Past Kuroshio Current variability in response to precession forcing during Early Pleistocene (MIS 36–41)

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The Kuroshio Current, a western boundary current of the North Pacific subtropical gyre, influences the marine environments and climate changes around the East Asia region because it transports heat from low to high latitudes. Although the Kuroshio Current variability in response to the precession has been investigated in the Late Pleistocene (e.g., Yamamoto et al., 2005; Oba et al., 2006), little is known regarding the Kuroshio Current fluctuations during the Early Pleistocene prior to the mid-Pleistocene transition (MPT). Here, we reconstructed the suborbital-scale Kuroshio Current variation during Marine Isotope Stage (MIS) 36–41 based on calcareous nannofossil assemblages in the Kiwada Formation of the Kazusa Group, distributed in the central part of the Boso Peninsula. In this study, the spectral and wavelet analyses were conducted using the PAST4 software (Hammer et al., 2001) to clarify the suborbital-scale fluctuations of nannofossil abundances.

Two warm-water calcareous nannofossil taxa, *Florisphaera profunda* and *Umbilicosphaera* spp., showed cyclic changes in the abundance, which were similar to glacial–interglacial cycles. Thus, we used a bandpass filter (0.024 kyr^{-1}) on the calcareous nannofossil abundance to extract the precession-related components. The spectral and wavelet analysis results of *Florisphaera profunda* and *Umbilicosphaera* spp. showed ~20 and ~10 kyrs periodicities. In particular, a ~20 kyr cycle of abundance in these taxa was remarkably recognized during MIS 37. According to Tanaka (1991), *Umbilicosphaera* spp. is abundant in the Kuroshio current axis, and *Florisphaera profunda* is dominant in the warm and stratified offshore waters. Thus, the increase and decrease of two taxa are interpreted as the northward and southward movements of the Kuroshio Front on the suborbital scale, respectively. Additionally, the precession components of these abundances were antiphase to the summer insolation variation at high latitudes. These results can be interpreted that the development of the summer Okhotsk high pressure strengthened the northerly winds during maximum insolation in high latitudes, prompting the southward migration of the Kuroshio Front. Therefore, it suggests that the past Kuroshio Current variability in response to precession was linked to high latitude insolation variations.

[References]

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