

Gold-rich Weathering Rinds Around Pyrite and Arsenopyrite from the Buckingham Mo-Cu Porphyry Deposit, Nevada; Evidence for Supergene Elemental Enrichment

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The Cretaceous Buckingham porphyry Mo-Cu deposit (~1.3 Bt averaging 0.058% Mo and 0.034% Cu) is located within the well-endowed Copper Basin district near Battle Mountain, Nevada, USA. LA-ICP-MS mapping of Fe-sulfides sampled around Buckingham show that pyrite and arsenopyrite have a distinct weathering rind of Fe-oxides and hydroxides enriched in trace elements (notably Au, Cu and Mo) and depleted in Fe and S relative to the core of the grain.

Mo and Cu mineralization within the Copper Basin district occurs in local quartz stockwork veins associated with the emplacement of Cretaceous granitic stocks and dikes in Cambrian metasedimentary rocks. The Cu deposits have undergone extensive supergene enrichment. Copper Basin also contains several porphyry-related Au ± Cu skarn deposits associated with the emplacement of Eocene granites that have produced over 3.5 million oz of Au since 1978. The Eocene Au skarn mineralization occurs on the margins of larger porphyry deposits as high-temperature, oxide-facies, hypogene Fe-sulfide veins in metasedimentary rocks, possibly representing shallow extension of an Eocene porphyry Cu-(Au-Mo) system. The Buckingham area lies along the Eureka mineral belt; an Eocene trend of disseminated, sediment-hosted Carlin-type Au mineralization. Gold in these deposits is hosted as Au-rich rims on arsenian pyrite/marcasite or arsenopyrite and/or disseminated in sulfides that formed during mineralization. A proposed genetic model for the Carlin-style deposits involves the emplacement of calc-alkaline intrusions in calcareous sedimentary rocks between 42 and 36 Ma. The Eureka trend deposits show skarn alteration and mineralization similar to that observed in the Copper Basin.

Four samples collected from the Eocene granites north of Buckingham yielded U-Pb ages ranging from 41 to 38 Ma (38.68 ± 0.53 , 39.29 ± 0.58 , 40.76 ± 0.41 , and 40.81 ± 0.51 Ma). These ages are similar to granitic intrusions related to Carlin-style hydrothermal Au mineralization found along the Eureka Au trend, suggesting that these granitic hydrothermal fluids may have been the source for initial hypogene Au mineralization near Buckingham.

The increased Au in the weathering rind of pyrite and arsenopyrite at Buckingham may suggest an overprinting mineralization similar to the nearby Eocene skarns or Carlin-style deposits. Alternatively, the cores of the sulfides acted as traps for the precipitation of precious metals from the hydrothermal event related to proximal Eocene granite intrusions. These precious metals were later concentrated in the weathering rind during supergene alteration.