

CALCAREOUS NANNOFOSSIL DATA AND MAGNETOSTRATIGRAPHY FROM THE ATLANTIC AND TETHYS OCEANS - An integrated approach to approximate the Jurassic/Cretaceous (J/K) boundary in low-latitudinal pelagic and hemipelagic sequences

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The Tithonian – Early Berriasian interval is characterized by a major calcareous nannofossil speciation event: several Cretaceous genera and species first appear and rapidly evolve (Bralower et al., 1989). Progressive increases in diversity, abundance and degree of calcification (Nannofossil Calcification Event – NCE; Bornemann et al., 2003) have also been documented.

Integrated magneto- and calcareous nannofossil biostratigraphy across the Jurassic/Cretaceous (J/K) boundary have been independently investigated in Tethyan land sections (Torre de Busi and Foza, Southern Alps) and at Atlantic Ocean DSDP sites (534A, Blake Bahama Basin and 105, Hatteras Basin).

Calcareous nannofossil biostratigraphy, absolute and relative abundances have been obtained using three different techniques: random settling slides (Geisen et al., 1999), simple smear slides and ultra-thin sections (7-8  $\mu\text{m}$  thick). Similar variations in nannofloral abundance and composition, including the NCE, have been documented in both Atlantic and Tethys oceans (low latitude associations).

All known calcareous nannofossil Zones and corresponding Subzones, following the biostratigraphic scheme of Bralower et al. (1989), have been recognized: NJ-19b; NJ-20a, NJ-20b; NJK-A, NJK-B, NJK-C across J/K boundary, NJK-D; NK-1

In the Middle Tithonian the nannoliths taxa *C. mexicana minor*, *C. mexicana mexicana*, and *P. beckmannii* increase significantly in abundance (Bornemann et al., 2003; Tremolada et al., 2006): the maximum relative abundance is reached between the calcareous nannofossil Zone NJ-20B and early NJK-A (Atlantic Ocean) or NJK-B (Tethys Ocean), followed by a decrease through NJK-A

and NJK-B. Nannoconids appear and rapidly evolve across the J/K boundary reaching high relative abundances in the lowermost Berriasian (from calcareous nannofossil Subzone NJK-C to NK-1).

Quantitative and morphometric studies have identified new potential events. Relative abundances of the placolith genera *Watznaueria* and the nannolith genera *Conusphaera* show opposite trends, while morphometric analysis show a size increase of placoliths, nannoliths and nannoconids during NCEs both in the Atlantic and Tethyan sections (new data): calibration with magnetostratigraphy indicate that these trends are useful as additional bio-horizons for locating the J/K boundary.

Calcareous nannofossil zonations and abundance variations of tethyan Torre de Busi section have also been correlated with calpionellid biostratigraphy, which has been investigated on the same samples used for the calcareous nannofossil study. It has been possible to identify the *Chitinoidella*, *Crassicollaria* and *Calpionella* Zones across the J/K boundary (Remane, 1986; Pop, 1994b and Reháková and Michalík, 1997).

Six polarity chrons (from CM22 to CM17) have been identified in DSDP site 534A, and in the tethyan land sections.

The speciation of highly-calcified and dissolution resistant calcareous nannofossil forms, and related remarkable abundance and size increases, and the relative trends between genera *Watznaueria* and *Conusphaera* could provide new reliable stratigraphic tools for the approximation of the J/K boundary in low latitudinal pelagic and hemipelagic sequences in the Atlantic and Tethyan Oceans. In conclusion integrated stratigraphy, derived from the correlation among several calcareous nannofossils events, capionellid zonation and magnetostratigraphic events, can be used to characterize the J/K boundary interval, and is believed essential for defining the Jurassic/Cretaceous boundary particularly in the absence of orthostratigraphic markers (e.g. ammonites).

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