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New Findings on the Gold Deportment, Quartz Textures, and Fluid Characteristics in the Red Dot Sulfide Zone at Marigold Mine, Nevada

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The Battle Mountain mining district hosts a variety of magmatic-hydrothermal ore deposits, as well as sedimentary rock-hosted Au deposits that lack a conclusive relationship to magmatism. Mining of the sedimentary-rock hosted deposits has been primarily limited to oxidized zones, so there is little information available about the hypogene ore characteristics and mineralizing processes. The Red Dot deposit is a sulfide ore zone recently intersected by deep drilling at Marigold Mine.

At Red Dot, early quartz and sulfide veinlet textures resemble D and E veins from porphyry systems. Early-stage pyrite is enriched in Hg and Ni but contains less As than ore-stage pyrite and little to no Ag or Au. Ore-stage quartz lacks fluid inclusions, but produces a yellow cathodoluminescence response typical of low-temperature hydrothermal environments. Ore-stage pyrite occurs as arsenian pyrite rims enriched in Au, As, Ag, Cu, and Sb that overgrow pre-ore pyrite; these rims have $\delta^{34}S$ stable isotope values consistent with porphyry pyrite elsewhere in the district. Alteration styles include decarbonatization, carbonation, sericitization, argillization, silicification, sulfide precipitation, and oxidation. The absence of zonation in the alteration styles suggests Red Dot is distal to any causative porphyry stock. District aeromagnetic data indicate an absence of any buried igneous bodies beneath Marigold, providing additional evidence that Red Dot is distal to any magmatic-hydrothermal fluid source.

Red Dot is ideally situated along a complex structural network capable of focusing fluids from laterally distant sources into the host rocks repeatedly through time. Cretaceous magmatic-hydrothermal fluids related to the emplacement of the Trenton Canyon Stock or local quartz monzonite dikes at Marigold Mine may have caused the early-stage alteration and sulfide mineralization at Red Dot. The early-stage alteration and sulfide mineralization could also be attributed to the emplacement of felsic dikes at the Lone Tree and Trenton Canyon Au deposits during the Eocene. Apatite and zircon (U-Th)/He data support an Eocene formation age for ore-stage quartz and pyrite.

The alteration styles, ore-stage sulfide textures, geochemical signature, base metal and Au mineralization, and distal nature of Red Dot most closely resembles the Cove deposit, 25 km to the south. At Cove, overprinting polymetallic and Carlin-like Au mineralization are genetically related to Eocene magmatic-hydrothermal fluids. We suggest that Red Dot represents a similar expression of magmatic-hydrothermal mineralization, but at a greater distance from the causative intrusion and in different host rocks that underwent ideal preparation for interaction with ore fluids.