THE 2.57 GA SALOBO AND IGARAPÉ BAHIA IOCG DEPOSITS, CARAJÁS PROVINCE: INSIGHTS OF THE ORE-FORMING FLUIDS AND TECTONO-MAGMATIC EVOLUTION OF THE CARAJÁS DOMAIN

Gustavo H. C. de Melo[1], Lena V. S. Monteiro[2], Roberto P. Xavier[3], Carolina P. N. Moreto[3]

[1] Department of Geology - School of Mines, Federal University of Ouro Preto (UFOP), Ouro Preto, MG, Brazil.
[2] Institute of Geosciences, University of São Paulo (USP), São Paulo, SP, Brazil.
[3] Institute of Geosciences, University of Campinas (UNICAMP), Campinas, SP, Brazil.

The northern sector of the Carajás Domain, in the Carajás Province, comprises a belt of iron oxide copper-gold deposits (IOCG). This belt includes Salobo, GT-46 and Furnas deposits within the Cinzento Shear Zone, and Igarapé Bahia and Grota Funda deposits hosted by the volcano-sedimentary sequence of the Itacaiúnas Supergroup. The origin of Salobo and Igarapé Bahia has been linked to ore-forming processes that took place at ca. 2.5 Ga. However, these deposits show contrasting host rocks, hydrothermal alteration types and ore assemblages. The host rocks of the Salobo deposit encompass basement gneisses, Neoarchean granitoids and supracrustal sequences. Within the central zone of the deposit, textures of the hosts have been entirely obliterated by intense mylonitization and hydrothermal alteration. These processes formed (tourmaline)-grunerite-almandine-biotite-rich rocks. In these rocks, bornite and chalcocite represent the ore minerals with large amounts of magnetite. The timing of the IOCG mineralization is constrained at 2,576 ± 8 Ma (Re-Os in molybdenite). The Igarapé Bahia deposit is hosted by volcanic rocks, graywackes and rhythmites of the Igarapé Bahia Group. Primary structures are preserved in the vicinities of the deposit. Within rhythmites, chalcopyrite nodules and layers occur concordantly to bedding and display no hydrothermal alteration halos or iron oxide. Sulfur isotope composition of chalcopyrite nodules yielded values ranging from +0.29 to +1.56‰, suggesting that sulfur was derived from the volcanic rocks. Here, copper mineralization may have been derived from syngenetic-exhalative processes. Towards the central zone of the deposit, mylonitization and hydrothermal alteration become more intense. In these zones, (tourmaline)–(biotite)-carbonate–chlorite mylonites and breccias with large contents of magnetite and chalcopyrite comprises the sites of the IOCG mineralization. At the Alemão orebody, a U-Pb monazite age set the timing of the IOCG mineralization at 2,559 ± 34 Ma. At Salobo, iron-enrichment and potassic alteration, at 565 ± 50 ºC, formed by hydrothermal fluids with magmatic signature, as evidenced by grunerite, garnet, tourmaline and biotite ($\delta^{18}O_{H2O}$ = +5.07 to +9.70‰, δD_{H2O} = –40.94 to –11.60‰). Sulfur isotopes in chalcopyrite and bornite (–0.37 to +1.63‰) also point to a magmatic sulfur source at Salobo. For the IOCG mineralization at Igarapé Bahia, fluids associated with tourmaline ($\delta^{18}O_{H2O}$ = +5.07 to +7.37‰, δD_{H2O} = –34.02 to –19.74‰, at 330 ±50°C) and calcite (for carbon; $\delta^{13}C_{CO2}$ = –9.32 to –4.93‰) also have magmatic signatures. However, fluids associated with the same calcite ($\delta^{18}O_{H2O}$ = +1.68 to 3.10‰, 330 ±50°C) and chlorite ($\delta^{18}O_{H2O}$ = +1.92 to +3.20‰, δD_{H2O} = -57.36 to -21.34‰, 255 ±50 ºC) suggest the influx of ^{18}O-depleted waters. Sulfur at Igarapé Bahia (+1.36 to +5.35‰ in chalcopyrite) might be derived from sulfate. The magmatic source for the ore-forming fluids for both deposits is assigned to exsolved magmatic brines from coeval ca. 2.5 Ga granites. The influx of ^{18}O-depleted fluids might reveal the mixing with formation water, especially at Igarapé Bahia. These results evidence the complex geological evolution of the

Carajás Domain, which reflect in the genesis of the IOCG deposits.

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