Deformation mechanisms of antigorite serpentinite at subduction zone conditions

A.L. AUZENDE[1], J. ESCARTIN[2], N. WALTE[3], S. GUILLOT[1], G. HIRTH[4], D.J. FROST[3]

[1]ISTerre, Université Grenoble Alpes, Grenoble, France
[2]Institut de Physique du Globe, CNRS, Paris, France
[3]Bayerische Geoinstitute, Bayreuth, Germany
[4]Dpt of Geological Sc, Brown University, Providence, USA

We performed deformation-DIA experiments on antigorite serpentinite at pressures of 1–3.5 GPa and temperatures of between 400 and 650◦C, bracketing the stability of antigorite under subduction zone conditions. For each set of pressure–temperature (*P–T*) conditions, we conducted two runs at strain rates of 5 ×10−5and 1 ×10−4s−1. We complemented our study with a sample deformed in a Griggs-type apparatus at 1 GPa and 400◦C [1], and with natural samples from Cuba and the Alps deformed under blueschist/eclogitic conditions. Optical and transmission electron microscopieswere used for microstructural characterization and determination of deformation mechanisms. Our observations on experimentally deformed antigorite prior to breakdown show that deformation is dominated by cataclastic flow with observable but minor contribution of plastic deformation (microkinking and (001) gliding mainly expressed by stacking disorder mainly). In contrast, in naturally deformed samples, plastic deformation structures are dominant(stacking disorder, kinking, pressure solution), with minor but also perceptible contribution of brittle deformation. When dehydration occurs in experiments, plasticity increases and is coupled to local embrittlement that we attribute to antigorite dehydration. In dehydrating samples collected in the Alps, embrittlement is also observed suggesting that dehydration may contribute to intermediate-depth seismicity. Our results thus show that semibrittle deformation operates within and above the stability field of antigorite. However, the plastic deformation recorded by naturally deformed samples was likely acquired at low strain rates. We also document that the corrugated structure of antigorite controls the strain accommodation mechanisms under subduction conditions, with preferred inter-and intra-grain cracking along (001) and gliding along both *a*and *b*. We also show that antigorite rheology in subduction zones is partly controlled by the presence of fluids, which can percolate within the exhumation channel via deformation-induced interconnected porosity

[1] Chernak & Hirth, 2010, *EPSL*, **296**, 23-33.