Melting phase relation of Fe-bearing PhD up to the uppermost lower mantle and transportation of H_2O to the deep Earth

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Dense hydrous magnesium silicates (DHMSs) are supposed to be one of the important water carriers to the deep Earth. We should think about the effect of iron when considering the role of DHMSs in water cycle, because iron is not only one of the most abundant elements in the Earth, but also in iron-enriched planetary systems such as Mars. In spite of the importance, few experiment has been conducted so far to clarify the effect of Fe in DHMSs systematically. Therefore we investigated the stability of Fe-bearing phase D (PhD) in AlOOH-FeOOH-PhD system between18 and 25 GPa at 1000-1500 ºC.

Fe-bearing PhD was synthesized by using two different iron contents in FeOOH-PhD binary system, and the Al, Fe-bearing compositions were like analog materials of MORB and pyrolite in AlOOH-FeOOH-PhD ternary system. Compared with Mg-PhD, iron slightly decreased the stability region of PhD in FeOOH-PhD system. We notice that iron substitution mechanism in PhD changed at the mantle transition zone pressure based on the cell volume parameter analysis.

Although Fe decreases the stability region of PhD, Al, Fe-bearing PhD drastically shift to higher temperatures in both MORB and pyrolite type compositions compared to pure Mg-PhD. Therefore, Al, Fe-bearing PhD could act as long water reservoir along subduction to the deep lower mantle. Our results also show that εFeOOH is another important hydrous mineral, which could coexist with bridgmanite, and will bring water not only to the deep lower mantle but also to iron-rich Martian core, together with DHMSs.

