Geophysical Research Abstracts, Vol. 7, 08364, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08364

Talc deformation: first results from the microstructural study of experimental and natural samples

M. Andreani (1), J. Escartin (1), G. Hirth (2) and B. Evans (3)

(1) Laboratoire de Geosciences Marines, IPG/CNRS, Paris, France, (2) Dpt. of Geology and Geophysics, WHOI, MA, USA, (3) Dpt. of Earth, Atmospheric and Planetary Sciences, MIT, MA, USA, Contact: andreani@ipgp.jussieu.fr

Talc is an alteration product found in hydrated oceanic lithosphere, and recent observations suggest that is common along shear zones, detachments, or fracture zones, where it probably indicates the circulation of reactive fluids during deformation. Talc is also formed in the down-going slab at subduction zones, when serpentinite dehydrates. As is true of some other sheet silicates, talc is relatively weak when deformed at low pressures. Its strength is ˜20% of the maximum strength of lizardite and its friction coefficient is only about 0.2. Likely, this mineral, when present, plays a major role in strain localization and in weakening. In spite of these potential implications, the mechanical behaviour and deformation mechanisms of talc are still poorly characterized.

Consequently, we ran conventional triaxial experiments on intact cores of pure talc rocks. The mechanical experiments were conducted from room temperature to 600°C, at confining pressures from 0 to 350MPa, and at strain rates of ˜10-5 s-1. To complement the mechanical tests, we also conducted detailed microstructural analyses, using optical and electron microscopes to characterize the deformation mechanisms and their potential evolution under these different P-T conditions. We present here preliminary observations of the microstructures of these experimentally deformed samples and compare them to the ones found in naturally deformed talc schists found along an oceanic detachment. Macroscopic structures on experimental core sections show that in all the samples, deformation is accommodated on shear zones oriented between ˜45° and 50° to the principal stress. The most intense localization is observed in the highest T sample (T=600C, P=300MPa). Deformation is more distributed in the low T ones where numerous shear zones of limited length, parallel to the main one, form

a deformation band in the conjugate direction, oriented at 40° to the principal stress. Both the strength and the qualitative macroscopic appearance are only slightly dependent on pressure at low T. SEM images of polished core sections reveal the internal structure of these shear zones. At low T, deformation is mainly accommodated by a cataclastic zone, about 150 microns wide, that shows a well developed foliation and localized shear planes. The sigmoidal foliation is underlined by a preferred reorientation of minerals by solid rotation and folding. Localized shear planes may result from intergranular motion or from intragranular slip along properly oriented 001 planes. This latter mechanism would be in accordance with the absence of dilation with deformation observed during experiments. In schists along oceanic detachment faults, talc occurs in association with amphibole, chlorite, and serpentine. The relative abundance of these minerals depends mostly on the nature of the protolith and the composition of reactive fluids infiltrating along the fault. Petrographic observations suggest a complex history of ductile to brittle deformation involving synkinematic growth of minerals and the production of cataclastic bands with foliations of varying intensity.