



Middle Eocene 15°C sea-surface water cooling and sea-ice formation in the central Arctic Ocean

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During IODP Expedition 302 (Arctic Coring Expedition – ACEX), a more than 200 m thick sequence of Paleogene organic-carbon (OC)-rich (black shale-type) sediments was drilled. Here, we present new biomarker data determined in ACEX sediment samples from the Middle Eocene time interval representing the period of prominent global cooling following the Early Eocene Climate Optimum (EECO). The biomarker data include concentrations of total C37 alkenones, C37:4 alkenones and n-alkanes, alkenone-based sea-surface temperature (SST), and accumulation rates of total organic carbon and specific biomarkers.

Over the studied time interval from about 49 to 44.5 Ma, alkenone-based SSTs (interpreted as summer temperatures; for background see Weller and Stein, 2008) display a distinct drop from ca. 26°C to 10°C, coinciding the global post-EECO cooling trend (Zachos et al., 2008). Prior to about 47 Ma, warm SST values between 18 and 26°C were predominant, interrupted by a prominent, short-lived cooling event near 47.3 Ma (270 mcd) at which SST dropped down to 5-10°C. At about 47 Ma (260 mcd), C37:4 alkenones occurred in significant amounts (>5% of total C37 alkenones), suggesting cold low-saline water (influence of sea ice and meltwater?). At about 46.3 Ma, summer SST dropped down to <17°C (range 8-17°C), coinciding with a significant increase in ice-rafted debris (IRD). Here, we propose a situation similar to that observed in the modern Baltic Sea where summer SSTs of >15°C and winter SSTs <1°C with sea-ice formation are typical (Weller and Stein 2008 and references therein). Our interpretation is supported by data and interpretation of sea-ice diatoms and IRD determined in the ACEX sequence (St. John, 2008; Stickley et al., 2009).

References

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