CHEMICAL AND STABLE ISOTOPE CONSTRAINTS ON THE METALLOGENETIC EVOLUTION OF THE JATOBÁ Cu-Au-(Ni-Zn) DEPOSIT, CARAJÁS MINERAL PROVINCE

Ângela Veloso [1]; Lena Monteiro [2]; Caetano Juliani [2]

[1] Universidade Federal de Uberlândia, Monte Carmelo, Minas Gerais, Brazil.
[2] Universidade de São Paulo, São Paulo, São Paulo, Brazil.

The Jatobá deposit is part of a cluster of IOCG deposits located within E-W and WNW–ESE-trending shear zones in the Carajás Province. The host rocks at Jatobá are attributed to the Itacaiúnas Supergroup and comprise metadiabase, metabasalt, mafic metatuff, felsic volcaniclastic rocks, and metarhyodacite (2,700 ±16 Ma).

The Jatobá deposit has mineralized zones formed in four stages, coeval to ductile (stages I and II) and ductile-brittle (stages III and IV) deformational events. The mineralization stage (I) was related to calcic alteration (actinolite-apatite) and resulted in replacement fronts and breccias with Ni-pyrrhotite (±Ni-pyrite ± Co-chalcopyrite) in the matrix. The mineralization stage (II), associated with potassic alteration (biotite–Cl-apatite), comprises Ni-pyrite–Co-chalcopyrite ± Ni-pyrrhotite. The ensuing mineralizing stages (III) and (IV) were accompanied by late biotite and chlorite, respectively. The latter was the most significant copper mineralization stage and encompasses branching veins with Co-chalcopyrite and siegenite (± Co-pyrite ± cassiterite ± sphalerite ± molybdenite ± uraninite ± monazite ± REE carbonates).

The early mineralization stage (I) is characterized by the highest contents of Fe_2O_3 (71.49 to 63.91 wt. %), Ni (3930 to 1270 ppm), Co (2320 to 670 ppm), V (740 to 590 ppm), Pd (81 to 372 ppb) and Pt (2 to 17 ppb), which decrease with the paragenetic evolution. An opposite trend was observed in relation to copper, gold, zinc, REE, and LILE (P, U, Th, Sn, W, and Nb). Highest contents of ΣREE (up to 6773.92 ppm), U (up to 48.50 ppm), Th (up to 23.30 ppm), P_2O_5 (up to 7.97 wt. %), Sn (up to 24 ppm), Nb (up to 7.50 ppm), W (up to 322.50), Zn (up to 482 ppm), gold (up to 1310.80 ppm) were characterized in ore samples formed during the main mineralization stage (IV). The high V, Ni and Cr concentration in Jatobá magnetite points to high-temperature conditions (about 500-700°C), especially during the early Ni-enriched mineralization event. Temperature decrease from the pre-mineralization iron metasomatism (558 ^{o}C) to mineralization stages (II = 507 ^{o}C; III = 422 ^{o}C; IV = 327 ^{o}C) was accompanied by a relatively narrow variation of calculated $\delta^{18}O_{H2O}$ values (9.53‰ to 5.41‰). The $\delta^{18}O_{H2O}$ and δD_{H2O} (–44.88‰ to –30.25‰) values overlap with those of primary magmatic waters and felsic magmatic water. The $\delta^{34}S_{sulfide}$ values of Jatobá sulfides (0.27‰ to 1.80‰) also point to magmatic sulfur sources. Increasing of $\delta^{34}S_{sulfide}$ values during the paragenetic evolution was accompanied by a decrease of Ni + Co and V contents and an increase of Sn + W + Nb content in ore samples.

The Jatobá deposit reveals a complex syn-tectonic evolution. Early Ni-rich mineralization stages have strong inheritance of mafic-(ultramafic) rocks possibly due to fluid-rock interaction involving deep-seated, overpressured hypersaline magmatic fluids. Stable isotope data point to fluid evolution and cooling without extensive fluid mixing even in the late Cu-rich mineralization stages at Jatobá.