Pu isotopes in water columns of the northern North Pacific

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Introduction

Anthropogenic radionuclides such as ^{239}Pu (half-life: 24,100 yr), ^{240}Pu (half-life: 6,560 yr) and ^{241}Pu (half-life: 14.325 yr) mainly have been released into the environment as the result of atmospheric nuclear weapons testing. In the North Pacific Ocean, two distinct sources of Pu isotopes can be identified; i.e., the global stratospheric fallout and close-in tropospheric fallout from nuclear weapons testing at the Pacific Proving Grounds in the Marshall Islands.[1] The objectives of this study are to measure the ^{240}Pu/^{239}Pu atom ratios in seawater from the northern North Pacific Ocean and to discuss the transport processes of Pu.

Materials and methods

Seawater samples were collected at Stn. DR-10 in the northern North Pacific and Stn. DR-13 in the Bering Sea with a double barrel PVC large-volume sampler.[2] The ^{240}Pu/^{239}Pu atom ratios were measured with a double-focusing SF-ICP-MS, which was equipped with a guard electrode to eliminate secondary discharge in the plasma and to enhance overall sensitivity. [3]

Results and discussion

The total (water + sediment) inventory of 53.8 Bq m^{-2} at Stn. DR-10 in the northern North Pacific was mostly the same as that (58.1 Bq m^{-2}) of the expected cumulative deposition density of atmospheric global fallout at the latitude of 40 – 50°N. The atom ratio of ^{240}Pu/^{239}Pu showed no notable variation from subsurface water of 100 m depth to deep water of 2000 m depth, then increased with depth to 0.255 at the bottom layer. The atom ratios in water column of the northern North Pacific were significantly higher than the mean global fallout ratio of 0.18.[4] High atom ratios of ^{240}Pu/^{239}Pu in the northern North Pacific prove the presence of close-in tropospheric fallout from nuclear weapons testing at the Pacific Proving Grounds.

[1] Yamada & Zheng (2010) *Sci. Total Environ.* **408**, 5951-5957. [2] Nagaya & Nakamura (1993) *Deep Ocean Circulation, Physics and Chemical Aspects*. *Elsevier,* 157-167. [3] Zheng & Yamada (2007) *Anal. Sci.* **23**, 611-615. [4] Kelley et al. (1999) *Sci. Total Environ.* **237/238**, 483-500.

Negative growth of the continental crust at present: Significance of arc subduction

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Subduction and recycling of differentiated material into the mantle are of significance not only for continental growth but also for creating mantle heterogeneities. Continental crust is predominantly created by arc magmatism and returned to the mantle via sediment subduction, subduction erosion and continental subduction [1]. Oceanic arcs, primary form of continental crust, have been thought to be entirely accreted during arc-collision due to its buoyant nature. Modern oceanic arcs are, however, mostly subducted into the mantle. The best examples of arc subduction are observed around the Japan islands [2,3]. Among the more than 15 examples of arc–arc collision in the western Pacific, arc–arc amalgamation is possible only in the case of parallel collision [2,4]. Parallel collision of two arcs is rather rare case, compared to the normal arc–arc collision, therefore these observation imply that the predominant subduction of arc crust is in general and that a majority of the intra-oceanic arc in the Earth history must have been subducted into the mantle.

Geophysical and geological studies document that sediment subduction and subduction erosion move large volumes of continental material toward the mantle, and comprehensive studies for the rate of continental reduction versus production suggest a balance, resulting in no growth of continental crust at present [5,6]. However, these estimates do not take into account the concept of arc subduction. Considering direct subduction of oceanic arcs into the mantle, we conclude negative growth of the continental crust on the Earth at present.

[1] Scholl & von Huene (2010) *Can. J. Earth Sci*. **47**, 633-654. [2] Yamamoto *et al*. (2009a) *Gondwana Res*. **15**, 443-453. [3] Yamamoto *et al*. (2009b) *Gondwana Res*. **16**, 572–580. [4] Santosh *et al*. (2009) *Gondwana Res*. **15**, 324-341. [5] Clift *et al*. (2009) *Earth Sci. Rev*. **97**, 80-104. [6] Stern & Scholl (2009) *Int. Geol. Rev.* **52**, 1-31 (2009).