

Paleohydrography in the Mixed Water Region deduced from diatom assemblage

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The Mixed Water Region (MWR) located between the Oyashio and Kuroshio Fronts is highly complicated hydrographic area. This region is also known for its high productivity. In order to understand a long-term variability of the structure of sea surface temperature (SST) and its relationship to the productivity in MWR, we analyzed the diatom assemblage data from six sediment cores located off Sanriku and Joban coasts. Sediment cores cover the last glacial cycle. Two of them are located under pathway of the Coastal Oyashio Intrusion (COI) and the other four are located at open ocean sites within MWR.

Oceanic diatom temperature index (Td') and diatom abundance (DA) were deduced from diatom assemblage data as proxies for SST and productivity, respectively. Td' at all the sites are higher during interglacials and lower during glacial periods. On the other hand, DAs show complicated temporal variability which seem to be characterized by 41-ky obliquity cycle.

In order to distinguish common SST and productivity feature for all the sites from a local variability at each site, we conducted principle component analysis on Td' and DA for the six sites. First principle component of Td' is common for all the sites and shows a variation in harmony with glacial cycle. Second principle component of Td' is positively correlated with two sites under influence of the COI and has negative or no correlation to open ocean sites. First principle component of DA shows a similar fluctuation pattern to the second principle component of Td' where lower Td' corresponds to higher DA. Second principle component of DA is also positively correlated with the two sites under influence of the COI, which would represent the enhancement or non-linear response of productivity within the COI area.

Second principle component of Td' indicates a southward penetration of the COI, while first principle component of Td' is interpreted as north-south migration of the Oyashio Front. Productivity (DA) in MWR could be enhanced only when the COI was strong and both of them show a coherent 41-ky periodicity. Interesting feature discovered here is that southern migration of nutrient-rich Oyashio water could not explain the higher productivity in MWR. The high production would be maintained by a strong perturbation associated with the southward migration of the COI. Considering the relationship between the wind stress by the Siberian High over the western North Pacific and anomalous southward intrusion of Oyashio (Sekine, 1988, JGR 93, C3, 2247-2255), a coherent 41-ky periodicity found both in the COI strength and the productivity suggests that the atmospheric circulation in the northern hemisphere also varied at this periodicity.