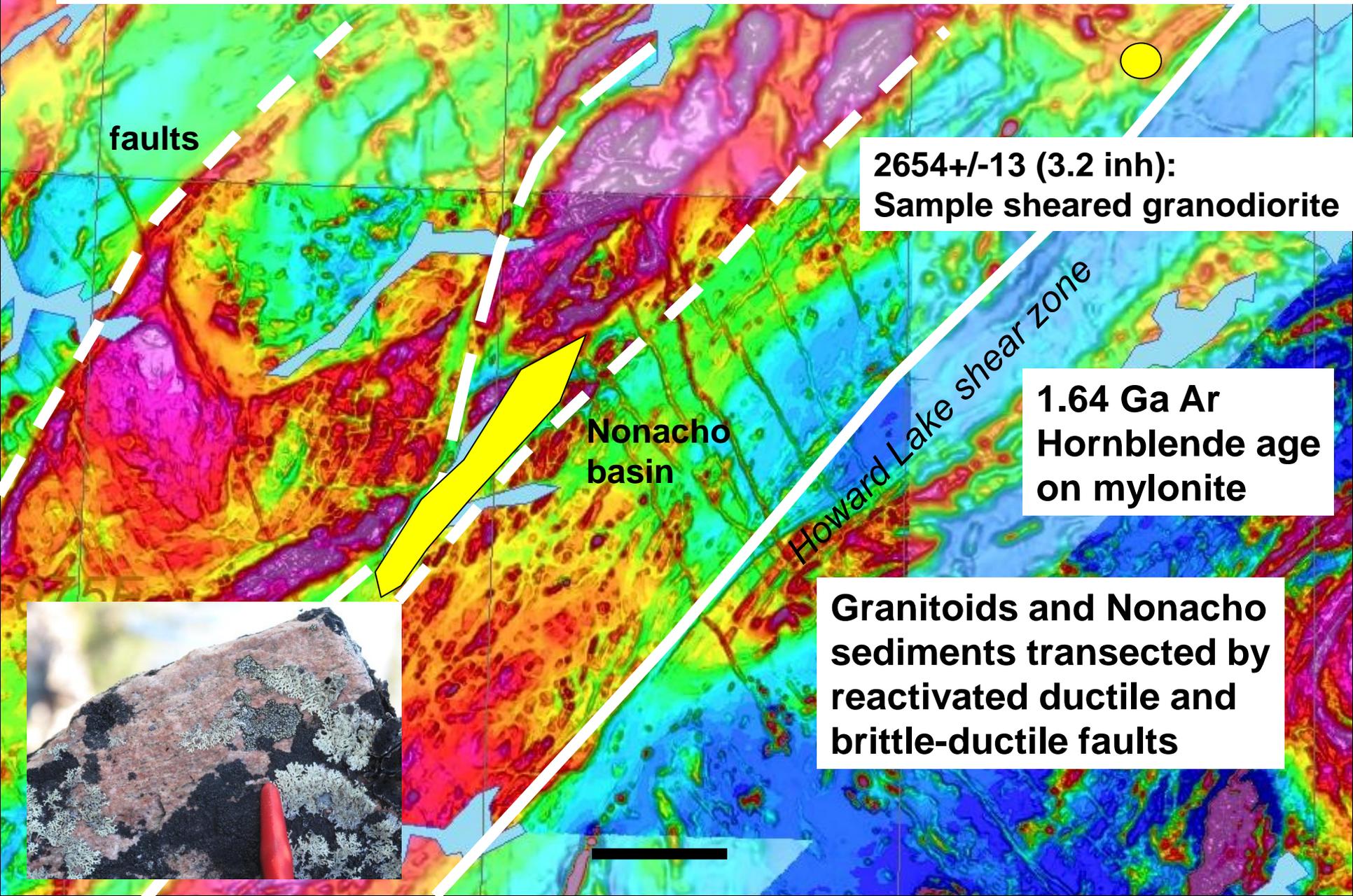
<http://gdr.nrcan.gc.ca/aeromag>





Few mineral occurrences are known in the area, 'likely due to the state of mapping

Porter domain and Howard Lake shear zone



faults

**2654+/-13 (3.2 inh):
Sample sheared granodiorite**

**Nonacho
basin**

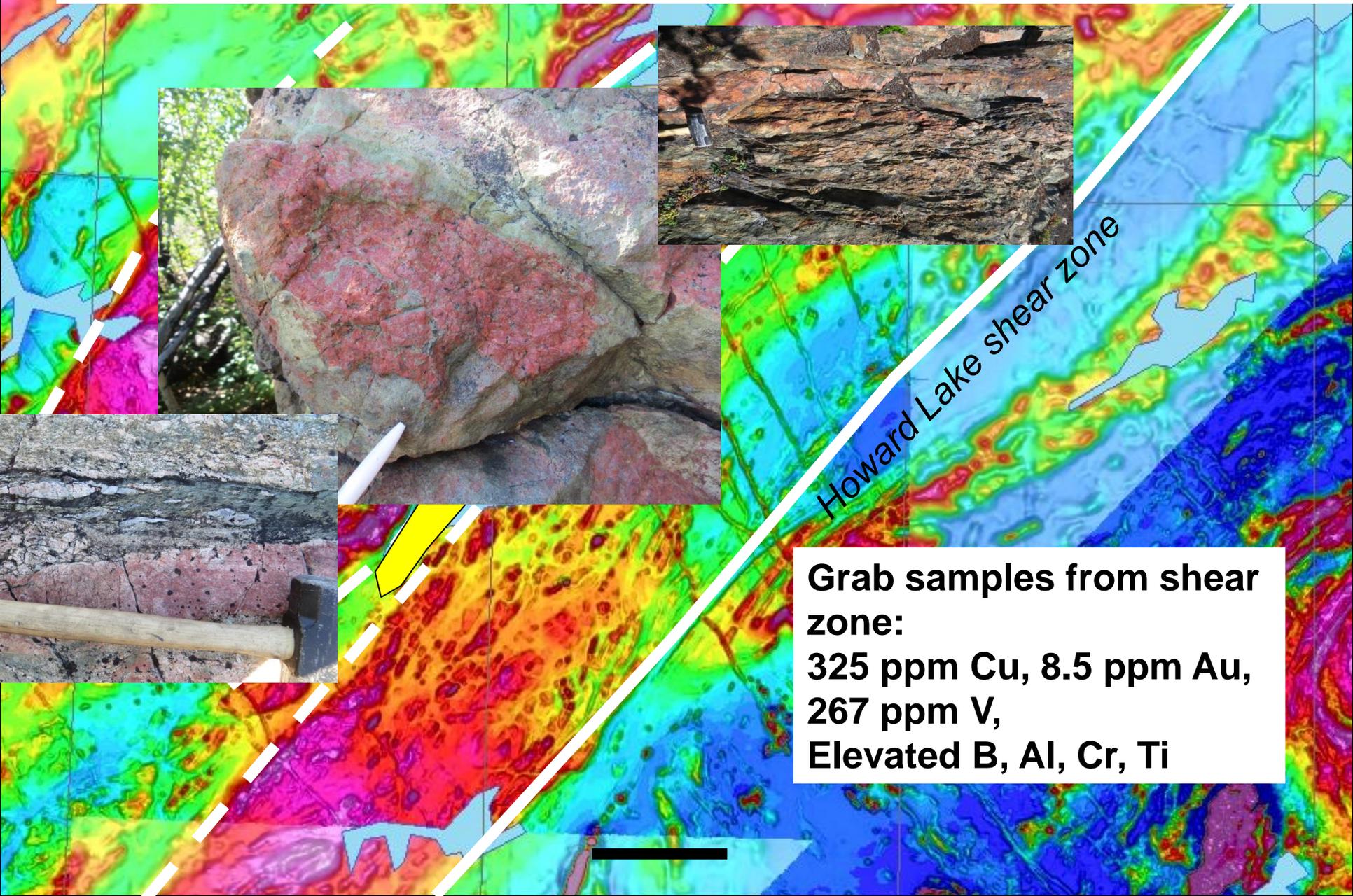
Howard Lake shear zone

**1.64 Ga Ar
Hornblende age
on mylonite**

**Granitoids and Nonacho
sediments transected by
reactivated ductile and
brittle-ductile faults**



Porter domain and Howard Lake shear zone

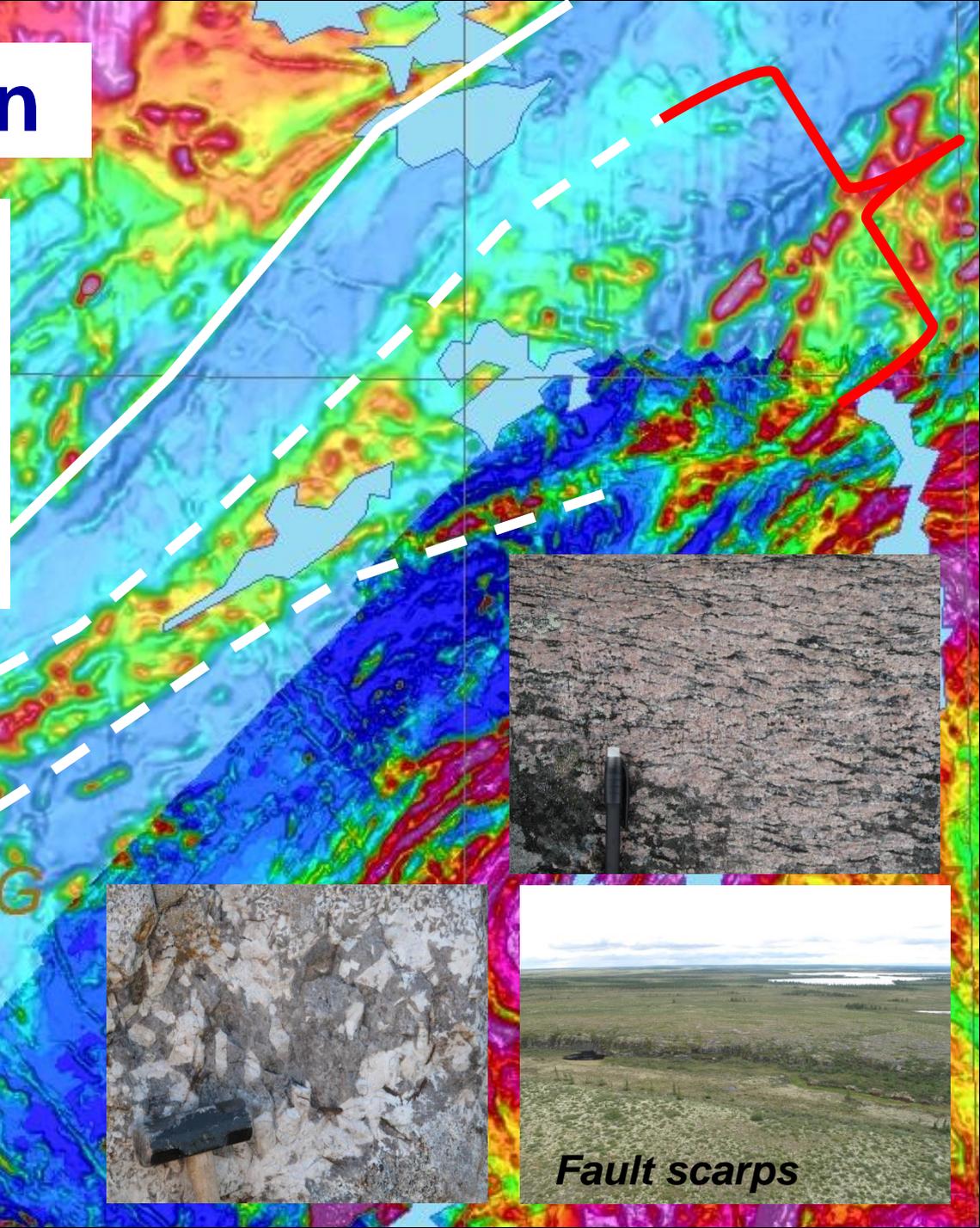


Howard Lake shear zone

**Grab samples from shear zone:
325 ppm Cu, 8.5 ppm Au,
267 ppm V,
Elevated B, Al, Cr, Ti**

Penylan domain

- Distinct fault bounded slice:
- Gabbro-anorthosite-diorite
Monzonite-monzogranite:
- Unique: 2.03-2.04 Ga
crystallization with
1.86 Ga metamorphism



Penylan domain

- Distinct fault bounded slice:
- Gabbro-anorthosite-diorite
Monzonite-monzogranite:
- Unique: 2.03-2.04 Ga
crystallization with
1.86 Ga metamorphism

2032 \pm 5:
Cpx-Opx
Quartz diorite

2043 \pm 22:
Monzonite



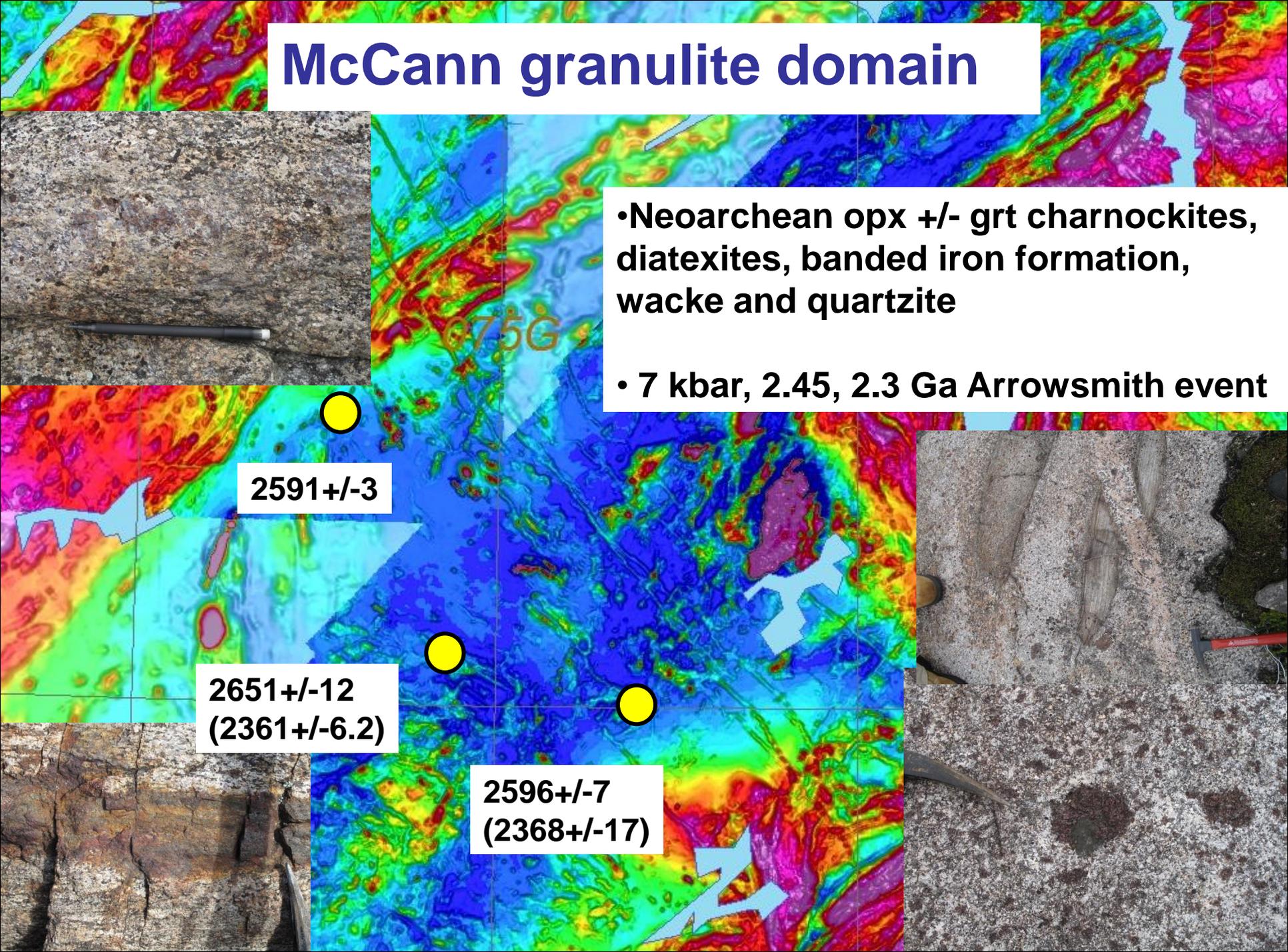
McCann granulite domain

- Neoproterozoic opx +/- grt charnockites, diatexites, banded iron formation, wacke and quartzite
- 7 kbar, 2.45, 2.3 Ga Arrowsmith event

2591+/-3

2651+/-12
(2361+/-6.2)

2596+/-7
(2368+/-17)

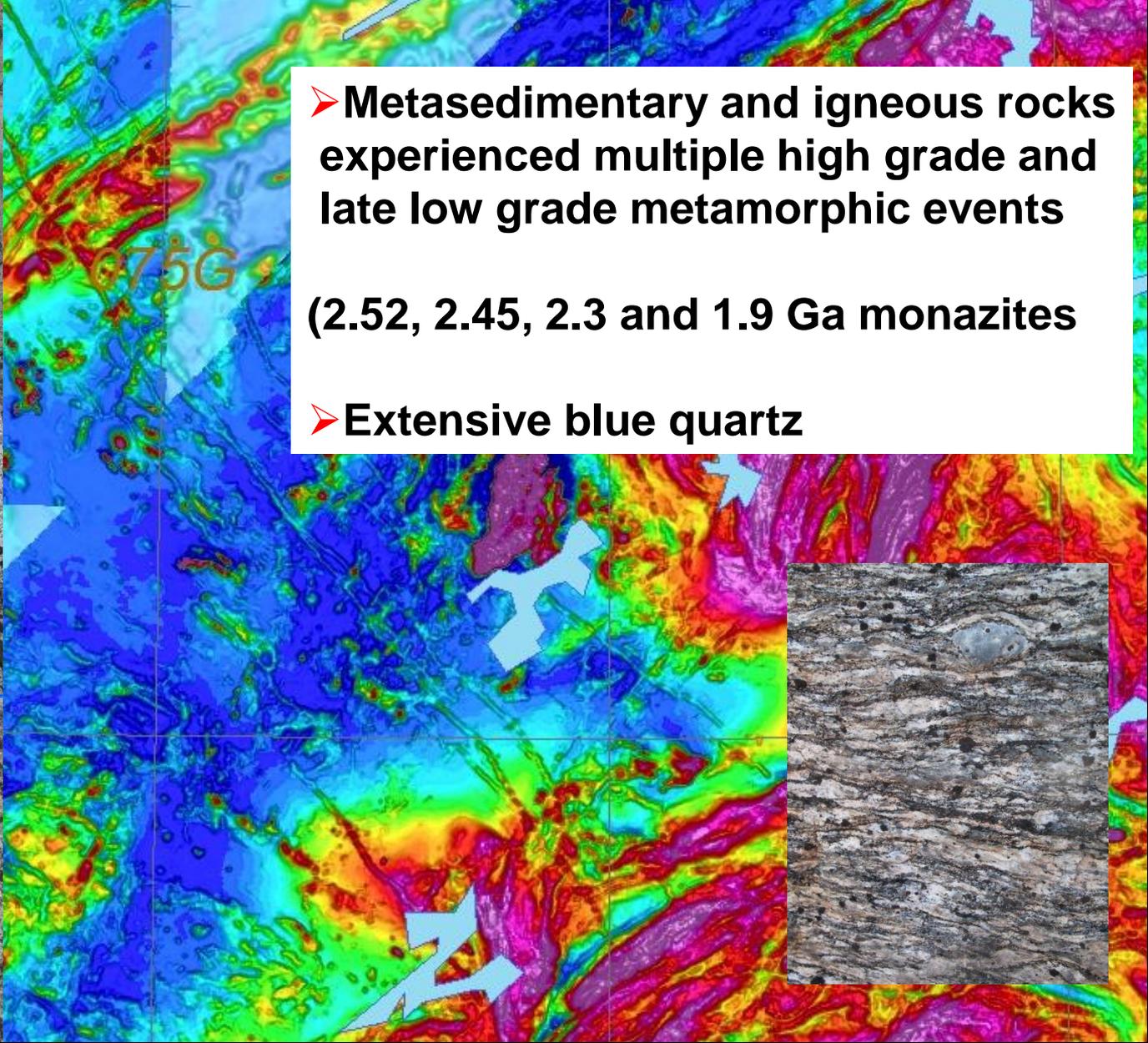


McCann granulite domain

➤ Metasedimentary and igneous rocks experienced multiple high grade and late low grade metamorphic events

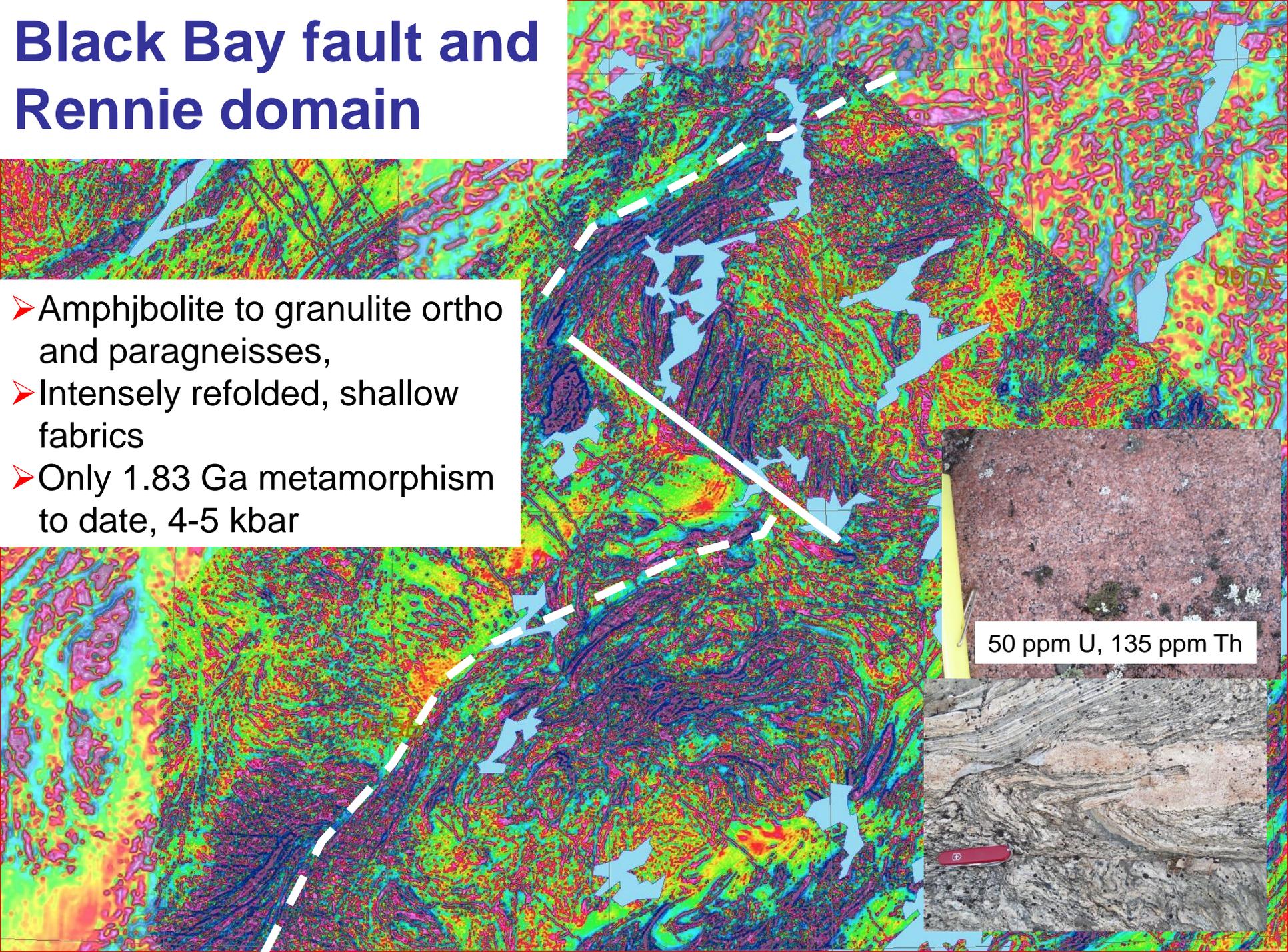
(2.52, 2.45, 2.3 and 1.9 Ga monazites)

➤ Extensive blue quartz



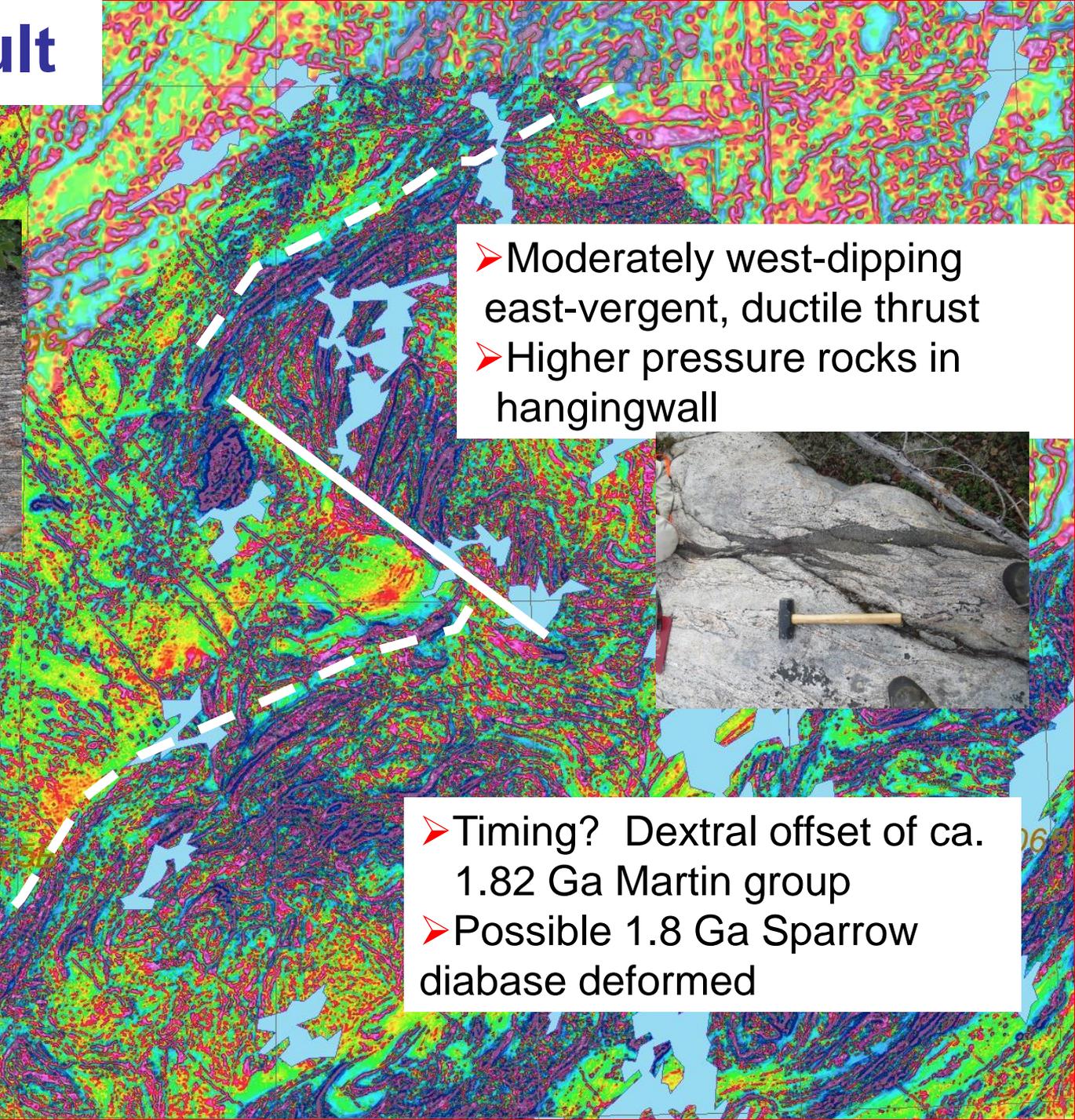
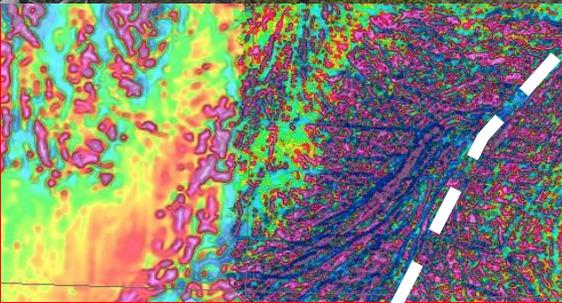
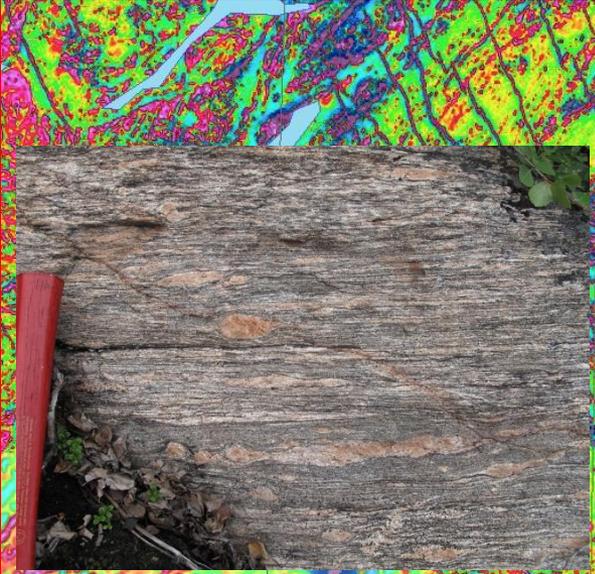
Black Bay fault and Rennie domain

- Amphibolite to granulite ortho and paragneisses,
- Intensely refolded, shallow fabrics
- Only 1.83 Ga metamorphism to date, 4-5 kbar



50 ppm U, 135 ppm Th

Black Bay fault

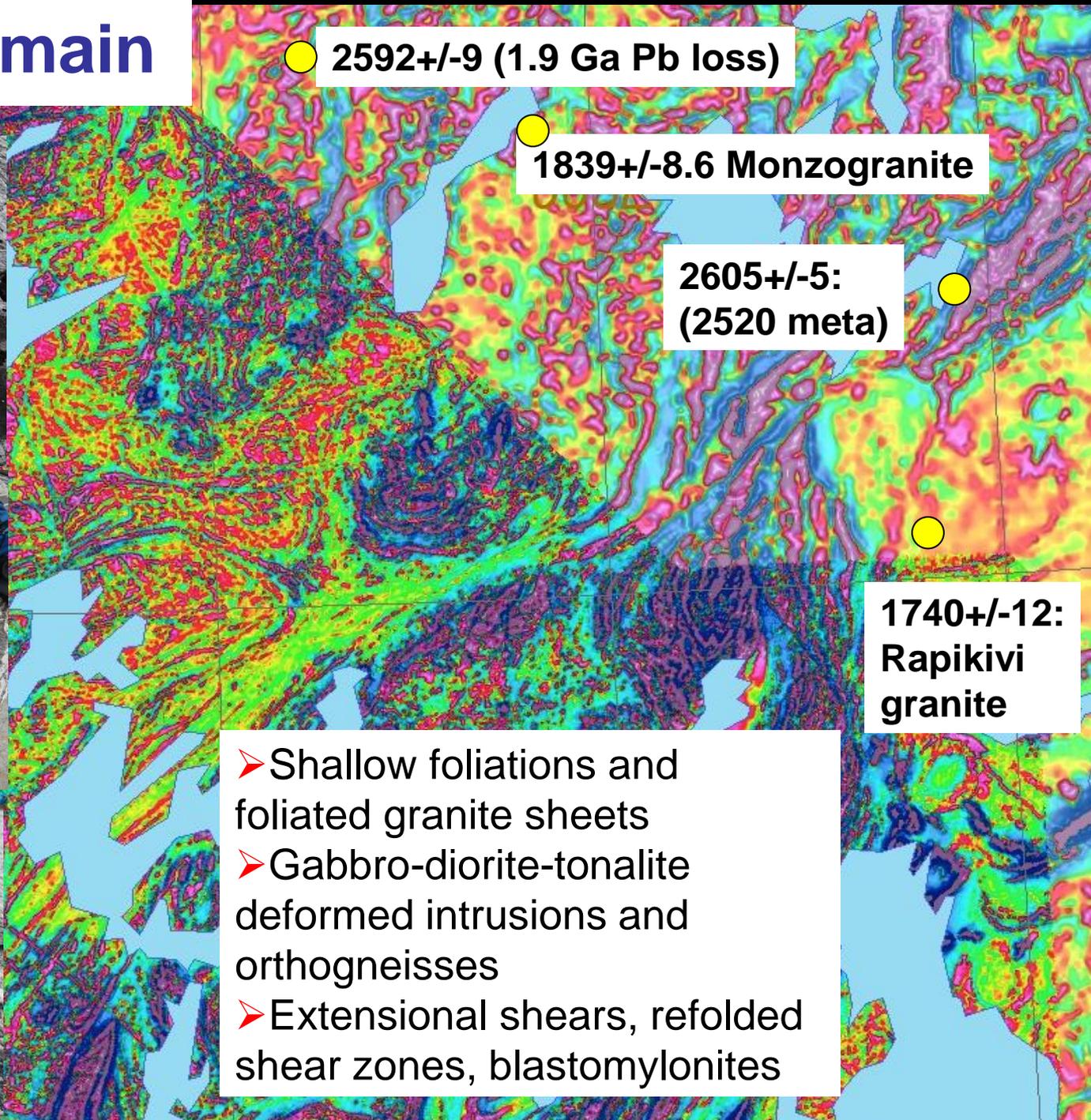
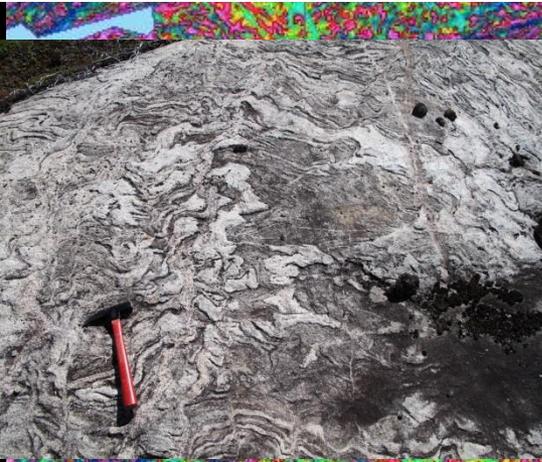


- Moderately west-dipping east-vergent, ductile thrust
- Higher pressure rocks in hangingwall



- Timing? Dextral offset of ca. 1.82 Ga Martin group
- Possible 1.8 Ga Sparrow diabase deformed

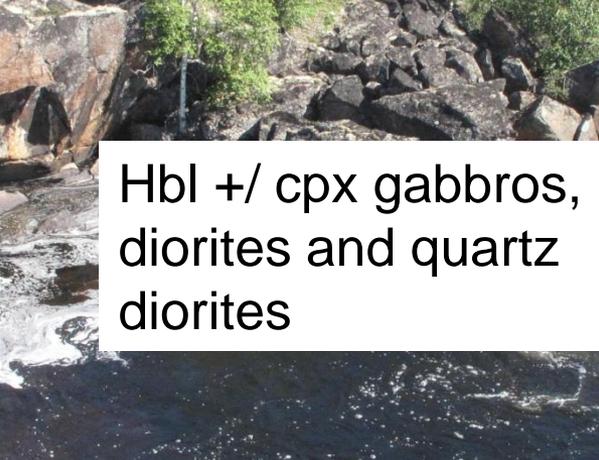
Firedrake domain



'late' Firedrake mafic and alkalic intrusions



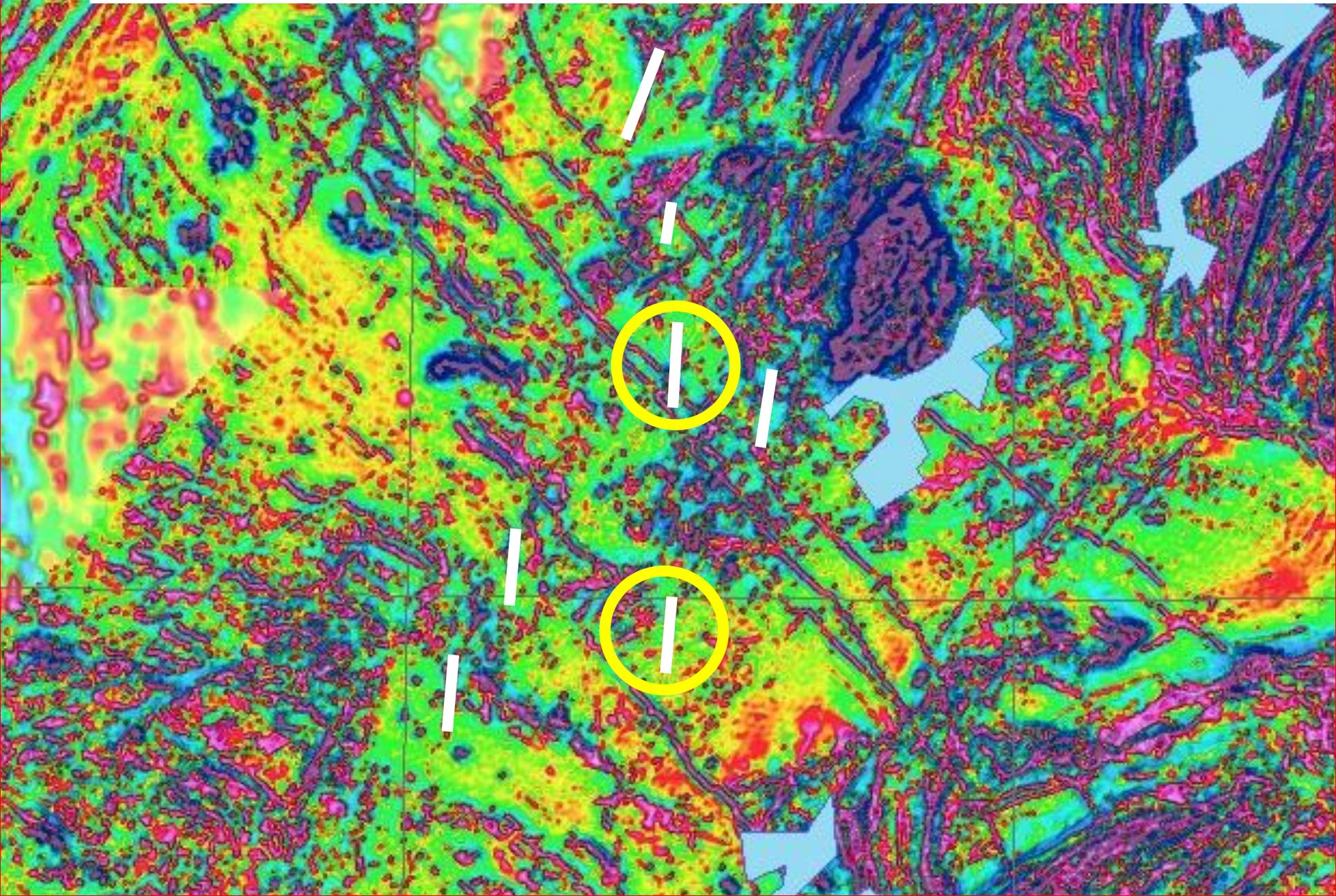
Cpx monzonites, monzodiorites
and diorites

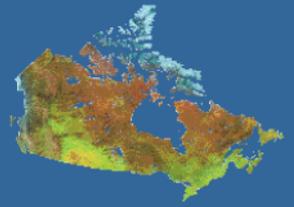


Hbl +/- cpx gabbros,
diorites and quartz
diorites



Is there an Axis Lake type Ni play in S Rae?





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Layered norites with grt-cpx symplectite reaction rims

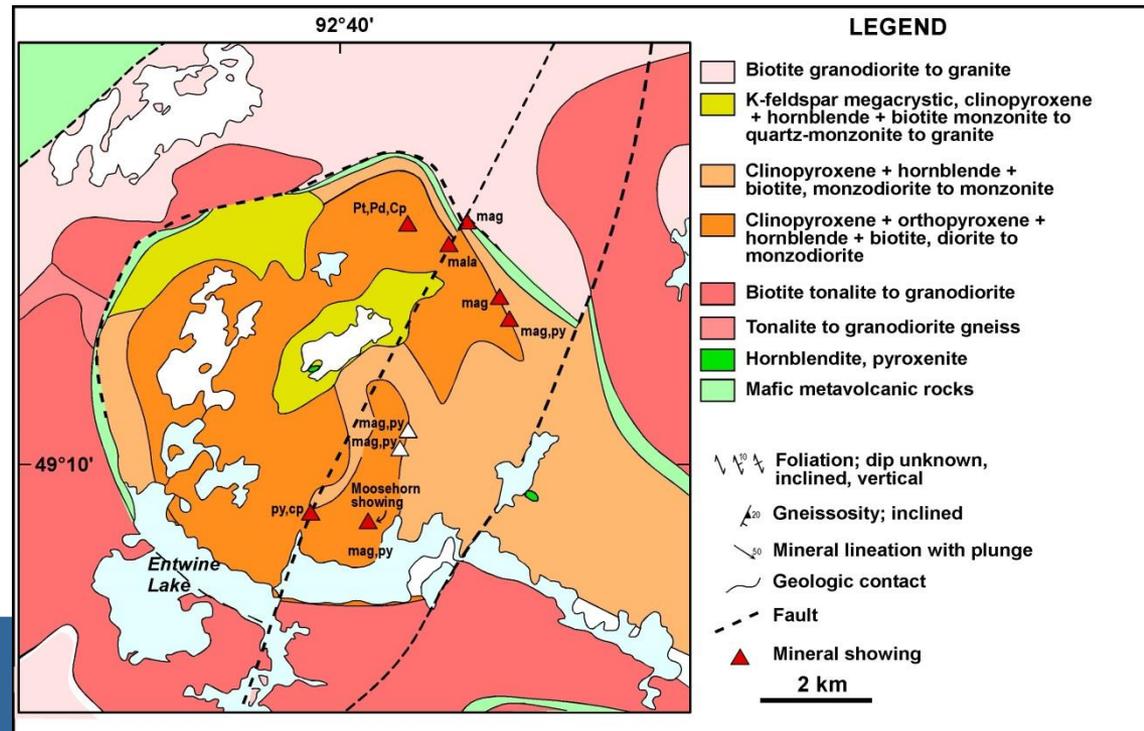
Firedrake exploration target? : Superior Province “Appinites” and Sanukitoids

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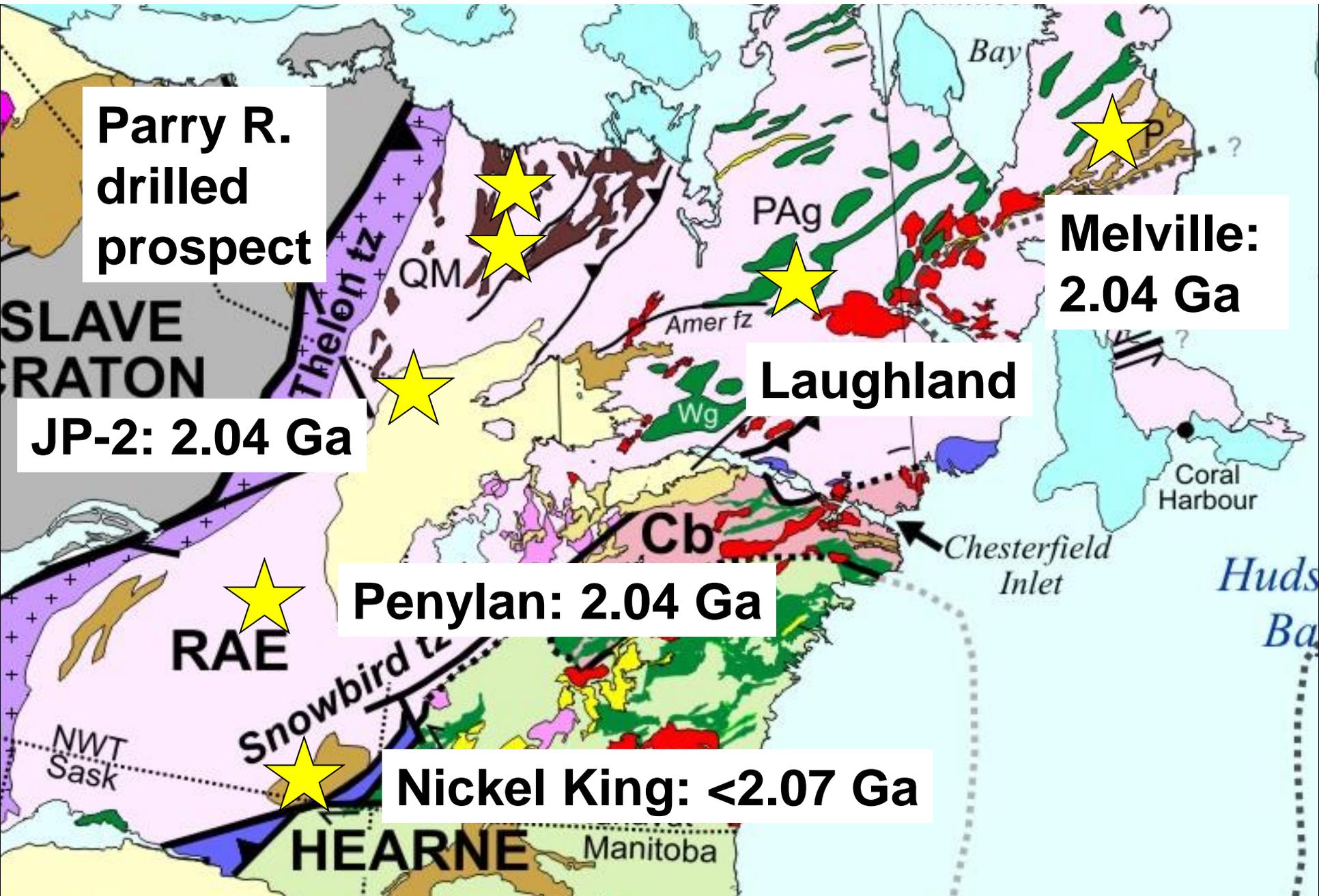
- Syn- to post-tectonic, wehrlite-clinopyroxenite-hornblendite-gabbro-diorite-monzonite-granodiorite suites with “*Appinite*” affinity (ca. 2680 to 2688 Ma)

• Syn- to post-tectonic, diorite-monzodiorite-monzonite suites with “*Sanukitoid*” affinity

• Host Ni-Cu-PGE mineralization similar to Alaskan layered alkaline bodies



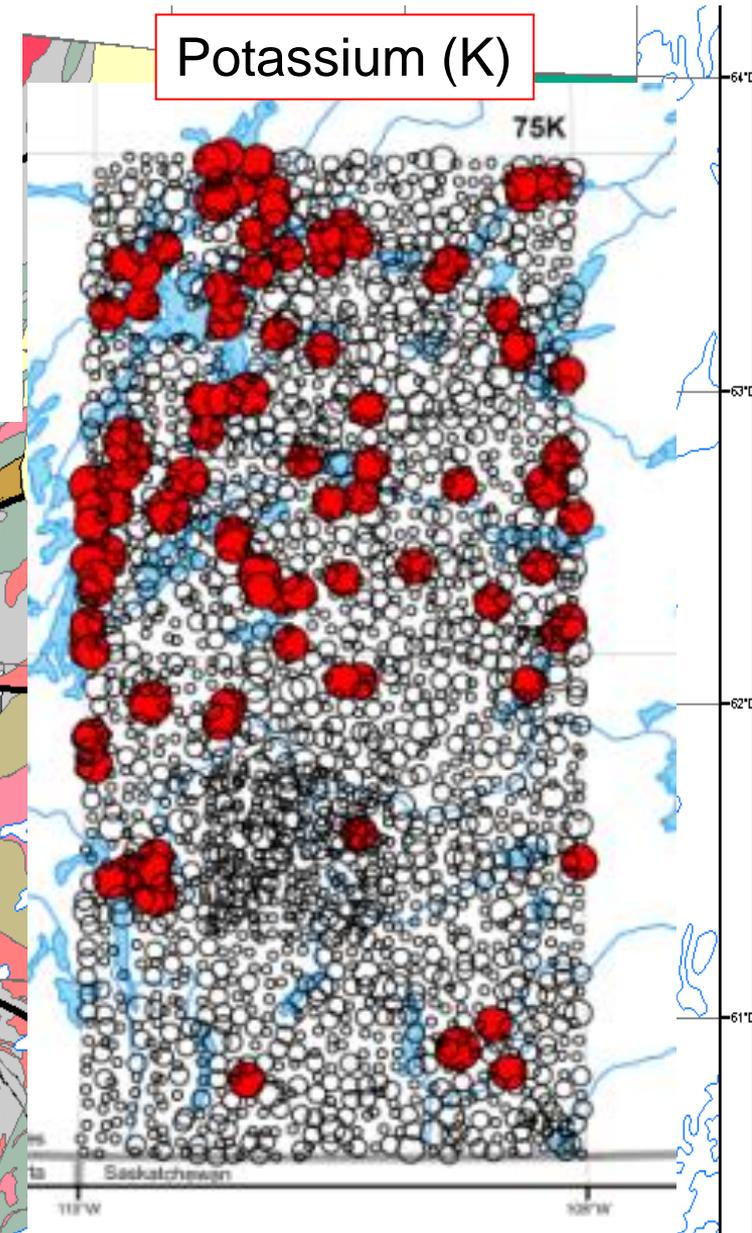
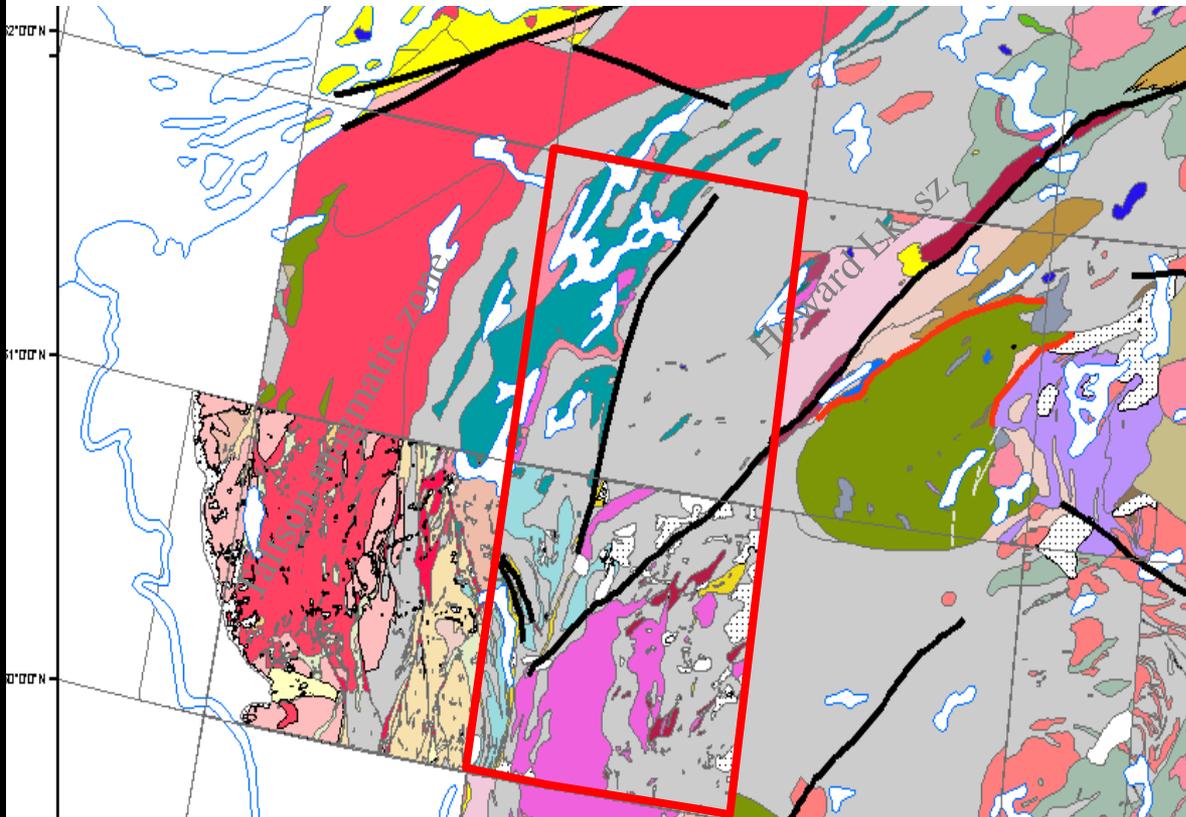
2.0 Ga mafic intrusions and Ni-Cu-PGEs?

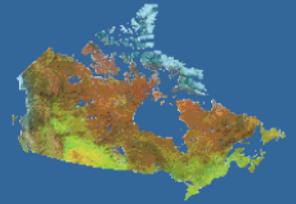


New lake sediment geochemical data: 75C, F

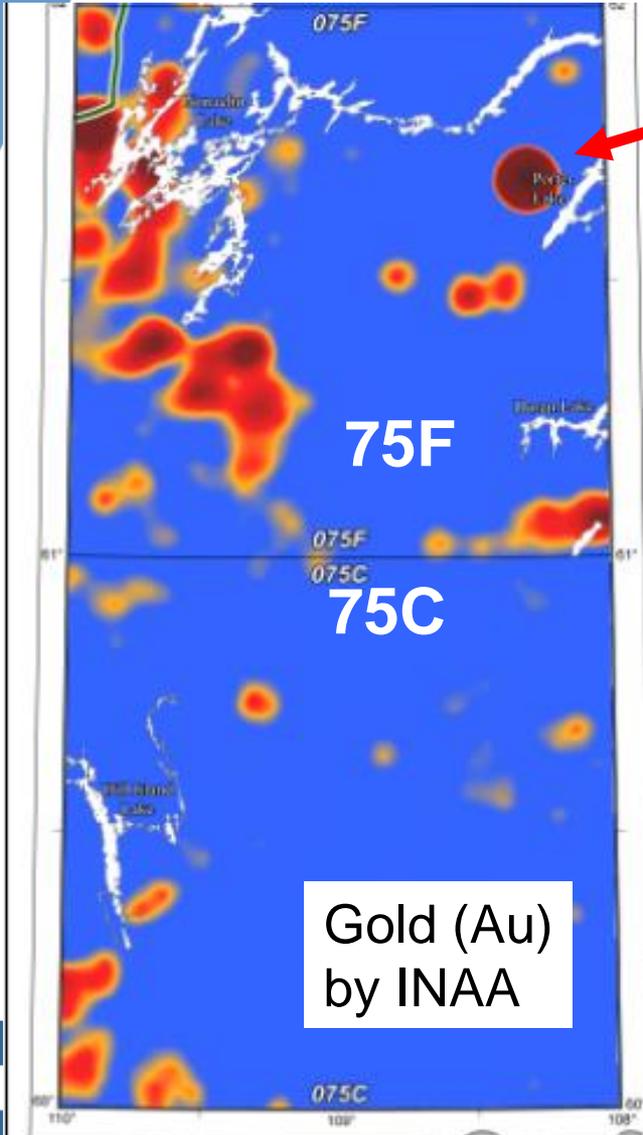
Open File 7232

- Re-analysis to modern standards of 3000 archived samples
- over 80 elements including Gold, PGEs, RE's





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Multi-element anomaly:

Au- 290 ppb

Ag- 322 ppb

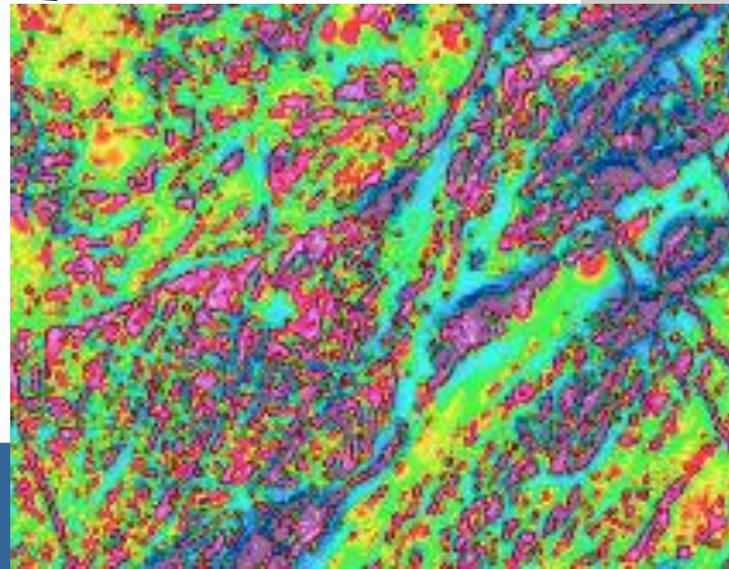
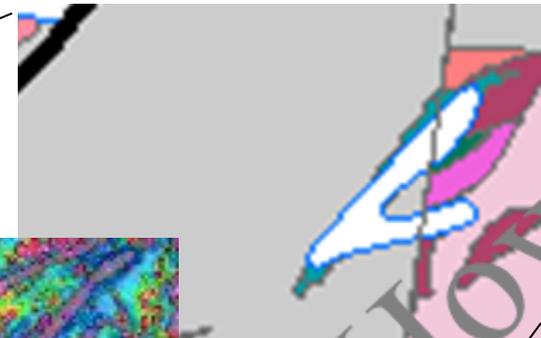
As-2923 ppb

Hg- 318 ppb

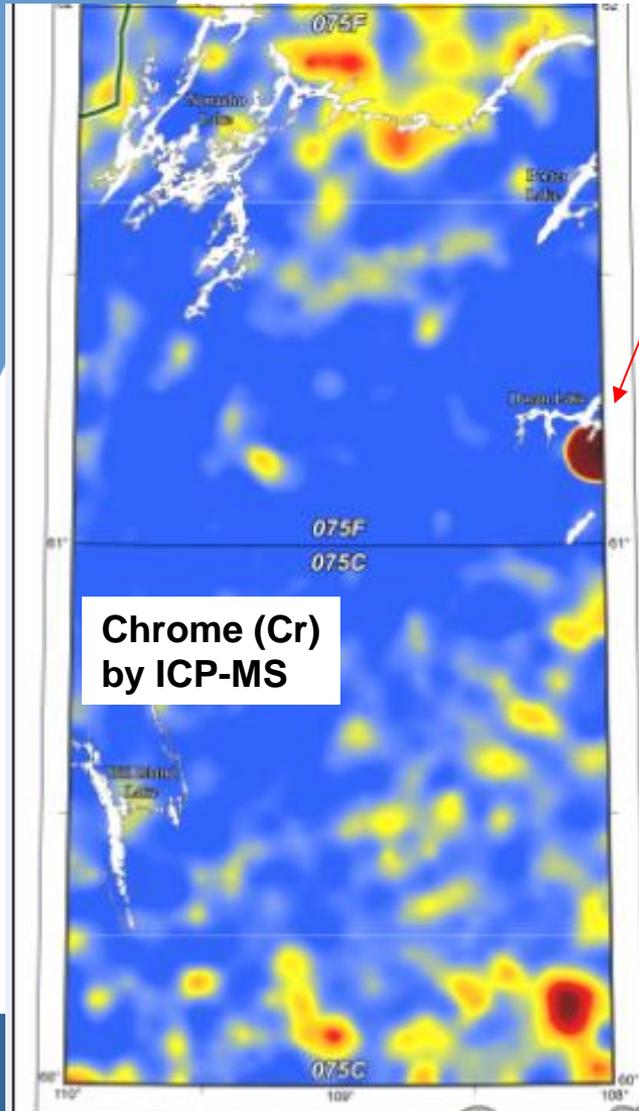
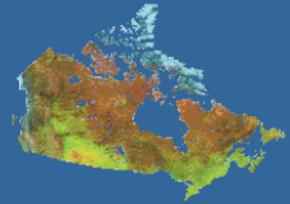
Sb- 30 ppb

Elevated: Cu, Ni

Geology OF5744



First vertical
Derivative
magnetics



Cluster of anomalies in samples around Doran lake:

Cr: 622 ppm

Pd: 31, 33 ppb

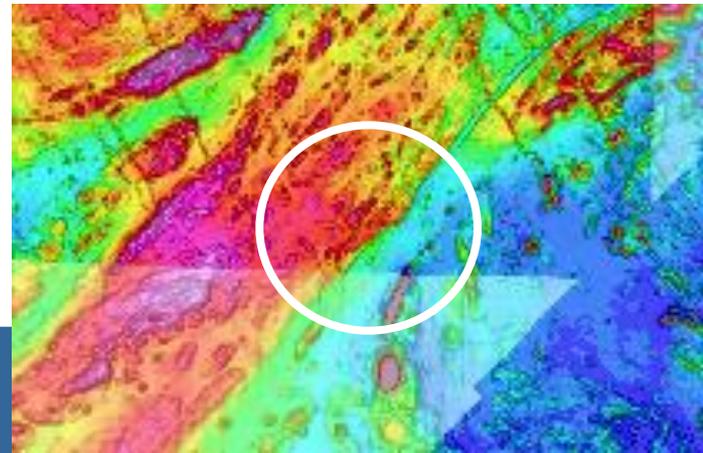
Pt: 2 ppb

V:

Ni: 350 ppb

Co:

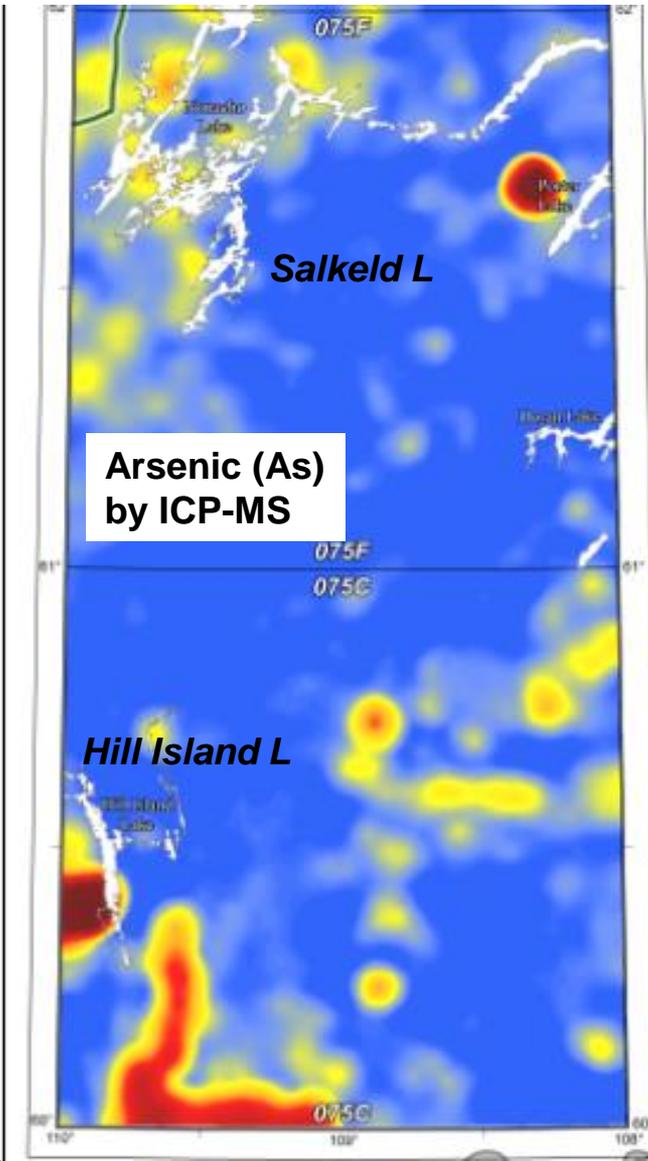
Anomaly is down-ice and along strike of the Penylan domain gabbro-anorthosites and the major Howard Lake shear zone



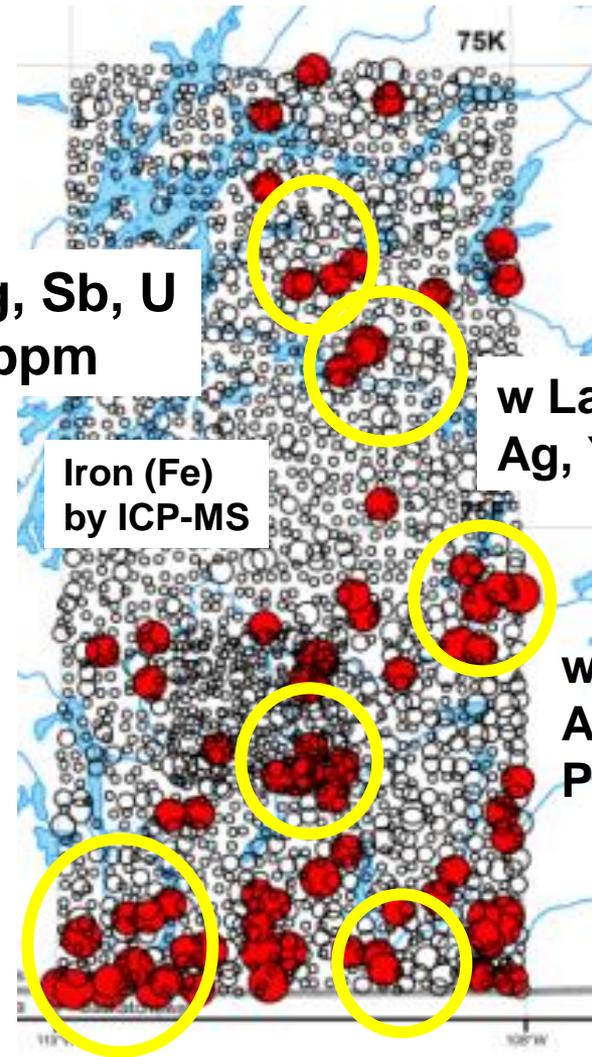
other Lake sediment anomalies....

Cluster of anomalies near of Hill Island and Salkeld Lakes:

Multi-element anomalies: Au, Ag, Fe, Ce +/- As, U, Co, Hg, Y, La, Re, Cu, Na



Fe, Au, Mo, Ag, Sb, U
Ce: 600-1400 ppm

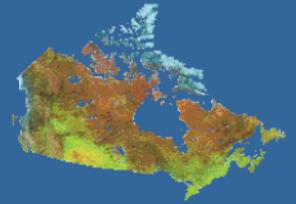


w La, Na, Cu
Ag, Y, Co

w La, Ce,
Au, Y, Co
Pb, Re

Fe, Au, Ag, Ce

Fe, K, U



- **South Rae comprises distinct lithostructural domains of differing metamorphic grade and age, bounded by major shear zones with evidence for reactivation and hydrothermal alteration**
- **Abundance of mafic-intermediate rocks compared many other parts of Churchill**
- **Late layered mafic intrusive suites appear to be unmapped**
- **Anomalous element abundances in lake sediments and grab samples**
- **Warrants systematic remapping**

