Geophysical Research Abstracts, Vol. 9, 03296, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03296
© European Geosciences Union 2007

Early Paleogene transient global warming events, carbon cycle dynamics, biomarkers, and dinoflagellates - a potent mix

Appy Sluijs

Palaeoecology, Institute of Environmental Biology, Utrecht University, Laboratory of Palaeobotany and Palynology, Budapestlaan 4, 3584 CD Utrecht, The Netherlands (A.Sluijs@bio.uu.n)

The Paleocene-Eocene thermal maximum (PETM, ∼55.5 Ma), Eocene Thermal Maximum 2 (ETM2, or '*Elmo*', ∼53.5 Ma) and ETM3 (or '*X*', ∼52.5 Ma) were short-lived (< 200 kyr) episodes of globally elevated temperatures superimposed on already warm background conditions. All these 'hyperthermals' are characterized by prominent a negative carbon isotope excursion (CIEs) in sedimentary carbon, which reflect transient massive injections of isotopically light carbon into the ocean-atmosphere system. The PETM is the best studied and most extreme hyperthermal and is associated with major changes in ocean chemistry and the hydrological cycle, as well as dramatic biotic response. For example, our studies show that subtropical dinoflagellates inhabited the Arctic Ocean during the PETM at temperatures exceeding 23°C.

Many authors have assumed that the isotopically light carbon led to pronounced global greenhouse warming during the PETM. However, from an expanded record in New Jersey, we record that both the onset of the global abundance of the subtropical dinoflagellate *Apectodinium* and surface-ocean warming as recorded by TEX_{86} preceded the CIE by several thousands of years. The offset between *Apectodinium* and the CIE was confirmed in other sites from New Jersey, the North Sea and New Zealand. The ∼3 kyrs time lag between the onset of warming and the CIE is consistent with the expected lag between bottom water warming and submarine methane hydrate dissociation, suggesting that the latter mechanism indeed caused the CIE. Associated dinoflagellate studies point to significant eustatic sea level rise during the PETM. This sea level rise appears to have been larger than can be explained by steric effects only, while the late Paleocene world is generally assumed to have lacked significant continental ice sheets.

If time allows, new results from ongoing studies will be presented, focusing on e.g., the PETM in the Southwestern Pacific, ETM2 in the Arctic Ocean, and ETM3 in the Tethys. The research presented is a result of collaborations with researchers from, amongst others, the Institute of Environmental Biology and Earth Sciences Department at Utrecht University, the Royal Netherlands Institute for Sea Research (NIOZ), the Earth Sciences Department at the University of California Santa Cruz, the Department of Earth Sciences at Rice University, Department of Paleoclimatology and Geomorphology at the Vrije Universiteit Amsterdam, the Earth and Atmospheric Sciences Department at Purdue University, the Department of Geology and Geophysics at Yale University and the Department of Geosciences at Bremen University. This research used samples provided by the Integrated Ocean Drilling Program.