

Reconstruction of sea-ice cover and primary production on the East Greenland Shelf (73°N) during the last 5200 years

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Over the last decades the extent and thickness of Arctic sea ice has changed dramatically and much more rapidly than predicted by climate models. Thus, high-resolution sea-ice reconstructions from pre-anthropogenic times are useful and needed in order to better understand the processes controlling the natural sea-ice variability. Here, we present the first high-resolution biomarker (IP25, sterols) approach over the last 5.2 ka from the East Greenland Shelf (for background about the biomarker approach see Belt et al., 2007; Müller et al., 2009, 2011). This area is highly sensitive to sea-ice changes, as it underlies the pathway of the East Greenland Current, the main exporter of Arctic freshwater and sea ice that affects the environmental conditions on the East Greenland Shelf and deep-water formation/ convection in the Northern North Atlantic.

After rather stable sea-ice conditions in the mid-Holocene we found a strong increase in sea ice, cumulating around 1.5 ka and associated with the Neoglacial cooling. The general trend especially during the last 1ka is interrupted by several short-lived events such as the prominent Medieval Warm Period and Little Ice Age, characterized by minimum and maximum sea-ice extent, respectively. Using a spectral analysis, we could identify several cyclicities, e.g. a 45-year cyclicity for cold events.

A comparison to similar records from the eastern Fram Strait revealed a slight time lag in the onset of the Neoglacial, but also suggesting the direct link of the East Greenland Shelf area to the Arctic sea-ice/freshwater outflow. A comparison of the biomarker data with a new foraminiferal record obtained from the same site (Perner et al., 2015) suggests that IP25 and foraminifera assemblages are probably controlled by rather different processes within the oceanographic systems, such as the sea-ice conditions and, for the foraminifera, water-mass changes and nutrient supply.

References:

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