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Deformation of olivine + antigorite aggregates : effect of phase proportions and in-situ evaluation of stress partitionning.

Nadege Hilairet (1), Thomas Ferrand (2), Paul Raterron (1), Sébastien Merkel (1), Guignard Jérémy (3), Alexandre Schubnel (2), Wilson Crichton (3), and Christopher Langrand (1)

(1) CNRS, UMET - Université Lille 1, Villeneuve d'Ascq, France (Nadege.hilairet@univ-lille1.fr), (2) Ecole Normale Supérieure, Paris, France, (3) European Synchrotron Radiation Facility, Grenoble, France

Serpentinization is expected to occur when fluids are released from the dehydrating subducting slabs and migrate into shear zones and the mantle wedge formed of peridotite. At shallow depths (15-30km) a few percent volume serpentine can lower the viscosity of peridotites by almost an order of magnitude [1], which can have major implications for strain localization in peridotite bodies. However, the deformation mechanisms observed at shallow depths are not easily extrapolable to deeper contexts and monomineralic rocks do not necessarily deform with the same mechanisms as multiphase rocks. The behavior of rocks with two phases of contrasted mechanical properties is highly non-linear with composition and cannot be easily modeled from its end-members. Here we investigate the rheology of antigorite + olivine « synthetic » peridotites with varying serpentine content (5 to 50%) at high pressure (2- 3 GPa, ca. 60-90 km depth), using the D-DIA large volume press and synchrotron powder X-ray diffraction and imaging. The results provide insights on the conditions under which serpentinized peridotites evolve in a regime dominated by the rheology of the strongest phase (olivine) or the weakest phase (antigorite).

[1] Escartin et al, Journal of Geophysical Research, 1997