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Neoglacial cooling culminates in rapid sea ice oscillations in eastern Fram Strait

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The spatial and temporal distribution of sea ice in the subpolar North Atlantic is mainly controlled by the advection of warm Atlantic Water via the Norwegian and West Spitsbergen Current in eastern Fram Strait. Simultaneously, polar water and sea ice from the Arctic Ocean is transported southward by the East Greenland Current. Hence, variations in the strength of this oceanic circulation regime may either stimulate or reduce the sea ice extent.
Based on organic geochemical studies of a high-resolution sediment core from eastern Fram Strait we provide new evidence for the highly variable character of the sea ice conditions in this area. The combination of the sea ice proxy IP25 (Belt et al., 2007) with phytoplankton derived biomarkers (e.g. brassicasterol, dinosterol; Volkman 2006) enables a reliable reconstruction of sea surface and sea ice conditions, respectively (Müller et al., 2009; 2010). By means of these biomarkers, we trace gradually increasing sea ice occurrences from the Mid to the Late Holocene – consistent with the neoglacial cooling trend. Throughout the past ca. 3,000 years (BP) we observe a significant short-term variability in the biomarker records, which points to rapid advances and retreats of the sea ice cover at the continental margin of West Spitsbergen. The co-occurrence of IP25 and phytoplankton markers, however, suggests that the primary productivity benefits from these sea ice surges. As such, higher amounts of open-water phytoplankton biomarkers together with peak abundances of IP25 indicate recurring periods of enhanced ice-edge phytoplankton blooms at the core site. To what extent a seesawing of temperate Atlantic Water may account for these sea ice fluctuations requires further investigation. Concurrent variations in Siberian river discharge (Stein et al., 2004) or Norwegian glacier extents (Nesje et al., 2001), however, strengthen that these fluctuations may be assigned to variations in the North Atlantic/Arctic Oscillation (NAO/AO) and (hence) a weakened/accelerated Atlantic Water input and Arctic sea ice export.

References

Belt, S.T., et al., 2007. Organic Geochemistry, 38(1), 16-27.
Müller, J., et al., 2009. Nature Geoscience, 2(11), 772-776.
Müller, J., et al., 2010. submitted to Earth & Planetary Science Letters.
Nesje, A., et al., 2001. The Holocene, 11(3), 267-280.
Stein, R., et al., 2004. Quaternary Science Reviews, 23(11-13), 1485-1511.
Volkman, J.K., 2006. Handbook of Environmental Chemistry, (2) Springer Verlag.