Paleoenvironmental changes of sea surface layer in the IODP Site U1423 recorded by algal biomarkers over the last 4 Ma

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The oceanographic condition in the Japan Sea has significantly changed from its establishment in the Miocene to present associated with global climate change, the intensification of the Asia monsoon system, and local tectonics in the Japanese islands. These changes have been evaluated mainly on the basis of microfossil compositions such as the foraminifera, radiolarian and diatom in marine sediments. However, long-term and continuous variations in sea surface temperature (SST) and marine production have been hardly reported by the biomarker investigations. In the present study, we conduct biomarker analysis such as the long-chain alkenone and alkyl diols in the sediment samples recovered from the IODP Site U1423 in the northeastern Japan Sea, which is under the direct influence of the Tsushima Warm Current (TWC) at the present, to reconstruct the long-term and continuous paleoceanographic variations over the last 4 Ma.
The SSTs estimated by long-chain alkenone unsaturation ratio ($U^{K'}_{37}$) range 9–25 ˚C over the last 4.0 Ma. The SSTs are generally higher than 20 ˚C during 4.5-3.0Ma, and gradually decrease during 3.0–1.6 Ma. Subsequently, the alkenone-based SSTs show the large fluctuation with remarkably lower values since 1.6 Ma.
The SSTs estimated xx during 4.5-1.6 Ma are almost similar to those in the northern part of the subtropical gyre (ODP site 1208; LaRiviere et al., 2012), which indicates substantial influence of the warm water current in the study site. On the other hand, the SSTs since 1.6 Ma are obviously lower than those in the ODP Site 1208 during several periods suggesting the restriction in the inflow of the warm currents into the Japan Sea because of the shallowing and/or narrowing of the southern gateway. In addition, dark color sediment layers are also observed in the horizons deposited from 1.6 Ma, and concentrations of long-chain alkenones are remarkably higher in these layers. These results suggest the establishments of anoxic bottom water probably caused by the restriction in the water exchanges.
The values of the diol index 2 (DI2), which is proposed as an indicator for diatom *Proboscia* production estimated from the compositions of long-chain alkyl diols, are higher during 4.5-2.7 Ma. This result suggests that diatom production was enhanced under eutrophic condition. The rapid decrease in the values of DI2 is observed at 2.7 Ma, which is synchronous with the decline in the biogenic opal sedimentation rate in the NW Pacific. In addition, no major local environmental changes were recorded in the estimated SSTs in Site U1423. Thus, the decreasing the diatom production recorded by DI2 at 2.7 Ma was possibly related to global paleoceanographic changes such as the northern hemisphere glaciation (NHG).

キーワード：アルケノン古水温、ジオール指標、日本海、古海洋
Keywords: alkenone-based temperature, Diol index, Japan Sea, Paleoceanography

