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Science Research Bldg. 1, 4th floor.

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Keywords

1. Ti partitioning
2. Silicate perovskite
3. Diamond inclusion



High-pressure experimental constraints on the partitioning behavior of Ti between Davemaoite and Bridgmanite.

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 pyroclitic lower mantle and subducted basaltic crust. Furthermore, studies of diamond inclusions have reported significant amounts of Ti in the form of $\text{Ca}(\text{Si},\text{Ti})\text{O}_3$ inclusions (Nestola et al. 2018), giving clues that substantial amount of Ti may be present in deep mantle minerals.

Here we present high pressure and high temperature phase equilibrium experiments in MgO-CaO-SiO_2 aggregates mixed with TiO_2 , Al_2O_3 and/or FeO at 20, 23 and 27 GPa and 1800 °C. The recovered samples were analyzed by electron microprobe and X-ray diffraction. When Al and Fe are not present, 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 experiments without Al and Fe. These new constraints on the partitioning of Ti between Dvm and Brg suggest high-Ti CaSiO_3 inclusions may originate from basalts entrapment in the mantle transition zone whereas Ti-bearing MgSiO_3 inclusions may be retrograde phases of basaltic Brg returned from the lower mantle.