The elemental behavior of granitic rocks during weathring process-Case study of Tono granite-

Kazuhiro Sasaki[1]; Hirokazu Fujimaki[2]

[1] Dept. of Petrol. Mineral. Econ. Geol., Grad. School of Sci., Tohoku Univ.; [2] Earth and Planetary Sci., Tohoku Univ.

Elemental behavior during chemical weathering from fresh granite to weathered rock and masa has been studied by using boring core of the Tono granitic pluton. The Tono granitic pluton is located in the central part of the Kitakami Mountains, NE Japan. This pluton is composed of quartzdiorite, tonalite and granodiorite becoming more felsic from the outer part inward, showing a zoned pluton. The Tono pluton is divided into four rock facies (the Marginal, Main, Central and the Arakawa-type facies) on the basis of the modal composition of mafic minerals (Kanisawa et al. 1986; Nishimura 1999).

The study samples are a bowling core of O1 and O2 bored in main facies. Standard penetration test was carried out every 1m in bowling. The samples were sampled using standard penetration test sampler. At first, samples are classified by weathering zone and identified constituent minerals with XRD and measured bulk chemical compositions by XRF. In addition, it was eluted samples by water and measured eluent compositions by ion chromatography and ICP-MS.

In this study, we classified in six weathering zones (Granite A, Granite B,Weathered granite A, Weathered granite B, Masa A and Masa B) after Kimiya(1992). This classification supports with rock mass classification method of Central Res. Inst. of Electric Power Industry (Tanaka, 1964) used by engineering works execution according to Chigira (2002).

The result of XRD analysis shows samples of the Granite A and B practically consist of plagioclase, alkali-feldspar, quartz, hornblende, biotite and clay minerals. And it shows some tendencies in the weathering zone as follows, (1) hornblende and biotite have decreased in the Weathered granite A, (2) more smectite contains the Weathered granite B, (3) chlorite hydro-biotite, Illite, vermiculite and kaolinite have decreased in the Masa A, (4) The Masa B contains halloysite, and less amount of chlorite hydro-biotite and vermiculite, and (5) plagioclase, quartz, alkali-feldspar are common independent of degree of weathering.

The result of bulk chemical composition analysis by using XRF shows Ti, Al, Fe, Mn, Mg, P, V, Cr, Ni, Y concentrate at the lowest part of the Masa A. Ca, Na, K, Rb, Sr, Nb simply decrease from lower to upper part, and Zr is contrary to those elements.

As a result of elution test, pH rises, as the depth is deepened. It shows a high value in lowest part of the Masa A in particular. The elution amount of Na^+, K^+, Ca^{2+} and Mg^+ are enriched in the Masa A. In addition to those ions, SO_4^{2-} is enriched in the surface. The Na/Ca ratio is high at the surface, the Granite A and lower part of the Masa A. As for the trace element, there is much elution amount and much Cr.Ni.Co.Cu.Zn,Pb in particular in the surface. There are a few MREE and HREE which mafic mineral includes a lot generally they are standardized analysis results of REE with fresh granite. In addition, there is a negative anomaly of Ce at the lower part of the Masa A, and positive anomaly at the upper part of the Masa A.

As total elemental behavior, sulfuric acid is supplied in the surface by rainwater, and it is thought that elements are leaching remarkably by it. The lower part of the Masa A is located in depth of ground water confirmed in bowling. At the place, decomposition of mafic minerals and clay minerals are generated. In addition, it is supposed that precipitation of iron and aluminum and other elemental accumulation with it are generated. Furthermore it is estimated that the lowest part of the Masa A was oxidic environment by eluent showing negative anomaly of Ce.