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Alkenone Temperature of the Pacific Warm Pool During the Last two Glacial Cycles

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Tropical cooling during glacial ages is the subject of a fierce controversy which has important implications in palaeoclimatology. The tropical cooling issue is also crucial for model-data comparisons aimed at determining the overall sensitivity of the climate system under different atmospheric CO_2 levels. In this context, the Pacific warm pool has been the focus of recent studies based on a variety of palaeothermometric methods. In particular, McCulloch et al. (1999) describe a sea surface temperature (SST) drop of 6 ºC during the penultimate glaciation based on Sr/Ca measured in Porites corals from New-Guinea. These data led McCulloch et al. to reinterpret the results of Linsley (1996) which were based on oxygen isotopes measured in planktonic foraminifera from a nearby site (ODP-769). Linsley originally invoked no SST change for the Sulu Sea core as evidenced by a good correlation between his oxygen isotope curve and published sea-level estimates. In order to obtain an independent view on this controversial issue, alkenones were measured in three deep-sea sediment cores: the same site ODP-769 used by Linsley (1996) and two long piston cores drilled in 1997: at about the same location in the Sulu Sea (MD972141) and off the north coast of New-Guinea (MD972140). During the last two glacial cycles the SST variations based on alkenones are similar in the Sulu Sea and off New-Guinea. The last two glacial periods are characterised by cooling on the order of 2-3 ºC. This is consistent with a 3-4 ºC glacial cooling derived from pollen records from a site of the northern coastal range of New-Guinea (Hope & Tulip, 1994). The agreement is rather satisfactory after taking into account that cooling is systematically amplified on continents by about 1.5 ºC as observed in most general circulation models (Bard, 1999, and references therein). Collectively these results disagree with a 6 ºC SST drop based on a standard interpretation of Sr/Ca in corals, but brings support to the works by Stoll & Schrag (1998) and Martin et al. (1999) who discuss global variations of the oceanic Sr/Ca ratio during glacial cycles. Due to these long term global Sr/Ca fluctuations, Martin et al. concluded that SST variations based on a standard interpretation of Sr/Ca, are overestimated by more than 3 ºC. Taking into account this systematic Sr/Ca bias would help to reconcile SST values based on alkenones and Sr/Ca in corals.

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