



HAL
open science

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

Petra Bragée, Florence Mazier, Peter Rosén, Anna Brostrom, Wilhelm Granéli, Dan Hammarlund

► To cite this version:

Petra Bragée, Florence Mazier, Peter Rosén, Anna Brostrom, Wilhelm Granéli, et al.. Recent brownification of South Swedish lake waters – an effect of climate change or land use?. 2nd Nordic Network of palaeoclimatology conference, Sep 2008, Hoor, Sweden. 2008. hal-01867332

HAL Id: hal-01867332

<https://univ-tlse2.hal.science/hal-01867332>

Submitted on 4 Sep 2018

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Petra Bragée¹, Florence Mazier¹, Peter Rosén², Anna Broström¹, Wilhelm Granéli³ and Dan Hammarlund¹

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.



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 (²¹⁰Pb and ¹³⁷Cs) 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)	Red	Green
Magnetic susceptibility	Green	Green
C and N content, C/N	Yellow	Yellow
Stable isotopes (δ ¹³ C, δ ¹⁵ N)	Yellow	Yellow
Pollen analysis	Yellow	Yellow
Diatom analysis	Red	Red
Biogenic silica (BSi)	Red	Red

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.

B. Study sites

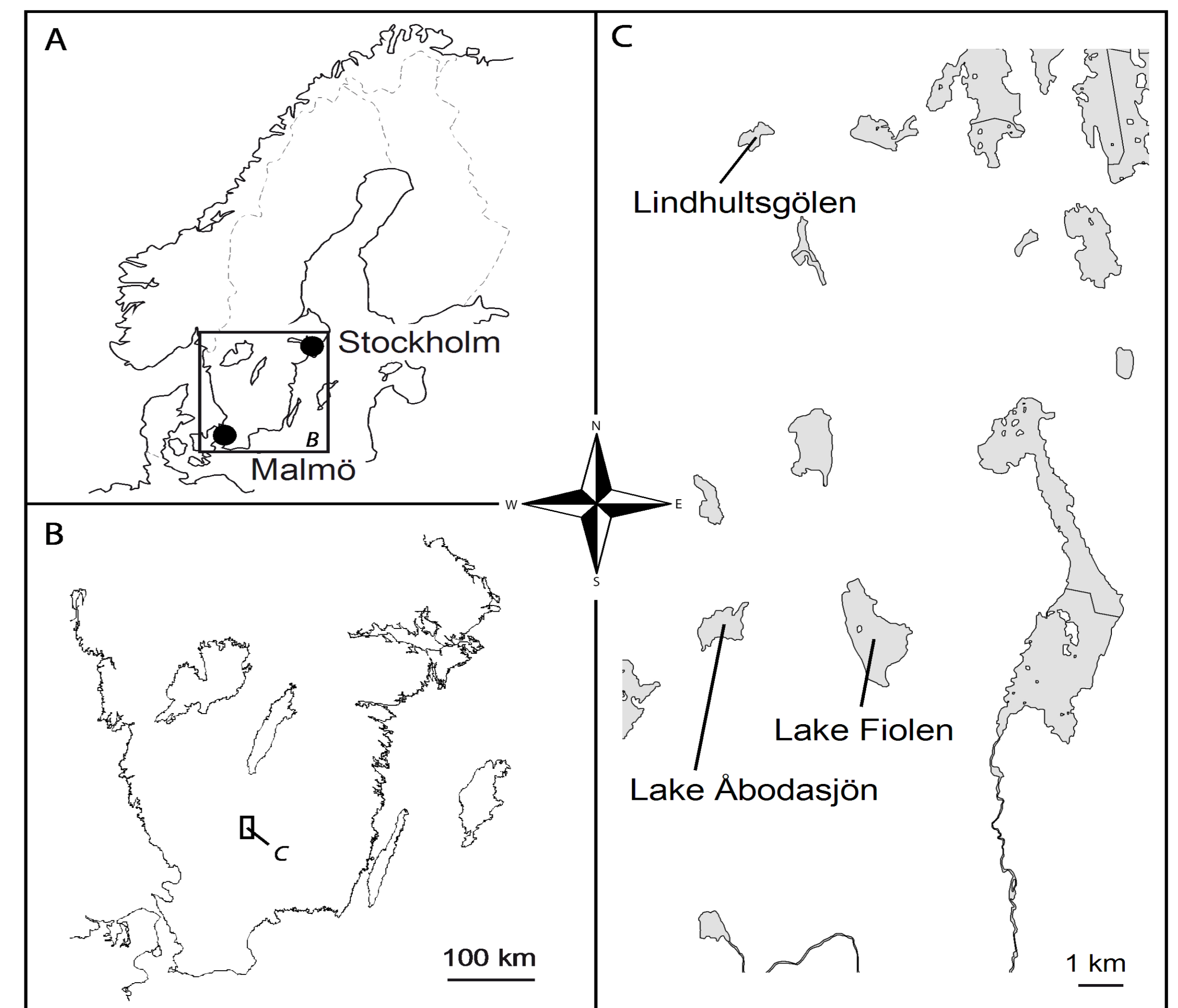


Figure 1. Location of the study sites including Lake Fiolen, used for the LRA modelling (see Daniel Fredh's poster).

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.

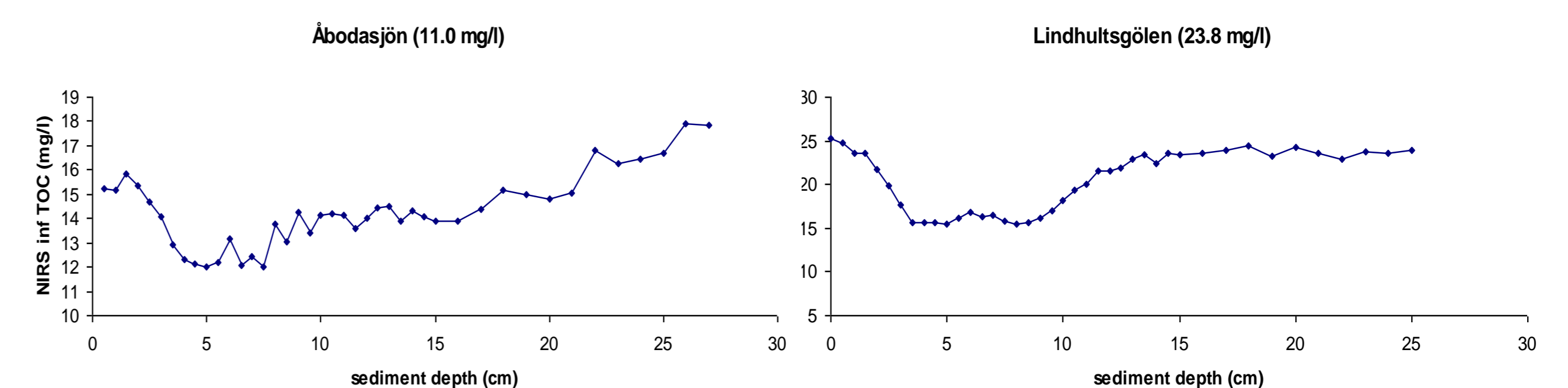


Figure 2. The two lakes show distinct increases in lake-water TOC concentration in the upper c. 4 cm of the sediments.

D. Preliminary results

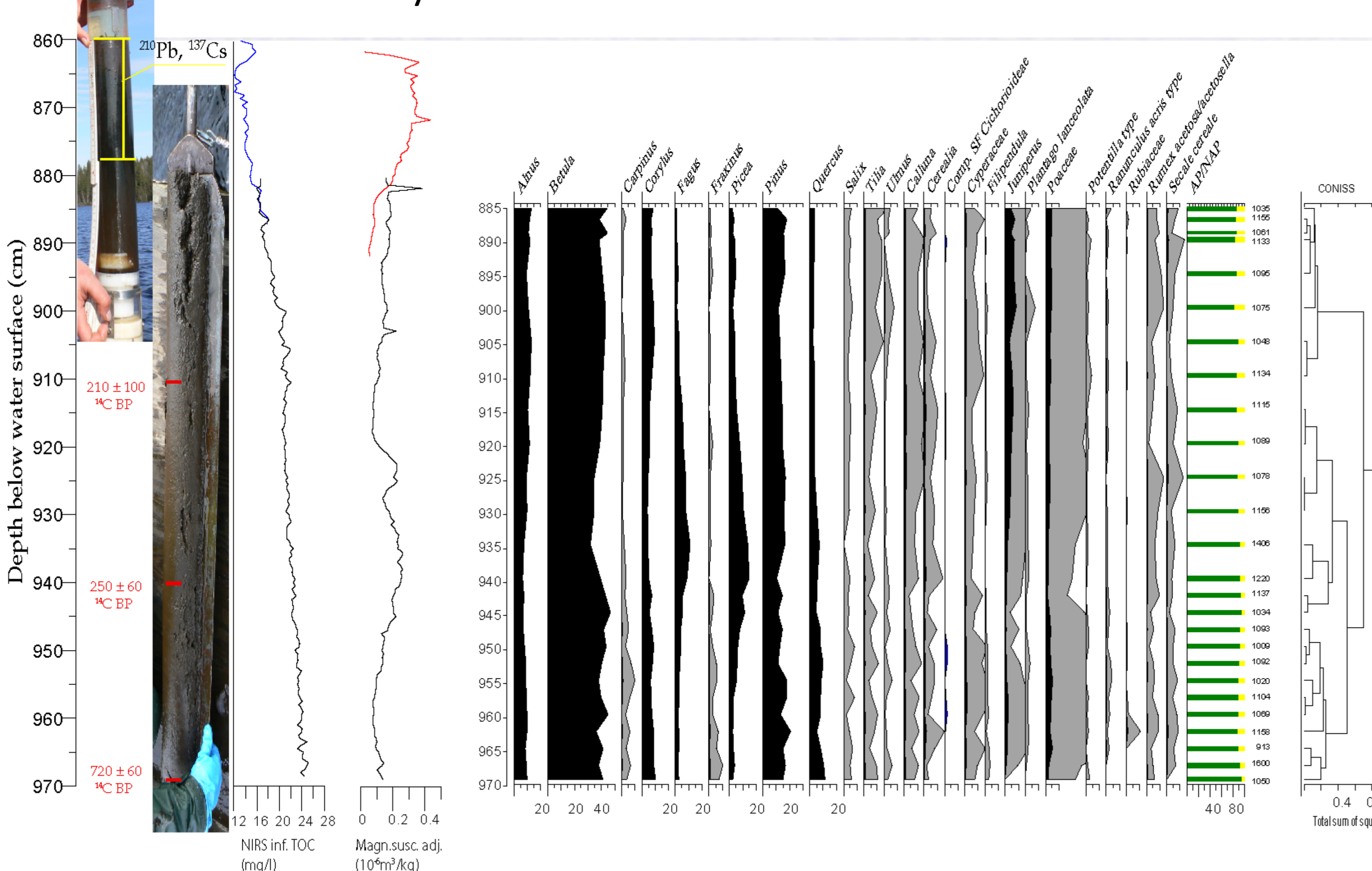


Figure 4. Radiocarbon dates, NIRS-inferred lake-water TOC concentration, magnetic susceptibility and preliminary pollen data from Lake Åboda plotted against depth below the water surface.



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 freezercorer 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 occurrence 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



Contact information

¹GeoBiosphere Science Centre
Department of Geology
Quaternary Sciences
Lund University
Sölvegatan 12
SE-223 62 Lund
Sweden
petra.bragee@geol.lu.se
florence.mazier@geol.lu.se

²Climate Impacts Research Centre
SE-981 07 Abisko
Sweden

³Department of Ecology
Lund University
Sölvegatan 37
SE-223 62 Lund
Sweden

References

Cronberg, G., Lindmark, G. and Björk, S. 1988. Mass development of the flagellate *Gonyostomum semen* (Raphidophyta) in Swedish forest lakes – an effect of acidification? *Hydrobiologica* **161**: 217-236.
Evans, C.D., Monteith, D.T. and Cooper D.M. 2004. Long-term increases in the surface water dissolved organic carbon: Observations, possible causes and environmental impacts. *Environmental pollution* **137**: 55-71.
Rosén, P. 2005. Total organic carbon (TOC) of lake water during the Holocene inferred from lake sediments and near-infrared spectroscopy (NIRS) in eight lakes from northern Sweden. *Biogeochemistry* **76**:503-516.
Roulet, N. and Moore, T.R. 2006. Browning the waters. *Nature* **444**:283-284.