Geophysical Research Abstracts
Vol. 15, EGU2013-1468, 2013
EGU General Assembly 2013

Alkenone-derived Sea Surface Temperature and Intermediate Water Temperature from Mg/Ca of Infaunal Foraminifera (Uvigerina peregrina) since 1 Ma in the SW Pacific

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The reconstruction of past surface, intermediate and deep-water temperatures is critical for our understanding of feedbacks within the ocean-climate system on orbital time-scales. Intermediate water temperature reconstruction is particularly important since intermediate waters, including Antarctic Intermediate Water (AAIW), could drive high-low latitude teleconnections. However, quantitative information about intermediate waters evolution through the Pleistocene remains scarce. Proxies for determining the paleotemperature of interior water masses have many caveats including the 'Carbonate Ion Effect' on the Magnesium to Calcium ratio (Mg/Ca) of benthic foraminifera. However, recent studies have demonstrated that the shallow-infaunal species, Uvigerina peregrina, co-precipitates Mg independent of carbonate saturation state, affording the use of Mg/Ca(U.peregrina) for paleotemperature reconstructions (Elderfield et al., 2010).

Herein, we present the first record of intermediate water temperatures from Mg/Ca(U.peregrina) that spans the Mid-Pleistocene Transition (MPT) and the Mid- Bruhnes Event (MBE), from a sediment core in the Southwest Pacific (DSDP site 593; 40°30'S, 167°41'E, 1068m water depth), which lies within the core of modern AAIW. Our new results suggest that interglacial intermediate water temperatures were $\sim$7 °C both before and after the MPT, but cooled to $\sim$5 °C in the later Pleistocene, after the MBE. Glacial intermediate water temperatures remain fairly constant ($\sim$ 2°C) throughout the last 1 Myrs. These results are in apparent disagreement with the typical view of smaller temperature fluctuations between glacials and interglacials during the '41-kyr world' before the MPT, and larger glacial-interglacial temperature fluctuations during the '100-kyr world' after the MPT. In contrast, deepwater temperatures from proximal ODP site 1123 (3290m water depth; Elderfield et al., 2010; 2012) are around 1 °C lower before the MPT, than for the remainder of the Pleistocene. However, the ODP site 1123 record also shows relatively constant bottom water temperatures ($\sim$-2 °C) over the last 1 Myrs. These new results therefore imply that the mechanisms which drive intermediate and deep water temperatures have varied through this time period, suggesting that variations in at least one of these water masses is driven by something other than Northern Hemisphere glaciation patterns. Using new alkenone evidence (the UK37' index) for sea-surface temperature changes at the same site, we assess the evidence for changing Southern Ocean surface circulation as a mechanism to explain the observed trends identified at DSDP 593.