

Mapping multielement anomalies using till geochemical data: defining prospective areas in south-central British Columbia

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The Bonaparte Lake area is part of the Quesnel terrane of the Canadian Cordillera and is proximal (< 50 km) to several porphyry Cu-Au and Cu-Mo deposits, including the Highland Valley Copper (production plus reserves of 8.48 Mt Cu and 0.22 Mt Mo), the Gibraltar (reserves of 1.87 Mt Cu and 0.060 Mt Mo), and the Mount Polley (0.007 Mt Cu, 0.95 tonnes Au) deposits. Two phases of ice flow occurred during the Late Wisconsinan Fraser glaciation in the area: an early flow to the west to southwest during ice advance and a later south-directed flow at glacial maximum. Geochemical data following an aqua regia leach on the clay fraction (<2 µm) of basal till (n = 726) are used to identify elements associated with Cu mineralization and delineate prospective geology. The principal component analysis (PCA) captures two element assemblages with Cu; Cu-Au-Mo-Ag-As-Hg-Pb-Sb, accounting for 32.3% of the total Cu variance in PC2, and Cu-Cr-V-As accounting for 16.8% of the total Cu variance in PC3. The mapping of unsupervised mode random forest (RF) votes based on these elements show anomalies along the northern boundary of the Thuya batholith. Judging from the bedrock geology and known mineralization, it is possible that skarn/porphyry Cu style mineralization occur in the anomalous area. This study shows that PCA and unsupervised mode RF of till data are effective at defining prospective areas for further exploration and potentially at detecting buried Cu deposits.