Cooling rates in high pressure granulite from Southern Brasília Orogen (SE-Brazil)

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A combination of U-Th-Pb_T monazite EPMA dating and LA-ICP-MS rutile dating is used to assess the cooling rates of high-pressure granulite from the Passos Nappe (SE - Brazil). These rocks have a pelitic protolith and record a peak assemblage of garnet + kyanite + rutile + K-feldspar + melt formed at 860 ˚C and 1.8 GPa. Retrograde conditions of 800 ˚C and 1.0 GPa are marked by grossular content, anorthite composition and biotite crystallization. Metamorphic peak conditions occurred *ca*. 635 Ma, based on monazite dating, whereas rutile ages of *ca*. 590 Ma record the late retrograde stage (at *ca*. 600 ˚C), associated with late chlorite replacing biotite. Muscovite K-Ar ages in the Passos Nappe of *ca.* 570-580 Ma record the final cooling stages upon exhumation to the upper crust (*ca.* 300 ˚C) [1]. The studied rocks result from the metamorphism of continental margin sediments in the deep root of this Cryogenian-Ediacaran continent-continent collisional zone, which is related with the early phases of western Gondwana formation. The retrograde path records exhumation to 600 ˚C at < 1.0 GPa at a relatively slow integrated cooling rate, of *ca.* 6 ˚C/Ma (to the peak in 635 Ma to retrograde in 590 Ma). This slow cooling rate can be partially explained by the increase of melt production during the decompression. The cooling rate of the final stage of the retrograde *P*–*T*–t path, based on the muscovite age, is faster (*ca.* 15 ˚C/Ma) than calculated for the earlier phase. We infer that channel flow occurred in the presence of melt during the metamorphic peak (*ca.* 630 Ma), transitioning to localized fault slice tectonics during later stages of the *P*–*T*–t path, at *ca.* 590 Ma at lower temperatures (e.g. [2]). This interpretation would be consistent with switching from a slow cooling rate during initial exhumation in a viscous channel to faster cooling in a fault-block dominated regime.

[1] Valeriano *et al.* (2000). *Revista Brasileira de Geociências* **30(1)**, 195–199. [2] Chakraborty *et al.* (2017) *Lithos* **282-283**, 464-482