Iron enrichment by sea ice melting in the surface water in the Okhotsk Sea

N. KANNA[1*], J. NISHIOKA[2] AND T. TOYOTA[2]

[1]Graduate School of Environmental Earth Science, Hokkaido University, Sapporo 060-0810, Japan (*correspondence: kanna@pop.lowtem.hokudai.ac.jp)

[2]Institute of Low Temperature Science, Hokkaido University, Sapporo 060-0819, Japan

The Sea of Okhotsk, one of the sub-polar marginal seas in Northern Hemisphere, is a seasonally ice-covered region. Previous work has reported high iron (Fe) concentration in sea ice, ~3821 nM for total dissolvable Fe (TDFe) and ~5.8 nM for dissolved Fe (DFe), in this region [1]. To evaluate the contribution of sea ice melting to Fe enrichment in the surface mixed-layer, hydrographic observations were conducted in the deep basin (>900 m) of the southern Okhotsk Sea in late-November 2013 (before sea ice cover) and in mid-February 2014 (during sea ice cover). A striking temporal increase in Fe concentrations, from ~6.5 nM for TDFe and ~0.96 nM for DFe in November, to ~62.5 nM for TDFe and ~3.37 nM for DFe in February was observed in the mixed-layer (Figure 1). The increase of the Fe concentrations in February coincided with a decrease in seawater salinity. The inventory of Fe in sea ice which should be released to the mixed-layer is estimated from the difference in Fe profiles between these two seasons. The estimated values are 7407 μmol m^{-2} for TDFe and 375 μmol m^{-2} for DFe. The estimate for inventory of TDFe calculated directly from collected sea ice and snow samples [1] shows 1649±445 μmol m^{-2} (mean±95% confidence level), which accounts for only 22% of that obtained from this study. Given any loss of Fe from sea ice before or during field sampling and the heterogeneity of Fe in sea ice, the Fe enrichment by sea ice melting in the surface water estimated from this study might be more precise than the values estimated just from sea ice and snow samples.

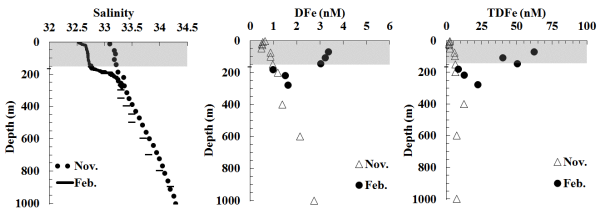

Figure 1: Vertical profiles of salinity, DFe, and TDFe concentrations in November and February. Hatched area shows surface mixed-layer depth observed in February.

[1] Kanna *et al*. (2014) *Progress in Oceanography* **126**, 44-57.