Hydrological fluctuations in the Holocene Baltic Sea

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Long-chain *n*-alkanes, generally synthesized by higher plants as part of a waxy protective layer, are ubiquitous organic compounds that provide insight into vegetation and hydrological history through their stable carbon [1] and hydrogen isotope ratios [2]. The climate history of the Baltic Sea, a marginal marine basin in Northwest Europe, has been investigated using sedimentological and micropaleontological techniques [3, 4], but comparatively few records of compound-specific isotope analyses exist for this region. C and H isotope ratios of C_{21} – C_{33} *n*-alkanes were analyzed from a piston core recovered from the Arkona Basin, in the western Baltic Sea, where saline North Sea water enters via the Danish Straits. The record spans the last ~11 kyr, covering fluctuations between freshwater and brackish phases. The Ancylus Lake phase (AL; 10.6 – 7.7 ka) was a period of gradual freshening as the result of continental uplift and melting of the Scandinavian Ice Sheet caused by increased global temperatures [3-6]. Micropaleontological evidence suggested freshwater species dominated until the large marine transgression Substantial change in the H isotope values of long-chain alkenones, produced by a select group of haptophyte algae, during this phase [5], suggested a significant change in hydrological conditions.

C and H isotope ratios of C_{21} – C_{33} *n*-alkanes record a series of fluctuations during the AL. Coincidentally, melting of the Laurentide Ice Sheet in North America deposited large volumes of melt water into the North Atlantic resulting in the slow-down of thermohaline circulation, in turn causing cold periods in Western Europe [7]. The isotopic shifts occur when distributions of *n*-alkanes are stable, thus are not the result of substantial changes in vegetation, but rather changes in the hydrolgical regime. Our findings emphasize the value of compound-specific isotope analyses for more in-depth understanding of past fluctuations in hydrological conditions.

[1]Diefendorf&Freimuth(2017) *Org. Geochem.* [2]Sachse et al.(2012) *Ann. Rev. Earth. Sci.* [3]Moros et al.(2002) *Boreas* [4]Andrén et al.(2000) *Boreas* [5]Weiss et al.(2020) *G-Cubed* [6]Cuzzone et al.(2016) *EPSL* [7]Fleitman et al.(2008) *Paleoceanography*