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Linking deformation of serpentine, anisotropy and seismicity of subduction

Bruno Reynard[1*]

[1]CNRS ENS Lyon France

Antigorite is a major component of hydrated serpentinites in subduction zone context. Its presence and deformability likely control the downdip extent of the seismogenic zone and exhumation processes. Large deformation of serpentinites may induce a strong anisotropy of various properties in serpentine bearing-rocks. For example, seismic anisotropy is potentially extreme in serpentinites and may allow their seismic detection as well as the determination of the deformation pattern at the plate interface and in the mantle wedge. Hydration of the mantle wedge down to 15 0 km may therefore exert a significant control on the tectonic evolution of subduction zones. Links between antigorite deformation, seismic properties, and seismicity are suggested from experimental deformation and elasticity measurements that we present here. Rheological measurements are consistent with "fast creep" events at timescales down to those associated with slow slip events and silent earthquakes. The impossibility of building stress in very serpentinized areas could also explain seismicity gaps, and high exhumation speed in a serpentinized mantle wedge. Elastic measurements confirm the guessed strong anisotropy of serpentine single-crystals and of serpentines with strong lattice-preferred orientations. The presence of serpentinites in subduction may well explain a significant part of seismic anisotropy with a rather complex deformation pattern involving kilometric folds in the mantle wedge.

Keywords: serpentine, deformation, subduction, seismicity, anisotropy