

Geochemical map of Sr isotopic ratios in Kyusyu, Japan

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Geochemical map means spatial distributions of chemical elements in the earth's land surface. It can become one of the tools for discerning natural and anthropogenic elements in the environment of the ground. Stream sediment is often used as a sample for making geochemical maps, because sediment could integrate the surface geology of its drainage area. Strontium isotopes in surficial deposits are, in particular, useful tracers for identify source materials controlling the distribution of chemical elements. Furthermore, Sr isotopic ratios in an individual's bone and teeth could directly reflect the isotopic ratios found in its consumed animals, plants, and finally bedrock of that geologic region, and therefore strontium isotope analysis of archaeological skeletons has been used in archaeology, by characterizing past human residential migration and mobility. Geochemical map of Sr isotopic ratios is very important for clearly deciding growth-places of animals and plants.

In Kyushu Island, Japan, various geological features with variable distributions of elements are situated. Metamorphic rocks or sedimentary rocks, Paleozoic-Mesozoic period, are distributed along some big fracture zones extending from NE to SW. In North Kyusyu area, metamorphic rocks or Cretaceous granites are mainly exposed along many fracture zones from NW to SE direction. Around some volcanic areas, we can see the land surface covered with a lot of igneous rocks or pyroclastic materials.

We tried to make a geochemical map of Sr isotopic ratios in the Kyusyu area. We estimated a variation of the Sr isotopic ratios in stream sediments in Kyusyu area, and investigated relation between the Sr isotopic ratios and the bedrock geology in the catchment area. We analyzed approximately 150 samples of stream sediments, mainly collected by the Geological Survey of Japan for geochemical maps covering the whole of Japanese islands, and partly collected by ourselves. First we ignited all samples at 950 degrees Celsius, because stream sediments probably include some organic matter. Then, samples were digested in HF and HClO₄, followed by cation exchange chromatography with 2.4M HCl for extraction of Sr fraction. Strontium isotopic ratios were measured by TIMS (belong to Graduate School of Environmental Studies, Nagoya University).

The $^{87}\text{Sr}/^{86}\text{Sr}$ ratios range from 0.704 to 0.717. The Sr isotopic ratios could be strongly controlled by the geological settings and situations though amount of weathering mineral in soil seems one of the factors of the variation. The stream sediments around Mts. Aso and Unzen, and in Kunisaki peninsula, covered with fresh lava, have values of 0.704 to 0.705. These Sr isotopic ratios of stream sediments agree with isotope data of lava formed from mantle magma. The result means that distribution of the Sr isotopic ratios in stream sediments is affected by the geological setting in the lava area. In the central area in Kyusyu Island, in where very complex geological setting is spread, stream sediments have various $^{87}\text{Sr}/^{86}\text{Sr}$ ratios caused by mixing of various geochemical features of different geological setting and/or environment. In the northern part of Nagasaki Prefecture, stream sediments have high Sr isotopic ratios because Paleocene sedimentary rock is distributed there. From these results, the distribution of Sr isotopic ratios in stream sediments mostly corresponds to that of predominant geological setting at the catchment area.