Evaluation of the origin of the Coastal Oyashio Water using fluorescent dissolved organic matter

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The western subarctic Pacific Ocean is a region where largest seasonal pCO_2 drawndown by biological activity is evident. The Coastal Oyashio Water (COW), characterized by low temperature and low salinity, is distributed at off eastern Hokkaido in spring and possibly affect massive spring phytoplankton bloom in this region. Although riverine waters and/or sea-ice melt water have been considered as freshwater end-members of the COW, the contribution and temporal/spatial distribution of each freshwater end-member has not been well documented. In this study, to evaluate the origin of the COW distributed at off eastern Hokkaido, we used humic-like fluorophores in dissolved organic matter (DOM) as a tracer of freshwater end-member. Since humic-like fluorophore in riverine water is refractory, a negative correlation is generally observed between humic-like fluorescence intensity and salinity in coastal environments. While, levels of humic-like fluorophores in sea-ice melt water are low compared with seawater, because DOM are ejected with brine during sea-ice formation. Thus, it would be able to evaluate the contribution of freshwater end-members of the COW from the relationship between humic-like fluorescence intensity and salinity.
Seawater samples were collected during the *Hakuho-Maru* KH-15-1 cruise conducted at off eastern Hokkaido during March 6 to 26, 2015. As freshwater end-members, riverine waters and sea-ice samples were also collected. The riverine waters were collected from streams/rivers at the eastern Hokkaido during September 18 to 21, 2011. The sea-ice samples were collected during the *Soya* cruise on February 14, 2012, February 25 and 28, 2013, and February 16, 2014. The sea-ice sample was melted in an acid-cleaned PTFE beaker in a dark at room temperature. Dissolved organic carbon (DOC) concentration, excitation-emission matrix (EEM) fluorescence, and absorbance were measured. The EEMs were decomposed into individual fluorescent components using parallel factor analysis (PARAFAC).
According to Hanawa and Mitsudera (1987), water masses were classified into three water masses, namely, the COW (T<2.0 ℃, S<33.0), the Oyashio Water (T<7.0 ℃, S=33.0-33.7, Sigma-theta<26.7), and the Low-layer Water (Sigma-theta>26.7). Four fluorescent components, obtained by EEM-PARAFAC, were categorized as two terrestrial humic-like components (C1 and C2), marine humic-like component (C3) and tryptophan-like component (C4) based on spectral comparisons with previous studies. In the COW, negative correlations were evident between salinity and fluorescence intensity of terrestrial humic-like components. In addition, the intercepts of the regression lines between salinity and terrestrial humic-like fluorescence intensities were within the range of the fluorescence intensities observed in the riverine waters. Since terrestrial humic-like fluorescence intensities in sea-ice samples were lower than those in seawater, the COW observed in this study was considered to be strongly influenced by riverine water. In addition, the intercepts were close to the value observed in the Kushiro River flowing through wetlands, implying that major freshwater end-member of the COW observed in this study originated from riverine water which is strongly influenced by wetlands.

Keywords: Coastal Oyashio Water, freshwater end-member, Fluorescent dissolved organic matter

