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Chemical Composition of Garnets and the Relation to Mineralizing Fluids in the Tucano Gold Deposit, Amapá State, Brazil

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The Tucano gold deposit, located in the northeastern segment of the Amazon Craton, within the Guiana Shield (Amapá State, Brazil) is a structurally controlled deposit hosted in amphibolite facies metasedimentary rocks of the Paleoproterozoic Serra do Navio greenstone belt, mainly in marble and banded iron formation (BIF). Mineralization is controlled by the N-S trending brittle-ductile Urucum shear zone and associated subsidiary structures. Hydrothermal alteration is characterized by skarn-type calc-silicate assemblages replacing metamorphic minerals and overprinting precursors' fabric. Since garnets are important minerals to consider further relation with mineralizing fluids, this work aims to investigate their chemical composition indicating similarities with gold mineralization. Petrographic investigation identified gold (< 100 μm) as interstitial or fracture-filling in silicates (amphibole, clinopyroxene, garnet). A petrological study was conducted on select diamond drill core samples analyzed by electron microprobe (EPMA), aiming to investigate the compositional variation between minerals from the metamorphic, igneous, and hydrothermal rocks on the area, with focus on garnet. X-ray semi-quantitative maps were reduced with XMapTools. Hydrothermal garnet shows a large compositional range, but in general it contains higher grossular (4 – 34%) and some minor andradite (up to 8%), when compared to metamorphic and magmatic ones. A Garnet-biotite geothermometry yielded the estimate for peak metamorphic temperature: 592 ± 25 °C (1 σ, n = 5). The same garnet crystals resulted in pressure estimates of 4.1 ± 0.6 kbars (1 σ, n = 5) using the geobarometer. Orogenic hypozonal gold mineralization at Tucano is characterized by high temperature hydrothermal minerals such as clinopyroxene, garnet, amphiboles, phlogopite and loellingite. Wide distal alteration zones suggest a high fluid/rock ratio, which is further manifested in the alteration mineralogy – clinopyroxene-garnet-amphiboles-phlogopite-magnetite-pyrrhotite – indicating an intense fluid-buffered composition.