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Geochemical Signatures of Magmatic Hydrothermal Alteration in Carbonate Rocks Around the Basin Porphyry in the Drum Mountains of West-Central Utah

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The Basin porphyry prospect in Utah, USA, is subeconomic with a historic noncompliant supergene resource of 4 Mt at 0.22% Cu. Mineralization styles in the district include minor carbonate-hosted vein/replacement/jasperoid Cu-Au-Ag, carbonate-hosted Mn replacement, pebble dike-hosted Au, and sediment-hosted disseminated Au. We investigate the whole-rock geochemical and C-O isotope signatures in the carbonate wall rocks up to 7 km from the intrusion to compare them with that of the giant Bingham porphyry deposit, Utah.

The stratigraphy is composed by a series of gently W-dipping early Phanerozoic platform carbonates overlying a thick sequence of siliciclastic units (Prospect Mountain quartzite). These have been intruded by composite diorite and monzonite stocks extending into the base of the carbonate sequence. We selectively sampled vein and wall rock from three lower carbonate units (the Tatow Member of the Pioche Formation, the Howell Limestone and the Dome Limestone) along a transect extending 2 km north and 7 km south of the Basin porphyry.

Multielement bulk-rock geochemistry displays good trends in many elements, increasing closer to the Basin porphyry. The strongest element trends are for Be, Ce, Co, Ni, S, Se, Ta, and Te, which show highest values in the immediate vicinity of the Basin porphyry and decrease to background levels about 1 km outboard. $\delta^{13}C$ isotope compositions of bulk rock show depletions of ~5‰ around the Basin porphyry relative to typical early Phanerozoic marine carbonates, and return to the typical values 1 km outboard. $\delta^{18}O$ values of the bulk samples show strong depletions extending out to ~3 km from the Basin porphyry, whereas all the rest show weak depletions relative to typical early phanerozoic marine carbonate values. Carbon and oxygen isotopes from carbonate veins reveal similar trends to the bulk isotopes, except that the higher stratigraphic units display less noise.