

Hydrogen diffusion experiment of apatite crystal

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Recently many studies focused on the origin of water in the solar system and Earth with Chondrite, differentiated meteorite, Moon and Mars (e.g., [1] [2] [3]). Especially H₂O and hydrogen isotopic compositions of apatite in the Moon and ordinary chondrites has been discussed about the origin of water in the magma of the Moon and at the Earth orbit material [2][4]. However, it is still controversial about the origin of water in the apatite grain since it is unclear about the investigation of H-diffusivity in the apatite during thermal metamorphism in the magma and parent body. In this study, we performed H-diffusion experiments using fluorapatite.

Some slices along c-axis from a durango apatite single crystal were used in the H-diffusion experiment. These slices polished with diamond are with mirror surface and then were annealed under D₂O/O₂ gas at 400°C-700°C for several hours. The pressure of D₂O is saturated at 60°C. H-diffusion coefficients in the samples were determined using depth profiles of D concentration of the samples obtained by secondary ion mass spectrometry (SIMS) (Cameca ims-4f-E7 at Kyoto university and Cameca ims-4f at NIMS). The standard mineral of a durango apatite grain with 40keV D dosed (5×10^{14} ions/cm²) is used to measure the D concentration of apatite. The water content of these slices from a apatite grain were measured. The minor impurities of apatite were also measured using SIMS and LA-ICPMS. The surface region with the D self-diffusion indicated that D diffusion was occurred by exchange with original hydrogen in apatite grain. In this talk we will report H-diffusion coefficient in the apatite using H-diffusion experiment and discuss about investigation of H-diffusivity in the apatite.

- [1] Greenwood et al. (2008) *Geophys. Res. Lett.*, **35**, L05203.
 [2] Greenwood et al. (2011) *Nature Geosci.*, **4**, 79-82. [3] Alexander et al. (2012) *Science*, **337**, 721-723 [4] Itoh et al. (2014) *Goldschmidt abstracts*, 2014 1099.