

Geology and Hydrothermal Alteration of the Poço Da Sociedade Gold Deposit, Central Brazil

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The formation of orogenic gold deposits requires a fertile source of ore-forming elements, favorable geotectonic conditions, and crustal-scale structures that enable the circulation and focusing of metal-bearing fluids. Post-depositional processes may also contribute to the preservation of mineralization.

The Poço da Sociedade gold deposit is an inactive open-pit mine located in central Brazil and represents one of the few orogenic gold systems within the southern segment of the Goiás Magmatic Arc. Mining activity dates back to the 18th century and continued until the 1990s, when operations ceased due to economic constraints. The deposit is hosted by a fore-arc metavolcano-sedimentary sequence (Anicuns–Itaberaí Sequence), in close proximity to high-grade gneisses interpreted as the deep crustal roots of the Brasília Orogen.

Despite its long mining history, the controls on mineralization remain poorly constrained. This study investigates its metallogeny through integrated geological and structural mapping at a 1:2,500 scale, characterization of hydrothermal alteration assemblages, stable isotope analyses (δD and $\delta^{18}O$), and three-dimensional geological modeling.

Mineralization occurs as quartz veins with disseminated sulphides (chalcopyrite, galena, pyrrhotite, and sphalerite) and free gold, hosted predominantly in calc-schists with subordinate quartzite layers. The hydrothermal alteration assemblage includes biotite, muscovite, chlorite, ankerite, garnet, hornblende, quartz, rutile, and ilmenite. Structurally, the deposit is controlled by a N40°E-oriented shear zone dipping ~50°NW and is spatially associated with a crustal-scale discontinuity marking the accretionary boundary between the Goiás Magmatic Arc and the Brasília Orogen.

Chlorite geothermometry and petrography indicate mineralization under retrograde metamorphic conditions above ~380 °C, following peak metamorphism at ~660 °C and ~1.2 GPa. Stable isotope data support a metamorphic origin for the fluids. Ore bodies are strongly controlled by lithological contrasts, particularly at contacts between calcareous schists and quartzite lenses.