

## Lake record of black carbon from southern Sweden reveals increased flux in the early 18<sup>th</sup> century

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Black carbon (BC) is produced by the incomplete combustion of organic matter and fossil fuels. The BC particles consist of highly condensed and aromatic carbon compounds with high resistance to degradation and are thus important for long-term carbon storage in soils and sediments. BC particles are also part of the particulate pollution with severe health consequences.

Here we present BC concentrations and accumulation rates derived from sediments of a small lake (Odensjön) in southern Sweden. The lake is situated at 60 m a.s.l. on a bedrock ridge, has a diameter of app. 150 m and a maximum water depth of 20 m. The lake is the southernmost site in Sweden with varved sediments. We have retrieved an 89 cm long freeze core and established a chronology based on <sup>210</sup>Pb, <sup>14</sup>C and varve counting. BC was quantified using the thermal chemical oxidation method (CTO375), and the proportion of BC derived from fossil fuels and biomass was assessed using radiocarbon measurements on the BC fraction.

Our BC record has relatively high maximum concentrations (>0.92%) and shows an early increase in concentration and accumulation rate starting around CE1700. This early rise in BC accumulation rate took place around 150 years before the main phase of industrialisation in Sweden and was likely an effect of increasing population and small-scale industrialisation in the region. The BC accumulation rate continued to increase steadily until an accelerated rise in the mid-20<sup>th</sup> century that has remained high until the present. The <sup>14</sup>C measurements of the BC fraction show that biomass was the main source of BC (72-91%) throughout the studied period. The maximum deposition of BC derived from fossil fuels was found in the 1970-1990. The BC deposition has remained high since 1990 with an increasing proportion derived from biomass burning and is probably linked to the increased use of biomass for energy production in Scandinavia.