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日本海南部の同位体ステージ 3 における千年スケール表層水変動
Millennial-scale surface water property change in the southern Japan Sea during the Marine Isotope Stage 3

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The deep sea environment in the glacial Japan Sea was more sensitive to surface climate change than today because of semi-closed situation due to sea-level low stands. The hemipelagic sediments in the sea are characterized by alternations of bioturbated, organic-poor light layers and finely laminated, organic-rich thin dark layers during the Marine Isotope Stage (MIS) 3. Such sedimentological evidence indicates drastic changes in bottom oxygen level during MIS3. Two possible mechanisms that explain depleted oxygen in bottom water are suggested. First, the dissolved oxygen consumption in bottom water was increased by high productivity due to upwelling. Second, the supply of dissolved oxygen to bottom water was decreased due to enhanced density stratification. These should be quite different situations in terms of surface water density structure. However, there are a few surface water property records at this time.

Here we conducted d18O and Mg/Ca analyses of planktonic foraminifera for a radiocarbon-dated sediment core KR07-12 PC3, which is taken from intermediate depth (329 m) of the southern Japan Sea. Sea surface temperature (SST) and d18O of seawater (d18Osw), which is a proxy of salinity, were reconstructed to reveal variations of surface water property during the MIS3. Results clearly showed millennial-scale surface environmental change. Reconstructed SST ranges from 4 to 9 degreeC which is much lower than modern SST (seasonal range: 11 to 26 degreeC) at the core site. Variations of SST and d18Osw were positively correlated (r = 0.78).

This positive correlation can be regarded as a mixing of two distinct water masses of high SST, d18Osw and low SST, d18Osw. The only one current of warm and saline water flows into the Japan Sea today is the Tsushima Warm Current (TWC). Therefore, the alternation of high SST, d18Osw and low SST, d18Osw during MIS 3 is explained by periodic changes in the strength of TWC inflow. This is consistent with planktonic foraminiferal assemblage in the East China Sea (ECS), which indicates the alternation of two water masses, Kuroshio-related water and coastal water. The millennial-scale variation of the TWC inflow into ECS and Japan Sea played an important role in determining surface water density.

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