# SOURCE-SPECIFIC BIOMARKERS AS PROXIES FOR ARCTIC SEA ICE AND WATER MASS DYNAMICS – MODERN CLIMATE CALIBRATIONS

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Highly branched isoprenoid (HBI) alkenes are structurally unusual secondary metabolites biosynthesised by a relatively small number of diatom genera (Volkman et al. 1994), but are, nonetheless, common constituents of global marine sediments. Over the past two decades, the sources and structures of numerous individual HBI lipid biomarkers have been reported, although their cellular roles remain unknown. However, the source-specific nature of HBIs makes them potentially useful biomarkers for paleo environmental studies.

In recent years, sedimentary analysis of a mono-unsaturated $C_{25}$ HBI alkene termed $IP_{25}$ (Belt et al. 2007), has been shown to provide a useful proxy measure of the past occurrence of Arctic sea ice, when identified in underlying sediments. More detailed descriptions of sea ice conditions have also been obtained by combining $IP_{25}$ data with those of other biomarkers, including those derived from open-water marine phytoplankton. For example, in a recent study, it was shown that the sedimentary abundances of $IP_{25}$ and a phytoplankton derived tri-unsaturated HBI (HBI III) across the Barents Sea exhibited opposing trends, with relatively high (low) $IP_{25}$ in regions of high (low) seasonal sea ice cover, while elevated concentrations of HBI III were observed within the region of the retreating ice margin. This inverse relationship has been interpreted as reflecting the spatial advance/retreat cycle of sea ice, a consistent annual feature of sea ice dynamics in the Barents Sea (Belt et al. 2015)

Building on this background, the data presented here includes distributions of a larger suite of HBI biomarkers compared to previous studies, and for an increased spatial coverage, including western Norway, the Barents Sea and northern Svalbard (Figure 1). Data was obtained through the analysis of surface sediments from across the region and water column samples taken from western and northern Svalbard (Figure 1). Biomarker relationships for West Svalbard contrast those found for the Barents Sea, likely reflecting the differences in sea ice dynamics between the two regions (Smik and Belt, 2017). Thus, sea ice conditions at the West Svalbard margin are known to experience rapid fluctuations, both seasonally and annually, in contrast to the consistent advance/retreat cycle of the Barents Sea. Since the different relative behaviours of $IP_{25}$ and phytoplankton biomarkers have also been observed in various downcore records (Belt et al. 2015, Cabedo-Sanz and Belt 2016, Müller et al. 2012) the new findings may prove to be a useful consideration when interpreting further temporal trends in biomarker records for sea ice reconstruction from West Svalbard, the Barents Sea and other Arctic regions in the future.

The study region also represents the confluence of northerly-flowing and relatively warm/saline currents (e.g. the North Atlantic Current (NAC) and its extension, the West Spitsbergen current (WSC)) and cold Arctic waters (e.g. the East Svalbard Current; ESC), thus providing a suitable testing ground for potentially new proxies that may be sensitive to water mass distribution. Here, we present preliminary findings that indicate that distributions of certain pelagic HBIs may, indeed, offer new potential as proxies for water mass (and thus SST) dynamics in high latitude settings.

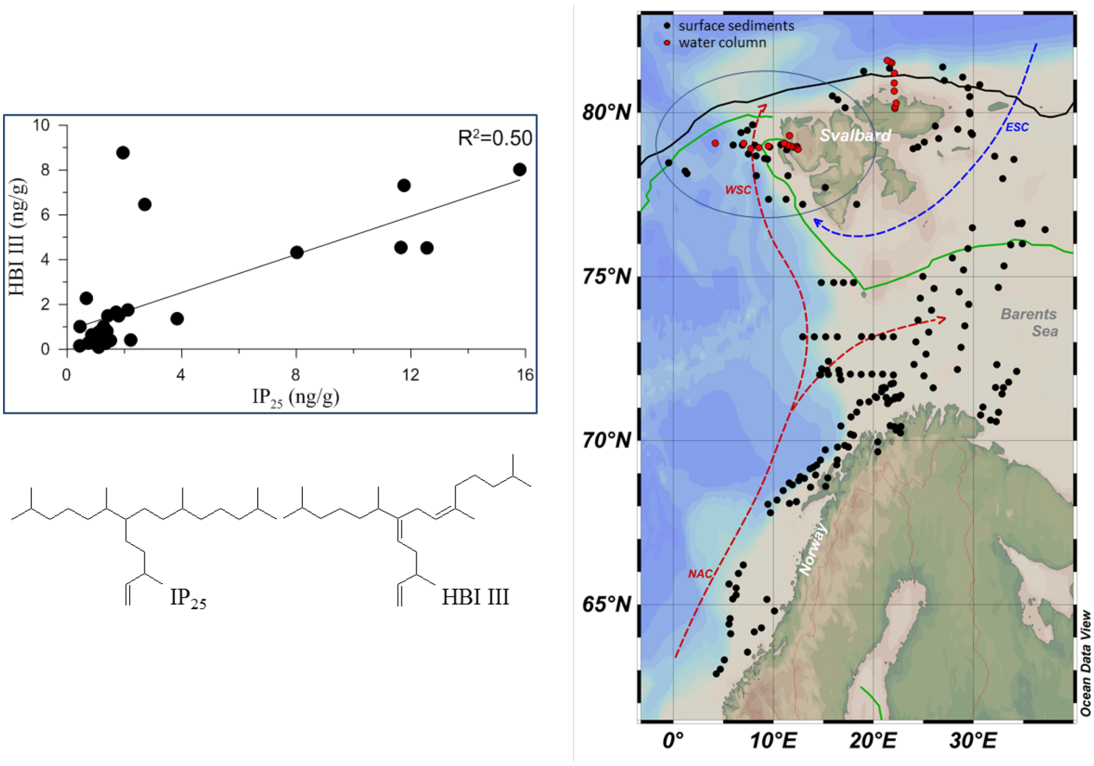


***Figure 1** Map of the study area with main ocean currents (red: North Atlantic Current (NAC), West Spitsbergen Current (WSC); blue: East Spitsbergen Current (ESC)). Full colour lines correspond to the median March (green) and September (black sea ice extent for the period 1979-2010 (NSIDC). Cross-plot of sedimentary HBI III vs $IP_{25}$ concentration for the Western Svalbard locations (circled on map) is also shown. Surface sediment and water column samples are represented by black and red circles, respectively.*

## References


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