

Detachment-Related IOCG Deposits of Central Arizona: Geological Characteristics and Age of Mineralization of Cu-Au Deposits in the Wickenburg Area

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Iron oxide copper gold (IOCG) deposits are commonly located in Precambrian intracratonic settings and Mesozoic magmatic arcs. However, deposits with similar characteristics also occur in Cenozoic extensional settings, possibly representing a distinct subgroup of this deposit type. This study reports on the geological characteristics of detachment-related IOCG deposits near Wickenburg in west-central Arizona, integrating field mapping, sample petrography, field emission scanning electron microscopy, fluid inclusion microthermometry, and U-Pb isotopic dating. The study area is situated along the eastern edge of the Colorado River Extensional Corridor (CREC), at the boundary between the Basin and Range and the Colorado Plateau physiographic provinces. This region experienced significant Miocene extension accommodated by large detachment faults. Field relationships reveal strongly localized high-grade ore zones within high-angle normal faults. Fault zones contain massive accumulations of specular hematite associated with quartz veins and breccias, with locally abundant chrysocolla and malachite. These structures are laterally extensive, forming map-scale lineaments ≥ 3 km in strike length. Representative samples were collected for fluid inclusion research and U-Pb isotopic dating of hematite by laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS). Fluid inclusion homogenization temperatures range up to 300°C, with salinities of 9.5-21.5 wt.% NaCl equivalent. The entrapped compositionally complex brines are distinct from ore-forming fluid in Laramide porphyry deposits and Miocene epithermal deposits. The U-Pb hematite dating yields mid-Miocene ages (~15-10 Ma) indicating that IOCG mineralization likely occurred as part of Basin and Range extension. Similar geological characteristics have been documented for other detachment-related deposits in Arizona, particularly within the CREC. These findings suggest that extension along the thickened margins of the Colorado Plateau during Miocene Basin and Range deformation can generate a distinct subtype of IOCG deposit formed by high-salinity basinal fluids rising along detachment fault-related structures.