

## Formation of Phase H – $\delta$ - AlOOH solid solution in the lower mantle

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Dense hydrous magnesium silicates (DHMS) are formed in a hydrous peridotite, whereas hydrous aluminous minerals exist in hydrous oceanic and continental crusts in subducting slabs [1,2]. Phase H ( $\text{MgSiO}_4\text{H}_2$ ) is the only phase in DHMS which can exist stably up to the middle-depth lower mantle conditions ( $\sim 50$  GPa) [3,4]. Its stability field can be extended significantly if it contains a large amount of  $\delta$ -AlOOH component and consequently forms *Al-rich Phase H –  $\delta$ -AlOOH solid solution (H –  $\delta$  s.s.)* [5].

However, the formation processes of *H –  $\delta$  s.s.* had been discussed only by high *P-T* experiments in simple  $\text{MgO-SiO}_2\text{-H}_2\text{O}$  (MSH) and  $\text{MgO-Al}_2\text{O}_3\text{-SiO}_2\text{-H}_2\text{O}$  (MASH) systems [5,6]. In the present study, we investigated the possible existence and stability of *H –  $\delta$  s.s.* formed in complex systems such as hydrous peridotite and MORB by high *P-T* experiments using *in-situ* synchrotron XRD with a double sided laser-heated diamond anvil cell and FE-SEM/EDS and STEM/EDS for analyses of the recovered samples.

Our results revealed that the *P* conditions at which *H –  $\delta$  s.s.* exists in a hydrous peridotite system were significantly close to those in the MSH system, suggesting that the solid solution phase had approximately pure- $\text{MgSiO}_4\text{H}_2$  composition. In other words, this phase does not contain enough amount of  $\delta$  component to extend its stability field.

We will also discuss possible existence of *H –  $\delta$  s.s.* in the complex hydrous MORB system in the lower mantle.

[1] e.g., Ohtani (2005) *Elements* **1**, 25-30. [2] e.g., Ohtani (2015) *Chem. Geol.* **418**, 6-15. [3] Tsuchiya (2013) *GRL*. **40**, 4570-4573. [4] Nishi *et al.* (2014) *Nature Geo.* **7**, 224-227. [5] Ohira *et al.* (2014) *EPSL*. **401**, 12-17. [6] Walter *et al.* (2015) *Chem. Geol.* **418**, 16-29.