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MgSiO2(OH)2-AlOOH系における含水H相およびδ相の固溶体による下部マントル底部への水素の輸送
Hydrogen transport into the bottom of the lower mantle by phase H- phase delta solid solution MgSiO2(OH)2-AlOOH

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Water circulation in a global scale is a key for understanding dynamics and evolution of the Earth. Subducting slabs transport water into the Earth's deep interior. There are many studies on the stability of hydrous phases under the deep mantle conditions, and several hydrous minerals such as phase D and superhydrous phase B have been reported to be stable to the top of the lower mantle. It has been reported that hydrous phase δ-AlOOH is stable up to the bottom of the lower mantle (Ohtani et al., 2005; Sano et al., 2008). Tsuchiya (2013) theoretically predicted that Phase H, $MgSiO_2(OH)_2$, which is the iso-structure with δ-AlOOH, is stable from 45 GPa to 55 GPa. This phase was experimentally confirmed at around 50 GPa (Nishi et al., 2014). Here, we present our recent results on synthesis experiments of hydrous phase H and a solid solution of phase H and phase δ up to the base of the lower mantle along the normal mantle geotherm. The high pressure and high temperature in situ X-ray diffraction experiments were performed by using a double-sided laser heated diamond anvil cell at BL10XU, SPring-8. We observed that the stability field of this new candidate of water reservoir, hydrous phase H, under the lower mantle conditions up to 75 GPa and 2000 K in the MgO-SiO_2-H_2O system, although the previous studies claimed that phase H is broken down at pressures above 55 GPa. Thus, hydrous phase H is a host phase of water in the lower mantle at least up to the depth of 2000 km along both slab and normal mantle geotherms. Our experiments also revealed that the solid solution of phase H and phase δ, AlOOH-$MgSiO_2(OH)_2$, containing 15 mol % of $MgSiO_2(OH)_2$ can coexist with Mg-perovskite and/or Mg-post perovskite up to 135 GPa and 2000 K. If this hydrous phase contacts with the metallic outer core, hydrogen could be dissolved into the core by forming iron hydride, FeH (Terasaki et al., 2012).

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