Formation of a hydration zone at the bottom of the lower mantle

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One of the major water carriers into the lower mantle is delta-AlOOH-phase H $MgSiO_2(OH)_2$ solid solution (aluminous phase H) [1]. Our experiments revealed that the solid solution containing water can be stable to the core-mantle boundary region, 120 GPa and 2500 K [2, 3], which is the condition along the normal mantle geotherm. The core-mantle boundary is the region with a large temperature gradient, thus dehydration or dehydration melting is inevitable at the core-mantle boundary.
There are three possibilities on the roles of this hydrous phase at the core-mantle boundary region: First, the reaction of this hydrous phase with the metallic core to introduce hydrogen into the core. Second, dehydration melting at the core-mantle boundary which might create a partial molten low velocity zone at the core-mantle boundary. Third, formation of a hydrated zone at the base of the lower mantle by suppling fluid dehydrated at the hot core-mantle boundary. Here, we consider a possible role of this hydrous phase for formation of a hydration region at the base of the lower mantle, the third process listed above.
Ohira et al. [2] revealed that hydration of aluminous bridgmanite creates delta-AlOOH phase and $MgSiO_3$ bridgmanite containing smaller amount of Al_2O_3. This hydration reaction can occur by suppling fluid dehydrated at the hot core-mantle boundary. Mashino et al. [4] measured the sound velocity of delta-AlOOH at high pressure and revealed that both Vp and Vs of this phase is greater than the major transition zone minerals such as ringwoodite and majorite, whereas the velocities are lower than bridgmanite at the bottom of the lower mantle. Drop of sound velocities can be expected by formation of delta-AlOOH phase by consuming Al_2O_3 in bridgmanite at the base of the lower mantle. Decrease of the sound velocity can be accounted for the low velocity nature at the core-mantle boundary. Thus, the bottom of the lower mantle may be a second largest water reservoir next to the mantle transition zone.
References:
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