# Artificial chemical weathering of volcanic glass by acidic solutions under the earth's surface conditions

M. MIZUGUCHI, A. ICHIYASU, J. NAOHARA AND S. KOBAYASHI*

Okayama Univ. of Sci., Okayama 700-0005, Japan. (*Correspondence: kobayashi@das.ous.ac.jp)

In order to elucidate the effect of acidic hydrothermal solutions and rainwater on volcanic glass, artificial chemical weathering of polished plates of obsidian as a volcanic glass was conducted using HCl, $HNO_3$ and $H_2SO_4$ solutions at pH 4, and $CO_2$ saturated water, and distilled water as artificial acidic solution under the earth surface condition in an open system. The each solution was dripped on the obsidian plates in each improved Soxhlet extraction apparatus at 50 °C using a roller pump with 150 mL/day for a different period of time up to 674 days. The weathered obsidian surface was studied by SEM, EPMA and microscopic techniques. The leached solutions were analyzed for 32 elements using ICP-MS.

The photomicrographs and SEM images of the artificial weathered obsidian surface showed that dissolution by the pH 4 three kind of acidic solutions is remarkable. Numerous irregular fractures and corroded pores like etch-pit formed on the surface. (Mg + Fe) / (Si + Al) (apfu) and (Na + Ca + K) / (Si + Al) ratios of obsidian surface decreased with increasing duration. In chemistry of the leached solutions, molar ratios of Mg, Zn and so on were high by three kinds of acidic solutions and $CO_2$ saturated water, respectively. The molar ratio is calculated from the cumulative total mole of released each element divided by the mole of the each element in the unaltered obsidian. The ratios are low for Si and Al, which are network former elements, having near the ionic radii of 40 – 50 pm and large bonding strength. The ratios are relatively high for elements having near the ionic radii of 75 pm and 120 pm. The other hand, Na and K having a small bonding strength are not soluble though these are network modifier elements and abundance elements in the glass. Most of each element in the obsidian is not proportional to each dissolved element in the leached solution except Na, K, Mn, Rb, Zr, Ga and Y. Therefore it is considered that dissolution process of amorphous obsidian is not stoichiometric for composition ratio of obsidian. It is expected that the results provide fundamental information such as mass transfer during the alteration of volcanic glass by acidic solutions under earth surface conditions.