MID-PLEISTOCENE TO HOLOCENE EVOLUTION OF THE KUROSHIO CURRENT, NORTHWEST PACIFIC OCEAN

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The subtropical warm and saline Kuroshio Current (KC) is one of the two major western boundary currents of the Northwest Pacific Ocean. It plays a major role in the meridional transport of heat from the Western Pacific Warm Pool (WPWP) to northern mid-latitudes, where it converges with the cold and less saline Oyashio Current (OC) forming the KC/OC interfrontal zone. Latitudinal fluctuations and changes in the relative strengths of the KC and OC exert a significant control on the climate evolution of the NW Pacific and East Asia. Therefore, studying past changes in the two ocean currents is crucial for understanding the climate evolution of the NW Pacific and adjacent continental areas. Even though millennial variation of the KC and OC is well documented (e.g. Oba et al., 2006; Sagawa et al., 2006; Yasudomi et al., 2014), information on their long-term variation and their role in affecting regional and global climate over geological time scales is sparse. Here, we reconstruct paleoceanographic and paleoclimatic changes in the NW Pacific by studying water temperature variations over the last 1.1 Ma based on three independent lipid paleothermometers (i.e. TEX^{H}_{86}, $U^{K'}_{37}$ and LDI). Deep-sea sediments used in this study were obtained from Site U1437 located in the Izu rear-arc (SE of Japan) during IODP Expedition 350.

The $U^{K'}_{37}$ (unsaturated ketone index) and LDI (long chain diol index) paleothermometers are based on the lipid distributions of haptophyte and eustigmatophyte algae and hence reflect sea surface temperatures (SSTs). In contrast, the TEX^{H}_{86} (based on glycerol dialkyl glycerol tetraethers of marine Thaumarchaeota) has been suggested to indicate subsurface temperatures corresponding to the depth of the thermocline (e.g., Lopes dos Santos et al., 2010; Yamamoto et al., 2012; Jonas et al., *in review*) instead of SST. At Site U1437, all three water temperature records showed overall similar seesaw-like trends as also seen in the global stack of $\delta^{18}O$ of benthic foraminifera (Lisiecki and Raymo, 2005), although the magnitude of temperature fluctuations varied between the different lipid paleothermometers (Fig. 1). TEX^{H}_{86}-based water temperatures ranged from 21.5 °C to 25.8 °C over the whole record. The LDI showed minimum SSTs of 21.2 °C and peaked at 26.5 °C. $U^{K'}_{37}$-based SSTs ranged from 24.1 to 29 °C. The latter corresponds to a $U^{K'}_{37}$-value of 1 and is beyond the upper calibration limit given by Müller et al. (1998). These peak SSTs during warm marine isotope stages (MIS) 5e (the Eemian) and 11 and at the base of cold MIS 30 were synchronous with high TEX^{H}_{86}-based water temperatures, indicating a strong influence of warm KC waters at Site U1437. In general, water temperatures varied by up to 4 °C during the various glacial-interglacial cycles.

Overall lower water temperatures in all three records coincide with more positive values in the global $\delta^{18}O$ stack (Fig. 1) and indicate a southward migration of colder OC and interfrontal zone waters over our site. In contrast, higher water temperatures at Site U1437 are interpreted as a stronger KC associated with an enhanced North Pacific Subtropical Gyre circulation. This resulted in a fortified export of tropical heat from the WPWP to northern mid-latitudes and fostered the northward migration of the KC. Offsets in the three lipid paleothermometer records may have resulted, among other factors, from different habitat depths and production seasons of the source organisms.

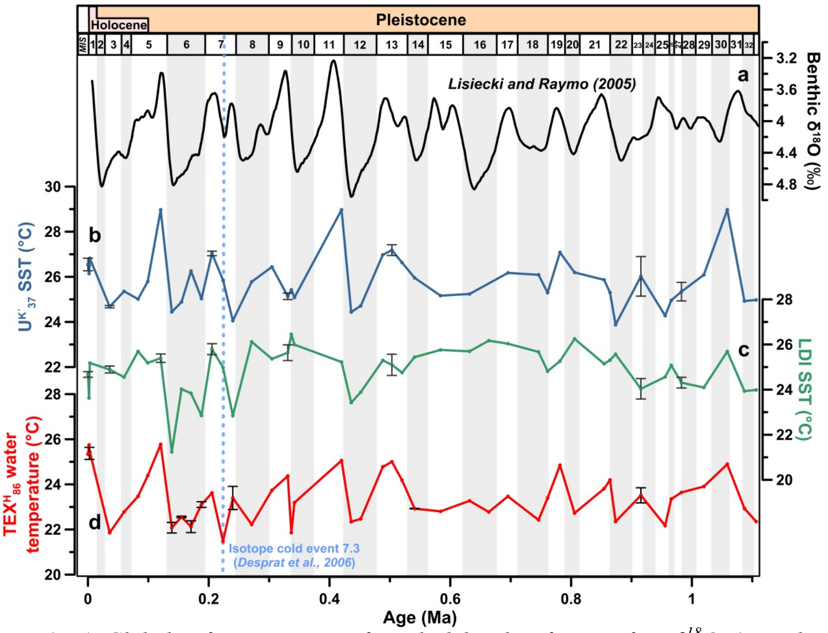

***Figure 1**. a) Global reference curve of stacked benthic foraminifera $\delta^{18}O$ (Lisiecki and Raymo, 2005) in comparison with Site U1437 sea surface (b: $U^{K'}_{37}$ and c: LDI) and thermocline (d: TEX^{H}_{86}) temperature records over the last 1.1 Ma. Cold marine isotope stages are displayed as grey bars.*

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