

Sulphide mineralization and hydrothermal alteration of the Captain deposit, Bathurst Mining Camp, New Brunswick, Canada

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The Captain deposit is a copper-cobalt-silver deposit located approximately 40 km south-southwest of Bathurst. The deposit is hosted by the Nepisiguit Falls Formation and consists of stringers, veins, semi-massive, and massive sulphides within a broad zone of chlorite-altered rhyodacite. The mineralized zone is a roughly tabular body dipping 70 to 80 degrees to the west with a strike length of approximately 150 m, thickness of 25 m, and a down-dip extent of at least 400 m. The mineralized zone does not exhibit any systematic metal zoning but does contain a number of small anastomosing copper-rich and cobalt-rich zones. An NI 43-101 compliant mineral resource estimate for the deposit has defined 1.97 million tonnes of ore grading of 0.84 wt% Cu and 0.045 wt% Co.

The Captain deposit is surrounded by a broad zone of chlorite alteration, with complete replacement of feldspar extending out to 100 m. Chlorite is enriched in iron near the center of the deposit ($\text{Fe}/(\text{Mg}+\text{Fe}) = 82$), reflecting higher temperatures and iron-rich fluids. In more distal areas relic feldspars are recognizable and the iron content of chlorite is lower ($\text{Fe}/(\text{Mg}+\text{Fe}) = 64$). Chlorite compositions typical of unaltered Nepisiguit Falls rhyodacite were not intersected within the limits of drilling.

Pyrite is the dominant sulphide phase at the Captain deposit and commonly consists of large, subhedral crystals. Complex oscillatory zoning of trace elements along with the high abundance of impurities in the crystal lattice suggests that the pyrite is not porphyroblastic but grew from a compositionally fluctuating vent fluid. Cobalt enriched zones within the pyrite may reach 4 wt% Co substituting for Fe. Zones of arsenian pyrite are also common with up to 5 wt% As. Bismuth occurs as cryptocrystalline inclusions in pyrite and as discrete grains of bismuthinite and native bismuth. Chalcopyrite is a later phase, replacing pyrite along grain boundaries, fractures, and growth planes.

The Captain deposit is interpreted to be the stringer zone of a volcanic-hosted massive sulphide system on the basis of: (1) high Cu, Co, and Bi and low Zn and Pb sulphide assemblages, (2) the absence of stratiform exhalative facies, (3) discordant relationship with stratigraphy, and (4) symmetrical styles, intensities and extent of alteration in both the structural footwall and hanging wall. The size of the stringer zone and the extent and intensity of the surrounding alteration implies a large hydrothermal vent system. Younging indicators suggest that the deposit is overturned, in which case a large exhalative volcanic-hosted massive sulphide deposit may exist at depth.