



An assessment of the potential of the hydrogen-isotopic composition of lipid biomarkers as a palaeohydrological proxy using independent proxy-data

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Lake Uddelermeer contains the longest continuous sediment record (15.5 m) in the Netherlands, spanning the interval from the onset of the Late-Glacial to the present. The lake has been the focus of palaeoecological studies since the 1950s onward, and a wealth of palaeoecological and palaeoclimatological data from lake Uddelermeer is available. Lake Uddelermeer has been shown to be sensitive to changes in atmospheric circulation patterns, and we are currently reconstructing past lake-level fluctuations at this study site.

In this study we aim to assess the applicability of lipid biomarkers (n-alkanes) and their stable hydrogen isotope composition (δD values) as a palaeoecological proxy. We compare our results against independent proxy-data from lake Uddelermeer, including palynological data, Ground Penetrating Radar imagery, fossil pigment measurements and chironomid analysis.

n-Alkane chain-length patterns have been assessed for 59 samples, ranging from the end of the Atlantic (at ca. 6000 BP) into the Subatlantic period (at ca. 2500 BP). Fluctuations in the n-alkane C27/C31 and C29/C31 ratios – corresponding to decreased forest cover relative to grassland vegetation in the area – occur at the Atlantic-Subboreal transition as determined in the pollen diagram Lake Uddelermeer. Surprisingly, the n-alkane ratios do not show any changes at the Subboreal-Subatlantic transition (as identified in the pollen diagram), which was expected due to the large changes in the lake ecosystem (e.g. distinct changes in chironomid fauna) and in palaeohydrology (e.g. lake level drop of ~ 2.4 m visible in GPR profile). Instead, changes in the n-alkane ratios correlate with changes in pollen percentages of human impact indicators such as Ericales. Our results suggest that, in this study, chain-length patterns are more representative for human impact than for climatic influence.

Ongoing measurements of the nC29 alkane δD values will provide new detailed information on palaeohydrological changes at Uddelermeer. The results of the hydrogen-isotopic analysis will provide detailed new information on the changes recognised in the other proxy-records at the Subboreal-Subatlantic transition, and might suggest enhanced evapotranspiration and/or precipitation as the potential causal factor. Together, the n-alkane chain-length patterns and the isotopic composition of the nC29 alkane provide a comprehensive picture of Holocene vegetation and hydrological changes.