Geophysical Research Abstracts, Vol. 8, 08040, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08040


# Indications for a permanent El Nino-like Climate State during the Pliocene from the east Pacific

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We present data for the east Pacific from ODP Sites 1239 and 1241 for the Pliocene time interval 5.0-2.4 Ma. Analyses for Mg/Ca were performed on the planktic foraminifers *Globigerinoides sacculifer* and *Globorotalia tumida* in order to reconstruct changes in water mass properties both concerning stratification in the upper water column and latitudinal changes. Site 1241 (5˚50N, 86˚26W, 2027 m water depth) is located on the northern side of the Cocos Ridge beneath the North Equatorial Counter Current, while Site 1239 (0˚40S, 82˚4W, 1414 m water depth) is located off the coast of Ecuador in the upwelling area of the "Cold Tongue". The present day sea surface temperature (SST) gradient between both sites is $\sim$5˚C. Upwelling intensity decreases strongly during El Niño in this area, causing the SST gradient to approach $\sim$0˚C. Our reconstructions on the mixed layer dwelling *G. sacculifer* indicate that during the Pliocene the SST gradient between both sites was strongly diminished in comparison with the present day gradient. This provides support for the idea of a permanent El Niño-like climate state during the Pliocene.

A further important feature accompanying El Niño is the deepening of the thermocline due to decreasing upwelling intensity. We analysed *G. tumida*, which lives at the bottom of the photic zone, to determine temperature changes in the upper water column. An increasing temperature gradient between *G. tumida* and *G. sacculifer* indicates a shallowing thermocline and a decreasing gradient indicates a deepening thermocline. This reconstruction indicates, contrary to the latitudinal reconstruction, that the thermocline already shallowed significantly between 4.5-4.0 Ma.

This discrepancy can be explained such that, when trade winds intensified after 4.5

Ma, they were not intense enough yet to cause colder upwelling water to reach the mixed-layer or the upwelled water was not cold enough to have a significant influence on the mixed layer. Our results, hence, provide indications for a permanent El Niño-like climate state during the earliest Pliocene, but after 4.5 Ma the climate state started to develop toward a more present La Niña-like situation.