Source-specific biomarkers as proxies for Arctic & Antarctic sea ice

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The Arctic and Antarctic are amongst the most sensitive regions on Earth towards climate change, as exemplified by dramatic changes in sea ice cover in recent decades. Indeed, sea ice is one of the main characteristics of the polar regions, with the former contributing to an array of climatically important parameters such as heat, moisture and gas exchange between the oceans and the atmosphere, light attenuation to surface waters due its high albedo, and brine/freshwater delivery during sea ice formation and melt, respectively.

In recent years, we have focussed research efforts on developing proxies for sea ice based largely on the occurrence and variable distribution of certain so-called highly branched isoprenoid (HBI) lipids derived from specific sea ice-associated (sympagic) amd open water (pelagic) diatoms. Thus, IP_{25} and $IPSO_{25}$ have been proposed as proxies for seasonal sea ice in the Arctic and Southern Ocean, respectively. As a complement to these sea ice proxies, a tri-unsaturated HBI is produced by diatoms in the pelagic environment, and has a sedimentary distribution that is strongly coupled to the overlying ice-edge conditions. Further, by combining sympagic and pelagic biomarker abundances together in the form of the so-called PIP_{25} index, it is sometimes possible to obtain semi-quantitative estimates of spring sea ice concentration.

This presentation will provide an overview of the background to certain HBIs as sea ice proxies and new data will be presented to illustrate how combined biomarker approaches can be used to obtain more detailed descriptions of sea ice dynamics. The use of these proxy development/calibration studies to obtain new case study paleo sea ice records from selected regions covering different timescales (recent centuries, the Holocene, glacial/interglacial cycles and the Mid-Pleistocene Transition) will also be presented.