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PROTRACTED METAMORPHIC EVOLUTION OF THE SOUTHERN BRASÍLIA OROGEN REVEALED BY MULTI-MINERAL PETROCHRONOLOGY OF HIGH-PRESSURE GRANULITES

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Petrochronology is a robust tool to investigate the pressure and temperature trajectories of metamorphic processes through time. The study of high-pressure granulites provides key insights into deep crustal processes linked to continental collision, shedding light on orogen dynamics throughout the Earth's history. This study examines felsic high-pressure granulites from the Carvalhos Klippe (Andrelândia Nappe System, Southern Brasília Orogen), formed due to the collision between the Paranapanema and São Francisco paleocontinents during assembly of West Gondwana in the Neoproterozoic. The studied samples consist of coarse-grained rutile-kyanite-orthoclase-garnet gneisses, reaching peak metamorphic with P-T conditions of ~825 °C and ~12 kbar according to phase equilibrium modelling and Zr-in-rutile thermometry. A complex geochronology record from monazite reveals at least 30 Ma of monazite growth along the metamorphic path, with distinct growth stages recorded by chemical and textural variations. Monazite enriched in Y-HREE and with low Th/U ratios records the prograde metamorphism around 630-620 Ma, represented by matrix monazite grains and inclusions within garnet porphyroblasts. Monazite Y-HREE-depleted domains with high Eu/Eu* are found in matrix, enclosed in garnet, and associated with retrograde biotite. These are interpreted to have formed during garnet stabilization and plagioclase consumption under high-pressure conditions linked to the metamorphic peak at 615-605 Ma. Monazite Y-HREE-enriched domains with high Th/U and low Eu/Eu* ratios span 605-600 Ma, potentially reflecting melt crystallization and garnet dissolution during the retrograde path. The cooling/exhumation path is constrained by rutile (*ca.* 550 Ma) and apatite U-Pb ages (*ca.* 540 Ma), and biotite Rb-Sr isochron dates (*ca.* 540 Ma). This dataset suggests slow-cooling of the high-pressure granulites from ~825°C at *ca.* 610 Ma to greenschist facies conditions (<500 °C) at *ca.* 550-540 Ma. Our results show the protracted metamorphic evolution of the Southern Brasília Orogen, characterized by a prograde stage at 630-620 Ma, reaching metamorphic peak conditions at 615-605 Ma, followed by decompression starting at *ca.* 600 Ma. Dominantly slow cooling rates prevailed until *ca.* 550-540 Ma.