Reassessing planktonic foraminiferal biostratigraphy across the Cenomanian-Turonian boundary interval (middle Cretaceous)

***Falzoni, F.*[1,*], Petrizzo, M.R.[1], Caron, M.[2], Leckie, R.M.[3]**

*1) Dipartimento di Scienze della Terra "A. Desio", Università degli Studi di Milano, Milano, Italy, *E-mail: francesca.falzoni@unimi.it*
2) Department of Geosciences, University of Fribourg, Fribourg, Switzerland
3) Department of Geosciences, University of Massachusetts-Amherst, Amherst, USA

The upper Cenomanian–lower Turonian is a key-stratigraphic interval, as it includes the mid-Cretaceous maximum greenhouse phase and a major perturbation of the global carbon cycle (i.e, the Oceanic Anoxic Event 2) testified by a globally and synchronously registered positive carbon isotope excursion and by the deposition of organic-rich facies in open marine environments. A turnover in planktonic foraminiferal assemblages (extinction of single-keeled rotaliporids replaced by double-keeled dicarinellids and marginotruncanids) and in other marine organisms has been related to these environmental perturbations; however, the reconstruction of the cause and effect relationship between ecological forcing and organism response requires a highly-resolved chronostratigraphic framework.

The appearance and extinction levels of planktonic foraminiferal species represent a powerful tool to trace accurate intra- and supra-basinal correlations. However, bioevents cannot be assumed to be globally synchronous, because the stratigraphic and geographic distribution of each species is modulated by its ecological preferences. The aim of this study is to test the synchronicity and reliability of planktonic foraminiferal bioevents across the C-T boundary interval by correlating each bioevent to the carbon isotope profile. To perform this study, we have completed a highly-resolved biostratigraphic analysis of the European reference section for the C/T boundary at Eastbourne (UK), and of core S57 (Tarfaya, Morocco). The sequence of bioevents identified is compared to those recorded in other coeval sections (the GSSP section for the base of the Turonian at Rock Canyon, Pueblo, Colorado [KENNEDY et al., 2005]; wadi Bahloul, Tunisia [CARON et al., 2006]; Clot Chevalier [FALZONI et al., 2016] and Pont d'Issole [GROSHENY et al., 2006], SE France; Gongzha, Tibet [BOMOU et al., 2013]) that satisfy the condition of lacking major unconformities and of yielding a highly-resolved planktonic foraminiferal and $\delta^{13}C$ record.

Results indicate that the extinctions of *Thalmanninella deeckei*, *Thalmanninella greenhornensis*, *Rotalipora cushmani* and "*Globigerinelloides" bentonensis* in the latest Cenomanian are extremely reliable bioevents for correlation. Other promising lowest occurrences (LOs) that, however, need to be better constrained by bio- and chemostratigraphy include the LOs of *Praeglobotruncana oraviensis* and of *Marginotruncana schneegansi*, the latter event falling close to the C/T boundary. By contrast, other bioevents, including the LO of *Helvetoglobotruncana helvetica*, the LO of several *Dicarinella* species, as well as the '*Heterohelix* shift' appear to be diachronous. Although the stenotopic ecological behavior of these species might explain these results, we believe that evolutionary transition between species, different species concepts among authors, and rarity of the species might partially account for the discrepancies observed in the identification of extinction and appearance levels in the sections compared in this study.

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