NGU REPORT 2024.001

Organic soil geochemistry in Hedmark and Møre and Romsdal counties, QC-report

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Summary: This survey constitutes a continuation of corresponding surveys undertaken in Trøndelag county as part of the National Geochemistry Mapping Project. Organic soil samples (humus) were collected in Hedmark (n= 787) and More and Romsdal (n=431) counties at a grid of 6 x 6 km. The <2 mm size fraction of these samples was analysed by ICP-MS for 53 elements following Aqua Regia digestion. In this report, quality of analytical results for the organic soil are documented in tables, and descriptive statistics.

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1. INTRODUCTION

As part of the National Geochemical Mapping Program of soil, mineral soil and O-horizon (i.e. organic soil) material, were collected in Hedmark (*n*= 787) and Møre and Romsdal (*n*= 431) counties during the field seasons of 2020-2021 and 2021-2022 at a density of 1 sample/ 36 km^2. An overview of the mapping progress is given in Table 1.

Table 1. ***Progress in the national geochemical mapping program of Norway.***

Survey	Year	Sampling density	Soil	Analysed Fraction	Lab
Finnmark and Troms[1)]	2011	1/40 km^2	Till	<0.063mm	ACME[*)]
Nordland[1)]	2011	1/40 km^2	Till	<2mm	ACME[*)]
North-Trøndelag and Fosen[2, 3)]	2013	1/36 km^2	Till Humus	<2mm	ACME[*)]
Southern Trøndelag[4, 5)]	2018/2019	1/36 km^2	Till Humus	<2mm	ACME[*)]
Hedmark[6]	2020/2021	1/36 km^2	Till Humus	<2mm	Bureau Veritas (formerly ACME)
Møre and Romsdal[7]	2021/2022	1/36 km^2	Till Humus	<2mm	Bureau Veritas

[1)]Reimann et al., 2011
[2)]Finne et al., 2014
[3)]Finne and Eggen, 2015
[4)]Flem et al., 2020
[5)]Flem et al., 2021
[6)]Flem et al. 2022
[7)]Acosta-Góngora et al. (2024)
[*)] At present, operating as Bureau Veritas Commodities Canada Ltd.

This report presents the quality control of organic soil sample analyses from Hedmark and Møre and Romsdal counties, and it represents a continuation of a national scale survey which has already covered the Trøndelag county (Finne and Eggen, 2015; Flem et al. 2021). The analytical data is available at https://www.ngu.no/ and https://geo.ngu.no/kart/geokjemi_mobil. The surveyed areas (sampling grid of 6km x 6 km) are shown in Figures 1 and 2.

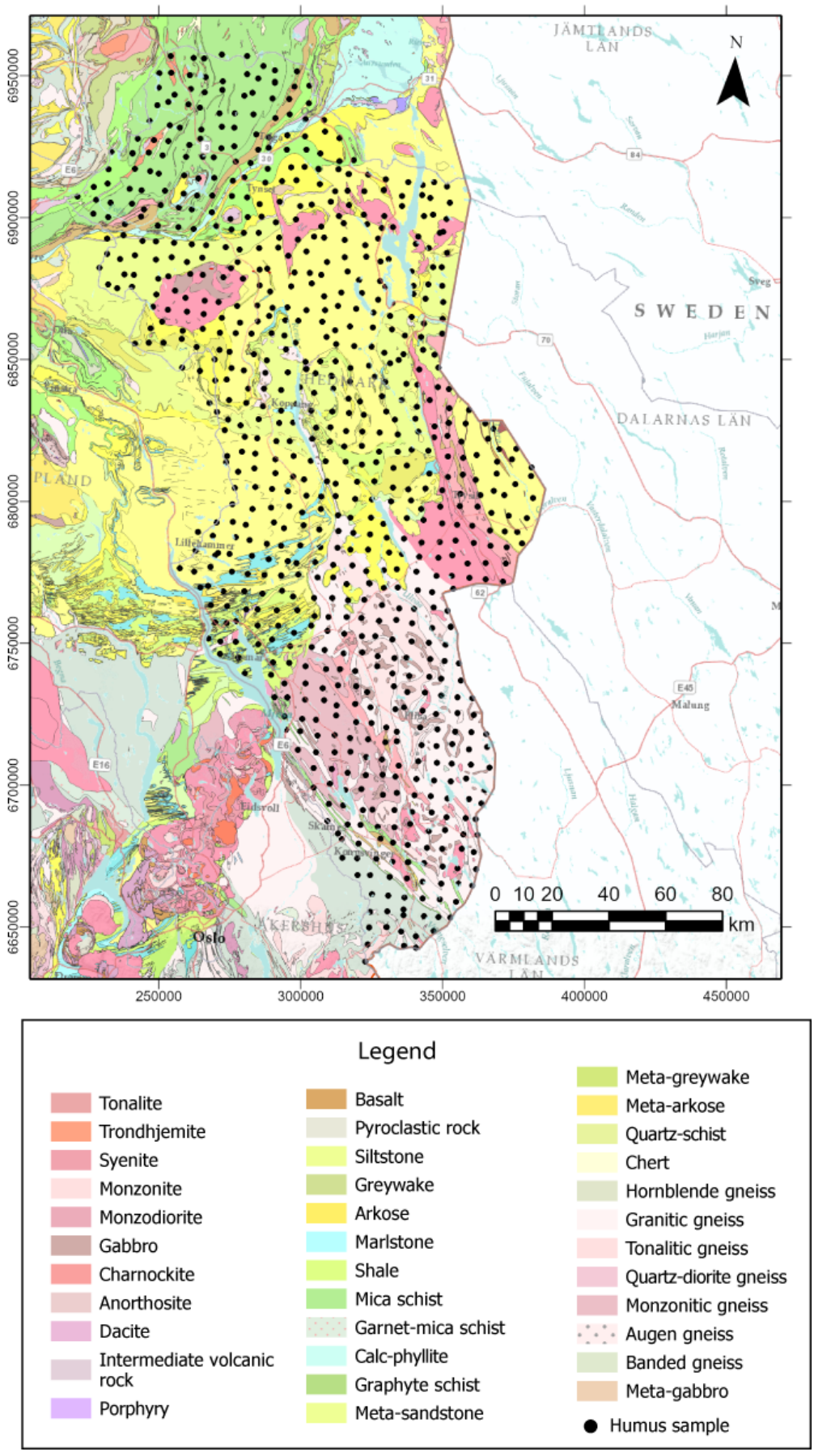

Figure 1. *Geology and sample distribution of the Hedmark county (sampling grid of 6 km x6 km). Bedrock map modified from Geological Survey of Norway (2021).*

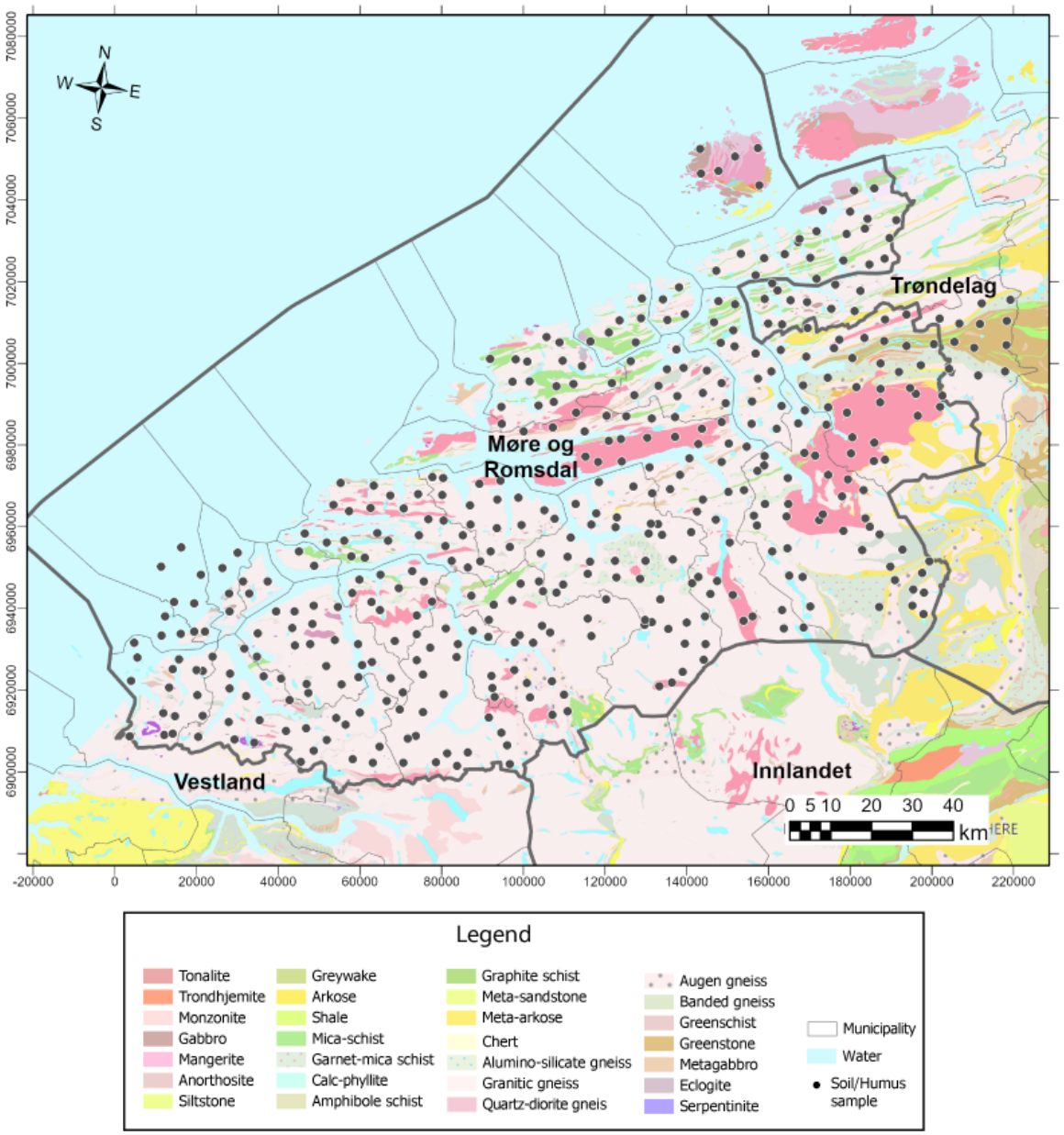

Figure 2. *.Geology and sample distribution of the Møre and Romsdal county (sampling grid of 6 km x6 km). Bedrock map modified from Geological Survey of Norway (2021).*

2.DESCRIPTION OF THE SURVEY AREA

2.1 Bedrock

2.1.1 Hedmark

Hedmark can be divided into four main bedrock types. The southernmost area is part of the basement, dominated by gneisses and granites (Fig. 1). The topography of this area is relatively uniform with low altitudes < 500 m. Towards the north, bedrock changes to deposits of Cambro-

Silurian age, limestone and clay slate in alternating layers with numerous black shale horizons (Fig. 1). Further north, the bedrock consists of stalagmite from the late Precambrian, which extends far north and covers the majority of Hedmark. In the northern most part of Hedmark, the Caledonian mountain range has elevations that vary from 600 to > 2000 m. This area is dominated by the Trondheim fields, heavily converted Cambro-Silurian slate, penetrated by magmatic rocks in connection with the Caledonian mountain range folding (Fig. 1; e.g**.,** Dahl et al., 2017; Ramberg et al., 2008).

2.1.2 Møre og Romsdal

The Møre and Romsdal County is mainly characterized by granitic gneisses (Fig. 2), which are part of the Western Gneiss Region (WGR). The WGR consists primarily of granitic gneisses, which were formed between 1700 and 1600 Ma and derived from igneous sources. These were strongly deformed and metamorphosed during the Caledonian Orogeny (ca. 420–390 Ma).

During the Caledonian continent-continent collision with Laurentia (Greenland), the WGR was subducted to mantle depths, locally at more than 100 km, marked by the widespread occurrence of high-pressure eclogite lenses, particularly along the western parts that were subjected to the highest pressures (Cuthbert et al., 2000; Hacker and Gans, 2005). The subduction also resulted in fragments of this mantle getting stuck to the downgoing continental slab –found as lenses of olivine-rich mantle peridotite.

During the Caledonian Orogeny, the WGR was overthrust by nappes, which comprise of schists, amphibolites and marbles and continued deformation led to in-folding of the nappes into the gneissic substrate (Terry et al., 2000; Tucker et al., 2004).

The various rocks therefore represent diverse mineral resources, including marble (allochthonous nappes) and olivine (mantle peridotite fragments). Historically, mining for Fe and Ti was undertaken from mafic rocks associated with the gneisses.

3. METHODS

3.1 Field work

A nationwide 6 x 6 km grid covering the Hedmark and Møre and Romsdal counties was used for the selection of sample sites (Figs. 1 and 2). The exact location of each sample site within a grid cell was determined in the field based on accessibility, where each sample was collected

as close as practically possible to the centre of the cell (i.e., sampling site). Though most sites could be reached by car, some required long walking trips. A Quaternary geology base map was always on hand to avoid sampling on top of glaciofluvial and marine deposits. All samples were taken on undeveloped land. The size of the surveyed areas was approximately 27,300 km^2 (Hedmark) and 14, 300 km^2 (Møre and Romsdal). At each sample site, soil samples representing the O-horizon (i.e., organic horizon) were taken in the same way as described by Finne et al. (2014) and Finne and Eggen (2015).

The soil O-horizon was sampled using composite samples comprising a minimum of 5 sub-samples taken with a steel spade within an area of approximately 100 m^2. The spade was used to cut out a square piece of organic soil of about 15 x 15x 10 cm (example shown Fig. 3). Living plant material was removed from the top of the sample and any non-organic material was removed from the bottom so that only the uppermost 3 cm of the humus and litter layer was retained. In the case that the O-horizon was less than 3 cm thick, the number of subsamples were increased to obtain sufficient material. Sampling and all sample handling of the organic soil were carried out using Nitrile gloves. The samples were stored in white Hubco soil sample bags, 7″ × 12-1/2″, made of a poly/cotton blend cloth obtained from Forestry Suppliers, Inc., US. These contamination-free bags allow organic samples to partially air-dry during transport without starting to develop mold. At each sample site, the vegetation and the general landscape were documented in several photos.

3.2 Sample preparation/pre-analysis

All soil samples were air dried at 30 °C upon arrival at the laboratory of the Geological Survey of Norway (NGU) in Trondheim, within days after sampling. They were subsequently sieved using a <2 mm nylon mesh (lumps were disaggregated by hand) and the passing fraction was retained for analysis. All samples were randomised before submission to the laboratory, and a project standard, field duplicates and sample duplicates were inserted in such a way that they were not recognisable by the laboratory following protocols described in Eggen et al. (2019).

***Figure 3**. Example of organic soil sample taken with a spade in a mountain landscape above the tree-line.*

3.3 Laboratory analysis

The randomized sample series of the <2-mm fraction was shipped to Bureau Veritas Minerals (former Acme Labs) in Vancouver Canada for chemical analysis. The standard package 'VG105 + EXT Dry Plant Material Analysis' involving splits of 5 g was selected. The analytical packages involve a modified Aqua Regia digestion which consists of 1:1:1 v/v concentrated ACS grade HCl, HNO3 and de-mineralized H2O. The analyses were performed by using a Perkin Elmer Elan 6000/9000 inductively coupled plasma mass spectrometer (ICPMS) for 53 elements. Details on the analytical procedure can be found on Bureau Veritas home page, https://commodities.bureauveritas.com/metals-minerals/exploration-and-mining/geoanalytical-services.

3.4 Quality control

It was agreed with the laboratory that all instrumental readings had to be reported, independent of detection limit (DL) or quantification limit (QL) set by the laboratory. Reporting limits used by the laboratory are usually set higher than the real quantification limit, as laboratory limits must cover long time operation conditions – possibly years. In addition, the data should not be rounded off, and at least one significant figure containing uncertainty had to be retained.

A project in-house reference material was prepared from natural humus material and analysed after every 20th sample in the randomized sample sequence.

For possible analytical comparison with the previous surveys undertaken in northern Trøndelag/Fosen (Finne and Eggen, 2014) and southern Trøndelag (Flem et al. 2020) a collection of samples was evenly distributed into the new sample series and re-analysed. The same laboratory, Bureau Veritas Minerals, Vancouver, Canada, have been used for all surveys.

The sampling and analytical design follows the unbalanced ANOVA design used in earlier surveys (e.g., Eggen and Finne, 2014; Eggen et al., 2017). The same information can be obtained from a balanced or an unbalanced sampling and analysis design, but an unbalanced design makes a more efficient use of resources (Reimann et al., 2008).

4. RESULTS

4.1 Analytical Quality Control, QC

4.1.1 In-house project standard

In Appendix 1, the analytical results for all samples (ordinary samples in addition to field duplicates and analytical duplicates, and the in-house project standard) are shown following the laboratory's analysis sequence order. The X-axis shows the random number given to the sample before shipping to the laboratory. Negative concentration values reported by the laboratory are replaced by a low positive value, (0.0000001 mg/kg). The laboratory detection limit is indicated by a red dashed line. The appropriateness of the in-house standard for this survey is good for most elements except Ta and S (large variability) and Th, W, Te, In, Re, Pd, and Pt (values at or below detection limit). Tantalum (Ta) might be out of analytical control (Appendix 1) as the in-house project standard shows a marked "undulating" trend in the random plot (Fig. 4) and most analyses have variations over ±20% of the median in X-plots (Appendix 2).

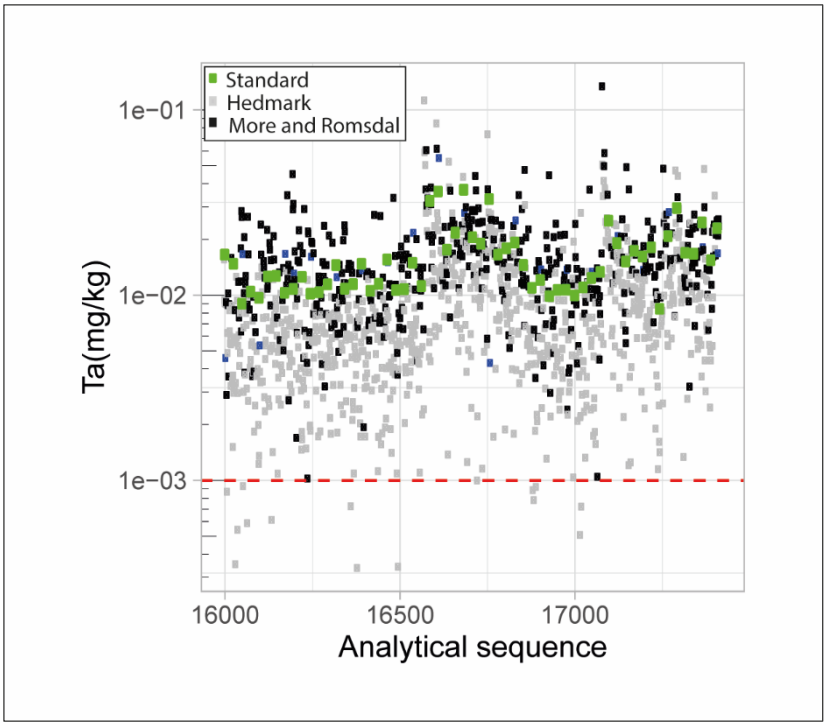

***Figure 4**. Random plot of Ta showing an analytical trend in the data. Dashed red line represents the detection limit*

Fifty-nine splits of the in-house project standard were analysed along with the samples, one split after approximately every 20th sample. X-charts for all elements of the in-house standard are given in Appendix 2. The analytical results are plotted in the same order as they were analysed. For all elements, the median is indicated by a solid black line, whereas dashed lines are drawn at ± 10% (blue) and ± 20% (red) relative to the median. A statistical summary for the project in-house standard is given in Table A1. This includes the minimum, median, and maximum concentration values (among other parameters) for all elements. The elements: W, Te, In, Re, Be, Pd and Pt have most concentrations at or below the laboratory detection limit (DL). It is thus not possible to calculate the analytical repeatability for these elements. Most of the other elements show acceptable analytical repeatability with a robust coefficient of variation (CVR<15%) for the in-house project standard (Table A1). However, the elements Nb, Au, Tl, and Ta show a precision (CVR) in growing order from 20 to 40%, mainly due to proximity to DL (e.g., Tl) and/or sample inhomogeneity (e.g. Au, Ta), see Appendix 1.

4.1.2 Samples re-analysed from previous surveys

A selection of 22 organic soil samples from the North Trøndelag and Fosen survey (Finne and Eggen, 2014) was re-analysed; 1134, 1265, 1372, 1474, 1502, 1505, 1509, 1511, 1517, 1519, 1523, 1531, 1540, 1559, 1580, 1593, 1657,1662, 1686, 1728, 1762, 1762_D along with the Hedmark and Møre and Romsdal samples. The results from the laboratory analyses for all 54 elements are shown in Appendix 3. Most elements show a very satisfactory reproducibility. However, most of these show systematically lower values in the new analytical report relative to the previous one. In general, Au, B, Be, Bi, Hf, In, Pd, Pt, Re, S, Se, Sc, Ta, Tl, Th, V, and W show low precision probably due to nugget effects, grain size distribution, low concentrations, and laboratory batch effects. Other elements, such as Ag, Al, As, Ba, Cd, Ce, Ca, Co, Cr, Fe, Cs, Cu, Ge, K, Hg, La, Mg, Na, Mn, Mo, Ni, P, Pb, Rb, Sb, Sn, Sr, Ti, Zn, Zr and Y, show a generally high repeatability. However, one must nevertheless be careful when combining the data sets from the various surveys also for these elements.

4.2 Precision and Analysis of variance (ANOVA)

At approximately every 20th sample location, a field duplicate was collected. After drying and sieving, a split of it was prepared and analysed with the rest of the samples (an analytical duplicate of the field duplicate). Table A2 gives a precision estimate for all elements, with concentrations above DL, of the field and analytical duplicate pairs. In addition, the number of pairs above DL of the total of 60 pairs analysed are given. The estimated precision given by the coefficient of variation (CV) for the field duplicates (ordinary sample compared with the field duplicate) ranges from 3% (P) to % 31 (Au). The analytical duplicate pairs (the duplicate field sample and the analytical duplicate) show a much smaller range and better precision compared to the ordinary sample and field duplicate pairs (Tables A1 and A2).

The correlation between ordinary sample and duplicate sample, and the correlation between duplicate sample and analytical duplicate, are shown in Appendices 4 and 5. Poor correlation is usually due to low concentrations (e.g., Be; Appendix 4) or due to natural variation (e.g., Au; Appendix 5).

The field and analytical duplicates can be used to carry out an unbalanced analysis of variance (ANOVA) for those elements with ≥4 duplicate pairs above DL. By unbalanced it is meant that unequal numbers of analysis occur at each level of design. In Table A3 the analysis of variance (ANOVA) is given for the 60 sites with a duplicate sample giving the distributed percentage

variabilities for all elements. The *p*-value given in Table A3 is for the F-test to determine if the variance at the "between" level are equal for the field and analytical duplicates. The field duplicate ANOVA indicates that the combined sampling and analytical variability is smaller than the between sites regional variability. Molybdenum, Mo, for instance, has an estimated regional variability of 92.1%, and 7.36% variability at site (local variability) and 0.55% analytical variability. However, elements such as Hf, K, Ge, Nb, Ca, Cu, U, Sc, Cr, Zr, Au, V, Ga, Fe, Al, Y, Ce, La and Be show higher local variability (≥20%). For some elements this mainly reflects the difficulties in determining these elements at low concentrations.

4.3 Data distribution

The geochemical distribution of each element for the Hedmark and Møre and Romsdal counties is presented in plots of the cumulative distribution function, ECDF (Appendix 6 and 7). The concentration is plotted along the X-axis and the cumulative probability is plotted along the Y-axis. These plots allow the direct visual recognition of breaks in the curve which may indicate different geochemical processes. Breaks in the uppermost 5-10 percentiles of the distribution are often used as thresholds for anomaly identification. All laboratory readings are shown including those below detection limit. Negative results are replaced by a low positive value. A statistical summary for data from both areas is provided in Tables A4 and A5.

5. SUMMARY

This report gives an evaluation of the quality of the data from the Hedmark and More and Romsdal geochemical organic soil survey. Few data are available for W, Te, In, Re, Pd, Be, and Pt due to too high detection limits. A sequence distribution trend detected for Ta indicate the presence of analytical artifacts for that element. Re-analysed samples from the Trøndelag surveys (Finne et al., 2014; Flem et al., 2020), show that 36 out of 52 elements have a general good repeatability between batches. However, one must nevertheless be careful when combining the data sets from the various surveys also for these elements. With careful use and working preferentially with quantiles, many elements in the national mapping program datasets, that do not have detection limit issues, can be merged and used as one dataset. However, it is the data user's responsibility to consider if the batch effects are within acceptable limits. Finally, the only objective of this report is to assess QA/QC parameters, so it is up to the user to carry out any exploratory data analysis (EDA) of the geochemical datasets.

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TABLES

Table A1. The in-house project organic soil standard

Laboratory detection limit and summary statistics for the organic soil standard. The minimum (MIN), median, mean maximum (MAX) are given. In addition, the interquartile range (IQR) and the robust coefficient of variation (CVR) are given as a measure of precision. The number of pairs (No. Pairs) used to calculate CVR is given, but this parameter is only reported for those elements having ≥ 4 pairs above DL.

Element	No. Pairs	Min	Median	Mean	Max	IQR	CVR
Mo	59	0.4	0.4	0.5	0.7	0.0	6.9
Cu	59	7.2	7.7	7.7	9.7	0.4	3.5
Pb	59	182.3	200.3	203.2	298.6	13.1	4.9
Zn	59	28.7	31.4	31.6	39.0	1.5	3.3
Ag	59	0.3	0.4	0.4	0.4	0.0	4.2
Ni	59	3.5	3.9	3.9	5.1	0.2	3.8
Co	59	1.3	1.5	1.5	1.8	0.1	4.1
Fe	59	2150.0	2292.0	2314.0	2859.0	107.0	3.0
As	59	1.1	1.2	1.3	1.7	0.2	12.4
U	59	0.1	0.1	0.1	0.2	0.0	0.0
Au	58	0.0	0.0	0.0	0.0	0.0	24.7
Th	14	0.2	0.2	0.2	0.2	0.0	0.0
Sr	59	33.5	35.6	36.0	45.2	1.6	3.3
Cd	59	0.6	0.6	0.6	0.8	0.0	2.4
Sb	59	2.6	3.4	3.6	6.5	0.6	11.9
Bi	59	0.1	0.1	0.1	0.2	0.0	0.0
V	59	3.0	4.0	4.0	5.0	1.0	0.0
Ca	59	3049.0	3339.0	3351.0	4025.0	158.0	4.0
P	59	654.0	685.0	695.0	830.0	37.0	4.0
La	59	1.1	1.2	1.2	1.4	0.1	3.9
Cr	59	3.0	3.2	3.3	5.2	0.2	4.6
Mg	59	1050.0	1122.0	1130.0	1349.0	64.0	4.0
Ba	59	26.1	28.1	28.2	34.0	1.5	3.7
Al	59	1417.0	1522.0	1531.0	1871.0	82.0	4.0
Na	59	160.0	170.0	173.0	205.0	12.0	5.0
K	59	510.0	543.0	547.0	669.0	34.0	4.0
W	0	–	–	–	–	–	–
Sc	59	0.5	0.5	0.5	0.6	0.0	0.0
Tl	59	0.0	0.1	0.1	0.1	0.0	24.7
S	59	1516.0	1793.0	1826.0	2491.0	220.0	10.0
Hg	59	0.2	0.2	0.2	0.3	0.0	4.3
Te	0	–	–	–	–	–	–
Ga	59	0.4	0.4	0.4	0.5	0.0	0.0
Cs	59	0.1	0.1	0.1	0.1	0.0	0.0
Ge	59	0.1	0.2	0.2	0.2	0.0	9.9
Hf	59	0.0	0.0	0.0	0.0	0.0	0.0
Nb	59	0.1	0.2	0.2	0.2	0.0	19.8
Rb	59	2.0	2.2	2.2	2.6	0.2	6.7
Sn	59	0.7	0.8	0.8	1.0	0.1	3.9

Element	No. Pairs	Min	Median	Mean	Max	IQR	CVR
Ta	59	0.0	0.0	0.0	0.0	0.0	39.5
Zr	59	0.6	0.7	0.7	0.7	0.1	6.5
Y	59	0.6	0.7	0.7	0.8	0.0	2.8
Ce	59	2.2	2.3	2.3	2.8	0.1	6.4
In	0	–	–	–	–	–	–
Re	0	–	–	–	–	–	–
Be	0	–	–	–	–	–	–
Li	59	0.1	0.1	0.1	0.2	0.0	13.5
Pd	0	–	–	–	–	–	–
Pt	3	0.0	0.0	0.0	0.0	0.0	–

Table A2. Precision of duplicates

The precision for field and analytical duplicates is presented in the table only for elements that have ≥4 pairs above DL. Abbreviations: CVR, robust covariation coefficient; No. Pair., Number of pairs above DL.

	Field duplicate		Analytical duplicate	
Element	No. Pair	CVR	No. Pair	CVR
Mo	60	13.3	60	3.2
Cu	60	17.4	60	3.1
Pb	60	30.8	60	3.3
Zn	60	22.5	60	3.7
Ag	60	40.3	60	7
Ni	60	23.4	60	3.5
Co	60	50.4	60	3.8
Mn	60	65.4	60	6.1
Fe	60	95	60	5.8
As	46	60.3	51	11.7
U	60	151.9	60	7.5
Au	43	42.2	43	31.4
Th	25	31.3	26	20.8
Sr	60	32.1	60	3.2
Cd	60	30.7	60	3.2
Sb	60	23.8	60	3.5
Bi	58	23.1	58	5.2
V	34	40.1	34	6.5
Ca	60	33.3	60	3.5
P	60	11.1	60	2.7
La	60	82.4	60	6.1
Cr	60	42.8	60	4.8
Mg	60	16.7	60	2.9
Ba	60	99.1	60	3.1
Ti	60	66.5	60	7.9
B	55	20.5	55	6.9
Al	60	49.7	60	4.1
Na	60	20.8	60	4.1
K	60	12.7	60	3.3
W	9	23.8	11	0
Sc	33	30.6	36	6.8
Tl	57	34.9	58	5.2
S	60	13.8	60	3.1
Hg	60	14.8	60	3.9
Se	55	17.3	55	9.2
Ga	56	50.7	56	6.9
Cs	59	41	59	4.6
Ge	44	35	44	8

Element	Field duplicate		Analytical duplicate	
	No. Pair	CVR	No. Pair	CVR
Hf	49	40.1	49	19.4
Nb	58	77.5	58	23
Rb	60	20.8	60	4.5
Sn	60	27.4	60	5.3
Ta	58	41.6	58	24.6
Zr	60	51	60	9
Y	60	82	60	5.5
Ce	60	78.4	60	5.6
Be	4	100.5	6	15.3
Li	60	57.5	60	9.5

Table A3. ANOVA

Analysis of variance table (ANOVA) for the 60 duplicate sites giving the distributed percentage variabilities for all elements with ≥4 pairs above MDL. The p-value is for the F-test. All variables were log-transformed prior to the calculation.

Element	Regional	Site	Analytical	p-value
Mo	92.10	7.36	0.55	0.44
Cu	73.76	24.90	1.34	0.21
Pb	82.67	16.97	0.36	0.22
Zn	85.69	13.84	0.47	0.18
Ag	90.43	9.31	0.26	0.39
Ni	91.51	8.24	0.25	0.42
Co	81.78	17.72	0.50	0.16
Mn	87.47	12.38	0.15	0.25
Fe	67.93	31.51	0.56	0.03
As	77.81	14.86	7.33	0.35
U	74.01	25.31	0.68	0.13
Au	35.70	28.20	36.10	0.03
Th	72.98	18.68	8.34	0.53
Sr	82.92	16.89	0.19	0.25
Cd	82.96	16.66	0.38	0.20
Sb	89.21	10.42	0.37	0.45
Bi	82.58	16.23	1.19	0.24
V	69.45	28.82	1.72	0.34
Ca	75.83	23.94	0.23	0.14
P	84.98	13.98	1.04	0.17
La	60.08	39.48	0.44	0.02
Cr	72.01	27.33	0.66	0.18
Mg	90.48	9.24	0.28	0.40
Ba	85.96	13.89	0.15	0.20
Ti	84.01	15.50	0.49	0.39
B	82.52	14.10	3.38	0.33
Al	66.61	33.13	0.26	0.07
Na	84.56	14.89	0.55	0.25
K	77.63	21.13	1.24	0.11
W	96.51	3.50	0.00	0.81
Sc	72.41	26.51	1.08	0.21
Tl	83.35	15.78	0.87	0.21
S	83.49	15.43	1.08	0.18
Hg	82.90	15.44	1.66	0.17
Se	85.85	9.48	4.67	0.36
Ga	68.33	30.22	1.45	0.16
Cs	86.64	12.97	0.39	0.30
Ge	76.58	21.22	2.20	0.11
Hf	66.50	20.03	13.47	0.34

Nb	75.37	21.73	2.90	0.31
Rb	89.08	10.56	0.37	0.30
Sn	85.95	13.02	1.03	0.25
Ta	81.58	14.61	3.81	0.39
Zr	71.14	27.34	1.52	0.05
Y	64.23	35.04	0.73	0.03
Ce	61.81	37.71	0.47	0.02
Be	22.72	72.80	4.49	0.82
Li	81.75	17.30	0.95	0.35

Table A4. Hedmark data

Summary statistics for the regional survey data (n=862) giving the number of samples above detection limit (DL), median, mean, minimum (Min) and maximum (Max) concentration values, and the measured concentration at the 5, 25, 50, 75% quantiles. In addition, the standard deviation (Stdev) is given as a measure on variation. All data is given in ppm.

Element	>DL	Min	Median	Mean	Stdev	Q5	Q25	Q50	Q75	Max
Mo	862	0.04	0.33	0.42	0.52	0.14	0.23	0.35	0.46	7.66
Cu	862	2.38	6.35	7.87	18.23	4.43	5.37	6.53	7.47	502.28
Pb	862	2.53	20.91	25.78	19.12	6.8	13.04	23.08	32.65	243.95
Zn	862	3.3	56.5	64	67.4	31	46.3	58.5	72.8	1899.5
Ag	862	0.026	0.232	0.328	0.335	0.071	0.133	0.257	0.396	3.531
Ni	862	0.8	2.6	4.4	16.8	1.5	2	2.7	3.7	476.4
Co	862	0.08	0.55	1.22	2.74	0.22	0.34	0.63	1.2	58.33
Mn	862	4	218	396	655	23	85	253	454	10685
Fe	862	213	1097	1842	2195	469	712	1213	2001	27799
As	785	0.2	0.5	0.7	0.6	0.2	0.3	0.5	0.8	6.9
U	859	0.02	0.08	0.27	0.86	0.03	0.05	0.09	0.16	10.65
Au	709	0.0003	0.0005	0.0006	0.0004	0.0003	0.0004	0.0005	0.0007	0.0049
Th	411	0.2	0.2	0.3	0.2	0.2	0.2	0.3	0.3	1.9
Sr	862	3	17.1	21.3	20.5	7.7	12.4	18.1	24.1	419.6
Cd	862	0.09	0.46	0.57	0.47	0.22	0.32	0.5	0.69	9.82
Sb	862	0.07	0.4	0.45	0.26	0.15	0.28	0.42	0.56	2.46
Bi	856	0.03	0.1	0.12	0.07	0.04	0.07	0.11	0.14	0.58
V	449	3	4	5	4	3	3	4	6	31
Ca	862	216	2359	3056	2629	884	1786	2525	3354	27790
P	862	477	884	924	239	627	759	910	1044	2810
La	862	0.16	1.27	3.99	15.14	0.38	0.75	1.48	2.94	318.06
Cr	862	0.9	1.9	2.9	3.7	1.2	1.6	2	2.7	51.7
Mg	862	206	530	656	471	318	421	556	722	5751
Ba	862	10.4	78	115.7	170.1	32.3	56.4	84.1	117.7	2903
Ti	862	6	39	59	64	14	24	42	67	532
B	721	2	2	3	2	2	2	3	3	14
Al	862	198	1048	1701	1978	459	703	1121	1762	24607
Na	862	32	108	118	49	55	84	114	142	321
K	862	138	975	1002	262	643	826	1012	1145	2769
W	206	0.2	0.2	0.3	0.4	0.2	0.2	0.2	0.3	4.4
Sc	459	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.4	2.2
Tl	847	0.03	0.11	0.14	0.08	0.04	0.08	0.13	0.18	0.74
S	861	507	1317	1385	379	885	1131	1362	1603	3294
Hg	862	0.05	0.195	0.203	0.059	0.124	0.163	0.202	0.235	0.595
Se	814	0.2	0.3	0.4	0.2	0.2	0.3	0.4	0.5	1.8
Te	16	0.03	0.03	0.04	0.01	0.03	0.03	0.03	0.04	0.09
Ga	817	0.2	0.4	0.5	0.4	0.2	0.3	0.4	0.6	5.3
Cs	859	0.04	0.2	0.27	0.23	0.07	0.12	0.22	0.33	1.83
Ge	626	0.02	0.08	0.1	0.08	0.02	0.04	0.09	0.13	0.72
Hf	745	0.01	0.01	0.016	0.01	0.01	0.01	0.01	0.02	0.12
Nb	832	0.02	0.12	0.19	0.21	0.03	0.07	0.14	0.22	1.68

Element	>DL	Min	Median	Mean	Stdev	Q5	Q25	Q50	Q75	Max
Rb	862	0.3	5.8	6.6	3.2	2.8	4.4	6.3	8.3	21.4
Sn	862	0.09	0.72	0.89	2.39	0.3	0.5	0.77	1.01	69.83
Ta	825	0.002	0.007	0.01	0.009	0.002	0.005	0.008	0.011	0.113
Zr	862	0.02	0.42	0.53	0.42	0.15	0.28	0.44	0.62	5
Y	862	0.058	0.514	1.871	6.753	0.146	0.287	0.598	1.216	128.144
Ce	862	0.3	2.5	6.5	23.1	0.7	1.4	2.9	5.9	465.1
In	9	0.03	0.03	0.03	0.01	0.03	0.03	0.03	0.04	0.04
Re	11	0.001	0.002	0.003	0.004	0.001	0.001	0.002	0.003	0.01
Be	90	0.2	0.3	0.8	3	0.2	0.2	0.3	0.4	26.6
Li	862	0.02	0.18	0.45	0.91	0.07	0.11	0.2	0.38	13.03
Pd	14	0.003	0.003	0.003	0.001	0.003	0.003	0.003	0.003	0.005
Pt	43	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.003	0.004

Table A5. Møre and Romsdal data

Summary statistics for the regional survey data (n=472) giving the number of samples above detection limit (DL), median, mean, minimum (Min) and maximum (Max) concentration values, and the measured concentration at the 5, 25, 50, 75% quantiles. In addition, the standard deviation (Stdev) are given as a measure on variation. All data is given in ppm.

Element	>DL	Min	Median	Mean	stdev	Q5	Q25	Q50	Q75	Max
Mo	472	0.03	0.3	0.41	0.4	0.12	0.2	0.33	0.48	4.46
Cu	472	1.83	7.7	11.06	28.64	4.32	6.11	8.05	9.79	519.87
Pb	472	1.34	11.23	23.48	149.93	3.43	6.81	11.69	16.24	3012.13
Zn	472	4.1	28.3	38	45.3	9.6	18.8	31	40.2	578.8
Ag	472	0.012	0.082	0.109	0.143	0.03	0.054	0.089	0.131	2.742
Ni	472	1	3.4	4.7	4.5	1.4	2.4	3.7	5.6	56.3
Co	472	0.19	1.24	1.99	3.57	0.39	0.77	1.36	1.94	51.3
Mn	472	4	60	134	225	12	25	74	143	2076
Fe	472	321	2081	3601	4392	613	1147	2266	3904	28914
As	328	0.2	0.4	0.5	0.6	0.2	0.3	0.4	0.6	9.7
U	472	0.02	0.12	0.29	0.54	0.03	0.07	0.14	0.25	5.92
Au	302	0.0003	0.0005	0.0007	0.0013	0.0003	0.0003	0.0005	0.0007	0.0183
Th	154	0.2	0.2	0.4	0.4	0.2	0.2	0.3	0.4	4.6
Sr	472	7.1	35.6	38	15.4	16.9	28.1	37.1	45.3	98.4
Cd	472	0.03	0.25	0.29	0.19	0.09	0.17	0.27	0.37	1.61
Sb	472	0.04	0.2	0.49	3.52	0.09	0.14	0.21	0.28	62.21
Bi	422	0.03	0.05	0.06	0.07	0.03	0.04	0.06	0.07	1.28
V	359	3	5	8	8	3	4	6	10	61
Ca	472	569	2684	3024	1783	1045	1975	2851	3582	21732
P	472	318	805	840	242	488	670	836	976	1817
La	472	0.2	2.5	6.03	10.97	0.5	1.1	2.81	6.07	99.31
Cr	472	1	2.7	4	3.9	1.4	1.8	2.9	4.4	29.7
Mg	472	448	1342	1475	732	741	1117	1406	1630	7362
Ba	472	6.9	38.2	49.7	36.8	14.8	26	42	61.7	292.1
Ti	472	18	143	216	231	42	86	155	253	2044
B	464	2	3	4	2	2	2	4	4	17
Al	472	216	1504	2845	3620	477	885	1721	2986	24659
Na	472	80	316	341	206	143	225	338	414	3411
K	472	248	790	858	366	474	648	819	968	4167
W	68	0.2	0.2	0.4	0.5	0.2	0.2	0.3	0.5	3.1
Sc	397	0.2	0.4	0.5	0.5	0.2	0.2	0.4	0.6	2.9
Tl	400	0.03	0.06	0.08	0.07	0.03	0.04	0.06	0.09	0.67
S	472	778	1733	1797	423	1215	1544	1790	2017	3988
Hg	472	0.059	0.188	0.201	0.081	0.092	0.135	0.197	0.248	0.496
Se	468	0.2	0.7	0.8	0.5	0.3	0.5	0.7	0.9	4.8
Te	11	0.03	0.03	0.04	0.01	0.03	0.03	0.03	0.04	0.07
Ga	454	0.2	0.6	0.9	1.1	0.2	0.3	0.6	1	10.1
Cs	471	0.03	0.14	0.21	0.18	0.06	0.1	0.16	0.26	1.41
Ge	430	0.02	0.09	0.11	0.09	0.02	0.06	0.1	0.13	0.67
Hf	353	0.01	0.01	0.012	0.005	0.01	0.01	0.01	0.01	0.04

Element	>DL	Min	Median	Mean	stdev	Q5	Q25	Q50	Q75	Max
Nb	472	0.02	0.33	0.55	0.7	0.07	0.18	0.36	0.63	7.19
Rb	472	0.7	3.4	4.7	5.7	1.4	2.3	3.6	4.9	62.7
Sn	472	0.05	0.4	0.44	0.25	0.16	0.27	0.42	0.56	2.11
Ta	470	0.002	0.014	0.016	0.011	0.005	0.01	0.015	0.02	0.134
Zr	472	0.03	0.25	0.32	0.24	0.1	0.18	0.27	0.39	2.29
Y	472	0.061	0.693	1.386	1.806	0.157	0.357	0.772	1.597	13.428
Ce	472	0.3	4.7	10.4	17.1	0.9	1.9	5.3	11.7	162.7
In	5	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.09
Re	5	0.001	0.001	0.003	0.003	0.001	0.001	0.002	0.003	0.009
Be	62	0.2	0.3	0.3	0.1	0.2	0.2	0.3	0.3	1
Li	471	0.02	0.13	0.41	0.94	0.04	0.07	0.15	0.34	12.68
Pd	2	0.003	0.004	0.004	0.001	0.003	0.003	0.004	0.004	0.004
Pt	25	0.002	0.002	0.003	0.001	0.002	0.002	0.003	0.003	0.005

Hedmark and Møre and Romsdal counties organic soil

APPENDICES

APPENDIX 1: RANDOM PLOTS

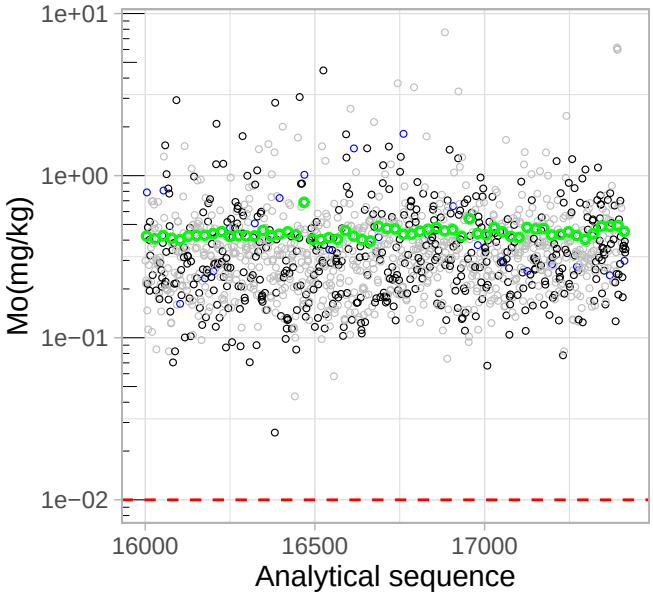
Random plots for all samples with field and analytical duplicates in addition to the in-house organic soil standard and re-analyses previous surveys.

Samples from the **Hedmark** county are coloured **grey** whereas those from **More and Romsdal** are shown in **black.**

The laboratory method detection limit (DL) is indicated by a **red dotted line**.

Samples from the in-house standard are coloured in **green** and samples from a previous survey in **blue**.

Negative laboratory concentration values set to a low positive value to fit the log scale.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1e−01
1e−02
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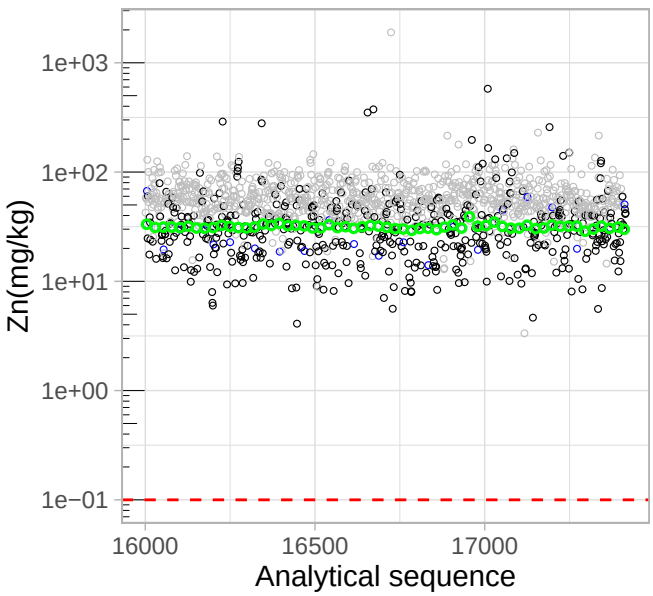
16500
17000
Analytical sequence


Zn(mg/kg)
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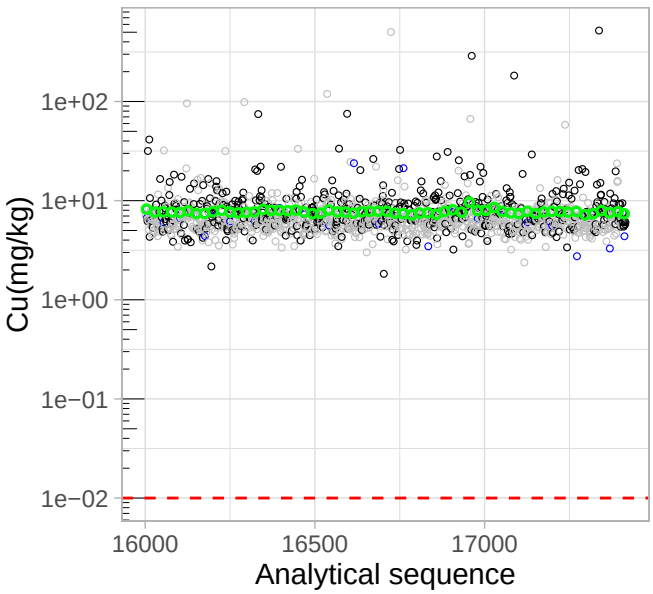
17000
Analytical sequence


Cu(mg/kg)
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1e−02
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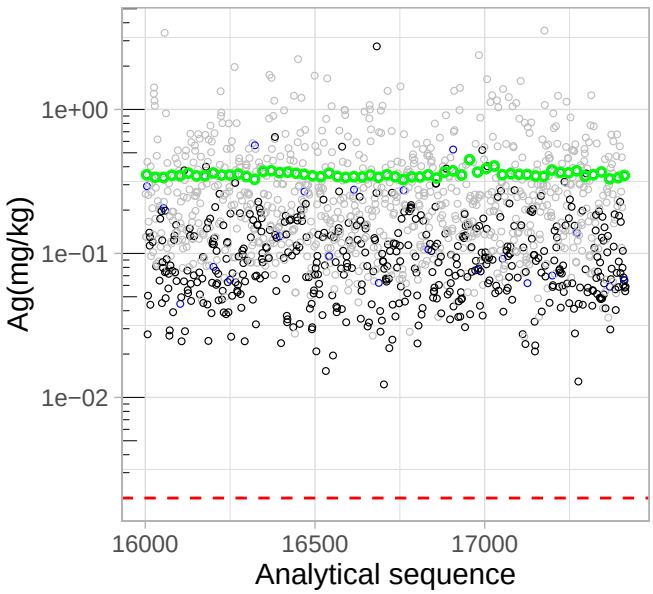
16500
17000
Analytical sequence


Ag(mg/kg)
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1e−02
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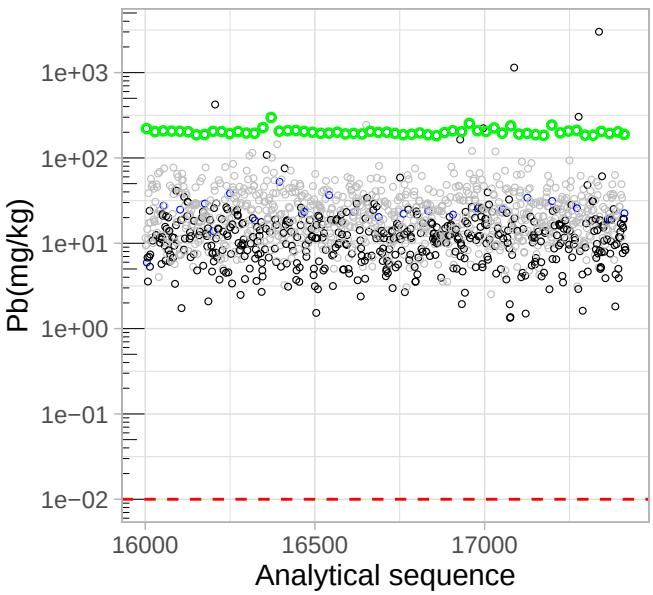
17000
Analytical sequence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1e+00
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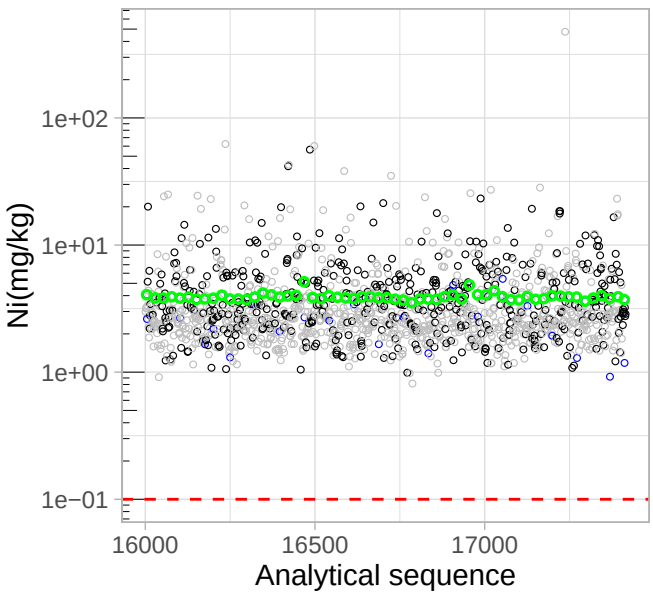
16500
17000
Analytical sequence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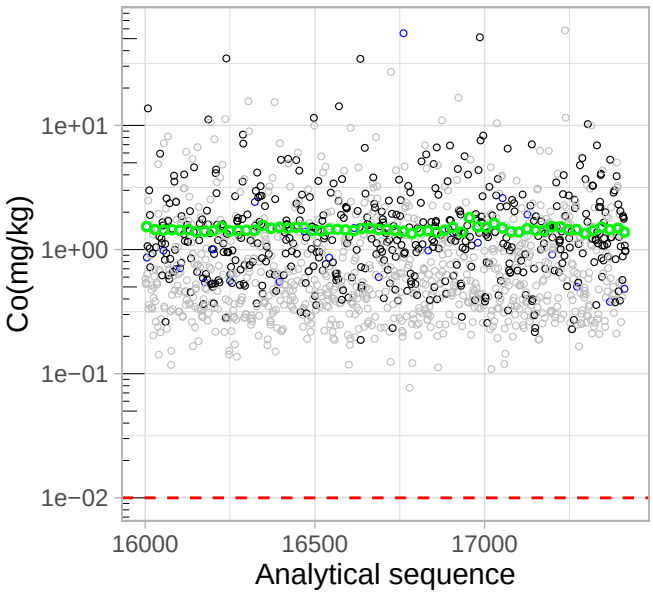
Co(mg/kg)
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17000
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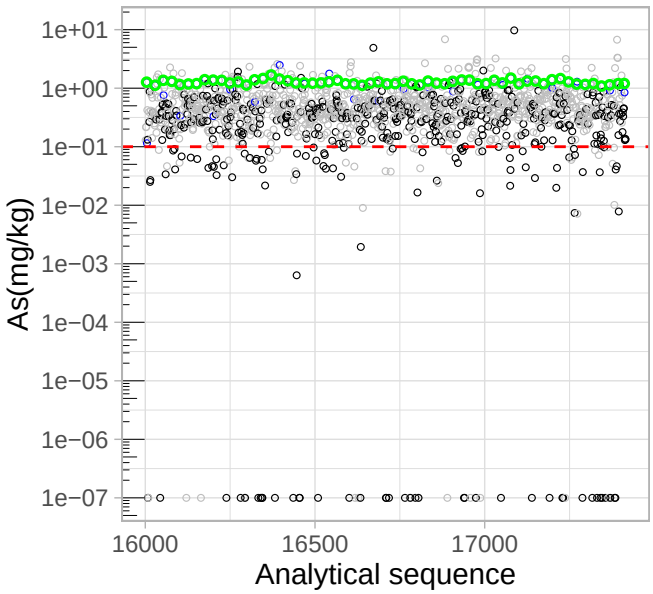
As(mg/kg)
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1e−06
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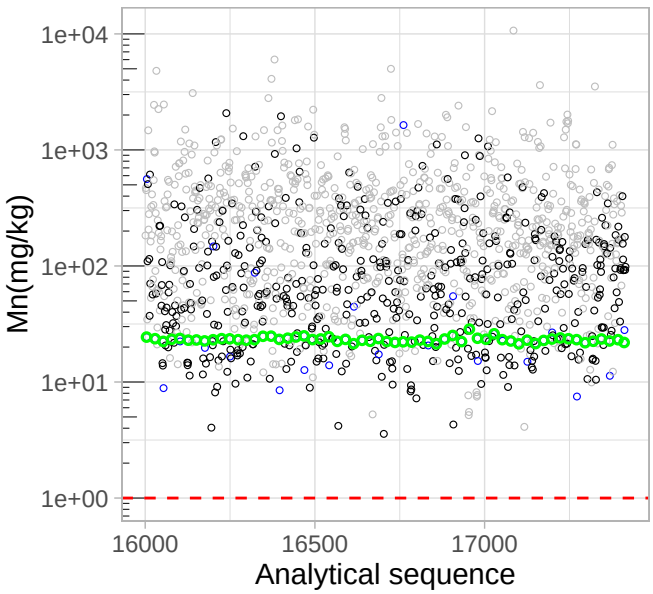
16500
17000
Analytical sequence


Mn(mg/kg)
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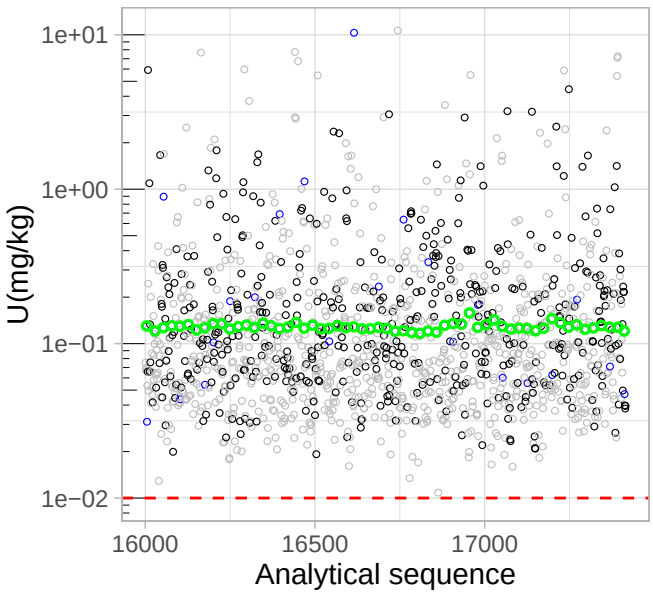
1e+02
1e+01
1e+00
16000
16500
17000
Analytical sequence


U(mg/kg)
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1e−01
1e−02
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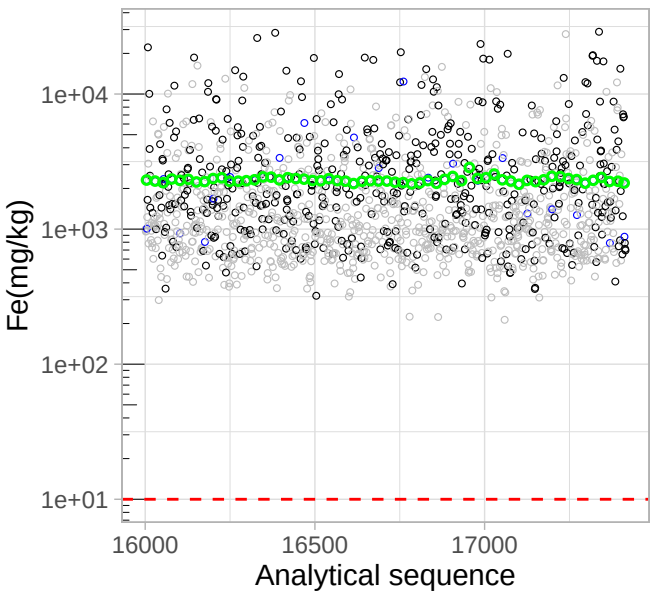
16500
17000
Analytical sequence


Fe(mg/kg)
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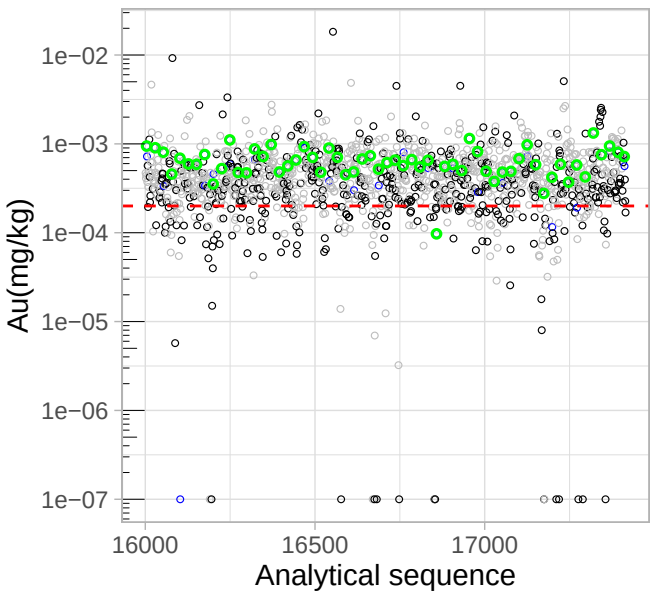
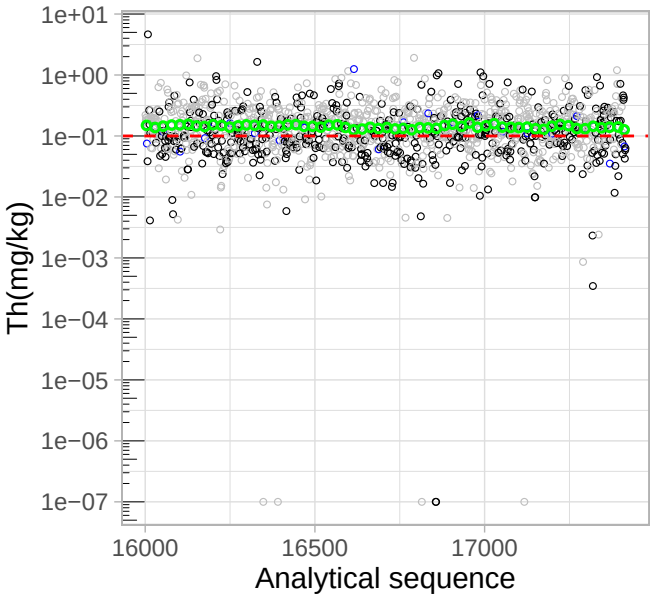
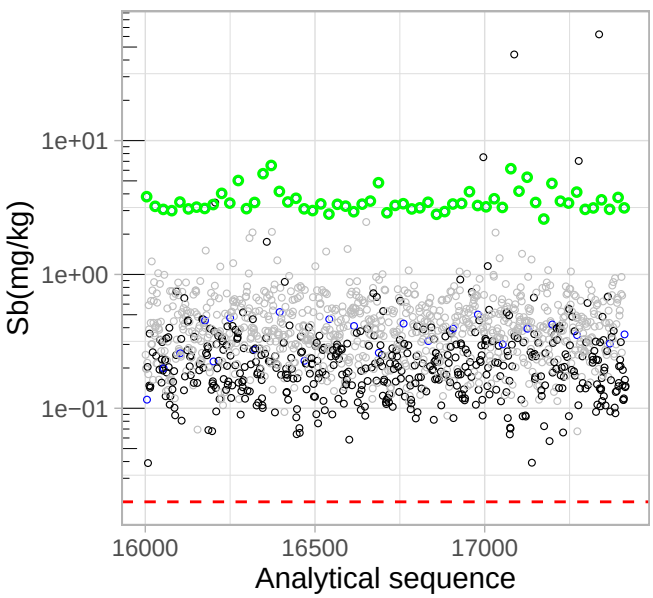
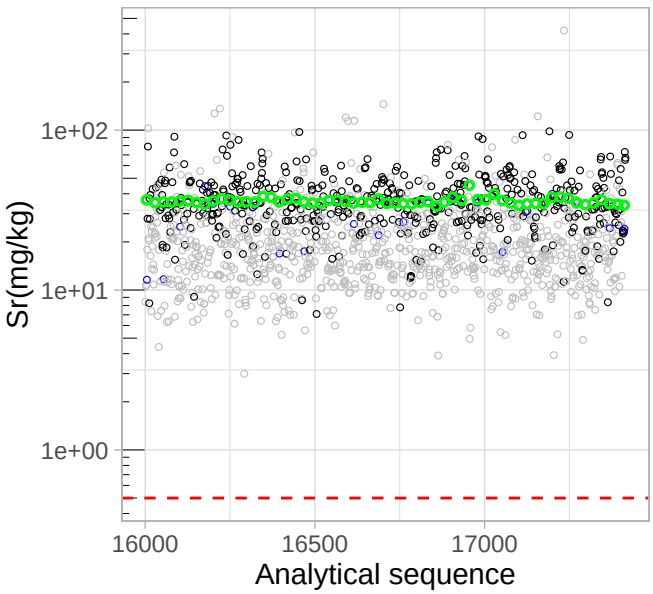
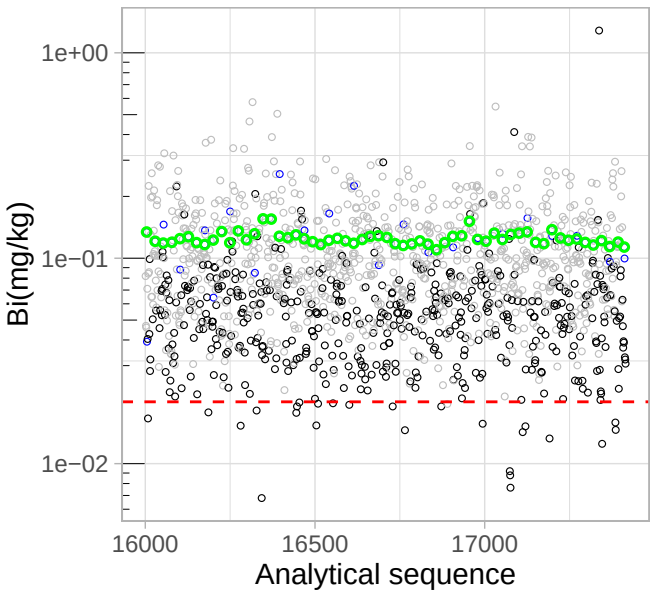
1e+03
1e+02
1e+01
16000
16500
17000
Analytical sequence

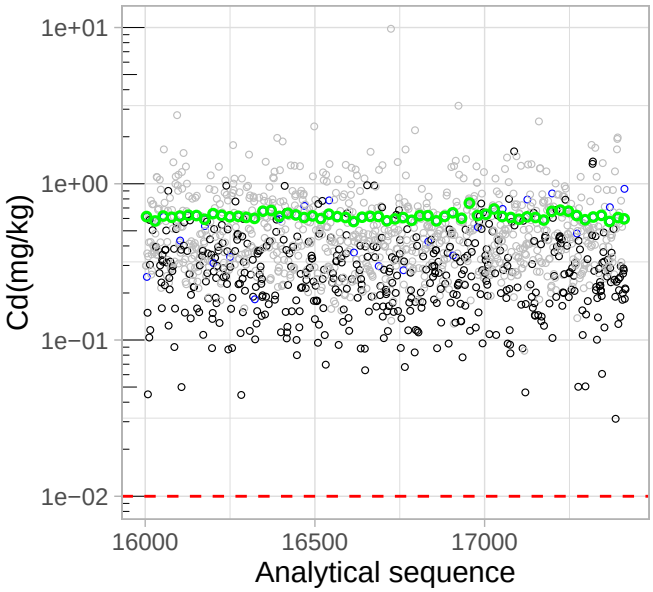

Au(mg/kg)
1e−02
1e−03
1e−04
1e−05
1e−06
1e−07
16000
16500
17000
Analytical sequence

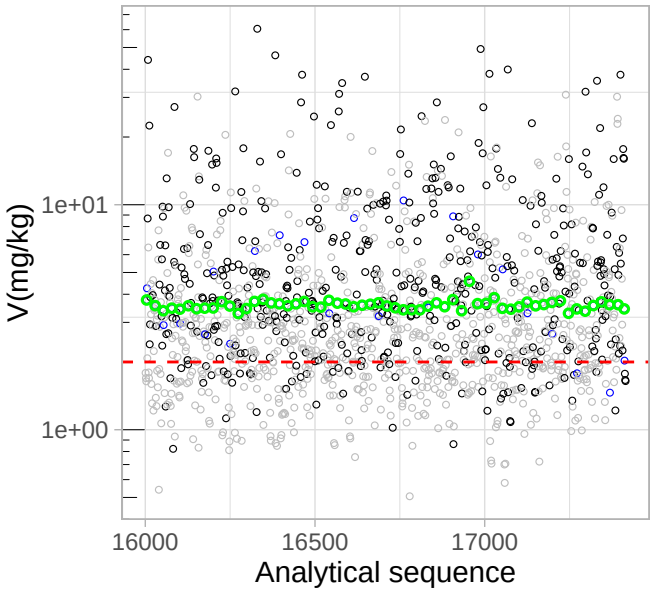

Th(mg/kg)
1e+01
1e+00
1e−01
1e−02
1e−03
1e−04
1e−05
1e−06
1e−07
16000
16500
17000
Analytical sequence

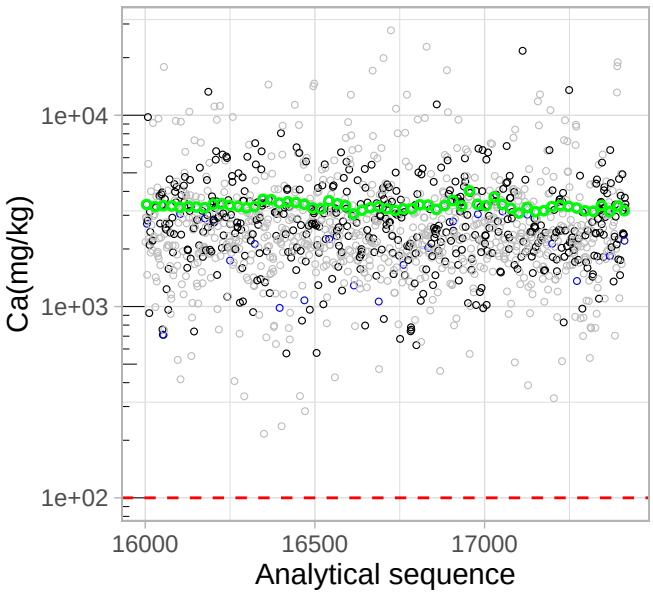

Sb(mg/kg)
1e+01
1e+00
1e−01
16000
16500
17000
Analytical sequence

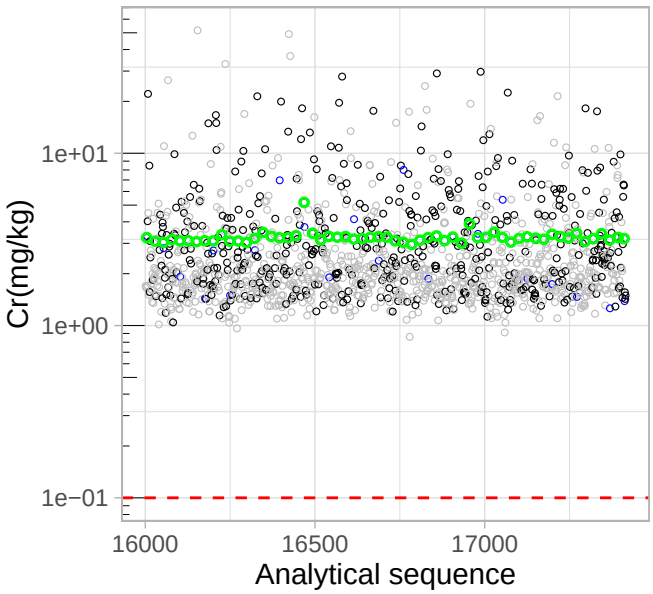

Sr(mg/kg)
1e+02
1e+01
1e+00
16000
16500
17000
Analytical sequence

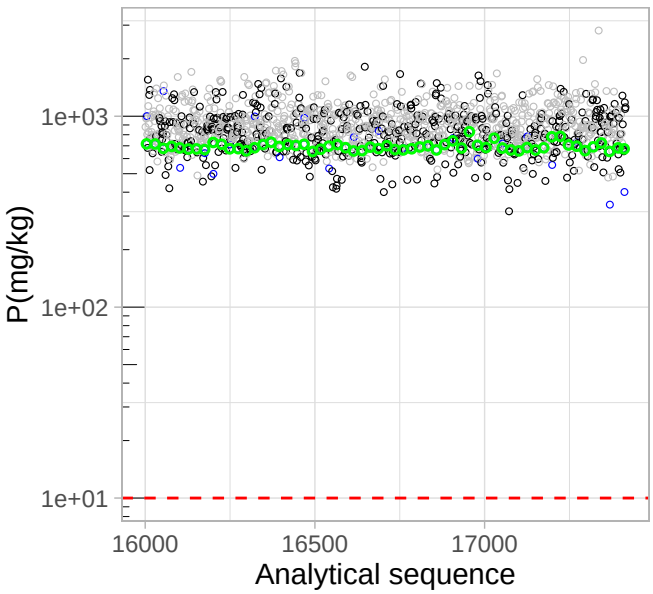

Bi(mg/kg)
1e+00
1e−01
1e−02
16000
16500
17000
Analytical sequence

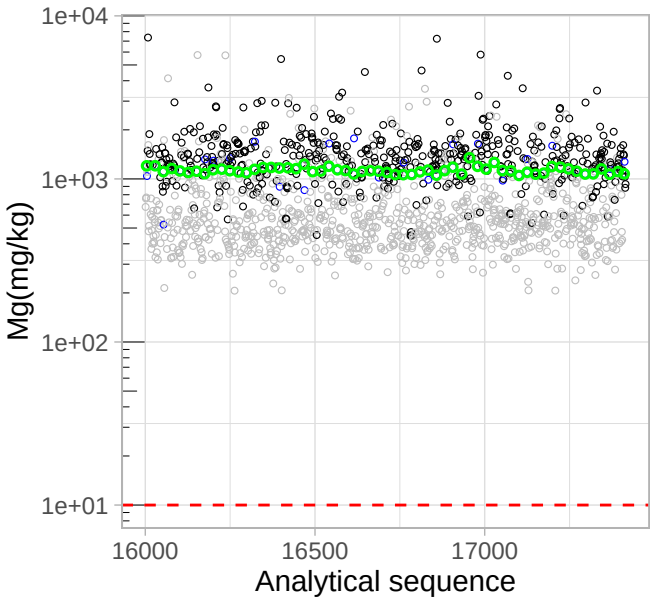

Cd(mg/kg)
1e+01
1e+00
1e−01
1e−02
16000
16500
17000
Analytical sequence

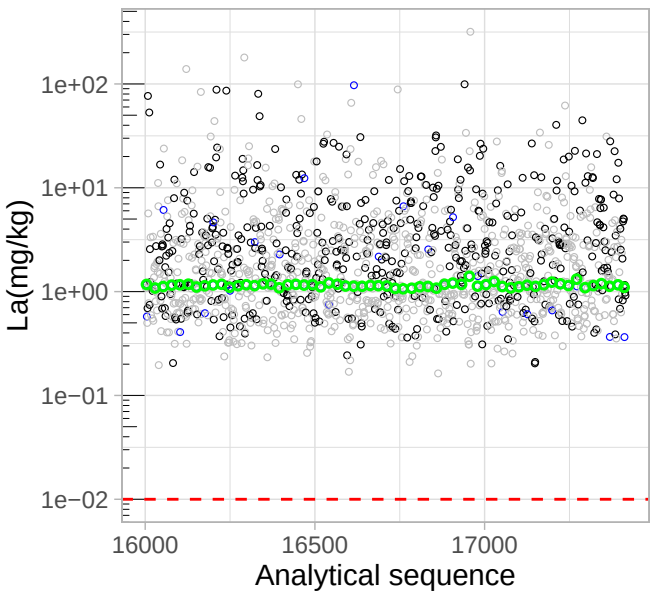

V(mg/kg)
1e+01
1e+00
16000
16500
17000
Analytical sequence

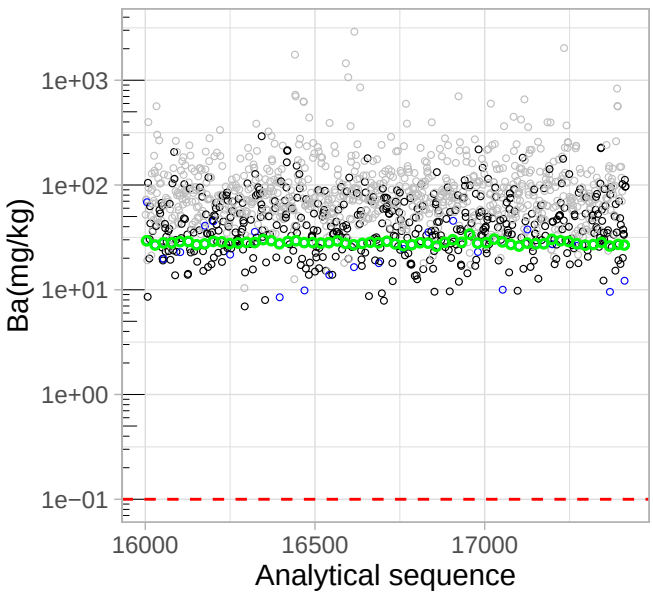

Ca(mg/kg)
1e+04
1e+03
1e+02
16000
16500
17000
Analytical sequence

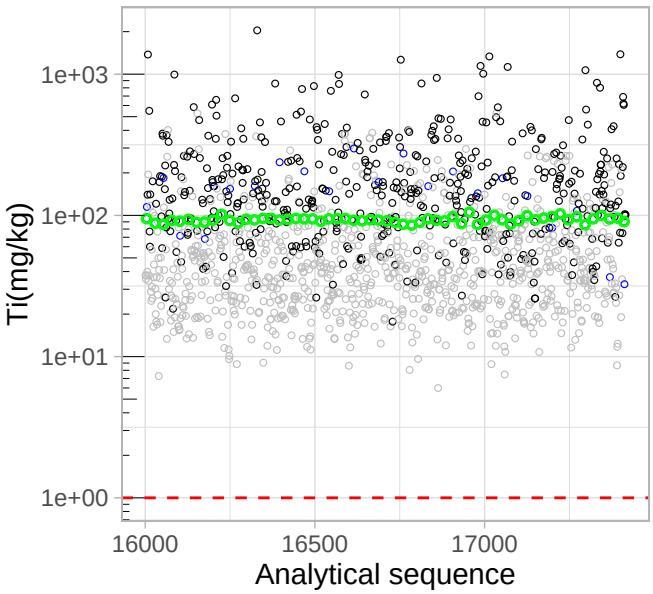

Cr(mg/kg)
1e+01
1e+00
1e−01
16000
16500
17000
Analytical sequence

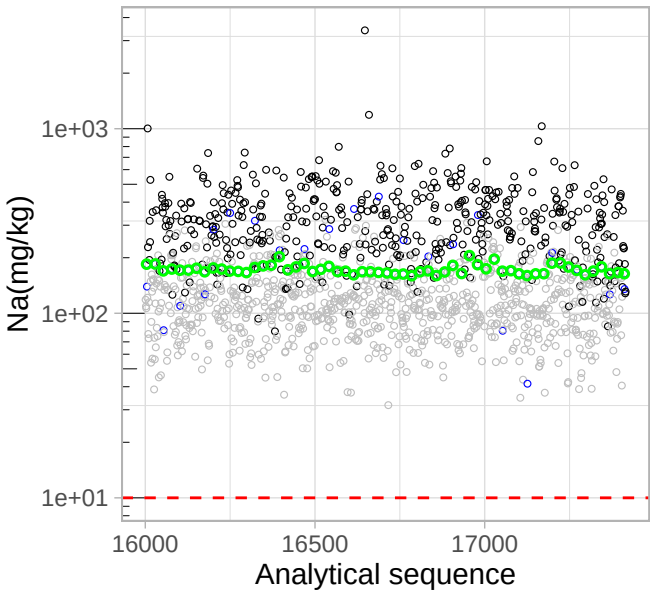

P(mg/kg)
1e+03
1e+02
1e+01
16000
16500
17000
Analytical sequence

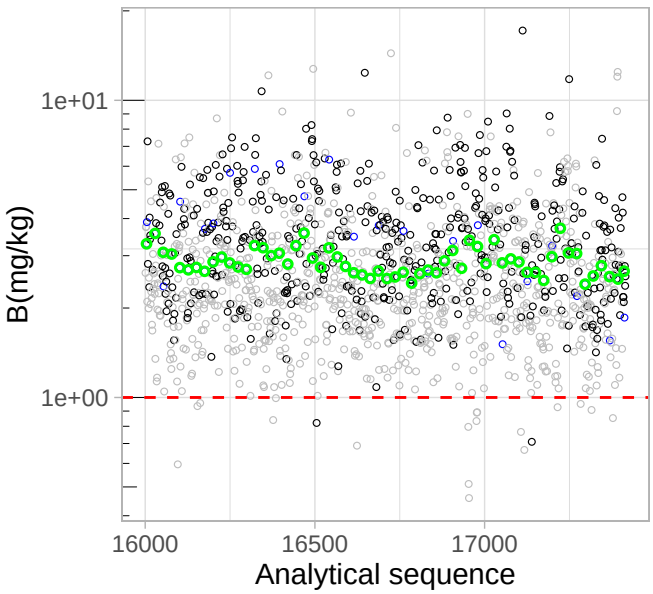

Mg(mg/kg)
1e+04
1e+03
1e+02
1e+01
16000
16500
17000
Analytical sequence

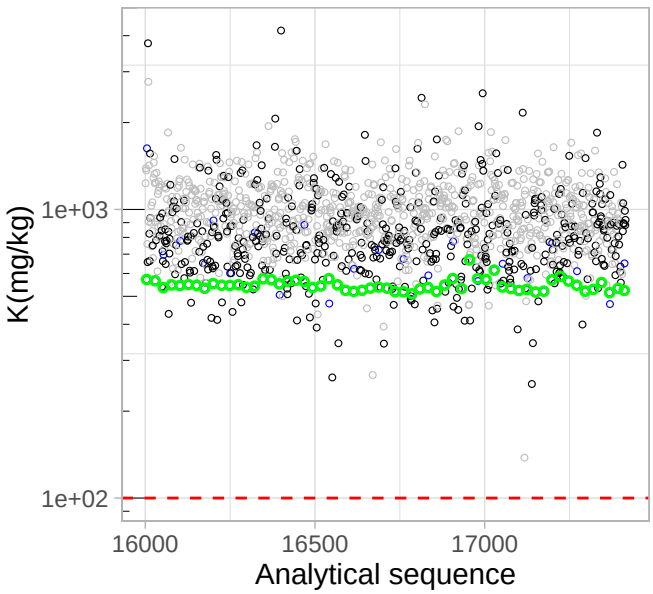

La(mg/kg)
1e+02
1e+01
1e+00
1e−01
1e−02
16000
16500
17000
Analytical sequence

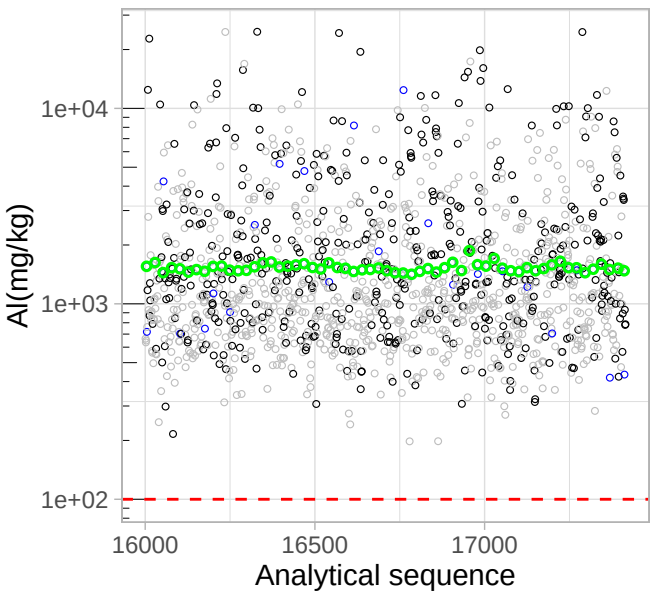

Ba(mg/kg)
1e+03
1e+02
1e+01
1e+00
1e−01
16000
16500
17000
Analytical sequence

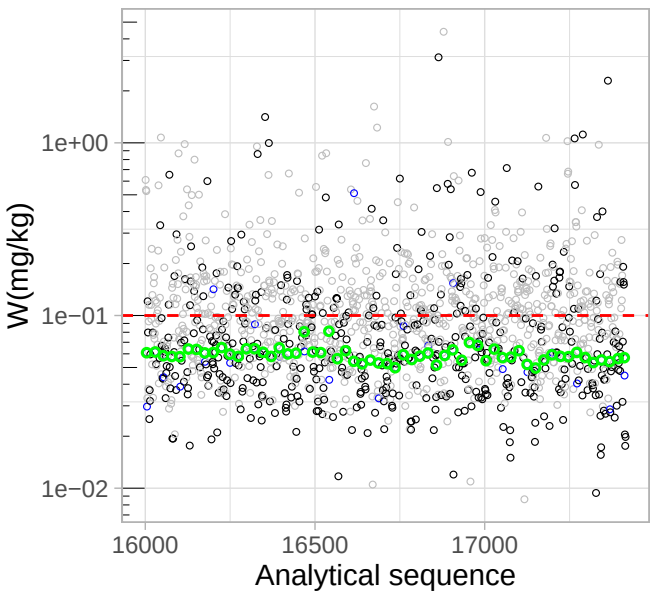

Ti(mg/kg)
1e+03
1e+02
1e+01
1e+00
16000
16500
17000
Analytical sequence

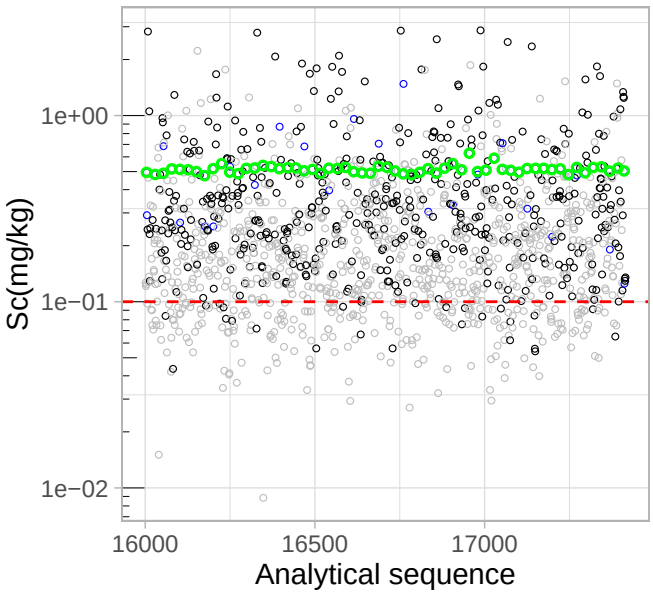

Na(mg/kg)
1e+03
1e+02
1e+01
16000
16500
17000
Analytical sequence

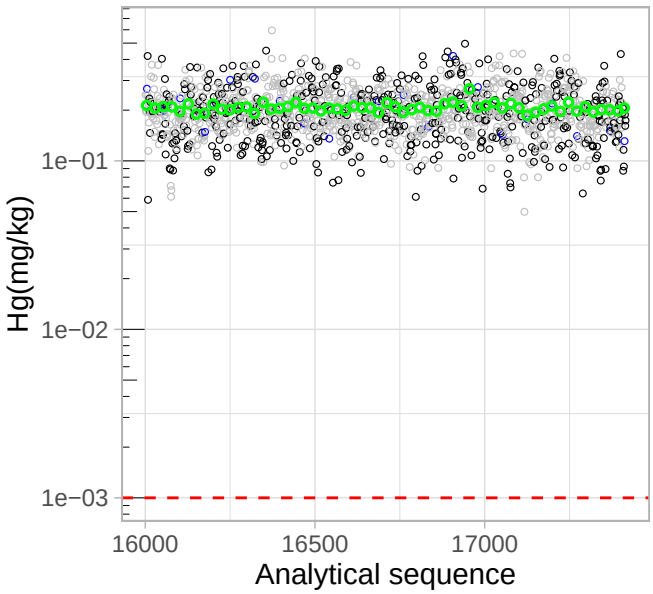

B(mg/kg)
1e+01
1e+00
16000
16500
17000
Analytical sequence

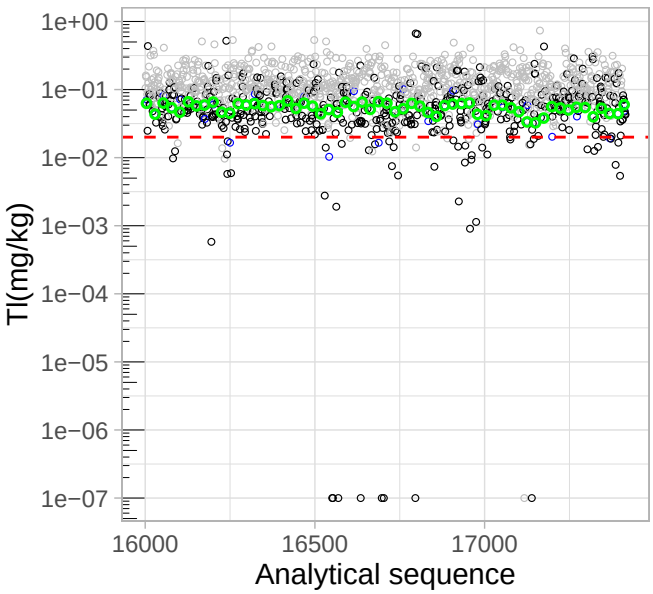

K(mg/kg)
1e+03
1e+02
16000
16500
17000
Analytical sequence

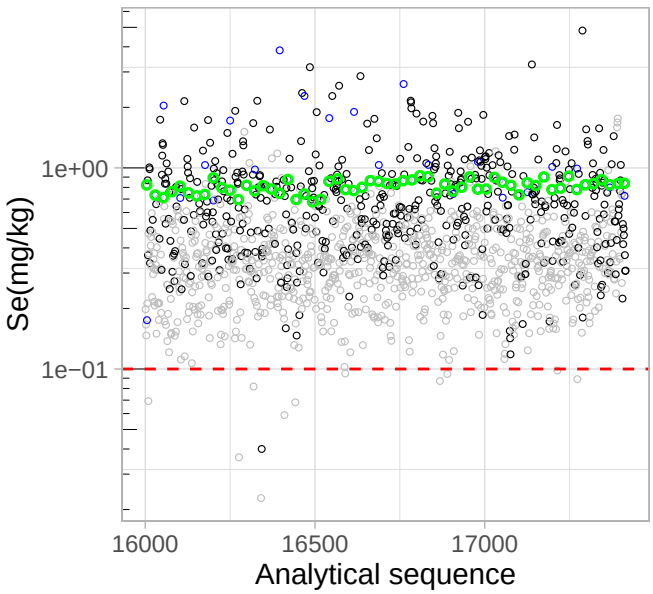

Al(mg/kg)
1e+04
1e+03
1e+02
16000
16500
17000
Analytical sequence

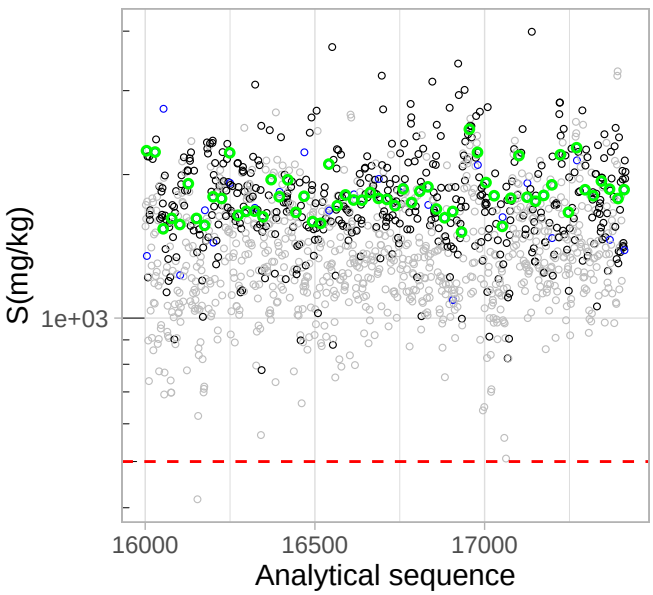

W(mg/kg)
1e+00
1e−01
1e−02
16000
16500
17000
Analytical sequence

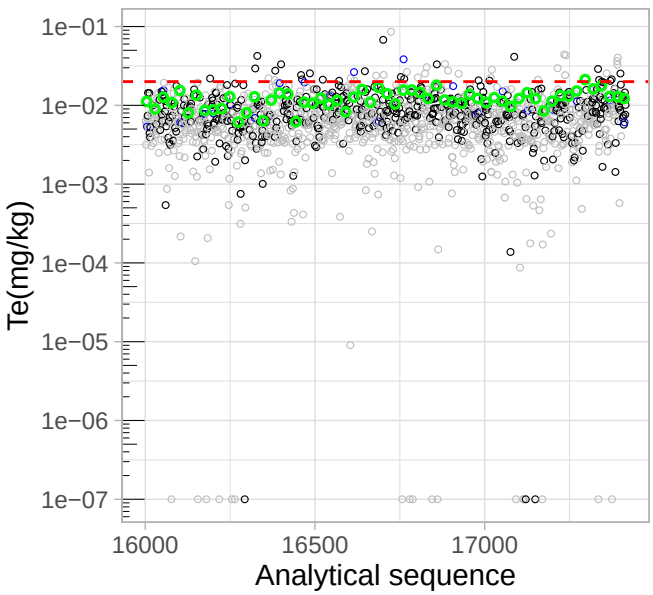

Sc(mg/kg)
1e+00
1e−01
1e−02
16000
16500
17000
Analytical sequence

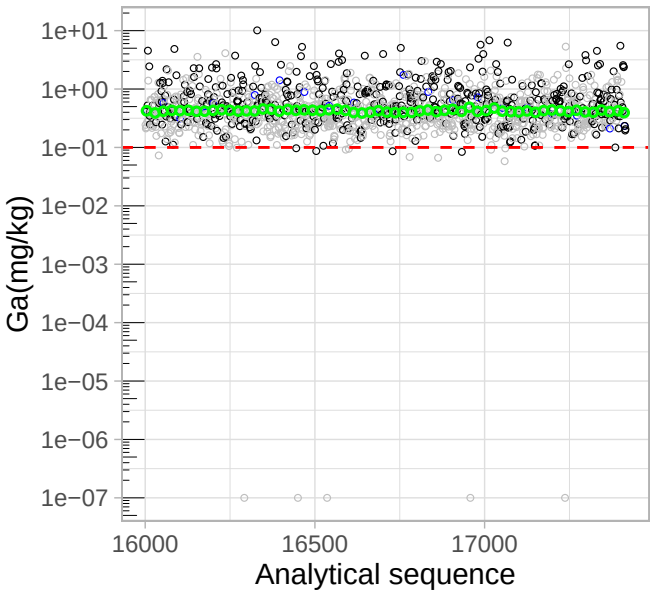

Hg(mg/kg)
1e−01
1e−02
1e−03
16000
16500
17000
Analytical sequence

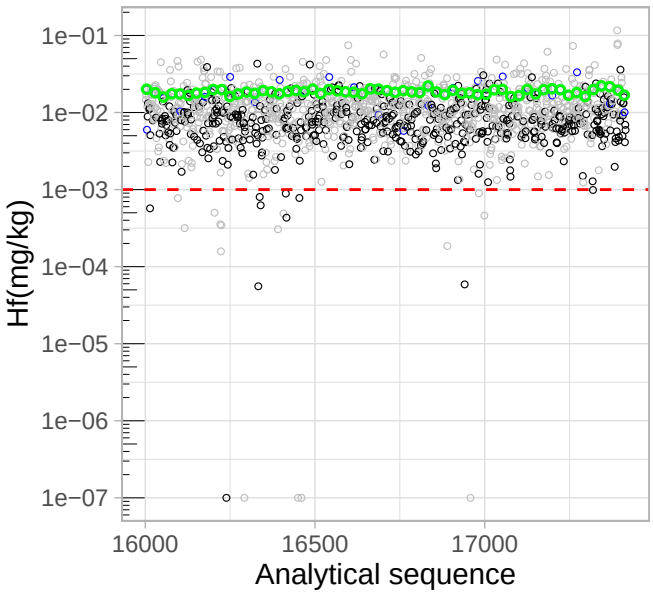

Tl(mg/kg)
1e+00
1e−01
1e−02
1e−03
1e−04
1e−05
1e−06
1e−07
16000
16500
17000
Analytical sequence

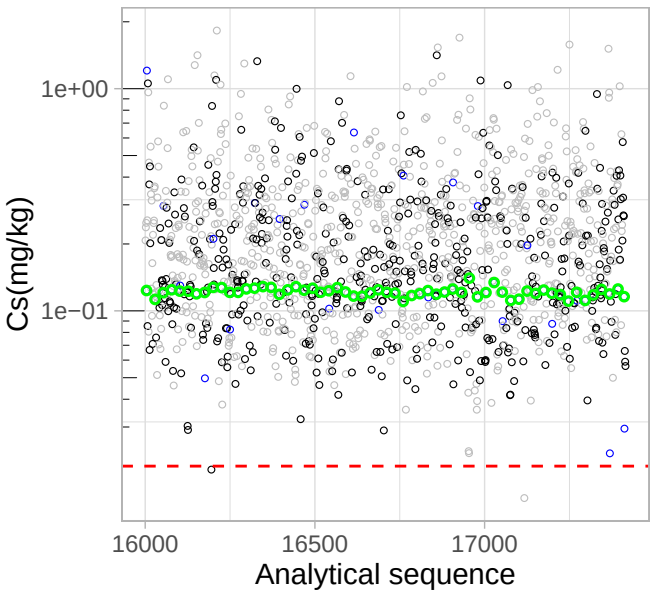

Se(mg/kg)
1e+00
1e−01
16000
16500
17000
Analytical sequence

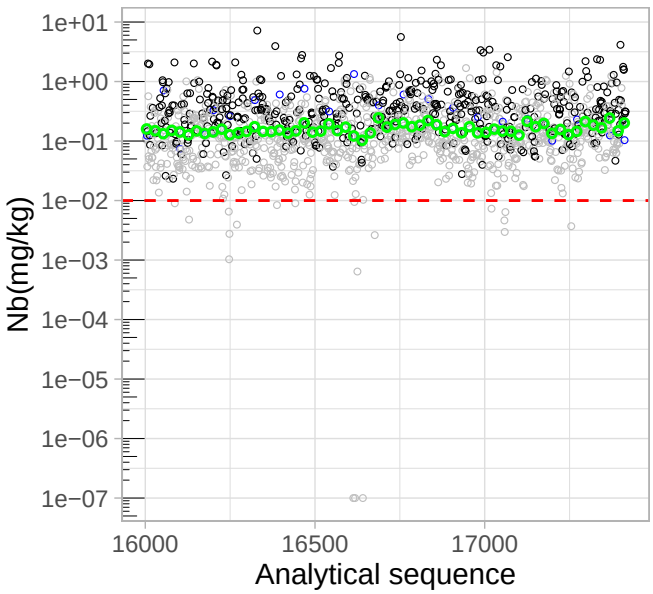

S(mg/kg)
1e+03
16000
16500
17000
Analytical sequence

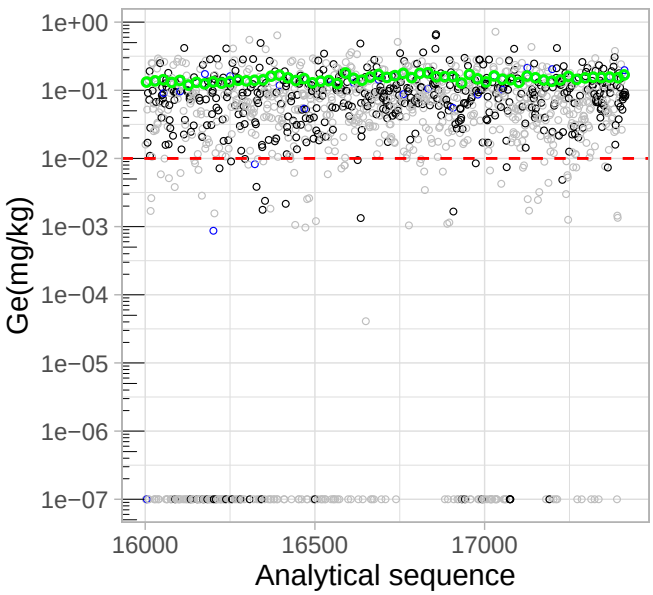

Te(mg/kg)
1e−01
1e−02
1e−03
1e−04
1e−05
1e−06
1e−07
16000
16500
17000
Analytical sequence

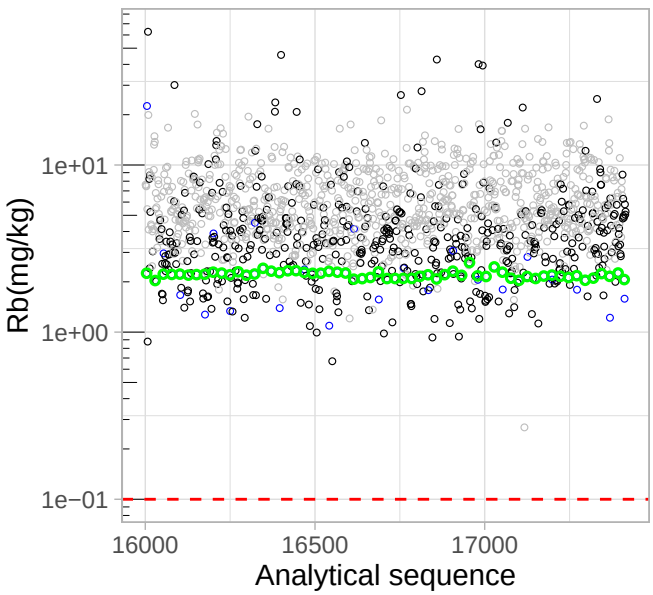

Ga(mg/kg)
1e+01
1e+00
1e−01
1e−02
1e−03
1e−04
1e−05
1e−06
1e−07
16000
16500
17000
Analytical sequence

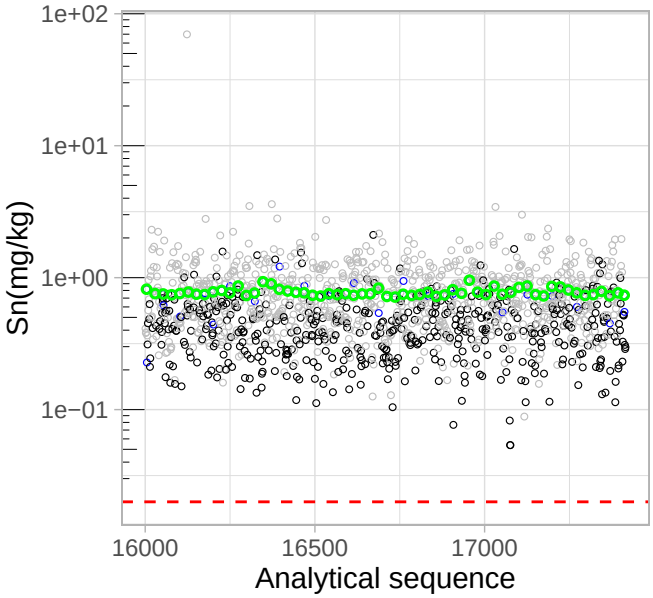

Hf(mg/kg)
1e−01
1e−02
1e−03
1e−04
1e−05
1e−06
1e−07
16000
16500
17000
Analytical sequence

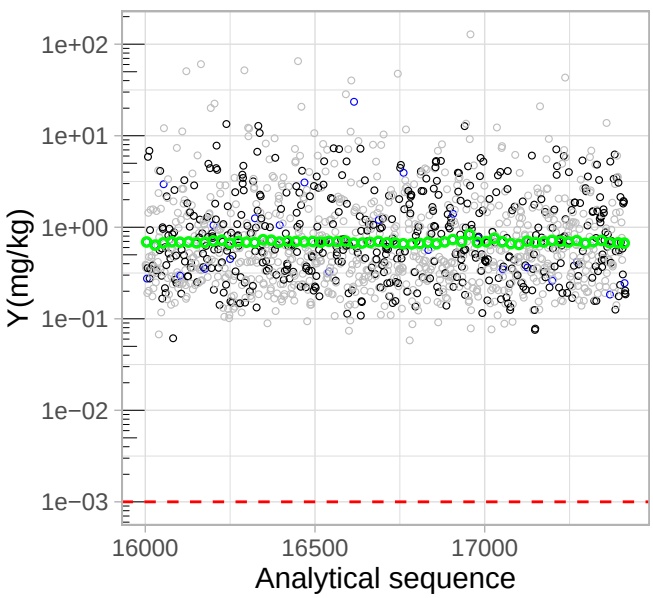

Cs(mg/kg)
1e+00
1e−01
16000
16500
17000
Analytical sequence

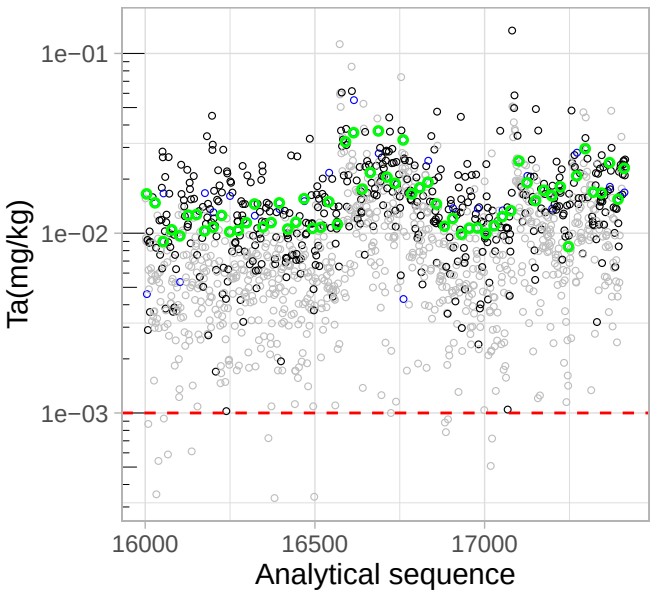

Nb(mg/kg)
1e+01
1e+00
1e−01
1e−02
1e−03
1e−04
1e−05
1e−06
1e−07
16000
16500
17000
Analytical sequence

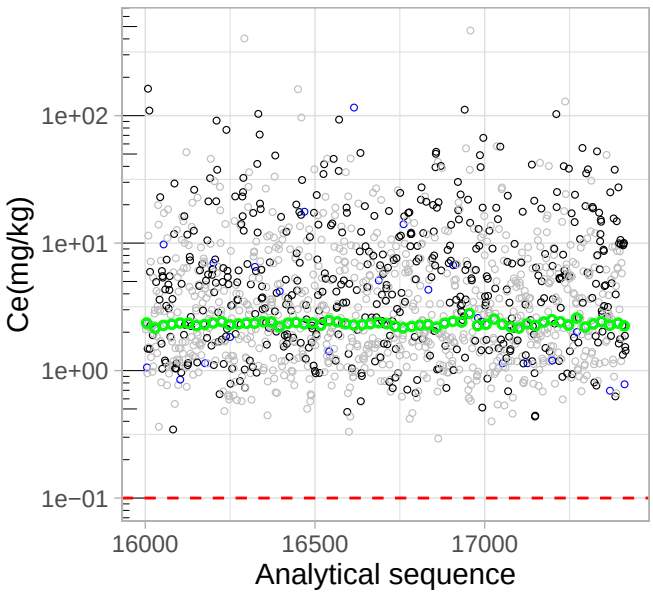

Ge(mg/kg)
1e+00
1e−01
1e−02
1e−03
1e−04
1e−05
1e−06
1e−07
16000
16500
17000
Analytical sequence

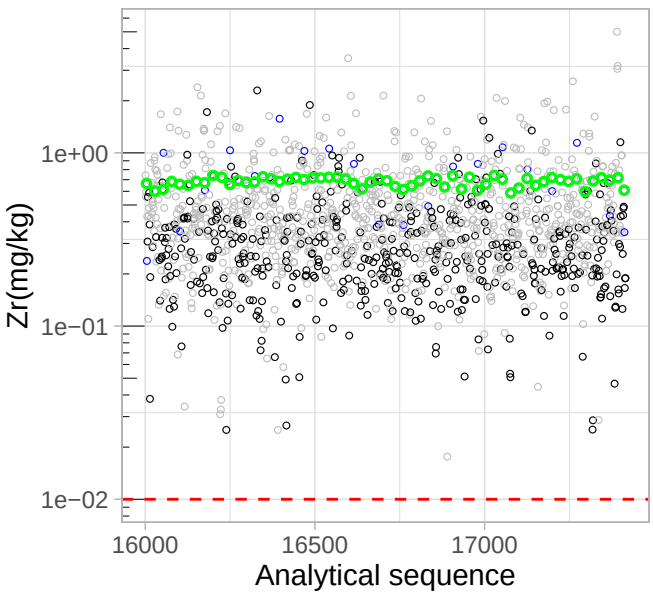

Rb(mg/kg)
1e+01
1e+00
1e−01
16000
16500
17000
Analytical sequence

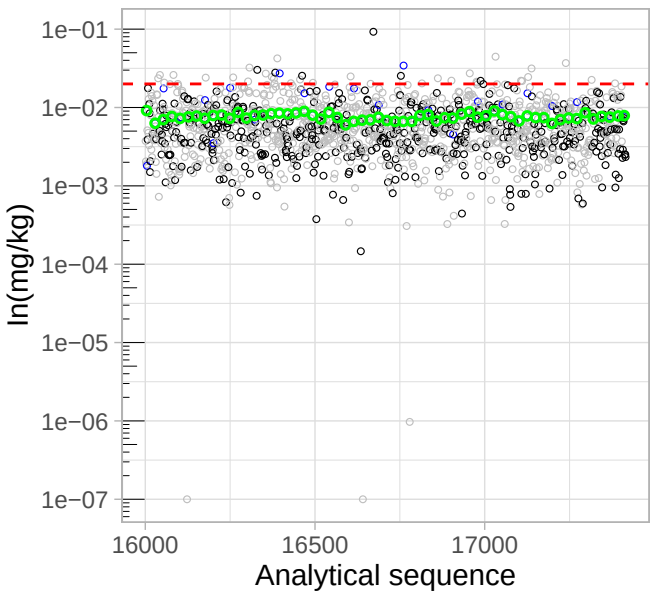

Sn(mg/kg)
1e+02
1e+01
1e+00
1e−01
16000
16500
17000
Analytical sequence

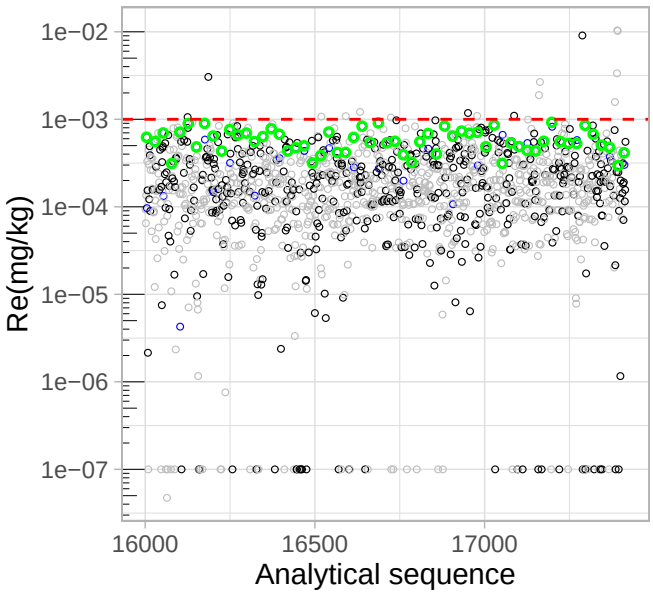

Y(mg/kg)
1e+02
1e+01
1e+00
1e−01
1e−02
1e−03
16000
16500
17000
Analytical sequence

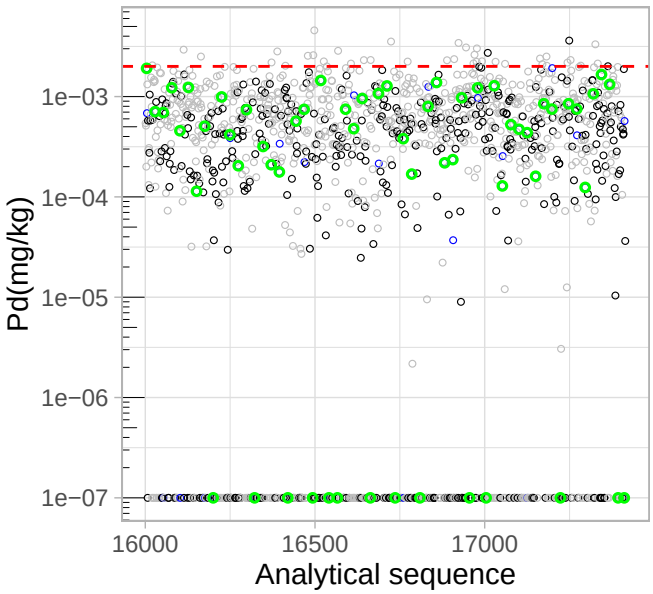

Ta(mg/kg)
1e−01
1e−02
1e−03
16000
16500
17000
Analytical sequence

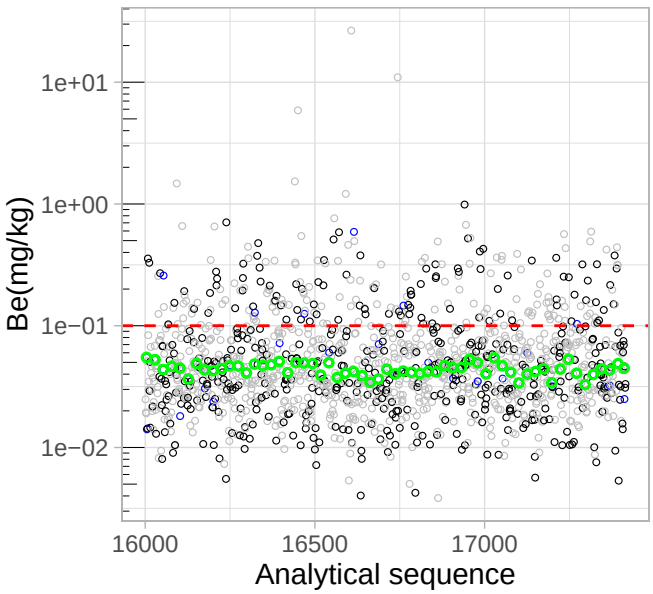

Ce(mg/kg)
1e+02
1e+01
1e+00
1e−01
16000
16500
17000
Analytical sequence

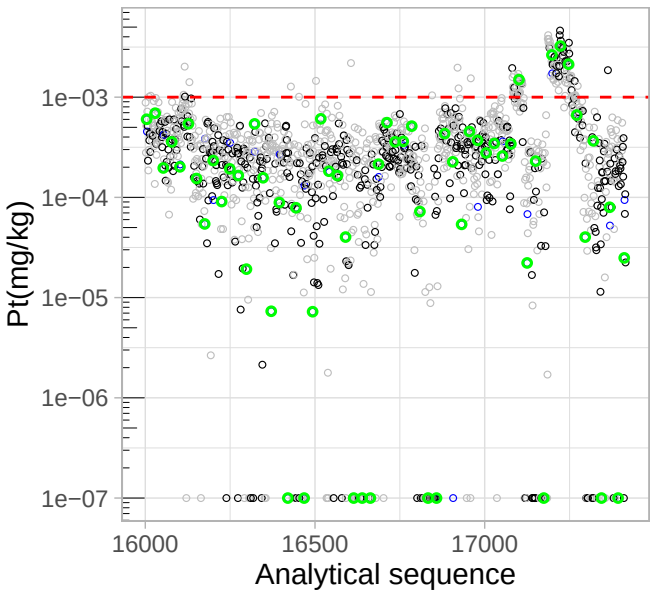

Zr(mg/kg)
1e+00
1e−01
1e−02
16000
16500
17000
Analytical sequence

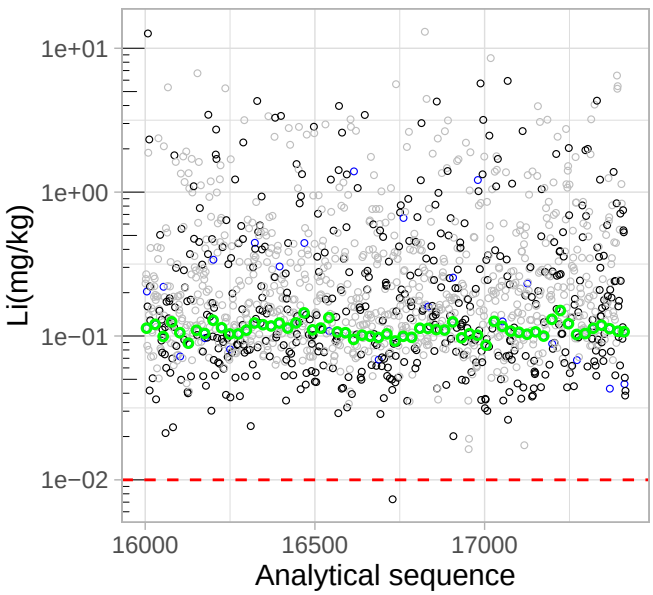

In(mg/kg)
1e−01
1e−02
1e−03
1e−04
1e−05
1e−06
1e−07
16000
16500
17000
Analytical sequence


Re(mg/kg)
1e−02
1e−03
1e−04
1e−05
1e−06
1e−07
16000
16500
17000
Analytical sequence


Pd(mg/kg)
1e−03
1e−04
1e−05
1e−06
1e−07
16000
16500
17000
Analytical sequence


Be(mg/kg)
1e+01
1e+00
1e−01
1e−02
16000
16500
17000
Analytical sequence


Pt(mg/kg)
1e−03
1e−04
1e−05
1e−06
1e−07
16000
16500
17000
Analytical sequence

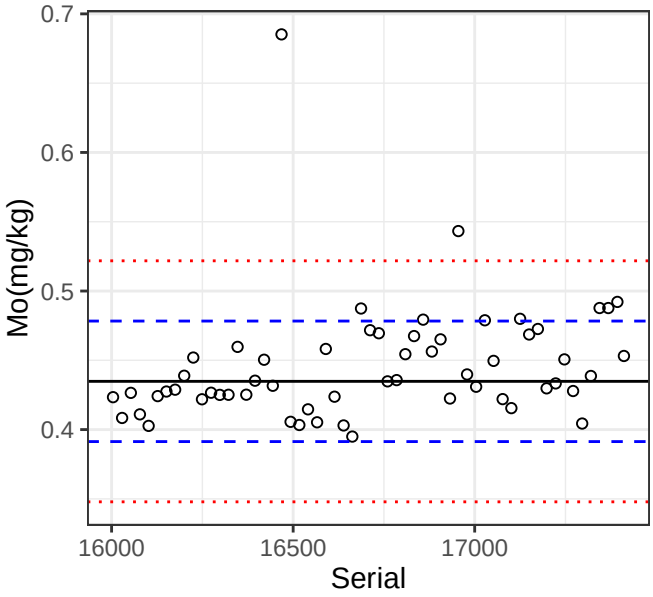

Li(mg/kg)
1e+01
1e+00
1e−01
1e−02
16000
16500
17000
Analytical sequence

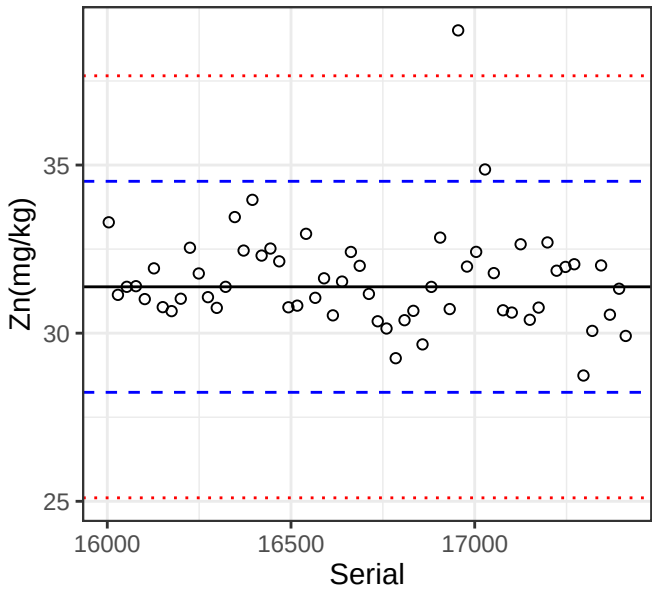
APPENDIX 2: X-CHARTS

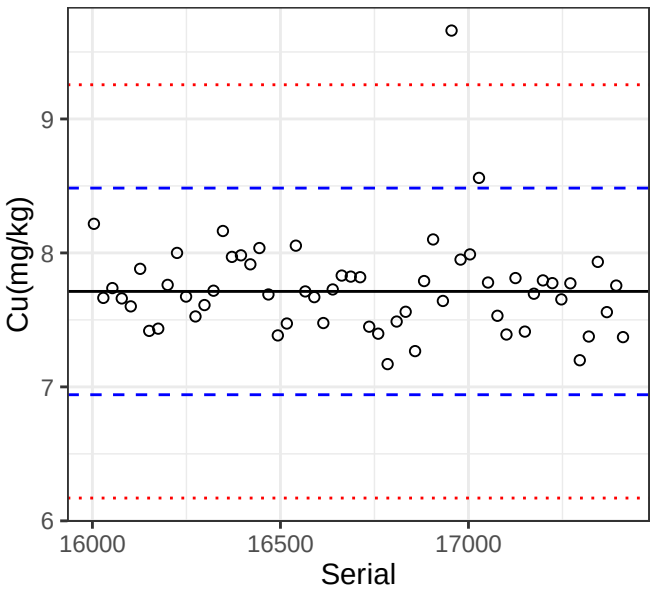
X-charts comprising splits of the in-house humus standard.

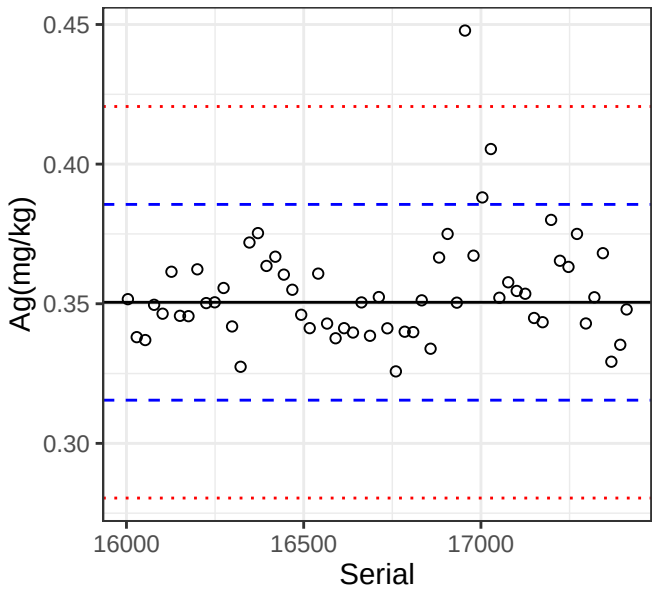
Analyses are plotted in the same order as the analytical sequence in the laboratory.

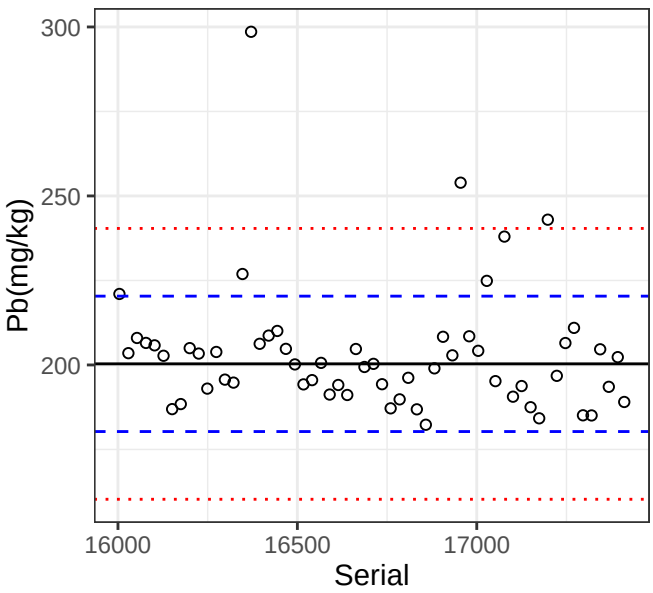
The median is indicated by a solid line, dashed lines are drawn at ±10% (blue) and ±20% (red) relative to the median.

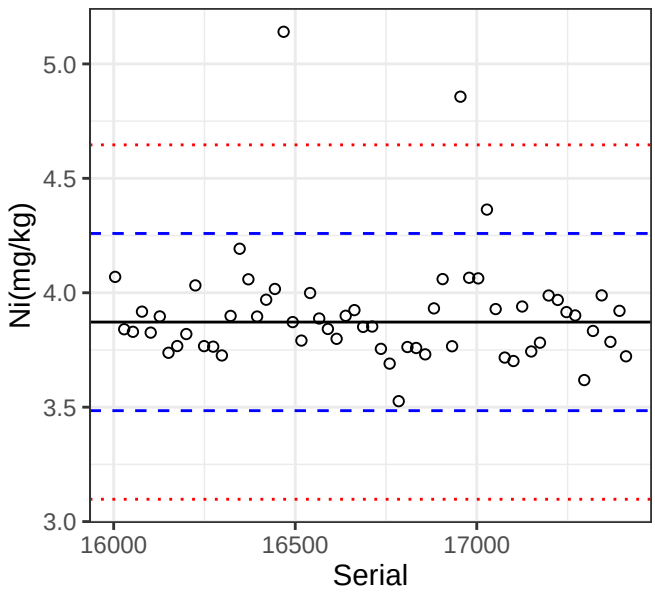

Mo(mg/kg)
0.7
0.6
0.5
0.4
16000
16500
17000
Serial

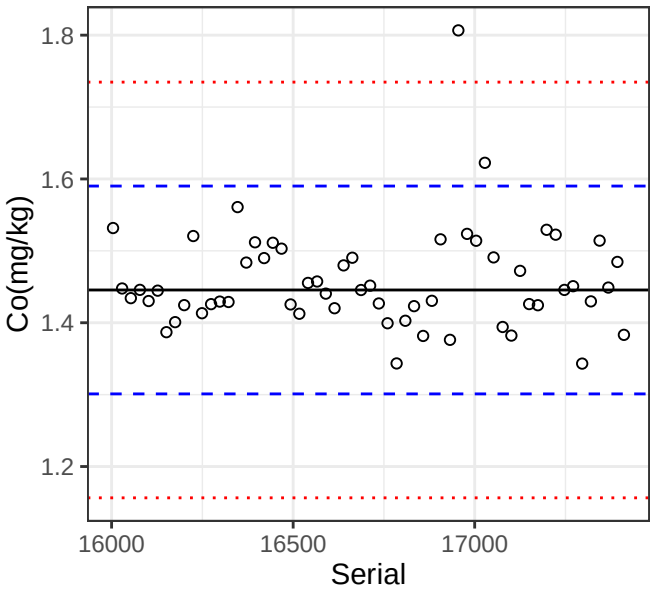

Zn(mg/kg)
35
30
25
16000
16500
17000
Serial

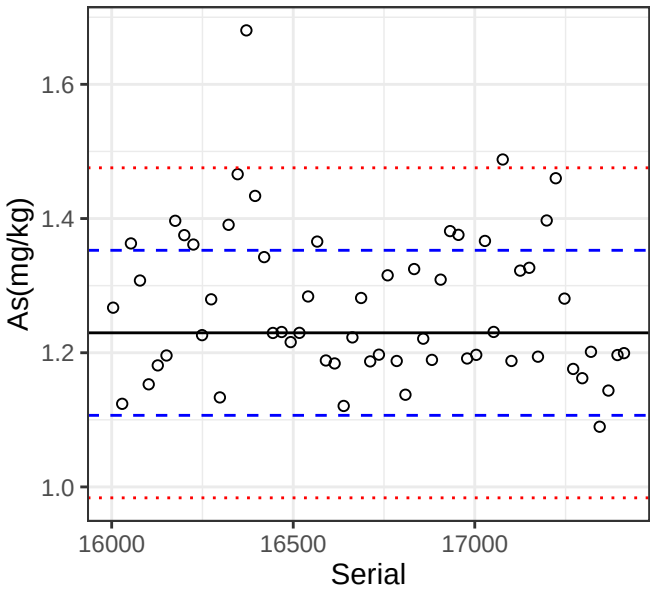

Cu(mg/kg)
9
8
7
6
16000
16500
17000
Serial

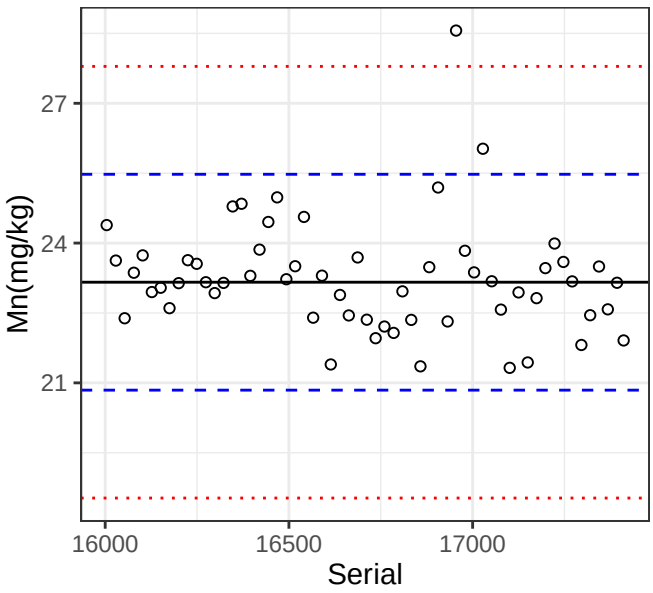

Ag(mg/kg)
0.45
0.40
0.35
0.30
16000
16500
17000
Serial

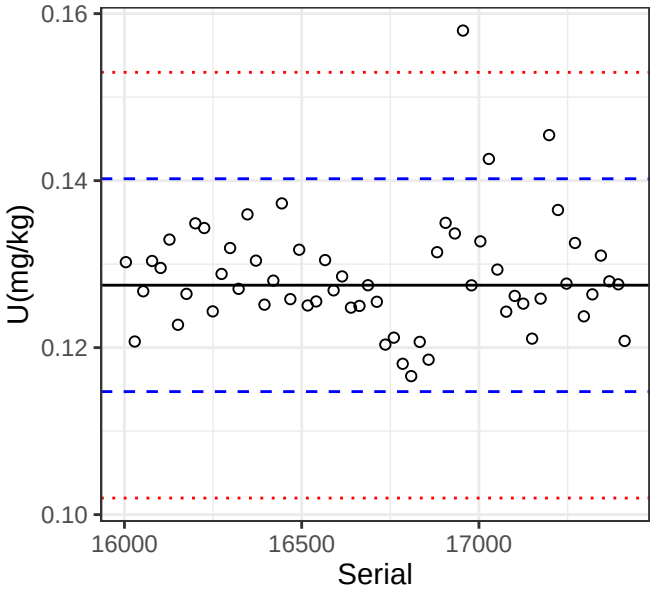

Pb(mg/kg)
300
250
200
16000
16500
17000
Serial

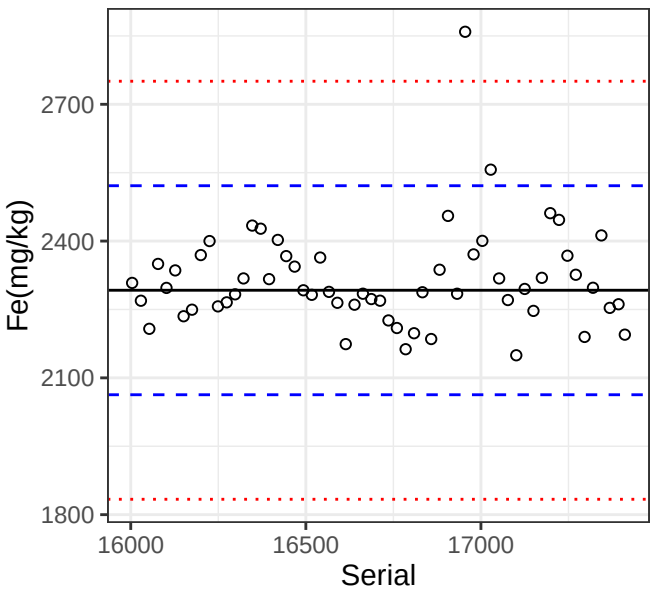

Ni(mg/kg)
5.0
4.5
4.0
3.5
3.0
16000
16500
17000
Serial

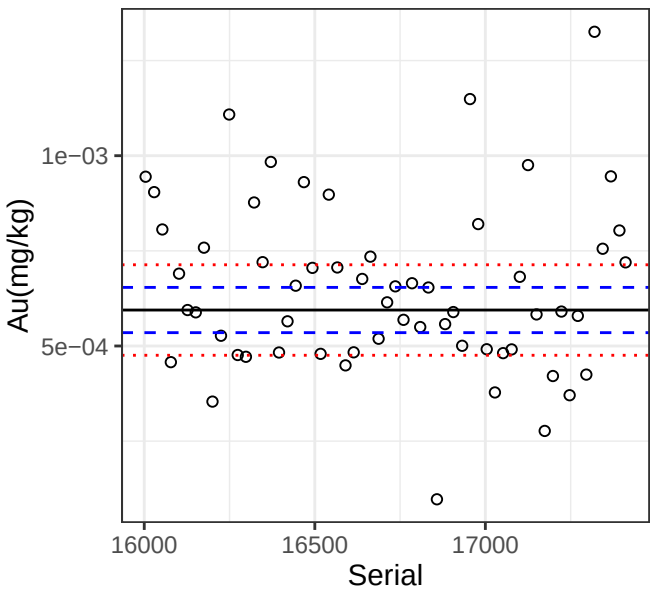

Co(mg/kg)
1.8
1.6
1.4
1.2
16000
16500
17000
Serial

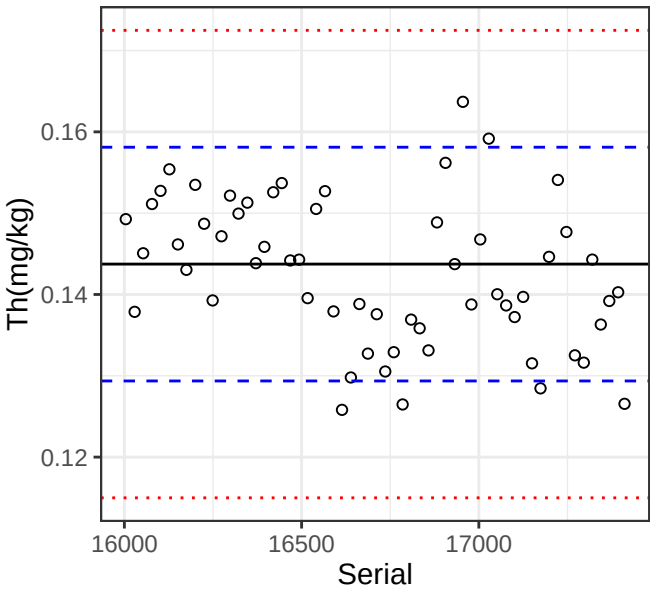

As(mg/kg)
1.6
1.4
1.2
1.0
16000
16500
17000
Serial

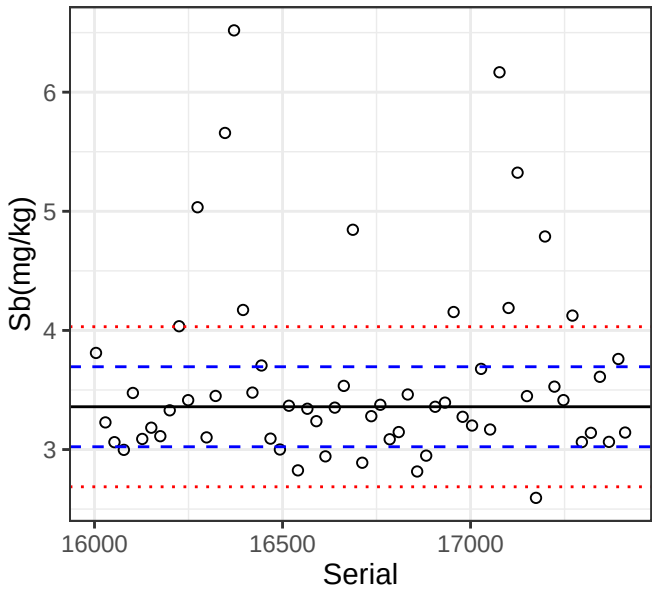

Mn(mg/kg)
27
24
21
16000
16500
17000
Serial

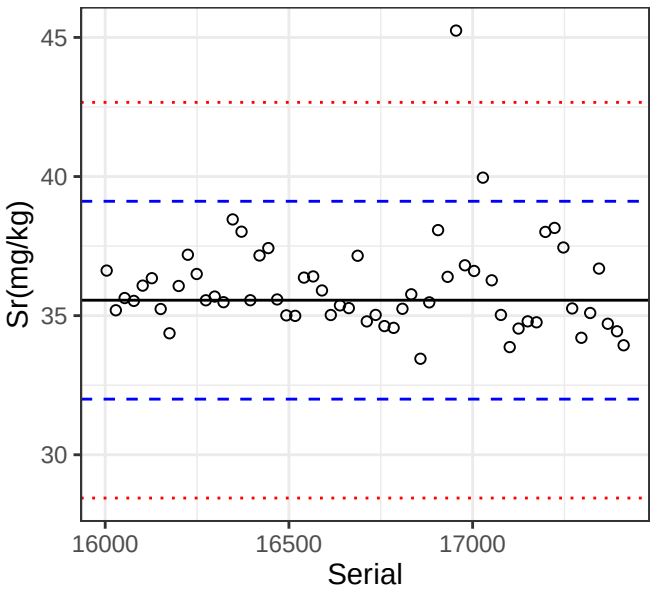

U(mg/kg)
0.16
0.14
0.12
0.10
16000
16500
17000
Serial

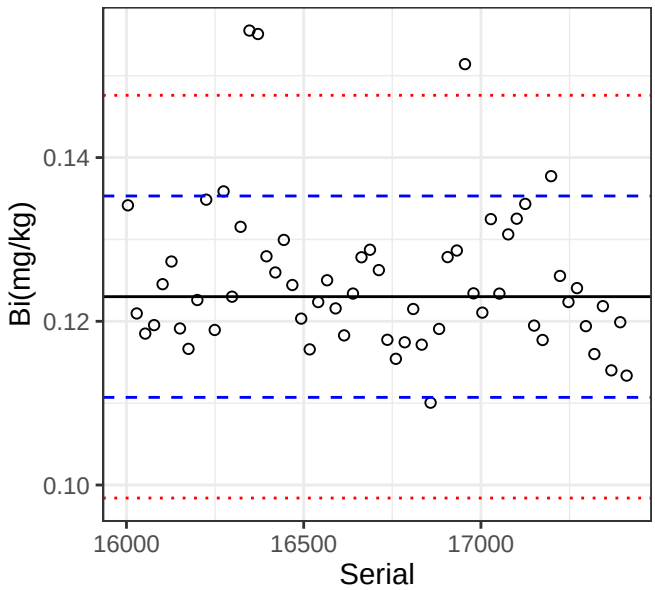

Fe(mg/kg)
2700
2400
2100
1800
16000
16500
17000
Serial

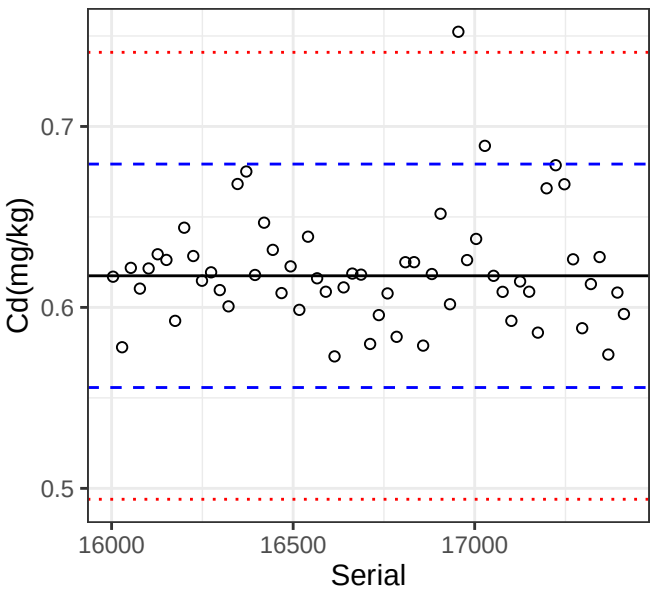

Au(mg/kg)
1e−03
5e−04
16000
16500
17000
Serial

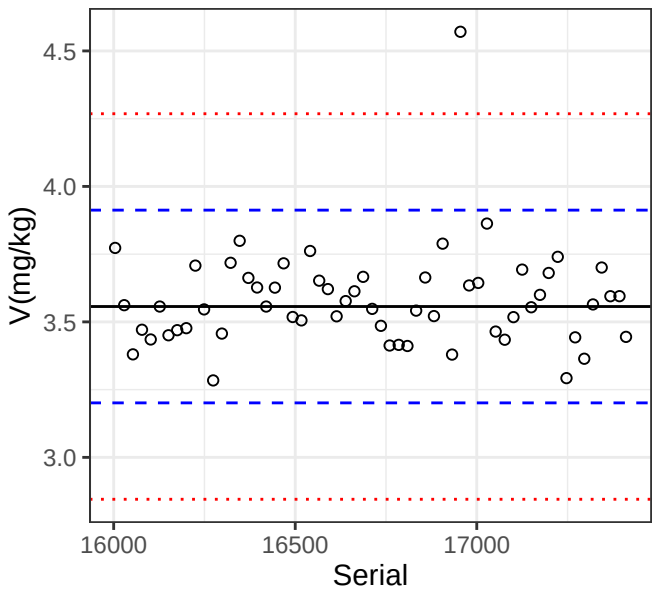

Th(mg/kg)
0.16
0.14
0.12
16000
16500
17000
Serial

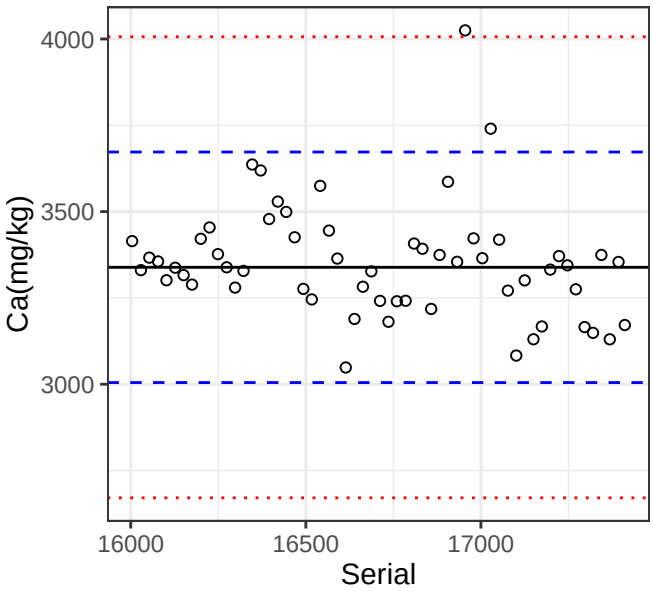

Sb(mg/kg)
6
5
4
3
16000
16500
17000
Serial

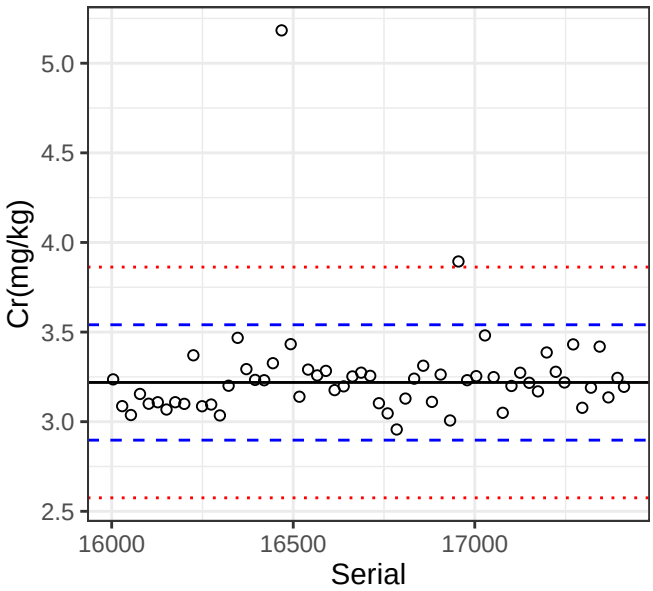

Sr(mg/kg)
45
40
35
30
16000
16500
17000
Serial

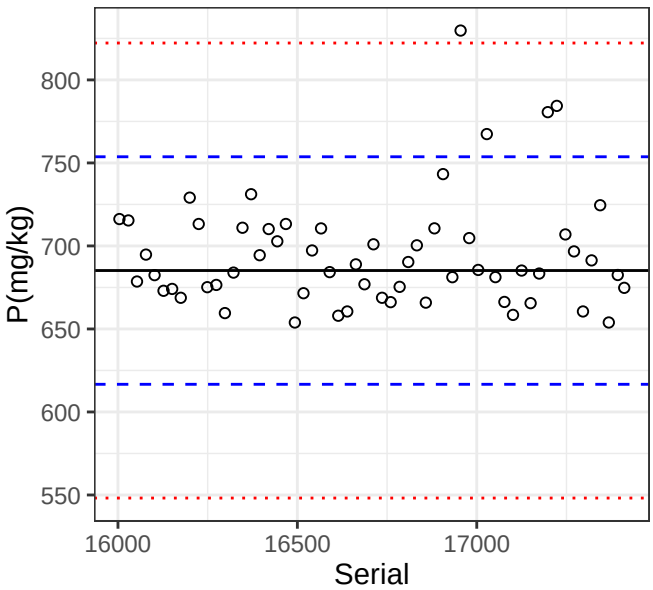

Bi(mg/kg)
0.14
0.12
0.10
16000
16500
17000
Serial

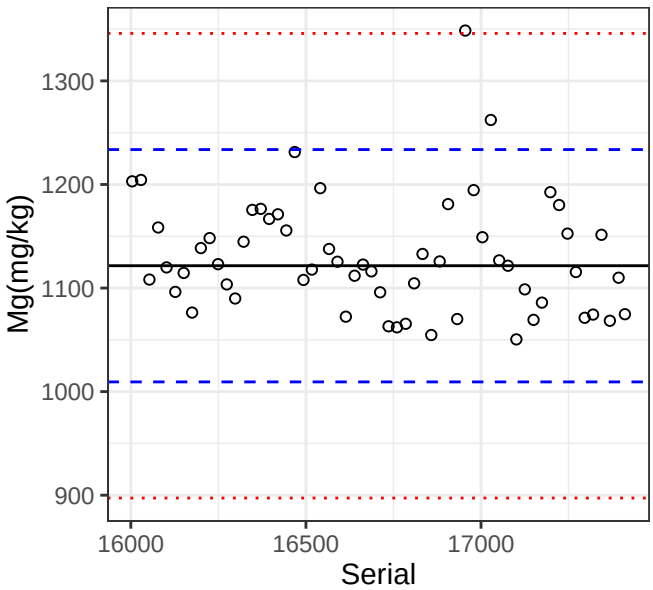

Cd(mg/kg)
0.7
0.6
0.5
16000
16500
17000
Serial

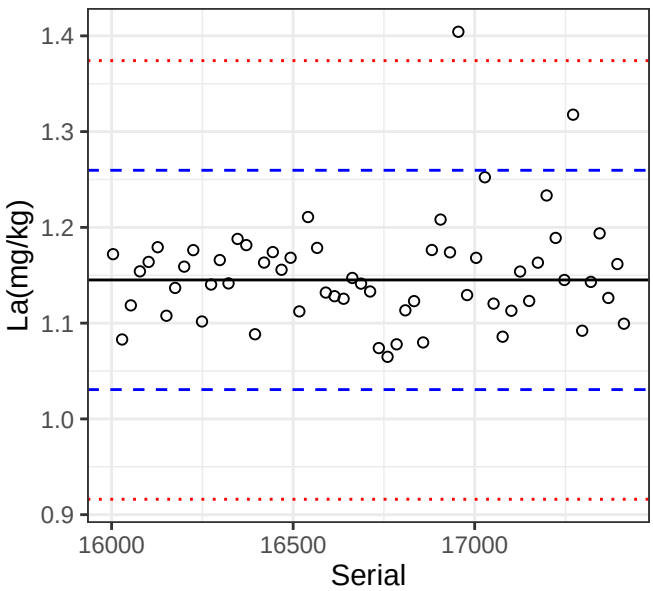

V(mg/kg)
4.5
4.0
3.5
3.0
16000
16500
17000
Serial

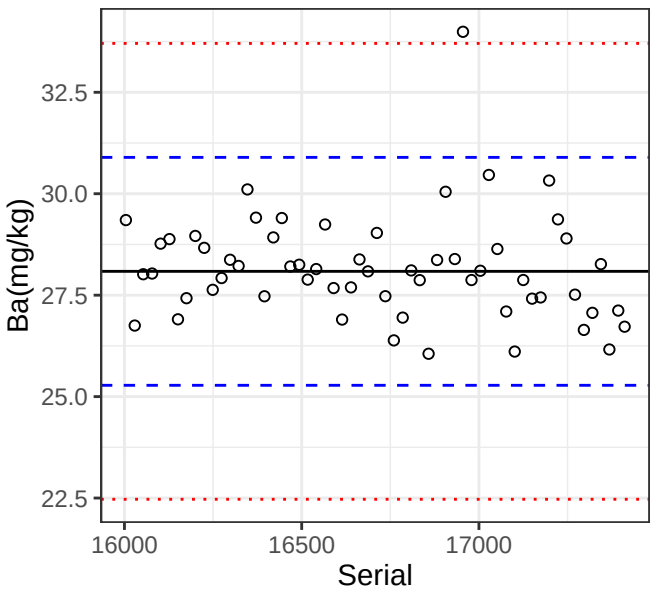

Ca(mg/kg)
4000
3500
3000
16000
16500
17000
Serial

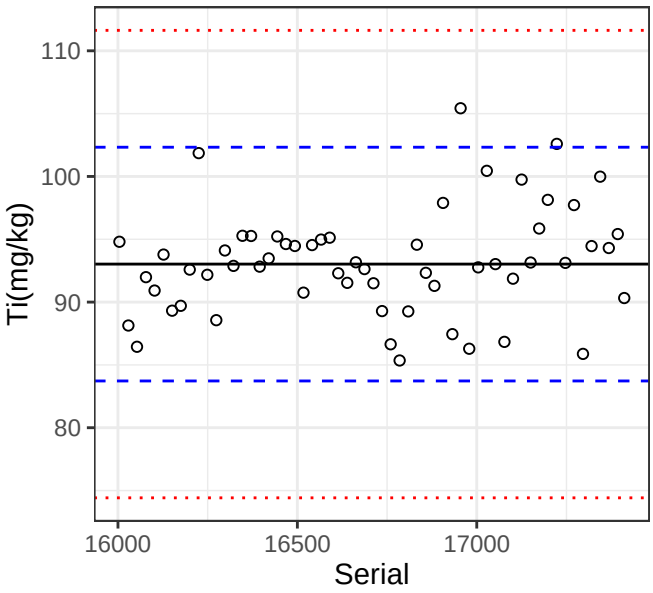

Cr(mg/kg)
5.0
4.5
4.0
3.5
3.0
2.5
16000
16500
17000
Serial

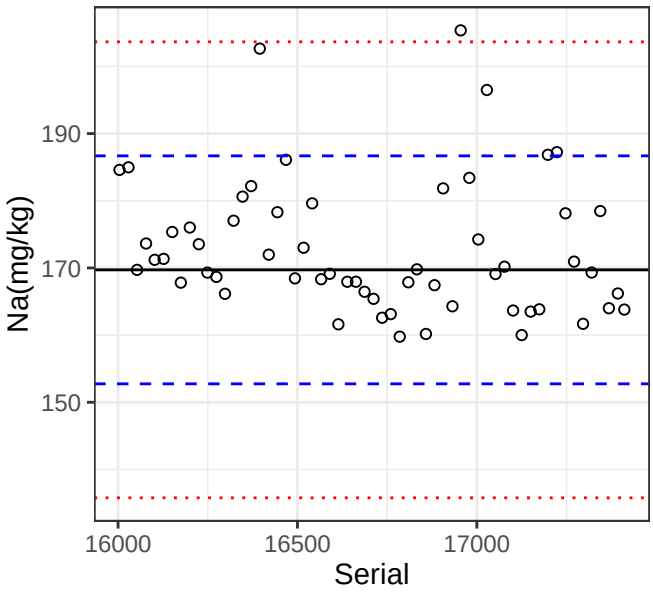

P(mg/kg)
800
750
700
650
600
550
16000
16500
17000
Serial

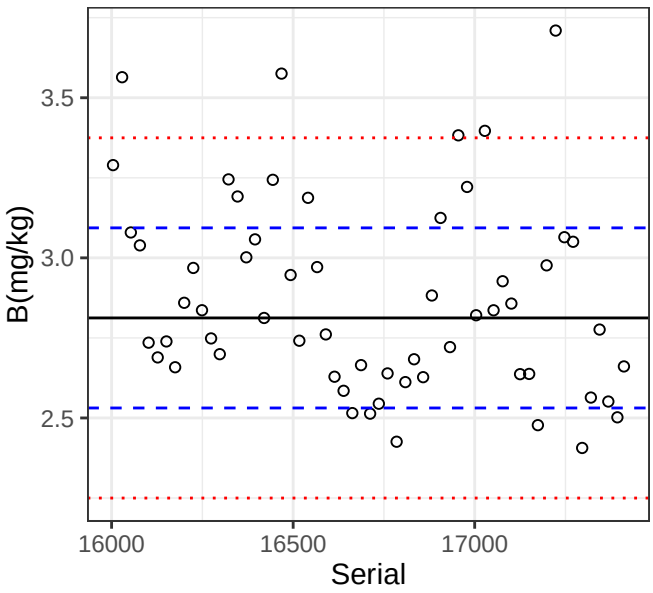

Mg(mg/kg)
1300
1200
1100
1000
900
16000
16500
17000
Serial

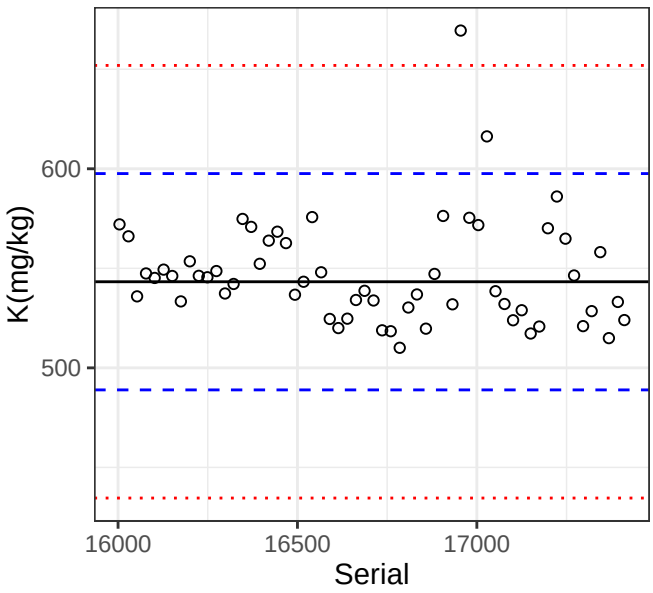

La(mg/kg)
1.4
1.3
1.2
1.1
1.0
0.9
16000
16500
17000
Serial

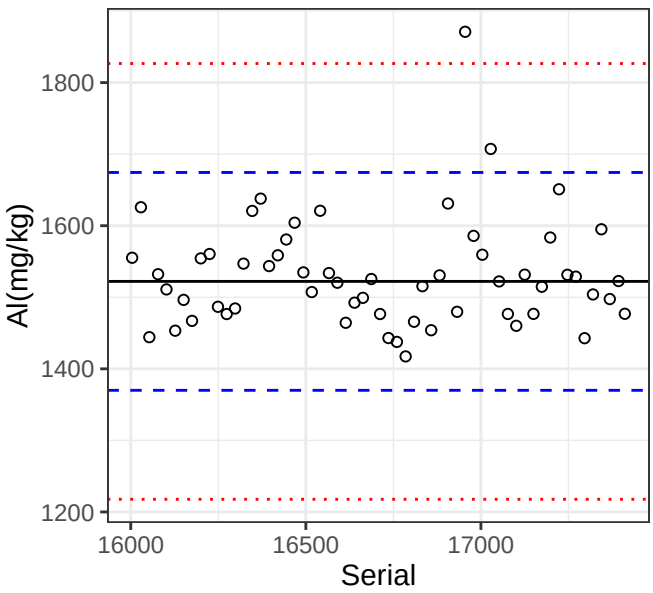

Ba(mg/kg)
32.5
30.0
27.5
25.0
22.5
16000
16500
17000
Serial

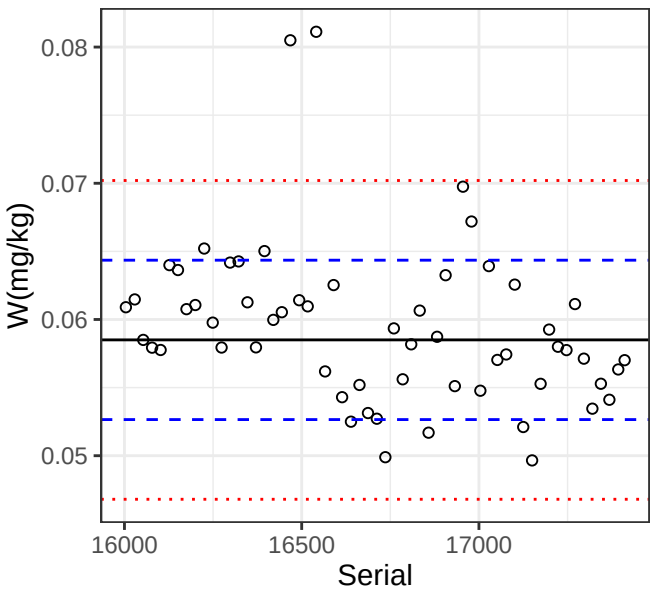

Ti(mg/kg)
110
100
90
80
16000
16500
17000
Serial

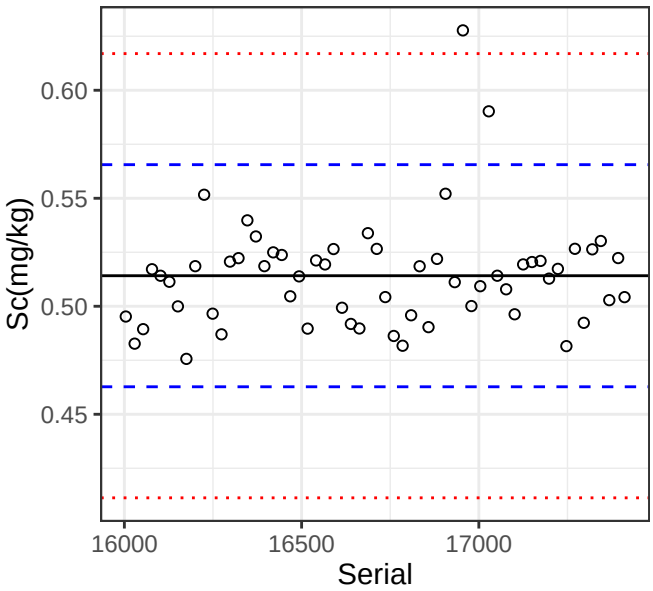

Na(mg/kg)
190
170
150
16000
16500
17000
Serial

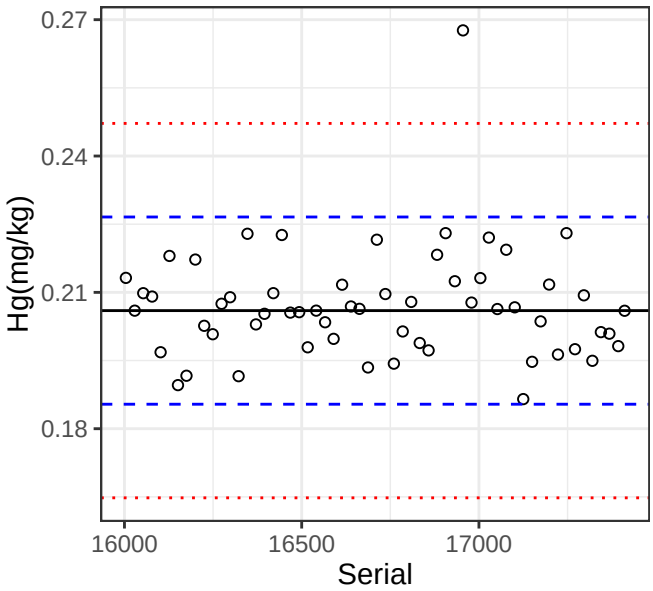

B(mg/kg)
3.5
3.0
2.5
16000
16500
17000
Serial

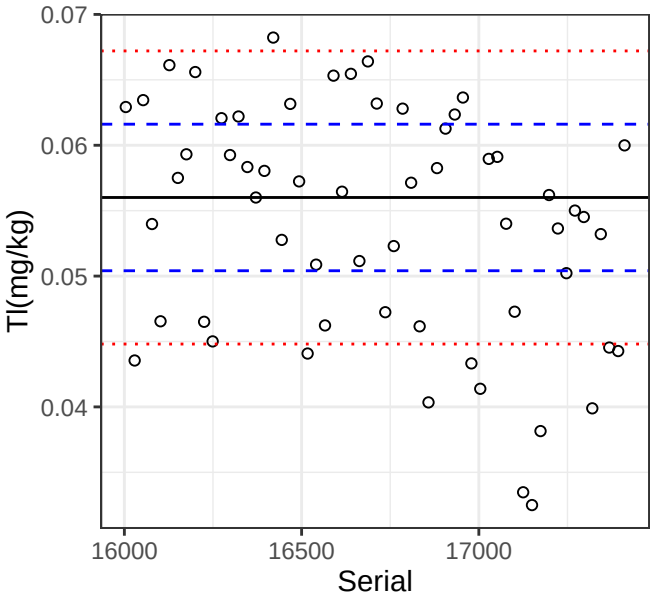

K(mg/kg)
600
500
16000
16500
17000
Serial

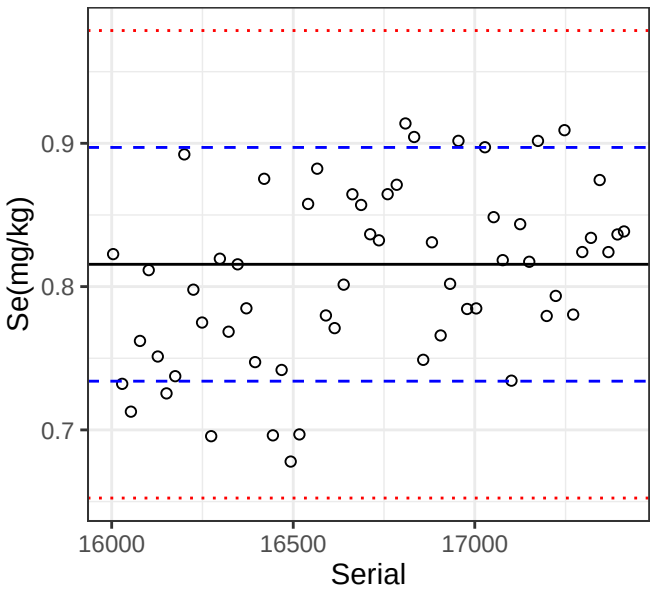

Al(mg/kg)
1800
1600
1400
1200
16000
16500
17000
Serial

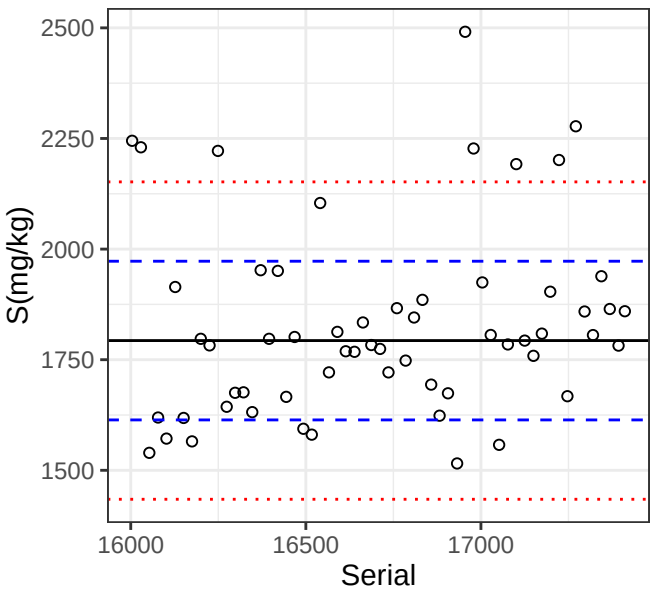

W(mg/kg)
0.08
0.07
0.06
0.05
16000
16500
17000
Serial

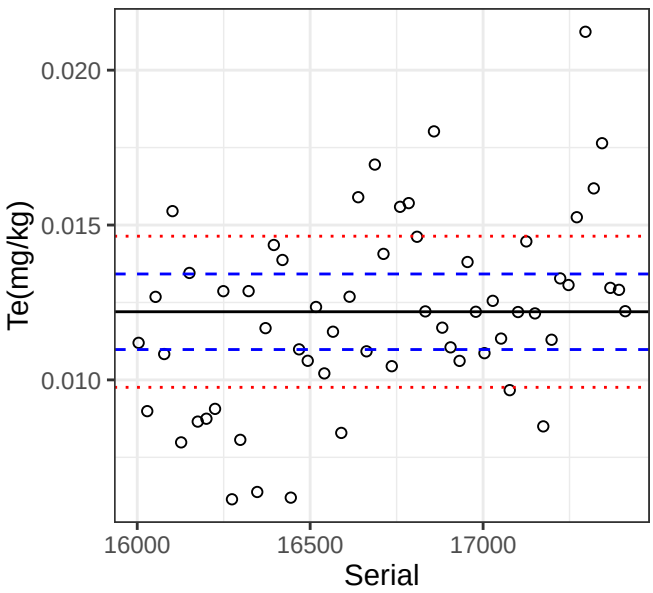

Sc(mg/kg)
0.60
0.55
0.50
0.45
16000
16500
17000
Serial

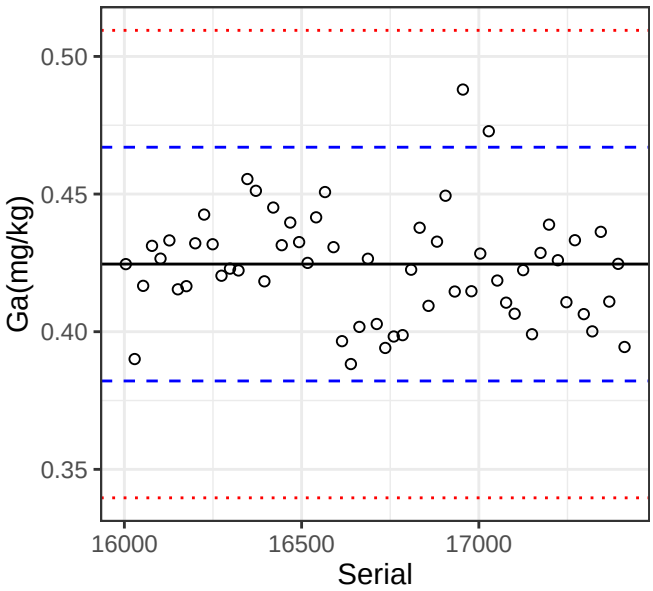

Hg(mg/kg)
0.27
0.24
0.21
0.18
16000
16500
17000
Serial

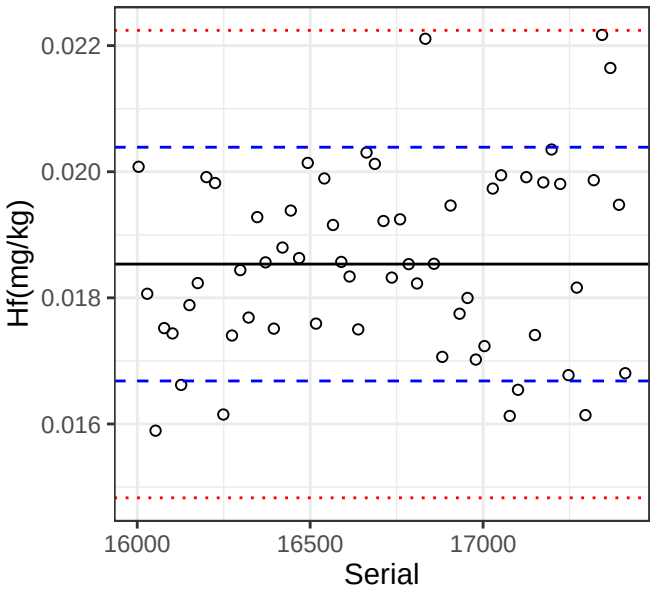

Tl(mg/kg)
0.07
0.06
0.05
0.04
16000
16500
17000
Serial

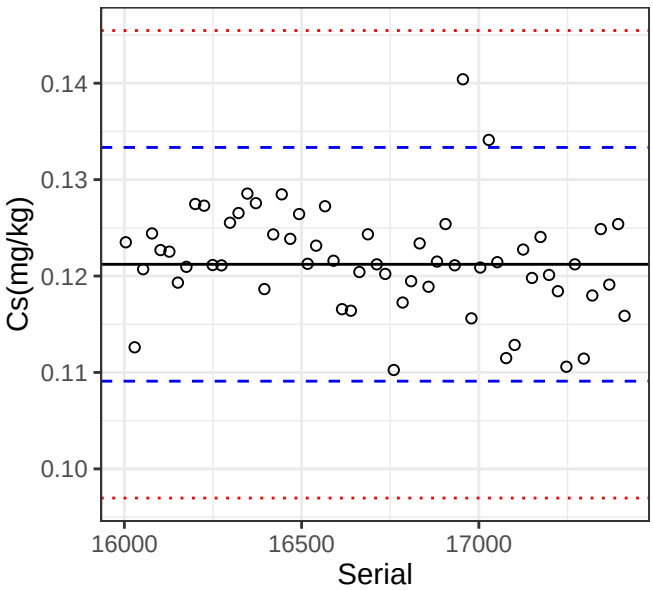

Se(mg/kg)
0.9
0.8
0.7
16000
16500
17000
Serial

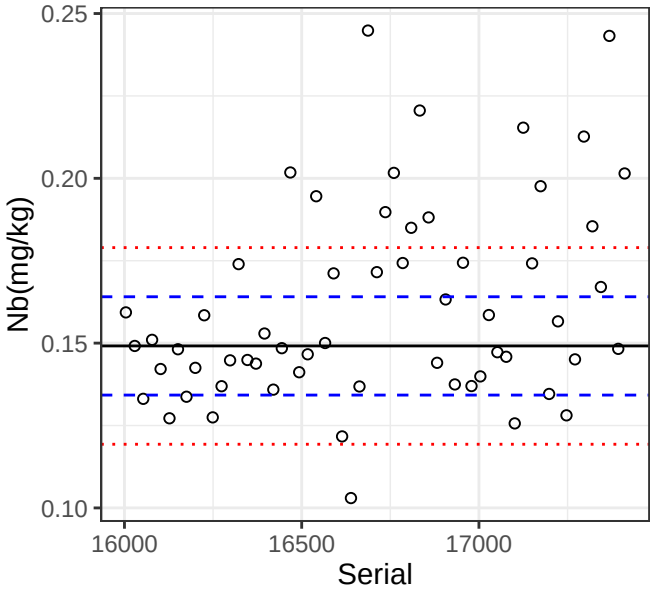

S(mg/kg)
2500
2250
2000
1750
1500
16000
16500
17000
Serial

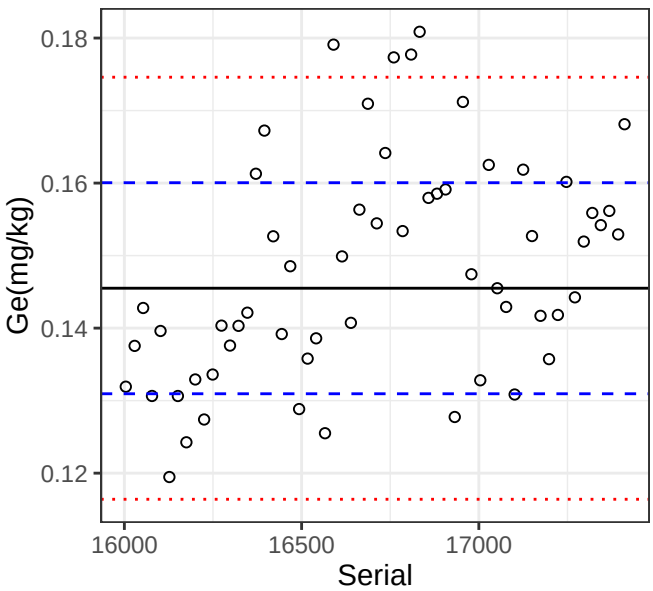

Te(mg/kg)
0.020
0.015
0.010
16000
16500
17000
Serial

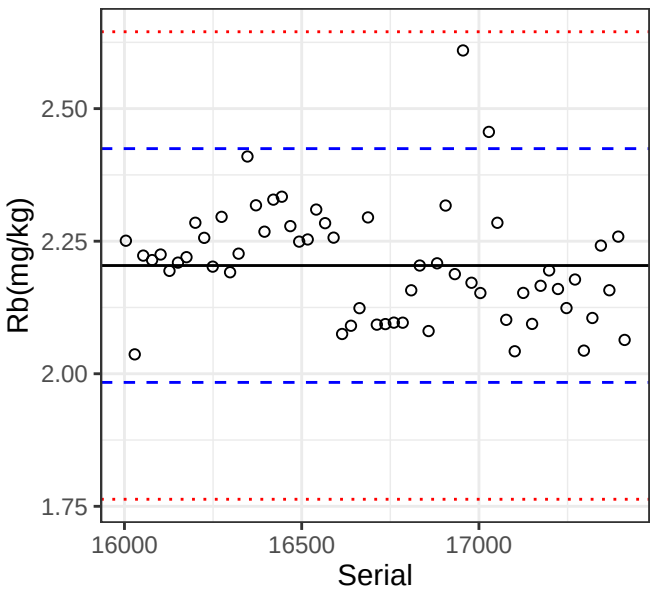

Ga(mg/kg)
0.50
0.45
0.40
0.35
16000
16500
17000
Serial

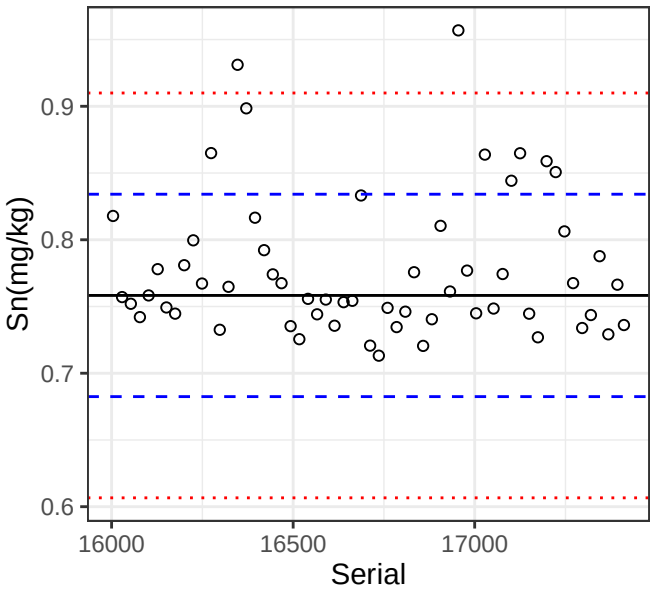

Hf(mg/kg)
0.022
0.020
0.018
0.016
16000
16500
17000
Serial

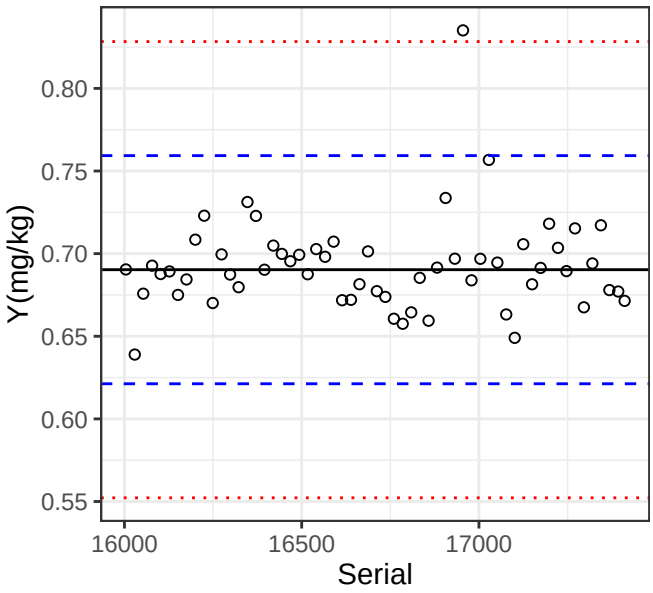

Cs(mg/kg)
0.14
0.13
0.12
0.11
0.10
16000
16500
17000
Serial

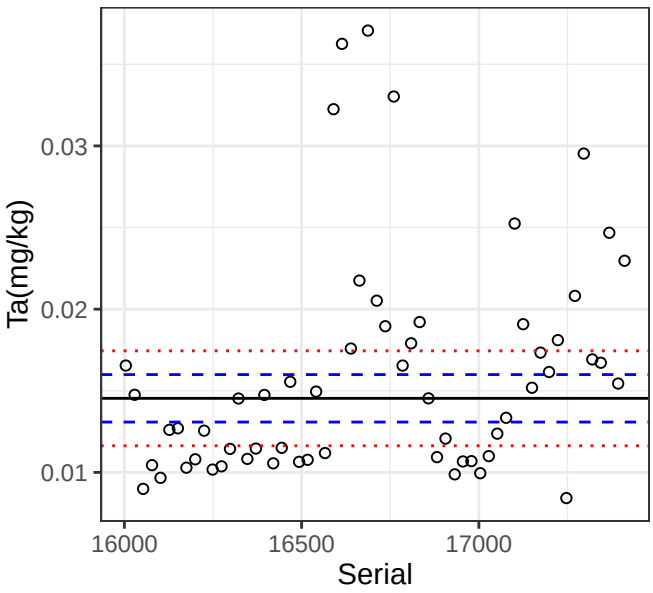

Nb(mg/kg)
0.25
0.20
0.15
0.10
16000
16500
17000
Serial

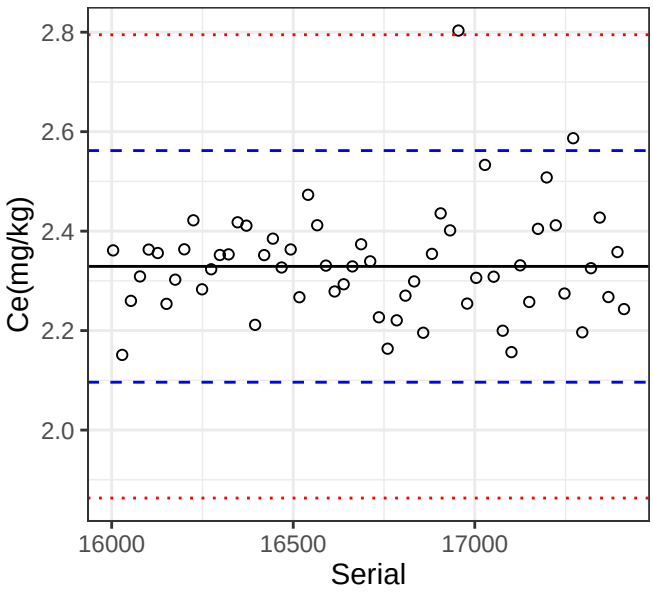

Ge(mg/kg)
0.18
0.16
0.14
0.12
16000
16500
17000
Serial

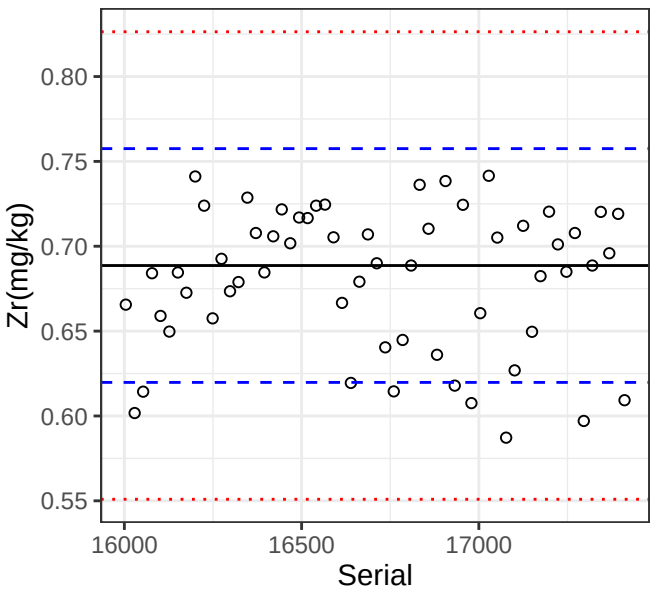

Rb(mg/kg)
2.50
2.25
2.00
1.75
16000
16500
17000
Serial

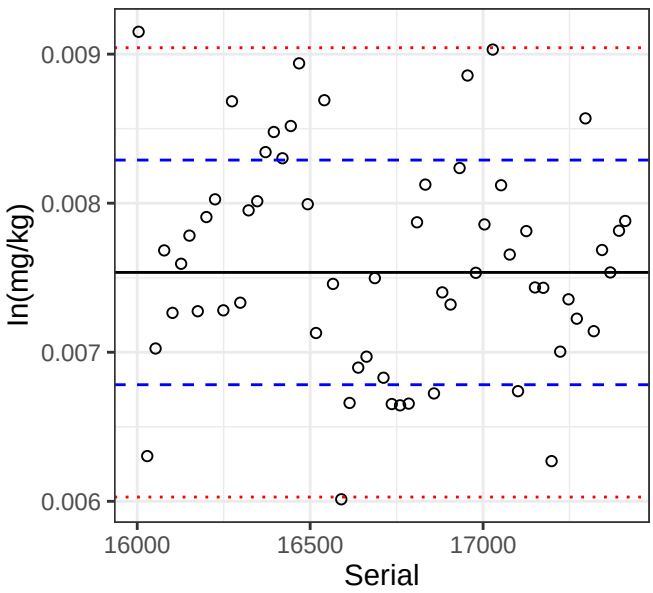

Sn(mg/kg)
0.9
0.8
0.7
0.6
16000
16500
17000
Serial

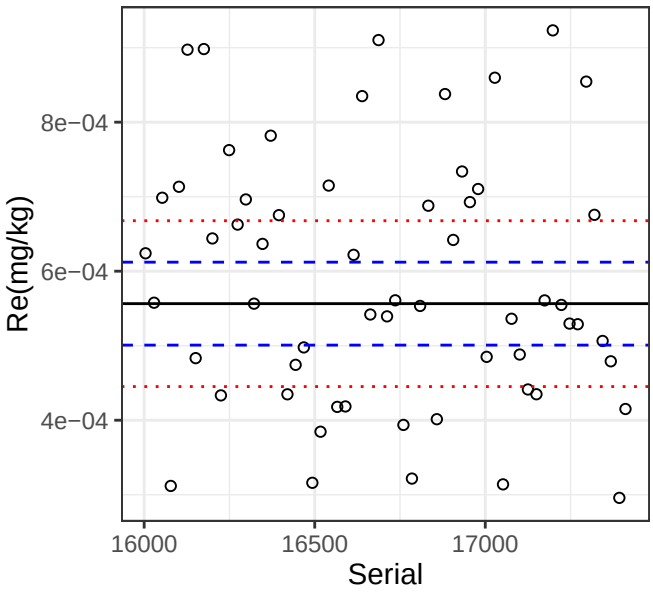

Y(mg/kg)
0.80
0.75
0.70
0.65
0.60
0.55
16000
16500
17000
Serial

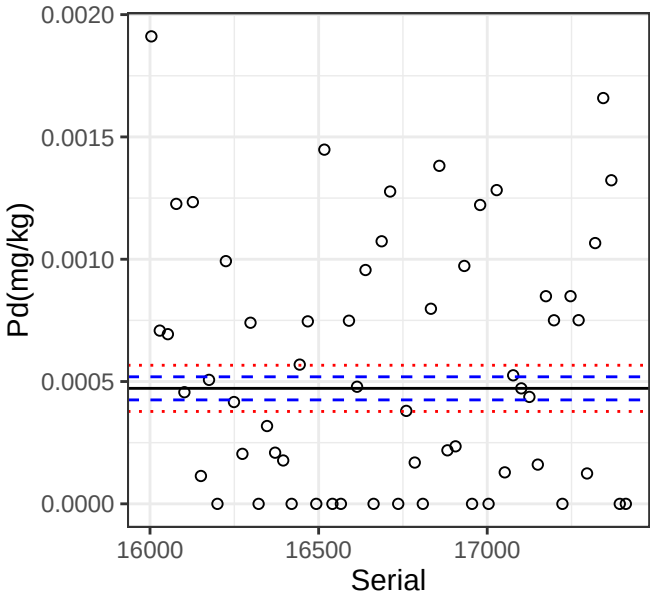

Ta(mg/kg)
0.03
0.02
0.01
16000
16500
17000
Serial

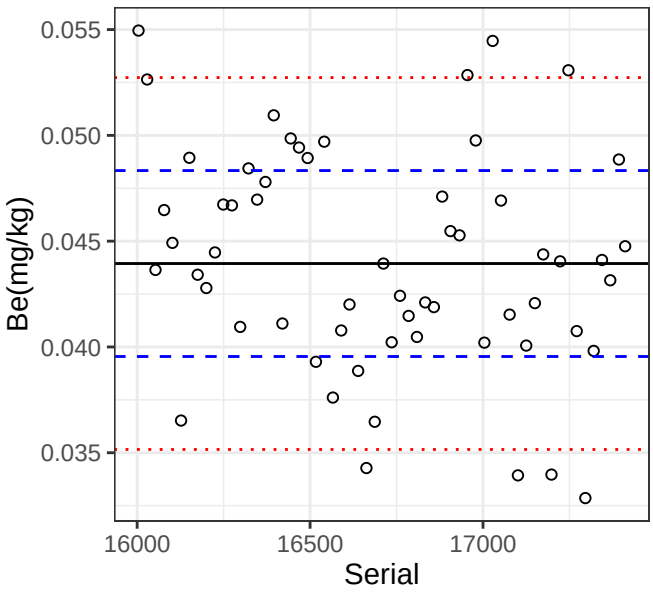

Ce(mg/kg)
2.8
2.6
2.4
2.2
2.0
16000
16500
17000
Serial

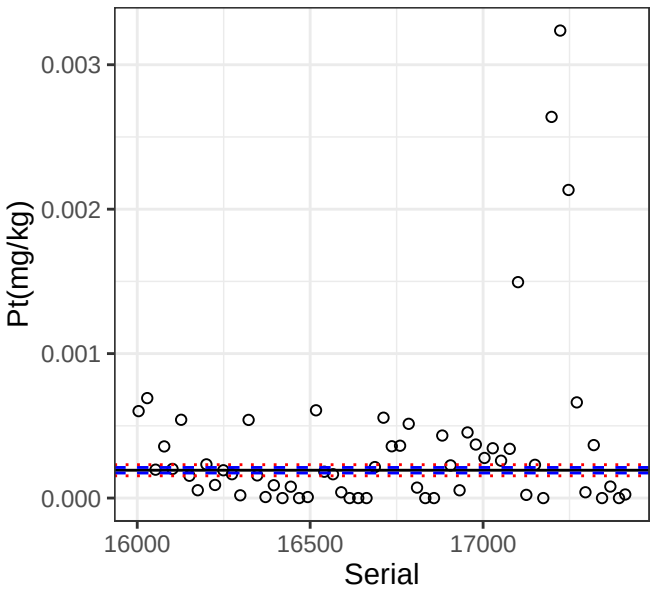

Zr(mg/kg)
0.80
0.75
0.70
0.65
0.60
0.55
16000
16500
17000
Serial

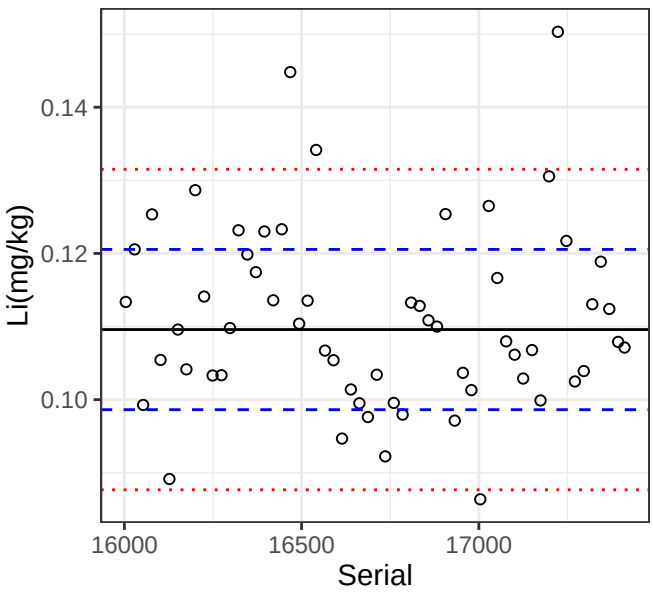

In(mg/kg)
0.009
0.008
0.007
0.006
16000
16500
17000
Serial


Re(mg/kg)
8e−04
6e−04
4e−04
16000
16500
17000
Serial


Pd(mg/kg)
0.0020
0.0015
0.0010
0.0005
0.0000
16000
16500
17000
Serial


Be(mg/kg)
0.055
0.050
0.045
0.040
0.035
16000
16500
17000
Serial

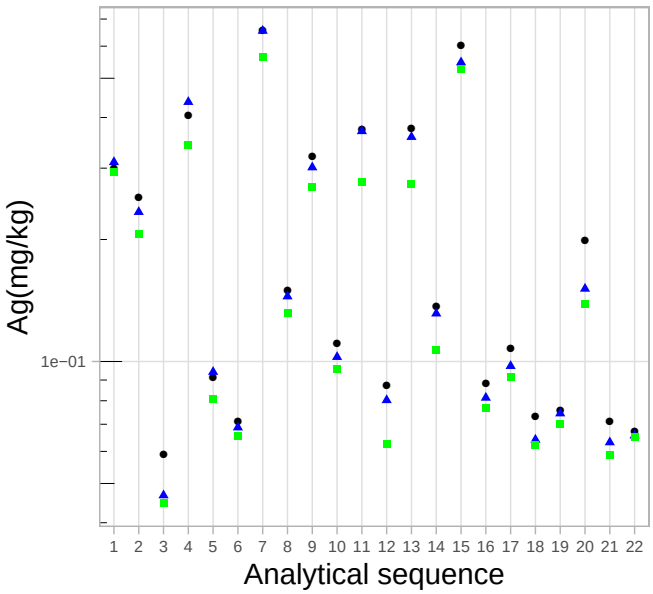

Pt(mg/kg)
0.003
0.002
0.001
0.000
16000
16500
17000
Serial

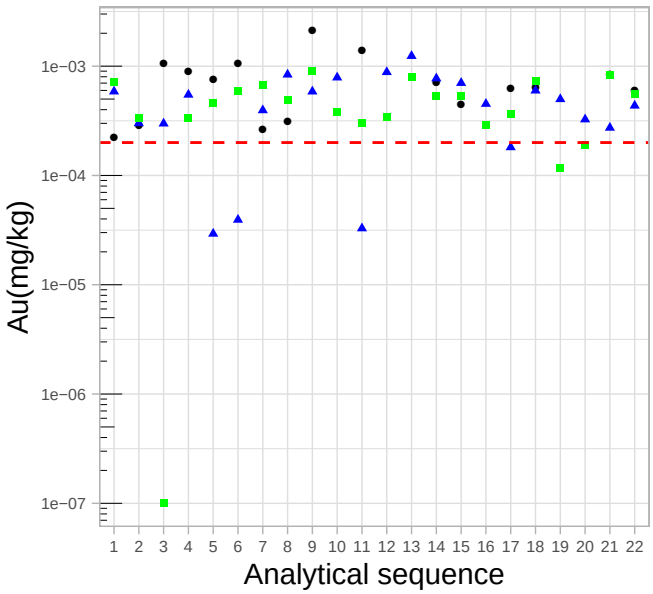

Li(mg/kg)
0.14
0.12
0.10
16000
16500
17000
Serial

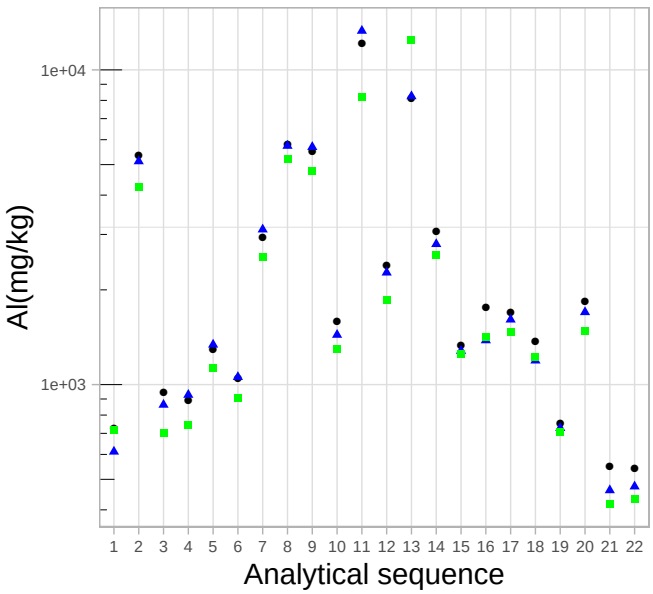
Appendix 3: Re-analysed samples from previous surveys

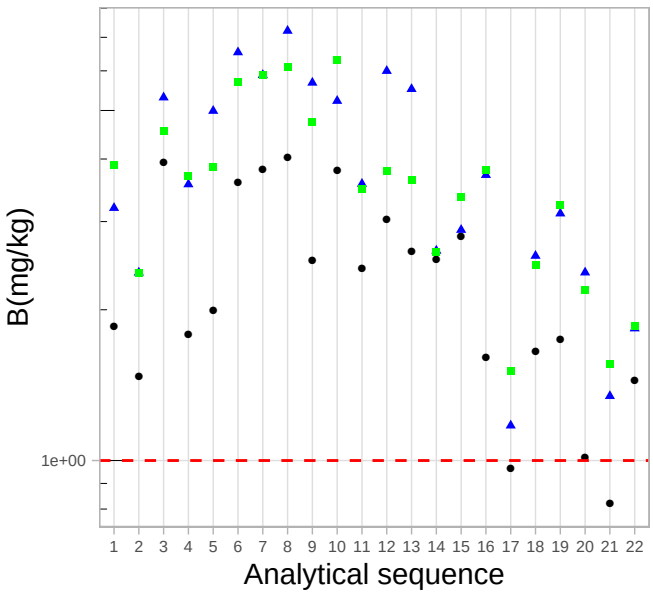
Appendix 3: Samples re-analysed from previous surveys analytical results (n= 22 samples ; no: 1134, 1265, 1372, 1474, 1502, 1505, 1509, 1511, 1517, 1519, 1523, 1531, 1540, 1559, 1580, 1593, 1657, 1662, 1686, 1728 and 1762) from the Nord Trøndelag and Fosen survey (Finne and Eggen, 2014) which were reanalysed along with the Sør Trøndelag samples in 2020 (Flem et al., 2020), and now for the third time with the present survey. The same laboratory, Bureau Veritas Minerals, Vancouver, Canada, has been used for all three sample collections. For elements with data close to detection limit (DL), this value (DL) was included in the plot as a horizontal line.

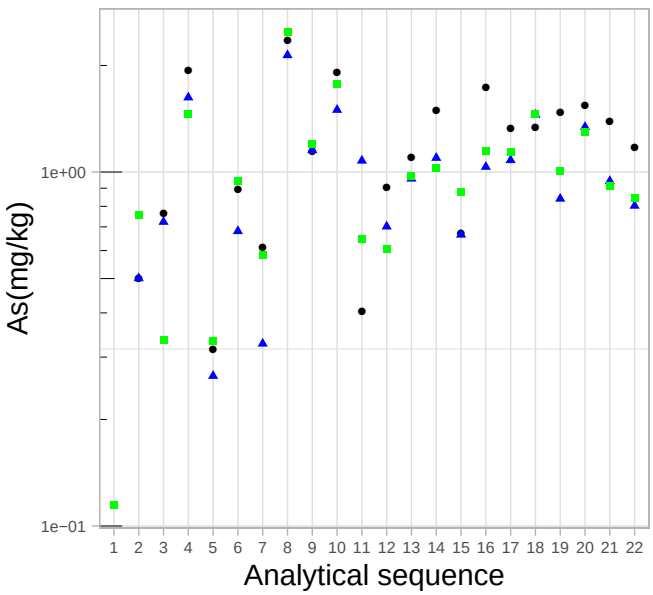
Year	Survey
● 2014	Nord Trøndelag/Føsen
▲ 2020	Sør-Trøndelag
■ 2023	Hedmark/More og Romsdal
------	Detection Limit

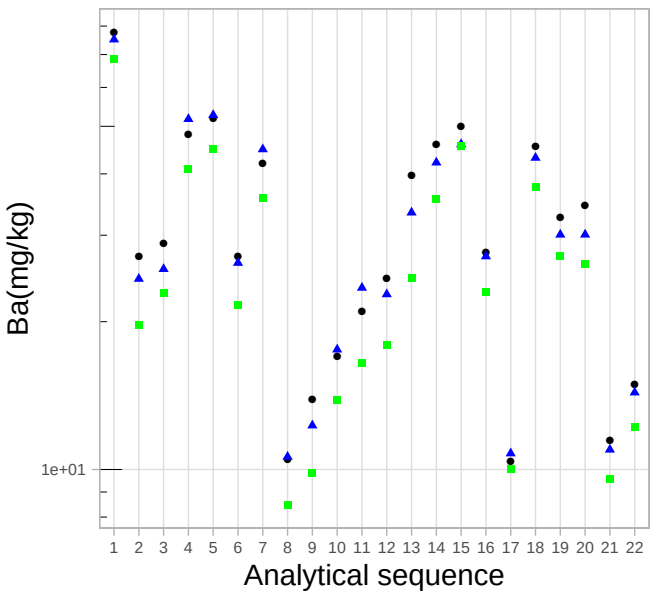

Ag(mg/kg)
1e−01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

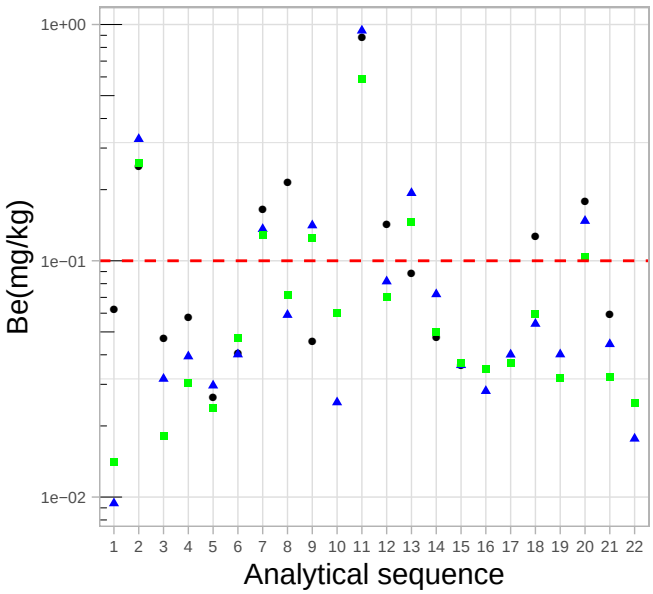

Au(mg/kg)
1e−03
1e−04
1e−05
1e−06
1e−07
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

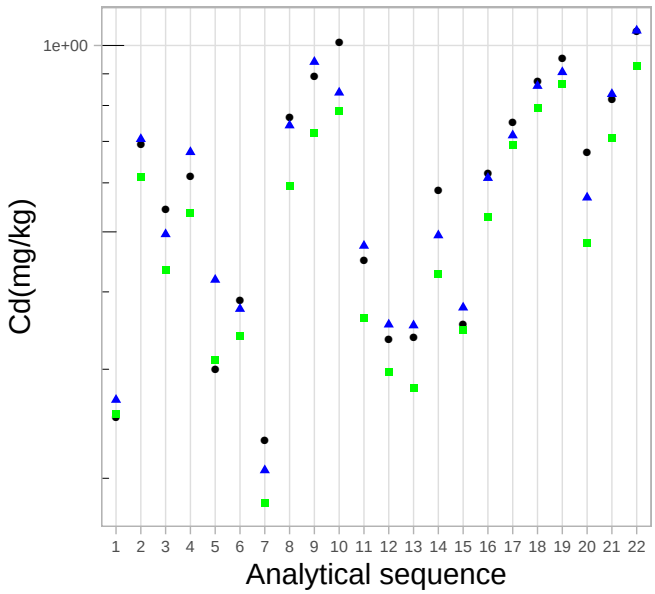

Al(mg/kg)
1e+04
1e+03
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


B(mg/kg)
1e+00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


As(mg/kg)
1e+00
1e−01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Ba(mg/kg)
1e+01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Be(mg/kg)
1e+00
1e−01
1e−02
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Cd(mg/kg)
1e+00
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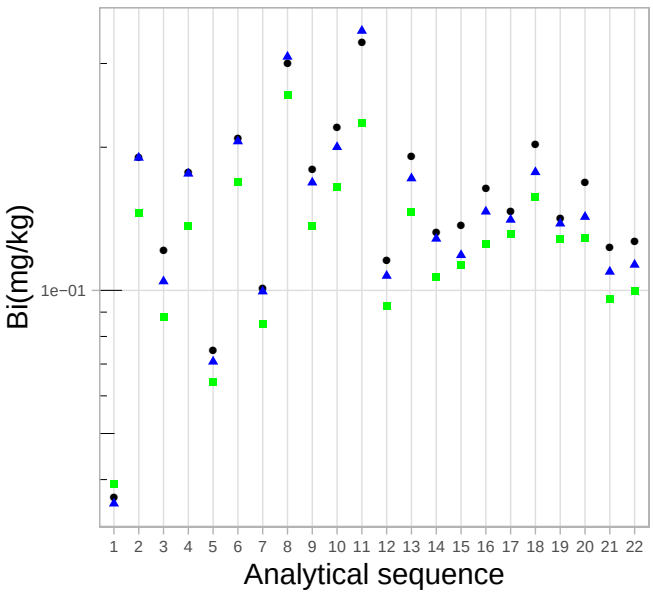
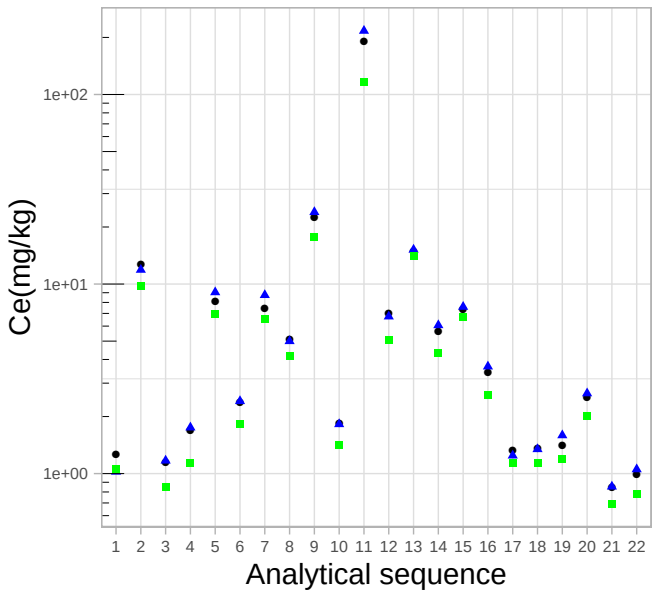
Analytical sequence


Bi(mg/kg)
1e−01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Ce(mg/kg)
1e+02
1e+01
1e+00
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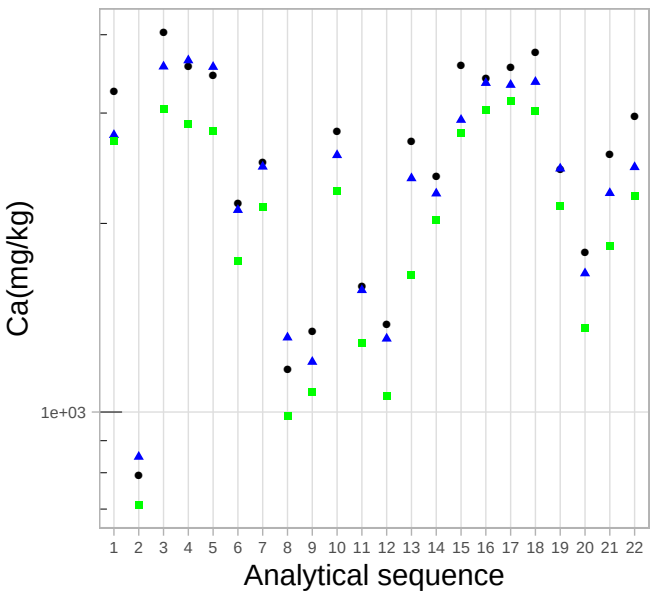
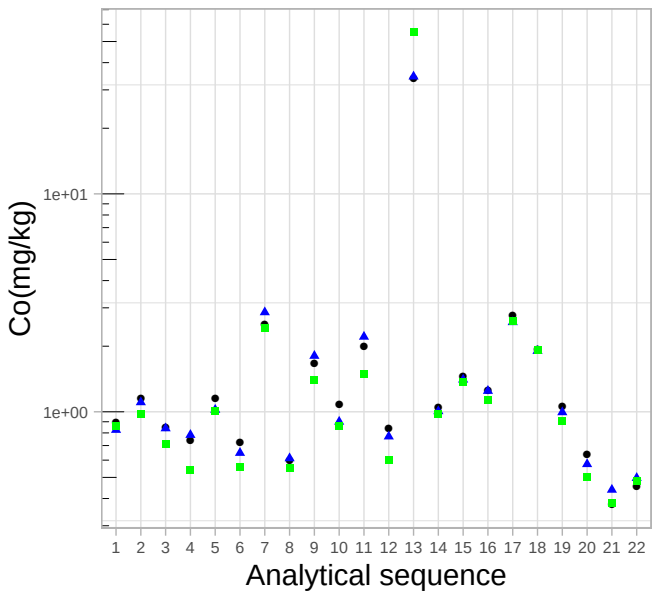
Analytical sequence


Ca(mg/kg)
1e+03
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Co(mg/kg)
1e+01
1e+00
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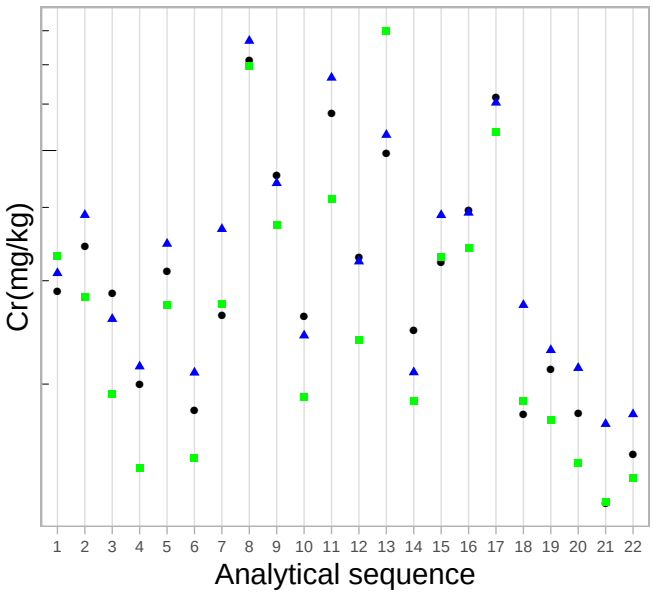
Analytical sequence


Cr(mg/kg)
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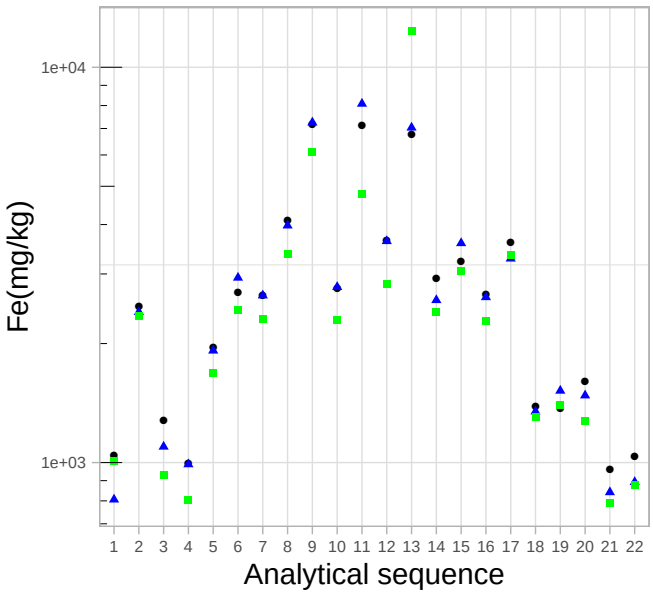
Analytical sequence


Fe(mg/kg)
1e+04
1e+03
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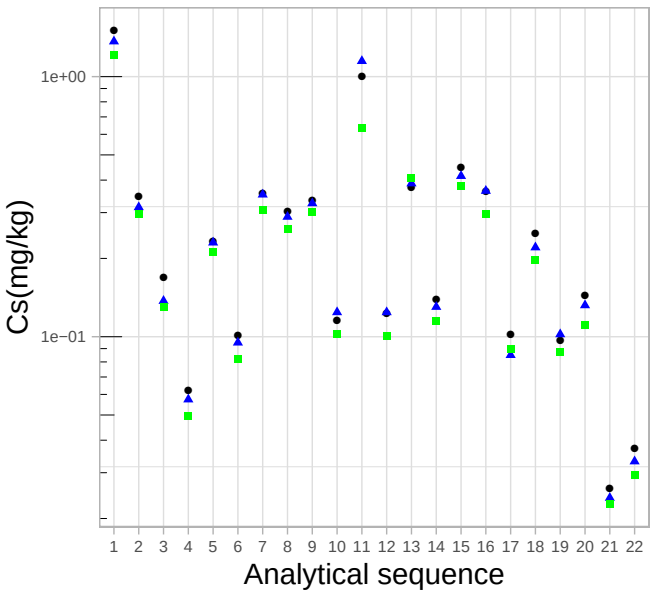
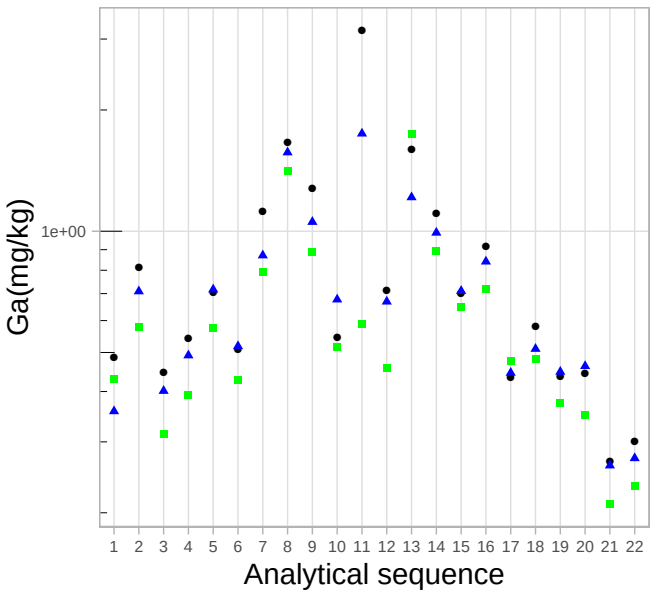
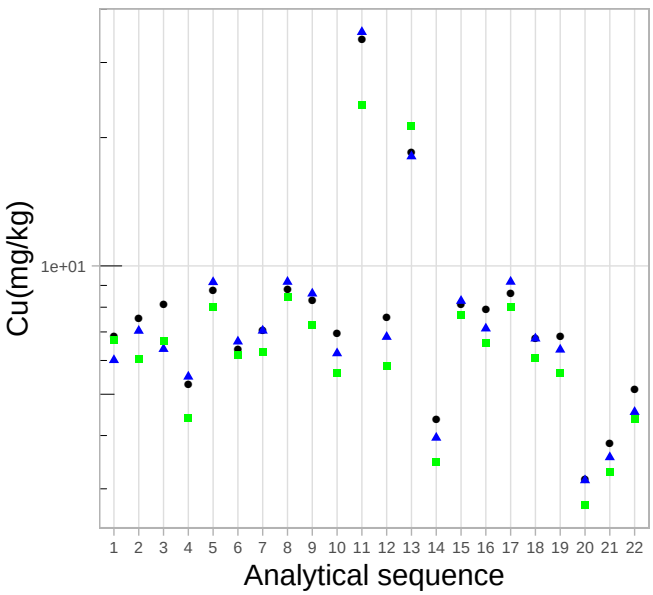
Analytical sequence


Cs(mg/kg)
1e+00
1e−01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Ga(mg/kg)
1e+00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Cu(mg/kg)
1e+01
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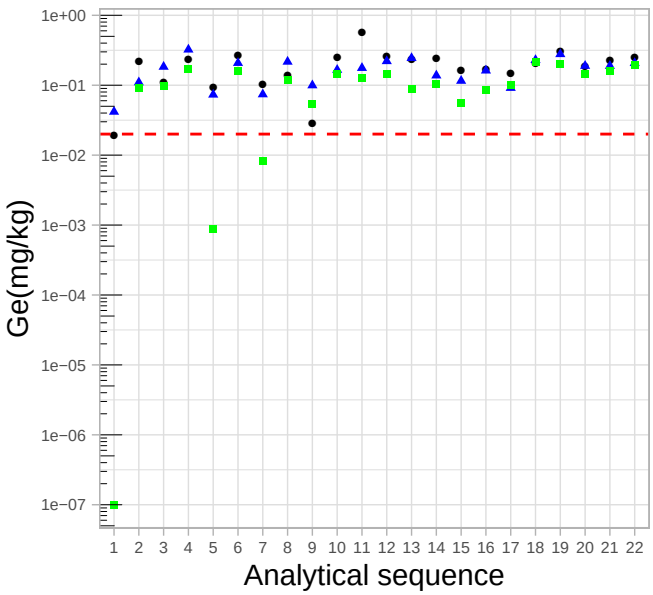
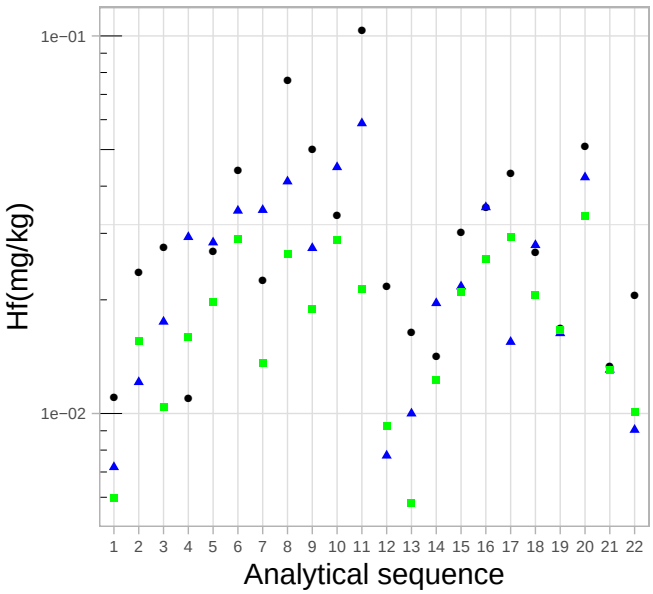
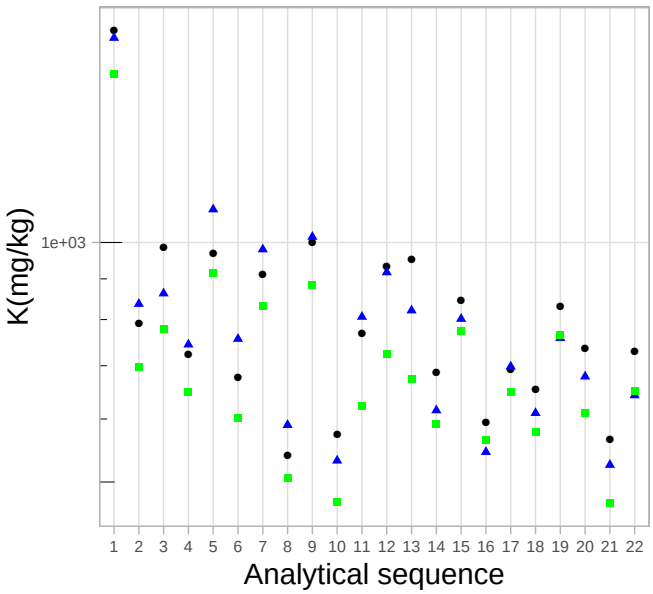
Analytical sequence


Ge(mg/kg)
1e+00
1e−01
1e−02
1e−03
1e−04
1e−05
1e−06
1e−07
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Hf(mg/kg)
1e−01
1e−02
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


K(mg/kg)
1e+03
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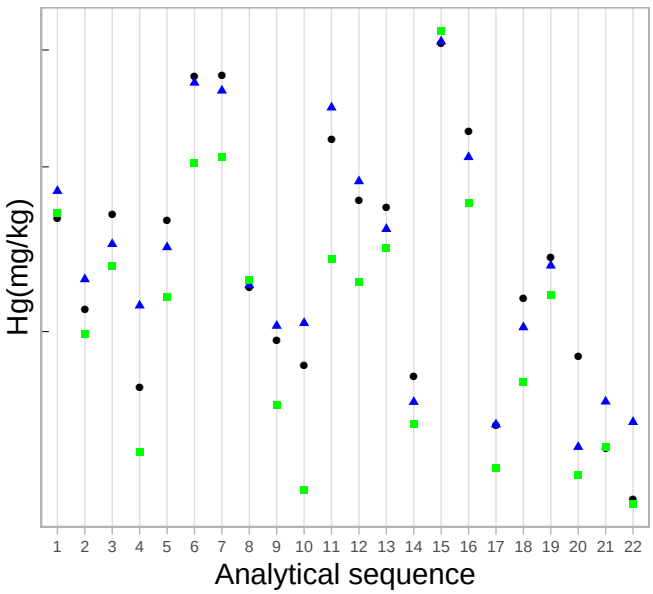
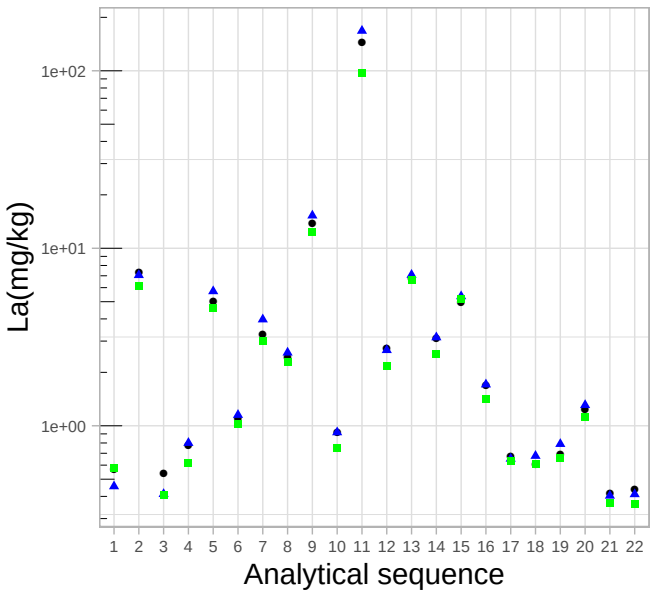
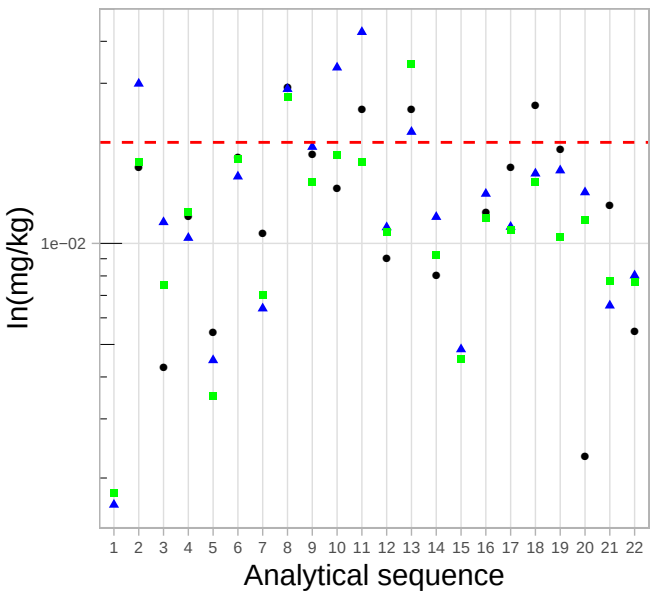
Analytical sequence


Hg(mg/kg)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


La(mg/kg)
1e+02
1e+01
1e+00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


In(mg/kg)
1e−02
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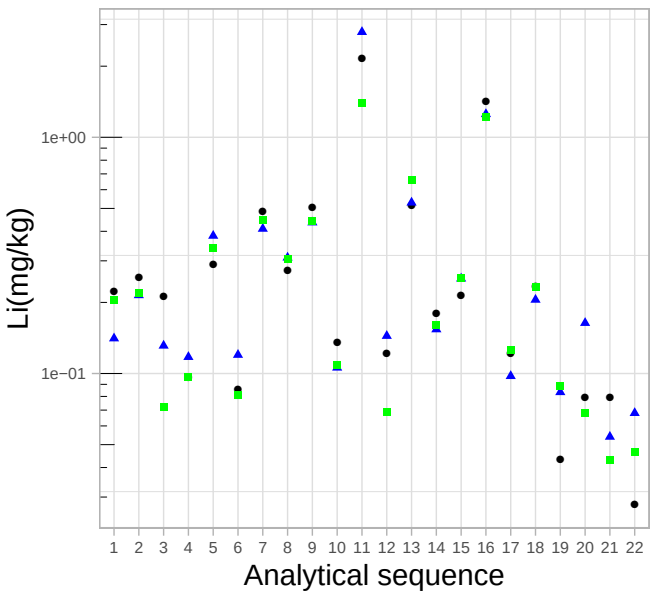
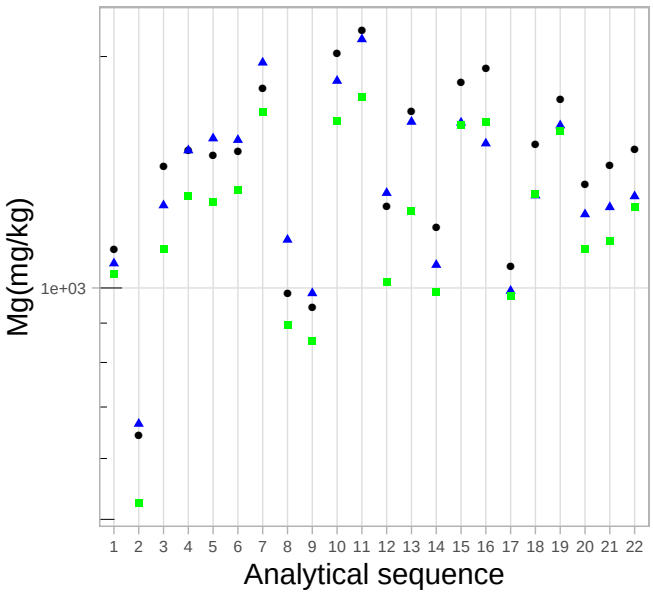
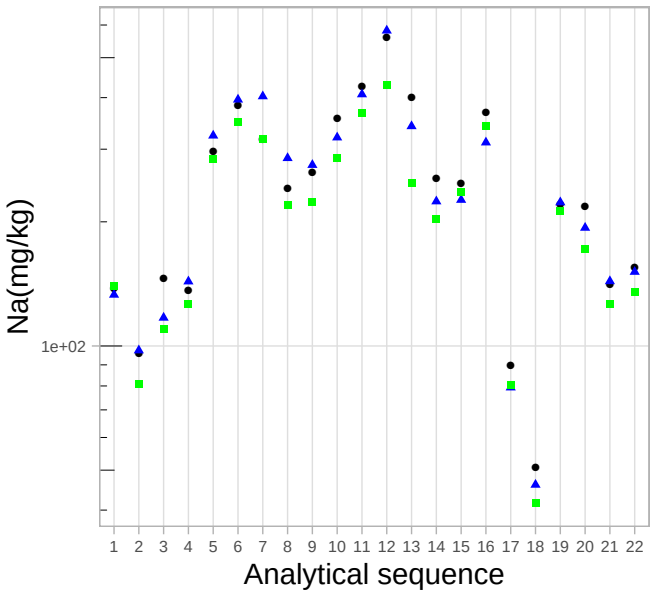
Analytical sequence


Li(mg/kg)
1e+00
1e−01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Mg(mg/kg)
1e+03
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Na(mg/kg)
1e+02
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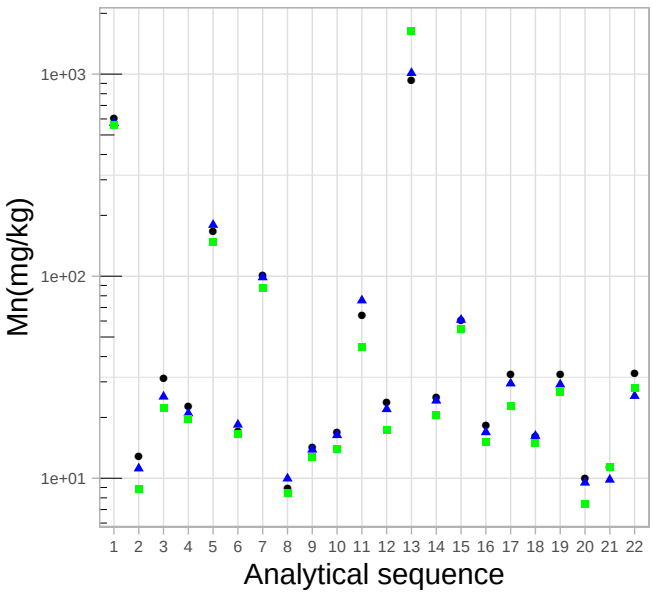
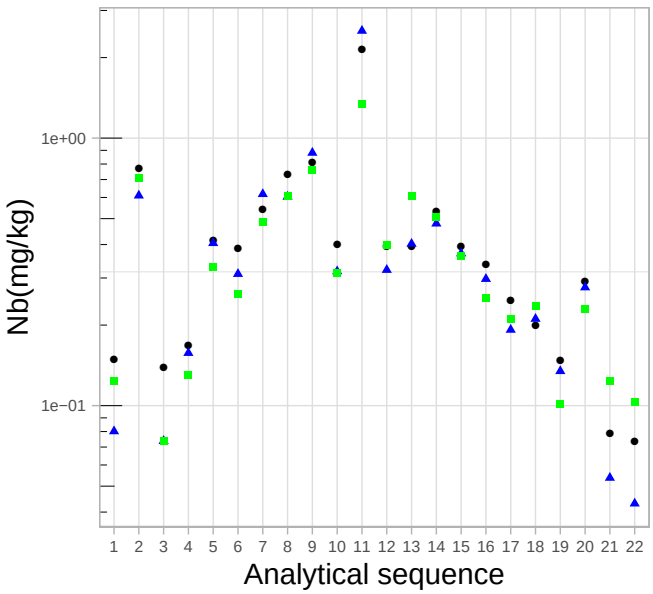
Analytical sequence


Mn(mg/kg)
1e+03
1e+02
1e+01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Nb(mg/kg)
1e+00
1e−01
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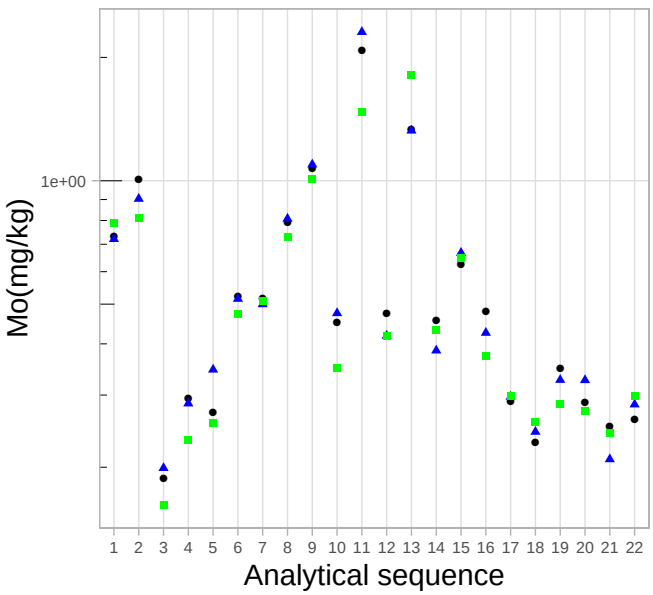
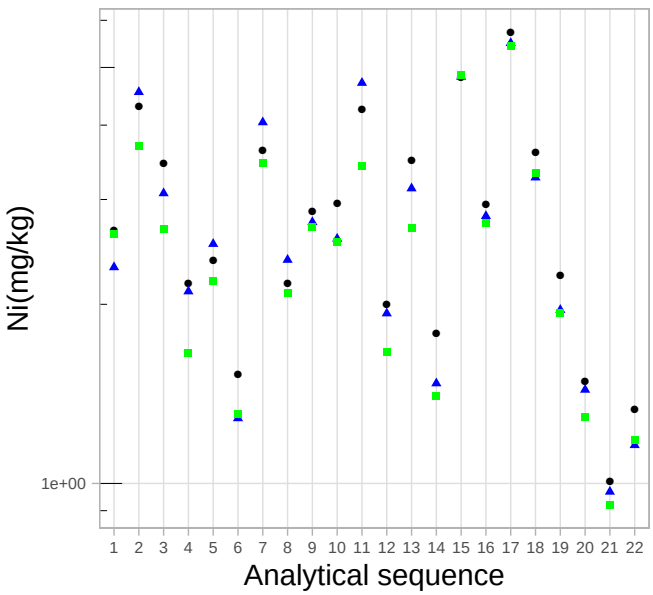
Analytical sequence


Mo(mg/kg)
1e+00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Ni(mg/kg)
1e+00
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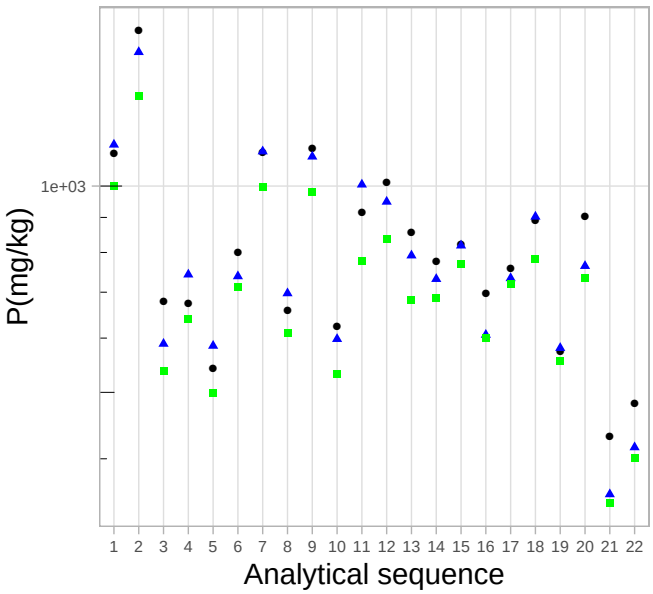
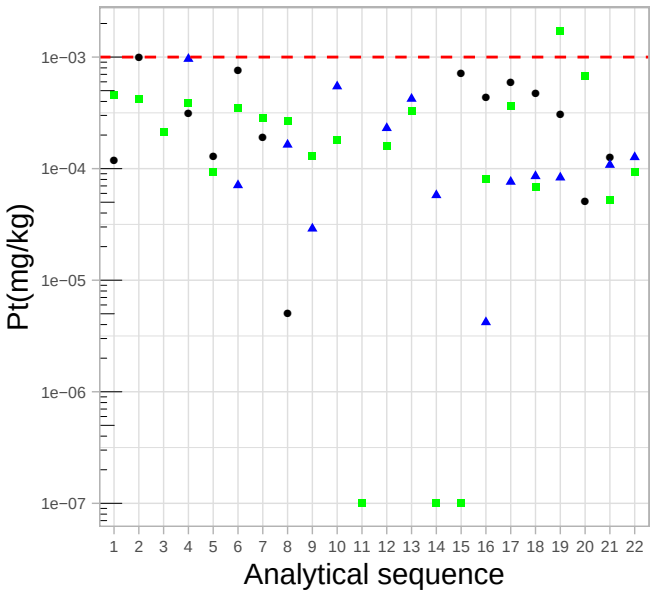
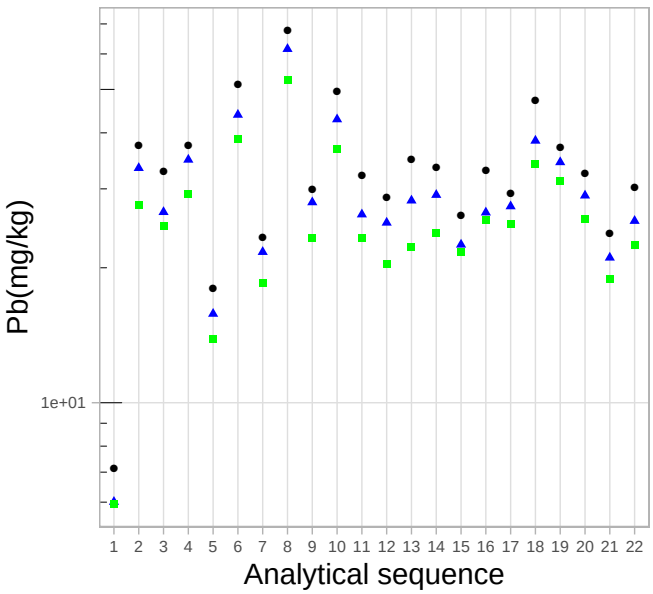
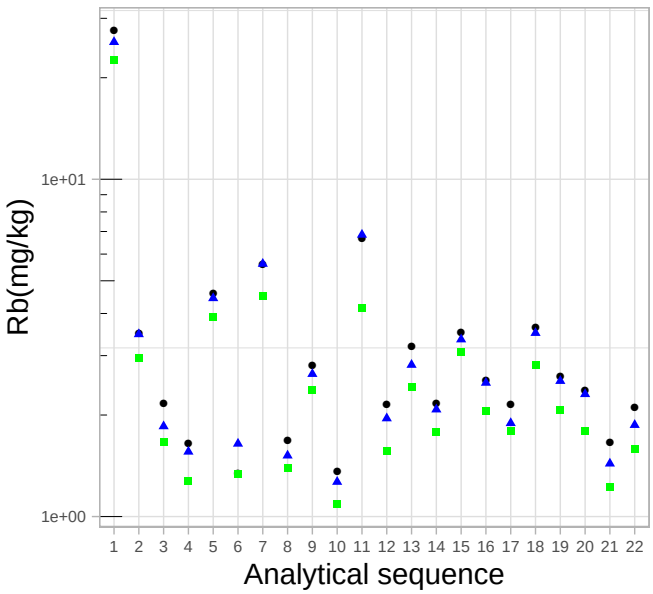
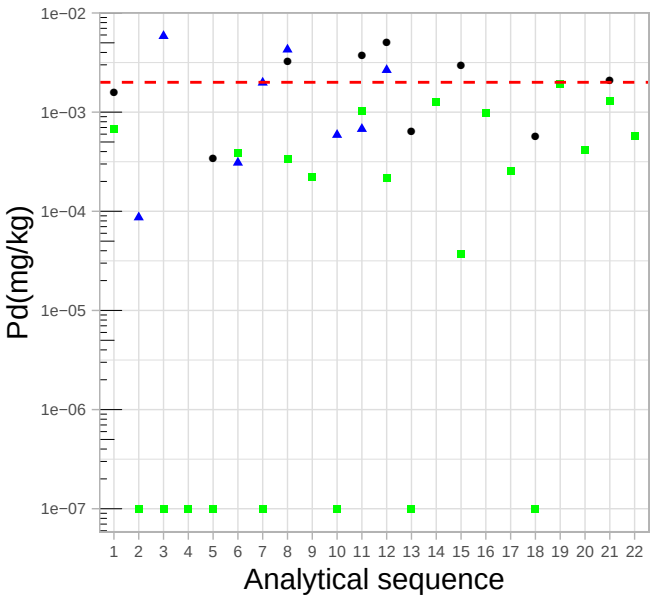
Analytical sequence

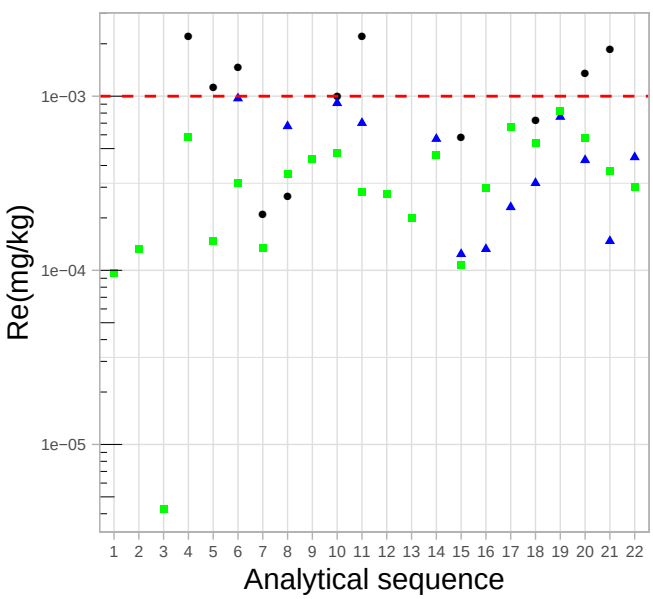

P(mg/kg)
1e+03
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

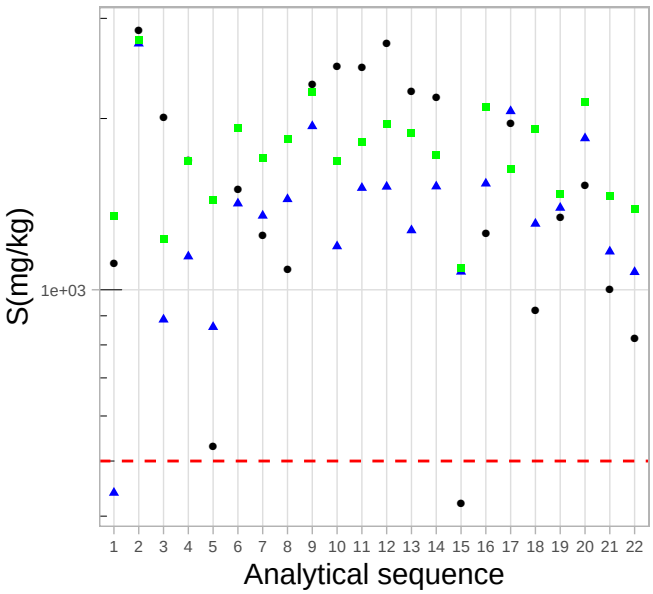

Pt(mg/kg)
1e−03
1e−04
1e−05
1e−06
1e−07
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

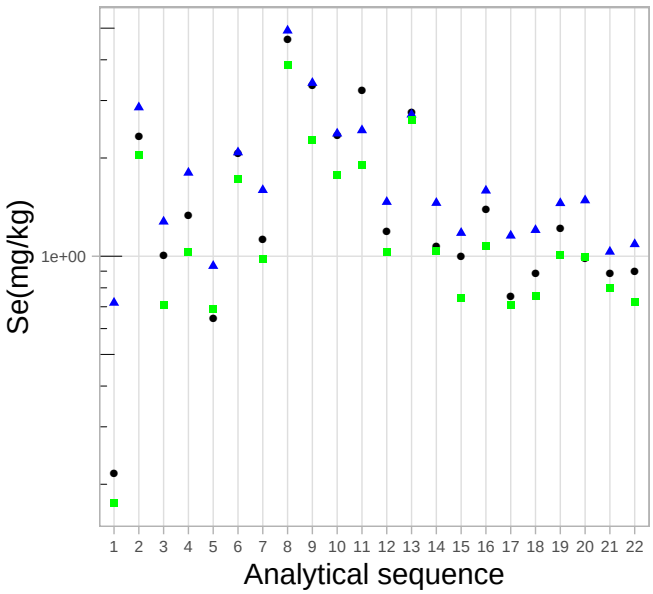

Pb(mg/kg)
1e+01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

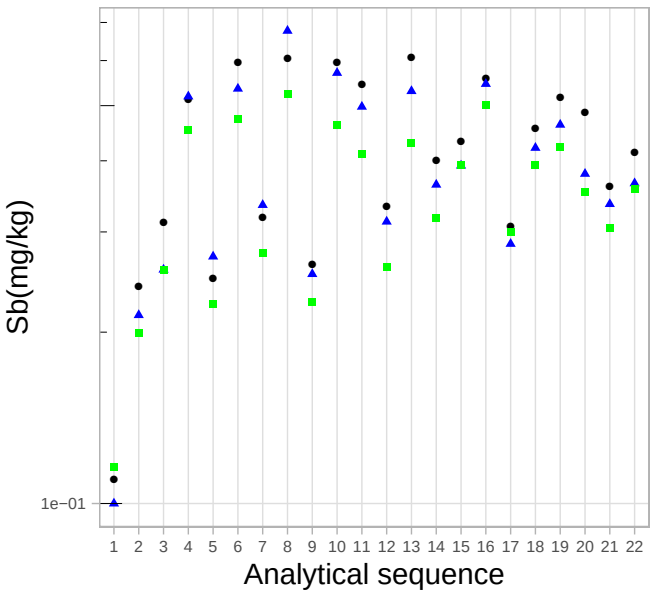

Rb(mg/kg)
1e+01
1e+00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

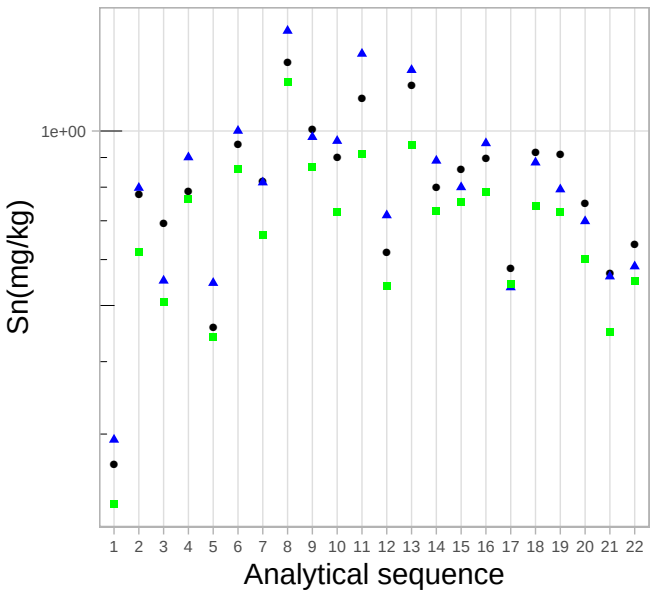

Pd(mg/kg)
1e−02
1e−03
1e−04
1e−05
1e−06
1e−07
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

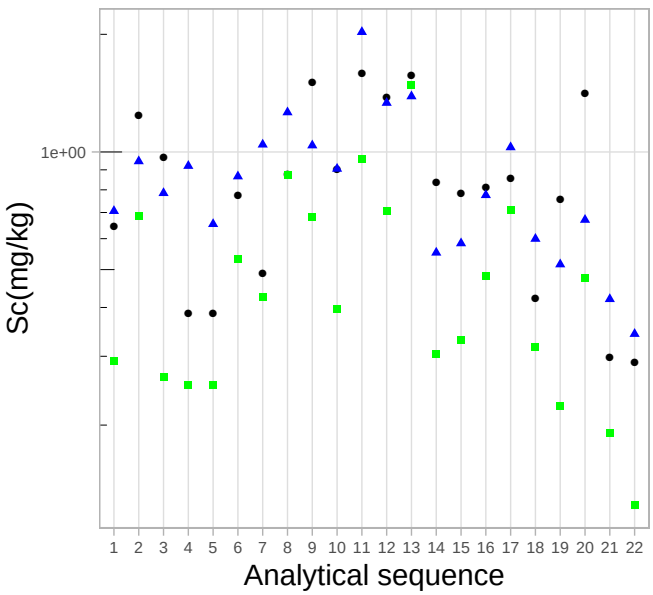

Re(mg/kg)
1e−03
1e−04
1e−05
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

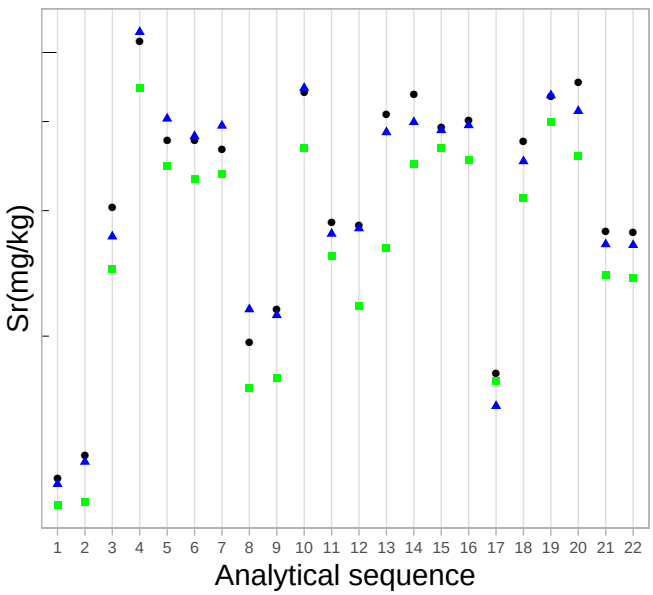

S(mg/kg)
1e+03
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

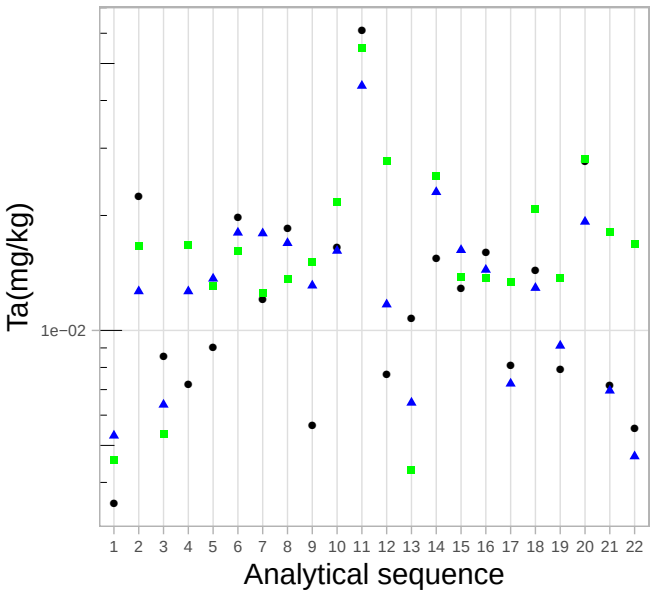

Se(mg/kg)
1e+00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

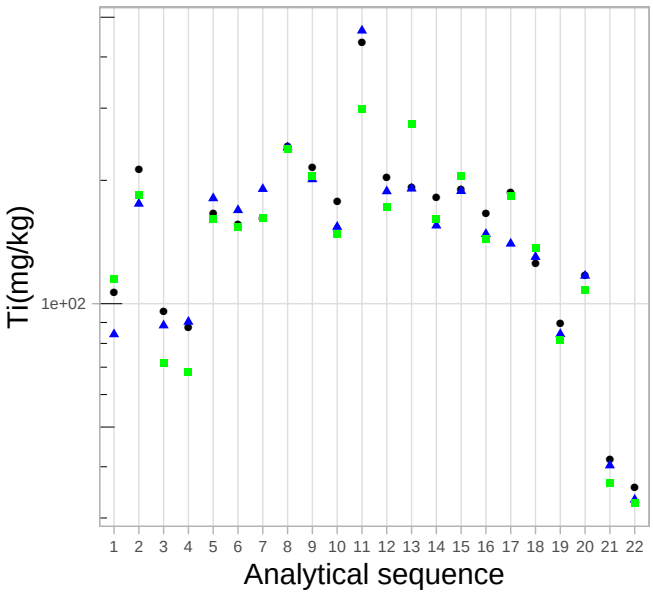

Sb(mg/kg)
1e−01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

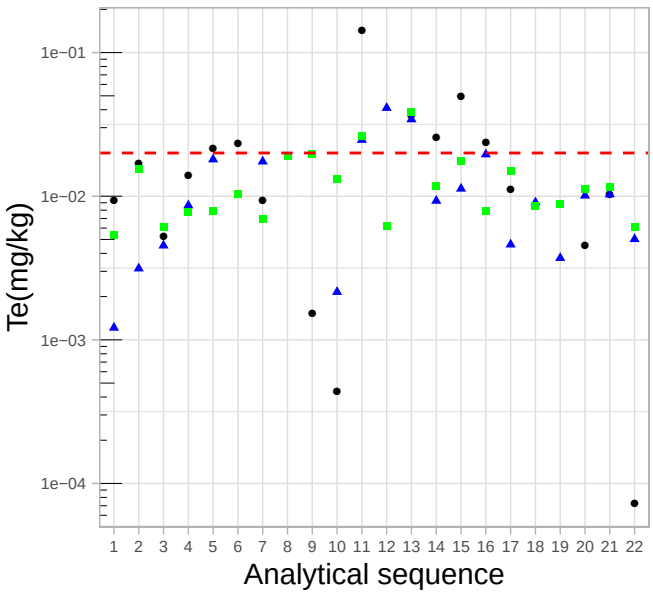

Sn(mg/kg)
1e+00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

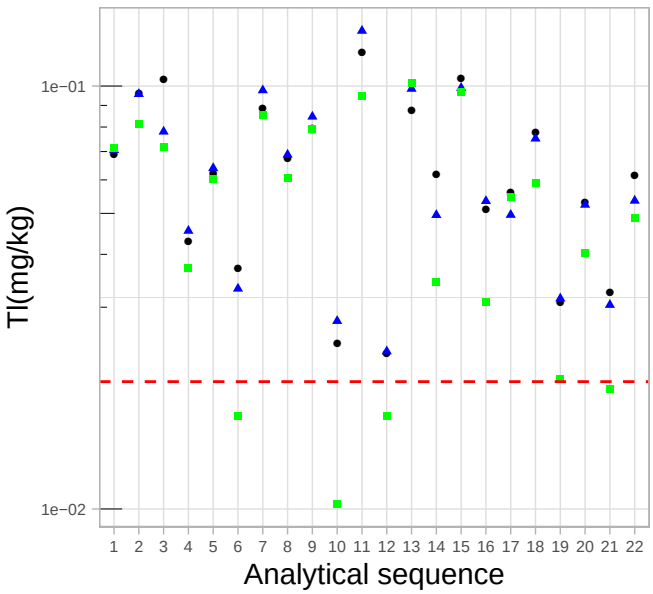

Sc(mg/kg)
1e+00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

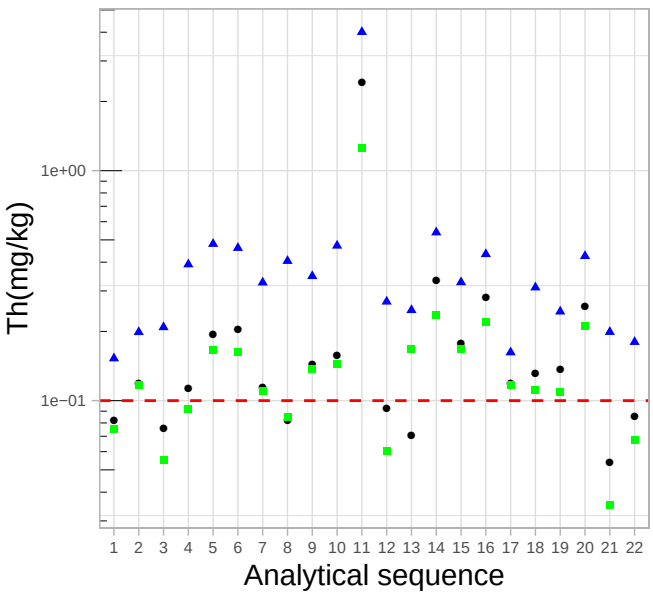

Sr(mg/kg)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

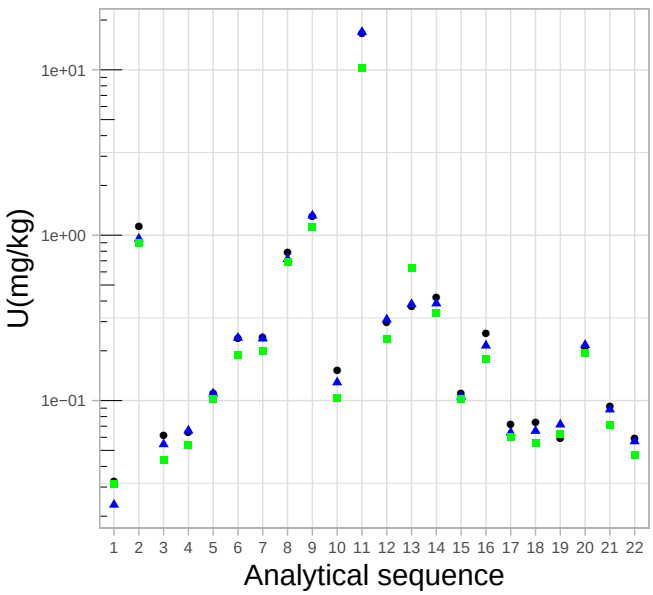

Ta(mg/kg)
1e−02
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

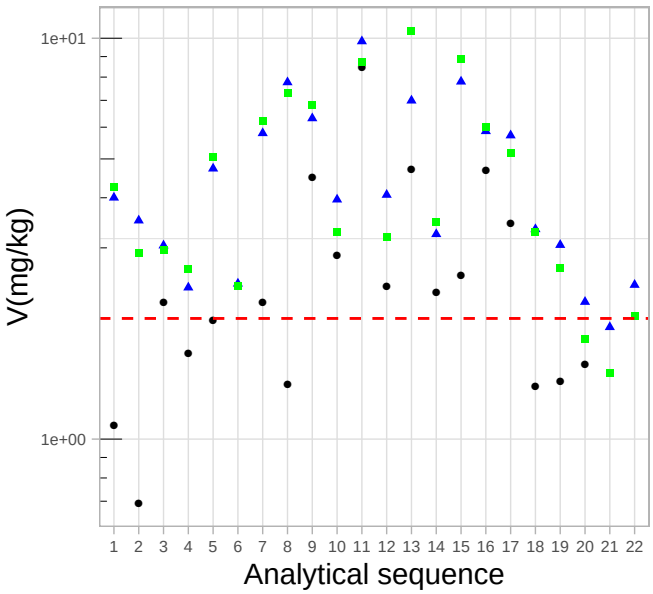

Ti(mg/kg)
1e+02
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

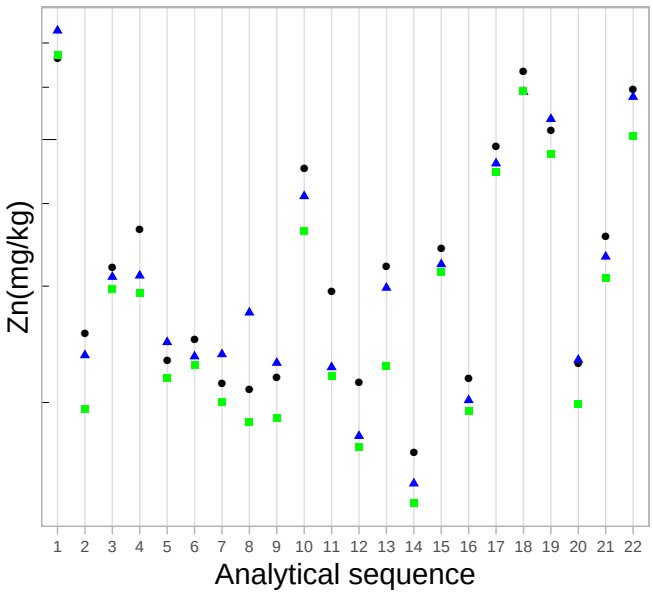

Te(mg/kg)
1e−01
1e−02
1e−03
1e−04
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

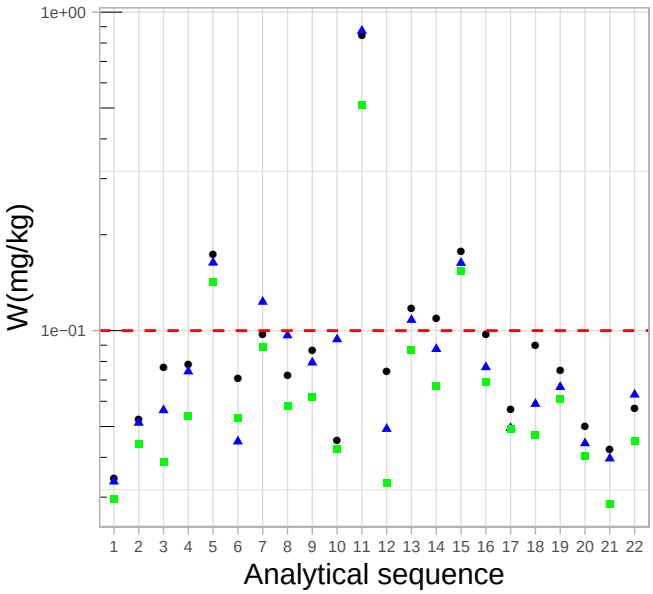

Tl(mg/kg)
1e−01
1e−02
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

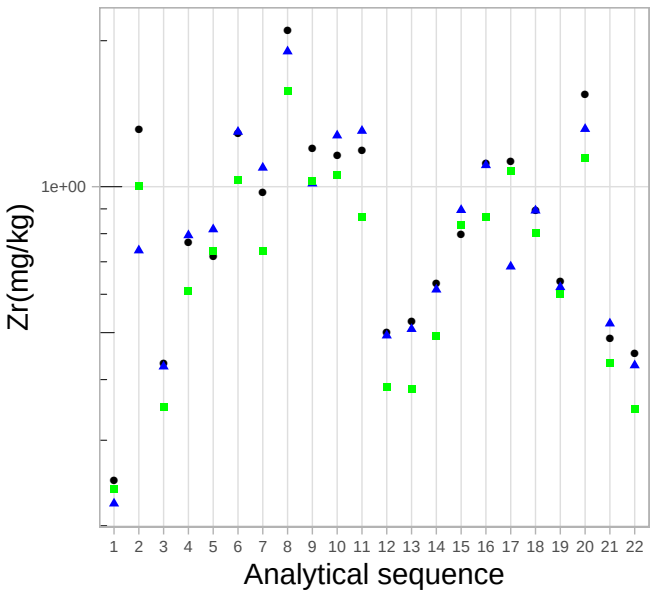

Th(mg/kg)
1e+00
1e−01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

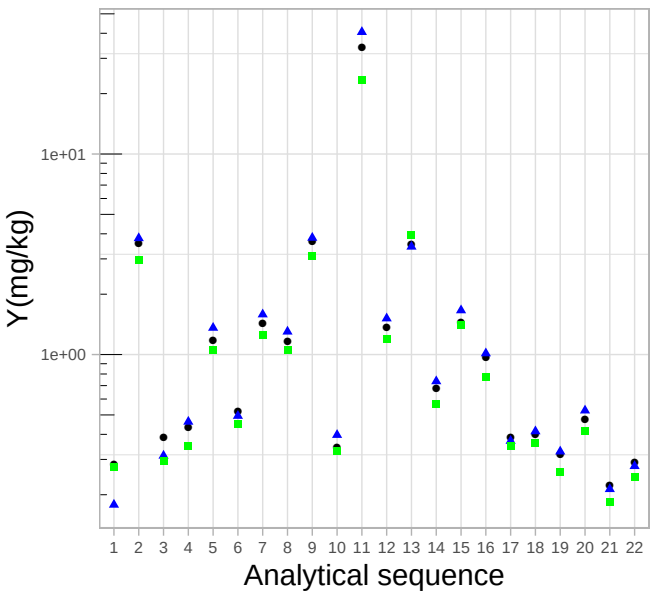

U(mg/kg)
1e+01
1e+00
1e−01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


V(mg/kg)
1e+01
1e+00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence


Zn(mg/kg)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

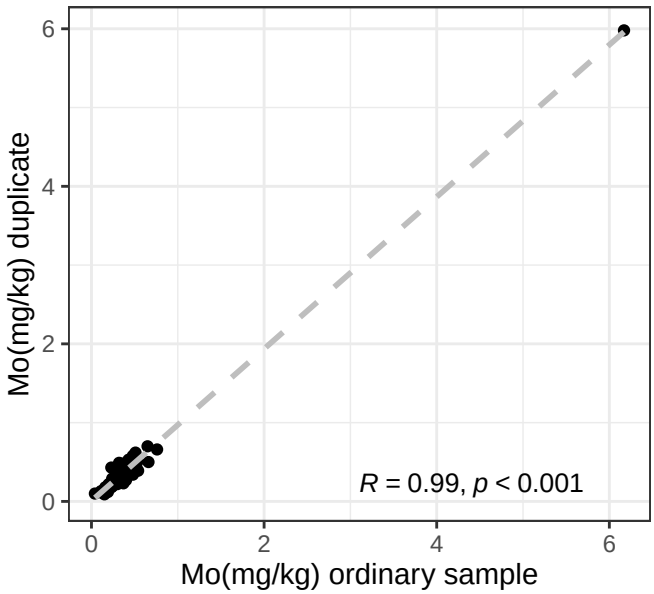

W(mg/kg)
1e+00
1e−01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

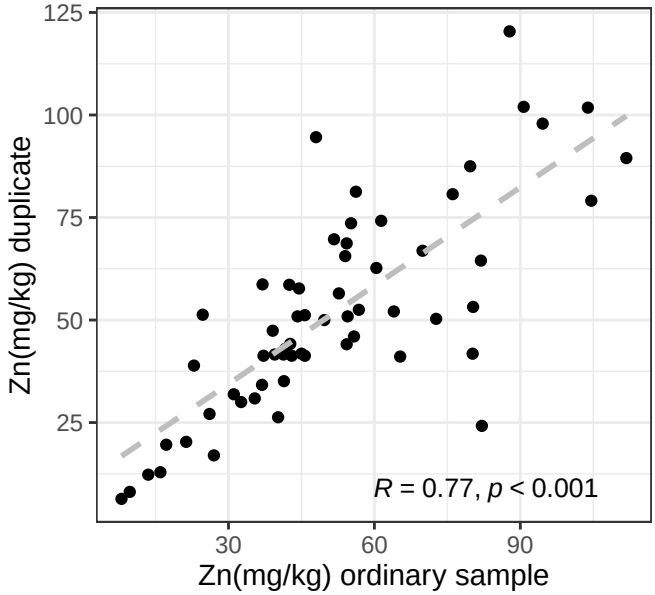

Zr(mg/kg)
1e+00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

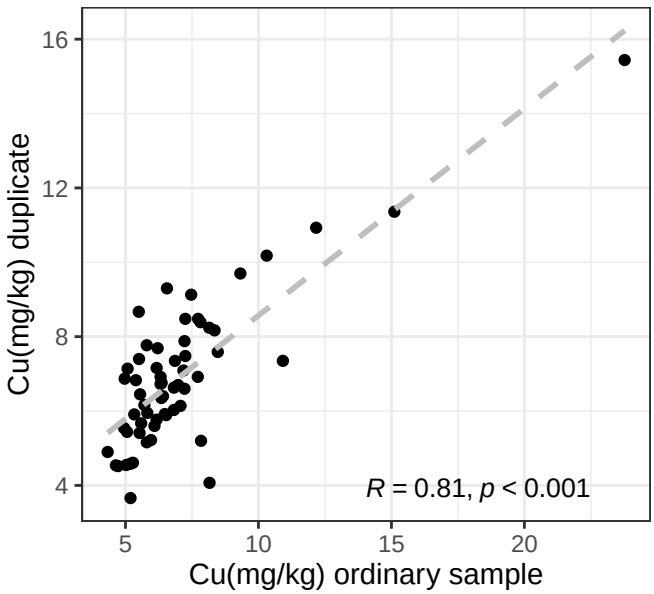

Y(mg/kg)
1e+01
1e+00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Analytical sequence

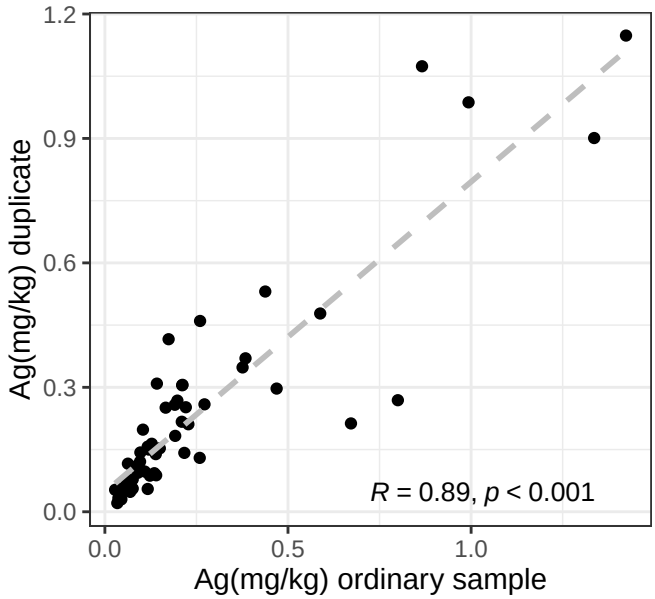
APPENDIX 4: Correlation plots, field duplicates

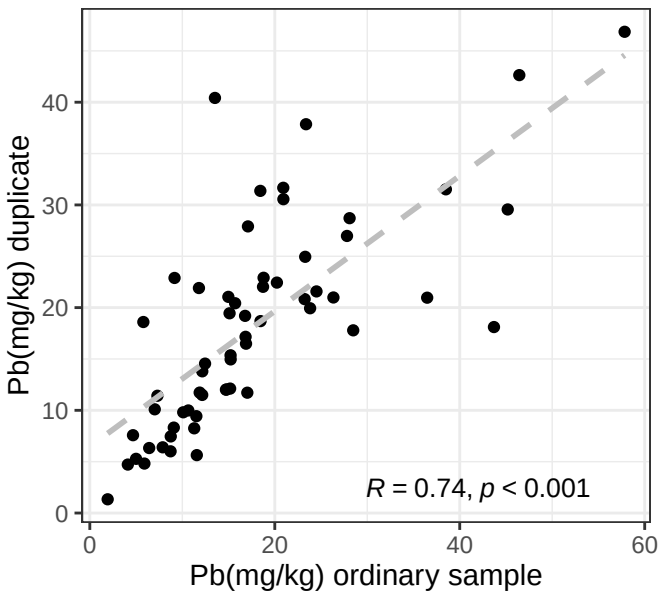
The correlation between ordinary and field duplicate samples shown for all elements that have at least four duplicate pairs above DL. Each plot includes the covariance or correlation coefficient.

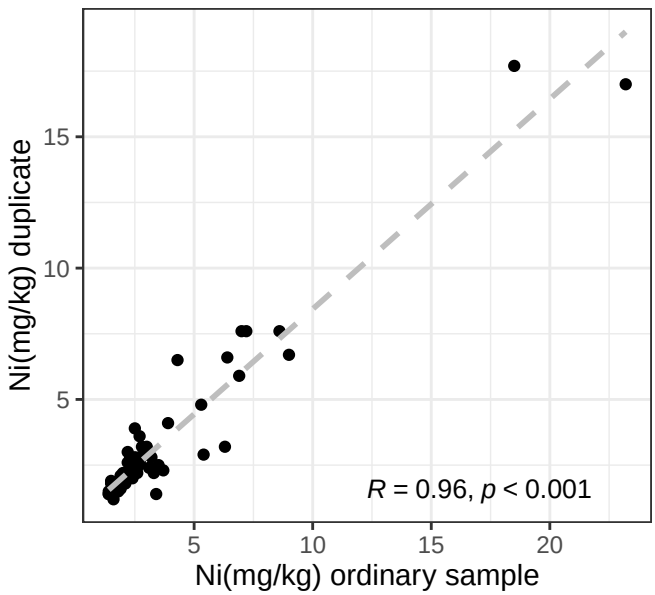

Mo(mg/kg) duplicate
Mo(mg/kg) ordinary sample
R = 0.99, p < 0.001

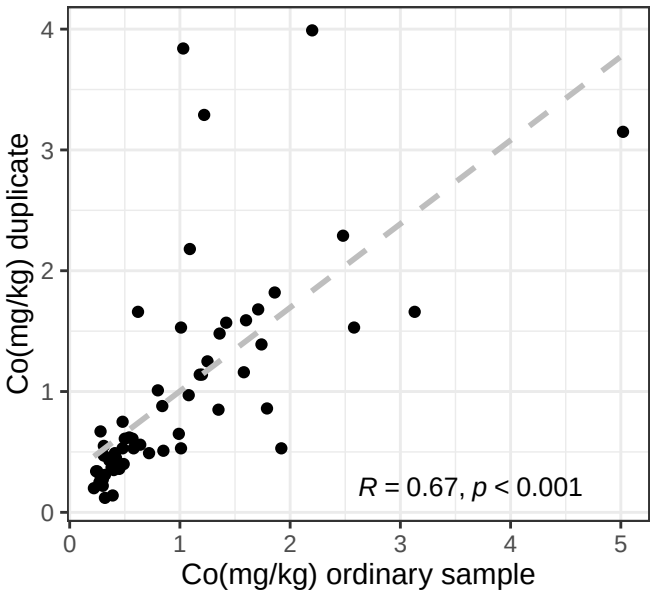

Zn(mg/kg) duplicate
Zn(mg/kg) ordinary sample
R = 0.77, p < 0.001

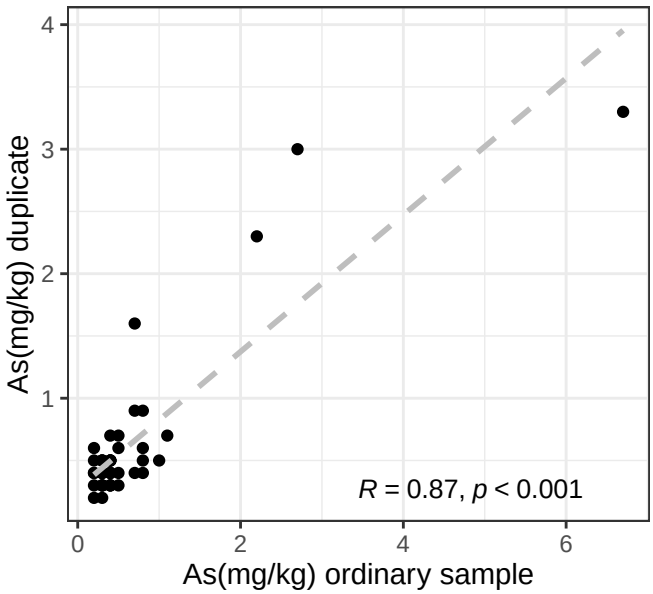

Cu(mg/kg) duplicate
Cu(mg/kg) ordinary sample
R = 0.81, p < 0.001

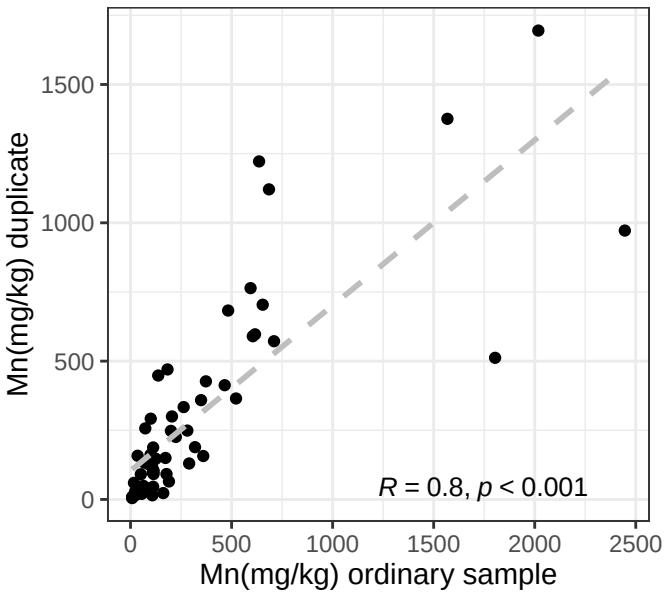

Ag(mg/kg) duplicate
Ag(mg/kg) ordinary sample
R = 0.89, p < 0.001

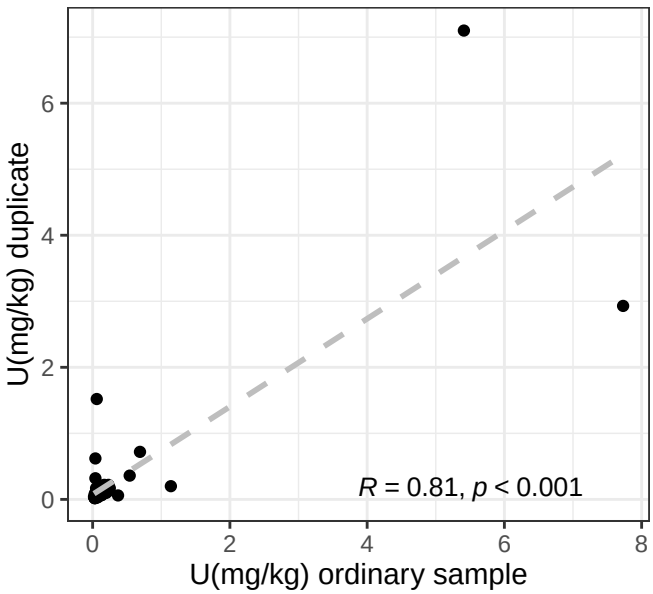

Pb(mg/kg) duplicate
Pb(mg/kg) ordinary sample
R = 0.74, p < 0.001

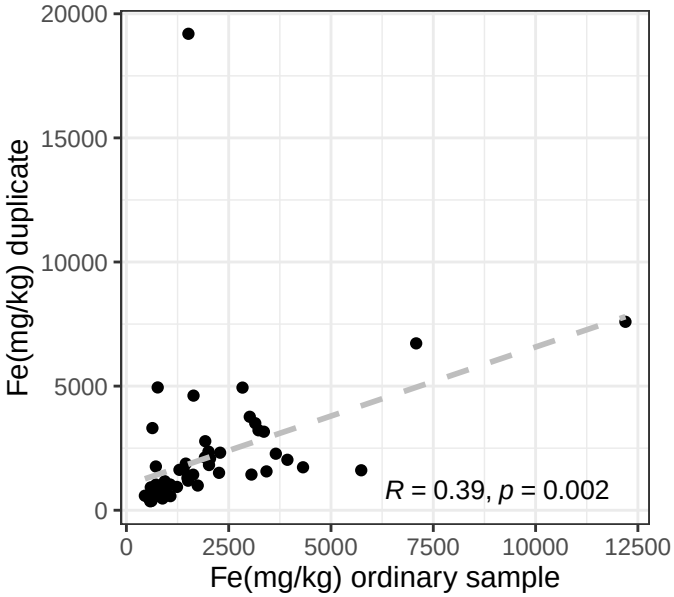

Ni(mg/kg) duplicate
Ni(mg/kg) ordinary sample
R = 0.96, p < 0.001

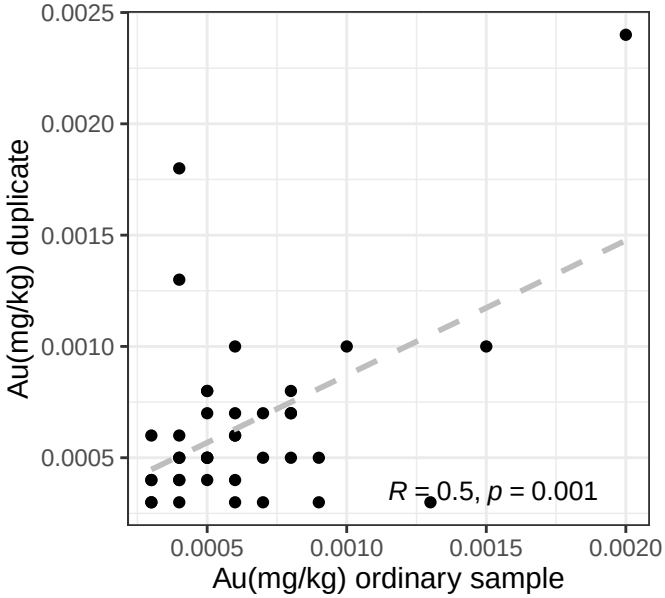

Co(mg/kg) duplicate
Co(mg/kg) ordinary sample
R = 0.67, p < 0.001

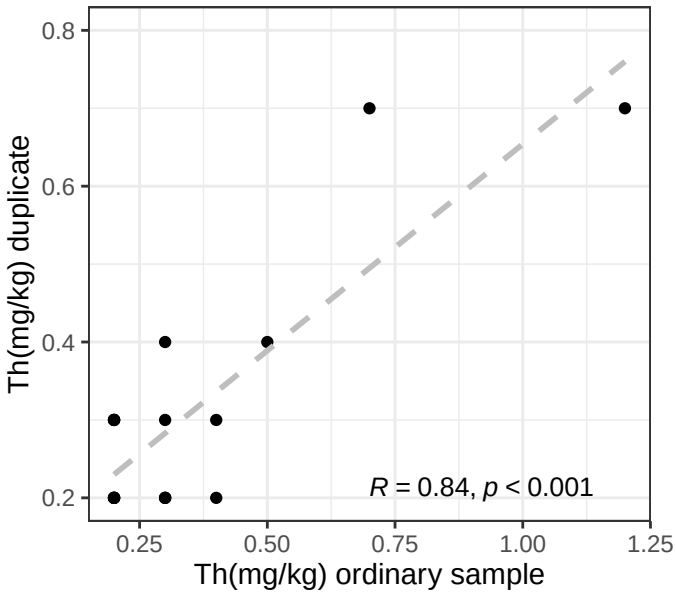

As(mg/kg) duplicate
As(mg/kg) ordinary sample
R = 0.87, p < 0.001

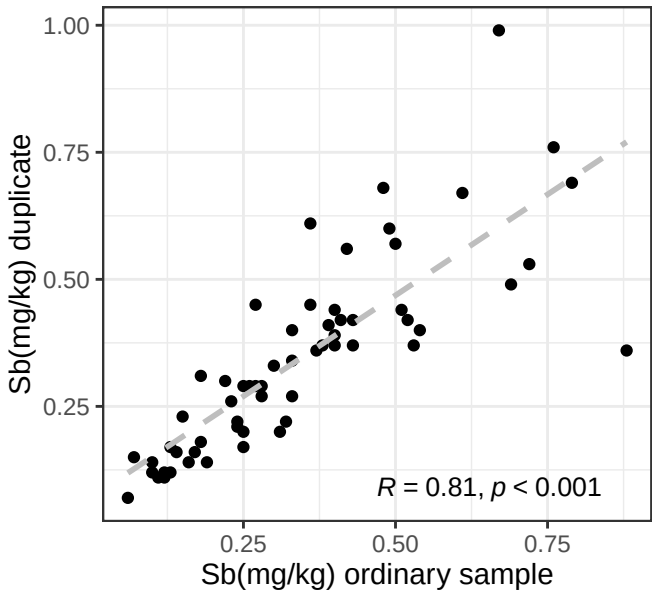

Mn(mg/kg) duplicate
Mn(mg/kg) ordinary sample
R = 0.8, p < 0.001

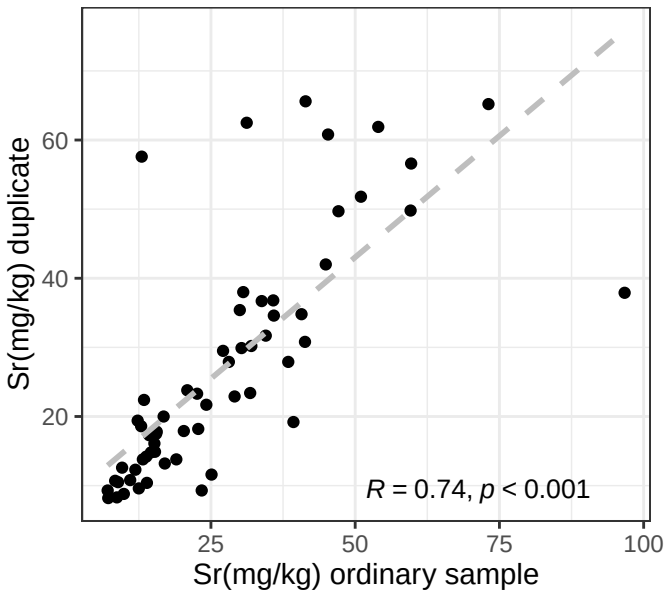

U(mg/kg) duplicate
U(mg/kg) ordinary sample
R = 0.81, p < 0.001

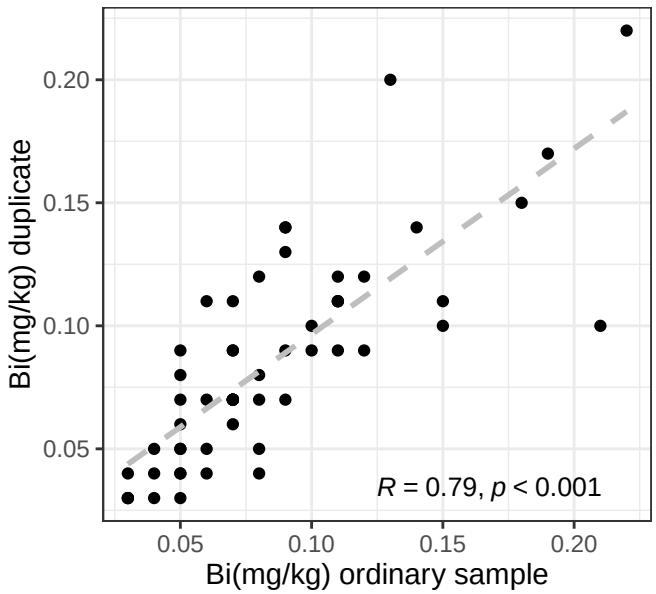

Fe(mg/kg) duplicate
Fe(mg/kg) ordinary sample
R = 0.39, p = 0.002

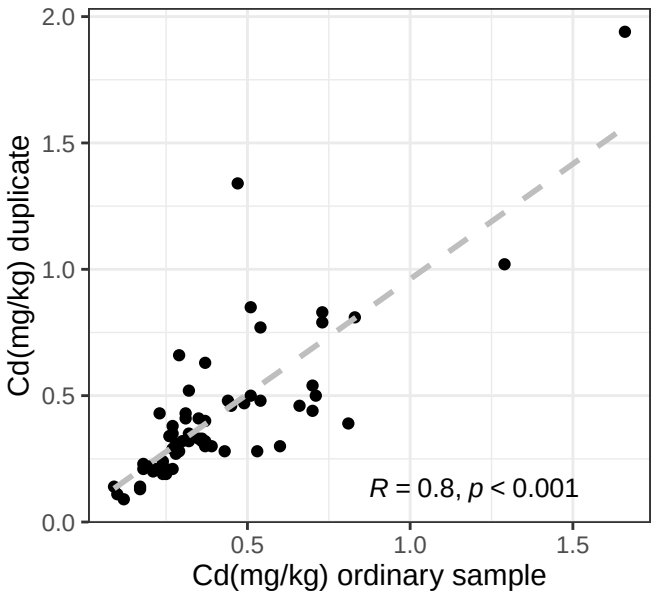

Au(mg/kg) duplicate
Au(mg/kg) ordinary sample
R = 0.5, p = 0.001

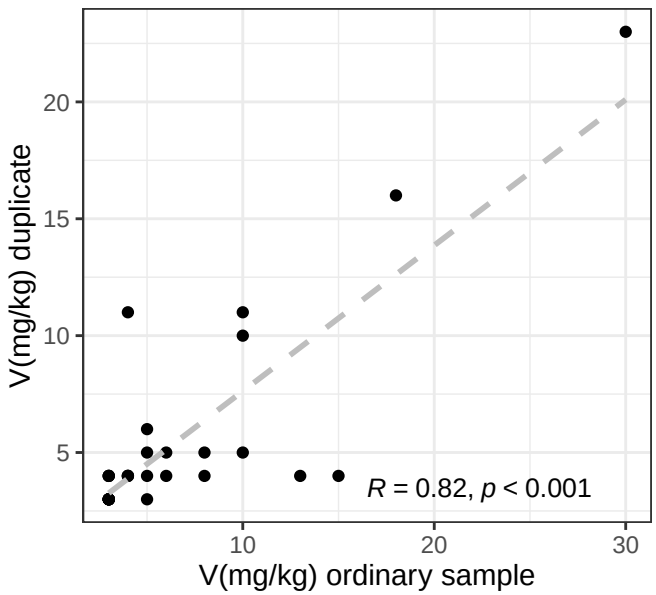

Th(mg/kg) duplicate
Th(mg/kg) ordinary sample
R = 0.84, p < 0.001

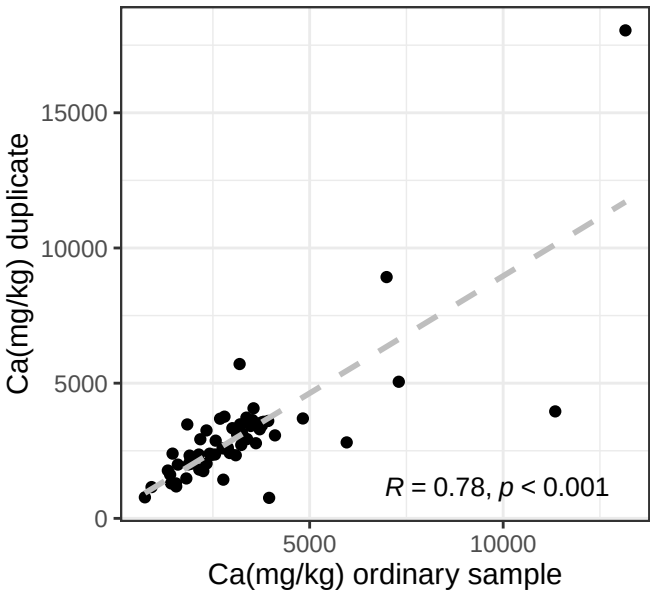

Sb(mg/kg) duplicate
Sb(mg/kg) ordinary sample
R = 0.81, p < 0.001

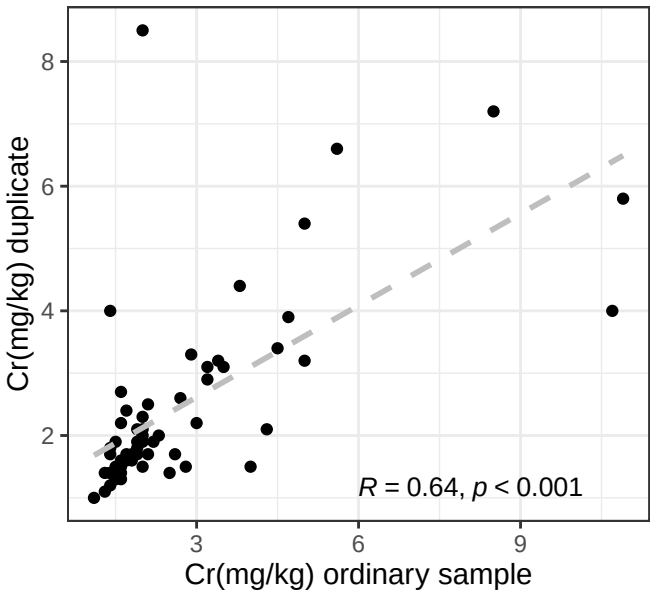

Sr(mg/kg) duplicate
Sr(mg/kg) ordinary sample
R = 0.74, p < 0.001

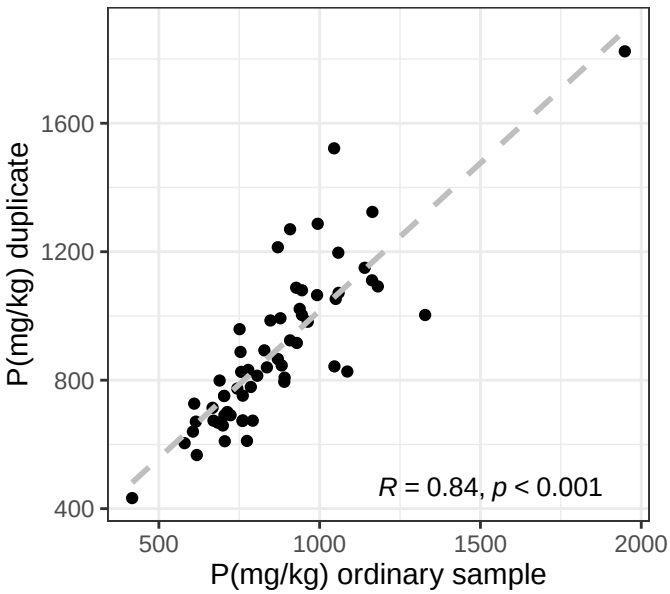

Bi(mg/kg) duplicate
Bi(mg/kg) ordinary sample
R = 0.79, p < 0.001

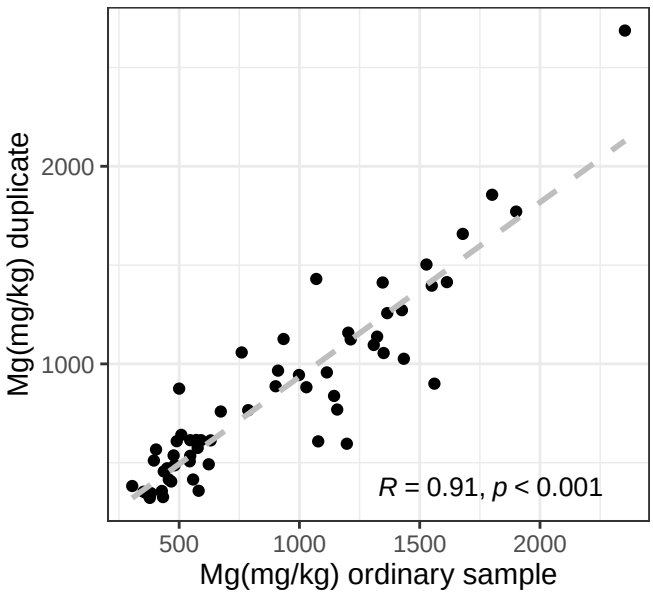

Cd(mg/kg) duplicate
Cd(mg/kg) ordinary sample
R = 0.8, p < 0.001

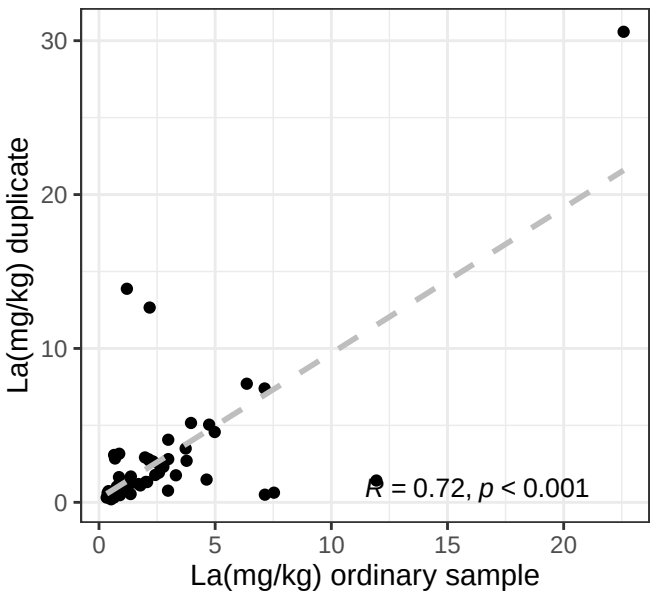

V(mg/kg) duplicate
V(mg/kg) ordinary sample
R = 0.82, p < 0.001

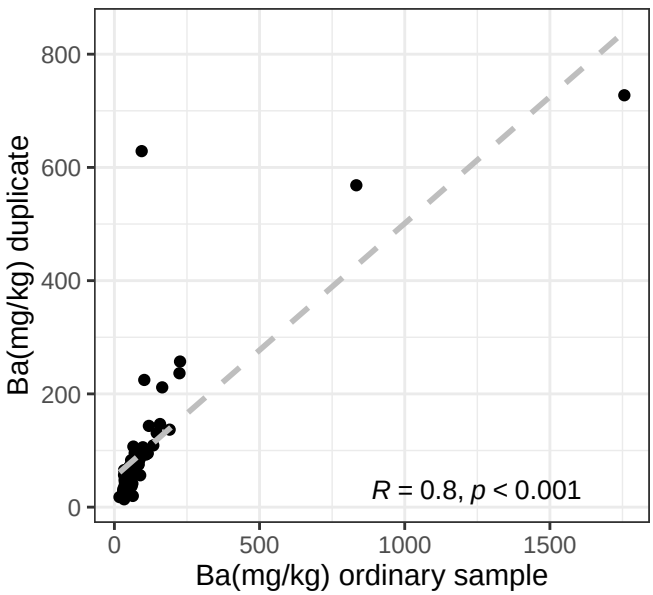

Ca(mg/kg) duplicate
Ca(mg/kg) ordinary sample
R = 0.78, p < 0.001

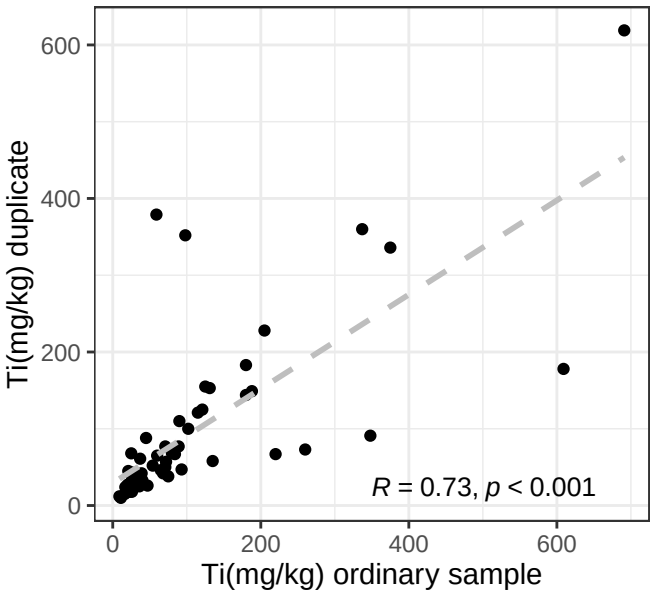

Cr(mg/kg) duplicate
Cr(mg/kg) ordinary sample
R = 0.64, p < 0.001

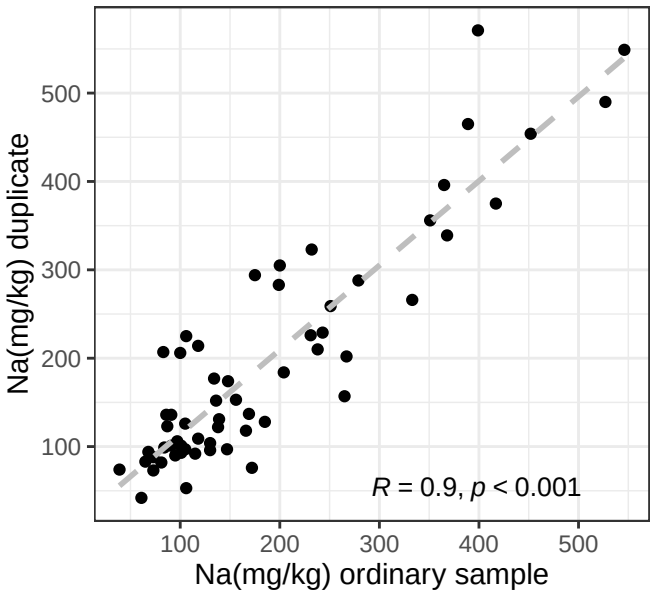

P(mg/kg) duplicate
P(mg/kg) ordinary sample
R = 0.84, p < 0.001

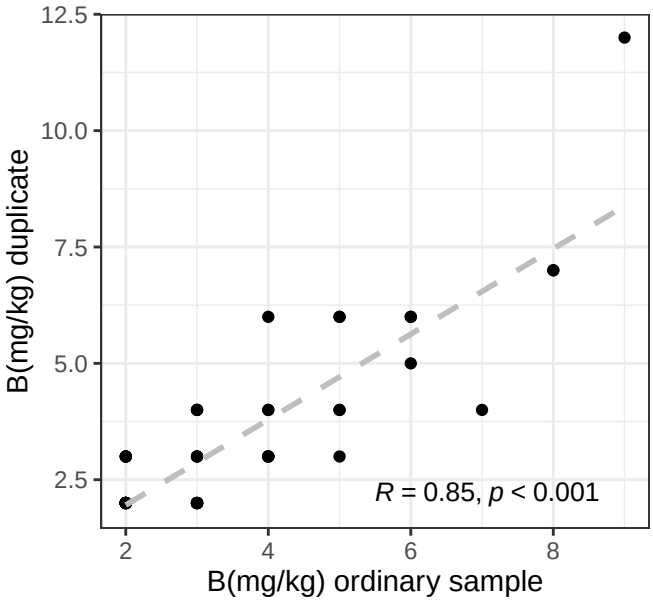

Mg(mg/kg) duplicate
Mg(mg/kg) ordinary sample
R = 0.91, p < 0.001

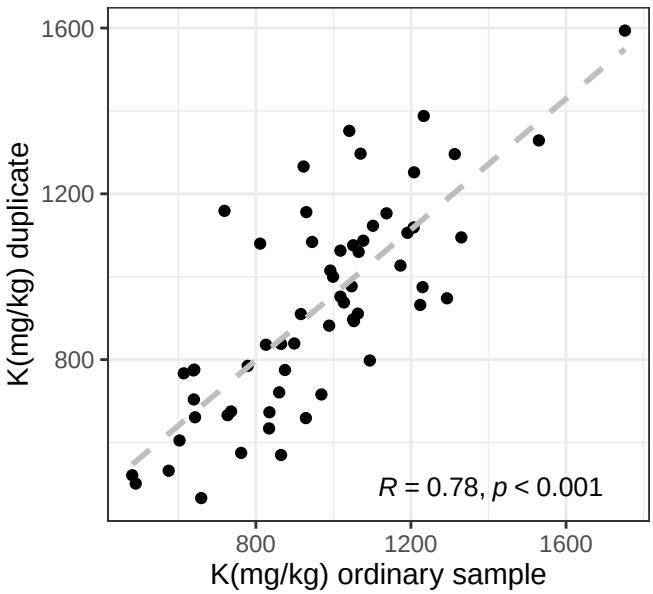

La(mg/kg) duplicate
La(mg/kg) ordinary sample
R = 0.72, p < 0.001

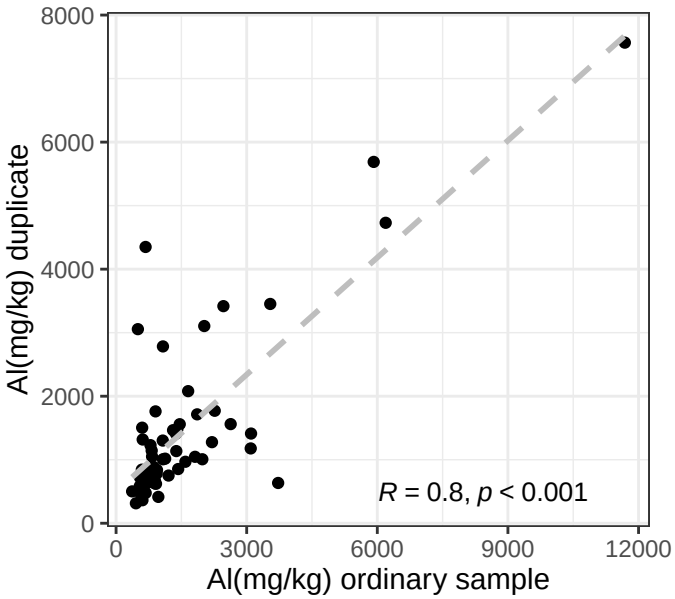

Ba(mg/kg) duplicate
Ba(mg/kg) ordinary sample
R = 0.8, p < 0.001

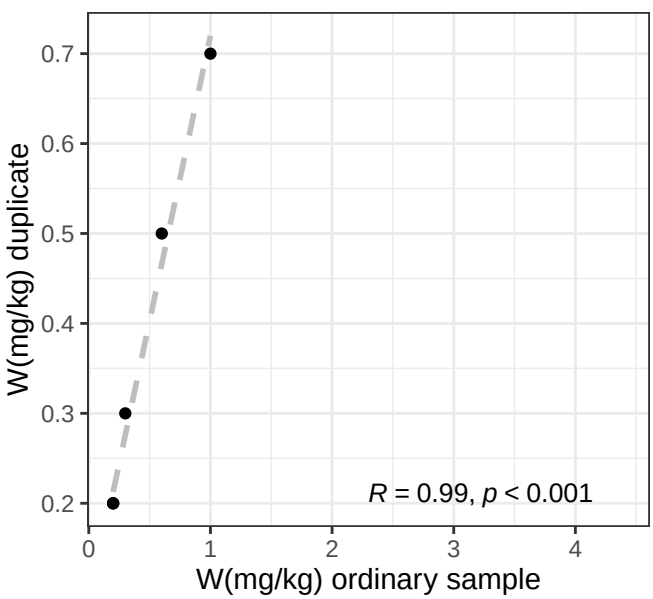

Ti(mg/kg) duplicate
Ti(mg/kg) ordinary sample
R = 0.73, p < 0.001
0
200
400
600

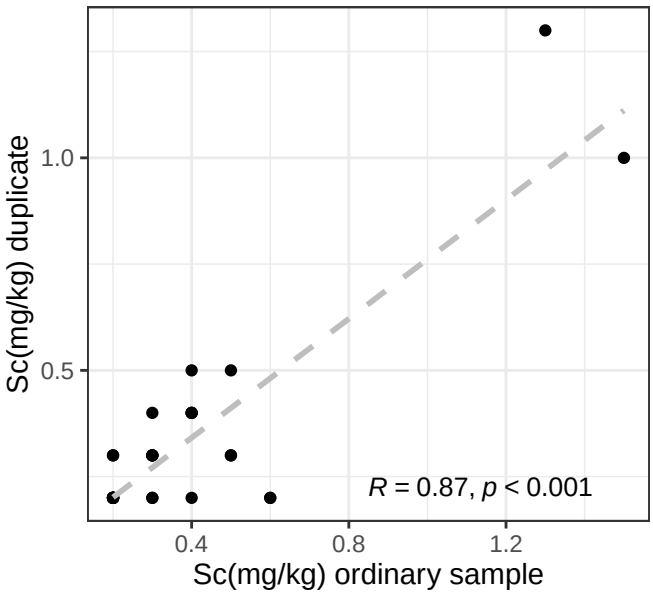

Na(mg/kg) duplicate
Na(mg/kg) ordinary sample
R = 0.9, p < 0.001
100
200
300
400
500

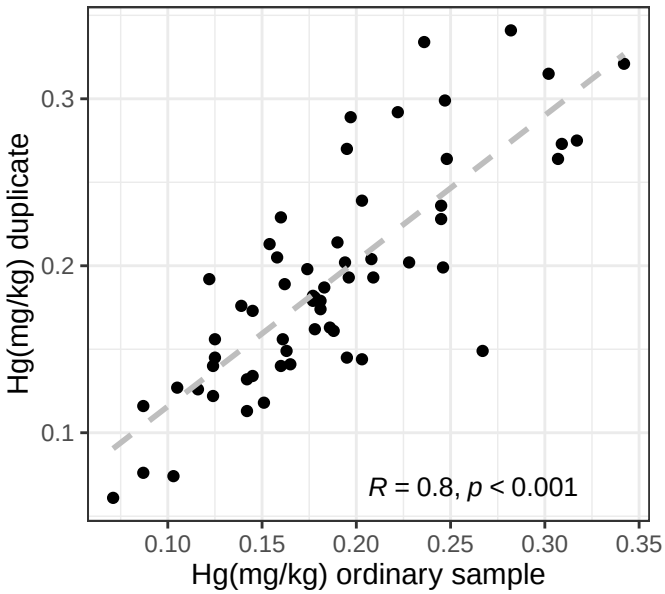

B(mg/kg) duplicate
B(mg/kg) ordinary sample
R = 0.85, p < 0.001
2.5
5.0
7.5
10.0
12.5
2
4
6
8

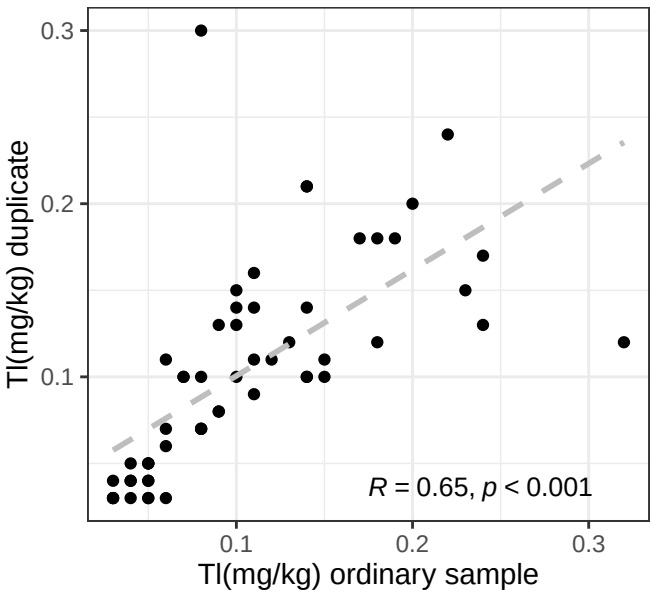

K(mg/kg) duplicate
K(mg/kg) ordinary sample
R = 0.78, p < 0.001
800
1200
1600

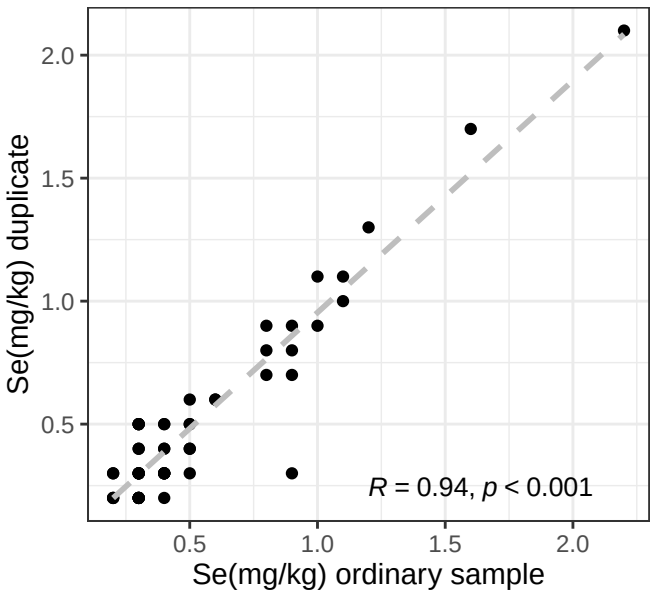

Al(mg/kg) duplicate
Al(mg/kg) ordinary sample
R = 0.8, p < 0.001
0
2000
4000
6000
8000
3000
6000
9000
12000

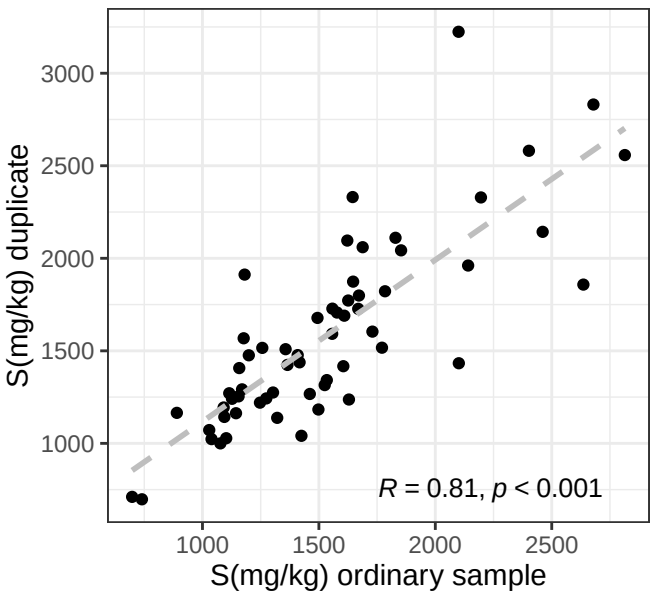

W(mg/kg) duplicate
W(mg/kg) ordinary sample
R = 0.99, p < 0.001
0.2
0.3
0.4
0.5
0.6
0.7
1
2
3
4

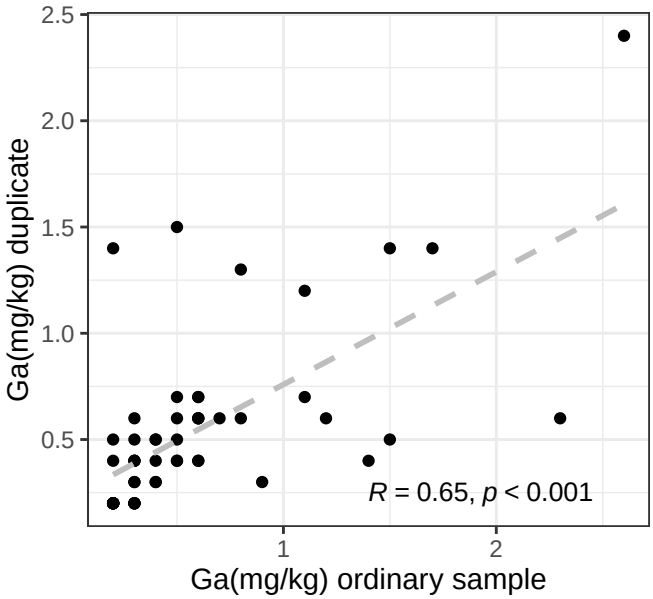

Sc(mg/kg) duplicate
Sc(mg/kg) ordinary sample
R = 0.87, p < 0.001

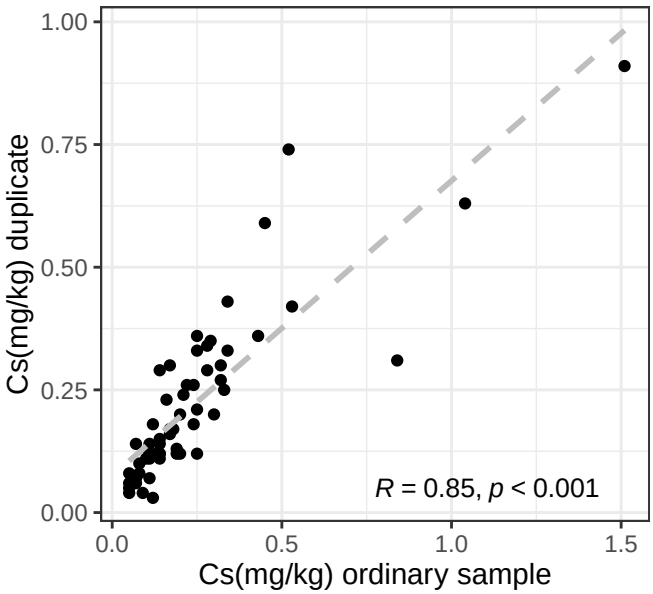

Hg(mg/kg) duplicate
Hg(mg/kg) ordinary sample
R = 0.8, p < 0.001

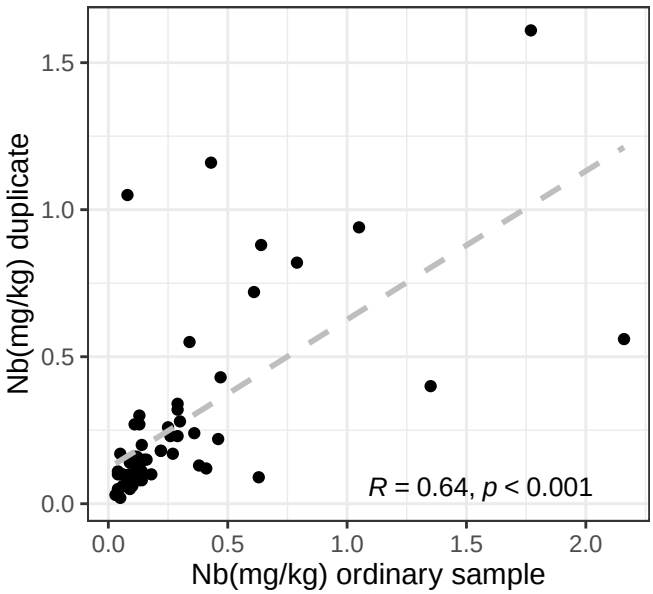

Tl(mg/kg) duplicate
Tl(mg/kg) ordinary sample
R = 0.65, p < 0.001

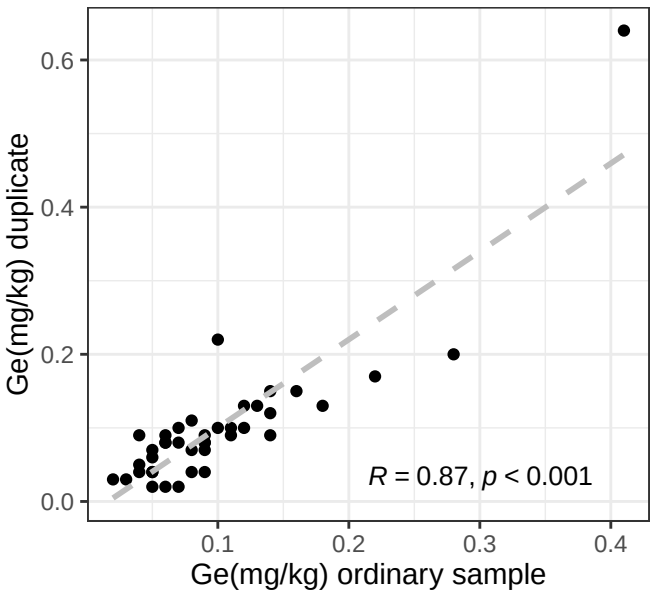

Se(mg/kg) duplicate
Se(mg/kg) ordinary sample
R = 0.94, p < 0.001

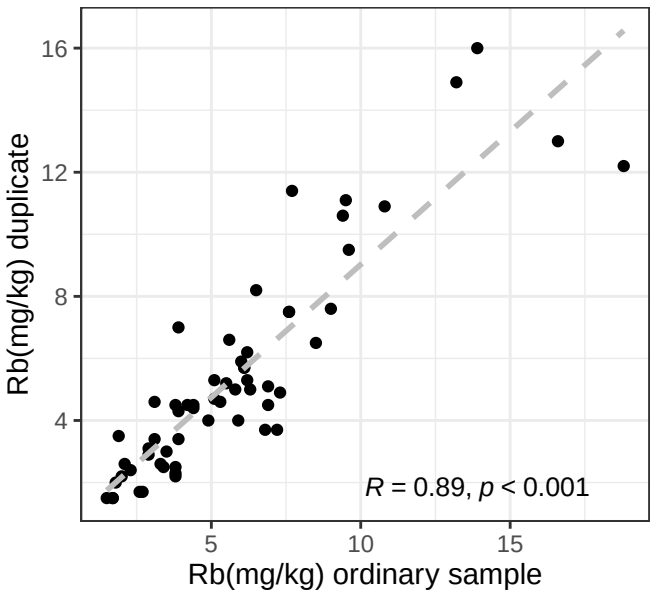

S(mg/kg) duplicate
S(mg/kg) ordinary sample
R = 0.81, p < 0.001

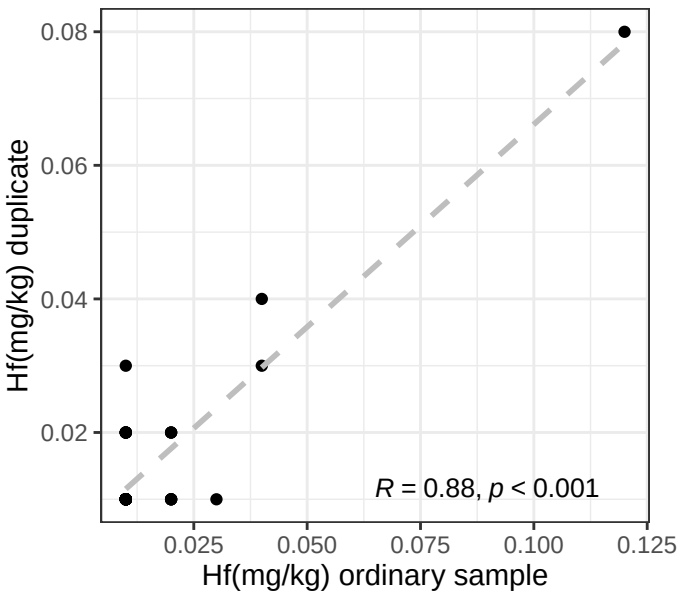

Ga(mg/kg) duplicate
Ga(mg/kg) ordinary sample
R = 0.65, p < 0.001

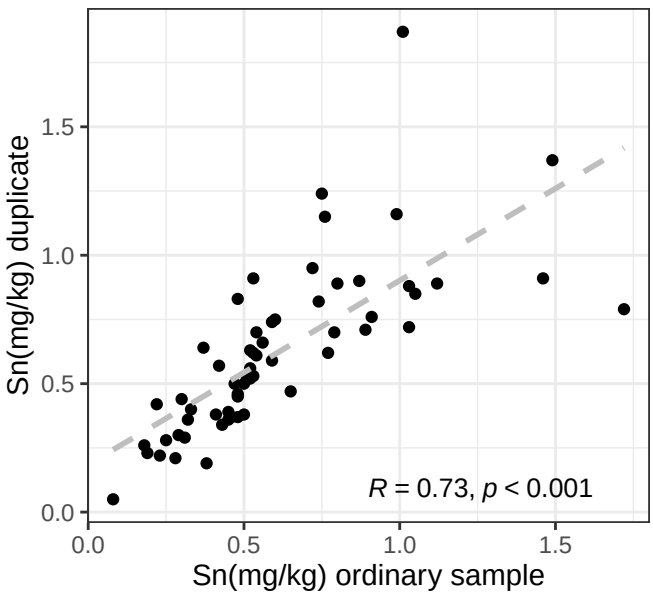

Cs(mg/kg) duplicate
Cs(mg/kg) ordinary sample
R = 0.85, p < 0.001

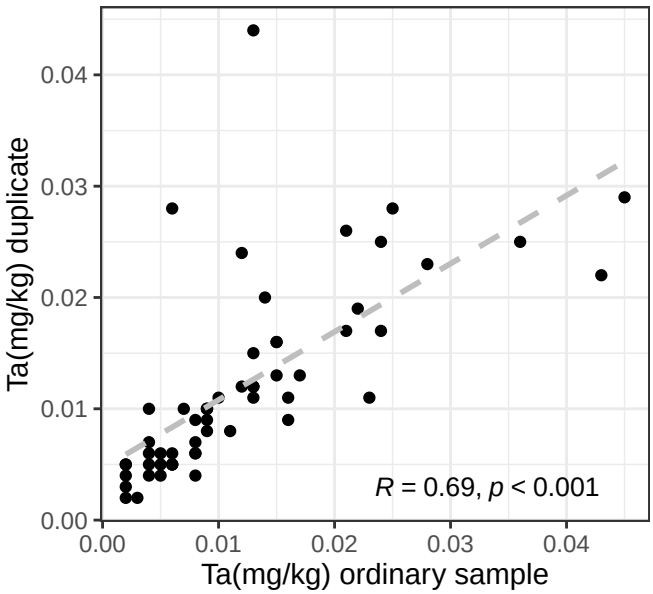

Nb(mg/kg) duplicate
Nb(mg/kg) ordinary sample
R = 0.64, p < 0.001

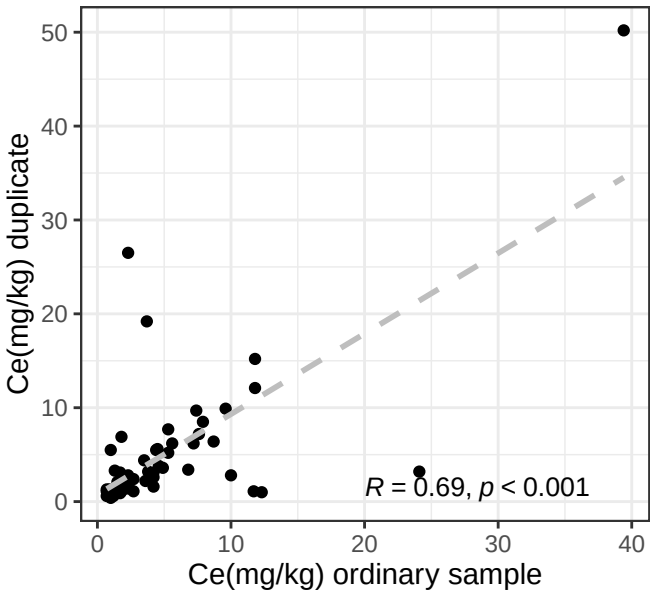

Ge(mg/kg) duplicate
Ge(mg/kg) ordinary sample
R = 0.87, p < 0.001

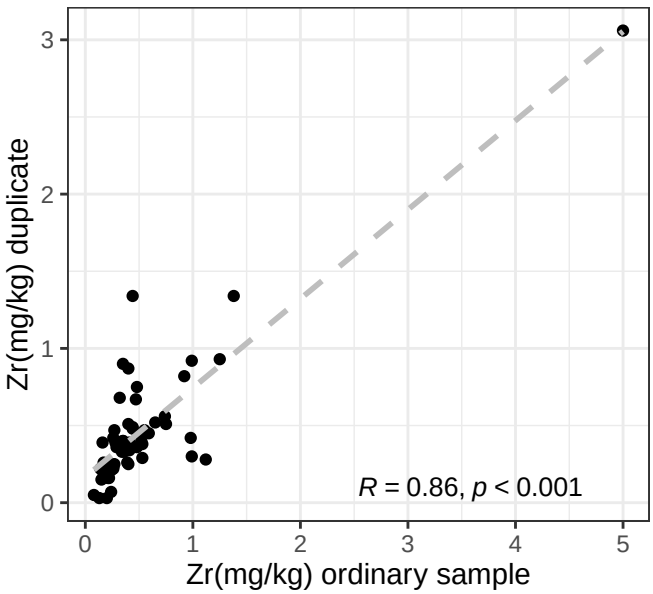

Rb(mg/kg) duplicate
Rb(mg/kg) ordinary sample
R = 0.89, p < 0.001

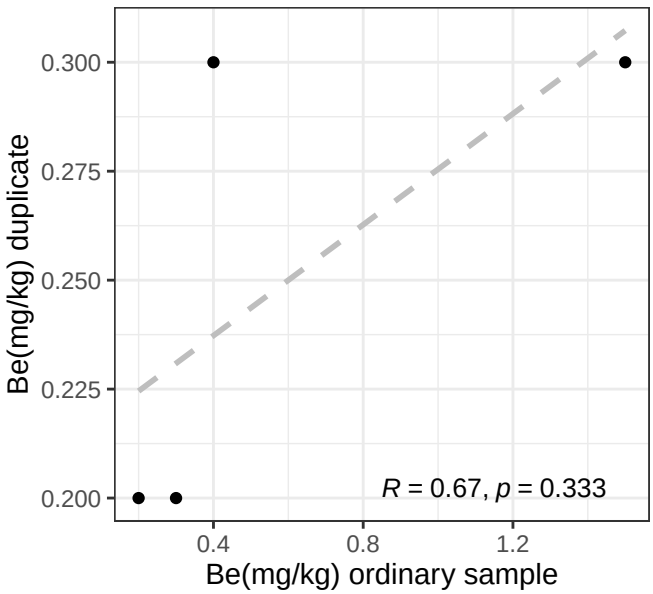

Hf(mg/kg) duplicate
Hf(mg/kg) ordinary sample
R = 0.88, p < 0.001

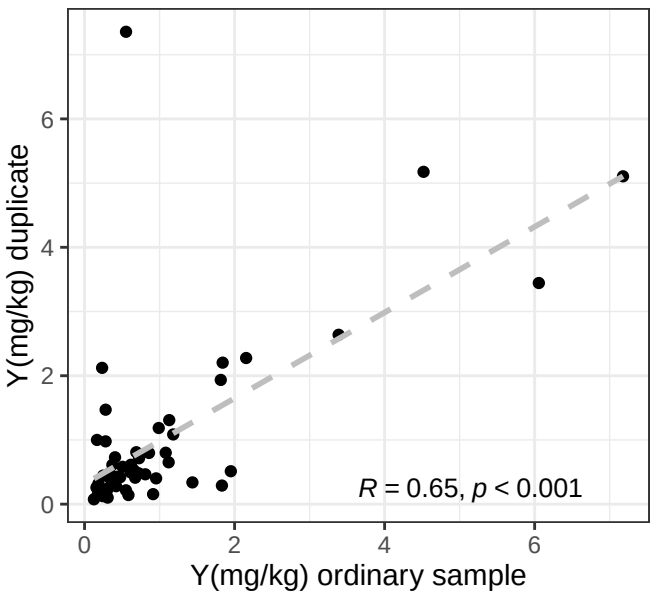

Sn(mg/kg) duplicate
Sn(mg/kg) ordinary sample
R = 0.73, p < 0.001

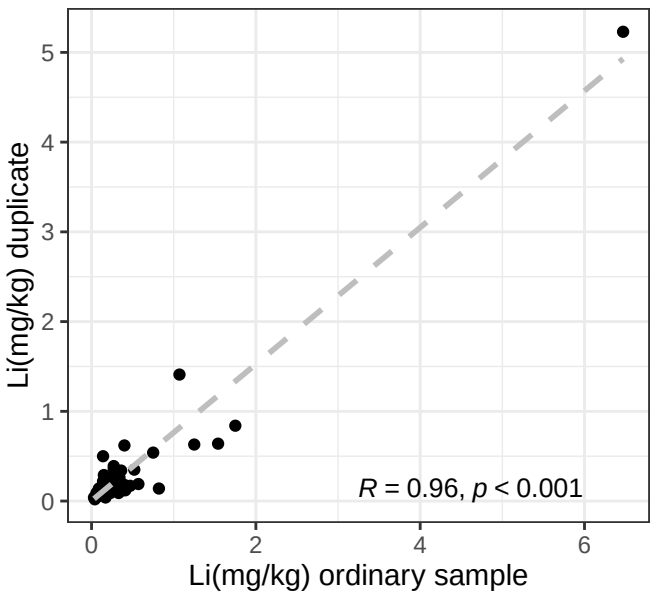

Ta(mg/kg) duplicate
Ta(mg/kg) ordinary sample
R = 0.69, p < 0.001


Ce(mg/kg) duplicate
Ce(mg/kg) ordinary sample
R = 0.69, p < 0.001


Zr(mg/kg) duplicate
Zr(mg/kg) ordinary sample
R = 0.86, p < 0.001

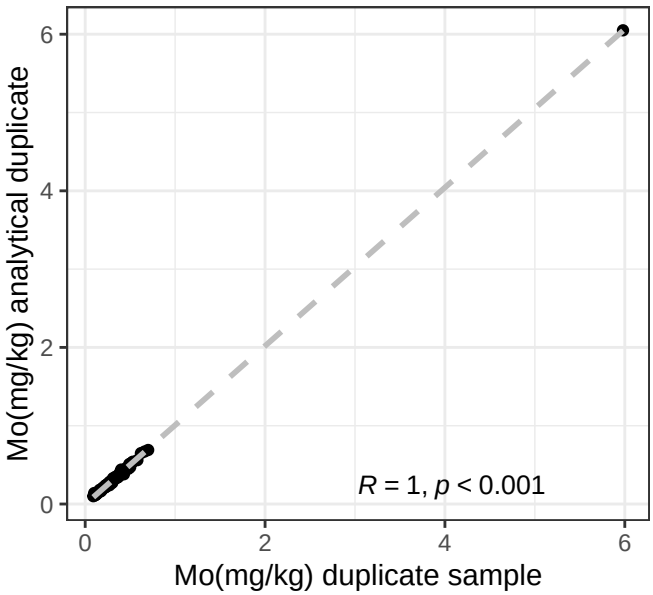

Be(mg/kg) duplicate
Be(mg/kg) ordinary sample
R = 0.67, p = 0.333

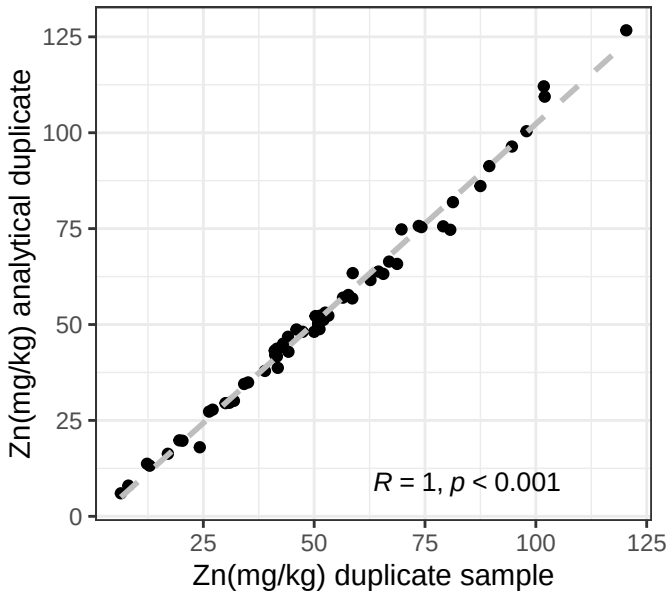

Y(mg/kg) duplicate
Y(mg/kg) ordinary sample
R = 0.65, p < 0.001

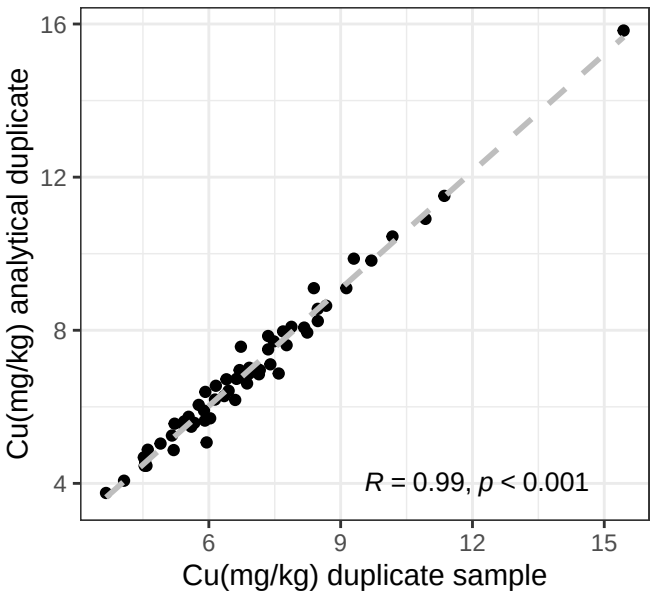

Li(mg/kg) duplicate
Li(mg/kg) ordinary sample
R = 0.96, p < 0.001

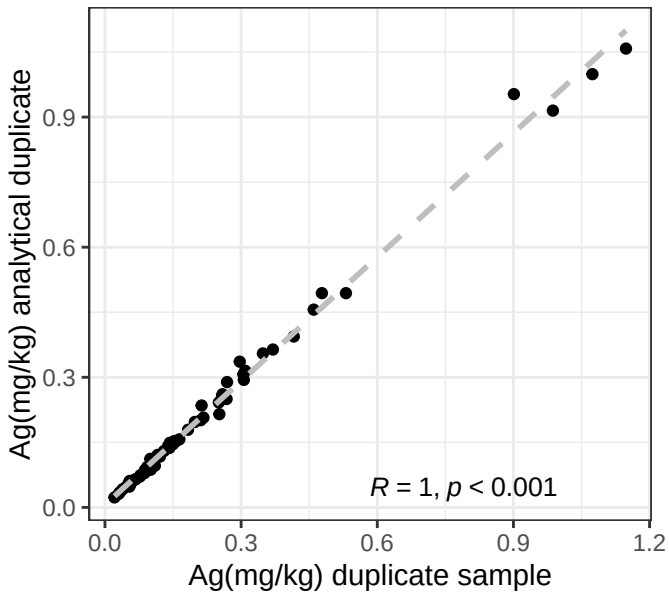
APPENDIX 5: Correlation plots, Analytical duplicates

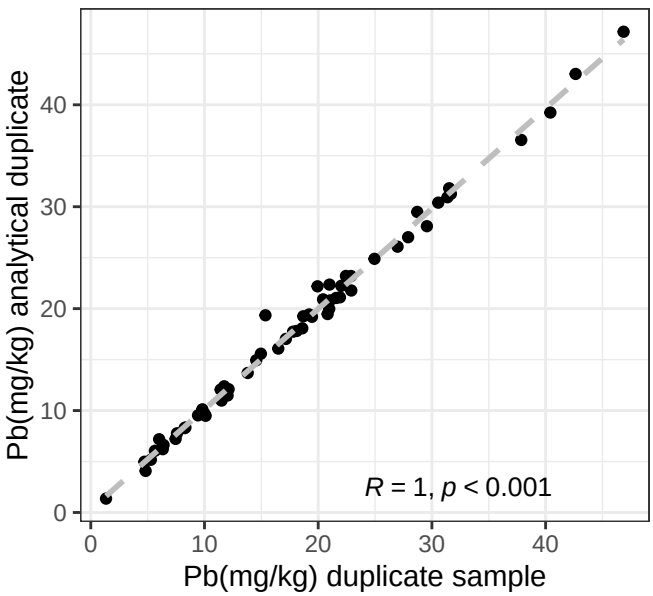
The correlation between duplicate and analytical duplicate samples shown for all elements that have at least four duplicate pairs above MDL. Each plot includes the covariance or correlation coefficient.

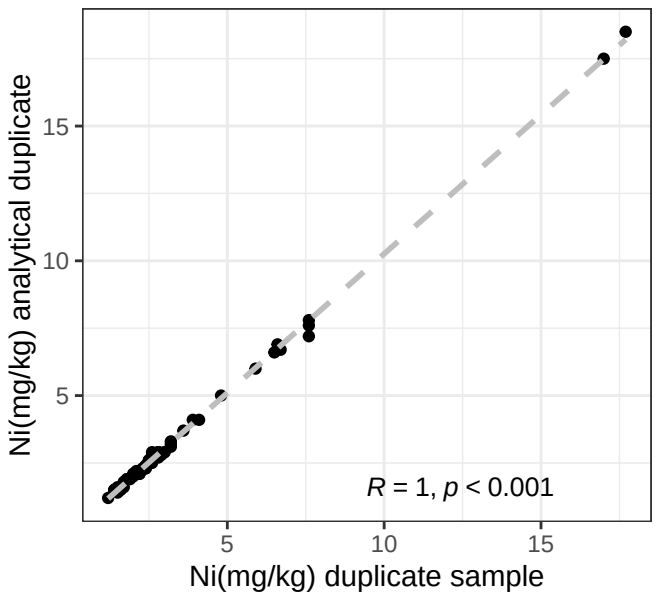

Mo(mg/kg) analytical duplicate
Mo(mg/kg) duplicate sample
R = 1, p < 0.001
0
2
4
6

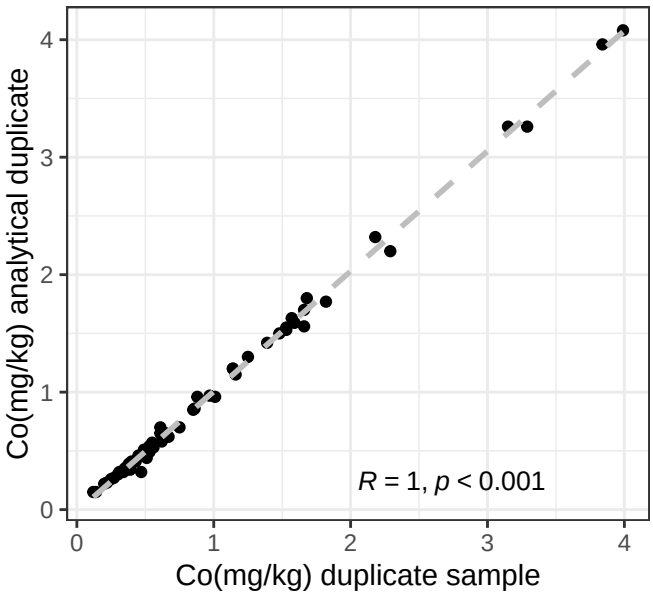

Zn(mg/kg) analytical duplicate
Zn(mg/kg) duplicate sample
R = 1, p < 0.001
0
25
50
75
100
125

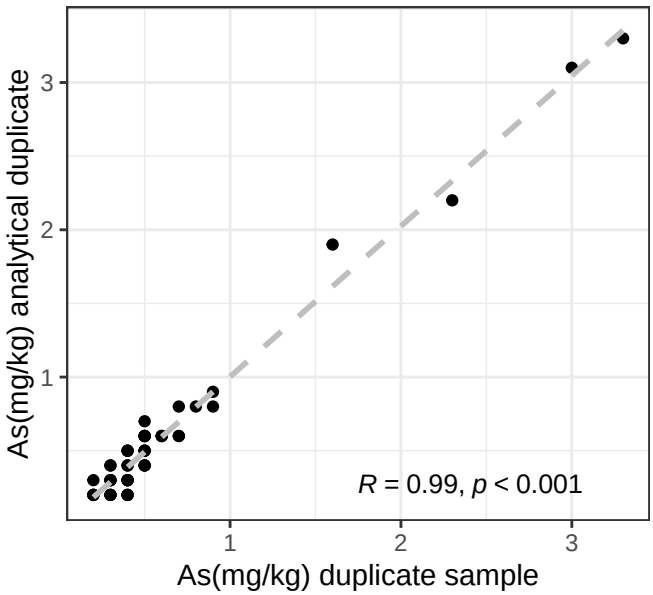

Cu(mg/kg) analytical duplicate
Cu(mg/kg) duplicate sample
R = 0.99, p < 0.001
4
6
8
9
12
15
16

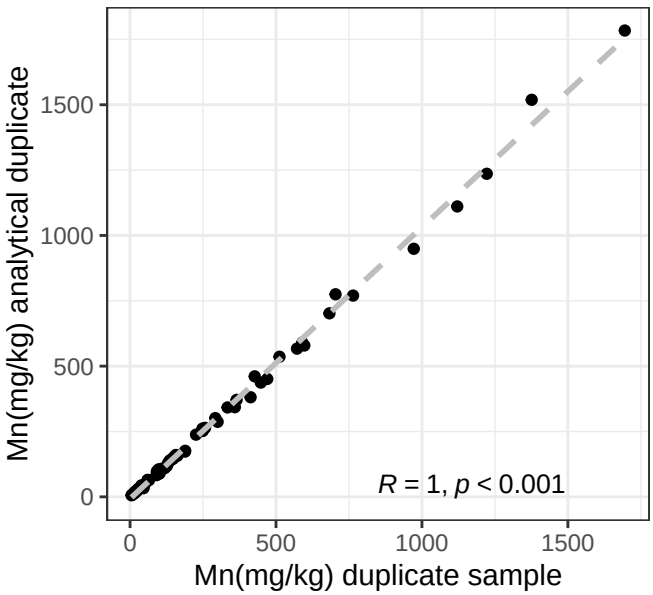

Ag(mg/kg) analytical duplicate
Ag(mg/kg) duplicate sample
R = 1, p < 0.001
0.0
0.3
0.6
0.9
1.2

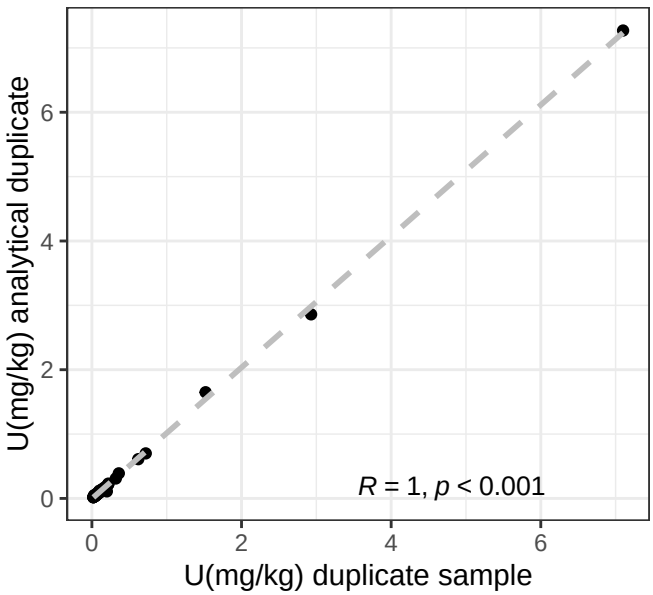

Pb(mg/kg) analytical duplicate
Pb(mg/kg) duplicate sample
R = 1, p < 0.001
0
10
20
30
40

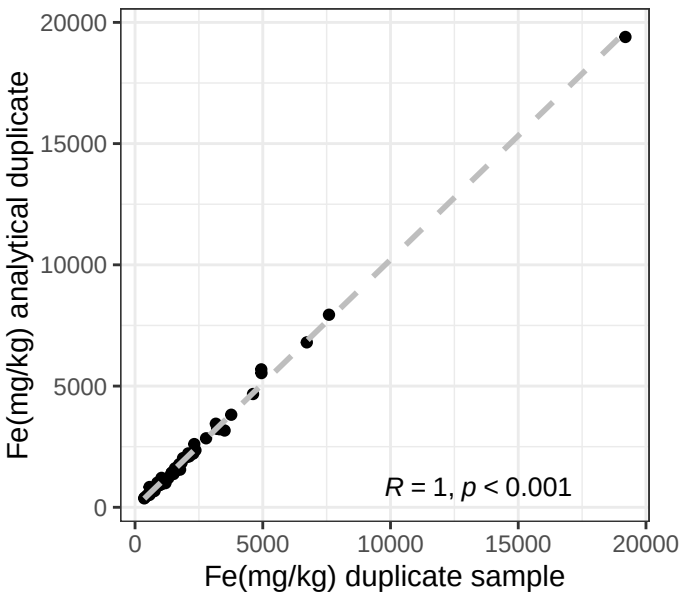

Ni(mg/kg) analytical duplicate
Ni(mg/kg) duplicate sample
R = 1, p < 0.001
5
10
15

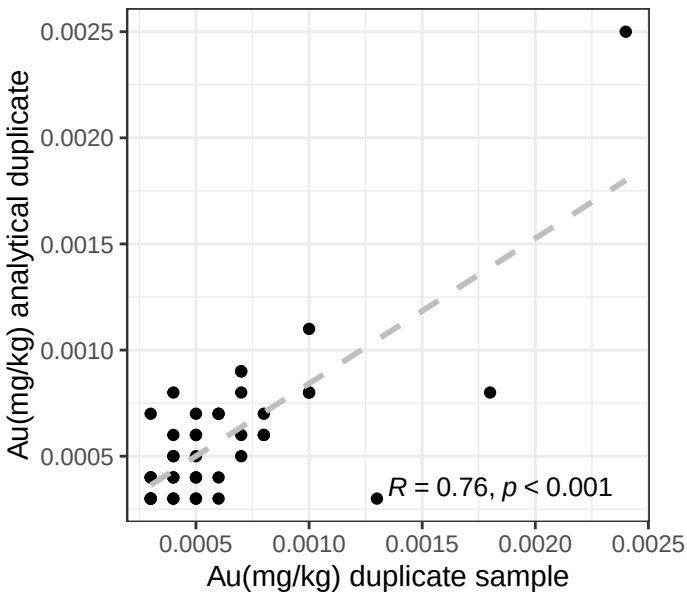

Co(mg/kg) analytical duplicate
Co(mg/kg) duplicate sample
R = 1, p < 0.001

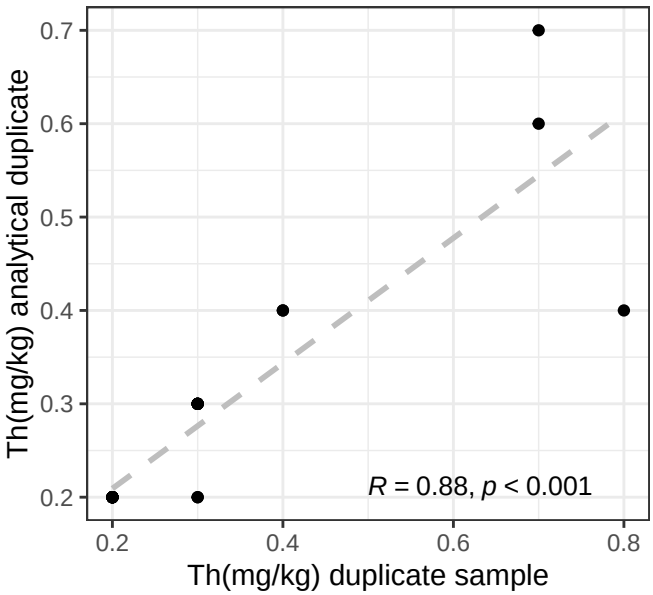

As(mg/kg) analytical duplicate
As(mg/kg) duplicate sample
R = 0.99, p < 0.001

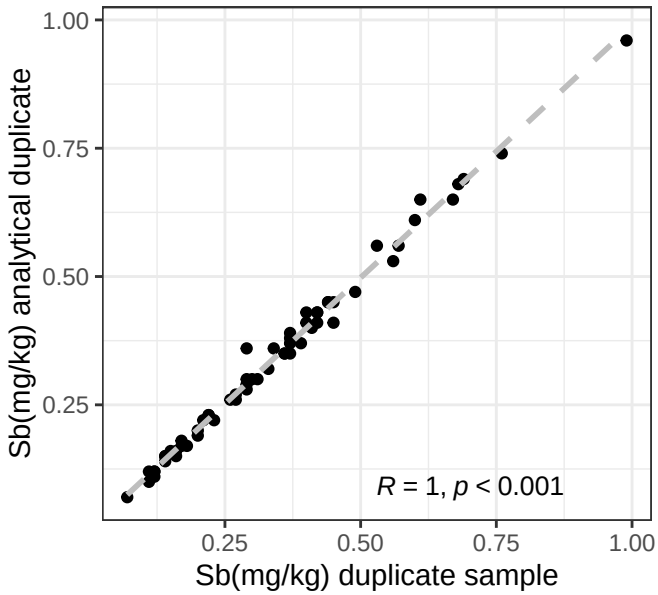

Mn(mg/kg) analytical duplicate
Mn(mg/kg) duplicate sample
R = 1, p < 0.001

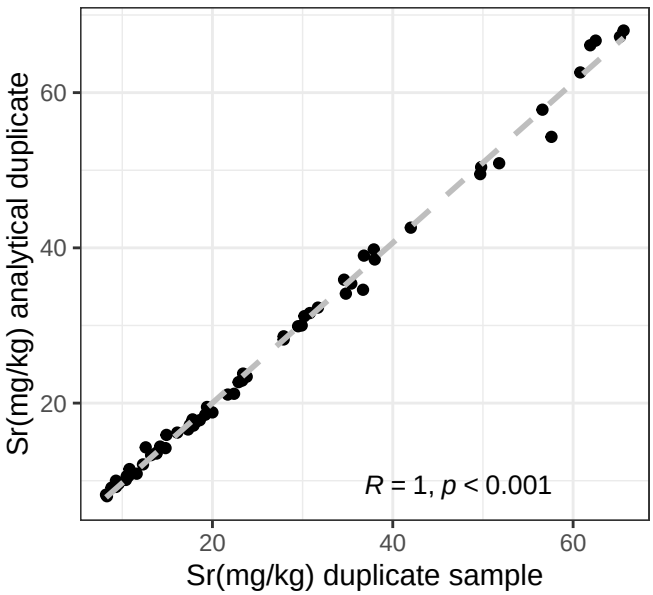

U(mg/kg) analytical duplicate
U(mg/kg) duplicate sample
R = 1, p < 0.001

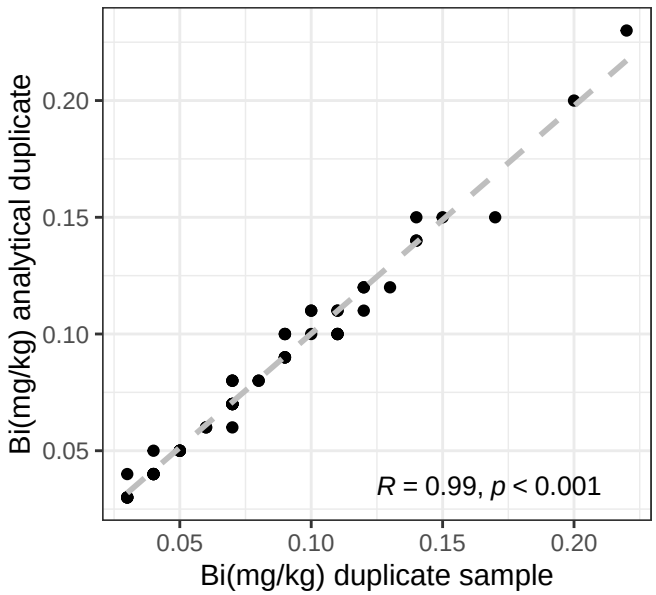

Fe(mg/kg) analytical duplicate
Fe(mg/kg) duplicate sample
R = 1, p < 0.001

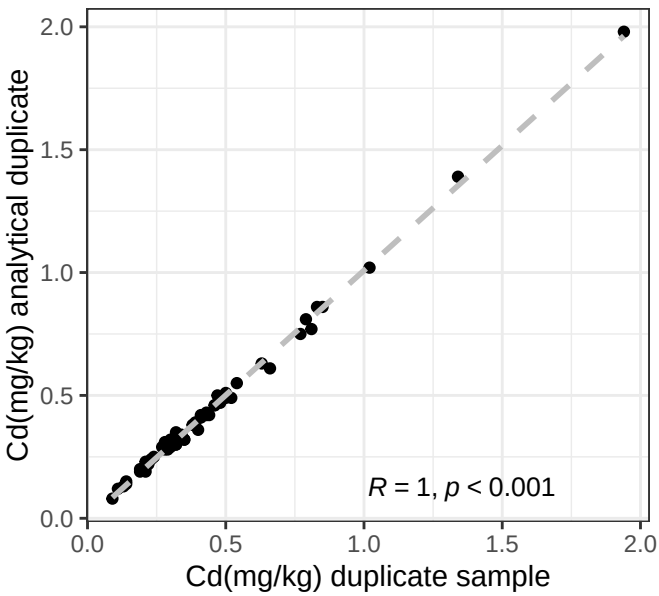

Au(mg/kg) analytical duplicate
Au(mg/kg) duplicate sample
R = 0.76, p < 0.001

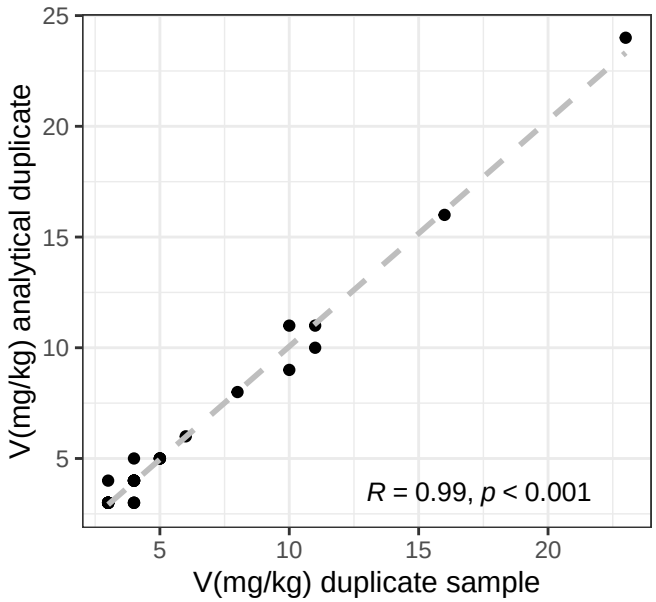

Th(mg/kg) analytical duplicate
Th(mg/kg) duplicate sample
R = 0.88, p < 0.001

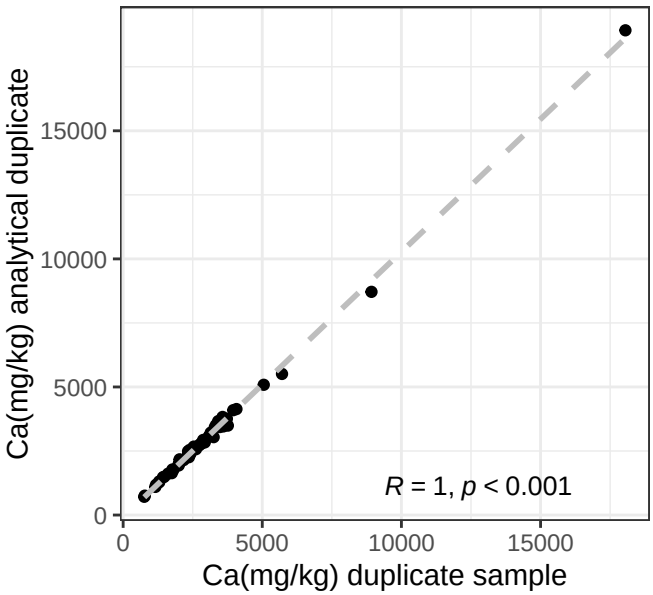

Sb(mg/kg) analytical duplicate
Sb(mg/kg) duplicate sample
R = 1, p < 0.001

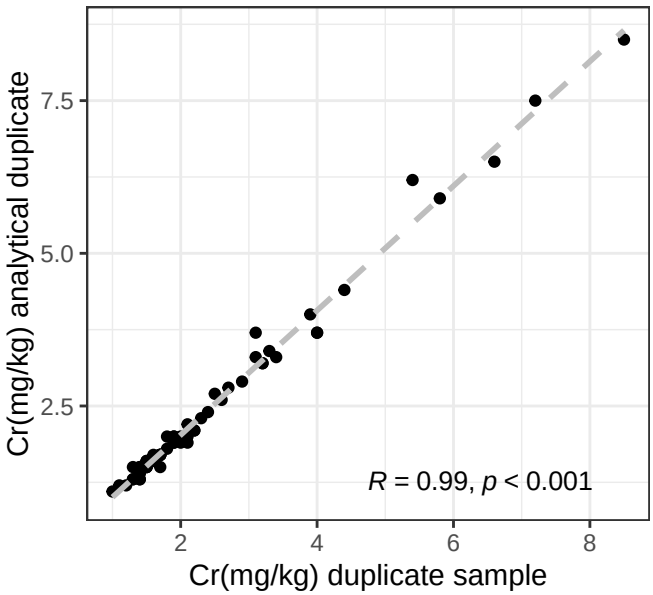

Sr(mg/kg) analytical duplicate
Sr(mg/kg) duplicate sample
R = 1, p < 0.001

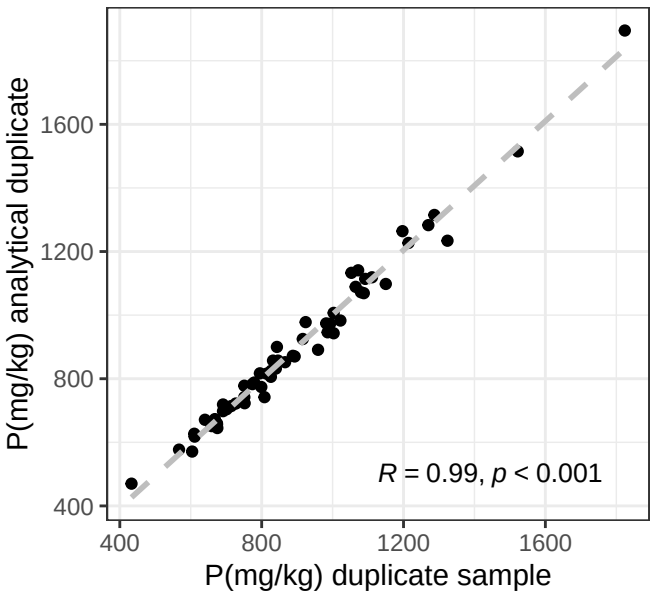

Bi(mg/kg) analytical duplicate
Bi(mg/kg) duplicate sample
R = 0.99, p < 0.001

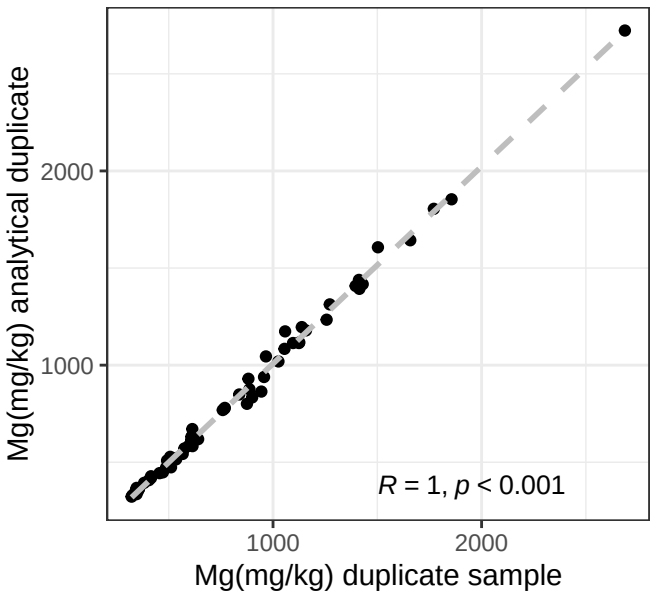

Cd(mg/kg) analytical duplicate
Cd(mg/kg) duplicate sample
R = 1, p < 0.001

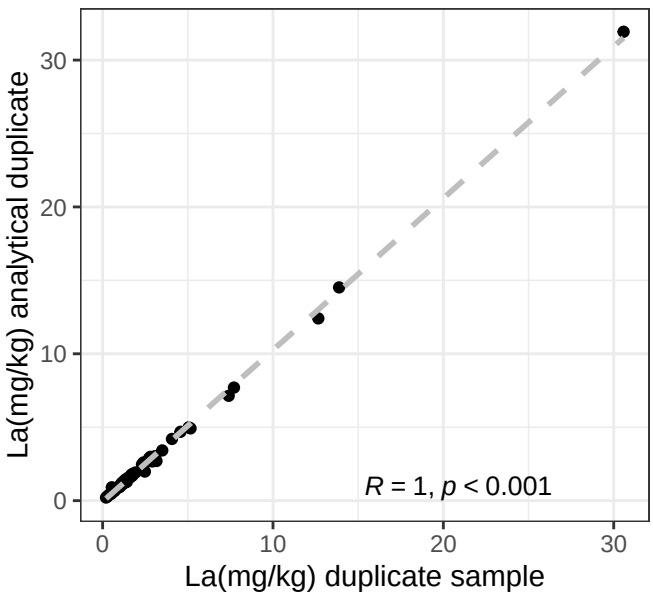

V(mg/kg) analytical duplicate
V(mg/kg) duplicate sample
R = 0.99, p < 0.001

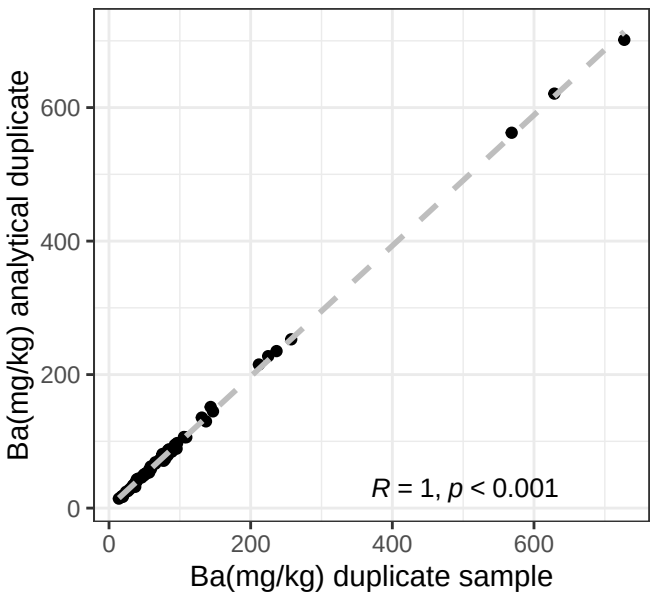

Ca(mg/kg) analytical duplicate
Ca(mg/kg) duplicate sample
R = 1, p < 0.001

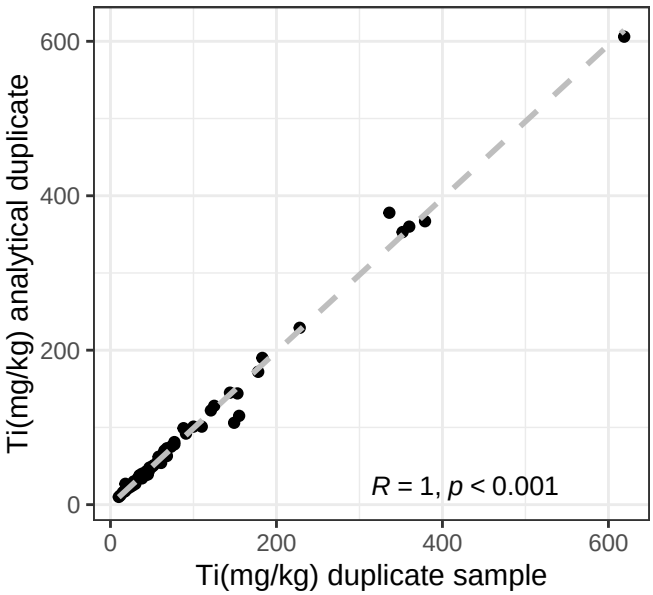

Cr(mg/kg) analytical duplicate
Cr(mg/kg) duplicate sample
R = 0.99, p < 0.001

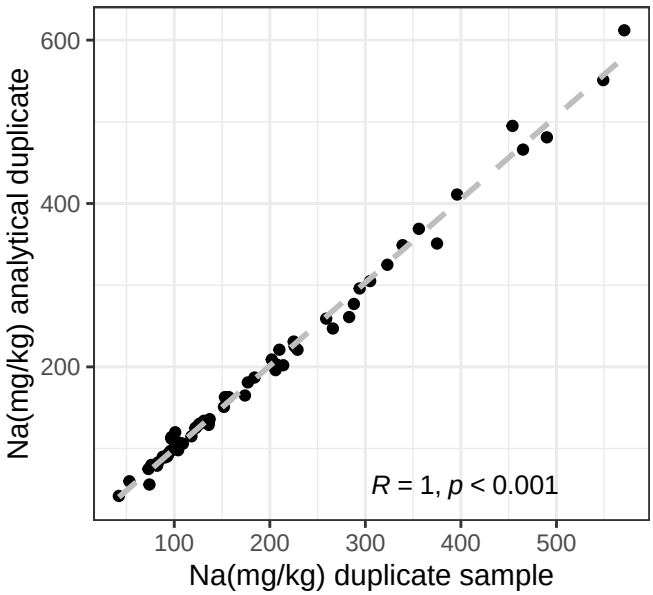

P(mg/kg) analytical duplicate
P(mg/kg) duplicate sample
R = 0.99, p < 0.001

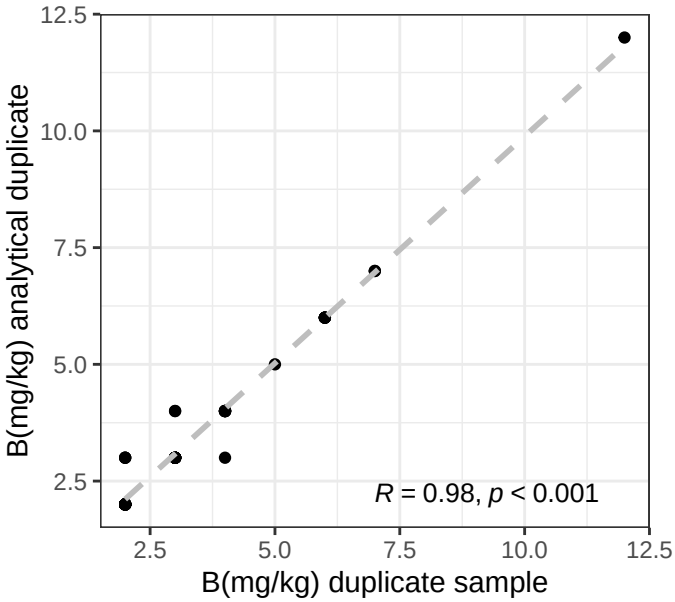

Mg(mg/kg) analytical duplicate
Mg(mg/kg) duplicate sample
R = 1, p < 0.001

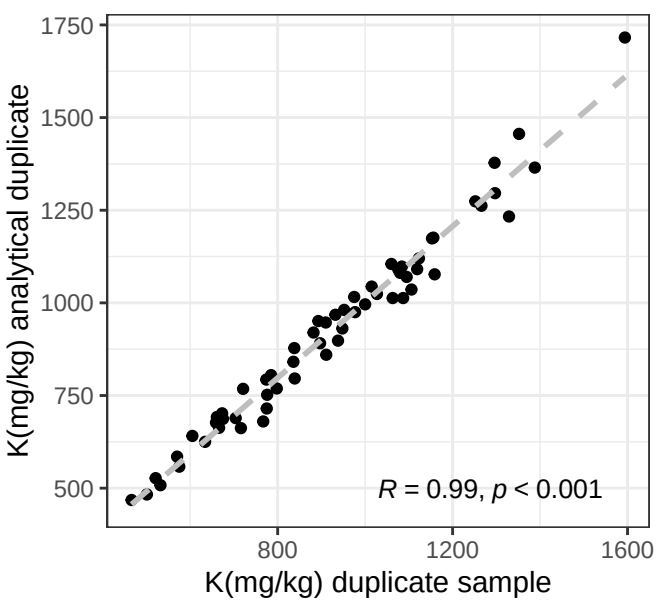

La(mg/kg) analytical duplicate
La(mg/kg) duplicate sample
R = 1, p < 0.001

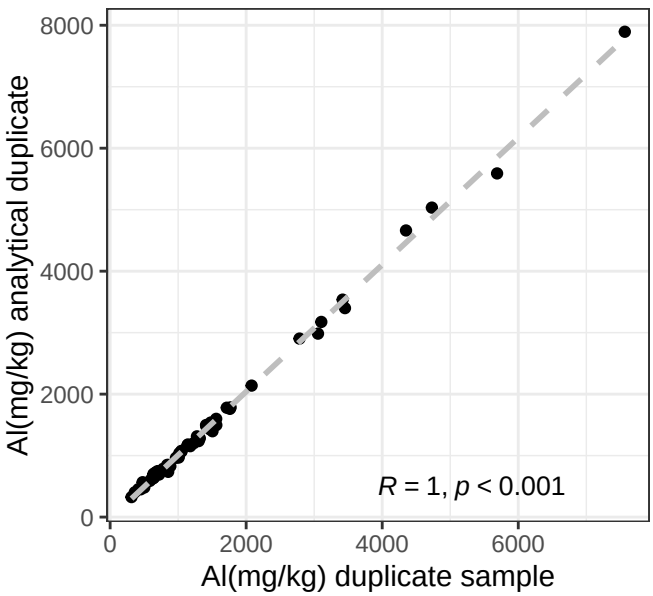

Ba(mg/kg) analytical duplicate
Ba(mg/kg) duplicate sample
R = 1, p < 0.001

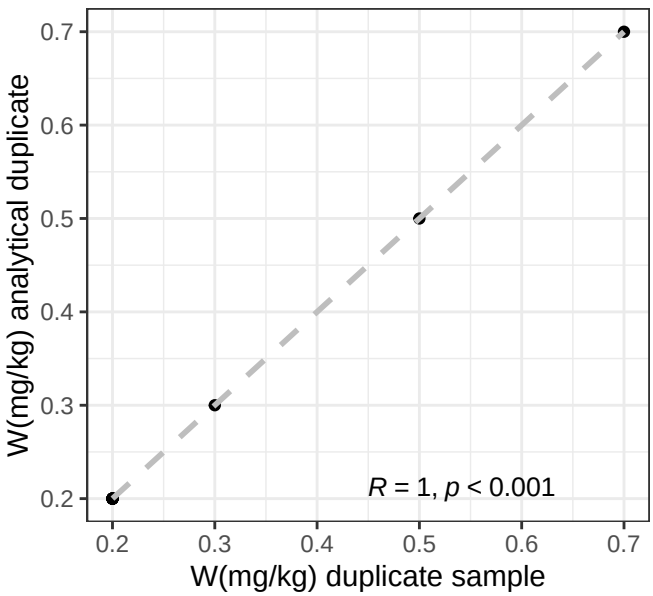

Ti(mg/kg) analytical duplicate
Ti(mg/kg) duplicate sample
R = 1, p < 0.001
0
200
400
600

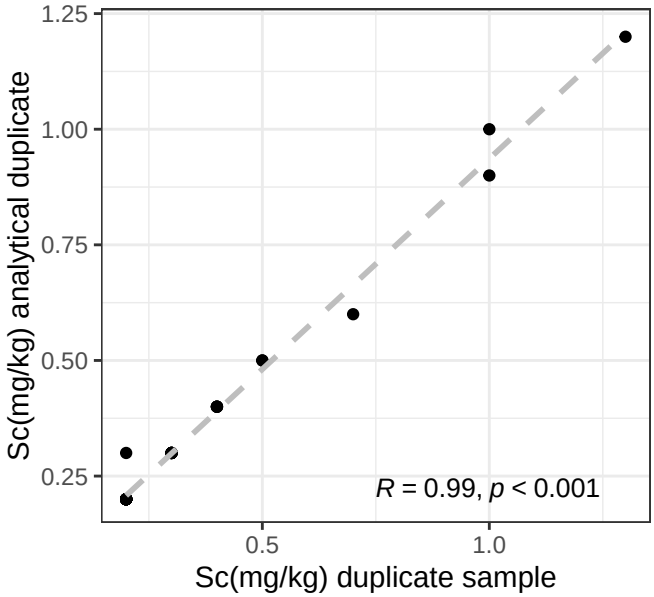

Na(mg/kg) analytical duplicate
Na(mg/kg) duplicate sample
R = 1, p < 0.001
100
200
300
400
500
600

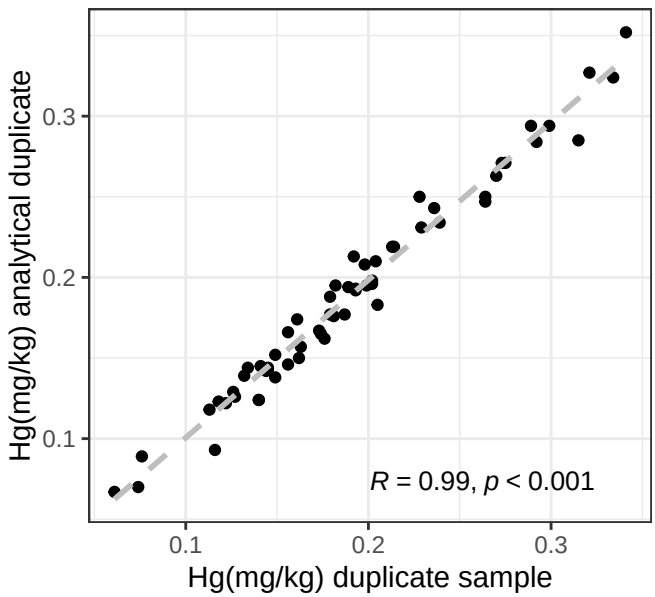

B(mg/kg) analytical duplicate
B(mg/kg) duplicate sample
R = 0.98, p < 0.001
2.5
5.0
7.5
10.0
12.5

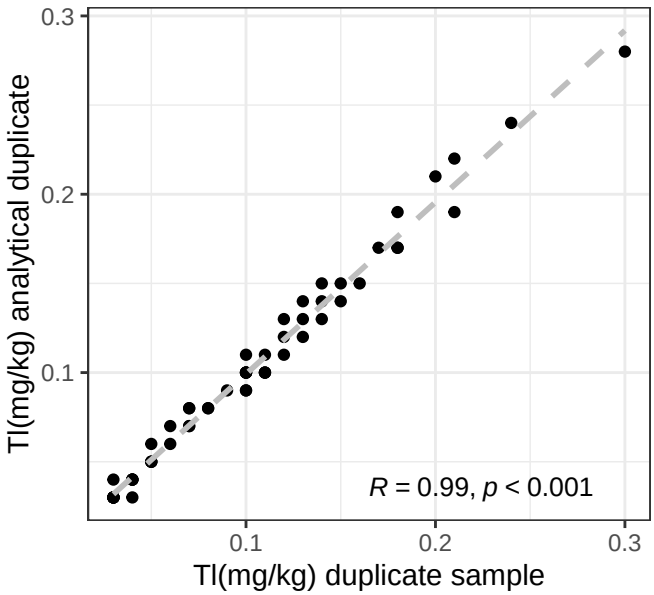

K(mg/kg) analytical duplicate
K(mg/kg) duplicate sample
R = 0.99, p < 0.001
500
750
1000
1250
1500
1750
800
1200
1600

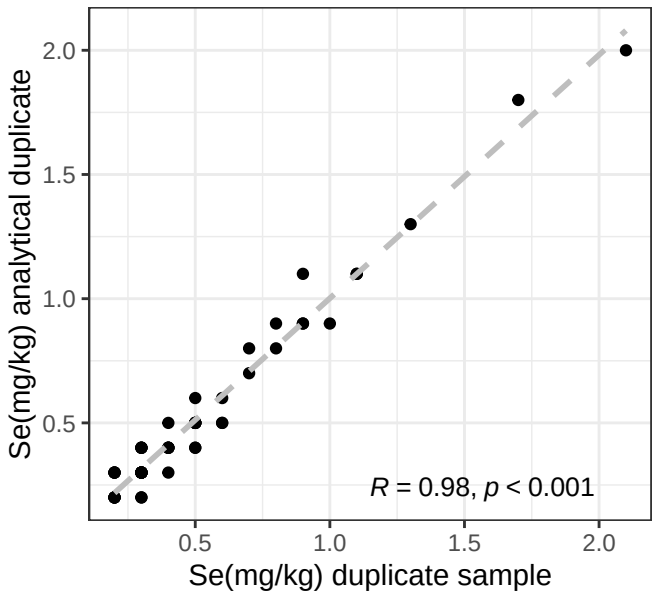

Al(mg/kg) analytical duplicate
Al(mg/kg) duplicate sample
R = 1, p < 0.001
0
2000
4000
6000
8000

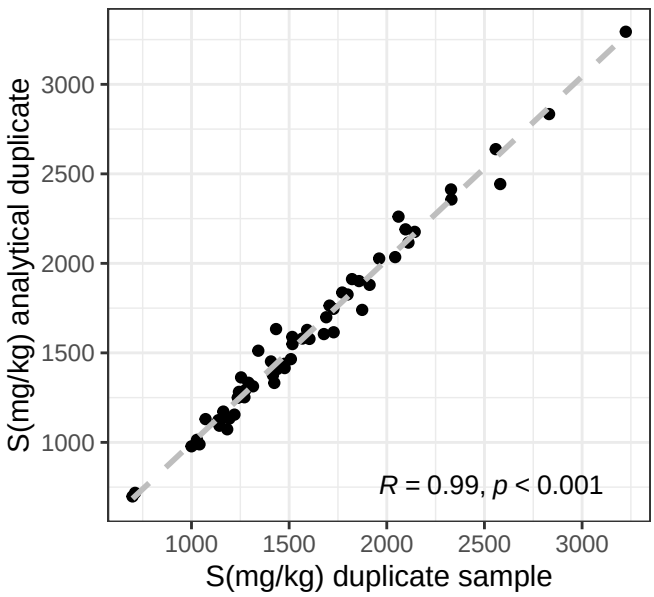

W(mg/kg) analytical duplicate
W(mg/kg) duplicate sample
R = 1, p < 0.001
0.2
0.3
0.4
0.5
0.6
0.7

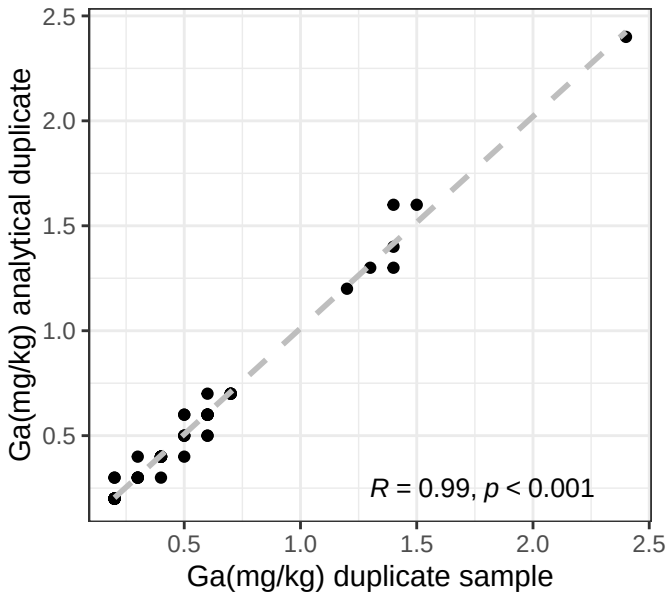

Sc(mg/kg) analytical duplicate
Sc(mg/kg) duplicate sample
R = 0.99, p < 0.001

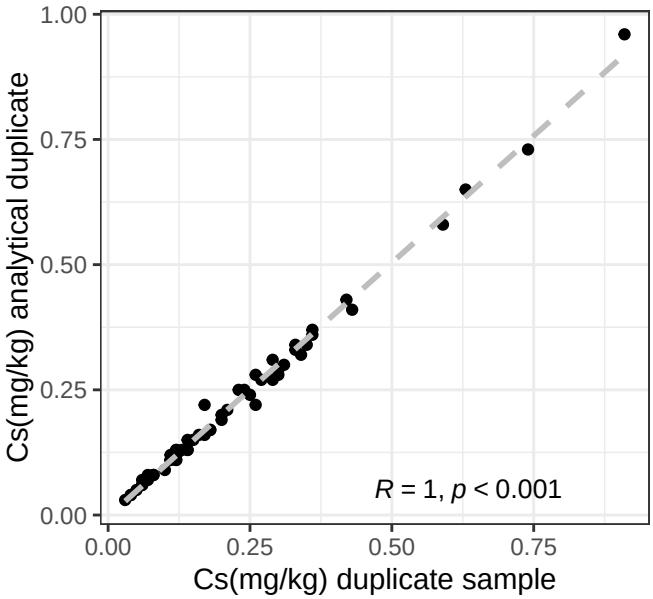

Hg(mg/kg) analytical duplicate
Hg(mg/kg) duplicate sample
R = 0.99, p < 0.001

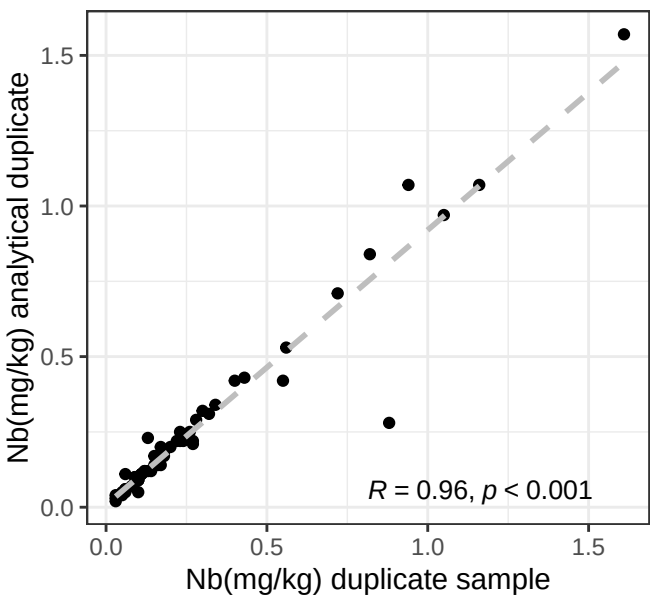

Tl(mg/kg) analytical duplicate
Tl(mg/kg) duplicate sample
R = 0.99, p < 0.001

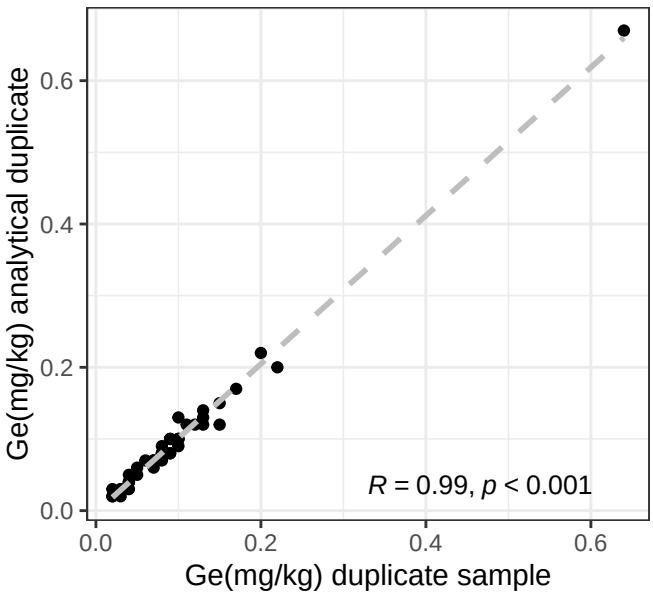

Se(mg/kg) analytical duplicate
Se(mg/kg) duplicate sample
R = 0.98, p < 0.001

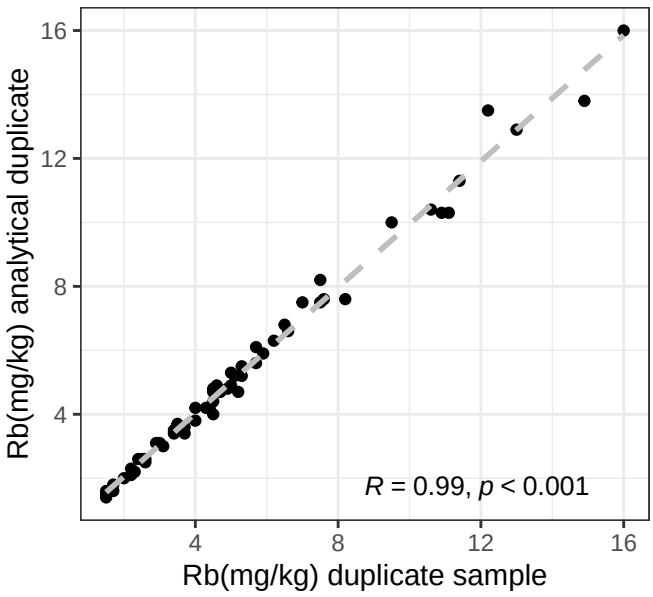

S(mg/kg) analytical duplicate
S(mg/kg) duplicate sample
R = 0.99, p < 0.001

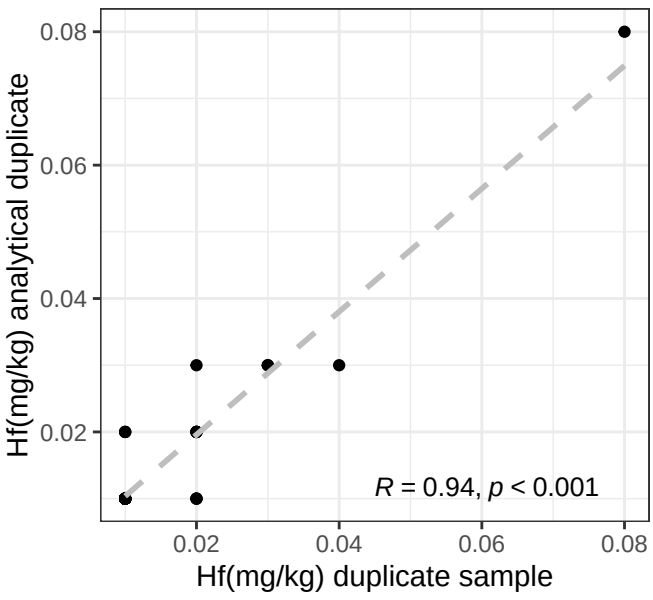

Ga(mg/kg) analytical duplicate
Ga(mg/kg) duplicate sample
R = 0.99, p < 0.001

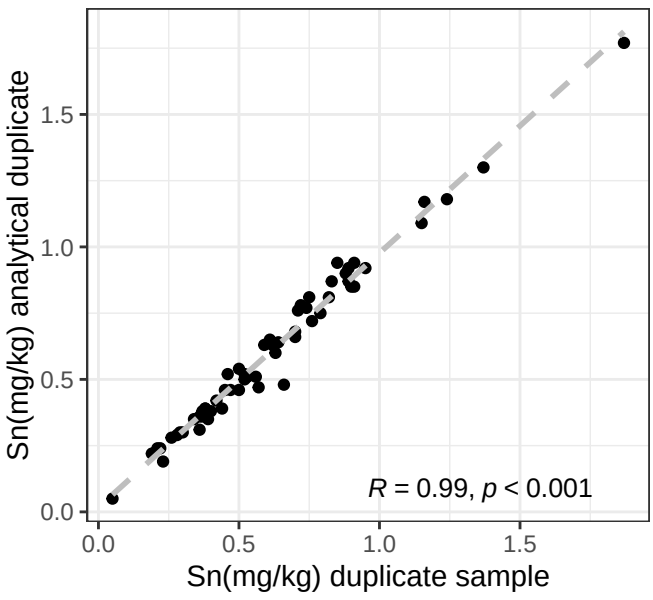

Cs(mg/kg) analytical duplicate
Cs(mg/kg) duplicate sample
R = 1, p < 0.001

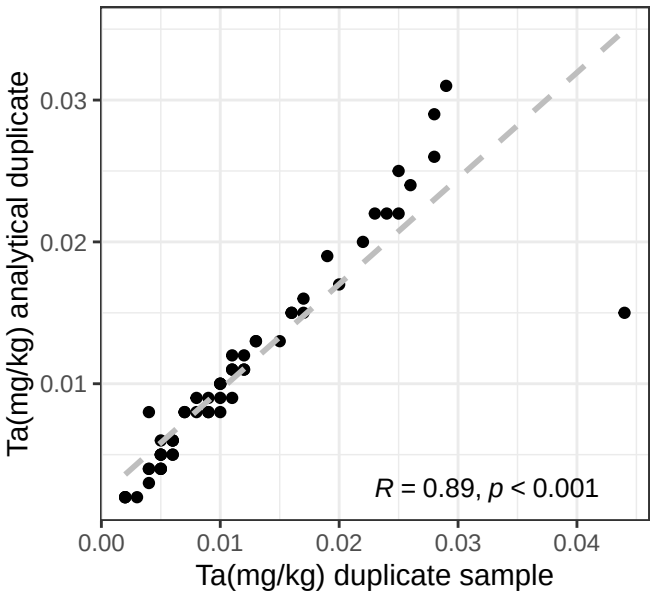

Nb(mg/kg) analytical duplicate
Nb(mg/kg) duplicate sample
R = 0.96, p < 0.001

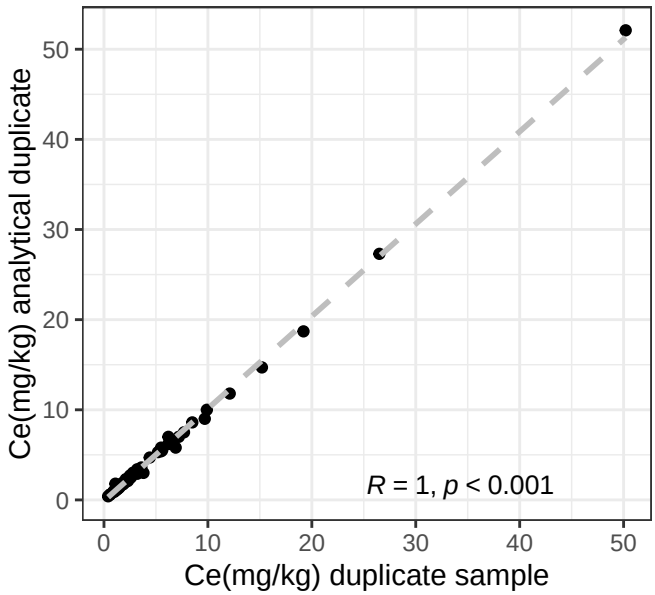

Ge(mg/kg) analytical duplicate
Ge(mg/kg) duplicate sample
R = 0.99, p < 0.001

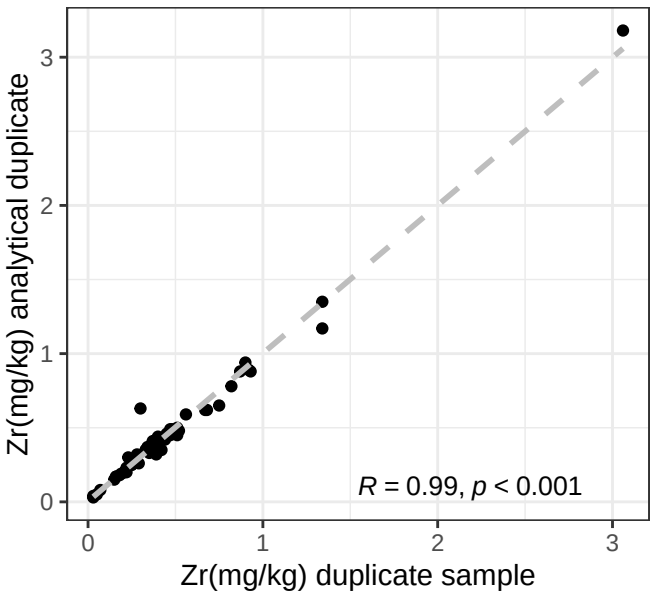

Rb(mg/kg) analytical duplicate
Rb(mg/kg) duplicate sample
R = 0.99, p < 0.001

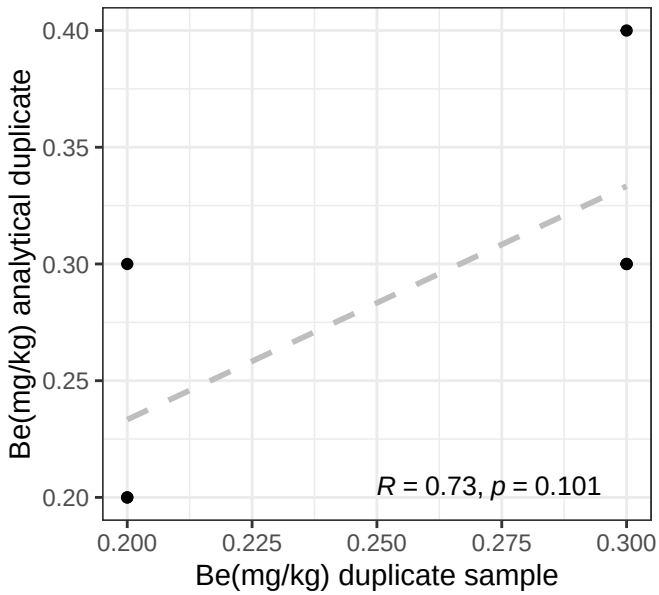

Hf(mg/kg) analytical duplicate
Hf(mg/kg) duplicate sample
R = 0.94, p < 0.001

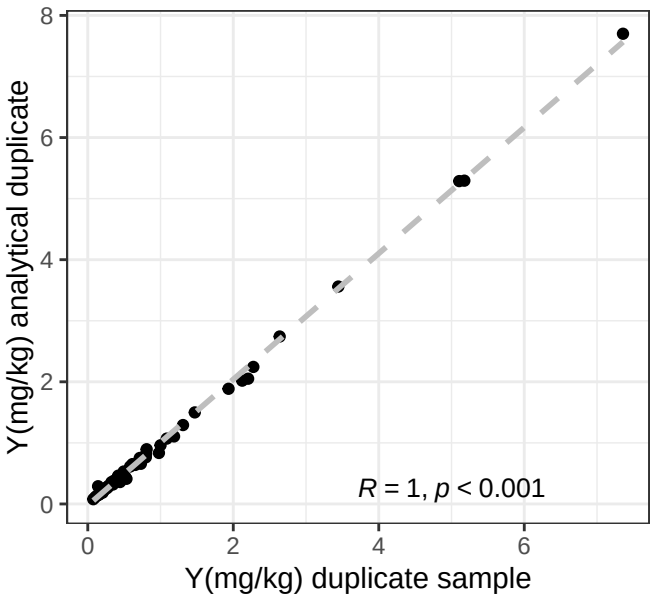

Sn(mg/kg) analytical duplicate
Sn(mg/kg) duplicate sample
R = 0.99, p < 0.001

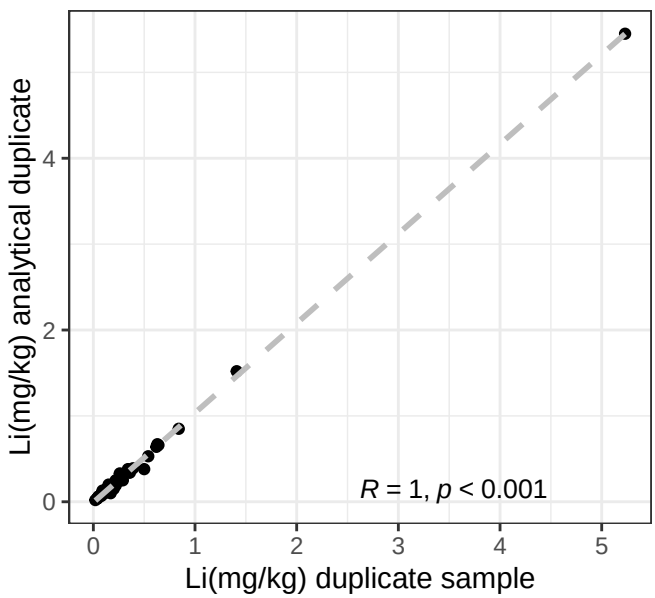

Ta(mg/kg) analytical duplicate
Ta(mg/kg) duplicate sample
R = 0.89, p < 0.001


Ce(mg/kg) analytical duplicate
Ce(mg/kg) duplicate sample
R = 1, p < 0.001


Zr(mg/kg) analytical duplicate
Zr(mg/kg) duplicate sample
R = 0.99, p < 0.001


Be(mg/kg) analytical duplicate
Be(mg/kg) duplicate sample
R = 0.73, p = 0.101


Y(mg/kg) analytical duplicate
Y(mg/kg) duplicate sample
R = 1, p < 0.001

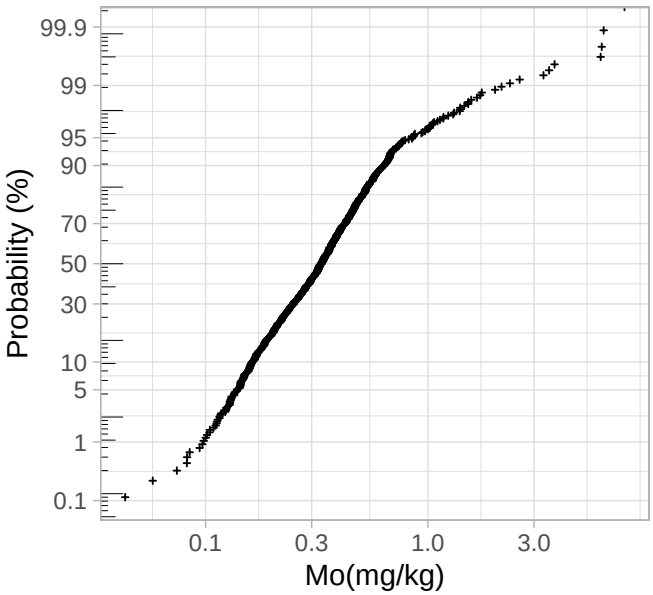

Li(mg/kg) analytical duplicate
Li(mg/kg) duplicate sample
R = 1, p < 0.001

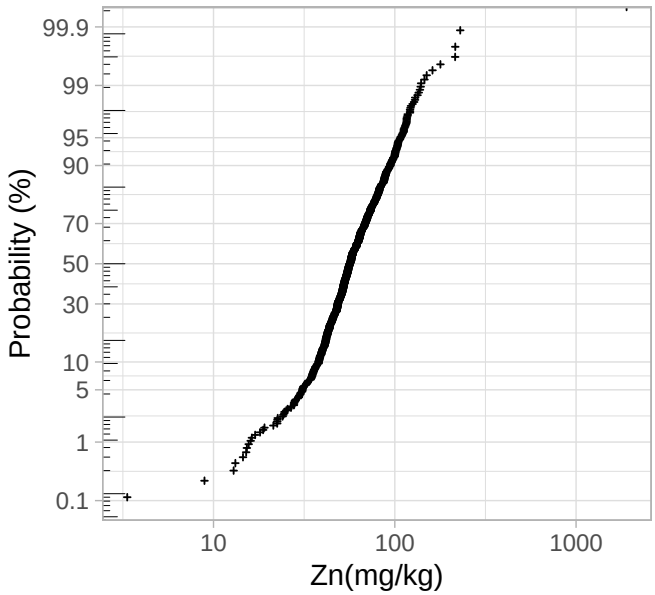
APPENDIX 6: ECDF-PLOTs Hedmark data

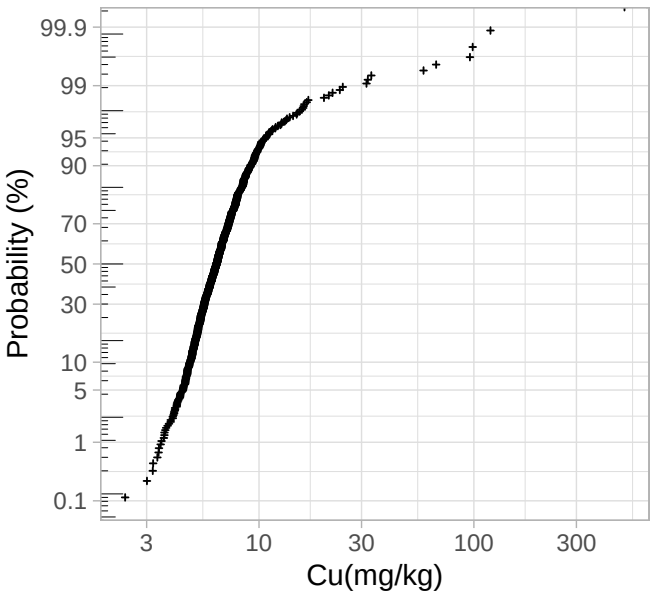
Plots of the empirical cumulative distribution function (ECDF-plots) for all 53 elements analysed.

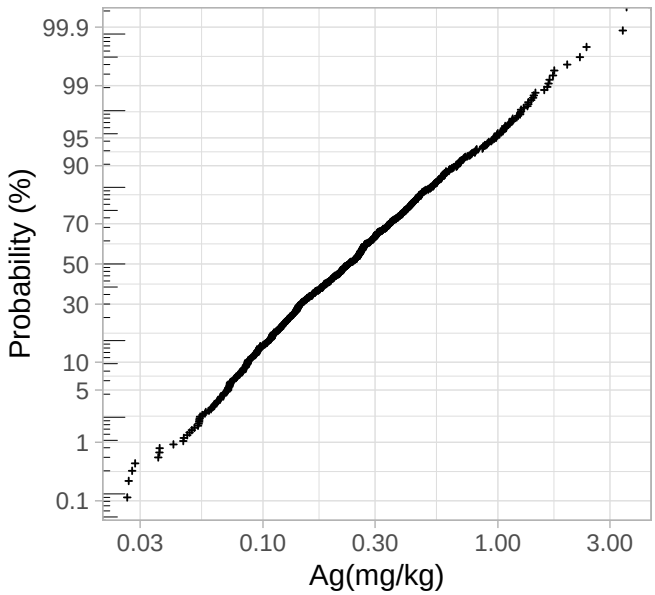
All laboratory readings are shown also for those below detection limit, negative reading is replaced by a low positive value (1×10^{-7}).

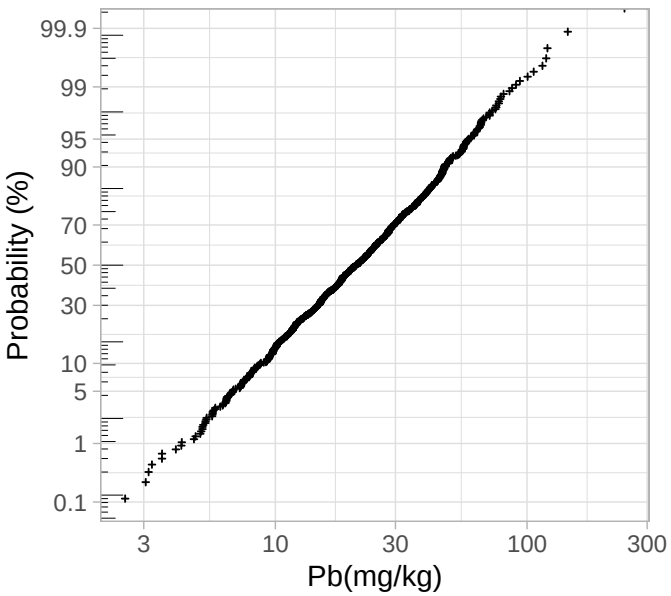
The laboratory detection limit (DL) is indicated by a red dotted line for selected elements which have data below or close to this value (DL).

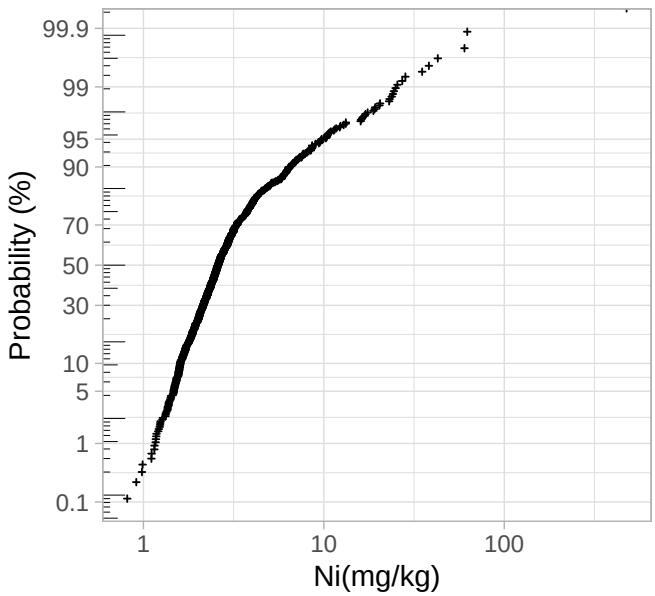

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
0.3
1.0
3.0
Mo(mg/kg)

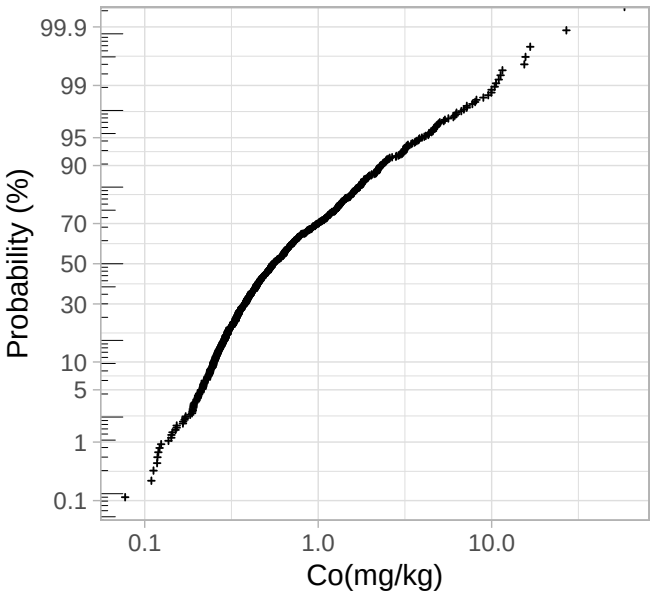

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
10
100
1000
Zn(mg/kg)

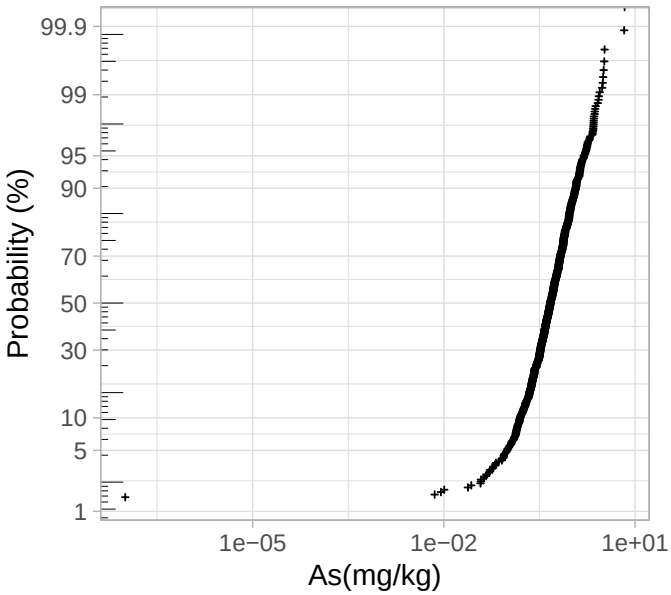

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
3
10
30
100
300
Cu(mg/kg)

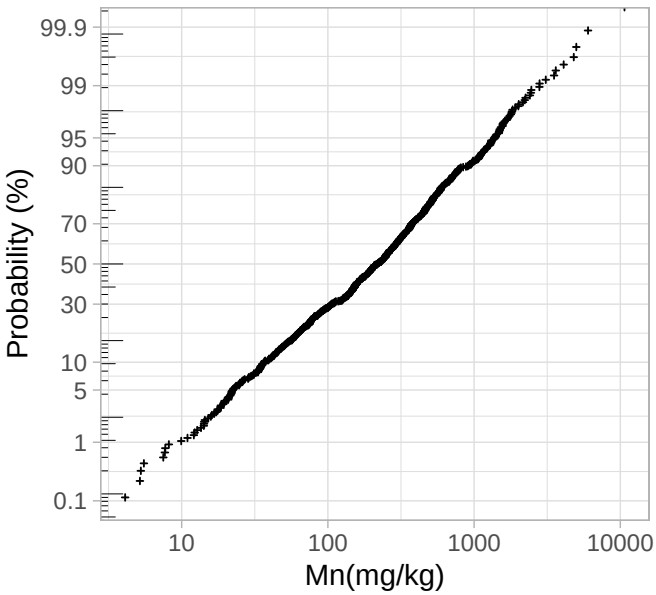

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.03
0.10
0.30
1.00
3.00
Ag(mg/kg)

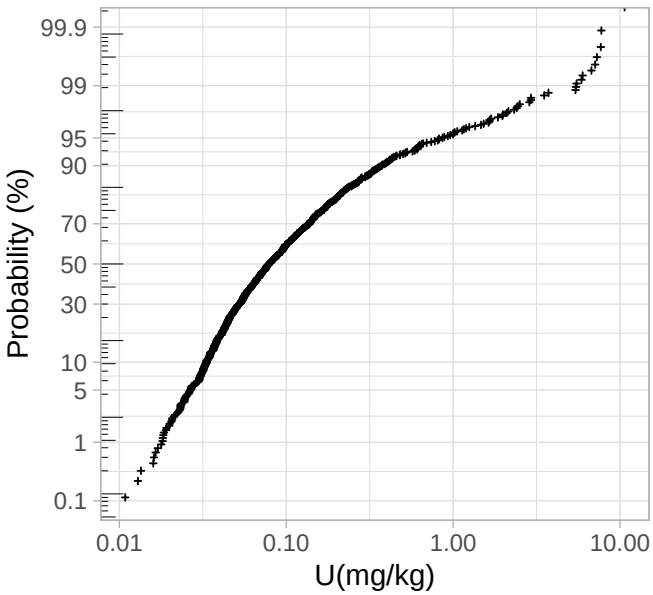

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
3
10
30
100
300
Pb(mg/kg)

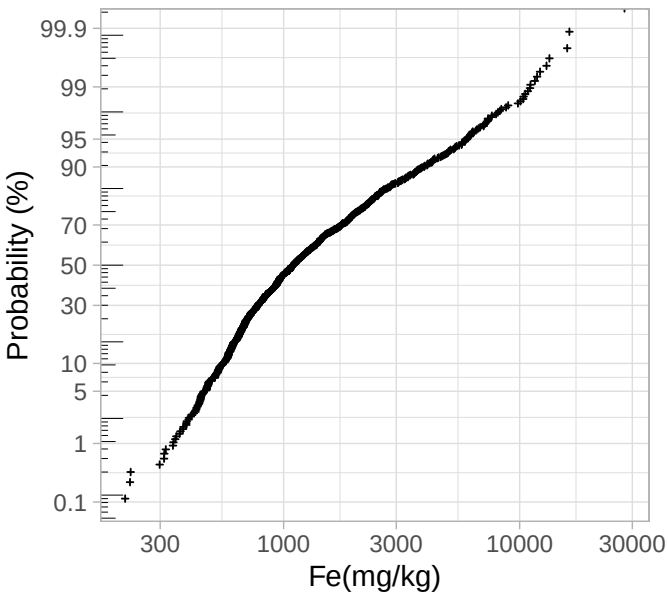

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
10
100
Ni(mg/kg)

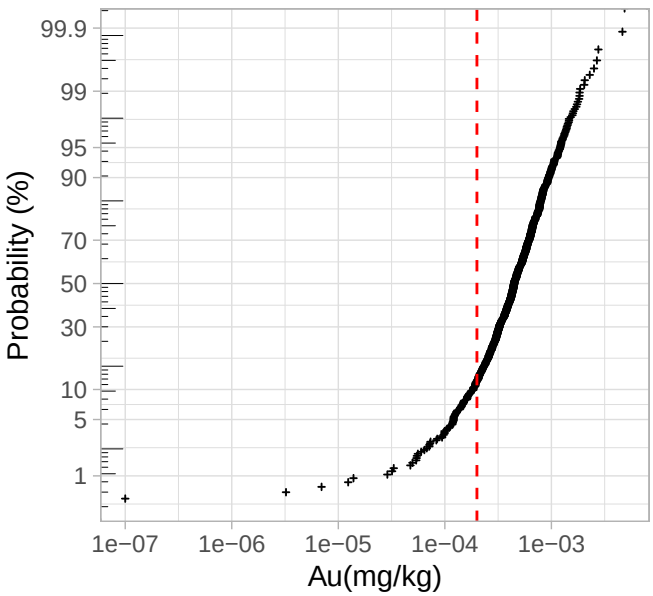

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
1.0
10.0
Co(mg/kg)

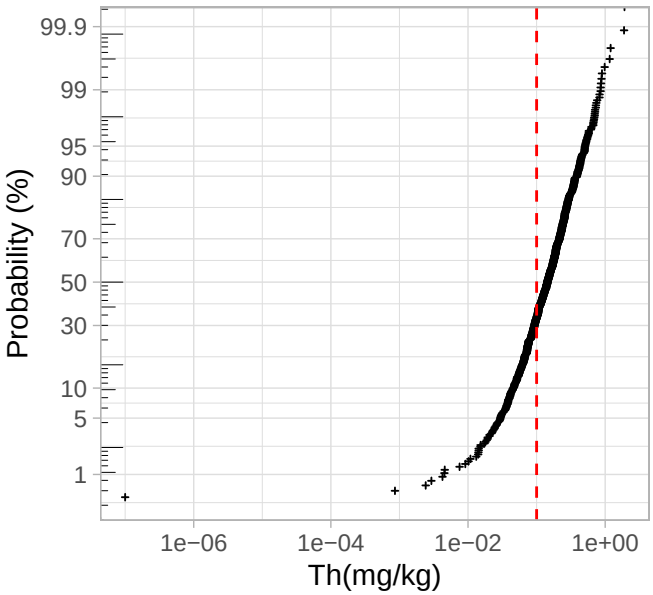

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
1e−05
1e−02
1e+01
As(mg/kg)

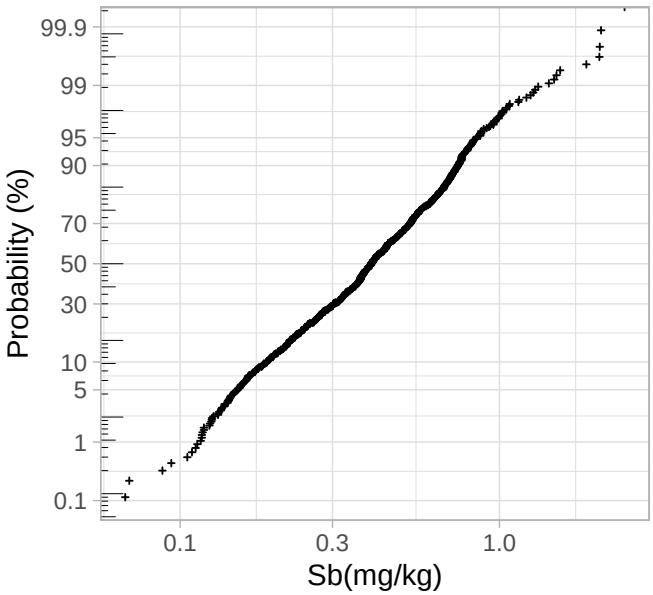

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
10
100
1000
10000
Mn(mg/kg)

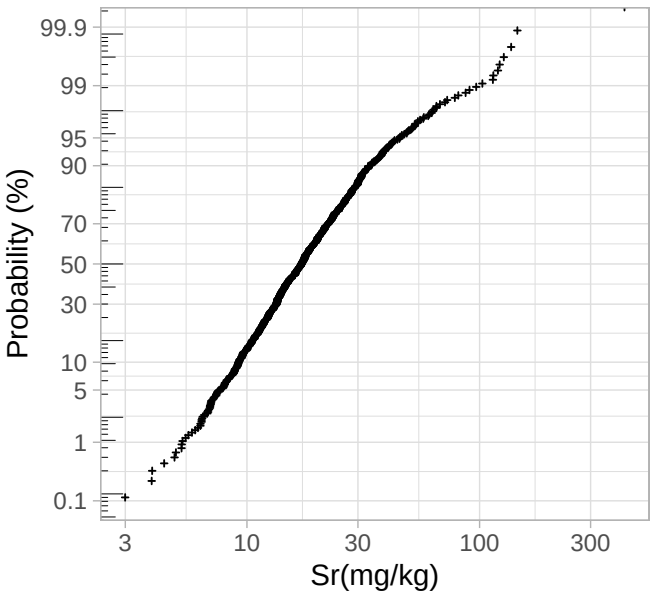

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.01
0.10
1.00
10.00
U(mg/kg)

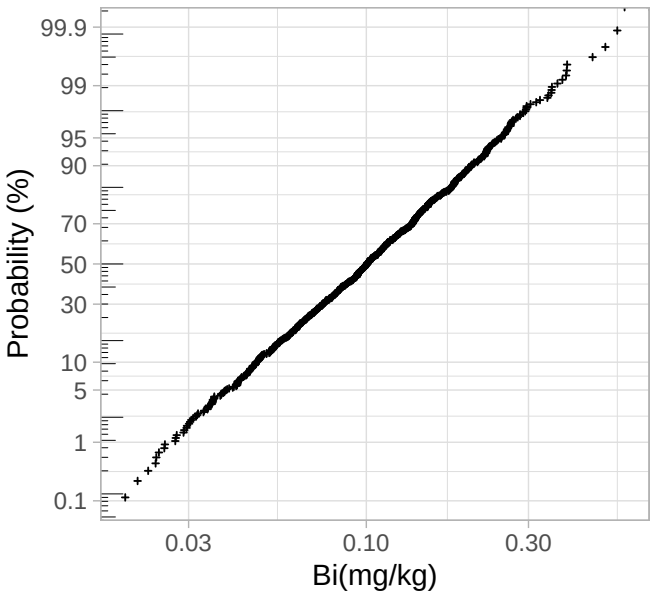

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
300
1000
3000
10000
30000
Fe(mg/kg)

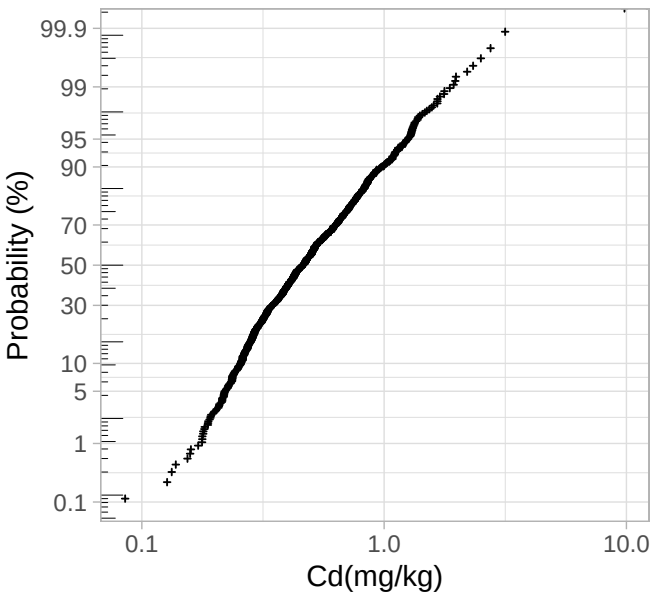

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
1e−07
1e−06
1e−05
1e−04
1e−03
Au(mg/kg)

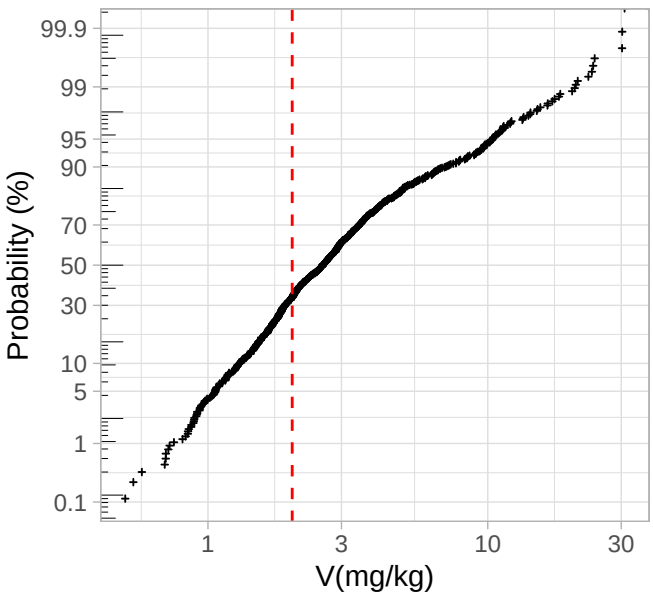

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
1e−06
1e−04
1e−02
1e+00
Th(mg/kg)

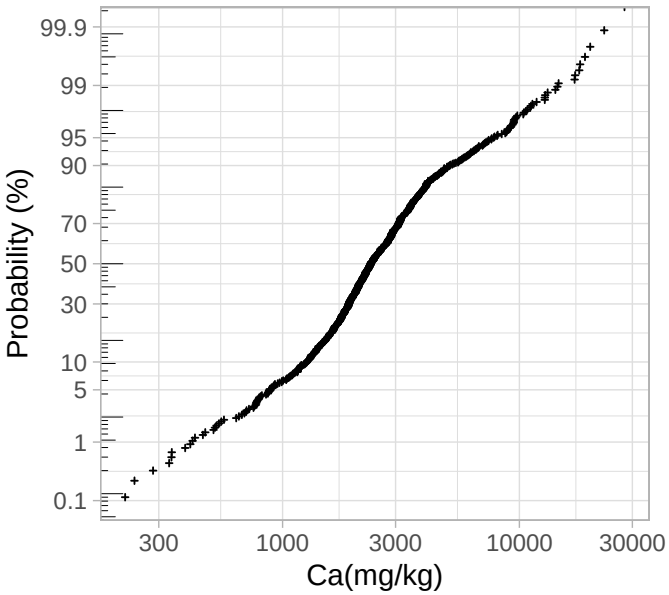

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
0.3
1.0
Sb(mg/kg)

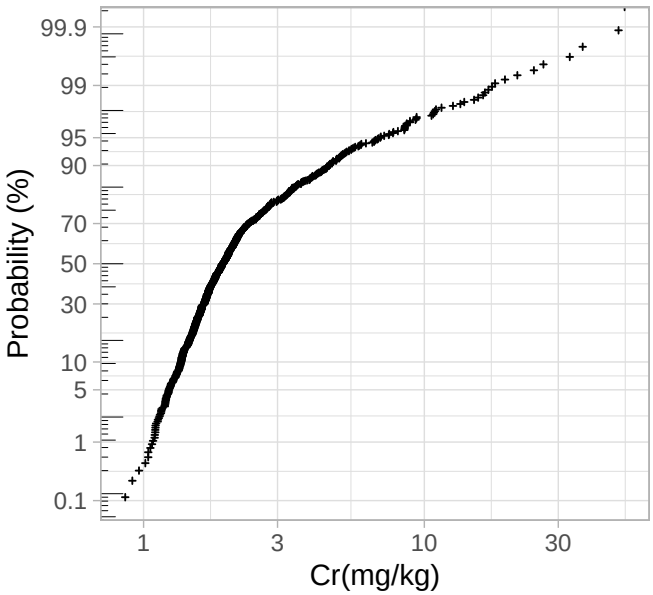

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
3
10
30
100
300
Sr(mg/kg)

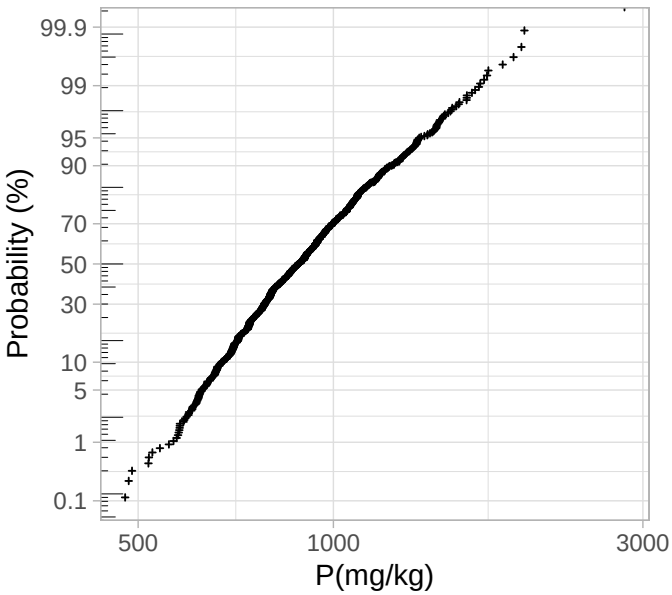

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.03
0.10
0.30
Bi(mg/kg)

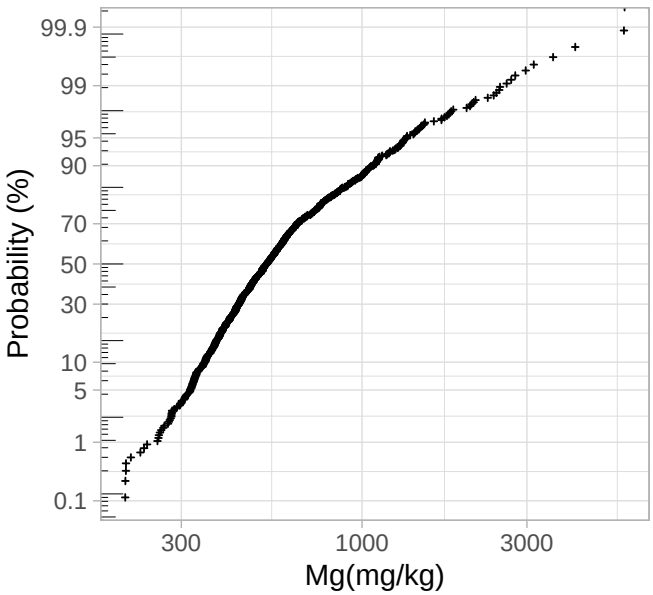

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
1.0
10.0
Cd(mg/kg)

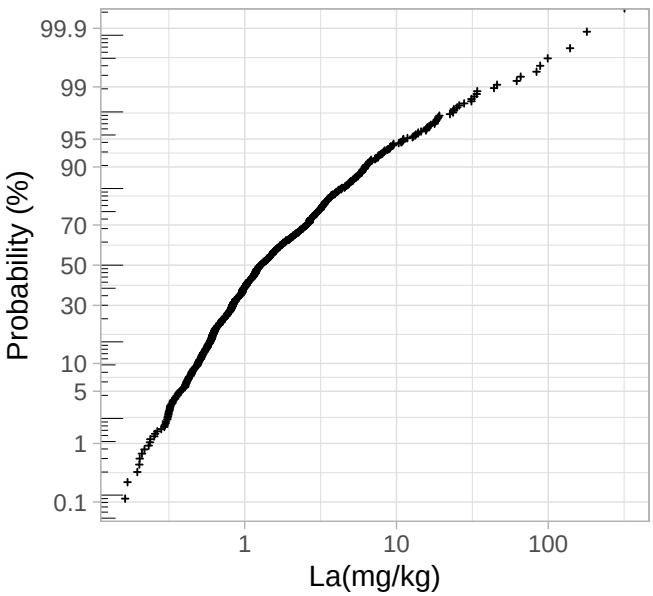

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
3
10
30
V(mg/kg)

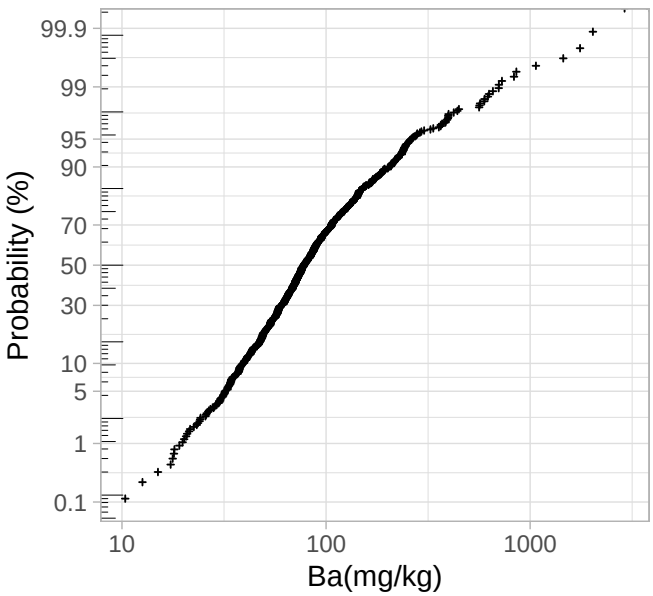

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
300
1000
3000
10000
30000
Ca(mg/kg)

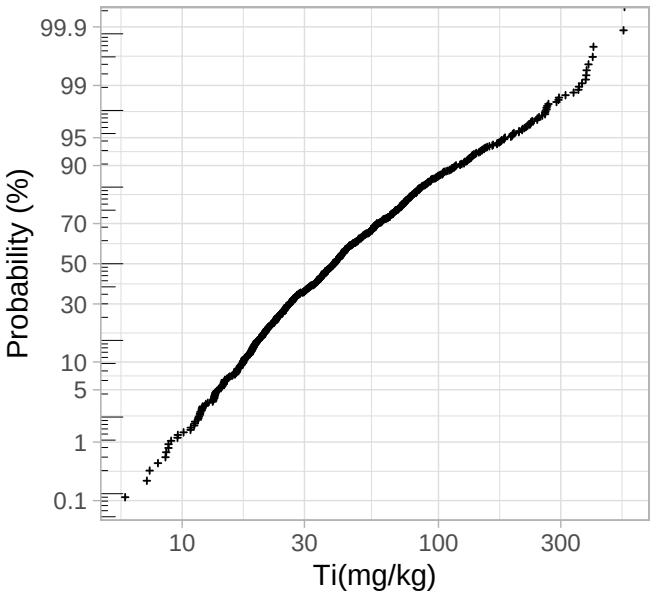

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
3
10
30
Cr(mg/kg)

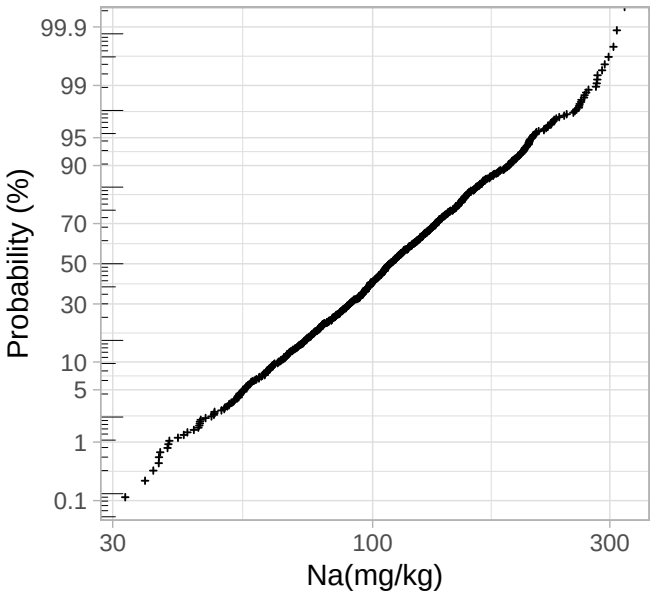

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
500
1000
3000
P(mg/kg)

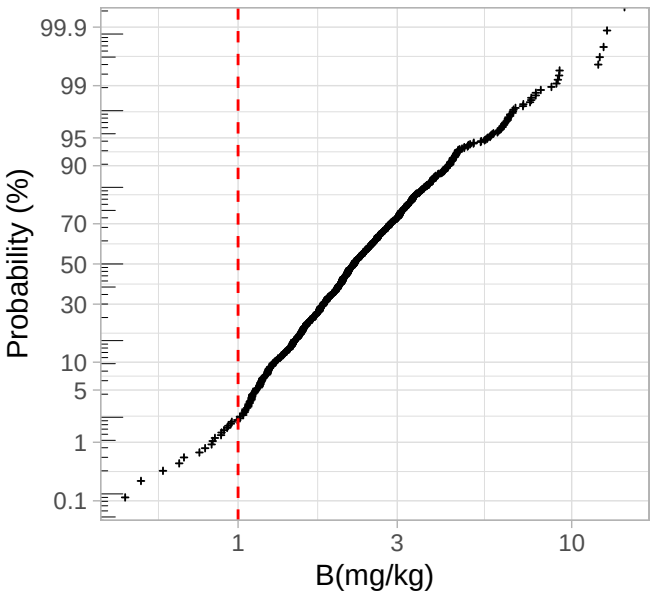

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
300
1000
3000
Mg(mg/kg)

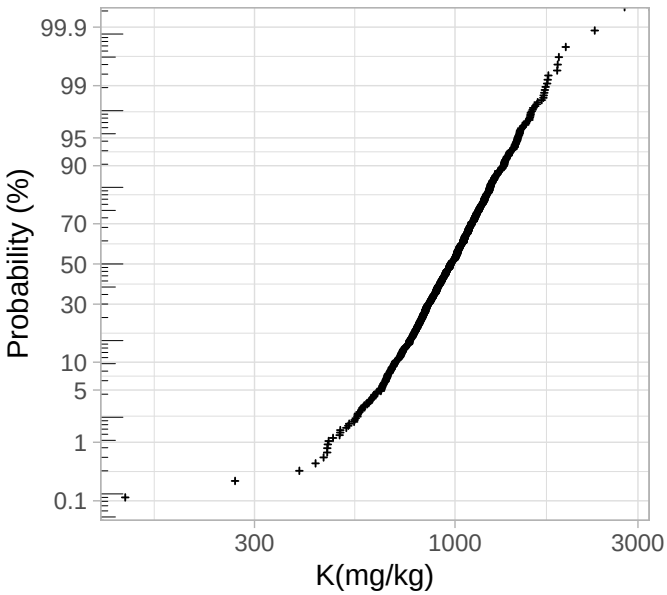

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
10
100
La(mg/kg)

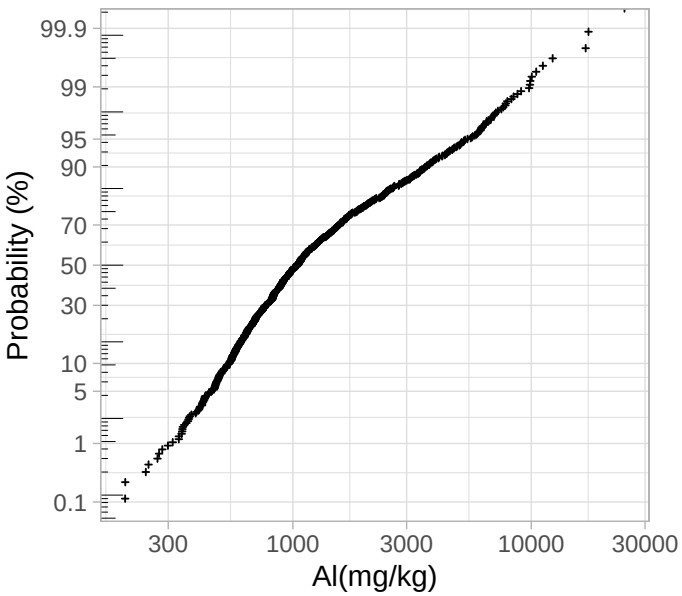

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
10
100
1000
Ba(mg/kg)

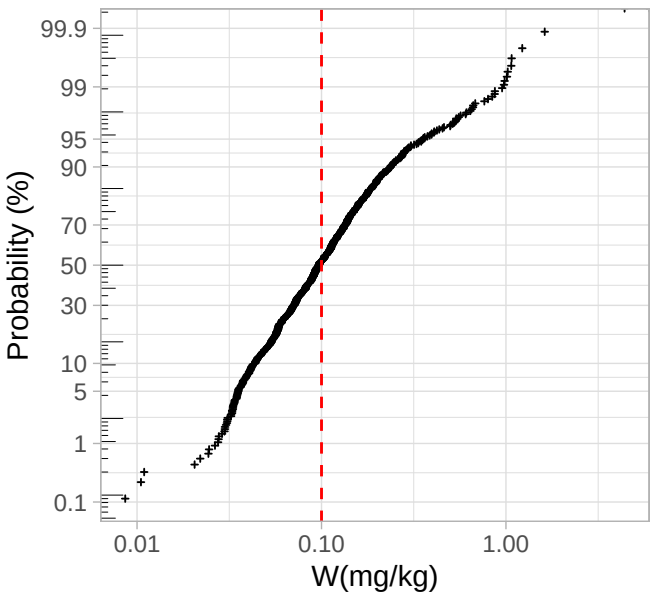

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
10
30
100
300
Ti(mg/kg)

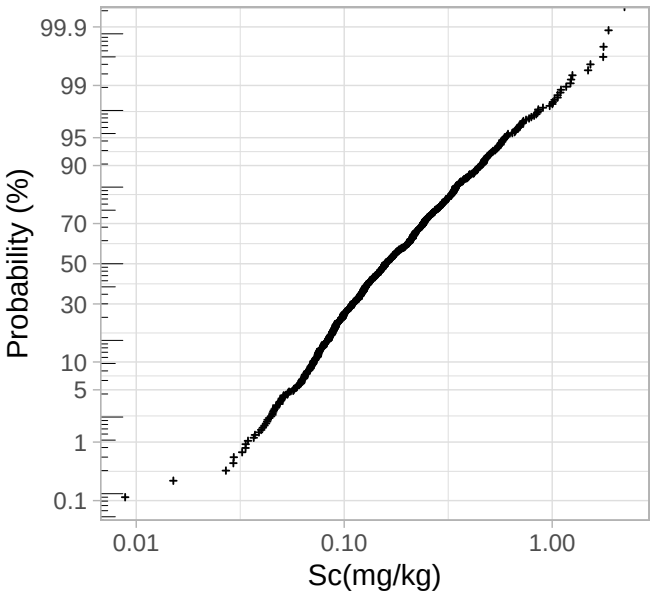

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
30
100
300
Na(mg/kg)

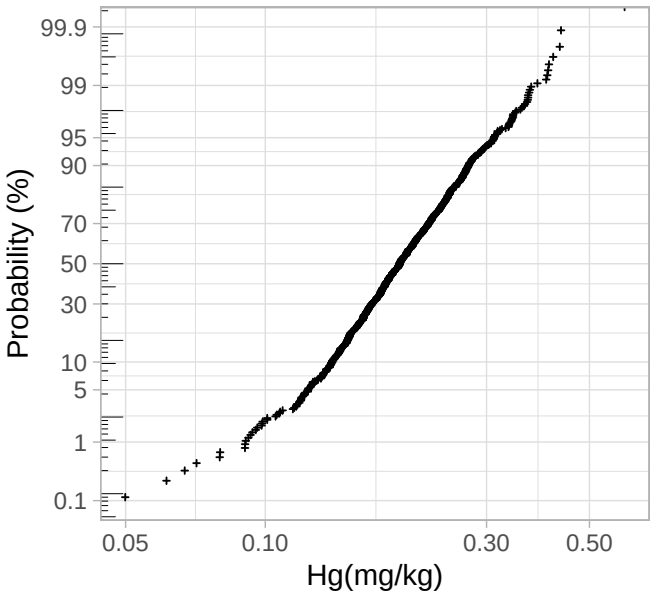

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
3
10
B(mg/kg)

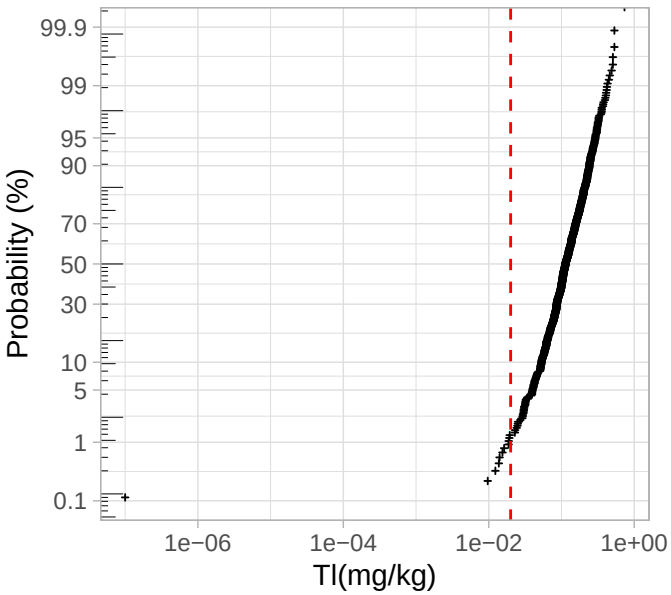

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
300
1000
3000
K(mg/kg)

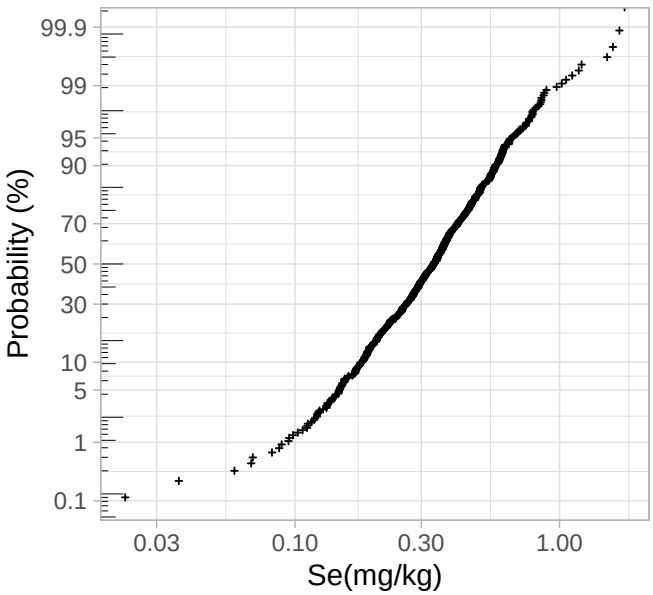

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
300
1000
3000
10000
30000
Al(mg/kg)

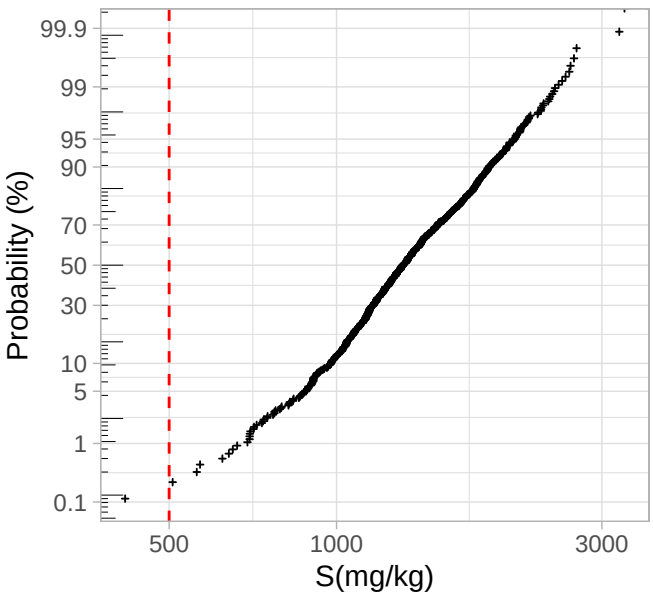

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.01
0.10
1.00
W(mg/kg)

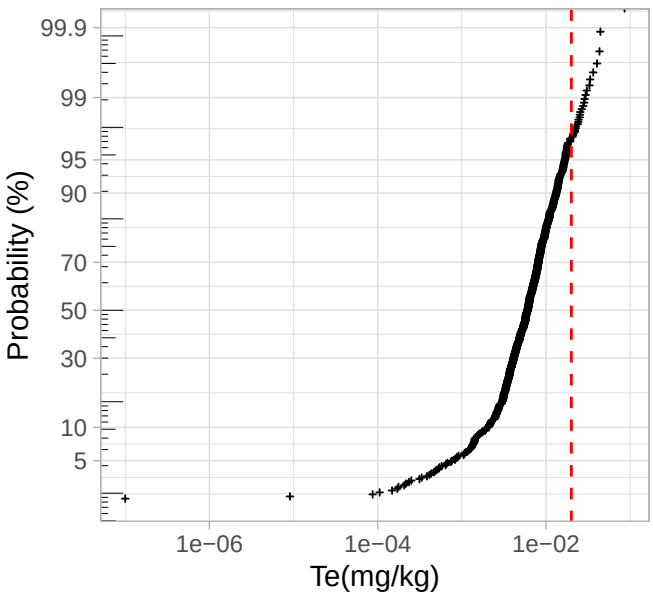

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.01
0.10
1.00
Sc(mg/kg)

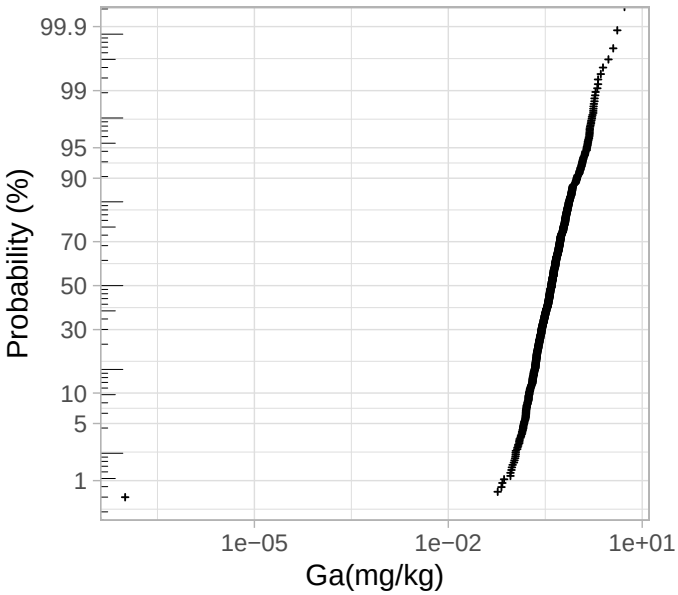

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.05
0.10
0.30
0.50
Hg(mg/kg)

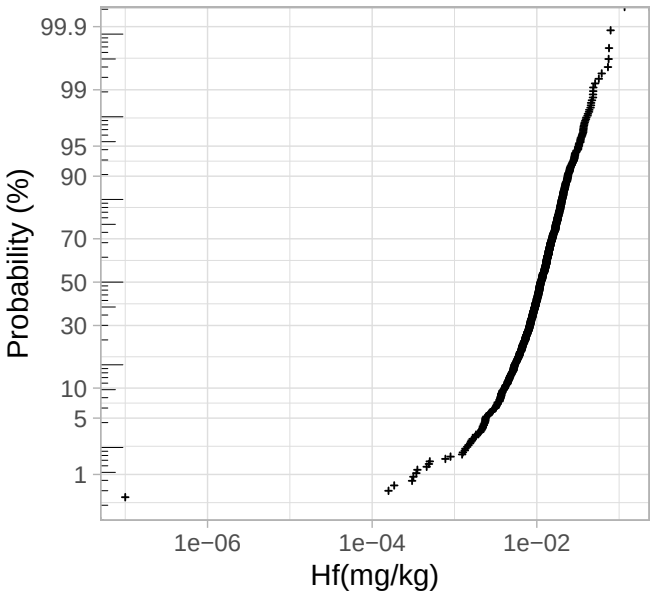

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1e−06
1e−04
1e−02
1e+00
Tl(mg/kg)

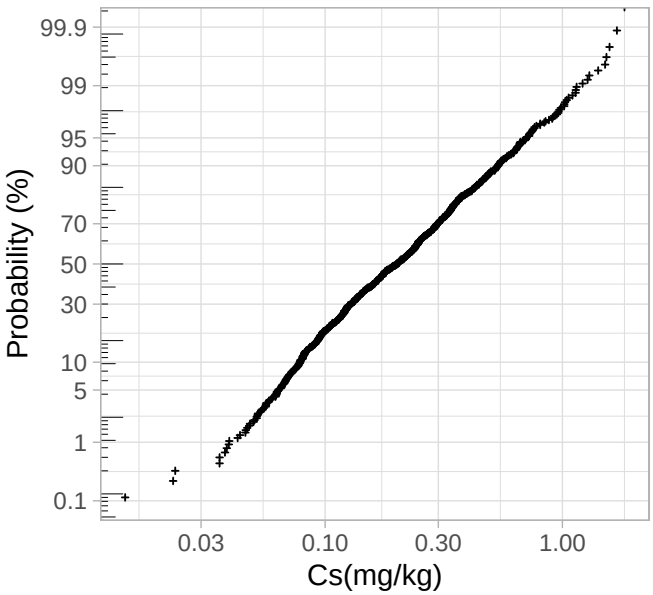

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.03
0.10
0.30
1.00
Se(mg/kg)

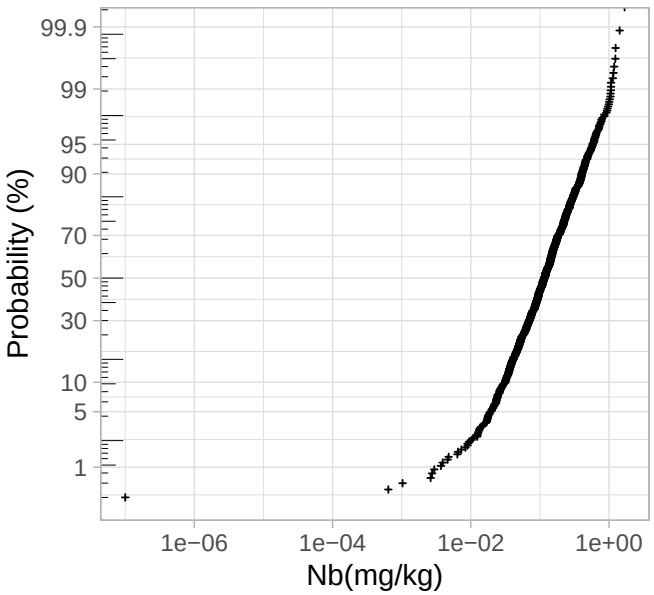

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
500
1000
3000
S(mg/kg)

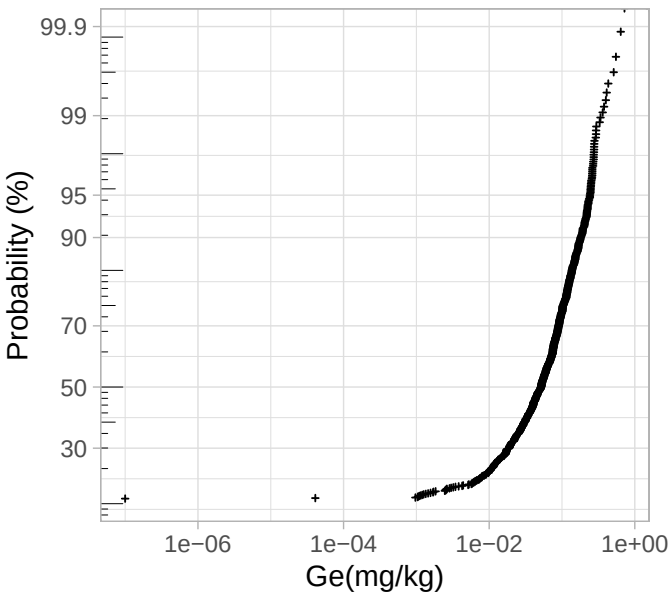

Probability (%)
99.9
99
95
90
70
50
30
10
5
1e−06
1e−04
1e−02
Te(mg/kg)

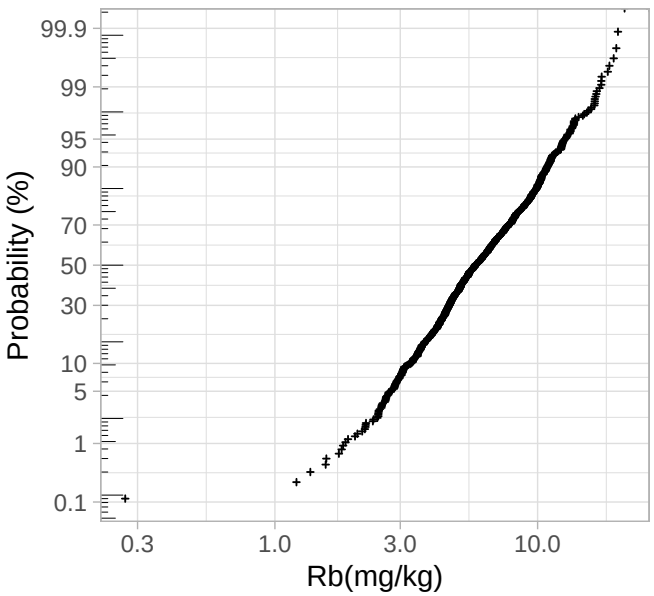

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
1e−05
1e−02
1e+01
Ga(mg/kg)

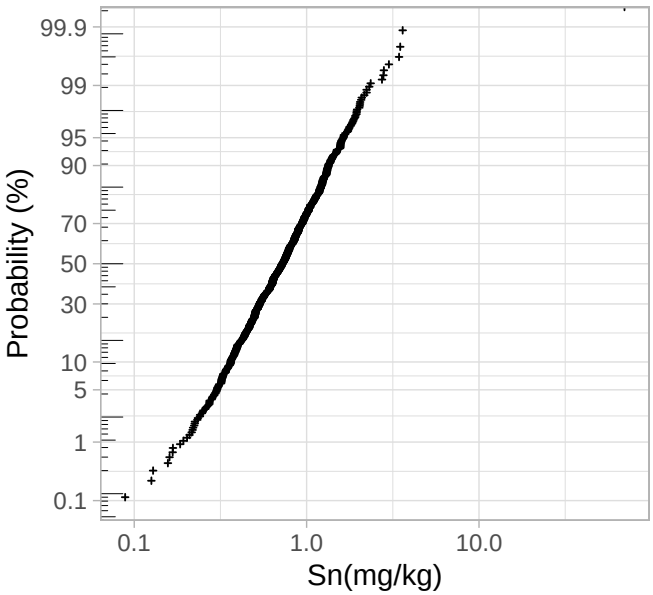

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
1e−06
1e−04
1e−02
Hf(mg/kg)

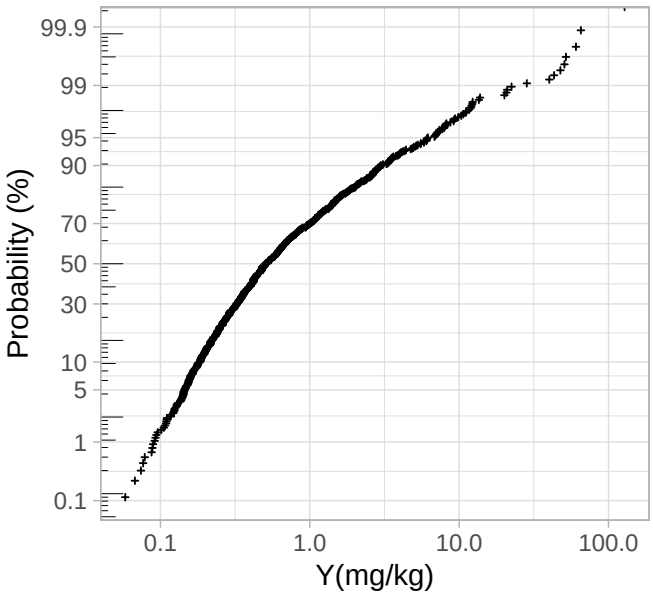

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.03
0.10
0.30
1.00
Cs(mg/kg)

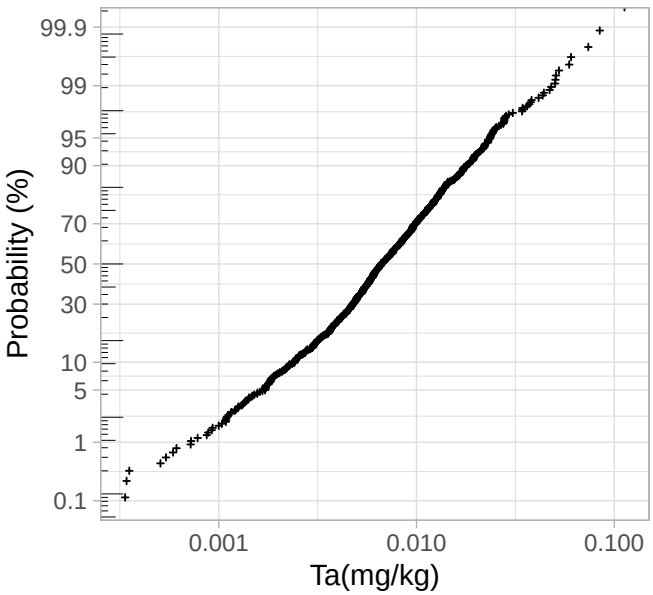

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
1e−06
1e−04
1e−02
1e+00
Nb(mg/kg)

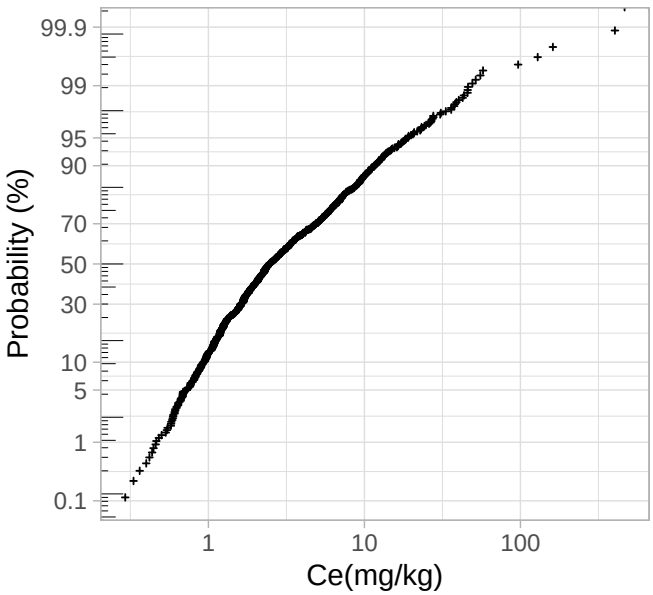

Probability (%)
99.9
99
95
90
70
50
30
1e−06
1e−04
1e−02
1e+00
Ge(mg/kg)

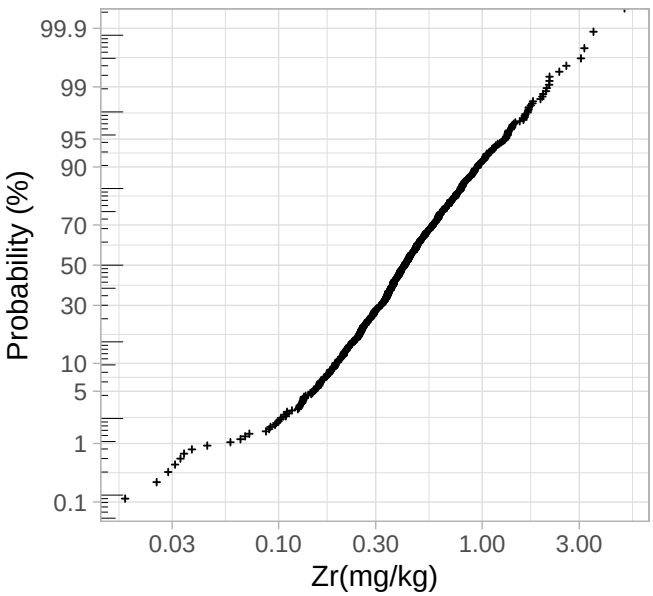

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.3
1.0
3.0
10.0
Rb(mg/kg)

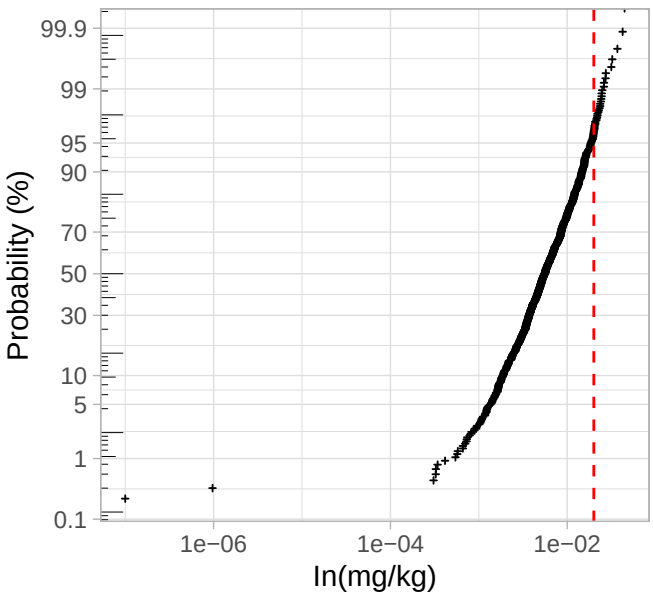

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
1.0
10.0
Sn(mg/kg)

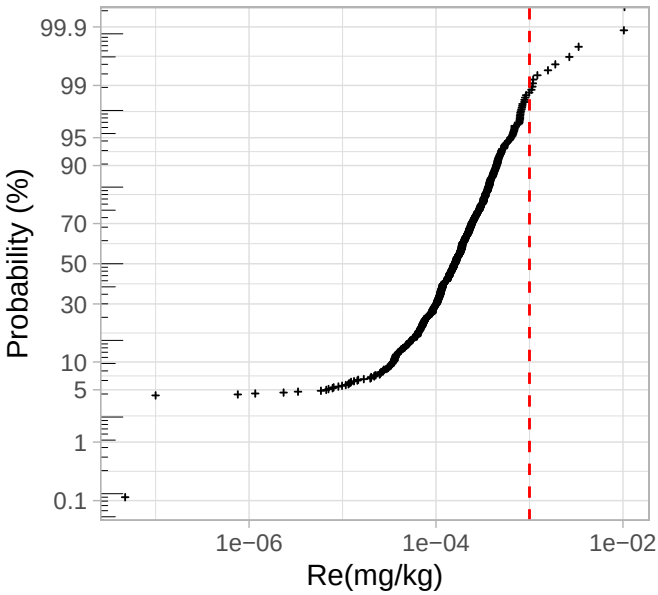

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
1.0
10.0
100.0
Y(mg/kg)

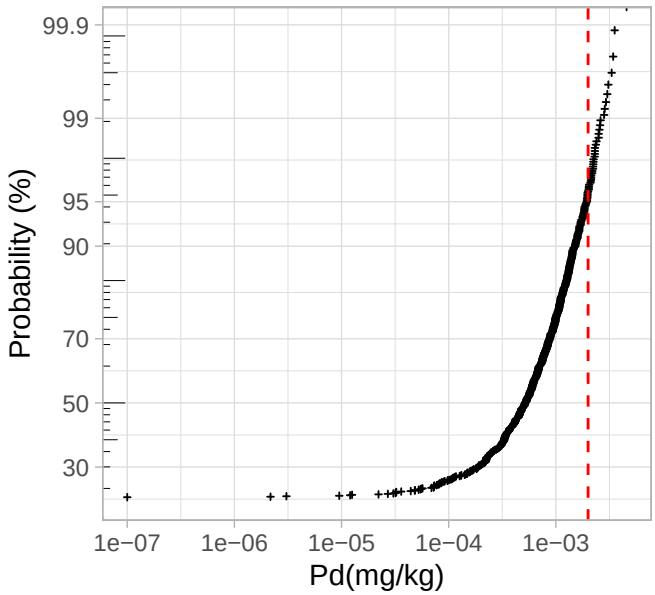

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.001
0.010
0.100
Ta(mg/kg)

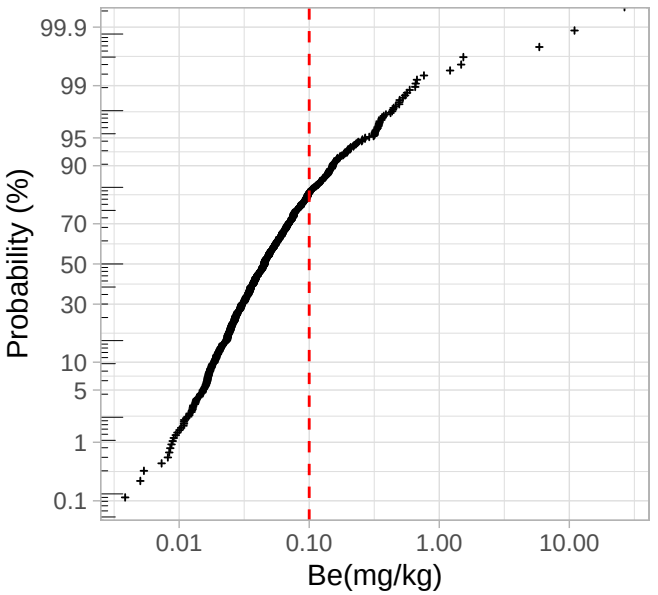

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
10
100
Ce(mg/kg)

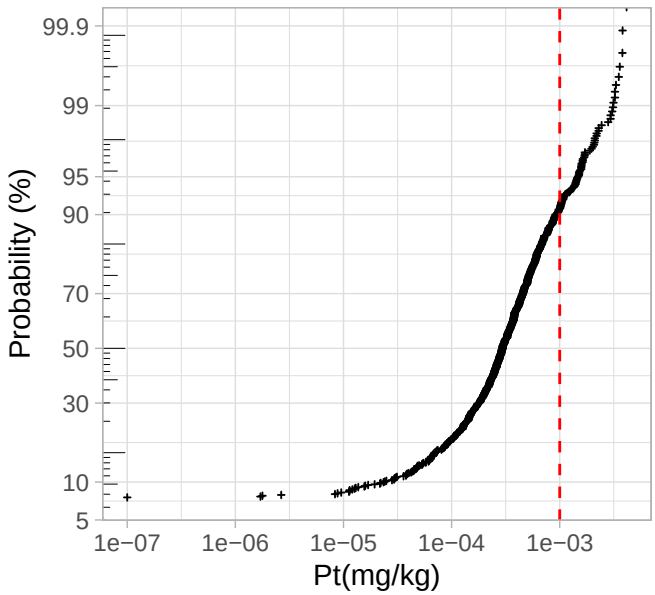

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.03
0.10
0.30
1.00
3.00
Zr(mg/kg)

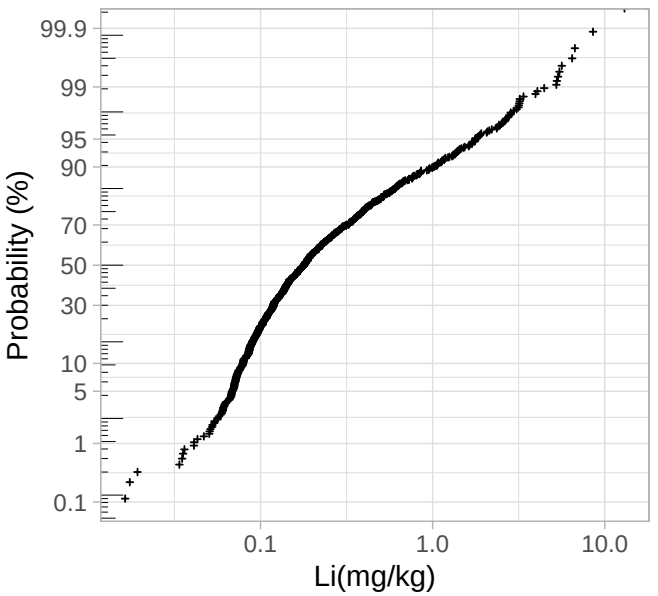

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1e−06
1e−04
1e−02
In(mg/kg)


Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1e−06
1e−04
1e−02
Re(mg/kg)


Probability (%)
99.9
99
95
90
70
50
30
1e−07
1e−06
1e−05
1e−04
1e−03
Pd(mg/kg)


Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.01
0.10
1.00
10.00
Be(mg/kg)


Probability (%)
99.9
99
95
90
70
50
30
10
5
1e−07
1e−06
1e−05
1e−04
1e−03
Pt(mg/kg)

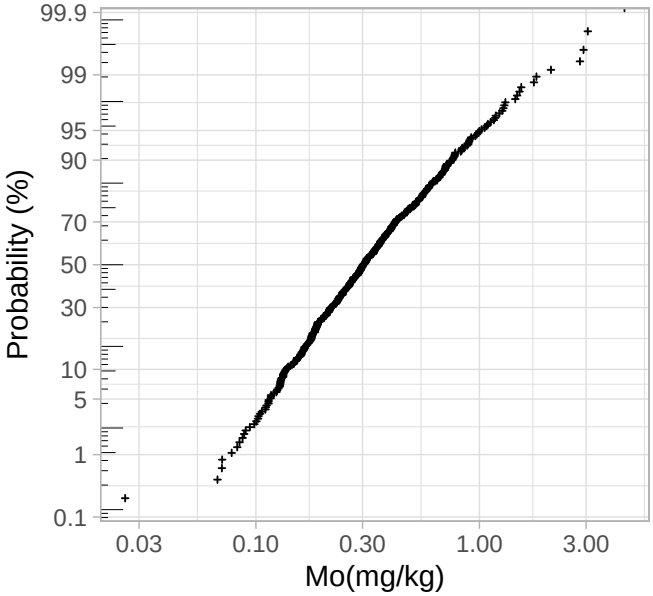

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
1.0
10.0
Li(mg/kg)

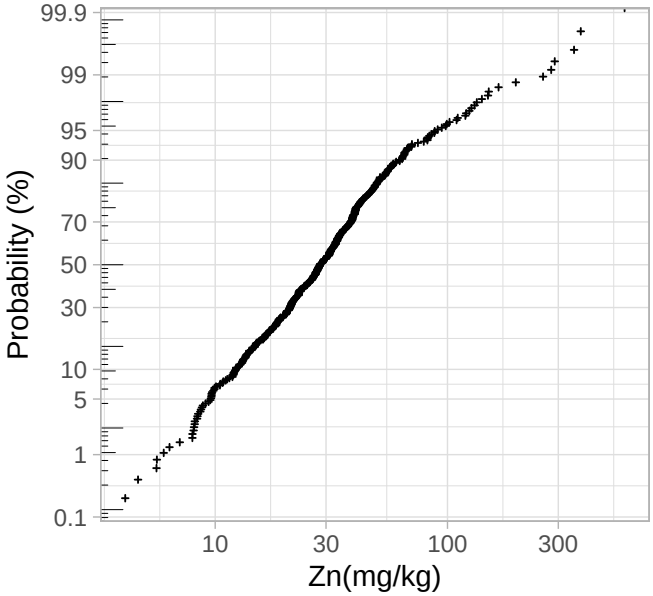
APPENDIX 7: ECDF-plots Møre and Romsdal data

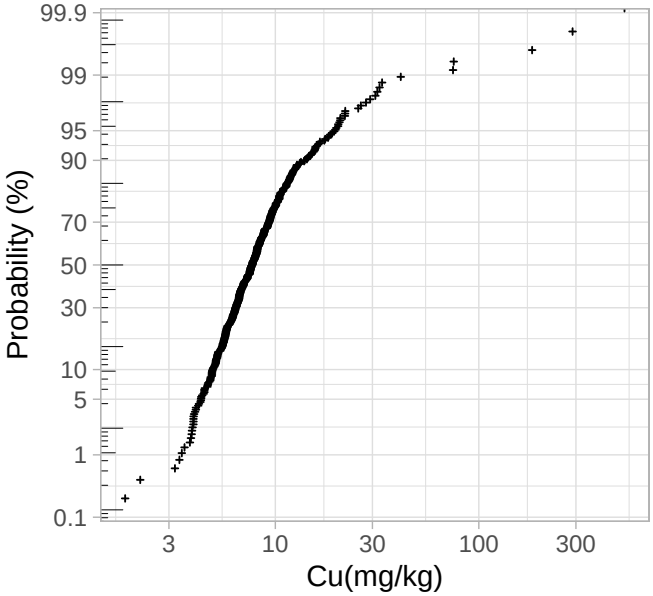
Plots of the empirical cumulative distribution function (ECDF-plots) for all 53 elements analysed.

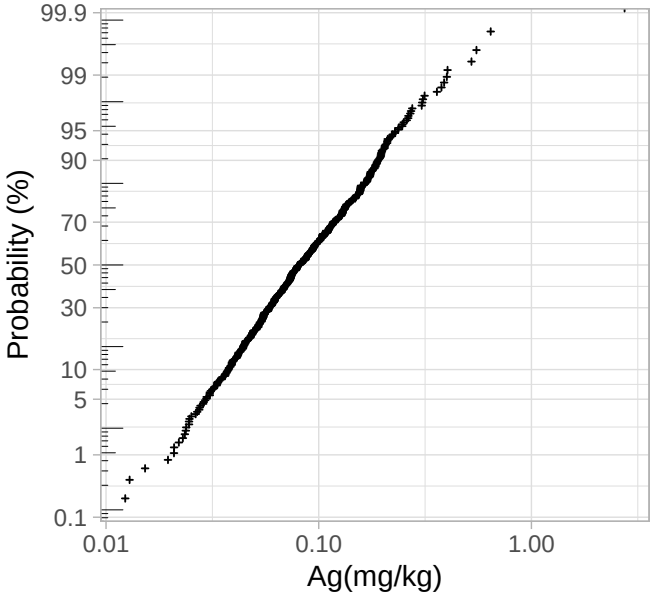
All laboratory readings are shown, including those below detection limit corresponding to negative readings which replaced by a low positive value (1×10^{-7}).

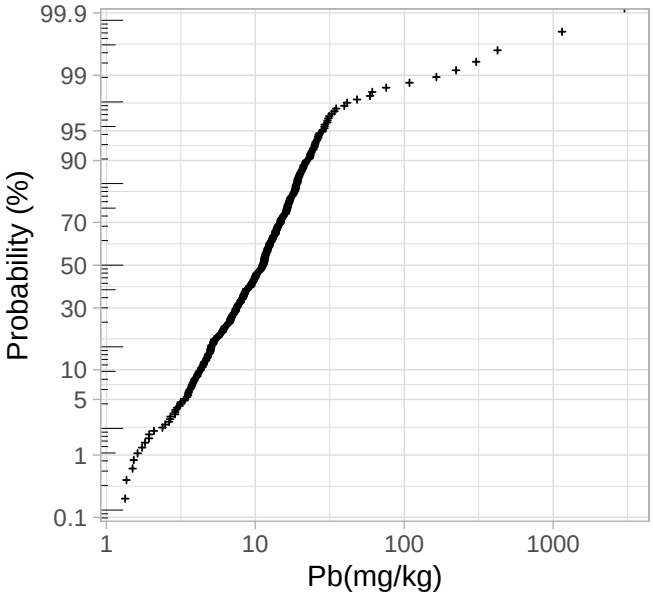
The laboratory detection limit (DL) is indicated by a red dotted line for selected elements which have data below or close to this value (DL).

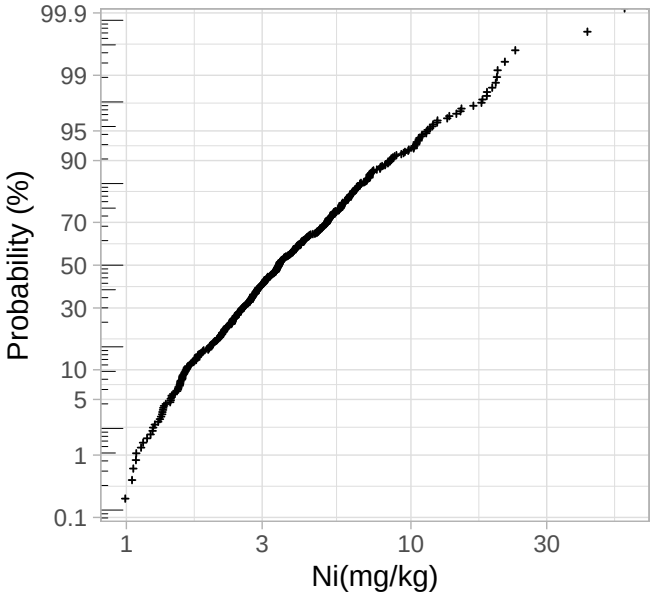

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.03
0.10
0.30
1.00
3.00
Mo(mg/kg)

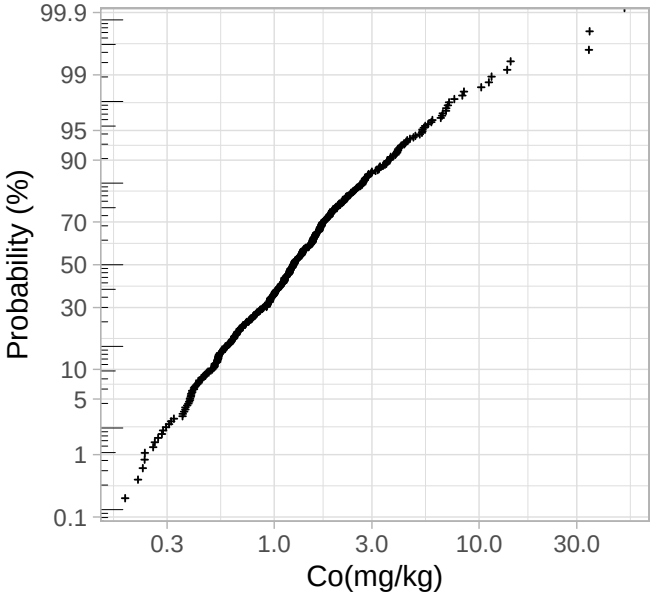

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
10
30
100
300
Zn(mg/kg)

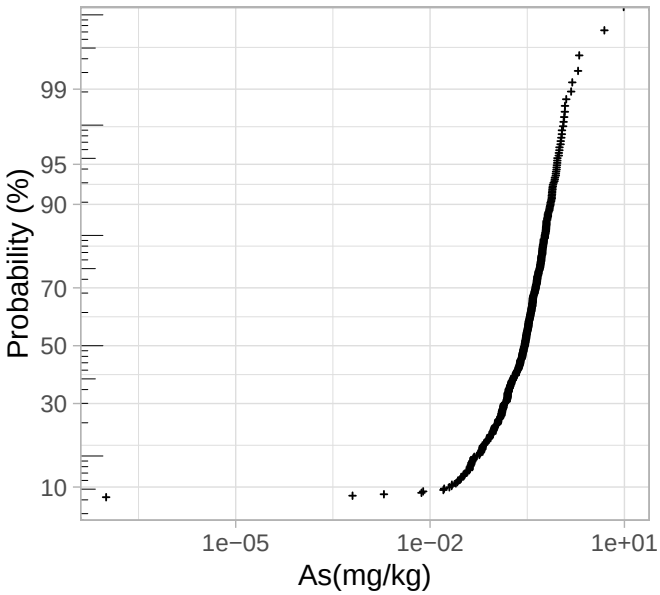

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
3
10
30
100
300
Cu(mg/kg)

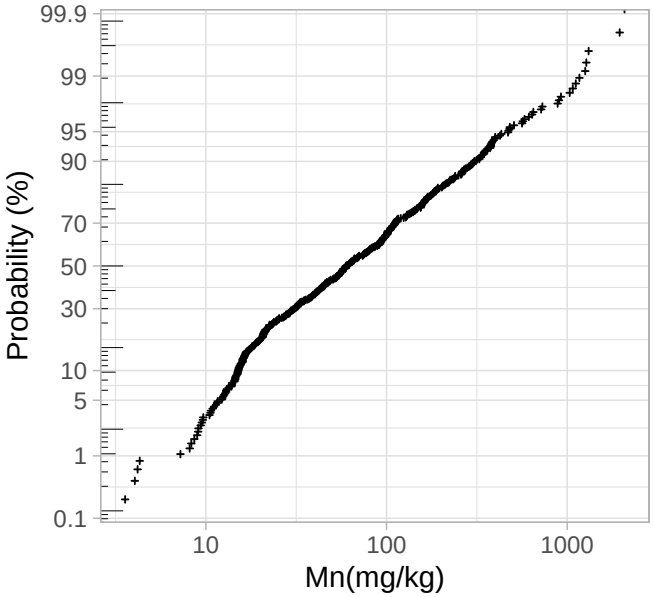

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.01
0.10
1.00
Ag(mg/kg)

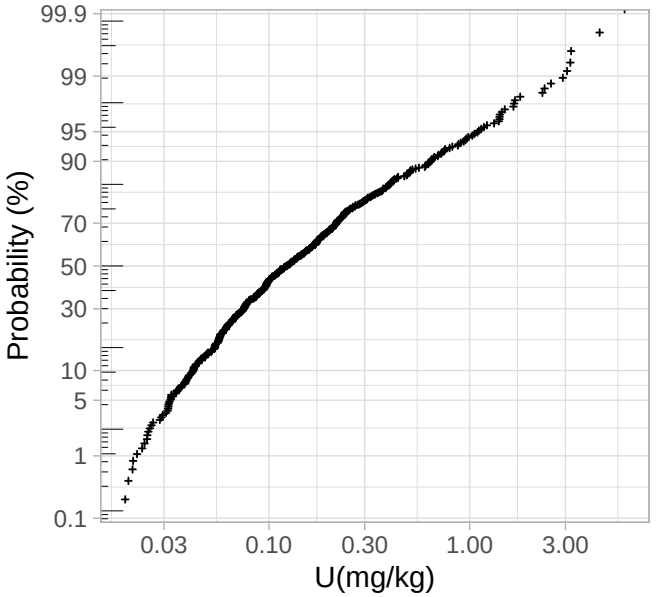

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
10
100
1000
Pb(mg/kg)

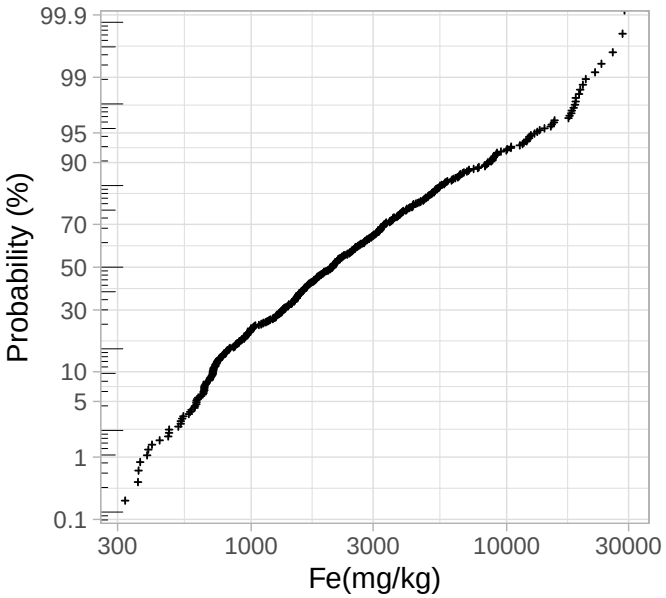

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
3
10
30
Ni(mg/kg)

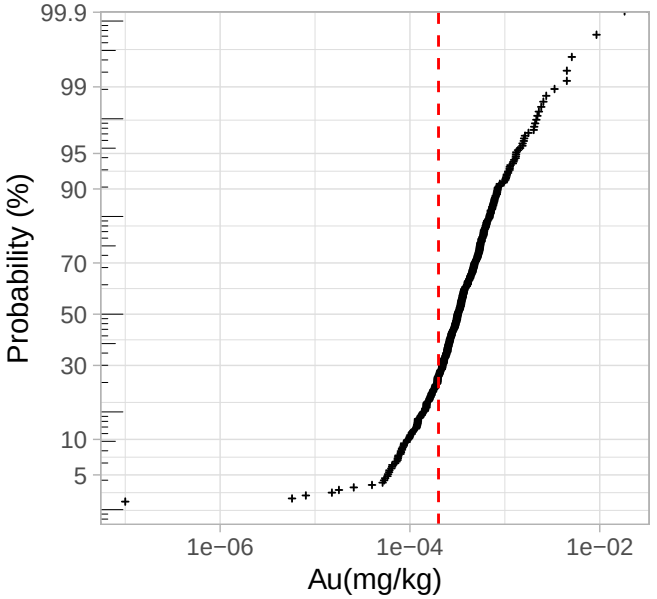

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.3
1.0
3.0
10.0
30.0
Co(mg/kg)

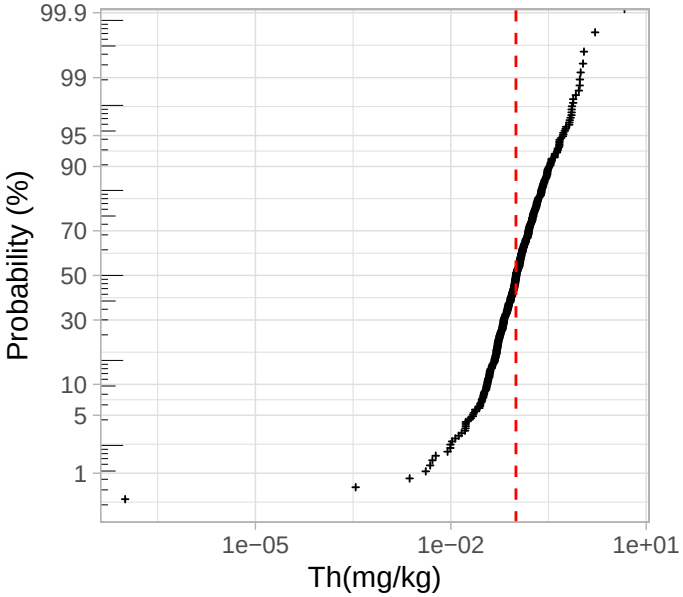

Probability (%)
99
95
90
70
50
30
10
1e−05
1e−02
1e+01
As(mg/kg)

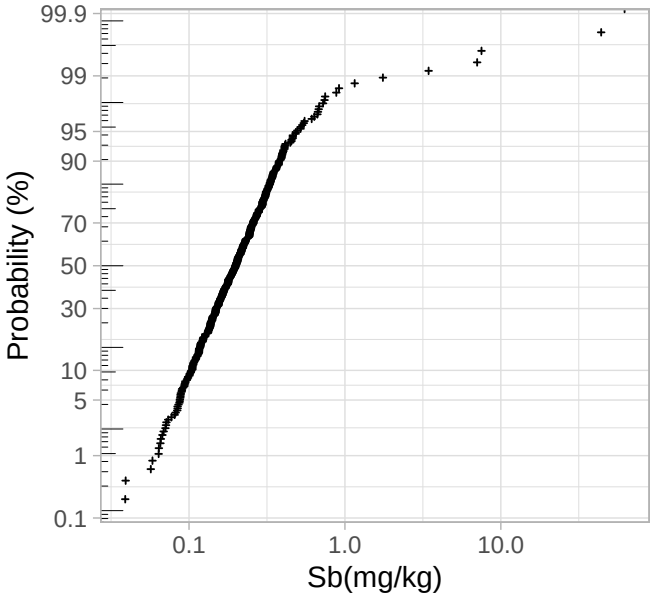

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
10
100
1000
Mn(mg/kg)

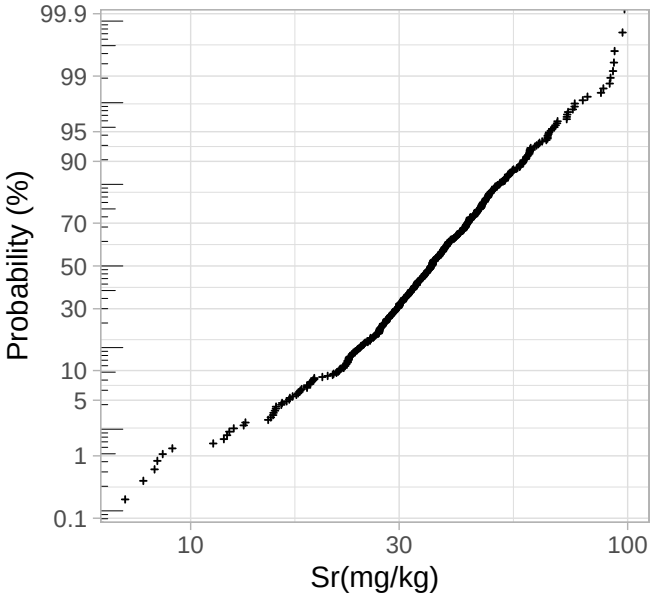

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.03
0.10
0.30
1.00
3.00
U(mg/kg)

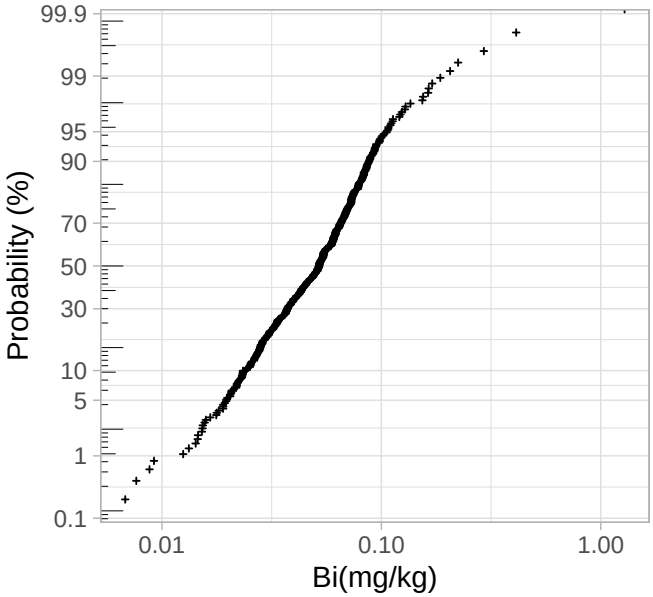

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
300
1000
3000
10000
30000
Fe(mg/kg)

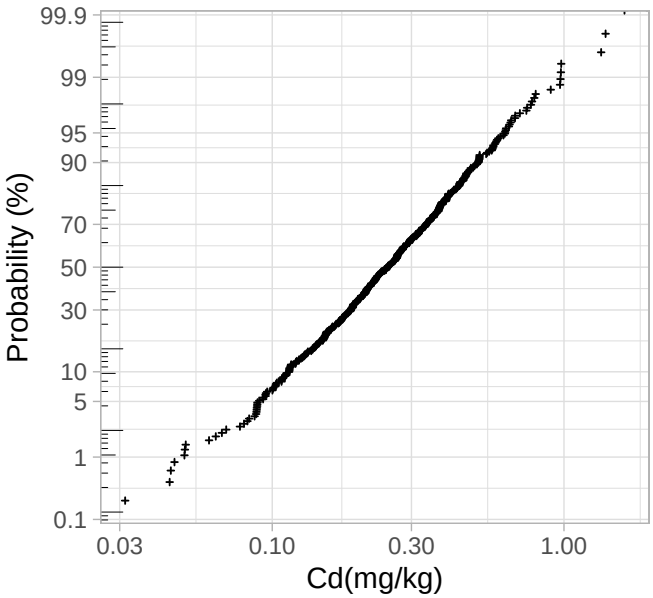

Probability (%)
99.9
99
95
90
70
50
30
10
5
1e−06
1e−04
1e−02
Au(mg/kg)

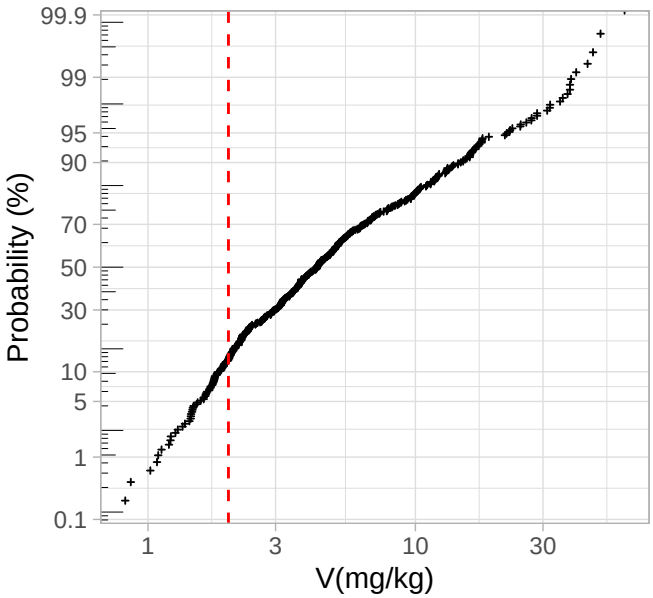

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
1e−05
1e−02
1e+01
Th(mg/kg)

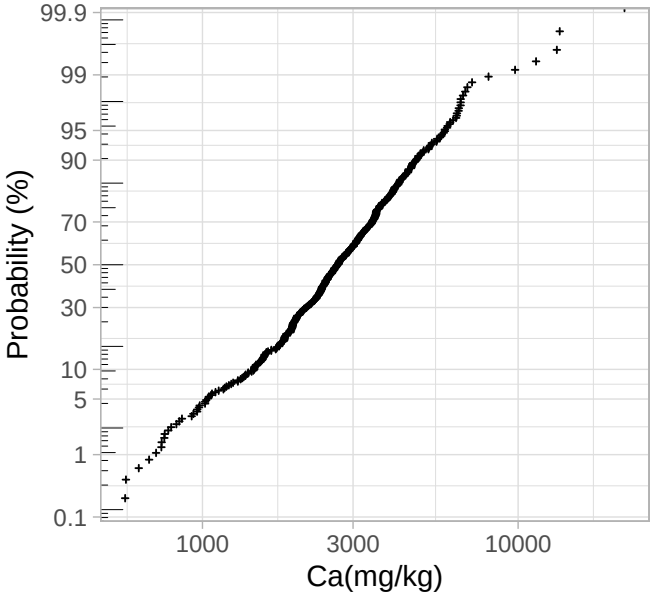

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
1.0
10.0
Sb(mg/kg)

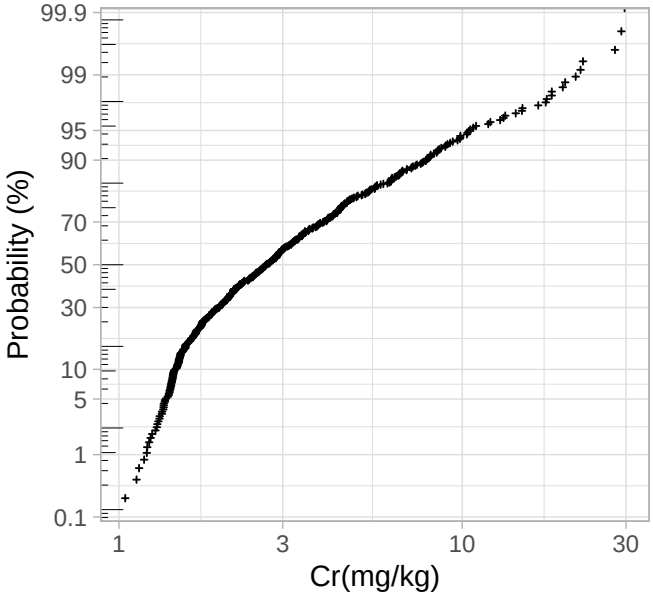

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
10
30
100
Sr(mg/kg)

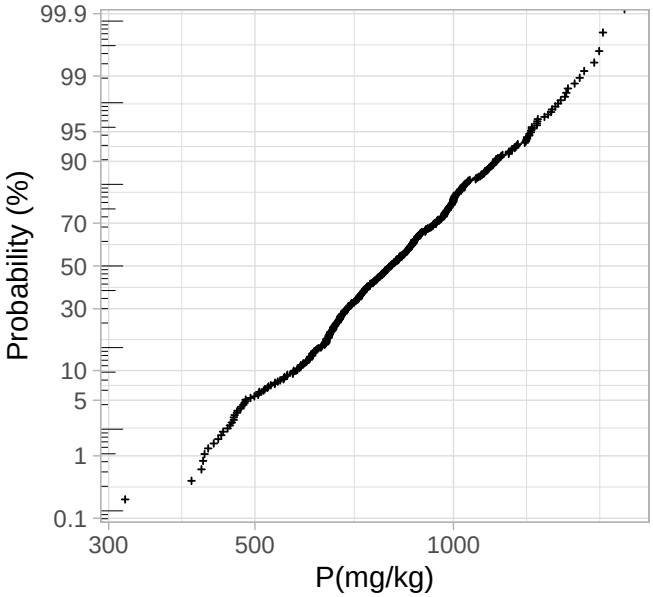

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.01
0.10
1.00
Bi(mg/kg)

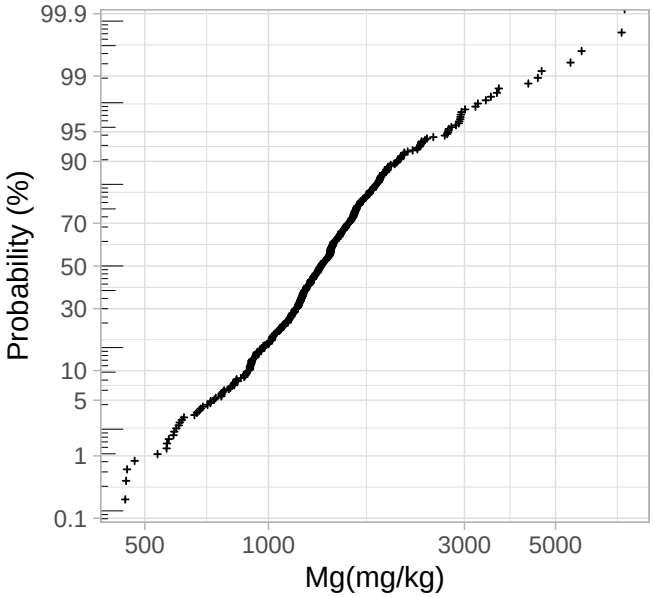

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.03
0.10
0.30
1.00
Cd(mg/kg)

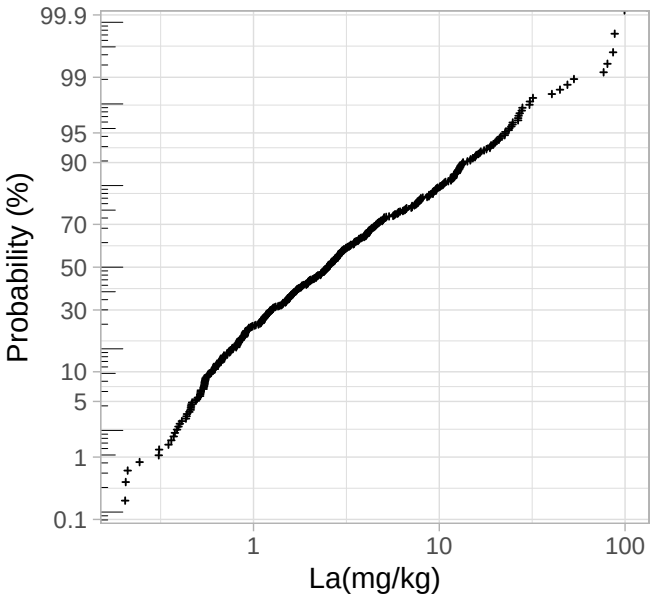

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
3
10
30
V(mg/kg)

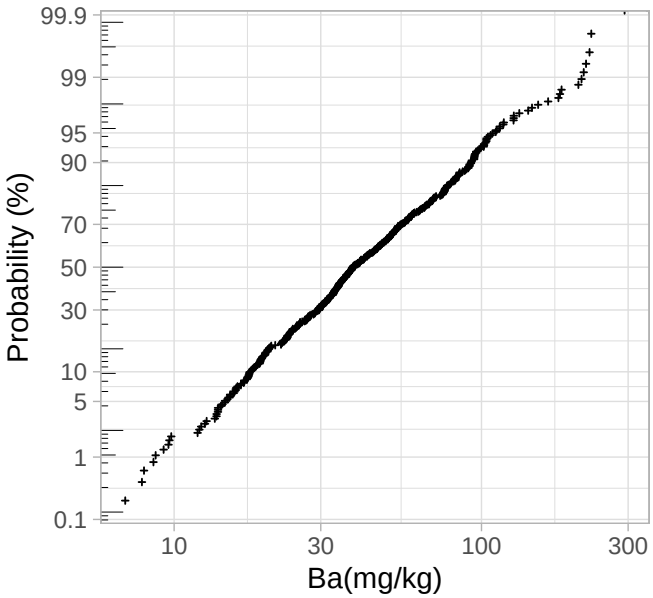

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1000
3000
10000
Ca(mg/kg)

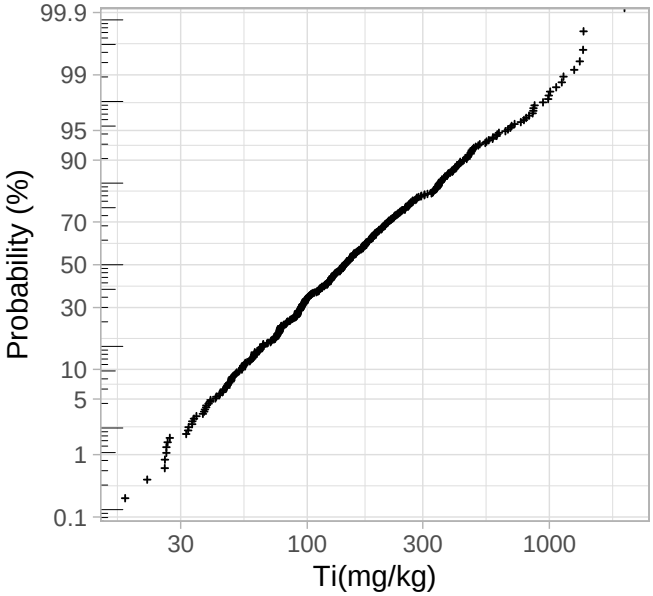

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
3
10
30
Cr(mg/kg)

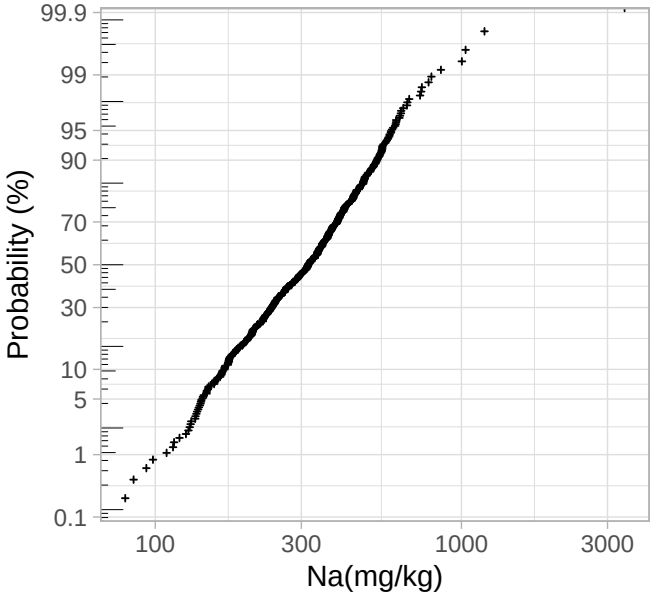

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
300
500
1000
P(mg/kg)

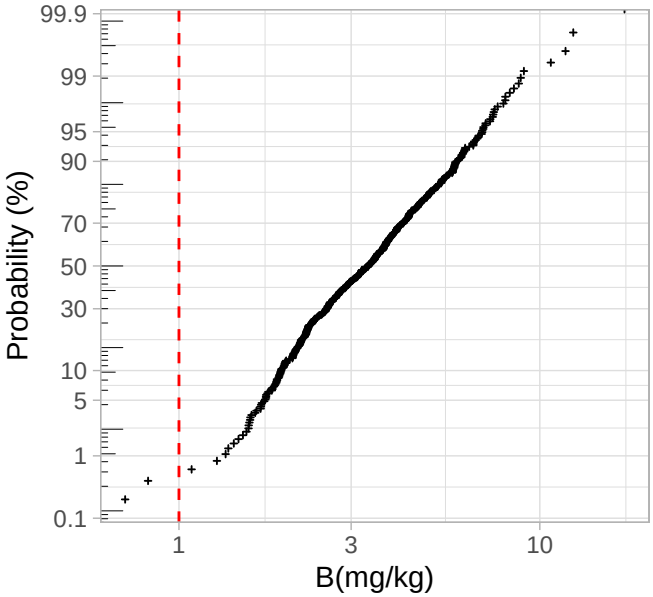

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
500
1000
3000
5000
Mg(mg/kg)

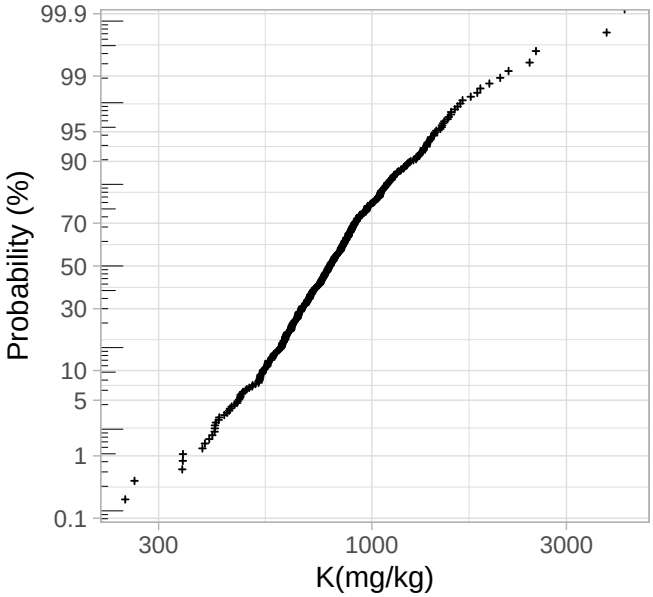

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
10
100
La(mg/kg)

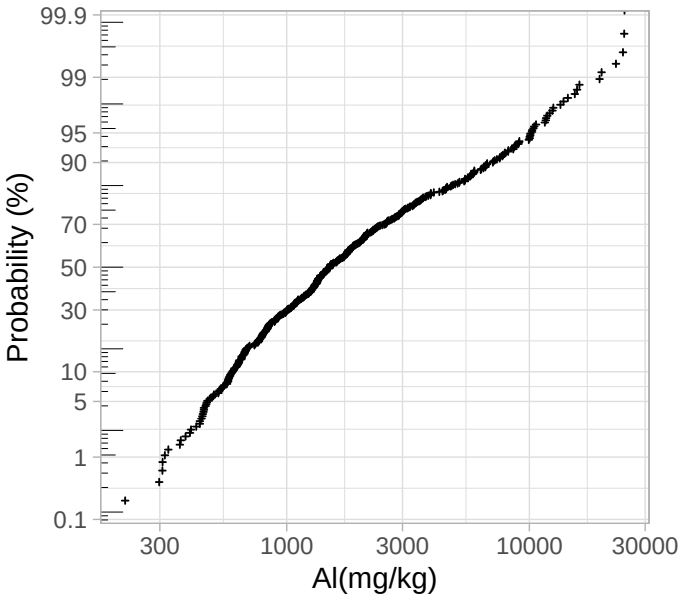

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
10
30
100
300
Ba(mg/kg)

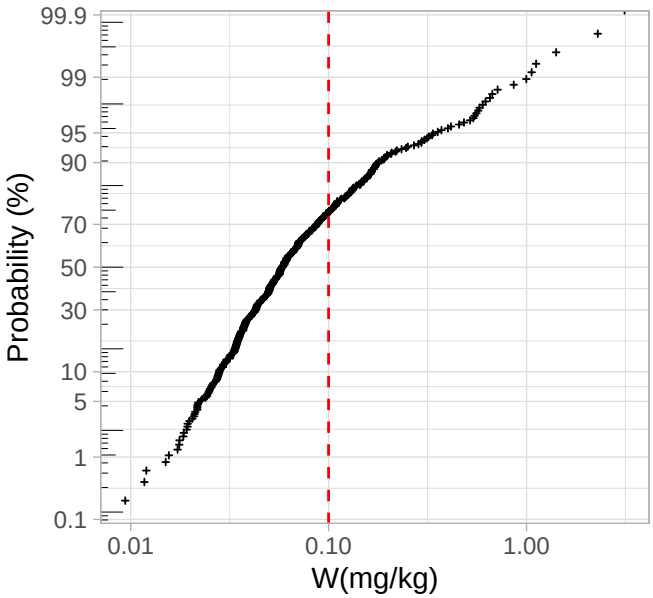

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
30
100
300
1000
Ti(mg/kg)

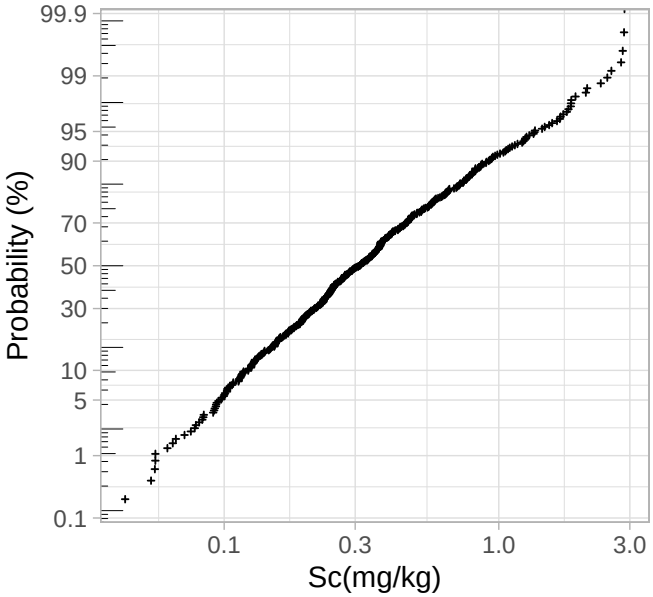

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
100
300
1000
3000
Na(mg/kg)

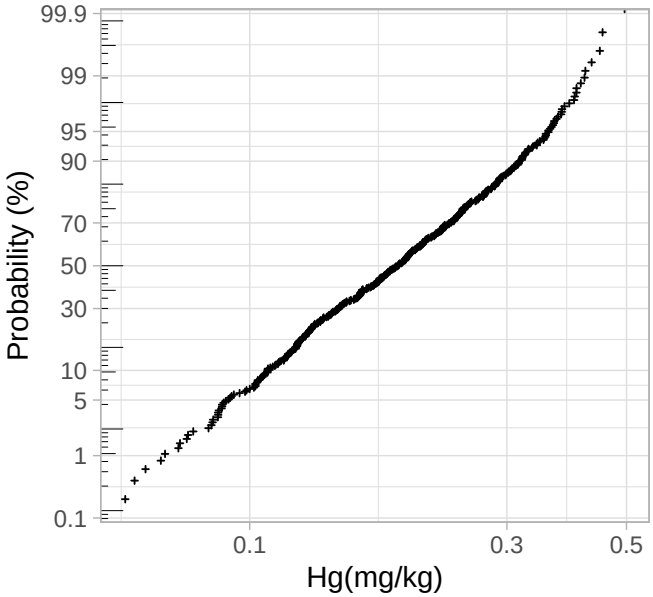

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
3
10
B(mg/kg)

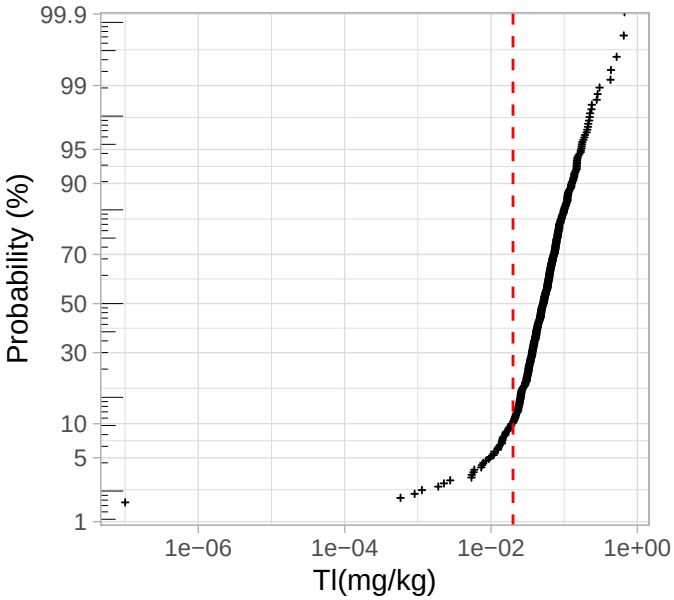

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
300
1000
3000
K(mg/kg)

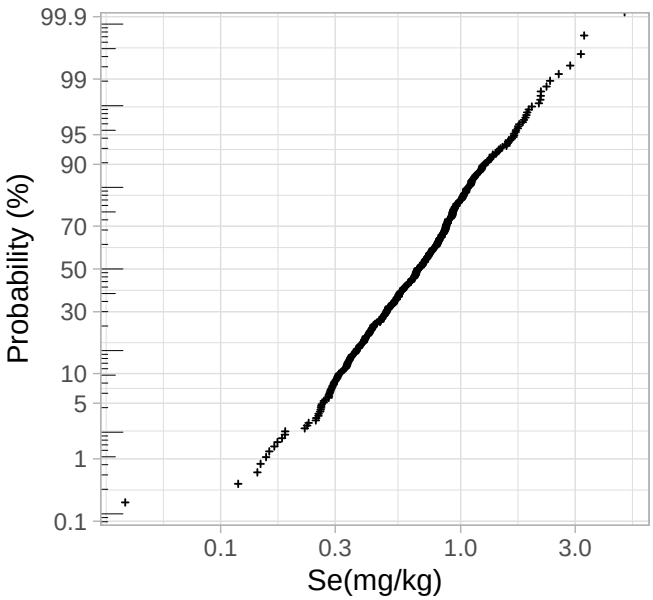

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
300
1000
3000
10000
30000
Al(mg/kg)

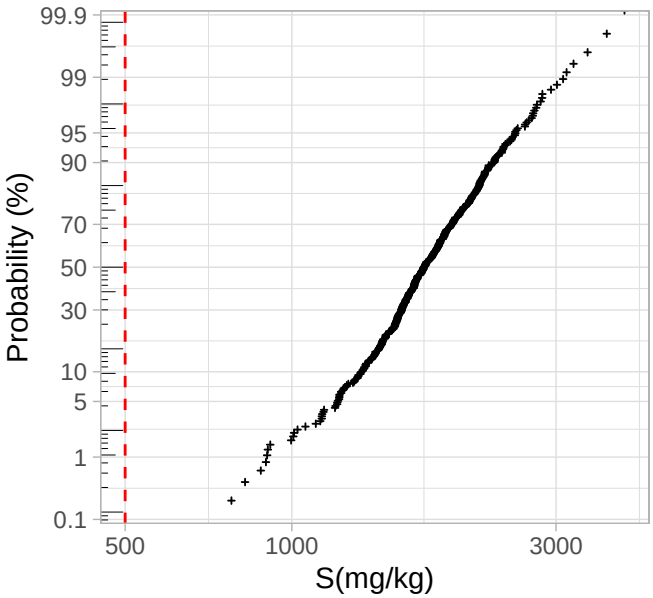

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.01
0.10
1.00
W(mg/kg)

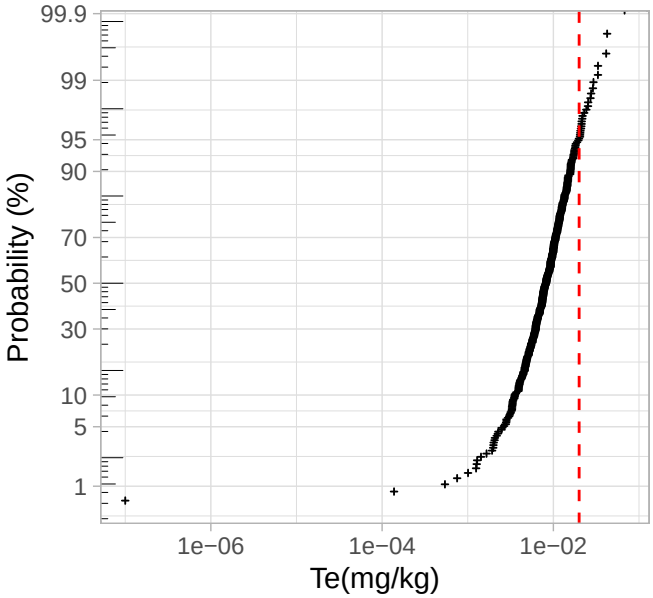

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
0.3
1.0
3.0
Sc(mg/kg)

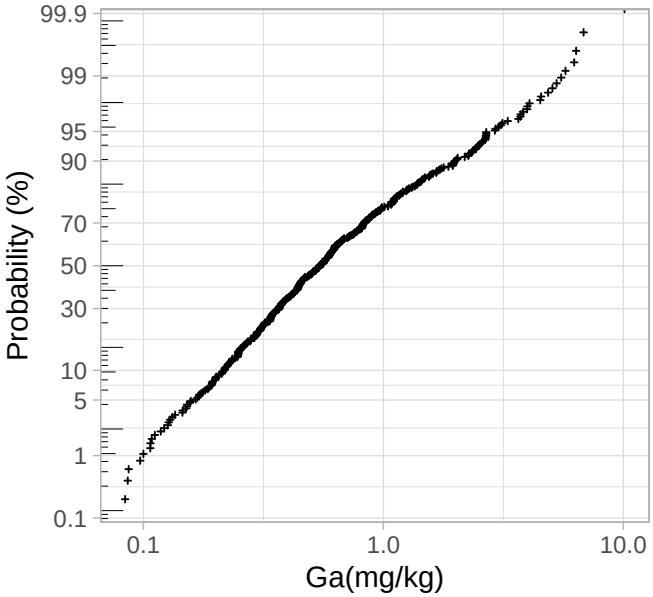

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
0.3
0.5
Hg(mg/kg)

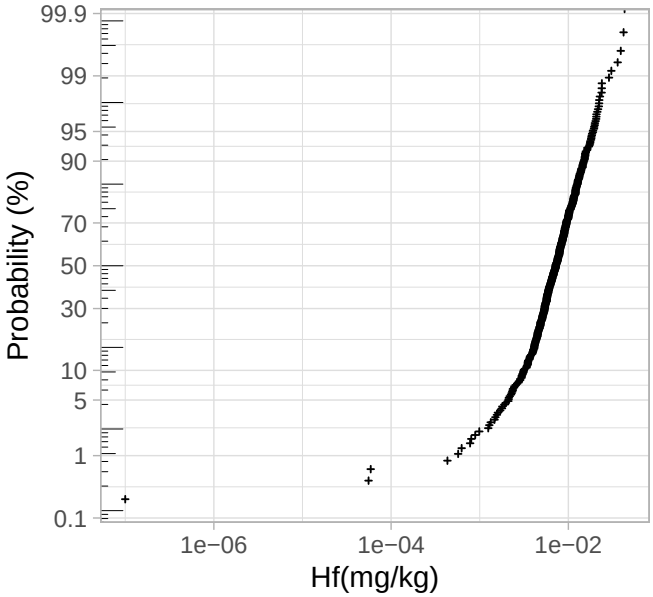

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
1e−06
1e−04
1e−02
1e+00
Tl(mg/kg)

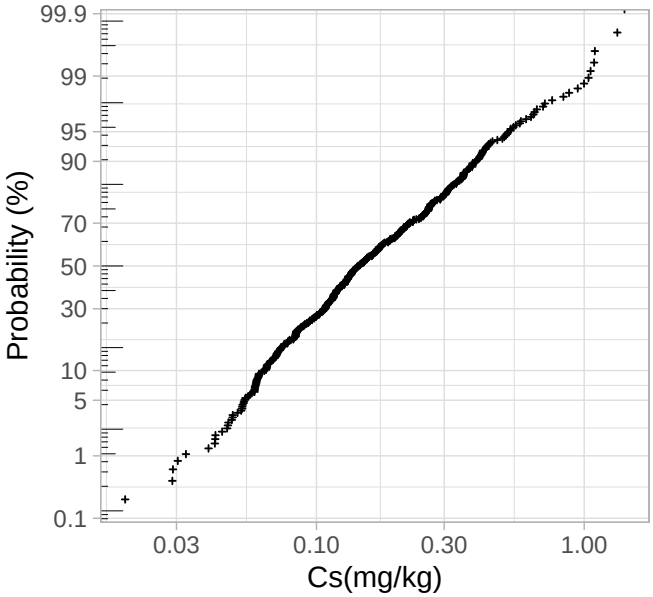

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
0.3
1.0
3.0
Se(mg/kg)

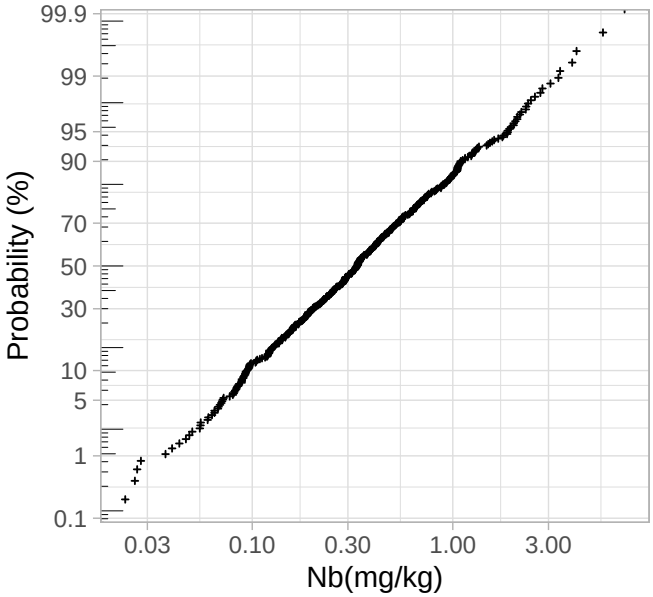

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
500
1000
3000
S(mg/kg)

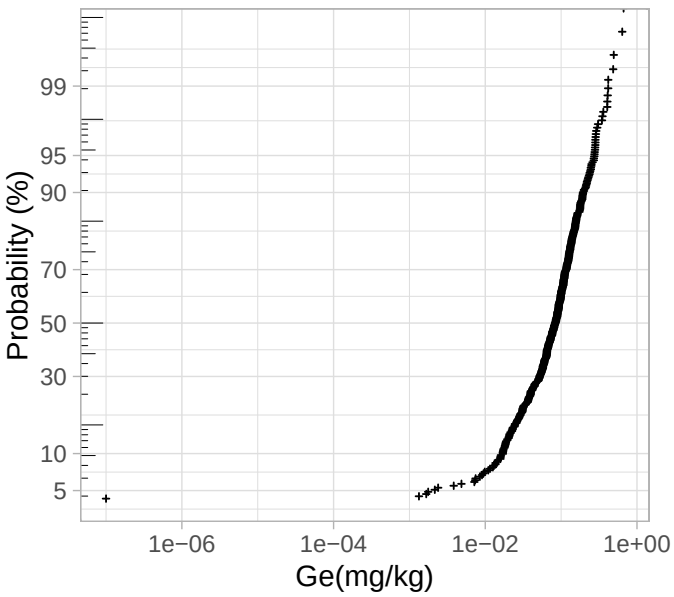

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
1e−06
1e−04
1e−02
Te(mg/kg)

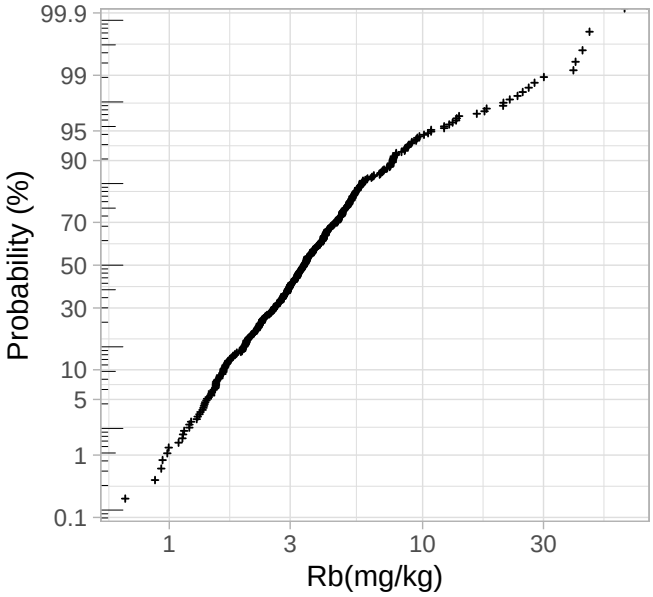

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
1.0
10.0
Ga(mg/kg)

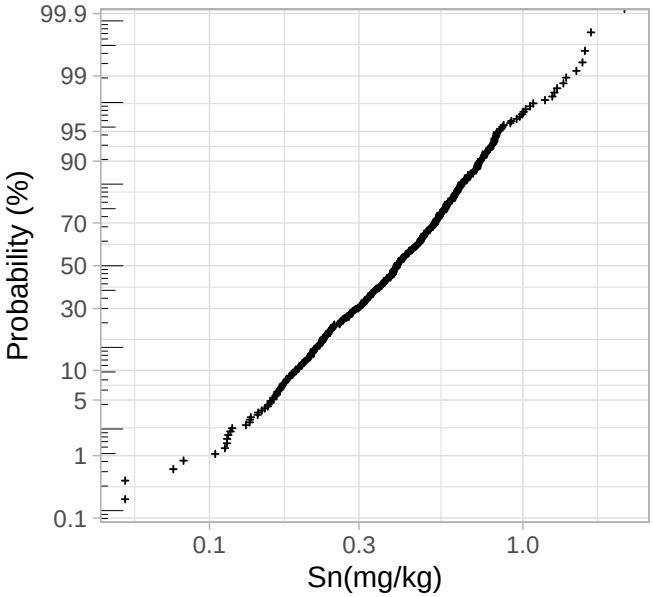

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1e−06
1e−04
1e−02
Hf(mg/kg)

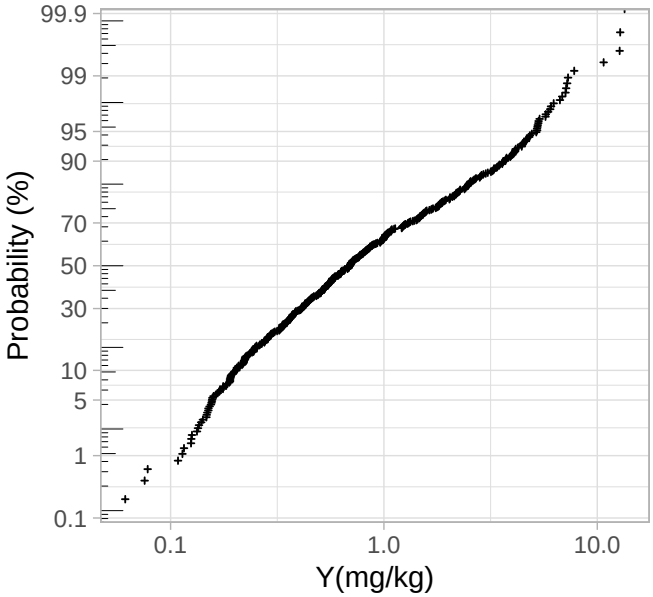

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.03
0.10
0.30
1.00
Cs(mg/kg)

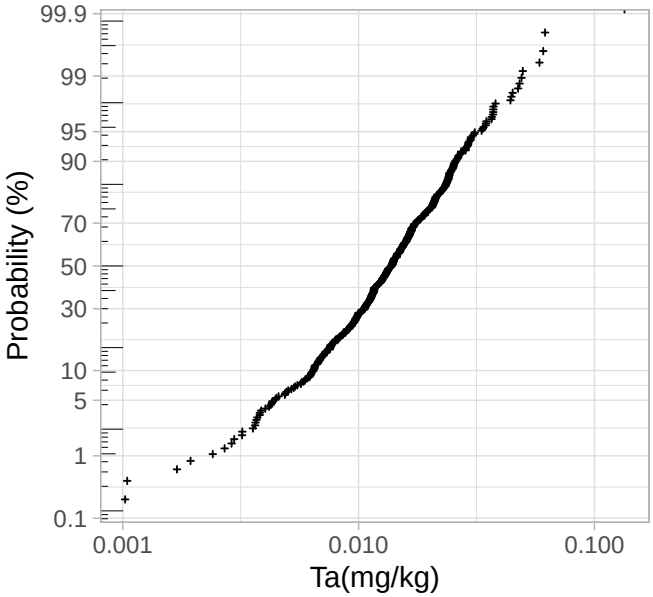

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.03
0.10
0.30
1.00
3.00
Nb(mg/kg)

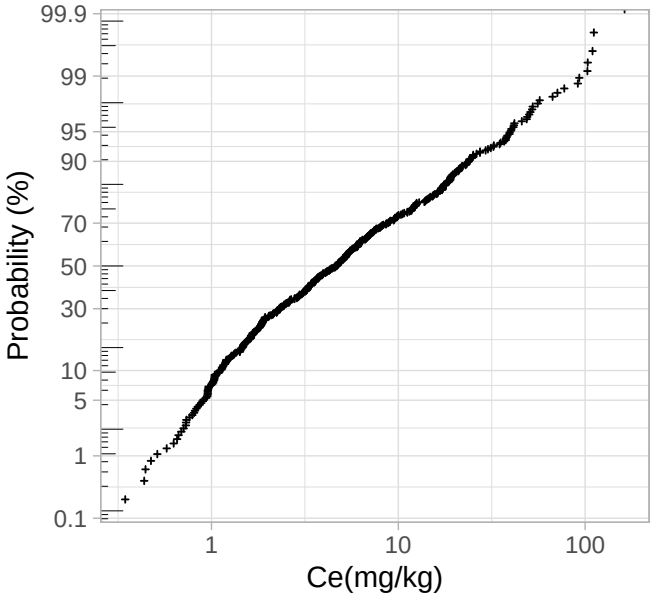

Probability (%)
99
95
90
70
50
30
10
5
1e−06
1e−04
1e−02
1e+00
Ge(mg/kg)

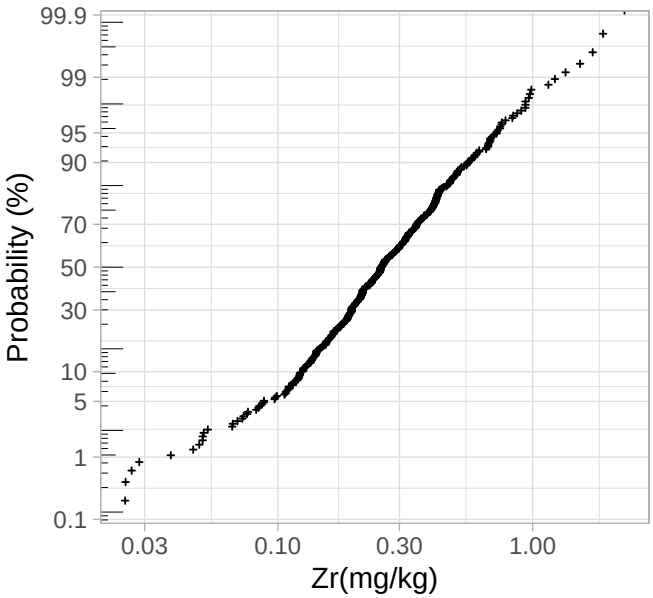

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
3
10
30
Rb(mg/kg)

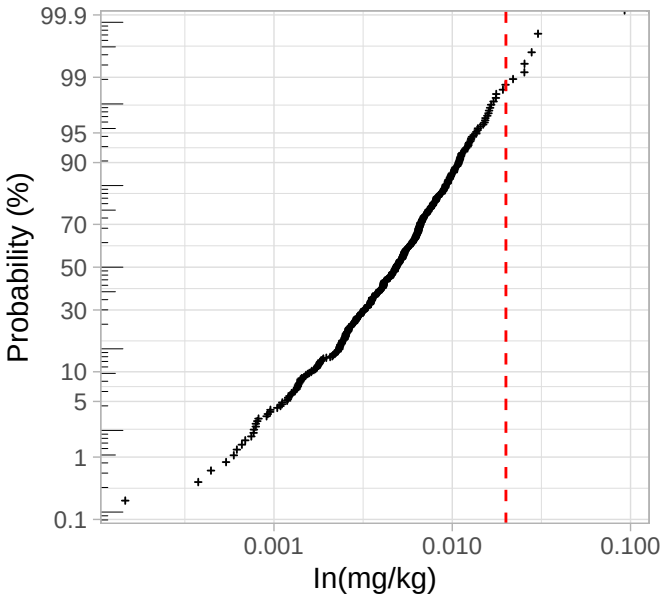

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
0.3
1.0
Sn(mg/kg)

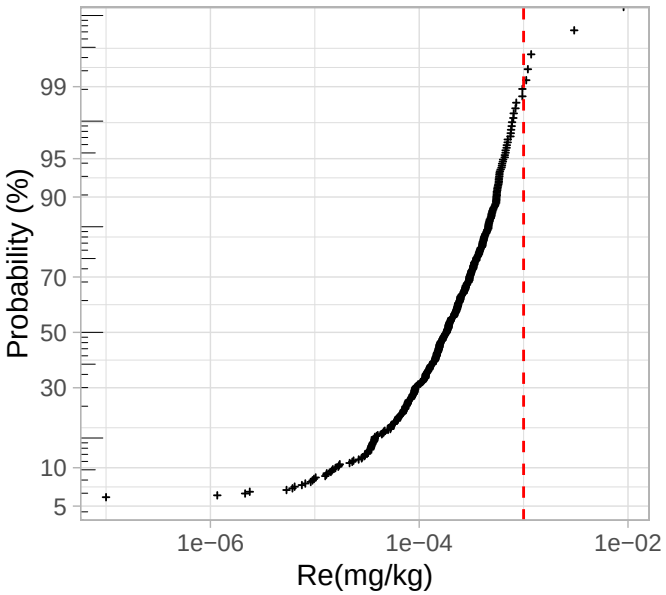

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.1
1.0
10.0
Y(mg/kg)

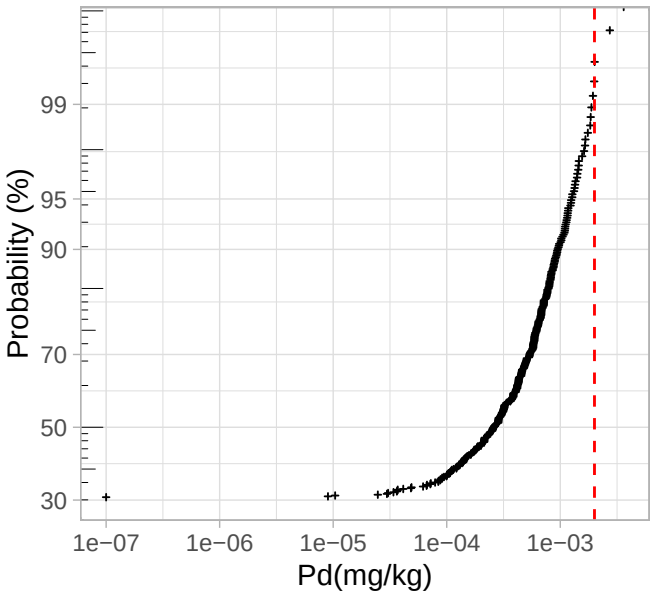

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.001
0.010
0.100
Ta(mg/kg)

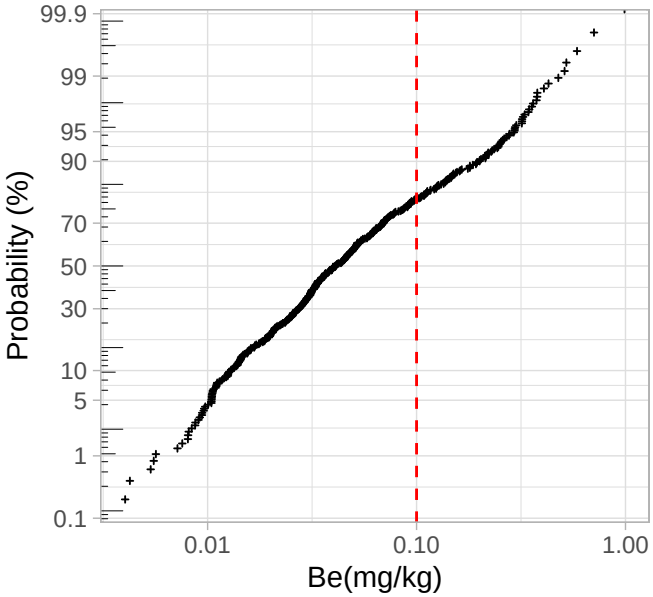

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
1
10
100
Ce(mg/kg)

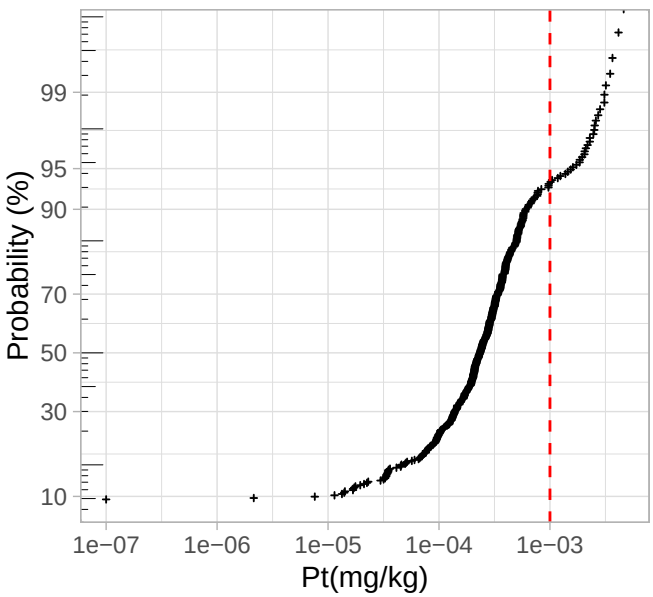

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.03
0.10
0.30
1.00
Zr(mg/kg)

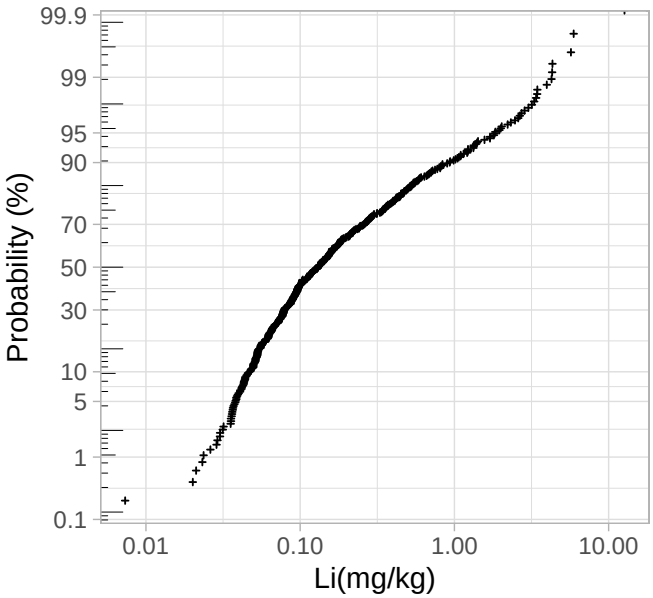

Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.001
0.010
0.100
In(mg/kg)


Probability (%)
99
95
90
70
50
30
10
5
1e−06
1e−04
1e−02
Re(mg/kg)


Probability (%)
99
95
90
70
50
30
1e−07
1e−06
1e−05
1e−04
1e−03
Pd(mg/kg)


Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.01
0.10
1.00
Be(mg/kg)


Probability (%)
99
95
90
70
50
30
10
1e−07
1e−06
1e−05
1e−04
1e−03
Pt(mg/kg)


Probability (%)
99.9
99
95
90
70
50
30
10
5
1
0.1
0.01
0.10
1.00
10.00
Li(mg/kg)

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