

Deformation and Structural Controls at the Broken Hammer Deposit: Sudbury, Ontario

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In the mining camp of Sudbury, Ontario, Cu-Ni-Platinum Group Element (PGE) footwall deposits are hosted by the basement rocks underlying the ca. 1.85 Ga Sudbury Igneous Complex (SIC). The SIC is interpreted as a differentiated impact melt sheet, which was flattened into its present elliptical shape during the 1.85 Ga – 1.80 Ga Penokean Orogeny. Footwall deposits are subdivided into “sharp-walled” vein and “low-sulphide” PGE-rich mineralization, the latter expressed by thin sulphide veinlets and disseminations. The Broken Hammer deposit, which is located in Archean rocks in the North Range of the SIC, is a hybrid footwall-type deposit containing sharp-walled massive sulphide vein and low-sulphide PGE-rich mineralization. It contains an indicated resource of 259, 500 tonnes grading 0.88% Cu, 0.1% Ni, and 12.14 g/tonne total precious metals (TPM). The deposit is now being mined as an open pit operation, which provides a unique opportunity to study the 3D geometry and the emplacement of the veins. The veins range in thickness from 1 to 50 cm and are composed primarily of chalcopyrite, millerite and platinum group minerals. The dip on the veins varies from steep (>60) to moderate (40-50) and the veins are typically thicker where they change orientation to more shallow dips. The veins have three main strike orientations: 070°, 130°, and 190°. The intersection of all these veins is coincident with the trend (220°) and plunge (30°) of the main ore body, suggesting that the veins formed during a single deformation event. The latter corresponds either to the collapse of the floor of the Sudbury structure during the modification stage of the impact, to the Penokean orogeny, or to a combination of both occurring simultaneously.