

Stable isotope ratios of Sr, Nd and Pb as environmental traceability index

*Takanori Nakano¹

1. Research Institute for Humanity and Nature, Inter-University Research Institute Corporation National Institutes for the Humanities

The stable isotopic ratios of Sr, Nd and Pb in environmental and artificial materials reflect the regional values of rock minerals and ores which are their origin. In this presentation, I introduce recent examples applied to atmospheric and terrestrial environments of Sr-Nd-Pb isotopes, which have been used in geological studies.

The isotope ratios of Sr, Nd, and Pb in Asian dust are known to differ depending on the particle size and constituent minerals and also to differ from those of coal ash and road dust. It also becomes clear that the Sr-Nd-Pb isotopic ratio of wet precipitation in Japan changes both locally and temporally, and the weak-acid soluble substances in the atmospheric aerosol have Sr-Nd-Pb isotopic ratios which are similar to the wet precipitation but are different from the acid-insoluble substances. These information suggests that the Japanese atmosphere is contributed by a variety of transboundary substances from the Asian continent as well as the substantial amounts of domestic substances. The areal and temporal change in the Sr-Nd-Pb isotopic ratio of the atmospheric precipitation is different from the sulfur isotope ratio, suggesting that the emission area and the atmospheric behavior of primary particles containing Sr, Nd, and Pb is different from secondary particles containing sulfur.

The Sr-Nd-Pb isotopic ratio of the atmospheric fallout is effective for the discrimination and of elements from basement rock, Asian dust, and volcanic ash, which are the source materials of Japanese soil. While the Sr and Nd isotopic ratio of river water and plants changes in accordance with the basement geology, the Pb isotopic ratio reflects the value of atmospheric fallout. Sr-Nd-Pb isotopes can be used as a traceability index of environmental materials and agricultural products. The Sr isotopic ratio of Japanese vegetables tends to be low in Northeast Japan and in the central and southern parts of Kyushu, where volcanic materials of Neogene-Quaternary time are dominant, while to be high (>0.708) in Southwest Japan and especially in the Kinki district, where Jurassic and Cretaceous-Paleogene accretionary prism and Cretaceous granitic rocks are widely distributed, However, the contribution of Sr from fertilizer is obvious in Japanese vegetables, suggesting that stable isotopes of Sr as well as Nd may be used for artificial impact assessment like Pb isotopes. In order to advance Sr-Nd-Pb isotopes as environmental traceability index, distribution on the Sr-Nd-Pb isotopic ratio for river water and groundwater are indispensable.

Keywords: Stable isotopes of Sr, Nd and Pb, traceability index, atmospheric environment, soil and vegetation ecosystem, product area identification of vegetables