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Early to mid-Holocene sea ice changes on the Labrador Shelf - biomarker evidence.

Henriette Kolling[1], Ralph Schneider[1], Annalena Lochte[1], Kirsten Fahl[2], and Ruediger Stein[2,3]
[1]Christian-Albrechts-University Kiel, Institute of Geosciences, Kiel, Germany
[2]Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany
[3]MARUM and Faculty of Geosciences, University of Bremen, Bremen, Germany

Understanding the Earth's climate system and by that improving predictions of future changes are of utmost importance. A key player in this context is the global thermohaline ocean circulation, of which North Atlantic deep ocean convection is an essential component. Hence, one important region for deep ocean convection is the Labrador Sea, where the warm Gulf Stream meets cold polar waters in the Subpolar Gyre. Sea surface temperature and salinity play a major role in this convective process; two factors that influence these parameters are seasonal sea ice cover and freshwater inflow. During the early Holocene a major freshening in the Labrador Sea at 8.5 ka BP has been associated with the collapse of the Hudson Bay Ice Saddle (Lochte et al., 2019a). This collapse was triggered by a subsurface warming of the western Labrador Sea, linked to the strengthening of the Irminger and West Greenland Current that could have accelerated the ice saddle collapse. However, the role of sea ice in this process is yet unknown.

Here, we present a reconstruction of sea ice cover during the respective time interval, based on the organic biomarker IP_{25}, a highly branched isoprenoid that is considered as a reliable proxy for past sea ice conditions. Actually, we apply the more advanced PIP_{25} sea ice index, together with other biomarkers for phytoplankton productivity, to reconstruct sea ice changes at centennial scale for the early to mid Holocene from a Labrador Shelf sediment core.

Based on this approach we infer that nearly perennial sea ice cover opened towards more seasonally, extremely fluctuating, conditions around 8.5 ka, parallel to the strengthening of Atlantic warm water inflow towards the Labrador Shelf. The shift to more seasonal sea ice cover may have favoured the advance of Atlantic water into Hudson Bay and could have accelerated the collapse and subsequent drainage of the Hudson Bay Ice Saddle. The opening of the sea ice triggered phytoplankton productivity and we find evidence for the establishment of a stable ice edge in the vicinity of the core location between 8.1 and 7.6 ka. With the establishment of the Labrador Sea Water formation around 7.4 ka (Lochte et al., 2019b) sea ice continued to fluctuate seasonally and reduced freshwater inflow favoured enhanced phytoplankton productivity.

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