Phytoplankton spring bloom impact to iron and manganese geochemistry in the surface sediments (nepheloid layer) of the Gulf of Riga (the Baltic Sea).

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Introduction

As well known organic material decomposition create seasonal changes in redox condition what directly affect geochemical behavior of Fe and Mn. The Gulf of Riga is semi-enclosed relatively shallow water body under strong fresh-water influence and with relatively high primary production. Therefore we can expected that organic matter decomposition processes on sediment surface in the Gulf of Riga will strongly influence Fe and Mn biogeochemistry. So the objective of this study was to investigate the impact of phytoplankton bloom dynamic and species compositions as well as hydrology to mechanisms governing Fe and Mn distribution and fate in the surface sediments in the Gulf of Riga.

Methods

During three-year period (2001-2003) 40 samples of surface sediments (around 0.2 - 0.3 cm nepheloid layer) for Fe and Mn analysis were collected by Kajak gravity corer in the central part (depth 44m) of the Gulf of Riga (figure 1). Simultaneously water for particulate iron and manganese, phytoplankton, oxygen and salinity analyses was sampled.

Conclusions

Relatively intensive and untypical spring dinoflagelates bloom as well as fast sedimentation caused quick oxygen depletion and local anoxic condition on top sediments in summer 2001 and it produced considerable Fe concentration changes in nepheloid layer in 2001.

The most suitable red-ox conditions for Mn accumulation in the nepheloid layer was in 2002 when obviously due to low biomass phytoplankton bloom deposition was low. Oxic condition in nepheloid layer and in the bottom water contributed to precipitation of dissolved Mn released from reduced sediment layers and accumulation in nepheloid layer.

More saline water inflow from the Baltic Proper in 2003 created stagnant situation in the central part of the Gulf of Riga. That prevented Mn accumulation transported from deeper sediment layers in the nepheloid layer.

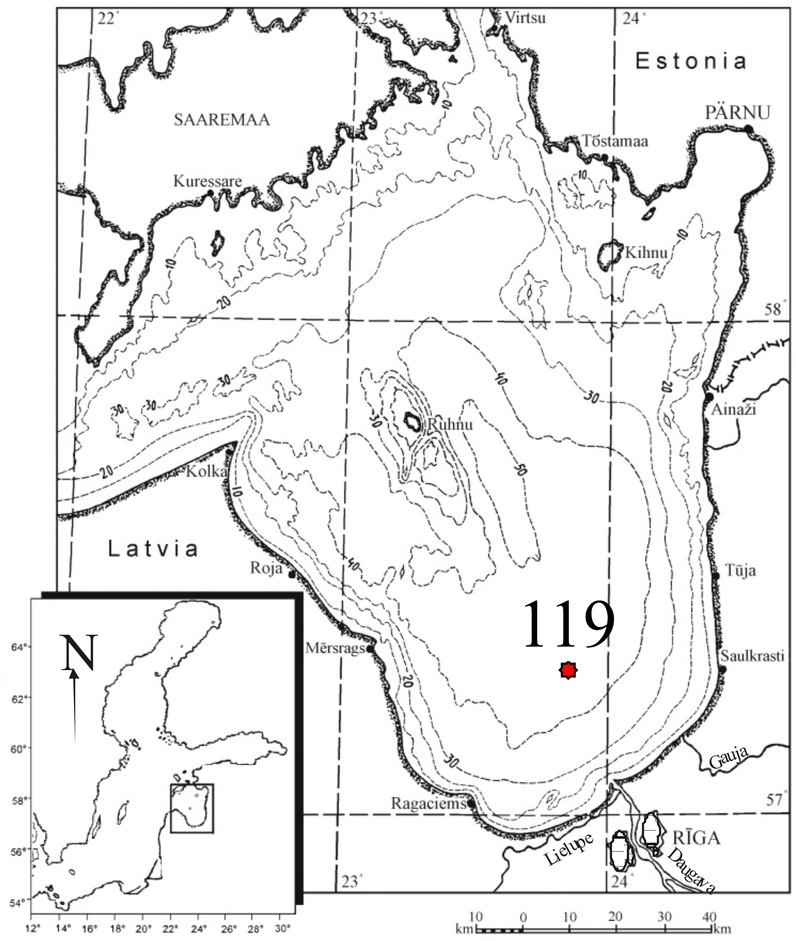

Figure 1. Sampling map for nepheloid layer studies in the Gulf of Riga (the Baltic Sea).

Results

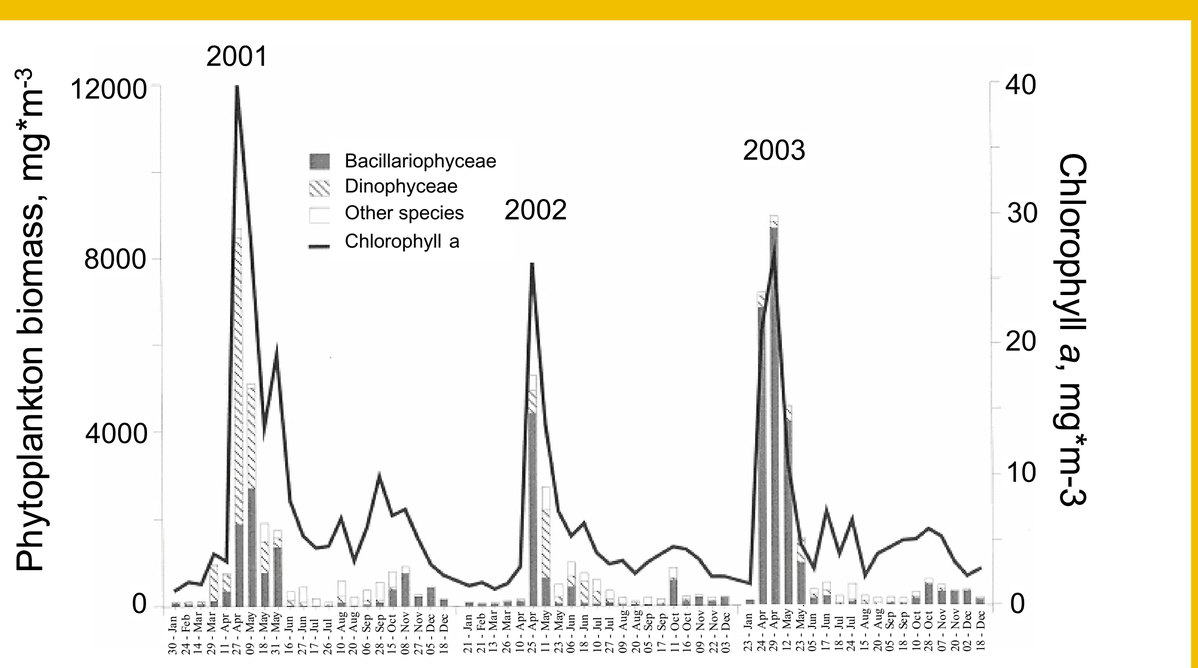

Figure 2. Phytoplancton biomass and chorophyll a distribution pattern in the water column (0 - 10 m) at station 119 during time period 2001 - 2003. Dominant groups were dinoflagelates (77%, mostly *Peridiniella catenata*) in 2001, diatoms (83%, mostly *Chaetoceros wighamii*) in 2002, and diatoms (95%, mostly *Achnanthes taeniata*) in 2003. Phytoplankton biomass was the lowest in 2002 in contrast with 2001 and 2003.

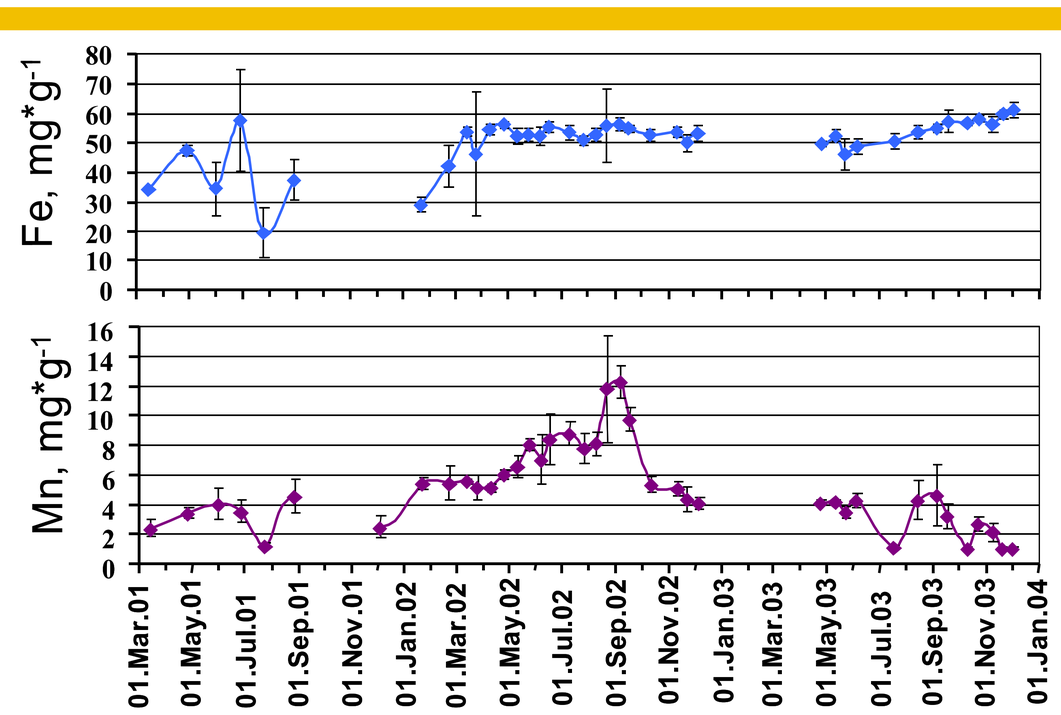

Figure 3. Iron and manganese distribution pattern in the nepheloid layer at station 119 during time period 2001 - 2003. The increase of particulate Mn concentration was always observed in late summer - autumn below the thermocline. In contrary no such increase of particulate Fe concentration was observed.

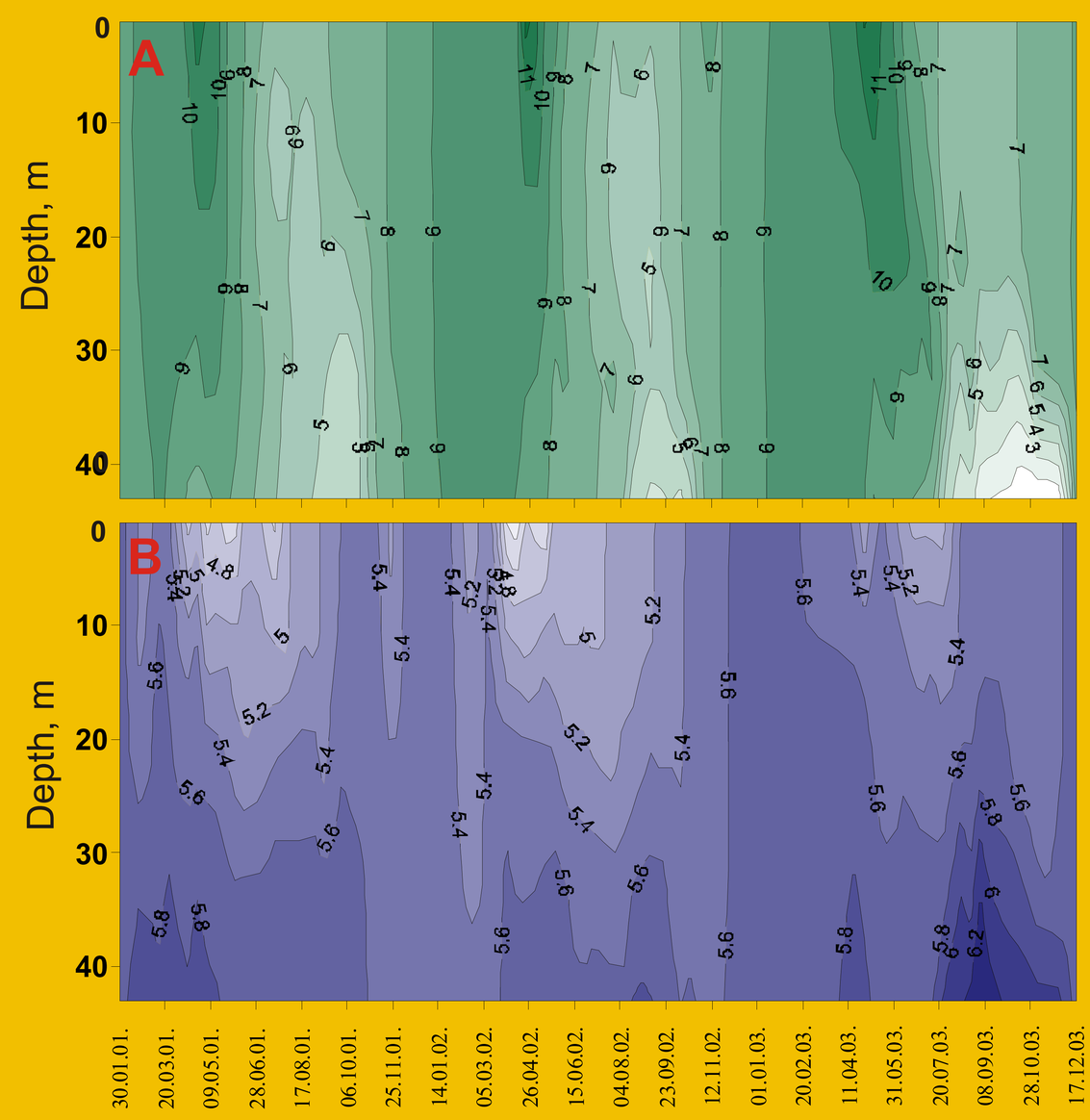

Figure 4. Distribution pattern of (A) oxygen (ml/l) and (B) salinity (PSU) in the water column at station 119 during time period 2001 - 2003. Stagnant water inflow from the Baltic Proper was observed in the bottom water layers in 2003.