Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SIT39-P03 会場:3 階ポスター会場 時間:5 月 2 日 14:00-15:15

660km 不連続面付近におけるパイロライト、MORB、ハルツバージャイトの相関係の比較：マルチセル法を用いた精密実験
Comparison of phase relations in pyrolite, MORB and harzburgite across 660-km discontinuity

石井 貴之 [1*] ; 糀谷 浩 [1] ; 赤荻 正樹 [1]
ISHII, Takayuki[1*] ; KOJITANI, Hiroshi[1] ; AKAOGI, Masaki[1]

[1] 学習院大学理学部
[1]Depertment of chemistry, Gakushuin University

Pyrolite is the model rock which composes the average upper mantle. It is accepted that 660-km seismic discontinuity is formed by post-spinel transition of pyrolite. MORB (mid-ocean ridge basalt) and harzburgite in slabs subduct to 660-km seismic discontinuity due to their higher densities than pyrolitic average mantle. It has been considered that the density cross-over between pyrolite and slab materials occurs due to post-spinel transition in pyrolite at the 660-km discontinuity, and MORB and harzburgite are trapped around the depth (e.g. Ringwood and Irifune, 1988). Therefore, the phase transition pressures of these mantle rocks are the important parameters to elucidate the dynamics around 660-km seismic discontinuity. We investigated detailed phase relations of pyrolite, MORB and harzburgite with multi-sample cell technique.

The starting materials were prepared from the oxide mixtures of pyrolite, MORB and harzburgite composition after McDonugh and Sun (1995) (excluding MnO, K_2O and P_2O_5), Melson et al. (1976) (P_2O_5) and Michael and Bonatti (1975), respectively. High-pressure and high-temperature experiments by quench method were performed at about 20-28 GPa and 1600-2200C for 2-10 hours using a Kawai-type 6-8 multianvil high-pressure apparatus at Gakushuin University. These samples were packed with pressure calibrants ($MgSiO_3$ or pyrope) in a Re multi-sample capsule with four holes. Temperature was controlled with a LaCrO3 heater and measured with a W5%Re-W26%Re thermocouple inserted in a Cr_2O_3-doped MgO pressure medium. Phases of recovered samples were identified with microfocus-Xray diffractometer and SEM-EDS.

In pyrolite at 1600-2200C, the mineral assemblage of $MgSiO_3$-rich perovskite (Mpv) + magnesiowustite (Mw) + garnet (Gt) + $CaSiO_3$-perovskite (Cpv) is stable at pressure range of 22-24 GPa, and changes to that of Mpv + Mw + Cpv above 24 GPa. The mineral assemblage of ringwoodite (Rw) + Gt + Cpv at 1600C transforms to that of Rw + Mw + Gt + Cpv due to transition of Rw to Gt + Mw at 1800-2000C, and Rw disappears perfectly above 2200C. In MORB, the mineral assemblage of Gt + stishovite (St) + Cpv changes to that of Mpv + St + Al-rich phase + Cpv with continuous post-garnet transition. In harzburgite at 1600C, the mineral assemblage of akimotoite (Ak) + Rw + Gt changes to that of Mpv + Mw by post-spinel transition after the Ak to Mpv transition. Above 1800C, no Ak was observed.

At 1600C, post-spinel transition in pyrolite occurred by about 0.5 GPa and 2 GPa lower pressure than that of harzburgite and post-garnet transition in MORB, respectively. The Clapeyron slope of post-spinel transition in harzburgite is larger than that of pyrolite, and both boundaries intersect at 2000C. From the comparisons of density profiles at 1600C, MORB and harzburgite have lower densities than pyrolite by post-spinel transition in pyrolite.

キーワード: ポストスピネル転移, ポストガーネット転移, 660-km 地震波不連続面, パイロライト, MORB, ハルツバージャイト
Keywords: post-spinel transition, post-garnet transition, 660-km discontinuity, pyrolite, MORB, harzburgite