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Elastic Wave Velocities of Antigorite-Bearing Serpentinite Mylonites

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The relationships between elastic wave velocities and petrofabrics were studied in antigorite-bearing serpentinite mylonites. Rock samples with antigorite content from 40 to 80 vol.% were collected from the Happo ultramafic complex, Central Japan. Compressional and shear wave velocities were measured by the pulse transmission technique at room temperature and confining pressures of up to 180 MPa. Petrofabrics were examined by optical microscopy and SEM-EBSD. Olivine a- and c-axes are weakly oriented perpendicular to the foliation and parallel to the lineation, respectively. Antigorite b- and c- axes are distinctly oriented parallel to the lineation and perpendicular to the foliation, respectively. Samples show strong anisotropy of velocity. The compressional wave velocity is fastest in the direction parallel to the lineation, and slowest in the direction perpendicular to the foliation. The shear wave oscillating parallel to the foliation has higher velocity than that oscillating perpendicular to the foliation. As the antigorite content increases, the mean velocity decreases but both azimuthal and polarization anisotropies are enhanced. Measured velocities were compared with velocities calculated from petrofabric data by using Voigt, Reuss and VRH averaging schemes. All averaging schemes show velocity anisotropy qualitatively similar to measurements. There are large velocity differences between Voigt and Reuss averages (0.7~1.0 km/s), reflecting the strong elastic anisotropy of antigorite. Measured velocities are found between Reuss and VRH averages. We think that the relatively low velocity is due to the platy shape of antigorite grains, the well developed shape fabric and their strong elastic anisotropy. Measured velocities will be compared with calculation considering layered structures in serpentinite mylonites.