



Benthic foraminiferal response to the K/T boundary event: inferences from the Elles section (Tunisia)

Alberto Venturati

Centro di Ricerca di Micropaleontologia Ambientale, 61100 Pesaro, Italy; E-mail: crma_ps@libero.it

Key words: Cretaceous/Tertiary boundary, benthic foraminifera, paleoecology, Tunisia

A high resolution, quantitative analysis of benthic foraminiferal assemblages distribution across the continuous and expanded Cretaceous/Tertiary Boundary (KTB) transition of the Elles section, allowed me to recognize peculiar paleoenvironmental changes taking place in this time interval. This research indicate that uppermost Maastrichtian benthic foraminiferal assemblages are fairly diversified with 58 species per samples on average. The benthic foraminiferal extinction rate is extraordinary low, with only two species (*Bolivinoidea draco* and *Sliteria varsoviensis*) becoming extinct at the KTB (fig. 1). However, benthic foraminiferal assemblages show a remarkable faunal turnover across the KTB in terms of diversity, abundance and community structure. In particular, a drastic decrease in abundance of infaunal forms is associated with a decrease in diversity at the KTB. Slightly higher in the Boundary Clay Layer (BCL), two successive remarkable increases in the proportion of agglutinating taxa are observed (fig. 1). Above the BCL, the diversity and the proportion of both infaunal and agglutinating forms show a recovery towards pre-KTB values. Just above the BCL, the relative abundance of agglutinating forms reverts to uppermost Maastrichtian values. Besides these changes in faunal parameters, benthic foraminiferal assemblages record the invasion of two new agglutinating taxa (*Ammomarginulina aubertae* and *Arenoturrspirillina* sp.) in the lowermost Danian (fig. 1).

The succession of events occurring at Elles is remarkably similar to that observed in the same interval of El Kef. A comparison of the two sequences allows to trace some biostratigraphical and paleoecological considerations. In particular, the bloom of epifaunal forms is interpreted as a response to a drastic decrease in the amount of particulate organic matter reaching the sea floor in the lowermost Danian. This event is likely related to the severe decrease of primary productivity that followed the KTB event as indicated by the carbon isotope record at both

sections (Keller, Lindinger, 1989; Stüben et al., 2003). At the same time, the increase in abundance of both agglutinating dwarfed specimens of *Gaudryina cretacea* and *G. pyramidata* (Venturati, 2000), and planktonic foraminifera species *Guembelitra irregularis* displaying an aberrant test due to irregular disposition and growth of the chambers (e.g. Keller et al., 2002), seems to indicate the emplacement of high stress paleoenvironmental conditions on the sea floor and water column. This interpretation is fully supported by the drastic decrease in diversity occurring at the KTB and persisting for the whole BCL. The incoming of *A. aubertae* and *Arenoturrspirillina* sp., in association with an invasion of Boreal dinoflagellate cool-water taxa which also occur in the lowermost Danian of El Kef (Brinkhuis et al., 1998; Galeotti et al., 2004), may reflect a short term cooling following the KTB. These forms, in fact, are absent or very rare in the uppermost Maastrichtian of the southern Tethys but are common constituents of benthic foraminiferal assemblages in the same interval in Boreal settings. Accordingly, a negative shift of the $\delta^{18}\text{O}$ record (Stüben et al., 1998) indicates a short term cooling occurring in the lowermost 5 cm of the BCL at Elles. The development of sinistrally coiled dominated *Cibicoides pseudoacutus* populations in the Elles and El Kef sections, might also be related to such a decrease in temperature (Venturati, 2000; Galeotti, Coccioni, 2002; Galeotti et al., 2004).

Besides its paleoclimatic significance, the development of sinistrally coiled populations in *C. pseudoacutus* is a potential biostratigraphic tool, representing a powerful marker to assess the completeness of stratigraphical sequences in Tethyan shallow water settings just above the KTB. Similarly, the two discrete increases in abundance of agglutinating forms within the BCL can be regarded as a potential tool for, at least, regional biostratigraphic correlation across the KTB.

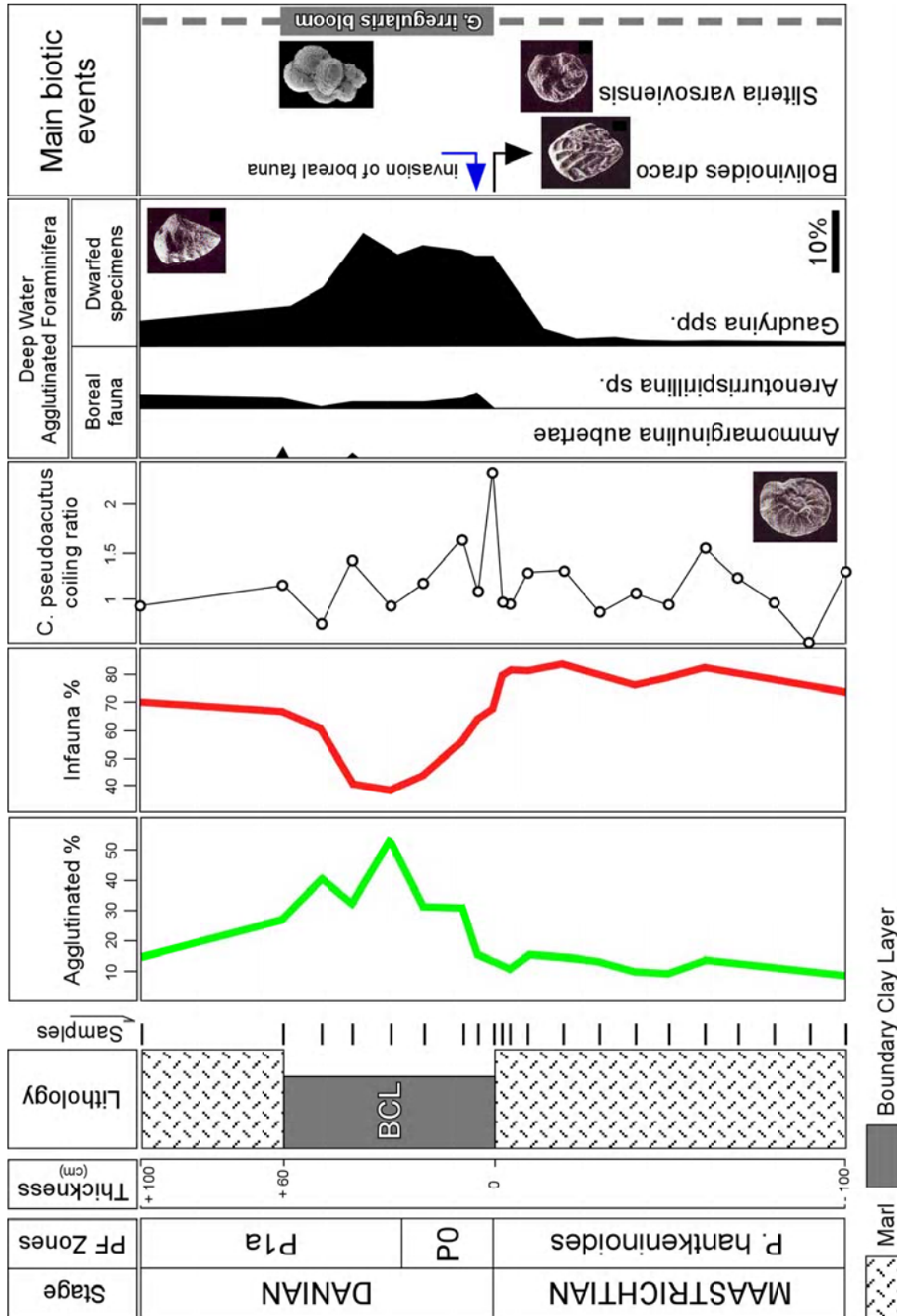


Fig. 1. Faunal parameters and selected benthic foraminifera across the K/T boundary at Elles section

References

- Brikhuis, H., J. P. Bujak, J. Smit, G. J. M. Versteegh, H. Visscher. 1998. Dinoflagellate-based sea surface reconstructions across the Cretaceous-Tertiary boundary. — *Palaeogeogr., Palaeoclim., Palaeoecol.*, 141, 67–83.
- Galeotti, S., R. Coccioni. 2002. Changes in coiling direction of *Cibicidoides pseudoacutus* across the Cretaceous/Tertiary boundary of Tunisia. — *Palaeogeogr., Palaeoclim., Palaeoecol.*, 178, 197–210.
- Galeotti, S., H. Brinkhuis, M. Huber. 2004. Records of post-Cretaceous-Tertiary boundary millennial-scale cooling from the western Tethys: A smoking gun from the impact-winter hypothesis? — *Geology*, 32, 529–532.
- Keller, G., M. Lindinger. 1989. Stable isotope, TOC and CaCO₃ record across the K/T Boundary of El Kef, Tunisia. — *Palaeogeogr., Palaeoclim., Palaeoecol.*, 73, 243–265.
- Keller, G., T. Adatte, W. Stinnesbeck, V. Luciani, N. Karoui-Yaakoub, D. Zaghbib-Turki. 2002. Paleobiogeography of the Cretaceous-Tertiary mass extinction in planktonic foraminifera. — *Palaeogeogr., Palaeoclim., Palaeoecol.*, 178, 257–297.
- Stüben, D., U. Kramar, Z. A. Berner, M. Meudt, G. Keller, S. Abramovich, T. Adatte, U. Hambach, W. Stinnesbeck. 2003. Late Maastrichtian paleoclimatic and paleoceanographic changes inferred from Sr/Ca ratio and stable isotopes. — *Palaeogeogr., Palaeoclim., Palaeoecol.*, 199, 107–127.
- Venturati, A. 2000. *Paleoecologia a foraminiferi bentonici al passaggio Cretacico/Terziario nella sezione di Elles (Tunisia)*. Università di Urbino, Unpublished Thesis, 1–90.