Natural causes for cyanobacterial blooms in the Baltic Sea

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Background

An increasing extent of cyanobacterial blooms has been observed in the Baltic Sea during the last decades. One of the suggested reasons for this is an increasing load of nutrients, mainly phosphorus (P), due to eutrophication. Studies have shown that the blooms are not man induced, but a natural phenomenon that has occurred in the Baltic Sea for the last c. 8000 years. Blooms can be detected using zeaxanthin, a very stable pigment biomarker for cyanobacteria. Many cyanobacteria are nitrogen-fixers, depending primarily on the supply of P in the water to bloom. This makes them competitive during low nitrogen/phosphorus (N/P)-ratios. When the Baltic Sea turned from a freshwater into a brackish water stage c. 8500 BP, the inflow of P-rich saline water probably lowered the N/P-ratio and thus made conditions suitable for cyanobacterial blooms.

Discussion of results

Results of the analysis of a sediment core from the Bornholm Basin in the southern Baltic Sea corroborates earlier results that extensive cyanobacterial blooms have occurred in the area during the last c. 8000 years. Earlier blooms were found to have been at least as massive as today and seem to have been triggered by a low N/P-ratio due to high P concentrations. There was no evidence for release of ironbound P from the sediments as a result of the anoxic bottom conditions initiated soon after the transition. The increasing P concentrations in the water probably to a large extent derived from the inflowing saline water.

Conclusions

Cyanobacterial blooms in the southern Baltic Sea started around the freshwater/brackish water (F/B) transition c. 8500 BP. The initiation of the blooms was probably caused by an increased input of nutrient rich oceanic water with a low N/P-ratio. We could not find any corroboration for additional input of P from the sediments during the F/B transition.

References

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Modern seasonal sources of east-Asian dust to Greenland

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A recent study of mineral dust aerosols extracted from snow and firn deposited over the last decade at the NorthGRIP, Greenland, ice camp (75.1°N, 042.3°W), has confirmed the eastern Asian source for Greenland dust and extended it to the present day [Bory et al., 2002]. Previous studies, carried out on ice-core dust, had established this Asian provenance for the last glacial period [Biscaye et al., 1997; Svensson et al, 2000]. In this recent study, a ~1.7-years dust record sampled at a ~2.4-month resolution showed that the provenance of the dust appears to vary seasonally, and that the source of the dust during the major spring deposition period is the Takla Makan desert of northwest China. Autumn-winter dust has a different source. These results were obtained using mineralogical and isotopic (Sr and Nd) composition of the dust, which was compared with the composition of small particles in potential source area (PSA) for Greenland dust.

Here we present a new 4-year dust record with a ~1.9-month resolution obtained during the 2001 field season at NorthGRIP. This longer record largely confirms the seasonal variability in the origin of mineral dust deposited in north central Greenland. An extensive collection of new PSA samples will help to pin point the other Asian source(s) from which the dust deposited in autumn-winter seasons is derived.

These results will provide new constraints on atmospheric dust-transport models, and will help to better interpret dust compositional variability of ancient ice-core samples, which, for analytical reasons, must integrate dust deposited over longer periods of time.

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