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A methodology for obtaining descriptive statistics relating to parent material

Chemical and Biological Hazards Programme

Internal Report IR/06/035

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CHEMICAL AND BIOLOGICAL HAZARDS PROGRAMME

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A methodology for obtaining descriptive statistics for soils overlying different parent material in the Humber-Trent Atlas region

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Summary

This report describes a methodology for generating descriptive statistics for soils above different parent materials in the British Geological Survey's (BGS) Humber-Trent Atlas region. There is a need to compile this type of statistics both for (i) public enquiries and (ii) populating domains on the new Parent Material Map under development at BGS. Instructions are given to link G-BASE soil data downloaded from the corporate Geochemistry Database, linking it spatially to v0.1 of the Parent Material Map within ArcMAP v9.1 and downloading the combined data into an Access database. A macro is run within Access to generate the required descriptive statistics that include maximum and minimum values, the range of data, arithmetic mean and standard deviations and geometric mean and standard deviation. For demonstration purposes, descriptive statistics are presented for the parent material classification used in the BGS Rock Classification Scheme (RCS). Further statistics were generated for parent materials split into the different geological ages of the RCS. This will produce more appropriate statistics for the Parent Material Map.

After completion of this report an updated version of the macro used to generate the descriptive statistics was created. This was too late to be used in the majority of work. However, in Appendix 4, a small additional example has been added using the improved macro that includes the facility to generate percentile values.

1 Introduction

Data generated from the BGS soil baseline geochemical survey (G-BASE) is held in the corporate 'Geochemistry Database'. A system is required that can allow rapid generation of descriptive geochemical statistics. These, for example, could be related to soils overlying a particular parent material or to a land-use on a spatial scale in a particular region. In addition, there has also arisen a need to generate descriptive statistics to populate domains on the new Parent Material Map that is under development at the BGS. This report summarises the methodology to obtain the required geochemical statistics. The use of the Parent Material Map instead of previous geological maps enables soils that have formed on superficial deposits such as glacial tills to be allocated their dominant soil forming parent material instead of their bedrock geology.

The work undertaken to develop this methodology produces summary statistics for a suite of elements situated on different parent materials within the Humber-Trent geochemical atlas region (BGS, 2006). Soil sampling was carried out between 1994 and 1996. Information about the study region, sampling strategies and analytical methods can be found in Rawlins *et al*. (2003). There are 3 stages to the process. These are (i) obtaining information from the corporate Geochemistry Database, (ii) placing it into an ArcMAP (v 9.1) context so that a parent material type can be attached to each data point and (iii) creating an access database of this information that will allow a macro developed by Andrew Bevan for the 'Geochemical and Mining Hazards' project (E2042S97 Task 1) to produce the relevant statistics. Version 1 of the macro, used here produces the following statistics: Count, Average, Standard Deviation (SD), Geometric Mean (GM), Minimum, Maximum, Range, Log

Geometric Mean (LGM) and Log Geometric Standard Deviation (LGSD). Version 2 of the macro will include the output of a range of percentile statistics.

2 Methods

At present the procedure is slightly cumbersome because of the continued updating of the Geochemical Database and Parent Material Map. Therefore what follows is a practical guide to give the user an idea of the procedures involved. Particular instructions may change slightly with future changes in the GIS software.

2.1 INSTRUCTIONS FOR OBTAINING INFORMATION FROM GEOCHEMISTRY DATABASE

Instructions in obtaining information from the Geochemistry Database are outlined in BGS report IR/04/026 (Johnson *et al*. 2004) and the user should refer to this document for obtaining the relevant information. An 'Oracle' user-name and password will be required. In the current example, the following data for the surface soils (A soils) from the Humber-Trent Atlas Region were downloaded: the 'Easting' and 'Northing' co-ordinates and the elements As, Ca, Cd, Cu, Fe, K, Mg, Mn, Ni, P and Zn were selected. The 'Easting' and 'Northing' co-ordinates are essential to allow the downloaded information to be spatially plotted and joined to the parent material classification. In addition 'atlas' information (the database code for the Humber-Trent geochemical atlas region is HUMB) was added into the newly formed database as one of the inputs in the macro requires this. There is usually some cleaning up of the data to be carried out after downloading it from the 'Geochemistry Database' to enable the macro to work. Three examples are:

(i) Checking that the numbers are in 'number' format instead of 'text' format. These can be converted in the Access Database by pressing the 'VIEW' symbol (Blue triangle with pencil). In each of the relevant rows for each of the elements go to the 'Data Type' column, insert cursor and a pull down menu will allow a change from 'text' to 'number'.

(ii) The macro will not work if any zero values are included. This is because of the log calculations in the statistics.

(iii) Decisions will have to be made regarding 'Detection Limits' where < figures are included in the downloaded data. The current practice is to insert a value equivalent to half of the detection limits. A list of detection limits can be found within the G-BASE documentation (e.g. geochemistry atlases).

2.2 INSTRUCTIONS FOR CREATING THE PARENT MATERIAL AND GEOCHEMISTRY DATABASE.

The parent material information is obtained from the new BGS Parent Material Map PMM) currently under development. Initial statistics obtained are from using v0.1. This part of the project requires taking the data downloaded from the Geochemistry Database, placing it into a GIS spatial context and joining this information with that from the PMM and creating a new database with both.

2.2.1 Part 1 – Creating a database file in the GIS

i. Open ArcMAP v 9.1 & load PMMv0.1 file

ii. Save Excel file of downloaded Geochemistry Database data as a DBF file (Dbase IV)

iii. Goto "tools" in the GIS pull down menus and select "Add XY data"

iv. Choose File via Browse dialogue

v. Select Easting in “X field” and select Northing in “Y field”.

vi. “Edit” for setting co-ordinate system

vii. Goto “select” then “projected co-ordinate system” then “National Grids” then “British National Grid.prj” then “Apply” then

viii. “OK” to leave XY data.

2.2.2 Part 2 – Creating a shape file of points and parent material data

i. Right click on “created file” in layers

ii. Select “data”, then “export data” then save, change name and ok

iii. Say “yes” to adding as a layer.

iv. Delete original file

Information is now stored as a shape file.

2.2.3 Part 3 – Joining shape file to the parent material data

i. Right click on shape file created, then “joins and relate”, then “joins”

ii. Select “Join data from another layer based on spatial location”

iii. Choose layer to join to (EW_provisional_V3_surface_geology_polygons)

iv. Choose “Each point falls inside”

v. Save and give file name.

vi. Check information by examining Attribute table of created file.

2.2.4 Part 5 - Exporting data table into Access

i. Open attributes of created table

ii. Options, then Export, TXT file and save.

iii. Creating Excel file from txt.file and then save Excel file as a dbf(iv) file after deleting irrelevant information.

iv. Open Access and goto “Get external data” and import Excel file.

2.3 STATISTICAL ANALYSIS

Geochemical statistics can be worked out for three different rock / parent material classifications used within BGS and obtained when joining the geochemistry data and parent material map, these being:

(i) Rock Classification Scheme (RCS)

(ii) Lex rock

(iii) Parent material based on the Rock Classification Scheme

In this example option (iii) is used.

i. Open Access database designed for this purpose by Bevan & Appleton (G-BASE Stats V1).

ii. Open G-BASE Stats V1

iii. Goto “Get External data”

iv. Import Excel Spreadsheet of geochemical and parent material data

v. Name and save Table

vi. GOTO ‘Forms’

vii. Double click on ‘Analyser’

viii. Load Table and answer questions.

ix. Press ‘OK’

Results should be produced in tables in ‘Access’ file

Export these to excel spreadsheets to tidy up.

3 Results

3.1 STATISTICS BASED ON ROCK CLASSIFICATION SCHEME

Tables 1-10 (see Appendix 1) report concentrations for the selected soil elements in parent materials based on the rock classification scheme. Using the parent materials based on the RCS, 30 different classes of parent materials have been identified in the Humber-Trent region. The 10 dominant parent material types are chalk, clay silt, clay-silt-gravel, diamicton, limestone, mudstone, mudstone-sandstone, sand, sand-gravel and sandstone. There are some parent material classifications where very few samples have been identified. These include basalt, breccia and gabbro and because these samples appear infrequently and are rock types not typically associated with the region, a question arises as to whether this is accurate data from the PMM and possibly needs to be checked. Potentially, the identification of these odd samples may aid ‘quality assurance’ in the new PMM.

The statistics presented include the arithmetic mean and SD. For all elements the SD for each of the parent materials is generally a large percentage of the arithmetic mean. Therefore, the geometric mean, the mean of a log-normal distribution that is positively skewed, is also given. The assumption is that the data are log-normally distributed.

3.2 STATISTICS BASED ON SPLITTING THE ROCK CLASSIFICATION SCHEME INTO GEOLOGICAL AGES

Tables 11 – 20 report results for the selected elements when the parent material categories derived from the rock classification scheme have been split up into

geological ages. The age related code appears as a column in the data table when the geochemistry is joined to the parent material. Therefore, in the Access database, the geological age and the parent material can be joined using the ‘Concatenate two fields in a query’ command. Doing this, raises the number of classes to 101 and produces more specific statistics for each parent material type. Abbreviations for the geological age can be found in Appendix 3.

4 Conclusions

This approach to delivering statistical data has proved effective but currently has its limitations because the Parent Material Map is still under development. Once Version 1 is published some of the ‘clunkiness’ in the procedure will be eliminated when assigning parent material type to the geochemical data. Ultimately a live linked system could be designed using a statistics package such as ‘S-Plus’ or ‘R’ to allow for constant updating of the data. However, this will require some system to allow for ‘0’ and ‘null’ values to be included. The datasets produced also offer opportunities to examine more closely the influence that parent material geochemistry may have on the development of soil geochemical properties and some initial analysis has been undertaken.

Appendix 1 : Descriptive statistics for selected soil elements based on the Rock Classification Scheme of the Humber Atlas region

Table 1: Descriptive statistics for As (mg kg^{-1}) in soil based on RCS of the Humber-Trent Atlas region

Key	Count As	Avg As	SD As	Gm As	Min As	Max As	Range As	LnGm As	LnGSD As
BASALT	1	11		11	11	11	0	2.40	
BRECCIA	1	33		33	33	33	0	3.50	
CHALK	348	15	18	12	0.1	275	275	2.50	0.52
CLAY-SILT	794	16	7	14	4	66	62	2.66	0.39
CLAY-SILT-SAND-GRAVEL	581	17	13	15	3	249	246	2.69	0.45
CLAYSTONE	9	17	8	15	6	34	28	2.70	0.49
DIAMICTON	1275	14	7	12	0.1	144	144	2.52	0.42
DIAMICTON-SAND-GRAVEL	8	16	12	14	9	46	37	2.63	0.54
DOLOSTONE	189	14	8	12	0.1	87	87	2.52	0.56
GABBRO	2	9	4	8	6	11	5	2.09	0.43
IRONSTONE	21	74	50	57	4	238	234	4.05	0.86
LIMESTONE	437	19	11	16	0.1	81	81	2.77	0.69
LIMESTONE-MUDSTONE	16	25	13	23	12	54	42	3.13	0.46
LIMESTONE-MUDSTONE-SANDSTONE	3	8	4	7	4	12	8	1.94	0.55
LIMESTONE-SANDSTONE	4	50	36	42	25	102	77	3.73	0.66
MUDSTONE	471	19	25	14	3	300	297	2.64	0.63
MUDSTONE-LIMESTONE	75	24	45	17	4	390	386	2.85	0.67
MUDSTONE-LIMESTONE-SANDSTONE	4	15	7	14	9	25	16	2.65	0.43
MUDSTONE-SANDSTONE	752	16	14	13	0.1	173	173	2.57	0.67
PEAT	97	18	12	14	2	72	70	2.67	0.68
SAND	145	18	19	14	3	152	149	2.60	0.67
SAND-GRAVEL	681	15	14	13	2	253	251	2.57	0.48
SAND-GRAVEL-BOULDERS	1	24		24	24	24	0	3.18	
SAND-MUD	2	13	2	12	11	14	3	2.52	0.17
SAND-SILT	3	10	1	10	9	11	2	2.33	0.12
SANDSTONE	896	15	14	12	0.1	189	189	2.50	0.55
SANDSTONE-CONGLOMERATE	3	12	1	12	11	12	1	2.46	0.05
SANDSTONE-IRONSTONE	3	96	71	80	40	176	136	4.38	0.75
SANDSTONE-MUDSTONE	10	15	5	14	8	21	13	2.62	0.38
SILTSTONE	22	10	4	10	6	24	18	2.26	0.27

Table 2: Descriptive statistics for Ca (mg kg^{-1}) in soil based on RCS directory of the Humber-Trent Atlas region

Key	Count Ca	Avg Ca	SD Ca	Gm Ca	Min Ca	Max Ca	Range Ca	LnGm Ca	LnGSD Ca
BASALT	1	10220		10220	10220	10220		9.23	
BRECCIA	1	5646		5646	5646	5646		8.64	
CHALK	348	85109	83377	44406	3002	341698	338696	10.70	1.28
CLAY-SILT	794	15318	15870	10277	1572	164810	163238	9.24	0.88
CLAY-SILT-SAND-GRAVEL	581	18610	25542	10849	179	251360	251181	9.29	1.04
CLAYSTONE	9	8076	8024	6127	1715	28945	27230	8.72	0.74
DIAMICTON	1275	18731	38033	7934	179	305248	305069	8.98	1.13
DIAMICTON-SAND-GRAVEL	8	4378	2602	3509	715	8648	7933	8.16	0.80
DOLOSTONE	189	57691	55604	30575	1572	230491	228919	10.33	1.31
GABBRO	2	7183	6822	5322	2359	12007	9648	8.58	1.15
IRONSTONE	21	15962	18277	9964	1358	79260	77902	9.21	0.98
LIMESTONE	437	42198	53238	18101	1429	303819	302390	9.80	1.41
LIMESTONE-MUDSTONE	16	25921	58167	7379	715	221986	221271	8.91	1.39
LIMESTONE-MUDSTONE-SANDSTONE	3	1834	1004	1617	786	2787	2001	7.39	0.65
LIMESTONE-SANDSTONE	4	31125	25113	23344	7004	65895	58891	10.06	0.93
MUDSTONE	471	20760	35005	9806	858	300317	299459	9.19	1.12
MUDSTONE-LIMESTONE	75	38020	55873	15850	572	261866	261294	9.67	1.34
MUDSTONE-LIMESTONE-SANDSTONE	4	44079	49698	28462	12507	117282	104775	10.26	1.04
MUDSTONE-SANDSTONE	752	6634	17045	3670	179	246714	246535	8.21	0.86
PEAT	97	17942	24317	7493	179	143297	143118	8.92	1.60
SAND	145	11550	30627	4980	179	269156	268977	8.51	1.08
SAND-GRAVEL	681	12304	24757	6325	179	266440	266261	8.75	0.97
SAND-GRAVEL-BOULDERS	1	44383		44383	44383	44383		10.70	
SAND-MUD	2	5539	2981	5122	3431	7647	4216	8.54	0.57
SAND-SILT	3	40047	4327	39893	36092	44669	8577	10.59	0.11
SANDSTONE	896	5153	13520	3085	179	272515	272336	8.03	0.88
SANDSTONE-CONGLOMERATE	3	3264	1135	3145	2573	4574	2001	8.05	0.32
SANDSTONE-IRONSTONE	3	11221	6305	10183	6790	18439	11649	9.23	0.53
SANDSTONE-MUDSTONE	10	31154	65479	11843	2930	216411	213481	9.38	1.21
SILTSTONE	22	8979	10761	5846	1858	48242	46384	8.67	0.87

Table 3: Descriptive statistics for Cu (mg kg^{-1}) in soil based on RCS directory of the Humber-Trent Atlas region

Key	Count Cu	Avg Cu	SD Cu	Gm Cu	Min Cu	Max Cu	Range Cu	LnGm Cu	LnGSD Cu
BASALT	1	38		38	38	38	0	3.64	
BRECCIA	1	37		37	37	37	0	3.61	
CHALK	348	19	6	18	9	46	37	2.89	0.27
CLAY-SILT	794	21	16	19	7	298	291	2.95	0.38
CLAY-SILT-SAND-GRAVEL	581	27	46	22	1	1085	1084	3.10	0.49
CLAYSTONE	9	15	5	14	6	21	15	2.62	0.40
DIAMICTON	1275	21	9	20	3	136	133	2.99	0.33
DIAMICTON-SAND-GRAVEL	8	21	7	20	13	30	17	2.98	0.33
DOLOSTONE	189	31	37	25	3	431	428	3.22	0.58
GABBRO	2	33	12	31	24	41	17	3.45	0.38
IRONSTONE	21	21	8	19	4	36	32	2.94	0.47
LIMESTONE	437	28	18	25	9	158	149	3.22	0.47
LIMESTONE-MUDSTONE	16	28	13	25	10	56	46	3.23	0.47
LIMESTONE-MUDSTONE-SANDSTONE	3	18	6	18	12	22	10	2.87	0.34
LIMESTONE-SANDSTONE	4	24	15	21	12	45	33	3.03	0.56
MUDSTONE	471	24	13	22	5	140	135	3.07	0.43
MUDSTONE-LIMESTONE	75	24	12	22	5	105	100	3.10	0.41
MUDSTONE-LIMESTONE-SANDSTONE	4	27	9	26	18	36	18	3.25	0.33
MUDSTONE-SANDSTONE	752	41	219	27	5	5920	5915	3.31	0.59
PEAT	97	21	14	16	1	94	93	2.78	0.83
SAND	145	20	33	14	3	368	365	2.64	0.76
SAND-GRAVEL	681	22	15	19	2	142	140	2.93	0.53
SAND-GRAVEL-BOULDERS	1	12		12	12	12	0	2.48	
SAND-MUD	2	20	1	20	19	21	2	2.99	0.07
SAND-SILT	3	9	1	9	8	10	2	2.23	0.13
SANDSTONE	896	27	45	21	1	880	879	3.02	0.62
SANDSTONE-CONGLOMERATE	3	40	17	37	21	54	33	3.61	0.50
SANDSTONE-IRONSTONE	3	29	7	28	21	34	13	3.33	0.26
SANDSTONE-MUDSTONE	10	17	6	16	10	25	15	2.78	0.36
SILTSTONE	22	24	11	23	15	61	46	3.12	0.36

Table 4: Descriptive statistics for Fe (mg kg^{-1}) in soil based on RCS of the Humber-Trent Atlas region

Key	Count Fe	Avg Fe	SD Fe	Gm Fe	Min Fe	Max Fe	Range Fe	LnGm Fe	LnGSD Fe
BASALT	1	52889		52889	52889	52889	0	10.88	
BRECCIA	1	36432		36432	36432	36432	0	10.50	
CHALK	348	23528	13606	20604	2490	148699	146209	9.93	0.53
CLAY-SILT	794	37553	12835	35229	4910	80193	75283	10.47	0.37
CLAY-SILT-SAND-GRAVEL	581	41639	16651	38382	3322	156784	153462	10.56	0.42
CLAYSTONE	9	31834	12822	28990	10925	49986	39061	10.27	0.49
DIAMICTON	1275	37298	11646	35381	3042	146832	143790	10.47	0.35
DIAMICTON-SAND-GRAVEL	8	21390	2010	21303	18045	23850	5805	9.97	0.10
DOLOSTONE	189	32157	10275	30135	6434	61184	54750	10.31	0.39
GABBRO	2	42688	9827	42118	35739	49636	13897	10.65	0.23
IRONSTONE	21	100541	74201	78115	6987	336789	329802	11.27	0.79
LIMESTONE	437	39790	14995	37393	7330	112408	105078	10.53	0.35
LIMESTONE-MUDSTONE	16	36627	8248	35596	16107	52679	36572	10.48	0.26
LIMESTONE-MUDSTONE-SANDSTONE	3	39959	22727	33890	13897	55651	41754	10.43	0.77
LIMESTONE-SANDSTONE	4	73159	40290	66211	41621	131417	89796	11.10	0.50
MUDSTONE	471	39904	21740	35901	2840	216513	213673	10.49	0.45
MUDSTONE-LIMESTONE	75	46062	27809	41100	11344	211946	200602	10.62	0.46
MUDSTONE-LIMESTONE-SANDSTONE	4	56706	23284	53010	30417	86691	56274	10.88	0.43
MUDSTONE-SANDSTONE	752	42903	13545	40909	5120	157407	152287	10.62	0.32
PEAT	97	36985	21754	28699	1245	107015	105770	10.26	0.85
SAND	145	27754	20641	20930	1042	115933	114891	9.95	0.82
SAND-GRAVEL	681	30442	16678	26111	2420	119038	116618	10.17	0.58
SAND-GRAVEL-BOULDERS	1	32354		32354	32354	32354	0	10.38	
SAND-MUD	2	37540	9283	36962	30976	44104	13128	10.52	0.25
SAND-SILT	3	18553	2270	18457	16044	20464	4420	9.82	0.13
SANDSTONE	896	35171	14689	32356	1455	150770	149315	10.38	0.43
SANDSTONE-CONGLOMERATE	3	29797	3376	29671	26689	33389	6700	10.30	0.11
SANDSTONE-IRONSTONE	3	125332	76566	109154	55239	207043	151804	11.60	0.66
SANDSTONE-MUDSTONE	10	31857	11307	29950	16667	51986	35319	10.31	0.38
SILTSTONE	22	28629	4522	28294	22542	36712	14170	10.25	0.16

Table 5: Descriptive statistics for K (mg kg^{-1}) in soil based on RCS of the Humber-Trent Atlas region

Key	Count K	Avg K	SD K	Gm K	Min K	Max K	Range K	LnGm K	LnGSD K
BASALT	1	17922		17922	17922	17922	0	9.79	
BRECCIA	1	11339		11339	11339	11339	0	9.34	
CHALK	348	11638	3195	11189	3536	24505	20969	9.32	0.29
CLAY-SILT	794	18637	4073	18156	8824	27269	18445	9.81	0.23
CLAY-SILT-SAND-GRAVEL	581	17629	4789	16977	2648	34989	32341	9.74	0.28
CLAYSTONE	9	15766	2856	15541	12153	20852	8699	9.65	0.18
DIAMICTON	1275	15449	3045	15122	3785	30033	26248	9.62	0.21
DIAMICTON-SAND-GRAVEL	8	18978	3105	18748	14344	22147	7803	9.84	0.17
DOLOSTONE	189	12814	3622	12081	1918	21417	19499	9.40	0.39
GABBRO	2	12684	3158	12486	10451	14917	4466	9.43	0.25
IRONSTONE	21	14209	3325	13828	6624	24023	17399	9.53	0.25
LIMESTONE	437	13442	2644	13165	3379	28082	24703	9.49	0.21
LIMESTONE-MUDSTONE	16	15196	3579	14798	8575	23857	15282	9.60	0.24
LIMESTONE-MUDSTONE-SANDSTONE	3	11721	3784	11332	8500	15888	7388	9.34	0.32
LIMESTONE-SANDSTONE	4	13029	1082	12995	11829	14020	2191	9.47	0.08
MUDSTONE	471	22176	7505	20877	7031	41654	34623	9.95	0.35
MUDSTONE-LIMESTONE	75	15975	3051	15663	7114	22637	15523	9.66	0.21
MUDSTONE-LIMESTONE-SANDSTONE	4	15343	6223	14549	10609	24505	13896	9.59	0.36
MUDSTONE-SANDSTONE	752	16800	4533	16237	4922	37512	32590	9.70	0.26
PEAT	97	15449	5505	13593	1021	24828	23807	9.52	0.64
SAND	145	14306	3352	13925	4673	24994	20321	9.54	0.24
SAND-GRAVEL	681	14623	3921	14162	4599	36051	31452	9.56	0.25
SAND-GRAVEL-BOULDERS	1	16220		16220	16220	16220	0	9.69	
SAND-MUD	2	14473	2471	14367	12725	16220	3495	9.57	0.17
SAND-SILT	3	14510	1058	14484	13290	15158	1868	9.58	0.07
SANDSTONE	896	17252	4617	16651	5246	32557	27311	9.72	0.27
SANDSTONE-CONGLOMERATE	3	15296	677	15286	14751	16054	1303	9.63	0.04
SANDSTONE-IRONSTONE	3	15324	5896	14615	10526	21906	11380	9.59	0.37
SANDSTONE-MUDSTONE	10	13715	2489	13515	9961	18412	8451	9.51	0.18
SILTSTONE	22	27462	6568	26700	19142	37919	18777	10.19	0.24

Table 6: Descriptive statistics for Mn (mg kg^{-1}) in soil based on RCS of the Humber-Trent Atlas region

Key	Count Mn	Avg Mn	SD Mn	Gm Mn	Min Mn	Max Mn	Range Mn	LnGm Mn	LnGSD Mn
BASALT	1	1239		1239	1239	1239	0	7.12	
BRECCIA	1	1123		1123	1123	1123	0	7.02	
CHALK	348	1221	506	1137	310	4337	4027	7.04	0.37
CLAY-SILT	794	696	363	628	209	3679	3470	6.44	0.44
CLAY-SILT-SAND-GRAVEL	581	1034	861	858	132	11246	11114	6.75	0.58
CLAYSTONE	9	489	220	446	201	968	767	6.10	0.47
DIAMICTON	1275	781	444	699	132	5329	5197	6.55	0.46
DIAMICTON-SAND-GRAVEL	8	810	174	794	573	1053	480	6.68	0.21
DOLOSTONE	189	1763	1003	1598	651	11517	10866	7.38	0.42
GABBRO	2	1023	394	984	744	1301	557	6.89	0.40
IRONSTONE	21	2525	3782	1396	132	17519	17387	7.24	1.07
LIMESTONE	437	1356	949	1168	279	9325	9046	7.06	0.51
LIMESTONE-MUDSTONE	16	911	371	833	294	1580	1286	6.73	0.46
LIMESTONE-MUDSTONE-SANDSTONE	3	1105	624	939	387	1518	1131	6.84	0.77
LIMESTONE-SANDSTONE	4	1539	921	1366	875	2858	1983	7.22	0.55
MUDSTONE	471	916	521	809	132	4996	4864	6.70	0.49
MUDSTONE-LIMESTONE	75	1084	851	914	333	5979	5646	6.82	0.54
MUDSTONE-LIMESTONE-SANDSTONE	4	949	575	810	441	1549	1108	6.70	0.67
MUDSTONE-SANDSTONE	752	1166	816	991	132	15413	15281	6.90	0.59
PEAT	97	629	540	491	132	3834	3702	6.20	0.69
SAND	145	764	778	553	132	5623	5491	6.32	0.77
SAND-GRAVEL	681	754	519	620	132	3501	3369	6.43	0.62
SAND-GRAVEL-BOULDERS	1	697		697	697	697	0	6.55	
SAND-MUD	2	918	323	889	689	1146	457	6.79	0.36
SAND-SILT	3	478	20	477	457	496	39	6.17	0.04
SANDSTONE	896	997	593	839	132	6583	6451	6.73	0.62
SANDSTONE-CONGLOMERATE	3	831	283	802	627	1154	527	6.69	0.32
SANDSTONE-IRONSTONE	3	2001	1396	1624	651	3439	2788	7.39	0.84
SANDSTONE-MUDSTONE	10	690	325	622	256	1332	1076	6.43	0.49
SILTSTONE	22	727	119	718	558	960	402	6.58	0.16

Table 7: Descriptive statistics for Mg (mg kg^{-1}) in soil based on RCS of the Humber-Trent Atlas

Key	Count Mg	Avg Mg	SD Mg	Gm Mg	Min Mg	Max Mg	Range Mg	LnGm Mg	LnGSD Mg
BASALT	1	12424		12424	12424	12424	0	9.43	
BRECCIA	1	5265		5265	5265	5265	0	8.57	
CHALK	348	4658	1363	4484	2280	11827	9547	8.41	0.27
CLAY-SILT	794	9462	3544	8688	1092	26144	25052	9.07	0.44
CLAY-SILT-SAND-GRAVEL	581	9427	5390	8136	1092	44635	43543	9.00	0.56
CLAYSTONE	9	5131	2473	4604	2280	9439	7159	8.43	0.50
DIAMICTON	1275	6752	6172	5916	1092	91159	90067	8.69	0.44
DIAMICTON-SAND-GRAVEL	8	4519	1139	4401	3474	6459	2985	8.39	0.24
DOLOSTONE	189	29099	24249	20441	3474	111441	107967	9.93	0.88
GABBRO	2	9442	5062	8737	5862	13021	7159	9.08	0.56
IRONSTONE	21	4980	2181	4633	2280	12424	10144	8.44	0.38
LIMESTONE	437	7352	7906	5863	1689	85791	84102	8.68	0.56
LIMESTONE-MUDSTONE	16	5787	1584	5586	3474	8841	5367	8.63	0.28
LIMESTONE-MUDSTONE-SANDSTONE	3	4270	912	4207	3474	5265	1791	8.34	0.21
LIMESTONE-SANDSTONE	4	4370	771	4318	3474	5265	1791	8.37	0.18
MUDSTONE	471	15889	13015	11570	1092	103088	101996	9.36	0.82
MUDSTONE-LIMESTONE	75	6816	2628	6247	1092	13021	11929	8.74	0.46
MUDSTONE-LIMESTONE-SANDSTONE	4	5562	2309	5242	3474	8841	5367	8.56	0.39
MUDSTONE-SANDSTONE	752	6277	4766	5567	302	78632	78330	8.62	0.44
PEAT	97	6581	4362	4847	302	20771	20469	8.49	0.91
SAND	145	4401	5108	3129	302	44038	43736	8.05	0.79
SAND-GRAVEL	681	5652	6414	4484	302	88776	88474	8.41	0.60
SAND-GRAVEL-BOULDERS	1	11230		11230	11230	11230	0	9.33	
SAND-MUD	2	6158	2951	5793	4071	8244	4173	8.66	0.50
SAND-SILT	3	9239	1243	9185	8244	10633	2389	9.13	0.13
SANDSTONE	896	4742	2062	4357	302	20771	20469	8.38	0.43
SANDSTONE-CONGLOMERATE	3	4668	597	4642	4071	5265	1194	8.44	0.13
SANDSTONE-IRONSTONE	3	5661	3789	4948	3474	10036	6562	8.51	0.61
SANDSTONE-MUDSTONE	10	4011	1916	3645	1689	8244	6555	8.20	0.46
SILTSTONE	22	21642	9857	19769	11230	47018	35788	9.89	0.43

Table 8: Descriptive statistics for Ni (mg kg^{-1}) in soil based on RCS of the Humber-Trent Atlas region

Key	Count Ni	Avg Ni	SD Ni	Gm Ni	Min Ni	Max Ni	Range Ni	LnGm Ni	LnGSD Ni
BASALT	1	94		94	94	94	0	4.54	
BRECCIA	1	47		47	47	47	0	3.85	
CHALK	348	30	11	28	12	118	106	3.34	0.31
CLAY-SILT	794	32	12	30	6	104	98	3.39	0.38
CLAY-SILT-SAND-GRAVEL	581	34	15	32	5	201	196	3.45	0.44
CLAYSTONE	9	24	12	21	8	43	35	3.06	0.55
DIAMICTON	1275	30	10	28	5	128	123	3.34	0.33
DIAMICTON-SAND-GRAVEL	8	15	3	14	10	18	8	2.66	0.21
DOLOSTONE	189	26	9	25	4	88	84	3.20	0.36
GABBRO	2	64	25	61	46	81	35	4.11	0.40
IRONSTONE	21	51	35	42	9	145	136	3.74	0.63
LIMESTONE	437	41	27	36	9	301	292	3.59	0.47
LIMESTONE-MUDSTONE	16	33	17	29	14	79	65	3.38	0.47
LIMESTONE-MUDSTONE-SANDSTONE	3	26	8	25	17	32	15	3.21	0.33
LIMESTONE-SANDSTONE	4	48	35	41	24	99	75	3.71	0.63
MUDSTONE	471	35	16	33	6	172	166	3.49	0.41
MUDSTONE-LIMESTONE	75	34	13	31	6	69	63	3.44	0.42
MUDSTONE-LIMESTONE-SANDSTONE	4	46	29	40	23	88	65	3.68	0.58
MUDSTONE-SANDSTONE	752	40	285	28	8	7804	7796	3.32	0.42
PEAT	97	24	14	20	3	60	57	2.98	0.73
SAND	145	17	11	14	2	59	57	2.67	0.62
SAND-GRAVEL	681	22	12	19	3	78	75	2.97	0.52
SAND-GRAVEL-BOULDERS	1	24		24	24	24	0	3.18	
SAND-MUD	2	26	13	24	17	35	18	3.19	0.51
SAND-SILT	3	15	3	15	13	18	5	2.72	0.16
SANDSTONE	896	23	12	20	4	114	110	3.02	0.45
SANDSTONE-CONGLOMERATE	3	25	9	24	17	34	17	3.18	0.35
SANDSTONE-IRONSTONE	3	90	43	84	64	140	76	4.43	0.44
SANDSTONE-MUDSTONE	10	25	12	22	9	43	34	3.09	0.52
SILTSTONE	22	30	10	29	20	56	36	3.36	0.29

Table 9: Descriptive statistics for P (mg kg^{-1}) in soil based on RCS of the Humber-Trent Atlas region

Key	Count P	Avg P	SD P	Gm P	Min P	Max P	Range P	LnGm P	LnGSD P
BASALT	1	1204		1204	1204	1204	0	7.09	
BRECCIA	1	1431		1431	1431	1431	0	7.27	
CHALK	348	1343	598	1229	353	4984	4631	7.11	0.42
CLAY-SILT	794	848	489	749	109	4264	4155	6.62	0.49
CLAY-SILT-SAND-GRAVEL	581	1029	652	893	109	4717	4608	6.79	0.51
CLAYSTONE	9	656	299	598	305	1252	947	6.39	0.46
DIAMICTON	1275	837	546	714	109	4848	4739	6.57	0.56
DIAMICTON-SAND-GRAVEL	8	1596	658	1489	982	2828	1846	7.31	0.39
DOLOSTONE	189	1066	623	920	109	3997	3888	6.82	0.55
GABBRO	2	1139	475	1088	803	1475	672	6.99	0.43
IRONSTONE	21	1896	1370	1479	218	5075	4857	7.30	0.76
LIMESTONE	437	1456	830	1258	109	6694	6585	7.14	0.55
LIMESTONE-MUDSTONE	16	650	392	564	262	1794	1532	6.33	0.54
LIMESTONE-MUDSTONE-SANDSTONE	3	621	360	542	262	982	720	6.30	0.67
LIMESTONE-SANDSTONE	4	1416	994	891	109	2509	2400	6.79	1.42
MUDSTONE	471	982	734	814	109	5346	5237	6.70	0.58
MUDSTONE-LIMESTONE	75	1123	890	899	262	5795	5533	6.80	0.64
MUDSTONE-LIMESTONE-SANDSTONE	4	1150	351	1110	755	1610	855	7.01	0.31
MUDSTONE-SANDSTONE	752	873	579	739	109	5525	5416	6.61	0.57
PEAT	97	1098	761	876	218	3997	3779	6.78	0.69
SAND	145	1476	1066	1145	109	5568	5459	7.04	0.75
SAND-GRAVEL	681	1460	925	1189	109	5433	5324	7.08	0.68
SAND-GRAVEL-BOULDERS	1	847		847	847	847	0	6.74	
SAND-MUD	2	2152	1907	1676	803	3500	2697	7.42	1.04
SAND-SILT	3	607	69	604	532	668	136	6.40	0.12
SANDSTONE	896	1248	900	997	109	6472	6363	6.90	0.68
SANDSTONE-CONGLOMERATE	3	1626	1124	1402	847	2915	2068	7.25	0.65
SANDSTONE-IRONSTONE	3	2662	2005	2047	711	4717	4006	7.62	0.97
SANDSTONE-MUDSTONE	10	1212	679	1060	532	2466	1934	6.97	0.54
SILTSTONE	22	824	360	761	441	1925	1484	6.63	0.40

Table 10: Descriptive statistics for Zn (mg kg^{-1}) in soil based on RCS of the Humber-Trent Atlas region

Key	Count Zn	Avg Zn	SD Zn	Gm Zn	Min Zn	Max Zn	Range Zn	LnGm Zn	LnGSD Zn
BASALT	1	184.00		184.00	184	184	0	5.21	
BRECCIA	1	336.00		336.00	336	336	0	5.82	
CHALK	348	77.08	20.07	74.56	29	167	138	4.31	0.26
CLAY-SILT	794	77.52	56.25	70.97	17	1229	1212	4.26	0.38
CLAY-SILT-SAND-GRAVEL	581	120.20	126.31	97.27	6	1401	1395	4.58	0.58
CLAYSTONE	9	61.22	21.95	57.12	26	85	59	4.05	0.42
DIAMICTON	1275	79.95	45.30	74.43	20	818	798	4.31	0.34
DIAMICTON-SAND-GRAVEL	8	70.25	21.27	67.32	38	105	67	4.21	0.32
DOLOSTONE	189	181.11	192.18	137.99	30	1908	1878	4.93	0.67
GABBRO	2	304.00	236.17	254.02	137	471	334	5.54	0.87
IRONSTONE	21	113.00	67.90	94.72	16	308	292	4.55	0.65
LIMESTONE	437	187.47	447.51	121.81	30	6647	6617	4.80	0.72
LIMESTONE-MUDSTONE	16	140.75	111.69	107.44	35	430	395	4.68	0.75
LIMESTONE-MUDSTONE-SANDSTONE	3	65.67	37.10	58.76	33	106	73	4.07	0.58
LIMESTONE-SANDSTONE	4	129.00	101.39	107.73	76	281	205	4.68	0.64
MUDSTONE	471	83.09	46.95	76.01	15	710	695	4.33	0.40
MUDSTONE-LIMESTONE	75	77.33	27.60	72.44	24	162	138	4.28	0.38
MUDSTONE-LIMESTONE-SANDSTONE	4	81.25	22.17	79.20	62	113	51	4.37	0.26
MUDSTONE-SANDSTONE	752	122.91	297.98	91.40	18	5655	5637	4.52	0.55
PEAT	97	85.94	129.94	58.97	8	984	976	4.08	0.81
SAND	145	62.63	45.16	48.88	7	275	268	3.89	0.74
SAND-GRAVEL	681	78.08	54.46	66.12	8	533	525	4.19	0.57
SAND-GRAVEL-BOULDERS	1	59.00		59.00	59	59	0	4.08	
SAND-MUD	2	84.50	4.95	84.43	81	88	7	4.44	0.06
SAND-SILT	3	33.00	5.57	32.67	27	38	11	3.49	0.17
SANDSTONE	896	89.87	101.69	75.42	6	2313	2307	4.32	0.53
SANDSTONE-CONGLOMERATE	3	130.00	38.00	126.47	98	172	74	4.84	0.28
SANDSTONE-IRONSTONE	3	187.00	89.60	174.14	121	289	168	5.16	0.45
SANDSTONE-MUDSTONE	10	71.90	30.11	66.63	35	137	102	4.20	0.41
SILTSTONE	22	85.18	49.72	78.90	56	302	246	4.37	0.34

Appendix 2 : Descriptive statistics for selected soil elements based on the Rock Classsification System with additional age related classification.

Table 11: Descriptive statistics for As (mg kg^{-1}) in soil based on RCS split into age classifications for the Humber-Trent Atlas region.

	Count As	Avg As	SD As	Gm As	Min As	Max As	Range As	LnGm As	LnGSD As
BASALT CX	1	11		11	11	11	0	2.40	
BRECCIA CX	1	33		33	33	33	0	3.50	
CHALK KA	2	63	71	38	13	113	100	3.65	1.53
CHALK KE	206	16	22	13	4	275	271	2.57	0.51
CHALK KS	10	10	2	9	6	12	6	2.25	0.25
CHALK KT	130	12	3	11	0.1	30	30	2.40	0.50
CLAY-SILT Q	794	16	7	14	4	66	62	2.66	0.39
CLAY-SILT-SAND-GRAVEL Q	581	17	13	15	3	249	246	2.69	0.45
CLAYSTONE JO	9	17	8	15	6	34	28	2.70	0.49
DIAMICTON Q	1275	14	7	12	0.1	144	144	2.52	0.42
DIAMICTON-SAND-GRAVEL Q	8	16	12	14	9	46	37	2.63	0.54
DOLOSTONE PU	189	14	8	12	0.1	87	87	2.52	0.56
GABBRO CL	2	9	4	8	6	11	5	2.09	0.43
IRONSTONE JS	14	67	59	47	4	238	234	3.85	0.98
IRONSTONE KV	7	88	23	85	62	120	58	4.44	0.26
LIMESTONE CF	8	14	3	14	11	21	10	2.62	0.22
LIMESTONE CI	12	13	3	13	10	18	8	2.53	0.20
LIMESTONE CJ	4	13	1	13	12	15	3	2.56	0.11
LIMESTONE CR	74	13	6	12	6	61	55	2.48	0.31
LIMESTONE CX	95	13	6	10	0.1	36	36	2.33	1.07
LIMESTONE JA	80	24	11	22	8	81	73	3.09	0.45
LIMESTONE JB	67	23	7	22	10	44	34	3.10	0.30
LIMESTONE JH	1	36		36	36	36	0	3.58	
LIMESTONE JN	44	26	17	22	8	78	70	3.07	0.57
LIMESTONE JS	6	29	12	27	17	50	33	3.29	0.40
LIMESTONE KB	1	52		52	52	52	0	3.95	
LIMESTONE PU	39	16	7	15	10	38	28	2.73	0.35
LIMESTONE TR	7	20	9	18	7	32	25	2.90	0.55
LIMESTONE-MUDSTONE CR	13	27	14	24	12	54	42	3.16	0.50
LIMESTONE-MUDSTONE JB	3	20	5	19	17	25	8	2.96	0.22
LIMESTONE-MUDSTONE-	3	8	4	7	4	12	8	1.94	0.55
LIMESTONE-SANDSTONE JE	4	50	36	42	25	102	77	3.73	0.66
MUDSTONE CI	2	11	0	11	11	11	0	2.40	0.00
MUDSTONE CR	2	22	6	22	18	26	8	3.07	0.26
MUDSTONE JA	4	35	6	34	30	44	14	3.54	0.17
MUDSTONE JC	16	16	6	15	8	32	24	2.70	0.36
MUDSTONE JD	42	27	25	21	9	126	117	3.06	0.63
MUDSTONE JE	1	32		32	32	32	0	3.47	
MUDSTONE JH	9	21	13	19	6	52	46	2.93	0.56
MUDSTONE JN	11	17	14	14	8	58	50	2.63	0.56
MUDSTONE JO	9	16	3	16	13	23	10	2.75	0.17
MUDSTONE JS	23	33	37	24	5	161	156	3.16	0.77
MUDSTONE JT	10	27	14	24	9	60	51	3.18	0.53
MUDSTONE KH	10	137	68	124	70	300	230	4.82	0.44
MUDSTONE KZ	1	101		101	101	101	0	4.62	

	Count As	Avg As	SD As	Gm As	Min As	Max As	Range As	LnGm As	LnGSD As
MUDSTONE PU	40	17	7	15	7	36	29	2.74	0.38
MUDSTONE Q	1	4		4	4	4	0	1.39	
MUDSTONE TA	22	12	13	10	6	68	62	2.28	0.49
MUDSTONE TC	3	10	2	10	8	11	3	2.26	0.16
MUDSTONE TD	6	9	2	9	7	12	5	2.20	0.21
MUDSTONE TL	192	11	4	10	3	29	26	2.30	0.31
MUDSTONE TN	7	12	4	12	8	18	10	2.48	0.31
MUDSTONE TR	59	18	7	16	5	38	33	2.80	0.40
MUDSTONE-LIMESTONE JA	1	20		20	20	20	0	3.00	
MUDSTONE-LIMESTONE JB	10	24	11	21	7	40	33	3.06	0.55
MUDSTONE-LIMESTONE JH	3	15	1	15	14	15	1	2.69	0.04
MUDSTONE-LIMESTONE JS	8	23	4	23	18	30	12	3.13	0.17
MUDSTONE-LIMESTONE KB	4	136	170	81	29	390	361	4.39	1.11
MUDSTONE-LIMESTONE TR	49	16	11	14	4	69	65	2.65	0.53
MUDSTONE-LIMESTONE-	4	15	7	14	9	25	16	2.65	0.43
MUDSTONE-SANDSTONE CA	241	15	14	13	3	173	170	2.57	0.50
MUDSTONE-SANDSTONE CB	250	20	18	17	4	163	159	2.82	0.53
MUDSTONE-SANDSTONE CC	57	14	6	13	7	46	39	2.55	0.31
MUDSTONE-SANDSTONE CE	1	8		8	8	8	0	2.08	
MUDSTONE-SANDSTONE CN	97	9	5	8	0.1	31	31	2.08	0.62
MUDSTONE-SANDSTONE CR	54	19	12	12	0.1	51	51	2.49	1.47
MUDSTONE-SANDSTONE PU	21	17	12	14	5	54	49	2.65	0.60
MUDSTONE-SANDSTONE TA	31	10	3	10	5	18	13	2.29	0.29
PEAT Q	97	18	12	14	2	72	70	2.67	0.68
SAND Q	145	18	19	14	3	152	149	2.60	0.67
SAND-GRAVEL Q	681	15	14	13	2	253	251	2.57	0.48
SAND-GRAVEL-BOULDERS Q	1	24		24	24	24	0	3.18	
SAND-MUD Q	5	11	2	11	9	14	5	2.41	0.16
SANDSTONE CA	190	14	8	12	3	87	84	2.52	0.42
SANDSTONE CB	127	17	13	15	3	82	79	2.69	0.53
SANDSTONE CC	65	15	6	14	7	44	37	2.66	0.35
SANDSTONE CE	14	7	3	7	3	12	9	1.87	0.41
SANDSTONE CG	15	8	3	7	3	12	9	2.01	0.41
SANDSTONE CH	7	8	1	8	6	10	4	2.05	0.19
SANDSTONE CK	44	9	8	7	2	54	52	2.00	0.52
SANDSTONE CX	1	9		9	9	9	0	2.20	
SANDSTONE CY	49	12	7	11	3	41	38	2.39	0.53
SANDSTONE CZ	96	10	4	9	0.1	26	26	2.17	0.62
SANDSTONE JA	2	30	7	30	25	35	10	3.39	0.24
SANDSTONE JC	2	19	0	19	19	19	0	2.94	0.00
SANDSTONE JO	1	12		12	12	12	0	2.48	
SANDSTONE JS	3	17	2	17	15	18	3	2.81	0.09
SANDSTONE JV	29	43	41	31	7	189	182	3.43	0.82
SANDSTONE KA	6	81	62	58	11	186	175	4.06	0.98
SANDSTONE PU	37	12	4	12	4	22	18	2.47	0.33
SANDSTONE TA	1	6		6	6	6	0	1.79	
SANDSTONE TC	2	9	3	9	7	11	4	2.17	0.32
SANDSTONE TL	205	13	8	12	6	118	112	2.52	0.30
SANDSTONE-CONGLOMERATE TL	3	12	1	12	11	12	1	2.46	0.05
SANDSTONE-IRONSTONE JE	3	96	71	80	40	176	136	4.38	0.75
SANDSTONE-MUDSTONE JA	2	17	3	17	15	19	4	2.83	0.17
SANDSTONE-MUDSTONE JB	1	21		21	21	21	0	3.04	
SANDSTONE-MUDSTONE JC	7	13	5	12	8	20	12	2.50	0.39
SILTSTONE TA	8	10	6	10	6	24	18	2.25	0.40
SILTSTONE TC	10	10	1	10	8	11	3	2.29	0.10
SILTSTONE TL	4	10	3	9	7	12	5	2.22	0.31

Table 12: Descriptive statistics for Ca (mg kg^{-1}) in soil based on RCS split into age classifications for the Humber-Trent Atlas region

Key	Count_Ca	Avg_Ca	SD_Ca	Gm_Ca	Min_Ca	Max_Ca	Range_Ca	LnGm_Ca	LnGSD_Ca
BASALT_CX	1	1022		10220	10220	10220	0	9.23	
BRECCIA_CX	1	5646		5646	5646	5646	0	8.64	
CHALK_KA	2	2837	21630	23898	13079	43668	30589	10.08	0.85
CHALK_KE	206	1003	91448	52626	3002	341698	338696	10.87	1.32
CHALK_KS	10	7639	55366	58046	19726	162165	142439	10.97	0.81
CHALK_KT	130	6253	65214	33555	3574	278161	274587	10.42	1.20
CLAY-SILT_Q	794	1531	15870	10277	1572	164810	163238	9.24	0.88
CLAY-SILT-SAND-GRAVEL_Q	581	1861	25542	10849	179	251360	251181	9.29	1.04
CLAYSTONE_JO	9	8076	8024	6127	1715	28945	27230	8.72	0.74
DIAMICTON_Q	1275	1873	38033	7934	179	305248	305069	8.98	1.13
DIAMICTON-SAND-GRAVEL_Q	8	4378	2602	3509	715	8648	7933	8.16	0.80
DOLOSTONE_PU	189	5769	55604	30575	1572	230491	228919	10.33	1.31
GABBRO_CL	2	7183	6822	5322	2359	12007	9648	8.58	1.15
IRONSTONE_JS	14	1831	20261	11511	1358	79260	77902	9.35	1.02
IRONSTONE_KV	7	1126	13618	7465	3216	41453	38237	8.92	0.88
LIMESTONE_CF	8	3243	774	3159	2073	4431	2358	8.06	0.25
LIMESTONE_CI	12	6230	8814	4238	2073	33877	31804	8.35	0.73
LIMESTONE_CJ	4	6078	70464	18379	2787	146085	143298	9.82	2.13
LIMESTONE_CR	74	1365	36999	5315	1572	245428	243856	8.58	1.00
LIMESTONE_CX	95	1058	17035	5881	1429	113566	112137	8.68	0.93
LIMESTONE_JA	80	8147	64620	57711	1429	303819	302390	10.96	0.94
LIMESTONE_JB	67	6327	52129	47344	4074	241640	237566	10.77	0.79
LIMESTONE_JH	1	1436		14365	14365	14365	0	9.57	
LIMESTONE_JN	44	7224	58700	50787	4217	250002	245785	10.84	0.93
LIMESTONE_JS	6	3035	23304	22106	6718	63608	56890	10.00	0.93
LIMESTONE_KB	1	8433		8433	8433	8433	0	9.04	
LIMESTONE_PU	39	4478	33062	35533	7576	179032	171456	10.48	0.70
LIMESTONE_TR	7	1104	11125	8228	3788	35449	31661	9.02	0.76
LIMESTONE-MUDSTONE_CR	13	5514	4434	4393	715	19225	18510	8.39	0.73
LIMESTONE-MUDSTONE_JB	3	1143	104022	69813	14365	221986	207621	11.15	1.42
LIMESTONE-MUDSTONE-	3	1834	1004	1617	786	2787	2001	7.39	0.65
LIMESTONE-SANDSTONE_JE	4	3112	25113	23344	7004	65895	58891	10.06	0.93
MUDSTONE_CI	2	4116	52255	18150	4217	78117	73900	9.81	2.06
MUDSTONE_CR	2	5289	2425	5003	3574	7004	3430	8.52	0.48
MUDSTONE_JA	4	3964	30871	29174	8005	79189	71184	10.28	0.99
MUDSTONE_JC	16	2288	29605	13139	2359	120713	118354	9.48	1.07
MUDSTONE_JD	42	2454	45800	9328	2216	228775	226559	9.14	1.23
MUDSTONE_JE	1	1072		10721	10721	10721	0	9.28	
MUDSTONE_JH	9	5335	61593	24888	5646	154232	148586	10.12	1.37
MUDSTONE_JN	11	6943	63523	40278	8148	165453	157305	10.60	1.18
MUDSTONE_JO	9	1973	14553	16555	8219	55532	47313	9.71	0.59
MUDSTONE_JS	23	1068	16783	6931	1572	85121	83549	8.84	0.81
MUDSTONE_JT	10	3164	61032	10896	2501	200116	197615	9.30	1.38
MUDSTONE_KH	10	2422	38612	9810	3002	98700	95698	9.19	1.26
MUDSTONE_KZ	1	5575		5575	5575	5575	0	8.63	
MUDSTONE_PU	40	2467	38372	11595	1858	185608	183750	9.36	1.18
MUDSTONE_Q	1	3003		300317	300317	300317	0	12.61	
MUDSTONE_TA	22	8931	7628	6423	1715	31590	29875	8.77	0.84
MUDSTONE_TC	3	3550	599	3513	2859	3931	1072	8.16	0.18
MUDSTONE_TD	6	1384	7851	11119	3145	21227	18082	9.32	0.82
MUDSTONE_TL	192	1756	26489	8841	1715	220128	218413	9.09	1.10
MUDSTONE_TN	7	2291	21525	14270	4360	51601	47241	9.57	1.08
MUDSTONE_TR	59	1513	22624	9064	858	125859	125001	9.11	0.92
MUDSTONE-LIMESTONE_JA	1	9848		98486	98486	98486	0	11.50	
MUDSTONE-LIMESTONE_JB	10	7747	82187	35217	572	261866	261294	10.47	1.74
MUDSTONE-LIMESTONE_JH	3	3254	7006	32029	25443	39451	14008	10.37	0.22

Key	Count_Ca	Avg_Ca	SD_Ca	Gm_Ca	Min_Ca	Max_Ca	Range_Ca	LnGm_Ca	LnGSD_Ca
MUDSTONE-LIMESTONE_JS	8	2489	21669	16749	5360	55961	50601	9.73	0.99
MUDSTONE-LIMESTONE_KB	4	6837	97561	24694	4288	211480	207192	10.11	1.77
MUDSTONE-LIMESTONE_TR	49	2873	47801	11878	2644	225702	223058	9.38	1.23
MUDSTONE-LIMESTONE-	4	4407	49698	28462	12507	117282	104775	10.26	1.04
MUDSTONE-SANDSTONE_CA	241	4512	10494	3088	179	154161	153982	8.04	0.71
MUDSTONE-SANDSTONE_CB	250	6471	9717	4090	500	79761	79261	8.32	0.83
MUDSTONE-SANDSTONE_CC	57	9553	18110	4376	1286	86264	84978	8.38	1.03
MUDSTONE-SANDSTONE_CE	1	2859		2859	2859	2859	0	7.96	
MUDSTONE-SANDSTONE_CN	97	5828	25011	2629	179	246714	246535	7.87	0.88
MUDSTONE-SANDSTONE_CR	54	8418	21448	4875	1572	159950	158378	8.49	0.76
MUDSTONE-SANDSTONE_PU	21	1274	21260	5872	2001	71113	69112	8.68	1.09
MUDSTONE-SANDSTONE_TA	31	1447	41593	5371	643	235208	234565	8.59	1.14
PEAT_Q	97	1794	24317	7493	179	143297	143118	8.92	1.60
SAND_Q	145	1155	30627	4980	179	269156	268977	8.51	1.08
SAND-GRAVEL_Q	681	1230	24757	6325	179	266440	266261	8.75	0.97
SAND-GRAVEL-BOULDERS_Q	1	4438		44383	44383	44383	0	10.70	
SAND-MUD_Q	5	2624	19205	17552	3431	44669	41238	9.77	1.16
SANDSTONE_CA	190	3955	5263	2917	179	58248	58069	7.98	0.73
SANDSTONE_CB	127	4373	4810	3308	429	41738	41309	8.10	0.69
SANDSTONE_CC	65	4377	5639	3121	429	42668	42239	8.05	0.76
SANDSTONE_CE	14	2371	1402	1765	179	4717	4538	7.48	0.96
SANDSTONE_CG	15	2163	1517	1608	357	5146	4789	7.38	0.87
SANDSTONE_CH	7	1915	1303	1315	179	3859	3680	7.18	1.12
SANDSTONE_CK	44	4019	8359	2262	179	57247	57068	7.72	1.02
SANDSTONE_CX	1	3788		3788	3788	3788	0	8.24	
SANDSTONE_CY	49	4229	6068	2582	179	37236	37057	7.86	1.03
SANDSTONE_CZ	96	2666	1805	1936	179	9363	9184	7.57	0.93
SANDSTONE_JA	2	1508	11421	12735	7004	23156	16152	9.45	0.85
SANDSTONE_JC	2	4110	859	4064	3502	4717	1215	8.31	0.21
SANDSTONE_JO	1	2365		23657	23657	23657	0	10.07	
SANDSTONE_JS	3	5003	1778	4799	3431	6933	3502	8.48	0.35
SANDSTONE_JV	29	2009	52092	7018	1930	272515	270585	8.86	1.13
SANDSTONE_KA	6	7920	71910	47849	5932	189896	183964	10.78	1.26
SANDSTONE_PU	37	5604	5432	4434	1001	28445	27444	8.40	0.62
SANDSTONE_TA	1	1357		13579	13579	13579	0	9.52	
SANDSTONE_TC	2	3538	252	3533	3359	3716	357	8.17	0.07
SANDSTONE_TL	205	4584	4292	3558	429	46741	46312	8.18	0.71
SANDSTONE-	3	3264	1135	3145	2573	4574	2001	8.05	0.32
SANDSTONE-IRONSTONE_JE	3	1122	6305	10183	6790	18439	11649	9.23	0.53
SANDSTONE-MUDSTONE_JA	2	1117	147972	39328	7147	216411	209264	10.58	2.41
SANDSTONE-MUDSTONE_JB	1	7004		7004	7004	7004	0	8.85	
SANDSTONE-MUDSTONE_JC	7	1156	8395	9060	2930	25801	22871	9.11	0.78
SILTSTONE_TA	8	1137	15357	6461	1858	48242	46384	8.77	1.08
SILTSTONE_TC	10	4045	1023	3907	2001	5360	3359	8.27	0.29
SILTSTONE_TL	4	1652	9203	13109	3288	24586	21298	9.48	0.93

Table 13: Descriptive statistics for Cu (mg kg^{-1}) in soil based on RCS split into age classifications for the Humber-Trent Atlas

Key	Count_ Cu	Avg_Cu	SD_Cu	Gm_ Cu	Min_Cu	Max_ Cu	Range_Cu	LnGm_ Cu	LnGSD_ Cu
BASALT_CX	1	38		38	38	38	0	3.64	
BRECCIA_CX	1	37		37	37	37	0	3.61	
CHALK_KA	2	20	6	20	16	24	8	2.98	0.29
CHALK_KE	206	19	6	18	9	46	37	2.90	0.29
CHALK_KS	10	17	4	16	11	25	14	2.79	0.24
CHALK_KT	130	18	5	18	10	43	33	2.87	0.23
CLAY-SILT_Q	794	21	16	19	7	298	291	2.95	0.38
CLAY-SILT-SAND-GRAVEL_Q	581	27	46	22	1	1085	1084	3.10	0.49
CLAYSTONE_JO	9	15	5	14	6	21	15	2.62	0.40
DIAMICTON_Q	1275	21	9	20	3	136	133	2.99	0.33
DIAMICTON-SAND-GRAVEL_Q	8	21	7	20	13	30	17	2.98	0.33
DOLOSTONE_PU	189	31	37	25	3	431	428	3.22	0.58
GABBRO_CL	2	33	12	31	24	41	17	3.45	0.38
IRONSTONE_JS	14	22	8	20	4	36	32	2.98	0.53
IRONSTONE_KV	7	18	7	17	11	33	22	2.84	0.34
LIMESTONE_CF	8	42	22	37	18	72	54	3.62	0.53
LIMESTONE_CI	12	26	10	25	14	47	33	3.20	0.37
LIMESTONE_CJ	4	30	15	27	21	52	31	3.31	0.43
LIMESTONE_CR	74	30	17	26	11	116	105	3.27	0.46
LIMESTONE_CX	95	38	26	32	13	158	145	3.46	0.54
LIMESTONE_JA	80	21	8	20	10	41	31	2.98	0.35
LIMESTONE_JB	67	20	6	19	9	45	36	2.94	0.30
LIMESTONE_JH	1	27		27	27	27	0	3.30	
LIMESTONE_JN	44	26	20	24	13	151	138	3.16	0.39
LIMESTONE_JS	6	30	4	30	25	36	11	3.39	0.15
LIMESTONE_KB	1	18		18	18	18	0	2.89	
LIMESTONE_PU	39	36	18	32	14	101	87	3.47	0.44
LIMESTONE_TR	7	20	10	18	10	38	28	2.90	0.46
LIMESTONE-MUDSTONE_CR	13	30	12	28	14	56	42	3.34	0.41
LIMESTONE-MUDSTONE_JB	3	17	9	16	10	27	17	2.75	0.51
LIMESTONE-MUDSTONE-	3	18	6	18	12	22	10	2.87	0.34
LIMESTONE-SANDSTONE_JE	4	24	15	21	12	45	33	3.03	0.56
MUDSTONE_CI	2	29	5	28	25	32	7	3.34	0.17
MUDSTONE_CR	2	82	65	68	36	128	92	4.22	0.90
MUDSTONE_JA	4	25	4	24	20	29	9	3.19	0.16
MUDSTONE_JC	16	20	5	19	9	28	19	2.95	0.28
MUDSTONE_JD	42	15	6	14	5	26	21	2.65	0.39
MUDSTONE_JE	1	20		20	20	20	0	3.00	
MUDSTONE_JH	9	29	9	28	18	47	29	3.33	0.31
MUDSTONE_JN	11	25	5	24	17	33	16	3.19	0.23
MUDSTONE_JO	9	15	1	15	13	17	4	2.72	0.09
MUDSTONE_JS	23	23	12	20	7	63	56	3.01	0.51
MUDSTONE_JT	10	23	10	21	12	41	29	3.04	0.42
MUDSTONE_KH	10	20	4	19	14	25	11	2.95	0.21
MUDSTONE_KZ	1	17		17	17	17	0	2.83	
MUDSTONE_PU	40	26	12	24	6	74	68	3.18	0.46
MUDSTONE_Q	1	14		14	14	14	0	2.64	
MUDSTONE_TA	22	23	26	19	13	140	127	2.93	0.47
MUDSTONE_TC	3	19	3	19	16	21	5	2.95	0.16
MUDSTONE_TD	6	33	10	31	21	51	30	3.44	0.30
MUDSTONE_TL	192	26	13	23	8	99	91	3.15	0.40
MUDSTONE_TN	7	23	3	23	21	29	8	3.14	0.12
MUDSTONE_TR	59	24	8	22	5	52	47	3.10	0.37
MUDSTONE-LIMESTONE_JA	1	18		18	18	18	0	2.89	
MUDSTONE-LIMESTONE_JB	10	18	8	16	5	27	22	2.75	0.55

Key	Count_ Cu	Avg_Cu	SD_Cu	Gm_ Cu	Min_Cu	Max_ Cu	Range_Cu	LnGm_ Cu	LnGSD_ Cu
MUDSTONE-LIMESTONE_JH	3	35	5	35	31	41	10	3.55	0.15
MUDSTONE-LIMESTONE_JS	8	25	5	25	16	31	15	3.20	0.20
MUDSTONE-LIMESTONE_KB	4	22	6	21	14	27	13	3.05	0.29
MUDSTONE-LIMESTONE_TR	49	25	14	23	10	105	95	3.13	0.39
MUDSTONE-LIMESTONE-	4	27	9	26	18	36	18	3.25	0.33
MUDSTONE-SANDSTONE_CA	241	52	380	25	6	5920	5914	3.23	0.59
MUDSTONE-SANDSTONE_CB	250	43	71	33	9	1046	1037	3.51	0.54
MUDSTONE-SANDSTONE_CC	57	32	20	29	14	113	99	3.35	0.45
MUDSTONE-SANDSTONE_CE	1	11		11	11	11	0	2.40	
MUDSTONE-SANDSTONE_CN	97	21	13	18	5	69	64	2.91	0.52
MUDSTONE-SANDSTONE_CR	54	48	32	40	15	172	157	3.70	0.58
MUDSTONE-SANDSTONE_PU	21	30	23	25	10	95	85	3.21	0.62
MUDSTONE-SANDSTONE_TA	31	19	6	18	10	32	22	2.88	0.29
PEAT_Q	97	21	14	16	1	94	93	2.78	0.83
SAND_Q	145	20	33	14	3	368	365	2.64	0.76
SAND-GRAVEL_Q	681	22	15	19	2	142	140	2.93	0.53
SAND-GRAVEL-BOULDERS_Q	1	12		12	12	12	0	2.48	
SAND-MUD_Q	5	14	6	13	8	21	13	2.53	0.43
SANDSTONE_CA	190	30	30	24	5	295	290	3.19	0.57
SANDSTONE_CB	127	47	103	30	7	880	873	3.39	0.69
SANDSTONE_CC	65	29	24	25	10	190	180	3.21	0.51
SANDSTONE_CE	14	16	9	15	9	39	30	2.68	0.47
SANDSTONE_CG	15	18	12	15	3	53	50	2.70	0.72
SANDSTONE_CH	7	13	4	12	5	19	14	2.48	0.42
SANDSTONE_CK	44	20	10	18	6	55	49	2.88	0.51
SANDSTONE_CX	1	24		24	24	24	0	3.18	
SANDSTONE_CY	49	32	47	21	1	314	313	3.04	0.91
SANDSTONE_CZ	96	17	9	14	2	52	50	2.66	0.55
SANDSTONE_JA	2	37	11	36	29	45	16	3.59	0.31
SANDSTONE_JC	2	15	7	14	10	20	10	2.65	0.49
SANDSTONE_JO	1	19		19	19	19	0	2.94	
SANDSTONE_JS	3	21	5	21	17	26	9	3.03	0.21
SANDSTONE_JV	29	15	5	14	5	24	19	2.64	0.35
SANDSTONE_KA	6	24	8	22	15	35	20	3.11	0.34
SANDSTONE_PU	37	23	10	21	9	52	43	3.06	0.41
SANDSTONE_TA	1	13		13	13	13	0	2.56	
SANDSTONE_TC	2	22	4	22	19	25	6	3.08	0.19
SANDSTONE_TL	205	20	14	18	7	125	118	2.88	0.47
SANDSTONE-	3	40	17	37	21	54	33	3.61	0.50
SANDSTONE-IRONSTONE_JE	3	29	7	28	21	34	13	3.33	0.26
SANDSTONE-MUDSTONE_JA	2	15	6	14	10	19	9	2.62	0.45
SANDSTONE-MUDSTONE_JB	1	12		12	12	12	0	2.48	
SANDSTONE-MUDSTONE_JC	7	19	6	18	10	25	15	2.87	0.36
SILTSTONE_TA	8	25	16	22	15	61	46	3.07	0.51
SILTSTONE_TC	10	24	4	24	17	30	13	3.18	0.17
SILTSTONE_TL	4	23	11	22	15	38	23	3.07	0.43

Table 14: Descriptive statistics for Fe (mg kg^{-1}) in soil based on RCS split into age classifications for the Humber-Trent Atlas region

Key	Count_ Fe	Avg_Fe	SD_Fe	Gm_Fe	Min_ Fe	Max_Fe	Range _Fe	LnGm_ Fe	LnGSD_Fe
SANDSTONE_CH	7	26716	11588	23974	8715	40649	31934	10.08	0.55
SANDSTONE_CK	44	40354	8725	39237	15695	58344	42649	10.58	0.25
SANDSTONE_CX	1	47636		47636	47636	47636	0	10.77	
SANDSTONE_CY	49	35956	12873	31574	2630	63394	60764	10.36	0.66
SANDSTONE_CZ	96	33169	10862	30748	3735	67751	64016	10.33	0.45
SANDSTONE_JA	2	61320	20143	59643	47077	75563	28486	11.00	0.33
SANDSTONE_JC	2	28172	9238	27404	21639	34704	13065	10.22	0.33
SANDSTONE_JO	1	28207		28207	28207	28207	0	10.25	
SANDSTONE_JS	3	41689	15690	39849	29039	59246	30207	10.59	0.36
SANDSTONE_JV	29	46028	28533	39307	8645	150770	142125	10.58	0.58
SANDSTONE_KA	6	64257	47158	49967	17079	139642	122563	10.82	0.81
SANDSTONE_PU	37	25726	7333	24770	15422	48601	33179	10.12	0.28
SANDSTONE_TA	1	19499		19499	19499	19499	0	9.88	
SANDSTONE_TC	2	28172	4936	27955	24682	31662	6980	10.24	0.18
SANDSTONE_TL	205	22875	5593	22320	8924	53441	44517	10.01	0.22
SANDSTONE-	3	29797	3376	29671	26689	33389	6700	10.30	0.11
SANDSTONE-IRONSTONE_JE	3	125332	76566	109154	55239	207043	151804	11.60	0.66
SANDSTONE-MUDSTONE_JA	2	28036	8066	27449	22332	33739	11407	10.22	0.29
SANDSTONE-MUDSTONE_JB	1	38159		38159	38159	38159	0	10.55	
SANDSTONE-MUDSTONE_JC	7	32048	13015	29662	16667	51986	35319	10.30	0.44
SILTSTONE_TA	8	30498	5011	30118	22542	36712	14170	10.31	0.17
SILTSTONE_TC	10	26639	3291	26471	23164	34501	11337	10.18	0.12
SILTSTONE_TL	4	29866	5245	29495	22744	35327	12583	10.29	0.19
BASALT_CX	1	52889		52889	52889	52889	0	10.88	
BRECCIA_CX	1	36432		36432	36432	36432	0	10.50	
CHALK_KA	2	52644	37200	45601	26339	78948	52609	10.73	0.78
CHALK_KE	206	23583	16284	19720	2490	148699	146209	9.89	0.61
CHALK_KS	10	20183	5784	19356	11204	26962	15758	9.87	0.31
CHALK_KT	130	23250	7028	21923	5392	44454	39062	10.00	0.37
CLAY-SILT_Q	794	37553	12835	35229	4910	80193	75283	10.47	0.37
CLAY-SILT-SAND-GRAVEL_Q	581	41639	16651	38382	3322	156784	153462	10.56	0.42
CLAYSTONE_JO	9	31834	12822	28990	10925	49986	39061	10.27	0.49
DIAMICTON_Q	1275	37298	11646	35381	3042	146832	143790	10.47	0.35
DIAMICTON-SAND-GRAVEL_Q	8	21390	2010	21303	18045	23850	5805	9.97	0.10
DOLOSTONE_PU	189	32157	10275	30135	6434	61184	54750	10.31	0.39
GABBRO_CL	2	42688	9827	42118	35739	49636	13897	10.65	0.23
IRONSTONE_JS	14	106311	86112	76778	6987	336789	329802	11.25	0.93
IRONSTONE_KV	7	89001	45313	80859	47147	180151	133004	11.30	0.46
LIMESTONE_CF	8	40306	6986	39794	30487	53441	22954	10.59	0.17
LIMESTONE_CI	12	33439	3990	33223	28004	40027	12023	10.41	0.12
LIMESTONE_CJ	4	26773	7157	25901	16317	32081	15764	10.16	0.31
LIMESTONE_CR	74	35478	8857	34254	7330	62841	55511	10.44	0.29
LIMESTONE_CX	95	36186	10916	34936	17632	86411	68779	10.46	0.25
LIMESTONE_JA	80	38169	12543	35821	7952	81781	73829	10.49	0.38
LIMESTONE_JB	67	40571	11551	38781	12652	71968	59316	10.57	0.32
LIMESTONE_JH	1	91048		91048	91048	91048	0	11.42	
LIMESTONE_JN	44	59696	22427	55680	23717	112408	88691	10.93	0.38
LIMESTONE_JS	6	70906	16239	69244	46251	91461	45210	11.15	0.24
LIMESTONE_KB	1	47356		47356	47356	47356	0	10.77	
LIMESTONE_PU	39	31376	6253	30716	15282	43622	28340	10.33	0.22
LIMESTONE_TR	7	46083	19162	42490	22472	77703	55231	10.66	0.45
LIMESTONE-MUDSTONE_CR	13	37948	6899	37411	29864	52679	22815	10.53	0.17
LIMESTONE-MUDSTONE_JB	3	30902	12813	28694	16107	38299	22192	10.26	0.50
LIMESTONE-MUDSTONE-	3	39959	22727	33890	13897	55651	41754	10.43	0.77
LIMESTONE-SANDSTONE_JE	4	73159	40290	66211	41621	131417	89796	11.10	0.50

Key	Count_Fe	Avg_Fe	SD_Fe	Gm_Fe	Min_Fe	Max_Fe	Range_Fe	LnGm_Fe	LnGSD_Fe
MUDSTONE_CI	2	36366	1172	36356	35537	37194	1657	10.50	0.03
MUDSTONE_CR	2	44454	5282	44297	40719	48189	7470	10.70	0.12
MUDSTONE_JA	4	54337	9835	53720	46321	68506	22185	10.89	0.17
MUDSTONE_JC	16	44573	15011	42013	20262	74388	54126	10.65	0.37
MUDSTONE_JD	42	41272	21838	36217	9610	104595	94985	10.50	0.52
MUDSTONE_JE	1	52056		52056	52056	52056	0	10.86	
MUDSTONE_JH	9	48017	25348	40417	9680	93741	84061	10.61	0.69
MUDSTONE_JN	11	51837	25077	47414	28004	115170	87166	10.77	0.43
MUDSTONE_JO	9	39084	5261	38744	30557	43901	13344	10.56	0.14
MUDSTONE_JS	23	63496	41049	53064	13414	192797	179383	10.88	0.62
MUDSTONE_JT	10	51235	18606	47079	15282	74108	58826	10.76	0.48
MUDSTONE_KH	10	109011	47816	101407	61596	216513	154917	11.53	0.39
MUDSTONE_KZ	1	109638		109638	10963	109638	0	11.60	
MUDSTONE_PU	40	37125	13613	34797	9750	80816	71066	10.46	0.37
MUDSTONE_Q	1	2840		2840	2840	2840	0	7.95	
MUDSTONE_TA	22	29731	5697	29208	19772	41824	22052	10.28	0.19
MUDSTONE_TC	3	26687	3584	26528	23367	30487	7120	10.19	0.13
MUDSTONE_TD	6	28218	8128	27203	16247	41411	25164	10.21	0.30
MUDSTONE_TL	192	31724	7694	30717	7609	51986	44377	10.33	0.27
MUDSTONE_TN	7	39544	5569	39224	33669	47769	14100	10.58	0.14
MUDSTONE_TR	59	44358	16927	40852	7400	93671	86271	10.62	0.44
MUDSTONE-LIMESTONE_JA	1	31802		31802	31802	31802	0	10.37	
MUDSTONE-LIMESTONE_JB	10	35493	14258	32139	11344	51224	39880	10.38	0.51
MUDSTONE-LIMESTONE_JH	3	51203	4515	51069	46454	55441	8987	10.84	0.09
MUDSTONE-LIMESTONE_JS	8	55850	13356	54471	37054	80816	43762	10.91	0.24
MUDSTONE-LIMESTONE_KB	4	91718	82967	67032	21367	211946	190579	11.11	0.94
MUDSTONE-LIMESTONE_TR	49	42870	21630	39339	14869	153742	138873	10.58	0.40
MUDSTONE-LIMESTONE-	4	56706	23284	53010	30417	86691	56274	10.88	0.43
MUDSTONE-SANDSTONE_CA	241	44561	12784	42844	14932	102658	87726	10.67	0.28
MUDSTONE-SANDSTONE_CB	250	45133	13360	43687	20052	157407	137355	10.68	0.24
MUDSTONE-SANDSTONE_CC	57	43393	12994	41862	25927	100098	74171	10.64	0.26
MUDSTONE-SANDSTONE_CE	1	30697		30697	30697	30697	0	10.33	
MUDSTONE-SANDSTONE_CN	97	39875	13272	37434	9750	75493	65743	10.53	0.38
MUDSTONE-SANDSTONE_CR	54	42844	14075	40224	5120	83306	78186	10.60	0.40
MUDSTONE-SANDSTONE_PU	21	34788	12515	32892	14450	72863	58413	10.40	0.34
MUDSTONE-SANDSTONE_TA	31	26591	7171	25631	9890	43139	33249	10.15	0.28
PEAT_Q	97	36985	21754	28699	1245	107015	105770	10.26	0.85
SAND_Q	145	27754	20641	20930	1042	115933	114891	9.95	0.82
SAND-GRAVEL_Q	681	30442	16678	26111	2420	119038	116618	10.17	0.58
SAND-GRAVEL-BOULDERS_Q	1	32354		32354	32354	32354	0	10.38	
SAND-MUD_Q	5	26148	11501	24367	16044	44104	28060	10.10	0.41
SANDSTONE_CA	190	42081	10411	40811	8372	103490	95118	10.62	0.26
SANDSTONE_CB	127	41549	15254	39760	22052	146832	124780	10.59	0.27
SANDSTONE_CC	65	38917	11379	37601	15282	95195	79913	10.53	0.26
SANDSTONE_CE	14	32547	9777	31184	14380	57449	43069	10.35	0.31
SANDSTONE_CG	15	35319	18923	26456	1455	65604	64149	10.18	1.02

Table 15: Descriptive statistics for K (mg kg^{-1}) in soil based on RCS split into age classifications for the Humber-Trent Atlas region

Key	Count_K	Avg_K	SD_K	Gm_K	Min_K	Max_K	Range_K	LnGm_K	LnGSD_K
BASALT_CX	1	17922		17922	17922	17922	0	9.79	
BRECCIA_CX	1	11339		11339	11339	11339	0	9.34	
CHALK_KA	2	18130	3850	17924	15407	20852	5445	9.79	0.21
CHALK_KE	206	11673	3531	11118	3536	24505	20969	9.32	0.32
CHALK_KS	10	11422	1387	11342	9065	13049	3984	9.34	0.13
CHALK_KT	130	11501	2590	11210	5977	19790	13813	9.32	0.23
CLAY-SILT_Q	794	18637	4073	18156	8824	27269	18445	9.81	0.23
CLAY-SILT-SAND-GRAVEL_Q	581	17629	4789	16977	2648	34989	32341	9.74	0.28
CLAYSTONE_JO	9	15766	2856	15541	12153	20852	8699	9.65	0.18
DIAMICTON_Q	1275	15449	3045	15122	3785	30033	26248	9.62	0.21
DIAMICTON-SAND-GRAVEL_Q	8	18978	3105	18748	14344	22147	7803	9.84	0.17
DOLOSTONE_PU	189	12814	3622	12081	1918	21417	19499	9.40	0.39
GABBRO_CL	2	12684	3158	12486	10451	14917	4466	9.43	0.25
IRONSTONE_JS	14	14371	4075	13810	6624	24023	17399	9.53	0.30
IRONSTONE_KV	7	13884	833	13863	12800	15083	2283	9.54	0.06
LIMESTONE_CF	8	13677	1925	13553	10451	15971	5520	9.51	0.15
LIMESTONE_CI	12	15156	2466	14975	11995	18901	6906	9.61	0.16
LIMESTONE_CJ	4	14471	2582	14302	12070	17681	5611	9.57	0.18
LIMESTONE_CR	74	13626	2646	13279	3379	23127	19748	9.49	0.25
LIMESTONE_CX	95	13055	2720	12799	7197	28082	20885	9.46	0.20
LIMESTONE_JA	80	12702	2357	12454	5811	19790	13979	9.43	0.21
LIMESTONE_JB	67	12777	1978	12605	7031	15813	8782	9.44	0.17
LIMESTONE_JH	1	10044		10044	10044	10044	0	9.21	
LIMESTONE_JN	44	12660	2183	12481	7844	20935	13091	9.43	0.17
LIMESTONE_JS	6	17558	3431	17271	13049	21500	8451	9.76	0.20
LIMESTONE_KB	1	12883		12883	12883	12883	0	9.46	
LIMESTONE_PU	39	15991	2280	15831	11015	22554	11539	9.67	0.14
LIMESTONE_TR	7	15591	1742	15509	13290	18171	4881	9.65	0.11
LIMESTONE-MUDSTONE_CR	13	15867	3265	15577	11181	23857	12676	9.65	0.20
LIMESTONE-MUDSTONE_JB	3	12288	4062	11847	8575	16627	8052	9.38	0.33
LIMESTONE-MUDSTONE-	3	11721	3784	11332	8500	15888	7388	9.34	0.32
LIMESTONE-SANDSTONE_JE	4	13029	1082	12995	11829	14020	2191	9.47	0.08
MUDSTONE_CI	2	13697	4825	13265	10285	17108	6823	9.49	0.36
MUDSTONE_CR	2	13170	1555	13124	12070	14269	2199	9.48	0.12
MUDSTONE_JA	4	13271	621	13260	12883	14186	1303	9.49	0.05
MUDSTONE_JC	16	16431	3918	15984	11015	23450	12435	9.68	0.24
MUDSTONE_JD	42	13786	2337	13601	9148	20528	11380	9.52	0.17
MUDSTONE_JE	1	17922		17922	17922	17922	0	9.79	
MUDSTONE_JH	9	16922	4468	16396	10368	25401	15033	9.70	0.27
MUDSTONE_JN	11	14769	3126	14487	10202	20935	10733	9.58	0.20
MUDSTONE_JO	9	16036	2165	15908	12800	19308	6508	9.67	0.13
MUDSTONE_JS	23	16500	3207	16212	11663	23857	12194	9.69	0.19
MUDSTONE_JT	10	14616	2366	14421	9388	18005	8617	9.58	0.18
MUDSTONE_KH	10	14649	1608	14563	11015	16868	5853	9.59	0.12
MUDSTONE_KZ	1	13207		13207	13207	13207	0	9.49	
MUDSTONE_PU	40	20454	5894	19712	9637	41654	32017	9.89	0.27
MUDSTONE_Q	1	7031		7031	7031	7031	0	8.86	
MUDSTONE_TA	22	32092	6553	31199	12725	38483	25758	10.35	0.27
MUDSTONE_TC	3	21148	259	21147	20852	21334	482	9.96	0.01
MUDSTONE_TD	6	26757	2951	26605	20935	29386	8451	10.19	0.12
MUDSTONE_TL	192	28155	4335	27793	14593	39787	25194	10.23	0.17
MUDSTONE_TN	7	25598	3846	25351	21176	31170	9994	10.14	0.15
MUDSTONE_TR	59	16604	3355	16317	11422	28979	17557	9.70	0.18
MUDSTONE-LIMESTONE_JA	1	10775		10775	10775	10775	0	9.28	
MUDSTONE-LIMESTONE_JB	10	12755	2220	12531	7114	14834	7720	9.44	0.21

Key	Count_K	Avg_K	SD_K	Gm_K	Min_K	Max_K	Range_K	LnGm_K	LnGSD_K
MUDSTONE-LIMESTONE_JH	3	21635	796	21626	21176	22554	1378	9.98	0.04
MUDSTONE-LIMESTONE_JS	8	17243	1664	17171	14269	19549	5280	9.75	0.10
MUDSTONE-LIMESTONE_KB	4	12763	2614	12558	9795	15647	5852	9.44	0.21
MUDSTONE-LIMESTONE_TR	49	16446	2548	16244	9637	22637	13000	9.70	0.16
MUDSTONE-LIMESTONE-	4	15343	6223	14549	10609	24505	13896	9.59	0.36
MUDSTONE-SANDSTONE_CA	241	15393	4479	14811	5487	32307	26820	9.60	0.28
MUDSTONE-SANDSTONE_CB	250	17901	3538	17563	10849	28082	17233	9.77	0.20
MUDSTONE-SANDSTONE_CC	57	17476	2511	17292	11015	22803	11788	9.76	0.15
MUDSTONE-SANDSTONE_CE	1	12800		12800	12800	12800	0	9.46	
MUDSTONE-SANDSTONE_CN	97	14803	3015	14504	7844	25725	17881	9.58	0.20
MUDSTONE-SANDSTONE_CR	54	15007	2892	14696	4922	22720	17798	9.60	0.22
MUDSTONE-SANDSTONE_PU	21	16721	3912	16343	12070	29062	16992	9.70	0.21
MUDSTONE-SANDSTONE_TA	31	27171	5199	26658	16220	37512	21292	10.19	0.20
PEAT_Q	97	15449	5505	13593	1021	24828	23807	9.52	0.64
SAND_Q	145	14306	3352	13925	4673	24994	20321	9.54	0.24
SAND-GRAVEL_Q	681	14623	3921	14162	4599	36051	31452	9.56	0.25
SAND-GRAVEL-BOULDERS_Q	1	16220		16220	16220	16220	0	9.69	
SAND-MUD_Q	5	14495	1444	14437	12725	16220	3495	9.58	0.10
SANDSTONE_CA	190	14402	3314	14072	8251	27186	18935	9.55	0.21
SANDSTONE_CB	127	16339	3584	15975	9961	32557	22596	9.68	0.21
SANDSTONE_CC	65	18888	2312	18746	13697	23940	10243	9.84	0.13
SANDSTONE_CE	14	14023	4514	13517	9231	27759	18528	9.51	0.27
SANDSTONE_CG	15	13146	3345	12789	9148	19632	10484	9.46	0.24
SANDSTONE_CH	7	11260	2933	10812	5246	14020	8774	9.29	0.34
SANDSTONE_CK	44	15921	3918	15449	8658	24347	15689	9.65	0.25
SANDSTONE_CX	1	15813		15813	15813	15813	0	9.67	
SANDSTONE_CY	49	16345	3635	15936	9471	25725	16254	9.68	0.23
SANDSTONE_CZ	96	16473	4625	15877	6707	32067	25360	9.67	0.27
SANDSTONE_JA	2	16951	2066	16888	15490	18412	2922	9.73	0.12
SANDSTONE_JC	2	13045	1379	13009	12070	14020	1950	9.47	0.11
SANDSTONE_JO	1	12883		12883	12883	12883	0	9.46	
SANDSTONE_JS	3	17737	2367	17627	15083	19632	4549	9.78	0.14
SANDSTONE_JV	29	14412	2824	14151	7114	24911	17797	9.56	0.20
SANDSTONE_KA	6	12223	1470	12154	10692	14917	4225	9.41	0.11
SANDSTONE_PU	37	18495	3528	18173	11829	26862	15033	9.81	0.19
SANDSTONE_TA	1	27111		27111	27111	27111	0	10.21	
SANDSTONE_TC	2	23168	3851	23007	20445	25891	5446	10.04	0.17
SANDSTONE_TL	205	21817	3794	21490	13132	31901	18769	9.98	0.17
SANDSTONE-	3	15296	677	15286	14751	16054	1303	9.63	0.04
SANDSTONE-IRONSTONE_JE	3	15324	5896	14615	10526	21906	11380	9.59	0.37
SANDSTONE-MUDSTONE_JA	2	12522	3622	12257	9961	15083	5122	9.41	0.29
SANDSTONE-MUDSTONE_JB	1	12642		12642	12642	12642	0	9.44	
SANDSTONE-MUDSTONE_JC	7	14209	2480	14031	11505	18412	6907	9.55	0.17
SILTSTONE_TA	8	34453	2530	34371	30116	37919	7803	10.44	0.07
SILTSTONE_TC	10	21166	2482	21050	19142	27676	8534	9.95	0.11
SILTSTONE_TL	4	29220	1394	29195	28082	31253	3171	10.28	0.05

Table 16: Descriptive statistics for Mn (mg kg^{-1}) in soil based on RCS split into age classifications for the Humber-Trent Atlas region

Key	Count_Mn	Avg_Mn	SD_Mn	Gm_Mn	Min_Mn	Max_Mn	Range_Mn	LnGm_Mn	LnGSD_Mn
BASALT_CX	1	1239		1239	1239	1239	0	7.12	
BRECCIA_CX	1	1123		1123	1123	1123	0	7.02	
CHALK_KA	2	906	11	906	898	914	16	6.81	0.01
CHALK_KE	206	1174	583	1070	310	4337	4027	6.98	0.42
CHALK_KS	10	1235	301	1198	744	1595	851	7.09	0.27
CHALK_KT	130	1300	362	1251	441	2703	2262	7.13	0.28
CLAY-SILT_Q	794	696	363	628	209	3679	3470	6.44	0.44
CLAY-SILT-SAND-GRAVEL_Q	581	1034	861	858	132	11246	11114	6.75	0.58
CLAYSTONE_JO	9	489	220	446	201	968	767	6.10	0.47
DIAMICTON_Q	1275	781	444	699	132	5329	5197	6.55	0.46
DIAMICTON-SAND-GRAVEL_Q	8	810	174	794	573	1053	480	6.68	0.21
DOLOSTONE_PU	189	1763	1003	1598	651	11517	10866	7.38	0.42
GABBRO_CL	2	1023	394	984	744	1301	557	6.89	0.40
IRONSTONE_JS	14	3340	4443	1852	132	17519	17387	7.52	1.18
IRONSTONE_KV	7	896	521	793	341	1998	1657	6.68	0.52
LIMESTONE_CF	8	2099	1352	1711	496	4206	3710	7.44	0.71
LIMESTONE_CI	12	1550	423	1499	1077	2362	1285	7.31	0.27
LIMESTONE_CJ	4	1960	1483	1570	596	4066	3470	7.36	0.79
LIMESTONE_CR	74	1589	961	1360	294	4678	4384	7.22	0.56
LIMESTONE_CX	95	1812	1420	1524	496	9325	8829	7.33	0.54
LIMESTONE_JA	80	887	295	837	279	2006	1727	6.73	0.36
LIMESTONE_JB	67	894	234	865	418	1820	1402	6.76	0.27
LIMESTONE_JH	1	5027		5027	5027	5027	0	8.52	
LIMESTONE_JN	44	1114	464	1038	418	3090	2672	6.95	0.37
LIMESTONE_JS	6	1430	626	1335	891	2595	1704	7.20	0.39
LIMESTONE_KB	1	1139		1139	1139	1139	0	7.04	
LIMESTONE_PU	39	1504	566	1400	480	3191	2711	7.24	0.40
LIMESTONE_TR	7	885	503	756	248	1696	1448	6.63	0.64
LIMESTONE-MUDSTONE_CR	13	969	382	885	294	1580	1286	6.79	0.47
LIMESTONE-MUDSTONE_JB	3	664	199	641	434	790	356	6.46	0.34
LIMESTONE-MUDSTONE-	3	1105	624	939	387	1518	1131	6.84	0.77
LIMESTONE-SANDSTONE_JE	4	1539	921	1366	875	2858	1983	7.22	0.55
MUDSTONE_CI	2	659	66	657	612	705	93	6.49	0.10
MUDSTONE_CR	2	2060	427	2038	1758	2362	604	7.62	0.21
MUDSTONE_JA	4	1150	137	1144	1053	1348	295	7.04	0.11
MUDSTONE_JC	16	640	406	566	232	2037	1805	6.34	0.48
MUDSTONE_JD	42	944	1041	665	209	4996	4787	6.50	0.77
MUDSTONE_JE	1	991		991	991	991	0	6.90	
MUDSTONE_JH	9	1280	542	1116	225	1929	1704	7.02	0.66
MUDSTONE_JN	11	743	354	676	380	1479	1099	6.52	0.45
MUDSTONE_JO	9	633	204	603	341	984	643	6.40	0.33
MUDSTONE_JS	23	939	671	771	341	2912	2571	6.65	0.62
MUDSTONE_JT	10	736	308	681	372	1301	929	6.52	0.42
MUDSTONE_KH	10	1138	341	1094	682	1859	1177	7.00	0.30
MUDSTONE_KZ	1	1588		1588	1588	1588	0	7.37	
MUDSTONE_PU	40	1407	674	1260	441	3377	2936	7.14	0.48
MUDSTONE_Q	1	132		132	132	132	0	4.88	
MUDSTONE_TA	22	757	223	730	457	1472	1015	6.59	0.27
MUDSTONE_TC	3	754	219	731	519	953	434	6.59	0.31
MUDSTONE_TD	6	891	214	870	620	1231	611	6.77	0.24
MUDSTONE_TL	192	871	261	835	232	1882	1650	6.73	0.29
MUDSTONE_TN	7	802	189	779	441	1077	636	6.66	0.27
MUDSTONE_TR	59	839	460	725	217	2316	2099	6.59	0.56
MUDSTONE-LIMESTONE_JA	1	867		867	867	867	0	6.77	

Key	Count_Mn	Avg_Mn	SD_Mn	Gm_Mn	Min_Mn	Max_Mn	Range_Mn	LnGm_Mn	LnGSD_Mn
MUDSTONE-LIMESTONE_JB	10	768	258	724	372	1131	759	6.58	0.38
MUDSTONE-LIMESTONE_JH	3	1211	321	1180	852	1472	620	7.07	0.29
MUDSTONE-LIMESTONE_JS	8	1035	596	909	480	2254	1774	6.81	0.53
MUDSTONE-LIMESTONE_KB	4	1607	875	1288	333	2331	1998	7.16	0.91
MUDSTONE-LIMESTONE_TR	49	1111	976	920	333	5979	5646	6.82	0.54
MUDSTONE-LIMESTONE-	4	949	575	810	441	1549	1108	6.70	0.67
MUDSTONE-SANDSTONE_CA	241	1126	552	983	132	3036	2904	6.89	0.56
MUDSTONE-SANDSTONE_CB	250	1320	614	1217	364	6521	6157	7.10	0.40
MUDSTONE-SANDSTONE_CC	57	1410	680	1282	356	4662	4306	7.16	0.44
MUDSTONE-SANDSTONE_CE	1	333		333	333	333	0	5.81	
MUDSTONE-SANDSTONE_CN	97	780	567	601	132	2688	2556	6.40	0.74
MUDSTONE-SANDSTONE_CR	54	1147	794	956	240	4407	4167	6.86	0.60
MUDSTONE-SANDSTONE_PU	21	1692	3199	999	310	15413	15103	6.91	0.82
MUDSTONE-SANDSTONE_TA	31	693	196	664	325	1030	705	6.50	0.31
PEAT_Q	97	629	540	491	132	3834	3702	6.20	0.69
SAND_Q	145	764	778	553	132	5623	5491	6.32	0.77
SAND-GRAVEL_Q	681	754	519	620	132	3501	3369	6.43	0.62
SAND-GRAVEL-BOULDERS_Q	1	697		697	697	697	0	6.55	
SAND-MUD_Q	5	654	290	612	457	1146	689	6.42	0.39
SANDSTONE_CA	190	1246	582	1101	132	3144	3012	7.00	0.54
SANDSTONE_CB	127	1270	612	1162	387	5530	5143	7.06	0.42
SANDSTONE_CC	65	1336	767	1222	372	6583	6211	7.11	0.40
SANDSTONE_CE	14	838	716	565	178	2393	2215	6.34	0.96
SANDSTONE_CG	15	744	525	557	170	1681	1511	6.32	0.84
SANDSTONE_CH	7	667	510	517	170	1665	1495	6.25	0.79
SANDSTONE_CK	44	827	588	651	132	3028	2896	6.48	0.72
SANDSTONE_CX	1	542		542	542	542	0	6.30	
SANDSTONE_CY	49	923	724	678	132	3083	2951	6.52	0.83
SANDSTONE_CZ	96	692	451	551	132	2486	2354	6.31	0.72
SANDSTONE_JA	2	999	175	991	875	1123	248	6.90	0.18
SANDSTONE_JC	2	539	28	538	519	558	39	6.29	0.05
SANDSTONE_JO	1	751		751	751	751	0	6.62	
SANDSTONE_JS	3	578	234	548	380	836	456	6.31	0.40
SANDSTONE_JV	29	682	370	589	201	1836	1635	6.38	0.57
SANDSTONE_KA	6	1842	863	1674	1053	2966	1913	7.42	0.48
SANDSTONE_PU	37	929	332	879	449	1998	1549	6.78	0.33
SANDSTONE_TA	1	782		782	782	782	0	6.66	
SANDSTONE_TC	2	713	296	681	503	922	419	6.52	0.43
SANDSTONE_TL	205	777	336	713	225	2401	2176	6.57	0.42
SANDSTONE-	3	831	283	802	627	1154	527	6.69	0.32
SANDSTONE-IRONSTONE_JE	3	2001	1396	1624	651	3439	2788	7.39	0.84
SANDSTONE-MUDSTONE_JA	2	899	175	890	775	1022	247	6.79	0.20
SANDSTONE-MUDSTONE_JB	1	472		472	472	472	0	6.16	
SANDSTONE-MUDSTONE_JC	7	662	361	584	256	1332	1076	6.37	0.54
SILTSTONE_TA	8	737	136	726	573	945	372	6.59	0.18
SILTSTONE_TC	10	672	75	668	558	798	240	6.50	0.11
SILTSTONE_TL	4	848	92	844	736	960	224	6.74	0.11

Table 17: Descriptive statistics for Mg (mg kg^{-1}) in soil based on RCS split into age classifications for the Humber-Trent Atlas region

Key	Count_Mg	Avg_Mg	SD_Mg	Gm_Mg	Min_Mg	Max_Mg	Range_Mg	LnGm_Mg	LnGSD_Mg
BASALT_CX	1	12424		12424	12424	12424	0	9.43	
BRECCIA_CX	1	5265		5265	5265	5265	0	8.57	
CHALK_KA	2	6459	844	6431	5862	7056	1194	8.77	0.13
CHALK_KE	206	4636	1533	4425	2280	11827	9547	8.40	0.30
CHALK_KS	10	4549	617	4510	3474	5265	1791	8.41	0.14
CHALK_KT	130	4673	1086	4550	2877	8841	5964	8.42	0.23
CLAY-SILT_Q	794	9462	3544	8688	1092	26144	25052	9.07	0.44
CLAY-SILT-SAND-GRAVEL_Q	581	9427	5390	8136	1092	44635	43543	9.00	0.56
CLAYSTONE_JO	9	5131	2473	4604	2280	9439	7159	8.43	0.50
DIAMICTON_Q	1275	6752	6172	5916	1092	91159	90067	8.69	0.44
DIAMICTON-SAND-GRAVEL_Q	8	4519	1139	4401	3474	6459	2985	8.39	0.24
DOLOSTONE_PU	189	29099	2424	20441	3474	111441	107967	9.93	0.88
GABBRO_CL	2	9442	5062	8737	5862	13021	7159	9.08	0.56
IRONSTONE_JS	14	5435	2514	4989	2280	12424	10144	8.52	0.42
IRONSTONE_KV	7	4071	844	3994	2877	5265	2388	8.29	0.21
LIMESTONE_CF	8	5414	1344	5250	3474	7056	3582	8.57	0.27
LIMESTONE_CI	12	6707	1283	6600	5265	9439	4174	8.79	0.19
LIMESTONE_CJ	4	7202	2029	6967	4668	8841	4173	8.85	0.31
LIMESTONE_CR	74	9134	1124	7256	2877	85791	82914	8.89	0.53
LIMESTONE_CX	95	7004	5186	6201	2877	35685	32808	8.73	0.42
LIMESTONE_JA	80	4407	1013	4296	2877	8244	5367	8.37	0.23
LIMESTONE_JB	67	4009	792	3926	1689	5862	4173	8.28	0.21
LIMESTONE_JH	1	2280		2280	2280	2280	0	7.73	
LIMESTONE_JN	44	4370	799	4296	2280	5862	3582	8.37	0.19
LIMESTONE_JS	6	7451	2577	7051	4071	10633	6562	8.86	0.37
LIMESTONE_KB	1	3474		3474	3474	3474	0	8.15	
LIMESTONE_PU	39	20972	1241	17788	7653	50003	42350	9.79	0.58
LIMESTONE_TR	7	5946	1478	5802	4071	8841	4770	8.67	0.24
LIMESTONE-MUDSTONE_CR	13	6228	1410	6083	4071	8841	4770	8.71	0.23
LIMESTONE-MUDSTONE_JB	3	3872	345	3861	3474	4071	597	8.26	0.09
LIMESTONE-MUDSTONE-	3	4270	912	4207	3474	5265	1791	8.34	0.21
LIMESTONE-SANDSTONE_JE	4	4370	771	4318	3474	5265	1791	8.37	0.18
MUDSTONE_CI	2	4370	2111	4107	2877	5862	2985	8.32	0.50
MUDSTONE_CR	2	5564	1266	5491	4668	6459	1791	8.61	0.23
MUDSTONE_JA	4	4519	299	4511	4071	4668	597	8.41	0.07
MUDSTONE_JC	16	5861	1985	5510	2280	9439	7159	8.61	0.38
MUDSTONE_JD	42	4313	1370	4082	1092	7056	5964	8.31	0.35
MUDSTONE_JE	1	7056		7056	7056	7056	0	8.86	
MUDSTONE_JH	9	7121	1988	6880	4668	10036	5368	8.84	0.28
MUDSTONE_JN	11	6132	1695	5913	3474	8841	5367	8.68	0.29
MUDSTONE_JO	9	7054	1429	6923	5265	8841	3576	8.84	0.21
MUDSTONE_JS	23	6743	2768	6132	1689	11827	10138	8.72	0.47
MUDSTONE_JT	10	4608	1392	4423	2877	6459	3582	8.39	0.30
MUDSTONE_KH	10	5265	933	5185	3474	6459	2985	8.55	0.19
MUDSTONE_KZ	1	3474		3474	3474	3474	0	8.15	
MUDSTONE_PU	40	17046	1816	12879	4071	103088	99017	9.46	0.68
MUDSTONE_Q	1	4668		4668	4668	4668	0	8.45	
MUDSTONE_TA	22	22454	8336	20204	2877	39859	36982	9.91	0.56
MUDSTONE_TC	3	13415	2409	13259	10633	14806	4173	9.49	0.19
MUDSTONE_TD	6	26141	9881	24002	9439	35685	26246	10.09	0.50
MUDSTONE_TL	192	24778	1157	22271	3474	74459	70985	10.01	0.47
MUDSTONE_TN	7	21115	1167	18847	11230	41650	30420	9.84	0.50
MUDSTONE_TR	59	7186	4173	6381	1689	30318	28629	8.76	0.48

Key	Count_Mg	Avg_Mg	SD_Mg	Gm_Mg	Min_Mg	Max_Mg	Range_Mg	LnGm_Mg	LnGSD_Mg
MUDSTONE-LIMESTONE_JA	1	2877		2877	2877	2877	0	7.96	
MUDSTONE-LIMESTONE_JB	10	3893	1126	3646	1092	5265	4173	8.20	0.44
MUDSTONE-LIMESTONE_JH	3	10832	1379	10776	10036	12424	2388	9.29	0.12
MUDSTONE-LIMESTONE_JS	8	7799	1486	7659	5265	9439	4174	8.94	0.21
MUDSTONE-LIMESTONE_KB	4	4817	299	4811	4668	5265	597	8.48	0.06
MUDSTONE-LIMESTONE_TR	49	7249	2490	6770	1092	13021	11929	8.82	0.41
MUDSTONE-LIMESTONE-	4	5562	2309	5242	3474	8841	5367	8.56	0.39
MUDSTONE-SANDSTONE_CA	241	5491	5005	4972	302	78632	78330	8.51	0.40
MUDSTONE-SANDSTONE_CB	250	6200	3004	5839	3474	37477	34003	8.67	0.31
MUDSTONE-SANDSTONE_CC	57	7902	7837	6308	2877	40456	37579	8.75	0.56
MUDSTONE-SANDSTONE_CE	1	3474		3474	3474	3474	0	8.15	
MUDSTONE-SANDSTONE_CN	97	4853	1740	4526	1689	10036	8347	8.42	0.39
MUDSTONE-SANDSTONE_CR	54	5409	1153	5257	1689	8244	6555	8.57	0.26
MUDSTONE-SANDSTONE_PU	21	9809	8341	7835	2877	33894	31017	8.97	0.63
MUDSTONE-SANDSTONE_TA	31	13692	6036	12305	4668	24950	20282	9.42	0.49
PEAT_Q	97	6581	4362	4847	302	20771	20469	8.49	0.91
SAND_Q	145	4401	5108	3129	302	44038	43736	8.05	0.79
SAND-GRAVEL_Q	681	5652	6414	4484	302	88776	88474	8.41	0.60
SAND-GRAVEL-BOULDERS_Q	1	11230		11230	11230	11230	0	9.33	
SAND-MUD_Q	5	8007	2408	7639	4071	10633	6562	8.94	0.37
SANDSTONE_CA	190	5230	1627	4985	1092	13021	11929	8.51	0.32
SANDSTONE_CB	127	5222	1517	5010	1689	9439	7750	8.52	0.29
SANDSTONE_CC	65	4861	1380	4678	2280	9439	7159	8.45	0.28
SANDSTONE_CE	14	3134	1231	2867	1092	5265	4173	7.96	0.47
SANDSTONE_CG	15	3979	2447	3114	302	9439	9137	8.04	0.85
SANDSTONE_CH	7	2851	1552	2164	302	4071	3769	7.68	0.99
SANDSTONE_CK	44	5631	2987	5067	1689	20771	19082	8.53	0.46
SANDSTONE_CX	1	5265		5265	5265	5265	0	8.57	
SANDSTONE_CY	49	3783	1465	3360	302	8841	8539	8.12	0.60
SANDSTONE_CZ	96	3941	1485	3655	1092	8244	7152	8.20	0.41
SANDSTONE_JA	2	4967	2111	4737	3474	6459	2985	8.46	0.44
SANDSTONE_JC	2	2283	840	2204	1689	2877	1188	7.70	0.38
SANDSTONE_JO	1	5862		5862	5862	5862	0	8.68	
SANDSTONE_JS	3	7452	2094	7245	5265	9439	4174	8.89	0.30
SANDSTONE_JV	29	3598	834	3494	1689	4668	2979	8.16	0.26
SANDSTONE_KA	6	5066	816	5014	4071	6459	2388	8.52	0.16
SANDSTONE_PU	37	5474	3329	4905	2877	19583	16706	8.50	0.43
SANDSTONE_TA	1	16597		16597	16597	16597	0	9.72	
SANDSTONE_TC	2	18687	2111	18627	17194	20180	2986	9.83	0.11
SANDSTONE_TL	205	4397	1858	4087	1092	13618	12526	8.32	0.37
SANDSTONE-	3	4668	597	4642	4071	5265	1194	8.44	0.13
SANDSTONE-IRONSTONE_JE	3	5661	3789	4948	3474	10036	6562	8.51	0.61
SANDSTONE-MUDSTONE_JA	2	2877	844	2814	2280	3474	1194	7.94	0.30
SANDSTONE-MUDSTONE_JB	1	2877		2877	2877	2877	0	7.96	
SANDSTONE-MUDSTONE_JC	7	4497	2114	4059	1689	8244	6555	8.31	0.51
SILTSTONE_TA	8	26739	9323	25547	17194	47018	29824	10.15	0.31
SILTSTONE_TC	10	14511	4984	13961	11230	27930	16700	9.54	0.27
SILTSTONE_TL	4	29275	9296	28248	20180	42247	22067	10.25	0.30

Table 18: Descriptive statistics for Ni (mg kg^{-1}) in soil based on RCS split into age classifications for the Humber-Trent Atlas region

Key	Count_Ni	Avg_Ni	SD_Ni	Gm_Ni	Min_Ni	Max_Ni	Range_Ni	LnGm_Ni	LnGSD_Ni
LIMESTONE-MUDSTONE_CR	13	36	17	32	14	79	65	3.47	0.46
LIMESTONE-MUDSTONE_JB	3	20	5	19	14	23	9	2.97	0.29
LIMESTONE-MUDSTONE-	3	26	8	25	17	32	15	3.21	0.33
LIMESTONE-SANDSTONE_JE	4	48	35	41	24	99	75	3.71	0.63
MUDSTONE_CI	2	46	25	42	28	64	36	3.75	0.58
MUDSTONE_CR	2	98	43	93	67	128	61	4.53	0.46
MUDSTONE_JA	4	39	3	39	36	42	6	3.66	0.09
MUDSTONE_JC	16	35	10	33	15	53	38	3.50	0.32
MUDSTONE_JD	42	29	14	26	6	63	57	3.27	0.51
MUDSTONE_JE	1	47		47	47	47	0	3.85	
MUDSTONE_JH	9	47	15	45	20	76	56	3.80	0.36
MUDSTONE_JN	11	38	13	36	20	61	41	3.58	0.36
MUDSTONE_JO	9	32	6	31	24	39	15	3.45	0.19
MUDSTONE_JS	23	46	28	39	10	136	126	3.65	0.61
MUDSTONE_JT	10	31	12	29	18	53	35	3.38	0.35
MUDSTONE_KH	10	48	19	45	23	93	70	3.80	0.38
MUDSTONE_KZ	1	36		36	36	36	0	3.58	
MUDSTONE_PU	40	31	11	29	13	59	46	3.38	0.36
MUDSTONE_Q	1	8		8	8	8	0	2.08	
MUDSTONE_TA	22	38	31	33	20	172	152	3.50	0.43
MUDSTONE_TC	3	23	2	23	21	25	4	3.12	0.09
MUDSTONE_TD	6	31	5	31	27	40	13	3.44	0.13
MUDSTONE_TL	192	35	11	33	11	71	60	3.51	0.31
MUDSTONE_TN	7	35	7	35	28	48	20	3.54	0.20
MUDSTONE_TR	59	35	14	31	6	65	59	3.45	0.51
MUDSTONE-LIMESTONE_JA	1	22		22	22	22	0	3.09	
MUDSTONE-LIMESTONE_JB	10	21	7	19	6	29	23	2.97	0.46
MUDSTONE-LIMESTONE_JH	3	49	4	49	46	54	8	3.89	0.09
MUDSTONE-LIMESTONE_JS	8	47	14	45	23	69	46	3.80	0.34
MUDSTONE-LIMESTONE_KB	4	50	19	46	23	68	45	3.83	0.48
MUDSTONE-LIMESTONE_TR	49	32	9	31	14	53	39	3.43	0.32
MUDSTONE-LIMESTONE-	4	46	29	40	23	88	65	3.68	0.58
MUDSTONE-SANDSTONE_CA	241	59	501	26	10	7804	7794	3.27	0.48
MUDSTONE-SANDSTONE_CB	250	35	43	31	16	671	655	3.43	0.36
MUDSTONE-SANDSTONE_CC	57	28	7	27	18	45	27	3.30	0.23
MUDSTONE-SANDSTONE_CE	1	20		20	20	20	0	3.00	
MUDSTONE-SANDSTONE_CN	97	26	10	24	8	63	55	3.18	0.39
MUDSTONE-SANDSTONE_CR	54	35	19	31	16	110	94	3.44	0.45
MUDSTONE-SANDSTONE_PU	21	28	17	24	9	92	83	3.20	0.49
MUDSTONE-SANDSTONE_TA	31	24	7	24	14	39	25	3.16	0.28
PEAT_Q	97	24	14	20	3	60	57	2.98	0.73
SAND_Q	145	17	11	14	2	59	57	2.67	0.62
SAND-GRAVEL_Q	681	22	12	19	3	78	75	2.97	0.52
SAND-GRAVEL-BOULDERS_Q	1	24		24	24	24	0	3.18	
SAND-MUD_Q	5	20	9	18	13	35	22	2.91	0.38
SANDSTONE_CA	190	27	13	25	6	114	108	3.21	0.38
SANDSTONE_CB	127	28	12	27	13	83	70	3.28	0.34
SANDSTONE_CC	65	27	8	26	15	56	41	3.24	0.27
SANDSTONE_CE	14	21	8	20	8	39	31	2.98	0.43
SANDSTONE_CG	15	25	16	20	4	62	58	3.00	0.72
SANDSTONE_CH	7	16	7	14	5	24	19	2.65	0.58
SANDSTONE_CK	44	26	9	24	9	48	39	3.19	0.37
SANDSTONE_CX	1	26		26	26	26	0	3.26	

Key	Count_Ni	Avg_Ni	SD_Ni	Gm_Ni	Min_Ni	Max_Ni	Range_Ni	LnGm_Ni	LnGSD_Ni
SANDSTONE_CY	49	21	8	19	4	46	42	2.95	0.50
SANDSTONE_CZ	96	20	8	19	4	64	60	2.93	0.41
SANDSTONE_JA	2	38	16	36	26	49	23	3.57	0.45
SANDSTONE_JC	2	23	11	22	15	31	16	3.07	0.51
SANDSTONE_JO	1	25		25	25	25	0	3.22	
SANDSTONE_JS	3	35	15	33	22	52	30	3.49	0.43
SANDSTONE_JV	29	22	15	20	10	90	80	2.98	0.46
SANDSTONE_KA	6	55	23	50	22	76	54	3.91	0.50
SANDSTONE_PU	37	17	5	16	10	35	25	2.76	0.30
SANDSTONE_TA	1	19		19	19	19	0	2.94	
SANDSTONE_TC	2	26	5	25	22	29	7	3.23	0.20
SANDSTONE_TL	205	15	5	14	7	44	37	2.65	0.31
SANDSTONE-	3	25	9	24	17	34	17	3.18	0.35
SANDSTONE-IRONSTONE_JE	3	90	43	84	64	140	76	4.43	0.44
SANDSTONE-MUDSTONE_JA	2	16	1	16	15	17	2	2.77	0.09
SANDSTONE-MUDSTONE_JB	1	20		20	20	20	0	3.00	
SANDSTONE-MUDSTONE_JC	7	28	13	25	9	43	34	3.20	0.60
SILTSTONE_TA	8	36	10	35	25	56	31	3.55	0.25
SILTSTONE_TC	10	23	3	23	20	30	10	3.13	0.13
SILTSTONE_TL	4	37	9	36	26	47	21	3.57	0.25
BASALT_CX	1	94		94	94	94	0	4.54	
BRECCIA_CX	1	47		47	47	47	0	3.85	
CHALK_KA	2	35	11	34	27	43	16	3.53	0.33
CHALK_KE	206	29	13	27	12	118	106	3.31	0.35
CHALK_KS	10	30	4	30	24	36	12	3.40	0.14
CHALK_KT	130	30	7	29	15	72	57	3.37	0.23
CLAY-SILT_Q	794	32	12	30	6	104	98	3.39	0.38
CLAY-SILT-SAND-GRAVEL_Q	581	34	15	32	5	201	196	3.45	0.44
CLAYSTONE_JO	9	24	12	21	8	43	35	3.06	0.55
DIAMICTON_Q	1275	30	10	28	5	128	123	3.34	0.33
DIAMICTON-SAND-GRAVEL_Q	8	15	3	14	10	18	8	2.66	0.21
DOLOSTONE_PU	189	26	9	25	4	88	84	3.20	0.36
GABBRO_CL	2	64	25	61	46	81	35	4.11	0.40
IRONSTONE_JS	14	61	39	49	9	145	136	3.90	0.71
IRONSTONE_KV	7	31	8	30	22	43	21	3.41	0.24
LIMESTONE_CF	8	45	20	42	24	89	65	3.74	0.41
LIMESTONE_CI	12	39	13	37	21	67	46	3.61	0.33
LIMESTONE_CJ	4	37	7	36	28	46	18	3.59	0.20
LIMESTONE_CR	74	48	24	44	18	132	114	3.78	0.44
LIMESTONE_CX	95	60	43	51	19	301	282	3.93	0.54
LIMESTONE_JA	80	31	14	29	9	90	81	3.37	0.36
LIMESTONE_JB	67	29	13	27	10	95	85	3.30	0.34
LIMESTONE_JH	1	99		99	99	99	0	4.60	
LIMESTONE_JN	44	39	14	36	20	81	61	3.60	0.33
LIMESTONE_JS	6	50	4	49	44	55	11	3.90	0.08
LIMESTONE_KB	1	18		18	18	18	0	2.89	
LIMESTONE_PU	39	28	5	28	17	40	23	3.32	0.18
LIMESTONE_TR	7	33	10	32	18	46	28	3.46	0.34

Table 19: Descriptive statistics for P (mg kg^{-1}) in soil based on RCS split into age classifications for the Humber-Trent Atlas region

Key	Count_P	Avg_P	SD_P	Gm_P	Min_P	Max_P	Range_P	LnGm_P	LnGSD_P
BASALT_CX	1	1204		1204	1204	1204	0	7.09	
BRECCIA_CX	1	1431		1431	1431	1431	0	7.27	
CHALK_KA	2	1613	954	1465	938	2287	1349	7.29	0.63
CHALK_KE	206	1410	689	1263	353	4984	4631	7.14	0.48
CHALK_KS	10	1004	343	957	620	1702	1082	6.86	0.32
CHALK_KT	130	1259	411	1196	397	2872	2475	7.09	0.32
CLAY-SILT_Q	794	848	489	749	109	4264	4155	6.62	0.49
CLAY-SILT-SAND-GRAVEL_Q	581	1029	652	893	109	4717	4608	6.79	0.51
CLAYSTONE_JO	9	656	299	598	305	1252	947	6.39	0.46
DIAMICTON_Q	1275	837	546	714	109	4848	4739	6.57	0.56
DIAMICTON-SAND-GRAVEL_Q	8	1596	658	1489	982	2828	1846	7.31	0.39
DOLOSTONE_PU	189	1066	623	920	109	3997	3888	6.82	0.55
GABBRO_CL	2	1139	475	1088	803	1475	672	6.99	0.43
IRONSTONE_JS	14	1990	1545	1469	218	5075	4857	7.29	0.86
IRONSTONE_KV	7	1707	1011	1499	620	3814	3194	7.31	0.54
LIMESTONE_CF	8	1094	612	985	620	2466	1846	6.89	0.46
LIMESTONE_CI	12	963	514	847	441	1881	1440	6.74	0.53
LIMESTONE_CJ	4	982	992	680	262	2422	2160	6.52	0.98
LIMESTONE_CR	74	1110	707	954	109	4355	4246	6.86	0.55
LIMESTONE_CX	95	1260	722	1110	532	4085	3553	7.01	0.48
LIMESTONE_JA	80	1666	779	1490	532	3997	3465	7.31	0.48
LIMESTONE_JB	67	1851	701	1734	620	4264	3644	7.46	0.37
LIMESTONE_JH	1	6694		6694	6694	6694	0	8.81	
LIMESTONE_JN	44	1725	774	1526	109	3679	3570	7.33	0.57
LIMESTONE_JS	6	1642	761	1469	576	2736	2160	7.29	0.55
LIMESTONE_KB	1	3814		3814	3814	3814	0	8.25	
LIMESTONE_PU	39	1302	824	1149	441	5568	5127	7.05	0.49
LIMESTONE_TR	7	769	336	708	353	1252	899	6.56	0.44
LIMESTONE-MUDSTONE_CR	13	524	224	482	262	982	720	6.18	0.43
LIMESTONE-MUDSTONE_JB	3	1193	551	1111	711	1794	1083	7.01	0.46
LIMESTONE-MUDSTONE-	3	621	360	542	262	982	720	6.30	0.67
LIMESTONE-SANDSTONE_JE	4	1416	994	891	109	2509	2400	6.79	1.42
MUDSTONE_CI	2	1004	605	908	576	1431	855	6.81	0.64
MUDSTONE_CR	2	1927	1719	1495	711	3142	2431	7.31	1.05
MUDSTONE_JA	4	1961	842	1846	1388	3186	1798	7.52	0.38
MUDSTONE_JC	16	884	521	756	353	2287	1934	6.63	0.58
MUDSTONE_JD	42	1319	932	1086	397	4355	3958	6.99	0.61
MUDSTONE_JE	1	711		711	711	711	0	6.57	
MUDSTONE_JH	9	1302	846	1089	489	2693	2204	6.99	0.63
MUDSTONE_JN	11	1308	942	1076	441	3679	3238	6.98	0.64
MUDSTONE_JO	9	697	279	640	262	1074	812	6.46	0.46
MUDSTONE_JS	23	1255	985	977	305	4582	4277	6.88	0.72
MUDSTONE_JT	10	1351	659	1234	620	2963	2343	7.12	0.44
MUDSTONE_KH	10	1850	1429	1481	532	5346	4814	7.30	0.69
MUDSTONE_KZ	1	2601		2601	2601	2601	0	7.86	
MUDSTONE_PU	40	897	722	718	218	3592	3374	6.58	0.64
MUDSTONE_Q	1	397		397	397	397	0	5.98	
MUDSTONE_TA	22	716	422	634	353	1973	1620	6.45	0.47
MUDSTONE_TC	3	756	162	744	576	890	314	6.61	0.23
MUDSTONE_TD	6	666	137	653	441	803	362	6.48	0.23
MUDSTONE_TL	192	760	413	691	218	3321	3103	6.54	0.41
MUDSTONE_TN	7	734	347	611	109	1252	1143	6.42	0.80
MUDSTONE_TR	59	1255	911	1020	305	4669	4364	6.93	0.64
MUDSTONE-LIMESTONE_JA	1	2872		2872	2872	2872	0	7.96	

Key	Count_P	Avg_P	SD_P	Gm_P	Min_P	Max_P	Range_P	LnGm_P	LnGSD_P
MUDSTONE-LIMESTONE_JB	10	1414	795	1185	397	2466	2069	7.08	0.66
MUDSTONE-LIMESTONE_JH	3	831	324	793	620	1204	584	6.68	0.36
MUDSTONE-LIMESTONE_JS	8	965	403	892	489	1523	1034	6.79	0.42
MUDSTONE-LIMESTONE_KB	4	2175	1187	1880	755	3548	2793	7.54	0.67
MUDSTONE-LIMESTONE_TR	49	985	886	788	262	5795	5533	6.67	0.62
MUDSTONE-LIMESTONE-	4	1150	351	1110	755	1610	855	7.01	0.31
MUDSTONE-SANDSTONE_CA	241	743	515	627	109	3997	3888	6.44	0.56
MUDSTONE-SANDSTONE_CB	250	936	605	810	109	5525	5416	6.70	0.52
MUDSTONE-SANDSTONE_CC	57	911	422	821	262	2422	2160	6.71	0.47
MUDSTONE-SANDSTONE_CE	1	353		353	353	353	0	5.87	
MUDSTONE-SANDSTONE_CN	97	782	546	640	109	3413	3304	6.46	0.65
MUDSTONE-SANDSTONE_CR	54	1273	807	1092	397	4447	4050	7.00	0.54
MUDSTONE-SANDSTONE_PU	21	992	420	897	353	1702	1349	6.80	0.49
MUDSTONE-SANDSTONE_TA	31	828	420	745	397	2016	1619	6.61	0.45
PEAT_Q	97	1098	761	876	218	3997	3779	6.78	0.69
SAND_Q	145	1476	1066	1145	109	5568	5459	7.04	0.75
SAND-GRAVEL_Q	681	1460	925	1189	109	5433	5324	7.08	0.68
SAND-GRAVEL-BOULDERS_Q	1	847		847	847	847	0	6.74	
SAND-MUD_Q	5	1225	1276	909	532	3500	2968	6.81	0.77
SANDSTONE_CA	190	967	537	828	109	2736	2627	6.72	0.58
SANDSTONE_CB	127	1054	747	863	109	5346	5237	6.76	0.63
SANDSTONE_CC	65	1145	509	1044	397	2645	2248	6.95	0.43
SANDSTONE_CE	14	715	699	535	262	2828	2566	6.28	0.72
SANDSTONE_CG	15	528	265	459	109	1026	917	6.13	0.59
SANDSTONE_CH	7	577	336	480	218	982	764	6.17	0.69
SANDSTONE_CK	44	869	613	710	109	3321	3212	6.57	0.64
SANDSTONE_CX	1	353		353	353	353	0	5.87	
SANDSTONE_CY	49	1285	1070	984	262	6201	5939	6.89	0.74
SANDSTONE_CZ	96	913	511	771	109	2915	2806	6.65	0.63
SANDSTONE_JA	2	1816	605	1764	1388	2243	855	7.48	0.34
SANDSTONE_JC	2	1927	639	1873	1475	2378	903	7.54	0.34
SANDSTONE_JO	1	1610		1610	1610	1610	0	7.38	
SANDSTONE_JS	3	621	341	557	305	982	677	6.32	0.59
SANDSTONE_JV	29	2734	1657	2103	109	6472	6363	7.65	0.87
SANDSTONE_KA	6	2527	1440	2257	1204	5254	4050	7.72	0.50
SANDSTONE_PU	37	1491	717	1311	353	3413	3060	7.18	0.54
SANDSTONE_TA	1	397		397	397	397	0	5.98	
SANDSTONE_TC	2	915	158	908	803	1026	223	6.81	0.17
SANDSTONE_TL	205	1716	976	1477	305	5974	5669	7.30	0.56
SANDSTONE-CONGLOMERATE_TL	3	1626	1124	1402	847	2915	2068	7.25	0.65
SANDSTONE-IRONSTONE_JE	3	2662	2005	2047	711	4717	4006	7.62	0.97
SANDSTONE-MUDSTONE_JA	2	1635	1176	1407	803	2466	1663	7.25	0.79
SANDSTONE-MUDSTONE_JB	1	982		982	982	982	0	6.89	
SANDSTONE-MUDSTONE_JC	7	1123	619	989	532	2151	1619	6.90	0.54
SILTSTONE_TA	8	684	267	645	441	1252	811	6.47	0.35
SILTSTONE_TC	10	1036	385	977	489	1925	1436	6.88	0.36
SILTSTONE_TL	4	576	110	568	441	711	270	6.34	0.20

Table 20: Descriptive statistics for Zn (mg kg^{-1}) in soil based on RCS split into age classifications for the Humber-Trent Atlas region

Key	Count_ Zn	Avg_Zn	SD_Zn	Gm_Zn	Min_ Zn	Max_ Zn	Range_ Zn	LnGm _Zn	LnGSD_ Zn
BASALT_CX	1	184		184	184	184	0	5.21	
BRECCIA_CX	1	336		336	336	336	0	5.82	
CHALK_KA	2	90	35	86	65	115	50	4.46	0.40
CHALK_KE	206	74	20	71	31	144	113	4.26	0.27
CHALK_KS	10	76	15	74	51	96	45	4.31	0.22
CHALK_KT	130	82	19	80	29	167	138	4.38	0.23
CLAY-SILT_Q	794	78	56	71	17	1229	1212	4.26	0.38
CLAY-SILT-SAND-GRAVEL_Q	581	120	126	97	6	1401	1395	4.58	0.58
CLAYSTONE_JO	9	61	22	57	26	85	59	4.05	0.42
DIAMICTON_Q	1275	80	45	74	20	818	798	4.31	0.34
DIAMICTON-SAND-GRAVEL_Q	8	70	21	67	38	105	67	4.21	0.32
DOLOSTONE_PU	189	181	192	138	30	1908	1878	4.93	0.67
GABBRO_CL	2	304	236	254	137	471	334	5.54	0.87
IRONSTONE_JS	14	129	78	104	16	308	292	4.64	0.76
IRONSTONE_KV	7	82	22	79	49	119	70	4.37	0.28
LIMESTONE_CF	8	193	99	173	99	348	249	5.15	0.50
LIMESTONE_CI	12	194	97	171	78	362	284	5.14	0.54
LIMESTONE_CJ	4	224	228	165	94	566	472	5.11	0.83
LIMESTONE_CR	74	170	130	137	58	644	586	4.92	0.62
LIMESTONE_CX	95	443	904	262	79	6647	6568	5.57	0.80
LIMESTONE_JA	80	79	29	74	31	205	174	4.30	0.36
LIMESTONE_JB	67	79	22	76	30	141	111	4.33	0.28
LIMESTONE_JH	1	275		275	275	275	0	5.62	
LIMESTONE_JN	44	97	41	90	36	261	225	4.49	0.39
LIMESTONE_JS	6	94	15	93	77	115	38	4.54	0.16
LIMESTONE_KB	1	75		75	75	75	0	4.32	
LIMESTONE_PU	39	139	77	125	51	401	350	4.83	0.45
LIMESTONE_TR	7	75	37	68	38	147	109	4.22	0.48
LIMESTONE-MUDSTONE_CR	13	160	116	126	40	430	390	4.83	0.73
LIMESTONE-MUDSTONE_JB	3	59	29	55	35	92	57	4.00	0.49
LIMESTONE-MUDSTONE-	3	66	37	59	33	106	73	4.07	0.58
LIMESTONE-SANDSTONE_JE	4	129	101	108	76	281	205	4.68	0.64
MUDSTONE_CI	2	117	9	116	110	123	13	4.76	0.08
MUDSTONE_CR	2	258	149	235	152	363	211	5.46	0.62
MUDSTONE_JA	4	114	17	113	96	135	39	4.72	0.15
MUDSTONE_JC	16	88	22	85	36	118	82	4.45	0.30
MUDSTONE_JD	42	62	25	57	16	115	99	4.04	0.44
MUDSTONE_JE	1	98		98	98	98	0	4.58	
MUDSTONE_JH	9	93	36	86	37	153	116	4.46	0.42
MUDSTONE_JN	11	79	19	77	45	104	59	4.35	0.25
MUDSTONE_JO	9	81	9	80	67	93	26	4.38	0.12
MUDSTONE_JS	23	102	60	88	28	293	265	4.48	0.56
MUDSTONE_JT	10	88	26	85	49	124	75	4.44	0.30
MUDSTONE_KH	10	100	32	95	49	168	119	4.56	0.33
MUDSTONE_KZ	1	95		95	95	95	0	4.55	
MUDSTONE_PU	40	124	67	109	56	306	250	4.69	0.49
MUDSTONE_Q	1	15		15	15	15	0	2.71	
MUDSTONE_TA	22	105	136	84	57	710	653	4.43	0.51
MUDSTONE_TC	3	65	9	65	59	75	16	4.17	0.13
MUDSTONE_TD	6	72	9	72	62	86	24	4.27	0.13
MUDSTONE_TL	192	71	15	69	19	133	114	4.24	0.23
MUDSTONE_TN	7	71	17	69	37	81	44	4.23	0.30
MUDSTONE_TR	59	82	29	76	19	146	127	4.34	0.42

Key	Count_ Zn	Avg_Zn	SD_Zn	Gm_Zn	Min_ Zn	Max_ Zn	Range_ Zn	LnGm _Zn	LnGSD_ Zn
MUDSTONE-LIMESTONE_JA	1	78		78	78	78	0	4.36	
MUDSTONE-LIMESTONE_JB	10	66	25	60	24	99	75	4.10	0.47
MUDSTONE-LIMESTONE_JH	3	89	13	89	82	104	22	4.49	0.14
MUDSTONE-LIMESTONE_JS	8	91	12	91	79	117	38	4.51	0.13
MUDSTONE-LIMESTONE_KB	4	103	43	97	62	155	93	4.57	0.43
MUDSTONE-LIMESTONE_TR	49	75	28	70	26	162	136	4.25	0.37
MUDSTONE-LIMESTONE-	4	81	22	79	62	113	51	4.37	0.26
MUDSTONE-SANDSTONE_CA	241	89	50	81	18	648	630	4.39	0.40
MUDSTONE-SANDSTONE_CB	250	121	146	102	36	1879	1843	4.63	0.45
MUDSTONE-SANDSTONE_CC	57	108	54	99	55	360	305	4.60	0.38
MUDSTONE-SANDSTONE_CE	1	56		56	56	56	0	4.03	
MUDSTONE-SANDSTONE_CN	97	75	41	66	19	279	260	4.19	0.51
MUDSTONE-SANDSTONE_CR	54	389	1009	161	52	5655	5603	5.08	0.99
MUDSTONE-SANDSTONE_PU	21	189	307	110	46	1396	1350	4.70	0.89
MUDSTONE-SANDSTONE_TA	31	79	34	74	40	214	174	4.31	0.34
PEAT_Q	97	86	130	59	8	984	976	4.08	0.81
SAND_Q	145	63	45	49	7	275	268	3.89	0.74
SAND-GRAVEL_Q	681	78	54	66	8	533	525	4.19	0.57
SAND-GRAVEL-BOULDERS_Q	1	59		59	59	59	0	4.08	
SAND-MUD_Q	5	54	29	48	27	88	61	3.87	0.54
SANDSTONE_CA	190	97	84	84	8	945	937	4.42	0.50
SANDSTONE_CB	127	121	210	94	38	2313	2275	4.55	0.52
SANDSTONE_CC	65	93	59	85	39	516	477	4.44	0.37
SANDSTONE_CE	14	59	21	54	21	85	64	4.00	0.46
SANDSTONE_CG	15	61	40	51	15	181	166	3.92	0.64
SANDSTONE_CH	7	42	14	38	12	54	42	3.64	0.52
SANDSTONE_CK	44	71	28	65	16	140	124	4.17	0.46
SANDSTONE_CX	1	61		61	61	61	0	4.11	
SANDSTONE_CY	49	88	61	72	7	394	387	4.28	0.68
SANDSTONE_CZ	96	74	46	62	6	304	298	4.12	0.63
SANDSTONE_JA	2	106	28	104	86	126	40	4.65	0.27
SANDSTONE_JC	2	59	3	59	57	61	4	4.08	0.05
SANDSTONE_JO	1	74		74	74	74	0	4.30	
SANDSTONE_JS	3	62	6	61	55	66	11	4.12	0.10
SANDSTONE_JV	29	58	24	54	26	145	119	3.99	0.38
SANDSTONE_KA	6	99	28	95	54	126	72	4.55	0.33
SANDSTONE_PU	37	90	57	80	34	377	343	4.39	0.44
SANDSTONE_TA	1	50		50	50	50	0	3.91	
SANDSTONE_TC	2	129	96	110	61	197	136	4.70	0.83
SANDSTONE_TL	205	86	80	73	25	890	865	4.30	0.48
SANDSTONE-	3	130	38	126	98	172	74	4.84	0.28
SANDSTONE-IRONSTONE_JE	3	187	90	174	121	289	168	5.16	0.45
SANDSTONE-MUDSTONE_JA	2	67	38	61	40	94	54	4.12	0.60
SANDSTONE-MUDSTONE_JB	1	57		57	57	57	0	4.04	
SANDSTONE-MUDSTONE_JC	7	75	33	70	35	137	102	4.25	0.43
SILTSTONE_TA	8	104	81	89	60	302	242	4.48	0.53
SILTSTONE_TC	10	77	10	77	61	94	33	4.34	0.13
SILTSTONE_TL	4	68	8	67	56	74	18	4.21	0.13

Appendix 3 : Description of Rock Classification Scheme geological age abbreviations.

RCS Age Code	Description
C	**CARBONIFEROUS**
CA	LANGSETTIAN
CB	DUCKMANTIAN
CC	BOLSOVIAN
CE	PENDLEIAN
CF	COURCEYAN
CG	ARNSBERGIAN
CH	CHOKIERIAN
CI	CHADIAN
CJ	ARUNDIAN
CK	KINDERSCOUTIAN
CL	DINANTIAN
CN	NAMURIAN
CR	ASBIAN
CX	BRIGANTIAN
CY	YEADONIAN
CZ	MARSDENIAN
J	**JURASSIC**
JA	AALENIAN
JB	BAJOCIAN
JC	CALLOVIAN
JD	KIMMERIDGIAN
JE	PLIENSBACHIAN
JH	HETTANGIAN
JN	BATHONIAN
JO	OXFORDIAN
JS	SINEMURIAN
JT	TOARCIAN
JV	VOLGIAN
K	**CRETACEOUS**
KA	ALBIAN
KE	CENOMANIAN
KH	HAUTERIVIAN
KS	SANTONIAN
KT	TURONIAN
KV	VALANGINIAN
KZ	RYAZANIAN
P	**PERMIAN**
PU	UPPER PERMIAN
Q	**QUATERNARY**
T	**TRIASSIC**
TA	ANISIAN
TC	CARNIAN
TD	LADINIAN
TL	SCYTHIAN
TN	NORIAN
TR	RHAETIAN

Appendix 4 : Instructions for using version 2 of the statistics generating macro.

Descriptive statistics and percentile classification of G-BASE data

For the Potentially Harmful Elements national map task of the Geochemical and Mining Hazards Project (E2042S97, Task 01) Andy Bevan has created a MS ACCESS macro to classify and statistically analyse G-BASE analytical data on the basis of a provided code. This code can be added to the data through a polygon join with X/Y data points in ArcGIS, e.g. for underlying geology or land use. The macro has been modified for G-BASE use and now also contains a routine to give a percentile classification of the classified data.

This note is a step by step account on how to use the macro. Its great advantage is that it can rapidly produce in one click summary statistics and percentile classification for a matrix of elements. Disadvantages are that the macro will fall over on zero or null data and the percentile classification is meaningless when the data class only contains a small number of samples.

Macro Name:	***Filename***	***Date***	***Time***	***Size(bytes)***
	GBASE Stats V2.mdb	24/02/2006	09:25:32	3260416

Location: w:\cbh\gbase\code\ACCESSmacros\

Requirements:

- MS ACCESS 2000
- Data file that can be imported as a table into MS ACCESS (e.g. MS Excel format)

The data file should contain:

- One or more elements for which you want summary statistics and percentile classification
- A field on which to subset the data (for G-BASE data this would often be the Atlas code)
- A field containing the codes by which you wish to classify your data (e.g. Lex rock code, land use code, sampler id etc.)

The analytical results should not contain:

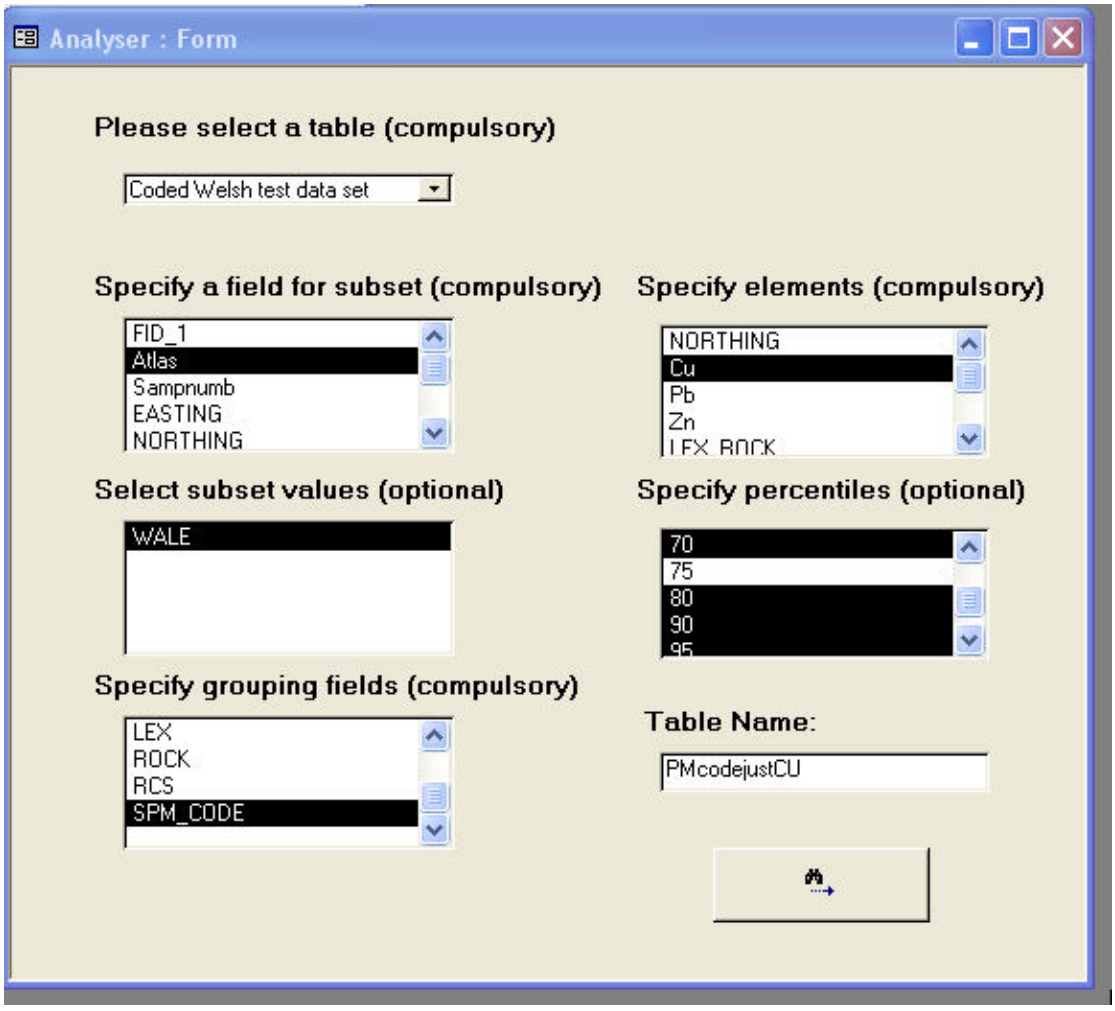
- null or zero values

- non-numeric characters
- a field name of As (AS is a reserved word in Basic programs)

The data file should be vetted carefully before being imported as an ACCESS table. If zeros exist in the data representing below detection results than a numeric substitute value should be inserted. If a null or zero represents not determined then these data records should be removed before processing. If a matrix of elements are being processed it is best to process records containing nulls/zeros individually – data can be selected from the original data table with an ACCESS query selecting only values >0 and the macro can use the query as the data input table.

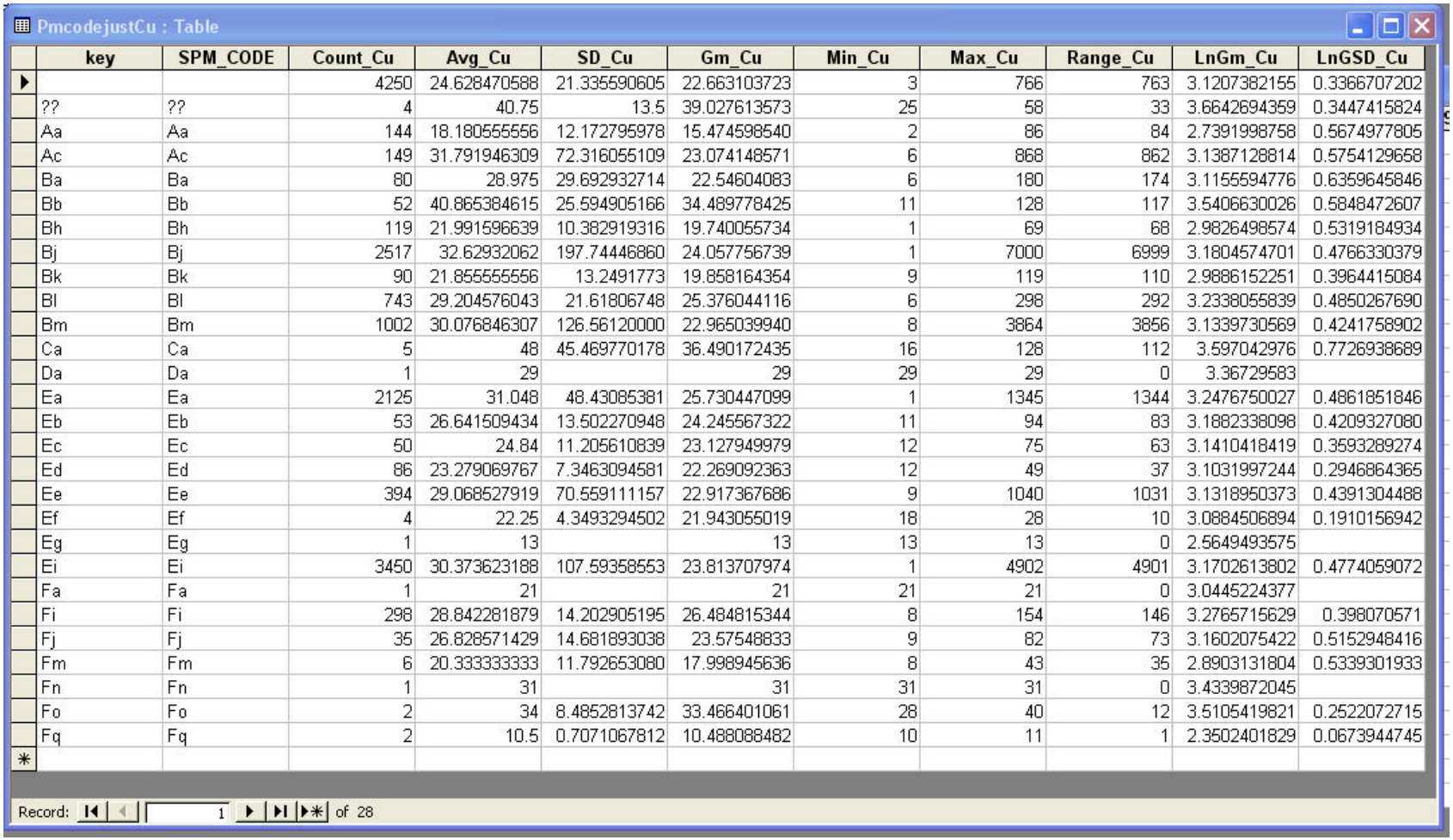
Running the Macro:

1. Make a copy of the macro stored at the location given above, i.e. don't use the original database – if everybody uses this it will soon fill up with data tables. Place your copy of the ACCESS database containing the macro in your workspace.
2. Open the database and open the "Analyser" form to get a dialogue screen as shown below:



3. Complete the dialogue box as instructed:
    i. Click on the fields presented in the menu lists to select
    ii. You can specify one or more element for processing
    iii. Select each percentile class you want calculated (not specifying any percentiles will result in the macro just doing the statistics)
    iv. Name the Table appropriately – you may create quite a number of tables and the name should reflected your selection and coding criteria

4. Click on the button at the bottom and the macro will start calculating producing summary statistic and percentile tables as shown in the following figures.

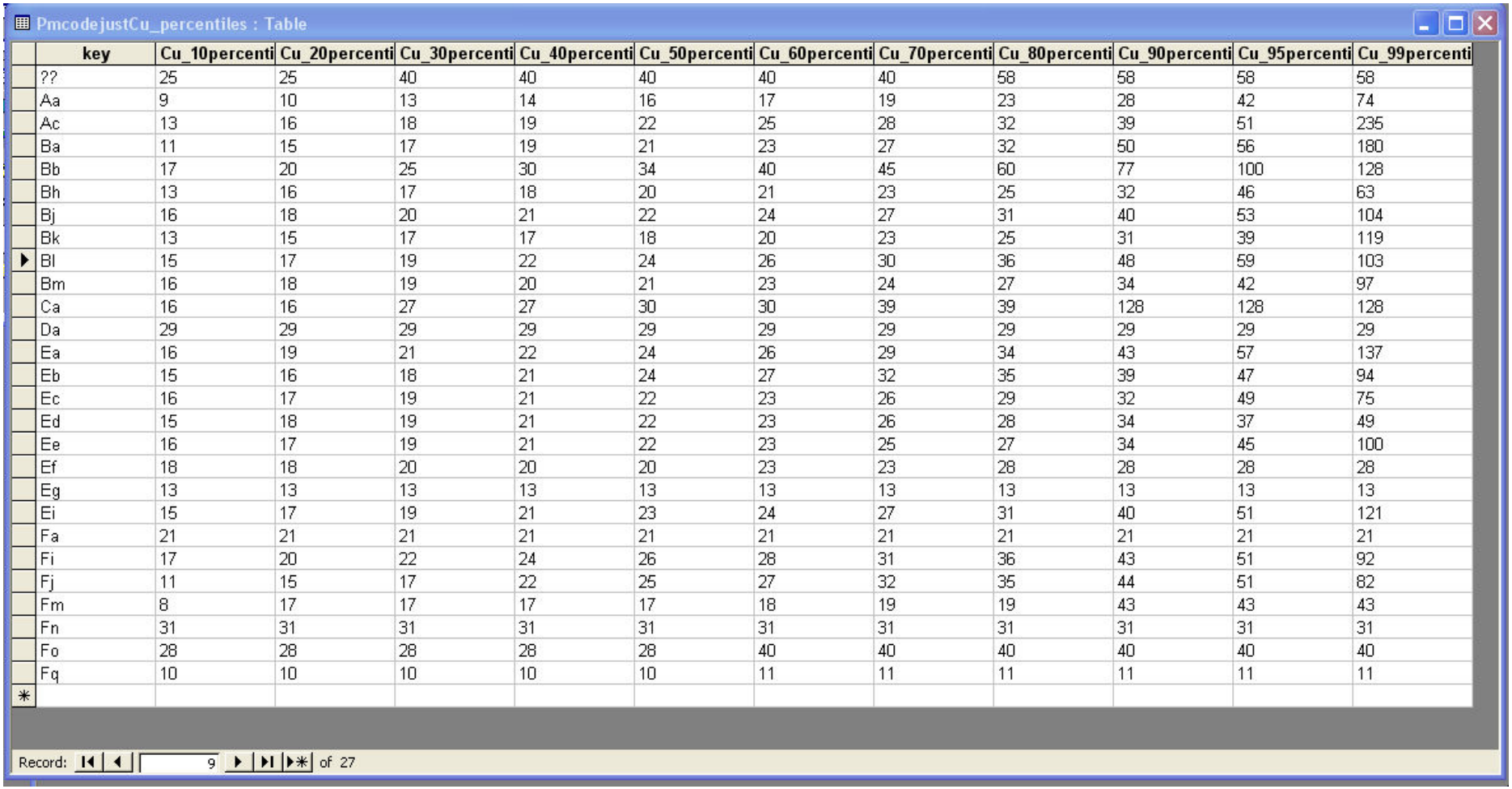


PmcodejustCu : Table

key	SPM_CODE	Count_Cu	Avg_Cu	SD_Cu	Gm_Cu	Min_Cu	Max_Cu	Range_Cu	LnGm_Cu	LnGSD_Cu
		4250	24.628470588	21.335590605	22.663103723	3	766	763	3.1207382155	0.3366707202
??	??	4	40.75	13.5	39.027613573	25	58	33	3.6642694359	0.3447415824
Aa	Aa	144	18.180555556	12.172795978	15.474598540	2	86	84	2.7391998758	0.5674977805
Ac	Ac	149	31.791946309	72.316055109	23.074148571	6	868	862	3.1387128814	0.5754129658
Ba	Ba	80	28.975	29.692932714	22.54604083	6	180	174	3.1155594776	0.6359645846
Bb	Bb	52	40.865384615	25.594905166	34.489778425	11	128	117	3.5406630026	0.5848472607
Bh	Bh	119	21.991596639	10.382919316	19.740055734	1	69	68	2.9826498574	0.5319184934
Bj	Bj	2517	32.62932062	197.74446860	24.057756739	1	7000	6999	3.1804574701	0.4766330379
Bk	Bk	90	21.855555556	13.2491773	19.858164354	9	119	110	2.9886152251	0.3964415084
Bl	Bl	743	29.204576043	21.61806748	25.376044116	6	298	292	3.2338055839	0.4850267690
Bm	Bm	1002	30.076846307	126.56120000	22.965039940	8	3864	3856	3.1339730569	0.4241758902
Ca	Ca	5	48	45.469770178	36.490172435	16	128	112	3.597042976	0.7726938689
Da	Da	1	29		29	29	29	0	3.36729583	
Ea	Ea	2125	31.048	48.43085381	25.730447099	1	1345	1344	3.2476750027	0.4861851846
Eb	Eb	53	26.641509434	13.502270948	24.245567322	11	94	83	3.1882338098	0.4209327080
Ec	Ec	50	24.84	11.205610839	23.127949979	12	75	63	3.1410418419	0.3593289274
Ed	Ed	86	23.279069767	7.3463094581	22.269092363	12	49	37	3.1031997244	0.2946864365
Ee	Ee	394	29.068527919	70.559111157	22.917367686	9	1040	1031	3.1318950373	0.4391304488
Ef	Ef	4	22.25	4.3493294502	21.943055019	18	28	10	3.0884506894	0.1910156942
Eg	Eg	1	13		13	13	13	0	2.5649493575	
Ei	Ei	3450	30.373623188	107.59358553	23.813707974	1	4902	4901	3.1702613802	0.4774059072
Fa	Fa	1	21		21	21	21	0	3.0445224377	
Fi	Fi	298	28.842281879	14.202905195	26.484815344	8	154	146	3.2765715629	0.398070571
Fj	Fj	35	26.828571429	14.681893038	23.57548833	9	82	73	3.1602075422	0.5152948416
Fm	Fm	6	20.333333333	11.792653080	17.998945636	8	43	35	2.8903131804	0.5339301933
Fn	Fn	1	31		31	31	31	0	3.4339872045	
Fo	Fo	2	34	8.4852813742	33.466401061	28	40	12	3.5105419821	0.2522072715
Fq	Fq	2	10.5	0.7071067812	10.488088482	10	11	1	2.3502401829	0.0673944745

Record: 1 of 28

Example of the summary statistics table produced for copper (in mg kg^{-1}) classified on the soil parent material code for sediment samples from the Welsh atlas area



PmcodejustCu_percentiles : Table

key	Cu_10percenti	Cu_20percenti	Cu_30percenti	Cu_40percenti	Cu_50percenti	Cu_60percenti	Cu_70percenti	Cu_80percenti	Cu_90percenti	Cu_95percenti	Cu_99percenti
??	25	25	40	40	40	40	40	58	58	58	58
Aa	9	10	13	14	16	17	19	23	28	42	74
Ac	13	16	18	19	22	25	28	32	39	51	235
Ba	11	15	17	19	21	23	27	32	50	56	180
Bb	17	20	25	30	34	40	45	60	77	100	128
Bh	13	16	17	18	20	21	23	25	32	46	63
Bj	16	18	20	21	22	24	27	31	40	53	104
Bk	13	15	17	17	18	20	23	25	31	39	119
Bl	15	17	19	22	24	26	30	36	48	59	103
Bm	16	18	19	20	21	23	24	27	34	42	97
Ca	16	16	27	27	30	30	39	39	128	128	128
Da	29	29	29	29	29	29	29	29	29	29	29
Ea	16	19	21	22	24	26	29	34	43	57	137
Eb	15	16	18	21	24	27	32	35	39	47	94
Ec	16	17	19	21	22	23	26	29	32	49	75
Ed	15	18	19	21	22	23	26	28	34	37	49
Ee	16	17	19	21	22	23	25	27	34	45	100
Ef	18	18	20	20	20	23	23	28	28	28	28
Eg	13	13	13	13	13	13	13	13	13	13	13
Ei	15	17	19	21	23	24	27	31	40	51	121
Fa	21	21	21	21	21	21	21	21	21	21	21
Fi	17	20	22	24	26	28	31	36	43	51	92
Fj	11	15	17	22	25	27	32	35	44	51	82
Fm	8	17	17	17	17	18	19	19	43	43	43
Fn	31	31	31	31	31	31	31	31	31	31	31
Fo	28	28	28	28	28	40	40	40	40	40	40
Fq	10	10	10	10	10	11	11	11	11	11	11

Record: 9 of 27

Example of the percentile classification table produced for copper (in mg kg^{-1}) grouped on the soil parent material code for sediment samples from the Welsh atlas area

References

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.

BGS 2006. *Regional Geochemistry of Humber-Trent: Stream water, stream sediment and soil.* (Keyworth, Nottingham: British Geological Survey). ISBN 0852 72534 - 5

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