Geological Setting and Geochemical Characterization of the Archean Host Units of Iron Oxide-Copper-Gold Deposits in the Southern Copper Belt, Carajás Mineral Province

Marco Antonio Delinardo da Silva,[1,†] Lena Virgínia Soares Monteiro,[2] Carolina Penteado Natividade Moreto,[1] Gustavo Henrique Coelho de Melo,[1] Roberto Perez Xavier,[1] Daniel Francisco Martins de Sousa,[1] and Ricardo Ceglio Benedetti [1]

[1] *Geoscience Institute, University of Campinas (UNICAMP)*
[2] *Geoscience Institute, University of São Paulo (USP)*

[†]Corresponding author: e-mail, marcodelinardo@gmail.com

The Carajás mineral province is one of the most important mineral provinces in the world. This province is represented by a well-preserved Archean nucleus located in the eastern part of the Amazonian craton. The province is divided into two tectonic domains: Carajás to the north and Rio Maria to the south. These domains, limited by a regional E-W shear zone, likely reveal distinct evolution during the Mesoarchean.

Iron oxide copper-gold deposits (IOCG) occur only in the Carajás domain. In the southern copper belt, the world-class IOCG deposits (e.g., Sossego, Cristalino, and Alvo 118) are located close to the limit of the two Archean domains, within a WNW-ESE shear zone.

In the region of Canaã dos Carajás, between the Planalto and Serra Dourada villages, the Visconde, Bacaba, Bacuri, and Castanha IOCG deposits occur along the Sossego-Cristalino WNW-ESE structural trend. The host rocks of these deposits comprise (1) ca. 3.0 Ga Bacaba Tonalite and ca. 2.84 to 2.86 Ga Serra Dourada Granite; (2) mafic bodies including norite, olivine diabases, diabases, and porphyritic gabbro; (3) ca. 2.74 Ga subvolcanic felsic rocks with compositions of alkali rhyolites, andesites, and dacite rhyolites; (4) intermediate and felsic metavolcanic units; (5) metaultramafic mylonitic rocks (talc-tremolite schist); and (6) biotite-scapolite and chlorite-bearing mylonites, with strong evidence of hydrothermal alteration (Fig. 1).

The main regional hydrothermal processes (sodic, potassic, and chloritic alteration) are structurally controlled and related to main ESE-WNW–trending shear zones with strike-slip lineation, but evidences of hydrothermal alteration have also been recognized along secondary NNW-SSE–trending shear zones with downdip lineation (Fig. 1). Consistent with observations, pulses of hydrothermal activity and, consequently, the mineralization event(s) might have been associated with the emplacement of the subvolcanic felsic rocks, mainly rhyolitic porphyries, at 2.74 Ga. The metaultramafic mylonitic slices are spatially closely related with ore zones, but their importance as a metal source is yet to be proven, although some IOCG deposits show significant enrichment in nickel and palladium.

The ca. 3.0 Ga Bacaba Tonalite and the ca. 2.86 Ga Serra Dourada Granite show calc-alkaline affinity, being classified as I type, but the latter also shows A-type characteristics. The rocks of the Serra Dourada Granite possibly were formed in a collisional environment. The contents of high field strength elements (HFSEs), large ion lithophile elements (LILEs), Rb, and Th of the Bacaba Tonalite are similar to those of tonalite-trondhjemite-granodiorite (TTG) rocks formed in precollisional settings.

These data suggest a possible Mesoarchean magmatic arc environment evolving to a collisional setting between 3.0 and 2.8 Ga. This tectonic evolution might be responsible for juxtaposion of the Rio Maria and Carajás domains in the Carajás mineral province. This scenario could favor mantle metasomatism and subsequent melting associated with

magmatism at 2.74 Ga, besides the development of major crustal discontinuities that represent important conduits for hydrothermal fluid migration and mineralization.

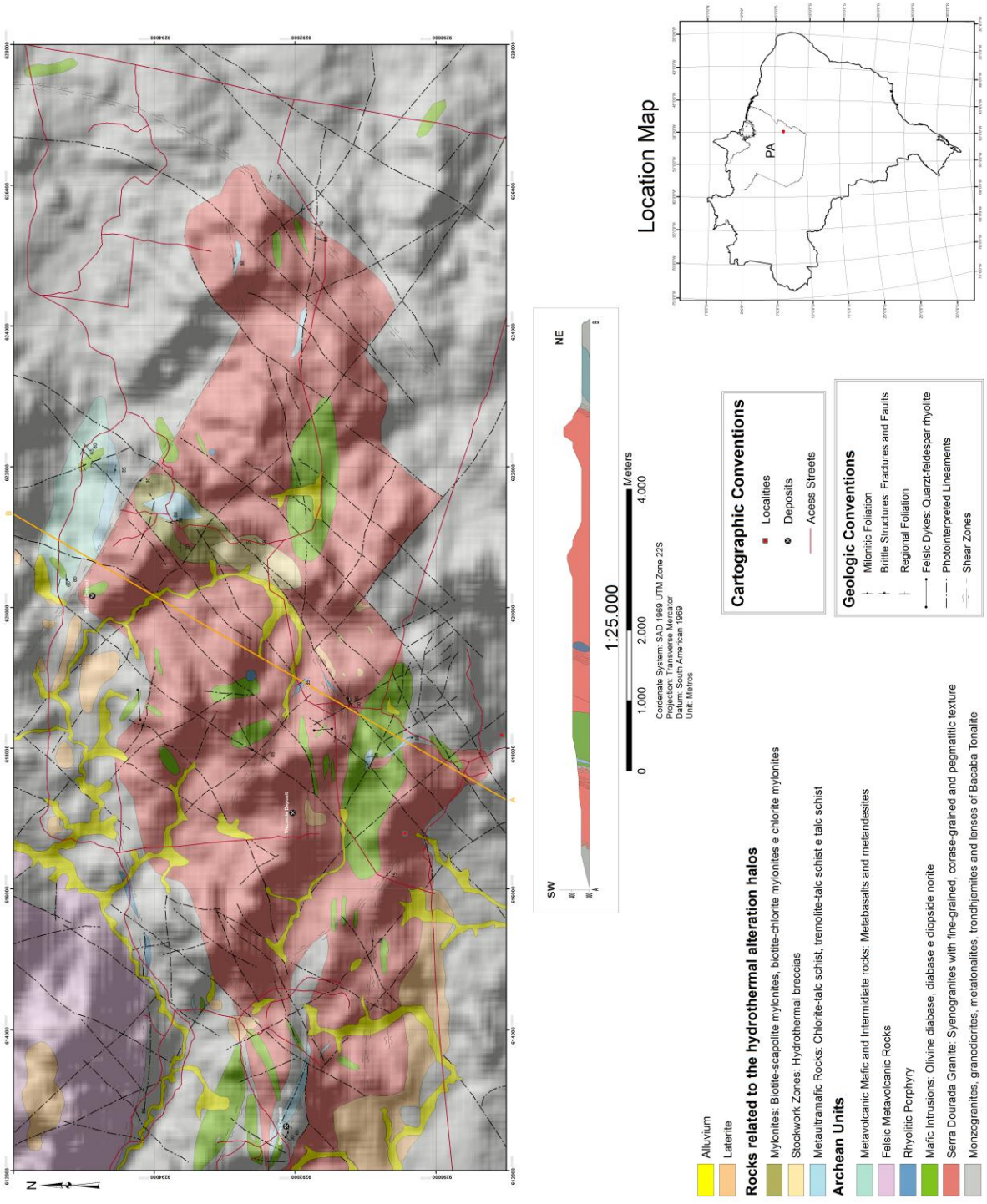

Fig. 1. Geologic map of the Carajás domain between the Planato and Serra Dourada villages, Canaã dos Carajás, Carajás mineral province.