Deformation and mineralogy of serpentinites in a high-pressure suite: the Tehuitzingo serpentinitic belt (south Mexico)

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The N-S Tehuitzingo serpentinitic belt (TSB) is the biggest outcrop of ultramafic rocks (8 km long and 800 m wide) in the HP rocks of the Acatlán Complex (southern Mexico). However, although numerous specialized studies have been carried out in this serpentinitic belt, a detailed structural analysis is still lacking. In this work we present a detailed study of the structures, texture and mineralogy to understand the emplacement and deformation history of serpentinites, as related to the serpentine polymorphs.

In the TSB we observed different and complex microstructures, including three foliations (S_1, S_2 and late S_3), lineations, fractures and faults. The grain-scale penetrative foliation S_1 has an average NNE-SSW trend and is cut by a NW-SE oriented spaced S_2 foliation. In general, S_1 is parallel to S_2, due to isoclinal folding. The S_3 foliation has a preferential N15°W oriented strike and is spaced. The TSB hosts rigid blocks of serpentinite, garnet-metaeclogite, garnet-mica-schist, amphibolite and metabasites which have sigmoidal bodies separated from the serpentinites by shear zones.

Petrological and mineralogical studies (SEM and Raman spectroscopy) allowed us to define different microstructures in the serpentinites, including: i) a penetrative S_1 foliation defined by acicular antigorite and a mixture of antigorite-lizardite crystals; ii) rigid blocks made mainly of lizardite; iii) the spaced S_2 foliation shows S-C structures and microfolding in antigorite; and iv) S_3 foliation has mainly lizardite.

The different microstructures and serpentine polymorphs suggest that the TSB preserved four deformation-serpentinization events: 1) D_1 formed the lizardite-bearing rigid blocks at <350 °C; 2); D_2 developed a penetrative S_1 foliation and acicular antigorite around the rigid blocks at 350-460 °C and >5 Kbar; 3) D_3 is preserved in retrograded garnets of the non-serpentinitic rigid blocks hosted in the serpentinites, and in the partial replacement of antigorite by lizardite in the S_1-S_2 fabrics at 250–400 °C; 4); D_4 is preserved as a cataclastic fabric developed in lizardite at ca. 100 °C (*i.e.*, compressive phase), fractures and normal faults (*i.e.*, extensional phase).