

Evidence for a temporary sea-level drop in the early stage of marine isotope stage 11

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To estimate a future global climate, it is important to reconstruct detailed paleoclimate and paleoenvironment, and analyze their variations. Marine Oxygen Isotope Stage 11 (MIS 11) is often discussed for its similarity with Holocene with respect to the variation pattern of insolation, length of an interglacial period and CO₂ concentration. Thus, paleoclimate and paleoenvironment changes during MIS 11 may provide useful informations to clarify the recent global warming. In this study, we conducted diatom analyses of a sediment core to reveal sea-level and paleoenvironmental changes during MIS 11.

We analyzed a sequence from an Osaka Bay 1700-m core, deposited with a very high sedimentation rate of about 50 cm/kyr on average, which is 5 to more than 20 times higher than the rate of deep-sea sediments. In addition to the preliminary diatom data reported elsewhere, we obtained new data. The sea-level variation estimated from diatom assemblages exhibits a temporary sea-level drop event occurred in the early stage of MIS 11. This event is recorded over a thickness of 90 cm at depth ~207 m in the 1700-m core.

According to our age model based on comparison with a standard marine oxygen isotope curve, the sea-level drop occurred at about 420 ka with an interval of 3 kyr. This drop is characterized by a short time span and occurrence in the early stage of warming. Thus, it is similar to the Younger Dryas event, which is a rapid cooling event during deglaciation after the last glacial period terminated. To see whether the sea-level drop was global, we examined paleoenvironment records from other areas. As a result, we found that the EPICA ice core from Antarctica showed a temporary cooling event with a decrease in deuterium of about 15 permillage corresponding to a temperature drop of about 20 degrees. It took place at ~420 ka in the beginning of MIS 11, which is well correlated with the sea-level drop event in the present study. The ODP Site 980 core shows a slight temporary increase of ice volume at around 420 ka, which is also correlated with the sea-level drop event. Thus, the temporary sea-level drop in the early stage of MIS 11 from the diatom record in Osaka Bay was confirmed to be a global cooling event. The present result adds new evidence that supports the climatological similarity between MIS 11 and Holocene.