LINKING METAMORPHIC AND METASOMATIC PROCESS TO CONSTRAIN THE T-T-X HISTORY OF NEOARCHEAN IOCG DEPOSITS FROM THE NORTHERN CARAJÁS PROVINCE (BRAZIL)

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The Carajás Province, located at the Amazon Craton, hosts the oldest and only known Neoarchean IOCG deposits (ca. 2.72-2.68 and 2.55 Ga) in the world. The copper-gold deposits and targets along the Cinzento Shear Zone (CZS) (Salobo, Furnas, GT-46, QT-02) in the northern part of the province, ore is enveloped by iron-rich rocks with large amounts of magnetite and uncommon Ca-Fe- and K-Fe-rich assemblage of silicates (grunerite, garnet and biotite). The origin of this distinct mineral association has been either entirely attributed to the Fe-metasomatic ore-forming hydrothermal processes (i.e., minerals precipitated from hydrothermal fluids) or associated with metamorphic processes developed prior to the mineralizing system (i.e., regional metamorphism and mineral growth). In spite of the divergent interpretations, the syn-tectonic origin for the Fe-silicates-rich rocks and Cu-Au ore is a consensus due to their confined occurrence within shear zones and contemporaneous development of shear structures and ore-bodies. However, the constrains on nature, pressure-temperature (P-T) conditions and timing (t) of this(these) deformational event(s) have yet never been assessed. In this work, we studied a set of garnet-rich rocks (schist, amphibolite and gneiss) from different areas along the CSZ, using electron probe microanalysis (EPMA), Lu-Hf and Sm-Nd garnet geochronology and $\delta^{18}O$ isotopes. These data were combined to constrain the temperature-time (T-t) evolution and characterize the role of hydrothermal fluids (-x) on metamorphic-metasomatic processes of IOCG deposits along the Cinzento Shear Zone. Garnet chemistry, texture and geochronology suggest mineral growth during thermal heating at ca 2.64 Ga (Lu-Hf garnet ages of 2644 ±12, 2638 ±28 and 2635 ±18 Ma), in equilibrium with biotite at ~785°C in schists, pargasite and grunerite, at ~611 °C in amphibolites and sillimanite at ~1025 °C in gneisses. We interpret this heating event is associated with compressive tectonics and crustal thickening, probably triggered by lithospheric weakening after the emplacement of sublithospheric melts (e.g. 2.76-2.7 Ga magmatism) and later radiogenic heating. Younger Sm-Nd garnet ages (2561 ±21, 2552 ±33, 2573 ±58 Ma) indicate slow cooling rates (<2.5 °C/Ma) for the studied rocks and might be related to low erosion rates and/or decrease on radiogenic heat production. Low strength of slowly cooling shear zone system facilitated hydrothermal fluids percolation along discontinuities from 2.58 to 2.54 Ga. Fluids temperatures, calculated from $\Delta^{18}O$ values of hydrothermal mineral pairs, indicate temperatures as low as 335 °C (GT46 deposit) to up to 640 °C (Salobo deposit) for the fluids that carried out dissolved metals and originated the multiple pulses of IOCG mineralization along the Cinzento Shear Zone.

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