



## **THE TIMING OF EVENTS SURROUNDING THE EOCENE-OLIGOCENE BOUNDARY – RESULTS FROM ODP LEG 199**

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The Eocene/Oligocene (E/O) boundary represents an extreme and rapid climatic transition from the “greenhouse” world of the Cretaceous and early Paleogene into the late Paleogene-Neogene “ice-house”. It is marked by a large and global deepening in the calcite compensation depth (CCD), as well as pronounced changes in the isotopic composition of carbon and oxygen in seawater, recorded in biogenic calcium carbonate. A good understanding is still lacking as to why climatic, palaeoceanographic and marine biological productivity changes occurred within a few tens of thousands of years, and what change in boundary conditions triggered a non-linear response of the climate system. Detailed palaeoceanographic records surrounding the E/O have been rare because of the lack of well-dated, expanded deep-sea sedimentary sections containing well-preserved calcareous microfossils.

Ocean Drilling Program Leg 199 recently recovered an extensive set of high-quality sediment cores across the E/O that span a latitudinal and depth transect in the central Pacific Ocean. We present new high-resolution records of bulk %CaCO<sub>3</sub>,  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  for a set of sites that form a depth transect, clearly delineating the relative depth with respect to the CCD during the transition. Our data show that a two-stepped deepening of the CCD coincides with a remarkably similar and simultaneous evolution of bulk  $\delta^{18}\text{O}$  values. We can demonstrate the imprint of climatic cycles around the E/O boundary, and very high-quality bio- and paleomagnetic datum points allow us to link these to Earth’s orbital variations. Shipboard measurements of sediment properties and down-hole log measurements also display an imprint of climatic cycles, and

allow us to obtain an astronomically calibrated time scale across the E/O. Our results put tighter constraints on the timing of the evolution of the CCD, mass accumulation rates, and biological productivity across the E/O, which display a distinct two-step shift in the most expanded section at the shallowest end of the transect (Site 1218). The initial deepening of the CCD occurred in less than 50 thousand years, and we observe a change in the nature and amplitude of climatic cycles that are recorded in sediments from Leg 199 across the E/O.