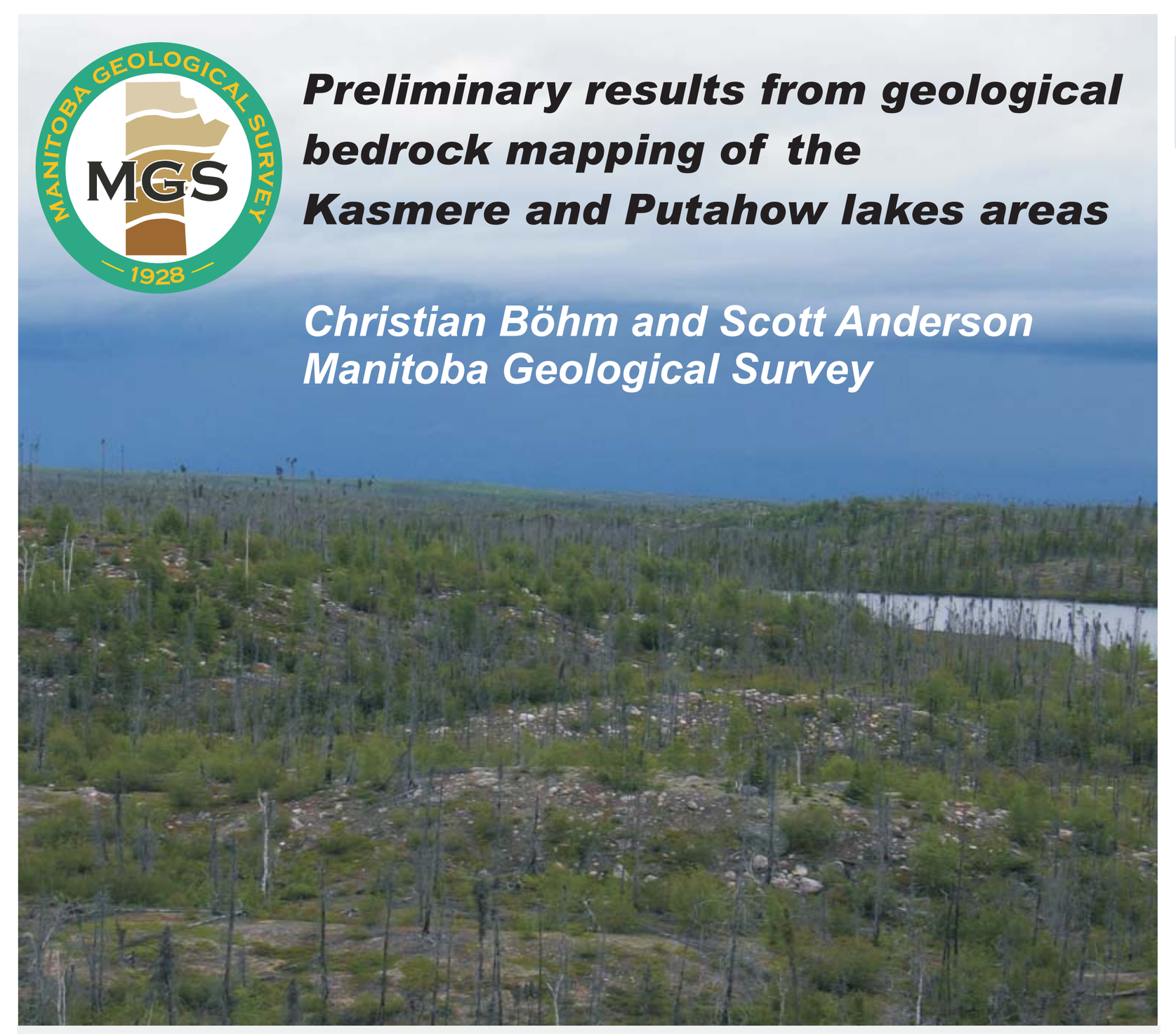
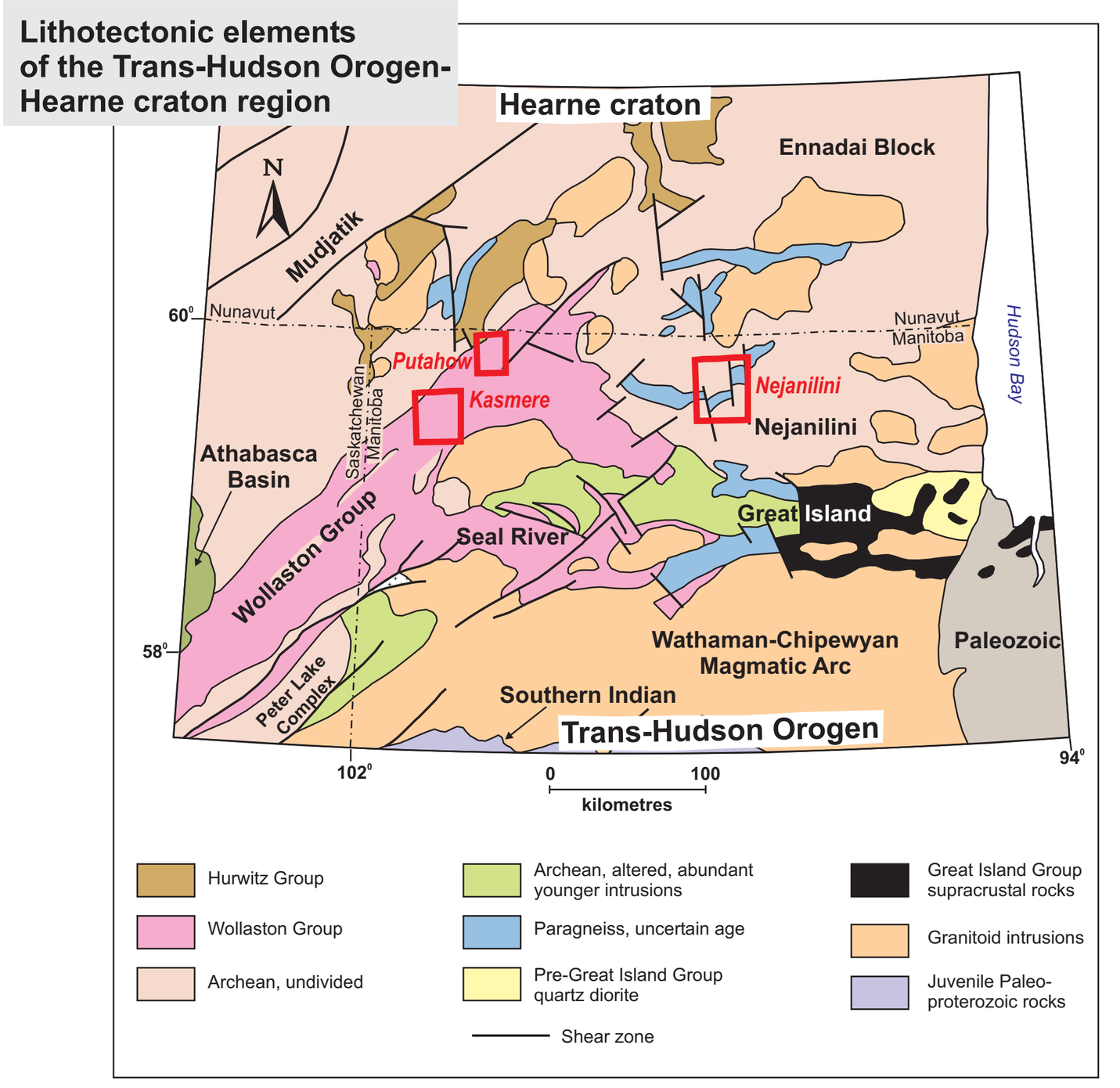
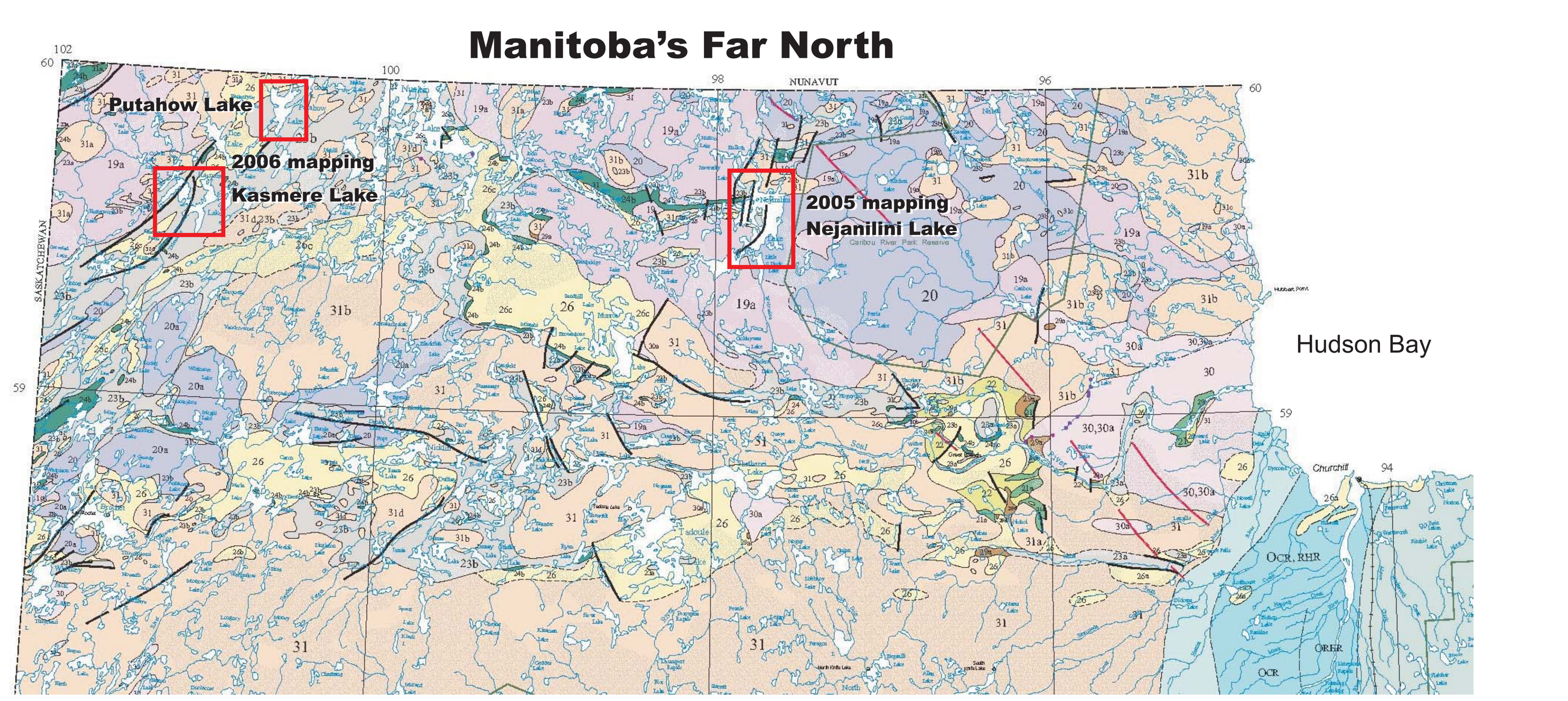


Preliminary results from geological bedrock mapping of the Kasmere and Putahow lakes areas

Christian Böhm and Scott Anderson
Manitoba Geological Survey



Lithotectonic elements of the Trans-Hudson Orogen-Hearne craton region
Hearne craton
Ennadai Block
Athabasca Basin
Wollaston Group
Seal River
Great Island
Nejanilini
Wathaman-Chipewyan Magmatic Arc
Southern Indian
Trans-Hudson Orogen
Paleozoic
Hurwitz Group
Wollaston Group
Archean, undivided
Paragneiss, uncertain age
Pre-Great Island Group quartz diorite
Granitoid intrusions
Juvenile Paleo-proterozoic rocks
Shear zone
kilometres



Summary

As part of the Manitoba Geological Survey's initiative to update the geological knowledge base of Manitoba's far north, field investigations in 2006 were focused on the Kasmere and Putahow lakes areas. Detailed bedrock mapping and sampling were undertaken for lithogeochemical, isotope geochemical and geochronological studies to improve the currently limited understanding of the nature and evolution of this portion of Manitoba's Precambrian shield, and to support ongoing uranium and gold exploration in the area.

On this poster, bedrock exposures at Kasmere and Putahow lakes are described and subdivided into

1) metasedimentary rocks of the Paleoproterozoic Wollaston Domain, which include semipelite, psammite, arkosic metasandstone, quartzite, calcsilicate rocks and calcareous greywacke; and
2) younger, Paleoproterozoic granitic intrusions and pegmatite. No examples of potential Archean basement rocks were observed in the map area.

The tentative field results from this year's mapping in the Kasmere and Putahow lakes areas, when compared with the 2005 mapping results from the Nejanilini Lake area, suggest no significant differences in the nature and composition of the metasedimentary successions in the two areas. This may indicate that Paleoproterozoic metasedimentary rocks previously assigned to the Wollaston (Kasmere and Putahow lakes) and the Hurwitz (Nejanilini Lake) supergroups likely formed contemporaneously and in a similar or related tectonic setting in northern Manitoba.

Several occurrences of sulphide mineralization in bedrock and boulders were sampled and submitted for geochemical analysis. Uranium (pitchblende) was observed in outcrop and boulders, with the latter likely to be of local provenance (see poster on surficial geology by G. Matile).

Regional Geology

The Kasmere and Putahow lakes map areas form part of the southeastern flank of the Hearne craton in Manitoba. The Archean continental crust of the Hearne craton is overlain by Paleoproterozoic cover rocks and, together with the cover rocks, has undergone varying degrees of thermotectonism during the Paleoproterozoic Trans-Hudson orogeny.

The Kasmere and Putahow lakes areas lie mainly within the Wollaston Domain and straddle the adjacent Mudjatik Domain to the northwest. A trough of low magnetic intensity, correlating with rocks of the Wollaston Domain, lies to the southeast of the more magnetic rock types in the Mudjatik Domain. This boundary is considered to be structural in origin. No examples of potential Archean basement rocks to the Wollaston Domain metasedimentary rocks were observed in the map areas. Hence, the geology of the map areas is interpreted to consist of

- Paleoproterozoic (ca. 2.1-1.9 Ga?) metasedimentary rocks of the Wollaston Supergroup, and
- granitic intrusive rocks probably related to magmatism during the Trans-Hudson orogeny ('Hudson granites').

The Wollaston Supergroup supracrustal rocks appear to occupy elongate dome-and-basin structures, whereas the granitic intrusions tend to abruptly truncate the sedimentary rocks and locally contain large xenolithic rafts of the adjacent country rock.

High-grade metamorphism, concurrent with deformation, is indicated by synkinematic garnet-cordierite-sillimanite porphyroblasts and leucosome veins in the metasedimentary rocks. They indicate relatively low-pressure, high-temperature regional metamorphism, corresponding to middle to upper amphibolite facies conditions. Structurally, these rocks show evidence for polyphase deformation with at least two generations of foliation and folds. The main phase of felsic intrusions appears to be syn- to post-deformational, based on both crosscutting and layer-parallel granitic injection and generally weak foliation in the felsic intrusive rocks.

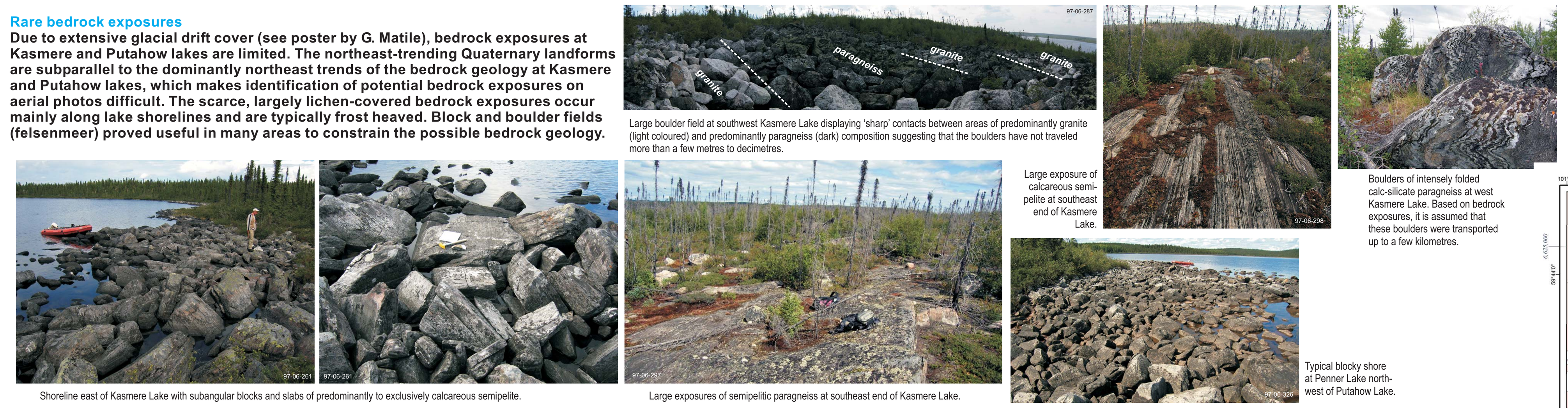
The basal unit of **the Wollaston Group** appears to be garnet-biotite semipelitic gneiss that contains and/or is overlain by a compositionally variable sequence of calcsilicate rocks, psammitic gneiss and locally quartzite and arkosic rocks. This metasedimentary succession may signify a tectonic change from a platform setting to possible uplift. Alternatively, the quartzite and arkosic rocks may define an antiformal culmination, and would thus be overlain by the calcsilicate rocks, which occur outside the quartzite at southeastern Kasmere Lake. The latter structural and resultant stratigraphic interpretation is more consistent with a classic basin subsidence.

Quartzite, semipelite and psammite samples from the Kasmere Lake and Putahow Lake-Goose Lake areas have been submitted for U-Pb zircon age dating and Nd isotope analysis. Results from these analyses will permit a more scientifically rigorous comparison of the metasedimentary rocks at Kasmere and Putahow lakes with those of the Wollaston Supergroup rocks in Saskatchewan, and possibly related metasedimentary rocks previously assigned to the Hurwitz Group at Nejanilini Lake.

Paleoproterozoic intrusive rocks include foliated to porphyritic granite, abundant leucocratic, weakly deformed potassic granitic rocks, and possibly related potassic granitic pegmatite. Larger granite bodies extend for several kilometres, whereas many smaller irregular bodies and pegmatite dikes are too small to be represented on the maps. These felsic intrusive rocks presumably belong to the ca. 1.86-1.75 Ga Hudson and/or Nueltin suite of granites. Except for larger granite bodies in the northwestern Kasmere Lake area, the felsic intrusions are not notably magnetic and therefore don't produce a magnetic contrast within the metasedimentary rocks.

Rare bedrock exposures

Due to extensive glacial drift cover (see poster by G. Matile), bedrock exposures at Kasmere and Putahow lakes are limited. The northeast-trending Quaternary landforms are subparallel to the dominantly northeast trends of the bedrock geology at Kasmere and Putahow lakes, which makes identification of potential bedrock exposures on aerial photos difficult. The scarce, largely lichen-covered bedrock exposures occur mainly along lake shorelines and are typically frost heaved. Block and boulder fields (felsenmeer) proved useful in many areas to constrain the possible bedrock geology.



Large boulder field at southwest Kasmere Lake displaying 'sharp' contacts between areas of predominantly granite (light coloured) and predominantly paragneiss (dark) composition suggesting that the boulders have not traveled more than a few metres to decimetres.

Large exposure of calcareous semipelite at southeast end of Kasmere Lake.

Boulders of intensely folded calc-silicate paragneiss at west Kasmere Lake. Based on bedrock exposures, it is assumed that these boulders were transported up to a few kilometres.

Shoreline east of Kasmere Lake with subangular blocks and slabs of predominantly to exclusively calcareous semipelite.

Large exposures of semipelitic paragneiss at southeast end of Kasmere Lake.

Typical blocky shore at Penner Lake northwest of Putahow Lake.

Gillander Lake Au-U

In 1976-77, several boulders containing high-grade Au-U mineralization were discovered by United Siscoe Mines Ltd. in the area between Kasmere Lake and Gillander Lake. Subsequent prospecting identified over 100 mineralized boulders in the Gillander Lake Au-U project area, in three main boulder trains (see sketch map). Despite an extensive follow-up program of geological mapping, prospecting, geophysical and geochemical surveys, overburden drilling and diamond drilling from 1976-80, no bedrock source was identified.

The boulders were described as "rusty calc-silicate" containing disseminated or fracture-controlled sulphide minerals. Assay results ranged up to 120 g/t Au and 4% U3O8, with anomalous Co and W.

In 2006, the MGS located and examined several of the Gillander Lake boulders, and submitted three samples for assay. The examined boulders range in size up to 0.5 m and are heavily oxidized and fractured, with very angular to subangular shapes. The boulders consist of medium to coarse-grained, apparently massive calc-silicate. In thin-section, these rocks exhibit a well-developed granoblastic polygonal texture defined by plagioclase-quartz-clinopyroxene-K-feldspar+/-biotite, with accessory apatite and titanite. Sulphide minerals consist of 1-2% blebby pyrite, with subordinate pyrrhotite. The feldspars are weakly saussuritized.

Two of the submitted samples returned high-grade Au values, and exhibit significantly enriched U, W, Pb, Ba, La and Ce.

Although the genesis of the mineralization remains uncertain, the calc-silicate paragenesis and Au-U-REE elemental association is suggestive of skarn or IOCG mineralization.

Sample number	Au ppm	S %	Exhalative suite: Cu ppm	Pb ppm	Zn ppm	Cd ppm	Ba ppm	Epithermal Suite: Ag ppm	As ppm	Sb ppm	Hg ppm	Mn ppm	Magmatic suite: Ni ppm	Cr ppm	Co ppm	Mo ppm	Bi ppm	W ppm	Rare-earth elements: La ppm	Ce ppm	Nd ppm	Yb ppm	Other: U ppm	Th ppm	Y ppm
97-06-260-1	25.1	1.79	22	604	23	< 0.3	440	3.5	< 0.5	< 0.1	< 1	294	37	41	69	2	44	862	553	444	82	8.2	2010	19.8	96
97-06-260-2	2.27	2.34	27	133	50	< 0.3	2340	3.5	< 0.5	< 0.1	< 1	291	45	76	102	< 1	20	883	33.4	68	51	4.4	286	7.3	32

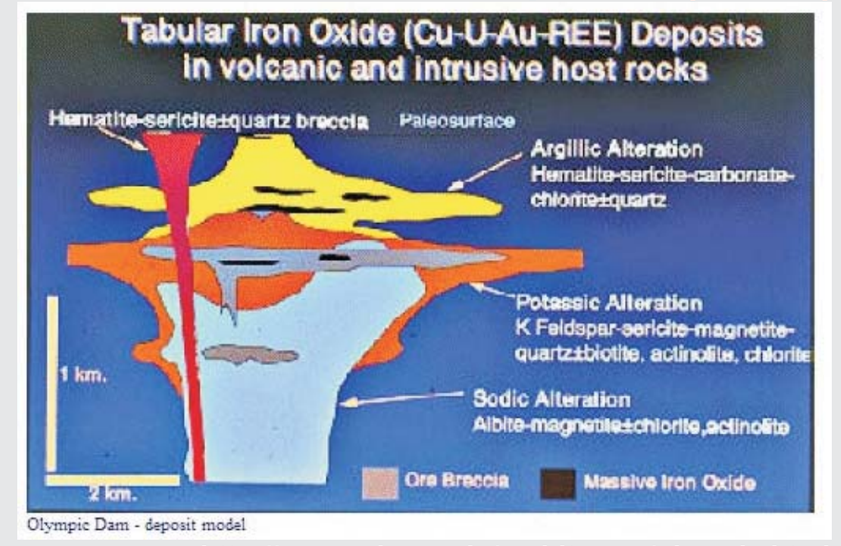
Economic Potential of the Wollaston Domain

The metasedimentary succession exposed at Kasmere and Putahow lakes is interpreted to represent a platformal cover sequence, which was likely deposited in a rifted-margin setting on top of the Archean Hearne Craton. Platformal cover sequences deposited in response to continental extension typically include restricted marine or subaerial basins, within which high heat-flow and magmatism associated with extension has the potential to produce significant hydrothermal and magmatic ore deposits.

On the basis of tectonic setting and known mineral occurrences, the Wollaston Domain in Manitoba is considered to have good potential for several deposit types, including: sediment-hosted base metal deposits [Broken Hill, Sullivan (SEDEX) and Zambian types], intrusion-associated polymetallic (Cu,Au,U,REE) deposits [IOCG and skarn types], magmatic Ni-Cu deposits [komatiite-associated], and basement-hosted U [unconformity type].

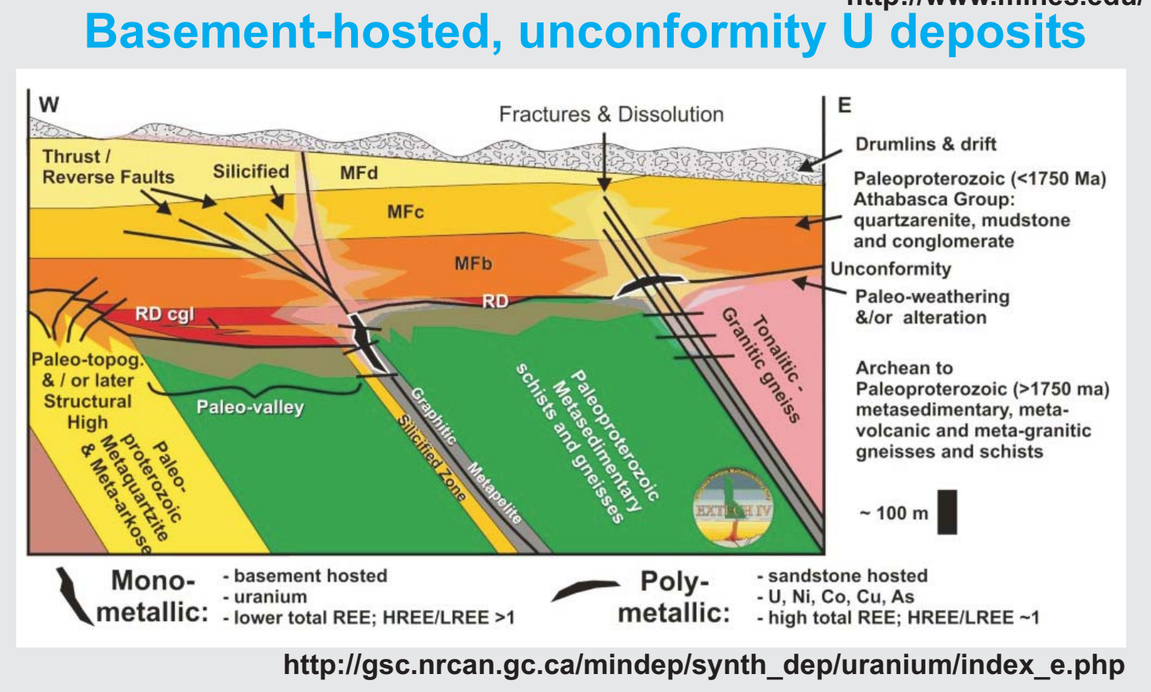
Iron Oxide Cu-Au-U-REE deposits (IOCG)

'Olympic Dam-type'



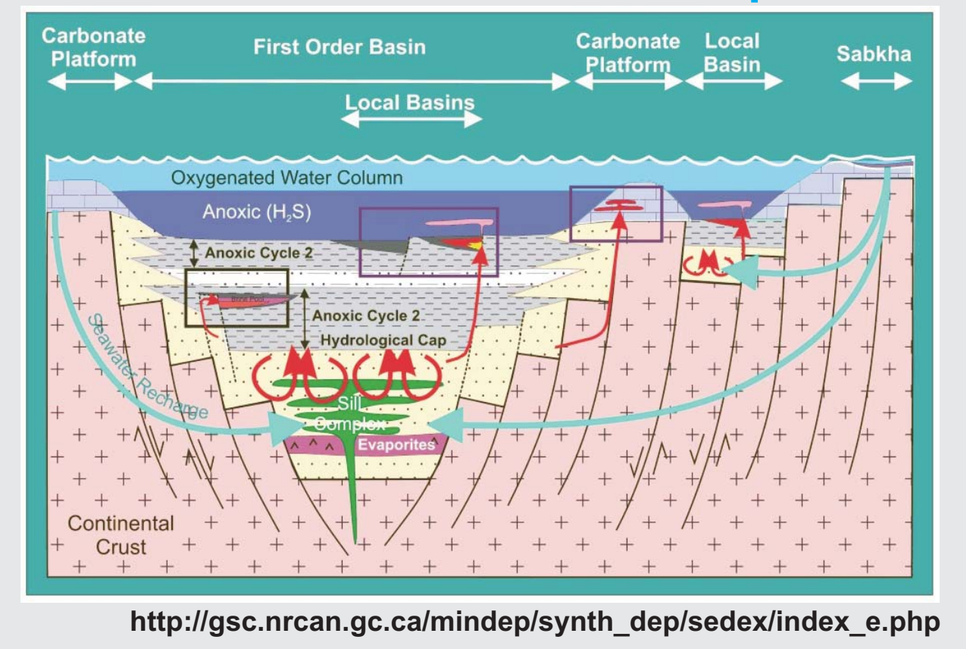
http://www.mines.edu/~mhitzman/olympic.html

Basement-hosted, unconformity U deposits



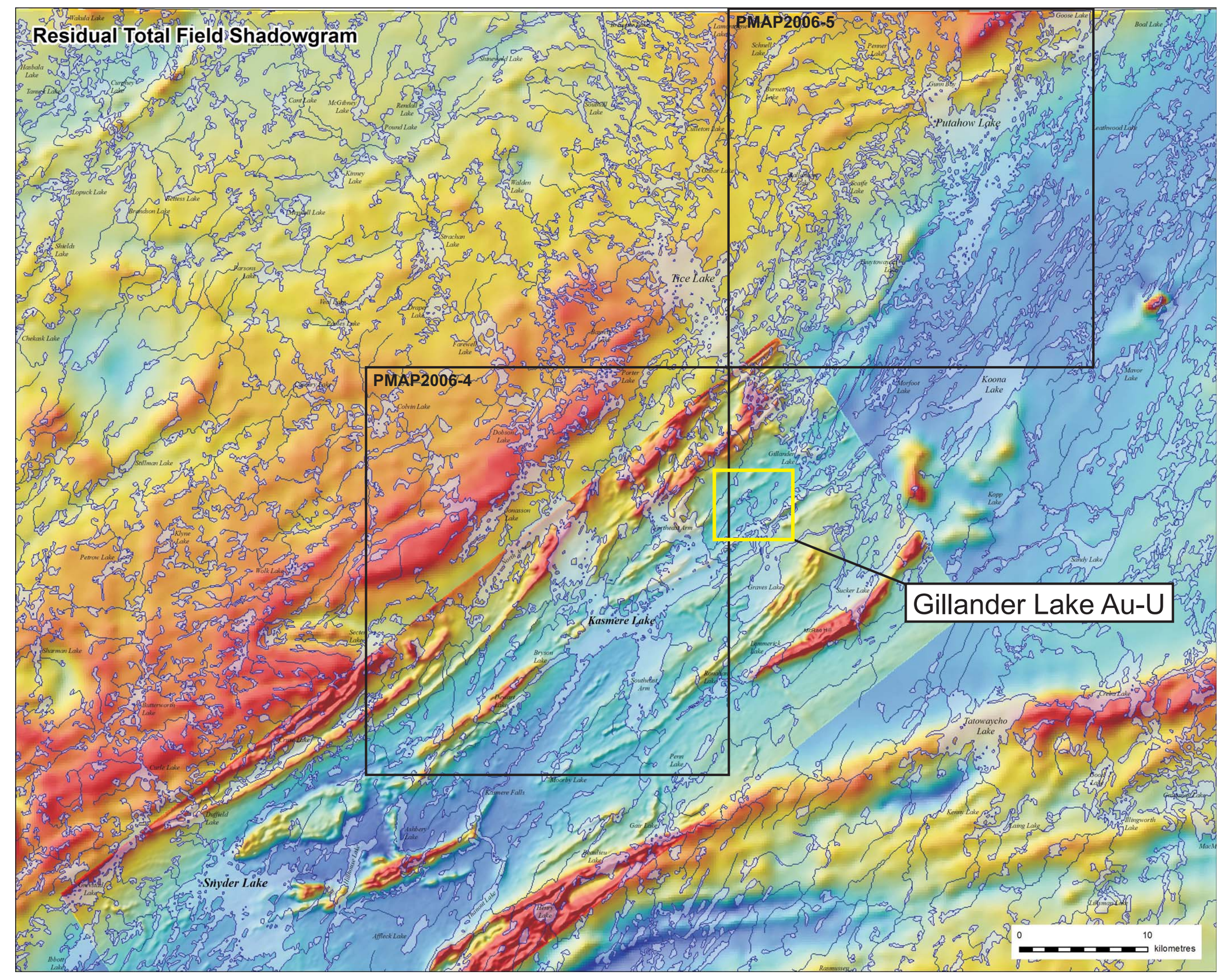
http://gsc.nrcan.gc.ca/mindep/synth_dep/uranium/index_e.php

Sediment-hosted base metal deposits

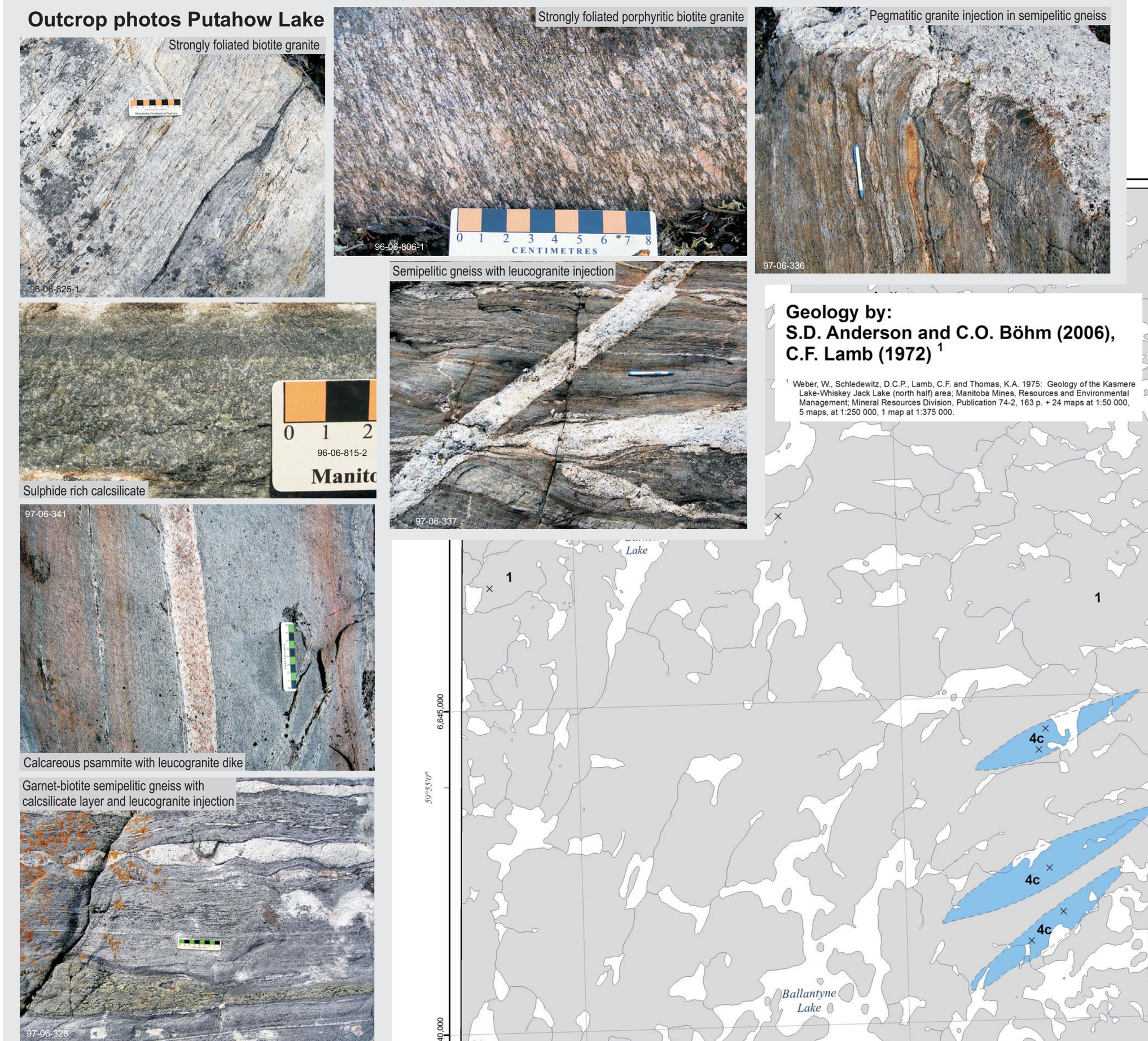


'Sullivan-type'
'Broken Hill-type'
'Zambian-type'

http://gsc.nrcan.gc.ca/mindep/synth_dep/sedex/index_e.php



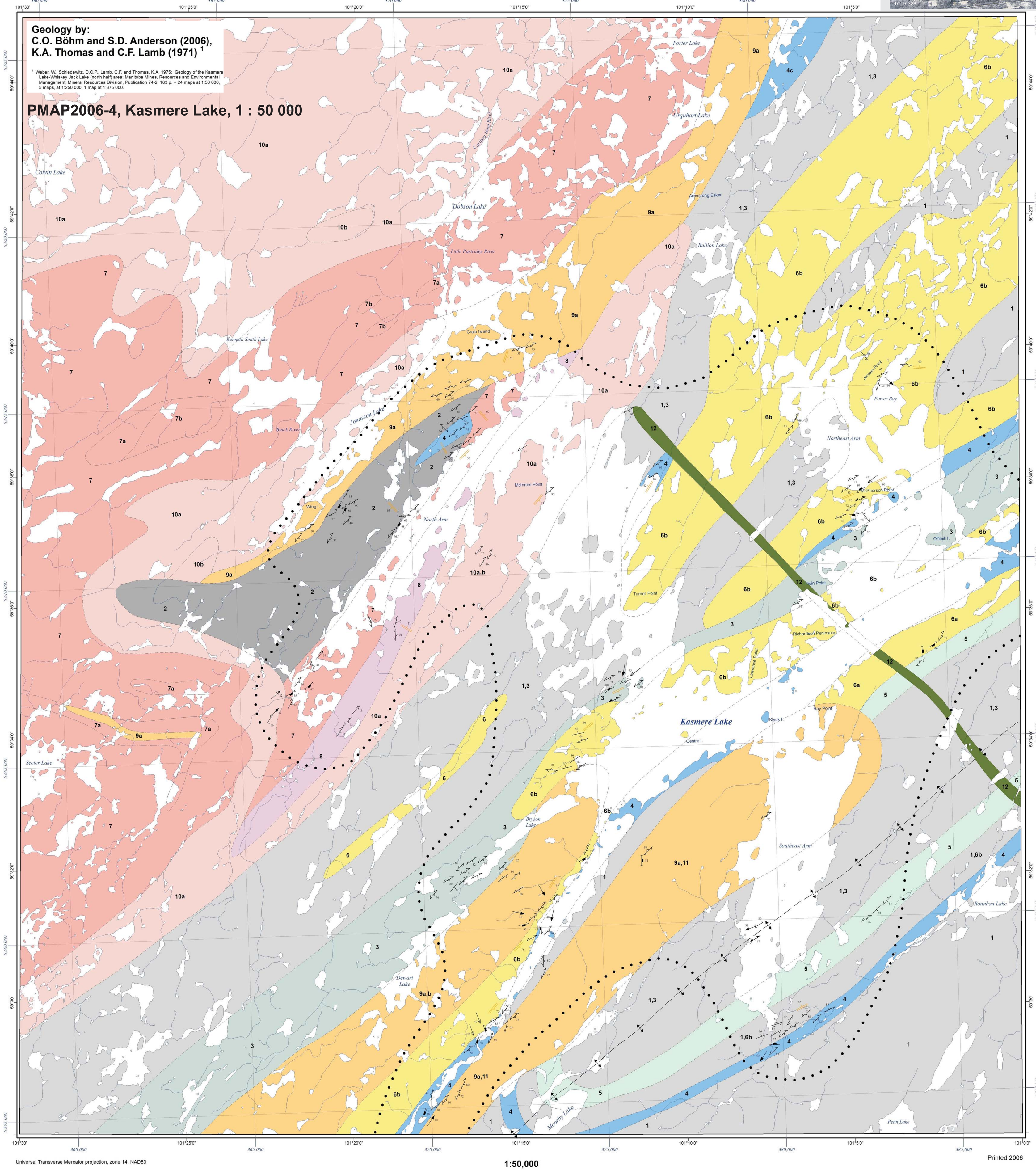
The magnetic data used in this map is a composite of (1) regional residual total field magnetic data with a pixel size of 200 m and (2) total field magnetic data at a pixel size of 62.5 m (eastern portion of map) from a survey done by the Geological Survey of Canada (Open File number 528, 1977).
This data is available from the Geological Survey of Canada through their download service at: http://gdr.agg.nrcan.gc.ca/wms/index_e.html



Geology by:
C.O. Böhm and S.D. Anderson (2006),
K.A. Thomas and C.F. Lamb (1971) [1]

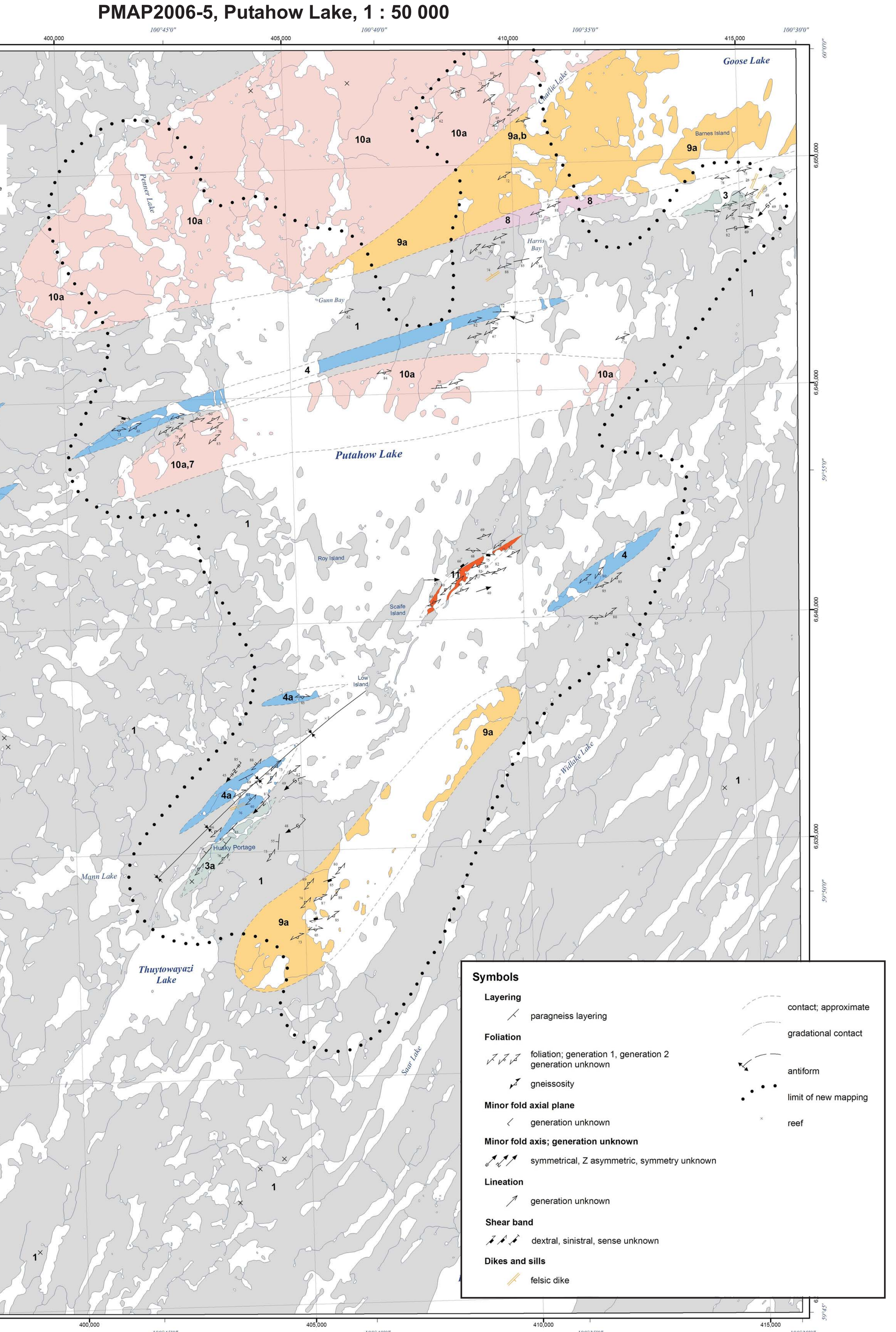
[1] Weber, W., Schledewitz, D.C.P., Lamb, C.F. and Thomas, K.A. 1975: Geology of the Kasmere Lake-Whiskey Jack Lake (north half) area; Manitoba Mines, Resources and Environmental Management; Mineral Resources Division, Publication 74-2, 163 p. + 24 maps at 1:50 000, 5 maps, at 1:250 000, 1 map at 1:375 000.

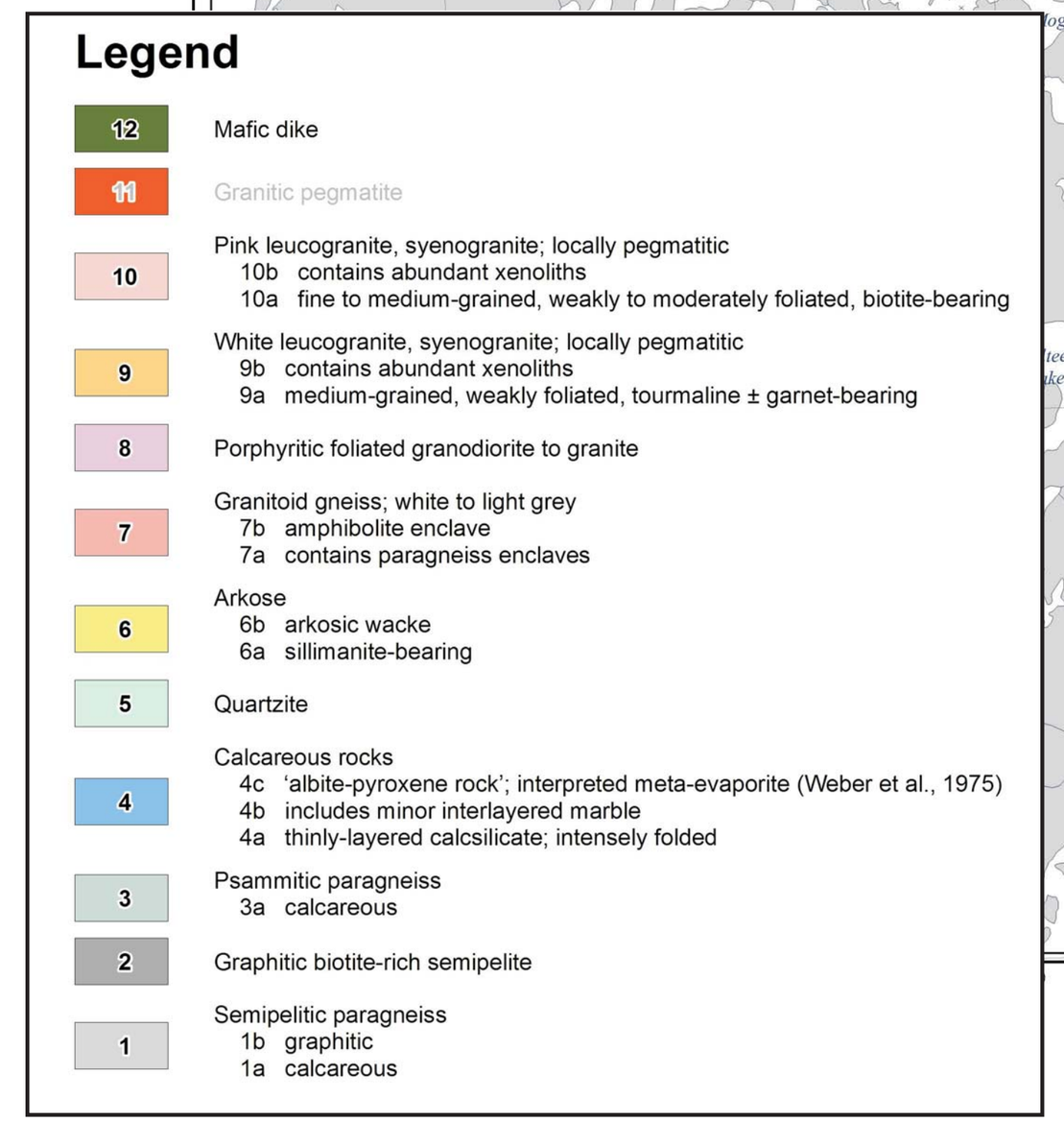
PMAP2006-4, Kasmere Lake, 1 : 50 000



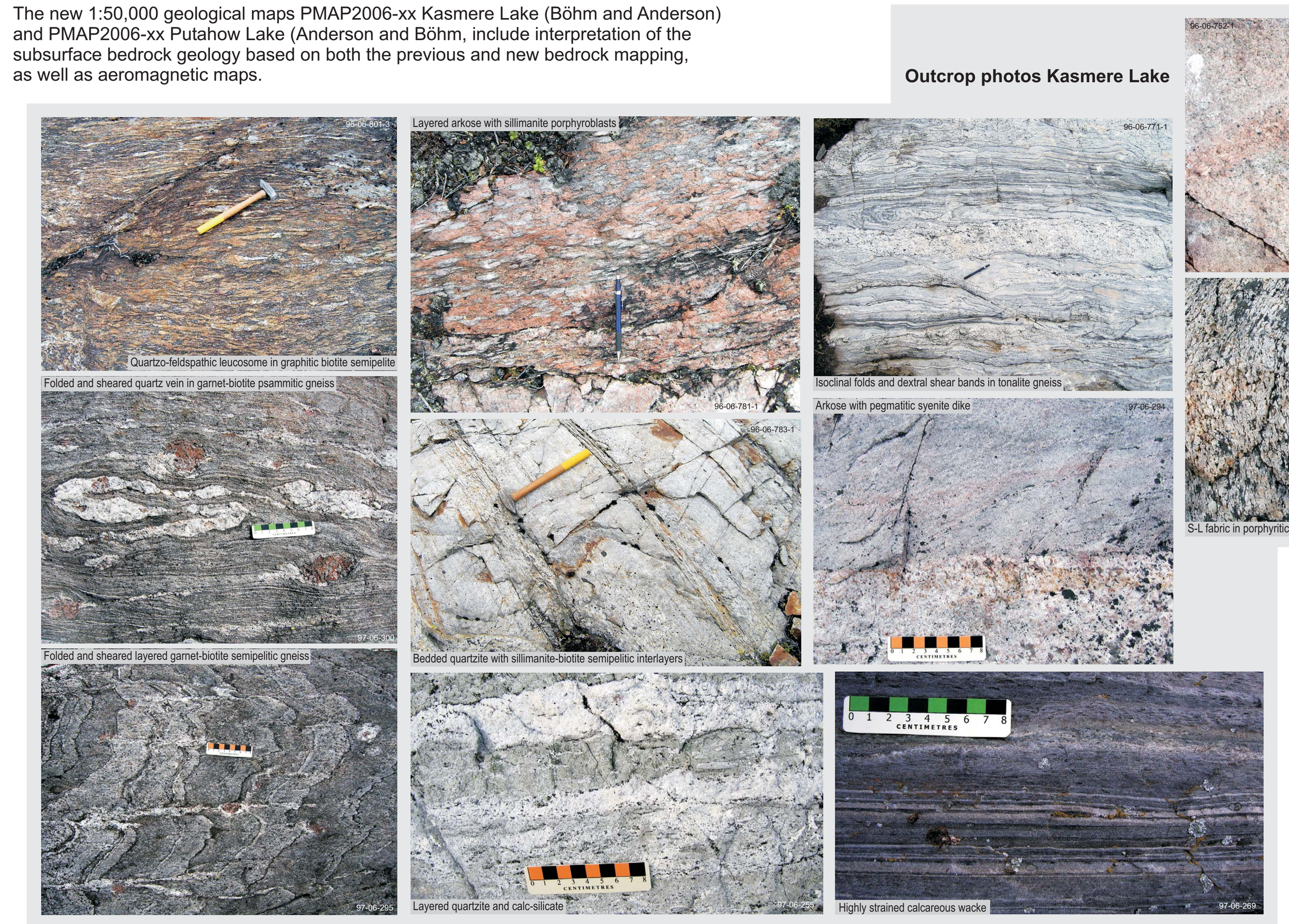
PMAP2006-5, Putahow Lake, 1 : 50 000

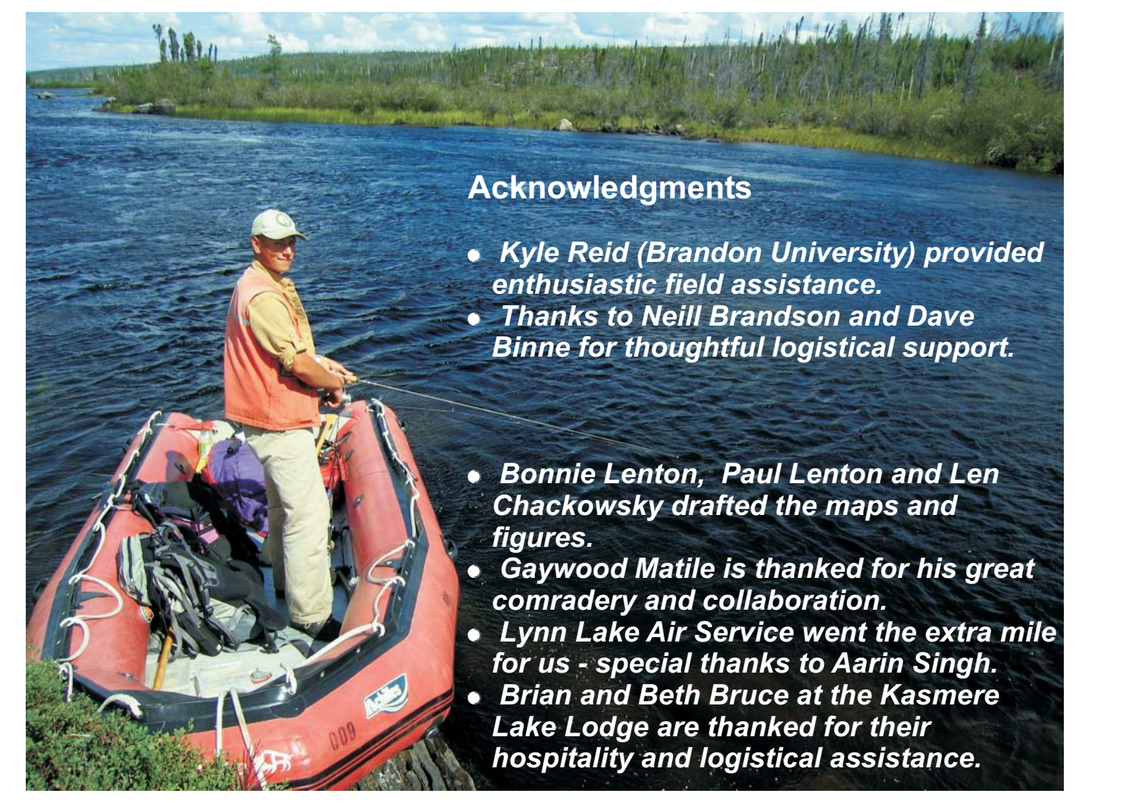
Geology by:
S.D. Anderson and C.O. Böhm (2006),
C.F. Lamb (1972)





The new 1:50,000 geological maps PMAP2006-xx Kasmere Lake (Böhm and Anderson) and PMAP2006-xx Putahow Lake (Anderson and Böhm, include interpretation of the subsurface bedrock geology based on both the previous and new bedrock mapping, as well as aeromagnetic maps.





Acknowledgments

- Kyle Reid (Brandon University) provided enthusiastic field assistance.
- Thanks to Neill Brandson and Dave Binne for thoughtful logistical support.
- Bonnie Lenton, Paul Lenton and Len Chackowsky drafted the maps and figures.
- Gaywood Matile is thanked for his great comradery and collaboration.
- Lynn Lake Air Service went the extra mile for us - special thanks to Aarin Singh.
- Brian and Beth Bruce at the Kasmere Lake Lodge are thanked for their hospitality and logistical assistance.