

Influence of majorite on mantle convection

ICHIKAWA, Hiroki^{1*} ; KAMEYAMA, Masanori² ; SENSU, Hiroki³ ; KAWAI, Kenji⁴ ; MARUYAMA, Shigenori⁵

¹GRC, Ehime University and ELSI, Tokyo Institute of Technology, ²Geodynamics Research Center, Ehime University, ³Planetary Exploration Research Center, Chiba Institute of Technology, ⁴Department of Earth and Planetary Sciences, Tokyo Institute of Technology, ⁵Earth-Life Science Institute, Tokyo Institute of Technology

Influence of MgSiO_3 majorite on the mantle convection has been investigated by using numerical simulations. According to a first principles study (Yu et al., 2011), wadsleyite decomposes to an assemblage of majorite plus periclase with a large negative Clapeyron slope. Since stability field of majorite is limited at high temperature, downwellings are considered to be unaffected by this phase boundary. On the contrary, the upwelling plumes may be significantly modified by this phase boundary. The asymmetry on upwelling and downwelling caused by the phase transitions may induce strong effects on the thermal evolution and the thermal structure of the mantle.

In this study, we performed 2-D numerical simulations on thermal convection of the mantle incorporating majorite stability field. According to our numerical results, very hot upwelling plumes are strongly influenced by the phase transitions related to majorite. The dynamics of these upwellings are controlled by the release and the absorption of latent heat induced by the transitions as well as interruption of currents due to the large negative Clapeyron slope of the transition between wadsleyite and majorite plus periclase.

Keywords: Mantle convection, Majorite, Phase transition