Characterisation of organic matter in sediments from the Wadden Sea of the German Bight

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The Wadden Sea is a highly dynamic system with important transport, recycling, degradation and accumulation of organic matter. The Holocene sedimentary sequences in NW Germany are strongly influenced by relative sea-level fluctuations due to climatic changes. Therefore, sediments of the German tidal flats show a complex structure and are a composite of sand, mud and organic matter of different origins.

For our study we drilled 2002 a 450 cm long sediment core on the Neuharlingersiel Nucken (Fig. 1) in June. The aim was to investigate the lipid composition of this core with organic geochemical methods. With the aid of the distributions of different biomarkers, we want to distinguish different sources of organic matter.

Earlier work was restricted to sediment layers extending to a maximum depth of 90 cm [1].

CONCLUSIONS:

Preliminary lithologic inspection recognized sand-dominant layers from the core top to a depth of 235 cm. Below this depth mud-dominant layers occur. These mud layers are characterized by homogeneous muds with intercalated thin sand layers. Occasionally plant stems and leaves are visually recognizable in these mud-rich layers. From 200 to 235 cm mussel shells are common.

Our TOC data confirm the results of the lithologic investigations. Down to a depth of 240 cm TOC values were very low (between 0.1 and 0.5%). In the deeper section TOC values increase to nearly 2% with the exception of a single low value of 0.16% at 300 cm depth (Fig. 2a).

The total lipid contents of nearly all detected compounds show a depth trend very similar to the TOC profile.

All n-alkane distribution patterns exhibit the typical odd-over-even carbon number predominance maxima at the long-chain C27, C29, and C31-n-alkanes. In most cases the C29-n-alkane is the most abundant homologue whereas the ratio between the C27- and C29-n-alkanes varies (Fig. 3b). In several layers (260, 280, 300 cm depth) the C27-n-alkane is particularly prominent (Fig. 4). These distribution patterns are characteristic of reed (Phragmites australis) grains [Wöstmann, unpublished results]. The n-alkanols occur with a strong even-over-odd carbon number predominance. Three types of distribution patterns were observed (Fig. 2c). They are different concerning the ratio between short- (C19-C21) and long-chain (C27-C31) n-alkanols (Fig. 3c).

Fatty acids are the dominant compounds in all sediment samples and they exhibit the typical even-over-odd carbon number predominance. Saturated and unsaturated n-fatty acids, mono- and diolefinic acids and α-hydroxy fatty acids were detected. Within the unsaturated n-fatty acids the maximum of the distribution patterns varied between C18:1, C20:1 and C22:1 (Fig. 2d). Compared to the other compounds, the total amounts of unsaturated fatty acids decrease with increasing depth (Fig. 2d).

In all samples the major sterol is 24-ethylcholesterol-5-en-3β-ol (C29). The relation between all C27, C29 and C31 Sterols is shown in Fig. 5. With increasing depth the proportion of C29 sterols increases.