Calcareous nannofossils from Late Cretaceous (Cenomanian-Campanian) shallow-marine deposits in northwest Germany - a record for coastal dynamics

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The early Late Cretaceous was characterized by a warm equable climate and a significant global sea-level rise that caused the flooding of vast continental areas. These oceanographic conditions favored the radiation of calcareous nannofossils, as evidenced by their unique diversity and high abundances in pelagic to hemipelagic environments. Previous studies of Cretaceous calcareous nannofossil biostratigraphy and paleoecology, therefore, focused on material from open ocean chalks and marls. For this study, we analyzed nannofossil assemblages from marginal marine settings in northwest Germany, about 5–15km off the former coastline. A detailed sampling of six recently drilled cores allowed us to study a sequence of glauconitic marls and sand-rich limestones of Cenomanian-early Campanian age for biostratigraphy and nannofossil diversity.

All 330 samples yielded rich and diverse calcareous nannofossil assemblages, which were first used to help establish a detailed biostratigraphic framework. Stable isotope data ($\delta^{13}C$ bulk rock) were then used to calibrate the biostratigraphic findings. The calcareous nannofossil biostratigraphy of the glauconite-rich sediments assigned the studied interval an earliest Cenomanian (nannofossil Zone UC0-1a) to early Campanian age (nannofossil Zone UC14) age. Seven major hiatuses, which were at stratigraphically different levels, were recognized. The accurate dating of these hiatuses resulted in the reconstruction of the dynamic evolution of the former coastline. Our findings allowed us to differentiate between eustatic and epirogenetic induced sea-level fluctuations. In addition to the global eustatic sea-level rise of the Cenomanian-Turonian interval, independent synsedimentary tectonic movements in the Turonian influenced regional sedimentation patterns. The diverse assemblages further improved the paleoecological understanding of calcareous nannofossils.