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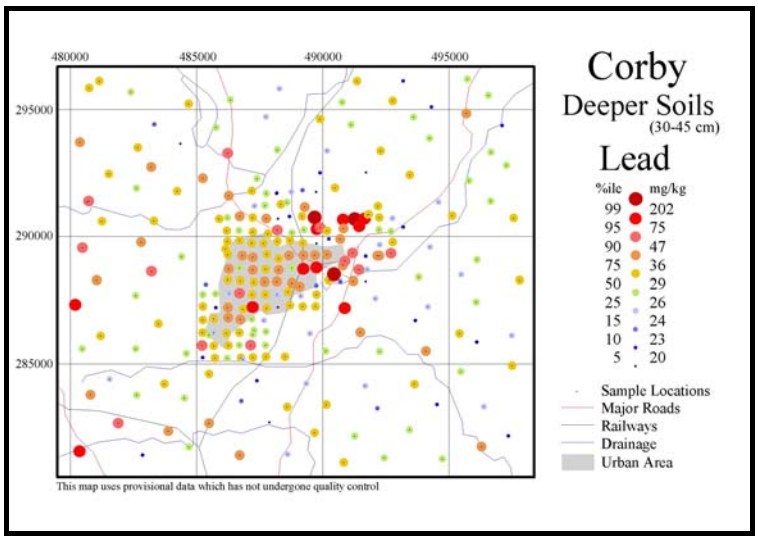
Presentation of lead and zinc data from soil geochemical surveys of the urban area of Corby and surrounding rural land

Environmental Protection Programme

Internal Report IR/04/095



BRITISH GEOLOGICAL SURVEY

INTERNAL REPORT IR/04/095

Presentation of provisional lead and zinc data from soil geochemical surveys of the urban area of Corby and surrounding rural land

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Key words

lead, zinc, soil, geochemistry, Corby.

Front cover

Figure showing lead in deeper Corby soils

Bibliographical reference

B. G. RAWLINS & K. E. O'DONNELL. 2004. Presentation of provisional lead and zinc data from soil geochemical surveys of the urban area of Corby and surrounding rural land. *British Geological Survey Internal Report*, IR/04/095. 11pp.

Keyworth, Nottingham British Geological Survey 2004

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Acknowledgements

The authors would like to acknowledge the contributions of all BGS staff and student volunteer workers involved in collection and analysis of G-BASE and GSUE soil samples, and Dr Chris Johnson for reviewing an initial draft of the report.

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Summary

Soil geochemical data recently released in a provisional form by the British Geological Survey may have implications for a legal case relating to the transfer of toxic waste in the town of Corby, Northamptonshire, UK. The BGS soil geochemical survey of Corby and surrounding rural land was undertaken in 1998, shortly after the transfer of the toxic waste (enriched in lead and zinc) was completed - according to information in the public domain. The BGS soil geochemistry data may therefore have relevance to the legal case. This report comprises a brief statistical summary and maps of the provisional data for lead and zinc, both in the urban area and the surrounding rural land. To date, the BGS has not undertaken any interpretation of the soil geochemical data presented in this report.

1 Introduction

A number of claimants are currently preparing a legal case in an attempt to demonstrate that limb deformities in a number of young children were caused by the alleged mismanagement of toxic waste by Corby Borough Council. BGS understands that the toxic waste was enriched in two metals (lead and zinc), and that the concentration and distributions of these elements in soil throughout the area may be relevant to any ensuing legal case (Verkaik, 2004).

During the summer months of 1998, the British Geological Survey undertook soil sampling throughout the urban area of Corby (Northamptonshire) and surrounding rural land as part of its G-BASE (Geochemical Baseline Survey of the Environment) project (see www.bgs.ac.uk/gbase). The British Geological Survey have also undertaken sampling of several other urban centres throughout the East Midlands including Nottingham, Derby, Kettering and Peterborough. It is anticipated that the data for these centres will be published by BGS in a standard report format before April 2005. Full details of the progress of sampling and analysis of all sample media (stream sediment, soil and stream water) are available on the G-BASE website (see above). This preliminary presentation of the soil chemical data for lead and zinc has been prepared in advance due to the potential public interest.

Given that the toxic waste at issue in the legal claims was apparently transported across the town over a period of several years up to 1997, results from the soil survey of this entire area may hold valuable information on:

1. the typical or background concentrations of potentially toxic elements in the soil for this area
2. typical or atypical patterns in the distribution of these elements

All the soil samples have been analysed for their total concentration of a broad range of potentially toxic elements, including As (arsenic), Cd (cadmium), Ni (nickel), Pb (lead) and Zn (zinc). At the time of writing (May 2004), the chemical data are provisional; they have not at this time been subject to the final stages of quality control during which minor adjustments are sometimes made to the concentrations of certain elements to ensure consistency with the other data released by the G-BASE project. However, it is our view they are suitable for use in a preliminary assessment of their worth in a future legal case.

The aim of this report is to provide an overview of the data in the form of a statistical summary and basic geochemical maps for Pb and Zn.

2 Soil sampling and chemical analysis

A total of 144 samples of soil were collected from two depth ranges (topsoil:0-15 cm, deeper soil: 30-45 cm) throughout the urban area of Corby. In addition, a series of soil samples were collected across the deeper depth range in the surrounding rural areas. In this preliminary assessment we have incorporated the analysis of 142 of these rural samples to provide an indication of local background concentrations in the rural environment around Corby. Although further information is recorded at each sampling site on the presence of any anthropogenic (extraneous) material in the soil samples (e.g. plastic, unusual particles etc), it was beyond the scope of this report to include such information.

2.1 URBAN SOIL SAMPLING PROTOCOL

In the urban survey, four sample sites were located within each National Grid one km square on 1:25,000 topographic Ordnance Survey map. Sample sites are notionally located at the centre of each the four 500 metre x 500 metre sub-cells within the kilometre square. Sampling is carried out on the least disturbed area of un-built ground close to the centre of each cell. This may be domestic gardens, allotments, parks, recreational ground, or, in the worst instance, a road verge or made ground. At each site a topsoil sample (0-15 cm depth) was taken from five holes augered at the corners and centre of a square with a side of length 20 metres using a hand auger and combined to form a bulked sample weighing around half a kilogram. Further deeper samples were collected in each auger hole at a depth of between 30 and 45 cm, and combined to form a bulked sample.

2.2 RURAL SOIL SAMPLING PROTOCOL

Sample sites were chosen from every second kilometre square of the British National Grid by simple random selection within each square, subject to the avoidance of roads, tracks, railways, domestic and public and gardens, and other seriously disturbed ground. At each site a deep soil sample (30-45 cm depth) was taken from five holes augered at the corners and centre of a square with a side of length 20 metres using a hand auger and combined to form a bulked sample weighing around half a kilogram. Topsoil samples (0-15 cm) were also collected at each site though these have not been routinely analysed and are kept stored for future reference.

2.3 CHEMICAL ANALYSIS

All samples of soil were dried and disaggregated; the topsoil samples were sieved to pass through a 2 mm sieve, the deeper samples were sieved to a smaller size fraction (150 microns). From each sample a 50-g sub-sample was ground in an agate planetary ball mill and pressed into pellets. The total concentrations of numerous major and trace elements (including Pb and Zn) were determined in each pellet by energy and wavelength dispersive XRFS (X-Ray Fluorescence Spectromerty).

3 Statistical summary

Summary statistics for the rural and urban geochemical data are presented in Table 1.

Table 1 – Summary statistics for the three soil sample types. All concentration values in milligrams per kilogram (mg/kg).

	Urban Topsoil (0-15 cm)		Urban deeper soil (30-45 cm)		Rural deeper soil (30-45cm)	
Element	Zn	Pb	Zn	Pb	Zn	Pb
Minimum	59	17	27	15	36	14
Maximum	*>2000	449	*>2000	1373	699	144
Mean	164	51	160	50	110	33
Median	112	37	107	32	99	28
Standard Deviation	211	48	230	117	70	18
†Number of outlying values	3	2	2	1	2	3
Number of samples	144	144	142	142	131	131

* estimated value

† denotes the number of samples with concentrations greater than the mean plus three standard deviations – a method often used to denote unusually large values in a distribution

4 Soil geochemical maps

In this report, we have presented the data in the form of simple proportional symbol maps showing the concentration of elements in soil samples at specific locations. To date, the BGS has not undertaken any interpretation of the geochemical data presented in this report.

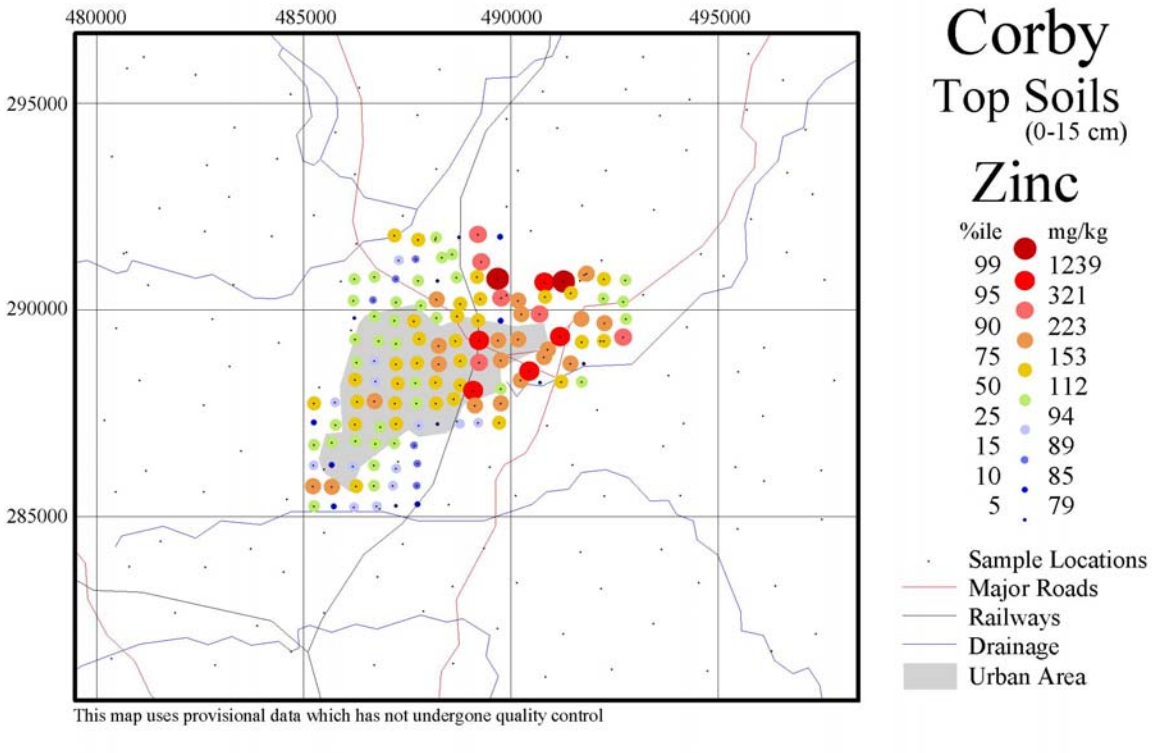

Figure 1 – Proportional symbol map showing the total concentration of Zn in urban topsoil of Corby (provisional data)

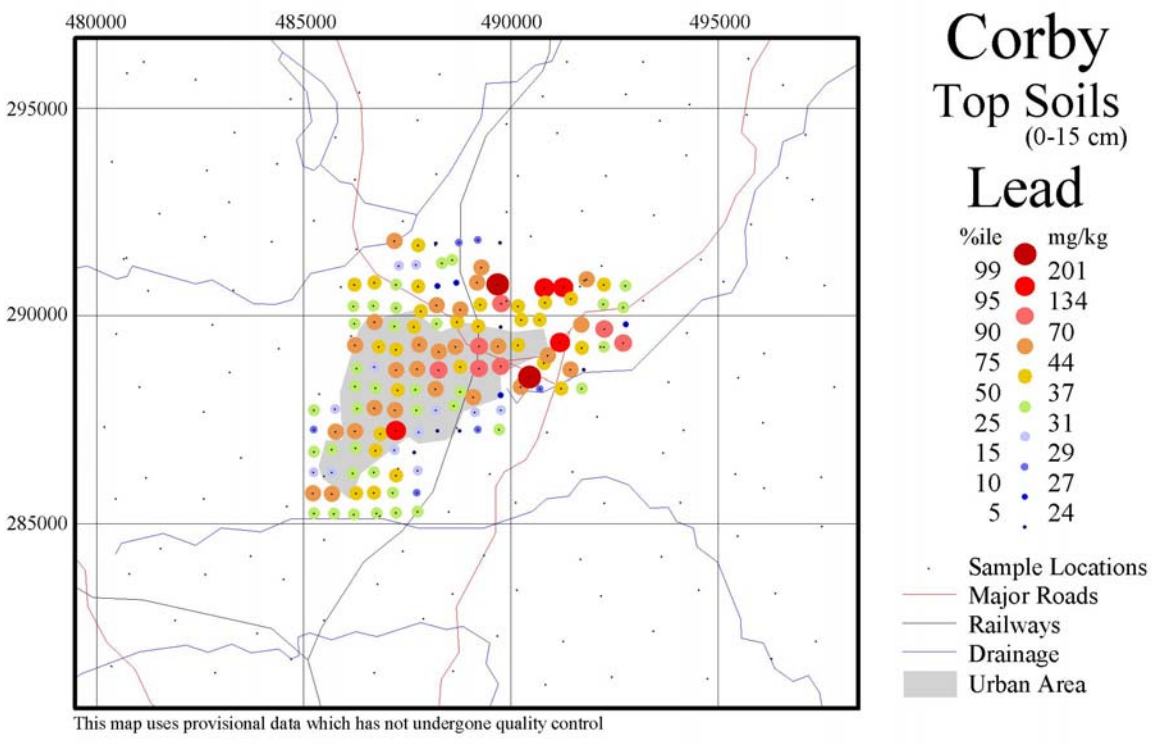

Figure 2 – Proportional symbol map showing the total concentration of Pb in urban topsoil of Corby (provisional data)

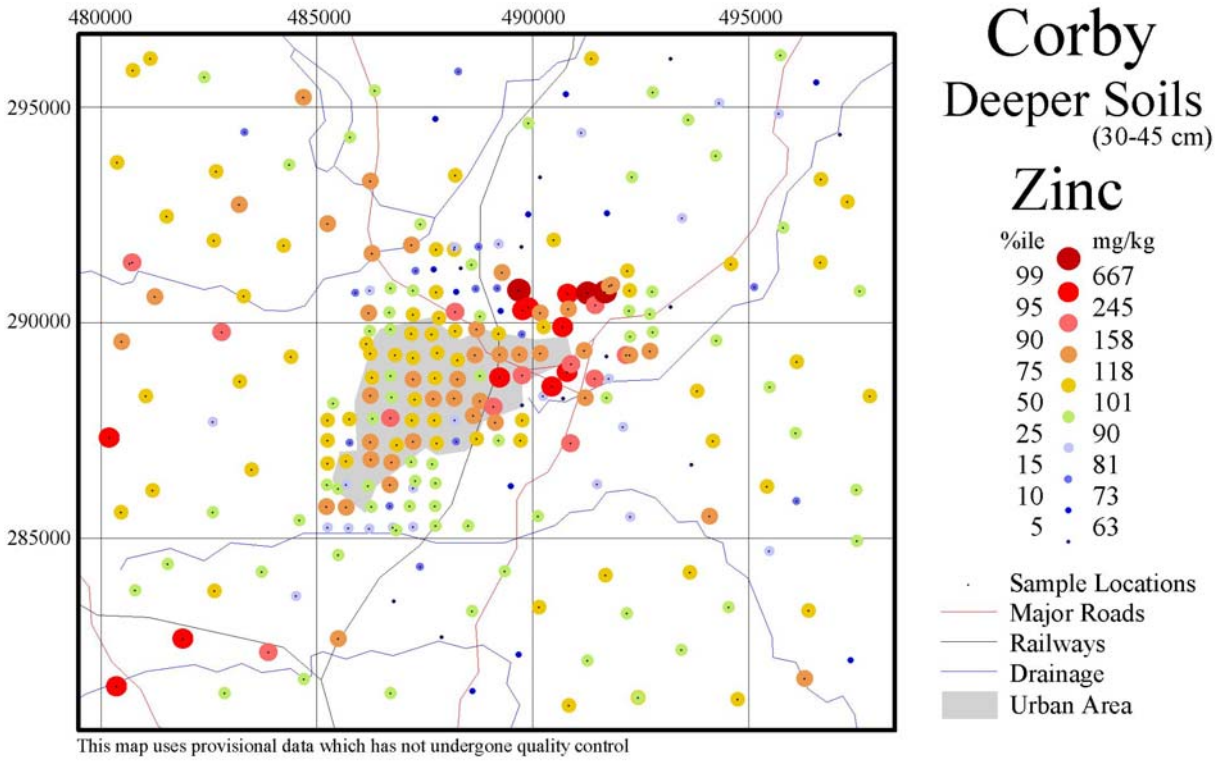

Figure 3 – Proportional symbol map showing the total concentration of Zn in deeper soils from the urban area of Corby and surrounding rural land (provisional data)

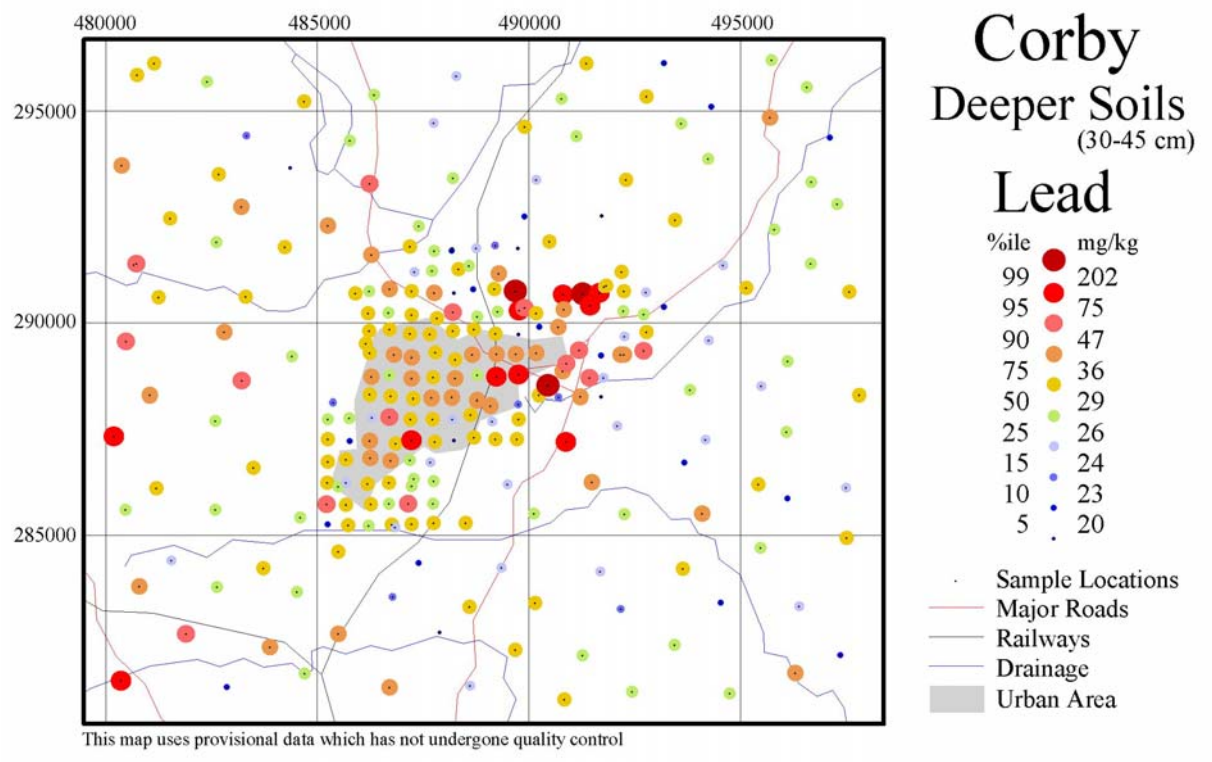

Figure 4 - Proportional symbol map showing the total concentration of Pb in deeper soils from the urban area of Corby and surrounding rural land (provisional data)

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