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On the frictional weakness of serpentine-bearing fault zones: implications for the activity of detachments

Telemaco Tesei, Christopher Harbord, Cristiano Collettini, Nicola De Paola, and Cecilia Viti
Durham University (telemaco.tesei@durham.ac.uk

Serpentinites are major constituents of oceanic lithosphere shear zones located at slow-spreading margins, transform plate boundaries and obduction complexes. In particular there is ample geological and geophysical evidence of the widespread serpentinization associated to fracture zones and detachment faulting at slow spreading ridges and magma-poor rifted margins.
Here we present laboratory experiments performed on a suite of serpentine samples, retrieved from a serpentine-rich shear zone. We observe that the main, low temperature polymorphs components of ocean-floor retrograde serpentinites (e.g. lizardite, chrysotile and polygonal serpentine) exhibit friction coefficients, $\mu < 0.2$, which are lower than previously reported, over a range of pressure and temperature conditions. We applied the frictional reactivation theory based on our experimental result to serpentine-bearing oceanic detachments. We show that detachments may slip until they rotate to very shallow dips $\sim$15°, as documented along some Atlantic detachments, accommodating large amounts of extension.