The Eccentricity cycle forcing (100 & 400 kyr) during the late Miocene in the Japan Sea and its impact of the local paleoceanography, evidence from data of radiolarians and sediment physical properties (IODP Expedition 346 Site U1425)

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During the late Miocene, the Earth climate underwent a deep cooling at high latitude of both hemispheres (7.5-5.5 Ma) and an aridification is recorded in central Asia at ca. 8 Ma (Herbert et al., 2016; Shen et al., 2017). At that time, the intermediate to deep-water of the North Pacific are known for be nutrient rich and dissolved oxygen deficient, the so-called Oxygen Minimum Zone (OMZ) water. The Japan Sea is a marginal sea of the North Pacific, opened by a continental rifting during the Early to Middle Miocene (ca. 25–13 Ma). Between 10 and 7 Ma, the Japan Sea was connected to the North Pacific by a northern strait, which sill depths is estimated to be about 1000m and an eastern strait, which sill depth is estimated to be about 100 m. Both straits are crucial in exchanging deep and shallow water between both seas.

The Integrated Ocean Drilling Program (IODP) Expedition 346 retrieved core sediments covering the late Miocene at two sites (Site U1425 and U1430) to reconstruct the paleoceanography of the Japan Sea since the Miocene. Previous studies have shown cyclic changes in microfossil assemblage and abundance as well as sediment physical properties data inferring a probable influence of the Milankovitch cycles at that time. In this study, we propose to clarify the plausible impact of the short and long eccentricity (100-400 kyr) cycles to the local paleoceanography. Therefore, we have analyzed changes in radiolarian assemblages at Site U1425 at resolution high enough to detect the impact of the 100 and 400 kyr cycles and compared these data to sediment physical properties. Radiolarians were selected because they are planktic micro-organism group bearing siliceous skeletons that are well preserved in the deep-sea sediments of the Japan Sea, and because their species comprise shallow to deep water species, which are sensitive to physical/ecological changes of the sea water. As a brief result, the eccentricity has probably regulated the cyclic inflow of warm water of the North Pacific into the Japan Sea through the eastern strait, causing alternation of relatively warm and cold marine environment in the Japan Sea at that time. Similarly, eccentricity have probably regulated inflows of the OMZ water from the Pacific to the Japan Sea. When there was inflow of OMZ water, anoxic condition probably prevailed in the Japan Sea bottom water, while when inflows of OMZ are inhibited, oxic condition prevailed. This mechanism may explain the alternation of light bioturbated and dark non-bioturbated sediment deposited at Site U1425 for the late Miocene.

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