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# Constraining prehistoric mercury pollution using peatlands as a natural archive: opportunities and challenges

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Mercury is a naturally occurring element that has been mobilized by humans for millennia through mining and metallurgy. Even at low concentrations, mercury is toxic to humans and wildlife, particularly in its organic form, methylmercury. Adverse health effects include developmental delays, cardiovascular disease, cancer, brain and kidney impairment, with children in utero and early life being especially vulnerable.

Prehistoric Scandinavian practices associated with mercury pollution are poorly documented, but mercury gilding objects have been found in Viking culture. In later periods, cinnabar has been used to illuminate manuscripts, in medicines and cosmetics.

Reconstructing past mercury pollution prior to observational records requires the use of natural archives such as ice sheets, lakes, trees, or peatlands. Over recent decades, peatlands have been recognized as effective sinks for gaseous, particulate, and precipitation-bound mercury. However, because mercury binds strongly to organic matter, processes that alter the organic matter matrix may also influence mercury retention, potentially confounding interpretations of past mercury records.

In this study we couple high-resolution molecular analysis of the peat organic constituents with total mercury content analysis, followed by multilinear regression modelling. The model successfully predicts mercury content (r2=0.93), demonstrating the strong control of peat decomposition processes to mercury retention in peatlands. Predicting mercury content from organic composition also enables differentiation between background and excess deposition, here interpreted as anthropogenic pollution. Seven periods of mercury pollution were recorded in southern Sweden during the last 2500 years, centred around 2100; 1340; 1160; 840; 670; 370 and 170 Cal yr BP, along with a sharp increase in background mercury deposition from 500 Cal yr BP towards the present. The highest mercury accumulation rate (18 µg m2yr-1) occurred during the last century and is 9 times greater than the background average (2 µm m2 yr-1) accumulation rate. These results will be compared to previous mercury pollution reconstruction studies from Scandinavia, as well as to archaeological studies, to decipher the sources and practices that lead to mercury pollution through time.