Contributions to thermo-tectonic history of the Rio Grande Rise (South Atlantic Ocean) as revealed by apatite (U-Th-Sm)/He thermochronology

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The Rio Grande Rise (RGR) consists of an aseismic, basaltic plateau currently submerged in the southwestern side of the South Atlantic Ocean. Its origin is still a matter of considerable debate, ranging from a microcontinent formed by fragmentation of the South American plate (1) to a basaltic ridge formed by expressive intra-plate magmatism triggered by the arrival of the Tristan da Cunha plume in the Cretaceous (2). The western portion of the RGR (WRGR) is crossed by a major rift-like structure known as the Cruzeiro do Sul Lineament (CSL) interpreted as tectonically active mainly from Upper Cretaceous to Middle Eocene (3). So far, understanding the development of the CSL is central to deciphering the thermo-tectonic history of the RGR with implications for the understanding of opening of the South Atlantic Ocean and the evolution of associated lithospheric plate margins. For this purpose, basaltic rocks from the northern and southern flanks of the CSL dredged during the Rio Grande Rise Project expedition (PROERG) carried out by the Geological Survey of Brazil (CPRM) were analysed for apatite (U-Th-Sm)/He (AHe) thermochronology. Thermal histories for these rocks (time-temperature paths) were obtained by the QTqt software (4). Single-grain AHe ages vary from ~5 to 65 Ma and the thermal histories indicate a phase of cooling at the southern flank in the Eocene, and three phases of cooling at the northern flank: in the Eocene, Miocene, and Pliocene, respectively. Based on published seismic and stratigraphic data (3,5,6), the Eocene cooling is mainly interpreted in terms of magmatic cooling and basement uplift and erosion, whereas the Miocene and the Pliocene cooling probably reflect tectonic driven basement uplift and erosion. The preliminary AHe data suggest that the CSL was tectonically active at least until the Pliocene. Plumes evolution also must be considered to explain these reactivations and uplifts.


