

Black Thor Intrusive Complex in the 2.7 Ga McFaulds Greenstone belt, Superior Province: a feeder system of an Archean Large Igneous Province?

H.J.E. Carson¹, C.M. Lesher¹ and M.G. Houlé²

¹Mineral Exploration Research Centre, Department of Earth Sciences, Goodman School of Mines, Laurentian University, Sudbury, Ontario P3E 2C6; ²Geological Survey of Canada, Earth Sciences Sector, Natural Resources Canada, Québec City, Québec G1K 9A9

The Ring of Fire Intrusive Suite (RoFIS) encompasses coeval ultramafic- and mafic-dominated intrusions, interpreted to represent the subvolcanic parts of a large igneous province that has either eroded away or not yet been identified due to limited outcrop in the region. The RoFIS contains world-class chromite deposits (e.g., Black Thor, Big Daddy, Blackbird), significant Ni-Cu-(PGE) mineralization (e.g., Eagle's Nest), and potentially significant Fe-Ti-V mineralization (e.g., Thunderbird). The Black Thor Intrusive Complex (BTIC) of the RoFIS is dominated by olivine ± pyroxene-rich cumulate rocks, contains an aggregate thickness of 100m chromite mineralization (much more than in typical stratiform chromite deposits) and is derived from a komatiitic magma with 22-23 wt% MgO. Mass balance calculations indicate that the BTIC contains ~30% more Ol and ~6% more Chr than the parental magma (i.e., 12x more Chr than cotectic proportions), indicating that the BTIC represents a feeder system in which Ol and Chr accumulated. The BTIC is at least 15 km long x 1.5 km wide x 1 km deep (open at depth). Combined with abundant nearly contemporaneous mafic-dominated ferrogabbroic intrusions and the missing volume of evolved magma required to mass balance BTIC cumulates, the volume of the magmatic system is inferred to be greater than 32,000 km³. Ni-Cu-(PGE) ores occur within magmatic feeders and along basal contacts of the ultramafic-dominated intrusions and formed early in the magmatic history of the system, chromite ores occur in the middle parts of the ultramafic-dominated intrusions and formed at an intermediate stage, and Fe-Ti-V mineralization occurs in mafic-dominated intrusions, more evolved parts of the entire system. Together these imply the presence of both deeper fractionation chambers (to produce the ferrogabbros) and overlying evolved lavas (fractionates of BTIC cumulates).