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# Seismic Evidence of Localized Distribution of Fluids or Melts in the Mantle Transition Zone

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Seismic tomography models have shown flattened broad high velocity anomaly (HVA), i.e., the image of a subducted slab (stagnant slab) trapped in the upper mantle transition zone (MTZ) associated with the northwestern Pacific subduction zones. Our body waveform analysis in a relatively high frequency band (approximately 0.03 to 1 Hz) has determined a fairly broad region of HVA's where the structure can be delineated largely with layered models but the typical wavelength of HVA is shorter than that in tomography models. The HVA's are accompanied by a depression of the "660 km" discontinuity depth (model M3.11) or not (model M2.0), indicating a possible variation of geochemical properties at the bottom of the upper mantle. A hypothesis is proposed for this implication, i.e., that the structural variation may represent the contrast between a hydrous garnet-rich layer (subducted crust) and bulk peridotite associated with a stagnant slab. This hypothesis is supported by the results of recent laboratory experiments. The garnet-rich layer can flow and descend faster than bulk peridotite as hydrous garnet is weaker and denser than peridotite in the MTZ (Katayama and Karato, 2008). Given that the Clapeyron slope for hydrous garnet-perovskite is positive at about 660 km (Sano et al., 2006), two zones of HVA with, and without a depression in the discontinuity depth may exist next to each other at the bottom of the MTZ (Tajima et al., 2008). Here we report highly localized low velocity anomaly (LVA) zones which are located in the region of structural change of the "660 km" discontinuity depth. The LVA zones were found from anomalous broadened P waveforms observed for deep focus events, which propagated close to data modeled with a typical layered model for a stagnant slab but could not be synthesized with such layered models (Tajima and Grand, 1998; Tajima and Nakagawa, 2006). Here note that the source processes of the events are short and simple, and the corresponding SH waveforms did not show such anomaly. The waveform modeling was carried out up to 1 Hz using a finite difference code. Results indicate that a highly localized LVA zone (about -10% anomaly) is responsible for broadening the P waveforms. The LVA zones may indicate fluids dehydrated from hydrous mineral compositions or melts through the phase transformation at the bottom of the MTZ. A number of studies propose that a certain amount of water can be transported through the subduction process, and stored in the MTZ as the lower mantle minerals may not include much water (e.g., Ohtani et al., 2004). However, the distribution or fate of "water" dehydrated from minerals which are descending further into the lower mantle has been known little. On the other hand a recent study suggests that the MTZ may be dry based on the electrical conductivity modeling (Yoshino et al., 2008). We suggest that if the distribution of transported water is very localized in the MTZ, then the debates do not have to be contradictory to each other.