Geochemical behavior of rare earth elements in hot spring waters of Kirishima area

Shingo Kawamura[1]; # Junichiro Ishibashi[2]; Tasuku Akagi[3]

[1] Earth and Planetary Sci., Graduate School of Sci., kyushu Univ; [2] Earth and Planetary Sci., Kyushu Univ; [3] Kyushu Univ.

Various types of hot spring waters are observed in Kirishima area. Some of the previous studies have revealed their geochemical features and proposed their formation mechanism (e.g., Fujita et al., 2000). We studied chemical composition of rare earth elements (REE) of the hot spring waters, in order to provide a new constraint for understanding water-rock interactions during evolution of hot spring waters.

Water samples were collected from 7 hot springs, in September, 2007. As soon as sampling, temperature, pH and electric conductivity were measured. Each sample was stored in a polypropylene bottle after filtration with 0.45 um filter. REE concentration was analyzed using ICP-MS, after preconcentration with solvent extraction using a mixture of HDEHP and H2MEHP.

Based on REE composition, the hot spring waters can be classified into the following 4 types.
type1: Light-REE-rich pattern and acid hot springs.
type2: Light-REE-poor pattern and acid hot springs.
type3: Light-REE-rich pattern with Ce anomaly and slightly acid hot springs.
type4: Light-Heavy-REE-pattern and high temperature neutral hot springs.
Basically, the classification according to the REE pattern well corresponds to diversity of hot spring water chemistry. However, it is noteworthy that the type 1 and type 2 hot spring waters showed somehow different REE patterns, although their major elements composition are very similar to each other.

The type 2 hot spring is attributed as evolved from the type 1 hot spring, because the type 2 waters are lower temperature and lower total REE concentrations. Assuming that the difference of the REE concentrations between the type 1 and type 2 equals to uptake into alteration minerals, we obtained solid-liquid partitioning of each REE. The estimated partitioning factors showed low at Dy and high at both LREE and HREE. Precipitation of alunite would explain the partitioning, because alunite has two cation sites of different sizes. Kikawada et al. (2004) reported that alunite collected from acidic hot springs in Kusatsu area showed enrichment in both LREE and HREE, which is in a good accordance with our consideration.