Unique spatio-teporal records of air pollution from urban sediment archives and their significance for understanding health

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Abstract

Early life exposure affects health outcomes in adulthood: pregnancy exposure encompasses mother, child and grandchild (fetal ovary holds next-generation eggs). Epigenetics may also transmit exposure effects between generations.
To understand the influences on health of the significant 19th and 20th century urban and industrial developments, beyond contemporary Air Quality Monitoring Stations (1990s) and black smoke/ sulphur dioxide data (1960s), needs high-quality historical environmental data.

We examined high-resolution pollution records in sediments from a chain of urban ponds on Merseyside (NW England; famous for industry and ill-health) by magnetic and trace metal analyses, dated with 210Pb chronologies. These histories of air pollution captured multi-element, site-specific information from the late 19th and the whole of the 20th century, close to populations who are most at risk; we combined the records to produce a regional history showing spatio-temporal trends.

Similarly, we examined street by street variations of particle deposition in contemporary urban dust in a deprived area of Bootle (Merseyside), affected by the location of industry, traffic management and the like, through magnetics and trace metal analyses.

The shape, size and composition of individual particles were established by scanning electron microscopy. For example, preserved in sediment from 1973 are particles < 10 mm and < 2.5 mm diameter, including combustion-derived spheres containing a range of metals (Cr, Fe, Sn, Ti and Zn), angular particles containing Yttrium, Sn and Zn, as well as Pb-coated amorphous particles. They reflect local industrial processes, including car manufacturing and metal recycling as well as road (leaded petrol) emissions at this time. The interrogation of past and present urban dusts can reveal small- and large-scale spatial distributions of multiple harmful metals within respirable size fractions.
This approach, allied with focusssed, high-quality epidemiological studies, can contribute much to our understanding of long-term health outcomes of air pollution in local communities.

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