The coupled evolution of temperature and carbonate chemistry change during the Paleocene–Eocene; new orbital-resolution trace metal records from the low-latitude Indian Ocean

JAMES BARNET[1], KATE LITTLER[1], DUSTIN HARPER[2], LEAH LEVAY[3], KIRSTY EDGAR[4], JAMES ZACHOS[2]

[1] Camborne School of Mines, University of Exeter, Penryn Campus, Cornwall, UK
[2] Earth & Planetary Sciences Department, University of California, Santa Cruz; Santa Cruz, CA, USA
[3] International Ocean Discovery Program, Texas A&M University, College Station, Texas, USA
[4] School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham, UK

The "greenhouse" climates of the Paleocene and Eocene have formed the focus for many proxy and modelling studies in recent decades, as they are the closest geological analogues for our future warmer anthropogenic world. Yet, the long-term evolution of ocean temperature and carbonate chemistry at orbital-resolution, especially at low latitudes, are still poorly constrained.

Here we present new orbital-resolution foraminiferal trace metal (Mg/Ca & B/Ca) records spanning the late Paleocene to early Eocene (~58–53 Ma) from a new splice between ODP Site 758 and IODP Site U1443, Ninetyeast Ridge, northern Indian Ocean. We generated coupled Mg/Ca and B/Ca records from well-preserved mixed layer and thermocline-dwelling planktic foraminifera, and benthic foraminifera deposited at a shallow palaeo-water depth (~1500 m), to construct temperature change and carbonate chemistry (related to pH and DIC concentration) across a water column depth transect above Ninetyeast Ridge. Our new trace metal records are the first long-term orbital-resolution records of their kind from the poorly studied Indian Ocean. We estimate both the magnitude of long-term warming and associated carbonate chemistry change from the late Paleocene–early Eocene, as well as the magnitude of change on orbital (405- & 100-kyr) timescales. In addition, a portion of the Paleocene-Eocene Thermal Maximum is resolved in our records, providing a critical minimum constraint for the magnitude of temperature and carbonate chemistry change within the low-latitude Indian Ocean during this hyperthermal event.