# Holocene hydrological changes and human presence in NW Arabia: Insights from lipid biomarker analysis of the Tayma palaeolake sediment record

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Holocene hydrological changes in NW Arabia and their influence on human migration and settlement are scarcely studied due to the lack of suitable climate archives. In particular, mechanisms and sources of increased moisture availability as well as the onset of oasis cultivation and culture during the early Holocene humid period are still not well understood.

Here, we present the first Holocene lipid biomarker record of the Arabian Peninsula from the Tayma palaeolake sediment sequence. We applied a combined approach of aquatic, terrestrial and faecal lipid biomarker and compound specific hydrogen isotope analyses, which allow tracing both hydrological and anthropogenic signals in the sediment deposits. Our investigations focused on the early Holocene annually laminated (varved) sediment section (ca. 8500 to 8000 cal. a BP) presenting a phase of maximum lake levels probably caused by increased moisture availability (Dinies et al., 2015; Engel et al., 2012).

During the early Holocene high lake level phase our results show increased concentrations of long-chain n-alkanes and faecal biomarkers suggesting grassland expansion and probably human occupation. The increase in grassland during this time is further supported by results from pollen analysis (Dinies et a., 2015). However, the increase in n-alkanes and faecal biomarkers did not occur simultaneously. While the rise of n-alkane concentrations predates the onset of varved sediments by about one century, the increase in faecal biomarker coincides with the beginning of varve preservation. Moreover, comparisons with sedimentological and geochemical data (i.e. diatom layer thickness, organic carbon content, $\delta^{13}C_{carbonate}$) suggest a coincidence of highest concentrations of faecal biomarkers and increased lake productivity. We discuss possible causes for these coincidences including prehistoric human activities as well as climate and environmental changes.

This study is a contribution to the research project "CLEAR – Holocene Climatic Events of Northern Arabia" (https://clear2018.wordpress.com/).

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