Seismic velocities of serpentinites: Can Vp/Vs be an indicator of serpentinites ?

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Serpentinites play an important role in the subduction of oceanic plates. They are formed through the hydration of mantle peridotites, and must have a strong influence on the slip behavior between the subducting slab and the overlying mantle. Our working hypothesis is that serpentinites is a cause of silent earthquakes. Their softness must suppress the acceleration of fault slip. In order to test this hypothesis, it is very important to clarify their distribution by geophysical observations.

Kamiya and Kobayashi(2000) found a serpentinized region on a subducting slab by seismic tomography. Based on the data of Christensen(1996), they characterized serpentinites by low-velocity and high-Poisson's ratio. However, it is not clear what kind of serpentinites were used in Christensen(1996). It is needed to clarify the variation in seismic velocities of serpentinites with the degree of serpentinization and their mineralogy.

Seismic velocities of serpentinites were measured by the pulse transmission technique. Serpentinites were sampled in Ohmi-Kotaki area, Niigata prefecture. Thin section and X-ray powder diffraction studies showed that most samples underwent carbonation reactions. The volume fraction of serpentines varies from 30 to 90%. We also measured seismic velocities of Horoman peridotites for comparison. Both compressional and shear wave velocities decrease with the increase in the volume fraction of serpentines. They increase with carbonation reactions. The ratio Vp/Vs increases with the increase of the volume fraction of serpentines, and decreases with carbonation reactions. Every serpentinite does not show low-velocity and high-Vp/Vs. However, we can say that low-velocity and high-Vp/Vs strongly suggests the existence of a serpentinite with a high volume fraction of serpentines.