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Response of early Paleogene nannofossils to periodically increased nutrient availability in the NE Peri-Tethys

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During the early Paleogene, three episodes of widespread throughout NE Peri-Tethys accumulation of sediments rich in TOC mark periodical occurrence of dramatically increased productivity caused by enhanced nutrient supply from the land. Two of these episodes (at the Paleocene/Eocene boundary and late early Eocene) took place under warm climate conditions, while third one (late middle Eocene) occurred during significant cooling, but all they where characterized by drastic turnovers in nannofossil assemblages.

Earliest short episode of TOC-rich sediment accumulation coherent to negative carbon isotope excursion (CIE) corresponds to Paleocene-Eocene Thermal Maximum (PETM) (NP9/NP10 boundary) and displays significant decrease in nannofossil abundance and major turnover in nannofossil assemblages involving wide occurrence of Rhomboaster spp. and asymmetric Discoaster anartios and D. araneus and dramatic shift in the ratio of the main taxa. Pre-PETM assemblages contain Coccolithus, Toweius, Fasciculithus, and Discoaster in nearly equal amount with minor Chiasmolithus and Sphenolithus concentrations. At the PETM onset, Chiasmolithus become removed, Coccolithus and Sphenolithus distinctly reduce, while Discoaster, Toweius and, in minor extend, Fasciculithus increase in relative abundance. Zygrhablithus bijugatus which is believed to be oligotrophic species is absolutely absent in PETM sediments.

Late early Eocene succession (NP12-NP13 zones) of NE Peri-Tethys includes a series of TOC-rich interlayers also characterized by negative 13C and 18O excursions and marked by similar reorganization of nannofossil assemblages when Chiasmolithus decline, Coccolithus, Sphenolithus and Zygrhablithus bijugatus decrease in abundance, while Discoaster and Toweius show remarkable bloom.

In the late middle Eocene, a transition from relatively warm water oxic conditions (Keresta Fm., CP13≈ NP15) to cooler anoxic environment and TOC-rich sediment accumulation (Kuma Fm., CP14≈NP16-NP17) shows dramatic change from assemblage dominated by Discoaster, elliptical Coccolithus (C. pelagicus) and, to a lesser extend, Chiasmolithus to assemblage highly enriched in Reticulofenestra, Dictyococcites and round Coccolithus (Cyclicargolithus floridanus), when discoasters reduce but still persist while chiasmoliths and Zygrhablithus bijugatus become extremely poor.

This pattern in nannofossil distribution during periods of enhanced nutrient input in the basin provides information for better understanding paleoecological affinities of nannofossil taxa. Thus, Discoaster, Toweius and Fasciculithus appeared to be warm water mesotrophic/eutrophic genera, warm water Sphenolithus and cool water Chiasmolithus, as well as Zygrhablithus bijugatus, seem to prefer oligotrophic conditions. Reticulofenestra and, possibly, Cyclicargolithus floridanus are more likely euritopic genera and their paleoecological affinity seems to be similar to Mesozoic Watznaueria thrived under a large spectrum of environments.

This conclusion contrasts to recent interpretation of discoasters as warm oligotrophic taxon and chiasmoliths as cool eutrophic taxon (Aubry, 1998; Bralower, 2002). Dramatic decline of Chiasmolithus with the onset of enhanced nutrient input under both warm and cool climatic conditions does not support this suggestion or the only assumption can be made considering chiasmoliths as relatively deep dwellers affected by anoxia corresponding TOC-rich sediment accumulation in the shallow epeiric basin of NE Peri-Tethys.

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