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**Title:** “NET TEXTURED” CU-FE SULFIDES ASSOCIATED WITH APATITE IN BIOTITE CLINOPYROXENITE FROM THE LORRAINE DEPOSIT, BC: MAGMATIC OR ENIGMATIC PORPHYRY MINERALIZATION?

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**Abstract:** The Early to Middle Jurassic Lorraine deposit is hosted within the Duckling Creek Syenite in north-central British Columbia. The deposit has been classified as an undersaturated alkalic Cu-Au porphyry, but has textural features not in agreement with modern concepts on porphyry formation. In particular, mineralization at various localities occurs in biotite-clinopyroxenite as net textured Cu-Fe sulfides (bornite and chalcopyrite), which is a texture commonly associated with intercumulus magmatic sulfides. Here we show that net textured Cu-Fe sulfides occur in areas of the biotite-clinopyroxenite that are associated with the replacement of intercumulus biotite and apatite with feldspar-dominated assemblages, and we suggest that feldspar-alteration is associated with the deposition of Cu-Fe sulfides. We also propose that the dissolution of apatite during feldspar-alteration may have been followed by the mobilization of P and reprecipitation of apatite within biotite clinopyroxenite along with Cu-Fe sulfides.

Mineralized biotite-clinopyroxenite is composed of orthocumulus clinopyroxene, intercumulus biotite, apatite and “net textured” or clots of magnetite and Cu-Fe sulfide ( $\pm$ pyrite). Apatite occurs as inclusions in augite, biotite and magnetite, as an intercumulus phase or as coarse-grained clots with Cu-Fe sulfides and magnetite in place of biotite. Coarse-grained apatite also contains Cu-Fe sulfide inclusions (20-200 $\mu$ m) with negative crystal shapes. These inclusions mostly occur within the cores of apatite and along crystal growth planes where no obvious fractures occur, suggesting that Cu-Fe sulfides with fluidal properties were trapped at the time of apatite crystallization.

Apatite-enriched mineralized biotite-clinopyroxenite also form sharp contacts with zones composed of euhedral to subhedral clinopyroxene and complex alkali feldspar-dominated assemblages. Where biotite and apatite are in contact with feldspar-dominated assemblages they show corroded margins, and biotite is replaced by sulfide and magnetite replacement along cleavages in places. Clinopyroxene crystals in contact with Cu-Fe sulfides have rims altered to actinolite-tremolite. Thus, evidence supporting the notion that Cu-Fe sulfides were deposited as a result of replacement of intercumulus biotite includes: 1) the occurrence of “net textured” Cu-Fe sulfides within biotite clinopyroxenite adjacent to feldspar-alteration fronts; 2) apatite replacement by feldspar-dominated assemblages and apatite-enrichment with Cu-Fe sulfides in biotite-clinopyroxenite; and 3) textural evidence for biotite replacement by sulfides along cleavages. These features suggest to us that Cu-Fe sulfides were deposited as a result of a biotite replacement rather than as primary magmatic sulfides.