USING TITANITE PETROCHRONOLOGY TO CONSTRAIN THE P-T-t EVOLUTION OF THE SOUTHERN BRASÍLIA OROGEN BASEMENT ROCKS

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Titanite (CaTiSiO5) is powerful petrochronometer for metamorphic rocks because of its capacity to record multiple evolution stages that are not usually documented by the less reactive mineral zircon. It is abundant in orthogneisses that lack other reactive geochronometers like monazite, and therefore a potent tool to decode metamorphic evolution of orogenic basement complexes. We report an in-situ titanite U-Pb and trace element dataset from upper amphibolite facies metatexitic gneisses from the Pouso Alegre Complex in the basement of the Neoproterozoic southern Brasília Orogen, SE Brazil. These orthogneisses record Paleoproterozoic igneous crystallization ages but were strongly reworked during the Neoproterozoic orogenic events. The titanite data were combined with petrographic observations, major phases compositions, phase equilibria modeling and U-Pb zircon dating and used to define the Neoproterozoic evolution. This includes the age and pressure-temperature conditions of the metamorphic peak attained at lower crust conditions and the exhumation to mid-crust levels. The dataset also gives clues on the effects of retrograde net-transfer reactions on titanite trace element compositions and how this can be used to track subduction-exhumation processes. The studied garnet-amphibole metatexitic gneisses record metamorphic peak conditions of 750-775 °C and 10.5-12.5 kbar constrained at ca. 628-618 Ma based on HREE+Y depleted titanite cores. A major melt crystallization event during cooling is recorded by leucosome zircons at ca. 616-615 Ma. The exhumation of the complex and re-equilibration to 550-625 °C at 6-9 kbar was associated with widespread generation of biotite + epidote/clinozoisite at the expense of garnet + amphibole along the main foliation. Trace element signatures of these retrograde reactions are recorded in titanite rims, which are HREE+Y enriched and strontium depleted, and were dated at 605.7 ± 6.2 Ma. The average zirconium contents of these titanite rims are higher than the cores suggesting disequilibrium partitioning of zirconium into titanite during the retrograde path, resulting in overestimated Zr-in-titanite temperatures for the rims. This is most likely a result of sluggish zirconium diffusion at lower temperatures that did not allow the maintenance of equilibrium between titanite and zircon. The exhumation of the complex was contemporaneous to the intrusion of leucogranite dykes dated at 607 ± 5.7 Ma, which are folded and show recrystallization textures indicating the continuation of deformation after their intrusion. Considering the Pouso Alegre Complex as part of the São Francisco paleo-continent reworked during the Neoproterozoic orogenesis, the data constrain a minimum age of ca. 620-630 Ma for the collision between the São Francisco paleo-continent and the Paranapanema block and suggest long-lived deformation and metamorphism during the southern Brasília orogeny. The dataset also indicates that titanite trace element uptake is sensitive to local trace element composition that changes as metamorphic reactions progress. Therefore, titanite trace element patterns can be used to link titanite to major mineral assemblages and metamorphic reactions.