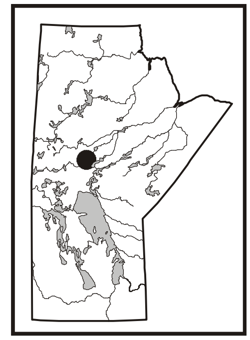
GS-10

BEAR ISLAND MAFIC DYKE (PARTS OF NTS 63J/16)

by E.B. Ducharme[1]



Ducharme, E.B. 1999: Bear Island mafic dyke (parts of NTS 63J/16); *in* Report of Activities, 1999, Manitoba Industry, Trade and Mines, Geological Services, p. 38-40.

SUMMARY

The Bear Island mafic dyke is located just east of the Thompson Nickel Belt (TNB). The northeast-trending gabbroic dyke is 70-80 m thick and is hosted by retrogressed Archean granulite of the Pikwitonei domain in the Superior Boundary Zone. Detailed petrologic and geochemical analyses (ongoing) of the dyke will provide additional constraints on the character of mafic magmatism, its timing, regional extent of rifting, and metamorphism in the Superior Boundary Zone. The Bear Island dyke is believed to be part of the 1883 Molson dyke swarm and is likely coeval with ultramafic magmatism in the Thompson Nickel Belt. An U-Pb age determination will be attempted to confirm this assumption (L. Heaman and K. Trope, University of Alberta). Samples of pegmatite pods within the dyke were obtained for precision zircon and/or baddeleyite isotopic analysis. Only preliminary observations have been made to date on the Bear Island mafic dyke, and these show characteristics similar to those of Molson dykes. The dyke is particularly interesting in that it retains primary and secondary mineralogy and textures, excellent for comparison purposes to those in the surrounding area, including the TNB.

INTRODUCTION

Recent geochronological data (L. Hulbert, Geological Survey of Canada, unpublished data; c.f. Peck et al., GS-21, this volume) highlight the regional scope of 1.88 Ga mafic and ultramafic magmatism in the Superior Boundary Zone, including the Thompson Nickel Belt (TNB), the Fox River Belt and the Molson dyke swarm. During the 1999 field season, the Bear Island dyke, a well exposed mafic dyke that occurs on Sipiwesk Lake and is believed to belong to the Molson swarm, was mapped in detail. Three, one metre square grids were used to map the best exposed areas of the dyke. Concurrently, sampling was completed in support of a petrographic and geochemical study. Forty-seven thin sections were cut and 23 samples were sent out for geochemical analysis. Additional sampling was completed on a lens of gabbroic to dioritic pegmatite within the Bear Island dyke. The pegmatite is similar in mineralogy and morphology to trace element-enriched magmatic veins and pods that are known to contain primary zircons in other Molson dykes (Peck and Heaman, 1998). The pegmatite sample will be crushed and, if suitable zircon or baddeleyite is recovered, analysed using high precision U-Pb isotopic analysis in order to obtain a crystallization age for the dyke (L. Heaman and K. Toope, University of Alberta).

The objectives of this study are (1) to document the field characteristics, petrology, mineralogy, lithogeochemistry, of the dyke; (2) compare this data with published data from similar dykes and, specifically, the Molson dyke swarm (Scoates and Macek, 1978). The detailed petrological and geochemical data may provide geological criteria for delineating dykes that are coeval with the Bear Island dyke within the Superior Boundary Zone. The dyke retains primary and secondary mineralogy and textures, excellent for comparison purposes to those in the surrounding area, including the TNB.

GEOLOGIC SETTING

The Bear Island dyke, 200 m east of Duck Rapids, lies approximately 100 km south of Thompson, Manitoba, along the Sipiwesk Lake segment of the Nelson River (Fig. GS-22-1, this volume). The study area is located at the northwestern margin of the Superior Province, which is transitional to the TNB to the west. The dyke intrudes Archean gneisses belonging to the Pikwitonei granulite domain. The country rock adjacent to the dyke is an orthopyroxene + clinopyroxene-bearing granulite gneiss which commonly exhibits retrogression to hornblende ± biotite bearing mineral assemblages. The Hudsonian front of retrograde metamorphism is interfingered throughout the area (Units Nx and En, Manitoba Energy and Mines, 1993), but generally located to the west of the study area.

PRELIMINARY RESULTS

The dyke strikes 047° and dips 79° southwest, which is similar to the orientation of other Molson dykes and principal structural trends in the adjacent TNB (Scoates and Macek, 1978). The only exposed contact crosscuts the Pikwitonei granulite gneiss at an oblique angle (54°) (Fig. GS-10-1). The estimated dyke thickness is 70-80 m. The typical jointing pattern of the dyke (similar to that of Molson dykes recorded by Scoates and Macek, 1978) has three defined joint systems, which allows for late fluids to migrate through the dyke.

The intrusion was mapped with respect to mineralogy, texture, colour, grain size, and structure. The dyke is largely gabbroic in

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GS-10-1: Relationship between dyke and host gneiss; the dyke cuts the Pikwitonei granulite gneiss at an oblique angle. The dyke exhibits 3 joint systems, one of those being perpendicular to the contact. One metre square grid for scale.

composition and seven lithologic layers (centimetre- to metre-scale) delineated within it have sharp or gradational contacts. Textural variations include aphanitic, pegmatitic, poikilitic, hypidiomorphic granular to xenomorphic, and porphyritic. Structures include massive and flow layered with local inclusions. The country rock shows a granoblastic (xenotopic) texture, and massive structure.

Secondary alteration (metasomatism) is attributed to circulation of silica-rich hydrous fluids along the joint planes and fractures (Fig. GS-10-2). All quartz veins are located within the altered areas of the dyke, and are nowhere in contact with fresh rock. This is excellent evidence for the relationship between the fluid channels and the alteration. (Fig. GS-10-2).

GEOCHRONOLOGY

At least two ages of mafic dyke emplacement (2092 Ma and 1883 Ma) are currently recognized in the Pikwitonei granulite domain (Böhm, 1998). The date of 1883 Ma established for the Molson dyke swarm (Heaman, 1986) is indistinguishable from the age of a mineralized ultramafic intrusion from the Setting Lake area, TNB (L. Hulbert, Geological Survey of Canada, unpublished data). The 1883 Ma magmatism was a major igneous event, probably related to continental rifting in the Superior Boundary Zone (Peck, 1998). Currently, the Bear Island dyke characteristics (joint patterns and orientations) suggests the dyke is part of the Molson dyke swarm (Scoates and Macek, 1978), and was therefore expected to yield an age of about 1883 Ma.

In June 1999, samples of a coarse grained gabbro-pyroxenite, and a pegmatitic pod (Fig. GS-10-3) were taken for geochronological analysis. The analysis is being conducted by Kim Toope and Larry Heaman (University of Alberta). The age of the Bear Island dyke will provide additional insights into the timing of continental rifting and dyke emplacement in the Superior Boundary Zone.

FUTURE WORK

During the next few months, a complete analysis will be done on the thin sections and chemistry data. A full report will be written on all aspects of the research (B.Sc. thesis, E.B. Ducharme, Geology Department, Brandon University).

ACKNOWLEDGEMENTS

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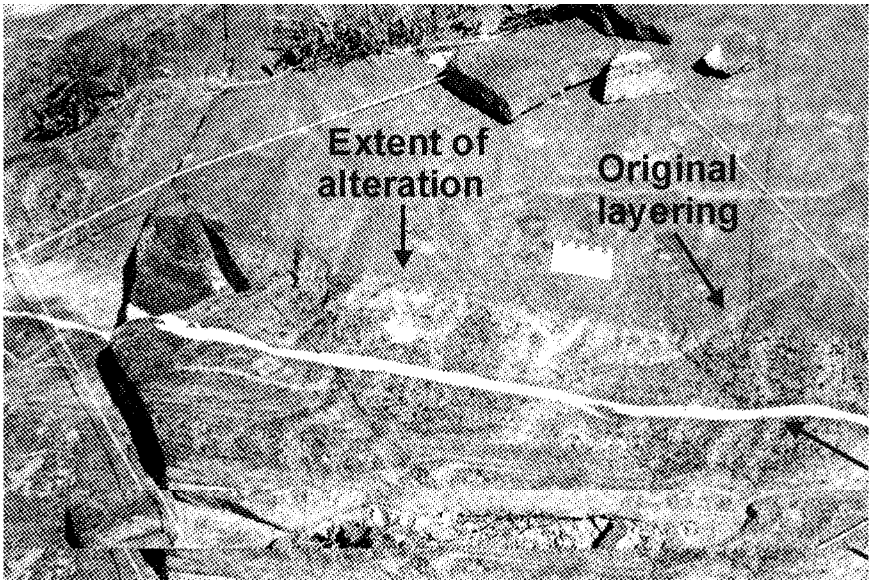
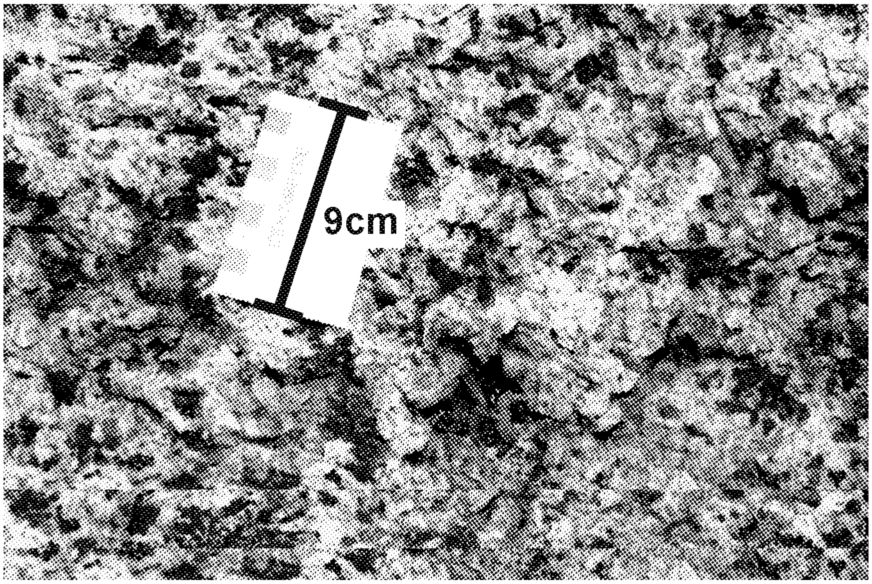


GS-10-2: Hornblende replacing orthopyroxene + clinopyroxene in the hydrated zone that surrounds the quartz vein, a water source. The rock is a gabbro with deformed original flow layering in which individual layers can be traced from the fresh gabbro across the retrogressed gabbro.



GS-10-3: A pegmatitic pod, believed to be the residual fluid, is quartz + plagioclase + potassium feldspar rich. The pegmatite patch (a source of water) is surrounded by a hornblende bearing, retrogressed gabbro.

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