Establishment of a correction method for matrix effect on water content of volcanic glass by SIMS analysis

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In the analyses of concentrations and isotope ratios by SIMS (Secondary Ion Mass Spectrometry), matrix-matched standard samples are required due to a matrix effect on correction coefficients. Regarding the water content of volcanic glasses, Miyagi and Yurimoto (Bull. Volcanol. Soc. Japan. 1995, v40, p349) reported that there is a matrix effect, but Hauri et al., (Chem. Geol. 2006, v235, p352) and Shimizu et al. (Geochem. J. 2017, v51, p299) reported that rhylolitic to basaltic glasses share a single linear calibration curve, and that the matrix effect was considered to be small.

In this study, we prepared ~50 volcanic glasses with foiditic, basaltic, andesitic, and rhyolitic compositions, that are collected from deep seafloor, or experimental products. Their H_2O contents were determined by the manometry method (rhyolitic glasses; Yamashita, J. Petrol. 1999, v40, p1497) or FTIR (Fourier transform infrared spectrometer), and were ranging from 0.02-4.8 wt%. The analyses were performed using CAMECA ims-1280HR at JAMSTEC, under the same conditions as Shimizu et al. (2017). The primary ion of Cs^+ of 20 keV 0.5 nA with 10 keV of eletron gun is used to analyze the 5 micron area on the surface of the volcanic glasses, and the $^{16}OH/^{30}Si$ ratios were compared with H_2O contents. We observed that the calibration curvesof H_2O vs. $^{16}OH/^{30}Si$ differed significantly depending on the composition of the volcanic glasses. At the same $^{16}OH/^{30}Si$ ratio, the water content differed up to five times depending on the composition of volcanic glasses, and we verified that there was a matrix effect. Although the calibration curve slopes of water [$H_2O/(^{16}OH/^{30}Si)$] weakly correlated with their SiO_2 content, they are more likely to be correlated with their molar weights (g/mol, a one oxygen mole basis) as King et al. (Am. Mineral. 2002, v87, p1077) reported. We suggest that maritx effect on H_2O content of volcanic glasses could be corrected with their molar weights, being applicable to volcanic glasses with any chemical composition.

Keywords: volcanic glass, SIMS, water content

