A new deep sea reference record for the Paleocene-Eocene Thermal Maximum: IODP Expedition 392 Site U1580 (Agulhas Plateau, Southwest Indian Ocean)

Thomas Westerhold¹, Steve Bohaty², Donald Penman³, Ashely Burkett⁴, Edoardo Dallanave⁵, and the Expedition 392 Scientists*

¹University Bremen, MARUM – Center for Marine Environmental Science, MARUM Research Faculty, Bremen, Germany (twesterhold@marum.de)
²Institute of Earth Sciences, Heidelberg University, Heidelberg, Germany
³Department of Geosciences, Utah State University, USA
⁴Boone Pickens School of Geology, Oklahoma State University, Stillwater, OK, USA
⁵Faculty of Geosciences, University of Bremen, Bremen, Germany
* A full list of authors appears at the end of the abstract

The abrupt onset of the Paleocene-Eocene Thermal Maximum (PETM) 56 million years ago represents one of the largest transient greenhouse gas-driven global warming events in the last 100 million years. Caused by a geologically rapid injection of exogenic carbon into the ocean and atmosphere system, the PETM is associated with large-scale ocean acidification. Related widespread dissolution of marine pelagic carbonate deposits, particularly in the early stages of the event, complicates marine paleoclimatic reconstructions and the establishment of robust age models at many sites. Recently, a new deep-sea sediment record spanning the PETM was recovered from the southern Agulhas Plateau in the Southwest Indian Ocean during International Ocean Discovery Program Expedition 392. The uppermost Paleocene/lowermost Eocene interval at Site U1580 was drilled in two parallel holes at 2560 m water depth, and consists of 75–95% carbonate across the event, with a reduction to 75–65% at the PETM onset. X-ray fluorescence-derived core scanning elemental data at 5 mm and 10 mm resolution and an unprecedented high-resolution bulk carbonate stable carbon and oxygen isotope record define a new marine composite reference record for the PETM at this site. The record is comparable to Ocean Drilling Program Site 690 (2914 m water depth) in the Atlantic sector of the Southern Ocean, where the event was first described and is still a primary reference sequence for paleoclimate reconstructions. Unlike Site 690, however, Site U1580 elemental data shows a clear cyclicity throughout the event that can be utilized for cyclostratigraphy. Additionally, the highly resolved bulk carbonate stable carbon isotope record provides a new reference for global correlation, which establishes a new benchmark for the different phases of the PETM. Here we present this new record and discuss the implications for timing and duration of the event, and set the stage for multi-proxy paleoclimate reconstructions spanning the PETM at IODP Site U1580.