British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

London Earth

London Earth: anthropogenic and geogenic controls on the soil chemistry of the UK's largest city

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Introduction

London Earth is the British Geological Survey's soil geochemical survey of the Greater London (UK) area. Comprising over 6400 sample sites collected at a density of four sites per km^2(black dots, Fig. 1), it is the most extensive and comprehensive urban geochemical mapping project carried out to date. The objective is to give insight into the environmental impacts of urbanisation and industrialisation, as well as to characterise the geochemical baseline of the UK's most populous city. The <2 mm fraction from the topsoil samples (5–20 cm) was analysed by X-ray fluorescence spectrometry (XRFS). Resulting data for over 50 elements were subject to rigorous quality control procedures to ensure accurate and comparable data.

Anthropogenic controls

Substantial anthropogenic modification to soil baseline concentrations is evident across the urban area. A notable feature is the 'central zone' of higher concentrations of, for example, Pb (Fig. 1) as well as Sb, CaO (Fig. 2) , Zn, Cu, Sn and As in the oldest, most intensely urbanised parts of the city. In the case of Pb, domestic waste, including coal ash, paint and ceramics, are likely sources along with the legacy of leaded petrol usage. More localised 'hotspots' of elevated concentrations of, for example, Cd, Cr (Fig. 3), Cu, Ni, Se and Zn relate to industrial areas in the vicinity of the Rivers Lee and Thames. The source of elevated levels of CaO in soils on alluvium adjacent to the major rivers requires further investigation.

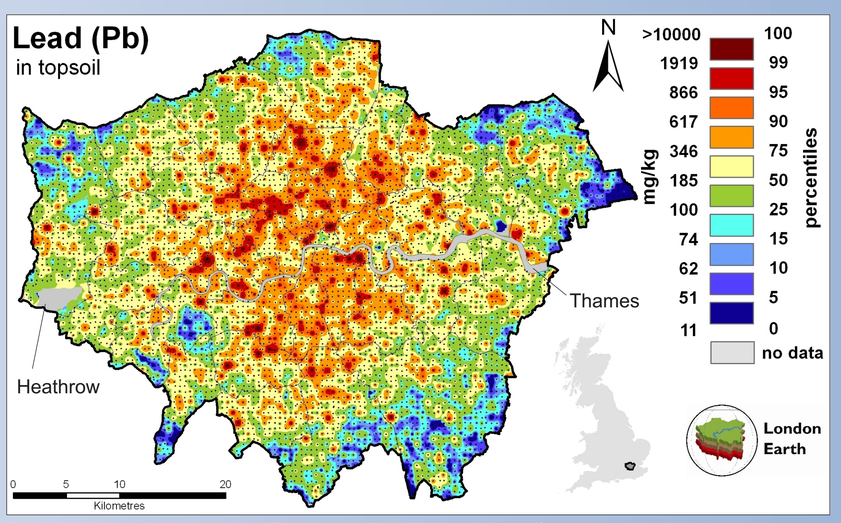

Figure 1. Interpolated map of total Pb concentrations in topsoils from Greater London. Sample locations indicated by black dots

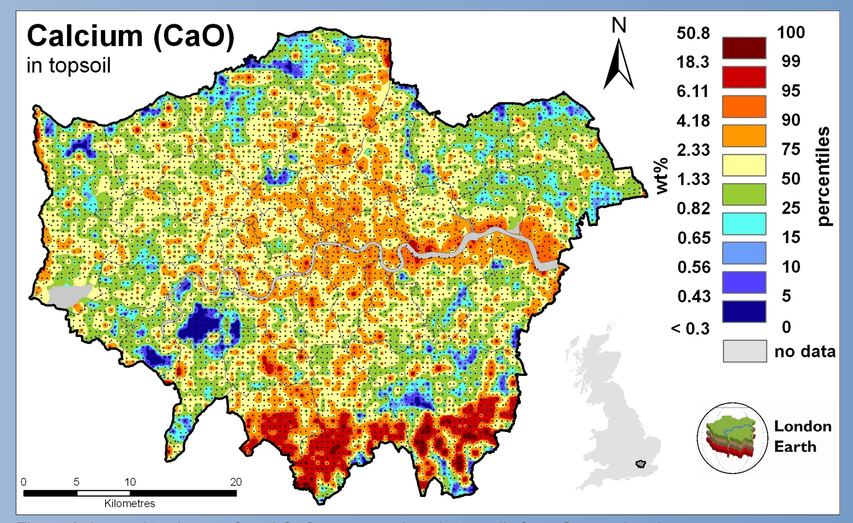

Figure 2. Interpolated map of total CaO concentrations in topsoils from Greater London.

Geogenic controls

Despite anthropogenic influences, a strong geological control on soil chemistry is observed for many elements. This is particularly evident in south London where high baseline concentrations of CaO (Fig. 2), Ce (Figs 4), I, La, Mn, Nd, P, Sr and Y relate to the outcrop of Cretaceous Chalk (Fig. 5 and 6). In the north-western quadrant of London and along the north-eastern boundary of the project area, high baseline concentrations for a number of elements such as Al, Ce (Fig. 4), Fe, Mg, K, Cr (Fig. 3), La, Ti, Ga, Rb and Ni) are associated with the outcrop of Palaeogene clays.

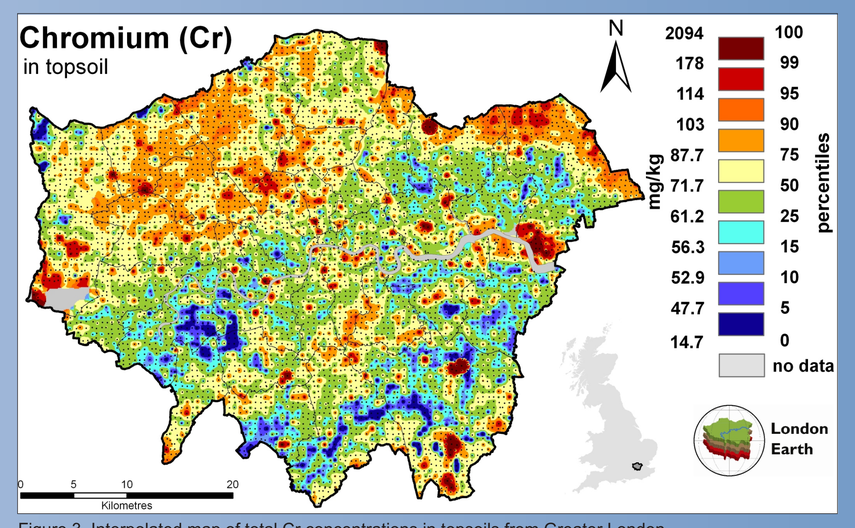

Figure 3. Interpolated map of total Cr concentrations in topsoils from Greater London.

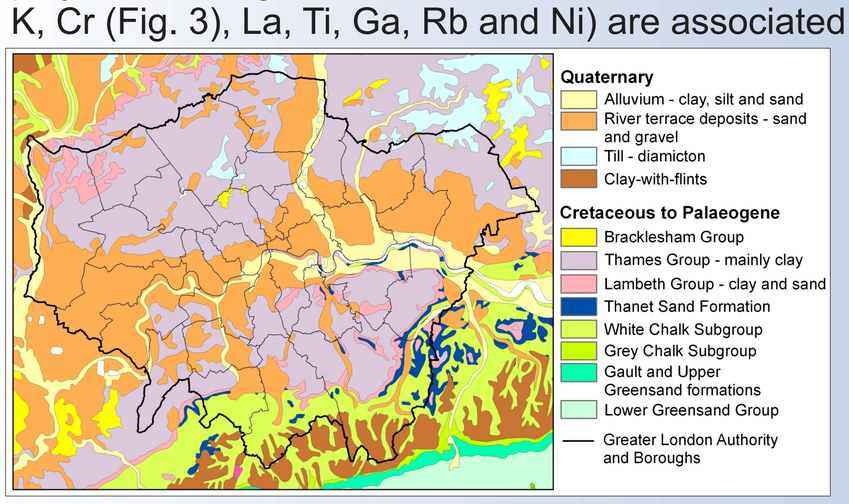

Figure 5. Superficial and bedrock geology of Greater London, scale 1:625 000

Pristine parks

One of the most interesting feature of the London Earth data are the consistently lower baseline concentrations of metals measured within the historic Royal Parks (Bushy and Richmond), Hampton Court and Wimbledon Common in south-west London (Fig. 7). Throughout the urban evolution of London these parks have avoided significant residential or industrial activity and remain free of imported soil, wastes or 'made ground'. Consequently, comparison of geochemical baselines, e.g. Ni (Fig. 7) within and outside the parks, where underlying geology is consistent, can help to provide an indication of long-term anthropogenic geochemical modification of London's soils.

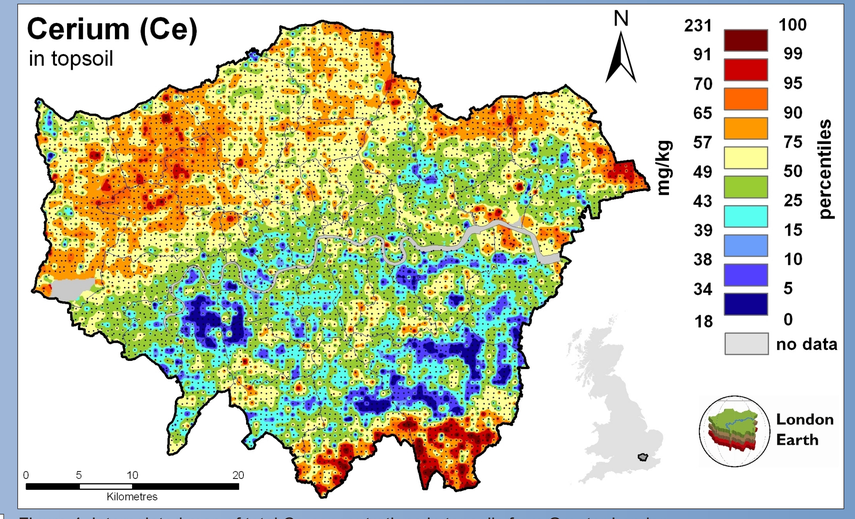

Figure 4. Interpolated map of total Ce concentrations in topsoils from Greater London.

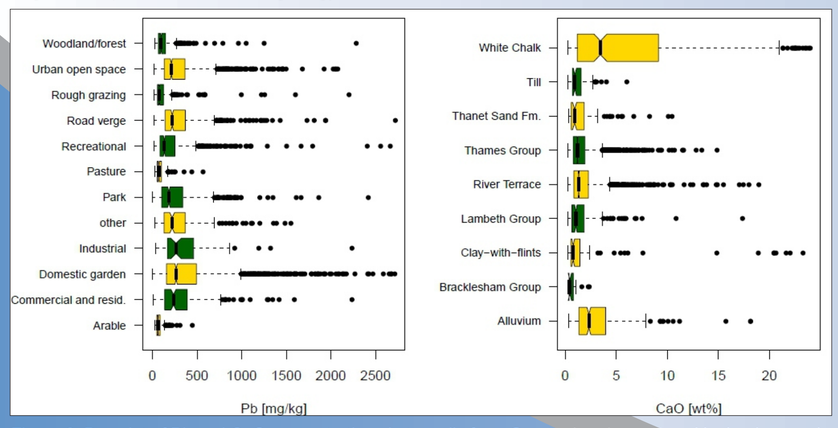

Figure 6. Box plot of Pb and CaO concentrations in topsoils from Greater London grouped by landuse and geology (Fig5) respectively.

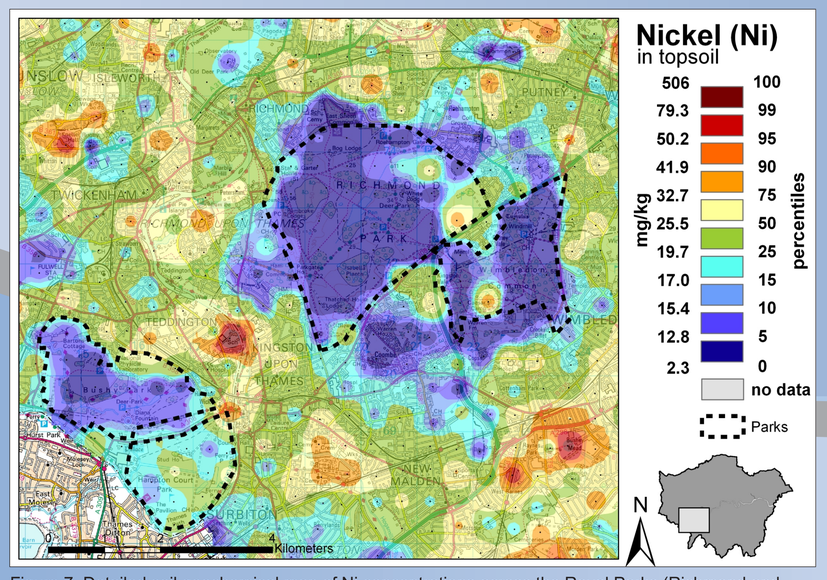

Figure 7. Detailed soil geochemical map of Ni concentrations across the Royal Parks (Richmond and Bushy), Hampton Court and Wimbledon Common in south-west London.

Conclusions

Soil baseline geochemical data from the London Earth project is a valuable resource to local government, environmental agencies, developers, academics and the general. It provides information on the background levels of over 50 chemical elements, many of which have potential health and environmental significance. More detailed local studies are required to assess any potential risks to health and environmental damage. However, the rural London Earth survey allows such studies to be put into their proper geogenic and anthropogenic context.

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For more information and to visit the London Earth soil geochemistry viewer go to www.bgs.ac.uk/gbase/londonearth