

## 沈み込み帯における2段階で進行するポストスピネル相転移のカイネティクスとそのマントル流への影響

### Kinetics of the two-stage post-spinel transformation under subduction zone conditions: Implications for mantle flow across the 660-km discontinuity

\*久保 友明<sup>1</sup>、糀谷 浩<sup>2</sup>、金嶋 聡<sup>1</sup>、肥後 祐司<sup>3</sup>、丹下 慶範<sup>3</sup>

\*Tomoaki Kubo<sup>1</sup>, Hiroshi Kojitani<sup>2</sup>, Satoshi Kaneshima<sup>1</sup>, Yuji Higo<sup>3</sup>, Yoshinori Tange<sup>3</sup>

1. 九州大学、2. 学習院大学、3. JASRI

1. Kyushu Univ., 2. Gakushuin Univ., 3. JASRI

Recent first-principles studies and thermodynamic calculations have revealed the presence of the stability field of akimotoite (Aki) and periclase (Pc) in  $\text{Mg}_2\text{SiO}_4$  at lower than  $\sim 1100^\circ\text{C}$ , suggesting that the post-spinel transformation occurs by a two-stage process in cold subducting slabs, that is ringwoodite (Rw)  $\Rightarrow$  Aki+Pc  $\Rightarrow$  bridgmanite (Brm)+Pc. However, the direct experiment to determine these phase boundaries have been kinetically difficult. Here we report results of in-situ X-ray and microstructural observations on the kinetics of the two-stage reaction “metastably” occurred at the Brm+Pc field of 24.5-27 GPa and 1050-1300 $^\circ\text{C}$  in  $\text{Mg}_2\text{SiO}_4$ . The reaction first occurs by nucleation and growth of metastable Aki+Pc eutectoid colonies on the parental Rw polycrystal, followed by overprint of bigger Brm+Pc eutectoid colonies on the metastable colonies. The faster appearance of the Aki+Pc assemblage may be due to the coherent nucleation. We deduced nucleation and growth kinetics of the eutectoid colonies in each reaction from time-resolved XRD data, which was used to evaluate kinetic boundaries under subduction zone conditions considering thermodynamic driving force. We found that the two-stage reaction is kinetically possible in cold slabs penetrating into the lower mantle, in which the pressure interval of the Aki+Pc field decreases from  $\sim 1.2$  GPa at 700 $^\circ\text{C}$  to zero at  $\sim 1100^\circ\text{C}$ . This potentially affects the slab dynamics across the upper and lower mantle boundary. We will discuss on density and velocity jumps of cold slabs expected through the two-stage post-spinel transformation and its seismological detection by using the S-to-P wave conversion at the discontinuity. Its effects on the slab rheology will also be investigated considering the grain-size evolution during the double eutectoid reactions.