Relationship between sea-level and millennial-scale oceanographic changes during Mioncene recorded in the Japan Sea sediments

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The millennial-scale paleoclimate change in the Quaternary is well observed after glacial-interglacial cycle is changed from 40 kyr to 100 kyr after 1 Ma (Tada, 2012). The collapse of Northern hemisphere ice sheet is indicated as the cause of the millennial-scale paleoclimate changes (Dansgaard et al., 1993).
In the Miocene period, cycles of sea-level changes fluctuate between 40 kyr and 100 kyr cycles (Holbourn et al., 2005). The millennial-scale paleoclimate change is also observed in Miocene (Tada, 1999), but the mechanisms and relationships between the millennial-scale climate changes and 40 kyr or 100 kyr sea-level changes are not well explained.
Since the Middle Miocene, the Japan Sea has been a semi-closed marginal sea. Because the sea has been connected to the North Pacific by relatively shallow sills, its paleoceanographic condition has been sensitive to glacio-eustatic sea-level changes (Itaki, 2016). The millennial-scale paleoceanographic changes in the Quaternary recorded in the alternation of dark- and light-color sediments reflect precipitation caused by the Asian summer monsoon (Tada et al., 1999). In this study, we revealed relationships between the millennial-scale paleoclimate changes and cycles of sea-level changes during the Miocene period using the Japan Sea hemipelagic sediments.
The Miocene hemipelagic sediments of the Japan Sea obtained during Integrated Ocean Drilling Program (IODP) Expedition 346 from Site U1425 (water depth ~2000 m) and Site U1430 (water depth ~1000 m) were used in this study (Tada et al., 2015). In the several intervals, the distinct laminae are observed in the Miocene sediments (Tada et al., 2015). The ages of the sediments are since 10 Ma at Site U1425 and since 12 Ma at Site U1430 (Kurokawa et al., 2019). Then, we could reconstruct oceanographic variation depending on the water depths.
We measured the elemental composition of the Miocene sediments using an XRF core scanner (ITRAX) in the Kochi University, Japan, with 2 mm or 1 cm interval. We also measured with 0.2 mm interval for sediments which has distinct laminae.
In the results, it is revealed that composition of the detrital materials show cyclicities similar to sea-level changes. The redox condition at the sea floor is also changed according to sea-level changes in several periods. The sediments with distinct laminae record productivity changes and redox condition at sea floor. In the presentation, we will discuss relationships between orbital-scale oceanographic changes and millennial-scale climate changes.

Keywords: The Japan Sea, Miocene, sea-level changes, XRF core scanner (ITRAX), IODP Exp. 346, millennial-scale climate change

