Reconstruction of vertical thermal structure in the western Pacific warm pool over the last 1 Myr

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The zonal atmospheric circulation in the tropical Pacific, the Walker circulation, is closely related to the zonal gradients of sea surface temperature (SST) and thermocline through the ocean-atmosphere interaction. Variability of such an interaction in a couple of years timescale is known as El Niño Southern Oscillation (ENSO), which has a great influence on climate not only in the tropics but also in wide areas on the globe. Proxy SST records revealed that the zonal SST gradient has changed in various timescales, and it is interpreted that the ENSO-like ocean-atmosphere interaction also worked on the longer timescale. However, there is no definitive evidence that the change in the zonal SST gradient was accompanied by change of the Walker circulation. Here we reconstruct thermocline temperature variability, which is sensitive to the strength of the Walker circulation. By comparing the variations of zonal and vertical temperature gradients, we examined whether the ENSO-like ocean-atmosphere interaction was functioning on the tens of thousands to hundreds of thousands of years timescale. The sample used in this study is a piston core MR14-02 PC4 collected on the Ontong-Java Plateau located in the western Pacific warm pool (WPWP). Surface and thermocline temperatures were reconstructed by Mg/Ca analyses of planktonic foraminifera, *Globigerinoides ruber* and *Pulleniatina obliquiloculata*, respectively, for the last million years. We compared the vertical temperature gradient (difference between surface and thermocline temperature: ΔT_{WPWP}) and the zonal temperature gradient (difference between *G. ruber* SST in this study and alkenone SST in the East Equatorial Pacific ODP Site 846 : ΔSST_{W-E}). As a result, the relationship between ΔT_{WPWP} and ΔSST_{W-E} in the past was not similar to that of the modern ENSO variability. This result suggests that the change of temperature structure in longer timescale was caused by a mechanism different from today. Also, ΔT_{WPWP} and ΔSST_{W-E} showed a longer time scale change than the glacial-interglacial cycles, and the cycle is approximately 400 kyr. This implies that the thermocline variability in the equatorial Pacific might be related to the Milankovitch cycle. The results of this study suggest that it is necessary to discuss vertical and meridional thermal structures in addition to the zonal SST gradient in order to understand the dynamics of past ocean-atmosphere interaction.

Keywords: Western Pacific warm pool, Planktonic foraminifera, Reconstruction of old water temperature

