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Record of the Paleocene/Eocene boundary global warming impact on deep-sea benthic foraminifers at low latitudes (Kharrouba section: Tunisia)

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The rapid global warming across the Paleocene/Eocene (P/E) induced changes in the benthic foraminiferal assemblages, and caused a destabilization of the benthic assemblages resulting in drastic extinction. This bioevent has been labelled the Benthic Foraminiferal Extinction Event (BFEE), and is well documented in some sections in the Tethyan realm, e.g., in Spain (Zumaya, Alamedilla, Caravaca sections), in Egypt (Dababiya section) and in Tunisia (section Ellès). In Tunisia, the P/E transition occurs in the upper part of the El Haria Formation, at a transition from a clay-rich to a limestone-rich facies. In the Kharrouba section in northern Tunisia, about 200 km to the North of the Ellès section, this part of the El Haria Formation is well exposed. We collected and investigated 81 samples across a 31.40 m thick interval into the P/E transition. Samples were spaced at 10 cm intervals close to the P/E transition, at 30 cm and then 70cm above and below the transition. Our investigations included high resolution biostratigraphic studies and paleoecological analysis. The deposits interval is rich in high diversified assemblages of small benthic foraminifers associated, as well as abundant Planktonic specimens. The samples range from late Paleocene to early Eocene in age, including the P5 and P6 planktonic foraminiferal Biozones. The high Planktonic/Benthic ratio values and the estimated depth range of benthic species (e.g., *Tappanina selmensis*, *Gaudryina pyramidata*, *Bulimina midwayensis*, and *Nuttallinella coronula*) in the Kharrouba section indicate that the environment was bathyal throughout the P/E transition period. Statistical analysis of the benthic Foraminifera (73 species) shows a severe temporary disappearance of the majority of species, with a low-diversity in the benthic assemblages present just after this temporary disappearance in an interval of about 30cm thick. This bioevent, probably the local expression of the global BFEE, occurred after the Last Appearance (LA) of *M. velascoensis*, within the *M. subbotina* Zone. Throughout the 30cm interval, benthic foraminifers are rare, and their assemblages are dominated by

bolivinids. The onset of this interval is marked by temporary disappearance of all the epibenthic species and many endobenthic ones.

The relative abundance of bolivinids increases at this interval, from 16.5% to 40% average. The bolivinid assemblages also contain common endobenthic morphotypes such as the calcareous *Tappanina* (11.1- 14.3%) and *Dentalina* (7-22%) and *Aragonia* (11.1-21.4%), with scarce and sporadic *Oolina*, buliminids, *Zeauvigerina* and *Fursenkoina*. During this bioevent in the lower part of the *Morozovella subbotinae* Zone (P6b), among the planktonic foraminifers' surface dwellers *Acarinina* species increased in relative abundance.

Immediately above as well as below the BFEE interval, the assemblages are more diverse, and bolivinids are less abundant (i.e., 16.5% below, 12.5% above the BFEE).

Hollis *et al.* (2005. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 215: 313–343) estimated the sedimentation rate for the early Eocene at 1.4 cm/kyr to 2.7 cm/kyr. So, considering that the BFEE interval is 30cm thick in the Kharrouba section, we estimate the duration of the small benthic foraminifers' temporary disappearance event between 11.1 kyr to 21.4 kyr. These values are included within the duration of the carbon isotope excursion (CIE), which was estimated by Röhl *et al.* (2000. *Geology*, 28: 927-930) at about 220 Kyr.