Types of Late Cretaceous and Cenozoic Sequences in the Southern North Sea Area

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About fifty 3rd order sequences are identified in outcrop and subsurface of northern Belgium (southern rim of the North Sea basin) since subsidence started in the late Cretaceous. Sequences and the relative sea-level evolution of this area, are plotted in the biostratigraphic and sequence chronostratigraphic scheme of Hardenbol et al., (1998) pointing out many similarities and also discrepancies. Major challenges in this respect are the resolution of the age determination of boundaries and the distinction between sequences of different order. Hiatuses between sequences are common and related to tectonic uplift and to strong sea-level lowering during the Neogene. The sequences differ in duration, in thickness, in lithology and in particular in the characteristics of the sequence boundaries.

Most sequences have flat abrasion type boundaries, lacking low stand deposits. The sequence boundary, coincides in this type of sequences with the transgressive surface and often contains some pebbles; more important lag deposits at the base of some sequences can be related to preceding tectonic uplift or tilting in the area. Upper surfaces can be bioturbated and indurated especially in chalky sediments. Transgressive sediments are generally characterised by particularly abundant glauconite. Sequence boundaries developed in offshore shelf clays are often poorly expressed. They can be recognised using grainsize trend analyses, from their expression on geophysical well logs, and their detailed evolution of chemical and mineralogical properties. However such detailed analysis also identifies higher order sequences.

Some sequences are characterised, on a regional scale, by incising several meters into underlying sediments. The incisions are filled by low stand deposits, filling in the erosive space as sedimentation resumes at the beginning of the renewed slow rise of the sea level. These sediments are composed of a variety of well preserved shallow marine and estuarine facies and can contain abundant reworked microfossils, minerals and terrestrial organic matter.

Deeply incised lower sequence boundaries also exist. Such incisions are regional as well but they can erode up to several tens of meters of underlying sediment and the incised boundary shows a marked relief representing the details of the currents that have shaped the erosive valley. Coarse lag sediments may be preserved but the sediment infill can vary from alluvial to lagoonal, estuarine and shallow marine facies. Apparently all such deeply eroding sequence boundaries can be related to particular tectonic activity in the area: North Sea scale regional uplift, local uplift between Paris and North Sea basins and the Roer Valley subsidence.