Geophysical Research Abstracts, Vol. 8, 07306, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07306

Eurasian Arctic ice sheet margins reflect glacial climatic trends during the last 500 ky

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Mid-to Late Quaternary climatic records from the sub-arctic North Atlantic, the Arctic Ocean and northern Eurasia reveal a number of long-term climatic trends in both peak glacial and peak interglacial climates. In our presentation we will show evidence for regional shifts of glaciation centers and for a strengthening of the oceanic heat transport during the last 500 ky. Furthermore, we will present a conceptual model of progressive long-term changes in Arctic climate.

Sediment core data of the last 500 ky from the Norwegian-Greenland Sea show a stepwise trend of decreasing fluxes of ice-rafted debris (IRD) during "full" glaciations, i.e., marine isotope stages (MIS) 12, 6, and 2. Strongest IRD deposition occurred in MIS 12, while it was lower in MIS 6 and 2. We interpret this observation as evidence for a decreasing discharge of sediment-laden icebergs from northern European ice sheets during peak glacials.

Results from the ESF-programme QUEEN suggest that developments in the Norwegian-Greenland Sea were accompanied by synchronous trends in the Arctic. Field observations from Russia and central Siberia provide evidence for at least four pre-Weichselian glaciations. Maximum southern extents were diachronous in the various areas before MIS 6, but they reached much further to the south than ever after. However, it was only the vast MIS 6 glaciation which, for the first time, also reached the N. Eurasian shelf break, forming an almost 2000 km long calving line. The discharge of icebergs from this ice margin is reflected in Arctic Ocean deep-sea sediments by a thick IRD-rich layer, deposited on top of older, usually more fine-grained sediments. During cold times ensuing MIS 6 (MIS 5b, 4, and 2) ice sheet

sizes progressively decreased. The southern ice sheet margins in Siberia shifted from the northernmost land areas in MIS 5b to near the present-day coastline in MIS 4, but IRD deposition in the Arctic Ocean was strong in both intervals. Finally, the ice sheet during the last glacial maximum (MIS 2) was mostly confined to Scandinavia, NW Europe, and the Barents Sea, while its influence on Arctic Ocean sedimentation was restricted to the western part of the Eurasian Basin.

The observed developments in the Norwegian-Greenland Sea and Eurasian Arctic during the last 500 ky indicate a progressive migration of glaciation limits towards the north, accompanied by a westward shift of glaciation centers across northwest Eurasia. These regional shifts were forced by major changes in oceanic heat transport which essentially influenced the pathways of atmospheric moisture transfer across northern Eurasia. It can be suspected that, within this process, the Arctic climate system became more and more sensitive to internal and external (e.g., anthropogenic) forcings.