The Carajás IOCG deposits: a SLIP-related mineral system?

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The Carajás Province (CP), located in the Amazonian craton, Brazil, contains world-class IOCG deposits (resources > 2 billion tons at 0.77 – 1.4 wt. % Cu; 0.28 – 0.86 g/t Au). The Mesoarchean units in the CP include ca. 3.07-2.96 Ga granulite to amphibolite facies TTG orthogneisses, ca. 2.97 Ga Al-depleted greenstone belts, and ca. 2.87-2.84 Ga granites. These units record the amalgamation of remnants of ancient oceanic plateaus and continental fragments.

The older IOCG-forming event (ca. 2.70-2.68 Ga) at Carajás postdates continental rifting, formation of a volcanic-sedimentary basin, and the emplacement of ultramafic-mafic intrusions, charnockites and anorogenic (A_2-type) granites at ca. 2.76-2.74 Ga. Neoarchean IOCG deposits (e.g. Sequeirinho, Cristalino) have been controlled by regional transcurrent shear zones, which might reflect reactivation of translithospheric discontinuities that limit tectonic blocks. The isotopic and chemical (Cu-Au-Fe-LREE-Ni-Co-Pd) ore signatures reveal deep-seated magmatic components and inheritance of the ultramafic and mafic rocks through fluid-rock interaction. A protracted tectono-thermal event (ca. 2.58-2.45 Ga) is also recorded in the northern portion of the CP. This event resulted in reactivation of regional shear zone, minor F-rich alkaline granite magmatism (e.g. Old Salobo granite), high-temperature hydrothermal alteration and IOCG formation and/or mobilization (e.g. Salobo, Alemão).

Paleoproterozoic IOCG deposits (ca. 1.90-1.88 Ga) were broadly coeval with the widespread ca. 1.88 Ga A_2-type granites recognized in the Amazonian craton. The ore signature (U-Nb-Sn-Y-Be-HREE-F) and high δ^{34}Scpy values (up >7.5‰), consistent with IOCG formation after the GOE, are typical of the these deposits (e.g. Alvo 118, Sossego). Multiple stages of metasomatic transfer and regional fluid flow have been controlled by the tectonic-thermal and magmatic evolution of the CP. The Carajás IOCG deposits share many similarities (A-type granites, ultramafic rocks, alteration patterns, high F and Cl contents in fluids) with major SLIP-related IOCG systems (e.g. Olympic Dam; Cloncurry). A suggested link of the Carajás IOCG deposits with SLIP deserves further investigation.