Hydrogen isotope analyses of forearc volcanic glasses from IODP Exp. 352 using IMS 1280-HR

TAKAYUKI USHIKUBO[1*], KENJI SHIMIZU[1], YUICHIRO UENO[2]

[1]Kochi Inst. for Core Sample Research, JAMSTEC, Nankoku, Kochi 783-8502, Japan (*ushikubot@jamstec.go.jp)

[2]Dept. Earth Planet Sci., Tokyo Institute of Technology, Tokyo, 162-8551, Japan

Hydrogen isotope (D/H) ratio of volcanic rock is useful tool to identify fluid sources and dehydration processes of magma. We established the in-situ analysis technique for H isotope of volcanic glass and melt inclusion with a multi-collector ion microprobe, CAMECA IMS 1280-HR at JAMSTEC. A 20kV Cs^+ primary beam (~5nA and 15μm in diameter) was used. The accelerating voltage of the secondary ions was 10kV. An electron gun was used for electrostatic chage compensation. With a aperture, the central 7μm×7μm area of the secondary ions was detected. The $^{16}OH^-$ and $^{16}OD^-$ ions for the D/H ratio were measured in multidetection mode with a Faraday cup and an elemctron multiplier, respectively. The measurement consisted of 50 cycles with 5s/cycle. The mass-resolving powers (M/ΔM) were set at ca. 5,000 for $^{16}OH^-$ and ca. 10,000 for $^{16}OD^-$, which are sufficient to separate interference $^{17}O^-$ and $^{17}OH^-$ signals. No $^{16}OH_2^-$ signal was recognized under the analytical condition.

The synthetic basaltic glass standard of [H_2O]= 3.34wt% and δD_{SMOW}=36±4‰ (2σ) was used as a running standard. H isotooe of the standard was tagged using thermal conversion elemental analyzer with isotope ratio mass spetrometry (TC/EA-IRMS) at Tokyo Inst. Tech. Unknown sample data are normalized to the data of bracketing standard analyses (n=8). Typical reproducibility of bracketing standard analyses was ±6‰ (2 SD). Analytical uncertainties (2SE) of unknown samples (H_2O down to 0.1wt%) are usually better than 10‰.

Fresh volcanic glasses of fore-arc basalts (FABs, typically SiO_2~51wt%, H_2O=0.11-0.82wt%) and boninites (typically SiO_2=54-60wt%, H_2O=1.5-2.1wt%) recovered from igneous basement of the Izu-Bonin-Mariana fore-arc by IODP Exp.352 were selected to investigate H isotopic signatures of the subduction initiation. Boninitic glasses have higher δD values of −84 to −63‰ than those of FAB glasses (δD=−100 to −75‰). Two anomalous δD values (−110‰ and −54‰) were also found in the FAB predominant site (U1440). These suggest that H isotope ratio of the mantle wedge was heterogeneous at the stage of FAB formation, then gradually increased and homogenized by an influx of a high δD fluid.