Southernmost Brazil and Uruguay basements thermal evolution investigated with low temperature thermochronometry

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Through the joint use of apatite fission tracks (AFT) and (U-Th)/He analysis in apatite (AHe) and zircons (ZHe), we evaluate the Phanerozoic thermotectonic evolution of the Rio Grande do Sul (RS) and Uruguay (UY) shields. These crustal segments were assembled during the multicollisional Brasiliano/Pan-African Orogeny (NeoP), West Gondwana formation. Regional shear zones cut through them and conditioned the subsequent Atlantic Ocean opening (Jur-Cre) on the eastern margins of the shields. In RS we obtained 18 AFT, 43 AHe and 30 ZHe ages. The eastern margin presents younger AFT ages (108±6 to 203±21 Ma) when compared to the western hinterland (200±34 to 302±31 Ma). AHe single crystal ages present a wide range, even intrasample, although 70% of them are Mesozoic. Such variability is a common signature of cratonic regions, where apatites remained for long periods at T<110°C and experienced complex thermal histories. Mean ZHe ages from the eastern RS are Permian, while the west presents Devonian ages. In UY we obtained 19 AFT, 45 AHe and 40 ZHe ages. UY AFT ages are Mesozoic, being younger towards the margin. UY He ages present similar dispersion to what is observed in the RS. Inverse thermal modelling indicates a Devonian-Carboniferous cooling phase in the west of the RS, time correlated with two events affecting southernmost Brazil: I) end of Gondwana glaciation, possibily leading to a regional uplift due to isostatic rebound, exposing basement rocks to weathering and raising erosion rates; II) Gondwanides Orogeny, that might have caused local uplift in response to compressive stresses at the SW margin of Gondwana. A major event affects most of the RS from the Permian to Jurassic, cooling rocks from 110°C to 50°C, likely related to lithosphere uplift and thinning preceding Gondwana breakup and Atlantic Ocean opening. Samples from the eastern RS suggest a subtle reheating afterwards, probably linked to a geothermal disturbance related to Gondwana rifting and associated magmatism. Final cooling to surface temperature affects the whole RS after the Paleocene. Future modelling will test whether UY had a similar thermotectonic history as the RS.