Overview of crustal architecture and endowment from the Metal Earth transects in the Superior Craton

METAL EARTH

A new Canadian research initiative funded by Canada First Research Excellence Fund.

CANADA FIRST RESEARCH EXCELLENCE FUND

Canada

SOCIETY OF ECONOMIC GEOLOGISTS FOUNDED 1920

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MERC Mineral Exploration Research Centre

November 27, 2023, MERC Short Course, Saskatoon Geological Open House

New insights into crustal-scale influences on gold and base metal endowment in the Archean Superior Province

Program:

9:00-9:40**: Dr. Ross Sherlock;** Overview of crustal architecture and endowment from the Metal Earth transects across the Southern Superior Province.

9:40-10:20: **Dr. Mostafa Naghizadeh;** Geophysical and Seismic Prospecting of the Southern Superior Province: Overview of Metal Earth Project

10:20-10:40: Break

10:40-11:20: **Kristine Nymoen;** Isotopic mapping and its application to understanding craton architecture and localization of mineral systems.

11:20-12:00: **Dr. Taus R.C. Jørgensen;** Crustal Architecture and VMS Endowment: Insights from the Rouyn-Noranda Camp, Abitibi Greenstone Belt.

12:00-1:00: Lunch

November 27, 2023, MERC Short Course, Saskatoon Geological Open House

New insights into crustal-scale influences on gold and base metal endowment in the Archean Superior Province

Program:

1:00-1:40: **Dr. Bruno Lafrance;** Differences in gold endowment in dome-and-keel and linear accretionary greenstone belts of the Superior Province.

1:40-2:20: **Michael Herzog;** Multi-scale controls on orogenic gold precipitation and remobilization in the Malartic-Val-d'Or District, Québec.

2:20-2:40: Break

2:40-3:20: **Dr. Ross Sherlock;** Gold Mineralization in the Larder Lake Segment of Larder Lake-Cadillac fault.

3:20-4:00: **Dr. Jack Simmons;** Archean orogenic gold deposits associated with structurally-controlled metasedimentary belts of the Superior Craton.

Mineral Exploration Research Center (MERC)

- **MERC is a collaborative center for mineral exploration research and education supported by industry, government and Laurentian University**

- Focused on field-based collaborative research on Exploration and Precambrian Ore Systems
- More than 100 faculty, research scientists, and graduate students working across the globe
- Lead organization on Metal Earth project
- Membership in MERC provides a seat at the advisory board.
  David Harquail, Interim Chair, François Robert, Science Advisor

MERC Foundation Members

- Foundation: 5 members
- Tier 1: 4 members
- Tier 2: 17 members

MERC Tier 1 Members

MERC Tier 2 Members

Agnico Eagle
Equinox Gold
Exiro
GFG Resources
Gold Fields
IEP, International Explorers and Prospectors
KGHM
McEwen Mining
Melkior
Noble Mineral Exploration
SRK Consulting
Sudbury Integrated Nickel Operation (Glencore)
Transition Metals
Vale
Wesdome

Metal Earth

- **METAL EARTH** is a **MERC** led collaborative research project focused on metal endowment in the Precambrian shield
- Partners with UQAC, U Laval, U Ottawa, U Toronto and U Alberta
- **THE GOAL** is to improve the science for targeting and finding new orebodies
- Fully-funded seven-year $104M applied R&D initiative.
- **Canada FIRST** Research Excellence Fund (CFREF) $49M, $5M from NOHFC, $1M from David Harquail and cash + in kind from 22 private sector and government survey partners
- Project started in summer 2017 and will end in August 2027

Metal Earth Components

- **FUNDAMENTAL SCIENCE:**

  Transform our understanding of Earth's early evolution and the processes that govern differential metal endowment

  Improve the science for targeting and finding new orebodies

- **APPLIED INNOVATION AND COMMERCIALIZATION COMPONENT:**

  Make Canada a global leader in mineral exploration research through open source delivery of new knowledge and the development of transformative technologies targeted at increasing exploration success

  Improve training of quality young geoscientists for the industry

Metal Earth Strategy

- Focus on Archean greenstone belts, which represent 60% of Earth history and almost 50% of Canada's metal wealth
- **Resolve ore system-scale controls at craton - greenstone belt - district - deposit scales**
- **Image ore and non-ore systems at full crust-mantle scale**
- Develop transformative 3D-4D data integration, analysis, and visualization tools that will aid discovery of new districts and new deposits
- **Focused on the Superior Craton as the level of framework geoscience is unprecedented, take this into other Precambrian terranes**

State of the Industry, why Metal Earth is needed

From Dan Wood's SEG newsletter

Value of discoveries less than the exploration investment

Unsustainable as an industry

Focus on Brownfields environments. Greenfields discoveries

are rare

Requires new search space to change

Deep

Covered

Remote

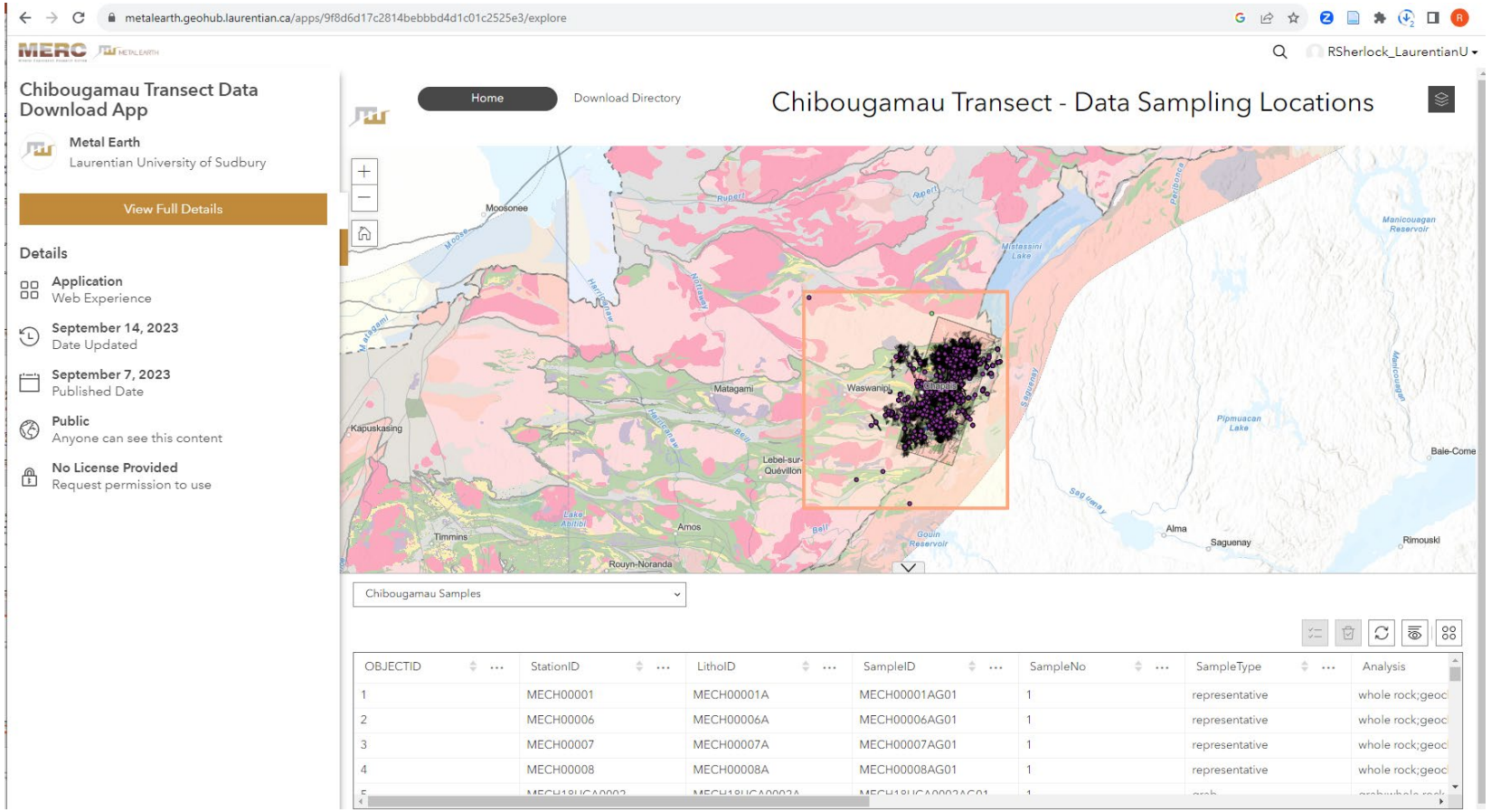
Needs new tools to be effective in these spaces

. . . from page 1 Transforming the Business of Gold Exploration: Adapting to Deeper Exploration (c

Commodity	Exploration Spend (2016 $b)		No of Discoveries #		Tier 1+2 Discoveries		Estimated Value (2016 $b)		Value / Spend
Gold	$65	33%	320	37%	4 + 17	26%	$30	32%	0.46
Copper	$35	18%	102	12%	3 + 15	22%	$17	18%	0.47
Nickel	$7	4%	34	4%	0 + 4	5%	$3	4%	0.47
Zinc + Lead	$11	5%	30	3%	1 + 4	6%	$5	6%	0.50
Uranium	$10	5%	28	3%	1 + 7	10%	$6	7%	0.61
Diamonds	$6	3%	11	1%	0 + 1	1%	$1	1%	0.19
Iron Ore	$20	10%	143	16%	0 + 3	4%	$6	7%	0.33
Coal	$24	12%	64	7%	1 + 6	9%	$8	8%	0.33
Other	$21	11%	135	16%	2 + 12	17%	$16	17%	0.75
	----	----	----	----	----	----	----	----	----
TOTAL	$197	100%	867	100%	12 + 69	100%	$92	100%	0.47

FIGURE 2. Discovery performance by commodity, 2007 to 2016. Value of discoveries (US$ 2016) estimated as $2 billion, $500 million, $80 million, and $10 million for tiers 1, 2, and 3 and unassigned, respectively (excludes unreported discoveries). Value/Spend is the ratio of the value of all discoveries to the total cost of exploration (break even = 1.0). From Schodde (2017), used with

Metal Earth Data Chibougamau, Malartic, Noranda online now



Geology
Geochemistry
Gravity
MT
Seismic

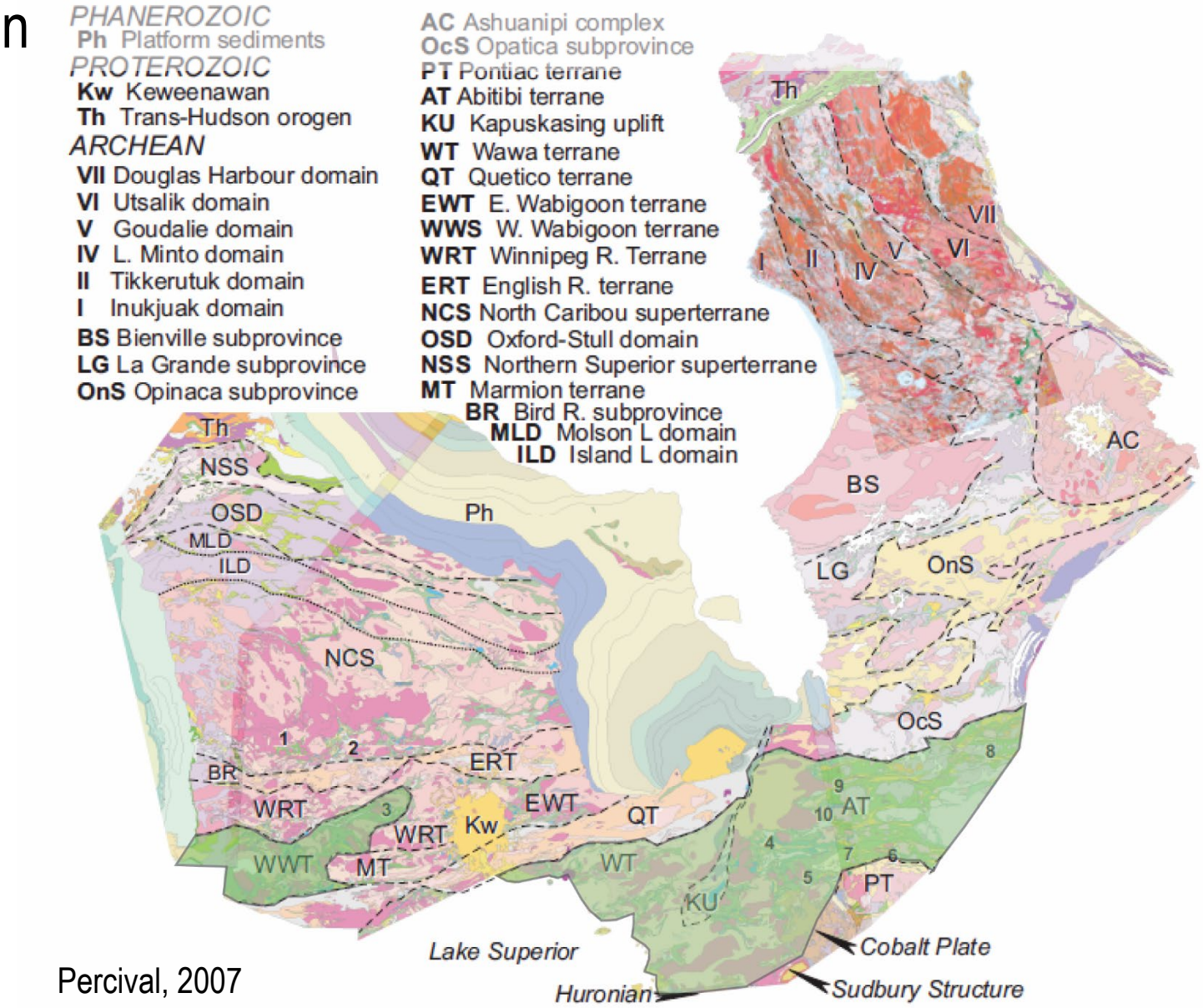
Geochron database (separate)

Open source

https://metalearth.geohub.laurentian.ca/

Superior Craton

Focused on Abitibi and Wabigoon subprovinces



Percival, 2007

FIGURE 2. Mosaic map of the Superior Province showing major tectonic elements. Data sources: Manitoba (1965); Ontario (1992); Quebec (2002) and (Leclair, 2005). Major mineral districts: 1: Red Lake; 2: Confederation Lake; 3: Sturgeon Lake; 4: Timmins; 5: Kirkland Lake; 6: Cadillac; 7: Noranda; 8: Chibougamau; 9: Casa Berardi; 10: Normétal

Metal Earth

Working at variety of scales
New map and geochron database

Craton Scale

Metal Earth: Craton-scale

New project aims to perform multi-isotopic mapping of the Superior Craton

Collection of large U-Pb-Hf-O-TE dataset on archived zircons

Ultimate goal is to:

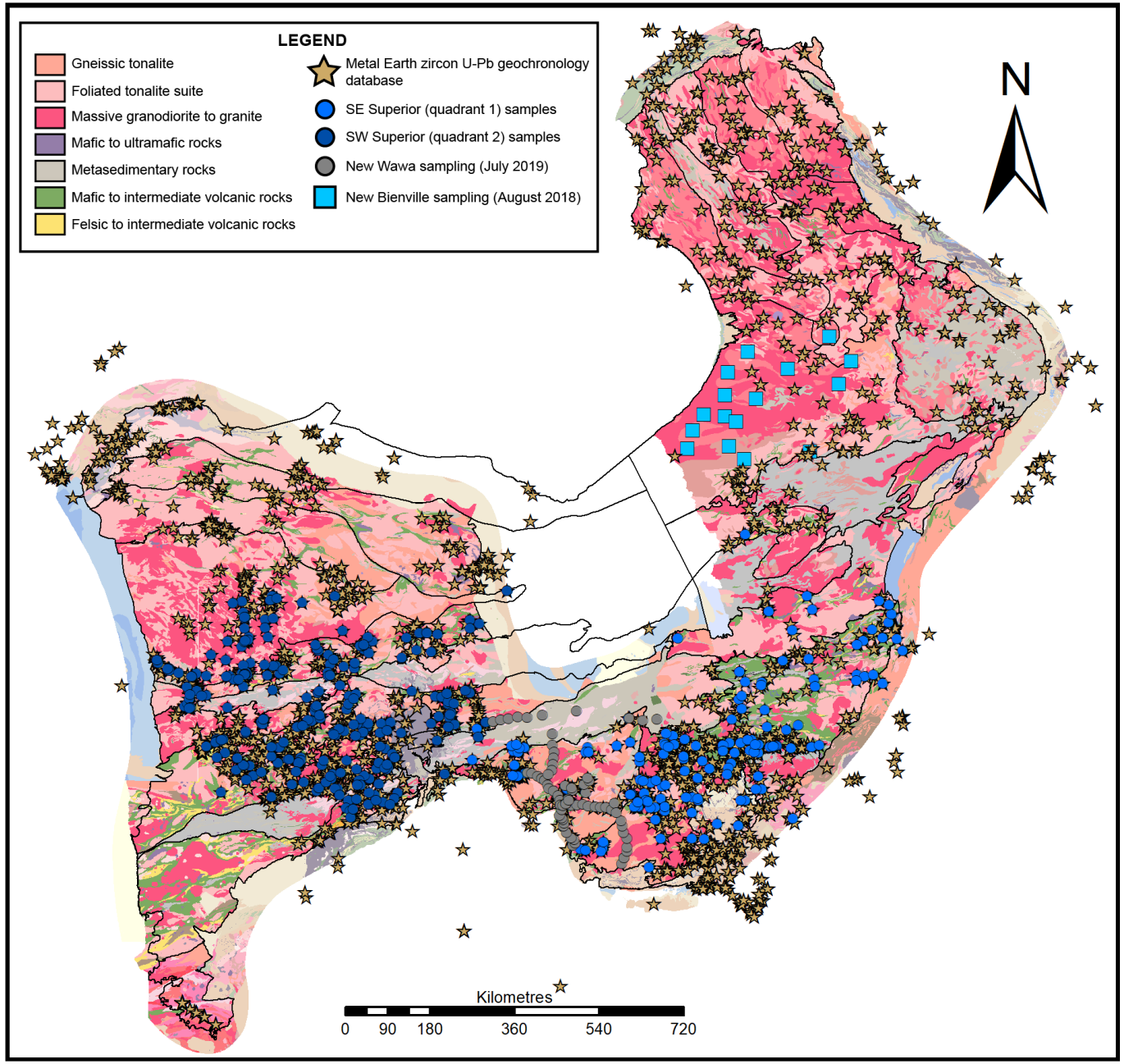
- Constrain time-space evolution of the craton
- Build an advanced knowledge of crustal architecture across the craton
- Relate these products to the localisation of mineral systems

Status:

Completion of SE Superior

SW Superior in progress

Kristine Nymoen will discuss

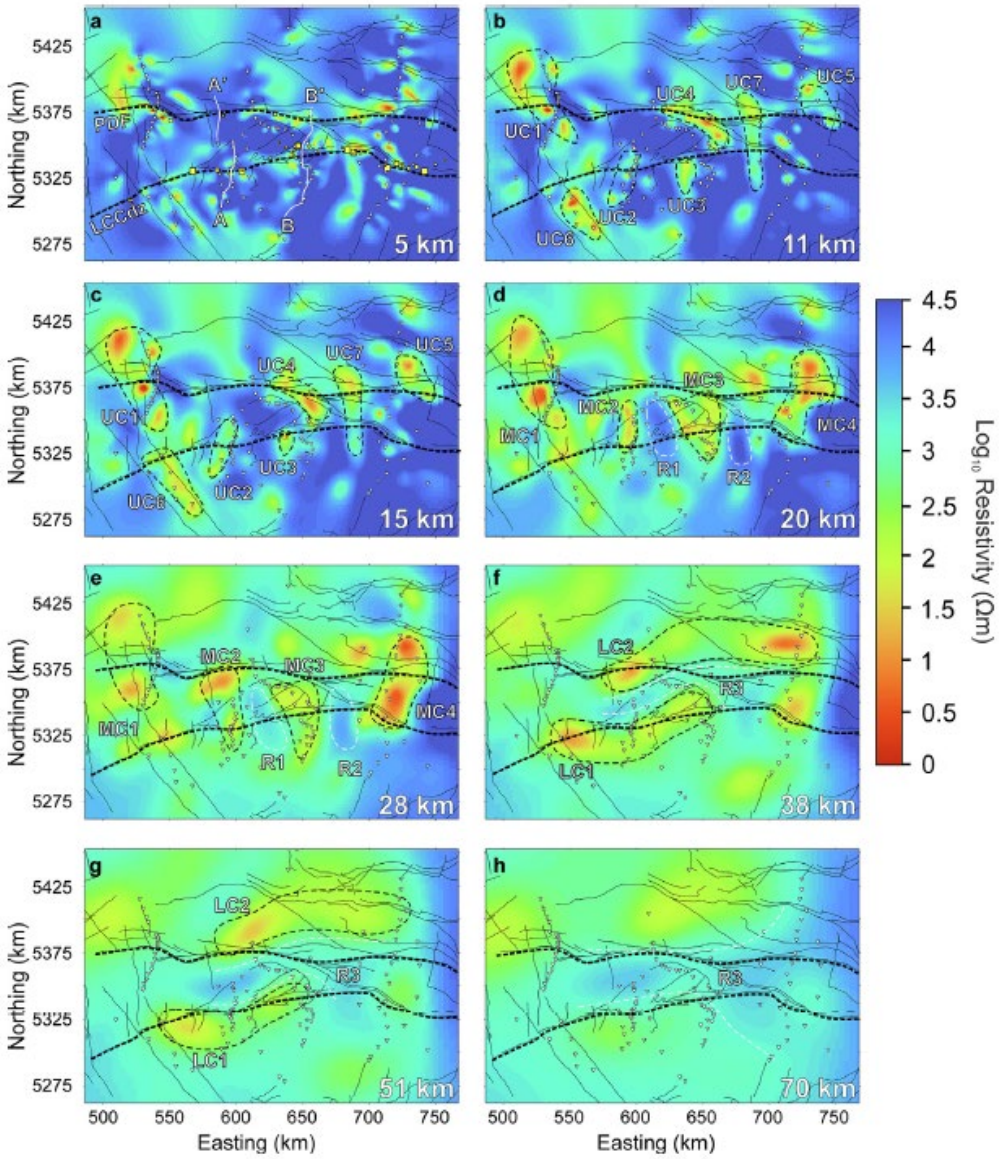


MT mapping of the crust

Large scale electrical resistivity in southern Abitibi as a series of depth slices

Clear correlation of conductive fingers from the lower crust focused along the breaks.

Interpreted as hydrothermal, magmatic and metal transfer



Gondwana Research 105 (2022) 84–95

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journal homepage: www.elsevier.com/locate/gr

Magmatic, hydrothermal and ore element transfer processes of the southeastern Archean Superior Province implied from electrical resistivity structure

Eric A. Roots [a,b,*], Graham J. Hill [c], Ben M. Frieman [a], Philip E. Wannamaker [d], Virginie Maris [d], Andrew J. Calvert [e], James A. Craven [b], Richard S. Smith [a], David B. Snyder [a,b]

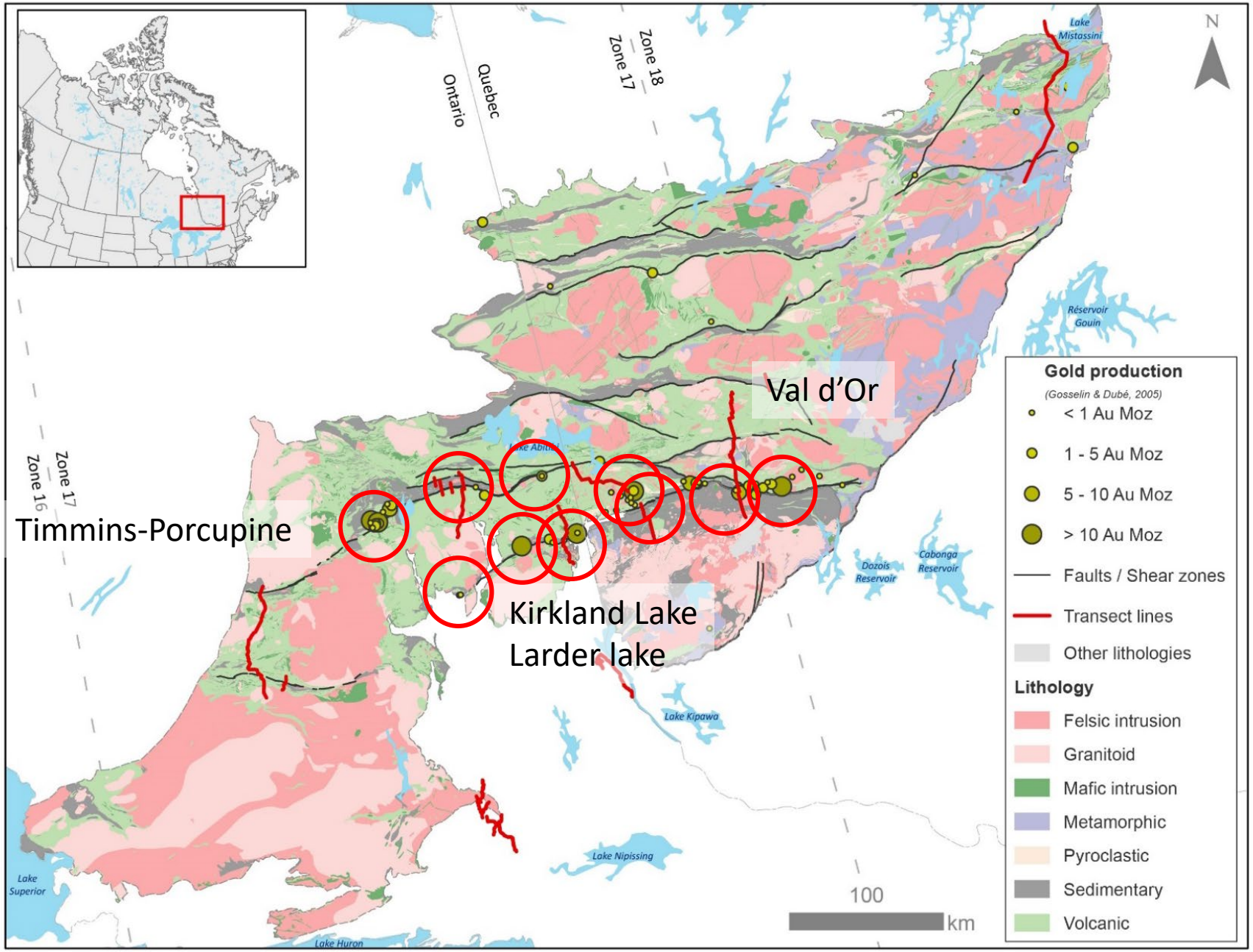
Fig. 3. Plan view sections through the resistivity model at depths of a) 5 km, b) 11 km, c) 15 km, d) 20 km, e) 28 km, f) 38 km, g) 51 km, and h) 70 km. Gold squares represent significant gold deposits as in Fig. 1. Thick black dashed lines represent approximate traces of the Larder Lake – Cadillac deformation zone (LLCdz, south) and the Porcupine – Destor deformation zone (PDdz, north). White lines in a) give the locations of the seismic lines and coincident vertical slices in Fig. 4. Labels and black / white dashed outlines in b-f correspond to MT anomalies discussed in the text.

Gold Endowment

Abitibi Transects

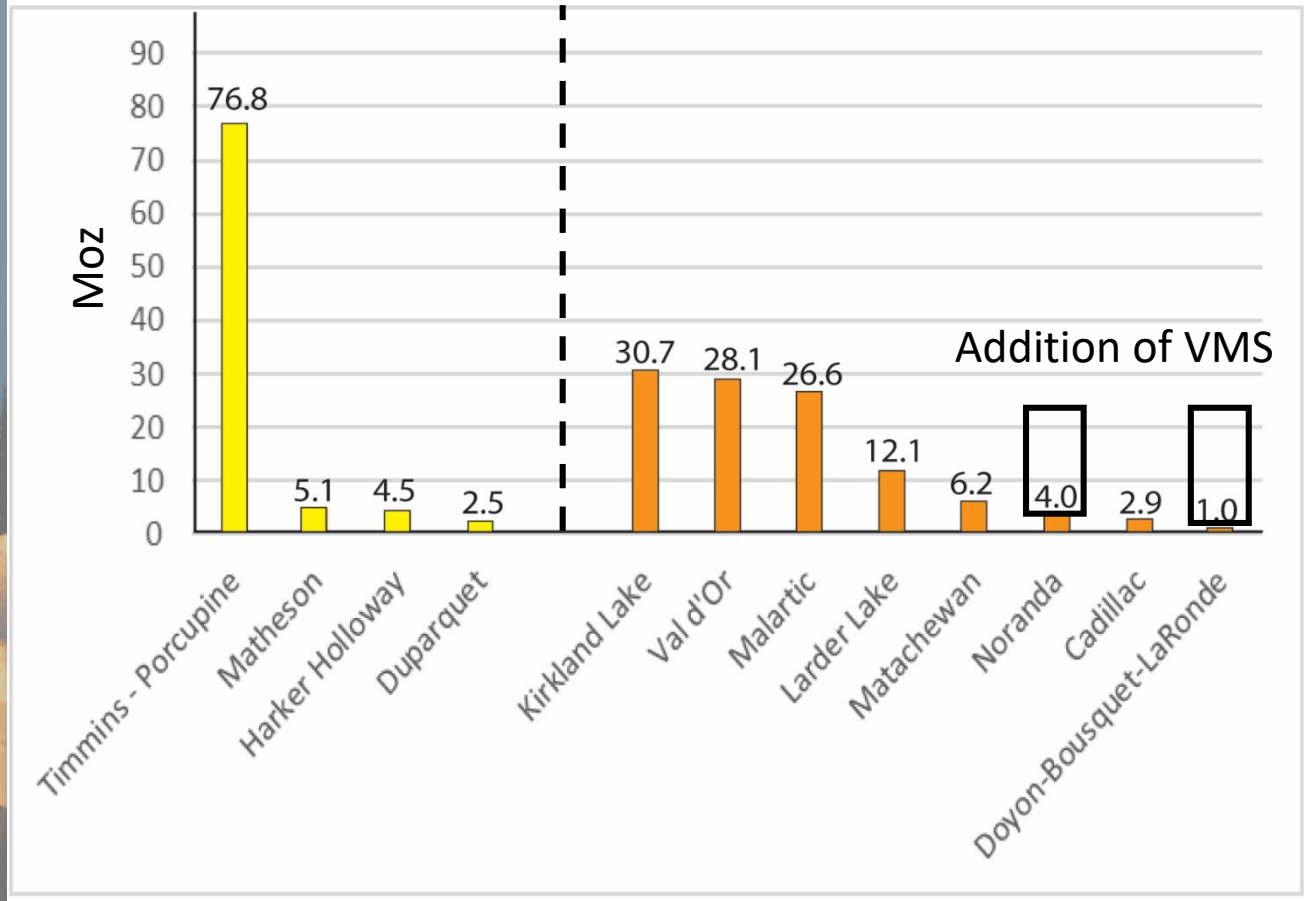
Deposits aligned along the Destor Porcupine fault and the Cadillac Larder Lake

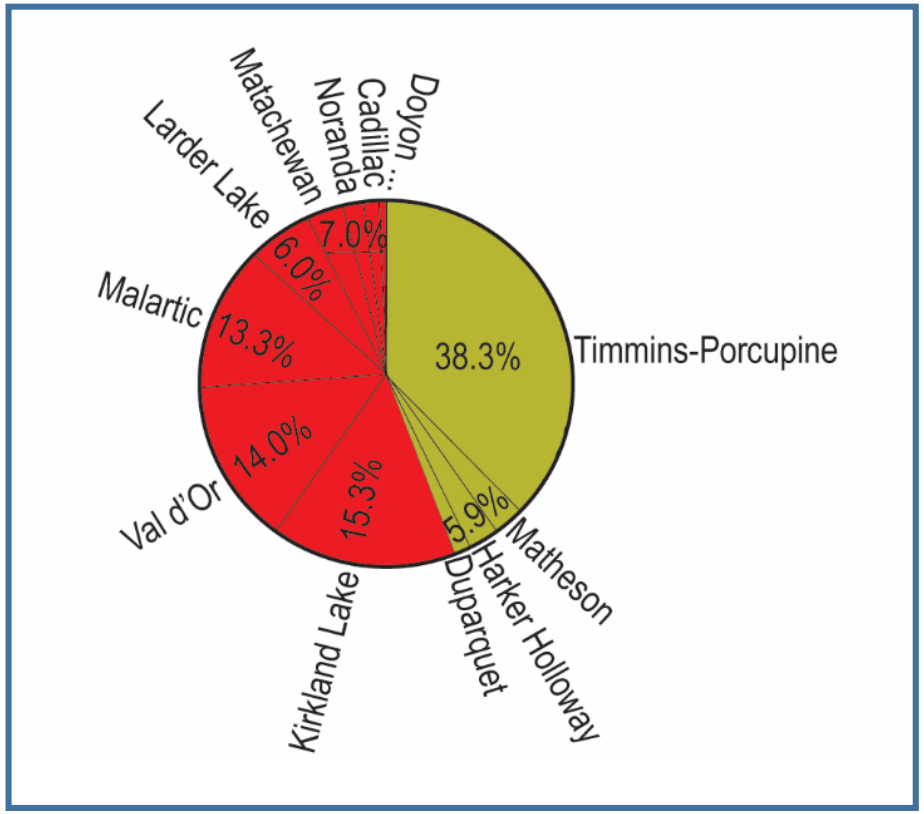
Drawing cross sections across ancestral faults/ volcanic and plutonic complexes of variable metal endowment



Gold Endowment

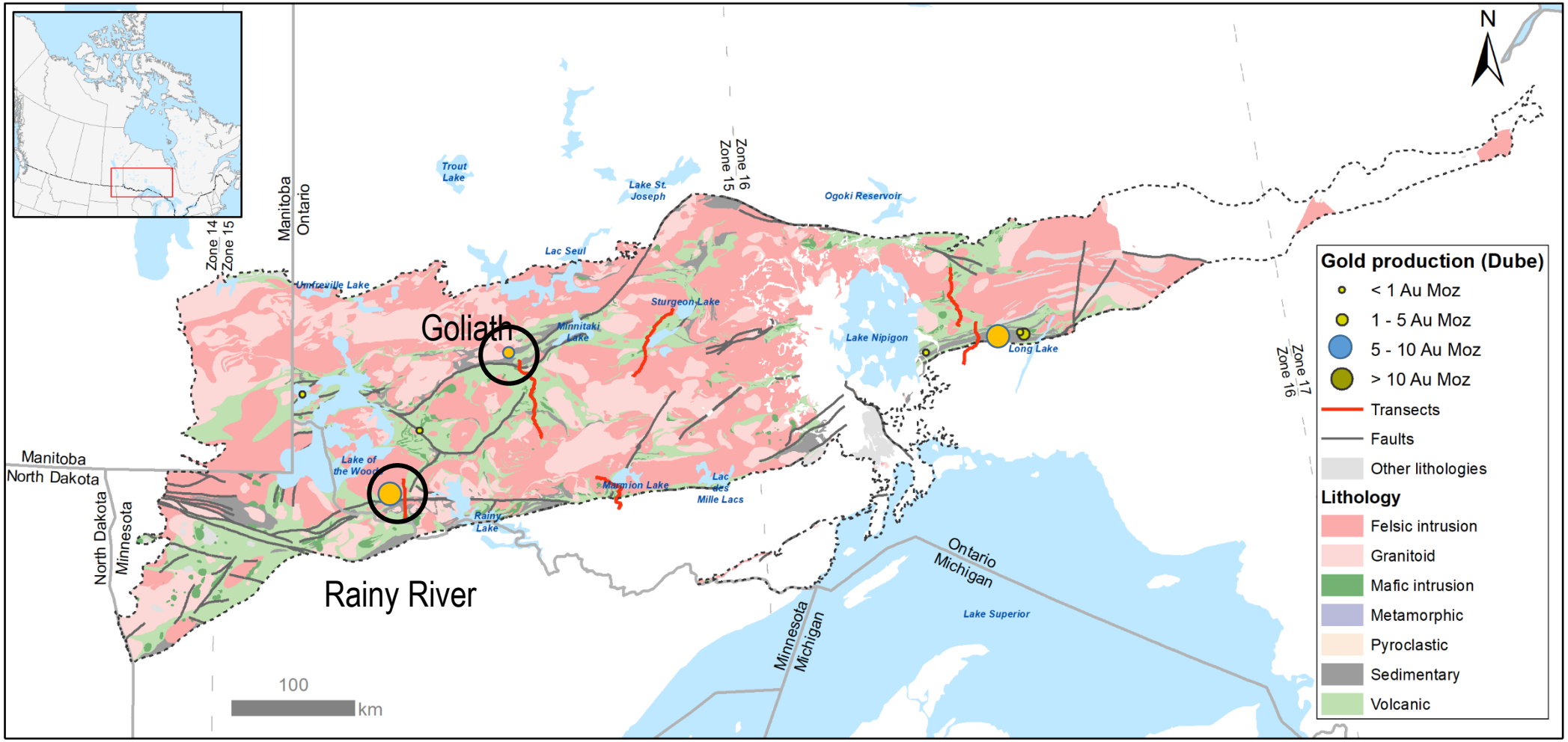
Destor Porcupine +89 Moz Cadillac-Larder Lake +112 Moz Au



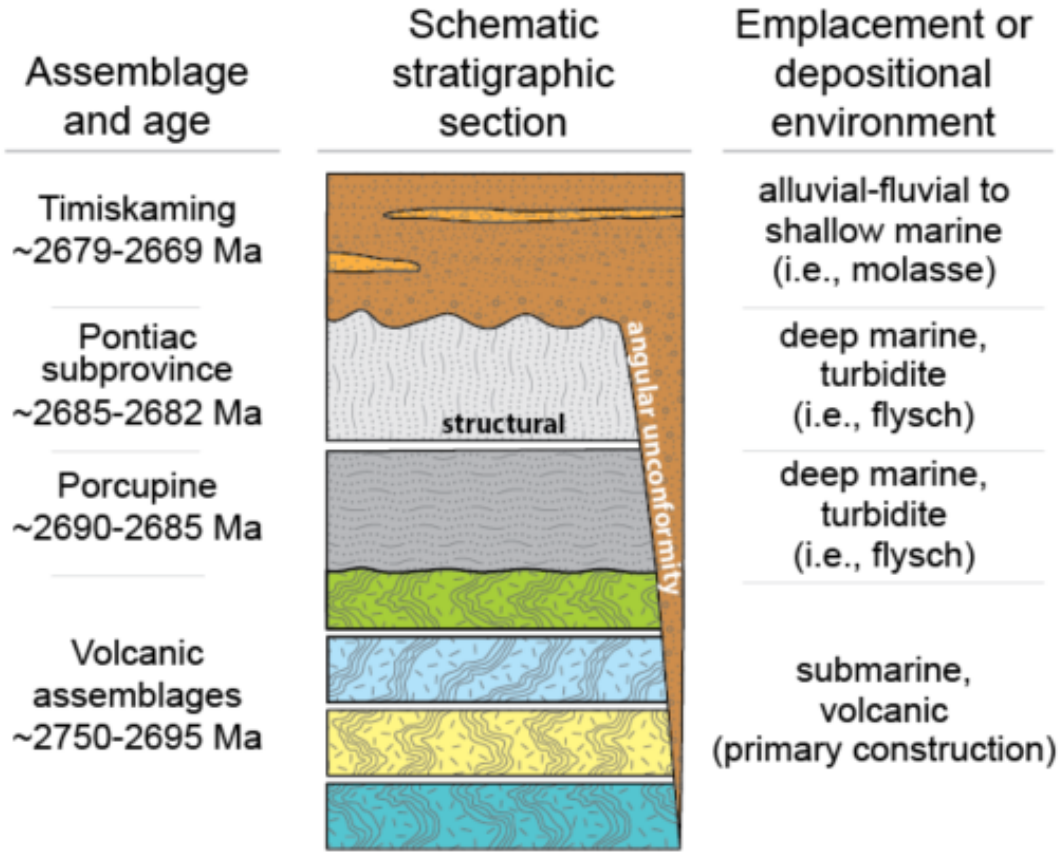


Monecke et al., 2017 Reviews in Economic Geology, v. 19 pp 7-49

Waibigoon Transects

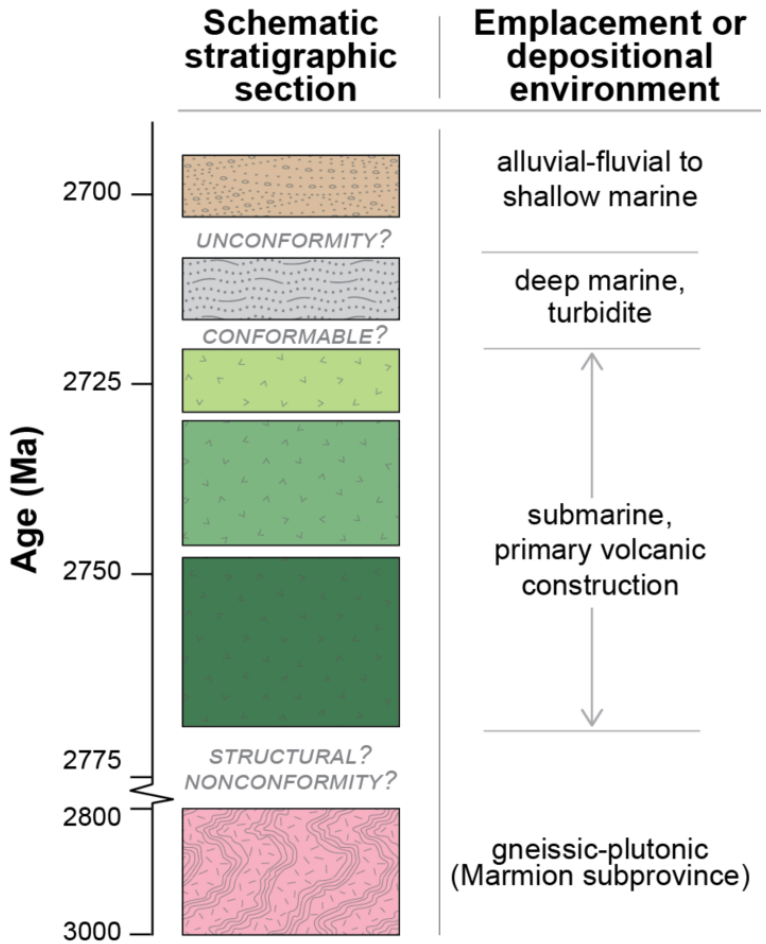


southern Abitibi subprovince



(Frieman, 2018; PhD thesis)

western Wabigoon subprovince



(Frieman, person. com)

STRATIGRAPHICALLY, THE ABITIBI = THE WABIGOON (+10-20 MA)

LIMITED GOLD ENDOWMENT IN THE WABIGOON

Abitibi Tr
Chibouga

NE part of Abit
Copper domin

Chibougamau

Deep Into the Chibougamau Area, Abitibi Greenstone Belt: Structure of a Neoarchean Crust Revealed by Seismic Reflection Profiling

Lucie Mathieu[1], David B. Snyder[2], Pierre Bedeaux[1], Saeid Cheraghi[2], Bruno Lafrance[2], Phil Thurston[2], and Ross Sherlock[2]

Copper-Gold camp, associated with intrusive rocks

Citation:
Mathieu, L., Snyder, D. B., Bedeaux, P., Cheraghi, S., Lafrance, B., Thurston, P., & Sherlock, R. (2020). Deep into the Chibougamau area, Abitibi greenstone belt: Structure of a Neoarchean crust revealed by seismic reflection profiling. *Tectonics*, *38*, e2020TC006223. https://doi.org/10.1029/2020TC006223

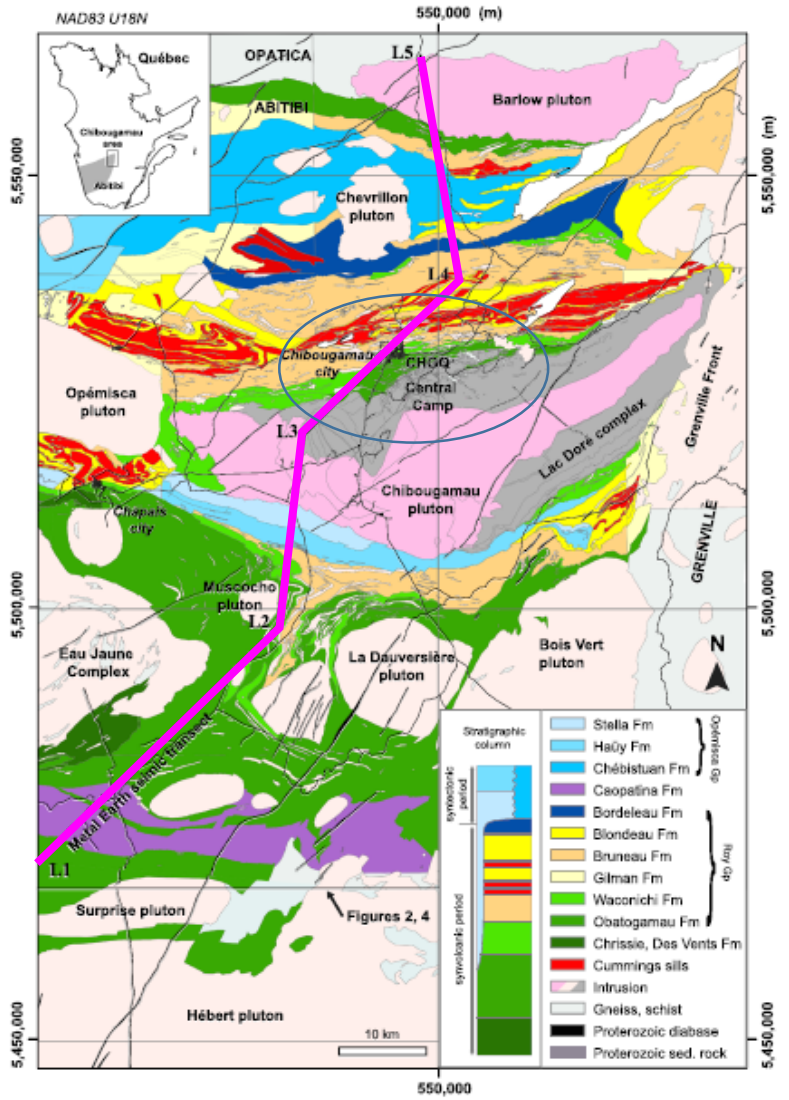
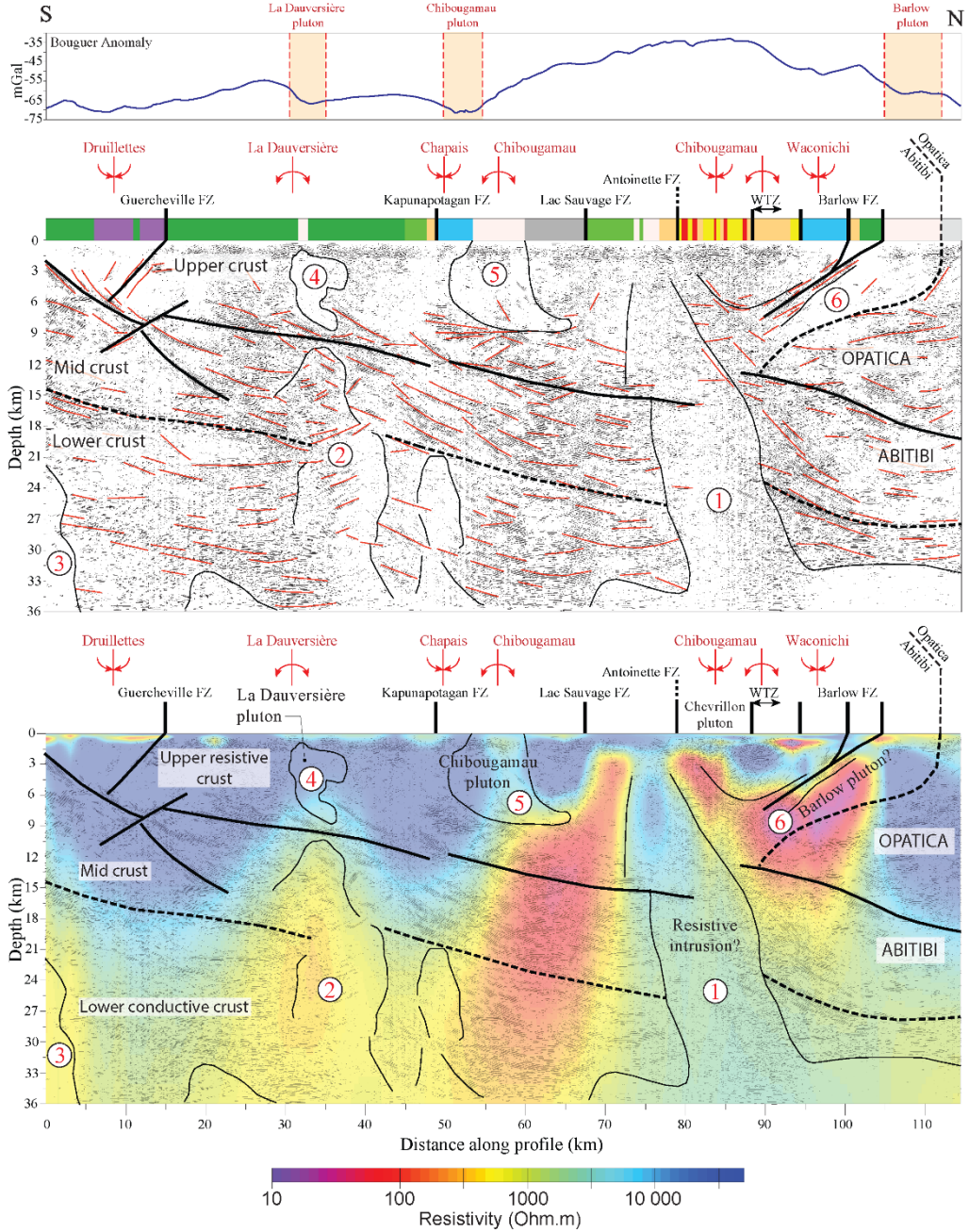


Figure 1. Geological map of the Chibougamau area, showing the main volcanic, sedimentary, and intrusive phases. The geological map is modified from the Ministère de l'Énergie et des Ressources Naturelles (MERN), Québec (SIGEOM, 2020). The projection is UTM NAD83 Zone 18N. The simplified stratigraphic column is inspired by the most recent stratigraphic interpretation (Leclerc et al., 2017). From base to top, the Cummings sills correspond to the Bourbeau, Venture, and Roberge sills. The Caopatina Formation is not integrated to the stratigraphic column because it has a poorly constrained age and an unresolved relationship with the Opémisca Group. The Gilman Formation is a remnant of a former stratigraphic interpretation (Leclerc et al., 2017). The permanent broadband station (CHGQ) is located in Chibougamau city (49.9105°N, 74.374833°W).

Chibougamau

1. Large intrusive complex, resistive and seismic isotropic, lower crust source, melting mafic volcanics ?
2. Intrusive complex from lower crust
5. Chibougamau pluton, rootless in upper crust
6. Barlow fault, Abitibi thrust over Opatica



Chibougamau

Chibougamau is a Cu-Au mining camp known for its magmatic-hydrothermal deposits centered on the Chibougamau pluton (Pilote et al., 1997). The imbrication of parts of the oceanic crust followed by rapid devolatilization and melting of mafic rocks to produce TTG suites, and possible mixing with mantle-derived melt to produce TTD, all seem favorable to the production of Cu-Au-bearing hydrous magmas.

Continued shortening during terrane imbrication caused additional burial and metamorphic devolatilization, producing fluids that induced orogenic gold style of mineralization in the Chibougamau area (Leclerc et al., 2017)

However, the paucity of economic Au deposits in the Chibougamau area likely reflects the absence of major transcrustal fault systems similar to those observed in the southern part of the Abitibi greenstone belt.

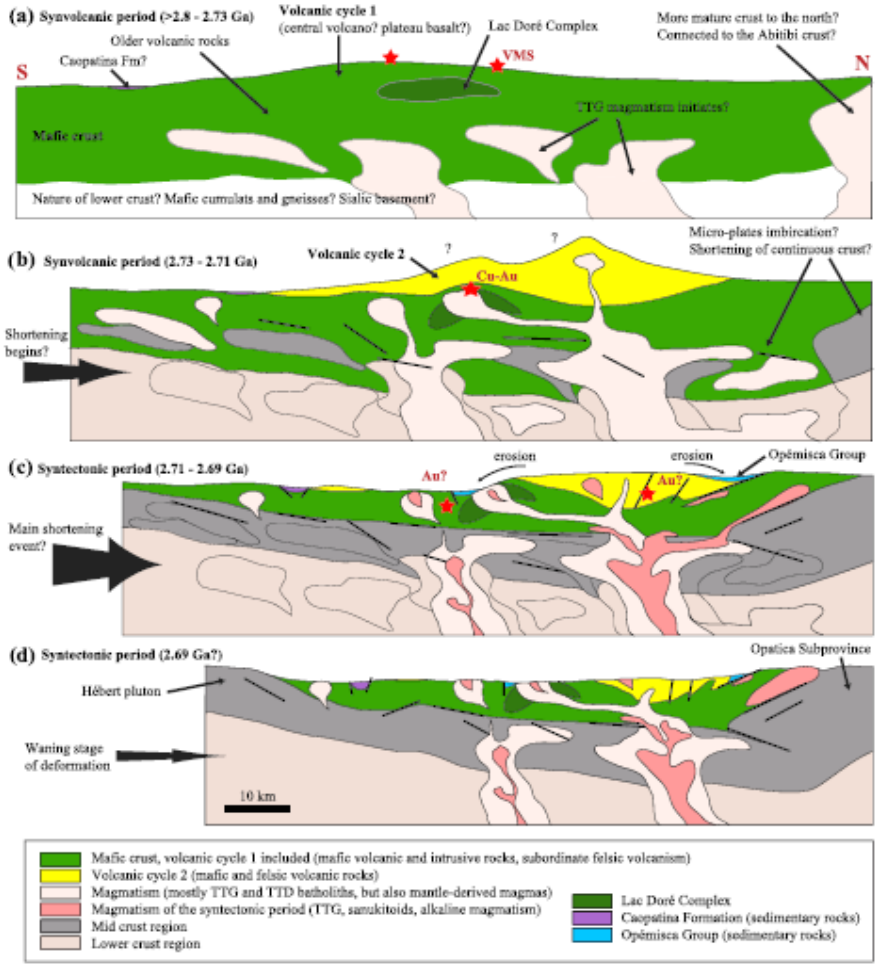
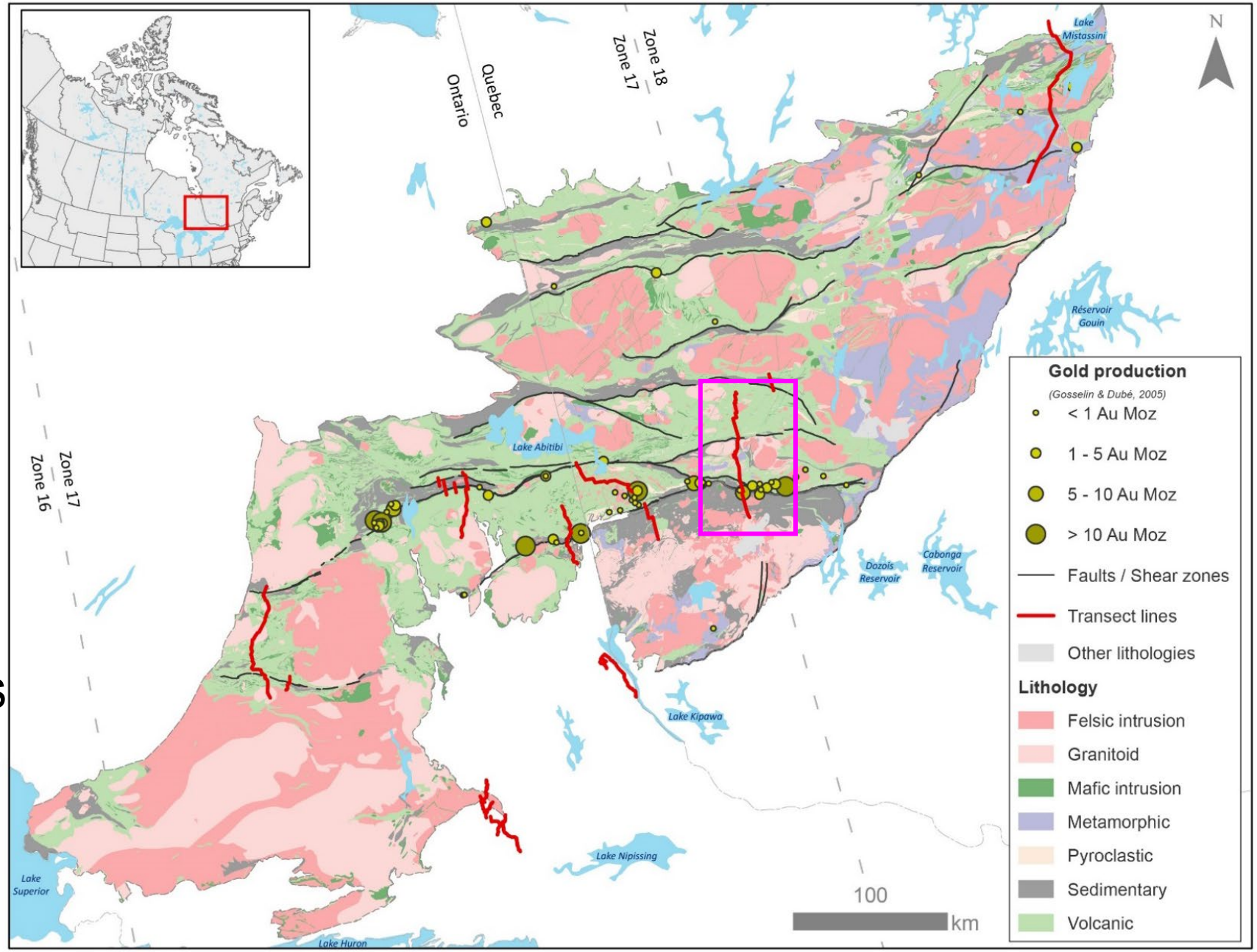


Figure 8. Evolution of the crust exposed in the Chibougamau area, between 2.80 and 2.69 Ga (see text for explanation). The vertical scale for surface top arbitrary. The base of the diagram is located, from (a) to (d), at about 30-km depth (normal Archean oceanic crust) to >35-km depth toward the end shortening event, prior to thinning related to post-Kenoran (?) and post-Grenville orogens extension (present-day crust is 35 km thick in the study area). crust evolved into more felsic midcrust and lower crust through metamorphism, magma injections, and local anatexis.

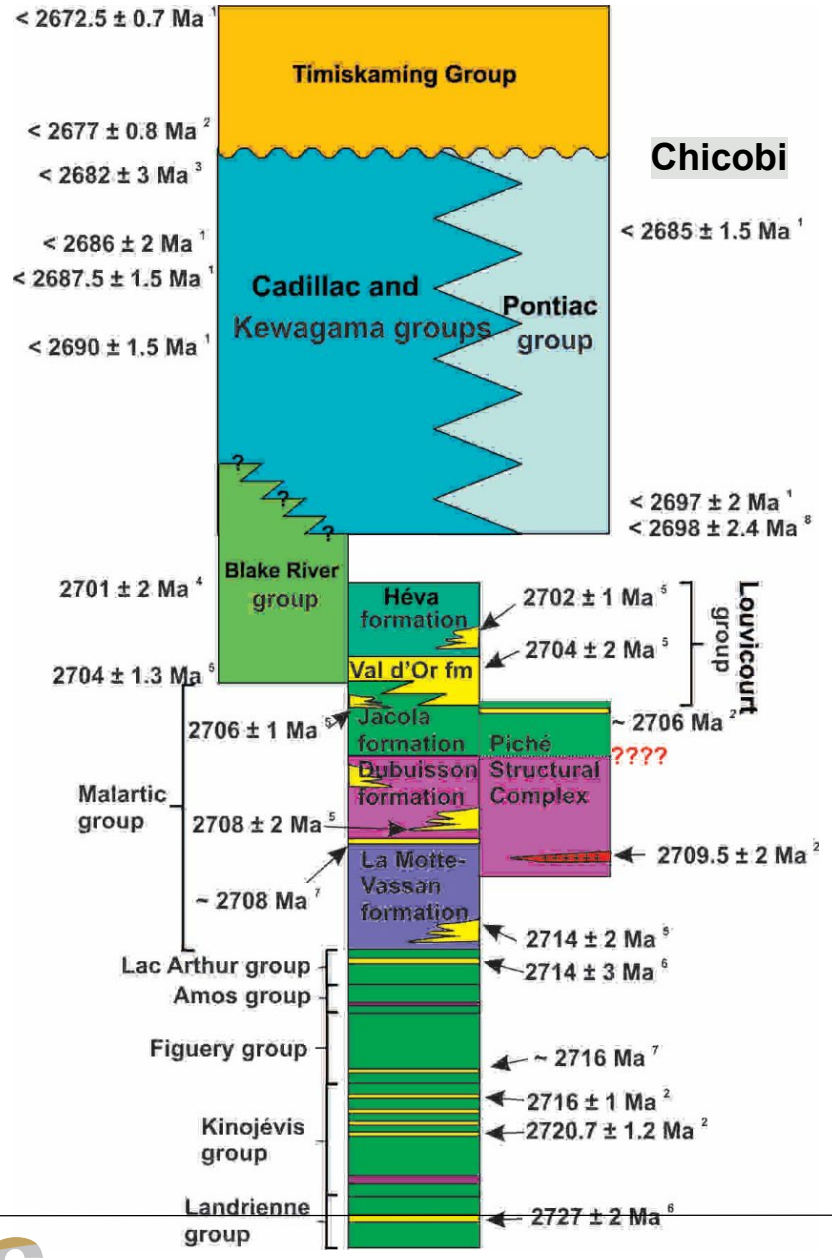
Abitibi Transects

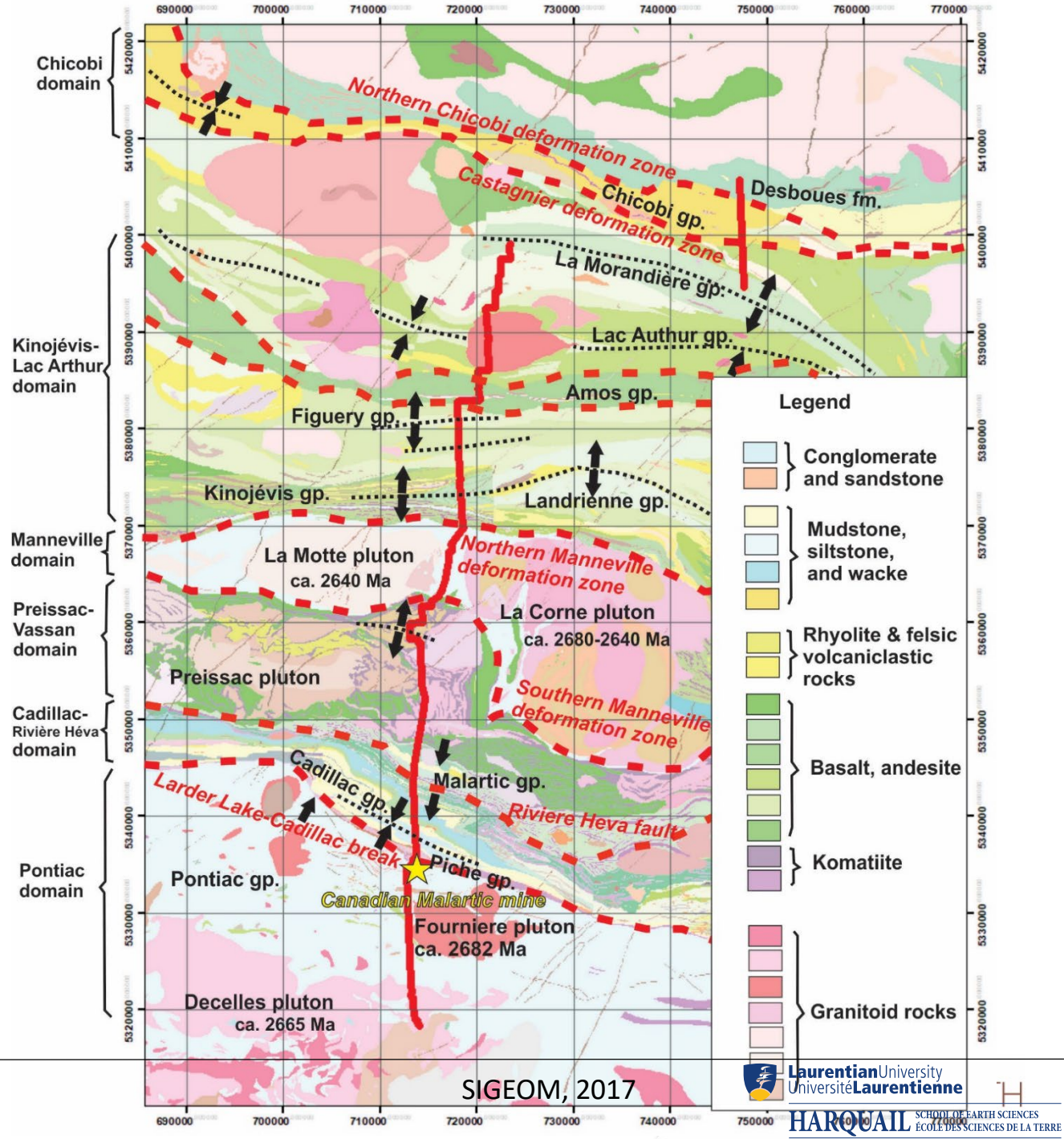
Seismic
MT
Gravity Magnetics
Focused geoscience

Drawing cross sections across greenstone belts



Stratigraphy and Age





Modified from Pilote et al. 2015 and Bedeaux et al., 2017

SIGEOM, 2017

Malartic Transect Geophysical Data

Malartic transect:

Regional R1 seismic line, 80 km

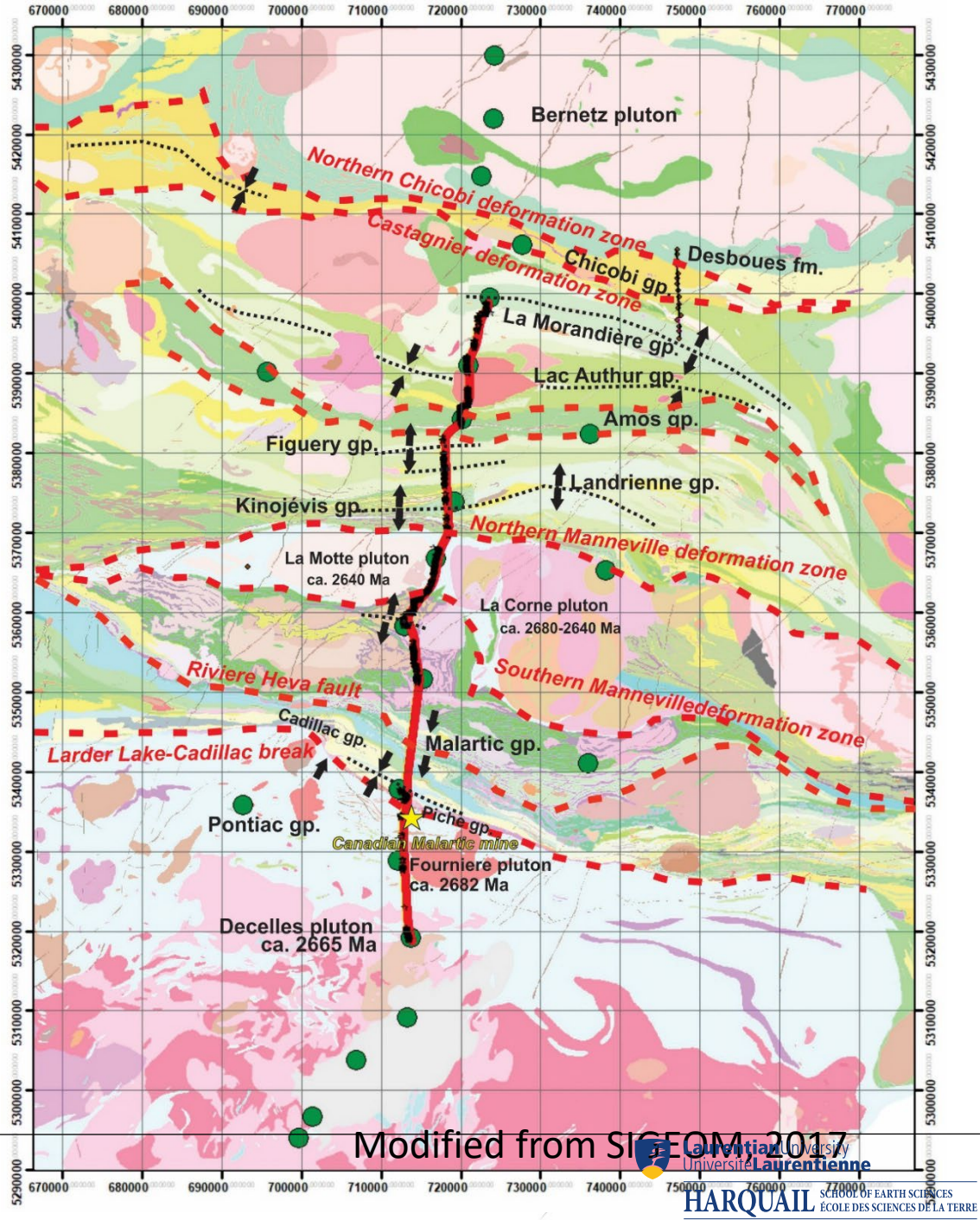
☆ Shot-spacing: 50m

O Receiver-spacing: 25m

Magnetotelluric stations (23 in total), 140 km

● Station-spacing: about 10 km

Gravity data along the seismic line

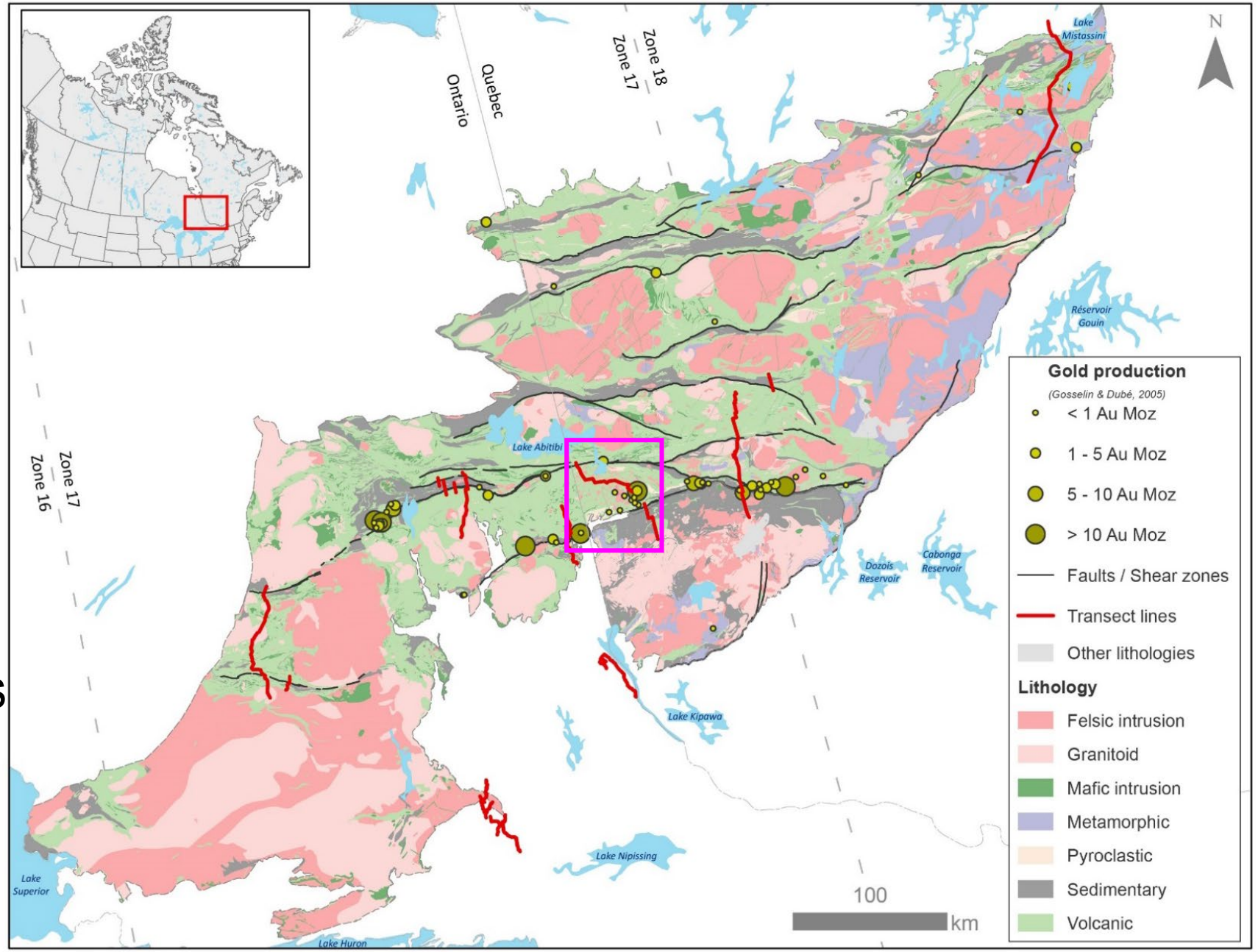


Modified from SIGEOM, 2017

Abitibi Transects

Seismic
MT
Gravity Magnetics
Focused geoscience

Drawing cross sections across greenstone belts



Noranda

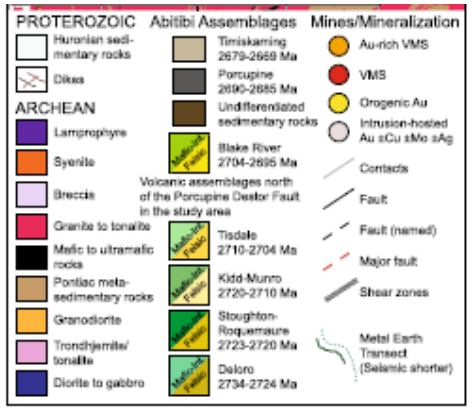
Metal Earth Transect

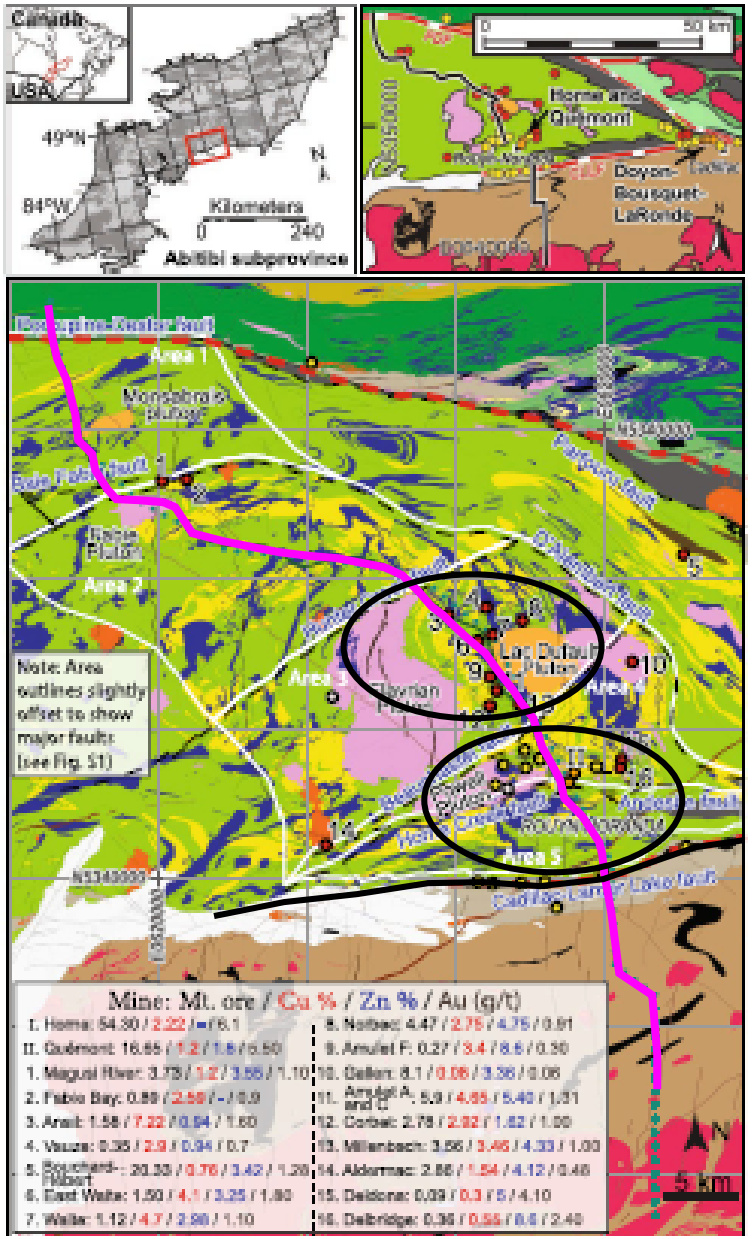
Cadillac – Larder Lake Break

Horne deposit

Main Camp

Taus will speak to this later today



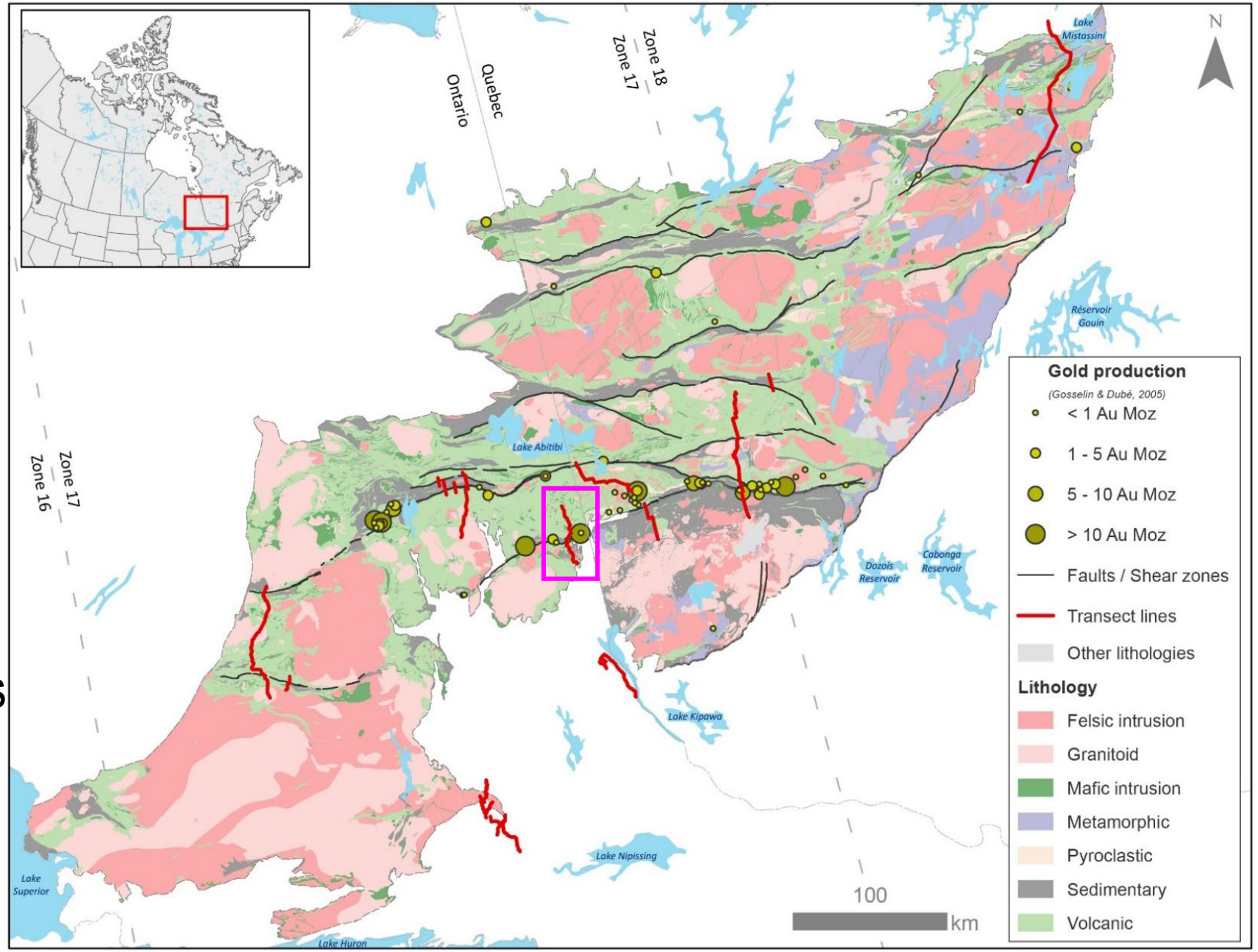


Jørgensen, T.R.C., Gibson, H.L., Roots, E.A. *et al.* The implications of crustal architecture and transcrustal upflow zones on the metal endowment of a world-class mineral district. *Sci Rep* **12**, 14710 (2022).

Abitibi Transects

Seismic
MT
Gravity Magnetics
Focused geoscience

Drawing cross sections across greenstone belts



Metal Earth

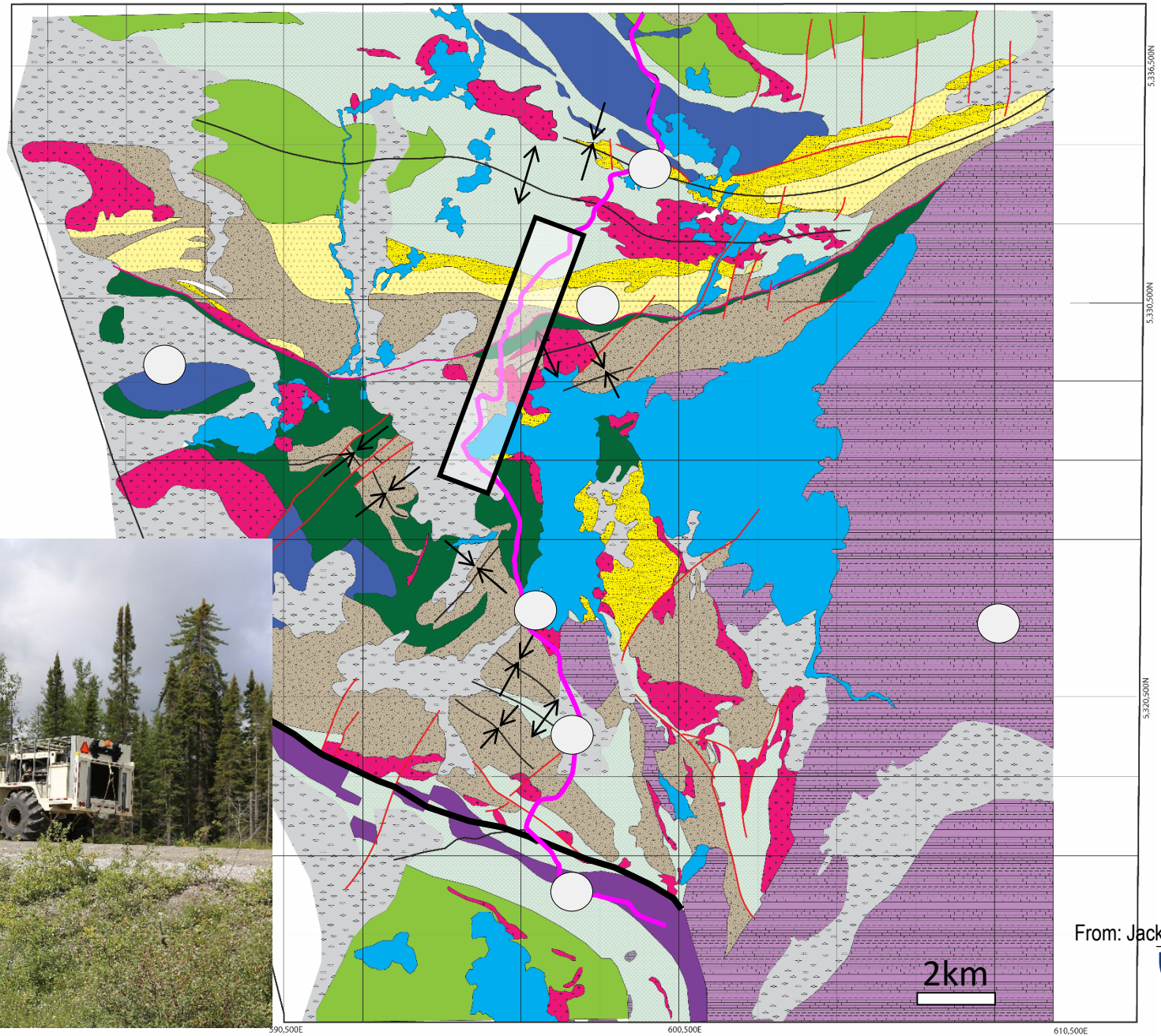
how are these faults expressed geophysically

Separate talk

Transect Scale Research

Larder Lake Transect

Seismic & MT



From: Jackson, 1995, OGS Map 2628, 1:50,000

LaurentianUniversity
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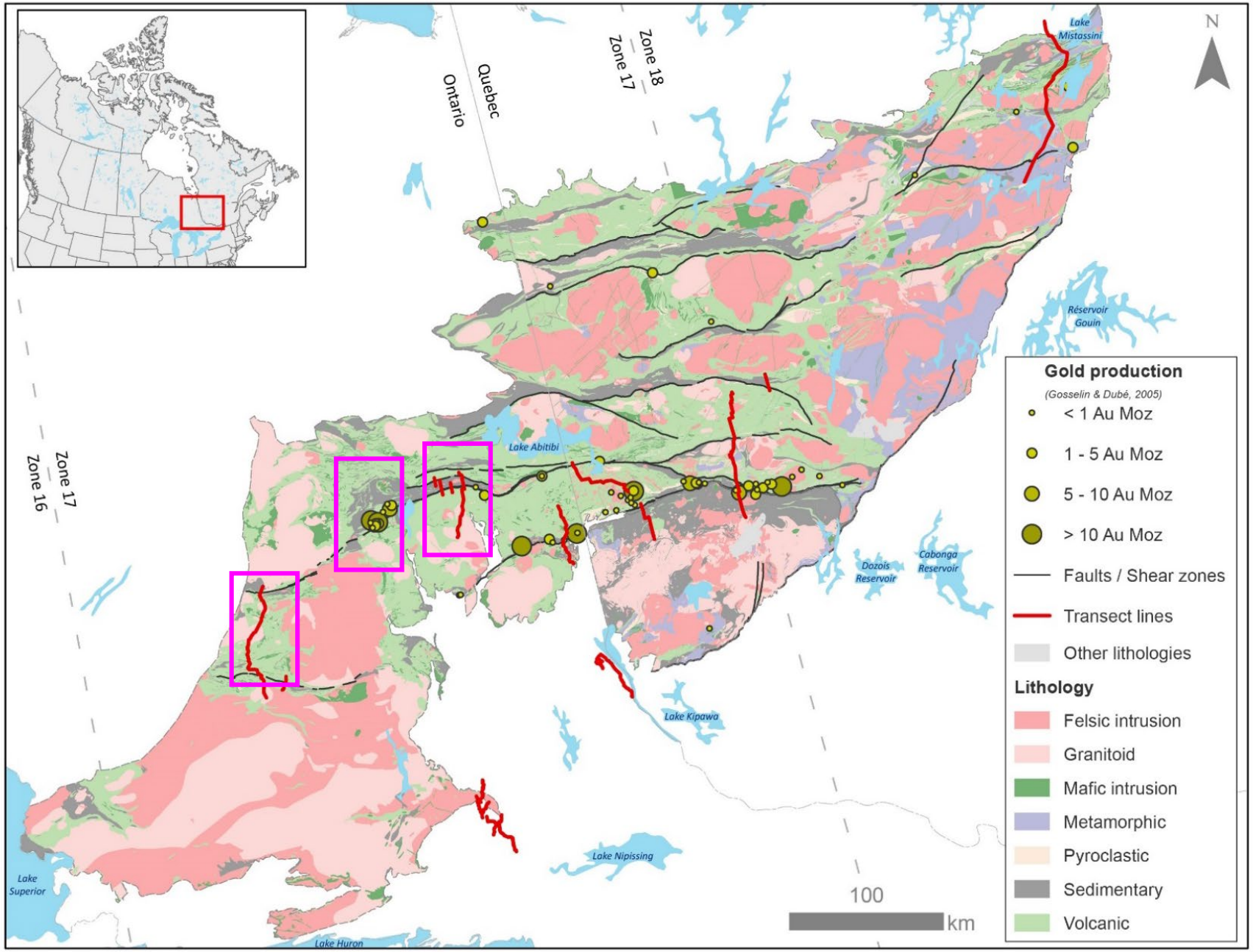
HARQUAIL SCHOOL OF EARTH SCIENCES ÉCOLE DES SCIENCES DE LA TERRE

Abitibi Transects

Rasmus Huaguard

John Ayer

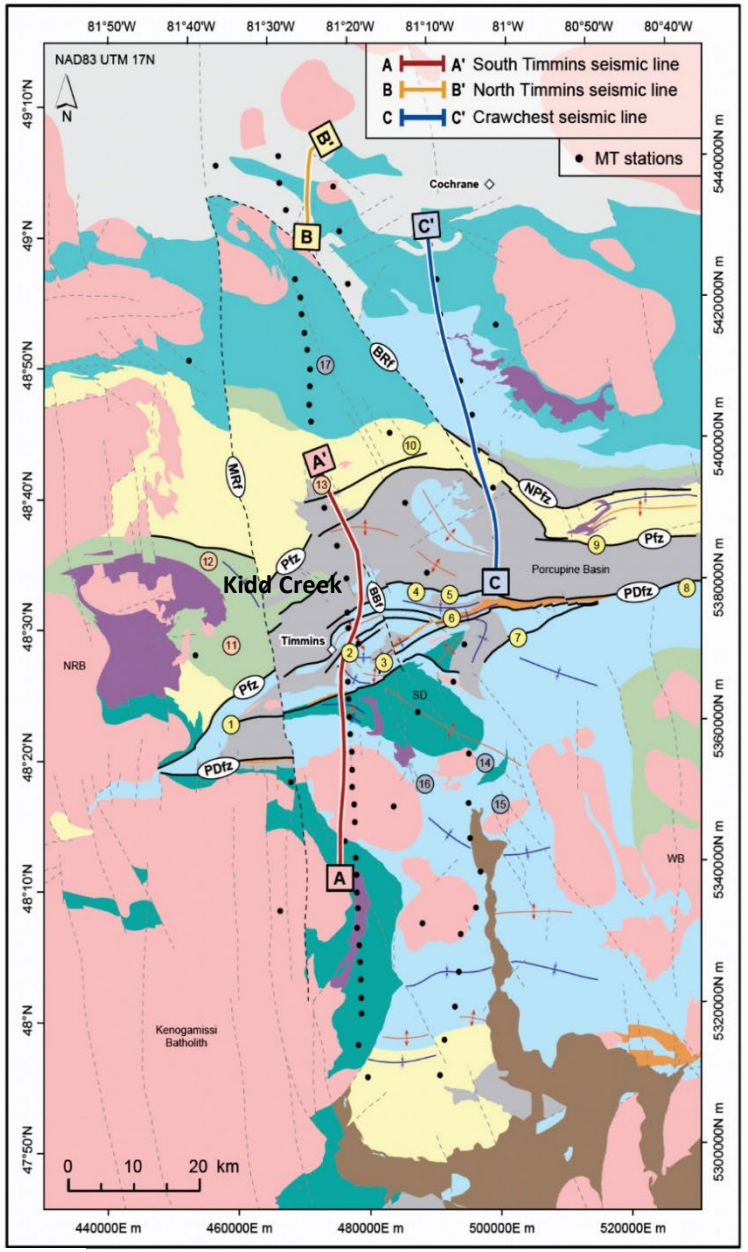


Timmins Region

- Hosts the world's largest Archean orogenic gold camp >75 M oz Au)

- Endowed with base metals
  - Kidd Creek & Kamiskotia VMS mines
  - Numerous Magmatic Ni-Cu-PGE deposits

- Metal Earth's 80 MT stations models ~10,000 Km^2 & combined with DA seismic lines improves understanding of:
  - Crustal architecture
  - Conductive corridors/fault zones
  - Alterations footprints



Lithostratigraphic framework

PC Proterozoic cover (<2500 Ma)

Intrusions

FI Felsic to intermediate intrusions (2750-2682 Ma)

MI Synvolcanic ultramafic to mafic intrusions (2750-2700 Ma)

Sedimentary rocks

Tm Timiskaming Assemblage (2676-2669 Ma)

P Porcupine Assemblage (2690-2685 Ma)

SG Scapa Group (<2697 Ma)

Volcanic rocks

BR Blake River Assemblage (2704-2696 Ma)

T Tisdale Assemblage (2710-2704 Ma)

KM Kidd-Munro Assemblage (2719-2710 Ma)

SR Stoughton-Roquemaure Assem. (2723-2720 Ma)

D Deloro Assemblage (2730-2724 Ma)

Structures

Archean faults ------ Late faults

Anticline Syncline

Gold (Au) deposits

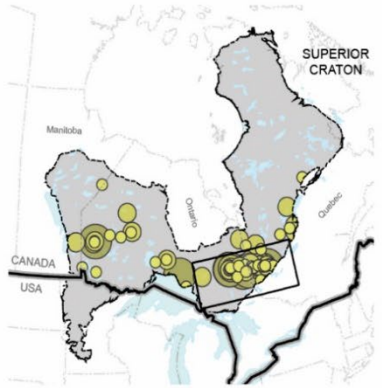
1. West Timmins mine
2. Hollinger mine
3. Dome mine
4. Bell Creek mine
5. Hoyle Pond mine
6. Pamour mine
7. Night Hawk Peninsula mine
8. Taylor mine
9. Clavos mine
10. Bradshaw mine

VMS deposits

11. Genex mine
12. Kam Kotia mine
13. Kidd Creek mine

Ni-Cu deposits

14. Langmuir mine
15. Premier mine
16. Redstone mine
17. Crawford deposit



Metal Earth Science

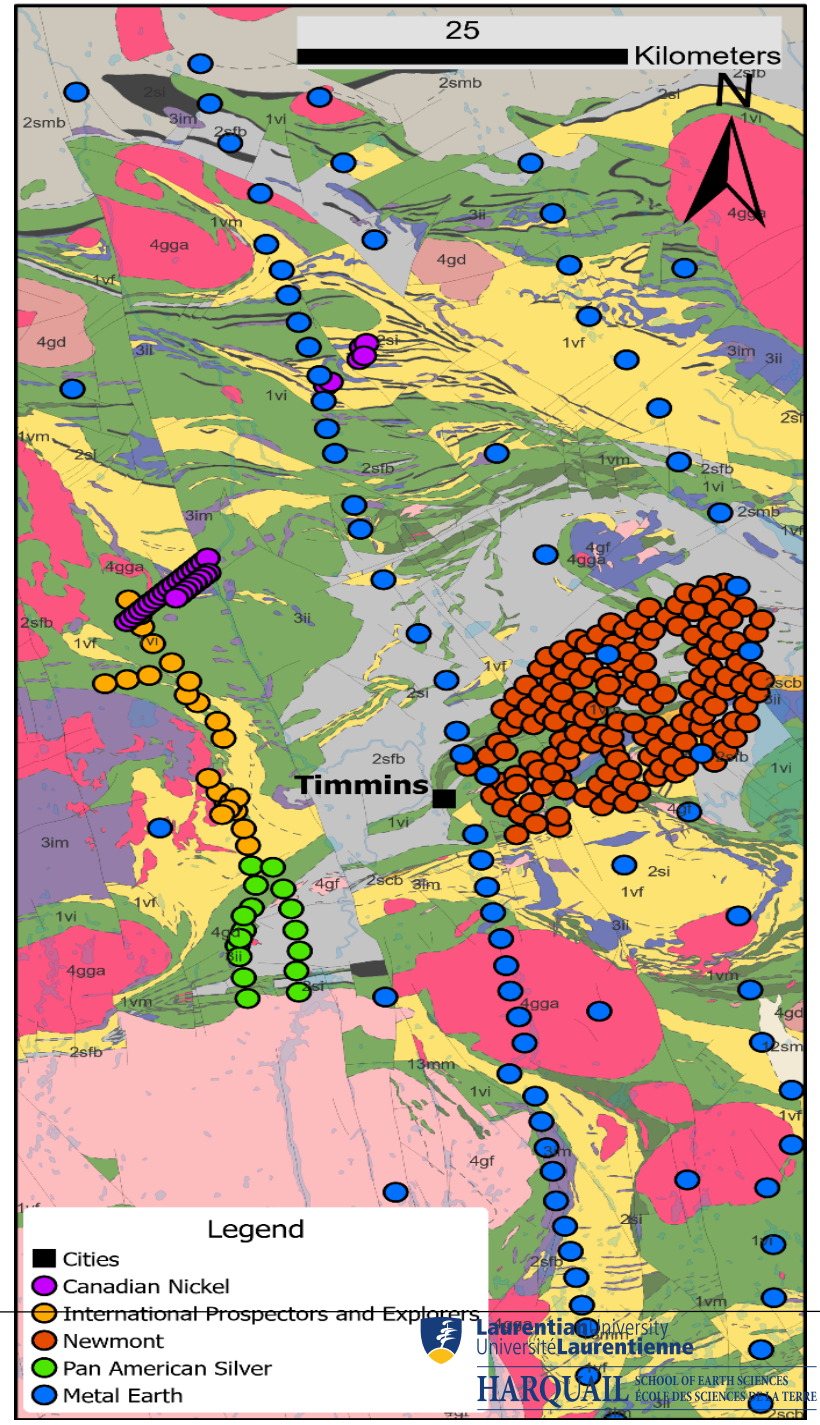
Timmins ~90Moz gold production

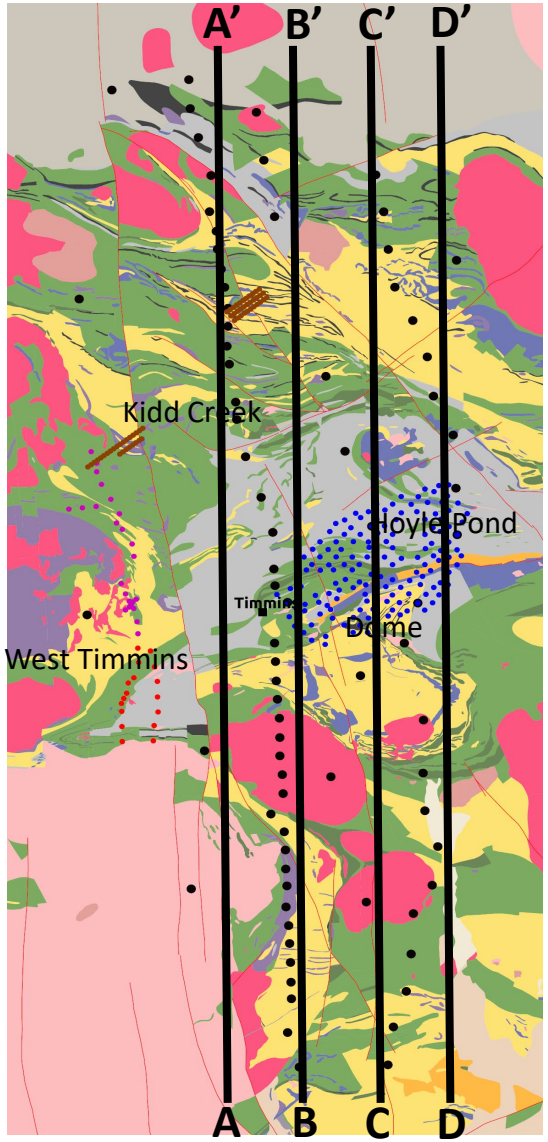
New MT data acquired between 2020 – 2021

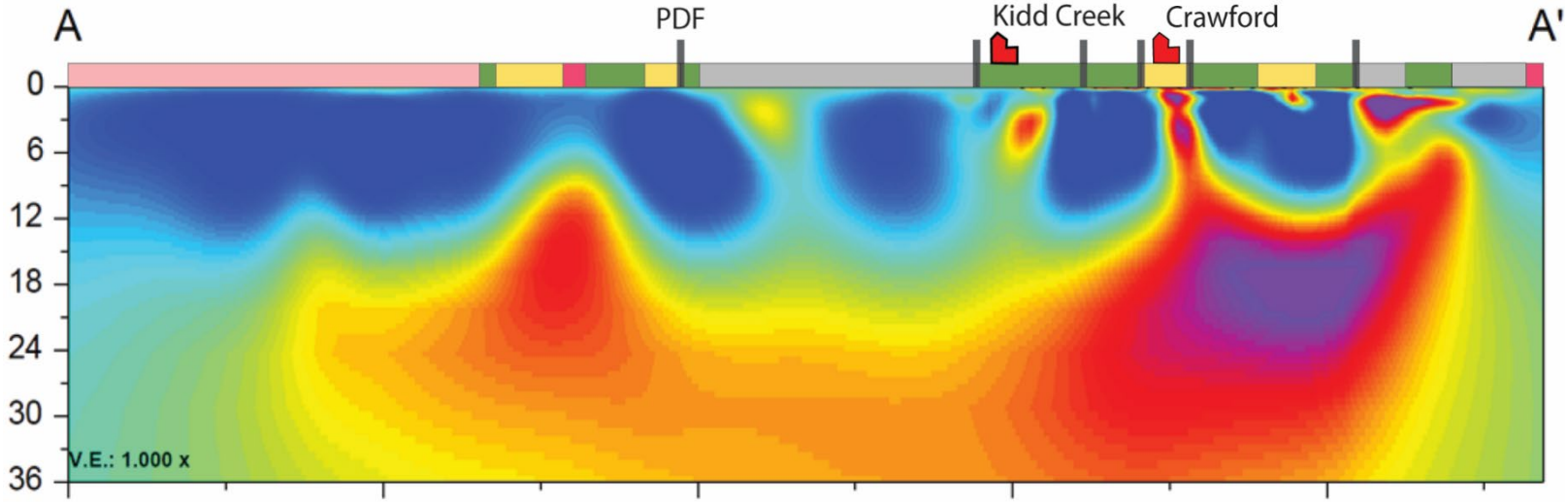
250 AMT – high resolution data targeting upper crust

Acquired by mining companies

30 Broadband MT – regional data targeting mid-crust to upper mantle structures Acquired by Metal Earth




A'
B'
C'
D'
Kidd Creek
Hoyle Pond
Timmins
Dome
West Timmins
A
B
C
D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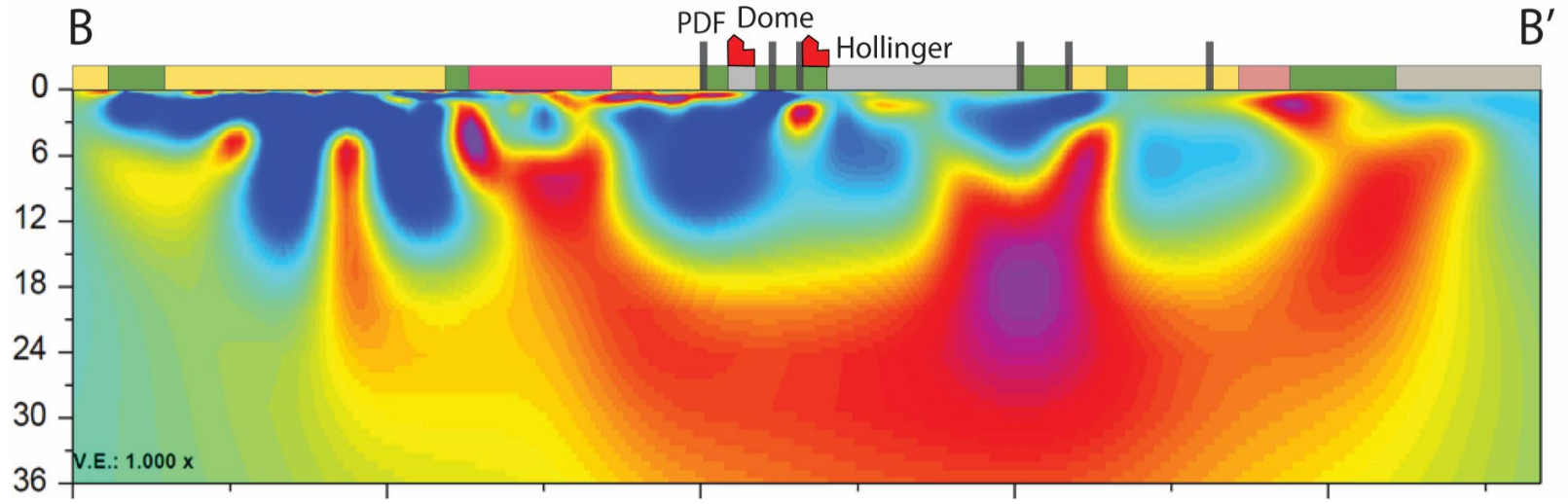
V.E.: 1.000 x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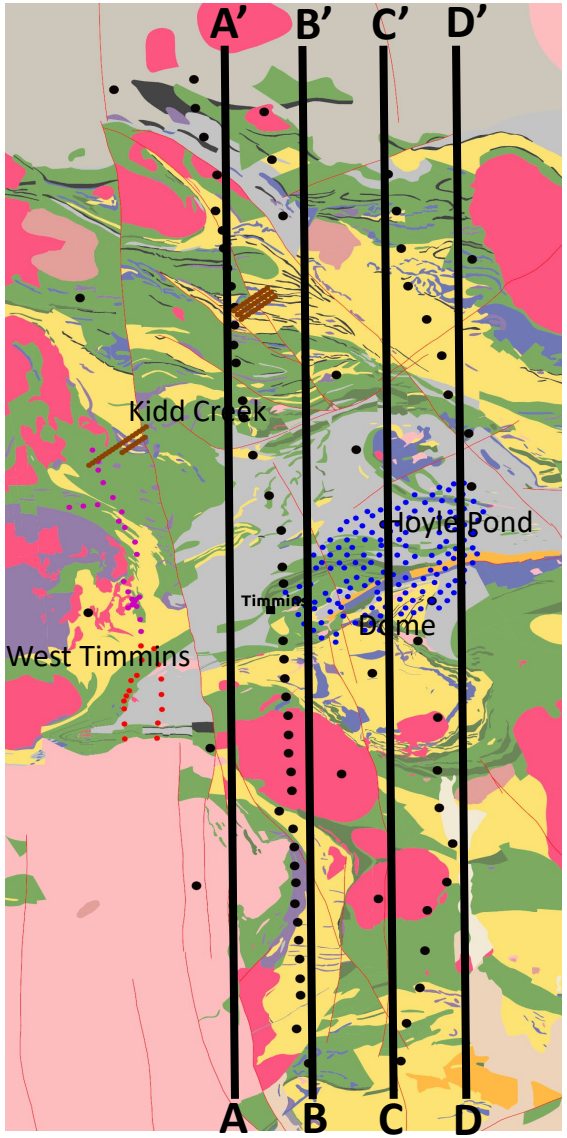
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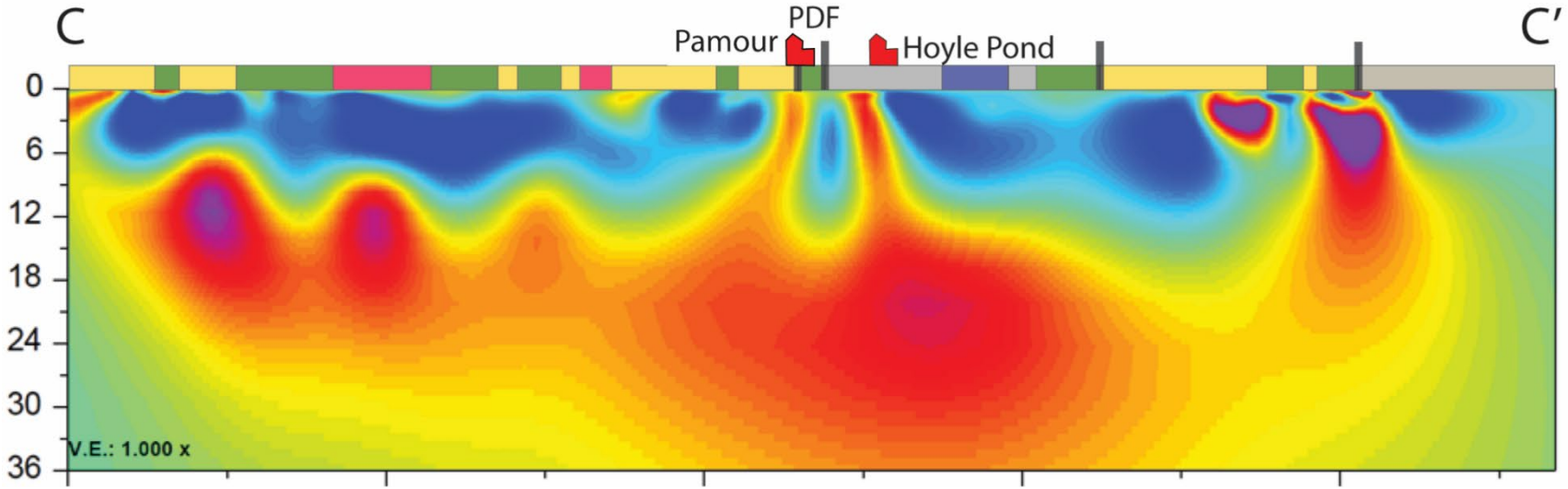
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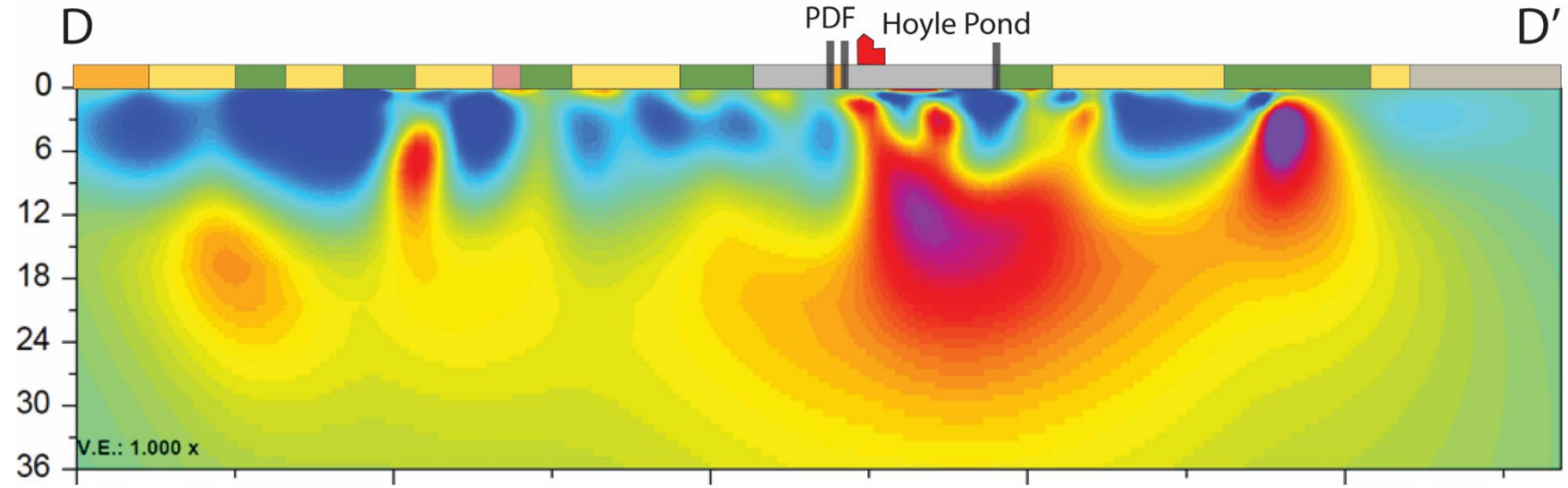
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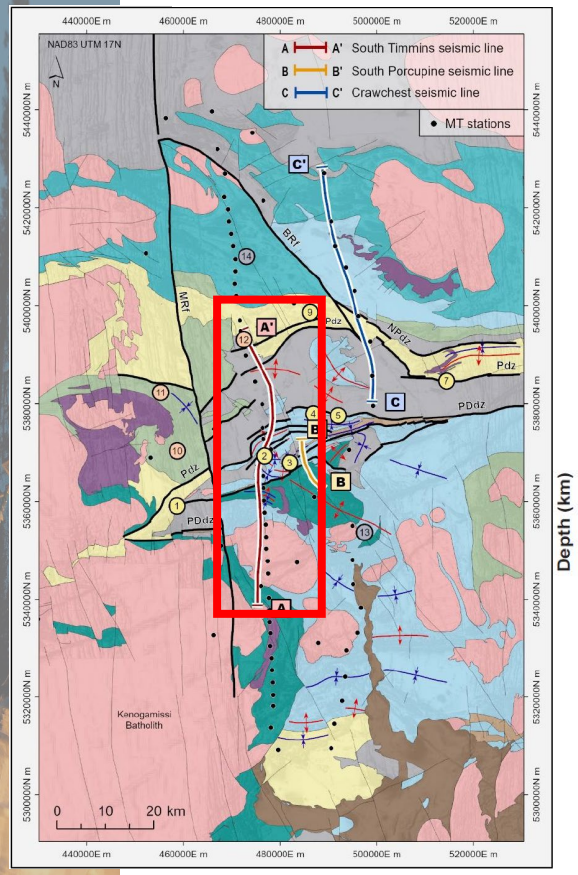
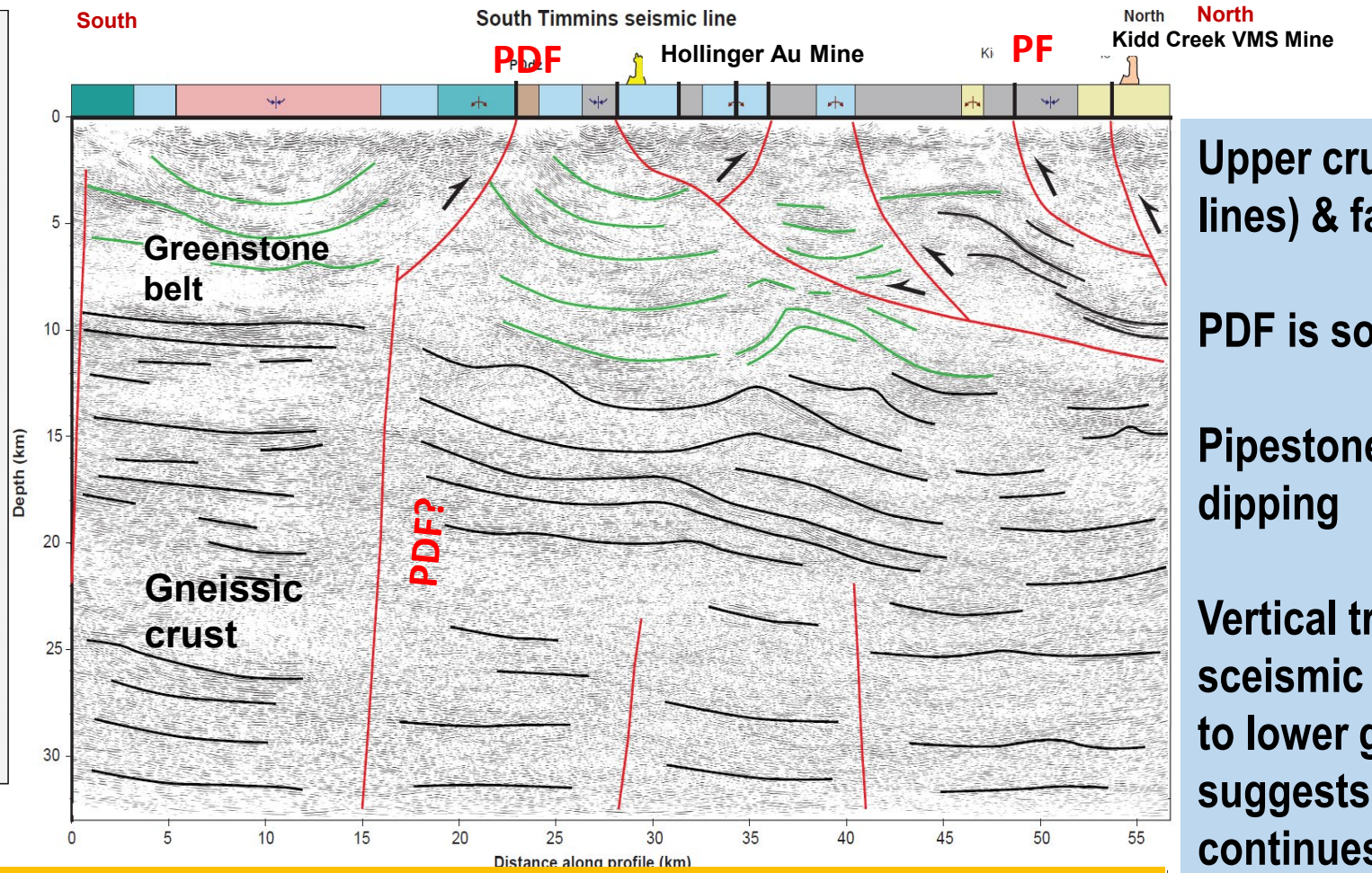
South Timmins Seismic line





Upper crust folded (green lines) & faulted (red lines)

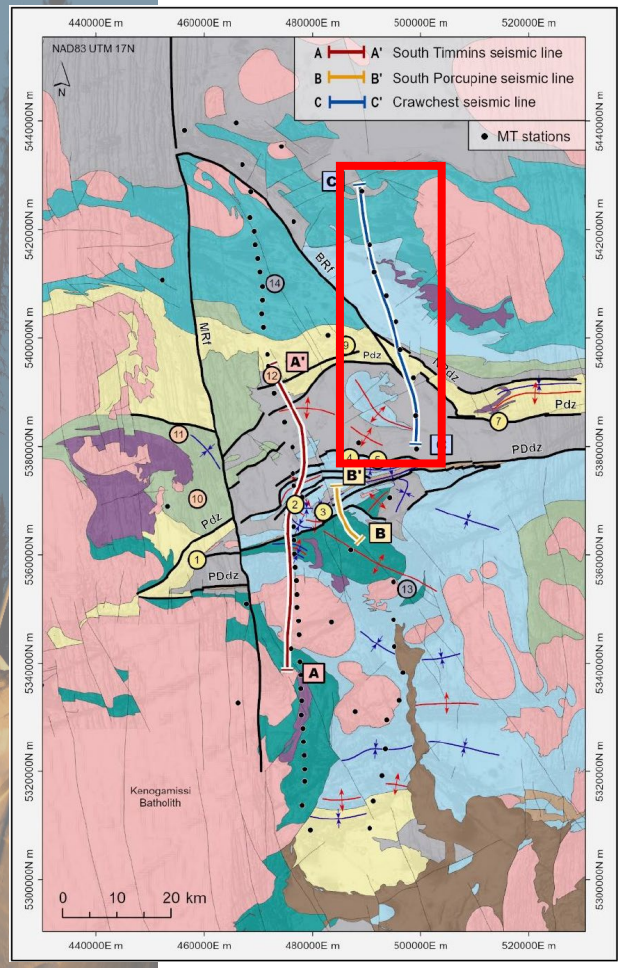
PDF is south-dipping

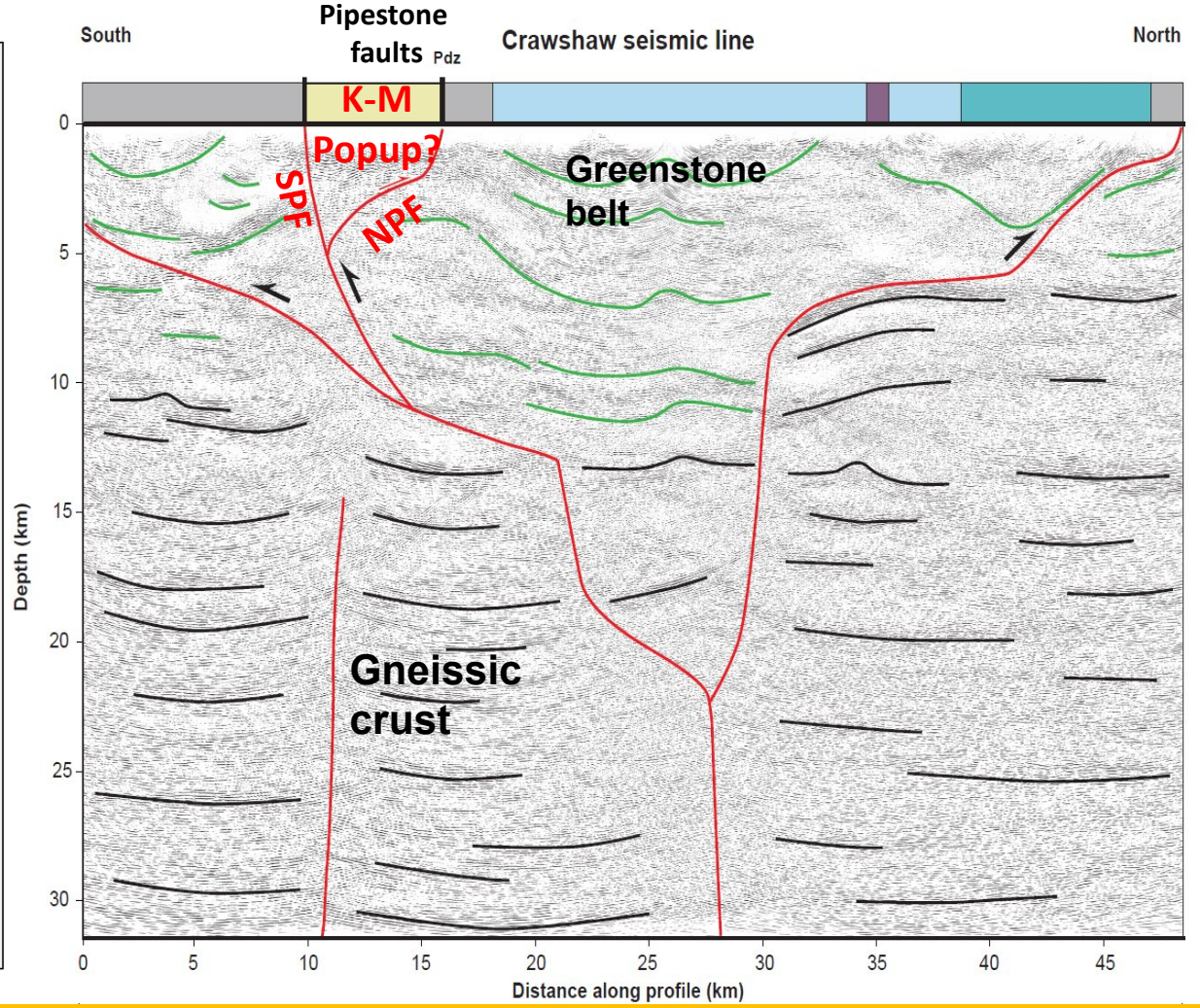
Pipestone fault is north-dipping

Vertical transparent sceismic zones in the mid- to lower gneissic crust suggests the PDF continues to depth

- Upper Crust greenstones - evidence of thin-skinned folds and thrusts
- Middle and Lower Crust - evidence of thick-skinned deformation (i.e., basement faulting)

Crawchest Seismic line





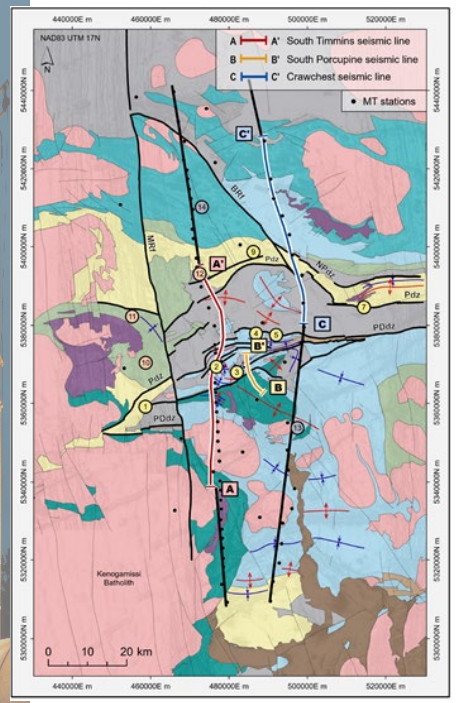
-Reflectors in the upper crust indicate fold & thrusts in upper crust greenstones

-Kidd Munro assemblage (yellow) bounded by Porcupine seds & Pipestone faults to north & south (pop-up structure?)

-Subvertical zones in the mid & lower crust suggest connection to crustal scale stuctures

- Upper Crust shows thin-skinned folds and thrusts
- Middle and Lower Crust shows thick-skinned deformation (basement faulting)

Combined MT and Seismic for Timmins and Crawchest Sections

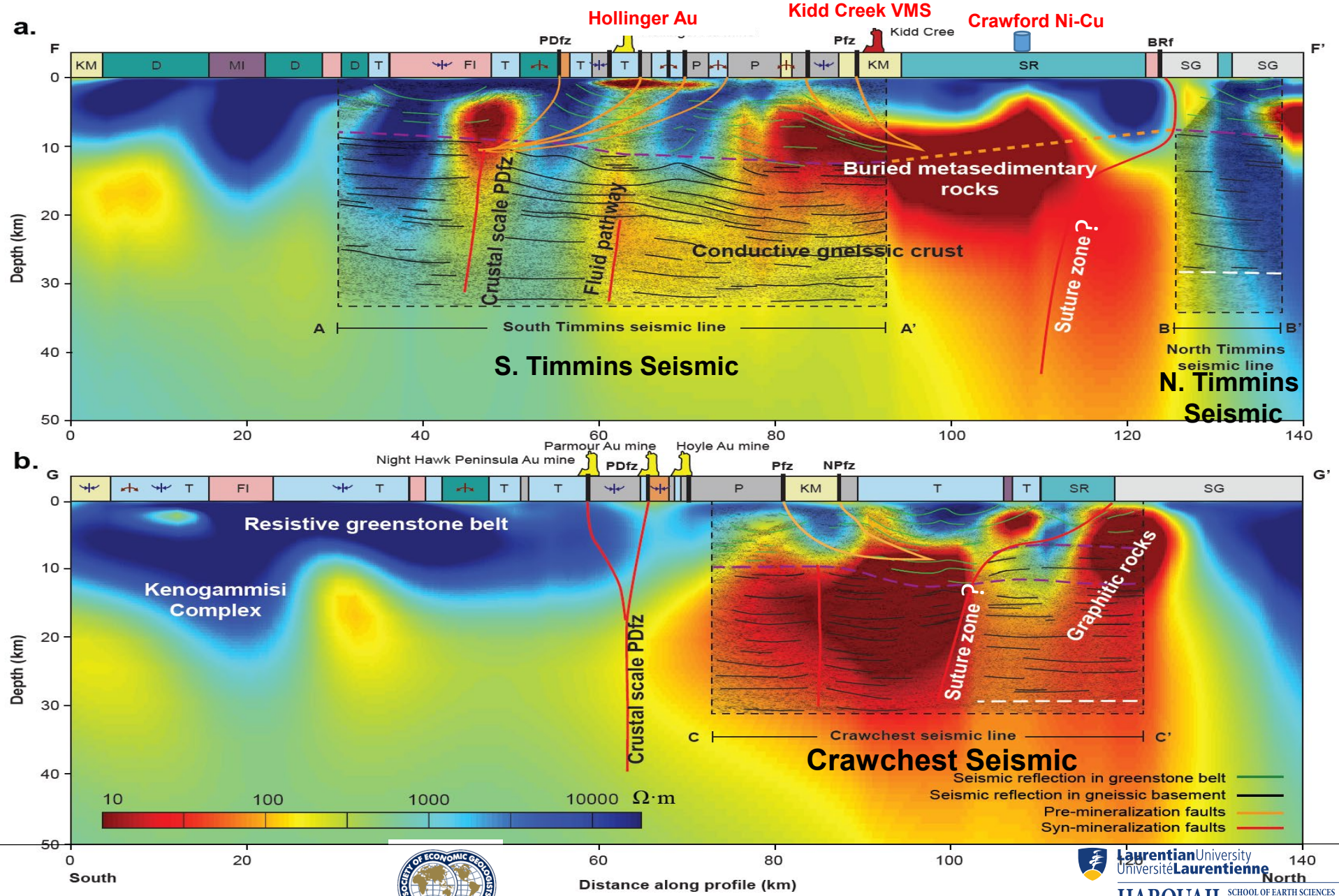


Lithostratigraphic framework

Intrusions
- Felsic to intermediate (syntectonic)
- Mafic to ultramafic (synvolcanic)

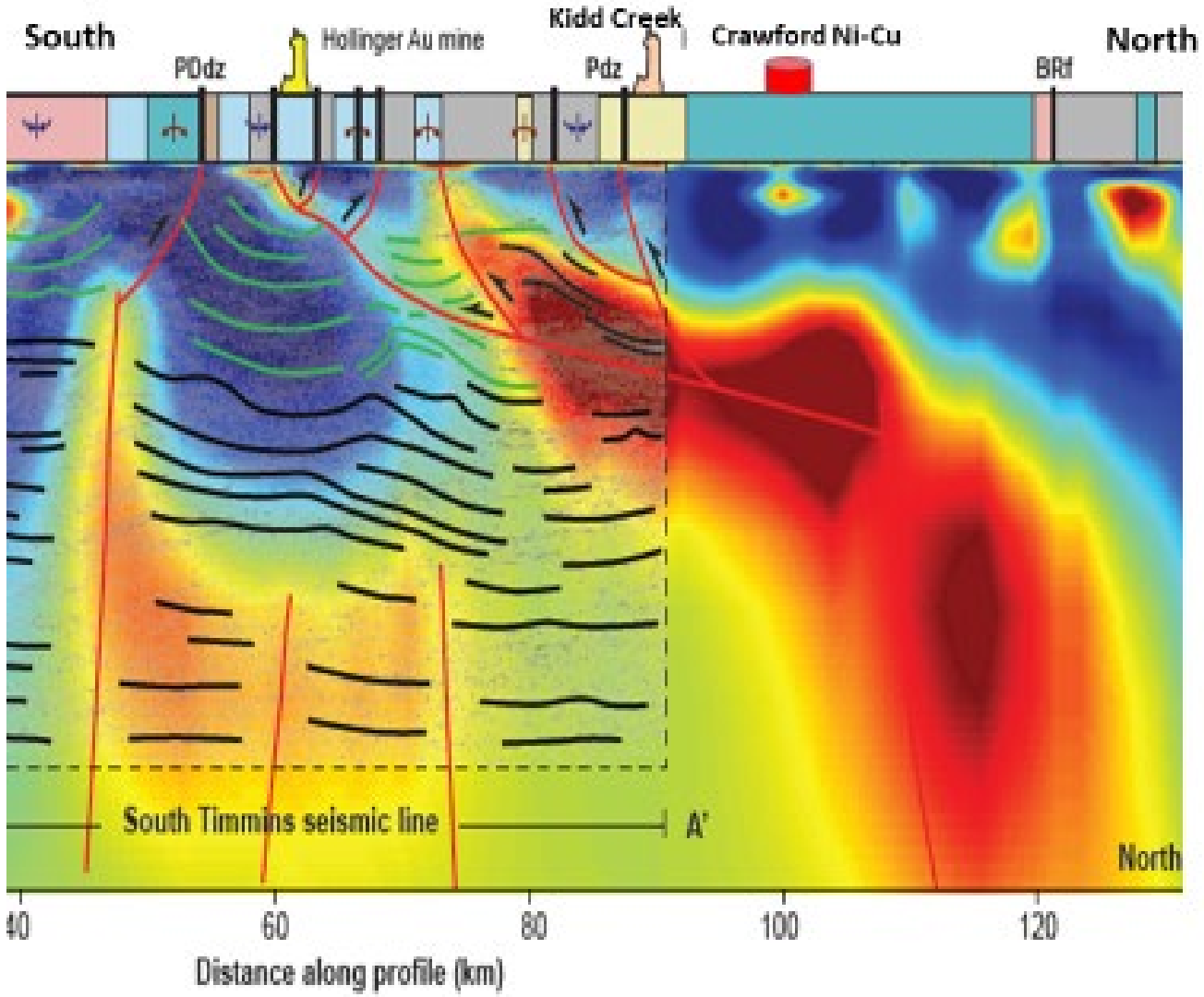
Sedimentary rocks
- Timiskaming Assemblage (2676-2669 Ma)
- Porcupine Assemblage (2690-2685 Ma)

Volcanic rocks
- Tisdale Assemblage (2704-2696 Ma)
- Kidd-Munro Assemblage (2719-2710 Ma)
- Stoughton-Roquemaure Assemblage (2723-2720 Ma)
- Deloro Assemblage (2730-2724 Ma)

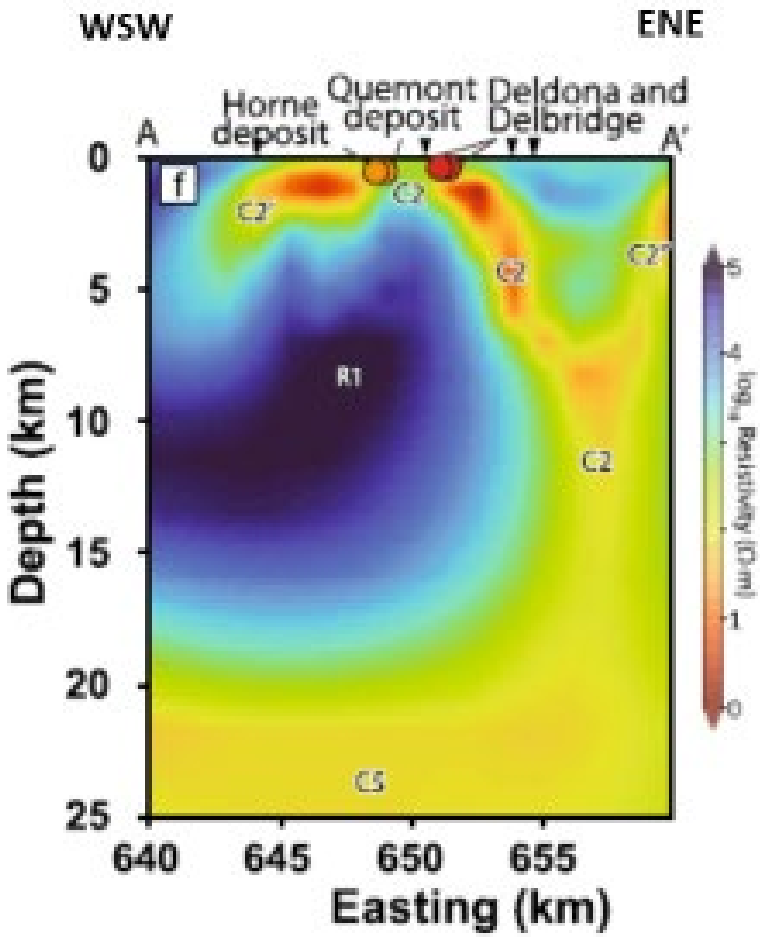


Northern Conductors and Base Metal Endowment?

Kidd Creek N-S Section ~60km

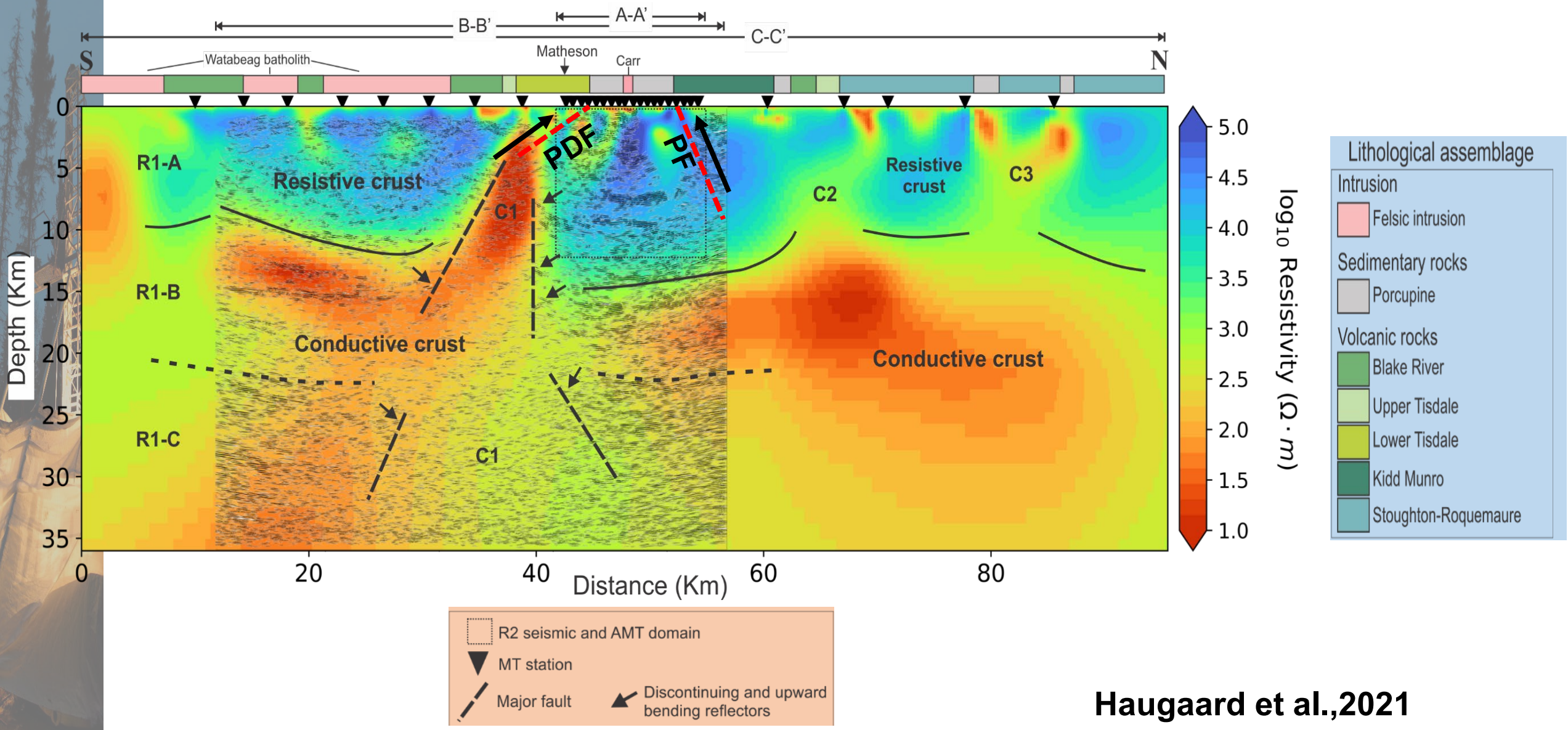


Noranda NE-SW Section ~20km



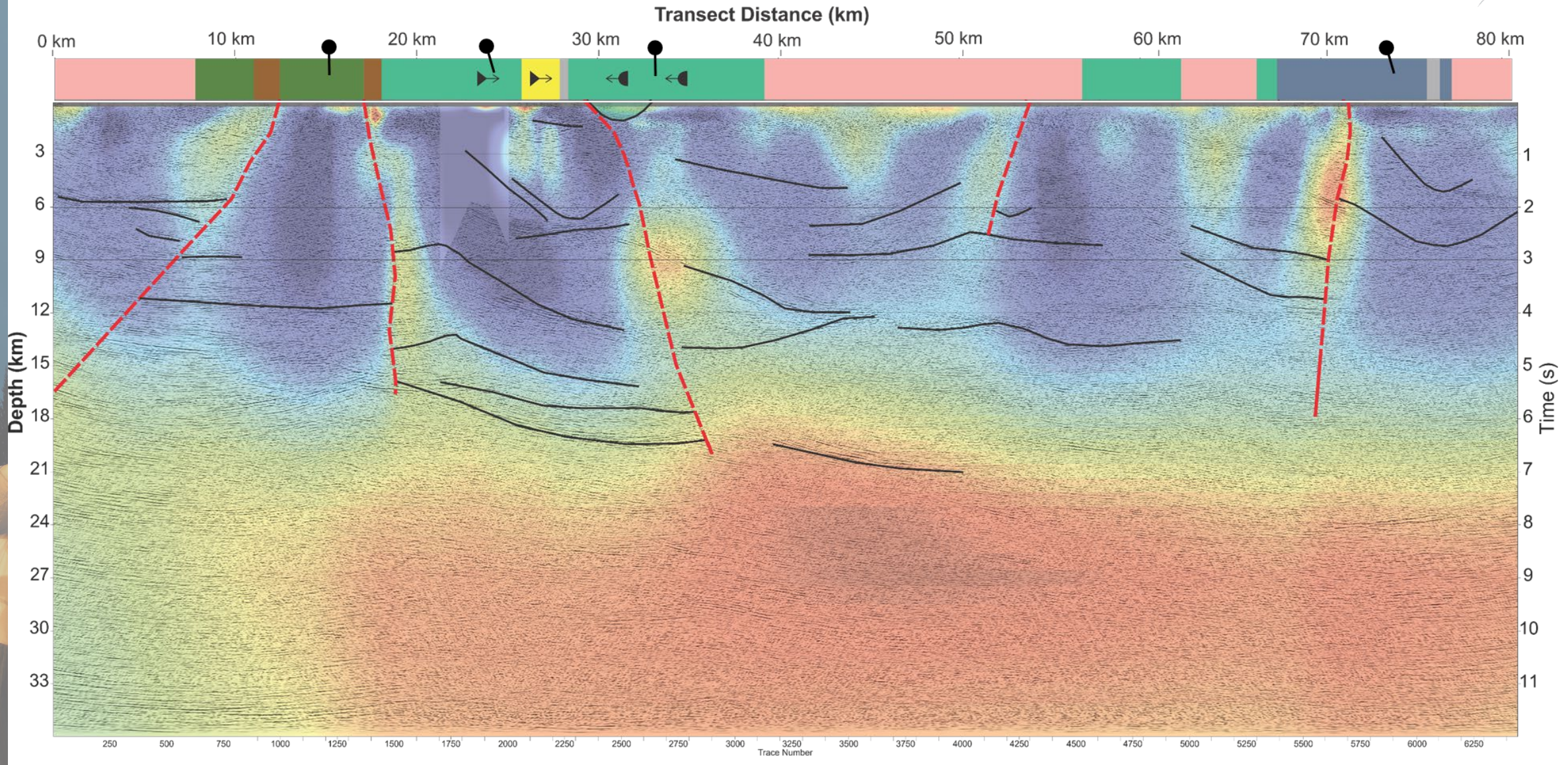
Jørgensen et al., 2022

Matheson Seismic and MT Section - Moderately Au Endowed

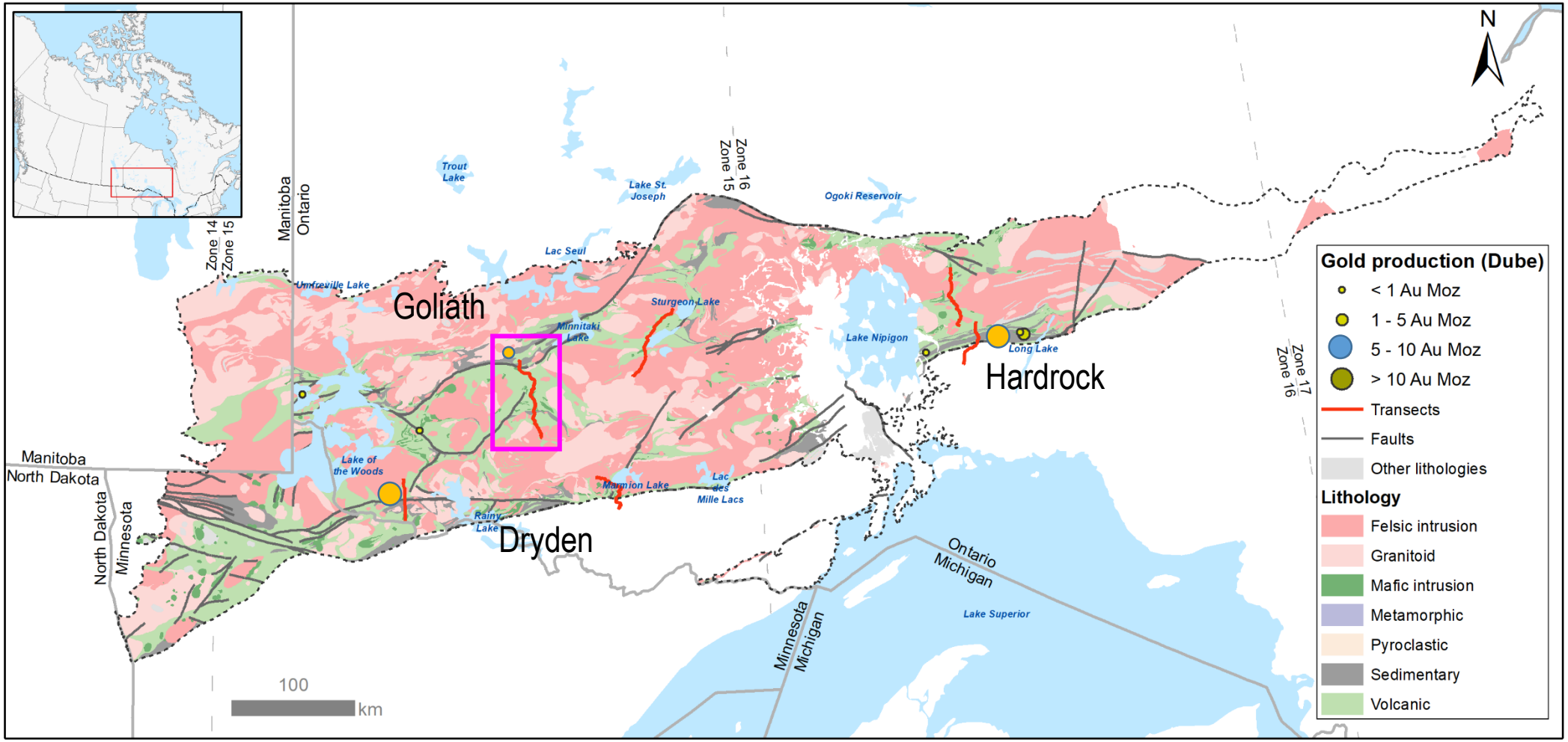


Haugaard et al.,2021

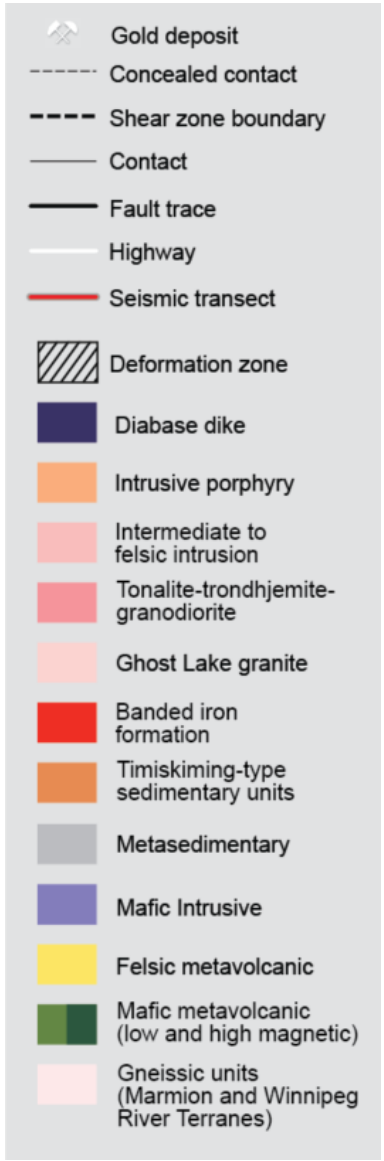
Swayze – A less-endowed greenstone belt? (Gemmell & Haugaard)

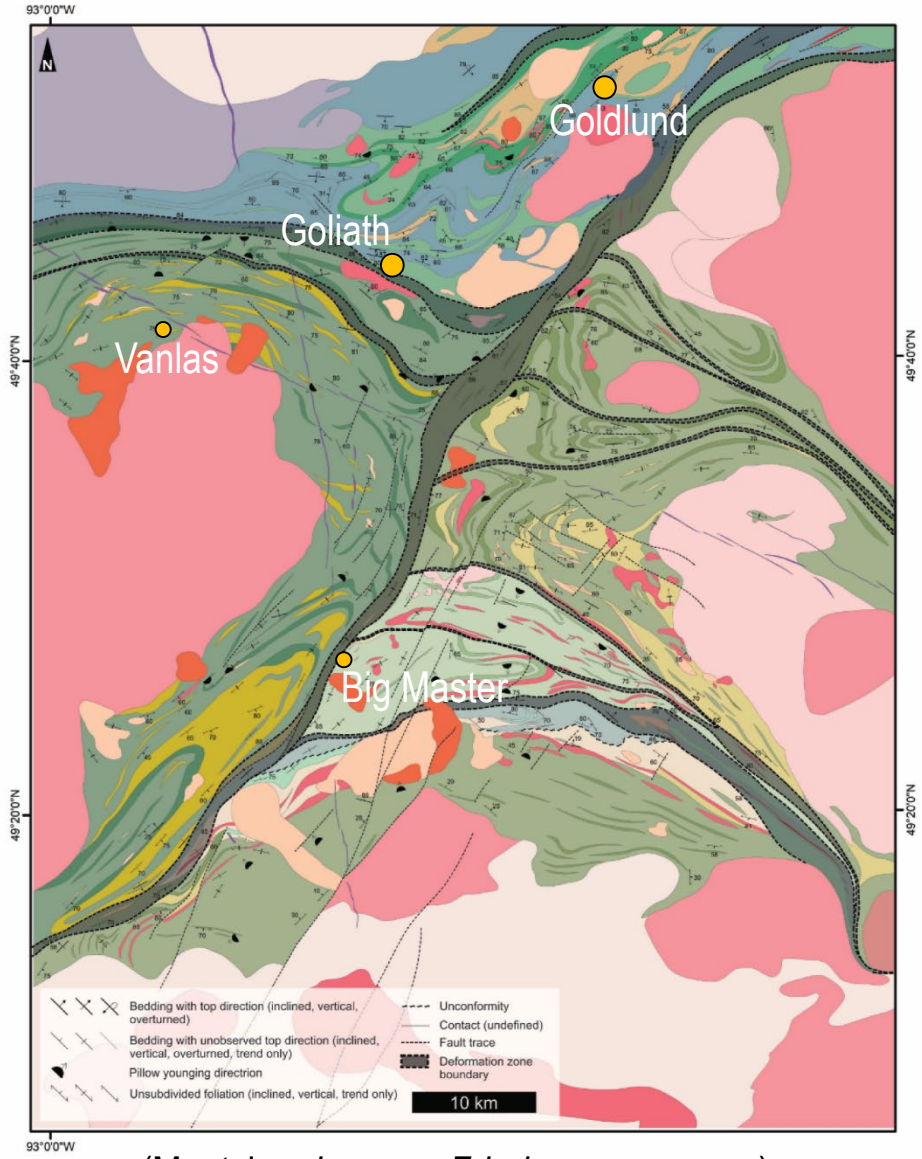


Waibigoon Transects



Dryden Area Geology

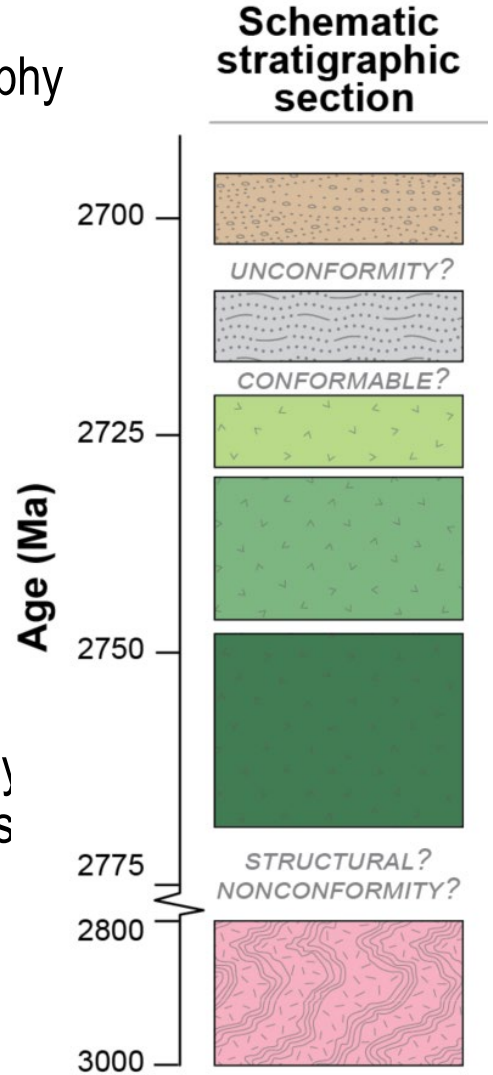




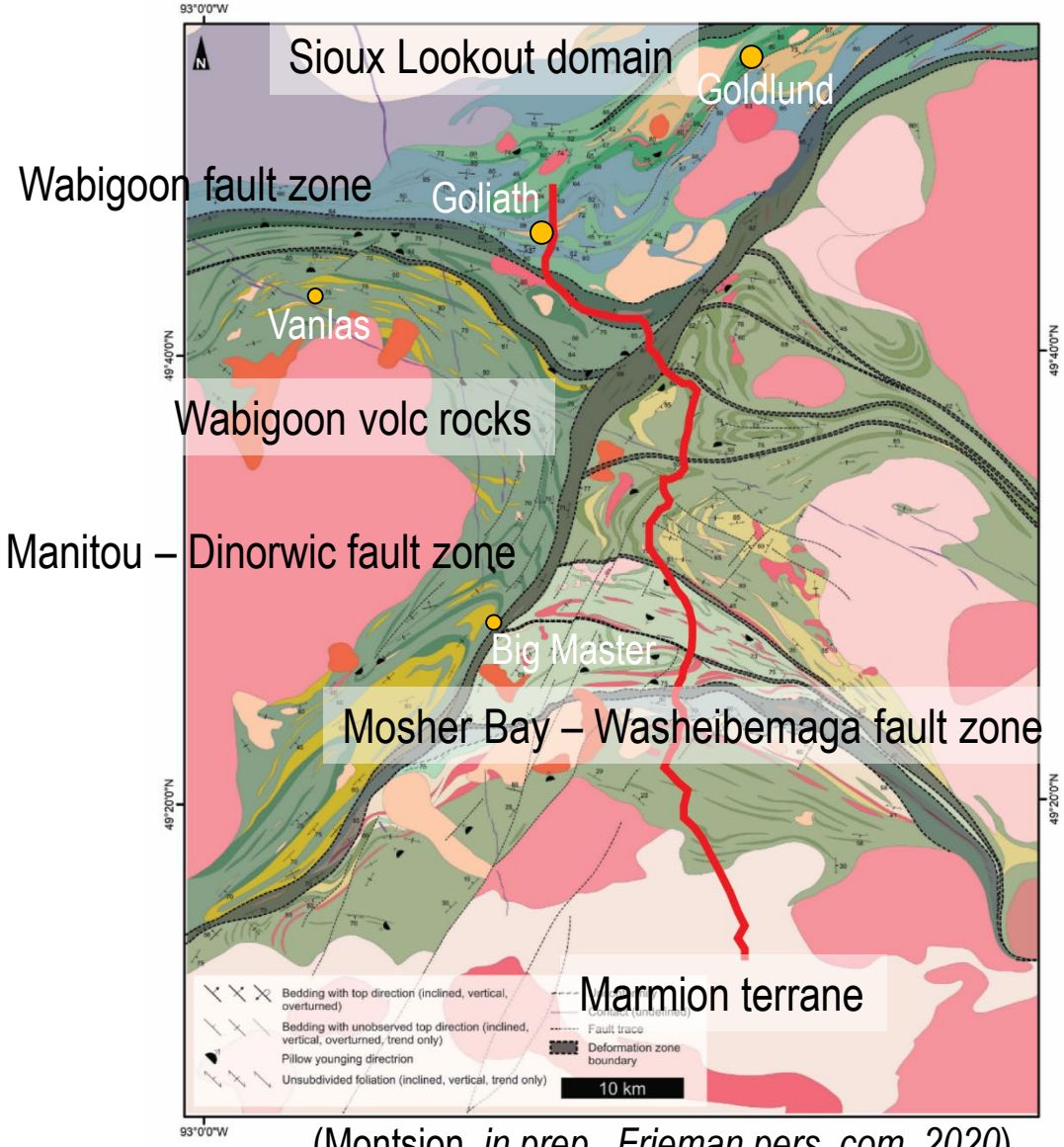
(Montsion, *in prep., Friedman pers. com*)

Supracrustal stratigraphy

- ~2750-2715 Ma bimodal volcanic successions
- 2715-2710 Ma turbiditic rocks (Sioux Lookout domain)
- 2705-2695 Ma coarse clastic sequences (Stormy and Manitou Lakes Groups)

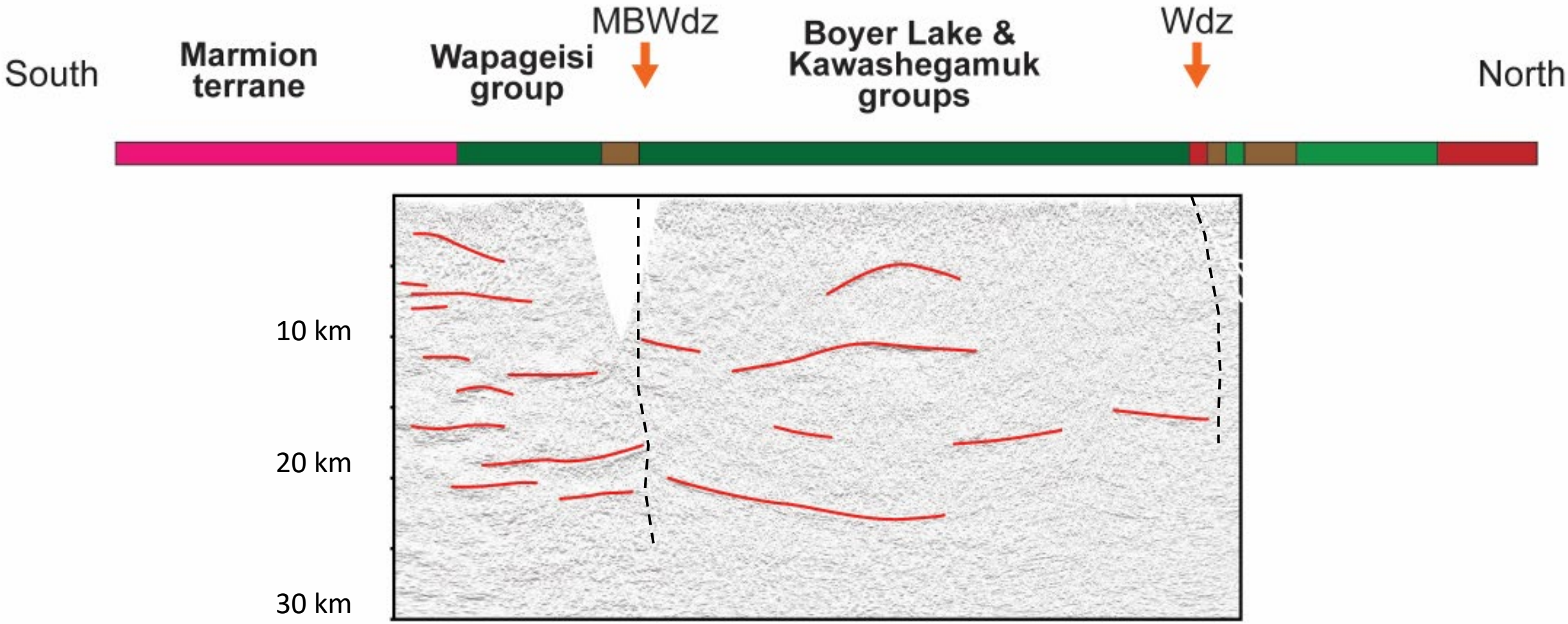


Dryden Area Geology



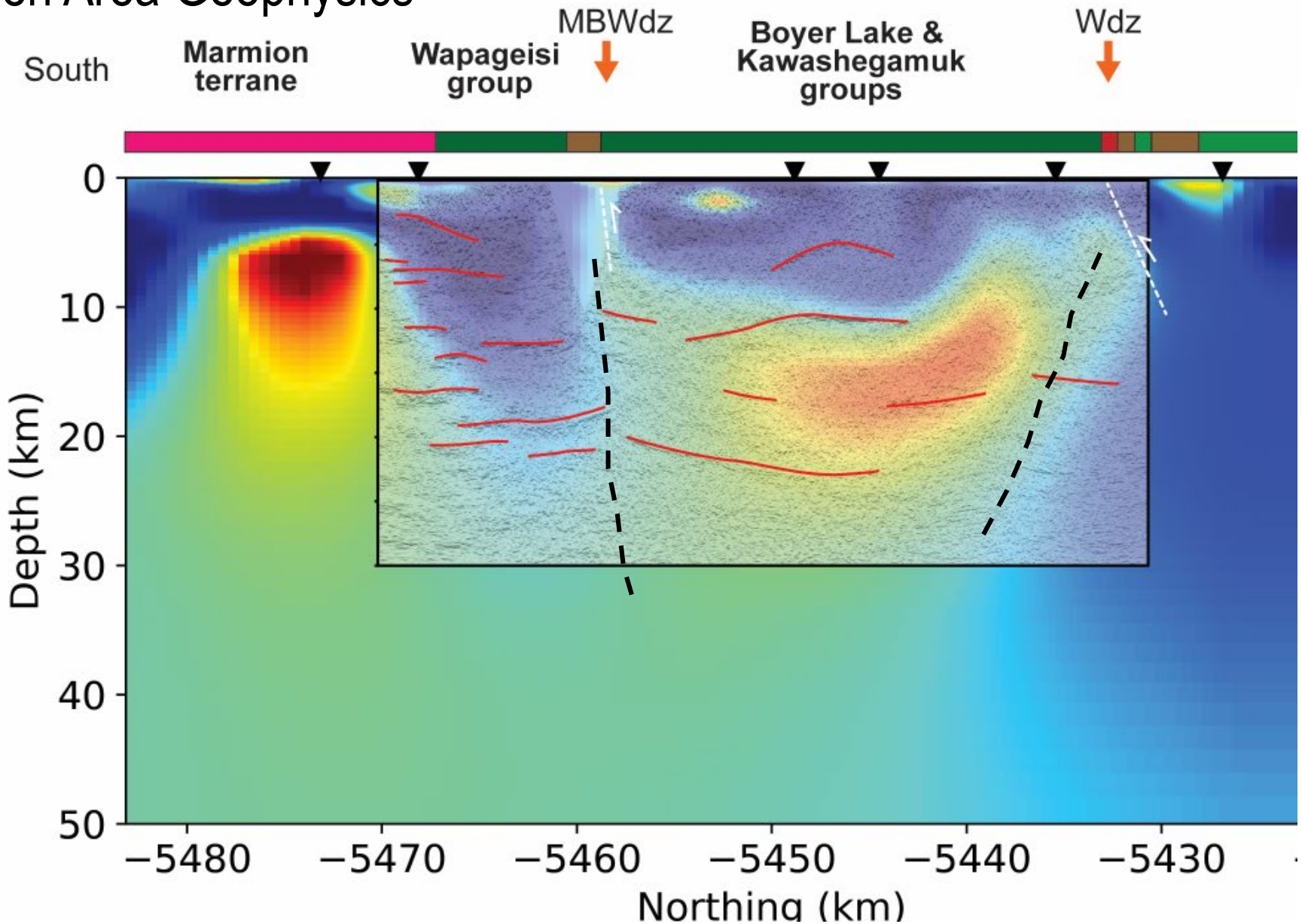
(Montsion, *in prep., Frieman pers. com. 2020*)

Dryden Area Seismic



(Frieman pers. com 2020)

Dryden Area Geophysics



Seismic maps deep seated fault systems, likely into the moho.

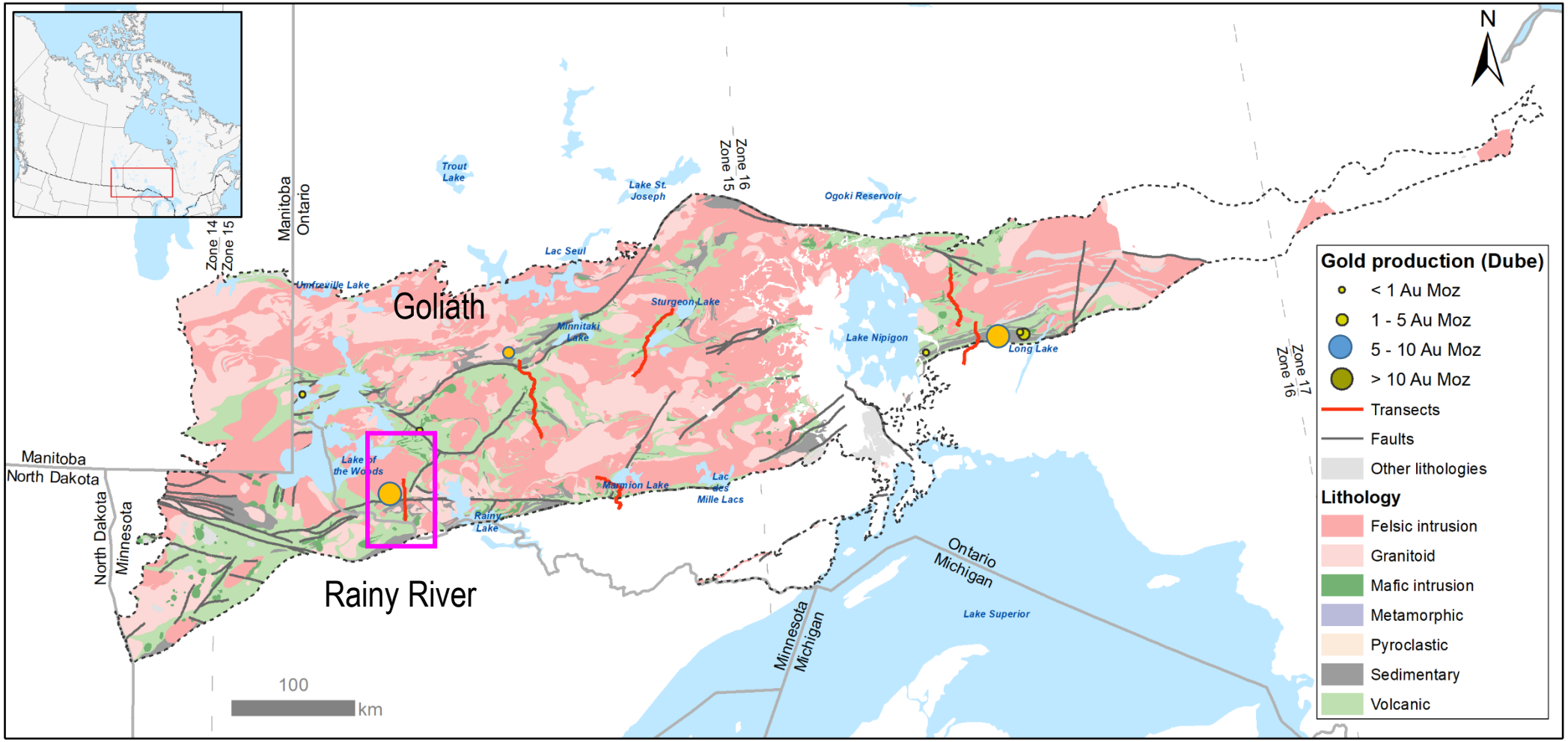
MT surveys shows contrasts mainly in the lower crust. But broken up

No significant contrast associated with the fault systems in the upper crust

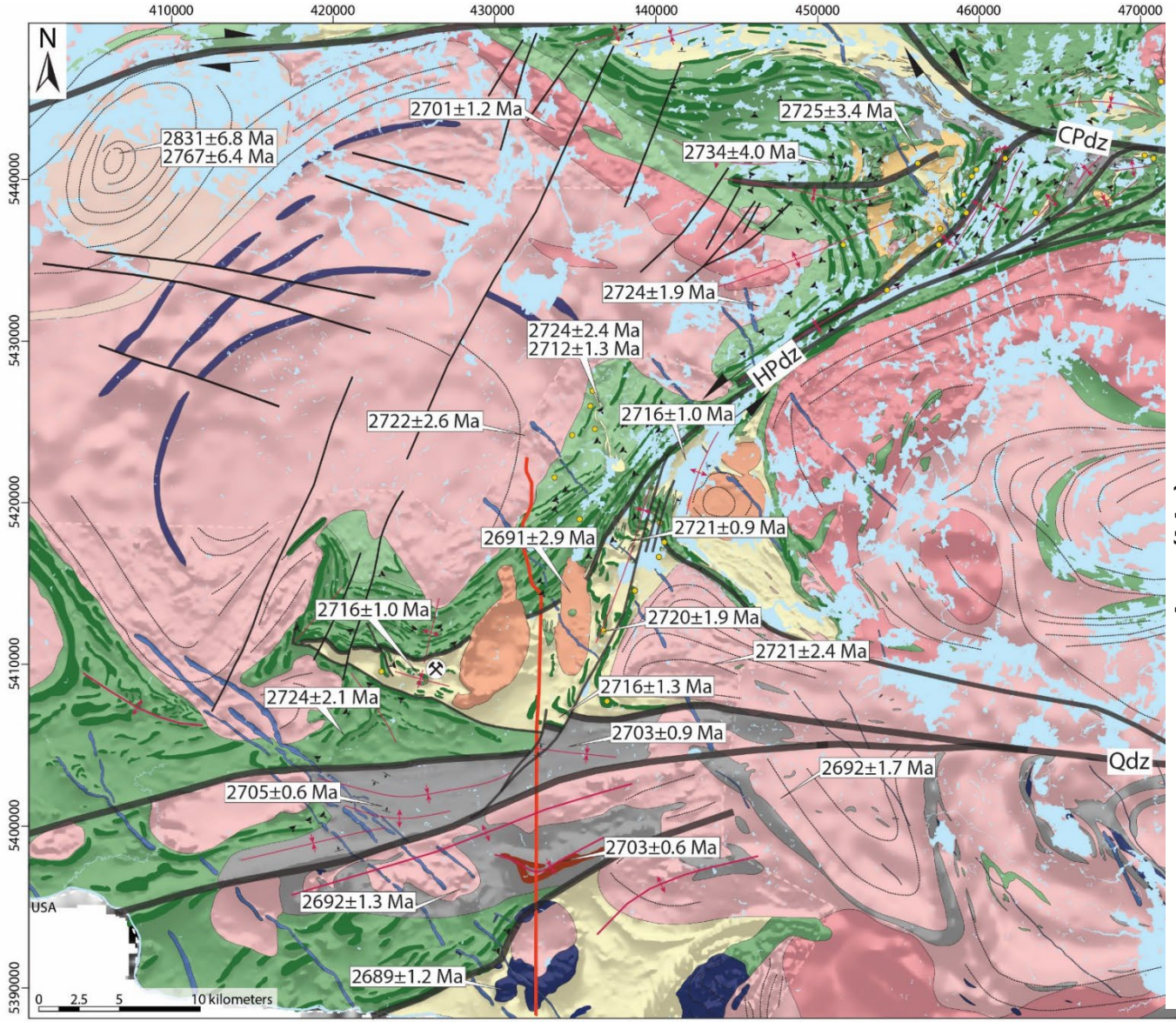
Different from Larder Lake and Abitibi transects

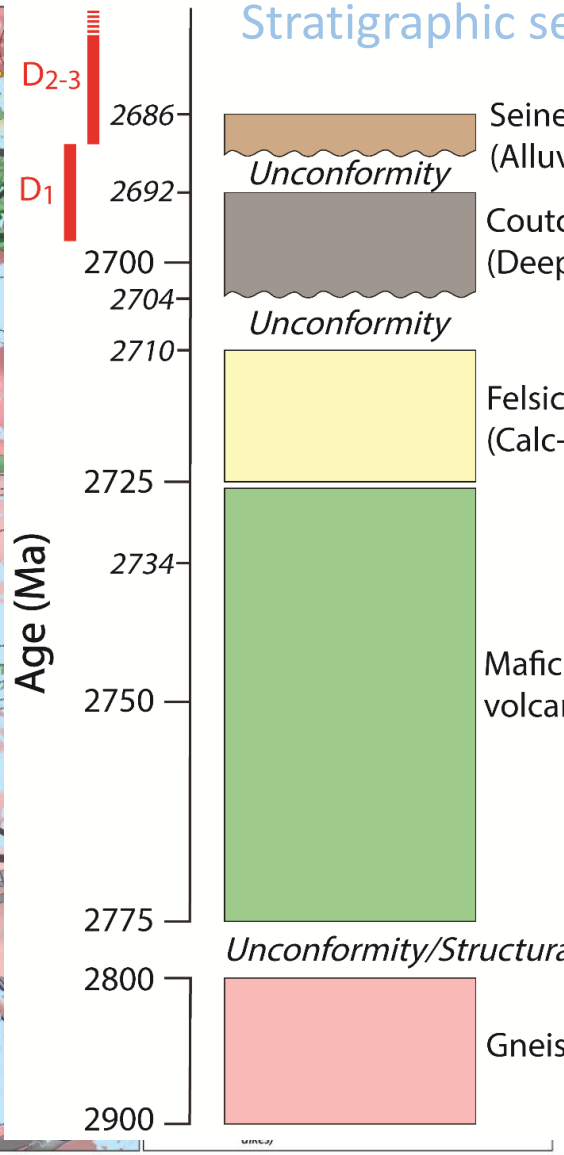
(Frieman pers. com 2020)

Waibigoon Transects

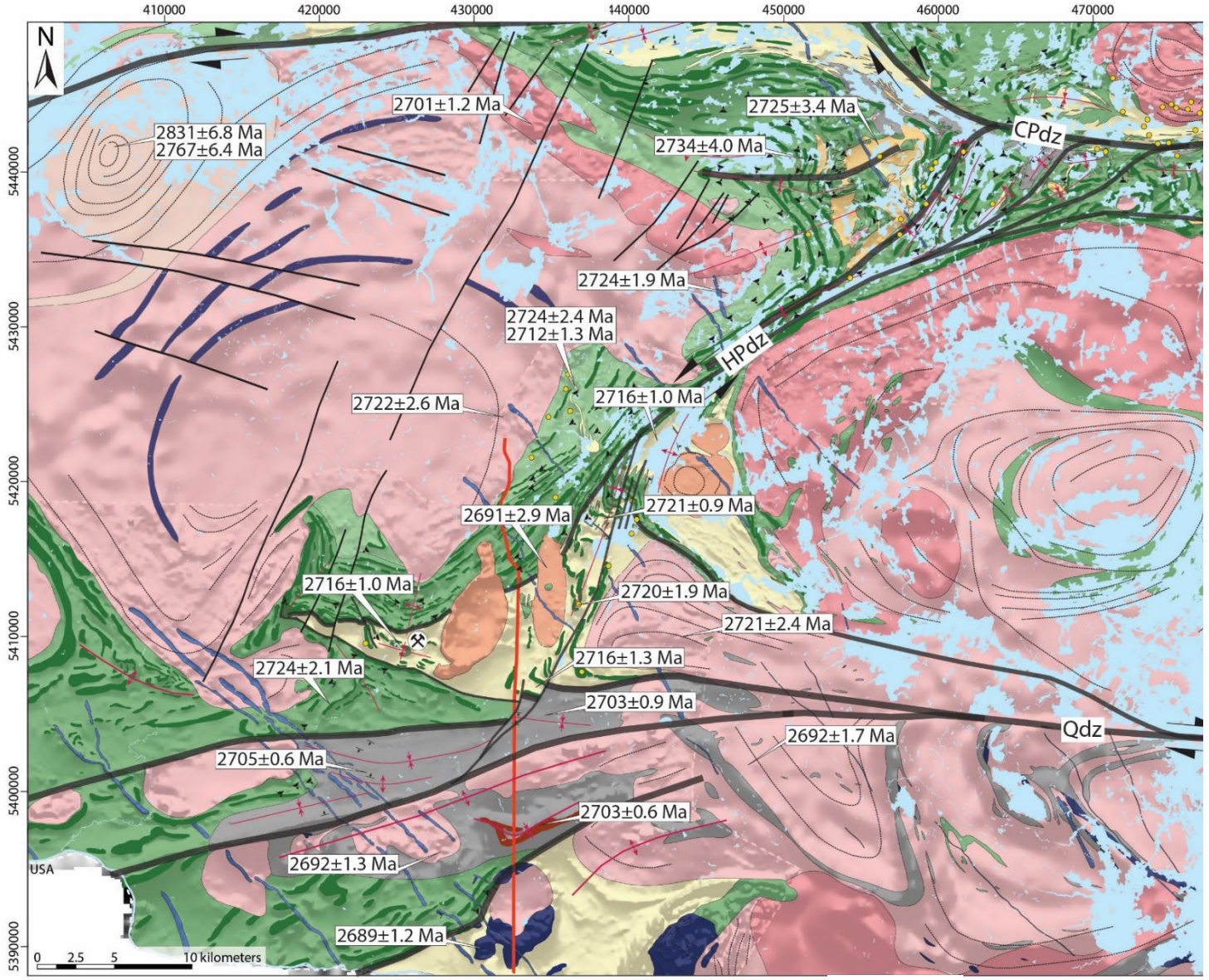


Rainy River transect – Regional geology





Rainy River transect – Regional geology

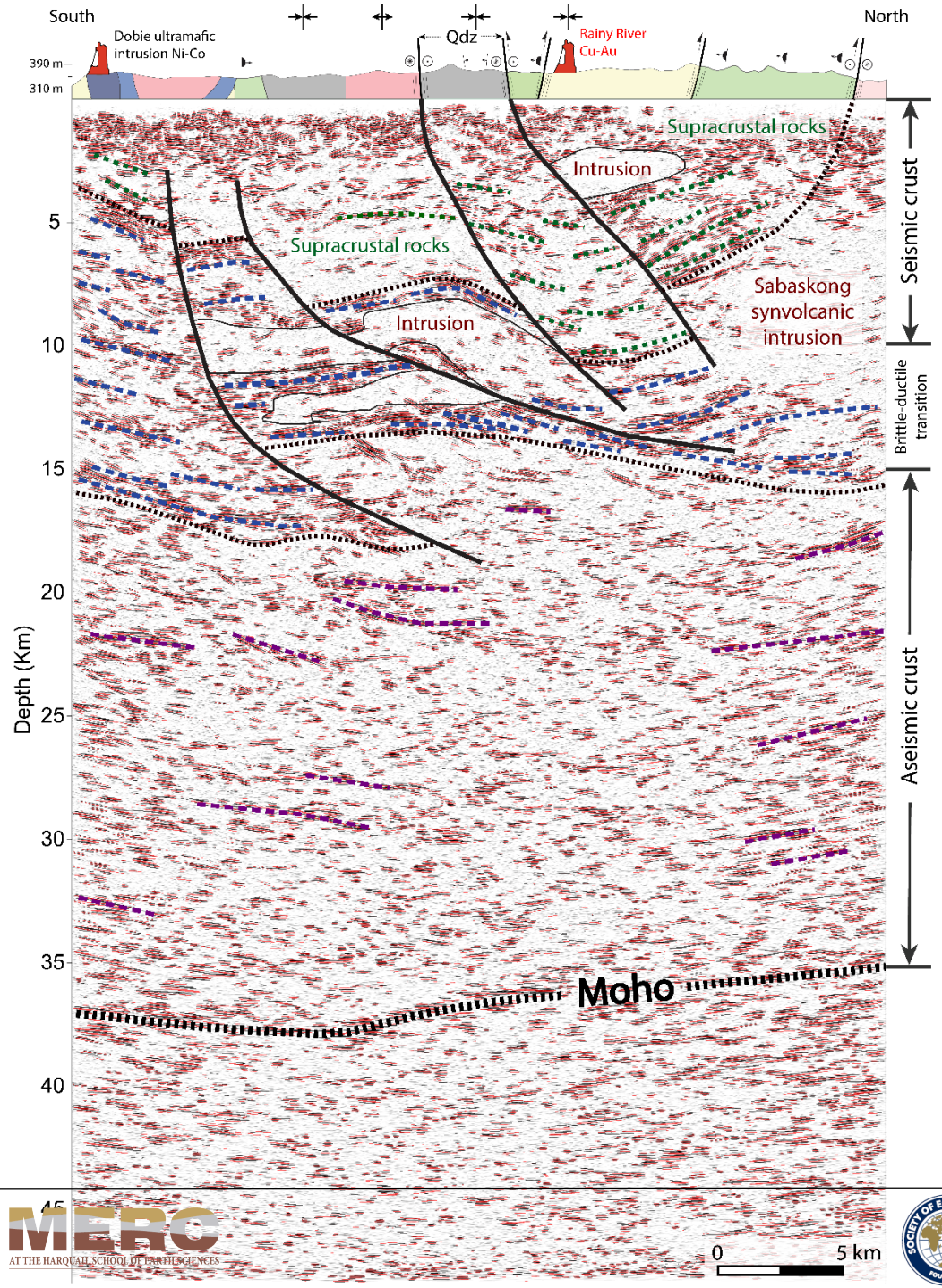


- **Synvolcanic Au-Ag-rich sulphide deposits (Rainy River 3.7 Moz of Au/9.4Moz of Ag):**
  - ➢ Relationship with Qdz?
  - ➢ Remobilization of gold mineralization during the regional deformation?
- **Synorogenic sedimentary basins and major deformation (Qdz) zones**

BUT poorly endowed:

- ➢ Geometry of deformation zone at depth
- ➢ Crustal stratigraphy and architecture
- ➢ Comparison with endowed transects from the Abitibi subprovince
- ➢ What parameters control the endowment of deformation zones?

Crustal architecture of the RRGB – R1 seismic profile



Upper crust:

- Weak seismic reflectivity
- Reflectors (sills/dikes?) dip toward to the S in the northern part and toward to the N in the southern part (Dome-and-keel structure?)
- Lower limit of the RRGB at ~5-9 km

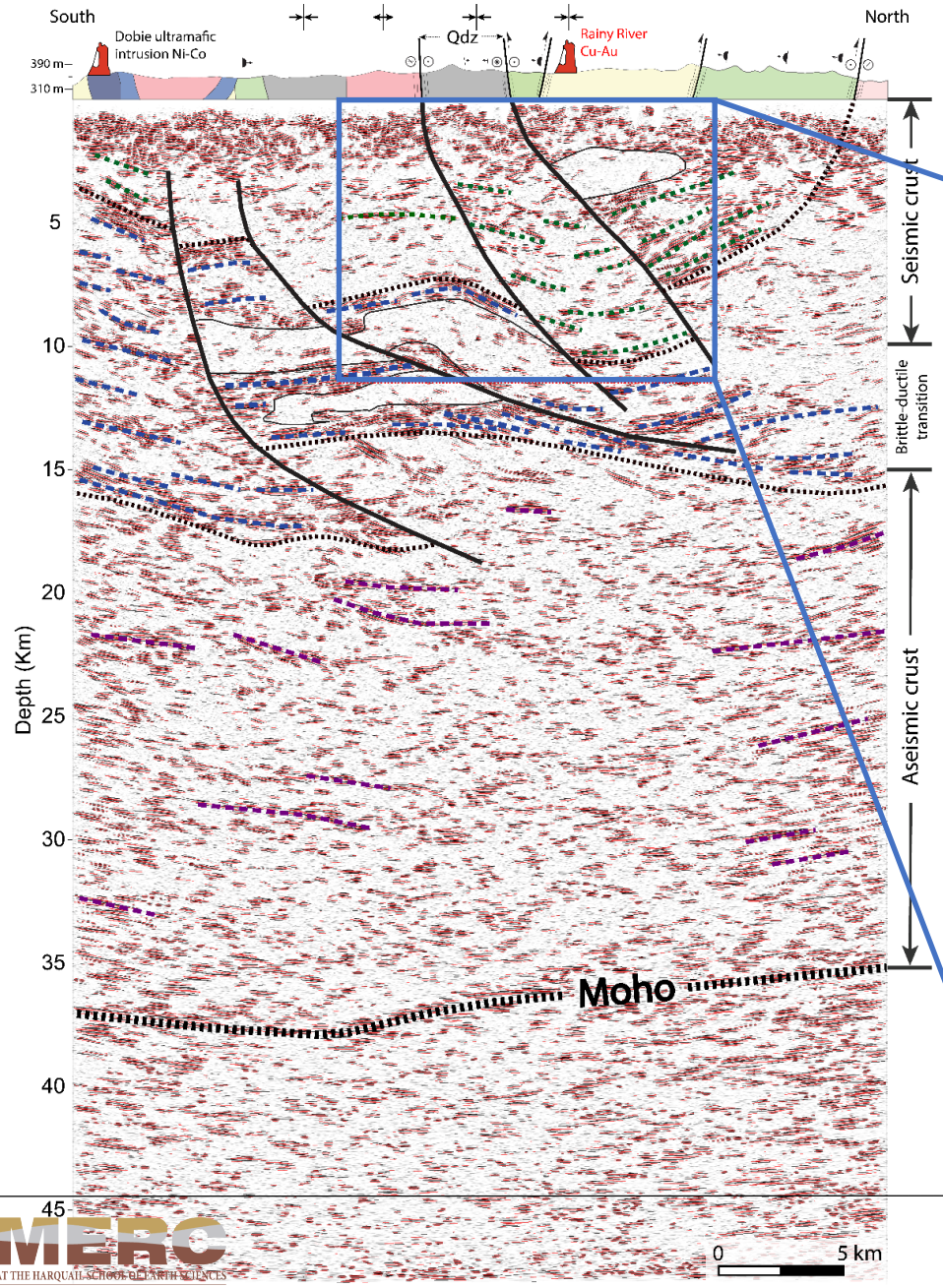
Middle crust:

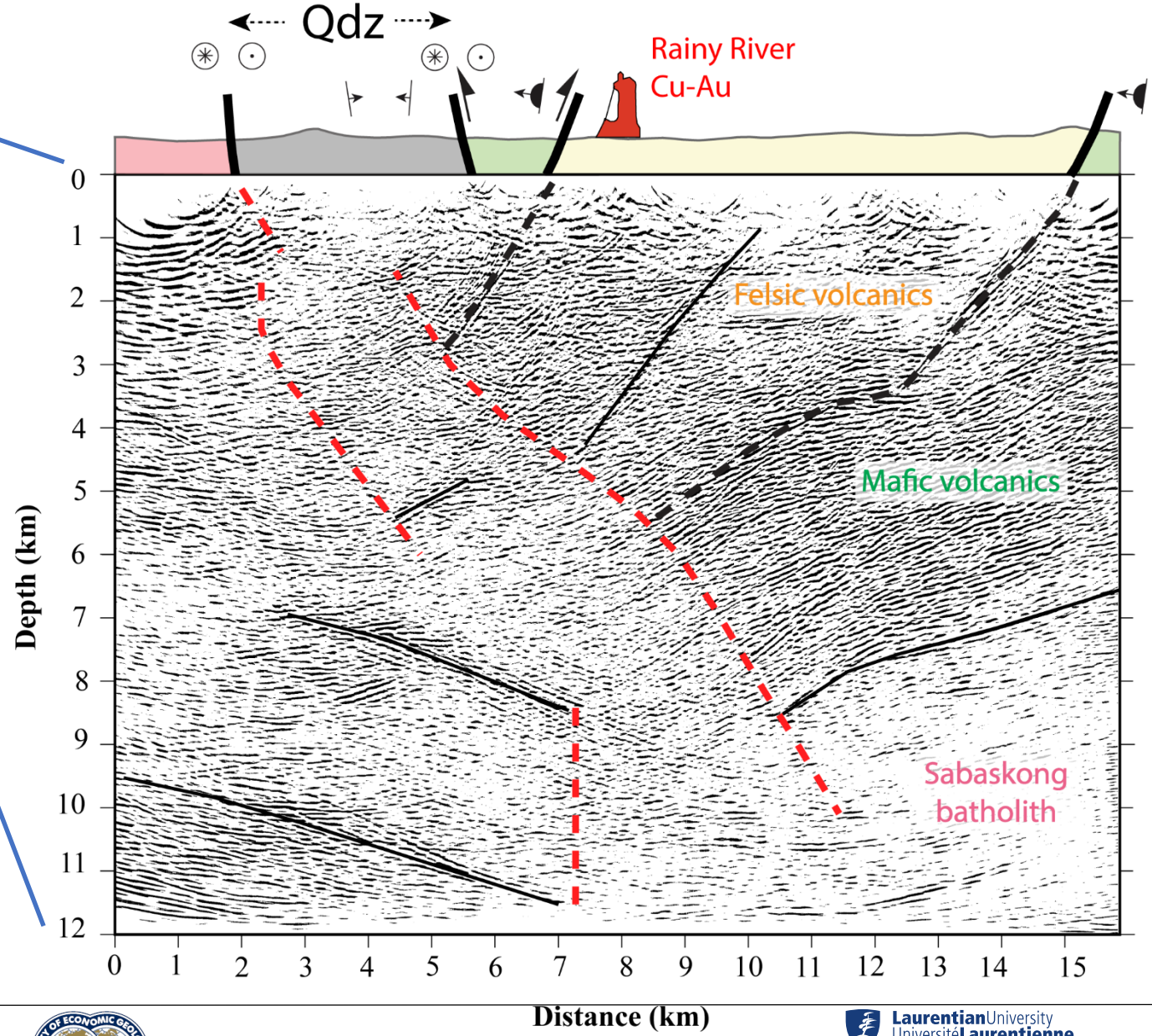
- Reflective crust between 9 and 15 km
- Less reflective domains = probable intrusions
- Interlayered mafic and TTG gneiss
- Depth extent of faults ~12-15 km

Lower crust:

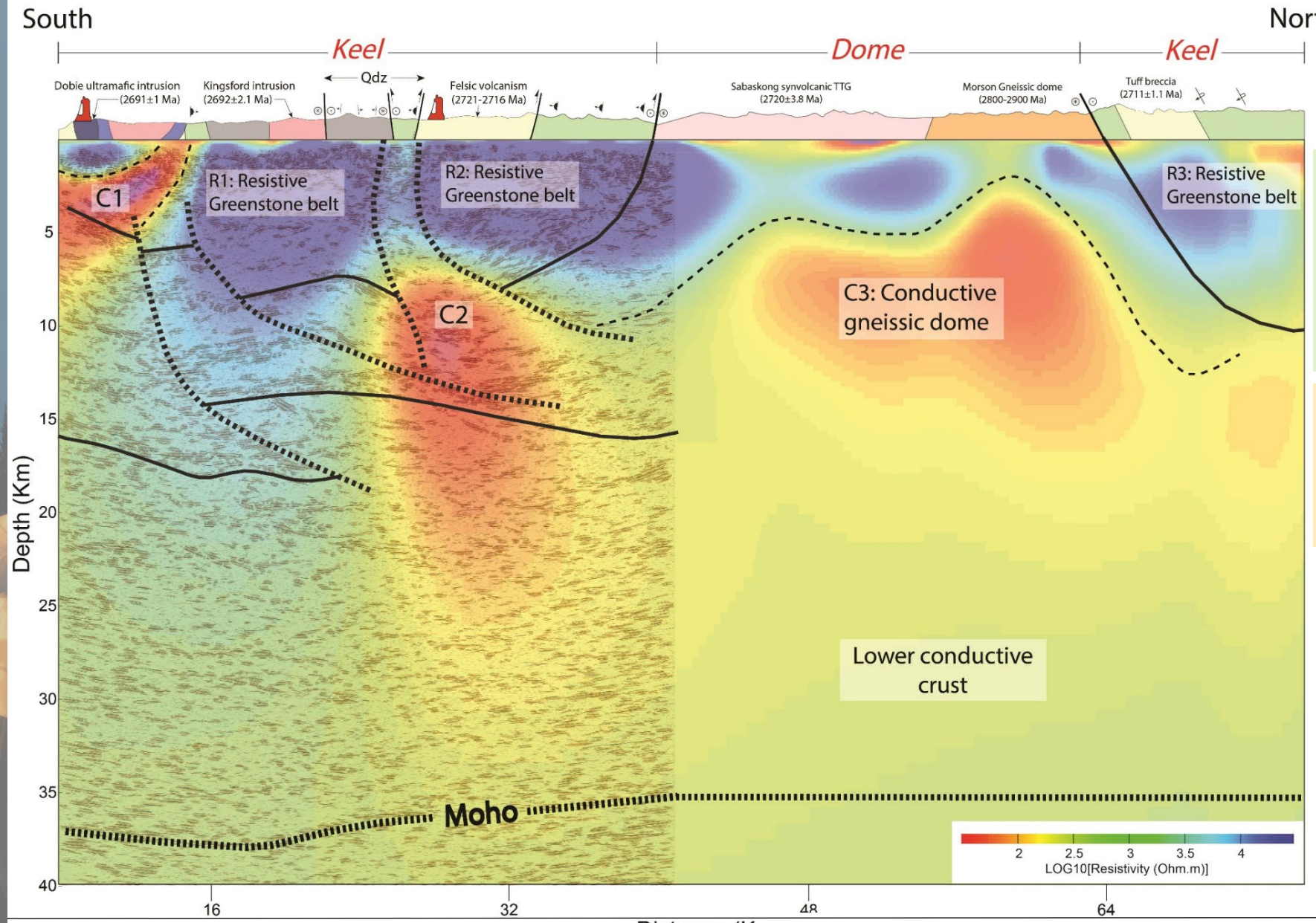
- Weak seismic reflectivity
- Subhorizontal reflectors
- Ductile homogeneous crust?
- Moho at ~37 km

Crustal architecture of the RRGB – R2 seismic profile





Crustal architecture of the RRGB – Full crustal seismic and MT



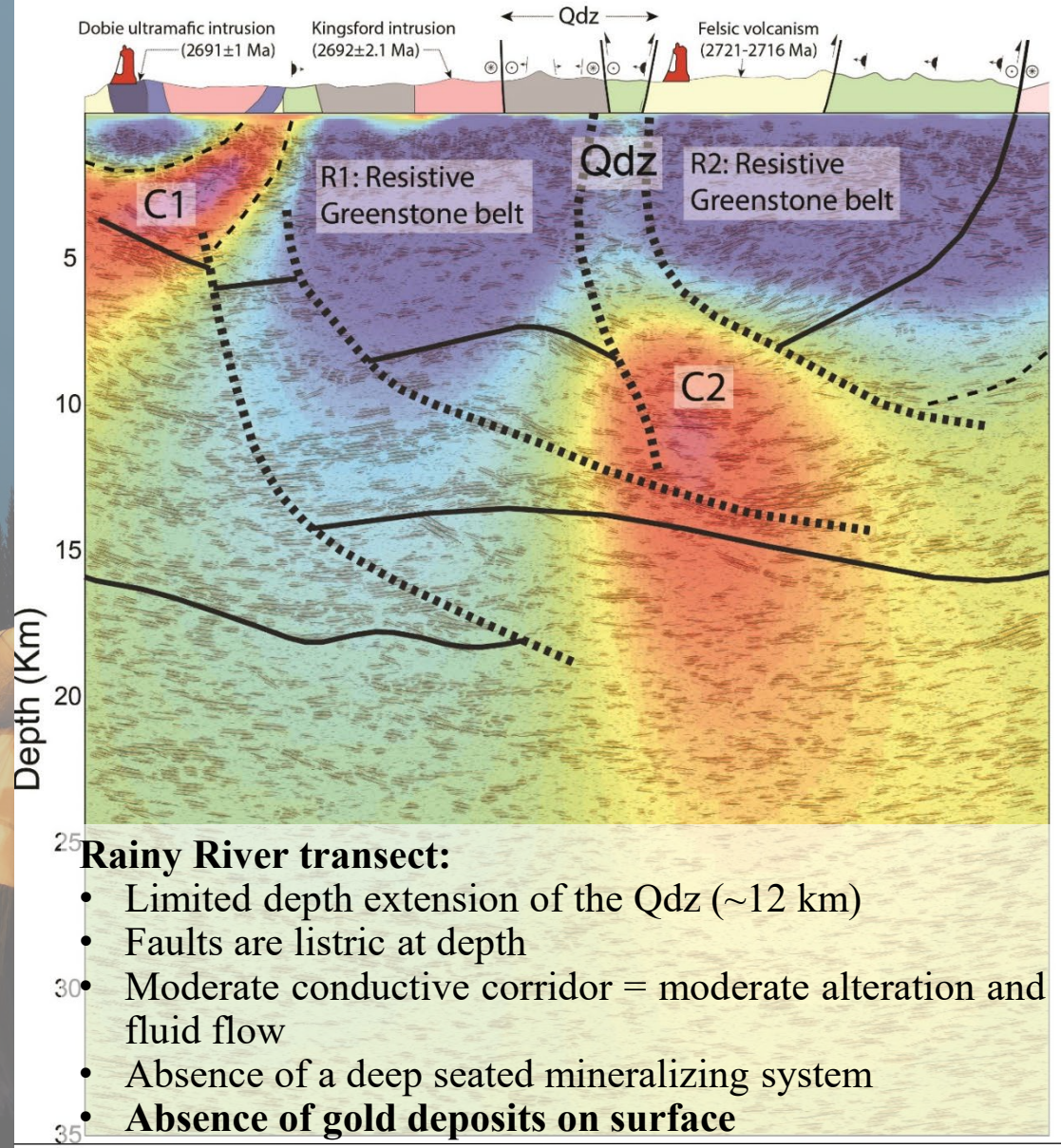
Upper crust:

- Resistive crust (R1, R2 and R3 anomalies) = Greenstone belts
- Subvertical relatively conductive corridor (C2) = depth extension of the Qdz?
- Conductive zone to the South (C1) = Ni-Cu Dobie ultramafic intrusion

Middle and lower crust:

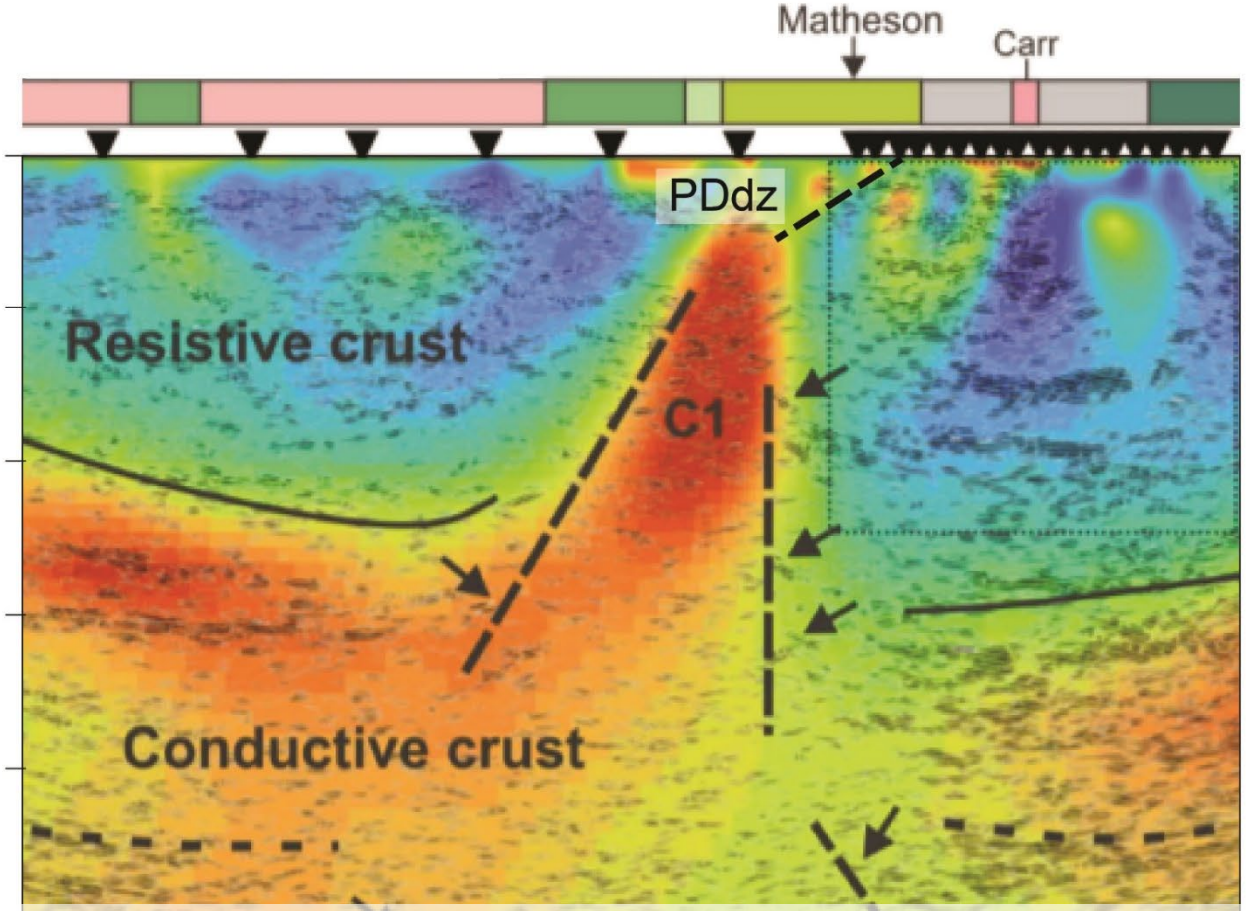
- Conductive lower crust = TTG gneisses
- C3 conductive anomaly = Gneissic dome related to Morson gneissic dome on surface?

s of fault geometry on gold endowment? – Comparison with the Matheson transect



Rainy River transect:

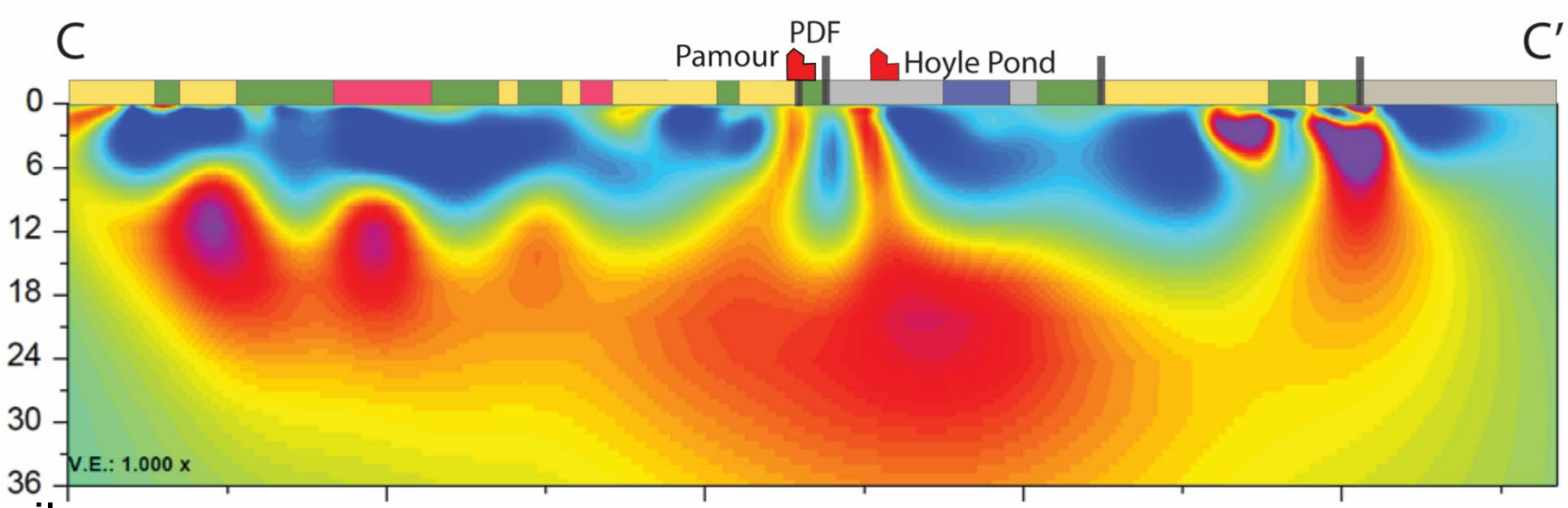
- Limited depth extension of the Qdz (~12 km)
- Faults are listric at depth
- Moderate conductive corridor = moderate alteration and fluid flow
- Absence of a deep seated mineralizing system
- **Absence of gold deposits on surface**



Matheson transect:

- Deep rooted PDdz (~30km)
- Faults are steep
- A deep-crustal conductive corridor connects the lower crust with the surface geology
- Existence of a deep seated mineralizing system – PDdz
- **Gold deposits on surface**

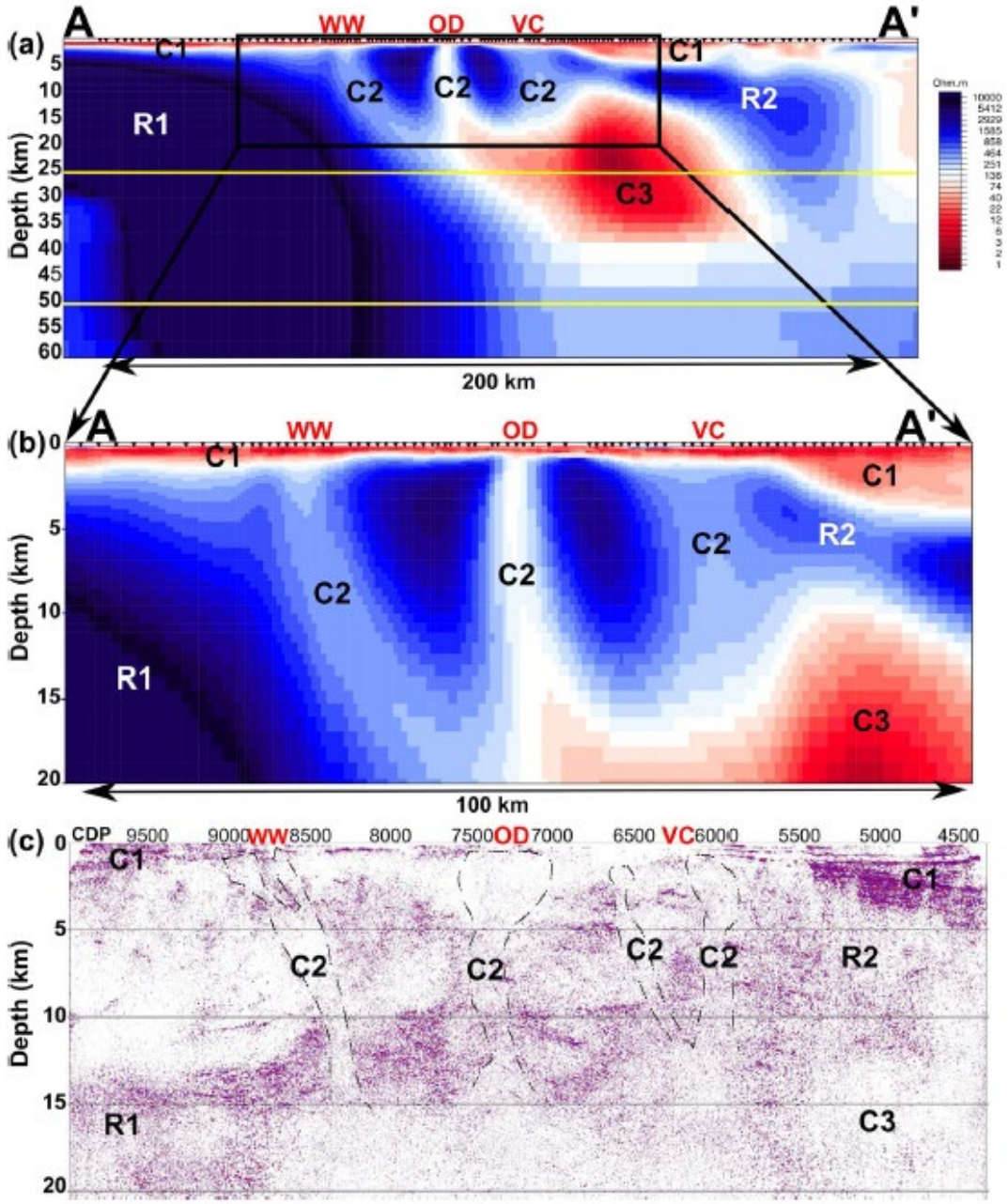
Geophysical signatures – Characteristics of fertile faults



All models display similar characteristics:

- ✓Largely resistive upper crust
- ✓Localized low resistivity zones in upper crust linked to laterally extensive mid-lower crust/upper mantle
- ✓Seismic opaque

Other Systems



Above the brittle-ductile transition, three narrow low resistivity zones (~100 Ωm) branch to the surface. The least resistive zone is remarkably aligned with the world-class IOCG-U Olympic Dam deposit and the other two with significant known IOCG-U mineral occurrences. These zones are spatially correlated with narrow regions of low seismic reflectivity in the upper crust, and the deeper lower-crust conductor is almost seismically transparent. We argue this whole-of-crust imaging encapsulates deep mineral system and maps pathways of metalliferous fluids from crust and mantle sources to emplacement at discrete locations.

Graham Heinson , Yohannes Didana, Paul Soeffky, Stephan Thiel & Tom Wise. Nature Scientific REPORTS | *(2018) 8:10608* | DOI:10.1038/s41598-018-29016-2

Major Structures Control the Gold

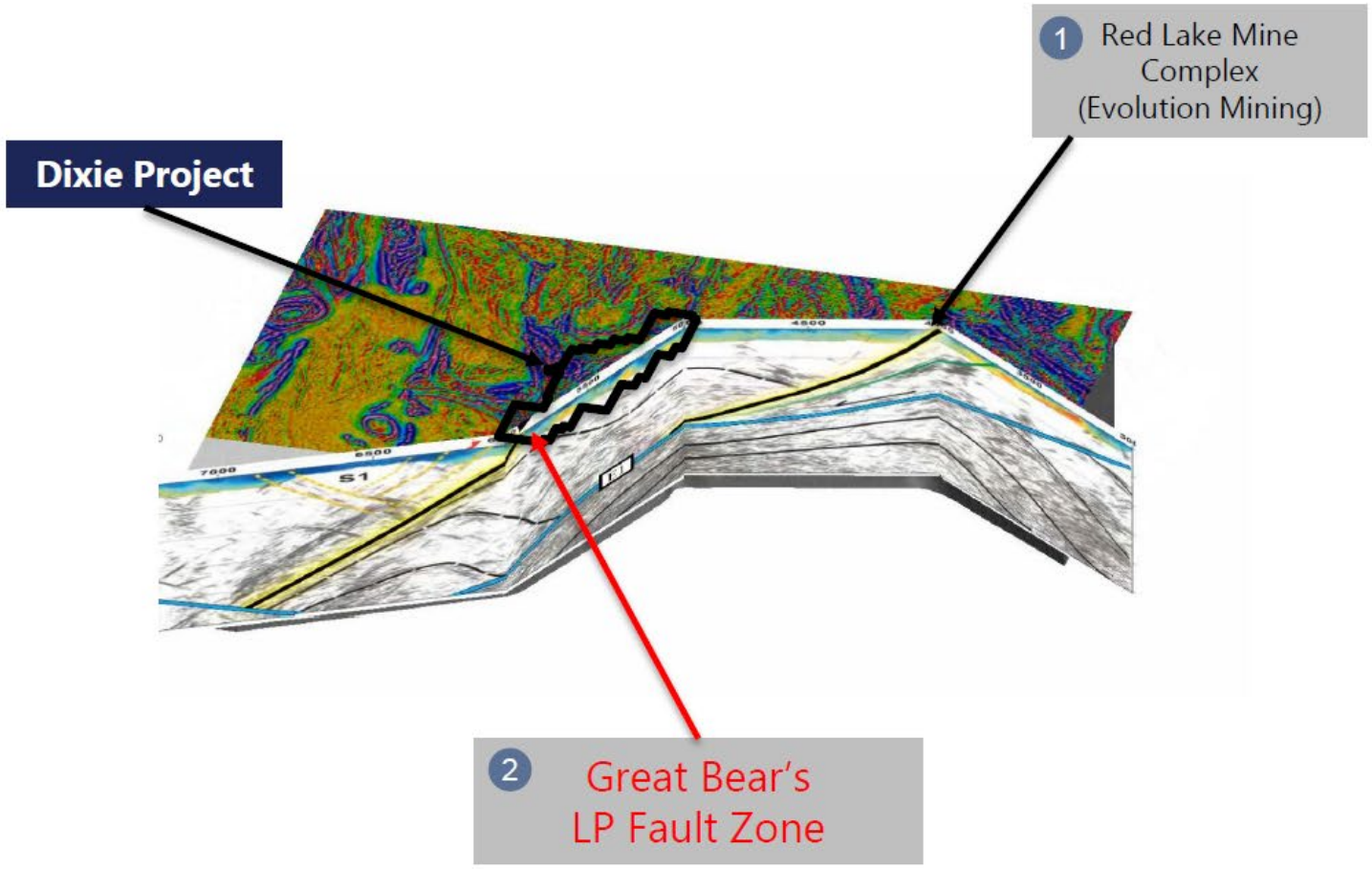
Two places in Red Lake where large structures bring gold to surface

1

Red Lake Mine Complex
Cumulative gold production of 25 million ounces

2

LP Fault
Four gold zones drilled to date with apparent continuity being drilled over 4km, within an 18km target



Seismic cross section after Zeng & Calvert, 2006

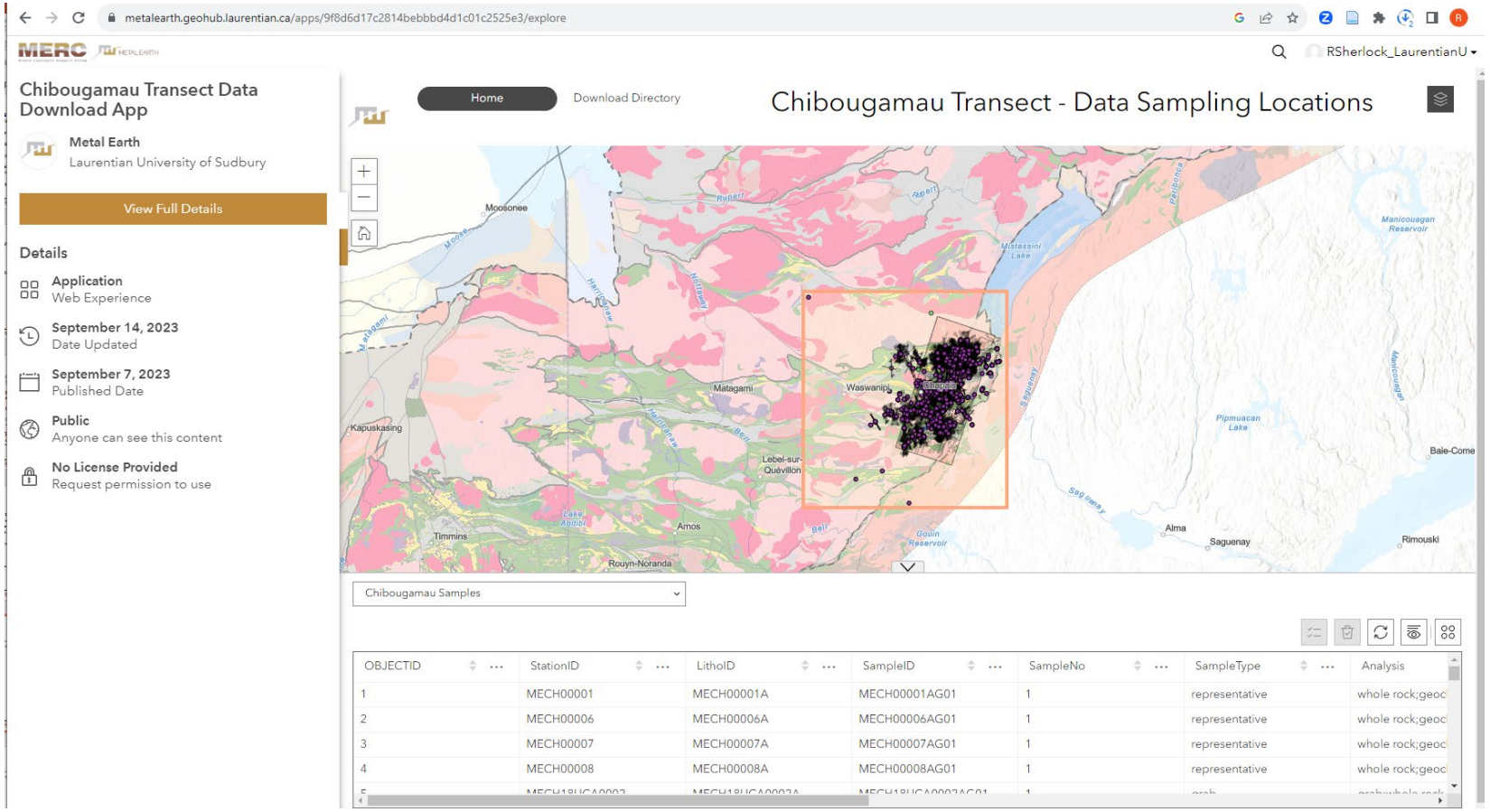
What are the differences between sections of variable endowment

Able to map fertile fault systems
Tend to be late, planar features, separating domains of variable seismic impedance
Upper crust largely resistive.
Broad zones of lower resistivity in lower crust.
Deep seated faults with associated lower resistivity in immediate HW (alteration)
Isotropic to seismic

Areas with weaker metal endowment why ??

- Weaker precious and base metal fertility in the supracrustal rocks ?
- Difference in volcanic rocks (ultramafic flows are notably absent in the Wabigoon)
- Was the timing of fluid generation different that the timing of deformation in the fault system
- Differences in overall lithospheric architecture, under plating by different substrate ?
- Differences in the geodynamic processes

Metal Earth Data Chibougamau / Malartic online now



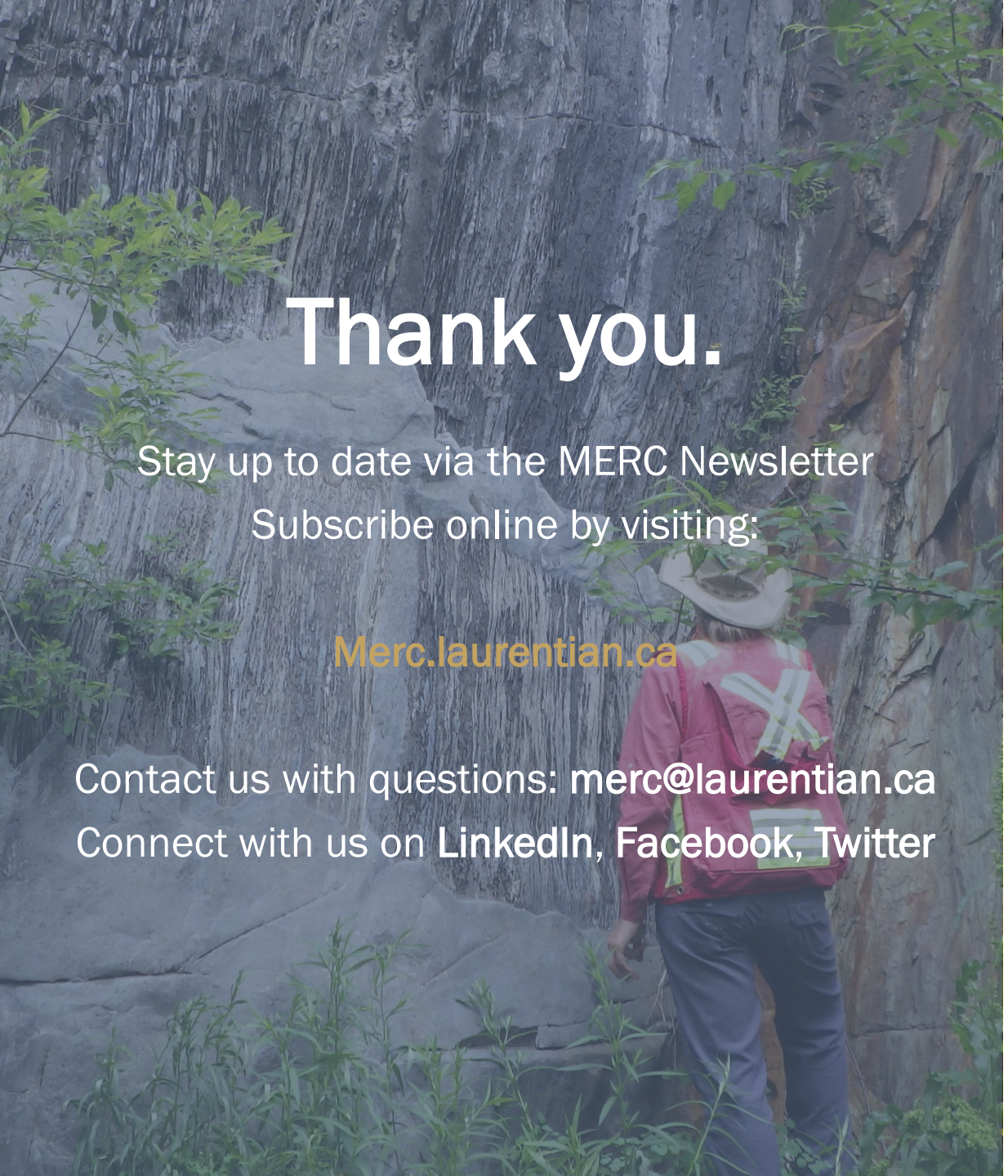
Geology
Geochemistry
Gravity
MT
Seismic

Geochron database (separate)

Superior Map

All open source

https://metalearth.geohub.laurentian.ca/



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