

## Porphyry-Like Au-Cu System in Paleoproterozoic Greenstone Belts

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The Toroparu Au-Cu(-Ag) system, located within the Mazaruni greenstone belt of the Guiana Shield, Guyana, South America, is a magmatic-hydrothermal system overprinted by an orogenic system. The ore is hosted in a cogenetic bimodal calc-alkaline igneous suite of intermediate volcanic, volcanoclastic, and intrusive host rocks metamorphosed to greenschist facies assemblages and lies on a regional NW-trending, sub-vertical, high-strained zone with a protracted deformation history.

The main mineralization stage has an assemblage of gold, chalcopyrite, bornite, pyrite II, covellite, molybdenite, and magnetite hosted within NW-trending extensional quartz carbonate  $\pm$  chlorite (QCBCHL) veins, veinlets, and fractures associated with dextral strike-slip movement. Ore-stage molybdenite yielded a Re-Os age of  $\sim 2160$  Ma, which overlaps with a  $\sim 2160$  Ma U-Pb zircon age for the host intrusion that is a fine- to medium-grained porphyritic tonalite-granodiorite. Hyperspectral imaging in shortwave infrared (SWIR, 1,000–2,500 nm) indicates that metamorphic chlorite (background) within the project area has absorption bands between 2,255 and 2,252 nm (Mg# 42–47). In contrast, proximal Au-Cu(-Ag) mineralization zones have chlorite that is Mg rich (Mg# > 90, < 2,245 nm); white mica has absorption bands between 2,205 and 2,215 nm. Fluid inclusion studies indicate the QZCBCHL hosts secondary two-phase aqueous types ( $L_{H_2O}$ - $V_{H_2O}$ ) with  $T_h = 100^\circ$  to  $160^\circ\text{C}$  and moderate to low salinities (22.0 to 0 wt. % equiv. NaCl).

Most of the base and precious metals at Toroparu are syn-magmatic and represent an early mineralization episode in the Mazaruni greenstone belt. The Las Cristinas Au-Cu deposit in Venezuela, the Gaoua Au-Cu deposit in Burkina Faso, and the Aitik Au-Cu deposit in Sweden are hosted in rock of similar ages and geological settings. These major ore systems, which differ from the typical orogenic gold of greenstone belts, emphasize the need for new exploration approaches to lead toward new magmatic-hydrothermal Au-Cu deposit discoveries elsewhere in Precambrian greenstone belts.