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Carlin-Type Gold as a Mineralization Spectrum: Evidence from Leeville

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The Leeville District, located in the North Carlin Trend, contains ore bodies hosted in different stratigraphic units. The north-east trending and west-dipping Basin Bounding extensional fault (BBF) bounds Leeville to the west, together with its parallel splay, the Four Corners extensional fault (FCF), act as major conduits for ore-forming fluids.

East of the FCF, the West Leeville (WLV) deposit displays stratabound gold mineralization with muscovite+illite+quartz±dolomite±kaolinite alteration, hosted within thickened, calcareous and carbonaceous, finely “wispy” laminated and locally detrital rich silty mudstone of the Wispy subunit of the Devonian Popovich formation (Dp-Ws).

West of the FCF, in its hangingwall, the Four Corners (FC) ore body is hosted within the locally calcareous graded- to massive-bedded siliceous and silty mudstones of the Devonian Rodeo Creek (Drc) formation. Gold mineralization at FC is disseminated to fracture-hosted and locally occurs within silica-sulfide-cemented breccia associated with an alteration assemblage of quartz±kaolinite+muscovite±illite±dickite±rhodochrosite±dolomite.

Gold mineralization at FC and WLV occur at similar elevation above the sea level; however, gold at FC is associated with higher concentrations of As, Sb and Cu.

Towards the north Turf, along the BBF-FCF corridor, gold mineralization deepens and can become vertical due to pre-Eocene metamorphism and alteration. Late diagenetic dolomitization and Jurassic hornfelsing are interpreted to have prepared the ground, allowing otherwise “unfavorable” Silurian Roberts Mountain (Srm) and Siluro-Devonian Bootstrap (Sdb) formations to host gold mineralization. The north Turf area shows lower Sb and the highest As concentrations with gold-bearing realgar and orpiment occurring paragenetically later than arsenian pyrite. The alteration assemblage consists of dolomite±muscovite±illite±montmorillonite±quartz followed by vein-hosted calcite±barite±kaolinite±quartz.

We propose that pre- and syn-mineralization geological processes and structural evolution resulted in distinct mineralization styles across the district. The Leeville Complex therefore, likely represents a spectrum of Carlin-type mineralization styles with varying ore body geometry, geochemical signatures and paragenetic evolution.