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Source-specific diatom lipid biomarkers as proxies for Arctic and Antarctic sea ice

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Sea ice plays a key role in controlling global climate due its influence over heat and gas exchange between the oceans and the atmosphere. In addition, sea ice exerts a strong influence over the absorption of incoming radiation at the ocean surface as a result of its high reflectivity or albedo. Driven, in part, by the recent dramatic changes to sea ice cover in both the Arctic and the Antarctic, the development of proxies for sea ice has received growing attention over the last 10 years or so. Amongst these, some so-called highly branched isoprenoid (HBI) lipid biomarkers have attracted considerable interest, not least, because they are derived from certain diatoms that reside and bloom within the sea ice matrix itself, thus providing a more direct indication of sea ice presence compared with some other proxies. The signature HBI sea proxies are a mono-unsaturated HBI (IP25) for the Arctic and a di-unsaturated HBI (C25:2) for the Antarctic, with different source organisms for each.
Although the variability in sedimentary abundances of IP25 and C25:2 in Arctic and Antarctic sediments generally reflect the corresponding changes in sea ice conditions, a more complete picture of reconstructing sea ice conditions likely requires a multi-proxy approach involving, for example, other lipid biomarkers that serve as proxy measures of nearby open water conditions or sea surface temperature. By adoption of such an approach, a research strategy aimed at improving estimates of sea ice concentrations or better definitions of sea ice conditions (e.g. marginal ice zone, polynyas, permanent ice cover) represents the next stage in lipid-based sea ice proxy development.
This presentation will focus on recent developments and future plans that involve a multi-proxy approach to improving sea ice reconstruction. An understanding of sources, ecology and environmental fate of various HBIs and other diatom lipids will likely be key in shaping the future direction of lipid-based sea ice proxy development.