# Hydrogen diffusion experiment of apatite: Effect of different water content

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Recently, there are many studies focusing on the origin and evolution of water in the Earth and solar system based on hydrogen isotopic compositions of apatite (e.g., [1] [2]). However, it is unclear whether the hydrogen isotopic compositions of apatite correspond to the magmatic water in the apatite crystallization or the diffused hydrogen from external water after apatite crystallization. H–diffusion in Durango apatite ($H_2O$: ~1000 ppm) has been recently reported that hydrogen diffusion is caused by hydrogen exchange reaction between the original OH and the diffused hydrogen from water [3]. In this study, H–diffusion experiment using natural Imilchil apatite ($H_2O$: ~10000 ppm) is performed, in order to estimate the H–diffusivity of apatite with higher $H_2O$ content.

Apatite crystal from Imilchil, Morocco was used for H–diffusion experiment. Samples were annealed under the same conditions of [3]. H–diffusion coefficients were determined using depth profiles of $^2H$ concentration obtained by Cameca ims 4f-E7 secondary ion mass spectrometry (SIMS) at LPS Kyoto University.

H–diffusion coefficients of Imilchil apatite are higher than those of Durango apatite by a factor of about 2 and its activation energy is consistent with that of Durango apatite [3]. H diffusivities of apatite are several orders of magnitude faster than those of other elements. As results, this study indicates that the effect of hydrogen diffusion in apatite during hydrothermal events should be considered to discuss about the hydrogen isotopic compositions of apatite crystals.

[1] Greenwood et al. (2011) *Nature Geosci.,* **4**, 79-82. [2] Usui et al. (2015) *Earth Planet. Sci. Lett.,* **410**, 140-151. [3] Itoh et al. (2015) *Goldschmidt abstract,* 1394.