The British Geological Survey’s Geochemical Baseline Survey of the Environment (G-BASE[^1]) project systematically maps the distribution of inorganic chemical elements in the surface environment of Great Britain (Johnson et al., 2005[^2]) to help characterise land quality. This systematic and high-resolution geochemical baseline mapping, completed in 2015, was initially based on drainage samples collected from low order streams (Plant, 1971[^3]) but has since been expanded to include soils. The work started in the late 1960s in northern Britain and was primarily concerned with mineral exploration. Since commencement, the geochemical mapping has progressed southwards. It is now principally focused on underpinning research projects, supporting stakeholders, and work on maintaining sustainable and healthy environments, particularly since the project’s remit was expanded to include the mapping of urban areas in the 1990s (Fordyce et al., 2005[^4]; Johnson and Ander, 2008[^5]; Flight and Scheib, 2011[^6]). The systematically collected rural and urban G-BASE[^1] soil database available for England is summarised in Figure 1 and the area covered by this atlas is indicated on this figure. Separate to the G-BASE[^1] survey, the National Soil Inventory (NSI[^7]) samples were collected by the Soil Survey of England and Wales. These were re-analysed by X-ray fluorescence spectrometry (XRFS) in the BGS laboratories to be compatible with the G-BASE[^1] dataset and reported by Rawlins et al. (2012)[^8]. The NSI[^7] samples were collected at a low density (1 site every 25 km²) and not from urban areas. With the high density G-BASE[^1] samples available for the London region there was no need to include the low density NSI[^7] samples in this atlas. For the last G-BASE rural survey (SSEEN) carried out in 2014/2015 (Figure 1, sample sites in blue), a lower sampling density was used. These samples were not used for this atlas, as the dataset here was compiled before the SSEEN results were available.
Figure 1 Map showing the distribution of systematically collected topsoil samples from England (until 2015) with the area covered by this atlas shown by the red rectangle around London. NSI (XRFS) covers the whole of England at a sample density of 1:25 km$^2$. G-BASE sampling densities for rural and urban are 1:2 km$^2$ and 4:1 km$^2$, respectively, except for the 2014 survey (in blue). Only G-BASE samples collected previous to 2014 are used in this atlas. (P929857).

By 2005 the geochemical survey had reached the outskirts of northern London and sampling in urban areas of London commenced with priority given to the area proposed for the main Olympic
site at Stratford. After sampling in some south Essex urban centres (Scheib and Brown, 2005\textsuperscript{[9]}, Scheib et al., 2006\textsuperscript{[10]}), a project sampling soils of the Greater London Authority area (GLA), known as the London Earth\textsuperscript{[11]} project, commenced in 2008 and was completed in 2009 (Johnson et al., 2010\textsuperscript{[12]}). Soils were collected from over 6000 sites across London at a density of four sites for every British National Grid (BNG) kilometre square (Knights and Scheib, 2010\textsuperscript{[13]} and Table 1). The GLA has an area of 1579 km\textsuperscript{2} (607 sq mi) and in 2011, was reported to contain a population of 8.2 million (ONS, 2012\textsuperscript{[14]}). The London Earth\textsuperscript{[11]} project represents the world’s largest systematic geochemical survey of an urban area.

Table 1 Details of the number of soil samples collected from each London local government district and urban centres in south Essex, 2005–2009 (after Knights and Scheib, 2010\textsuperscript{[15]})

<table>
<thead>
<tr>
<th>London local government districts</th>
<th>Sample sites</th>
<th>Date of sampling</th>
<th>London local government districts</th>
<th>Sample sites</th>
<th>Date of sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barnet</td>
<td>354</td>
<td>2008</td>
<td>Lewisham</td>
<td>143</td>
<td>2009</td>
</tr>
<tr>
<td>Bexley</td>
<td>269</td>
<td>2009</td>
<td>Merton</td>
<td>155</td>
<td>2009</td>
</tr>
<tr>
<td>Brent</td>
<td>176</td>
<td>2008</td>
<td>Newham</td>
<td>164</td>
<td>2006 &amp; 2008</td>
</tr>
<tr>
<td>Bromley</td>
<td>610</td>
<td>2009</td>
<td>Redbridge</td>
<td>233</td>
<td>2008</td>
</tr>
<tr>
<td>Camden</td>
<td>92</td>
<td>2008</td>
<td>Richmond upon Thames</td>
<td>247</td>
<td>2009</td>
</tr>
<tr>
<td>City of London</td>
<td>16</td>
<td>2008</td>
<td>Royal Borough of Kensington and Chelsea</td>
<td>57</td>
<td>2008</td>
</tr>
<tr>
<td>City of Westminster</td>
<td>87</td>
<td>2008</td>
<td>Royal Borough of Kingston upon Thames</td>
<td>149</td>
<td>2009</td>
</tr>
<tr>
<td>Croydon</td>
<td>353</td>
<td>2009</td>
<td>Southwark</td>
<td>106</td>
<td>2009</td>
</tr>
<tr>
<td>Ealing</td>
<td>227</td>
<td>2008</td>
<td>Sutton</td>
<td>181</td>
<td>2009</td>
</tr>
<tr>
<td>Enfield</td>
<td>325</td>
<td>2008</td>
<td>Tower Hamlets</td>
<td>87</td>
<td>2006 &amp; 2008</td>
</tr>
<tr>
<td>Hackney</td>
<td>75</td>
<td>2006 &amp; 2008</td>
<td>Wandsworth</td>
<td>146</td>
<td>2009</td>
</tr>
<tr>
<td>Hammersmith and Fulham</td>
<td>69</td>
<td>2008</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Haringey</td>
<td>118</td>
<td>2008</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harrow</td>
<td>206</td>
<td>2008</td>
<td>Basildon</td>
<td>115</td>
<td>2005</td>
</tr>
<tr>
<td>Hornsby</td>
<td>234</td>
<td>2008 &amp; 2009</td>
<td>Southend-on-Sea</td>
<td>271</td>
<td>2006</td>
</tr>
<tr>
<td>Islington</td>
<td>63</td>
<td>2008</td>
<td>Stanford-le-Hope and Shell Haven</td>
<td>51</td>
<td>2006</td>
</tr>
</tbody>
</table>

South Essex urban centres

| Grays and Tilbury               | 180         | 2005 & 2006 |
| Southend-on-Sea                 | 271         | 2006           |
| Stanford-le-Hope and Shell Haven | 51          | 2006           |

A selection of geochemical maps showing element concentrations in topsoil for the GLA area were published online in 2011 as part of the London Earth\textsuperscript{[11]} project and the database of soil results made publicly available (Johnson et al., 2011\textsuperscript{[16]}). In addition to sampling urban areas, the G-BASE\textsuperscript{[1]} project has continued to collect soils from rural areas at a density of 1 site every 2 km\textsuperscript{2} using the same sampling and analytical methods as used in the urban area. The region around the GLA has, therefore, been sampled also (Figure 2). As a result, in this atlas it is possible to study the London soils in the context of surrounding rural areas, so that the impact of urbanisation on the geochemical baseline can be determined. The atlas provides details of the sampling and analytical methodology along with initial data exploration to accompany a set of extrapolated grid geochemical maps for
each soil element created using the parent-material polygon-mapping method described by Appleton and Adlam (2012)\cite{1}. The data exploration is reported here and is seen as a resource and catalyst for further research on the surface chemical environment of London.

Figure 2 Map showing the topsoil sample locations in the London Region. (P929858).

References

1. \cite{1} Geochemical Baseline Survey of the Environment (G-BASE)
   \url{http://www.bgs.ac.uk/gbase/home.html}
8. NSI | Soils Summary Information
   http://www.bgs.ac.uk/gbase/sampleindexmaps/soilnsi.html

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