

Mineralization, Fluid Characteristics, and Tectonic Setting of Cu–(Mo) Porphyry System at the Canada Wall Prospect, Ratanakiri Province, Northeastern Cambodia

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The Canada Wall prospect is located in Andong Meas District, Ratanakiri Province, northeastern Cambodia, within the Dalat–Kratie Belt of the Indochina Terrane, representing a mineralized belt associated with Cretaceous subduction-related magmatic arc. This study aims to characterize fluid evolution associated with Cu–(Mo) mineralization in a porphyry system and constrain the tectonic setting of its formation using petrography, fluid inclusion microthermometry, and whole-rock geochemistry.

Mineralized quartz veins/veinlets are subdivided into three main types based on mineral assemblages and paragenesis. Early-stage veins consist of quartz + chalcopyrite + magnetite ± pyrite, indicating high-temperature mineralization. The main stage comprises quartz + molybdenite + chalcopyrite + pyrite ± magnetite, whereas late-stage veinlets are calcite + quartz + pyrite. Fluid inclusion studies reveal three types: Type I (liquid-rich, L+V), Type II (vapor-rich, V+L), and Type III (halite-bearing, L+V+S). Early-stage veins characterize by Type I and II inclusions, with homogenization temperatures of 310 to >500 °C and salinities of 15–42 wt.% NaCl equivalent. Halite-bearing inclusions indicate high-salinity fluids typical of porphyry systems. In the main stage, homogenization temperatures range from 250–460 °C with salinities of 4–16 wt.% NaCl equivalent, dominated by Type I and II inclusions. The late stage 180–330 °C and salinities (3–12 wt.% NaCl equivalent), with predominantly Type I inclusions.

Based on whole-rock chemistry, SiO₂ vs. K₂O and Na₂O vs. K₂O diagrams indicate that the intrusive rocks plot within the calc-alkaline to high-K calc-alkaline series and correspond to I-type granitoids. Primitive mantle-normalized trace element patterns show enrichment in LILE and negative Nb–Ta–Ti anomalies. The Rb vs. (Nb + Y) and Nb vs. Y discrimination diagrams classify the samples as volcanic arc granites. In addition, the (La/Yb)_n versus Yb_n plot suggests formation within a moderately thick crust (~30–55 km). These mineralization, fluid characteristics, geochemical signatures are valuable indicators for further exploration of porphyry copper deposits.