

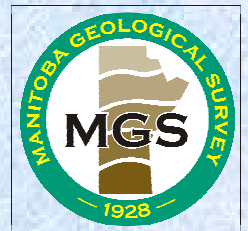
# Towards a new stratigraphy of the Bird River Belt

H.P. Gilbert (MGS)



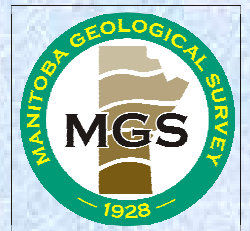
# Bird River Belt projects initiated in 2005

1. **Paul Gilbert (MGS)**  
Regional mapping (1: 20 000 scale) with focus on stratigraphy and geochemistry of supracrustal rocks.
2. **Manuel Duguet (post doctoral student, Univ. of Waterloo)**  
Regional mapping (1: 20 000 – 1: 50 000 scale) with focus on structural geology and tectonic history.
3. **Paul Kremer (MSc graduate student, Univ. of Waterloo)**  
Geological mapping (1: 10 000 scale) of Bernic Lake area with focus on the setting of granitic pegmatite intrusions.
4. **Caroline Mealin (MSc graduate student, Univ. of Waterloo)**  
Detailed mapping of mafic-ultramafic Bird River Sill with focus on PGE mineralization potential.



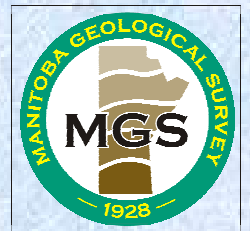
# Bird River Belt projects rationale

- Area last mapped over 25 years ago
- Previous mapping known to be inconsistent
- Since the previous mapping, advances in the geological sciences and new techniques (geochemistry and geochronology) now provide the opportunity to gain significant advances in our understanding of the geology of the area
- Provide support for current active exploration

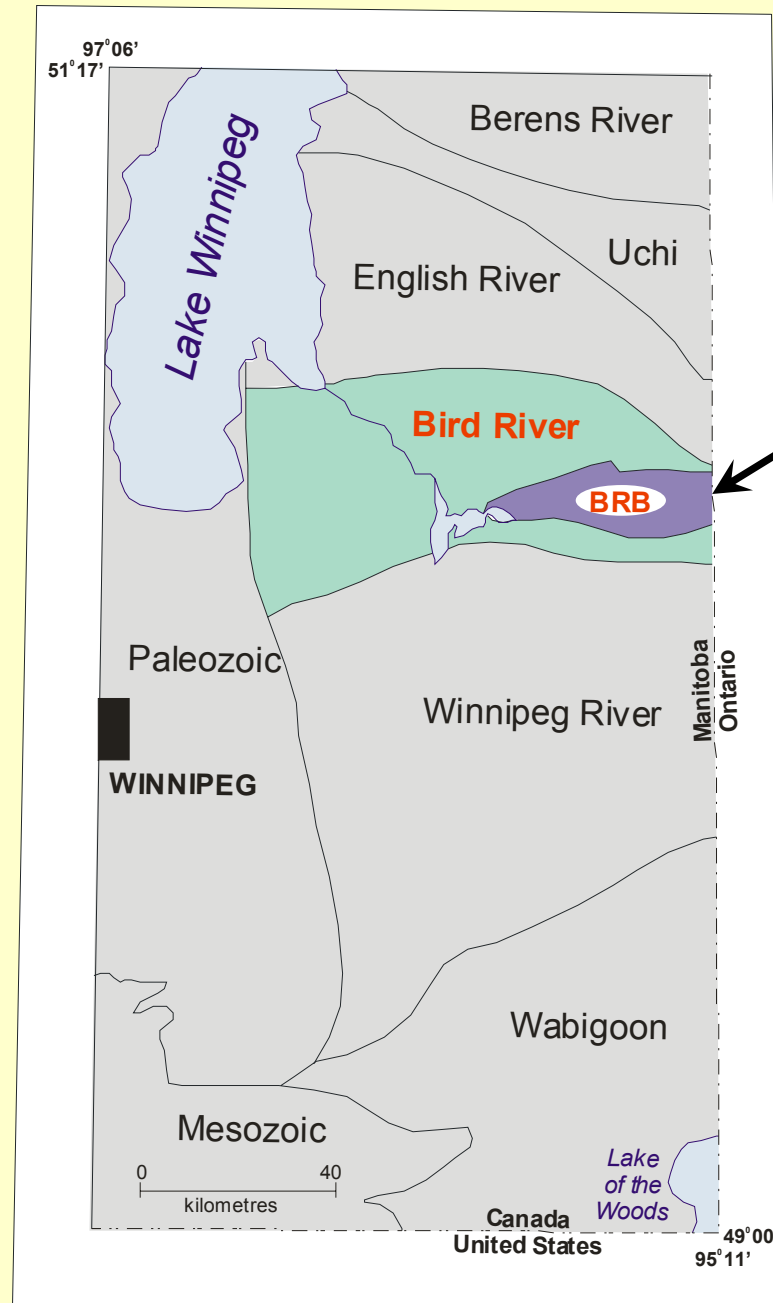


# Road map

1. Setting of Neoproterozoic Bird River greenstone belt
2. Geological overview
3. Results of mapping 2005-2006 ~  
Geochemistry  
Stratigraphy
4. Summary



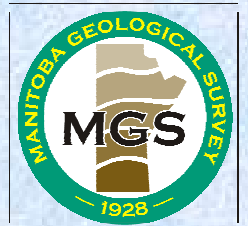
# Geological Domains in southwest Superior Province



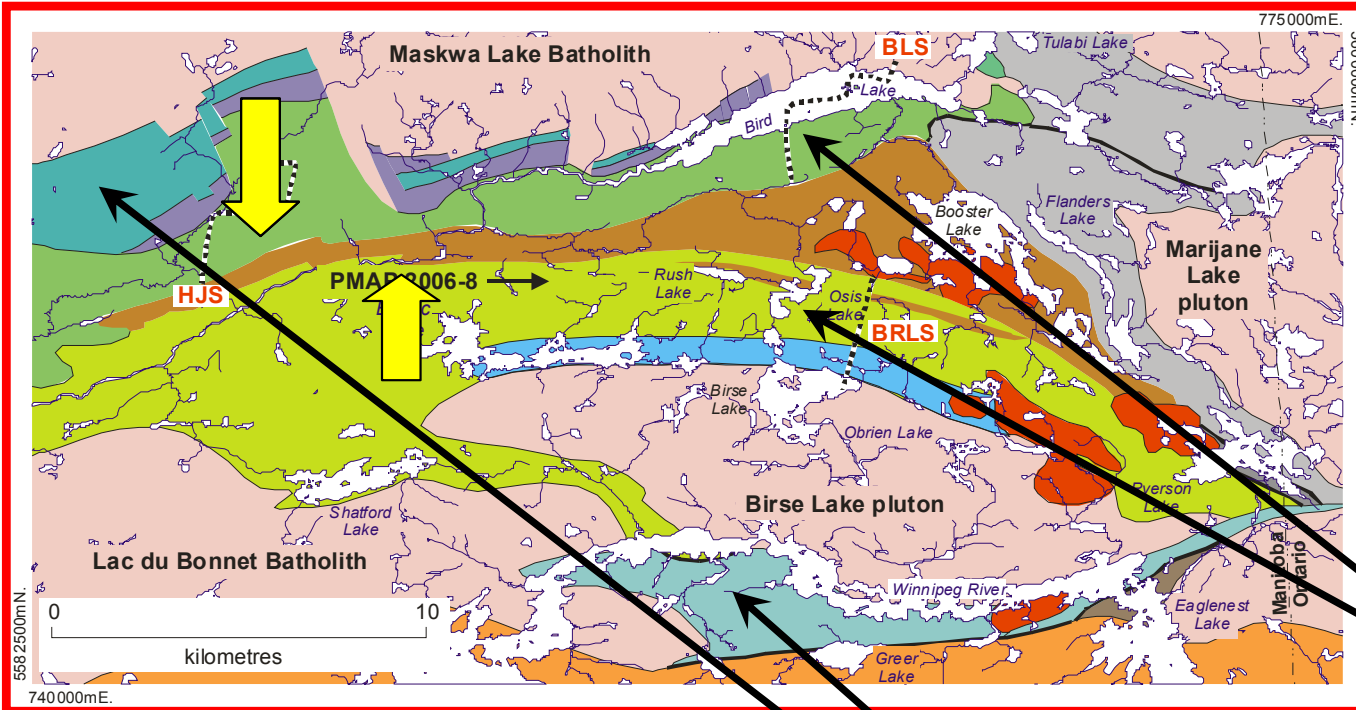
Bird River Belt



# Geological overview



# Bird River Belt – volcanic components



## Late intrusive rocks

Granite, (Lac du Bonnet batholith,  $2660 \pm 3$  Ma)

## Sedimentary rocks

FLANDERS LAKE FORMATION ( $2697 \pm 18$  Ma)

Arenite, polymictic conglomerate  
*Fault, inferred*

BOOSTER LAKE FORMATION ( $2712 \pm 17$  Ma)

Greywacke-siltstone turbidite  
*Unconformity, inferred*

## Intrusive rocks

Granodiorite, tonalite gabbro, quartz-feldspar porphyry ( $2725 \pm 6$  Ma ;  $2729 \pm 9$  Ma)

**Metavolcanic and metasedimentary rocks – arc assemblage ( $2740 \pm 4$  Ma)**

Mafic to felsic volcanic rocks; turbidite, chert, iron-formation, conglomerate; derived gneiss and schist

## Intrusive rocks

BIRD RIVER SILL ( $2745 \pm 5$  Ma)  
Dunite, peridotite, picrite, anorthosite and gabbro  
*Fault, inferred*

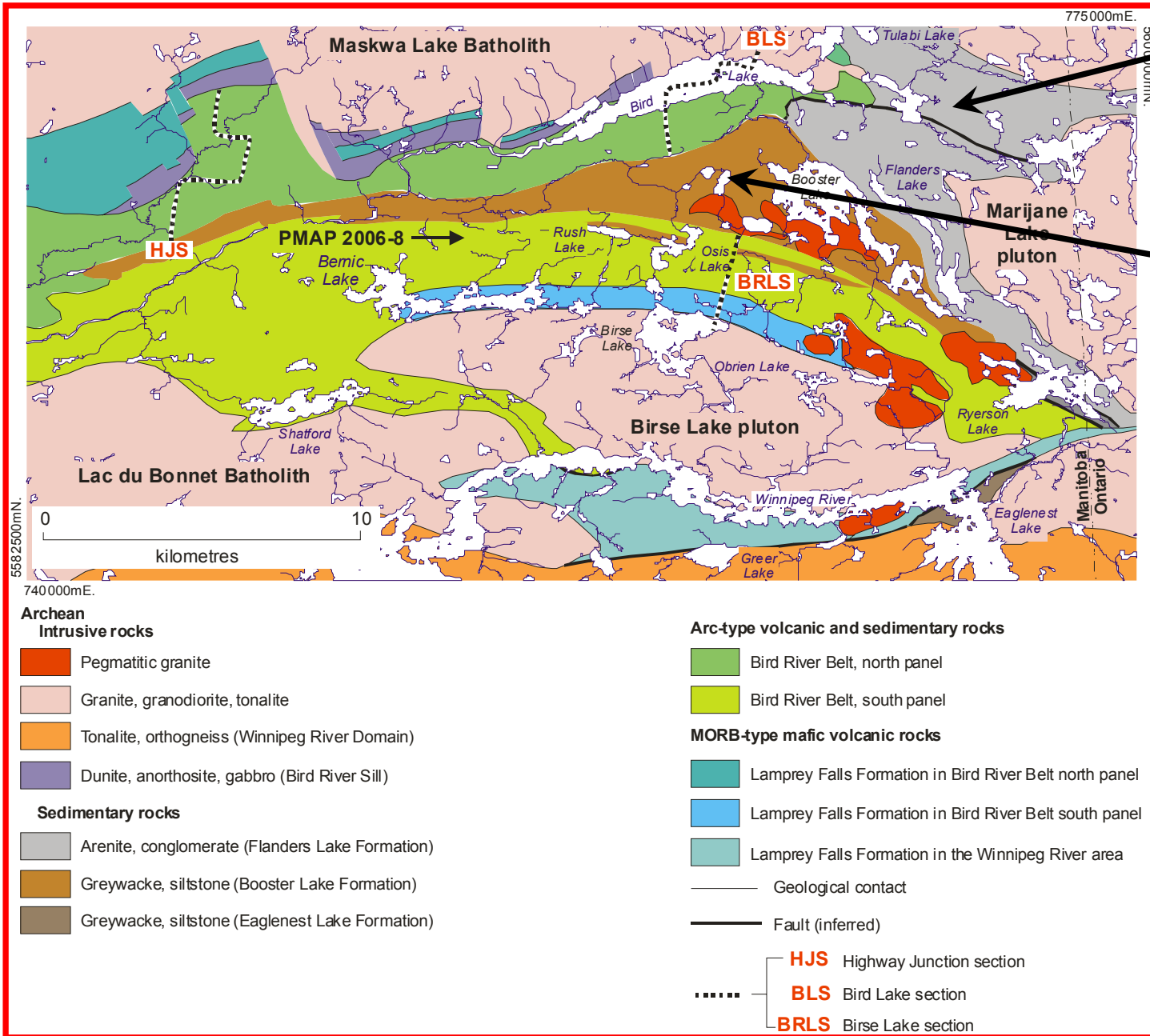
**MORB-type basalt and metasedimentary rocks**

LAMPREY FALLS FORMATION

The Bird River Belt consists mainly of an **volcanosedimentary arc-type assemblage ( $2740$  Ma)** in two tectonostratigraphic components ~ a **south-facing** ↓ **calc-alkaline north panel** and a **north-facing** ↑ **tholeiitic south panel**.

Older ( $> 2745$  Ma) **MORB-type volcanic rocks (Lamprey Falls Formation)** occur along the north and south margins of the belt.

# BRB – postvolcanic sedimentary rocks



**Flanders Lake Formation  
(2697 ± 18 Ma)**

**Booster Lake Formation  
(2712 ± 17 Ma)**

**New detrital zircon data indicate these two formations postdate the volcanism by approx. 30 m.y.**



# BRB – economic geology

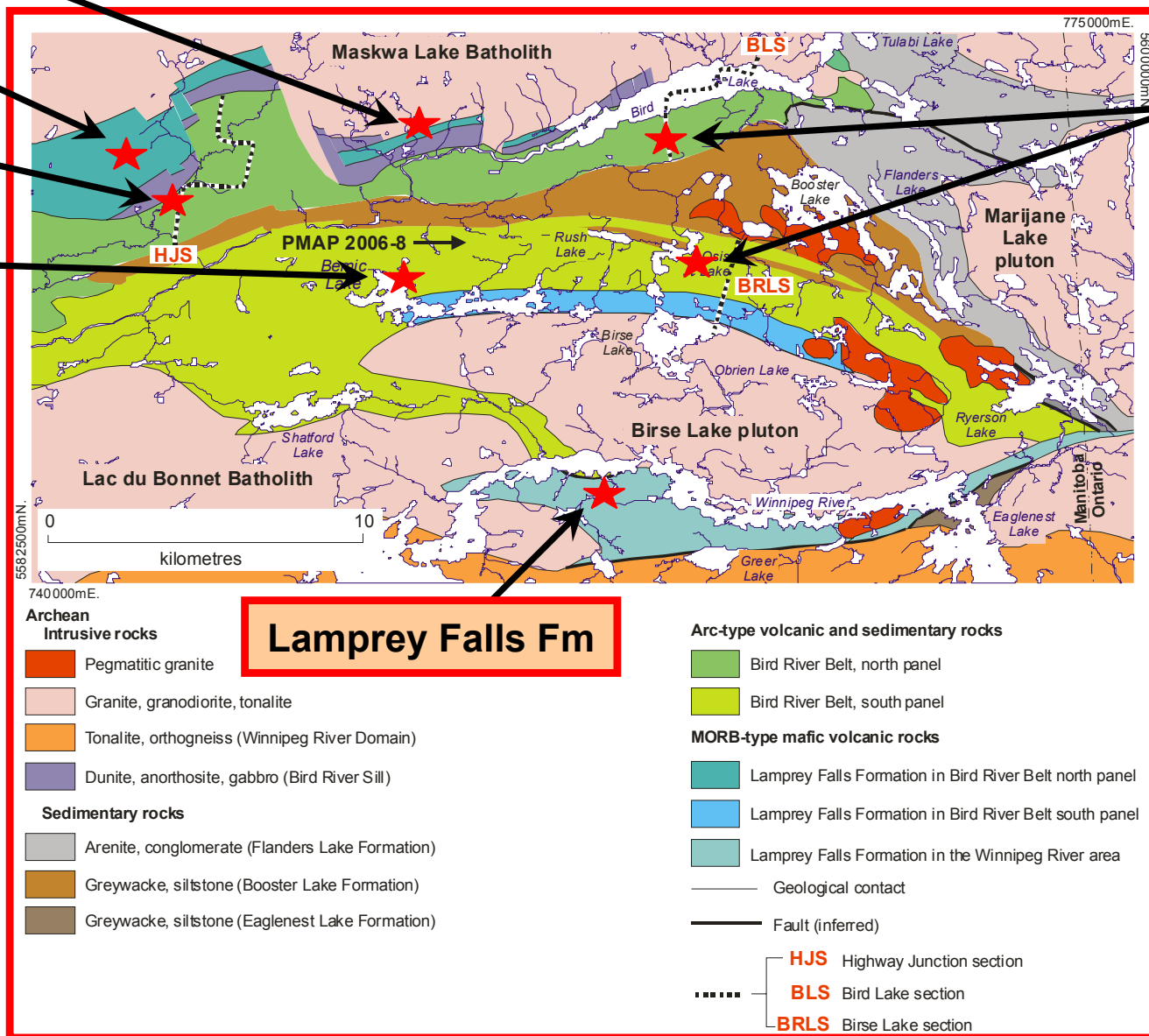
Maskwa-Dumbarton

Lamprey Falls Fm

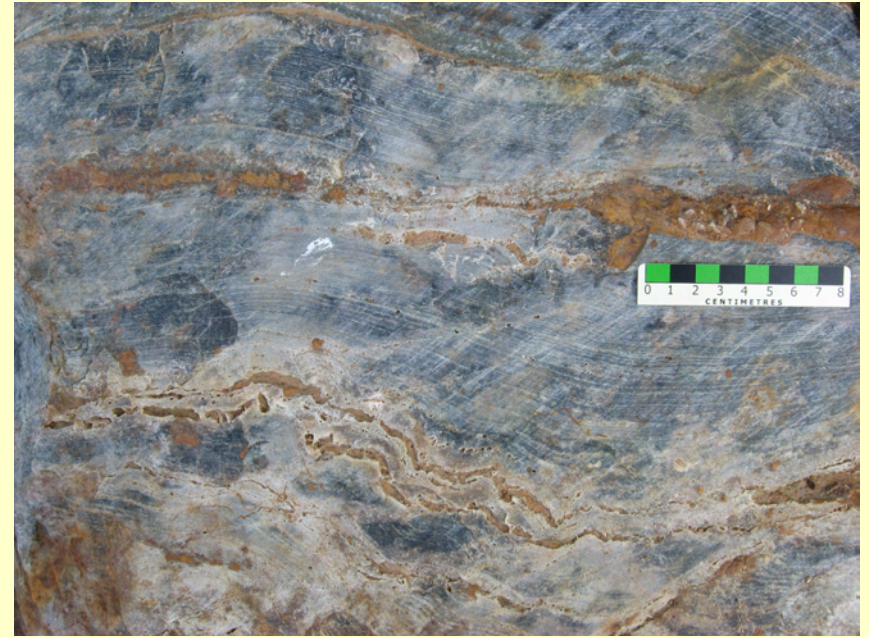
Bird River Sill

TANCO  
(Cabot Corp)

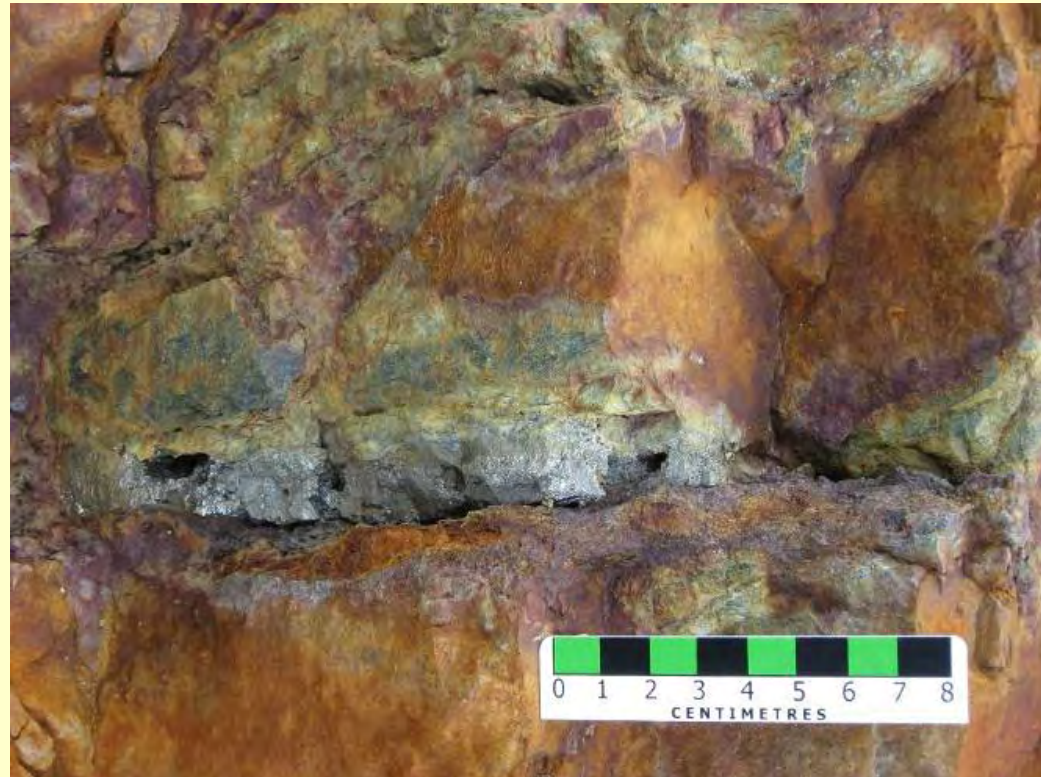
Bird River Belt is known for the TANCO Mine (Cs and Ta), Maskwa-Dumbarton Mine (Cu-Ni) and PGE potential of the Bird River Sill. Additional exploration targets include (1) arc-type rocks (2) Lamprey Falls Fm at BRB north flank (Cu, Zn, Ni and PGE in gabbro) and (3) Lamprey Falls Fm at Winnipeg River (iron formation with base-metal mineralization).



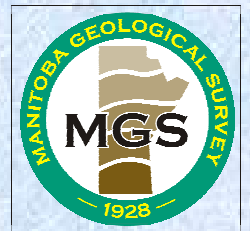
A  
r  
c



**Mineralization in iron  
formation within  
Lamprey Falls basalt,  
Winnipeg River area**



# Bird River Belt Geochemistry

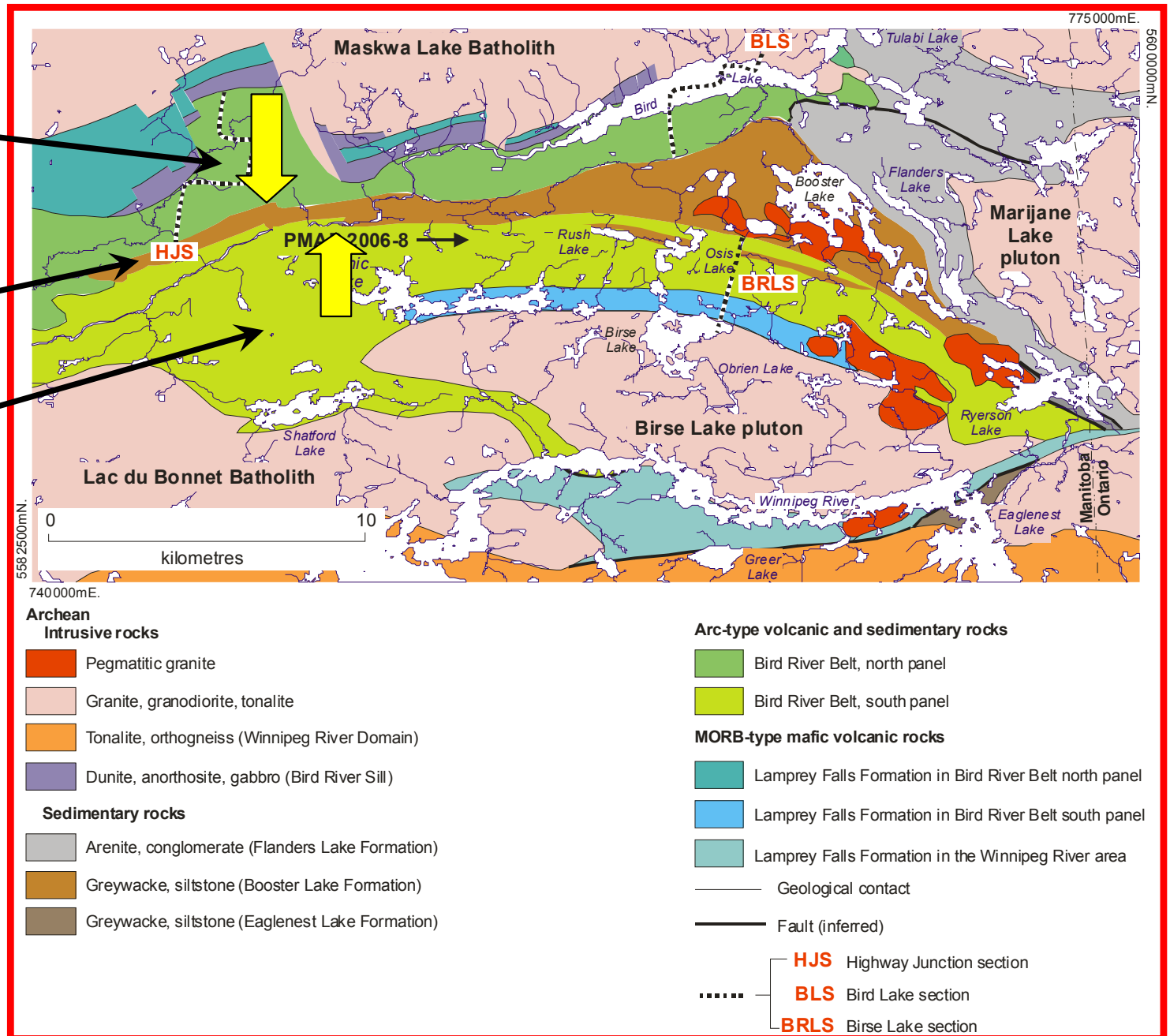


# Bird River Belt – north and south panels

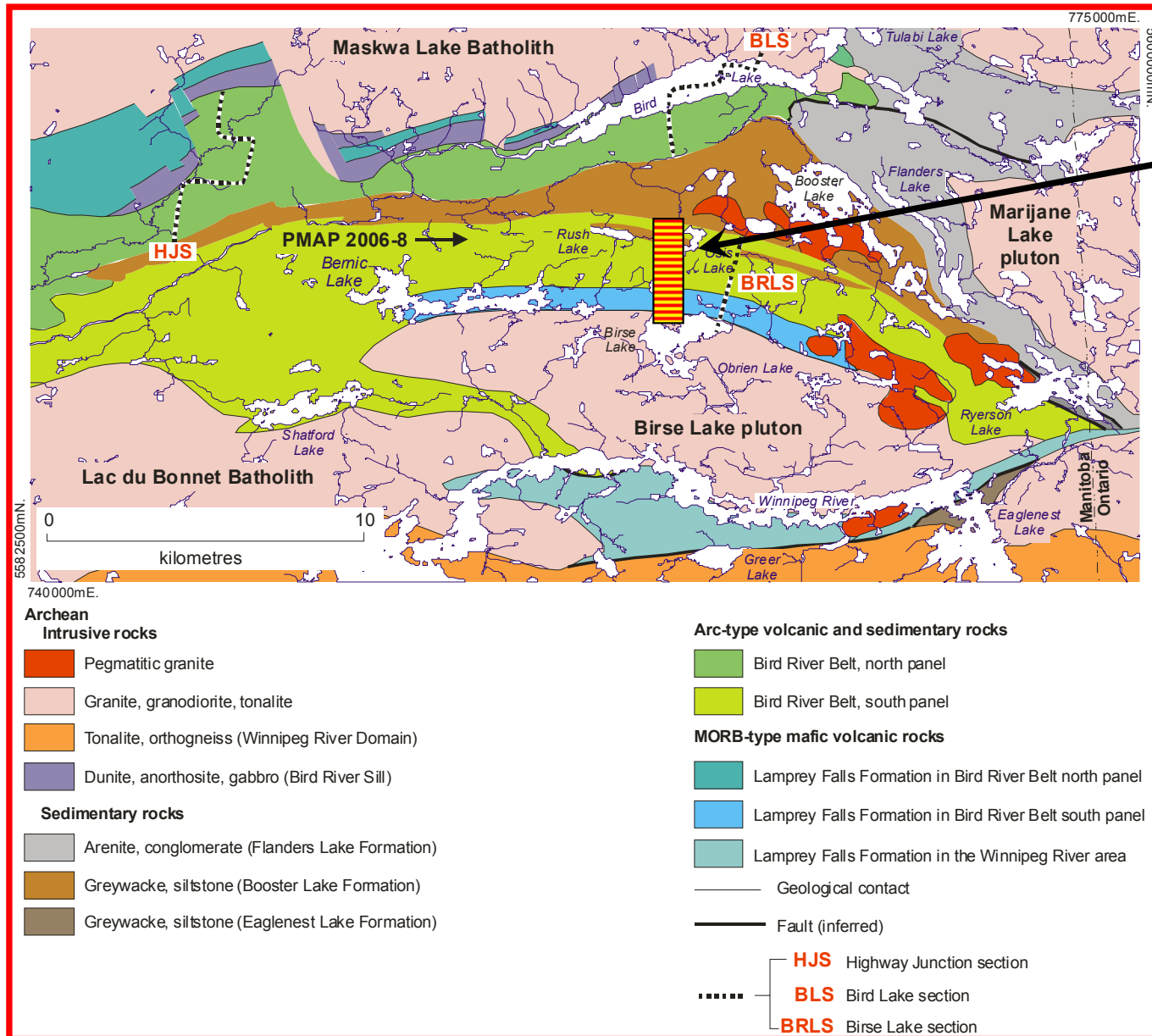
BRB north panel

Booster Lake Formation

BRB south panel

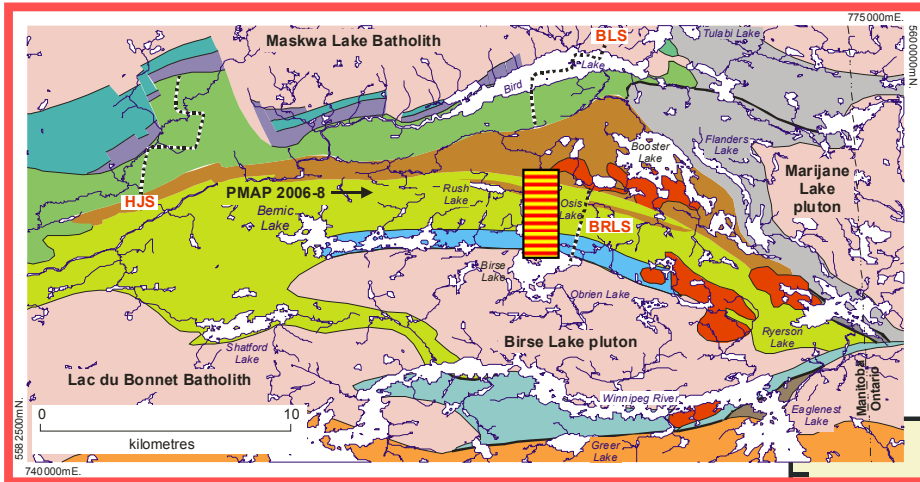


# Bird River greenstone belt – east part

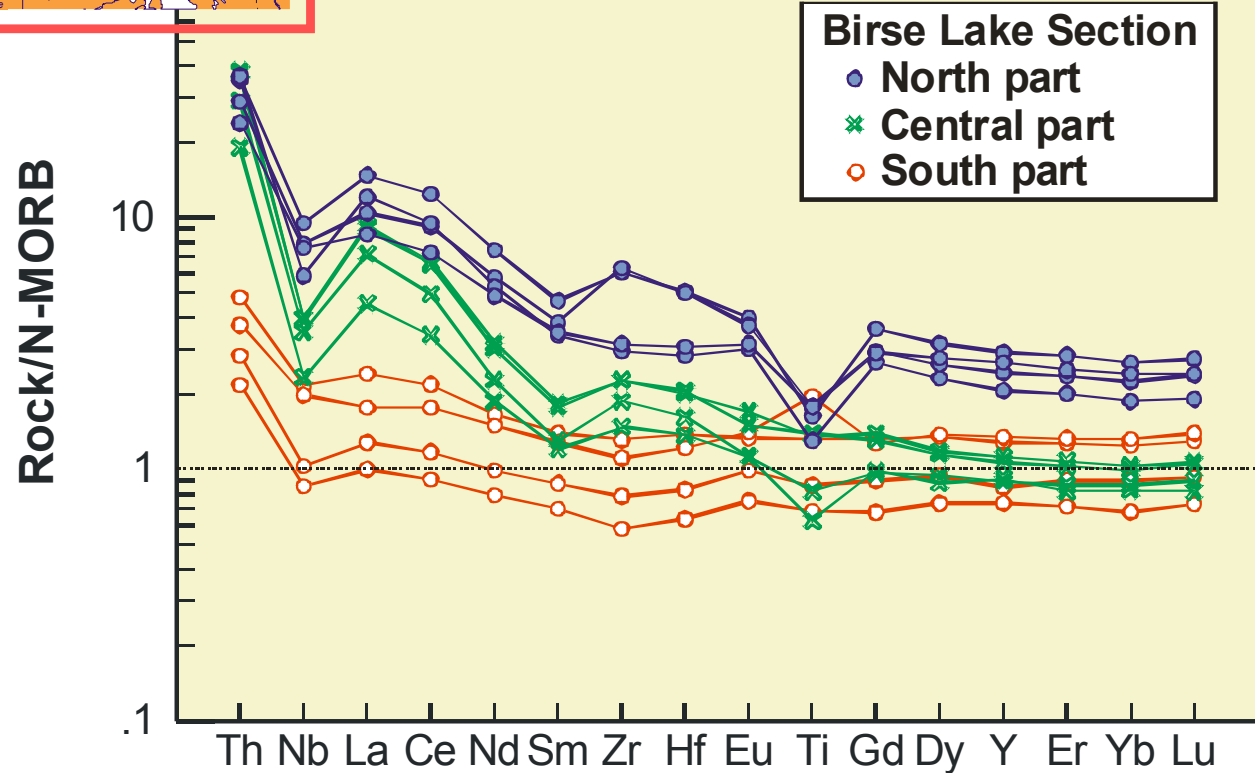


**Birse Lake section**

# Bird River Belt south panel - Birse Lake section



**Birse Lake section**

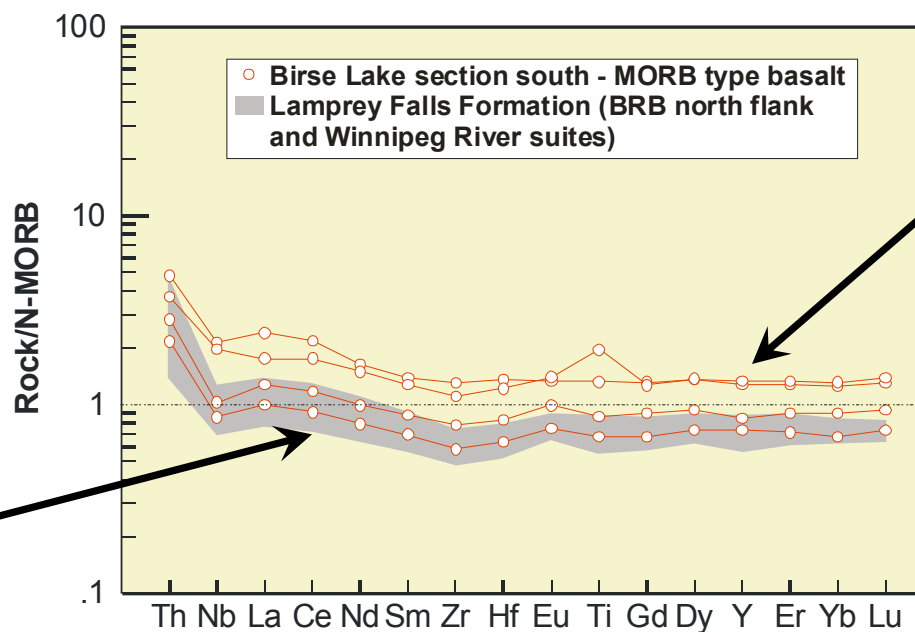
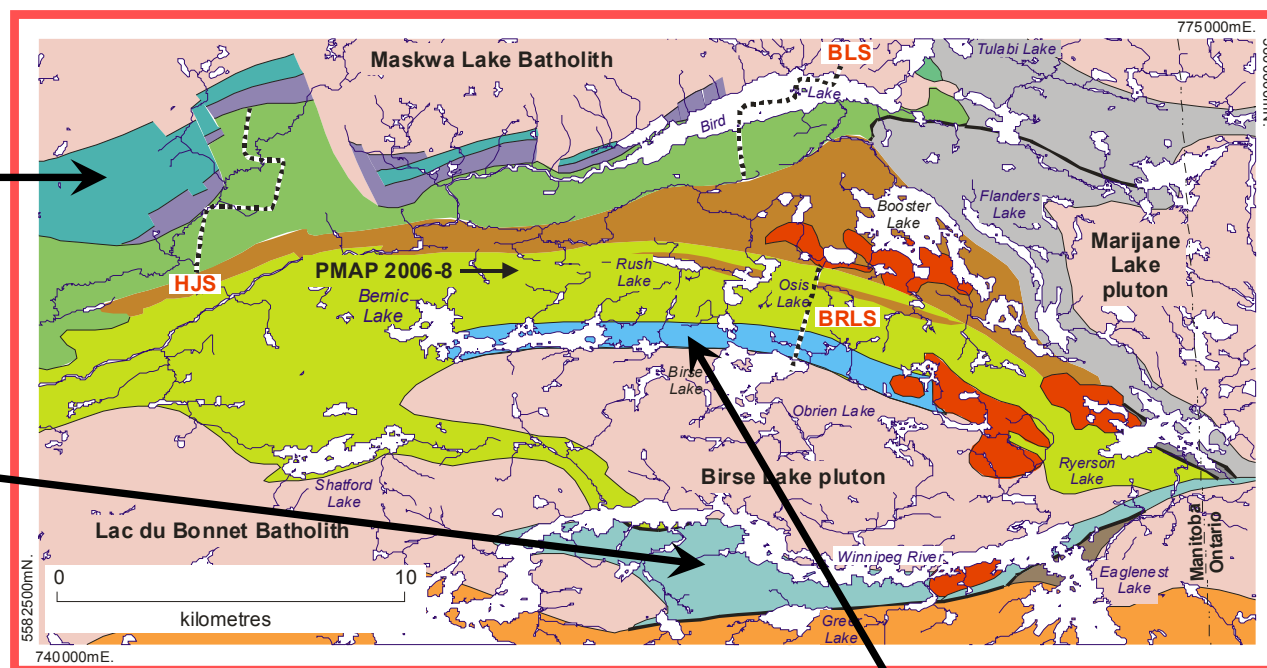


# MORB-type basalt localities in the Bird River Belt

Lamprey Falls Formation  
(BRB North Flank)

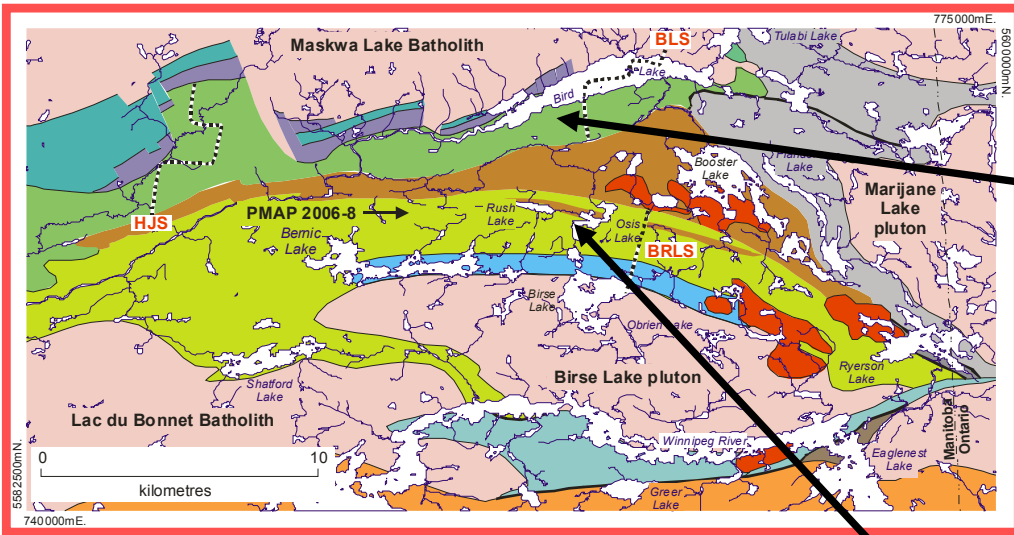
Lamprey Falls Formation  
(Winnipeg River)

Lamprey Falls Formation  
(BRB North Flank as well as  
Winnipeg River)

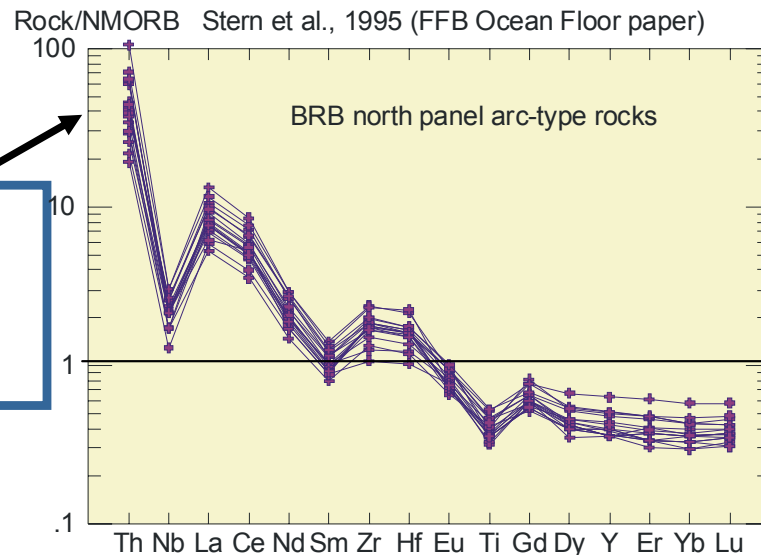


Birse Lake section south part (= Lamprey Falls Fm. ?)

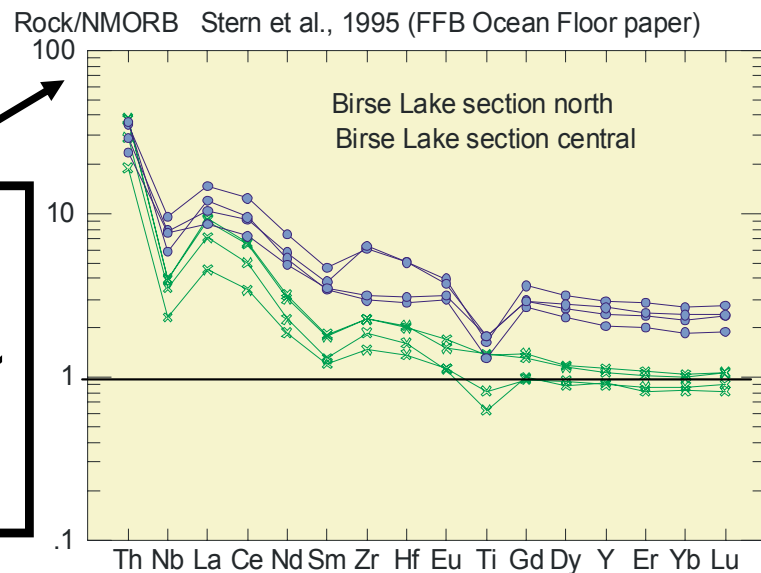
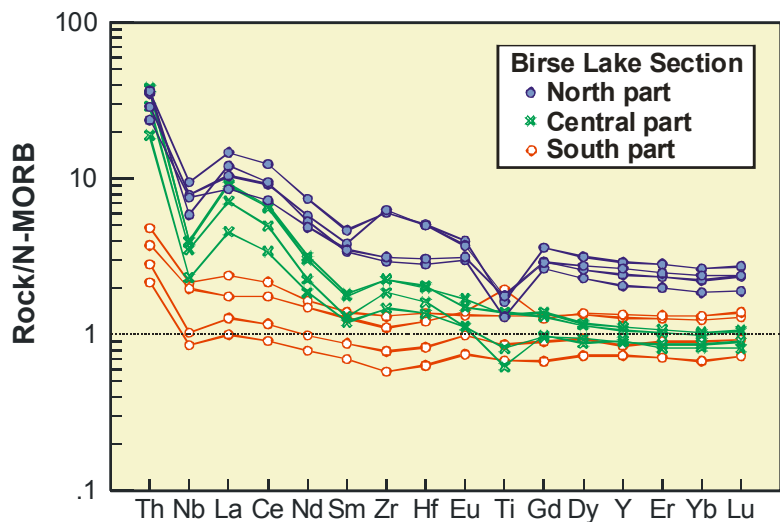
# Arc-type volcanic rocks



**BRB  
North  
panel**

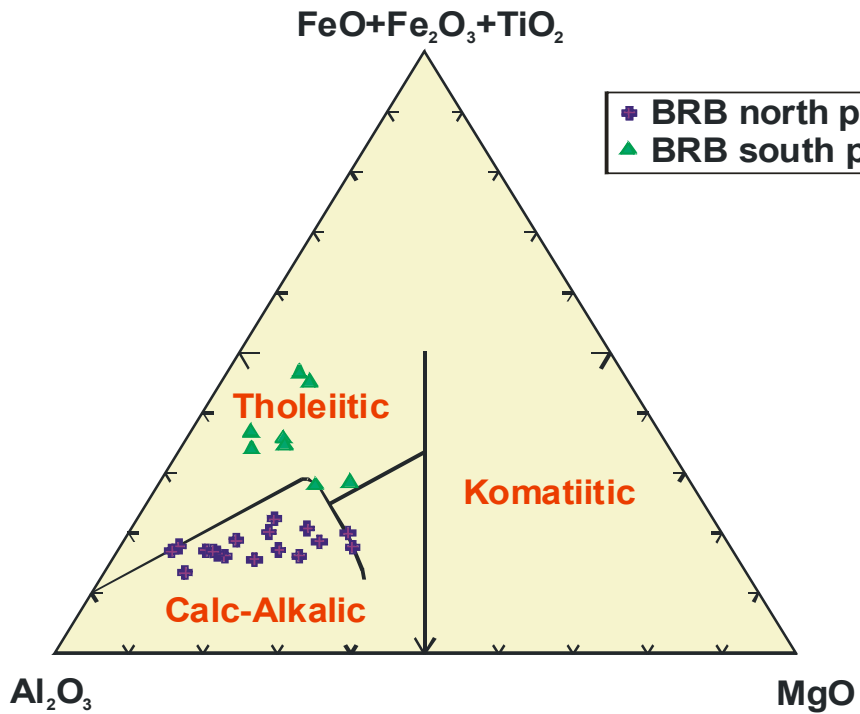


**Birse  
Lake  
section ~  
north  
central**

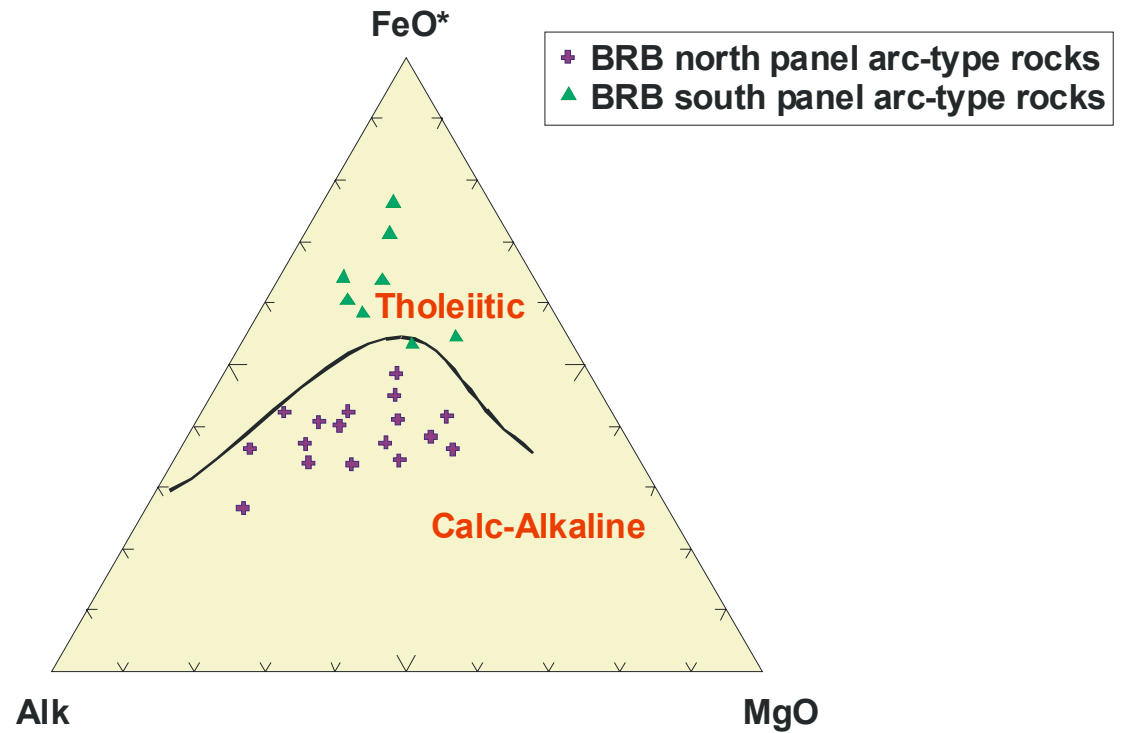




# BRB arc-type volcanic rocks – north and south panels

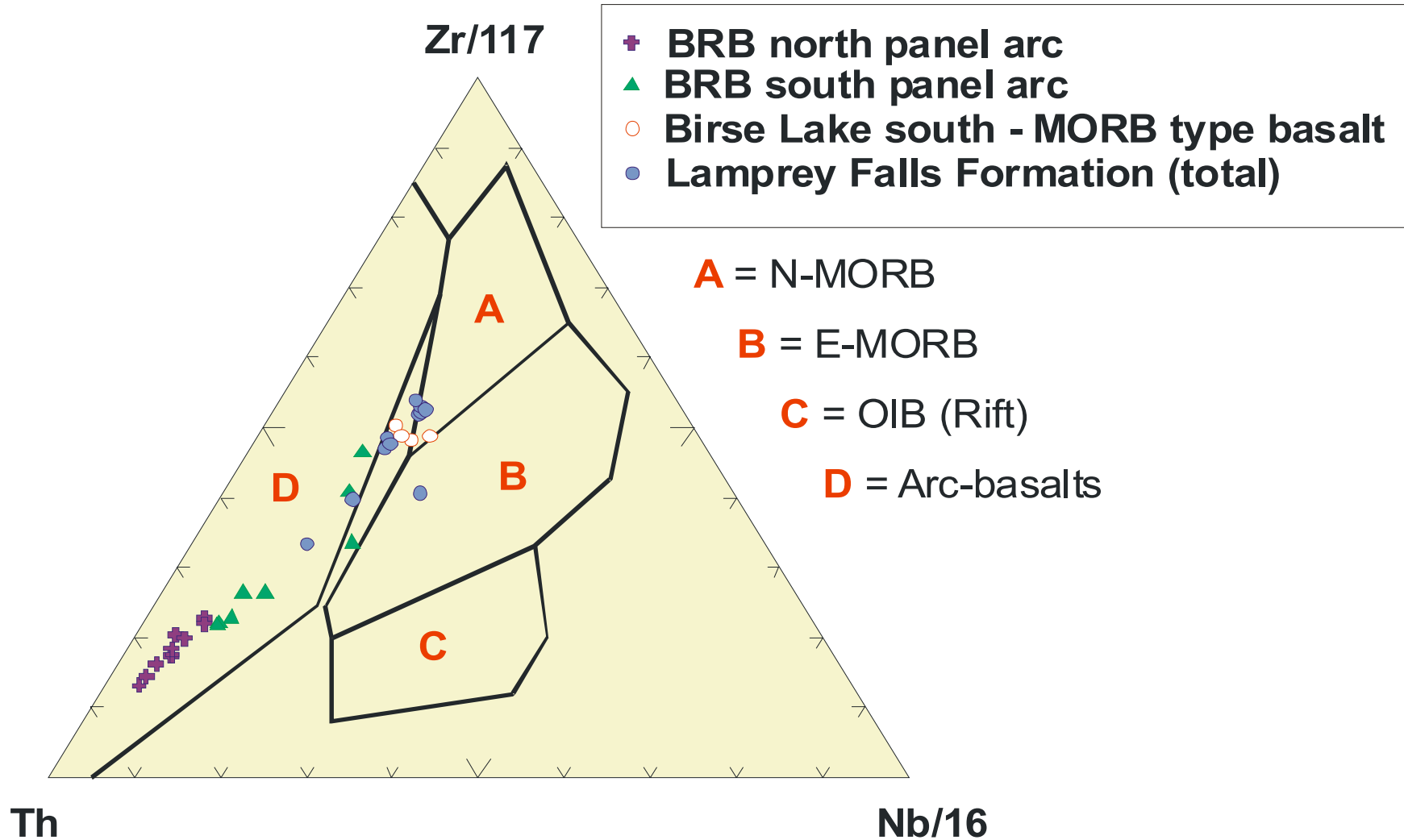


**Jensen cation diagram**



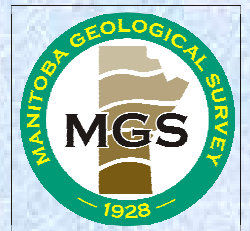
**AFM**

# Bird River greenstone belt – all volcanic rocks



# **Bird River Belt Stratigraphy**

- 1. MORB-type volcanic rocks**
- 2. Arc-type assemblage**
- 3. Booster Lake Formation**



# Bird River Belt Stratigraphy

**1. MORB-type volcanic rocks**

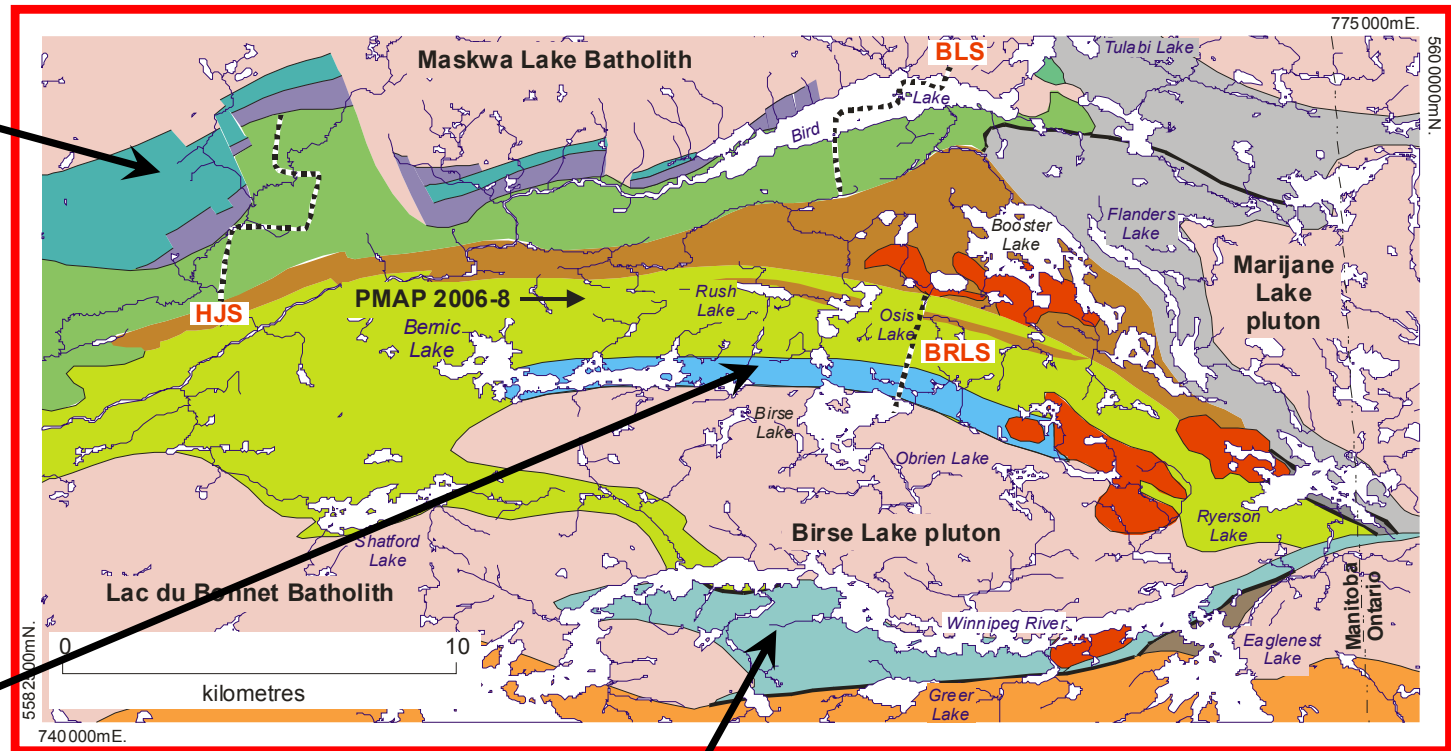
**2. Arc-type assemblage**

**3. Booster Lake Formation**



# MORB-type basalt localities in the Bird River Belt

Lamprey Falls Fm  
(BRB north flank)



Birse Lake  
section south part

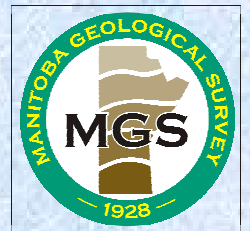


Lamprey Falls Formation (Winnipeg River)



# Bird River Belt Stratigraphy

1. MORB-type volcanic rocks
2. Arc-type assemblage
3. Booster Lake Formation

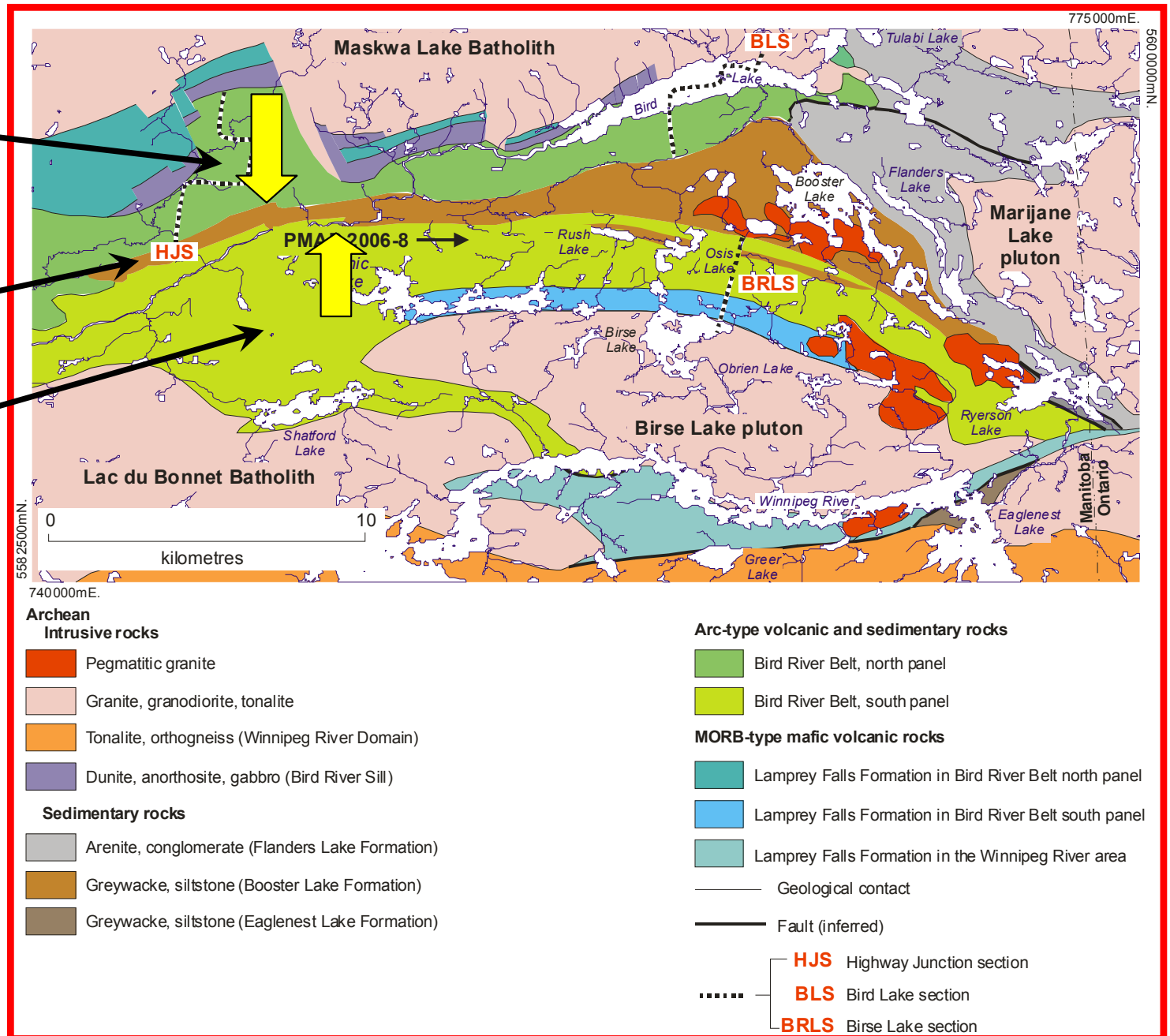


# Bird River Belt – north and south panels

BRB north panel

Booster Lake Formation

BRB south panel

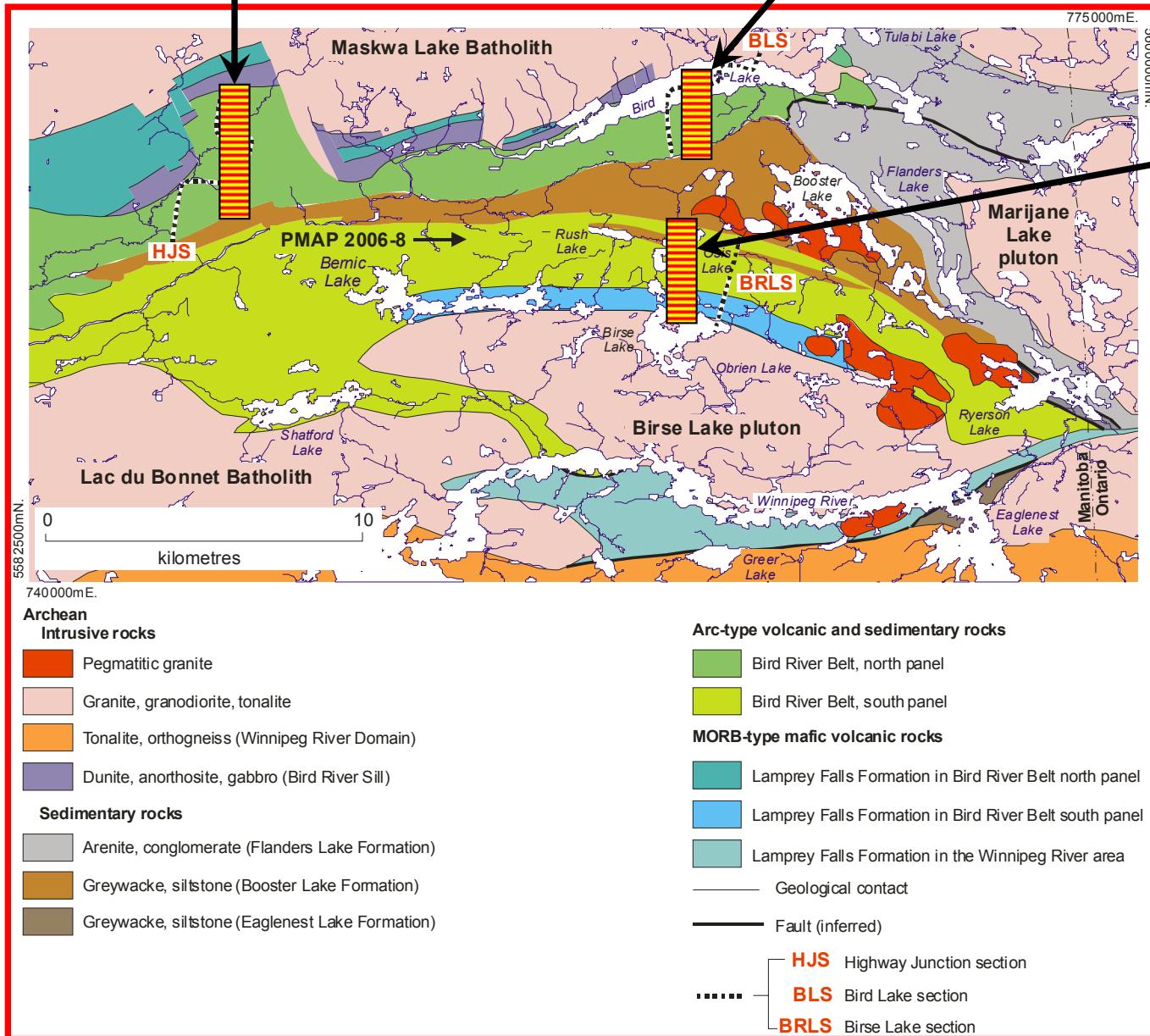


# Bird River greenstone belt - arc assemblage sections

Highway Junction section

Bird Lake section

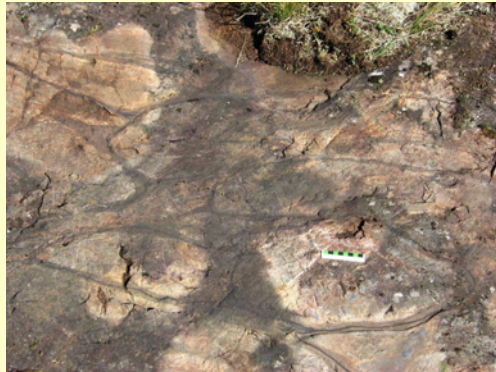
Birse Lake section





# BRB south panel (Birse Lake section)

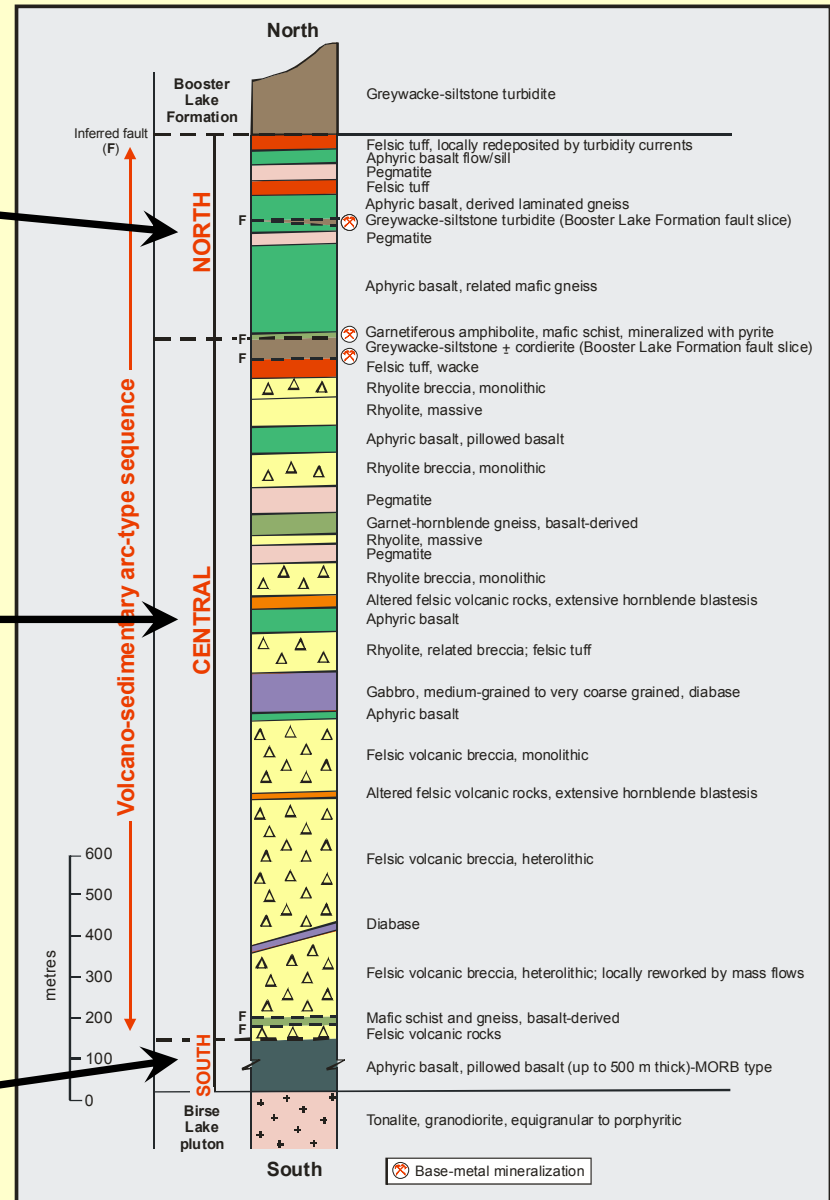
north  
(arc)



central  
(arc)

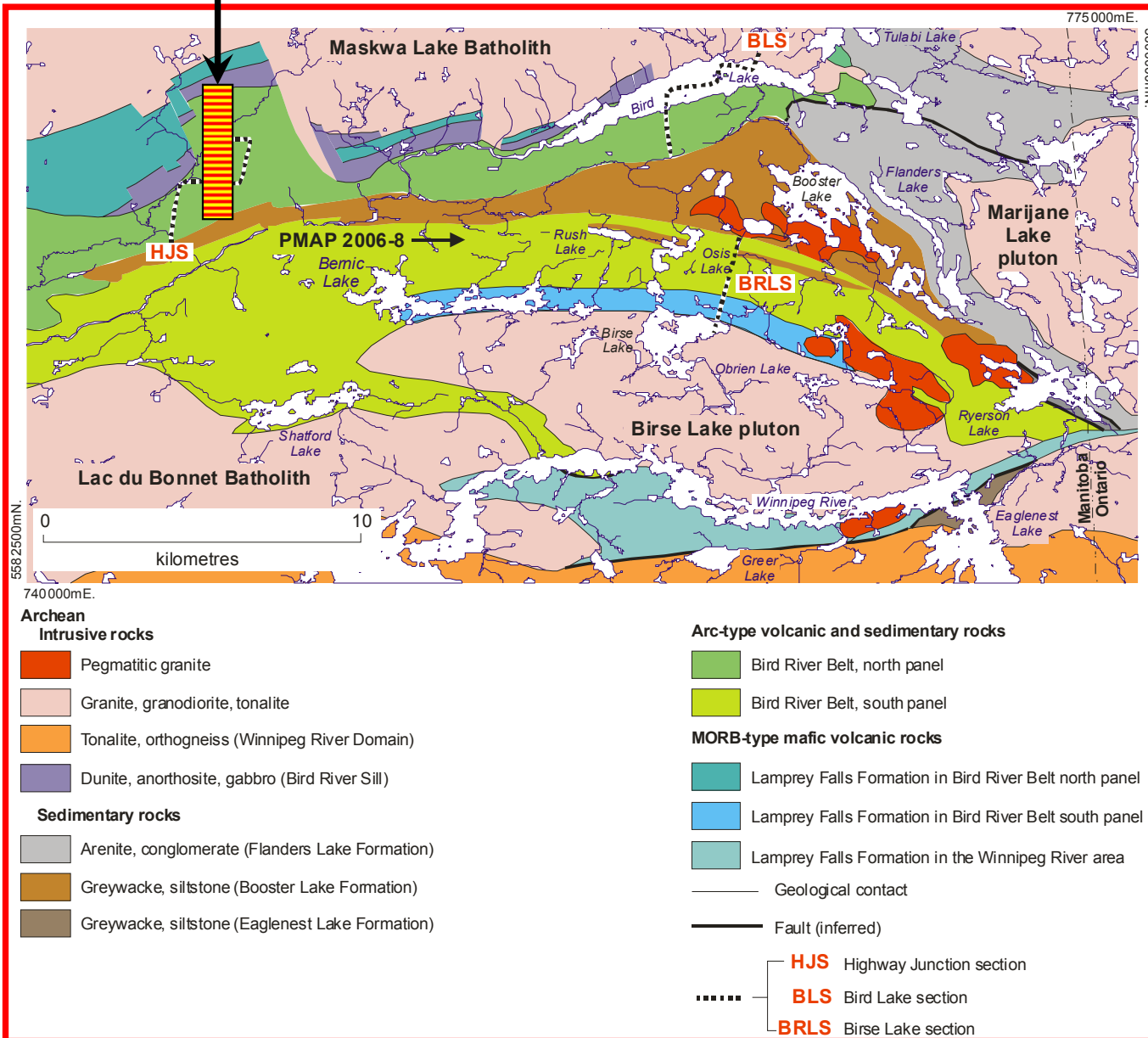


south  
(MORB)

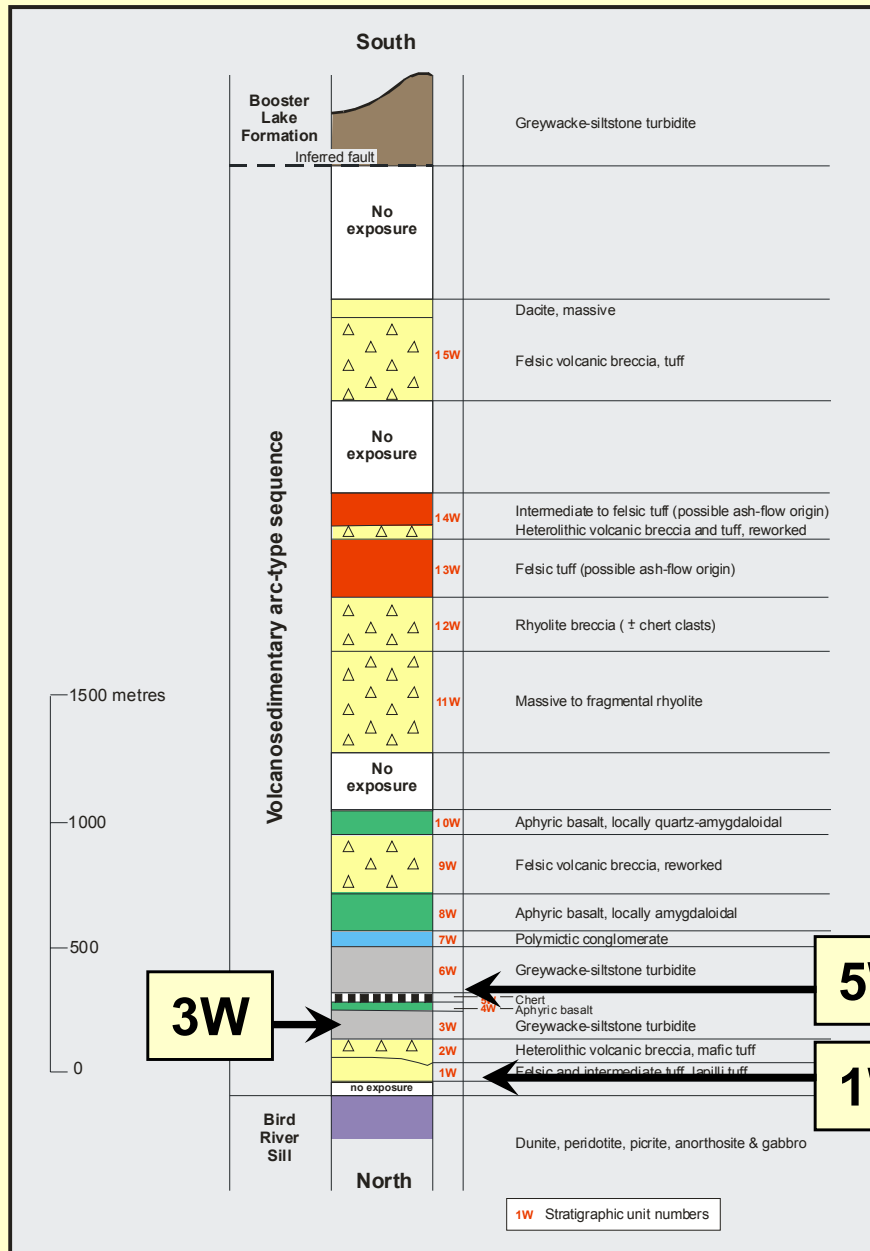


# Bird River greenstone belt – east part

## Highway Junction section



# BRB north panel - Highway Junction section



**5W**  
Synsedimentary folds in laminated chert



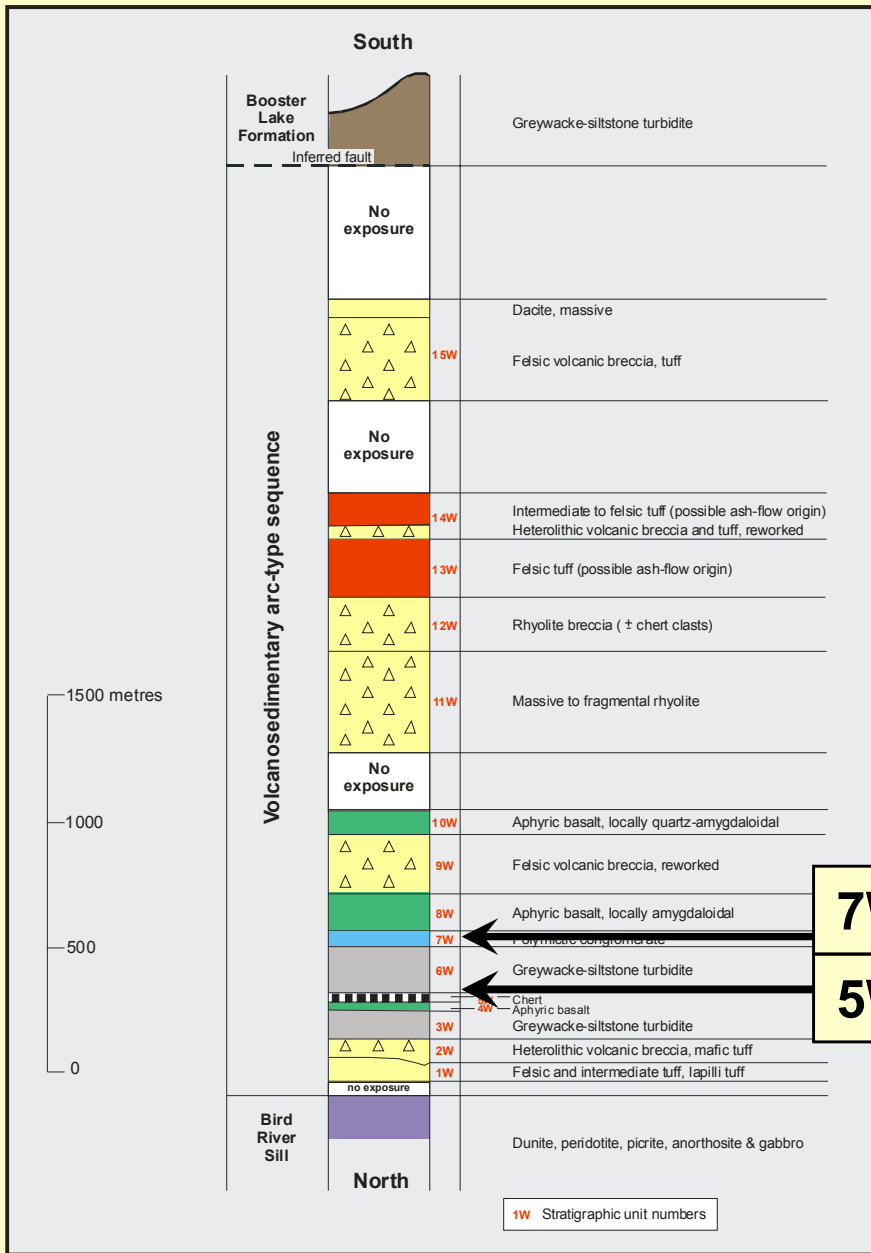
**3W**  
Scoured chert laminae and rip-ups in feldspathic greywacke turbidite



**1W**  
Laminated green-weathering tuff and overlying lapilli tuff mass-flow deposit



# BRB north panel - Highway Junction section



**7W**  
Polymictic conglomerate with basalt and gabbro fragments



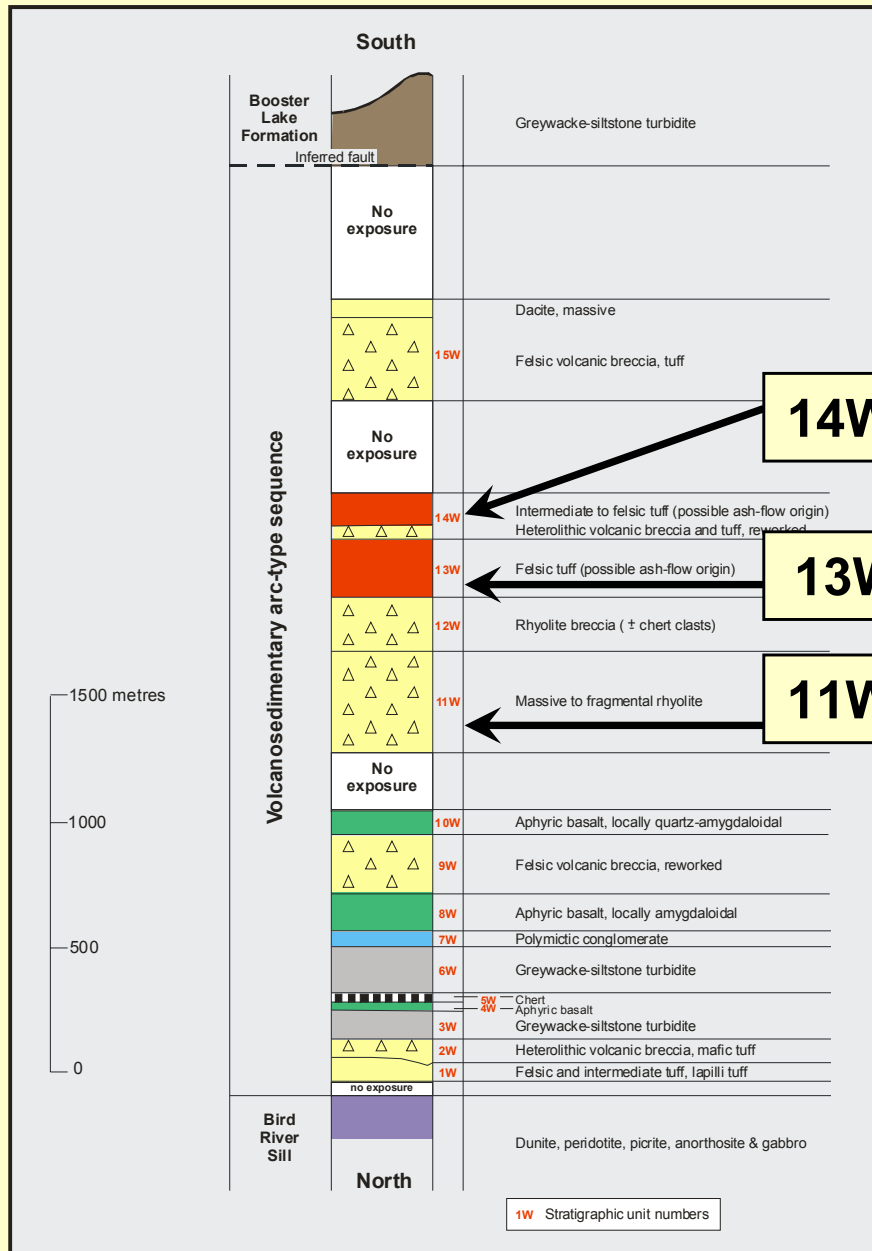
**7W**  
Bedded chert boulder in polymictic conglomerate



**5W**  
Bedded chert within 25 m thick member



# BRB north panel - Highway Junction section



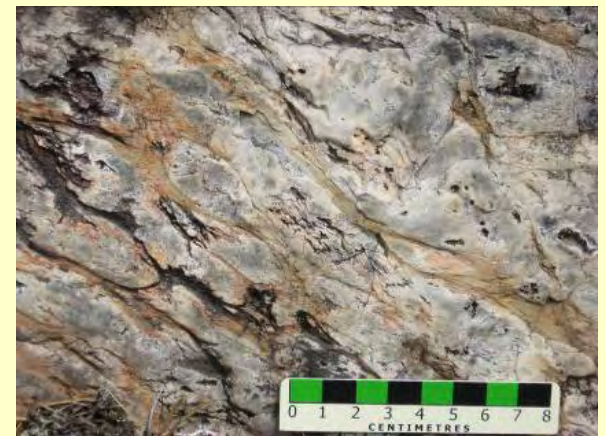
**14W**  
Chert rip-up  
in reworked  
lapilli tuff



**13W**  
Felsic clasts in tuff  
of possible ash-flow  
origin

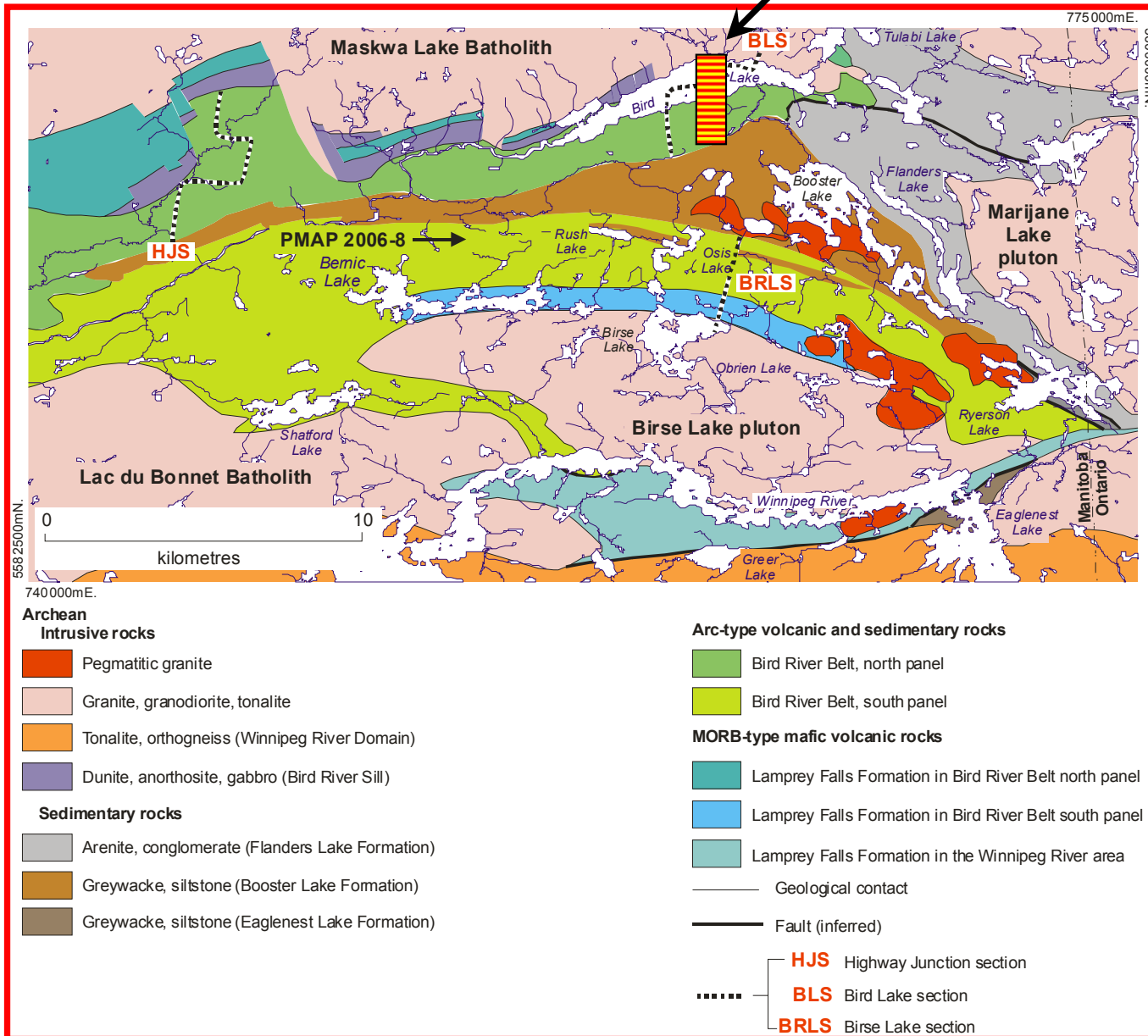


**11W**  
Thermal contraction  
fractures in massive  
rhyolite

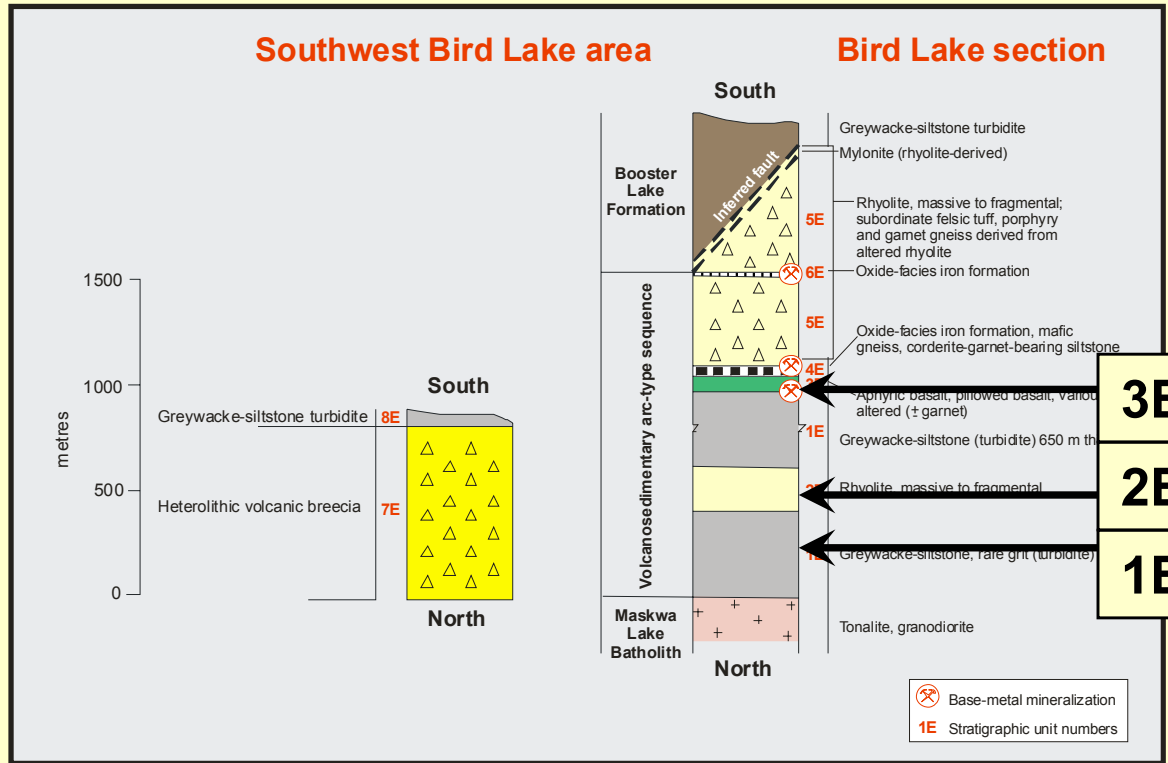


# Bird River greenstone belt – east part

## Bird Lake section



# BRB north panel - Bird Lake section



**3E**  
Pillow basalt  
weathers out  
in spires, due  
carbonatized  
domains



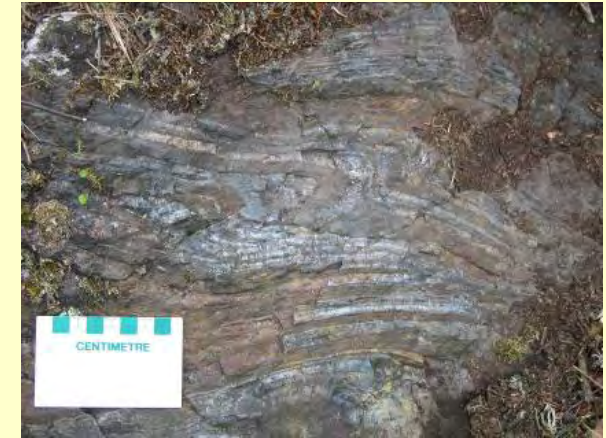
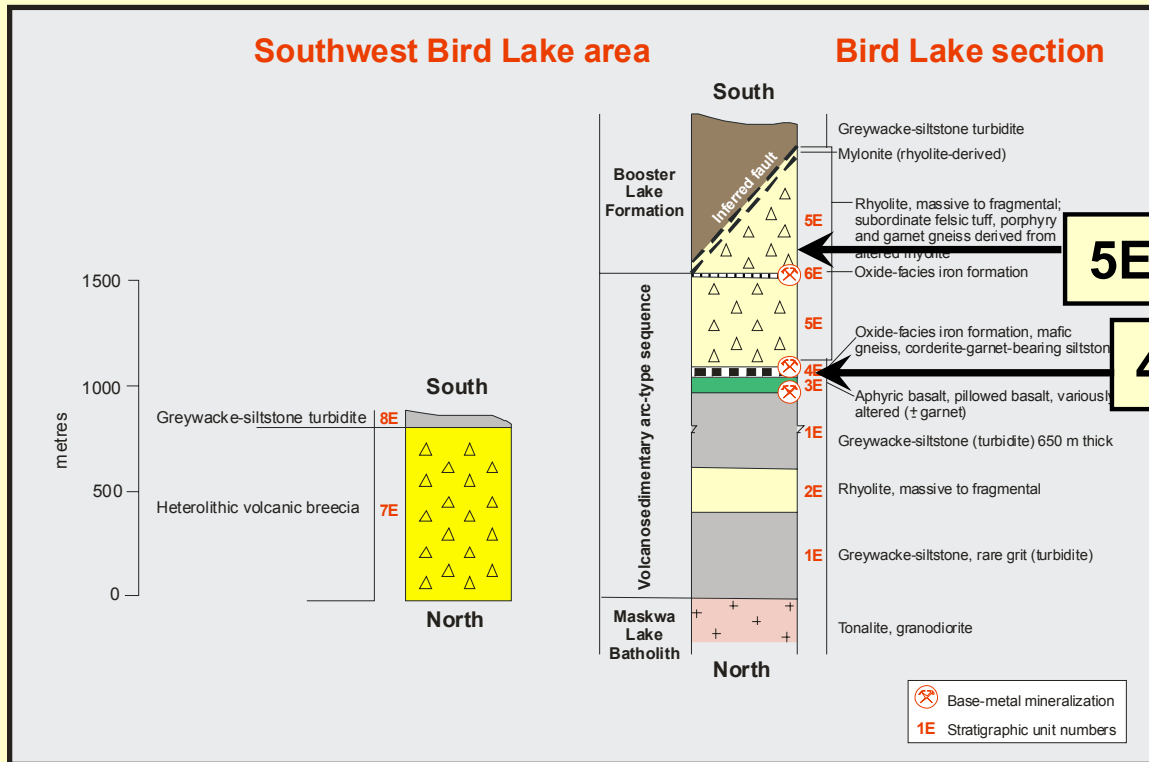
**2E**  
Rhyolite  
breccia of  
autoclastic  
origin



**1E**  
Quartz grit channel  
deposit  
within turbidite  
sequence



# BRB north panel - Bird Lake section



**6E**  
Layered chert and magnetiferous siltstone



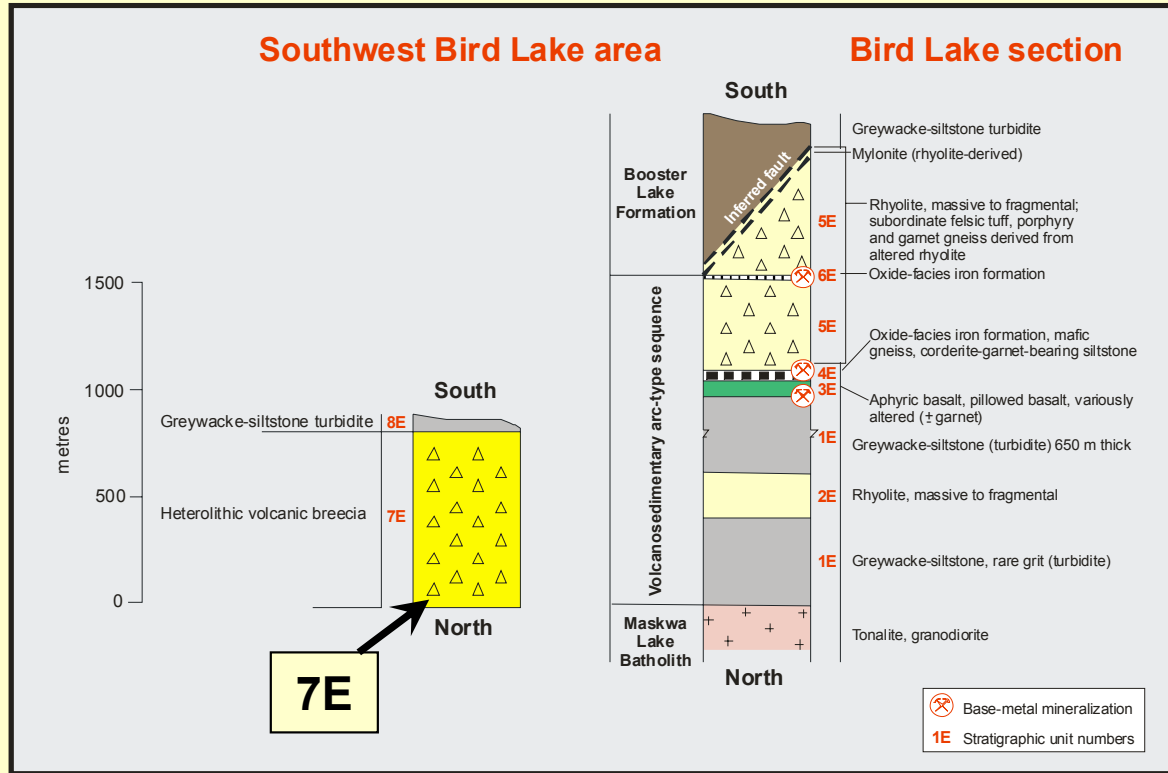
**5E**  
Mylonitic rhyolite close to the faulted contact with Booster Lake Formation



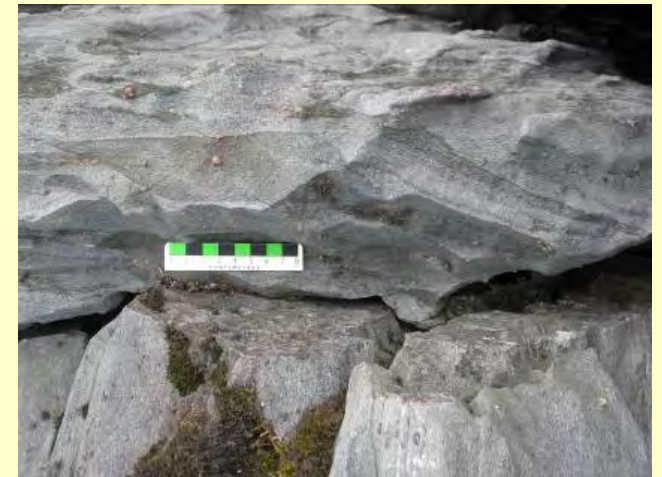
**4E**  
Garnet and oval cordierite porphyroblasts in meta-siltstone (associated with iron formation)



# BRB north panel – southwest Bird Lake area



**7E** Dark blue cordierite porphyroblasts in volcanic breccia matrix



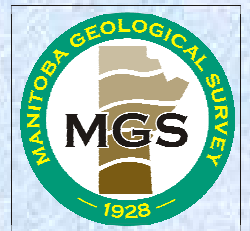
**7E** Angular mafic and felsic fragments in volcanic breccia

**7E** Rhyolite boulder in heterolithic mass flow deposit

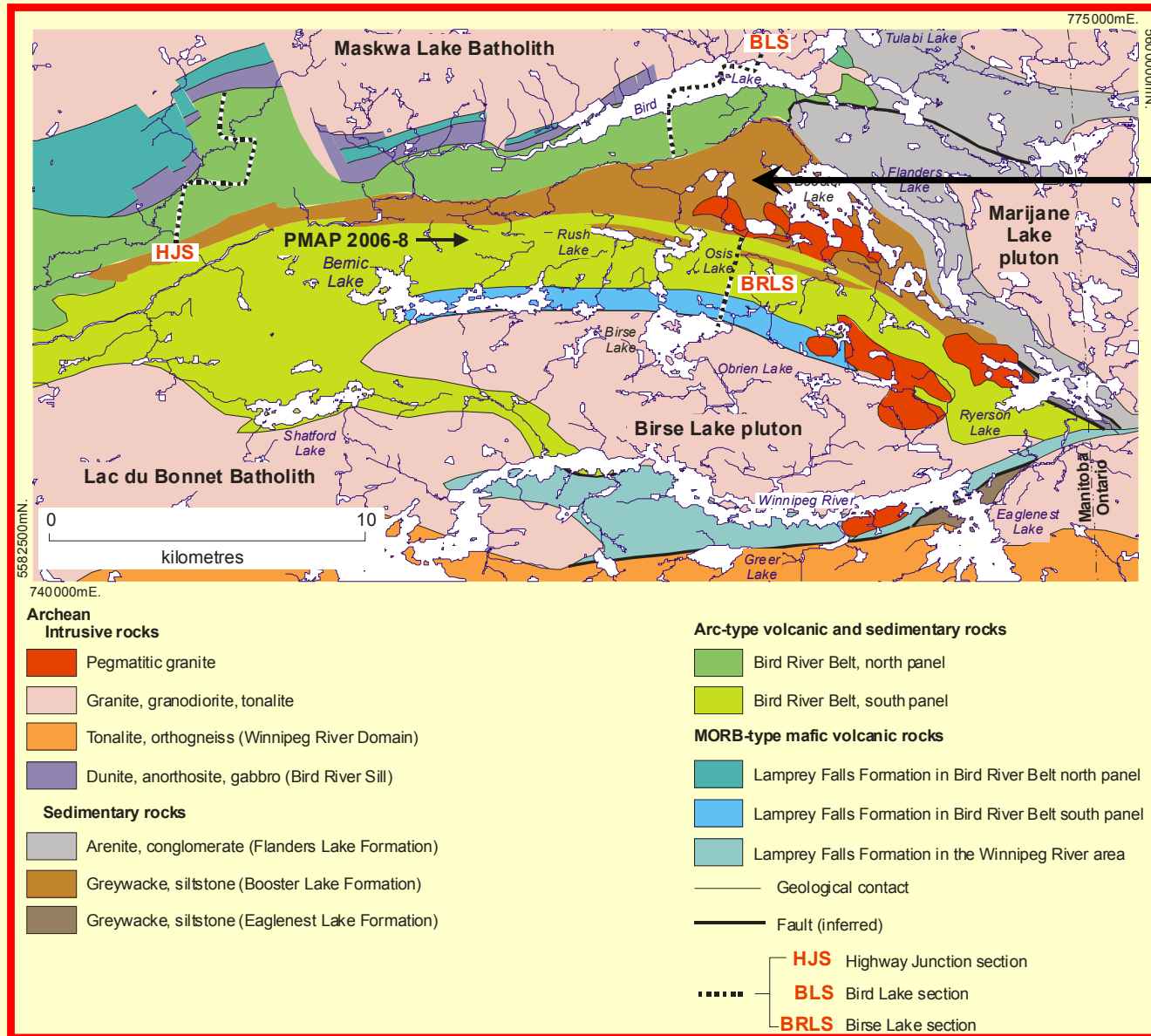


# Bird River Belt Stratigraphy

1. MORB-type volcanic rocks
2. Arc-type assemblage
3. Booster Lake Formation



# Bird River greenstone belt – east part

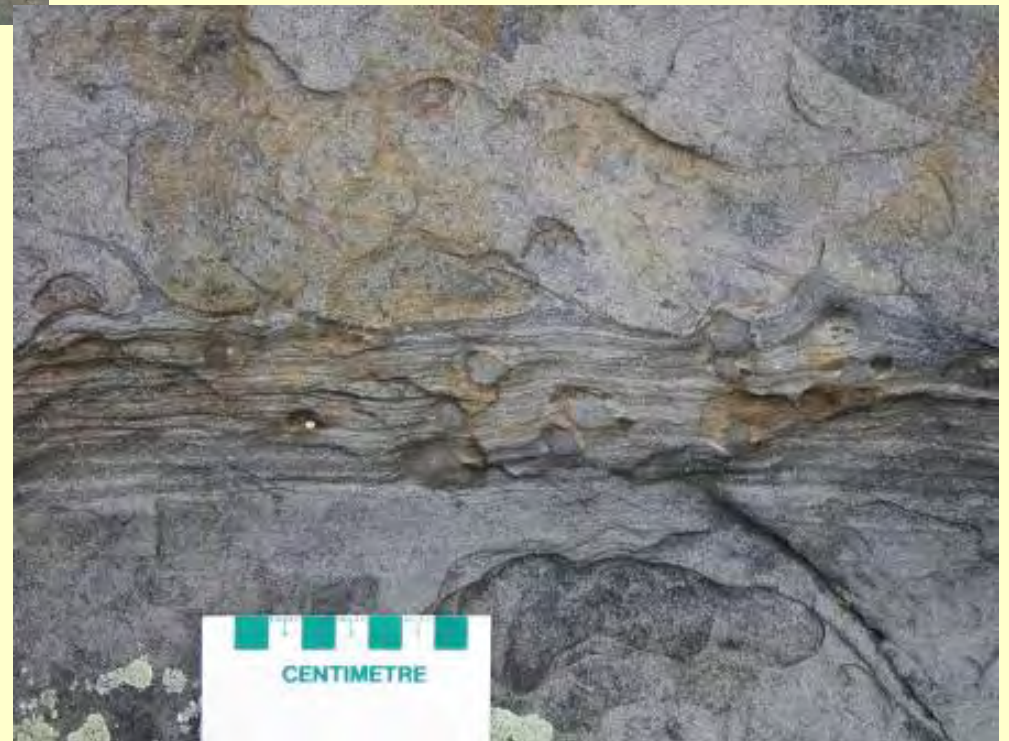


**Booster Lake Formation**



**Graded bedding in Booster  
Lake Fm. turbidite**

**Flame structure in Booster  
Lake Fm. turbidite**

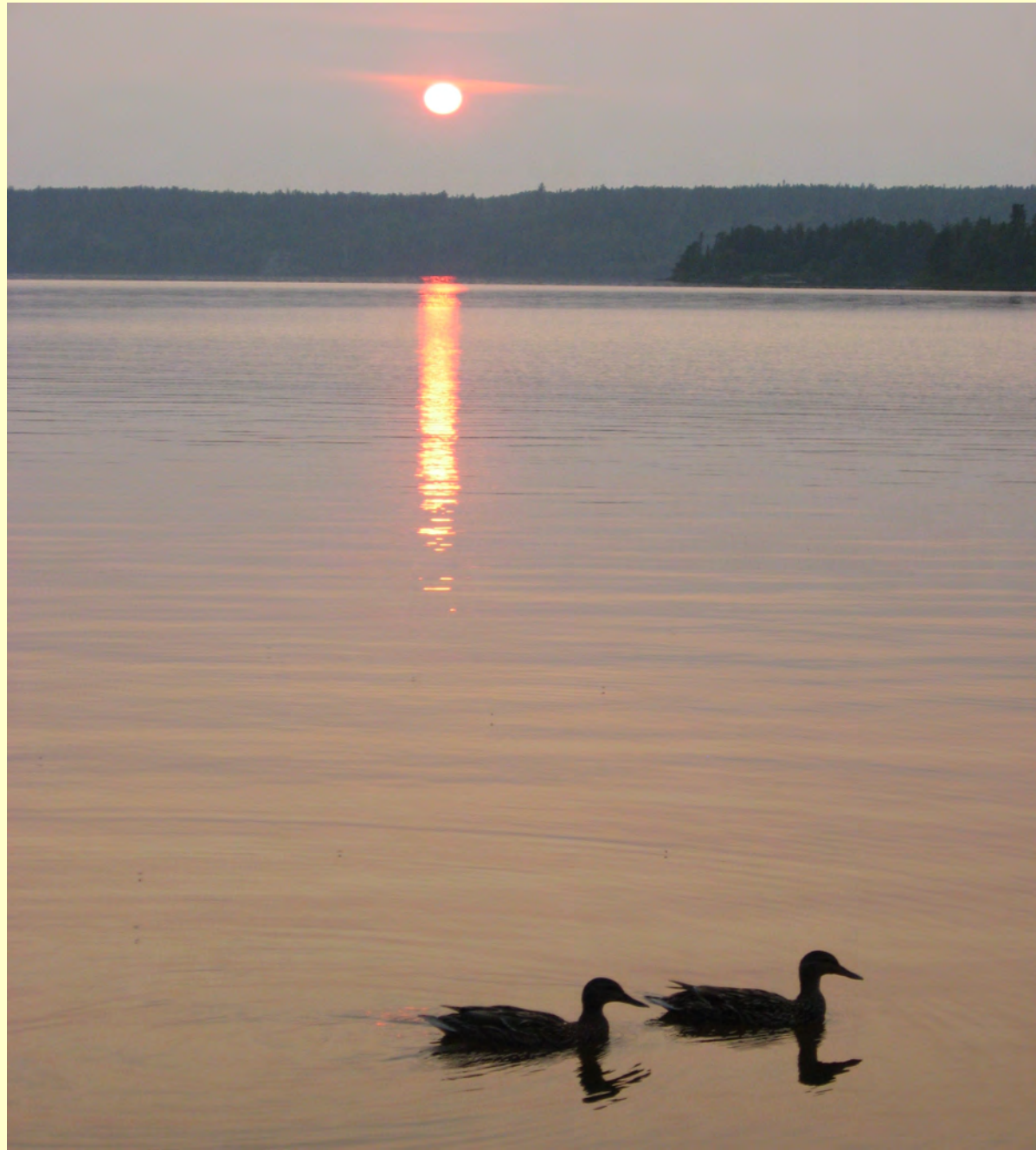




**Bedding-foliation discordance and cordierite porphyroblasts in Booster Lake Fm. turbidite**

# Summary

- ❑ Neoproterozoic Bird River Belt consists of an arc-type **calc-alkaline north panel** ( $> 2740 \pm 4$  Ma) and **tholeiitic south panel**. Older ( $> 2745$  Ma) MORB-type volcanic rocks (**Lamprey Falls Formation**) occur along the north and south margins of the belt
- ❑ The arc-type panels are separated by faulted **Booster Lake Formation** turbidites that extend through the centre of the belt. **Flanders Lake Formation** fluvial-alluvial rocks overlie the arc-type assemblage at east end of the belt.
- ❑ New data indicate an age of  $2697 \pm 18$  Ma for the **Flanders Lake Formation** and  $2712 \pm 17$  Ma for **Booster Lake Formation**, indicating these formations postdate the volcanism by approximately 30 m.y.
- ❑ Bird River Belt is known primarily for Tanco Mine (Cs and Ta), Maskwa-Dumbarton Mine (Cu-Zn) and the PGE potential of the Bird River Sill. Additional **base-metal and Au exploration targets** exist within arc-type volcanic rocks and iron formation in the Bird River Belt. North of the arc assemblage, **base-metal and PGE mineralization** occurs in gabbros in the Lamprey Falls Formation; equivalent rocks at the Winnipeg River contain **mineralized oxide-facies iron formation**.



**Please visit posters T7 to T10  
for more information about  
the Bird Lake area**

