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Variations in upper water-column dynamics in the northern North Atlantic during the last 20,000 years as revealed by coccolithophorid assemblages

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A coccolith-based micropaleontological investigation of ODP sites 980 and 984 from the Feni and Gardar contour drifts of the northern North Atlantic was conducted in order to reconstruct the pattern and timing of surface circulation changes in the area during the last 20,000 years. In addition, sea-surface paleotemperature records from both sites were generated at high resolution based on the widely used alkenone paleothermometer.

The down-core variations in coccolith assemblage composition indicate that changes in properties of surface waters in the northern North Atlantic occurred stepwise during the Termination I. Sparse occurrences of coccolithophores together with a higher number of reworked pre-Quaternary species are observed before about 13,500 cal yr BP, indicating harsh environmental conditions and the influence of melt-water. The stepwise increase of North Atlantic Drift water influence from 13,500 to about 10,000 cal yr BP was associated with the increase in absolute numbers of coccolithophores in the whole area and coincides with maximum Northern Hemisphere summer insolation. A considerable cooling of the surface waters as indicated by a prominent change in the relative abundances of the dominant coccolith species occurred after about 5000 cal yr BP. In addition, a successive increase in millennial-scale perturbations of the surface hydrology towards the Neoglaciation (the last ca. 5000 years) is documented by changes in accumulation of the species, in particular of *Emiliania huxleyi*. These successive decreases in the numbers of *E. huxleyi*, as previously described by Giraudeau et al. (2000, EPSL 179), is in phase with recorded Holocene advection of cool, ice-bearing waters from the Greenland-Iceland seas to the North Atlantic. These long-term

reorganisations of the surface hydrology are interpreted as the response of the North Atlantic to the combined forces of the solar insolation and the waning Laurentide ice sheet.