Paleoceanographic reconstruction in the northwestern Pacific during MIS 19 using ultra-high temporal resolution oxygen isotope profiles and planktonic foraminiferal assemblage

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The orbital configuration during Marine Isotope Stage (MIS) 19 are characterized by a weak eccentricity-precession forcing and an obliquity maximum associated with a precession minimum as well as MIS 1, although the both absolute values of obliquity are different. Thus, MIS 19c, one of the sub-stages during MIS 19, is assumed as the best analogue for the present interglacial suggesting the timing of the next glacial inception in the future when the anthropogenic influences are excluded.

The Chiba composite section (CbCS) at east-central Japanese island faces the northwestern Pacific containing the Kuroshio Extension Front (KEF) which is north limit of the Kuroshio Current transporting amount of heat and water from the Equatorial to mid-latitude. Modern observation, climate model, and geologic records reveal that variations of the oceanic fronts in the northwestern Pacific (surface temperature and latitudinal position) and atmospheric circulation in the North Pacific interact. However, response of the KEF to external and internal forcings under the modern orbital configuration remain unclear.

Here, we reconstruct detailed paleoceanographic variations in the northwestern Pacific during MIS 19 using stable oxygen isotope ($\delta^{18}O$) and planktonic foraminiferal assemblage records form the CbCS. Spectral and wavelet analyses were conducted in order to assess periodicity of our new $\delta^{18}O$ records. Vertical water temperature structure and their gradient (ΔT), and relative abundance variation of warm-water species exhibit latitudinal displacements of the KEF on multi-millennial scale across the MIS 20–19 transition and during late MIS 19 (MIS 19b to 19a). Results of the spectral and wavelet analyses for the $\delta^{18}O$ records show periodicities of 2,300–6,000 year during late MIS 19. Similarities of timing and periodicity between paleoceanographic records from the CbCS and North Atlantic indicate that disruption of the Atlantic meridional overturning circulation due to freshwater discharge into the North Atlantic caused the southward displacements of the KEF via atmospheric dynamic. A power of the 9,700 year-periodicity in surface planktonic $\delta^{18}O$ and ΔT is stronger during MIS 19c, which probably originates from tropics caused by equatorial insolation at equinoxes with the orbital perihelion. This result indicates the seasonality of the insolation at low-latitudes paced the sea surface condition at the CbCS throughout MIS 19 and this low-latitude influence became larger especially when the North Atlantic forcing by freshwater discharges and AMOC variability was low. Our result suggests that millennial-scale stability and variation of oceanographic condition along the KEF under this orbital configuration depend on North Atlantic climate variability.

Keywords: China composite section, MIS 19, Oxygen isotope, Planktonic foraminifer, northwestern Pacific, Kuroshio Extension Front

