

Exploring for Cu-Au Alkalic Porphyry Deposits from the Fringes

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The late Triassic - early Jurassic Iron Mask batholith (IMB) in southern British Columbia (BC) hosts several alkalic porphyry Cu-Au mineralized centers such as New Afton, Ajax, Copper King, and Python. This research identifies mineral and chemical footprints of the alkalic porphyry deposits in the IMB through fieldwork, petrography, geochronology, and geochemistry. Results were compared with the footprint of the nearby calc-alkalic Nora and other BC porphyry deposits.

Pathfinder elements in the studied alkalic porphyry deposits extend horizontally from a central core of Pd, Pt, Cu, and Au (~100m wide) to Te, Re, and Se (~700m wide) and further distal V, As, and Sb (~1 km wide). Vertically, at New Afton, a higher concentration of Mo occurs at depth (~750m deep) along with depleted Zn and Mg. This is overlain by a zone of high concentrations of Cu, Au, Pd, and Pt. Near the surface, Te, V, As, and Sb have higher concentrations. Consistent with element zonation, the mineral chemistry of pyrites, chlorites, and epidotes shows distinctive anomalous elements (e.g., Te, Se, Co, V) distribution with proximity to mineralized centers. Similarly, mineral chemistry inferred from short-wave infrared spectroscopy (SWIR) shows zonation in chlorites and white micas, with Mg-Fe-rich chlorites and phengitic white micas proximal to ore and Fe-Mg-rich chlorites and structurally controlled muscovitic white micas distal.

Results corroborate previous studies that hydrothermal alteration in alkalic porphyry deposits is more cryptic than calc-alkalic deposits. Porphyry emplacement and alteration are typically asymmetric and structurally controlled. Similarly, anomalous pathfinder element values are generally less pronounced than those in the calc-alkalic porphyry deposits, except for Te, Pd, As, Ag, and V, which have higher concentrations. These results help to identify the signature of the alkalic porphyry mineralization early during exploration and vector toward potential mineralization.