Mid-Pliocene Warm Period (3.3-3 ma) Sea-Level Reconstructions from the Wanganui Basin, New Zealand

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Here we present precession-paced sea-level cycles of c. 15 ± 5 m amplitude occurring during the Mid-Pliocene Warm Period (MPWP; 3.3 – 3.0 Ma), demonstrated from two sediment cores representing progressively deeper environments of the paleo shelf, recovered in the shallow marine stratigraphic sequence of the Wanganui Basin, New Zealand. This continuous and high resolution (c. 1 m.kyr-1) direct record of sea-level, enables an assessment of the frequency and amplitude of sea-level cyclicity in order to improve our understanding of ice sheet dynamics in a warmer world. The MPWP has been characterized by CO2 levels of 400 ppm with global average temperatures 2-3°C above present and is identified as an analogue for future warming scenarios. Previous estimates of global sea-level suggests peak interglacial values of 22 m ± 10 m above present day, however they contain indirect or discontinuous records, therefore unable to resolve the full amplitude and frequency of sea-level cycles.

Paleobathymetry of the sediment cores have been reconstructed utilizing newly developed, modelled wave-induced seafloor sediment distribution, in conjunction with foraminiferal census counts used in a modern analogue technique, to provide quantitative paleo-water depths of the sediments. A two-dimensional backstripping approach, removing the regional effects of loading (sediment and water), compaction and tectonic subsidence, has been applied to obtain regional sea-level cycles (not as yet corrected for glacial isostatic adjustment).

An integrated age model was established with tephrochronology, biostratigraphy and the identification of two paleomagnetic reversals (Kaena and Mammoth subchrons), which is constrained within a regional chronostratigraphic framework. A correlation of the new Wanganui drill cores with a deep sea paleoclimate record off eastern New Zealand (ODP1124) provides additional constraints for the age model and indicates precession-paced sea-level changes are in phase with high latitude Southern Hemisphere insolation. This implies an important role is played the Antarctic Ice Sheets on MPWP global sea-level change.

Keywords: MPWP, sea-level, precession, Wanganui Basin