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Brittle-ductile transition of serpentinites in subduction zones: Roles of pore fluid pressure

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Geophysical observations suggest that the mantle wedge and subducting slabs and partly serpentinized. Low-velocity and high-Vp/Vs anomaly zones were identified along the subducting plate boundary in SW Japan, where slow earthquakes and deep tremors occur, whereas no such velocity anomaly zones have been observed in the source region of the 2011 Tohoku-oki earthquake (M9) in the NE Japan subduction zone (Shimizu, 2014). These facts indicate that seismogenic processes on the plate interfaces are greatly influenced by the presence or absence of serpentinites and overpressurized fluids. Relationships between intermediate-depth earthquakes and dehydration of serpentinites have been discussed based on high-PT deformation experiments and the studies of thermal structures in subduction zones. Several different mechanisms have been proposed for mechanical instability in double seismic zones in subducting slabs triggered by dehydration reaction. In this talk, I briefly review the rheological and frictional properties of serpentinites at high-PT conditions and show some experimental results of ourselves, and then discuss the influence of pore fluid pressure on brittle-ductile transition of serpentinites and seismogenic processes in subduction zones.

Reference

Shimizu, I., 2014, Rheological profile across the NE Japan interplate megathrust in the source region of the 2011 Mw9.0 Tohoku-oki earthquake, Earth, Planets and Space, 66:73, doi:10.1186/1880-5981-66-73
(http://www.earth-planets-space.com/content/66/1/73)

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Keywords: serpentine, pore pressure, rheology, brittle-ductile transition, seismogenic zone, high-PT deformation experiment