Determination of ^{236}U in environmental samples by triple quadrupole ICP-MS

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The anthropogenic uranium isotope ^{236}U (half-life: 2.34×10^{7} y) is one of the most important environmental tracers. Uranium-236 is produced by the nuclear reaction of ^{235}U with thermal neutrons in reactors. It is found in spent nuclear fuel and the reprocessed uranium made from spent nuclear fuel. Therefore, ^{236}U can be used as a tracer to investigate the distribution of anthropogenic uranium.

Advances in inductively coupled plasma quadrupole mass spectrometry with a reaction cell have enabled us to determine trace elements in a number of environmental matrices. The measurement of ^{236}U by ICP-MS is very difficult due to a high background noise caused by ^{235}UH. Recently, a triple quadrupole ICP-MS (ICP-MS/MS) can be available to measure $^{236}U/^{238}U$. The ^{235}UH signal was reduced by using O_2 as a reaction gas to improve the precision and accuracy of the $^{236}U/^{238}U$ isotopic ratio measurements (Tanimizu et al., 2013). This analytical approach has the potential to provide a more sensitive and robust technique for the quantitative analysis of ultra-trace ^{236}U in the environmental samples.

In this study, we examined the applicability of the method to determine ^{236}U in a sediment core sample collected in Tokyo Bay. An ICP-MS/MS (Agilent 8800, Agilent Technologies) with a desolvating nebulizer (Aridus Ⅱ, Cetac Technologies) was used for the measurement of $^{236}U/^{238}U$ ratios. The sediment core samples were dissolved by a mixture of acids, and the matrix elements were removed by a separation technique using UTEVA resin. The measured ratios were corrected by normalizing the $^{236}U/^{238}U$ ratio of XSTC-829 to 2.2×10^{-7}.

The sources of anthropogenic uranium in Tokyo Bay were investigated on the basis of $^{236}U/^{238}U$ ratio in the sediment core. The $^{236}U/^{238}U$ ratios in the core increased from 1970. Moreover, The $^{236}U/^{238}U$ ratios in the sediment core in the 1980s in Tokyo Bay were still high. This result suggests that the main source of anthropogenic uranium in Tokyo Bay might not be the global fallout in the 1960s. In this presentation, we would like to discuss the possible sources of the anthropogenic uranium in Tokyo Bay.