Experimental investigation of the effect of contamination on chromite crystallization in the Ring of Fire deposit, Ontario, Canada

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Economically significant chromitite deposits are rare, despite chromite being a common accessory mineral in primitive mafic rocks. There were no known significant chromitite deposits in Canada until 2007, when it was discovered that the Ring of Fire Complex (ROF), located in the James Bay lowlands of northern Ontario, contains massive chromitite accumulations potentially worth billions of dollars. The processes responsible for ore-grade accumulation of chromite can be simplified into two hypotheses: chromite deposits form (1) due to fluid dynamic processes involving crystal sorting from komatiite melts in large conduits, or (2) due to komatiitic magma interacting with contaminants during its transit to the surface. This thesis project aims to test the second hypothesis. Experiments are underway in which komatiitic magma, similar in composition to that parental to the ROF deposit, is mixed with contaminants resembling the local country rocks. Temperature and oxygen fugacity are controlled by using vertical tube gas-mixing furnaces. The resultant changes in chromite solubility and composition will be measured using electron microprobe analysis. The composition and relative timing of crystallization of experimentally-produced chromite will be compared to ROF samples to assess the validity of the contamination hypothesis. A refined understanding of the controls on chromite crystallization processes is important for effective strategizing when discovering new deposits, as focusing exploration efforts to locations with magmatic systems having the most potential for forming ore-grade chromite deposits may decrease the cost of exploration programs.

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