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High-resolution record on Deep-sea Ostracods across the Paleocene–Eocene Thermal Maximum in DSDP Site 401, Bay of Biscay, Spain

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The Paleocene-Eocene thermal maximum (PETM) is an extreme climate event (~56 Ma; Hilgen et al. 2010) that caused a major turnover of Cenozoic deep-sea benthic faunas (e.g., Thomas 2007). The PETM associated with abrupt ocean warming (e.g., Tripati & Elderfield 2005) and a marked shoaling of the carbonate compensation depth and shift in ocean circulation (e.g., Zachos et al. 2005; Nunes & Norris, 2006). At the onset of the PETM, deep-sea benthic foraminifers experienced an extinction of 35–50 % of cosmopolitan taxa. During the PETM they constituted unique faunas that are called the "excursion", "disaster" and "opportunistic" faunas (e.g., Thomas & Shackelton 1996; Thomas 1998).

Previous studies on ostracod turnovers across the PETM revealed a contrasting pattern of moderate levels of extinctions and origination in shallow-marine Tethyan sections (e.g., Morsi & Speijer 2003), temporary disappearance and replacement by a novel assemblage in the deep Southern Ocean (Steineck & Thomas 1996; Webb et al. 2009), and no replacement of species and extinction in a deep-sea Tethyan section (Caravaca, Spain; Guernet & Molina 1997) and deep western North Atlantic (Blake Nose, US East Coast; Guernet & Belliner 2000), in contrast with deep-sea foraminifera. However any studies have not illustrated deep-sea ostracod faunal changes during the PETM before, except for the studies in the Southern Ocean.

Here we present a higher resolution record of deep-sea ostracods across the PETM and represent the faunal changes in the Deep Sea Drilling Project (DSDP) Site 401 (47°25.650'N, 8°46.618'W, 2495 m water depth), outside of the Bay of Biscay, Spain, North Atlantic. Our samples were previously used to construct a foraminiferal stable isotope record through the PETM (Nunes & Norris 2006).

We obtain 20 ostracod species from 90 samples and identify four assemblages, observing species diversity and stratigraphic distribution of the species. All the assemblages were occupied by *Krithe cassicaudata* van den Bold, 1946 through the late Paleocene to the early Eocene.

We find a sharp drop in diversity from a pre-PETM standing stock of 12 common species to a PETM assemblage of only one species at the same time as the benthic foraminiferal extinction event (Fig. 1). All but three species reappear in the later parts of the PETM. A post-PETM assemblage increases their diversity, showing 10 species.

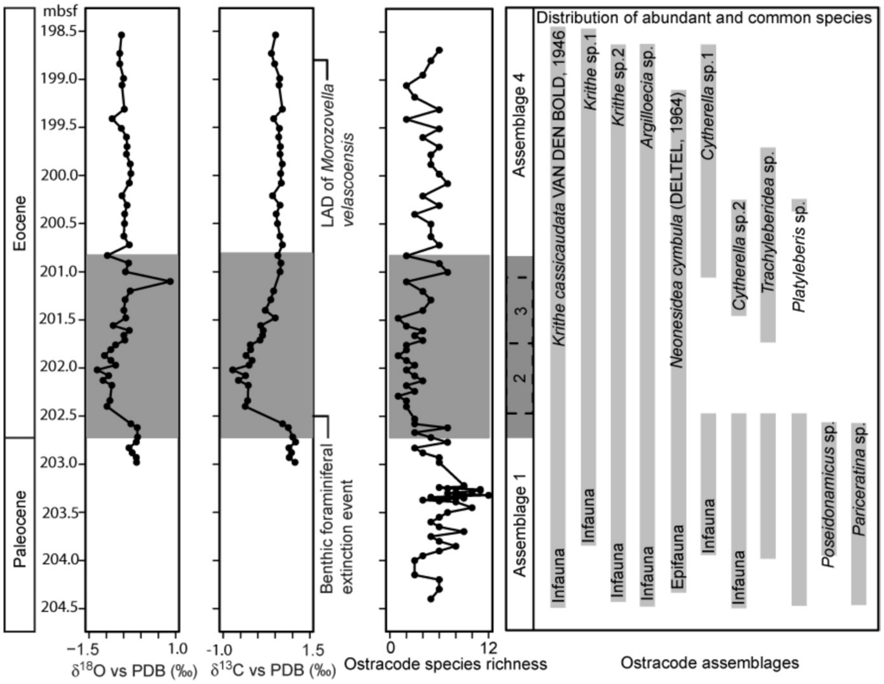

Fig. 1: The late Paleocene–early Eocene foraminiferal oxygen ($\delta^{18}O$) and carbon ($\delta^{13}C$) stable isotopes and ostracod assemblages in DSDP Site 401. A dark gray area means the carbon isotope excursion zone that is the PETM. References are as follows: the stable isotope data, NUNES & NORRIS (2006); the foraminiferal biostratigraphic events, PAK & MILLER (1992) and PARDO et al. (1997); the ostracod data, YAMAGUCHI & NORRIS (submitted); the mode of ostracod life, ELOFSON (1941) and MADDOCKS (1969a, b).

We do not observe any “excursion” ostracod species as has been observed in benthic foraminifers. However, the ostracod assemblages changed from a relatively diverse ecological assemblage before and after the PETM to one dominated by infaunal species typical of low oxygen conditions during the PETM. The absence of major extinction and temporary nature of species disappearances stand comparable to turnover in the Tethyan shallow-marine sections and stands in sharp contrast to the ~50 % species-level extinction in benthic foraminifers.

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