Application of Alteration and Geochemical Vectors for Blind Porphyry Cu-Au-Ag-Mo Exploration: An Example from Camp Creek, Thorn District, British Columbia, Canada

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Improving exploration success for strategic metals such as copper will be required to meet increasing global demand. Blind porphyry deposits present a unique exploration challenge, and advancements in exploration methods will become increasingly necessary. Integrating field and core logging with lithogeochemical (4-acid-ICPMS), shortwave-infrared spectroscopy (SWIR), and micro-XRF data can identify host rock, alteration, and trace element zonation patterns, providing insights to improve blind porphyry exploration.

The Late Cretaceous Camp Creek Cu-Au-Ag-Mo property is located near the western margin of the Stikine terrane in northwestern British Columbia, 90 km ENE from Juneau, Alaska. Zones of high-sulfidation Au-Cu and sediment-hosted Au occur, such as those at Oban, Glenfiddich, and Outlaw. Recent drilling by Brixton Metals beneath zones of advanced-argillic alteration at Camp Creek identified blind porphyry mineralization below an oxidized pyrite-rich zone. New Re-Os dates of quartz-molybdenite veins in Camp Creek and in Oban breccia clasts have similar ages (86-87 Ma), suggesting a link between porphyry and epithermal-type mineralization.

The mineralization at Camp Creek occurs with biotite and K-feldspar alterations that are overprinted by chlorite and sericite. Trace element composition, particularly Zr, Ti, and Sc, led to the identification of five intrusive units (Z, Y, W, X, and V). The X porphyry, characterized by lower Zr concentrations and phenocrysts of plagioclase, biotite, quartz, and hornblende, is the main host to the mineralization. SWIR data shows vertical alteration from pyrophyllite near-surface, which transitions to illite and then muscovite with depth. Sericite crystallinity increases with depth, and its composition becomes phengitic. Sericite is white near the surface but transitions to pale-green and green with depth. Pyrite:chalcopyrite ratio decreases with depletion in Na-Ca, whereas the MDRU porphyry index increases with depth. These geochemical and mineralogical variations provide effective tools to characterize host rocks and alteration, and vector toward blind porphyry mineralization in BC and elsewhere.