Spatial and Temporal Relationships Between Structures, Magmatism, and Carlin-Type Gold Deposits in the Pequop Mountains, Northeast Nevada

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Carlin-type gold deposits at Long Canyon and West Pequop in the Pequop Mountains mark two of Nevada's newest discoveries. Although the Pequop Mountains and surrounding areas were long considered less prospective because of their "off-trend" location on the Paleozoic platform, the unusual occurrences of Carlin-type gold deposits have revitalized exploration and geologic study in this region. Recent mapping and radiometric dating in the Pequops establishes abundant Jurassic intrusions (165–159 Ma), and Eocene (41–39 Ma) intrusions and volcanic rocks, with lesser Cretaceous intrusions (~72? Ma). Intrusions not only provide a crucial means to constrain the age of Carlin-type mineralization but their age range brackets Mesozoic deformation and metamorphism related to the Sevier Orogeny and subsequent Tertiary extension and uplift of metamorphic core complexes. Both are controversial topics that have direct implication for the geologic setting and formation depth of Carlin-type deposits. The goals of this study are to establish the character, timing, and spatial relationships between tectonism, magmatism, and hydrothermal activity that led to significant gold deposition in this region.

In the Pequop Mountains, Carlin-type gold mineralization occurs primarily in platform carbonate rocks of Middle Cambrian through Early Silurian age and in altered dikes. Oxide gold grades at the Long Canyon and West Pequop deposits range up to 57.1 g/t, with average grades ≥2 g/t. Deposits have corresponding high concentrations of arsenic, antimony, mercury and thallium. Primary hosts are thin-bedded, silty limestones that bound more resistant dolostone, although robust mineralized zones often occur within dissolution breccia bodies. Intersections between silty limestone-dolostone contacts and high-angle dikes or faults likely served as conduits for mineralized hydrothermal fluids.

Dikes are abundant in the Pequop Mountains as mafic through felsic compositions. Jurassic lamprophyres are the most abundant in the gold deposits and commonly host ore due to their primary high carbonate and iron contents, promoting reactivity and sulfidation during hydrothermal activity. Most dikes, including lamprophyres, are pre-mineral and exhibit strong alteration; some dikes are less altered and may postdate mineralization. The youngest mineralized dikes are Eocene spherulitic rhyolites at West Pequop. Mineralized rhyolite dikes indicate Carlin-type mineralization postdates these 41 to 39 Ma intrusions. Spherulitic textures in the Eocene rhyolites where they intrude high-grade metamorphic rocks suggest the following: (1) very shallow level of emplacement at ~40 Ma, and (2) significant exhumation pre-40 Ma. Seeming in conflict with this interpretation, Eocene volcanic rocks regionally rest on uppermost Paleozoic rocks everywhere, indicating little exhumation by that time.

$^{40}Ar/^{39}Ar$, U-Pb, and apatite fission-track will be applied to date more intrusions, bracket the timing of deformation, uplift, and mineralization, and further constrain the depth of mineralization. In ore zones, dike samples grading from unmineralized to mineralized may be particularly useful for apatite fission-track and/or $^{40}Ar/^{39}Ar$ sericite dating of hydrothermal activity. Results from each analysis will be evaluated and correlated with all other data to produce a model for the evolution of the hydrothermal systems that formed the deposits.