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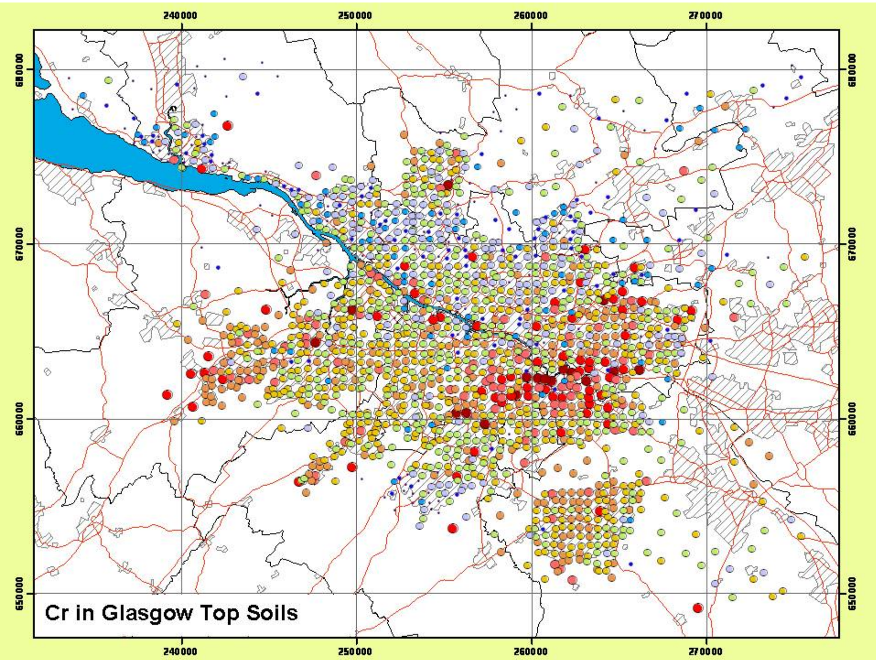
# Urban Soil Geochemistry of Glasgow - Appendices 1 and 2 Methods, Tables and Figures

Land Use Planning and Development Programme

Open Report OR/08/002



BRITISH GEOLOGICAL SURVEY

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# Urban Soil Geochemistry of Glasgow - Appendices 1 and 2 Methods, Tables and Figures

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Map showing the distribution of chromium in Glasgow top soils (blue-red symbols = low-high Cr content).

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# Guide to Report Layout

This report describes the British Geological Survey (BGS) urban soil geochemical survey of Glasgow and is presented in three volumes as follows:

**Urban Soil Geochemistry of Glasgow – Main Report**

- Summary of the Glasgow soil geochemical survey
- Project description, data interpretation, conclusions and bibliography

**Urban Soil Geochemistry of Glasgow – Appendices 1 and 2 Methods, Tables and Figures**

- The data collection, analysis and interpretation methods employed by the survey
- Presentation of the tables and figures referred to in the Main Report.

**Urban Soil Geochemistry of Glasgow – Appendices 3-6 Geochemical Maps**

- Presentation of geochemical maps of parameter concentrations in Glasgow top and deeper soils referred to in the Main Report

The Appendices 1 and 2 volume presented here should be read in conjunction with the Main Report.

# Contents

**TABLES**

**FIGURES**

# Glossary – Appendices 1 and 2

The acronyms used in this report are fully listed in the Main Report volume. Those referred to in Appendices 1 and 2 are also listed here.

| | |
|---|---|
| ANOVA | Analysis of Variance |
| BGS | British Geological Survey |
| CLEA | Contaminated Land Exposure Assessment |
| EA | Environment Agency (England and Wales) |
| ED-XRFS | Energy Dispersive X-ray Fluorescence Spectrometry |
| ESRI | Environmental Systems Research Institute |
| G-BASE | Geochemical Baseline Survey of the Environment |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| GSNI | Geological Survey of Northern Ireland |
| ICRCL | Interdepartmental Committee for the Redevelopment of Contaminated Land |
| LLD | Lower Limits of Detection |
| LLR | Lower Limits of Reporting |
| LOI | Loss on Ignition |
| MAC | Maximum Admissible Concentration |
| OS | Ordnance Survey |
| RM | Reference Material |
| SEPA | Scottish Environment Protection Agency |
| SGV | Soil Guideline Value |
| SSL | Soil Screening Level |
| SSV | Soil Screening Value |
| UK | United Kingdom |
| ULR | Upper Limits of Reporting |
| US-EPA | United States Environmental Protection Agency |
| VROM | Dutch Ministry of Housing, Spatial Planning and Environment |
| WD-XRFS | Wavelength Dispersive X-ray Fluorescence Spectrometry |
| XRFS | X-ray Fluorescence Spectrometry |

# Appendix 1 Urban Soil Geochemical Survey Methods

## A1.1 INTRODUCTION

Geochemical surveys rely on carefully devised sampling, error control, analytical standards, and protocols to ensure data quality and consistency and to provide the best possible estimate of likely element concentrations in the surface environment (Johnson, 2005). In the urban environment, ground investigation reports frequently contain analytical data on the chemical composition of different sites. However, in order to compare data from different surveys it is important to know the sampling and analytical methods used so that the likely effects, if any, of the survey procedures on the analytical outcome can be assessed. For example, many metals are concentrated in the fine clay material in soils; therefore if a fine fraction of the soil is analysed, this will invariably return much higher metal concentrations than an analysis of the coarse fraction. This section outlines the standardised methods used to generate data in the geochemical soil survey of Glasgow.

## A1.2 SAMPLE COLLECTION

Following the standard Geochemical Baseline Survey of the Environment (G-BASE) sampling methodology (Johnson, 2005), 1381 soil samples were collected at a density of 4 per $km^2$ in the Glasgow urban area during summer 2001 (Figure 3.1). Within the sampled area, each 1 kilometre national grid-square on 1: 25 000 scale Ordnance Survey (OS) maps was subdivided into four sub-squares with 500 m x 500 m dimensions. A soil sample was collected as close as possible to the centre point of each 500 m square accepting access and ground characteristic limitations. Common sites for collection included gardens, parks, road verges, open spaces, school yards, sports fields and waste ground. The urban area was defined as the limit of the built environment of Dumbarton, Glasgow, Paisley, Johnson and East Kilbride as shown on OS 1: 25 000 scale maps.

In addition to establishing the urban geochemistry, the project aimed to characterise the rural environment around Glasgow for comparison with the built-up area. However, due to access restrictions in place during the foot and mouth epidemic, it was not possible to survey the rural environment during 2001. Hence, this survey was carried out during summer 2002 and involved the collection of 241 rural soil samples at a density of 1 per 2 $km^2$ according to standard G-BASE procedures (Johnson, 2005). In rural areas, geology is the dominant control on surface geochemical distributions (Rawlins et al., 2003). To make direct comparisons between the rural and urban environments it was important to survey soils developed over the same Carboniferous lithologies that underlie much of Glasgow. However, the size of the rural survey was restricted by project funds to approximately 240 sample sites and with this limited number of sites, it was not possible to design a sampling strategy to give both statistically significant information over the main lithologies of the area and a uniform area of coverage around the city. Therefore, the rural survey extends further to the north-east and south-east of Glasgow over the Carboniferous lithologies in these areas than it does over the Clyde Plateau Volcanic Formation, which lies immediately to the north and south of the urban area in the Campsie and Renfrew Hills (Figure 3.1).

Sampling was carried out by a team of 8 - 10 university students led by BGS staff members. The teams worked in pairs but were interchanged daily to reduce the possibility of sampling bias being introduced by the use of individual procedures.

At each site, two separate soil samples, a top and a deeper sample each of approximately 250 g of unsieved material were collected using a handheld Dutch auger. This sampling strategy provides information on the chemistry of near-surface soils, which may be influenced by atmospheric pollution, and of deeper soils, which should more closely represent substrate materials at each site. Each sample was a composite of five sub-samples collected from the corners and centre of a 20 x 20 m square (Figure A1.1). The top few centimetres of surface vegetation was discarded and sub-samples from standard depths of 5 – 20 cm for top soils and 35 – 50 cm for deeper soils collected. The sub-samples were homogenised to form one top sample and one deeper sample from each site. The top samples were coded 'A' and the deeper samples coded 'S' upon collection. Observations of soil colour, depth and clast lithology and abundance were also recorded at site, and the samples were classified into seven textural groups (gravel, sand, sandy-silt, silt, silty-clay, sandy-clay and clay) (Johnson, 2005) (Table A1.1).

At each sample site, information on the location, geology, contamination, land use and other features required for data interpretation was entered on a computer-compatible field data card in standard BGS format (Table A1.1). Locations were determined using a Garmin-12® global positioning system unit (GPS) and were plotted on master copies of the 1: 25 000 and 1: 50 000 OS maps at the end of sampling (Johnson, 2005). The field cards were pre-numbered according to a random number system (see Section A1.4.1 of this report). The area codes for the Glasgow urban and rural surveys were 61 and 62 respectively and each site was assigned a 4-digit randomised number in sample batches of 100.

For quality assurance purposes, two sets of field duplicates per batch of 100 samples were collected in the same way as the original samples a few meters away from the original sites, following standard G-BASE procedures (Johnson, 2005).

## A1.3 ANALYTICAL METHODS

### A1.3.1 Sample Preparation

Following collection, the soils were air and oven-dried at <30 °C to prevent the volatilisation of Se. Samples were dry-sieved through nylon mesh to a <2 mm size fraction. The samples were then homogenised, coned and quartered and sub-samples taken for analyses. A 10 g split was taken for pH analysis and a further 2 g split for loss on ignition (LOI). A 30 g sub-sample was ground in an agate planetary ball mill until 95% was <53 µm. This pulverised material was further sub-sampled to obtain a 12 g split for element analysis by X-ray Fluorescence Spectrometry (XRFS).

XRFS pellets were prepared by grinding the 12 g aliquot of milled material with 3 g of binder for 3 minutes in an agate planetary ball mill. This mixture was then pressed into a 40 mm diameter pellet at 250 kN using a Herzog (HTP-40) semi-automatic press. The binder consists of 9 parts EMU120FD styrene co-polymer (BASF plc) and 1 part Ceridust 3620, a micronised polyethylene wax (Hoechst), after Van Zyl (1982).

Once preparation was completed, sample residue materials were stored in the G-BASE sample archive where they form part of the BGS National Geoscience Data Centre collection.

### A1.3.2 X-ray Fluorescence Spectrometry (XRFS) Analysis

Major, minor and trace element determinations were carried out by Wavelength-Dispersive X-ray Fluorescence Spectrometry (WD-XRFS) (Ingham and Vrebos, 1994) and Energy-Dispersive X-ray Fluorescence Spectrometry (ED-XRFS).

Two Philips PW2400 sequential WD-XRFS fitted with rhodium-anode X-ray tubes (3 kW 60 kV) were used for $Na_2O$, MgO, $Al_2O_3$, $SiO_2$, $P_2O_5$, $K_2O$, CaO, $TiO_2$, MnO, $Fe_2O_3$, Sc, V, Cr, Co, Cs, Ba, La, Ce, Nd and Sm as one suite and Ni, Cu, Zn, Ga, Ge, As, Se, Br, Rb, Sr, Y, Zr, Nb, Mo, Hf, Ta, W, Tl, Pb, Bi, Th and U as another. Concentrations of the major elements are expressed as oxide weight percent. The full configurations of the instruments are given in Tables A1.2 and A1.3. The Philips spectrometers were controlled using Philips SuperQ application software package, version 3.0H, running under a MicroSoft ™ Windows2000 operating system.

Each pellet was irradiated by X-rays, which induce secondary X-ray fluorescence of the atoms within the sample. This secondary radiation was collimated onto a diffraction crystal and its intensity at selected peak and background positions in the X ray spectrum was measured using either a proportional gas flow or a scintillation detector mounted on a goniometer.

The net intensity at each of the peak positions was calibrated against known synthetic standards and Reference Materials (RMs). Calibrations were performed using the manufacturer's calibration algorithms and making corrections for matrix effects and spectral line overlap interferences listed in Table A1.3. Trace elements whose characteristic X-ray lines lie on the long-wavelength side of the Fe absorption edge (Sc, V, Cr, Cs, Ba, La, Ce, Nd and Sm) are affected by absorption from major elements (Fe, Mn and Ti), and this absorption is not corrected for by this calibration method. Therefore, the results for these trace elements are not as accurate as those for others.

The calibration lines were established using numerous RMs, placing the slope to give the best fit through the average of the predominantly silicate RMs. If the sample composition differs widely from this average it may produce erroneous results. The elements Ni, Cu, Zn, Sr, Zr, Ba and Pb, which are usually present at trace levels, will cause interference if they are present at concentrations above approximately 0.5%, leading to uncorrected errors in most analytes.

A Spectro X-LAB2000 ED-XRFS fitted with a palladium-anode X-ray tube (400 W 54 kV) was used for Ag, Cd, Sn, Sb, Te and I. The Spectro X-LAB2000 was controlled using an X-LABPRO application software package, version 2.4, running under a MicroSoft ™ Windows2000 operating system.

In the ED-XRFS, the primary X-radiation is scattered off a secondary or polarisation target, which is used to optimise the effectiveness of the exciting X-radiation and to minimise the spectral background. Three different secondary/polarisation targets are used to give optimal coverage of 52 elements from Na to U; all elements are measured to improve the accuracy of the corrections on the analytes of interest. As in WD-XRFS, the atoms within the sample emit characteristic X-radiation and rather than being diffracted and the whole of the emitted X-ray spectrum is detected simultaneously using a Si (Li) detector. The acquired spectrum is de-convoluted then evaluated using a calibration prepared by the instrument manufacturer, making corrections for matrix effects and spectral line overlap interferences.

For both WD-XRFS and ED-XRFS, mineralogical and particle-size effects contribute to the overall analytical error. The calibrations were validated by analysis of RMs and regularly corrected for instrumental drift.

The lower limits of detection (LLD) are shown in Table A1.4 with lower limits of reporting (LLR) for the major elements and upper reporting limits (ULR) based on the calibration standard or validation RM with the highest concentration. The LLDs are theoretical values for the concentration equivalent to three standard deviations above the background count rate for the analyte in a silica matrix. High instrumental stability results in practical values for these materials approaching the theoretical detection limit.

Individual results are not reliable below the quoted lower limits, but reliable estimates of average or typical values over an area may be obtained at lower levels of concentration; meaningful patterns may thus be recognised for some elements at levels lower than the LLD and LRL. Reliability also decreases above the ULR, but results do, nevertheless, give an indication of the concentration in the sample. Results outside the limits were therefore reported and entered into the database.

### A1.3.3 Soil pH

Soil pH was determined by adding 10 g of <2 mm sample to 25 ml of 0.01M $CaCl_2.2H_2O$ (calcium chloride). The mixture was shaken to form a slurry prior to analysis by pH electrode. This method of pH determination generally gives lower results (0.5 pH units) than water-based methods (Rowell, 1994).

### A1.3.4 Soil Loss on Ignition (LOI)

LOI was determined on 2 g of <2 mm material heated in a furnace and kept at 450 °C for a minimum of 4 hours. The LOI is percentage difference in weight before and after heating.

## A1.4 ERROR CONTROL AND DATA QUALITY

### A1.4.1 Field and Laboratory

Systematic error in analysis was monitored using a method based on randomised sample site numbers (Plant, 1973). Samples were collected in random number order but analysed in sequential order so that any within-batch analytical instrument drift can be distinguished from genuine geographic variances. No within-batch analytical drift problems were evident in the samples.

Rigorous field-based control procedures at each stage of the sampling process are designed to minimise error (Johnson, 2005). Long-term analytical drift between batches of samples was monitored using a series of standards representing a range of concentration for each element. The standards included several bulk soil samples collected over representative rock types, three of which were analysed in every batch of 100 samples. Time versus concentration plots for each of these reference samples were prepared. Tolerance limits arbitrarily set at the mean ± 2σ were used to assess data quality. Simple arithmetic correlations were applied to normalise the data to the rest of the UK geochemistry database for systematic drift (Lister and Johnson, 2005). Those applied to the Glasgow soils datasets are outlined in Table A1.5. No normalisation of Ag or Cd was attempted due to sub-detection levels of these elements in the G-BASE reference standards.

Variability in the sampling and analytical methods was monitored by means of field and analytical duplicate samples and analytical standards. Values below the lower limit of detection were assigned to a value of one half of the detection limit and all field duplicate sample results removed prior to statistical treatment according to standard G-BASE procedures (Lister and Johnson, 2005).

G-BASE reference standards S13B, S15B, S23B and S57A were included in the XRFS analytical runs and results demonstrate good accuracy of the data compared to reference values (Table A1.6). However, Bi, Cd, Mo, Te, Tl and Se show poorer accuracy due to the very low abundance of these elements in the standards, close to or below the limits of detection.

### A1.4.2 Analysis of Variance

Sampling and analytical precision were calculated using a procedure based on analysis of variance (ANOVA). Field duplicate soil samples were collected at 34 sites, representing approximately one site in 50; the sites were chosen using random number lists. Each field duplicate sample was dried and split into two portions, producing a total of four analytical replicates from each site. As a check against mis-labelling or other errors, the analyses of the replicates were plotted against each other, for selected elements of differing chemical properties, to assess whether any sample pairs were consistently out-lying. The results for the replicate pairs of samples were averaged, and the field duplicate sample pairs were examined in a similar manner. No labelling errors were found. The field and analytical replicate results are outlined in Figures A1.2 to A1.5 and in general demonstrate excellent repeatability of the analytical and field methods, namely points plot close to a line of gradient one passing through the origin. However, elements such as Ag, Bi, Cd, Cs, Hf, I, Sb, Ta, Tl, U and W present in low concentrations close to the detection limit show more variability as expected. Field duplicate results for Cu, Pb, Sn and Zn show some outlying values indicating the presence of gross metal contamination in the urban environment.

Plots of cumulative frequency versus concentration for each element in the soils were examined to assess the degree to which the distribution of the element conformed to a Gaussian distribution; as a result, the concentrations of all trace and major elements were log-transformed before undergoing ANOVA, to improve their conformity to the model distribution (Plant et al., 1975).

A random nested model of ANOVA was selected because all the analyses were part of a single randomised dataset (Snedecor and Cochran, 1989). The NESTED procedure from the SAS™

statistical software package was used to perform the ANOVA (SAS Institute Inc., 1989). Residual variance (representing inter-alia inhomogeneities introduced in sample preparation and sub-sampling, and errors in chemical analysis), between-sample variance (representing within-site variability as well as any variability introduced by the process of sample collection) and between-site variance (representing the natural distribution of the elements in the soils) were calculated.

Since the frequency distribution of most elements is multi-modal and none fit the Gaussian model perfectly, there is an unquantifiable overstatement of the between-site variance, a problem that is inherent in using ANOVA on geochemical data. Statistical F-tests have not been quoted because the data do not satisfy this and other assumptions required for formal analysis of variance.

The percentages of variance attributable to between-site, between-sample and residual variance are given in Tables A1.7 and A1.8, and provide a general indication of the reliability of the geochemical data. In most cases approximately 90% of the variability can be attributed to between site variance demonstrating the robustness of the field sampling method. ANOVA results for Cu, Sn and Zn fall below the 90% between site variance level largely as a result of the inhomogeneous nature of the soil and presence of one or two outlying values, which do not fit the general trend of the rest of the data (Figures A1.3 and A1.5). Sample preparation and analytical variability (within sample) is very low (<2% for most elements) indicating the reliability of the analytical techniques. Results for Ag, Bi, Cd, Cs, Hf, I, Sb, Ta, Tl, U and W probably reflect the fact that concentrations of these elements in soils are close to the limit of detection. Therefore, results should be treated with more caution than for other elements (Tables A1.7 and A1.8).

## A1.5 DATA PRESENTATION AND GLASGOW SOILS GIS

Once full error control and data quality procedures were completed, the Glasgow soil geochemical results were merged with locational and field-observation data into datasets for top (A) and deeper (S) soils in Excel® spreadsheet format. A summary of the data held in the datasets, once control samples were removed, is given in Table A1.9. On completion of the project, the data were formally loaded into the BGS Corporate Oracle® Geochemistry Database (Harris and Coats, 1992) where they may be retrieved by means of a database front-end.

Within the G-BASE project, it is standard procedure to present the data as a series of single-element maps showing the spatial distribution of the results. Rural geochemical data are commonly presented as continuous interpolated surface maps as these aid the identification of regional geochemical patterns. However, interpolated maps do not provide a suitable method for presenting urban data. At the close scale of interrogation necessary in urban areas, interpolations can give misleading results, as the spatial extent of high element values can be over-emphasised. As a result, methods of presenting urban geochemical data as graduated symbol maps have been developed by the G-BASE project (Fordyce and Ander, 2003). Graduated symbol maps avoid uncertain extrapolation between sampling points (as portrayed in interpolated-surface maps) and display the data in a form that more truly indicates the spatial representation of urban samples.

Geochemical maps for the current project were generated using a geographic information system (GIS) software package. A GIS is a computer system for capturing, storing, checking, integrating, overlaying, manipulating, analysing and displaying spatial data. Maps are the most common type of spatial data and show the distribution of features and the locational relationships between objects. A GIS is based upon databases that allow spatial information such as grid references or postcodes, which can only be visualised by plotting on a map, to be linked to attribute data. Attribute data provide other information about points in space such as the type of a building or road, or the height of a hill. A GIS digitally integrates databases and maps to produce a very powerful tool for environmental analysis. One of the main benefits of a GIS is the ready ability to store different information as separate data layers, which can be superimposed and interrogated simultaneously. GIS make cartography and data analysis easier and as such allow the storage of large amounts of data in a systematic format with easy output of information as maps and reports. Due to their versatility and widespread applicability, GIS use has become common and Local Authorities employ GIS increasingly to aid urban planning.

The importance of geoscience information and GIS to urban planning has been outlined by Ellison et al. (1998) and Hooker et al. (2000). Over recent years the BGS has been developing several urban GIS procedures for Local Authorities (for example, Brown and Marchant, 2000; Ellison et al., 2002; Merritt and Whitbread, 2008). Future GIS developments involving geochemical data are likely to take place within the broader context of urban planning and contaminated land prioritisation. A number of GIS software packages are commercially available and the Environmental Systems Research Institute (ESRI) ArcGIS9.2® software was selected for the present study, as it is the BGS corporate standard and is the system most commonly used by Local Authorities.

Within the Glasgow Soils GIS, the geochemical information is held as shapefiles whereas the background Cultural and Geological data are stored as feature classes in a geodatabase. Each dataset is presented as a layer in the GIS (Table A1.10).

Maps of element concentrations in top (A) and deeper (S) soils were created using the ArcGIS9.2® graduated symbol option and are presented in the appendices of this report. The geochemical maps are plotted using a full range of percentiles to describe the data distribution (Appendices 3 and 4). Elements are classified according to the 5$^{th}$, 10$^{th}$, 25$^{th}$, 50$^{th}$, 75$^{th}$, 90$^{th}$, 95$^{th}$ and 99$^{th}$ percentiles of the real data whereby circle-symbol size and colour correspond to the data percentile class. In addition to percentile-class plots, the data are presented as a series of maps relating to regulatory guideline values to highlight areas of potential interest within the urban environment (Appendices 5 and 6). The percentile and regulatory guideline maps in the GIS can be readily interpreted and assessed in the context of other environmental information for contaminated land and urban planning purposes.

It should be noted that for data close to the analytical detection limit, the results were rounded up to the nearest integer and this may lead to several percentile classes in the data distribution with the same element concentration. Whilst this is a true reflection of the data and prevents "over-interpretation" of the data to decimal points, which are not significant, it leads to the absence of several percentile classes on the graduated symbol maps for some elements such as Ag, Bi, Cd, and Sb.

The geochemical sample sites are presented against a backdrop of topographic information (Appendices 3-6).

# Appendix 2 Urban Soil Geochemistry Tables and Figures

## PART A - TABLES

Table 1.1 Potentially harmful elements for human, animal and plant health

| Chemical Symbol | Element Name | Chemical Symbol | Element Name |
|---|---|---|---|
| Al | Aluminium | Mn | Manganese |
| As | Arsenic | Mo | Molybdenum |
| B | Boron | Ni | Nickel |
| Ba | Barium | Pb | Lead |
| Bi | Bismuth | Sb | Antimony |
| Cd | Cadmium | Se | Selenium |
| Cl | Chlorine | Sn | Tin |
| Co | Cobalt | Te | Tellurium |
| Cr | Chromium | Th | Thorium |
| Cu | Copper | Tl | Thallium |
| F | Fluorine | U | Uranium |
| Fe | Iron | V | Vanadium |
| Hg | Mercury | Zn | Zinc |
| I | Iodine | | |

Although potentially harmful in excess, the majority of elements are essential to health in small doses. Elements listed in blue have no/limited biological function and are generally toxic to most organisms (From Appleton, 1995)

Table 1.2 Soil quality guideline values from various national sources

| Parameter | Units | Current UK Human CLEA Soil Guideline (2011) | | | Former UK Human CLEA Soil Guideline (2008) | | | Former UK Human ICRCL Soil Guideline | Proposed UK Ecological Guideline | German Agricultural Soil Guideline | Dutch Soil Intervention Value | US-EPA Generic Soil Screen Levels |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Residential | Allotment | Commercial | Residential plant uptake/ allotment | Residential no plant uptake | Commercial/ industrial | | | | | |
| Antimony (Sb) | mg $kg^{-1}$ | | | | | | | | | 5 | 22 | 31 |
| Arsenic (As) | mg $kg^{-1}$ | 32 | 43 | 640 | 20 | 20 | 500 | 10 | | 20 | 76 | 0.4 |
| Barium (Ba) | mg $kg^{-1}$ | | | | | | | | | | | 5500 |
| Cadmium (Cd) | mg $kg^{-1}$ | 10 | 1.8 | 230 | 1 (pH 6) | 30 | 1400 | 3 | 1.15 | 1.5 | 13 | 78 |
| Chromium (Cr) | mg $kg^{-1}$ | | | | 130 | 200 | 5000 | 600 | 21.1 | 100 | 180 | 390 |
| Cobalt (Co) | mg $kg^{-1}$ | | | | | | | | | 50 | 190 | |
| Copper (Cu) | mg $kg^{-1}$ | | | | | | | 130 | 88.4 | 100 | 190 | |
| Lead (Pb) | mg $kg^{-1}$ | | | | 450 | 450 | 750 | 500 | 167.9 | 100 | 530 | 400 |
| Molybdenum (Mo) | mg $kg^{-1}$ | | | | | | | | | 5 | 190 | |
| Nickel (Ni) | mg $kg^{-1}$ | 130 | 230 | 1800 | 50 | 75 | 5000 | 70 | 25.1 | | 100 | 1600 |
| Selenium (Se) | mg $kg^{-1}$ | 350 | 120 | 13000 | 35 | 260 | 8000 | 3 | | 10 | | 390 |
| Thallium (Tl) | mg $kg^{-1}$ | | | | | | | | | 1 | | |
| Tin (Sn) | mg $kg^{-1}$ | | | | | | | | | 50 | | |
| Uranium (U) | mg $kg^{-1}$ | | | | | | | | | 5 | | |
| Vanadium (V) | mg $kg^{-1}$ | | | | | | | | | 50 | | 550 |
| Zinc (Zn) | mg $kg^{-1}$ | | | | | | | 300 | 90.1 | 300 | 720 | 23000 |

Former CLEA Guideline (2008) = EA (2008a) 'Typical' Soil Guideline Values for defined land uses (SGV)
Current CLEA Guideline (2011) = EA (2011) 'Typical' Soil Guideline Values for defined land uses (SGV)
Former ICRCL Guideline = ICRCL (1987) UK Soil Trigger Values for Residential Gardens and Allotments
UK Ecological Guideline = EA (2008b) Proposed ecological risk assessment Soil Screening Values (SSV)
German Guideline = Reimann and Caritat (1998) Maximum Admissible Concentration (MAC) in Agricultural Soils
Dutch Soil Intervention Value = VROM (2009) Soil Intervention Values
US-EPA = US-EPA (1996) Generic Soil Screening Levels (SSL)

Table 2.1 Rationalised geology groupings for the present project related to BGS standard 1: 50 000 geological classifications

| **Rationalised Rock Unit** | **BGS DigMap® Codes** | **1: 50 000 Geology Classification** |
|---|---|---|
| **Carboniferous Rocks** | | |
| Coal Measures | UCMS-MEAS, MCMS-MEAS, LCMS-MEAS, PGP-MEAS | Coal Measures Group and Passage Formation |
| Limestone Coal Formation | LSC-MEAS | Limestone Coal Formation |
| Lower and Upper Limestone Formations | LLMS-MEAS, ULGS-MEAS, BKLS-LMST, BLLS-LMST, BBLS-LMST, CAL-LMST, CAS-LMST, DYLS-LMST, HCLS-LMST, HHLS-LMST, HUR-LMST, ILS-LMST, LLS-LMST, MAHO-LMST, OLS-LMST, P2-LMST, TOHO-LMST, BGN-MDST, LLGS-MEAS | Lower Limestone Formation and Upper Limestone Formation |
| Strathclyde Group | LWM-MEAS, DMQ-CONG, BGN-MDST, BGN-MDSL | Strathclyde Group |
| Inverclyde Group | INV-SARL | Inverclyde Group |

| | | |
|---|---|---|
| **Devonian Rocks** | | |
| Lower and Upper Devonian Sandstones | KNW-SDST, SCK-SDST, THF-SDST, RON-CONG, OXF-MDST, IMC-CONG, KNW-CORN, KNW-VCSR, THF-SDSL, CXF-MDSD | Devonian Stratheden and Strathmore Groups |

| | | |
|---|---|---|
| **Dalradian Rocks** | | |
| Dalradian | DCBG-PSPE, DCDP-PELM, DCBB-PSPE | Southern Highland Group and Bullrock Greywacke Formation |

| | | |
|---|---|---|
| **Intrusives/Extrusives** | | |
| Clyde Plateau Volcanic Formation | All other codes in the area | Clyde Plateau Volcanic Formation |

Table 3.1 Summary statistics for element concentrations in Glasgow top and deeper soils

| **Urban A** | $Al_2O_3$ | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ |
| Min | 6.2 | 0.10 | 3.01 | 0.26 | 0.3 | 0.014 | 0.1 | 0.025 | 30.3 | 0.235 | 0.25 | 1.1 | 77 | 0.25 | 0.25 | 0.25 | 11 | 4.0 | 38 | 1 | 14.0 | 3.2 | 0.3 | 1.7 | 1 |
| Max | 25.6 | 17.84 | 20.18 | 2.93 | 19.5 | 0.878 | 1.7 | 1.44 | 71.9 | 2.992 | 23.50 | 282.8 | 10978 | 15.9 | 87.8 | 16.00 | 1181 | 560.0 | 4286 | 10 | 3679.9 | 54.3 | 90.6 | 16.5 | 26 |
| Median | 14.7 | 0.92 | 6.43 | 1.34 | 1.1 | 0.104 | 0.7 | 0.32 | 55.0 | 0.998 | 0.25 | 9.2 | 445 | 0.3 | 17.1 | 0.25 | 74 | 25.0 | 108 | 1 | 51.4 | 14.6 | 3.9 | 5.4 | 3 |
| Mean | 14.8 | 1.15 | 6.66 | 1.37 | 1.2 | 0.113 | 0.8 | 0.35 | 54.8 | 1.094 | 0.32 | 10.9 | 481 | 0.5 | 18.8 | 0.38 | 76 | 28.4 | 125 | 2 | 76.2 | 15.0 | 4.8 | 5.4 | 4 |
| Count | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 |
| **Urban S** | $Al_2O_3$ | 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 |
| | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ |
| Min | 7.6 | 0.07 | 2.93 | 0.28 | 0.4 | 0.012 | 0.1 | 0.025 | 30.4 | 0.401 | 0.25 | 0.45 | 53 | 0.25 | 0.5 | 0.25 | 12 | 3.8 | 40 | 1 | 6.1 | 6.2 | 0.3 | 1.0 | 1 |
| Max | 26.8 | 20.30 | 20.23 | 3.37 | 21.2 | 1.164 | 1.9 | 1.07 | 64.1 | 3.079 | 16.90 | 1001.0 | 7038 | 25.8 | 77.1 | 6.60 | 1183 | 477.7 | 4363 | 9 | 3181.8 | 46.6 | 75.9 | 22.6 | 36 |
| Median | 15.5 | 1.03 | 6.67 | 1.42 | 1.2 | 0.105 | 0.7 | 0.24 | 54.9 | 1.002 | 0.25 | 8.5 | 455 | 0.3 | 11.4 | 0.25 | 77 | 28.6 | 104 | 1 | 47.3 | 15.6 | 3.4 | 5.3 | 2 |
| Mean | 15.6 | 1.37 | 6.91 | 1.46 | 1.3 | 0.117 | 0.7 | 0.26 | 54.7 | 1.093 | 0.33 | 11.3 | 499 | 0.5 | 13.1 | 0.36 | 81 | 33.0 | 124 | 2 | 82.9 | 16.0 | 4.5 | 5.4 | 3 |
| Count | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 |
| **Rural A** | $Al_2O_3$ | 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 |
| | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ |
| Min | 0.7 | 0.05 | 2.84 | 0.30 | 0.05 | 0.005 | 0.1 | 0.060 | 3.4 | 0.179 | 0.25 | 3.7 | 67 | 0.25 | 2.7 | 0.25 | 12 | 8.5 | 28 | 1 | 2.9 | 2.2 | 1.1 | 2.2 | 1 |
| Max | 22.8 | 11.14 | 10.63 | 3.42 | 5.9 | 0.438 | 2.0 | 1.81 | 77.8 | 3.073 | 2.60 | 55.3 | 1249 | 2.1 | 209.2 | 2.30 | 208 | 74.9 | 285 | 20 | 348.8 | 35.5 | 68.3 | 9.9 | 53 |
| Median | 14.1 | 0.58 | 6.45 | 1.18 | 1.0 | 0.093 | 0.7 | 0.37 | 55.5 | 1.207 | 0.25 | 9.1 | 391 | 0.5 | 19.0 | 0.25 | 70 | 20.7 | 98 | 3 | 31.0 | 14.9 | 3.2 | 6.6 | 5 |
| Mean | 13.5 | 0.75 | 6.55 | 1.27 | 1.1 | 0.113 | 0.7 | 0.41 | 54.8 | 1.363 | 0.27 | 10.0 | 407 | 0.5 | 24.8 | 0.33 | 69 | 21.9 | 104 | 3 | 38.1 | 15.1 | 3.9 | 6.5 | 8 |
| Count | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 |
| **Rural S** | $Al_2O_3$ | 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 |
| | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ |
| Min | 2.3 | 0.05 | 2.76 | 0.26 | 0.1 | 0.005 | 0.05 | 0.025 | 1.2 | 0.106 | 0.25 | 2.4 | 23 | 0.25 | 1.4 | 0.25 | 2 | 8.7 | 25 | 1 | 0.4 | 0.35 | 0.3 | 1.0 | 1 |
| Max | 24.7 | 7.95 | 12.63 | 3.73 | 7.5 | 0.597 | 2.6 | 1.31 | 98.0 | 3.112 | 1.30 | 400.3 | 1544 | 4.1 | 268.0 | 11.60 | 482 | 123.4 | 283 | 7 | 474.2 | 53.3 | 110.6 | 11.0 | 41 |
| Median | 15.7 | 0.50 | 6.93 | 1.27 | 1.1 | 0.096 | 0.7 | 0.20 | 63.4 | 1.138 | 0.25 | 7.2 | 359 | 0.3 | 14.1 | 0.25 | 63 | 22.2 | 91 | 2 | 23.9 | 15.7 | 2.0 | 6.0 | 3 |
| Mean | 15.3 | 0.70 | 7.11 | 1.37 | 1.3 | 0.116 | 0.8 | 0.25 | 62.3 | 1.308 | 0.26 | 9.7 | 391 | 0.3 | 21.9 | 0.38 | 65 | 25.1 | 97 | 2 | 31.1 | 16.0 | 2.9 | 5.9 | 4 |
| Count | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 237 | 241 | 241 | 241 | 241 | 241 |
| **All A** | $Al_2O_3$ | 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 |
| | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ |
| Min | 0.7 | 0.05 | 2.84 | 0.26 | 0.1 | 0.005 | 0.1 | 0.025 | 3.4 | 0.179 | 0.25 | 1.1 | 67 | 0.25 | 0.25 | 0.25 | 11 | 4.0 | 28 | 1 | 2.9 | 2.2 | 0.3 | 1.7 | 1 |
| Max | 25.6 | 17.84 | 20.18 | 3.42 | 19.5 | 0.878 | 2.0 | 1.81 | 77.8 | 3.073 | 23.50 | 282.8 | 10978 | 15.9 | 209.2 | 16.00 | 1181 | 560.0 | 4286 | 20 | 3679.9 | 54.3 | 90.6 | 16.5 | 53 |
| Median | 14.7 | 0.87 | 6.43 | 1.32 | 1.1 | 0.104 | 0.7 | 0.32 | 55.1 | 1.017 | 0.25 | 9.1 | 436 | 0.3 | 17.2 | 0.25 | 73 | 25.0 | 107 | 2 | 47.9 | 14.7 | 3.7 | 5.5 | 4 |
| Mean | 14.6 | 1.09 | 6.64 | 1.36 | 1.2 | 0.113 | 0.7 | 0.36 | 54.8 | 1.134 | 0.32 | 10.8 | 470 | 0.5 | 19.7 | 0.37 | 75 | 27.4 | 122 | 2 | 70.5 | 15.0 | 4.7 | 5.6 | 4 |
| Count | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 |
| **All S** | $Al_2O_3$ | 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 |
| | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ |
| Min | 2.3 | 0.05 | 2.76 | 0.26 | 0.05 | 0.005 | 0.05 | 0.025 | 1.2 | 0.106 | 0.25 | 0.45 | 23 | 0.25 | 0.5 | 0.25 | 2 | 3.8 | 25 | 1 | 0.4 | 0.35 | 0.3 | 1.0 | 1 |
| Max | 26.8 | 20.30 | 20.23 | 3.73 | 21.2 | 1.164 | 2.6 | 1.31 | 98.0 | 3.112 | 16.90 | 1001.0 | 7038 | 25.8 | 268.0 | 11.60 | 1183 | 477.7 | 4363 | 9 | 3181.8 | 53.3 | 110.6 | 22.6 | 41.0 |
| Median | 15.5 | 0.93 | 6.69 | 1.41 | 1.2 | 0.104 | 0.7 | 0.24 | 55.3 | 1.012 | 0.25 | 8.3 | 446 | 0.3 | 11.8 | 0.25 | 76 | 27.5 | 102 | 1 | 43.0 | 15.6 | 3.1 | 5.4 | 2.0 |
| Mean | 15.6 | 1.27 | 6.94 | 1.45 | 1.3 | 0.116 | 0.7 | 0.26 | 55.9 | 1.125 | 0.32 | 11.0 | 483 | 0.4 | 14.5 | 0.37 | 78 | 31.8 | 120 | 2 | 75.1 | 16.0 | 4.3 | 5.4 | 3.3 |
| Count | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1605 | 1609 | 1609 | 1609 | 1609 | 1609 |

Min = minimum Max = maximum A = top soils S = deeper soils

| Urban A | La | Mo | Nb | Ni | Pb | Rb | Sb | Sc | Se | Sn | Sr | Ta | Te | Th | Tl | U | V | W | Y | Zn | Zr | pH | LOI @ 450C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | | % |
| Min | 1.75 | 0.4 | 0.3 | 6.0 | 13.4 | 0.9 | 0.5 | 4 | 0.1 | 1.0 | 27.1 | 0.6 | 0.5 | 1.0 | 0.25 | 0.3 | 25 | 0.35 | 2.4 | 38.8 | 0.4 | 3.39 | 2.42 |
| Max | 507 | 33.4 | 61.4 | 1038.1 | 5001.0 | 98.9 | 173.5 | 34 | 14.5 | 658.6 | 424.5 | 3.8 | 4.1 | 18.0 | 10.6 | 6.2 | 737 | 154.9 | 75.3 | 1780.8 | 815.6 | 8.79 | 36.25 |
| Median | 36 | 2.1 | 15.1 | 46.9 | 127.1 | 40.0 | 1.3 | 14 | 0.9 | 10.2 | 111.0 | 0.6 | 0.5 | 6.9 | 0.6 | 1.6 | 131 | 1.0 | 21.3 | 151.9 | 249.1 | 5.20 | 9.02 |
| Mean | 37 | 2.4 | 16.9 | 54.9 | 180.1 | 41.0 | 2.4 | 14 | 1.0 | 18.7 | 121.5 | 0.9 | 0.5 | 7.0 | 0.7 | 1.7 | 147 | 1.3 | 21.9 | 201.0 | 248.7 | 5.31 | 9.49 |
| Count | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1381 | 1380 | 1381 | 1381 | 1381 | 1379 | 1381 |
| **Urban S** | **La** | **Mo** | **Nb** | **Ni** | **Pb** | **Rb** | **Sb** | **Sc** | **Se** | **Sn** | **Sr** | **Ta** | **Te** | **Th** | **Tl** | **U** | **V** | **W** | **Y** | **Zn** | **Zr** | **pH** | **LOI @ 450C** |
| | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | | % |
| Min | 6 | 0.4 | 0.8 | 9.6 | 9.9 | 0.25 | 0.5 | 5 | 0.1 | 0.9 | 35.8 | 0.6 | 0.5 | 0.6 | 0.25 | 0.3 | 38 | 0.35 | 2.5 | 31.9 | 0.4 | 2.99 | 1.53 |
| Max | 408 | 37.1 | 87.3 | 859.0 | 5001.0 | 118.1 | 207.0 | 57 | 15.1 | 1393.5 | 1765.5 | 5.8 | 1.4 | 27.9 | 16.2 | 11.8 | 969 | 47.8 | 98.8 | 1773.6 | 1112.3 | 8.88 | 50.04 |
| Median | 37 | 1.9 | 15.8 | 48.0 | 101.3 | 42.9 | 1.0 | 14 | 0.8 | 9.0 | 119.1 | 0.6 | 0.5 | 7.5 | 0.6 | 1.7 | 128 | 0.8 | 22.5 | 129.6 | 247.1 | 5.78 | 6.35 |
| Mean | 38 | 2.3 | 17.5 | 58.0 | 171.3 | 44.9 | 2.6 | 14 | 1.0 | 22.5 | 134.9 | 0.9 | 0.5 | 7.6 | 0.7 | 1.7 | 146 | 1.2 | 23.4 | 187.3 | 248.9 | 5.80 | 6.99 |
| Count | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1368 | 1367 | 1368 | 1368 | 1368 | 1367 | 1368 |
| **Rural A** | **La** | **Mo** | **Nb** | **Ni** | **Pb** | **Rb** | **Sb** | **Sc** | **Se** | **Sn** | **Sr** | **Ta** | **Te** | **Th** | **Tl** | **U** | **V** | **W** | **Y** | **Zn** | **Zr** | **pH** | **LOI @ 450C** |
| | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | | % |
| Min | 4 | 0.4 | 1.4 | 2.3 | 14.0 | 1.9 | 0.5 | 2 | 0.1 | 1.1 | 14.8 | 0.6 | 0.5 | 0.6 | 0.25 | 0.3 | 13 | 0.35 | 2.1 | 13.7 | 8.8 | 2.75 | 2.97 |
| Max | 113 | 5.2 | 50.1 | 227.2 | 955.7 | 109.3 | 28.0 | 32 | 6.6 | 176.2 | 462.4 | 3.9 | 2.6 | 13.1 | 2.2 | 4.6 | 753 | 6.6 | 62.1 | 917.7 | 391.4 | 7.24 | 94.85 |
| Median | 33 | 1.4 | 16.7 | 33.8 | 77.5 | 34.7 | 0.5 | 13 | 0.9 | 6.1 | 83.5 | 0.6 | 0.5 | 5.8 | 0.6 | 2.3 | 128 | 1.3 | 18.2 | 105.4 | 258.5 | 4.84 | 9.95 |
| Mean | 34 | 1.5 | 18.9 | 39.2 | 98.0 | 37.2 | 1.3 | 13 | 1.0 | 10.4 | 88.9 | 1.0 | 0.5 | 5.8 | 0.6 | 2.3 | 149 | 1.5 | 18.3 | 122.3 | 248.7 | 4.80 | 12.74 |
| Count | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 240 |
| **Rural S** | **La** | **Mo** | **Nb** | **Ni** | **Pb** | **Rb** | **Sb** | **Sc** | **Se** | **Sn** | **Sr** | **Ta** | **Te** | **Th** | **Tl** | **U** | **V** | **W** | **Y** | **Zn** | **Zr** | **pH** | **LOI @ 450C** |
| | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | | % |
| Min | 11 | 0.4 | 0.8 | 0.3 | 6.6 | 0.9 | 0.5 | 2 | 0.1 | 0.4 | 14.2 | 0.6 | 0.5 | 0.3 | 0.25 | 0.3 | 9 | 0.35 | 0.4 | 7.6 | 0.4 | 2.81 | 1.62 |
| Max | 204 | 7.3 | 57.5 | 343.2 | 1149.7 | 128.8 | 53.3 | 42 | 12.3 | 128.6 | 620.1 | 3.7 | 0.5 | 13.0 | 3.3 | 5.0 | 649 | 8.0 | 85.8 | 1132.4 | 506.5 | 7.12 | 97.34 |
| Median | 37 | 1.4 | 17.9 | 31.8 | 38.0 | 39.0 | 0.5 | 13 | 0.7 | 2.7 | 86.5 | 0.6 | 0.5 | 6.1 | 0.5 | 2.0 | 117 | 1.2 | 19.0 | 84.0 | 289.0 | 5.05 | 6.23 |
| Mean | 38 | 1.6 | 20.3 | 39.7 | 62.9 | 42.3 | 1.0 | 13 | 0.8 | 4.9 | 95.8 | 1.0 | 0.5 | 6.1 | 0.5 | 2.1 | 134 | 1.3 | 19.3 | 98.7 | 283.4 | 5.04 | 8.99 |
| Count | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 |
| **All A** | **La** | **Mo** | **Nb** | **Ni** | **Pb** | **Rb** | **Sb** | **Sc** | **Se** | **Sn** | **Sr** | **Ta** | **Te** | **Th** | **Tl** | **U** | **V** | **W** | **Y** | **Zn** | **Zr** | **pH** | **LOI @ 450C** |
| | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | | % |
| Min | 1.75 | 0.4 | 0.3 | 2.3 | 13.4 | 0.9 | 0.5 | 2 | 0.1 | 1.0 | 14.8 | 0.6 | 0.5 | 0.6 | 0.25 | 0.3 | 13 | 0.35 | 2.1 | 13.7 | 0.4 | 2.75 | 2.42 |
| Max | 507 | 33.4 | 61.4 | 1038.1 | 5001.0 | 109.3 | 173.5 | 34 | 14.5 | 658.6 | 462.4 | 3.9 | 4.1 | 18.0 | 10.6 | 6.2 | 753 | 154.9 | 75.3 | 1780.8 | 815.6 | 8.79 | 94.85 |
| Median | 35 | 2.0 | 15.3 | 45.7 | 118.3 | 39.4 | 1.3 | 13 | 0.9 | 9.5 | 107.2 | 0.6 | 0.5 | 6.8 | 0.6 | 1.7 | 131 | 1.1 | 20.9 | 144.4 | 249.7 | 5.11 | 9.16 |
| Mean | 36 | 2.3 | 17.2 | 52.6 | 167.9 | 40.5 | 2.3 | 14 | 1.0 | 17.4 | 116.6 | 0.9 | 0.5 | 6.8 | 0.6 | 1.8 | 147 | 1.3 | 21.4 | 189.3 | 248.7 | 5.23 | 9.97 |
| Count | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1621 | 1622 | 1622 | 1622 | 1620 | 1621 |
| **All S** | **La** | **Mo** | **Nb** | **Ni** | **Pb** | **Rb** | **Sb** | **Sc** | **Se** | **Sn** | **Sr** | **Ta** | **Te** | **Th** | **Tl** | **U** | **V** | **W** | **Y** | **Zn** | **Zr** | **pH** | **LOI @ 450C** |
| | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | | % |
| Min | 6 | 0.4 | 0.8 | 0.3 | 6.6 | 0.25 | 0.5 | 2 | 0.1 | 0.4 | 14.2 | 0.6 | 0.5 | 0.3 | 0.25 | 0.3 | 9 | 0.35 | 0.4 | 7.6 | 0.4 | 2.81 | 1.53 |
| Max | 408 | 37.1 | 87.3 | 859.0 | 5001.0 | 128.8 | 207.0 | 57 | 15.1 | 1393.5 | 1765.5 | 5.8 | 1.4 | 27.9 | 16.2 | 11.8 | 969 | 47.8 | 98.8 | 1773.6 | 1112.3 | 8.88 | 97.34 |
| Median | 37 | 1.8 | 15.9 | 45.8 | 87.2 | 42.5 | 0.5 | 14 | 0.8 | 7.3 | 114.4 | 0.6 | 0.5 | 7.3 | 0.5 | 1.7 | 126 | 0.9 | 22.1 | 121.3 | 251.8 | 5.58 | 6.34 |
| Mean | 38 | 2.2 | 17.9 | 55.3 | 154.9 | 44.5 | 2.3 | 14 | 0.9 | 19.8 | 129.0 | 1.0 | 0.5 | 7.4 | 0.6 | 1.8 | 144 | 1.2 | 22.8 | 174.0 | 254.1 | 5.69 | 7.29 |
| Count | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1608 | 1609 |

Table 3.2 Summary statistics for element concentrations in UK national and regional soil datasets and world averages

| Statistics | Soil Type | $Al_2O_3$ | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ |
| Minimum | Humber A | 0.2 | 0.03 | 0.19 | nd | 0.10 | 0.001 | nd | 0.03 | nd | 0.02 | 0.40 | 0.5 | 24 | nd | nd | 0.35 | nd | 1.0 | 0.8 | nd | 0.5 | nd | nd | nd |
| | Humber S | nd | 0.03 | 0.15 | 0.12 | 0.05 | 0.017 | nd | 0.03 | nd | 0.002 | 0.40 | 0.5 | 2 | nd | nd | 0.40 | 4 | 2.0 | 2.0 | nd | 0.5 | 0.2 | nd | nd |
| | Scotland A | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 0.02 | nd | nd | 2.3 | nd | 0.2 | nd | nd | nd |
| | E&W A | 0.1 | 0.007 | 0.06 | 0.007 | 0.007 | 0.0004 | nd | 0.008 | nd | nd | nd | nd | 11 | nd | nd | <0.20 | nd | 0.2 | 0.2 | nd | 1.0 | nd | nd | nd |
| Maximum | Humber A | 22.2 | 48.06 | 33.02 | nd | 13.40 | 1.560 | nd | 2.22 | nd | 1.95 | 26.00 | 342.0 | 85071 | nd | nd | 61.00 | nd | 140.4 | 2534.0 | nd | 703.0 | nd | nd | nd |
| | Humber S | nd | 47.81 | 48.15 | 5.02 | 18.48 | 2.262 | nd | 1.53 | nd | 2.76 | 19.00 | 389.0 | 126700 | nd | nd | 62.00 | 354 | 723.0 | 6787.0 | nd | 5920.0 | 181.7 | nd | nd |
| | Scotland A | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 0.97 | nd | nd | 216.0 | nd | 63.9 | nd | nd | nd |
| | E&W A | 15.0 | 47.56 | 37.80 | 2.48 | 10.40 | 5.500 | nd | 1.25 | nd | nd | nd | nd | 2973 | nd | nd | 40.90 | nd | 322.0 | 838.0 | nd | 1508.0 | nd | nd | nd |
| Mean | Humber A | 11.5 | 2.12 | 4.85 | nd | 1.13 | 0.100 | nd | 0.29 | nd | 0.66 | 0.80 | 16.0 | 528 | nd | nd | 1.18 | nd | 19.4 | 74.1 | nd | 22.2 | nd | nd | nd |
| | Humber S | nd | 2.89 | 5.28 | 1.97 | 1.33 | 0.124 | nd | 0.25 | nd | 0.71 | 1.50 | 15.9 | 569 | nd | nd | 0.80 | 80 | 21.7 | 85.2 | nd | 25.4 | 13.0 | nd | nd |
| | Scotland A | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 0.16 | nd | nd | 44.7 | nd | 9.4 | nd | nd | nd |
| | E&W A | 5.3 | 1.94 | 4.00 | 0.60 | 0.60 | 0.100 | nd | 0.17 | nd | nd | nd | nd | 141 | nd | nd | 0.80 | nd | 10.6 | 41.2 | nd | 23.0 | nd | nd | nd |
| Median | Humber A | 11.6 | 0.81 | 4.66 | nd | 0.80 | 0.080 | nd | 0.26 | nd | 0.68 | 0.40 | 13.0 | 376 | nd | nd | 1.00 | nd | 19.1 | 71.0 | nd | 18.0 | nd | nd | nd |
| | Humber S | nd | 0.81 | 5.04 | 1.88 | 0.97 | 0.104 | nd | 0.19 | nd | 0.74 | 1.00 | 12.4 | 388 | nd | nd | 0.40 | 80 | 21.0 | 83.0 | nd | 20.0 | 12.3 | nd | nd |
| | Humber C A | 12.0 | 0.64 | 5.80 | nd | 0.60 | 0.140 | nd | 0.30 | nd | 0.66 | 0.40 | 15.0 | 504 | nd | nd | 2.00 | nd | 24.0 | 77.0 | nd | 38.0 | nd | nd | nd |
| | Scotland A | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 0.15 | nd | nd | 41.4 | nd | 7.4 | nd | nd | nd |
| | E&W A | 5.3 | 0.46 | 3.80 | 0.56 | 0.50 | 0.070 | nd | 0.15 | nd | nd | nd | nd | 121 | nd | nd | 0.70 | nd | 9.8 | 39.3 | nd | 18.0 | nd | nd | nd |
| | World Soils A | 15.0 | 2.00 | 5.00 | 1.60 | 1.50 | 0.070 | 1.3 | 0.17 | 60 | 0.67 | 0.07 | 5.0 | 500 | 0.3 | 10 | 0.30 | 65 | 10.0 | 80.0 | 3 | 25.0 | 14.0 | 2.1 | 5 |

Humber A = <2 mm G-BASE rural soils from the Humber-Trent regional atlas area (British Geological Survey, 2009) (n = 6575)
Humber S = <150 µm G-BASE rural soils from the Humber-Trent regional atlas area (British Geological Survey, 2009) (n = 6575)
Scotland A = <2 mm mineral soils National Soil Inventory of Scotland (SEPA, 2001; Paterson et al., 2003) (n = 291)
E&W A = <2 mm National Soil Inventory of England and Wales (McGrath and Loveland, 1992) (n = 5692)
Humber C A = <2 mm G-BASE rural soils over Coal Measures from the Humber-Trent regional atlas area (British Geological Survey, 2009) (n = 958)
World Soils A = <2 mm world medians (Reimann and Caritat, 1998)

A = top soils
S = deeper soils
LOI = loss on ignition
nd = no data

| Statistics | Soil Type | I | La | Mo | Nb | Ni | Pb | Rb | Sb | Sc | Se | Sn | Sr | Ta | Te | Th | Tl | U | V | W | Y | Zn | Zr | pH | LOI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | | wt% |
| Minimum | Humber A | nd | nd | 0.4 | nd | 0.5 | 2 | 1.0 | 0.5 | nd | 0.2 | 0.4 | 9 | nd | nd | nd | nd | 0.3 | 9 | nd | nd | 3 | 2 | 2.76 | 0.4 |
| | Humber S | nd | 1 | 0.4 | 0.5 | 2.0 | 1 | 0.5 | 0.5 | nd | 0.2 | 0.4 | 11 | nd | nd | 0.2 | nd | 0.3 | 14 | nd | 3 | 6 | 1 | nd | nd |
| | Scotland A | nd | nd | nd | nd | 0.4 | 4 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 4 | nd | nd | nd |
| | E&W A | nd | nd | nd | nd | 0.8 | 3 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 5 | nd | 2.90 | 0.1 |
| Maximum | Humber A | nd | nd | 43.2 | nd | 459.0 | 35930 | 159.0 | 118.0 | nd | 20.1 | 263.0 | 2178 | nd | nd | nd | nd | 14.8 | 831 | nd | nd | 7106 | 4320 | 7.97 | 56.5 |
| | Humber S | nd | 166 | 884.8 | 54.4 | 7804.0 | 24700 | 174.0 | 63.0 | nd | 23.4 | 641.0 | 1883 | nd | nd | 100.6 | nd | 76.0 | 1013 | nd | 306 | 6647 | 8089 | nd | nd |
| | Scotland A | nd | nd | nd | nd | 233.0 | 239 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 224 | nd | nd | nd |
| | E&W A | nd | nd | nd | nd | 440.0 | 16338 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 3648 | nd | 9.20 | 65.9 |
| Mean | Humber A | nd | nd | 2.7 | nd | 23.5 | 105 | 67.0 | 0.8 | nd | 0.4 | 5.2 | 75 | nd | nd | nd | nd | 2.2 | 88 | nd | nd | 94 | 261 | 6.58 | 4.4 |
| | Humber S | nd | 40 | 2.4 | 12.6 | 30.7 | 78 | 76.0 | 3.0 | nd | 0.4 | 4.9 | 94 | nd | nd | 8.4 | nd | 2.6 | 94 | nd | 26 | 99 | 418 | nd | nd |
| | Scotland A | nd | nd | nd | nd | 20.5 | 32 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 54 | nd | nd | nd |
| | E&W A | nd | nd | nd | nd | 24.5 | 74 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 97 | nd | nd | nd |
| Median | Humber A | nd | nd | 2.2 | nd | 22.0 | 43 | 65.0 | 0.5 | nd | 0.2 | 4.0 | 66 | nd | nd | nd | nd | 2.1 | 83 | nd | nd | 72 | 255 | 6.78 | 3.5 |
| | Humber S | nd | 39 | 1.8 | 13.0 | 27.0 | 38 | 74.0 | 3.0 | nd | 0.2 | 4.0 | 80 | nd | nd | 8.4 | nd | 2.5 | 88 | nd | 26 | 77 | 379 | nd | nd |
| | Humber C A | nd | nd | 3.0 | nd | 25.0 | 104 | 75.0 | 1.0 | nd | 0.5 | 8.0 | 67 | nd | nd | nd | nd | 1.7 | 99 | nd | nd | 115 | 256 | 5.40 | 13.0 |
| | Scotland A | nd | nd | nd | nd | 17.5 | 23 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 48 | nd | nd | nd |
| | E&W A | nd | nd | nd | nd | 22.6 | 40 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 82 | nd | 6.00 | 3.6 |
| | World Soils A | 2 | 35 | 1.2 | 12.0 | 20.0 | 17 | 65.0 | 0.5 | 12 | 0.3 | 4.0 | 240 | 1.1 | 0.006 | 9.4 | 0.5 | 2.7 | 90 | 1.5 | 20 | 70 | 230 | nd | nd |

Table 3.3 Glasgow soil versus UK national and regional and world soil median ratio comparisons

| **Median Values** | **$Al_2O_3$** | **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** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ |
| Scotland A | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 0.15 | nd | nd | 41.4 | nd | 7.4 | nd | nd | nd |
| E&W A | 5.3 | 0.46 | 3.80 | 0.56 | 0.50 | 0.070 | nd | 0.15 | nd | nd | nd | nd | 121 | nd | nd | 0.70 | nd | 9.8 | 39.3 | nd | 18.0 | nd | nd | nd |
| Humber A | 11.6 | 0.81 | 4.66 | nd | 0.80 | 0.080 | nd | 0.26 | nd | 0.680 | 0.40 | 13.0 | 376 | nd | nd | 1.00 | nd | 19.1 | 71.0 | nd | 18.0 | nd | nd | nd |
| Humber Coal C A | 12.0 | 0.64 | 5.80 | nd | 0.60 | 0.140 | nd | 0.30 | nd | 0.660 | 0.40 | 15.0 | 504 | nd | nd | 2.00 | nd | 24.0 | 77.0 | nd | 38.0 | nd | nd | nd |
| World Soils A | 15.0 | 2.00 | 5.00 | 1.60 | 1.50 | 0.070 | 1.3 | 0.17 | 60 | 0.670 | 0.07 | 5.0 | 500 | 0.3 | 10 | 0.30 | 65 | 10.0 | 80.0 | 3 | 25.0 | 14.0 | 2.1 | 5 |
| Humber S | nd | 0.81 | 5.04 | 1.88 | 0.97 | 0.104 | nd | 0.19 | nd | 0.740 | 1.00 | 12.4 | 388 | nd | nd | 0.40 | 80 | 21.0 | 83.0 | nd | 20.0 | 12.3 | nd | nd |
| Urban A | 14.7 | 0.92 | 6.43 | 1.34 | 1.10 | 0.104 | 0.7 | 0.32 | 55.0 | 0.998 | 0.25 | 9.2 | 445 | 0.3 | 17.1 | 0.25 | 74 | 25.0 | 108.0 | 1 | 51.4 | 14.6 | 3.9 | 5.4 |
| Rural A | 14.1 | 0.58 | 6.45 | 1.18 | 1.00 | 0.093 | 0.7 | 0.37 | 55.5 | 1.207 | 0.25 | 9.1 | 391 | 0.5 | 19.0 | 0.25 | 70 | 20.7 | 98.2 | 3 | 31.0 | 14.9 | 3.2 | 6.6 |
| Urban S | 15.5 | 1.03 | 6.67 | 1.42 | 1.20 | 0.105 | 0.7 | 0.24 | 54.9 | 1.002 | 0.25 | 8.5 | 455 | 0.3 | 11.4 | 0.25 | 77 | 28.6 | 104.0 | 1 | 47.3 | 15.6 | 3.4 | 5.3 |
| Rural S | 15.7 | 0.50 | 6.93 | 1.27 | 1.10 | 0.096 | 0.7 | 0.20 | 63.4 | 1.138 | 0.25 | 7.2 | 359 | 0.3 | 14.1 | 0.25 | 63 | 22.2 | 91.0 | 2 | 23.9 | 15.7 | 2.0 | 6.0 |
| **Ratios** | | | | | | | | | | | | | | | | | | | | | | | | |
| Urban A/Scotland A | | | | | | | | | | | | | | | | *1.7* | | | *2.6* | | *6.9* | | | |
| Rural A/Scotland A | | | | | | | | | | | | | | | | *1.7* | | | *2.4* | | *4.2* | | | |
| Urban A/E&W A | *2.8* | *2.0* | *1.7* | *2.4* | *2.2* | *1.5* | | *2.1* | | | | | *3.7* | | | *0.4* | | *2.6* | *2.7* | | *2.9* | | | |
| Rural A/E&W A | *2.7* | *1.3* | *1.7* | *2.1* | *2.0* | *1.3* | | *2.5* | | | | | *3.2* | | | *0.4* | | *2.1* | *2.5* | | *1.7* | | | |
| Urban A/Humber A | *1.3* | *1.1* | *1.4* | | *1.4* | *1.3* | | *1.2* | | *1.5* | *0.6* | *0.7* | *1.2* | | | *0.3* | | *1.3* | *1.5* | | *2.9* | | | |
| Rural A/Humber A | *1.2* | *0.7* | *1.4* | | *1.3* | *1.2* | | *1.4* | | *1.8* | *0.6* | *0.7* | *1.0* | | | *0.3* | | *1.1* | *1.4* | | *1.7* | | | |
| Urban A/Humber C A | *1.2* | *1.4* | *1.1* | | *1.8* | *0.7* | | *1.1* | | *1.5* | *0.6* | *0.6* | *0.9* | | | *0.1* | | *1.0* | *1.4* | | *1.4* | | | |
| Rural A/Humber C A | *1.2* | *0.9* | *1.1* | | *1.7* | *0.7* | | *1.2* | | *1.8* | *0.6* | *0.6* | *0.8* | | | *0.1* | | *0.9* | *1.3* | | *0.8* | | | |
| Urban A/World A | *1.0* | *0.5* | *1.3* | *0.8* | *0.7* | *1.5* | *0.5* | *1.9* | *0.9* | *1.5* | *3.6* | *1.8* | *0.9* | *0.8* | *1.7* | *0.8* | *1.1* | *2.5* | *1.4* | *0.3* | *2.1* | *1.0* | *1.9* | *1.1* |
| Rural A/ World A | *0.9* | *0.3* | *1.3* | *0.7* | *0.7* | *1.3* | *0.5* | *2.2* | *0.9* | *1.8* | *3.6* | *1.8* | *0.8* | *1.7* | *1.9* | *0.8* | *1.1* | *2.1* | *1.2* | *1.0* | *1.2* | *1.1* | *1.5* | *1.3* |
| Urban S/Humber S | | *1.3* | *1.3* | *0.8* | *1.2* | *1.0* | | *1.3* | | *1.4* | *0.3* | *0.7* | *1.2* | | | *0.6* | *1.0* | *1.4* | *1.3* | | *2.4* | *1.3* | | |
| Rural S/Humber S | | *0.6* | *1.4* | *0.7* | *1.1* | *0.9* | | *1.1* | | *1.5* | *0.3* | *0.6* | *0.9* | | | *0.6* | *0.8* | *1.1* | *1.1* | | *1.2* | *1.3* | | |

Humber A = <2 mm G-BASE rural soils from the Humber-Trent regional atlas area (British Geological Survey, 2009) (n = 6575)
Humber S = <150 μm G-BASE rural soils from the Humber-Trent regional atlas area (British Geological Survey, 2009) (n = 6575)
Humber C A = <2 mm G-BASE rural soils over Coal Measures from the Humber-Trent regional atlas area (British Geological Survey, 2009) (n = 958)
Scotland A = <2 mm mineral soils National Soil Inventory of Scotland (SEPA, 2001; Paterson et al., 2003) (n = 291)
E&W A = <2 mm National Soil Inventory of England and Wales (McGrath and Loveland, 1992) (n = 5692)
World A = <2 mm world medians (Reimann and Caritat, 1998)
Urban A = <2 mm Glasgow urban top soils (n = 1381)
Urban S = <2 mm Glasgow urban deeper soils (n = 1368)
Rural A = <2 mm Glasgow rural top soils (n = 241)
Rural S = <2 mm Glasgow rural deeper soils (n =241)

A = top soils
S = deeper soils
LOI = loss on ignition
nd = no data

| Median Values | I | La | Mo | Nb | Ni | Pb | Rb | Sb | Sc | Se | Sn | Sr | Ta | Te | Th | Tl | U | V | W | Y | Zn | Zr | pH | LOI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | | wt% |
| Scotland A | nd | nd | nd | nd | 17.5 | 23.0 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 48.0 | nd | nd | nd |
| E&W A | nd | nd | nd | nd | 22.6 | 40.0 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 82.0 | nd | 6.00 | 3.60 |
| Humber A | nd | nd | 2.2 | nd | 22.0 | 43.0 | 65.0 | 0.5 | nd | 0.2 | 4.0 | 66.0 | nd | nd | nd | nd | 2.1 | 83 | nd | nd | 72.0 | 255.0 | 6.78 | 3.50 |
| Humber Coal A | nd | nd | 3.0 | nd | 25.0 | 104.0 | 75.0 | 1.0 | nd | 0.5 | 8.0 | 67.0 | nd | nd | nd | nd | 1.7 | 99 | nd | nd | 115.0 | 256.0 | 5.40 | 13.00 |
| World Soils A | 2 | 35 | 1.2 | 12.0 | 20.0 | 17.0 | 65.0 | 0.5 | 12 | 0.3 | 4.0 | 240.0 | 1.1 | 0.006 | 9.4 | 0.5 | 2.7 | 90 | 1.5 | 20.0 | 70.0 | 230.0 | nd | nd |
| Humber S | nd | 39 | 1.8 | 13.0 | 27.0 | 38.0 | 74.0 | 3.0 | nd | 0.2 | 4.0 | 80.0 | nd | nd | 8.4 | nd | 2.5 | 88 | nd | 26.0 | 77.0 | 379.0 | nd | nd |
| Urban A | 3 | 36 | 2.1 | 15.1 | 46.9 | 127.1 | 40.0 | 1.3 | 14 | 0.9 | 10.2 | 111.0 | 0.6 | 0.5 | 6.9 | 0.6 | 1.6 | 131 | 1.0 | 21.3 | 151.9 | 249.1 | 5.20 | 9.02 |
| Rural A | 5 | 33 | 1.4 | 16.7 | 33.8 | 77.5 | 34.7 | 0.5 | 13 | 0.9 | 6.1 | 83.5 | 0.6 | 0.5 | 5.8 | 0.6 | 2.3 | 128 | 1.3 | 18.2 | 105.4 | 258.5 | 4.84 | 9.95 |
| Urban S | 2 | 37 | 1.9 | 15.8 | 48.0 | 101.3 | 42.9 | 1.0 | 14 | 0.8 | 9.0 | 119.1 | 0.6 | 0.5 | 7.5 | 0.6 | 1.7 | 128 | 0.8 | 22.5 | 129.6 | 247.1 | 5.78 | 6.35 |
| Rural S | 3 | 37 | 1.4 | 17.9 | 31.8 | 38.0 | 39.0 | 0.5 | 13 | 0.7 | 2.7 | 86.5 | 0.6 | 0.5 | 6.1 | 0.5 | 2.0 | 117 | 1.2 | 19.0 | 84.0 | 289.0 | 5.05 | 6.23 |
| **Ratios** | | | | | | | | | | | | | | | | | | | | | | | | |
| Urban A/Scotland A | | | | | *2.7* | *5.5* | | | | | | | | | | | | | | | *3.2* | | | |
| Rural A/Scotland A | | | | | *1.9* | *3.4* | | | | | | | | | | | | | | | *2.2* | | | |
| Urban A/E&W A | | | | | *2.1* | *3.2* | | | | | | | | | | | | | | | *1.9* | | *0.9* | *2.5* |
| Rural A/E&W A | | | | | *1.5* | *1.9* | | | | | | | | | | | | | | | *1.3* | | *0.8* | *2.8* |
| Urban A/Humber A | | | *1.0* | | *2.1* | *3.0* | *0.6* | *2.6* | | *4.5* | *2.6* | *1.7* | | | | | *0.8* | *1.6* | | | *2.1* | *1.0* | *0.8* | *2.6* |
| Rural A/Humber A | | | *0.6* | | *1.5* | *1.8* | *0.5* | *1.0* | | *4.5* | *1.5* | *1.3* | | | | | *1.1* | *1.5* | | | *1.5* | *1.0* | *0.7* | *2.8* |
| Urban A/Humber C | | | *0.7* | | *1.9* | *1.2* | *0.5* | *1.3* | | *1.8* | *1.3* | *1.7* | | | | | *0.9* | *1.3* | | | *1.3* | *1.0* | *1.0* | *0.7* |
| Rural A/Humber C A | | | *0.5* | | *1.4* | *0.7* | *0.5* | *0.5* | | *1.8* | *0.8* | *1.2* | | | | | *1.4* | *1.3* | | | *0.9* | *1.0* | *0.9* | *0.8* |
| Urban A/World A | *1.5* | *1.0* | *1.8* | *1.3* | *2.3* | *7.5* | *0.6* | *2.6* | *1.2* | *3.0* | *2.6* | *0.5* | *0.5* | **83.3* | *0.7* | *1.2* | *0.6* | *1.5* | *0.7* | *1.1* | *2.2* | *1.1* | | |
| Rural A/ World A | *2.5* | *0.9* | *1.2* | *1.4* | *1.7* | *4.6* | *0.5* | *1.0* | *1.1* | *3.0* | *1.5* | *0.3* | *0.5* | **83.3* | *0.6* | *1.1* | *0.9* | *1.4* | *0.9* | *0.9* | *1.5* | *1.1* | | |
| Urban S/Humber S | | *0.9* | *1.1* | *1.2* | *1.8* | *2.7* | *0.6* | *0.3* | | *4.0* | *2.3* | *1.5* | | | *0.9* | | *0.7* | *1.5* | | *0.9* | *1.7* | *0.7* | | |
| Rural S/Humber S | | *0.9* | *0.8* | *1.4* | *1.2* | *1.0* | *0.5* | *0.2* | | *3.5* | *0.7* | *1.1* | | | *0.7* | | *0.8* | *1.3* | | *0.7* | *1.1* | *0.8* | | |

Ratio values should be ignored as the majority of Te values are below the detection limit

Table 3.4 Comparison of parameter median values in top and deeper Glasgow urban and rural soils

| Median | $Al_2O_3$ | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ |
| Urban A | 14.7 | 0.87 | 6.43 | 1.34 | 1.1 | 0.104 | 0.7 | 0.32 | 55.0 | 0.998 | 0.25 | 9.2 | 445 | 0.3 | 17.1 | 0.25 | 74 | 25.0 | 108 | 1 | 51.4 | 14.6 | 3.9 | 5.4 |
| Urban S | 15.5 | 1.03 | 6.67 | 1.42 | 1.2 | 0.105 | 0.7 | 0.24 | 54.9 | 1.002 | 0.25 | 8.5 | 455 | 0.3 | 11.4 | 0.25 | 77 | 28.6 | 104 | 1 | 47.3 | 15.6 | 3.4 | 5.3 |
| *Ratio A/S* | *0.9* | *0.8* | *1.0* | *0.9* | *0.9* | *1.0* | *1.0* | *1.3* | *1.0* | *1.0* | *1.0* | *1.1* | *1.0* | *1.0* | *1.5* | *1.0* | *1.0* | *0.9* | *1.0* | *1.0* | *1.1* | *0.9* | *1.1* | *1.0* |
| Rural A | 14.1 | 0.58 | 6.45 | 1.18 | 1.0 | 0.093 | 0.7 | 0.37 | 55.5 | 1.207 | 0.25 | 9.1 | 391 | 0.5 | 19.0 | 0.25 | 70 | 20.7 | 98 | 3 | 31.0 | 14.9 | 3.2 | 6.6 |
| Rural S | 15.7 | 0.50 | 6.93 | 1.27 | 1.1 | 0.096 | 0.7 | 0.20 | 63.4 | 1.138 | 0.25 | 7.2 | 359 | 0.3 | 14.1 | 0.25 | 63 | 22.2 | 91 | 2 | 23.9 | 15.7 | 2.0 | 6.0 |
| *Ratio A/S* | *0.9* | *1.2* | *0.9* | *0.9* | *0.9* | *1.0* | *1.0* | *1.9* | *0.9* | *1.1* | *1.0* | *1.3* | *1.1* | *2.0* | *1.3* | *1.0* | *1.1* | *0.9* | *1.1* | *1.5* | *1.3* | *0.9* | *1.6* | *1.1* |

| Median | I | La | Mo | Nb | Ni | Pb | Rb | Sb | Sc | Se | Sn | Sr | Ta | Te | Th | Tl | U | V | W | Y | Zn | Zr | pH | LOI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | mg kg$^{-1}$ | | % |
| Urban A | 3 | 36 | 2.1 | 15.1 | 46.9 | 127.1 | 40.0 | 1.3 | 14 | 0.9 | 10.2 | 111.0 | 0.6 | 0.5 | 6.9 | 0.6 | 1.6 | 131 | 1.0 | 21.3 | 151.9 | 249.1 | 5.20 | 9.02 |
| Urban S | 2 | 37 | 1.9 | 15.8 | 48.0 | 101.3 | 42.9 | 1.0 | 14 | 0.8 | 9.0 | 119.1 | 0.6 | 0.5 | 7.5 | 0.6 | 1.7 | 128 | 0.8 | 22.5 | 129.6 | 247.1 | 5.78 | 6.35 |
| *Ratio A/S* | *1.5* | *1.0* | *1.1* | *1.0* | *1.0* | *1.3* | *0.9* | *1.3* | *1.0* | *1.1* | *1.1* | *0.9* | *1.0* | *1.0* | *0.9* | *1.0* | *0.9* | *1.0* | *1.3* | *0.9* | *1.2* | *1.0* | *0.9* | *1.4* |
| Rural A | 5 | 33 | 1.4 | 16.7 | 33.8 | 77.5 | 34.7 | 0.5 | 13 | 0.9 | 6.1 | 83.5 | 0.6 | 0.5 | 5.8 | 0.6 | 2.3 | 128 | 1.3 | 18.2 | 105.4 | 258.5 | 4.84 | 9.95 |
| Rural S | 3 | 37 | 1.4 | 17.9 | 31.8 | 38.0 | 39.0 | 0.5 | 13 | 0.7 | 2.7 | 86.5 | 0.6 | 0.5 | 6.1 | 0.5 | 2.0 | 117 | 1.2 | 19.0 | 84.0 | 289.0 | 5.05 | 6.23 |
| *Ratio A/S* | *2.0* | *0.9* | *1.0* | *0.9* | *1.1* | *2.0* | *0.9* | *1.0* | *1.0* | *1.3* | *2.3* | *1.0* | *1.0* | *1.0* | *1.0* | *1.1* | *1.2* | *1.1* | *1.1* | *1.0* | *1.3* | *0.9* | *1.0* | *1.6* |

A = top soils S = deeper soils

Table 3.5 Spearman Rank Correlation Coefficient matrix for parameters in Glasgow urban top soils

| | $Al_2O_3$ | CaO | $Fe_2O_3$ | $K_2O$ | $Na_2O$ | MgO | MnO | $P_2O_5$ | $SiO_2$ | $TiO_2$ | Ag | As | Ba | Bi | Br | Cd | Ce | Co | Cr | Cs | Cu | Ga | Ge | Hf | I | La | Mo | Nb | Ni | Pb | Rb | Sb | Sc | Se | Sn | Sr | Ta | Te | Th | Tl | U | V | W | Y | Zn | Zr | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $Al_2O_3$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CaO | 0.017 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $Fe_2O_3$ | 0.593 | 0.397 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $K_2O$ | 0.280 | 0.150 | 0.073 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $Na_2O$ | -0.562 | 0.161 | -0.154 | 0.128 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MgO | 0.018 | 0.527 | 0.402 | 0.503 | 0.551 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MnO | 0.344 | 0.398 | 0.736 | 0.038 | -0.111 | 0.336 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $P_2O_5$ | -0.246 | 0.277 | 0.145 | -0.250 | 0.247 | 0.130 | 0.268 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $SiO_2$ | -0.546 | -0.464 | -0.800 | -0.039 | 0.192 | -0.324 | -0.593 | -0.292 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $TiO_2$ | 0.601 | 0.113 | 0.737 | 0.024 | -0.006 | 0.354 | 0.479 | 0.138 | -0.648 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ag | -0.030 | 0.258 | 0.148 | -0.043 | -0.037 | 0.030 | 0.065 | 0.152 | -0.215 | -0.107 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| As | 0.066 | 0.182 | 0.191 | -0.028 | -0.043 | 0.008 | 0.002 | 0.238 | -0.268 | -0.010 | 0.328 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ba | 0.193 | 0.582 | 0.329 | 0.394 | 0.022 | 0.354 | 0.281 | 0.188 | -0.423 | 0.053 | 0.369 | 0.365 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bi | 0.069 | 0.141 | 0.161 | 0.020 | -0.028 | 0.053 | 0.101 | 0.102 | -0.156 | 0.023 | 0.247 | 0.216 | 0.195 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Br | -0.012 | -0.018 | 0.182 | -0.307 | 0.106 | 0.005 | 0.113 | 0.526 | -0.399 | 0.332 | 0.060 | 0.274 | -0.003 | 0.046 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cd | -0.074 | 0.335 | 0.107 | -0.037 | -0.005 | 0.044 | 0.105 | 0.209 | -0.215 | -0.142 | 0.528 | 0.299 | 0.430 | 0.222 | 0.080 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ce | 0.684 | 0.168 | 0.336 | 0.221 | -0.572 | -0.128 | 0.196 | -0.082 | -0.451 | 0.194 | 0.169 | 0.228 | 0.429 | 0.147 | 0.012 | 0.171 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Co | 0.436 | 0.549 | 0.786 | 0.064 | -0.123 | 0.369 | 0.622 | 0.261 | -0.775 | 0.486 | 0.296 | 0.356 | 0.544 | 0.214 | 0.228 | 0.295 | 0.485 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cr | 0.344 | 0.309 | 0.478 | -0.065 | -0.314 | 0.073 | 0.371 | 0.155 | -0.522 | 0.242 | 0.276 | 0.391 | 0.365 | 0.205 | 0.197 | 0.309 | 0.478 | 0.592 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cs | -0.207 | -0.414 | -0.712 | -0.010 | -0.128 | -0.424 | -0.575 | -0.181 | 0.498 | -0.494 | -0.120 | -0.085 | -0.276 | -0.102 | -0.073 | -0.103 | -0.017 | -0.567 | -0.254 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cu | 0.013 | 0.489 | 0.208 | -0.013 | -0.061 | 0.061 | 0.131 | 0.286 | -0.331 | -0.112 | 0.410 | 0.606 | 0.614 | 0.227 | 0.167 | 0.454 | 0.358 | 0.532 | 0.479 | -0.189 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ga | 0.826 | 0.307 | 0.773 | 0.226 | -0.368 | 0.232 | 0.482 | 0.047 | -0.780 | 0.646 | 0.171 | 0.288 | 0.406 | 0.181 | 0.212 | 0.117 | 0.664 | 0.716 | 0.501 | -0.376 | 0.276 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ge | 0.049 | 0.228 | 0.111 | -0.185 | -0.181 | -0.177 | 0.024 | 0.348 | -0.303 | -0.081 | 0.333 | 0.626 | 0.431 | 0.199 | 0.393 | 0.328 | 0.396 | 0.432 | 0.412 | -0.022 | 0.742 | 0.308 | | | | | | | | | | | | | | | | | | | | | | | | |
| Hf | 0.199 | -0.213 | 0.039 | -0.029 | -0.116 | -0.180 | -0.081 | -0.142 | 0.033 | 0.176 | -0.094 | -0.097 | -0.150 | -0.029 | 0.018 | -0.098 | 0.111 | -0.070 | 0.021 | -0.029 | -0.104 | 0.081 | -0.043 | | | | | | | | | | | | | | | | | | | | | | | |
| I | -0.025 | -0.344 | 0.009 | -0.302 | 0.052 | -0.129 | 0.065 | 0.339 | -0.050 | 0.283 | -0.217 | -0.012 | -0.374 | -0.070 | 0.584 | -0.266 | -0.228 | -0.120 | -0.103 | 0.064 | -0.268 | -0.024 | -0.015 | 0.068 | | | | | | | | | | | | | | | | | | | | | | |
| La | 0.523 | 0.044 | 0.042 | 0.174 | -0.585 | -0.304 | -0.045 | -0.130 | -0.227 | -0.035 | 0.143 | 0.227 | 0.346 | 0.104 | -0.040 | 0.161 | 0.917 | 0.253 | 0.367 | 0.226 | 0.331 | 0.450 | 0.419 | 0.094 | -0.251 | | | | | | | | | | | | | | | | | | | | | |
| Mo | 0.236 | 0.361 | 0.480 | -0.061 | -0.057 | 0.138 | 0.275 | 0.308 | -0.519 | 0.267 | 0.285 | 0.585 | 0.407 | 0.207 | 0.356 | 0.292 | 0.364 | 0.581 | 0.481 | -0.305 | 0.561 | 0.480 | 0.514 | -0.096 | -0.020 | 0.252 | | | | | | | | | | | | | | | | | | | | |
| Nb | 0.669 | 0.196 | 0.796 | 0.101 | -0.072 | 0.369 | 0.519 | 0.088 | -0.661 | 0.931 | -0.036 | 0.051 | 0.162 | 0.074 | 0.229 | -0.055 | 0.324 | 0.570 | 0.361 | -0.535 | -0.018 | 0.726 | -0.035 | 0.200 | 0.143 | 0.077 | 0.372 | | | | | | | | | | | | | | | | | | | |
| Ni | 0.310 | 0.581 | 0.584 | 0.043 | -0.142 | 0.283 | 0.419 | 0.257 | -0.642 | 0.264 | 0.341 | 0.493 | 0.611 | 0.233 | 0.194 | 0.364 | 0.539 | 0.853 | 0.689 | -0.393 | 0.715 | 0.608 | 0.601 | -0.118 | -0.234 | 0.391 | 0.642 | 0.381 | | | | | | | | | | | | | | | | | | |
| Pb | -0.100 | 0.331 | 0.043 | -0.108 | -0.048 | -0.079 | 0.000 | 0.336 | -0.205 | -0.199 | 0.377 | 0.621 | 0.562 | 0.204 | 0.273 | 0.445 | 0.252 | 0.351 | 0.368 | -0.063 | 0.832 | 0.149 | 0.790 | -0.098 | -0.158 | 0.278 | 0.471 | -0.139 | 0.539 | | | | | | | | | | | | | | | | | |
| Rb | 0.610 | 0.051 | 0.244 | 0.775 | -0.334 | 0.202 | 0.181 | -0.295 | -0.168 | 0.112 | -0.007 | 0.101 | 0.374 | 0.058 | -0.279 | -0.012 | 0.517 | 0.192 | 0.187 | -0.026 | 0.054 | 0.479 | -0.025 | 0.046 | -0.235 | 0.452 | 0.087 | 0.230 | 0.175 | -0.031 | | | | | | | | | | | | | | | | |
| Sb | -0.125 | 0.343 | 0.022 | -0.059 | -0.014 | -0.055 | -0.025 | 0.246 | -0.158 | -0.248 | 0.387 | 0.545 | 0.513 | 0.202 | 0.131 | 0.433 | 0.204 | 0.311 | 0.337 | -0.061 | 0.776 | 0.097 | 0.651 | -0.112 | -0.229 | 0.232 | 0.405 | -0.183 | 0.483 | 0.791 | -0.020 | | | | | | | | | | | | | | | |
| Sc | 0.593 | 0.512 | 0.746 | 0.134 | -0.205 | 0.337 | 0.528 | 0.166 | -0.817 | 0.541 | 0.234 | 0.339 | 0.531 | 0.160 | 0.241 | 0.240 | 0.611 | 0.828 | 0.599 | -0.445 | 0.453 | 0.809 | 0.393 | -0.055 | -0.131 | 0.401 | 0.573 | 0.619 | 0.784 | 0.284 | 0.303 | 0.236 | | | | | | | | | | | | | | |
| Se | 0.282 | 0.215 | 0.354 | -0.207 | -0.319 | -0.155 | 0.213 | 0.346 | -0.528 | 0.167 | 0.287 | 0.551 | 0.352 | 0.210 | 0.468 | 0.311 | 0.476 | 0.510 | 0.490 | -0.120 | 0.546 | 0.505 | 0.720 | -0.063 | 0.114 | 0.428 | 0.582 | 0.201 | 0.582 | 0.572 | 0.051 | 0.463 | 0.544 | | | | | | | | | | | | | |
| Sn | -0.069 | 0.294 | 0.036 | -0.058 | -0.028 | -0.045 | -0.022 | 0.263 | -0.175 | -0.176 | 0.352 | 0.575 | 0.497 | 0.186 | 0.186 | 0.389 | 0.259 | 0.322 | 0.330 | -0.054 | 0.787 | 0.140 | 0.697 | -0.077 | -0.190 | 0.280 | 0.430 | -0.119 | 0.493 | 0.817 | -0.006 | 0.729 | 0.261 | 0.462 | | | | | | | | | | | | |
| Sr | 0.108 | 0.793 | 0.424 | 0.241 | 0.231 | 0.517 | 0.338 | 0.278 | -0.507 | 0.153 | 0.320 | 0.318 | 0.677 | 0.190 | 0.081 | 0.377 | 0.333 | 0.682 | 0.354 | -0.403 | 0.613 | 0.413 | 0.404 | -0.176 | -0.348 | 0.199 | 0.463 | 0.250 | 0.724 | 0.450 | 0.142 | 0.454 | 0.628 | 0.343 | 0.412 | | | | | | | | | | | |
| Ta | 0.210 | 0.138 | 0.339 | 0.048 | 0.046 | 0.211 | 0.243 | 0.074 | -0.287 | 0.357 | 0.016 | -0.031 | 0.098 | 0.068 | 0.089 | -0.005 | 0.076 | 0.269 | 0.126 | -0.218 | -0.008 | 0.284 | -0.051 | 0.026 | 0.069 | -0.040 | 0.123 | 0.378 | 0.184 | -0.081 | 0.023 | -0.099 | 0.232 | 0.032 | -0.066 | 0.135 | | | | | | | | | | |
| Te | -0.049 | -0.006 | -0.059 | 0.020 | -0.006 | 0.008 | -0.050 | -0.014 | 0.045 | -0.081 | 0.094 | 0.022 | -0.005 | 0.011 | -0.058 | 0.066 | -0.101 | -0.038 | 0.029 | 0.039 | 0.033 | -0.057 | -0.031 | -0.070 | -0.038 | -0.094 | -0.045 | -0.076 | -0.041 | 0.005 | -0.018 | 0.046 | -0.040 | -0.037 | -0.068 | -0.026 | -0.021 | | | | | | | | | |
| Th | 0.735 | 0.156 | 0.414 | 0.250 | -0.642 | -0.136 | 0.250 | -0.194 | -0.430 | 0.180 | 0.210 | 0.267 | 0.416 | 0.092 | -0.106 | 0.201 | 0.831 | 0.454 | 0.511 | -0.114 | 0.339 | 0.681 | 0.334 | 0.151 | -0.284 | 0.744 | 0.354 | 0.341 | 0.486 | 0.252 | 0.644 | 0.218 | 0.580 | 0.435 | 0.238 | 0.258 | 0.023 | -0.041 | | | | | | | | |
| Tl | 0.090 | 0.192 | 0.118 | -0.040 | -0.185 | -0.093 | 0.067 | 0.168 | -0.211 | -0.077 | 0.308 | 0.442 | 0.383 | 0.146 | 0.168 | 0.352 | 0.299 | 0.290 | 0.311 | -0.029 | 0.486 | 0.258 | 0.521 | -0.084 | -0.078 | 0.297 | 0.324 | -0.022 | 0.392 | 0.581 | 0.111 | 0.471 | 0.270 | 0.484 | 0.469 | 0.258 | -0.038 | -0.012 | 0.327 | | | | | | | |
| U | 0.505 | 0.048 | 0.183 | 0.086 | -0.459 | -0.178 | 0.059 | -0.067 | -0.272 | 0.139 | 0.071 | 0.242 | 0.190 | 0.092 | 0.033 | 0.048 | 0.629 | 0.242 | 0.330 | 0.071 | 0.190 | 0.441 | 0.291 | 0.073 | -0.072 | 0.629 | 0.348 | 0.236 | 0.309 | 0.092 | 0.382 | 0.093 | 0.390 | 0.386 | 0.113 | 0.140 | 0.034 | -0.018 | 0.621 | 0.161 | | | | | | |
| V | 0.423 | 0.448 | 0.711 | -0.053 | -0.058 | 0.286 | 0.457 | 0.343 | -0.784 | 0.581 | 0.241 | 0.479 | 0.440 | 0.201 | 0.441 | 0.247 | 0.444 | 0.809 | 0.598 | -0.457 | 0.516 | 0.724 | 0.525 | -0.014 | 0.035 | 0.258 | 0.701 | 0.629 | 0.790 | 0.387 | 0.082 | 0.314 | 0.822 | 0.605 | 0.337 | 0.598 | 0.251 | -0.060 | 0.395 | 0.299 | 0.329 | | | | | |
| W | -0.083 | 0.096 | -0.235 | -0.030 | -0.154 | -0.233 | -0.179 | 0.038 | 0.056 | -0.340 | 0.239 | 0.272 | 0.253 | 0.084 | 0.018 | 0.303 | 0.283 | 0.022 | 0.207 | 0.275 | 0.385 | -0.024 | 0.399 | -0.101 | -0.214 | 0.409 | 0.221 | -0.265 | 0.216 | 0.397 | 0.030 | 0.386 | 0.054 | 0.253 | 0.370 | 0.146 | -0.078 | -0.006 | 0.222 | 0.264 | 0.257 | 0.099 | | | | |
| Y | 0.605 | 0.487 | 0.628 | 0.230 | -0.301 | 0.197 | 0.435 | 0.100 | -0.669 | 0.354 | 0.288 | 0.351 | 0.641 | 0.212 | 0.091 | 0.300 | 0.795 | 0.783 | 0.578 | -0.363 | 0.552 | 0.773 | 0.488 | 0.039 | -0.283 | 0.611 | 0.558 | 0.495 | 0.788 | 0.400 | 0.420 | 0.344 | 0.836 | 0.549 | 0.367 | 0.657 | 0.187 | -0.041 | 0.735 | 0.355 | 0.478 | 0.722 | 0.186 | | | |
| Zn | 0.030 | 0.559 | 0.282 | -0.008 | -0.028 | 0.130 | 0.255 | 0.375 | -0.383 | -0.032 | 0.388 | 0.551 | 0.663 | 0.249 | 0.183 | 0.511 | 0.312 | 0.542 | 0.490 | -0.243 | 0.844 | 0.307 | 0.654 | -0.117 | -0.235 | 0.257 | 0.546 | 0.065 | 0.675 | 0.794 | 0.055 | 0.714 | 0.459 | 0.525 | 0.698 | 0.603 | 0.031 | 0.015 | 0.311 | 0.484 | 0.136 | 0.512 | 0.325 | 0.533 | | |
| Zr | 0.253 | -0.395 | -0.042 | -0.031 | -0.200 | -0.286 | -0.104 | -0.258 | 0.188 | 0.177 | -0.214 | -0.264 | -0.273 | -0.041 | -0.092 | -0.240 | 0.110 | -0.214 | -0.026 | 0.044 | -0.276 | 0.017 | -0.172 | 0.648 | 0.128 | 0.094 | -0.265 | 0.196 | -0.275 | -0.248 | 0.074 | -0.255 | -0.185 | -0.191 | -0.207 | -0.381 | 0.055 | -0.048 | 0.141 | -0.158 | 0.097 | -0.169 | -0.105 | -0.044 | -0.270 | |
| pH | -0.011 | 0.706 | 0.142 | 0.245 | 0.053 | 0.313 | 0.201 | -0.112 | -0.052 | -0.135 | 0.148 | -0.022 | 0.352 | 0.083 | -0.444 | 0.215 | 0.052 | 0.179 | 0.076 | -0.244 | 0.221 | 0.040 | -0.106 | -0.107 | -0.454 | -0.005 | 0.055 | -0.022 | 0.221 | 0.050 | 0.168 | 0.167 | 0.153 | -0.141 | 0.067 | 0.428 | 0.020 | 0.039 | 0.133 | 0.040 | -0.007 | 0.020 | 0.034 | 0.214 | 0.285 | -0.186 | |
| LOI | 0.267 | 0.259 | 0.382 | -0.199 | -0.202 | -0.019 | 0.269 | 0.469 | -0.679 | 0.363 | 0.203 | 0.395 | 0.316 | 0.140 | 0.668 | 0.257 | 0.393 | 0.489 | 0.429 | -0.127 | 0.408 | 0.510 | 0.563 | -0.059 | 0.233 | 0.327 | 0.524 | 0.324 | 0.495 | 0.427 | -0.043 | 0.294 | 0.547 | 0.686 | 0.355 | 0.305 | 0.117 | -0.036 | 0.284 | 0.346 | 0.299 | 0.640 | 0.214 | 0.464 | 0.444 | -0.192 | -0.206 |

n = 1368 r = 0.074 p-value <0.01 (Koch and Link, 1971) Significant correlations are shown in yellow. Excluding results for Te, which were mainly below LLD

Table 3.6 Spearman Rank Correlation Coefficient matrix for parameters in Glasgow urban deeper soils

| | $Al_2O_3$ | CaO | $Fe_2O_3$ | $K_2O$ | $Na_2O$ | MgO | MnO | $P_2O_5$ | $SiO_2$ | $TiO_2$ | Ag | As | Ba | Bi | Br | Cd | Ce | Co | Cr | Cs | Cu | Ga |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $Al_2O_3$ | | | | | | | | | | | | | | | | | | | | | | |
| CaO | -0.049 | | | | | | | | | | | | | | | | | | | | | |
| $Fe_2O_3$ | 0.554 | 0.315 | | | | | | | | | | | | | | | | | | | | |
| $K_2O$ | 0.430 | 0.045 | 0.126 | | | | | | | | | | | | | | | | | | | |
| $Na_2O$ | 0.054 | 0.450 | 0.382 | 0.509 | | | | | | | | | | | | | | | | | | |
| MgO | 0.281 | 0.317 | 0.701 | 0.027 | 0.291 | | | | | | | | | | | | | | | | | |
| MnO | -0.605 | 0.098 | -0.177 | -0.024 | 0.469 | -0.109 | | | | | | | | | | | | | | | | |
| $P_2O_5$ | -0.268 | 0.376 | 0.195 | -0.304 | 0.187 | 0.300 | 0.314 | | | | | | | | | | | | | | | |
| $SiO_2$ | -0.524 | -0.462 | -0.812 | -0.111 | -0.348 | -0.544 | 0.213 | -0.310 | | | | | | | | | | | | | | |
| $TiO_2$ | 0.561 | 0.024 | 0.722 | 0.096 | 0.359 | 0.444 | 0.008 | 0.169 | -0.610 | | | | | | | | | | | | | |
| Ag | -0.063 | 0.268 | 0.148 | -0.096 | -0.011 | 0.105 | -0.027 | 0.196 | -0.209 | -0.121 | | | | | | | | | | | | |
| As | -0.049 | 0.331 | 0.190 | -0.080 | 0.063 | 0.085 | 0.040 | 0.338 | -0.268 | -0.048 | 0.347 | | | | | | | | | | | |
| Ba | 0.185 | 0.559 | 0.277 | 0.322 | 0.315 | 0.246 | -0.040 | 0.219 | -0.441 | 0.025 | 0.352 | 0.421 | | | | | | | | | | |
| Bi | 0.052 | 0.208 | 0.218 | -0.064 | 0.087 | 0.161 | -0.050 | 0.134 | -0.228 | 0.062 | 0.220 | 0.211 | 0.167 | | | | | | | | | |
| Br | -0.179 | -0.033 | 0.137 | -0.437 | -0.065 | 0.133 | 0.215 | 0.615 | -0.261 | 0.275 | 0.094 | 0.213 | -0.038 | 0.037 | | | | | | | | |
| Cd | -0.092 | 0.335 | 0.112 | -0.117 | -0.006 | 0.129 | -0.034 | 0.256 | -0.248 | -0.147 | 0.530 | 0.344 | 0.391 | 0.178 | 0.146 | | | | | | | |
| Ce | 0.709 | 0.153 | 0.319 | 0.310 | -0.079 | 0.175 | -0.604 | -0.127 | -0.458 | 0.170 | 0.132 | 0.168 | 0.452 | 0.104 | -0.176 | 0.160 | | | | | | |
| Co | 0.381 | 0.516 | 0.763 | 0.047 | 0.352 | 0.610 | -0.119 | 0.354 | -0.787 | 0.459 | 0.272 | 0.380 | 0.504 | 0.264 | 0.192 | 0.300 | 0.467 | | | | | |
| Cr | 0.393 | 0.342 | 0.518 | 0.014 | 0.162 | 0.373 | -0.300 | 0.194 | -0.594 | 0.291 | 0.271 | 0.403 | 0.415 | 0.225 | 0.113 | 0.314 | 0.497 | 0.627 | | | | |
| Cs | -0.127 | -0.351 | -0.638 | 0.024 | -0.331 | -0.534 | -0.088 | -0.225 | 0.429 | -0.424 | -0.114 | -0.131 | -0.202 | -0.154 | -0.072 | -0.100 | 0.003 | -0.489 | -0.238 | | | |
| Cu | -0.077 | 0.576 | 0.166 | -0.093 | 0.089 | 0.144 | -0.010 | 0.400 | -0.329 | -0.148 | 0.381 | 0.658 | 0.583 | 0.247 | 0.165 | 0.424 | 0.292 | 0.520 | 0.481 | -0.196 | | |
| Ga | 0.832 | 0.265 | 0.762 | 0.358 | 0.279 | 0.457 | -0.408 | 0.049 | -0.788 | 0.617 | 0.138 | 0.180 | 0.395 | 0.165 | 0.020 | 0.123 | 0.665 | 0.686 | 0.568 | -0.301 | 0.201 | |
| Ge | -0.097 | 0.390 | 0.055 | -0.268 | -0.140 | 0.052 | -0.063 | 0.442 | -0.248 | -0.167 | 0.338 | 0.625 | 0.453 | 0.196 | 0.345 | 0.385 | 0.282 | 0.415 | 0.375 | -0.050 | 0.800 | 0.157 |
| Hf | 0.188 | -0.243 | 0.024 | -0.027 | -0.167 | -0.051 | -0.055 | -0.112 | 0.029 | 0.220 | -0.097 | -0.198 | -0.175 | -0.058 | 0.044 | -0.142 | 0.064 | -0.100 | -0.034 | 0.013 | -0.171 | 0.039 |
| I | -0.149 | -0.401 | -0.052 | -0.349 | -0.186 | 0.051 | 0.130 | 0.268 | 0.077 | 0.217 | -0.191 | -0.098 | -0.414 | -0.125 | 0.614 | -0.199 | -0.345 | -0.167 | -0.186 | 0.052 | -0.269 | -0.187 |
| La | 0.563 | 0.073 | 0.038 | 0.258 | -0.229 | -0.046 | -0.604 | -0.176 | -0.242 | -0.052 | 0.112 | 0.157 | 0.394 | 0.032 | -0.207 | 0.154 | 0.926 | 0.253 | 0.392 | 0.207 | 0.285 | 0.462 |
| Mo | 0.179 | 0.434 | 0.487 | -0.105 | 0.146 | 0.300 | -0.079 | 0.378 | -0.577 | 0.240 | 0.290 | 0.597 | 0.397 | 0.218 | 0.287 | 0.313 | 0.335 | 0.612 | 0.539 | -0.286 | 0.580 | 0.440 |
| Nb | 0.616 | 0.145 | 0.781 | 0.158 | 0.389 | 0.488 | -0.057 | 0.170 | -0.668 | 0.925 | -0.032 | 0.040 | 0.144 | 0.109 | 0.188 | -0.048 | 0.308 | 0.564 | 0.424 | -0.452 | -0.037 | 0.700 |
| Ni | 0.260 | 0.613 | 0.536 | 0.031 | 0.298 | 0.405 | -0.145 | 0.348 | -0.657 | 0.219 | 0.332 | 0.537 | 0.611 | 0.263 | 0.119 | 0.370 | 0.518 | 0.842 | 0.728 | -0.335 | 0.727 | 0.572 |
| Pb | -0.229 | 0.461 | -0.012 | -0.227 | -0.072 | 0.022 | 0.025 | 0.412 | -0.162 | -0.259 | 0.372 | 0.643 | 0.528 | 0.215 | 0.269 | 0.442 | 0.129 | 0.304 | 0.298 | -0.109 | 0.829 | 0.013 |
| Rb | 0.690 | 0.019 | 0.262 | 0.837 | 0.269 | 0.148 | -0.397 | -0.321 | -0.237 | 0.155 | -0.042 | 0.032 | 0.332 | -0.007 | -0.411 | -0.058 | 0.558 | 0.168 | 0.242 | 0.008 | -0.021 | 0.562 |
| Sb | -0.212 | 0.471 | -0.011 | -0.129 | -0.015 | 0.010 | 0.035 | 0.312 | -0.139 | -0.295 | 0.404 | 0.588 | 0.513 | 0.201 | 0.128 | 0.461 | 0.140 | 0.297 | 0.320 | -0.076 | 0.758 | 0.026 |
| Sc | 0.582 | 0.483 | 0.718 | 0.186 | 0.330 | 0.475 | -0.251 | 0.189 | -0.826 | 0.485 | 0.234 | 0.325 | 0.531 | 0.205 | 0.096 | 0.258 | 0.625 | 0.813 | 0.672 | -0.363 | 0.432 | 0.802 |
| Se | 0.248 | 0.319 | 0.397 | -0.203 | -0.099 | 0.302 | -0.314 | 0.385 | -0.546 | 0.168 | 0.293 | 0.542 | 0.379 | 0.238 | 0.389 | 0.358 | 0.421 | 0.548 | 0.525 | -0.172 | 0.556 | 0.455 |
| Sn | -0.204 | 0.398 | -0.021 | -0.172 | -0.052 | -0.016 | 0.036 | 0.352 | -0.127 | -0.240 | 0.350 | 0.600 | 0.447 | 0.194 | 0.193 | 0.398 | 0.133 | 0.259 | 0.276 | -0.079 | 0.789 | 0.009 |
| Sr | 0.064 | 0.802 | 0.387 | 0.135 | 0.461 | 0.301 | 0.176 | 0.388 | -0.540 | 0.108 | 0.317 | 0.424 | 0.649 | 0.212 | 0.058 | 0.359 | 0.323 | 0.678 | 0.413 | -0.337 | 0.676 | 0.392 |
| Ta | 0.231 | 0.078 | 0.355 | 0.081 | 0.197 | 0.239 | -0.005 | 0.074 | -0.308 | 0.366 | -0.001 | -0.050 | 0.075 | 0.043 | 0.081 | -0.043 | 0.122 | 0.284 | 0.145 | -0.177 | -0.015 | 0.302 |
| Th | 0.761 | 0.153 | 0.398 | 0.340 | -0.096 | 0.224 | -0.696 | -0.217 | -0.452 | 0.156 | 0.192 | 0.203 | 0.416 | 0.088 | -0.246 | 0.199 | 0.850 | 0.428 | 0.545 | -0.076 | 0.263 | 0.703 |
| Tl | 0.019 | 0.258 | 0.080 | -0.051 | -0.077 | 0.049 | -0.160 | 0.178 | -0.212 | -0.156 | 0.297 | 0.418 | 0.371 | 0.138 | 0.144 | 0.381 | 0.222 | 0.246 | 0.296 | -0.047 | 0.467 | 0.176 |
| U | 0.513 | 0.054 | 0.158 | 0.103 | -0.171 | 0.058 | -0.502 | -0.064 | -0.275 | 0.108 | 0.048 | 0.240 | 0.216 | 0.026 | -0.046 | 0.081 | 0.675 | 0.252 | 0.422 | 0.118 | 0.217 | 0.448 |
| V | 0.350 | 0.468 | 0.692 | -0.069 | 0.298 | 0.452 | -0.035 | 0.431 | -0.805 | 0.550 | 0.252 | 0.483 | 0.438 | 0.228 | 0.379 | 0.283 | 0.402 | 0.821 | 0.654 | -0.406 | 0.531 | 0.665 |
| W | -0.047 | 0.165 | -0.246 | -0.067 | -0.213 | -0.156 | -0.160 | 0.050 | 0.029 | -0.341 | 0.174 | 0.243 | 0.250 | 0.007 | -0.007 | 0.242 | 0.301 | 0.035 | 0.235 | 0.283 | 0.398 | -0.005 |
| Y | 0.568 | 0.484 | 0.598 | 0.251 | 0.211 | 0.421 | -0.327 | 0.138 | -0.687 | 0.304 | 0.279 | 0.351 | 0.636 | 0.216 | -0.047 | 0.308 | 0.798 | 0.769 | 0.615 | -0.301 | 0.518 | 0.747 |
| Zn | -0.070 | 0.607 | 0.238 | -0.121 | 0.130 | 0.246 | 0.017 | 0.498 | -0.392 | -0.071 | 0.404 | 0.619 | 0.629 | 0.272 | 0.256 | 0.485 | 0.239 | 0.530 | 0.484 | -0.256 | 0.865 | 0.238 |
| Zr | 0.208 | -0.461 | -0.055 | -0.031 | -0.270 | -0.099 | -0.111 | -0.225 | 0.219 | 0.233 | -0.218 | -0.349 | -0.331 | -0.072 | 0.006 | -0.268 | 0.037 | -0.267 | -0.116 | 0.064 | -0.375 | -0.039 |
| pH | 0.021 | 0.743 | 0.118 | 0.210 | 0.292 | 0.159 | -0.050 | -0.034 | -0.139 | -0.156 | 0.152 | 0.151 | 0.383 | 0.117 | -0.460 | 0.178 | 0.143 | 0.209 | 0.182 | -0.224 | 0.334 | 0.125 |
| LOI | 0.141 | 0.347 | 0.341 | -0.264 | -0.028 | 0.276 | -0.148 | 0.574 | -0.591 | 0.256 | 0.225 | 0.432 | 0.365 | 0.167 | 0.613 | 0.326 | 0.299 | 0.511 | 0.451 | -0.126 | 0.515 | 0.400 |

| | Ge | Hf | I | La | Mo | Nb | Ni | Pb | Rb | Sb | Sc | Se | Sn | Sr | Ta | Th | Tl | U | V | W | Y | Zn | Zr | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hf | -0.133 | | | | | | | | | | | | | | | | | | | | | | | |
| I | -0.082 | 0.132 | | | | | | | | | | | | | | | | | | | | | | |
| La | 0.322 | 0.046 | -0.347 | | | | | | | | | | | | | | | | | | | | | |
| Mo | 0.534 | -0.153 | -0.079 | 0.226 | | | | | | | | | | | | | | | | | | | | |
| Nb | -0.088 | 0.202 | 0.076 | 0.072 | 0.373 | | | | | | | | | | | | | | | | | | | |
| Ni | 0.610 | -0.189 | -0.310 | 0.394 | 0.670 | 0.361 | | | | | | | | | | | | | | | | | | |
| Pb | 0.817 | -0.164 | -0.145 | 0.176 | 0.465 | -0.184 | 0.514 | | | | | | | | | | | | | | | | | |
| Rb | -0.141 | -0.003 | -0.317 | 0.494 | 0.051 | 0.252 | 0.164 | -0.155 | | | | | | | | | | | | | | | | |
| Sb | 0.680 | -0.177 | -0.246 | 0.180 | 0.430 | -0.189 | 0.500 | 0.798 | -0.092 | | | | | | | | | | | | | | | |
| Sc | 0.336 | -0.076 | -0.245 | 0.431 | 0.585 | 0.592 | 0.771 | 0.217 | 0.348 | 0.216 | | | | | | | | | | | | | | |
| Se | 0.631 | -0.126 | 0.035 | 0.364 | 0.605 | 0.220 | 0.625 | 0.521 | 0.048 | 0.438 | 0.552 | | | | | | | | | | | | | |
| Sn | 0.738 | -0.114 | -0.176 | 0.173 | 0.421 | -0.169 | 0.459 | 0.851 | -0.116 | 0.750 | 0.173 | 0.424 | | | | | | | | | | | | |
| Sr | 0.516 | -0.206 | -0.392 | 0.216 | 0.527 | 0.236 | 0.751 | 0.506 | 0.099 | 0.520 | 0.634 | 0.416 | 0.446 | | | | | | | | | | | |
| Ta | -0.060 | 0.048 | 0.020 | 0.010 | 0.125 | 0.385 | 0.165 | -0.087 | 0.074 | -0.080 | 0.242 | 0.048 | -0.089 | 0.111 | | | | | | | | | | |
| Th | 0.225 | 0.055 | -0.366 | 0.774 | 0.327 | 0.308 | 0.477 | 0.134 | 0.673 | 0.150 | 0.604 | 0.430 | 0.127 | 0.254 | 0.086 | | | | | | | | | |
| Tl | 0.487 | -0.170 | -0.107 | 0.244 | 0.317 | -0.098 | 0.381 | 0.538 | 0.073 | 0.451 | 0.260 | 0.455 | 0.442 | 0.279 | -0.061 | 0.270 | | | | | | | | |
| U | 0.293 | 0.035 | -0.137 | 0.688 | 0.350 | 0.208 | 0.345 | 0.098 | 0.384 | 0.094 | 0.418 | 0.428 | 0.099 | 0.141 | 0.034 | 0.643 | 0.170 | | | | | | | |
| V | 0.509 | -0.030 | -0.044 | 0.227 | 0.703 | 0.625 | 0.790 | 0.352 | 0.058 | 0.316 | 0.799 | 0.620 | 0.302 | 0.638 | 0.265 | 0.359 | 0.263 | 0.324 | | | | | | |
| W | 0.429 | -0.080 | -0.216 | 0.422 | 0.163 | -0.262 | 0.251 | 0.355 | 0.011 | 0.392 | 0.085 | 0.232 | 0.351 | 0.210 | -0.064 | 0.232 | 0.238 | 0.346 | 0.117 | | | | | |
| Y | 0.431 | -0.027 | -0.404 | 0.632 | 0.550 | 0.459 | 0.779 | 0.318 | 0.421 | 0.317 | 0.838 | 0.541 | 0.278 | 0.661 | 0.198 | 0.729 | 0.299 | 0.499 | 0.693 | 0.222 | | | | |
| Zn | 0.753 | -0.184 | -0.209 | 0.207 | 0.573 | 0.035 | 0.692 | 0.837 | -0.046 | 0.754 | 0.436 | 0.577 | 0.746 | 0.651 | 0.029 | 0.220 | 0.480 | 0.157 | 0.540 | 0.319 | 0.493 | | | |
| Zr | -0.266 | 0.633 | 0.223 | 0.033 | -0.323 | 0.198 | -0.369 | -0.313 | 0.006 | -0.327 | -0.246 | -0.246 | -0.252 | -0.444 | 0.069 | 0.021 | -0.259 | 0.016 | -0.205 | -0.137 | -0.147 | -0.340 | | |
| pH | 0.096 | -0.163 | -0.526 | 0.111 | 0.162 | -0.036 | 0.339 | 0.221 | 0.204 | 0.314 | 0.237 | 0.037 | 0.211 | 0.486 | -0.001 | 0.222 | 0.120 | 0.049 | 0.102 | 0.126 | 0.309 | 0.330 | -0.299 | |
| LOI | 0.631 | -0.065 | 0.148 | 0.254 | 0.534 | 0.261 | 0.547 | 0.515 | -0.102 | 0.383 | 0.476 | 0.710 | 0.443 | 0.401 | 0.120 | 0.230 | 0.371 | 0.293 | 0.650 | 0.239 | 0.432 | 0.594 | -0.183 | -0.073 |

n = 1368; r = 0.074 p-value <0.01 (Koch and Link, 1971) Significant correlations are shown in yellow. Excluding results for Te, which were mainly below LLD

Table 3.7 Spearman Rank Correlation Coefficient matrix for parameters in Glasgow rural top soils

| | $Al_2O_3$ | CaO | $Fe_2O_3$ | $K_2O$ | $Na_2O$ | MgO | MnO | $P_2O_5$ | $SiO_2$ | $TiO_2$ | Ag | As | Ba | Bi | Br | Cd | Ce | Co | Cr | Cs | Cu | Ga | Ge | Hf | I | La | Mo | Nb | Ni | Pb | Rb | Sb | Sc | Se | Sn | Sr | Ta | Th | Tl | U | V | W | Y | Zn | Zr | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $Al_2O_3$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CaO | 0.225 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $Fe_2O_3$ | 0.471 | 0.616 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $K_2O$ | 0.275 | -0.059 | -0.019 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $Na_2O$ | -0.312 | 0.301 | 0.210 | 0.221 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MgO | 0.134 | 0.475 | 0.553 | 0.491 | 0.662 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MnO | 0.223 | 0.578 | 0.791 | -0.044 | 0.174 | 0.403 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $P_2O_5$ | -0.171 | 0.613 | 0.447 | -0.220 | 0.429 | 0.305 | 0.558 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $SiO_2$ | -0.207 | -0.591 | -0.624 | 0.123 | -0.055 | -0.357 | -0.541 | -0.449 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $TiO_2$ | 0.398 | 0.579 | 0.859 | -0.028 | 0.374 | 0.582 | 0.568 | 0.452 | -0.610 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ag | 0.127 | 0.200 | 0.084 | 0.079 | 0.079 | 0.076 | 0.013 | 0.161 | -0.103 | 0.110 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| As | 0.013 | 0.239 | 0.127 | 0.136 | 0.203 | 0.190 | 0.129 | 0.264 | -0.133 | 0.057 | 0.211 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ba | 0.411 | 0.466 | 0.270 | 0.577 | 0.194 | 0.457 | 0.261 | 0.093 | -0.253 | 0.227 | 0.288 | 0.384 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bi | 0.263 | 0.187 | 0.336 | 0.052 | 0.071 | 0.103 | 0.286 | 0.204 | -0.135 | 0.217 | 0.138 | 0.243 | 0.224 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Br | -0.329 | 0.384 | 0.312 | -0.215 | 0.370 | 0.316 | 0.349 | 0.621 | -0.569 | 0.404 | 0.067 | 0.213 | -0.019 | 0.051 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cd | -0.070 | 0.148 | -0.099 | -0.036 | -0.067 | -0.106 | 0.028 | 0.120 | -0.196 | -0.129 | 0.269 | 0.260 | 0.262 | 0.182 | 0.140 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ce | 0.666 | 0.145 | 0.052 | 0.188 | -0.463 | -0.221 | 0.020 | -0.163 | -0.057 | -0.041 | 0.184 | 0.143 | 0.397 | 0.140 | -0.400 | 0.212 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Co | 0.411 | 0.731 | 0.867 | 0.042 | 0.193 | 0.543 | 0.784 | 0.469 | -0.602 | 0.699 | 0.171 | 0.264 | 0.490 | 0.354 | 0.298 | 0.114 | 0.150 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cr | 0.561 | 0.460 | 0.525 | 0.073 | -0.111 | 0.237 | 0.383 | 0.184 | -0.366 | 0.446 | 0.106 | 0.183 | 0.417 | 0.324 | 0.021 | 0.146 | 0.421 | 0.575 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cs | -0.284 | -0.568 | -0.845 | 0.113 | -0.352 | -0.480 | -0.680 | -0.472 | 0.440 | -0.744 | -0.115 | -0.095 | -0.141 | -0.264 | -0.302 | 0.115 | 0.078 | -0.741 | -0.336 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cu | 0.191 | 0.490 | 0.258 | 0.071 | 0.093 | 0.185 | 0.297 | 0.372 | -0.180 | 0.132 | 0.226 | 0.561 | 0.505 | 0.370 | 0.127 | 0.344 | 0.338 | 0.512 | 0.448 | -0.199 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ga | 0.741 | 0.548 | 0.786 | 0.243 | 0.088 | 0.534 | 0.518 | 0.218 | -0.583 | 0.736 | 0.215 | 0.200 | 0.529 | 0.372 | 0.181 | 0.038 | 0.381 | 0.749 | 0.638 | -0.576 | 0.375 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ge | 0.058 | 0.348 | 0.087 | -0.197 | -0.067 | -0.066 | 0.128 | 0.284 | -0.225 | -0.009 | 0.182 | 0.450 | 0.277 | 0.289 | 0.251 | 0.368 | 0.253 | 0.310 | 0.268 | -0.029 | 0.744 | 0.239 | | | | | | | | | | | | | | | | | | | | | | | | |
| Hf | 0.334 | -0.020 | 0.097 | -0.026 | -0.070 | -0.126 | -0.003 | -0.036 | 0.246 | 0.155 | 0.061 | -0.109 | -0.020 | 0.120 | -0.328 | -0.075 | 0.302 | 0.041 | 0.144 | -0.148 | 0.048 | 0.103 | -0.032 | | | | | | | | | | | | | | | | | | | | | | | |
| I | -0.369 | 0.187 | 0.236 | -0.243 | 0.278 | 0.193 | 0.365 | 0.558 | -0.399 | 0.265 | -0.027 | 0.145 | -0.239 | 0.008 | 0.831 | 0.061 | -0.434 | 0.169 | -0.096 | -0.258 | 0.001 | -0.010 | 0.084 | -0.256 | | | | | | | | | | | | | | | | | | | | | | |
| La | 0.411 | -0.075 | -0.335 | 0.146 | -0.523 | -0.424 | -0.296 | -0.315 | 0.139 | -0.348 | 0.148 | 0.103 | 0.277 | 0.012 | -0.442 | 0.274 | 0.866 | -0.193 | 0.202 | 0.446 | 0.220 | 0.060 | 0.246 | 0.170 | -0.470 | | | | | | | | | | | | | | | | | | | | | |
| Mo | 0.280 | 0.571 | 0.619 | -0.030 | 0.157 | 0.344 | 0.563 | 0.478 | -0.476 | 0.387 | 0.163 | 0.445 | 0.387 | 0.376 | 0.389 | 0.133 | 0.221 | 0.678 | 0.495 | -0.496 | 0.534 | 0.569 | 0.433 | -0.071 | 0.281 | -0.019 | | | | | | | | | | | | | | | | | | | | |
| Nb | 0.529 | 0.578 | 0.856 | 0.046 | 0.298 | 0.547 | 0.563 | 0.386 | -0.517 | 0.930 | 0.144 | 0.053 | 0.301 | 0.298 | 0.258 | -0.104 | 0.127 | 0.700 | 0.557 | -0.733 | 0.194 | 0.787 | 0.015 | 0.282 | 0.128 | -0.217 | 0.526 | | | | | | | | | | | | | | | | | | | |
| Ni | 0.425 | 0.705 | 0.609 | 0.118 | 0.129 | 0.445 | 0.521 | 0.399 | -0.437 | 0.491 | 0.196 | 0.339 | 0.590 | 0.372 | 0.203 | 0.186 | 0.324 | 0.790 | 0.749 | -0.490 | 0.710 | 0.672 | 0.495 | 0.062 | 0.005 | 0.053 | 0.651 | 0.565 | | | | | | | | | | | | | | | | | | |
| Pb | -0.018 | 0.326 | 0.039 | -0.141 | 0.002 | -0.017 | 0.088 | 0.266 | -0.227 | -0.031 | 0.198 | 0.489 | 0.301 | 0.298 | 0.264 | 0.436 | 0.200 | 0.261 | 0.255 | 0.008 | 0.743 | 0.183 | 0.859 | -0.086 | 0.107 | 0.243 | 0.404 | -0.004 | 0.416 | | | | | | | | | | | | | | | | | |
| Rb | 0.468 | -0.173 | -0.006 | 0.838 | -0.104 | 0.246 | 0.003 | -0.356 | 0.217 | -0.138 | 0.025 | 0.101 | 0.471 | 0.138 | -0.415 | -0.063 | 0.374 | 0.040 | 0.167 | 0.124 | 0.099 | 0.249 | -0.135 | 0.090 | -0.354 | 0.296 | 0.007 | -0.004 | 0.113 | -0.112 | | | | | | | | | | | | | | | | |
| Sb | -0.122 | 0.067 | -0.244 | -0.056 | -0.064 | -0.201 | -0.190 | 0.058 | 0.020 | -0.271 | 0.202 | 0.422 | 0.194 | 0.155 | 0.076 | 0.406 | 0.169 | -0.042 | 0.068 | 0.237 | 0.527 | -0.064 | 0.610 | -0.029 | -0.041 | 0.300 | 0.152 | -0.245 | 0.176 | 0.681 | -0.063 | | | | | | | | | | | | | | | |
| Sc | 0.556 | 0.684 | 0.748 | 0.092 | 0.101 | 0.508 | 0.554 | 0.321 | -0.702 | 0.693 | 0.201 | 0.317 | 0.562 | 0.322 | 0.283 | 0.133 | 0.334 | 0.816 | 0.639 | -0.549 | 0.502 | 0.852 | 0.375 | -0.059 | 0.056 | 0.061 | 0.666 | 0.673 | 0.747 | 0.341 | 0.073 | 0.060 | | | | | | | | | | | | | | |
| Se | 0.131 | 0.447 | 0.411 | -0.289 | -0.031 | 0.079 | 0.383 | 0.435 | -0.617 | 0.361 | 0.123 | 0.367 | 0.154 | 0.238 | 0.557 | 0.328 | 0.117 | 0.465 | 0.311 | -0.302 | 0.401 | 0.427 | 0.540 | -0.208 | 0.440 | 0.011 | 0.532 | 0.282 | 0.424 | 0.520 | -0.270 | 0.223 | 0.537 | | | | | | | | | | | | | |
| Sn | 0.034 | 0.267 | -0.046 | -0.059 | 0.002 | -0.067 | -0.006 | 0.247 | -0.062 | -0.116 | 0.206 | 0.475 | 0.312 | 0.258 | 0.112 | 0.371 | 0.313 | 0.161 | 0.200 | 0.021 | 0.733 | 0.117 | 0.773 | 0.025 | -0.010 | 0.338 | 0.342 | -0.058 | 0.390 | 0.818 | -0.026 | 0.675 | 0.226 | 0.310 | | | | | | | | | | | | |
| Sr | 0.258 | 0.675 | 0.531 | 0.317 | 0.545 | 0.677 | 0.455 | 0.371 | -0.395 | 0.538 | 0.245 | 0.357 | 0.672 | 0.222 | 0.241 | 0.104 | 0.110 | 0.645 | 0.383 | -0.469 | 0.412 | 0.590 | 0.156 | -0.101 | 0.036 | -0.082 | 0.489 | 0.535 | 0.592 | 0.205 | 0.143 | 0.018 | 0.653 | 0.268 | 0.153 | | | | | | | | | | | |
| Ta | 0.226 | 0.362 | 0.545 | 0.022 | 0.221 | 0.383 | 0.422 | 0.358 | -0.395 | 0.563 | 0.027 | -0.039 | 0.143 | 0.158 | 0.264 | -0.056 | -0.048 | 0.435 | 0.280 | -0.410 | 0.108 | 0.475 | 0.045 | 0.096 | 0.164 | -0.267 | 0.278 | 0.585 | 0.337 | -0.028 | -0.071 | -0.201 | 0.379 | 0.169 | -0.028 | 0.327 | | | | | | | | | | |
| Th | 0.769 | 0.027 | 0.133 | 0.296 | -0.472 | -0.141 | 0.056 | -0.291 | 0.068 | -0.037 | 0.141 | 0.102 | 0.383 | 0.222 | -0.518 | 0.099 | 0.826 | 0.176 | 0.472 | -0.001 | 0.301 | 0.439 | 0.166 | 0.357 | -0.511 | 0.687 | 0.172 | 0.154 | 0.316 | 0.140 | 0.586 | 0.108 | 0.303 | 0.018 | 0.222 | 0.064 | -0.054 | | | | | | | | | |
| Tl | 0.022 | 0.132 | -0.042 | 0.002 | -0.144 | 0.020 | -0.001 | -0.008 | -0.201 | -0.064 | 0.063 | 0.252 | 0.229 | 0.100 | 0.181 | 0.330 | 0.127 | 0.091 | 0.151 | 0.132 | 0.328 | 0.150 | 0.418 | -0.219 | 0.053 | 0.196 | 0.180 | -0.090 | 0.207 | 0.434 | 0.005 | 0.322 | 0.209 | 0.313 | 0.350 | 0.088 | -0.008 | 0.097 | | | | | | | | |
| U | 0.406 | 0.024 | -0.154 | 0.040 | -0.410 | -0.295 | -0.147 | -0.116 | 0.037 | -0.169 | 0.132 | 0.257 | 0.243 | 0.128 | -0.247 | 0.236 | 0.646 | -0.065 | 0.316 | 0.230 | 0.264 | 0.152 | 0.269 | 0.140 | -0.233 | 0.677 | 0.136 | -0.059 | 0.179 | 0.256 | 0.215 | 0.220 | 0.153 | 0.183 | 0.310 | -0.045 | -0.198 | 0.607 | 0.187 | | | | | | | |
| V | 0.382 | 0.709 | 0.767 | -0.035 | 0.274 | 0.516 | 0.582 | 0.477 | -0.678 | 0.801 | 0.206 | 0.313 | 0.447 | 0.339 | 0.474 | 0.101 | 0.101 | 0.790 | 0.620 | -0.594 | 0.454 | 0.773 | 0.341 | -0.024 | 0.241 | -0.149 | 0.693 | 0.745 | 0.700 | 0.327 | -0.106 | 0.048 | 0.874 | 0.575 | 0.178 | 0.648 | 0.421 | 0.096 | 0.192 | 0.051 | | | | | | |
| W | -0.176 | -0.217 | -0.618 | -0.010 | -0.331 | -0.444 | -0.448 | -0.238 | 0.201 | -0.553 | 0.080 | 0.059 | 0.037 | -0.162 | -0.107 | 0.317 | 0.258 | -0.453 | -0.066 | 0.602 | 0.039 | -0.339 | 0.199 | -0.126 | -0.179 | 0.518 | -0.195 | -0.498 | -0.188 | 0.240 | -0.026 | 0.368 | -0.250 | 0.004 | 0.242 | -0.258 | -0.319 | 0.101 | 0.308 | 0.415 | -0.301 | | | | | |
| Y | 0.707 | 0.585 | 0.546 | 0.204 | -0.050 | 0.250 | 0.409 | 0.185 | -0.309 | 0.426 | 0.273 | 0.330 | 0.648 | 0.342 | -0.077 | 0.168 | 0.699 | 0.657 | 0.603 | -0.433 | 0.591 | 0.745 | 0.424 | 0.284 | -0.234 | 0.409 | 0.577 | 0.563 | 0.735 | 0.345 | 0.276 | 0.153 | 0.720 | 0.338 | 0.373 | 0.538 | 0.223 | 0.657 | 0.173 | 0.415 | 0.576 | -0.068 | | | | |
| Zn | 0.302 | 0.660 | 0.512 | 0.021 | 0.175 | 0.328 | 0.531 | 0.479 | -0.421 | 0.405 | 0.211 | 0.467 | 0.558 | 0.429 | 0.287 | 0.359 | 0.290 | 0.692 | 0.557 | -0.416 | 0.787 | 0.590 | 0.651 | 0.083 | 0.088 | 0.092 | 0.621 | 0.472 | 0.763 | 0.654 | 0.040 | 0.350 | 0.659 | 0.535 | 0.557 | 0.553 | 0.289 | 0.261 | 0.317 | 0.199 | 0.661 | -0.054 | 0.680 | | | |
| Zr | 0.390 | -0.053 | 0.021 | -0.010 | -0.170 | -0.241 | -0.084 | -0.093 | 0.329 | 0.077 | 0.035 | -0.188 | -0.014 | 0.099 | -0.431 | -0.074 | 0.393 | -0.036 | 0.200 | -0.063 | 0.067 | 0.085 | -0.017 | 0.802 | -0.359 | 0.292 | -0.136 | 0.245 | 0.057 | -0.061 | 0.136 | -0.021 | -0.112 | -0.272 | 0.085 | -0.155 | 0.078 | 0.487 | -0.212 | 0.241 | -0.098 | -0.025 | 0.303 | 0.046 | | |
| pH | 0.257 | 0.428 | 0.082 | 0.103 | 0.015 | 0.057 | 0.079 | 0.129 | 0.110 | -0.004 | 0.112 | 0.019 | 0.235 | 0.134 | -0.287 | 0.049 | 0.306 | 0.184 | 0.208 | -0.106 | 0.281 | 0.133 | 0.088 | 0.248 | -0.267 | 0.245 | 0.063 | 0.128 | 0.287 | 0.093 | 0.152 | 0.023 | 0.105 | -0.095 | 0.176 | 0.205 | -0.004 | 0.360 | -0.043 | 0.214 | 0.059 | -0.009 | 0.373 | 0.229 | 0.341 | |
| LOI | -0.025 | 0.426 | 0.339 | -0.196 | 0.017 | 0.187 | 0.289 | 0.392 | -0.683 | 0.399 | 0.125 | 0.192 | 0.170 | 0.058 | 0.685 | 0.218 | -0.040 | 0.360 | 0.220 | -0.206 | 0.205 | 0.373 | 0.320 | -0.307 | 0.462 | -0.096 | 0.404 | 0.302 | 0.305 | 0.328 | -0.331 | 0.192 | 0.476 | 0.626 | 0.129 | 0.227 | 0.252 | -0.211 | 0.251 | -0.016 | 0.537 | 0.038 | 0.182 | 0.413 | -0.386 | -0.278 |

n = 241; r = 0.147 p-value <0.01 (Koch and Link, 1971) Significant correlations are shown in yellow. Excluding results for Te, which were mainly below LLD

Table 3.8 Spearman Rank Correlation Coefficient matrix for parameters in Glasgow rural deeper soils

| | $Al_2O_3$ | CaO | $Fe_2O_3$ | $K_2O$ | $Na_2O$ | MgO | MnO | $P_2O_5$ | $SiO_2$ | $TiO_2$ | Ag | As | Ba | Bi | Br | Cd | Ce | Co | Cr | Cs | Cu | Ga | Ge | Hf | I | La | Mo | Nb | Ni | Pb | Rb | Sb | Sc | Se | Sn | Sr | Ta | Th | Tl | U | V | W | Y | Zn | Zr | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $Al_2O_3$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CaO | 0.253 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $Fe_2O_3$ | 0.526 | 0.596 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $K_2O$ | 0.404 | -0.051 | 0.032 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $Na_2O$ | 0.230 | 0.484 | 0.542 | 0.514 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MgO | 0.227 | 0.563 | 0.736 | -0.017 | 0.413 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MnO | -0.312 | 0.285 | 0.158 | 0.163 | 0.643 | 0.199 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $P_2O_5$ | -0.116 | 0.679 | 0.456 | -0.223 | 0.368 | 0.622 | 0.471 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $SiO_2$ | -0.534 | -0.718 | -0.736 | -0.059 | -0.450 | -0.563 | -0.004 | -0.429 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $TiO_2$ | 0.471 | 0.644 | 0.853 | 0.045 | 0.610 | 0.567 | 0.373 | 0.529 | -0.697 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ag | -0.135 | 0.189 | -0.047 | -0.171 | -0.080 | 0.001 | -0.047 | 0.121 | -0.257 | -0.090 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| As | 0.054 | 0.147 | 0.038 | 0.282 | 0.192 | 0.091 | 0.177 | 0.131 | -0.111 | -0.033 | 0.041 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ba | 0.433 | 0.517 | 0.281 | 0.585 | 0.528 | 0.269 | 0.213 | 0.183 | -0.457 | 0.339 | 0.010 | 0.411 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bi | 0.138 | 0.213 | 0.211 | -0.012 | 0.094 | 0.216 | -0.053 | 0.155 | -0.212 | 0.143 | 0.007 | 0.048 | 0.144 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Br | -0.287 | 0.434 | 0.273 | -0.227 | 0.292 | 0.405 | 0.461 | 0.737 | -0.371 | 0.392 | 0.222 | 0.086 | -0.018 | 0.074 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cd | -0.078 | 0.249 | 0.041 | -0.098 | -0.002 | 0.186 | 0.020 | 0.280 | -0.298 | 0.026 | 0.306 | 0.167 | 0.185 | 0.135 | 0.274 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ce | 0.792 | 0.496 | 0.531 | 0.233 | 0.163 | 0.403 | -0.268 | 0.180 | -0.588 | 0.468 | -0.019 | 0.152 | 0.540 | 0.245 | -0.126 | 0.075 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Co | 0.492 | 0.676 | 0.880 | 0.105 | 0.572 | 0.791 | 0.199 | 0.500 | -0.735 | 0.785 | 0.048 | 0.129 | 0.479 | 0.252 | 0.274 | 0.147 | 0.579 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cr | 0.621 | 0.497 | 0.557 | 0.212 | 0.324 | 0.376 | -0.129 | 0.158 | -0.591 | 0.507 | 0.070 | 0.135 | 0.481 | 0.293 | -0.014 | 0.073 | 0.674 | 0.610 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cs | 0.583 | 0.264 | 0.541 | 0.117 | 0.215 | 0.244 | -0.225 | -0.016 | -0.521 | 0.491 | -0.031 | -0.196 | 0.134 | 0.127 | -0.093 | -0.154 | 0.481 | 0.426 | 0.495 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cu | 0.268 | 0.612 | 0.347 | 0.111 | 0.308 | 0.407 | 0.116 | 0.518 | -0.409 | 0.314 | 0.060 | 0.391 | 0.527 | 0.252 | 0.267 | 0.266 | 0.495 | 0.517 | 0.535 | 0.039 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ga | 0.853 | 0.534 | 0.763 | 0.353 | 0.532 | 0.466 | -0.011 | 0.222 | -0.763 | 0.733 | -0.015 | 0.117 | 0.557 | 0.244 | 0.035 | 0.057 | 0.762 | 0.748 | 0.692 | 0.614 | 0.431 | | | | | | | | | | | | | | | | | | | | | | | | |
| Ge | 0.093 | 0.358 | 0.040 | -0.149 | -0.085 | 0.180 | -0.035 | 0.378 | -0.129 | 0.057 | 0.024 | 0.333 | 0.295 | 0.116 | 0.196 | 0.247 | 0.332 | 0.170 | 0.237 | -0.199 | 0.658 | 0.140 | | | | | | | | | | | | | | | | | | | | | | | |
| Hf | 0.274 | -0.099 | 0.021 | 0.031 | -0.180 | -0.102 | -0.140 | -0.102 | 0.163 | 0.068 | -0.223 | -0.203 | -0.029 | 0.038 | -0.243 | -0.160 | 0.215 | -0.090 | 0.120 | 0.043 | 0.008 | 0.102 | 0.173 | | | | | | | | | | | | | | | | | | | | | | |
| I | -0.090 | 0.389 | 0.469 | -0.106 | 0.383 | 0.627 | 0.390 | 0.658 | -0.448 | 0.470 | 0.098 | 0.085 | -0.020 | 0.060 | 0.800 | 0.217 | -0.013 | 0.424 | 0.057 | 0.077 | 0.223 | 0.168 | 0.061 | -0.182 | | | | | | | | | | | | | | | | | | | | | |
| La | 0.792 | 0.493 | 0.504 | 0.223 | 0.128 | 0.354 | -0.318 | 0.133 | -0.598 | 0.446 | -0.004 | 0.144 | 0.543 | 0.236 | -0.164 | 0.086 | 0.961 | 0.538 | 0.699 | 0.492 | 0.481 | 0.749 | 0.337 | 0.199 | -0.055 | | | | | | | | | | | | | | | | | | | | |
| Mo | 0.332 | 0.560 | 0.555 | -0.071 | 0.249 | 0.481 | 0.042 | 0.480 | -0.527 | 0.500 | 0.046 | 0.336 | 0.321 | 0.215 | 0.249 | 0.213 | 0.540 | 0.545 | 0.508 | 0.260 | 0.569 | 0.497 | 0.413 | -0.017 | 0.298 | 0.533 | | | | | | | | | | | | | | | | | | | |
| Nb | 0.566 | 0.596 | 0.849 | 0.108 | 0.564 | 0.546 | 0.280 | 0.445 | -0.664 | 0.948 | -0.121 | -0.046 | 0.361 | 0.191 | 0.249 | -0.014 | 0.560 | 0.761 | 0.586 | 0.516 | 0.319 | 0.769 | 0.061 | 0.201 | 0.356 | 0.535 | 0.506 | | | | | | | | | | | | | | | | | | |
| Ni | 0.507 | 0.689 | 0.649 | 0.213 | 0.529 | 0.544 | 0.100 | 0.422 | -0.659 | 0.608 | 0.083 | 0.249 | 0.603 | 0.324 | 0.184 | 0.173 | 0.655 | 0.791 | 0.825 | 0.374 | 0.729 | 0.708 | 0.333 | -0.030 | 0.233 | 0.640 | 0.589 | 0.633 | | | | | | | | | | | | | | | | | |
| Pb | 0.053 | 0.424 | 0.061 | -0.152 | -0.037 | 0.201 | 0.035 | 0.452 | -0.192 | 0.091 | 0.101 | 0.430 | 0.290 | 0.102 | 0.287 | 0.289 | 0.306 | 0.185 | 0.258 | -0.163 | 0.697 | 0.135 | 0.794 | 0.044 | 0.153 | 0.321 | 0.430 | 0.074 | 0.347 | | | | | | | | | | | | | | | | |
| Rb | 0.537 | -0.192 | 0.009 | 0.838 | 0.222 | -0.004 | -0.193 | -0.362 | 0.029 | -0.092 | -0.205 | 0.227 | 0.439 | -0.017 | -0.431 | -0.125 | 0.336 | 0.044 | 0.286 | 0.197 | 0.101 | 0.331 | -0.062 | 0.135 | -0.226 | 0.341 | -0.027 | 0.018 | 0.167 | -0.088 | | | | | | | | | | | | | | | |
| Sb | -0.003 | 0.255 | -0.037 | 0.005 | -0.062 | 0.079 | -0.034 | 0.208 | -0.146 | -0.054 | 0.200 | 0.367 | 0.251 | 0.165 | 0.129 | 0.258 | 0.190 | 0.078 | 0.250 | -0.083 | 0.405 | 0.064 | 0.417 | -0.036 | 0.023 | 0.208 | 0.359 | -0.054 | 0.243 | 0.498 | 0.003 | | | | | | | | | | | | | | |
| Sc | 0.691 | 0.687 | 0.742 | 0.222 | 0.546 | 0.520 | 0.064 | 0.320 | -0.822 | 0.735 | 0.070 | 0.202 | 0.618 | 0.211 | 0.149 | 0.138 | 0.723 | 0.809 | 0.734 | 0.537 | 0.552 | 0.868 | 0.197 | -0.063 | 0.252 | 0.719 | 0.551 | 0.710 | 0.800 | 0.231 | 0.169 | 0.115 | | | | | | | | | | | | | |
| Se | 0.273 | 0.567 | 0.501 | -0.221 | 0.124 | 0.485 | -0.032 | 0.555 | -0.669 | 0.457 | 0.205 | 0.249 | 0.181 | 0.230 | 0.478 | 0.368 | 0.451 | 0.517 | 0.374 | 0.206 | 0.482 | 0.441 | 0.414 | -0.109 | 0.493 | 0.448 | 0.549 | 0.387 | 0.499 | 0.479 | -0.202 | 0.245 | 0.531 | | | | | | | | | | | | |
| Sn | 0.148 | 0.428 | 0.106 | -0.007 | 0.030 | 0.182 | 0.051 | 0.429 | -0.180 | 0.124 | 0.029 | 0.361 | 0.401 | 0.142 | 0.194 | 0.207 | 0.383 | 0.210 | 0.268 | -0.093 | 0.720 | 0.224 | 0.733 | 0.183 | 0.068 | 0.385 | 0.377 | 0.142 | 0.396 | 0.812 | 0.026 | 0.454 | 0.255 | 0.354 | | | | | | | | | | | |
| Sr | 0.316 | 0.698 | 0.513 | 0.310 | 0.667 | 0.441 | 0.528 | 0.470 | -0.565 | 0.612 | 0.052 | 0.333 | 0.699 | 0.134 | 0.252 | 0.146 | 0.425 | 0.633 | 0.446 | 0.190 | 0.492 | 0.559 | 0.165 | -0.145 | 0.246 | 0.402 | 0.422 | 0.547 | 0.621 | 0.240 | 0.096 | 0.194 | 0.694 | 0.328 | 0.271 | | | | | | | | | | |
| Ta | 0.227 | 0.310 | 0.461 | 0.034 | 0.357 | 0.305 | 0.223 | 0.332 | -0.388 | 0.512 | 0.003 | -0.015 | 0.212 | 0.116 | 0.196 | 0.109 | 0.258 | 0.418 | 0.288 | 0.217 | 0.173 | 0.426 | 0.132 | 0.149 | 0.232 | 0.241 | 0.283 | 0.537 | 0.373 | 0.024 | -0.090 | 0.029 | 0.360 | 0.208 | 0.104 | 0.298 | | | | | | | | | |
| Th | 0.759 | -0.039 | 0.131 | 0.394 | -0.117 | -0.002 | -0.528 | -0.328 | -0.135 | -0.015 | -0.074 | 0.144 | 0.319 | 0.089 | -0.533 | -0.043 | 0.679 | 0.135 | 0.490 | 0.340 | 0.229 | 0.495 | 0.206 | 0.372 | -0.381 | 0.694 | 0.193 | 0.141 | 0.294 | 0.162 | 0.684 | 0.166 | 0.329 | 0.081 | 0.233 | 0.015 | -0.033 | | | | | | | | |
| Tl | 0.136 | 0.204 | -0.006 | 0.005 | -0.058 | 0.011 | -0.220 | 0.035 | -0.239 | -0.058 | 0.267 | 0.258 | 0.114 | 0.148 | 0.033 | 0.236 | 0.171 | 0.043 | 0.199 | -0.011 | 0.290 | 0.132 | 0.298 | -0.076 | 0.008 | 0.207 | 0.203 | -0.085 | 0.194 | 0.273 | 0.078 | 0.199 | 0.206 | 0.326 | 0.190 | 0.041 | -0.061 | 0.185 | | | | | | | |
| U | 0.442 | -0.017 | -0.177 | 0.148 | -0.322 | -0.156 | -0.500 | -0.236 | -0.056 | -0.191 | 0.062 | 0.231 | 0.222 | 0.058 | -0.345 | 0.067 | 0.482 | -0.112 | 0.269 | 0.130 | 0.183 | 0.183 | 0.291 | 0.194 | -0.313 | 0.534 | 0.158 | -0.088 | 0.117 | 0.274 | 0.390 | 0.172 | 0.167 | 0.156 | 0.264 | -0.071 | -0.139 | 0.678 | 0.261 | | | | | | |
| V | 0.474 | 0.775 | 0.774 | 0.057 | 0.569 | 0.567 | 0.261 | 0.529 | -0.798 | 0.837 | 0.076 | 0.227 | 0.530 | 0.203 | 0.396 | 0.203 | 0.554 | 0.823 | 0.673 | 0.441 | 0.585 | 0.759 | 0.281 | -0.074 | 0.421 | 0.544 | 0.637 | 0.768 | 0.781 | 0.343 | -0.054 | 0.199 | 0.877 | 0.620 | 0.325 | 0.720 | 0.420 | 0.083 | 0.177 | -0.019 | | | | | |
| W | -0.131 | -0.239 | -0.636 | 0.000 | -0.450 | -0.441 | -0.349 | -0.277 | 0.250 | -0.569 | 0.187 | 0.068 | 0.019 | -0.043 | -0.216 | 0.160 | -0.022 | -0.489 | -0.139 | -0.323 | -0.052 | -0.288 | 0.217 | 0.048 | -0.381 | 0.003 | -0.213 | -0.531 | -0.259 | 0.181 | 0.068 | 0.219 | -0.262 | -0.099 | 0.134 | -0.256 | -0.254 | 0.203 | 0.205 | 0.421 | -0.366 | | | | |
| Y | 0.735 | 0.550 | 0.550 | 0.245 | 0.251 | 0.406 | -0.114 | 0.226 | -0.538 | 0.523 | -0.043 | 0.207 | 0.600 | 0.248 | -0.105 | 0.064 | 0.907 | 0.623 | 0.627 | 0.402 | 0.570 | 0.768 | 0.377 | 0.248 | -0.023 | 0.884 | 0.539 | 0.607 | 0.674 | 0.369 | 0.301 | 0.199 | 0.742 | 0.414 | 0.455 | 0.490 | 0.282 | 0.623 | 0.154 | 0.437 | 0.596 | -0.046 | | | |
| Zn | 0.237 | 0.754 | 0.523 | 0.006 | 0.420 | 0.593 | 0.285 | 0.703 | -0.621 | 0.550 | 0.173 | 0.312 | 0.509 | 0.267 | 0.515 | 0.385 | 0.475 | 0.651 | 0.483 | 0.050 | 0.772 | 0.515 | 0.564 | -0.032 | 0.447 | 0.439 | 0.576 | 0.517 | 0.699 | 0.644 | -0.081 | 0.352 | 0.609 | 0.636 | 0.602 | 0.590 | 0.377 | 0.043 | 0.253 | 0.027 | 0.728 | -0.143 | 0.550 | | |
| Zr | 0.219 | -0.112 | 0.031 | -0.045 | -0.241 | -0.112 | -0.130 | -0.092 | 0.217 | 0.114 | -0.250 | -0.302 | -0.088 | 0.024 | -0.234 | -0.181 | 0.198 | -0.082 | 0.095 | 0.074 | -0.046 | 0.053 | 0.129 | 0.771 | -0.219 | 0.184 | -0.041 | 0.258 | -0.065 | 0.038 | 0.076 | -0.010 | -0.128 | -0.205 | 0.182 | -0.199 | 0.186 | 0.341 | -0.245 | 0.172 | -0.103 | -0.035 | 0.234 | -0.069 | |
| pH | 0.290 | 0.288 | 0.108 | 0.121 | 0.003 | 0.098 | -0.149 | -0.008 | -0.032 | 0.004 | -0.081 | 0.068 | 0.230 | 0.119 | -0.299 | -0.055 | 0.355 | 0.154 | 0.319 | 0.150 | 0.292 | 0.204 | 0.195 | 0.275 | -0.237 | 0.362 | 0.134 | 0.114 | 0.269 | 0.226 | 0.225 | 0.153 | 0.186 | 0.003 | 0.304 | 0.121 | -0.042 | 0.421 | 0.055 | 0.275 | 0.095 | 0.031 | 0.389 | 0.121 | 0.283 | |
| LOI | 0.017 | 0.553 | 0.287 | -0.285 | 0.098 | 0.321 | 0.033 | 0.602 | -0.590 | 0.375 | 0.257 | 0.120 | 0.145 | 0.162 | 0.621 | 0.381 | 0.237 | 0.345 | 0.168 | 0.065 | 0.365 | 0.274 | 0.344 | -0.219 | 0.450 | 0.229 | 0.395 | 0.269 | 0.333 | 0.419 | -0.392 | 0.254 | 0.357 | 0.727 | 0.313 | 0.273 | 0.249 | -0.201 | 0.249 | -0.020 | 0.503 | 0.059 | 0.217 | 0.612 | -0.277 | -0.220 |

n = 241; r = 0.147 p-value <0.01 (Koch and Link, 1971) Significant correlations are shown in yellow. Excluding results for Te, which were mainly below LLD

Table 3.9 Comparison of parameter median values in Glasgow rural and urban top and deeper soils

| Median | $Al_2O_3$ | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | wt% | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ |
| Urban A | 14.7 | 0.92 | 6.43 | 1.34 | 1.1 | 0.104 | 0.7 | 0.32 | 55.0 | 0.998 | 0.25 | 9.2 | 445 | 0.3 | 17.1 | 0.25 | 74 | 25.0 | 108 | 1 | 51.4 | 14.6 | 3.9 | 5.4 |
| Rural A | 14.1 | 0.58 | 6.45 | 1.18 | 1.0 | 0.093 | 0.7 | 0.37 | 55.5 | 1.207 | 0.25 | 9.1 | 391 | 0.5 | 19.0 | 0.25 | 70 | 20.7 | 98 | 3 | 31.0 | 14.9 | 3.2 | 6.6 |
| *Ratio U/R* | *1.0* | *1.6* | *1.0* | *1.1* | *1.1* | *1.1* | *1.0* | *0.9* | *1.0* | *0.8* | *1.0* | *1.0* | *1.1* | *0.5* | *0.9* | *1.0* | *1.1* | *1.2* | *1.1* | *0.3* | *1.7* | *1.0* | *1.2* | *0.8* |
| Urban S | 15.5 | 1.03 | 6.67 | 1.42 | 1.2 | 0.105 | 0.7 | 0.24 | 54.9 | 1.002 | 0.25 | 8.5 | 455 | 0.3 | 11.4 | 0.25 | 77 | 28.6 | 104 | 1 | 47.3 | 15.6 | 3.4 | 5.3 |
| Rural S | 15.7 | 0.50 | 6.93 | 1.27 | 1.1 | 0.096 | 0.7 | 0.20 | 63.4 | 1.138 | 0.25 | 7.2 | 359 | 0.3 | 14.1 | 0.25 | 63 | 22.2 | 91 | 2 | 23.9 | 15.7 | 2.0 | 6.0 |
| *Ratio U/R* | *1.0* | *2.1* | *1.0* | *1.1* | *1.1* | *1.1* | *1.0* | *1.2* | *0.9* | *0.9* | *1.0* | *1.2* | *1.3* | *1.0* | *0.8* | *1.0* | *1.2* | *1.3* | *1.1* | *0.5* | *2.0* | *1.0* | *1.7* | *0.9* |

| Median | I | La | Mo | Nb | Ni | Pb | Rb | Sb | Sc | Se | Sn | Sr | Ta | Te | Th | Tl | U | V | W | Y | Zn | Zr | pH | LOI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | mg $kg^{-1}$ | | % |
| Urban A | 3 | 36 | 2.1 | 15.1 | 46.9 | 127.1 | 40.0 | 1.3 | 14 | 0.9 | 10.2 | 111.0 | 0.6 | 0.5 | 6.9 | 0.6 | 1.6 | 131 | 1.0 | 21.3 | 151.9 | 249.1 | 5.20 | 9.02 |
| Rural A | 5 | 33 | 1.4 | 16.7 | 33.8 | 77.5 | 34.7 | 0.5 | 13 | 0.9 | 6.1 | 83.5 | 0.6 | 0.5 | 5.8 | 0.6 | 2.3 | 128 | 1.3 | 18.2 | 105.4 | 258.5 | 4.84 | 9.95 |
| *Ratio U/R* | *0.6* | *1.1* | *1.5* | *0.9* | *1.4* | *1.6* | *1.2* | *2.6* | *1.1* | *1.0* | *1.7* | *1.3* | *1.0* | *1.0* | *1.2* | *1.0* | *0.7* | *1.0* | *0.8* | *1.2* | *1.4* | *1.0* | *1.1* | *0.9* |
| Urban S | 2 | 37 | 1.9 | 15.8 | 48.0 | 101.3 | 42.9 | 1.0 | 14 | 0.8 | 9.0 | 119.1 | 0.6 | 0.5 | 7.5 | 0.6 | 1.7 | 128 | 0.8 | 22.5 | 129.6 | 247.1 | 5.78 | 6.35 |
| Rural S | 3 | 37 | 1.4 | 17.9 | 31.8 | 38.0 | 39.0 | 0.5 | 13 | 0.7 | 2.7 | 86.5 | 0.6 | 0.5 | 6.1 | 0.5 | 2.0 | 117 | 1.2 | 19.0 | 84.0 | 289.0 | 5.05 | 6.23 |
| *Ratio U/R* | *0.8* | *1.0* | *1.3* | *0.9* | *1.5* | *2.7* | *1.1* | *2.0* | *1.1* | *1.1* | *3.3* | *1.4* | *1.0* | *1.0* | *1.2* | *1.2* | *0.9* | *1.1* | *0.7* | *1.2* | *1.5* | *0.9* | *1.1* | *1.0* |

R = rural U = urban A = top soils S = deeper soils

Table 3.10 Selected element concentrations in Glasgow parkland top soils compared to previous studies

| **Element** | **Present Study n = 350** | | **Madrid et al. (2006) n = 27 (Glasgow Green and Alexandria Park)** | |
|---|---|---|---|---|
| | **Minimum mg $kg^{-1}$** | **Maximum mg $kg^{-1}$** | **Minimum mg $kg^{-1}$** | **Maximum mg $kg^{-1}$** |
| Cr | 38 | 1092 | 17 | 131 |
| Cu | 8 | 619 | 24 | 678 |
| Ni | 6 | 295 | 16 | 53 |
| Pb | 13 | 1071 | 41 | 894 |
| Zn | 39 | 1667 | 64 | 377 |

Top soil present study = 5 – 20 cm depth Top soil Madrid et al. (2996) study = 0 – 20 cm depth

Table 3.11 Percentage of top and deeper soils exceeding the former UK CLEA residential/ allotment SGVs in the Glasgow dataset.

| **Former UK SGV (EA 2008)** | **As** | **Cd** | **Cr** | **Ni** | **Pb** | **Se** |
|---|---|---|---|---|---|---|
| **mg kg$^{-1}$** | **20** | **1 (pH 6)** | **130** | **50** | **450** | **35** |
| **Glasgow Top Soils:** | | | | | | |
| Number whole dataset | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 |
| Number exceeding guideline | 74 | 78 | 358 | 651 | 74 | 0 |
| *Percentage exceeding guideline* | *5* | *5* | *22* | *40* | *5* | *0* |
| **Glasgow Deeper Soils:** | | | | | | |
| Number whole dataset | 1609 | 1609 | 1609 | 1609 | 1609 | 1069 |
| Number exceeding guideline | 80 | 70 | 272 | 669 | 79 | 0 |
| *Percentage exceeding guideline* | *5* | *4* | *17* | *42* | *5* | *0* |

EA (2008) = EA (2008a) Soil Guideline Value (SGV) for residential land use – As, Cr, Ni, Pb; for allotment land use – Cd, Se

Table 3.12. Percentage of top and deeper soils exceeding the current UK CLEA SGVs in the Glasgow dataset.

| | **Residential Garden Land Use** | | | | | | **Allotment Land Use** | | | | | **Commercial Land Use** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SGV mg $kg^{-1}$ | Number in Whole Dataset | Number ≥SGV in Whole Dataset | Percentage ≥SGV in Whole Dataset | Number of Garden Soils | Number of Garden Soils ≥SGV | SGV mg $kg^{-1}$ | Number ≥SGV in Whole Dataset | Percentage ≥SGV in Whole Dataset | Number of Allotment Soils | Number of Allotment Soils ≥SGV | SGV mg $kg^{-1}$ | Number ≥SGV in Whole Dataset | Percentage ≥SGV in Whole Dataset | Number of Commercial Soils | Number of Commercial Soils ≥SGV |
| **Top Soils:** | | | | | | | | | | | | | | | | |
| As | 32 | 1622 | 26 | 2 | 69 | 1 | 43 | 17 | 1 | 1 | 0 | 640 | 0 | 0 | 185 | 0 |
| Cd | 10 | 1622 | 1 | <1 | 69 | 0 | 1.8 | 26 | 2 | 1 | 0 | 230 | 0 | 0 | 185 | 0 |
| Cr* | 130 | 1622 | 358 | 22 | 69 | 13 | 130 | 358 | 22 | 1 | 0 | 2000 | 1 | <1 | 185 | 1 |
| Ni | 130 | 1622 | 38 | 2 | 69 | 2 | 230 | 6 | <1 | 1 | 0 | 1800 | 0 | 0 | 185 | 0 |
| Pb* | 450 | 1622 | 74 | 5 | 69 | 5 | 450 | 74 | 5 | 1 | 0 | 750 | 28 | 2 | 185 | 2 |
| Se | 350 | 1622 | 0 | 0 | 69 | 0 | 120 | 0 | 0 | 1 | 0 | 13000 | 0 | 0 | 185 | 0 |
| **Deeper Soils:** | | | | | | | | | | | | | | | | |
| As | 32 | 1609 | 29 | 2 | 69 | 0 | 43 | 21 | 1.3 | 0 | 0 | 640 | 1 | <1 | 180 | 0 |
| Cd | 10 | 1609 | 1 | <1 | 69 | 0 | 1.8 | 28 | 2 | 0 | 0 | 230 | 0 | 0 | 180 | 0 |
| Cr* | 130 | 1609 | 272 | 17 | 69 | 9 | 130 | 272 | 17 | 0 | 0 | 2000 | 3 | <1 | 180 | 2 |
| Ni | 130 | 1609 | 61 | 4 | 69 | 4 | 230 | 15 | <1 | 0 | 0 | 1800 | 0 | 0 | 180 | 0 |
| Pb* | 450 | 1609 | 79 | 5 | 69 | 3 | 450 | 79 | 5 | 0 | 0 | 750 | 32 | 2 | 180 | 7 |
| Se | 350 | 1609 | 0 | 0 | 69 | 0 | 120 | 0 | 0 | 0 | 0 | 13000 | 0 | 0 | 180 | 0 |

SGV = UK Soil Guideline Values (SGV) (EA, 2011)

* = Soil Guideline Values have yet to be updated, still referring to EA (2008a)

Table 3.13 Land use recorded in the Glasgow dataset categorised in terms of likely human interaction with soil.

| Number | Land Use Category | Rationale |
|---|---|---|
| 0 | Unknown | |
| 1 | Residential gardens, allotments, schools, playgrounds, parks and sports facilities | Interaction with soil likely through children playing, sports activities and vegetable production |
| 2 | Ornamental gardens, residential grass areas, nature reserves, woodland, agriculture | Interaction with soil may be likely through recreational activities, children playing and crop and animal production |
| 3 | Urban open spaces, recreational land, commercial and residential (non garden) land, derelict land | Interaction with soil may occur through recreational activities and children playing |
| 4 | River and canal banks, road verges, car parks, municipal land including hospitals, cemeteries and colleges | Interaction with soil may occur through recreational activities but not likely |
| 5 | Industrial sites, waste treatment sites, railway verges, moorland | Interaction with soil may occur but not likely due to limited public access to many of these areas |

Table 3.14 Percentage of top and deeper soils exceeding selected international soil guidelines in the Glasgow dataset.

| Soil Guideline mg $kg^{-1}$ | Ba | Co | Cu | Mo | Sb | V | Zn | German Agricultural Soil Guideline mg $kg^{-1}$ | Sn | Tl | U |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5500 | 190 | 190 | 190 | 22 | 550 | 720 | | 50 | 1 | 5 |
| Total Number Glasgow Top Soils | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 | Number Glasgow Agricultural Top Soils | 249 | 249 | 249 |
| Number ≥Guideline in Whole Dataset | 1 | 1 | 66 | 0 | 14 | 5 | 36 | Number Agricultural Top Soils ≥ Guideline | 3 | 11 | 0 |
| Percentage ≥Guideline in Whole Dataset | *<1* | *<1* | *4* | *0* | *<1* | *<1* | *2* | Percentage Agricultural Top Soils ≥ Guideline | *<1* | *4* | *0* |
| Total Number Glasgow Deeper Soils: | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 | Number Glasgow Agricultural Deeper Soils | 243 | 243 | 243 |
| Number ≥Guideline in Whole Dataset | 1 | 1 | 82 | 0 | 22 | 7 | 39 | Number Agricultural Deeper Soils ≥ Guideline | 1 | 11 | 0 |
| Percentage ≥Guideline in Whole Dataset | *<1* | *<1* | *5* | *0* | *<1* | *<1* | *2* | Percentage Agricultural Deeper Soils ≥ Guideline | *<1* | *5* | *0* |

Ba, V = US-EPA Soil Screening Levels (SSL) (US-EPA, 1996)
Co, Cu, Mo, Sb, Zn = Dutch Soil Intervention Values (VROM, 2009)
German Agricultural Soil Guideline = Maximum Admissible Concentration (MAC) (Reimann and Caritat, 1998)

Table 3.15 Percentage of top and deeper soils exceeding the proposed UK ecological SSVs in the Glasgow dataset.

| UK Soil Screening Value (SSV) | **Cd** | **Cr** | **Cu** | **Ni** | **Pb** | **Zn** |
|---|---|---|---|---|---|---|
| mg $kg^{-1}$ | 1.15 | 21.1 | 88.4 | 25.1 | 167.9 | 90.1 |
| Total Number Glasgow Top Soils | 1622 | 1622 | 1622 | 1622 | 1622 | 1622 |
| Number ≥SSV in Whole Dataset | 64 | 1622 | 275 | 1518 | 491 | 1388 |
| Percentage ≥SSV in Whole Dataset | *4* | *100* | *17* | *94* | *30* | *86* |
| Total Number Glasgow Deeper Soils: | 1609 | 1609 | 1609 | 1609 | 1609 | 1609 |
| Number ≥SSV in Whole Dataset | 50 | 1609 | 272 | 1466 | 393 | 1169 |
| Percentage ≥SSV in Whole Dataset | *3* | *100* | *17* | *91* | *24* | *73* |

UK SSV = EA (2008b) proposed ecological risk assessment Soil Screening Values (SSV)

Table A1.1 Summary of field observation information recorded on G-BASE field data cards

| Observation | Description |
|---|---|
| Soil Type | Category of samples collected A = top soil; S = deeper soil |
| Map | 1: 25 000 (urban) and 1: 50 000 (rural) OS map sheet covering the sampling area |
| Collectors | Initials of the BGS staff involved in collecting the samples |
| Date | Date of sample collection |
| Weather | Indication of rainfall conditions at the time of sampling |
| Contamin | List of contaminants evident at the site |
| Land Use | Categories of land use at the site according to the BGS corporate land use classification scheme |
| Bedrock | Indication if bedrock is cropping out at the site or not |
| Drift | Indication of the type of drift deposits evident at the site |
| Site Geology | Indication of the type of bedrock if present at the site |
| Map Geology | Bedrock as indicated by the BGS 1:50 000 Geological Map |
| Soil Colour | Qualitative assessment of the soil colour BL = black, DB = dark-brown, LB = light-brown RE = red, OR = orange, YE = yellow, GR = green, GY = grey |
| Soil Texture | Qualitative assessment of the soil texture into gravel, sand, sandy-silt, silt, silty-clay, sandy-clay and clay classes |
| Clasts | The lithology of the soil clasts found at the site |
| Depth | Sampling depth |
| Comments | Any other comments about the site |

Table A1.2 Configuration of the PW2400 WD-XRFS

| | |
|---|---|
| Model: | PW2400 |
| Serial No: | DY611 and DY615 |
| Tube: | Rhodium Super Sharp Tube |
| Tube rating: | 3 kW<br>Max. 60 kV<br>Max. 125 mA |
| Detectors: | Gas Flow Proportional Counter (2 μm window)<br>Scintillation Counter |
| Gas: | Argon/Methane (P10) |
| Crystals/<br>2d spacing Å: | LiF220 2.848 (lithium fluoride)<br>LiF200 4.027 (lithium fluoride)<br>GE111 6.532 (germanium)<br>PE002 8.742 (pentaerythritol)<br>PX-1 49.100 (multi-layer) |
| Beam filters/<br>Thickness: | Brass 100 μm<br>Brass 300 μm<br>Aluminium 200 μm<br>Aluminium 750 μm |
| Channel masks<br>(diameters): | 48 mm<br>37 mm<br>25 mm<br>30 mm |
| Collimator<br>spacing: | 700 μm<br>300 μm<br>100 μm |
| Sample Changer: | PW2510 102 positions |

Table A1.3 Configuration of the Spectro X-LAB 2000 ED-XRFS

| | |
|---|---|
| Model: | X-LAB 2000 |
| Serial No: | 9902/98A |
| Tube: | Palladium End Window Tube |
| Tube rating: | 400 W<br>Max. 54 kV<br>Max. 15 mA |
| Detector: | Liquid nitrogen cooled lithium drifted silicon (solid state) |
| Secondary target (and beam filter): | Molybdenum (Niobium)<br>Cobalt (Iron)<br>Titanium (None)<br>Aluminium (None) |
| Polarisation target (and beam filter): | Aluminium oxide (Tantalum)<br>Boron carbide (Palladium)<br>Highly oriented pyrolytic graphite (None) |

Table A1.4 Glasgow soils analytes and limits of detection

| Analyte | Name | Method | Units | LLD | LRL | ULR |
|---|---|---|---|---|---|---|
| $Al_2O_3$ | Aluminium | WD-XRFS | wt% | - | 0.1 | 100 |
| CaO | Calcium | WD-XRFS | wt% | - | 0.10 | 70 |
| $Fe_2O_3$ | Iron | WD-XRFS | wt% | - | 0.01 | 100 |
| $K_2O$ | Potassium | WD-XRFS | wt% | - | 0.05 | 15 |
| MgO | Magnesium | WD-XRFS | wt% | - | 0.1 | 100 |
| MnO | Manganese | WD-XRFS | wt% | - | 0.010 | 100 |
| $Na_2O$ | Sodium | WD-XRFS | wt% | - | 0.1 | 60 |
| $P_2O_5$ | Phosphorous | WD-XRFS | wt% | - | 0.05 | 40 |
| $SiO_2$ | Silicon | WD-XRFS | wt% | - | 0.1 | 100 |
| $TiO_2$ | Titanium | WD-XRFS | wt% | - | 0.020 | 50 |
| Ag | Silver | ED-XRFS | mg $kg^{-1}$ | 0.5 | | 1000 |
| As | Arsenic | WD-XRFS | mg $kg^{-1}$ | 0.9 | | 1000 |
| Ba | Barium | WD-XRFS | mg $kg^{-1}$ | 5.1 | | 500000 |
| Bi | Bismuth | WD-XRFS | mg $kg^{-1}$ | 0.5 | | 1000 |
| Br | Bromine | WD-XRFS | mg $kg^{-1}$ | 0.5 | | 1000 |
| Cd | Cadmium | ED-XRFS | mg $kg^{-1}$ | 0.5 | | 1000 |
| Ce | Cerium | WD-XRFS | mg $kg^{-1}$ | 3.8 | | 1000 |
| Co | Cobalt | WD-XRFS | mg $kg^{-1}$ | 1.2 | | 1000 |
| Cr | Chromium | WD-XRFS | mg $kg^{-1}$ | 1.3 | | 6000 |
| Cs | Caesium | WD-XRFS | mg $kg^{-1}$ | 2.0 | | 1000 |
| Cu | Copper | WD-XRFS | mg $kg^{-1}$ | 0.8 | | 7000 |
| Ga | Gallium | WD-XRFS | mg $kg^{-1}$ | 0.7 | | 1000 |
| Ge | Germanium | WD-XRFS | mg $kg^{-1}$ | 0.6 | | 1000 |
| Hf | Hafnium | WD-XRFS | mg $kg^{-1}$ | 0.7 | | 1000 |
| I | Iodine | ED-XRFS | mg $kg^{-1}$ | 2.0 | | 1000 |
| La | Lanthanum | WD-XRFS | mg $kg^{-1}$ | 3.5 | | 1000 |
| Mo | Molybdenum | WD-XRFS | mg $kg^{-1}$ | 0.8 | | 1000 |
| Nb | Niobium | WD-XRFS | mg $kg^{-1}$ | 0.6 | | 1000 |
| Ni | Nickel | WD-XRFS | mg $kg^{-1}$ | 0.6 | | 3000 |
| Pb | Lead | WD-XRFS | mg $kg^{-1}$ | 0.5 | | 5000 |
| Rb | Rubidium | WD-XRFS | mg $kg^{-1}$ | 0.5 | | 4000 |
| Sb | Antimony | ED-XRFS | mg $kg^{-1}$ | 1.0 | | 1000 |
| Sc | Scandium | WD-XRFS | mg $kg^{-1}$ | 1.3 | | 1000 |
| Se | Selenium | WD-XRFS | mg $kg^{-1}$ | 0.2 | | 1000 |
| Sn | Tin | ED-XRFS | mg $kg^{-1}$ | 0.8 | | 1500 |
| Sr | Strontium | WD-XRFS | mg $kg^{-1}$ | 0.6 | | 5000 |
| Ta | Tantallum | WD-XRFS | mg $kg^{-1}$ | 1.2 | | 1000 |
| Te | Tellurium | ED-XRFS | mg $kg^{-1}$ | 1.0 | | 1000 |
| Th | Thorium | WD-XRFS | mg $kg^{-1}$ | 0.6 | | 1000 |
| Tl | Thallium | WD-XRFS | mg $kg^{-1}$ | 0.5 | | 1000 |
| U | Uranium | WD-XRFS | mg $kg^{-1}$ | 0.6 | | 1000 |
| V | Vanadium | WD-XRFS | mg $kg^{-1}$ | 1.3 | | 1500 |
| W | Tungsten | WD-XRFS | mg $kg^{-1}$ | 0.7 | | 1000 |
| Y | Yttrium | WD-XRFS | mg $kg^{-1}$ | 0.8 | | 1000 |
| Zn | Zinc | WD-XRFS | mg $kg^{-1}$ | 0.5 | | 2000 |
| Zr | Zirconium | WD-XRFS | mg $kg^{-1}$ | 0.8 | | 2000 |
| pH | pH | Slurry | pH | | | |
| LOI | Loss on Ignition | Furnace | wt% | | | |

LLD = Lower Limit of Detection
LLR = Lower Limit of Reporting
ULR = Upper Limit of Reporting

Table A1.5 Normalisation factors applied to the Glasgow soils dataset

| Element | Normalisation Factors | | | |
|---|---|---|---|---|
| | **Urban A Soils** | **Urban S Soils** | **Rural A Soils** | **Rural S Soils** |
| $Al_2O_3$ | ($Al_2O_3$ x 0.9441) + 2.004 | ($Al_2O_3$ x 0.9085) + 2.464 | | ($Al_2O_3$ x 0.9057) + 1.974 |
| Ba | | | | (Ba x 1.0755) – 72.347 |
| Bi | Bi + 0.4 | Bi + 0.4 | Bi + 0.4 | |
| Br | | | | (Br x 1.0353) + 0.7714 |
| Ca | | | | |
| Ce | (Ce x 1.1724) + 7.898 | (Ce x 1.1733) + 8.8446 | (Ce x 1.1698) + 8.6937 | (Ce x 1.3313) - 19.697 |
| Co | (Co x 1.4019) + 1.5711 | (Co x 1.6776) – 1.3902 | (Co x 0.8494) + 8.6144 | (Co x 0.9119) + 8.5675 |
| Cr | (Cr x 0.7111) +18.192 | (Cr x 0.7243) + 16.947 | (Cr x 0.7497) + 11.972 | (Cr x 0.7349) + 16.079 |
| Cs | | | | (Cs x 0.875) – 1.1667 |
| $Fe_2O_3$ | ($Fe_2O_3$ x 0.7363) + 2.2501 | ($Fe_2O_3$ x 0.7305) + 2.2552 | ($Fe_2O_3$ x 0.6521) + 2.7245 | ($Fe_2O_3$ x 0.6739) + 2.6799 |
| Hf | | | (Hf x 0.9957) + 1.6082 | |
| I | | | | (I x 0.9066) – 1.6264 |
| $K_2O$ | ($K_2O$ x 0.9102) + 0.2398 | ($K_2O$ x 0.8972) + 0.276 | ($K_2O$ x 0.9128) + 0.1585 | ($K_2O$ x 0.9054) + 0.2137 |
| La | (La x 1.1506) + 1.8029 | (La x 1.1086) + 3.6508 | (La x 1.1578) + 1.9168 | (La x 1.002) + 3.5773 |
| Mo | Mo + 1 | Mo + 1 | Mo + 1.0 | (Mo x 1.0375) + 1.3182 |
| Sb | Sb – 0.5 | Sb – 0.5 | Sb – 0.4 | |
| Se | Se + 0.3 | Se + 0.3 | Se + 0.3 | (Se x 0.8267) + 0.3293 |
| $SiO_2$ | ($SiO_2$ x 0.4829) + 26.695 | ($SiO_2$ x 0.4679) + 27.433 | | |
| Sn | (Sn x 1.0381) + 0.7902 | (Sn x 1.14) + 0.4179 | (Sn x 1.1172) + 0.67 | |
| Tl | Tl + 0.5 | Tl + 0.5 | (Tl x 0.5687) + 0.572 | (Tl x 0.6829) + 0.6146 |
| U | U – 1 | U – 1 | | |
| Zn | (Zn x 0.8887) + 2.4903 | (Zn x 0.8853) + 2.1052 | (Zn x 0.8592) + 3.6907 | (Zn x 0.8821) + 3.2003 |
| Zr | (Zr x 1.0068) – 11.129 | (Zr x 1.0025) – 12.224 | (Zr x 1.082 ) – 33.581; Zr >33 | (Zr x 1.0143 ) – 5.3625 |

A = top soils S = deeper soils

Table A1.6 Results for G-BASE reference standards S13B, S15B, S23B and S57A included in the Glasgow soils analyses.

| Element | Units | S13B | Measured Values | | | | S15B | Measured Values | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Reference Value | Mean | Min | Max | N | Reference Value | Mean | Min | Max | N |
| $Al_2O_3$ | wt% | 16.5 | 19.7 | 18.6 | 20.2 | 18 | 12.2 | 13.0 | 12.5 | 13.4 | 18 |
| CaO | wt% | 0.69 | 0.50 | 0.48 | 0.52 | 18 | 0.75 | 0.54 | 0.52 | 0.55 | 18 |
| $Fe_2O_3$ | wt% | 6.86 | 7.11 | 6.89 | 7.21 | 18 | 6.37 | 6.45 | 6.37 | 6.54 | 18 |
| K2O | wt% | 2.28 | 2.39 | 2.36 | 2.42 | 18 | 2.77 | 2.79 | 2.70 | 2.83 | 18 |
| MgO | wt% | 1.3 | 1.4 | 1.3 | 1.5 | 18 | 1.5 | 1.7 | 1.6 | 1.7 | 18 |
| MnO | wt% | 0.096 | 0.108 | 0.105 | 0.111 | 18 | 0.143 | 0.154 | 0.150 | 0.158 | 18 |
| $Na_2O$ | wt% | 0.4 | 0.2 | 0.2 | 0.2 | 18 | 0.7 | 0.5 | 0.5 | 0.5 | 18 |
| $P_2O_5$ | wt% | 0.13 | 0.12 | 0.12 | 0.12 | 18 | 0.13 | 0.11 | 0.11 | 0.11 | 18 |
| $SiO_2$ | wt% | 57.8 | 58.2 | 55.9 | 59.0 | 18 | 67.6 | 69.7 | 68.4 | 70.7 | 18 |
| $TiO_2$ | wt% | 0.80 | 0.81 | 0.80 | 0.82 | 18 | 0.71 | 0.66 | 0.65 | 0.67 | 18 |
| Ag | mg $kg^{-1}$ | 0.38 | 0.25 | 0.25 | 0.25 | 18 | 0.25 | 0.25 | 0.25 | 0.25 | 18 |
| As | mg $kg^{-1}$ | 14.7 | 13.8 | 12.7 | 14.8 | 18 | 19.3 | 17.8 | 16.5 | 18.9 | 18 |
| Ba | mg $kg^{-1}$ | 989 | 846 | 818 | 882 | 18 | 697 | 613 | 584 | 630 | 18 |
| Bi | mg $kg^{-1}$ | 0.7 | 0.2 | 0.1 | 0.4 | 11 | 0.8 | 0.3 | 0.0 | 0.8 | 17 |
| Br | mg $kg^{-1}$ | 5.5 | 5.4 | 4.8 | 6.6 | 18 | 12.1 | 12.2 | 11.4 | 14.6 | 18 |
| Cd | mg $kg^{-1}$ | 0.44 | 0.25 | 0.25 | 0.25 | 18 | 0.45 | 0.25 | 0.25 | 0.25 | 18 |
| Ce | mg $kg^{-1}$ | 83 | 80 | 78 | 83 | 18 | 66 | 55 | 51 | 57 | 18 |
| Co | mg $kg^{-1}$ | 17.8 | 16.0 | 14.0 | 18.9 | 18 | 13.5 | 12.3 | 9.1 | 14.3 | 18 |
| Cr | mg $kg^{-1}$ | 94.9 | 116 | 113 | 119 | 18 | 82 | 92 | 90 | 96 | 18 |
| Cs | mg $kg^{-1}$ | 14 | 12 | 11 | 14 | 18 | 10 | 8 | 7 | 8 | 18 |
| Cu | mg $kg^{-1}$ | 18.7 | 16.9 | 15.8 | 18.0 | 18 | 13.4 | 12.1 | 11.0 | 13.4 | 18 |
| Ga | mg $kg^{-1}$ | 22.8 | 22.6 | 21.4 | 23.7 | 18 | 15.5 | 14.4 | 13.3 | 15.0 | 18 |
| Ge | mg $kg^{-1}$ | 1.3 | 1.6 | 0.9 | 2.2 | 18 | 1.4 | 1.7 | 1.1 | 2.6 | 18 |
| Hf | mg $kg^{-1}$ | 4.9 | 3.7 | 2.5 | 5.1 | 18 | 12.7 | 11.5 | 10.0 | 12.9 | 18 |
| I | mg $kg^{-1}$ | ND | 1 | 1 | 1 | 18 | ND | 1 | 1 | 3 | 18 |
| La | mg $kg^{-1}$ | 46 | 42 | 39 | 44 | 18 | 37 | 28 | 26 | 29 | 18 |
| Mo | mg $kg^{-1}$ | 0.8 | 0.5 | 0.0 | 1.1 | 18 | 0.8 | 0.2 | 0.0 | 0.4 | 12 |
| Nb | mg $kg^{-1}$ | 15.1 | 13.9 | 13.4 | 14.3 | 18 | 13.8 | 13.3 | 12.8 | 13.7 | 18 |
| Ni | mg $kg^{-1}$ | 43.1 | 44.7 | 42.1 | 46.5 | 18 | 31.9 | 32.4 | 31.2 | 34.6 | 18 |
| Pb | mg $kg^{-1}$ | 62.5 | 60.7 | 56.3 | 63.3 | 18 | 82.7 | 80.3 | 78.3 | 82.0 | 18 |
| Rb | mg $kg^{-1}$ | 117.2 | 114.1 | 110.5 | 117.1 | 18 | 112.9 | 109.3 | 107.7 | 111.4 | 18 |
| Sb | mg $kg^{-1}$ | 0.89 | 0.50 | 0.50 | 0.50 | 18 | 3.18 | 3.68 | 3.30 | 4.00 | 18 |
| Sc | mg $kg^{-1}$ | 13 | 14 | 13 | 16 | 18 | 11 | 11 | 9 | 13 | 18 |
| Se | mg $kg^{-1}$ | 0.4 | 0.2 | 0.0 | 0.4 | 18 | 0.5 | 0.3 | 0.1 | 0.5 | 18 |
| Sn | mg $kg^{-1}$ | 3 | 2 | 2 | 3 | 18 | 3 | 2 | 2 | 3 | 18 |
| Sr | mg $kg^{-1}$ | 126.3 | 128.9 | 124.6 | 132.1 | 18 | 89.7 | 91.0 | 89.7 | 93.5 | 18 |
| Ta | mg $kg^{-1}$ | 1.0 | 0.8 | 0.0 | 1.3 | 17 | 0.8 | 0.7 | 0.1 | 1.3 | 17 |
| Te | mg $kg^{-1}$ | 0.0 | 0.50 | 0.50 | 0.50 | 18 | 0.06 | 0.50 | 0.50 | 0.50 | 18 |
| Th | mg $kg^{-1}$ | 10.9 | 11.6 | 10.7 | 12.4 | 18 | 10.4 | 10.6 | 9.8 | 11.1 | 18 |
| Tl | mg $kg^{-1}$ | 0.7 | 0.3 | 0.1 | 0.7 | 15 | 0.5 | 0.1 | 0.0 | 0.3 | 12 |
| U | mg $kg^{-1}$ | 3.2 | 3.7 | 3.1 | 4.5 | 18 | 3.1 | 3.2 | 2.5 | 4.4 | 18 |
| V | mg $kg^{-1}$ | 90 | 101 | 96 | 105 | 18 | 87 | 89 | 85 | 92 | 18 |
| W | mg $kg^{-1}$ | 0.7 | 0.7 | 0.0 | 1.5 | 18 | 2.3 | 2.0 | 1.1 | 2.7 | 18 |
| Y | mg $kg^{-1}$ | 20.2 | 21.3 | 20.1 | 22.3 | 18 | 24.7 | 24.7 | 23.7 | 26.1 | 18 |
| Zn | mg $kg^{-1}$ | 107.9 | 110.8 | 108.1 | 114.8 | 18 | 65.9 | 69.7 | 68.0 | 72.2 | 18 |
| Zr | mg $kg^{-1}$ | 179.9 | 172.9 | 167.2 | 177.4 | 18 | 552.1 | 560.5 | 545.0 | 577.0 | 18 |

| Element | Units | S23B | Measured Values | | | | S57A | Measured Values | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Reference Value | Mean | Min | Max | N | Reference Value | Mean | Min | Max | N |
| $Al_2O_3$ | wt% | 13.4 | 14.9 | 14.4 | 15.2 | 12 | 9.1 | 9.1 | 8.6 | 9.5 | 12 |
| CaO | wt% | 1.78 | 1.63 | 1.59 | 1.66 | 12 | 0.66 | 0.46 | 0.44 | 0.48 | 12 |
| $Fe_2O_3$ | wt% | 6.49 | 6.51 | 6.40 | 6.61 | 12 | 2.65 | 2.49 | 2.46 | 2.52 | 12 |
| K2O | wt% | 3.78 | 4.03 | 3.96 | 4.08 | 12 | 1.98 | 1.90 | 1.85 | 1.94 | 12 |
| MgO | wt% | 1.7 | 2.0 | 1.8 | 2.0 | 12 | 0.7 | 0.6 | 0.6 | 0.6 | 12 |
| MnO | wt% | 0.359 | 0.377 | 0.371 | 0.384 | 12 | 0.058 | 0.060 | 0.057 | 0.062 | 12 |
| $Na_2O$ | wt% | 1.8 | 1.6 | 1.5 | 1.6 | 12 | 0.7 | 0.6 | 0.6 | 0.6 | 12 |
| $P_2O_5$ | wt% | 0.36 | 0.34 | 0.33 | 0.34 | 12 | 0.30 | 0.25 | 0.23 | 0.26 | 12 |
| $SiO_2$ | wt% | 55.3 | 57.4 | 56.5 | 58.3 | 12 | 78.0 | 83.1 | 80.9 | 85.8 | 12 |
| $TiO_2$ | wt% | 1.00 | 0.94 | 0.92 | 0.95 | 12 | 0.54 | 0.49 | 0.48 | 0.50 | 12 |
| Ag | mg $kg^{-1}$ | 0.34 | 0.25 | 0.25 | 0.25 | 12 | 0.25 | 0.25 | 0.25 | 0.25 | 12 |
| As | mg $kg^{-1}$ | 94.2 | 90.7 | 88.4 | 92.5 | 12 | 10.6 | 9.5 | 8.2 | 10.5 | 12 |
| Ba | mg $kg^{-1}$ | 751 | 656 | 640 | 677 | 12 | 347 | 316 | 301 | 333 | 12 |
| Bi | mg $kg^{-1}$ | 3.0 | 5.3 | 4.7 | 5.8 | 12 | 0.7 | 0.2 | 0.0 | 0.3 | 8 |
| Br | mg $kg^{-1}$ | 17.4 | 18.3 | 16.7 | 21.0 | 12 | 7.8 | 8.0 | 7.2 | 9.2 | 12 |
| Cd | mg $kg^{-1}$ | 0.60 | 0.32 | 0.25 | 0.60 | 12 | 0.47 | 0.25 | 0.25 | 0.25 | 12 |
| Ce | mg $kg^{-1}$ | 111 | 107 | 103 | 110 | 12 | 56 | 57 | 54 | 59 | 12 |
| Co | mg $kg^{-1}$ | 18.0 | 15.8 | 13.4 | 19.4 | 12 | 6.9 | 5.6 | 3.0 | 7.8 | 12 |
| Cr | mg $kg^{-1}$ | 57 | 60 | 56 | 62 | 12 | 49 | 52 | 49 | 56 | 12 |
| Cs | mg $kg^{-1}$ | 15 | 12 | 11 | 12 | 12 | 4 | 7 | 6 | 7 | 12 |
| Cu | mg $kg^{-1}$ | 57.8 | 56.7 | 55.1 | 58.1 | 12 | 18.3 | 16.0 | 15.3 | 16.7 | 12 |
| Ga | mg $kg^{-1}$ | 23.5 | 23.2 | 22.5 | 23.9 | 12 | 10.2 | 8.3 | 7.7 | 8.6 | 12 |
| Ge | mg $kg^{-1}$ | 1.3 | 1.5 | 0.6 | 2.1 | 12 | 1.4 | 1.5 | 1.1 | 2.0 | 12 |
| Hf | mg $kg^{-1}$ | 11.6 | 10.7 | 9.5 | 12.2 | 12 | 10.8 | 11.3 | 10.1 | 12.3 | 12 |
| I | mg $kg^{-1}$ | ND | 5 | 4 | 6 | 12 | ND | 4 | 3 | 4 | 12 |
| La | mg $kg^{-1}$ | 60 | 53 | 51 | 54 | 12 | 31 | 33 | 32 | 35 | 12 |
| Mo | mg $kg^{-1}$ | 31.4 | 29.1 | 28.4 | 29.9 | 12 | 0.5 | 0.2 | 0.0 | 0.4 | 6 |
| Nb | mg $kg^{-1}$ | 21.6 | 22.6 | 22.0 | 23.5 | 12 | 11.5 | 10.4 | 10.0 | 10.9 | 12 |
| Ni | mg $kg^{-1}$ | 20.5 | 21.1 | 19.0 | 23.9 | 12 | 13.5 | 13.1 | 12.1 | 13.8 | 12 |
| Pb | mg $kg^{-1}$ | 110.9 | 107.2 | 105.6 | 108.5 | 12 | 36.5 | 35.5 | 34.1 | 36.8 | 12 |
| Rb | mg $kg^{-1}$ | 184.1 | 179.9 | 177.0 | 182.2 | 12 | 81.0 | 77.0 | 75.3 | 78.3 | 12 |
| Sb | mg $kg^{-1}$ | 2.84 | 2.90 | 2.60 | 3.30 | 12 | 1.47 | 1.23 | 0.50 | 1.60 | 12 |
| Sc | mg $kg^{-1}$ | 13 | 13 | 11 | 14 | 12 | 5 | 6 | 5 | 8 | 12 |
| Se | mg $kg^{-1}$ | 0.4 | 0.1 | 0.1 | 0.1 | 6 | 0.2 | 0.1 | 0.0 | 0.1 | 8 |
| Sn | mg $kg^{-1}$ | 6 | 5 | 5 | 6 | 12 | 3 | 2 | 2 | 3 | 12 |
| Sr | mg $kg^{-1}$ | 198.6 | 203.0 | 200.1 | 205.5 | 12 | 67.6 | 68.6 | 67.5 | 69.9 | 12 |
| Ta | mg $kg^{-1}$ | 1.4 | 0.6 | 0.0 | 2.2 | 11 | 0.6 | 0.4 | 0.0 | 0.6 | 11 |
| Te | mg $kg^{-1}$ | 0.06 | 0.50 | 0.50 | 0.50 | 12 | 0.04 | 0.54 | 0.50 | 1.00 | 12 |
| Th | mg $kg^{-1}$ | 26.2 | 27.9 | 27.3 | 29.4 | 12 | 8.2 | 8.6 | 8.1 | 9.3 | 12 |
| Tl | mg $kg^{-1}$ | 1.0 | 0.5 | 0.2 | 0.8 | 12 | 0.7 | 0.2 | 0.0 | 0.3 | 9 |
| U | mg $kg^{-1}$ | 39.0 | 38.1 | 37.2 | 39.0 | 12 | 2.8 | 3.2 | 2.7 | 3.7 | 12 |
| V | mg $kg^{-1}$ | 111 | 111 | 108 | 114 | 12 | 40 | 41 | 38 | 44 | 12 |
| W | mg $kg^{-1}$ | 37.9 | 37.0 | 35.9 | 38.0 | 12 | 1.1 | 1.4 | 1.2 | 1.5 | 12 |
| Y | mg $kg^{-1}$ | 25.1 | 25.2 | 24.4 | 26.1 | 12 | 17.6 | 18.7 | 17.9 | 19.4 | 12 |
| Zn | mg $kg^{-1}$ | 125.0 | 127.7 | 125.4 | 131.5 | 12 | 56.2 | 59.2 | 58.0 | 60.5 | 12 |
| Zr | mg $kg^{-1}$ | 452.6 | 455.2 | 444.9 | 465.9 | 12 | 535.1 | 530.6 | 513.2 | 548.0 | 12 |

Min = minimum Max = maximum N = Number ND = No data

Table A1.7 Percentage of variance in top (A) soils attributable to between-site, between-sample and within-sample variance

| Element | Between Site % | Between Sample % | Within Sample % |
|---|---|---|---|
| $Al_2O_3$ | 95.18 | 4.18 | 0.64 |
| CaO | 90.31 | 9.46 | 0.23 |
| $Fe_2O_3$ | 95.97 | 3.90 | 0.13 |
| $K_2O$ | 94.96 | 4.64 | 0.40 |
| MgO | 91.68 | 7.35 | 0.98 |
| MnO | 94.26 | 5.23 | 0.51 |
| $Na_2O$ | 97.33 | 1.81 | 0.86 |
| $P_2O_5$ | 90.38 | 9.06 | 0.56 |
| $SiO_2$ | 91.36 | 4.04 | 4.60 |
| $TiO_2$ | 97.19 | 2.51 | 0.30 |
| Ag | 62.95 | 7.32 | 29.74 |
| As | 90.74 | 5.46 | 3.80 |
| Ba | 88.23 | 8.71 | 3.06 |
| Bi* | 0 | 0 | 0 |
| Br | 95.23 | 4.18 | 0.59 |
| Cd | 59.16 | 0.00 | 40.84 |
| Ce | 92.70 | 4.03 | 3.27 |
| Co | 87.98 | 4.34 | 7.68 |
| Cr | 90.03 | 5.91 | 4.06 |
| Cs | 76.40 | 4.44 | 19.16 |
| Cu | 77.75 | 21.96 | 0.30 |
| Ga | 91.91 | 6.28 | 1.81 |
| Ge | 93.39 | 3.70 | 2.91 |
| Hf | 58.44 | 0.13 | 41.43 |
| I | 90.17 | 5.57 | 4.25 |
| La | 92.22 | 4.33 | 3.45 |
| Mo | 84.75 | 5.83 | 9.42 |
| Nb | 96.73 | 2.81 | 0.46 |
| Ni | 94.42 | 5.21 | 0.37 |
| Pb | 88.61 | 10.39 | 1.00 |
| Rb | 93.00 | 6.56 | 0.44 |
| Sb | 77.64 | 6.28 | 16.08 |
| Sc | 87.79 | 6.39 | 5.82 |
| Se | 80.28 | 7.50 | 12.22 |
| Sn | 63.59 | 22.46 | 13.96 |
| Sr | 92.25 | 7.56 | 0.20 |
| Ta | 14.40 | 9.99 | 75.60 |
| Te* | 0 | 0 | 0 |
| Th | 88.43 | 5.56 | 6.01 |
| Tl | 31.49 | 16.48 | 52.02 |
| U* | 70.03 | 0 | 34.04 |
| V | 96.41 | 3.12 | 0.47 |
| W | 63.23 | 7.64 | 29.13 |
| Y | 93.14 | 4.67 | 2.19 |
| Zn | 62.15 | 37.23 | 0.63 |
| Zr | 94.08 | 4.01 | 1.91 |

All data log transformed
*Assumed to be zero, negative value

Table A1.8 Percentage of variance in deeper (S) soils attributable to between-site, between-sample and within-sample variance

| Element | Between Site % | Between Sample % | Within Sample % |
|---|---|---|---|
| $Al_2O_3$ | 90.43 | 8.91 | 0.66 |
| CaO | 89.95 | 9.71 | 0.34 |
| $Fe_2O_3$ | 93.07 | 6.69 | 0.24 |
| $K_2O$ | 93.39 | 6.14 | 0.47 |
| MgO | 91.05 | 8.31 | 0.64 |
| MnO | 87.84 | 11.28 | 0.87 |
| $Na_2O$ | 90.24 | 8.72 | 1.04 |
| $P_2O_5$ | 83.93 | 15.39 | 0.68 |
| $SiO_2$ | 91.84 | 4.82 | 3.34 |
| $TiO_2$ | 94.51 | 5.14 | 0.35 |
| Ag* | 0 | 0 | 0 |
| As | 86.03 | 10.16 | 3.81 |
| Ba | 88.20 | 9.86 | 1.93 |
| Bi | 51.93 | 24.48 | 23.58 |
| Br | 88.15 | 11.58 | 0.27 |
| Cd | 45.98 | 53.55 | 0.47 |
| Ce | 82.09 | 14.96 | 2.96 |
| Co | 85.68 | 8.61 | 5.71 |
| Cr | 86.80 | 10.13 | 3.07 |
| Cs | 71.84 | 15.62 | 12.54 |
| Cu | 67.28 | 32.37 | 0.36 |
| Ga | 90.67 | 7.87 | 1.46 |
| Ge | 78.15 | 17.34 | 4.52 |
| Hf | 52.00 | 14.92 | 33.08 |
| I | 77.22 | 17.65 | 5.12 |
| La | 74.80 | 22.56 | 2.64 |
| Mo | 75.56 | 6.03 | 18.41 |
| Nb | 94.12 | 5.09 | 0.79 |
| Ni | 88.38 | 11.29 | 0.33 |
| Pb | 73.61 | 25.70 | 0.70 |
| Rb | 94.62 | 5.02 | 0.36 |
| Sb | 68.48 | 23.56 | 7.96 |
| Sc | 89.90 | 3.30 | 6.80 |
| Se | 74.57 | 19.26 | 6.17 |
| Sn | 70.73 | 19.12 | 10.15 |
| Sr | 92.27 | 7.45 | 0.29 |
| Ta* | 0 | 0 | 0 |
| Te* | 0 | 0 | 0 |
| Th | 86.38 | 7.61 | 6.02 |
| Tl | 35.20 | 16.17 | 48.63 |
| U | 57.75 | 16.46 | 25.79 |
| V | 95.18 | 4.34 | 0.48 |
| W | 57.47 | 12.44 | 30.09 |
| Y | 89.93 | 8.24 | 1.83 |
| Zn | 83.38 | 16.26 | 0.37 |
| Zr | 93.15 | 5.38 | 1.47 |

All data log transformed
*Assumed to be zero, negative value

Table A1.9 Summary of data available from the Glasgow soils survey

| Sample Type | Number of Samples | Analytes | Analytical Method |
|---|---|---|---|
| Top (A) Soils <2mm | 1622 | 46 elements | XRFS |
| | 1622 | pH | Electrode |
| | 1622 | Loss on Ignition | Furnace |
| Deeper (S) Soils <2 mm | 1609 | 46 elements | XRFS |
| | 1609 | pH | Electrode |
| | 1609 | Loss on Ignition | Furnace |

Table A1.10 List of environmental datasets incorporated to the Glasgow soils geochemistry GIS

| **GROUP LAYER NAME**<br>**Layer Name** | **Description** | **Source** |
|---|---|---|
| A SOIL <2MM | Geochemical data for top soils | BGS |
| S SOIL <2MM | Geochemical data for deeper soils | BGS |
| A SOIL EXCEEDANCES | Geochemical data for top soils | BGS |
| S SOIL EXCEEDANCES | Geochemical data for deeper soils | BGS |
| Site Land Use | Land Use recorded at each site | BGS |
| Soil Sampling Sites | Sample locations | BGS |
| CULTURAL DATA | | |
| Drainage | | OS Meridian |
| County boundaries and labels | | OS Meridian |
| Roads | | OS Meridian |
| Coastline | | OS Meridian |
| Lakes | | OS Meridian |
| Railways | | OS Meridian |
| Urban areas | | OS Meridian |
| Quarry locations and labels | | BGS |
| Project extent | | BGS |
| GEOLOGY | | |
| Rationalised Soil Geology 50k | Simplified bedrock geology | BGS |
| Bedrock 50k | 1:50000 bedrock geology | BGS |
| Superficial 50k | 1:50000 superficial deposits | BGS |
| Artificial Ground 50k | 1:50000 artificial deposits | BGS |
| Mass Movement 50k | 1:50000 mass movement | BGS |
| Bedrock 250k | 1:250000 bedrock geology | BGS |
| Bedrock 625k | 1:625000 bedrock geology | BGS |
| Superficial Deposits 625k | 1:625000 superficial deposits | BGS |
| Glasgow Solid 10k | 1:10000 bedrock geology | BGS |
| Glasgow Drift 10k | 1:10000 superficial deposits | BGS |
| Glasgow Faults | 1:10000 faults | BGS |
| Coal Lines 10k | 1:10000 coal lines | BGS |
| Igneous 10k | 1: 10000 igneous rocks | BGS |

## PART B – FIGURES

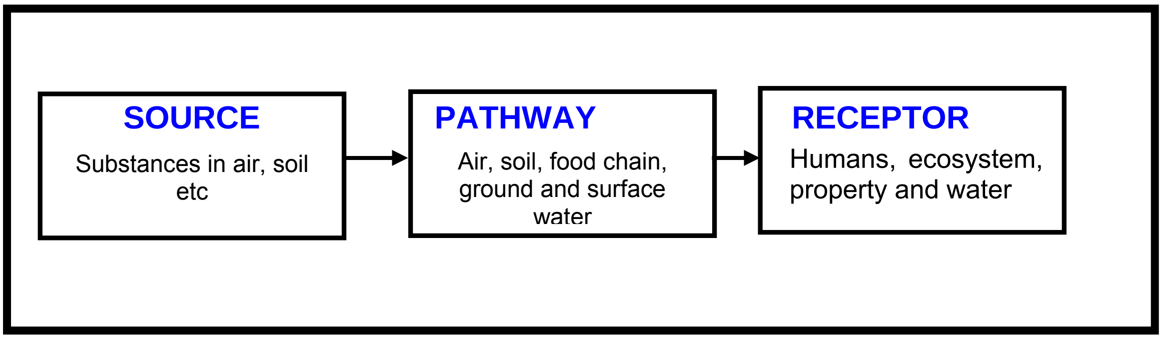



**Figure 1.1 Concept of source, pathway and receptor in the assessment of contaminated land.**

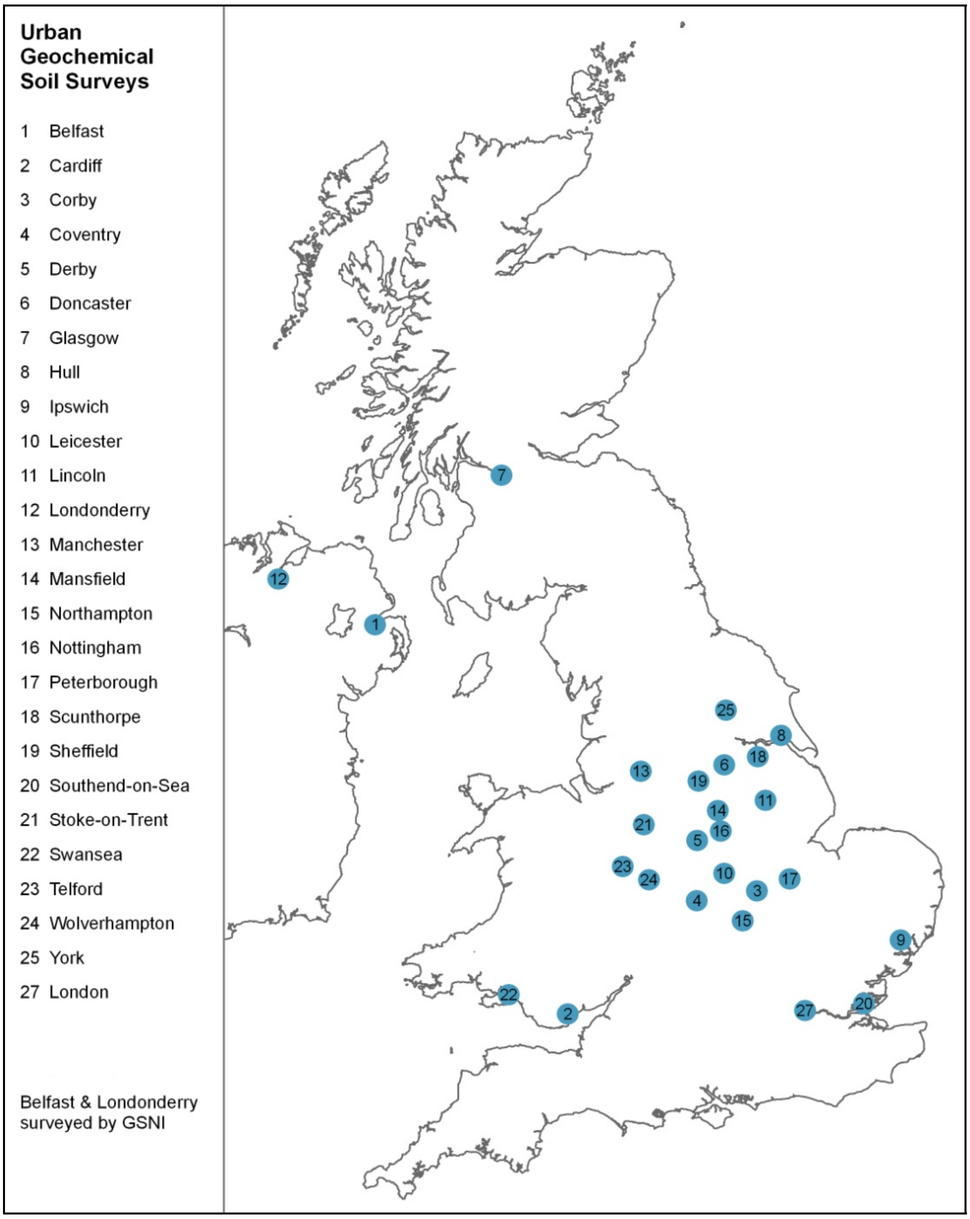
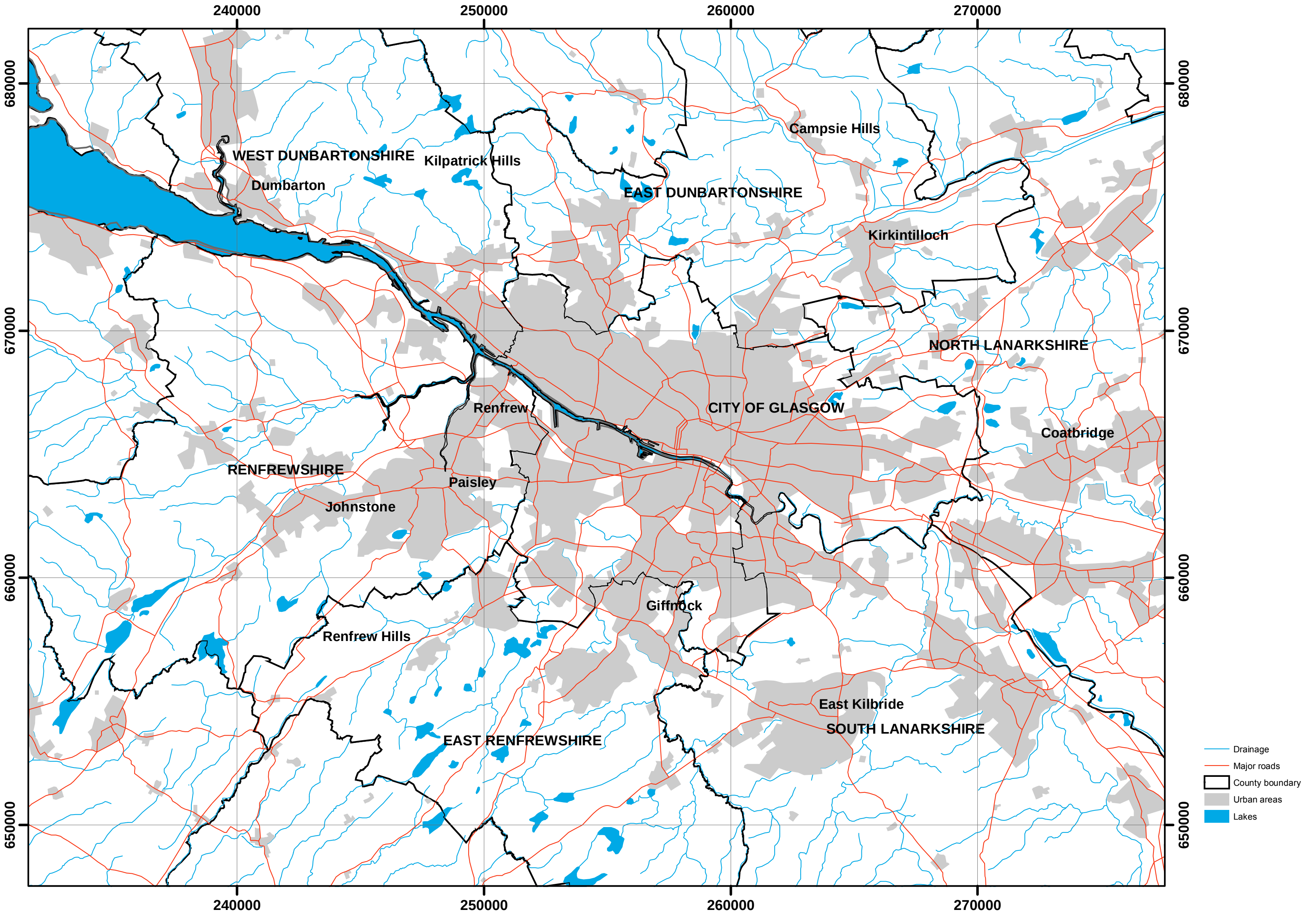
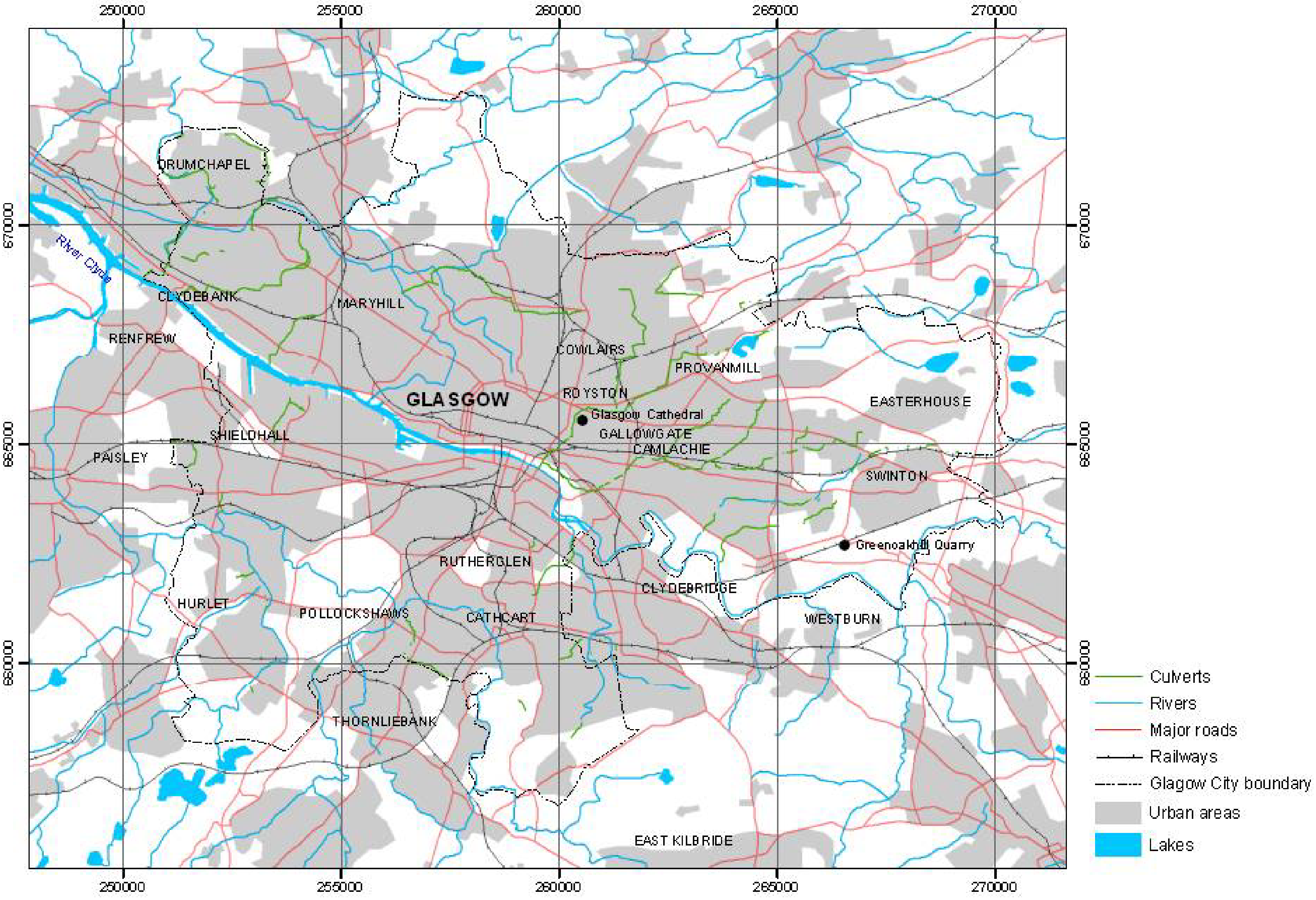



**Figure 1.2 Map showing the UK urban areas surveyed by the G-BASE project to date.**



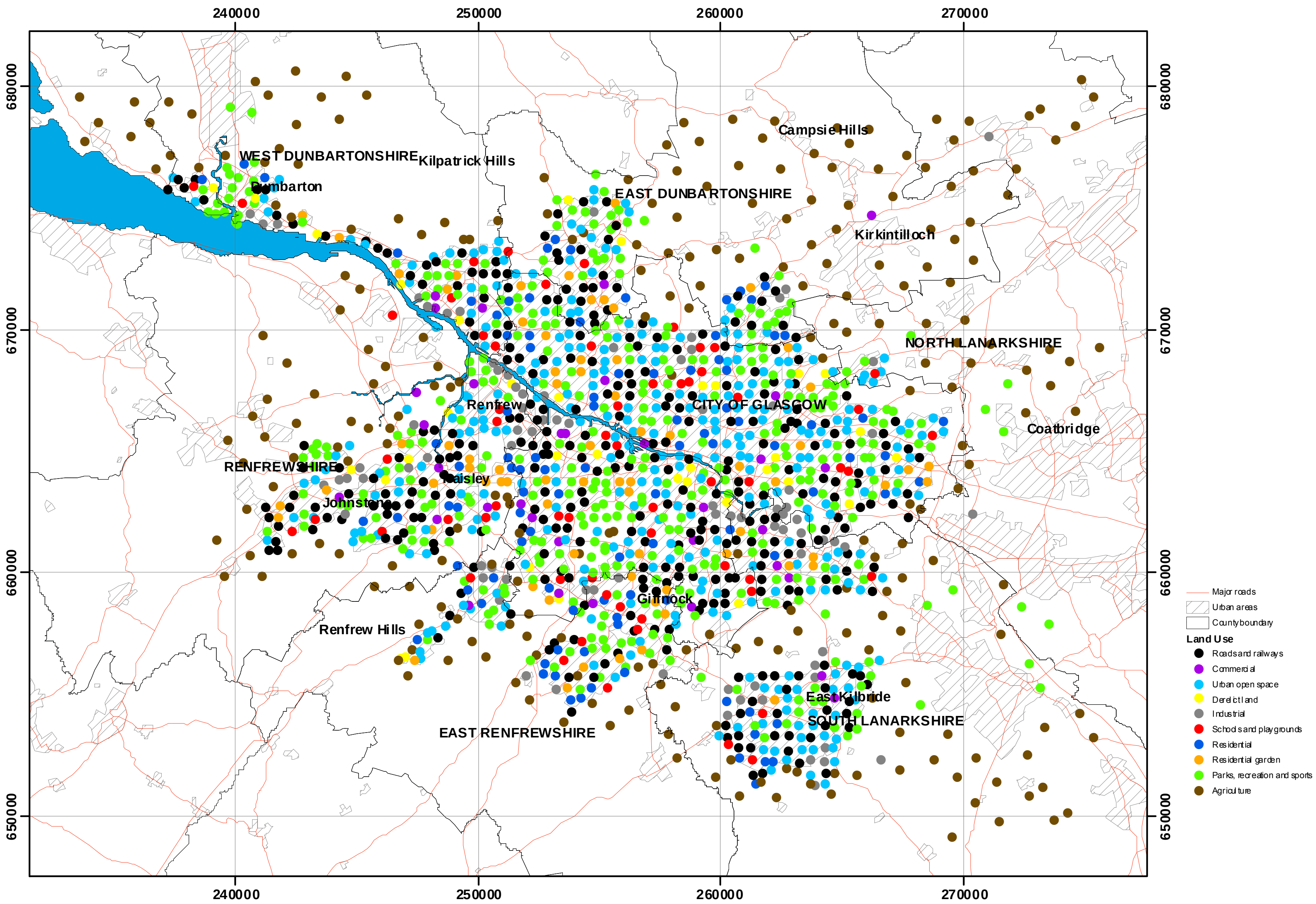

Grid squares = 10 km

**Figure 2.1 Topographic map of the Glasgow soils study area.**




Grid squares = 5 km

**Figure 2.2 Map of the Glasgow area showing selected sites associated with former industrial activity and post-war redevelopment.**




Grid squares = 10 km

**Figure 2.3 Map of land use recorded at each soil sample site across the Glasgow study area.**

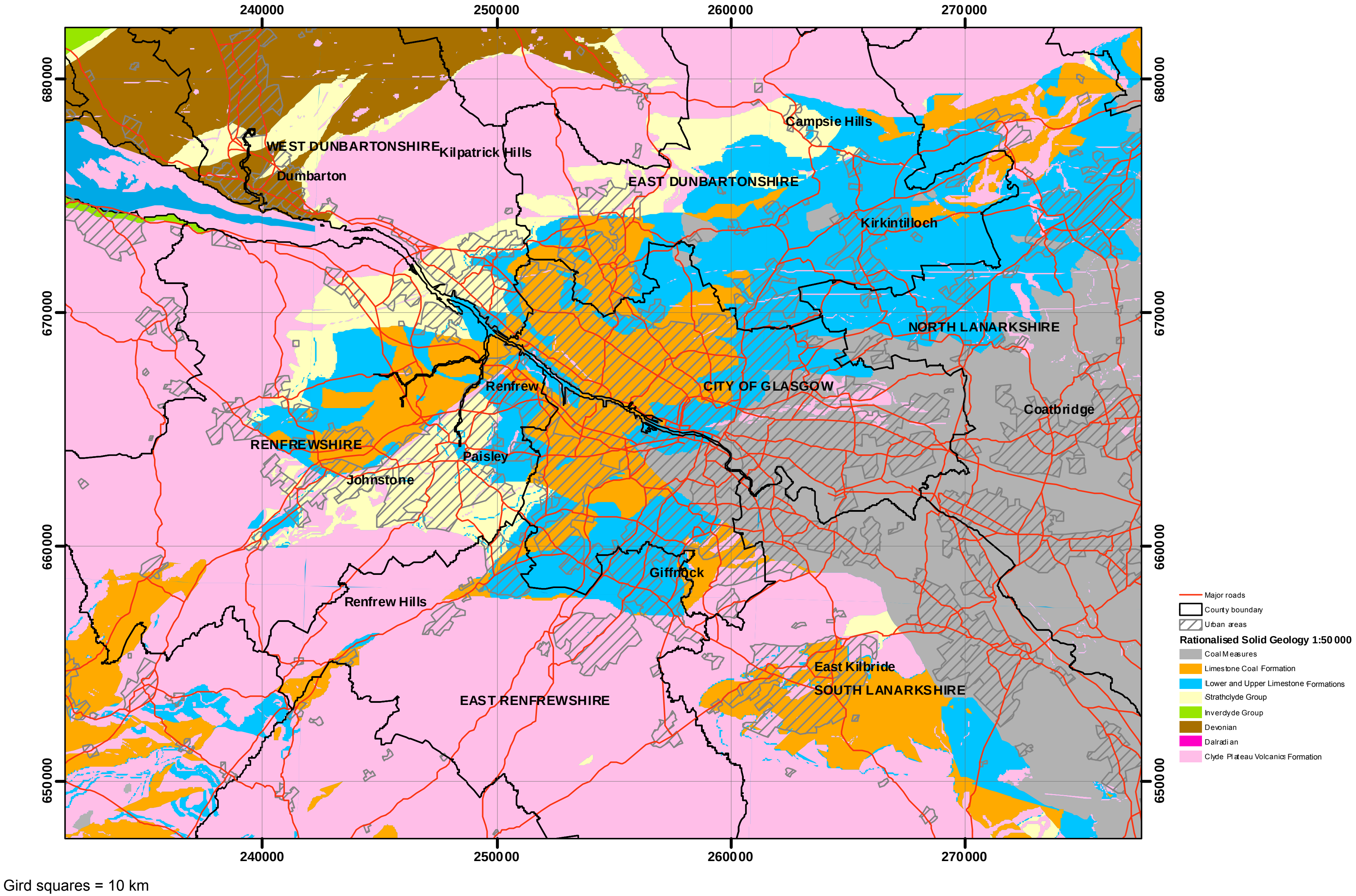



**Figure 2.4 Simplified bedrock geology map of the Glasgow study area derived from BGS DigMap® data.**

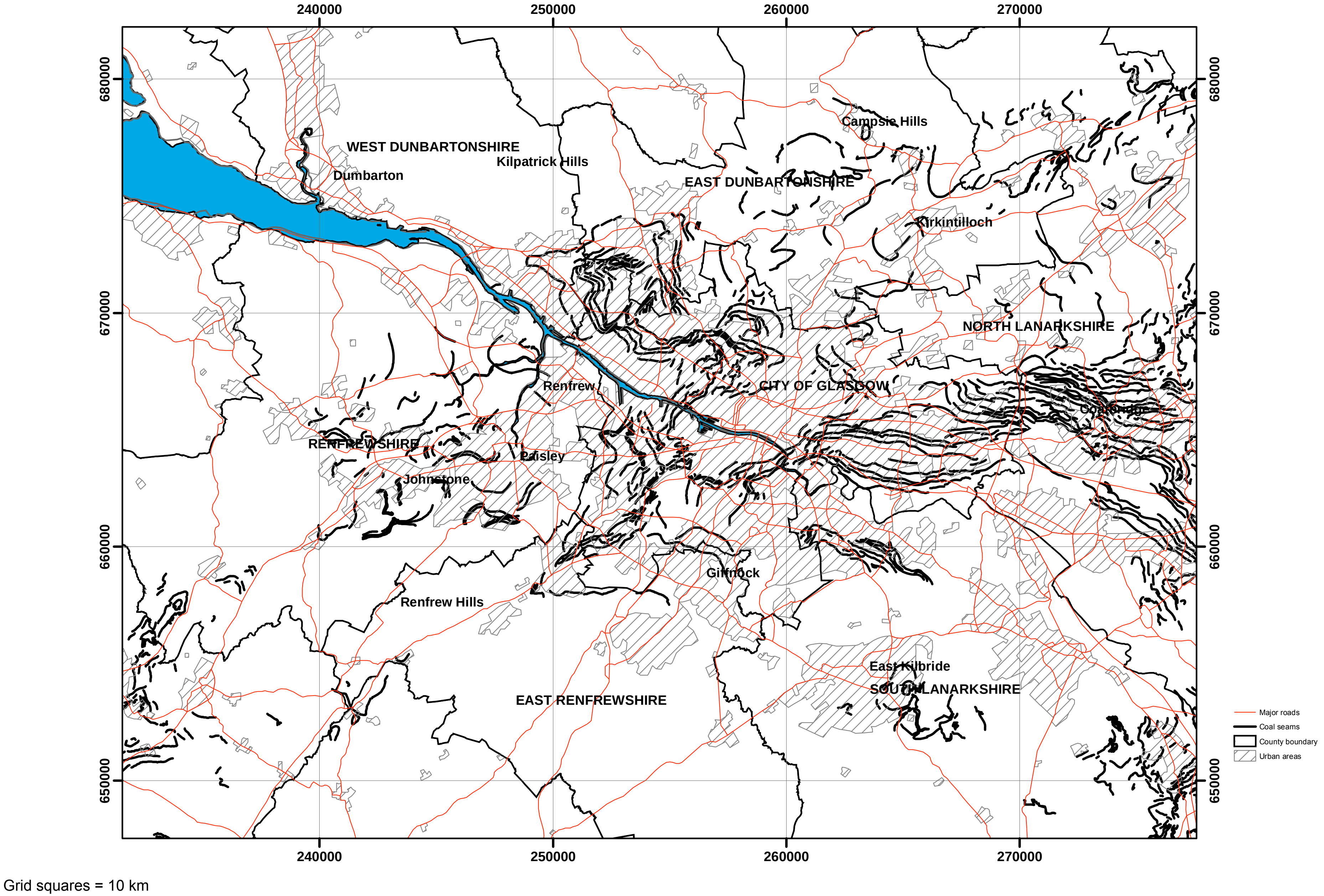
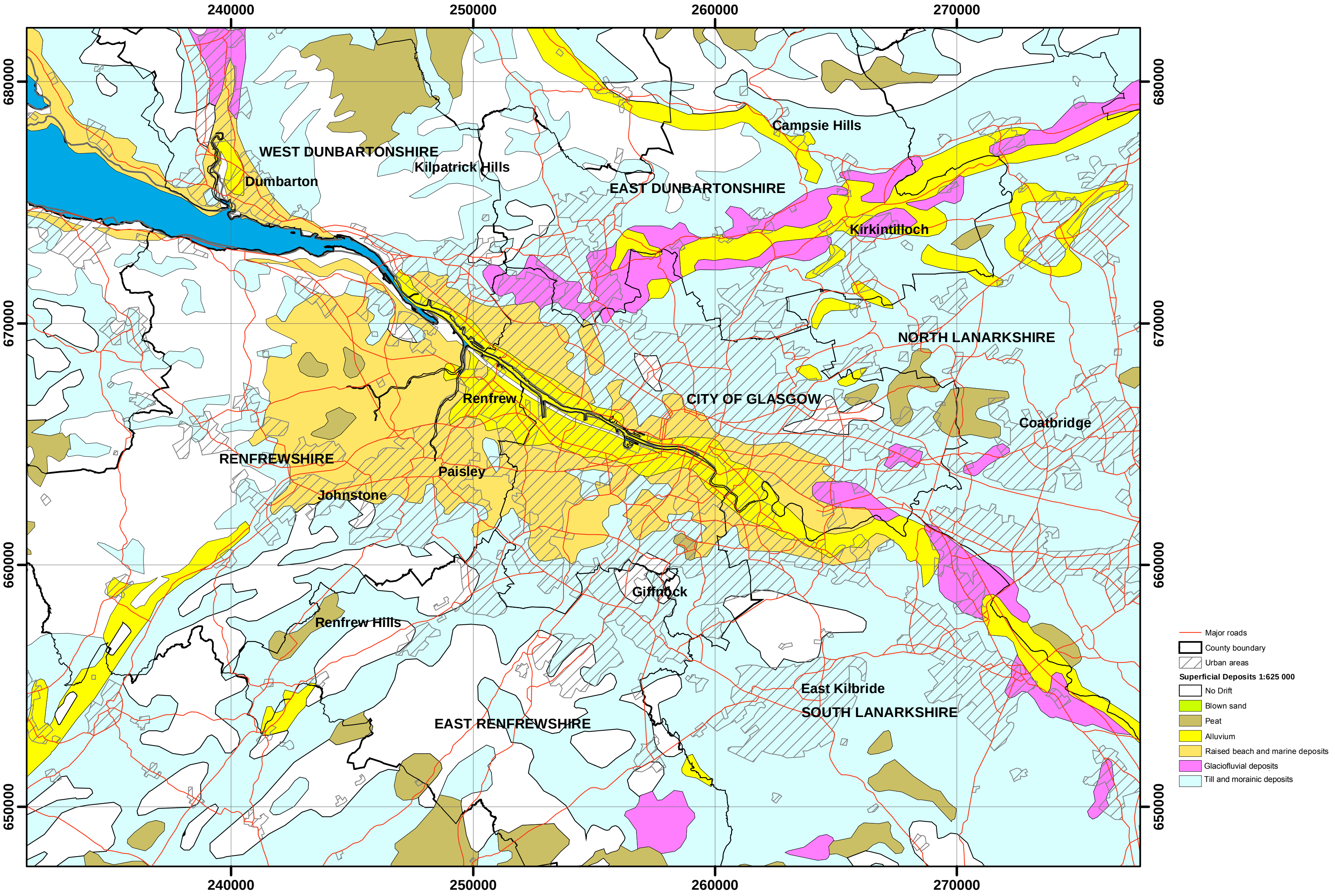



**Figure 2.5 Coal seams of the Glasgow study area derived from BGS DigMap® data.**




Grid squares = 10 km

**Figure 2.6 Superficial deposits (drift) map of the Glasgow study area derived from BGS DigMap® data.**

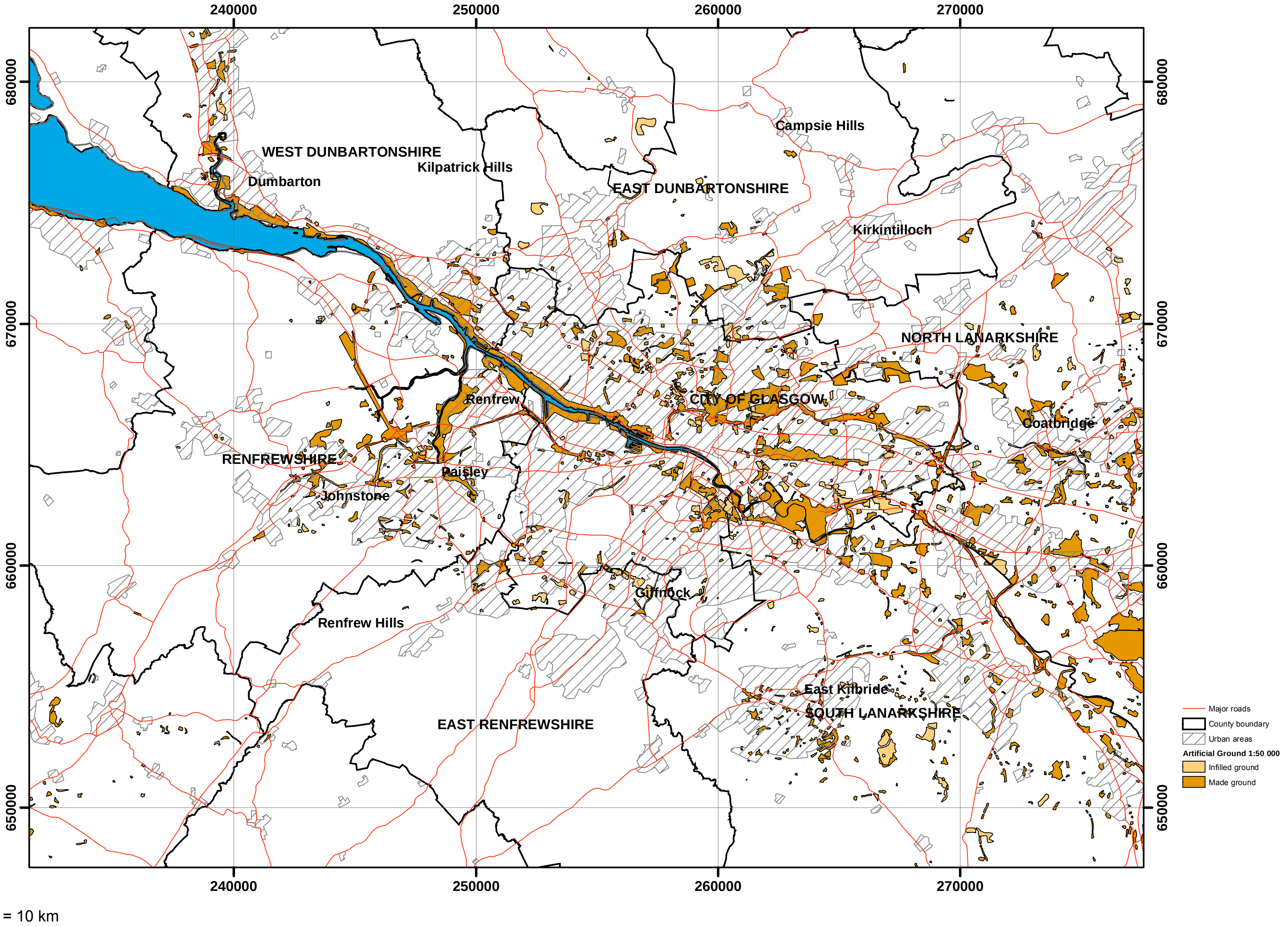



**Figure 2.7 Made and infilled ground in the Glasgow study area derived from BGS DigMap® data.**

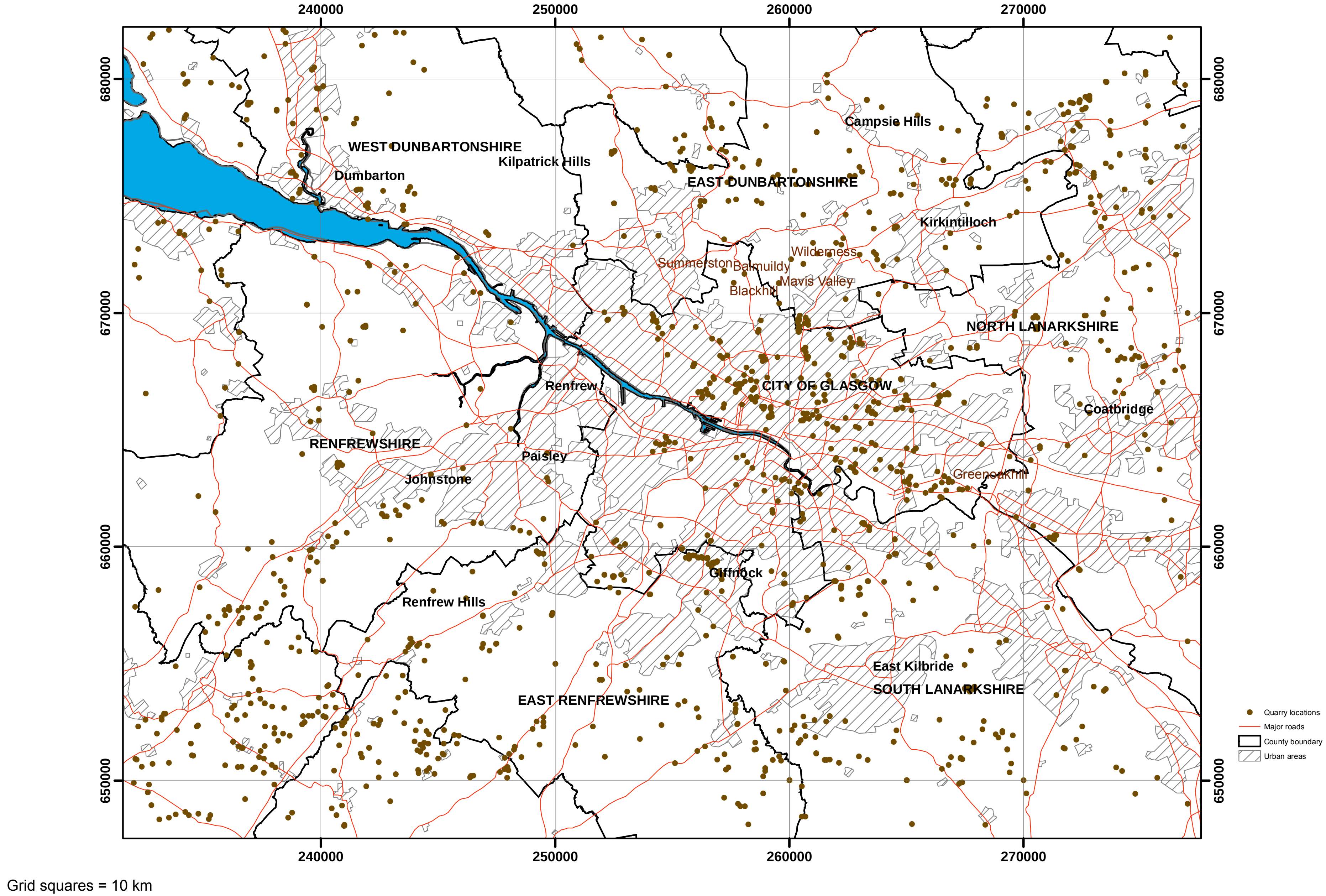
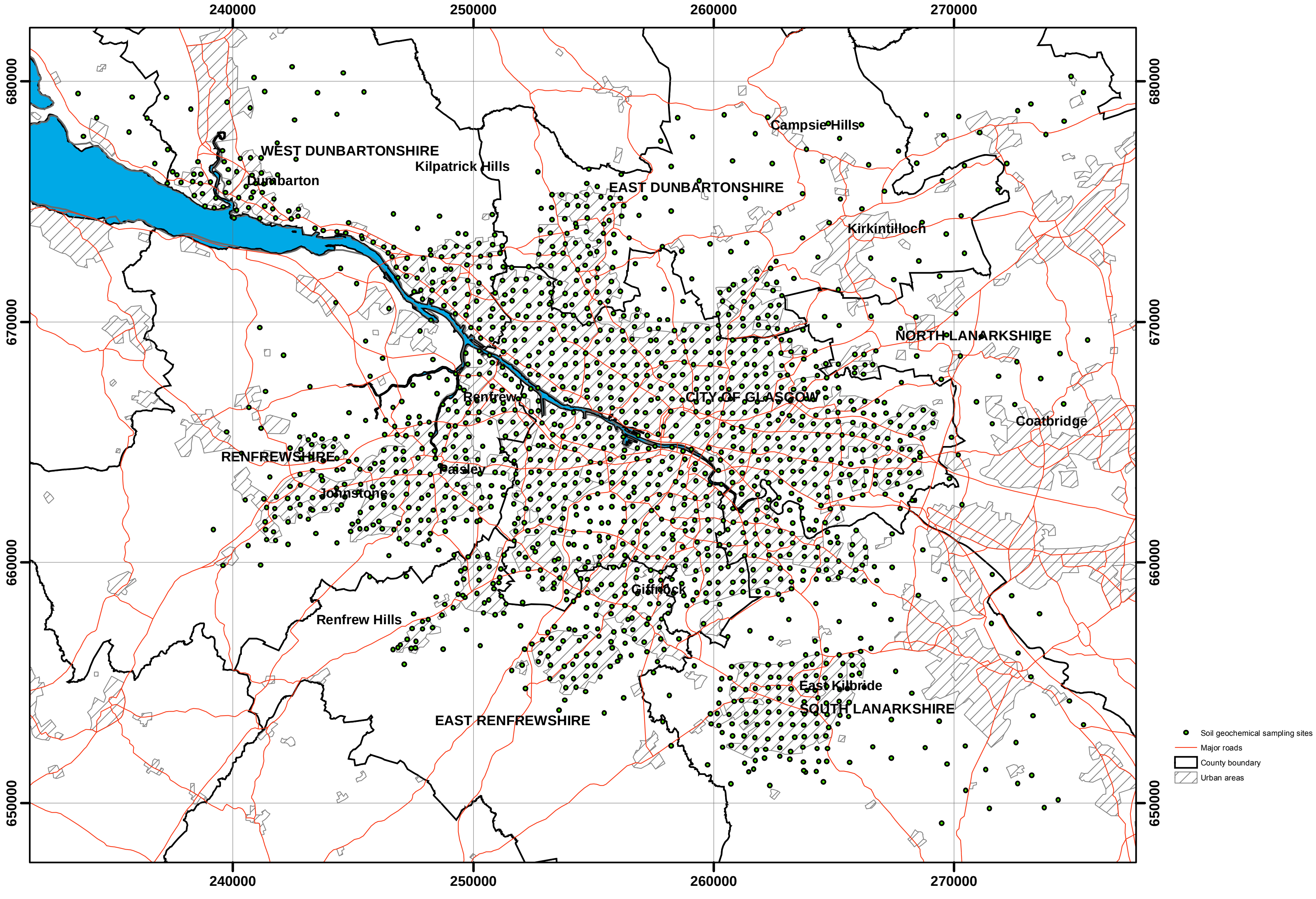
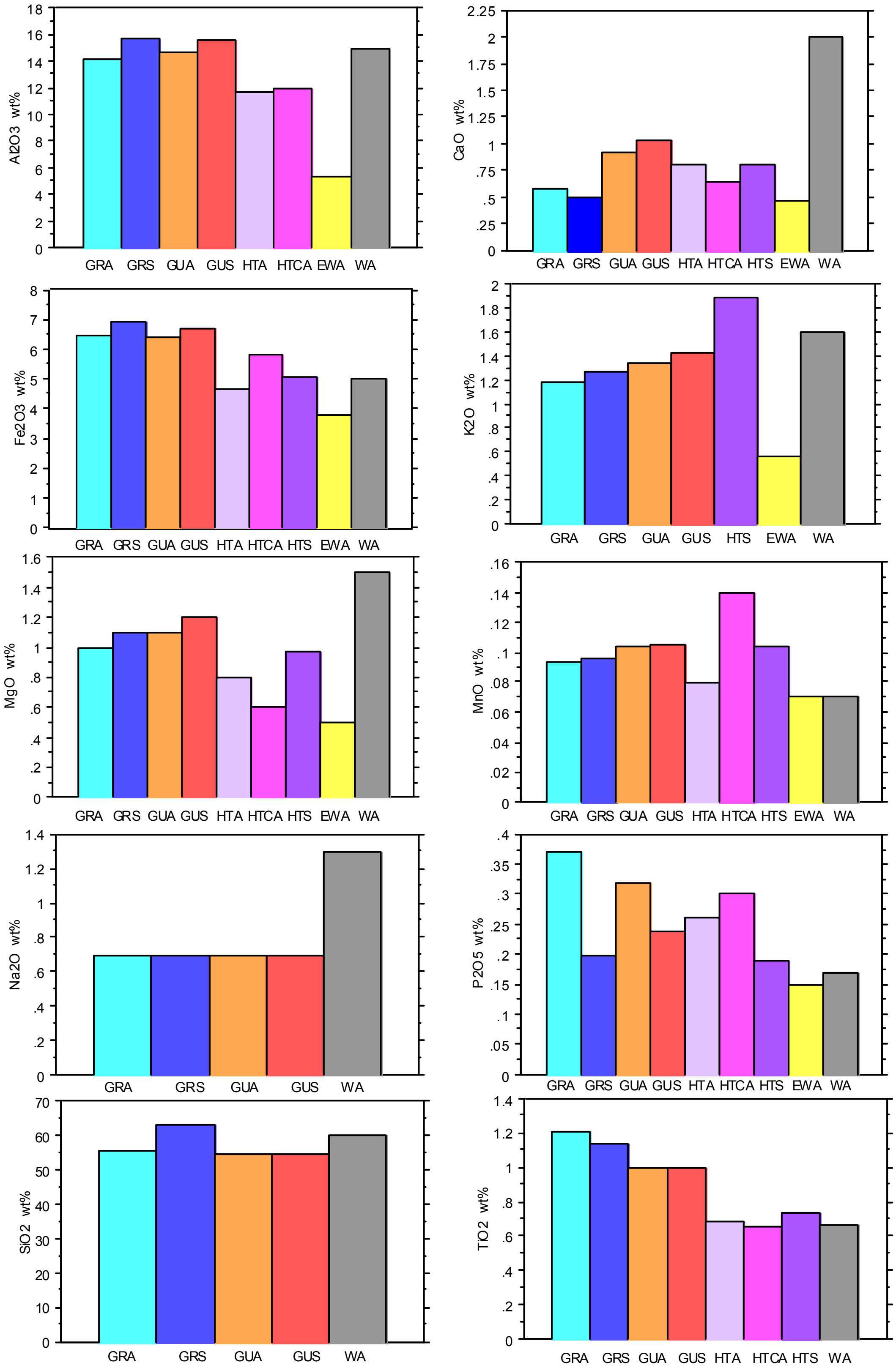



**Figure 2.8 Quarry locations in the Glasgow study area derived from BGS data.**



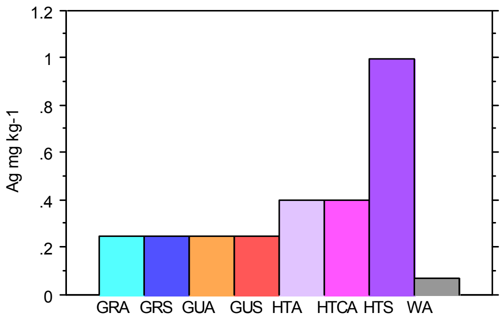

Grid squares = 10 km

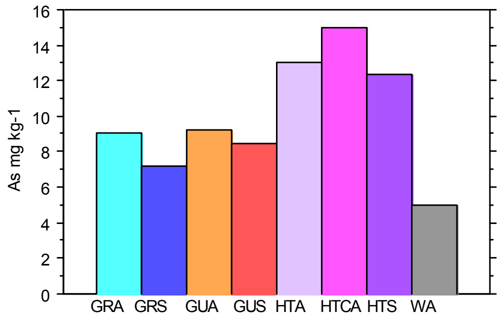
**Figure 3.1 Location of geochemical sampling sites across the Glasgow soils study area.**

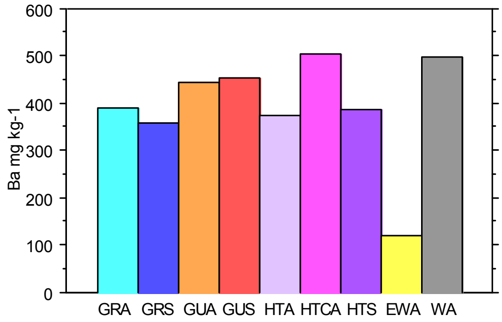


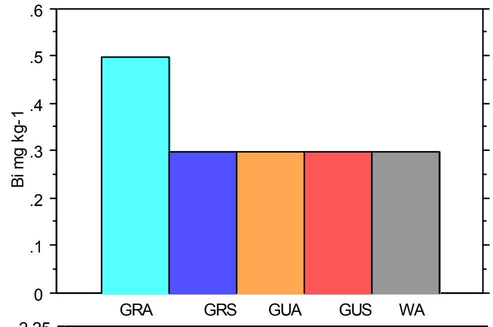

GRA = Glasgow Rural <2 mm top soils (n = 241)
GRS = Glasgow Rural <2 mm deeper soils (n = 241)
GUA = Glasgow Urban <2 mm top soils (n = 1381)
GUS = Glasgow Urban <2 mm deeper soils (n = 1368)
HTA = <2 mm G-BASE rural top soils from the Humber-Trent atlas area (British Geological Survey, 2009) (n = 6575)
HTS = <150 µm G-BASE rural deeper soils from the Humber-Trent atlas area (British Geological Survey, 2009) (n = 6575)
HTCA = <2 mm G-BASE rural top soils over Coal Measures, Humber-Trent atlas area (British Geological Survey, 2009) (n = 958)
EWA = <2 mm top soils National Soil Inventory of England and Wales (McGrath and Loveland, 1992) (n = 5692)
SA = <2 mm mineral top soils National Soil Inventory of Scotland (SEPA, 2001; Paterson et al., 2003) (n = 291)
WA = <2 mm world top soils medians (Reimann and Caritat, 1998)

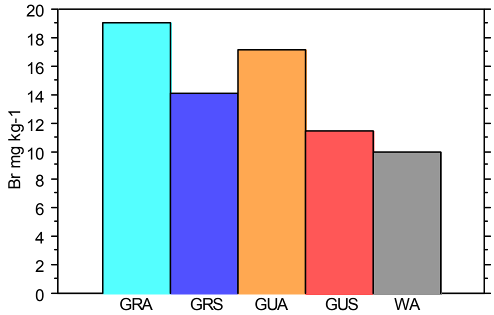
**Figure 3.2 Bar charts showing median element concentrations in the Glasgow soils dataset versus UK national and regional and world datasets.**

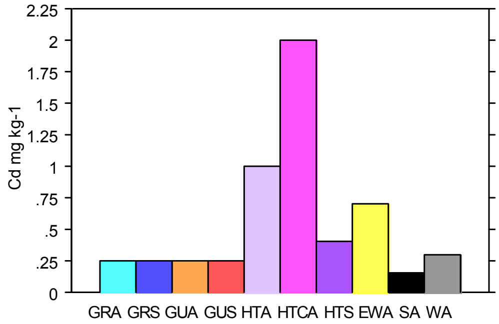

Ag mg kg-1
1.2
1
.8
.6
.4
.2
0
GRA GRS GUA GUS HTA HTCA HTS WA

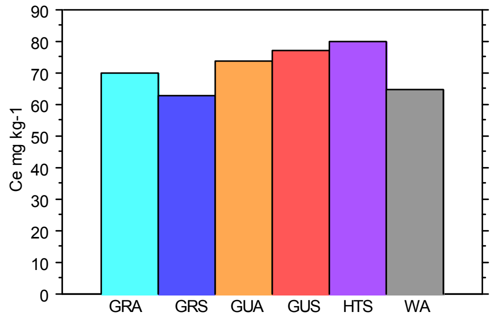

As mg kg-1
16
14
12
10
8
6
4
2
0
GRA GRS GUA GUS HTA HTCA HTS WA

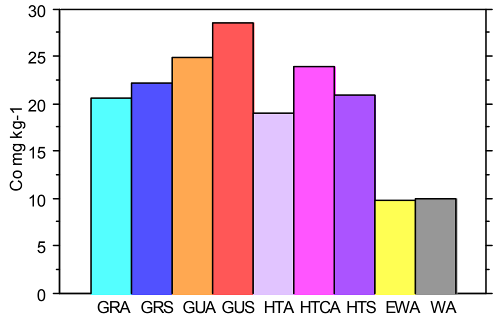

Ba mg kg-1
600
500
400
300
200
100
0
GRA GRS GUA GUS HTA HTCA HTS EWA WA

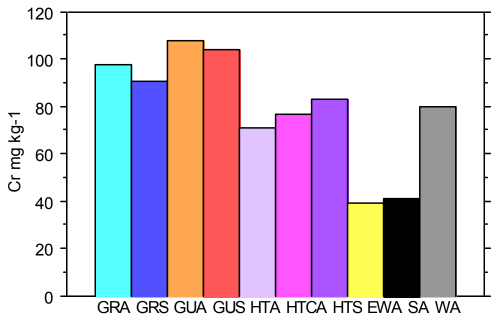

Bi mg kg-1
.6
.5
.4
.3
.2
.1
0
GRA GRS GUA GUS WA

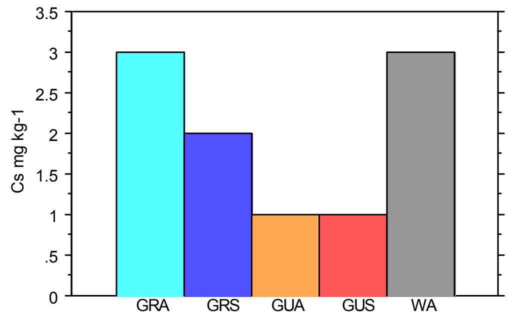

Br mg kg-1
20
18
16
14
12
10
8
6
4
2
0
GRA GRS GUA GUS WA

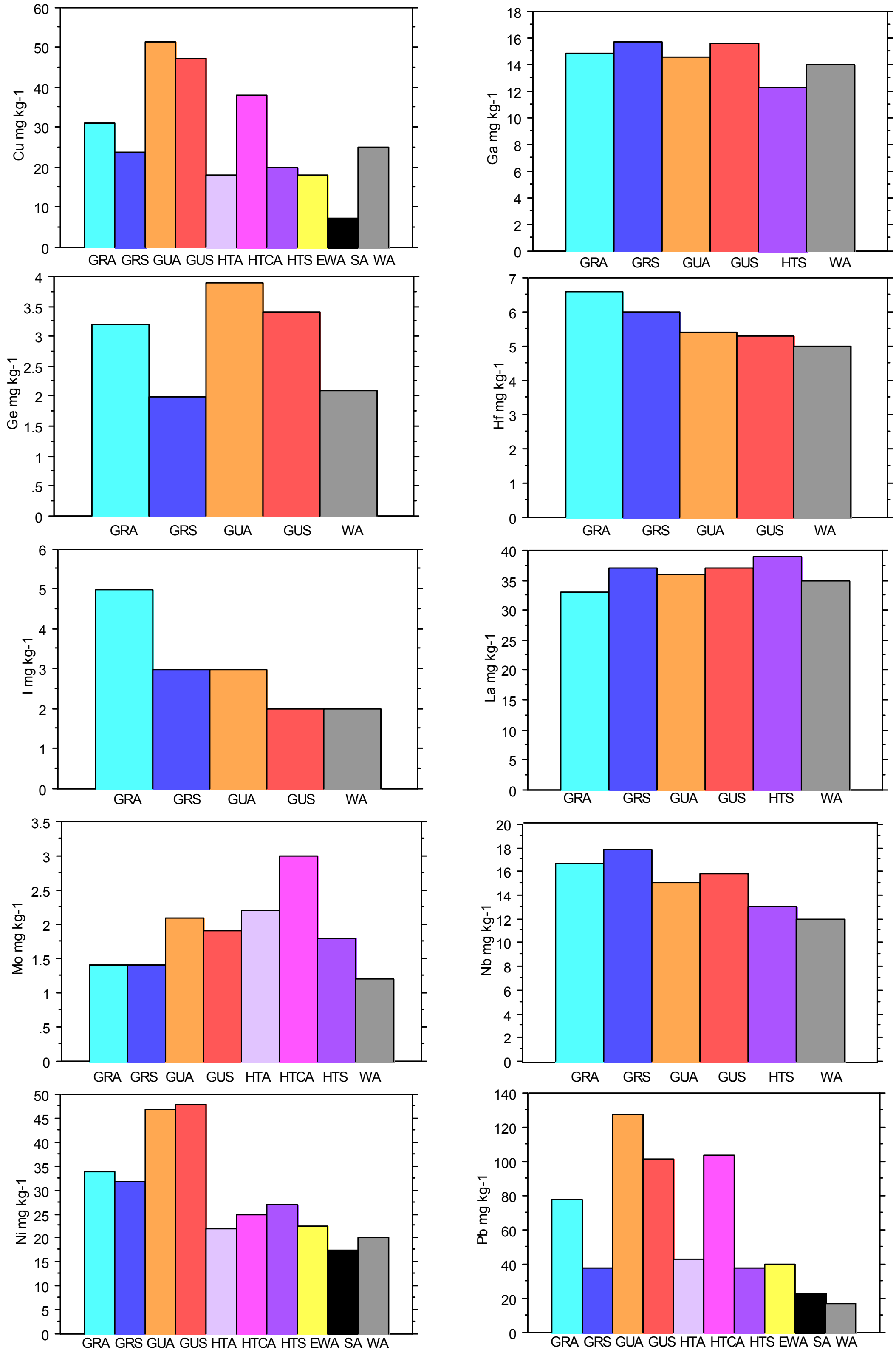

Cd mg kg-1
2.25
2
1.75
1.5
1.25
1
.75
.5
.25
0
GRA GRS GUA GUS HTA HTCA HTS EWA SA WA

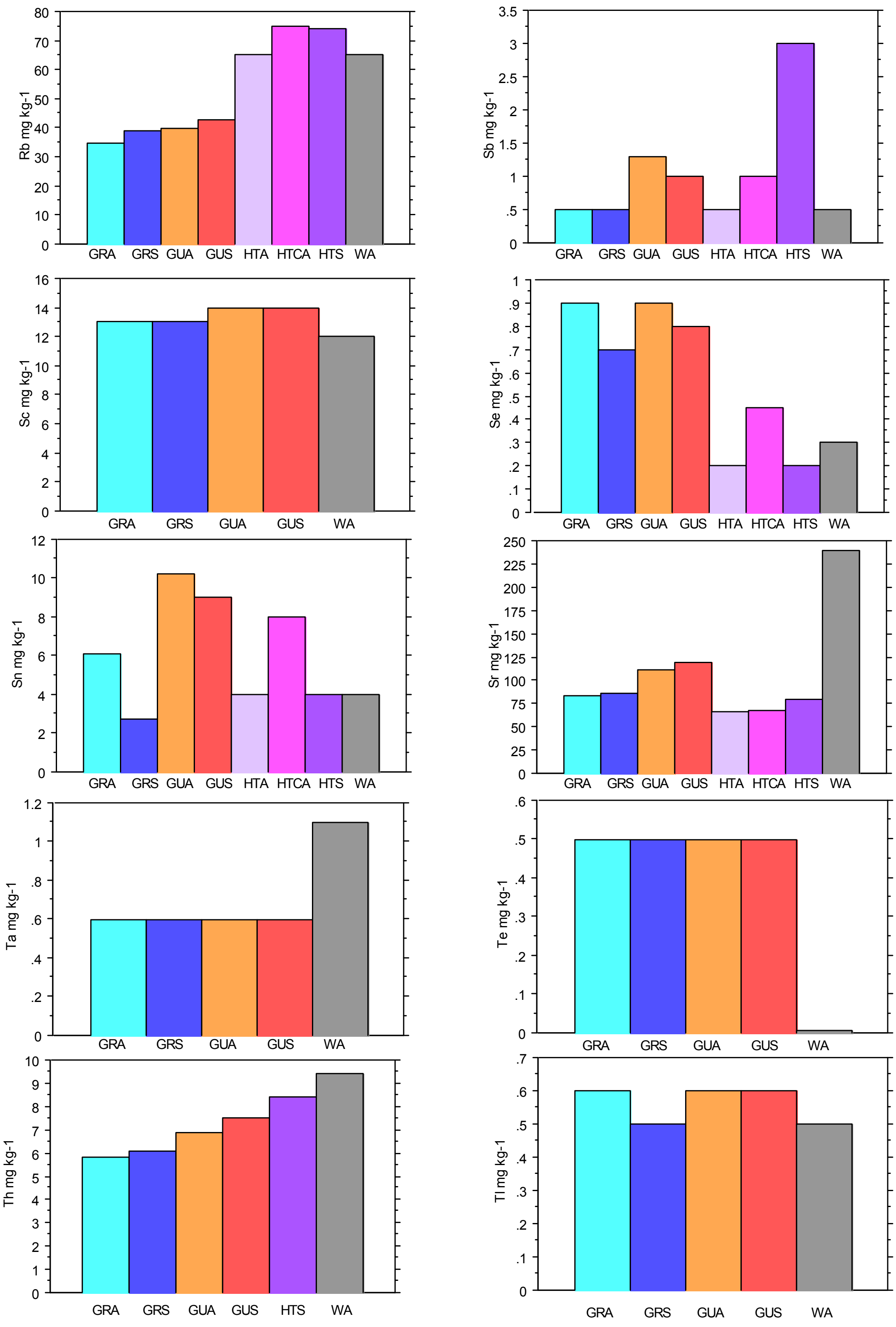

Ce mg kg-1
90
80
70
60
50
40
30
20
10
0
GRA GRS GUA GUS HTS WA

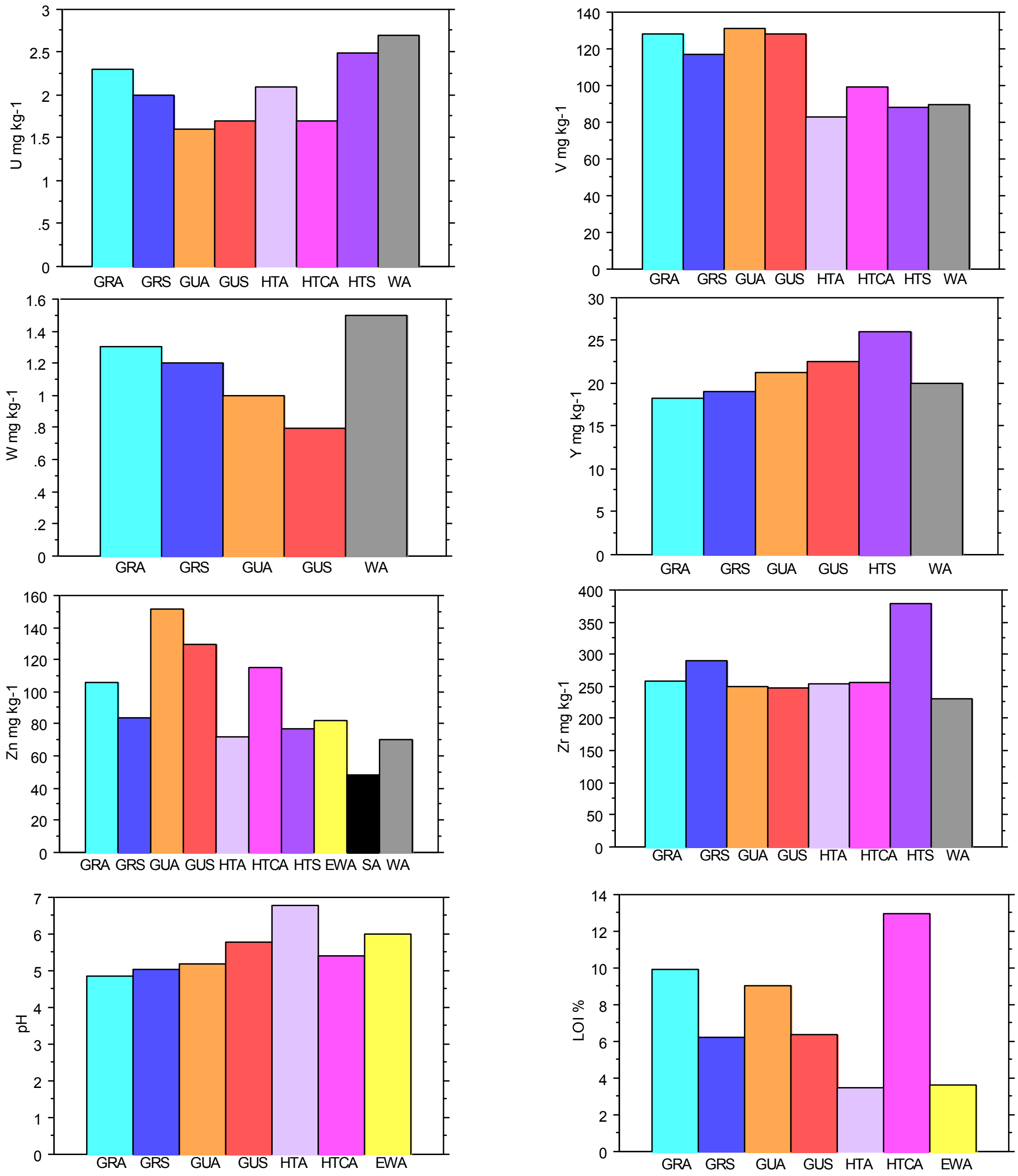

Co mg kg-1
30
25
20
15
10
5
0
GRA GRS GUA GUS HTA HTCA HTS EWA WA

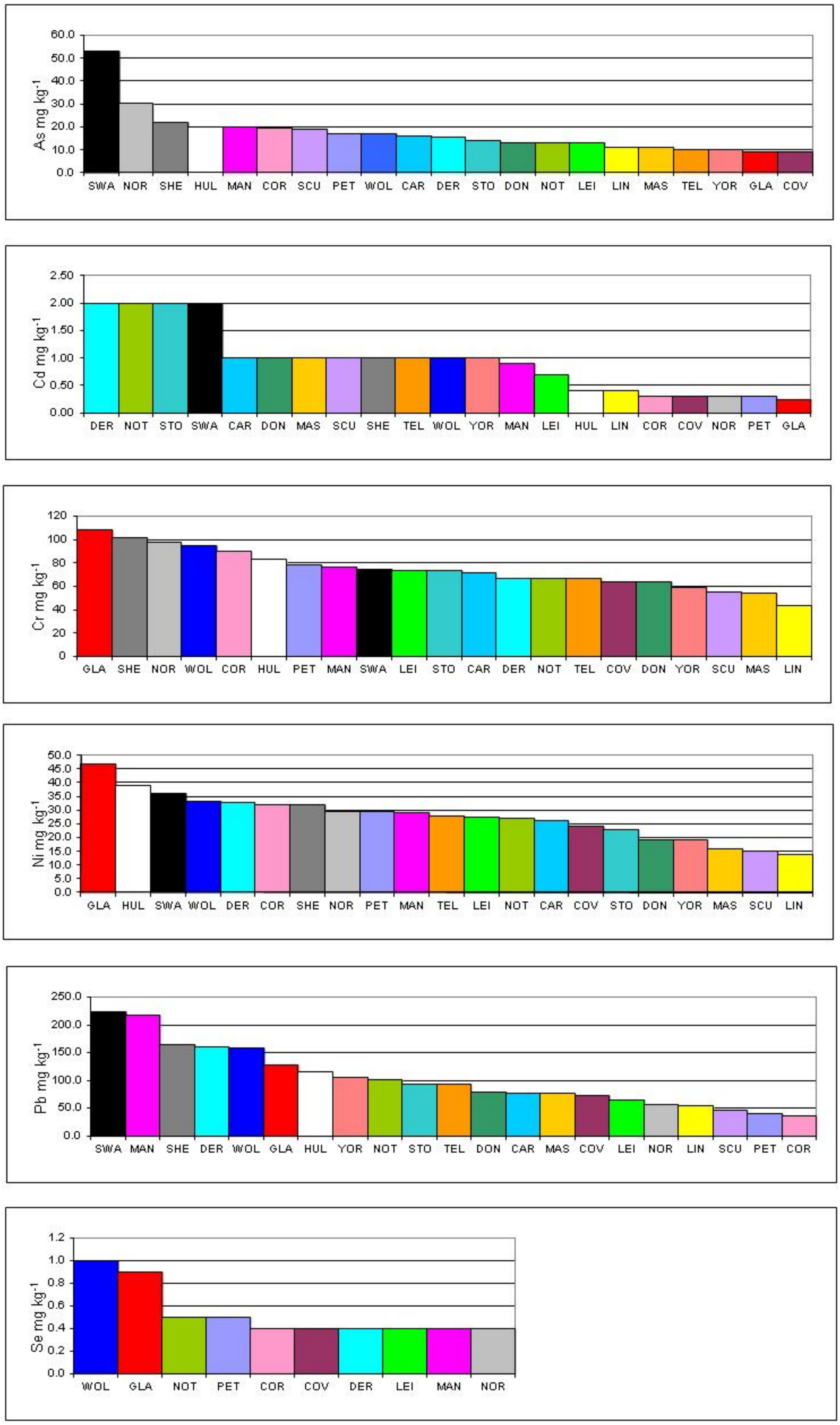

Cr mg kg-1
120
100
80
60
40
20
0
GRA GRS GUA GUS HTA HTCA HTS EWA SA WA


Cs mg kg-1
3.5
3
2.5
2
1.5
1
.5
0
GRA GRS GUA GUS WA


Cu mg kg-1
GRA GRS GUA GUS HTA HTCA HTS EWA SA WA
Ga mg kg-1
GRA GRS GUA GUS HTS WA
Ge mg kg-1
GRA GRS GUA GUS WA
Hf mg kg-1
GRA GRS GUA GUS WA
I mg kg-1
GRA GRS GUA GUS WA
La mg kg-1
GRA GRS GUA GUS HTS WA
Mo mg kg-1
GRA GRS GUA GUS HTA HTCA HTS WA
Nb mg kg-1
GRA GRS GUA GUS HTS WA
Ni mg kg-1
GRA GRS GUA GUS HTA HTCA HTS EWA SA WA
Pb mg kg-1
GRA GRS GUA GUS HTA HTCA HTS EWA SA WA


Rb mg kg-1
GRA GRS GUA GUS HTA HTCA HTS WA
Sb mg kg-1
GRA GRS GUA GUS HTA HTCA HTS WA
Sc mg kg-1
GRA GRS GUA GUS WA
Se mg kg-1
GRA GRS GUA GUS HTA HTCA HTS WA
Sn mg kg-1
GRA GRS GUA GUS HTA HTCA HTS WA
Sr mg kg-1
GRA GRS GUA GUS HTA HTCA HTS WA
Ta mg kg-1
GRA GRS GUA GUS WA
Te mg kg-1
GRA GRS GUA GUS WA
Th mg kg-1
GRA GRS GUA GUS HTS WA
Tl mg kg-1
GRA GRS GUA GUS WA

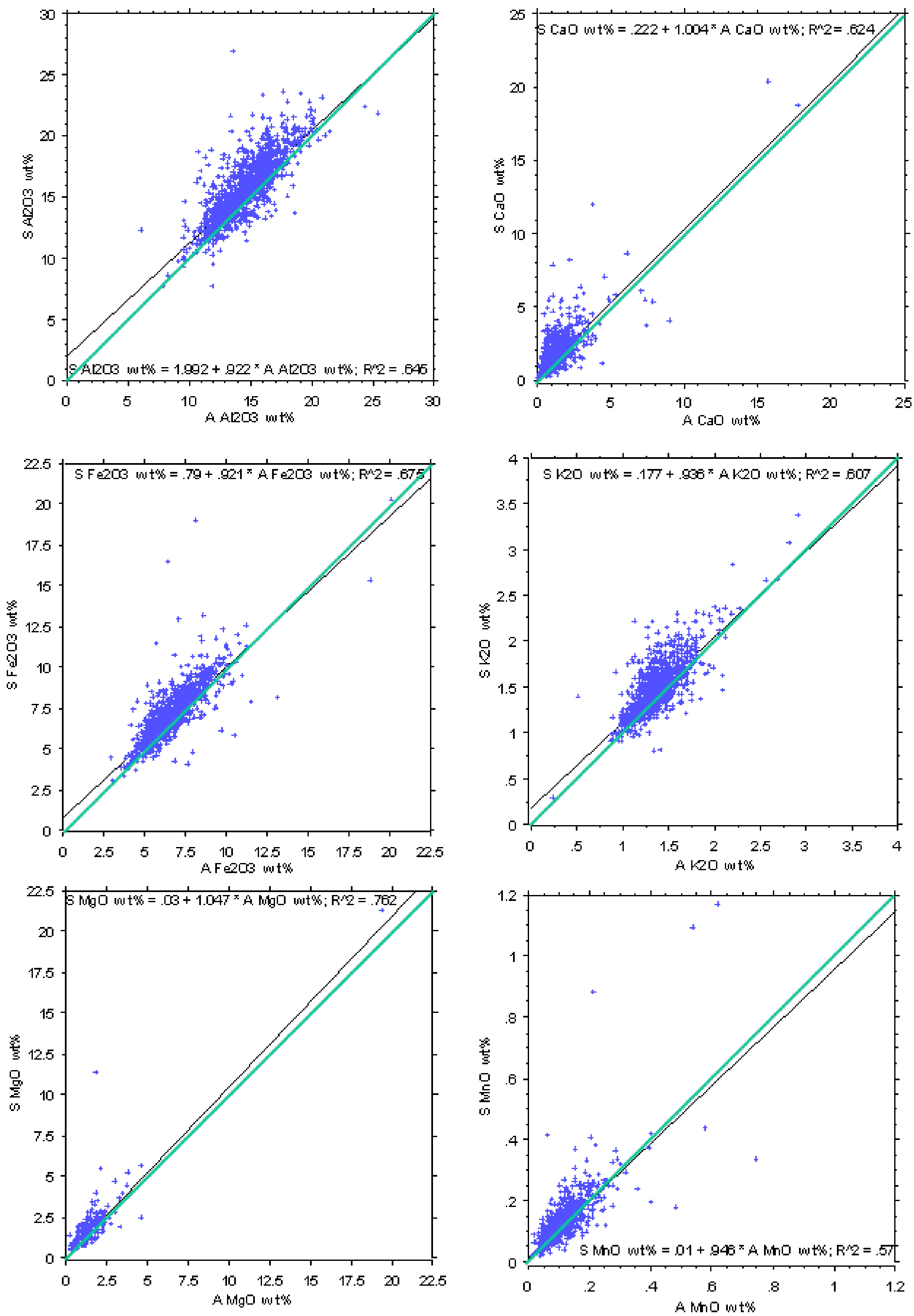

U mg kg-1
3
2.5
2
1.5
1
.5
0
GRA GRS GUA GUS HTA HTCA HTS WA
V mg kg-1
140
120
100
80
60
40
20
0
GRA GRS GUA GUS HTA HTCA HTS WA
W mg kg-1
1.6
1.4
1.2
1
.8
.6
.4
.2
0
GRA GRS GUA GUS WA
Y mg kg-1
30
25
20
15
10
5
0
GRA GRS GUA GUS HTS WA
Zn mg kg-1
160
140
120
100
80
60
40
20
0
GRA GRS GUA GUS HTA HTCA HTS EWA SA WA
Zr mg kg-1
400
350
300
250
200
150
100
50
0
GRA GRS GUA GUS HTA HTCA HTS WA
pH
7
6
5
4
3
2
1
0
GRA GRS GUA GUS HTA HTCA EWA
LOI %
14
12
10
8
6
4
2
0
GRA GRS GUA GUS HTA HTCA EWA




Se data are available for ten urban centres only

| Code | City | N | Code | City | N | Code | City | N | Code | City | N |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CAR = | Cardiff | 508 | HUL = | Hull | 409 | NOR = | Northampton | 275 | STO = | Stoke | 747 |
| COR = | Corby | 133 | LEI = | Leicester | 680 | NOT = | Nottingham | 637 | SWA = | Swansea | 373 |
| COV = | Coventry | 396 | LIN = | Lincoln | 216 | PET = | Peterborough | 276 | TEL = | Telford | 295 |
| DER = | Derby | 276 | MAN = | Manchester | 300 | SCU = | Scunthorpe | 196 | WOL = | Wolverhampton | 285 |
| DON = | Doncaster | 279 | MAS = | Mansfield | 257 | SHE = | Sheffield | 575 | YOR = | York | 191 |
| GLA = | Glasgow | 1381 | | | | | | | | | |

**Figure 3.3 Bar charts showing six median element concentrations in top soil in Glasgow versus 20 other UK urban centres.**

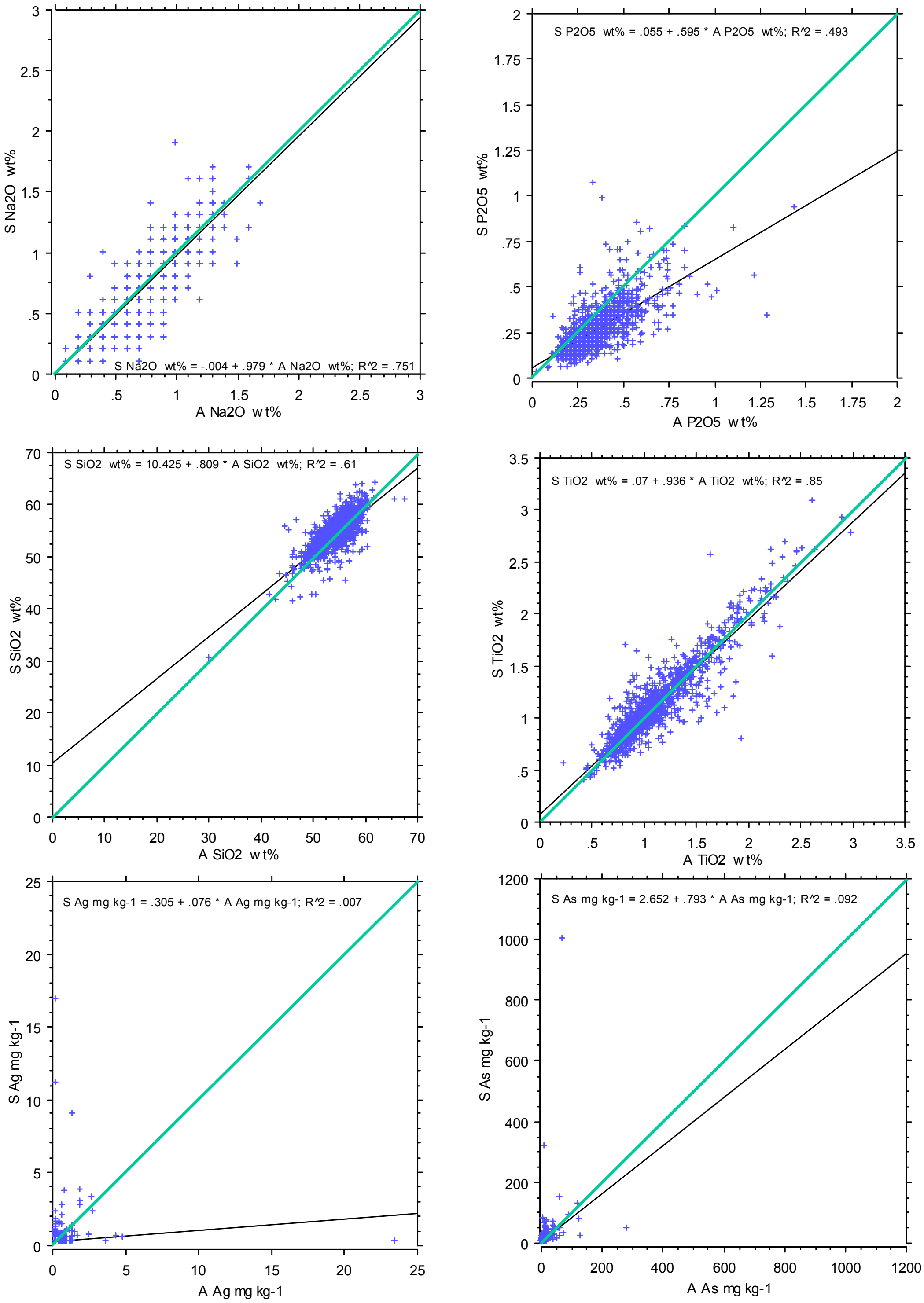


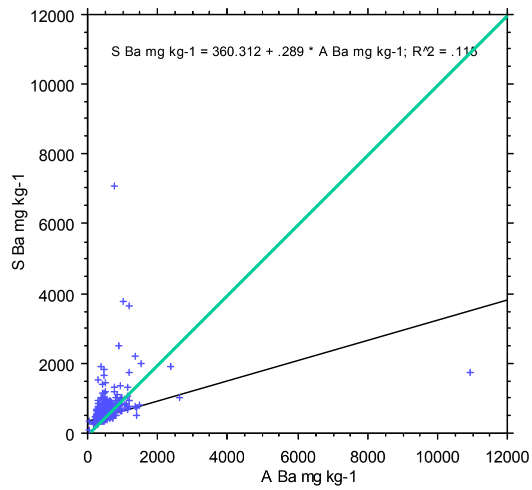

A = top soils S = deeper soils n = 1368

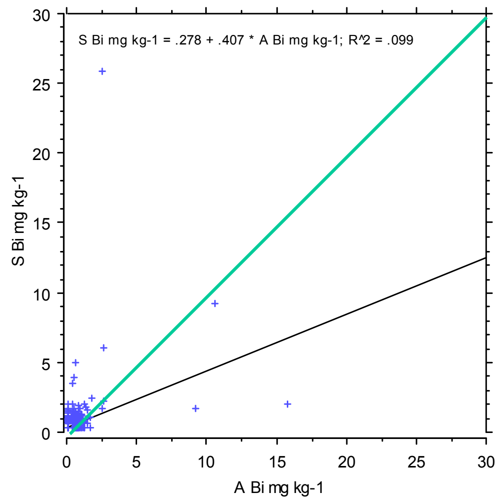
Regression lines are plotted for data exploratory analysis only and do not necessarily imply a significant relationship

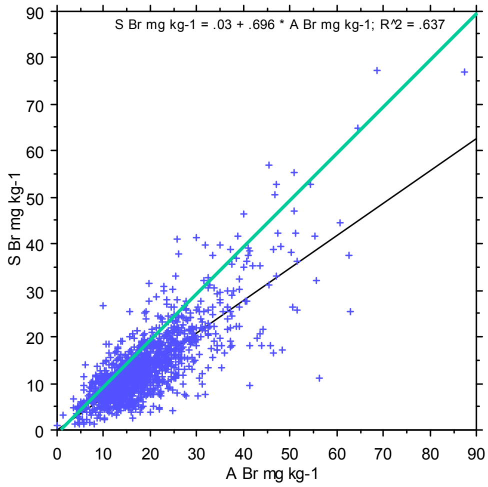
Theoretical 1:1 relationship

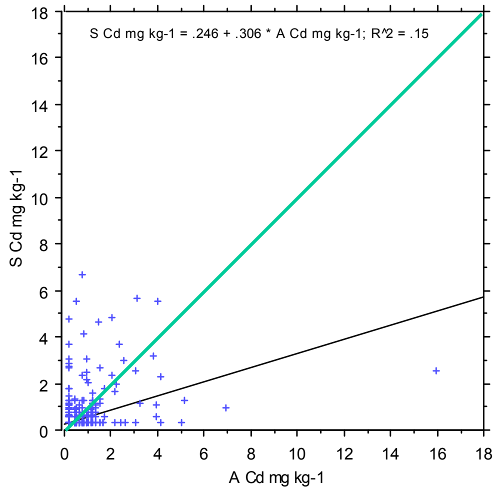
**Figure 3.4 Regression plots of parameter concentrations in top versus deeper Glasgow urban soils**

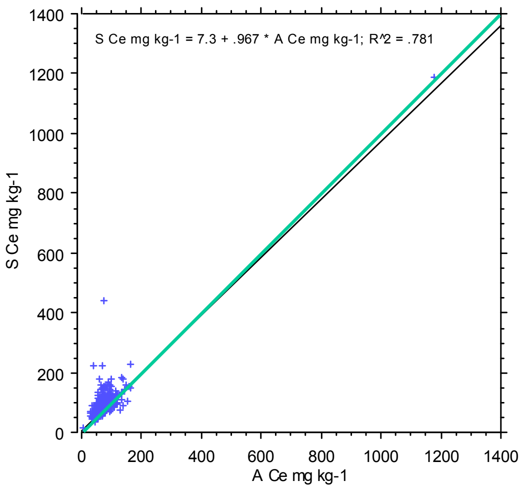

S Na2O wt% = -.004 + .979 * A Na2O wt%; R^2 = .751
S Na2O wt%
A Na2O wt%
S P2O5 wt% = .055 + .595 * A P2O5 wt%; R^2 = .493
S P2O5 wt%
A P2O5 wt%
S SiO2 wt% = 10.425 + .809 * A SiO2 wt%; R^2 = .61
S SiO2 wt%
A SiO2 wt%
S TiO2 wt% = .07 + .936 * A TiO2 wt%; R^2 = .85
S TiO2 wt%
A TiO2 wt%
S Ag mg kg-1 = .305 + .076 * A Ag mg kg-1; R^2 = .007
S Ag mg kg-1
A Ag mg kg-1
S As mg kg-1 = 2.652 + .793 * A As mg kg-1; R^2 = .092
S As mg kg-1
A As mg kg-1

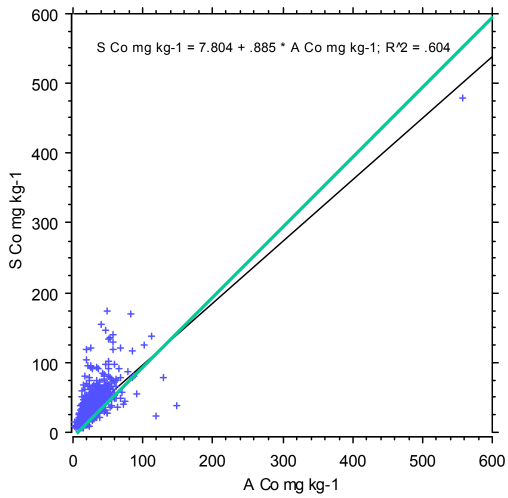

S Ba mg kg-1 = 360.312 + .289 * A Ba mg kg-1; R^2 = .115
S Ba mg kg-1
A Ba mg kg-1

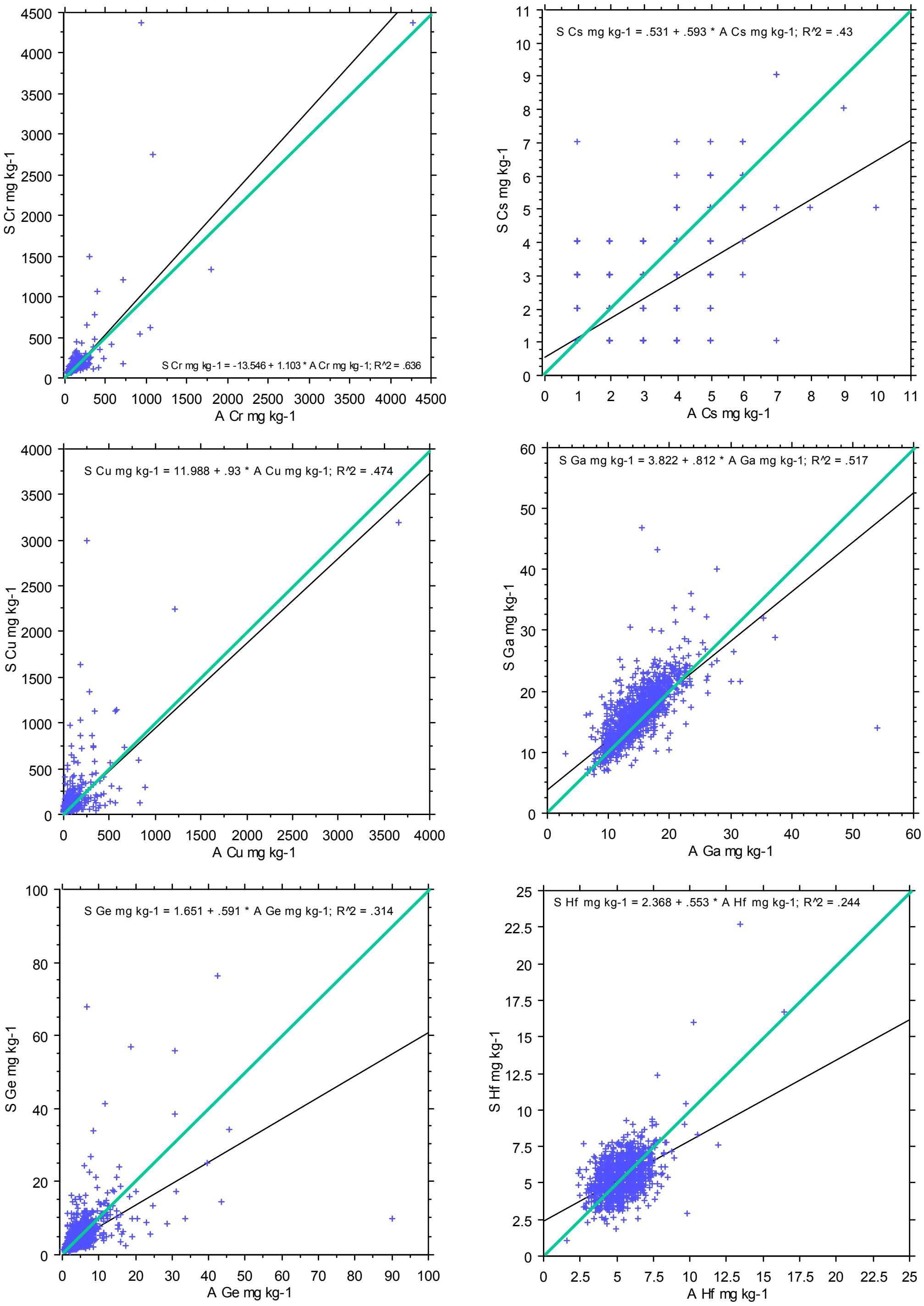

S Bi mg kg-1 = .278 + .407 * A Bi mg kg-1; R^2 = .099
S Bi mg kg-1
A Bi mg kg-1


S Br mg kg-1 = .03 + .696 * A Br mg kg-1; R^2 = .637
S Br mg kg-1
A Br mg kg-1

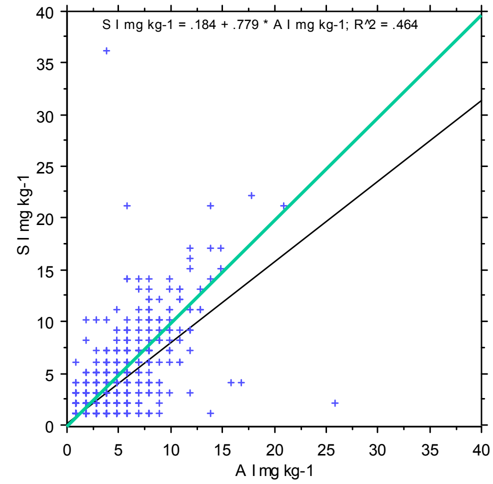

S Cd mg kg-1 = .246 + .306 * A Cd mg kg-1; R^2 = .15
S Cd mg kg-1
A Cd mg kg-1

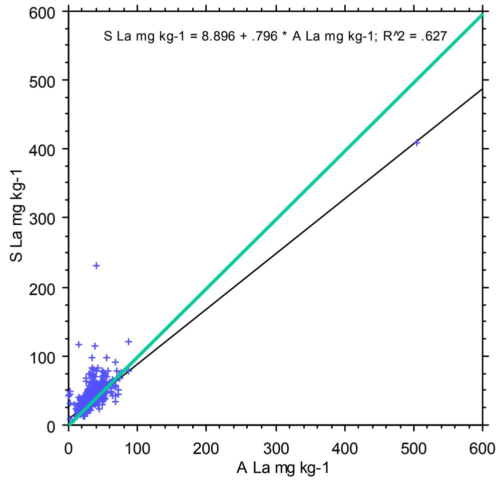

S Ce mg kg-1 = 7.3 + .967 * A Ce mg kg-1; R^2 = .781
S Ce mg kg-1
A Ce mg kg-1

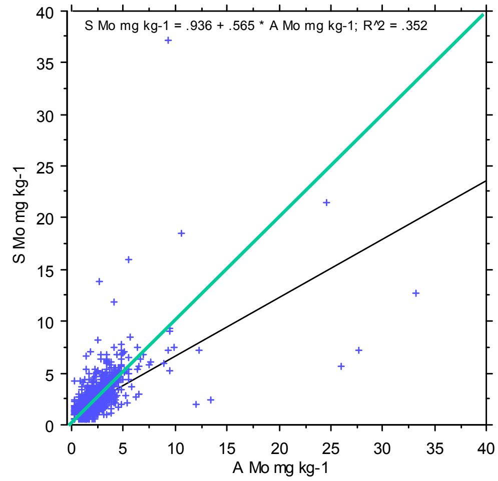

S Co mg kg-1 = 7.804 + .885 * A Co mg kg-1; R^2 = .604
S Co mg kg-1
A Co mg kg-1

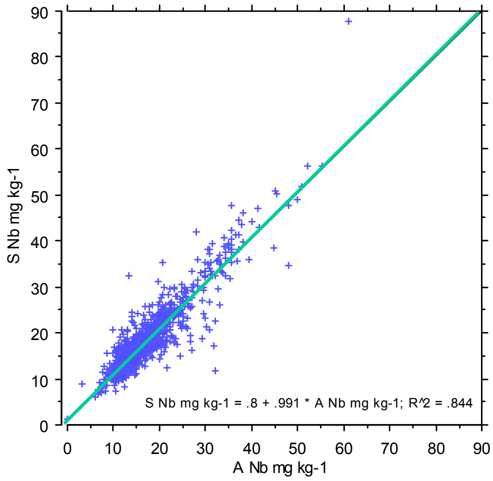


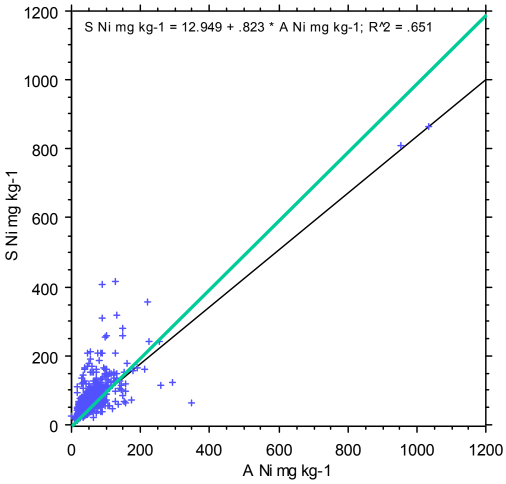
S Cr mg kg-1 = -13.546 + 1.103 * A Cr mg kg-1; R^2 = .636
S Cr mg kg-1
A Cr mg kg-1
S Cs mg kg-1 = .531 + .593 * A Cs mg kg-1; R^2 = .43
S Cs mg kg-1
A Cs mg kg-1
S Cu mg kg-1 = 11.988 + .93 * A Cu mg kg-1; R^2 = .474
S Cu mg kg-1
A Cu mg kg-1
S Ga mg kg-1 = 3.822 + .812 * A Ga mg kg-1; R^2 = .517
S Ga mg kg-1
A Ga mg kg-1
S Ge mg kg-1 = 1.651 + .591 * A Ge mg kg-1; R^2 = .314
S Ge mg kg-1
A Ge mg kg-1
S Hf mg kg-1 = 2.368 + .553 * A Hf mg kg-1; R^2 = .244
S Hf mg kg-1
A Hf mg kg-1

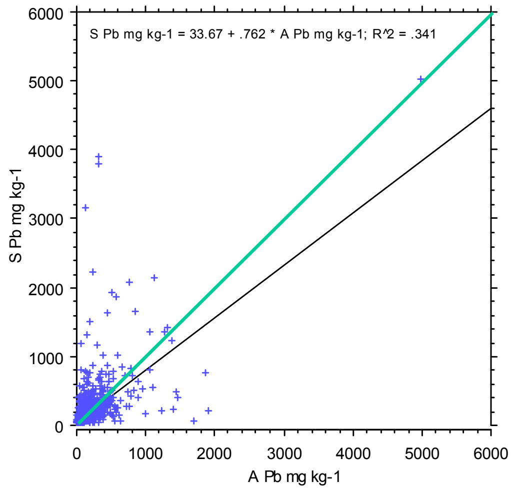

S I mg kg-1 = .184 + .779 * A I mg kg-1; R^2 = .464
S I mg kg-1
A I mg kg-1

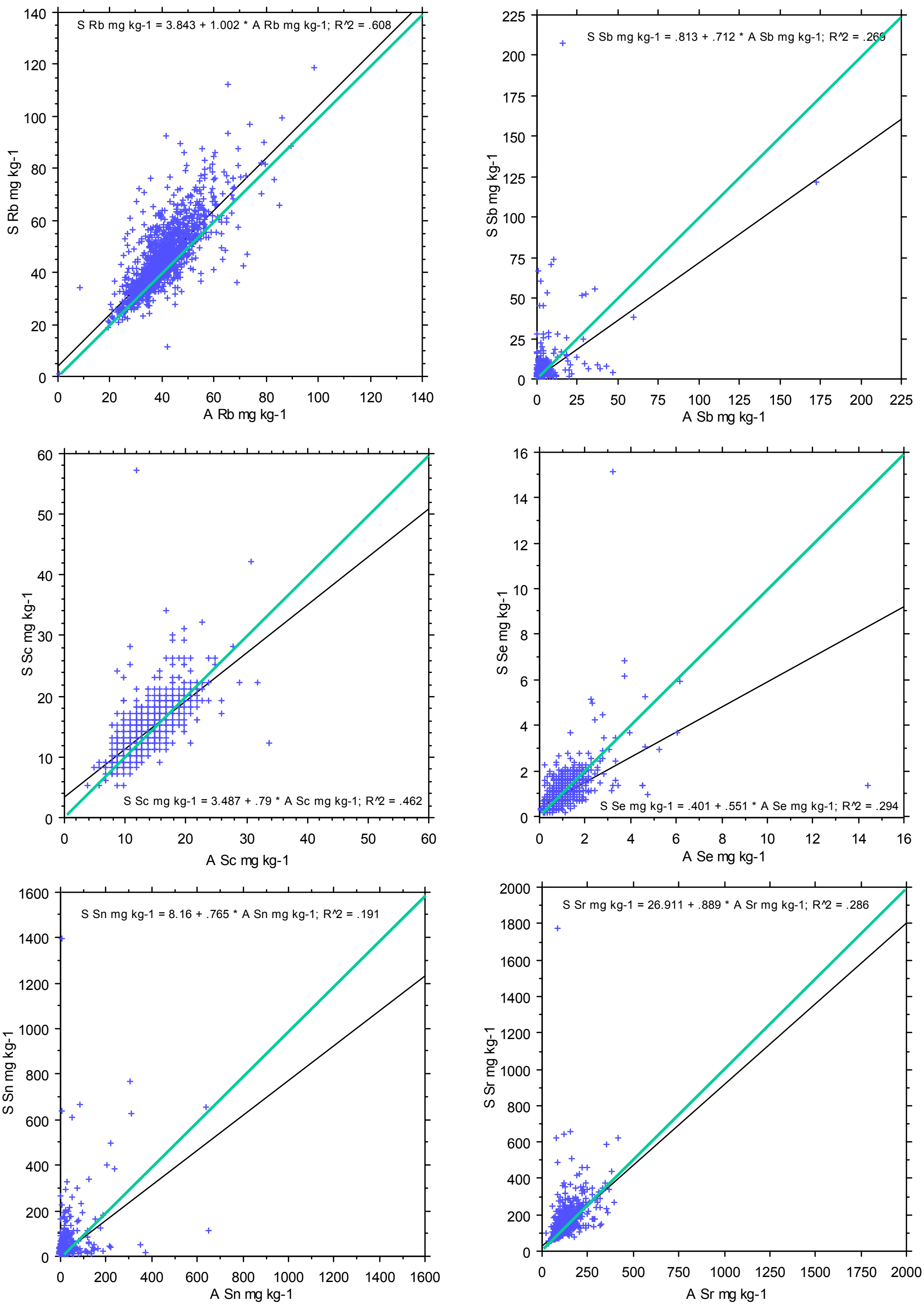

S La mg kg-1 = 8.896 + .796 * A La mg kg-1; R^2 = .627
S La mg kg-1
A La mg kg-1

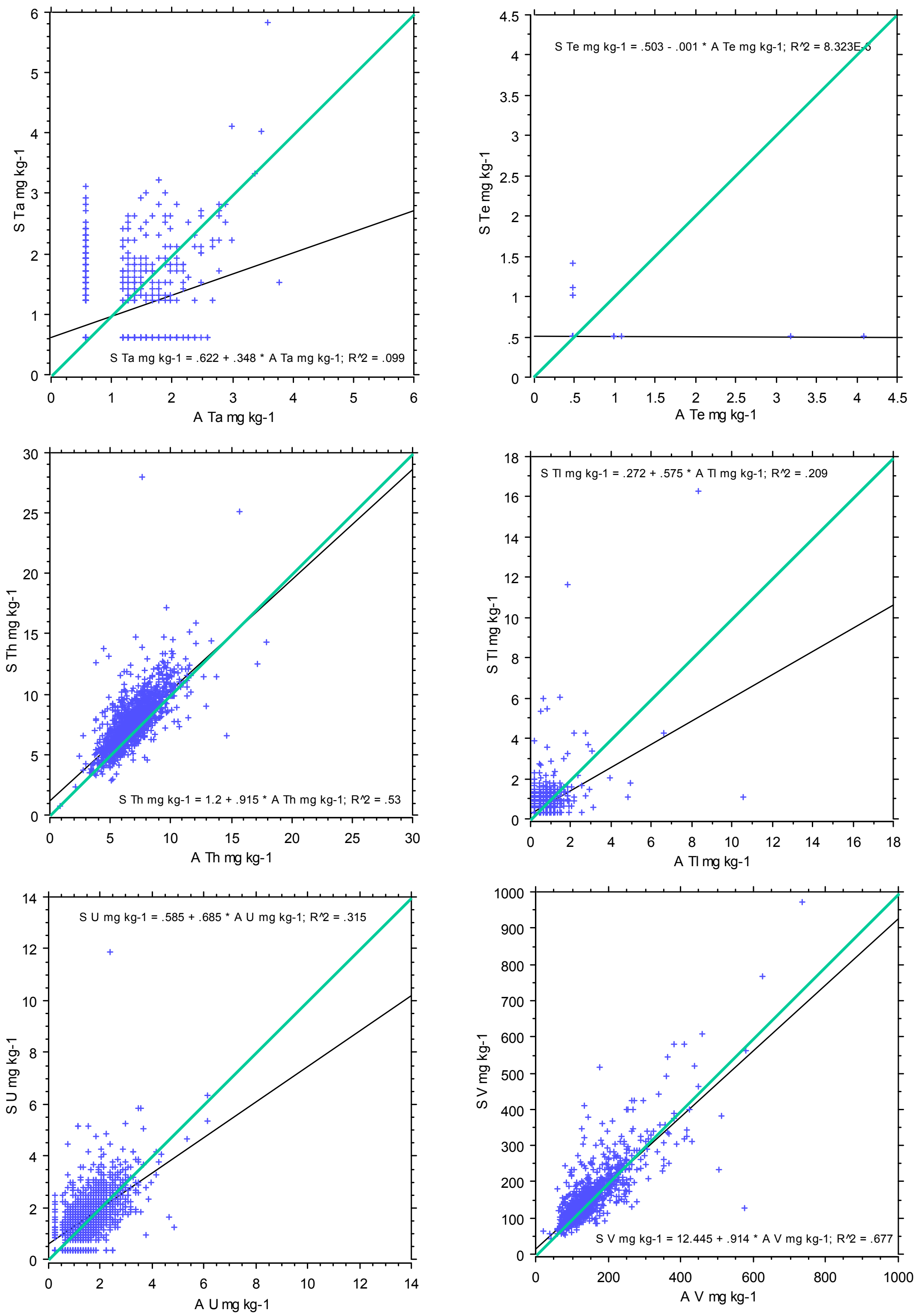

S Mo mg kg-1 = .936 + .565 * A Mo mg kg-1; R^2 = .352
S Mo mg kg-1
A Mo mg kg-1

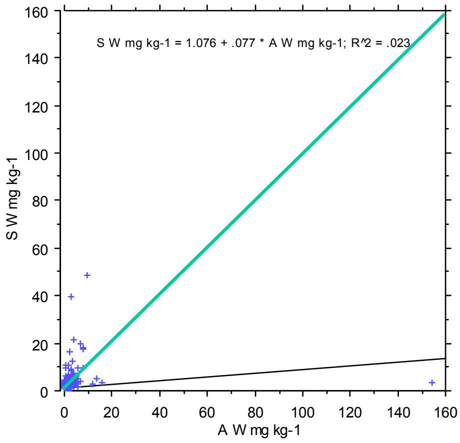

S Nb mg kg-1 = .8 + .991 * A Nb mg kg-1; R^2 = .844
S Nb mg kg-1
A Nb mg kg-1

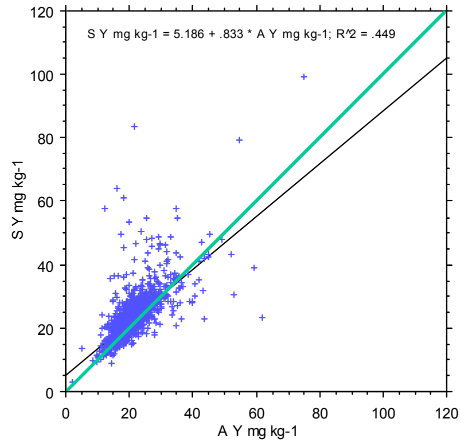

S Ni mg kg-1 = 12.949 + .823 * A Ni mg kg-1; R^2 = .651
S Ni mg kg-1
A Ni mg kg-1

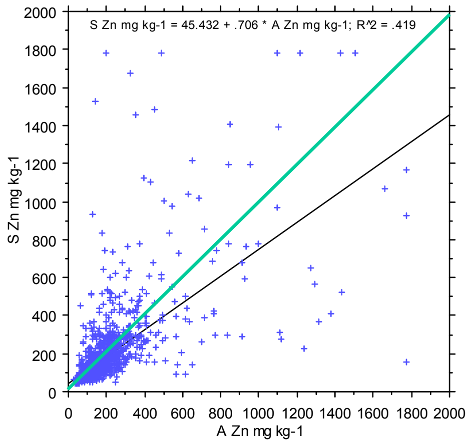

S Pb mg kg-1 = 33.67 + .762 * A Pb mg kg-1; R^2 = .341
S Pb mg kg-1
A Pb mg kg-1

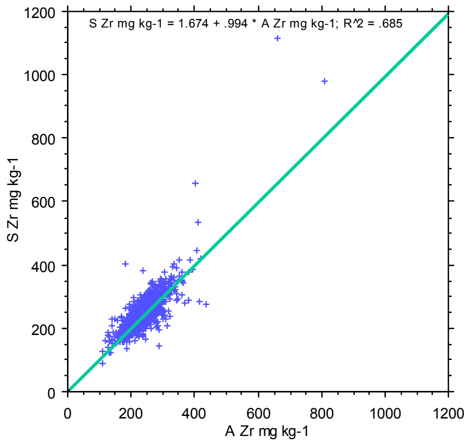

S Rb mg kg-1 = 3.843 + 1.002 * A Rb mg kg-1; R^2 = .608
S Rb mg kg-1
A Rb mg kg-1
S Sb mg kg-1 = .813 + .712 * A Sb mg kg-1; R^2 = .269
S Sb mg kg-1
A Sb mg kg-1
S Sc mg kg-1 = 3.487 + .79 * A Sc mg kg-1; R^2 = .462
S Sc mg kg-1
A Sc mg kg-1
S Se mg kg-1 = .401 + .551 * A Se mg kg-1; R^2 = .294
S Se mg kg-1
A Se mg kg-1
S Sn mg kg-1 = 8.16 + .765 * A Sn mg kg-1; R^2 = .191
S Sn mg kg-1
A Sn mg kg-1
S Sr mg kg-1 = 26.911 + .889 * A Sr mg kg-1; R^2 = .286
S Sr mg kg-1
A Sr mg kg-1

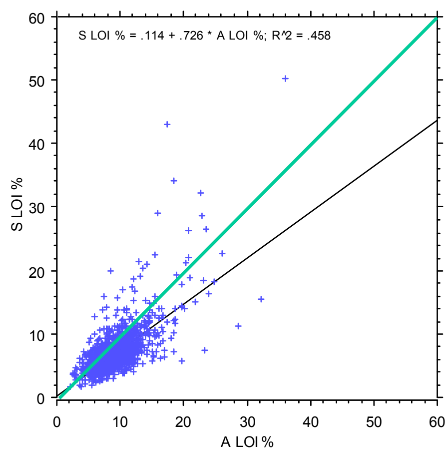

S Ta mg kg-1 = .622 + .348 * A Ta mg kg-1; R^2 = .099
A Ta mg kg-1
S Ta mg kg-1
S Te mg kg-1 = .503 - .001 * A Te mg kg-1; R^2 = 8.323E-6
A Te mg kg-1
S Te mg kg-1
S Th mg kg-1 = 1.2 + .915 * A Th mg kg-1; R^2 = .53
A Th mg kg-1
S Th mg kg-1
S Tl mg kg-1 = .272 + .575 * A Tl mg kg-1; R^2 = .209
A Tl mg kg-1
S Tl mg kg-1
S U mg kg-1 = .585 + .685 * A U mg kg-1; R^2 = .315
A U mg kg-1
S U mg kg-1
S V mg kg-1 = 12.445 + .914 * A V mg kg-1; R^2 = .677
A V mg kg-1
S V mg kg-1

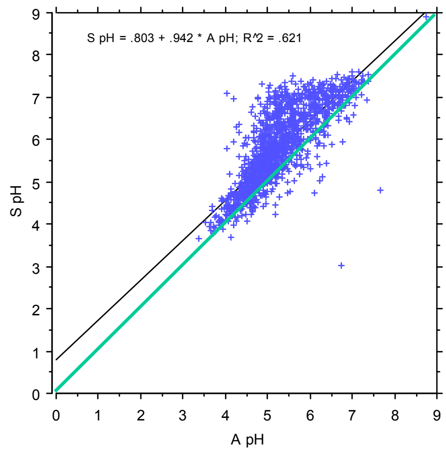

S W mg kg-1 = 1.076 + .077 * A W mg kg-1; R^2 = .023
S W mg kg-1
A W mg kg-1

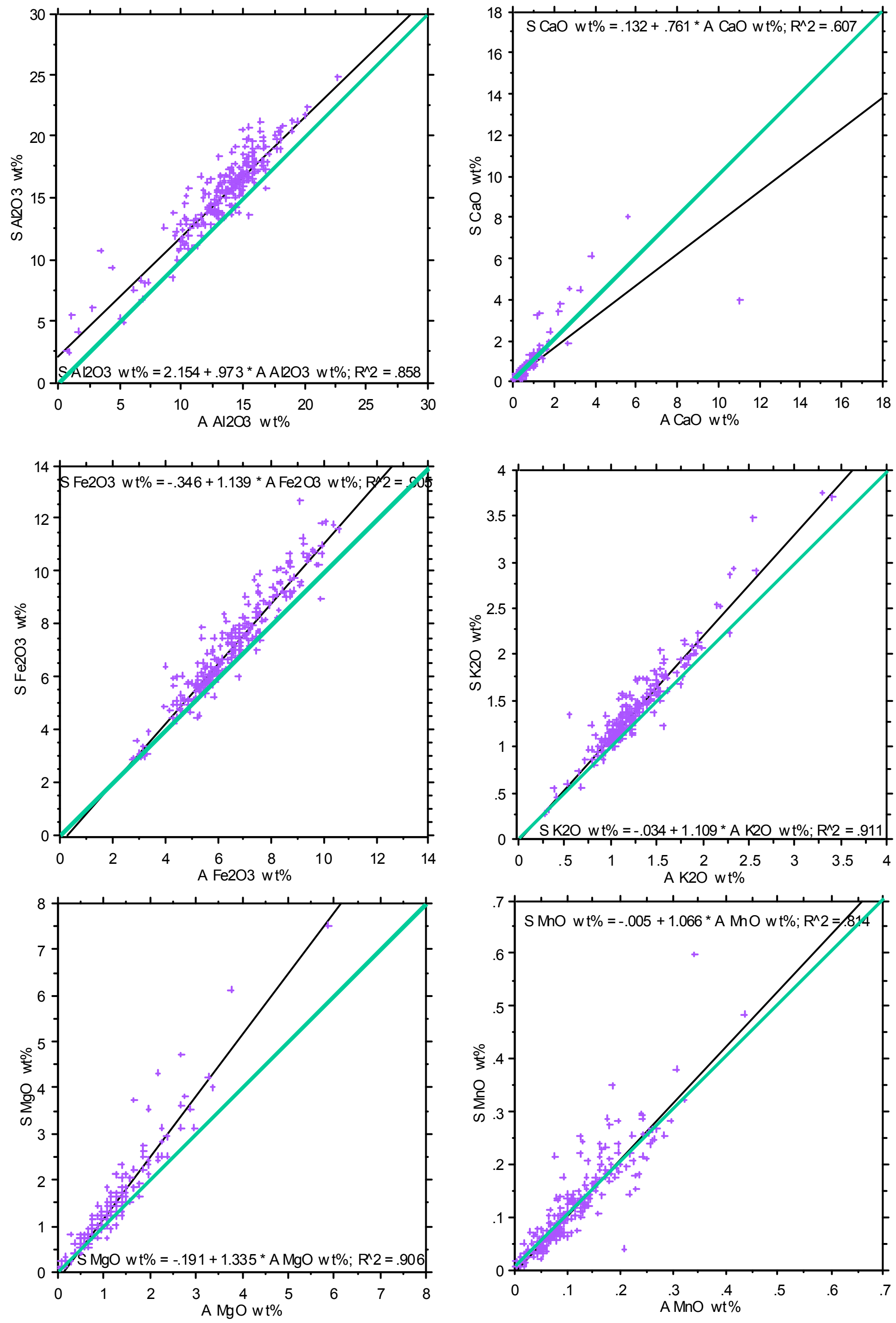

S Y mg kg-1 = 5.186 + .833 * A Y mg kg-1; R^2 = .449
S Y mg kg-1
A Y mg kg-1


S Zn mg kg-1 = 45.432 + .706 * A Zn mg kg-1; R^2 = .419
S Zn mg kg-1
A Zn mg kg-1


S Zr mg kg-1 = 1.674 + .994 * A Zr mg kg-1; R^2 = .685
S Zr mg kg-1
A Zr mg kg-1


S LOI % = .114 + .726 * A LOI %; R^2 = .458
S LOI %
A LOI %


S pH = .803 + .942 * A pH; R^2 = .621
S pH
A pH

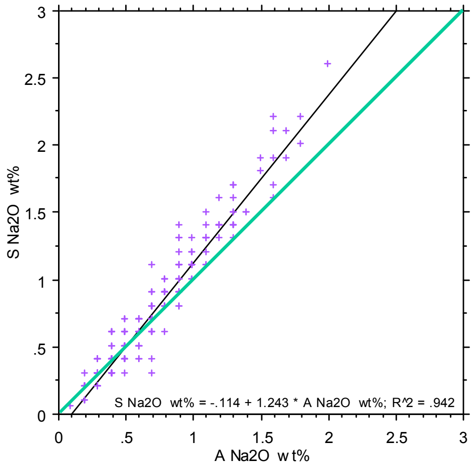


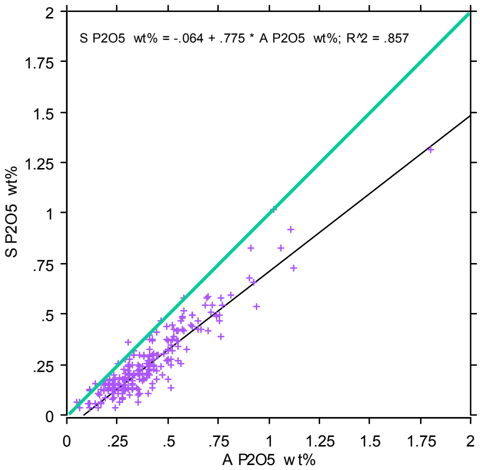

A = top soils S = deeper soils n = 241

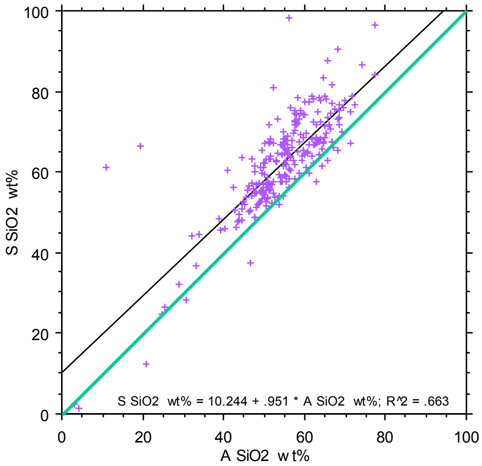
Regression lines are plotted for data exploratory analysis only and do not necessarily imply a significant relationship

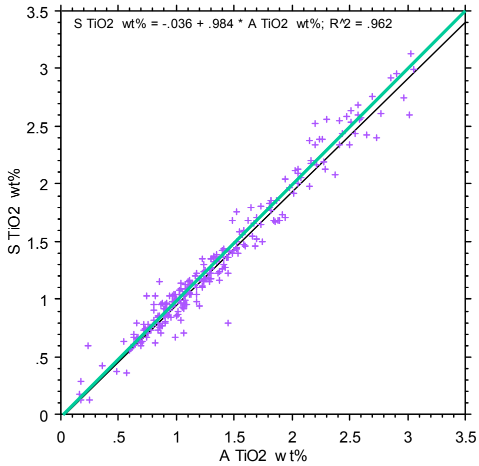
Theoretical 1:1 relationship

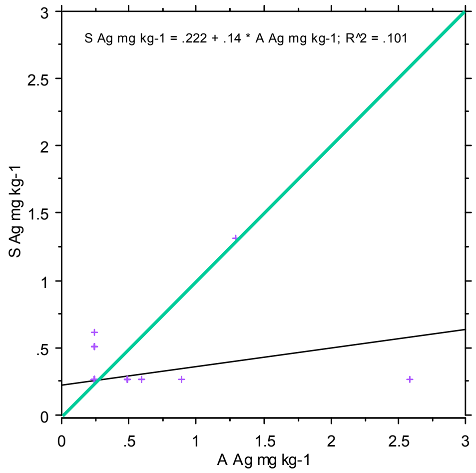
**Figure 3.5 Regression plots of parameter concentrations in top versus deeper Glasgow rural soils**

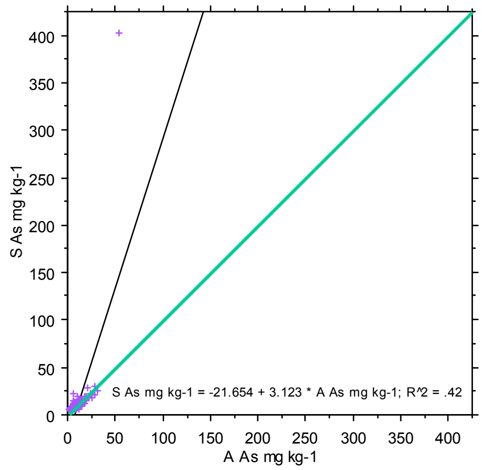

S Na2O wt% = -.114 + 1.243 * A Na2O wt%; R^2 = .942
S Na2O wt%
A Na2O wt%

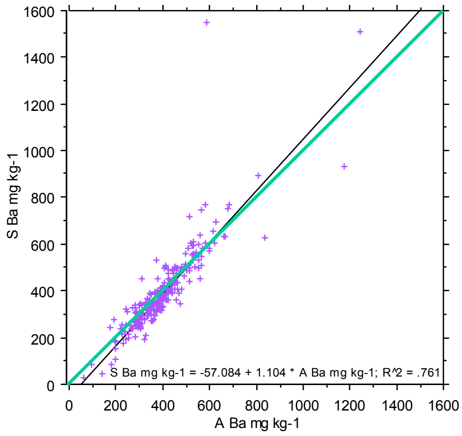

S P2O5 wt% = -.064 + .775 * A P2O5 wt%; R^2 = .857
S P2O5 wt%
A P2O5 wt%

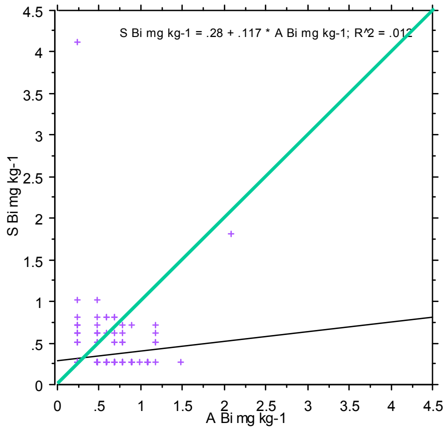

S SiO2 wt% = 10.244 + .951 * A SiO2 wt%; R^2 = .663
S SiO2 wt%
A SiO2 wt%

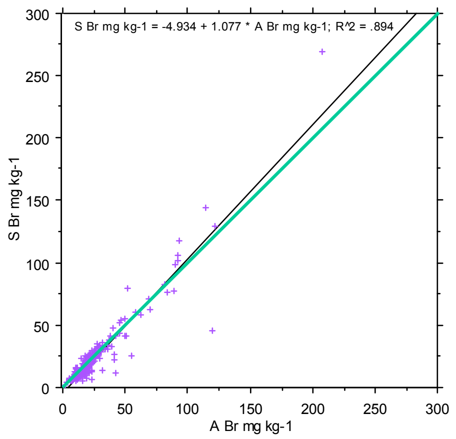

S TiO2 wt% = -.036 + .984 * A TiO2 wt%; R^2 = .962
S TiO2 wt%
A TiO2 wt%

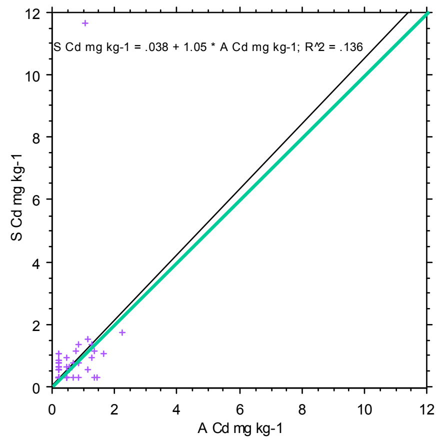

S Ag mg kg-1 = .222 + .14 * A Ag mg kg-1; R^2 = .101
S Ag mg kg-1
A Ag mg kg-1

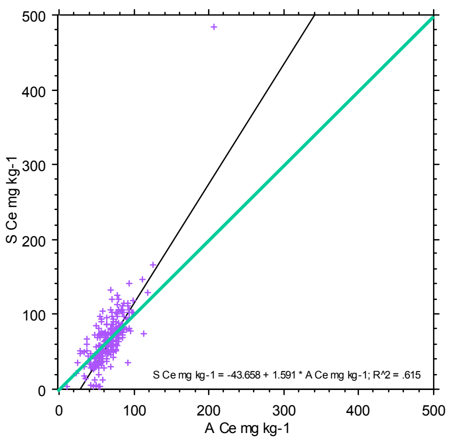

S As mg kg-1 = -21.654 + 3.123 * A As mg kg-1; R^2 = .42
S As mg kg-1
A As mg kg-1

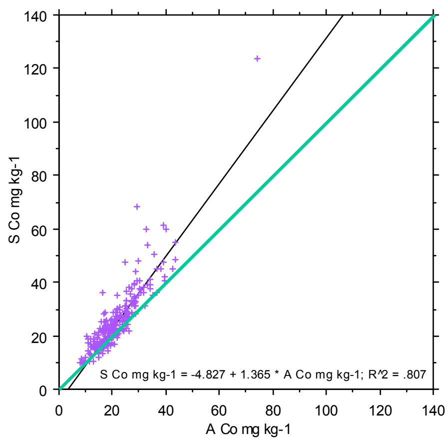

S Ba mg kg-1 = -57.084 + 1.104 * A Ba mg kg-1; R^2 = .761
S Ba mg kg-1
A Ba mg kg-1

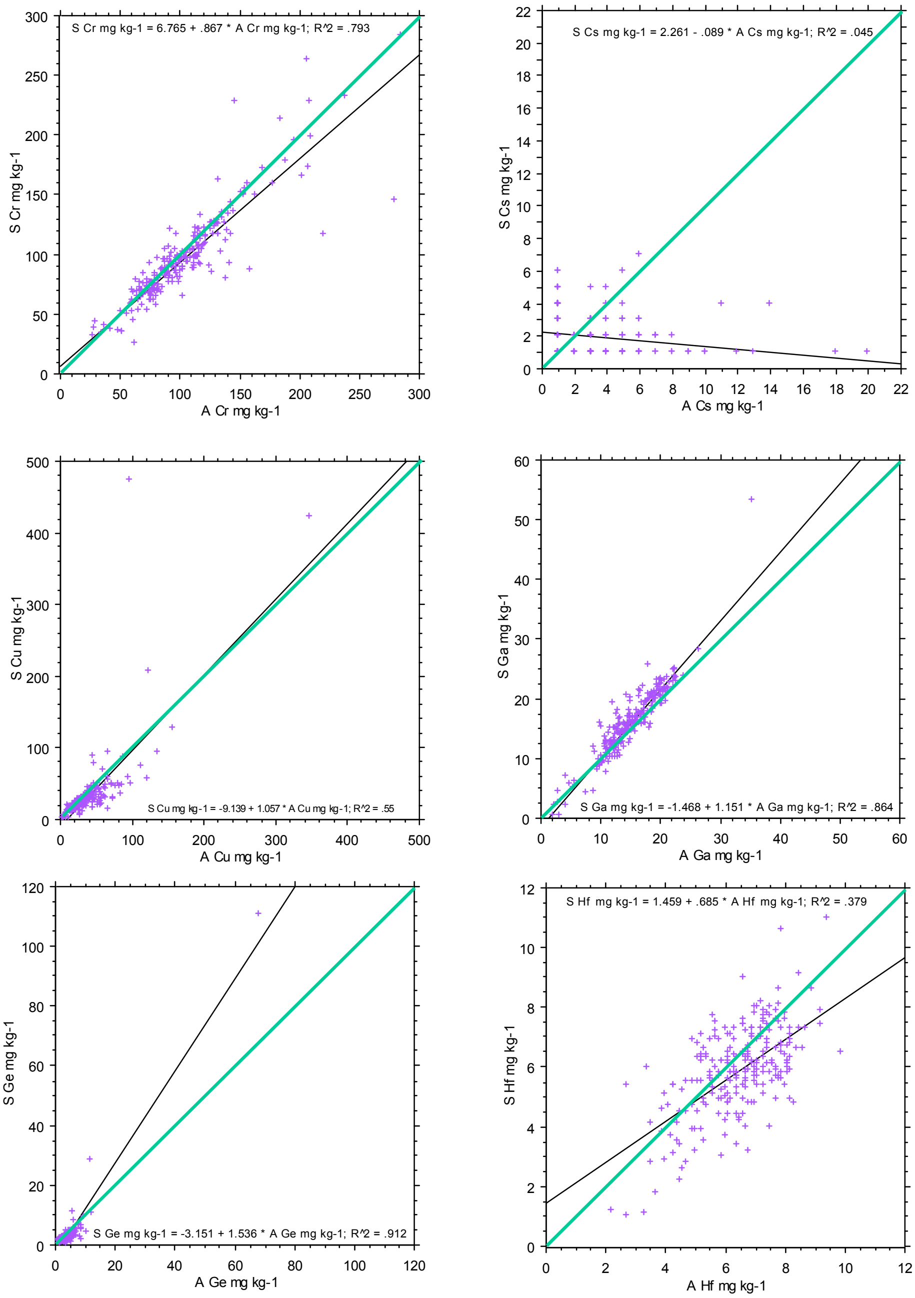

S Bi mg kg-1 = .28 + .117 * A Bi mg kg-1; R^2 = .012
S Bi mg kg-1
A Bi mg kg-1

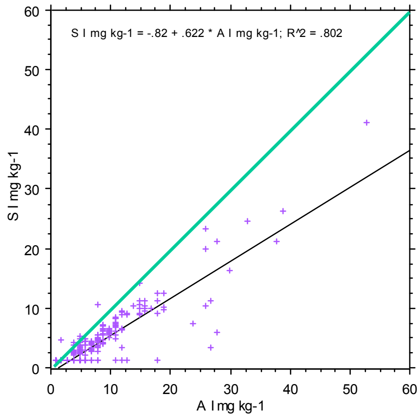

S Br mg kg-1 = -4.934 + 1.077 * A Br mg kg-1; R^2 = .894
S Br mg kg-1
A Br mg kg-1

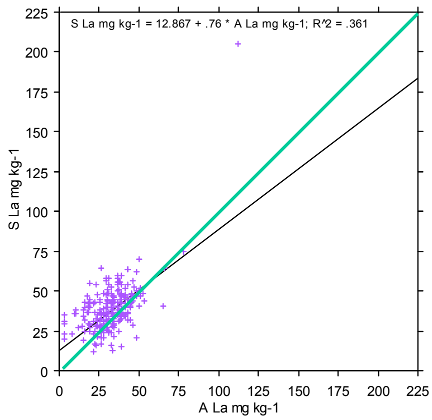

S Cd mg kg-1 = .038 + 1.05 * A Cd mg kg-1; R^2 = .136
S Cd mg kg-1
A Cd mg kg-1

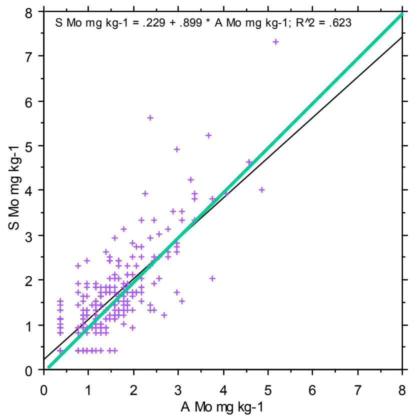

S Ce mg kg-1 = -43.658 + 1.591 * A Ce mg kg-1; R^2 = .615
S Ce mg kg-1
A Ce mg kg-1

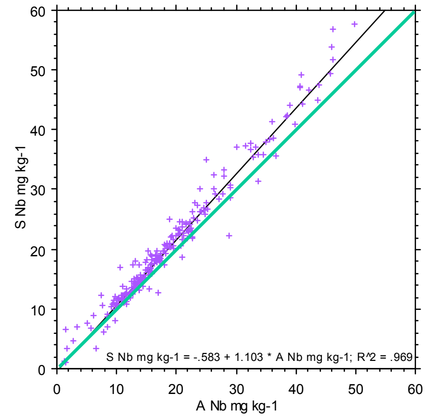

S Co mg kg-1 = -4.827 + 1.365 * A Co mg kg-1; R^2 = .807
S Co mg kg-1
A Co mg kg-1

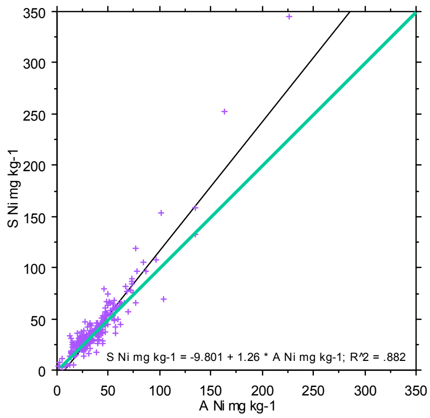

S Cr mg kg-1 = 6.765 + .867 * A Cr mg kg-1; R^2 = .793
S Cr mg kg-1
A Cr mg kg-1
S Cs mg kg-1 = 2.261 - .089 * A Cs mg kg-1; R^2 = .045
S Cs mg kg-1
A Cs mg kg-1
S Cu mg kg-1 = -9.139 + 1.057 * A Cu mg kg-1; R^2 = .55
S Cu mg kg-1
A Cu mg kg-1
S Ga mg kg-1 = -1.468 + 1.151 * A Ga mg kg-1; R^2 = .864
S Ga mg kg-1
A Ga mg kg-1
S Ge mg kg-1 = -3.151 + 1.536 * A Ge mg kg-1; R^2 = .912
S Ge mg kg-1
A Ge mg kg-1
S Hf mg kg-1 = 1.459 + .685 * A Hf mg kg-1; R^2 = .379
S Hf mg kg-1
A Hf mg kg-1

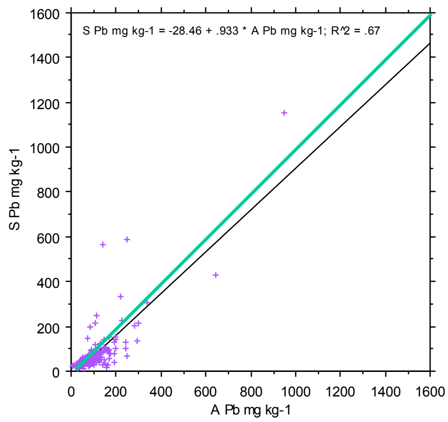

S I mg kg-1 = -.82 + .622 * A I mg kg-1; R^2 = .802
S I mg kg-1
A I mg kg-1

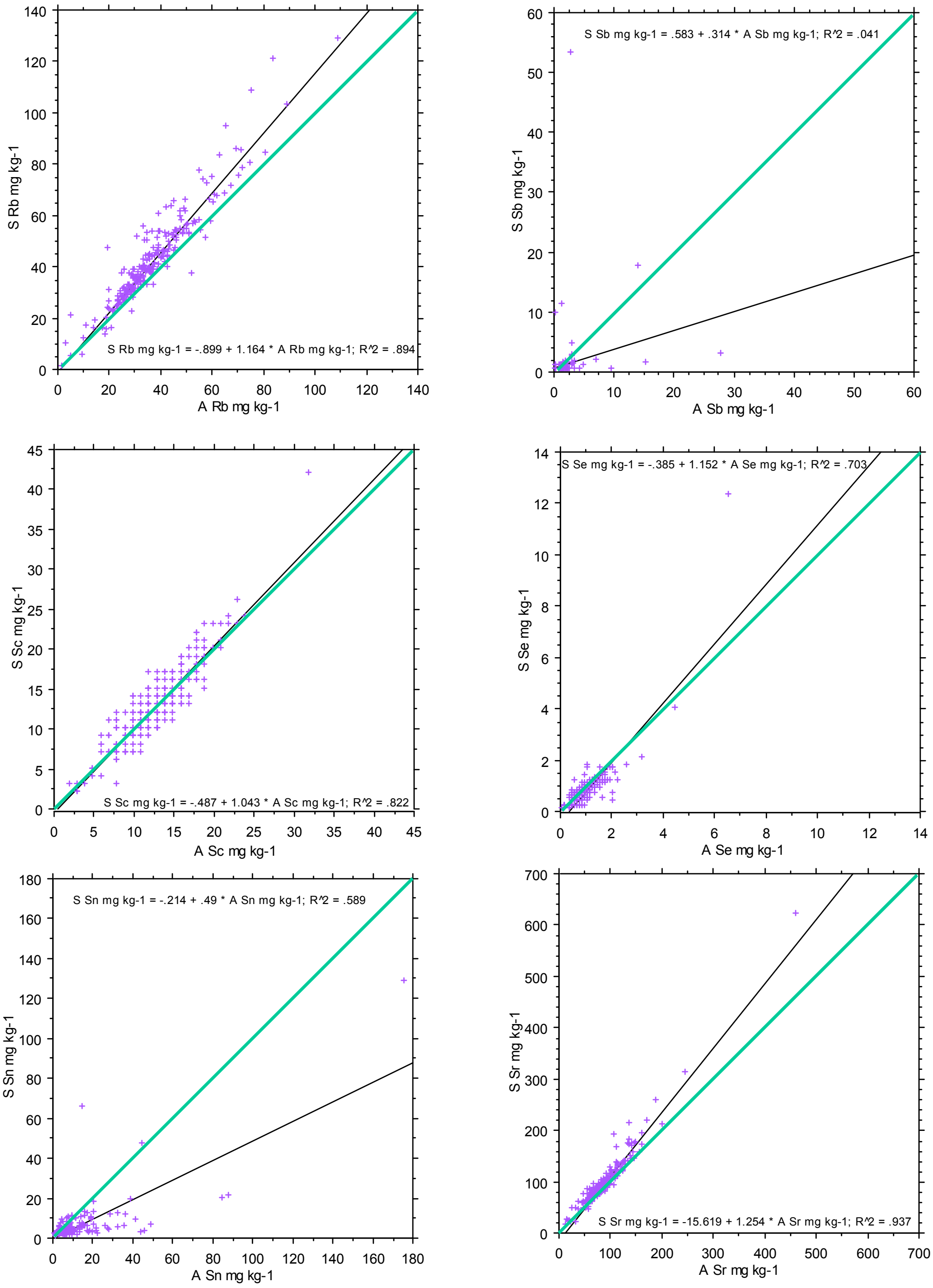

S La mg kg-1 = 12.867 + .76 * A La mg kg-1; R^2 = .361
S La mg kg-1
A La mg kg-1

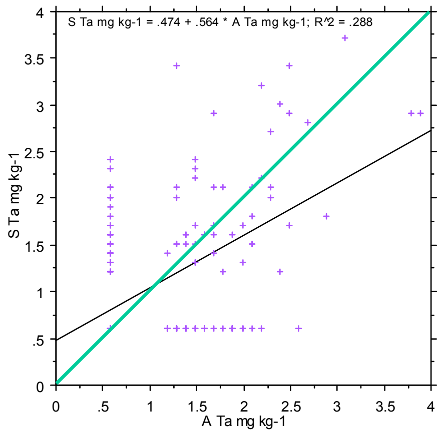

S Mo mg kg-1 = .229 + .899 * A Mo mg kg-1; R^2 = .623
S Mo mg kg-1
A Mo mg kg-1

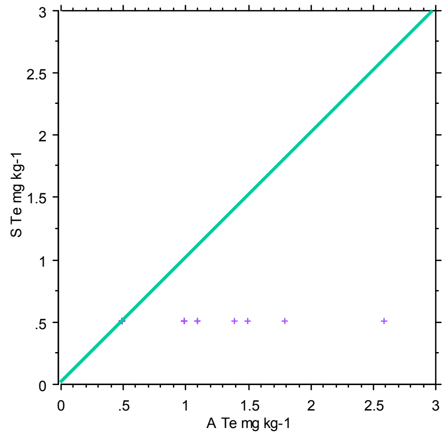

S Nb mg kg-1 = -.583 + 1.103 * A Nb mg kg-1; R^2 = .969
S Nb mg kg-1
A Nb mg kg-1

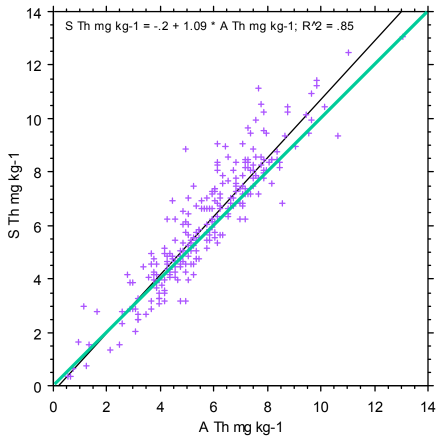

S Ni mg kg-1 = -9.801 + 1.26 * A Ni mg kg-1; R^2 = .882
S Ni mg kg-1
A Ni mg kg-1

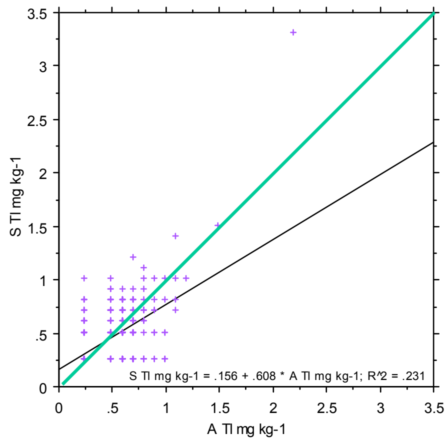

S Pb mg kg-1 = -28.46 + .933 * A Pb mg kg-1; R^2 = .67
S Pb mg kg-1
A Pb mg kg-1

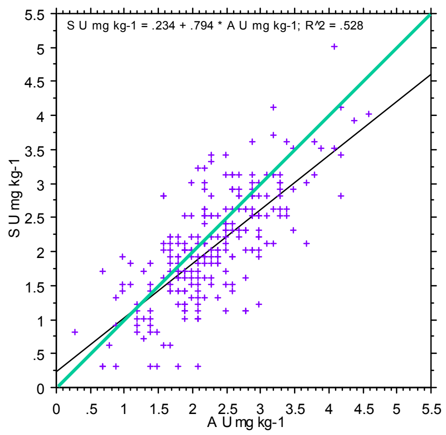

S Rb mg kg-1 = -.899 + 1.164 * A Rb mg kg-1; R^2 = .894
S Rb mg kg-1
A Rb mg kg-1
S Sb mg kg-1 = .583 + .314 * A Sb mg kg-1; R^2 = .041
S Sb mg kg-1
A Sb mg kg-1
S Sc mg kg-1 = -.487 + 1.043 * A Sc mg kg-1; R^2 = .822
S Sc mg kg-1
A Sc mg kg-1
S Se mg kg-1 = -.385 + 1.152 * A Se mg kg-1; R^2 = .703
S Se mg kg-1
A Se mg kg-1
S Sn mg kg-1 = -.214 + .49 * A Sn mg kg-1; R^2 = .589
S Sn mg kg-1
A Sn mg kg-1
S Sr mg kg-1 = -15.619 + 1.254 * A Sr mg kg-1; R^2 = .937
S Sr mg kg-1
A Sr mg kg-1

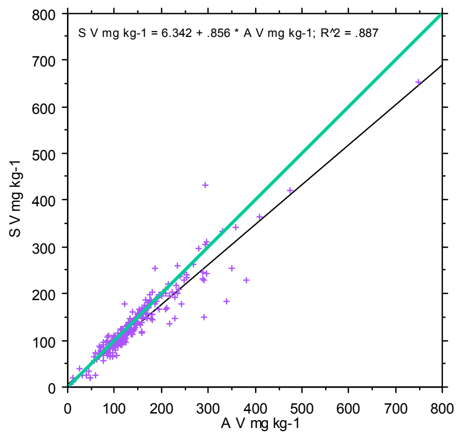

S Ta mg kg-1 = .474 + .564 * A Ta mg kg-1; R^2 = .288
S Ta mg kg-1
A Ta mg kg-1

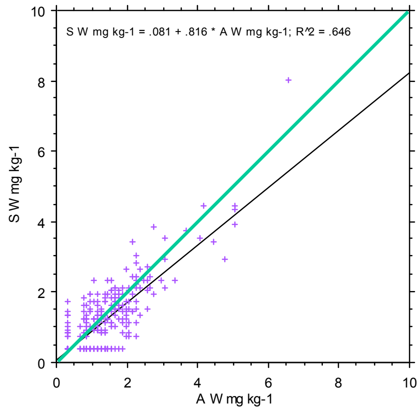

S Te mg kg-1
A Te mg kg-1

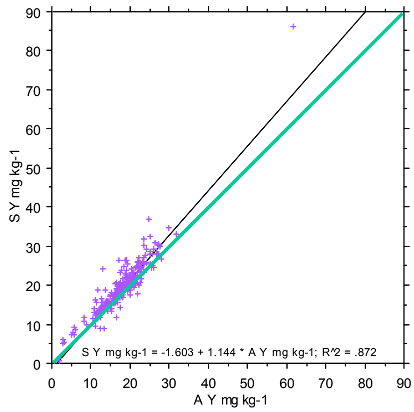

S Th mg kg-1 = -.2 + 1.09 * A Th mg kg-1; R^2 = .85
S Th mg kg-1
A Th mg kg-1

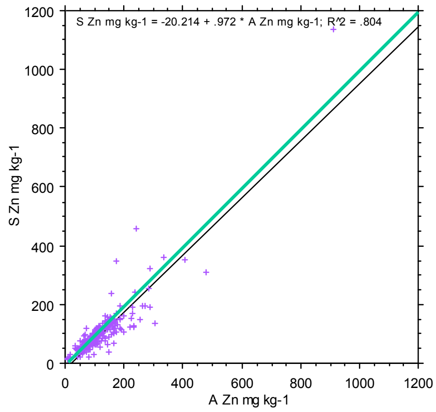

S Tl mg kg-1 = .156 + .608 * A Tl mg kg-1; R^2 = .231
S Tl mg kg-1
A Tl mg kg-1

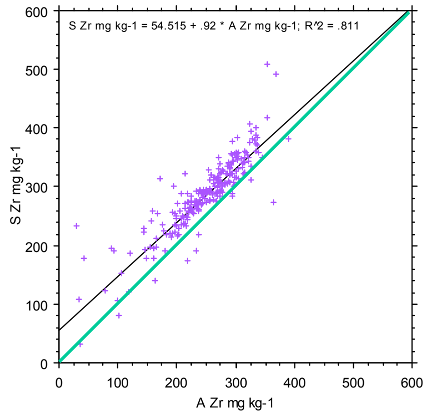

S U mg kg-1 = .234 + .794 * A U mg kg-1; R^2 = .528
S U mg kg-1
A U mg kg-1

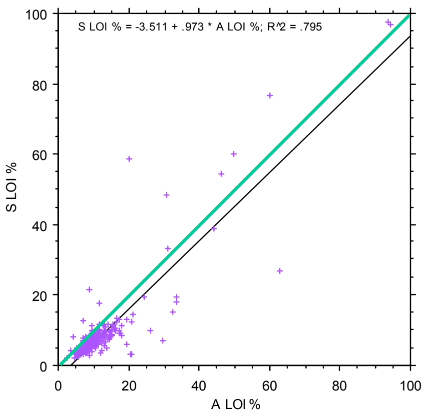

S V mg kg-1 = 6.342 + .856 * A V mg kg-1; R^2 = .887
S V mg kg-1
A V mg kg-1

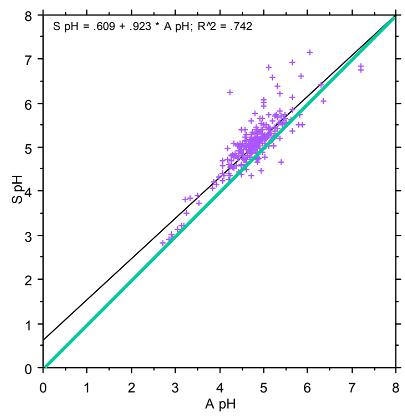

S W mg kg-1 = .081 + .816 * A W mg kg-1; R^2 = .646
S W mg kg-1
A W mg kg-1

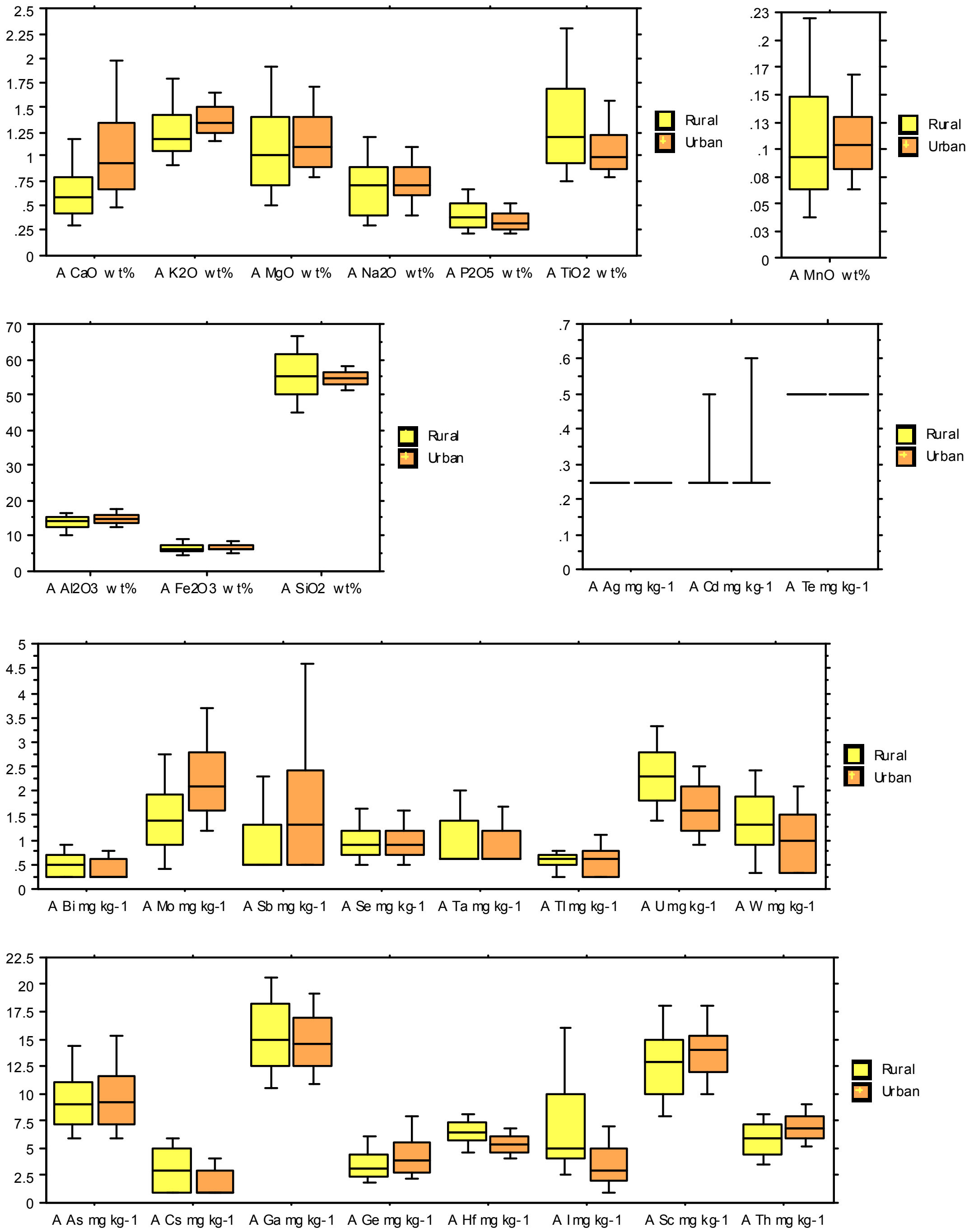

S Y mg kg-1 = -1.603 + 1.144 * A Y mg kg-1; R^2 = .872
S Y mg kg-1
A Y mg kg-1


S Zn mg kg-1 = -20.214 + .972 * A Zn mg kg-1; R^2 = .804
S Zn mg kg-1
A Zn mg kg-1


S Zr mg kg-1 = 54.515 + .92 * A Zr mg kg-1; R^2 = .811
S Zr mg kg-1
A Zr mg kg-1

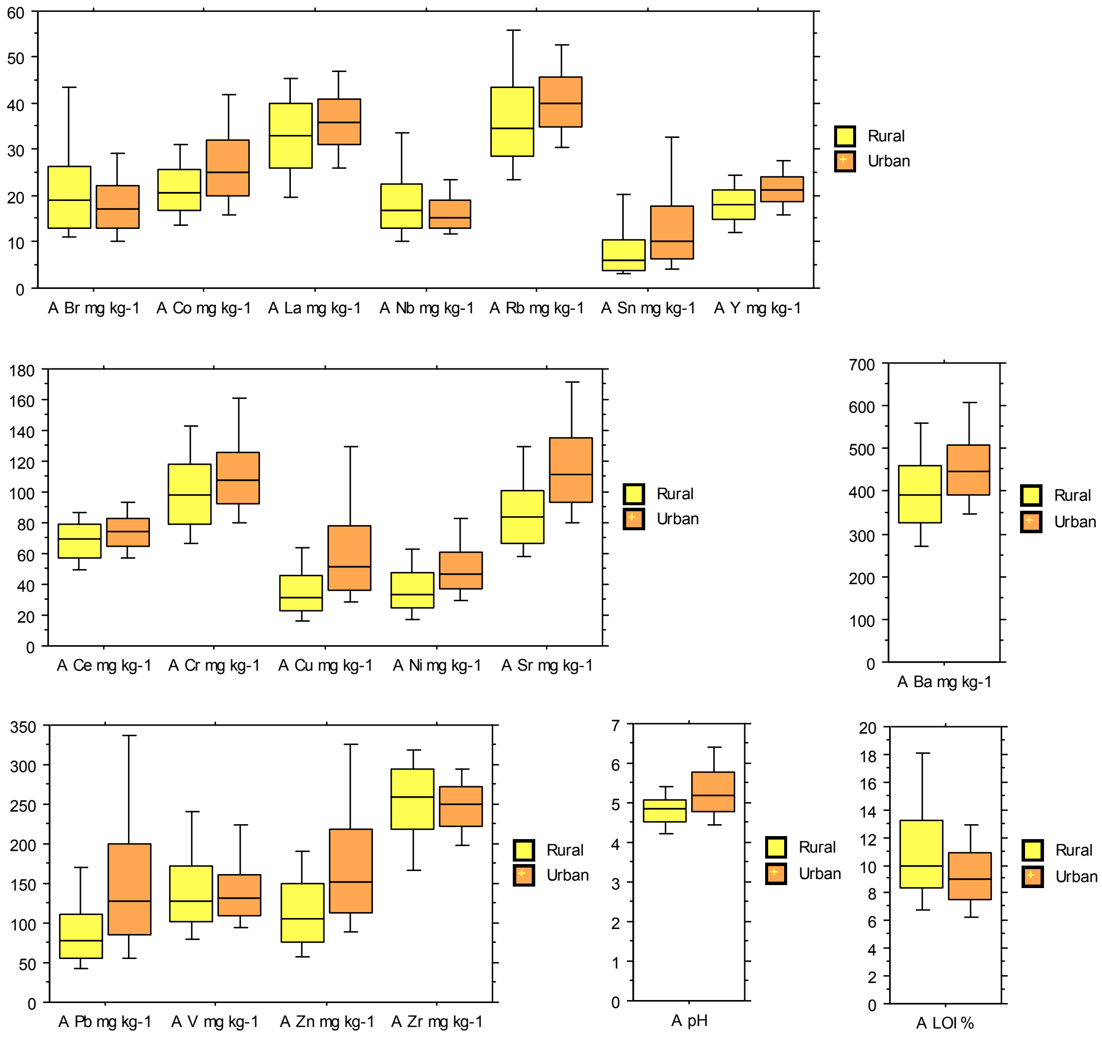

S LOI % = -3.511 + .973 * A LOI %; R^2 = .795
S LOI %
A LOI %

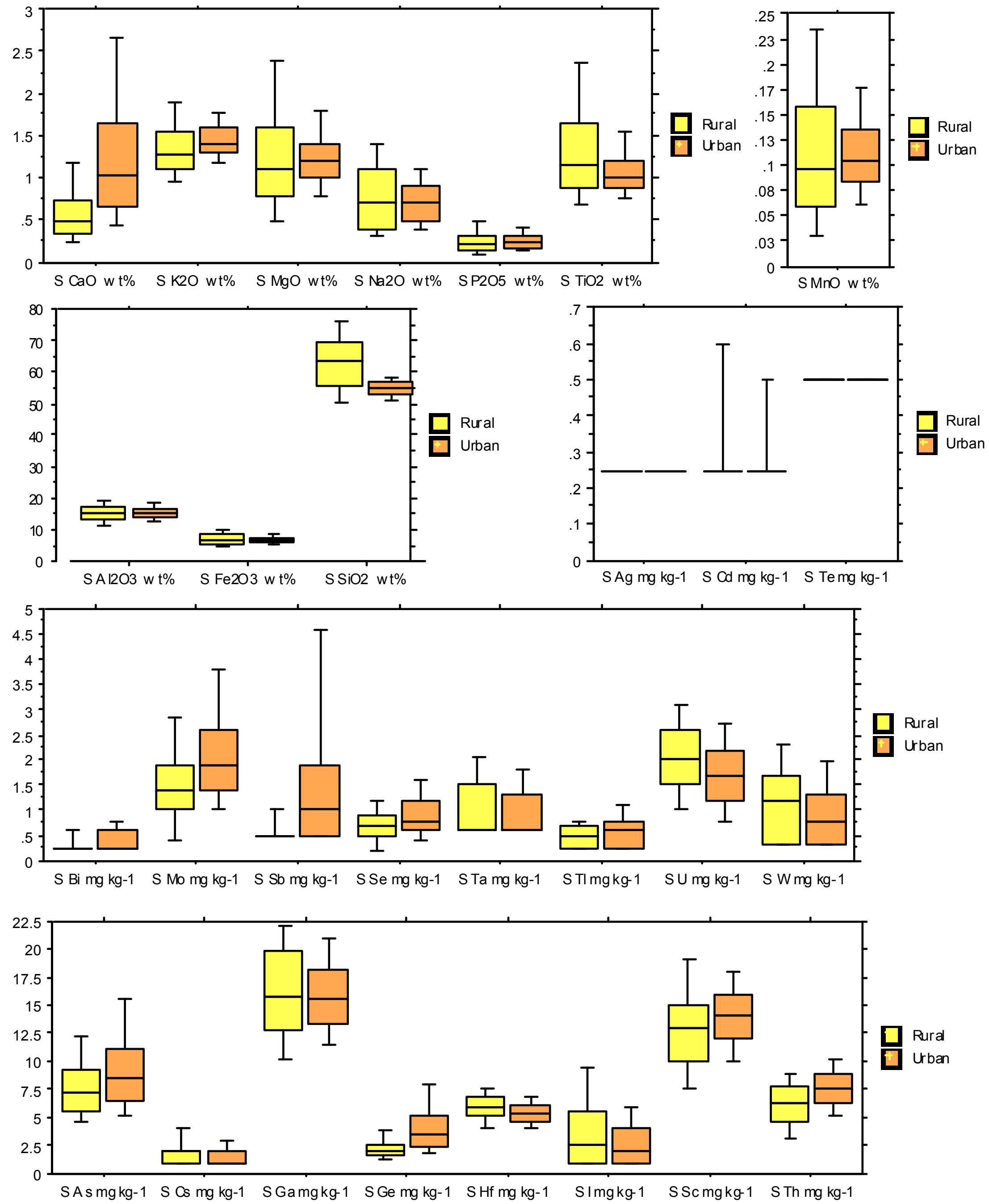

S pH = .609 + .923 * A pH; R^2 = .742
S pH
A pH




A = top soils n urban = 1368 n rural = 241

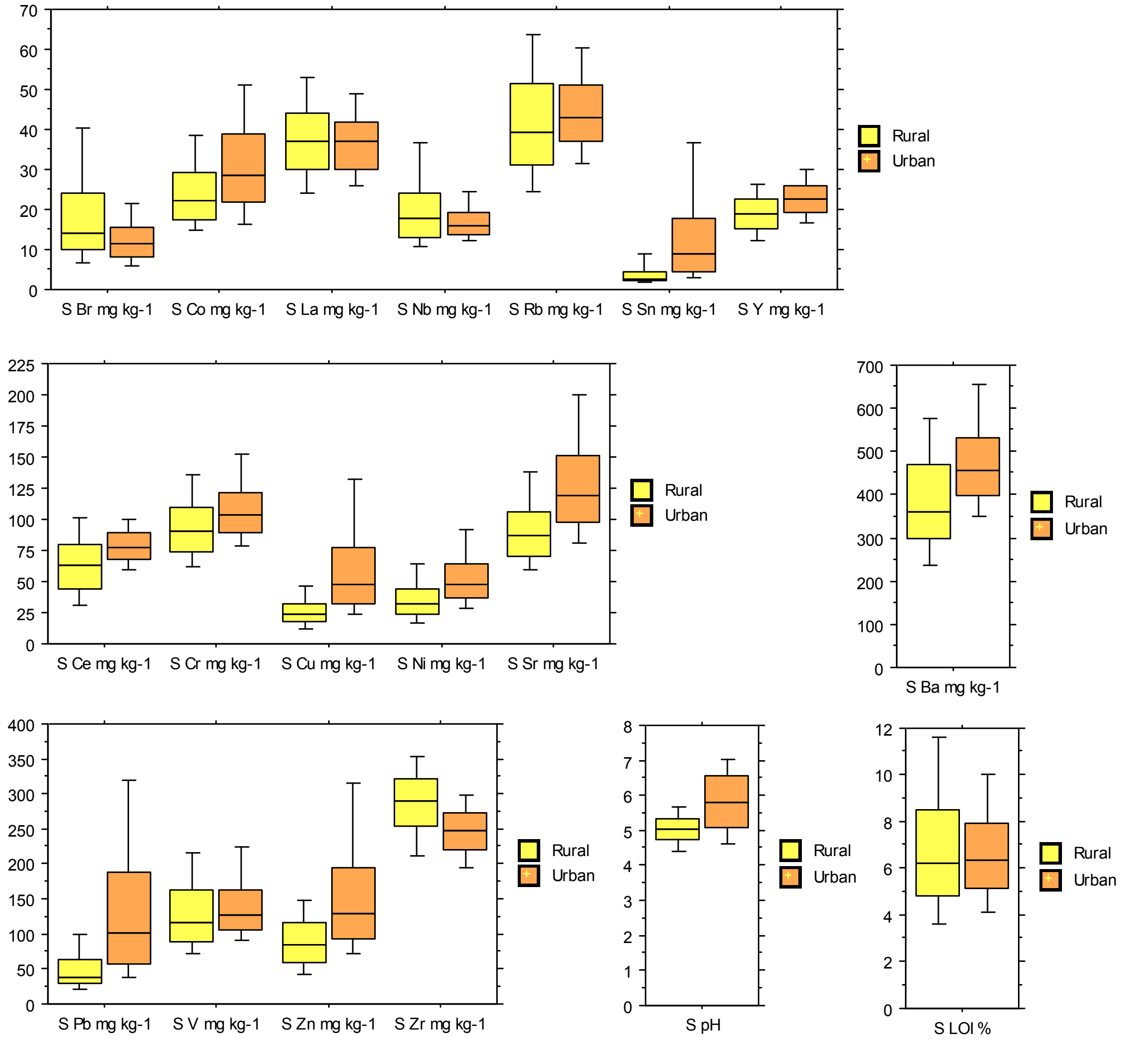
**Figure 3.6 Box and whisker plots of the 10th, 25th, 50th, 75th and 90th percentiles of parameter distributions in rural and urban Glasgow top soils.**

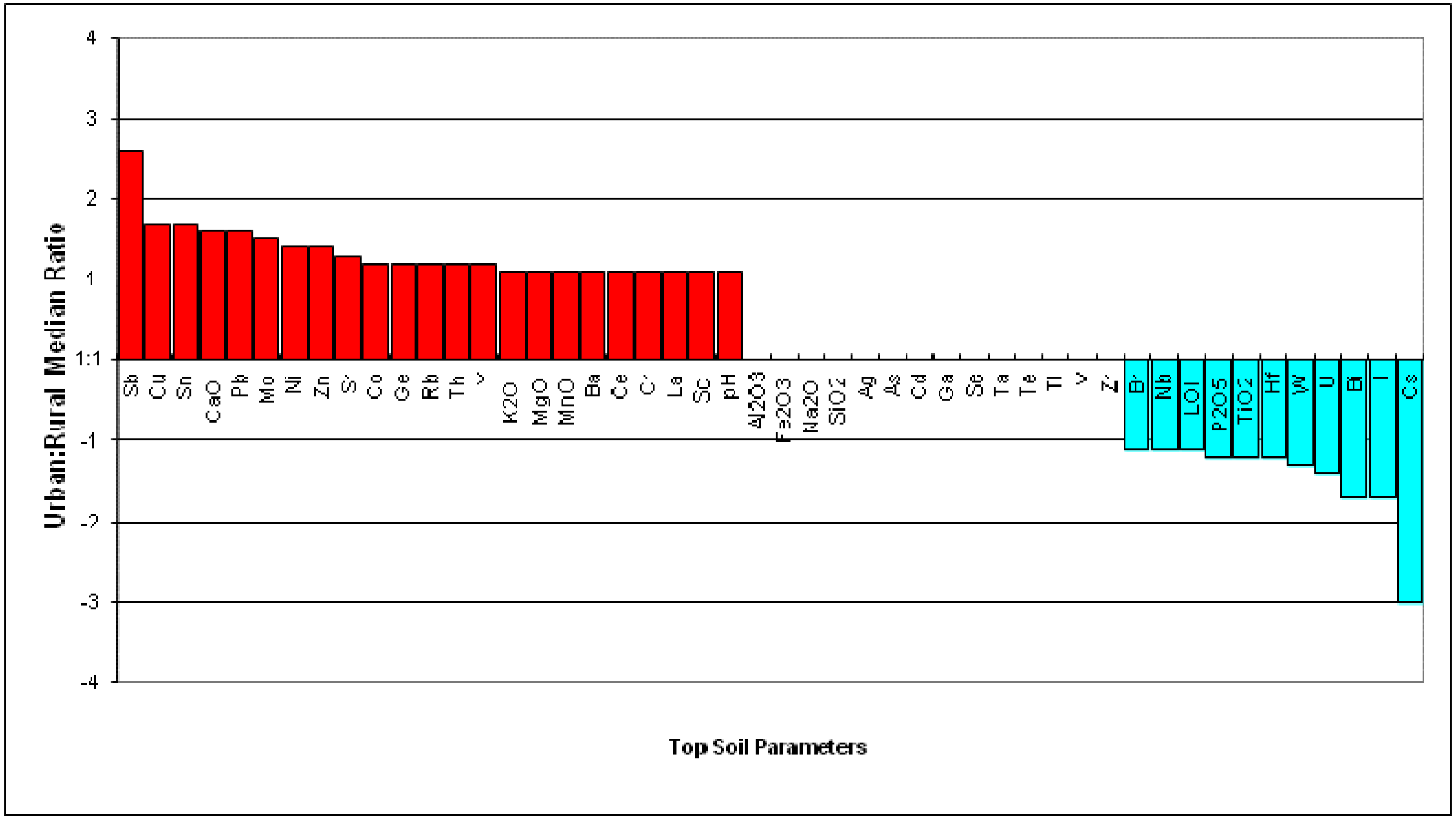

A Br mg kg-1
A Co mg kg-1
A La mg kg-1
A Nb mg kg-1
A Rb mg kg-1
A Sn mg kg-1
A Y mg kg-1
A Ce mg kg-1
A Cr mg kg-1
A Cu mg kg-1
A Ni mg kg-1
A Sr mg kg-1
A Ba mg kg-1
A Pb mg kg-1
A V mg kg-1
A Zn mg kg-1
A Zr mg kg-1
A pH
A LOI %
Rural
Urban




S = deeper soil n urban = 1368 n rural = 241

**Figure 3.7 Box and whisker plots of the 10th, 25th, 50th, 75th and 90th percentiles of parameter distributions in rural and urban Glasgow deeper soils.**


S Br mg kg-1
S Co mg kg-1
S La mg kg-1
S Nb mg kg-1
S Rb mg kg-1
S Sn mg kg-1
S Y mg kg-1
Rural
Urban
S Ce mg kg-1
S Cr mg kg-1
S Cu mg kg-1
S Ni mg kg-1
S Sr mg kg-1
Rural
Urban
S Ba mg kg-1
Rural
Urban
S Pb mg kg-1
S V mg kg-1
S Zn mg kg-1
S Zr mg kg-1
Rural
Urban
S pH
Rural
Urban
S LOI %
Rural
Urban

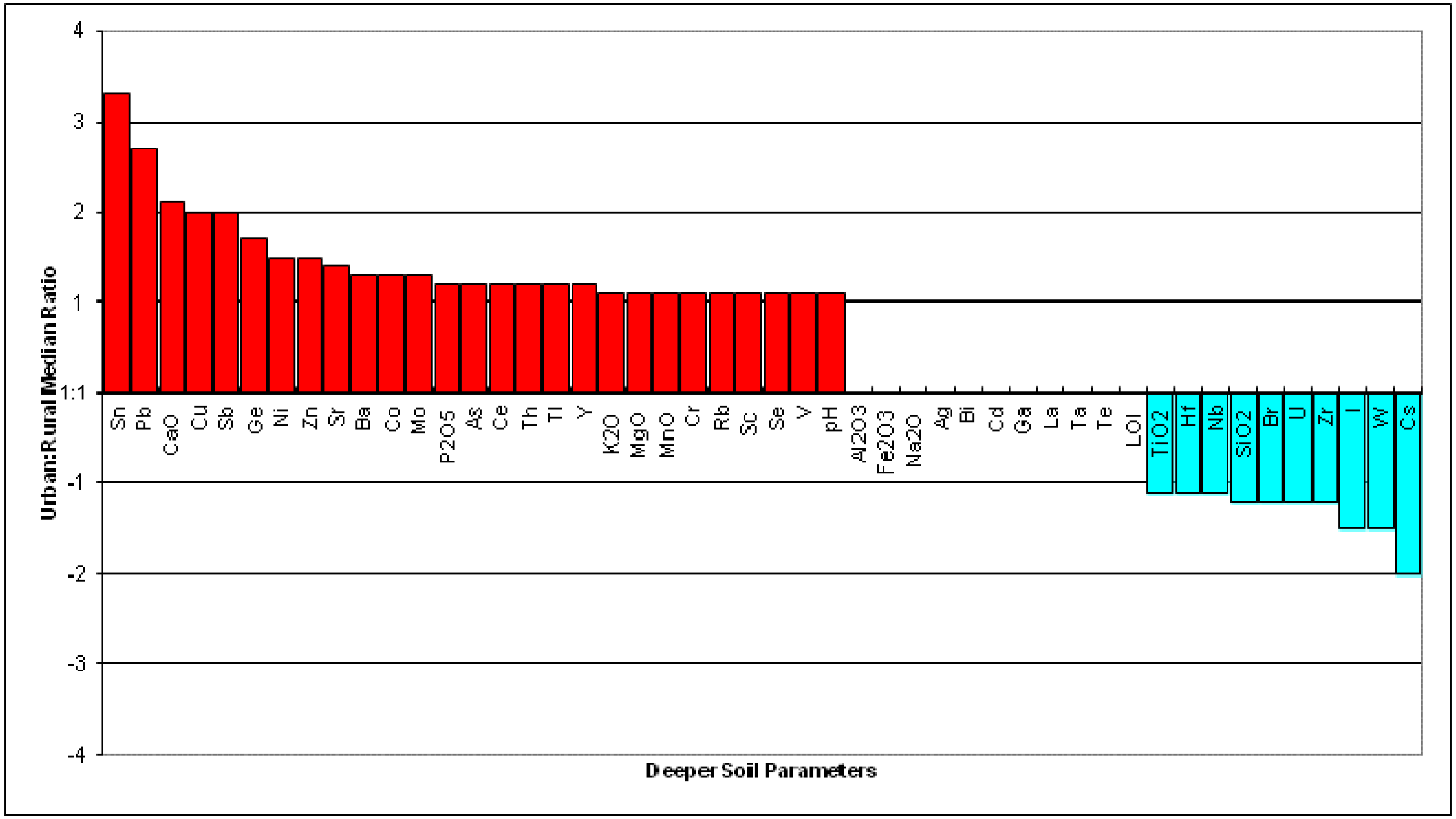



1:1 median ratio; no enhancement in urban or rural soils

+ value = urban/rural ratio; enhancement in urban soils relative to rural soils; for example, the Sb median is 2.6 times higher in urban than rural soils

- value = rural/urban ratio; enhancement in rural soils relative to urban soils; for example, the Cs median is 3 times higher in rural than urban soils

**Figure 3.8. Parameter enhancement in urban versus rural Glasgow top soils based on median values**

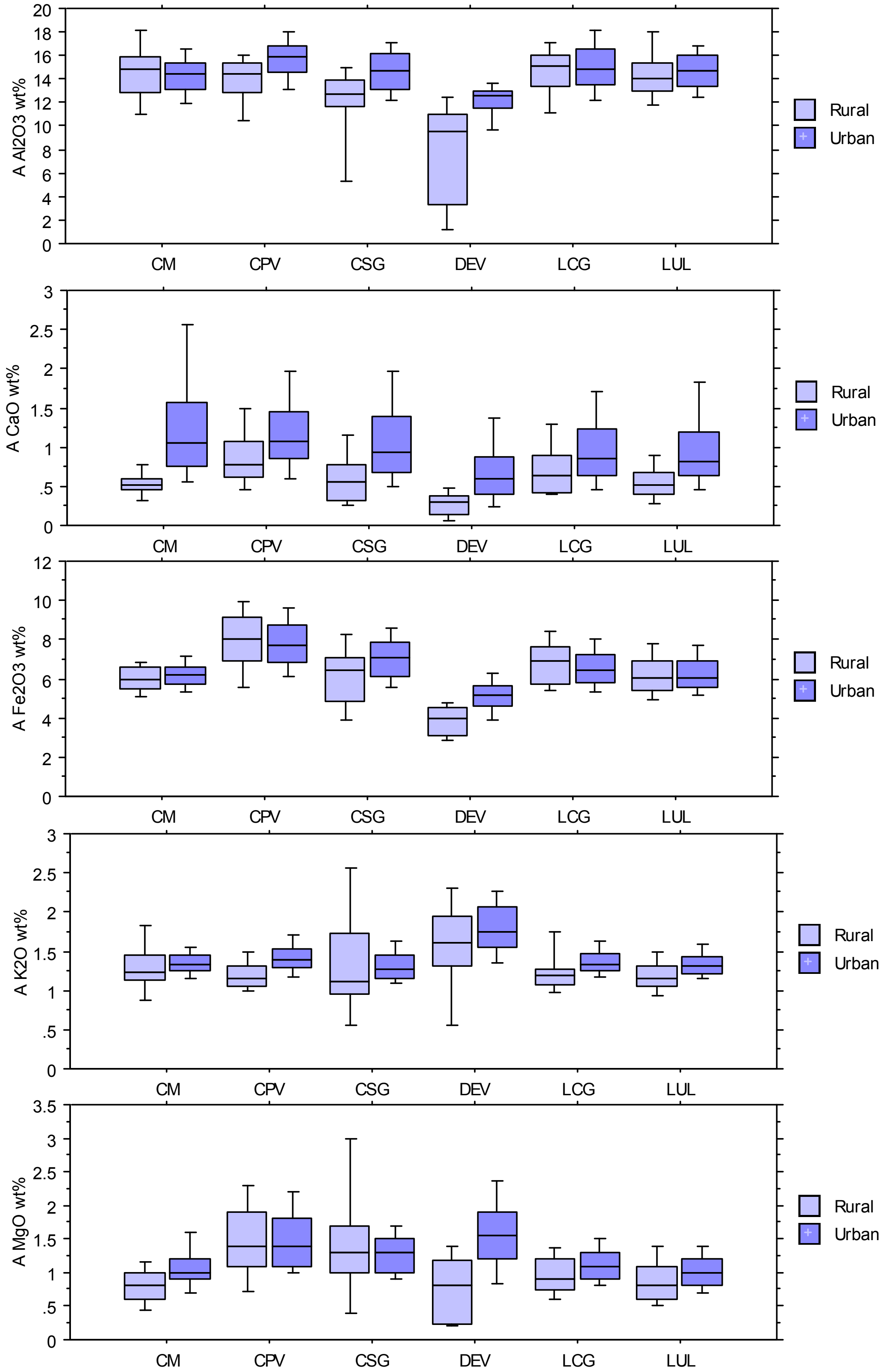



1:1 median ratio, no enhancement in urban or rural soils

+ value = urban/rural ratio, enhancement in urban soils relative to rural soils; for example, the Cu median is 2 times higher in urban than rural soils

- value = rural/urban ratio, enhancement in rural soils relative to urban soils; for example, the Cs median is 2 times higher in rural than urban soils

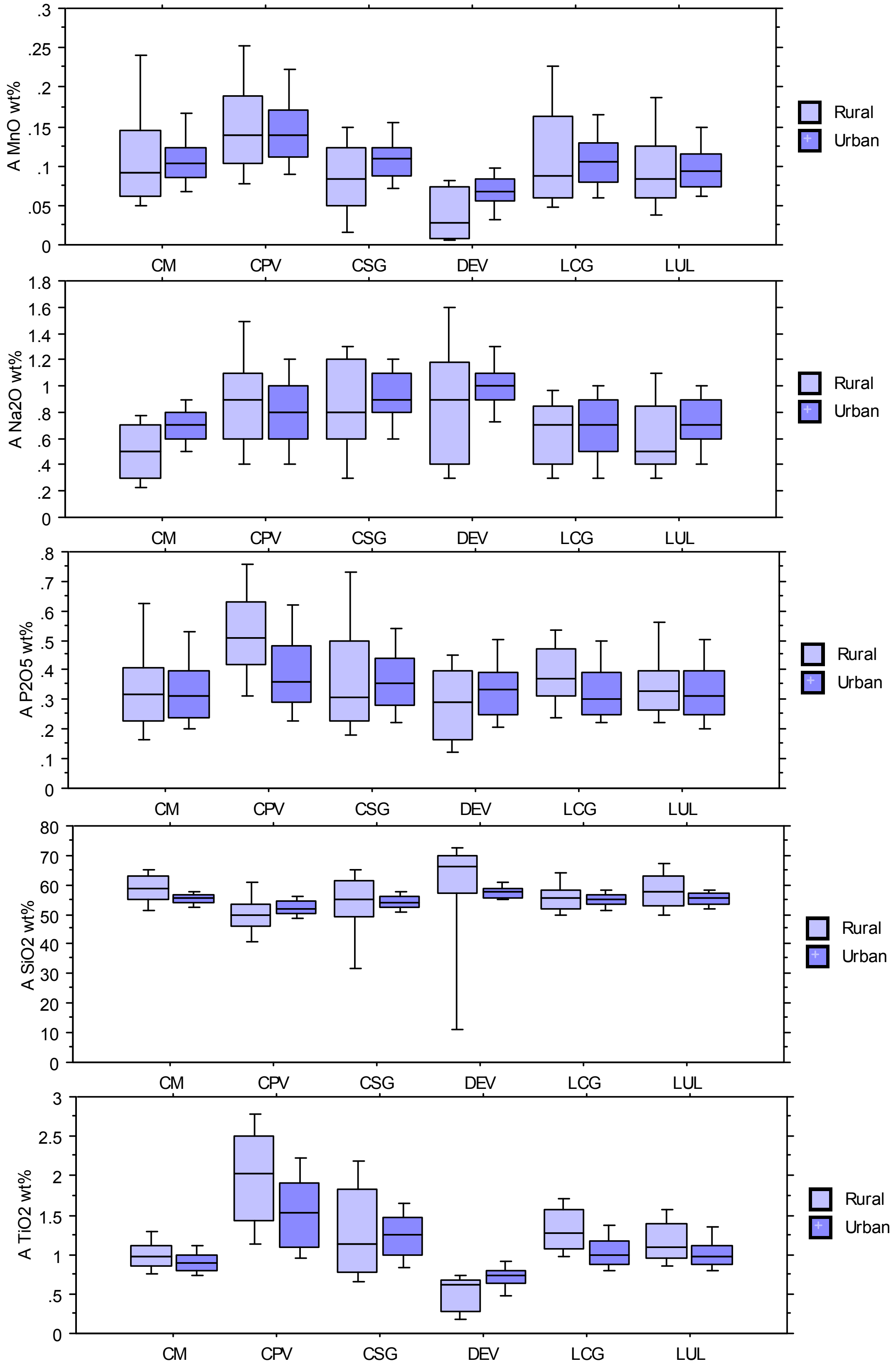
**Figure 3.9. Parameter enhancement in urban versus rural Glasgow deeper soils based on median values**

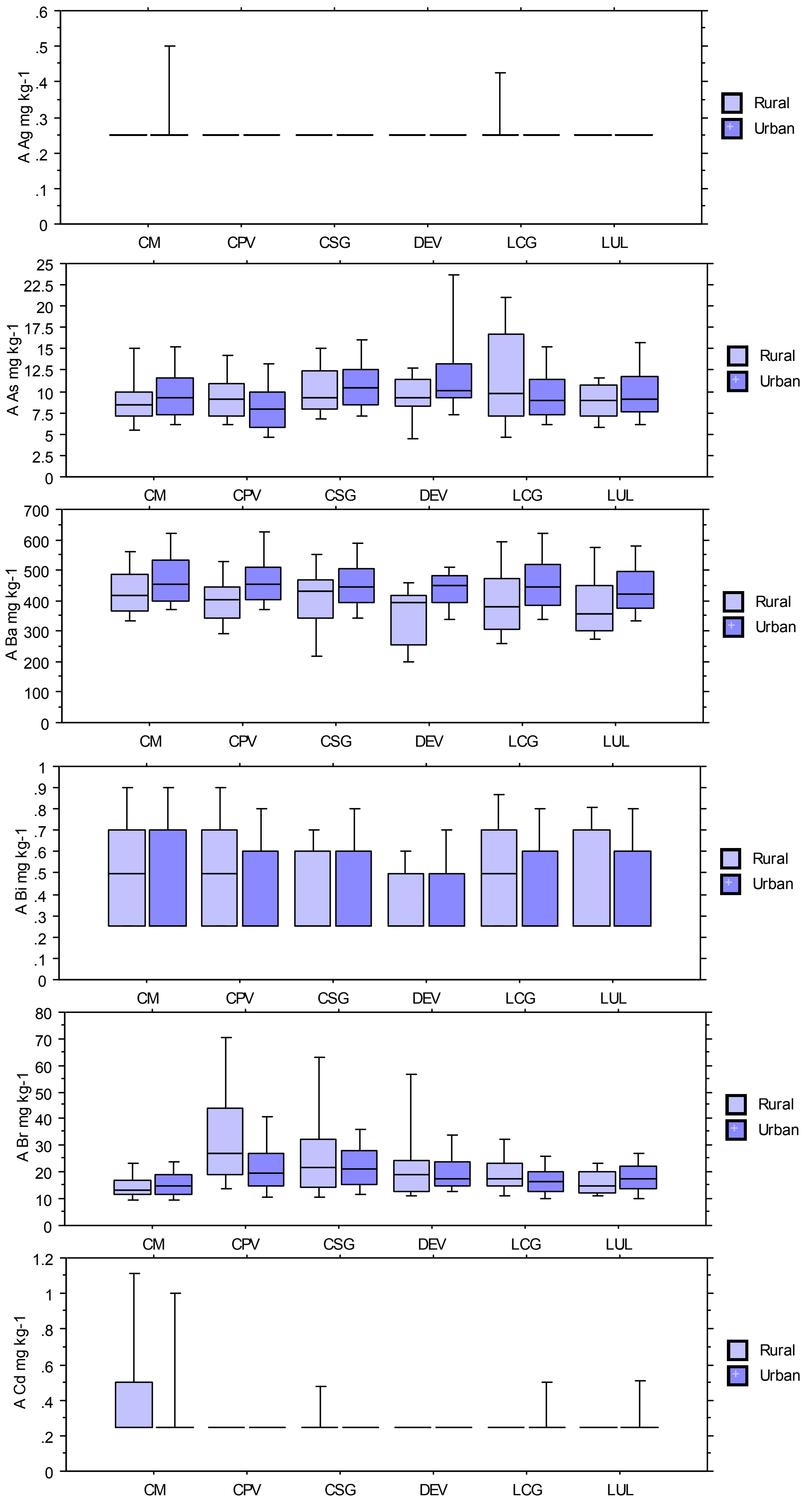


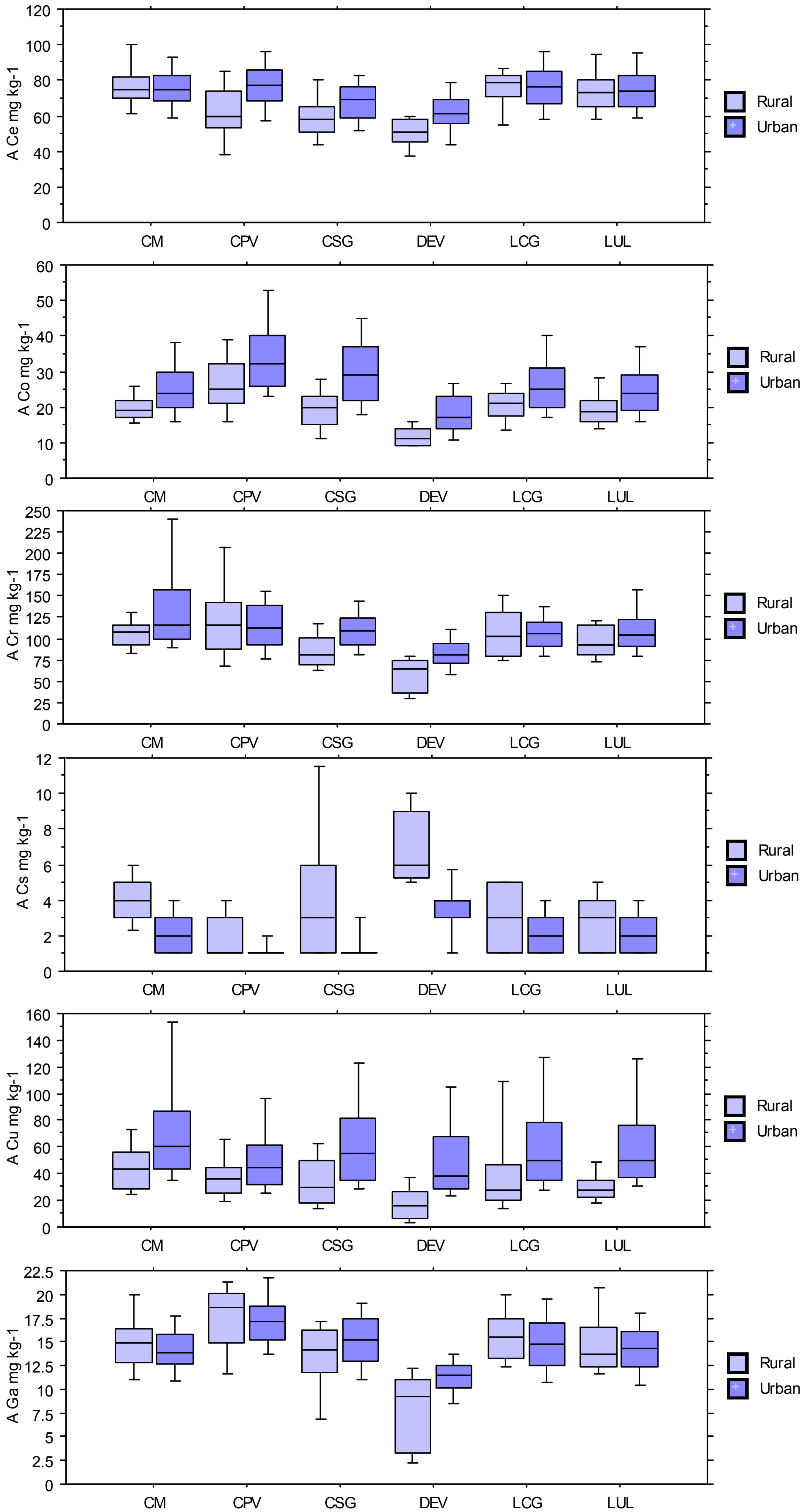

CM = Coal Measures: n rural = 38; n urban = 265
CSG = Strathclyde Group: n rural = 30; n urban = 174
LCG = Limestone Coal Formation: n rural = 28; n urban = 425
A = top soil

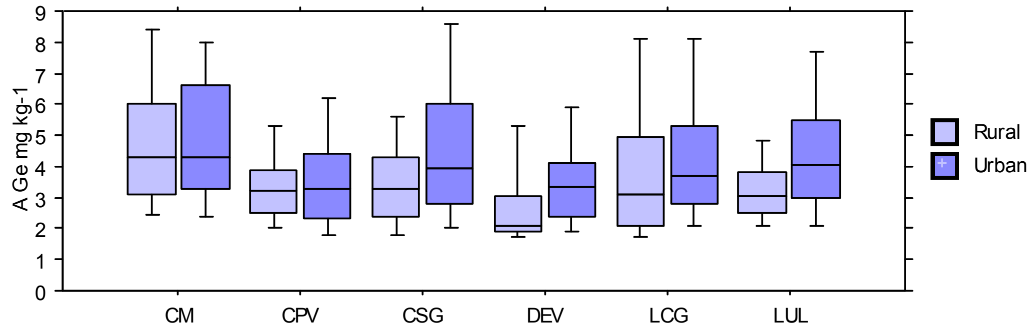
CPV = Clyde Plateau Volcanic Formation: n rural = 66; n urban = 175
DEV = Devonian Sandstones: n rural = 15; n urban = 38
LUL = Lower and Upper Limestone Formations: n rural = 64; n urban = 304

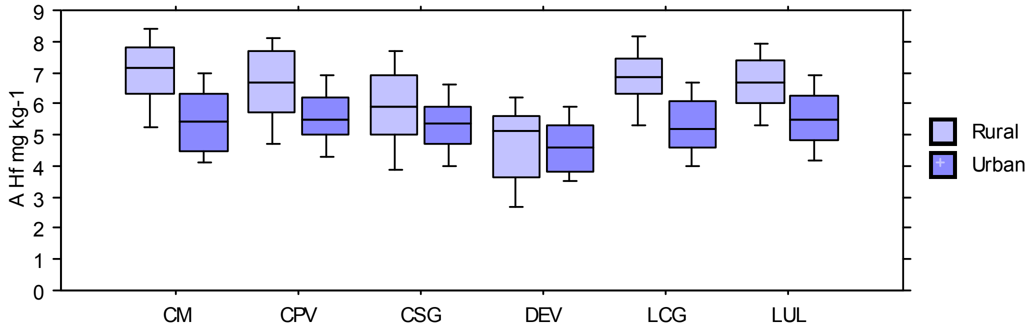
**Figure 3.10 Box and whisker plots of the 10$^{th}$, 25$^{th}$, 50$^{th}$, 75$^{th}$ and 90$^{th}$ percentiles of parameter distributions over the main geological units in rural and urban Glasgow top soils.**

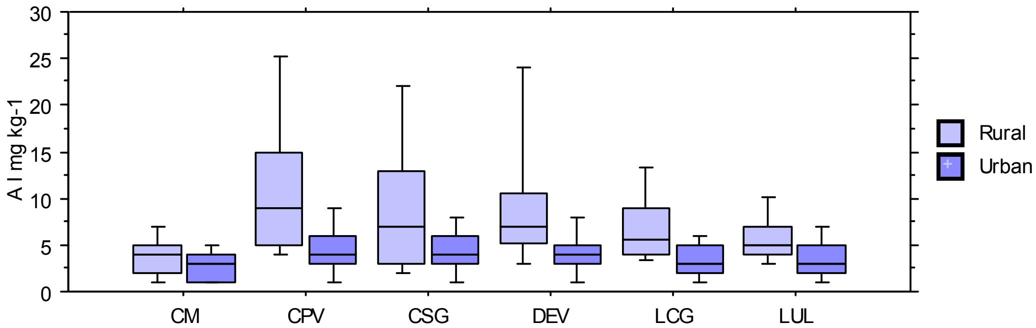

A MnO wt%
.3
.25
.2
.15
.1
.05
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
A Na2O wt%
1.8
1.6
1.4
1.2
1
.8
.6
.4
.2
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
A P2O5 wt%
.8
.7
.6
.5
.4
.3
.2
.1
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
A SiO2 wt%
80
70
60
50
40
30
20
10
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
A TiO2 wt%
3
2.5
2
1.5
1
.5
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

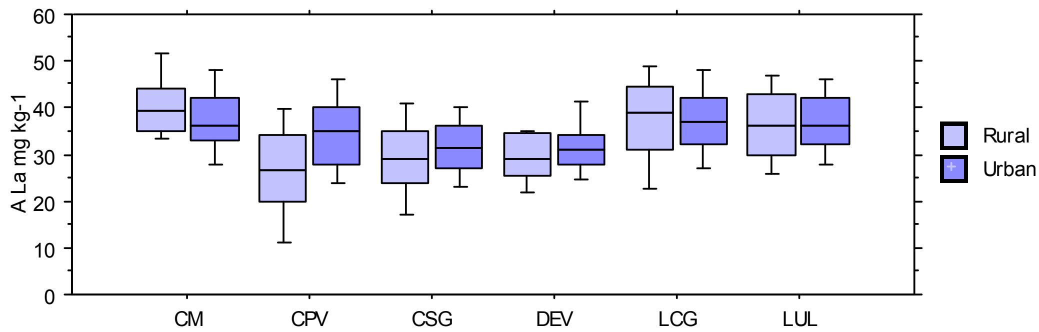

A Ag mg kg-1
A As mg kg-1
A Ba mg kg-1
A Bi mg kg-1
A Br mg kg-1
A Cd mg kg-1
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

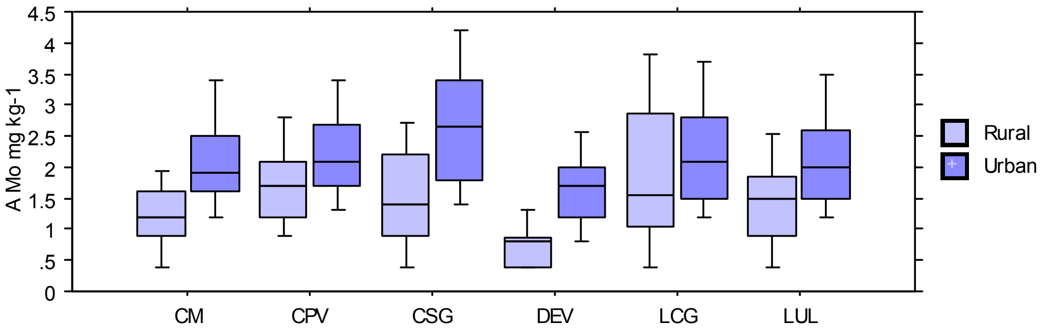

A Ce mg kg-1
0
20
40
60
80
100
120
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
A Co mg kg-1
0
10
20
30
40
50
60
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
A Cr mg kg-1
0
25
50
75
100
125
150
175
200
225
250
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
A Cs mg kg-1
0
2
4
6
8
10
12
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
A Cu mg kg-1
0
20
40
60
80
100
120
140
160
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
A Ga mg kg-1
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

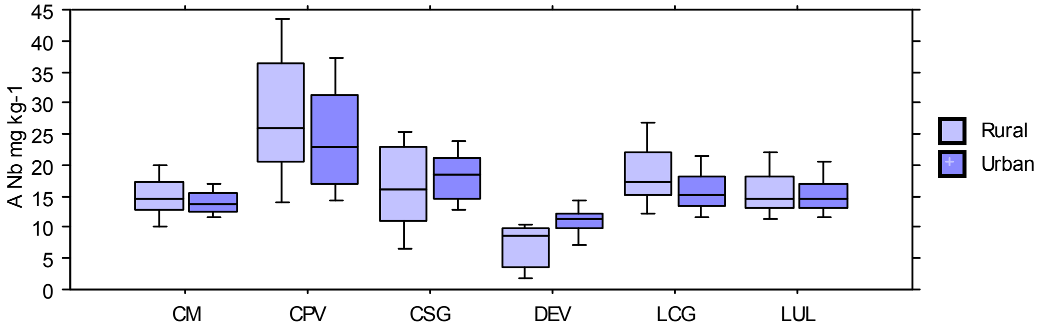

A Ge mg kg-1
0
1
2
3
4
5
6
7
8
9
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

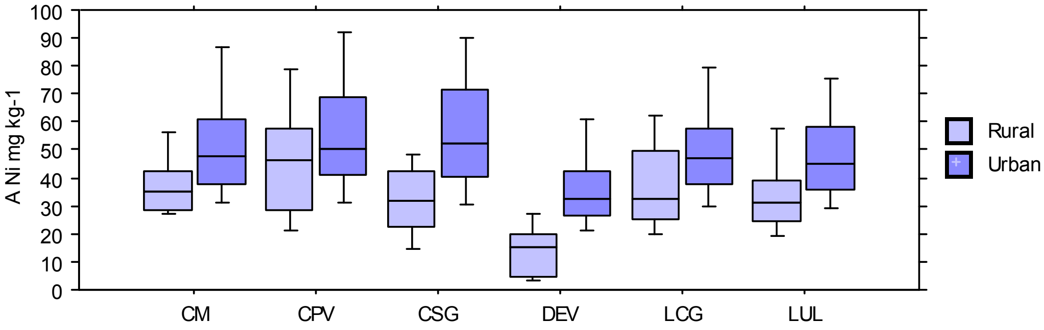

A Hf mg kg-1
0
1
2
3
4
5
6
7
8
9
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

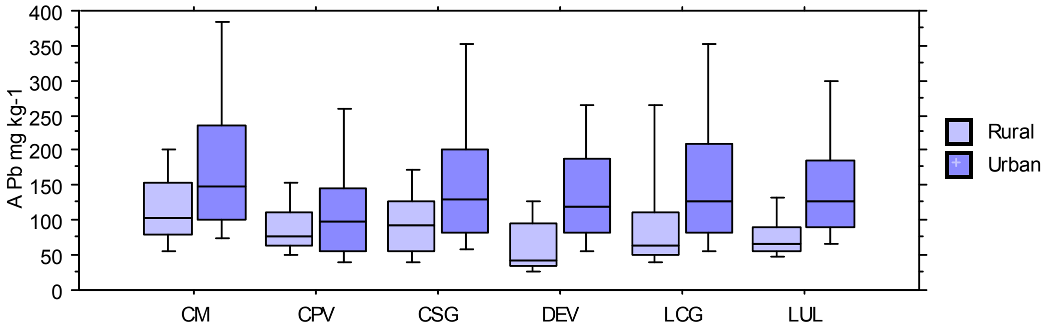

A I mg kg-1
0
5
10
15
20
25
30
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

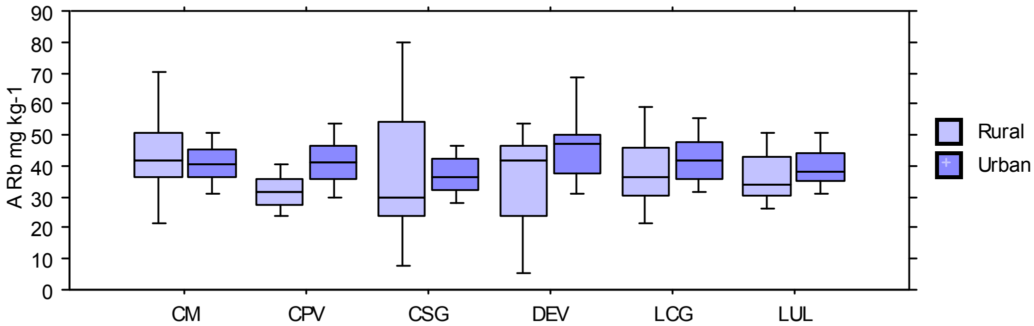

A La mg kg-1
0
10
20
30
40
50
60
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

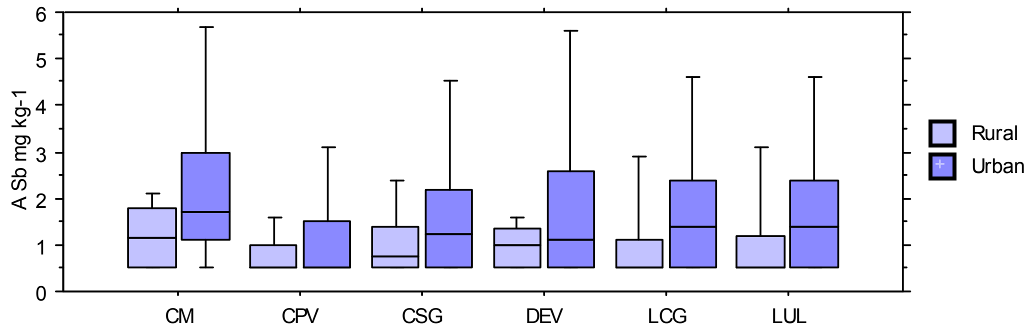

A Mo mg kg-1
0
.5
1
1.5
2
2.5
3
3.5
4
4.5
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

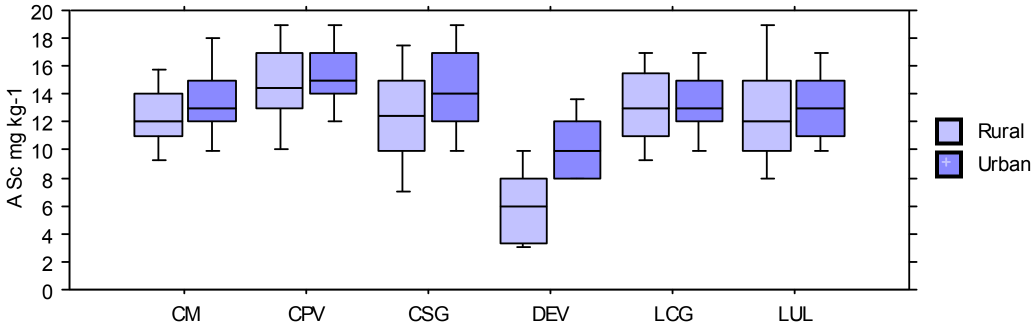

A Nb mg kg-1
0
5
10
15
20
25
30
35
40
45
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

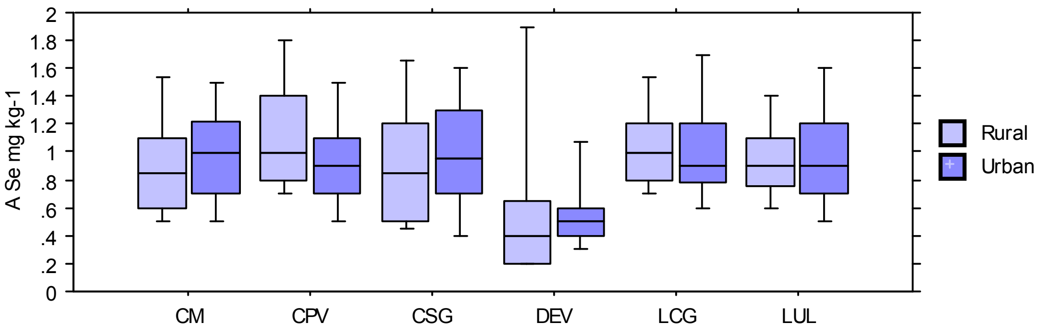

A Ni mg kg-1
100
90
80
70
60
50
40
30
20
10
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

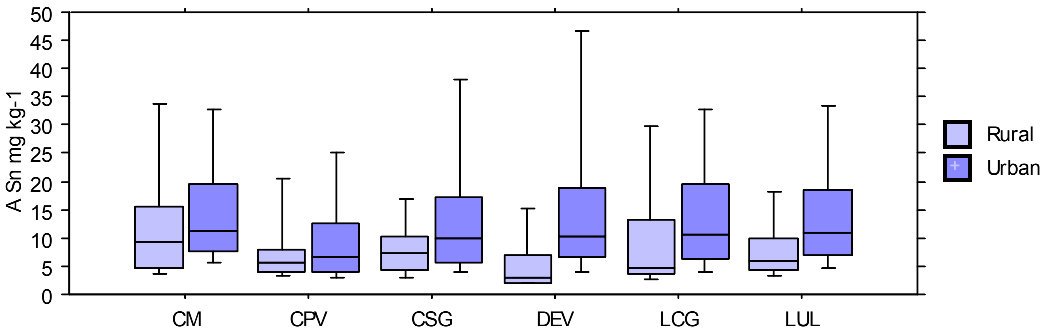

A Pb mg kg-1
400
350
300
250
200
150
100
50
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

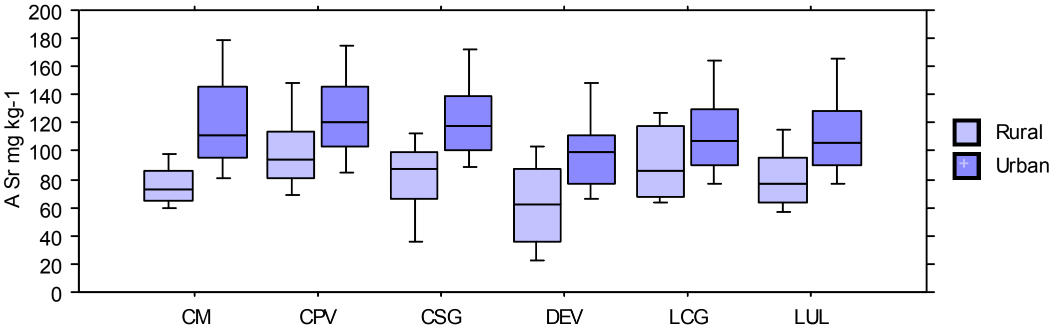

A Rb mg kg-1
90
80
70
60
50
40
30
20
10
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

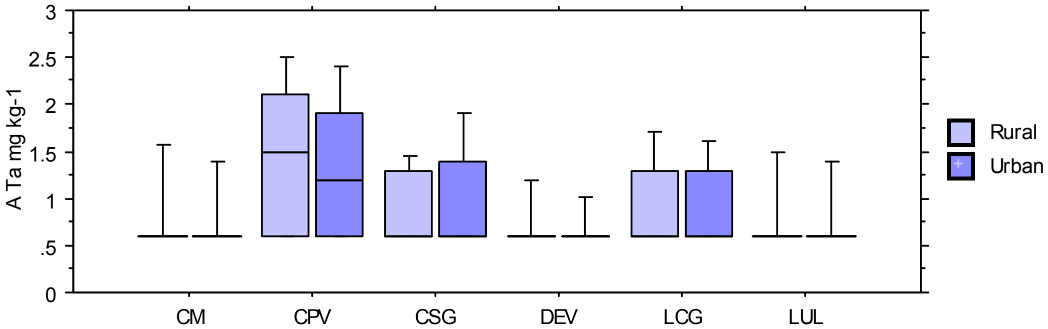

A Sb mg kg-1
6
5
4
3
2
1
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

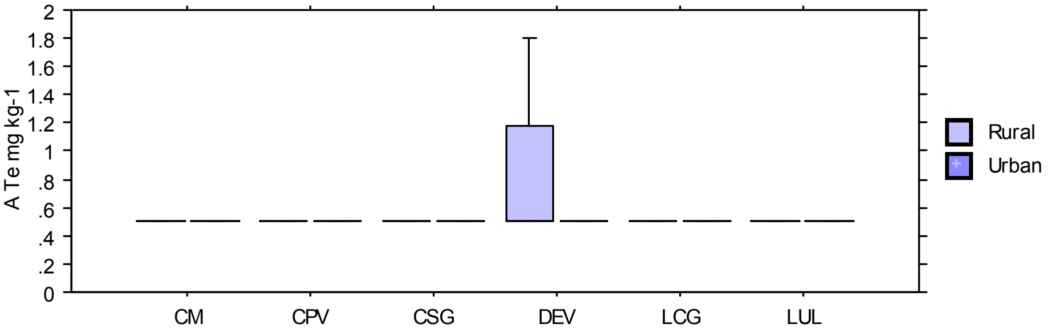

A Sc mg kg-1
20
18
16
14
12
10
8
6
4
2
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

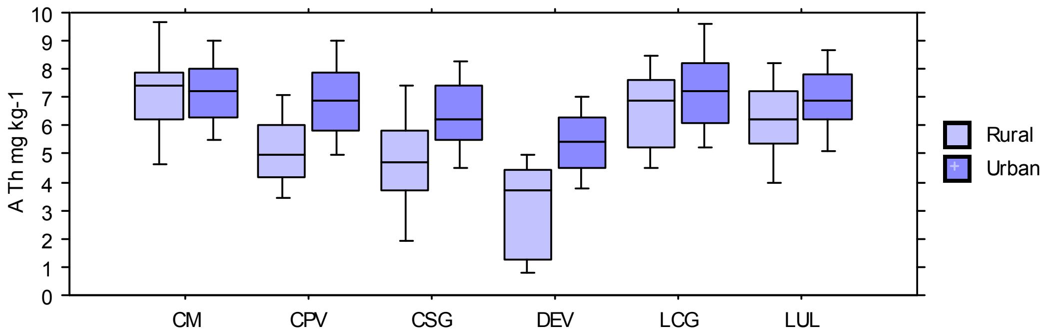

A Se mg kg-1
2
1.8
1.6
1.4
1.2
1
.8
.6
.4
.2
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

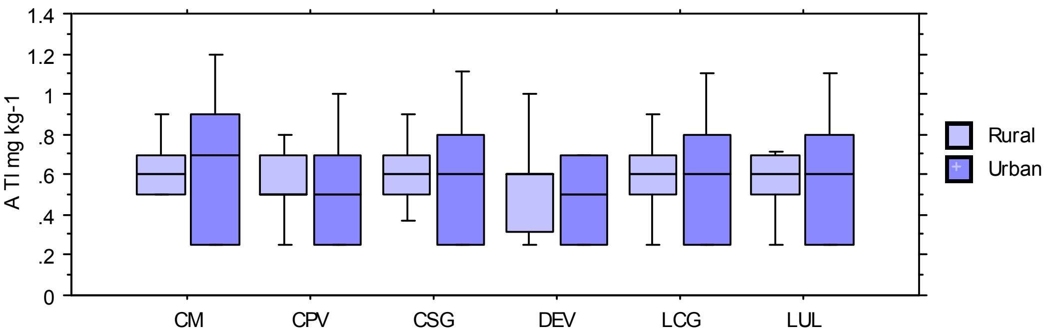

A Sn mg kg-1
50
45
40
35
30
25
20
15
10
5
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

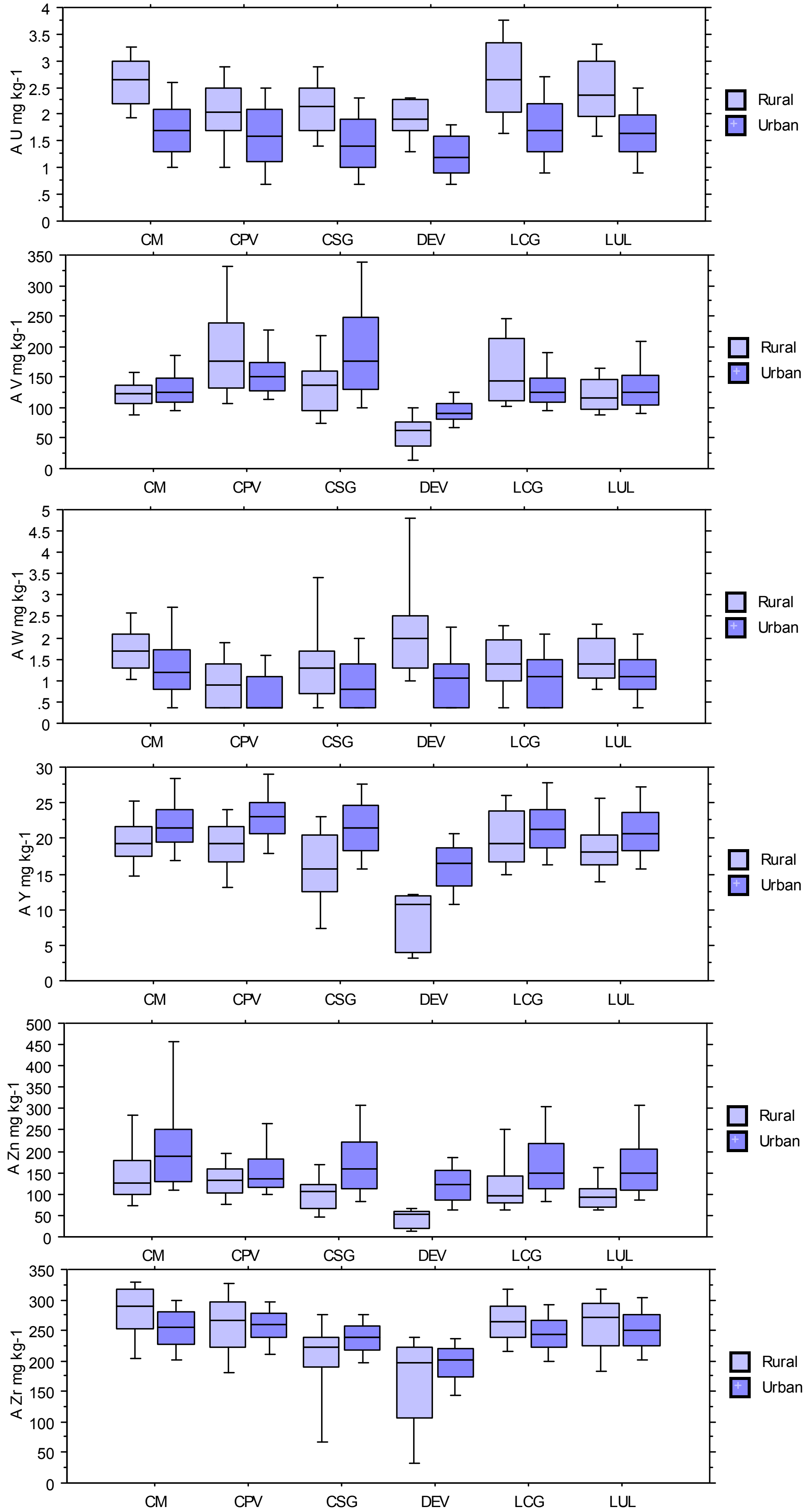

A Sr mg kg-1
200
180
160
140
120
100
80
60
40
20
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

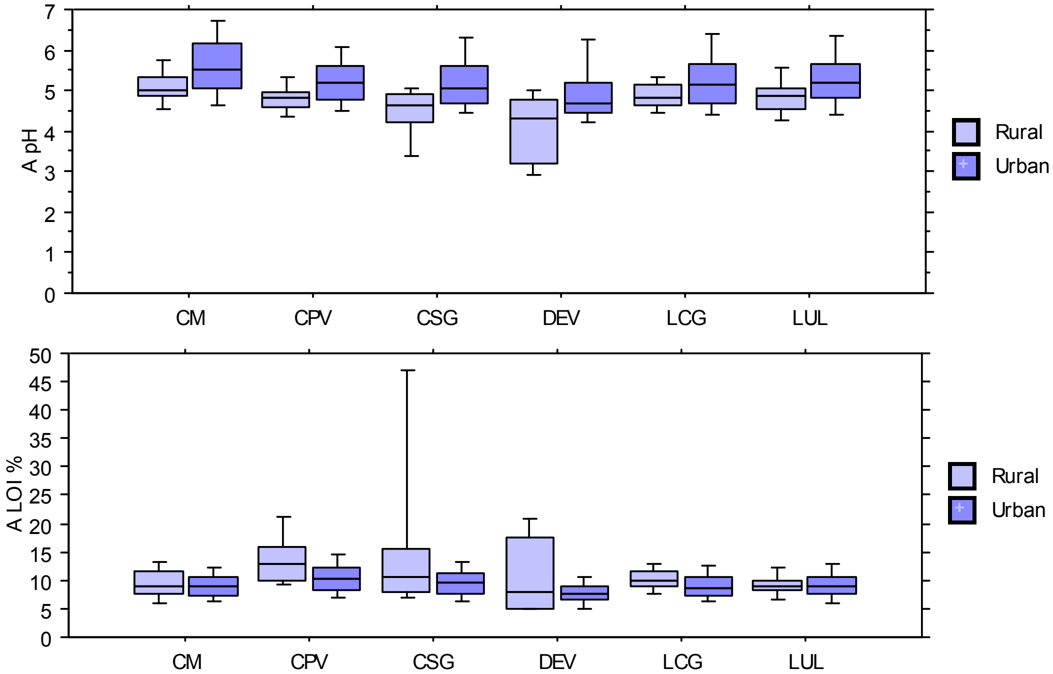

A Ta mg kg-1
3
2.5
2
1.5
1
.5
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

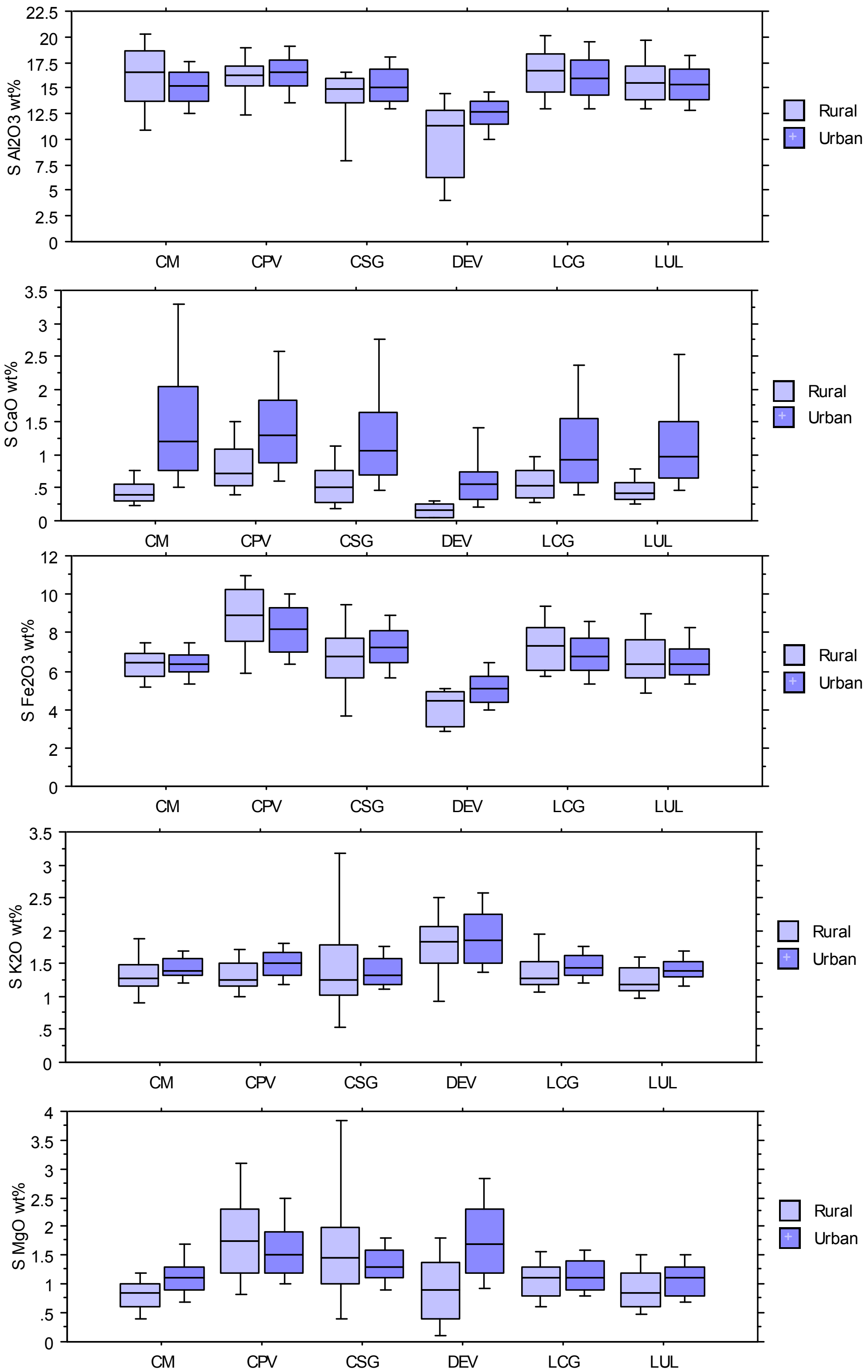

A Te mg kg-1
2
1.8
1.6
1.4
1.2
1
.8
.6
.4
.2
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban


A Th mg kg-1
10
9
8
7
6
5
4
3
2
1
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban


A Tl mg kg-1
1.4
1.2
1
.8
.6
.4
.2
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban


A U mg kg-1
A V mg kg-1
A W mg kg-1
A Y mg kg-1
A Zn mg kg-1
A Zr mg kg-1
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

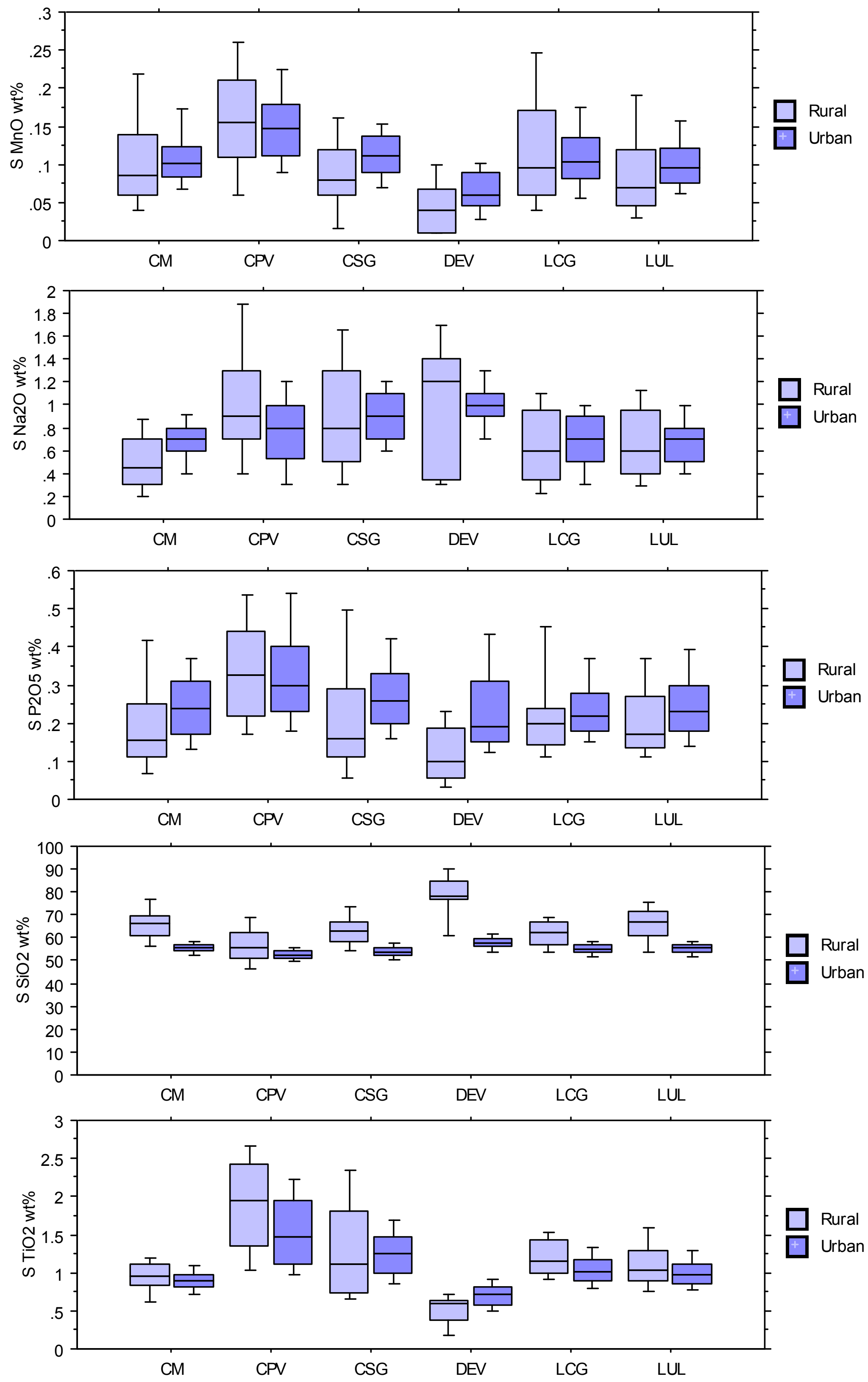

A pH
Rural
Urban
CM
CPV
CSG
DEV
LCG
LUL
A LOI %
Rural
Urban
CM
CPV
CSG
DEV
LCG
LUL

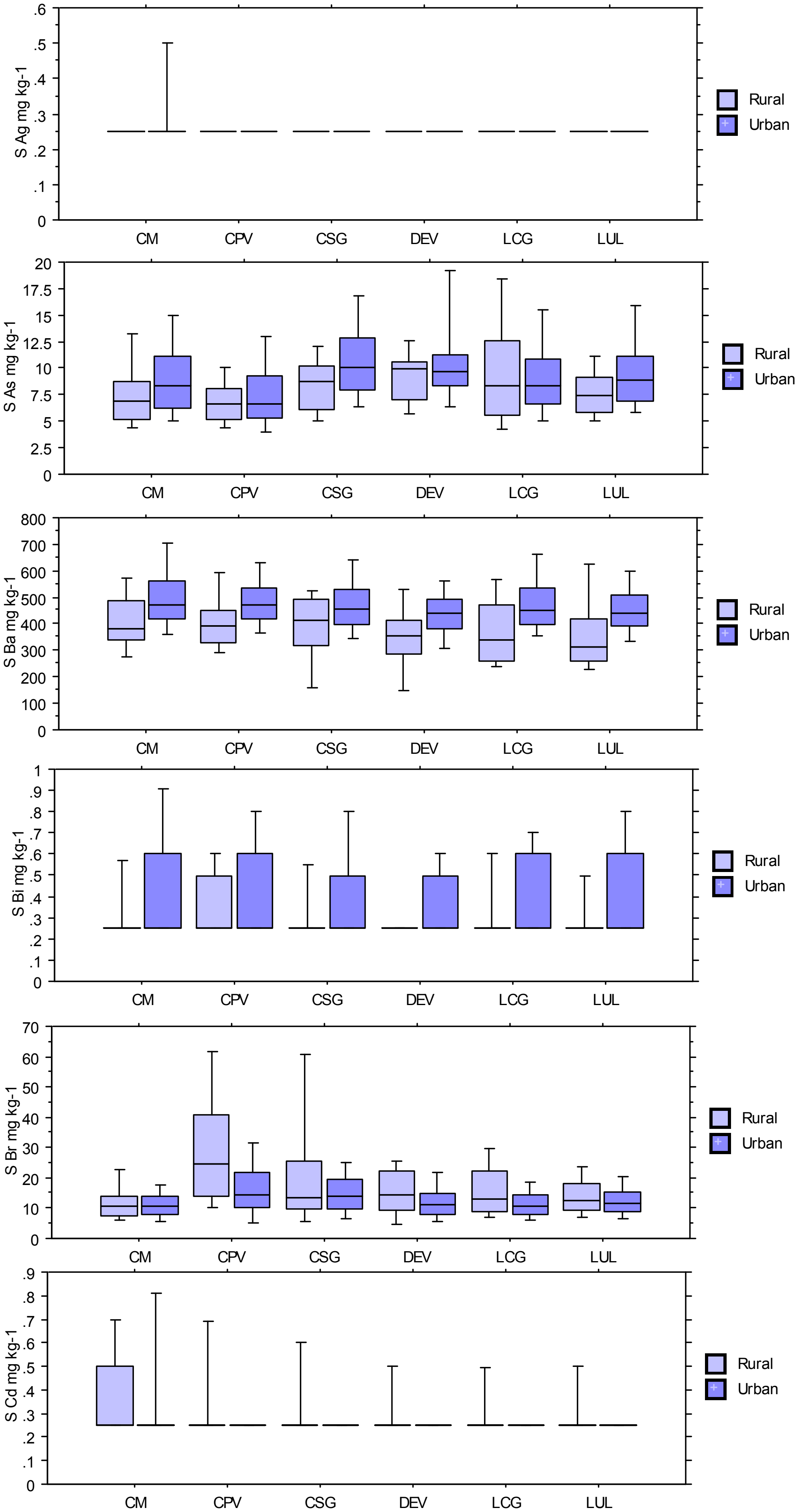


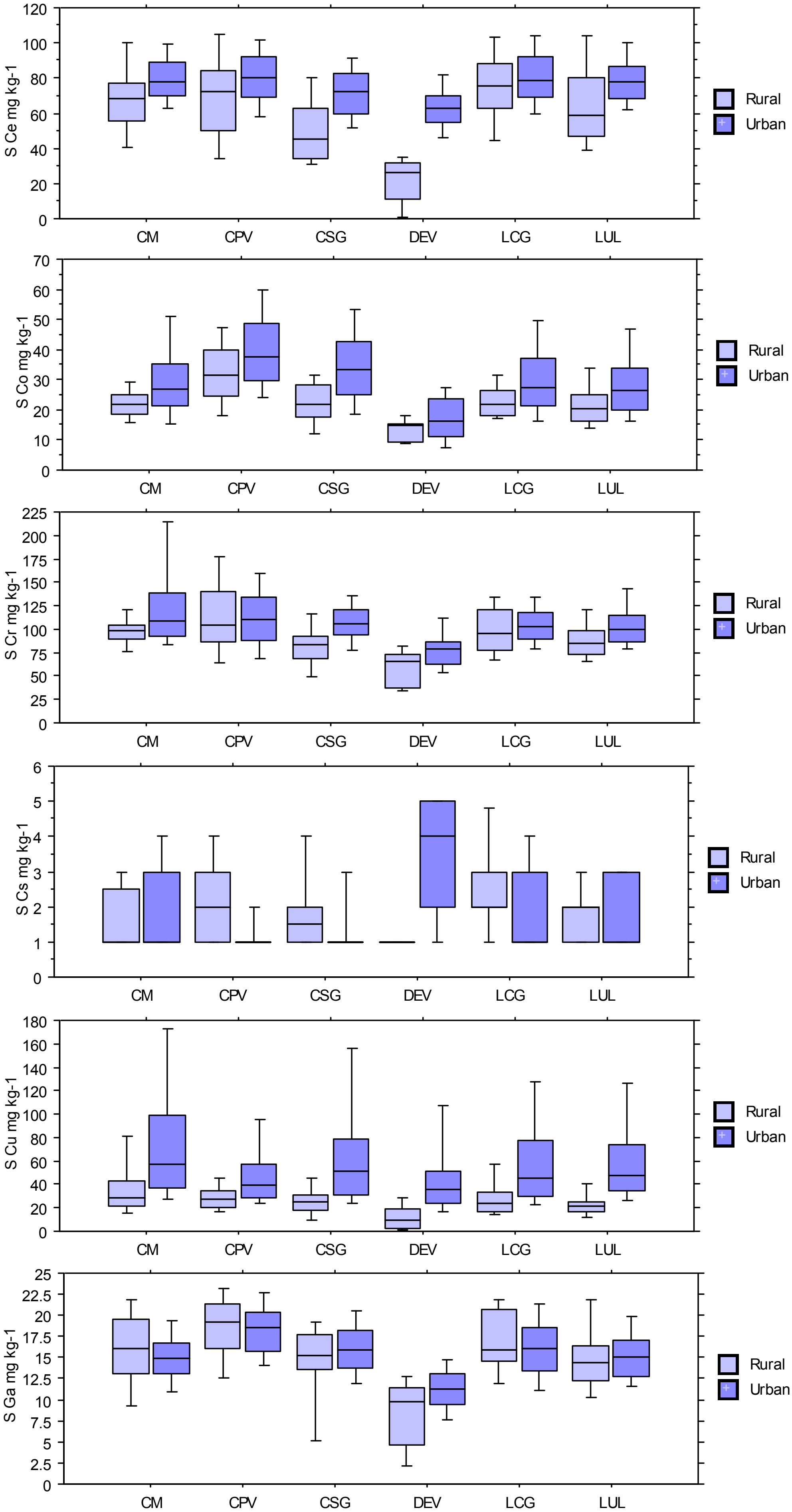

CM = Coal Measures: n rural = 38; n urban = 264
CSG = Strathclyde Group: n rural = 30; n urban = 174
LCG = Limestone Coal Formation: n rural = 28; n urban = 413
S = deeper soil

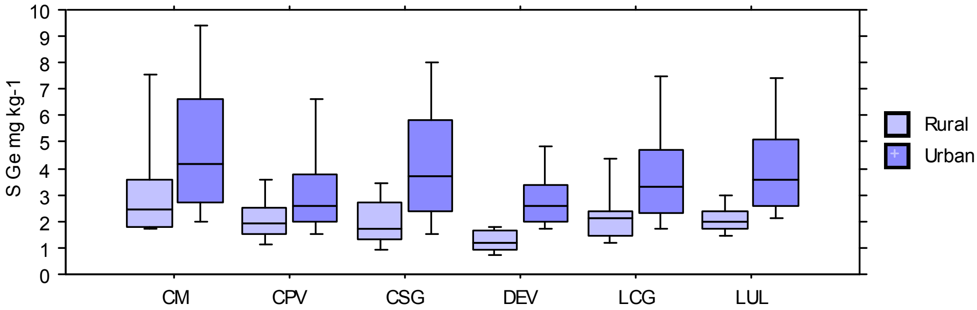
CPV = Clyde Plateau Volcanic Formation: n rural = 66; n urban = 175
DEV = Devonian Sandstones: n rural = 15; n urban = 38
LUL = Lower and Upper Limestone Formations: n rural = 64; n urban = 304

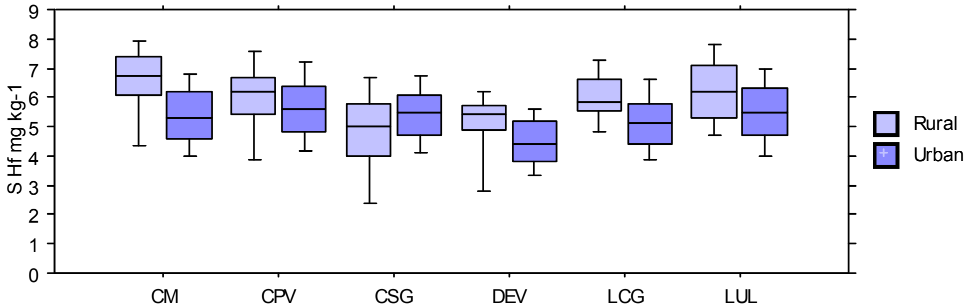
**Figure 3.11 Box and whisker plots of the 10$^{th}$, 25$^{th}$, 50$^{th}$, 75$^{th}$ and 90$^{th}$ percentiles of parameter distributions over the main geological units in rural and urban Glasgow deeper soils.**

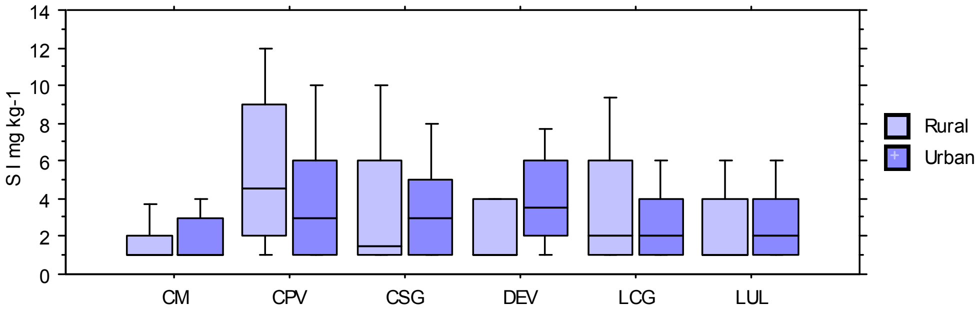

S MnO wt%
.3
.25
.2
.15
.1
.05
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
S Na2O wt%
2
1.8
1.6
1.4
1.2
1
.8
.6
.4
.2
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
S P2O5 wt%
.6
.5
.4
.3
.2
.1
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
S SiO2 wt%
100
90
80
70
60
50
40
30
20
10
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
S TiO2 wt%
3
2.5
2
1.5
1
.5
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

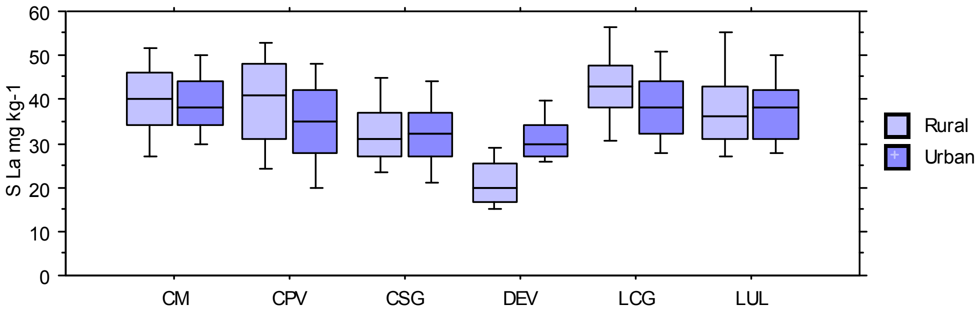

S Ag mg kg-1
0
.1
.2
.3
.4
.5
.6
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
S As mg kg-1
0
2.5
5
7.5
10
12.5
15
17.5
20
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
S Ba mg kg-1
0
100
200
300
400
500
600
700
800
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
S Bi mg kg-1
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
S Br mg kg-1
0
10
20
30
40
50
60
70
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
S Cd mg kg-1
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

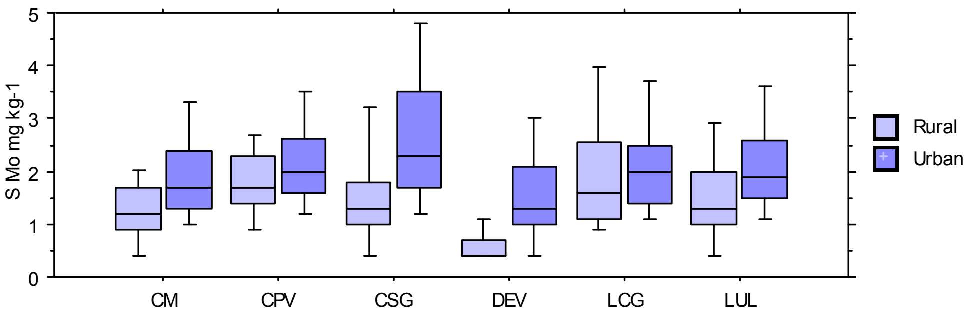

S Ce mg kg-1
0 20 40 60 80 100 120
CM CPV CSG DEV LCG LUL
Rural
Urban
S Co mg kg-1
0 10 20 30 40 50 60 70
CM CPV CSG DEV LCG LUL
Rural
Urban
S Cr mg kg-1
0 25 50 75 100 125 150 175 200 225
CM CPV CSG DEV LCG LUL
Rural
Urban
S Cs mg kg-1
0 1 2 3 4 5 6
CM CPV CSG DEV LCG LUL
Rural
Urban
S Cu mg kg-1
0 20 40 60 80 100 120 140 160 180
CM CPV CSG DEV LCG LUL
Rural
Urban
S Ga mg kg-1
0 2.5 5 7.5 10 12.5 15 17.5 20 22.5 25
CM CPV CSG DEV LCG LUL
Rural
Urban

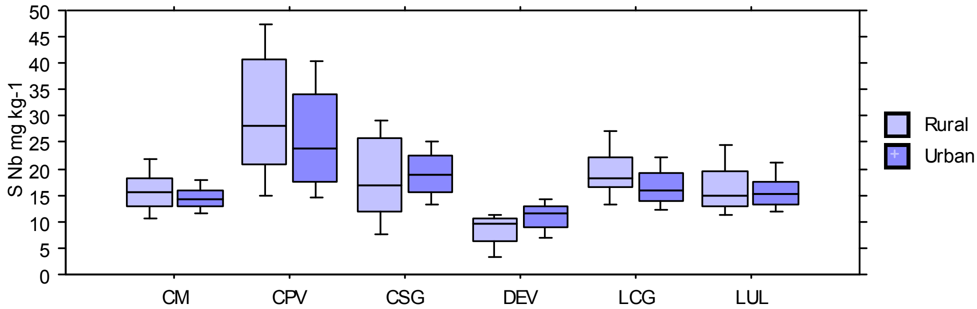

S Ge mg kg-1
10
9
8
7
6
5
4
3
2
1
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

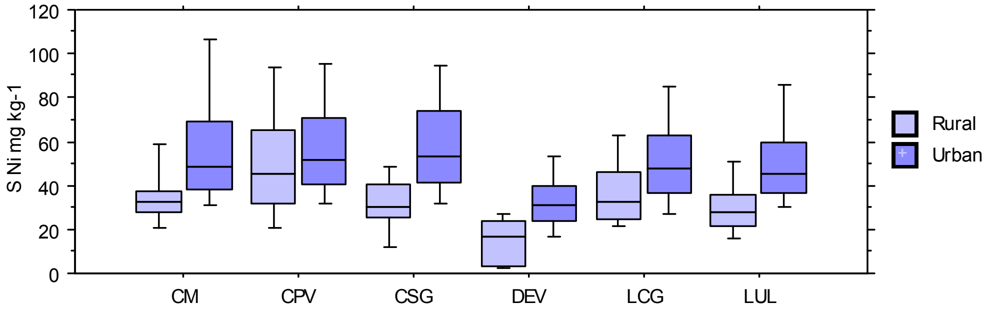

S Hf mg kg-1
9
8
7
6
5
4
3
2
1
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

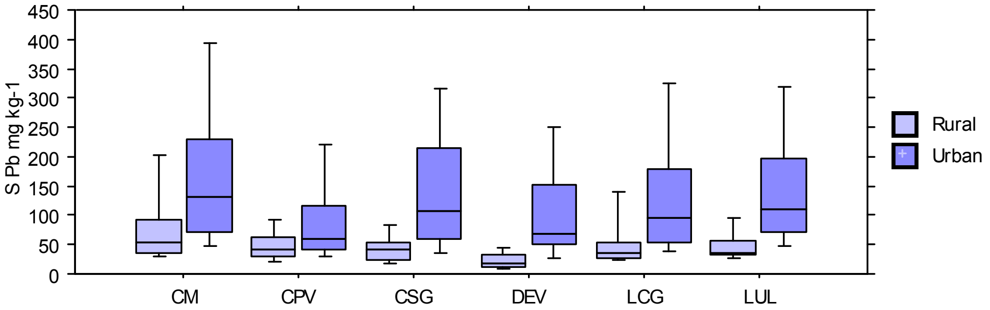

S I mg kg-1
14
12
10
8
6
4
2
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

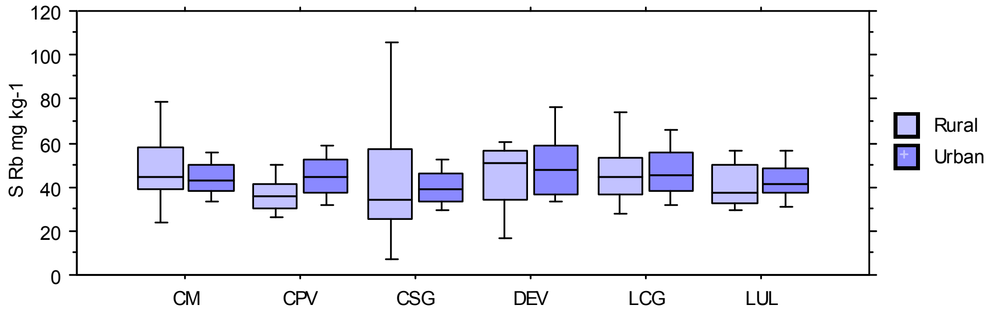

S La mg kg-1
60
50
40
30
20
10
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

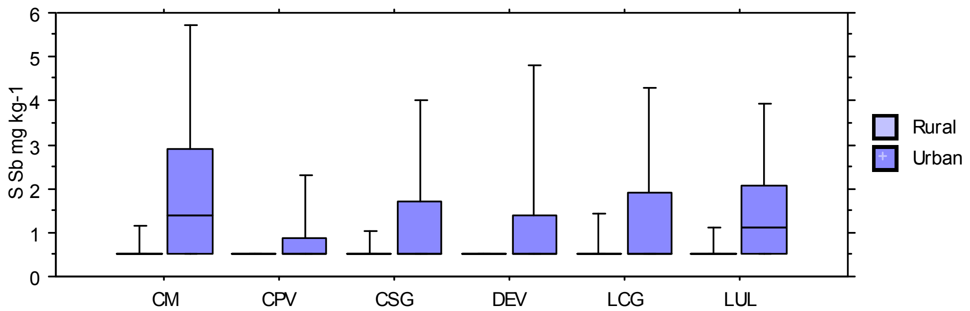

S Mo mg kg-1
5
4
3
2
1
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

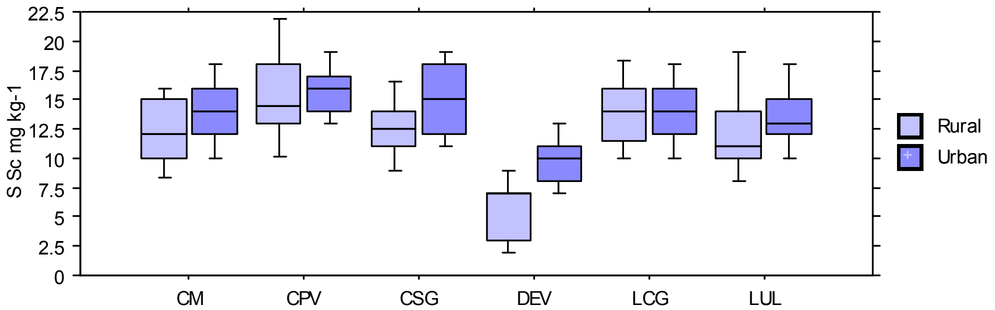

S Nb mg kg-1
50
45
40
35
30
25
20
15
10
5
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

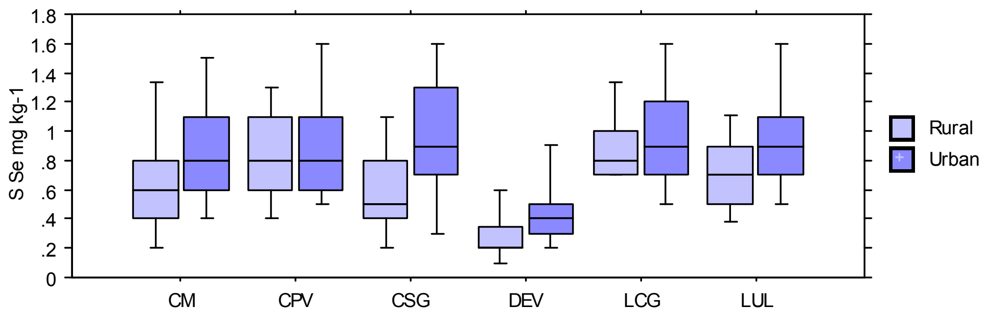

S Ni mg kg-1
0
20
40
60
80
100
120
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

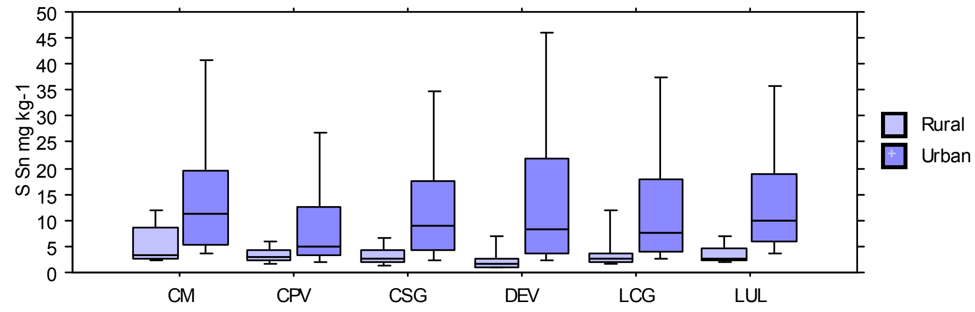

S Pb mg kg-1
0
50
100
150
200
250
300
350
400
450
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

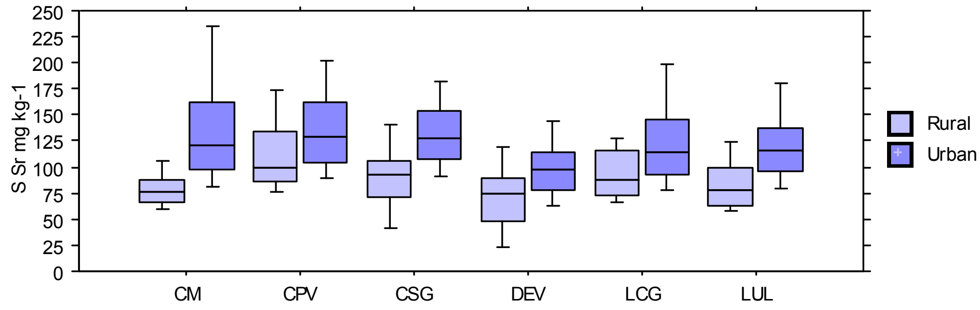

S Rb mg kg-1
0
20
40
60
80
100
120
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

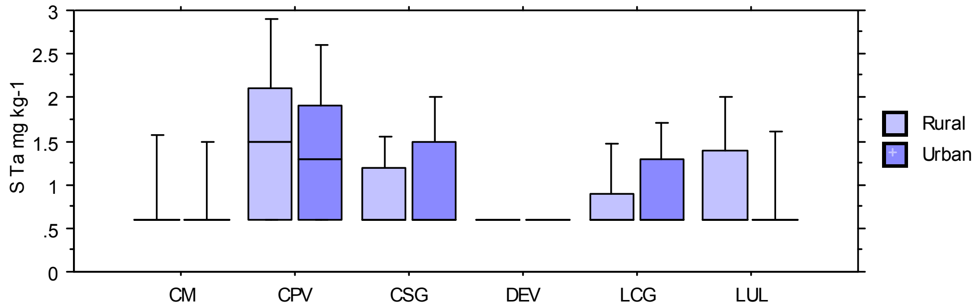

S Sb mg kg-1
0
1
2
3
4
5
6
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

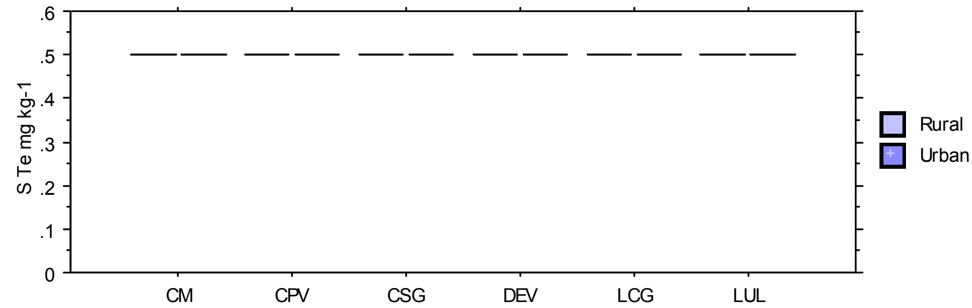

S Sc mg kg-1
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

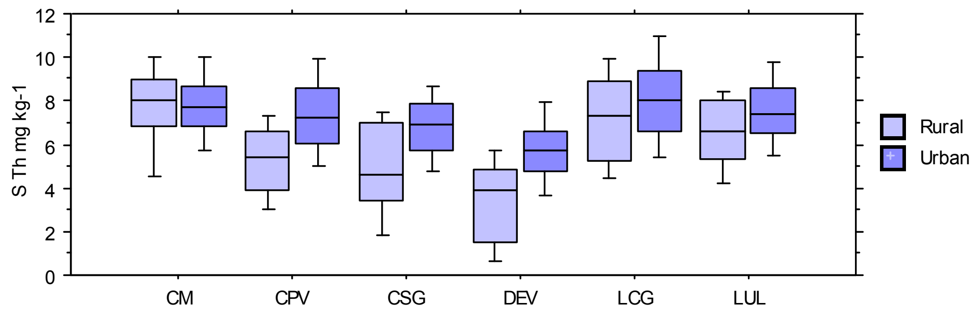

S Se mg kg-1
0
.2
.4
.6
.8
1
1.2
1.4
1.6
1.8
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

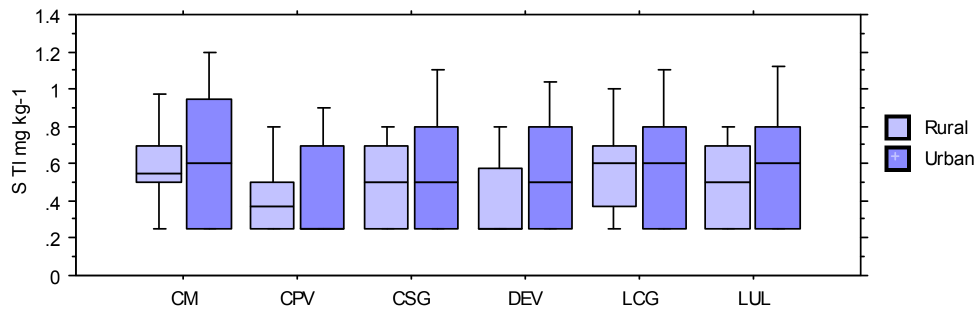

S Sn mg kg-1
50
45
40
35
30
25
20
15
10
5
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

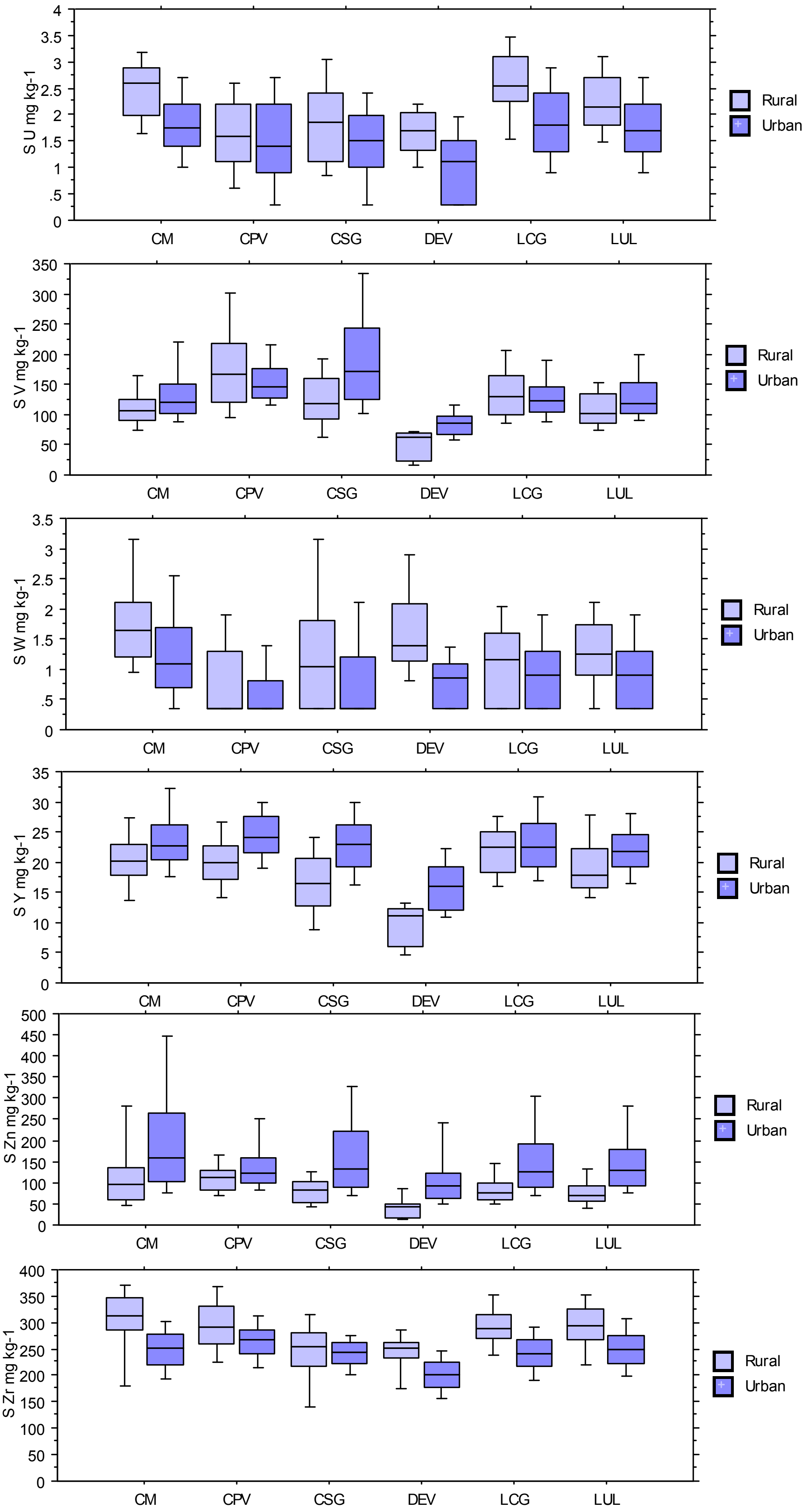

S Sr mg kg-1
250
225
200
175
150
125
100
75
50
25
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

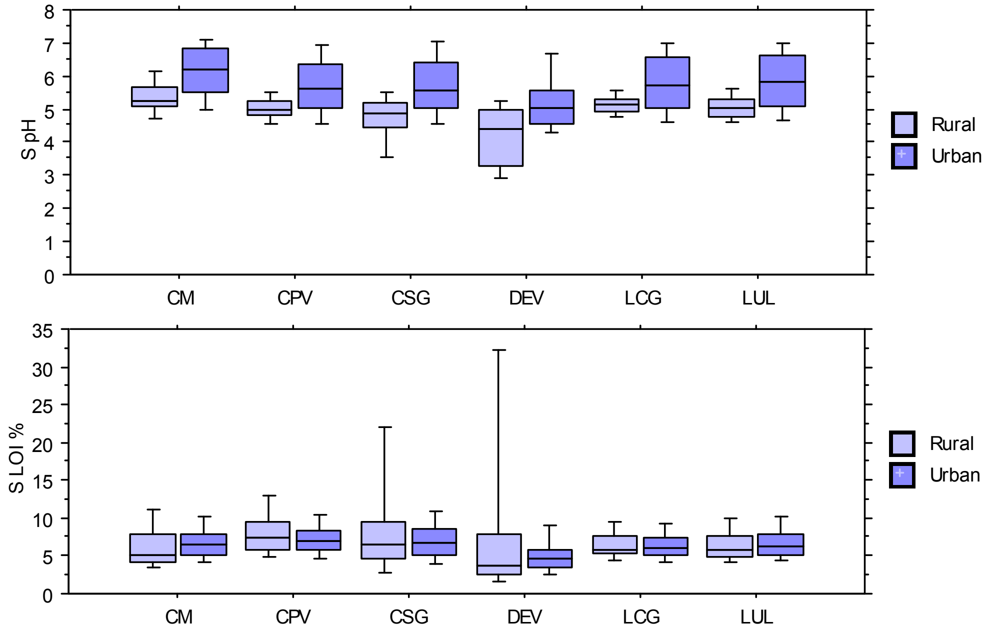

S Ta mg kg-1
3
2.5
2
1.5
1
.5
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

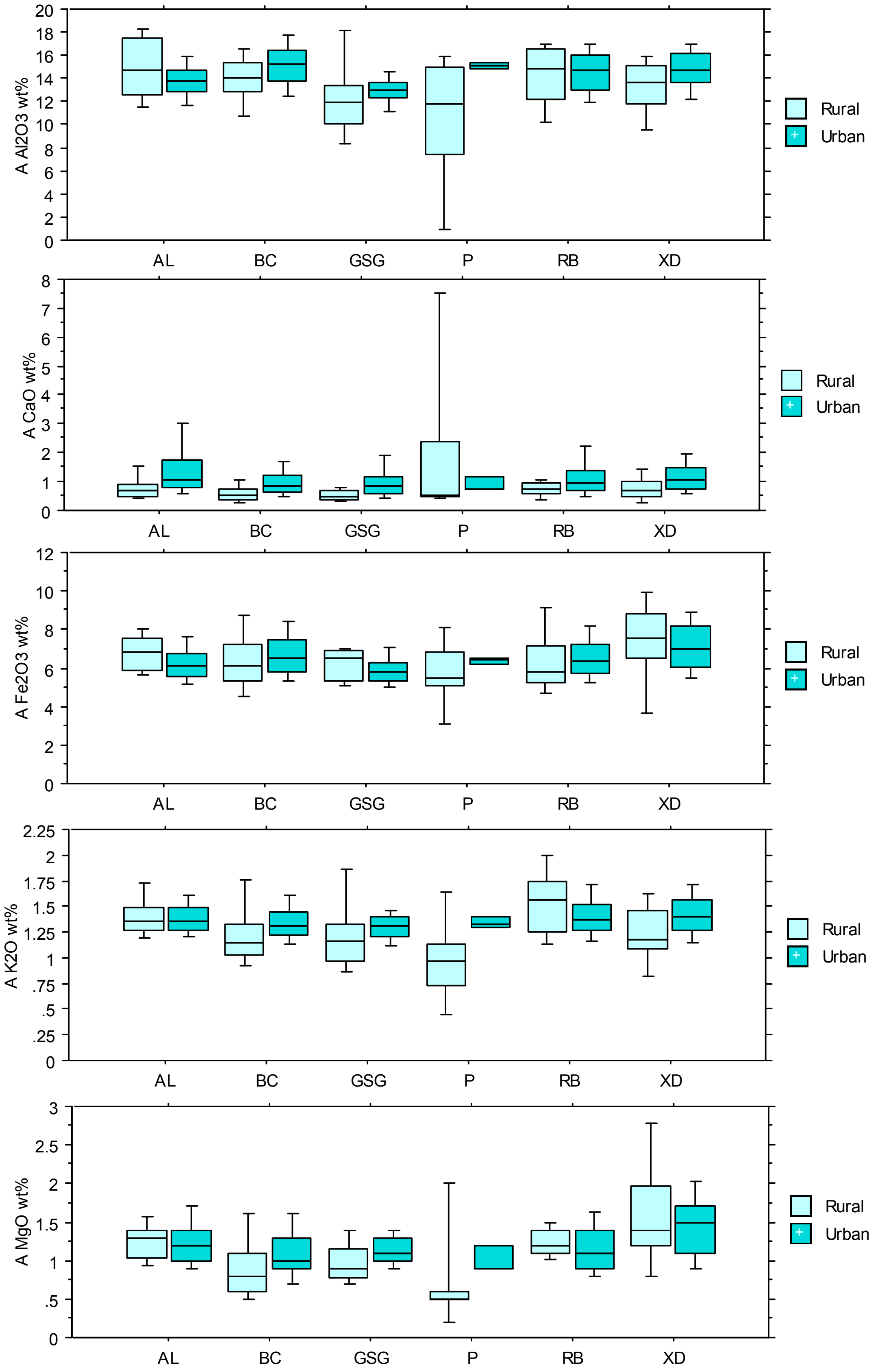

S Te mg kg-1
.6
.5
.4
.3
.2
.1
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban


S Th mg kg-1
12
10
8
6
4
2
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban


S Tl mg kg-1
1.4
1.2
1
.8
.6
.4
.2
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban


S U mg kg-1
S V mg kg-1
S W mg kg-1
S Y mg kg-1
S Zn mg kg-1
S Zr mg kg-1
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

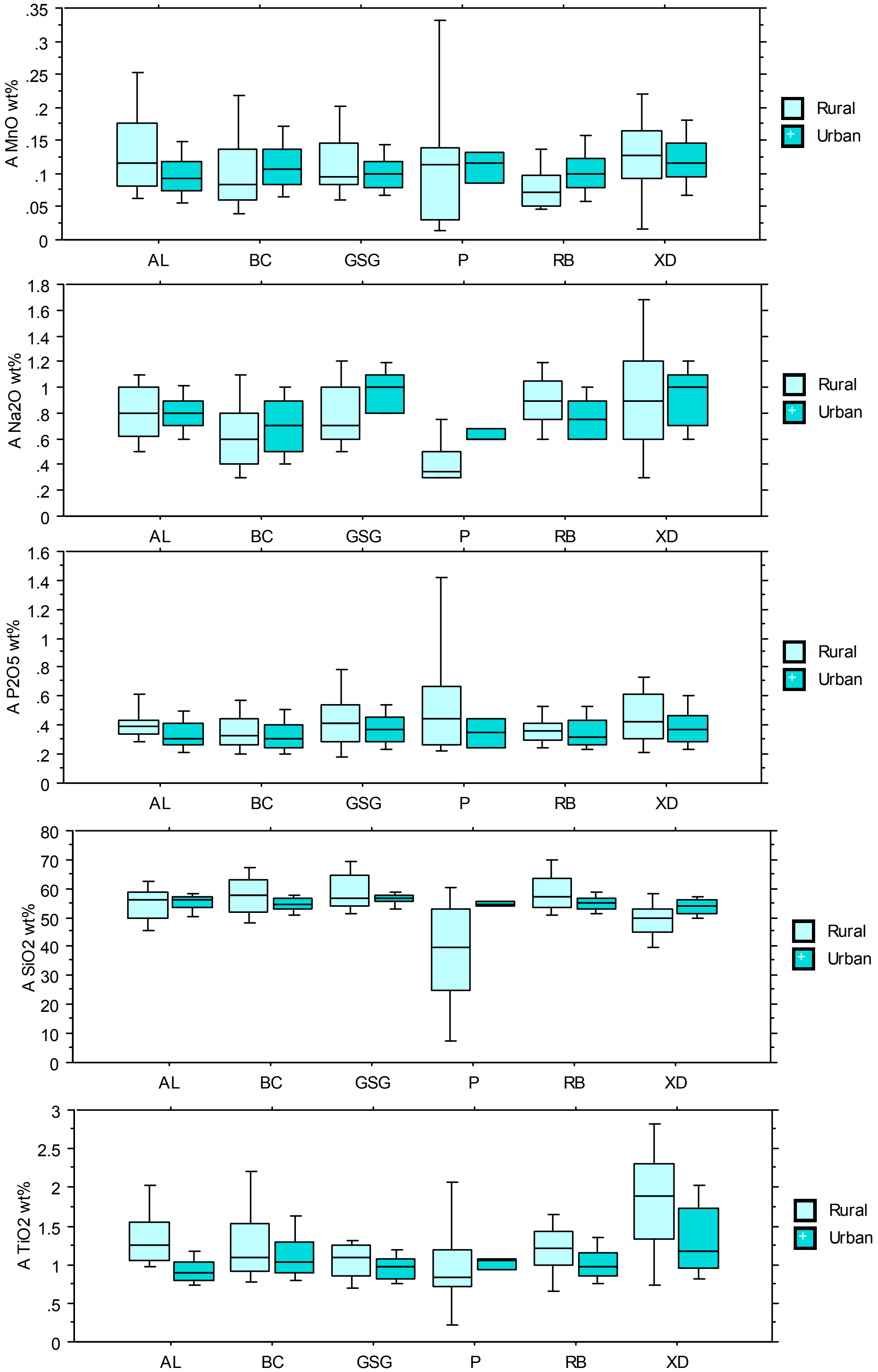

S pH
8
7
6
5
4
3
2
1
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban
S LOI %
35
30
25
20
15
10
5
0
CM
CPV
CSG
DEV
LCG
LUL
Rural
Urban

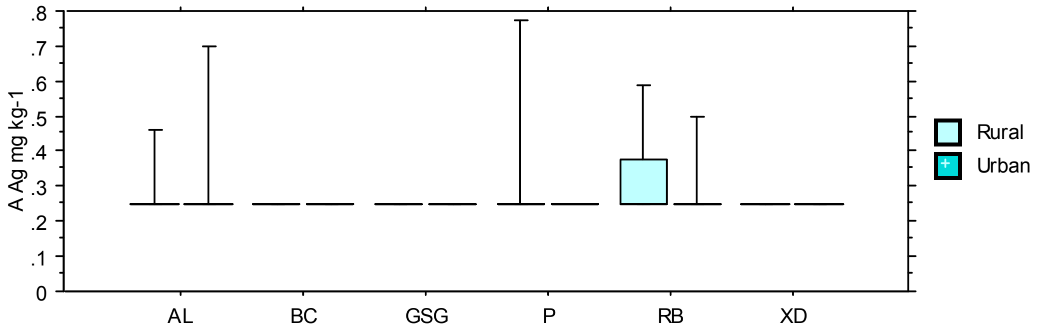
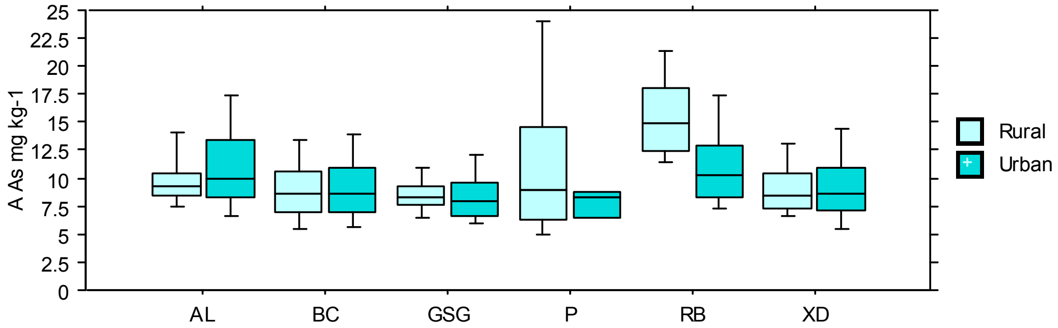
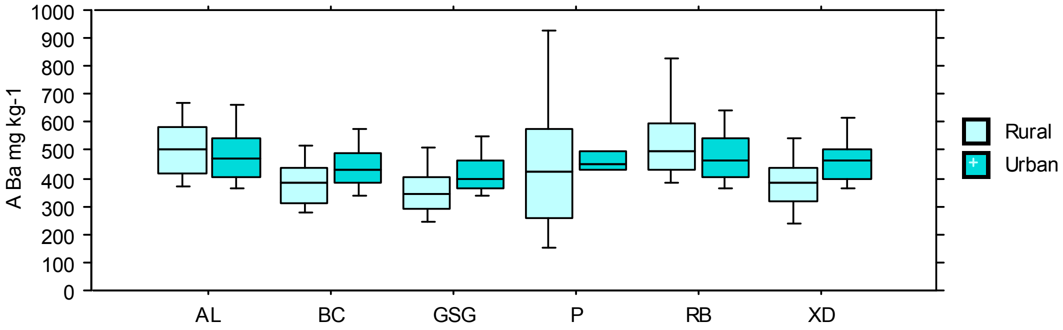
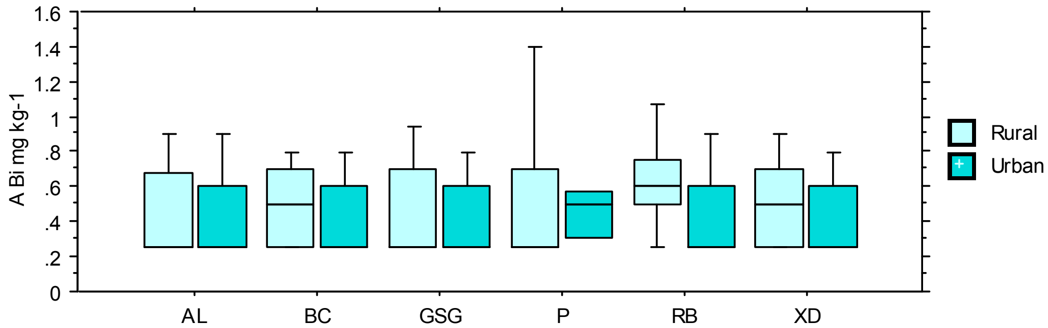
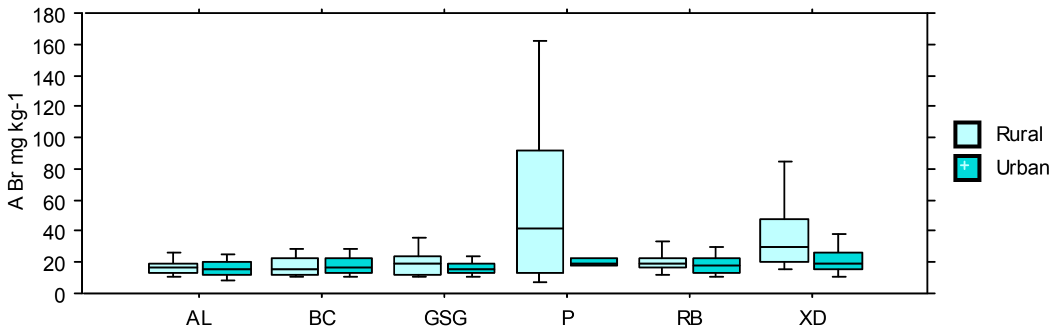
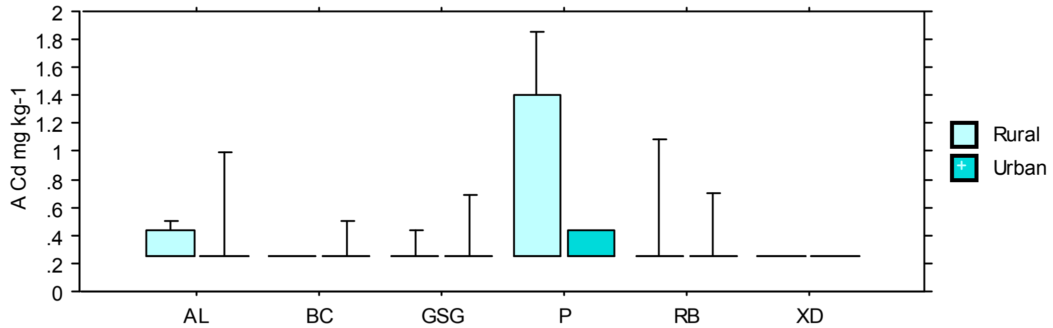


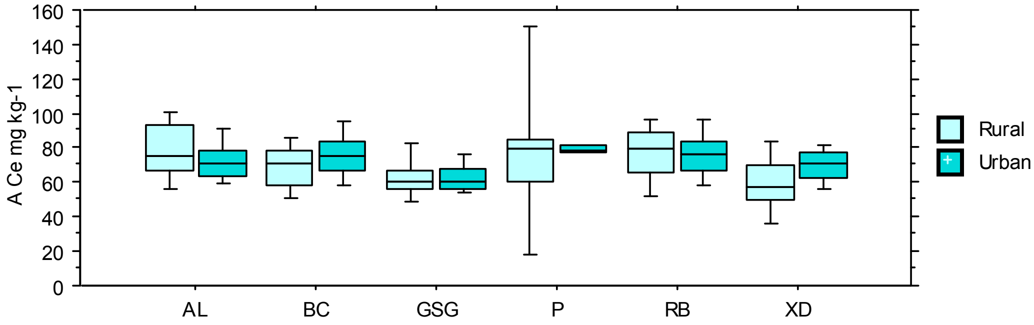

AL = Alluvium: n rural = 19; n urban = 134
GSG = Glaciofluvial deposits: n rural = 13; n urban = 46
RB = Raised beach and marine deposits: n rural = 16; n urban = 372
A = top soil

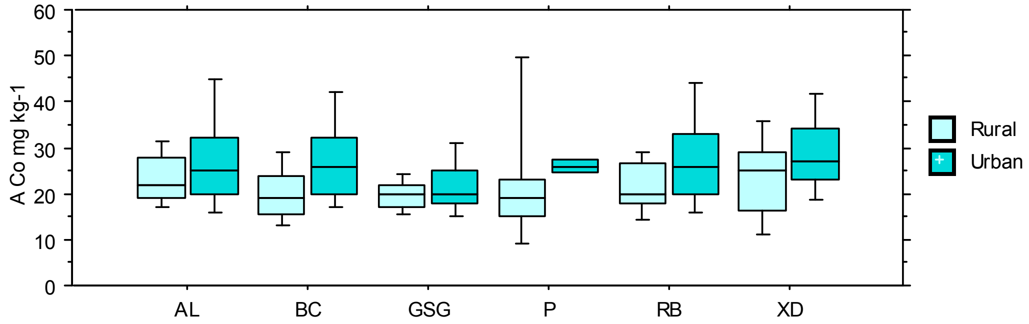
BC = Till and morainic deposits: n rural = 136; n urban = 724
P = Peat: n rural = 10; n urban = 3
XD = No drift: n rural = 47; n urban = 102

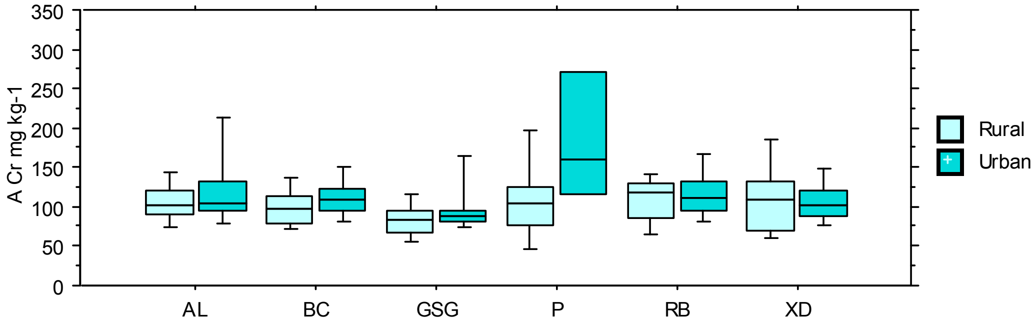
**Figure 3.12 Box and whisker plots of the 10th, 25th, 50th, 75th and 90th percentiles of parameter distributions over the main superficial deposits in rural and urban Glasgow top soils.**

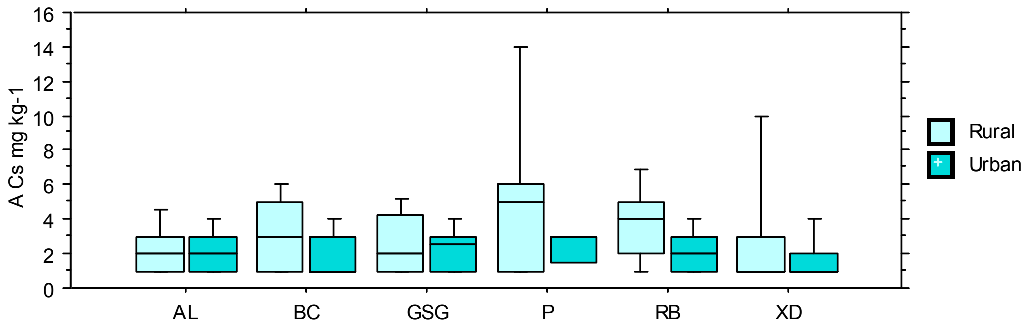

A MnO wt%
.35
.3
.25
.2
.15
.1
.05
0
AL
BC
GSG
P
RB
XD
Rural
Urban
A Na2O wt%
1.8
1.6
1.4
1.2
1
.8
.6
.4
.2
0
AL
BC
GSG
P
RB
XD
Rural
Urban
A P2O5 wt%
1.6
1.4
1.2
1
.8
.6
.4
.2
0
AL
BC
GSG
P
RB
XD
Rural
Urban
A SiO2 wt%
80
70
60
50
40
30
20
10
0
AL
BC
GSG
P
RB
XD
Rural
Urban
A TiO2 wt%
3
2.5
2
1.5
1
.5
0
AL
BC
GSG
P
RB
XD
Rural
Urban

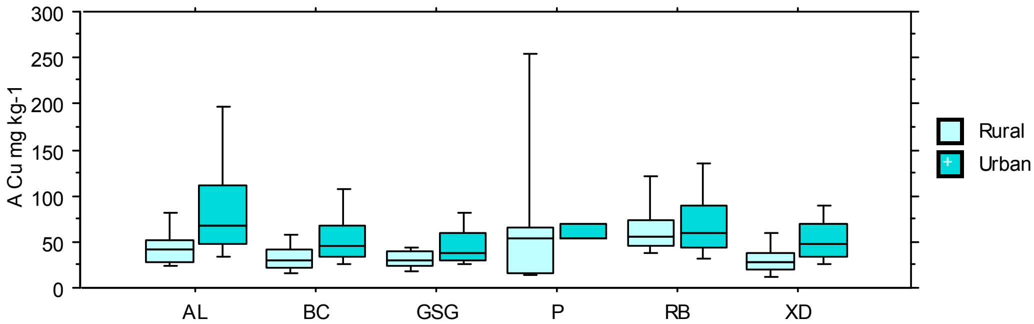

A Ag mg kg-1
0
.1
.2
.3
.4
.5
.6
.7
.8
AL
BC
GSG
P
RB
XD
Rural
Urban

A As mg kg-1
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
AL
BC
GSG
P
RB
XD
Rural
Urban

A Ba mg kg-1
0
100
200
300
400
500
600
700
800
900
1000
AL
BC
GSG
P
RB
XD
Rural
Urban

A Bi mg kg-1
0
.2
.4
.6
.8
1
1.2
1.4
1.6
AL
BC
GSG
P
RB
XD
Rural
Urban

A Br mg kg-1
0
20
40
60
80
100
120
140
160
180
AL
BC
GSG
P
RB
XD
Rural
Urban

A Cd mg kg-1
0
.2
.4
.6
.8
1
1.2
1.4
1.6
1.8
2
AL
BC
GSG
P
RB
XD
Rural
Urban

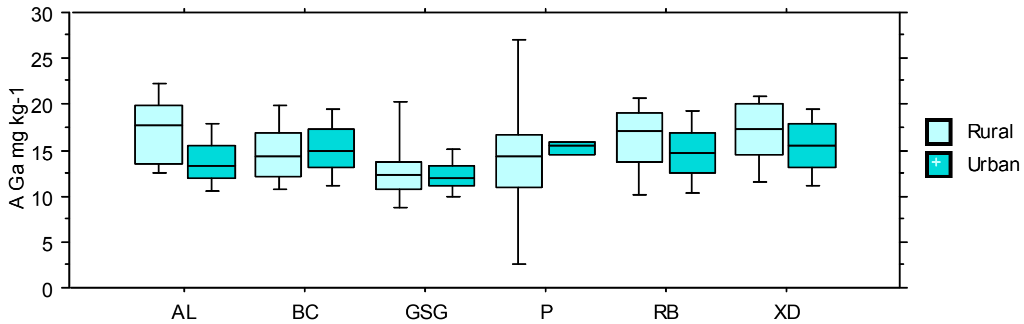

A Ce mg kg-1
160
140
120
100
80
60
40
20
0
AL
BC
GSG
P
RB
XD
Rural
Urban

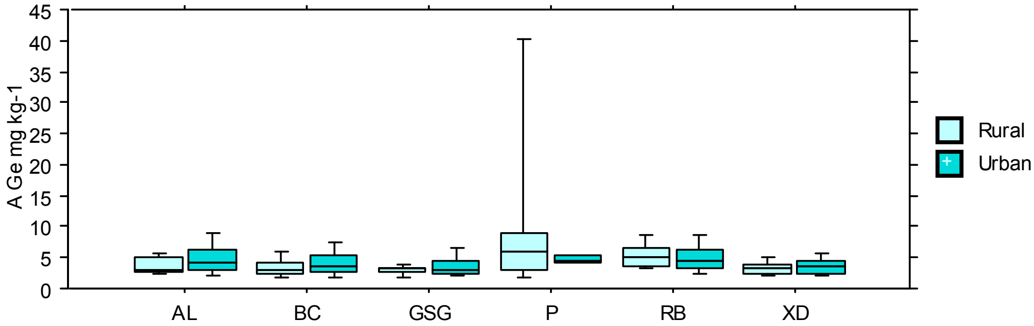

A Co mg kg-1
60
50
40
30
20
10
0
AL
BC
GSG
P
RB
XD
Rural
Urban

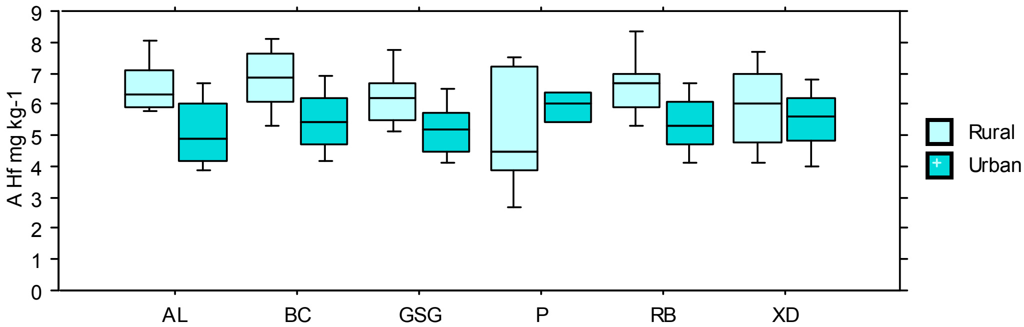

A Cr mg kg-1
350
300
250
200
150
100
50
0
AL
BC
GSG
P
RB
XD
Rural
Urban

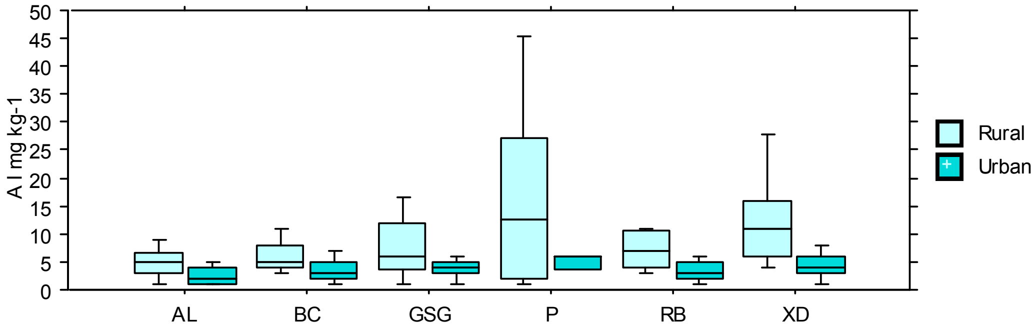

A Cs mg kg-1
16
14
12
10
8
6
4
2
0
AL
BC
GSG
P
RB
XD
Rural
Urban

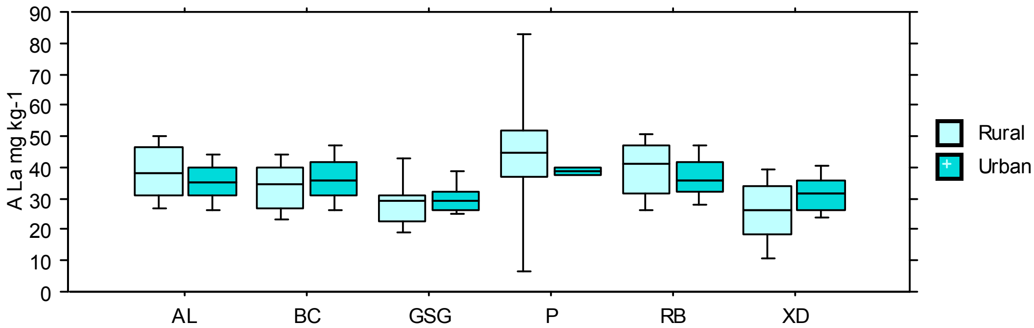

A Cu mg kg-1
300
250
200
150
100
50
0
AL
BC
GSG
P
RB
XD
Rural
Urban

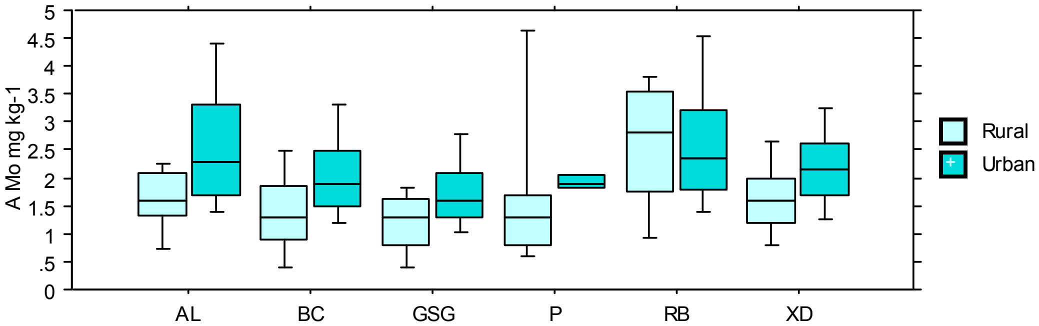

A Ga mg kg-1
30
25
20
15
10
5
0
AL
BC
GSG
P
RB
XD
Rural
Urban

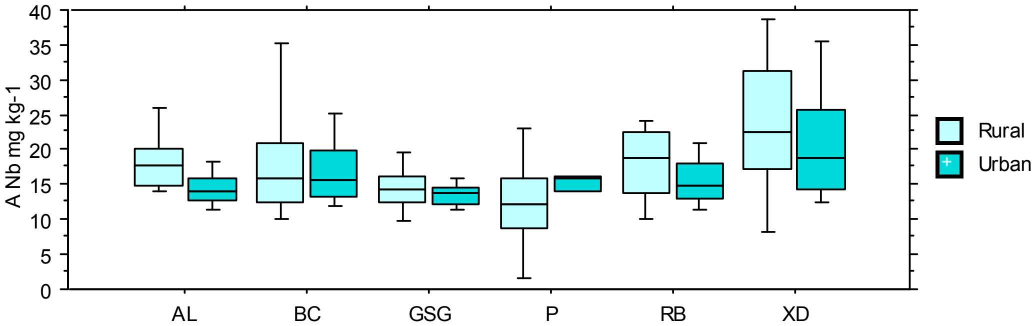

A Ge mg kg-1
0
5
10
15
20
25
30
35
40
45
AL
BC
GSG
P
RB
XD
Rural
Urban

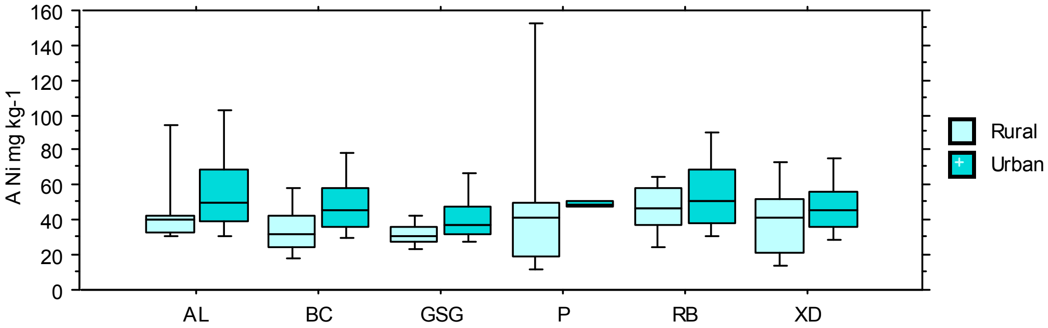

A Hf mg kg-1
0
1
2
3
4
5
6
7
8
9
AL
BC
GSG
P
RB
XD
Rural
Urban

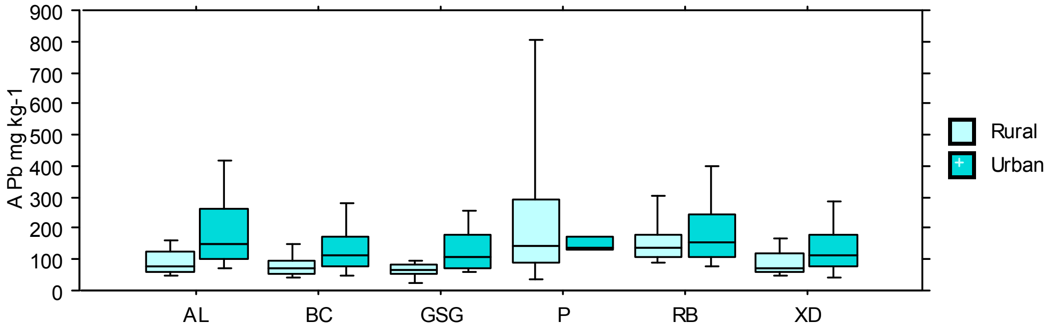

A I mg kg-1
0
5
10
15
20
25
30
35
40
45
50
AL
BC
GSG
P
RB
XD
Rural
Urban

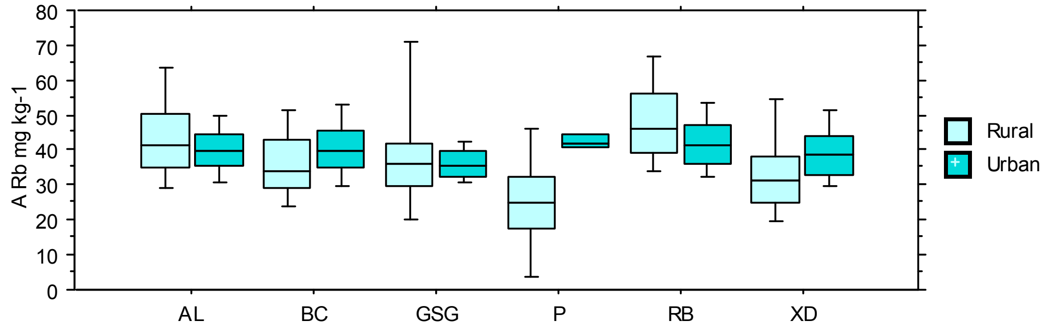

A La mg kg-1
0
10
20
30
40
50
60
70
80
90
AL
BC
GSG
P
RB
XD
Rural
Urban

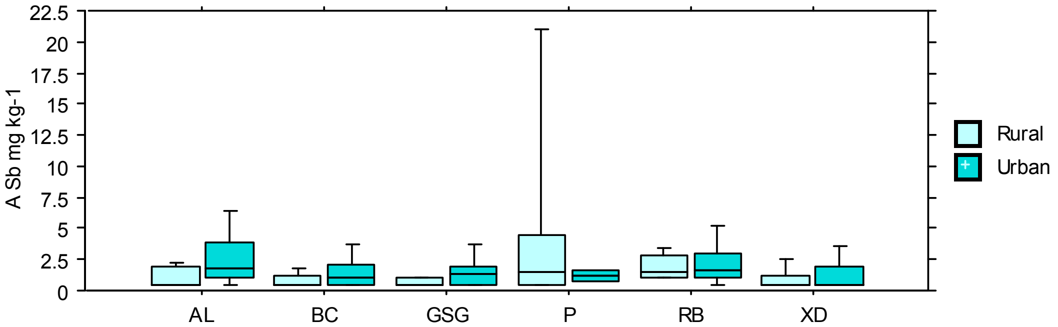

A Mo mg kg-1
0
.5
1
1.5
2
2.5
3
3.5
4
4.5
5
AL
BC
GSG
P
RB
XD
Rural
Urban

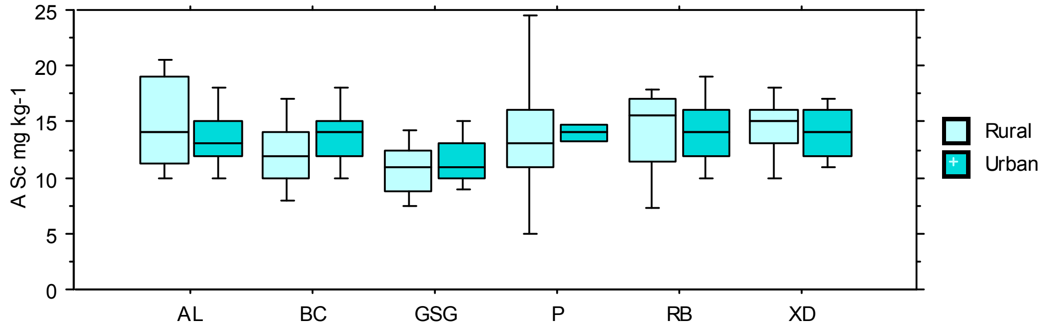

A Nb mg kg-1
0
5
10
15
20
25
30
35
40
AL
BC
GSG
P
RB
XD
Rural
Urban

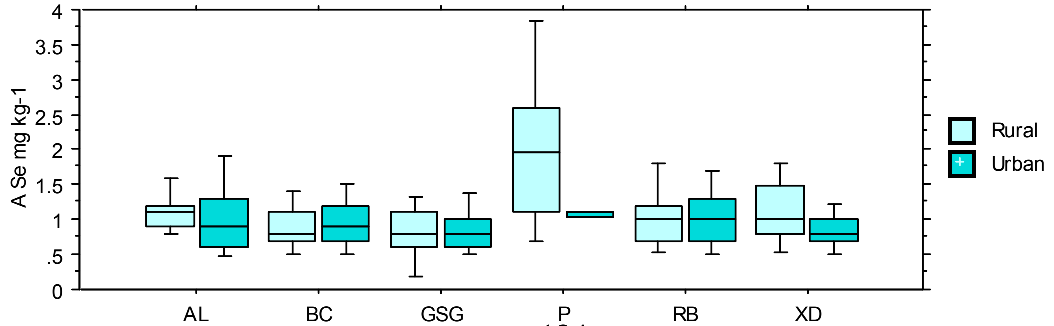

160
140
120
100
80
60
40
20
0
A Ni mg kg-1
AL
BC
GSG
P
RB
XD
Rural
Urban

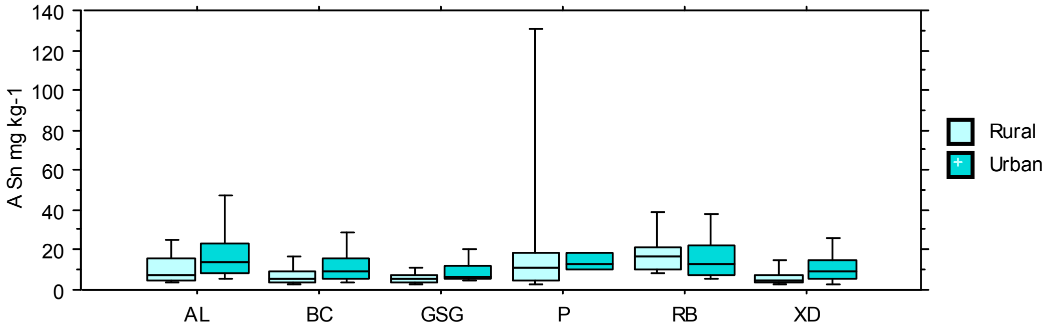

900
800
700
600
500
400
300
200
100
0
A Pb mg kg-1
AL
BC
GSG
P
RB
XD
Rural
Urban

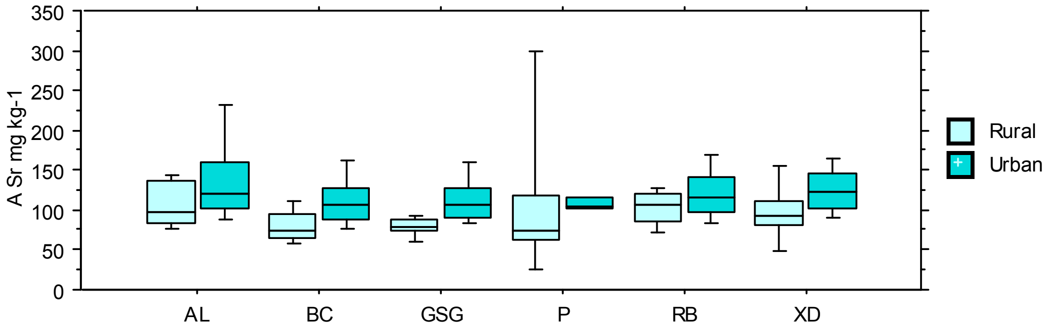

80
70
60
50
40
30
20
10
0
A Rb mg kg-1
AL
BC
GSG
P
RB
XD
Rural
Urban

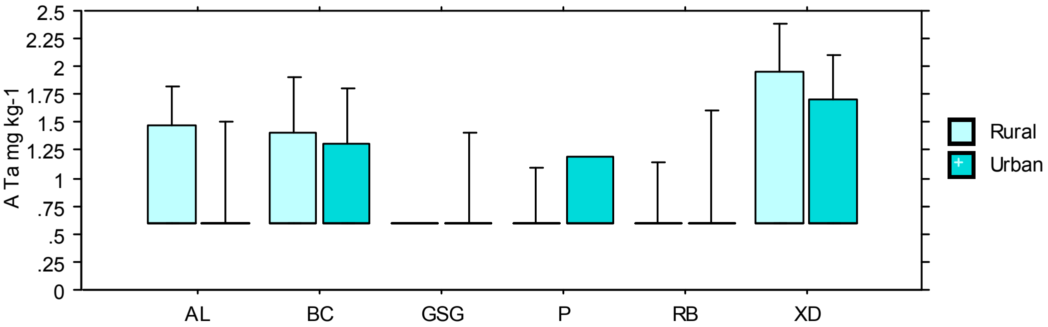

22.5
20
17.5
15
12.5
10
7.5
5
2.5
0
A Sb mg kg-1
AL
BC
GSG
P
RB
XD
Rural
Urban

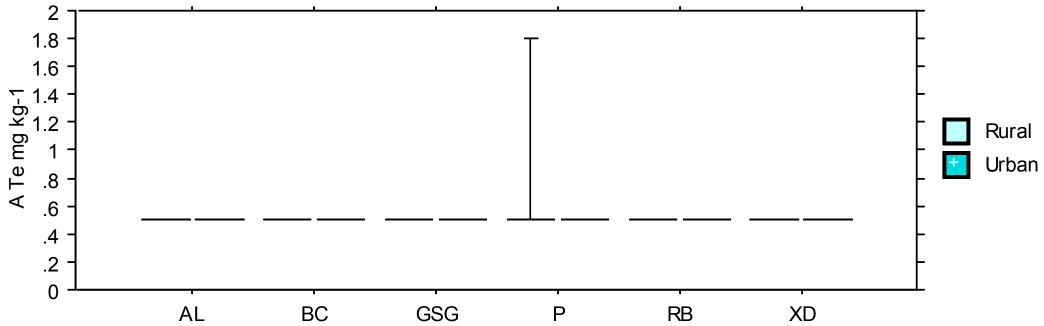

25
20
15
10
5
0
A Sc mg kg-1
AL
BC
GSG
P
RB
XD
Rural
Urban

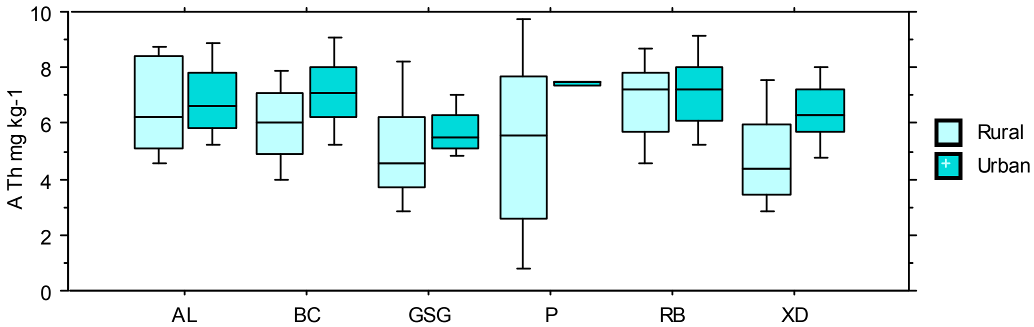

4
3.5
3
2.5
2
1.5
1
.5
0
A Se mg kg-1
AL
BC
GSG
P
RB
XD
Rural
Urban

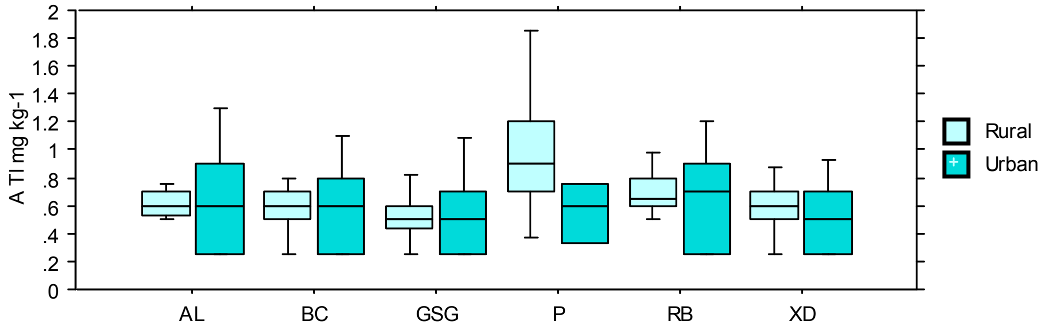

A Sn mg kg-1
140
120
100
80
60
40
20
0
AL
BC
GSG
P
RB
XD
Rural
Urban

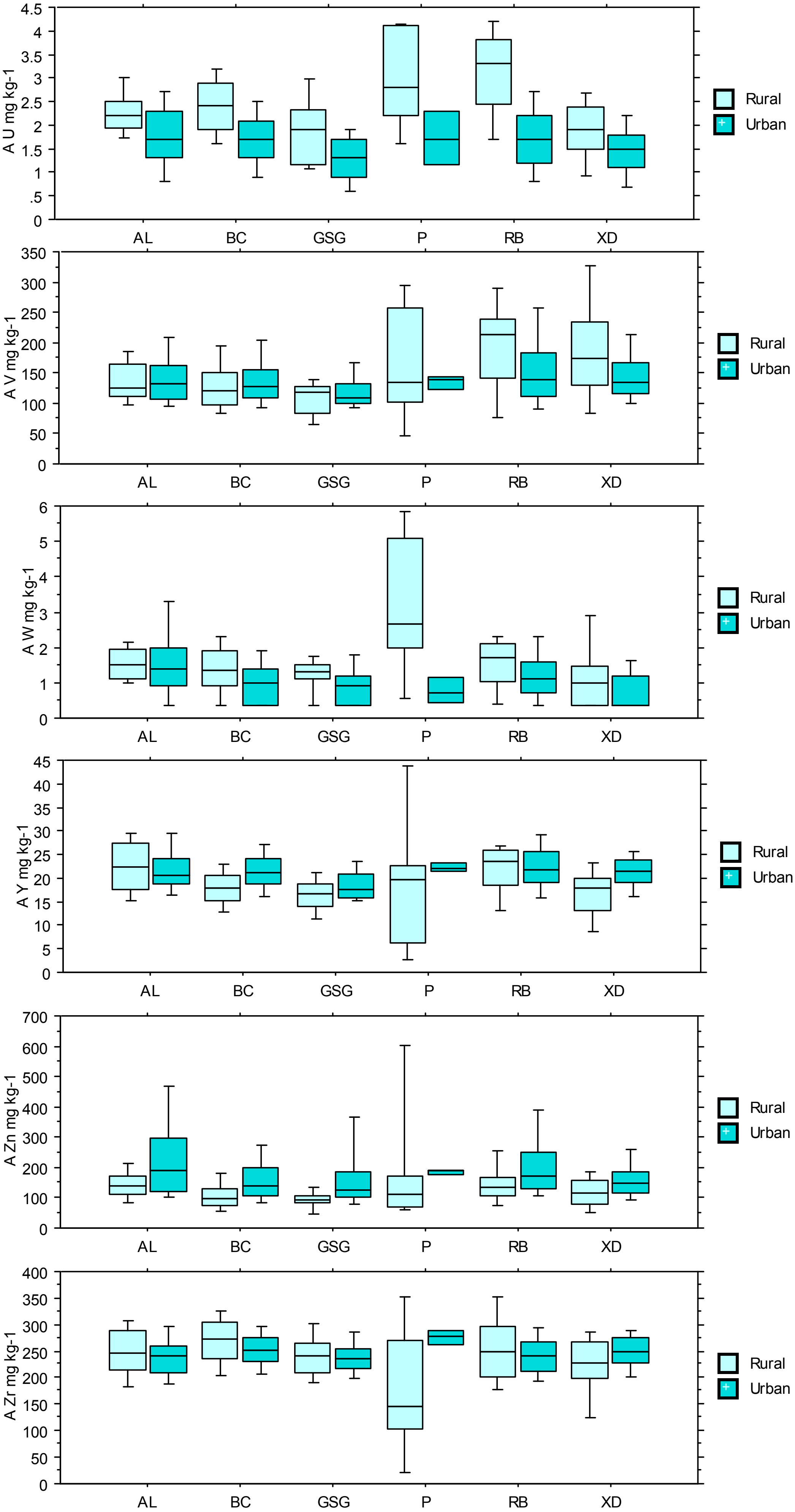

A Sr mg kg-1
350
300
250
200
150
100
50
0
AL
BC
GSG
P
RB
XD
Rural
Urban

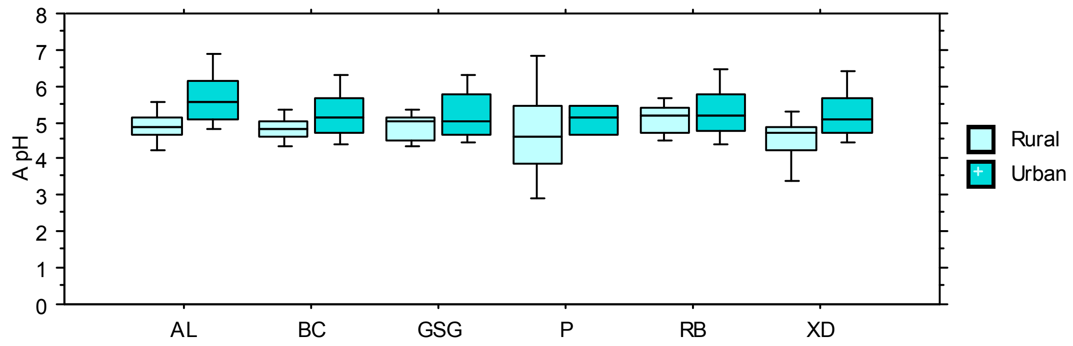

A Ta mg kg-1
2.5
2.25
2
1.75
1.5
1.25
1
.75
.5
.25
0
AL
BC
GSG
P
RB
XD
Rural
Urban

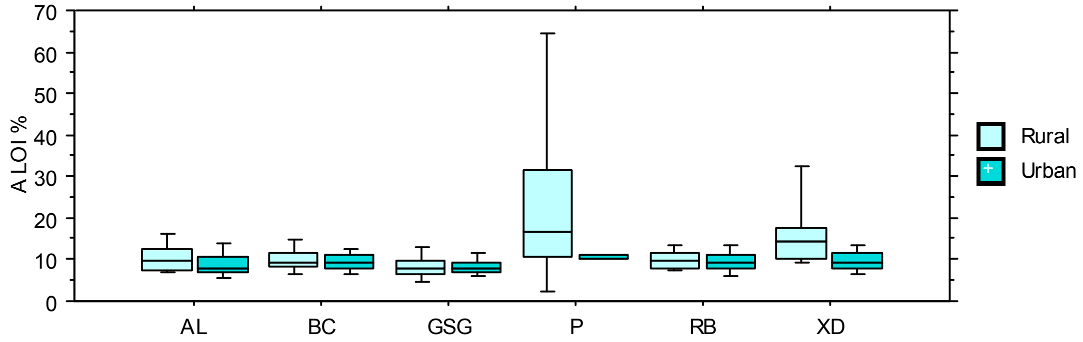

A Te mg kg-1
2
1.8
1.6
1.4
1.2
1
.8
.6
.4
.2
0
AL
BC
GSG
P
RB
XD
Rural
Urban

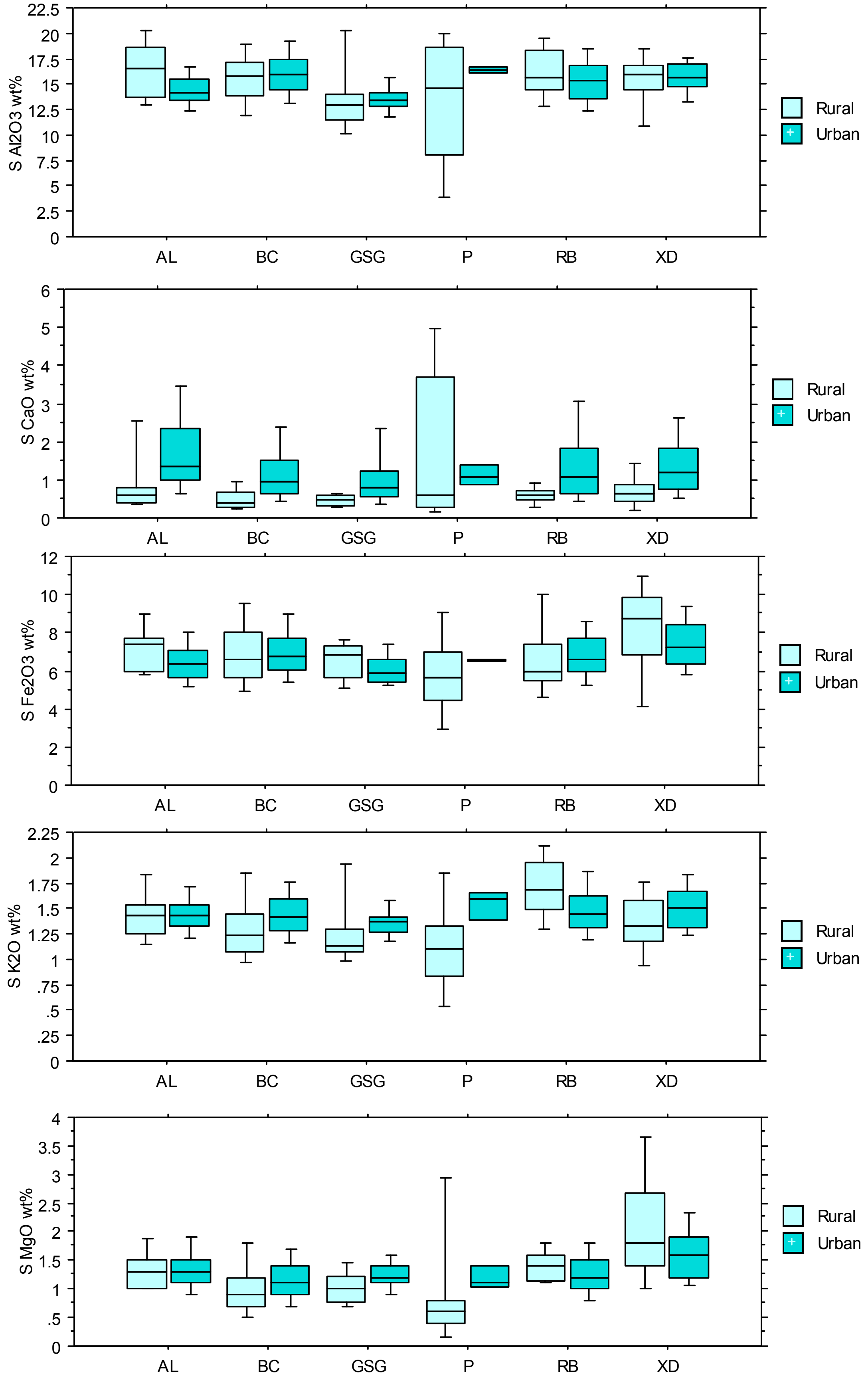

A Th mg kg-1
10
8
6
4
2
0
AL
BC
GSG
P
RB
XD
Rural
Urban


A Tl mg kg-1
2
1.8
1.6
1.4
1.2
1
.8
.6
.4
.2
0
AL
BC
GSG
P
RB
XD
Rural
Urban


A U mg kg-1
A V mg kg-1
A W mg kg-1
A Y mg kg-1
A Zn mg kg-1
A Zr mg kg-1
AL
BC
GSG
P
RB
XD
Rural
Urban

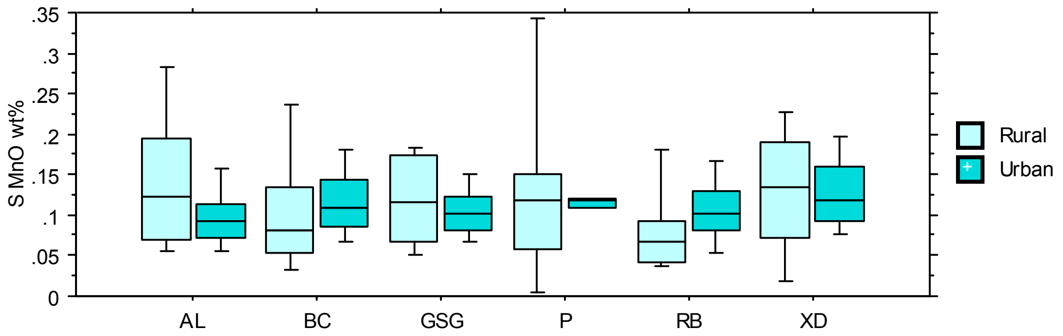

A pH
Rural
Urban
AL
BC
GSG
P
RB
XD

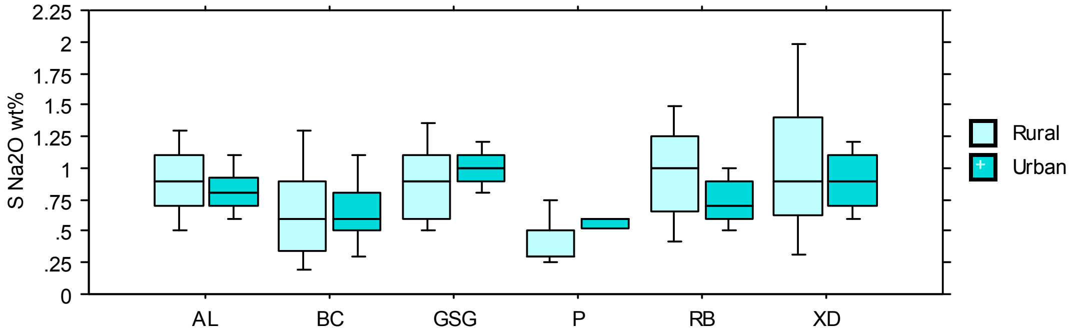

A LOI %
Rural
Urban
AL
BC
GSG
P
RB
XD

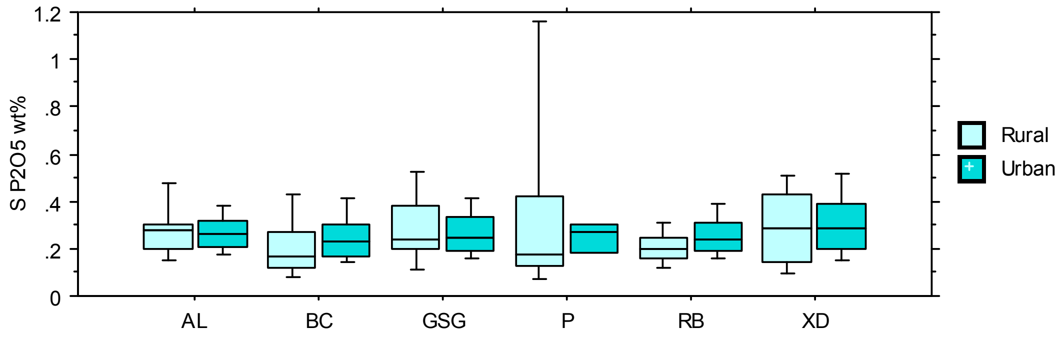


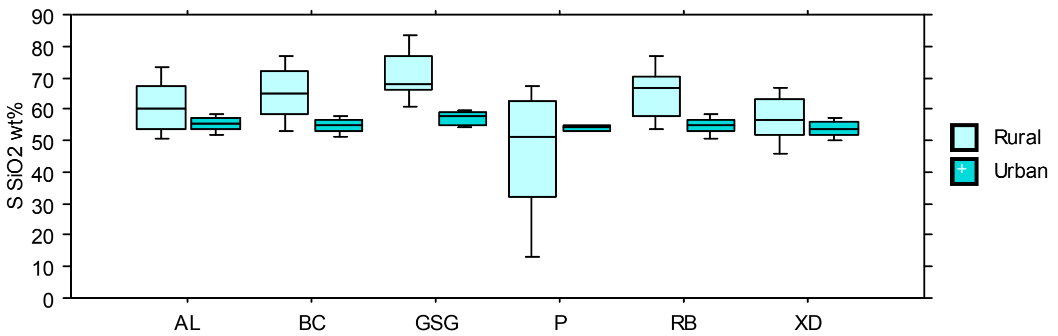

AL = Alluvium: n rural = 19; n urban = 133
GSG = Glaciofluvial deposits: n rural = 13; n urban = 46
RB = Raised beach and marine deposits: n rural = 16; n urban = 361
S = deeper soil
BC = Till and morainic deposits: n rural = 136; n urban = 723
P = Peat: n rural = 10; n urban = 3
XD = No drift: n rural = 47; n urban = 102

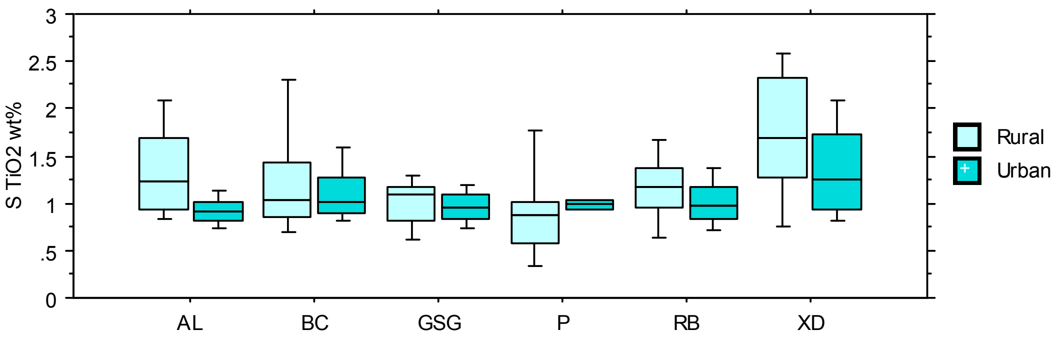
**Figure 3.13 Box and whisker plots of the 10th, 25th, 50th, 75th and 90th percentiles of parameter distributions over the main superficial deposits in rural and urban Glasgow deeper soils.**

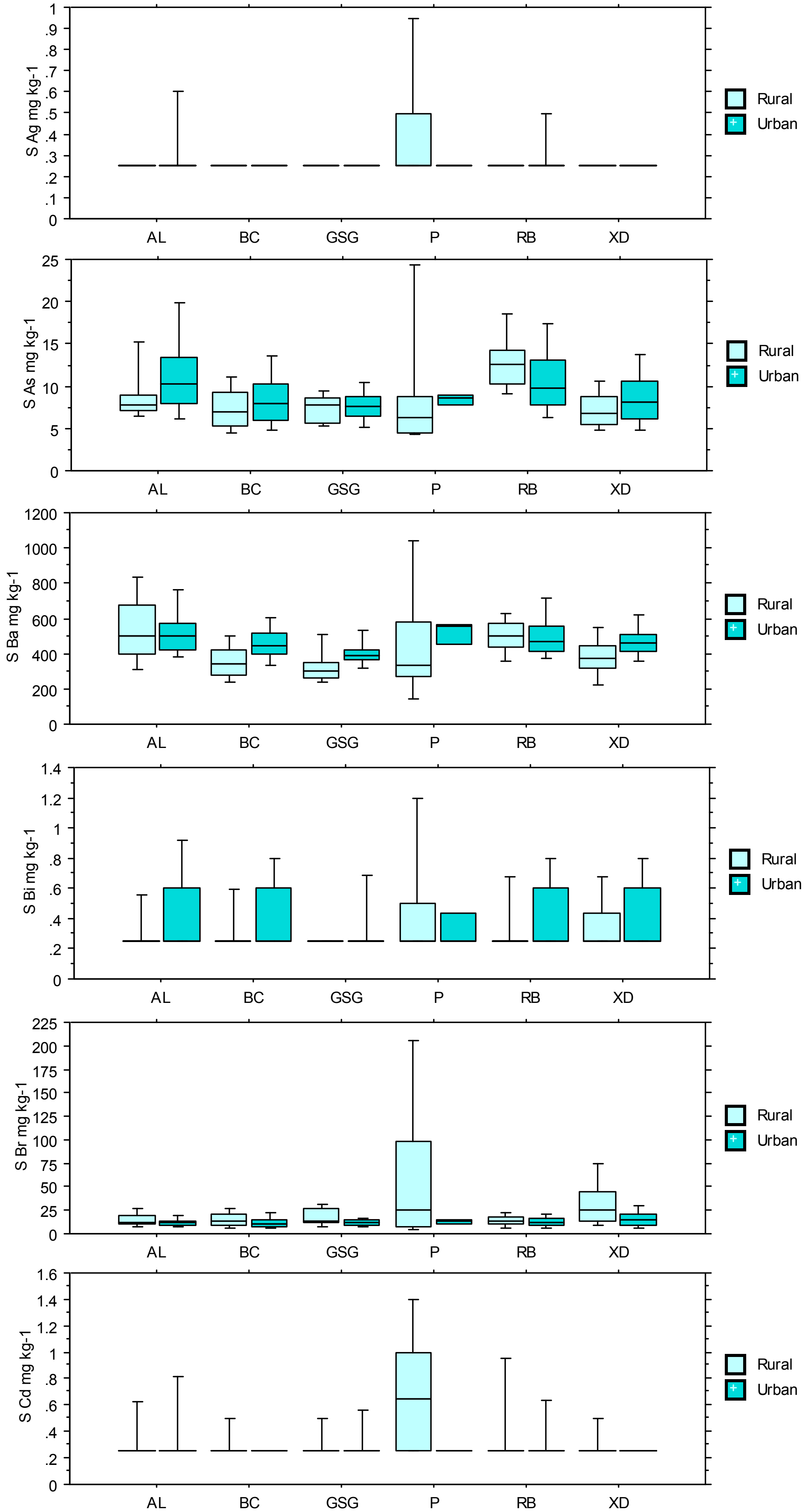

S MnO wt%
0
.05
.1
.15
.2
.25
.3
.35
AL
BC
GSG
P
RB
XD
Rural
Urban

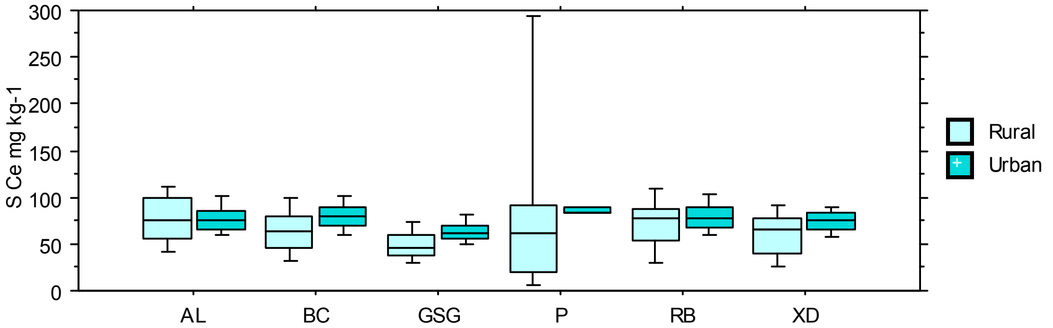

S Na2O wt%
0
.25
.5
.75
1
1.25
1.5
1.75
2
2.25
AL
BC
GSG
P
RB
XD
Rural
Urban

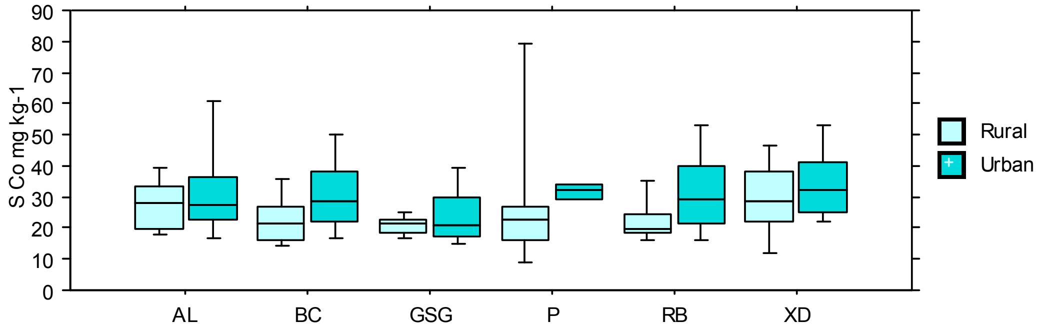

S P2O5 wt%
0
.2
.4
.6
.8
1
1.2
AL
BC
GSG
P
RB
XD
Rural
Urban

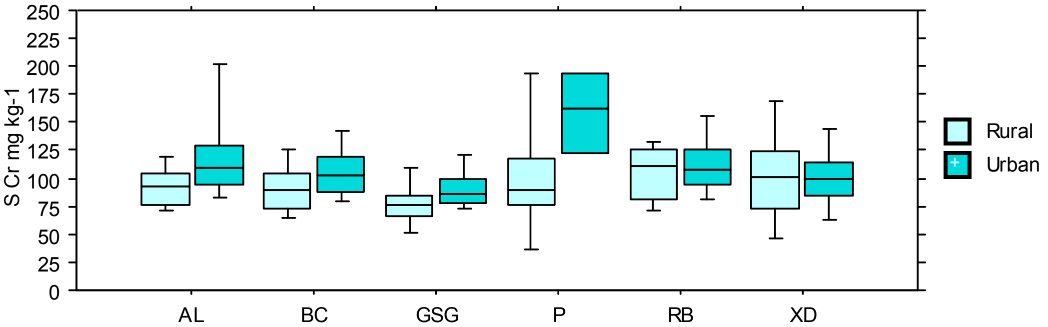

S SiO2 wt%
0
10
20
30
40
50
60
70
80
90
AL
BC
GSG
P
RB
XD
Rural
Urban

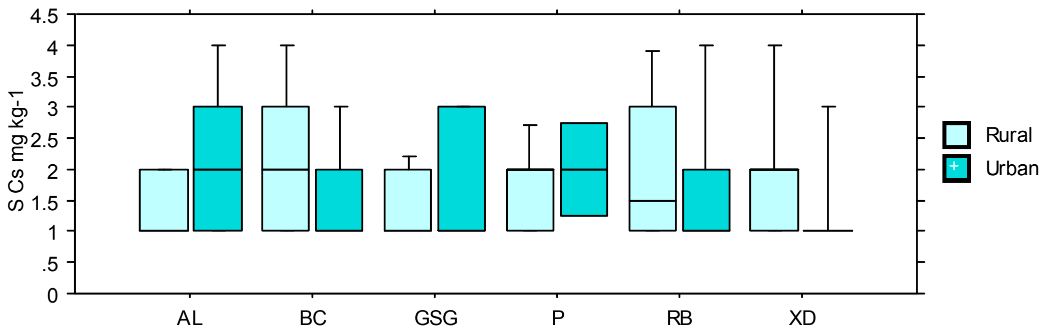

S TiO2 wt%
0
.5
1
1.5
2
2.5
3
AL
BC
GSG
P
RB
XD
Rural
Urban

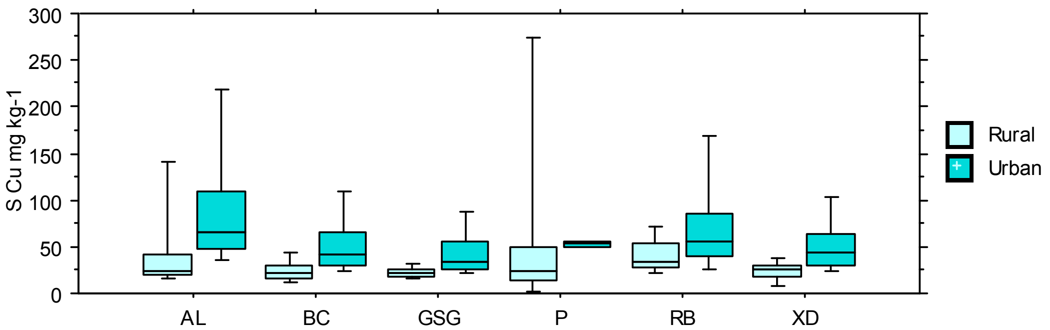

S Ag mg kg-1
S As mg kg-1
S Ba mg kg-1
S Bi mg kg-1
S Br mg kg-1
S Cd mg kg-1
AL
BC
GSG
P
RB
XD
Rural
Urban

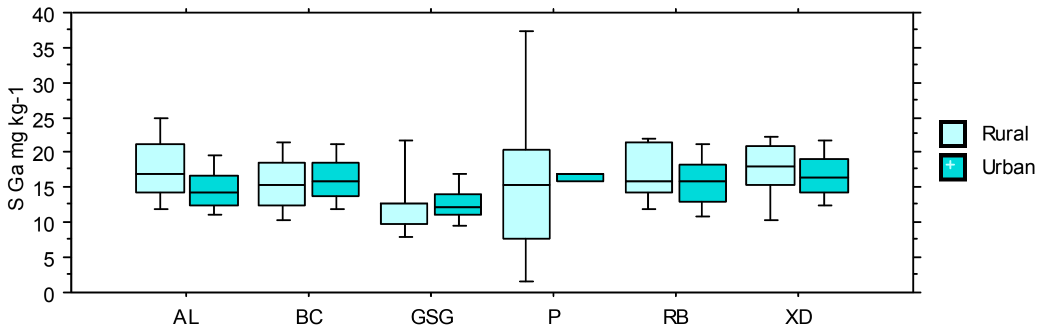

S Ce mg kg-1
300
250
200
150
100
50
0
AL
BC
GSG
P
RB
XD
Rural
Urban

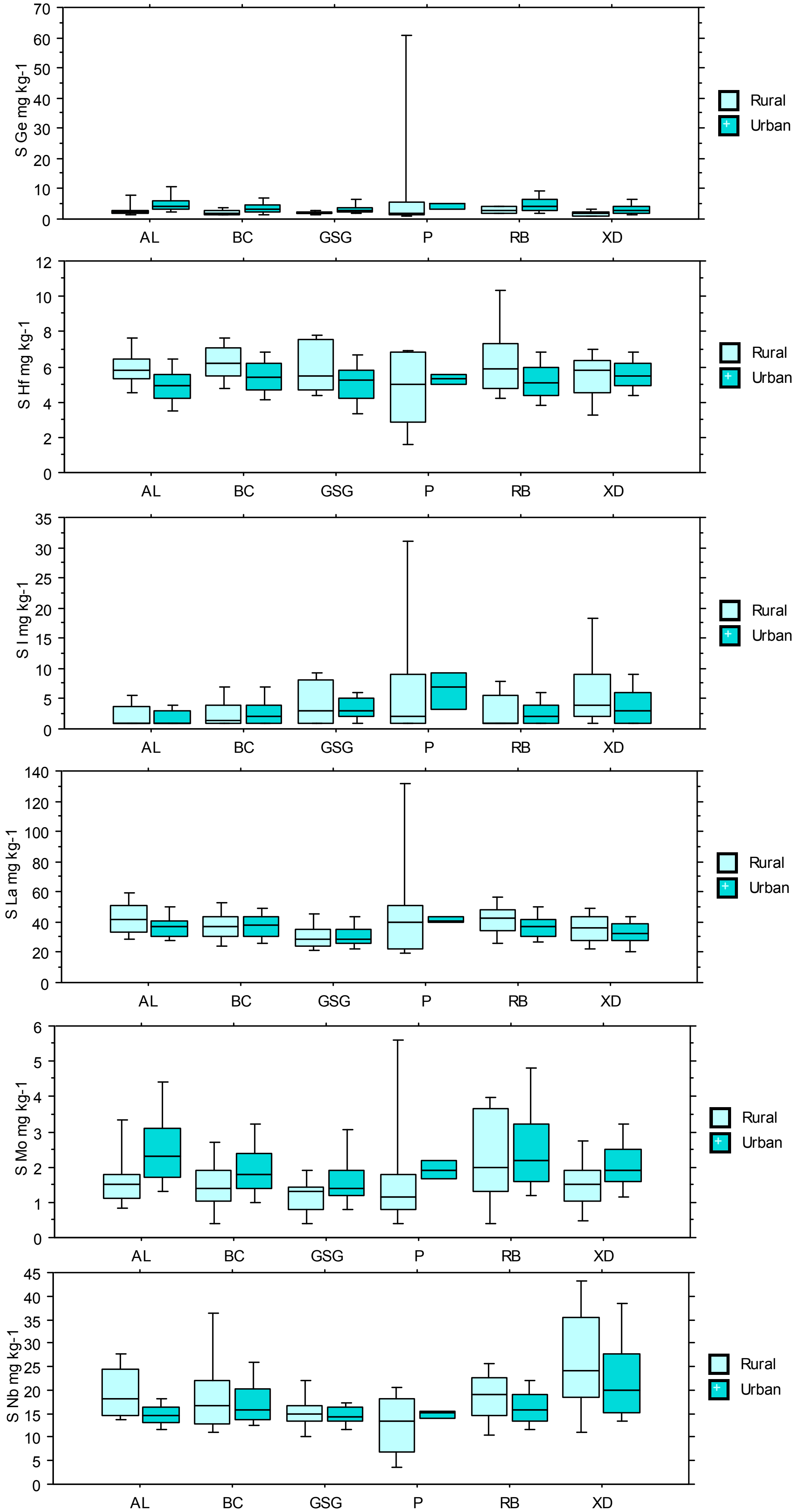

S Co mg kg-1
90
80
70
60
50
40
30
20
10
0
AL
BC
GSG
P
RB
XD
Rural
Urban

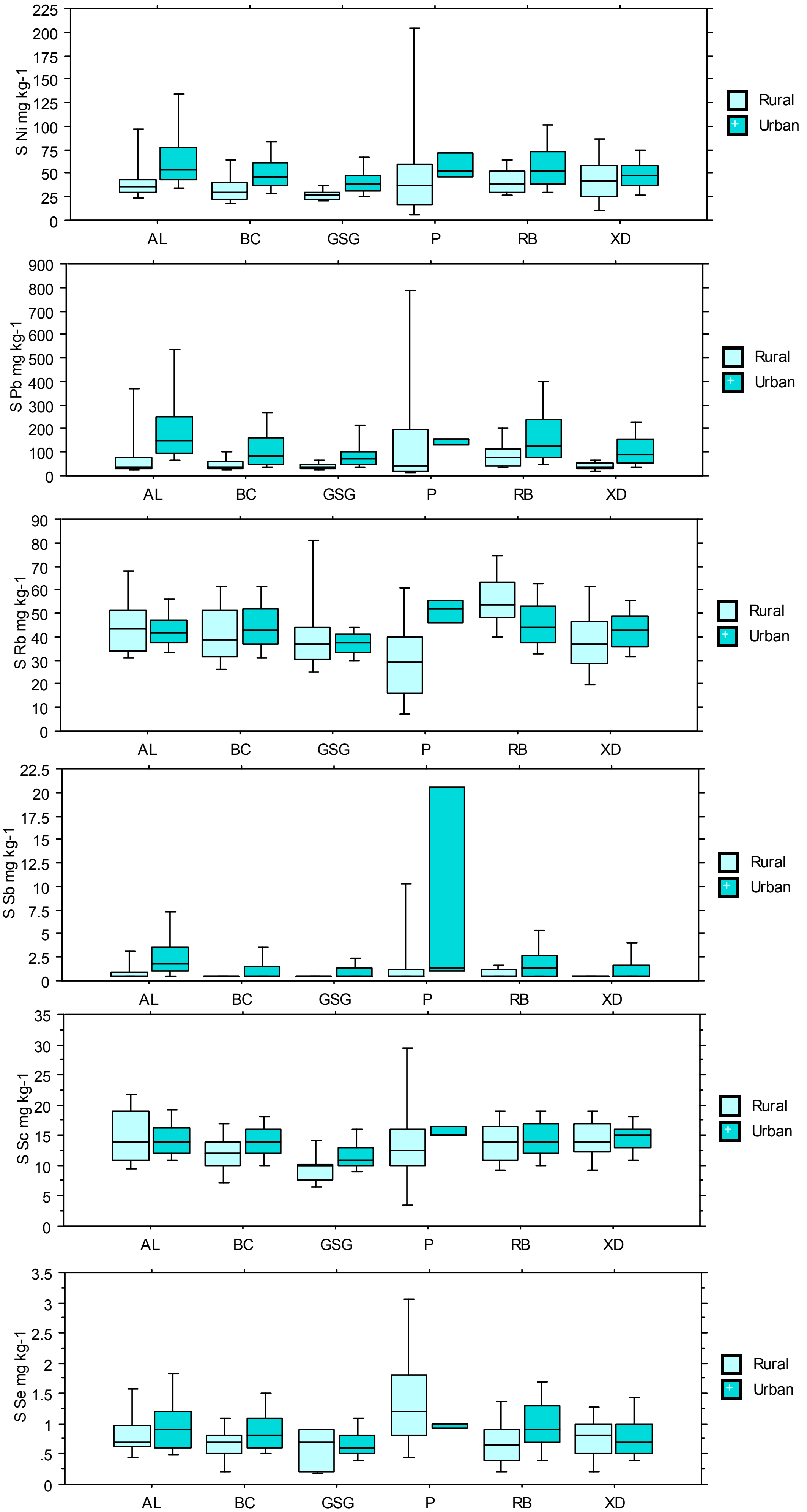

S Cr mg kg-1
250
225
200
175
150
125
100
75
50
25
0
AL
BC
GSG
P
RB
XD
Rural
Urban

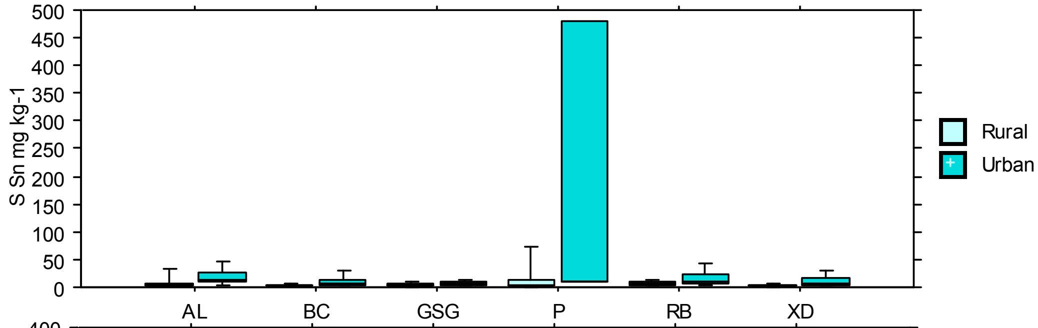

S Cs mg kg-1
4.5
4
3.5
3
2.5
2
1.5
1
.5
0
AL
BC
GSG
P
RB
XD
Rural
Urban

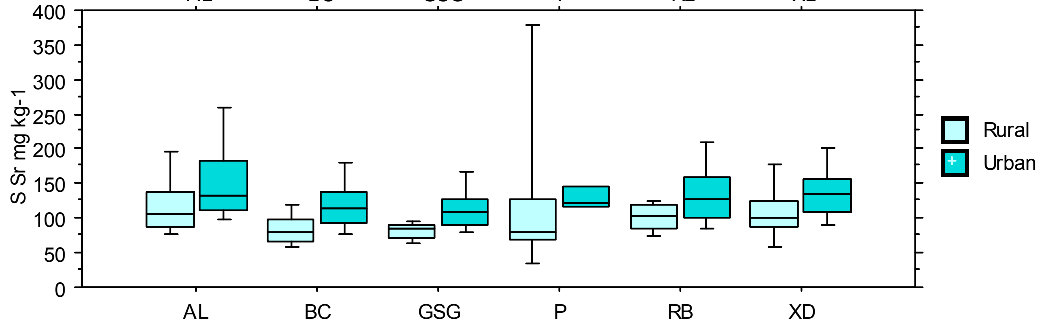

S Cu mg kg-1
300
250
200
150
100
50
0
AL
BC
GSG
P
RB
XD
Rural
Urban

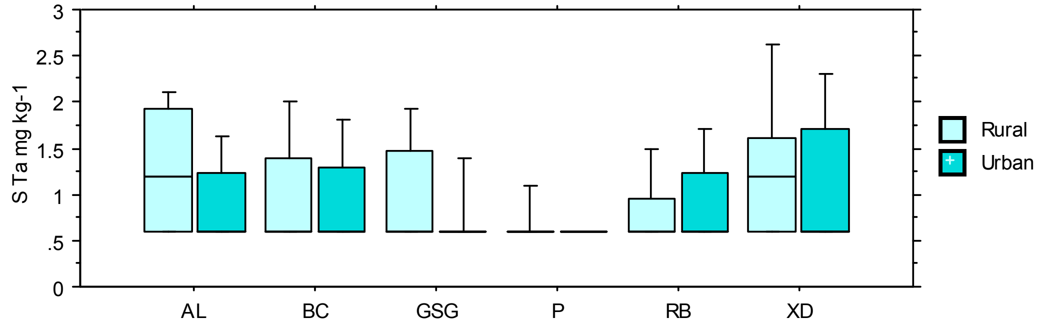

S Ga mg kg-1
40
35
30
25
20
15
10
5
0
AL
BC
GSG
P
RB
XD
Rural
Urban

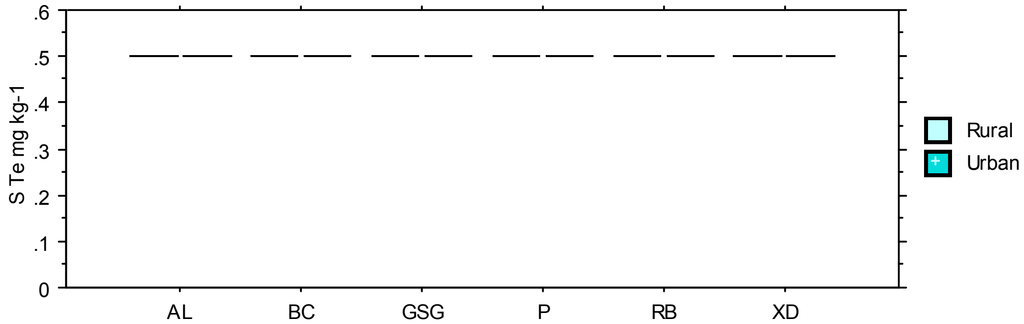

S Ge mg kg-1
0
10
20
30
40
50
60
70
AL
BC
GSG
P
RB
XD
Rural
Urban
S Hf mg kg-1
0
2
4
6
8
10
12
AL
BC
GSG
P
RB
XD
Rural
Urban
S I mg kg-1
0
5
10
15
20
25
30
35
AL
BC
GSG
P
RB
XD
Rural
Urban
S La mg kg-1
0
20
40
60
80
100
120
140
AL
BC
GSG
P
RB
XD
Rural
Urban
S Mo mg kg-1
0
1
2
3
4
5
6
AL
BC
GSG
P
RB
XD
Rural
Urban
S Nb mg kg-1
0
5
10
15
20
25
30
35
40
45
AL
BC
GSG
P
RB
XD
Rural
Urban

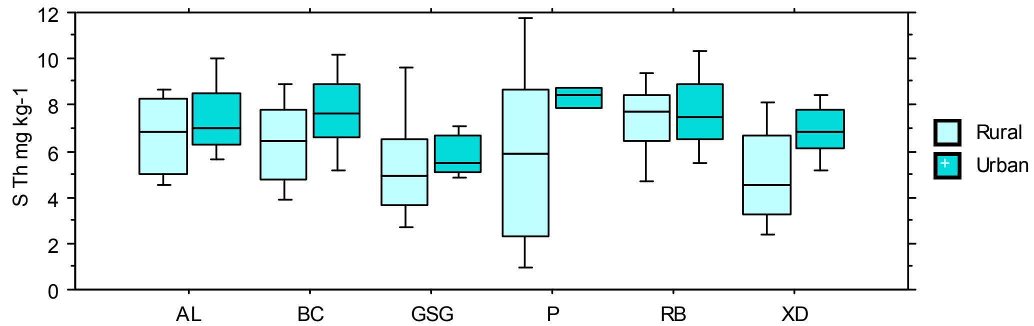

S Ni mg kg-1
S Pb mg kg-1
S Rb mg kg-1
S Sb mg kg-1
S Sc mg kg-1
S Se mg kg-1
AL
BC
GSG
P
RB
XD
Rural
Urban

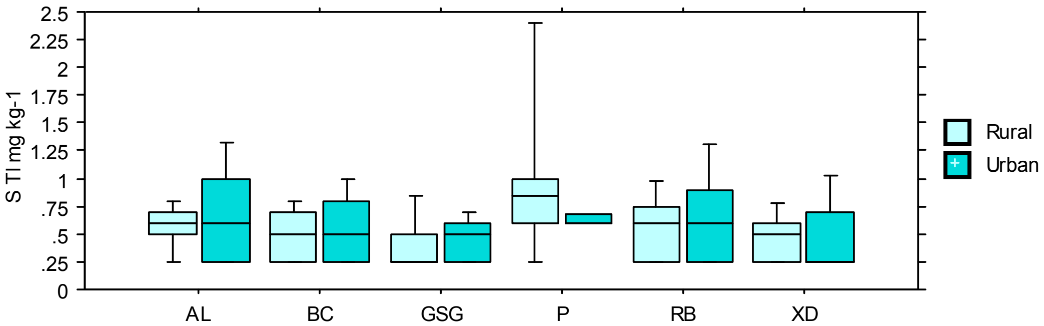

S Sn mg kg-1
0
50
100
150
200
250
300
350
400
450
500
AL
BC
GSG
P
RB
XD
Rural
Urban

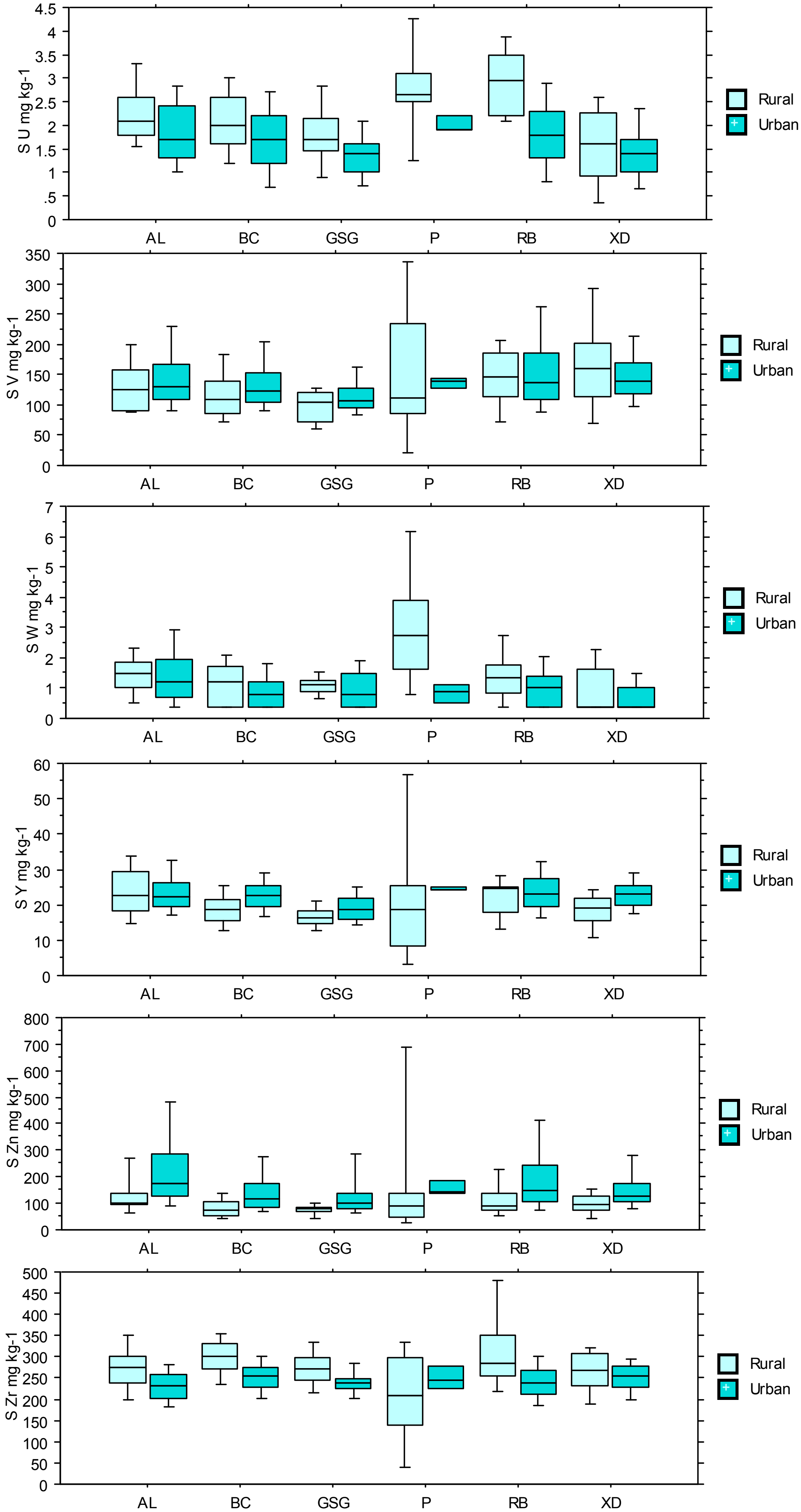

S Sr mg kg-1
0
50
100
150
200
250
300
350
400
AL
BC
GSG
P
RB
XD
Rural
Urban

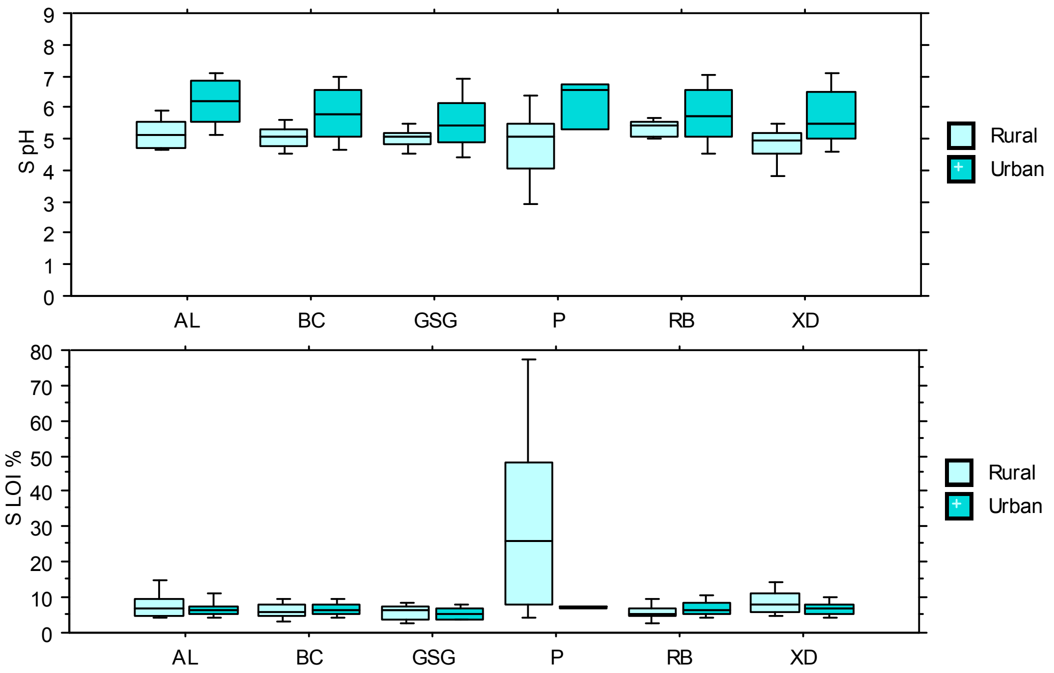

S Ta mg kg-1
0
.5
1
1.5
2
2.5
3
AL
BC
GSG
P
RB
XD
Rural
Urban


S Te mg kg-1
0
.1
.2
.3
.4
.5
.6
AL
BC
GSG
P
RB
XD
Rural
Urban


S Th mg kg-1
0
2
4
6
8
10
12
AL
BC
GSG
P
RB
XD
Rural
Urban


S Tl mg kg-1
0
.25
.5
.75
1
1.25
1.5
1.75
2
2.25
2.5
AL
BC
GSG
P
RB
XD
Rural
Urban


S U mg kg-1
4.5
4
3.5
3
2.5
2
1.5
1
.5
0
AL
BC
GSG
P
RB
XD
Rural
Urban
S V mg kg-1
350
300
250
200
150
100
50
0
AL
BC
GSG
P
RB
XD
Rural
Urban
S W mg kg-1
7
6
5
4
3
2
1
0
AL
BC
GSG
P
RB
XD
Rural
Urban
S Y mg kg-1
60
50
40
30
20
10
0
AL
BC
GSG
P
RB
XD
Rural
Urban
S Zn mg kg-1
800
700
600
500
400
300
200
100
0
AL
BC
GSG
P
RB
XD
Rural
Urban
S Zr mg kg-1
500
450
400
350
300
250
200
150
100
50
0
AL
BC
GSG
P
RB
XD
Rural
Urban


S pH
9
8
7
6
5
4
3
2
1
0
AL
BC
GSG
P
RB
XD
Rural
Urban
S LOI %
80
70
60
50
40
30
20
10
0
AL
BC
GSG
P
RB
XD
Rural
Urban

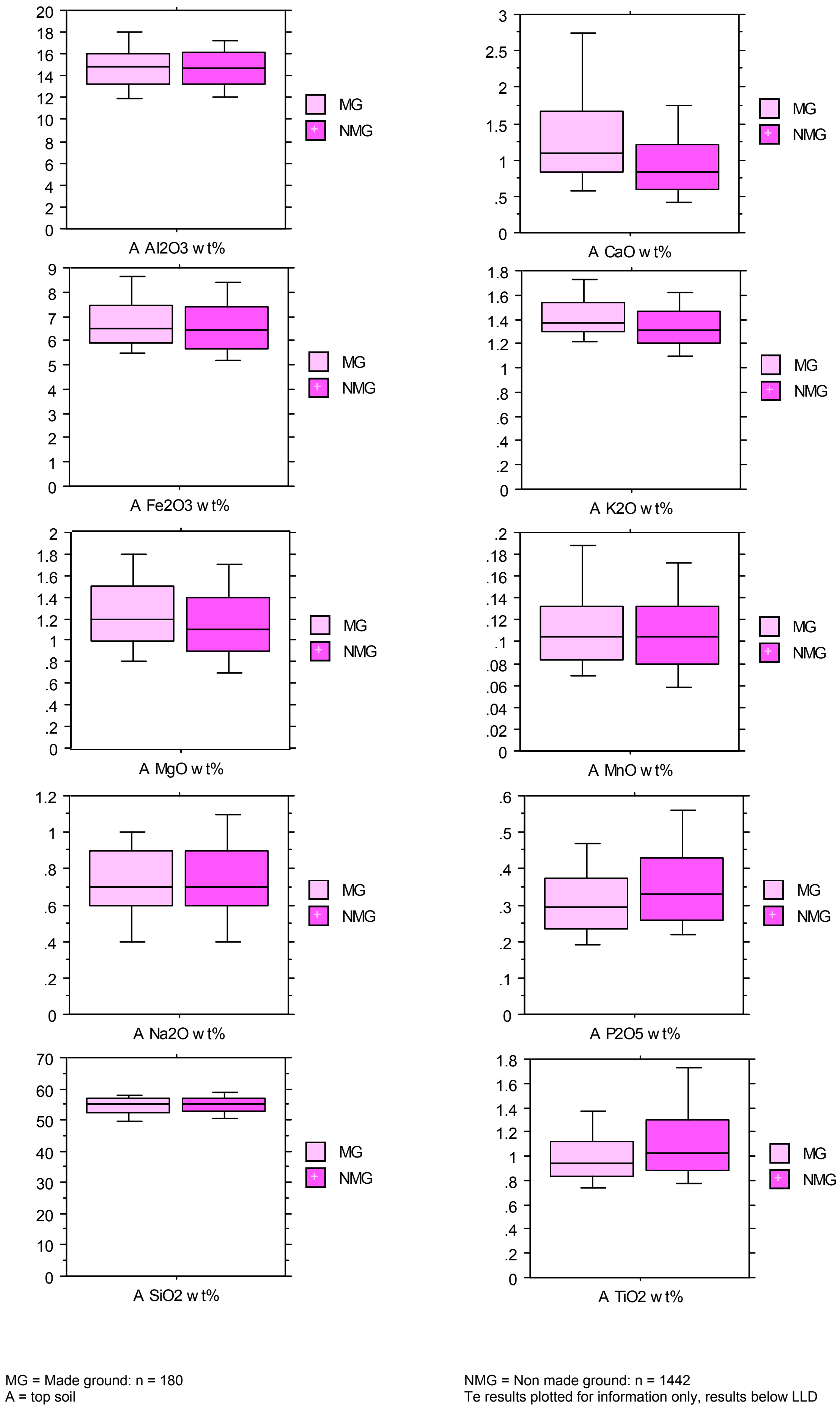
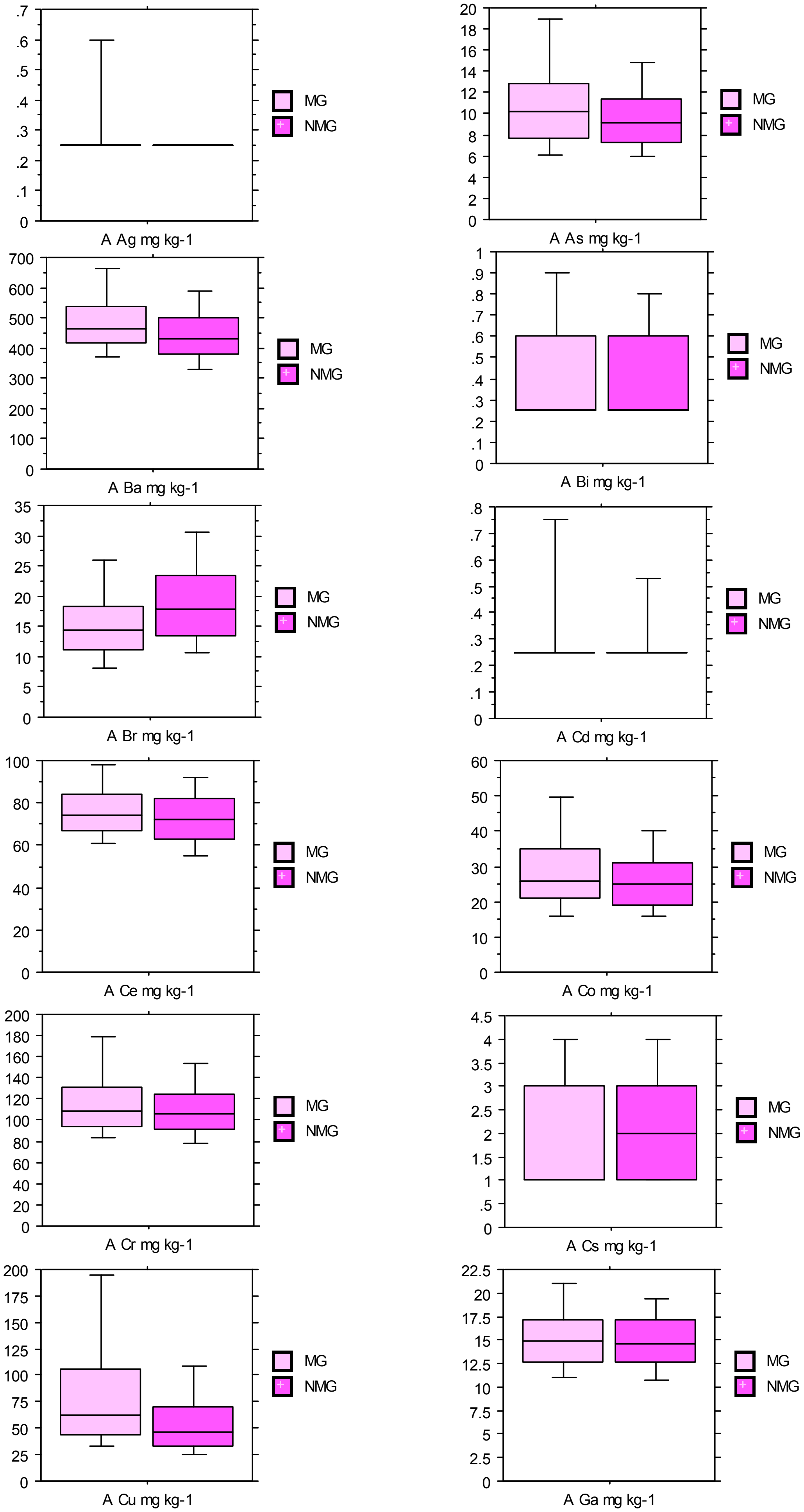
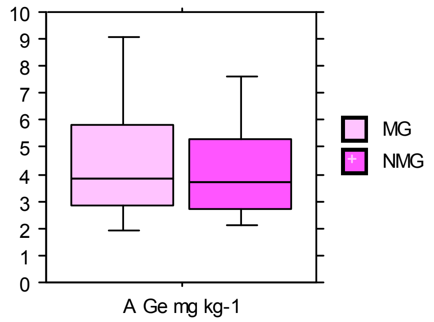
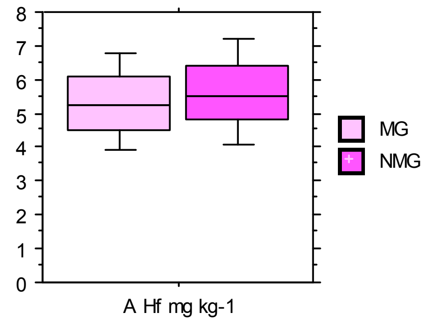


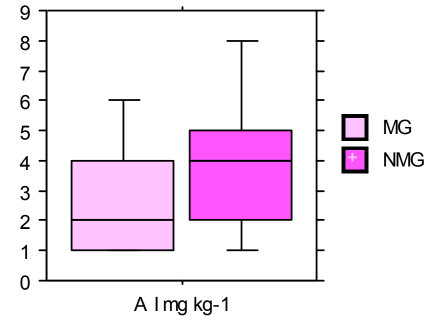

**Figure 3.14 Box and whisker plots of the 10th, 25th, 50th, 75th and 90th percentiles of parameter distributions over artificial deposits in Glasgow top soils.**

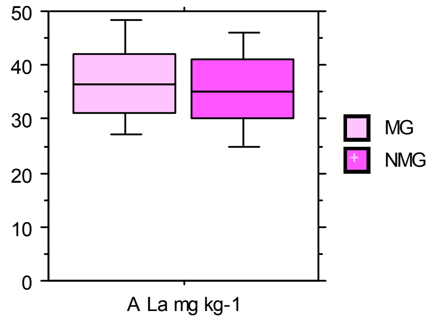


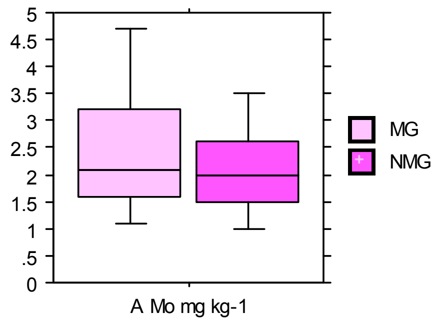
A Ag mg kg-1
A As mg kg-1
A Ba mg kg-1
A Bi mg kg-1
A Br mg kg-1
A Cd mg kg-1
A Ce mg kg-1
A Co mg kg-1
A Cr mg kg-1
A Cs mg kg-1
A Cu mg kg-1
A Ga mg kg-1
MG
NMG

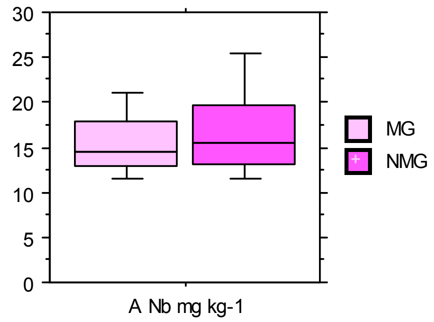

0 1 2 3 4 5 6 7 8 9 10
MG
NMG
A Ge mg kg-1

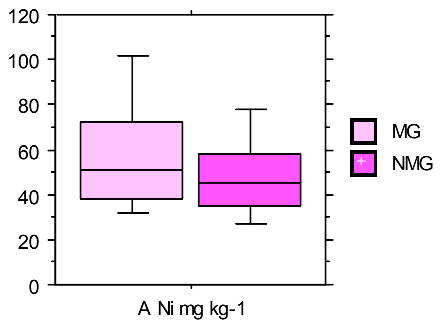

0 1 2 3 4 5 6 7 8
MG
NMG
A Hf mg kg-1

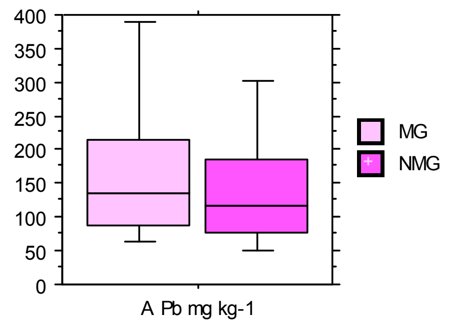

0 1 2 3 4 5 6 7 8 9
MG
NMG
A I mg kg-1

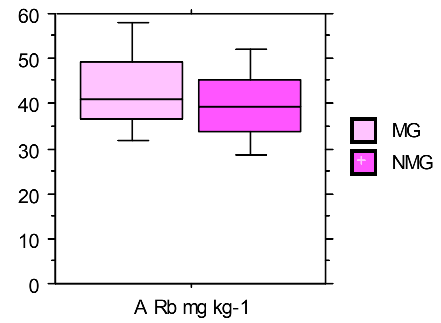

0 10 20 30 40 50
MG
NMG
A La mg kg-1

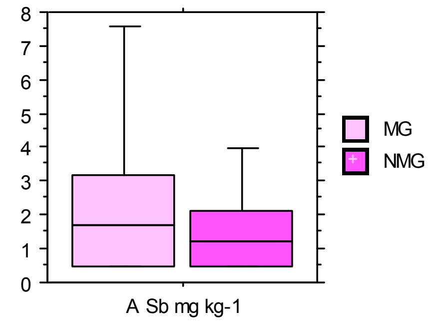

0 .5 1 1.5 2 2.5 3 3.5 4 4.5 5
MG
NMG
A Mo mg kg-1

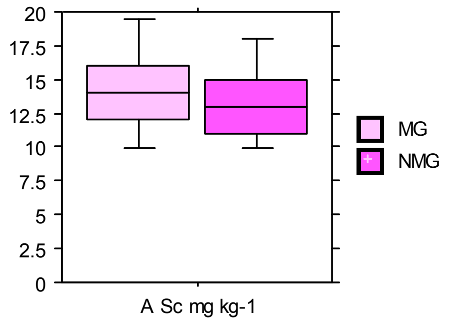

0 5 10 15 20 25 30
MG
NMG
A Nb mg kg-1

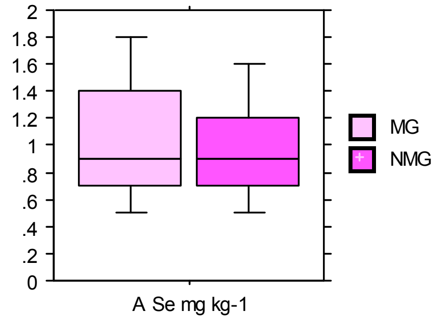

0 20 40 60 80 100 120
MG
NMG
A Ni mg kg-1

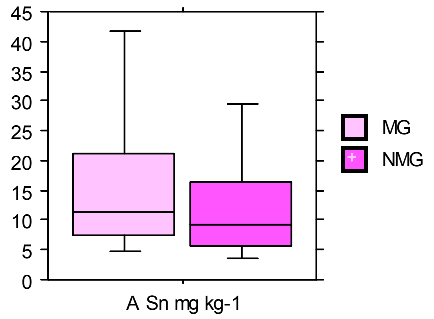

0 50 100 150 200 250 300 350 400
MG
NMG
A Pb mg kg-1

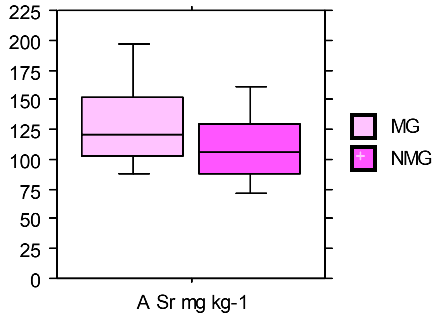

0 10 20 30 40 50 60
MG
NMG
A Rb mg kg-1

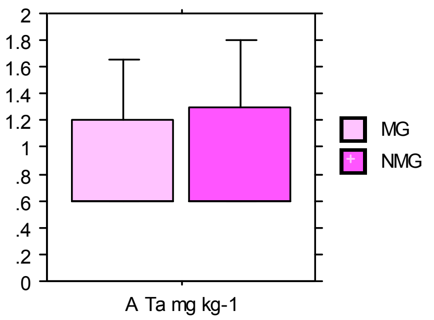

0 1 2 3 4 5 6 7 8
MG
NMG
A Sb mg kg-1

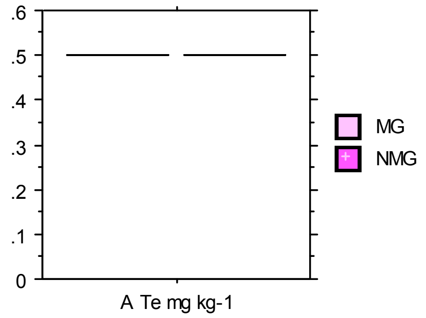

0 2.5 5 7.5 10 12.5 15 17.5 20
MG
NMG
A Sc mg kg-1

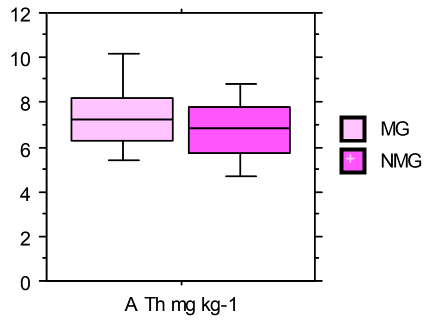

0 .2 .4 .6 .8 1 1.2 1.4 1.6 1.8 2
MG
NMG
A Se mg kg-1

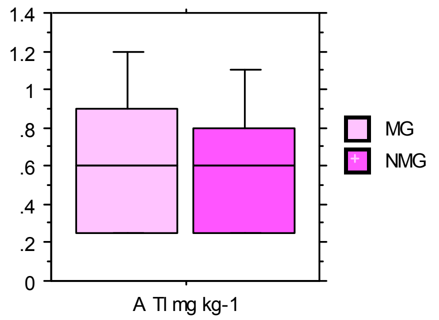

0 5 10 15 20 25 30 35 40 45
MG
NMG
A Sn mg kg-1

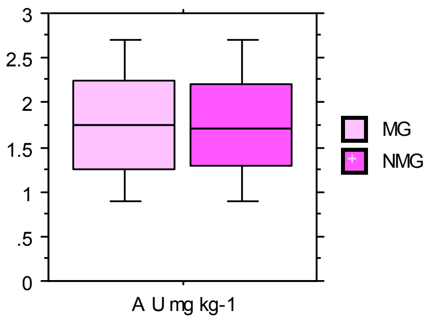

0 25 50 75 100 125 150 175 200 225
MG
NMG
A Sr mg kg-1

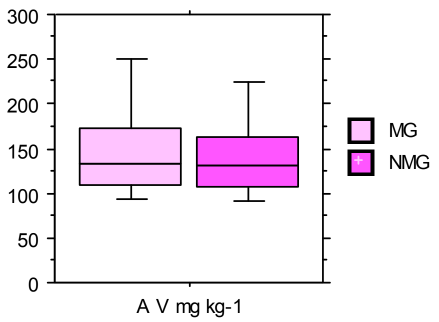

0 .2 .4 .6 .8 1 1.2 1.4 1.6 1.8 2
MG
NMG
A Ta mg kg-1

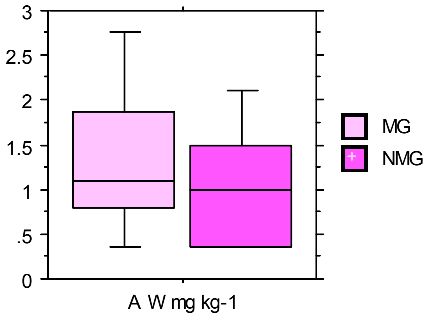

0 .1 .2 .3 .4 .5 .6
MG
NMG
A Te mg kg-1

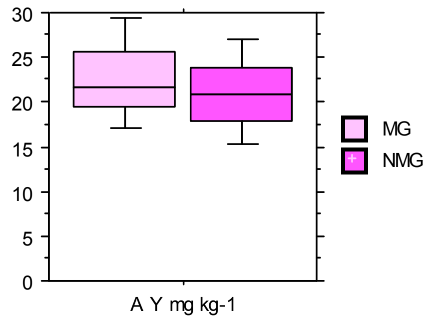

0 2 4 6 8 10 12
MG
NMG
A Th mg kg-1

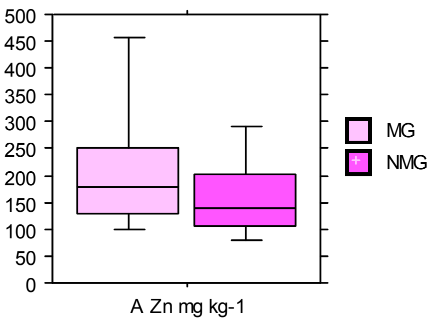

0 .2 .4 .6 .8 1 1.2 1.4
MG
NMG
A Tl mg kg-1

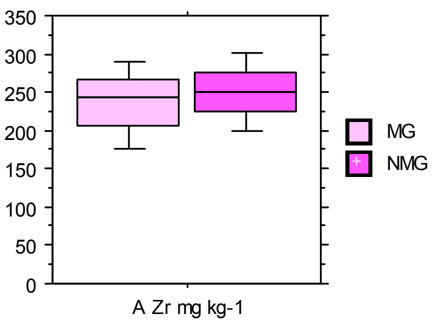

0 .5 1 1.5 2 2.5 3
MG
NMG
A U mg kg-1

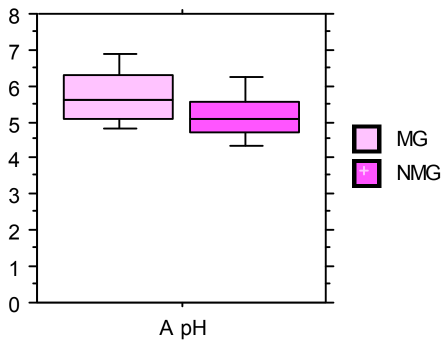

0 50 100 150 200 250 300
MG
NMG
A V mg kg-1

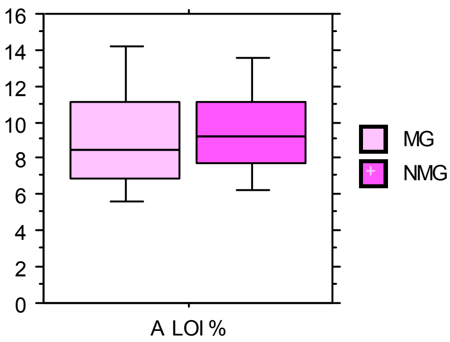

0 .5 1 1.5 2 2.5 3
MG
NMG
A W mg kg-1

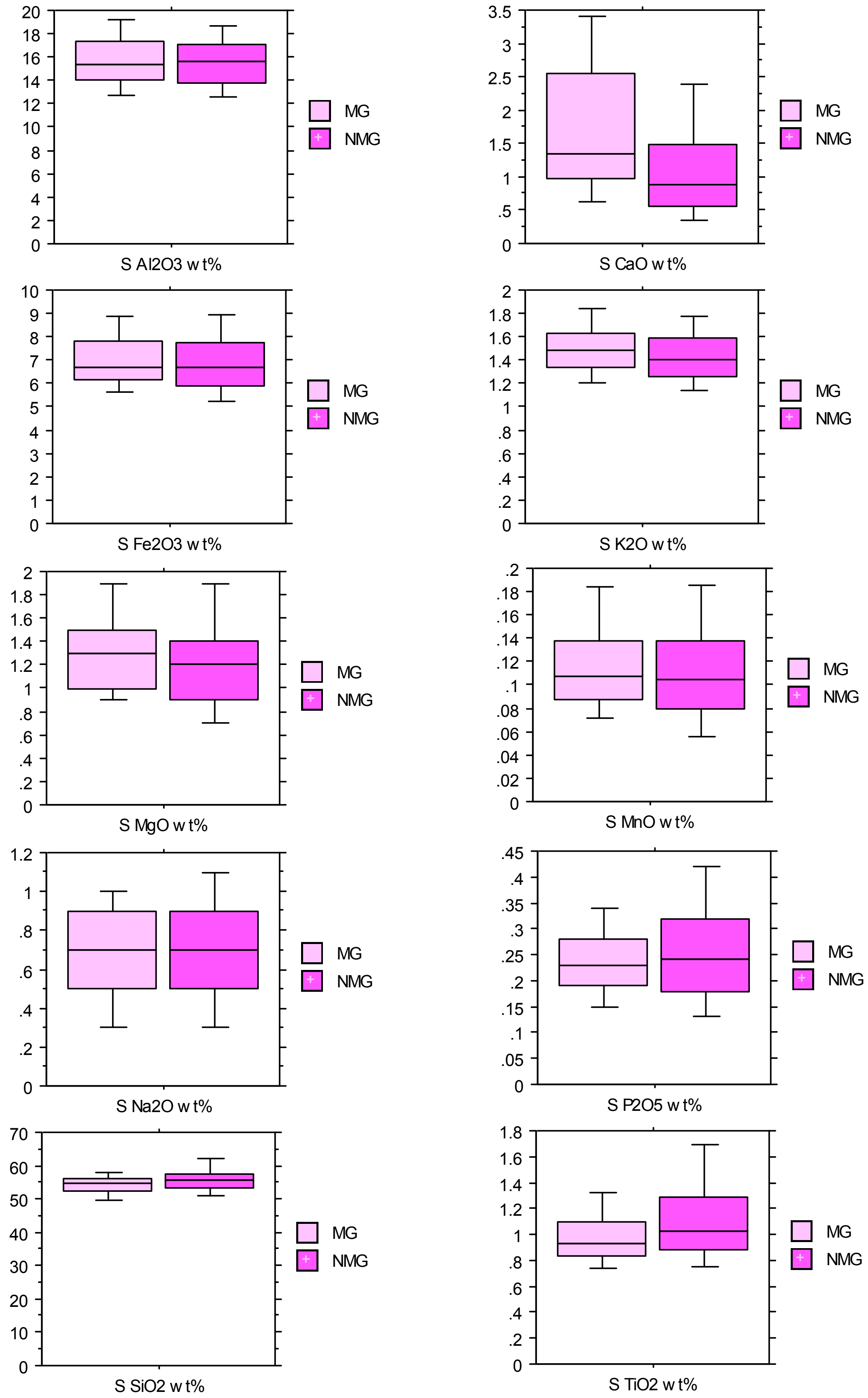

0 5 10 15 20 25 30
MG
NMG
A Y mg kg-1


0 50 100 150 200 250 300 350 400 450 500
MG
NMG
A Zn mg kg-1


0 50 100 150 200 250 300 350
MG
NMG
A Zr mg kg-1


8
7
6
5
4
3
2
1
0
A pH
MG
NMG

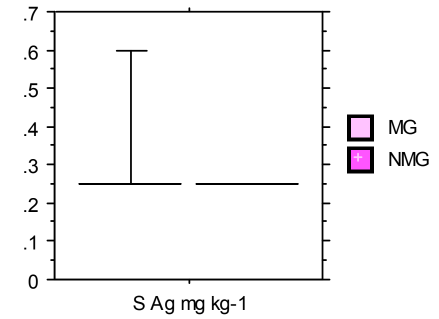

16
14
12
10
8
6
4
2
0
A LOI %
MG
NMG



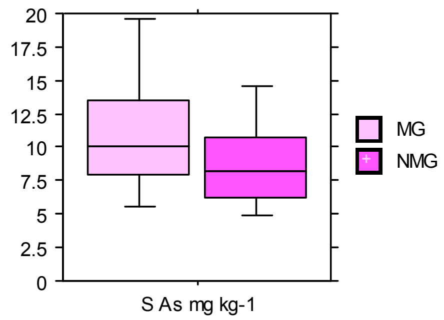

MG = Made ground: n = 175
S = deeper soil

NMG = Non made ground: n = 1434
Te results plotted for information only, results below LLD

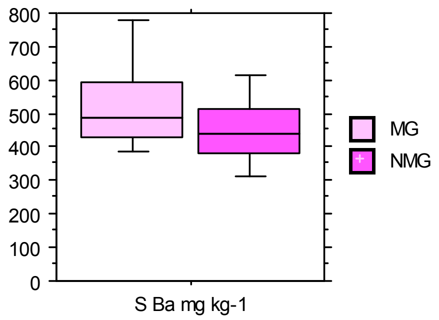
**Figure 3.15 Box and whisker plots of the 10th, 25th, 50th, 75th and 90th percentiles of parameter distributions over artificial deposits in Glasgow deeper soils**



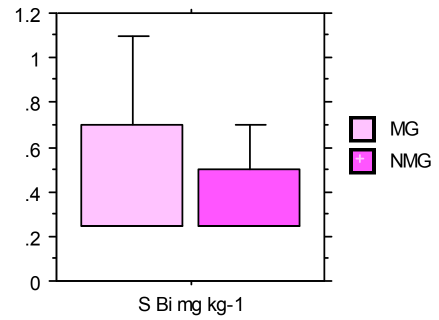
0
.1
.2
.3
.4
.5
.6
.7
MG
NMG
S Ag mg kg-1

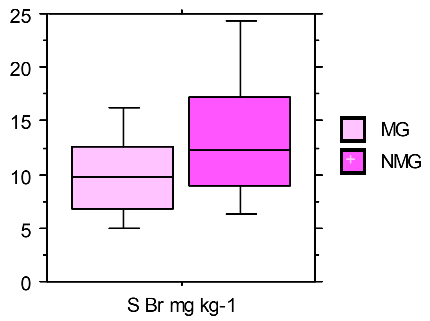
0
2.5
5
7.5
10
12.5
15
17.5
20
MG
NMG
S As mg kg-1

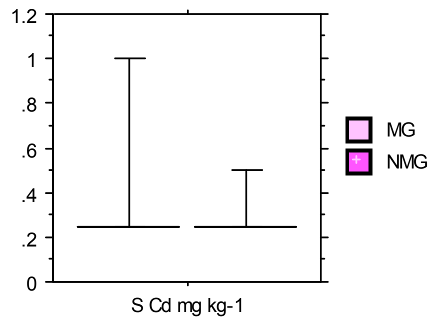
0
100
200
300
400
500
600
700
800
MG
NMG
S Ba mg kg-1

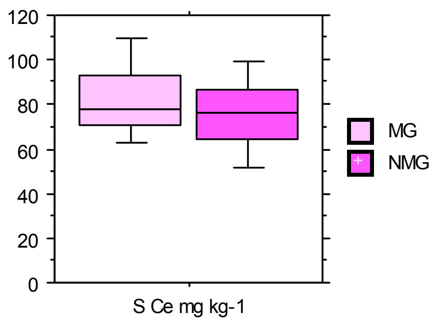
0
.2
.4
.6
.8
1
1.2
MG
NMG
S Bi mg kg-1

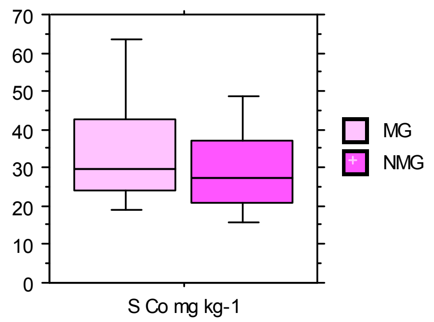
0
5
10
15
20
25
MG
NMG
S Br mg kg-1

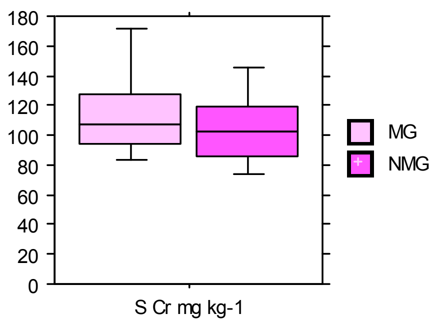
0
.2
.4
.6
.8
1
1.2
MG
NMG
S Cd mg kg-1

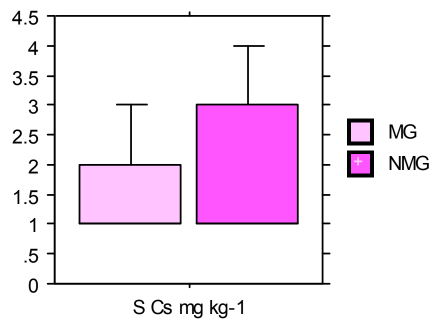
0
20
40
60
80
100
120
MG
NMG
S Ce mg kg-1

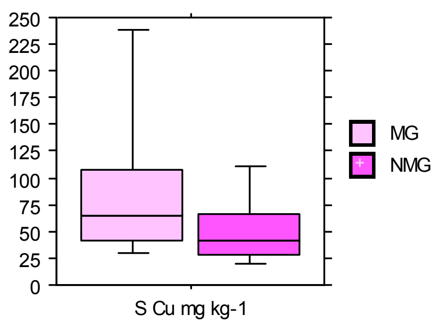
0
10
20
30
40
50
60
70
MG
NMG
S Co mg kg-1

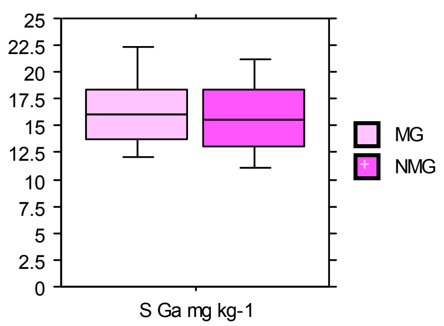
0
20
40
60
80
100
120
140
160
180
MG
NMG
S Cr mg kg-1

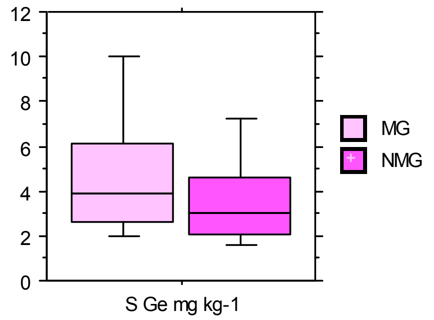
0
.5
1
1.5
2
2.5
3
3.5
4
4.5
MG
NMG
S Cs mg kg-1

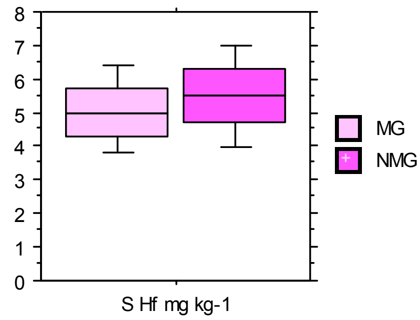



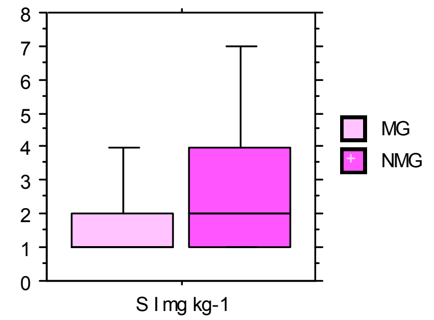
0
25
50
75
100
125
150
175
200
225
250
MG
NMG
S Cu mg kg-1

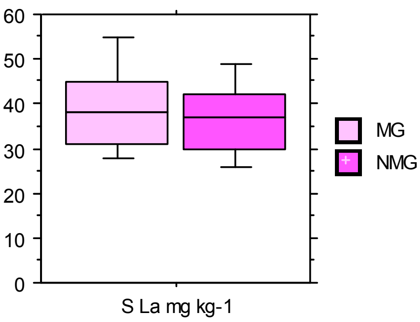



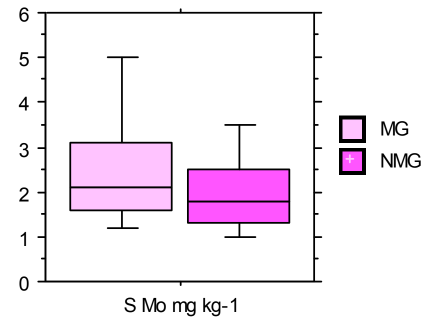
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
MG
NMG
S Ga mg kg-1

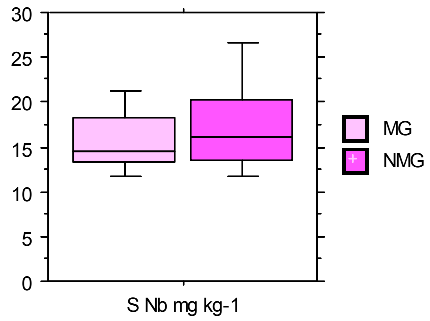

0 2 4 6 8 10 12
MG
NMG
S Ge mg kg-1

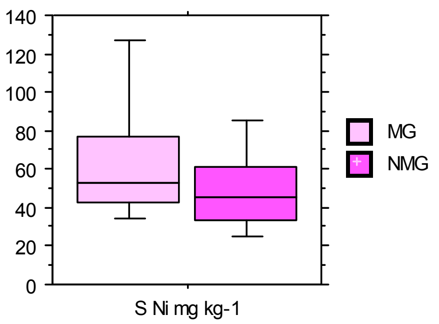

0 1 2 3 4 5 6 7 8
MG
NMG
S Hf mg kg-1

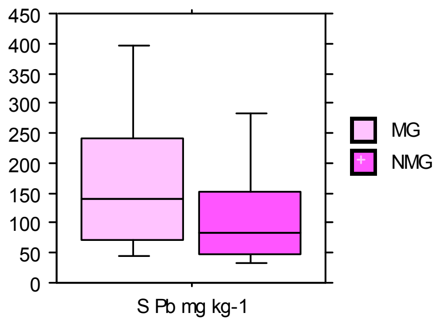

0 1 2 3 4 5 6 7 8
MG
NMG
S I mg kg-1

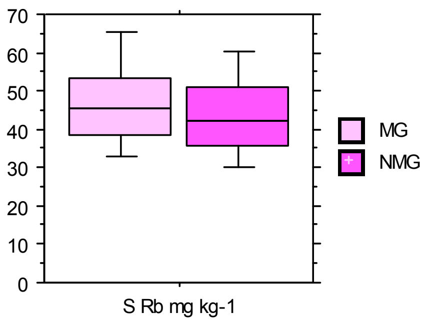

0 10 20 30 40 50 60
MG
NMG
S La mg kg-1

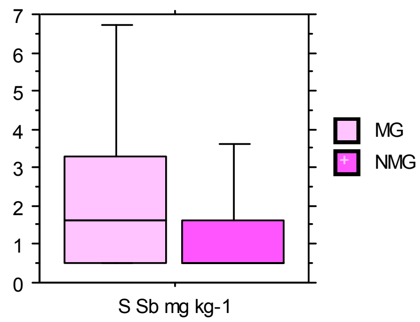

0 1 2 3 4 5 6
MG
NMG
S Mo mg kg-1

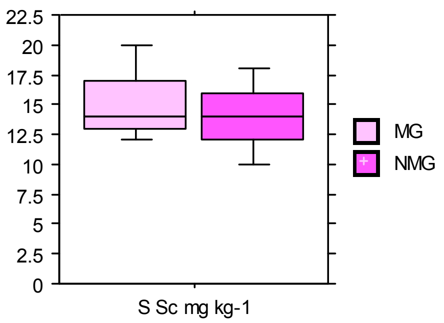

0 5 10 15 20 25 30
MG
NMG
S Nb mg kg-1

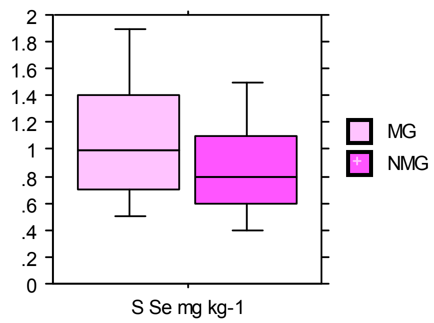

0 20 40 60 80 100 120 140
MG
NMG
S Ni mg kg-1

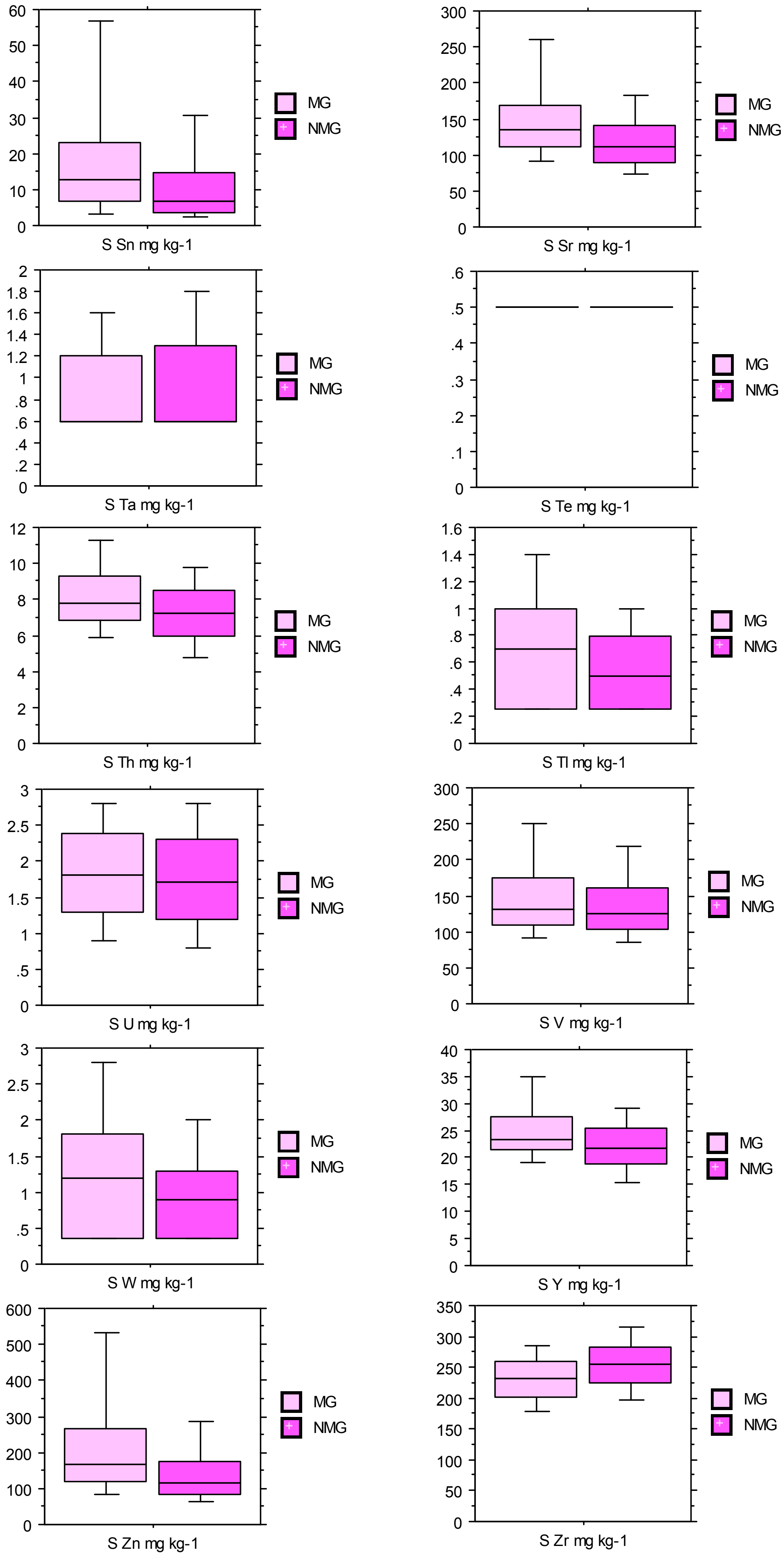

0 50 100 150 200 250 300 350 400 450
MG
NMG
S Pb mg kg-1

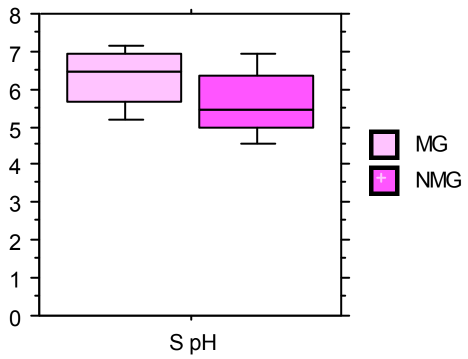

0 10 20 30 40 50 60 70
MG
NMG
S Rb mg kg-1


0 1 2 3 4 5 6 7
MG
NMG
S Sb mg kg-1

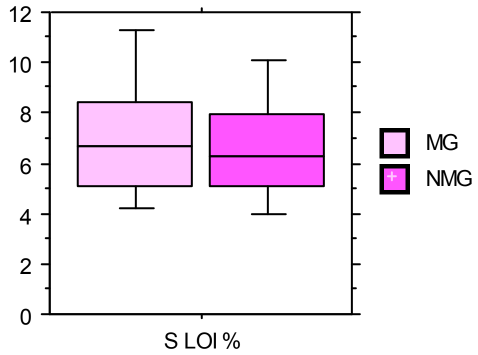

0 2.5 5 7.5 10 12.5 15 17.5 20 22.5
MG
NMG
S Sc mg kg-1


0 .2 .4 .6 .8 1 1.2 1.4 1.6 1.8 2
MG
NMG
S Se mg kg-1

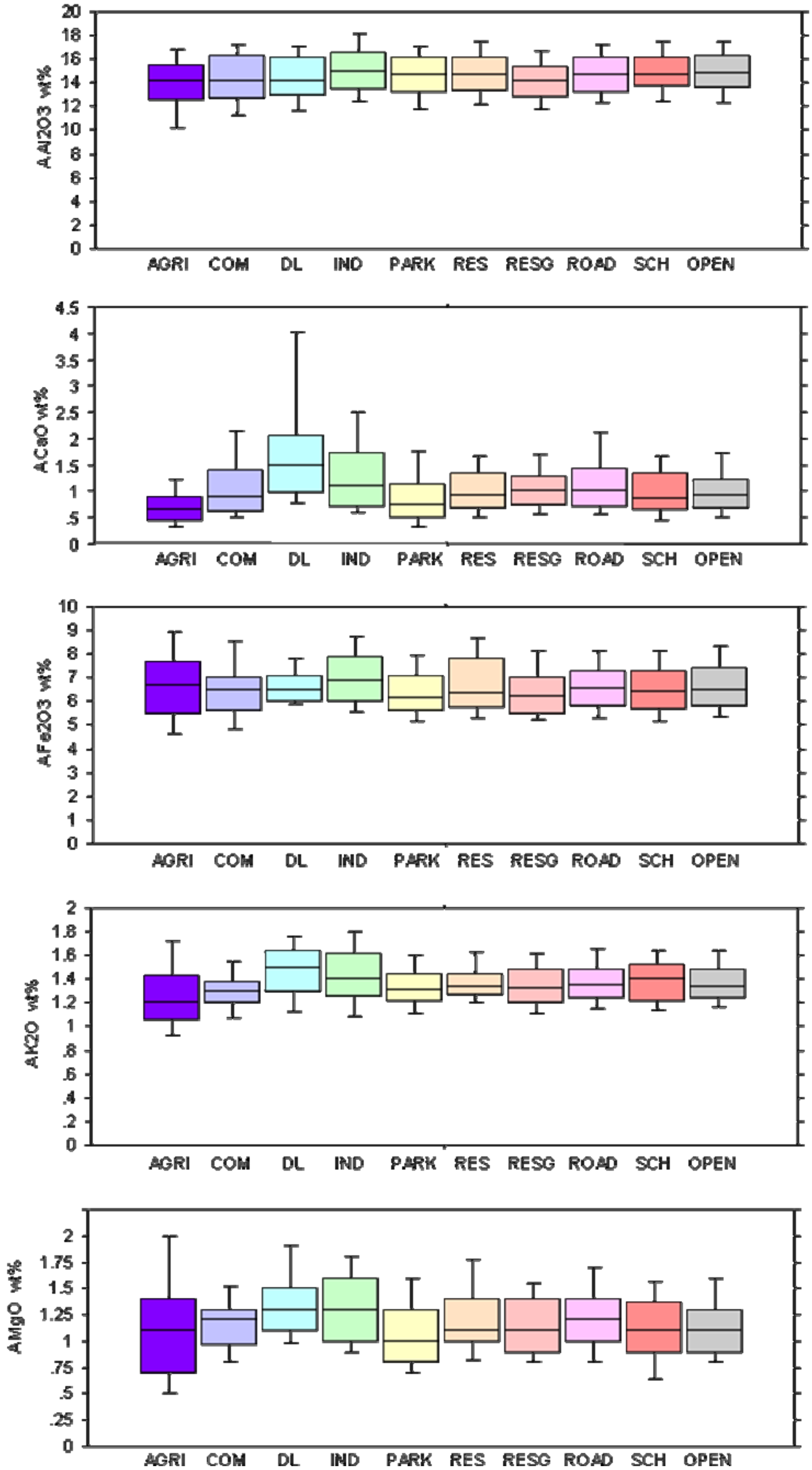

S Sn mg kg-1
S Sr mg kg-1
S Ta mg kg-1
S Te mg kg-1
S Th mg kg-1
S Tl mg kg-1
S U mg kg-1
S V mg kg-1
S W mg kg-1
S Y mg kg-1
S Zn mg kg-1
S Zr mg kg-1
MG
NMG



8
7
6
5
4
3
2
1
0
MG
NMG
S pH

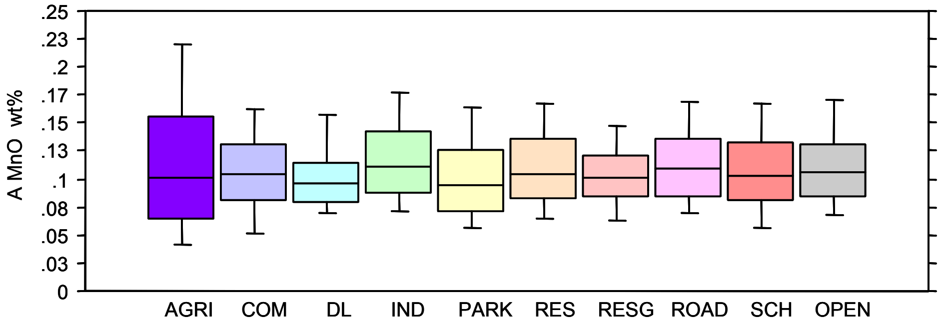



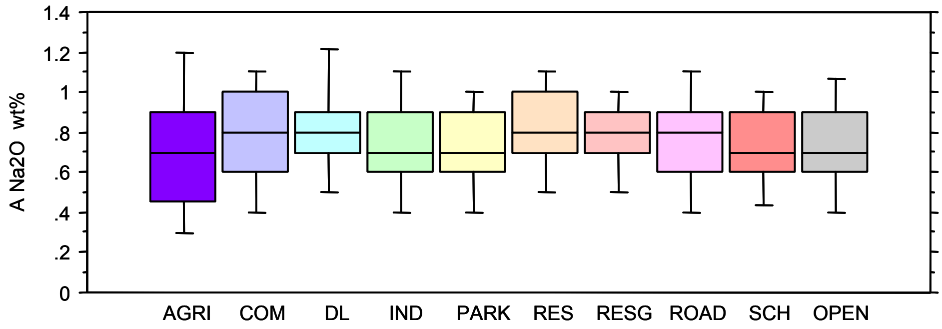
12
10
8
6
4
2
0
MG
NMG
S LOI %

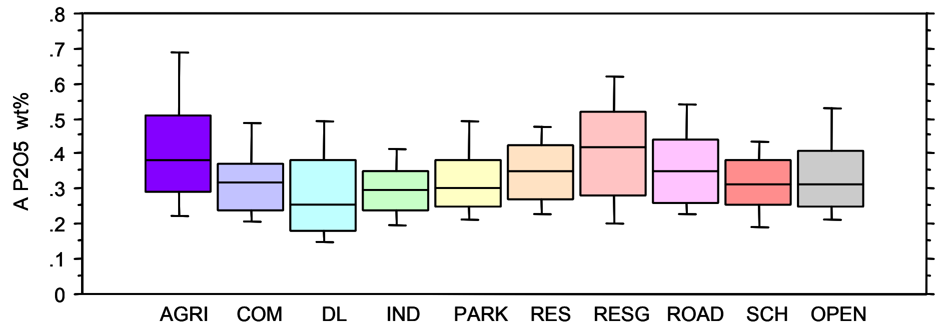


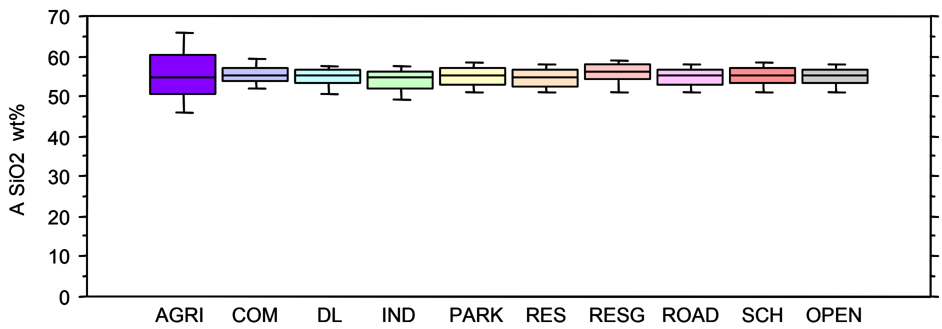

AGRI = Agriculture n = 256
COM = Commercial n = 33
DL = Derelict Land n = 34
IND = Industrial n = 82
PARK = Parks, Recreational, Sports n = 350
RES = Residential n = 97
RESG = Residential Garden n = 70
ROAD = Roads and Railways n = 323
SCH = Schools and Playgrounds n = 59
OPEN = Urban Open Space n = 298
A = top soils

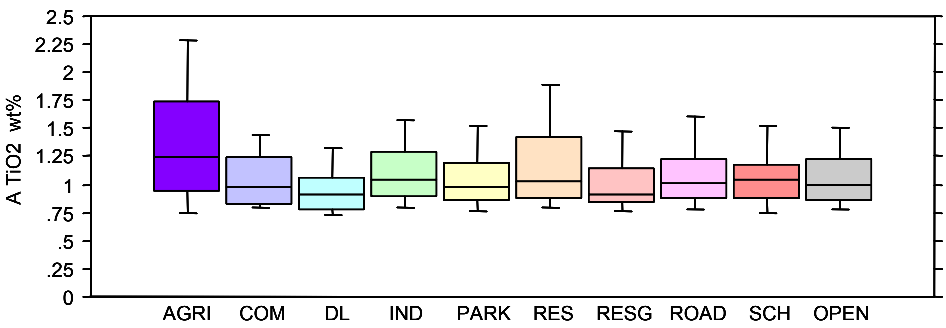
**Figure 3.16 Box and whisker plots of the 10$^{th}$, 25$^{th}$, 50$^{th}$, 75$^{th}$ and 90$^{th}$ percentiles of parameter distributions over different land uses in Glasgow top soils.**

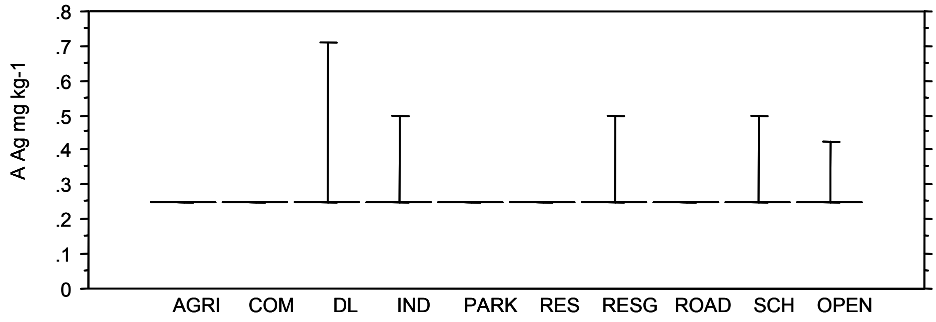

A MnO wt%
.25
.23
.2
.17
.15
.13
.1
.08
.05
.03
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

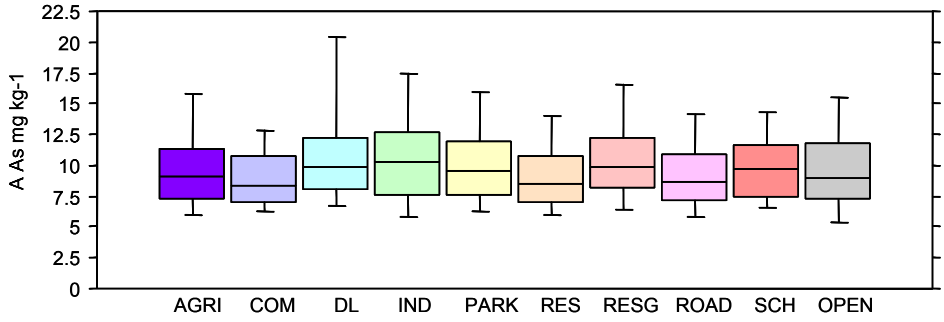

A Na2O wt%
1.4
1.2
1
.8
.6
.4
.2
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

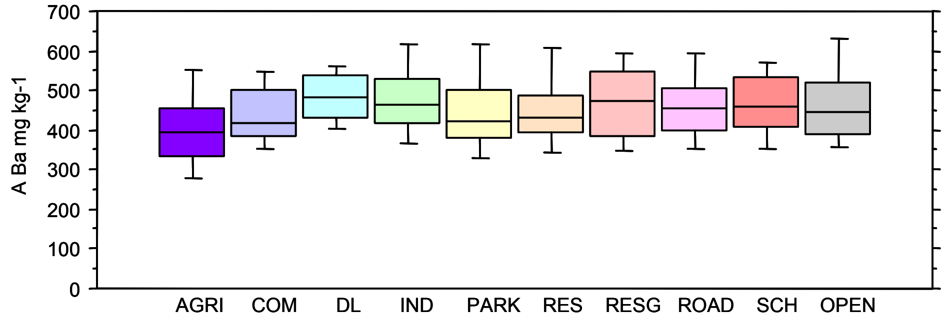

A P2O5 wt%
.8
.7
.6
.5
.4
.3
.2
.1
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

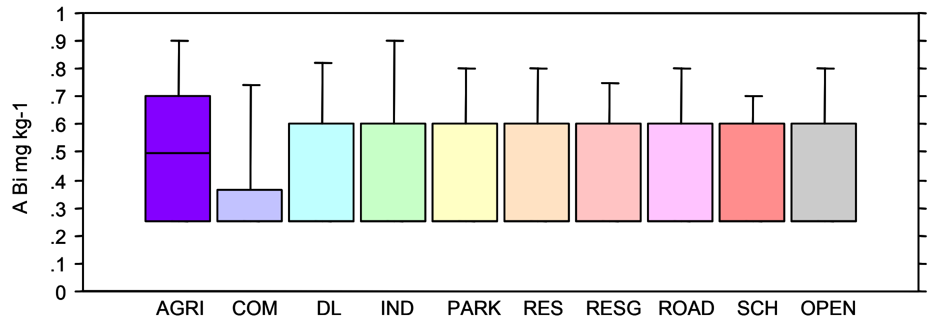

A SiO2 wt%
70
60
50
40
30
20
10
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

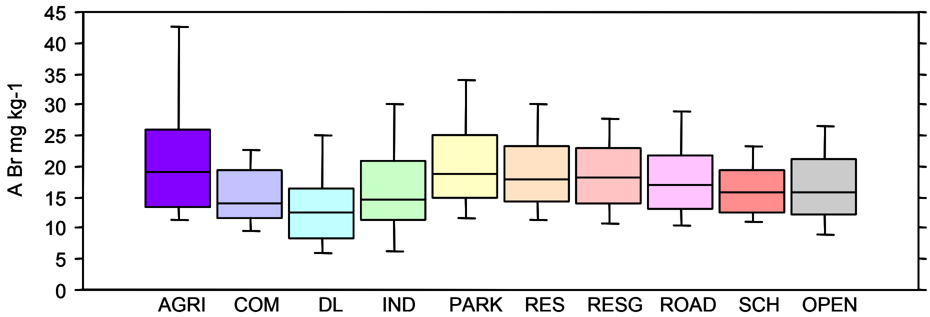

A TiO2 wt%
2.5
2.25
2
1.75
1.5
1.25
1
.75
.5
.25
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

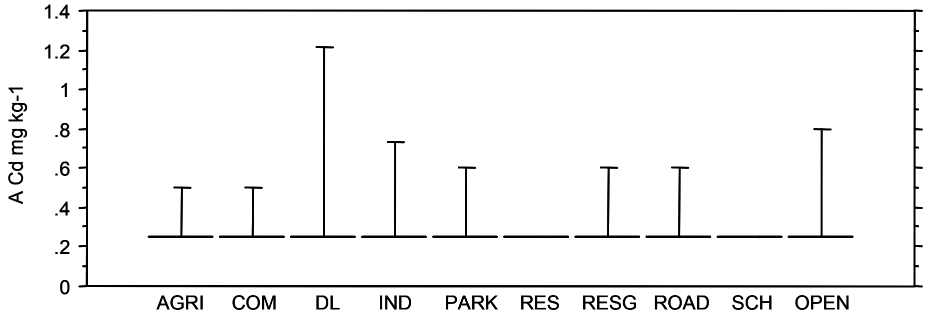

A Ag mg kg-1
0
.1
.2
.3
.4
.5
.6
.7
.8
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

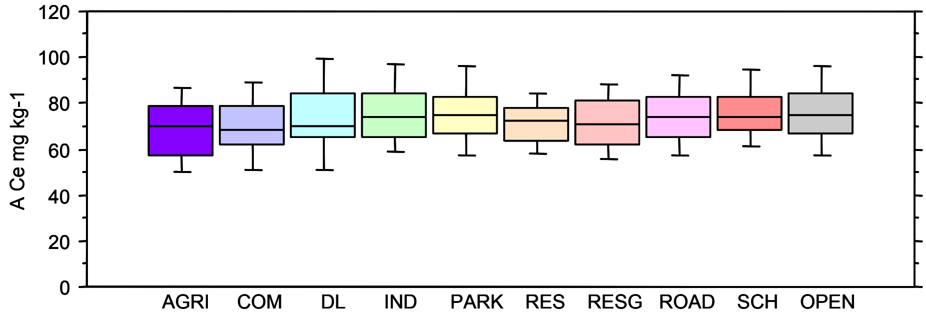

A As mg kg-1
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

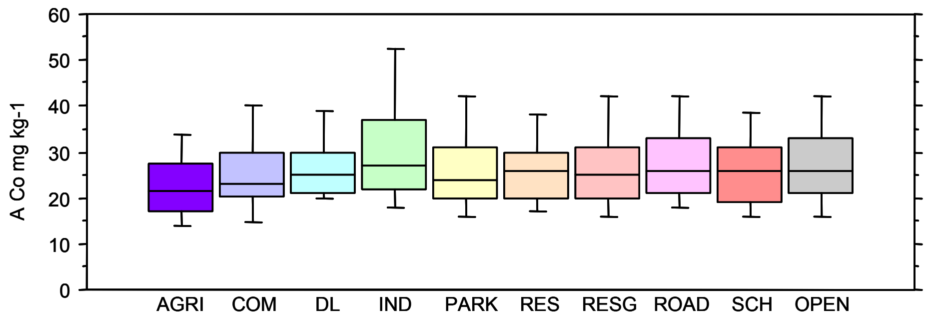

A Ba mg kg-1
0
100
200
300
400
500
600
700
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

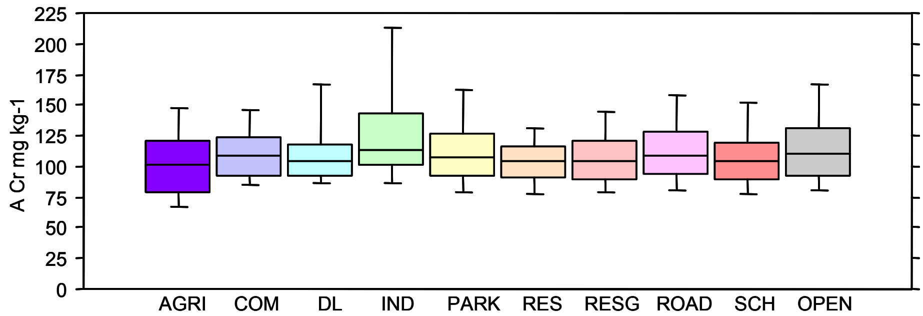

A Bi mg kg-1
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

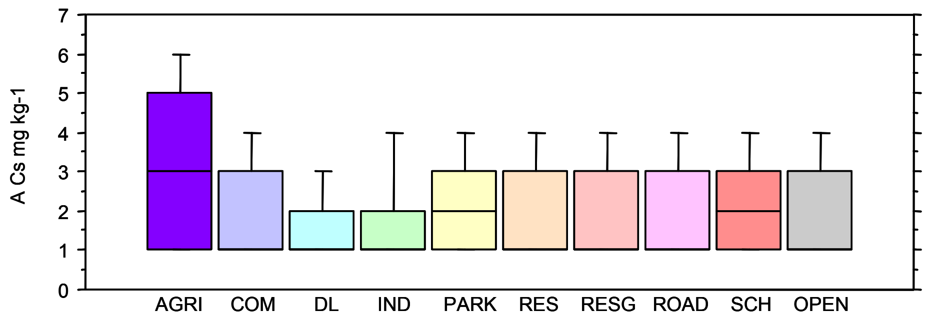

A Br mg kg-1
0
5
10
15
20
25
30
35
40
45
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

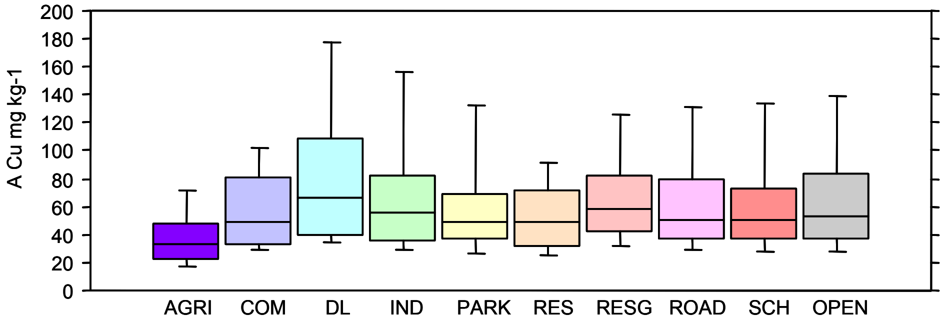

A Cd mg kg-1
1.4
1.2
1
.8
.6
.4
.2
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

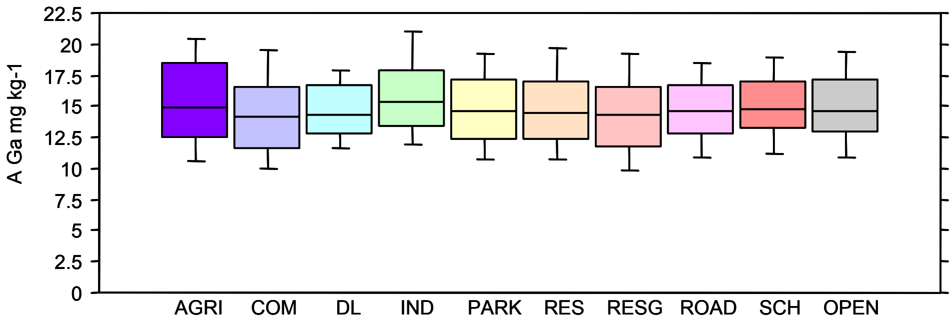

A Ce mg kg-1
120
100
80
60
40
20
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

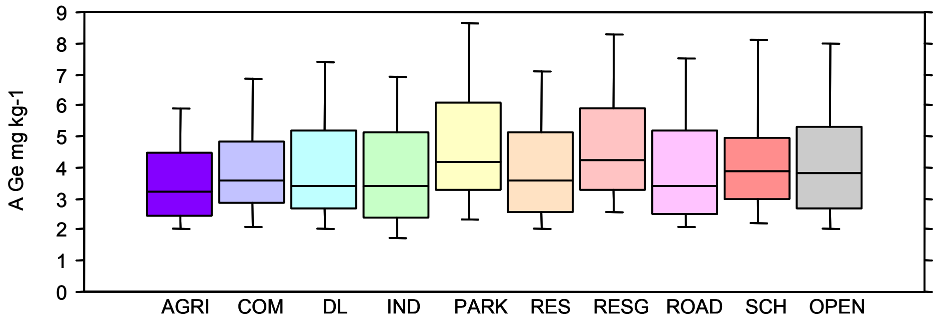

A Co mg kg-1
60
50
40
30
20
10
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

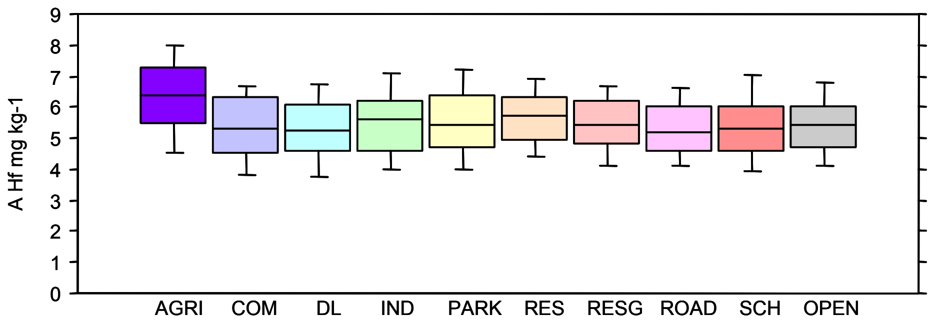

A Cr mg kg-1
225
200
175
150
125
100
75
50
25
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

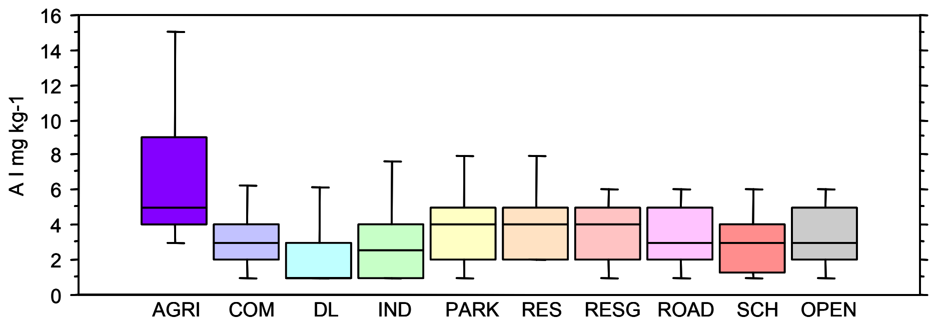

A Cs mg kg-1
7
6
5
4
3
2
1
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

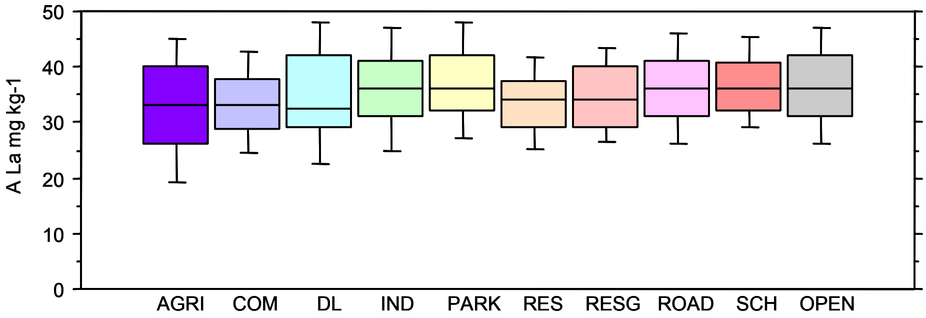

A Cu mg kg-1
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

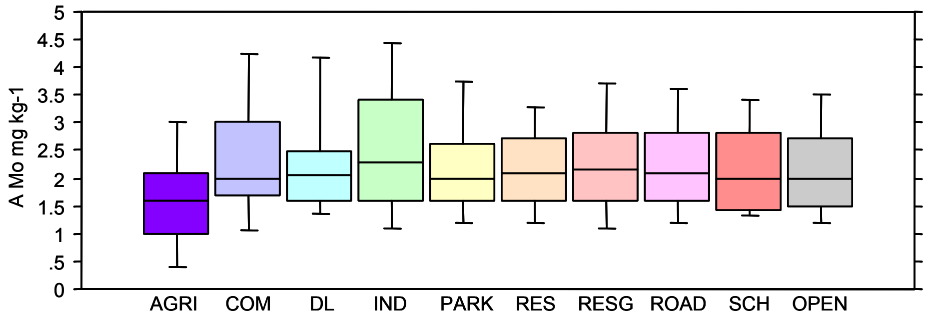

A Ga mg kg-1
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

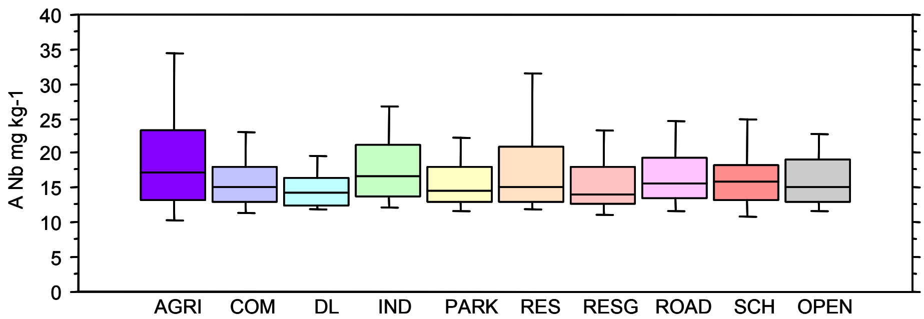

A Ge mg kg-1
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

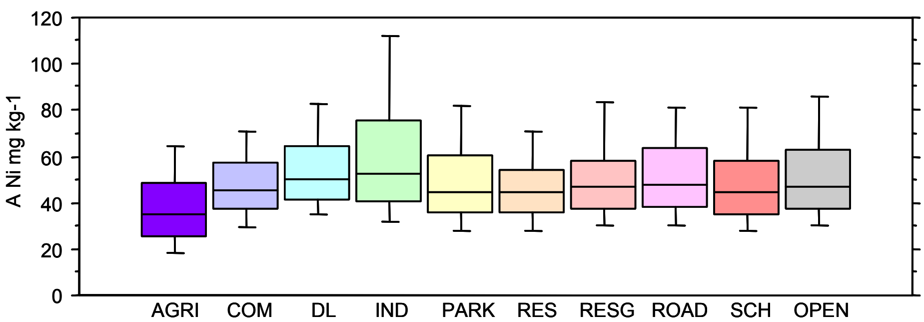

A Hf mg kg-1
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

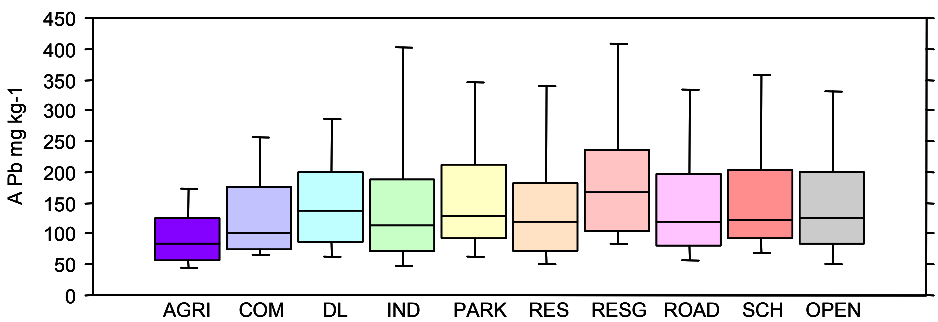

A I mg kg-1
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

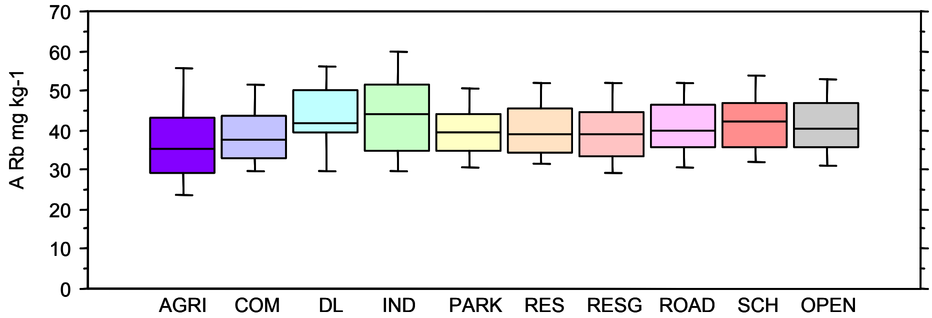

A La mg kg-1
0
10
20
30
40
50
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

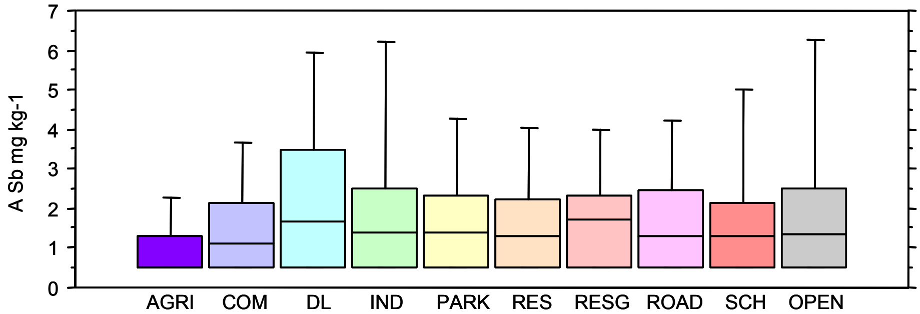

A Mo mg kg-1
0
.5
1
1.5
2
2.5
3
3.5
4
4.5
5
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

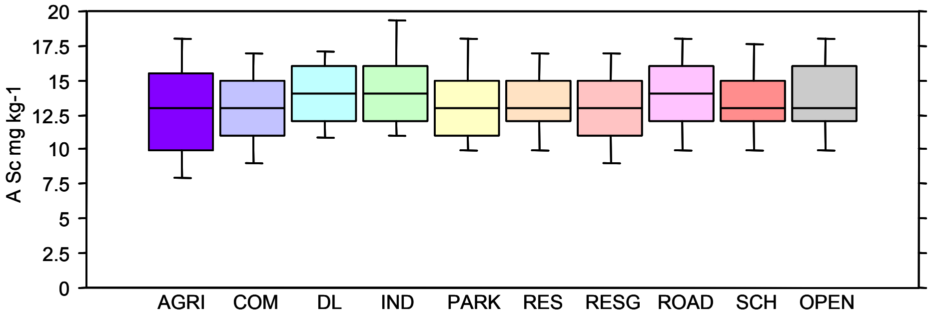

A Nb mg kg-1
0
5
10
15
20
25
30
35
40
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

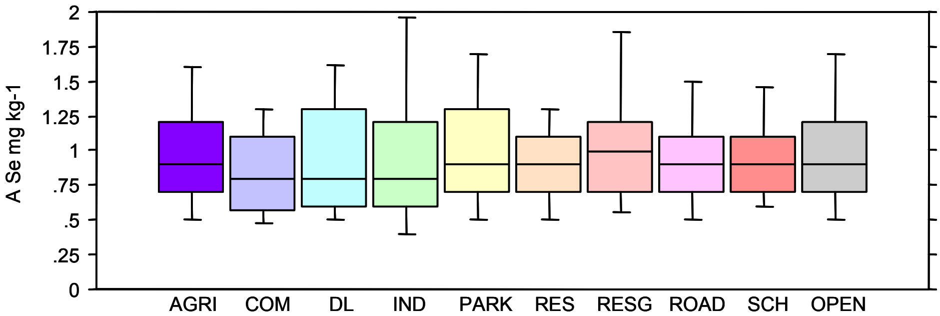

A Ni mg kg-1
0
20
40
60
80
100
120
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

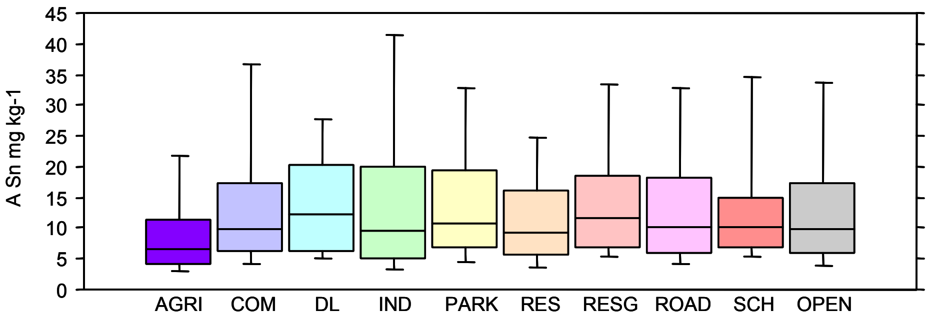

A Pb mg kg-1
0
50
100
150
200
250
300
350
400
450
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

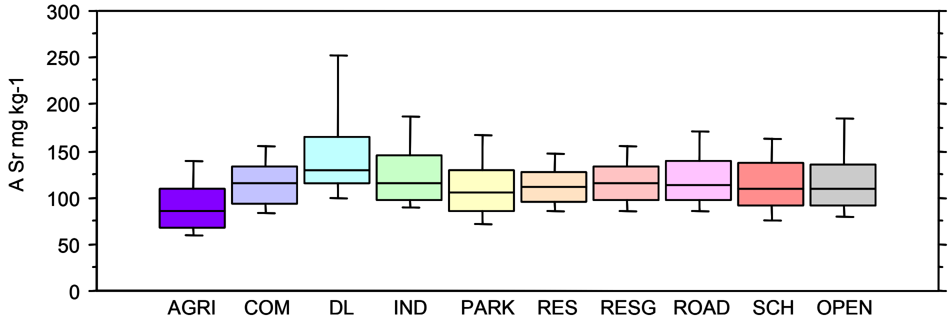

A Rb mg kg-1
0
10
20
30
40
50
60
70
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

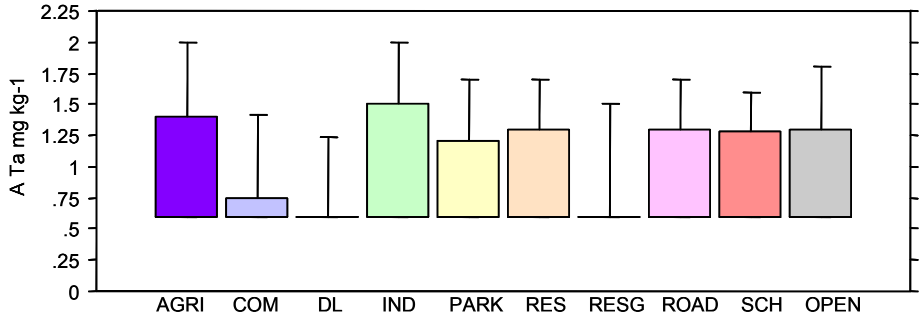

A Sb mg kg-1
0
1
2
3
4
5
6
7
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

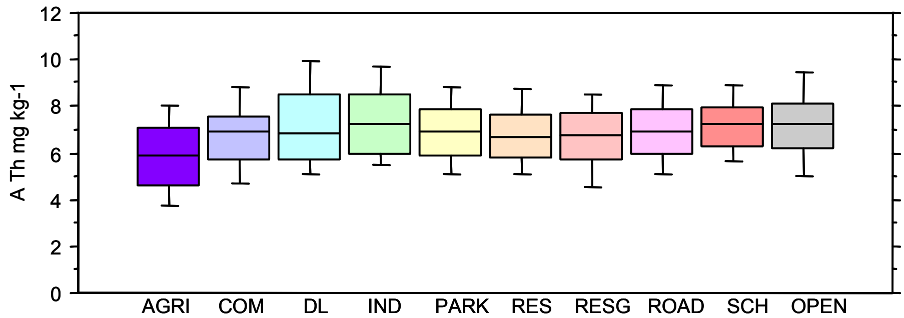

A Sc mg kg-1
0
2.5
5
7.5
10
12.5
15
17.5
20
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

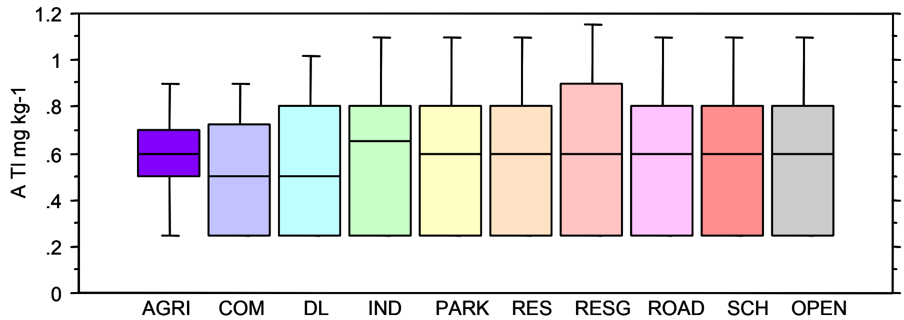

A Se mg kg-1
0
.25
.5
.75
1
1.25
1.5
1.75
2
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

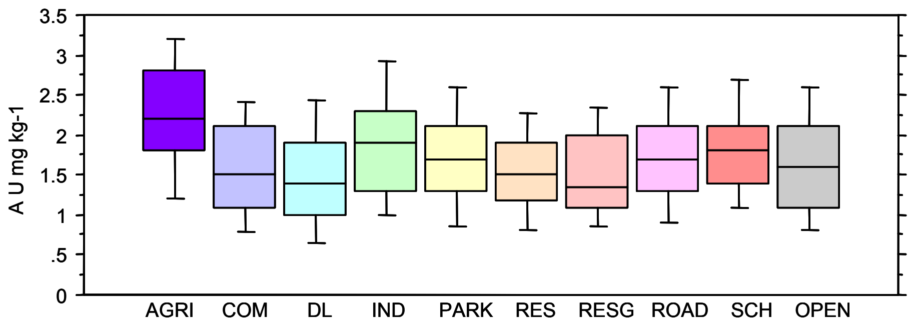

A Sn mg kg-1
0
5
10
15
20
25
30
35
40
45
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

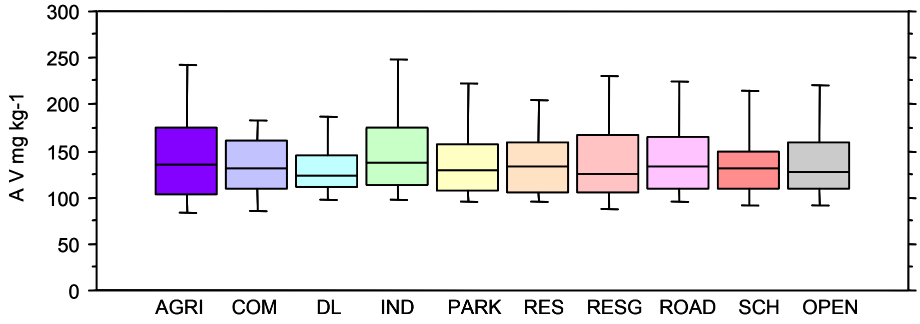

A Sr mg kg-1
300
250
200
150
100
50
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

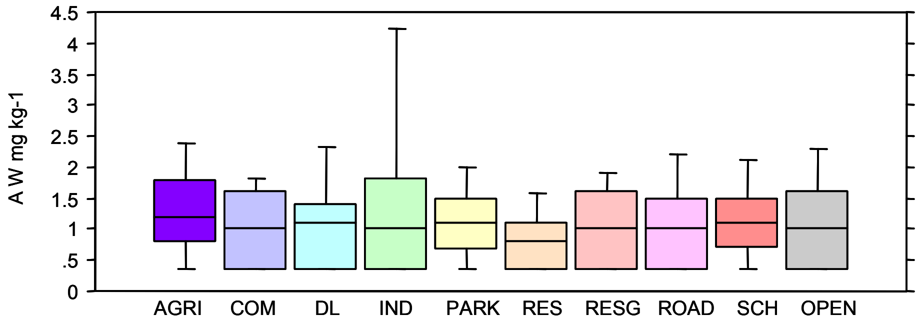

A Ta mg kg-1
2.25
2
1.75
1.5
1.25
1
.75
.5
.25
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

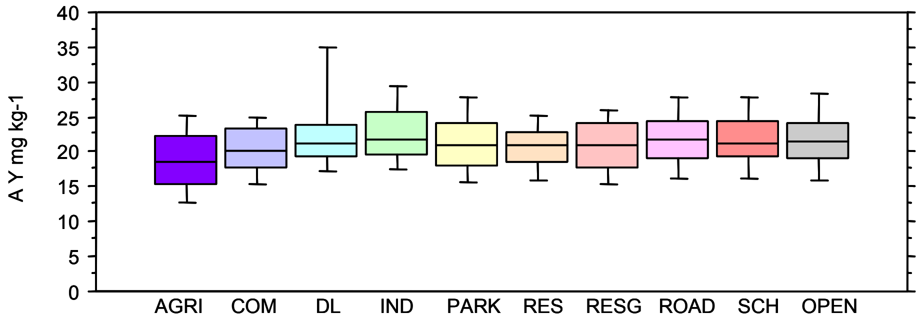

A Th mg kg-1
12
10
8
6
4
2
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

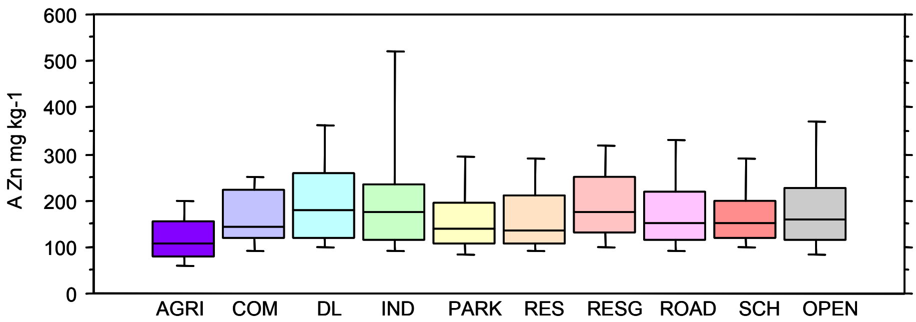

A Tl mg kg-1
1.2
1
.8
.6
.4
.2
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

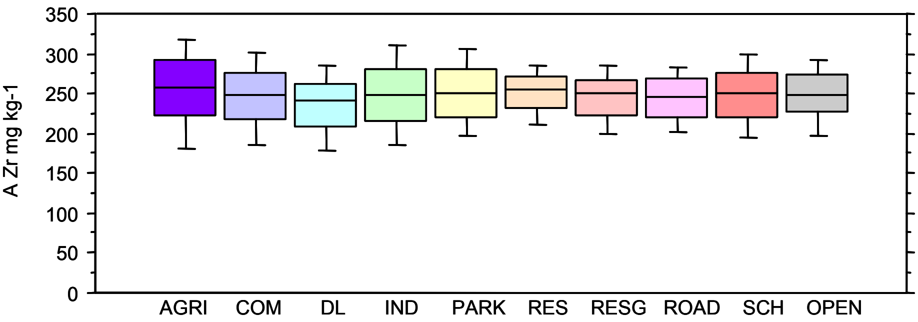

A U mg kg-1
3.5
3
2.5
2
1.5
1
.5
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

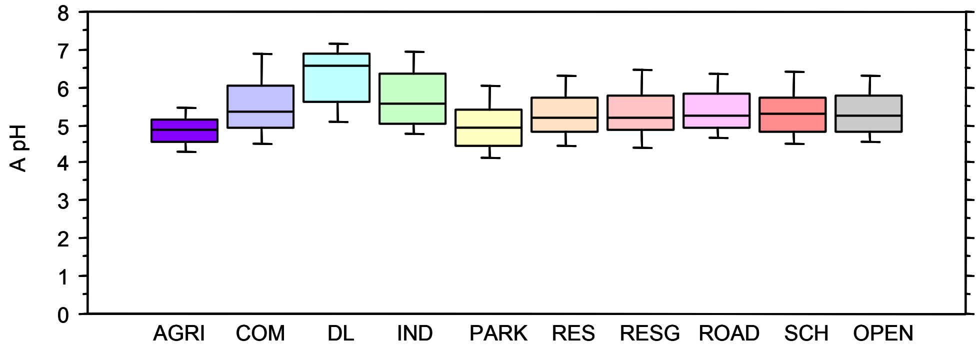

A V mg kg-1
300
250
200
150
100
50
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

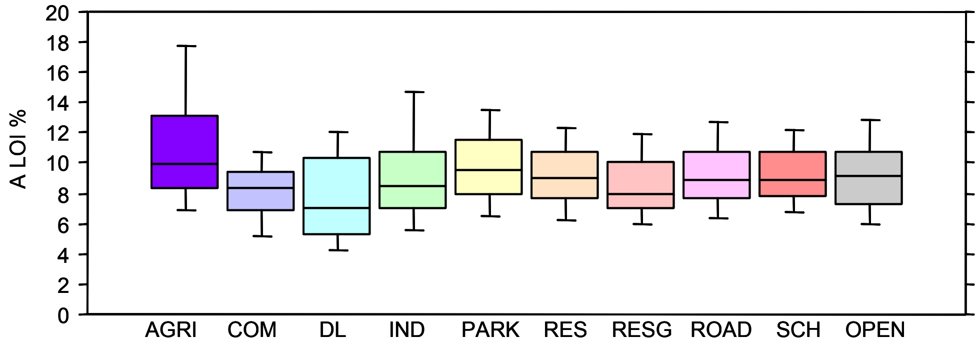

A W mg kg-1
4.5
4
3.5
3
2.5
2
1.5
1
.5
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

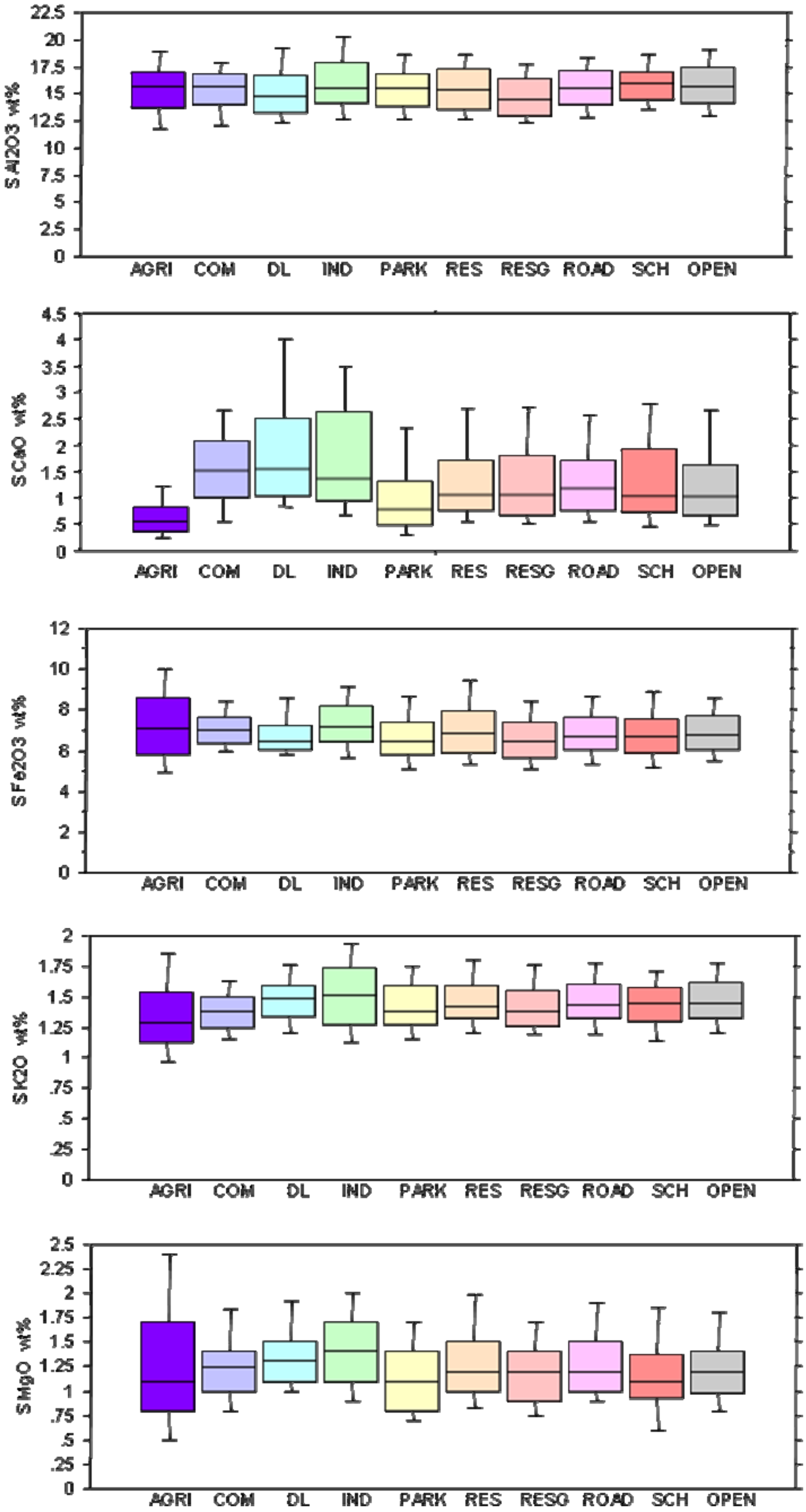

A Y mg kg-1
40
35
30
25
20
15
10
5
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN


A Zn mg kg-1
600
500
400
300
200
100
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN


A Zr mg kg-1
350
300
250
200
150
100
50
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

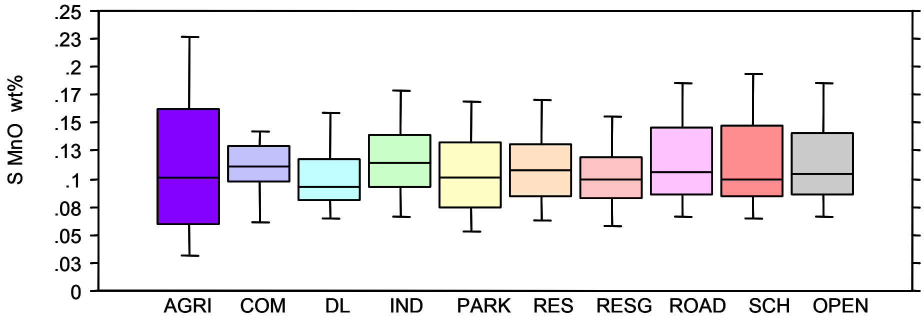

A pH
0
1
2
3
4
5
6
7
8
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

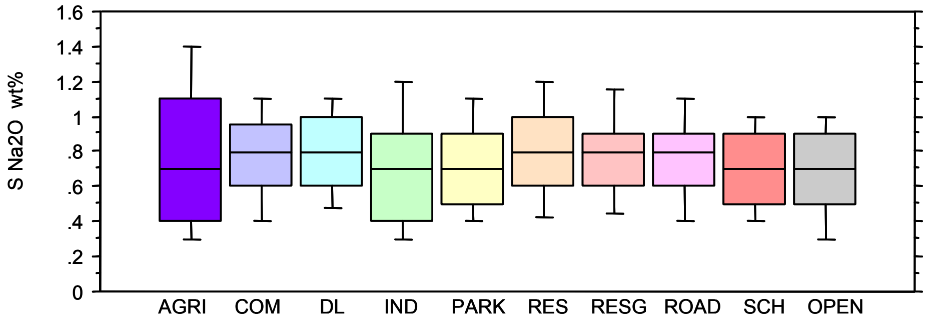

A LOI %
0
2
4
6
8
10
12
14
16
18
20
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

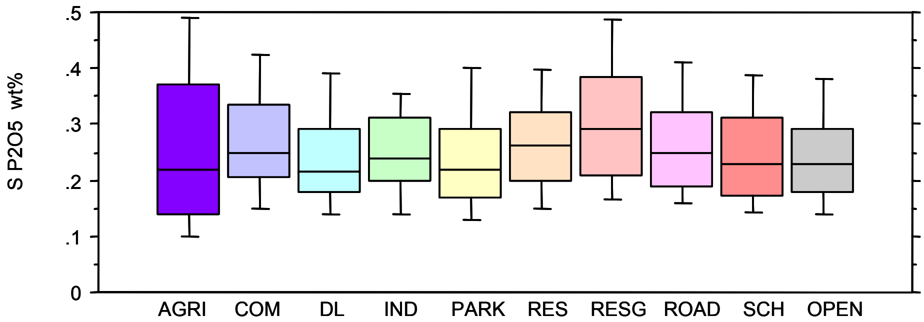


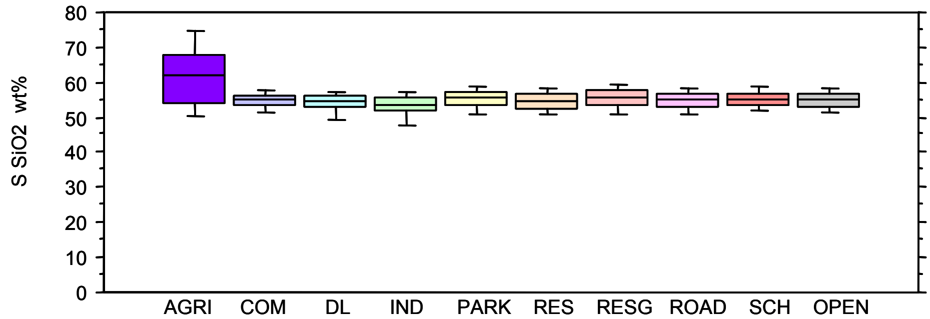

AGRI = Agriculture n = 250
IND = Industrial n = 80
RESG = Residential Garden n = 69
OPEN = Urban Open Space n = 297
COM = Commercial n = 32
PARK = Parks, Recreational, Sports n = 348
ROAD = Roads and Railways n = 323
S = deeper soils
DL = Derelict Land n = 34
RES = Residential n = 97
SCH = Schools and Playgrounds n = 59

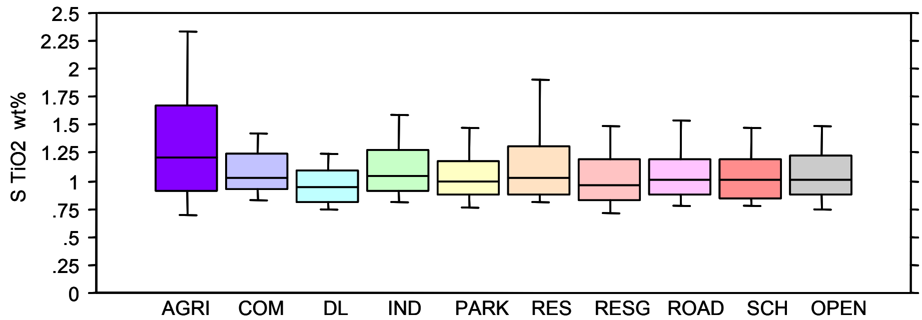
**Figure 3.17 Box and whisker plots of the 10th, 25th, 50th, 75th and 90th percentiles of parameter distributions over different land uses in Glasgow deeper soils.**

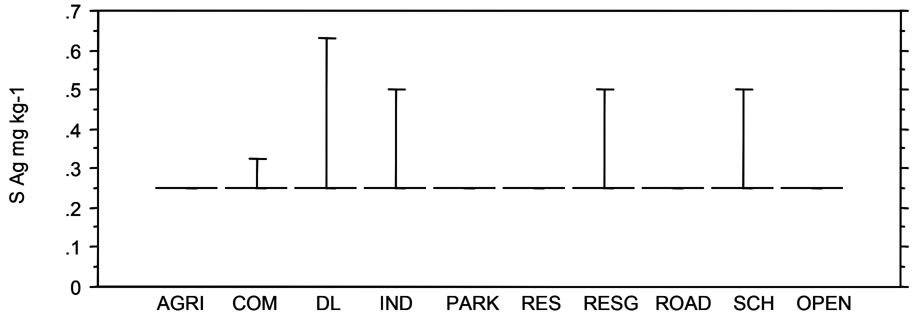

S MnO wt%
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

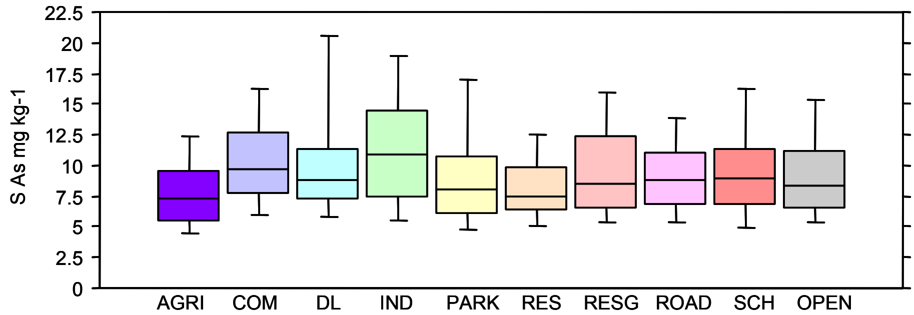

S Na2O wt%
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

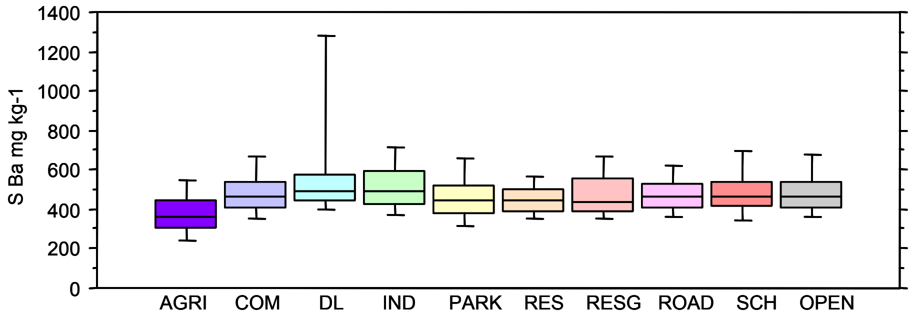

S P2O5 wt%
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

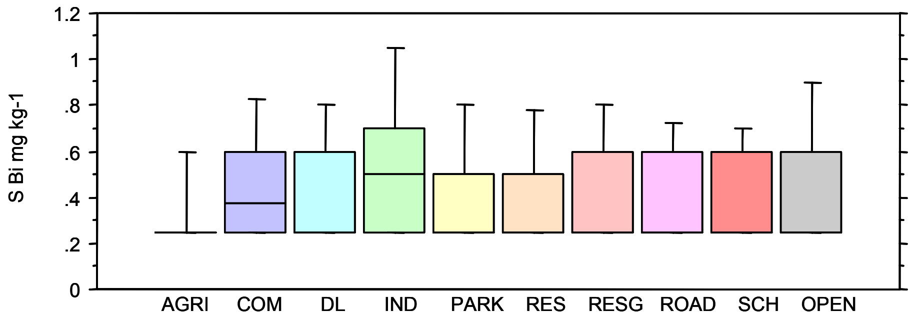

S SiO2 wt%
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

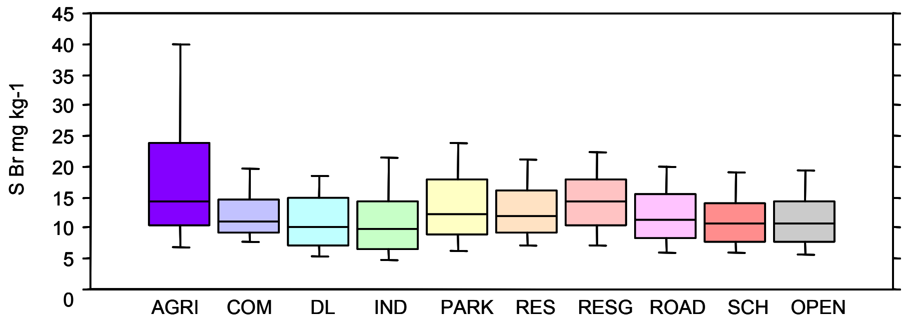

S TiO2 wt%
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

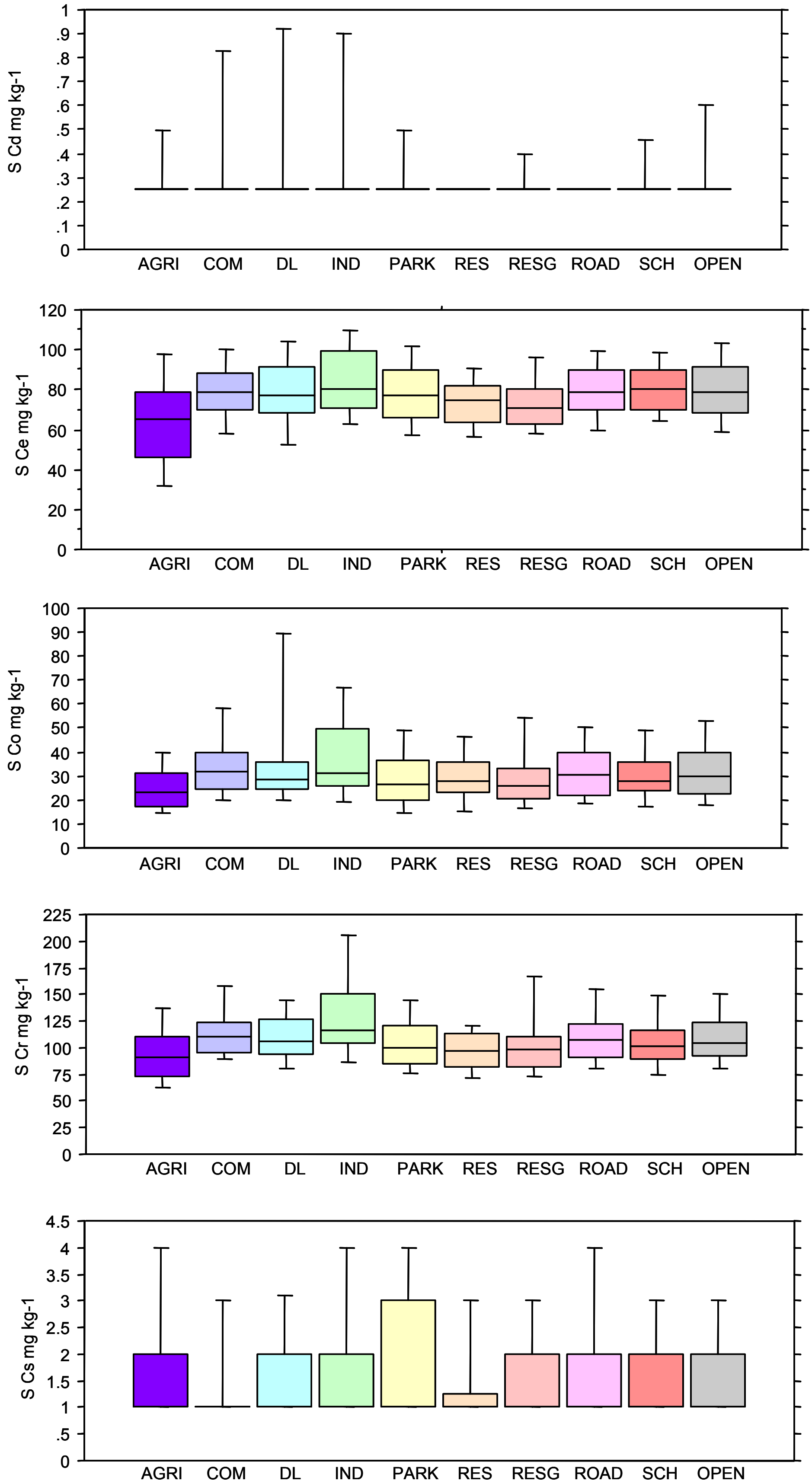

S Ag mg kg-1
.7
.6
.5
.4
.3
.2
.1
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

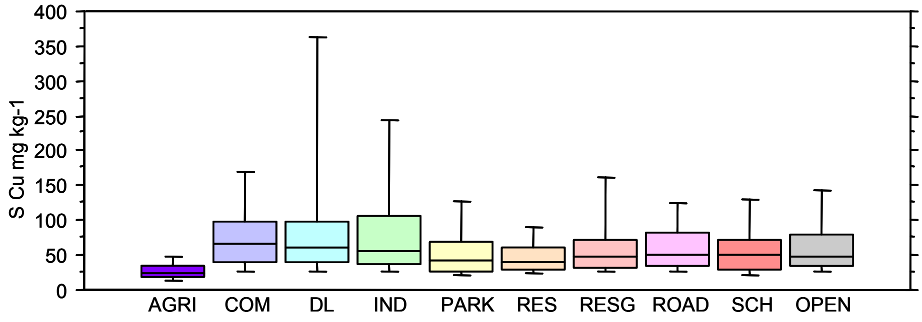

S As mg kg-1
22.5
20
17.5
15
12.5
10
7.5
5
2.5
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

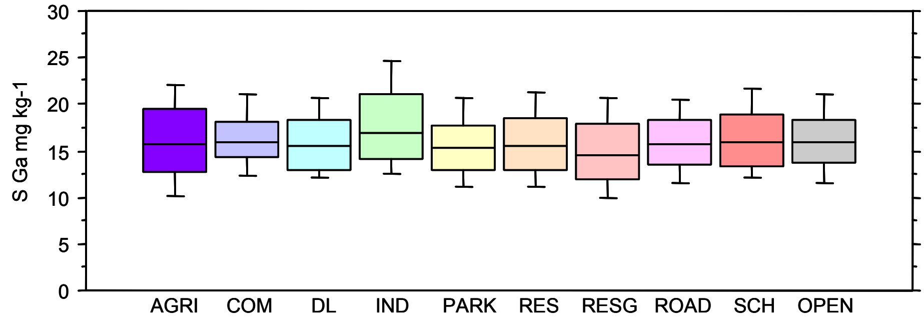

S Ba mg kg-1
1400
1200
1000
800
600
400
200
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

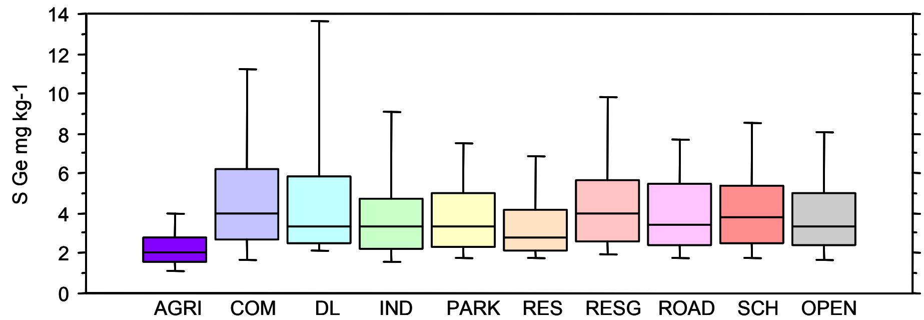

S Bi mg kg-1
1.2
1
.8
.6
.4
.2
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

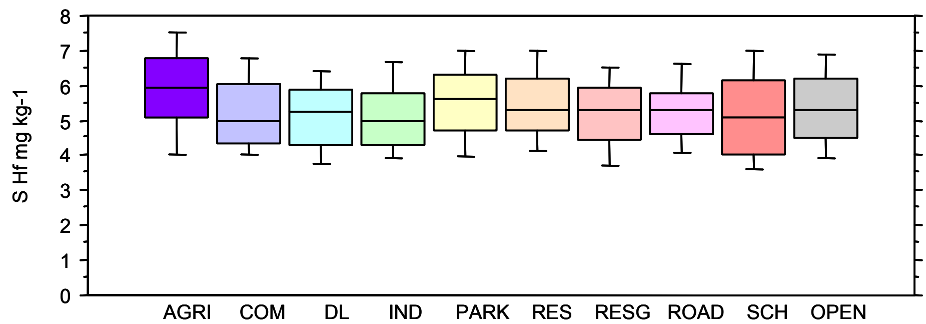

S Br mg kg-1
45
40
35
30
25
20
15
10
5
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

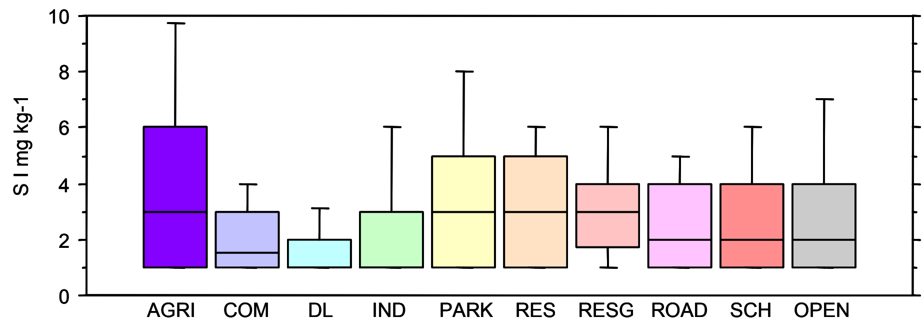

S Cd mg kg-1
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN
S Ce mg kg-1
S Co mg kg-1
S Cr mg kg-1
S Cs mg kg-1

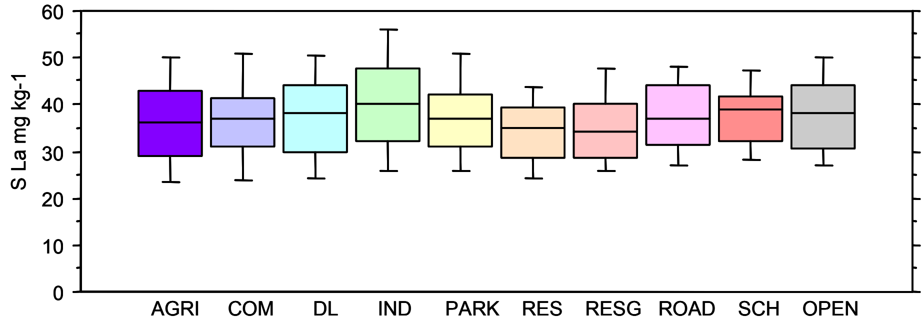

S Cu mg kg-1
400
350
300
250
200
150
100
50
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

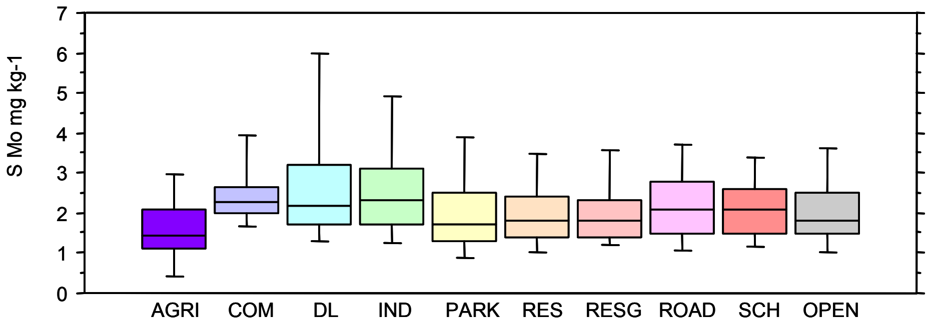

S Ga mg kg-1
30
25
20
15
10
5
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

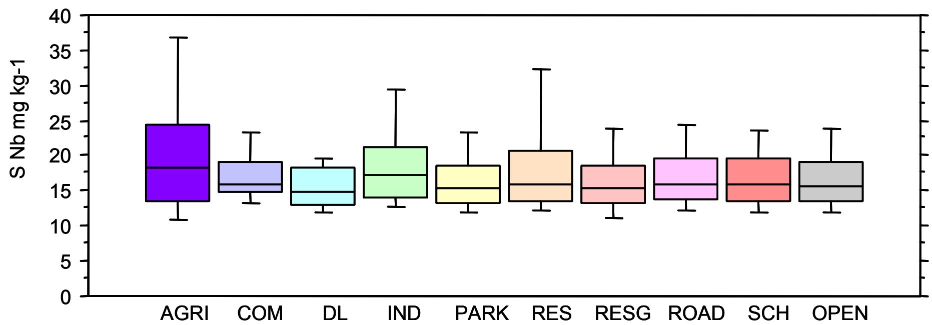

S Ge mg kg-1
14
12
10
8
6
4
2
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

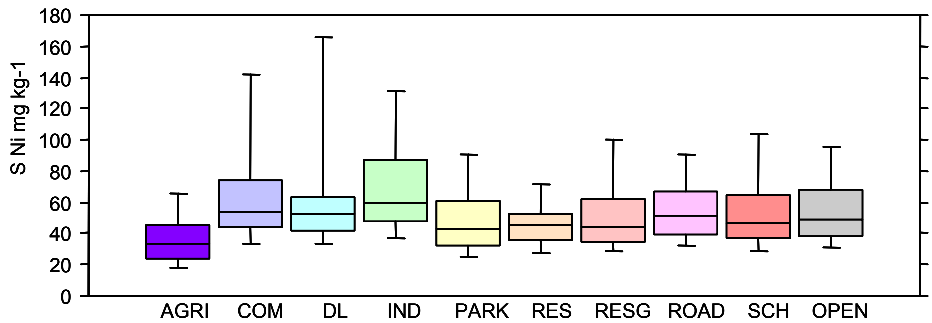

S Hf mg kg-1
8
7
6
5
4
3
2
1
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

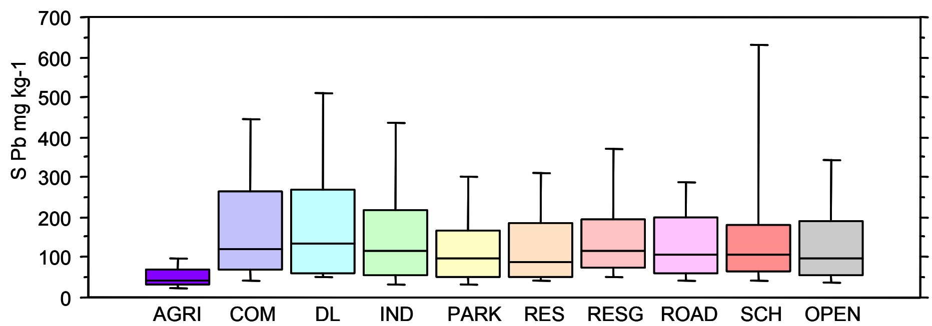

S I mg kg-1
10
8
6
4
2
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

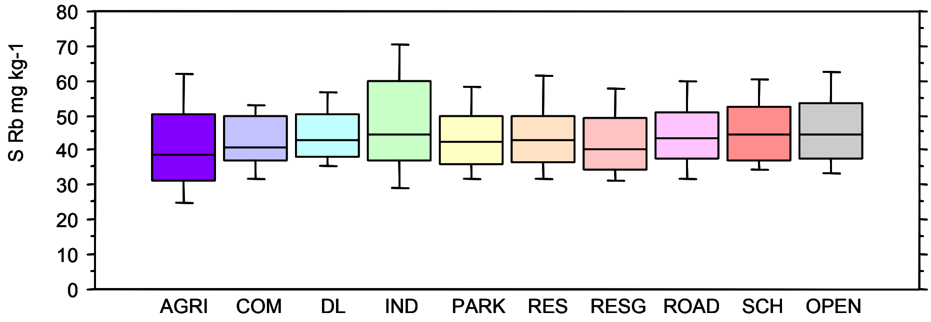

S La mg kg-1
0
10
20
30
40
50
60
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

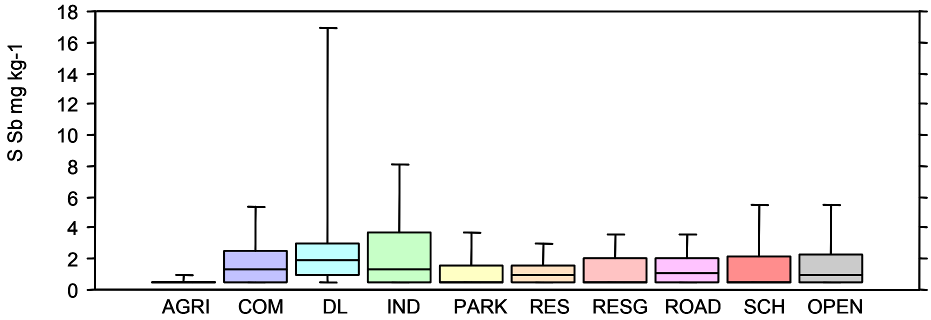

S Mo mg kg-1
0
1
2
3
4
5
6
7
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

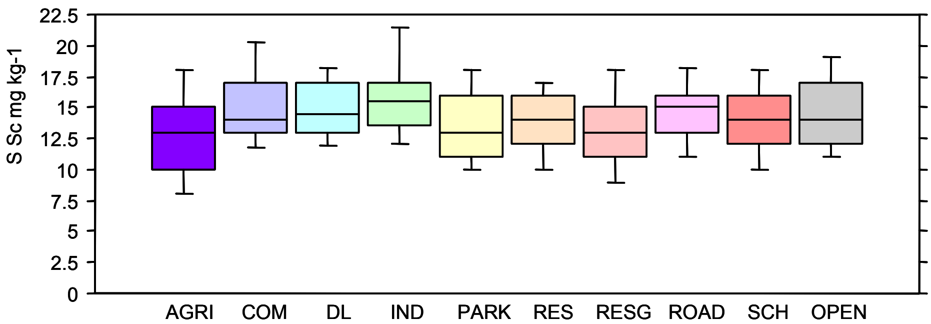

S Nb mg kg-1
0
5
10
15
20
25
30
35
40
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

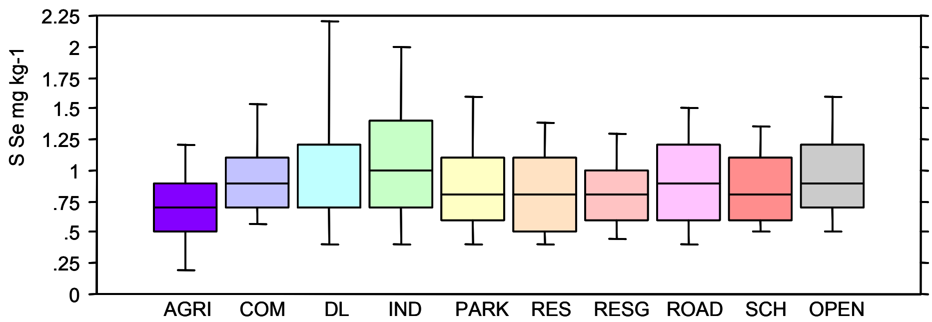

S Ni mg kg-1
0
20
40
60
80
100
120
140
160
180
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

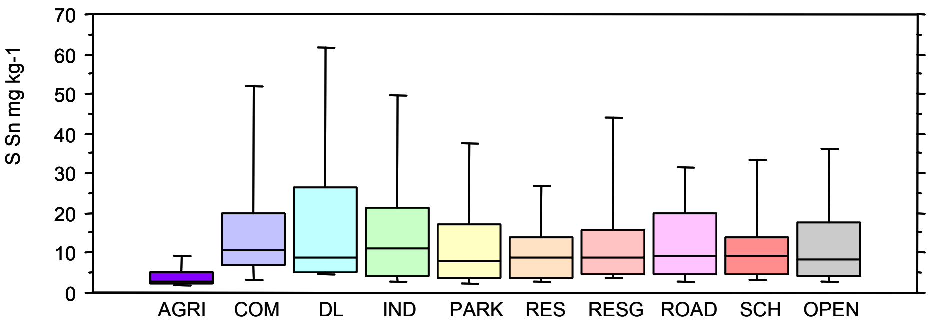

S Pb mg kg-1
0
100
200
300
400
500
600
700
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

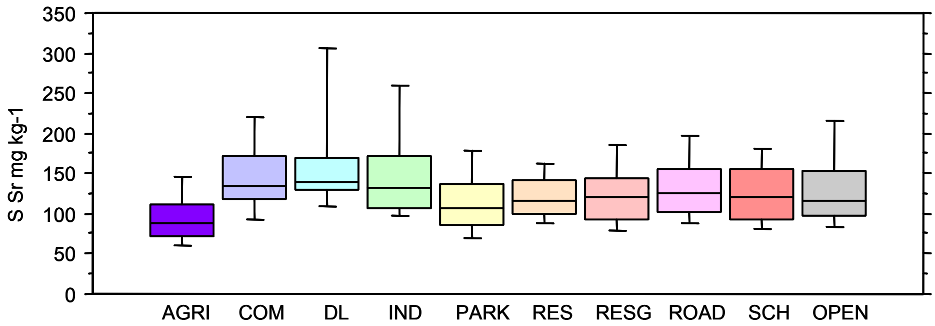

S Rb mg kg-1
80
70
60
50
40
30
20
10
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

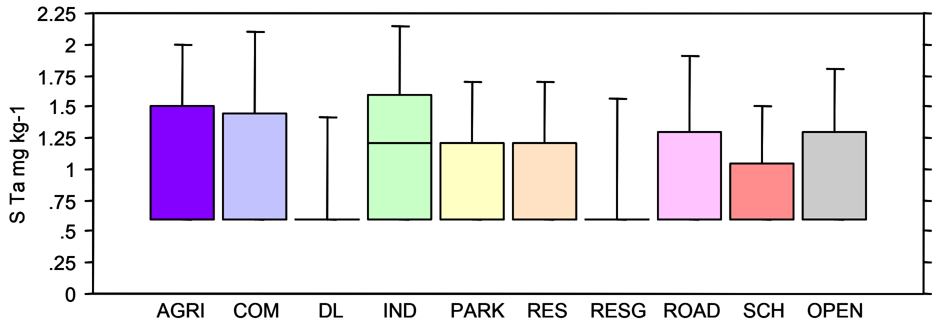

S Sb mg kg-1
18
16
14
12
10
8
6
4
2
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

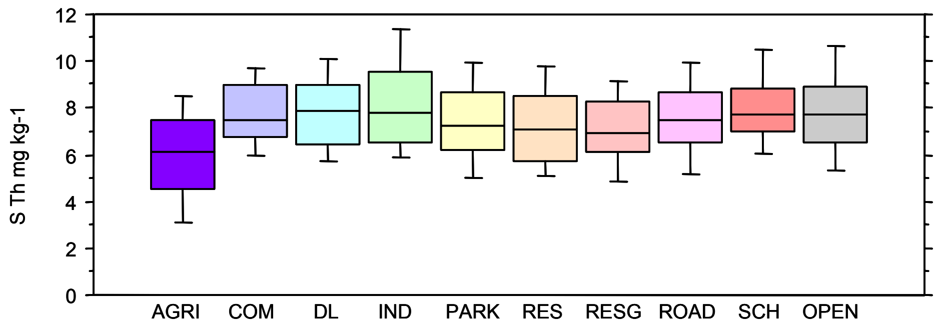

S Sc mg kg-1
22.5
20
17.5
15
12.5
10
7.5
5
2.5
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

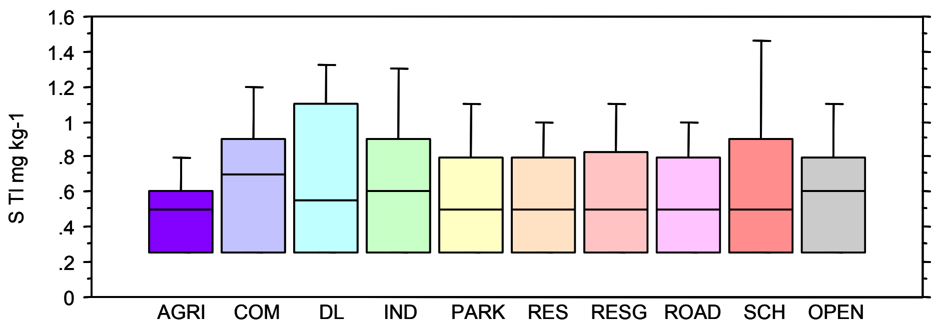

S Se mg kg-1
2.25
2
1.75
1.5
1.25
1
.75
.5
.25
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

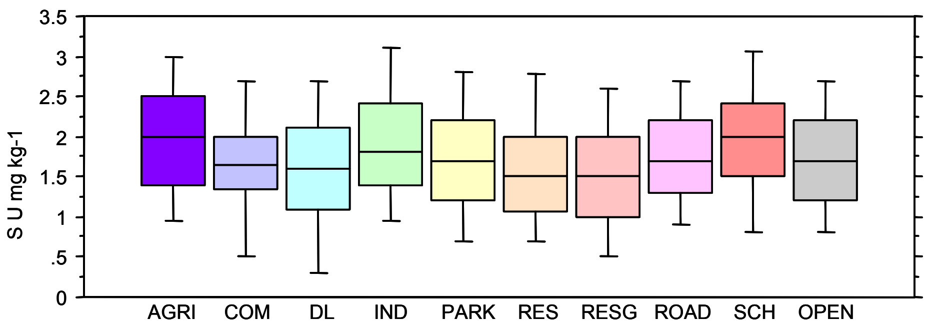

S Sn mg kg-1
70
60
50
40
30
20
10
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

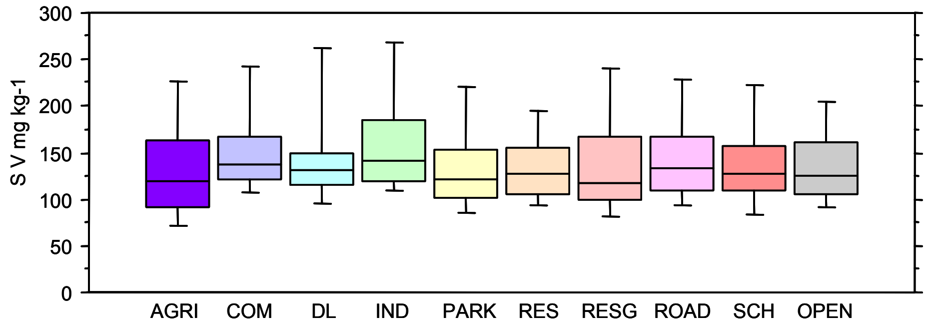

S Sr mg kg-1
0
50
100
150
200
250
300
350
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

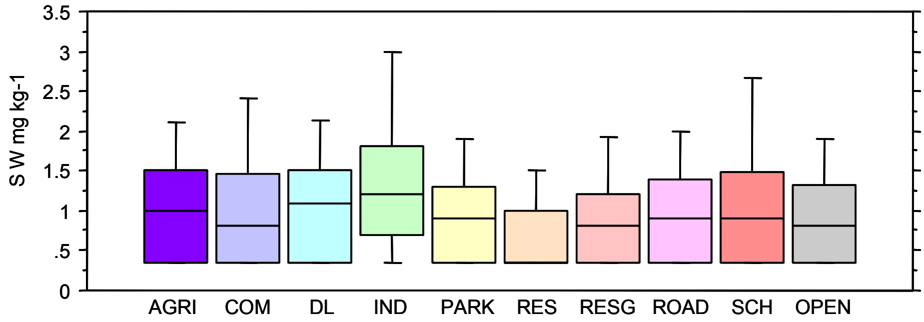

S Ta mg kg-1
0
.25
.5
.75
1
1.25
1.5
1.75
2
2.25
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

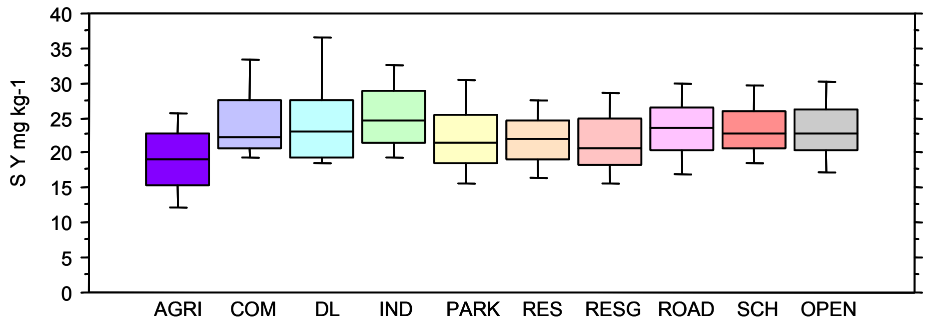

S Th mg kg-1
0
2
4
6
8
10
12
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

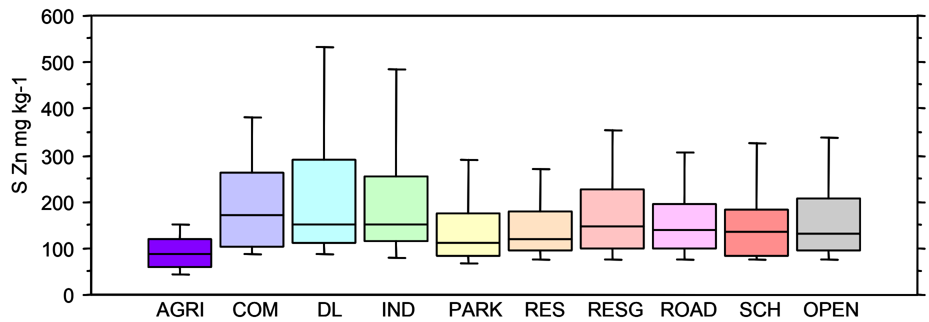

S Tl mg kg-1
0
.2
.4
.6
.8
1
1.2
1.4
1.6
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

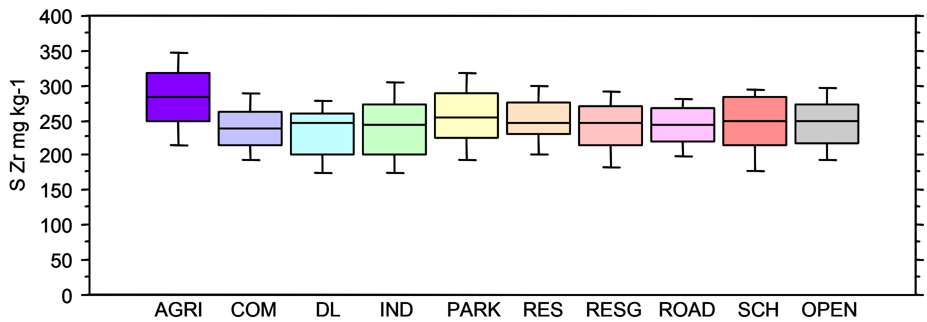

S U mg kg-1
0
.5
1
1.5
2
2.5
3
3.5
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

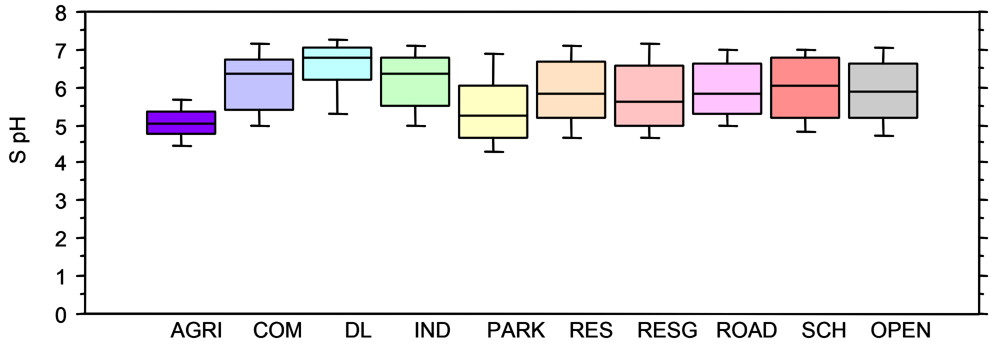

S V mg kg-1
300
250
200
150
100
50
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

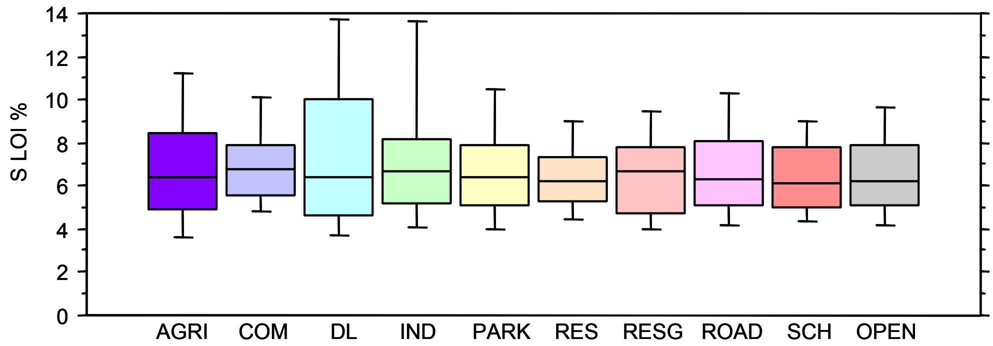

S W mg kg-1
3.5
3
2.5
2
1.5
1
.5
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN

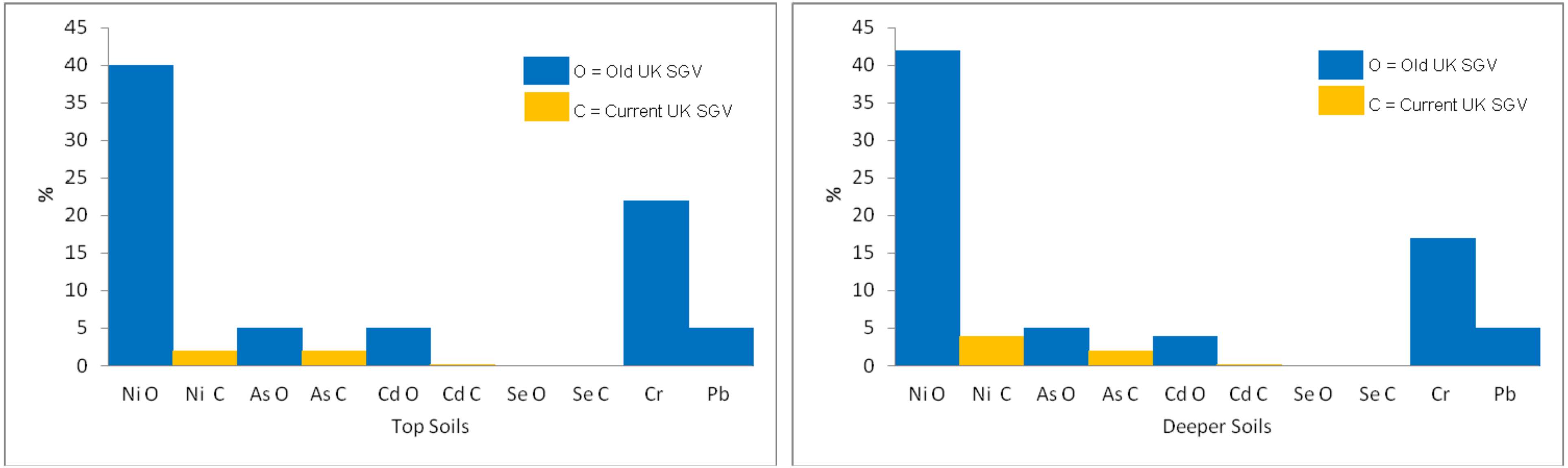

S Y mg kg-1
40
35
30
25
20
15
10
5
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN


S Zn mg kg-1
600
500
400
300
200
100
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN


S Zr mg kg-1
400
350
300
250
200
150
100
50
0
AGRI COM DL IND PARK RES RESG ROAD SCH OPEN


S pH
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN

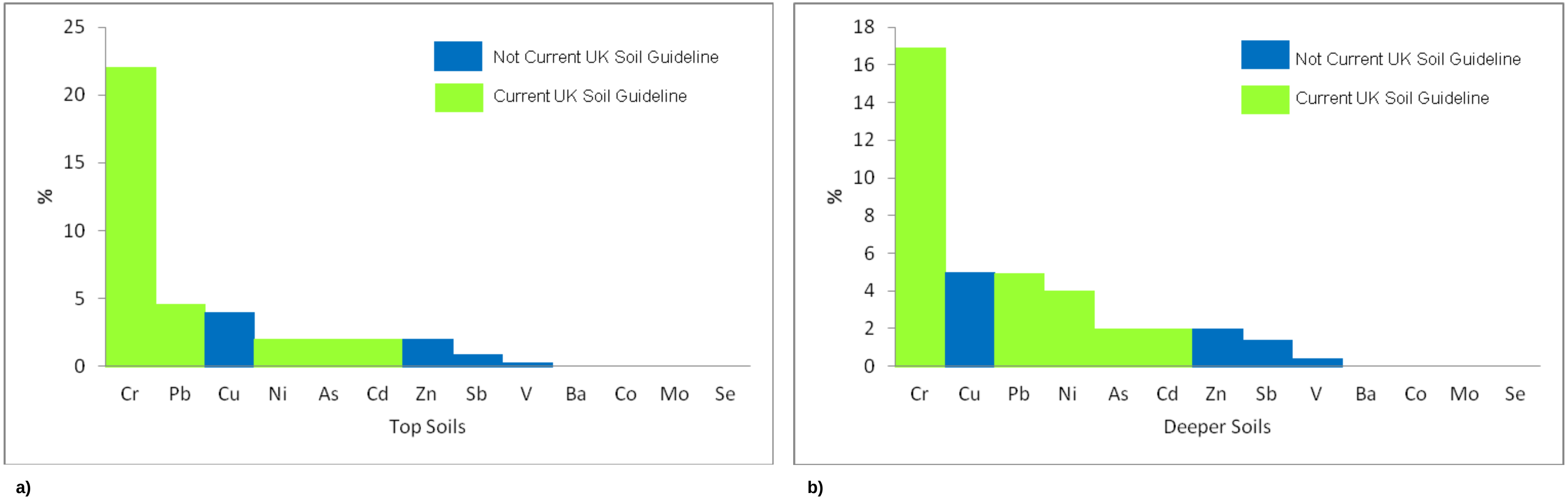

S LOI %
AGRI
COM
DL
IND
PARK
RES
RESG
ROAD
SCH
OPEN




a) b)

O = Old UK CLEA Soil Guideline Value (SGV) (EA, 2008a) C = Current UK CLEA Soil Guideline Values (SGV) (EA, 2011)

**Figure 3.18. Charts showing the percentage of Glasgow (a) top and (b) deeper soils that exceed the former and current UK CLEA soil guideline values.**




Current UK Soil Guideline = CLEA Guideline (EA, 2008a): Cr and Pb residential; (EA, 2011): As, Ni residential; Cd, Se allotment
Not Current UK Soil Guideline = Dutch Soil Intervention Values (VROM, 2009): Co, Cu, Mo, Sb, Zn; US-EPA Soil Screening Levels (US-EPA, 1996): Ba, V

**Figure 3.19. Charts showing the percentage of Glasgow (a) top and (b) deeper soils that exceed selected soil guideline values from the UK and elsewhere**

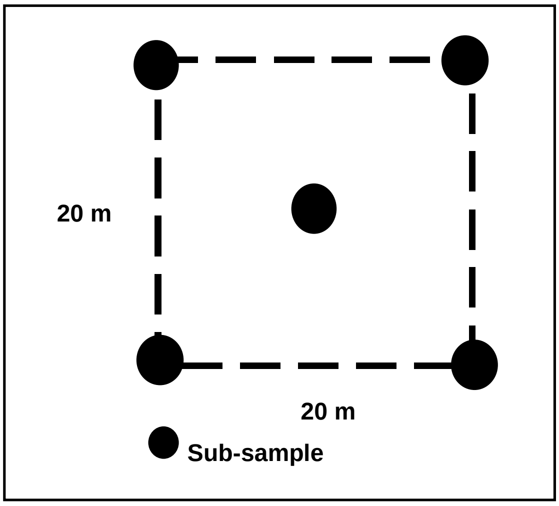
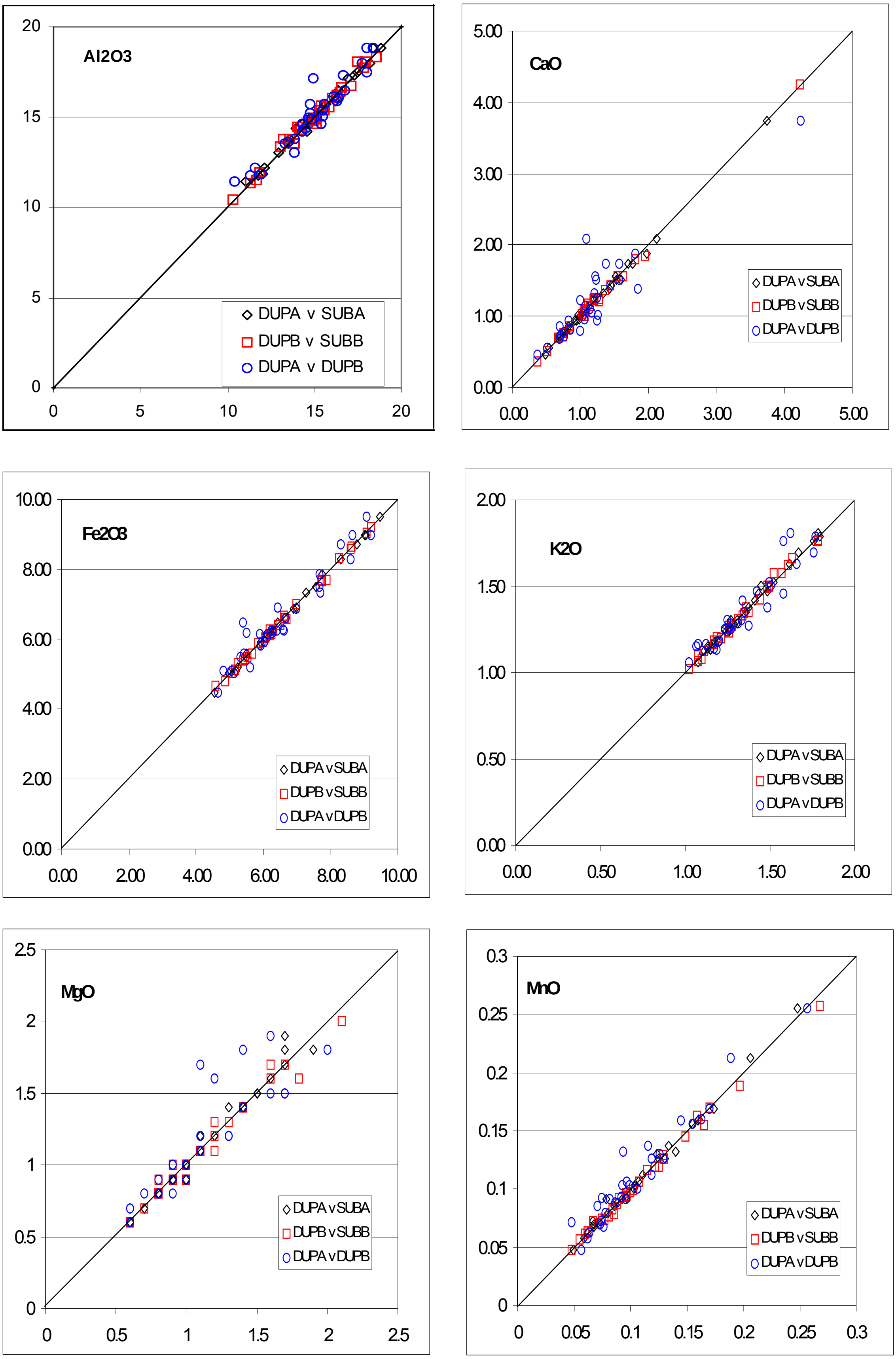



**Figure A1.1 Diagram of the G-BASE composite soil site sampling plan.**

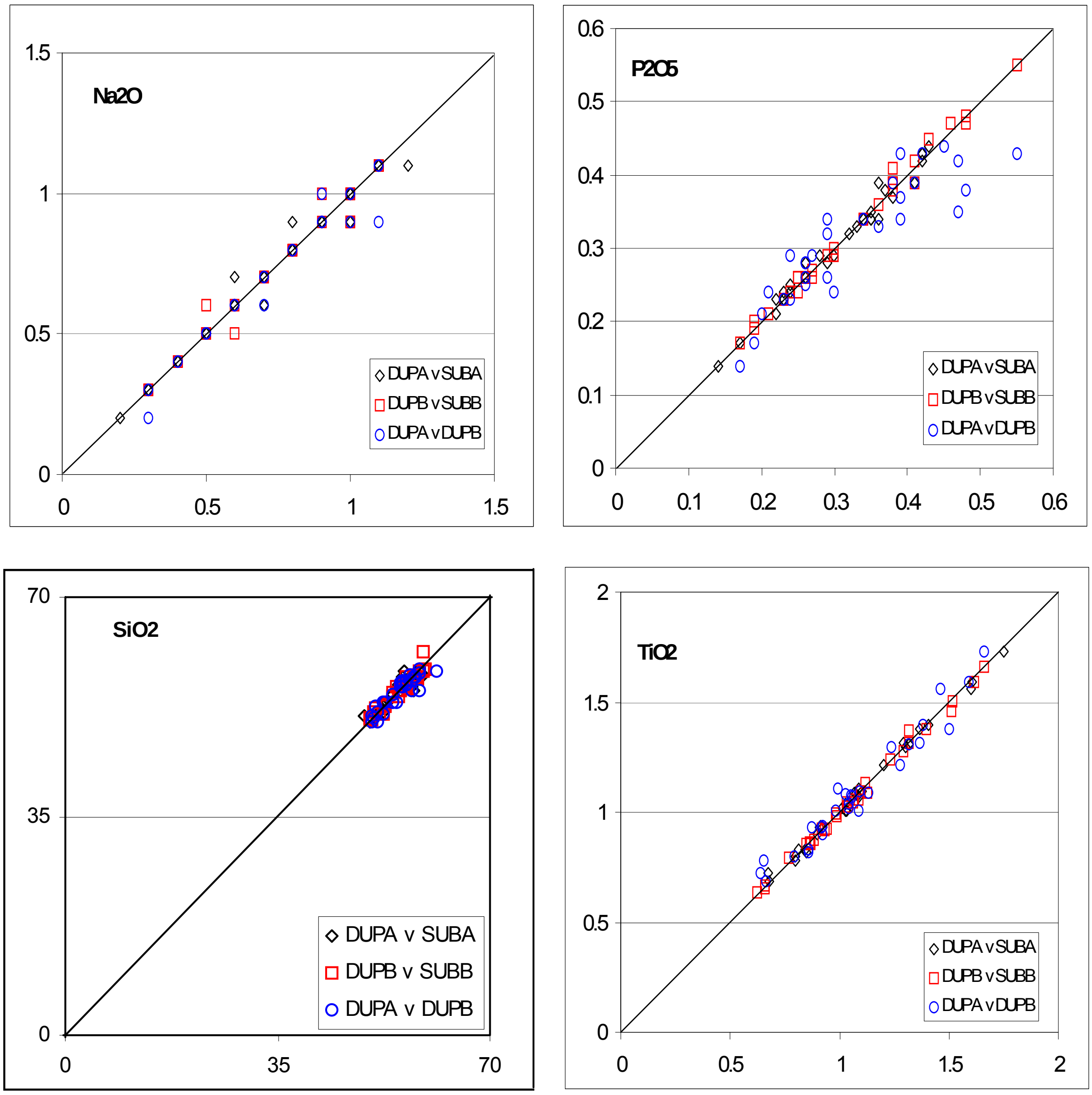


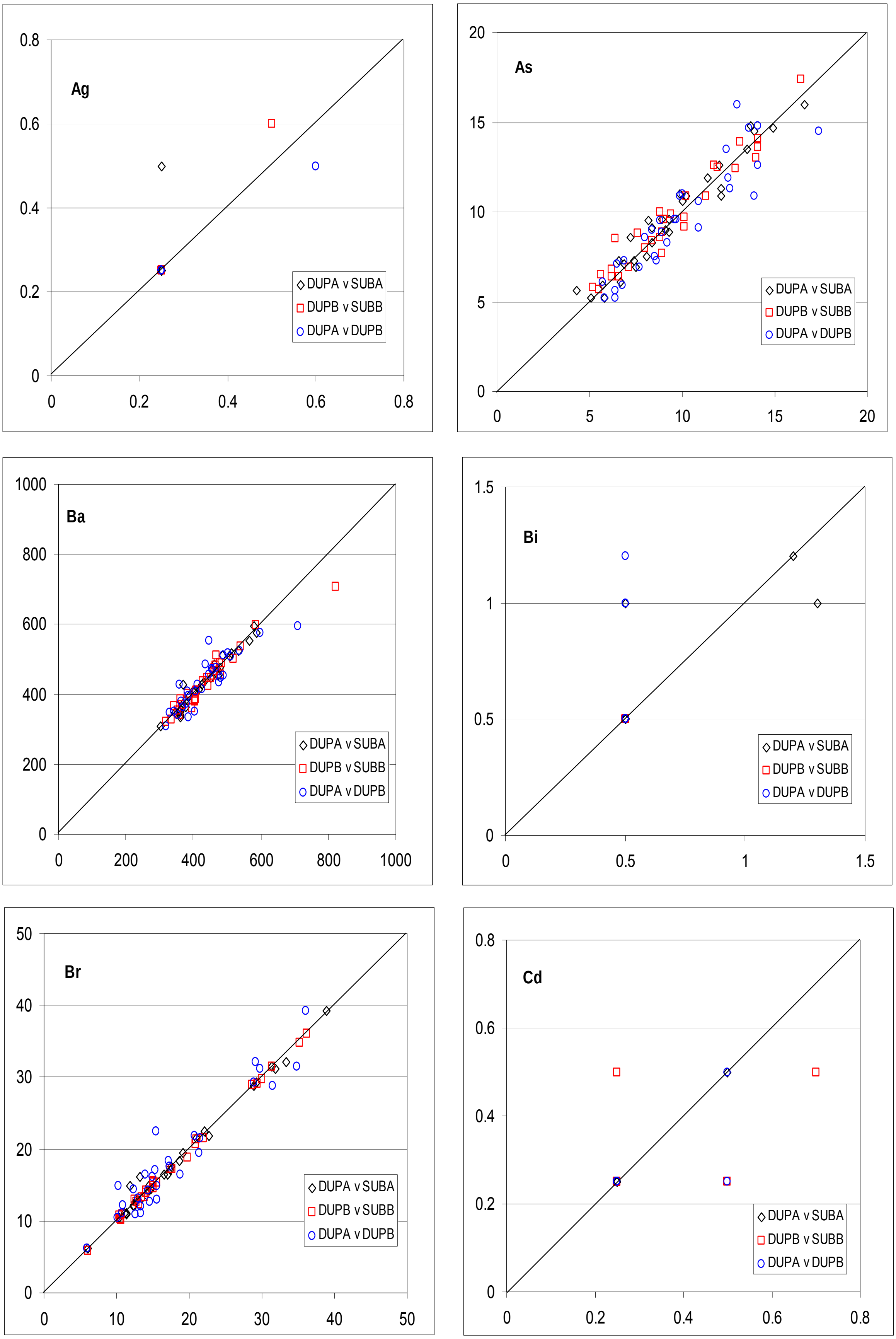

All concentrations in wt%
Dup = Field duplicate
Number = 34

First column listed = Y axis
Sub = Analytical replicate

Second column listed = X axis
Diagonal line shows theoretical 1:1 relationship

**Figure A1.2 Plots of major element field and analytical duplicate results in Glasgow top (A) soils**


Na2O
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
P2O5
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
SiO2
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
TiO2
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

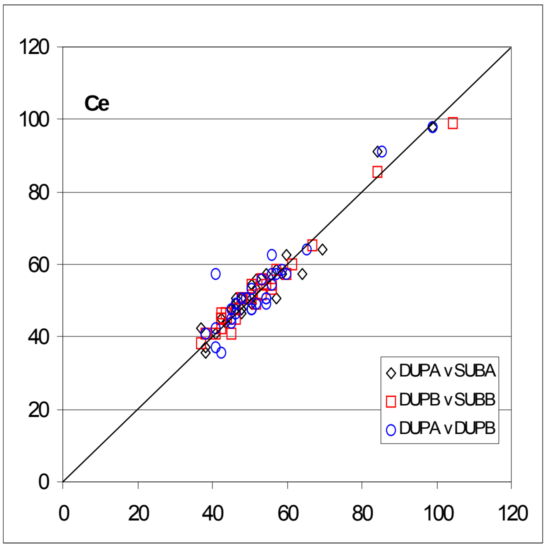


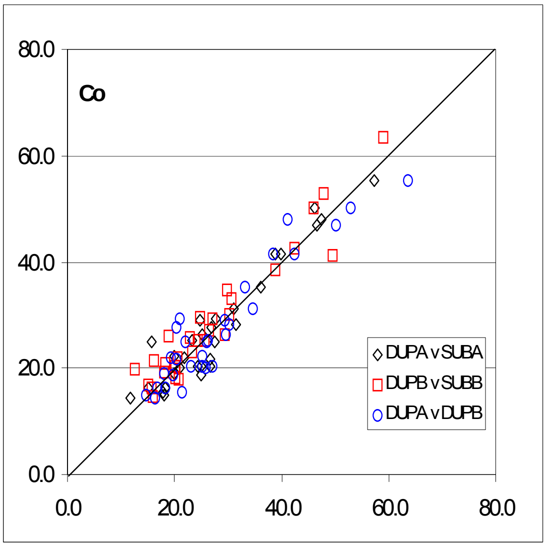

All concentrations in mg kg$^{-1}$
Dup = Field duplicate
Number = 34

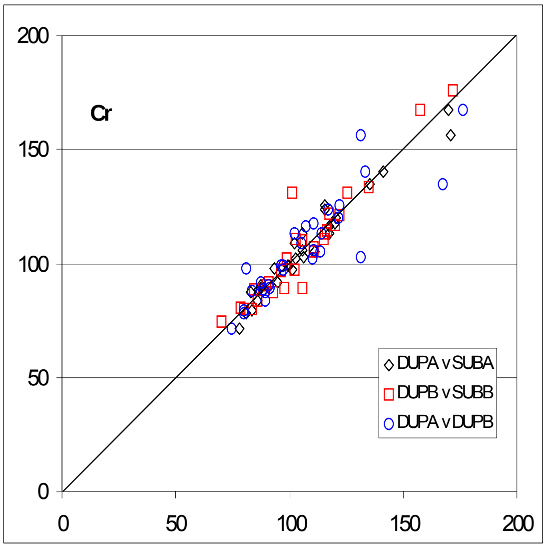
First column listed = Y axis
Sub = Analytical replicate

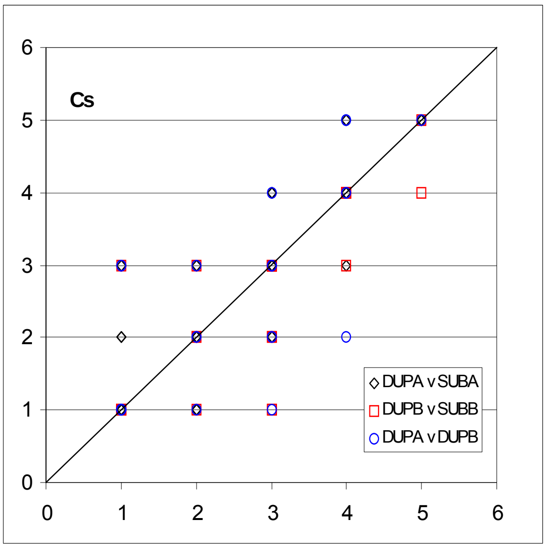
Second column listed = X axis
Diagonal line shows theoretical 1:1 relationship

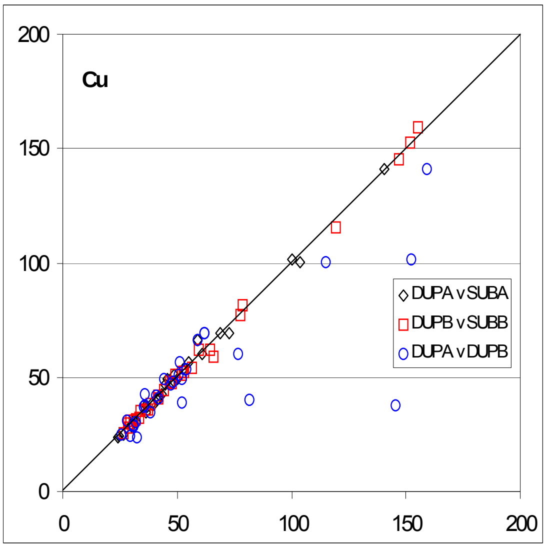
**Figure A1.3 Plots of trace element field and analytical duplicate results in Glasgow top (A) soils**

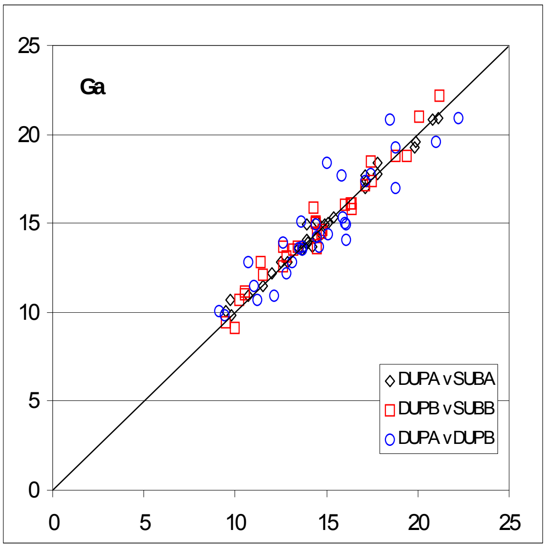

Ce
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

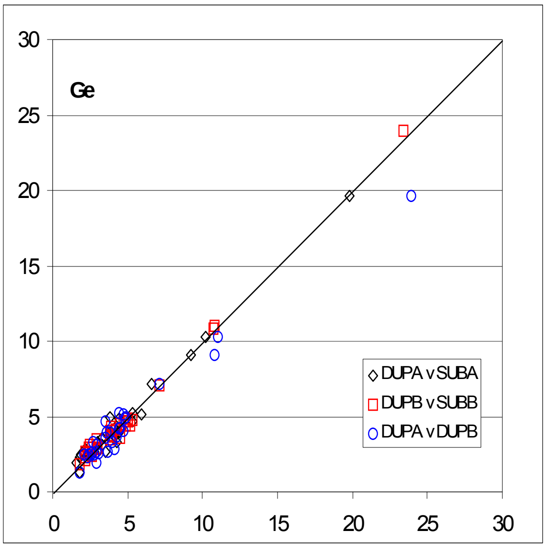

Co
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

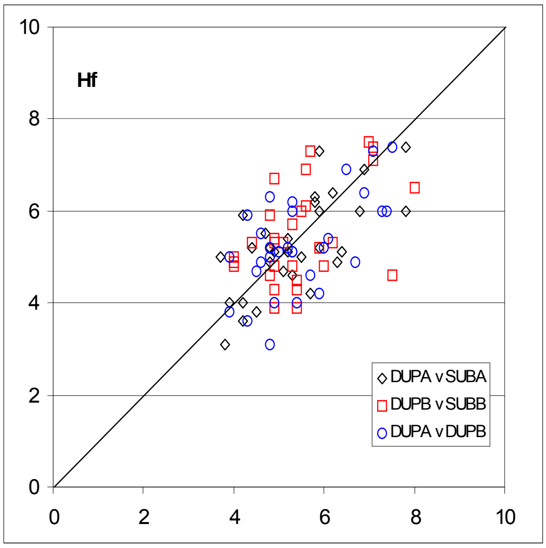

Cr
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

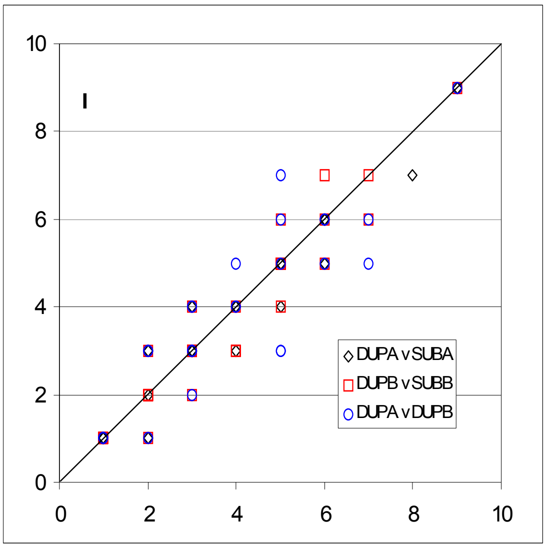

Cs
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

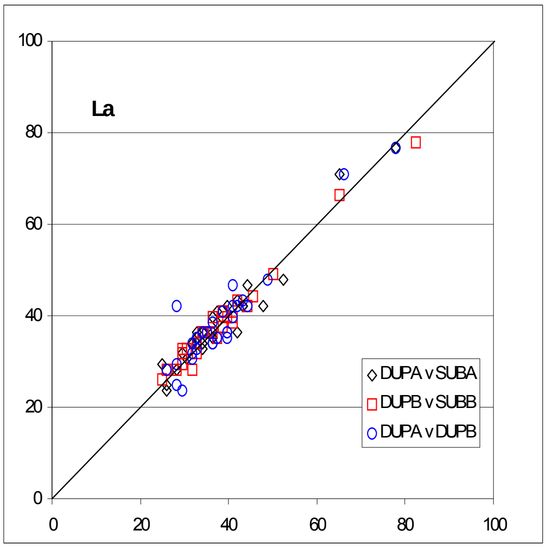

Cu
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

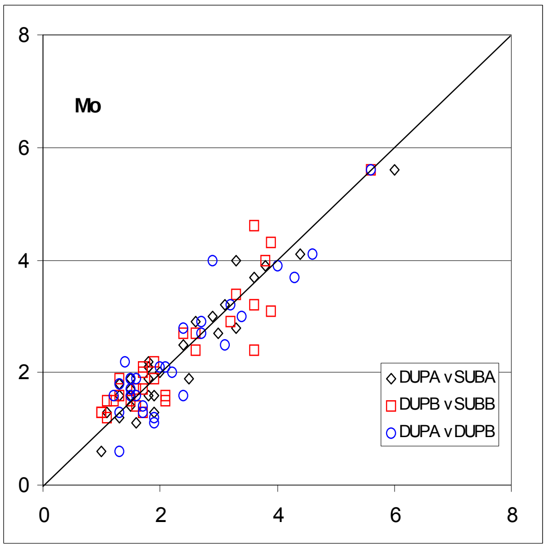

Ga
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

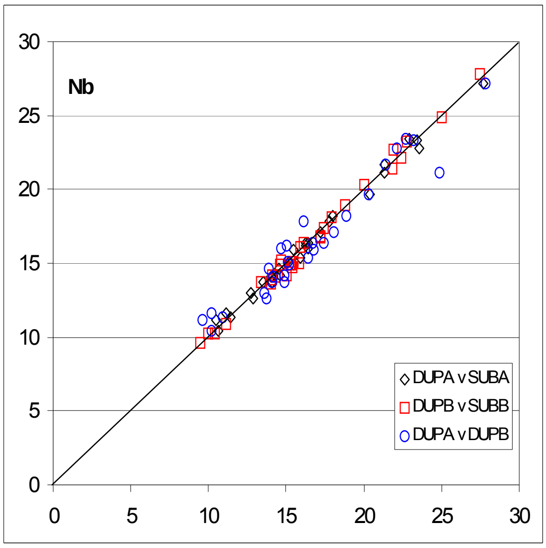

Ge
0
5
10
15
20
25
30
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

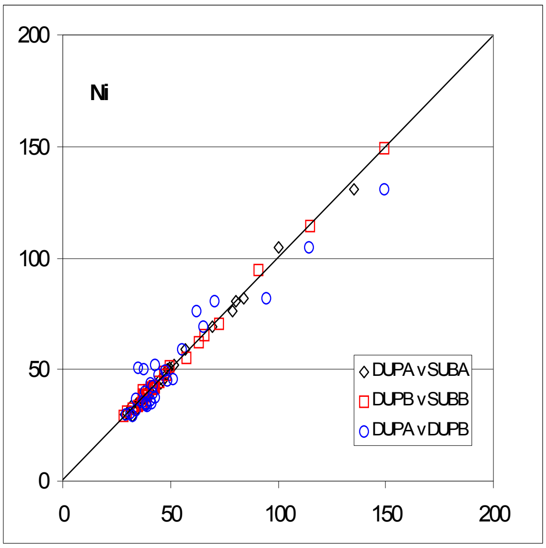

Hf
0
2
4
6
8
10
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

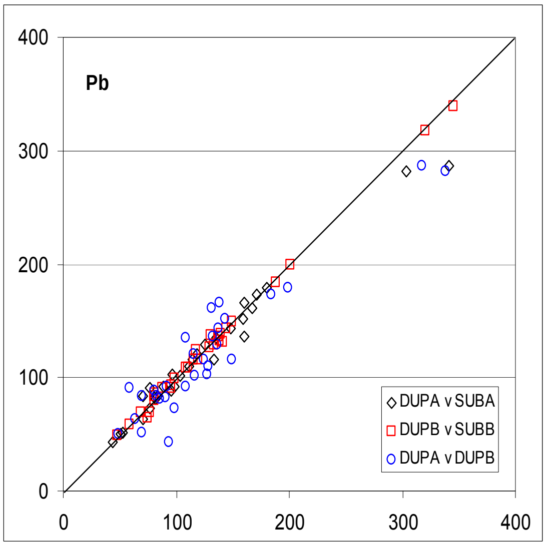

I
0
2
4
6
8
10
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

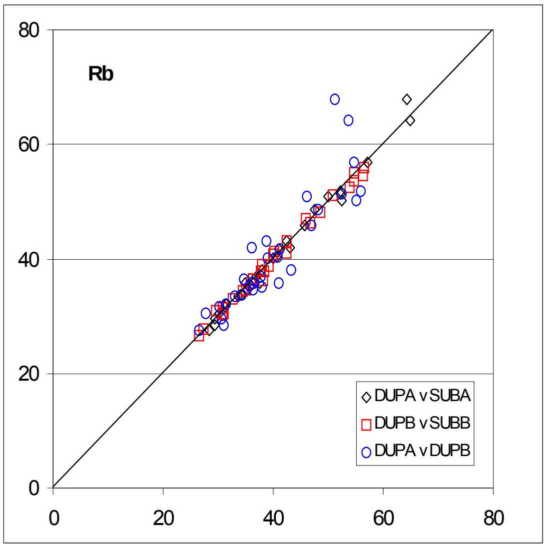

La
0
20
40
60
80
100
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

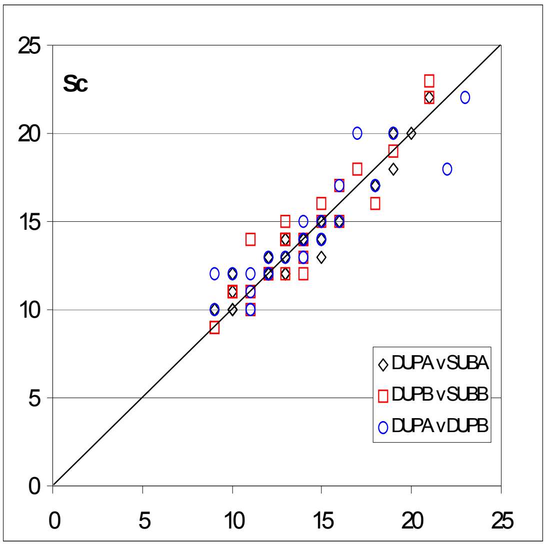

Mo
0
2
4
6
8
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

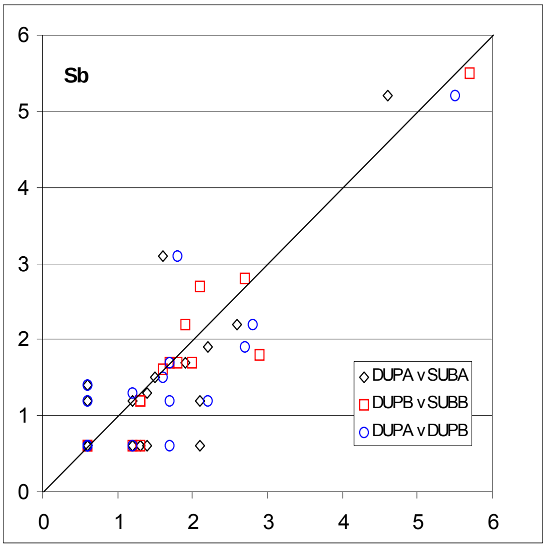

Nb
0
5
10
15
20
25
30
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

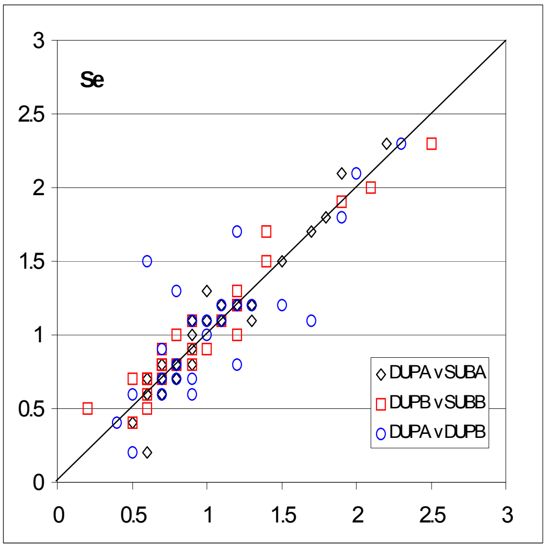

Ni
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

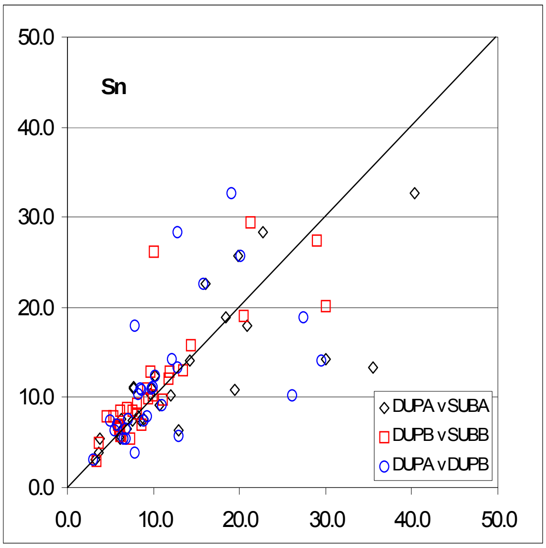

Pb
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

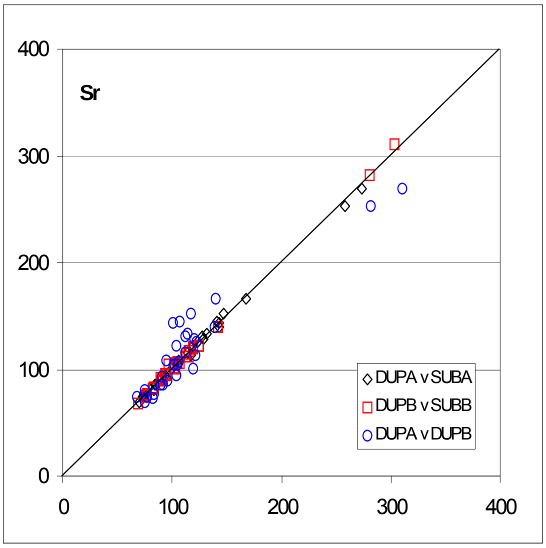

Rb
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

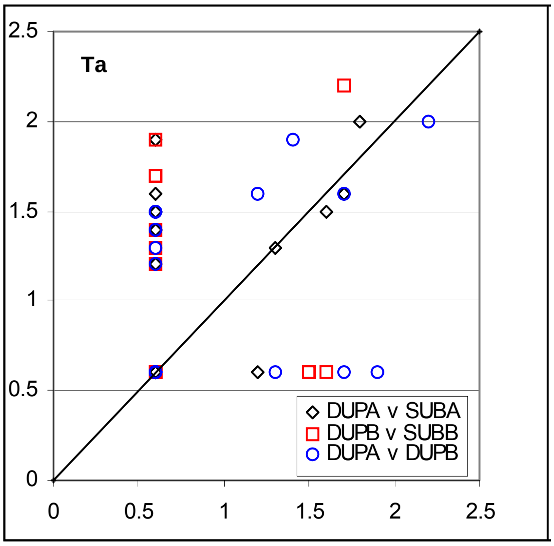

Sc
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

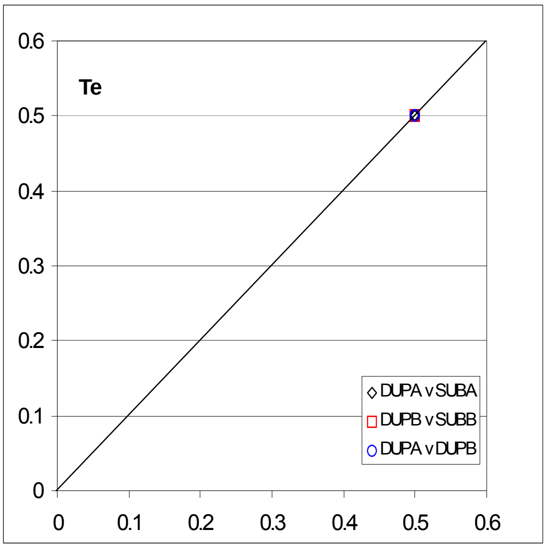

Sb
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

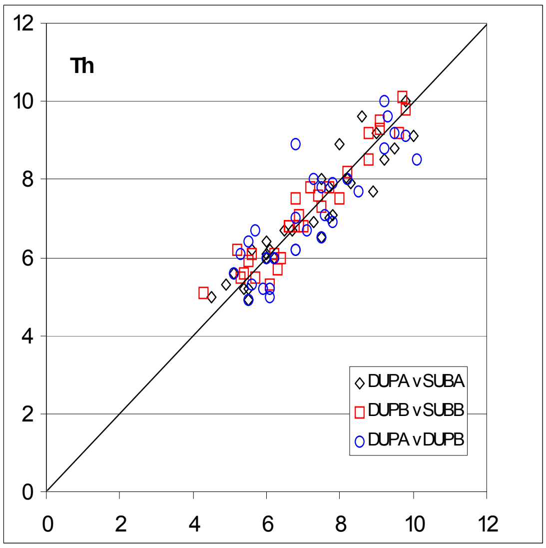

Se
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

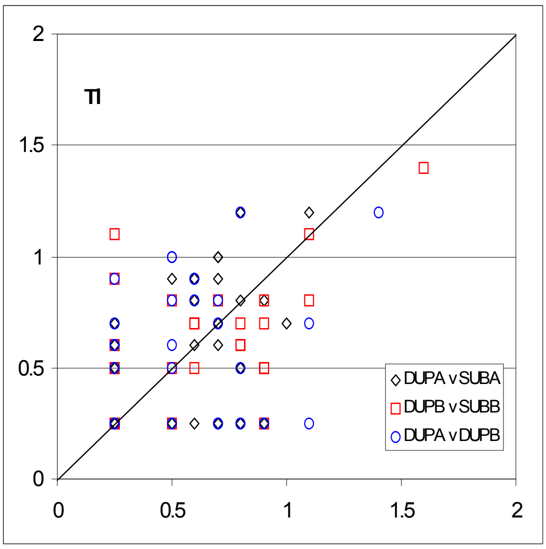

Sn
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0.0
10.0
20.0
30.0
40.0
50.0

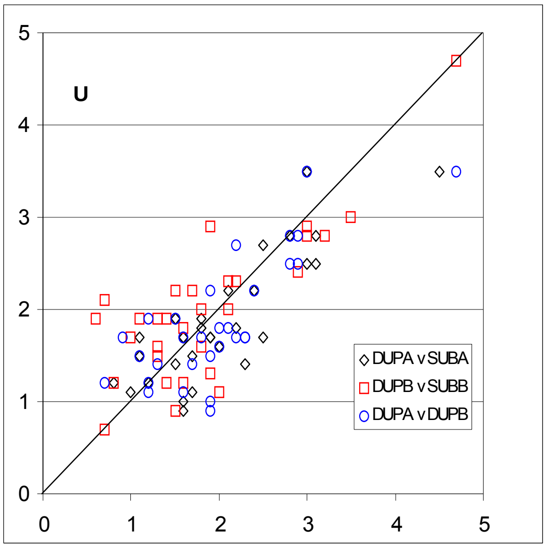

Sr
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
100
200
300
400


Ta
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
0.5
1
1.5
2
2.5

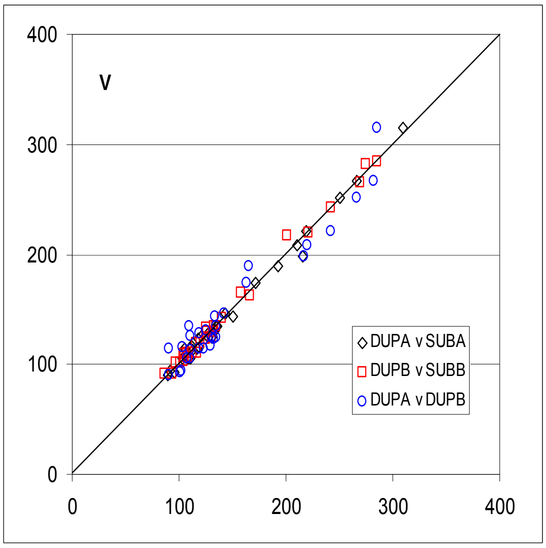

Te
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
0.1
0.2
0.3
0.4
0.5
0.6


Th
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
2
4
6
8
10
12

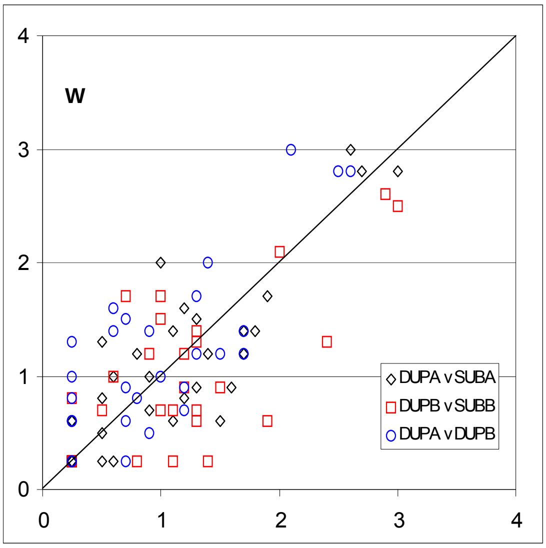

Tl
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
0.5
1
1.5
2



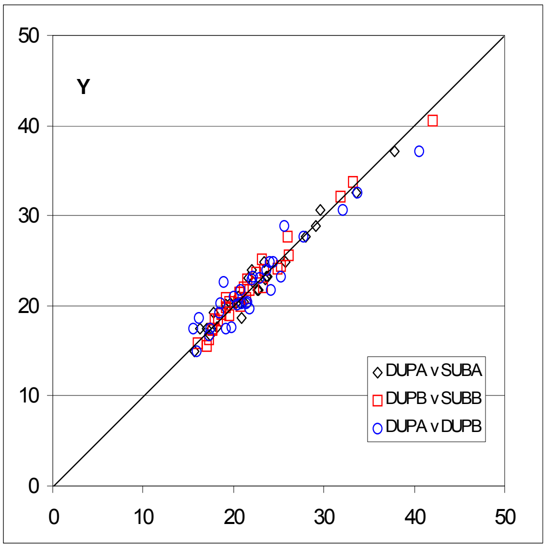
U
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
1
2
3
4
5

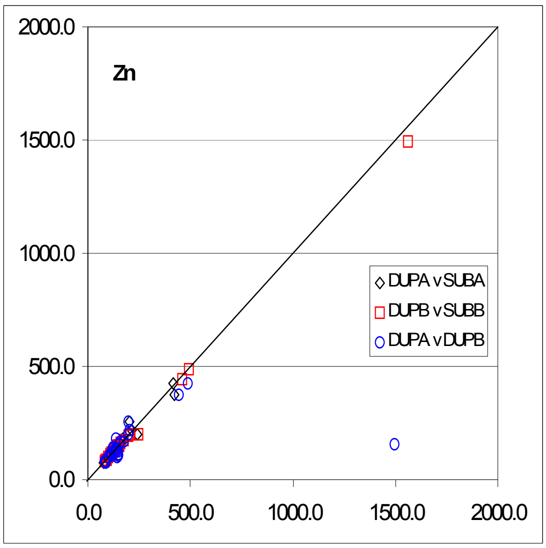
V
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
100
200
300
400

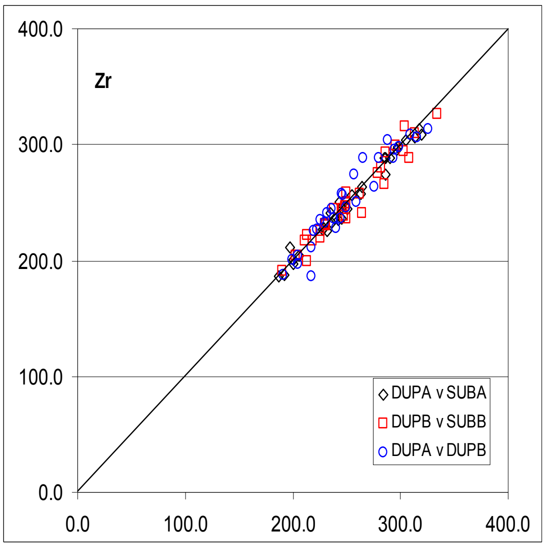
W
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
1
2
3
4

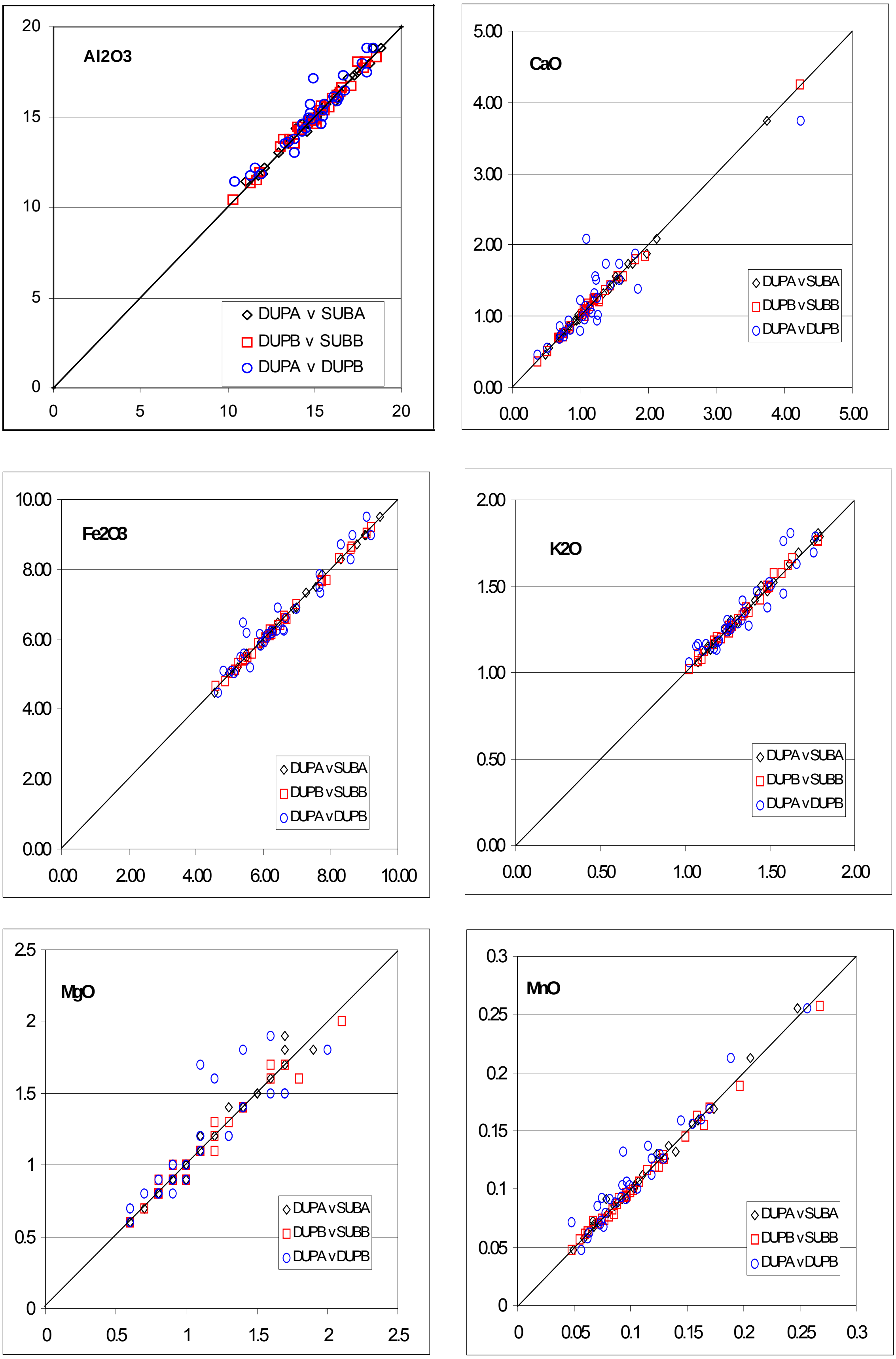
Y
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
10
20
30
40
50

Zn
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0.0
500.0
1000.0
1500.0
2000.0

Zr
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0.0
100.0
200.0
300.0
400.0

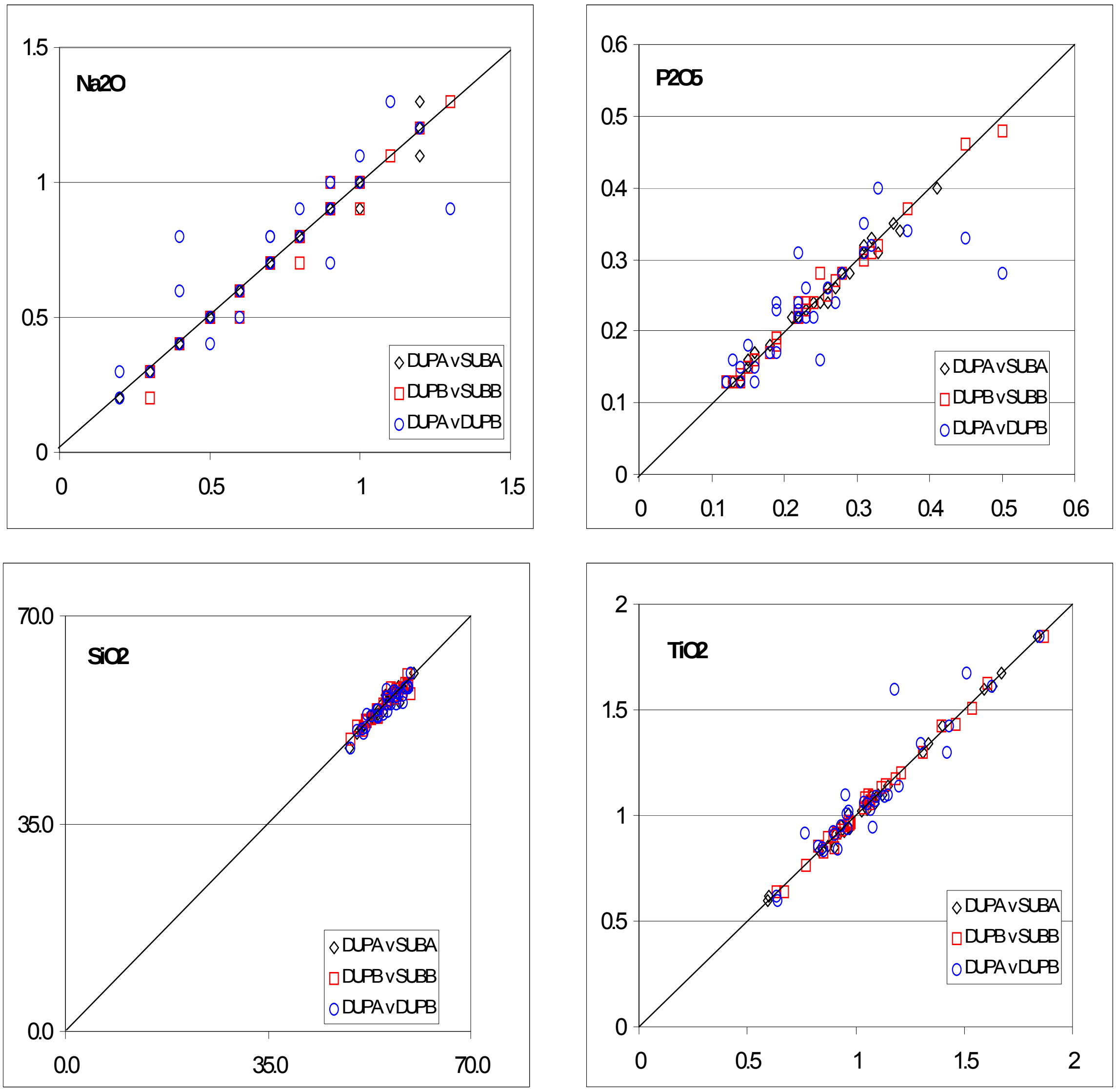


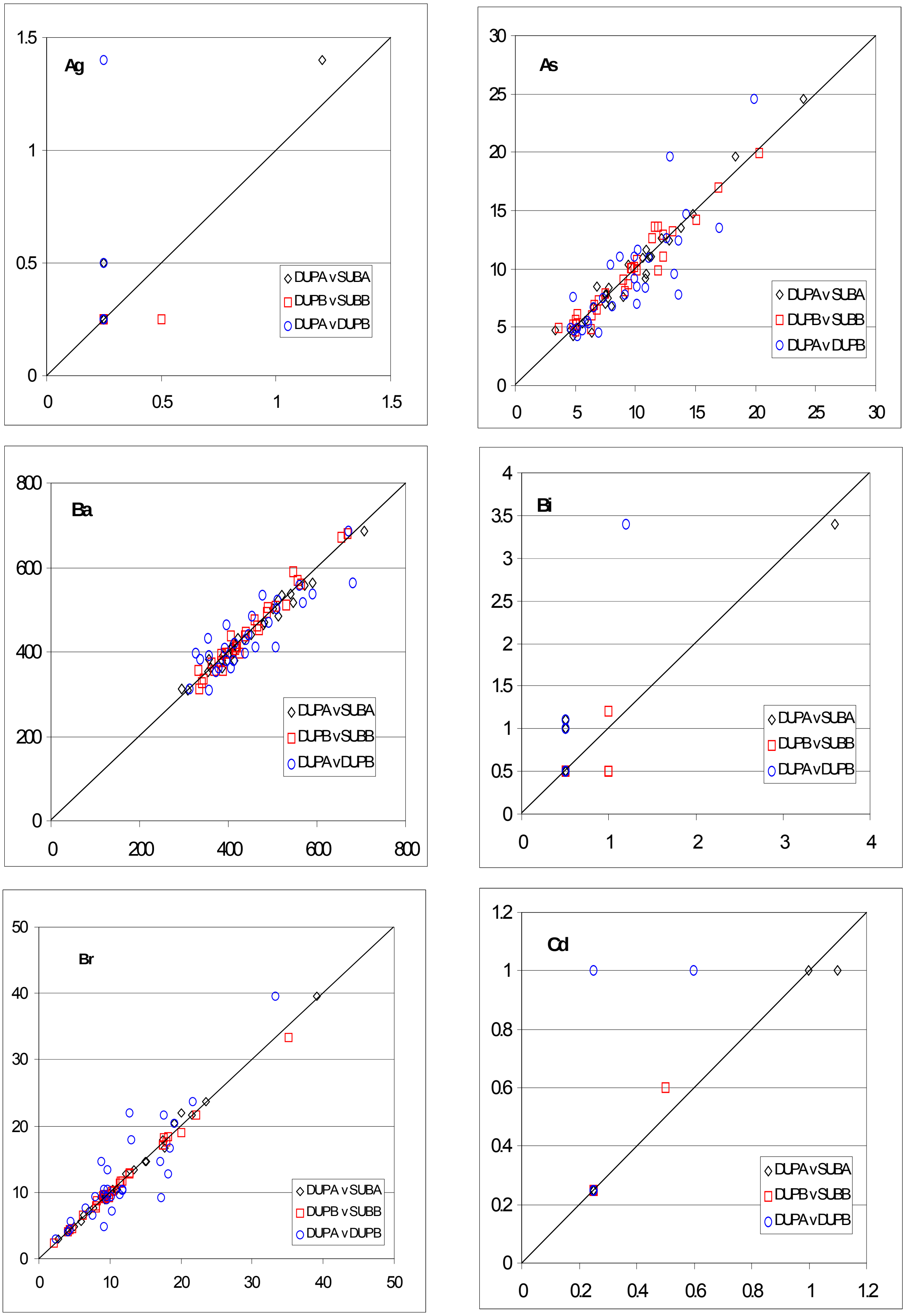

All concentrations in wt%
Dup = Field duplicate
Number = 34

First column listed = Y axis
Sub = Analytical replicate

Second column listed = X axis
Diagonal line shows theoretical 1:1 relationship

**Figure A1.4 Plots of major element field and analytical duplicate results in Glasgow deeper (S) soils**


Na2O
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
P2O5
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
SiO2
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
TiO2
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

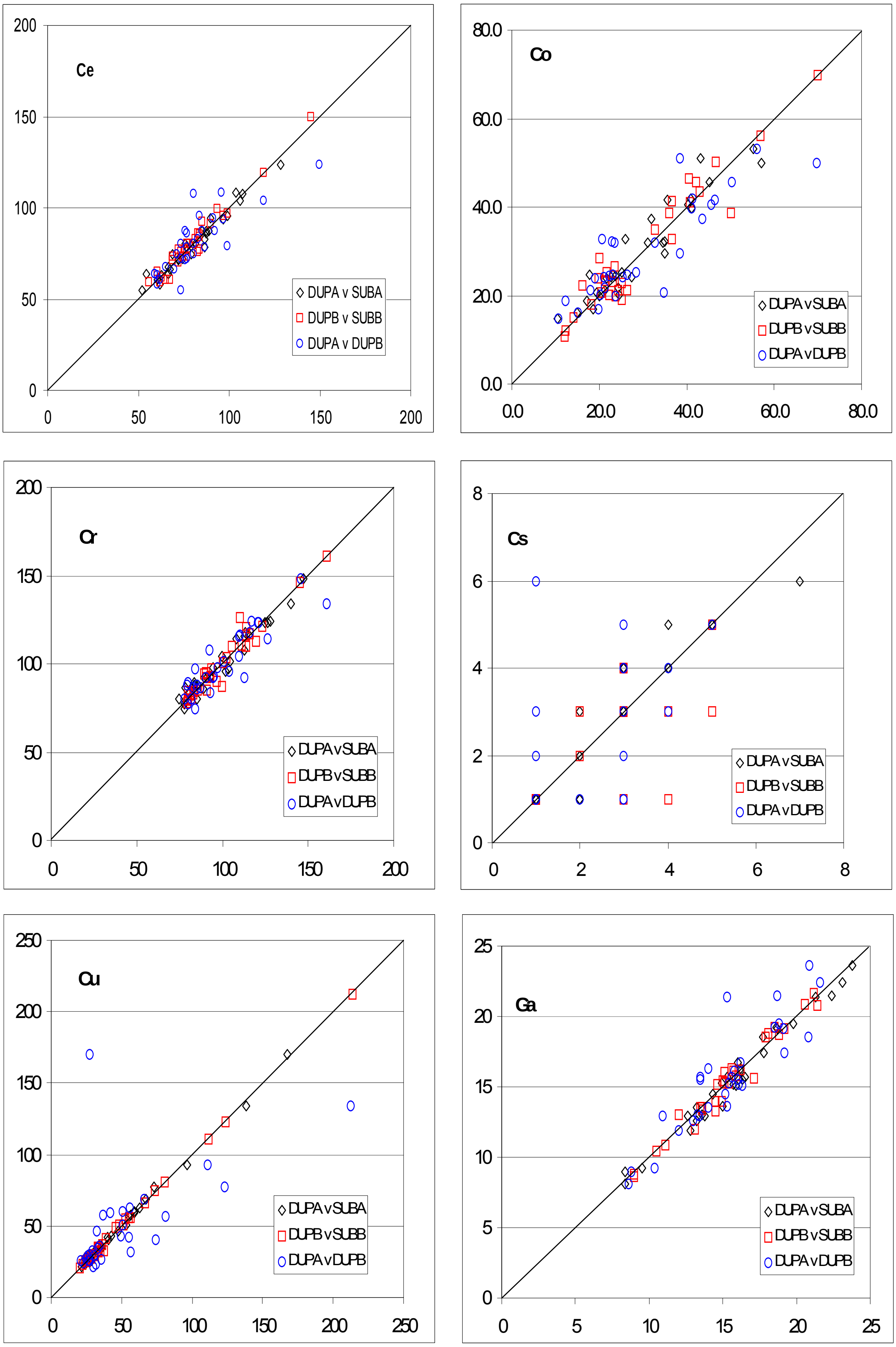



All concentrations in mg kg$^{-1}$
Dup = Field duplicate
Number = 34

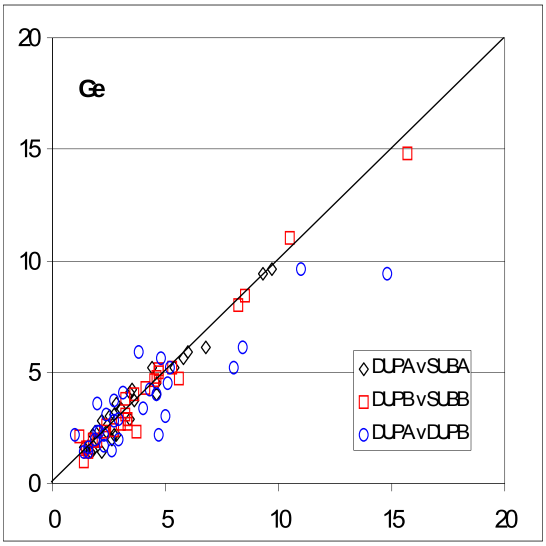
First column listed = Y axis
Sub = Analytical replicate

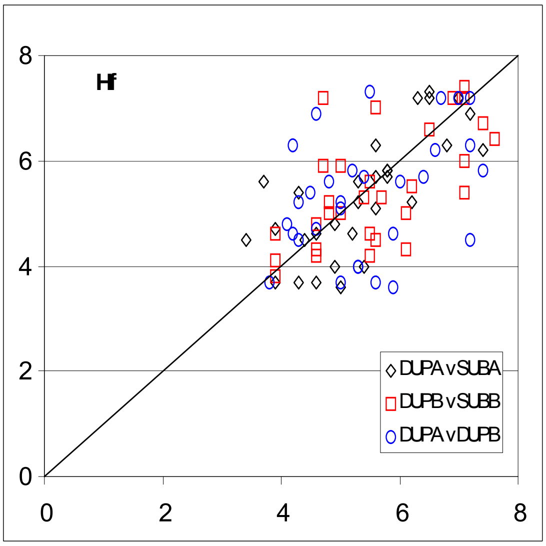
Second column listed = X axis
Diagonal line shows theoretical 1:1 relationship

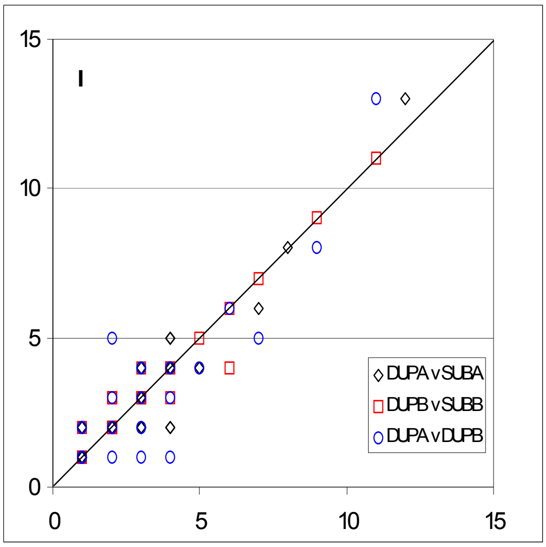
**Figure A1.5 Plots of trace element field and analytical duplicate results in Glasgow deeper (S) soils**

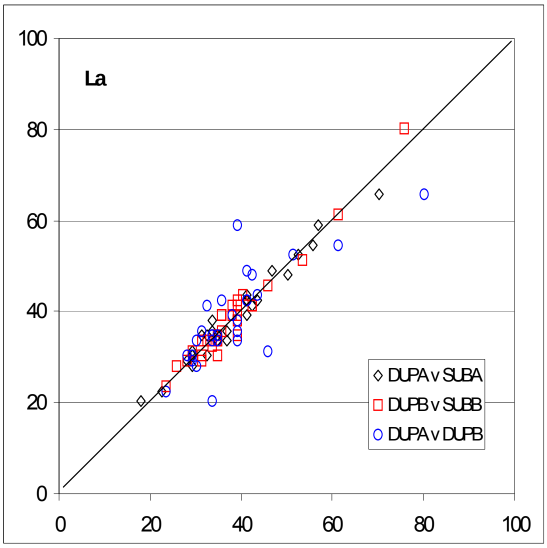


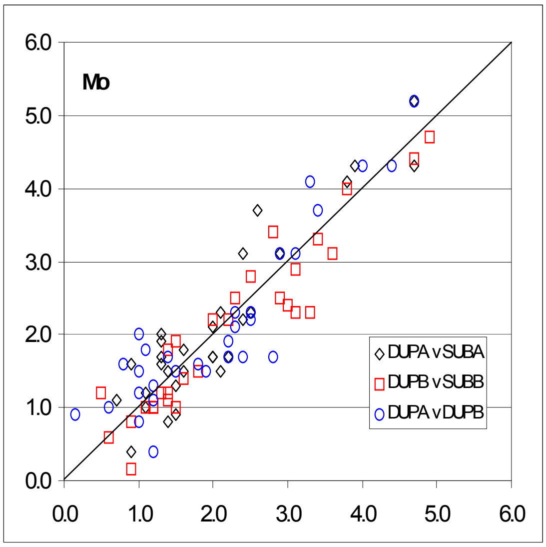
Ce
0
50
100
150
200
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
Co
0.0
20.0
40.0
60.0
80.0
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
Cr
0
50
100
150
200
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
Cs
0
2
4
6
8
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
Cu
0
50
100
150
200
250
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
Ga
0
5
10
15
20
25
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

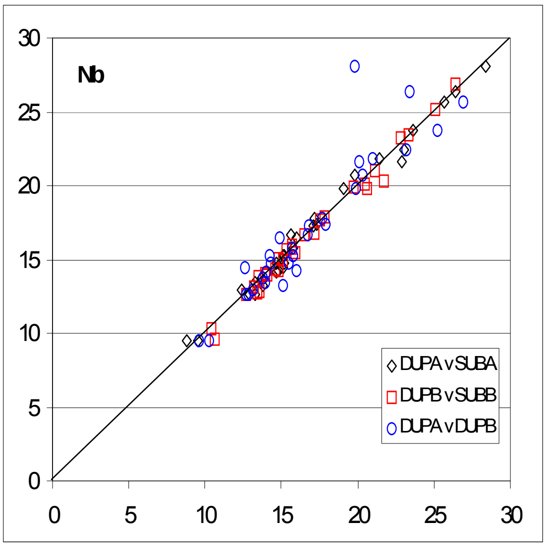

Ge
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
5
10
15
20

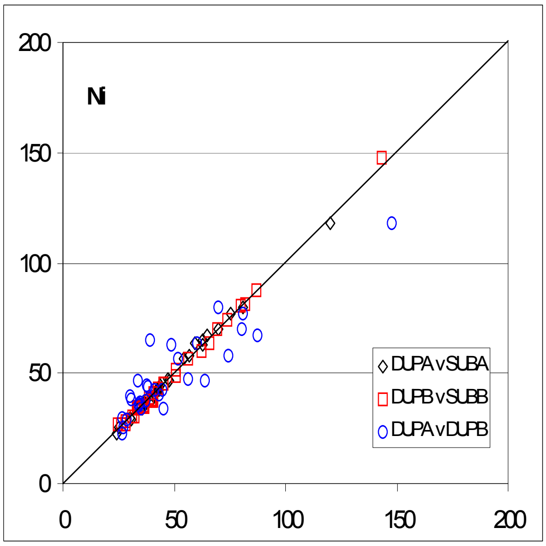

Hf
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
2
4
6
8

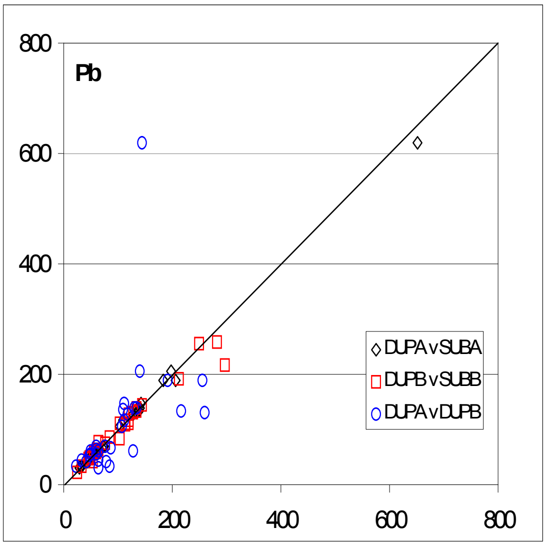

I
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
5
10
15

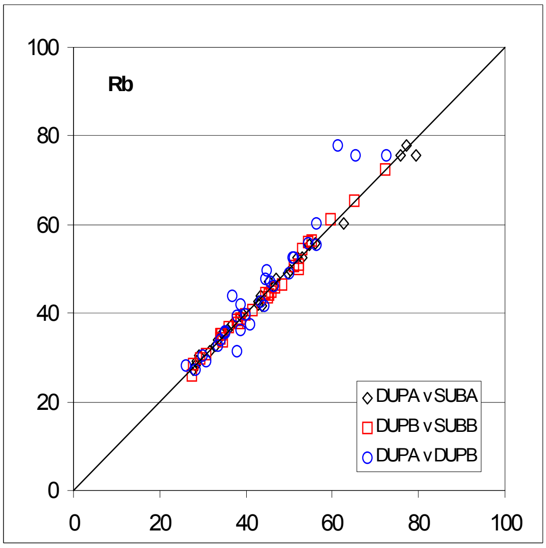

La
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
20
40
60
80
100

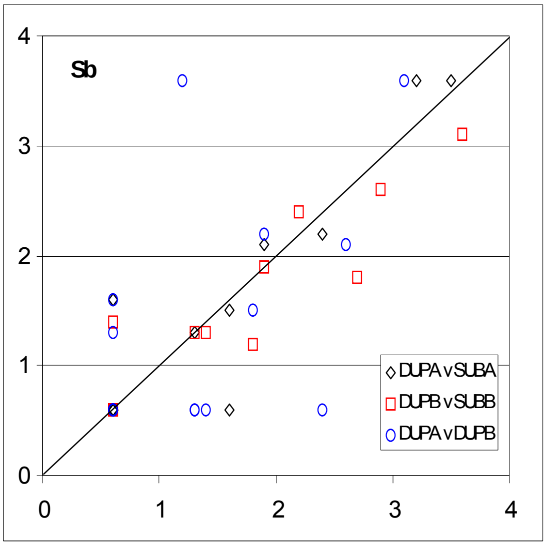

Mo
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0.0
1.0
2.0
3.0
4.0
5.0
6.0

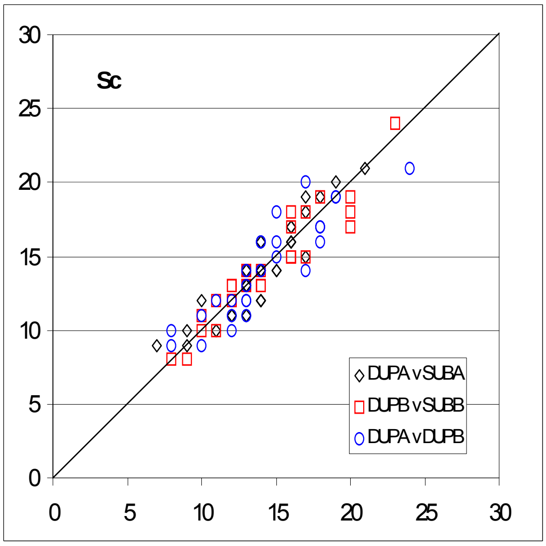

Nb
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
5
10
15
20
25
30

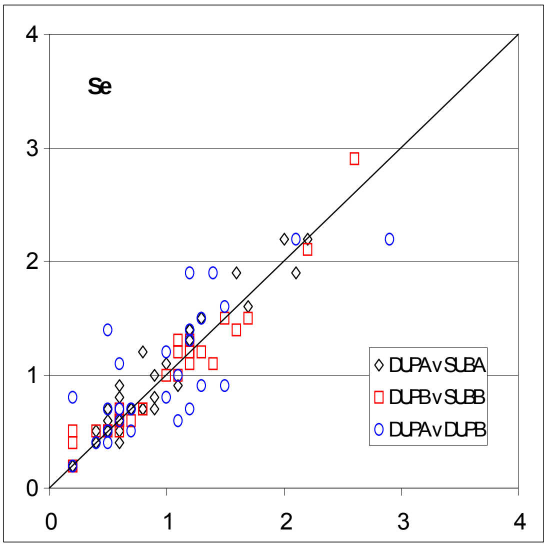

Ni
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
50
100
150
200

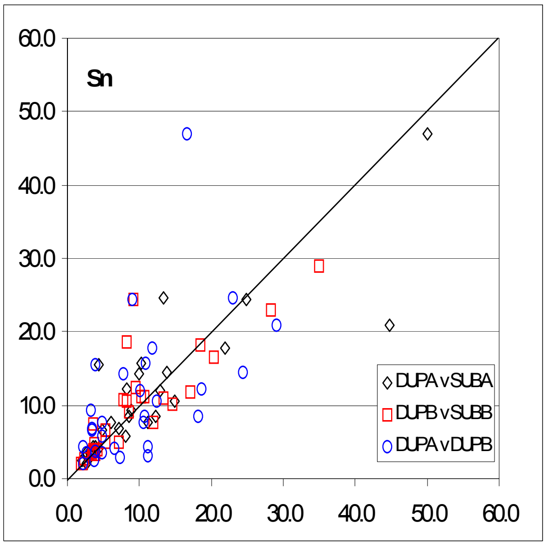

Pb
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
200
400
600
800

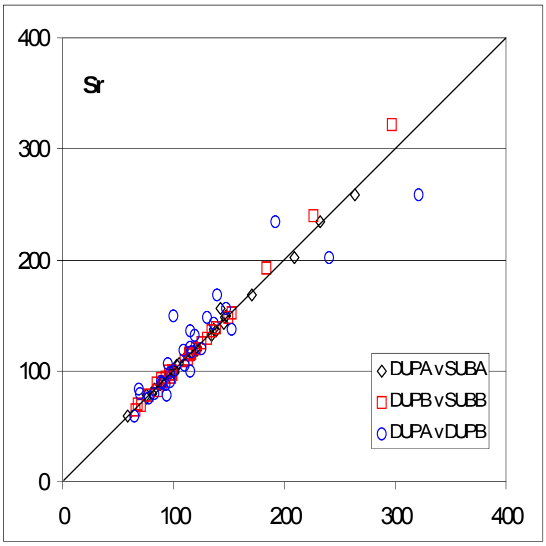

Rb
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
20
40
60
80
100

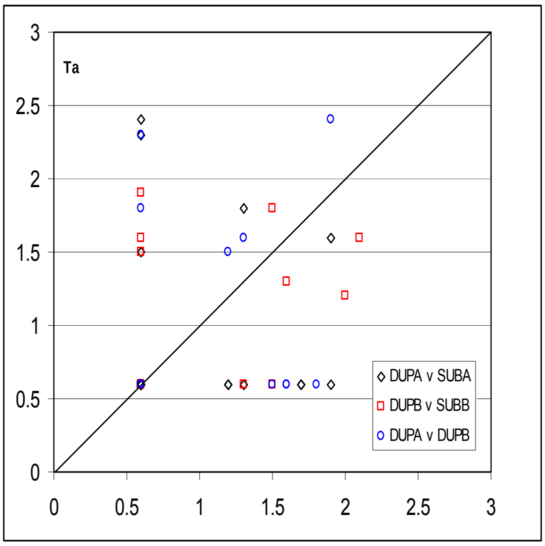

Sb
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
1
2
3
4

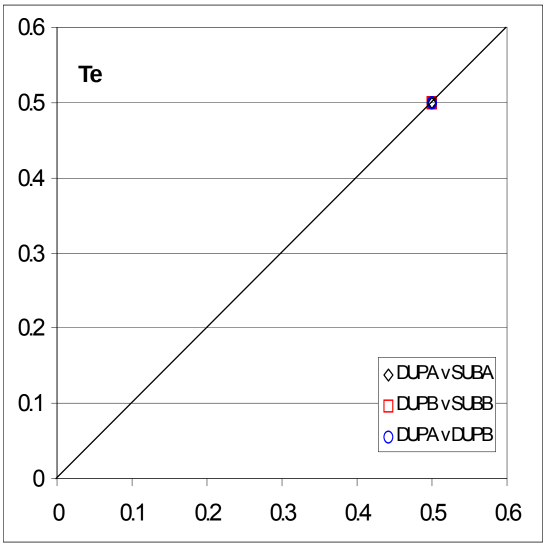

Sc
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
5
10
15
20
25
30

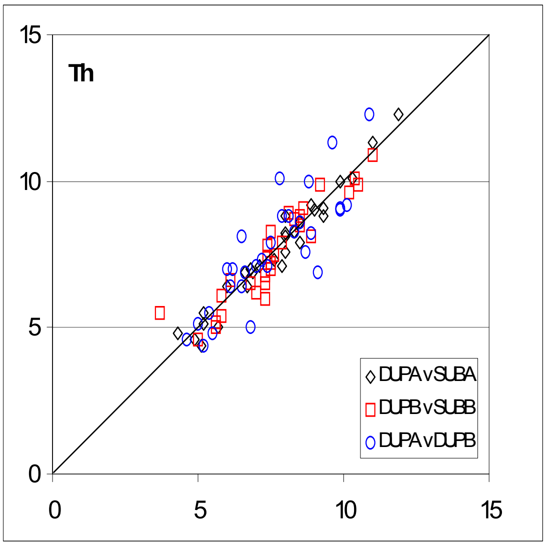

Se
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
0
1
2
3
4

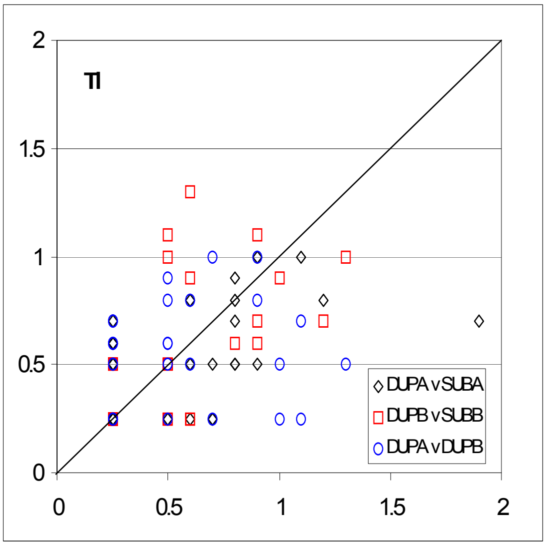

Sn
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB

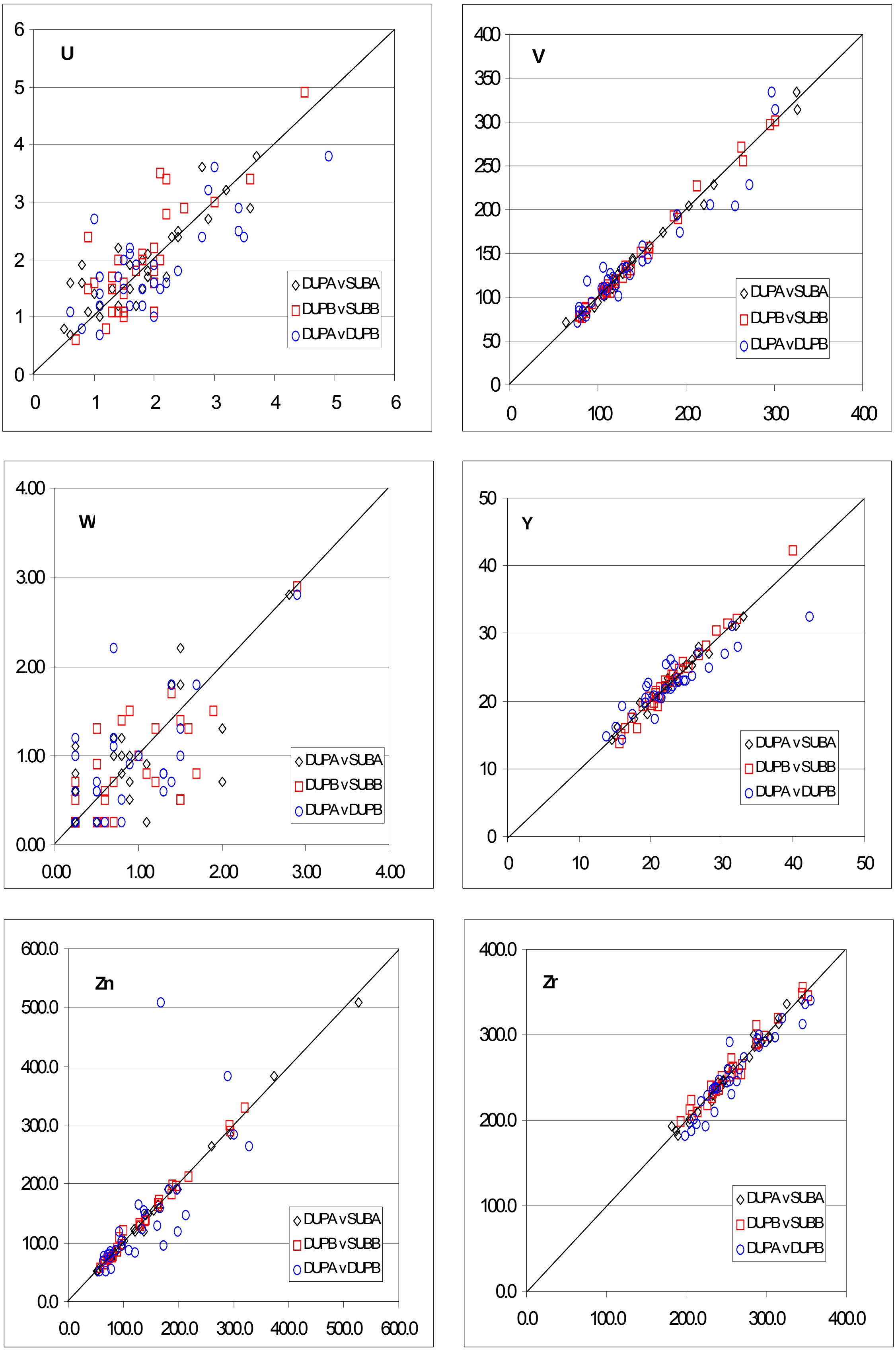

Sr
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB


Ta
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB


Te
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB


Th
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB


Tl
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB


U
DUPA v SUBA
DUPB v SUBB
DUPA v DUPB
V
W
Y
Zn
Zr

# References – Appendices 1 and 2

Most of the references listed below are held in the Library of the British Geological Survey at Keyworth, Nottingham. Copies of the references may be purchased from the Library subject to the current copyright legislation.

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