

TIMING OF THE POST-OROGENIC HYDROTHERMAL FLUID FLOW IN THE ESPINHAÇO RANGE: CONSTRAINTS ON MONAZITE AND RUTILE

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RESUMO: Quartz-vein formation is usually related to fluid-hosted diffusion or to metre- to kilometre-scale fluid-flow. Large-scale fluid flow is typically related to crustal-scale processes that may be responsible for mineralization, facilitate deformation and/or cause mineralogical, bulk chemical or isotopic resetting. By contrast, veins formed by local fluid-rock interaction reflects smaller scale processes with restricted fluid volumes that do not have widespread impact. In this context, the Espinhaço Range (SE Brazil) is characterised by widespread quartz vein systems that crosscut the greenschist facies metasediments of the Espinhaço Supergroup. This range represents the thin-skinned thrust-fold belt of the Araçuaí Orogen, a protracted, polyphase and polymetamorphic Neoproterozoic orogen that was generated between 630-480Ma. The quartz metre-scale veins host monazite±rutile±hematite±xenotime±tourmaline±gold. In this study quartz vein-hosted monazite from two localities (Olhos D'Água and Chapada) are investigated. Monazite U-Pb ages, mineral major (monazite) and trace elements (quartz, rutile) and Sm-Nd isotopic compositions were acquired at UFOP by Laser Ablation-Inductively Coupled-Mass Spectrometry (LA-ICP-MS) in order to constrain the vein timing, precipitation temperature, and origin of the fluid. Monazite REE patterns exhibit strong relative enrichment in LREE, over the HREE and negligible Eu anomalies ($\text{Eu}/\text{Eu}^*=0.8$); consistent with a hydrothermal origin. U-Pb concordia ages obtained by LA-SF-ICP-MS are $483\pm 5\text{Ma}$ for the Chapada monazite and a lower intercept age (Tera-Wasseburg) of $484\pm 5\text{Ma}$ for the Olhos D'Água sample. These ages are slightly younger than an ID-TIMS U-Pb age of $495.5\pm 0.5\text{Ma}$ for quartz-vein hosted hydrothermal monazite in the Diamantina area (Gonçalves *et al.*, *this volume*). TitaniQ geothermometry pooled temperatures around 340°C . Sm-Nd composition (LA-MC-ICP-MS) yielded an $\epsilon_{\text{Nd}_t}=-18.0\pm 0.4$ for both monazite samples. Our data supports the idea that the fluids are related to the post-orogenic collapse of the Araçuaí Orogen (520–480Ma), from the anatectic-metamorphic core (E) in direction to the fold-thrust belt (Espinhaço range, W). Large-scale fluid flows following the direction of decreasing metamorphic grades have been described in several terranes worldwide (e.g., southern Australia). Our data considerably shorten the likely duration of the hydrothermal fluid flow in the Espinhaço range. Previous studies from the same area have suggested that fluid flow occurred as late as ca.425Ma. However, this age was constrained by non-matrix matched dating and was therefore underestimated by at least 4-5% due to the analytical approach. The upper limit (ca.520Ma) was constrained by U-Pb dating of rutile from quartz-veins about 80km to the south and xenotimes from quartz-veins (20km south) have also been dated in ca.510Ma. Within the anatetic core of the orogen, some ages around ca.490Ma has also been reported in monazites from granitoids. That can be explained by the reset of monazite in the presence of alkaline-bearing fluids that also crystalized several pegmatite bodies of the same age within the orogen. Hydrothermal monazite from similar hydrothermal quartz veins has recently been dated at 496Ma in the Quadrilátero Ferrífero region (200km south). We interpret the hydrothermalism in the Espinhaço range as a large-scale, low-temperature, fluid-flow that occurred for about 30Ma. U-Pb ages of rutile are in processes in order to better constrain the upper limit of this event.

PALAVRAS-CHAVE: ESPINHAÇO RANGE, HYDROTHERMALISM, U-Pb