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# Pseudotachylytes: towords a depth of origin

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Pseudotachylytes (pst) are the evidence of fossil frictional melts formed by seismic slip, meteoric impacts or large landslides. Fault-related pseudotachylytes record ancient hypocentres, usually located at upper crustal depths. However, evidence derived from both present seismicity and fossil earthquake sources, indicate that also the lower continental crust and subducting slabs may be the site where seismic events can be generated.

The present work shows the main distinguishing features of tectonically induced pseudotachylytes in relation to its formation depth. Our results are based on numerous examples from different depth of origin, e.g. the Mather Peninsula/Antarctica, the Serrre Massif/Calabria, the Idefjord Terrane/Sweden, the Ivrea Zone/Italy, the Alpine Fault/New Zealand, the Guajira Complex/Colombia, the Bucaramanga Fault/Colombia and others.

Independent on their depth of origin and the composition of the protolith, pseudotachylytes are composed of a fine-grained matrix, clasts as relicts of the protolith, newly formed minerals resulting from devitrification or crystallization during rapid cooling. In addition, most pst show chilled margins, flow folds, layering, branching injection veins, evidence of post-seismic creep and cataclastic as well as ductile grain-size reduction before melting starts. Therefore, the described features are not diagnostic for the evaluation of the paleo-depth of the seismic failure.

One of the best criterions to obtain data on the depth of formation is the stability of newly formed (quenched) minerals, which are crystallized directly from the melt as well as post-slip minerals overgrowing the pseudotachylyte matrix. Garnet, biotite and pyroxene play a major role in estimating the depth of frictional melts and therefore the depth of the approximately paleo-hypocenters. Frictional melts from normal crust and subducted crust behave in most parts similar in respect to fabric evolution. However, melt generated-high-pressure minerals are diagnostic for seismic events in subduction zones Furthermore, the presence or lack of amygdules, reactivation fabrics and different types of injection veins as well as the composition of the newly formed melts are typical signatures of the paleo-depth.

New work on the chemical composition of pst reveals diagnostic heterogeneities Compositional layering, displayed by chemical segregation, indicates the sequence of previously melted minerals and fluid contents. The new study suggests a pressure-dependant composition and configuration of these layers.

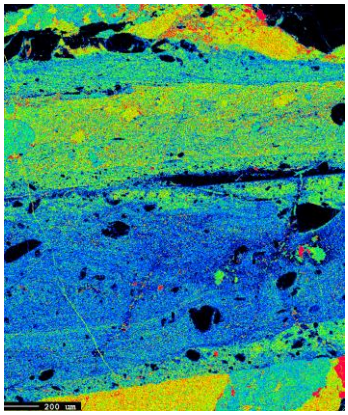

*Figure 1: Layered distribution of Fe in a lower crustal pseudotachylyte,( Calabria) indicating a sequence of previously melted minerals.*