M.Sc. THESIS DEFENCE

by

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"TECTONIC HISTORY OF THE NEPEWASSI DOMAIN, CENTRAL GNEISS BELT, GRENVILLE PROVINCE, ONTARIO: A LITHOLOGICAL, STRUCTURAL, METAMORPHIC AND GEOCHRONOLOGICAL STUDY"

PLACE: The Milligan Room, 8th Floor Biology Wing, LSC, Dalhousie University

DATE: Thursday, December 8, 2016

TIME: 9:00 a.m.

EXAMINING COMMITTEE:

Dr. Brendan Murphy  St. Francis Xavier University  External Examiner

Dr. Michael Easton  Ontario Geological Survey  Reader

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PLEASE NOTE: A copy of the thesis is available in the main Earth Sciences Office
ABSTRACT

The Nepewassi domain is a parautochthonous unit within the Central Gneiss Belt of the Grenville Province, Ontario. The Southern subdomain of the Nepewassi domain, the focus of this study, is composed of migmatitic quartz monzonite, the West Bay batholith, and three lithological associations: a tonalitic and granodioritic grey gneiss association, the bimodal West Phase association, and a thin, north-south trending supracrustal association that separates the West Phase association from the West Bay batholith. Supracrustal rocks coincide with an east-dipping ductile shear zone, the West Arm High strain zone (WAHSZ). Fold interference patterns east of the WAHSZ indicate that two phases of folding affected the Southern subdomain. Mineral assemblages indicate amphibolite facies metamorphism across the study area. Two pelites, one within the WAHSZ and one west of it, yielded P-T results of 6.8 ± 1 kbar - 632 ± 25°C and 7.3 ± 1 kbar - 656 ± 25°C respectively. A garnet amphibolite on the east edge of the WAHSZ yielded P-T conditions of 10.6 ± 0.5 kbar - 773 ± 25°C, consistent with the hypothesis that deeper rocks east of the WAHSZ were thrust over those to the west.

Igneous and detrital zircon U-Pb geochronology was completed using laser ablation – inductively coupled plasma – mass spectrometry. Tonalitic and granodioritic gneisses returned ages of 2673.2 ± 14 Ma and 2685.8 ± 4.8 Ma, similar to previously determined igneous ages in the Nepewassi domain and the cratonic foreland. Detrital zircons in four quartzite samples, three from metasupracrustal rocks within the WAHSZ and one at a higher structural level, were analyzed to determine provenance. All four samples have a detrital population peak at ca. 2.7 Ga. One quartzite within the WAHSZ yielded metamorphic ages of ca. 1.75 Ga, and the quartzite located structurally above the WAHSZ yielded a ca. 1.75 Ga detrital peak. Metamorphic monazite from a metapelite, within the WAHSZ was analyzed in situ using U-Th-Pb geochronology. The age spectra show a large Grenvillian peak at 990 Ma and smaller Paleoproterozoic peaks with a dominant peak at ca.1760 Ma and a subsidiary peak at 1820 Ma.

The combination of igneous, detrital, and metamorphic ages provides significant insight into the tectonic history of the rocks of the Nepewassi domain. We can now infer that Laurentian (Superior Province) cratonic basement rocks were the source of detritus for metasedimentary rocks in the Nepewassi domain. Metamorphic and intrusive rocks formed ca. 1.75 Ga may have provided sediment for the structurally higher and younger quartzite. The ca. 2.7 Ga detrital zircon population in the Nepewassi quartzite samples closely resembles those from metasedimentary formations in the Huronian Supergroup, which were deposited on the Paleoproterozoic passive margin on the southern edge of the Laurentian craton. These data support the hypothesis that metasediments now in the Nepewassi domain were originally deposited on the passive margin of Laurentia after ca. 2.4 Ga and prior to ca. 1.75 Ga. The passive margin was inverted and imbricated at or before ca. 1.82 Ga and subsequently reworked during the Grenvillian orogeny.