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

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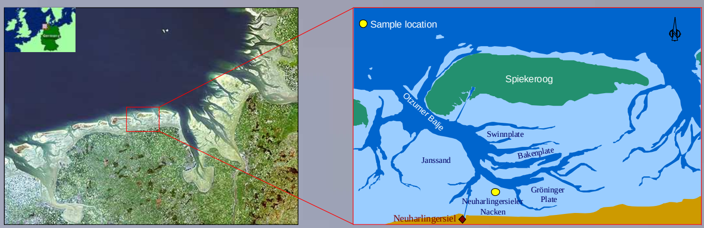

Fig. 1: Sampling location in the backbarrier tidal flat of Spiekeroog island (NW Germany)

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 Neuharlingersieler Nacken (Fig. 1) in June. The aim was to investigate the lipid composition of the sediment 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].

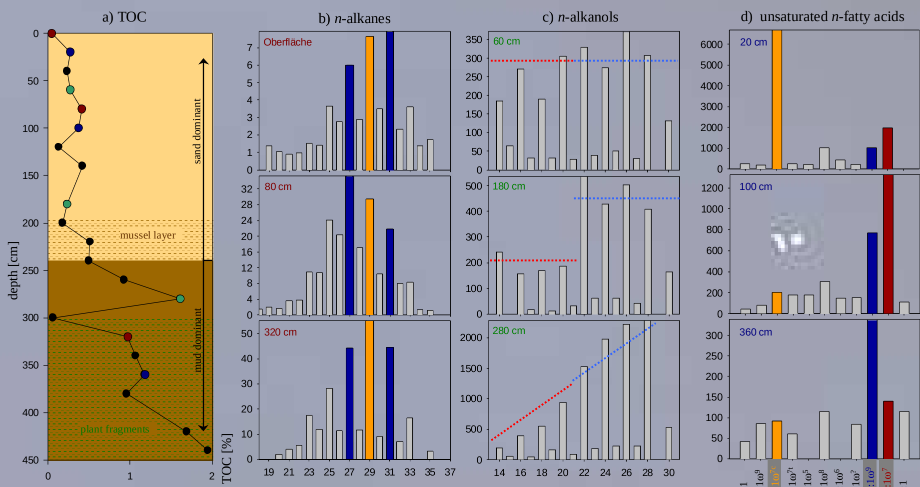

Fig. 2: a) Profile of TOC contents [%] in the sediment core; b)-d) Distribution patterns of *n*-alkanes, *n*-alkanols and unsaturated *n*-fatty acids at different depths (x-axis: carbon number, y-axis content [µg/kg sediment]).

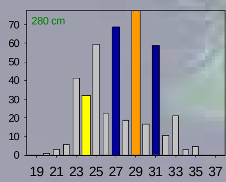

Fig. 4: Distribution pattern of *n*-alkanes at 280 cm depth (x-axis: carbon number, y-axis: content [µg/kg sediment]).

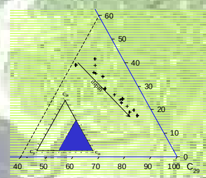

Fig. 5: Relative distribution of C_{27}, C_{28} and C_{29} sterols in the sediment core.

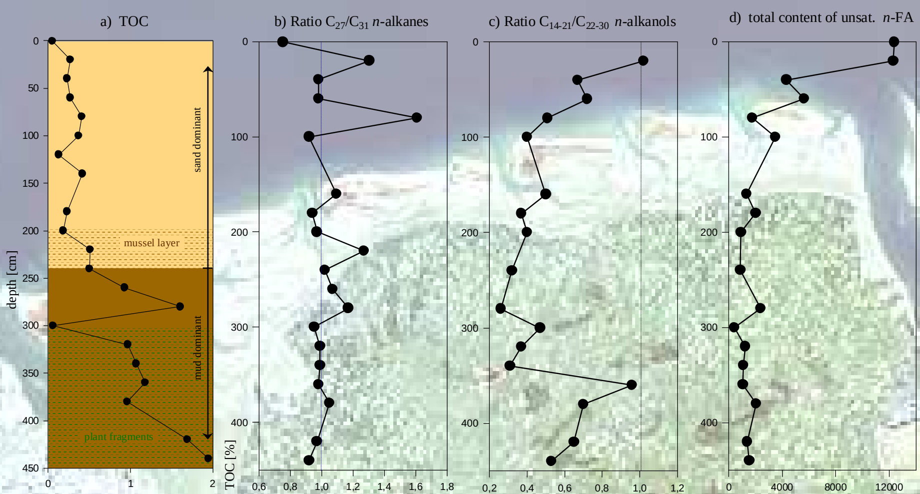

Fig. 3: a) Profile of TOC contents [%] in the sediment core; b)-c) Ratios of C_{27}/C_{31} *n*-alkanes, and $C_{14\text{-}21}/C_{22\text{-}30}$ *n*-alkanols (x-axis: ratio, y-axis: depth [cm]); d) total content of unsaturated *n*-fatty acids (x-axis: content [µg/kg sediment] , y-axis depth [cm]).

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 recognitable in these mud-rich layers. From 200 cm 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 exeption of a single low value of 0.1% 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 C_{27}, C_{29} and C_{31} *n*-alkanes. In most cases the C_{29} *n*-alkane is the most abundant homologue, whereas the ratio between the C_{27} and C_{31} *n*-alkanes varies (Fig. 3b). In several layers (260 cm, 280 cm, 420 cm) the C_{24} *n*-alkane is particulary enriched (Fig. 4). These distribution patterns are characteristic of reed (*phragmites australis*) peats [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- (C_{14}-C_{21}) and long-chain (C_{22}-C_{30}) 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, *iso*- and *anteiso*-fatty acids and ω-hydroxy fatty acids were detected. Within the unsaturated *n*-fatty acids the maximum of the distribution patterns varied between $C_{16:1\omega7}$, $C_{18:1\omega9}$ and $C_{18:1\omega7}$ (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-ethylcholest-5-en-3β–ol (C_{29}). The relation between all C_{27}, C_{28} and C_{29} Sterols is shown in Fig. 5. With increasing depth the proportion of C_{29} sterols increases.

ACKNOWLEDGEMENT:
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REFERENCE:
[1] Volkman, J.K., Rohjans, D., Rullkötter, J., Scholz-Böttcher, B.M., Liebezeit, G., 2000. Sources and diagenesis of organic matter in tidal flat sediments from the German Wadden Sea. Continental Shelf Research 20, 1139-1158.