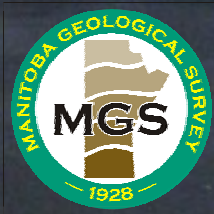
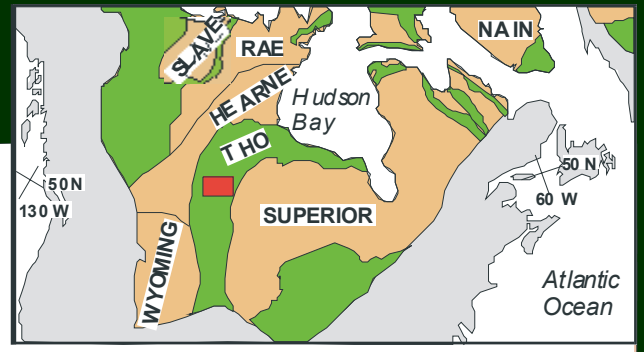
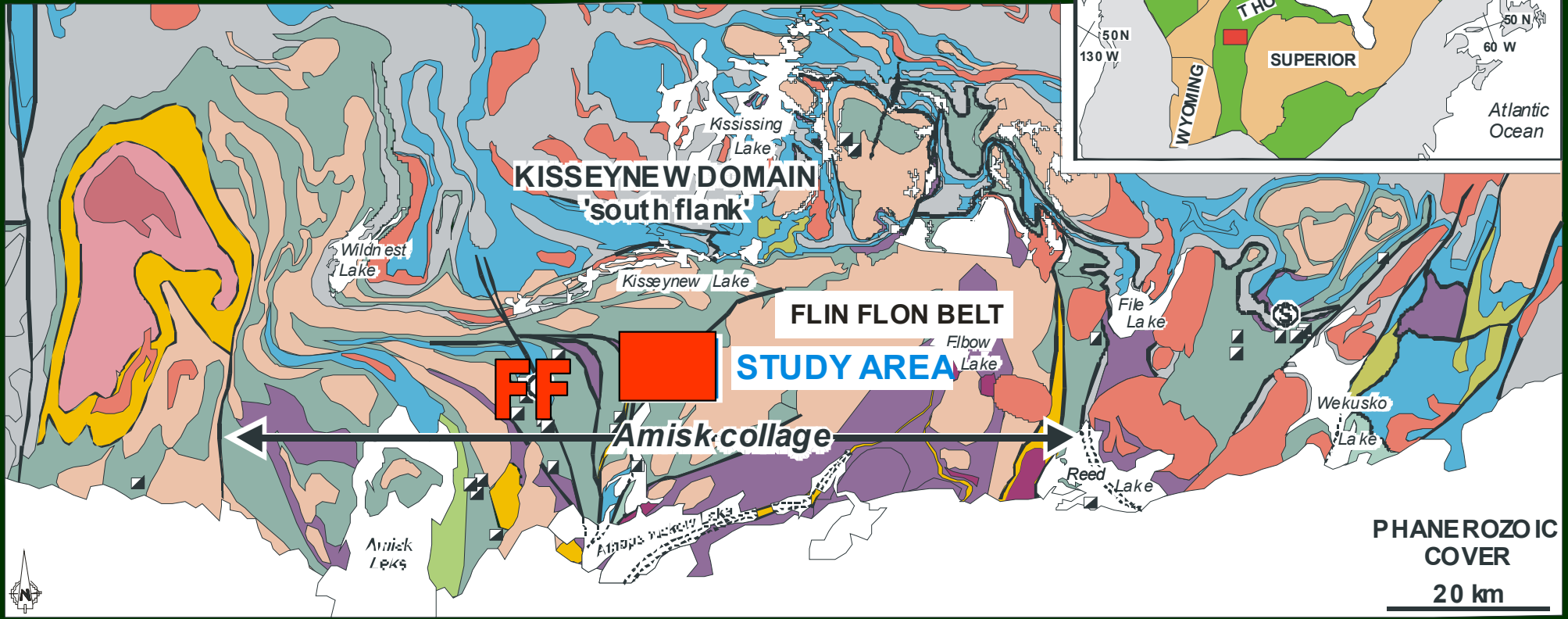


Application of geochemistry for the
assessment of economic potential of
tectonically distinct volcanic terranes
in the northern Flin Flon Belt,
Manitoba, Canada

by
Paul Gilbert





PHANEROZOIC COVER
20 km





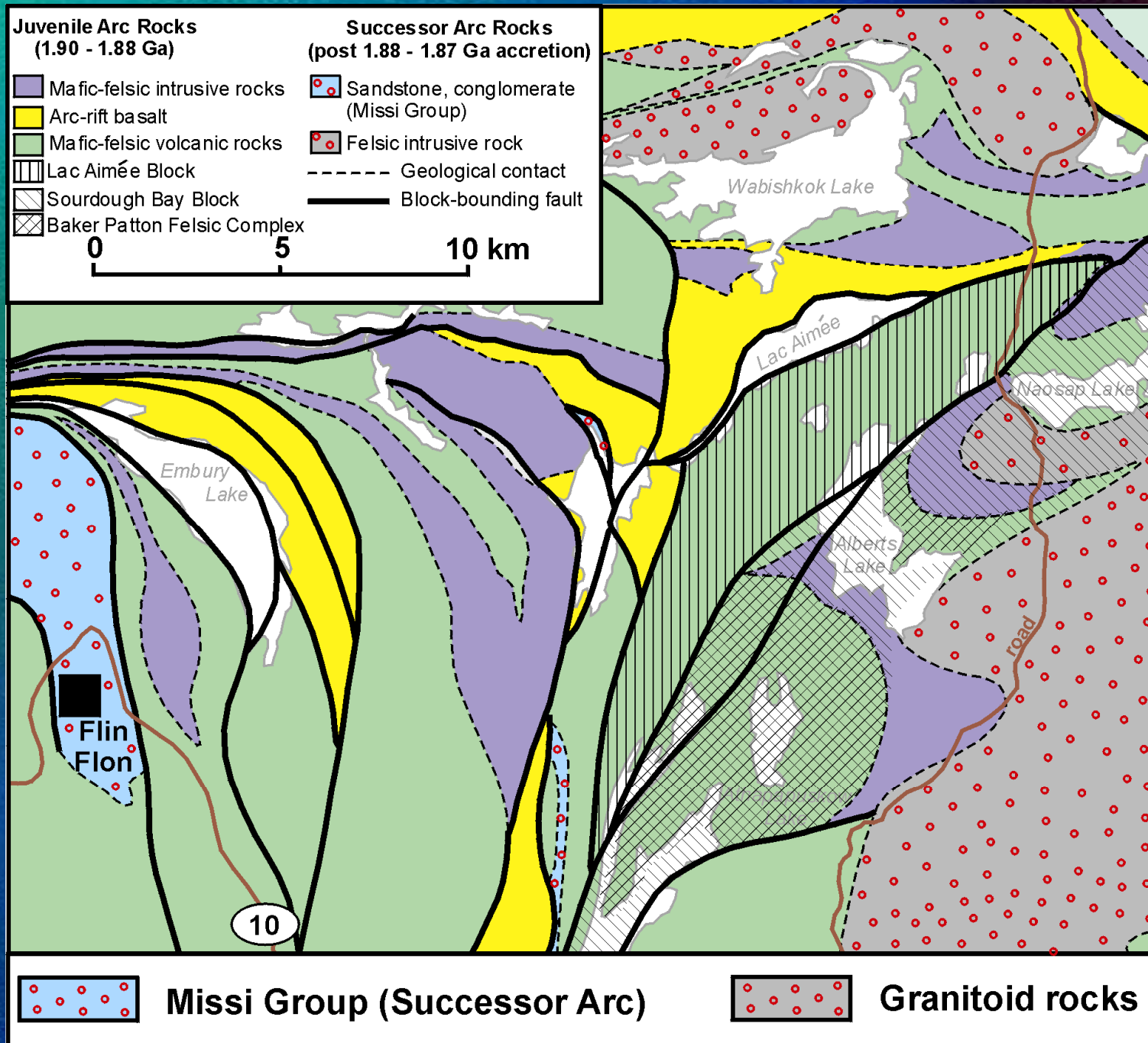
35 D

ATTENTION
BLASTING
IN CRUSHER
WHEN WHISTLE
IS BLOWING

136



Northern FF Belt: Geochemical Assemblages

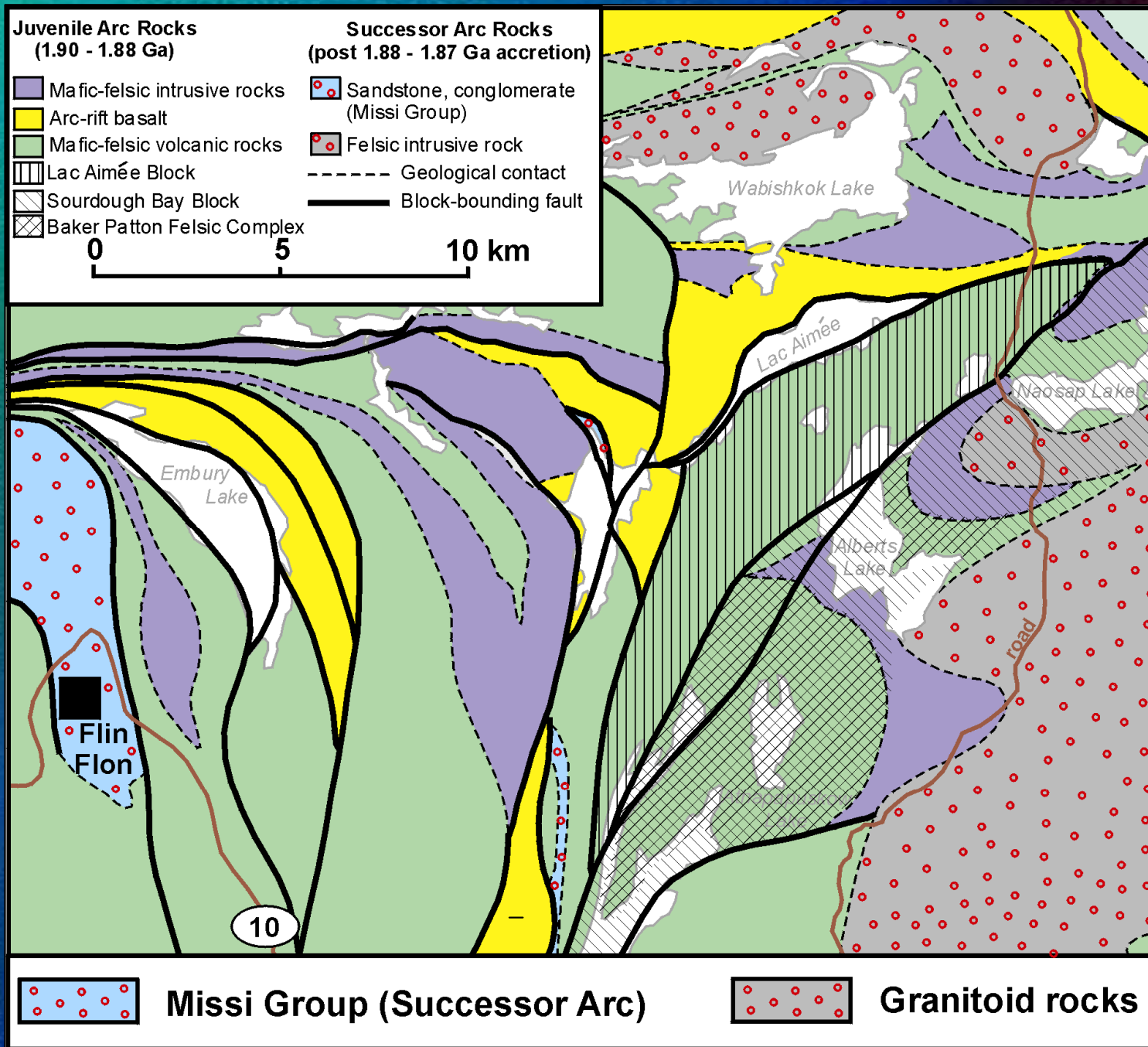




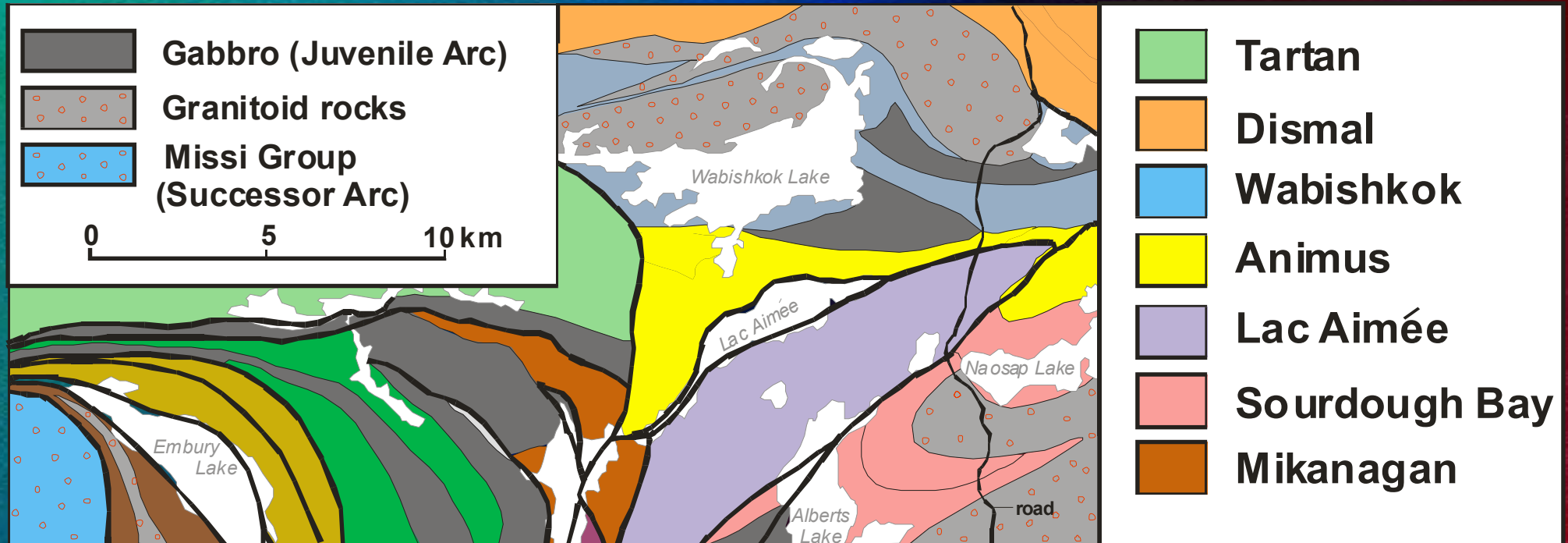
Simplified tectonic history of the Flin Flon Belt

Pre-accretion period (1.906 – 1.881 Ga) - 'Juvenile arc'	
1.9 – 1.88	Juvenile arc and BABB volcanism, and turbidite sedimentation - Flin Flon arc assemblage Elbow-Athapapuskow ocean-floor assemblage
Tectonic accretion - 1.88 to 1.87	Amisk collage
Post-accretion period (1.876 – 1.838 Ga) - 'Successor arc'	Juvenile calc-alkaline plutons
1.87 – 1.847	Marine to subaerial sedimentation
1.84 – 1.81	Peak orogeny, continental collision

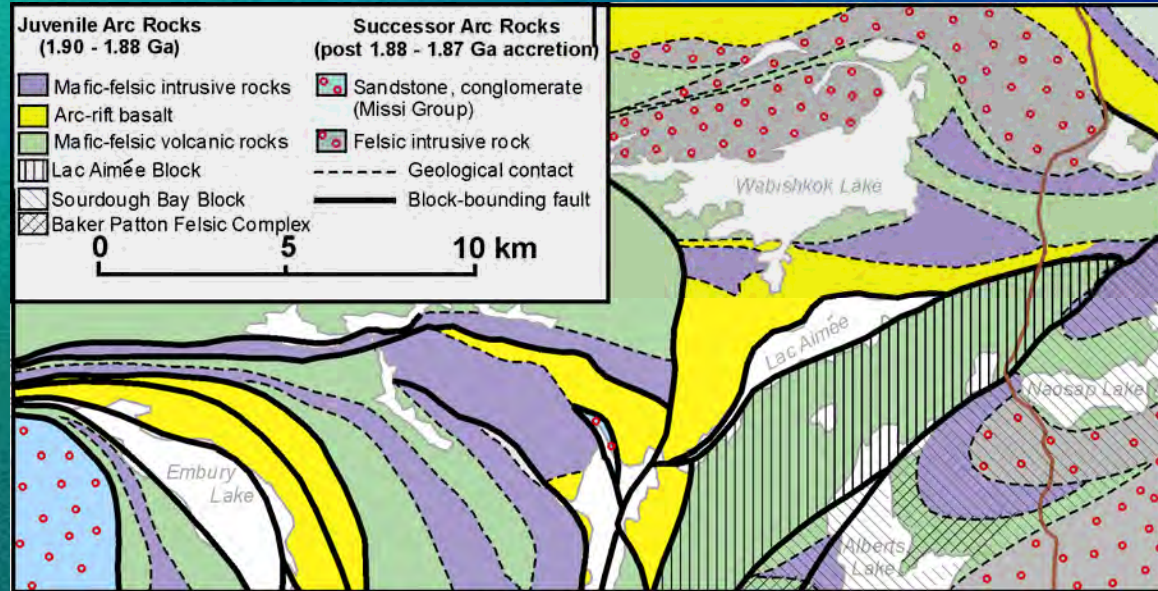
Northern FF Belt: Geochemical Assemblages



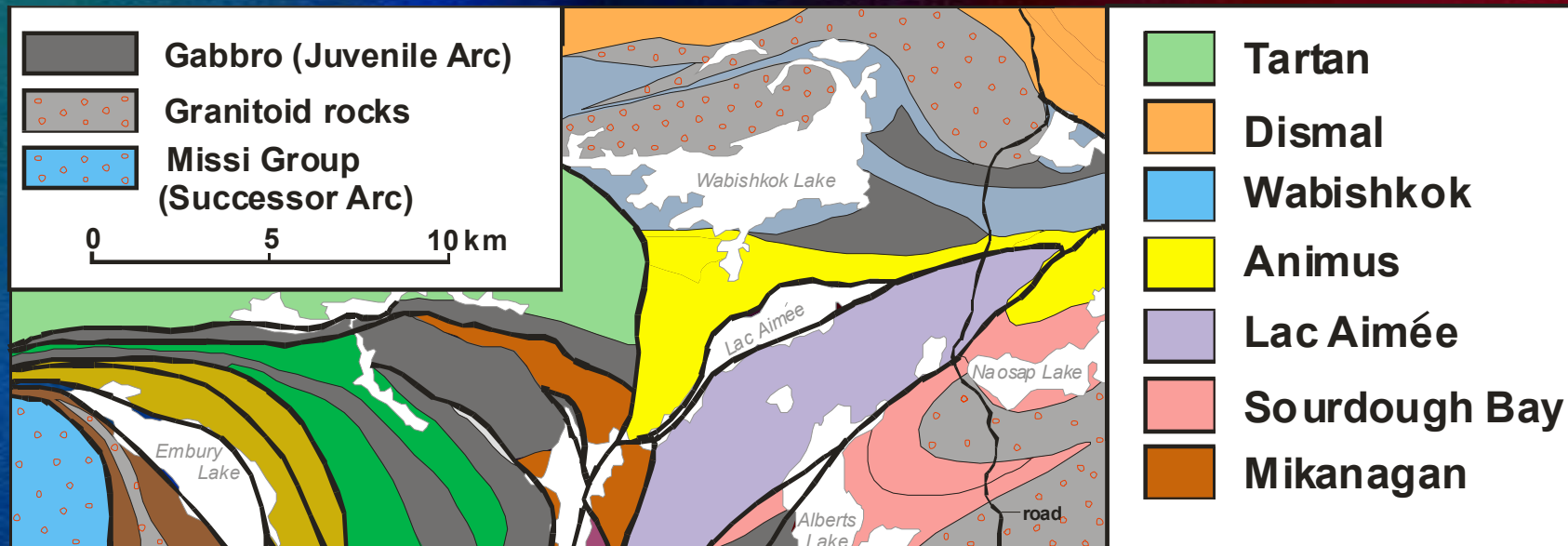
Northern FF Belt: Fault Blocks



Northern FF Belt: Geochemical Assemblages



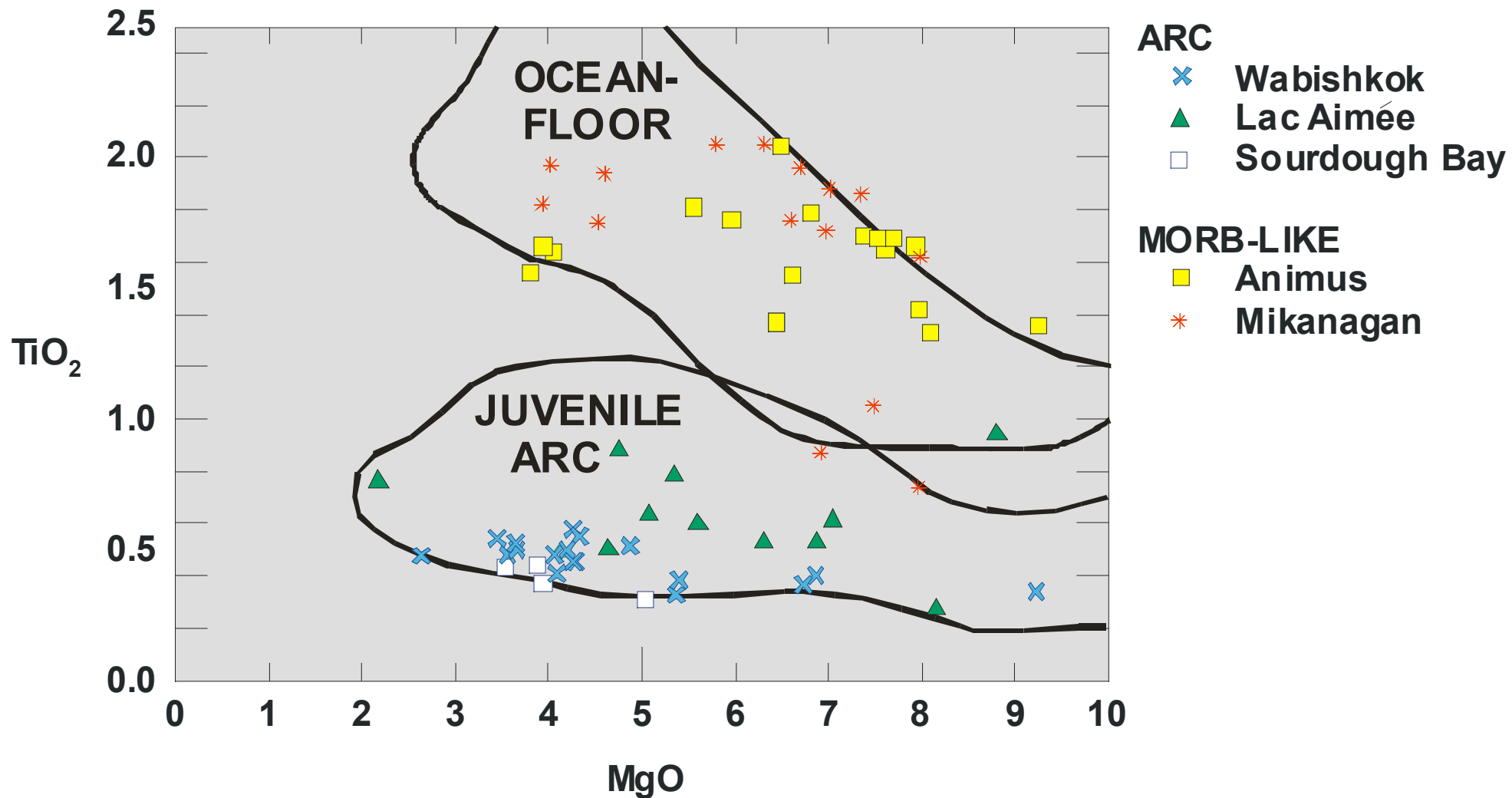
Northern FF Belt: Fault Blocks



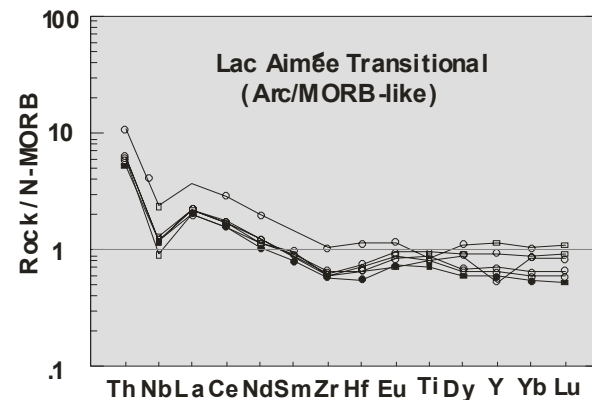
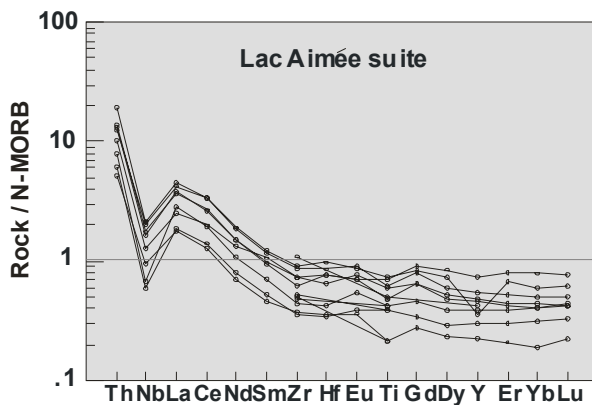


Selected Element Averages

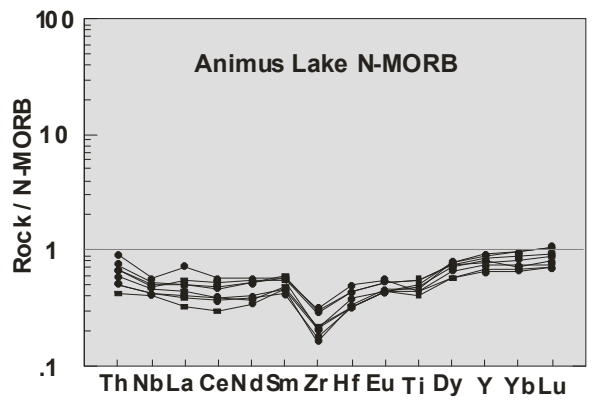
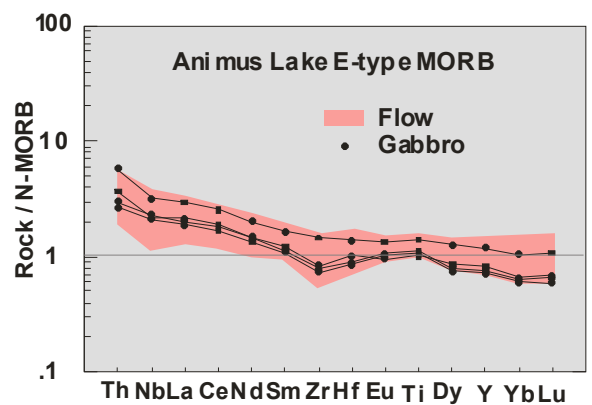
Fault Block	Tectonic type	SiO ₂ %	TiO ₂ %	FeO total %	Th ppm
Wabishkok Lake, Lac Aimée, Sourdough Bay	ARC	56	0.5	10.6	0.7
Animus Lake	E-MORB	50	1.6	12.6	0.5
Mikanagan Lake	E-MORB	51	1.9	13.4	0.9
Animus Lake	N-MORB	49	0.6	11.4	0.1
Lac Aimée	TRANS Arc/E-MORB	55	1.1	13.6	0.8
Dismal Lake	TRANS N-MORB/Arc	50	0.9	11.2	0.1



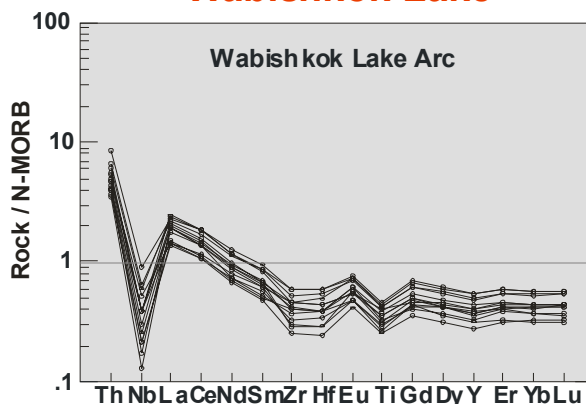
Lac Aimée



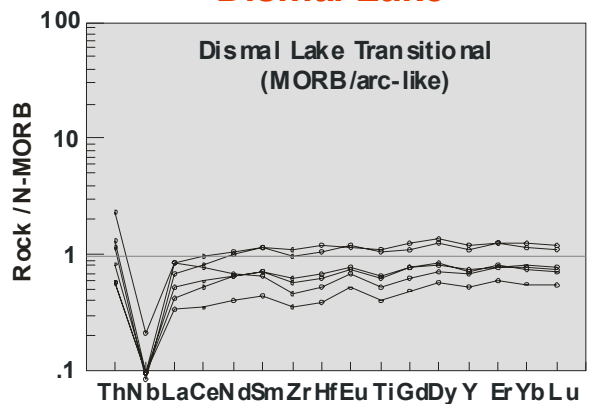
Animus Lake



Wabishkok Lake



Dismal Lake





1 ARC BASALTS

- enrichment of LREE + Th
- Nb negative anomaly
- negative profile due to HFSE depletion (Ti, Zr and Hf)



2 E-MORB BASALTS - e.g. ANIMUS LAKE BASALT

- REE contents similar to MORB, but moderately higher LREE
- No REE depletion
- No Nb spike



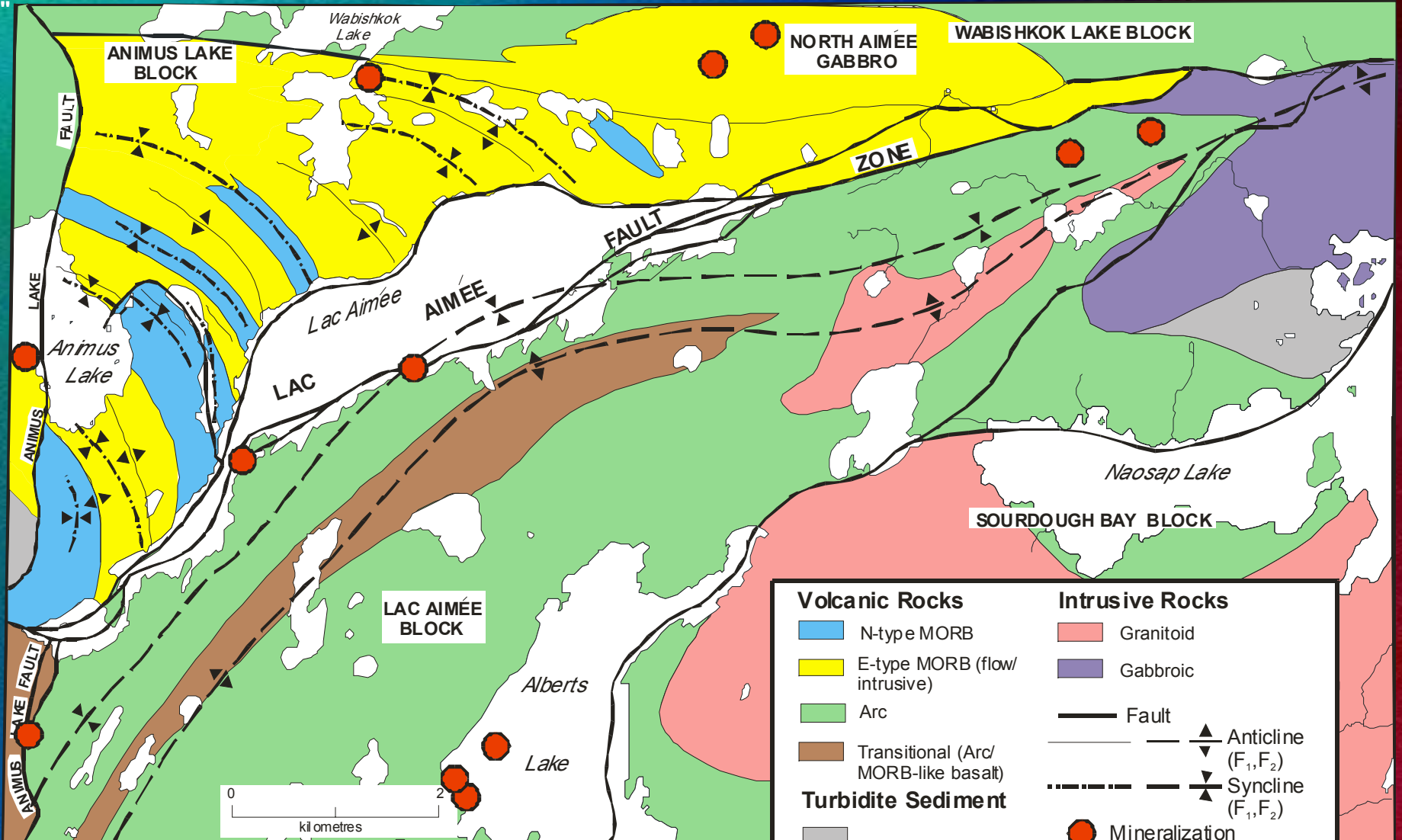
GEOCHEMICAL TYPES

1. Arc
2. E-MORB
3. Dismal Lake Transitional
4. Lac Aimee Transitional
5. Animus Lake N-MORB



101°37'30"
54°53'00"

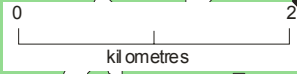
101°25'00"
54°53'00"



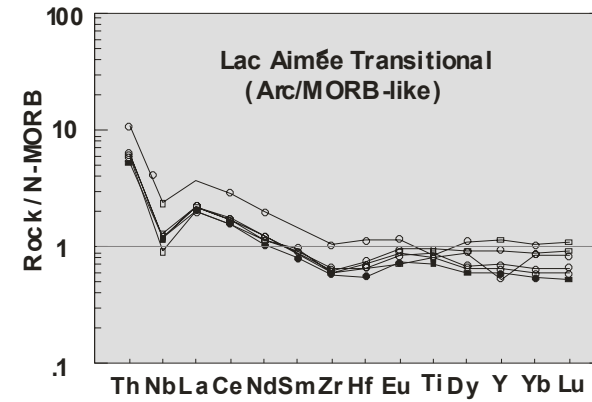
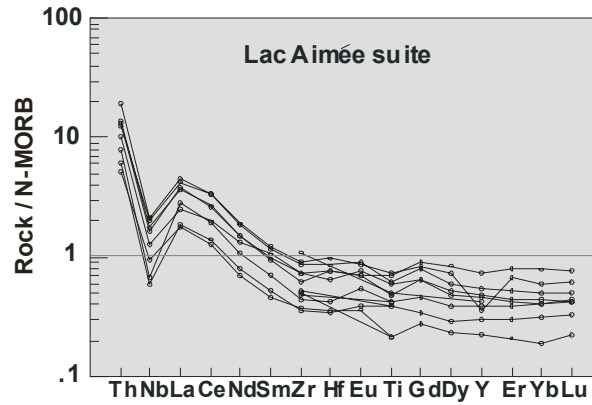
Volcanic Rocks		Intrusive Rocks	
	N-type MORB		Granitoid
	E-type MORB (flow/intrusive)		Gabbroic
	Arc		Fault
	Transitional (Arc/MORB-like basalt)		Anticline (F ₁ , F ₂)
	Turbidite Sediment		Syncline (F ₁ , F ₂)
			Mineralization (base metal)

54°48'40"
101°37'30"

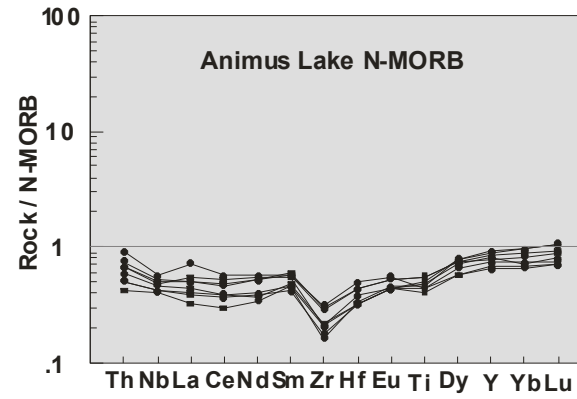
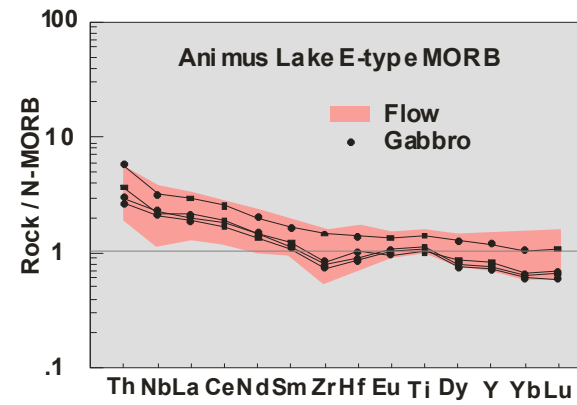
54°48'40"
101°25'00"



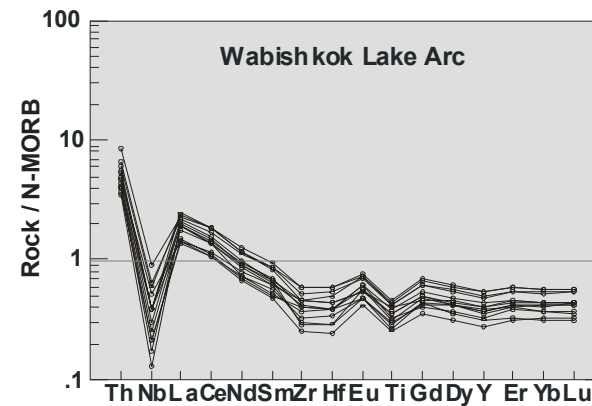
Lac Aimée



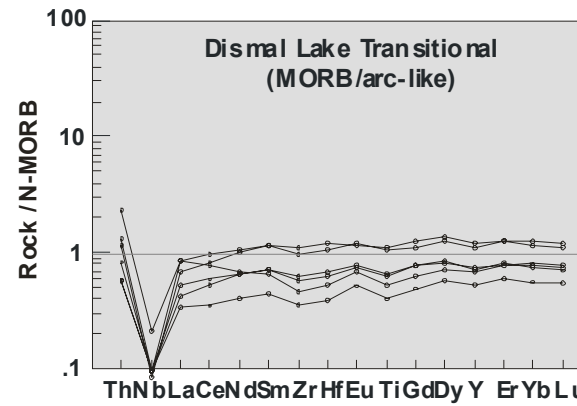
Animus Lake



Wabishkok Lake



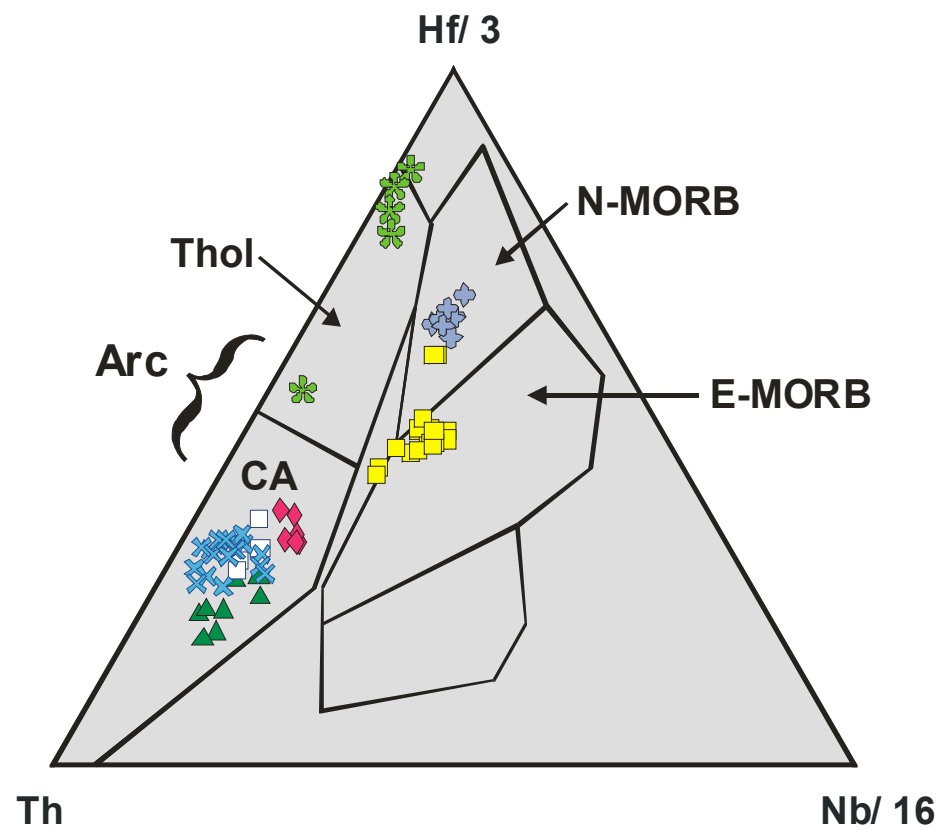
Dismal Lake





Selected Element Averages

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- | | | |
|---|---------------|----------------------------|
| × | Wabishkok | } ARC |
| ▲ | Lac Aimée | |
| □ | Sourdough Bay | |
| ◆ | Lac Aimée | TRANSITIONAL ARC/MORB-like |
| ■ | Animus | E-MORB |
| ⊕ | Animus | N-MORB |
| ✱ | Dismal | TRANSITIONAL MORB/ARC-like |



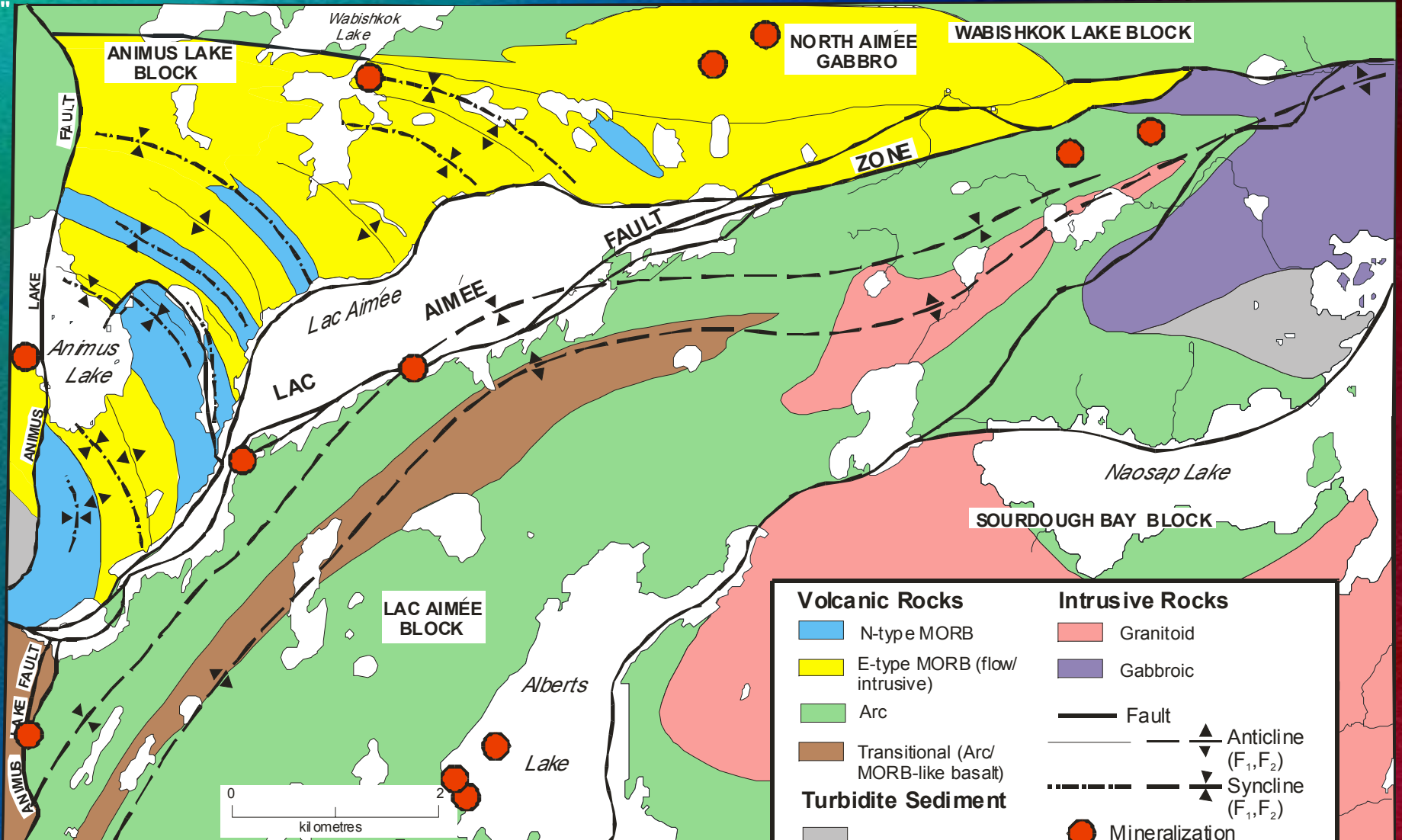
Arc-rift terranes

- MORB-like basalts + ferrobasalts
- Intra-arc extension-related turbidite basins



101°37'30"
54°53'00"

101°25'00"
54°53'00"



54°48'40"
101°37'30"

54°48'40"
101°25'00"

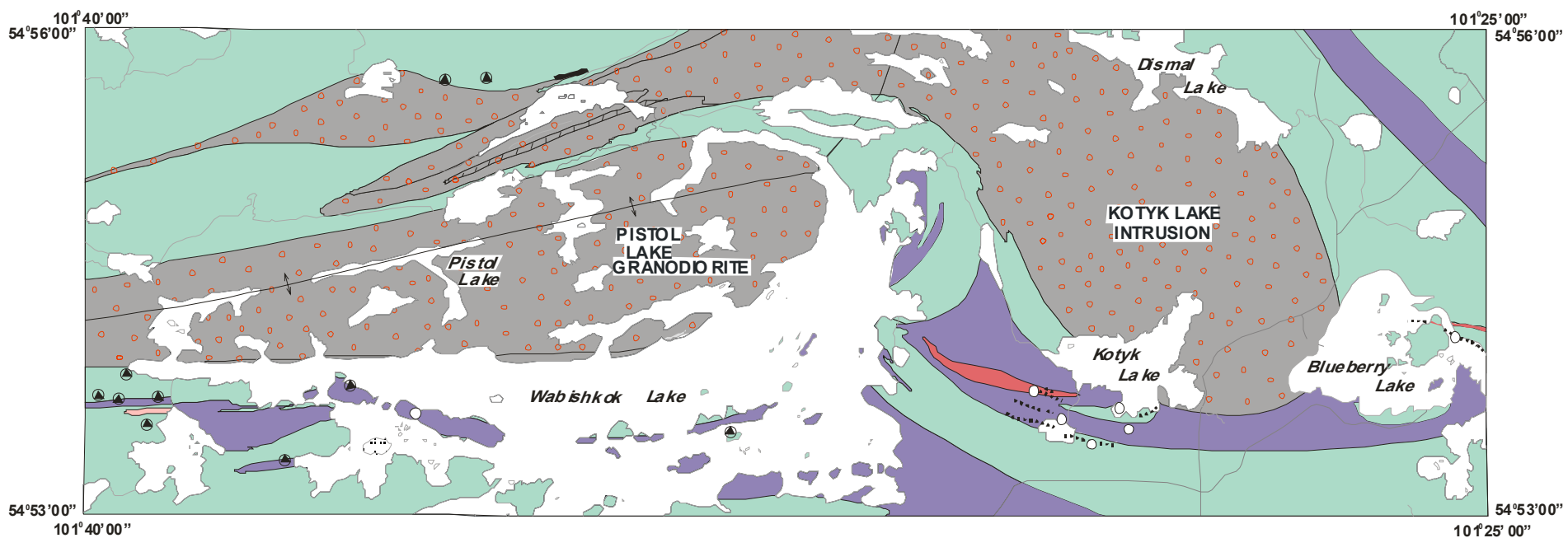
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	Turbidite Sediment		Syncline (F ₁ , F ₂)
			Mineralization (base metal)

- Turbidite in Lac Aimée Block
with scour structure and graded bedding



- Rhyolite flow in Lac Aimée Block with flow banding





LEGEND

- (4a) Granodiorite, granite
- (4b) Quartz diorite, tonalite, diorite, granodiorite (/// with enclaves of unit 1)
- (3a) Gabbro, hornblendite
- (3b) Pyroxenite
- (2a) Rhyolite, massive to fragmental
- (2b) Feldspar-quartz porphyry
- (1a-h) Basalt, gabbro, amphibolite, mafic gneiss; minor volcanic breccia

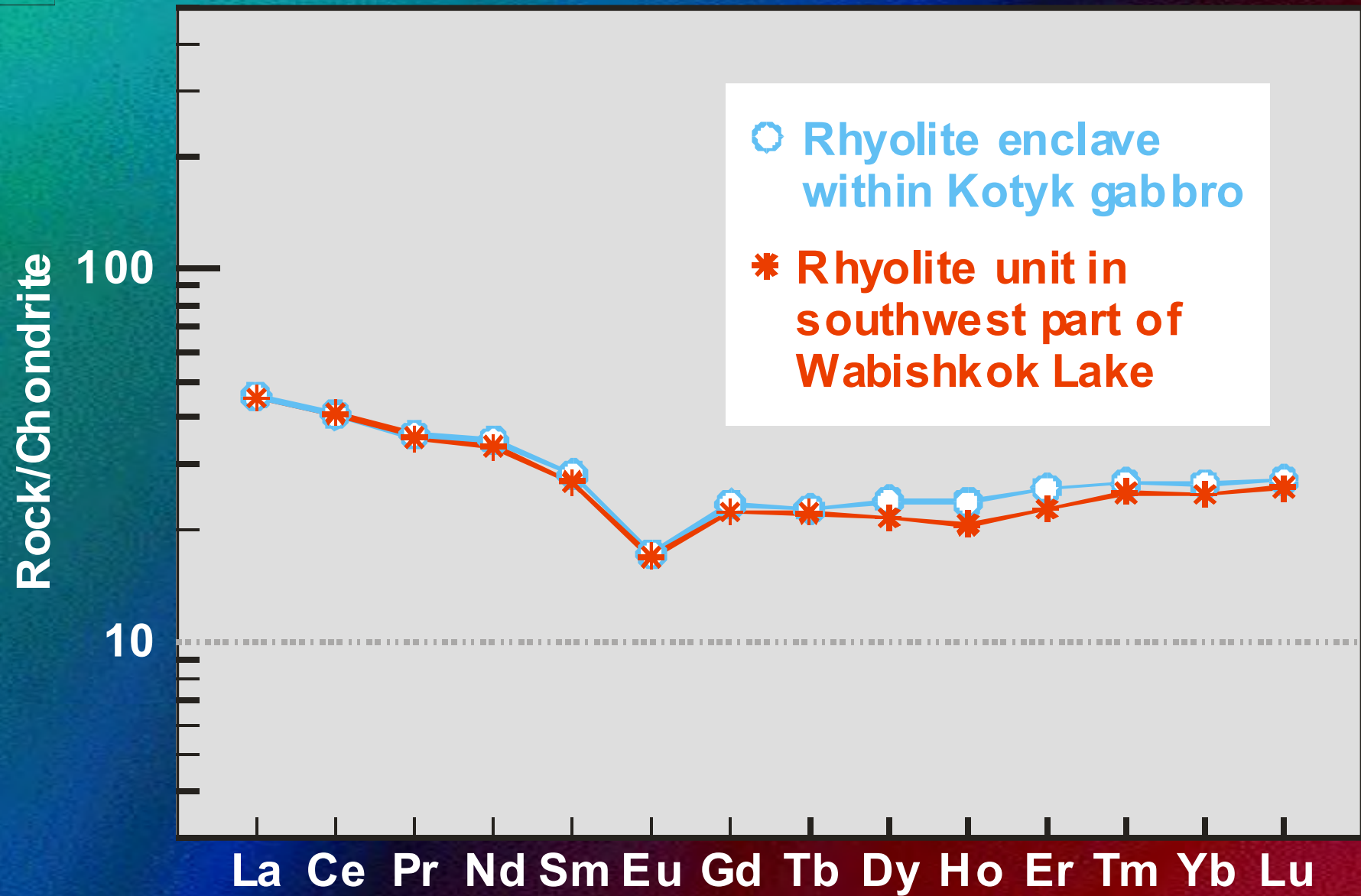
SYMBOLS

- Geological contact (approximate)
- Wabishkok Lake antiform
- Mineralization (pyrite±pyrrhotite)
- Diamond-drill hole
- Electromagnetic conductor
- Gravel road, track

Note: Unit numbers correspond to those on Preliminary Map 2001F-3



- Fragmental rhyolite flow east of Wabishkok Lake





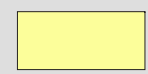
Rock/Chondrite

100

10

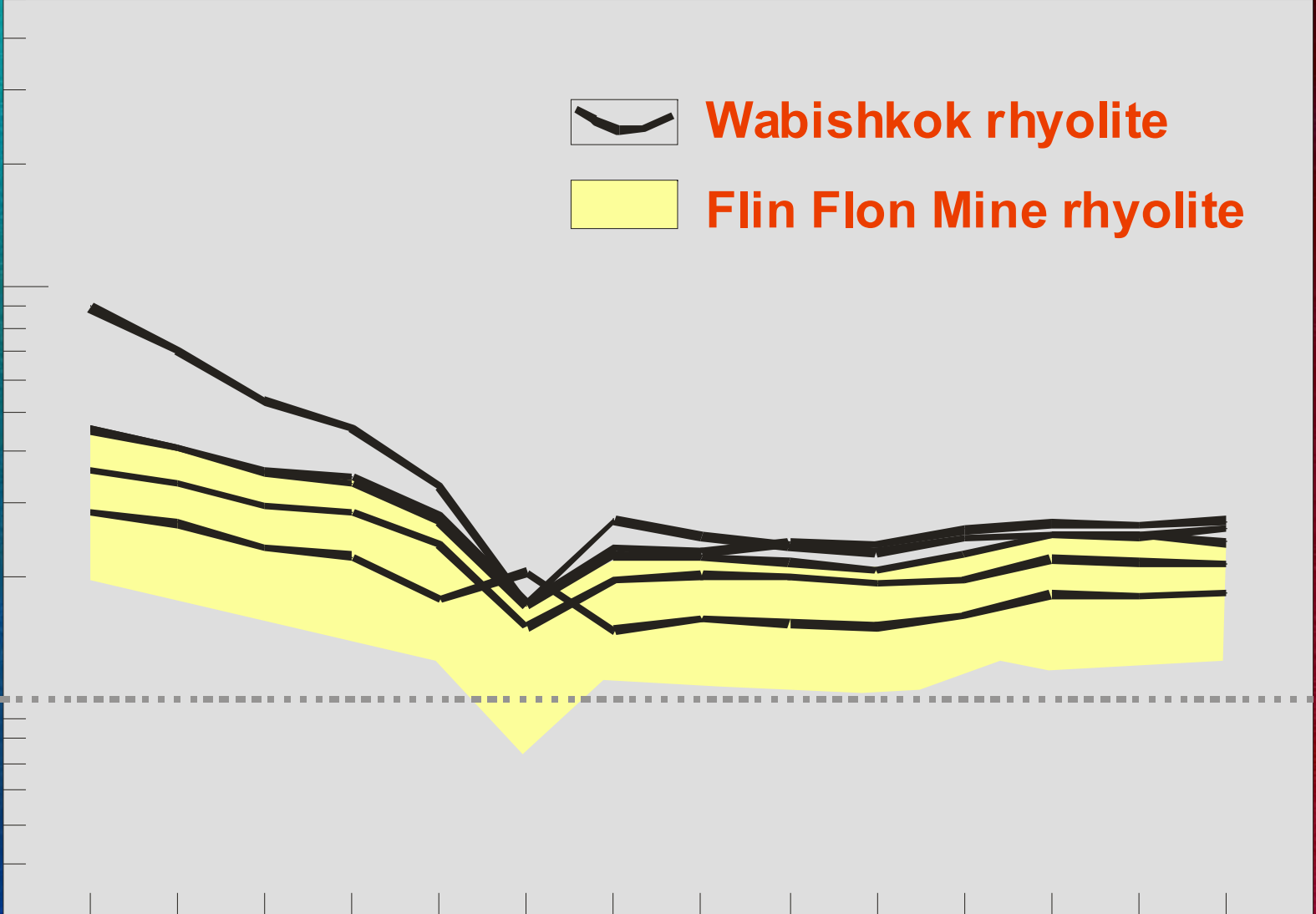


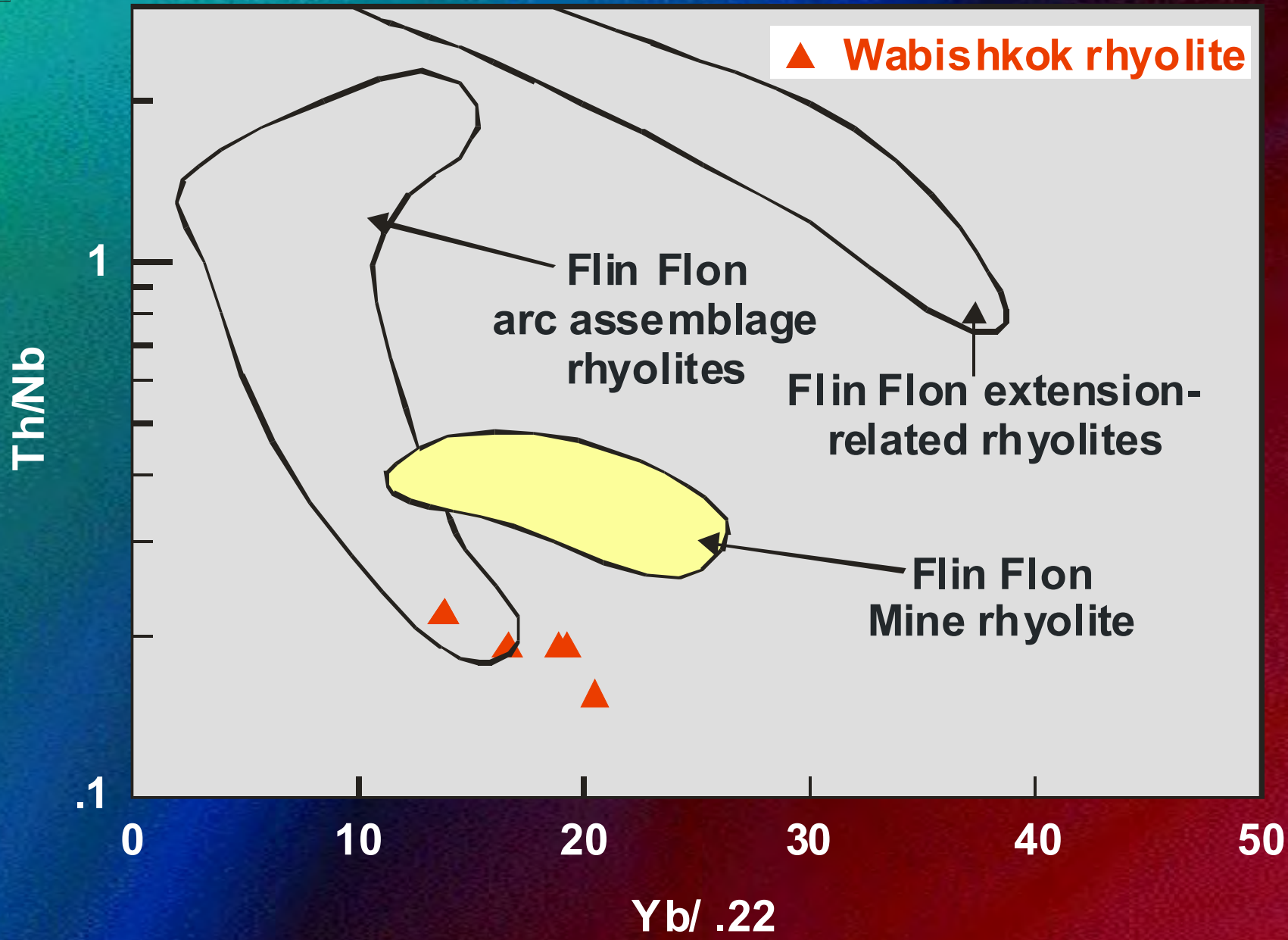
Wabishkok rhyolite

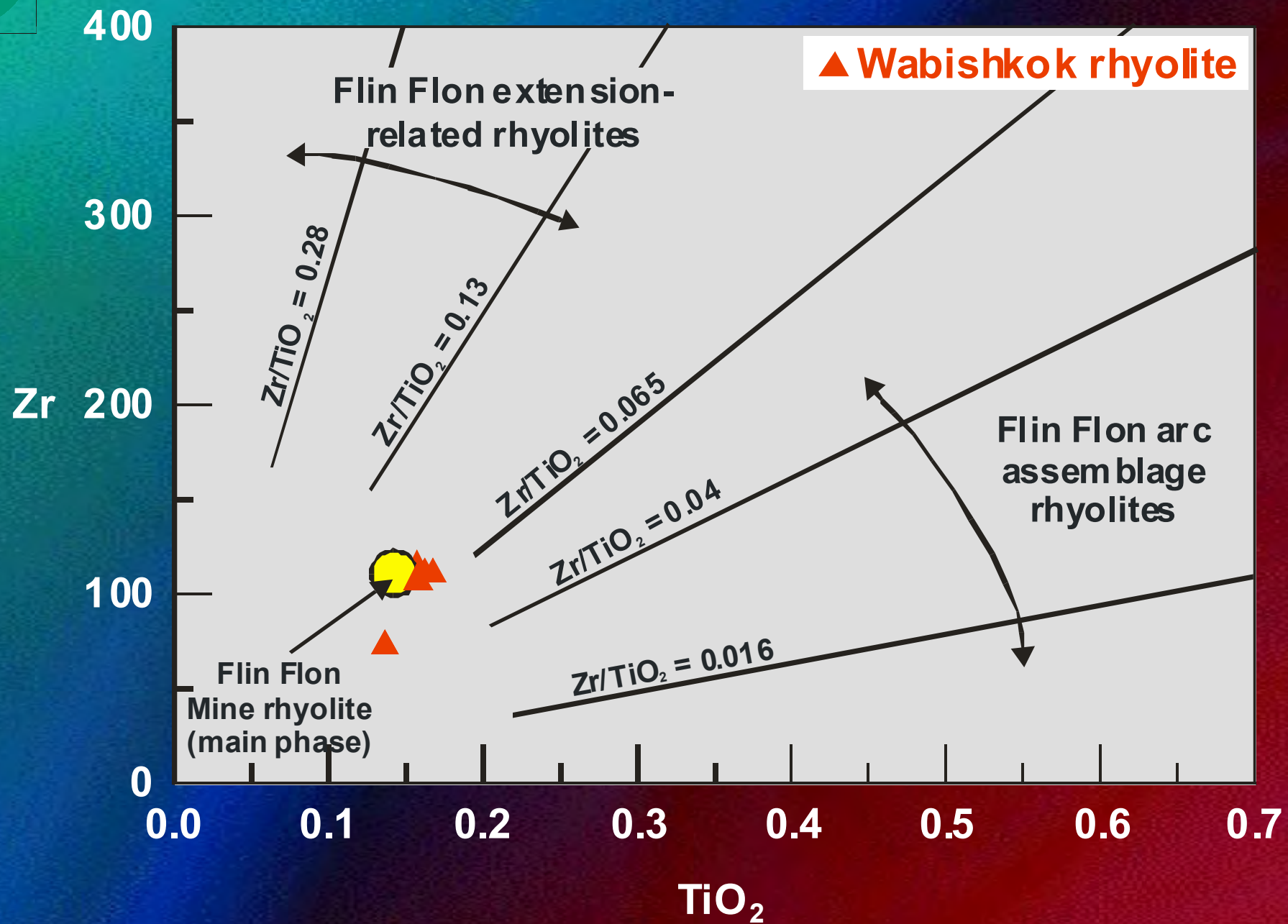


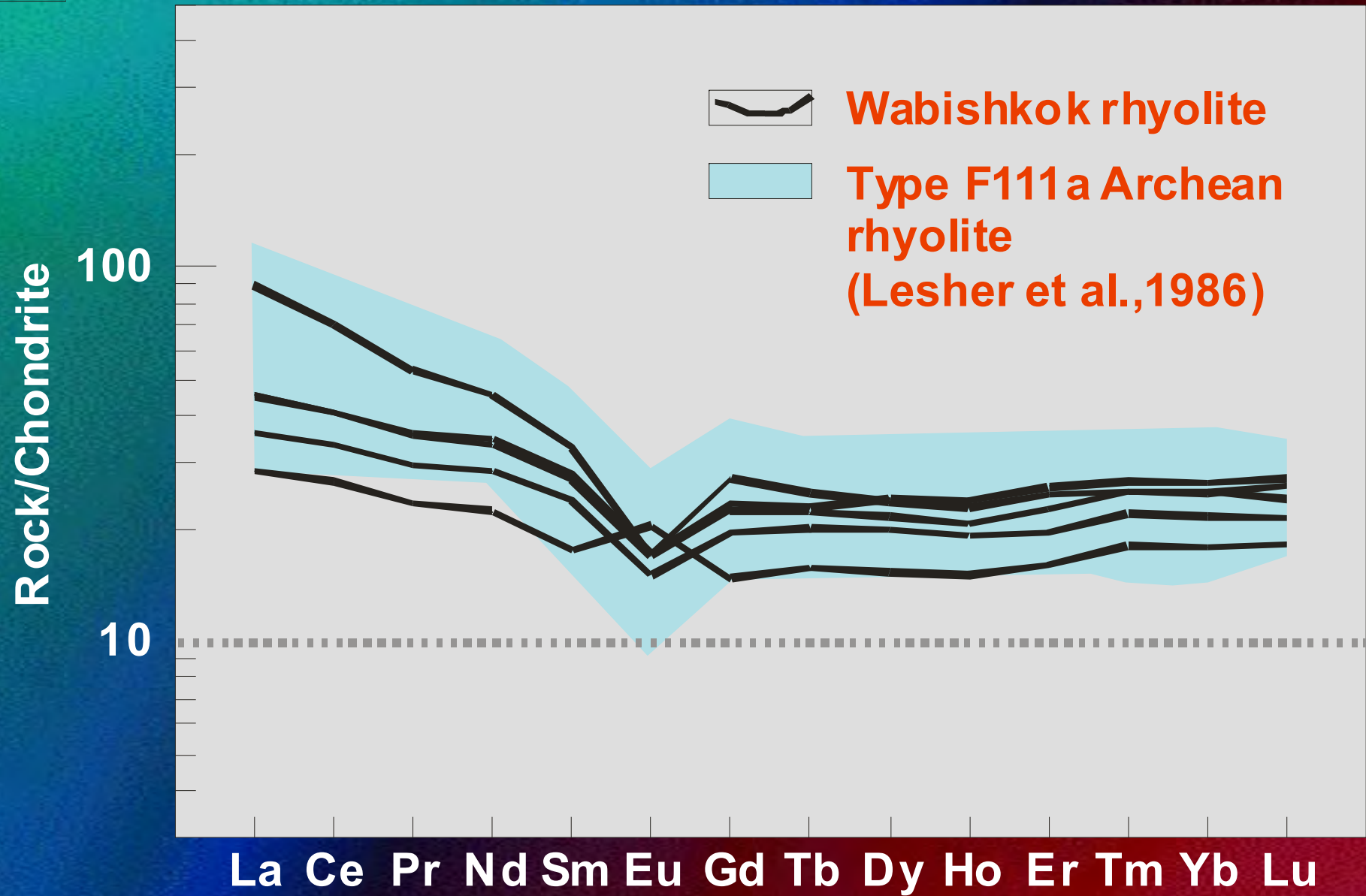
Flin Flon Mine rhyolite

La Ce Pr Nd Sm Eu Gd Tb Dy Ho Er Tm Yb Lu









Ti/ 100

▲ Wabishkok rhyolite

Zr/ 10

Y

