Scaling pseudotachylytes from the lab to the field

*Thomas P. Ferrand[1], Alexandre Schubnel[2], Nadège Hilairet[3], Loïc Labrousse[4], Stefan Nielsen[5]

1. Earthquake Research Institute, 2. Ecole Normale Supérieure, Paris, France, 3. Unité Matériaux et Transformations, Université de Lille, France, 4. Sorbonne Université, Institut des Sciences de la Terre Paris, France, 5. Department of Earth Sciences, Durham University, United Kingdom

Recent experimental and field results described high-pressure pseudotachylytes that formed in peridotite at mantle depth in similar pressure-temperature conditions. The pseudotachylyte is the rock originating from the solidification of the rupture-induced magma, often referred to as “frictional” melt, which transiently forms and aids sliding on the fault plane.
The pseudotachylyte thickness *a* scales with the relative displacement. The scaling law seems continuous over eight orders of magnitude from the laboratory to the field scale, for measured sliding varying from microns to meters. For magnitudes between -6 and 9, experimental and natural high-pressure faults show striking similarities.
In most lithologies, a kink is observed in the scaling law when the sliding and thickness reach 1 mm and 100 μm, respectively, i.e. Mw >1. This saturation of the pseudotachylyte thickness is due to the scale-depend efficiency of thermal diffusivity, and may also be affected by variations in magma mobility. Previous studies show a similar kink in seismological estimations of the fracture energy *G* as a function of *D*, for *D* > 10cm. The saturation of both *a* and *G* for large magnitudes would mark the transition from adiabatic to diffusive rupture propagation.
In addition, experimental micro-pseudotachylytes and experimental faults due to transformational faulting follow the same scaling law, which brings into light that transformational faulting could hide a transient melting stage.

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