SEG 100 Conference: Celebrating a Century of Discovery

D7
Fluid Inclusions and Origin of Carlin-style Mineralization at the Cove Deposit, Nevada

Sarah R. Shapley[1], John Muntean[2], Matthieu Harlaux[2]
1. University of Nevada, Reno, Reno, NV, USA, 2. Nevada Bureau of Mines and Geology, Reno, NV, USA

Carlin-style gold deposition provides up to 5% of the global gold budget and is the leading gold source in the Unites States. Despite its significance, there is not a consensus on the source of gold or fluid for these deposits. The fine-grained nature of ore assemblages as well as lack of associated quartz veins and suitable/workable fluid inclusions (FI) makes it difficult to ascertain the conditions of mineralization, including the temperature, pressure, salinity, and source of the hydrothermal fluids. The Cove deposit, located in north-central Nevada, grades from deep base metal vein type mineralization (BMVT) to Carlin-style mineralization. Both types formed during the Eocene between 39.2 and 34.3 Ma. Past research provides a geologic framework, including identifying magmatic signatures for sulfur isotopes of BMVT mineralization. The association of BMVT with Carlin-style mineralization affords a unique opportunity to investigate fluid sources of Carlin-style mineralization. Additionally, oxygen isotopes in carbonates have been proposed as a vector for Carlin-style deposits to evaluate the extent of fluid-rock interactions. Current work tests this vector at Cove.

This study combines petrography, microthermometry, and Raman spectrometry analysis of FIs to characterize BMVT mineralization fluids. Petrographic study identified three categories of FIs. Group (I) are rounded, lobate, two-phase FIs with 20-40 volume % vapor bubbles. Preliminary microthermometry for group (I) indicates moderate homogenization temperatures (236°-362°C, avg = 330°C) and low salinities (1.7-4.9 wt % NaCl eqiv, avg = 3.7 wt % NaCl eqiv). These conditions are consistent for “E-veins”- an emerging classification of base metal veining distal to or late in porphyry systems, when coupled with previously obtained $\delta^{34}S$ values at Cove. Group (II) crosscuts (group I) and shows reequilibration textures, prohibiting further work. Group (III) consists of rounded, lobate to irregularly shaped FIs. Multi (5-7)-phase hypersaline brine FIs locally coexist in the same fracture planes with vapor FIs in low proportions, indicating that they may be trapped during phase separation, while other FI planes trap only brines. The presence of multiple fluids at similar modern depths at the Cove deposit may indicate overprinting of the deposit during its formation or multiple pulses of fluid emerging from depth. Next steps will evaluate the potential for BMVT fluids to evolve to Carlin-style mineralization by quantifying the metal content of individual FIs by LA-ICP-MS to search for specific geochemical signatures such as Au, As, Hg, and Tl enrichments.

A challenge in locating Carlin-style mineralized systems is the scarcity of exploration vectors. Oxygen isotope analysis in carbonates has been invoked as a possible method of measuring the extent of fluid-rock interactions, with depleted $\delta^{18}O$ values correlating to higher degrees of fluid-rock interaction and elevated gold grades. Preliminary results show depleted $\delta^{18}O$ values in Au-bearing samples relative to barren ones, supporting that $\delta^{18}O$ values in carbonates are a potentially effective vector into Carlin’s cryptic alteration halos. The knowledge gained from characterization of fluids, geochemistry, and $\delta^{18}O$ values of carbonates could result in more advanced metallogenic models for distal-disseminated and Carlin-style gold deposits in the McCoy district, Nevada, and elsewhere in the world.