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Surface-water exchange between the East Sea/Japan Sea and neighboring seas during the last glacial and deglacial periods: geochemical and diatom signatures

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A 13-m long piston core PC-03 is collected at the location (the depth of 283 m) under the main flow path of the Tsushima Warm Current in the southeastern East Sea/Japan Sea. Geochemical properties ($CaCO_3$, TOC, and opal contents) and diatom assemblages were examined to trace the history of the surface-water exchange between the East Sea/Japan Sea and neighboring seas. Core PC-03 covers the last glacial and deglacial period from 47.8 to 10.6 cal. kyr BP, based on the 19 AMS 14C dating and a volcanic ash layer (AT). Geochemical properties and diatom abundance began to decrease since about 35 ka when the global sea level started to fall, indicating the isolation of the East Sea/Japan Sea from the neighboring seas. Minimum geochemical contents and low diatom abundance until 17.8 ka reflect the depressed surface-water production because of water column stratification during the Last Glacial Maximum when cold temperature and low salinity are supported by low diatom temperature index (Td'), high abundance of cold-water species (C. marginatus, N. seminae), and high abundance of freshwater species (Melosira spp.). The Oyashio Current Water flowed into the East Sea/Japan Sea through the Tsugaru Strait at about 17.2 ka, recording the maximum diatom abundance with an increase of a cold-water species Neodenticula seminae. Gradual increase of geochemical contents since 17 ka also indicates the resumed surface circulation in the East Sea/Japan Sea. High C/N ratios (ca. 11.7) during 17 to 13 ka were attributed to an increased contribution of resuspended terrestrial particles from the submerged continental shelf with sea-level rising. The surface-water exchange with the East China Sea through the Korea/Tsushima Strait was intensified since 13 ka, providing high abundance of P. sulcata, which indicates the East China Sea Coastal Water. Finally, presence of Fragilariopsis doliolus after 10.8 ka represents the first entrance of the Tsushima Warm Current from the East China Sea.