Geochemical features of the aerosols and surface soils collected over China and Sr and Nd isotope utilization as a tracer

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Introduction:

Aeolian dust is micro particles transported to a long range through atmosphere by wind. For example, those originated from inland Asia is called Asian dust, known as Kosa in Japan. For recent increasing attention, it is important to identify the origin, transportation process, and flux of Asian dust, having a significant influence on the global climate and on geochemical mass cycles. We need some tracers having an ability to preserve the source information to evaluate the chemical contribution of Asian dust to the atmosphere and human environment. Usually, we collect and analyse the samples as aerosols or fall out particles over the dust contributed area, and chemically compare to possible source components.

Sr isotope composition is a good tracer for the source identification of Asian dust. Recent Japanese aerosol studies suggested that the present main source of them is a north-eastern part of China by Sr isotope and meteorological data. Unfortunately, Sr isotope data for surface soils in the northern and north-eastern parts of China is very scarce. Many isotope studies of loess or surface soils have been mainly concerned with around the Taklimakan Desert and the Central Loess Plateau. In addition, to compare the long-range transported materials and surface soil particles, we must concern the variability for a geochemical feature depending on particle size, although almost reported data is of no size-segregated samples. Therefore, we report the chemical and Sr isotope data of aerosols, actually rising particles in air, and size segregated surface soil particles collected in China and discuss the correlation for Asian dust collected in Japan.

Method:

Aerosol samples collected at three sites in north-western to central parts of China (Qira, Aksu: western to north-western, Shapotou: central China) by High-volume air sampler on PTFE filter. All samples was decomposed and analysed chemical and isotopic compositions. On the other hand, surface soil samples collected in several sites of China, and size segregated (less than 38 and/or 5 micron, respectively) and analysed. To evaluate the chemical alteration through long-range dust transport, we carried out acetic acid leaching experiment for aerosols and surface soils, and analysed acetic residue and leachate fraction in addition to bulk fraction.

Result and discussion:

The chemical composition of Chinese aerosols is similar to each other, though it showed some differences for the dissolved mineral contents. On the other hand, Sr isotope ratio (87Sr/86Sr) of aerosols in three sites shows 0.71284 - 0.71312 (Qira), 0.71223 - 0.71241 (Aksu), 0.71423 - 0.71492 (Shapotou) in bulk components, and 0.71826 - 0.72050 (Qira), 0.71865 - 0.72013 (Aksu), 0.717622 - 0.71935 (Shapotou) in acetic acid residue. These slight differences are explained by the evaporated salt minerals contents, and the dissolution of those minerals results not only 87Sr/86Sr but also 87Rb/86Sr increase in residual components (bulk: 87Rb/86Sr = 0.6 - 1.0, residue: 87Rb/86Sr = 1.7 - 3.0). Although a plot of 87Sr/86Sr and 87Rb/86Sr for bulk components shows a slight difference by sampling localities, the feature is more obvious in the residual component. Although the Chinese aerosols in north-western to central parts did not consistent with the end-member of aeolian dust transported to Japan, the new data of Sr isotope composition of the size-segregated surface soils collected in north to north-eastern parts of China showed different isotopic features and support to be closer relationship to the end-member of Japanese aerosols. In addition, we report the Nd isotope consideration for some of them, because it has been indicated to another good tracer for Asian dust in recent study.

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