

Comparison of biological pump efficiency between Holocene and glacial periods in the northwestern North Pacific

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The sediment coring was undertaken during the MR00-K03 cruise from May 9 to June 10 in 2000, as an investigation of a JAMSTEC project on Biogeochemical Change of the Past Northern North Pacific and its Adjacent Seas. The main objective was to understand the past environmental change such as sea surface temperature, productivity and deep water circulation in the northwestern North Pacific and the Okhotsk Sea throughout the late Quaternary period (ca 150,000 yr).

In this presentation, we show a result of the paleo flux of organic carbon and compare the paleoproductivity between Holocene and the glacial periods. We estimated paleoproductivity of subtropical gyre and subarctic gyre in the northwestern North Pacific and the Okhotsk Sea during the past 20kyr. The efficiency of biological pump was compared between Holocene (0-10kyrBP), the termination period (10-17kyrBP) and the last glacial maximum (17-22kyrBP).

The paleoproductivity was determined by the organic carbon - based equations 1~3) using organic carbon content recorded in sediment cores. During Holocene, paleo primary productivity (PaP) at St. 8s, the station around the polar front (45N, 170E, water depth 1800m) was the lowest among the stations in the pelagic sea and PaP was the highest at St. 3, the subarctic gyre (50N, 165E, water depth 5500m). The PaP at PC-01, the southeastern site in the Pacific side of the Kuril-Shan Strait (46N, 152E, water depth 2800m), 130~160gC/m²/yr was the highest among this study sites.

During 10~17kyrBP, the PaP at PC-01 varied from 150gC/m²/yr to 340gC/m²/yr and was extremely high compared with that during Holocene. The PaP at St. 8s and St. 3 was also higher than that during the Holocene. The PaP at St. 5, the subtropical gyre (38N, 162E, water depth 5000m) corresponded to that of Holocene.

During the last glacial period, 17~22kyrBP, the PaP was slightly higher than that during Holocene at all stations except for St. 3.

Seasonality in productivity controls the amount of export flux. Strongly pulsed productivity brings more powerful export flux rather than annually constant production, because heterotrophic organisms are less efficient in decomposing organic carbon. Thus, we compared efficiency of export flux between the Holocene and the glacial periods with considering the seasonality of productivity of this study area based on a time-series sediment trap data 4). Assuming less different in seasonality of productivity between the Holocene and the last glacial period, export flux in the glacial time was slightly higher than that in Holocene. It is provably that the efficiency of biological pump enhanced in the glacial time compared with that during Holocene in the northwestern North Pacific.

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