Constraining the magnitude and spatial pattern of low-to-mid latitudes western Pacific ocean temperature changes in the past 25 kyr

*Sze Ling Ho[1], Sicheng Le[1], Ren Yi Ooi[1], RAUL TAPIA[1], Da-Cheng Lin[2], Min-Te Chen[2], Yuan-Pin Chang[3], Masanobu Yamamoto[4], Liang-Jian Shiau[2,5], Chuan-Chou Shen[6], Pai-Sen Yu[7]

1. Institute of Oceanography, National Taiwan University, Taipei, Taiwan., 2. Institute of Applied Geosciences, National Taiwan Ocean University, Keelung, Taiwan, 3. Department of Oceanography, National Sun Yat-sen University, Kaohsiung, Taiwan, 4. Faculty of Environmental Earth Science, Hokkaido University, Sapporo, Japan, 5. Exploration and Development Research Institute, CPC Corporation, Miaoli, Taiwan, 6. High-Precision Mass Spectrometry and Environment Change Laboratory (HISPEC), Department of Geosciences, National Taiwan University, Taipei, Taiwan, 7. Taiwan Ocean Research Institute, NARLabs, Kaohsiung, Taiwan

Upper ocean (0–200 m) temperature reflects large scale ocean circulations and the atmospheric-ocean heat exchange. It is therefore a useful metric in characterizing paleoclimate, including the roles played by the East Asian Monsoon and the Indo-Pacific Warm Pool in driving the hydroclimate of East Asia. Geochemical proxies are widely used to reconstruct past ocean temperature, but may yield discrepant estimates due to chemical and ecological differences. This uncertainty in reconstructions can be constrained by a multiproxy approach. However, most existing paleoclimate studies in East Asia are inferred from single paleotemperature proxy. Consequently, the multiproxy discussion in this region is in fact based largely on different proxies from different sites, rendering it challenging to disentangle the effect of local climate from proxy discrepancy. In this study, we aim to characterize the magnitude and spatial pattern of the upper ocean temperature change in the western Pacific using an integrative multiproxy, multisite approach. Our sediment core sites span the South China Sea, Indo-Pacific Warm Pool and Kuroshio region. We generate a multiproxy paleotemperature database by combining newly generated data with published data. For all these sites, we obtain paleotemperature records inferred from three proxies, each based on vastly different source organisms, namely planktic foraminifera-based Mg/Ca, haptophyte-based UK’ 37, and archaea-based TEX86. As all proxies have their own pros and cons, this approach allows us to take advantage of the strengths of proxies to constrain the uncertainty of the others, thereby improving the robustness of paleoclimate reconstructions. As well as providing a constraint to the magnitude and spatial pattern of temperature change, this multiproxy database allows mapping of the ocean temperature change between distinct climate periods such as the Holocene and Last Glacial, which are often used to benchmark climate models. We envisage that this systematic multiproxy approach will refine our understanding of past changes in the oceans surrounding East Asia.

Keywords: South China Sea, Multiproxy, Sea surface temperature, East Asian Monsoon

