

Characteristics and Genesis of Carlin-type Gold Deposits in SW China

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The Carlin-type gold deposit in Dian-Qian-Gui area, SW China represents the world's second-largest Carlin-type gold province, following only to Nevada in the USA. To date, more than 100 Carlin-type gold deposits/occurrences have been discovered in this region, with total verified gold resources exceeding 1,000 tons.

These deposits are situated within the Youjiang Basin, a tectonically complex area that has undergone multiple stages of evolution, including rifting, passive-margin sedimentation, orogenic deformation, and late-stage extensional tectonics. The deposits are structurally and lithologically controlled, with orebodies preferentially hosted by carbonate-bearing rocks and controlled by high-angle faults and/or anticlines. Hydrothermal alteration related to gold deposition is characterized by dissolution of calcite, jasperoid replacement of calcite, sulfidation of Fe in Fe-dolomite/Fe-calcite to form Au-bearing pyrite and dolomite, illitization of K-feldspar/muscovite, and subordinate quartz veining. Gold occurs predominantly as ionic gold incorporated into the lattice of arsenian pyrite, which is also anomalously enriched in Sb, Hg, and Tl. Late-ore-stage mineral, including stibnite, realgar, calcite, quartz, and lesser orpiment and cinnabar, typically fill open spaces. Fluid inclusion studies indicate that mineralization occurred at depths of approximately 2 to 8 km and temperatures ranging from 190 to 300°C.

Sulfur and magnesium isotopes studies point to a magmatic hydrothermal fluid source. Recent mercury isotope data reveal predominantly negative $\Delta^{199}\text{Hg}$ values, suggesting that ore-forming metals were remobilized from the Precambrian basement. Integrating these geological and isotopic lines of evidence, we propose a genetic model involving magmatic-hydrothermal fluids that scavenged metals from basement lithologies during ascent and ultimately precipitated ore in structurally favorable traps.