# Fluorine as a proxy of water in mantle

*Kenji Shimizu[1], Motoo Ito[1], Qing Chang[2], Jun-Ichi Kimura[2]

1. Kochi Core Center, Japan Agency for Marine-Earth Science and Technology, 2. D-SEG, Japan Agency for Marine-Earth Science and Technology

Water-cerium ratio of basalt has been utilized for evaluating the water abundance in its source mantle due to its inheritance from the source mantle. However, dissimilar chemical properties of cerium ($Ce^{3+}$; lithophile) to water ($OH^-$; volatile) in the mantle limit its quantification. Fluorine is an effective element for this purpose, because it is volatile element and has similar chemical properties to the mantle water. We precisely determined water and fluorine concentrations of deep submarine basaltic glasses from mid-oceanic ridges (MOR) of Pacific, Atlantic and Indian Ocean, a Hawaii hotspot, and a Fiji back arc basin using an FTIR and an ion chromatography. We found a strong linear correlation of F [ppm] = (477 ± 7) ×$H_2O$ [wt.%] + (47 ±2). This F–$H_2O$ mantle array represents melting of mantles ranging from a near-dry depleted MOR mantle (DMM: $H_2O$ = 100ppm; $H_2O$/F=10) to a hydrous primitive mantle (PM: $H_2O$ = 750ppm; $H_2O$/F=18.5). Other data of ours, produced by nanoSIMS, and existing data of submarine basaltic glasses and olivine-hosted melt inclusions plot on the mantle array in most MORs, deviate positively ($H_2O$-enrichment) in arcs, negatively ($H_2O$-defficient) in hotspots. These are consequences of melting of a pristine depleted mantle (MORs), the selective water enriched mantle by the subducting slab (arcs), and water depleted mantle by the dehydrated recycled slab materials (hotspots), respectively. The F–$H_2O$ systematics of basalt glass is a versatile tool for understanding the origin and behavior of mantle water.

Keywords: Fluorine, volcanic glass, volatile element, water

 