Recent brownification of South Swedish lake waters – an effect of climate change or land use?

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A. Introduction

Dissolved organic carbon (DOC) content, especially terrestrial humic matter (DHM), and water colour of many lakes and streams have increased substantially during the last decades (Evans et al. 2004, Roulet and Moore 2006). Brownification not only reduces the quality of these waters as drinking water supplies and for recreational purposes, but lake biodiversity is also expected to be effected. The aim of this project is to evaluate the potential underlying causes of the recent brownification of South Swedish lakes. A multiproxy approach is applied (fig 3.) for reconstruct on of the biogeochemical and biological changes within selected lakes, and the vegetation/land use changes within their catchments for the past c. 1000 years. Here we present the study area, main methods, preliminary results and links to Fredh et al. project.

B. Study sites

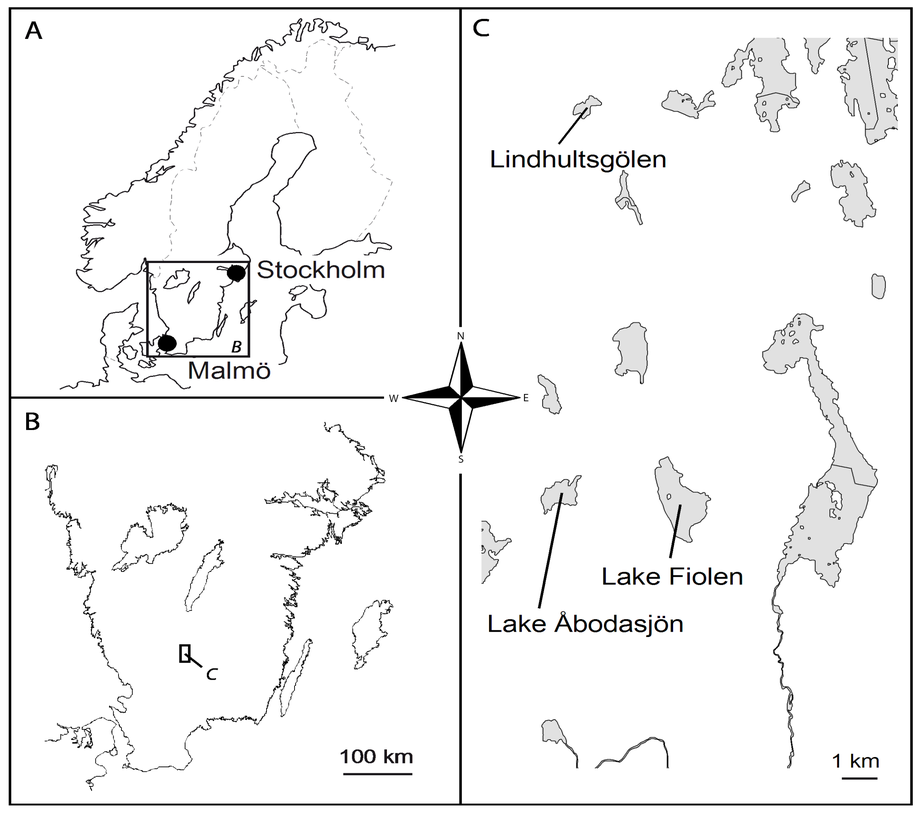

Figure 1. Location of the study sites including Lake Fiolen, used for the LRA modelling (see Daniel Fredh´s poster).

The study area is situated in southern Sweden (fig 1.). The selection of lakes was based on; 1. recent water colour trends (fig 2.), 2. size and 3. catchment properties. Lake Åbodasjön is 50 ha and the catchment is influenced by anthropogenic activities. Lake Lindhultsgöl is 7,1 ha and the surroundings consist of forests and wetlands. Field work was carried out in April 2008 and sediments were obtained with a Kajak corer and a Russian peat corer.

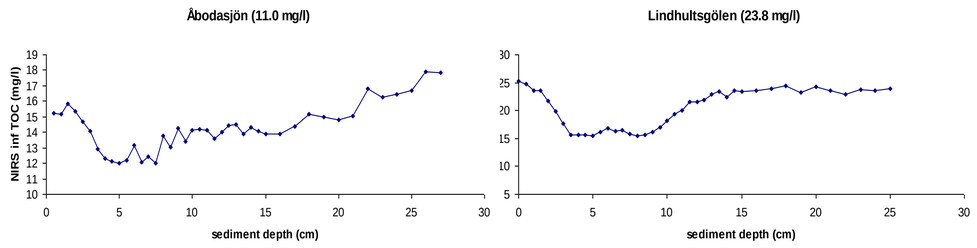

Figure 2. The two lakes show distinct increases in lake-water TOC concentration in the upper *c*. 4 cm of the sediments.

C. Methods

TOC concentration

Past changes in lake-water total organic carbon (TOC) concentration are based on near-infrared spectroscopy (NIRS) of the lake sediments. Recent studies have shown that NIRS of lake sediments exhibit good correlations with TOC concentrations of lake-water (Rosén 2005). The method utilizes the fact that the organic fraction of lake sediments has a distinctive NIR signal that can be summarized using multivariate statistical tools. New models for South Swedish lakes with TOC content variations up to 30 mg/l are in progress.

Chronology

Accurate chronologies will be based on radioisotope modelling (^{210}Pb and ^{137}Cs) in combination with radiocarbon dating. Core correlation is based on highly resolved proxy data.

Catchment vegetation

A novel modelling approach, the Landscape Reconstruction Algorithm (LRA), will be used to quantify catchment-scale vegetation changes based on pollen data. Past land cover in terms of absolute areas of different landscape units (forest, open land, pastures, cultivated areas, etc.) will be estimated (see also poster by Daniel Fredh et al.).

Lake Åbodasjön	**Kajak core 0-32 cm**	**Russian core 20,5-109 cm**
NIRS (TOC concentration)		
Magnetic susceptibility		
C and N content, C/N		
Stable isotopes (δ^{13}C, δ^{15}N)		
Pollen analysis		
Diatom analysis		
Biogenic silica (BSi)		

Figure 3. Methods applied to the sediment sequence from Lake Åboda. Table of the methods for the sediment of the Lake Åboda. Green =finished, Yellow=in progress and Red=planned.

D. Preliminary results

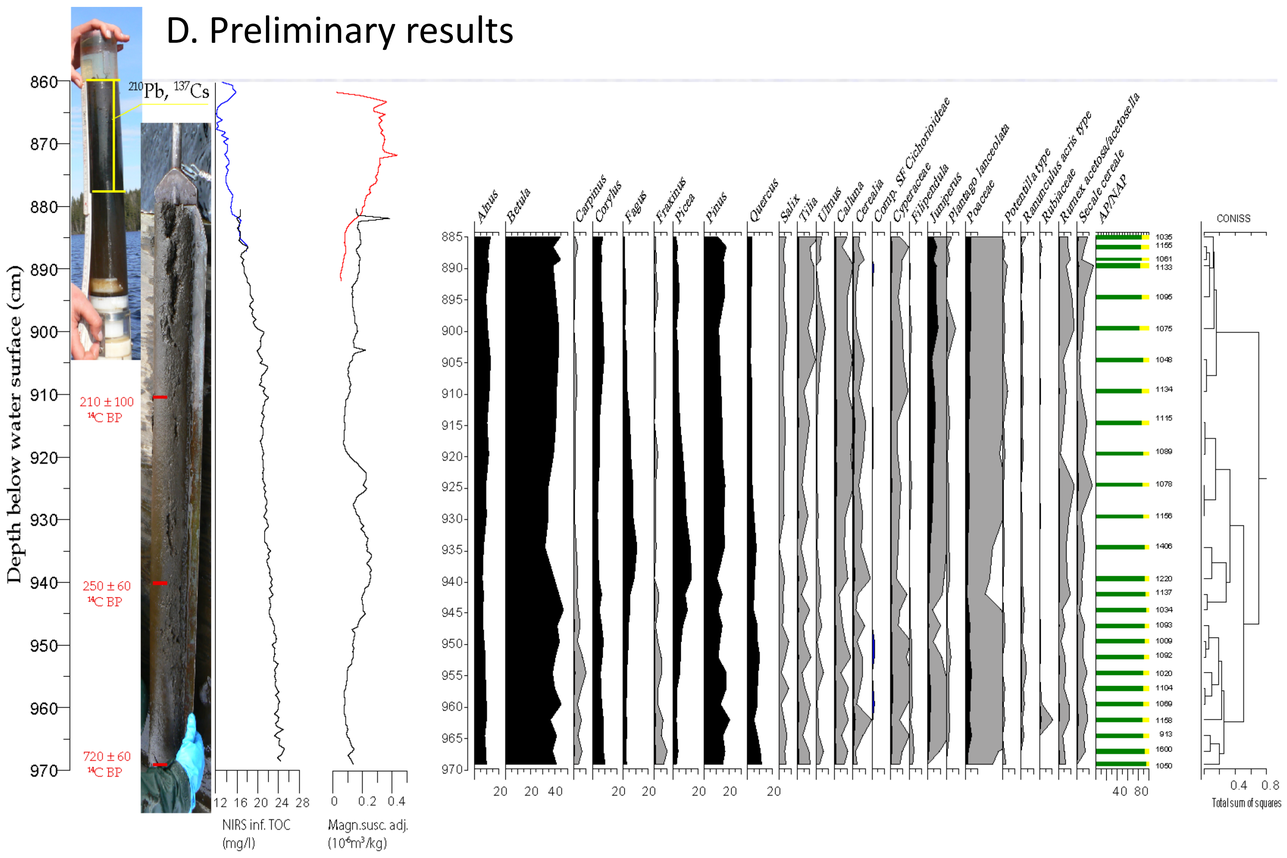

Figure 4. Radiocarbon dates, NIRS-inferred lake-water TOC concentration, magnetic susceptibility and preliminary pollen data from Lake Åboda plotted against depth below the water surface.

E. Next steps

- Establish an accurate chronology.
- Apply the same approach and methods for the sediment sequence from Lake Lindhultsgöl.
- Quantitative vegetation reconstructions using the LRA modelling.
- Sample the lakes with a freezecorer to enable continuous and more highly resolved subsampling.
- The flagellate *Gonyostomum semen* (fig.5.) is an invasive algae which is favoured by increased lake water DHM content (Cronberg et al 1988). If its resting cysts can be found in the lake sediments, information about its occurence and its connection to different changes in the lake, TOC concentration for example, might be evaluated.

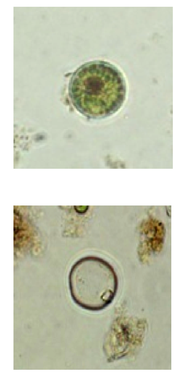

Figure 5. Photographs of the algae *Gonyostomum semen*, a) living cell b) empty cyst

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