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The n-alkane composition of the Late-glacial lake sediments from eastern Baltic correlates with paleoclimatic episodes

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While global and hemispheric climatic evolution during the last deglaciation is relatively well understood, regional and local responses to global forcing are still debated. In particular, the effect of the vast Scandinavian Ice Sheet on European climate during the Late Glacial is largely unknown. Lake sediment records can offer insight into the local and regional environmental changes during the dynamical period of last deglaciation. Here we focus on a study site in Eastern Latvia, Baltic region, Lake Lielais Svētiņu, in the southeastern sector of the last Scandinavian glaciation. The lake sediment has been previously multi-proxy studied including plant macrofossil and pollen analyses, total organic carbon and total nitrogen measurements (expressed as atomic C/N ratio). Here we analyse the biomarker distribution of these lake sediments to demonstrate the link between paleobotanical proxies and n-alkane content of the sediment as well to compare the n-alkane content (and its stable hydrogen isotope composition) with other terrestrial paleoclimatic records across Europe.

We find abundant n-alkanes in all sediment samples: The $n\mathrm{C}_{17}$ alkane is present in the samples since 14100 cal y BP, with two periods of notably higher influx ∼13300 cal y BP and ∼12800 cal y BP and is virtually absent between 12500-11650 cal y BP. The higher influx values are tied with the elevated accumulation of microscopic green algae in non-pollen palynomorph record of the lake, confirming an aquatic source. The $n\mathrm{C}_{23}$ to $n\mathrm{C}_{31}$ influxes display highest values ∼12850 cal y BP. The dynamics in the content of $n\mathrm{C}_{23}$ to $n\mathrm{C}_{31}$ alkanes follow the trends in plant macrofossil record, displaying higher values after the rise in the count of the terrestrial plant macroremains.

The selected proxies detect the paleoclimatic episodes and the vegetation development during the Late Glacial in the region. The elevated amount of n-alkanes detected ∼14100 cal y BP could be correlated with so-called Bølling warming period, when vegetation becomes established and in-lake production increases. Another rise in n-alkane influx is noted between ∼13800-13280 cal y BP (so-called Allerød warming) that is sharply interrupted ∼13280-13000 cal y BP (correlates with GI-1b cooling episode). The maximum influx ∼12850 cal y BP and subsequent decline in the amount of n-alkanes since 12600 cal y BP mark the beginning of the Younger Dryas cooling and the notable shift in the vegetation. The n-alkane influx has a small increase between ∼12400-12300 cal y BP and starts to rise again ∼12100 cal y BP continuously up to the start of the Holocene. The sediment C/N atomic ratio dynamics loosely follows the changes in the$n$-alkane content. The preliminary results demonstrate the link of n-alkanes to local vegetation and connection to paleoclimatic changes. We plan to measure the δD values from n-alkanes for more precise paleoenvironmental recontruction.