



# GEM2

## New regional geology and mineral occurrences of the South Rae in Northwest Territories from GEM2: implications for continuation of the Boomerang, Black Bay and Axis-Thye Lake trends

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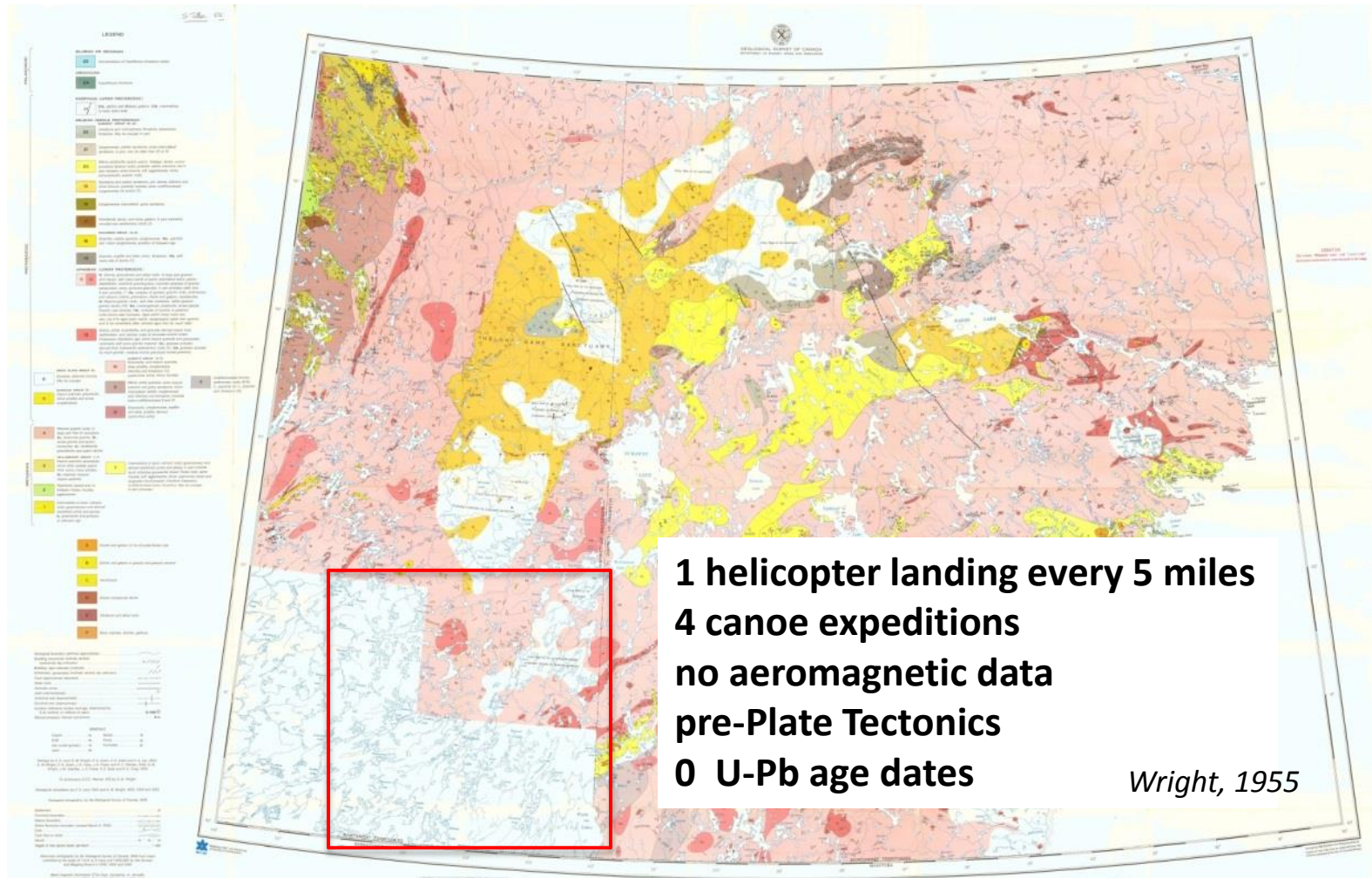
UQÀM  
Université du Québec à Montréal

SFU



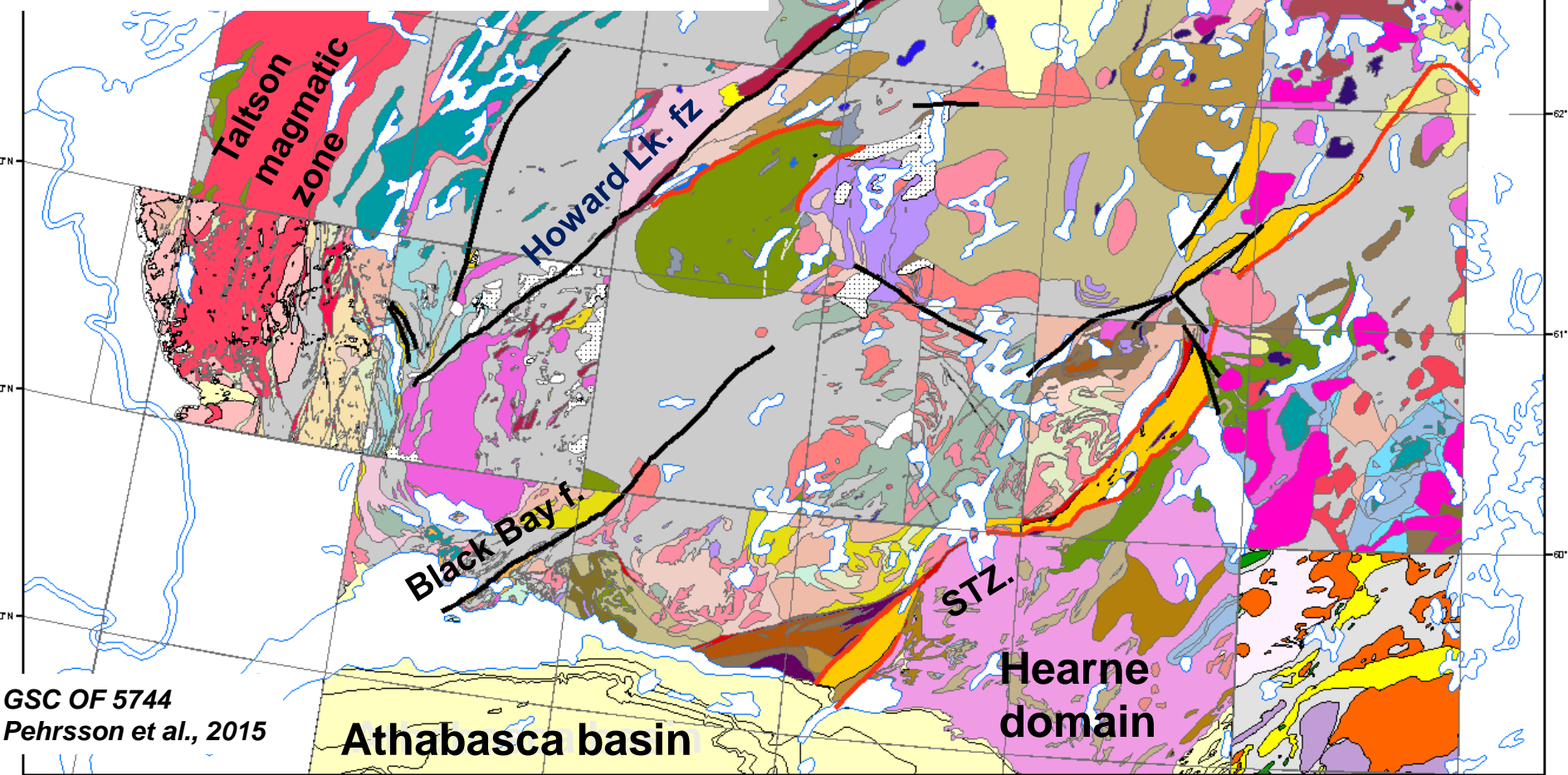
UNIVERSITY OF  
WATERLOO

# South Rae, NWT: Last unmapped part of the Canadian Shield



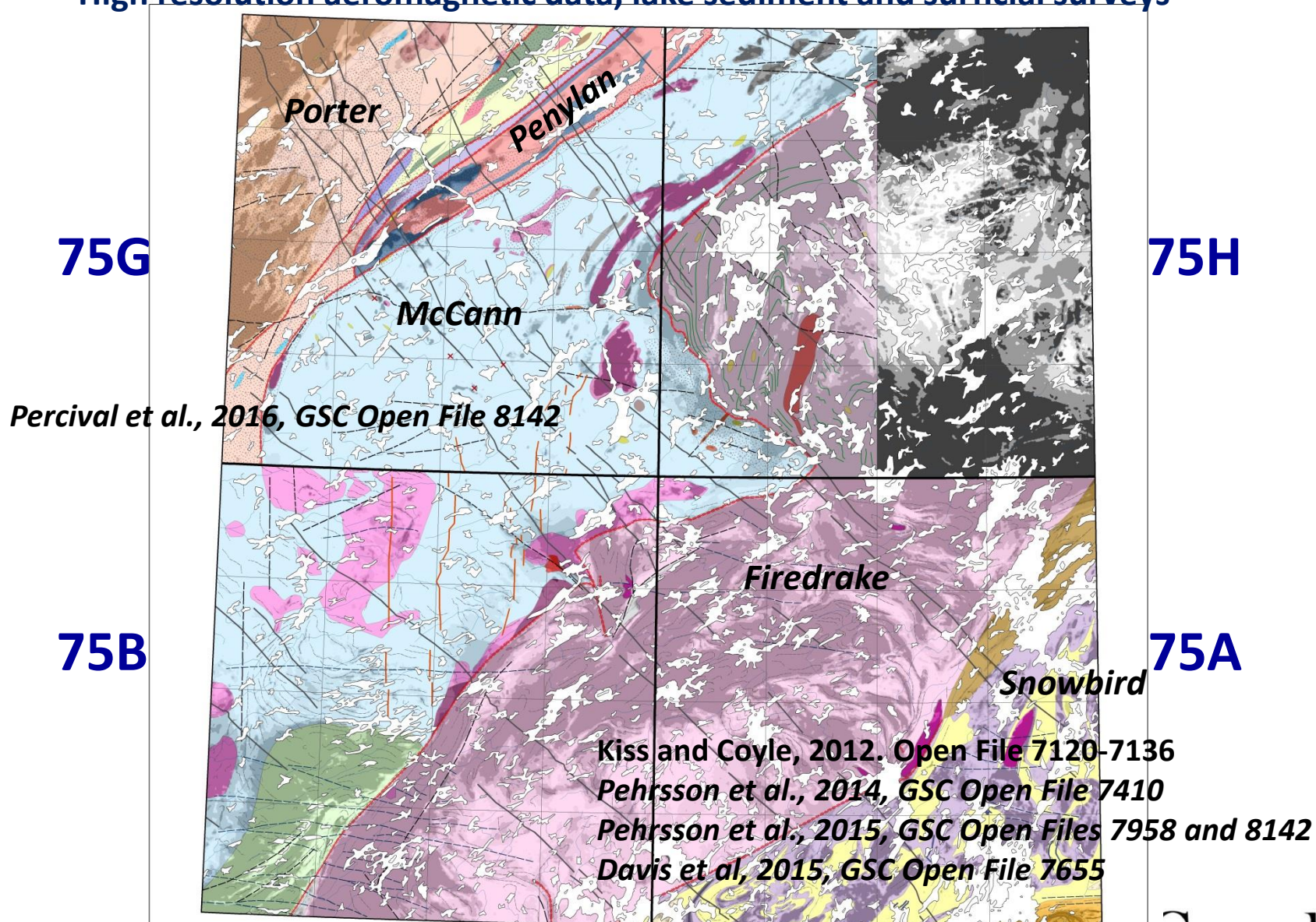
# Starting point.....

Can the domains and bounding structures of N Sask be continued into NWT?

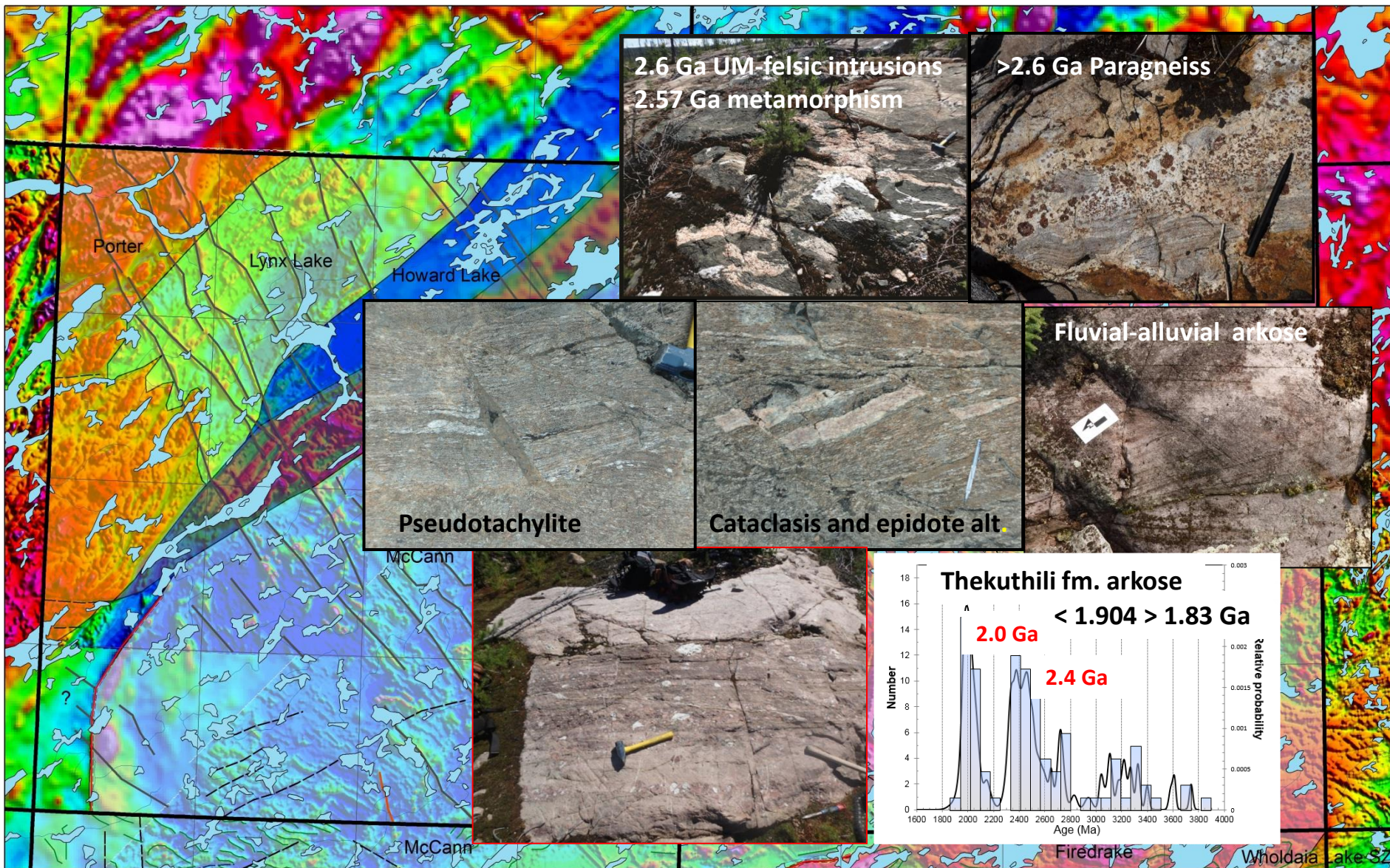


# GEM 2 Framework mapping: 2012, 2015-16

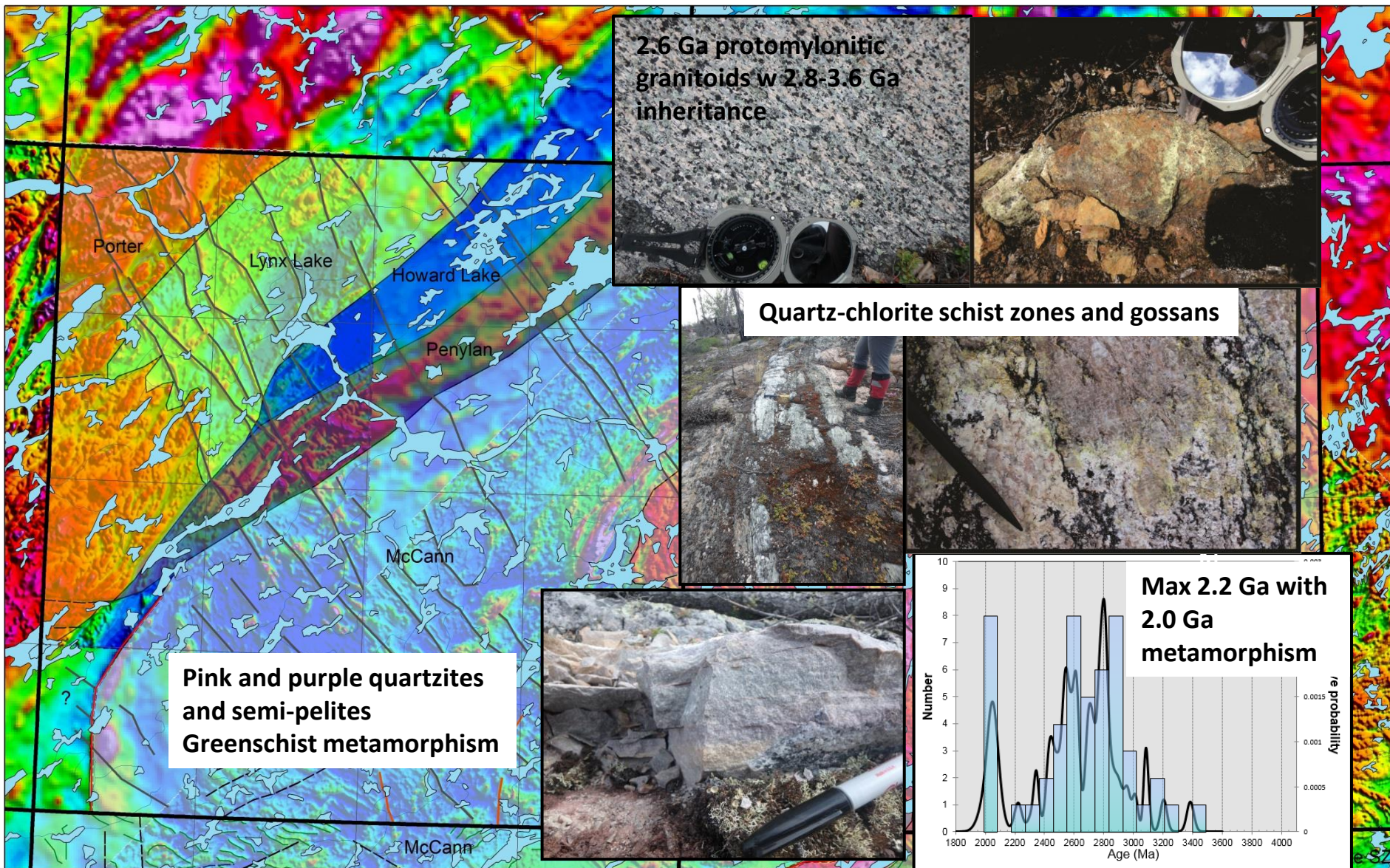
High resolution aeromagnetic data, lake sediment and surficial surveys



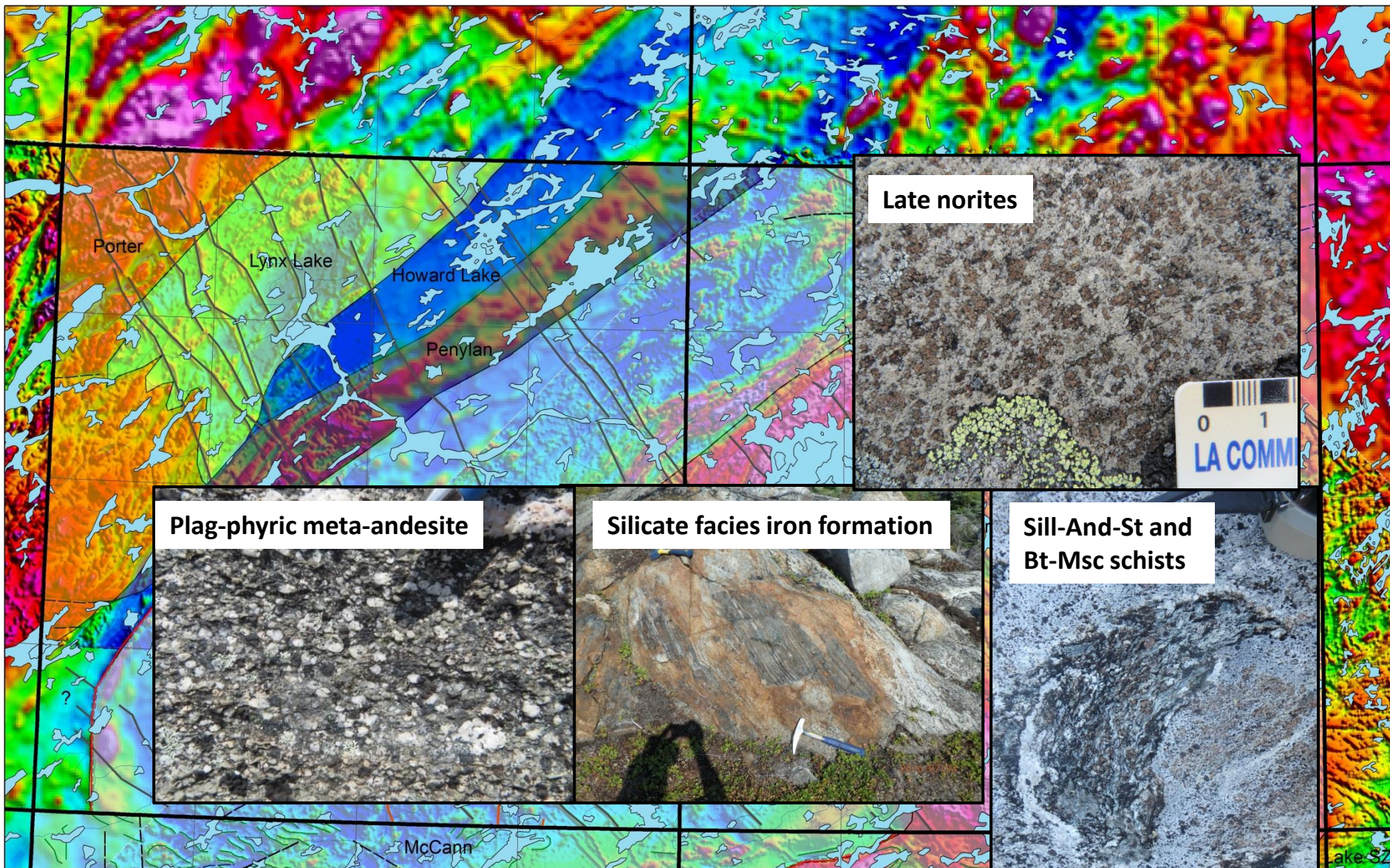
# Porter domain



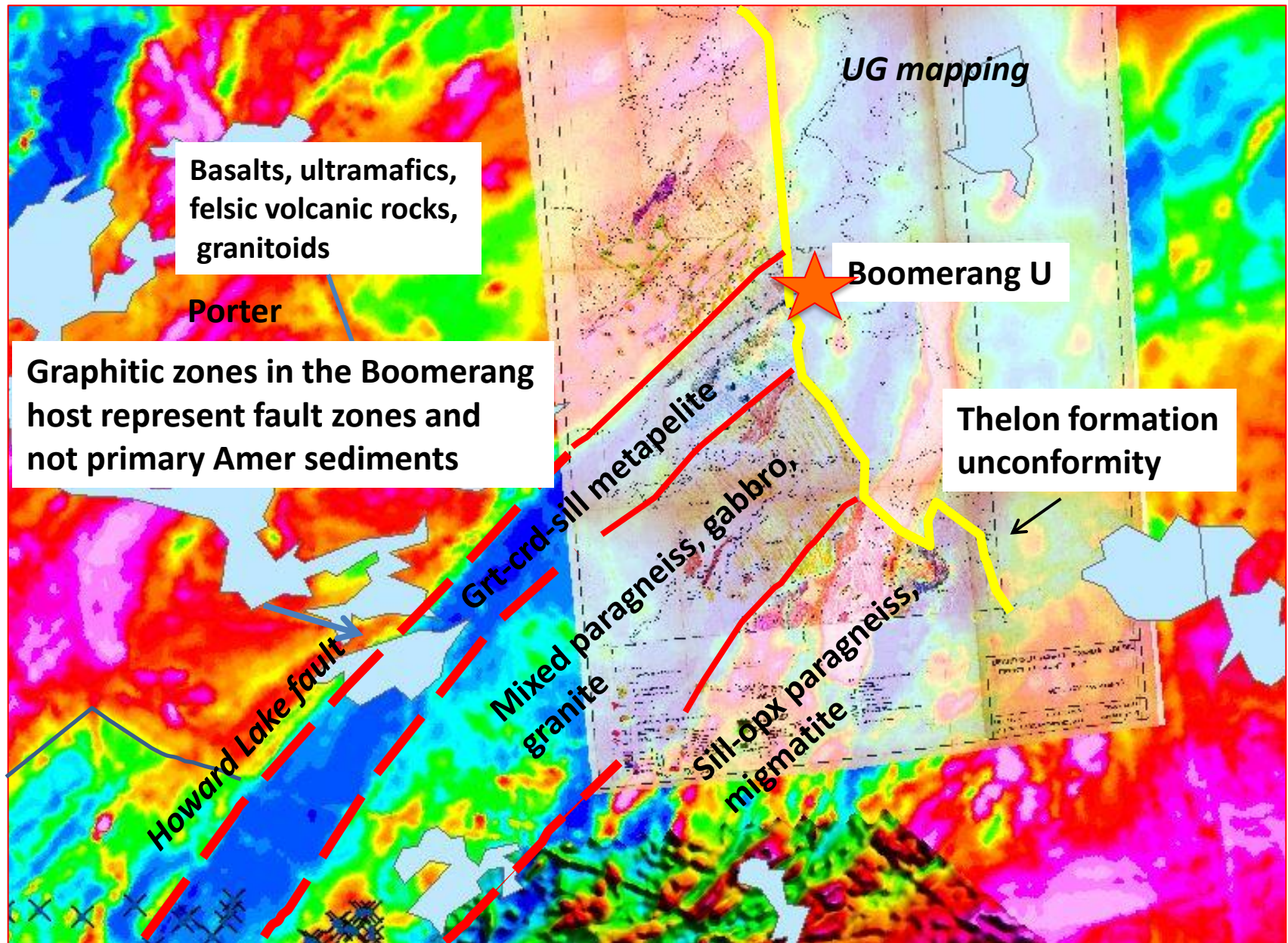
# Lynx domain



# Howard Lake domain



# Continuation of the host to Boomerang

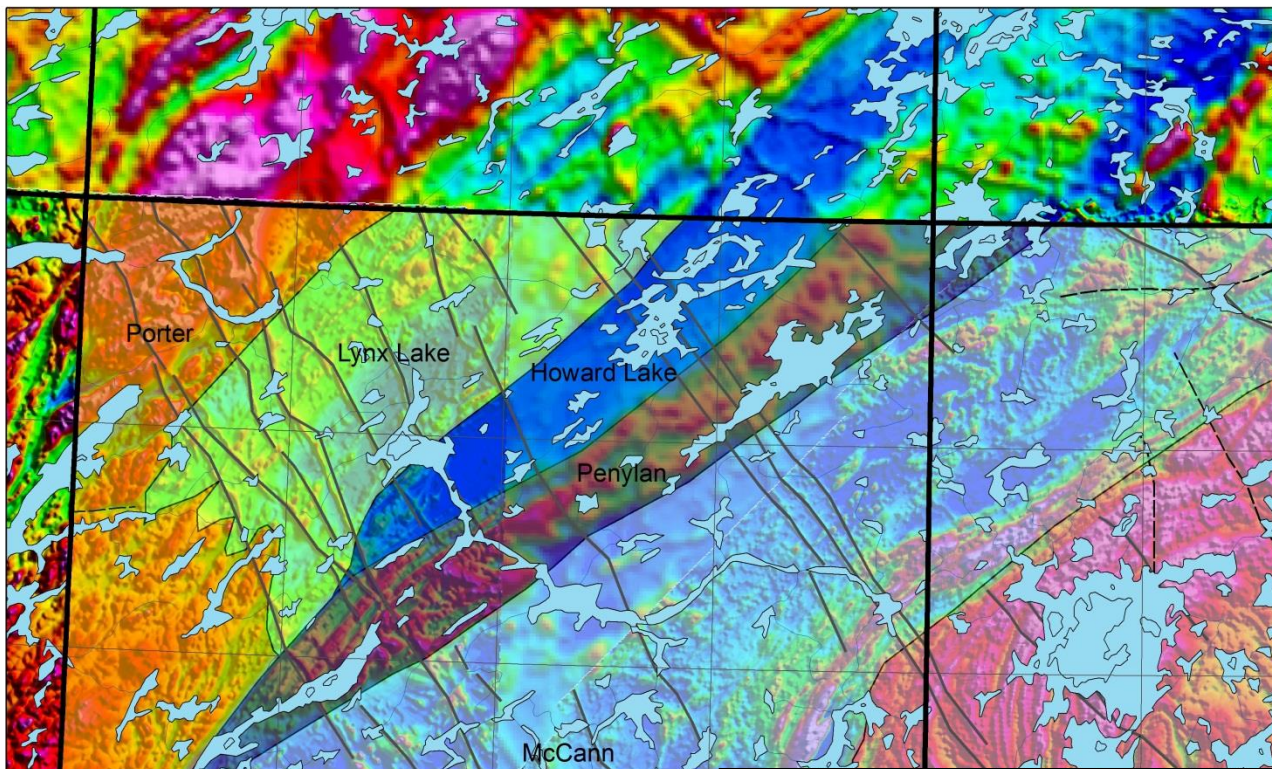


Howard Lale

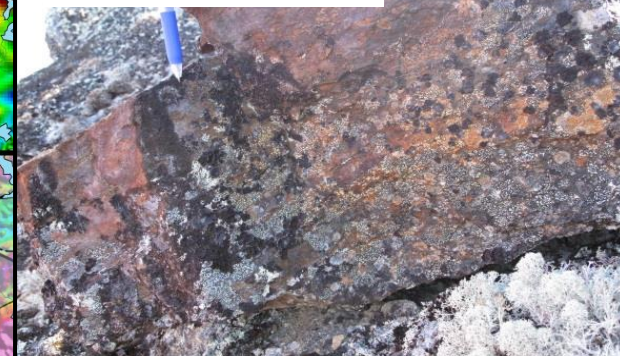
Penylan

McCann

# Penylan domain



Ultramafic layers



Mylonitic boundaries



2.03 Ga monzogranite



2.04-.02 Ga mafic complex



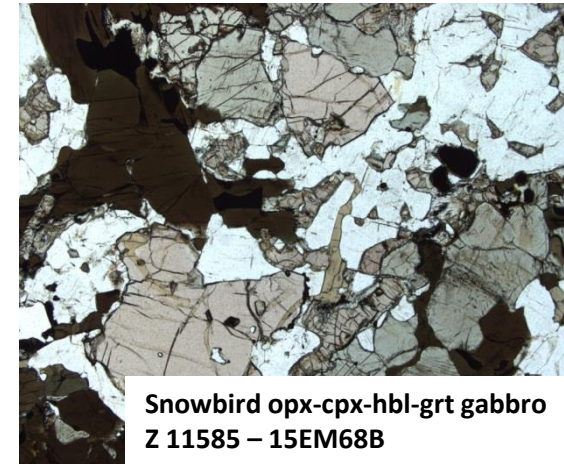
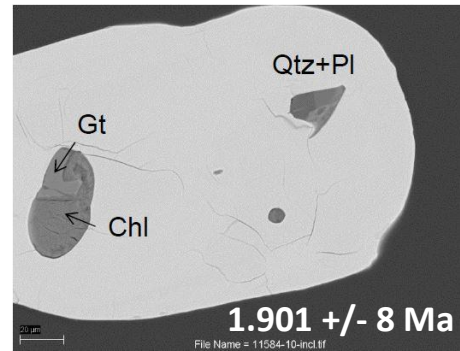
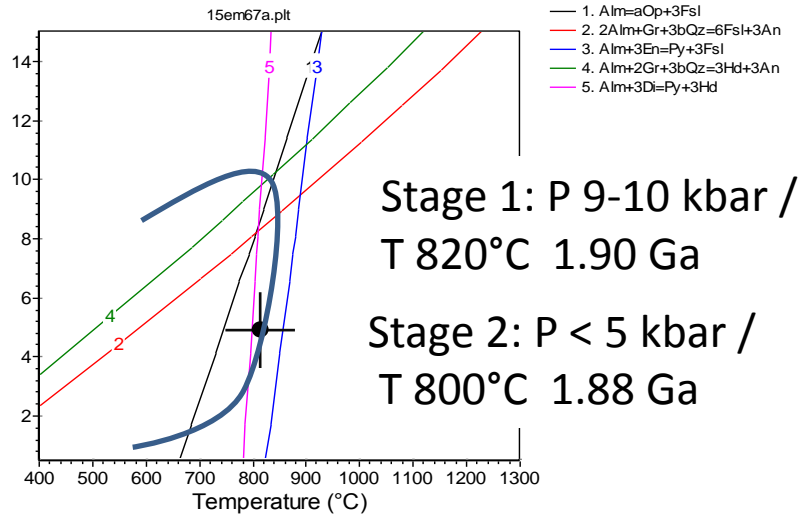
Distinct fault bounded slice with high pressure metamorphic assemblages



1 CM

# Snowbird orogeny : regional hi P

Near Isothermal decompression.....

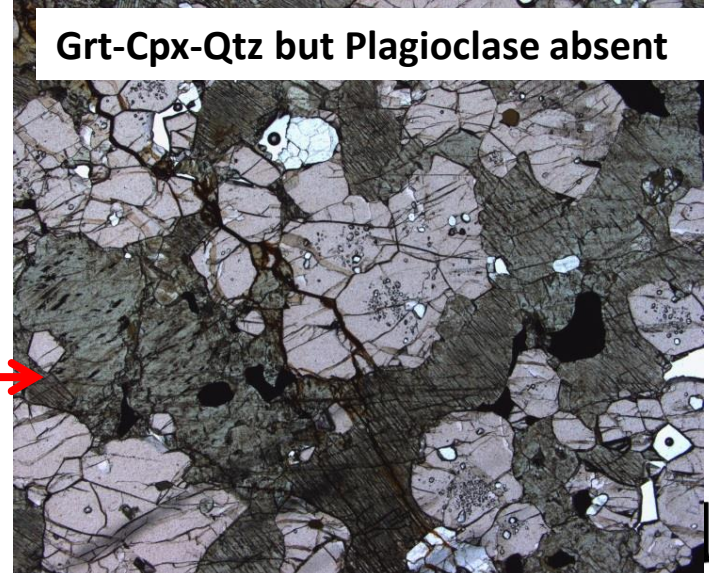


Amphibole-plagioclase thermometry (Holland & Blundy 1994): edenite + albite = richterite + anorthite  
 empirical Ti-in-amph (Otten 1984) Schmidt (1992) and Anderson & Smith (1995) barometry

Occurs in 2.04 Ga gabbroic-anorthosites



Grt-Cpx-Qtz but Plagioclase absent

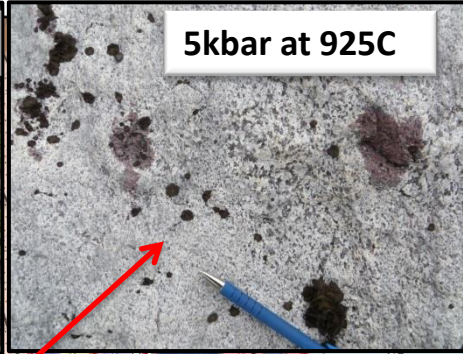


# McCann domain

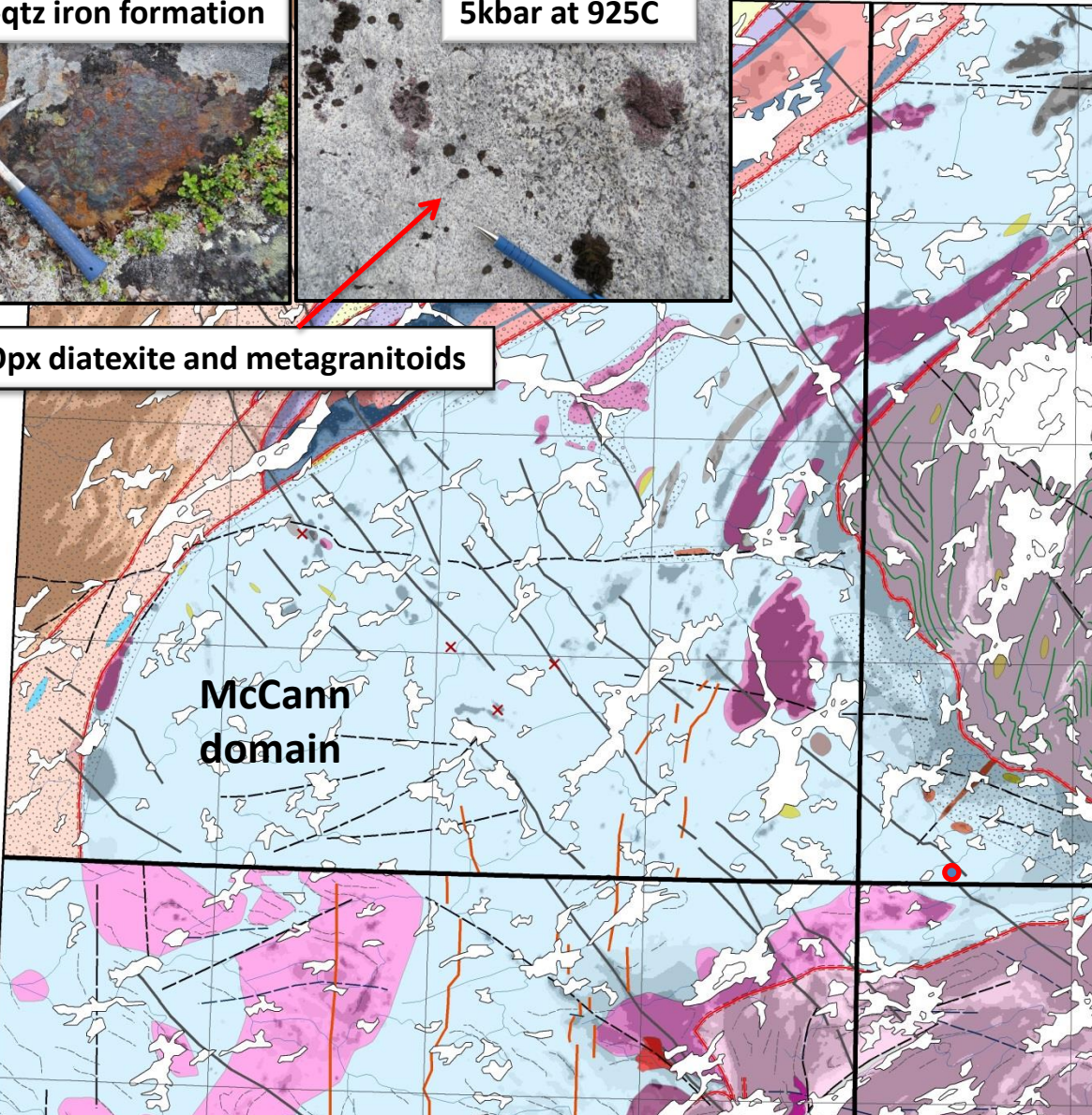
Grt-mag-qtz iron formation



5kbar at 925C



Grt-Opx diatexite and metagranitoids



McCann domain

2066+/-20 Ma

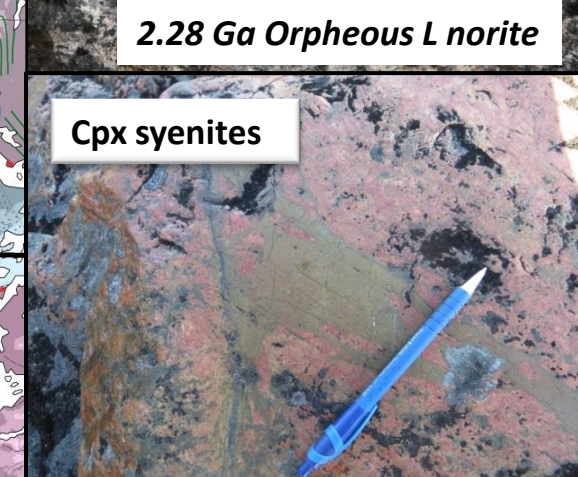


Grt-Cpx-Plg symplectite rims



2.28 Ga Orpheous L norite

Cpx syenites



# Firedrake domain: Train North

2.7 Ga Grt-  
Cpx-Opx  
diorite-  
tonalite  
orthogneiss

Cut by mafic dykes.....

1.9-1.85 Ga syenites along  
boundaries

Deformed  
into straight  
gneisses

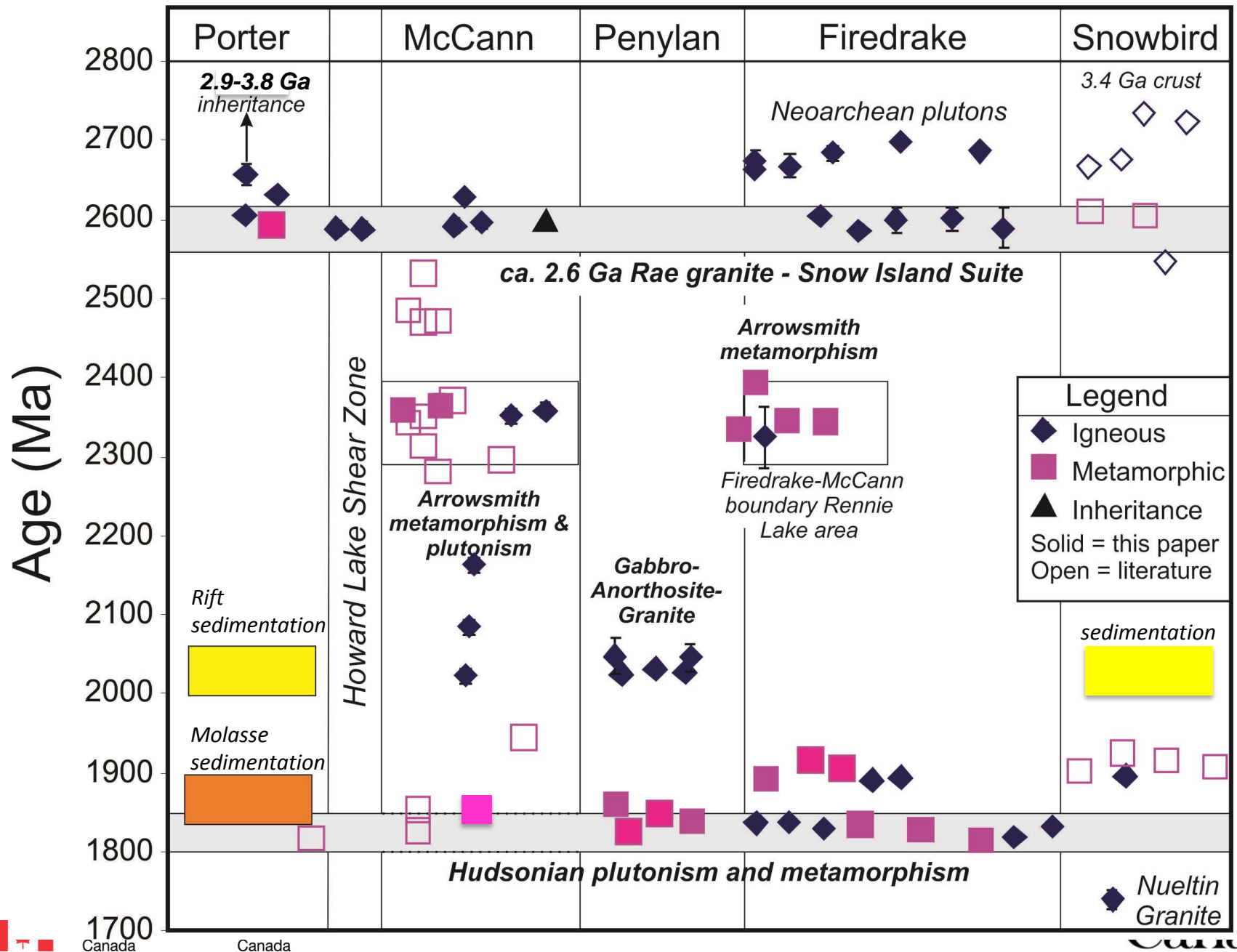
Variably intruded by  
1.83 Ga soupy migmatitic  
granodiorites

Paleopressures of 8-14 Kbar 1.9-1.85 Ga

And blastomylonites

Ca

# Domain subdivision: geophysics, mapping and supporting geoscience

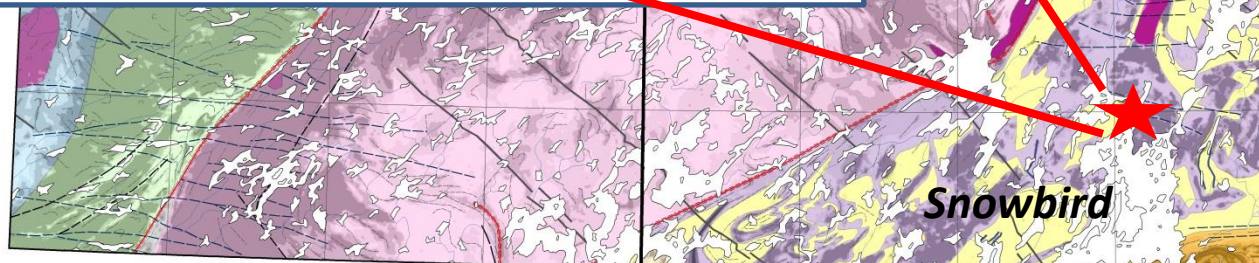
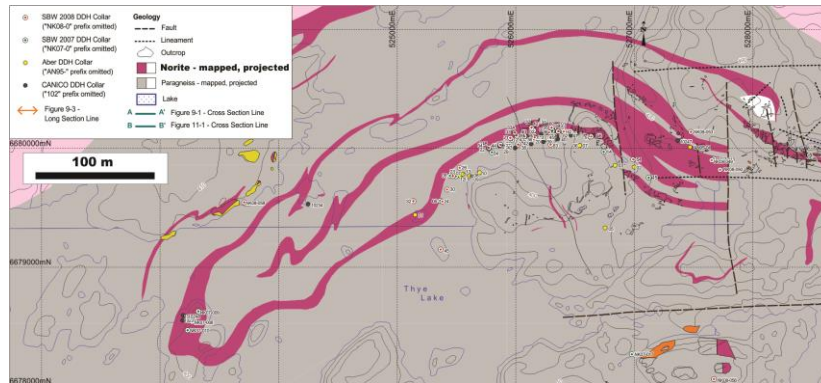


**Z-11591/Z-8617**  
**Thye Lake metanorite**

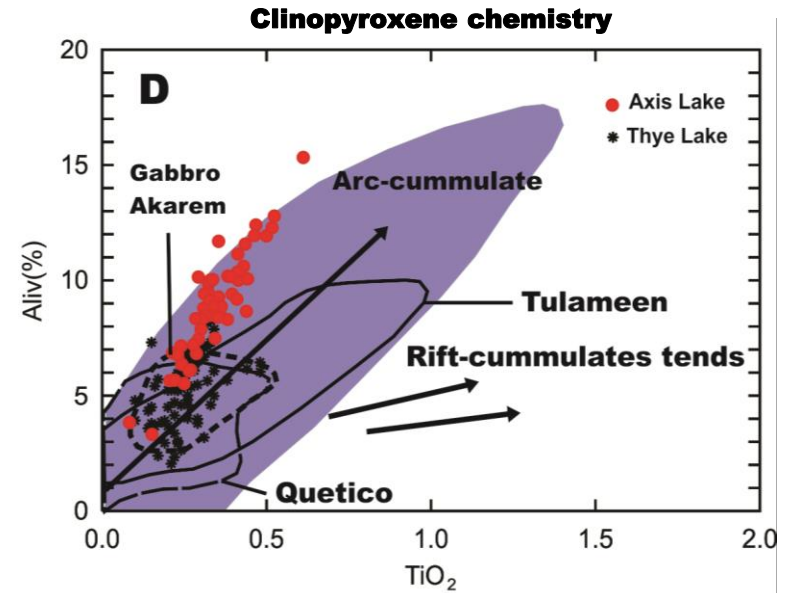
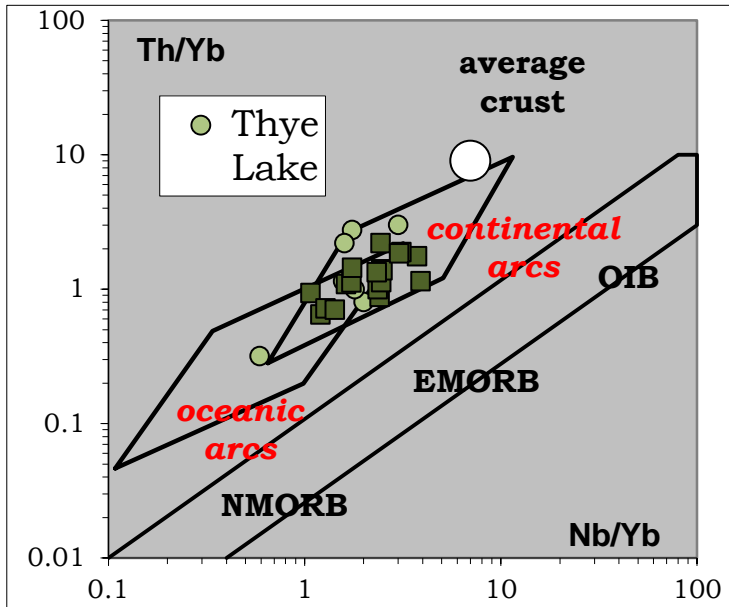
Intercepts at  
 $1907 \pm 20$  &  $2609 \pm 29$  Ma  
 MSWD = 3.8

Mean  $1907.1 \pm 0.4$ ,  $n=6$   
 MSWD = 0.84,  $p.o.f. = 0.52$

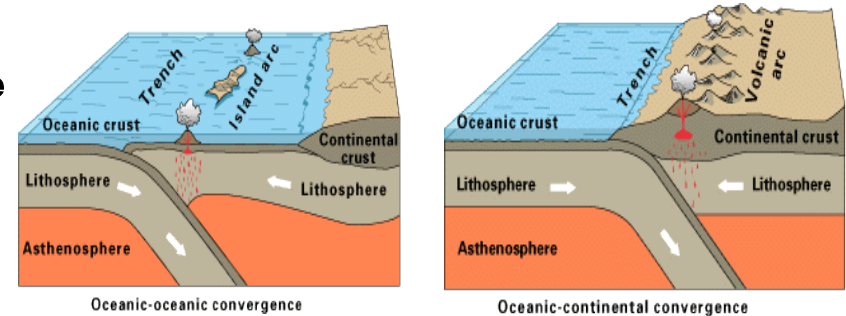
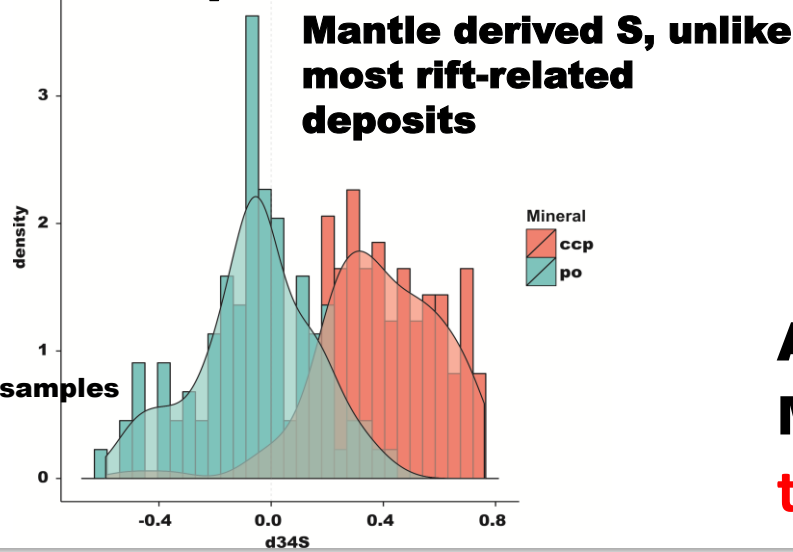
Inset:  $^{207}\text{Pb}/^{235}\text{Pb}$  ratio with error bars and a mean line at approximately 1.907.



# Thye and Axis Lake: Archean Alaska-type deposits

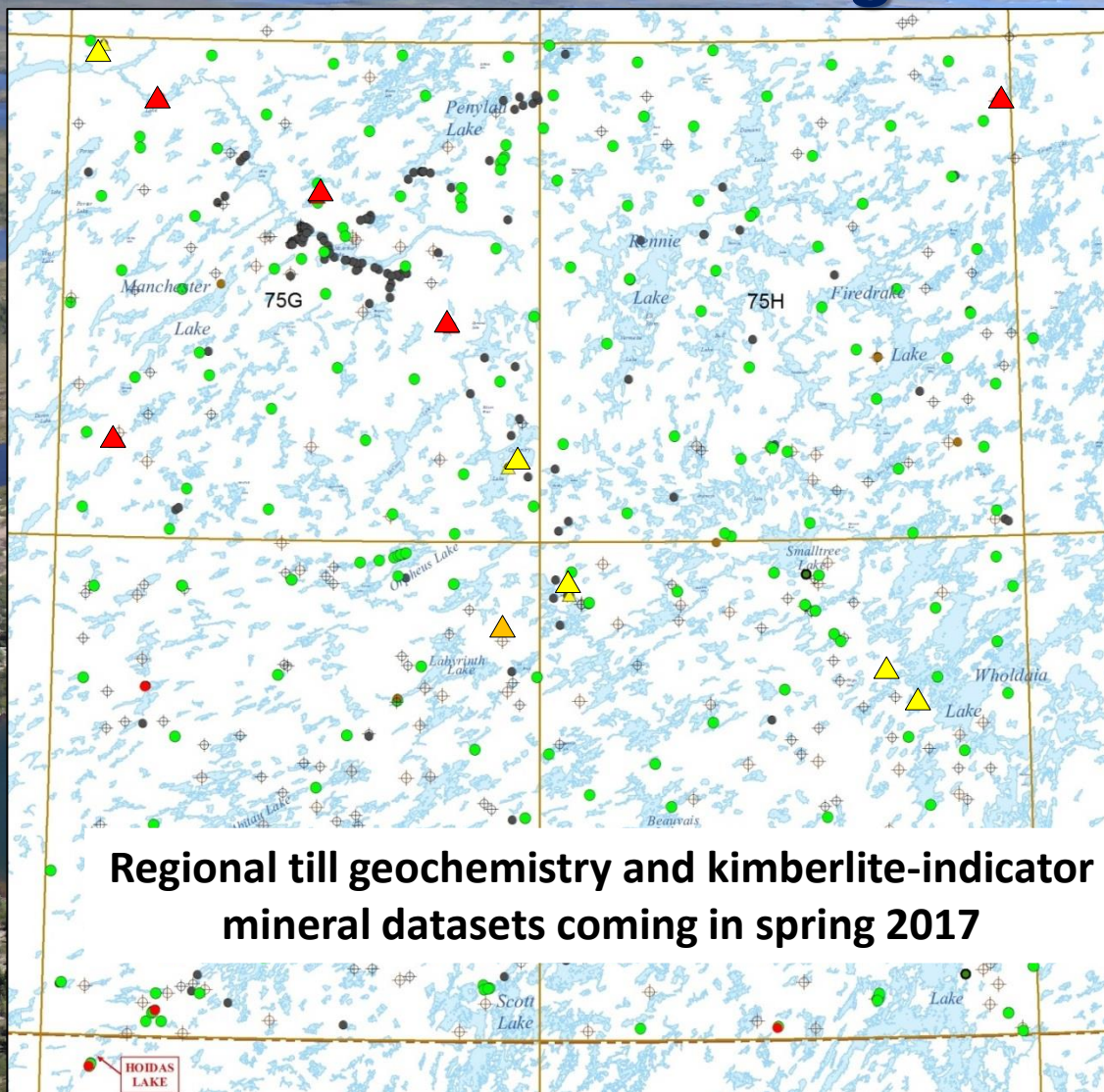


## In-situ S isotopes



**Alaska-type (Quetico, Giant Mascot), convergent margin type**

# Surficial Geological Investigations



- 660 stations (all) 420 ground observations
- 200 till samples 11 geochron samples
- 195 ice movement indicator sites

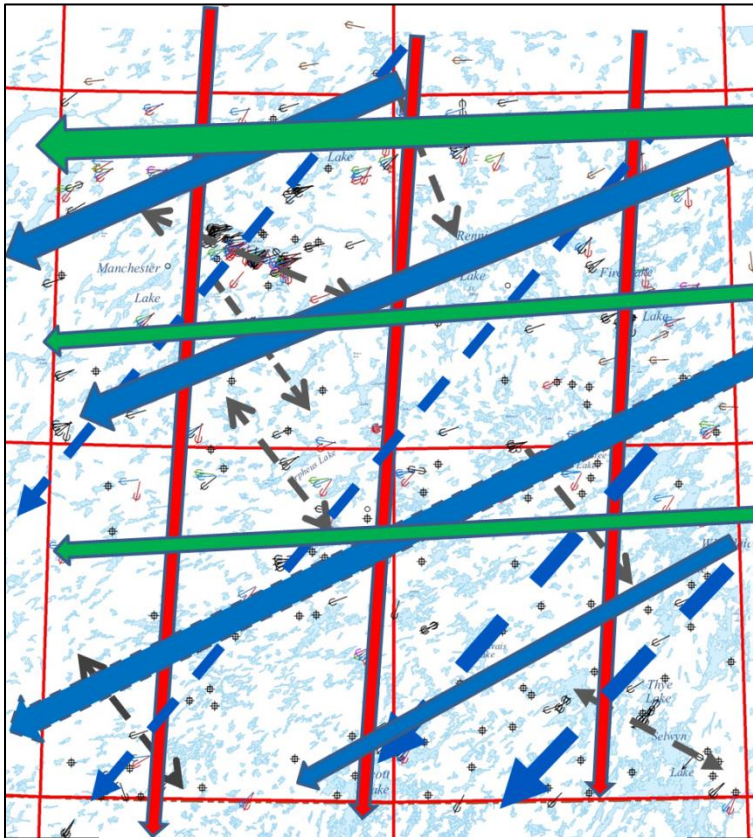
- ❖ Focused field mapping: nature and distribution of sediments and landforms, ice-flow indicators;
- ❖ Conduct targeted till geochemistry and indicator minerals sampling concurrent with Quaternary geological mapping
- ❖ Reconstruct the ice flow chronology and both glacial - deglacial histories (geochron),
- ❖ Model glacial dispersal patterns (MSc Lauzon, UQAM)

Ground observations (no sample) (2015/16; 2014)  
 Ground observations (2015/16; 2014)  
 Ice movement indicator sites

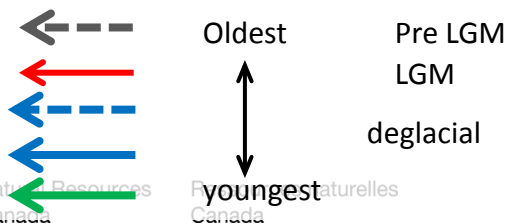
South Rae, NWT

# Ice-flow Chronology

Deglacial ice flow shifts in clockwise rotation – migrating ice divide



Preliminary Ice Flow Chronology

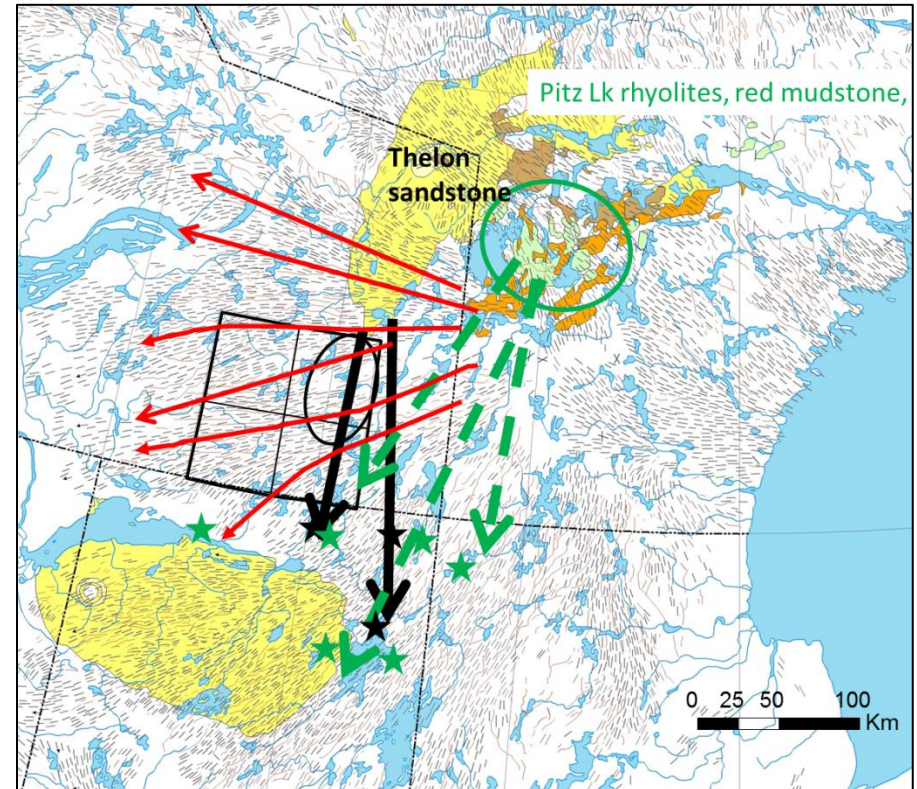


National Resources Canada

Natura

# Dubawnt Supergroup erratics:

Evidence of long transport and glacial dispersal by southward flow



Sandstone



Pitz Lake Fm



# Ice Marginal Lakes

Cumulative area inundated by sequential lakes over time as ice margin retreated

Highest strandlines




○ ~430-445±5m asl

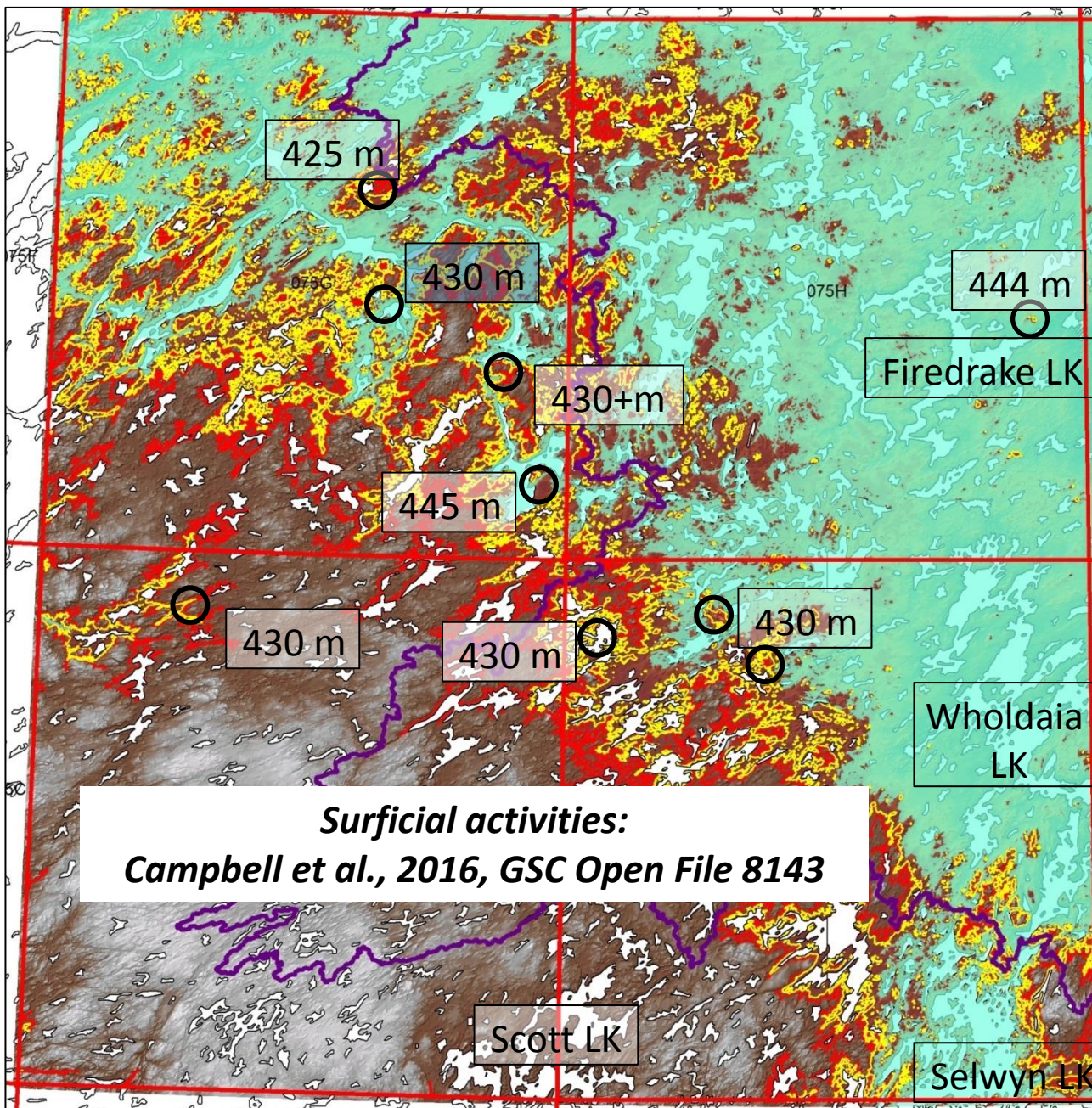
Below 410m



= extensive winnowing and reworking of sediments (till) on low relief terrain

Also short-lived ice-marginal lakes ≥450 m asl in 75 A & B

 Drainage divide  
 440 m asl  
 430 m asl



**Surficial activities:**  
**Campbell et al., 2016, GSC Open File 8143**



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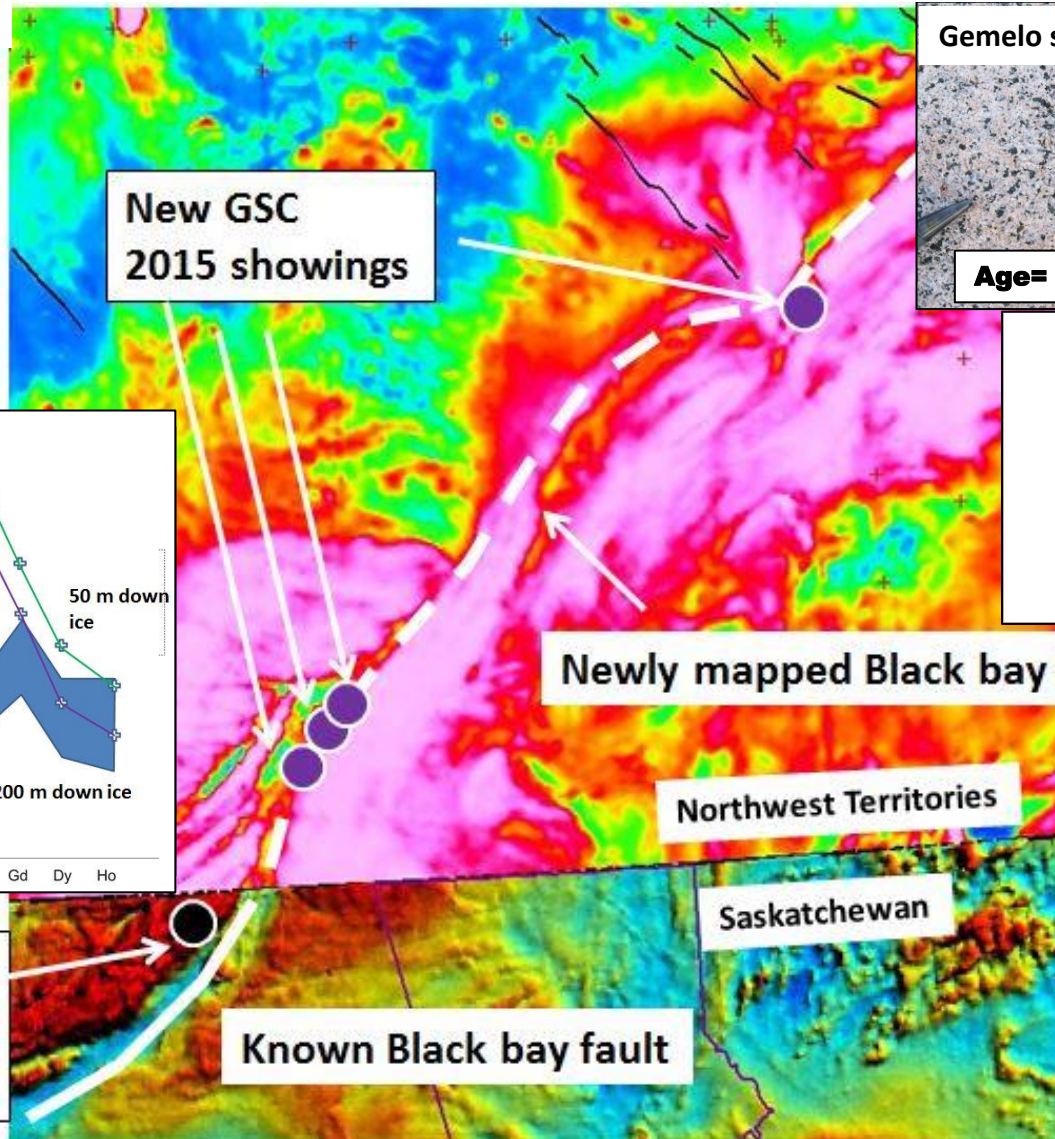
Ressources naturelles  
Canada

25 12.5

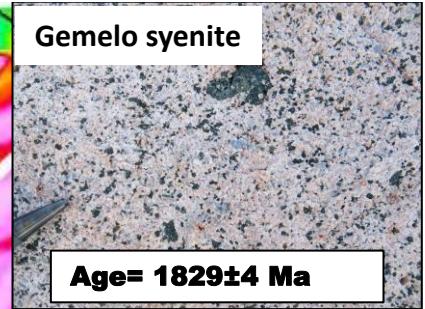


# Late shear zones accommodate uplift of the youngest parts of the high P block and localized intrusion of mineralized alkalic magmatic rocks

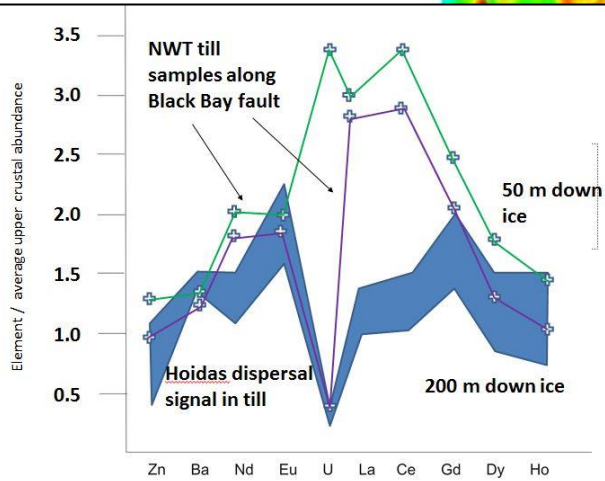
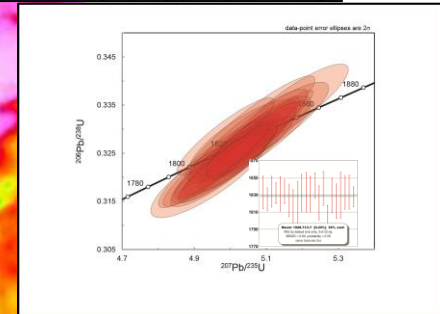
Diopside hyalophane veins



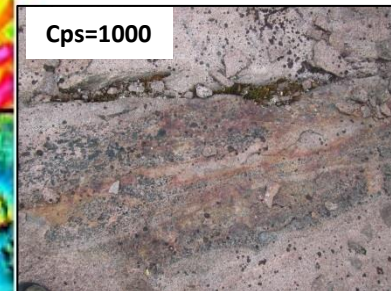
Gemelo syenite



Age =  $1829 \pm 4$  Ma



Cps=1000

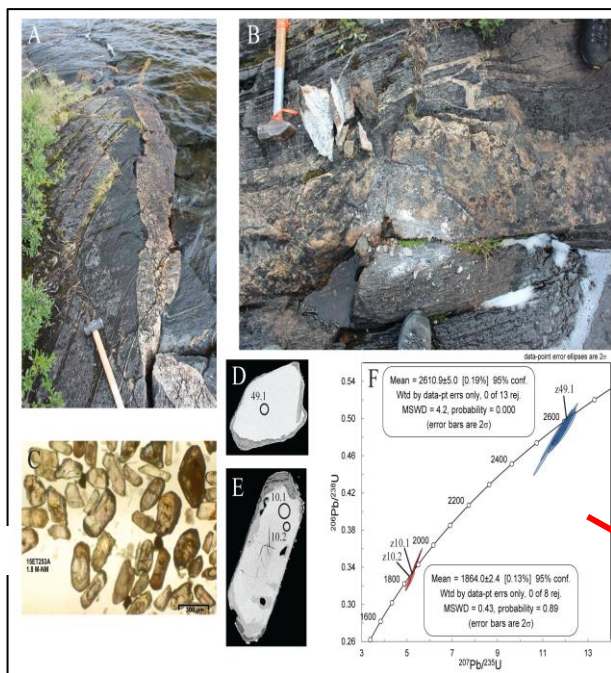


Mineralization  
Cpx-aln-mag-hyph



# Wholdaia Lake shear zone

Wholdaia L



75A, B till geochem and IM data  
Lauzon et al poster S5

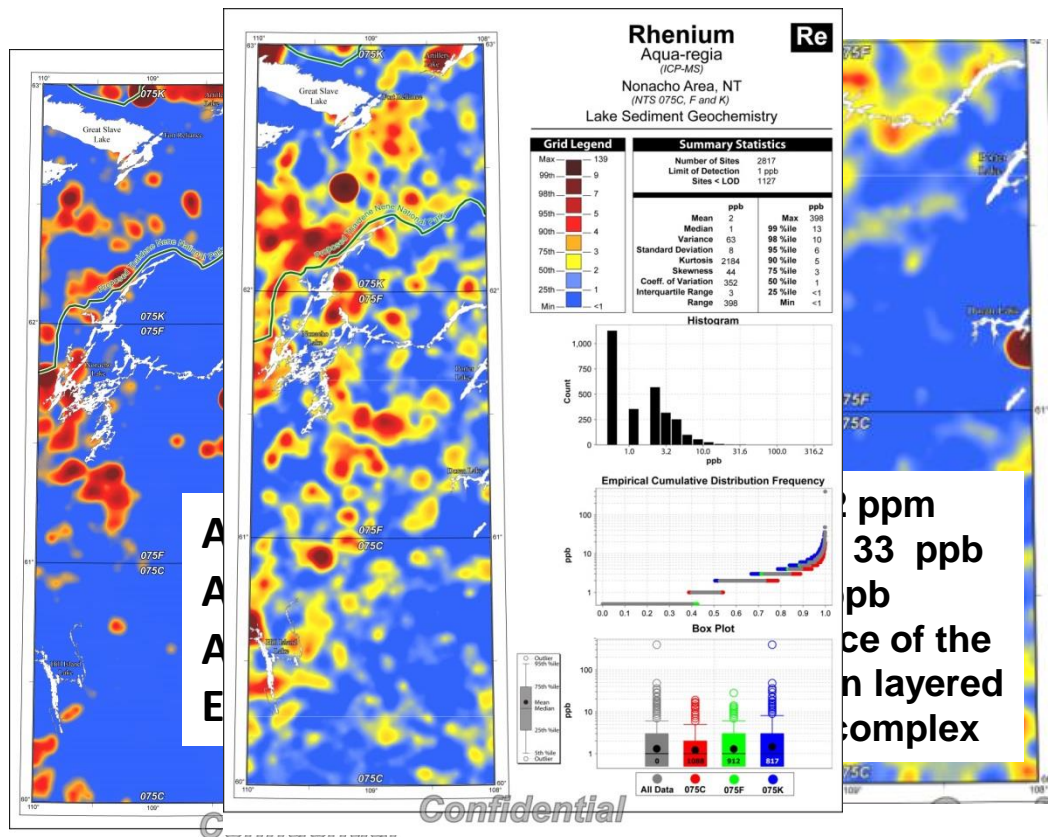


Elevated Rare Earths  
in till and rare pristine  
gold grains

**Firedrake**

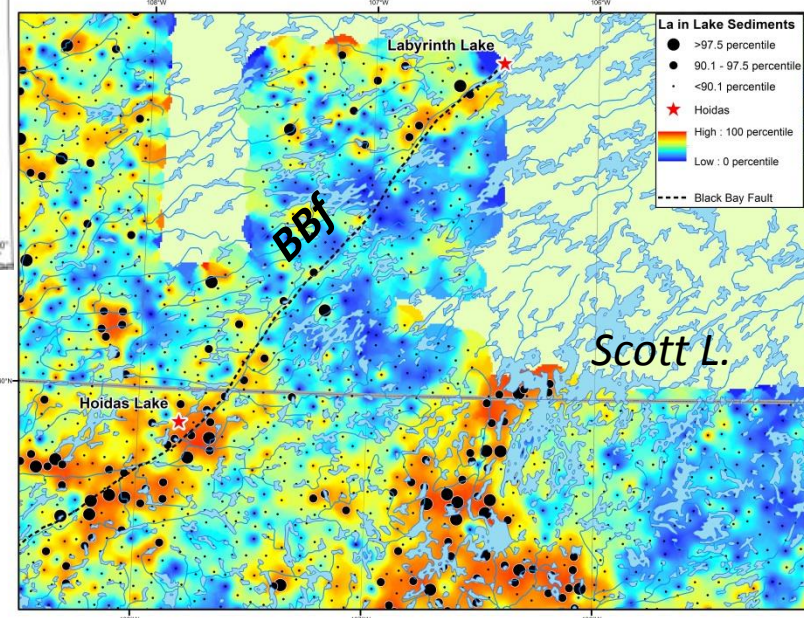
**Snowbird**

# New 75A and 75K lake sediment surveys



**McCurdy et al. poster S7**

**Black Bay fault zone and Scott Lake areas are the focus of Elevated La, Ce, Th in lake sediments and surface waters**



McCurdy, M. et al 2016. Regional lake sediment geochemical data, Nonacho Basin – East Arm of Great Slave Lake Region, Northwest Territories (NTS 75-C, NTS 75-F and NTS 75-K); Geological Survey of Canada, [Open File 8010](#)

McCurdy, M., et al., 2016. Geochemical data for lake sediments and surface waters, Abitau Lake area, Northwest Territories (NTS 75-B); Geological Survey of Canada, [Open File 8082](#)

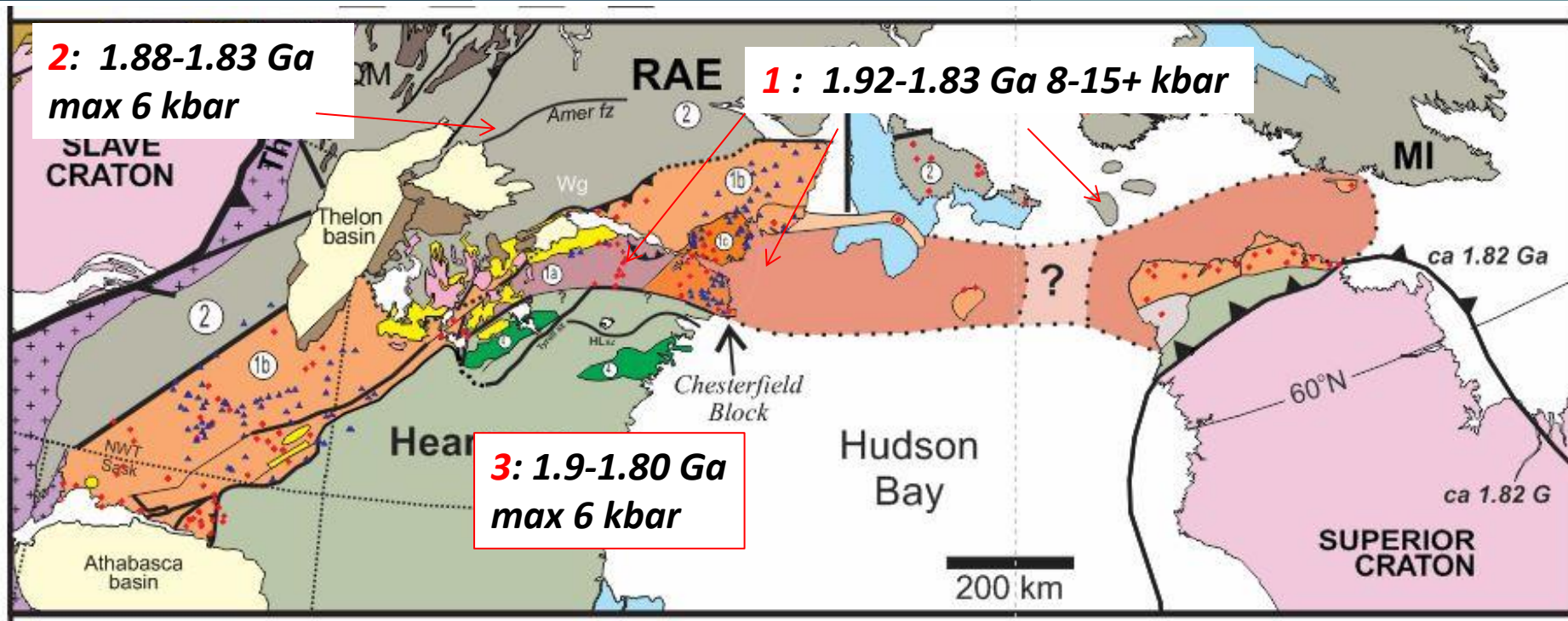
**Just released!**



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*High P assemblages:  
Grt-Cpx-Plag-Qtz Grt-Hbl-Plag-Qtz*

*Zircon and monazite ages  
of metamorphism 8kbar+*

*2.3 Ga Grt-Hbl-Plag-Qtz tonalite  
Orthogneiss with ca 1.9 Ga rims*

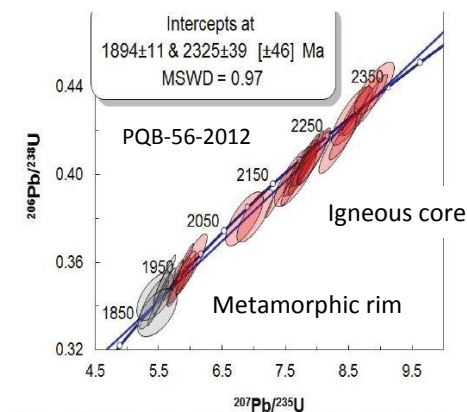
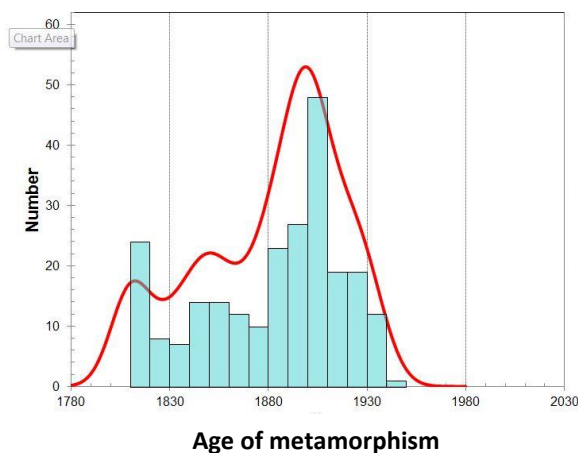
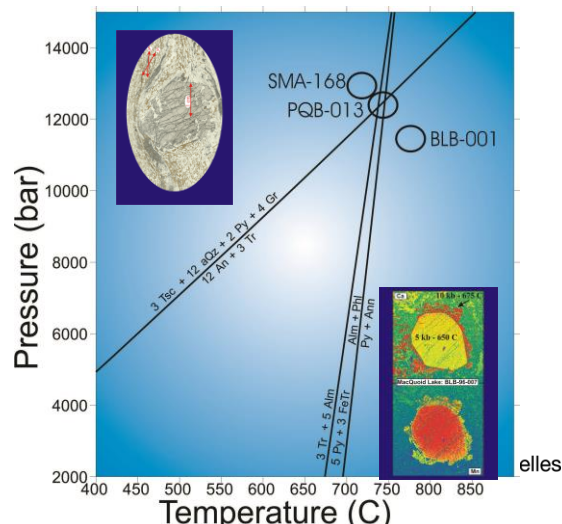
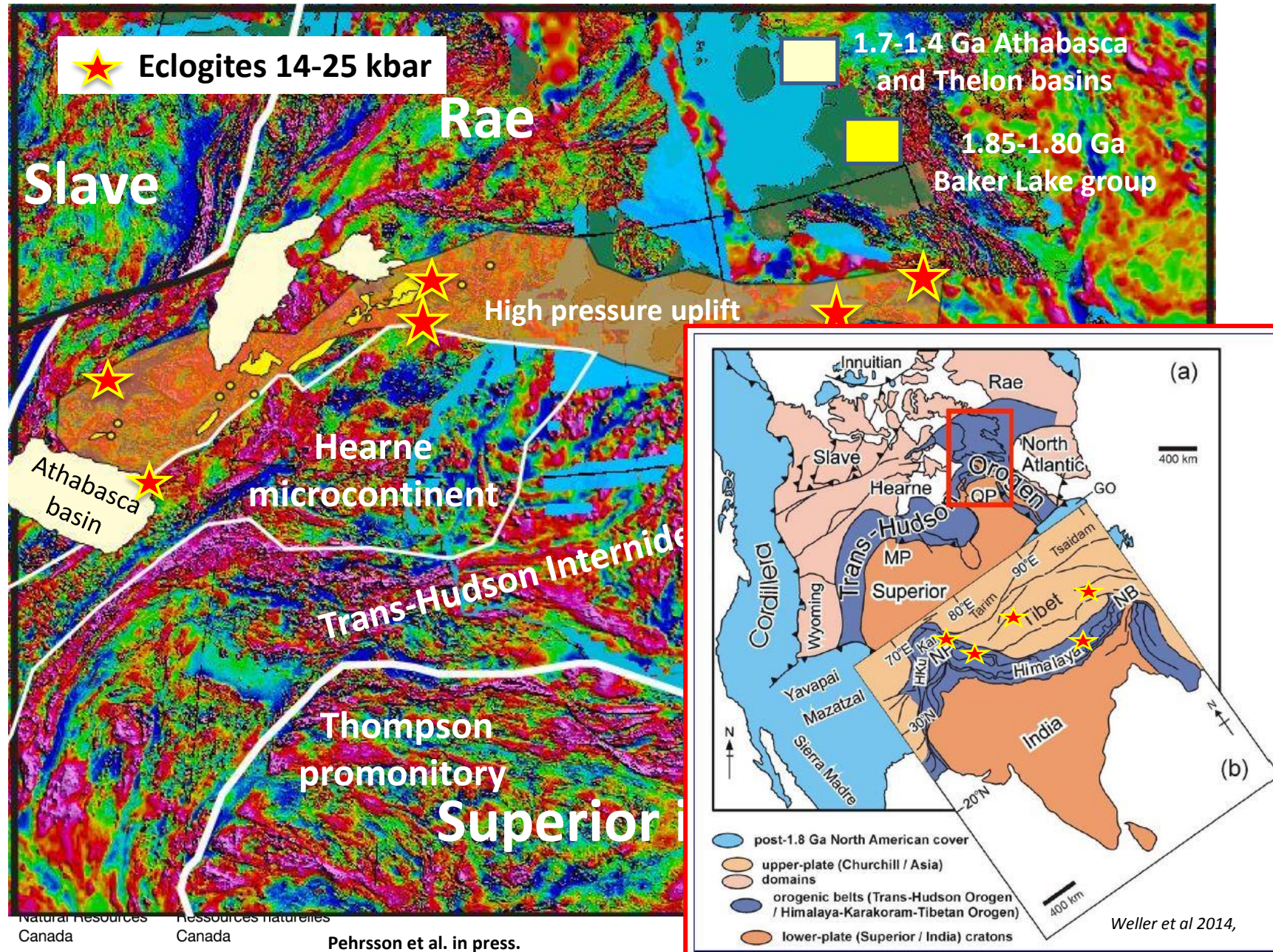
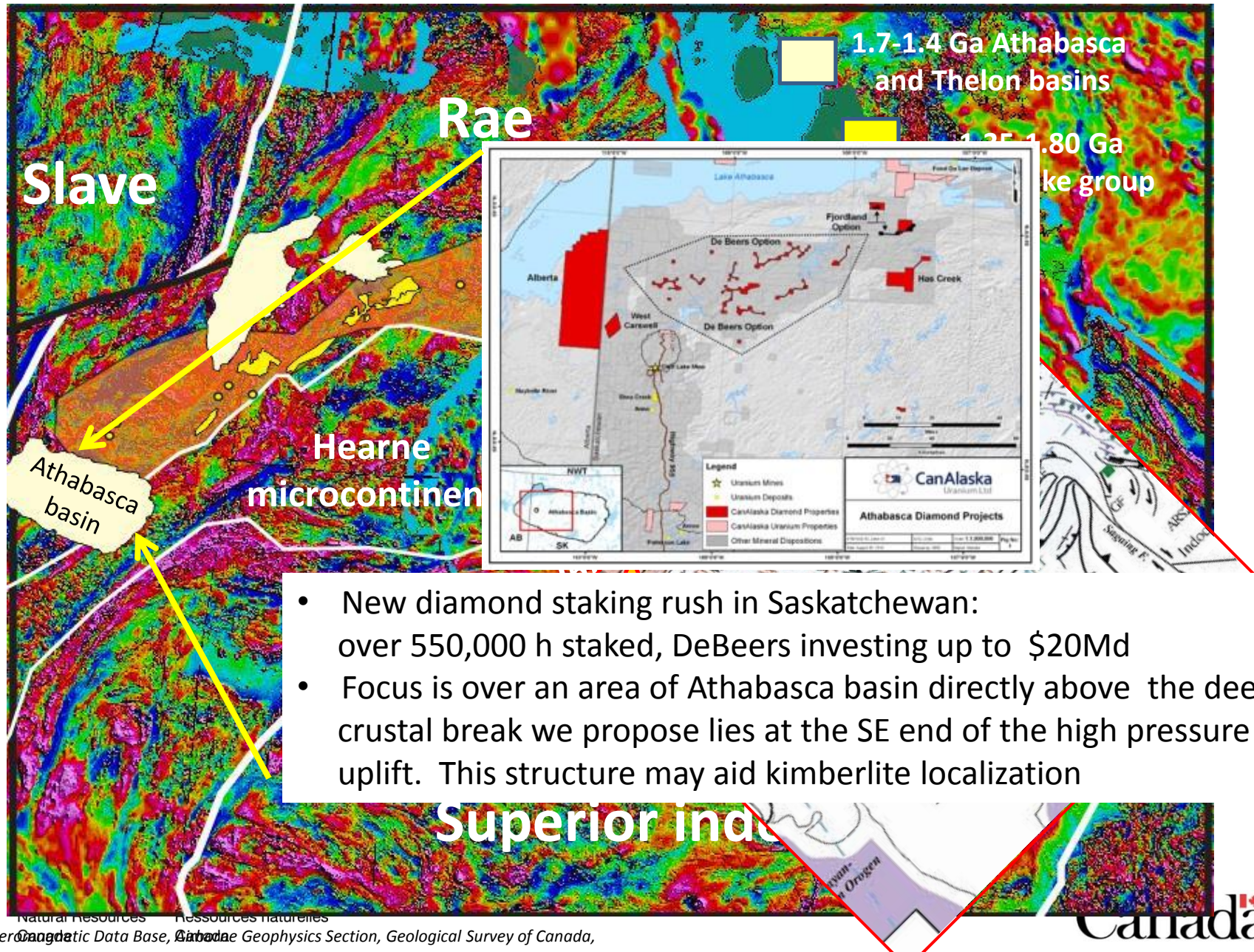


Figure 10854-4: Concordia diagram illustrating discordia array defined by analyses of bright rims (grey ellipses) and analyses of oscillatory zoned zircon (red ellipses)

# High pressure metamorphism: plate morphology control?

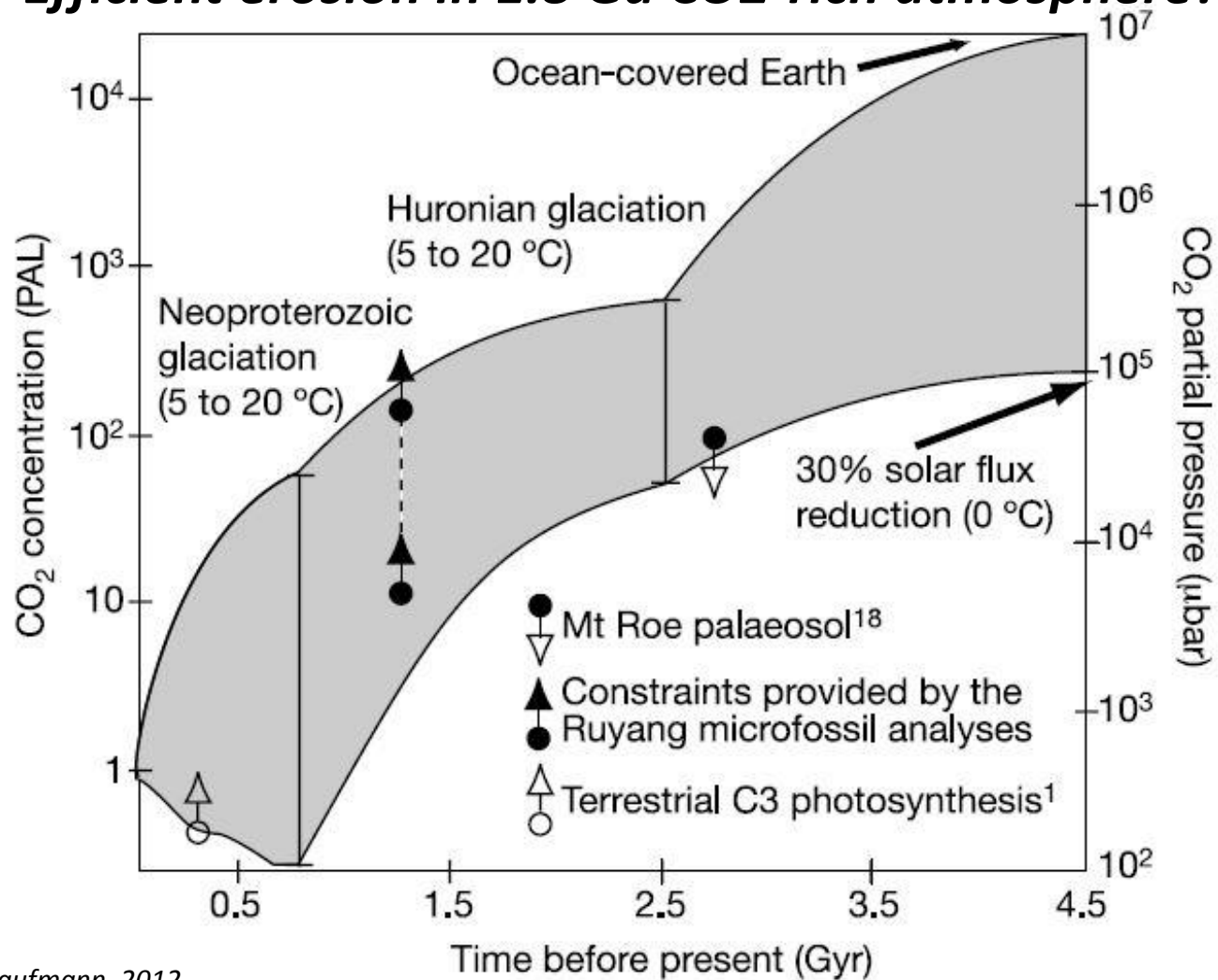


## Metallogenic implications for Diamonds and Uranium



## Examples of exhumation mechanisms of orogenic crust.

### *Efficient erosion in 1.8 Ga CO<sub>2</sub>-rich atmosphere?*



Kaufmann, 2012

London

**Thanks to our RAP students: Ben Neil, Anna Haiben, Nigel Bocking,  
Blake Mowbray and Glenn Robinson**

**Helicopter Transport Services, Transwest Air, Scott's General Store,  
Discovery Mining Services**

**Communities of Stoney Rapids, SK and Lutselk'e, NWT**

