



Historical record of the combustion products BC and PAH 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 recent sediment cores is a useful tool to evaluate the effectiveness of political decisions on changing fuel strategy and further mitigation efforts. Furthermore, such records may also be useful for validation of atmospheric hindcast modeling. 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 (1,2). 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 $0.11 \text{ g m}^{-2} \text{ yr}^{-1}$ was found in the sediment section dated to the period 970-986. The highest BC flux of $0.31 \text{ g m}^{-2} \text{ yr}^{-1}$ 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 $456 \mu\text{g m}^{-2} \text{ yr}^{-1}$ in sediment from 1959 and the second of $264 \mu\text{g m}^{-2} \text{ yr}^{-1}$ 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 technology of home heating systems and of vehicles.

(1) Van Metre, P. C.; Mahler, B. J.; Furlong, E. T. Urban sprawl leaves its PAH signature. *Environ. Sci. Technol.* 2000, 34, 4064-4070. (2) Lima, A. L. C.; Eglinton, T. I.; Reddy, C. M. High-resolution record of pyrogenic polycyclic aromatic hydrocarbon deposition during the 20th century. *Environ. Sci. Technol.* 2003, 37, 53-61.