

Plasticity of antigorite serpentinite

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Antigorite serpentinite is believed to be widespread in and along oceanic plates undergoing subduction. Deformation of serpentinite probably plays an important role in subduction and exhumation process of slab. However, rheological behavior of serpentinite is poorly understood, especially at more than 1GPa. Here I conducted constant strain rate deformation experiments of antigorite serpentinite and microstructural observation of recovered samples, in order to clarify the rheological characteristic of it. Experimental conditions are ca. 1 GPa and 3 GPa confining pressures, and 350 C to 700 C temperatures at 2.0 to 2.4×10^{-5} /s strain rate. I got the following three results. 1) At 1 GPa confining pressure conditions, the samples were deformed brittly near reaching steady state conditions. The maximum strength of the samples increases with an increasing temperature. 2) At 3 GPa confining pressure conditions, the samples were deformed plastically to reach the steady state conditions. The flow strength decreases with an increasing temperature. 3) The typical microstructure of recovered samples from both 1 GPa and 3 GPa confining pressure conditions is the damage of (001) planes of antigorites which is recognized from tilting and destruction to amorphousization. This should be caused by (001) lattice slip.

These results indicate that deformation of antigorite serpentinite at 1 GPa is controlled by two microstructural processes, that are (001) lattice slip and recovery. These are non-thermal and thermal activation processes, respectively. This fact is entirely different from deformation characteristic of the other mantle mineral such as olivine and garnet, in which the deformation is controlled by lattice deformation and recovery processes. Both of these are thermal activation processes.