Role of water transported into the deep mantle by subducting slabs

*大谷 栄治[1]、袁 亮[1]、大平 格[1]、シャツキー アントン[2]、リタソフ コンスタンチン[2]
*Eiji Ohtani[1], Liang Yuan[1], Itaru Ohira[1], Anton Shatskiy[2], Konstantin Litasov[2]

1. 東北大学大学院理学研究科地学専攻、2. ロシア科学アカデミーソボレフ地質学鉱物学研究所
1. Department of Earth and Planetary Materials Science, Graduate School of Science, Tohoku University, 2. Sobolev Institute of Geology and Mineralogy, Russian Academy of Science

Seismic wave velocity and electrical conductivity profiles together with mineral physics data suggest existence of the stagnant slabs in the wet mantle transition zone (1, 2). it was also suggested based on hydrous mineral inclusions in diamond such as hydrous ringwoodite (3). Hydrous minerals such as hydrous phase EGG and hydrous phase d (4), and aluminous phase TAPP (5) has been reported as inclusions in diamond. These aluminous mineral inclusions might be continental and/or oceanic crustal components subducted in the wet mantle transition zone contains. Dense hydrous magmas might exist at the base of the upper mantle. Fluids or volatile-rich magmas may exist at the top of the lower mantle due to crossing of the convective descent of the cold hydrated slabs showing a large contrast of water contents between the mineral assemblages in the mantle transition zone and those of the lower mantle. Dense magmas are not likely to be formed at this depth and the hydrous magmas generated in this region move upwards and metasomatize the overlying mantle transition zone. Water can be transported further into the lower mantle by collapse of the stagnant slabs, which supply water into the lower mantle and the core-mantle boundary. Hydrous phase d-H solid solution may be the most important hydrous phase in lower mantle (6). Existence of this phase reduces the aluminum content in coexisting bridgmantite and post-perovskite, and thus modifies the physical properties of the lower mantle. Hydrous phase d-H solid solution can be accumulated at the base of the lower mantle. The iron-water reaction at the core-mantle boundary can create pyrite-type FeOOH which can be a potential candidate material for ULVZ (7). Thus, water plays important roles on structure and dynamics of the mantle transition zone and the lower mantle.

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