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Petrochronology and thermal modeling of Variscan pseudotachylites from the Corsica-Sardinia Massif.

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The study of exhumed pseudotachylites – i.e. frictional melts produced along a fault plane during co-seismic slip - is crucial for understanding the physical conditions and the mechanical processes that control the behavior of seismogenic faults. The majority of pseudotachylites are reported from relatively shallow and cold structures (0.2-0.4 GPa, 300–450 °C). However, frictional melting might be transiently allowed at intermediate to lower-crustal depths (10–40 km), as suggested by the occasional seismicity of the lower crust.
In this contribution, we focus on the evolution of Variscan pseudotachylites from north Sardinia (Italy). Field relationships clearly indicate that the dense network of pseudotachylites developed during decompression of the lower crust, in a single event that occurred after an early Carboniferous melting stage and right before a second, much more extensive (biotite dehydration-melting), anatectic event.
The timing of faulting has been constrained by structural analysis and ELA-ICP-MS U/Th-Pb zircon, monazite and xenotime dating. Petrological analysis and pseudosection modelling constrain the conditions of early Carboniferous melting to about 720-740°C and 1.1–1.3 GPa. The second melting stage occurred at lower pressure (0.3–0.4 GPa), after the background temperature of metamorphic rocks was already below 600°C.
Simplified 1 and 2d numerical models demonstrate that transient heating related to the sudden injection of a large volume of frictional melts has the potential to rise the local temperature, triggering extensive melting at upper crustal conditions