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Pliocene-Pleistocene changes in Arctic sea-ice cover: New biomarker records from Fram Strait/Yermak Plateau (ODP Sites 911 and 912)

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Recently, a novel and promising biomarker proxy for reconstruction of Arctic sea-ice conditions was developed and is based on the determination of a highly branched isoprenoid with 25 carbons (IP25; Belt et al., 2007). Following this pioneer IP25 study by Belt and colleagues, several IP25 studies of marine surface sediments and sediment cores as well as sediment trap samples from northpolar areas were carried out successfully and allowed detailed reconstruction of modern and late Quaternary sea ice variability in these regions (e.g., Massé et al., 2008; Müller et al., 2009, 2011; Vare et al., 2009; Belt et al., 2010; Fahl and Stein, 2012; for review see Stein et al., 2012). Here, we present new (low-resolution) biomarker records from Ocean Drilling Program (ODP) Sites 911 and 912, representing the Pliocene-Pleistocene time interval (including the interval of major intensification of Northern Hemisphere Glaciation near 2.7 Ma). These data indicate that sea ice of variable extent was present in the Fram Strait/southern Yermak Plateau area during most of the time period under investigation. In general, an increase in sea-ice cover seems to correlate with phases of extended late Pliocene-Pleistocene continental ice-sheets. At ODP Site 912, a significant increase in sea-ice extension occurred near 1.2 Ma (Stein and Fahl, 2012). Furthermore, our data support the idea that a combination of IP25 and open water, phytoplankton biomarker data ("PIP25 index"; Müller et al., 2011) may give more reliable and quantitative estimates of past sea-ice cover (at least for the study area). This study reveals that the novel IP25/PIP25 biomarker approach has potential for semi-quantitative paleo-sea ice studies covering the entire Quaternary and motivate to carry out further detailed high-resolution research on ODP/IODP material using this proxy.

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