

Genesis of a Precambrian Porphyry Mineralization: Sucupira Cu-Au Deposit, Central Brazil

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Precambrian porphyry deposits are rare and highly susceptible to processes that may affect their preservation. This study focuses on the Sucupira Cu–Au deposit, investigated through geochronological, petrographic, and geochemical data to constrain its evolution and preservation. The deposit is part of the Chapada District, a Cu–Au porphyry system located in central-western Brazil, within the Mara Rosa Segment of the Goiás Magmatic Arc, formed during the Brasiliano Orogeny. The tectonic evolution of the Mara Rosa Segment comprises: (i) an early event between 930 and 800 Ma, related to an intraoceanic island arc; and (ii) a later event between 670 and 600 Ma, associated with a continental magmatic arc. U–Pb geochronological data indicate that the Sucupira deposit has a protolith crystallization age of 879.6 ± 4.6 Ma, hosted by rocks dated at 906 ± 18 Ma, placing it within the early stage of volcanic activity in the Mara Rosa Segment. Due to its age and geotectonic setting, primary porphyry features are metamorphosed and deformed. Mineralization occurs as disseminated chalcopyrite and pyrite aligned along foliation planes and associated with biotite in deeper levels. The host rocks include porphyritic metadiorite, metavolcanic, and metavolcanosedimentary units. Hydrothermal alteration is subdivided into potassic, sericitic, and transitional zones, with A-type and B-type veins that are folded and/or disrupted. Index minerals are largely metamorphic products of hydrothermal precursors, including biotite and K-feldspar in the potassic zone, and kyanite and muscovite in the sericitic zone. Mineral chemistry suggests an overlap between magmatic-hydrothermal and metamorphic stages, with partial preservation of primary signatures. Despite its Precambrian age and post-mineralization metamorphic overprint expressed by mineralogical, textural, and structural modifications, the Sucupira deposit represents a well-preserved example of an ancient porphyry system in a complex orogenic setting.