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A comparative study of the variability of argon isotopic behaviour in pseudotachylites: Examples from Surinam, Turkey, Norway, and Alps.

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Pseudotachylites are produced by frictional melting on a time scale of seconds during large earthquakes and therefore represent a unique opportunity to study the mechanism of coseismic faulting and possibly date brittle deformation. Although these melts can be generated at variable depths and pressure-temperature conditions (i.e. from upper mantle to surface conditions), most of them record seismogenic rupture close to the ductile-brittle transition. An important challenge for geochronologists is to provide meaningful ages for these melts that help to constrain both the short and long term evolution of faults and the propagation of rupture at different depths. Several attempts have been made to date pseudotachylites using mainly the $^{40}Ar/^{39}Ar$ method. However because flash melting conditions do not allow large isotopic exchanges and because the physical and chemical characteristics of pseudotachylites vary depending on the host rock lithology and mode of generation, interpretating the results is generally not straightforward.

During this study, we selected pseudotachylites from different geological settings in order to investigate the effects of several parameters on the behaviour of argon isotopes during flash melting, especially P-T conditions, host rock lithology and age, fluid infiltration, relative abundance of clasts, chemical and physical properties of glass matrix ... The characteristics of these pseudotachylites were examined by a combination of microscopic, chemical microprobe analyses and cathodoluminescence, SEM, BSE and EBSD imaging. Finally, we applied the laser-probe $^{40}Ar/^{39}Ar$ dating method on rock thin sections and small glass chips. The variability of results on samples from Surinam, Turkey, Alps and Norway is discussed in the light of the characteristics of

each pseudotachylite type.