

Attempt to determine Pu isotope ratio in settling particles using SF-ICP-MS with a high efficiency sample introduction system

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The study on the distribution of plutonium (Pu) and its isotopes in the western North Pacific Ocean has been an interesting research topic due to the need for radiological assessment and the application potential for tracing oceanographic processes occurring in the region. It was known that the plutonium isotopes, ^{239}Pu (half-life: 24,400 y) and ^{240}Pu (half-life: 6,580 y), have been added to the Pacific Ocean mainly as a consequence of global (stratospheric) fallout which originated primarily from high-yield nuclear testing by the United States and the former Soviet Union and it has been well established that the maximum deposition of stratospheric fallout occurred in 1963. A second source has been close-in fallout from Bikini Atoll weapons tests, which were conducted in the 1950s. Several studies performed in the 1970s & 1990s have observed general excess inventories of Pu over those anticipated from global fallout in the sediment and water columns. It has been speculated that the main source of these excess inventories could be close-in and tropospheric fallout derived from large scale nuclear explosions on Bikini and Enewetok atolls in the 1950s.

In recent years, through the study of Pu isotope ratio ($^{240}\text{Pu}/^{239}\text{Pu}$) in the sediment cores and the water column, the wide existence of Bikini close-in fallout Pu in Okinawa Trough (1,2), in Sagami Bay (3), in the Japan Sea (4 -7) and in the North Pacific (8) have been disclosed. These studies provided direct evidence to support the above-mentioned speculation. However, the transportation routes of Bikini close-in fallout Pu (direct tropospheric deposition vs. oceanic current transportation) are still a question of debate. Further studies on the Pu isotope ratios in settling particles sampled by using sediment trap are important in order to get an insight into the mechanism of Pu transportation process in the ocean. In this work, we report our recent effort to establish an analytical method for the determination of $^{240}\text{Pu}/^{239}\text{Pu}$ isotope ratio in settling particles collected in the East China Sea by using a sector-field ICP-MS with a high efficiency sample introduction system.

References

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