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Paleoceanography of the Japan Sea during the late Miocene inferred from radiolarian data (IODP Exp. 346 Site U1425 & U1430)

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Active tectonism has influenced the paleogeography of the Northwest Pacific since the Early Miocene, and thus have drastically modified the paleogeography of this area. The Japan Sea, a back-arc basin opened by a continental rifting during the Early to Middle Miocene (ca. 25–13 Ma) is one of the consequences of such activity. Past studies have shown that during the late Miocene, only the northern and eastern straits connecting to the North Pacific were opened, with a relatively deep sill depth for the northern strait and a shallow sill depths for the eastern strait. On the other hand, Earth climate underwent a stepwise cooling since the middle Miocene (the Mid Miocene cooling at ca. 15 Ma and the late Miocene Cooling between ca. 5.5 and 8 Ma). Therefore, reconstruction of the paleoceanography of the Japan Sea during the Miocene is complex because several factors should be considered such as the regional tectonism, global climatic context and lastly the Milankovitch cycles. The Integrated Ocean Drilling Program (IODP) Expedition 346 retrieved core sediments covering the late Miocene at two sites (Site U1425 and U1430). In this study, we propose to reconstruct the paleoceanography of the Japan Sea for the late Miocene with the local tectonism, global climatic context and the Milankovitch cycles taken into account, by analyzing changes in radiolarians assemblages at site U1425 and U1430. Radiolarians are planktic micro-organism group bearing siliceous skeletons, which fossils are known for be well preserved in the deep-sea sediments of the Japan Sea. Their species also comprise shallow to deep water species, whose are sensitive to changes in sea water physical/ecological properties. As key results, our data showed that during the late Miocene, the sill depths of the northern strait was likely close to 1000 m, enabling inflow of Oxygen Minimum Zone (OMZ) deep-water of the North Pacific. Additionally, inflows of N. Pacific warm water occurred through the shallow eastern strait between 7 and 10 Ma and these inflows are likely paced by the orbital parameters. Therefore, our data suggest that the shallow water of the Japan Sea cyclically fluctuated from relatively warm to cold environment.