Geophysical Research Abstracts, Vol. 8, 01480, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01480

Palaeoceanographic changes across the Lower/Upper Maastrichtian boundary in Denmark

N.H. Schovsbo (1), B. Lauridsen (2), C. Knudsen (1) and L. Stemmerik (1)

(1) Geological Survey of Denmark and Greenland (GEUS), (2) Geological Institute University of Copenhagen, Denmark (nsc@geus.dk)

During Late Cretaceous time an extensive, relatively deep epicontinental sea covered most of NW Europe. Hinterland relief was low and potential source areas were restricted in extent so siliciclastic supply was limited and deposition of nannofossil chalk dominated over large areas from a palaeolatitude of 35°N northwards to 50°N where the carbonates passed into siliciclastics. Decimetre to metre-scale cyclicity is a characteristic feature of the European chalk, and it is generally accepted that it is controlled by subtle fluctuations in climate dictated by orbital forcing in the Milankovitch frequency band (dominated by the 21 ka precession cycle). The typical cyclicity in the Danish area is developed as chalk/flint cycles in the onshore area and as fabric cycles in the Central Graben.

The monotonous white chalk succession in the Danish area is interrupted in the uppermost Lower Maastrichtian to lowermost Upper Maastrichtian by the incoming of a number of distinctive marl beds. The presence of these beds in the chalk forms a characteristic interval recognisable in northern and eastern Denmark. The palaeoenvironmental control on the chalk/marl cycles has been studied by geochemical fingerprinting of the mid-Maastrichtian succession in Rørdal Quarry, northern Denmark. The methods applied are analysis of clay mineralogy, major and minor elements determination by means of ICP-MS technique and stable isotope analysis.

At Rørdal the marl beds are measuring between 30-60 cm and each chalk/marl couplet are on average 125 cm. The variation in provenance sensitive indicators such as the Rare Earth Elements indicates that the composition of the source area to the clay minerals did not vary between the individual marl beds. This suggests that the chalk/marls cycles can be viewed as a simple source-to-basin system possibly controlled by the

21 ka precession cycle by analogy with similar cycles elsewhere in the Chalk Group. Oxygen and carbon isotope values of bulk samples display a cyclic variation in-phase with the chalk/marl cycles. The amplitude of the oxygen isotope variation corresponds to fluctuations in the palaeotemperature of approximately 4 °C during the chalk/marls cycles with the marl beds representing the coldest palaeotemperatures. Inorganic productivity and nutrient proxies normalised to aluminium content (e.g. Ba/Al and P/Al ratios) exhibit a variation dominated by a longer periodicity than that expressed by individual chalk/marl cycles.