Formation of pseudotachylyte in the lower crust plastic regimes: Evidence from the Woodroffe thrust, central Australi

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Most reported fault-related pseudotachylytes are cataclasite-related, which have formed at shallow depths in brittle dominated seismogenic fault zones by both frictional melting and crushing mechanisms. Pseudotachylyte has also been described in association with mylonitic rocks having formed in deep-level fault shear zones within the semi-brittle to crystal-plastic regimes. However, the mechanism of coseismic shear zone formation in the lower crust is still poorly understood.
A >3.0 km-wide pseudotachylyte generation zone including a 1.5 km-wide mylonitized shear zone marked by large volumes of sub-mm- to cm-scale pseudotachylyte veins is developed along the Woodroffe thrust (central Australia) (Lin et al., 2005; Lin, 2008). The pseudotachylytes display typical melt-origin features, including rounded and embayed clasts, spherulitic and dendritic microlites, and flow structures within a fine-grained matrix. Three types of pseudotachylyte are identified on the basis of deformation texture, vein morphology, and host rock lithology: cataclasite-related (C-Pt), mylonite-related (M-Pt), and ultramylonite-related (Um-Pt). The textural and structural relationships between these pseudotachylyte veins and wall rocks indicate multiple stages of pseudotachylyte veins that formed at different times and depths.
Preliminary works have been performed by Lin et al. (2005) and Lin (2008), which have reported large volumes of coexisting C-Pt, M-Pt, and Um-Pt in cataclastic and mylonitic rocks within individual shear zones along the Woodroffe thrust. The M-Pt and Um-Pt veins contain distinct evidence of ductile deformation, including flattened and aligned fragments of host rocks that were re-oriented parallel to the foliation within the mylonite and ultramylonite, as evidenced from the continuity of the foliation between the host rock and vein fragments. These M-Pt and Um-Pt veins generally cut across the mylonitic foliation, and can locally be traced back to parent veins oriented parallel to the mylonitic foliation. These overprinting structural relationships indicate tat repeated pseudotachylyte-generating events occurred within the crystal-plastic dominated shear zone and that the pseudotachylyte veins themselves were mylonitized during ongoing plastic deformation. Here, we describe the microstructural and chemical characteristics of pseudotachylytes and discuss the processes leading to coseismic shear zone formation in the lower crust.
References:
Lin, A. et al., 2005, Propagation of seismic slip from brittle to ductile crust: Evidence from pseudotachylyte of the Woodroffe thrust, central Australia. *Tectonophysics* 402, 21-35.
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