ポスター｜R3：高圧科学・地球深部

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R3：高圧科学・地球深部

研究発表優秀賞エントリー

[R3-P-10] 高圧実験におけるデーブマオアイトとブリッジマナイト間の Ti の分配挙動の制約

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Compared to mantle minerals, oceanic lithologies transported in subducting slabs are enriched in Ca, Al and Fe, but also minor elements such as Ti, Mn, Ni, etc ... Among them, titanium has been of particular interest, because it can incorporate the crystal structure of both bridgmanite (Brg) and davemaoite (Dvm), two of the major constituent minerals of the pyrolitic lower mantle and subducted basaltic crust. Furthermore, studies of diamond inclusions have reported significant amounts of Ti in the form of $Ca(Si,Ti)O_3$ inclusions (Nestola+2018), giving clues that substantial amount of Ti may be present in deep mantle minerals.Petrological studies have shown that Ti can influence the chemical composition and crystal structure of Brg and Dvm, which in turn may change mineralogical models of the deep Earth. For example, it was reported that the presence of Ti could stabilize Brg at lower P than that of the 660-km discontinuity (Matrosova+ 2020). It is also known that Ti favors structural distortions in Dvm, which has been proposed to explain low seismic velocity regions in the Earth’s lower mantle (Thomson+ 2019). Therefore, understanding which phases Ti preferentially partitions into is essential for interpreting the composition and structure of the Earth’s mantle. Here we present the results of high pressure and high temperature phase equilibrium experiments in MgO-CaO-SiO_2 aggregates mixed with TiO_2, Al_2O_3 and/or FeO components, at 27 GPa and 1800 °C for approximately 10 hours using Kawai-type multianvil press (ORANGE3000) at the Geodynamics Research Center (GRC, Ehime). The recovered samples were analyzed by electron microprobe and X-ray diffraction. Preliminary data at 27 GPa showed that in a simplified system, without Al and Fe, Ti preferentially partitioned into Dvm (up to 16 wt.% TiO_2) rather than Brg (~0.3 wt.% TiO_2). In contrast, in experiments containing Al and Fe, Ti incorporation into Dvm seems to be inhibited (~10 wt.% TiO_2) while amount of Ti in Brg is found ~6 times larger (up to 1.8 wt.% TiO_2) than in the experiments without Al and Fe. These results suggest $Ca(Si,Ti)O_3$ found as inclusions in diamond may not originate from the lower mantle. On the other hand, we found Brg may host a substantial amount of Ti along with Al and Fe, which could have some implications for seismic structures beneath subduction zones.