Millenial-scale variabilities of the subsurface dichothermal layer in the Sea of Okhotsk during the late Quaternary

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The Sea of Okhotsk is characterized by an extended seasonal sea-ice cover and is considered as a possible source area of the North Pacific Intermediate Water (NPIW). Therefore, the reconstruction of past sea surface temperature (SST) and subsurface structures in the Sea of Okhotsk is indispensable for the study of the past variations in the NPIW formation and of the detailed climate changes in the Northwest Pacific. We measured the concentration of alkenones in the Sea of Okhotsk surface sediments to understand the distribution of the marine biomarkers. We also produced the detailed oxygen isotopes of planktonic and benthic foraminifers and alkenone SSTs for a core XP98-PC1 with high sedimentation rate, which was collected from the slope off Kamchatka Peninsula in the Sea of Okhotsk.

The alkenone records indicated that the SSTs were almost constant throughout the Holocene at approximately 8.5 degree C at the site of core XP98-PC1. Alkenone SSTs are also lowered by 2 degree C at the early deglaciation and a similar warm SST were detected in the glacial periods in the Okhotsk Sea. Oxygen isotopes of planktonic foraminifera (Grobigerina bulloides and Neogloboquadrina pachyderma), however, showed the short-term fluctuations during the last 70 kyrs. Because the average depth habitat of N. pachyderma was estimated for about 100 m in the southern Okhotsk Sea (Bauch et al., 2002), the planktonic oxygen isotope variabilities were mainly caused by a rapid change in subsurface dichothermal layer (DTL) temperatures due to thermocline depth oscillation. The warmer DTL in the Sea of Okhotsk may correspond to warmer climate signals of the Polar Circulation Index in the Greenland ice core (Mayewski et al., 1997) and the regional sea level high stands (Razjigaeva et al., 2004). Therefore the millennial scale oscillations of subsurface temperature and thermocline depth were periodically occurred in the Sea of Okhotsk. These results suggest that past variability of DTL and subsurface structure may have been caused by the time-series variation of deep mixing rates due to the Asian monsoon intensity over the Sea of Okhotsk.