Geology and petrogenesis of Ni-Cu-PGE mineralization in the Eagle's Nest deposit, McFaulds Lake greenstone belt, Ontario, Canada

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The Meso- to Neoarchean McFaulds Lake greenstone belt (a.k.a 'Ring of Fire') in northern Ontario is one of the most important mineral districts discovered within the Canadian Shield in the last decade. This region is well known for its remarkable chromite endowment, but it also hosts significant but poorly constrained magmatic Ni-Cu-PGE mineralization, such as at Eagle's Nest, Blue Jay (formerly known as AT-12), and locally within other parts of the system. The Eagle's Nest deposit occurs within the feeder system of the Double Eagle intrusive complex, which represents the southwest part of the system, whereas Blue Jay occurs within the feeder system of the Black Thor intrusive complex, which represents the northeast part of the system. Together, these define a 15 km long, up to 3 km thick, and over 1 km deep ultramafic sill complex that consists of at least two discrete sill bodies. In both areas, the intrusion is differentiated into a thick, lower ultramafic sequence, which consists of komatiitic dunite, lherzolite, websterite, and chromitite (Blackbird, Black Horse, Big Daddy, Black Creek, Black Label, and Black Thor chromite deposits), that is overlain by a thinner mafic sequence containing melanogabbro, mesogabbro, leucogabbro, and lesser anorthosite. Several styles of Ni-Cu-PGE mineralization occur within these intrusions, the most significant of which is massive/semi-massive/net/disseminated sulfide mineralization within the feeder systems that is found at the Eagle's Nest deposit and the Blue Jay occurrence. The objective of this MSc study is to better understand the parameters that are responsible for the generation of the Eagle's Nest Ni-Cu-PGE deposit, a subvertical pipe-like body approximately 200 m long, up to 50 m thick, and at least 1600 m deep (open at depth). The relationships between the sulfide textural facies and the metal zoning within the ore body are poorly constrained and will be investigated in this study. Preliminary observations indicate that the feeder system was dynamic, as suggested by numerous crosscutting relationships between massive and net-textured sulfides and the occurrence of net-textured sulfides and barren peridotite clasts within massive sulfides. Other Ni-Cu-PGE occurrences (e.g., East Zone, Eagle Two) also occur in the vicinity, and their relation to the Eagle's Nest deposit will be investigated. Understanding the fundamental characteristics of Ni-Cu-PGE mineralization at Eagle's Nest will provide critical information for the evolution of this large Cr and Ni-Cu-PGE system associated with Archean komatiitic magmatism in the Superior Province.