

Mineralogy and Petrogenesis of Ni-Cu-PGE Mineralization in the Black Thor Intrusive Complex, McFaulds Lake Greenstone Belt, Ontario

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Abstract

The 2.7 Ga Black Thor Intrusive Complex (BTIC) is located in the James Bay Lowlands of northern Ontario and is composed primarily of dunite, lherzolite, olivine websterite, websterite and chromitite (Black Thor and Black Label horizons) with mela-leucogabbro and minor anorthositic gabbro. A Late Pyroxenite composed primarily of websterite intruded the lower and middle ultramafic series rocks and locally brecciated the Black Label chromitite horizon. Ni-Cu-PGE mineralization within the BTIC can be subdivided into four different styles (basal contact style, magmatic breccia style, reef style, and vein style) occurring within the following zones: 1) AT-12 Extension (hosted primarily by lherzolite along the contact between the feeder and adjacent granitoids), 2) Basal Contact (hosted primarily by lherzolite along the contact between the BTIC and underlying granitoids), 3) NW Breccia (hosted primarily by websterite in a magmatic breccia zone along the SW contact between Black Label and the Late Pyroxenite), 4) F2 (hosted primarily by websterite in a magmatic breccia zone along the NE contact between Black Label and the Late Pyroxenite), 5) an unnamed zone (hosted by websterite between the F2 and NW Breccia), 6) Black Label chromitite (hosted primarily by websterite interlayers), and 7) Black Thor Chromitite (hosted primarily by talc schist interlayers). Sulfide textures include: interstitial disseminated (<20% sulfide), blebby (5-20%), patchy net-textured (20-30%), net-textured (20-40%), ragged (20-40%), vein (30-100%), semi-massive (50-90%), and massive (>90%). AT-12E and Contact Zone are dominated by disseminated, patchy net-textured, blebby, and vein textures; NW Breccia and F2 are dominated by disseminated and blebby textures; Black Label is dominated by patchy net-textured and vein textures, and Black Thor is dominated by disseminated textures. The predominant mineral assemblages are: 1) pyrrhotite-pentlandite-chalcopyrite-magnetite, 2) chalcopyrite-pyrrhotite-(pentlandite), and 3) chalcopyrite-(magnetite). Platinum-group minerals (PGMs) are commonly spatially associated with sulfide-bearing minerals and secondary silicates. The principal PGMs identified thus far include sperrylite (PtAs₂), paolouite (Pd₂Sn), and minor PGE tellurides and arsenides. Two main magmatic mineralizing events appear to have occurred within the BTIC: an early event forming basal contact style mineralization in the Basal Contact and AT-12 Extension zones, and a later event forming magmatic breccia style mineralization in the F2 and NW breccia zones.