



## **A 700-year sediment record of black carbon combustion particles in Aspvreten, a Swedish background area**

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Black carbon (BC) particles and polycyclic aromatic hydrocarbons (PAH) are emitted during incomplete combustion of carbonaceous fuels and vegetation fires. Time-trend-analysis of these combustion products in sediment cores is a useful tool to for validation of atmospheric hindcast modeling. It can also be utilized to evaluate the effectiveness of political decisions on changing fuel strategy and further mitigation efforts. Furthermore, such records may also be. This first investigation of a high resolution record from northern Europe is in part motivated by two recent studies from North America showing trend break toward again increasing PAH concentrations in sediment records corresponding to the last decade.

Historical BC and PAH fluxes were determined in radiochronologically dated lake sediment cores collected near the Aspvreten EMEP (European Monitoring and Evaluation Program) station located in a rural area, 70 km south of Stockholm, Sweden. The nearly 700-year long deposition record exhibits multiple structures for both BC and PAHs that are/were related to historically varying energy consumption patterns. The lowest BC flux of 0.11 g m<sup>-2</sup> yr<sup>-1</sup> was found in the sediment section dated to the period 970-986 a.d. The highest BC flux of 0.31 g m<sup>-2</sup> yr<sup>-1</sup> was measured between 1950s and 1970s. For PAHs, several features with flux changes could be detected. Further, two distinct maximum peaks were measured: the first of almost 456 µg m<sup>-2</sup> yr<sup>-1</sup> in sediment from 1959 and the second of 264 µg m<sup>-2</sup> yr<sup>-1</sup> in sediment dated to 1977. Between these two peaks, the PAH flux decreased two-fold that corresponded to the

largest PAH flux decrease over the full record. The most recent sediment (mid-1990s to 2004) exhibited fairly constant BC and PAH fluxes, but with an indication to begin to increase. At two time periods, these two combustion products were decoupled from each other where the BC flux decreased at the same time as the PAH flux increased. The observed increase in combustion related pollution was consistent with high coal usage in the 1930s with its high particulate matter emissions, an increase in usage of oil products in early 1960s, and the growth of the population. The declines in fluxes can be linked to improvements in combustion technologies.