

Far Field Geochemistry and C-O Isotope Signatures of the Bingham Porphyry Cu-Au-Mo Deposit in Carbonate Wallrocks

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Far field signals in carbonates around the Bingham Canyon porphyry Cu-Mo-Au deposit may help with vectoring in other projects. Bingham comprises multi-phase Eocene-aged igneous rocks emplaced in folded and thrust Paleozoic strata, producing proximal porphyry-style mineralization and adjacent skarn deposits in carbonates. Outboard from the porphyry-skarn zones, there are Pb-Zn-Ag vein and carbonate replacement orebodies, and carbonate veins occur in distal carbonate rocks. This study sampled whole rock and veins of the Jordan and Commercial limestones along a 17-km transect between Bingham Canyon and the Stockton porphyry system.

The 182 whole-rock C-O isotope data show that most samples within ~2.5 km of Bingham and Stockton have hydrothermal signatures ($<19\text{‰ } \delta^{18}\text{O}$; $<-1.8\text{‰ } \delta^{13}\text{C}$). Samples farther out have marine carbonate signatures, with some exceptions. There is no smooth trend, indicating untreated whole-rock C-O isotope composition is a moderately strong indicator but not a vector. Temperature-corrected data are expected to show smooth trends.

In carbonate whole-rock geochemistry data, Cu, Mo, Fe, and other elements decrease to background levels in <1 km, whereas Ag, As, P, and REEs decrease between ~4 and 6 km. Sr increases, then levels off, over <1 km. Mn, Zn, Cd, and Ba increase to maxima at ~1 km then decrease to background at ~2–4 km. Vein calcite LA-ICP-MS data show decreasing trends in REEs, Fe, Mg, S, and Pb, whereas Ba and P increase outboard to a distance of ~2–8 km, while Mn and Zn increase to ~2-km distance before dropping to background levels ~4 km outboard. Compared with WR data, vein data shows stronger signals. In whole-rock calcite, the trends of Fe and Pb persist (in shorter ranges), whereas other trends disappear, likely because sedimentary calcite contains more S, Mg, P, etc., masking hydrothermal signals. Additional samples along the transect should help refine, strengthen, or verify these trends.