Elasticity of akimotoite under the mantle conditions: Implications for double discontinuities at the depth of ~700 km in subduction zones

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The double discontinuities at the depth of ~700 km have been found by seismic studies in subduction zones (Deuss et al., 2006) and have been interpreted as the result of the post-spinel and akimotoite-bridgmanite transitions, respectively. For pyrolitic compositions, under the conditions of cold slab, akimotoite could be stable at the bottom of the MTZ and the ULM (Akaogi et al., 2002; Hirose, 2002;). According to Hirose (2002), majorite first transforms to akimotoite at the depth of ~600-660 km below ~1873 K and further to bridgmanite at a deeper depth (Hirose, 2002).

In this study, we investigated the elastic properties of $MgSiO_3$ akimotoite at simultaneously high pressure and temperature with first-principles calculations and all computational details are the same as those in previous works for the elasticity of ringwoodite, bridgmanite, and stishovite (Núñez Valdez et al., 2012; Shukla et al., 2015; Yang and Wu, 2014).These calculations provided self-consistent and high-precision elasticity and density data for the mantle minerals at the mantle conditions without any extrapolation and are ideal for investigating the V_P, V_S, and density contrasts between minerals. Combining these calculated results, we evalued the possible transitions related to the discontinuities at the depth of ~700 km.

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