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Seismological mapping of serpentinites in forearc mantle

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Serpentines play key roles in subduction zone processes, including transport of water and sesimogenesis. Geophysical mapping of serpentinized region is essential to understand subduction zone processes. Christensen (1996) suggested that serpentinites be distinguished from other rocks by their anomalously high Poisson's ratio. Watanabe et al. (2007), however, showed that Christensen's argument can only be applied to Low-T type serpentinized peridotites (containing lizardite and/or chrysotile), and that High-T type (containing antigorite) has distinctly higher velocities and lower Poisson's ratio. For a good interpretation of seismological observations, it is essential to use seismic properties of serpentines appropriate for the expected temperature condition. In order to explore warm subduction zones where antigorite is expected, we have studied seismic properties of antigorite. Experimental details are presented separately in a poster of this special session (Yano et al.). Based on our results, we constructed a Vp-Vp/Vs diagram to infer materials in forearc mantles. Dry forearc mantle is assumed to be olivine + orthopyroxene (Hyndman and Peacock, 2003). The temperature can vary from 400C to 600C (Hacker et al., 2003). Dry forearc mantle shows Vp=8.0-8.3 km/s and Vp/Vs=1.73-1.74. If this dry material is completely replaced by antigorite, Vp drops to 6.7 km/s and Vp/Vs increases to 1.95. We also considered the influence of (supercritical) aqueous fluids on seismic velocities. The dihedral angle of H2O in peridotite systems is higher than 60 degree (Mibe et al., 1999). When fluids exist in equilibrium with solid phases, they decrease Vp/Vs. Fluids could temporarily fill cracks and take a very thin shape. In this case, fluids tend to increase Vp/Vs.