Fate of water in subducted hydrous sediments deduced from stability fields of FeOOH and AlOOH up to 20 GPa

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Fe- and Al-hydroxides (FeOOH and AlOOH) in sedimentary rocks form the top part of the subducted oceanic lithosphere and are known to be stable along a normal geotherm in the lower mantle. Banded Iron Formations (BIFs) and bauxite ore deposits formed in the Earth’s oceans can transport significant amount of water into the Earth’s deep interior by subduction of FeOOH and AlOOH and may occasionally serve water to the core. However, stabilities of these hydrous phases have not been well constrained in upper mantle conditions. We determined dehydration curves for FeOOH and AlOOH in upper mantle and mantle transition zone conditions (5–20 GPa, 673–1573K)by quench and *in situ*X-ray diffraction to constrain their capability of water transport to the deep mantle. Dehydration temperatures of these minerals increase with increasing pressure. Comparison between our results and geothermal gradients of subducting slab surfaces demonstrates dehydration of FeOOH in early subduction stage (around 2 GPa). In most cases, diaspore (AlOOH) also dehydrates in early subduction. Despite the implications of the stability of these phases at high pressure, our results show that the sediments located at the slab surface are unlikely candidates for transporting water to the deep mantle.

Keywords: water, sediment, dehydration, hydrous minerals, subduction

