Distributions of nickel, copper and zinc isotopes in the North Pacific Ocean

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Nickel, copper, and zinc play important roles as a micronutrient for organisms and as geochemical tracers in the ocean[1]. Dissolved Ni, Cu, and Zn have concentrations of 0.01–10 nmol/kg in seawater and their distributions exhibit a nutrient type for Ni and Zn, a nutrient-scavenging hybrid type for Cu. To elucidate the biogeochemical cycling of these metals in the ocean, it is useful to determine the profiles of their isotopes in the ocean, because isotopic fractionation occurs during various biogeochemical processes. Previously, we have developed a method for analysis of Cu isotopes in seawater using NOBIAS Chelate-PA1 resin that has both iminodiacetic and ethylendiaminetriacetic acid moieties[2]. Recently, we have developed a simple and rapid method which enables the isotopic measurement of Ni, Cu, and Zn after single chelating extraction followed by single anion exchange chromatography.

Using this method, we revealed distributions of δ^{60}Ni, δ^{65}Cu, and δ^{66}Zn in the subarctic North Pacific. δ^{60}Ni value decreases with depth in the depth range of 20−600 m and was homogeneous in the depth deeper than 600 m. There was a negative correlation between [Ni] and δ^{60}Ni. δ^{65}Cu and δ^{66}Zn values in surface seawater were lower than those of deep seawater. The minimum value was found at a depth of 100 m for δ^{66}Zn and at 300 m for δ^{65}Cu. We will discuss biogeochemical cycling of Ni, Cu, and Zn based on these data.

[1] SCOR Working Group (2007), Chemie der Erde - Geochemistry 67, 85-131.

[2] Takano, S., Tanimizu, M., Hirata, T. and Sohrin, Y. (2013), Analytica Chimica Acta 784, 33-41.