The role of contamination in the formation of chromitites in the Ring of Fire Intrusive Suite, James Bay Lowlands, Ontario

ERIN KELTIE*[1], JAMES BRENAN[1], JAMES MUNGALL[2], AND RYAN WESTON[3]

[1]Department of Earth Sciences, Dalhousie University, 1355 Oxford Street, Halifax NS Canada B3H 4R2, (*correspondance: eekeltie@dal.ca)

[2]Department of Earth Sciences, Carleton University, 1125 Colonel By Drive, Ottawa ON Canada K1S 5B6

[3]Noront Resources Ltd., 886A Alloy Place, Thunder Bay ON Canada P7B 6E6

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 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 extensively tested by experiment. We have addressed this shortcoming in a series of experiments involving mixtures of komatiite-ROFIS country rock, komatiite-magnetite, or komatiite-additional chromite, 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.% additional chromite on Fe-presaturated Pt loops at 1192-1462ºC and 0.1 MPa at the FMQ oxygen buffer in a vertical tube furnace. Results show that assimilation of Fe-rich material increases the chromite liquidus temperature, but it is unclear if this is sufficient to result in chromite-only crystallization. The range of Cr# of chromite from contamination experiments (0.45-0.65) overlaps that of natural ROFIS chromite, but the Fe# (0.11-0.45) is uniformly lower than the natural samples. The addition of Fe via magnetite assimilation caused chromite to have a higher Fe#, but lower Cr#. Results suggest that the iron-rich nature of the ROFIS chromites is consistent with subsolidus chromite-olivine exchange, and does not reflect a primary magmatic signature. Experiments at more oxidizing conditions, and to assess olivine liquidus temperatures are in progress.