Geophysical Research Abstracts
Vol. 14, EGU2012-12195-1, 2012
EGU General Assembly 2012

The deformation micro-structures and the relationships of crystal orientation between olivine and antigorite in serpentinized peridotite from Toba area, SW Japan

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Foliated serpentinite with lattice preferred orientation (LPO) has strong elastic anisotropy, and is considered as a cause for seismic anisotropy observed in subduction zones (Katayama et al., 2009; Jung, 2011). However, deformation mechanisms of antigorite LPO are unclear. We measured crystal orientation of antigorite and olivine, to clarify the chronological relations between shear deformation and formation of antigorite LPO. The crystal orientations are measured by the U-stage optically. In addition, we try to measure the antigorite orientations by EBSD.

The studied samples are from lenticular serpentinite bodies intruded in a Jurassic accretionary complex, Toba area, southwest Japan. Shear zones ($<$10 m), consisting of foliated antigorite serpentinite, develop in the serpentinite body at the outcrop scale. The serpentinite mainly consist of antigorite and olivine. The serpentinite develops foliation and lineation, defined by the fabric of antigorite and elongated olivine grains.

Olivine and antigorite shows mylonitic textures, such as porphyroclast-system and a composite planar fabric. Antigorite blades are crystallized in the pressure shadow and pull-apart of olivine porphyroclast, indicating syn-kinematic growth. Olivine grains develop deformation bands, and its composition is homogeneous. The serpentinite also undergoes serpentinization at low temperature, crystallizing lizardite and chrysotile.

Relic olivine grains have lattice preferred orientation (LPO), which formed before the antigorite serpentinization. The LPOs of olivine show point maximum. However, these concentrations deviate from the foliation and lineation of serpentinite mylonite.

LPOs of antigorite, determined by U-stage as well as EBSD, from olivine free domains, show that b axes of antigorite are parallel to the lineation, c axes are normal to the foliation or form a partial girdle distribution normal to the lineation, and a axes show a point maximum or make a partial girdle normal to the lineation. The LPOs of antigorite, from aggregate of olivine and antigorite, are controlled by the crystal orientation of host olivine grain. The following are the relationships recognized by the optical measurements,

(1) [100]ol//[100]atg, (010)ol//(001)atg, [001]ol //[010]atg,

(2) [100]ol//[010]atg, (010)ol//(001)atg, [001]ol //[100]atg.

In both cases, b axes of antigorite tend to be parallel to the lineation.

The shear deformation would align the b axis of antigorite to be parallel to the lineation (shear direction), although the crystal relationships between antigorite and olivine are topotaxial (Boudier et al. 2010).