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Southern Ocean Surface and Intermediate Water Temperature from Alkenones and Mg/Ca of Infaunal Foraminifera for the last 1.5 Ma

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The reconstruction of past surface (SST), intermediate, and deep-water temperatures is critical to our understanding of feedbacks within the ocean-climate system. Intermediate water temperature (IWT) reconstruction is particularly important since intermediate waters, including Antarctic Intermediate Water (AAIW), are proposed to be an important driver in high-low latitude teleconnections, despite limited intermediate-depth records through the Pliocene and Pleistocene. Paleotemperature proxies have caveats, including the 'Carbonate Ion Effect' on the Magnesium to Calcium ratio (Mg/Ca) of benthic foraminifera. However, recent studies demonstrated that the infaunal species, Uvigerina peregrina, co-precipitates Mg independent of secondary effects, affording the use of U.peregrina Mg/Ca as a paleotemperature proxy (Elderfield et al., 2010).

We present the first 1.5 Ma record of IWT from Mg/CaU.peregrina coupled with an alkenone- derived UK37' SST record from a sediment core in the Southwest Pacific (DSDP site 593; 1068m water depth), in the core of modern AAIW. Our new data reconstruct interglacial IWTs at $\sim$7°C before and after the Mid-Pleistocene Transition (MPT), whereas values of $\sim$5°C occur in the later Pleistocene. Glacial IWT remained fairly constant ($\sim$2°C) throughout the last 1 Ma. These results are in apparent disagreement with the typical idea that glacial-interglacial temperature fluctuations were smaller in the '41-kyr world' before the MPT, than during the '100-kyr world', after the MPT. At proximal ODP site 1123 (3290m water depth; Elderfield et al., 2012), interglacial deepwater temperatures increase by $\sim$1°C after the MPT, with relatively constant glacial deepwater temperatures ($\sim$-2°C) over the last 1 Ma. New results from DSDP 593 therefore imply that the mechanisms that drive intermediate and deep water temperatures varied, suggesting that at least one of these watermasses has properties driven by something other than Northern Hemisphere glaciation patterns.