SOURCE-SPECIFIC BIOMARKERS AS PROXIES FOR ARCTIC SEA ICE AND WATER MASS DYNAMICS: PAST CLIMATE RECONSTRUCTIONS

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C_{25} highly-branched isoprenoids (HBIs) are diatom-produced, source-specific biomarkers ubiquitous within the global ocean (e.g. Belt and Müller, 2013). Over the last decade, HBI biomarkers have been utilised in paleoclimatological reconstructions of the past sea ice regime (e.g. Hoff et al., 2016). One such biomarker, designated IP_{25}, has been identified as a suitable proxy for the presence of seasonal Arctic sea ice, and has been used to both map the recent sea ice extent and reconstruct past ice variability at centennial to millennial timescales spanning the early Holocene, the Younger Dryas, Last Deglaciation, the Last Glacial Maximum, and earlier Weichselian Glaciation, among others (Belt and Müller, 2013; Hoff et al., 2016). Additionally, the Z-isomer of a tri-unsaturated C_{25} HBI (HBI III) has been used in conjunction with IP_{25} to derive semi-quantitative descriptions of the seasonal sea ice edge in the hydrographically complex Barents Sea. Specifically, increased abundances of HBI III relative to those of IP_{25} were observed in the Marginal Ice Zone, while the inverse was true for areas of robust seasonal ice cover (Belt et al., 2015; Smik et al., 2016). Overall, the near-ubiquitous presence, source specificity and continued characterisation of novel HBIs promote their development as geochemical proxies through spatial calibration to modern climate, with subsequent application in past climate reconstructions.

Further potential of IP_{25} and other HBI biomarkers as proxies for paleo-reconstruction of past climate regimes is revealed herein through analysis of several well-dated, high resolution sedimentary cores distributed across contrasting climate settings in the Barents Sea. The individual concentrations and relative abundance down-core profiles of various HBIs are evaluated against corresponding spatial distributions in surface sediments, which were shown previously to characterise modern seasonal sea ice presence and variability (Navarro-Rodriguez et al., 2013; Belt et al., 2015). Settings exhibiting contrasting modern climate are explored, including sites of increased Atlantic Water inflow at the western Barents Sea continental shelf, and those characterised by colder waters and robust ice cover near the eastern Svalbard margin. Specifically, influences of water masses from currents transporting warm Atlantic Water and colder, less saline Arctic Water are characterised by significantly different assemblages of tri-unsaturated HBI isomers. Additionally, and in accordance with previous investigations (e.g. Navarro-Rodriguez et al., 2013), IP_{25} is found to characterise the sea ice regime.

Overall, considerably different assemblages and spatial variability of HBIs are observed at locations of different sea ice and water mass dynamics. In contrast, surface distributions and down-core profiles within similar locations show significant agreement. Such concordant trends observed between down-core sedimentary records and proximal surface sediments further support the development and application of HBI biomarkers as source-specific paleoclimate proxies.

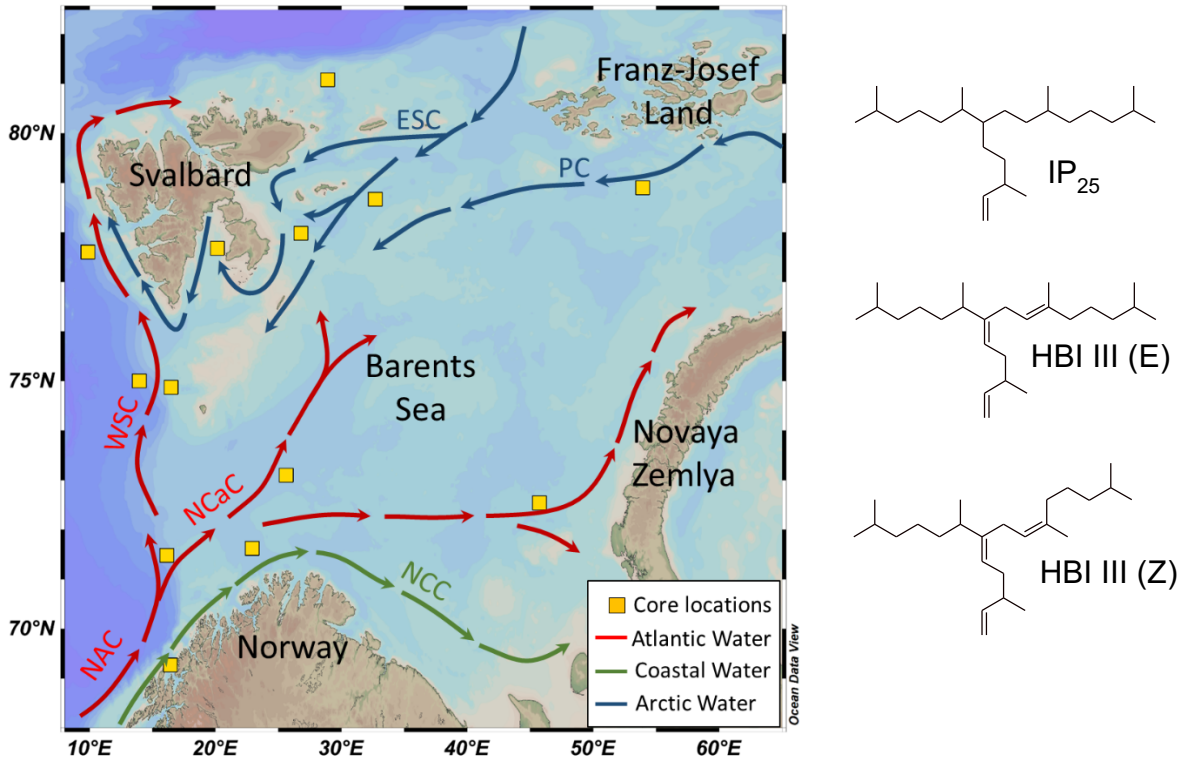

Figure 1 a) *Map of the Barents Sea and neighbouring regions showing core sampling locations and various oceanic surface currents; NAC = North Atlantic Current, NCaC = North Cape Current, WSC = West Spitsbergen Current, ESC = East Spitsbergen Current, PC = Persey Current, NCC = Norwegian Coastal Current;* ***b)*** *Structural formulae of HBI compounds analysed in the current study.*

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