

Paragenetic Sequence of the Alvo Buriti Sector, Chapada Cu–Au Porphyry Deposit, Mara Rosa Magmatic Arc, Central Brazil

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The Chapada Cu-Au deposit, located in the Mara Rosa magmatic arc of Central Brazil, is a large-tonnage, low-grade Precambrian porphyry system. Current reserves (proven and probable) are approximately 996 Mt grading 0.23% Cu and 0.12 g/t Au, while the deposit also hosts an inferred resource of ~48 Mt grading 0.22% Cu and 0.09 g/t Au. Mineralization is disseminated and hosted mainly by biotite-rich schists and gneisses. The Alvo Buriti copper domain, representing part of Chapada, is strongly overprinted by intense deformation and metamorphism.

Petrography, microstructural analysis and mineral chemistry allow reconstruction of a detailed paragenetic sequence. Two main stages were defined: (I) a deformed and metamorphosed porphyry (Dn event, dextral shear), characterized by magmatic quartz chessboard structures, K-feldspar, biotite, and sulfides including chalcopyrite, magnetite, and minor pyrite, with mineralization associated with biotite; and (II) a shear-zone overprint (Dn+1 event, sinistral shear), expressed in three steps: retrograde alteration with epidote replaced by quartz and chlorite; sulfide remobilization accompanied by epidote replaced by carbonates; and late remobilization marked by pyrite dominating over chalcopyrite and magnetite, migrating into axial zones, with late carbonates and mineralization associated with sericite.

Microstructural analysis identified three foliation domains reflecting different deformation intensities: a weakly foliated domain (stage I and early stage II), a foliated domain, and a crenulated domain (stage II). Mineral chemistry shows re-equilibrated primary biotite, pervasive chlorite alteration marking the transition from amphibolite to greenschist facies, and remobilized chalcopyrite and pyrite consistent with a magmatic-hydrothermal origin.

This paragenetic reconstruction demonstrates that the paragenetic stages are intimately controlled by shear-zone development, where deformation and fluid-rock interaction governed sulfide remobilization, alteration patterns, and grade variability. These insights provide new constraints on the tectono-hydrothermal evolution of Chapada and expand understanding of how shear-related processes shape porphyry-type mineralization in Precambrian terranes.