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PETM in a shallow marine environment: Benthic foraminiferal Turnover and echinoid bloom (Sidi Nasseur, Tunisia)

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Despite a large number of studies on the Paleocene/Eocene thermal maximum (PETM) in continental margin sections, our knowledge of the PETM in inner to middle neritic environments remains quite poor. In order to unravel faunal and paleoenvironmental changes in shallow marine settings during the PETM, we investigated the Sidi Nasseur (NAS) section in Tunisia. The section exposes upper Paleocene to lower Eocene shales and marls of the El Haria Formation. The lower 9 m of the NAS section is marked by moderately rich, fairly diversified nannofossil associations, containing the typical pre-PETM taxa of the middle part of NP9 (*Discoaster multiradiatus*, *D. falcatus*, *Rhomboaster cuspis*, *Fasciculithus alanii*, *F. schaubii*, etc.). The upper half of the section (10.50 - 17.50 m) is very poor in nannofossils (*Coccolithus pelagicus* and a few *D. multiradiatus* are present), partly because of selective decalcification, excluding refined age attributions. The lower 9m of the NAS section contain a benthic foraminiferal assemblage with numerous large *Frondicularia*, *Nodosaria*, *Lenticulina*, many small calcareous and arenaceous species, but only rare planktic foraminifera, pointing to inner to middle neritic deposition (~ 50 m paleodepth). A faunal turnover is situated within a carbonate-poor interval interpreted as a decalcified zone, rich in arenaceous foraminifera. From 10.50 to 17.50 m the foraminiferal assemblages consist of many minute trochospiral and bi-/triserial benthic taxa. *Frondicularia* and *Nodosaria* do not reappear above the carbonate-poor interval. Planktic foraminifera become frequent above the carbonate-poor interval and consist to a large extent of flat-spired species of *Acarinina*, including the multi-chambered variety of *Acarinina sibaiyaensis*. This planktic assemblage typifies

the well-known planktic excursion assemblage observed within the PETM worldwide. From 12m onwards, spines and shell fragments of burrowing echinoids become increasingly abundant in the foraminiferal residues, a phenomenon not previously observed in Tethyan PETM sections. Parallel to the main twofold benthic foraminiferal succession, also two different ostracod assemblages are identified: a diverse *Paracosta kefensis* assemblage (up to 9 m), typical of Paleocene neritic deposits in Tunisia, followed by an oligotaxic *Reticulina sangalkamensis* assemblage in the upper part of the section (10.15 - 17.50 m). Faunal parameters suggest more stressed, probably food-rich sea-floor conditions during the PETM. SEM observations provide information of the preservation of microfossils including the echinoid spines. In the lower part, *Frondicularia* specimens show signs of partial re-crystallization. *Nodosaria* and the echinoid spines, however, appear excellently preserved with only infilling by diagenetic calcite, separable from the shells. Stable isotopic studies are conducted on *Nodosaria*, echinoid spines and organic carbon (TOC). The foraminiferal $\delta^{13}C_{carb}$ record of the uppermost Paleocene (*Nodosaria*) is fairly stable, with individual measurements varying between -1 and 0.5‰. Isotopic data from the echinoid spines ($\delta^{13}C_{carbonate}$) show a very wide scatter, which may reflect undetected diagenetic overprint or vital effects. Only the TOC $\delta^{13}C_{org}$ record provides a continuous sequence and reveals a 4‰ negative excursion (from -24.5‰ to -28.5‰) very similar to the $\delta^{13}C_{org}$ record of Dababiya, the GSSP of the basal Eocene in Egypt. Surprisingly however, the onset of the excursion shows an enigmatic 1-2m lag relative to all faunal indications (particularly the *Acarinina* excursion assemblage) of the position of the onset of the PETM. Further study should clarify the reasons behind this apparent decoupling between the faunal and $\delta^{13}C_{org}$ record.

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