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Millennial-scale changes in temperature and salinity in the western North Pacific during the last deglaciation

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The last deglaciation is an important epoch to understand the mechanism of abrupt climate changes. It is well known that millennial-scale warm (Bolling-Allerod :BA) and cold (Younger Dryas :YD) events occurred at high-latitude North Atlantic during the last deglaciation. Our study of high-resolution Mg/Ca-based sea surface temperature (SST) reconstructions covering the last deglaciation in the northern East China Sea using Globigerinoides ruber revealed distinct signals of the Heinrich event 1 (H1), BA and YD events, suggesting a close link between East China Sea and North Atlantic climate during the last deglaciation. On the other hand, such millennial-scale SST events are not obvious at lower latitude sites in the northwestern Pacific, implying that the latitudinal gradient of SST along the northwestern Pacific become increased during the cold events. In this study, we compiled high-resolution Mg/Ca-based SST records using G. ruber and reconstructed changes in latitudinal gradient of SST in the middle to low latitude northwestern Pacific. The result suggests latitudinal gradients of SST from the equator to 32°N along the western margin of the North Pacific were approximately 3 ℃ during the Holocene, approximately 4.5 ℃ during the BA, and approximately 5 ℃ during H1 and YD periods. Absolute values during YD were approximately 1.3 ℃ warmer than that during the H1. Compiled data also suggest that fundamental glacial to interglacial change in global temperature occurred at the beginning of BA (15.7 ka) in the northern and southern parts of the East China Sea, while more subtle warming occurred at 19 ka in the western tropical Pacific. It is suggested that the post LGM warming, started earlier in the tropical region, did not reach to subtropical northwestern Pacific, whereas signals of millennial-scale cold events in the northern hemisphere were attenuated toward the equator. On the other hand, oxygen isotope of seawater ($d^{18}O_{sw}$: as a function of salinity) did not show significant oscillations associated with H1 and YD in the East China Sea, whereas distinct signal of these events were observed in $d^{18}O$ of stalagmite in south China. During YD, increase in $d^{18}O$ of seawater in the moisture source region or a switch of the moisture source region and much lower cave temperature may explain the increase in $d^{18}O_{sw}$of stalagmite, in which case the amount of rainfall over the south China did not decrease during the YD.

Keywords: East Asian summer monsoon, last deglaciation, Mg/Ca, temperature gradient, North Pacific, oxygen isotope