Distribution and behavior of main and trace elements in fault zones

Hiroshi Nagata[1]; Teruyuki Honda[2]; Teruki Iwatsuki[3]

[1] Energy Science and Nuclear Engineering, Musashi Tech; [2] Atom. Ener. Res. Lab., Musashi Inst. Tech.; [3] JAEA

In the geologic disposal for the high-level radioactive wastes, it is an important subject that constructing the methodology for understanding the effect of the faults regarding the mass transfer because of the necessity of estimating precisely the characteristics of that in geological environment.

In this work, main and trace elements in the fault zone and the parent rock samples collected from the sedimentary rocks in Horonobe, Hokkaido, Japan, were determined and it was discussed on the distribution and behavior of the natural analogue elements such as lanthanoids (Ln's), uranium (U) and thorium (Th) in those samples.

A total of twenty three samples including six fault zone ones (i.e. two fault gouge and four fault breccia samples) and seventeen parent rock samples neighboring each fault zone were taken from two cores (i.e. ca. 700 m and ca. 600 m each in depth) bored by the Horonobe Underground Research Center of Japan Atomic Energy Agency.

It was used that neutron activation analysis and ICP-MS for the determination of trace elements, XRF for the determination of main elements and XRD for the identification of minerals, respectively.

As the results, the following conclusions were obtained in this work. In general, the clay minerals are produced accompanying the formation of the faults in many cases. In the present work, the production of the clay minerals was apparently recognized in three samples of the six, showing the similar chemical compositions as smectite which is a main mineral composing bentonite in two samples of the three.

In addition, it was observed that Ln's, especially light Ln's, were enriched in those two samples. It is expected that the bentonite has the high ability of sorption for some radionuclides. In fact, it showed the tendency in this work that light Ln's were especially enriched in the clay minerals in the faults as well. Judging from the similar distributions between Th and light Ln's, it is suggested that the transfer characteristics of those elements in the rock mass were closely related to the ion radii. While regarding the transfer characteristics of U and heavy Ln's, it should be considered not only the ion radii but also other chemical factors such as redox conditions.

Further investigation is necessary on the characteristics of the mass transfer including the inside of the faults.