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Blueschist- and Eclogite facies Pseudotachylytes: Products of Earthquakes in Collision- and Subduction zones

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Pseudotachylytes are the products of violent geological processes such as metorite impacts and seismic faulting. The fault-rock weakening processes leading to release of earthquakes are commonly related to phenomena such as grain size reduction and gouge formation, pressurization of pore-fluids and in some cases to melting by frictional heating. Explaining the frequently observed intermediate and deep earthquakes by brittle failure is, however, inherently difficult to reconcile because of extremely high normal stresses occuring at depth. In recent years several mechanisms for seismic events on deep faults have been suggested. These include:
a) The most commonly accepted mechanism, dehydration embrittlement coupled to prograde metamorphic dehydration of wet rocks, such as serpentinites, at depth.
b) Grain-size dependent flow-laws coupled with shear heating instability has been suggested as an alternative to explain repeated seismic faulting in Wadati-Benioff zones.
c) Self-localized-thermal-runaway (SLTR) has been forwarded as a mechanism for ultimate failure of visco-elastic materials and as mechanism to explain the co-existence of shear zones and pseudotachylyte fault veins formed at eclogite facies conditions.

All these mechanism point to the importance of metamorphism and/or metasomatism in understanding the mechanism(s) of intermediate- and deep earthquakes. Exhumed high to ultra-high pressure [(U)HP] metamorphic rocks are recognized in many orogenic belts. These complexes provide avenues to study a number of important products of geological processes including earthquakes with hypocentres at great depths. (U)HP co-seismic fault rocks are difficult to find in the field; nevertheless, a number of occurrences of co-seismic fault rocks from such complexes have been described after the initial discovery of such rocks in Norway (see: Austrheim and Boundy, Science 1994).
In this talk we review some observations and interpretations based on these hitherto rarely observed but important co-seismic fault rocks from deep-crust and mantle complexes.