

Geology of McInnes Lake Greenstone Belt, Northwestern Ontario

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Location



Figure 1: Location map

The McInnes Lake greenstone belt is situated in the Berens River Subprovince approximately 150 km north of Red Lake (Figure 1) and trends northward in contrast to most of the supracrustal belts in the Sachigo, Uchi and Berens River subprovinces. This belt is composed of a series of Mesoproterozoic volcanic units ranging from ultramafic to felsic with interlayered clastic and chemical sediments. The belt is crosscut by several dikes, sills as well as small stocks of variable composition and surrounded by several granitoids. This greenstone belt thins out to form part of the volcanic slivers that trend south towards the Red Lake belt.

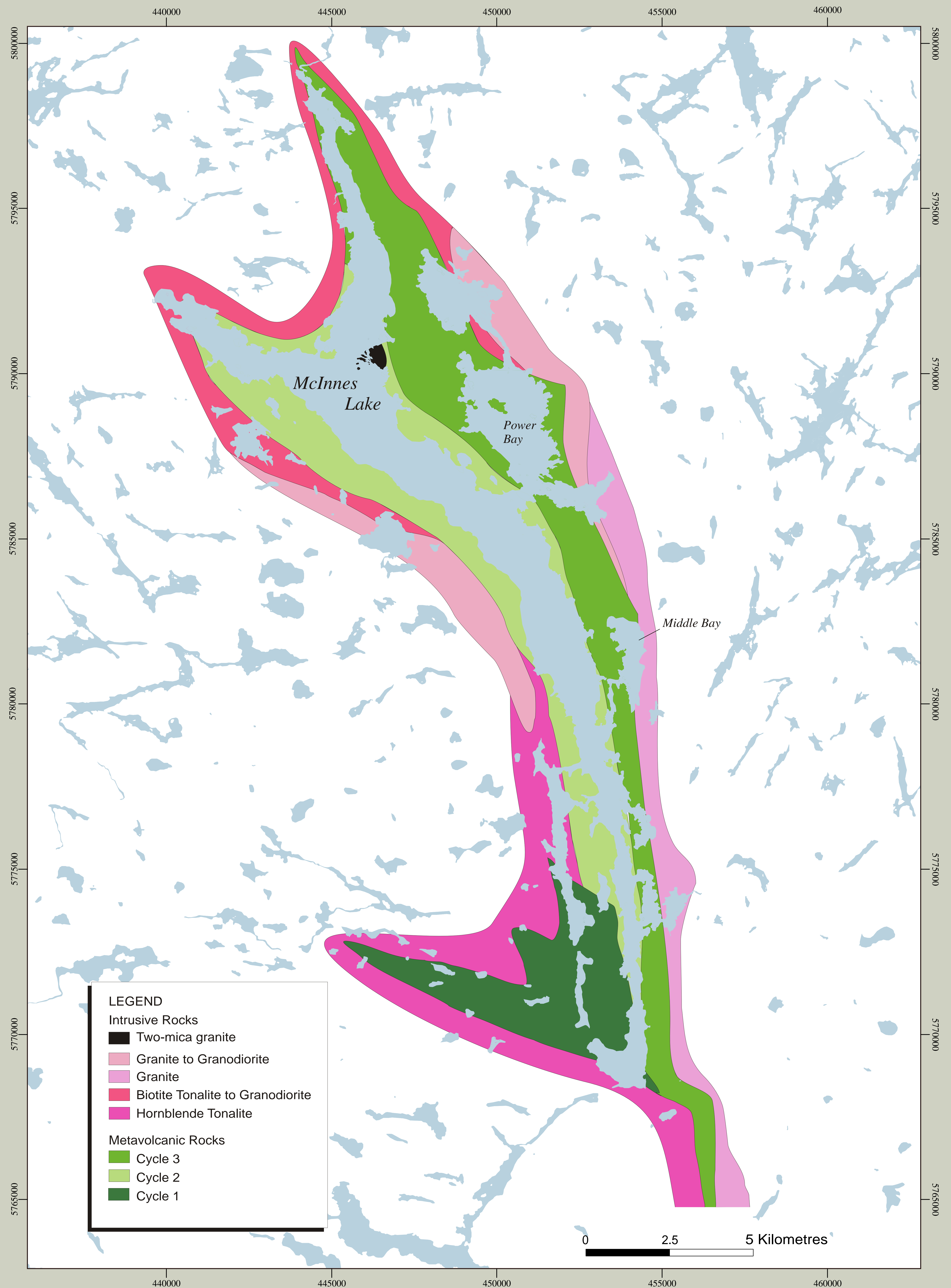


Figure 2: Volcanic cycles of the McInnes greenstone belt and the surrounding intrusions.



Cycle 1

In the southwestern part of the belt, a sequence of mafic to intermediate volcanic rocks is tentatively labelled Cycle 1 (see Figure 2). The mafic flows and tuffs (Photo 1) are interlayered with intermediate pyroclastic rocks (Photo 2). This is the oldest cycle in the belt: 2974 ± 2 Ma (Stone 1998). This age is correlative with the Balmer assemblage, 2964-2992 Ma (Sanborn-Barrie, Skulski and Parker 2001) in the Red Lake greenstone belt or on the western margin of the Confederation belt (Rogers 2002).



Photo 1. Mafic lapilli tuff breccia typically found in the oldest cycle.



Photo 2. Lapilli tuff breccia with fragments up to 30 cm in size. This tuff has been affected by some flattening.

Cycle 2

Cycle 2 covers the whole northwestern part of the belt and is continuous to the south where it pinches out (see Figure 2). The base of cycle 2 is composed of mafic metavolcanic rocks. Intermediate metavolcanic pyroclastic rocks, compose the larger section of this belt. (Photo3). The upper unit of this cycle is dominated by beds of clastic and chemical sediments (Photo4).



Photo 3. Nicely preserved series of tuff beds in intermediate volcanic rocks.



Photo 4: The banded iron formation is a good marker unit which caps this cycle. This unit is continuous from north to south.

Cycle 3

Cycle 3 is larger than previously mapped (Cortis et al. 1988). It covers the northeastern part of the belt and is continuous to the south where it thins to form part of the volcanic slivers that trend south towards the Red Lake belt (Buse, 2006) (see Figure 2). The basal unit is composed of mafic massive to pillowed flows (Photo 5) with associated breccias. The intermediate to felsic unit overlying the mafic metavolcanics is composed mostly of lapilli tuff (Photo 6) and lapilli tuff breccias, which grade into more felsic tuffs to the northeast.



Photo 5. Pillowed basalt with vesicles and amygdules. This unit is extensive in cycle 3 indicating an eastern stratigraphic top.



Photo 6. Typical mafic lapilli tuff of this cycle. Generally, they are grading indicating an eastern stratigraphic top.

Structure

The map area is complexly deformed. A north striking S1 penetrative foliation is apparent throughout the supracrustal rocks. Lineation generally plunges to the south however plunges easterly in the southwest part of the belt. East of McInnes Lake, low angle dips on foliation planes and down dip lineations indicate the supracrustal rocks are thrust over the granitic plutons. Several top indicators indicate an eastward facing stratigraphy. The top indicators coupled with the continuous, tabular stratigraphy and the available geochronology indicate that the strata predominantly young to the east.

The most intense deformation event resulted in a transpression deformation (Stott et al. 2006) creating Z folds (Photo 7) having a south trending axial plane with axes plunging south, accompanied by dextral shear sense indicators throughout the belt (Photos 7,8,9,10).

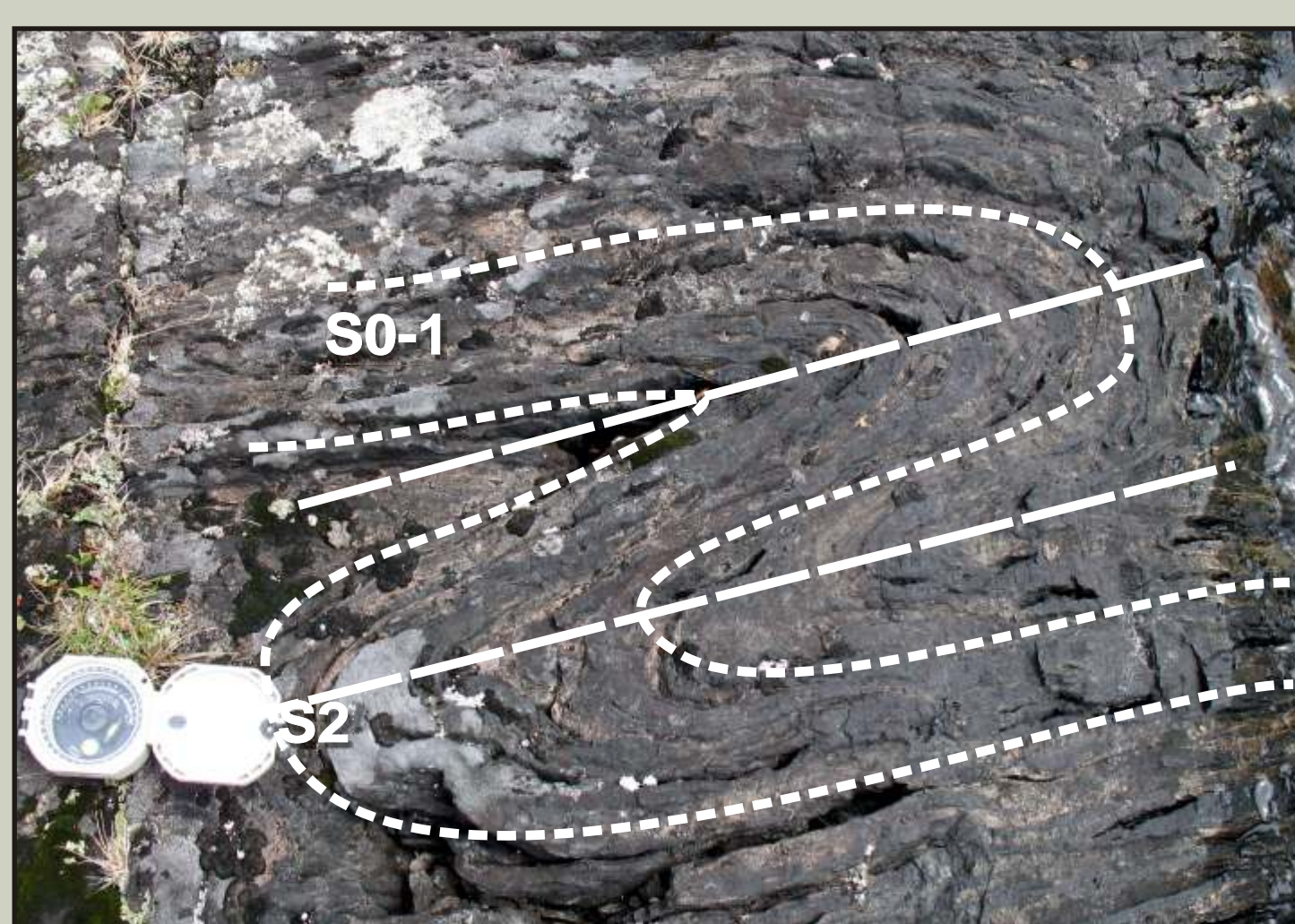


Photo 7. Regional transpression deformation (D2) created asymmetric z folds having a south trending axial plane with axes plunging south.



Photo 8. Back rotation of a quartz vein indicating a dextral movement.

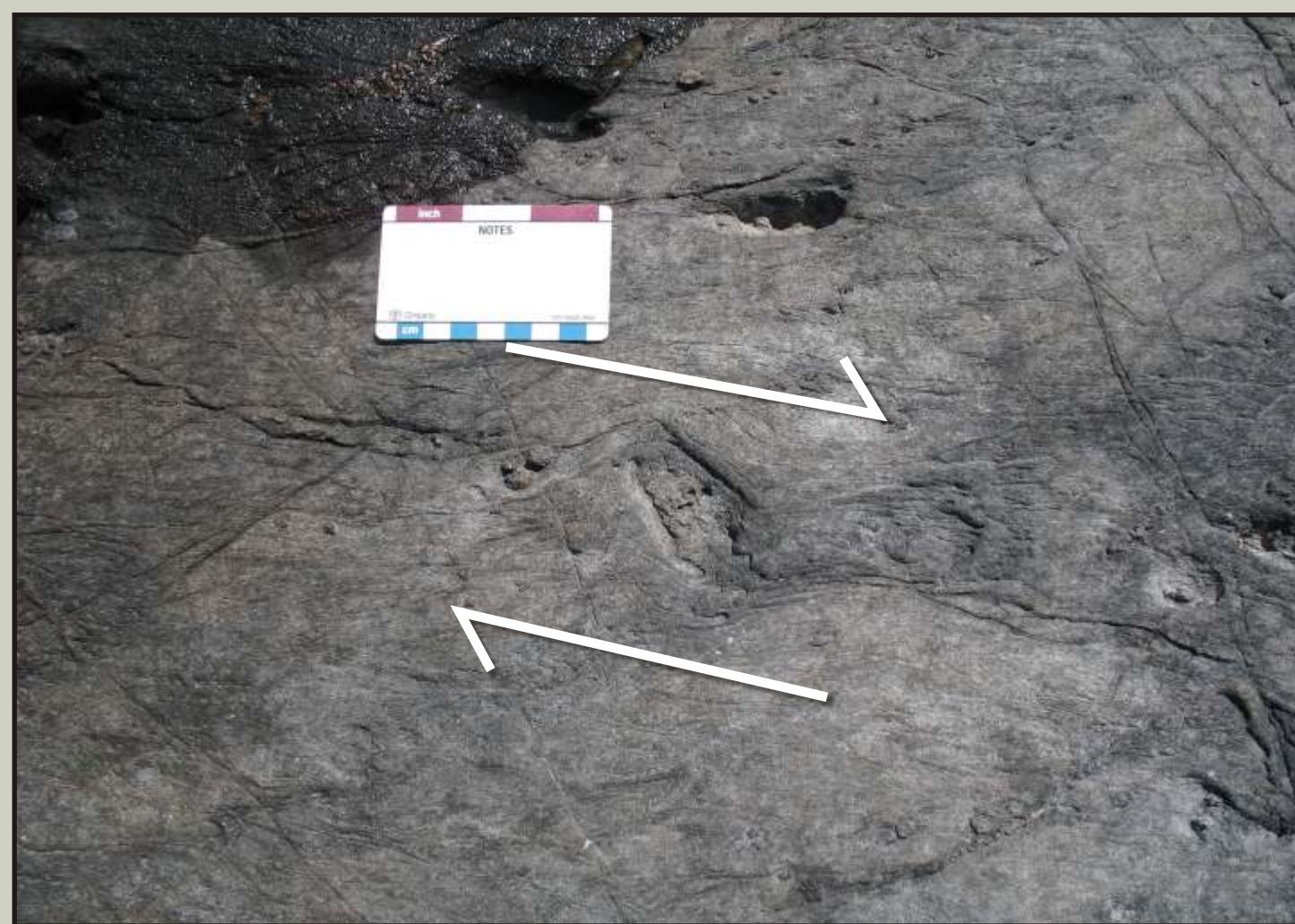


Photo 9. Dextral rotation of a fragment which was generated by the regional transpression.



Photo 10. Rare brittle dextral faults. Generally these brittle faults are sinistral due to readjustment.

Acknowledgement

Independent mapping was done by T.Mumford who worked as a senior assistant. D. Kuiper, L. Robichaud and I. Johnson worked as junior assistants collecting some of the data. The cooperation of Andreas Lichtblau, Resident Geologist in Red Lake was greatly appreciated as well as the comments given by Greg Stott and the discussions with Sara Buse, Neil Pettigrew and Etienne Dinel. Thank you to Green Airways who provided exceptional service

Intrusions



Photo 11. On the eastern shore of McInnes Lake, a series of north trending mafic dikes crosscut all cycles. These dikes are generally massive to weakly foliated. Poikilitic mafic dikes contain feldspar oikocrysts as large as 8 cm locally. The dikes might be correlated to the Proterozoic gabbroic intrusions mentioned by Stone (1998).



Photo 12. Large potassic feldspar in the 2 mica intrusion, which is the last intrusion event in this mapping area. This 2-mica, garnetiferous granite occurs as small stocks and sheets throughout the belt. The major intrusion is at the southern end of the northeastern arm of the lake (see Figure 2). It is typically undeformed with weak foliation and lineation. It is composed primarily of quartz, potassic feldspar and plagioclase containing secondary minerals such as muscovite, biotite and garnet.



Photo 13. Cycle 2 is bound on the eastern side by this granite suite. It is generally well foliated with biotite and hornblende and is locally potassic feldspar megacrystic.



Photo 14. This granitoid is part of the biotite tonalite to granodiorite that bound the northern part of the McInnes Lake Greenstone belt. It is generally medium grained well foliated to gneissic and contains approximately 15% mafics.



Photo 15. The contact between the greenstone and the granitoid is typically a lit-par-lit injection of the granitoid in a more gneissic greenstone rock.



Photo 16. The contacts are often injection of granitoids into the greenstone.