Geological setting and characteristics of Siluro-Devonian porphyry-related Cu-Au skarn deposits in northern New Brunswick

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Numerous contact metasomatic Cu-Au skarn deposits occur in proximity to small Siluro-Devonian intermediate to felsic stocks and/or dikes throughout northern New Brunswick, and the adjacent Gaspé Peninsula of Québec. One of the best examples and the only producing porphyry-skarn deposit is in Murdochville, Québec (Mines Gaspé). The skarns at Mines Gaspé contain(ed) approximately 60 Mt averaging 1.3% Cu (A-B-C zones) and 8.9 Mt grading 3.16% Cu (E zone), both of which are spatially associated with the Copper Mountain Porphyry that contain(ed) 200 Mt grading 0.4% Cu and 0.2% Mo.

In northern New Brunswick, the skarn occurrences are principally hosted within the late Ordovician to early Silurian Matapédia Group, which consists of thin-bedded, dark grey argillaceous limestone and calcareous siltstone. In northeastern New Brunswick, the Upsalquitch (calcareous slate and sandstone) and La Vieille (nodular limestone) formations of the early Silurian Chaleurs Group and the Elmtree Formation of the Tetagouche Group also host several major skarn occurrences. The subalkaline, peraluminous intrusions that intrude these sequences are syn-tectonic to post-tectonic with respect to the Acadian orogeny and range in composition from granodiorite to granite. The larger, younger plutons, i.e., Nicholas Dénys Granodiorite and Antinouri Lake Granite, seem to be somewhat independent of obvious late fault structures. However, the late Silurian stocks and dike swarms found in the north-central part of the Province form en echelon arrays that suggest that their distribution is, to some extent, fault controlled. A protracted intrusive history, which is evident from cross-cutting relationships, produces variable intensities of deuteric and endoskarn alteration within these intrusions. Similarly, the distribution of mineralized skarns is usually closely related to complex brittle structures (e.g., McKenzie Gulch faults and Rocky Brook-Millstream Fault Zone). These structures acted as conduits for high-temperature fluids that evolved from the intrusions during crystallization. The chalcopyrite-bearing exoskarns are commonly related to the high-temperature prograde skarns that consist of moderately oxidized-proximal (Fe-Mg diopside-intermediate andradite-magnetite-pyrite) to reduced-distal (hedenbergite-grossularite-pyrite) skarn assemblages. The locally siliceous chlorite-carbonate-rich arsenopyrite, base-metal, and Au-bearing vein systems, which are spatially related to the skarns, crosscut the prograde assemblages and occur distal to them as well. The complex fault-control, base-metal zoning, porphyry dike/stock association, and argillaceous carbonate-bearing lithotypes for skarn and vein mineralization are very similar to porphyry-related Cu-Au systems in the Basin and Range Province of the southwestern United States.