Copper skarn-associated felsic intrusive rocks in the McKenzie Gulch area (NTS 21 O/10), Restigouche County, New Brunswick

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The McKenzie Gulch area contains numerous Cu-mineralized garnet-pyroxene skarn occurrences. The most significant of these is the Legacy Deposit containing approximately 500,000 tonnes grading 1.7% Cu. The occurrences are hosted by Upper Ordovician through Lower Silurian calcareous sedimentary rocks of the Matapedia Group and are spatially associated with Lower through Middle Devonian, high-angle, northeast-trending, syntectonic felsic intrusive rocks. Detailed petrographic and geochemical investigations of cores recovered by Noranda Mining and Exploration has enabled subdivision of these intrusive rocks, providing a better understanding of their petrogenesis and temporal relationship to skarn mineralization.

Felsic intrusive rocks in the McKenzie Gulch area can be subdivided into two compositionally and texturally distinct units: the Plagioclase-Hornblende Porphyry unit and the Quartz-Plagioclase Porphyry unit. Of these, the Plagioclase-Hornblende Porphyry unit can be further subdivided on the basis of textural variations into two subunits or phases, a fine grained Aplitic Porphyry phase and an equigranular Tonalite phase. Cross-cutting relationships indicate rocks of the Quartz-Plagioclase Porphyry unit are younger than those of the Plagioclase-Hornblende Porphyry unit.

The Plagioclase-Hornblende Porphyry unit is probably temporally and genetically related to Cu-mineralized garnet-pyroxene skarn occurrences as indicated by local development of endoskarn within this intrusive unit, its overall fractured and altered appearance, and reactive contacts with sedimentary country rocks. In contrast, the younger Quartz-Plagioclase Porphyry unit is typically more massive and only weakly altered and commonly possesses unreacted contacts with sedimentary country rocks suggesting that it is not associated with skarn mineralization.

Geochemical data indicate the felsic rocks are grano-

dioritic to tonalitic in composition, subalkaline with a calc-alkaline affinity, metaluminous and have an infracrustal (I-) type, volcanic-arc signature. Geochemical results also support the petrographic discrimination of distinct felsic units on the basis of select major and trace elements. Overall these data indicate a trend towards increasing SiO_2 and decreasing TiO_2, Al_2O_3, MgO, P_2O_5, Sc, V, Y, and Nb from the Plagioclase-Hornblende Porphyry unit through to the Quartz-Plagioclase Porphyry unit, consistent with evolution by fractional crystallization. This interpretation is supported by intrusive contact relationships. Rare-earth-element (REE) contents are similar for all felsic intrusive units being characteristically low with steep negative slopes and positive Eu anomalies. Similarities in REE contents suggest the individual felsic intrusive units were likely produced from the same magmatic source and the observed geochemical variations between these units are likely attributable to fractionation processes.

Geochemical comparison of the McKenzie Gulch porphyries with other Devonian felsic intrusive rocks in the region suggests the McKenzie Gulch porphyries are most similar to felsic porphyritic rocks of the Mount Sugarloaf stock. Rocks of the McKenzie Gulch porphyries and Mount Sugarloaf stock, together with those of the Mount Squaw Cap stocks and Nicholas Dénys Granodiorite in New Brunswick, as well as the Mines Gaspé, Mont Hog's Back and Mont Chauve porphyries in Quebec, constitute an Early to Middle Devonian calc-alkalic magmatic suite. These rocks are characterized by depleted concentrations of incompatible elements and have an inherited volcanic-arc signature that reflects the tectonomagmatic signature of their source rocks. This intrusive suite was emplaced during the Acadian Orogeny, at which time collision between the Laurentian and Gondwanan plates resulted in juxtaposition of hot mantle asthenosphere against the base of the crust causing partial melting of the lower crust and mantle.