

Strontium isotope constraints on the provenance of dissolved cations in rain at Kyotanabe and Nishinomiya, western Japan

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We determined the elemental and Sr isotope compositions of monthly wet precipitation at Kyotanabe and Nishinomiya to elucidate the seasonal and regional variation in the provenance of dissolved cations.

Concentrations of Ca and Sr of precipitation tended to become high in spring and low in autumn and winter. The pH values became high in spring. The Sr isotopic composition varied seasonally with high $^{87}\text{Sr}/^{86}\text{Sr}$ in spring and low $^{87}\text{Sr}/^{86}\text{Sr}$ during summer and winter season. Aian dust events are frequent in spring and the maximum $^{87}\text{Sr}/^{86}\text{Sr}$ in the spring precipitation was close to the $^{87}\text{Sr}/^{86}\text{Sr}$ for calcium carbonate in loess in China. Accordingly, the elevated $^{87}\text{Sr}/^{86}\text{Sr}$, Ca and Sr concentrations and pH values in the spring precipitation are attributed to the dissolution of calcium carbonate in Asian dust.

If Sr in rain during summer and winter season is assumed to be a mixture of non-Asian dust components (sea salt and soil mineral dust and anthropogenic emission around the sampling sites), then it is possible to calculate the relative contribution of Asian dust in rain. The Asian dust component is estimated to vary 16-60% and 4-36% in the spring precipitation at Kyotanabe and Nishinomiya, respectively.

We calculated the non-sea-salt (nss) proportion of Sr in rain on a Na basis. The nss-Sr proportion is estimated 23% and 15% in precipitation at Kyotanabe and Nishinomiya, respectively. The nss- nssSO_4^{2-} and NO_3^- concentrations of precipitation at Nishinomiya were higher than those of precipitation at Kyotanabe. This result shows that the precipitation at Nishinomiya was affected by the anthropogenic materials.

We calculated the $^{87}\text{Sr}/^{86}\text{Sr}$ of the mixture of non-sea salt component in rain using the proportions of sea-salt-Sr and nss-Sr and the $^{87}\text{Sr}/^{86}\text{Sr}$ of seawater. The $^{87}\text{Sr}/^{86}\text{Sr}$ of the mixture of non-sea salt component in rain at Kyotanabe and Nishinomiya were close to but slightly less than the $^{87}\text{Sr}/^{86}\text{Sr}$ ratios for exchangeable cations from the sediments of the Osaka group and Rokko granite, respectively. These results suggest that there are the contributions of local mineral dust and the anthropogenic emissions which has the lower $^{87}\text{Sr}/^{86}\text{Sr}$ in rain at Kyotanabe and Nishinomiya.

Keywords: precipitation, Sr isotope, Asian dust