

# The 432nd Geodynamics Seminar

## The fate of sulfate mineral during subduction to the deep mantle

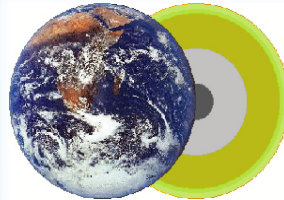
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### Abstract

Sulfur is one of the major magmatic volatile components and forms a variety of chemical species in the Earth's crust. Recent studies showed that the total amount of sulfur input (supplied) into subduction zone is clearly higher than the output from arc volcanoes, suggesting that at least a part of sulfur-bearing minerals such as sulfates and sulfides are recycled to the deep mantle (Jego and Dasgupta 2013, Evans et al. 2014). Anhydrite ( $\text{CaSO}_4$ ) is one of the most abundant sulfate minerals in the crust and widely occurs as precipitates from hydrothermal chimneys in ocean floor sediments. It was also found as inclusions in diamond from Juina region, Brazil (Wirth et al. 2009), suggesting the sulfur recycling from crusts to mantle through subduction. However, little is known about the stable phase relation and stability of  $\text{CaSO}_4$  in the mantle conditions. Thus, in the present study we performed a series of high pressure experiments up to 90 GPa, 2400 K using a laser heating diamond anvil cell (LHDAC) and multi-anvil apparatus combined with synchrotron radiation for in-situ X-ray diffraction measurements. The results showed that  $\text{CaSO}_4$  forms three thermodynamically stable polymorphs: anhydrite (below 3 GPa), monazite-type phase (between 3 and ~13 GPa) and barite-type phase (stable up to at least 93 GPa). We then carried out multi-anvil experiments to further study the effect of oxygen fugacity ( $f\text{O}_2$ ) on the stability of  $\text{CaSO}_4$  in water-saturated systems. On the basis of electron microscopic observation of the recovered samples, sulfate/sulfide boundaries were determined under PT conditions corresponding to subducted slab. The results showed that sulfate is stable at  $f\text{O}_2$  above  $\log -9$ , while sulfide becomes stable below  $\log -11$  at 6 GPa and  $800^\circ\text{C}$ , suggesting that the sulfate/sulfide boundary is located between  $f\text{O}_2 = \log -11$  and  $-9$ . At higher pressure (9 GPa,  $800^\circ\text{C}$ ), the boundary also seems to be located at around  $f\text{O}_2 = \log -10$ , which is significantly lower than the estimate (between  $\log -7.2$  and  $-5.5$ ) at 3 GPa and  $1050^\circ\text{C}$  reported by a previous study (Jego and Dasgupta 2014).

詳細は当センターホームページ: <http://www.grc.ehime-u.ac.jp/> をご覧ください

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