マントル遷移層の還元反応による脱水融解
Redox dehydration melting of mantle transition zone deduced from the H_2O storage capacity

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Knowledge of the H_2O storage capacities of minerals forming mantle peridotite provides essential constraints on estimation of H_2O content and the onset of hydrous partial melting in the mantle. In the mantle transition zone, wadsleyite can store significant amount of H_2O in their crystal structures under extremely high oxygen fugacity. However, the H_2O storage capacity has not been determined under the low oxygen fugacity predicted from the mantle transition zone[7]. Here we report that the H_2O storage capacity of wadsleyite in equilibrium with the peridotite assemblage under lower oxygen fugacity is much smaller than that under higher one. Very low H_2O storage capacity of wadsleyite can attribute to the low H_2O activity in the melt. Considering the more reducing state in the deep mantle, dominant speciation of volatile phases is not H_2O but H_2. Low H_2O activity in the reduced deep mantle requires that H_2O storage capacity in the Earth’s mantle is much smaller than that predicted from the maximum H_2O concentration determined under the high oxygen fugacity. The hydrated and oxidised subducted slab will induce “redox dehydration melting” through decrease of oxygen fugacity by the surrounding reduced mantle transition zone. H_2O in the generated melt will be reduced to hydrogen through the oxidation of iron-bearing minerals. Fe-H melt or FeH_x trapping the released hydrogen would become the main carrier of hydrogen into the deep mantle.

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