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Evaluation of the potential of organic geochemical proxies from lake sediments from Central India to reconstruct monsoon variability during the Holocene

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A better understanding of the past variations of the Indian Monsoon system, which has a deep societal impact on the subcontinent, is essential to determine its behavior under a changing global climate. We aim to reconstruct the variability of the Indian Monsoon, which has both spatially as well as temporally variable nature, during the last 10,000 years using lipid biomarker abundances and stable isotopes from continuous, high-resolution lake sediments in a climatically sensitive region of Central India. Previous sedimentological and geochemical studies on bulk material from a well dated long lake sediment core covering the last 11,000 years have already shown evidence of rapid changes in lithology, sedimentation rate, paleo lake productivity and supply of terrestrial organic matter.

Changes in the abundance of source-specific organic compounds - lipid biomarkers - can be useful for the interpretation of past changes in hydrology and ecosystem of the lake and its catchment area as well as their relation to climatic factors. We have identified a number of suitable biomarker compounds for paleohydrological and environmental reconstruction from surface sediments and short cores. Identified biomarker compounds include both aquatic and terrestrial biomarkers. Among the aquatic biomarkers short chain n-alkanes and phytane, most probably derived from cyanobacteria and microbial biomarkers like moretene, diploptene and other hopenes were present. Additionally long chain n-alkanes from vascular land plants from the lake catchment area were identified. Interestingly, the triterpene lipid tetrahymanol and tetrahymanone was found to be the biomarker of highest concentration in all analyzed surface sediments, with concentrations higher than the ubiquitous short-chain fatty acids. Tetrahymanol is often attributed to certain protozoa and frequently found in hypersaline lakes. However, studies have shown that this lipid can also be found in sizable amounts in phototrophic bacteria. We aim to better understand the source for this particular compound, its importance in paleoecology and also its possibly diagentic relation to tetrahymanone.

Modern samples of terrestrial and water plants, soils and phytoplankton will be analyzed for their biomarker content. The seasonal variability in the modern lake ecosystem and lake limnology will be monitored through sediment trap studies and monitoring equipment deployed in the lake to obtain a better understanding of the sources of the compounds in sediments and their ability to record ecological and hydrological variations through their stable isotopic composition, a prerequisite for the planned down-core studies.