Tracing the subarctic North Pacific intermediate water by using the decoupling of dissolved zinc and silicate

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Introduction

Zinc (Zn) is an essential trace nutrient for marine microorganisms and one of key parameters in international GEOTRACES project. Recent studies have revealed basin-scale distributions of dissolved Zn and the relationship between dissolved Zn and silicate[1, 2]. In the subarctic North Pacific, the decoupling of dissolved Zn and silicate occurs in the subarctic North Pacific intermediate water (sigma-theta: 26.6 – 27.5)[3]. In this study, we will present zonal section transect data of dissolved Zn across the subarctic and subtropical western North Pacific to trace the subarctic North Pacific intermediate water by using relationship between dissolved Zn and silicate.

Methods

Seawater samples were collected in the western North Pacific during the R/V Hakuho-maru KH-12-3 cruise (from July to August 2012), by using a CTD-CMS including acid-cleaned Teflon-coated X-Niskin samplers. Zn in seawater was determined with cathodic stripping voltammetry (CSV) with ammonium 1-pyrrolidinedithiocarbamate (APDC) after UV-digestion.

Results and Discussion

The relationships between dissolved Zn and silicate in the western North Pacific clearly indicated a decoupling of dissolved Zn and silicate in subarctic regions. Based on the linear relationship between dissolved Zn and silicate in the eastern subtropical North Pacific[4, 5], we calculated Zn*, a deviation from the relationship, as follows.

$$Zn^* = [Zn] - 0.053 \times [silicate] + 0.332$$

High Zn* values were observed in the intermediate water masses from subarctic to subtropical regions. Our zonal section data indicates that Zn* could be a very useful tracer to trace the subarctic North Pacific intermediate water in the entire western North Pacific.

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