

**CHANGES IN MARINE PRODUCTIVITY ACROSS THE MID-LATE
CRETACEOUS (CENOMANIAN-TURONIAN BOUNDARY) IN WEST-CENTRAL
JORDAN**

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The widespread deposition of marine black shales during the Cretaceous oceanic anoxic events (OAEs) occurred under extreme climatic and oceanographic conditions, accompanied by perturbations in the ecology of primary producers (e.g., Kuypers et al., 1999; 2001; 2004). Deciphering changes in the community of marine primary producers can give us a better understanding of paleoenvironmental conditions controlling primary production, nutrients and carbon cycling during these events.

Using a molecular-isotopic approach, we reconstruct the relationship between the structure of planktonic communities and paleoenvironmental conditions during the mid-late Cretaceous OAE-2 (Cenomanian-Turonian boundary) at the Levant carbonate platform deposit of Central Jordan. Due to its position in an inner shelf platform in the western part of the Neotethys, this area was particularly sensitive to sea level variations. Based on a high resolution record of $\delta^{13}\text{C}_{\text{carbonate}}$ and total organic carbon (TOC), three episodes of black shales deposition with different $\delta^{13}\text{C}$ signature have been defined and studied in detail in one section of Central Jordan (GM3): the Mid Cenomanian Event (MCE), the OAE-2, and a post-OAE-2 event of high productivity.

Three main ecological structures were defined through the section: a) an extended period of equally distributed prokaryotic and eukaryotic signals during both the MCE and OAE-2 indicated by a rather stable sterane over hopane ratio of ~ 0.5 ; b) a short post-OAE-2 interval with predominant cyanobacterial signals, indicated by the presence of methyl-branched alkanes; c) a short interval of about 20 kyr with a predominance of eukaryotes and presumably high productivity and nutrient input, characterized by an exceptionally high abundance of pristane and phytane (3.5 mg g^{-1} TOC, 50% of the hydrocarbon fraction) and almost an absence of hopanes. To our knowledge, such a high relative abundance of presumably chlorophyll-derived pristane and phytane lacks any precedent. The last two

ecological structures and the return to previous conditions occurred in a relatively short interval of time, reflecting a highly dynamic environment.

Additionally, the post-OAE event with the same unusual feature was studied in another section (KB3) located ca. 30 km from GM3, in the center of which was a sub-basin within the Levant platform, corroborating that this event of high eukaryotic productivity and anomalously high preservation of pristine and phytane was at least regional.

The possible role of nitrogen fixation by cyanobacteria will be discussed based on the presence of 2-methylhopanoids and nitrogen isotopes, whereas the possible stratification of the water column and development of photic zone euxinia will be assessed on the presence of isorenieratene derivatives after desulfurization. We will examine the role of changes in productivity and ecology as a result of the relationship between sea-level changes and nutrients input combined with microfossil data.

REFERENCES

- Kuypers M., Pancost R. and Sinninghe Damsté J. (1999). A large and abrupt fall in atmospheric CO₂ concentration during Cretaceous times. *Nature*, 399, 342-345.
- Kuypers M., Blokker P., Erbacher J., Kinkel H., Pancost R., Schouten S., and Sinninghe Damsté J. (2001). Massive expansion of marine archaea during a Mid-Cretaceous oceanic anoxic event. *Science*, 293, 92-94.
- Kuypers M., van Breugel Y., Schouten S., Erba E. and Sinninghe Damsté J. (2004). N₂-fixing cyanobacteria supplied nutrient N for Cretaceous oceanic anoxic events. *Geology*, 32, 853-856.