Spatial and Temporal Evolution of Hydrothermal Fluids of the Round Mountain Gold Deposit, Nevada

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The Round Mountain gold deposit is a bulk-minable volcanic-hosted low-sulfidation epithermal deposit with 20 million contained ounces of gold. Unlike most volcanic-hosted epithermal precious metal deposits, where gold and silver are concentrated in structurally controlled veins, stockworks, or breccias, the majority of the gold at Round Mountain is disseminated in a poorly welded tuff. This atypical style of gold deposition is rare and relatively poorly understood. The objective of this study is to document styles of alteration and mineralization with the goal of identifying fluids pathways for the ore-forming hydrothermal fluids and the evolution of these fluids. Scientific studies of the deposit have not been conducted since the early 1990s. Since then, the amount of drilling and depth of mining has increased significantly, allowing for a more comprehensive spatial analysis of the alteration and mineralization within the deposit.

Results from detailed core logging, petrography, whole-rock geochemical assays, and hyperspectral data indicate disseminated mineralization is associated with strong potassic alteration expressed geochemically by the metasomatic enrichment of potassium and depletion of sodium and minor calcium. This metasomatic change is best observed mineralogically by monitoring changes within the volcanic matrix and primary plagioclase sites. Multiple enigmatic overprinting phases of concentrically-zoned alteration assemblages consisting of inner silica-adularia, middle illite, and outer smectite zones exist within the mineralized poorly welded tuff. Permeability in the poorly welded unit likely decreased with each successive phase of potassic alteration, spatially tightening the observed alteration zonation over time. Significant remobilization of precious metals by progressive alteration phases within the poorly welded tuff was not observed. Minor gold and silver mineralization occurs locally in fracture-focused high-grade veins. The temporal relationship between the fracture-focused high-grade veins and the disseminated ore is unknown at this time but research is ongoing.

At the deposit scale, mineralization occurs above the axis as well as along the steep southwestern slope of a significant west-northwest–oriented paleoridge in the underlying Paleozoic metasedimentary unit. The paleo-ridge is associated with a dominant deposit scale structural trend oriented N70W. The paleo-ridge and structural trend are thought to be the main controls on the upwelling hydrothermal fluids responsible for mineralization and alteration. Mineralization is likely associated with the change from fracture-focused fluid pathways in the structurally prepared underlying Paleozoic meta-sedimentary unit to diffuse fluid flow and ponding in the more permeable overlying poorly welded volcanic unit. Hydrothermal water-rock interaction, mixing with meteoric water and minor boiling are thought to contribute to precious metal precipitation but more work is necessary to constrain the contributions of each.