London Atlas: Overview

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Ferreira, A, Johnson, C C, Appleton, J D, Flight, D M A, Lister, T R, Knights, K V, Ander, L, Scheib, C, Scheib, A, Cave, M, Wragg, J, Fordyce, F and Lawley, R. 2017. London Region Atlas of Topsoil Geochemistry. *British Geological Survey*.

The London Region Atlas of Topsoil Geochemistry (LRA) is a further step towards understanding the chemical quality of soils in London, following a previous project called London Earth carried out by the British Geological Survey (BGS) (Johnson et al., 2010[1]). The main advantage of the LRA is that it includes soil geochemical data from the counties surrounding London; placing the city within the context of its rural hinterland, allowing assessments of the impact of urbanisation on soil quality.

The London Region Atlas of Topsoil Geochemistry is a product derived from the BGS Geochemical Baseline Survey of the Environment (G-BASE[2]) project. The London Region Geochemical Dataset (**LRD**, *n*=8400), on which the atlas is based, includes TOPSOIL data from two complementary surveys: i) the urban London Earth (LOND) and ii) the rural South East England (SEEN). The LRA covers the Greater London Authority (GLA) and its outskirts in a rectangular area of 80x62 km. This extends from British National Grid coordinates Easting 490000–570000, and Northing 153000–215000. The urban **LOND** and the rural **SEEN** surveys contribute with 6801 and 1599 samples respectively to the **LRD**.

The concentrations of 44 inorganic chemical elements (Al_2O_3, CaO, Fe_2O_3, K_2O, MgO, MnO, Na_2O, P_2O_5, SiO_2, TiO_2, Ag, As, Ba, Bi, Br, Cd, Ce, Co, Cr, Cs, Cu, Ga, Ge, Hf, I, La, Mo, Nb, Nd, Ni, Pb, Rb, Sb, Sc, Se, Sn, Sr, Th, U, V, W, Y, Zn and Zr), loss on ignition (LOI) and pH in topsoil are included in the LRA. For each element, a map showing the distribution in topsoil across the atlas area and a one-page sketch of descriptive statistics and graphs are presented. Statistics and graphs for whole dataset (**LRD**), London urban subset (**LOND**) and London surroundings rural subset (**SEEN**), as well as graphs of topsoil element concentrations over each simplified geology unit are shown.

The LRD has been used already in a study aiming to detect geogenic (geological) signatures and controls on soil chemistry in the London region (Appleton et al., 2013[3]). It includes maps showing the distribution of Al, Si, La and I (and Th, Ca, Mn, As, Pb and Zr in supplementary material) and it is concluded that the spatial distribution of a range of elements is primarily controlled by the rocks from where soil derives, and that these geogenic patterns are still recognisable inside the urban centre. Other studies have been done that are based on data in the **LRD**, namely using the **LOND** subset or part of it. The main focus of these studies was the mercury content (Scheib et al., 2010[4]), the influence of land use on geochemistry (Knights and Scheib, 2011[5]; Lark and Scheib, 2013[6]); the bioaccessibility of pollutants such as As and Pb (Appleton et al., 2012[7]; Appleton et al., 2012[8]; Cave, 2012[9]; Appleton et al., 2013[10]; Cave et al., 2013[11]) and the lability of lead in soils (Mao et al., 2014[12]); the determination of normal background concentrations of contaminants in English soil (Ander et al., 2013[13]) and the contribution of geochemical and other environmental data to the future of the cities (Ludden et al., 2015[14]).

The London Region Atlas of Topsoil Geochemistry formally presents detailed information for all chemical elements in the **LRD**. This information can be easily visualised and elements compared as its production and layout is standardised. Differences in topsoil element concentrations between the centre of the city and its outskirts can be assessed by observing the map and comparing statistics and graphs reported for the **LOND** and **SEEN** subsets respectively. This urban/rural contrast is

particularly evident for elements such as Pb, Sb, Sn, Cu and Zn, for which mean concentrations in the urban environment are two to three times higher than those observed in the rural environment. This is a typical indicator suite of urban soil pollution reported in several other cities in the UK also (Fordyce et al., 2005[15]).

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