H_2O partitioning between wadsleyite and garnet and between ringwoodite and garnet

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Water is the most abundant volatile component on the Earth's surface, and it has been supplied to the Earth's interiors by subducted slab. Water influences the physical properties and melting temperature of minerals. Especially, it is clarified that the high-pressure polymorphs of olivine, wadsleyite and ringwoodite can contain 3wt% of H2O in their crystal structures, and the mantle transition zone (MTZ) should be a water reservoir in the Earth's interior. On the other hand, majorite garnet (Mj) is the second abundant mineral in MTZ, and it is important to clarify the water solubility in Mj and the partitioning of H2O between wadsleyite and Mj and between ringwoodite and Mj to constrain the water in the mantle. We have conducted high pressure experiment to clarify the partitioning of H2O between wadsleyite and Mj and between ringwoodite and Mj.

High-pressure experiments were conducted by MA-8 type (Kawai-type) high-pressure apparatus in Ehime University, and the chemical compositions were determined by EPMA. The water contents of minerals were measured by SIMS in Hokkaido University.

We succeeded to synthesize large (~50 micron) coexisting crystals of wadsleyite and Mj, and of ringwoodite and Mj, and we could clarify the partitioning of H2O between those coexisting minerals. The partition coefficients between wadsleyite and Mj and between ringwoodite and Mj were about 10 and about 5, respectively. We (Inoue, 2004) have already determined that the partition coefficient between wadsleyite and ringwoodite is about 2, and it is consistent with the present results. Thus the contributions for the water reservoir in MTZ are mainly the existence of wadsleyite and ringwoodite, and a few effect for the existence of Mj.