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The impact of the mid-Maastrichtian Event on nitrate-phosphate limitation from DSDP Leg 198, Hole 1210B, Shatsky Rise: Using high-resolution X-ray fluorescence analysis and calcareous nannofossil paleoecology to reconstruct the paleo-nutrient regime

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The late Campanian–Maastrichtian (~74–66 Mya) is characterized by a transition from extreme greenhouse conditions, where sea surface temperatures were estimated to be ~33 °C or higher, to "cool" greenhouse, where sea surface temperatures decreased by ~ 7 °C. Superimposed on this general cooling are discrete climatic events, including the mid-Maastrichtian Event (MME). This was a short-lived warming interval, dated ~69 Ma, lasting ~0.5. m.y. During this event, inoceramid bivalves went extinct, the collapse of rudist bivalve-dominated reef systems occurred, as well as a significant decrease in many warm water benthic fauna [1].

Studies that assess the paleoecological response of organisms to the MME tend to focus mostly on organisms in the benthic realm and less so on the planktonic realm. Paleoecological analyses of late Campanian–Maastrichtian calcareous nannofossil assemblages at Walvis Ridge reveal a significant overturn of the calcareous nannoplankton assemblages immediately after the MME. Taxa that are indicators of eutrophic/mesotrophic conditions become almost extinct, while taxa that are indicators of oligotrophic conditions bloom. The assemblage turnover also coincides with an increase in $\delta^{13}C$ values that gradually increase at the K–Pg boundary.

The abrupt changes in calcareous nannoplankton assemblages, $\delta^{13}C$ values, the inoceramids bivalves, and the impact on benthic fauna are attributed to seafloor oxygenation, which resulted in the nutrient regime to switch from nitrate-dominated to phosphate-dominated [1]. XRF core scanning analyses were carried out on cores Leg 198, Hole 1210B, Shatsky Rise to test this hypothesis. This locality was chosen because the Campanian–Maastrichtian sediment succession is unlithified calcareous nannofossil ooze. Given that there are calcareous oozes, the total organic carbon is negligible. The results show an increase in phosphorus just before the MME; there is also a significant increase in glauconite. It is plausible that this resulted from changes in redox conditions, where the increase phosphorus before the MME could potentially be used as a proxy for oxygenation of the seafloor, and ultimately, a change from nitrated dominated a phosphorus dominated paleo-nutrient regime.

[1] Frank, T. D., & Arthur, M. A. (1999). Tectonic forcings of Maastrichtian ocean–climate evolution. *Paleoceanography*, *14*(2), 103-117.