Episodic tremor and slip explained by crack-seal veins and viscous shear in subduction mélanges

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Episodic tremor and slow slip (ETS) occurs in the transition zone between the locked seismogenic zone and deeper, stably sliding zones. Actual conditions of ETS are enigmatic, due to lack of direct geological observations and low resolution of geophysical information from the ETS source. We report that crack-seal shear and extension veins in subduction mélanges record repeated low-angle thrust-sense frictional sliding and tensile fracturing at near-lithostatic fluid pressures. Crack-seal veins are coeval with viscous shear zones that accommodated deformation by pressure solution creep. The minimum time interval between thrusting events is less than a few years. The short recurrence time of low-angle brittle thrusting at near-lithostatic fluid overpressures within viscous shear zones, recorded in subduction mélanges, could explain frequent release of accumulated strain by ETS.

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