Tertiary Stratigraphy, Alteration Zones, and Precious Metal Deposits in the Patterson Mining District, Sweetwater Mountains, and Comparison to the Bodie Hills, California

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The Sweetwater Mountains, Mono County, CA and Lyon County, NV, consist of pre-Tertiary sedimentary and volcanic rocks, Mesozoic granitic rocks, and Tertiary volcanic rocks that are variably altered. The Sweetwater Mountains lie within the Walker Lane, a seismic belt of transtension and shear deformation that accommodates 15 to 25% of Pacific-North America plate motion. The western andesite assemblage is a subduction-related continental margin arc that erupted mostly within the Walker Lane. Typical rock compositions are calc-alkaline and consist of mostly andesite and dacite with minor rhyolite. The western andesite assemblage hosts both low-sulfidation and high-sulfidation epithermal deposits related spatially and temporally to magmatism in the ancestral Cascades arc.

Areas of strong alteration in the Sweetwater Mountains, including silicification and intermediate and advanced argillic alteration, contain breccias and veins that were mined sporadically for silver and gold in the Patterson mining district. Production since the 1860s is estimated at 3.4 Moz silver and 3,000 oz gold, and was mostly derived from the Silverado, Kentuck, and Monte Cristo mines. Besides gold and silver, the area has been explored for concealed porphyry molybdenum deposits. In addition, prospects commonly contain strongly anomalous concentrations of iron, manganese, tungsten, and copper. Low-sulfidation epithermal and porphyry molybdenum systems are classifications proposed for the metal deposits.

The Sweetwater Mountains are directly west of the Bodie Hills, which contain similar stratigraphy and were the focus of a recent USGS project. It is unknown if the mineralization in the Sweetwater Mountains is related to multiple alteration events such as in the Bodie Hills, including mineralization related to porphyry molybdenum deposits and possibly other magmatic-hydrothennal events. The stratigraphy, structure, rock types, hydrothermal mineral assemblages, and geochronology of the Sweetwater Mountains will be characterized and correlated to the stratigraphy and mineral deposits in the Bodie Hills.

Initial results include the identification of rhyolite, trachyandesite, dacite, basalt, porphyritic rock, and heterolithic breccias in the Sweetwater Mountains. Mineralized breccias typically contain a dark gray matrix rich in pyrite, chalcopyrite, arsenopyrite, and sphalerite, and ore minerals are very fine grained. Correlation matrices show that Au is weakly positively correlated with Cu and Mo, and strongly positively correlated with Hg, P, and Te. Ag is weakly positively correlated with Mo and strongly positively correlated with Te. Alteration minerals have been determined by petrographic and SW1R analyses, and include montmorillonite, kaolinite, illite, alunite, and quartz. Mineralization is associated with silicic alteration, which zones outward to argillic alteration.

Further work will include detailed mapping, petrography, and identification of minerals through use of instrumental analysis (SEM, IR, and XRD), whole-rock chemical analysis, and dating of minerals ($^{40}Ar/^{39}Ar$ and U-Pb methods). An emphasis will be made on understanding the spatial and temporal relationships of hydrothermal events relative to magmatism in the Sweetwater Mountains. Outcomes include a better understanding of time-space relationships between volcanism and various styles of hydrothermal alteration and mineralization in continental andesitic volcanic arc terrains.