Multi-Scale Structural and Geochemical Analysis of Gold Mineralization at the REN Deposit, Carlin Trend, Nevada

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The REN deposit, located along the northern Carlin Trend in Nevada, hosts 1.5 Moz of inferred and 0.06 Moz of indicated gold resources at an average grade of 6.9 g/t Au (Fiddes et al., 2025). Despite its resource potential, the geologic controls on mineralization are not well constrained. This study aims to develop a comprehensive geological framework for REN by investigating the influence of faults, breccia bodies, and dikes on hydrothermal fluid flow and gold deposition. The deposit is hosted in reactive Lower Plate carbonate rocks, particularly the Devonian Popovich and Silurian-Devonian Roberts Mountains formations, which are favorable for decarbonatization, pyritization, and subsequent gold deposition (Rhys et al., 2015; Cline et al., 2005). High-angle faults such as the Corona and JB3 faults are interpreted to have facilitated hydrothermal fluid flow during Carlin-type mineralization (~42–34 Ma) (Spalding et al., 2005). Intrusive bodies, including Jurassic and Eocene dikes, show compositional and structural alignment with these faults, suggesting a potential genetic link (Spalding et al., 2005). Proposed methods include petrography, geochemistry, and U-Pb zircon and Ar-Ar geochronology to constrain the timing of dike emplacement and faulting. Additional calcite veins and breccia cement analyses will be used to interpret fluid flow pathways and chemical conditions associated with gold precipitation. Comparing mineralized and unmineralized breccia textures will further elucidate their roles in gold localization. This study aims to enhance the understanding of structural and mineralization controls at the REN deposit. The findings aim to clarify the timing and relationship between faulting, intrusion, and gold mineralization, potentially improving exploration strategies in the northern Carlin Trend and contributing to more effective resource evaluation.