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Earthquake fossil: ultralcataclastic veins occurred along the Arima-Takatsuki Tectonic Line

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In this study, we present a case study of veinlet ultracataclastic rocks from the Arima-Takatsuki Tectonic Line (ATTL), southwest Japan. Field investigations and meso-microstructural analyses reveal that numerous veinlet ultralcataclastic rocks, composed of aphanitic pseudotachylyte (Pt) and unconsolidated fault gouge and alluvial deposits, are widely developed within a wide fault zone of ˜200 m as simple veins, breccias, and complex networks along the ATTL. These veinlet fault rocks generally show dark, green, gray, brownish-red in color. Microstructurally, all these veins are mainly characterized by a superfine- to fine-grained matrix and angular?subangular fragments ranging in size from sub-micron scale to several millimeters. Powder X-ray diffraction patterns show that all veins are characterized by crystalline materials composed mainly of quartz and feldspar, similar to the host granitic rocks.

Based on the meso- and microstructural features of ultracataclastic veins and the results of powder X-ray diffraction analyses, we conclude that i) all veinlet ultracaclastic rocks were generated mainly by crushing, ii) the veinlet and network veins formed repeatedly within the fault-fracture zone via the rapid fluidization and injection of superfine- to fine-grained materials during seismic faulting events; iii) the pseudotachylyte veins formed by crushing but not melting. The present results show that the fluidized ultracataclastic veins record paleoseismic faulting events that occurred within a seismogenic fault zone; consequently, these features are a type of earthquake fossil, as is melt-origin pseudotachylyte.

Reference: Lin, A. (2011). Seismic slip recorded in the fluidized ultractaclastic veins formed along the coseismic shear zone during the 2008 Mw7.9 Wenchuan earthquake, Geology, in press.

Keywords: pseudotachylyte, veinlet fault rock, Arima-Takatsuki Tectonic Line