New insight on the paleoclimatic evolution in the Boreal Realm at the onset of the Early Cretaceous chalk sea

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During the Albian, the open marine carbonate production underwent a profound revolution with the onset of the dominance of planktonic production in the total carbonate budget. This led to the deposition of vast amounts of chalk across the world’s Oceans as a result of the accumulation of large amounts of nannoplankton. The worldwide Upper Cretaceous white chalks are however not the first true chalks (i.e. deposits dominated by calcareous nannofossils) to be recorded in Earth’s History. Already during the Barremian, chalks were deposited in the North Sea Central Graben. These chalks did not extend until the Albian, since a ‘nannoconid crisis’ occurred at the onset of the early Aptian OAE-1a, with the deposition of an organic-rich marlstone layer named the Fischschiefer. To better understand if climatic changes have governed the occurrence of the Barremian true chalks and the switch to organic-rich marlstones during OAE-1a, we have reconstructed the evolution of climate in the North Sea Basin based on clay mineral assemblages. Clay mineral composition and distribution are proven indicators of paleoclimate and evolution of a basin as the formation of clay minerals in soils depends on the climate under which it develops. Hence, based on high-resolution clay mineral data from various cores from the North Sea, a paleoclimatic reconstruction of the late Hauterivian to early Aptian stratigraphic interval is proposed. Based on a long-term decrease of kaolinite content, a trend toward aridification is observed during the late Barremian, concordant with the development of the first true chalks. A sharp increase in kaolinite content is recorded at the onset of OAE-1a, with its highest peak occurring towards the end of the event. This suggest that a significant increase in humidity accompanies the unfolding of OAE-1a in the North Sea Basin. Further investigation is needed to confirm the hypothesis that paleoclimatic changes in the Boreal Realm are responsible for the onset of chalk deposition and the change in clay mineral assemblages.
