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LINKING ZIRCON AND MONAZITE GROWTH EPISODES TO PARTIAL MELTING AND MELT CRYSTALLIZATION EVENTS: AN EXAMPLE FROM THE SOCORRO-GUAXUPÉ NAPPE, SE BRAZIL.

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The integration of REE patterns of zircon and monazite with coexisting major minerals (e.g. garnet) can provide a direct link between age and pressure/temperature information for metamorphic events. A combination of imaging techniques, EMPA and LA-ICP-MS dating and trace element geochemistry was applied to characterize distinct zircon and/or monazite growth episodes in high-grade rocks from the Socorro-Guaxupé Nappe (SGN), Brazil, to place constraints on the timing of the partial melting and melt crystallization. The SGN represents the lower crustal root of a magmatic arc emplaced at the active margin of the Paranapanema plate, and is divided into three distinct units: Basal Granulite Unit, Intermediate Diatexite Unit and Upper Migmatite Unit. High-T metamorphism is recorded at 850-950°C, 5-8 kbar as a result of the Ediacaran collision between the Paranapanema and the São Francisco plates during the southern Brasília orogeny (Campos Neto and Caby, 1999, Precambr. Res.). Samples from the Upper Migmatite Unit include a schollen migmatite, a stromatic Grt-Bt metatexite and a mafic granulite within a segregated leucosome. Oscillatory zoned zircon cores (n = 167) are texturally and chemically distinct from metamorphic overgrowths (YbN/GdN = 2-5), marked by steep HREE patterns (YbN/GdN = 9-31). Cores yield oldest dates scattering from ca. 640-720 Ma, interpreted as igneous inheritance. Monazite cores preserve prograde growth ages of ca. 630 Ma prior to the partial melting event, providing an upper age limit for granulite facies metamorphism in the SGN. Apatite-related monazite records the initial stages of decompression at ca. 630 Ma. This is followed by extensive zircon and monazite growth in equilibrium with garnet, which provides evidence for the onset of melt crystallization at ca. 615 Ma. The development of Y+HREE-rich and/or Th-rich, HREE+Y-poor monazite rims at ca. 600-590 Ma is evidence for a late stage of garnet growth and melt crystallization. Cryogenian inheritance in oscillatory zoned zircon cores (n = 264) of ca. 640-720 Ma has been also identified in six different lithotypes from the Basal Granulite Unit based on textural, chemical and geochronological criteria. The timing of melt crystallization in this unit is recorded at ca. 616 Ma in a Grt-bearing felsic granulite and at ca. 613 Ma (n = 54; MSWD = 0.82) by abundant soccer ball zircon growth in a mafic granulite. Sector-zoned and highly luminescent zircon overgrowths in leucosomes are HREE-depleted and yielded slightly younger concordia ages of ca. 611 Ma for a coarse-grained hornblende-bearing granite and ca. 608 Ma for a fine-grained granite. The $^{87}Sr/^{86}Sr$ (625Ma) and εNd (625Ma) values in 15 samples range from ~0.705 to 0.711 and from -5 to -11, respectively, providing evidence for an older crustal contribution in the formation of the SGN. The smaller isotopic range exhibited by migmatites ($^{87}Sr/^{86}Sr$ (625Ma) = 0.706-0.709; εNd (625Ma) = -7 to -8) is interpreted as Sr and Nd isotopic homogenization during partial melting in the Upper Migmatite Unit.