Annual and seasonal variations of chemical composition of stream sediments collected at the same sampling site

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Distribution of element concentrations in stream sediments is mainly controlled by the surface geology of the drainage area, and therefore, geochemical mapping for stream sediments could give strict distribution of natural background concentrations of elements, and could also reveal artificial addition caused by a variety of different pollutants arising from human and industrial activities to the background. However, analytical results of sediment samples contain variations due to heterogeneous distribution of sediment at a sampling site.

During 14 years from 1994 to 2007, we have collected stream sediments of more than 1,500 samples in the northeastern Aichi prefecture, and every year from 1994 to 2004, we have collected sediment samples at the same sites. Here we discuss on annual, seasonal and spatial variations of chemical composition of stream sediments collected at the sampling site.

Sediment samples collected were passed through 16 mesh sieve with stream water once, passed through 80 mesh sieve with stream water twice, and then filtered using commercial paper filters. The samples were brought back to the laboratory, and dried at room temperature. Then, they were pulverized and homogenized by agate ball mills. Major element composition in the sediment samples was measured by XRF using Shimazu SXF-1200 at Nagoya University. Glass beads were prepared by fusion with $Li_2B_4O_7$ as a flux. The amounts of sample and flux are 0.7: 6.0 g. Trace-element composition in the sediment samples was measured by INAA. About 120 mg of a sample was put into a plastic bag and irradiated for 5 minutes together with the standards in the JRR-3 or JRR-4 in Japan Atomic Energy Research Institute. The gamma-rays were detected by the Ge detector (GEM359150, EG&G ORTEC) at Radioisotope Center in Nagoya University.

Most of major elements showed the concentrations with +/-20% variations while Ti and P showed relatively fluctuated concentrations. The large deviation of Ti concentration suggests heterogeneous distribution of small grains of Ti-rich minor minerals such as Fe-Ti oxide and sphene in sediment samples. The anomalous high values of Fe, Mn, and P in samples collected on 2001. There was a heavy rain around Tokai areas on October 11, 2000, when many trees were blew down and a lot of landslides were occurred. The stream sediments sampled in 2001 could contain foreign materials added by the washout.

On the other hand, most of trace elements, except for Cr, Hf, and Th, of the samples showed the concentrations with +/-(30-50) % deviations. Trace-element concentrations in a sediment sample could be significantly perturbed by heterogeneous distribution of the elements at the sampling site, when compared with major-element concentrations. The amount of sediment samples used in XRF is about 700 mg, whereas that in INAA is about 120 mg, and the values obtained by INAA is relatively affected by sample heterogeneity. The high deviations in Cr, Hf, and Th might be caused by heterogeneous distribution of small accessory minerals such as chromite, magnetite and zircon at the sampling site, and heterogeneous sample aliquots used in INAA analysis.