Preliminary Results from Geological Mapping in Pukatawakan Bay, Southern Indian Lake, Manitoba

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Introduction

Fieldwork conducted during the summer of 2008 at Southern Indian Lake was the first in a multiseason project in collaboration with the Geological Survey of Canada under Phase 3 of the federal government's Targeted Geoscience Initiative (TGI-3). The primary focus of this project is to sample, map in detail and reassess the mineral potential of supracrustal assemblages along the northeastern extent of the Churchill River system in the Southern Indian Lake area (Pukatawakan Bay, Pine Lake, Partridge Breast Lake). The new data will provide a basis for comparing the supracrustal rocks in the Southern Indian Lake area with similar and potentially related sequences that occur along regional strike to the west, in both Manitoba and Saskatchewan (e.g., Lynn Lake, La Ronge and Rottenstone domains).

Given that the tectonostratigraphic position of volcanic rocks in the Southern Indian Lake area within the regional framework of the THO is similar to those in the Lynn Lake and Rusty Lake belts, it is possible that they represent eastward extensions, albeit tectonically and magmatically dismembered, of related or equivalent supracrustal sequences, and may therefore share similar potential for VMS-type, orogenic lode gold and magmatic sulphide mineralization.

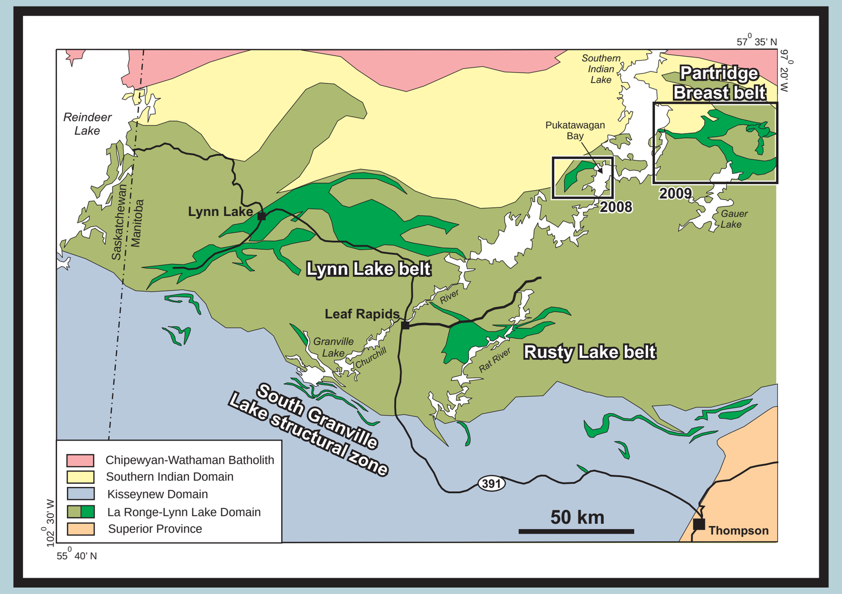


Figure 1. Simplified geology of the Trans-Hudson Orogen (THO) in Manitoba. The 2008 mapping area at Pukatawakan Bay and the proposed 2009 mapping area at Partridge Breast Lake are outlined.

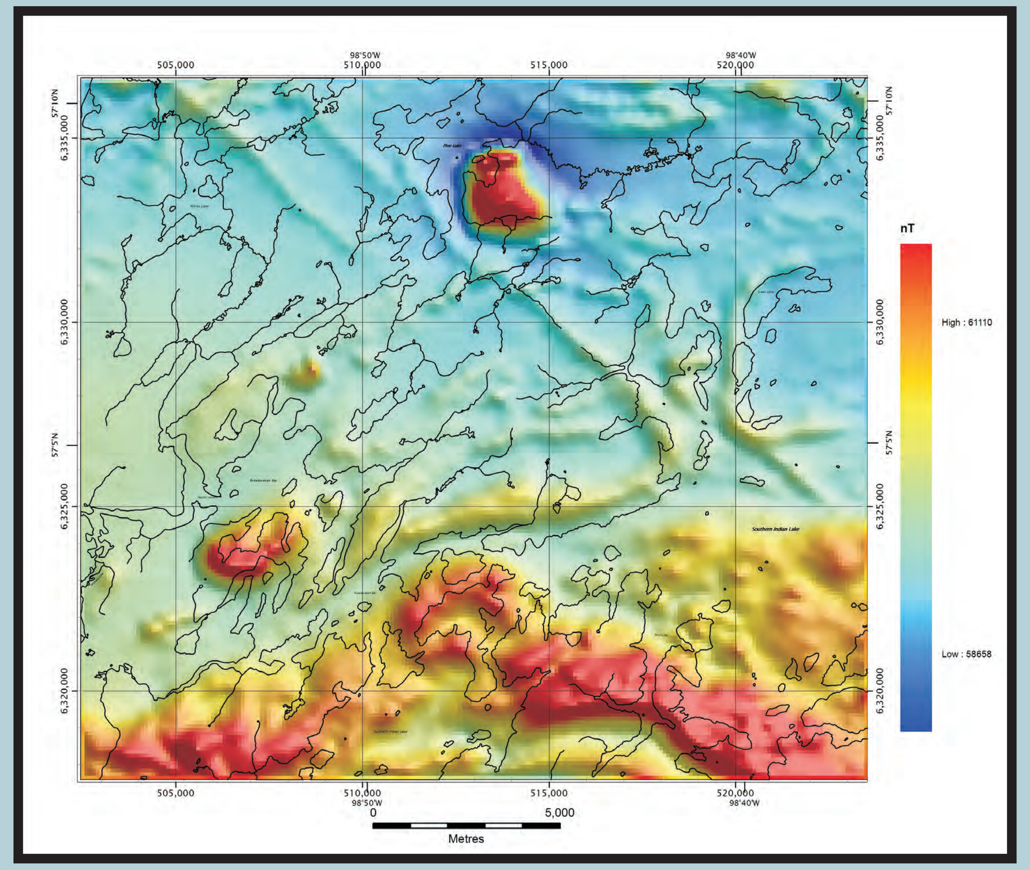


Figure 2. Part of the aeromagnetic survey showing total magnetic intensity of the area depicted in Figure 3. The survey was flown at 300 metre line spacing in the spring of 2008 by the Geological Survey of Canada.

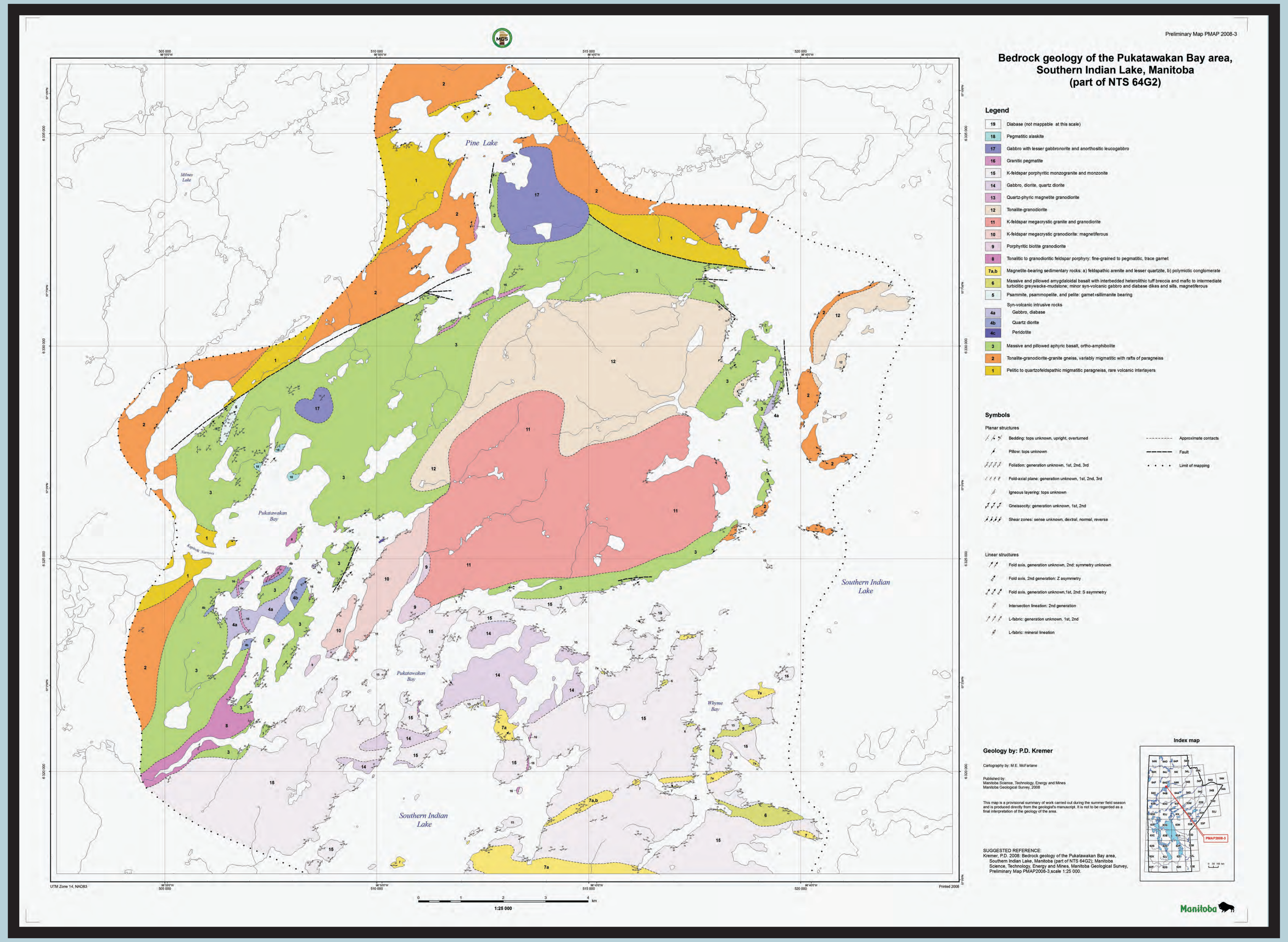


Figure 3. Preliminary bedrock geological map of the Pukatawakan Bay area, in the west central portion of Southern Indian Lake, northern Manitoba

Mineralization in Pukatawakan Bay

Disseminated, stringer, and blebby sulphide occurrences (pyrite-chalcopyrite-pyrrhotite) are found throughout the Pukatawakan Bay area associated with the following lithological and/or structural environments:

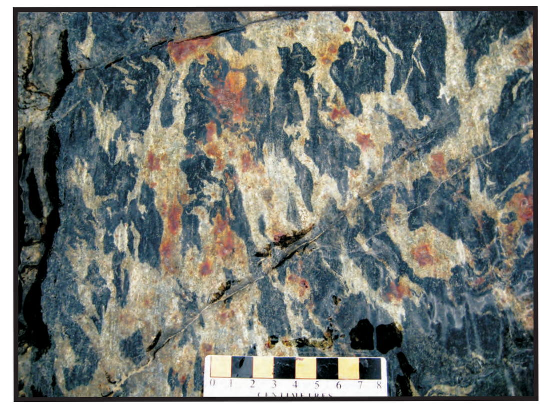
1) along syn-D, feldspar porphyry dikes that intrude volcanic rocks throughout the Pukatawakan Bay assemblage,

2) along a major structure and its subsidiary splays that mark the tectonized and highly altered unconformity between the volcanic rocks and their basement to the northwest,

3) within a layered ultramafic-mafic(gabbronorite-anorthositic leucogabbro) intrusion on the eastern shore of Pine Lake, and

4) in Cu-rich fracture veins in Whyme Bay; Cu values up to 2.2% have been reported by Frohlinger, 1972

Assay results from 21 samples collected in the summer of 2008 are pending.



Sulphide in altered zones in basalt

Mineralized shear zone between gneiss an basalt

Boudinaged and mineralized porphyry dike

Gossanous screen in tectonized zone

Geology of the Pukatawakan Bay Belt

Mapping in the Pukatawakan Bay belt has identified two seemingly distinct assemblages of poly-deformed mafic volcanic and syn-volcanic intrusive rocks with associated interlayered sedimentary rocks, herein termed the Pukatawakan Bay and Whyme Bay assemblages, which both overlie an older suite of mixed para- and orthogneiss. The Whyme Bay assemblage is itself unconformably overlain by fluvial-alluvial sedimentary rocks, dominated by polymictic conglomerate and well-bedded to massive arenite. The two volcano-sedimentary assemblages are both intruded and physically separated by multiple generations of voluminous, fine-grained to pegmatitic, gabbroic to monzonitic batholiths, stocks and dikes (3). All rocks, with the exception of certain late intrusions, have been metamorphosed to mid- to upper amphibolite facies

Basement Gneiss

Banded orthogneiss, south of Long Point

Basaltic dike cutting paragneiss

The oldest rocks in the Pukatawakan Bay area are an intermixed gneissic suite (4a) of both igneous and sedimentary origin. Ortho- and paragneiss occupy northern and western extents of the map area, and are generally poorly exposed in outcrop.

On the shore south of Long Point, gneiss is crosscut by diabase and gabbroic dikes that are petrographically indistinguishable in the field from, and therefore possibly represent feeders to, the volcanic rocks of the Pukatawakan Bay assemblage (4b), suggesting that the gneiss represents the basement rocks onto which the volcanic rocks were extruded. A sample of relatively homogenous orthogneiss was collected on a small island east of Pukatawakan Bay for U-Pb geochronology to further assess the relationship between the gneissic and volcanic rocks.

Pukatawakan Bay Assemblage

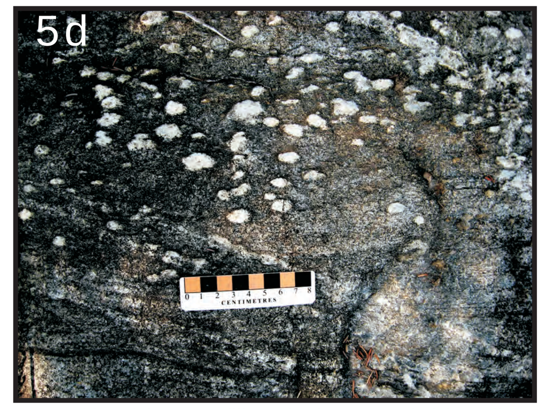
A continuous sequence of mafic volcanic rocks occurs at Pukatawakan Bay and extends northeast through Pine Lake and south of Long Point. The basalt weathers dark grey and is aphyric and nonamygdaloidal. Both pillowed and massive flows occur (5a), with locally recognizable flow-top facies including amoeboid pillow breccia and pillow-fragment breccia (5b). Characteristic exposures, however, consist of highly flattened and strained flows that are often completely recrystallized to homogeneous, fine- to medium-grained ortho-amphibolite in which any primary features are difficult or impossible to discern. Light grey-green zones of calcsilicate alteration occur in all exposures of basalt and amphibolite, often imparting a mottled texture to the rock (5c).

Basalt is interbedded with attenuated, discontinuous beds of fine-grained sedimentary rock. In a few locations in the northwestern portion of Pukatawakan Bay, continuous, mappable sedimentary sequences consist of thinly bedded greywacke, psammopelite and pelite, with occasional narrow calcsilicate beds. Garnet and sillimanite in rare sedimentary outcrops represent the peak, upper-amphibolite grade metamorphic assemblage (5d).

Pillow basalt in the Pukatawakan Bay assemblage

Pillow fragment breccia, same outcrop as 5a

Pervasive calc-silicate alteration in basalt



Faserkiesel (quartz-sillimanite intergrowths) in pelite

Whyme Bay Assemblage

Heterolithic tuff breccia in Whyme Bay assemblage

Pinitized cordierite porphyroblastsin turbidite

A second sequence of quartz, feldspar, and/or chlorite amygdaloidal mafic volcanic and associated sedimentary rocks, historically assigned to the Sickle Group (Cranstone, 1972; Frohlinger, 1972), occurs southeast of Pukatawakan Bay along the length of Whyme Bay. Both pillowed and massive flows occur at Whyme Bay, but tuff and tuff breccia are predominant between flows (6a), which is different from the mafic flows at Pukatawagan Bay.

Well- and thin-bedded, magnetite-bearing greywacke-mudstone turbidite sequences with garnet-cordierite-anthophyllite metamorphic assemblages are dispersed throughout the Whyme Bay volcanic rocks (6b). The strongly pinitized cordierite porphyroblasts are oriented oblique to bedding, overgrow the layer-parallel (S_1) foliation and show dextral asymmetry.

Clastic Sedimentary Rocks

A presumably younger sequence of magnetite-bearing, clastic sedimentary rocks, occurs spatially associated with the Whyme Bay assemblage. The dominant sedimentary facies is well-bedded to massive, fine- to medium-grained, magnetite-bearing arenitic sandstone with well-preserved primary features such as normal graded bedding and crossbedding (7a). A large exposure of polymictic, clast-supported conglomerate contains clasts similar to lithologies observed in the Whyme Bay assemblage, suggesting a possible unconformable relationship (7b). Sample for detrital zircon analyses have been collected from both suites to test this hypothesis.

Well-bedded feldspathic arenite

Clast-supported polymictic conglomerate

Structural Geology

On the basis of outcrop and overprinting relationships, three discrete generations of ductile deformation (D_1-D_3) have been identified in supracrustal rocks in the Pukatawakan Bay area; an earlier phase of deformation is restricted to the mixed basement gneiss sequence and is not manifested in any of the younger rocks.

Supracrustal rocks of the Pukatawakan and Whyme Bay assemblages invariably contain a strongly developed, layer-parallel, S_1 transposition fabric. The S_1 foliation at Pukatawakan Bay generally strikes east to northeast, dips steeply and is axial planar to rare, metre-scale isoclinal F_1 folds (8a).

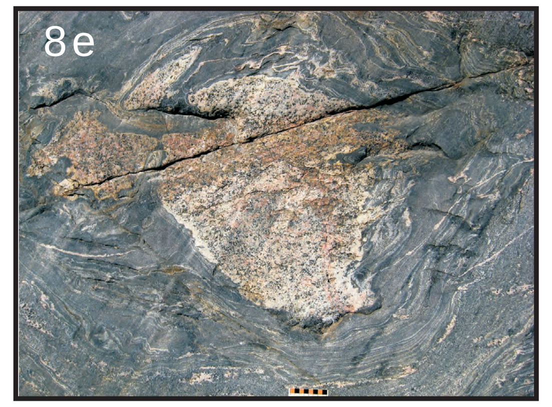
Isoclinal F_1 fold in bedded arenite

Isoclinal F_1 fold refolded by dextral F_2 folds

These early structures in the Pukatawakan Bay supracrustal rocks are strongly reworked into a northeasterly orientation by subsequent deformation, attributed to D_2. The S_1 foliation is folded by tight to isoclinal F_2 folds with a variably developed S_2 axial-planar foliation that strikes northeast (8b). At Whyme Bay, S_1 fabrics are only mildly reworked by macroscopic, upright, z-asymmetric F_2 folds (8c). The northeast-trending S_2 foliation is only weakly to moderately developed. All linear structures associated with D_2 deformation plunge moderately to steeply northeast. Numerous outcrop-scale chloritic shear zones with dextral kinematic indicators provide evidence for a strong dextral shear component associated with D_2 (8d). Garnet, cordierite and sillimanite porphyroblasts in metasedimentary rocks overgrew the S_1 foliation and developed asymmetric pressure shadows consistent with dextral kinematics, suggesting that peak metamorphic conditions were reached during D_2 (6b).

Upright F_2 fold with moderately developed S2 foliation

Dextral asymmetric boudinage of granitic dyke



Outcrop-scale dome and basin fold interference

Outcrop-scale dome and basin fold interference

Broad, northwest-trending, gentle to open, F_3 crossfolds that increase in frequency and spacing eastward are responsible for local reorientation of D_2 structures throughout the map area. In rare cases, dome and basin fold interference patterns are created between F_2 and F_3 folds (8e, f).