Geo*PT*52 — AN INTERNATIONAL PROFICIENCY TEST FOR ANALYTICAL GEOCHEMISTRY LABORATORIES — REPORT ON ROUND 52

(Metalliferous Shale, EMS-1) / January 2023

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Abstract

Results are presented for Round 52 of the Geo*PT* Proficiency Testing programme for analytical geochemistry laboratories organised by the International Association of Geoanalysts (IAG). The test material distributed in this round was the Metalliferous Shale, EMS-1, provided by Dr Vind of the Geological Survey of Estonia. In this report, the data contributed by 87 laboratories are listed, together with an assessment of consensus values, consequent *z*-scores and a series of charts to show for each analyte the distribution of contributed results and the overall performance of participating laboratories.

Introduction

This fifty-second round of Geo*PT*, the international proficiency testing programme for geoanalytical laboratories, was conducted in a similar manner to earlier rounds (reports listed in Appendix 1). The programme is designed to be a key part of the routine quality assurance procedures employed by an analytical geochemistry laboratory. It is organised by the International Association of Geoanalysts and is conducted in accordance with a published protocol (IAG, 2020). The overall aim of the programme is to provide participating laboratories with information on their performance in the form of *z*-scores for each reported measurement result so that individual laboratories can decide whether the quality of their data is satisfactory in relation both to their chosen fitness-for-purpose criteria and to the performance of other laboratories participating in this round. In circumstances where a *z*-score from a reported result is unsatisfactory, a participating laboratory is encouraged to investigate for unsuspected analytical bias and to take corrective action when it appears justified.

Steering Committee for Round 52:

P.C. Webb (administrator and results assessor), P.J. Potts (results reviewer), C.J.B. Gowing (distribution manager and results reviewer), M. Thompson (statistical advisor), J. Vind (supplier of EMS-1 material).

Timetable for Round 52:

Distribution of sample: September 2022
Results accepted from: 31st October 2022
Results submission deadline: 16th December 2022
Release of report: January 2023

GeoPT52 Test Material Details

The Metalliferous Shale test material, EMS-1, is an Ordovician black shale collected from the Sillamäe area of Eastern Estonia by Tallinn University of Technology, Department of Geology and supplied to the Geological Survey of Estonia, which arranged the processing, division and bottling at X-Ray Mineral Services Finland Oy. Subsequently, material from a number of bottles was divided and packeted for distribution as a PT sample at the British Geological Survey (BGS), Keyworth, under the direction of Dr Charles Gowing.

The test material was evaluated for homogeneity by the Geological Survey of Estonia and, following characterisation by X-Ray Services Finland Oy, an assessment of the results showed that this material was sufficiently homogeneous to be suitable for use in this proficiency test. Participants were made aware that this test material is mineralised, containing significantly elevated levels of some constituents, especially As, Corg, Mo, Pb, S, V, U and Zn, and to take appropriate precautions.

Submission of Results

For Geo*PT*52 (EMS-1), a total of 3273 measurement results were submitted by 87 laboratories and are listed in Table 1. We are disappointed that these numbers are much reduced compared with the remarkably high level of participation in Round 51 of Geo*PT*. We believe this may have partly been a consequence of our warning that this test material has a more extreme composition than is usual for our routine test sample, but cannot discount the fact that a larger than usual number of laboratories reported that they were suffering instrumental issues that prevented them from reporting within the submission window. Of the measurements submitted, 1209 results were designated by their originators as data quality 1 (see the ***z*-score analysis section** below for explanation of data quality) and are shown in **bold**, whereas 2064 results were specified as data quality 2 and are shown underlined. Results from all laboratories submitting data were used to assess consensus values for each measurand.

Only two laboratories reported values of '0' (i.e. zero) in this round. We **continue** to remind participants **not** to report zeros or values that are close to detection limits, and below their recognised limits of quantification that have an unacceptably large uncertainty associated with them. In addition, it is apparent that a few laboratories reported **results for F and S in units of g/100g instead of mg/kg**. The distribution of S data may have been improved considerably by correct reporting. Consequently, we must respectfully, but **firmly remind participants** that **measurement results** of **all constituents listed as elements should be reported in mg/kg**. Please be aware that **erroneous results cannot be altered or removed once they have been submitted** and that corresponding ***z*-scores will be adversely affected**.

Assigned values and results summary

Following procedures described in earlier rounds, and detailed fully in the Geo*PT* protocol (IAG, 2020), robust statistical procedures were used to derive consensus values for measurands in this test material: these consensus values being judged to be the best available estimates of the true composition of the test material. Values were assigned on the basis that: i) sufficient laboratories (15 or more) had contributed data for effective estimation of the consensus, ii) visual assessment gave confidence that a substantial proportion of the results distribution was symmetrically disposed about the consensus value, iii) the ratio of the uncertainty in the location estimate to the target precision was an acceptably small value, and iv) an evaluation of measurement results by analytical procedure – including both the method of analysis and the form of sample preparation – indicated that no significant procedural bias was discernible amongst measurement results from which the consensus was derived. Where these criteria were largely, but not fully met, or where obvious anomalies in the dataset could be accommodated by judicious selection of the consensus, values were credited with 'provisional' rather than 'assigned' status.

Data assessments involved an examination of bar charts showing the distribution of results contributed for each measurand (as presented in Figures 1 and 2). In addition, a variety of plots, permitting discrimination of data by method of measurement and by sample preparation procedure, as developed by Thomas Meisel using the statistical package 'R' and made available using the Shiny App (*https://www.shinyapps.io*), were also examined. This approach enables us, when necessary, to refine the selection of consensus values by taking account of data distributions according to measurement procedure. As notified to participants in 2022, the facility now exists for participants to observe Geo*PT* data distributions in a similar way using Shiny App graphics through the link: *https://geoanalyst.shinyapps.io/GeoPTcommon2/*. This enables you to view all data submitted according to the principle of measurement, the method of sample preparation, and the chosen fitness-for-purpose criterion, using a variety of forms of graph.

Consensus values derived from the contributed data are listed in Table 2. They were provided in 13 instances by the Huber robust mean, a procedure that accommodates outliers, but is unreliable when a dataset is skewed. In such circumstances, the median is often a more robust estimator of the consensus and was employed in 24 cases. For more severely skewed and strongly tailed datasets, the median may not be an adequate estimator and a mode can often provide a more effective means of estimating the location of the consensus. In this round the use of a mode as a consensus estimator was preferred in 20 cases, and in 9 of those, the distribution of data was sufficiently compatible with the conditions outlined above to justify its designation as an assigned value. Although the choice of a mode may sometimes be used to 'fine tune' the location of the consensus, the use of modes in this round was necessary more often because datasets were skewed and the source of the skew could be attributed to a known analytical problem or problems as discussed later. The procedure used to determine modes was mostly as described by Thompson (2017) involving the estimation of the mass fraction corresponding to the maximum value of the kernel density distribution for the dataset. Such modes can provide a robust estimate of the consensus location that represents the most coherent part of the data distribution where the data may often be symmetrically disposed, although the dataset as a whole may be asymmetric.

Table 2 lists consensus values distinguished as assigned or provisional for 9 major components and 48 trace elements in Geo*PT*52 (EMS-1). Barcharts that were judged to have satisfactory distributions for consensus values to be designated as assigned or provisional, enabling *z*-scores to be calculated, are shown in Figure 1. Statistical data, consensus values and status designations are listed in full in Table 2 for the 57 analytes: SiO_2, TiO_2, Al_2O_3, Fe_2O_3T, MnO, MgO, CaO, K_2O, P_2O_5, Ag, As*, Ba, Be, Bi, C(tot)*, Cd, Ce, Co, Cr*, Cs, Cu*, Dy, Er, Eu, Ga*, Gd, Hf*, Hg*, Ho, In*, La, Li, Lu, Mo*, Nb*, Nd, Ni, Pb*, Pr, Rb, Sb*, Sc, Se*, Sm, Sn, Sr, Ta, Tb, Th, Tl*, Tm, U*, V*, W*, Y, Yb and Zr*. Of these, the measurands of the 18 analytes marked '*' were credited only with provisional status. Provisional status were conferred because either: i) a relatively small number of results (less than 15, but usually more than 9) contributed to the consensus, or ii) the results were unduly dispersed in relation to the target value, or iii) the distribution of results was significantly skewed, or iv) the dataset was affected by bias in one or more methods employed but the remaining data defined a viable consensus.

It is significant that there were more provisional results than usual in this round. This was partly because several data distributions were highly dispersed, e.g. As, Mo, Pb, S, U, V and Zn. See, for example, for U in Figure 0.1, where the consensus value was credited with provisional status partly due to the overall dispersion of data, but also due to the apparent bias between populations of XRF and ICP-MS results. High dispersion in many of these cases may have been because the test material EMS-1 contains higher mass fractions of these elements than normally encountered, leading to measurements being outside routine calibration ranges and there being inadequate means of validation. Such reasons for the increased dispersion of results for high mass fractions is highlighted in Meisel et al. (2021). With the presence of unusually high mass fractions of some elements in EMS-1, there is also the possibility that unexpected interferences may bring about increased levels of dispersion in particular instances. One example is the mutual interference in the XRF measurement of As and Pb, from which data of both elements may well be degraded. Note that, of the provisional results, those for As, Cr and W have a relatively high degree of uncertainty associated with them.

Bar charts for the 12 analytes: Fe(II)O, Na_2O, H_2O^+, CO_2, LOI, C(org), Cl, F, Ge, S, Te and Zn are plotted in Figure 2 for information only, as the data were either

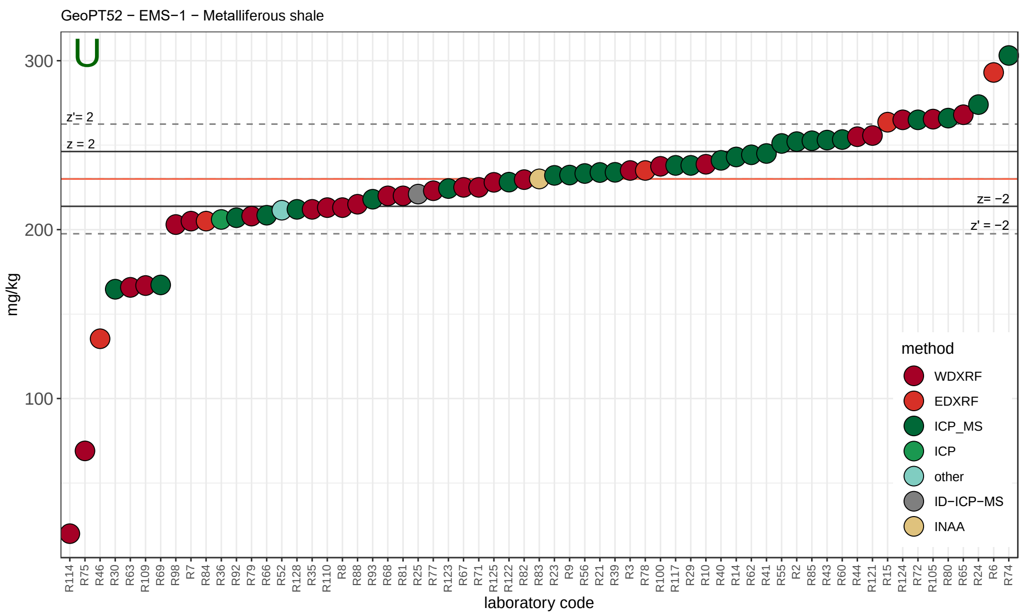


Figure 0.1 A sequential data distribution plot for EMS-1 of sorted U results distinguished according to method of measurement where greater than usual dispersion for U is observed and there is obvious bias between populations of XRF and ICP-MS results. Key to methods: WDXRF – Wavelength dispersive XRF; EDXRF – Energy Dispersive XRF; ICP-MS – Inductively coupled plasma – mass spectrometry; ICP – Inductively coupled plasma – atomic/optical emission spectrometry; ID-ICP-MS – Isotope dilution inductively coupled plasma – mass spectrometry; INAA – Instrumental neutron activation analysis.

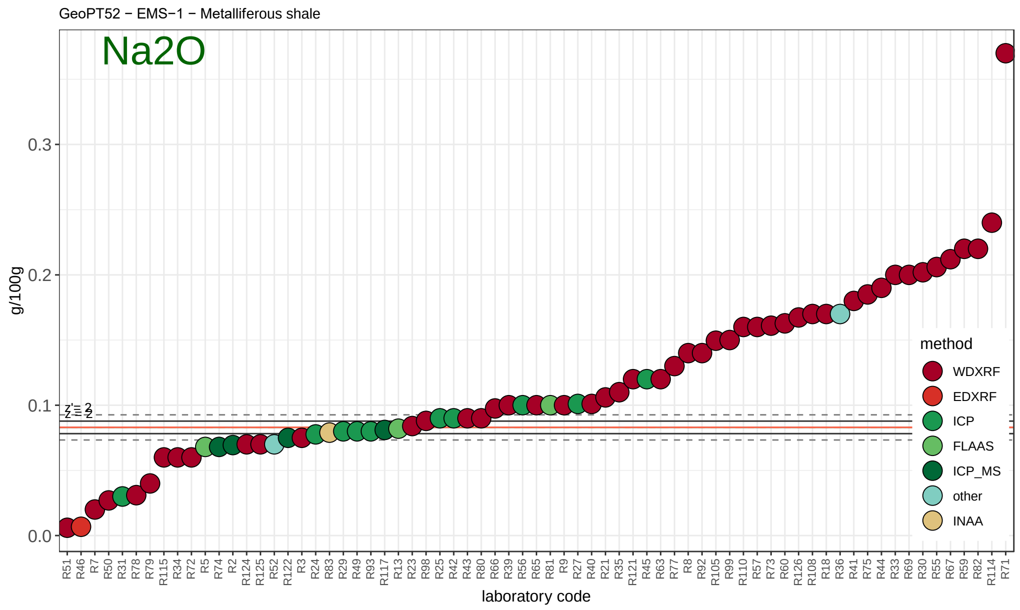


Figure 0.2 A sequential data distribution plot for EMS-1 of sorted Na_2O results distinguished according to method of measurement where dispersion of XRF data is particularly marked. Key to methods as for Figure 0.1. FLAAS – Flame AAS.

insufficient in number, or the distribution was too highly skewed or too highly dispersed for a sufficiently reliable determination of a consensus for the estimation of *z*-scores. The Na_2O data distribution was severely degraded, as shown in Figure 0.2, not only because the Na_2O mass fraction is low (probably < 0.1 g/100g), but also because the XRF results are affected by the Zn Lα line interference of Na Kα which is significant on account of the high Zn content, of around 3000 mg/kg.

Although the majority of datasets in this round are symmetrically disposed, a number feature notable asymmetry. Low tails are apparent for As, Sb and Zr, partly due in the case of As and Zr to XRF measurements on powder pellets (PP), and additionally in the case of Zr to the incomplete dissolution of refractory zircons as recognised by Potts et al. (2014). High tails are a more common feature, especially for SiO_2, Al_2O_3, Cr, Ga, Nb, Pb, Sc, and V. In several of these cases (SiO_2, Al_2O_3, Cr,

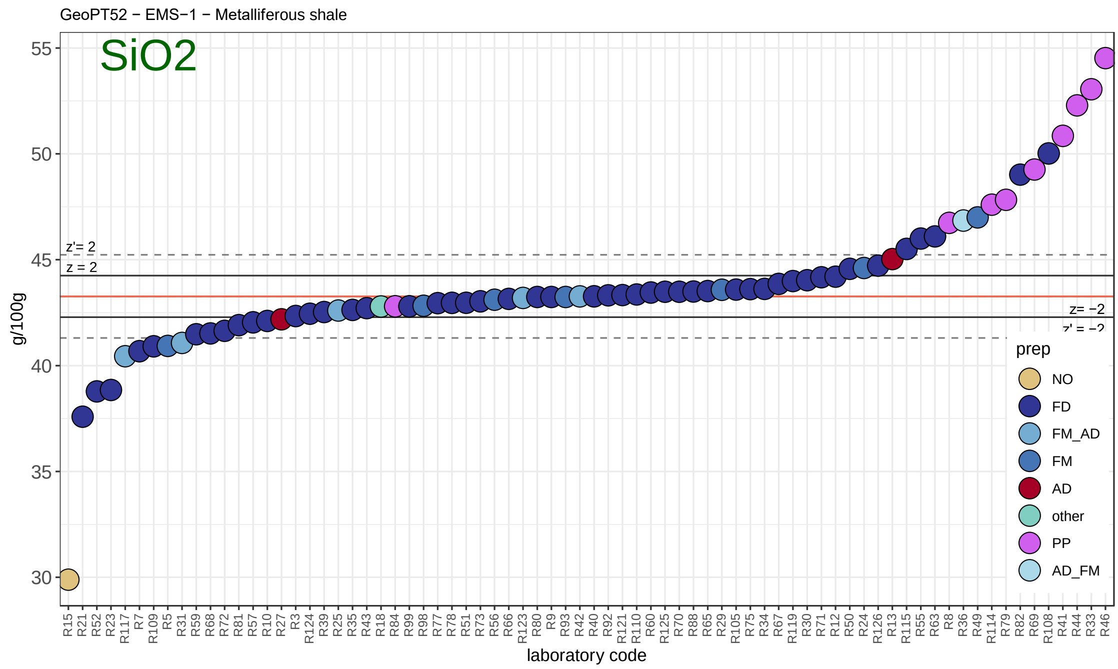


Figure 0.3 A sequential plot for EMS-1 of sorted SiO_2 results distinguished according to method of sample preparation typifies several data distributions. XRF PP (powder pellet) data form a distinct high tail. XRF FD (fusion disc) and ICP-MS data with sample preparation involving fusion (FM_AD and AD_FM) form a convincing consensus. AD is acid digestion, NO is no preparation and other is not defined.

Sc and V) much of the anomalously high data is provided by XRF measurements on powder pellets (PP), as illustrated for SiO_2 in Figure 0.3. It is well known that preparation of powder pellets frequently causes alignment of platy minerals such as clays and micas which are known to be major components of this shale, thus producing inhomogeneity that could more severely affect elements measured on low energy X-rays that have relatively shallow depth of penetration. Consequently the consensus values for such elements where bias was apparent, were taken from medians and modes that de-emphasised the contribution of the powder pellet data.

In contrast, data distributions for most REEs are remarkably well constrained and well behaved. So too is data for In which is given only provisional status on account of the limited number (10) of observations.

Both Rb and Sc are given assigned status despite significant dispersion, because much of which appears to be caused by XRF results, and more weight was given to the ICP-MS data, which was considered to be more reliable. Much greater dispersion was noted for Nb (Figure 0.4), most severely affecting XRF data and consequently provisional status was conferred.

As is often the case, some sets of results, including those of TiO_2, MnO, MgO, P_2O_5, Nb, Sr and Ta feature stepped distributions caused by over-rounding of much of the contributed data. We continue to recommend that for proficiency testing purposes all measurands should be quoted to **at least one decimal place more than would be routinely presented** to a client. This would enable our statistical procedures to define the consensus more effectively. This recommendation is especially relevant to distributions of major element components when reported at low mass fractions.

Z-score analysis

As in previous rounds, laboratories were invited to choose one of two performance standards against which their analytical results would be judged:

Data quality 1 for laboratories working to a 'pure geochemistry' standard of performance, where analytical results are designed for geochemical research and where care is taken to provide data of high precision and accuracy, sometimes at the expense of a reduced sample throughput rate.

Data quality 2 for laboratories working to an 'applied geochemistry' standard of performance, where, although precision and accuracy are still important, the main objective is to provide results on large numbers of samples collected, for example, as part of geochemical mapping projects or geochemical exploration programmes.

The **standard deviation for proficiency** (σ_{pt}) – also referred to as the target precision – for each measurand

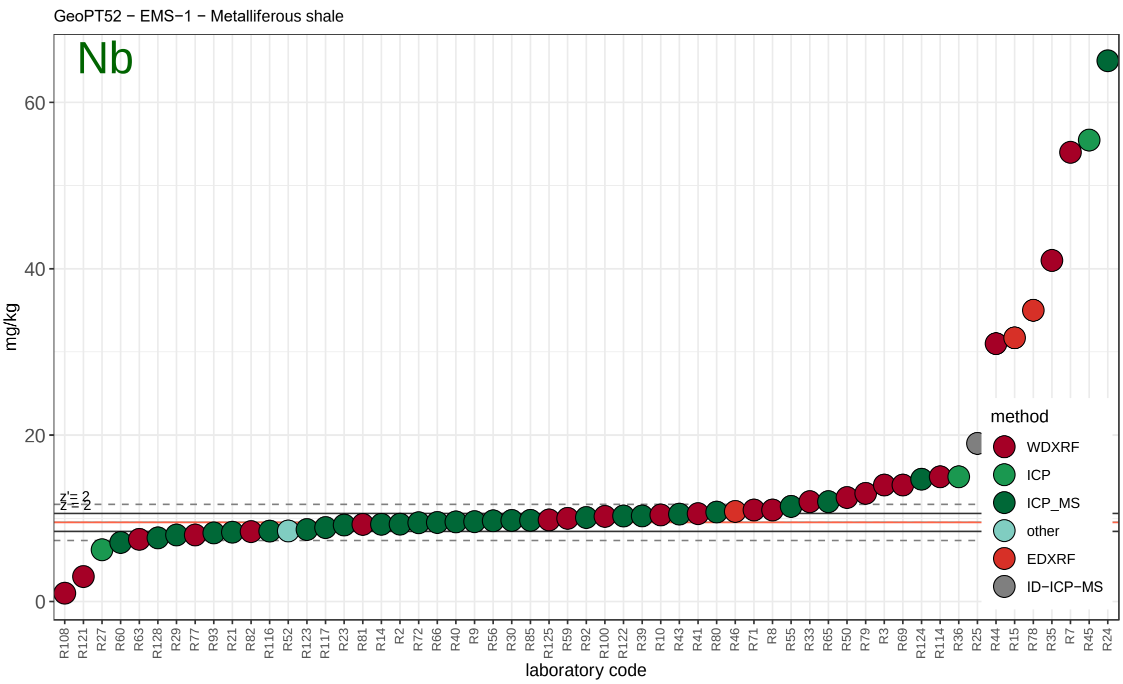


Figure 0.4 A sequential data distribution plot for EMS-1 of sorted Nb results distinguished according to method of measurement where dispersion of XRF data is obvious, whereas the ICP_MS data is largely coherent. Key to methods as for Figure 0.1. ID-ICP-MS – Isotope dilution ICP-MS.

assessed was calculated from a modified form of the Horwitz function as follows:

$$\sigma_{pt} = k.x_{pt}^{0.8495}$$

Where x_{pt} is the mass fraction of the element; the factor k = 0.01 for pure geochemistry laboratories (quality 1) and k = 0.02 for applied geochemistry laboratories (quality 2).

Z-scores were calculated for each elemental measurement submitted by each laboratory from:

$$z_i = [x_i - x_{pt}] / \sigma_{pt}$$

Where x_i is the contributed measurement result, x_{pt} is the assigned (or provisional) value and σ_{pt} is the target standard deviation (all as mass fractions). *Z*-scores for results contributed to Geo*PT*52 are listed in Table 3. Those of results designated as data **quality 1** are shown in **bold**: those of data quality 2 are shown underlined. *Z*-scores derived from *provisional value*s of measurands are shown in *italics*.

Participating laboratories are invited to assess their performance using the following criteria:–

Z-score results in the range $-2<z<2$ are considered to be 'satisfactory' (in the sense that no action is called for by the participating laboratory). If the *z*-score for an element falls outside this range, more especially if it is outside the range $-3<z<3$, laboratories are advised to examine their procedures, and if necessary, take appropriate action to ensure that their determinations are not subject to unsuspected analytical bias.

Overall performance

A summary of the overall performance of individual laboratories for this round is plotted in multiple *z*-score charts in Figure 3. In these charts, the *z*-score performance for each element is distinguished by symbols that make it easy to identify whether the results were satisfactory or gave *z*-scores that exceeded the action limits. This chart is designed to help individual laboratories judge their overall performance in this proficiency testing round. Participants should always review their *z*-scores in accordance with their own fitness-for-purpose criteria.

Participation in future rounds

The benefit from proficiency testing arises from regular participation and laboratories are invited to contribute to Round 53, the test materials for which will be distributed during March 2023.

Acknowledgements

The authors once again thank Andrea Mills (BGS) for much-valued assistance in distributing these samples and Thomas Meisel (Montanuniversität Leoben, Austria) for both maintaining the system and developing procedures involving the package 'R' and the Shiny App which has greatly assisted in the investigation of data according to analytical procedure, provided the graphics featured in Figures 0.1, 0.2, 0.3 and 0.4, as well as facilitating the analysis of datasets involving modes derived according to Thompson (2017).

We are also most grateful to Päärn Paiste of the University of Tartu, Estonia for facilitating this collaboration between the IAG and the Estonian Geological Survey, and thanks are due to X-ray Mineral Services Finland Oy (Lorenza Sardisco, Jesal Hirani, Tim J. Pearce) for initial preparation and characterisation of the sample.

References

IAG (2020) Protocol for the operation of the Geo*PT* Proficiency testing scheme. International Association of Geoanalysts (Keyworth, UK), 18pp. *http://www.geoanalyst.org/wp-content/uploads/2020/07/GeoPT-revised-protocol-2020.pdf*.

Meisel, T. C., Webb, P. C., and Rachetti, A. (2022). Highlights from 25 Years of the Geo*PT* Programme: What Can be Learnt for the Advancement of Geoanalysis. *Geostandards and Geoanalytical Research*. *https://onlinelibrary.wiley.com/doi/10.1111/ggr.12424*

Potts P.J., Webb P.C. and Thompson M. (2014) Bias in the determination of Zr, Y and rare earth element concentrations in selected silicate rocks by ICP-MS when using some routine acid dissolution procedures: Evidence from the Geo*PT* proficiency testing programme. *Geostandards and Geoanalytical Research*, 39, 403–416.

Thompson, M. (2017) On the role of the mode as a location parameter for the results of proficiency tests in chemical measurement. *Anal. Methods*, **9**, p.5534-5540.

References of more general relevance

Potts P.J., Webb, P.C. and Thompson M. (2013) An assessment of performance in the routine analysis of silicate rocks based on an analysis of data submitted to the Geo*PT* proficiency testing programme for geochemical laboratories (2001–2011) *Geostandards and Geoanalytical Research*, **37**, 403–416.

Potts P.J., Thompson M., and Webb, P.C. (2015) The reliability of assigned values from the Geo*PT* proficiency testing programme from an evaluation of data for six test materials that have been characterised as certified reference materials. *Geostandards and Geoanalytical Research*, **39**, 407–417.

Potts P.J., Webb, P.C. and Thompson M. (2019) The Geo*PT* proficiency testing programme as a scheme for the certification of geological reference materials. *Geostandards and Geoanalytical Research*, **43**, 409–418.

Potts P.J. and Webb, P.C (2019) An evaluation of methods for assessing the competence of laboratories based on performance in the Geo*PT* proficiency testing scheme. *Geostandards and Geoanalytical Research*, **43**, 217–22.

Webb, P.C., Potts P.J., Thompson M., Wilson, S.A. and Gowing, C.J.B. (2019) The long-term robustness and stability of consensus values as composition location estimators for a typical geochemical test material in the Geo*PT* proficiency testing programme. *Geostandards and Geoanalytical Research*, **43**, 397–408.

ADDENDUM — IMPORTANT NOTICES TO ANALYSTS

New procedural coding for Round 52

Please note that **additional analytical technique and sample preparation codes** are now available. Where relevant, please revise your procedure definition to specify the codes **LA-ICP-MS for laser ablation-ICP-MS measurement and either NP for nano-particulate pellets or FD for glass discs** to provide more accurate definitions of procedures in subsequent rounds.

Change in uncertainty estimation, 2020

A change was made to the algorithm for the estimation of the uncertainty of median values and implemented for the first time in Round 47/47A. As described in the revised Geo*PT* protocol (IAG, 2020), median uncertainties are increased by a factor of 1.2533 compared to those from rounds prior to that date. Uncertainty values previously reported for values estimated as medians should be increased by this factor.

Explicit advice to analysts for reporting of procedures involving ignition and fusion

Note that some laboratories are still listing their procedure for determining LOI as the same as that employed for major elements, rather than providing separate, specific details. We must remind analysts that it is important to provide information that is appropriate for every analyte. Indeed, analysts reporting measurement results for procedures involving fusion, sintering or ignition, and in particular, LOI determinations, should specify the correct method used and give details both of the temperature used and where appropriate, the end-point criterion, e.g., the duration of ignition. This information should be supplied in the description of the relevant **Procedure,** as **Additional Details**.

We recommend that details of gravimetric procedures are included under **Analytical Technique details** rather than under **Sample Preparation details**. For gravimetric analysis, other than drying, which should in any case be carried out according to our instructions, there is no other sample preparation involved.

Access to graphical displays of Geo*PT* data distributions

With thanks to Thomas Meisel for the Shiny App graphical implementation:
https://www.geoanalyst.shinyapps.io/GeoPTcommon2

Appendix 1

Publication status of proficiency testing reports.

Previous reports are available for download from the IAG website (*http://www.geoanalyst.org/*).

Geo*PT*1
Thompson M., Potts P.J., Kane J.S. and Webb P.C. (1996)
Geo*PT*1. International proficiency test for analytical geochemistry laboratories - Report on round 1. Geostandards Newsletter: The Journal of Geostandards and Geoanalysis, 20, 295-325.

Geo*PT*2
Thompson M., Potts P.J., Kane J.S., Webb P.C. and Watson, J.S. (1998)
Geo*PT*2. International proficiency test for analytical geochemistry laboratories - Report on round 2. Geostandards Newsletter: The Journal of Geostandards and Geoanalysis, 22 127-156.

Geo*PT*3
Thompson M., Potts P.J., Kane J.S. and Chappell B.W. (1999a)
Geo*PT*3. International proficiency test for analytical geochemistry laboratories - Report on round 3. Geostandards Newsletter: The Journal of Geostandards and Geoanalysis, 23, 87-121.

Geo*PT*4
Thompson M., Potts P.J., Kane J.S., Webb P.C. and Watson J.S. (1999b)
Geo*PT*4. International proficiency test for analytical geochemistry laboratories - Report on round 4. Published in the electronic version of Geostandards Newsletter: The Journal of Geostandards and Geoanalysis (Summer 2000).

Geo*PT*5
Thompson M., Potts P.J., Kane J.S., and Wilson S. (1999c)
Geo*PT*5. International proficiency test for analytical geochemistry laboratories - Report on round 5. Published in the electronic version of Geostandards Newsletter: The Journal of Geostandards and Geoanalysis (Summer 2000).

Geo*PT*6
Potts P.J., Thompson M., Kane J.S., Webb P.C. and Carignan J. (2000)
GEO*PT*6 - an international proficiency test for analytical geochemistry laboratories - report on round 6 (OU-3: Nanhoron microgranite) and 6A (CAL-S: CRPG limestone). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*7
Potts P.J., Thompson M., Kane J.S., and Petrov L.L. (2000)
GEO*PT*7 - an international proficiency test for analytical geochemistry laboratories - report on round 7 (GBPG-1 Garnet-biotite plagiogneiss). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*8
Potts P.J., Thompson M., Kane J.S., Webb, P.C. and Watson J.S. (2000)
GEO*PT*8 - an international proficiency test for analytical geochemistry laboratories - report on round 8 / February 2001 (OU-4 Penmaenmawr microdiorite). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*9
Potts P.J., Thompson M., Webb, P.C. and Watson J.S. (2001)
GEO*PT*9 - an international proficiency test for analytical geochemistry laboratories - report on round 9 / July 2001 (OU-6 Penrhyn slate). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*10
Potts P.J., Thompson M., Webb, P.C., Watson J.S. and Wang Yimin (2001)
GEO*PT*10 - an international proficiency test for analytical geochemistry laboratories - report on round 10 / December 2001 (CH-1 Marine sediment). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*11
Potts P.J., Thompson M., Chenery S.R., Webb, P.C. and Watson J.S. (2002)
GEO*PT*11 - an international proficiency test for analytical geochemistry laboratories - report on round 11 / July 2002 (OU-5 Leaton dolerite). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*12
Potts P.J., Thompson M., Chenery S.R., Webb, P.C. and Batjargal B. (2003)
GEO*PT*12 - an international proficiency test for analytical geochemistry laboratories - report on round 12 / January 2003 (GAS Serpentinite). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*13
Potts P.J., Thompson M., Chenery S.R., Webb, P.C. and Kasper H.U. (2003)
GEO*PT*13 - an international proficiency test for analytical geochemistry laboratories - report on round 13 / July 2003 (Köln Loess). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*14
Potts P.J., Thompson M., Chenery S.R., Webb, P.C. and B. Batjargal (2004)
Geo*PT*14 - an international proficiency test for analytical geochemistry laboratories - report on round 14 / January 2004 (OShBO - alkaline granite). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*15
Potts P.J., Thompson M., Chenery S.R., Webb, P.C. and Wang Yimin (2004)
Geo*PT*15 - an international proficiency test for analytical geochemistry laboratories - report on round 15 / June 2004 (Ocean floor sediment MSAN). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*16
Potts P.J., Thompson M., Webb, P.C. and S.Wilson (2005)
Geo*PT*16 - an international proficiency test for analytical geochemistry laboratories - report on round 16 / February 2005 (Nevada basalt, BNV-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*17
Potts P.J., Thompson M., Webb, P.C. and J. Nicholas Walsh (2005)
Geo*PT*17 - an international proficiency test for analytical geochemistry laboratories - report on round 17 / July 2005 (Calcareous sandstone, OU-8). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*18
Webb, P.C., Thompson M., Potts P.J. and L. Paul Bedard (2006)
Geo*PT*18 - an international proficiency test for analytical geochemistry laboratories - report on round 18 / Jan 2006 (Quartz Diorite, KPT-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*19
Webb, P.C., Thompson M., Potts P.J. and B. Batjargal (2006)
Geo*PT*19 - an international proficiency test for analytical geochemistry laboratories - report on round 19 / July 2006 (Gabbro, MGR-N). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*20
Webb, P.C., Thompson M., Potts P.J. and M. Burnham (2007) Geo*PT*20 - an international proficiency test for analytical geochemistry laboratories - report on round 20 / Jan 2007 (Ultramafic rock, OPY-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*21
Webb, P.C., Thompson M., Potts P.J. and B. Batjargal (2007)
Geo*PT*21 - an international proficiency test for analytical geochemistry laboratories - report on round 21 / July 2007 (Granite, MGT-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Appendix 1 (Cont'd)

Geo*PT*22
Webb, P.C., Thompson, M., Potts, P.J. and Batjargal, B. (2008)
Geo*PT*22 - an international proficiency test for analytical geochemistry laboratories - report on round 22 / January 2008 (Basalt, MBL-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*23
Webb, P.C., Thompson, M., Potts, P.J., Watson, J.S. and Kriete, C. (2008)
Geo*PT*23 - an international proficiency test for analytical geochemistry laboratories - report on round 23 / September 2008 (Separation Lake pegmatite, OU-9) and 23A (Manganese nodule, FeMn-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*24
Webb, P.C., Thompson, M., Potts, P.J. and Watson, J.S. (2009)
Geo*PT*24 - an international proficiency test for analytical geochemistry laboratories - report on round 24 / January 2009 (Longmyndian greywacke, OU-10). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*25
Webb, P.C., Thompson, M., Potts, P.J. and Enzweiler, J. (2009)
Geo*PT*25 - an international proficiency test for analytical geochemistry laboratories - report on round 25 / July 2009 (Basalt, HTP-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*26
Webb, P.C., Thompson, M., Potts, P.J. and Loubser, M. (2010)
Geo*PT*26 - an international proficiency test for analytical geochemistry laboratories - report on round 26 / January 2010 (Ordinary Portland cement, OPC-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*27
Webb, P.C., Thompson, M., Potts, P.J. and Batjargal, B. (2010)
Geo*PT*27 - an international proficiency test for analytical geochemistry laboratories - report on round 27 / July 2010 (Andesite, MGL-AND). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*28
Webb, P.C., Thompson, M., Potts, P.J. and Wilson, S. (2011)
Geo*PT*28 - an international proficiency test for analytical geochemistry laboratories - report on round 28 / January 2011 (Shale, SBC-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*29
Webb, P.C., Thompson, M., Potts, P.J. and Wilson, S. (2011)
Geo*PT*29 - an international proficiency test for analytical geochemistry laboratories - report on round 29 / July 2011 (Nephelinite, NKT-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*30
Webb, P.C., Thompson, M., Potts, P.J., Long, D. and Batjargal, B. (2012)
Geo*PT*30 - an international proficiency test for analytical geochemistry laboratories - report on round 30 / January 2012 (Syenite, CG-2) and 30A (Limestone, ML-2). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*31
Webb, P.C., Thompson, M., Potts, P.J and Wilson, S. (2012)
Geo*PT*31 - an international proficiency test for analytical geochemistry laboratories - report on round 31 / July 2012 (Modified river sediment, SdAR-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*32
Webb, P.C., Thompson, M., Potts, P.J and Webber, E. (2013)
Geo*PT*32 - an international proficiency test for analytical geochemistry laboratories - report on round 32 / January 2013 (Woodstock Basalt, WG-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*33
Webb, P.C., Thompson, M., Potts, P.J., Prusisz, B., and Young, K. (2013)
Geo*PT*33 - an international proficiency test for analytical geochemistry laboratories - report on round 33 / July-August 2013 (Ball Clay, DBC-1). International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*34
Webb, P.C., Thompson, M., Potts, P.J and Wilson, S. (2014)
Geo*PT*34 - an international proficiency test for analytical geochemistry laboratories - report on round 34 (Granite, GRI-1) / January 2014. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*35
Webb, P.C., Thompson, M., Potts, P.J and Wilson, S. (2014)
Geo*PT*35 - an international proficiency test for analytical geochemistry laboratories - report on round 35 (Tonalite, TLM-1) / August 2014. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*35A
Webb, P.C., Thompson, M., Potts, P.J and Wilson, S. (2014)
Geo*PT*35A - an international proficiency test for analytical geochemistry laboratories - report on round 35A (Metalliferous sediment, SdAR-H1) / August 2014. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*36
Webb, P.C., Thompson, M., Potts, P.J and Wilson, S. (2015)
Geo*PT*36 - an international proficiency test for analytical geochemistry laboratories - report on round 36 (Gabbro, GSM-1) / January 2015. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*36A
Webb, P.C., Thompson, M., Potts, P.J and Wilson, S. (2015)
Geo*PT*36A - an international proficiency test for analytical geochemistry laboratories - report on round 36A (Metal-rich sediment, SdAR-M2) / January 2015. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*37
Webb, P.C., Thompson, M., Potts, P.J, Gowing, C.J.B. and Burnham, M. (2015)
Geo*PT*37 - an international proficiency test for analytical geochemistry laboratories - report on round 37 (Rhyolite, ORPT-1) / July 2015. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*37A
Webb, P.C., Thompson, M., Potts, P.J, Gowing, C.J.B. and Wilson, S. (2015)
Geo*PT*37A - an international proficiency test for analytical geochemistry laboratories - report on round 37A (Blended sediment, SdAR-L2) / July 2015. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*38
Webb, P.C., Thompson, M., Potts, P.J, Gowing, C.J.B. and Wilson, S.A. (2016)
Geo*PT*38 - an international proficiency test for analytical geochemistry laboratories - report on round 38 (Gabbro, OU-7) / January 2016. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*38A
Webb, P.C., Thompson, M., Potts, P.J, Gowing, C.J.B. and Meisel, T. (2016)
Geo*PT*38A - an international proficiency test for analytical geochemistry laboratories – special report on round 38A (Modified harzburgite, HARZ01) / June 2016. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*39
Webb, P.C., Thompson, M., Potts, P.J, Gowing, C.J.B. and Wilson, S.A. (2016)
Geo*PT*39 - an international proficiency test for analytical geochemistry laboratories - report on round 39 (Syenite, SyMP-1) / July 2016. International Association of Geoanalysts: Unpublished report.

Appendix 1 (Cont'd)

Geo*PT*39A
Webb, P.C., Thompson, M., Potts, P.J, and Gowing, C.J.B. (2016) Geo*PT*39A - an international proficiency test for analytical geochemistry laboratories - report on round 39A (Nepheline syenite, MNS-1) / July 2016. International Association of Geoanalysts: Unpublished report.

Geo*PT*40
Webb, P.C., Thompson, M., Potts, P.J, Gowing, C.J.B. and Wilson, S.A. (2017)
Geo*PT*40 - an international proficiency test for analytical geochemistry laboratories - report on round 40 (Silty marine shale, ShWYO-1) / January 2017. International Association of Geoanalysts: Unpublished report.

Geo*PT*40A
Webb, P.C., Thompson, M., Potts, P.J, Gowing, C.J.B. and Wilson, S.A. (2017)
Geo*PT*40A - an international proficiency test for analytical geochemistry laboratories - report on round 40A (Calcareous organic-rich shale, ShTX-1) / January 2017. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*41
Webb, P.C., Thompson, M., Potts, P.J, Gowing, C.J.B. and Wilson, S.A. (2017)
Geo*PT*41 - an international proficiency test for analytical geochemistry laboratories - report on round 41 (Andesite, ORA-1) / July 2017. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*41A
Webb, P.C., Thompson, M., Potts, P.J, Gowing, C.J.B. and Wilson, S.A. (2017)
Geo*PT*41A - an international proficiency test for analytical geochemistry laboratories - report on round 41A (Mineralized stream sediment, SSCO-1) / July 2017. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*42
Webb, P.C., Thompson, M., Potts, P.J., Gowing, C.J.B. and Burnham, M. (2018)
Geo*PT*42 – an international proficiency test for analytical geochemistry laboratories – report on round 42 (Queenston shale, QS-1) / January 2018. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*43
Webb, P.C., Potts, P.J., Thompson, M. and Gowing, C.J.B. (2018)
Geo*PT*43 – an international proficiency test for analytical geochemistry laboratories – report on round 43 (Dolerite, ADS-1) / July 2018. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*44
Webb, P.C., Potts, P.J., Thompson, M., Gowing, C.J.B. (2019)
Geo*PT*44 – an international proficiency test for analytical geochemistry laboratories – report on round 44 (Calcareous shale, ShCX-1) / January 2019. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*44A
Webb, P.C., Potts, P.J., Thompson, M. Gowing, C.J.B. and Wilson, S.A. (2019)
Geo*PT*44A – an international proficiency test for analytical geochemistry laboratories – report on round 44A (Calcareous mudrock, CM-1) / January 2019. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*45
Webb, P.C., Potts, P.J., Thompson, M. Gowing, C.J.B. and Wilson, S.A. (2019)
Geo*PT*45 – an international proficiency test for analytical geochemistry laboratories – report on round 45 (Silicified siltstone, GONV-1) / July 2019. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*46
Webb, P.C., Potts, P.J., Thompson, M. and Gowing, C.J.B. (2020)
Geo*PT*46 – an international proficiency test for analytical geochemistry laboratories – report on round 46 (Granodiorite, HG-1) / January 2020. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*46A
Webb, P.C., Potts, P.J., Thompson, M. Gowing, C.J.B. and Wilson, S.A. (2020)
Geo*PT*46A – an international proficiency test for analytical geochemistry laboratories – report on round 46A (Phosphate rock, POLC-1) / January 2020. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*47
Webb, P.C., Potts, P.J., Thompson, M. and Gowing, C.J.B. (2020)
Geo*PT*47 – an international proficiency test for analytical geochemistry laboratories – report on round 47 (Silty Soil BIM-1) / December 2020. International Association of Geoanalysts, Keyworth, Keyworth. Unpublished report.

Geo*PT*47A
Webb, P.C., Potts, P.J., Thompson, M. and Gowing, C.J.B. (2020)
Geo*PT*47A – an international proficiency test for analytical geochemistry laboratories – report on round 47A (Silty Soil, NES-1) / December 2020. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*48
Webb, P.C., Potts, P.J., Thompson, M., Gowing, C.J.B., Glodny, J., Wiedenbeck, M. (2021)
Geo*PT*48 – an international proficiency test for analytical geochemistry laboratories – report on round 48 (Monzonite, MzBP-1) / April 2021. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*49
Webb, P.C., Potts, P.J., Thompson, M., Gowing, C.J.B., and Wilson, S.A. (2021)
Geo*PT*49 – an international proficiency test for analytical geochemistry laboratories – report on round 49 (Basalt, BVA-1) / July 2021. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*50
Webb, P.C., Potts, P.J., Thompson, M., and Gowing, C.J.B. (2022)
Geo*PT*50 – an international proficiency test for analytical geochemistry laboratories – report on round 50 (Calcified sediment, CSd-1) / January 2022. International Association of Geoanalysts, Keyworth. Unpublished report.

Geo*PT*51
Webb, P.C., Potts, P.J., Thompson, M., Gowing, C.J.B. and Renno, A.D. (2022) Geo*PT*51 – an international proficiency test for analytical geochemistry laboratories – report on round 51 (Leucomonzogranite, GMN-1) / July 2022. International Association of Geoanalysts, Keyworth, Keyworth. Unpublished report.

Geo*PT*51A
Webb, P.C., Potts, P.J., Thompson, M. and Gowing, C.J.B. (2022)
Geo*PT*51A – an international proficiency test for analytical geochemistry laboratories – report on round 51A (Granite, MEG-1) / July 2022. International Association of Geoanalysts, Keyworth. Unpublished report

Table 1 - GeoPT52 Contributed data for Metalliferous shale, EMS-1. 16/12/2022

Lab Code		R2	R3	R5	R6	R7	R8	R9	R10	R12	R13	R14	R15	R18
SiO2	g 100g^{-1}		**42.34**	40.93		40.68	46.74	43.24	**42.109**	44.2	45.03		29.89	42.79
TiO2	g 100g^{-1}	**0.443**	**0.5**			0.48	0.51	0.49	**0.505**	0.48	0.5		0.41	0.46
Al2O3	g 100g^{-1}	**7.32**	**7.79**	7.33		7.5	8.27	7.95	**7.796**	8.1	7.86		3.7	7.96
Fe2O3T	g 100g^{-1}	**7.913**	**8.04**	8.7		7.94	8.17	8.25	**8.16**	8.18	8.138		7.55	7.75
Fe(II)O	g 100g^{-1}										2.89			
MnO	g 100g^{-1}	**0.094**	**0.1**			0.99	0.1	0.1	**0.103**	0.1	0.113		0.08	0.1
MgO	g 100g^{-1}	**1.149**	**1.26**	1.15		1.25	1.24	1.23	**1.497**	1.25	1.27			1.33
CaO	g 100g^{-1}	**7.981**	**8.69**	6.37		8.22	8.76	8.68	**8.463**	8.85	7.72		8.3	8.25
Na2O	g 100g^{-1}	**0.069**	**0.075**	0.068		0.02	0.14	0.1			0.082			0.17
K2O	g 100g^{-1}	**4.525**	**4.96**	4.576		4.73	5.31	4.99	**5.132**	5.13	4.22		5.12	4.7
P2O5	g 100g^{-1}	**0.820**	**0.86**			0.78	0.94	0.906	**0.812**	0.91	0.83		1.69	
H2O+	g 100g^{-1}			3.31							8.904		1.73	
CO2	g 100g^{-1}					5.06					4.89			
LOI	g 100g^{-1}		22	18		21.48	19.11	14.66			22.74			20.14
Ag	mg kg^{-1}							1.87				**1.75**		
As	mg kg^{-1}		40.5		154	131		160.7	**142.331**			**67.3**	130.3	
Au	mg kg^{-1}													
B	mg kg^{-1}													
Ba	mg kg^{-1}	**331.1**	**332**		349	310	335	324.9	**339.601**		235	**345**	255.3	
Be	mg kg^{-1}							1.73				**1.76**		
Bi	mg kg^{-1}	**0.225**						0.21				**0.22**		
Br	mg kg^{-1}													
C(org)	mg kg^{-1}				55500	53773					62626			
C(tot)	mg kg^{-1}				65000	67603		70100			75965			
Cd	mg kg^{-1}	**16.08**			14.8	26		14.9	**13.551**			**15.8**	17.5	
Ce	mg kg^{-1}	**108.7**					117	115.1	**113.441**		86.3	**120**		
Cl	mg kg^{-1}												540.5	
Co	mg kg^{-1}	**14.04**			14.9		16	13.4	**14.544**			**15.3**	184.4	
Cr	mg kg^{-1}	**43.14**	**42**			70	64	49	**58.581**			**47.5**	88.9	
Cs	mg kg^{-1}	**3.372**	**8**					3.1				**3.35**		
Cu	mg kg^{-1}	**102.1**	**130**		103.7	80	95	98	**88.609**			**105.9**	91.8	
Dy	mg kg^{-1}	**12.03**						11.6			9.33	**12.4**		
Er	mg kg^{-1}	**6.16**						5.8			4.66	**6.25**		
Eu	mg kg^{-1}	**2.965**						2.9			2.44	**3.06**		
F	mg kg^{-1}										1272			
Ga	mg kg^{-1}					11		10.17	**10.773**			**18**		
Gd	mg kg^{-1}	**13.96**						13.91			10.79	**14.7**		
Ge	mg kg^{-1}							1.4				**7.13**		
Hf	mg kg^{-1}	**3.724**	3					4.1	**10.117**			**2.93**		
Hg	mg kg^{-1}													
Ho	mg kg^{-1}	**2.346**						2.2			1.86	**2.32**		
I	mg kg^{-1}													
In	mg kg^{-1}	**0.096**												
Ir	mg kg^{-1}													
La	mg kg^{-1}	**42.98**						46	**52.603**		36.2	**48**		
Li	mg kg^{-1}	**13.57**						12.6				**13.7**		
Lu	mg kg^{-1}	**0.634**						0.6			0.515	**0.58**		
Mo	mg kg^{-1}	**532.3**	**498**	428.9	597	476		536	**545.376**			**575**	564.7	
N	mg kg^{-1}													
Nb	mg kg^{-1}	**9.298**	**14**			54	11	9.6	**10.406**			**9.28**	31.7	
Nd	mg kg^{-1}	**60**						60.4	**66.882**		48.5	**64.8**		
Ni	mg kg^{-1}	**156.2**	**161**		145	122	161	149.4	**153.764**			**173.4**		
Pb	mg kg^{-1}	**246.8**		321.9	218	212	197	228	**207.232**			**217**	223.5	
Pd	mg kg^{-1}													
Pr	mg kg^{-1}	**14.33**						15			11.63	**15.5**		
Pt	mg kg^{-1}													
Rb	mg kg^{-1}	**77.54**	**79**		80.1	86	71	73	**74.643**			**77.9**		
Re	mg kg^{-1}													
Rh	mg kg^{-1}													
Ru	mg kg^{-1}													
S	mg kg^{-1}					33000		55300		49000	60776		33584	
Sb	mg kg^{-1}				14.4			13.86	**12.436**			**14.6**		
Sc	mg kg^{-1}	**9.353**	**12.5**					8.6	**17.082**			**9.61**		
Se	mg kg^{-1}								**4.996**			**9.49**	4.8	
Sm	mg kg^{-1}	**13.37**						13.6	**17.598**		10.8	**14.5**		
Sn	mg kg^{-1}	**1.815**						2				**1.82**		
Sr	mg kg^{-1}	**72.22**	**72**		73.2	67	63	71.52	**70.327**		65.1	**78.3**	70.5	
Ta	mg kg^{-1}	**0.668**	**41**					0.8				**1.25**		
Tb	mg kg^{-1}	**2.102**						1.9			1.63	**2.09**		
Te	mg kg^{-1}											**0.29**		
Th	mg kg^{-1}	**12.1**	10.5					12.05	**8.089**			**12.1**	13.7	
Tl	mg kg^{-1}	**10.38**						9.89	**11.823**			**10.3**		
Tm	mg kg^{-1}	**0.827**						0.8			0.649	**0.75**		
U	mg kg^{-1}	**252.1**	**235**		293	205	213	232.3	**238.690**			**243**	263.6	
V	mg kg^{-1}	**711.7**	**775**		805	775	763	761	**889.722**			**805**	723.8	
W	mg kg^{-1}	**1.156**						1				**2.85**		
Y	mg kg^{-1}	**76.98**	**75**		75.2	67	72	71.6	**75.144**		59.82	**77.1**		
Yb	mg kg^{-1}	**4.753**						4.38	**4.918**		3.821	**4.68**		
Zn	mg kg^{-1}	**3185**	**3069**	2943	2827	2349	2817	2995	**2583.876**			**3111**	2507.400	
Zr	mg kg^{-1}	**141.7**	**143.5**		141	103	130	141	**139.421**			**105**	134	

Bold entries are Data Quality 1 - Underlined entries are Data Quality 2

Table 1 - GeoPT52 Contributed data for Metalliferous shale, EMS-1. 16/12/2022

Lab Code		R21	R23	R24	R25	R27	R29	R30	R31	R33	R34	R35	R36	R39
SiO2	$g\ 100g^{-1}$	37.585	**38.85**	44.61	**42.6**	**42.184**	43.58	**44.033**	41.07	53.05	43.62	42.63	46.85	**42.53**
TiO2	$g\ 100g^{-1}$	0.451	**0.464**	0.467	**0.53**	**0.493**	0.503	**0.504**	0.47	0.42	0.51	0.502	0.45	**0.486**
Al2O3	$g\ 100g^{-1}$	6.987	**8.25**	7.82	**8.03**	**8.01**	8.11	**8.086**	7.47	8.55	8.02	8.13	8.06	**7.89**
Fe2O3T	$g\ 100g^{-1}$	7.582	**7.63**	7.907	**7.97**	**8.26**	8.11	**8.616**	7.85	6.23	8.19	8.27	8.17	**8**
Fe(II)O	$g\ 100g^{-1}$	6.822											1.94	
MnO	$g\ 100g^{-1}$	0.092	**0.095**	0.090	**0.1**	**0.103**	0.1	**0.113**	0.1	0.08	0.1	0.1	0.1	**0.101**
MgO	$g\ 100g^{-1}$	1.135	**1.17**	1.225	**1.25**	**8.523**	1.25	**1.345**	1.21	1.31	1.25	1.23	1.26	**1.24**
CaO	$g\ 100g^{-1}$	8.262	**7.43**	8.376	**8.4**	**8.523**	8.91	**8.635**	8.22	7.45	8.68	8.48	8.53	**8.56**
Na2O	$g\ 100g^{-1}$	0.106	**0.084**	0.078	**0.09**	**0.101**	0.08	**0.202**	0.03	0.2	0.06	0.11	0.17	**0.1**
K2O	$g\ 100g^{-1}$	4.439	**4.24**	4.711	**4.9**	**5.21**	5.03	**4.821**	4.92	4.81	5.02	4.94	5.02	**4.83**
P2O5	$g\ 100g^{-1}$	0.736	**0.766**	0.832	**0.89**	**0.86**	0.88	**0.868**	0.83	0.97	0.88	0.901	0.87	**0.841**
H2O+	$g\ 100g^{-1}$	3.671												
CO2	$g\ 100g^{-1}$	1.685												
LOI	$g\ 100g^{-1}$	18.191	**21.1**		**24**	**23.181**	17.17	**17.823**	16.17		22.31	16.1	19.35	**14.78**
Ag	$mg\ kg^{-1}$	1.81	**1.923**		**2.3**	1.3								
As	$mg\ kg^{-1}$	59.636	**169.4**	153	**155**	174			161			111		**42**
Au	$mg\ kg^{-1}$	0.032												
B	$mg\ kg^{-1}$													
Ba	$mg\ kg^{-1}$	286.576	**330.9**	152.4	**337**	**336.3**	348	**339**		349	328	303	332	**340**
Be	$mg\ kg^{-1}$	1.274	**1.776**	1.7	**1.9**		2	**2.503**	1.5					
Bi	$mg\ kg^{-1}$	1.274	**0.207**		**0.4**									
Br	$mg\ kg^{-1}$													
C(org)	$mg\ kg^{-1}$	55462.702		59000	**75750**				60800					
C(tot)	$mg\ kg^{-1}$	72311.794	**73387**	72600	**64500**				76400					
Cd	$mg\ kg^{-1}$	14.28	**15.46**	15	**15**	15.5		**14.76**	15.9			18		
Ce	$mg\ kg^{-1}$	97.067	**117.4**	120	**194**		113	**123.2**				126	108	**119.070**
Cl	$mg\ kg^{-1}$			72					55					
Co	$mg\ kg^{-1}$	12.734	**14.16**	15	**12**	**13.93**		**17.19**	14.8	14	17		15	
Cr	$mg\ kg^{-1}$	36.932	**46.51**	36		**766.4**		**55.44**	38	94	45		55	**55**
Cs	$mg\ kg^{-1}$	3.368	**3.13**	3	**2.45**			**3.608**					3.4	**3.28**
Cu	$mg\ kg^{-1}$	93.064	**98.15**	93	**108**	94		**126.9**	105	101	103	319	97	**38**
Dy	$mg\ kg^{-1}$	11.417	**11.57**	14	**12.1**		11.8	**10.47**					11	**12.76**
Er	$mg\ kg^{-1}$	5.822	**6.098**	7.6	**6.3**		6.2	**4.906**					6	**6.41**
Eu	$mg\ kg^{-1}$	2.925	**2.99**	3.4	**3**		2.95	**3.091**					2.4	**3.12**
F	$mg\ kg^{-1}$	347.255		1370										
Ga	$mg\ kg^{-1}$	9.948	**19.45**		**13.5**			**11.74**		15	12			**9**
Gd	$mg\ kg^{-1}$	9.072	**14.03**	16	**11**		12.7	**14.43**					13	**15**
Ge	$mg\ kg^{-1}$	0.868			**1.4**									
Hf	$mg\ kg^{-1}$	2.483	**3.504**		**3.5**		3.4	**3.702**						**3.9**
Hg	$mg\ kg^{-1}$	0.031			**0.35**			**0.153**	0.192					
Ho	$mg\ kg^{-1}$	2.188	**2.367**	2.7	**2**		2.2	**1.863**					0.6	**2.48**
I	$mg\ kg^{-1}$													
In	$mg\ kg^{-1}$	0.105												
Ir	$mg\ kg^{-1}$	0.006												
La	$mg\ kg^{-1}$	39.177	**42.26**	47	**49**		46	**46.09**				54	45	**48.41**
Li	$mg\ kg^{-1}$	14.418	**13.89**	12	**12**			**17.02**					14	
Lu	$mg\ kg^{-1}$	0.607	**0.632**				0.69	**0.457**					1.47	**0.69**
Mo	$mg\ kg^{-1}$	432.048	**534.9**	493	**499**			**584.7**			492	638	491	**559.4**
N	$mg\ kg^{-1}$													
Nb	$mg\ kg^{-1}$	8.33	**9.192**	65	**19**	**6.22**	8	**9.748**		12		41	15	**10.29**
Nd	$mg\ kg^{-1}$	59.062	**60.59**	6.3	**63**		60.3	**61.58**					60	**64.12**
Ni	$mg\ kg^{-1}$	135.864	**153.2**	156	**166**	**13.93**		**191.1**	149	144	151	144	165	**82**
Pb	$mg\ kg^{-1}$	191.353	**206.3**	213	**250**	294.6		**208.9**	199	209		200	205	**154.040**
Pd	$mg\ kg^{-1}$	0.004												
Pr	$mg\ kg^{-1}$	14.158	**14.67**	15	**9**		14.3	**14.07**					12	**15.45**
Pt	$mg\ kg^{-1}$	0.003												
Rb	$mg\ kg^{-1}$	78.516	**75.22**	63	**74.7**		72	**88.74**		82		78	71	**79.7**
Re	$mg\ kg^{-1}$													
Rh	$mg\ kg^{-1}$	0.014												
Ru	$mg\ kg^{-1}$	0.006												
S	$mg\ kg^{-1}$	55174.013	**58919**	56400					46360					
Sb	$mg\ kg^{-1}$	13.889	**17.76**	14	**12.5**			**15.54**	4.8					
Sc	$mg\ kg^{-1}$	7.815	**8.968**		**7**	**336.3**	9	**9.178**		10			8	**9.5**
Se	$mg\ kg^{-1}$	2.944			**1**	3.89			1.7					
Sm	$mg\ kg^{-1}$	13.372	**13.92**	15	**10**		13.2	**13.36**					12	**14.54**
Sn	$mg\ kg^{-1}$	1.576						**1.734**	1.4					
Sr	$mg\ kg^{-1}$	74.54	**71.62**	68	**74.5**	**75.05**	75	**85.99**	100	62	69	91	77	**76**
Ta	$mg\ kg^{-1}$	0.451	**0.723**				0.7	**0.609**						**0.74**
Tb	$mg\ kg^{-1}$	0.48	**2.093**	2.4	**1**		2	**1.889**					2.6	**2.28**
Te	$mg\ kg^{-1}$	0.169			**0.1**				9.7					
Th	$mg\ kg^{-1}$	13.126	**12.39**	14	**9.5**		11.6	**8.905**		10		13	12	**12.72**
Tl	$mg\ kg^{-1}$	6.538	**9.909**	10					7.1					
Tm	$mg\ kg^{-1}$	0.742	**0.789**		**0.79**		0.82	**0.6**					0.5	**0.87**
U	$mg\ kg^{-1}$	233.815	**232.1**	274	**221**		238	**164.7**				212	206	**233.910**
V	$mg\ kg^{-1}$	679.120	**763.7**	763		**8.9**	772	**917.3**	692	740	736	702	744	**682**
W	$mg\ kg^{-1}$	1.073	**1.407**											
Y	$mg\ kg^{-1}$	66.498	**71.65**	73	**73**	**165.5**	70	**74.89**		67	70	74	74	**80.83**
Yb	$mg\ kg^{-1}$	4.307	**4.405**	5.4	**5.1**		4.8	**3.589**					6.5	**4.83**
Zn	$mg\ kg^{-1}$	2440.329	**2804**	2987	**2965**	2955		**3084.100**	2725	2592	2509	2443	2790	**3240**
Zr	$mg\ kg^{-1}$	80.472	**111.7**		**128**	**105.6**	152	**178.990**		136		130	132	**148**

Bold entries are Data Quality 1 - Underlined entries are Data Quality 2

Table 1 - GeoPT52 Contributed data for Metalliferous shale, EMS-1. 16/12/2022

Lab Code		R40	R41	R42	R43	R44	R45	R46	R49	R50	R51	R52	R55	R56
SiO2	g 100g^{-1}	43.271	50.85	43.27	42.713	52.29		54.521	47	44.57	**42.966**	38.78	**46**	43.11
TiO2	g 100g^{-1}	0.496	0.49	0.483	0.465	0.52	0.44	0.438	0.49	0.737	**0.468**	0.44	**0.471**	0.5
Al2O3	g 100g^{-1}	7.948	8.28	7.92	7.834	9.46	8.874	8.063	7.86	7.24	**7.718**	7.13	**8.51**	7.82
Fe2O3T	g 100g^{-1}	8.324	7.72	8.37	8.281	7.79	8.684	6.098	8	9.12	**7.908**	7.37	**8**	7.2
Fe(II)O	g 100g^{-1}	5												
MnO	g 100g^{-1}	0.103	0.08	0.099	0.102	0.11	0.118	0.078	0.1	0.115	**0.087**	0.09	**0.104**	0.1
MgO	g 100g^{-1}	1.269	1.22	1.24	1.289	1.22	1.474	0.83	2.43	1.35	**1.31**	1.13	**1.454**	1.28
CaO	g 100g^{-1}	8.646	8.47	8.53	8.738	7.95	9.4	6.894	8.22	8.71	**8.476**	7.68	**8.53**	7.85
Na2O	g 100g^{-1}	0.101	0.18	0.09	0.09	0.19	0.12	0.007	0.08	0.027	**0.006**	0.07	**0.206**	0.1
K2O	g 100g^{-1}	4.875	4.71	5.02	5.089	5.45	4.63	5.109	4.44	4.78	**4.74**	4.51	**4.98**	4.81
P2O5	g 100g^{-1}	0.853	0.85	0.852	0.874	0.92	0.639	0.695	0.77	0.818	**0.844**	0.8	**0.898**	0.85
H2O+	g 100g^{-1}							3.073	3.18		**2.83**			
CO2	g 100g^{-1}											25.98		
LOI	g 100g^{-1}		19.11		17.87	19.12	19.065		10.6	18.08		32	**20.14**	24.28
Ag	mg kg^{-1}				2.05							1.29		
As	mg kg^{-1}		178.220					107.540	131.310			137.770		
Au	mg kg^{-1}													
B	mg kg^{-1}													
Ba	mg kg^{-1}	348.590	355	332	327	329	350.298	205.437	346	301	**322**	309.820	**395**	332.8
Be	mg kg^{-1}	1.776	2.05		1.8								**2.1**	1.9
Bi	mg kg^{-1}				0.26									
Br	mg kg^{-1}							0.69						
C(org)	mg kg^{-1}								57100					
C(tot)	mg kg^{-1}	75846		75100					70800		**72207**	70841		
Cd	mg kg^{-1}	14.273			14.3				11.5				**9.81**	
Ce	mg kg^{-1}	117.417	122.8	112	116		142.704					106.2	**135.6**	115.5
Cl	mg kg^{-1}													
Co	mg kg^{-1}	15.23	17.4	15	14.3	20	15.695		14.93	16.7		13.14	**17.3**	9.3
Cr	mg kg^{-1}	48.47	55.6	47	52.9	95	47.33	47.594	56.23	79.4		47.84	**56.5**	46.4
Cs	mg kg^{-1}	3.417			3.64			2.031				2.12	**3.85**	3
Cu	mg kg^{-1}	103.260	101		109	103	125.636	63.836	74.24	95.6		84.07	**116.6**	60.7
Dy	mg kg^{-1}	12.905	13.31		13.86		5.66					10.96	**14.47**	12.1
Er	mg kg^{-1}	6.622	6.6		6.24		3560.500					5.89	**7.43**	6.1
Eu	mg kg^{-1}	3.268	3.2		3.49		4.592					2.76	**3.57**	3
F	mg kg^{-1}					1473								
Ga	mg kg^{-1}	10.592	11		11.3	19		11.183				10.15	**11.84**	11.2
Gd	mg kg^{-1}	14.944	14.88		13.4		6.493					12.92	**16.94**	14.2
Ge	mg kg^{-1}		1.38											
Hf	mg kg^{-1}	3.226	4.68		4.05							3.54	**4.6**	4.1
Hg	mg kg^{-1}													
Ho	mg kg^{-1}	2.538	2.45		2.31							2.13	**2.88**	2.5
I	mg kg^{-1}							2.031						
In	mg kg^{-1}	0.100												
Ir	mg kg^{-1}													
La	mg kg^{-1}	46.899	55.78	45	46.5		57.31			37		42.79	**54.1**	46.8
Li	mg kg^{-1}	13.58			13.2		16.924						**16.14**	
Lu	mg kg^{-1}	0.666	0.75		0.65		0.675					0.6	**0.762**	0.7
Mo	mg kg^{-1}	526.885	450.130	491	583		495.668	413.949	556.1			471.170	**547**	520.6
N	mg kg^{-1}													
Nb	mg kg^{-1}	9.567	10.56		10.5	31	55.464	10.829		12.5		8.48	**11.43**	9.7
Nd	mg kg^{-1}	65.28	69.02		69.7		39.535	48.912				56.3	**73.5**	62.5
Ni	mg kg^{-1}	164.390	125	140	171	147	159.178	94.987	152.8	152		142.620	**187.2**	146.7
Pb	mg kg^{-1}	217.110	254		238	260	203.226	152.514	129.8	175.5		195.870	**250**	149.4
Pd	mg kg^{-1}													
Pr	mg kg^{-1}	15.759	16.31		14.8		7.744					13.44	**17.83**	15.3
Pt	mg kg^{-1}													
Rb	mg kg^{-1}	84.357	83.24		77.4	90	89.79	64.198	68.6	119		69.53	**90.2**	76.1
Re	mg kg^{-1}				0.13									
Rh	mg kg^{-1}													
Ru	mg kg^{-1}													
S	mg kg^{-1}	57966		56200		48900		50227.570		45441	**55047**	57895		
Sb	mg kg^{-1}	14.497			15.02				9.942			11.03	**15.89**	
Sc	mg kg^{-1}	9.14	10		9.79	10	8.172					8.01	**11.89**	
Se	mg kg^{-1}				6.46									
Sm	mg kg^{-1}	14.839	14.7		15.7							12.76	**16.49**	14.1
Sn	mg kg^{-1}	1.43			1.94				1.754				**2.25**	0.5
Sr	mg kg^{-1}	75.91	72		80	85	79.403	53.346	68.74	67.4		67.32	**85.5**	73.8
Ta	mg kg^{-1}	0.669	0.9		0.67		1.801					0.61	**0.838**	1.1
Tb	mg kg^{-1}	2.237	2.37		2.09							1.8	**2.52**	2.2
Te	mg kg^{-1}													
Th	mg kg^{-1}	11.540	13.12		14			9.064		9.9		11.07	**13.2**	12.4
Tl	mg kg^{-1}				11.3								**12.07**	0.1
Tm	mg kg^{-1}	0.849	0.9		0.84							0.7	**0.997**	0.9
U	mg kg^{-1}	240.972	245.060		253	255		135.386				211.450	**251**	233.2
V	mg kg^{-1}	785.7	800	808	830	856	833.882	741.313	841.4	541.2		678.690	**850**	783.3
W	mg kg^{-1}	1.279			1.28		44.34						**1.481**	2
Y	mg kg^{-1}	77.945	77.78	71	75.1	73	88.394	53.548		53.3		67.22	**84.6**	78.4
Yb	mg kg^{-1}	4.960	5.31		4.69		4.77					4.34	**5.74**	4.9
Zn	mg kg^{-1}	3085	2650	2677	3130	2440	2738.479	2147.583	2925	2247	**2748**	2626.150	**3339**	3168
Zr	mg kg^{-1}	122	145	131		144	81.785	110.981		105.9	**104**	122.090	**167.1**	141.4

Bold entries are Data Quality 1 - Underlined entries are Data Quality 2

Table 1 - GeoPT52 Contributed data for Metalliferous shale, EMS-1. 16/12/2022

Lab Code		R57	R59	R60	R62	R63	R65	R66	R67	R68	R69	R70	R71	R72
SiO2	g 100g^{-1}	42.043	**41.48**	43.451		**46.099**	43.52	43.15	**43.86**	41.519	49.26	**43.49**	44.17	41.64
TiO2	g 100g^{-1}	0.476	**0.56**	0.501		**0.553**	0.5	0.488	**0.502**	0.451	0.52	**0.49**	0.48	0.48
Al2O3	g 100g^{-1}	7.787	**7.36**	7.958		**8.545**	7.94	7.884	**8.075**	7.805	8.75	**8.25**	8.26	7.64
Fe2O3T	g 100g^{-1}	8.03	**9.79**	8.210		**8.93**	8.33	8.151	**8.202**	8.06	8.57		8.31	7.98
Fe(II)O	g 100g^{-1}							3.85			2.69	**8.08**		
MnO	g 100g^{-1}	0.108	**0.11**	0.101		**0.111**	0.09	0.108	**0.102**	0.107	0.11	**0.1**	0.1	0.1
MgO	g 100g^{-1}	1.259	**1.12**	1.318		**1.332**	1.28	1.246	**1.208**	1.223	1.31	**1.24**	1.29	1.22
CaO	g 100g^{-1}	8.304	**9.49**	8.599		**9.453**	8.78	8.621	**8.712**	8.325	8.16	**8.47**	8.54	8.46
Na2O	g 100g^{-1}	0.16	**0.22**	0.163		**0.12**	0.1	0.098	**0.212**		0.2		0.37	0.06
K2O	g 100g^{-1}	4.843	**5.27**	4.954		**5.416**	5.16	4.939	**5.009**	5.038	5.52	**4.87**	5.18	4.86
P2O5	g 100g^{-1}	0.845	**0.92**	0.874		**0.920**	0.88	0.872	**0.831**	0.944	1.05	**0.8**	0.88	0.87
H2O+	g 100g^{-1}							6.45						
CO2	g 100g^{-1}							4.745						
LOI	g 100g^{-1}	18.82	18.11	17.134		**3.36**	13.55	17.8	20.85	16.91		**15.96**	19.35	13.48
Ag	mg kg^{-1}			2.3			2	2.22						2.04
As	mg kg^{-1}	169	**143**		**182.330**	**152.1**	188	169.5	138.2		112		144	169.5
Au	mg kg^{-1}													
B	mg kg^{-1}													
Ba	mg kg^{-1}	328	312	325.830		**374**	338	317.9	320.3		348	**380**	367	337
Be	mg kg^{-1}			1.6	**1.98**		3.67	1.34			1.83			1.8
Bi	mg kg^{-1}			0.3		**0.7**	0.3	0.2						0.223
Br	mg kg^{-1}													
C(org)	mg kg^{-1}							58986.500						54900
C(tot)	mg kg^{-1}			68999		**107200.000**	79000	71930		70100				68700
Cd	mg kg^{-1}	17		17.2			21.5	15.26	16					16.45
Ce	mg kg^{-1}	115	155	109.9	**119.820**	**115**	125	110.9	119.4		93.09			128
Cl	mg kg^{-1}													
Co	mg kg^{-1}	23	16	16			14	15.65	18.1		20		17	15.3
Cr	mg kg^{-1}	54		59.6		**53.1**	64	50.5	55.6		77		45	43.6
Cs	mg kg^{-1}			4.2			3.3	3.35						3.75
Cu	mg kg^{-1}	105	**119**	98.1		**106.2**	114	96	97.9		111			104
Dy	mg kg^{-1}			11.9	**13.18**	**12.44**	12.4	12.29			11.17			11.7
Er	mg kg^{-1}			6.5	**6.5**		6.45	6.45			5.7			6.34
Eu	mg kg^{-1}			2.9	**2.8**		2.9	3.105			2.7			2.88
F	mg kg^{-1}					**0.76**			1837					
Ga	mg kg^{-1}	13				**9.6**	14	10.5			6			10.6
Gd	mg kg^{-1}			14	**13.23**		16	14.015	19.3		12.44			14
Ge	mg kg^{-1}			8.5	**1.5**		2	2			1.42			0.3
Hf	mg kg^{-1}			2.9	**4.74**	**5.6**	4	4			5.46			3.07
Hg	mg kg^{-1}							0.465						
Ho	mg kg^{-1}			2.3	**2.46**		2.42	2.47			2.16			2.36
I	mg kg^{-1}													
In	mg kg^{-1}						0.152							0.106
Ir	mg kg^{-1}													
La	mg kg^{-1}	52	**64**	43.2	**52.09**	**50.4**	53	42.4	48.4		47.65			46.1
Li	mg kg^{-1}						15	12.05						15.4
Lu	mg kg^{-1}			0.6	**0.75**		0.73	0.74			0.63			0.62
Mo	mg kg^{-1}		600	562		**469.5**	563	543.250	546.6	540				555
N	mg kg^{-1}													
Nb	mg kg^{-1}		**10**	7.1		**7.47**	12	9.5			14		11	9.47
Nd	mg kg^{-1}	51		59.6	**69.72**	**65**	62.8	63.55	67.3		51.84			61.6
Ni	mg kg^{-1}	145	**169**	166.7		**178.4**	173	147.450	149.1		148			177.5
Pb	mg kg^{-1}	228	**209**			**246.1**	228	213.950	204.7		206		209	254
Pd	mg kg^{-1}			0.3										
Pr	mg kg^{-1}			14	**15.74**		14.8	13.85	14.6		14.91			15.1
Pt	mg kg^{-1}			0.03										
Rb	mg kg^{-1}		**60**	84.7	**83.56**	**83**	87	75.65	70.7		76.86		71	79.6
Re	mg kg^{-1}			0.16			0.141							0.126
Rh	mg kg^{-1}													
Ru	mg kg^{-1}			0.03										
S	mg kg^{-1}		61000	57614		**3.707**	61400	58602.500	50715	59300		**25400**		5.96
Sb	mg kg^{-1}			12.4		**36.3**	15	15.82	15.5					14.75
Sc	mg kg^{-1}		12	13.1		**9.6**	16.6		9.2		9		13	8.86
Se	mg kg^{-1}						11.6							4.39
Sm	mg kg^{-1}			13.2	**14.51**	**13.8**	14.3	11.845	18.2		12.93			12.95
Sn	mg kg^{-1}			2.1	**2.35**	**6.4**	5				2.37			1.84
Sr	mg kg^{-1}	79	**74**	88.5		**77.6**	87.3	75.95	70.3		72		69	84.2
Ta	mg kg^{-1}			0.7	**0.88**	**0.6**	0.8	0.75			0.79			0.64
Tb	mg kg^{-1}			2.1	**2.17**		2.06	1.915			1.99			2.09
Te	mg kg^{-1}			0.2			0.32							0.228
Th	mg kg^{-1}	13		12.8	**13.09**	**13.7**	23	10.98	13.3		11.19			11.95
Tl	mg kg^{-1}			17.7			10.3	9.67	10.2					9.34
Tm	mg kg^{-1}			0.8	**0.86**		0.79	0.855			0.8			0.76
U	mg kg^{-1}			253.3	**244.310**	**165.8**	268	208.5	225	220	167.260		225	265
V	mg kg^{-1}	1249	781	733.970		**818.2**	884	764.350	853.8	661	725	**780**	879	850
W	mg kg^{-1}						1.4	1						1.065
Y	mg kg^{-1}	80	**81**	77.2		**83.1**	84	68.86	71.7		85		72	73.6
Yb	mg kg^{-1}			4.6	**5.3**	**2.58**	4.88	4.41			4.52			4.77
Zn	mg kg^{-1}	2967	**3200**	2756.800		**3158.900**	4470	3005	2632	3189	2880	**3000**	2544	3380
Zr	mg kg^{-1}	144	**181**	103.7		**153.5**	156	146.5	48.4	111	137		140	158

Bold entries are Data Quality 1 - Underlined entries are Data Quality 2

Table 1 - GeoPT52 Contributed data for Metalliferous shale, EMS-1. 16/12/2022

Lab Code		R73	R74	R75	R77	R78	R79	R80	R81	R82	R83	R84	R85	R88
SiO2	g 100g^{-1}	43.036		**43.61**	**42.95**	42.963	**47.83**	43.24	**41.91**	49.02		42.8		43.5
TiO2	g 100g^{-1}	0.49	**0.473**	**0.564**	**0.48**	0.484	**0.63**	0.48	**0.478**	0.54	**0.52**	0.535		0.495
Al2O3	g 100g^{-1}	7.869	**8.55**	**8.05**	**7.94**	7.795	**9.12**	7.89	**7.83**	8.8	**8.18**	9.64		7.99
Fe2O3T	g 100g^{-1}	8.149	**8.177**	**8.159**	**8.11**	8.134	**8.92**	8.3	**8.16**	9.43	**8.277**	7.74		8.215
Fe(II)O	g 100g^{-1}													
MnO	g 100g^{-1}	0.102	**0.107**	**0.115**	**0.099**	0.14	**0.113**	0.1	**0.104**	0.96	**0.105**	0.085		0.101
MgO	g 100g^{-1}	1.253	**1.18**	**1.28**	**1.25**	1.264	**1.31**	1.25	**1.2**	1.48	**1.14**			1.26
CaO	g 100g^{-1}	8.521	**7.62**	**8.576**	**8.58**	8.545	**10.71**	8.68	**8.19**	9.91	**8.67**	9.25		8.57
Na2O	g 100g^{-1}	0.161	**0.068**	**0.185**	**0.13**	0.031	**0.04**	0.09	**0.1**	0.22	**0.079**			
K2O	g 100g^{-1}	4.945	**4.95**	**4.89**	**5**	5.027	**5.89**	4.93	**4.857**	5.45	**5.023**	5.47		4.96
P2O5	g 100g^{-1}	0.86	**0.807**	**0.844**	**0.86**	0.871	**0.9**	0.87	**0.846**	1.052				0.856
H2O+	g 100g^{-1}				**3.46**		**6.12**	5.7						
CO2	g 100g^{-1}							4.9						
LOI	g 100g^{-1}	17.47		**22.22**	**22.84**	23.236		18.5	**17.44**	14.1				16.61
Ag	mg kg^{-1}							2.04	**2.04**					
As	mg kg^{-1}		**116.2**	**125**	**146**	171		192	142	139.4	**164**	167		150.6
Au	mg kg^{-1}										**0.019**			
B	mg kg^{-1}		**69.5**											
Ba	mg kg^{-1}		**352.530**	**315**	**353**	312	**378**	334	308	341.2	**370**	324.8	**324.996**	325
Be	mg kg^{-1}		**1.76**					1.92	**1.78**				**1.88**	
Bi	mg kg^{-1}							0.24						
Br	mg kg^{-1}								10.9					
C(org)	mg kg^{-1}							52800						
C(tot)	mg kg^{-1}						**12500**	71100		70824				
Cd	mg kg^{-1}		**15.94**					17.5	14.9	15.7		17.5		
Ce	mg kg^{-1}		**159.810**	**110**	**114**	104	**117**	129.5	**115**	110.3	**121**	110.3	**113.435**	117.2
Cl	mg kg^{-1}			**141**			29	130						
Co	mg kg^{-1}		**15.165**	**18**	**15**	10	**22**	17.5	14.7	14.4	**15.4**		**14.021**	
Cr	mg kg^{-1}		**42.105**		**51**		**81**	50.8	41.3	43.9	**48**	312	**44.297**	
Cs	mg kg^{-1}				**10**			3.94	11.2		**3.7**		**3.143**	
Cu	mg kg^{-1}		**113.142**	**97**	**92**	109	**115**	118	80.3	88.3		109.3	**97.812**	100.3
Dy	mg kg^{-1}		**14.633**					13.75	**12.6**		**13.9**		**12.508**	
Er	mg kg^{-1}		**6.58**					6.98	**6.76**				**6.166**	
Eu	mg kg^{-1}		**3.308**					3.66	**3.23**		**3.14**		**3.075**	
F	mg kg^{-1}			**1892**			1077	1240						1670
Ga	mg kg^{-1}		**18.62**	**11**	**9**	22	**14**	12.5	10.3	13.2	**9.1**		**10.881**	
Gd	mg kg^{-1}		**16.786**					16.4	**15.1**				**14.351**	
Ge	mg kg^{-1}							0.36						
Hf	mg kg^{-1}				**2**	11	**8**	3.15	**3.93**	23.7	**3.92**		**3.879**	
Hg	mg kg^{-1}							0.164		0.2				
Ho	mg kg^{-1}		**2.452**					2.69	**2.42**				**2.38**	
I	mg kg^{-1}								1.7					
In	mg kg^{-1}							0.118						
Ir	mg kg^{-1}													
La	mg kg^{-1}			**14**	**49**	41	**65**	49.4	**47.6**	48.6	**46.7**	41.3	**47.468**	
Li	mg kg^{-1}							16.3					**12.375**	
Lu	mg kg^{-1}		**0.712**					0.691	**0.68**				**0.649**	
Mo	mg kg^{-1}		**664.820**	**208**	**489**	621	**478**	575	**447**	537.4	**520**	520.5	**505.401**	534.2
N	mg kg^{-1}													
Nb	mg kg^{-1}				**8**	35	**13**	10.75	9.27	8.4			**9.756**	
Nd	mg kg^{-1}		**80.82**	**55**	**71**	63	**60**	69.6	**64.4**	68	**63**	60	**60.719**	
Ni	mg kg^{-1}		**162.140**	**158**	**146**	164	**140**	193	139	140.9	**150**		**152.299**	152.2
Pb	mg kg^{-1}		**285.840**	**87**	**206**	199	**322**	257	209	202.7		300	**239.963**	
Pd	mg kg^{-1}													205.5
Pr	mg kg^{-1}		**16.87**					16.9	**14.4**				**15.044**	
Pt	mg kg^{-1}													
Rb	mg kg^{-1}			**61**	**71**	100	**1102**	92.4	66.6	71.8	**82**	82.1	**76.314**	81.5
Re	mg kg^{-1}							0.138						
Rh	mg kg^{-1}		**0.007**											
Ru	mg kg^{-1}													
S	mg kg^{-1}			**111017.000**	**1**		57543	64800	41500	66614		51321		
Sb	mg kg^{-1}					12		16.85	13.5	10.6	**14.5**			
Sc	mg kg^{-1}		**11.47**	**11**	**6**		**14**	10.15	12.7	31.4	**9.41**		**8.927**	
Se	mg kg^{-1}		**4.05**		**4**	3		4.97	4.23	6.2	**5**			
Sm	mg kg^{-1}		**16.26**		**15**			15.7	**14.7**	19.7	**10.8**		**13.788**	
Sn	mg kg^{-1}					2	**1**	1.88	1.95	2.8			**1.874**	
Sr	mg kg^{-1}		**75.23**	**51**	**69**	72	**78**	95.9	63.5	66.4	**150**	76.3	**72.291**	73.2
Ta	mg kg^{-1}						**3**	0.76	**0.47**		**0.63**		**0.743**	
Tb	mg kg^{-1}		**2.179**					2.43	**2.24**		**2.17**		**2.169**	
Te	mg kg^{-1}		**0.408**					0.209						
Th	mg kg^{-1}		**21.62**		**11**	10	**12**	12.95	8.79	8.2	**12.4**		**12.291**	
Tl	mg kg^{-1}		**11.33**		**7**			11.35	**10.6**	11.7			**10.061**	
Tm	mg kg^{-1}		**0.822**					0.901	**0.87**				**0.807**	
U	mg kg^{-1}		**303.080**	**69**	**223**	235	**208**	266	220	229.6	**230**	205	**252.619**	215
V	mg kg^{-1}		**729.087**	**913**	**828**	683	**902**	847	730	844.9	**830**	386.2	**720.793**	817.2
W	mg kg^{-1}				**2**			1.235			**1.2**		**1.3**	
Y	mg kg^{-1}			**45**	**71**	74		83.2	66.9	72.3			**75.94**	72
Yb	mg kg^{-1}		**5.04**		**4**			5.2	**5.15**	2.6	**4.85**		**4.846**	
Zn	mg kg^{-1}		**3254.490**	**2632**	**2704**	2980	**2464**	3530	2512	2567.200	**3180**	3008.500	**2788.289**	2741
Zr	mg kg^{-1}		**122.690**	**139**	**133**	136	**132**	123.5	121	133.6	**300**	142.6	**138.843**	140.1

Bold entries are Data Quality 1 - Underlined entries are Data Quality 2

Table 1 - GeoPT52 Contributed data for Metalliferous shale, EMS-1. 16/12/2022

Lab Code		R92	R93	R98	R99	R100	R105	R106	R108	R109	R110	R114	R115	R116
SiO2	g 100g^{-1}	43.32	43.24	42.825	42.8		43.59		50.02	40.91	43.36	47.6	45.51	
TiO2	g 100g^{-1}	0.45	0.49	0.492	0.5	0.561	0.492		0.59	0.47	0.46	0.47	0.56	
Al2O3	g 100g^{-1}	7.82	7.96	7.759	7.98		7.814		9.67	7.79	7.9	8.47	8.63	
Fe2O3T	g 100g^{-1}	7.98	8.41	8.231	8.1		8.256		8.73	7.91	8.38	6.03	8.51	
Fe(II)O	g 100g^{-1}		4.054							5.51				
MnO	g 100g^{-1}	0.1	0.1	0.106	0.06	0.098	0.104		0.11	0.09	0.1	0.09	0.11	
MgO	g 100g^{-1}	1.26	1.23	1.304	1.23		1.212		3.57	1.44	1.23	1.27	1.38	
CaO	g 100g^{-1}	9.12	8.82	8.642	8.52		8.774		9.07	8.3	8.12	6.5	8.72	
Na2O	g 100g^{-1}	0.14	0.08	0.088	0.15		0.150		0.17	0.91	0.16	0.24	0.06	
K2O	g 100g^{-1}	4.76	5.03	5.242	4.96		4.971		5.05	4.8	4.99	5.22	5.15	
P2O5	g 100g^{-1}	0.89	0.9	0.768	0.88		0.872		0.83	0.88	0.87	0.76	0.94	
H2O+	g 100g^{-1}		4.439											
CO2	g 100g^{-1}		25.731											
LOI	g 100g^{-1}	17.37	23.3	16.44	22.48		15.61		12.16	15.17	19.76	17.48	19.6	
Ag	mg kg^{-1}		1.844	1.78		1.885				1.37				
As	mg kg^{-1}		157	155.360		158.7	163.4	132		177.740	143			152.3
Au	mg kg^{-1}					0.006								
B	mg kg^{-1}		76.822	44.24										
Ba	mg kg^{-1}	327	318	331		339.9	242.6	378.9	322	329.330	334	272		311.9
Be	mg kg^{-1}	1.81	1.77					2.08						1.86
Bi	mg kg^{-1}		0.21			0.212								0.203
Br	mg kg^{-1}													
C(org)	mg kg^{-1}		57665				58230							
C(tot)	mg kg^{-1}			71348			75270							
Cd	mg kg^{-1}		14.9	15.11		15.592		19.35		12.95	12			15.47
Ce	mg kg^{-1}	119	114	111.880		123.3	118.6	105.1			130			108.8
Cl	mg kg^{-1}		89.255											
Co	mg kg^{-1}	14.8	14.6	12.81		16.4	18.19	16.26	2	11.41	12	21		13.33
Cr	mg kg^{-1}	49.6	51.3	40.02		66.6	90.69		124	45.89	65	77		43.58
Cs	mg kg^{-1}	3.18	3.14	2.5										3.05
Cu	mg kg^{-1}	98.1	107	92.72		102.7	121.2	96.91	82	104.930	106	71		93.25
Dy	mg kg^{-1}	11.8	12.3	12.22				12.42						11.85
Er	mg kg^{-1}	6.09	6.06	6.25				5.75						6.18
Eu	mg kg^{-1}	2.72	3.08	3.02				2.97						2.98
F	mg kg^{-1}		1280								1336		1800	
Ga	mg kg^{-1}	11.7	11.7			10.34	12.31	12.41			10			14.29
Gd	mg kg^{-1}	13.6	13.5	14.49				15.31						14.55
Ge	mg kg^{-1}	1.12	1.73											11.02
Hf	mg kg^{-1}	3.61	3.82											2.96
Hg	mg kg^{-1}		0.211			0.185								
Ho	mg kg^{-1}	2.29	2.46	2.31				2.03						2.23
I	mg kg^{-1}													
In	mg kg^{-1}		0.1			0.089								0.101
Ir	mg kg^{-1}													
La	mg kg^{-1}	44.3	45	44.83		59.4	24.65	41.67			61	26		42.72
Li	mg kg^{-1}	13.1	13.548					10.9						13.15
Lu	mg kg^{-1}	0.62	0.649	0.6				0.61						0.629
Mo	mg kg^{-1}		550	591.770		559.920	578.2			521.830		540	600	511.5
N	mg kg^{-1}			1855										
Nb	mg kg^{-1}	10.1	8.24			10.23			1			15		8.46
Nd	mg kg^{-1}	60.1	61.8	63.03			57.4	64.35			86			59.18
Ni	mg kg^{-1}	158	158	144.690		153.920	165.5	174.570	74	148.590	132	89		144.4
Pb	mg kg^{-1}	204	221	288.160		213.050	240.5	204	339	220.270	166	27	370	190.5
Pd	mg kg^{-1}													2.52
Pr	mg kg^{-1}	14.3	14.5	18.81				13.25						13.93
Pt	mg kg^{-1}													
Rb	mg kg^{-1}	78.1	76.5	79		75.42	88.38		31		87	181		72.42
Re	mg kg^{-1}													
Rh	mg kg^{-1}													
Ru	mg kg^{-1}													
S	mg kg^{-1}		54948	49674						57693.330	42449	59300	52800	
Sb	mg kg^{-1}		13.5	11.01		9.085	18.52			9.22				7.33
Sc	mg kg^{-1}	9.55	9.82	7.92		10.6	21.74	8.6	1	8.74	9			9.47
Se	mg kg^{-1}		4.285	4.24		4.078				4.49				9.39
Sm	mg kg^{-1}	13.7	14	13.97				13.64						13.36
Sn	mg kg^{-1}		1.74							3.6				1.499
Sr	mg kg^{-1}	74.2	72.3	63		70.62	73.91		45	75.1	68	45		68.74
Ta	mg kg^{-1}	0.72	0.8											0.667
Tb	mg kg^{-1}	2.07	2.07	2.1				1.93						2.12
Te	mg kg^{-1}					0.187								
Th	mg kg^{-1}	11.2	11.6	11.97		11.01	20.69				4			
Tl	mg kg^{-1}			6.96		4.021				7.36				8.99
Tm	mg kg^{-1}	0.8	0.812	0.78				0.66						0.763
U	mg kg^{-1}	207	218	203		237.470	265.4			166.9	213	20		
V	mg kg^{-1}	752	760	774		876.340	658	757	578	776.250	723	382	840	745.2
W	mg kg^{-1}		1.53											
Y	mg kg^{-1}	79.7	72.8	76.61		74.91	86.75	68.1	20		87	33		66.6
Yb	mg kg^{-1}	4.63	4.73	4.53				4.8						4.59
Zn	mg kg^{-1}	2698	3427	3240		2681.360	2920	2872	3769	3037.120	2974	2379	3450	2865
Zr	mg kg^{-1}	143	142	139		138.510	164.3		106		132	101		107.1

Bold entries are Data Quality 1 - Underlined entries are Data Quality 2

Table 1 - GeoPT52 Contributed data for Metalliferous shale, EMS-1. 16/12/2022

Lab Code		R117	R119	R121	R122	R123	R124	R125	R126	R128	-	-	-	-
SiO2	g 100g^{-1}	40.44	43.99	43.33		43.196	**42.45**	43.49	44.72					
TiO2	g 100g^{-1}	0.494	0.519	0.49	**0.466**	0.509	**0.502**	0.5	0.565	0.481				
Al2O3	g 100g^{-1}	7.88	8.731	7.94	**7.8**	8.137	**7.77**	7.97	8.187	7.83				
Fe2O3T	g 100g^{-1}	8.278	8.641	8.35	**8.05**	7.79	**8.17**	8.34	8.551	8.11				
Fe(II)O	g 100g^{-1}													
MnO	g 100g^{-1}	0.1	0.093	0.1	**0.097**	0.105	**0.1**	0.108	0.117	0.102				
MgO	g 100g^{-1}	1.239	1.29	1.27	**1.23**	1.246	**1.23**	1.28	1.315	1.28				
CaO	g 100g^{-1}	8.831	8.74	8.46	**8.62**	8.943	**8.55**	8.678	9.537	8.4				
Na2O	g 100g^{-1}	0.081		0.12	**0.075**		**0.07**	0.07	0.167					
K2O	g 100g^{-1}	5.171	4.963	5.04	**4.88**	4.971	**4.92**	4.861	5.441	4.98				
P2O5	g 100g^{-1}	0.823	0.885	0.86	**0.877**	0.898	**0.853**	0.883	0.946	0.761				
H2O+	g 100g^{-1}													
CO2	g 100g^{-1}													
LOI	g 100g^{-1}		12.168	14.28		17.68	**20.54**	14.71						
Ag	mg kg^{-1}	1.876								1.823				
As	mg kg^{-1}	167.5	350	151.8		32.18		168		167				
Au	mg kg^{-1}									0.096				
B	mg kg^{-1}	65.07												
Ba	mg kg^{-1}	335		380.6	**357.3**	326.170	**387**	306		350				
Be	mg kg^{-1}	2.196				2.01		1.94		1.93				
Bi	mg kg^{-1}	0.232								0.204				
Br	mg kg^{-1}													
C(org)	mg kg^{-1}													
C(tot)	mg kg^{-1}													
Cd	mg kg^{-1}	15.52			**34.77**			13.6		15.6				
Ce	mg kg^{-1}	106.4		155	**121.920**	110.040	**101**	125						
Cl	mg kg^{-1}													
Co	mg kg^{-1}	13.98			**14.39**	12.32	**17**	13		13.34				
Cr	mg kg^{-1}	60.08		33.7	**49.38**	51.35		49.5		46.14				
Cs	mg kg^{-1}	3.339			**3.37**	3.09	**2.91**	3.3		3.27				
Cu	mg kg^{-1}	92.67		102.1	**96.07**	80.48	**109**	101		94.94				
Dy	mg kg^{-1}	11.91			**12.06**	12.7	**10.2**	12.8						
Er	mg kg^{-1}	5.928			**6.05**	6.4	**5.07**	6.56						
Eu	mg kg^{-1}	2.921			**2.96**	3.19	**3**	3.14						
F	mg kg^{-1}						1487							
Ga	mg kg^{-1}	8.547		9.9	**11.02**	13.98	**9**	10.3		7.848				
Gd	mg kg^{-1}	13.66			**14.66**	15.01	**12.1**	15.2						
Ge	mg kg^{-1}							1.92		0.86				
Hf	mg kg^{-1}	3.315			**3.31**	3.51	**3.53**	4.1						
Hg	mg kg^{-1}					0.16		0.183						
Ho	mg kg^{-1}	2.341			**2.4**	2.43	**2.08**	2.45						
I	mg kg^{-1}													
In	mg kg^{-1}									0.107				
Ir	mg kg^{-1}													
La	mg kg^{-1}	43.35		53	**48.9**	46.04	**40.5**	46.6						
Li	mg kg^{-1}	11.86			**13.43**	11.33				13.5				
Lu	mg kg^{-1}	0.614			**0.651**	0.67	**0.56**	0.647						
Mo	mg kg^{-1}	544			**529.1**	452.710		515		539				
N	mg kg^{-1}													
Nb	mg kg^{-1}	8.891		3	**10.28**	8.65	**14.7**	9.8		7.651				
Nd	mg kg^{-1}	59.87			**62.59**	62.92	**58**	62.9						
Ni	mg kg^{-1}	167.1		155.8	**161.4**	122.5	**165**	168		156.8				
Pb	mg kg^{-1}	230		344	**220**	69.36	**257**	227		223.2				
Pd	mg kg^{-1}													
Pr	mg kg^{-1}	13.76			**15.1**	15.35	**13.1**	15.7						
Pt	mg kg^{-1}													
Rb	mg kg^{-1}	74.36	81	64.9	**81.49**	76.52	**86**	72.8						
Re	mg kg^{-1}													
Rh	mg kg^{-1}													
Ru	mg kg^{-1}													
S	mg kg^{-1}	58525					39075							
Sb	mg kg^{-1}	13.51				3.26		14		14.91				
Sc	mg kg^{-1}			13.2	**9.51**	8.89	**19**	10.4		9.549				
Se	mg kg^{-1}	4.776												
Sm	mg kg^{-1}	13.1			**13.88**	14.09	**12.1**	14.5						
Sn	mg kg^{-1}	1.67						1.3		1.858				
Sr	mg kg^{-1}	70.9	76	71.7	**73.08**	69.58	**79**	73		79.25				
Ta	mg kg^{-1}	0.665			**0.712**	0.67		0.678		0.97				
Tb	mg kg^{-1}	2.027			**2.19**	2.2	**1.88**	2.16						
Te	mg kg^{-1}													
Th	mg kg^{-1}	9.907		11.4	**12.06**	11.94	**10.5**	10.5		12.52				
Tl	mg kg^{-1}	10.26				4.5				9.593				
Tm	mg kg^{-1}	0.792			**0.833**	0.83	**0.69**	0.837						
U	mg kg^{-1}	238		255.7	**228.1**	224.3	**265**	228		212				
V	mg kg^{-1}	762	1010	871.3	**758.6**	763.350	**872**	779		756.7				
W	mg kg^{-1}	0.832								0.957				
Y	mg kg^{-1}	70.94		82.3	**81.7**	77.43	**79**	76.2						
Yb	mg kg^{-1}	4.57			**4.72**	4.96	**4.05**	4.9						
Zn	mg kg^{-1}	3186	2760	2778.500	**3060**	2984.500	**3043**	3238		3027				
Zr	mg kg^{-1}	126.8	33	182.7	**124.1**	123.910	**152**	141						

Bold entries are Data Quality 1 - Underlined entries are Data Quality 2

Table 2 - GeoPT52 Consensus values and statistical summary for Metalliferous shale, EMS-1.

	Consensus Value	Uncertainty of consensus value	Horwitz Target Precision	Uncertainty/ Target Precision	Number of reported results	Robust Mean of results	Robust SD of results	Median of results	Status of consensus value	Type of consensus value
	X_{pt}	$u(X_{pt})$	σ_{pt}	$u(X_{pt}) / \sigma_{pt}$	n					
	g 100g $^{-1}$	g 100g $^{-1}$	g 100g $^{-1}$			g 100g $^{-1}$	g 100g $^{-1}$	g 100g $^{-1}$		
SiO2	43.27	0.1975	0.4909	0.4024	74	43.52	2.064	43.27	Assigned	Median
TiO2	0.4911	0.00341	0.01093	0.312	80	0.4911	0.0305	0.49	Assigned	Robust Mean
Al2O3	7.89	0.03141	0.1156	0.2716	80	7.998	0.3565	7.949	Assigned	Mode
Fe2O3T	8.152	0.0369	0.1189	0.3104	79	8.152	0.328	8.16	Assigned	Robust Mean
MnO	0.1015	0.000928	0.002865	0.3239	80	0.1015	0.0083	0.1	Assigned	Robust Mean
MgO	1.252	0.006312	0.0242	0.2608	78	1.262	0.06084	1.252	Assigned	Median
CaO	8.576	0.0464	0.1241	0.3738	80	8.524	0.3656	8.543	Assigned	Mode
K2O	4.965	0.02381	0.07802	0.3052	80	4.965	0.213	4.962	Assigned	Robust Mean
P2O5	0.8691	0.006171	0.01775	0.3476	76	0.8624	0.05013	0.8691	Assigned	Median
	mg kg $^{-1}$	mg kg $^{-1}$	mg kg $^{-1}$			mg kg $^{-1}$	mg kg $^{-1}$	mg kg $^{-1}$		
Ag	1.881	0.06025	0.1368	0.4405	20	1.906	0.2385	1.881	Assigned	Median
As	158.7	6	5.921	1.013	53	149.2	25.96	152.3	Provisional	Mode
Ba	332.3	2.562	11.09	0.231	76	332.3	22.33	332	Assigned	Robust Mean
Be	1.845	0.02956	0.1346	0.2197	32	1.863	0.1832	1.845	Assigned	Median
Bi	0.2138	0.004502	0.02157	0.2088	18	0.2448	0.05035	0.2238	Assigned	Mode
C(tot)	71350	873	1062	0.8223	25	71780	3923	71350	Provisional	Median
Cd	15.5	0.2147	0.8207	0.2617	41	15.59	1.684	15.5	Assigned	Median
Ce	116	1.432	4.537	0.3157	59	116.7	9.22	116	Assigned	Median
Co	14.8	0.301	0.7891	0.3814	64	15.17	2.213	15	Assigned	Mode
Cr	48	2.07	2.144	0.9655	64	53.92	12.71	50.9	Provisional	Mode
Cs	3.253	0.0586	0.2179	0.2689	36	3.334	0.4297	3.319	Assigned	Mode
Cu	98.05	2.44	3.933	0.6204	70	100.1	12.21	100.7	Provisional	Mode
Dy	12.24	0.1642	0.6713	0.2447	41	12.24	1.052	12.22	Assigned	Robust Mean
Er	6.244	0.06477	0.3791	0.1708	39	6.244	0.4045	6.24	Assigned	Robust Mean
Eu	3	0.03305	0.2034	0.1625	40	3.038	0.2189	3	Assigned	Median
Ga	10.88	0.341	0.6076	0.5612	49	11.5	2.177	11.02	Provisional	Mode
Gd	14.35	0.299	0.7687	0.389	40	14.17	1.466	14.11	Assigned	Mode
Hf	3.827	0.1257	0.2501	0.5025	40	3.827	0.7948	3.772	Provisional	Robust Mean
Hg	0.185	0.01401	0.01907	0.7343	11	0.1892	0.04351	0.185	Provisional	Median
Ho	2.353	0.03376	0.1655	0.204	38	2.329	0.1925	2.353	Assigned	Median
In	0.103	0.002057	0.0116	0.1773	10	0.1042	0.009604	0.103	Provisional	Median
La	46.65	0.8686	2.093	0.4151	58	46.81	5.604	46.65	Assigned	Median
Li	13.52	0.3777	0.7309	0.5168	26	13.58	1.658	13.52	Assigned	Median
Lu	0.649	0.01252	0.0554	0.2261	37	0.652	0.06244	0.649	Assigned	Median
Mo	534.9	8.541	16.62	0.5139	61	529.1	50.71	534.9	Provisional	Median
Nb	9.5	0.235	0.5415	0.434	57	10.76	3.11	10.1	Provisional	Mode
Nd	62.16	0.7343	2.671	0.275	53	62.16	5.346	62.5	Assigned	Robust Mean
Ni	153.1	1.841	5.743	0.3205	70	153.1	15.4	152.5	Assigned	Robust Mean
Pb	212.5	4.47	7.587	0.5891	69	220.1	36.46	213.9	Provisional	Mode
Pr	14.67	0.1875	0.7833	0.2394	40	14.67	1.186	14.73	Assigned	Robust Mean
Rb	76.69	1.96	3.192	0.614	66	78.32	8.585	77.95	Assigned	Mode
Sb	14.4	0.601	0.771	0.7795	36	13.46	2.87	13.94	Provisional	Mode
Sc	9.3	0.245	0.5318	0.4607	54	10.15	2.193	9.55	Assigned	Mode
Se	4.39	0.2247	0.281	0.7996	23	4.609	1.439	4.39	Provisional	Median
Sm	13.9	0.2101	0.7482	0.2808	44	13.95	1.361	13.9	Assigned	Median
Sn	1.858	0.0835	0.1354	0.6168	29	1.891	0.4495	1.858	Assigned	Median
Sr	73.24	0.7754	3.07	0.2526	74	73.24	6.67	73.04	Assigned	Robust Mean
Ta	0.7	0.033	0.05908	0.5586	36	0.7491	0.1403	0.7215	Assigned	Mode
Tb	2.099	0.02957	0.1502	0.1969	39	2.099	0.1847	2.1	Assigned	Robust Mean
Th	12	0.2506	0.6603	0.3794	55	11.78	1.665	12	Assigned	Median
Tl	10	0.4486	0.5656	0.7931	29	9.5	2.177	10	Provisional	Median
Tm	0.812	0.01051	0.06701	0.1568	37	0.8023	0.06925	0.8	Assigned	Mode
U	230	4.214	8.115	0.5193	63	229.8	26.72	230	Provisional	Median
V	763	9.47	22.48	0.4213	77	777.3	78.46	772	Provisional	Mode
W	1.2	0.12	0.09338	1.285	20	1.34	0.3751	1.28	Provisional	Mode
Y	74	0.9086	3.097	0.2934	66	74.41	6.867	74	Assigned	Median
Yb	4.761	0.06026	0.3011	0.2001	44	4.722	0.4157	4.761	Assigned	Median
Zr	138.8	2.76	5.285	0.5222	69	132.2	20.84	136	Provisional	Mode

Table 3 - GeoPT52 Z-scores for Metalliferous shale, EMS-1. 16/12/2022

Lab Code	R2	R3	R5	R6	R7	R8	R9	R10	R12	R13	R14	R15	R18
SiO2	*	**-1.90**	-2.38	*	-2.64	3.53	-0.03	**-2.37**	0.95	1.79	*	-13.63	-0.49
TiO2	**-4.36**	**0.82**	*	*	-0.51	0.87	-0.05	**1.28**	-0.51	0.41	*	-3.71	-1.42
Al2O3	**-4.93**	**-0.86**	-2.42	*	-1.69	1.64	0.26	**-0.81**	0.91	-0.13	*	-18.12	0.30
Fe2O3T	**-2.01**	**-0.94**	2.30	*	-0.89	0.07	0.41	**0.06**	0.12	-0.06	*	-2.53	-1.69
MnO	**-2.78**	**-0.54**	*	*	155.03	-0.27	-0.27	**0.51**	-0.27	2.00	*	-3.76	-0.27
MgO	**-4.24**	**0.35**	-2.10	*	-0.03	-0.24	-0.44	**10.15**	-0.03	0.38	*	*	1.62
CaO	**-4.79**	**0.92**	-8.89	*	-1.43	0.74	0.42	**-0.91**	1.10	-3.45	*	-1.11	-1.31
K2O	**-5.64**	**-0.06**	-2.49	*	-1.51	2.21	0.16	**2.14**	1.06	-4.77	*	0.99	-1.70
P2O5	**-2.76**	**-0.51**	*	*	-2.51	2.00	1.04	**-3.21**	1.15	-1.10	*	23.12	*
Ag	*	*	*	*	*	*	-0.04	*	*	*	**-0.95**	*	*
As	*	*-9.98*	*	*-0.40*	*-2.34*	*	*0.17*	***-2.76***	*	*	***-15.44***	*-2.40*	*
Ba	**-0.10**	**-0.02**	*	0.75	-1.00	0.12	-0.33	**0.66**	*	-4.38	**1.15**	-3.47	*
Be	*	*	*	*	*	*	-0.43	*	*	*	**-0.63**	*	*
Bi	**0.50**	*	*	*	*	*	-0.09	*	*	*	**0.29**	*	*
C(tot)	*	*	*	*-2.99*	*-1.76*	*	*-0.59*	*	*	*2.17*	*	*	*
Cd	**0.71**	*	*	-0.43	6.40	*	-0.37	**-2.37**	*	*	**0.37**	1.22	*
Ce	**-1.61**	*	*	*	*	0.11	-0.10	**-0.56**	*	-3.27	**0.88**	*	*
Co	**-0.96**	*	*	0.06	*	0.76	-0.89	**-0.32**	*	*	**0.63**	107.46	*
Cr	***-2.27***	***-2.80***	*	*	*5.13*	*3.73*	*0.23*	***4.93***	*	*	***-0.23***	*9.54*	*
Cs	**0.54**	**21.78**	*	*	*	*	-0.35	*	*	*	**0.44**	*	*
Cu	***1.03***	***8.12***	*	*0.72*	*-2.29*	*-0.39*	*-0.01*	***-2.40***	*	*	***2.00***	*-0.79*	*
Dy	**-0.31**	*	*	*	*	*	-0.47	*	*	-2.16	**0.25**	*	*
Er	**-0.22**	*	*	*	*	*	-0.59	*	*	-2.09	**0.02**	*	*
Eu	**-0.17**	*	*	*	*	*	-0.25	*	*	-1.38	**0.30**	*	*
Ga	*	*	*	*	*0.10*	*	*-0.58*	***-0.18***	*	*	***11.72***	*	*
Gd	**-0.51**	*	*	*	*	*	-0.29	*	*	-2.32	**0.46**	*	*
Hf	***-0.41***	*-1.65*	*	*	*	*	*0.55*	***25.15***	*	*	***-3.59***	*	*
Hg	*	*	*	*	*	*	*	*	*	*	*	*	*
Ho	**-0.04**	*	*	*	*	*	-0.46	*	*	-1.49	**-0.20**	*	*
In	***-0.57***	*	*	*	*	*	*	*	*	*	*	*	*
La	**-1.75**	*	*	*	*	*	-0.16	**2.84**	*	-2.50	**0.65**	*	*
Li	**0.06**	*	*	*	*	*	-0.63	*	*	*	**0.24**	*	*
Lu	**-0.28**	*	*	*	*	*	-0.44	*	*	-1.21	**-1.25**	*	*
Mo	***-0.16***	***-2.22***	*-3.19*	*1.87*	*-1.77*	*	*0.03*	***0.63***	*	*	***2.41***	*0.90*	*
Nb	***-0.37***	***8.31***	*	*	*41.09*	*1.39*	*0.09*	***1.67***	*	*	***-0.41***	*20.50*	*
Nd	**-0.81**	*	*	*	*	*	-0.33	**1.77**	*	-2.56	**0.99**	*	*
Ni	**0.54**	**1.38**	*	-0.71	-2.71	0.69	-0.32	**0.12**	*	*	**3.53**	*	*
Pb	***4.52***	*	*7.21*	*0.36*	*-0.03*	*-1.02*	*1.02*	***-0.69***	*	*	***0.59***	*0.72*	*
Pr	**-0.44**	*	*	*	*	*	0.21	*	*	-1.94	**1.06**	*	*
Rb	**0.27**	**0.72**	*	0.53	1.46	-0.89	-0.58	**-0.64**	*	*	**0.38**	*	*
Sb	*	*	*	*-0.00*	*	*	*-0.35*	***-2.55***	*	*	***0.26***	*	*
Sc	**0.10**	**6.02**	*	*	*	*	-0.66	**14.63**	*	*	**0.58**	*	*
Se	*	*	*	*	*	*	*	***2.16***	*	*	***18.15***	*0.73*	*
Sm	**-0.71**	*	*	*	*	*	-0.20	**4.94**	*	-2.07	**0.80**	*	*
Sn	**-0.31**	*	*	*	*	*	0.52	*	*	*	**-0.28**	*	*
Sr	**-0.33**	**-0.40**	*	-0.01	-1.02	-1.67	-0.28	**-0.95**	*	-1.33	**1.65**	-0.45	*
Ta	**-0.54**	**682.17**	*	*	*	*	0.85	*	*	*	**9.31**	*	*
Tb	**0.02**	*	*	*	*	*	-0.66	*	*	-1.56	**-0.06**	*	*
Th	**0.15**	-1.14	*	*	*	*	0.04	**-5.92**	*	*	**0.15**	1.29	*
Tl	***0.67***	*	*	*	*	*	*-0.10*	***3.22***	*	*	***0.53***	*	*
Tm	**0.22**	*	*	*	*	*	-0.09	*	*	-1.22	**-0.93**	*	*
U	***2.72***	***0.62***	*	*3.88*	*-1.54*	*-1.05*	*0.14*	***1.07***	*	*	***1.60***	*2.07*	*
V	***-2.28***	***0.53***	*	*0.93*	*0.27*	*-0.00*	*-0.04*	***5.64***	*	*	***1.87***	*-0.87*	*
W	***-0.47***	*	*	*	*	*	*-1.07*	*	*	*	***17.67***	*	*
Y	**0.96**	**0.32**	*	0.19	-1.13	-0.32	-0.39	**0.37**	*	-2.29	**1.00**	*	*
Yb	**-0.03**	*	*	*	*	*	-0.63	**0.52**	*	-1.56	**-0.27**	*	*
Zr	***0.54***	***0.88***	*	*0.20*	*-3.39*	*-0.84*	*0.20*	***0.11***	*	*	***-6.40***	*-0.46*	*

Bold entries are Data Quality 1 - Underlined entries are Data Quality 2 - *Entries in italics* are derived from Provisional Values.

Table 3 - GeoPT52 Z-scores for Metalliferous shale, EMS-1. 16/12/2022

Lab Code	R21	R23	R24	R25	R27	R29	R30	R31	R33	R34	R35	R36	R39
SiO2	-5.79	-9.01	1.36	-1.37	-2.21	0.32	1.55	-2.24	9.96	0.36	-0.65	3.65	-1.51
TiO2	-1.83	-2.48	-1.11	3.56	0.18	0.55	1.19	-0.96	-3.25	0.87	0.50	-1.88	-0.46
Al2O3	-3.90	3.11	-0.30	1.21	1.04	0.95	1.69	-1.82	2.85	0.56	1.04	0.74	0.00
Fe2O3T	-2.40	-4.39	-1.03	-1.53	0.91	-0.18	3.90	-1.27	-8.08	0.16	0.49	0.07	-1.28
MnO	-1.67	-2.28	-2.00	-0.54	0.58	-0.27	3.93	-0.27	-3.76	-0.27	-0.27	-0.27	-0.19
MgO	-2.41	-3.37	-0.55	-0.06	300.49	-0.03	3.86	-0.86	1.21	-0.03	-0.44	0.18	-0.48
CaO	-1.26	-9.23	-0.81	-1.42	-0.43	1.35	0.48	-1.43	-4.54	0.42	-0.39	-0.19	-0.13
K2O	-3.37	-9.29	-1.63	-0.83	3.14	0.42	-1.84	-0.29	-0.99	0.35	-0.16	0.35	-1.73
P2O5	-3.75	-5.80	-1.04	1.18	-0.51	0.31	-0.05	-1.10	2.84	0.31	0.90	0.03	-1.58
Ag	-0.26	0.31	*	3.07	-2.12	*	*	*	*	*	*	*	*
As	-8.37	1.81	-0.48	-0.62	1.29	*	*	0.19	*	*	-4.03	*	-19.71
Ba	-2.06	-0.12	-8.11	0.43	0.36	0.71	0.61	*	0.75	-0.19	-1.32	-0.01	0.70
Be	-2.12	-0.51	-0.54	0.41	*	0.58	4.89	-1.28	*	*	*	*	*
Bi	24.58	-0.31	*	8.64	*	*	*	*	*	*	*	*	*
C(tot)	0.45	1.92	0.59	-6.45	*	*	*	2.38	*	*	*	*	*
Cd	-0.74	-0.05	-0.30	-0.61	0.00	*	-0.90	0.24	*	*	1.52	*	*
Ce	-2.09	0.31	0.44	17.19	*	-0.33	1.59	*	*	*	1.10	-0.88	0.68
Co	-1.31	-0.81	0.13	-3.55	-1.10	*	3.03	0.00	-0.51	1.39	*	0.13	*
Cr	-2.58	-0.70	-2.80	*	335.06	*	3.47	-2.33	10.73	-0.70	*	1.63	3.26
Cs	0.26	-0.57	-0.58	-3.69	*	*	1.63	*	*	*	*	0.34	0.12
Cu	-0.63	0.03	-0.64	2.53	-0.51	*	7.34	0.88	0.38	0.63	28.09	-0.13	-15.27
Dy	-0.61	-0.99	1.31	-0.20	*	-0.32	-2.63	*	*	*	*	-0.92	0.78
Er	-0.56	-0.39	1.79	0.15	*	-0.06	-3.53	*	*	*	*	-0.32	0.44
Eu	-0.18	-0.05	0.98	0.00	*	-0.12	0.45	*	*	*	*	-1.48	0.59
Ga	-0.77	14.10	*	4.31	*	*	1.42	*	3.39	0.92	*	*	-3.09
Gd	-3.43	-0.42	1.07	-4.36	*	-1.07	0.10	*	*	*	*	-0.88	0.85
Hf	-2.69	-1.29	*	-1.31	*	-0.85	-0.50	*	*	*	*	*	0.29
Hg	-4.04	*	*	8.65	*	*	-1.66	0.17	*	*	*	*	*
Ho	-0.50	0.08	1.05	-2.13	*	-0.46	-2.96	*	*	*	*	-5.30	0.77
In	0.09	*	*	*	*	*	*	*	*	*	*	*	*
La	-1.79	-2.10	0.08	1.12	*	-0.16	-0.27	*	*	*	1.76	-0.39	0.84
Li	0.61	0.50	-1.04	-2.09	*	*	4.78	*	*	*	*	0.33	*
Lu	-0.38	-0.31	*	*	*	0.37	-3.47	*	*	*	*	7.41	0.74
Mo	-3.09	0.00	-1.26	-2.16	*	*	3.00	*	*	-1.29	3.10	-1.32	1.47
Nb	-1.08	-0.57	51.25	17.54	-6.06	-1.39	0.46	*	2.31	*	29.09	5.08	1.46
Nd	-0.58	-0.59	-10.46	0.31	*	-0.35	-0.22	*	*	*	*	-0.40	0.73
Ni	-1.50	0.02	0.25	2.25	-24.23	*	6.62	-0.36	-0.79	-0.18	-0.79	1.04	-12.38
Pb	-1.39	-0.82	0.03	4.94	5.41	*	-0.47	-0.89	-0.23	*	-0.82	-0.49	-7.70
Pr	-0.33	-0.00	0.21	-7.24	*	-0.24	-0.77	*	*	*	*	-1.71	0.99
Rb	0.29	-0.46	-2.14	-0.62	*	-0.73	3.78	*	0.83	*	0.21	-0.89	0.94
Sb	-0.33	4.36	-0.26	-2.47	*	*	1.48	-6.23	*	*	*	*	*
Sc	-1.40	-0.62	*	-4.33	614.92	-0.28	-0.23	*	0.66	*	*	-1.22	0.38
Se	-2.57	*	*	-12.06	-0.89	*	*	-4.79	*	*	*	*	*
Sm	-0.35	0.03	0.74	-5.21	*	-0.47	-0.72	*	*	*	*	-1.27	0.86
Sn	-1.04	*	*	*	*	*	-0.92	-1.69	*	*	*	*	*
Sr	0.21	-0.53	-0.85	0.41	0.59	0.29	4.15	4.36	-1.83	-0.69	2.89	0.61	0.90
Ta	-2.11	0.39	*	*	*	0.00	-1.54	*	*	*	*	*	0.68
Tb	-5.39	-0.04	1.00	-7.32	*	-0.33	-1.40	*	*	*	*	1.67	1.20
Th	0.85	0.59	1.51	-3.79	*	-0.30	-4.69	*	-1.51	*	0.76	0.00	1.09
Tl	-3.06	-0.16	0.00	*	*	*	*	-2.56	*	*	*	*	*
Tm	-0.52	-0.34	*	-0.33	*	0.06	-3.16	*	*	*	*	-2.33	0.87
U	0.24	0.26	2.71	-1.11	*	0.49	-8.05	*	*	*	-1.11	-1.48	0.48
V	-1.87	0.03	-0.00	*	-33.55	0.20	6.86	-1.58	-0.51	-0.60	-1.36	-0.42	-3.60
W	-0.68	2.22	*	*	*	*	*	*	*	*	*	*	*
Y	-1.21	-0.76	-0.16	-0.32	29.55	-0.65	0.29	*	-1.13	-0.65	0.00	0.00	2.21
Yb	-0.75	-1.18	1.06	1.12	*	0.06	-3.89	*	*	*	*	2.89	0.23
Zr	-5.52	-5.14	*	-2.05	-6.29	1.24	7.60	*	-0.27	*	-0.84	-0.65	1.73

Bold entries are Data Quality 1 - Underlined entries are Data Quality 2 - *Entries in italics* are derived from Provisional Values.

Table 3 - GeoPT52 Z-scores for Metalliferous shale, EMS-1. 16/12/2022

Lab Code	R40	R41	R42	R43	R44	R45	R46	R49	R50	R51	R52	R55	R56
SiO2	0.00	7.72	-0.00	-0.57	9.19	*	11.46	3.80	1.32	-0.62	-4.57	**5.56**	-0.16
TiO2	0.20	-0.05	-0.37	-1.19	1.32	-2.34	-2.43	-0.05	11.25	-2.11	-2.34	**-1.84**	0.41
Al2O3	0.25	1.69	0.13	-0.24	6.79	4.25	0.75	-0.13	-2.81	-1.49	-3.29	**5.36**	-0.30
Fe2O3T	0.72	-1.82	0.92	0.54	-1.52	2.24	-8.64	-0.64	4.07	-2.06	-3.29	**-1.28**	-4.01
MnO	0.17	-3.76	-0.44	0.08	1.48	2.87	-4.18	-0.27	2.35	-5.08	-2.01	**0.86**	-0.27
MgO	0.36	-0.65	-0.24	0.77	-0.65	4.60	-8.71	24.35	2.04	2.42	-2.51	**8.37**	0.59
CaO	0.28	-0.43	-0.19	0.65	-2.52	3.32	-6.78	-1.43	0.54	-0.81	-3.61	**-0.37**	-2.92
K2O	-0.58	-1.63	0.35	0.80	3.11	-2.15	0.92	-3.36	-1.18	-2.88	-2.92	**0.19**	-0.99
P2O5	-0.45	-0.54	-0.48	0.14	1.44	-6.48	-4.90	-2.79	-1.44	-1.41	-1.94	**1.63**	-0.54
Ag	*	*	*	0.62	*	*	*	*	*	*	-2.16	*	*
As	*	_1.65_	*	*	*	*	_-4.32_	_-2.31_	*	*	_-1.77_	*	*
Ba	0.74	1.03	-0.01	-0.24	-0.15	0.81	-5.72	0.62	-1.41	-0.92	-1.01	**5.66**	0.02
Be	-0.26	0.76	*	-0.17	*	*	*	*	*	*	*	**1.89**	0.20
Bi	*	*	*	1.07	*	*	*	*	*	*	*	*	*
C(tot)	_2.12_	*	_1.77_	*	*	*	*	_-0.26_	*	_0.81_	_-0.24_	*	*
Cd	-0.75	*	*	-0.73	*	*	*	-2.44	*	*	*	**-6.93**	*
Ce	0.16	0.75	-0.44	0.00	*	2.94	*	*	*	*	-1.08	**4.32**	-0.06
Co	0.27	1.65	0.13	-0.32	3.29	0.57	*	0.08	1.20	*	-1.05	**3.17**	-3.48
Cr	_0.11_	_1.77_	_-0.23_	_1.14_	_10.96_	_-0.16_	_-0.10_	_1.92_	_7.32_	*	_-0.04_	_**3.96**_	_-0.37_
Cs	0.37	*	*	0.89	*	*	-2.81	*	*	*	-2.60	**2.74**	-0.58
Cu	_0.66_	_0.38_	*	_1.39_	_0.63_	_3.51_	_-4.35_	_-3.03_	_-0.31_	*	_-1.78_	_**4.72**_	_-4.75_
Dy	0.50	0.80	*	1.21	*	-4.90	*	*	*	*	-0.95	**3.33**	-0.10
Er	0.50	0.47	*	-0.01	*	4687.75	*	*	*	*	-0.47	**3.13**	-0.19
Eu	0.66	0.49	*	1.20	*	3.91	*	*	*	*	-0.59	**2.80**	0.00
Ga	_-0.24_	_0.10_	*	_0.35_	_6.68_	*	_0.25_	*	*	*	_-0.60_	_**1.58**_	_0.26_
Gd	0.39	0.34	*	-0.62	*	-5.11	*	*	*	*	-0.93	**3.37**	-0.10
Hf	_-1.20_	_1.70_	*	_0.45_	*	*	*	*	*	*	_-0.57_	_**3.09**_	_0.55_
Hg	*	*	*	*	*	*	*	*	*	*	*	*	*
Ho	0.56	0.29	*	-0.13	*	*	*	*	*	*	-0.67	**3.19**	0.44
In	_-0.12_	*	*	*	*	*	*	*	*	*	*	*	*
La	0.06	2.18	-0.39	-0.04	*	2.55	*	*	-2.31	*	-0.92	**3.56**	0.04
Li	0.04	*	*	-0.22	*	2.33	*	*	*	*	*	**3.58**	*
Lu	0.15	0.91	*	0.01	*	0.23	*	*	*	*	-0.44	**2.04**	0.46
Mo	_-0.24_	_-2.55_	_-1.32_	_1.45_	*	_-1.18_	_-3.64_	_0.64_	*	*	_-1.92_	_**0.73**_	_-0.43_
Nb	_0.06_	_0.98_	*	_0.92_	_19.85_	_42.44_	_1.23_	*	_2.77_	*	_-0.94_	**3.56**	_0.18_
Nd	0.58	1.28	*	1.41	*	-4.24	-2.48	*	*	*	-1.10	**4.25**	0.06
Ni	0.98	-2.45	-1.14	1.56	-0.53	0.53	-5.06	-0.03	-0.10	*	-0.91	**5.94**	-0.56
Pb	_0.30_	_2.73_	*	_1.68_	_3.13_	_-0.61_	_-3.95_	_-5.45_	_-2.44_	*	_-1.10_	_**4.94**_	_-4.16_
Pr	0.69	1.05	*	0.08	*	-4.42	*	*	*	*	-0.79	**4.03**	0.40
Rb	1.20	1.03	*	0.11	2.09	2.05	-1.96	-1.27	6.63	*	-1.12	**4.23**	-0.09
Sb	_0.06_	*	*	_0.40_	*	*	*	_-2.89_	*	*	_-2.19_	_**1.93**_	*
Sc	-0.15	0.66	*	0.46	0.66	-1.06	*	*	*	*	-1.21	**4.87**	*
Se	*	*	*	_3.68_	*	*	*	*	*	*	*	*	*
Sm	0.63	0.53	*	1.20	*	*	*	*	*	*	-0.76	**3.46**	0.13
Sn	-1.58	*	*	0.30	*	*	*	-0.38	*	*	*	**2.90**	-5.02
Sr	0.44	-0.20	*	1.10	1.92	1.00	-3.24	-0.73	-0.95	*	-0.96	**3.99**	0.09
Ta	-0.26	1.69	*	-0.25	*	9.32	*	*	*	*	-0.76	**2.34**	3.39
Tb	0.46	0.90	*	-0.03	*	*	*	*	*	*	-1.00	**2.80**	0.33
Th	-0.35	0.85	*	1.51	*	*	-2.22	*	-1.59	*	-0.70	**1.82**	0.30
Tl	*	*	*	_1.15_	*	*	*	*	*	*	*	_**3.66**_	_-8.75_
Tm	0.27	0.66	*	0.21	*	*	*	*	*	*	-0.84	**2.76**	0.66
U	_0.68_	_0.93_	*	_1.42_	_1.54_	*	_-5.83_	*	*	*	_-1.14_	_**2.59**_	_0.20_
V	_0.50_	_0.82_	_1.00_	_1.49_	_2.07_	_1.58_	_-0.48_	_1.74_	_-4.93_	*	_-1.88_	_**3.87**_	_0.45_
W	_0.42_	*	*	_0.43_	*	_230.99_	*	*	*	*	*	_**3.01**_	_4.28_
Y	0.64	0.61	-0.48	0.18	-0.16	2.32	-3.30	*	-3.34	*	-1.09	**3.42**	0.71
Yb	0.33	0.91	*	-0.12	*	0.01	*	*	*	*	-0.70	**3.25**	0.23
Zr	_-1.59_	_0.58_	_-0.74_	*	_0.49_	_-5.40_	_-2.64_	*	_-3.12_	-6.59	_-1.58_	_**5.35**_	_0.24_

Bold entries are Data Quality 1 - Underlined entries are Data Quality 2 - _Entries in italics_ are derived from Provisional Values.

Table 3 - GeoPT52 Z-scores for Metalliferous shale, EMS-1. 16/12/2022

Lab Code	R57	R59	R60	R62	R63	R65	R66	R67	R68	R69	R70	R71	R72
SiO2	-1.25	-3.65	0.18	*	5.76	0.25	-0.12	1.20	-1.78	6.10	0.45	0.92	-1.66
TiO2	-0.69	6.31	0.46	*	5.68	0.41	-0.16	1.00	-1.83	1.32	-0.10	-0.51	-0.51
Al2O3	-0.45	-4.58	0.29	*	5.66	0.22	-0.03	1.60	-0.37	3.72	3.11	1.60	-1.08
Fe2O3T	-0.51	13.77	0.24	*	6.54	0.75	-0.01	0.42	-0.39	1.76	*	0.66	-0.72
MnO	1.13	2.95	-0.06	*	3.30	-2.01	1.04	0.16	0.95	1.48	-0.54	-0.27	-0.27
MgO	0.15	-5.43	1.38	*	3.33	0.59	-0.12	-1.80	-0.59	1.21	-0.48	0.80	-0.65
CaO	-1.10	7.36	0.09	*	7.07	0.82	0.18	1.10	-1.01	-1.68	-0.85	-0.15	-0.47
K2O	-0.78	3.91	-0.07	*	5.78	1.25	-0.17	0.57	0.47	3.56	-1.22	1.38	-0.67
P2O5	-0.68	2.87	0.14	*	2.89	0.31	0.08	-2.14	2.11	5.10	-3.89	0.31	0.03
Ag	*	*	1.53	*	*	0.44	1.24	*	*	*	*	*	0.58
As	0.87	-2.65	*	3.99	-1.11	2.47	0.91	-1.73	*	-3.94	*	-1.24	0.91
Ba	-0.19	-0.91	-0.29	*	3.76	0.26	-0.65	-0.54	*	0.71	4.30	1.57	0.21
Be	*	*	-0.91	1.00	*	6.78	-1.88	*	*	-0.06	*	*	-0.17
Bi	*	*	2.00	*	22.55	2.00	-0.32	*	*	*	*	*	0.21
C(tot)	*	*	-1.11	*	33.77	3.60	0.27	*	-0.59	*	*	*	-1.25
Cd	0.91	*	1.04	*	*	3.66	-0.15	0.30	*	*	*	*	0.58
Ce	-0.11	4.30	-0.67	0.84	-0.22	0.99	-0.56	0.37	*	-2.52	*	*	1.32
Co	5.20	0.76	0.76	*	*	-0.51	0.54	2.09	*	3.29	*	1.39	0.32
Cr	1.40	*	2.70	*	2.38	3.73	0.58	1.77	*	6.76	*	-0.70	-1.03
Cs	*	*	2.17	*	*	0.11	0.22	*	*	*	*	*	1.14
Cu	0.88	5.33	0.01	*	2.07	2.03	-0.26	-0.02	*	1.65	*	*	0.76
Dy	*	*	-0.25	1.41	0.31	0.12	0.04	*	*	-0.79	*	*	-0.40
Er	*	*	0.34	0.67	*	0.27	0.27	*	*	-0.72	*	*	0.13
Eu	*	*	-0.25	-0.98	*	-0.25	0.26	*	*	-0.74	*	*	-0.30
Ga	1.74	*	*	*	-2.11	2.57	-0.31	*	*	-4.02	*	*	-0.23
Gd	*	*	-0.23	-1.46	*	1.07	-0.22	3.22	*	-1.24	*	*	-0.23
Hf	*	*	-1.85	3.65	7.09	0.35	0.35	*	*	3.26	*	*	-1.51
Hg	*	*	*	*	*	*	7.34	*	*	*	*	*	*
Ho	*	*	-0.16	0.65	*	0.20	0.35	*	*	-0.58	*	*	0.02
In	*	*	*	*	*	2.11	*	*	*	*	*	*	0.13
La	1.28	8.29	-0.82	2.60	1.79	1.52	-1.02	0.42	*	0.24	*	*	-0.13
Li	*	*	*	*	*	1.01	-1.01	*	*	*	*	*	1.28
Lu	*	*	-0.44	1.82	*	0.73	0.82	*	*	-0.17	*	*	-0.26
Mo	*	1.96	0.82	*	-3.93	0.85	0.25	0.35	0.15	*	*	*	0.60
Nb	*	0.92	-2.22	*	-3.75	2.31	0.00	*	*	4.16	*	1.39	-0.03
Nd	-2.09	*	-0.48	2.83	1.06	0.12	0.26	0.96	*	-1.93	*	*	-0.11
Ni	-0.71	2.77	1.18	*	4.41	1.73	-0.49	-0.35	*	-0.44	*	*	2.12
Pb	1.02	-0.46	*	*	4.43	1.02	0.10	-0.51	*	-0.43	*	-0.23	2.73
Pr	*	*	-0.43	1.36	*	0.08	-0.53	-0.05	*	0.15	*	*	0.27
Rb	*	-5.23	1.25	2.15	1.98	1.62	-0.16	-0.94	*	0.03	*	-0.89	0.46
Sb	*	*	-1.30	*	28.40	0.39	0.92	0.71	*	*	*	*	0.23
Sc	*	2.54	3.57	*	0.56	6.86	*	-0.09	*	-0.28	*	3.48	-0.41
Se	*	*	*	*	*	12.83	*	*	*	*	*	*	0.00
Sm	*	*	-0.47	0.82	-0.13	0.27	-1.37	2.87	*	-0.65	*	*	-0.63
Sn	*	*	0.89	3.63	33.55	11.60	*	*	*	1.89	*	*	-0.07
Sr	0.94	0.25	2.49	*	1.42	2.29	0.44	-0.48	*	-0.20	*	-0.69	1.79
Ta	*	*	0.00	3.05	-1.69	0.85	0.42	*	*	0.76	*	*	-0.51
Tb	*	*	0.00	0.47	*	-0.13	-0.61	*	*	-0.36	*	*	-0.03
Th	0.76	*	0.61	1.65	2.57	8.33	-0.77	0.98	*	-0.61	*	*	-0.04
Tl	*	*	6.81	*	*	0.27	-0.29	0.18	*	*	*	*	-0.58
Tm	*	*	-0.09	0.72	*	-0.16	0.32	*	*	-0.09	*	*	-0.39
U	*	*	1.44	1.76	-7.91	2.34	-1.32	-0.31	-0.62	-3.87	*	-0.31	2.16
V	10.81	0.40	-0.65	*	2.46	2.69	0.03	2.02	-2.27	-0.85	0.76	2.58	1.94
W	*	*	*	*	*	1.07	-1.07	*	*	*	*	*	-0.72
Y	0.97	2.26	0.52	*	2.94	1.61	-0.83	-0.37	*	1.78	*	-0.32	-0.06
Yb	*	*	-0.27	1.79	-7.24	0.20	-0.58	*	*	-0.40	*	*	0.01
Zr	0.49	7.98	-3.32	*	2.77	1.62	0.72	-8.56	-2.63	-0.17	*	0.11	1.81

Bold entries are Data Quality 1 - Underlined entries are Data Quality 2 - *Entries in italics* are derived from Provisional Values.

Table 3 - GeoPT52 Z-scores for Metalliferous shale, EMS-1. 16/12/2022

Lab Code	R73	R74	R75	R77	R78	R79	R80	R81	R82	R83	R84	R85	R88
SiO2	-0.24	*	0.69	-0.65	-0.31	9.29	-0.03	-2.77	5.86	*	-0.48	*	0.23
TiO2	-0.05	-1.65	6.67	-1.01	-0.32	12.71	-0.51	-1.19	2.24	2.65	2.01	*	0.18
Al2O3	-0.09	5.71	1.38	0.43	-0.41	10.64	0.00	-0.52	3.93	2.51	7.57	*	0.43
Fe2O3T	-0.01	0.21	0.06	-0.36	-0.08	6.46	0.62	0.06	5.37	1.05	-1.73	*	0.26
MnO	0.08	1.90	4.52	-0.89	6.71	4.00	-0.27	0.86	149.80	1.21	-2.89	*	-0.09
MgO	0.03	-2.95	1.18	-0.06	0.26	2.42	-0.03	-2.13	4.72	-4.61	*	*	0.18
CaO	-0.22	-7.70	0.00	0.03	-0.12	17.19	0.42	-3.11	5.37	0.76	2.72	*	-0.02
K2O	-0.13	-0.19	-0.96	0.45	0.40	11.86	-0.22	-1.38	3.11	0.75	3.24	*	-0.03
P2O5	-0.25	-3.50	-1.41	-0.51	0.05	1.74	0.03	-1.30	5.15	*	*	*	-0.37
Ag	*	*	*	*	*	*	0.58	1.17	*	*	*	*	*
As	*	-7.18	-5.69	-2.14	1.04	*	2.81	-1.41	-1.63	0.90	0.70	*	-0.68
Ba	*	1.83	-1.56	1.87	-0.91	4.12	0.08	-1.09	0.40	3.40	-0.34	-0.65	-0.33
Be	*	-0.63	*	*	*	*	0.28	-0.48	*	*	*	0.26	*
Bi	*	*	*	*	*	*	0.61	*	*	*	*	*	*
C(tot)	*	*	*	*	*	-55.43	-0.12	*	-0.25	*	*	*	*
Cd	*	0.54	*	*	*	*	1.22	-0.37	0.12	*	1.22	*	*
Ce	*	9.66	-1.32	-0.44	-1.32	0.22	1.49	-0.22	-0.63	1.10	-0.63	-0.57	0.13
Co	*	0.46	4.06	0.25	-3.04	9.12	1.71	-0.06	-0.25	0.76	*	-0.99	*
Cr	*	-2.75	*	1.40	*	15.39	0.65	-1.56	-0.96	-0.00	61.56	-1.73	*
Cs	*	*	*	30.96	*	*	1.58	18.24	*	2.05	*	-0.51	*
Cu	*	3.84	-0.27	-1.54	1.39	4.31	2.54	-2.26	-1.24	*	1.43	-0.06	0.29
Dy	*	3.57	*	*	*	*	1.13	0.54	*	2.48	*	0.41	*
Er	*	0.89	*	*	*	*	0.97	1.36	*	*	*	-0.21	*
Eu	*	1.51	*	*	*	*	1.62	1.13	*	0.69	*	0.37	*
Ga	*	12.74	0.20	-3.09	9.15	5.13	1.33	-0.48	1.91	-2.93	*	0.00	*
Gd	*	3.17	*	*	*	*	1.33	0.98	*	*	*	0.00	*
Hf	*	*	*	-7.31	14.34	16.68	-1.35	0.41	39.73	0.37	*	0.21	*
Hg	*	*	*	*	*	*	-0.55	*	0.39	*	*	*	*
Ho	*	0.60	*	*	*	*	1.02	0.40	*	*	*	0.16	*
In	*	*	*	*	*	*	0.65	*	*	*	*	*	*
La	*	*	-15.60	1.12	-1.35	8.77	0.66	0.45	0.47	0.02	-1.28	0.39	*
Li	*	*	*	*	*	*	1.90	*	*	*	*	-1.57	*
Lu	*	1.14	*	*	*	*	0.38	0.56	*	*	*	0.00	*
Mo	*	7.82	-19.67	-2.76	2.59	-3.42	1.21	-5.29	0.08	-0.90	-0.43	-1.77	-0.02
Nb	*	*	*	-2.77	23.55	6.46	1.15	-0.21	-1.02	*	*	0.47	*
Nd	*	6.99	-2.68	3.31	0.16	-0.81	1.39	0.84	1.09	0.31	-0.40	-0.54	*
Ni	*	1.57	0.85	-1.24	0.95	-2.28	3.47	-1.23	-1.06	-0.54	*	-0.14	-0.08
Pb	*	9.67	-16.54	-0.86	-0.89	14.43	2.93	-0.23	-0.65	*	5.77	3.62	*
Pr	*	2.81	*	*	*	*	1.42	-0.35	*	*	*	0.47	*
Rb	*	*	-4.91	-1.78	3.65	321.20	2.46	-1.58	-0.77	1.66	0.85	-0.12	0.75
Sb	*	*	*	*	-1.56	*	1.59	-0.58	-2.46	0.13	*	*	*
Sc	*	4.08	3.20	-6.21	*	8.84	0.80	3.20	20.78	0.21	*	-0.70	*
Se	*	-1.21	*	-1.39	-2.47	*	1.03	-0.28	3.22	2.17	*	*	*
Sm	*	3.15	*	1.47	*	*	1.20	1.07	3.88	-4.14	*	-0.15	*
Sn	*	*	*	*	0.52	-6.34	0.08	0.34	3.48	*	*	0.12	*
Sr	*	0.65	-7.24	-1.38	-0.20	1.55	3.69	-1.59	-1.11	25.01	0.50	-0.31	-0.01
Ta	*	*	*	*	*	38.93	0.51	-3.89	*	-1.18	*	0.73	*
Tb	*	0.53	*	*	*	*	1.10	0.94	*	0.47	*	0.46	*
Th	*	14.57	*	-1.51	-1.51	0.00	0.72	-2.43	-2.88	0.61	*	0.44	*
Tl	*	2.35	*	-5.30	*	*	1.19	1.06	1.50	*	*	0.11	*
Tm	*	0.15	*	*	*	*	0.66	0.87	*	*	*	-0.07	*
U	*	9.01	-19.84	-0.86	0.31	-2.71	2.22	-0.62	-0.02	0.00	-1.54	2.79	-0.92
V	*	-1.51	6.67	2.89	-1.78	6.18	1.87	-0.73	1.82	2.98	-8.38	-1.88	1.21
W	*	*	*	8.57	*	*	0.19	*	*	0.00	*	1.07	*
Y	*	*	-9.36	-0.97	0.00	*	1.49	-1.15	-0.27	*	*	0.63	-0.32
Yb	*	0.92	*	-2.53	*	*	0.73	1.29	-3.59	0.29	*	0.28	*
Zr	*	-3.06	0.03	-1.10	-0.27	-1.29	-1.45	-1.69	-0.50	30.49	0.36	0.00	0.12

Bold entries are Data Quality 1 - Underlined entries are Data Quality 2 - *Entries in italics* are derived from Provisional Values.

Table 3 - GeoPT52 Z-scores for Metalliferous shale, EMS-1. 16/12/2022

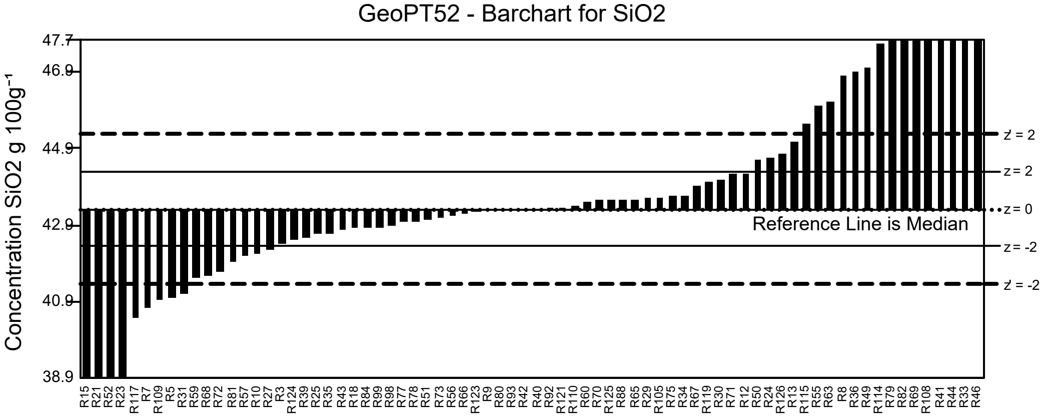
Lab Code	R92	R93	R98	R99	R100	R105	R106	R108	R109	R110	R114	R115	R116
SiO2	0.05	-0.06	-0.91	-0.48	*	0.33	*	13.75	-4.81	0.18	8.82	2.28	*
TiO2	-1.88	-0.10	0.09	0.41	3.20	0.03	*	9.05	-1.93	-2.84	-1.93	3.15	*
Al2O3	-0.30	0.61	-1.13	0.39	*	-0.33	*	15.39	-0.86	0.09	5.02	3.20	*
Fe2O3T	-0.72	2.17	0.66	-0.22	*	0.44	*	4.86	-2.04	1.91	-17.85	1.50	*
MnO	-0.27	-0.54	1.56	-7.25	-0.54	0.43	*	2.95	-4.03	-0.54	-4.03	1.48	*
MgO	0.18	-0.89	2.17	-0.44	*	-0.82	*	95.81	7.79	-0.89	0.76	2.66	*
CaO	2.19	1.97	0.53	-0.23	*	0.80	*	3.98	-2.22	-3.67	-16.73	0.58	*
K2O	-1.31	0.83	3.55	-0.03	*	0.04	*	1.09	-2.11	0.32	3.27	1.19	*
P2O5	0.59	1.74	-5.69	0.31	*	0.07	*	-2.20	0.62	0.05	-6.14	2.00	*
Ag	*	-0.27	-0.73	*	0.02	*	*	*	-3.73	*	*	*	*
As	*	-0.29	-0.56	*	0.00	0.40	-2.25	*	3.22	-2.65	*	*	-1.08
Ba	-0.24	-1.29	-0.11	*	0.34	-4.04	2.10	-0.92	-0.26	0.16	-5.43	*	-1.84
Be	-0.13	-0.56	*	*	*	*	0.87	*	*	*	*	*	0.11
Bi	*	-0.17	*	*	-0.05	*	*	*	*	*	*	*	-0.50
C(tot)	*	*	0.00	*	*	1.85	*	*	*	*	*	*	*
Cd	*	-0.73	-0.48	*	0.06	*	2.35	*	-3.11	-4.26	*	*	-0.04
Ce	0.33	-0.44	-0.91	*	0.80	0.29	-1.20	*	*	3.09	*	*	-1.59
Co	0.00	-0.25	-2.52	*	1.01	2.15	0.93	-16.22	-4.30	-3.55	7.86	*	-1.86
Cr	0.37	1.54	-3.72	*	4.34	9.95	*	35.45	-0.99	7.93	13.52	*	-2.06
Cs	-0.17	-0.52	-3.46	*	*	*	*	*	*	*	*	*	-0.93
Cu	0.01	2.28	-1.35	*	0.59	2.94	-0.14	-4.08	1.75	2.02	-6.88	*	-1.22
Dy	-0.32	0.10	-0.02	*	*	*	0.14	*	*	*	*	*	-0.57
Er	-0.20	-0.49	0.02	*	*	*	-0.65	*	*	*	*	*	-0.17
Eu	-0.69	0.39	0.10	*	*	*	-0.07	*	*	*	*	*	-0.10
Ga	0.67	1.35	*	*	-0.44	1.18	1.26	*	*	-1.45	*	*	5.61
Gd	-0.49	-1.11	0.18	*	*	*	0.62	*	*	*	*	*	0.26
Hf	-0.43	-0.03	*	*	*	*	*	*	*	*	*	*	-3.47
Hg	*	1.36	*	*	0.00	*	*	*	*	*	*	*	*
Ho	-0.19	0.65	-0.26	*	*	*	-0.98	*	*	*	*	*	-0.74
In	*	-0.26	*	*	-0.59	*	*	*	*	*	*	*	-0.17
La	-0.56	-0.79	-0.87	*	3.05	-5.26	-1.19	*	*	6.86	-9.87	*	-1.88
Li	-0.29	0.03	*	*	*	*	-1.79	*	*	*	*	*	-0.51
Lu	-0.26	0.00	-0.88	*	*	*	-0.35	*	*	*	*	*	-0.36
Mo	*	0.91	3.42	*	0.75	1.30	*	*	-0.79	*	0.31	1.96	-1.41
Nb	0.55	-2.33	*	*	0.67	*	*	-15.70	*	*	10.16	*	-1.92
Nd	-0.39	-0.14	0.33	*	*	-0.89	0.41	*	*	8.93	*	*	-1.12
Ni	0.43	0.85	-1.46	*	0.07	1.08	1.87	-13.77	-0.79	-3.67	-11.16	*	-1.52
Pb	-0.56	1.12	9.97	*	0.04	1.85	-0.56	16.67	1.02	-6.13	-24.45	10.38	-2.90
Pr	-0.24	-0.22	5.28	*	*	*	-0.91	*	*	*	*	*	-0.95
Rb	0.22	-0.06	0.72	*	-0.20	1.83	*	-14.31	*	3.23	32.68	*	-1.34
Sb	*	-1.17	-4.40	*	-3.45	2.67	*	*	-6.72	*	*	*	-9.17
Sc	0.24	0.98	-2.60	*	1.22	11.70	-0.66	-15.61	-1.05	-0.56	*	*	0.32
Se	*	-0.37	-0.53	*	-0.56	*	*	*	0.36	*	*	*	17.79
Sm	-0.13	0.13	0.09	*	*	*	-0.17	*	*	*	*	*	-0.72
Sn	*	-0.87	*	*	*	*	*	*	12.87	*	*	*	-2.65
Sr	0.16	-0.31	-3.34	*	-0.43	0.11	*	-9.20	0.61	-1.71	-9.20	*	-1.47
Ta	0.17	1.69	*	*	*	*	*	*	*	*	*	*	-0.56
Tb	-0.10	-0.20	0.00	*	*	*	-0.56	*	*	*	*	*	0.14
Th	-0.61	-0.61	-0.05	*	-0.75	6.58	*	*	*	-12.12	*	*	*
Tl	*	*	-5.37	*	-5.29	*	*	*	-4.67	*	*	*	-1.79
Tm	-0.09	0.00	-0.48	*	*	*	-1.13	*	*	*	*	*	-0.73
U	-1.42	-1.48	-3.33	*	0.46	2.18	*	*	-7.78	-2.09	-25.88	*	*
V	-0.24	-0.13	0.49	*	2.52	-2.34	-0.13	-8.23	0.59	-1.78	-16.95	1.71	-0.79
W	*	3.53	*	*	*	*	*	*	*	*	*	*	*
Y	0.92	-0.39	0.84	*	0.15	2.06	-0.95	-17.44	*	4.20	-13.24	*	-2.39
Yb	-0.22	-0.10	-0.77	*	*	*	0.06	*	*	*	*	*	-0.57
Zr	0.39	0.60	0.03	*	-0.03	2.41	*	-6.21	*	-1.29	-7.16	*	-6.01

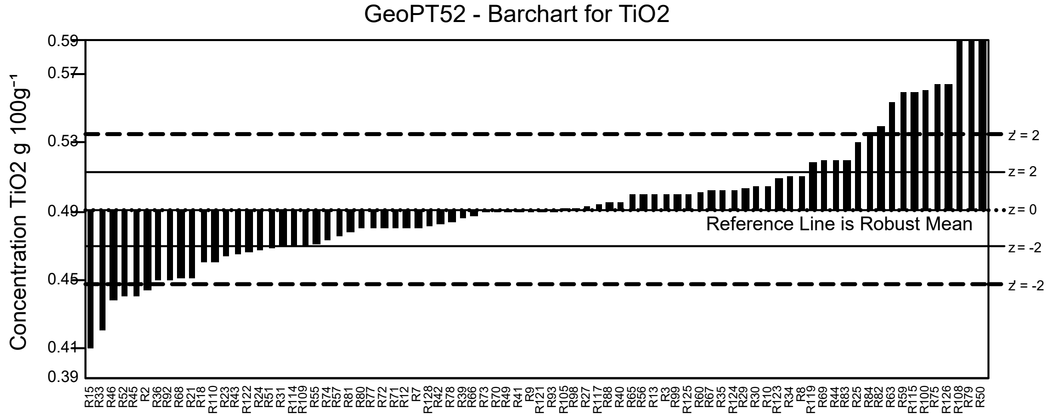
Bold entries are Data Quality 1 - Underlined entries are Data Quality 2 - *Entries in italics* are derived from Provisional Values.

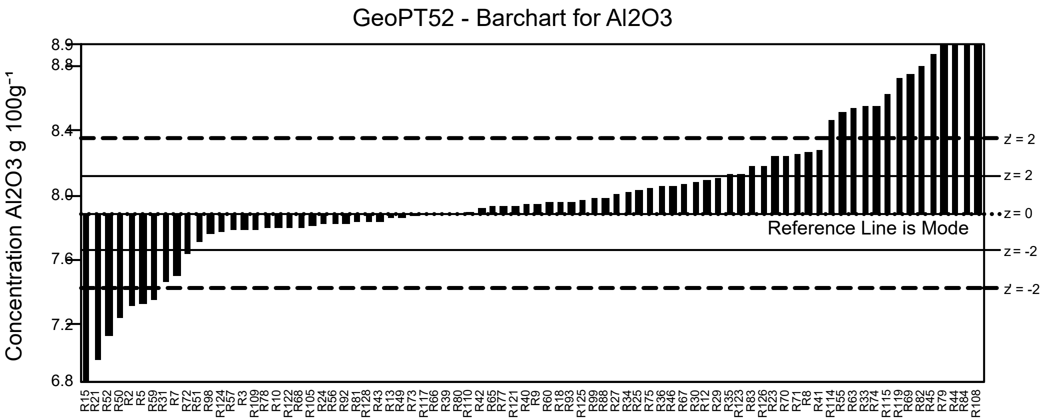
Table 3 - GeoPT52 Z-scores for Metalliferous shale, EMS-1. 16/12/2022

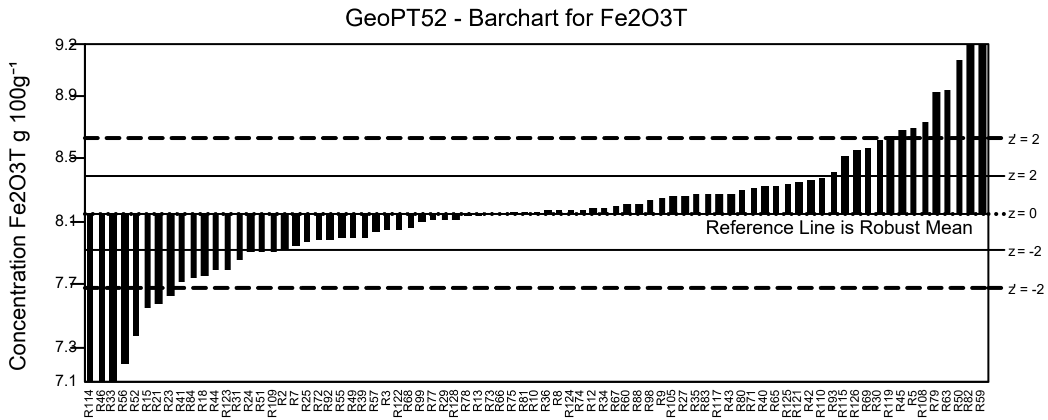
Lab Code	R117	R119	R121	R122	R123	R124	R125	R126	R128
SiO2	-2.88	0.73	0.06	*	-0.08	**-1.67**	0.22	1.48	*
TiO2	0.13	1.28	-0.05	**-2.29**	0.82	**1.00**	0.41	3.36	-0.46
Al2O3	-0.04	3.64	0.22	**-0.78**	1.07	**-1.04**	0.35	1.28	-0.26
Fe2O3T	0.53	2.05	0.83	**-0.86**	-1.52	**0.15**	0.79	1.68	-0.18
MnO	-0.27	-1.58	-0.27	**-1.59**	0.60	**-0.54**	1.13	2.61	0.08
MgO	-0.26	0.80	0.38	**-0.89**	-0.11	**-0.89**	0.59	1.31	0.59
CaO	1.03	0.66	-0.47	**0.35**	1.48	**-0.21**	0.41	3.87	-0.71
K2O	1.32	-0.01	0.48	**-1.09**	0.04	**-0.58**	-0.67	3.05	0.10
P2O5	-1.30	0.45	-0.25	**0.45**	0.82	**-0.90**	0.39	2.15	-3.04
Ag	-0.02	*	*	*	*	*	*	*	-0.21
As	*0.74*	*16.15*	*-0.58*	*	*-10.68*	*	*0.79*	*	*0.70*
Ba	0.12	*	2.18	**2.26**	-0.27	**4.94**	-1.18	*	0.80
Be	1.30	*	*	*	0.61	*	0.35	*	0.32
Bi	0.43	*	*	*	*	*	*	*	-0.23
C(tot)	*	*	*	*	*	*	*	*	*
Cd	0.01	*	*	**23.48**	*	*	-1.16	*	0.06
Ce	-1.06	*	4.30	**1.30**	-0.66	**-3.31**	0.99	*	*
Co	-0.52	*	*	**-0.52**	-1.57	**2.79**	-1.14	*	-0.93
Cr	*2.82*	*	*-3.34*	***0.64***	*0.78*	*	*0.35*	*	*-0.43*
Cs	0.20	*	*	**0.54**	-0.37	**-1.58**	0.11	*	0.04
Cu	*-0.68*	*	*0.52*	***-0.50***	*-2.23*	***2.78***	*0.38*	*	*-0.39*
Dy	-0.24	*	*	**-0.26**	0.35	**-3.03**	0.42	*	*
Er	-0.42	*	*	**-0.51**	0.21	**-3.10**	0.42	*	*
Eu	-0.19	*	*	**-0.20**	0.47	**0.00**	0.34	*	*
Ga	*-1.92*	*	*-0.81*	***0.23***	*2.55*	***-3.09***	*-0.48*	*	*-2.50*
Gd	-0.45	*	*	**0.40**	0.43	**-2.93**	0.55	*	*
Hf	*-1.02*	*	*	***-2.07***	*-0.63*	***-1.19***	*0.55*	*	*
Hg	*	*	*	*	*-0.66*	*	*-0.05*	*	*
Ho	-0.04	*	*	**0.28**	0.23	**-1.65**	0.29	*	*
In	*	*	*	*	*	*	*	*	*0.17*
La	-0.79	*	1.52	**1.08**	-0.15	**-2.94**	-0.01	*	*
Li	-1.14	*	*	**-0.13**	-1.50	*	*	*	-0.02
Lu	-0.32	*	*	**0.04**	0.19	**-1.61**	-0.02	*	*
Mo	*0.27*	*	*	***-0.35***	*-2.47*	*	*-0.60*	*	*0.12*
Nb	*-0.56*	*	*-6.00*	***1.44***	*-0.78*	***9.60***	*0.28*	*	*-1.71*
Nd	-0.43	*	*	**0.16**	0.14	**-1.56**	0.14	*	*
Ni	1.22	*	0.23	**1.44**	-2.66	**2.07**	1.30	*	0.32
Pb	*1.15*	*	*8.67*	***0.99***	*-9.43*	***5.87***	*0.96*	*	*0.71*
Pr	-0.58	*	*	**0.55**	0.43	**-2.01**	0.66	*	*
Rb	-0.36	0.68	-1.85	**1.50**	-0.03	**2.92**	-0.61	*	*
Sb	*-0.58*	*	*	*	*-7.23*	*	*-0.26*	*	*0.33*
Sc	*	*	3.67	**0.39**	-0.39	**18.24**	1.03	*	0.23
Se	*0.69*	*	*	*	*	*	*	*	*
Sm	-0.53	*	*	**-0.03**	0.13	**-2.41**	0.40	*	*
Sn	-0.69	*	*	*	*	*	-2.06	*	0.00
Sr	-0.38	0.45	-0.25	**-0.05**	-0.60	**1.88**	-0.04	*	0.98
Ta	-0.30	*	*	**0.20**	-0.25	*	-0.19	*	2.29
Tb	-0.24	*	*	**0.60**	0.33	**-1.46**	0.20	*	*
Th	-1.58	*	-0.45	**0.09**	-0.05	**-2.27**	-1.14	*	0.39
Tl	*0.23*	*	*	*	*-4.86*	*	*	*	*-0.36*
Tm	-0.15	*	*	**0.31**	0.13	**-1.82**	0.19	*	*
U	*0.49*	*	*1.58*	***-0.23***	*-0.35*	***4.31***	*-0.12*	*	*-1.11*
V	*-0.02*	*5.49*	*2.41*	***-0.20***	*0.01*	***4.85***	*0.36*	*	*-0.14*
W	*-1.97*	*	*	*	*	*	*	*	*-1.30*
Y	-0.49	*	1.34	**2.49**	0.55	**1.61**	0.36	*	*
Yb	-0.32	*	*	**-0.14**	0.33	**-2.36**	0.23	*	*
Zr	*-1.14*	*-10.01*	*4.15*	***-2.79***	*-1.41*	***2.49***	*0.20*	*	*

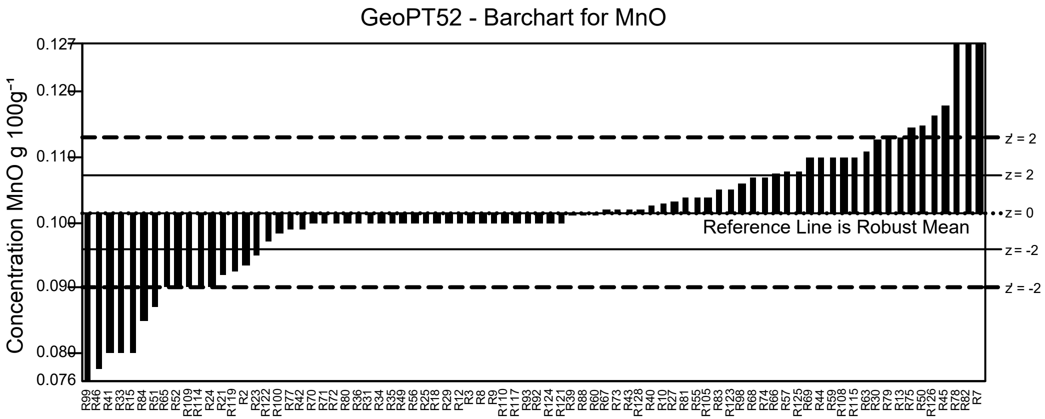
Bold entries are Data Quality 1 - Underlined entries are Data Quality 2 - *Entries in italics* are derived from Provisional Values.

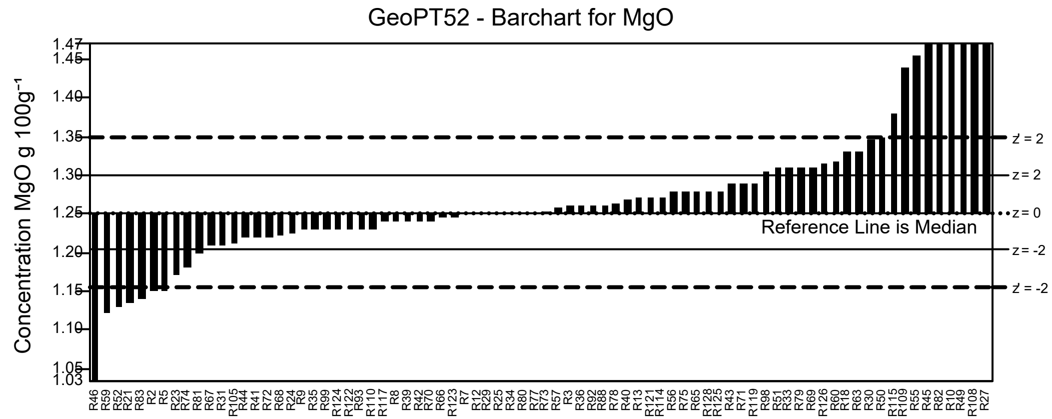

GeoPT52 - Barchart for SiO2
Concentration SiO2 g 100g⁻¹
47.7
46.9
44.9
42.9
40.9
38.9
z' = 2
z = 2
z = 0
Reference Line is Median
z = -2
z' = -2


GeoPT52 - Barchart for TiO2
Concentration TiO2 g 100g⁻¹
0.59
0.57
0.53
0.49
0.45
0.41
0.39
z' = 2
z = 2
z = 0
Reference Line is Robust Mean
z = -2
z' = -2

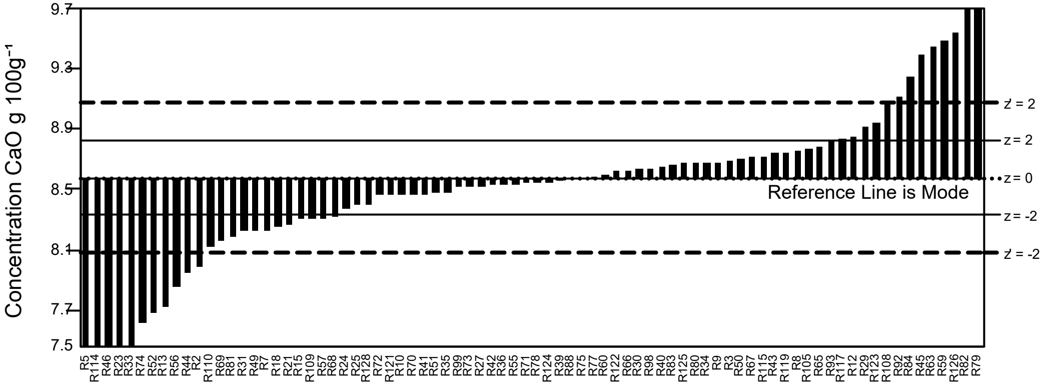

GeoPT52 - Barchart for Al2O3
Concentration Al2O3 g 100g⁻¹
8.9
8.8
8.4
8.0
7.6
7.2
6.8
z' = 2
z = 2
z = 0
Reference Line is Mode
z = -2
z' = -2


GeoPT52 - Barchart for Fe2O3T
Concentration Fe2O3T g 100g⁻¹
9.2
8.9
8.5
8.1
7.7
7.3
7.1
z' = 2
z = 2
z = 0
Reference Line is Robust Mean
z = -2
z' = -2

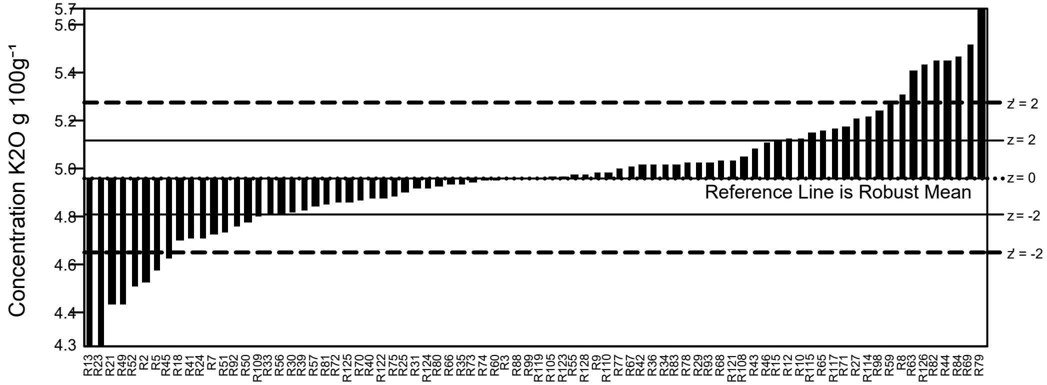

GeoPT52 - Barchart for MnO
Concentration MnO g 100g⁻¹
0.127
0.120
0.110
0.100
0.090
0.080
0.076
z' = 2
z = 2
z = 0
Reference Line is Robust Mean
z = -2
z' = -2


GeoPT52 - Barchart for MgO
Concentration MgO g 100g⁻¹
1.47
1.45
1.40
1.35
1.30
1.25
1.20
1.15
1.10
1.05
1.03
z' = 2
z = 2
z = 0
Reference Line is Median
z = -2
z' = -2

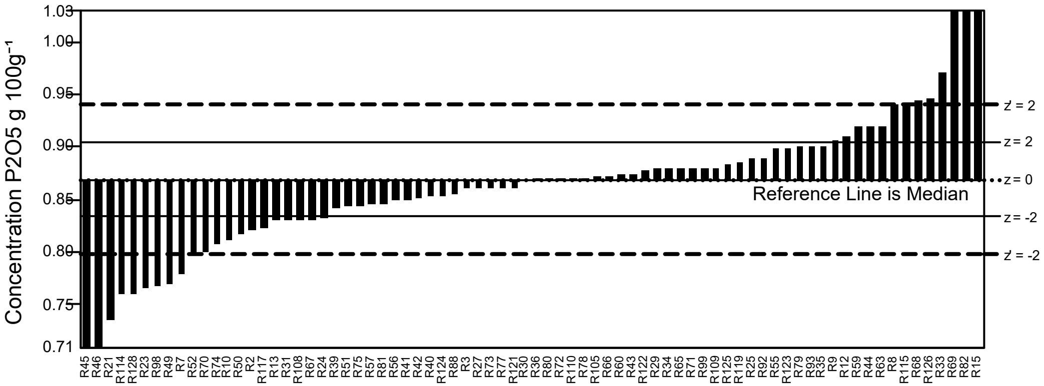
GeoPT52 - Barchart for CaO



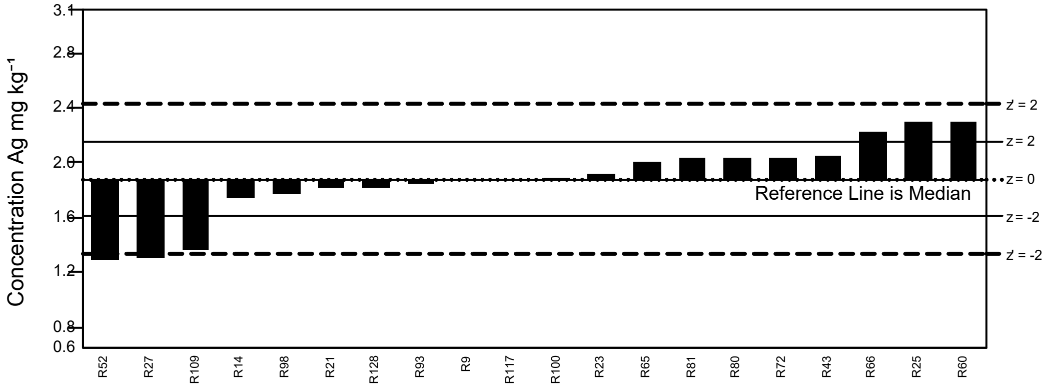
GeoPT52 - Barchart for K2O



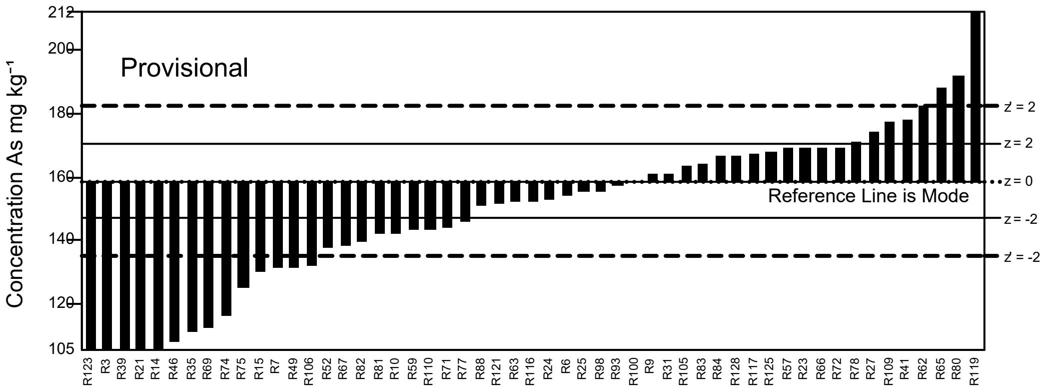
GeoPT52 - Barchart for P2O5



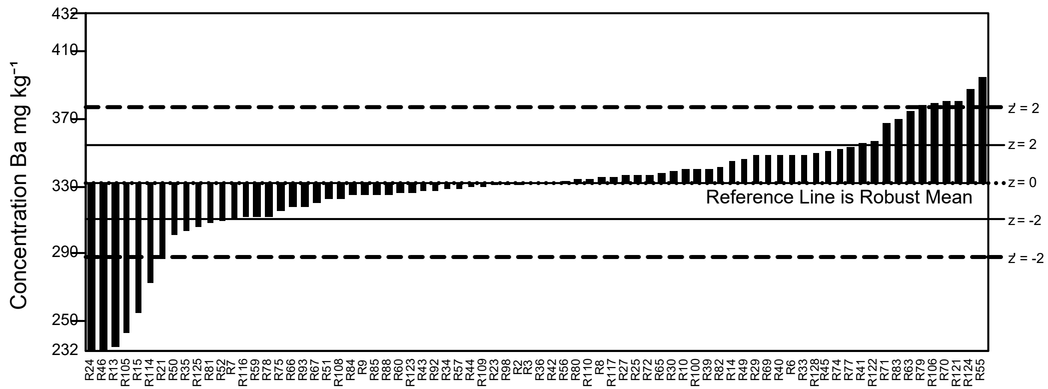
GeoPT52 - Barchart for Ag



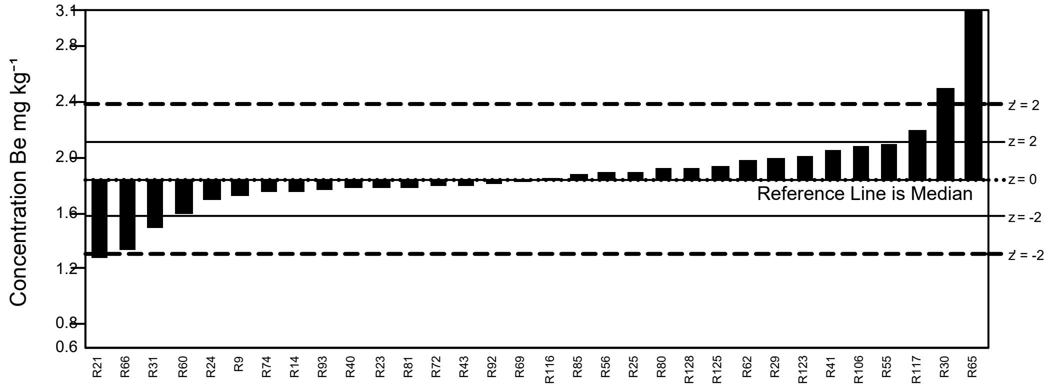
GeoPT52 - Barchart for As



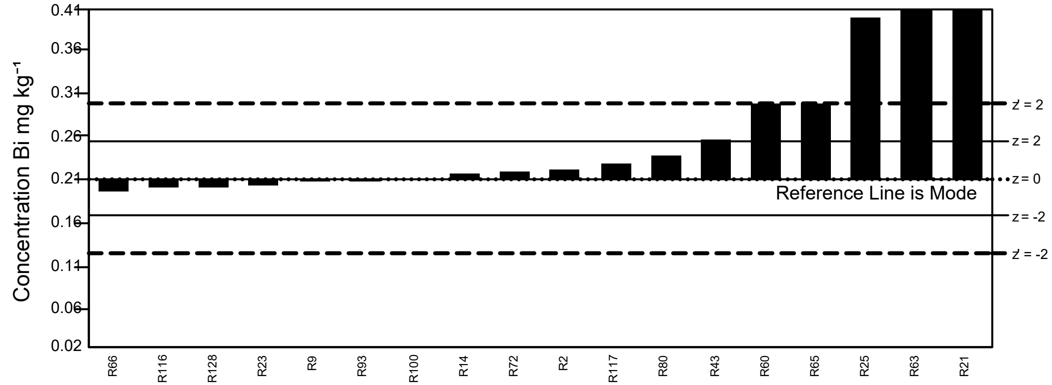
GeoPT52 - Barchart for Ba



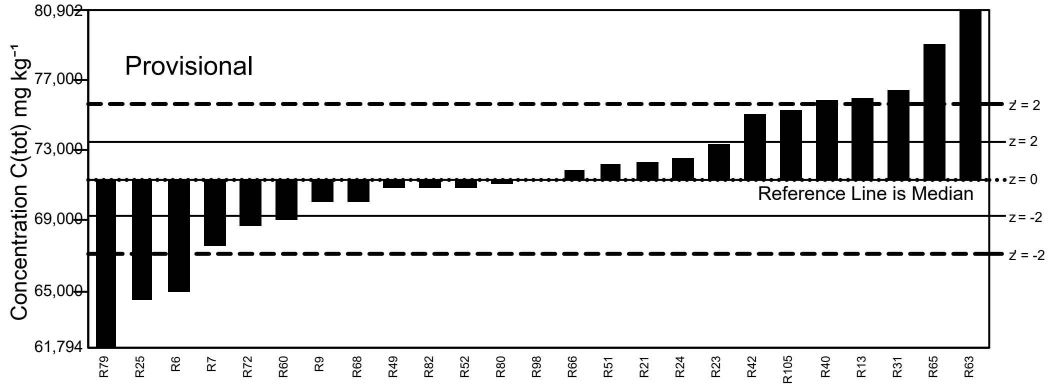
GeoPT52 - Barchart for Be



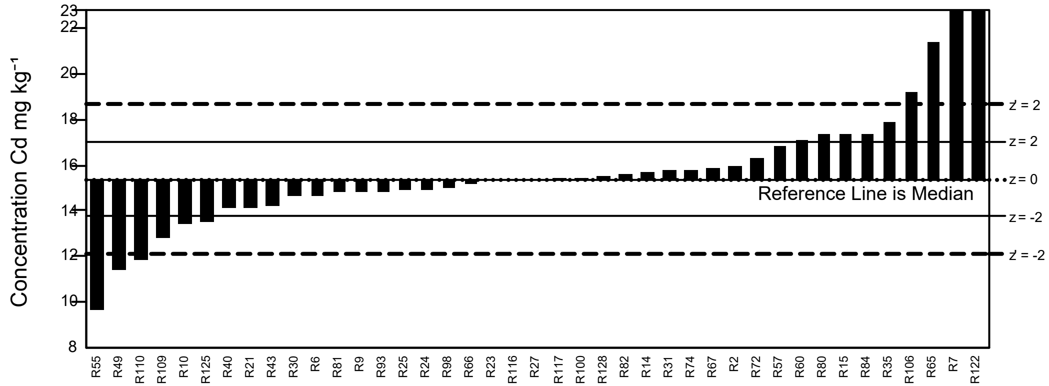
GeoPT52 - Barchart for Bi



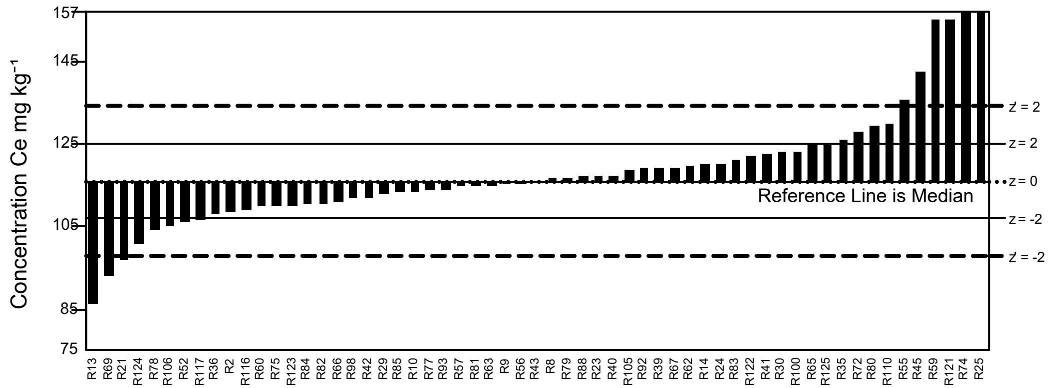
GeoPT52 - Barchart for C(tot)



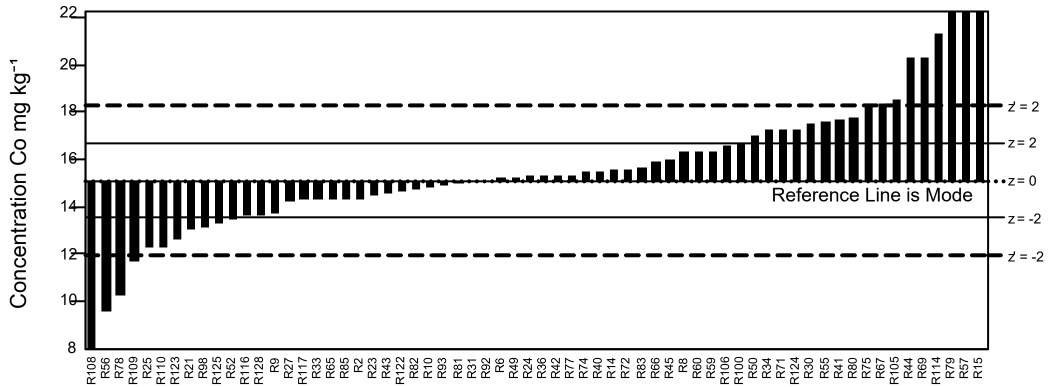
GeoPT52 - Barchart for Cd



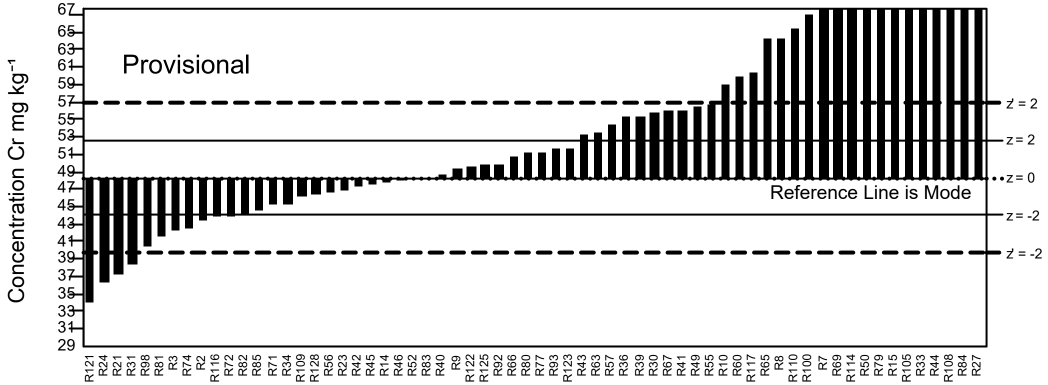
GeoPT52 - Barchart for Ce



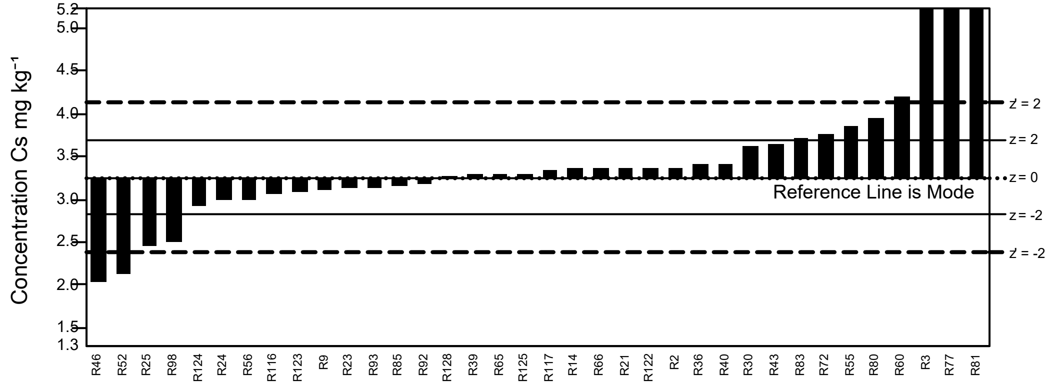
GeoPT52 - Barchart for Co



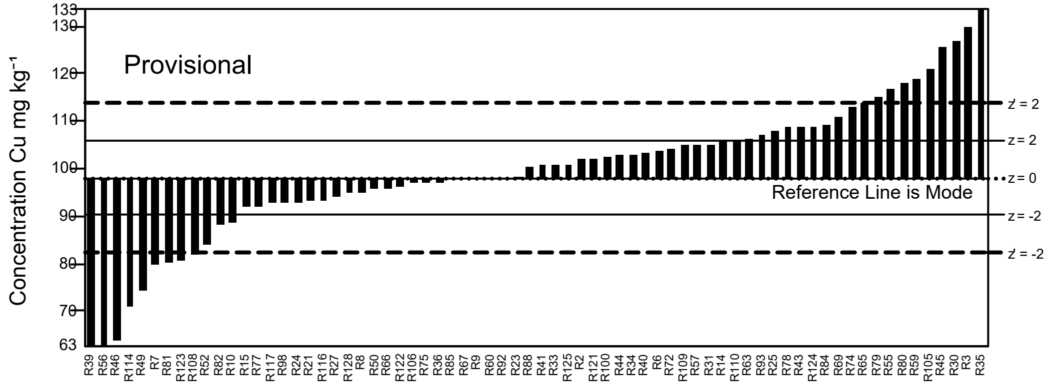
GeoPT52 - Barchart for Cr



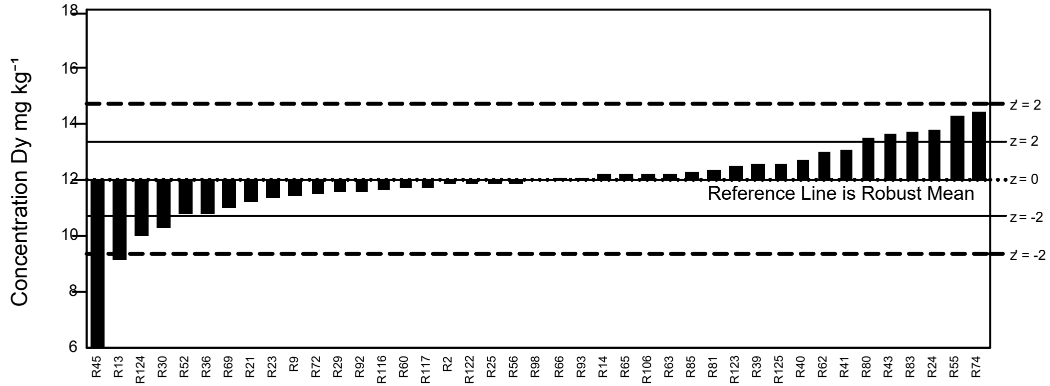
GeoPT52 - Barchart for Cs



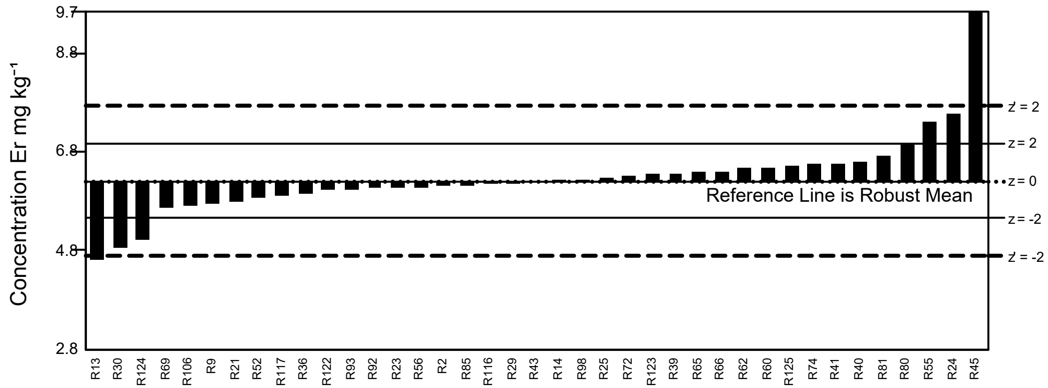
GeoPT52 - Barchart for Cu



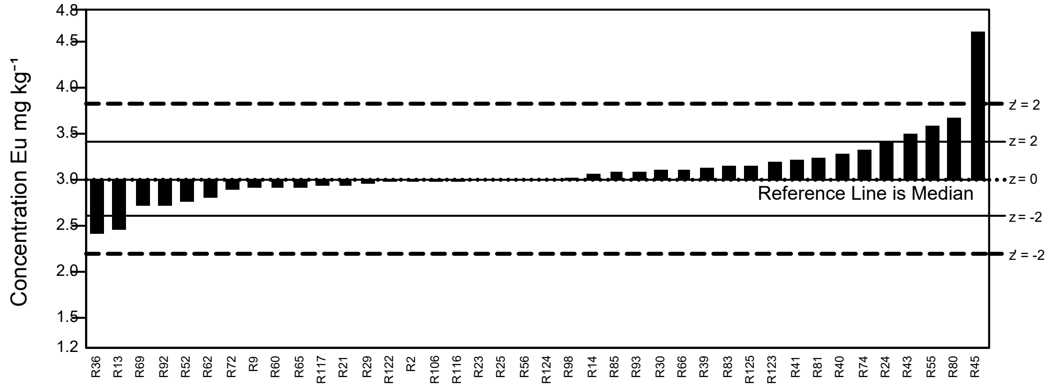
GeoPT52 - Barchart for Dy



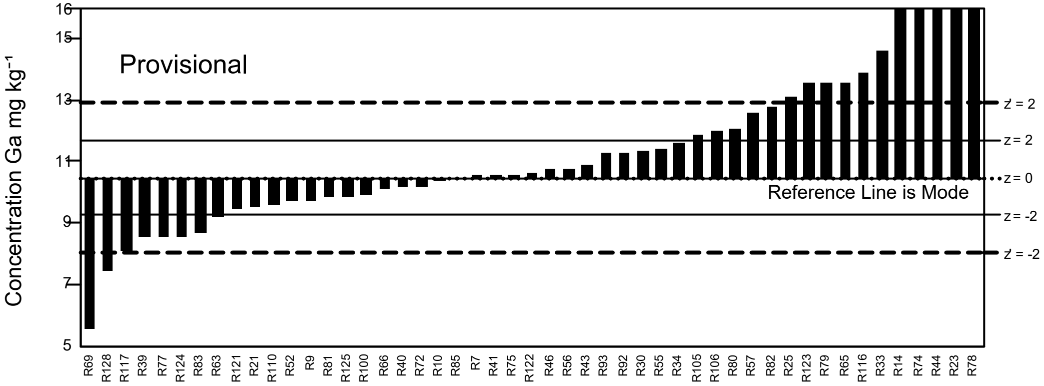
GeoPT52 - Barchart for Er



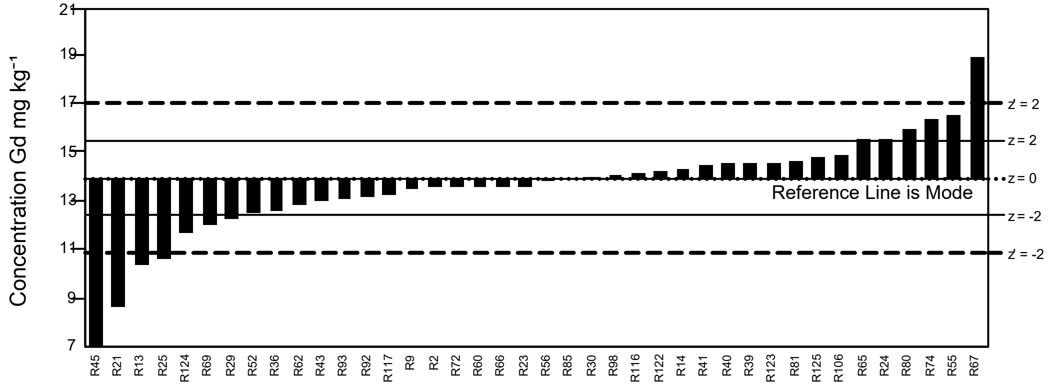
GeoPT52 - Barchart for Eu



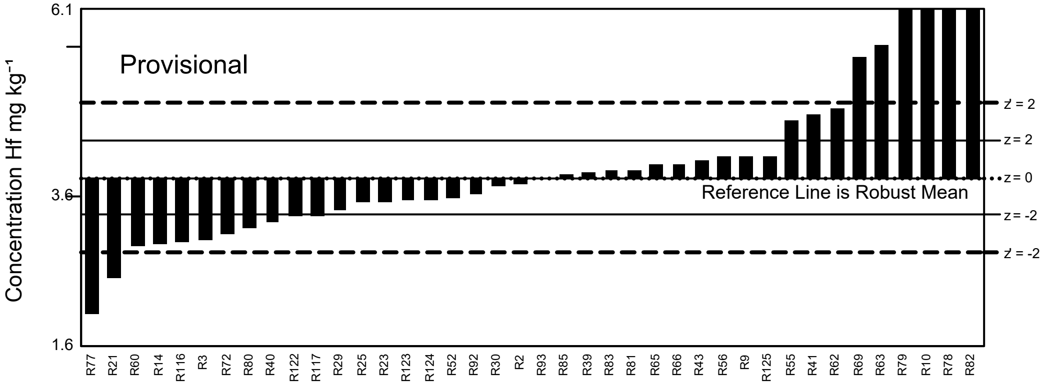
GeoPT52 - Barchart for Ga



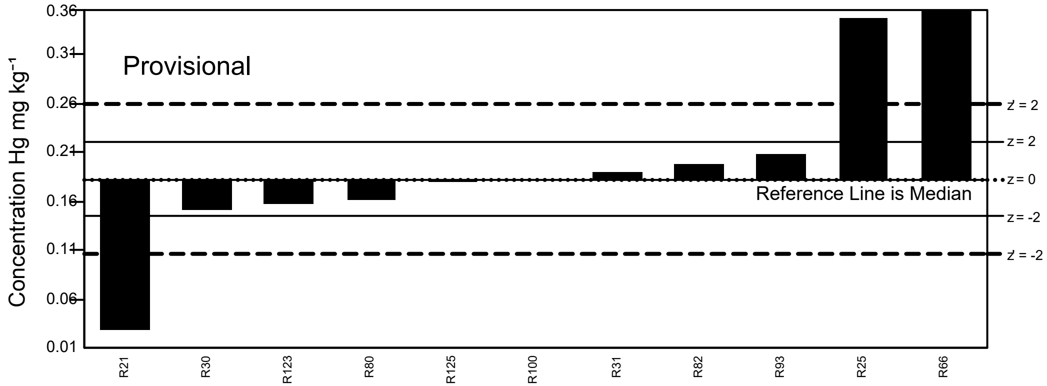
GeoPT52 - Barchart for Gd



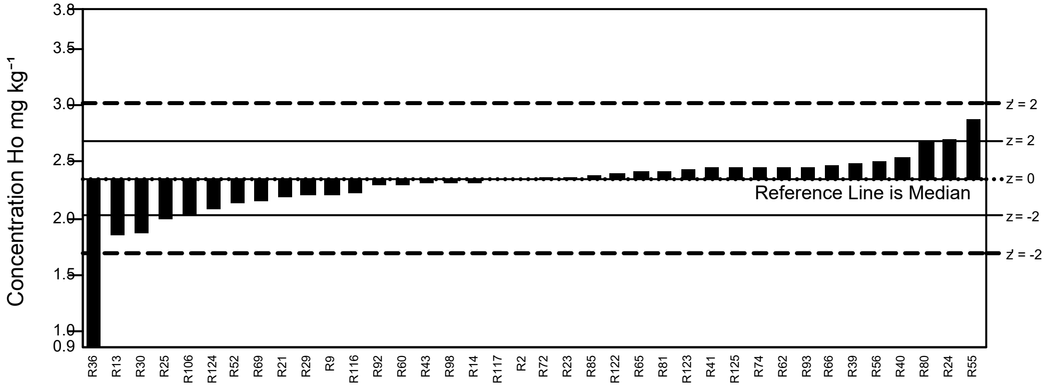
GeoPT52 - Barchart for Hf



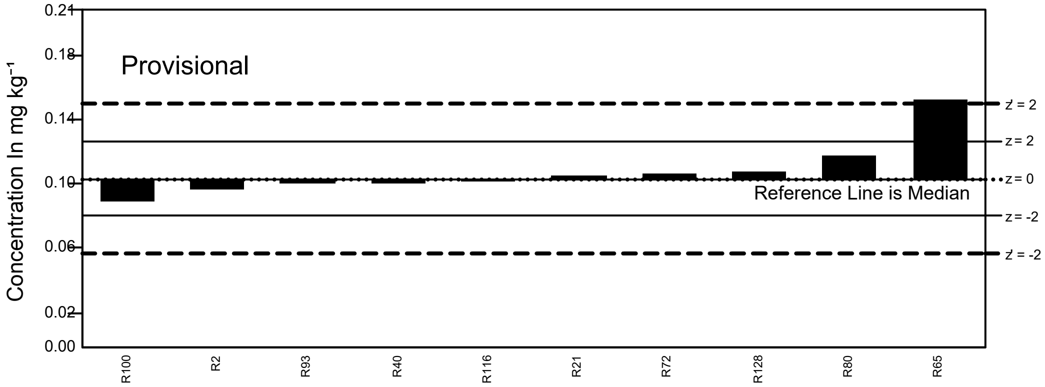
GeoPT52 - Barchart for Hg

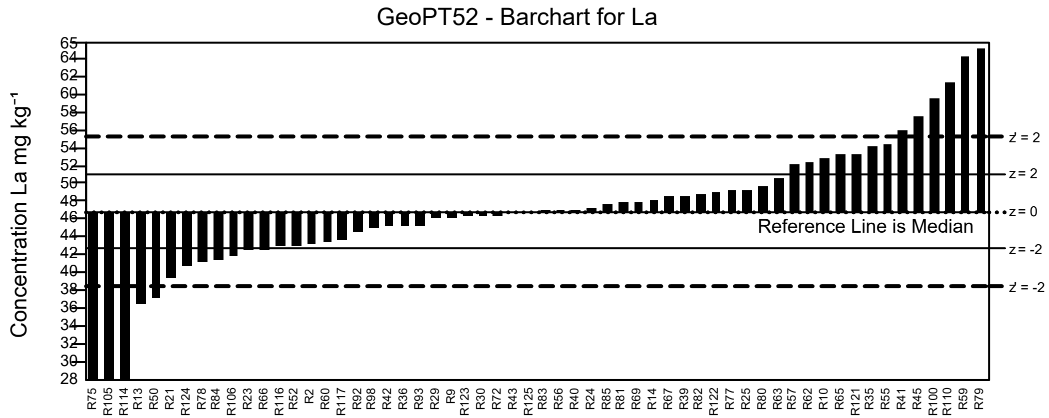


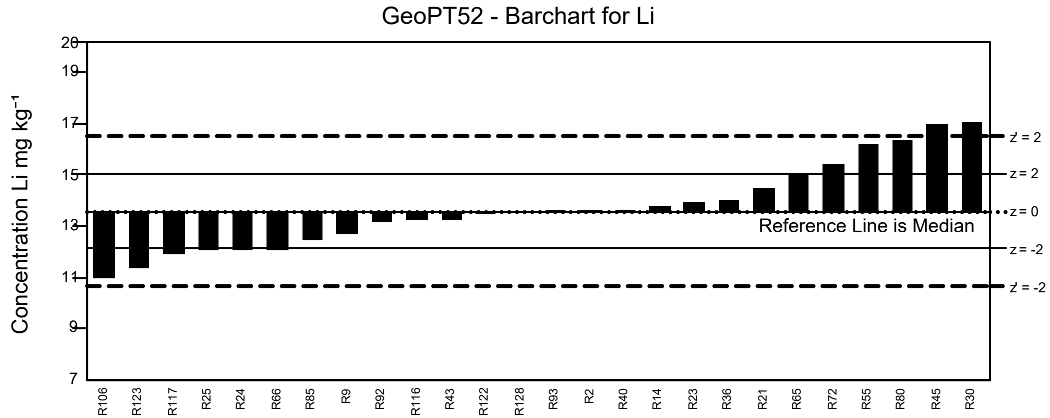
GeoPT52 - Barchart for Ho

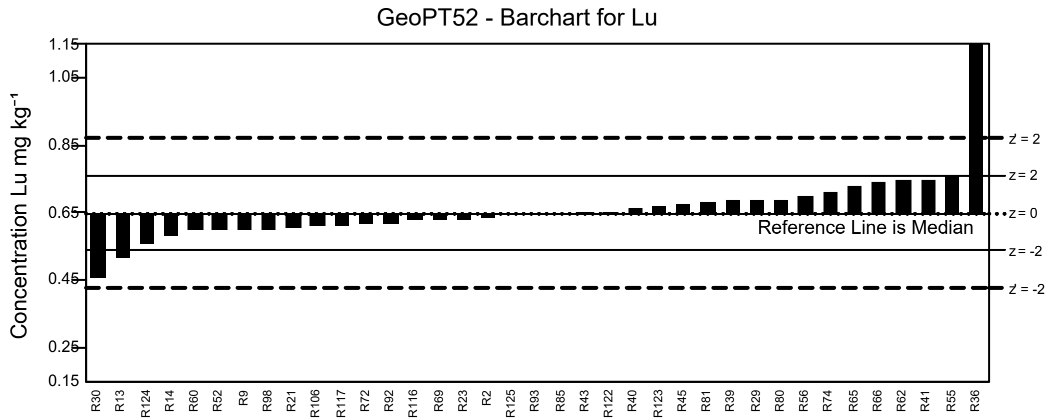


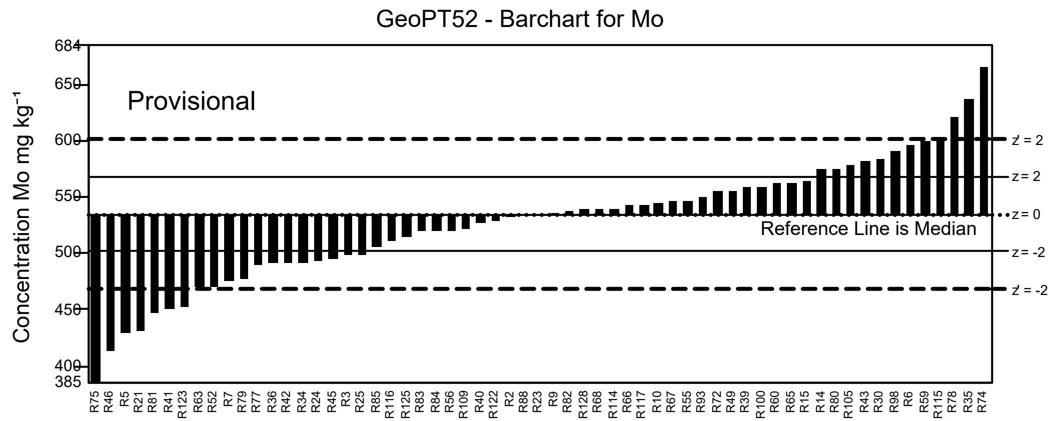
GeoPT52 - Barchart for In

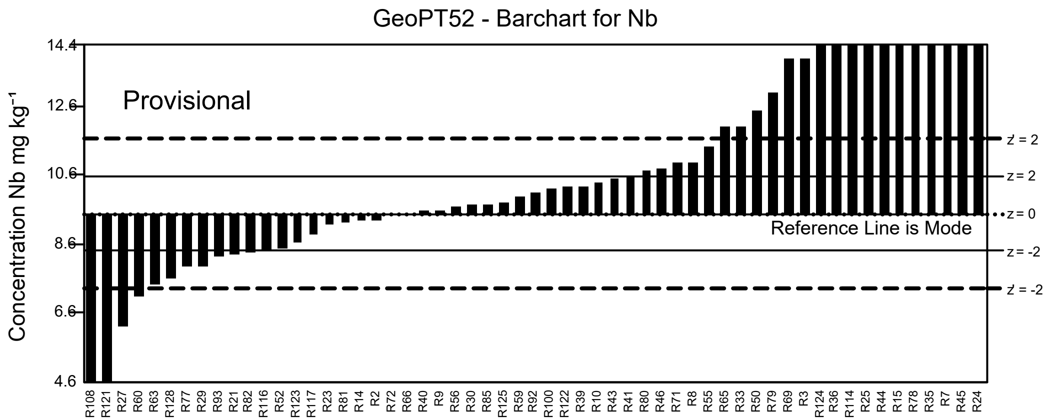


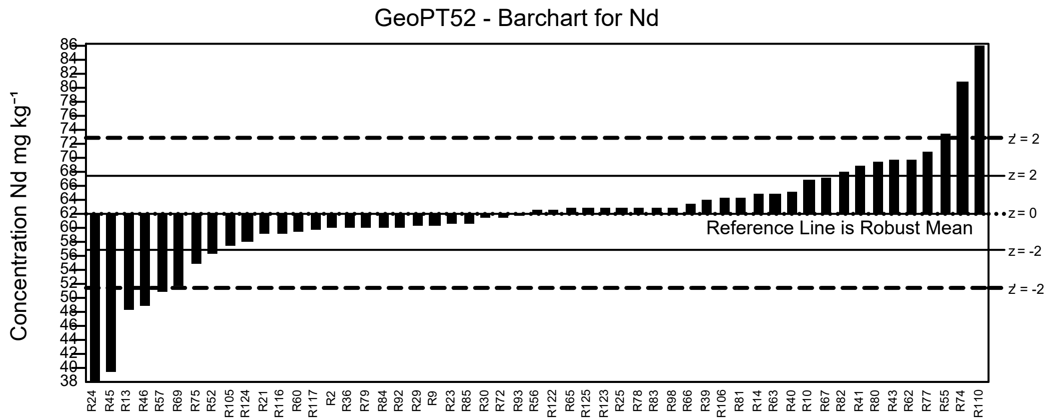

GeoPT52 - Barchart for La
Concentration La mg kg⁻¹
65 64 62 60 58 56 54 52 50 48 46 44 42 40 38 36 34 32 30 28
z' = 2
z = 2
z = 0
z = -2
z' = -2
Reference Line is Median
R75 R105 R114 R13 R50 R21 R124 R78 R84 R106 R23 R66 R116 R52 R2 R60 R117 R92 R98 R42 R36 R93 R29 R9 R123 R30 R72 R43 R125 R83 R56 R40 R24 R85 R81 R69 R14 R67 R39 R82 R122 R77 R25 R80 R63 R57 R62 R10 R65 R121 R35 R55 R41 R45 R100 R110 R59 R79

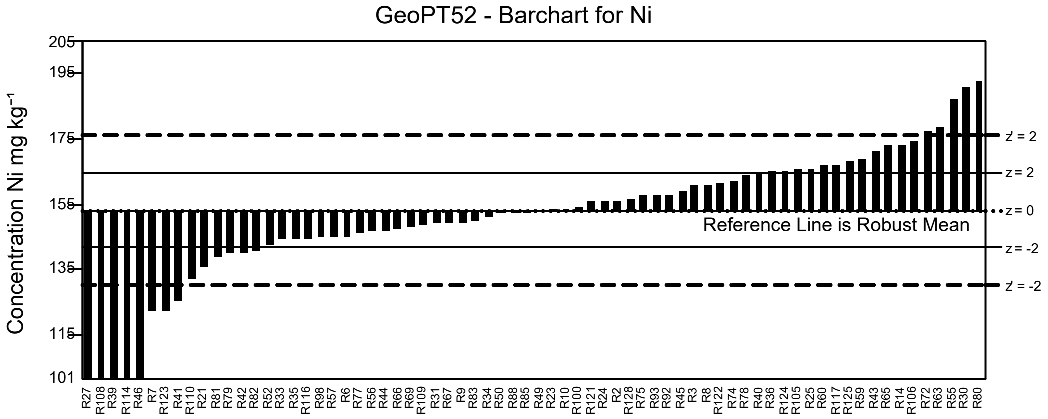

GeoPT52 - Barchart for Li
Concentration Li mg kg⁻¹
20 19 17 15 13 11 9 7
z' = 2
z = 2
z = 0
z = -2
z' = -2
Reference Line is Median
R106 R123 R117 R25 R24 R66 R85 R9 R92 R116 R43 R122 R128 R93 R2 R40 R14 R23 R36 R21 R65 R72 R55 R80 R45 R30

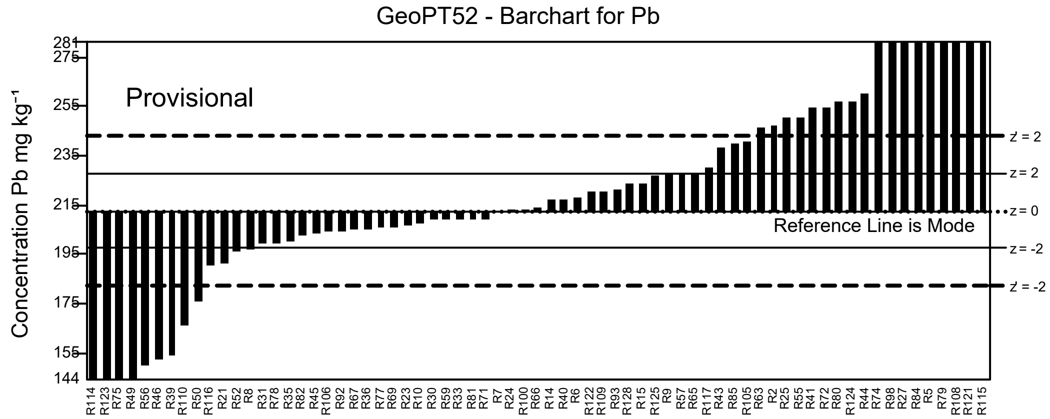

GeoPT52 - Barchart for Lu
Concentration Lu mg kg⁻¹
1.15 1.05 0.85 0.65 0.45 0.25 0.15
z' = 2
z = 2
z = 0
z = -2
z' = -2
Reference Line is Median
R30 R13 R124 R14 R60 R52 R9 R98 R21 R106 R117 R72 R92 R116 R69 R23 R2 R125 R93 R85 R43 R122 R40 R123 R45 R81 R39 R29 R80 R56 R74 R65 R66 R62 R41 R55 R36

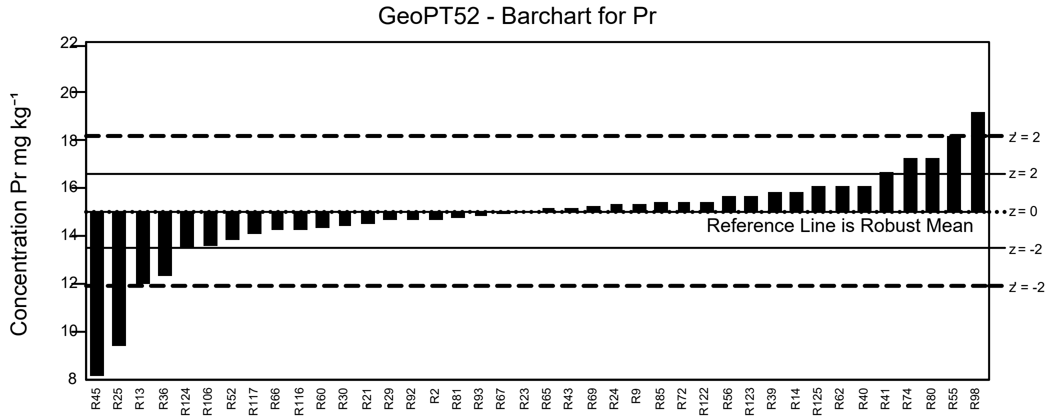

GeoPT52 - Barchart for Mo
Concentration Mo mg kg⁻¹
684 650 600 550 500 450 400 385
Provisional
z' = 2
z = 2
z = 0
z = -2
z' = -2
Reference Line is Median
R75 R46 R5 R21 R81 R41 R123 R63 R52 R7 R79 R77 R36 R42 R34 R24 R45 R3 R25 R85 R116 R125 R83 R84 R56 R109 R40 R122 R2 R88 R23 R9 R82 R128 R68 R114 R66 R117 R10 R67 R55 R93 R72 R49 R39 R100 R60 R65 R15 R14 R80 R105 R43 R30 R98 R6 R59 R115 R78 R35 R74

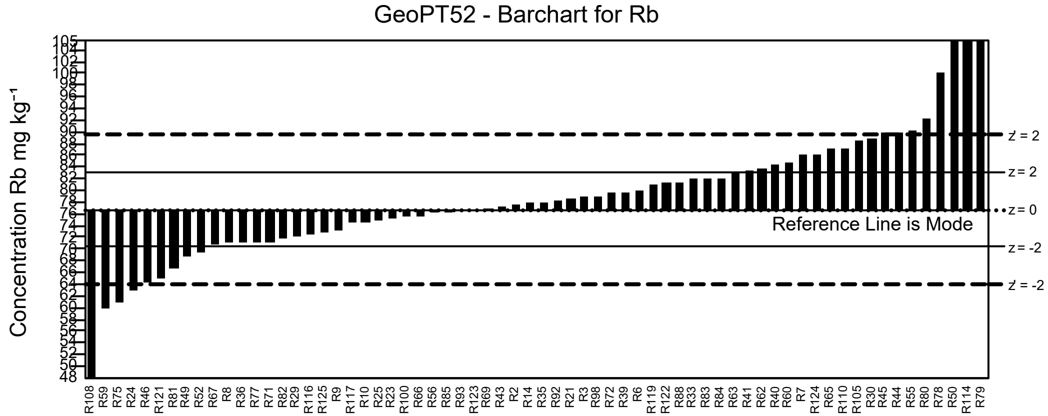

GeoPT52 - Barchart for Nb
Concentration Nb mg kg⁻¹
14.4 12.6 10.6 8.6 6.6 4.6
Provisional
z' = 2
z = 2
z = 0
z = -2
z' = -2
Reference Line is Mode
R108 R121 R27 R60 R63 R128 R77 R29 R93 R21 R82 R116 R52 R123 R117 R23 R81 R14 R2 R72 R66 R40 R9 R56 R30 R85 R125 R59 R92 R100 R122 R39 R10 R43 R41 R80 R46 R71 R8 R55 R65 R33 R50 R79 R69 R3 R124 R36 R114 R25 R44 R15 R78 R35 R7 R45 R24

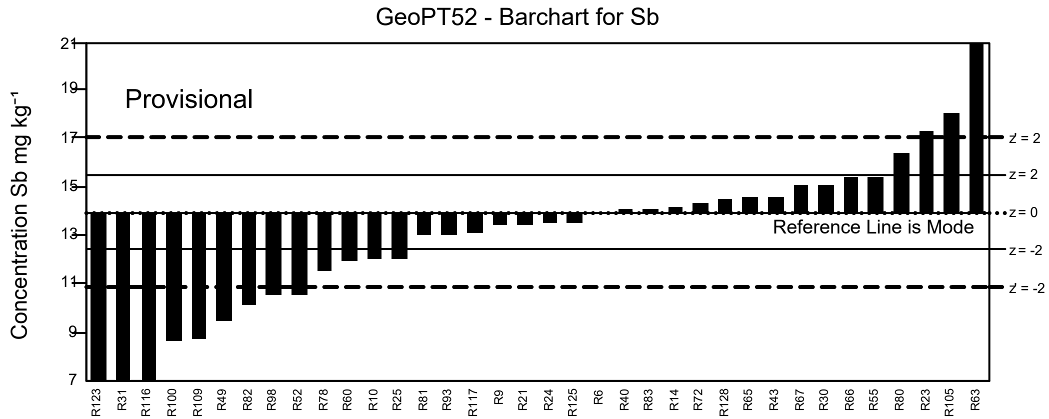

GeoPT52 - Barchart for Nd
Concentration Nd mg kg⁻¹
86 84 82 80 78 76 74 72 70 68 66 64 62 60 58 56 54 52 50 48 46 44 42 40 38
z' = 2
z = 2
z = 0
z = -2
z' = -2
Reference Line is Robust Mean
R24 R45 R13 R46 R57 R69 R75 R52 R105 R124 R21 R116 R60 R117 R2 R36 R79 R84 R92 R29 R9 R23 R85 R30 R72 R93 R56 R122 R65 R125 R123 R25 R78 R83 R98 R66 R39 R106 R81 R14 R63 R40 R10 R67 R82 R41 R80 R43 R62 R77 R55 R74 R110

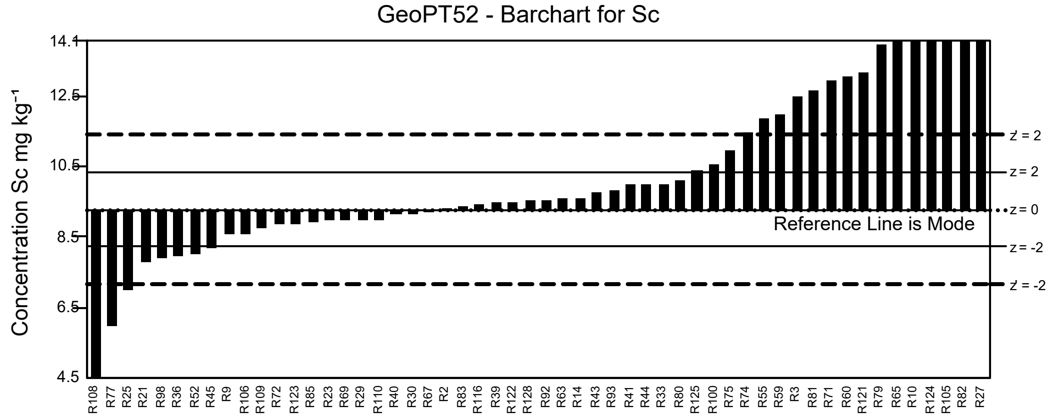

GeoPT52 - Barchart for Ni
Concentration Ni mg kg⁻¹
Reference Line is Robust Mean
z' = 2
z = 2
z = 0
z = -2
z' = -2


GeoPT52 - Barchart for Pb
Provisional
Concentration Pb mg kg⁻¹
Reference Line is Mode
z' = 2
z = 2
z = 0
z = -2
z' = -2

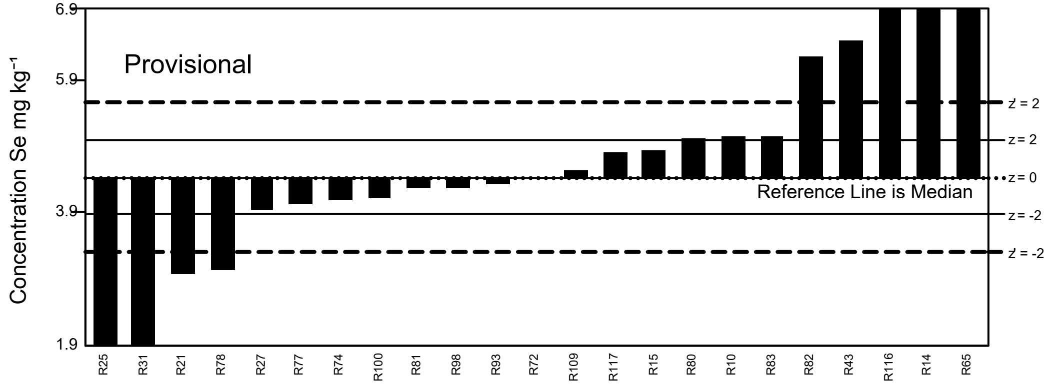

GeoPT52 - Barchart for Pr
Concentration Pr mg kg⁻¹
Reference Line is Robust Mean
z' = 2
z = 2
z = 0
z = -2
z' = -2


GeoPT52 - Barchart for Rb
Concentration Rb mg kg⁻¹
Reference Line is Mode
z' = 2
z = 2
z = 0
z = -2
z' = -2

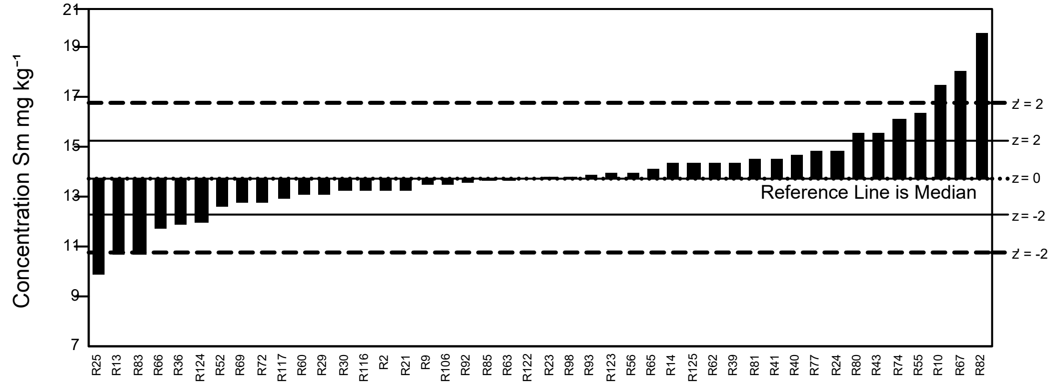

GeoPT52 - Barchart for Sb
Provisional
Concentration Sb mg kg⁻¹
Reference Line is Mode
z' = 2
z = 2
z = 0
z = -2
z' = -2


GeoPT52 - Barchart for Sc
Concentration Sc mg kg⁻¹
Reference Line is Mode
z' = 2
z = 2
z = 0
z = -2
z' = -2

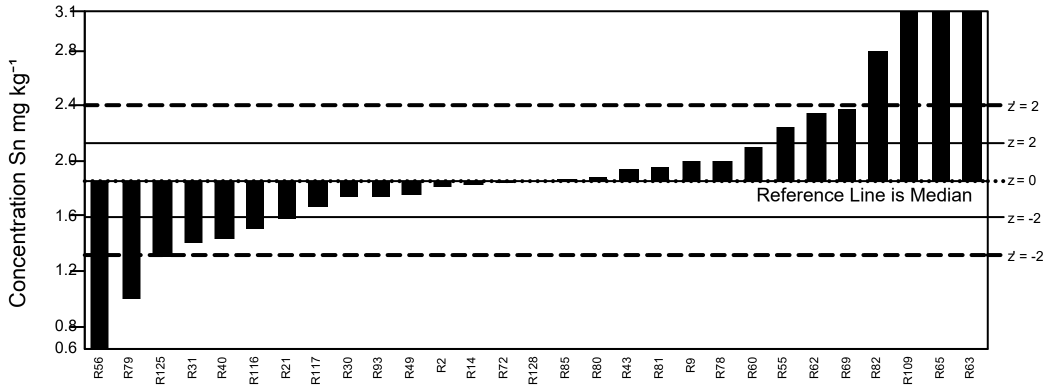
GeoPT52 - Barchart for Se



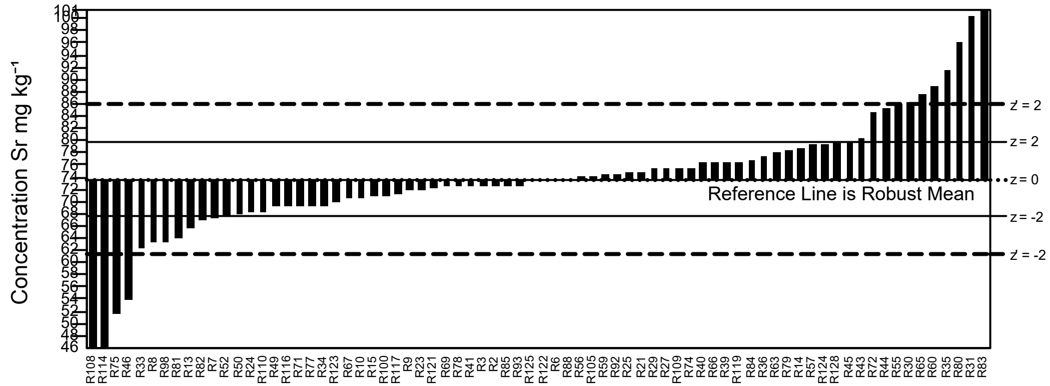
GeoPT52 - Barchart for Sm



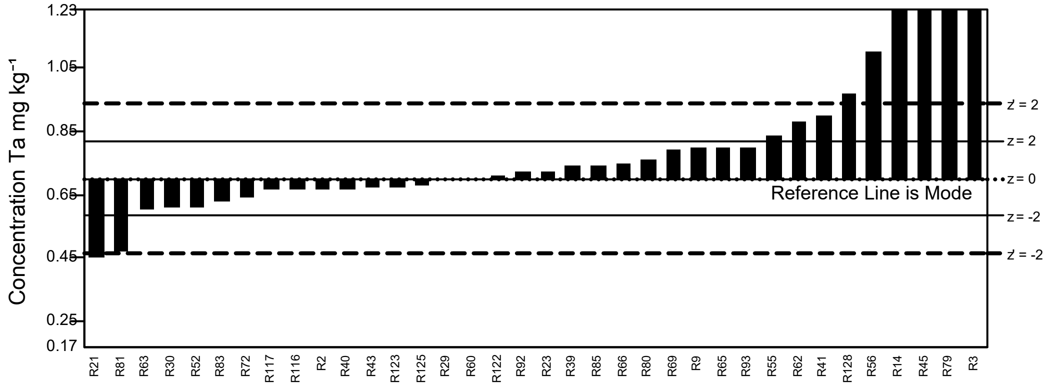
GeoPT52 - Barchart for Sn



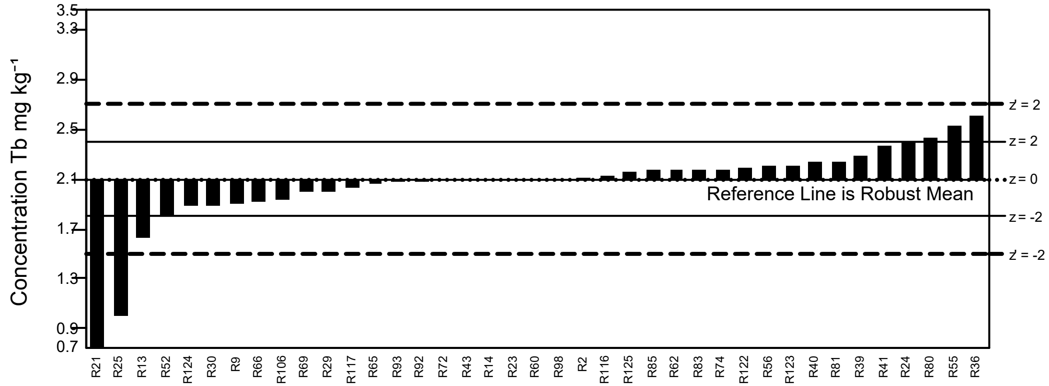
GeoPT52 - Barchart for Sr

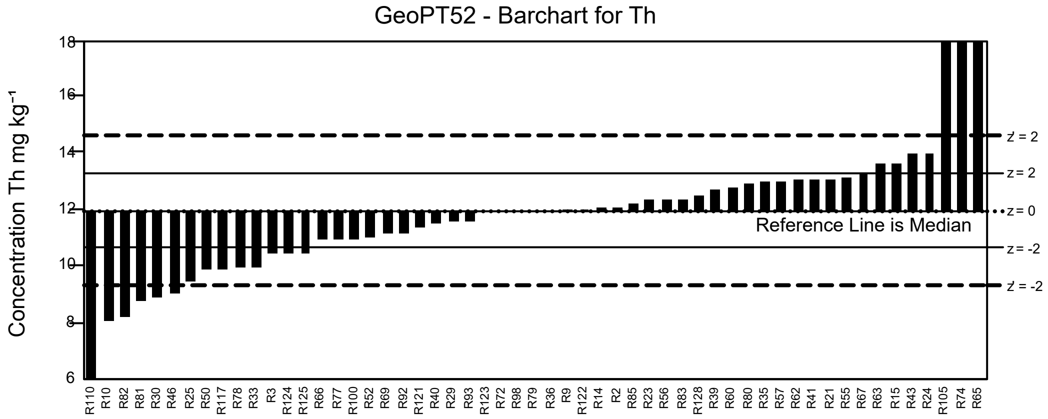


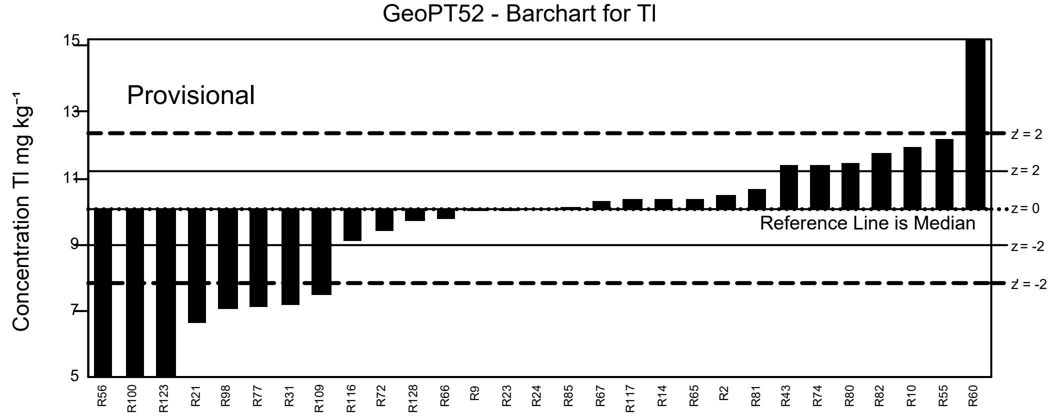
GeoPT52 - Barchart for Ta

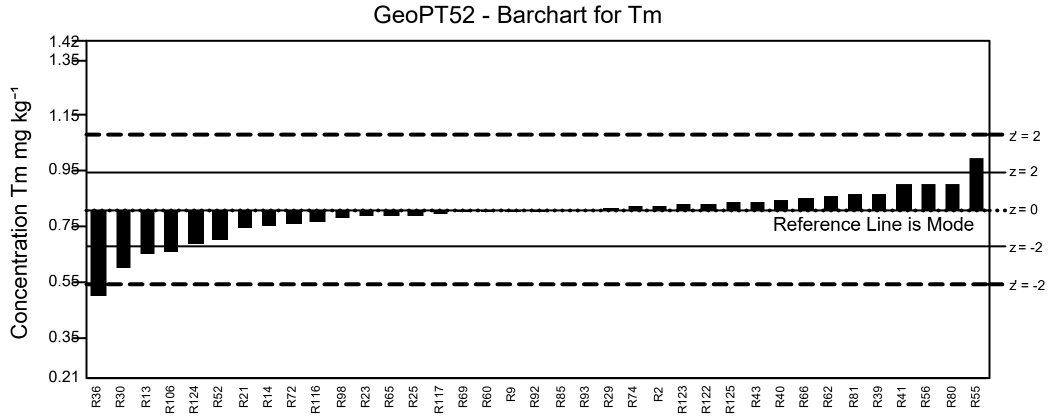


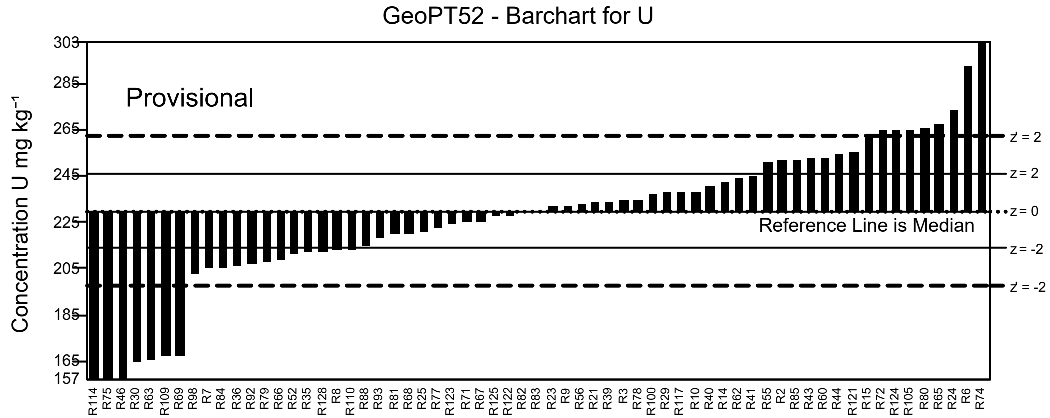
GeoPT52 - Barchart for Tb

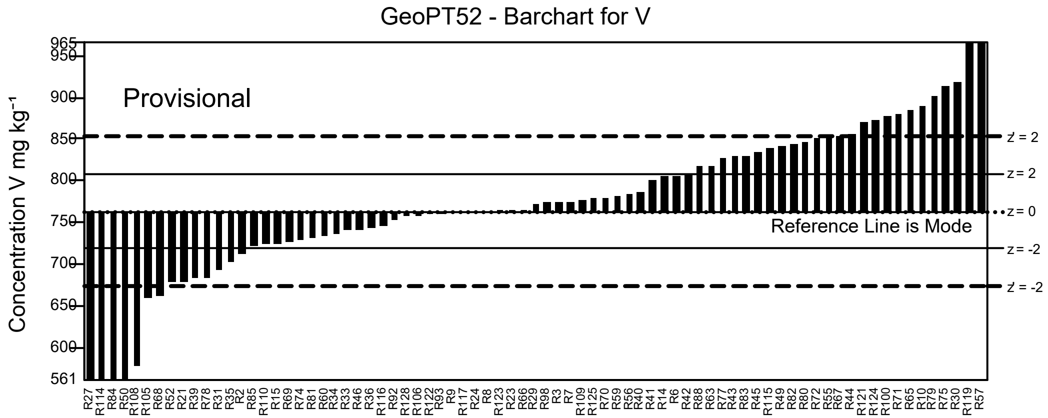


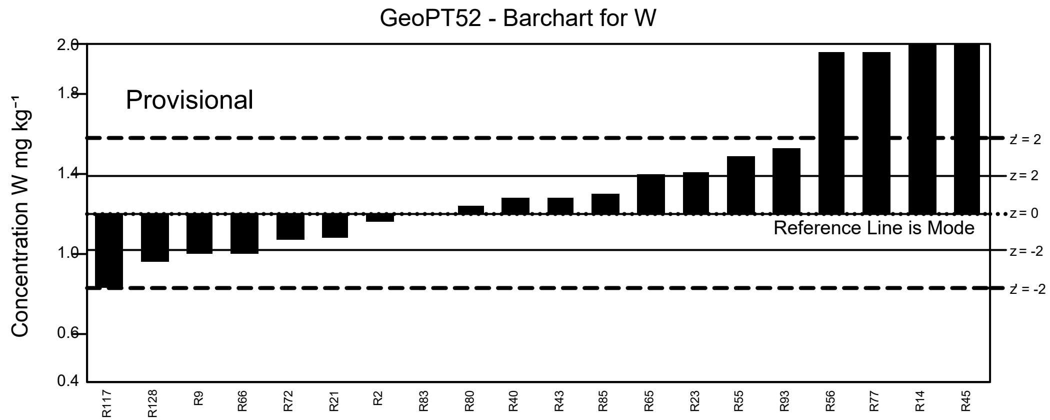

GeoPT52 - Barchart for Th
Concentration Th mg kg⁻¹
Reference Line is Median
z' = 2
z = 2
z = 0
z = -2
z' = -2

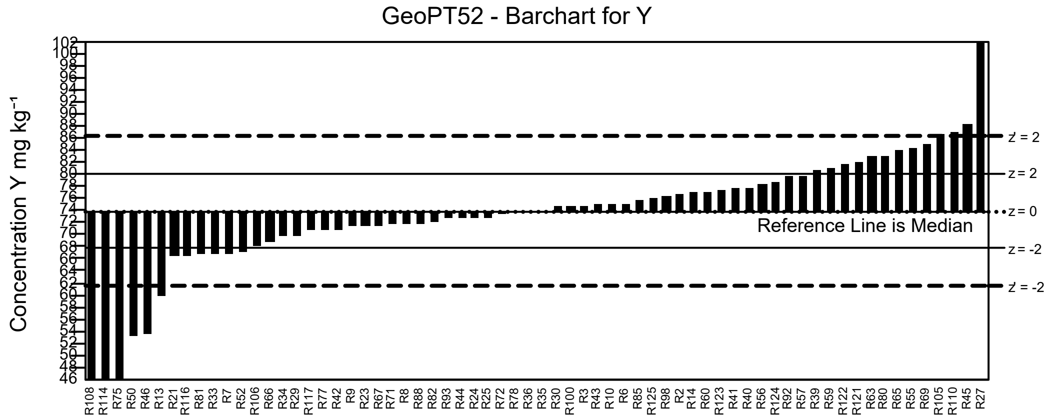

GeoPT52 - Barchart for Tl
Provisional
Concentration Tl mg kg⁻¹
Reference Line is Median
z' = 2
z = 2
z = 0
z = -2
z' = -2

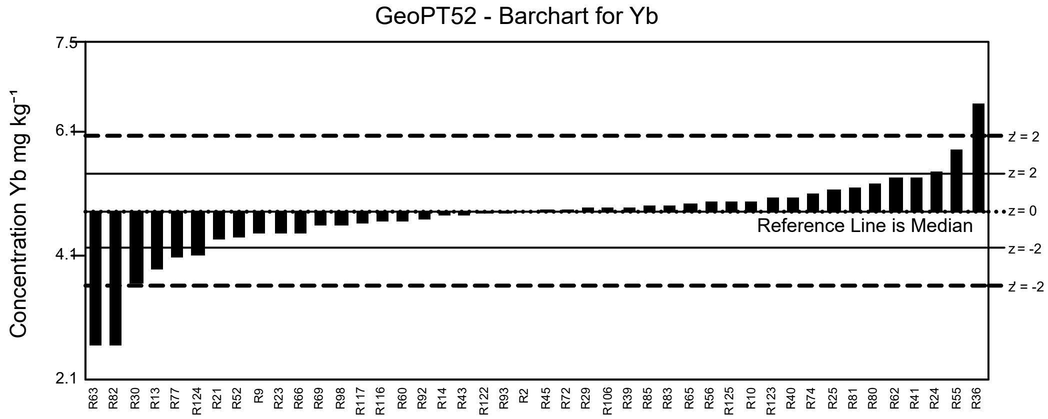

GeoPT52 - Barchart for Tm
Concentration Tm mg kg⁻¹
Reference Line is Mode
z' = 2
z = 2
z = 0
z = -2
z' = -2


GeoPT52 - Barchart for U
Provisional
Concentration U mg kg⁻¹
Reference Line is Median
z' = 2
z = 2
z = 0
z = -2
z' = -2


GeoPT52 - Barchart for V
Provisional
Concentration V mg kg⁻¹
Reference Line is Mode
z' = 2
z = 2
z = 0
z = -2
z' = -2


GeoPT52 - Barchart for W
Provisional
Concentration W mg kg⁻¹
Reference Line is Mode
z' = 2
z = 2
z = 0
z = -2
z' = -2





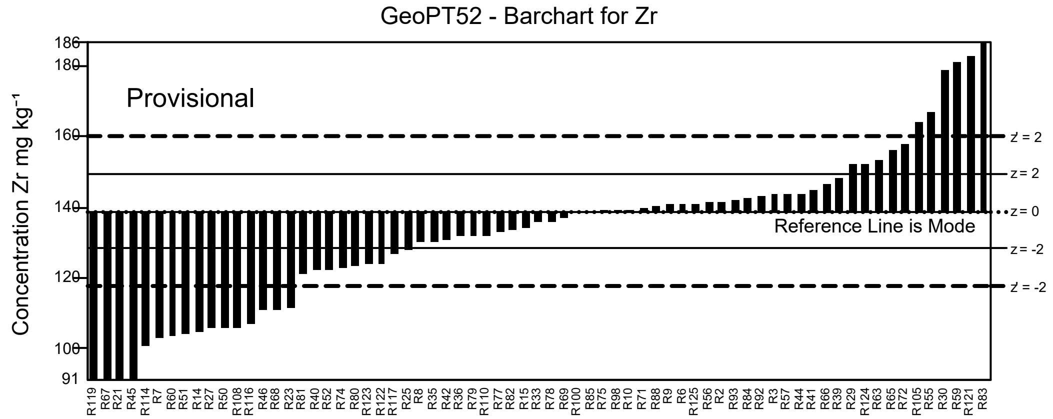
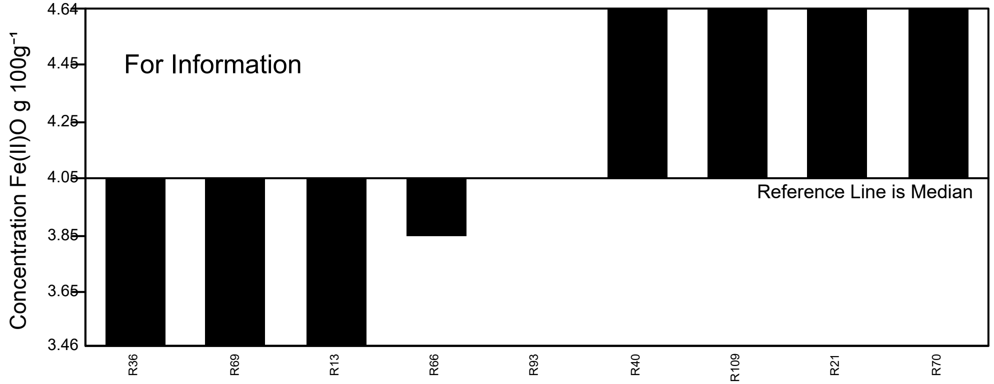
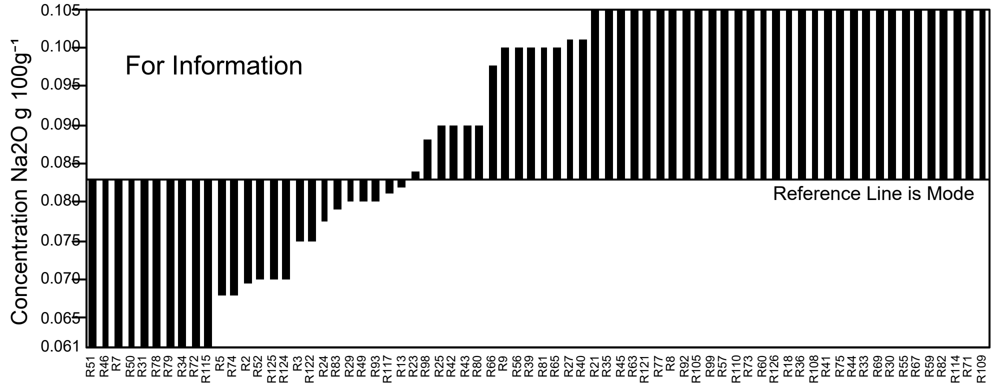


Figure 1: GeoPT52 - Metalliferous shale, EMS-1. Data distribution charts for elements for which values were assigned or provisional values given for guidance. Horizontal lines show the limits for -2<z<2 for pure geochemistry labs (solid lines) and -2<z'<2 for applied geochemistry labs (pecked lines).

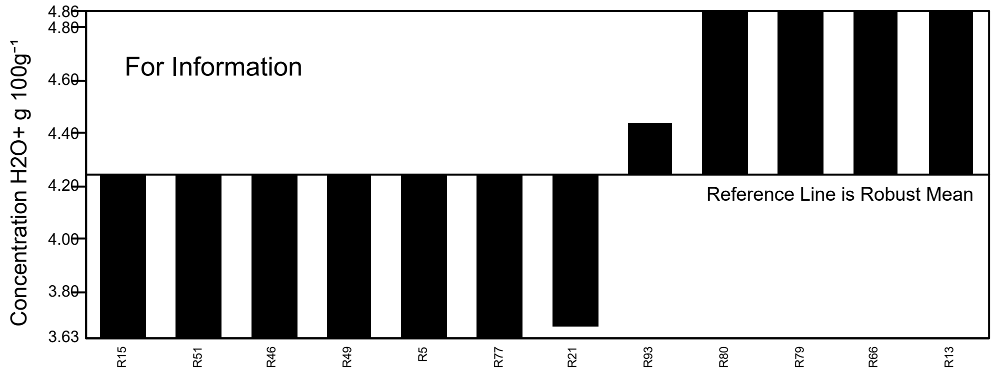
GeoPT52 - Barchart for Fe(II)O



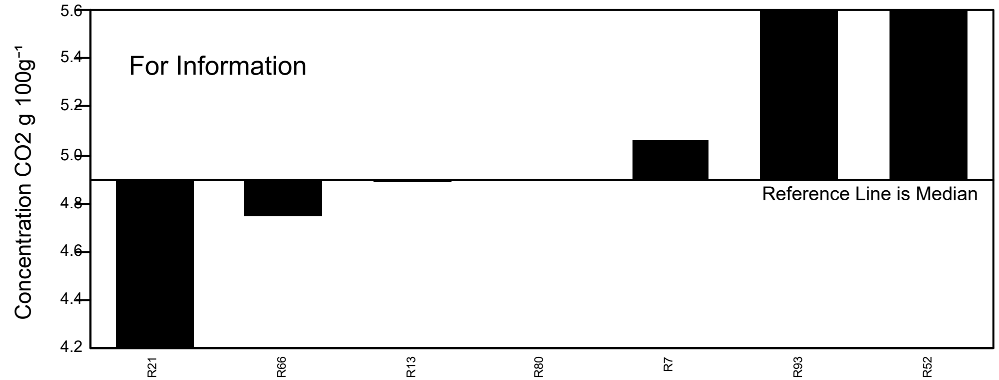
GeoPT52 - Barchart for Na2O



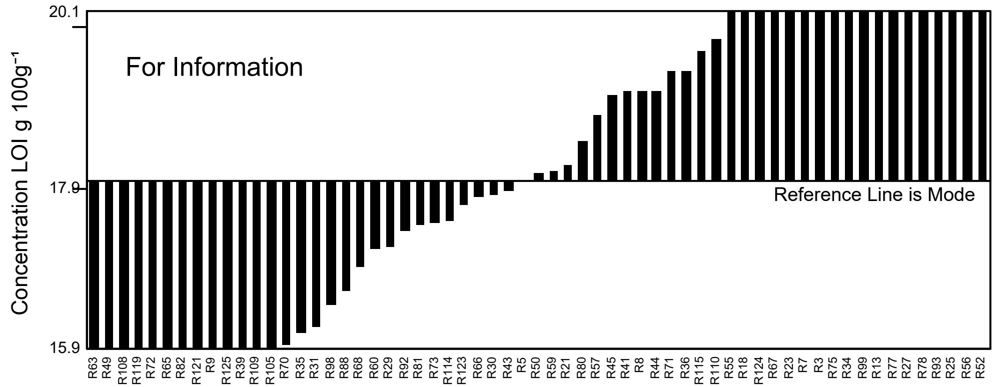
GeoPT52 - Barchart for H2O+



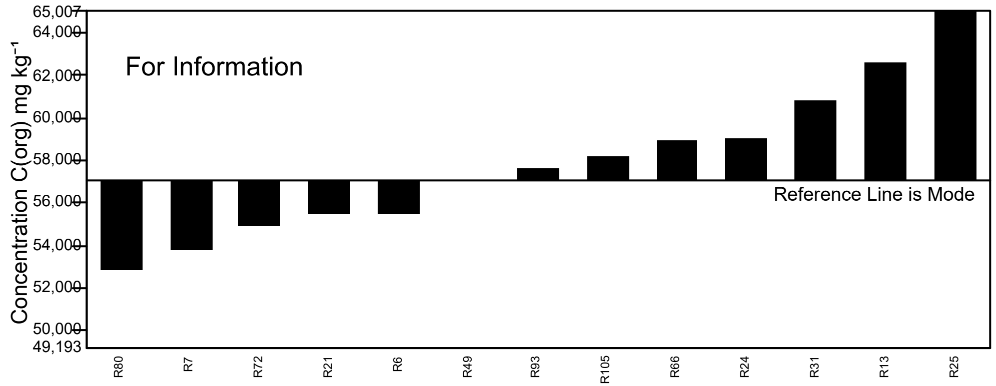
GeoPT52 - Barchart for CO2

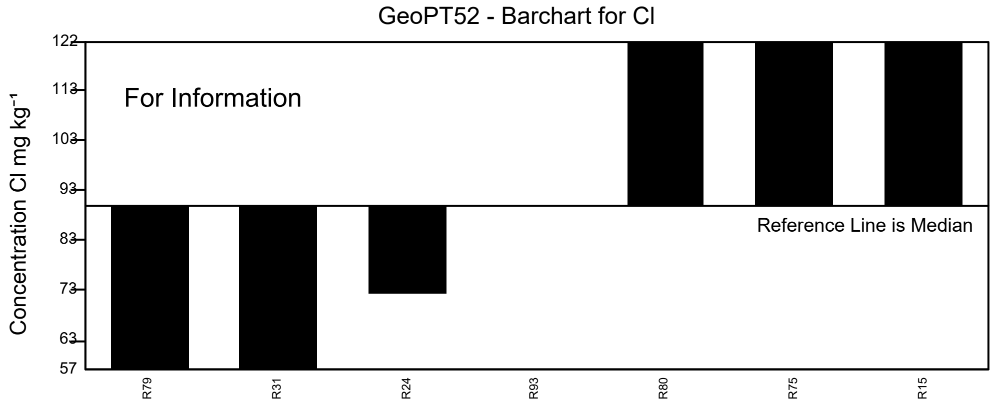


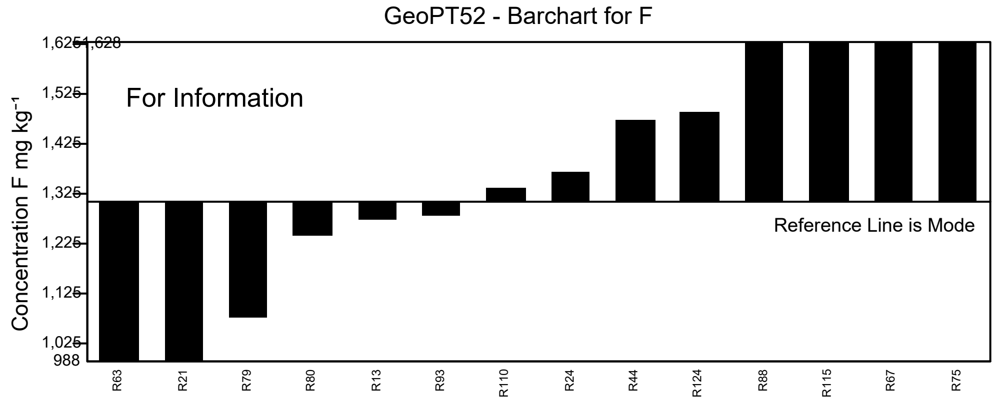
GeoPT52 - Barchart for LOI

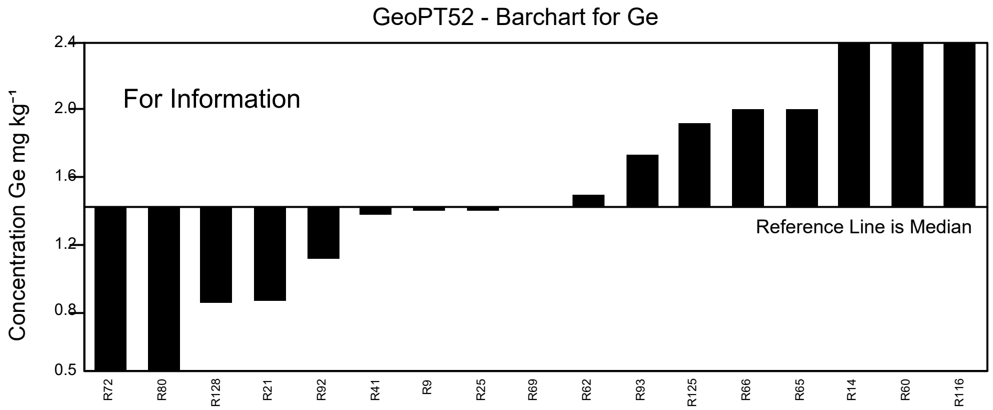


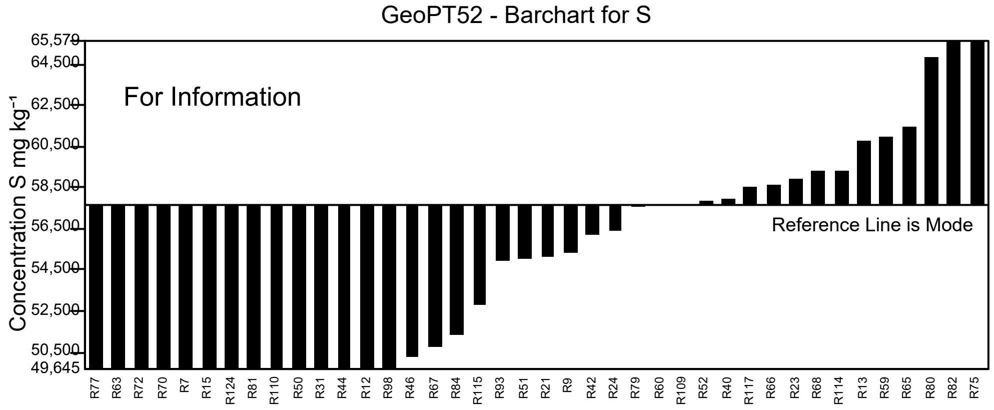
GeoPT52 - Barchart for C(org)

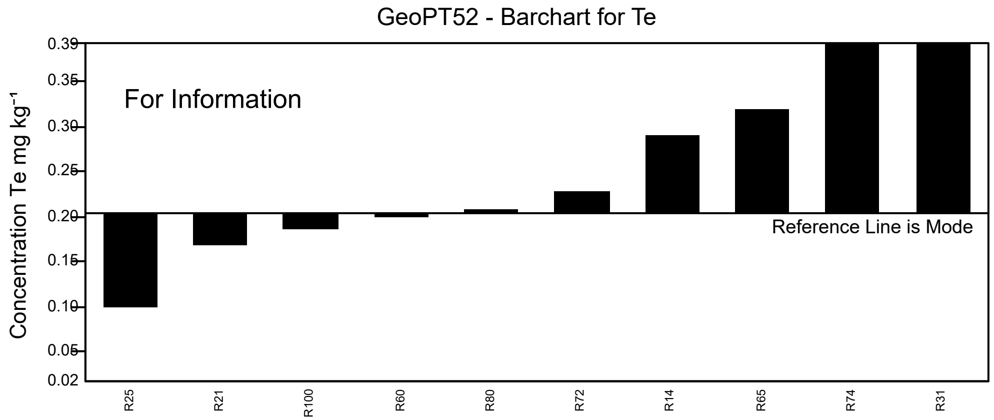












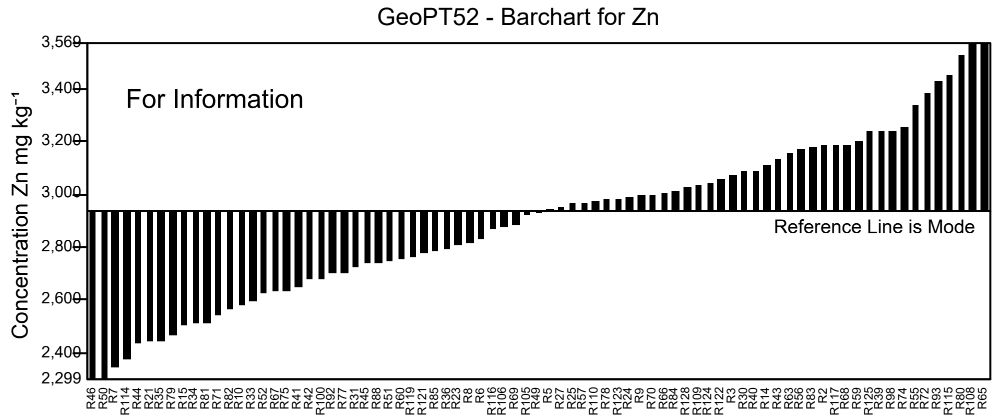
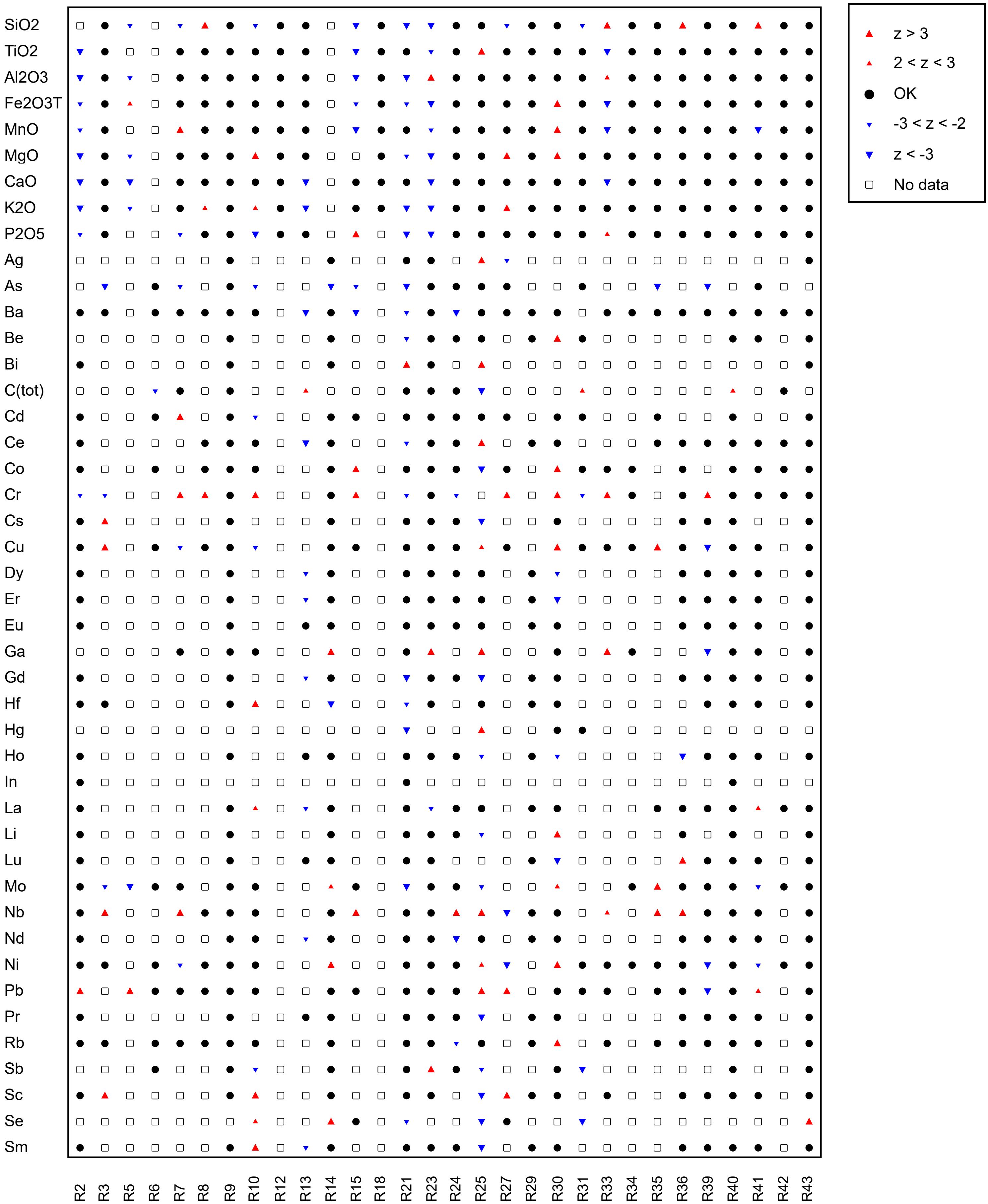


Figure 2: GeoPT52 - Metalliferous shale, EMS-1. Data distribution charts provided for information only for elements for which values could not be assigned.

Multiple Z-Score Chart for GeoPT52



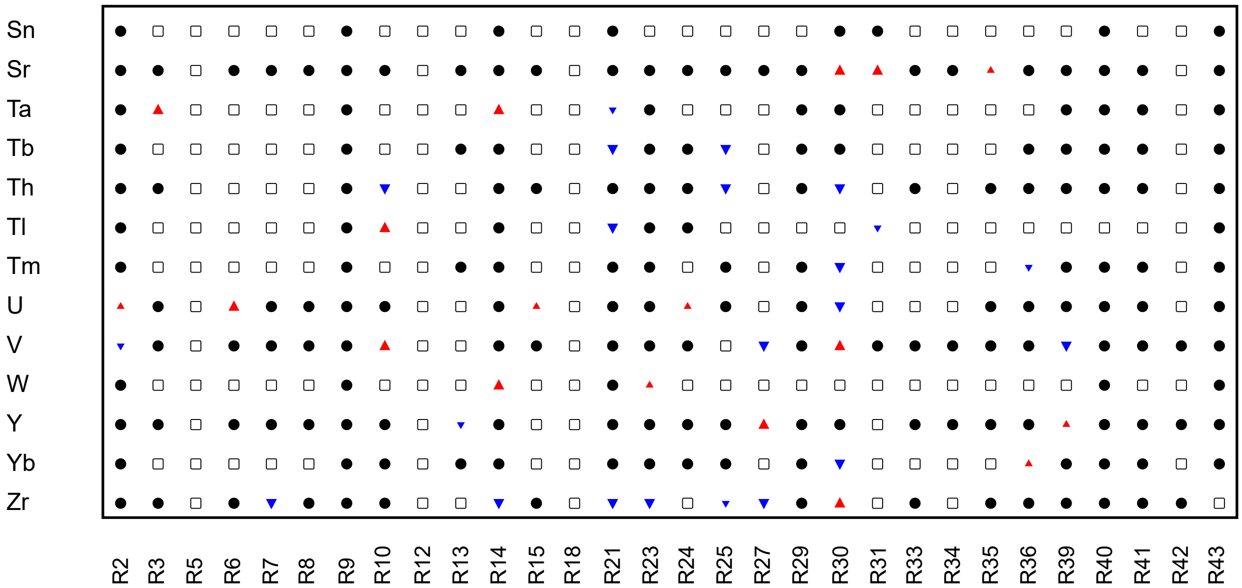
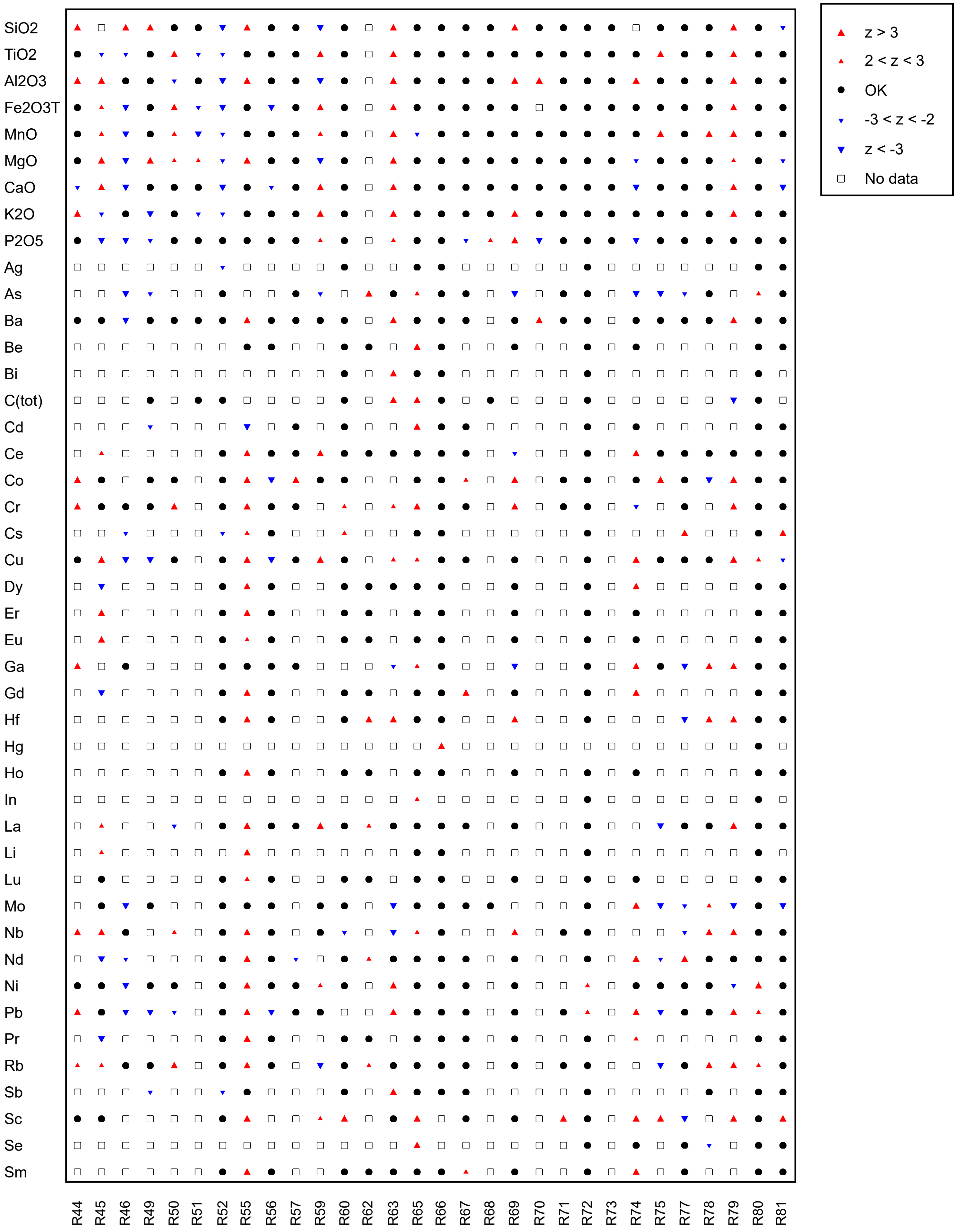
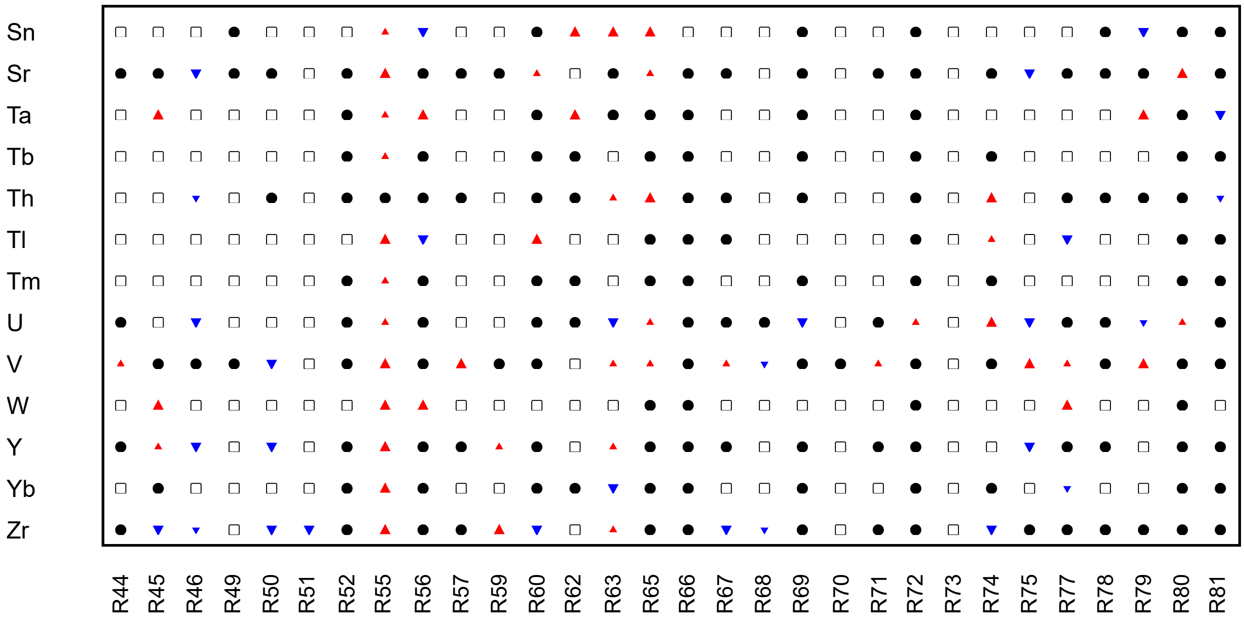


Figure 3: GeoPT52 - Metalliferous shale, EMS-1. Multiple z-score charts for laboratories participating in the GeoPT52 round. Symbols indicate whether or not an elemental result complies with the -2<z<+2 criteria (see key).

Multiple Z-Score Chart for GeoPT52





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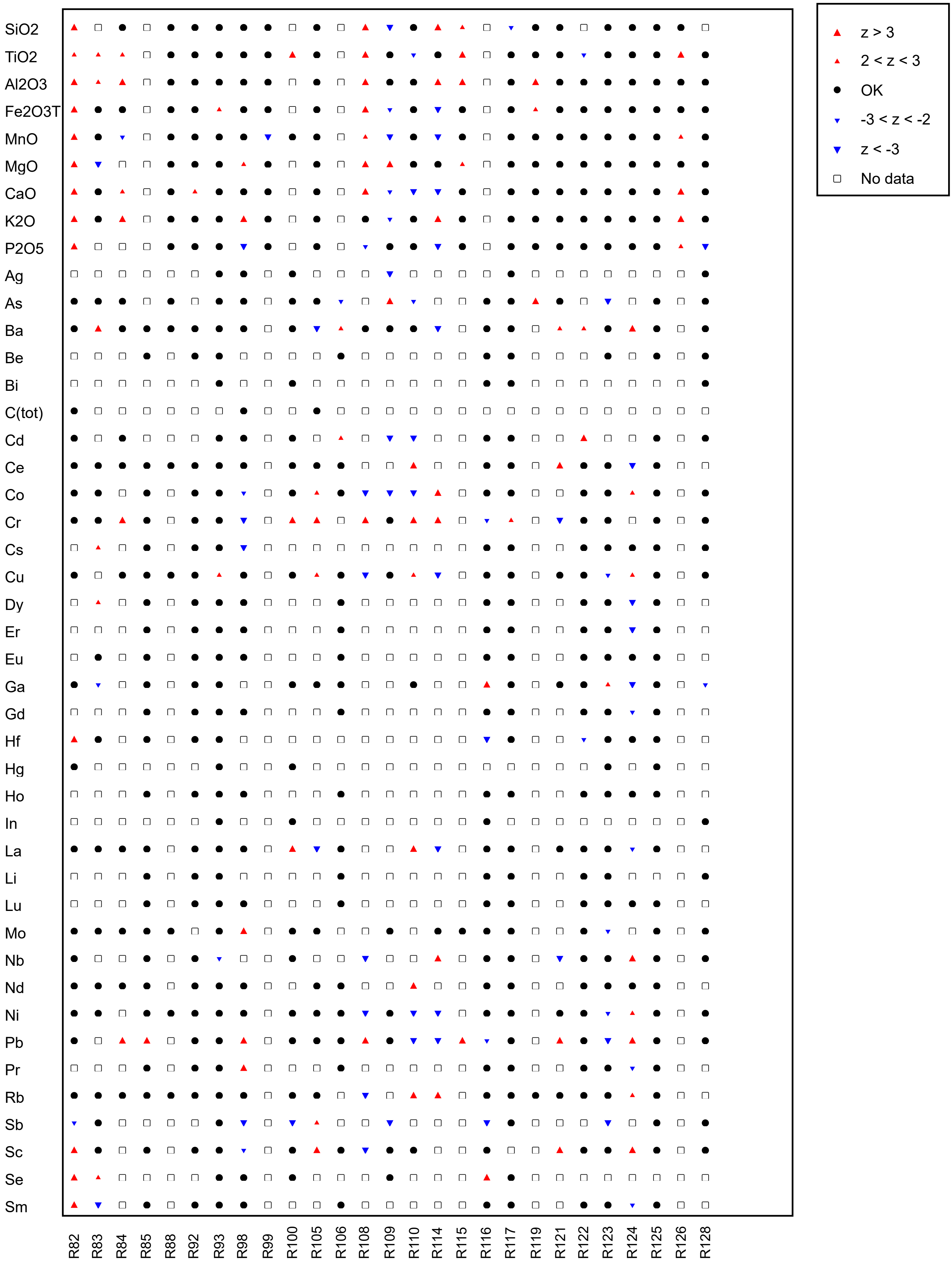
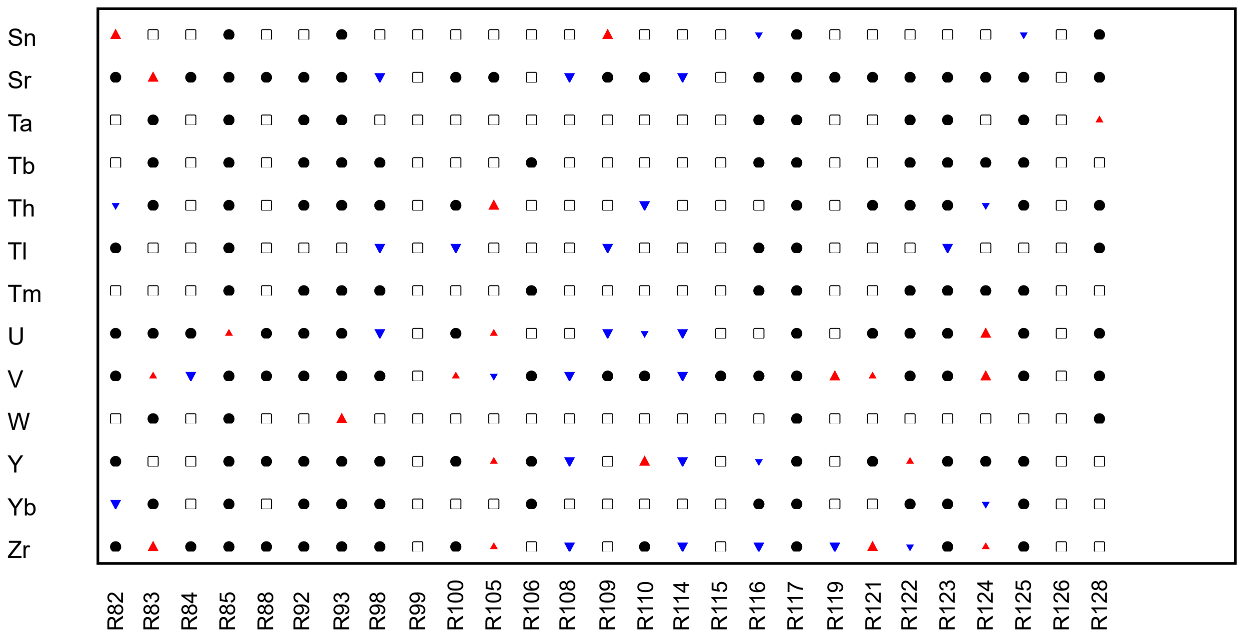
Multiple Z-Score Chart for GeoPT52





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