Rapid Analysis of $^{90}$Sr in Small Bone Samples
—Applicability of Sr Resin for ICP-MS of $^{90}$Sr in Hard Tissues—

Strontium-90 ($^{90}$Sr) is a typical fission product, has a half-life of 28.8 y, and has bone-seeking properties. The radioactivity concentration of $^{90}$Sr in hard tissues of mammals (e.g., bones, teeth) is positively correlated with that of plants or soils obtained from the fields where the mammals have grown. Thus, the $^{90}$Sr concentration in hard tissues can be used to clarify the $^{90}$Sr distribution in the local environment. However, the conventional $^{90}$Sr analysis method (i.e., the radiometric method) needs samples of at least 1 g and thus cannot be used to determine $^{90}$Sr in small bone, tooth, or fish otolith samples.

Recently, a $^{90}$Sr analysis method in soil and plants using inductively coupled plasma mass spectrometry (ICP-MS) has been developed that has a comparable detection limit. Although this method can be used to analyze small samples with low Ca content, such as soils and plants, the high concentration of Ca and isobar (e.g., zirconium-90; $^{91}$Zr) in hard tissues interferes with $^{90}$Sr measurements. To measure the radioactivity concentration of $^{90}$Sr in hard tissues using ICP-MS, therefore, we investigated using a resin column to clarify the $^{90}$Sr concentration in small bone and tooth samples, as shown in Fig.1-33. The activity concentrations determined by ICP-MS after separation were in good agreement with those by the conventional radiometric method, as shown in Table 1-1. Further, the $^{90}$Sr detection limit using ICP-MS of 0.1 g samples was lower than that of the radioactivity measurement. Therefore, coupling the proposed separation technique with ICP-MS can be used to quantify the $^{90}$Sr concentration in small bone and tooth samples of terrestrial animals, thereby allowing researchers to track the distribution of $^{90}$Sr in animal habitats.

This work was performed in collaboration with Tohoku University as part of a project entitled, “Investigation of Sr incorporation recorded in teeth of animals related to environmental transfer”.

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Reference