Time-Space Relationships Between Sediment-hosted Gold Mineralization and Intrusion-Related Polymetallic Mineralization at Kinsley Mountain, Nevada

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Controversy remains about whether Carlin-type gold deposits (CTGDs) are distal products of intrusion-related systems. If related to intrusions, it is important to understand what types of magmatic hydrothermal systems form productive CTGDs. Gold mineralization at Kinsley Mountain, located in eastern Nevada, is similar to large CTGDs farther west in that gold is strongly associated with fine-grained pyrite, silicification, and decarbonatization, as well as stibnite, realgar, and orpiment. The gold mineralization at Kinsley is hosted by deformed Cambrian carbonate and siliciclastic rocks. Petrography on sample transects from unmineralized rock to high-grade mineralization (>10 g/t Au) shows hydrothermal alteration of interbedded fine-grained limestone and shale containing calcite, quartz, muscovite, and pyrite to quartz, ferroan dolomite, calcite, and abundant pyritohedral arsenian-pyrite in the Secret Canyon Shale. The Dunderberg Shale shows hydrothermal alteration of interbedded fine-grained limestone and shale containing calcite, quartz, muscovite, and minor pyrite to quartz, calcite, abundant muscovite, and abundant arsenian-pyrite. The presence of ore-stage ferroan dolomite, calcite, and muscovite, and the abundance of pyritohedral arsenian-pyrite lacking the core-rim relationships are not typically present in ores found in CTGDs.

Within 3 km of the gold mineralization, an Eocene, coarse-grained granodiorite stock and associated dikes intrude the Cambrian carbonate section, presenting a unique opportunity to investigate the temporal and possible genetic relationships between the intrusive complex and the gold mineralization. Along the contact of the stock, tungsten was mined from garnet-pyroxene skarn with retrograde tremolite, talc, clinozoisite, sericite, and pyrite. Polymetallic mineralization associated with quartz veins and gossanous replacements occurs within 1 km of the stock. Molybdenite in a dike in the skarn was dated by Re-Os at 37.88 ± 0.2 Ma. The intrusive rocks commonly have endoskarn near the margins of the stock, locally are sericitically altered, but lack potassic alteration. Sericitically altered dikes extend into the area of gold mineralization, where they typically contain <5 ppb Au, with a few intercepts up to 130 ppb Au. Country rocks adjacent to dikes are typically unaltered and contain <5 ppb Au. A dike with deformed and sheared biotite returned a LA-ICPMS U-Pb date on zircon of 36.1 ± 0.81 Ma, suggesting a Tertiary deformation event. No major faults occur between the gold mineralization and the stock, and they occur at approximately the same elevation. Undated Tertiary andesite and dacite lava flows, which are fresh to very weakly altered, occur along the flanks of the range, locally on-lapping the Paleozoic rocks. One of the flows near the stock was dated by LA-ICPMS U-Pb at 35.5 ± 0.25 Ma. These preliminary data suggest the gold mineralization predates the intrusive complex, and indicated uplift, erosion, and continued magmatism in the late Eocene.

To constrain temporal relationships, ongoing studies include U-Pb dating of the stock and additional dikes using the SHRIMP at Stanford University; $^{40}Ar/^{39}Ar$ dating of zones of muscovite in gold ore zones, on phlogopite-bearing skarn, and on sanidine and biotite in volcanic rocks, and apatite fission track dating of apatite, much of it hydrothermal, from ore-bearing zones and from the stock and dikes.