Speciation of Iodine in soil-water systems by XANES and HPLC-ICP-MS

Y.S. SHIMAMOTO* AND Y. TAKAHASHI

Hiroshima University, Hiroshima 739-8526 (*correspondence: shima-yoko@hiroshima-u.ac.jp)

Background

Radioactive iodine is released from processing of nuclear fuel, nuclear accidents, etc. To predict the fate of radioactive iodine, we have to consider two transport pathways: 1) via atmosphere; 2) from deep underground emitted from underground nuclear-waste repositorys. In the case 1, initial iodine chemical forms are IO_3^- and I^-, while I^- is the main initial form in the case 2. In order to compare the deference of initial inorganic iodine forms, column experiments and field observation were performed.

Experimental and Sampling

The 150 g of dried paddy field soil were packed into the acrylic column. Fifty milliliters of 0.5% IO_3^- or I^- solution were added to the column. After all the solution flowed out, soil and pore water were taken at 1 cm intervals. The concentration of iodine in soil and solution were determined by ICP-MS. Iodine chemical forms in soil and solution were determined by K-edge X-ray adsorption near edge structure (XANES) and HPLC-ICP-MS, respectively.

Natural soil and pore water samples were collected in Yoro area, Chiba, Japan. The soil profile was flooded with brine water from a tube well containing iodine (iodine concentration: 5.27 mg/kg). Iodine chemical forms of soil and pore water were determined.

Results and Discussion

Column experiment: IO_3^- was adsorbed onto soil component near the surface of the soil column, while most of the I^- was retained in solution and flowed downward. In the column added IO_3^-, IO_3^- is rapidly reduced to I^- and the fraction of I^- in solution is larger than IO_3^- at the bottom of the column. The reduction of IO_3^- changes iodine mobility in soil.

Natural soil and water samples: The depth profile of iodine concentration in soil correlates quite well with that of organic carbon content. The XANES spectra of soil samples were well fitted by the spectrum of iodine in humic acid. Accordingly, most of the iodine in soil is combined with organic matter such as humic substances. In soil water, both iodide ion and organic iodine bound to dissolved humic substances were found. Since most of the iodine was bound to organic substances in the soil phase, it is suggested that iodine can be retained in soil mainly in the form of organic iodine species, especially associated with humic substances.

Geochemistry and mineralogy of basaltic rocks from the Lyra Basin, the western edge of the Ontong Java Plateau

K. SHIMIZU[1]*, T. SANO[2], M.L.G. TEJADA[3], Q. CHANG[1], K. SATO[1], K. SUZUKI[1] AND M. NAKANISHI[4]

[1]IFREE, JAMSTEC, Yokosuka, 237-0061, Japan (*correspondence: shimmy@jamstec.go.jp)
[2]National Museum of Nature and Science, Tokyo, Japan
[3]University of the Philippines, Quezon City, Philippines
[4]Graduate School of Science, Chiba University, Chiba, Japan

The Lyra Basin lies along the western edge of the Early Cretaceous (~122 Ma) Ontong Java Plateau (OJP), the world's largest oceanic plateau. We have done geophysical and geological investigations in the Lyra Basin aboard JAMSTEC's R/V KAIREI in December 2006 to examine whether there is any relationship between this basin and the main plateau.

We obtained ~50 kg of dredged samples from two sites near the Lyra Trough, consisting of Mn-crust-coated volcaniclastics and some fresh basaltic and picritic rocks. Clast size varied from several millimeters to several tens of centimeters. Fresh fragments are olivine (Fo 78-86) – clinopyroxene (titanaugite; Wo ~45, En ~47, Fs ~8; TiO_2 ~1.8 wt%) phyric alkalic basalts with estimated liquid composition of ~46 wt% SiO_2, ~8 wt% MgO, ~4 wt% Na_2O+K_2O, and ~4wt% TiO_2, different from previously reported compositions of OJP lavas (liquid composition: SiO_2~50 wt%, MgO~8wt%, Na_2O+K_2O~2wt%, TiO_2~1wt%). These basaltic clasts also have highly enriched chondrite-normalized-incompatible trace element patterns (La/Yb_N ~12), which are completely different from those of OJP volcanic rocks (~1.2). ^{40}Ar-^{39}Ar dating of clinopyroxene separates and groundmass of two fresh samples gave two different ages. The ^{40}Ar-^{39}Ar plateau ages of groundmass are much younger (65-70Ma) than the main OJP (~122Ma), whereas the ^{40}Ar-^{39}Ar total ages of clinopyroxene separates are comparable (100-130Ma) to the age of OJP emplacement.

Present data set indicates that basaltic volcanic rocks from the Lyra Basin are possibly formed by very low degrees of mantle melting long after the main eruption stage of OJP. The presence of older clinopyroxenes could either 1) represent older plateau or Lyra Basin crust, incorporated during ascent of alkalic magmas within the basin 65-70 Ma or 2) represent excess Ar of the alkalic magmas, crystallized in magma chamber around 120 Ma, co-existing with the magmas for ~50Ma until they erupted at 65-70 Ma.