PT.001

Timing of the partial melting in the Socorro-Guaxupé Nappe, Brazil: constraints from in-situ monazite and zircon dating of migmatites and garnet-bearing leucosome

Rocha BC[1], Moraes R[1], Möller A[2], Cioffi CR[1], Jercinovic MJ[3] - [1]Instituto de Geociências - Universidade de São Paulo - Departamento de Mineralogia e Geotectônica, [2]University of Kansas - Department of Geology, [3]University of Massachusetts - Department of Geosciences

Linking geochronological information from zircon and monazite to petrological data can ideally provide a direct assessment of the duration of metamorphic processes and events. The growth of monazite under high-grade conditions tends to define a narrower age distribution than zircon within the same rock, because pre-metamorphic inheritance is less common. Integration of full thin-section compositional maps with high-resolution X-ray compositional maps has the potential to link dates obtained from distinct monazite compositional domains to specific metamorphic reactions. This approach is used to investigate high-grade metasedimentary rocks from the Socorro-Guaxupé Nappe (MG) Brazil, to place constraints on the timing of the partial melting. The Socorro-Guaxupé Nappe represents the root of a magmatic arc emplaced at the active margin of the Paranapanema plate during the Neoproterozoic. High-temperature metamorphism recorded by granulites and migmatites is a result of the Ediacaran collision between the Paranapanema and the São Francisco plates during the southern Brasília orogeny. Studied rocks include a stromatic metatexite, a schollen migmatite (leucosome and host garnet-biotite gneiss) and mafic granulite within the segregated leucosome. Three distinct REE patterns are recognized within leucosome, suggesting fractional crystallization in the evolution of an anatectic melt. Mesosome exhibits the highest REE contents and is characterized by negative Eu anomaly (Eu/Eu* = 0.4-0.8). The $^{87}Sr/^{86}Sr_{(625Ma)}$ and $\varepsilon_{Nd(625Ma)}$ values of leucosome and mesosome range from ~0.706 to 0.709 and from -7 to -8, respectively, suggesting Sr and Nd isotopic homogenization during partial melting. U-Pb zircon dates from the analyzed samples show a large spread from *ca*. 600 to 720 Ma. The younger dates ranging from 600 to 630 Ma are interpreted to date major episodes of melt crystallization after granulite-facies metamorphism. The older dates from 640 to 720 Ma may be related to inheritance. Mafic granulite yields zircon ages from 600-650 Ma. Inherited zircon cores with oscillatory zoning from mafic granulite have higher Th/U ratios (0.7-1.2) than CL-bright rims and recrystallized domains (0.02-0.5). Migmatites are characterized by zircons with low Th/U ratios and by abundant monazite in a variety of textural settings (locally up to 3mm large euhedral grains within leucosome). Zircon growth related to the partial melting event typically has lower Th/U ratios as monazite scavenges Th. Monazite mapping and chemical dating revealed complex zoning patterns. Y-rich resorbed monazite cores (14000-26000 ppm) occur mainly as inclusions in garnet and most likely correspond to the pre-garnet stages of prograde metamorphism at *ca*. 630 Ma. Monazite crystallized from melt is Th-rich (60000-125000 ppm) and Y-depleted (<4000 ppm) due to growth in the presence of peritectic garnet at 620-600 Ma. High-Y rims (7000-12000 ppm) can be related to retrograde garnet-breakdown between 618 and 594 Ma. High-Th rims (70000-100000 ppm) are interpreted as a late recrystallization event at 608-592 Ma. The main growth stage of monazite is related to melt crystallization. Thus, monazite is a valuable tool in deciphering distinct episodes of metamorphism, partial melting and crystallization in arc-related metasedimentary rocks compared to zircon, as monazite grains grow entirely during the metamorphic event and inheritance is only seen in zircon.