Microstructures as a tectonic guide to unravel structural controls on Cu-Au mineralization at the Neoarchean Pantera IOCG deposit, Carajás Domain

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The Carajás Domain in the southern part of the Archean Carajás Province is the host to a broad variety of cooper – gold systems, including world-class iron-oxide-copper-gold (IOCG) deposits. The IOCG deposits are concentrated along three regional-scale shear systems, named Cinzento, Carajás and Canaã. The Pantera deposit (20.8 Mt @ 1.7 % Cu and 0.2 g/t Au) in the western sector of the Canaã shear system is part of these IOCG systems, where it is controlled by a splay of the Canaã shear system, herein named the Ourilândia shear zone. The Ourilândia shear zone stands out in magnetic maps as an E-W trend anastomosed structure involving less deformed granitoids of the Ourilândia plutonic suite. This array is also observed in macroscopic scale (5 to 30 cm thick) where there is a subvertical ductile to brittle-ductile shear zones with mylonitic foliation along E-W, ENE and WNW strikes and with high-angle dips (>70°). Hydrothermal alteration zones marked by distal K-feldspar-albite1, sodic-calcic (albite1-epidote1-scapolite-hastingsite-titanite2), and proximal calcic-ferric (actinolite-apatite1-magnetite1) are essentially controlled by S-C-C' surfaces and microfolds than indicate sinistral shear sense. The calcic-ferric hydrothermal alteration envelopes the main Cu-Au ore zones containing chalcopyrite1-magnetite1±millerite at the Pantera deposit. Late K-Si (biotite2-quartz-magnetite2-titanite3) alteration and restricted Cu mineralization (chalcopyrite2 ± pyrite) are related to kink band, δ-type magnetite porphyroclast and indicates a superimposed fabric in dextral motion along the E-W shear system. U-Pb titanite geochronology has been conducted in this study to understand the timing of IOCG mineralization, and possibly remobilization during deformation. Titanite (1) in less deformed and hydrothermally altered granitoids yielded a crystallization age of 2912 ±88 Ma (n=9; MSWD: 4.8), whereas titanite (2) related to the sodic-calcic alteration showed an age of 2747 ±82 Ma (n=15; MSWD= 2.6). Titanite (3) contained in the superimposed dextral fabrics defined ages of 2196 ±117 Ma (n=5; MSWD= 2.4) and 2091 ±39 Ma (n=17; MSWD=4.2). The titanite (1) age overlaps zircon ages of the Ourilândia plutonic suite, suggesting to be coeval with the crystallization of these granitoids. Titanite (2) age indicates the timing of the nucleation of the Ourilândia shear zone and formation of the Pantera IOCG mineralization, which is contemporaneous with other Neoarchean copper deposits along the Southern Copper Belt (i.e., Sequeirinho). Titanite (3) ages, on the other hand, mark the reactivation of the Ourilândia shear zone in the Rhyacian, related to the Transamazonic event, which was also accompanied by hydrothermal fluid circulation, copper remobilization and formation of more restricted copper mineralized zones in the deposit area.

Keywords: Mineral exploration, Carajás Province, geochronology, structural control