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学 位 論 文 内 容 の 要 旨

博士(環境科学)

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学 位 論 文 題 名

Hydrological evolution of the eastern tropical Pacific during the last 430,000 years (過去43万年間の東部熱帯太平洋の水理学的変化)

The core samples of sites 1241, 1239 and 1237 were retrieved during Ocean Drilling Program (ODP) leg 202 in the eastern tropical Pacific (ETP). This study is divided into fourth sections, in the first section, we propose that the difference between $\text{TEX}_{86}^{\text{H}}$ - and U_{37}^{K} '-derived temperatures (ΔT) and the abundance ratio of GDGTs to alkenones (GDGT/alkenone ratio) are potential upwelling indices which show a consistent results with other upwelling indices, and discuss changes in upwelling intensity over the past 430 ka. We assume that $\text{TEX}_{86}^{\text{H}}$ reflects sea surface temperature (SST) in upwelling periods, while U_{37}^{K} ' reflects SST both in upwelling and non-upwelling periods based on modern observation on upwelling and marine productions. The ΔT and GDGT/alkenone ratio were maximal during the last five deglaciations, suggesting intensified upwelling. The intensification of upwelling in the EEP coincided with those at the Peru margin and in the Southern Ocean. This coincidence suggests that the reorganization of the Southern Hemisphere atmospheric circulation induced the intensification of the subtropical high-pressure cell, causing stronger southeast trade winds along the west coast of South America and the southern westerlies over the Southern Ocean, enhancing upwelling in both regions.

In the second section, GDGTs and alkenones were analyzed for sediment samples retrieved from ODP Site 1241 over the last 150,000 years to understand the hydrological evolution of the eastern Pacific warm pool (EPWP). GDGTs and alkenone concentrations showed higher values in MIS 2 and MIS 6, which suggest the enhancement of primary production at glacial periods. However, the GDGT- ($\text{TEX}_{86}^{\text{H}}$ -) and alkenone- (U_{37}^{K} ') derived temperature depicted the different surface temperature evolution over the last 150,000 years. Alkenone-derived temperature was marked by less variable during the glacial-interglacial cycles, whereas $\text{TEX}_{86}^{\text{H}}$ - showed a pronounced variation in the glacial-interglacial cycles that was similar to Mg/Ca-derived temperature records obtained nearby cores in the EPWP. Given that enhanced primary productivity during glacials suggest nutricline shoaling, unchanged U_{37}^{K} ' over glacial-interglacial cycles can be interpreted to be related to the shift of alkenone production depth because the algae favors to dwell just above the nutricline. $\text{TEX}_{86}^{\text{H}}$ seems not to be influenced by glacial-interglacial changes in nutricline depths, recording an integrated temperature in surface and thermocline water. The shallow nutricline in the EPWP during glacial maxima most likely reflected the intense formation of Antarctic intermediate water.

In the third section, GDGTs and alkenones were analyzed for sediment samples retrieved from ODP Site 1237 to understand the hydrological evolution of the Peru margin

during the deglaciation. The $\text{TEX}_{86}^{\text{H}}$ and U_{37}^{K} reflect the temperature signal of surface or near surface water. The result of GDGTs and alkenones is consistent with $\delta^{15}\text{N}$ from nearby core CD38-02 (Ganeshram et al., 2000). Thus, higher concentrations of GDGTs and alkenones at the last deglaciation suggest the enhancement of primary production due to intensified upwelling. This finding indicate that the intensified upwelling is prevailing along the western coast of South America continent during deglaciation interval.

In the fourth section, as a concluding remark, we compared $\text{TEX}_{86}^{\text{H}}$ and U_{37}^{K} at the different sites along the western coast of South America; off Panama, Ecuador and Peru to discuss latitudinal gradient of SST. The U_{37}^{K} records display latitudinal SST gradient as same as that in modern SST over the last two glacial cycles, yet at warmer region, the U_{37}^{K} is reflected the temperature of the deeper water column owing to the changeable production depth of alkenone. The $\text{TEX}_{86}^{\text{H}}$ show a typical glacial-interglacial cycle. The increased temperature in $\text{TEX}_{86}^{\text{H}}$ and U_{37}^{K} at Site 1237 is earlier than Sites 1241 and 1239. Thus, an early increased temperature in higher latitude regions suggests that the upwelling was enhanced earlier in the coast of Peru margin and then pursued by the coast of Ecuador and Panama basin during the deglaciation. The result of GDGT and alkenone suggest that the hydrological evolution in the ETP was influenced by intensified coastal upwelling along the western coast of South America during the last deglaciation. We suggest that the enhancement of upwelling along the western coast of South America is linked to the intensification of southeast trade wind.