Lead spreading through sub-surface water over the North Pacific

*宗林 由樹[1]、鄭 臨潔[1]、南 知晴[1]、高野 祥太朗[1]
*Yoshiki Sohrin[1], Linjie Zheng[1], Tomoharu Minami[1], Shotaro Takano[1]

1. 京都大学化学研究所
1. Institute for Chemical Research, Kyoto University

The international research programme GEOTRACES is revealing global distributions of trace elements in the ocean (http://www.geotraces.org). We have been studying the distributions of Al, Mn, Fe, Co, Ni, Cu, Zn, Cd, and Pb in seawater using our chelating resin extraction-ICP-MS method (Minami et al., 2015) as a part of Japan GEOTRACES. This presentation reports our novel results from the North Pacific.
Seawater samples were collected during R/V Hakuho Maru cruises of KH-05-2 (along 160˚W), KH-11-7 (along 165˚E), and KH-12-4 (along 47˚N) using a clean sampling system. The vertical profiles of dissolved Al, Mn, Co, Ni, Cu, and Cd were quite similar between cross-over stations of KH-05-2 and KH-12-4. However, a sub-surface maximum of dissolved Pb significantly decreased from 2005 to 2012. The decrease is consistent with the decrease of Pb in sub-surface water in the North Atlantic (Lee et al., 2011). On the ocean section along 160˚W, the sub-surface Pb maximum was observed to the north of 10˚N with a core at ~35˚N and ~200 m depth. On an isopycnic surface of s_0 = 26.00, the sub-surface Pb maximum decreased from 165˚E to 130˚W. In addition, both the dissolved Pb and Co showed scavenged profiles with a strong correlation >300 m depth for all stations. Although the concentrations of Co were high in surface waters near continents, those of Pb were high in surface waters beneath westerlies.
It is widely recognized that the sub-surface Pb maximum is caused by anthropogenic sources and the decrease in the Atlantic is due to the phase-out of leaded gasoline in the United States and Europe (Lee et al., 2011). Our data suggest that the decrease is slower in the Pacific. It is very likely that anthropogenic lead is majorly caused by coal burning in China, carried to the North Pacific by westerlies, dissolved in mixing layers, and spreaded through sub-surface water over the North Pacific by current systems.

Lee, J.-M., Boyle, E.A., Echegoyen-Sanz, Y., Fitzsimmons, J.N., Zhang, R. and Kayser, R.A. (2011) Analysis of trace metals (Cu, Cd, Pb, and Fe) in seawater using single batch nitrilotriacetate resin extraction and isotope dilution inductively coupled plasma mass spectrometry. Anal. Chim. Acta 686, 93-101.
Minami, T., Konagaya, W., Zheng, L., Takano, S., Sasaki, M., Murata, R., Nakaguchi, Y. and Sohrin, Y. (2015) An off-line automated preconcentration system with ethylenediaminetriacetate chelating resin for the determination of trace metals in seawater by high-resolution inductively coupled plasma mass spectrometry. Anal. Chim. Acta 854, 183-190.

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