Geophysical Research Abstracts
Vol. 14, EGU2012-887, 2012
EGU General Assembly 2012

Pre-rifting evolution of Neoproterozoic to Cambrian low to high grade metamorphic rocks of the South Atlantic passive continental margin, as revealed by 40Ar/39Ar and Zircon Fission-Track thermochronology, SE Brazil

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Pre-rift structures in Neoproterozoic metamorphic rocks are significant for the rift and post-rift evolution of the South Atlantic passive continental margin. The metamorphic basement has been deformed and metamorphosed during the Neoproterozoic orogeny (U-Pbmonazite: 613±1 and 607±3 Ma, Hackspacher et al. 2004). The data we present focus on a key location within the Mantiqueira Province, where the Jacutinga Shear Zone (JSZ) was active during the Neoproterozic as a major ductile thrust zone with a transform component. The JSZ is located at the border between the Southern Brasília Belt (Varginha - Guaxupé Terrane) and the Central Ribeira Belt. In general, metamorphic rocks of the Brasilia belt cooled below 350 °C around 599±1 and 587±1 Ma (40Ar/39Ar muscovite, Hackspacher et al. 2004). The JSZ has a long living history of structural evolution. Brittle reactivations of the JSZ and the neighbouring area leads to rock uplift, erosion and sedimentation of siliciclastic sediments into the subsiding part of the JSZ segment forming the Eleutério Basin. The oldest sedimentation age within the Eleutério Basin is considered to be 606 Ma with a basin inversion around 480 Ma (Teixeira, 2000). Tracing the JSZ into the Paraná Basin indicates a possible influence of the JSZ during the early evolution of the Paraná Basin. To better understand the movement and cooling history related to the tectonic evolution and the subsidence and inversion history of the Eleutério Basin, zircon fission-track thermochronology (ZFT) was applied. Four ages, ranging between 408 ± 41 and 476 ± 33 Ma, were obtained on low grade Cambrian sedimentary rocks of the Eleutério Basin, and basement gneisses, and mylonitic rocks of the JSZ. Within the error all four ZFT-ages are the same and might have been caused by a fast cooling after a heating event. Moreover, the weighted age of 456 ± 23 Ma is showing that a cooling process affected both the Cambrian low grade sedimentary rocks and the Neoproterozoic high grade metamorphic rocks.
The obtained ZFT and the existing 40Ar/39Arbiotite/muscovite ages support a better timing for the evolution of the Eleutério Basin and its inversion. The Brasília Belt tectonics related to the JSZ, promoted a local transtensional environment with related sedimentation. Therefore, sedimentation in the basin is suggested to be constrained between 580 and 530 Ma. 40Ar/39Arbiotite ages of 490 ± 1 Ma date the low grade metamorphism of the Cambrian siliciclastic rocks and, therefore, the resetting of the zircon fission-track system as well. Combining the 490 Ma 40Ar/39Ar ages and ZFT cooling ages at 456 ± 23 Ma, gives a mean cooling rate of 2.5 °C/Ma between 490 and 456 Ma. This cooling might be caused by the inversion of the Eleutério Basin and the erosion of younger sedimentary units. The cooling and inversion process within the Eleutério Basin is time equivalent to the first subsidence and sediment deposition within the Paraná Basin.