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Identification of the Home of the Salt by Stable Isotope Analysis

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Summary

This study aimed at obtaining information on the home country of the salt sold in Japanese market by stable isotope analysis. Fourteen salt samples from 9 countries were purchased in Kanagawa prefecture and element concentrations in them were determined by ICP atomic emission spectrometry (Na, Mg, K, Ca) and ICP mass spectrometry. Sodium, Mg, Ca, Li, B, Rb, Sr, Ba, Pb were determinable in all/most of the samples. Among these elements, B and Sr were selected as a candidate element whose isotopic information provides with home of the salt because they are known to have isotopic variation in the environment. Isotopic ratios of Li and Pb were also known to vary in the environment, however, they were not examined in this study because there is no suitable separation technique available for Li in our laboratory and the concentration of Pb was too low.

Separation of B and Sr was carried out by a solid phase extraction by using boron-specific ion exchange resin (IRA 743) and chelete disk, respectively. Recoveries of these separations were quantitative for standard solution, but not necessarily satisfactory for salt samples. The presence of matrix should have some effect on the recovery. However, it was judged that low recovery did not affect result of isotopic measurement. The measurement of isotope ratios ($^{11}B/^{10}B$ and $^{87}Sr/^{86}Sr$) was carried out by ICP mass spectrometry using NIST SRM for correction of mass discrimination.

$^{11}B/^{10}B$ of the salt samples ranged from 4.029-4.242. Japanese sea salt had 4.217±0.015 (n=6) which agreed well with Chinese and French sea salts. While rock salts from the USA, Chili, Germany and Bolivia had 4.074±0.051. It was clearly possible to discriminate sea salt and rock salt by its $^{11}B/^{10}B$.

On the contrary $^{87}Sr/^{86}Sr$ did not vary among the samples: mean and standard deviation of 11 samples was 0.709±0.0025. Since it is known that sea water has rather constant $^{87}Sr/^{86}Sr$ (0.709) over the world, this result was not unexpected. Low abundance of Rb (<1 μg/g) in rock salt resulted in $^{87}Sr/^{86}Sr$ around the original values of 0.709. Thus $^{87}Sr/^{86}Sr$ was not a good indicator of the home of salt in this study.

In summary, only $^{11}B/^{10}B$ was found to have a limited potential to discriminate home of salt.