

# **Bird River greenstone belt in Manitoba – Neoproterozoic arc magmatism in the western Superior Province**

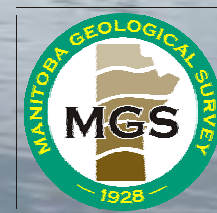
**Paul Gilbert**

**Manitoba Geological Survey**

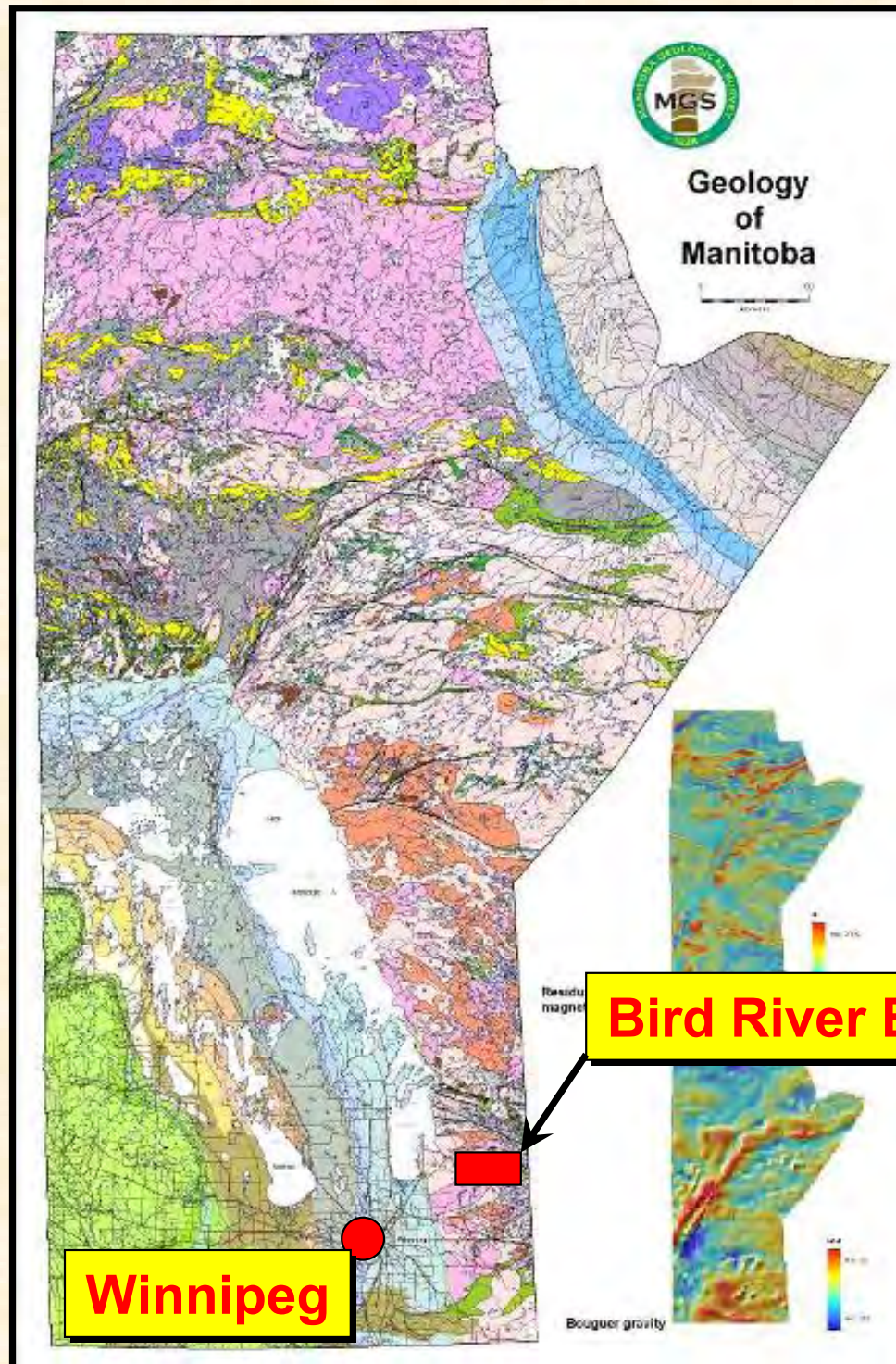




# Location of Bird River Belt

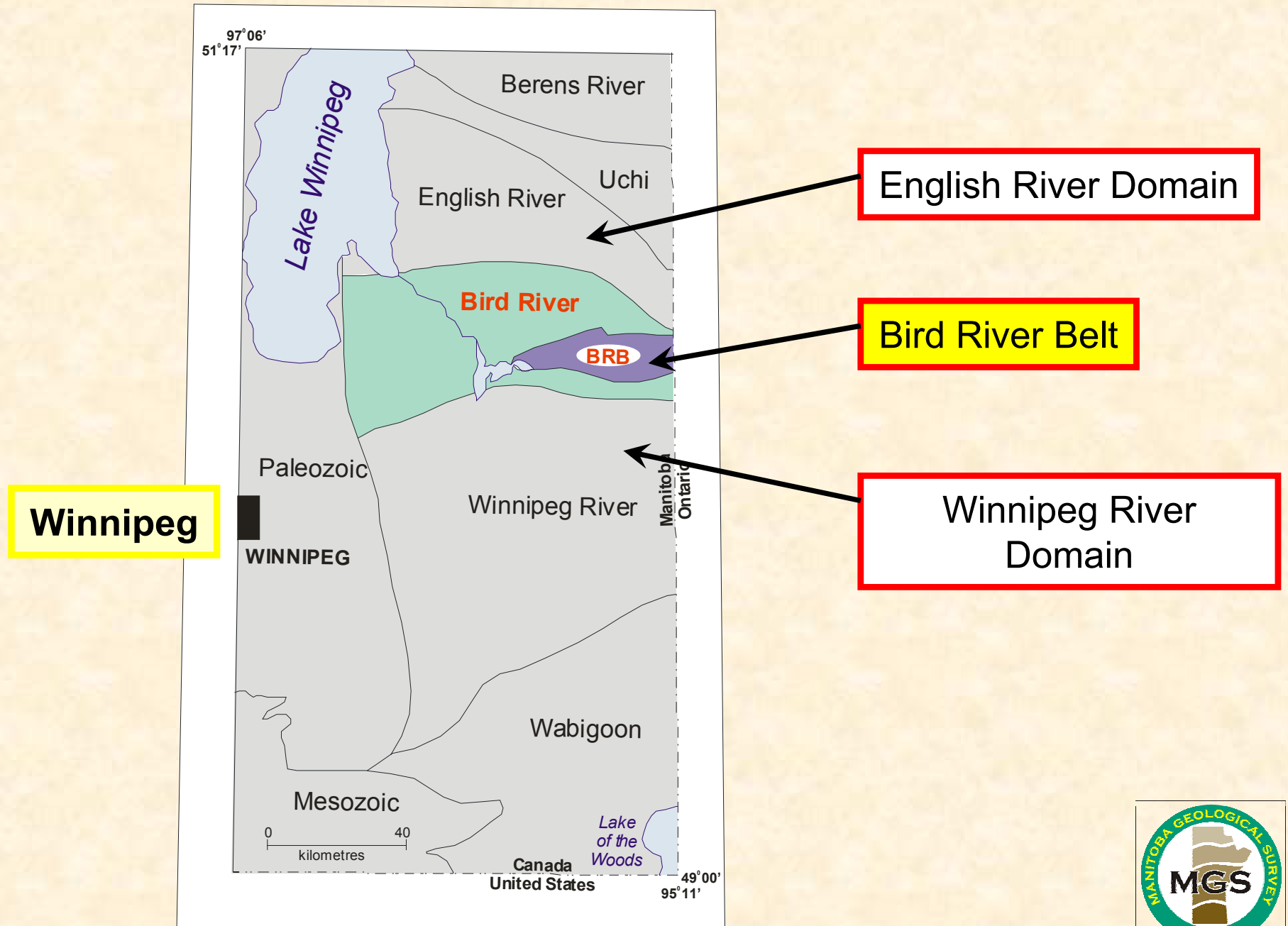


# Location of Bird River Belt in Manitoba






# Geological Domains in southwest Superior Province



# Bird River Belt extent

 Neoarchean Bird River Belt  
(150 km Manitoba-Ontario)

contains

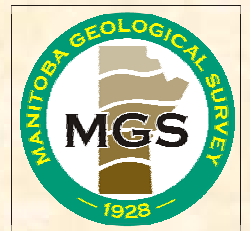
TANCO Mine ~  
75% world Cs; also Ta

Bird River Sill ~  
PGE, Cr (Ni, Cu, Zn)



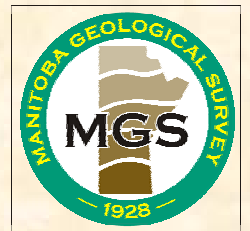
# Outline of presentation

1. Geological overview Bird River Belt
2. Geochemical – geochronological update
3. Regional domain relationships
4. Summary

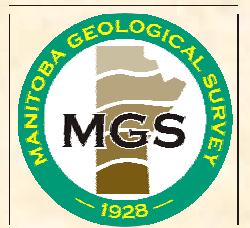


# Bird River Belt projects initiated in 2005

1. Paul Gilbert (**Manitoba Geological Survey**)  
1: 20 000 scale mapping
2. Manuel Duguet (**Post doctoral student, Univ. of Waterloo**)  
Regional mapping (1: 50 000 scale) with focus on structural geology
3. Paul Kremer (**MSc graduate student, Univ. of Waterloo**)  
Setting of TANCO pegmatite
4. Caroline Mealin (**MSc graduate student, Univ. of Waterloo**)  
Mapping of mafic-ultramafic Bird River Sill (PGE potential)



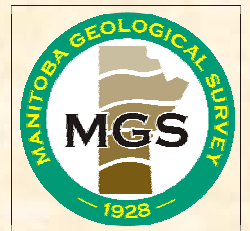
# Geological overview



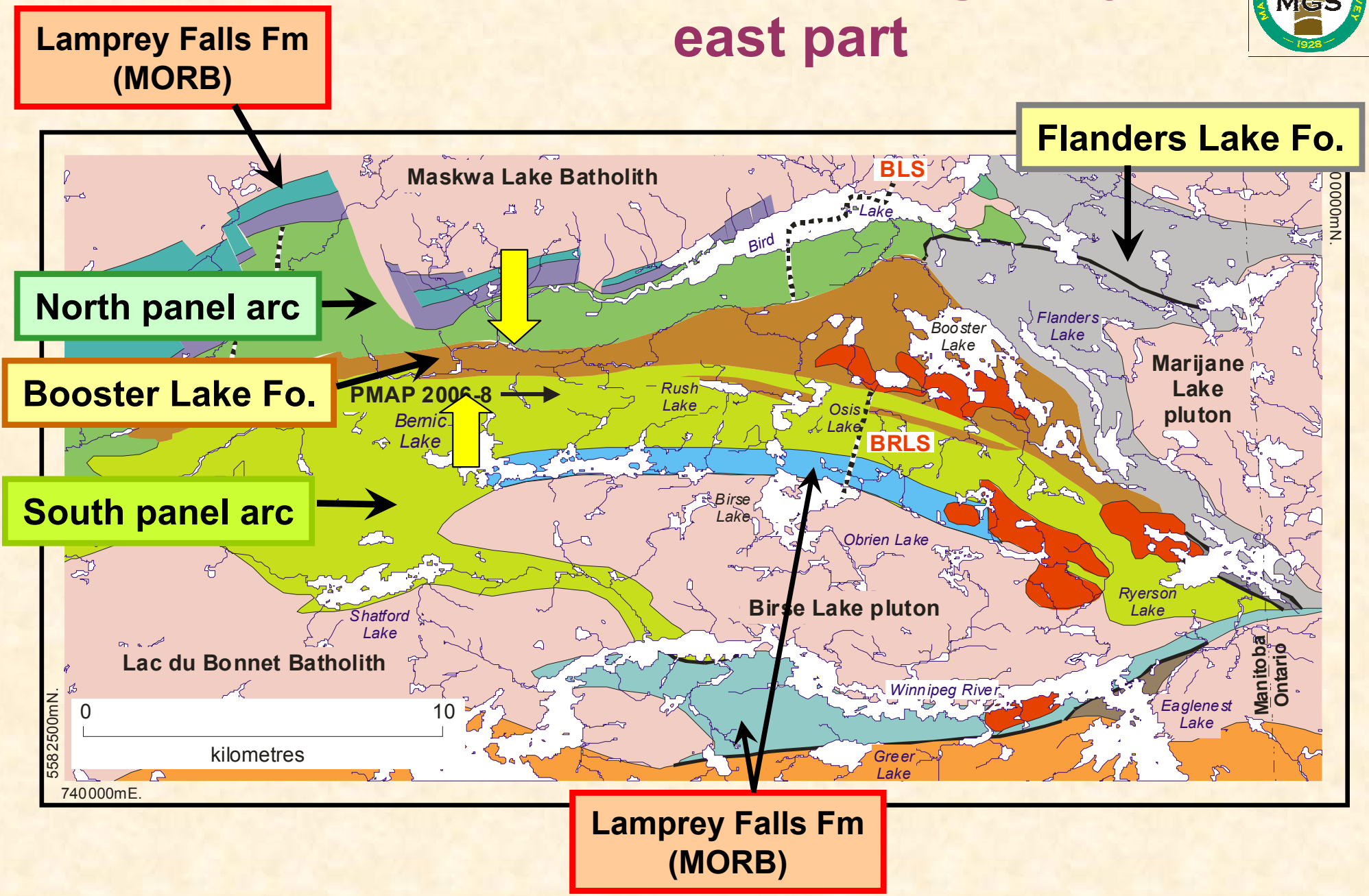


# **Bird River Belt Stratigraphy**

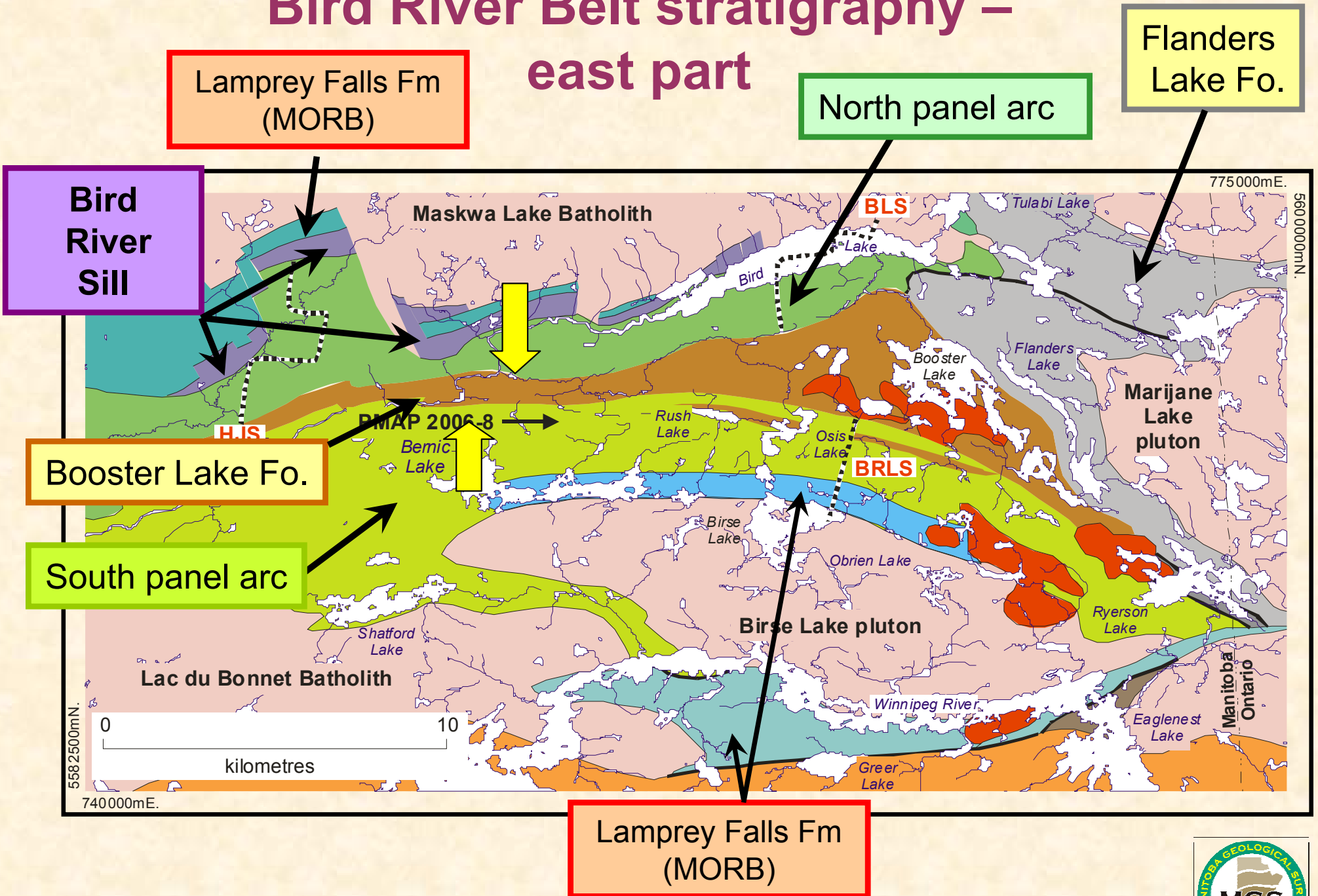
- 1. MORB-type volcanic rocks**
- 2. Arc-type assemblage**
- 3. Younger sedimentary rocks**



# Bird River Belt stratigraphy – east part



# Bird River Belt stratigraphy – east part



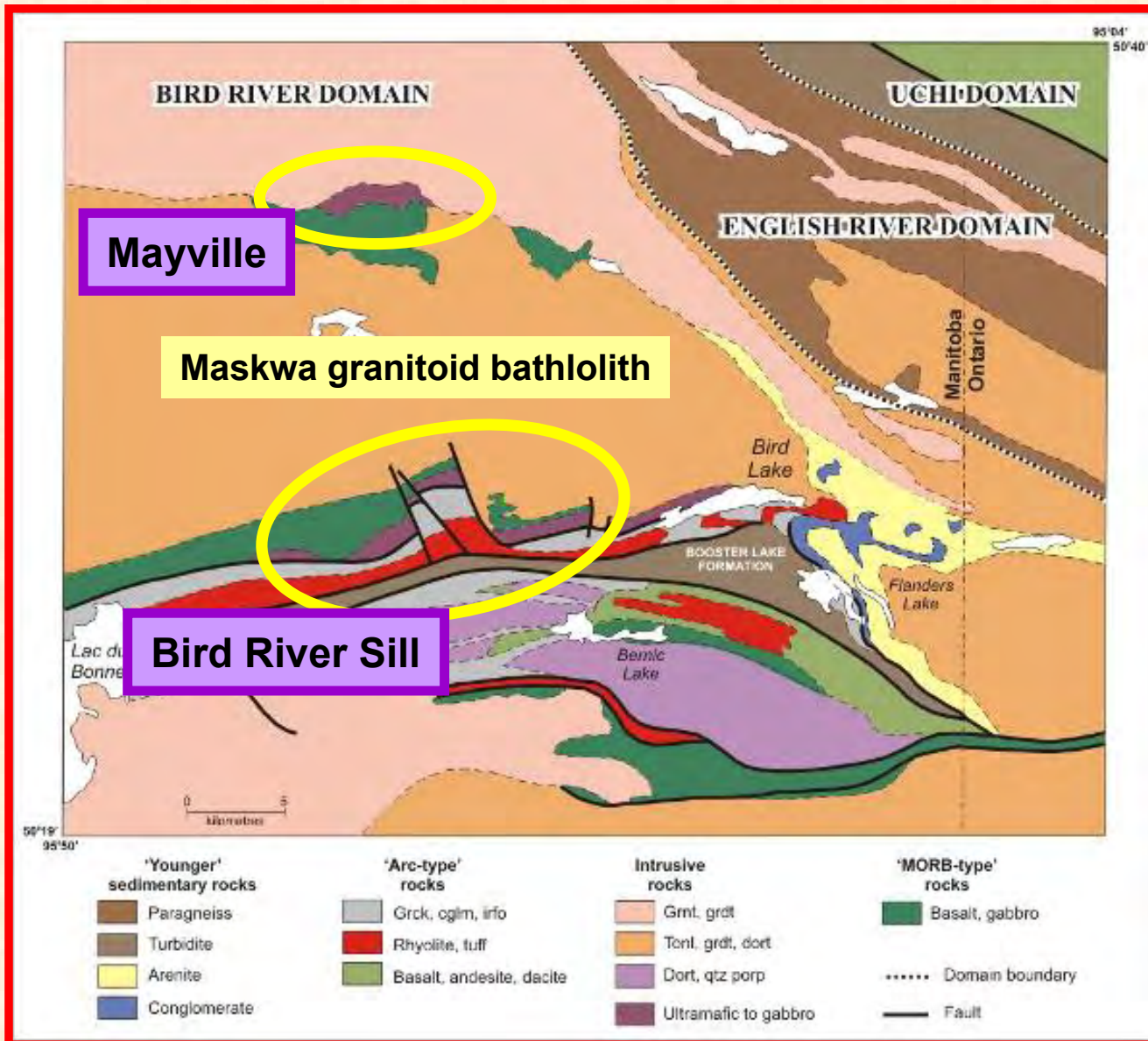


# Bird River Sill

- Mafic-ultramafic sill (Neoarchean  $2745 \pm 5$  Ma)
- First explored 1898
- Chromite deposits identified 1940's; current exploration for PGE ( $\pm$  Ni, Cu, Zn)



# Mafic-ultramafic intrusions (PGE, Cr, Ni, Cu)



**Domains**

**Uchi**

**English River**

**Bird River**

**Winnipeg River**





# MORB-type Lamprey Falls Formation (LFF)

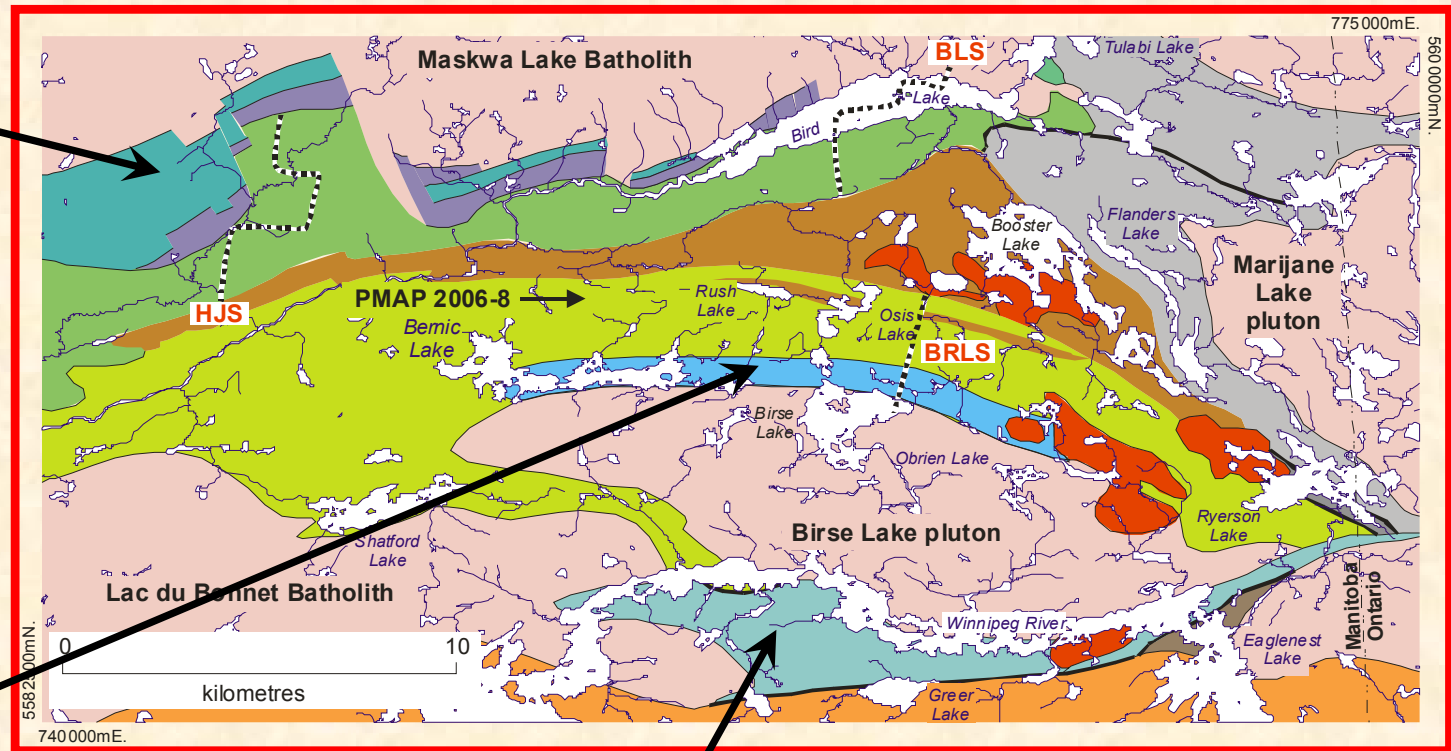
North flank LFF



South flank LFF



Winnipeg River LFF





# Arc-type rocks



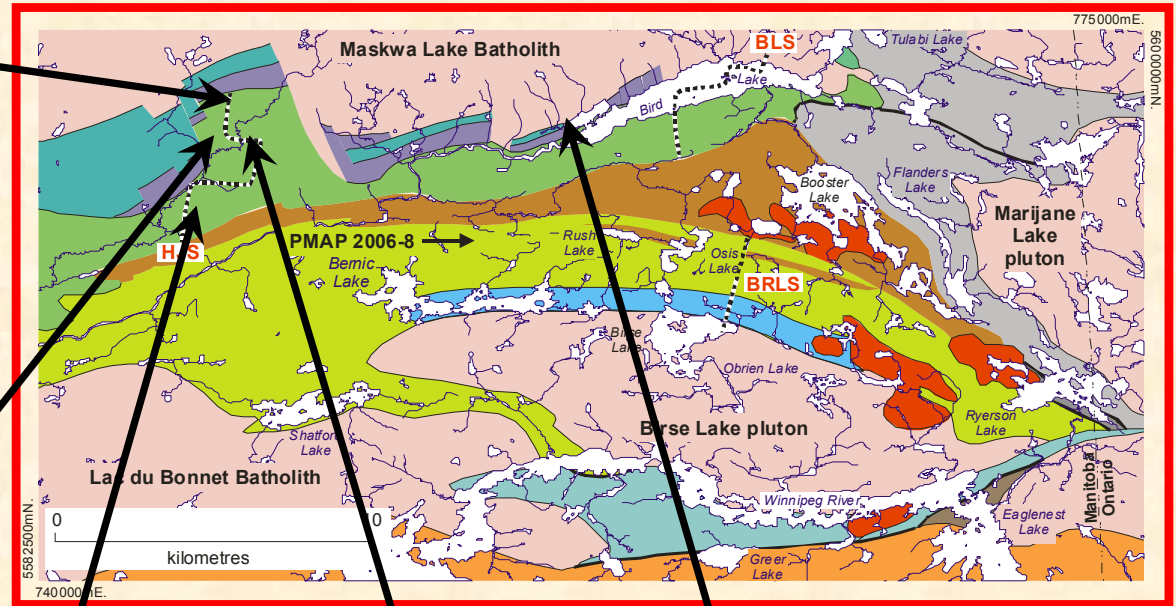
Debris flow



Chert



Turbidite



Volcanogenic cglm



Cordierite schist



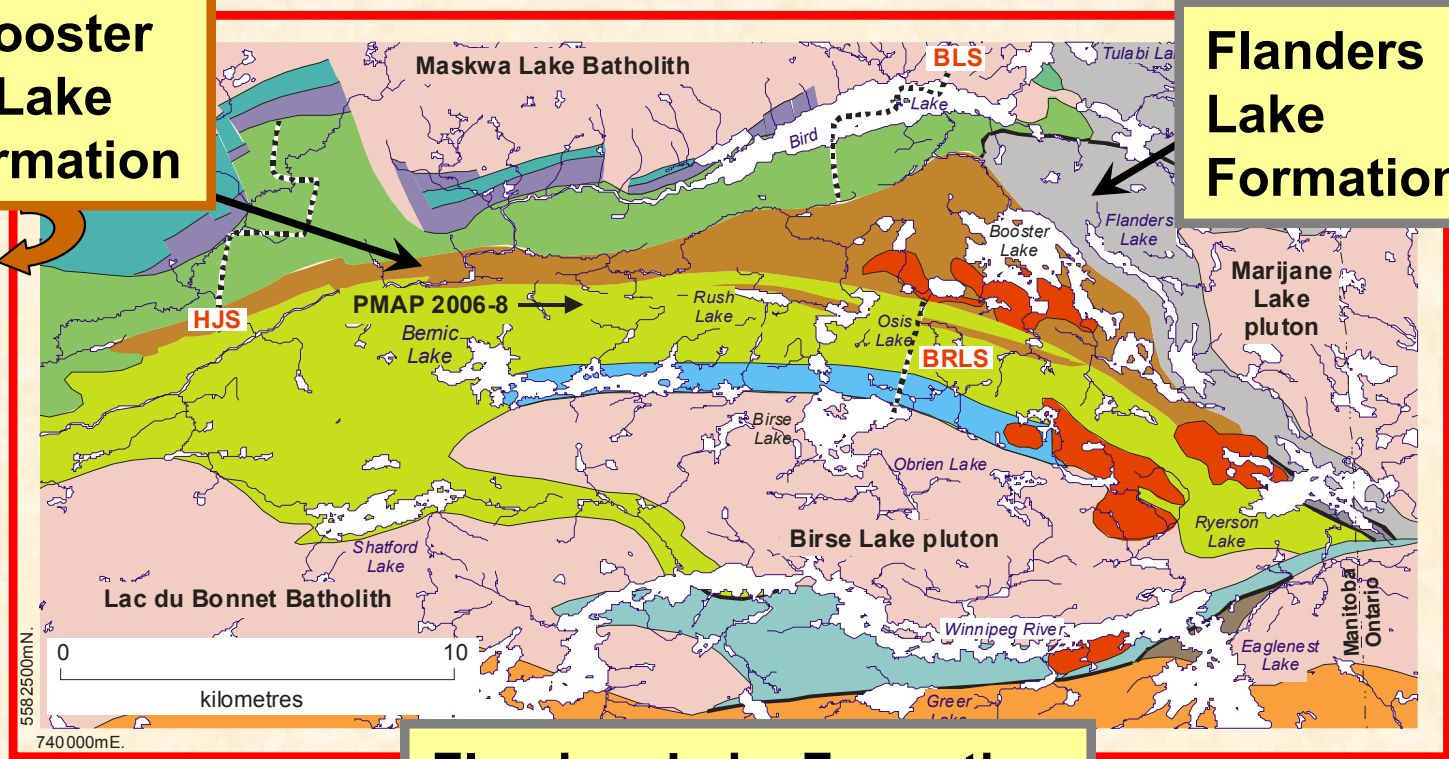
# Younger sedimentary rocks



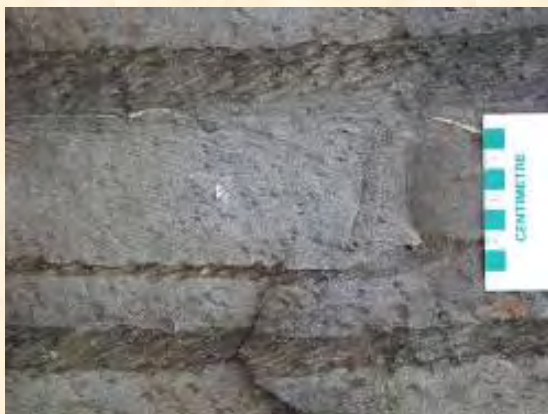
**Booster Lake Formation**



**Flanders Lake Formation**



**Flanders Lake Formation**



**Turbidite**



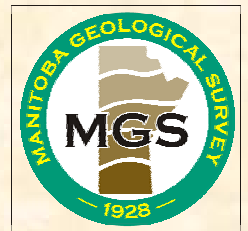
**Conglomerate**



**Arenite**

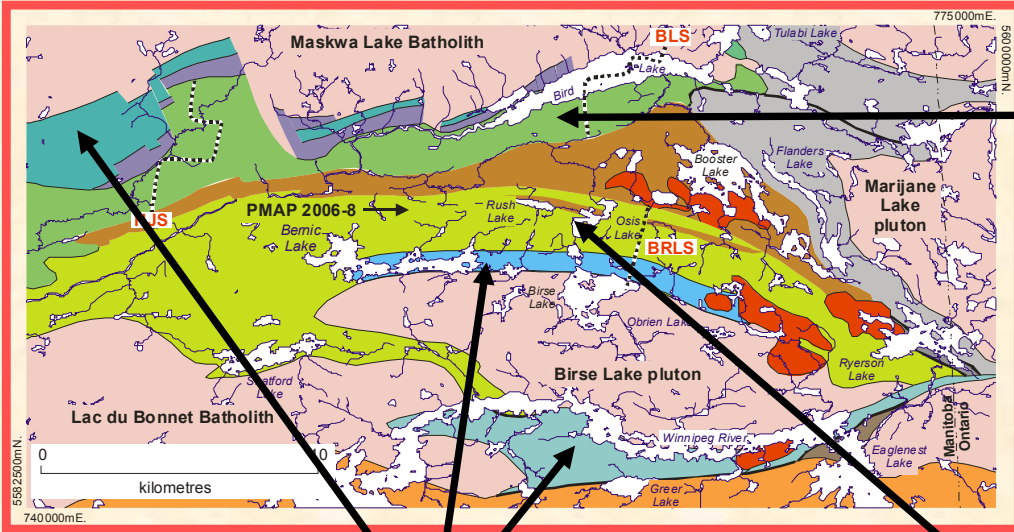
# Bird River Belt Geochemistry

- **MORB-type basaltic rocks**
- **Arc-type assemblage ~**
  - North panel... calc-alkaline**
  - South panel... tholeiitic**

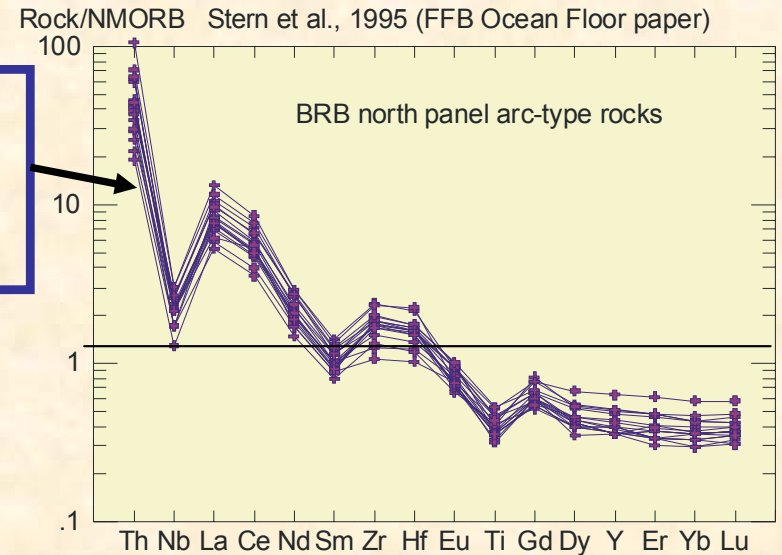




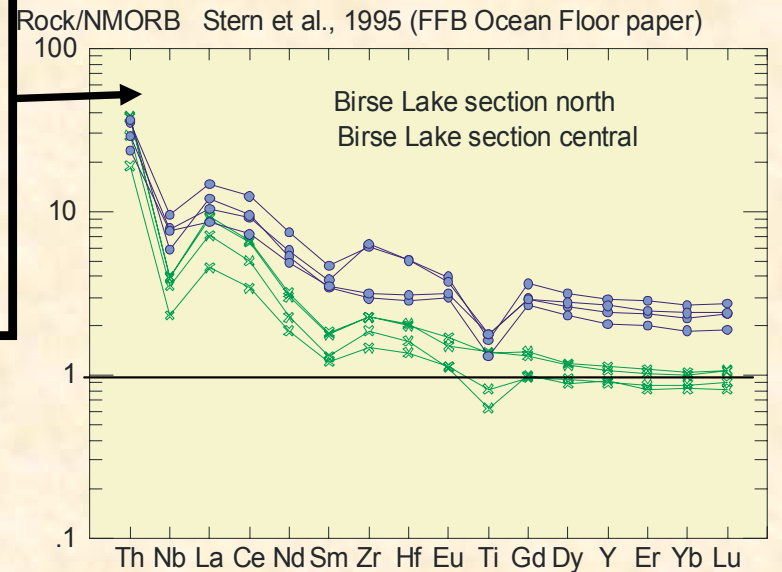
# Bird River Belt - Geochemistry



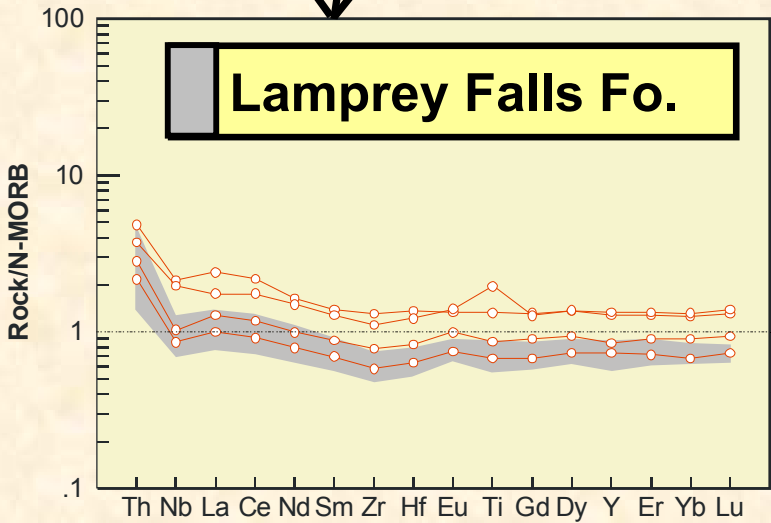
**BRB  
North  
panel**



**BRB  
South  
Panel ~  
north  
central**



**Lamprey Falls Fo.**

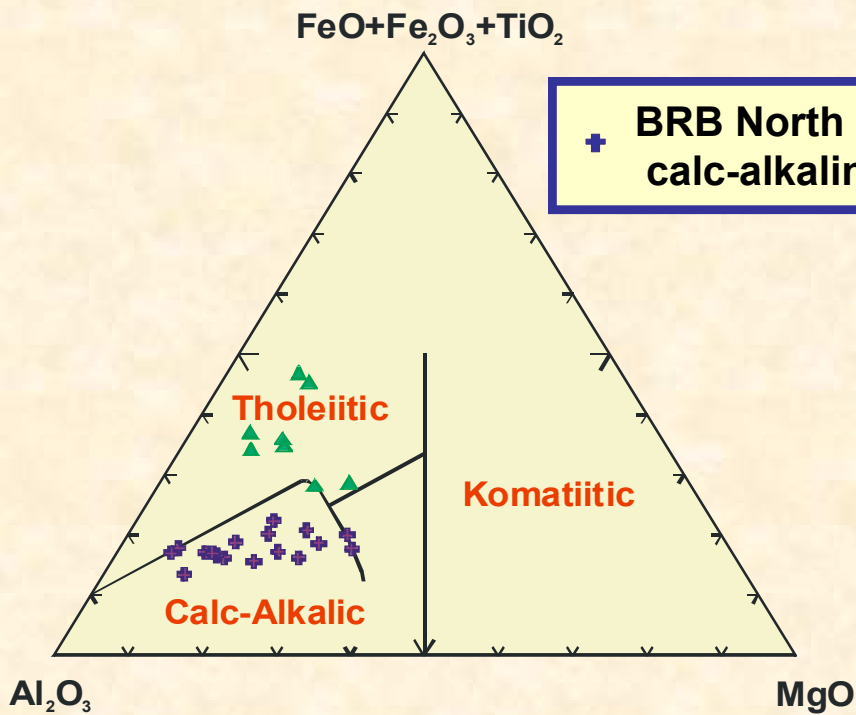
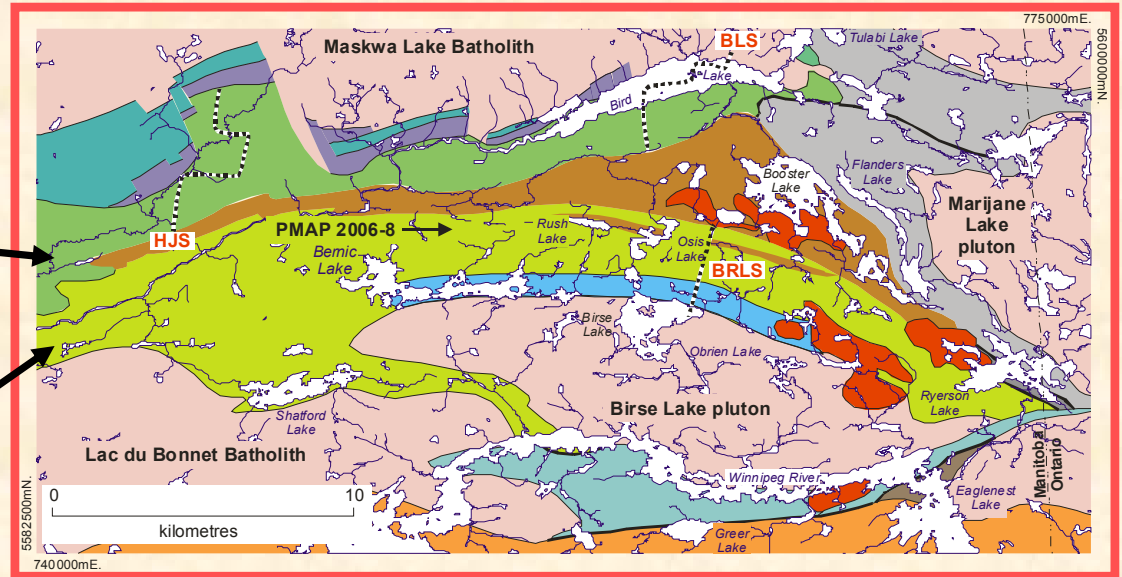


**N-MORB normalized-extended element plots**

# Arc volcanic rocks

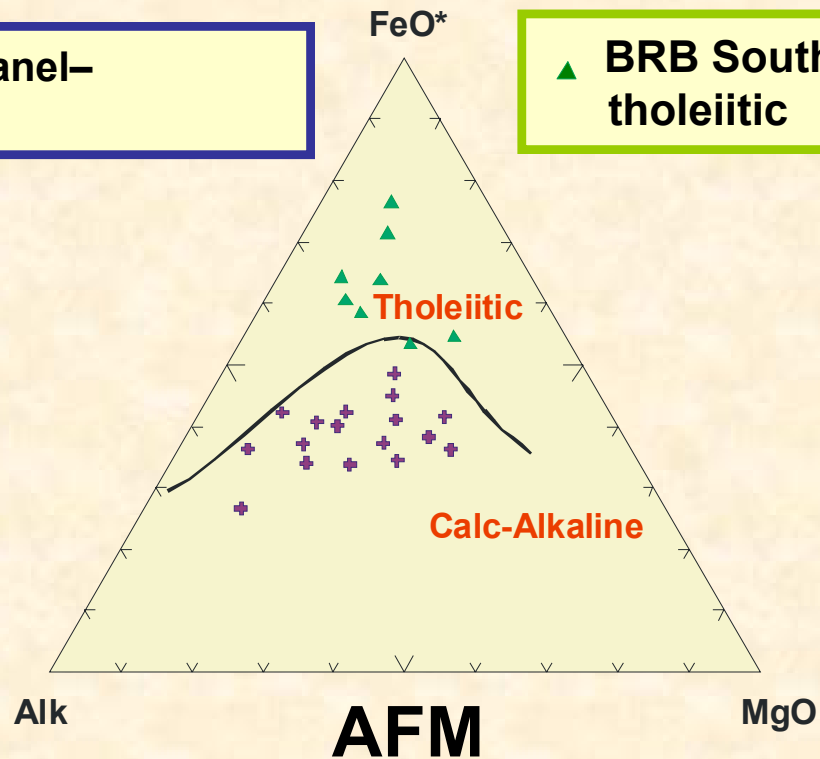
+ BRB North panel – calc-alkaline

▲ BRB South panel - tholeiitic



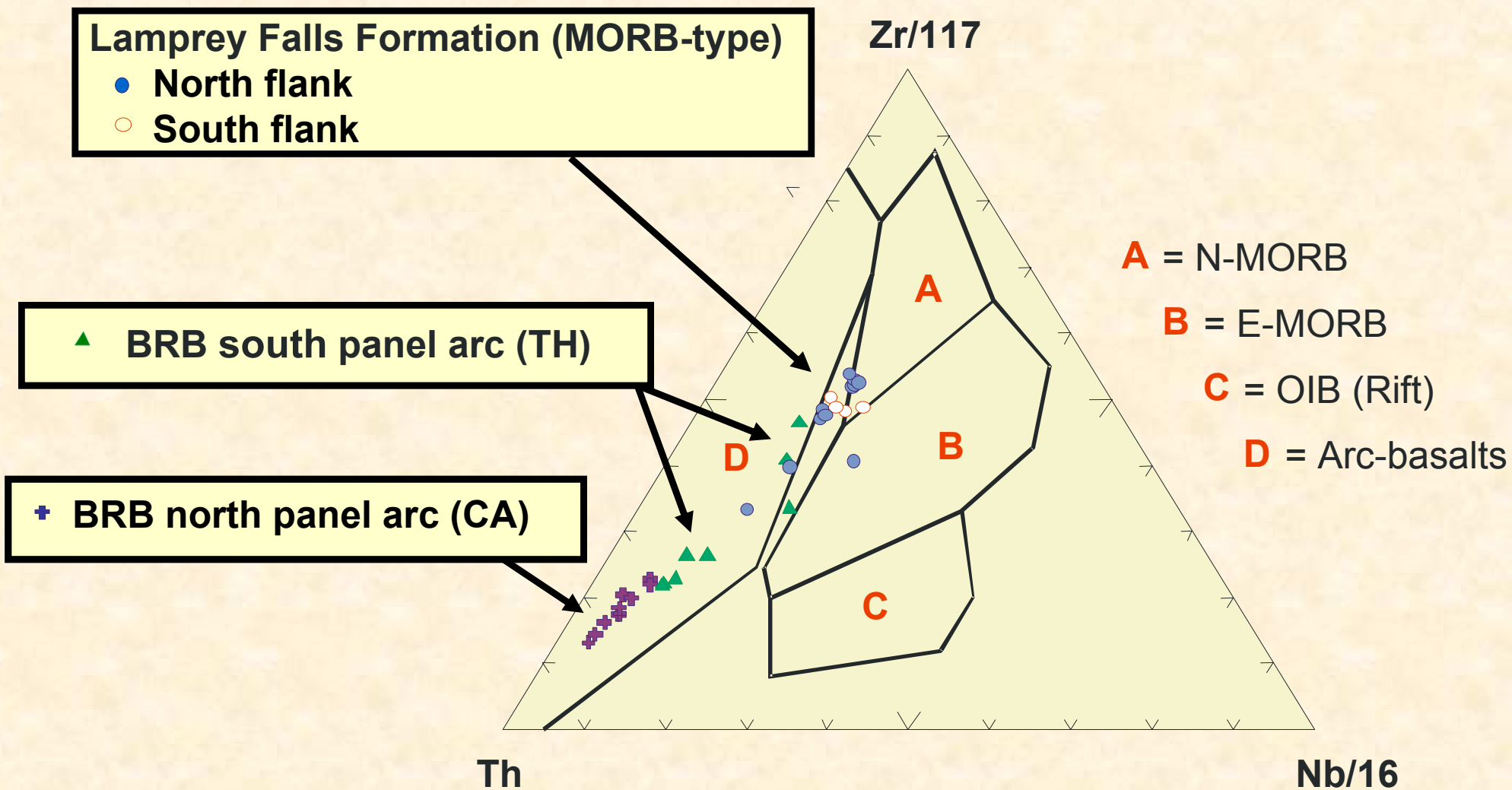
+ BRB North panel – calc-alkaline

▲ BRB South panel – tholeiitic



Jensen cation diagram

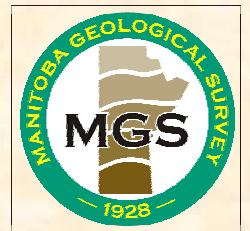
# Summary of Geochemistry



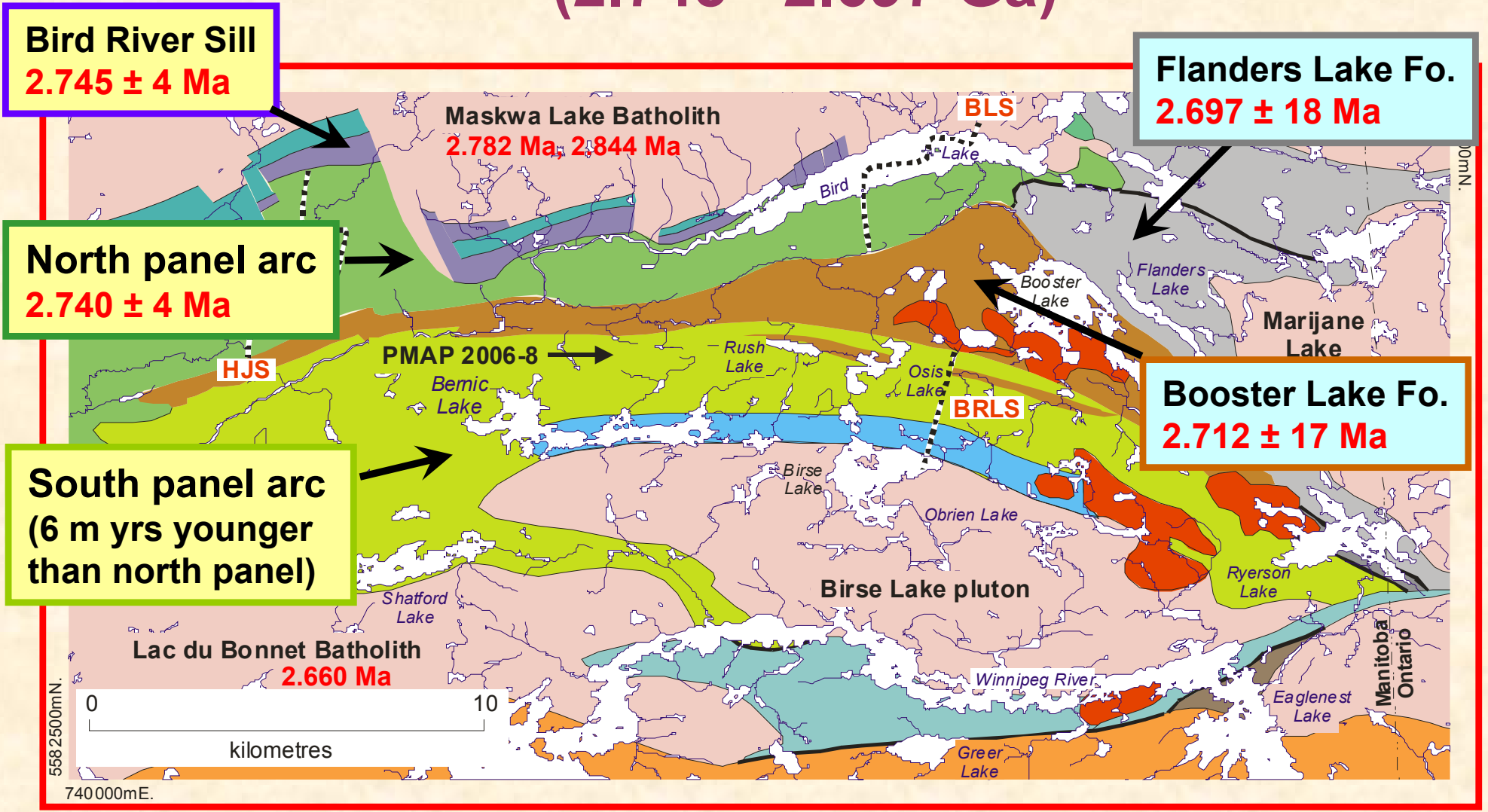
Ternary diagram of Wood, D.A. (1980)



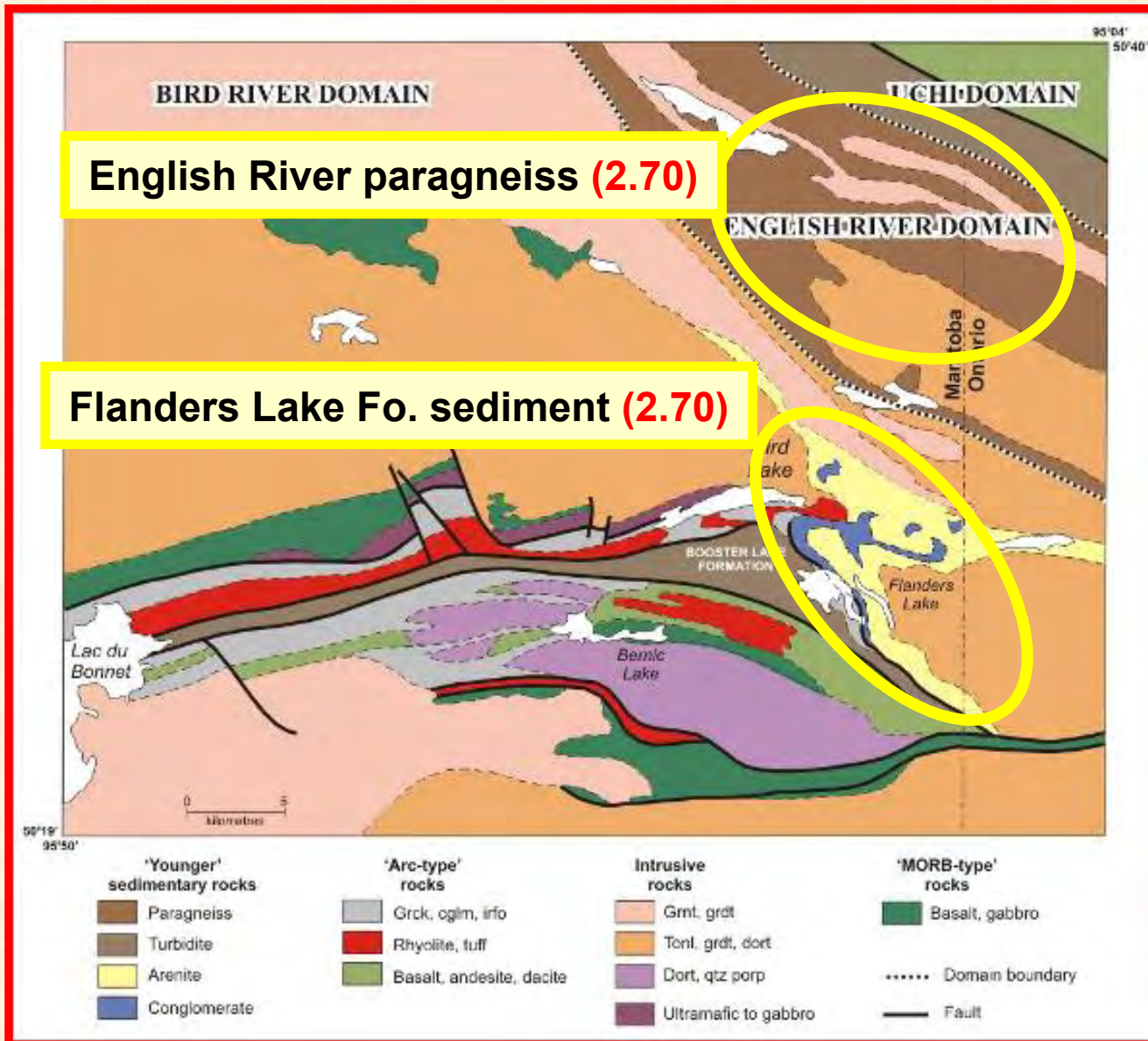
# Bird River Belt Geochronology



# Bird River Belt Geochronology (2.745 - 2.697 Ga)



# Geological Domains in SW Superior Province



**Uchi (2.90 – 2.70)**

**English River (2.70)**

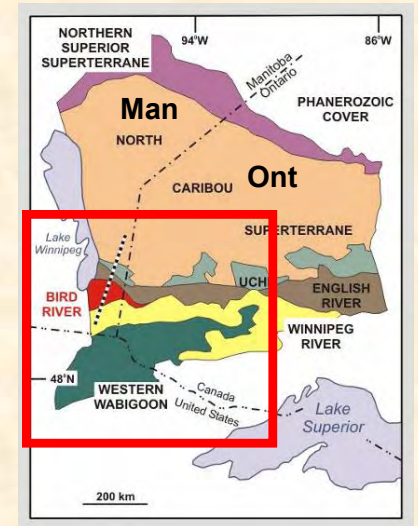
**Bird River (volc 2.74)**

**Winnipeg River  
(3.4 – 2.8)**

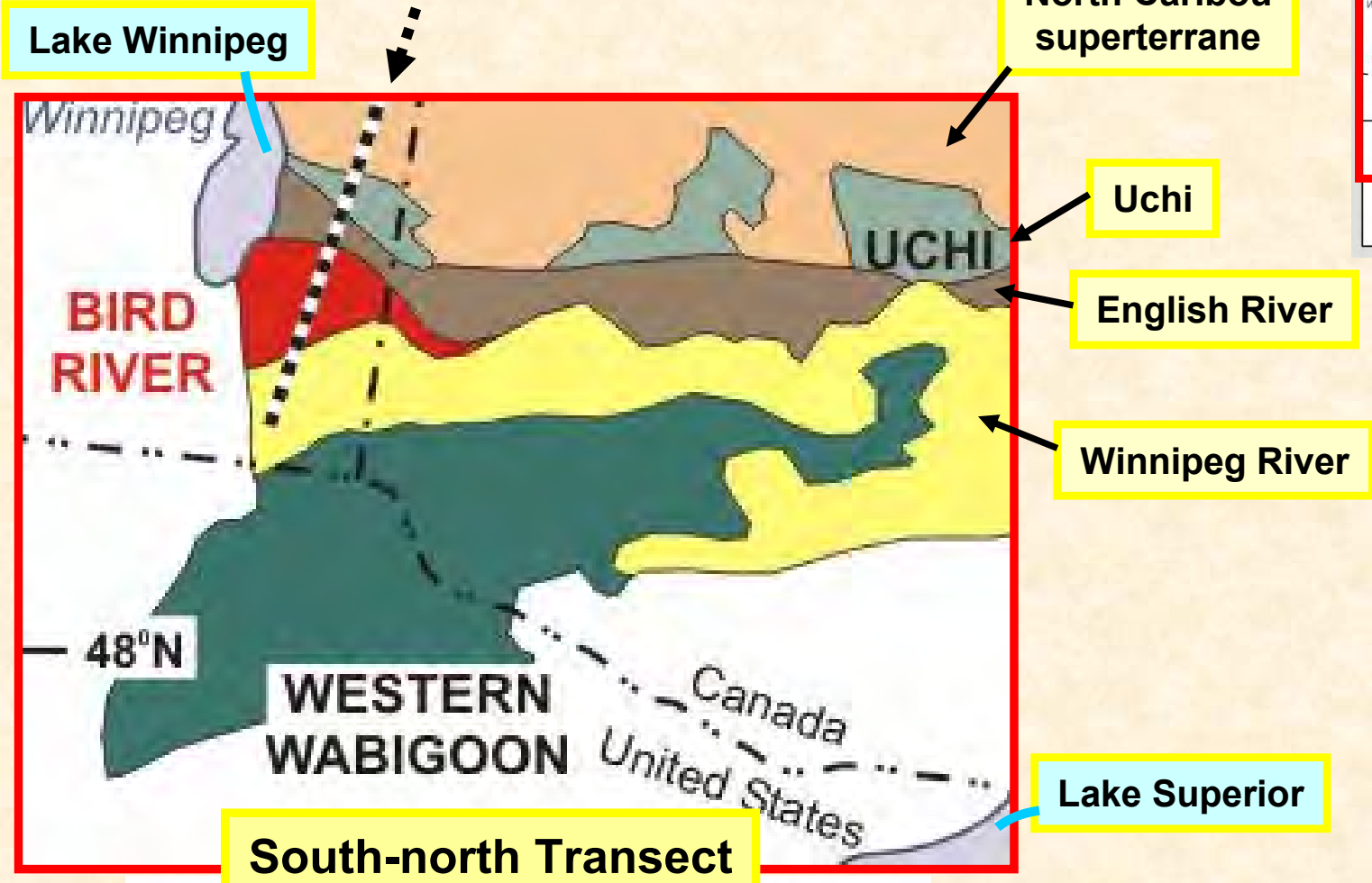




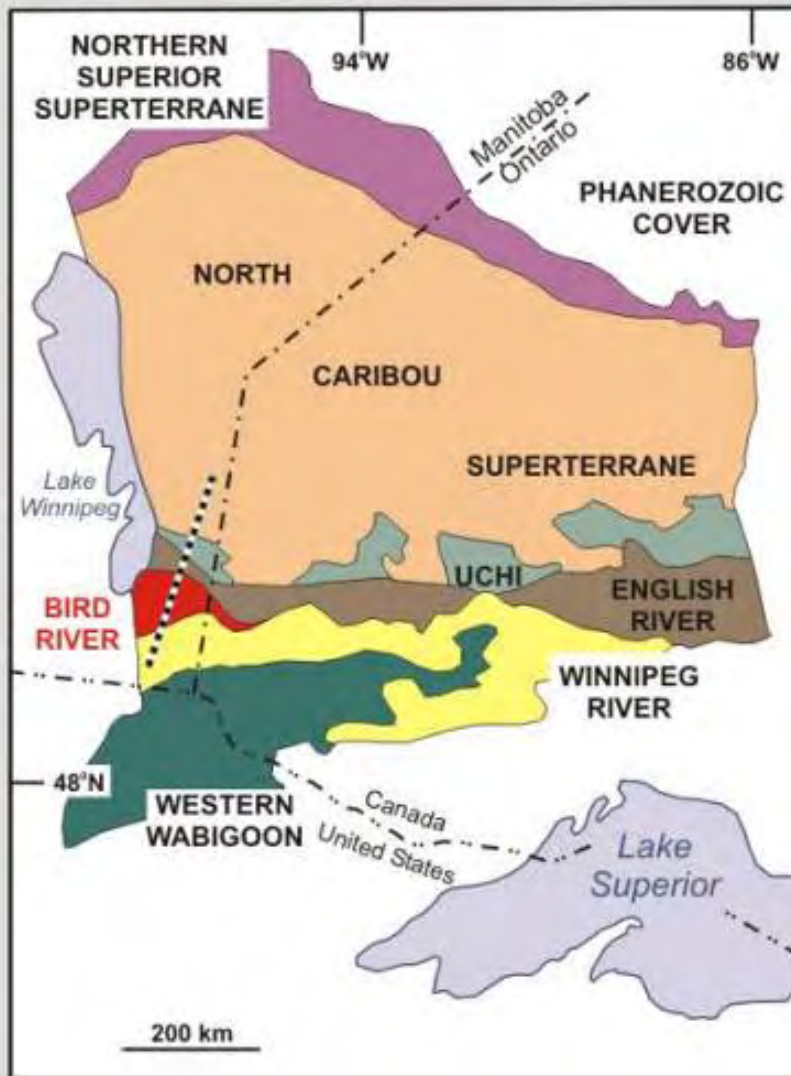
# Domains in SW Superior Province



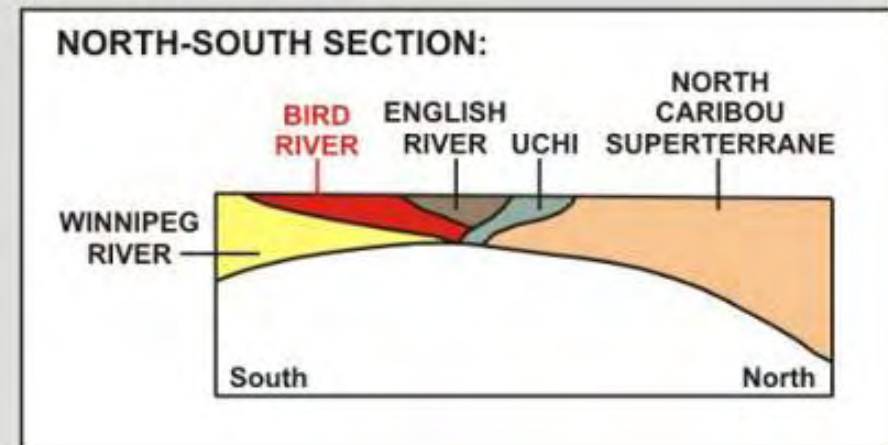
Transect Line



# Western Superior Province: ages



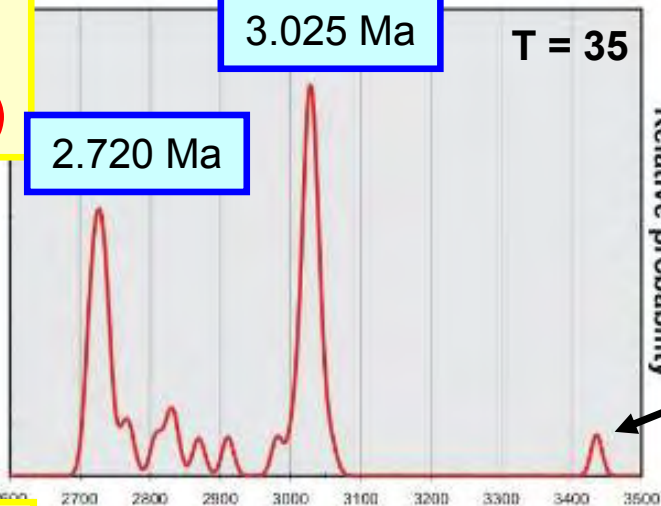
- NORTHERN SUPERIOR SUPERTERRANE 3.9 – 2.8 Ma
- NORTH CARIBOU SUPERTERRANE 3.0 – 2.87 Ma
- WINNIPEG RIVER TERRANE 3.4 - 2.8 Ma
- BIRD RIVER BELT (2.74-2.70 Ga)  
Arc volcanic and sedimentary rocks 2.74 – 2.70 Ma
- Volcanic rocks, Continental Arc
- Metasedimentary rocks 2.70 Ma
- Volcanic rocks, Oceanic Arc
- ..... NORTH-SOUTH SECTION



# Detrital zircon data: provenance of younger sedimentary rocks

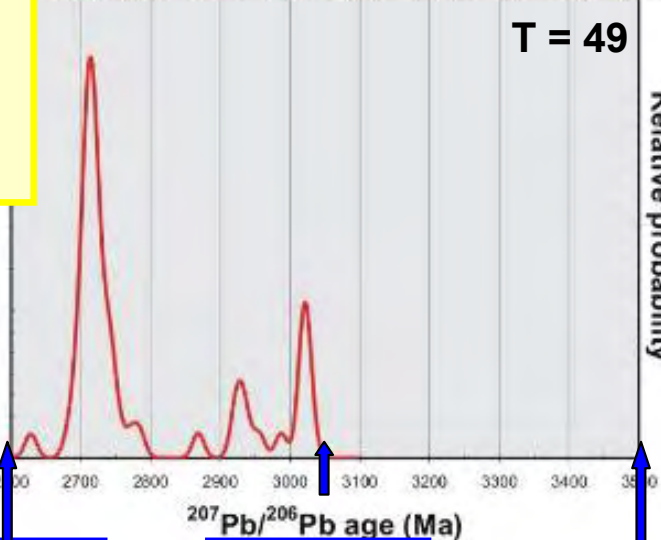
**Booster Lake Formation**

**(2.712 ± 17 Ma)**



**Flanders Lake Formation**

**(2.697 ± 18 Ma)**



**Scale**

2.600 Ma

3.050 Ma

3.500 Ma

**North Caribou Superterrane**

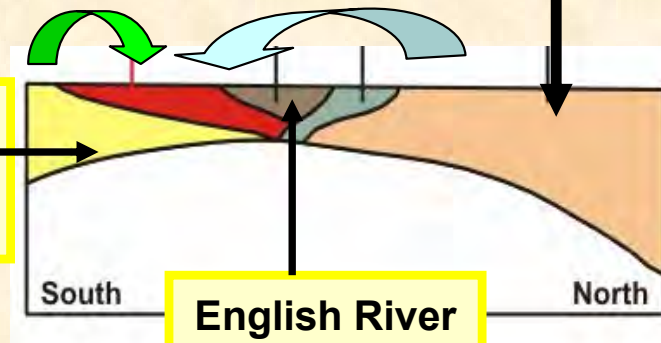
**(3.0 – 2.8)**

**Winnipeg River**

**(3.4 – 2.8)**

**English River**

**(2.70)**





# Summary

❑ Neoproterozoic Bird River Belt consists mainly of arc-type rocks that were deposited on the margins of a flanking continental terrane.

Arc-type components include

~ **tholeiitic, calc-alkaline and MORB-type basalts (arc-rift origin?).**

❑ Post arc volcanism.. collisional tectonics and synorogenic sedimentation

~ **turbidite-type marine and fluvial-alluvial continental sediments**

(postdate volcanics by 10 – 20 m. yrs).

❑ These ‘younger’ sedimentary rocks are apparently derived both from volcanic rocks and granitoid plutons in flanking continental terranes. They are structurally emplaced and may be allochthonous fault slices derived from the adjacent English River Domain north of Bird River Belt.

❑ Bird River Belt is the subject of ongoing mapping by MGS in support of current exploration for PGE, base-metals and rare-element bearing pegmatites. New data will focus on the west part of the belt.

