



Timing of seismic slip revealed by in situ Rb-Sr pseudotachylyte dating in Northeast Brazil

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Abstract

7) Pseudotachylytes are frictional melts that form during seismic slips, serving as evidence of past earthquakes. Understanding the recurrence of these seismic slip events in relation to orogenic cycles is crucial for gaining a comprehensive understanding of faulting and the development of fluid pathways. However, accurately dating pseudotachylytes poses significant challenges. Previous attempts to determine their ages, especially in mid- to upper-crustal settings, have utilized methods such as ⁴⁰Ar/³⁹Ar, zircon fission-track, and monazite U-Pb dating. Depending on the depth at which pseudotachylytes form within the crust, traditional methods like ⁴⁰Ar/³⁹Ar and zircon fission-track dating may yield ambiguous results due to closure temperatures lower than the ambient temperature, making it difficult to distinguish pseudotachylyte formation from host-rock cooling. To address this challenge, we introduce a novel approach for dating upper-crustal pseudotachylytes containing potassium-bearing minerals using the in situ Rb-Sr method.

We conducted in situ Rb-Sr dating on a pseudotachylyte sample obtained from the West Pernambuco shear zone, located in the Borborema Province of Northeast Brazil. This sample comprises mylonite with a granitic composition from the Paleoproterozoic Itaizinho Complex. The isochron analysis of the host-rock, which contains muscovite and K-feldspar, yielded an age of 566 ± 7 Ma (MSWD=0.6; N = 90), interpreted as the cooling age. In contrast, the isochron analysis of fine-grained muscovite from the pseudotachylyte yielded an age of 447 ± 7 Ma (MSWD=1.6; N=96), indicating the age of pseudotachylyte formation. REE spidergrams of the fine-grained muscovite from both the pseudotachylyte and the host-rock confirm their distinct nature as different phases, with the pseudotachylyte showing enrichment in both light and heavy rare earth elements compared to the host-rock. Furthermore, independent constraints from other thermochronometers and the deposition of the Tacaratu Formation directly in the crystalline basement suggest that the study area likely resided near the surface during the Silurian-Devonian period (approximately 440-360 Ma).

Our findings demonstrate the viability of using the in situ Rb-Sr method for dating K-bearing pseudotachylytes, offering a less time-consuming alternative. Moreover, data from the Pernambuco shear zone indicate that seismic slip activity occurred long after the orogenic cycle of the Brasiliano/Pan-African event (approximately 650-550 Ma), likely within a stable setting during the formation of an intracratonic basin.



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Programme

📅 17:00 to 18:30 on 05/14/2024
👤 room 1
(https://eventos.galoa.com.br/ssagi-2024/calendar/activity/11517)

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Track

- 4. Low Temperature Geochronology Applied to Tectonics and Geomorphology

Keywords

pseudotachylyte

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seismic slip

faulting

upper crust

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