



Flint and porcellanite occurrences in upper Campanian – Maastrichtian chalk, Stevns, eastern Denmark – implications for sea floor conditions

H.B. Madsen, L. Stemmerik and N. Schovsbo

Geological Survey of Denmark and Greenland, Denmark, (hbm@geus.dk)

Flint and porcellanite nodules are common in the chalk of north Western Europe. They are believed to have formed just below the sea bottom in shelf settings during periods with low sedimentation rates. The later diagenetic history though still remains uncertain.

The stratigraphic distribution of flint and porcellanite nodules in the upper Campanian – Maastrichtian chalk in the 456 m long Stevns-1 core, Stevns Klint, Denmark shows inverse correlation to the abundance of marls. Silica nodules are only abundant in the pure, upper Maastrichtian chalk where they are 0.5–25 cm thick with an average of 4 cm. In intervals of interbedded chalk and marl, the nodules are smaller and less abundant. The nodules primarily occur in burrows of *Thalassinoides* and have a variable and irregular shape. Further silicification resulted in a more lensoidal shape constricted to the sedimentary layers. A few nodules are tabular and were clearly not initially precipitated in a burrow.

The lithology of the nodules changes upwards from being porcellanite in the lower part to porcellanite/flint with a clear transition to pure flint nodules at the top. This is the opposite of what is to be expected if the distribution was controlled by later diagenetic transformation of metastable silica to flint. This implies that formation of flint is not entirely controlled by burial diagenesis. Instead the mineralogy of the silica nodules is believed to reflect primary differences in the depositional conditions such as changes in sea bottom temperatures and amount of siliciclastic clay. The upward change from porcellanite to flint correlates to a long term shift in palaeotemperature recorded by a shift towards less negative $\delta^{18}\text{O}$ values of the chalk. Thus the porcellanite nodules formed during warmer periods whereas the flint nodules reflect cooler sea

water conditions. Also, the presence of clay influenced the mineralogy of the nodules as it apparently inhibited precipitation of opal-CT so that silica nodules are small, less abundant and composed of flint with thin rinds of porcellanite in intervals dominated by interbedded chalk-marl. Time series analysis of the silica occurrences suggests cyclicity related to earth orbital parameters.