M.Sc. THESIS DEFENCE

by

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"AN EXPERIMENTAL STUDY OF THE ROLE OF CONTAMINATION IN THE FORMATION OF CHROMITITES IN THE RING OF FIRE INTRUSIVE SUITE"

PLACE: *Room 3-44 (SOSB)*

DATE: *Wednesday, October 31, 2018*

TIME: *10:00 a.m.*

EXAMINING COMMITTEE:

Dr. Jacob Hanley	*Saint Mary's University*	*External Examiner*
Dr. James Mungall	*Carleton University*	*Co-Supervisor*
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PLEASE NOTE: *A copy of the thesis is available in the main Earth Sciences Office*

ABSTRACT

The Ring of Fire Intrusive Suite (ROFIS) in the James Bay lowlands, Ontario, is emplaced into the 2.734 Ga McFauld's Lake greenstone belt, and hosts five chromite deposits, together comprising ~201.3 million tonnes of measured and indicated chromite resources. The formation process of these and other stratiform chromitites worldwide is still debated, with numerous models for their petrogenesis, one of which is the contamination of a primitive magma by surrounding country rock during ascent and emplacement. Although this process is likely to occur, with evidence for this in the ROFIS context, its effect on chromite crystallization has not been rigorously experimentally tested. This thesis addresses this shortcoming in a series of experiments involving komatiite-ROFIS country rock mixtures, komatiite-magnetite mixtures, and chromite-doped komatiite to measure phase equilibrium, chromite solubility, and chromite composition. Experiments involved equilibrating synthetic komatiite (2187 ppm Cr) containing 0-50 wt.% Cr-free contaminants and 0-2 wt.% chromite on Fe-presaturated Pt loops at 1192-1462ºC and 0.1 MPa at the fayalite-magnetite-quartz (FMQ) oxygen buffer in a vertical tube furnace. Results show that assimilation of Fe-rich material decreases the chromium content of the melt at chromite saturation and decreases the olivine-in temperature, thereby increasing the temperature interval over which chromite crystallizes alone. Assimilation of 16 wt.% of BIF is enough to increase the volume of chromite crystallization from the ROFIS parental melt 5-fold, and is consistent with other metrics of parental melt contamination. These results indicate that assimilation of Fe-rich country rocks by komatiite may contribute to chromite accumulation in stratiform chromitites.