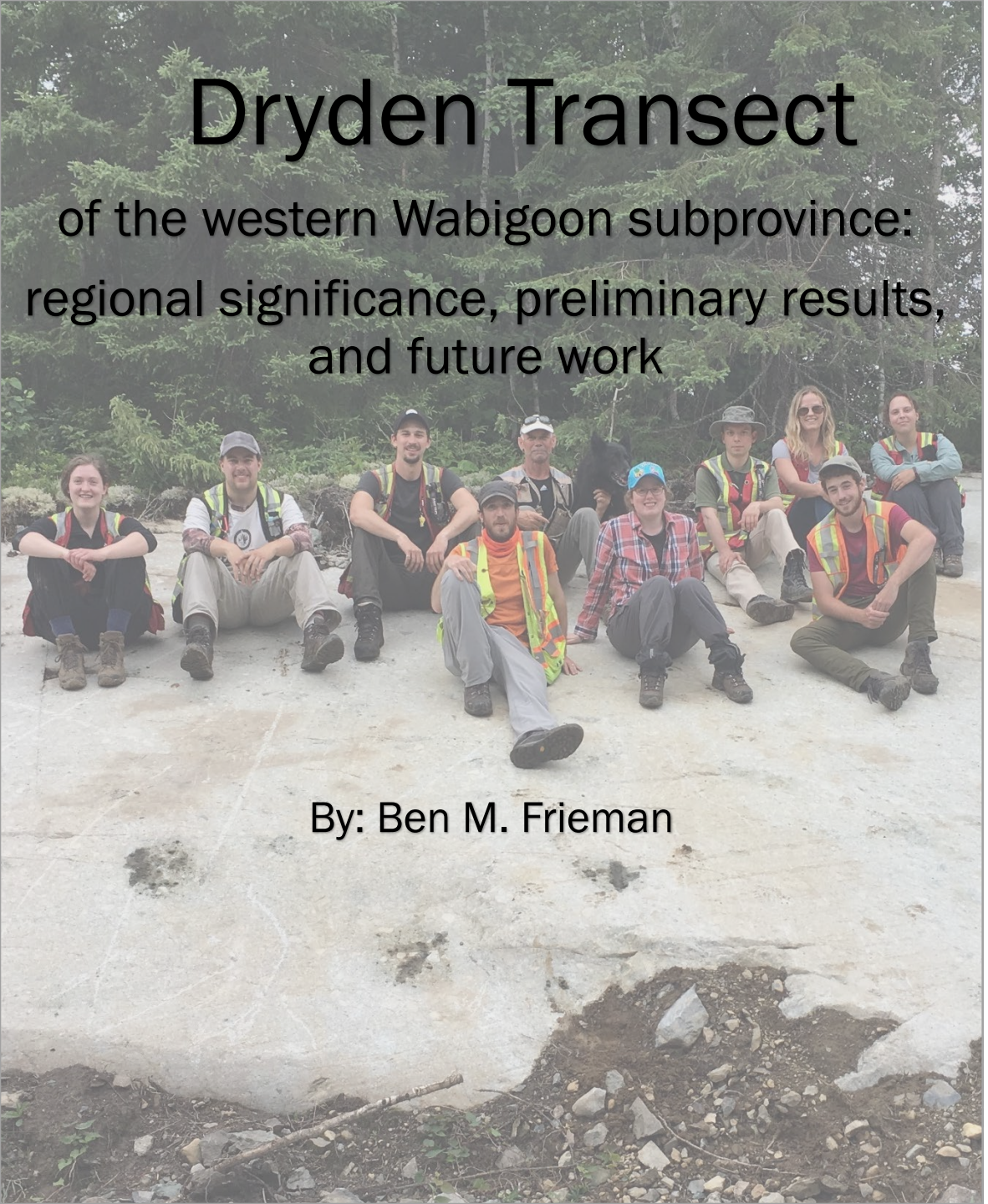
Dryden Transect

of the western Wabigoon subprovince: regional significance, preliminary results, and future work



By: Ben M. Frieman

METAL EARTH

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

CANADA FIRST RESEARCH EXCELLENCE FUND

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HARQUAIL SCHOOL OF EARTH SCIENCES ÉCOLE DES SCIENCES DE LA TERRE

MERC Mineral Exploration Research Centre

Motivation and Project Significance

The Goal of Metal Earth

ELUCIDATE THE FACTORS THAT CONTRIBUTE TO VARIABLE METAL ENDOWMENTS IN GREENSTONE BELTS OF THE SUPERIOR PROVINCE

Based on new field, geochronological, and geochemical investigations combined with a range of geophysical data sets (e.g., seismic, MT, airborne magnetic)

The Abitibi subprovince

- **Contains several world-class and many smaller, economic base and precious metal deposits**
- **Known deposits total >150 Moz Au and ~775 Mt polymetallic ore from VMS**

The western Wabigoon subprovince

- **Contains no world-class deposits**
- **Known deposits total <10 Moz Au**

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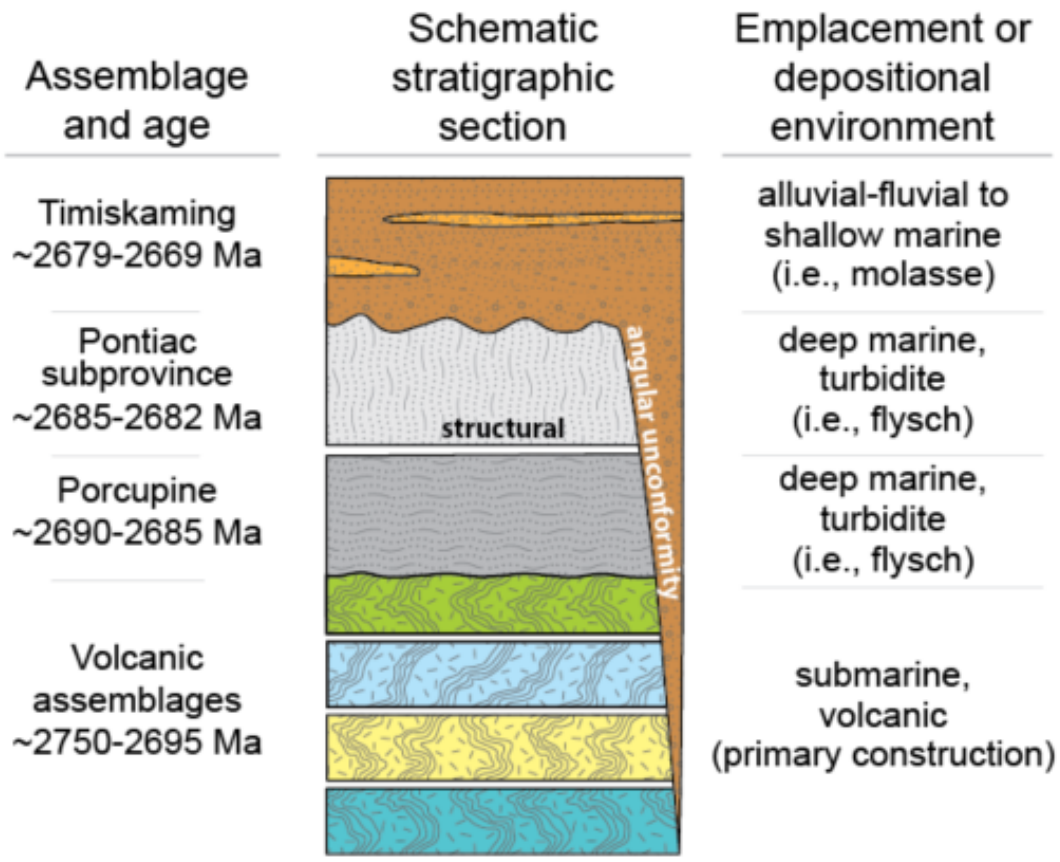
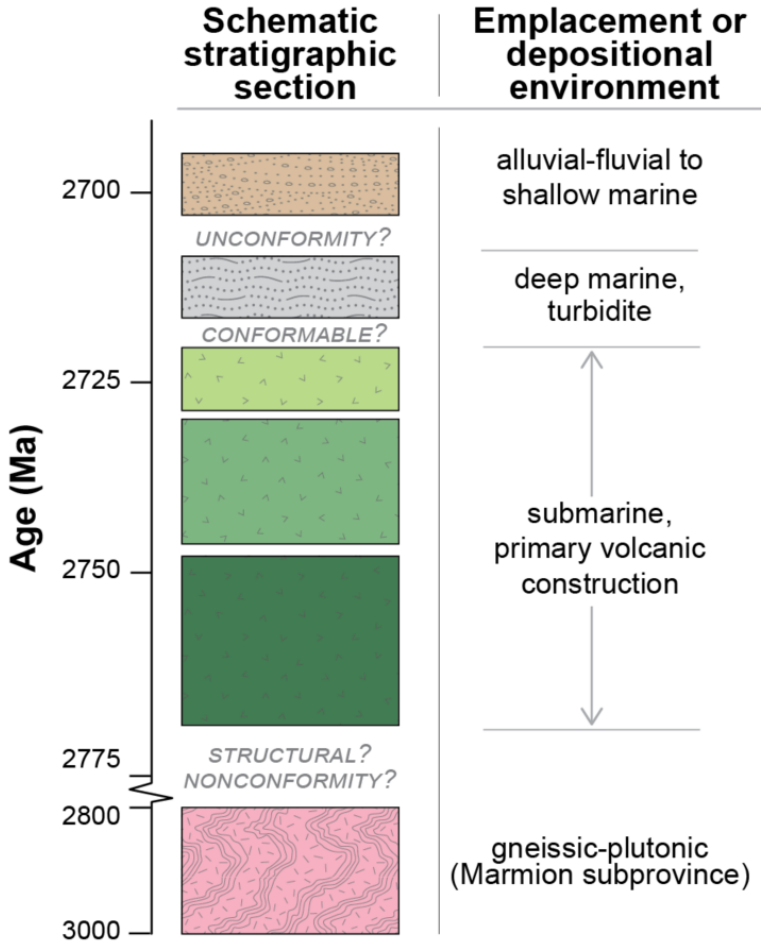
Correlative Stratigraphic Evolution

southern Abitibi subprovince



(Frieman, 2018; PhD thesis)

western Wabigoon subprovince



Stratigraphically, the Abitibi = the Wabigoon (-20 Ma)

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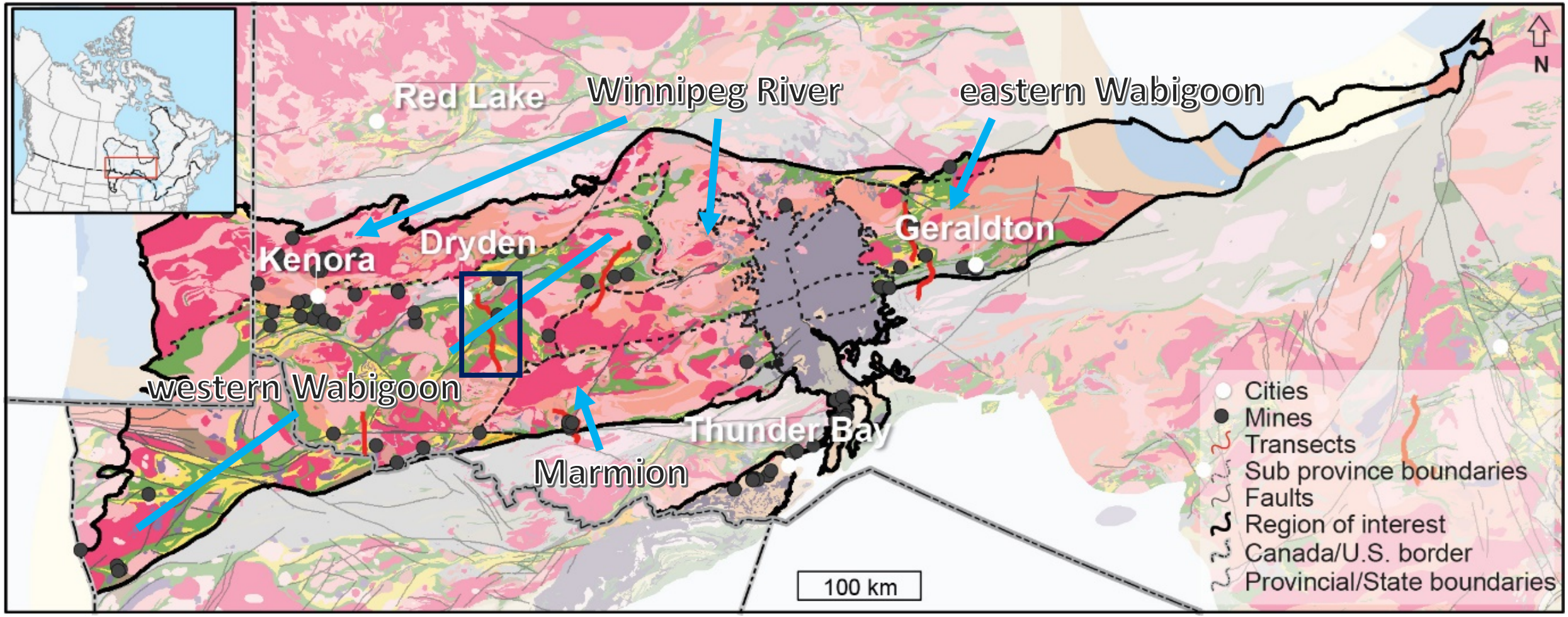
The Western Superior Province Study Region



(Modified fromMontsion et al., *2018; MERC-ME publication)*

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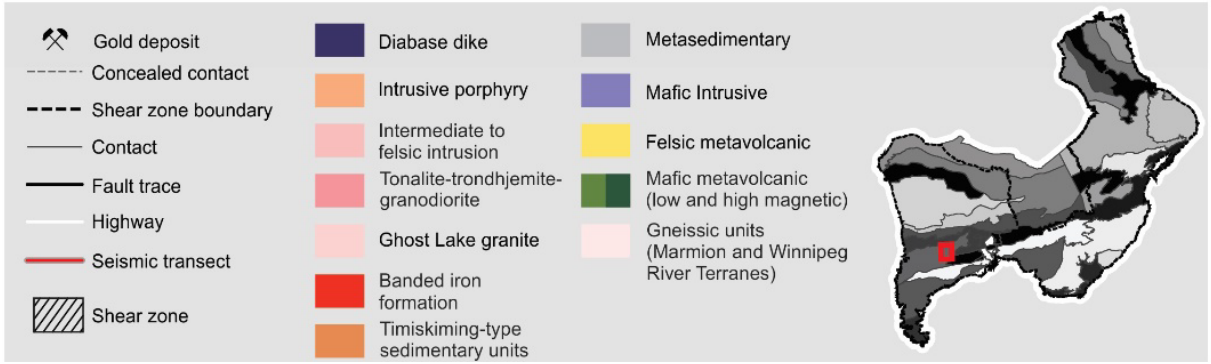
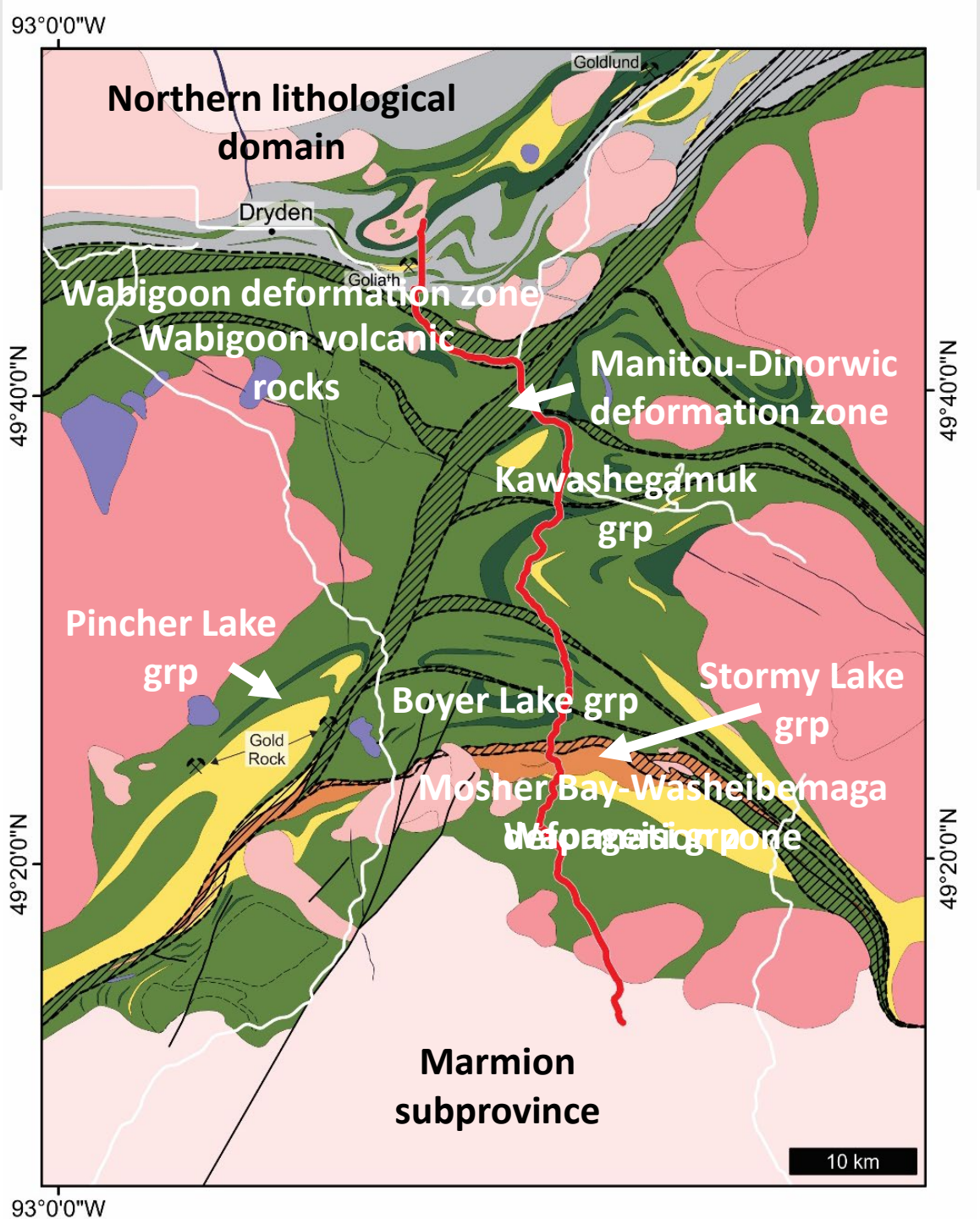
Research Goals & Geologic Setting

In order to establish factors that contributed to poor metal endowment in the western Wabigoon subprovince, we aim to:

- Refine the stratigraphic development (determine contact relationships and ages)
- Refine the structural, magmatic, and metamorphic evolution
- Integrate these results into a new synthesis for the geodynamic setting for the western Wabigoon subprovince
- Establish comparative relationships to the well endowed Abitibi subprovince

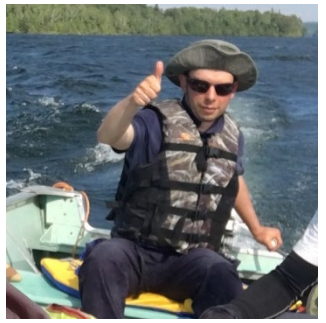




Transect Personnel & Associated Researchers

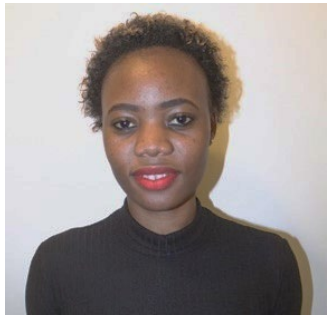
The Dryden team (i.e., the Wabigoonies)

- Faculty: Dr. Stéphane Perrouty (HES)
- PDF/RA: Dr. Ben Frieman (ME)
- PhD: Rebecca Montsion (ME-Thematic)
- MSc 1: Kendra Zammit (ME)
- MSc 2: David Downie (ME)
- MSc 3: Amokelani Mavundza (ME-GSM)
- MSc 4: Matshidiso Modiba (ME-GSM)
- BSc 1: Katharina Holt (Queens)
- BSc 2: Brandon Smith (ME-Thematic)
- Honorary: Chubs the camp dog









(Chubs not Brandon)

GIS analytics – Thematic PhD Project

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- BSc 1: Katharina Holt (Queens)
- BSc 2: Brandon Smith (MERC)

Project overview:

Advancing GIS-based prospectivity techniques to aid in the exploration of greenstone belts

- Study includes comparative case studies in the western Wabigoon and Abitibi subprovinces
- Utilize lithological, geochemical, and structural data sets
- Incorporate 3D implicit modelling into prospectivity analysis
- Develop techniques to incorporate uncertainty analysis into prospectivity analysis

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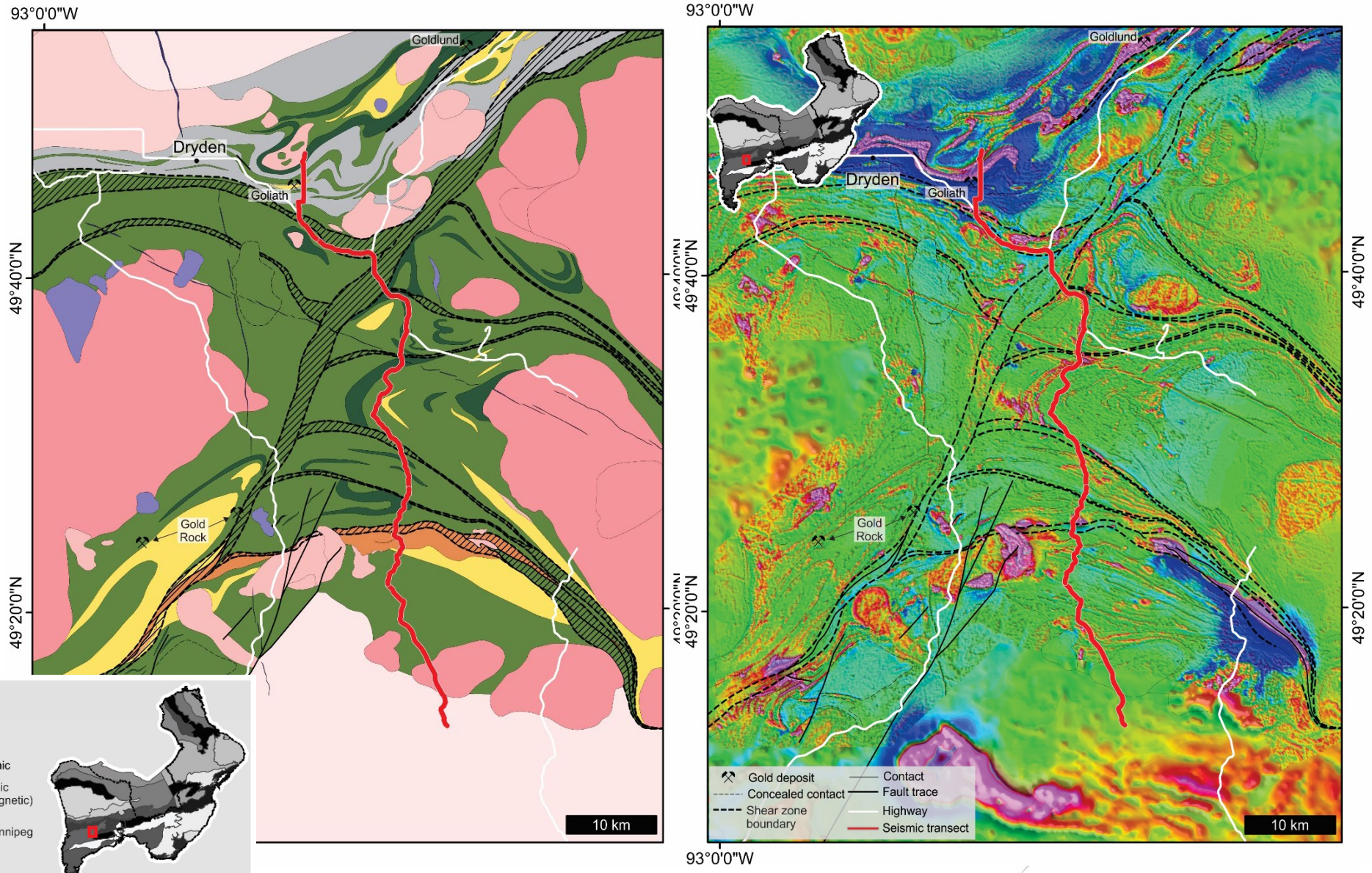
New Geological Map for the Dryden Study Area

New geologic map based on existing lithological observations and geophysical data
(Montsion et al., in prep)



Structural Evolution of the Western Wabigoon Subprovince

The Dryden team (i.e., the Wabigoonies)

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- BSc 2: Brandon Smith (MERC)

Project overview:

Structural and metallogenic evolution of the western Wabigoon subprovince

- Focus on the deformation histories of major high-strain corridors
- To determine the relative and absolute timing of deformation (mapping and geochronology)
- Investigate structural controls on known occurrences (e.g., Gold Rock and Goldlund)

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Intrusion-related Systems in the WWS

The Dryden team (i.e., the Wabigoonies)

- Faculty: Dr. Stéphane Perrouty (HES)
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- BSc 2: Brandon Smith (MERC)

Project overview:

- Structural, geochemical, and metallogenic setting of intrusive bodies

Significance:

- Intrusion-related gold occurrences are common but no significant deposits of this type occur in the study area

Data sets utilized:

- In part, the study includes detailed mapping, characterization of alteration systems by mass balance calculations, and geochronology

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Amokelani and Matshidiso MSc studies

The Dryden team (i.e., the Wabigoonies)

- Faculty: Dr. Stéphane Perrouty (HES)
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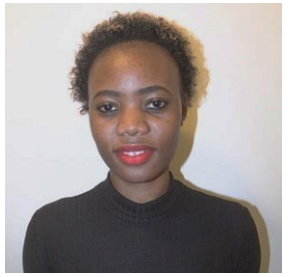
- BSc 2: Brandon Smith (MERC)

Project overviews:

- Characterizing the magnetic response of felsic to intermediate intrusions of the western Wabigoon subprovince
  - Characterize the magnetic patterns of intrusive rocks
  - Link magnetic response to physical properties (e.g., mineralogy, textures, etc.)
  - Aid in interpretations of magnetic signatures elsewhere in the Superior Province as they may relate to REE, Li, or Au deposits



- Volcanosedimentary facies of the Stormy Lake group: provenance, paleoenvironmental evolution, and geodynamic significance

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Katharina Holt - BSc Thesis (Queens University)

The Dryden team (i.e., the Wabigoonies)

- Faculty: Dr. Stéphane Perrouty (HES)
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- BSc 2: Brandon Smith (MERC)

Project overview:

Thesis titled:

'Kinematic analysis of the Manitou-Dinorwic deformation zone and its implications for mineral exploration in the western Wabigoon subprovince'

- Incorporated regional structural observations with outcrop-scale mapping and microstructural
- Results suggest that felsic dikes within the fault zone may have imparted a rheological control on the location of gold mineralization
- Results further constrain the Manitou-Dinorwic deformation zone as a major, NE-trending sinistral transpressive high-strain zone

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Ben Frieman, PDF/RA: Research goals

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Major research themes:

1) Regional synthesis of the stratigraphic and structural evolution (2 manuscripts)
   - Incorporate geophysics with new mapping, geochronology, and geochemistry
   - Compilation of existing geochemistry and geochronology
2) Geodynamic significance recorded by successor basin deposits (1 manuscript)
   - Detrital zircon age patterns by LA-ICP-MS
   - Whole-rock geochemistry of intercalated volcanic rocks
   - Structural history of the basins
3) Meso- to Neoarchean evolution of the western Marmion subprovince (1 manuscript)
   - Sample collection largely complete
   - LA-ICP-MS on zircon in spring

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