Elasticity of superhydrous phase B at the mantle temperature and pressure: Implications for 800-km discontinuity and water flow into lower mantle

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The water in Earth’ s interior exerts a controlling influence on the dynamical and chemical evolution of the Earth. Many evidences from mineral physics, geophysics, and geochemistry suggest that the some of plate subductions transport water to the deep Earth. Superhydrous phase B (ShyB) is considered to be an important candidate for transporting water into the transition zone and lower mantle since it is stable up to ~ 31 GPa and 1400 ℃ and will decompose into bridgmanite, periclase and water at a depth of ~ 800 km [*Komabayashi and Omori*, 2006].

We investigated the elasticity of ShyB at high temperature and pressure using first principle calculations *[Yang et al., 2017]*. Our first-principles calculations indicate that the decomposition of ShyB will cause the V_p, V_s, and density increase by 7.5%, 15.0% and 12%, respectively. Thus the decomposition of a small amount of ShyB sufficiently generates 800-km the discontinuity and may be related to the seismic discontinuity at the depth of ~ 800 km in Western-Pacific Subduction Zones [*Liu et al.*, 2016; *Porritt and Yoshioka*, 2016]. The water released from the decomposition of ShyB promotes the partial melt, which can further explain the low-velocity anomalies just above 800-km discontinuity. The result supports strongly the appearance of ShyB at the lower mantle and has many significant implications on deep water cycle.

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