Connectivity of aqueous fluid in wadsleyite aggregate

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The water released from descending oceanic lithosphere can dramatically influence the chemical and physical properties of the Earth's materials. In order to understand these effects, it is important to know whether released water (fluid phase) can percolate into the mantle wedge or be trapped in the subducting slab. It is well known that the dihedral angle provides useful information on determining the distribution and connectivity of the fluid phase. If the dihedral angle is larger than 60 degree, the fluid is trapped at the mineral grain boundaries as disconnected fluid pockets and therefore be transported to the deeper mantle together with subducting slab. On the other hand, if the dihedral angle is smaller than 60 degree, the fluid can migrate through grain edges as permeable flow.

In previous studies, the dihedral angles of olivine and H2O in conditions up to 5 GPa and of pyrope and H2O up to 13 GPa were examined. But those of the more high-pressure conditions were not much investigated. In this study, distribution of the fluid in polycrystalline wadsleyite has been investigated by measuring the dihedral angle. High-pressure experiments were carried out at 15 GPa and 1300 degrees C for 2-10 hours using multi-anvil apparatus. The dihedral angle between fluid and wadsleyite were measured from the backscattered image of recovered samples. The dihedral angle were 43 degree for 5 hours duration and be 52 degree for 10 hours duration. Sample texture and the fluid distribution of this study show similar texture with those of texturally equilibrated sample from previous studies. This result suggests that the aqueous fluid can form interconnected network in wadsleyite aggregates and therefore percolate thorough the mantle transition zone.