**Lake water and sediments chemistry data along with temporal data on environmental drivers**

Björnerås, C, Weyhenmeyer, G. A., Hammarlund, D., Persson, P. and Kritzberg, E. S. 2022. *Sediment records shed light on drivers of decadal iron concentration increase in a boreal lake.* Journal of Geophysical Research: Biogeosciences Volume 127, issue 3. <https://doi.org/10.1029/2021JG006670>

The water chemistry data that was used to analyze temporal changes in iron (Fe), water color, organic carbon (as total organic carbon (TOC) and potassium permanganate consumption (KMnO4)), sulfate (SO4) and pH (Fig.2, Fig.S1 and Fig.S4 in Björnerås et al. 2022) in the three main inflows to Lake Bolmen (Storån, Lillån and Unnen) and in the lake outflow (Bolmån) is found in Sheet 1 (Water chemistry) in the data file (IronSediments). This long-term monitoring data was collected by the company Sydvatten, which produces drinking water from the lake, and by the Swedish University of Agricultural Sciences (SLU), which maintains the Swedish national lake inventory program (<http://miljodata.slu.se/mvm/>).

The long-term data on climate, atmospheric sulfur (S) deposition and land-use data that was used to make made predictions on variations in the annual mean Fe concentration in the lake outlet Bolmån during 1966 to 2018 (Fig.3) is found in Sheet 2 (Drivers) in the data file. Data sources are listed in Björnerås et al. 2022.

Data from analyses of the Lake Bolmen sediments are also included in the data file. These include sediment accumulation rates based on the 210Pb dating (Fig.4; Sheet 3; Chronology), sediment concentrations and accumulation rates of Fe, S, silicon (Si), biogenic silicon (BSi), aluminum (Al), manganese (Mn), carbon (C), and nitrogen (N) (Fig.5 and Fig.7; Sheet 4; Sediment AR). The data file further contains data collected with a XRF analyzer on frozen sediments (Fig.8; Sheet 5; XRF), as well as EXAFS data analyzed with linear combination fitting and first shell fitting approaches (Fig.6 and Fig.S3; Sheet 6 and 7; EXAFS\_LCF and EXAFS\_First\_shell\_fitting). The Fe K-edge X-ray absorption spectra were collected at the Stanford Synchrotron Radiation Lightsource (SSRL), at beamline 4-1, California, USA.

A detailed description of sample/data collection, treatment, and analyses can be found in the methods section in Björnerås et al. 2022.

Not applicable and missing data are represented by n/a in the data file.

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**The data file (IronSediments.xlsx) contains:**

**Sheet 1 - Water chemistry:**

Column A: Name of lake inflow/outflow

Column B: Sampling year

Column C: Water color in mg Pt L-1

Column D: Fe concentration in mg L-1

Column E: SO4 concentration in mg L-1

Column F: pH

Column G: TOC concentration in mg L-1

Column H: KMnO4 concentration in mg L-1

**Sheet 2 - Drivers:**

Column A: Location - Lake Bolmen catchment

Column B: Sampling year

Column C: Spruce volume in the catchment in m3

Column D: Annual precipitation in mm

Column E: Atmospheric S deposition in mg S m-2 yr-1

Column F: Yearly mean air temperature (℃)

Column G: Long-term mean precipitation for the time period 1961-1990 in mm

Column H: Deviation in annual precipitation from the long-term(1961-1990) mean

**Sheet 3 – Chronology:**

Column A: Sediment depth in cm

Column B: Total 210Pb activity in Bq kg-1

Column C: Error total 210Pb activity in Bq kg-1

Column D: Supported 210Pb activity in Bq kg-1

Column E: Error supported 210Pb activity in Bq kg-1

Column F: Unsupported 210Pb activity in Bq kg-1

Column G: Error unsupported 210Pb activity in Bq kg-1

Column H: 137Cs activity in Bq kg-1

Column I: Error 137Cs activity in Bq kg-1

Column K: 241Am activity in Bq kg-1

Column L: Sediment deposition year (AD)

Column M: Error sediment deposition year (AD)

**Sheet 4 – Sediment AR:**

Column A: Sediment deposition year based on 210Pb sediment dating

Column B: Sediment depth in cm

Column C: Dry weight sediment accumulation rate in g cm2 yr-1

Column D: Yearly mean Fe concentration (mg L-1) in the outflow of Lake Bolmen

Column E: Al concentration in mg g-1

Column F: Fe concentration in mg g-1

Column G: Mn concentration in mg g-1

Column H: S concentration in mg g-1

Column I: Si concentration in mg g-1

Column J: C concentration in %

Column K: N concentration %

Column L: Fe accumulation rate in mg cm2 yr-1

Column M: S accumulation rate in mg cm2 yr-1

Column N: Si accumulation rate in mg cm2 yr-1

Column O: Biogenic Si (BSi) accumulation rate in mg cm2 yr-1

Column P: Mn accumulation rate in mg cm2 yr-1

Column Q: Al accumulation rate in mg cm2 yr-1

Column R: Molar Fe to Mn ratio

Column S: Molar Fe to Al ratio

Column T: C accumulation rate in mg cm2 yr-1

Column U: N accumulation rate in mg cm2 yr-1

**Sheet 5 – XRF:**

Column A: Sediment depth in cm

Column B: Sediment Si concentration in ppm

Column C: Sediment titanium (Ti) concentration in ppm

Column D: Sediment Fe concentration in ppm

Column E: Sediment Mn concentration in ppm

Column F: Sediment potassium (K) concentration in ppm

Column G: K to Ti ratio

Column H: Si to Ti ratio

Column I: Fe to Ti ratio

Column J: Mn to Ti ratio

**Sheet 6 – EXAFS\_LCF:**

Column A: Sediment depth in cm

Column B: Sediment Fe accumulation rate in mg cm2 yr-1

Column C: Contribution of Fe-oxyhydroxides (FeOOH) in linear combination fitting of

sediment sample spectra

Column D: Contribution of organically complexed Fe (Fe-OM) in linear combination fitting of sediment sample spectra

Column E: Contribution of Fe-bearing silicates (Fe-Si) in linear combination fitting of sediment sample spectra

Column F: Contribution of Fe-bearing clays (Fe-clay) in linear combination fitting of sediment sample spectra

Column G: Contribution of Fe sulfides (FeS) in linear combination fitting of sediment sample spectra

Column H: Contribution of Fe phosphates (Fe-P) in linear combination fitting of sediment sample spectra

Column I: Contribution of Fe carbonates (FeCO3) in linear combination fitting of sediment sample spectra

Column J: Sediment accumulation rate of FeOOH in mg cm2 yr-1

Column K: Sediment accumulation rate of Fe-OM in mg cm2 yr-1

Column L: Sediment accumulation rate of Fe-Si in mg cm2 yr-1

Column M: Sediment accumulation rate of Fe-clay in mg cm2 yr-1

Column N: Sediment accumulation rate of FeS in mg cm2 yr-1

Column O: Sediment accumulation rate of Fe-P in mg cm2 yr-1

Column P: Sediment accumulation rate of FeCO3 in mg cm2 yr-1

**Sheet 7 – EXAFS\_First\_shell\_fitting:**

Column A: Sediment depth in cm

Column B: Distance (Å-1) in k-space

Column C: k3-weighted EXAFS

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**Contact me at:**

Caroline Björnerås

Quaternary Sciences, Department of Geology

Lund University

Sölvegatan 12

22362 Lund, Sweden

E-mail: [caroline.bjorneras@geol.lu.se](mailto:caroline.bjorneras@geol.lu.se) & [caroline.bjorneras@gmail.com](mailto:caroline.bjorneras@gmail.com)