Natural analogue study on long-term reaction of bentonite and highly alkaline groundwater

MASAYA OI[1], NAOTATSU SHIKAZONO, MINORU YAMAKAWA[2] AND NAOKI FUJII[3]

[1]3-14-1, Hiyoshi, Kouhokuku,Yokohamashi, Kanagawa, Japan (ooimasaya@gmail.com, sikazono@applc.keio.ac.jp)
[2]1-15-7, Tsukishima, tyuoku,Tokyo, Japan (amakawa_ytmy@ybb.ne.jp, fujii@rwmc.or.jp)

Geological disposal of high-level nuclear waste has been planned and developed in many countries worldwide. In Japan, it is to be vitrified and an overpack enclosing metallic containers that contain the vitrified waste is to be placed in a deep geological repository with the multibarrier system consisting of an engineered barrier and a natural barrier by geological formations. One of the possible buffer materials for the engineered barrier is bentonite, which should possess the property of long-term stability, although the functions required for it depend on the method of disposal of the waste. When used with cement materials as reinforcing agents, however, the functions required for the bentonite-based barrier material may deteriorate due to such phenomena as dissolution and change of properties by highly alkaline groundwater formed by reactions of the cement materials with groundwater. Since it takes hundreds of thousands of years for the radioactivity of high-level nuclear waste to decrease to the natural background level, it is impossible to clarify the reaction mechanism of bentonite and highly alkaline groundwater in the laboratory for such a long time. An appropriate method to examine such a long-term system is natural analogue study that is an investigation of a natural system that has some similarities with a radioactive waste repository and its surrounding environment.

The Mangatarem district, in the Philippines, was chosen as a study area in this natural analogue study. Through the investigation of the Mangatarem district, we tried to elucidate the long-term interaction of bentonite with highly alkaline groundwater

Analytical results reveal some differences between the trench and outcrop samples. Assuming that the source rock of bentonite and zeolite is common for the rock samples of the two sampling points, those differences are probably attributable to the difference in the reaction of the source rock with the highly alkaline groundwater that had come up along faults.

Iron isotopic signature for weathered ordinary chondrites: Application of the LAL sampling-ICP-MS technique for cosmochemical sample

S. OKABAYASHI[1]*, T.D. YOKOYAMA[1], T. YOKOYAMA[2] AND T. HIRATA[1]

[1]Laboratory for Planetary Sciences, Kyoto University, Kitashirakawa Oiwakecho, Kyoto, 606-0582, Japan (*correspondence: okabayashi-s-aa@kueps.kyoto-u.ac.jp)
[2]Department of Earth and Planetary Sciences, Tokyo Institute of Technology, O-okayama 2-12-1, Meguro, Tokyo, 152-8551, Japan

The laser ablation in liquid (LAL) is one of the most versatile techniques to produce the nanoparticles of the solid materials. Our recent research revealed the LAL can be also applied for the sampling technique of the solid samples to measure the elemental and isotopic composition using the mass spectrometer [1, 2]. The LAL sampling technique provides the micro scale sampling, sample integration, and the elimination of the coexistent elements through the ion exchange chromatography. These advantages enable the high-precision measurement of the micro region on the solid samples.

In this study, we have measured the δ^{56}Fe and δ^{57}Fe values of the Fe-Ni grains and the related weathering products in the ordinary chondrites. The cut pipette tip filled with deionized water was placed on the polished meteorite surface and the laser ablation was performed through the water layer. After the LAL procedure, the sample suspension was collected using the micropipette. The resulting sample suspension was decomposed and dissolved in conc. HCl, then the resulting solution was used for the ^{56}Fe/^{54}Fe and ^{57}Fe/^{54}Fe ratio measurements using the multiple collector-ICP-MS technique. The measured $\delta^{56, 57}$Fe values of metal grains showed good agreement with the previously reported values [3]. In contrast, the iron isotopic signature for weathering products found in the identical meteorite samples revealed that the measured $\delta^{56, 57}$Fe values were significantly higher than those for the inherent metal grains. It should be noted that the inherent part of the metallic grains were commonly surrounded by the weathered parts. Possible cause of the present large difference in the measured iron isotope ratios between the fresh and weathered metal grains will be discussed in this presentation.

[1] Okabayashi *et al*. (2011) *J. Anal. At. Spectrom*. DOI, 10.1039/c0ja00200c. [2] Douglas *et al*. (2011) *J. Anal. At. Spectrom*. DOI, 10.1039/c0ja00144a. [3] Theis *et al*. (2008) *Geochim. Cosmochim. Acta* **72**, 4440–4456.