BIOMARKERS OF PEAT-FORMING PLANTS AND THEIR SIGNAL IN TIDAL FLAT SEDIMENTS OF THE GERMAN BIGHT

Ralf Wöstmann, Claus Köller and Jürgen Rullkötter

Institute of Chemistry and Biology of the Marine Environment (ICBM),
Carl von Ossietzky University of Oldenburg, P.O. Box 2503, D-26111 Oldenburg, Germany,
E-mail: r.woestmann@icbm.de

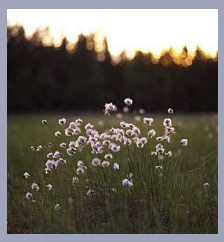
Fig.1: Map of the German Bight

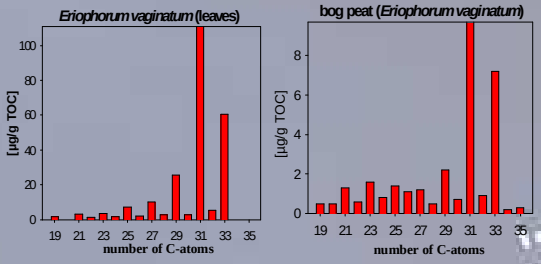
Introduction

Intertidal areas are important coastal environments of organic matter transport, recycling, degradation and accumulation. Induced by the Holocene sea level rise a number of different peat layers developed in the surface of today´s Wadden Sea of NW Germany. Furthermore, lipid analysis of Wadden Sea sediments showed a significant component of terrestrial organic matter derived from erosion of peat layers in this highly dynamic area. In order to characterise these peats and their remnants in tidal flat sediments in a paleochemotaxonomical way, recent plant material as well as different types of peats were selected for biomarker investigation. Recent plant material was linked paleochemotaxonomically to deposited peats and Wadden Sea sediments by means of selected biomarkers.

Results

The *n*-alkane distribution pattern of peat-forming plants show a strong predominance of odd over even carbon numbers in all samples typical for higher plant waxes (Eglinton and Hamilton, 1967). A significant variation in the maximum of the carbon number distribution between raised bog plants and fen plants was detected.





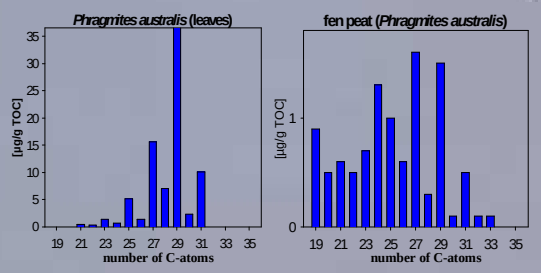


Fig.2: Histogram of the *n*-alkane distributions of a bog peat forming plant (*Eriophorum vaginatum*) and a fen peat forming plant (*Phragmites australis*)

The raised bog plants showed an *n*-alkane maximum at C_{31}, the fen plants at C_{27} and C_{29}. This is in agreement with results of the botanical and geochemical analysis of different types of Holocene peat layers in this area (e.g., Köller, 2002).

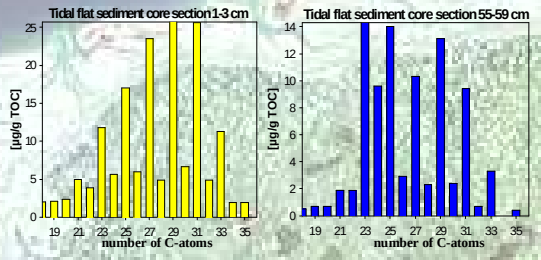


Fig.3: Histogram of the *n*-alkane distributions of selected samples from a tidal flat sediment core

In the selected Wadden Sea sediment core the *n*-alkane distribution showed an odd over even carbon number predominance with maxima at C_{27}, C_{29} and C_{31} in the surface sediment layer, indicating an origin from different peat types. The significant change in the distribution pattern at 51-59 cm depth shows the input of typical fen peat material.

In addition, pentacyclic triterpenoids are characteristic biomarkers for bog and fen plant communities. Their distribution patterns and total amounts allow a clear distinction between raised- bog- forming plants and fen- peat- forming plants. Whereas all analysed fen- peat- forming plants were barren of triterpenoids, raised- bog- forming plants like *Erica tetralix* contain triterpenoids at a level of more than 10% of the total lipid extract (**Fig.4**). All other bog- forming plants also contain high amounts of triterpenoids like α-amyrin, β-amyrin, friedelin, lupeol, multiflorenon and taraxerol. However, individual triterpenoids are not plant- specific biomarkers because of possible diagenetic effects.

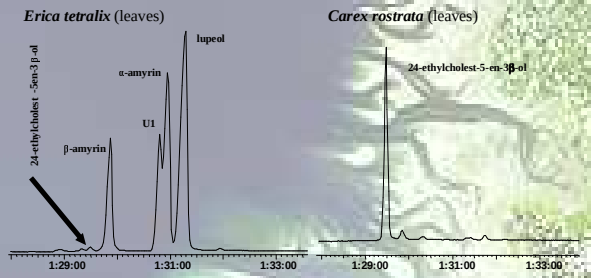


Fig.4: RIC of n-hexane soluble extract of a raised-bog forming plant (*Erica tetralix*) and a fen peat-forming plant (*Carex rostrata*). U1= betulinaldehyde

When titerpenoids were found in fen peats they are due to the influence of non- peat- forming plant material like birch trees (*betula sp.*) which supply, e.g., betulin. Most of the investigated sediment core samples showed a high concentration of betulin and lupeol, which demonstrate the significance of organic matter from trees of the *Betulaceae* family (Volkman *et al.*, 2000).

Conclusions

The distributions of characteristic biomarkers shows that the molecular composition of peat-forming plants corresponds to that of the lipid extracts from Wadden Sea sediments. These data attest to the importance of recycled ancient organic material in the carbon cycle of this coastal environment. They are complementary to the microscopic paleobotanical analysis and highly specific.

References

Eglinton G. and Hamilton R.J., 1967. Leaf epicular waxes. Science 208, 1322-1335.

Köller C., 2002. Paläochemotaxonomie von Torfen Nordwestdeutschlands. Dissertation, Universität Oldenburg

Volkman JK., Rohjans D., Rullkötter J., Scholz-Böttcher BM., Liebezeit G., 2000. Sources and diagenesis of organic matter in tidal flat sediments from the German Wadden Sea. Cont. Shelf Res. 20, 1139-1158.