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IOCG DEPOSITS OF THE CARAJÁS PROVINCE: FOOTPRINTS OF ARCHEAN AND PALEOPROTEROZOIC HYDROTHERMAL SYSTEMS

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RESUMO: The Carajás Province contains one of the world's highest known concentrations of IOCG deposits. These mineral deposits reveal important inheritance of their host rocks and the long-term tectonic evolution of the Carajás Province. Mesoarchean host rocks include ca. 3.07 Ga TTG-like orthogneisses and migmatites (Xingu Complex) and the ca. 2.99 Ga Sequeirinho Granite and Bacaba Tonalite, which represent magnesian, calcic to calc-alkalic, metaluminous to peraluminous rocks generated in magmatic arc. The ca. 2.84 Ga Serra Dourada Granite also hosts several IOCG deposits. It has high-K calc-alkaline affinity and is similar to syn-collisional granites. Additionally, a ca. 2.97 Ga Al-depleted greenstone belt sequence is represented by lenses of dacite (Pista metavolcanic rock) and metaultramafic rocks, including blackwall alteration zones. Collectively, these lithotypes record the amalgamation of remnants of ancient oceanic plateaus and continental fragments. The widespread Neoarchean bimodal magmatism is represented by ca. 2.74 Ga ferroan, calc-alkalic to alkali-calcic, metaluminous granites, granophyres and associated mafic units. The post-orogenic A_2-type Sossego Granophyric Granite and Castanha Porphyry (Y/Nb >1; Sc/Nb <2; Rb/Nb <15) and the A_1-type Curral Granite reflect transition from extension of thickened arc crust to rifting setting during the Neoarchean. These granites are variably deformed and hydrothermally altered within shear zones, which might reflect reactivation of translithospheric discontinuities that limit tectonic blocks. Alkaline granites also include the ca. 2.57 Ga Old Salobo Granite and ca. 1.88 Ga A_1-type Nb-Y-Sn-U-enriched granites and quartz porphyries. Available geochronological data indicate that the IOCG deposits were formed at 2.7 Ga, 2.57 Ga and 1.88 Ga, but an early hydrothermal system may have operated beneath and within an active volcano-sedimentary basin (Itacaiúnas Supergroup) at 2.76 Ga. An important issue related to the IOCG deposits refers to the relationship between extensive regional hydrothermal systems and magmatism, which may be unraveled by lithochemical and isotopic evidences. The relatively deeper-emplaced Archean IOCG deposits have been formed by mixing involving magmatic-derived ($d^{18}O_{fluid}$ = 6.0-7.8‰ at 550 °C) and meteoric fluids. Contents of [(Nb*10)-(TiO_2*100)-Zr] of ore samples indicate strong inheritance of the host rocks in the Neoarchean deposits (e.g. 2.74 Ga gabbros in the Sequeirinho orebody; ca. 2.74 Ga Castanha Porphyry in the Castanha deposit). Additionally, the Archean IOCG ore also show the highest contents of Fe-LREE-Mo-Ni-Co-Pd. This possibly reflects magmatic signatures through mechanisms of fluid-rock interaction involving Mesoarchean and Neoarchean units. The shallow-emplaced Alvo 118 deposit reveals major contribution of surface-derived fluids ($d^{18}O_{fluid}$ = –0.4 to –5.2‰ at 300°C) and sulfate ($d^{34}S_{cpy}$ >7.5‰), which is consistent with its formation after the GOE. Its ore samples have elevated U-Au and the highest Nb-Sn-Y-Bi-Be-HREE contents, indicating inheritance of the ca. 1.88 Ga granites. Ore from Paleoproterozoic (e.g. Sossego orebody) and Neoarchean deposits overprinted by Paleoproterozoic hydrothermal events (e.g. Salobo and Bacaba) show intermediate composition in relation to Archean and Paleoproterozoic ores. These data allow identification of great diversity of Neoarchean IOCG deposits as function of fluid-rock interaction within structural corridors, overprinting of Archean deposits and installation of Paleoproterozoic hydrothermal systems with distinctive lithochemical and isotopic signatures.

PALAVRAS-CHAVE: IOCG DEPOSITS, CARAJÁS PROVINCE, MAGMATISM