

## RECONSTRUCTING SEA SURFACE SALINITY OF THE EOCENE ARCTIC BASIN

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Through analyses of unique microlaminated sediments of Arctic drill cores, recovered from the Lomonosov ridge in the central Arctic Ocean during Integrated Ocean Drilling Program (IODP) Expedition 302, it has been shown that enormous quantities of the free floating freshwater fern *Azolla* grew and reproduced in situ in the Arctic Ocean during the Eocene (Fig.1) (Brinkhuis *et al.*, 2006). The presence of the freshwater fern *Azolla*, both within the Arctic basin and in all Nordic seas, suggests that at least the sea surface waters were frequently dominated by fresh- or brackish water during an interval of at least 800 kyrs. Initial modeling attempts have shown that the prevailing warm greenhouse conditions could induce an intensified hydrological cycle with precipitation exceeding evaporation at these high latitudes (Brinkhuis *et al.*, 2006, Pagani *et al.*, 2006), thus potentially creating a freshwater surface layer in the Arctic Basin. However, this amazing finding needs confirmation using independent proxy data. We aim to measure stable hydrogen isotope ( $\delta D$ ) values of several biomarkers to provide insight into the degree of mixing between high (isotopically heavy) and low salinity water (isotopically light).

An organic geochemical survey has revealed that the quite immature arctic sediments mainly consist of a mixture of terrestrial and aquatic organic matter. Amongst the biomarkers identified thus far are sterols ( $\beta$ -sitosterol), mid-chain hydroxy acids, long-chain fatty acids and n-alkanes and hopanoids. Also some long chain ( $C_{28} - C_{36}$ ) diols have been determined, most probably derived from algae thriving in Arctic basin surface waters. We anticipate the usage of the encountered diols and n-alkanes for the hydrogen isotope analyses to be able to make palaeosalinity estimates.

To evaluate the results of this compound specific isotope analyses, a modeling campaign has been set up: The so-called Community Climate System Model (CCSM3) is

used together with a modified version of the Community Atmosphere Model (CAM3), developed by NCAR. Combined with specific Eocene boundary conditions, the model simulates the distribution of  $\delta D$  values of incoming precipitation, which will allow for comparison and ultimately quantitative estimation of salinity levels of the Arctic Ocean during the Eocene *Azolla* event.



Figure 1. The early Eocene geographic distribution of *Azolla* in the Arctic and Nordic basins. Stars indicate locations where *Azolla* has been found.

## REFERENCES

- Brinkhuis H., et al. (2006) Episodic fresh surface waters in the Eocene Arctic Ocean, *Nature*, **441**, 606-609.
- Pagani M., et al. (2006) Arctic hydrology during global warming at the Palaeocene/ Eocene thermal maximum, *Nature*, **442**, 671-675.