THE LATE CENOZOIC ARCTIC OCEAN – AN EXTREME PELAGIC HABITAT

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The Arctic Ocean is still a poorly explored extreme end member of the modern pelagic habitats with a late Cenozoic history of a change from ice-free conditions to a permanent sea-ice cover. Progress in deciphering its history has been achieved through a number of major expeditions leading ice breakers up to the North Pole and by collecting numerous sediment cores which could be correlated to the North Atlantic based on stratigraphies developed from stable O-isotopes, radiocarbon dates, Be-fluxes as well as conventional bio- and lithostratigraphic criteria (Figs. 1-4; Eisenhauer et al., 1994; Spielhagen et al. 1997; Nørgaard-Pedersen et al. 1998). The Arctic Ocean has been covered by sea ice since the Pliocene at least providing a pelagic habitat to floras and faunas adapted to the extreme environment of a high latitude ice-covered ocean basins. During glacial extremes, large amounts of terrigenous ice-rafted debris were carried by floods of icebergs originating both from the northern margins of large ice sheets in North America and in Eurasia. Gradients in the distributions of Be- and O-isotopes suggest a continuous advection of various water masses from the North Atlantic via the Norwegian-Greenland Sea. The central and western Arctic Ocean seems to have received large volumes of fresh water, both during glacial and interglacial times (Fig. 5; Spielhagen and Erlenkeuser 1994), thus an important drainage of eastern Siberia has to be assumed during times of the existence of glacial ice sheets over North America. The paleoceanographic response of the Arctic Ocean to the mid- and late Cenozoic cooling of the Northern Hemisphere remains to be explored until suitable drilling techniques have been developed.

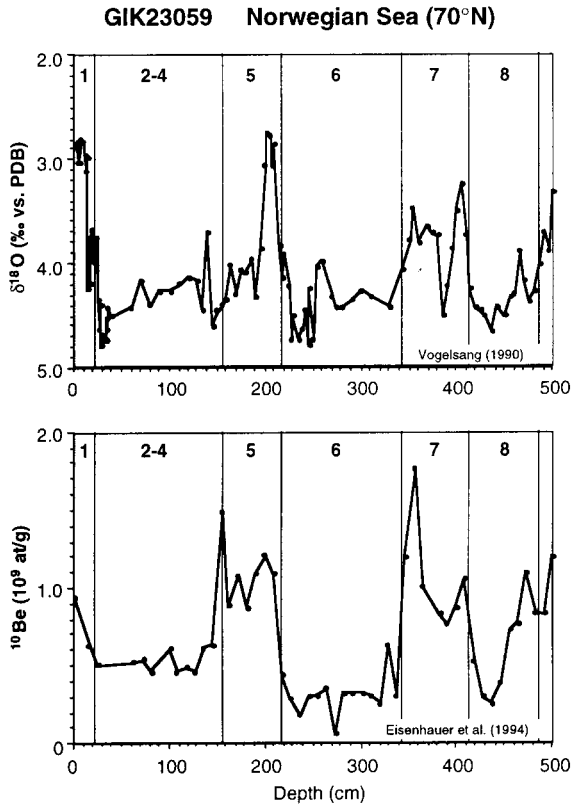

Fig. 1. Correlation of $\delta^{18}O$ and ^{10}Be isotope ratios in core GIK23059 from the Norwegian-Greenland Sea.

References:

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Nørgaard-Pedersen, N., Spielhagen, R.F, Thiede, J., and Kassens, H., 1998. Central Arctic Surface Ocean Environment During the Past 80,000 Years. Paleoceanography, 13(2): 193-204.

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Spielhagen, R.F., and Erlenkeuser, H., 1994. Stable Oxygen and Carbon Isotopes in Planktic Foraminifers From Arctic Ocean Surface Sediments: Reflection of the Low Salinity Surface Water Layer. Marine Geology, 119: 227-250.

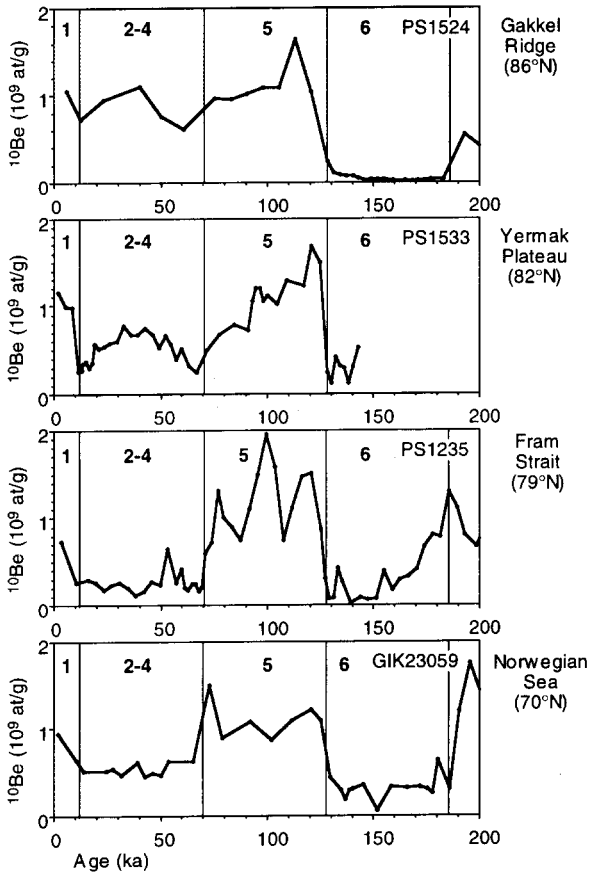

Fig. 2. Transect of cores from the Norwegian-Greenland Sea through Fram-Strait into the Arctic Ocean. Correlation through ^{10}Be-Isotope stratigraphy (modified from Eisenhauer et al. 1994).

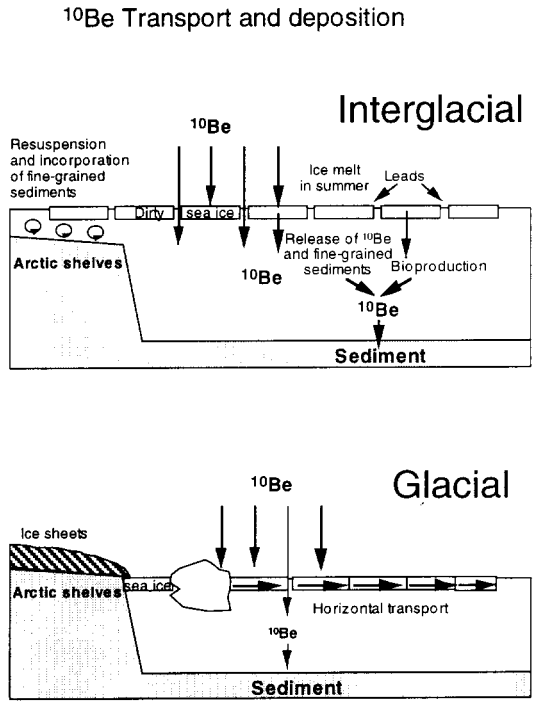

Fig. 3. Diagrams illustrating the sedimentation mechanisms of ^{10}Be during glacial and interglacial times.

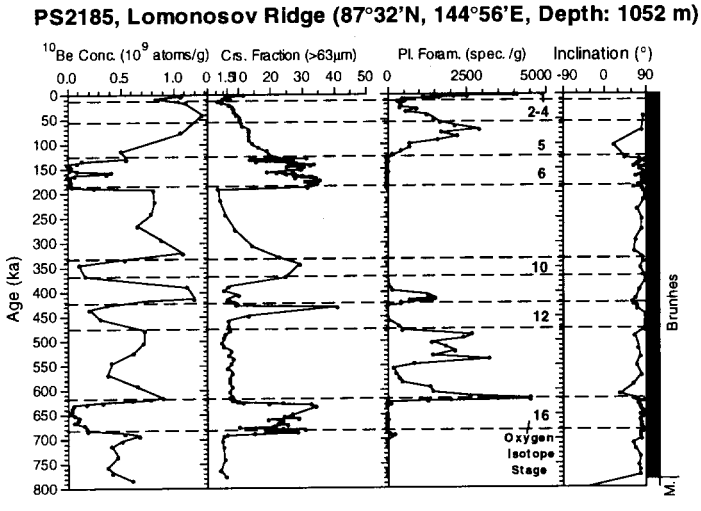

Fig. 4. Proxy data on central Arctic Ocean paleocanography during the past 700,000 years (modified from Spielhagen et al 1994).

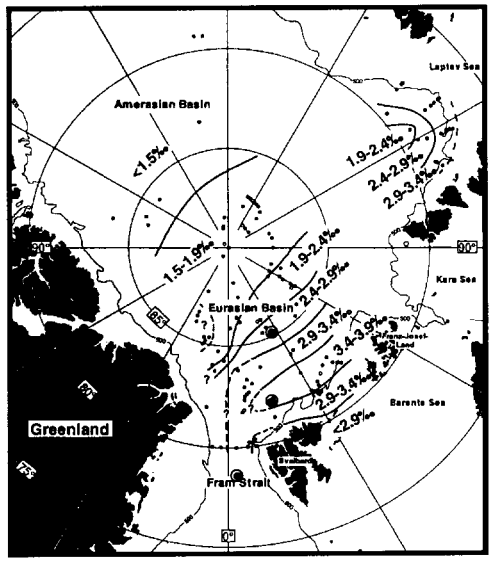

Fig. 5. Stable O-Isotope ratios in planktic foraminifers (*Neogloboquadrina pachyderma* sin.) from Arctic Ocean seafloor surface sediments. Large dots mark positions of cores illustrated in Fig. 2 (from Spielhagen et al. 1994).