Worldwide Open Proficiency Test for Analytical Laboratories involved in Air Pollution Studies

PTXRFIAEA14

Determination of elemental composition of a Urban Dust Loaded on Air Filters

CONTENTS

FOREWORD

The IAEA assists its Member States laboratories to continuously improve their analytical performance by producing reference materials, by developing standardized analytical methods, and by conducting inter-laboratory comparisons and proficiency tests. To ensure a reliable worldwide, rapid and consistent response, the IAEA Nuclear Science and Instrumentation Laboratory in Seibersdorf, Austria, coordinates proficiency tests for Member States laboratories.

This summary report presents the results of the worldwide proficiency test PTXRFIAEA14 on the determination of elemental composition of a Urban Dust loaded on air filters. Methodologies, statistical analysis, and evaluation of results (for each element and for each laboratory) are also reported. The test was carried out within the IAEA project Nuclear Instrumentation, under the Accelerators and Nuclear Spectrometry Subprogram, Nuclear Science Program. The main objective of the project is to enhance capability of interested Member States in effective utilization of nuclear spectrometry and analytical services in industry, human health, agriculture, and in monitoring and evaluation of the environment.

This proficiency test was designed to identify potential analytical problems, to support IAEA Member States laboratories to improve the quality of their analytical results, to maintain their accreditation and to provide a regular forum for discussion and technology transfer in this topic.

The coordinator of the proficiency test and responsible for this publication was Mr. A. Migliori of the IAEA Nuclear Science and Instrumentation Laboratory, Seibersdorf (Austria).

1. INTRODUCTION

The PTXRFIAEA14 proficiency test was aimed at analytical laboratories involved in air pollution studies. The participants were requested to use their established and proven analytical procedures for the determination of concentrations of chemical elements in a Urban Dust loaded on air filters.

Air filters, with established homogeneity of Urban Dust and well characterized known target values of the mass fractions of analytes, were distributed to participating laboratories. The laboratories were requested to analyze the samples using established techniques following their analytical procedures. Based on the results of the proficiency test presented in this report, each participating laboratory should assess its analytical performance by using the specified criteria and, if appropriate, to identify discrepancies, and to correct relevant analytical procedures.

The Proficiency Test was announced on March 12th, 2018. The air filters were distributed to the participating laboratories in April 2018. The deadline for submission of the results was July 13th, 2018. For the first time, the proficiency test organized by NSIL was implemented exploiting a web based platform (www.pt-nsil.com) to facilitate and improve the processes and actions required for the organization and functionality of the exercise for the participants and the coordinator. Detailed instructions for analysts were also available on the website.

The submitted results were processed, grouped versus analytes/laboratories and compared with the analyte's assigned values. The values of *z*- and of *u*-scores were calculated for three fit-for-purpose levels. For the definitions of the *z*- and *u*-scores please see Section 3.2. The obtained results as well as the description of the data evaluation procedures are described in this report. Each laboratory was assigned a code, therefore full anonymity of the presented results is guaranteed. The link between the laboratory code and the laboratory name is known only to the organizers of the proficiency test and to the laboratory itself.

2. DESCRIPTION OF THE TEST SAMPLE

The test sample was a Urban Dust loaded on air filters prepared and tested by an external independent laboratory. The Urban Dust was collected on a 47mm diameter polycarbonate filter. The air filters were distributed to 59 laboratories in petri-slide dishes. Each participant received one loaded filter and one blank filter. Since the load was slightly different for each filter, information was provided on the petri-slide dishes on the area and the total mass of the load. The participants were asked to submit their results as weight fraction, which is the same for every filter, following their routine analytical procedures. Only one result per element per analytical technique should be submitted. Each result should be accompanied by an estimate of its uncertainty expressed as one standard deviation. No restriction on the number of the reported elements was imposed.

3. DETAILS OF THE EXERCISE

3.1. ASSIGNED VALUE AND TARGET STANDARD DEVIATION

Assigned values X_A were defined in two steps. For a first evaluation, the reference values supplied by the provider of the material, established by independent inter-laboratory survey, were used as assigned values and the calculated *z*- and *u*-scores were promptly reported to the participants as a preliminary assessment included in the certificate of participation.

After receiving the results from all participants, an evaluation of their density distribution was made. For those elements without well characterized values from the producer but having more than 5 reported valid results and exhibiting a normal distribution (Figs 3-28), the median values were used as assigned values for a second evaluation. These values are presented in Table 2 in italic character.
The results for 45 analytes were submitted by participants of this proficiency test. The *z*- and *u*-scores were calculated for all the submitted results of all analytes except 21 elements, for which the assigned values were not available.
For each analyte a target value of the standard deviation has been assigned using a modified Horwitz function as proposed in the reference [1]:

$$H_A = \begin{cases} 0.22 X_A & X_A < 1.2 \cdot 10^{-7} \\ 0.02 (X_A)^{0.8495} & 1.2 \cdot 10^{-7} \le X_A \le 0.138 \\ 0.01 \sqrt{X_A} & X_A > 0.138 \end{cases} \quad (1)$$

In Eqn. (1) the assigned value of analyte, X_A, is expressed as a mass fraction. The target value of the standard deviation, σ_A is related to H_A by a factor k:

$$\sigma_A = kH_A, \quad k = 0.5, 1.0, 1.5 \quad (2)$$

Depending on the value of the factor k the target value of the standard deviation is recognized as fit-for-purpose at three levels of uncertainty: k = 0.5 - appropriate for high precision analysis; k = 1.0 - appropriate for well-established routine analysis; k = 1.5 - satisfactory for common analytical tasks. The relative value of the target standard deviation, *RSD*, expressed in per cent, is defined as follows:

$$RSD = \frac{\sigma_A}{X_A} \cdot 100\% \quad (3)$$

The relative value of the target standard deviation as a function of the assigned mass fraction of the analyte, X_A, is shown in Fig. 1 for the three different values of the k factor.

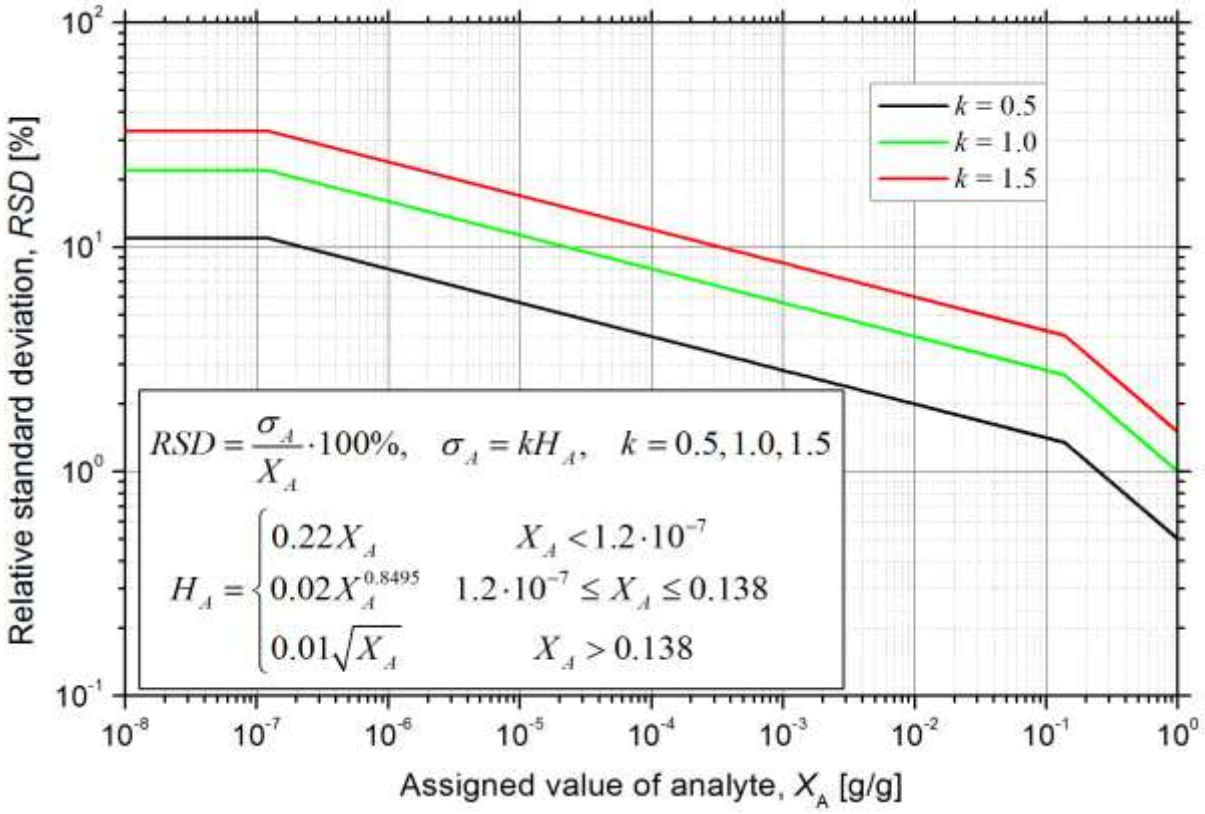

FIG. 1. Relative value of the target standard deviation, RSD, as a function of the assigned mass fraction of the analyte, X_A, calculated by using a modified Horwitz function, Eqn. (1).

3.2. *z*-SCORES AND *u*-SCORES

The reported concentrations of analytes were compared with the assigned values by using the *z*-score analysis. For every result a *z*-score was calculated:

$$z = \frac{x - X_A}{\sigma_A} \tag{4}$$

The term '*x*' denotes the reported mass fraction of analyte. Defined by different fit-for-purpose ranges of the target standard deviation, three different values of *z*-scores were calculated by combining Eqns. (2) and (4). Assuming that appropriate values for X_A and σ_A have been used and that the underlying distribution of analytical errors is normal, apart from outliers, in a well-behaved analytical system *z*-scores would be expected to fall outside the range $-2 \le z \le 2$ in about 4.6% of instances, and outside the range $-3 < z < 3$ only in about 0.3%. Therefore, based on the *z*-scores, the following decision limits were established:

$$\begin{aligned} |z| &\le 2 && \text{- a satisfactory result} \\ 2 < |z| &< 3 && \text{- the result is considered questionable} \\ |z| &\ge 3 && \text{- the result is considered unsatisfactory} \end{aligned} \tag{5}$$

The advice to the laboratory is that, independent of the fit-for-purpose range selected by the laboratory, any *z*-score for an element outside the range $-2 \le z \le 2$ should be examined by the analyst and all steps of the analytical procedure verified to identify the source(s) of the analytical bias.

For every participant the rescaled sum of *z*-scores, *RSZ*, as well as the sum of squared *z*-scores, *SSZ*, were calculated as defined by the following equations:

$$RSZ = \frac{\sum_{i=1}^{L} z_i}{\sqrt{L}} \tag{6}$$

$$SSZ = \sum_{i=1}^{L} (z_i)^2 \tag{7}$$

The symbol '*L*' denotes the number of results provided by the laboratory/participant for all the analytes determined. The summing up in Eqns. (6) and (7) takes into account all *z*-scores for all analytes with known assigned values reported by participant. The *RSZ* can be interpreted as a standardized normally distributed variable, with expected value equal to zero and unit variance. It is sensitive in detecting a small consistent bias in an analytical system, however, it is not sensitive in cases where there are even big errors but having opposite signs. The *SSZ* takes no account of the signs because it depends on the squared *z*-scores. It has a chi-squared (χ^2) distribution with *L* degrees of freedom. The *SSZ* can be regarded as complementary to *RSZ*, which means that if *RSZ* is well within the range $-3 < RSZ < 3$ and if at the same time the value of *SSZ* is above the $\chi^2_{critical}$ value the overall performance of the laboratory requires improvement.

The reported results were accompanied by the standard uncertainty estimate made by the participant. The values were used to calculate the *u*-scores:

$$u = \frac{|x - X_A|}{\sqrt{(\sigma_A)^2 + (\sigma_x)^2}} \tag{8}$$

The symbol 'σ_x' denotes the standard uncertainty of the submitted result *x*. If the assumptions about X_A and σ_A and about the normality of the underlying distributions are correct, and the laboratory estimate of σ_x takes into account all the significant sources of uncertainty, the *u*-scores would have a truncated normal distribution with unit variance. In a well-behaved analytical system only 0.1% of *u*-scores would fall outside the range $u < 3.29$. Therefore, the following decision limits for the *u*-scores were established:

$u \le 1.64$ - reported result does not differ from the assigned value
$1.64 < u \le 1.95$ - reported result probably does not differ from the assigned value
$1.95 < u \le 2.58$ - it is not clear whether the reported and assigned values differ (9)
$2.58 < u \le 3.29$ - reported result is probably different from the assigned value
$3.29 < u$ - reported result differs from the assigned value

The *u*-scores are especially useful for deciding whether the laboratory fit-for-purpose criteria are fulfilled. By comparing Eqn. (4) and Eqn. (8) one can notice that for corresponding values of *u*-score and *z*-score the following inequality is always fulfilled:

$$u \le |z| \tag{10}$$

It implies that if the *u*-score is larger than 3.29 also the decision limit for the corresponding *z*-score is triggered and the laboratory has to check the analytical procedure as well as review the uncertainty budget estimation. If *u*-score stays below the value of 1.64 and at the same time the *z*-score decision limit is triggered ($|z| > 3$) the laboratory should reevaluate its fit-for-purpose status for that particular analyte.

3.3. CONSENSUS VALUES

To examine the overall performance of the participating laboratories the submitted results have been statistically processed and the consensus values were calculated. The results were tested for the presence of outliers using a set of seven outlier rejection tests, shown below:

Description of symbols:

$x_1 < ... < x_n$	- set of analytical results
$\bar{x}$	- mean value
s	- standard deviation

(11)

1. Coefficient of kurtosis [2], number of results: $5 \le n \le 100$, two-sided test, confidence level = 0.95:

$$b_2 = \frac{n\sum_{i=1}^{n}(\bar{x} - x_i)^4}{\left[\sum_{i=1}^{n}(\bar{x} - x_i)^2\right]^2} \tag{12}$$

   If b_2 > critical value then reject the result that is at the furthest distance from the mean, decrease *n*, repeat the procedure until $b_2 \le$ critical value.

2. Coefficient of skewness [2], number of results, $5 \le n \le 60$, one-sided test, confidence level = 0.95:

$$\sqrt{b_1} = \frac{\sqrt{n}\sum_{i=1}^{n}(x_i - \bar{x})^3}{\left[\sum_{i=1}^{n}(x_i - \bar{x})^2\right]^{3/2}} \tag{13}$$

   If $\left|\sqrt{b_1}\right|$ > critical value then: if $\sqrt{b_1}$ is positive then reject x_n, otherwise reject x_1, decrease *n*, repeat the procedure until $\left|\sqrt{b_1}\right| \le$ critical value.

3. Veglia's test [3,4], number of results: $4 \le n \le \infty$, two-sided test, confidence level = 0.95:

$$h = \sqrt{\frac{n}{n-1}}\,\frac{|x_k - \bar{x}_{n-1}|}{s_{n-1}} \tag{14}$$

where:

x_k , examined value, the result at the furthest distance from the mean

$\bar{x}_{n-1}$, the mean value of the population of the results with the examined result excluded

s_{n-1}, the standard deviation of the population of the results with the examined result excluded

If $h >$ critical value then reject x_k otherwise temporarily exclude the x_k from the population of results and proceed with testing the next outlier candidate, if the following value of $h >$ critical value then reject both results, decrease n respectively, repeat the procedure until $h \leq$ critical value.

4. Dixon's test [5], number of results: $3 \leq n \leq 25$, two-sided test, confidence level = 0.95:

If x_1 is at the furthest distance from the mean value, then calculate:

$$r = \begin{cases} (x_2 - x_1)/(x_n - x_1), & 3 \leq n \leq 7 \\ (x_2 - x_1)/(x_{n-1} - x_1), & 8 \leq n \leq 10 \\ (x_3 - x_1)/(x_{n-1} - x_1), & 11 \leq n \leq 13 \\ (x_3 - x_1)/(x_{n-2} - x_1), & 14 \leq n \leq 25 \end{cases} \tag{15a}$$

If x_n is at the furthest distance from the mean value then calculate:

$$r = \begin{cases} (x_n - x_{n-1})/(x_n - x_1), & 3 \leq n \leq 7 \\ (x_n - x_{n-1})/(x_n - x_2), & 8 \leq n \leq 10 \\ (x_n - x_{n-2})/(x_n - x_2), & 11 \leq n \leq 13 \\ (x_n - x_{n-2})/(x_n - x_3), & 14 \leq n \leq 25 \end{cases} \tag{15b}$$

If $r >$ critical value then reject the tested result, decrease n, repeat the procedure until $r \leq$ critical value.

5. Outlier rejection test proposed in [2], number of results: $4 \leq n \leq 100$, two-sided test, confidence level = 0.95:

$$w/s = (x_n - x_1)/s \tag{16}$$

If $w/s >$ critical value then: if $x_n - \bar{x} = \bar{x} - x_1$, reject both x_1 and x_n, otherwise reject x_k ($x_k = x_1$ *or* $x_k = x_n$), the result that is at the furthest distance from the mean, for the remaining population of results ($n' = n - 1$) calculate: $T_k = |\bar{x}' - x_k|/s'$, where: $\bar{x}'$ is the mean value and s' is the standard deviation of the population of the results excluding the rejected value x_k, if $T_k >$ critical value then reject also the second extreme result, decrease n respectively, repeat the procedure until $w/s \leq$ critical value.

6. Outlier rejection test proposed in [6], number of results: $3 \le n < \infty$, two-sided test, confidence level = 0.95:

$$B_4 = \left| x_k - \bar{x} \right| / s \tag{17}$$

where:

x_k , examined value

If B_4 > critical value then reject the tested result, repeat the procedure until $B_4 \le$ critical value.

7. Outlier rejection test proposed in [7], number of results: $3 \le n \le 100$, two-sided test, confidence level = 0.95:

$$S_k^2 / S = \frac{\sum_{i=1, i \ne k}^{n} (x_i - \bar{x}')^2}{\sum_{i=1, i \ne k}^{n} (x_i - \bar{x})^2}, \quad k = 1 \, or \, k = n \tag{18}$$

where:

x_k , examined value, the result at the furthest distance from the mean

$\bar{x}'$, the mean value of the population of the results with the examined result x_k excluded

If S_k^2 / S > critical value then reject x_k , decrease *n*, repeat the procedure until $S_k^2 / S \le$ critical value.

The results which passed the outlier rejection procedures were used to calculate the consensus mean value of analyte, X_C, and corresponding consensus value of its standard deviation, σ_C:

$$X_C = \frac{\sum_{i=1}^{m} x_i}{m} \tag{19}$$

and

$$\sigma_C = \sqrt{\frac{\sum_{i=1}^{m} (x_i - X_C)^2}{m(m-1)}} \tag{20}$$

The term *m* denotes the number of reported values for a given analyte excluding the outliers rejected by at least one of the outlier rejections tests. The summing up in Eqn. (19) and (20) takes into account only the results which passed all the outlier rejection tests. The obtained consensus values were compared with the assigned values of the analytes.

4. RESULTS

The test air filters were distributed to 59 laboratories for chemical composition analysis. Out of the 59 laboratories, 43 participated in the test submitting 568 individual results for 45 chemical elements. All submitted results have been evaluated. The list of the participating laboratories is presented at the end of this report.

The techniques used by the participants and their codes are listed in Table 1.

TABLE 1. THE CODING, DESCRIPTION AND THE ABBREVIATED NAMES OF THE ANALYTICAL TECHNIQUES USED BY PARTICIPANTS OF THE PROFICIENCY TEST EXERCISE

Technique Code	Description	Abbreviation
1.13	EDXRF, radioisotope excitation, 109Cd	EDXRFISO-CD
1.14	EDXRF, radioisotope excitation, 238Pu	EDXRFISO-PU
1.21	EDXRF, X-ray tube direct excitation	EDXRFTUBE-DIRECT
1.22	EDXRF, X-ray tube and filter	EDXRFTUBE-FILTERS
1.23	EDXRF, X-ray tube and secondary targets	EDXRFTUBE-ST
1.32	TXRF with monochromator	TXRF-MON
2	Wavelength dispersive X-ray fluorescence	WDXRF
4.2	PIXE, vacuum chamber	PIXE-VAC
5.1	K0 Neutron Activation Analysis	K0 NAA
5.2	Neutron Activation Analysis using reference materials for calibration	RNAA
7.2	Inductively Coupled Plasma Mass Spectrometry	ICP-MS

In Table 2 a summary of the assigned analyte values, the target values of standard deviation (obtained by using modified Horwitz function), the consensus values and their standard deviations are shown. The elements for which the median values were considered as the assigned values are presented in italic. For 21 elements the assigned and target standard deviation values were not available. The consensus values (Eqn. 19) and corresponding standard deviations (Eqn. 20) were calculated based on 503 reported analytical results after excluding 65 results classified as outliers. The correlation between the assigned and the consensus values is shown in Fig. 2.

TABLE 2. THE ASSIGNED VALUES OF ANALYTES, THE TARGET VALUES OF THE STANDARD DEVIATIONS AND THE CONSENSUS VALUES.

Analyte symbol	Assigned value of the analyte, X_A	Target value of standard deviation, σA			Consensus value of the analyte, X_C	Consensus value of the standard deviation, σ_C	Number of results	Number of outliers
		k = 0.5	k = 1.0	k = 1.5				
	[%]							
Al	3.410	0.057	0.113	0.170	3.41	0.22	25	2
Ca	-	-	-	-	2.00	0.16	31	2
Fe	*5.080*	*0.080*	*0.159*	*0.239*	*5.09*	*0.09*	*41*	*11*
K	0.979	0.020	0.039	0.059	0.94	0.05	28	3
Mg	1.083	0.021	0.043	0.064	1.15	0.10	19	1
Si	*10.610*	*0.149*	*0.297*	*0.446*	*11.11*	*0.68*	*21*	*2*
	[mg/kg]							
Ag	-	-	-	-	2.43	0.29	1	0
As	*23.130*	*1.153*	*2.306*	*3.459*	*17.46*	*3.89*	*11*	*1*
Ba	753	22.225	44.450	66.674	471	50.26	6	2
Br	-	-	-	-	122	38.51	7	0
Cd	-	-	-	-	3.26	1.44	3	1
Ce	-	-	-	-	41.75	0.35	4	2
Cl	1426	38.232	76.464	115	1228	96.47	12	3
Co	-	-	-	-	15.73	0.90	14	7
Cr	412	13.315	26.631	39.946	336	34.65	28	2
Cs	-	-	-	-	3.90	0.43	3	1
Cu	*1450*	*38.778*	*77.555*	*116*	*1240*	*116*	*32*	*1*
Eu	-	-	-	-	0.15	0.02	1	0
Ga	18.700	0.963	1.925	2.888	23.50	2.80	1	0
Hf	-	-	-	-	24.38	27.97	2	0
Hg	-	-	-	-	4.10	0.30	1	0
La	21.900	1.101	2.202	3.302	20.55	0.95	7	2
Mn	558	17.229	34.458	51.688	550	57.81	31	0
Mo	-	-	-	-	46.28	24.25	3	0
Na	3360	79.182	158	238	2354	353	16	0
Ni	243	8.503	17.006	25.509	171	21.08	23	5
P	1806	46.728	93.457	140	1348	159	15	0
Pb	*660*	*19.870*	*39.740*	*59.611*	*654*	*57.7*	*29*	*0*
Rb	63.800	2.730	5.460	8.191	59.29	11.84	6	0
S	*2930*	*70.486*	*141*	*211*	*2801*	*183*	*21*	*2*
Sb	-	-	-	-	157	20.23	8	4
Sc	-	-	-	-	5.63	0.17	6	1

Analyte symbol	Assigned value of the analyte, X_A	Target value of standard deviation, σA			Consensus value of the analyte, X_C	Consensus value of the standard deviation, σ_C	Number of results	Number of outliers
		k = 0.5	k = 1.0	k = 1.5				
	[mg/kg]							
Se	-	-	-	-	16.32	7.20	1	0
Sm	-	-	-	-	2.32	1.09	3	0
Sn	-	-	-	-	76.42	9.31	3	1
Sr	130	4.998	9.996	14.994	74.52	15.74	10	1
Tb	-	-	-	-	679	57.70	1	0
Th	-	-	-	-	4.49	0.82	5	2
Ti	2600	63.682	127	191	2381	163	29	3
Tl	-	-	-	-	0.98	0.01	1	0
U	-	-	-	-	18.55	22.69	2	0
V	94.500	3.812	7.624	11.435	90.47	12.95	14	0
W	-	-	-	-	7.30	1.20	1	0
Zn	*1759*	*45.693*	*91.387*	*137*	*1636*	*131*	*36*	*2*
Zr	131	5.031	10.061	15.092	193	27.85	6	1

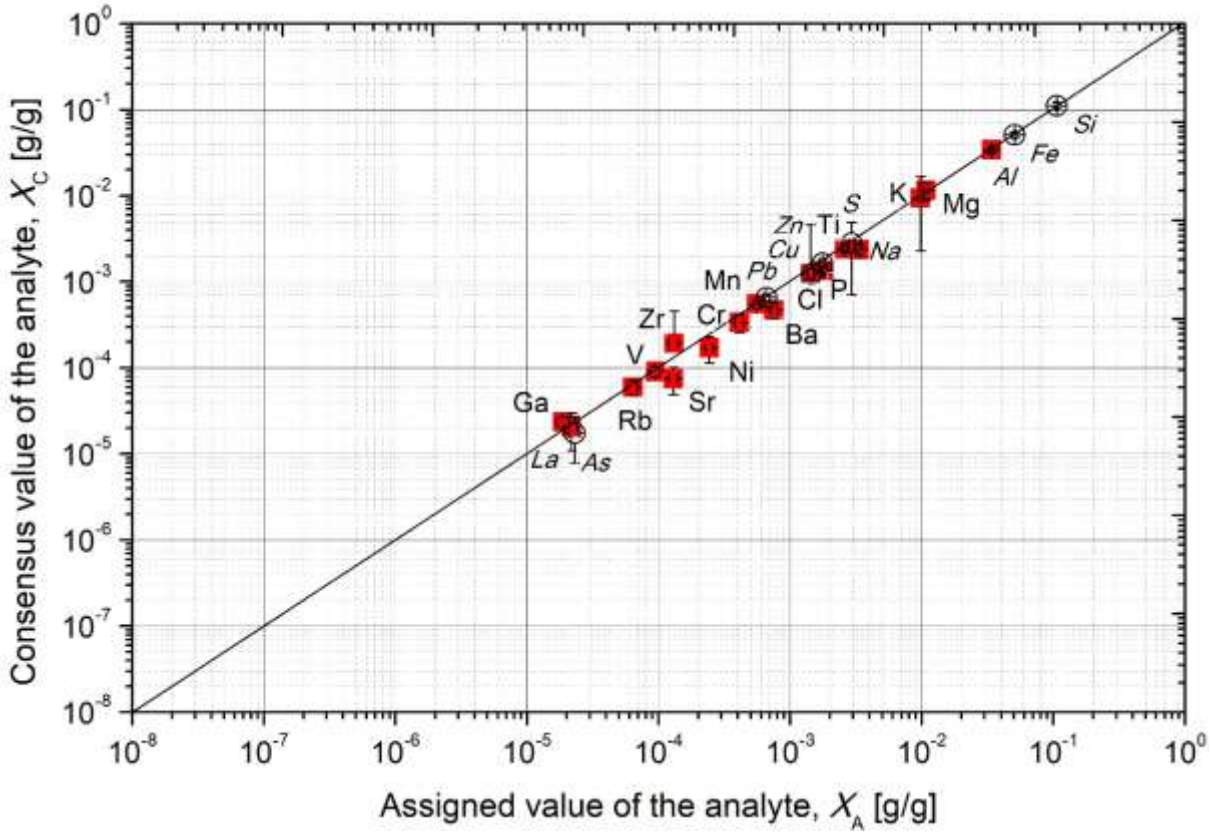

FIG. 2. Correlation between assigned, X_A, and consensus values of analytes, X_C[1].

Table 3 lists the values of the z- and u-scores for all submitted results. In brackets next to the element symbol the assigned values of element concentration and the target standard deviation for k = 1 are shown. The z- and u-scores were calculated for the three different fit-for-purpose ranges, as defined by Eqn. (2). The results rejected by the outliers rejection procedures were marked with "*" in the "Analyte concentration" column.

Table 4 shows the combined z-scores for the three different fit-for-purpose ranges, the RSZ and SSZ as defined in Eqns. (6) and (7), for the participating laboratories. The analytes without assigned values were not considered.

Figs. 3-28 and 29-51 present the distributions of the proficiency test results. In Figs 3-28 the individual results are marked with filled circles. The dotted lines show the range of the accepted results (these results were used to calculate the consensus values). The outliers are marked with arrows. Also shown are the estimated parameters of the distribution (after outlier rejection): mode, median, and the mean value. For few elements, the result of density distributions could only be used as indicators of the trends observed in the reported data due to the limited number of results (only density distributions of analytes for which at least 5 results passed the outlier

[1] The uncertainties of the assigned values were calculated according to Eqn. (2) with $k = 1$. The uncertainties of the consensus values were calculated according to Eqn. (20), except for the results reported by a single laboratory, in such a case the laboratory estimate of the uncertainty was shown in the plot. Solid red squares correspond to assigned values taken from the provider of the material. Hollow black circles correspond to the median values of the reported results.

rejection tests are shown). All the populations of results, after outlier rejection, have passed a normality test (Kolmogorov-Smirnov). Figs. 29-51 show the bar chart distributions of the *z*-scores for the analytes with at least 6 submitted results. The results are sorted in ascending order versus laboratory/technique code. The bar charts show the distance between the reported and the assigned values of the analyte. The submitted results and their uncertainties are marked with filled squares accompanied by uncertainty bars. The horizontal lines show the admissible levels of z-score, $|z| < 2$, for three different ranges defined by factor k in Eqn. (2): $k = 0.5$ (solid black lines), $k = 1.0$ (solid green lines) and $k = 1.5$ (solid red lines).

For every participating laboratory its overall performance is presented in Figs. 52-94. The plots presented in this figure relate all the *u*-scores and *z*-scores calculated for a given laboratory. The hollow symbols denote the values calculated for specific fit-for-purpose levels as defined in Eqn. (2) with factor k, namely: $k = 0.5$ (black triangles), $k = 1.0$ (green circles), and $k = 1.5$ (red squares). The decision limits of unsatisfactory results were marked with black lines ($|z| > 3$, $u > 3.29$). They divide the plot area in four quadrants. Due to inequality (10) all the points accompanied by a laboratory estimate of the uncertainty fall always below the line $u = |z|$. The smaller the laboratory estimate of the uncertainty the closer the related point to the $u = |z|$ line. Points in the immediate proximity of the dashed diagonal line ($u = |z|$) have underestimated uncertainty values. The well performing laboratories would have more points located in the lower-left quadrant of the plot. If there are many points located in the upper-right quadrant it suggests that these results do not fall in the defined fit-for-purpose targets and that the laboratory provided too “narrow” uncertainty estimate.

Fig. 95 shows the partitioning of the results between different analytical techniques. The largest fraction of analyses was carried out with the energy dispersive spectrometry, whereas about 3.5% with wavelength dispersive mode. PIXE accounts for about 13% of the total results, NAA for about 9 % and ICPMS for about 10%.

TABLE 3. SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
Al (3.410 ± 0.113) [%]										
152	5.2	0.070*	0.007	10.00	-58.91	-29.45	-19.64	58.46	29.40	19.62
39	7.2	0.167*	0.009	5.39	-57.20	-28.60	-19.07	56.49	28.51	19.04
5	1.21	1.270	0.059	4.65	-37.74	-18.87	-12.58	26.15	16.74	11.89
78	1.23	1.443	0.046	3.19	-34.69	-17.35	-11.56	26.94	16.07	11.16
162	7.2	1.800	0.400	22.22	-28.40	-14.20	-9.47	3.99	3.87	3.70
87	1.23	1.857	0.133	7.16	-27.39	-13.70	-9.13	10.74	8.89	7.19
159	7.2	2.410	0.240	9.96	-17.64	-8.82	-5.88	4.06	3.77	3.40
151	7.2	2.799	0.009	0.32	-10.78	-5.39	-3.59	10.64	5.37	3.59
116	1.32	3.251	0.327	10.06	-2.80	-1.40	-0.93	0.48	0.46	0.43
146	4.2	3.350	0.500	14.93	-1.06	-0.53	-0.35	0.12	0.12	0.11
148	4.2	3.406	0.778	22.84	-0.07	-0.04	-0.02	0.01	0.01	0.01
204	1.21	3.485	0.316	9.07	1.32	0.66	0.44	0.23	0.22	0.21
129	4.2	3.521	0.018	0.51	1.96	0.98	0.65	1.87	0.97	0.65
158	1.22	3.630	0.200	5.51	3.88	1.94	1.29	1.06	0.96	0.84
145	1.22	3.713	0.254	6.84	5.34	2.67	1.78	1.16	1.09	0.99
137	1.22	3.780	0.540	14.29	6.53	3.26	2.18	0.68	0.67	0.65
155	4.2	3.847	0.268	6.97	7.71	3.85	2.57	1.60	1.50	1.38
102	1.23	3.894	0.584	15.00	8.54	4.27	2.85	0.82	0.81	0.80
138	1.23	3.900	0.640	16.41	8.64	4.32	2.88	0.76	0.75	0.74
100	1.22	4.119	0.350	8.50	12.50	6.25	4.17	2.00	1.93	1.82
113	1.23	4.272	0.018	0.42	15.20	7.60	5.07	14.49	7.51	5.04
98	2.0	4.320	0.270	6.25	16.05	8.02	5.35	3.30	3.11	2.85
149	1.23	4.387	0.224	5.11	17.23	8.62	5.74	4.23	3.89	3.47
124	1.21	4.950	0.020	0.40	27.16	13.58	9.05	25.61	13.37	8.99
3	1.23	5.095	0.126	2.47	29.72	14.86	9.91	12.20	9.94	7.96
Ca [%]										
77	1.21	0.039	0.004	10.26	-	-	-	-	-	-
152	5.2	0.071	0.004	5.63	-	-	-	-	-	-
104	1.32	0.071	0.002	2.82	-	-	-	-	-	-
64	1.14	1.200	0.400	33.33	-	-	-	-	-	-
53	1.32	1.200	0.200	16.67	-	-	-	-	-	-
78	1.23	1.341	0.032	2.39	-	-	-	-	-	-
153	2.0	1.557	0.602	38.66	-	-	-	-	-	-
131	1.22	1.845	0.067	3.63	-	-	-	-	-	-
129	4.2	1.867	0.024	1.29	-	-	-	-	-	-
146	4.2	1.920	0.096	5.00	-	-	-	-	-	-
155	4.2	1.941	0.136	7.01	-	-	-	-	-	-
151	7.2	1.946	0.010	0.51	-	-	-	-	-	-
148	4.2	1.973	0.451	22.86	-	-	-	-	-	-
138	1.23	2.050	0.220	10.73	-	-	-	-	-	-
113	1.23	2.178	0.035	1.61	-	-	-	-	-	-
149	1.23	2.297	0.108	4.70	-	-	-	-	-	-
102	1.23	2.303	0.230	9.99	-	-	-	-	-	-
98	2.0	2.310	0.310	13.42	-	-	-	-	-	-
35	1.23	2.340	0.770	32.91	-	-	-	-	-	-

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
54	1.21	2.358	0.307	13.02	-	-	-	-	-	-
3	1.23	2.421	0.055	2.27	-	-	-	-	-	-
90	1.23	2.520	0.330	13.10	-	-	-	-	-	-
116	1.32	2.588	0.167	6.45	-	-	-	-	-	-
137	1.22	2.800	0.450	16.07	-	-	-	-	-	-
158	1.22	2.800	0.140	5.00	-	-	-	-	-	-
204	1.21	2.810	0.130	4.63	-	-	-	-	-	-
5	1.21	2.860	0.133	4.65	-	-	-	-	-	-
124	1.21	3.160	0.020	0.63	-	-	-	-	-	-
73	1.21	3.200	0.100	3.13	-	-	-	-	-	-
87	1.23	8.820*	0.001	0.01	-	-	-	-	-	-
68	1.23	47.570*	12.590	26.47	-	-	-	-	-	-
				Fe (5.080 ± 0.159) [%]						
142	1.22	0.013*	0.005	38.46	-63.70	-31.85	-21.23	63.57	31.83	21.23
104	1.32	0.078*	0.001	1.28	-62.88	-31.44	-20.96	62.88	31.44	20.96
152	5.2	0.140*	0.010	7.14	-62.10	-31.05	-20.70	61.62	30.99	20.68
77	1.21	0.420*	0.040	9.52	-58.58	-29.29	-19.53	52.34	28.41	19.26
5	1.21	1.250*	0.058	4.64	-48.15	-24.07	-16.05	38.90	22.62	15.59
78	1.23	2.582*	0.029	1.12	-31.40	-15.70	-10.47	29.50	15.45	10.39
153	2.0	2.743*	0.340	12.40	-29.38	-14.69	-9.79	6.69	6.23	5.63
39	7.2	3.240*	0.110	3.40	-23.13	-11.57	-7.71	13.55	9.51	7.00
87	1.23	3.988	0.004	0.10	-13.73	-6.86	-4.58	13.71	6.86	4.58
159	7.2	4.010	0.400	9.98	-13.45	-6.73	-4.48	2.62	2.49	2.30
131	1.22	4.495	0.033	0.73	-7.35	-3.68	-2.45	6.79	3.60	2.43
100	1.22	4.524	0.154	3.40	-6.99	-3.49	-2.33	3.21	2.51	1.96
162	7.2	4.600	0.900	19.57	-6.03	-3.02	-2.01	0.53	0.53	0.52
155	4.2	4.726	0.327	6.92	-4.45	-2.23	-1.48	1.05	0.97	0.87
137	1.22	4.770	0.790	16.56	-3.90	-1.95	-1.30	0.39	0.38	0.38
204	1.21	4.835	0.657	13.59	-3.08	-1.54	-1.03	0.37	0.36	0.35
146	4.2	4.890	0.240	4.91	-2.39	-1.19	-0.80	0.75	0.66	0.56
64	1.14	4.910	0.200	4.07	-2.14	-1.07	-0.71	0.79	0.67	0.55
35	1.23	4.968	0.692	13.93	-1.41	-0.70	-0.47	0.16	0.16	0.15
61	5.2	4.980	0.250	5.02	-1.26	-0.63	-0.42	0.38	0.34	0.29
53	1.32	5.000	0.600	12.00	-1.01	-0.50	-0.34	0.13	0.13	0.12
95	1.32	5.000	0.300	6.00	-1.01	-0.50	-0.34	0.26	0.24	0.21
151	7.2	5.075	0.005	0.10	-0.06	-0.03	-0.02	0.06	0.03	0.02
113	1.23	5.087	0.025	0.49	0.09	0.04	0.03	0.08	0.04	0.03
102	1.23	5.139	0.513	9.98	0.74	0.37	0.25	0.11	0.11	0.10
138	1.23	5.190	0.560	10.79	1.38	0.69	0.46	0.19	0.19	0.18
129	4.2	5.278	0.065	1.23	2.49	1.24	0.83	1.93	1.15	0.80
145	1.22	5.296	0.362	6.84	2.72	1.36	0.91	0.58	0.55	0.50
148	4.2	5.354	1.223	22.84	3.44	1.72	1.15	0.22	0.22	0.22
40	5.1	5.400	0.300	5.56	4.02	2.01	1.34	1.03	0.94	0.83
90	1.23	5.410	0.500	9.24	4.15	2.07	1.38	0.65	0.63	0.60
54	1.21	5.494	0.824	15.00	5.20	2.60	1.73	0.50	0.49	0.48
98	2.0	5.510	0.360	6.53	5.41	2.70	1.80	1.17	1.09	1.00
149	1.23	5.542	0.260	4.69	5.81	2.90	1.94	1.70	1.52	1.31
79	1.13	5.650	0.153	2.71	7.17	3.58	2.39	3.31	2.58	2.01
3	1.23	5.661	0.106	1.87	7.30	3.65	2.43	4.38	3.04	2.22

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
116	1.32	5.846	0.060	1.03	9.63	4.81	3.21	7.69	4.50	3.11
139	5.2	5.950	0.530	8.91	10.94	5.47	3.65	1.62	1.57	1.50
124	1.21	6.980*	0.034	0.49	23.88	11.94	7.96	21.96	11.68	7.88
73	1.21	7.700*	0.100	1.30	32.94	16.47	10.98	20.50	13.94	10.13
158	1.22	11.140*	0.670	6.01	76.18	38.09	25.39	8.98	8.80	8.52
K (0.979 ± 0.039) [%]										
152	5.2	0.051*	0.005	9.80	-47.25	-23.62	-15.75	45.79	23.43	15.69
77	1.21	0.077*	0.009	11.69	-45.92	-22.96	-15.31	41.75	22.38	15.13
151	7.2	0.533	0.008	1.50	-22.71	-11.35	-7.57	21.03	11.13	7.50
78	1.23	0.555	0.023	4.14	-21.59	-10.79	-7.20	14.02	9.31	6.70
5	1.21	0.626	0.029	4.63	-17.97	-8.99	-5.99	10.08	7.23	5.38
129	4.2	0.642	0.016	2.49	-17.16	-8.58	-5.72	13.30	7.95	5.52
53	1.32	0.700	0.300	42.86	-14.20	-7.10	-4.73	0.93	0.92	0.91
87	1.23	0.795	0.001	0.13	-9.37	-4.68	-3.12	9.36	4.68	3.12
155	4.2	0.813	0.058	7.13	-8.45	-4.23	-2.82	2.71	2.37	2.01
148	4.2	0.818	0.187	22.86	-8.20	-4.10	-2.73	0.86	0.84	0.82
113	1.23	0.840	0.024	2.86	-7.08	-3.54	-2.36	4.48	3.02	2.18
131	1.22	0.860	0.039	4.53	-6.06	-3.03	-2.02	2.73	2.15	1.68
146	4.2	0.870	0.040	4.60	-5.55	-2.77	-1.85	2.45	1.94	1.53
204	1.21	0.916	0.038	4.15	-3.21	-1.60	-1.07	1.47	1.15	0.90
138	1.23	0.937	0.090	9.61	-2.14	-1.07	-0.71	0.46	0.43	0.39
116	1.32	0.942	0.039	4.14	-1.88	-0.94	-0.63	0.85	0.67	0.52
137	1.22	0.953	0.167	17.52	-1.32	-0.66	-0.44	0.15	0.15	0.15
98	2.0	1.000	0.100	10.00	1.07	0.53	0.36	0.21	0.20	0.18
40	5.1	1.000	0.050	5.00	1.07	0.53	0.36	0.39	0.33	0.27
149	1.23	1.027	0.048	4.67	2.44	1.22	0.81	0.93	0.77	0.63
102	1.23	1.031	0.103	9.99	2.65	1.32	0.88	0.50	0.47	0.44
145	1.22	1.123	0.077	6.86	7.33	3.67	2.44	1.81	1.67	1.49
158	1.22	1.142	0.057	4.99	8.30	4.15	2.77	2.70	2.35	1.99
73	1.21	1.200	0.100	8.33	11.25	5.63	3.75	2.17	2.06	1.90
3	1.23	1.245	0.004	0.32	13.54	6.77	4.51	13.27	6.74	4.50
124	1.21	1.430	0.018	1.26	22.96	11.48	7.65	16.93	10.44	7.32
90	1.23	1.470	0.320	21.77	25.00	12.50	8.33	1.53	1.52	1.51
68	1.23	20.640*	1.500	7.27	1001.00	500.50	333.67	13.11	13.10	13.10
Mg (1.083 ± 0.043) [%]										
152	5.2	0.053	0.007	13.21	-48.13	-24.07	-16.04	45.75	23.75	15.95
131	1.22	0.432	0.005	1.16	-30.42	-15.21	-10.14	29.62	15.11	10.11
124	1.21	0.578	0.012	2.08	-23.60	-11.80	-7.87	20.58	11.36	7.73
129	4.2	0.648	0.009	1.39	-20.33	-10.16	-6.78	18.74	9.95	6.71
145	1.22	1.068	0.073	6.84	-0.70	-0.35	-0.23	0.20	0.18	0.15
162	7.2	1.100	0.200	18.18	0.79	0.40	0.26	0.08	0.08	0.08
204	1.21	1.150	0.120	10.43	3.13	1.57	1.04	0.55	0.53	0.49
137	1.22	1.220	0.210	17.21	6.40	3.20	2.13	0.65	0.64	0.62
158	1.22	1.250	0.100	8.00	7.80	3.90	2.60	1.63	1.54	1.41
3	1.23	1.307	0.180	13.77	10.47	5.23	3.49	1.24	1.21	1.17
102	1.23	1.308	0.196	14.98	10.51	5.26	3.50	1.14	1.12	1.09
155	4.2	1.358	0.110	8.10	12.85	6.43	4.28	2.45	2.33	2.16
151	7.2	1.425	0.008	0.56	15.98	7.99	5.33	14.97	7.85	5.29

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
149	1.23	1.501	0.072	4.80	19.53	9.77	6.51	5.56	4.99	4.33
138	1.23	1.520	0.400	26.32	20.42	10.21	6.81	1.09	1.09	1.08
100	1.22	1.534	0.095	6.19	21.07	10.54	7.02	4.63	4.33	3.93
113	1.23	1.616	0.046	2.85	24.91	12.45	8.30	10.51	8.48	6.75
98	2.0	1.640	0.110	6.71	26.03	13.01	8.68	4.97	4.72	4.37
153	2.0	5.893*	0.158	2.68	224.76	112.38	74.92	30.17	29.38	28.20
				Si (10.610 ± 0.297) [%]						
77	1.21	1.270*	0.140	11.02	-62.81	-31.40	-20.94	45.73	28.41	19.97
5	1.21	1.330*	0.062	4.66	-62.40	-31.20	-20.80	57.60	30.54	20.60
78	1.23	4.804	0.114	2.37	-39.04	-19.52	-13.01	30.99	18.23	12.61
131	1.22	8.016	0.060	0.75	-17.44	-8.72	-5.81	16.18	8.55	5.76
204	1.21	8.997	0.141	1.57	-10.85	-5.42	-3.62	7.87	4.90	3.45
129	4.2	9.437	0.024	0.25	-7.89	-3.94	-2.63	7.79	3.93	2.63
146	4.2	9.550	0.950	9.95	-7.13	-3.56	-2.38	1.10	1.06	1.01
3	1.23	9.832	0.157	1.60	-5.23	-2.62	-1.74	3.60	2.31	1.64
155	4.2	9.942	0.934	9.39	-4.49	-2.25	-1.50	0.71	0.68	0.65
137	1.22	10.300	1.800	17.48	-2.08	-1.04	-0.69	0.17	0.17	0.17
102	1.23	10.559	1.584	15.00	-0.34	-0.17	-0.11	0.03	0.03	0.03
100	1.22	10.607	0.414	3.90	-0.02	-0.01	-0.01	0.01	0.01	0.00
145	1.22	10.850	0.742	6.84	1.61	0.81	0.54	0.32	0.30	0.28
148	4.2	11.041	2.522	22.84	2.90	1.45	0.97	0.17	0.17	0.17
149	1.23	11.359	0.531	4.67	5.04	2.52	1.68	1.36	1.23	1.08
113	1.23	11.579	0.031	0.27	6.52	3.26	2.17	6.38	3.24	2.17
158	1.22	11.880	0.630	5.30	8.54	4.27	2.85	1.96	1.82	1.65
138	1.23	12.200	2.000	16.39	10.69	5.35	3.56	0.79	0.79	0.78
73	1.21	15.800	0.600	3.80	34.90	17.45	11.63	8.40	7.75	6.94
87	1.23	16.830	0.001	0.01	41.83	20.91	13.94	41.82	20.91	13.94
68	1.23	17.440	1.740	9.98	45.93	22.96	15.31	3.91	3.87	3.80

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
				Ag [mg/kg]						
151	7.2	2.429	0.288	11.86	-	-	-	-	-	-
				As (23.130 ± 2.306) [mg/kg]						
159	7.2	0.002	0.001	50.00	-20.06	-10.03	-6.69	20.06	10.03	6.69
104	1.32	0.340	0.018	5.29	-19.76	-9.88	-6.59	19.76	9.88	6.59
152	5.2	0.491	0.030	6.11	-19.63	-9.82	-6.54	19.63	9.82	6.54
139	5.2	18.500	2.800	15.14	-4.02	-2.01	-1.34	1.53	1.28	1.04
98	2.0	23.000	6.000	26.09	-0.11	-0.06	-0.04	0.02	0.02	0.02
151	7.2	23.267	1.745	7.50	0.12	0.06	0.04	0.07	0.05	0.04
149	1.23	24.455	8.231	33.66	1.15	0.57	0.38	0.16	0.16	0.15
40	5.1	24.800	4.900	19.76	1.45	0.72	0.48	0.33	0.31	0.28
124	1.21	28.650	4.900	17.10	4.79	2.39	1.60	1.10	1.02	0.92
61	5.2	31.100	8.300	26.69	6.91	3.46	2.30	0.95	0.93	0.89
146	4.2	117.000*	59.000	50.43	81.41	40.70	27.14	1.59	1.59	1.59
				Ba (753 ± 44.450) [mg/kg]						
159	7.2	0.045*	0.004	8.89	-33.88	-16.94	-11.29	33.88	16.94	11.29
104	1.32	81.300*	0.590	0.73	-30.22	-15.11	-10.07	30.21	15.11	10.07
87	1.23	346.936	0.178	0.05	-18.27	-9.14	-6.09	18.27	9.14	6.09
162	7.2	438.000	88.000	20.09	-14.17	-7.09	-4.72	3.47	3.20	2.85
40	5.1	524.000	105.000	20.04	-10.30	-5.15	-3.43	2.13	2.01	1.84
155	4.2	576.000	131.000	22.74	-7.96	-3.98	-2.65	1.33	1.28	1.20
				Br [mg/kg]						
152	5.2	0.072	0.010	13.89	-	-	-	-	-	-
124	1.21	4.030	0.200	4.96	-	-	-	-	-	-
204	1.21	50.000	7.000	14.00	-	-	-	-	-	-
138	1.23	157.000	54.000	34.39	-	-	-	-	-	-
131	1.22	197.060	7.650	3.88	-	-	-	-	-	-
155	4.2	203.000	44.000	21.67	-	-	-	-	-	-
148	4.2	244.000	61.000	25.00	-	-	-	-	-	-
				Cd [mg/kg]						
151	7.2	2.248	0.200	8.90	-	-	-	-	-	-
39	7.2	4.280	0.340	7.94	-	-	-	-	-	-
3	1.23	86.652*	68.670	79.25	-	-	-	-	-	-
				Ce [mg/kg]						
204	1.21	32.800*	3.100	9.45	-	-	-	-	-	-
61	5.1	41.500	8.200	19.76	-	-	-	-	-	-
40	5.1	42.000	2.000	4.76	-	-	-	-	-	-
131	1.22	257.120*	38.280	14.89	-	-	-	-	-	-
				Cl (1426 ± 76.464) [mg/kg]						
129	4.2	219.111*	173.693	79.27	-31.57	-15.78	-10.52	6.79	6.36	5.80
113	1.23	767.300	9.800	1.28	-17.23	-8.61	-5.74	16.69	8.54	5.72
138	1.23	832.000	139.000	16.71	-15.54	-7.77	-5.18	4.12	3.74	3.30
155	4.2	1158.000	83.000	7.17	-7.01	-3.50	-2.34	2.93	2.37	1.89

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
204	1.21	1210.000	70.000	5.79	-5.65	-2.82	-1.88	2.71	2.08	1.61
148	4.2	1239.000	284.000	22.92	-4.89	-2.45	-1.63	0.65	0.64	0.61
149	1.23	1273.373	63.015	4.95	-3.99	-2.00	-1.33	2.07	1.54	1.17
158	1.22	1420.000	92.000	6.48	-0.16	-0.08	-0.05	0.06	0.05	0.04
146	4.2	1495.000	150.000	10.03	1.80	0.90	0.60	0.45	0.41	0.37
131	1.22	1658.610	122.690	7.40	6.08	3.04	2.03	1.81	1.61	1.38
124	1.21	5965.790*	20.000	0.34	118.74	59.37	39.58	105.22	57.44	38.99
145	1.22	40976.000*	2866.000	6.99	1034.48	517.24	344.83	13.80	13.79	13.79
				Co [mg/kg]						
152	5.2	0.621*	0.060	9.66	-	-	-	-	-	-
77	1.21	3.400*	0.300	8.82	-	-	-	-	-	-
151	7.2	12.501	1.369	10.95	-	-	-	-	-	-
40	5.1	13.000	1.000	7.69	-	-	-	-	-	-
124	1.21	14.690	2.400	16.34	-	-	-	-	-	-
139	5.2	16.500	2.400	14.55	-	-	-	-	-	-
204	1.21	16.700	1.300	7.78	-	-	-	-	-	-
61	5.2	18.300	3.500	19.13	-	-	-	-	-	-
149	1.23	18.384	2.205	11.99	-	-	-	-	-	-
131	1.22	149.100*	20.350	13.65	-	-	-	-	-	-
148	4.2	205.000*	78.300	38.20	-	-	-	-	-	-
145	1.22	303.000*	31.000	10.23	-	-	-	-	-	-
146	4.2	320.000*	95.000	29.69	-	-	-	-	-	-
153	2.0	1436.625*	46.644	3.25	-	-	-	-	-	-
				Cr (412 ± 26.631) [mg/kg]						
159	7.2	0.026	0.003	11.54	-30.94	-15.47	-10.31	30.94	15.47	10.31
104	1.32	5.280	0.210	3.98	-30.55	-15.27	-10.18	30.54	15.27	10.18
77	1.21	5.800	0.600	10.34	-30.51	-15.25	-10.17	30.48	15.25	10.17
152	5.2	28.180	4.200	14.90	-28.83	-14.41	-9.61	27.49	14.24	9.56
78	1.32	72.427	4.682	6.46	-25.50	-12.75	-8.50	24.06	12.56	8.44
137	1.22	199.000	14.000	7.04	-16.00	-8.00	-5.33	11.02	7.08	5.03
151	7.2	283.506	34.799	12.27	-9.65	-4.83	-3.22	3.45	2.93	2.43
139	5.2	317.000	38.000	11.99	-7.13	-3.57	-2.38	2.36	2.05	1.72
138	1.23	324.000	41.000	12.65	-6.61	-3.30	-2.20	2.04	1.80	1.54
158	1.22	351.000	25.000	7.12	-4.58	-2.29	-1.53	2.15	1.67	1.29
3	1.23	364.186	61.762	16.96	-3.59	-1.80	-1.20	0.76	0.71	0.65
61	5.1	367.000	29.000	7.90	-3.38	-1.69	-1.13	1.41	1.14	0.91
155	4.2	389.000	35.000	9.00	-1.73	-0.86	-0.58	0.61	0.52	0.43
113	1.23	393.500	29.500	7.50	-1.39	-0.69	-0.46	0.57	0.47	0.37
149	1.23	399.002	22.931	5.75	-0.98	-0.49	-0.33	0.49	0.37	0.28
204	1.21	422.000	24.000	5.69	0.75	0.38	0.25	0.36	0.28	0.21
148	4.2	422.000	97.700	23.15	0.75	0.38	0.25	0.10	0.10	0.09
102	1.23	426.681	42.668	10.00	1.10	0.55	0.37	0.33	0.29	0.25
162	7.2	442.000	88.000	19.91	2.25	1.13	0.75	0.34	0.33	0.31
116	1.32	448.000	11.000	2.46	2.70	1.35	0.90	2.08	1.25	0.87
131	1.22	454.440	10.120	2.23	3.19	1.59	1.06	2.54	1.49	1.03
146	4.2	455.000	45.000	9.89	3.23	1.61	1.08	0.92	0.82	0.71
129	4.2	520.934	173.693	33.34	8.18	4.09	2.73	0.63	0.62	0.61
40	5.1	530.000	30.000	5.66	8.86	4.43	2.95	3.60	2.94	2.36

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
124	1.21	546.980	24.000	4.39	10.14	5.07	3.38	4.92	3.77	2.90
53	1.32	580.000	140.000	24.14	12.62	6.31	4.21	1.19	1.18	1.15
5	1.21	1180.000*	54.897	4.65	57.68	28.84	19.23	13.60	12.59	11.31
79	1.13	2157.491*	34.329	1.59	131.09	65.54	43.70	47.40	40.17	33.14
Cs [mg/kg]										
151	7.2	3.590	0.817	22.76	-	-	-	-	-	-
40	5.1	4.200	0.200	4.76	-	-	-	-	-	-
152	5.2	9.759*	1.000	10.25	-	-	-	-	-	-
Cu (1450 ± 77.555) [mg/kg]										
159	7.2	0.119	0.012	10.08	-37.39	-18.69	-12.46	37.39	18.69	12.46
77	1.21	6.400	0.700	10.94	-37.23	-18.61	-12.41	37.22	18.61	12.41
142	1.22	15.000	0.500	3.33	-37.01	-18.50	-12.34	37.00	18.50	12.34
68	1.23	128.450	45.000	35.03	-34.08	-17.04	-11.36	22.25	14.74	10.60
137	1.22	187.000	19.000	10.16	-32.57	-16.29	-10.86	29.25	15.82	10.71
5	1.21	322.000	14.980	4.65	-29.09	-14.54	-9.70	27.13	14.28	9.62
204	1.21	816.000	33.000	4.04	-16.35	-8.17	-5.45	12.45	7.52	5.24
78	1.32	898.271	50.147	5.58	-14.23	-7.11	-4.74	8.70	5.97	4.36
102	1.23	1137.817	113.781	10.00	-8.05	-4.03	-2.68	2.60	2.27	1.92
100	1.22	1300.000	166.000	12.77	-3.87	-1.93	-1.29	0.88	0.82	0.74
113	1.23	1318.100	80.100	6.08	-3.40	-1.70	-1.13	1.48	1.18	0.93
155	4.2	1325.000	99.000	7.47	-3.22	-1.61	-1.07	1.18	0.99	0.82
53	1.32	1360.000	360.000	26.47	-2.32	-1.16	-0.77	0.25	0.24	0.24
90	1.23	1375.000	175.000	12.73	-1.93	-0.97	-0.64	0.42	0.39	0.36
131	1.22	1403.220	20.230	1.44	-1.21	-0.60	-0.40	1.07	0.58	0.40
98	2.0	1450.000	190.000	13.10	0.00	0.00	0.00	0.00	0.00	0.00
104	1.32	1475.000	8.400	0.57	0.64	0.32	0.21	0.63	0.32	0.21
148	4.2	1490.000	342.000	22.95	1.03	0.52	0.34	0.12	0.11	0.11
73	1.21	1491.000	90.000	6.04	1.06	0.53	0.35	0.42	0.35	0.28
158	1.22	1500.000	83.000	5.53	1.29	0.64	0.43	0.55	0.44	0.35
116	1.32	1506.000	31.000	2.06	1.44	0.72	0.48	1.13	0.67	0.47
162	7.2	1517.000	300.000	19.78	1.73	0.86	0.58	0.22	0.22	0.21
151	7.2	1521.049	34.458	2.27	1.83	0.92	0.61	1.37	0.84	0.59
3	1.23	1556.513	74.656	4.80	2.75	1.37	0.92	1.27	0.99	0.77
149	1.23	1568.815	78.280	4.99	3.06	1.53	1.02	1.36	1.08	0.85
146	4.2	1610.000	81.000	5.03	4.13	2.06	1.38	1.78	1.43	1.13
35	1.23	1660.000	260.000	15.66	5.42	2.71	1.81	0.80	0.77	0.74
64	1.14	1900.000	580.000	30.53	11.60	5.80	3.87	0.77	0.77	0.76
79	1.13	2025.645	23.362	1.15	14.84	7.42	4.95	12.72	7.11	4.85
129	4.2	2119.576	415.441	19.60	17.27	8.63	5.76	1.60	1.58	1.55
138	1.23	2460.000	266.000	10.81	26.05	13.02	8.68	3.76	3.65	3.48
124	1.21	5254.530*	115.000	2.19	98.11	49.06	32.70	31.35	27.43	23.26
Eu [mg/kg]										
152	5.2	0.149	0.020	13.42	-	-	-	-	-	-
Ga (18.700 ± 1.925) [mg/kg]										
204	1.21	23.500	2.800	11.91	4.99	2.49	1.66	1.62	1.41	1.19

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
				Hf [mg/kg]						
204	1.21	4.600	1.300	28.26	-	-	-	-	-	-
131	1.22	44.160	20.050	45.40	-	-	-	-	-	-
				Hg [mg/kg]						
40	5.1	4.100	0.300	7.32	-	-	-	-	-	-
				La (21.900 ± 2.202) [mg/kg]						
152	5.2	0.756*	0.100	13.23	-19.21	-9.60	-6.40	19.13	9.59	6.40
151	7.2	17.737	1.362	7.68	-3.78	-1.89	-1.26	2.38	1.61	1.17
40	5.1	19.400	1.000	5.15	-2.27	-1.14	-0.76	1.68	1.03	0.72
61	5.2	21.000	1.600	7.62	-0.82	-0.41	-0.27	0.46	0.33	0.25
139	5.2	21.200	2.500	11.79	-0.64	-0.32	-0.21	0.26	0.21	0.17
204	1.21	23.400	1.800	7.69	1.36	0.68	0.45	0.71	0.53	0.40
131	1.22	81.800*	34.360	42.00	54.42	27.21	18.14	1.74	1.74	1.74
				Mn (558 ± 34.458) [mg/kg]						
159	7.2	0.046	0.005	10.87	-32.38	-16.19	-10.79	32.38	16.19	10.79
104	1.32	7.370	0.198	2.69	-31.96	-15.98	-10.65	31.96	15.98	10.65
152	5.2	12.600	0.700	5.56	-31.66	-15.83	-10.55	31.63	15.82	10.55
77	1.21	26.900	3.600	13.38	-30.83	-15.41	-10.28	30.17	15.33	10.25
145	1.22	255.000	19.000	7.45	-17.59	-8.79	-5.86	11.81	7.70	5.50
39	7.2	323.000	21.000	6.50	-13.64	-6.82	-4.55	8.65	5.82	4.21
157	7.2	348.000	21.000	6.03	-12.19	-6.09	-4.06	7.73	5.20	3.76
78	1.32	365.004	34.757	9.52	-11.20	-5.60	-3.73	4.98	3.94	3.10
35	1.23	473.000	94.000	19.87	-4.93	-2.47	-1.64	0.89	0.85	0.79
131	1.22	484.370	16.980	3.51	-4.27	-2.14	-1.42	3.04	1.92	1.35
204	1.21	496.000	23.000	4.64	-3.60	-1.80	-1.20	2.16	1.50	1.10
53	1.32	500.000	120.000	24.00	-3.37	-1.68	-1.12	0.48	0.46	0.44
100	1.22	512.000	19.000	3.71	-2.67	-1.33	-0.89	1.79	1.17	0.84
102	1.23	512.018	51.201	10.00	-2.67	-1.33	-0.89	0.85	0.75	0.63
162	7.2	514.000	100.000	19.46	-2.55	-1.28	-0.85	0.43	0.42	0.39
98	2.0	530.000	70.000	13.21	-1.63	-0.81	-0.54	0.39	0.36	0.32
146	4.2	555.000	55.000	9.91	-0.17	-0.09	-0.06	0.05	0.05	0.04
129	4.2	590.585	203.150	34.40	1.89	0.95	0.63	0.16	0.16	0.16
151	7.2	599.730	82.005	13.67	2.42	1.21	0.81	0.50	0.47	0.43
158	1.22	610.000	35.000	5.74	3.02	1.51	1.01	1.33	1.06	0.83
137	1.22	623.000	53.000	8.51	3.77	1.89	1.26	1.17	1.03	0.88
113	1.23	628.100	32.300	5.14	4.07	2.03	1.36	1.91	1.48	1.15
124	1.21	664.300	10.000	1.51	6.17	3.08	2.06	5.34	2.96	2.02
155	4.2	696.000	55.000	7.90	8.01	4.00	2.67	2.39	2.13	1.83
148	4.2	710.000	162.000	22.82	8.82	4.41	2.94	0.93	0.92	0.89
149	1.23	718.466	47.355	6.59	9.31	4.66	3.10	3.18	2.74	2.29
116	1.32	735.000	9.000	1.22	10.27	5.14	3.42	9.11	4.97	3.37
138	1.23	886.000	83.000	9.37	19.04	9.52	6.35	3.87	3.65	3.35
3	1.23	987.009	157.835	15.99	24.90	12.45	8.30	2.70	2.66	2.58
68	1.23	1259.500	46.500	3.69	40.72	20.36	13.57	14.15	12.12	10.09
90	1.23	1425.000	270.000	18.95	50.32	25.16	16.77	3.20	3.19	3.15

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
Mo [mg/kg]										
159	7.2	0.004	0.001	25.00	-	-	-	-	-	-
151	7.2	56.821	5.627	9.90	-	-	-	-	-	-
204	1.21	82.000	11.000	13.41	-	-	-	-	-	-
Na (3360 ± 158) [mg/kg]										
152	5.2	128.000	6.400	5.00	-40.82	-20.41	-13.61	40.68	20.39	13.60
77	1.21	245.400	22.500	9.17	-39.33	-19.67	-13.11	37.84	19.47	13.05
145	1.22	371.000	67.000	18.06	-37.75	-18.87	-12.58	28.82	17.38	12.11
131	1.22	727.380	56.160	7.72	-33.25	-16.62	-11.08	27.12	15.67	10.79
129	4.2	820.289	46.870	5.71	-32.07	-16.04	-10.69	27.60	15.38	10.49
102	1.23	2104.960	315.740	15.00	-15.85	-7.93	-5.28	3.86	3.55	3.18
151	7.2	2618.691	46.819	1.79	-9.36	-4.68	-3.12	8.06	4.49	3.06
155	4.2	2802.000	1817.000	64.85	-7.05	-3.52	-2.35	0.31	0.31	0.30
40	5.1	3059.000	150.000	4.90	-3.80	-1.90	-1.27	1.77	1.38	1.07
124	1.21	3089.000	120.000	3.88	-3.42	-1.71	-1.14	1.88	1.36	1.02
100	1.22	3307.000	162.000	4.90	-0.67	-0.33	-0.22	0.29	0.23	0.18
98	2.0	3440.000	220.000	6.40	1.01	0.51	0.34	0.34	0.30	0.25
148	4.2	3476.000	736.000	21.17	1.46	0.73	0.49	0.16	0.15	0.15
139	5.2	3576.000	210.000	5.87	2.73	1.36	0.91	0.96	0.82	0.68
137	1.22	3584.000	44.000	1.23	2.83	1.41	0.94	2.47	1.36	0.93
113	1.23	4314.100	670.300	15.54	12.05	6.02	4.02	1.41	1.39	1.34
Ni (243 ± 17.006) [mg/kg]										
159	7.2	0.018	0.002	11.11	-28.58	-14.29	-9.53	28.58	14.29	9.53
77	1.21	2.200	0.200	9.09	-28.32	-14.16	-9.44	28.31	14.16	9.44
104	1.32	5.026	0.066	1.31	-27.99	-13.99	-9.33	27.99	13.99	9.33
78	1.32	109.980	7.423	6.75	-15.64	-7.82	-5.21	11.78	7.17	5.01
158	1.22	136.000	25.000	18.38	-12.58	-6.29	-4.19	4.05	3.54	3.00
35	1.23	150.000	70.000	46.67	-10.94	-5.47	-3.65	1.32	1.29	1.25
146	4.2	160.000	48.000	30.00	-9.76	-4.88	-3.25	1.70	1.63	1.53
3	1.23	177.557	76.301	42.97	-7.70	-3.85	-2.57	0.85	0.84	0.81
138	1.23	200.000	28.000	14.00	-5.06	-2.53	-1.69	1.47	1.31	1.14
87	1.23	204.200	0.001	0.00	-4.56	-2.28	-1.52	4.56	2.28	1.52
155	4.2	215.000	22.000	10.23	-3.29	-1.65	-1.10	1.19	1.01	0.83
151	7.2	229.368	24.164	10.54	-1.60	-0.80	-0.53	0.53	0.46	0.39
113	1.23	230.500	42.200	18.31	-1.47	-0.74	-0.49	0.29	0.27	0.25
116	1.32	237.000	7.000	2.95	-0.71	-0.35	-0.24	0.54	0.33	0.23
102	1.23	241.786	24.178	10.00	-0.14	-0.07	-0.05	0.05	0.04	0.03
149	1.23	241.887	18.793	7.77	-0.13	-0.07	-0.04	0.05	0.04	0.04
204	1.21	246.000	14.000	5.69	0.35	0.18	0.12	0.18	0.14	0.10
131	1.22	290.380	13.110	4.51	5.57	2.79	1.86	3.03	2.21	1.65
148	4.2	469.000*	110.000	23.45	26.58	13.29	8.86	2.05	2.03	2.00
124	1.21	593.350*	24.000	4.04	41.20	20.60	13.73	13.76	11.91	10.00
53	1.32	610.000*	140.000	22.95	43.16	21.58	14.39	2.62	2.60	2.58
129	4.2	915.624*	355.512	38.83	79.10	39.55	26.37	1.89	1.89	1.89
5	1.21	1140.000*	53.036	4.65	105.49	52.75	35.16	16.70	16.11	15.24

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
P (1806 ± 93.457) [mg/kg]										
77	1.21	13.600	1.700	12.50	-38.36	-19.18	-12.79	38.33	19.18	12.78
3	1.23	396.837	85.827	21.63	-30.16	-15.08	-10.05	14.42	11.11	8.57
78	1.23	570.553	10.706	1.88	-26.44	-13.22	-8.81	25.77	13.13	8.79
131	1.22	1008.510	15.930	1.58	-17.07	-8.53	-5.69	16.15	8.41	5.65
155	4.2	1250.000	92.000	7.36	-11.90	-5.95	-3.97	5.39	4.24	3.32
158	1.22	1280.000	120.000	9.38	-11.26	-5.63	-3.75	4.08	3.46	2.85
149	1.23	1472.608	114.830	7.80	-7.13	-3.57	-2.38	2.69	2.25	1.84
129	4.2	1502.727	132.047	8.79	-6.49	-3.25	-2.16	2.17	1.87	1.57
116	1.32	1567.000	204.000	13.02	-5.11	-2.56	-1.70	1.14	1.07	0.97
148	4.2	1593.000	366.000	22.98	-4.56	-2.28	-1.52	0.58	0.56	0.54
113	1.23	1644.100	14.100	0.86	-3.46	-1.73	-1.15	3.32	1.71	1.15
137	1.22	1794.000	249.000	13.88	-0.26	-0.13	-0.09	0.05	0.05	0.04
138	1.23	1910.000	510.000	26.70	2.23	1.11	0.74	0.20	0.20	0.20
204	1.21	1990.000	170.000	8.54	3.94	1.97	1.31	1.04	0.95	0.84
146	4.2	2220.000	222.000	10.00	8.86	4.43	2.95	1.82	1.72	1.58
Pb (660 ± 39.740) [mg/kg]										
159	7.2	0.054	0.005	9.26	-33.21	-16.61	-11.07	33.21	16.61	11.07
104	1.32	6.600	0.940	14.24	-32.88	-16.44	-10.96	32.85	16.44	10.96
142	1.22	96.000	8.000	8.33	-28.38	-14.19	-9.46	26.33	13.91	9.38
153	2.0	311.022	46.646	15.00	-17.56	-8.78	-5.85	6.88	5.69	4.61
90	1.23	455.000	210.000	46.15	-10.32	-5.16	-3.44	0.97	0.96	0.94
204	1.21	473.000	32.000	6.77	-9.41	-4.71	-3.14	4.96	3.67	2.76
78	1.32	479.253	30.759	6.42	-9.10	-4.55	-3.03	4.94	3.60	2.69
155	4.2	553.000	135.000	24.41	-5.38	-2.69	-1.79	0.78	0.76	0.73
79	1.13	569.338	14.531	2.55	-4.56	-2.28	-1.52	3.68	2.14	1.48
149	1.23	593.791	51.393	8.66	-3.33	-1.67	-1.11	1.20	1.02	0.84
87	1.23	616.963	0.099	0.02	-2.17	-1.08	-0.72	2.17	1.08	0.72
131	1.22	632.940	21.310	3.37	-1.36	-0.68	-0.45	0.93	0.60	0.43
148	4.2	635.000	158.000	24.88	-1.26	-0.63	-0.42	0.16	0.15	0.15
98	2.0	659.000	210.000	31.87	-0.05	-0.03	-0.02	0.00	0.00	0.00
53	1.32	660.000	200.000	30.30	0.00	0.00	0.00	0.00	0.00	0.00
151	7.2	669.064	15.396	2.30	0.46	0.23	0.15	0.36	0.21	0.15
162	7.2	685.000	140.000	20.44	1.26	0.63	0.42	0.18	0.17	0.16
3	1.23	716.217	177.121	24.73	2.83	1.41	0.94	0.32	0.31	0.30
116	1.32	729.000	21.000	2.88	3.47	1.74	1.16	2.39	1.54	1.09
158	1.22	742.000	76.000	10.24	4.13	2.06	1.38	1.04	0.96	0.85
157	7.2	753.000	45.000	5.98	4.68	2.34	1.56	1.89	1.55	1.25
39	7.2	775.000	47.000	6.06	5.79	2.89	1.93	2.25	1.87	1.51
146	4.2	840.000	170.000	20.24	9.06	4.53	3.02	1.05	1.03	1.00
145	1.22	857.000	74.000	8.63	9.91	4.96	3.30	2.57	2.35	2.07
113	1.23	917.600	77.300	8.42	12.96	6.48	4.32	3.23	2.96	2.64
124	1.21	924.300	46.000	4.98	13.30	6.65	4.43	5.27	4.35	3.51
35	1.23	947.000	81.000	8.55	14.44	7.22	4.81	3.44	3.18	2.85
138	1.23	1230.000	158.000	12.85	28.69	14.34	9.56	3.58	3.50	3.38
137	1.22	1443.000	375.000	25.99	39.41	19.70	13.14	2.09	2.08	2.06

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
Rb (63.800 ± 5.460) [mg/kg]										
78	1.32	24.371	1.398	5.74	-14.44	-7.22	-4.81	12.85	7.00	4.75
131	1.22	36.090	13.970	38.71	-10.15	-5.07	-3.38	1.95	1.85	1.71
137	1.22	60.000	16.000	26.67	-1.39	-0.70	-0.46	0.23	0.22	0.21
35	1.23	61.000	22.000	36.07	-1.03	-0.51	-0.34	0.13	0.12	0.12
204	1.21	66.000	7.000	10.61	0.81	0.40	0.27	0.29	0.25	0.20
124	1.21	108.250	11.000	10.16	16.28	8.14	5.43	3.92	3.62	3.24
S (2930 ± 141) [mg/kg]										
77	1.21	190.700*	21.400	11.22	-38.86	-19.43	-12.95	37.19	19.21	12.89
78	1.23	1355.974	36.067	2.66	-22.33	-11.17	-7.44	19.88	10.82	7.34
100	1.22	1449.000	297.000	20.50	-21.01	-10.51	-7.00	4.85	4.50	4.06
158	1.22	1790.000	130.000	7.26	-16.17	-8.09	-5.39	7.71	5.94	4.59
204	1.21	1860.000	130.000	6.99	-15.18	-7.59	-5.06	7.24	5.58	4.31
137	1.22	1909.000	44.000	2.30	-14.49	-7.24	-4.83	12.29	6.91	4.73
153	2.0	2725.144	46.639	1.71	-2.91	-1.45	-0.97	2.42	1.38	0.95
113	1.23	2838.600	18.300	0.64	-1.30	-0.65	-0.43	1.26	0.64	0.43
155	4.2	2886.000	201.000	6.96	-0.62	-0.31	-0.21	0.21	0.18	0.15
146	4.2	2890.000	145.000	5.02	-0.57	-0.28	-0.19	0.25	0.20	0.16
138	1.23	2930.000	276.000	9.42	0.00	0.00	0.00	0.00	0.00	0.00
53	1.32	2940.000	1320.000	44.90	0.14	0.07	0.05	0.01	0.01	0.01
116	1.32	3052.000	170.000	5.57	1.73	0.87	0.58	0.66	0.55	0.45
148	4.2	3079.000	705.000	22.90	2.11	1.06	0.70	0.21	0.21	0.20
131	1.22	3210.500	21.560	0.67	3.98	1.99	1.33	3.81	1.97	1.32
3	1.23	3302.446	155.244	4.70	5.28	2.64	1.76	2.18	1.78	1.42
129	4.2	3349.502	153.813	4.59	5.95	2.98	1.98	2.48	2.01	1.60
145	1.22	3617.000	248.000	6.86	9.75	4.87	3.25	2.66	2.41	2.11
98	2.0	3630.000	150.000	4.13	9.93	4.97	3.31	4.22	3.40	2.70
149	1.23	4409.213	214.447	4.86	20.99	10.49	7.00	6.55	5.76	4.91
68	1.23	46592.920*	1057.000	2.27	619.45	309.73	206.48	41.22	40.95	40.51
Sb [mg/kg]										
159	7.2	0.014*	0.001	7.14	-	-	-	-	-	-
152	5.2	1.843*	0.250	13.56	-	-	-	-	-	-
87	1.23	108.072	0.001	0.00	-	-	-	-	-	-
151	7.2	146.292	0.590	0.40	-	-	-	-	-	-
40	5.1	167.000	9.000	5.39	-	-	-	-	-	-
139	5.2	205.000	14.000	6.83	-	-	-	-	-	-
124	1.21	871.860*	40.000	4.59	-	-	-	-	-	-
153	2.0	5879.793*	46.639	0.79	-	-	-	-	-	-
Sc [mg/kg]										
152	5.2	0.436*	0.050	11.47	-	-	-	-	-	-
151	7.2	5.038	0.569	11.29	-	-	-	-	-	-
139	5.2	5.550	0.610	10.99	-	-	-	-	-	-
204	1.21	5.600	1.200	21.43	-	-	-	-	-	-
61	5.2	5.970	0.210	3.52	-	-	-	-	-	-
40	5.1	6.000	0.300	5.00	-	-	-	-	-	-

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
				Se [mg/kg]						
151	7.2	16.319	7.198	44.11	-	-	-	-	-	-
				Sm [mg/kg]						
152	5.2	0.155	0.020	12.90	-	-	-	-	-	-
61	5.2	3.110	0.110	3.54	-	-	-	-	-	-
139	5.2	3.690	0.410	11.11	-	-	-	-	-	-
				Sn [mg/kg]						
151	7.2	69.831	4.401	6.30	-	-	-	-	-	-
162	7.2	83.000	16.000	19.28	-	-	-	-	-	-
145	1.22	2084.000*	127.000	6.09	-	-	-	-	-	-
				Sr (130 ± 9.996) [mg/kg]						
104	1.32	2.910	0.085	2.92	-25.43	-12.71	-8.48	25.42	12.71	8.48
87	1.23	36.130	0.001	0.00	-18.78	-9.39	-6.26	18.78	9.39	6.26
78	1.32	42.716	3.035	7.11	-17.46	-8.73	-5.82	14.93	8.36	5.71
151	7.2	54.099	7.937	14.67	-15.19	-7.59	-5.06	8.09	5.95	4.47
148	4.2	65.800	27.000	41.03	-12.85	-6.42	-4.28	2.34	2.23	2.08
35	1.23	76.000	16.000	21.05	-10.80	-5.40	-3.60	3.22	2.86	2.46
204	1.21	124.000	16.000	12.90	-1.20	-0.60	-0.40	0.36	0.32	0.27
137	1.22	128.000	11.000	8.59	-0.40	-0.20	-0.13	0.17	0.13	0.11
131	1.22	141.020	11.210	7.95	2.20	1.10	0.73	0.90	0.73	0.59
124	1.21	293.170*	13.000	4.43	32.65	16.32	10.88	11.72	9.95	8.22
				Tb [mg/kg]						
131	1.22	679.350	57.700	8.49	-	-	-	-	-	-
				Th [mg/kg]						
152	5.2	2.981	0.400	13.42	-	-	-	-	-	-
204	1.21	4.700	0.600	12.77	-	-	-	-	-	-
61	5.2	5.800	1.500	25.86	-	-	-	-	-	-
124	1.21	14.940*	2.500	16.73	-	-	-	-	-	-
131	1.22	23.270*	9.480	40.74	-	-	-	-	-	-
				Ti (2600 ± 127) [mg/kg]						
159	7.2	0.068*	0.007	10.29	-40.83	-20.41	-13.61	40.83	20.41	13.61
77	1.21	12.900*	2.200	17.05	-40.62	-20.31	-13.54	40.60	20.31	13.54
152	5.2	38.400*	5.800	15.10	-40.22	-20.11	-13.41	40.06	20.09	13.40
162	7.2	556.000	110.000	19.78	-32.10	-16.05	-10.70	16.08	12.15	9.27
5	1.21	795.000	36.986	4.65	-28.34	-14.17	-9.45	24.51	13.61	9.28
78	1.32	901.254	97.687	10.84	-26.68	-13.34	-8.89	14.57	10.58	7.92
151	7.2	989.607	41.122	4.16	-25.29	-12.64	-8.43	21.24	12.03	8.24
129	4.2	1839.520	169.340	9.21	-11.94	-5.97	-3.98	4.20	3.59	2.98
131	1.22	2056.220	128.120	6.23	-8.54	-4.27	-2.85	3.80	3.01	2.36
53	1.32	2130.000	480.000	22.54	-7.38	-3.69	-2.46	0.97	0.95	0.91
155	4.2	2193.000	159.000	7.25	-6.39	-3.20	-2.13	2.38	2.00	1.64
87	1.23	2242.640	0.008	0.00	-5.61	-2.81	-1.87	5.61	2.81	1.87
146	4.2	2330.000	116.000	4.98	-4.24	-2.12	-1.41	2.04	1.57	1.21

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
113	1.23	2431.000	35.100	1.44	-2.65	-1.33	-0.88	2.32	1.28	0.87
148	4.2	2454.000	562.000	22.90	-2.29	-1.15	-0.76	0.26	0.25	0.25
204	1.21	2490.000	175.000	7.03	-1.73	-0.86	-0.58	0.59	0.51	0.42
137	1.22	2544.000	435.000	17.10	-0.88	-0.44	-0.29	0.13	0.12	0.12
145	1.22	2553.000	175.000	6.85	-0.74	-0.37	-0.25	0.25	0.22	0.18
35	1.23	2600.000	500.000	19.23	0.00	0.00	0.00	0.00	0.00	0.00
116	1.32	2656.000	234.000	8.81	0.88	0.44	0.29	0.23	0.21	0.19
102	1.23	2688.093	268.809	10.00	1.38	0.69	0.46	0.32	0.30	0.27
98	2.0	2740.000	450.000	16.42	2.20	1.10	0.73	0.31	0.30	0.29
3	1.23	2883.525	84.849	2.94	4.45	2.23	1.48	2.67	1.85	1.36
138	1.23	2900.000	293.000	10.10	4.71	2.36	1.57	1.00	0.94	0.86
149	1.23	2916.766	142.714	4.89	4.97	2.49	1.66	2.03	1.66	1.33
90	1.23	3070.000	410.000	13.36	7.38	3.69	2.46	1.13	1.09	1.04
124	1.21	3252.150	46.000	1.41	10.24	5.12	3.41	8.30	4.82	3.32
158	1.22	3640.000	230.000	6.32	16.33	8.17	5.44	4.36	3.96	3.48
73	1.21	4045.000	244.000	6.03	22.69	11.35	7.56	5.73	5.25	4.66
					Tl [mg/kg]					
104	1.32	0.980	0.013	1.33	-	-	-	-	-	-
					U [mg/kg]					
204	1.21	2.500	0.400	16.00	-	-	-	-	-	-
131	1.22	34.590	7.800	22.55	-	-	-	-	-	-
					V (94.500 ± 7.624) [mg/kg]					
159	7.2	0.007	0.001	14.29	-24.79	-12.39	-8.26	24.79	12.39	8.26
152	5.2	1.600	0.200	12.50	-24.37	-12.19	-8.12	24.34	12.18	8.12
3	1.23	58.927	33.375	56.64	-9.33	-4.67	-3.11	1.06	1.04	1.01
149	1.23	79.845	20.306	25.43	-3.84	-1.92	-1.28	0.71	0.68	0.63
204	1.21	85.000	20.000	23.53	-2.49	-1.25	-0.83	0.47	0.44	0.41
146	4.2	88.000	26.000	29.55	-1.71	-0.85	-0.57	0.25	0.24	0.23
151	7.2	91.582	7.332	8.01	-0.77	-0.38	-0.26	0.35	0.28	0.21
137	1.22	93.360	5.000	5.36	-0.30	-0.15	-0.10	0.18	0.13	0.09
131	1.22	102.300	26.000	25.42	2.05	1.02	0.68	0.30	0.29	0.27
155	4.2	103.000	29.000	28.16	2.23	1.11	0.74	0.29	0.28	0.27
158	1.22	114.000	18.000	15.79	5.12	2.56	1.71	1.06	1.00	0.91
124	1.21	114.790	20.000	17.42	5.32	2.66	1.77	1.00	0.95	0.88
145	1.22	160.000	14.000	8.75	17.18	8.59	5.73	4.51	4.11	3.62
113	1.23	174.200	35.100	20.15	20.91	10.45	6.97	2.26	2.22	2.16
					W [mg/kg]					
204	1.21	7.300	1.200	16.44	-	-	-	-	-	-
					Zn (1759 ± 91.387) [mg/kg]					
159	7.2	0.130	0.013	10.00	-38.49	-19.25	-12.83	38.49	19.25	12.83
5	1.21	50.000	2.326	4.65	-37.40	-18.70	-12.47	37.35	18.69	12.47
142	1.22	85.000	41.000	48.24	-36.64	-18.32	-12.21	27.27	16.71	11.70
77	1.21	101.600	10.900	10.73	-36.27	-18.14	-12.09	35.28	18.01	12.05
104	1.32	668.000	1.890	0.28	-23.88	-11.94	-7.96	23.86	11.94	7.96
124	1.21	1161.880	40.000	3.44	-13.07	-6.53	-4.36	9.83	5.99	4.18

TABLE 3 (cont.). SUMMARY OF THE REPORTED RESULTS AND THE CALCULATED *z*- AND *u*-SCORES

Laboratory code	Technique code	Analyte concentration	Standard dev.	Relative std. dev., [%]	*z*-scores			*u*-scores		
					$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$
78	1.32	1216.337	95.928	7.89	-11.88	-5.94	-3.96	5.11	4.10	3.24
131	1.22	1410.780	37.730	2.67	-7.62	-3.81	-2.54	5.88	3.52	2.45
87	1.23	1413.300	0.440	0.03	-7.57	-3.78	-2.52	7.57	3.78	2.52
64	1.14	1450.000	430.000	29.66	-6.76	-3.38	-2.25	0.71	0.70	0.68
100	1.22	1486.000	336.000	22.61	-5.97	-2.99	-1.99	0.81	0.78	0.75
155	4.2	1573.000	118.000	7.50	-4.07	-2.04	-1.36	1.47	1.25	1.03
113	1.23	1672.200	77.300	4.62	-1.90	-0.95	-0.63	0.97	0.73	0.55
98	2.0	1690.000	410.000	24.26	-1.51	-0.76	-0.50	0.17	0.16	0.16
151	7.2	1721.516	17.171	1.00	-0.82	-0.41	-0.27	0.77	0.40	0.27
146	4.2	1730.000	86.000	4.97	-0.63	-0.32	-0.21	0.30	0.23	0.18
148	4.2	1747.000	400.000	22.90	-0.26	-0.13	-0.09	0.03	0.03	0.03
39	7.2	1770.000	112.000	6.33	0.24	0.12	0.08	0.09	0.08	0.06
90	1.23	1780.000	315.000	17.70	0.46	0.23	0.15	0.07	0.06	0.06
61	5.1	1790.000	154.000	8.60	0.68	0.34	0.23	0.19	0.17	0.15
116	1.32	1818.000	37.000	2.04	1.29	0.65	0.43	1.00	0.60	0.42
158	1.22	1840.000	97.000	5.27	1.77	0.89	0.59	0.76	0.61	0.48
3	1.23	1845.824	84.771	4.59	1.90	0.95	0.63	0.90	0.70	0.54
138	1.23	1900.000	235.000	12.37	3.09	1.54	1.03	0.59	0.56	0.52
145	1.22	1930.000	133.000	6.89	3.74	1.87	1.25	1.22	1.06	0.90
157	7.2	1940.000	113.000	5.82	3.96	1.98	1.32	1.48	1.25	1.02
149	1.23	2000.463	105.190	5.26	5.28	2.64	1.76	2.11	1.73	1.40
40	5.1	2002.000	116.000	5.79	5.32	2.66	1.77	1.95	1.65	1.35
35	1.23	2150.000	360.000	16.74	8.56	4.28	2.85	1.08	1.05	1.02
129	4.2	2398.616	521.949	21.76	14.00	7.00	4.67	1.22	1.21	1.19
73	1.21	2432.000	192.000	7.89	14.73	7.36	4.91	3.41	3.16	2.85
102	1.23	2517.420	251.742	10.00	16.60	8.30	5.53	2.96	2.83	2.65
79	1.13	3004.007	24.059	0.80	27.25	13.62	9.08	24.11	13.17	8.95
54	1.21	3334.382	366.782	11.00	34.48	17.24	11.49	4.26	4.17	4.02
204	1.21	4160.000*	570.000	13.70	52.55	26.27	17.52	4.20	4.16	4.10
137	1.22	4677.000*	510.000	10.90	63.86	31.93	21.29	5.70	5.63	5.53
				Zr (131 ± 10.061) [mg/kg]						
137	1.22	130.000	30.000	23.08	-0.20	-0.10	-0.07	0.03	0.03	0.03
54	1.21	137.600	19.265	14.00	1.31	0.66	0.44	0.33	0.30	0.27
148	4.2	202.000	78.000	38.61	14.11	7.06	4.70	0.91	0.90	0.89
146	4.2	210.000	80.000	38.10	15.70	7.85	5.23	0.99	0.98	0.97
158	1.22	283.000	38.000	13.43	30.21	15.11	10.07	3.97	3.87	3.72
145	1.22	1753.000*	133.000	7.59	322.43	161.21	107.48	12.19	12.16	12.12

TABLE 4. THE COMBINED *z*-SCORES FOR THE PARTICIPATING LABORATORIES

Lab Code	Number of analytes	Rescaled sum of scores (RSZ)			Sum of squared scores (SSZ)			Critical value
		$k = 0.5$	$k = 1.0$	$k = 1.5$	$k = 0.5$	$k = 1.0$	$k = 1.5$	χ^2
3	15	12.17	6.09	4.06	3012	753	335	27.49
5	9	-32.64	-16.32	-10.88	25463	6366	2829	19.02
35	9	-0.23	-0.12	-0.08	575	144	63.88	19.02
39	5	-39.33	-19.66	-13.11	4026	1007	447	12.83
40	8	1.54	0.77	0.51	252	63.00	28.00	17.53
53	9	9.21	4.61	3.07	2296	574	255	19.02
54	3	23.67	11.83	7.89	1217	304	135	9.35
61	5	0.96	0.48	0.32	61.90	15.48	6.88	12.83
64	3	1.56	0.78	0.52	185	46.24	20.55	9.35
68	5	748	374	249	1390660	347665	154518	12.83
73	6	48.00	24.00	16.00	3162	791	351	14.45
77	12	-140.77	-70.39	-46.92	21049	5262	2339	23.34
78	15	-83.04	-41.52	-27.68	8050	2012	894	27.49
79	5	78.61	39.31	26.20	18219	4555	2024	12.83
87	10	-20.75	-10.38	-6.92	3577	894	397	20.48
90	7	28.37	14.18	9.46	3339	835	371	16.01
95	1	-1.01	-0.50	-0.34	1.01	0.25	0.11	5.02
98	12	16.86	8.43	5.62	1075	269	119	23.34
100	9	-2.54	-1.27	-0.85	1149	287	128	19.02
102	12	4.18	2.09	1.39	793	198	88.10	23.34
104	10	-90.09	-45.05	-30.03	10294	2574	1144	20.48
113	17	13.78	6.89	4.59	2048	512	228	30.19
116	12	6.04	3.02	2.01	263	65.81	29.25	23.34
124	17	94.80	47.40	31.60	29803	7451	3311	30.19
129	15	0.88	0.44	0.29	9847	2462	1094	27.49
131	19	-15.43	-7.71	-5.14	6037	1509	671	32.85
137	18	11.55	5.78	3.85	7288	1822	810	31.53
138	15	24.68	12.34	8.23	2823	706	314	27.49
139	5	0.84	0.42	0.28	194	48.62	21.61	12.83
142	4	-82.86	-41.43	-27.62	7575	1894	842	11.14
145	14	363	181	121	1176436	294109	130715	26.12
146	17	22.07	11.03	7.36	7270	1818	808	30.19
148	17	6.51	3.26	2.17	1296	324	144	30.19
149	17	18.29	9.15	6.10	1428	357	159	30.19
151	16	-19.80	-9.90	-6.60	1966	491	218	28.85
152	11	-126.97	-63.49	-42.32	18341	4585	2038	21.92
153	4	87.46	43.73	29.15	51699	12925	5744	11.14
155	18	-10.66	-5.33	-3.55	820	205	91.10	31.53
157	3	-2.05	-1.02	-0.68	186	46.54	20.68	9.35
158	17	29.55	14.77	9.85	7826	1956	870	30.19
159	12	-101.51	-50.75	-33.84	11129	2782	1237	23.34
162	9	-25.74	-12.87	-8.58	2091	523	232	19.02
204	20	-0.79	-0.40	-0.26	3595	899	399	34.17

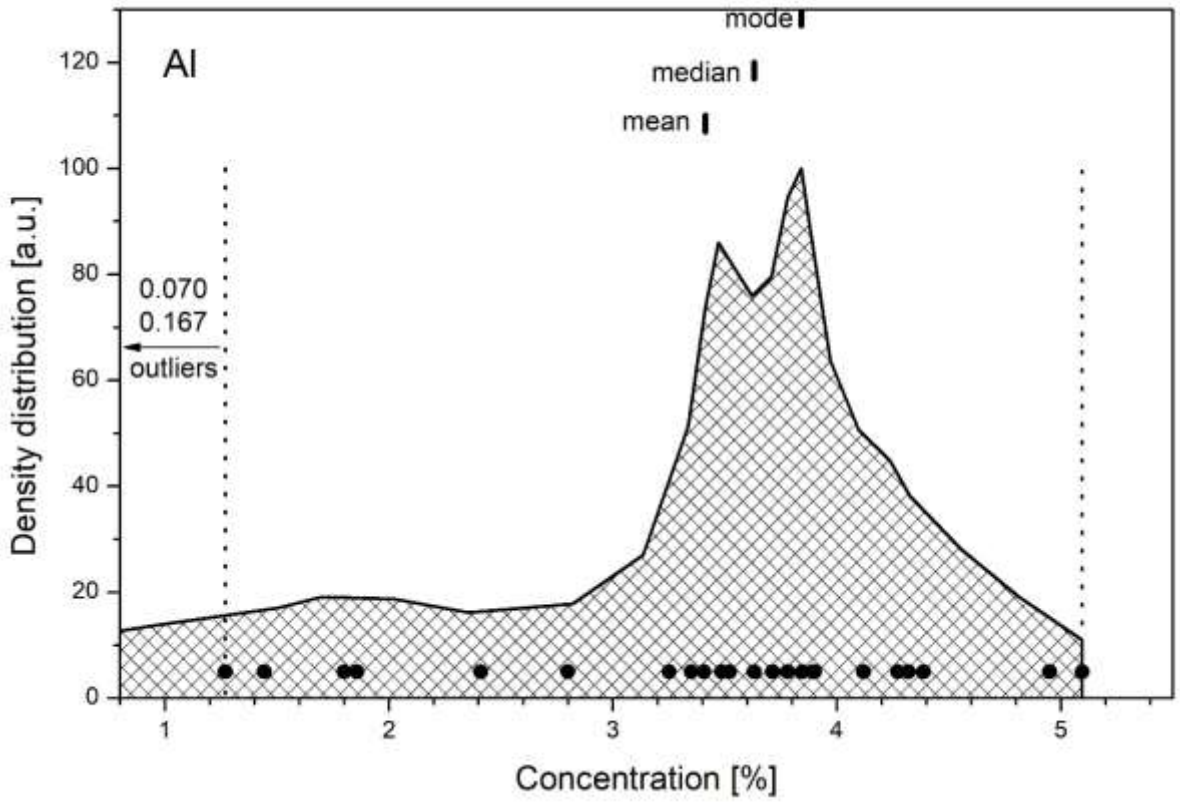

FIG. 3. The density distribution function for the analyte Al.

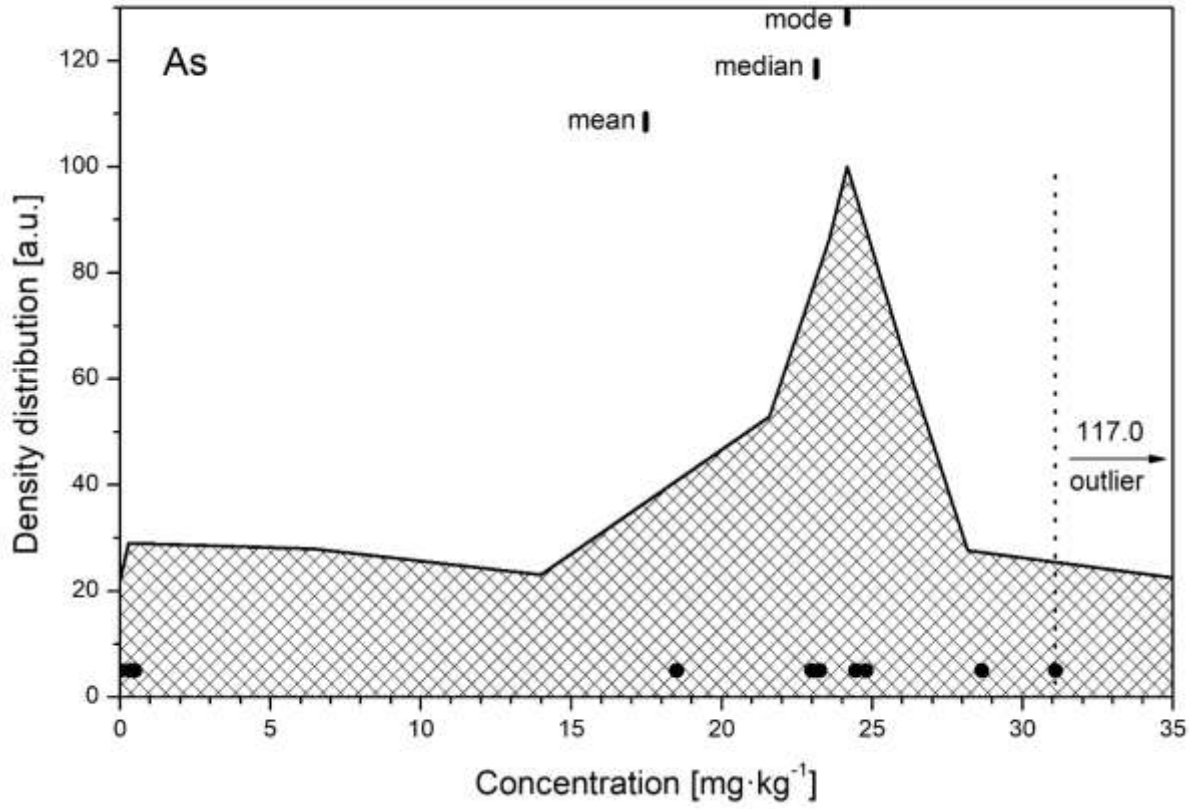

FIG. 4. The density distribution function for the analyte As.

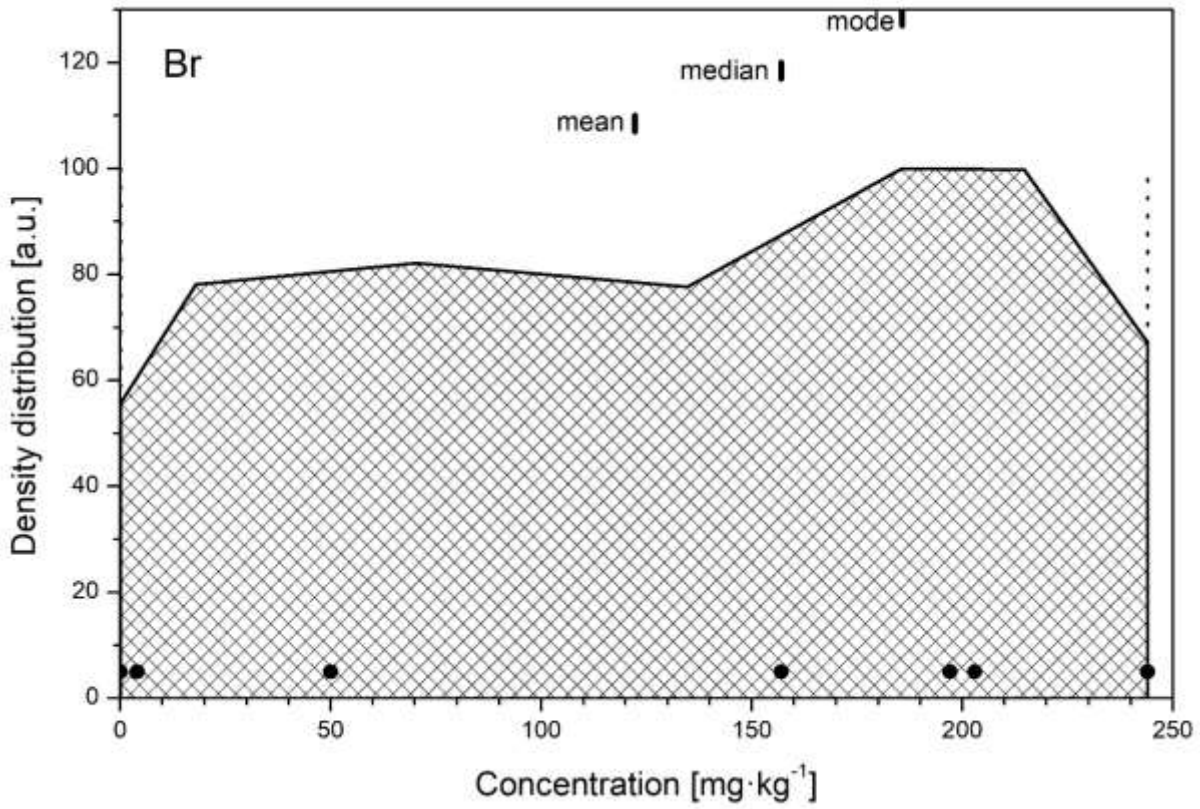

FIG. 5. The density distribution function for the analyte Br.

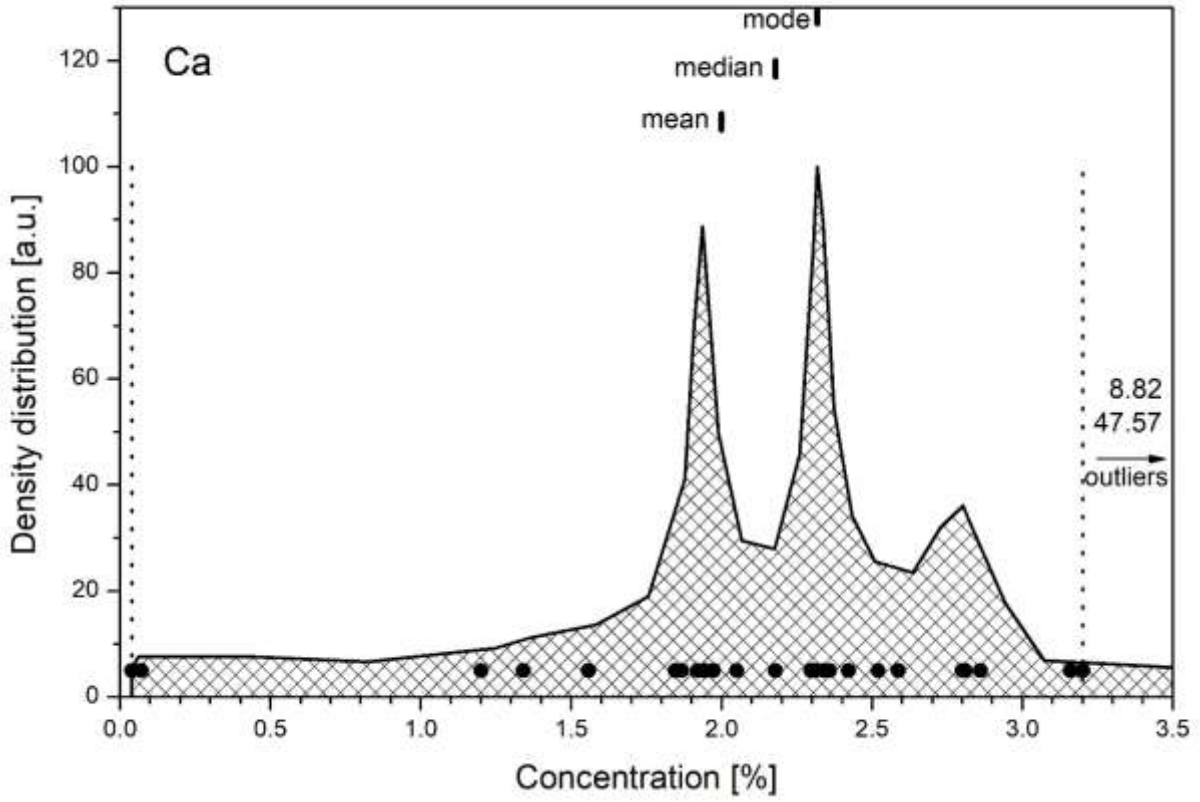

FIG. 6. The density distribution function for the analyte Ca.

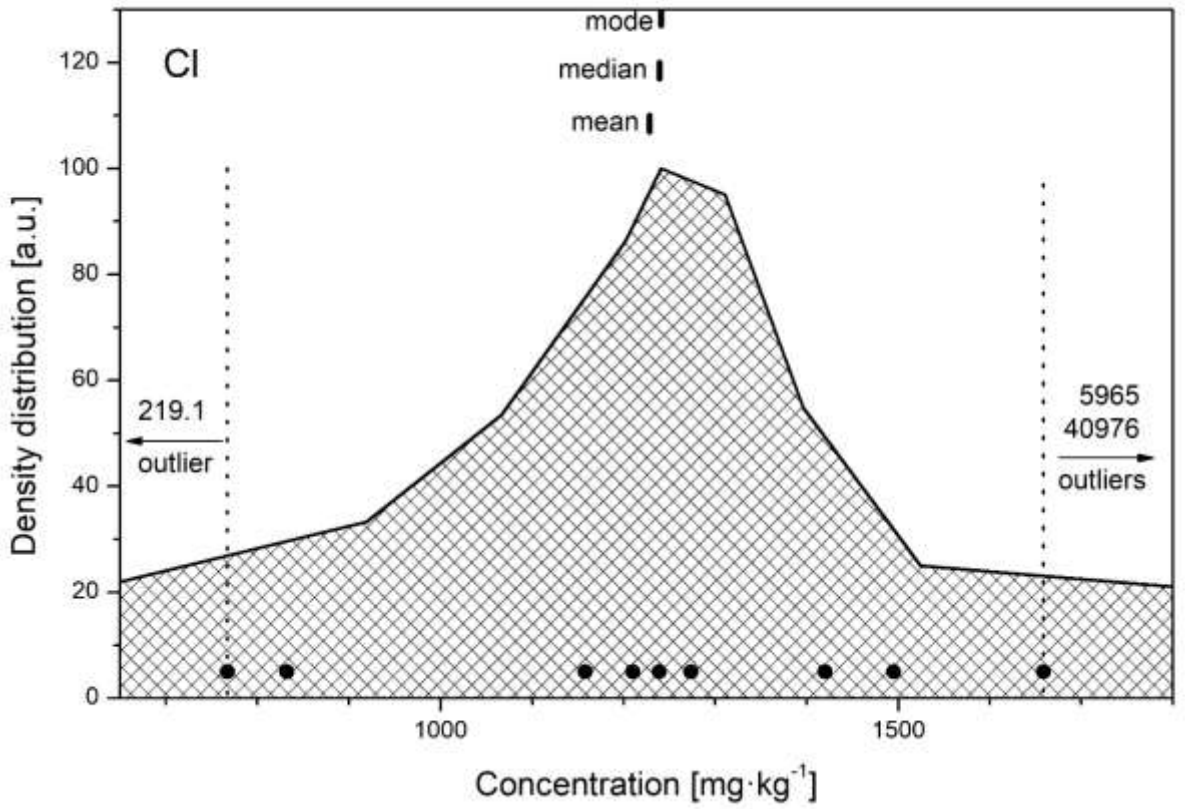

FIG. 7. The density distribution function for the analyte Cl.

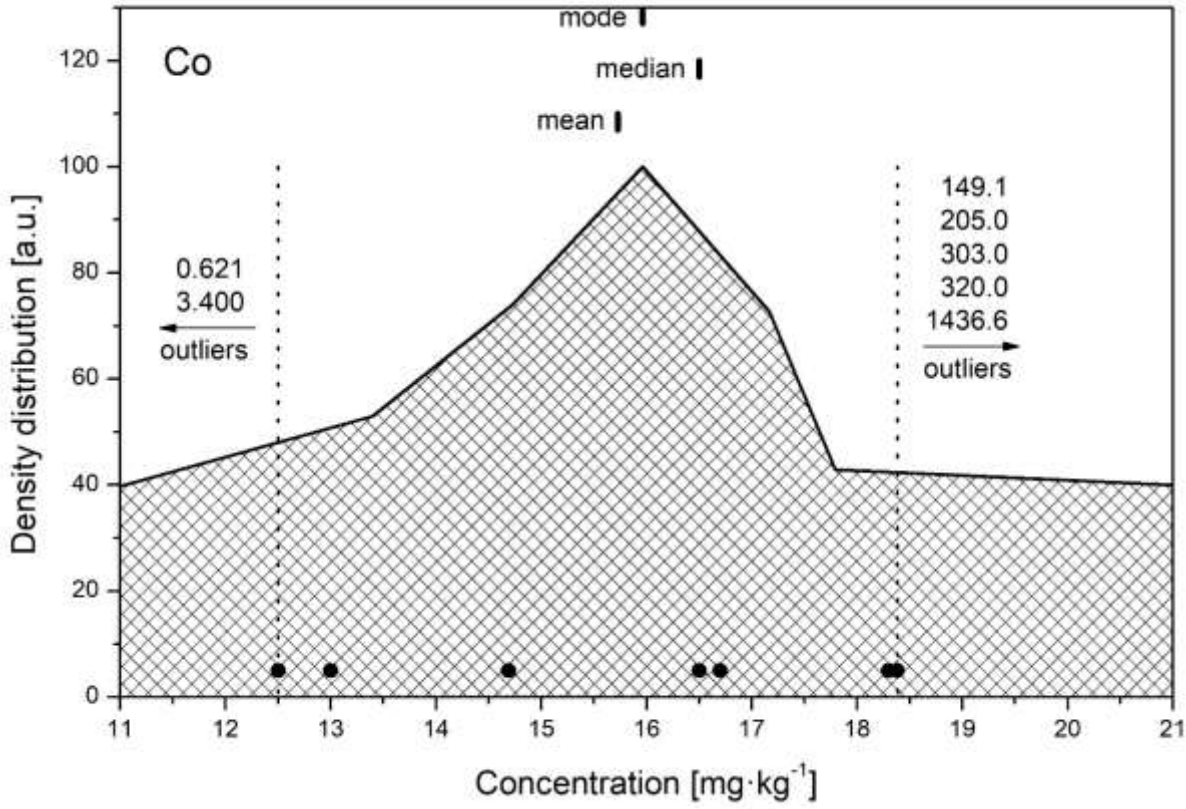

FIG. 8. The density distribution function for the analyte Co.

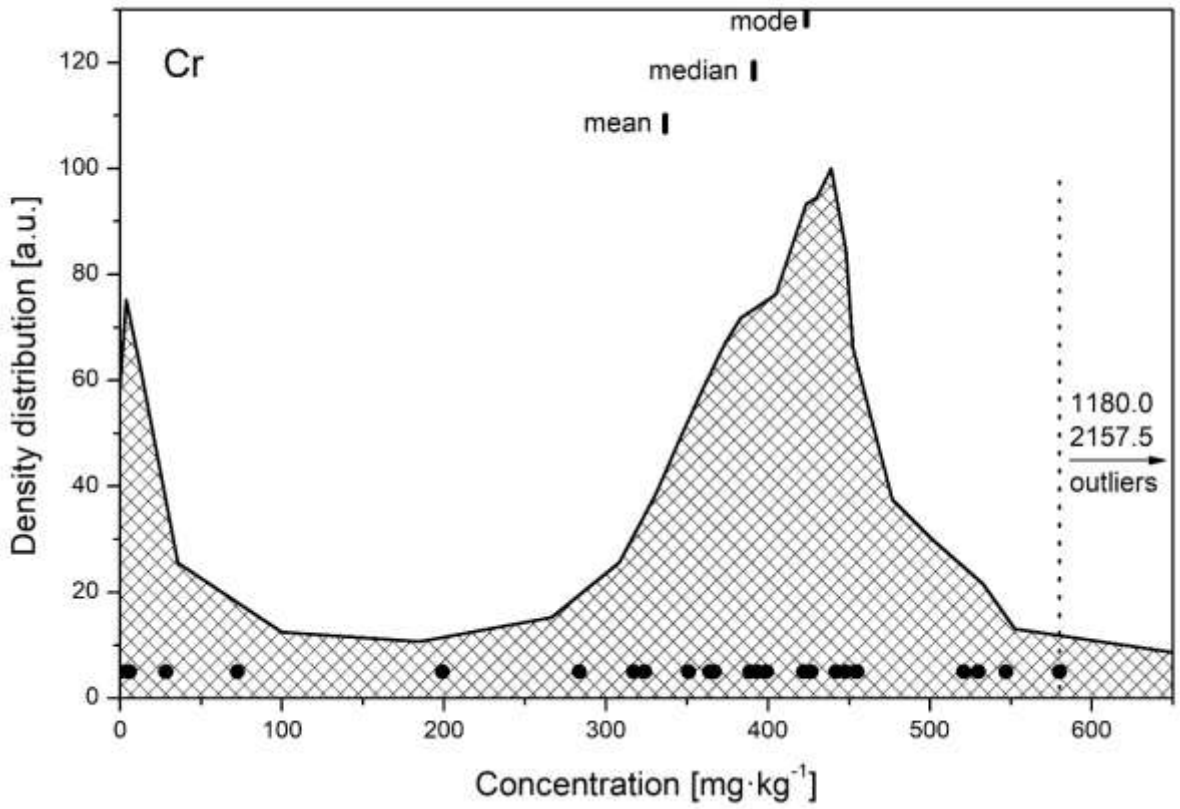

FIG. 9. The density distribution function for the analyte Cr.

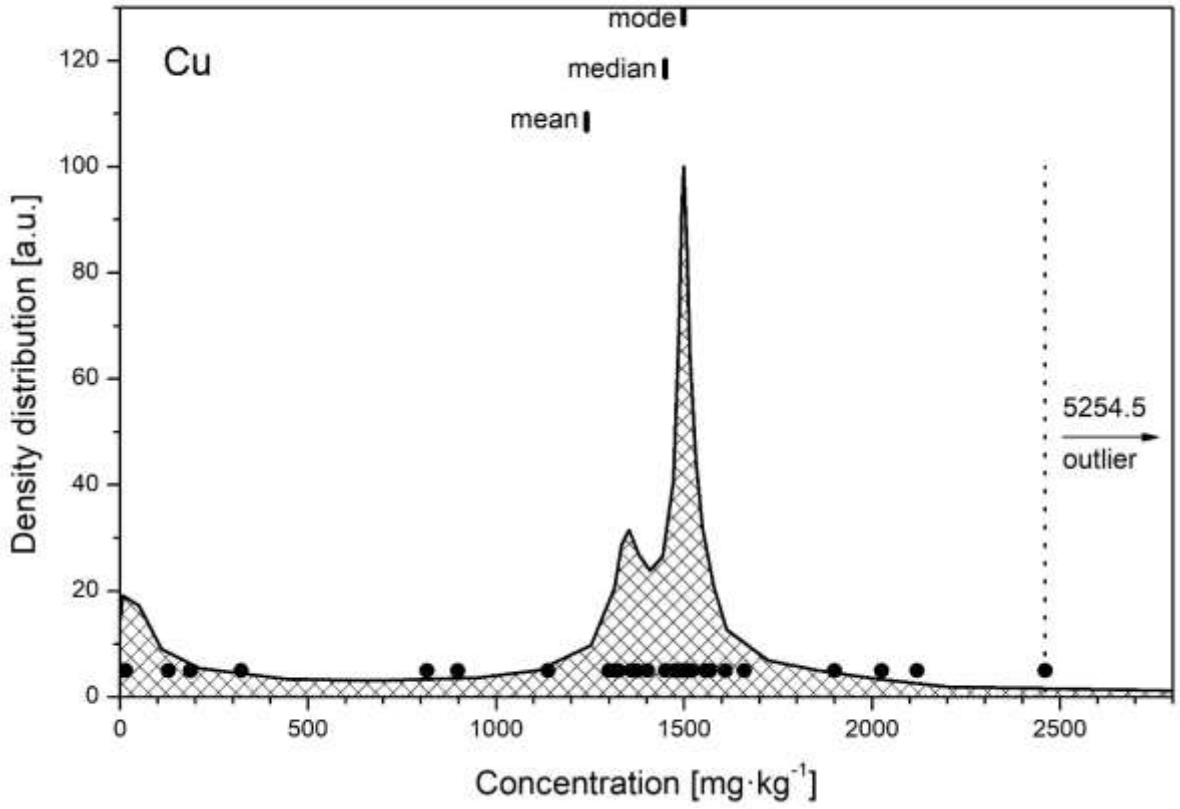

FIG. 10. The density distribution function for the analyte Cu.

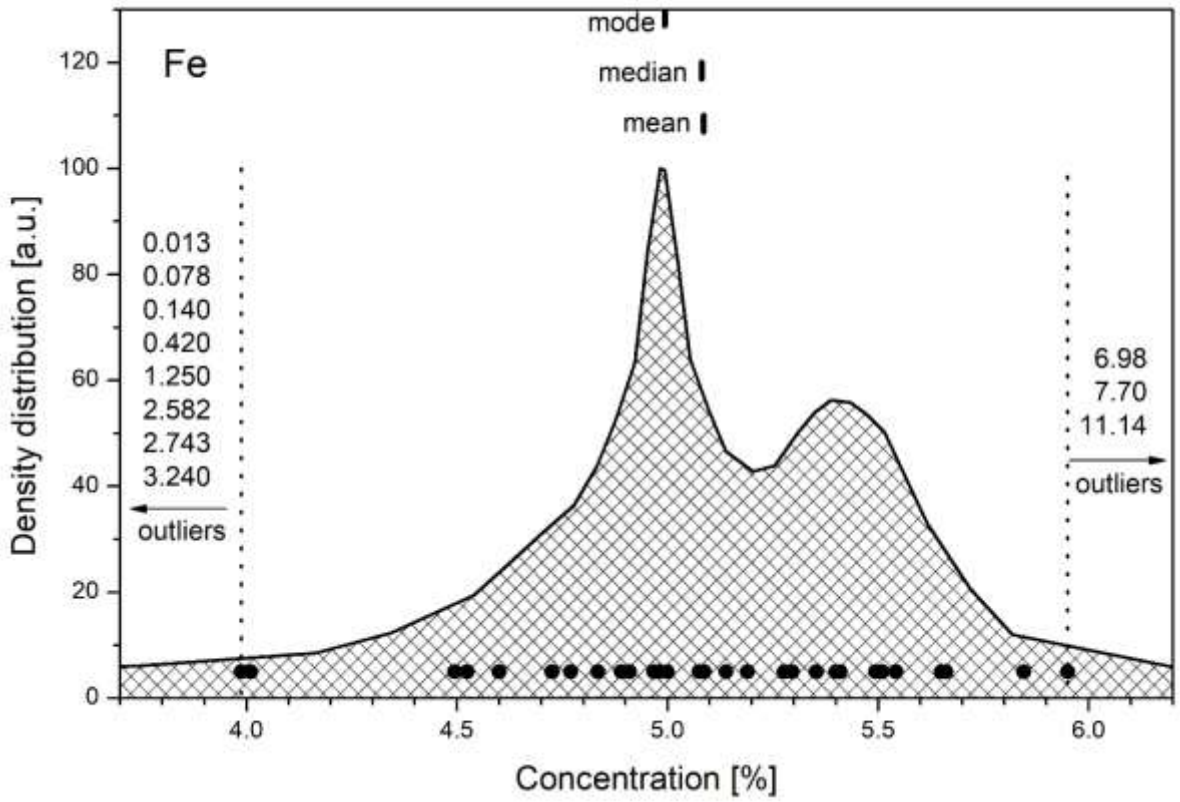

FIG. 11. The density distribution function for the analyte Fe.

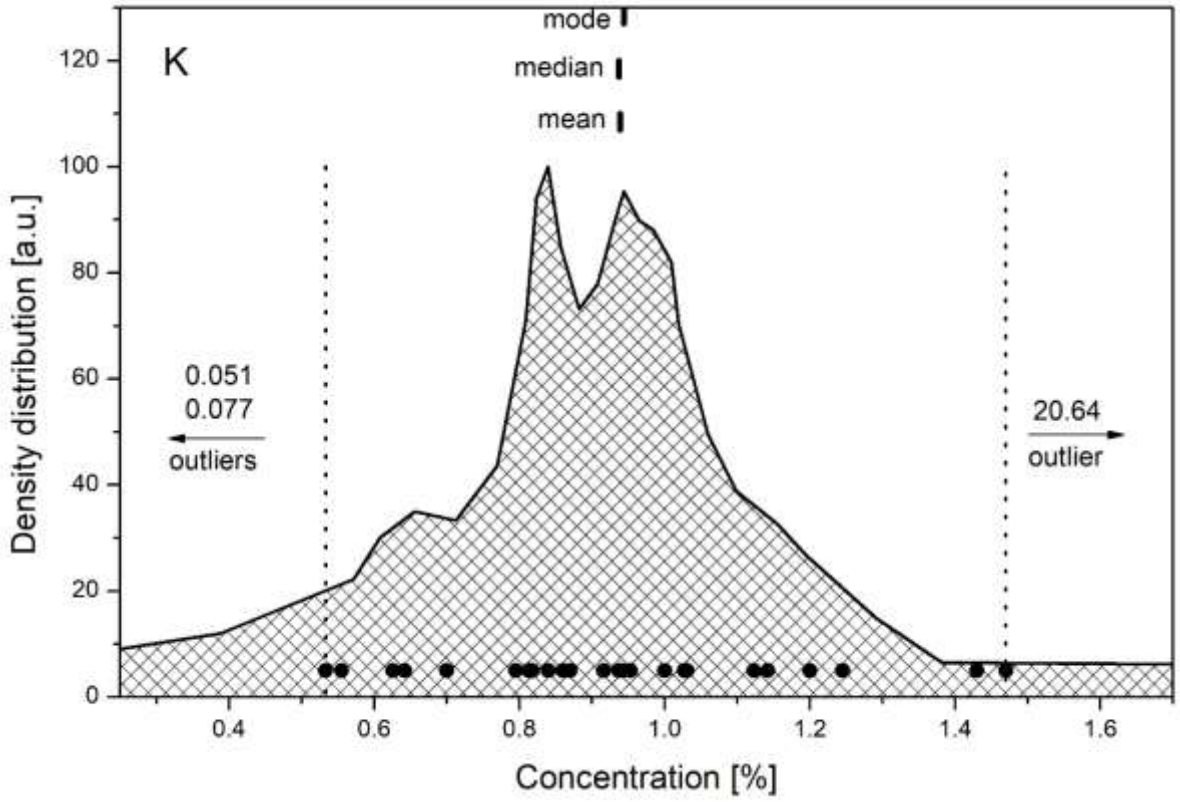

FIG. 12. The density distribution function for the analyte K.

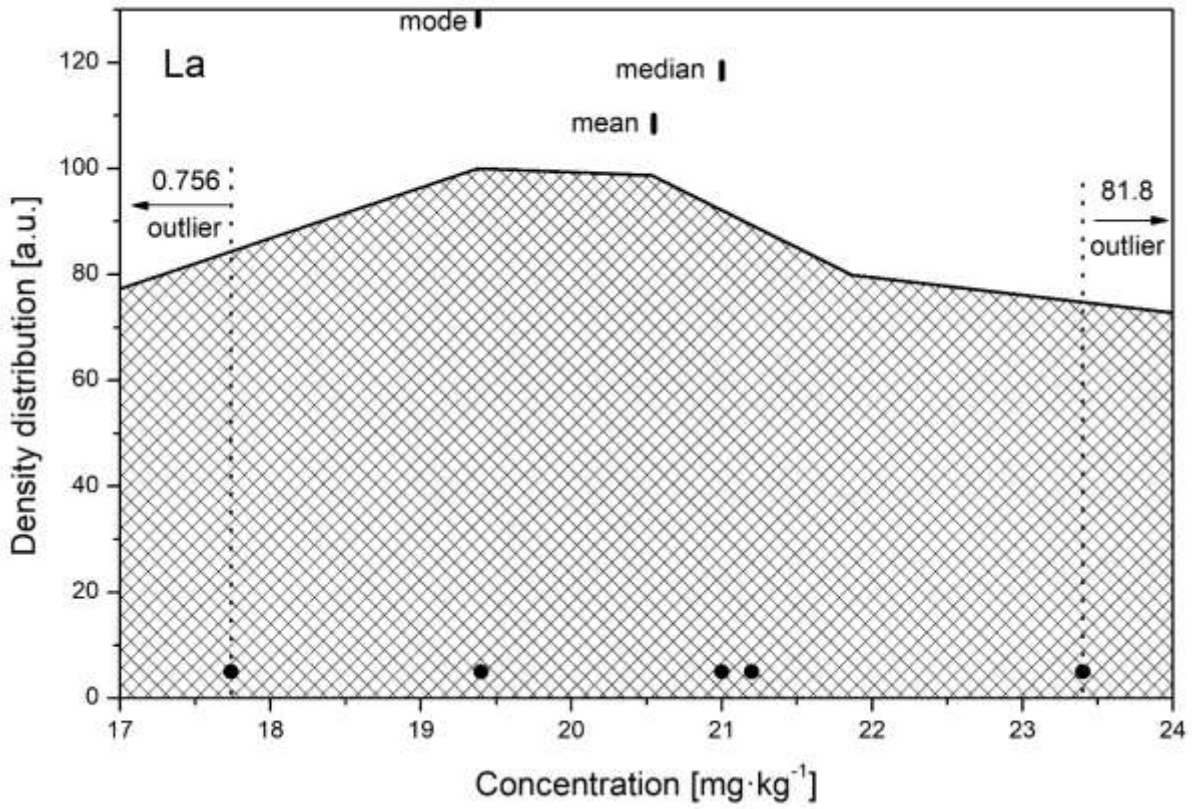

FIG. 13. The density distribution function for the analyte La.

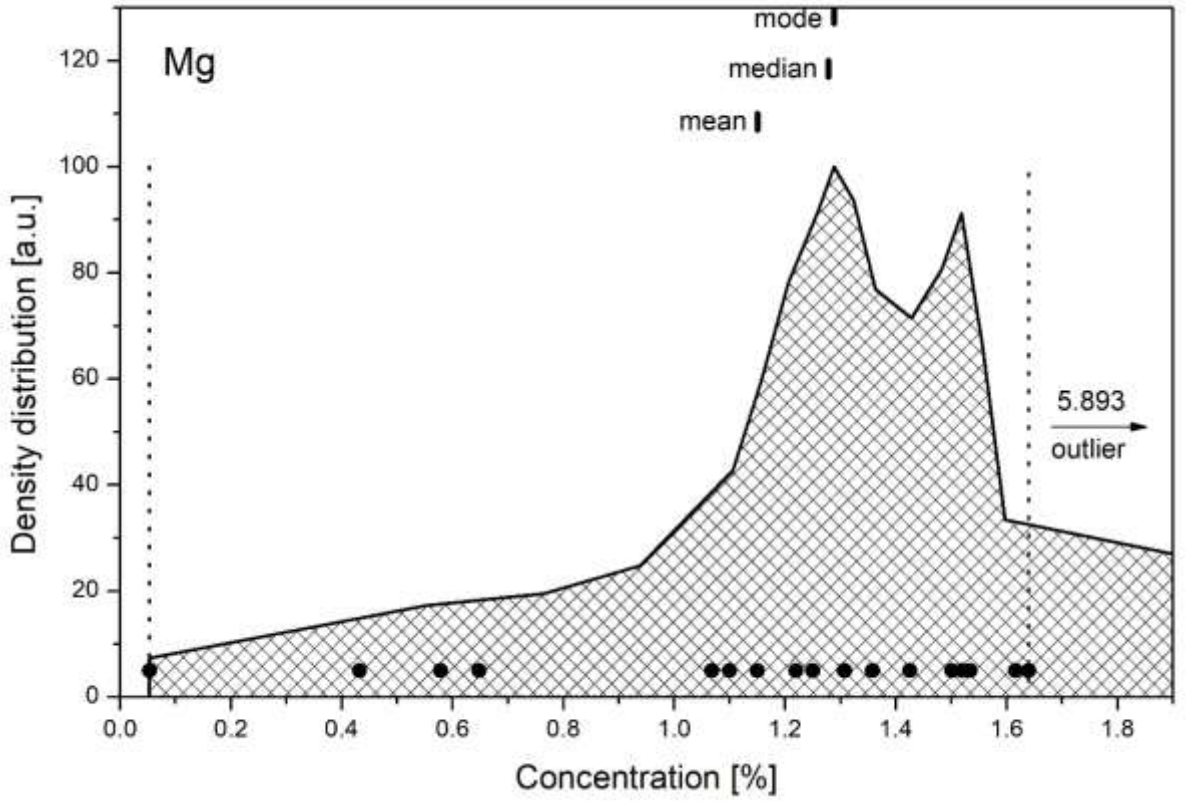

FIG. 14. The density distribution function for the analyte Mg.

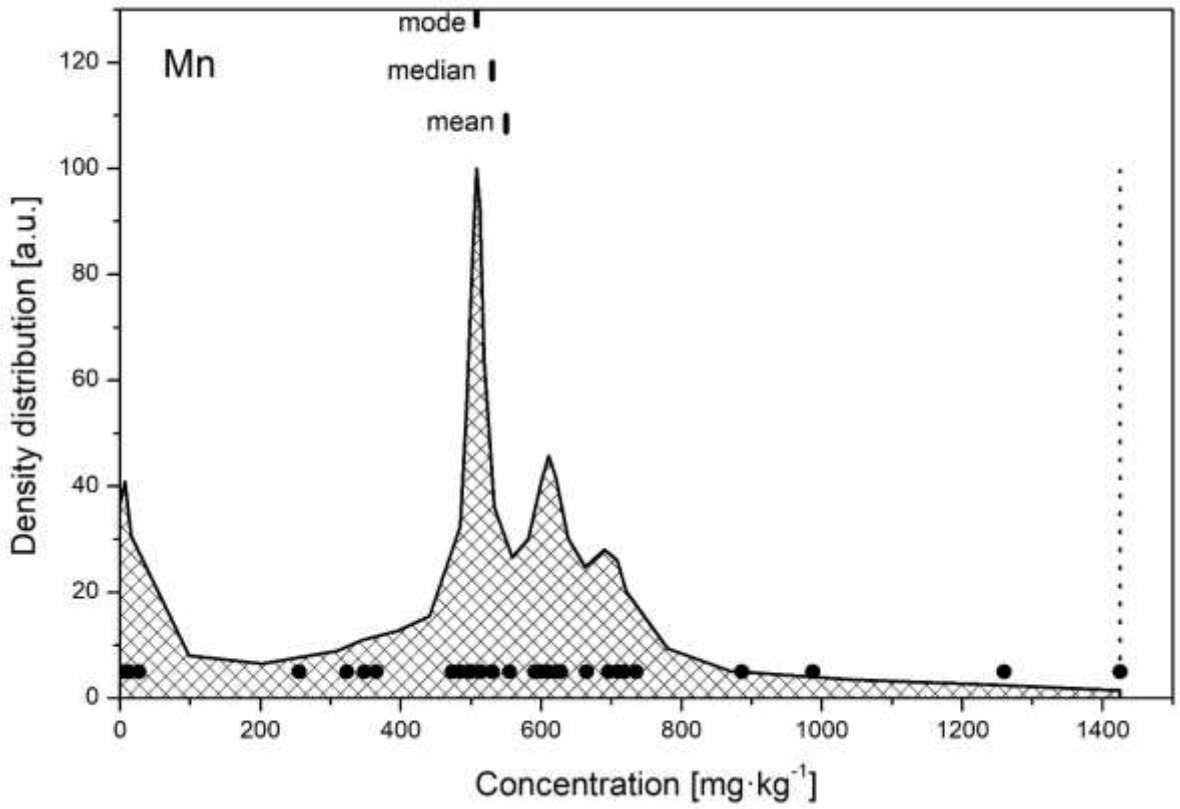

FIG. 15. The density distribution function for the analyte Mn.

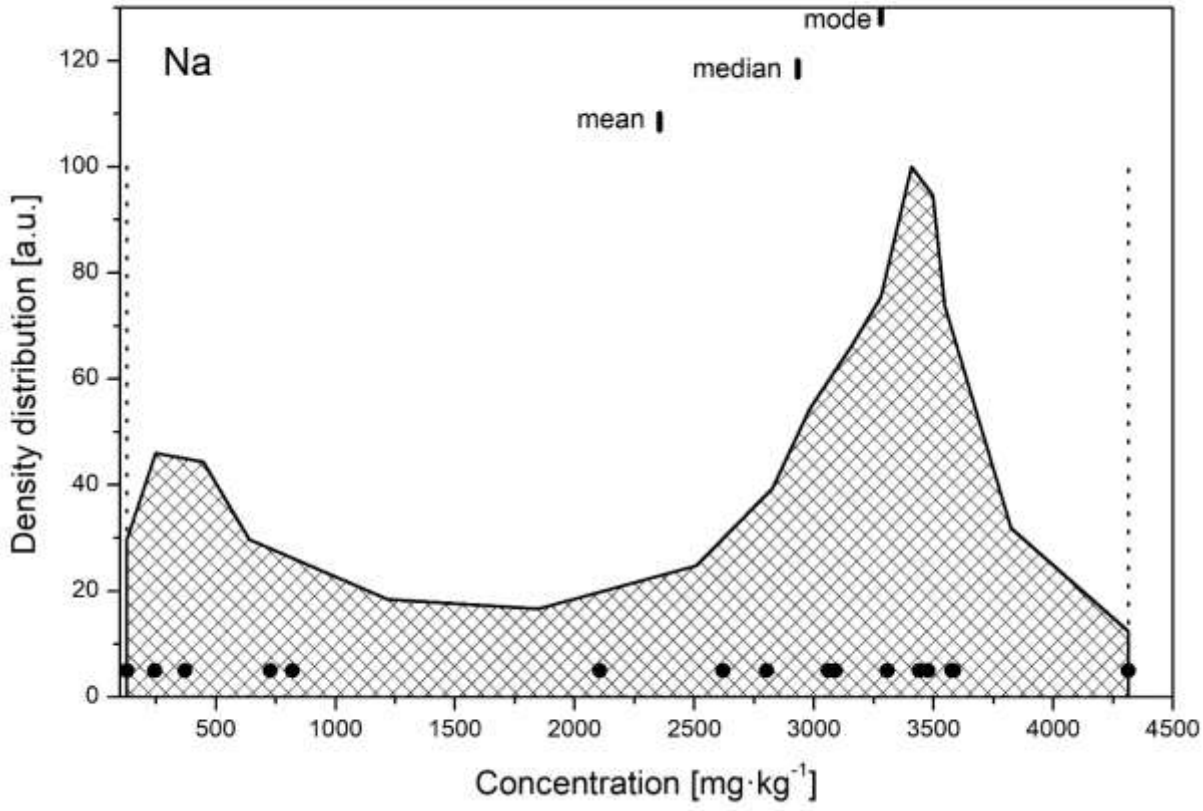

FIG. 16. The density distribution function for the analyte Na.

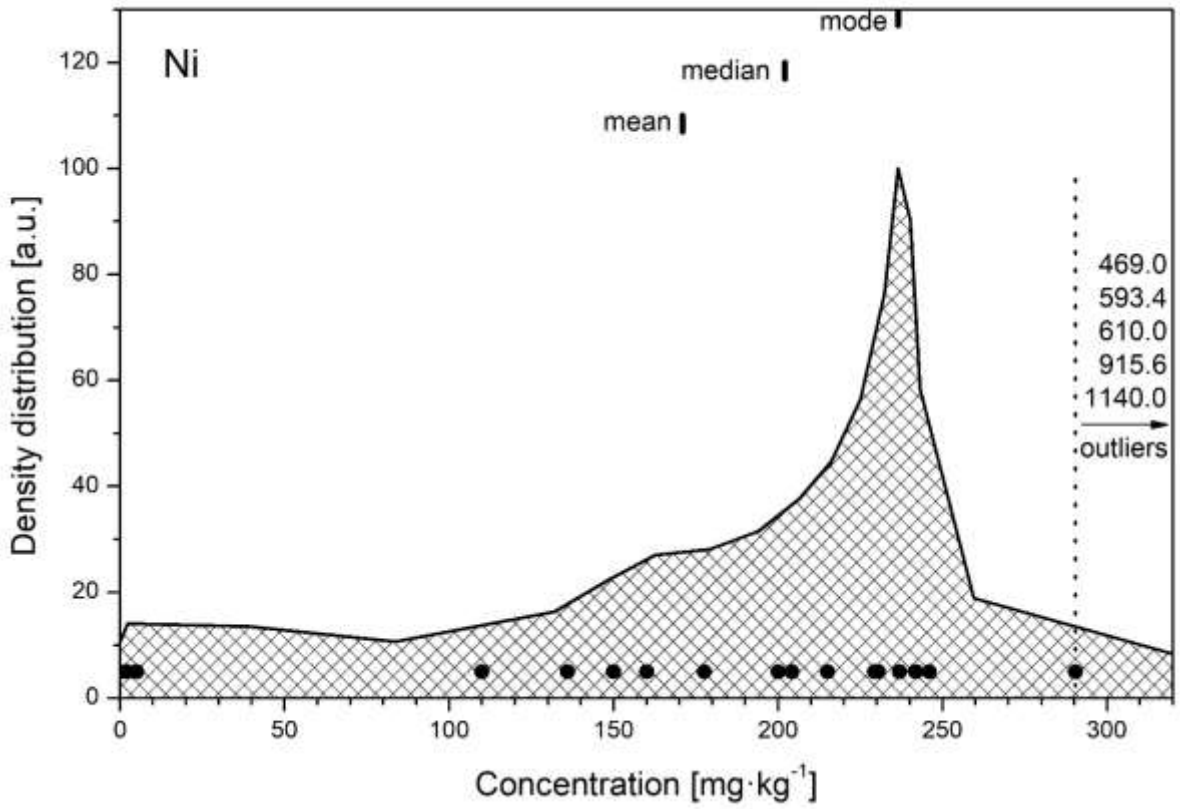

FIG. 17. The density distribution function for the analyte Ni.

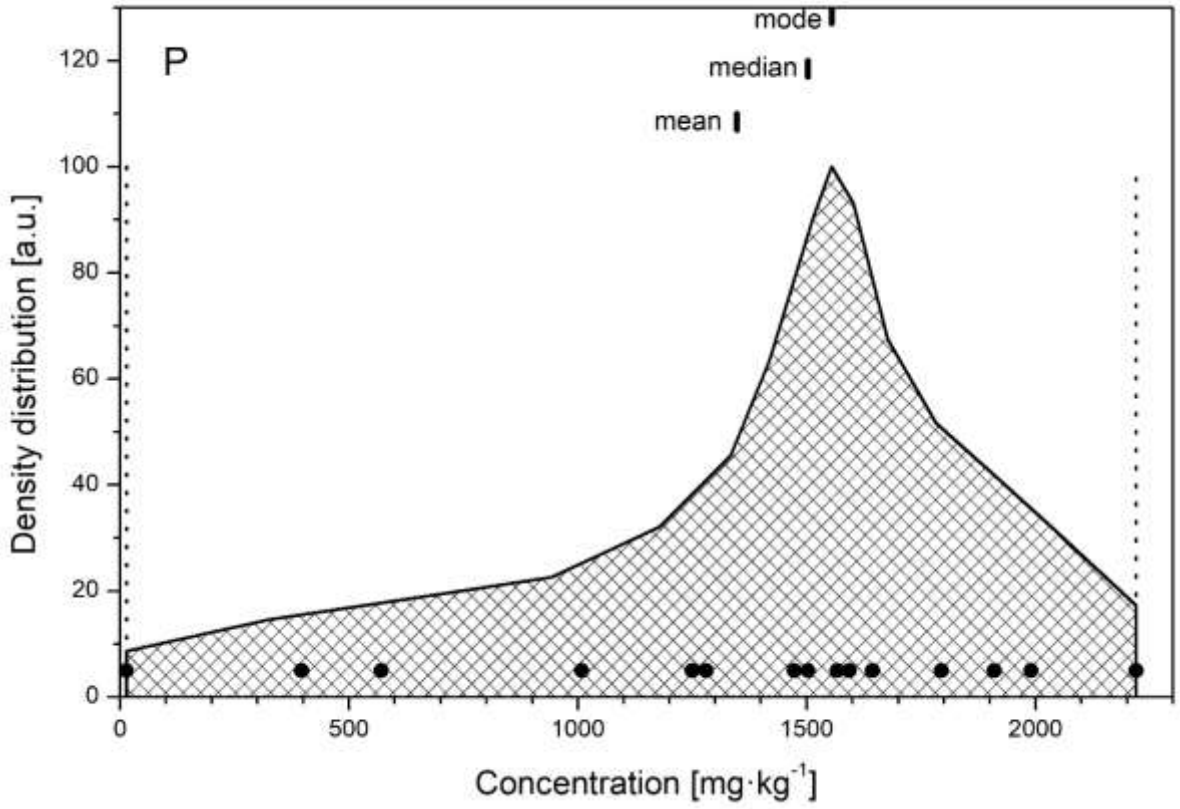

FIG. 18. The density distribution function for the analyte P.

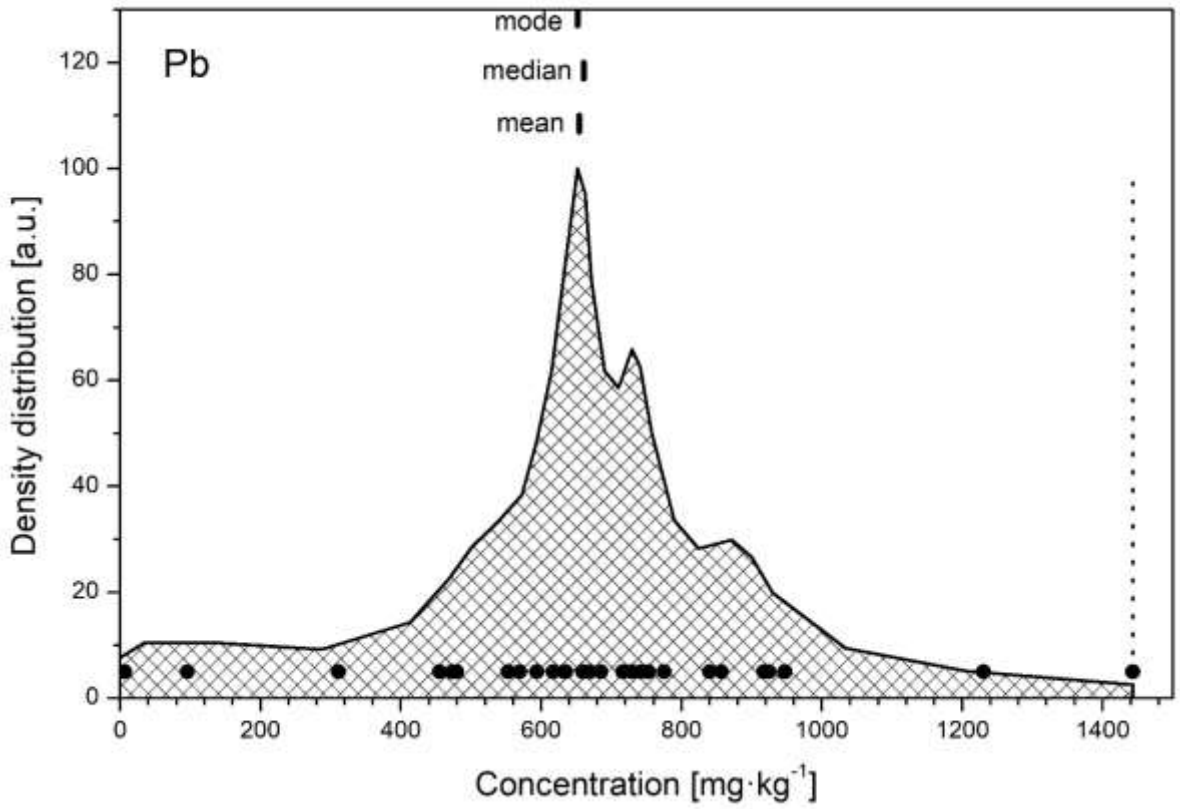

FIG. 19. The density distribution function for the analyte Pb.

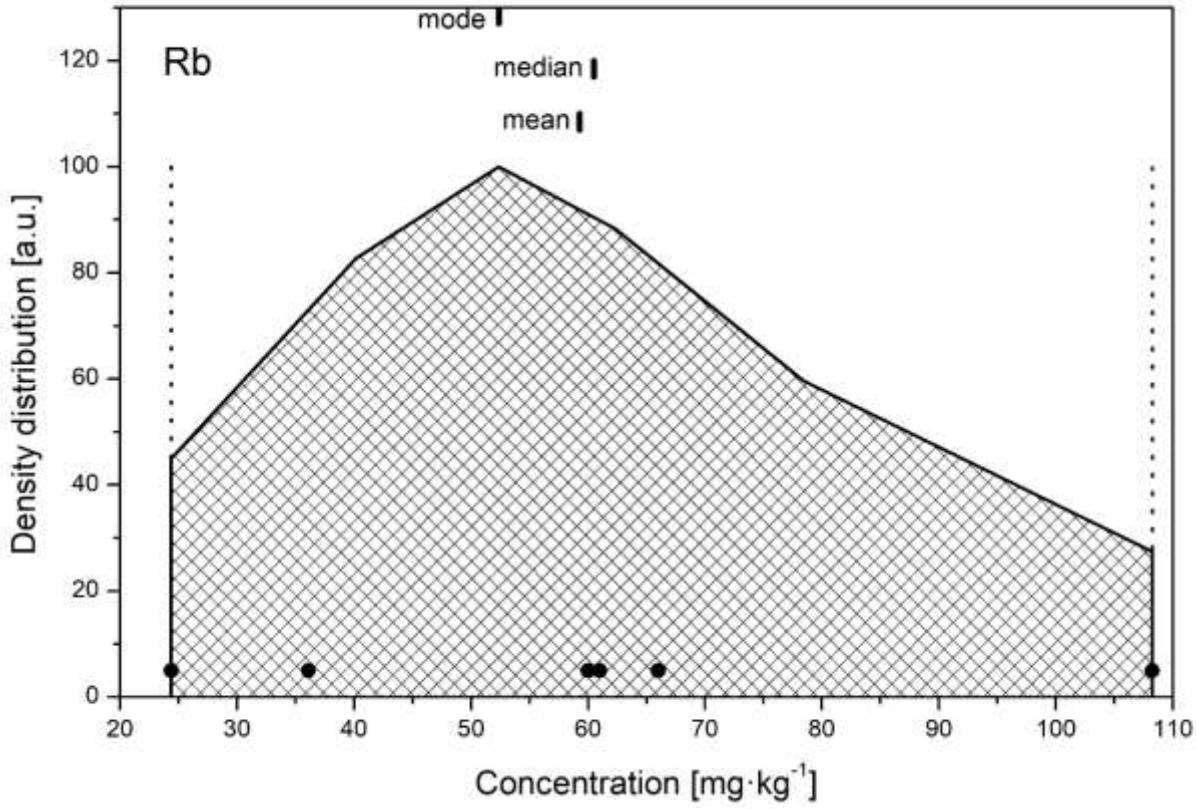

FIG. 20. The density distribution function for the analyte Rb.

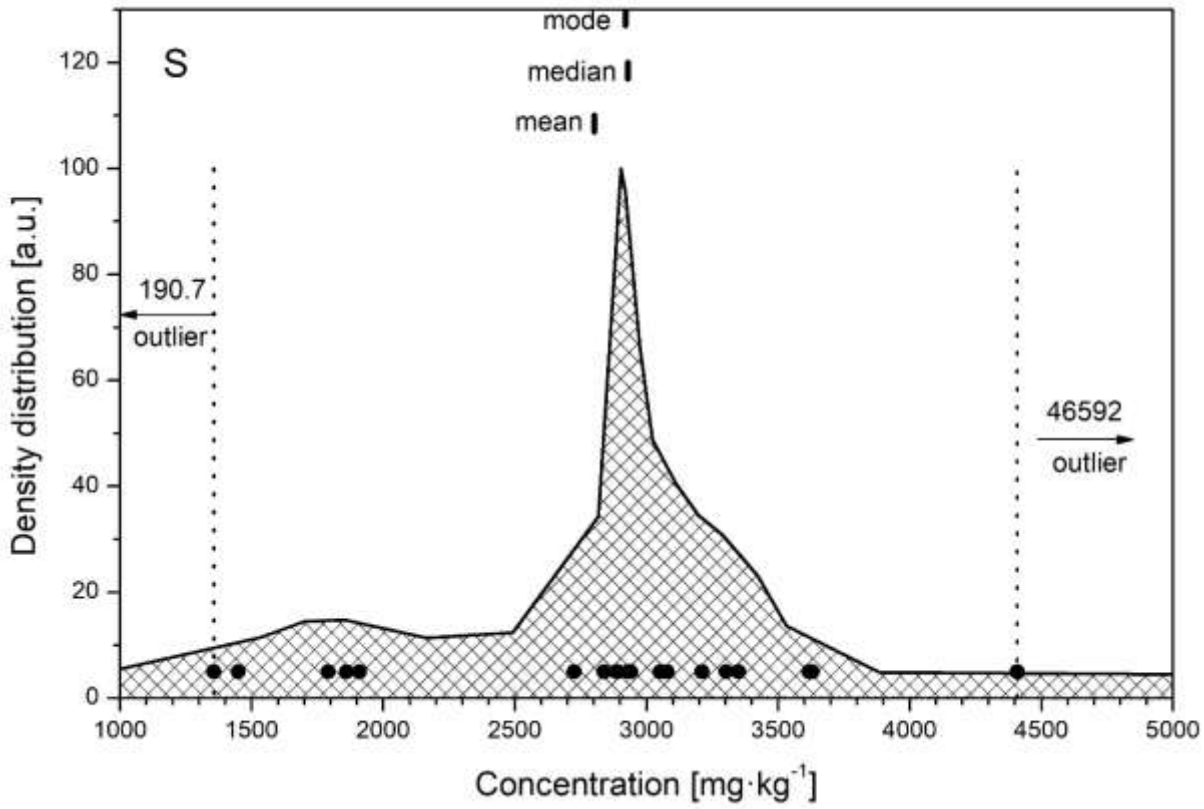

FIG. 21. The density distribution function for the analyte S.

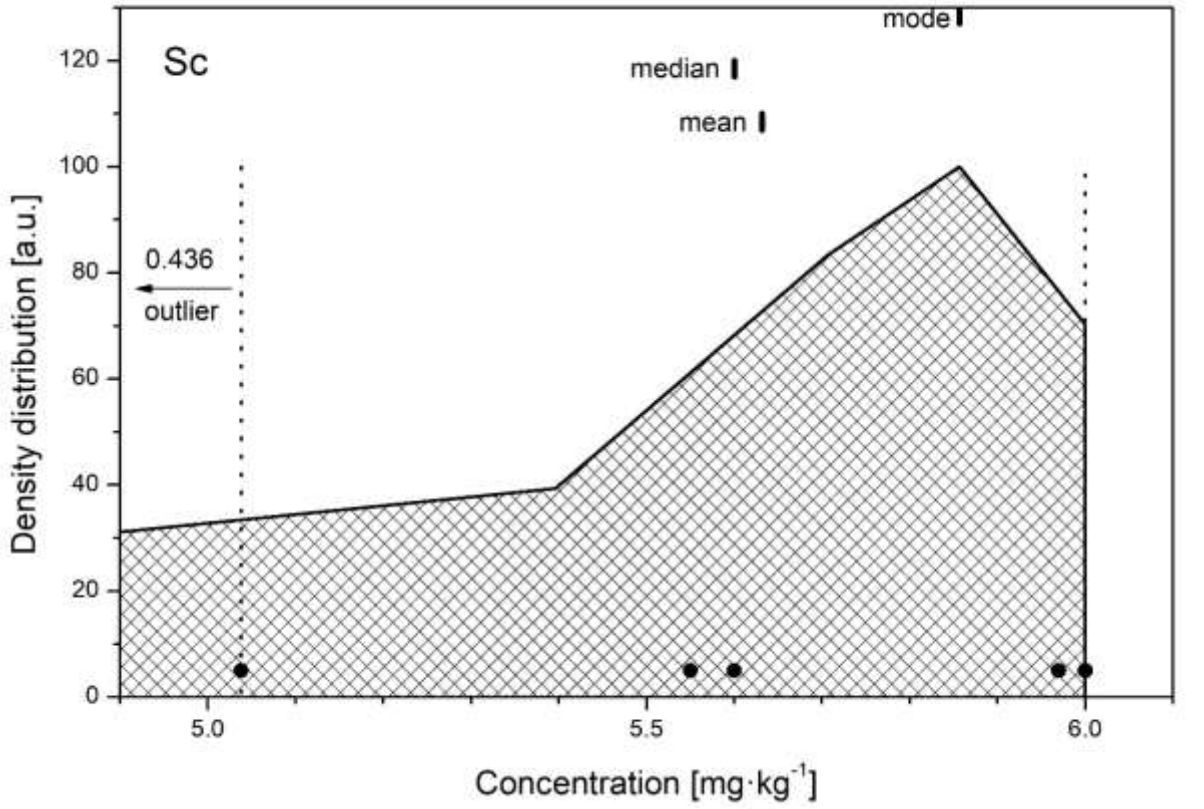

FIG. 22. The density distribution function for the analyte Sc.

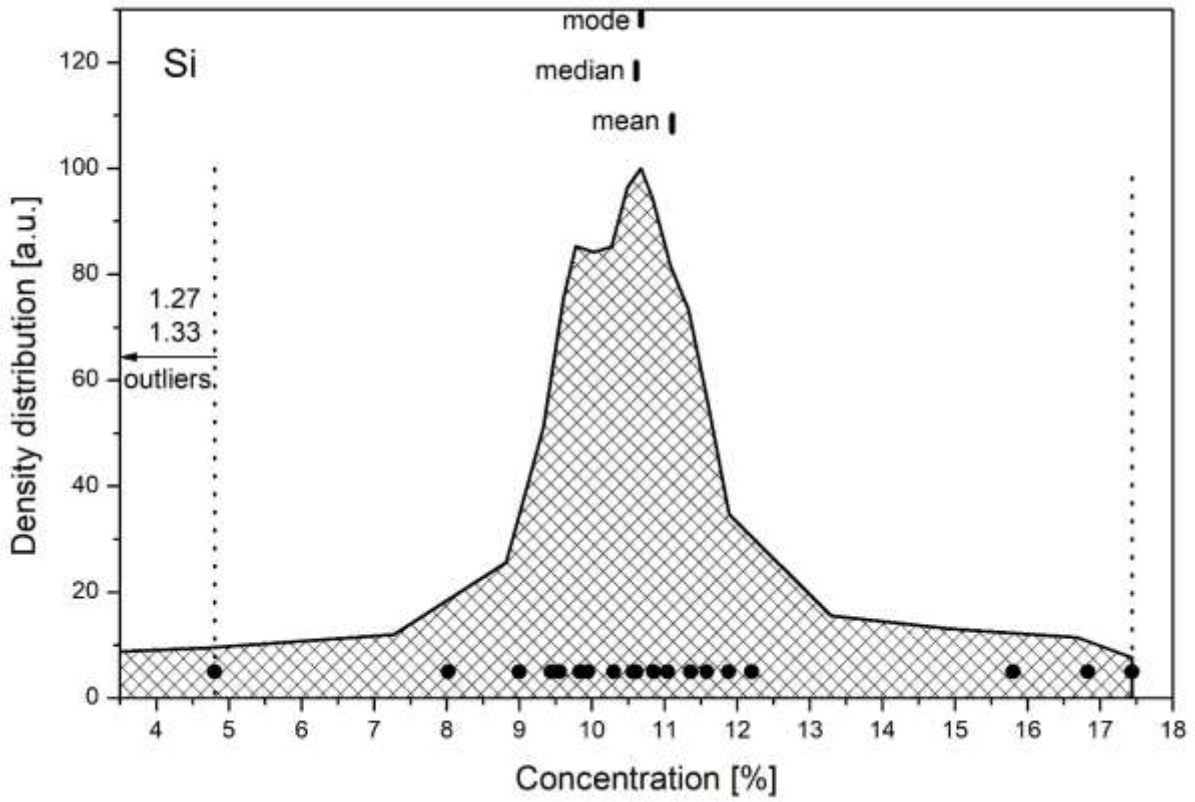

FIG. 23. The density distribution function for the analyte Si.

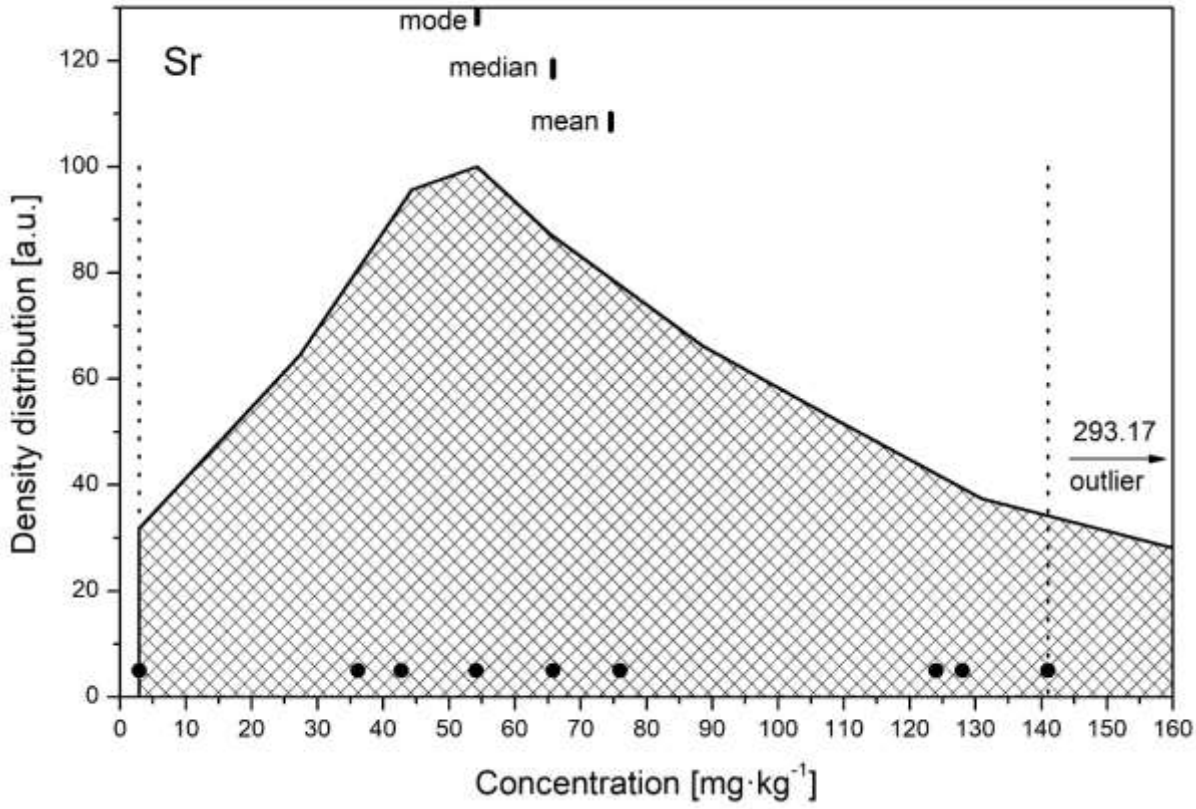

FIG. 24. The density distribution function for the analyte Sr.

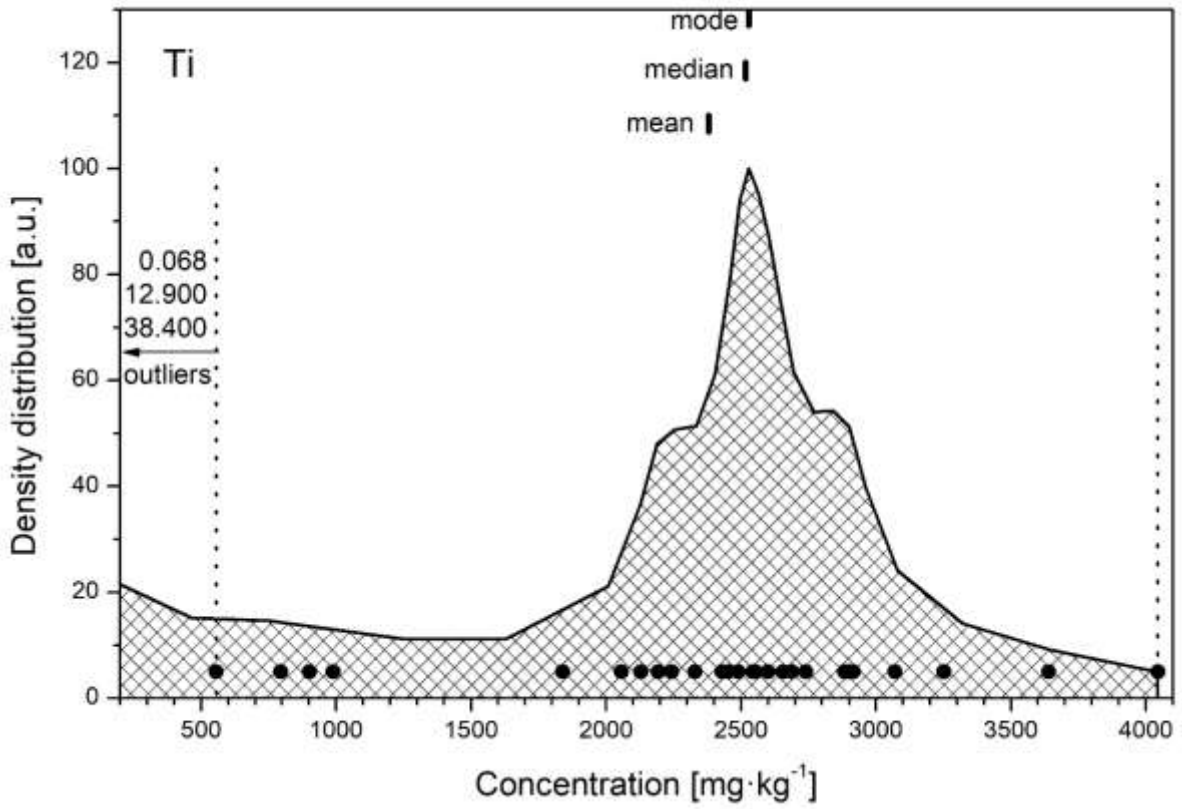

FIG. 25. The density distribution function for the analyte Ti.

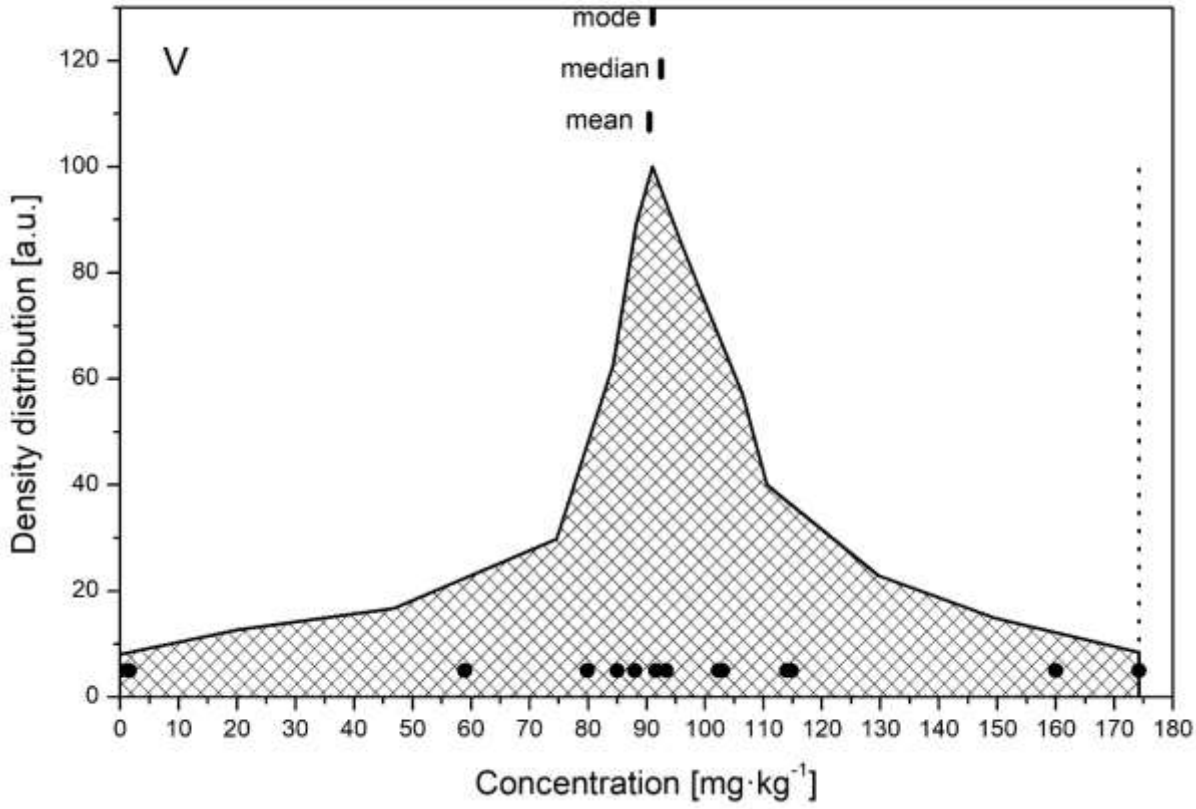

FIG. 26. The density distribution function for the analyte V.

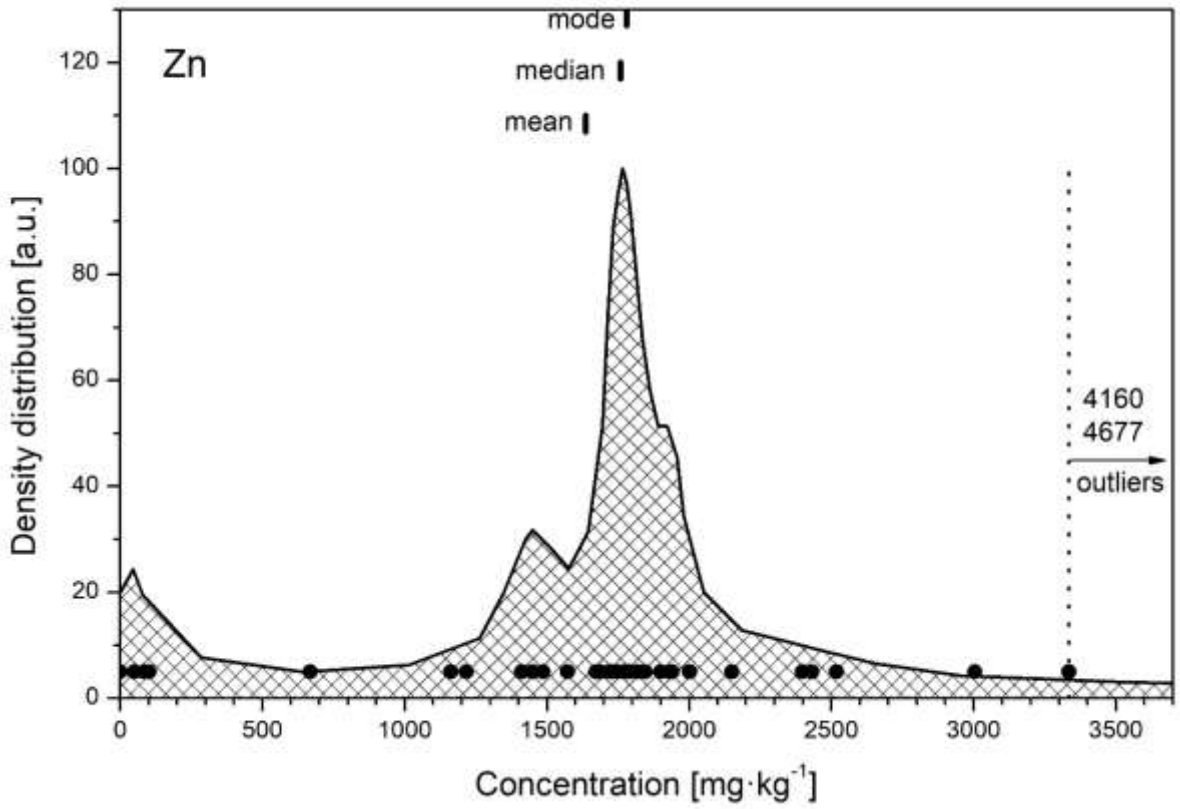

FIG. 27. The density distribution function for the analyte Zn.

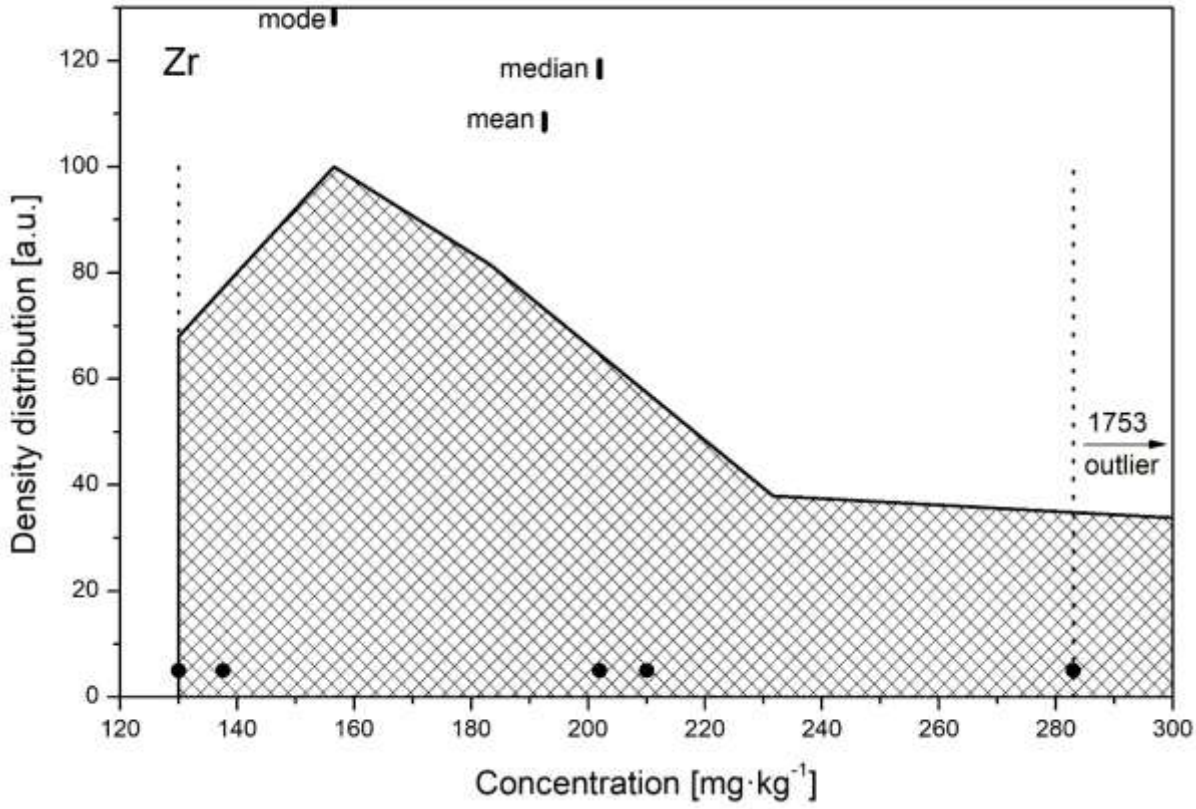

FIG. 28. The density distribution function for the analyte Zr.

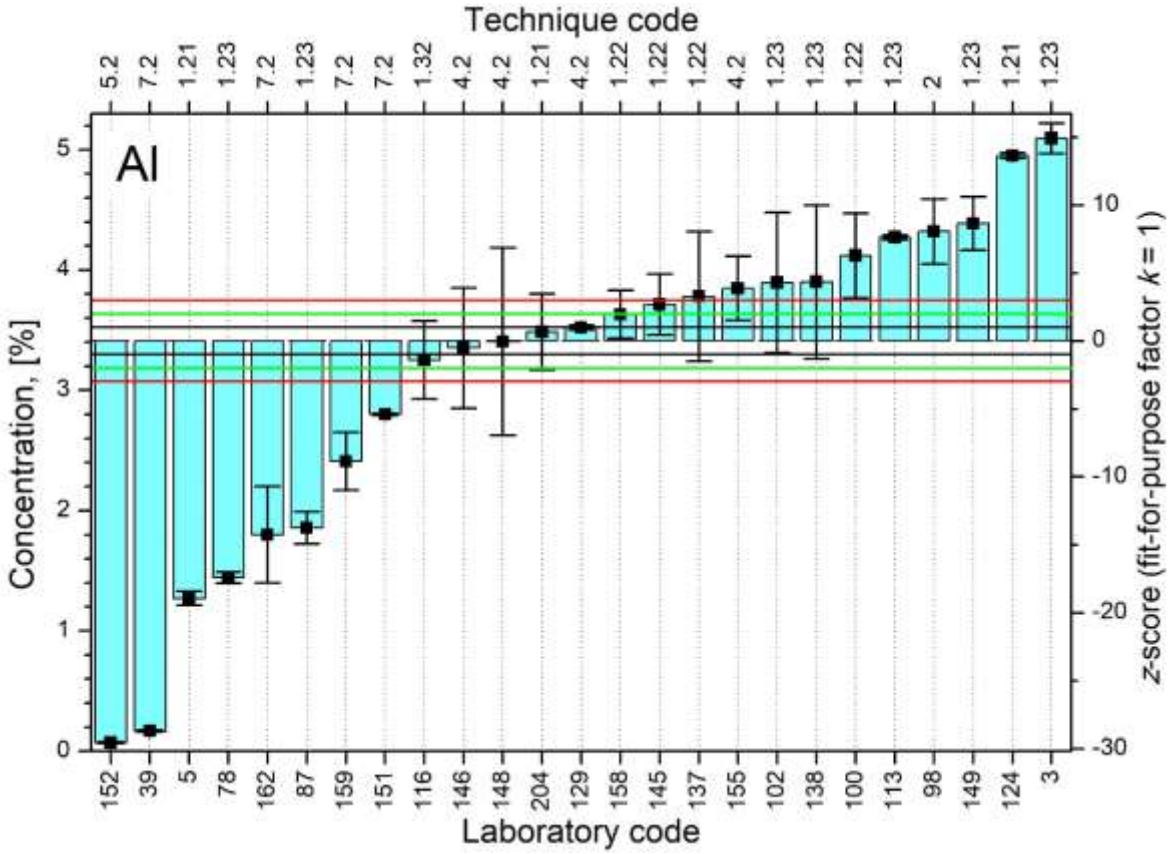

FIG. 29. Distributions of z-scores for analyte Al.

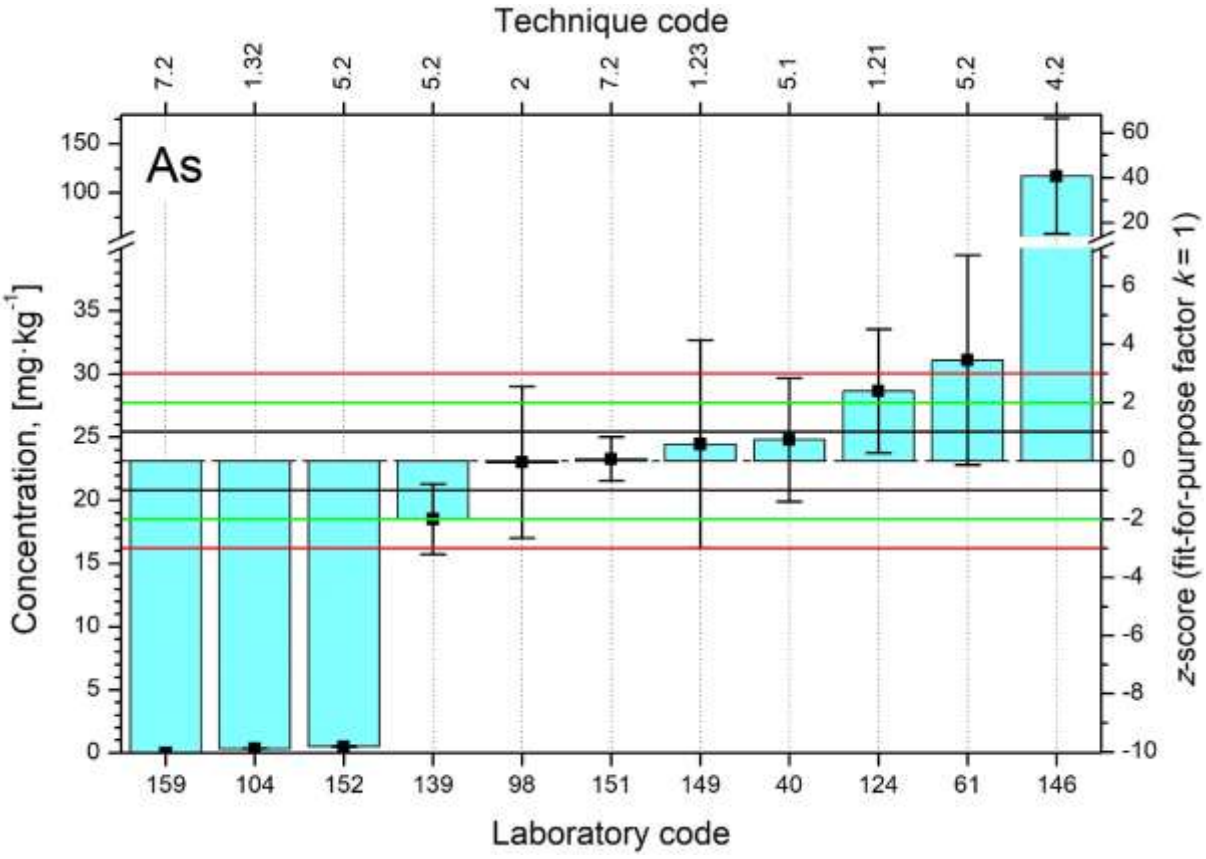

FIG. 30. Distributions of z-scores for analyte As.

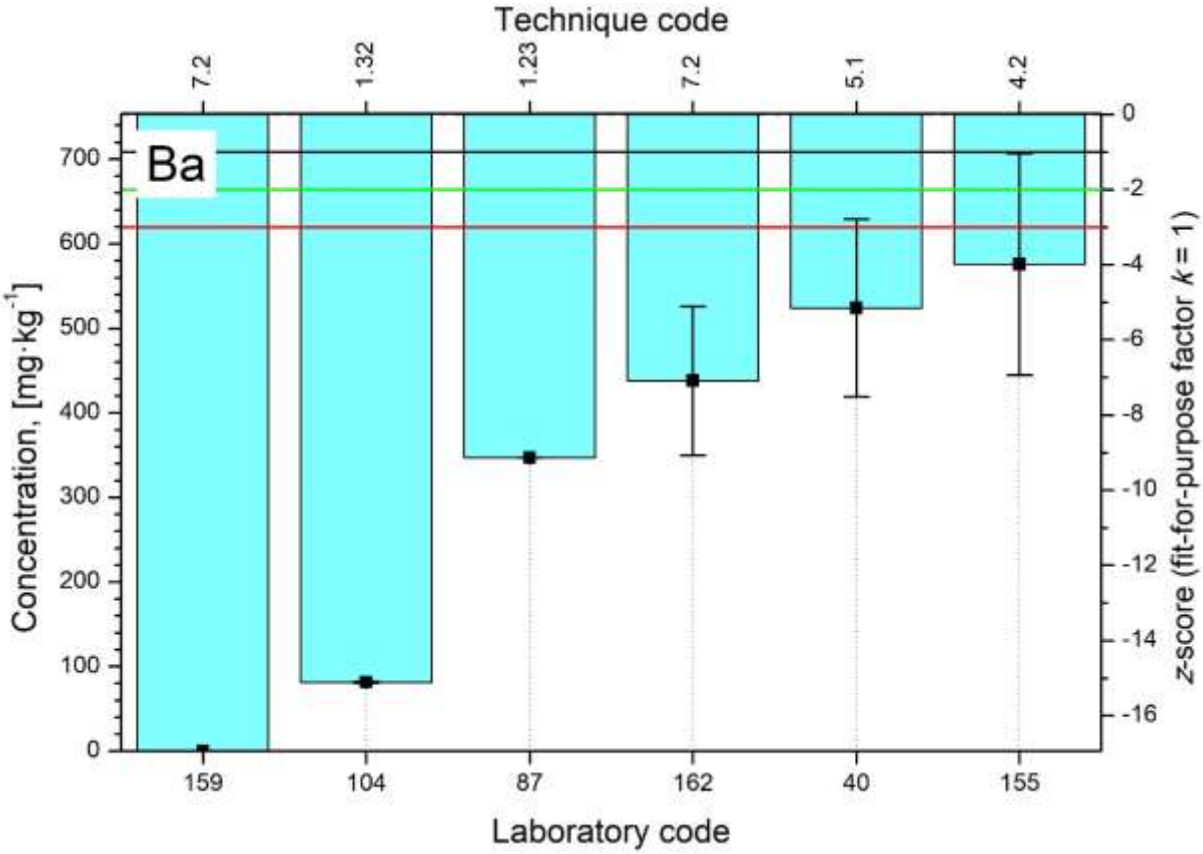

FIG. 31. Distributions of z-scores for analyte Ba.

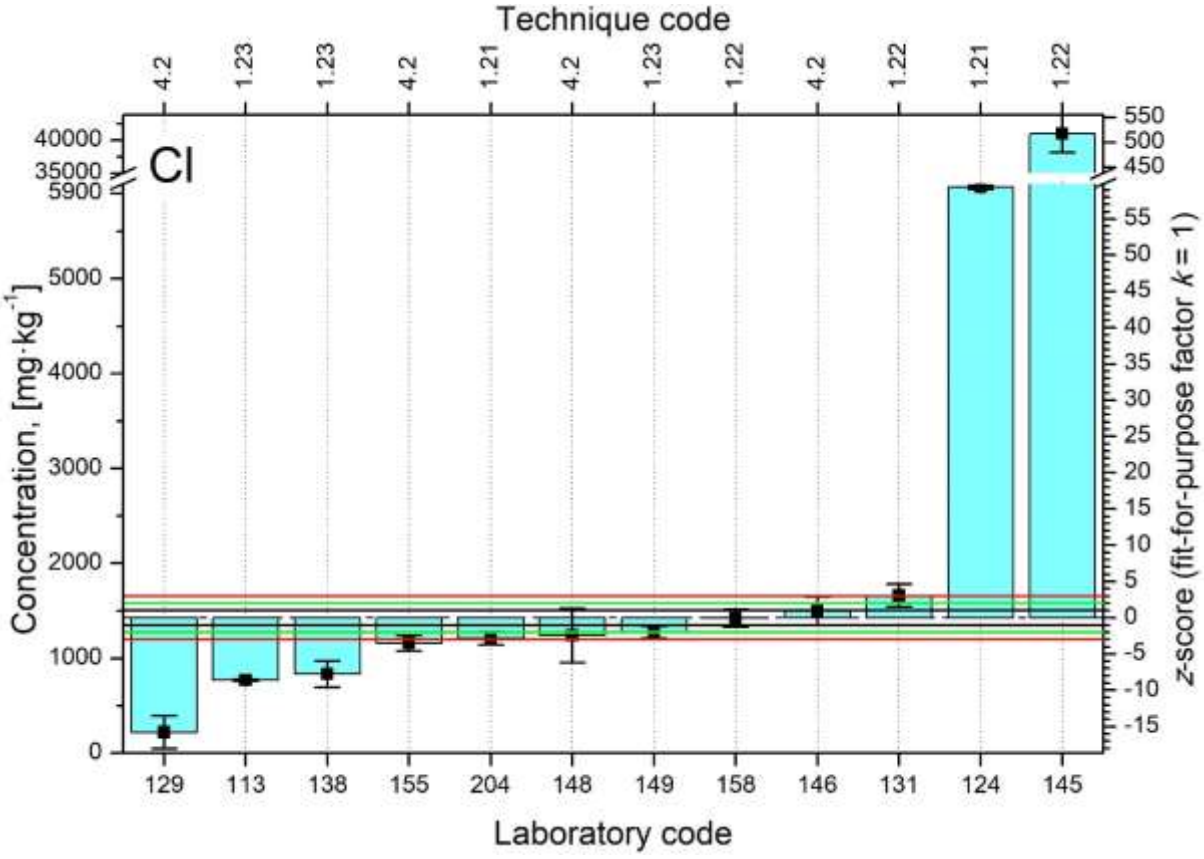

FIG. 32. Distributions of z-scores for analyte Cl.

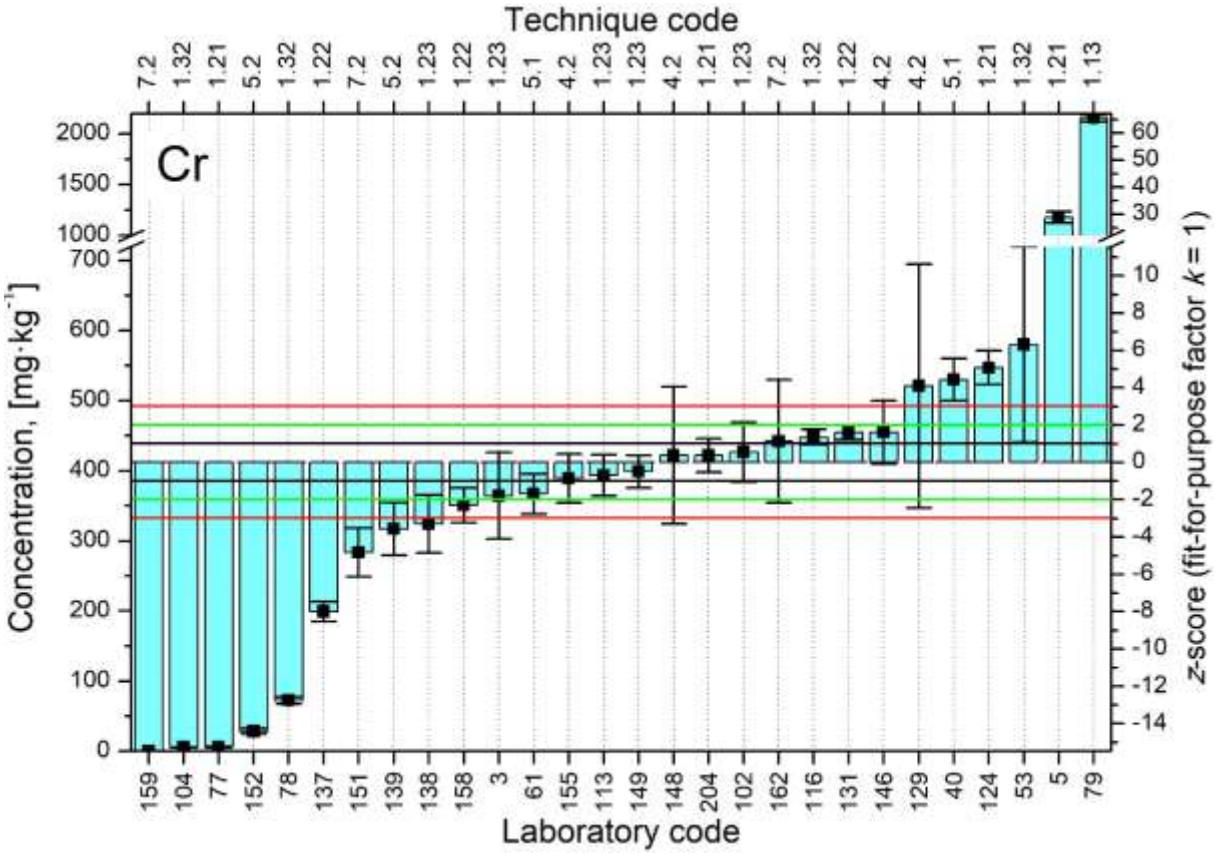

FIG. 33. Distributions of z-scores for analyte Cr.

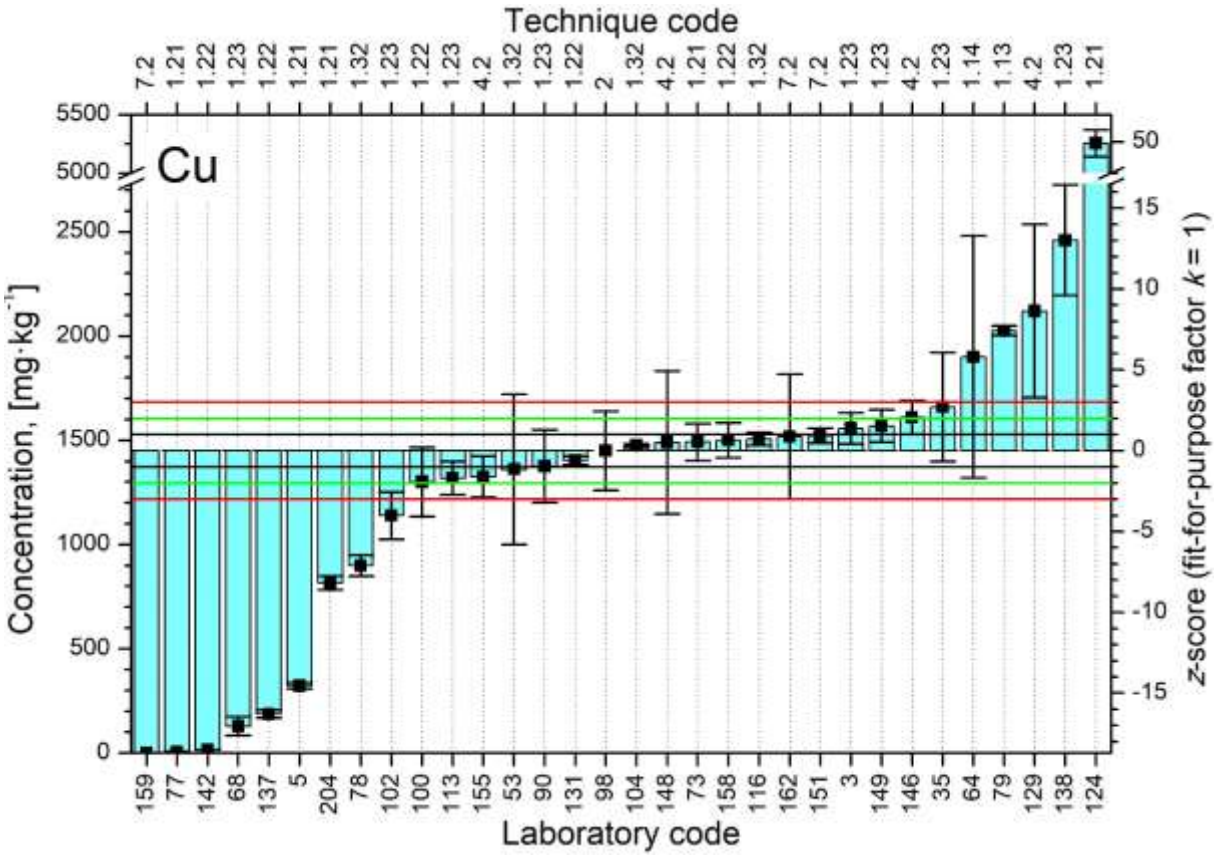

FIG. 34. Distributions of z-scores for analyte Cu.

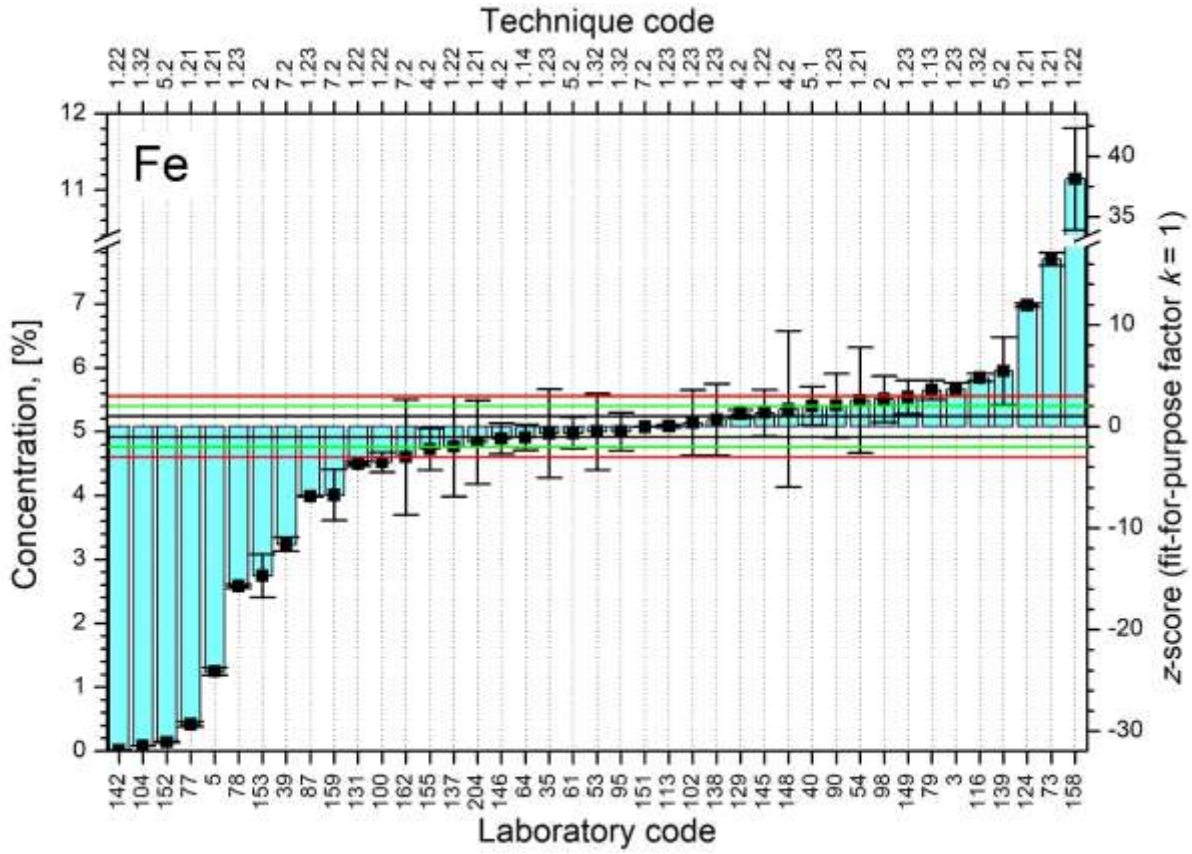

FIG. 35. Distributions of z-scores for analyte Fe.

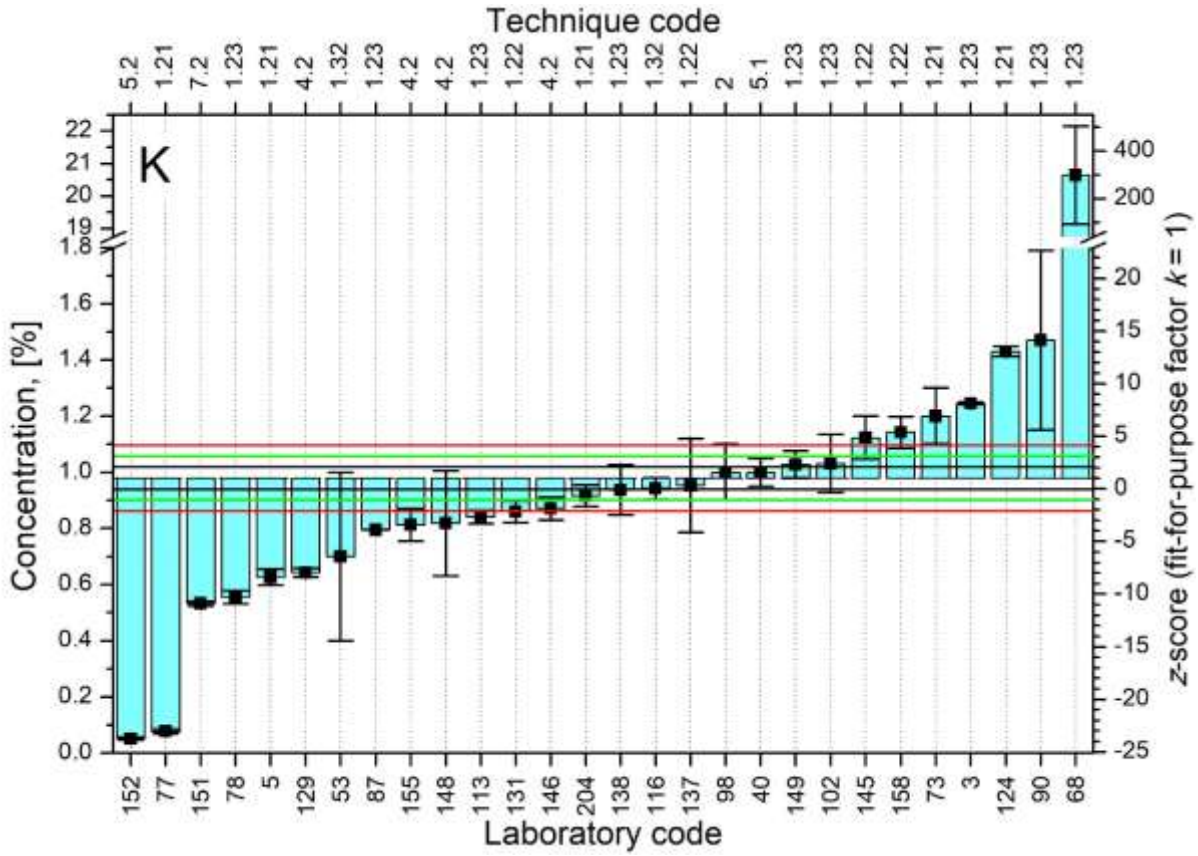

FIG. 36. Distributions of z-scores for analyte K.

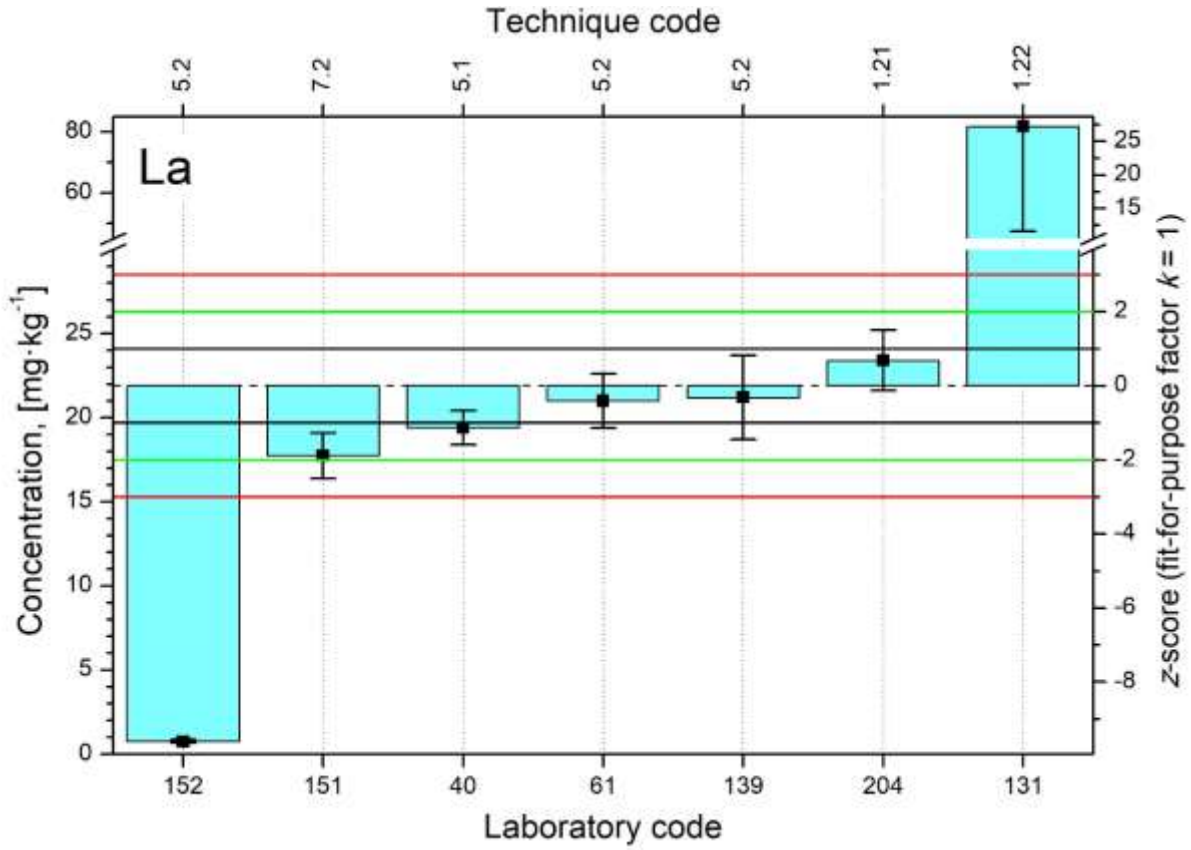

FIG. 37. Distributions of z-scores for analyte La.

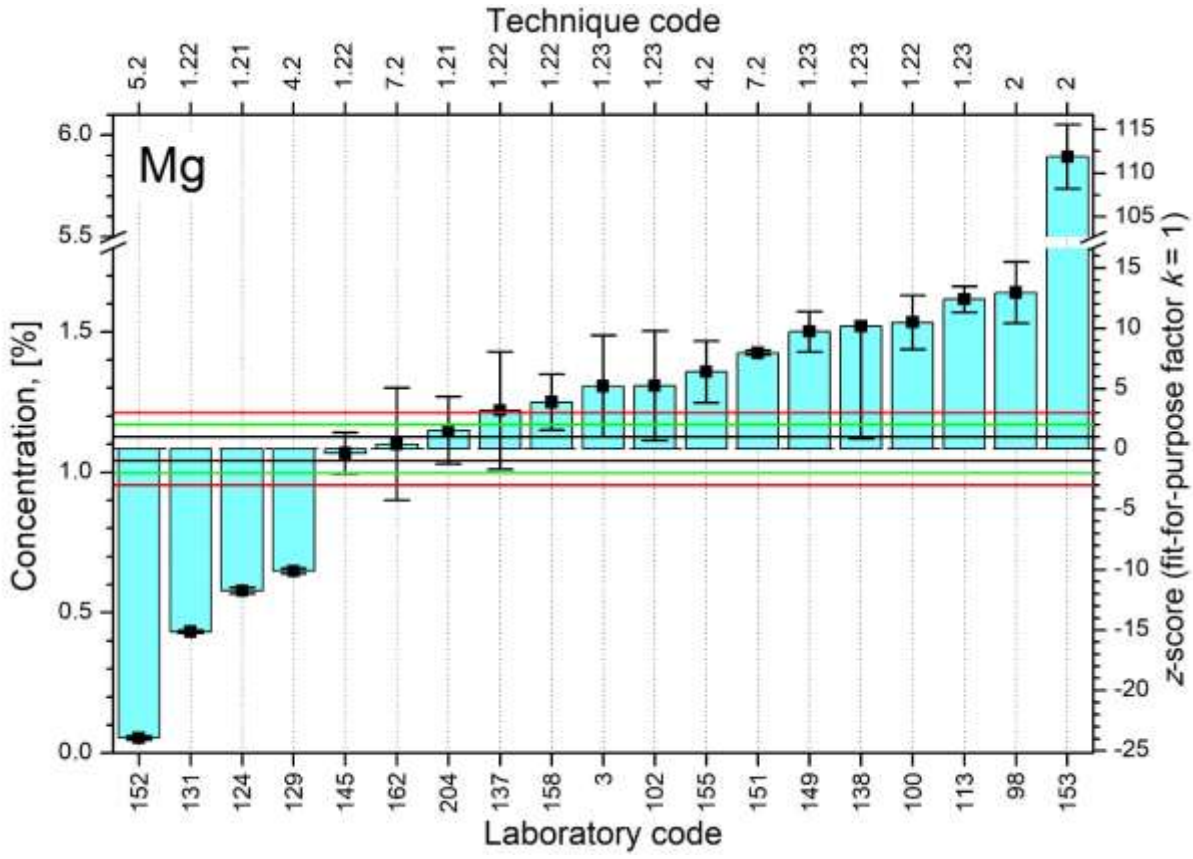

FIG. 38. Distributions of z-scores for analyte Mg.

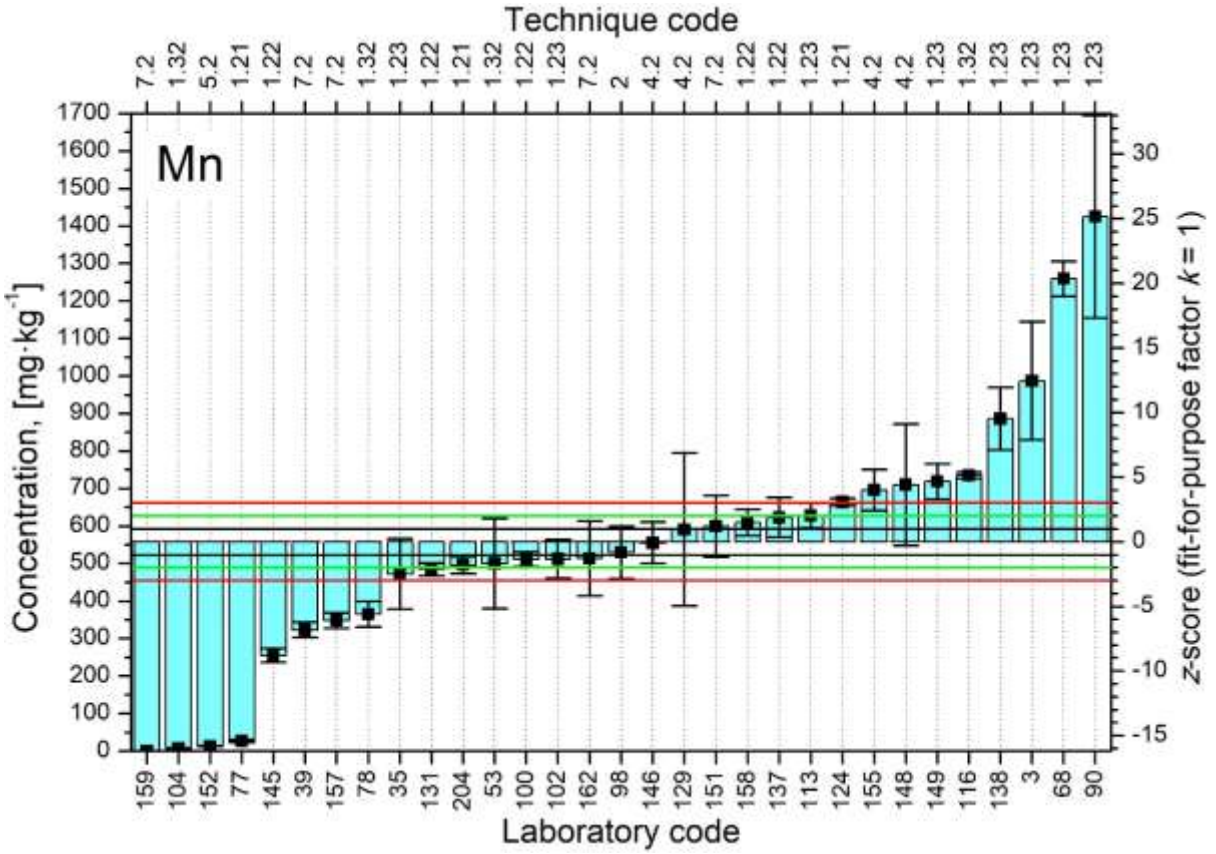

FIG. 39. Distributions of z-scores for analyte Mn.

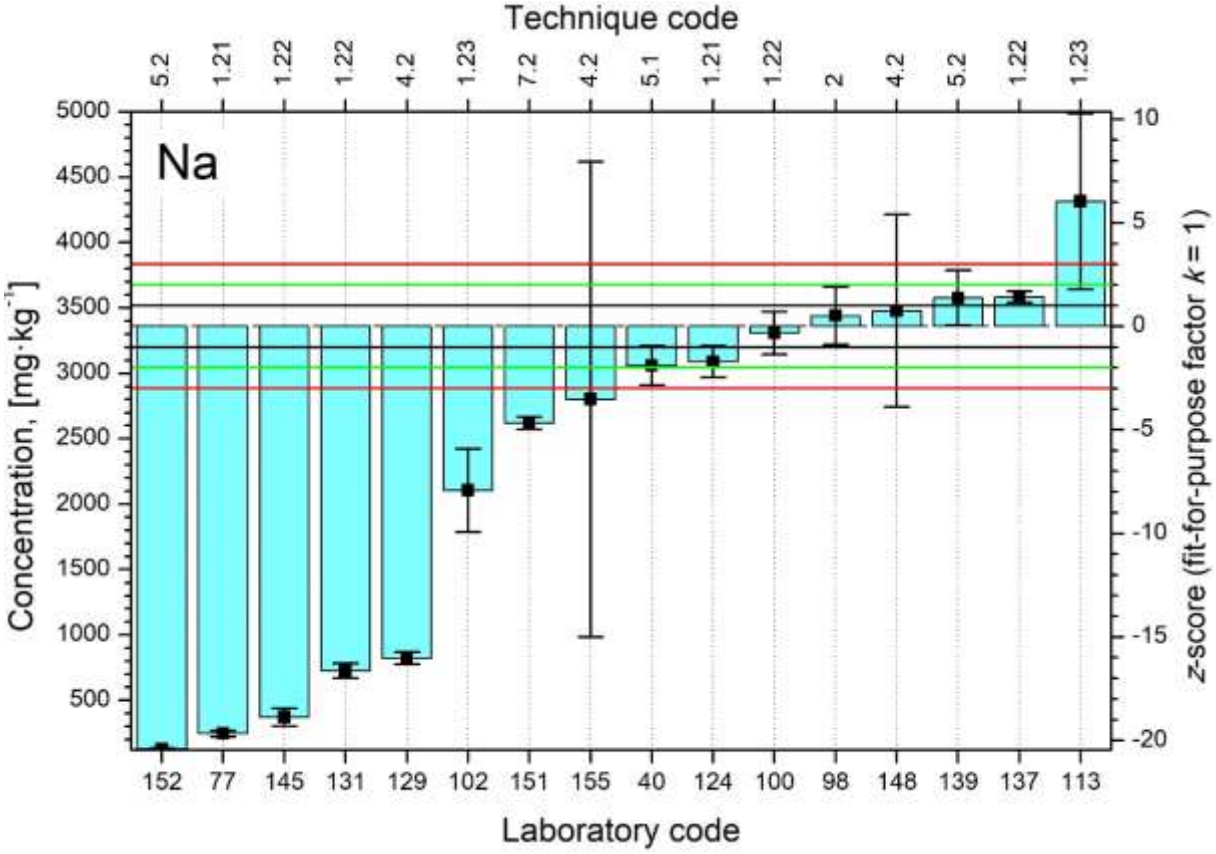

FIG. 40. Distributions of z-scores for analyte Na.

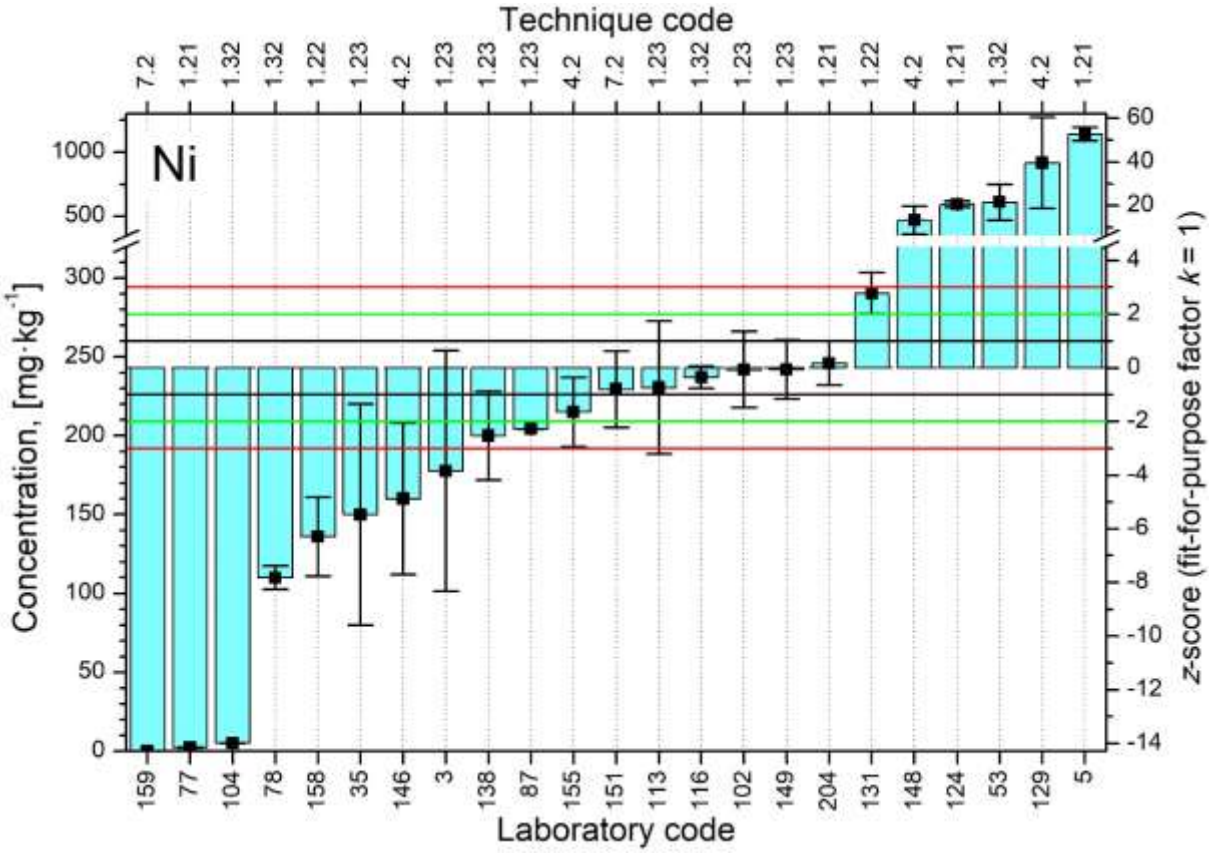

FIG. 41. Distributions of z-scores for analyte Ni.

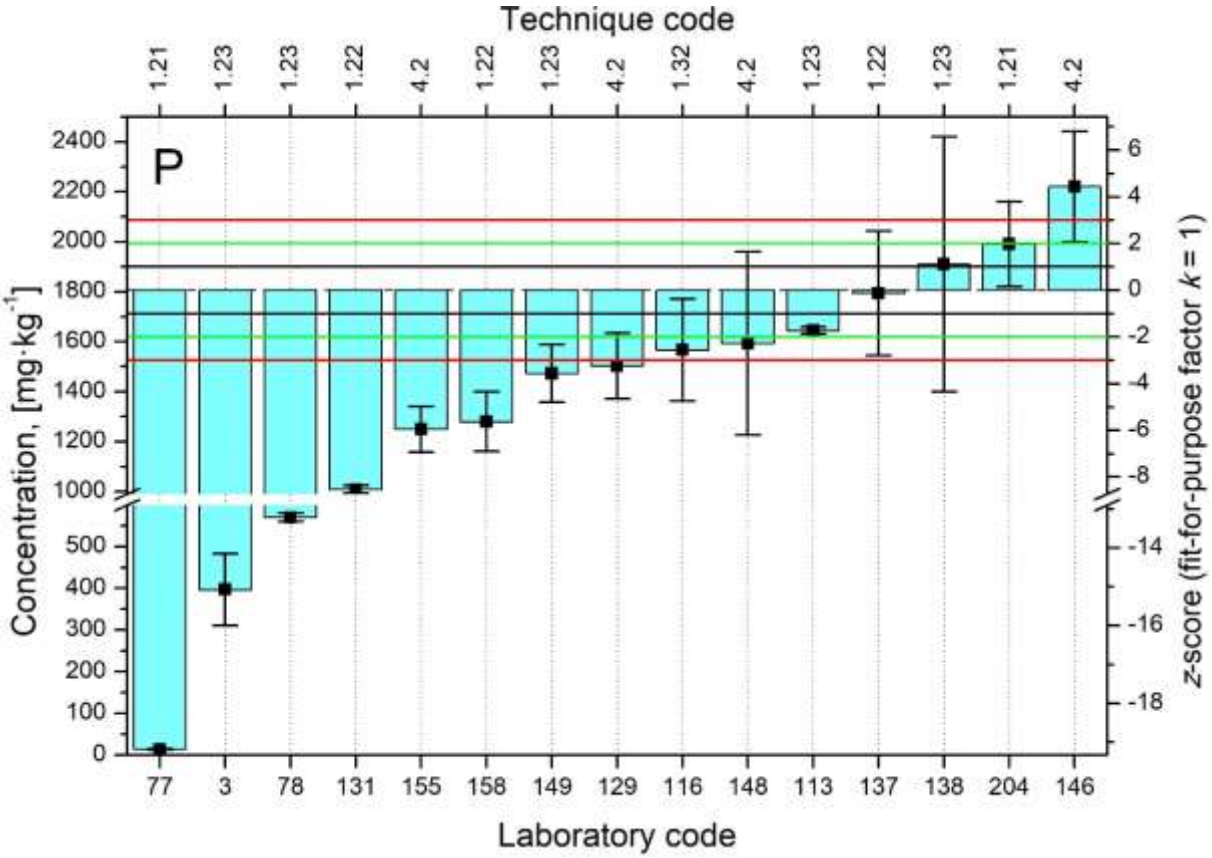

FIG. 42. Distributions of z-scores for analyte P.

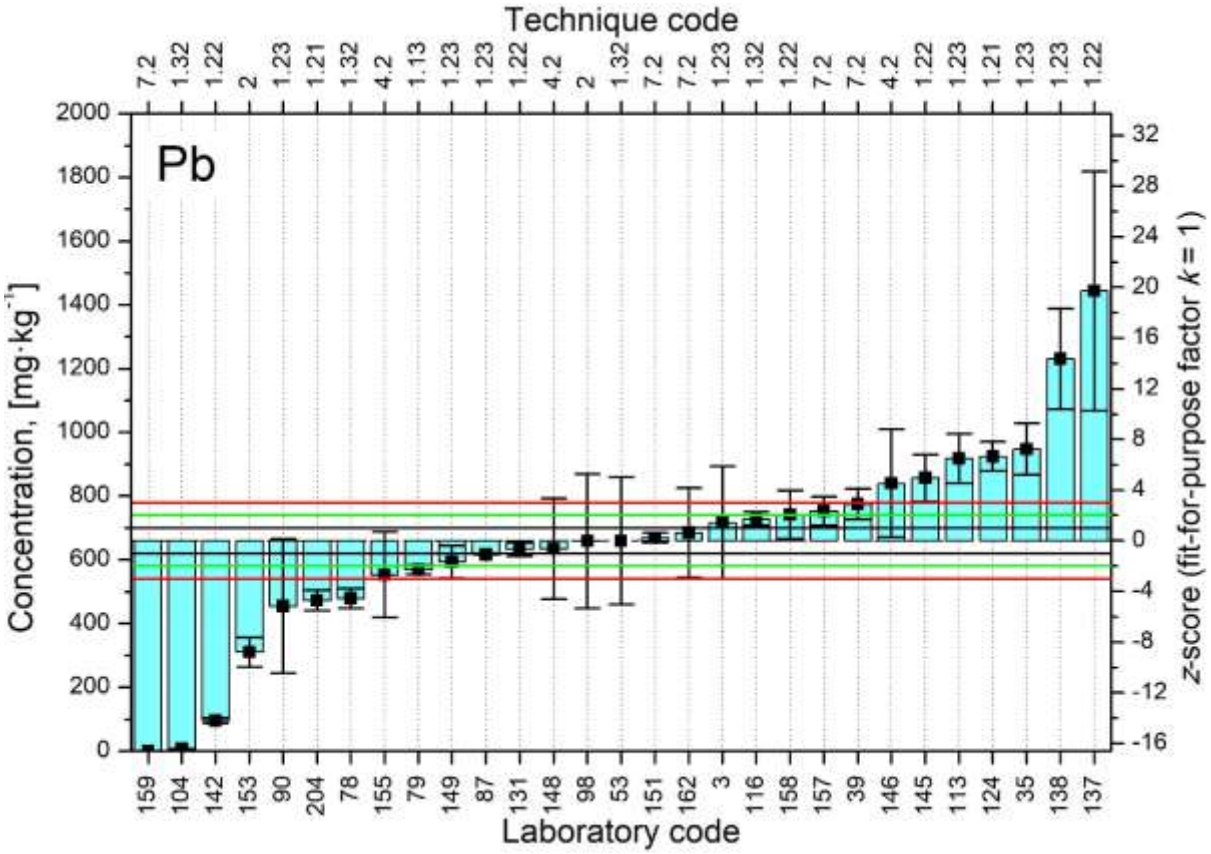

FIG. 43. Distributions of z-scores for analyte Pb.

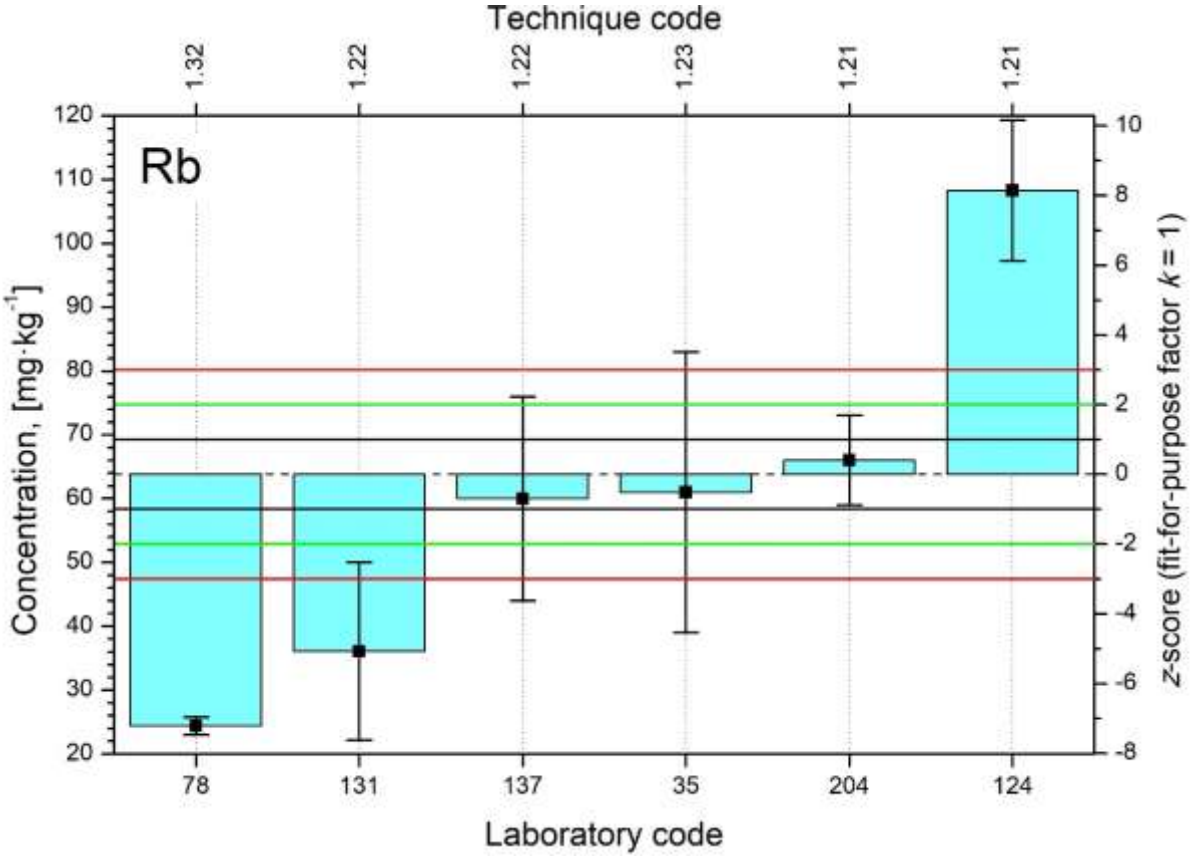

FIG. 44. Distributions of z-scores for analyte Rb.

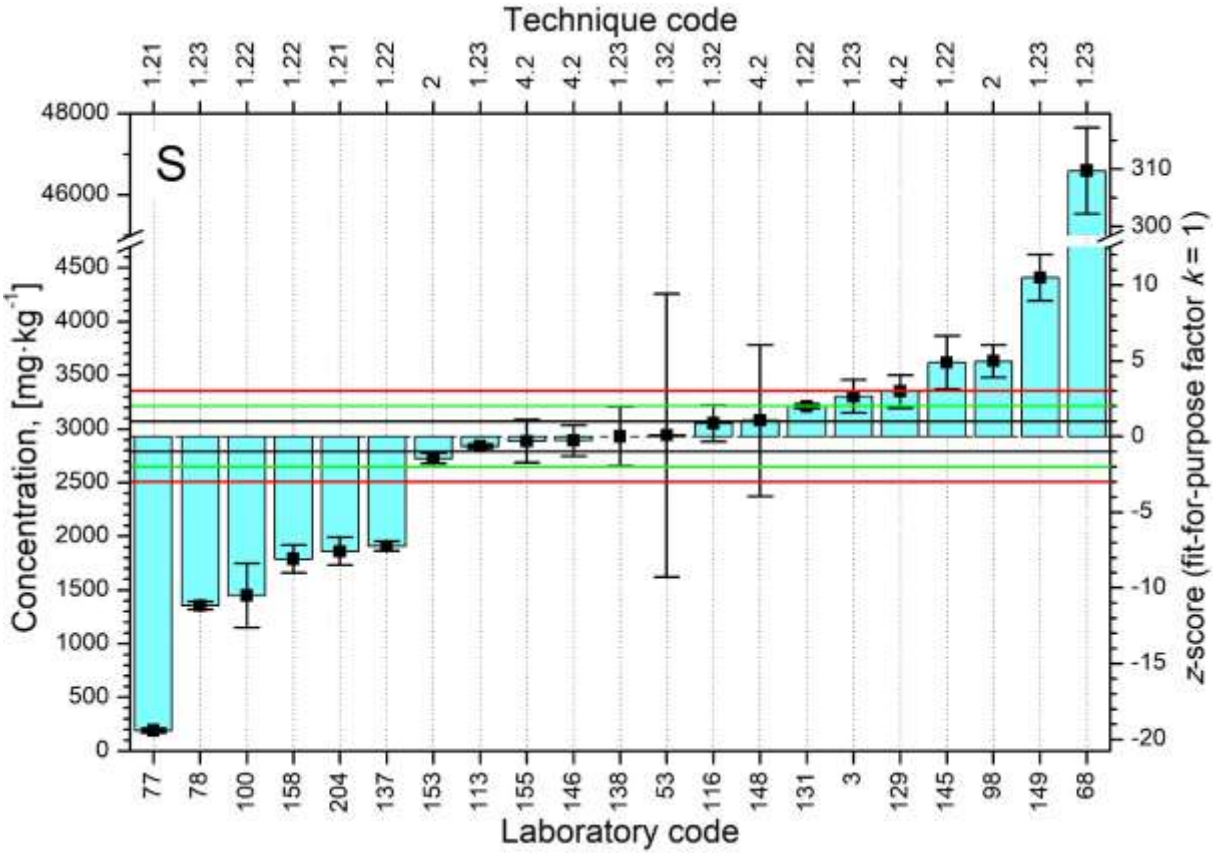

FIG. 45. Distributions of z-scores for analyte S.

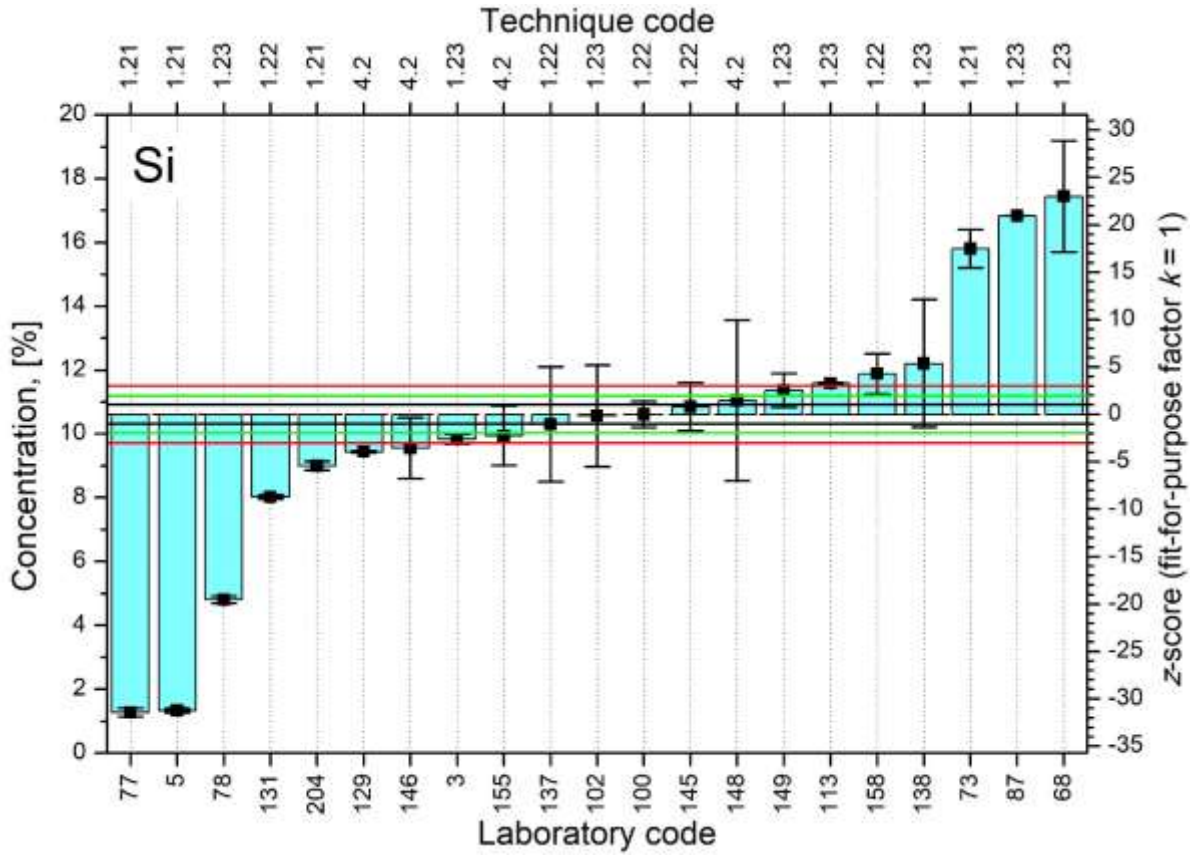

FIG. 46. Distributions of z-scores for analyte Si.

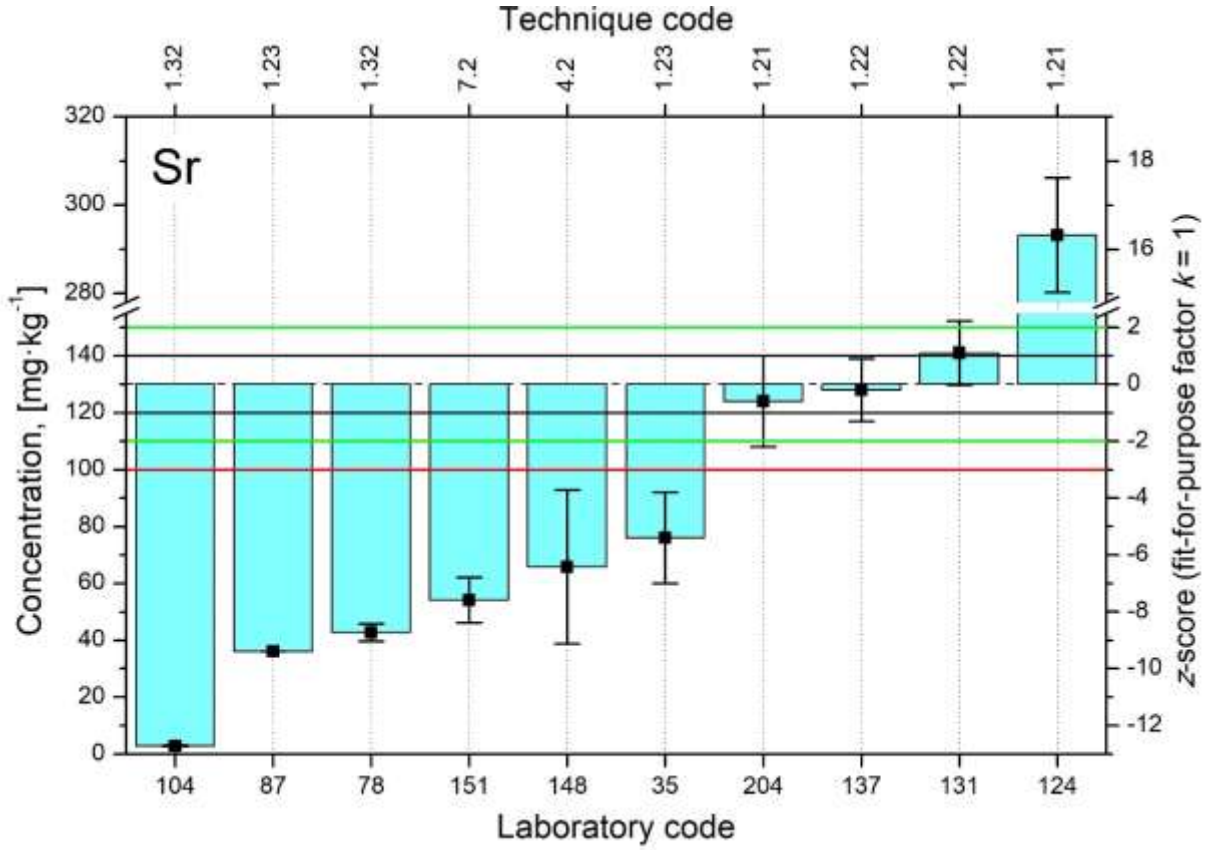

FIG. 47. Distributions of z-scores for analyte Sr.

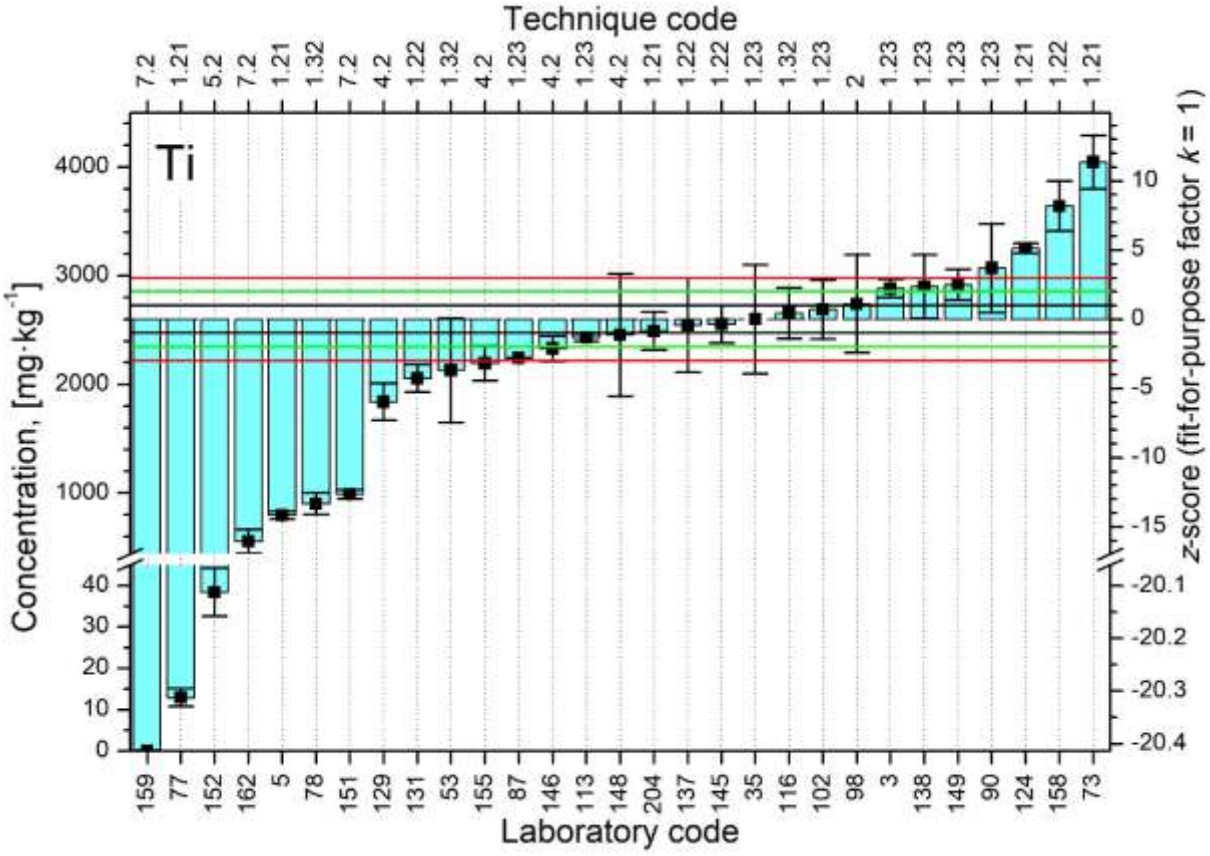

FIG. 48. Distributions of z-scores for analyte Ti.

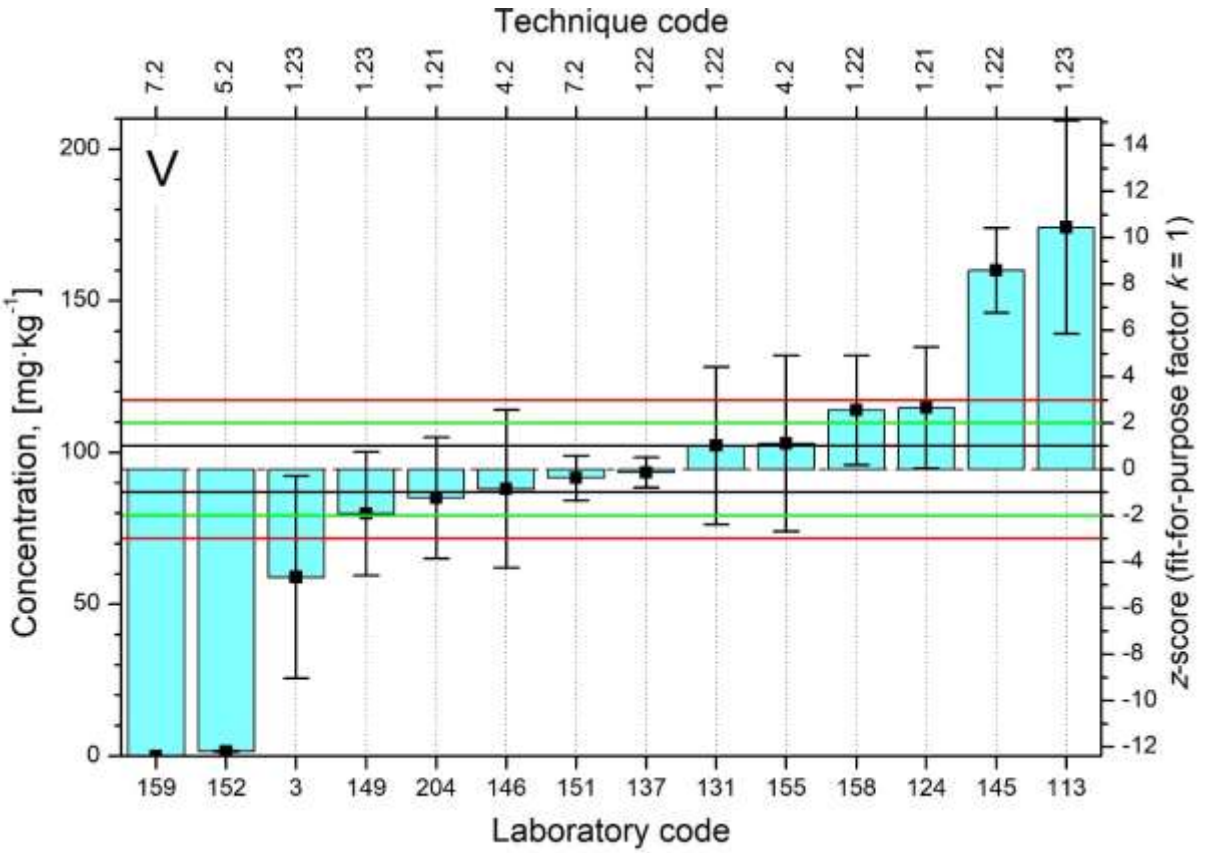

FIG. 49. Distributions of z-scores for analyte V.

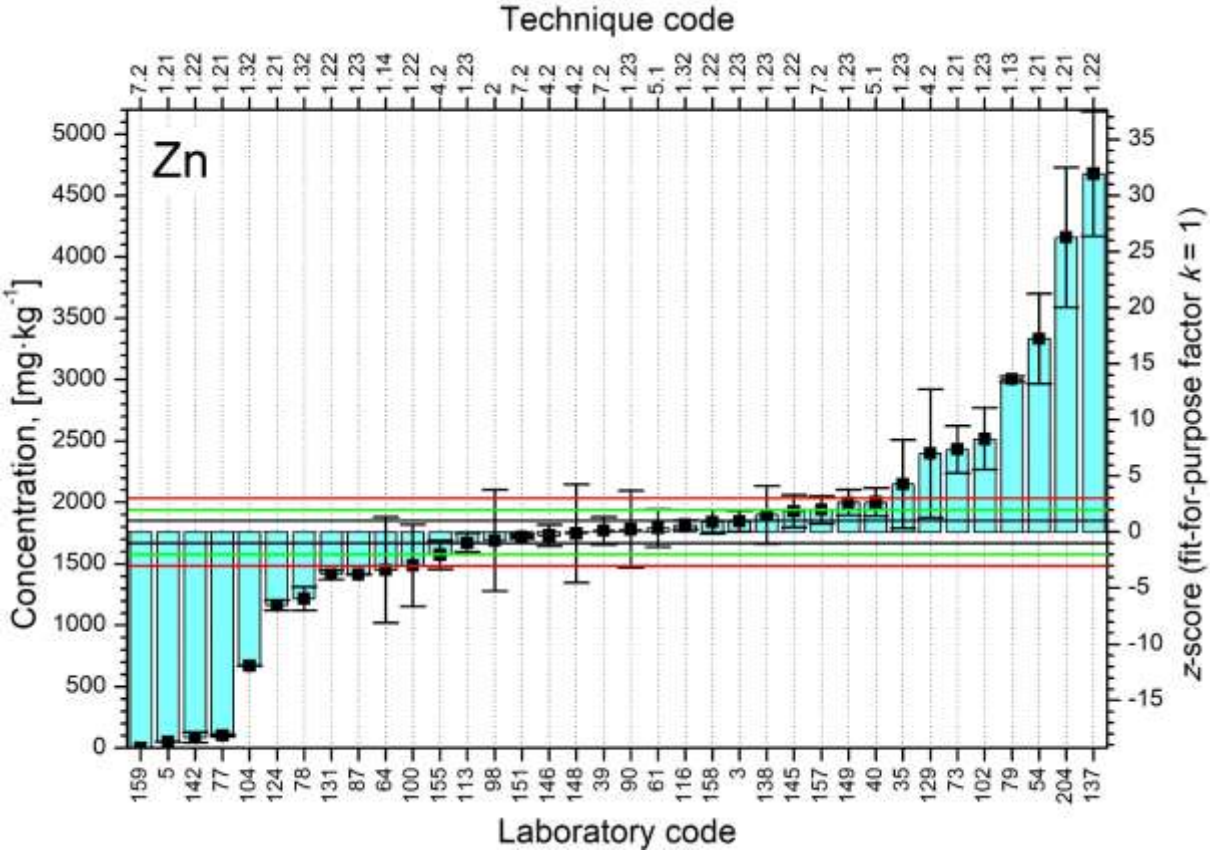

FIG. 50. Distributions of z-scores for analyte Zn.

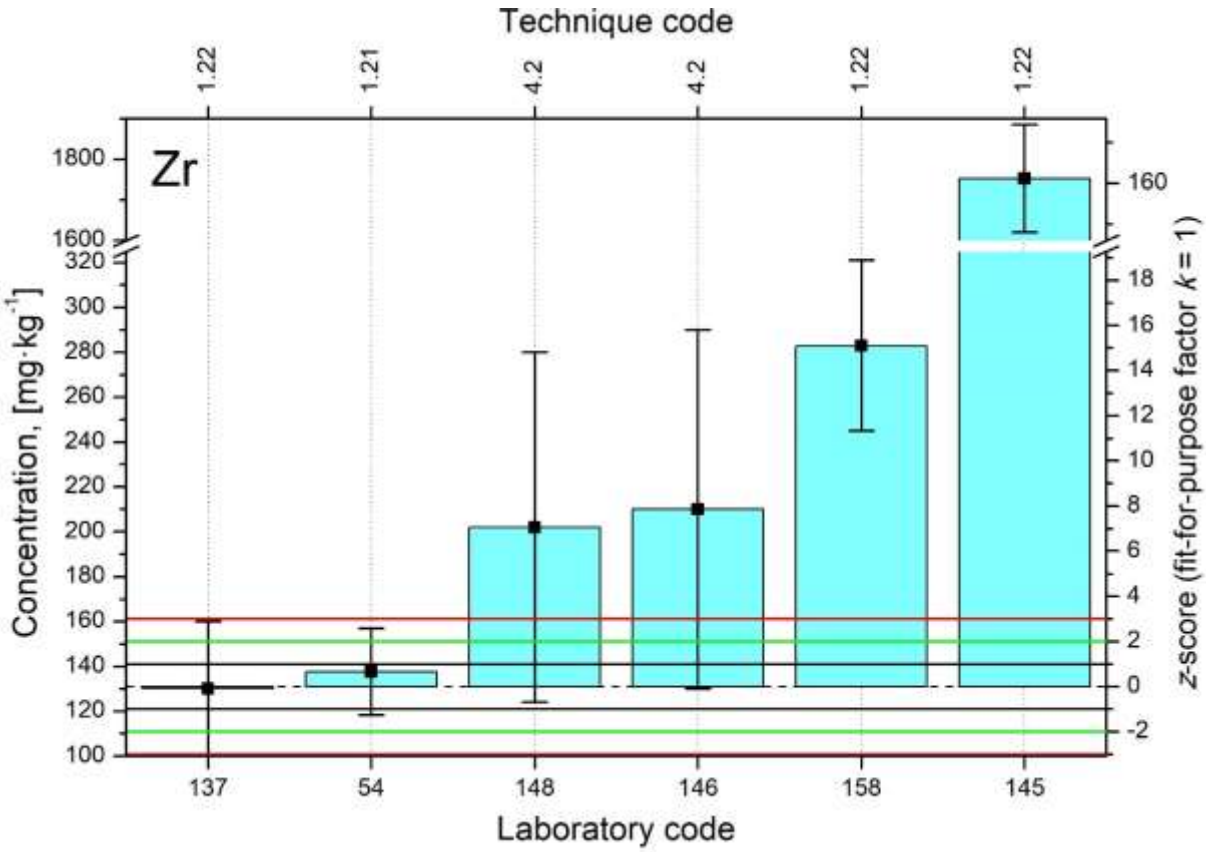

FIG. 51. Distributions of z-scores for analyte Zr.

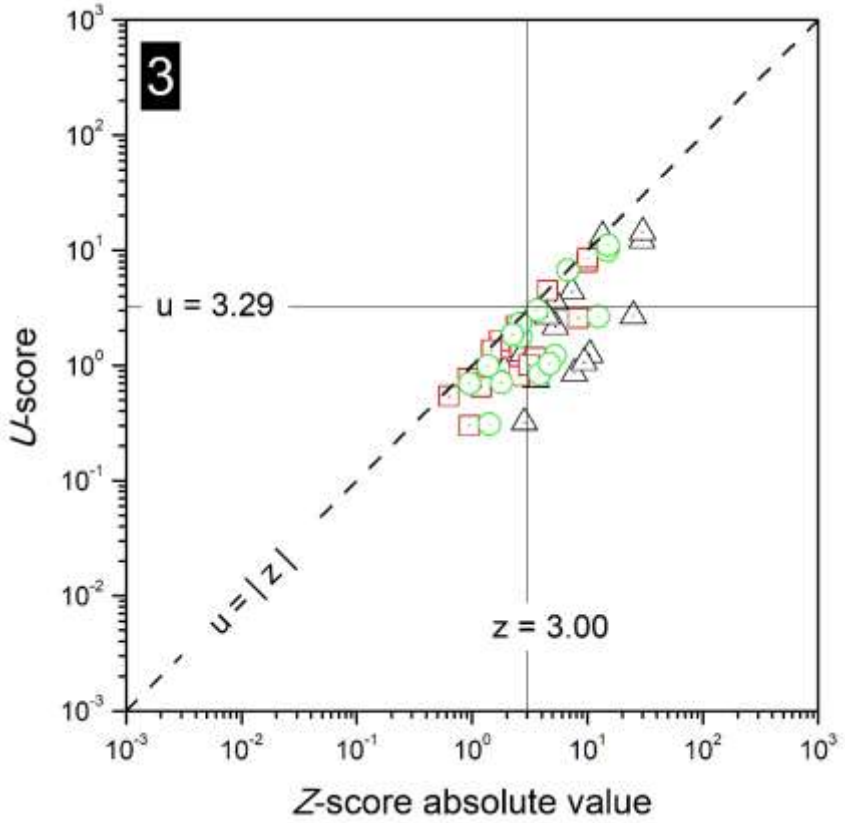

FIG. 52. Combined plots of z- and u-scores for the laboratory with code 3.

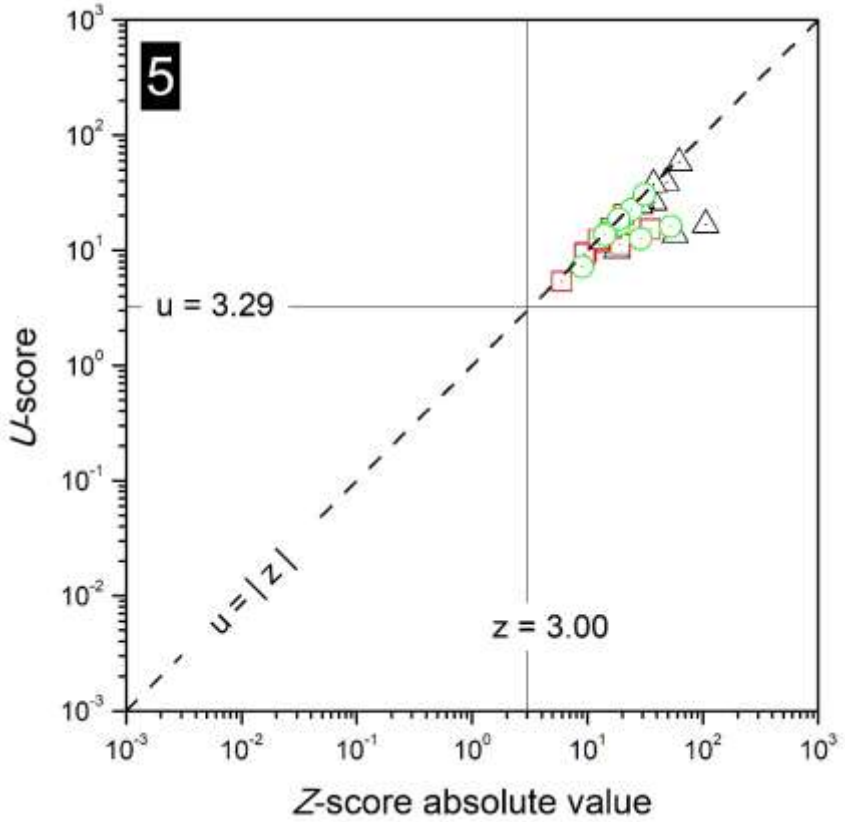

FIG. 53. Combined plots of z- and u-scores for the laboratory with code 5.

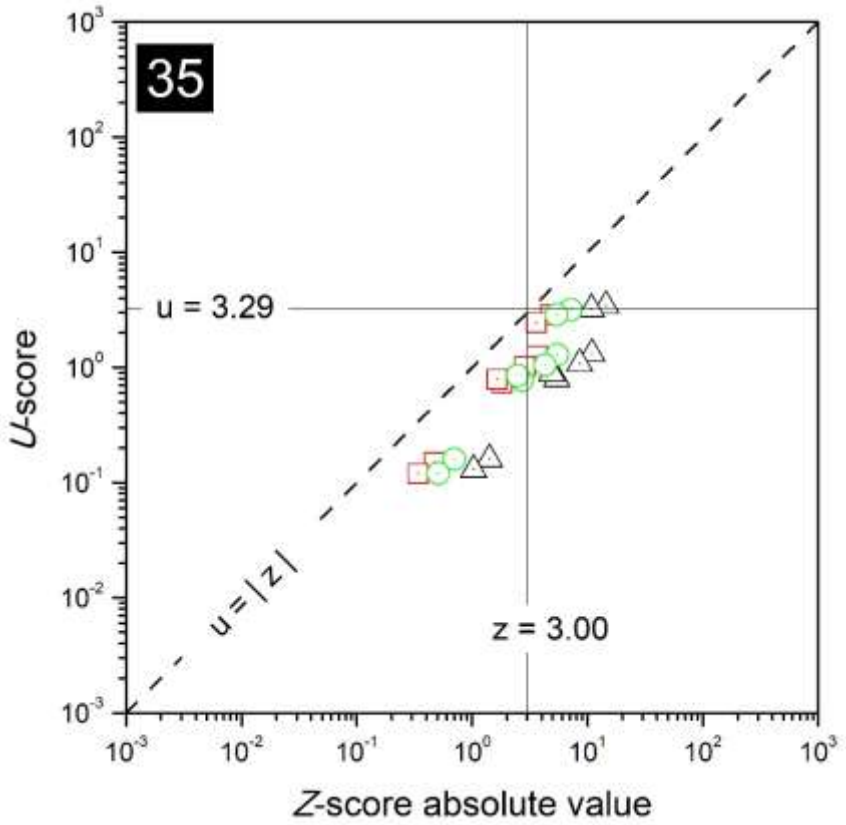

FIG. 54. Combined plots of z- and u-scores for the laboratory with code 35.

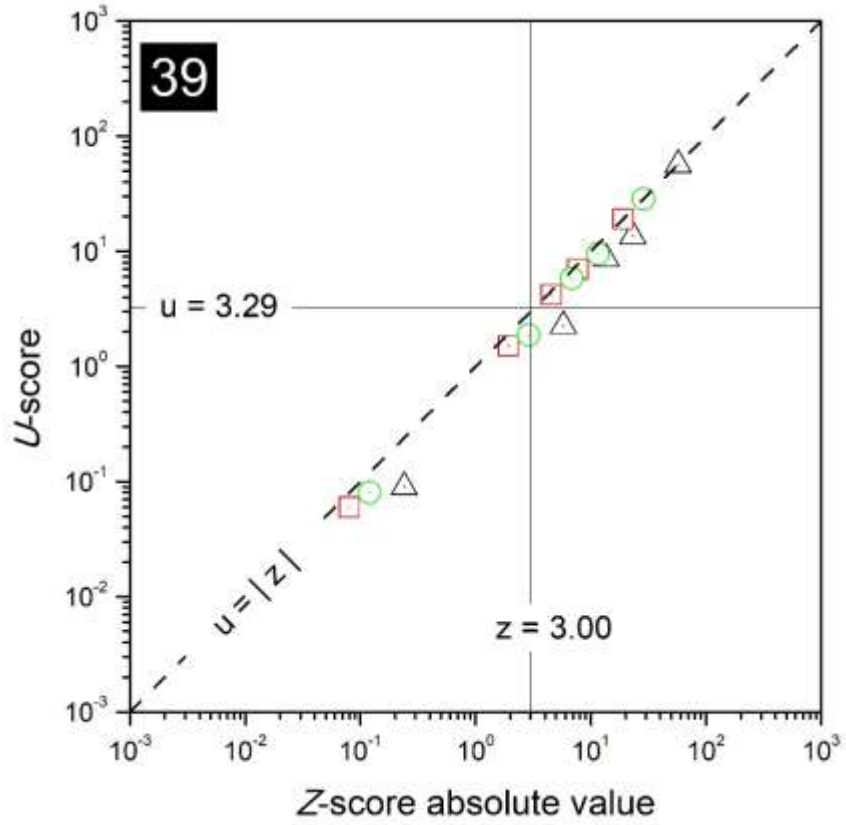

FIG. 55. Combined plots of z- and u-scores for the laboratory with code 39.

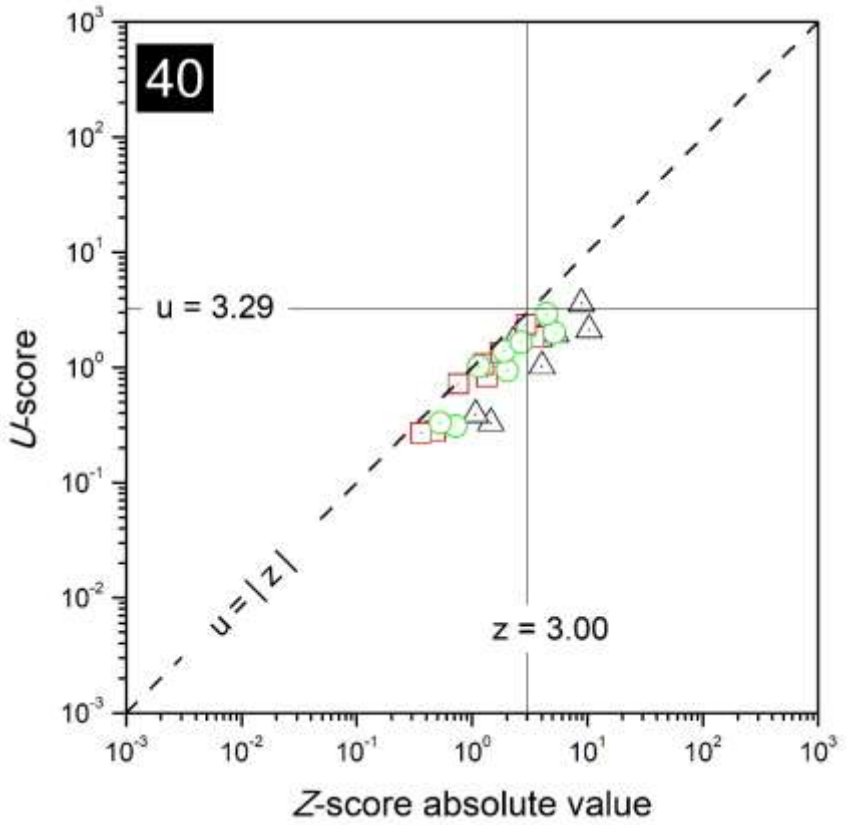

FIG. 56. Combined plots of z- and u-scores for the laboratory with code 40.

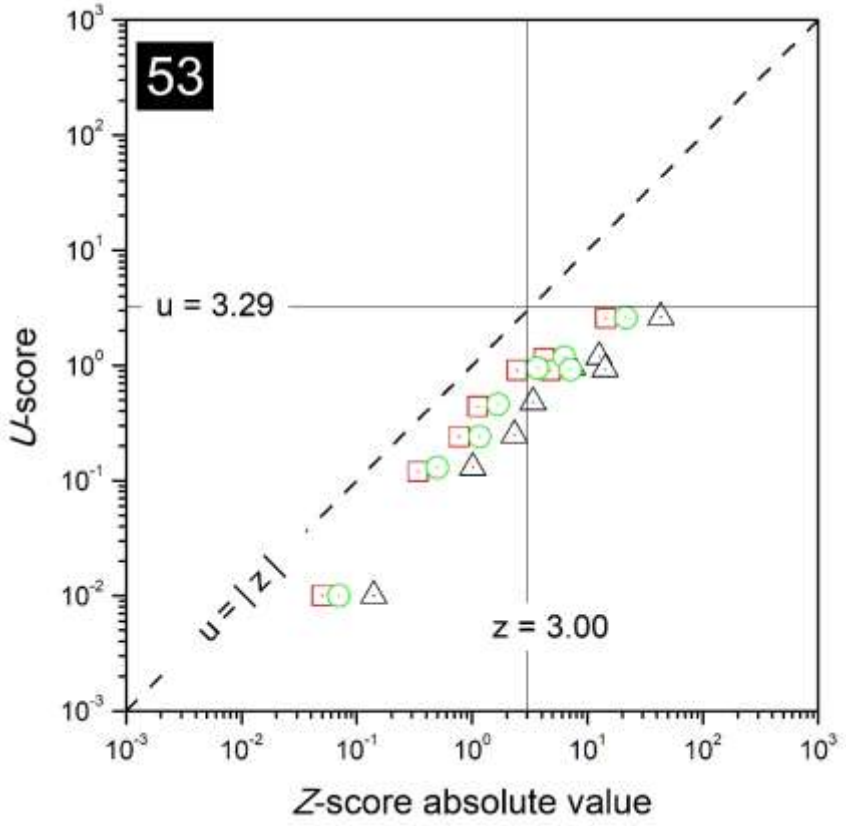

FIG. 57. Combined plots of z- and u-scores for the laboratory with code 53.

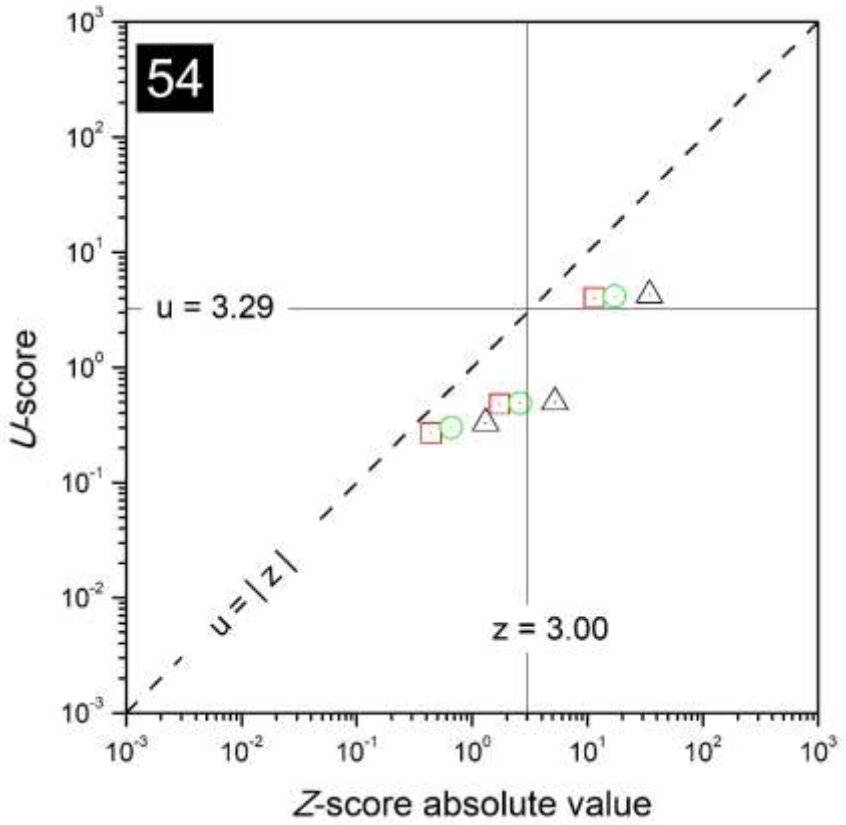

FIG. 58. Combined plots of z- and u-scores for the laboratory with code 54.

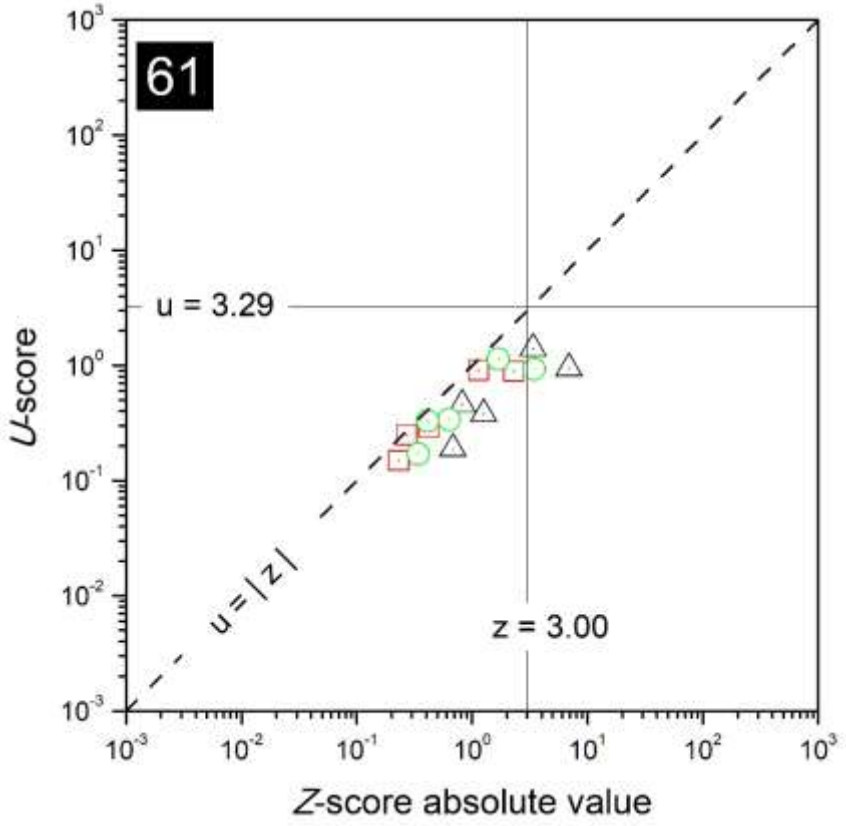

FIG. 59. Combined plots of z- and u-scores for the laboratory with code 61.

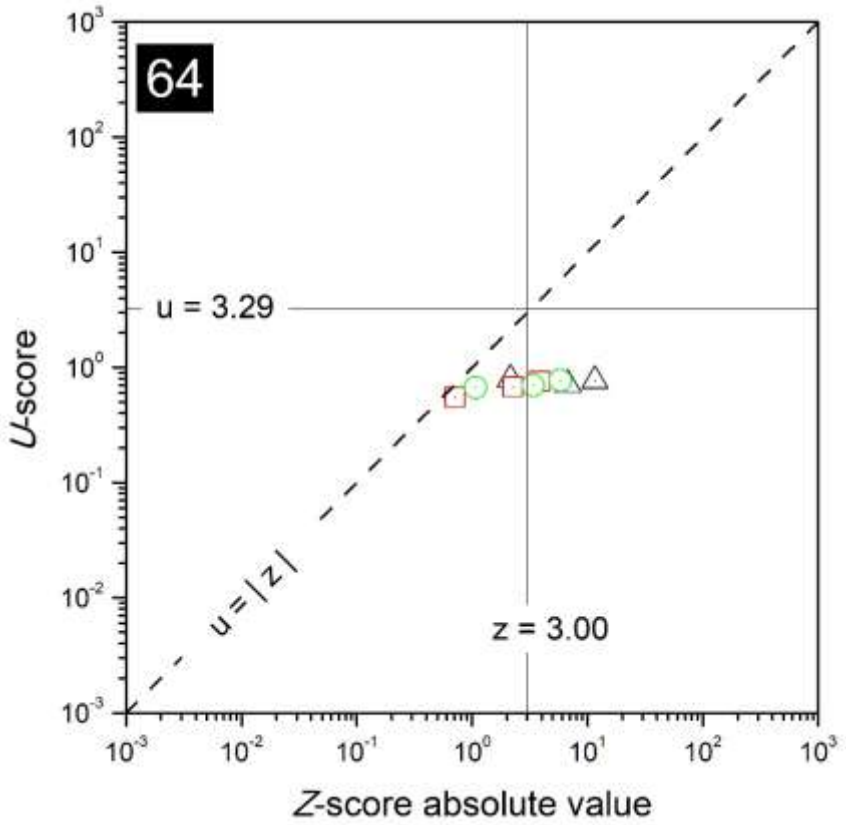

FIG. 60. Combined plots of z- and u-scores for the laboratory with code 64.

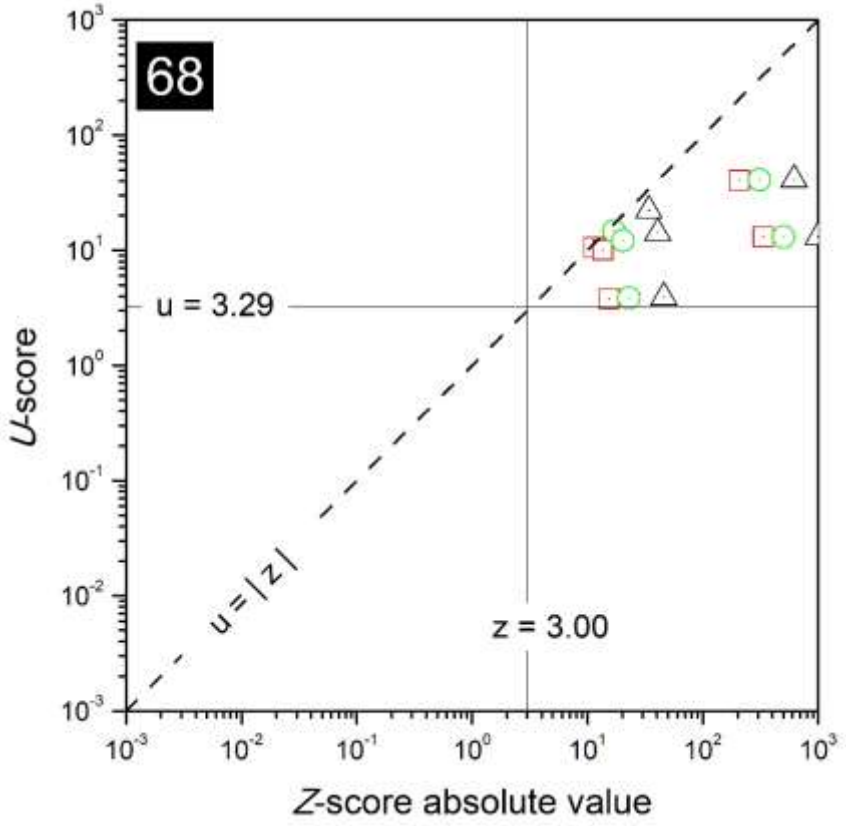

FIG. 61. Combined plots of z- and u-scores for the laboratory with code 68.

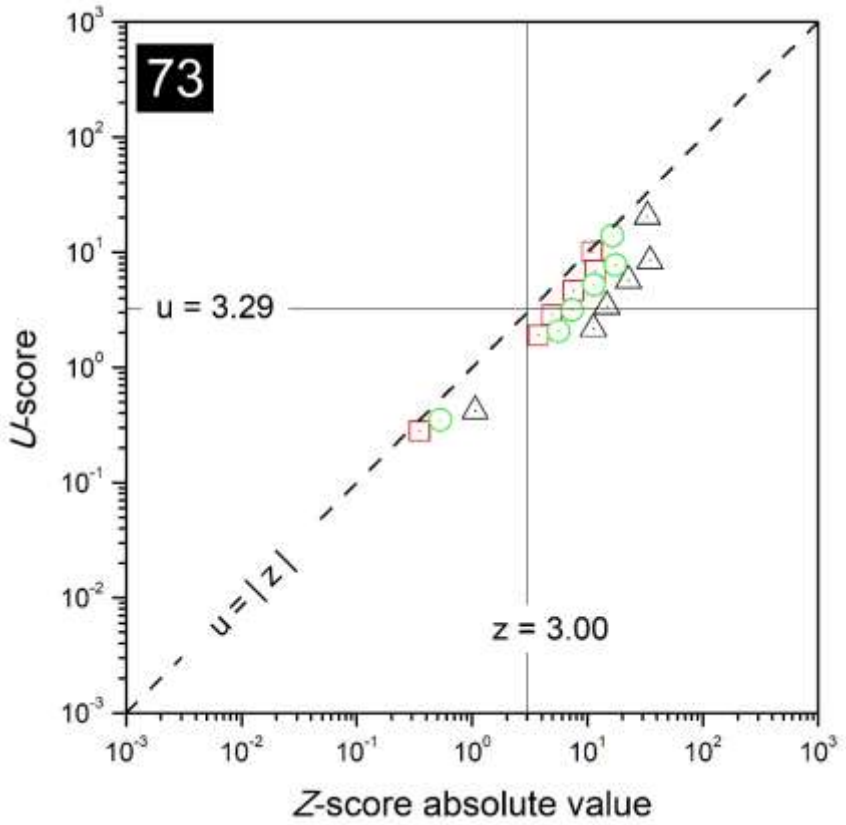

FIG. 62. Combined plots of z- and u-scores for the laboratory with code 73.

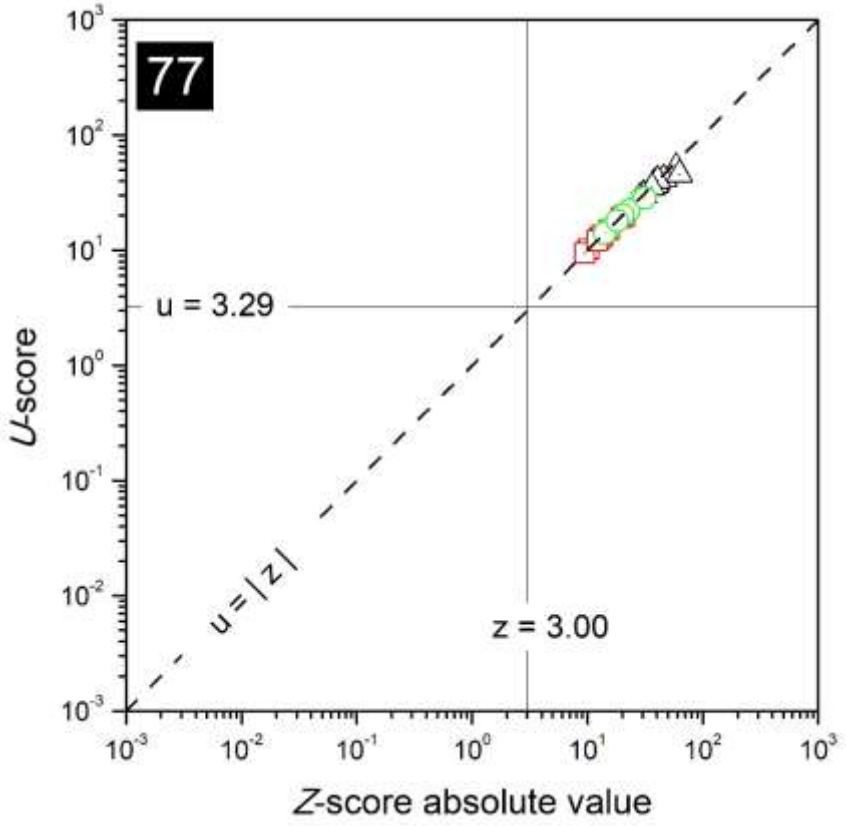

FIG. 63. Combined plots of z- and u-scores for the laboratory with code 77.

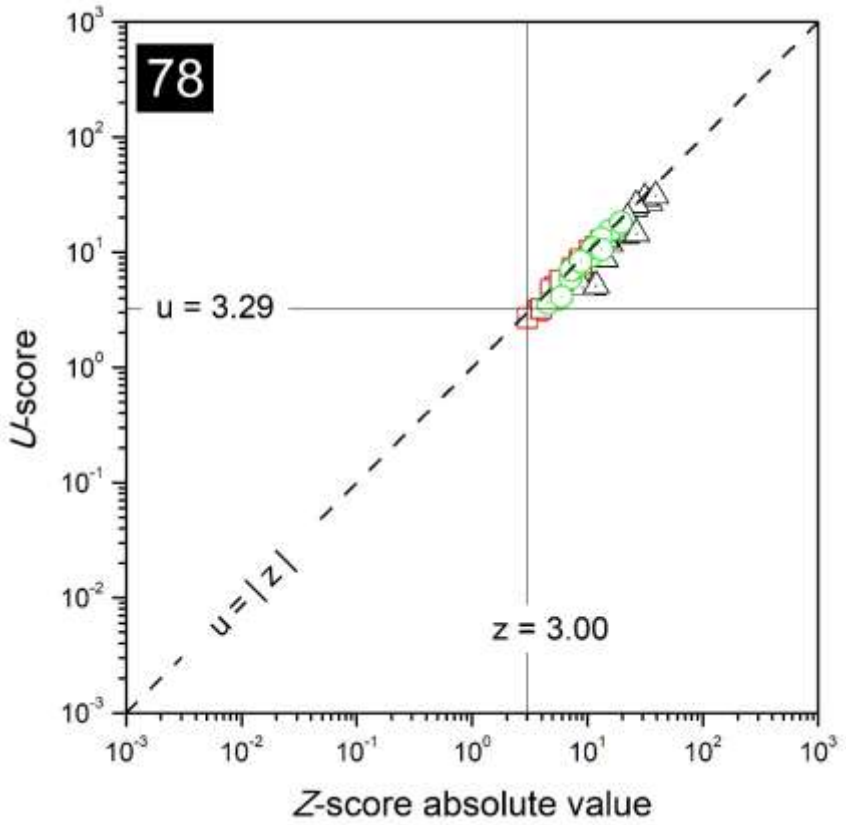

FIG. 64. Combined plots of z- and u-scores for the laboratory with code 78.

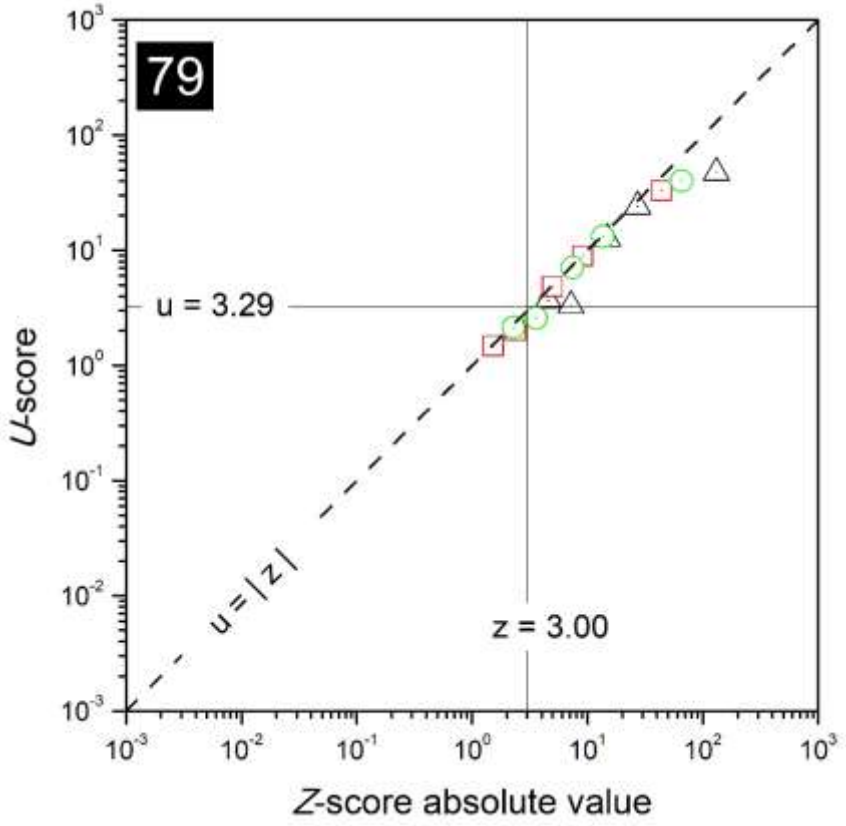

FIG. 65. Combined plots of z- and u-scores for the laboratory with code 79.

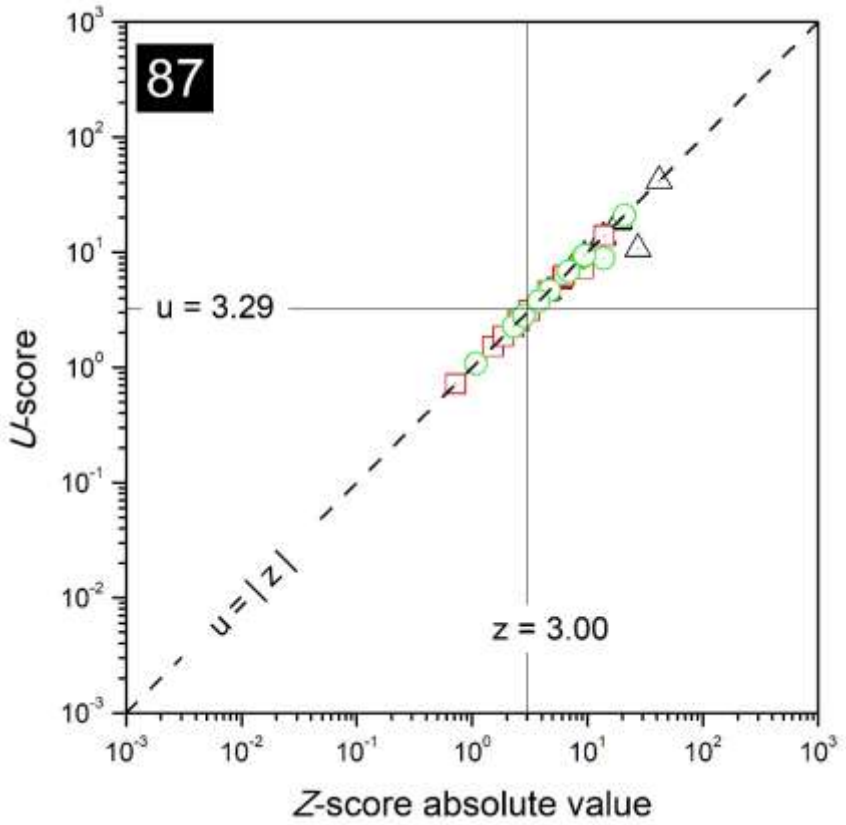

FIG. 66. Combined plots of z- and u-scores for the laboratory with code 87.

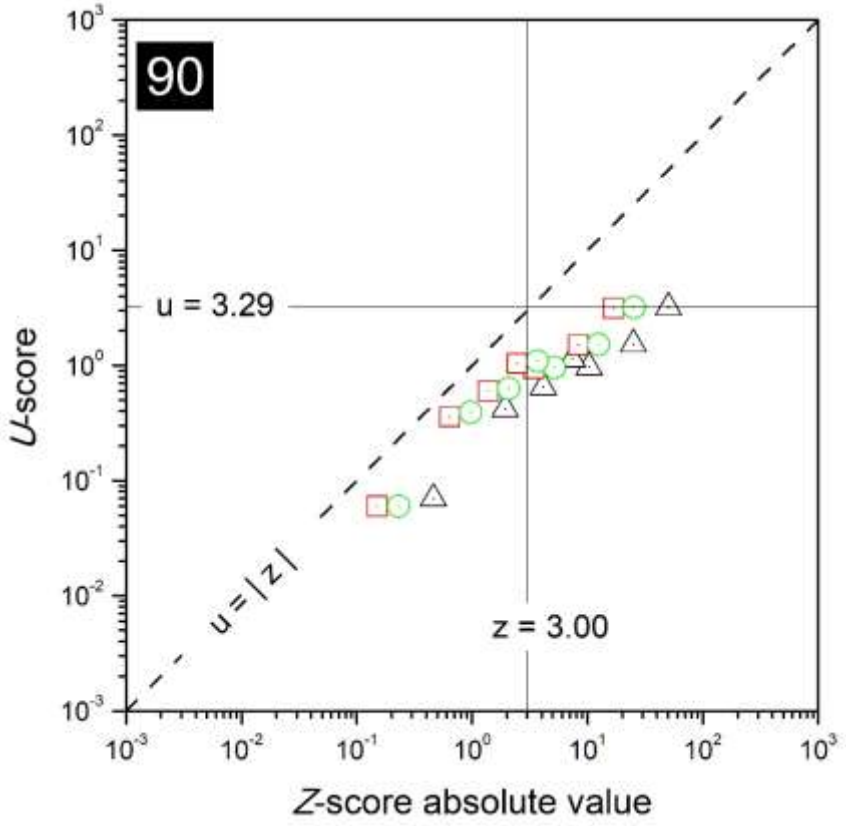

FIG. 67. Combined plots of z- and u-scores for the laboratory with code 90.

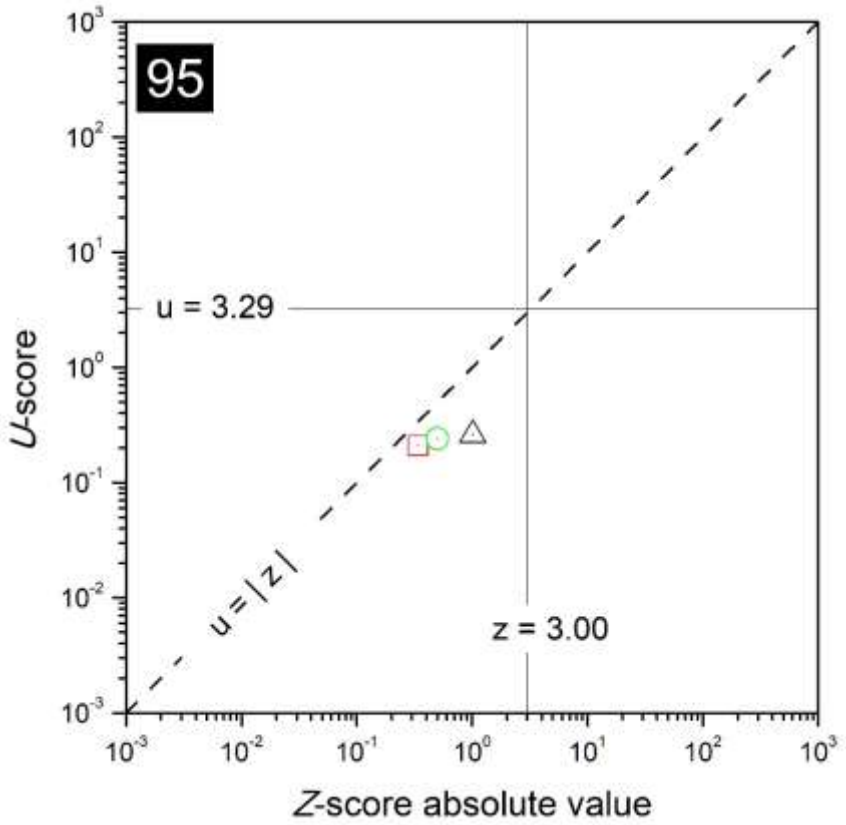

FIG. 68. Combined plots of z- and u-scores for the laboratory with code 95.

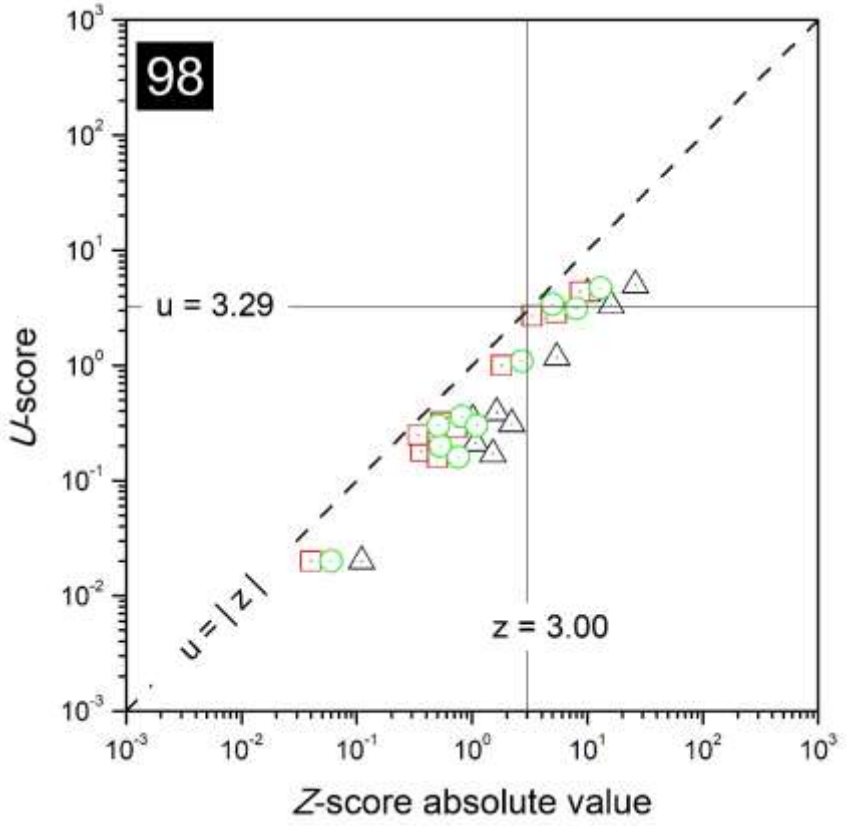

FIG. 69. Combined plots of z- and u-scores for the laboratory with code 98.

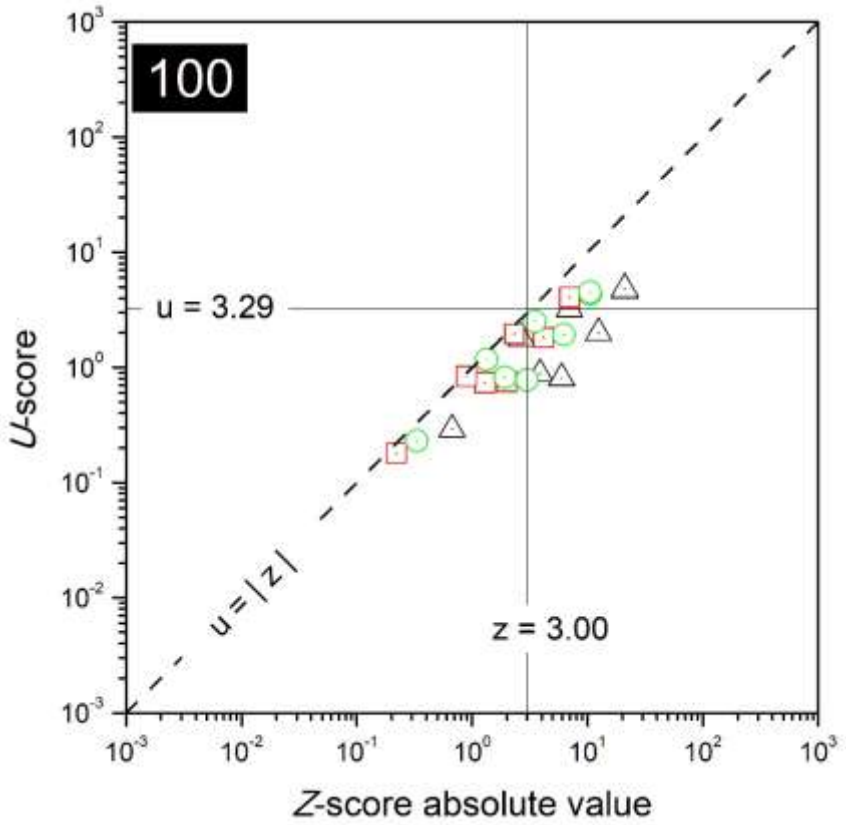

FIG. 70. Combined plots of z- and u-scores for the laboratory with code 100.

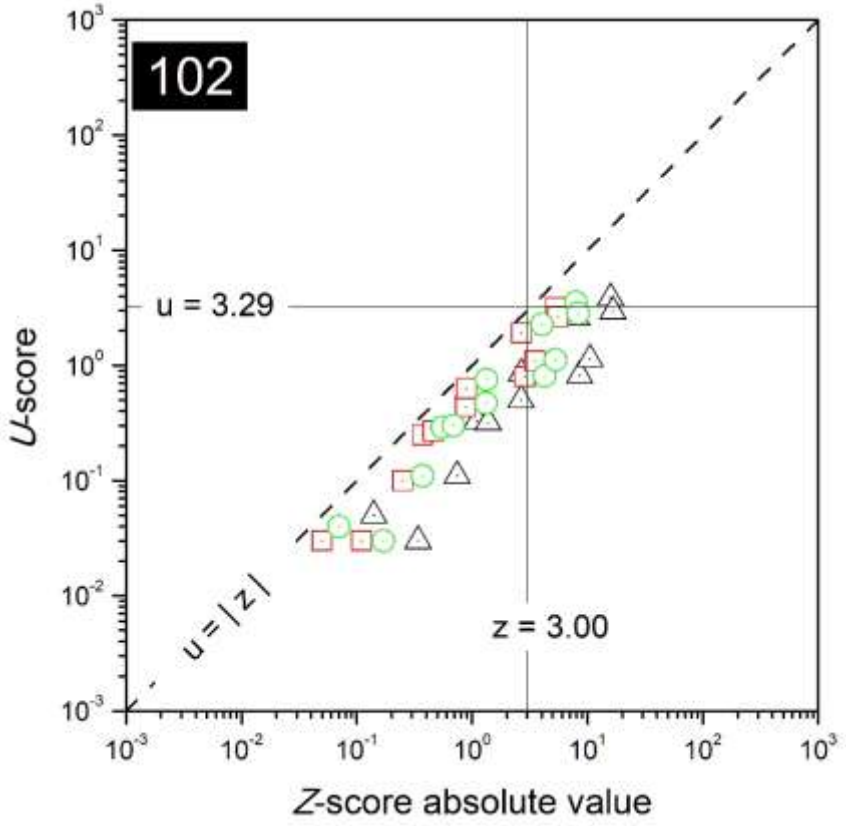

FIG. 71. Combined plots of z- and u-scores for the laboratory with code 102.

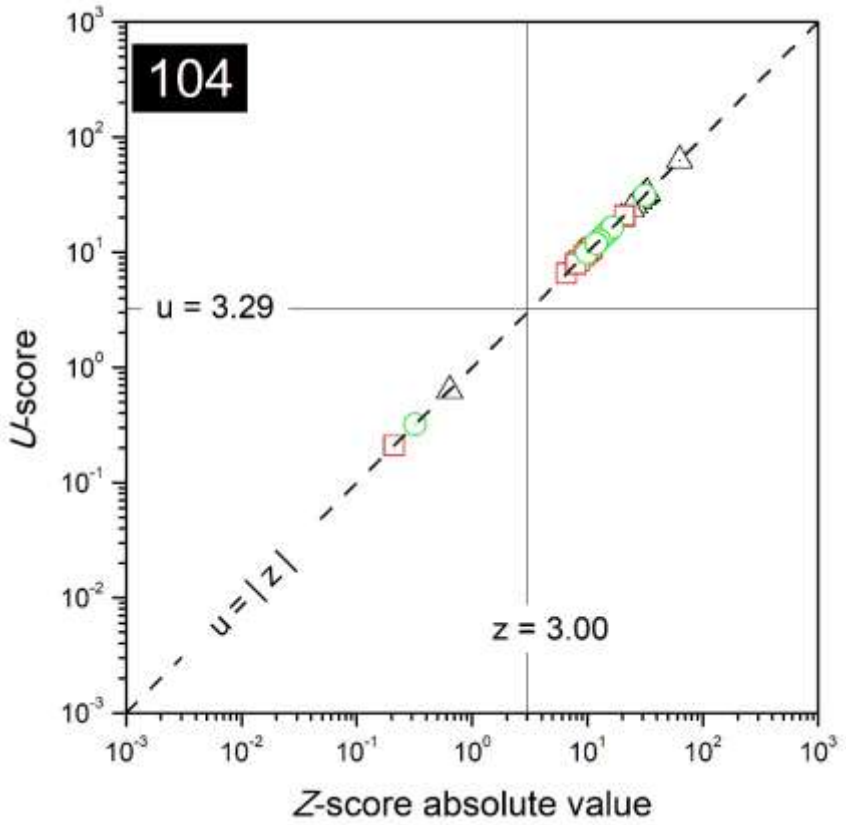

FIG. 72. Combined plots of z- and u-scores for the laboratory with code 104.

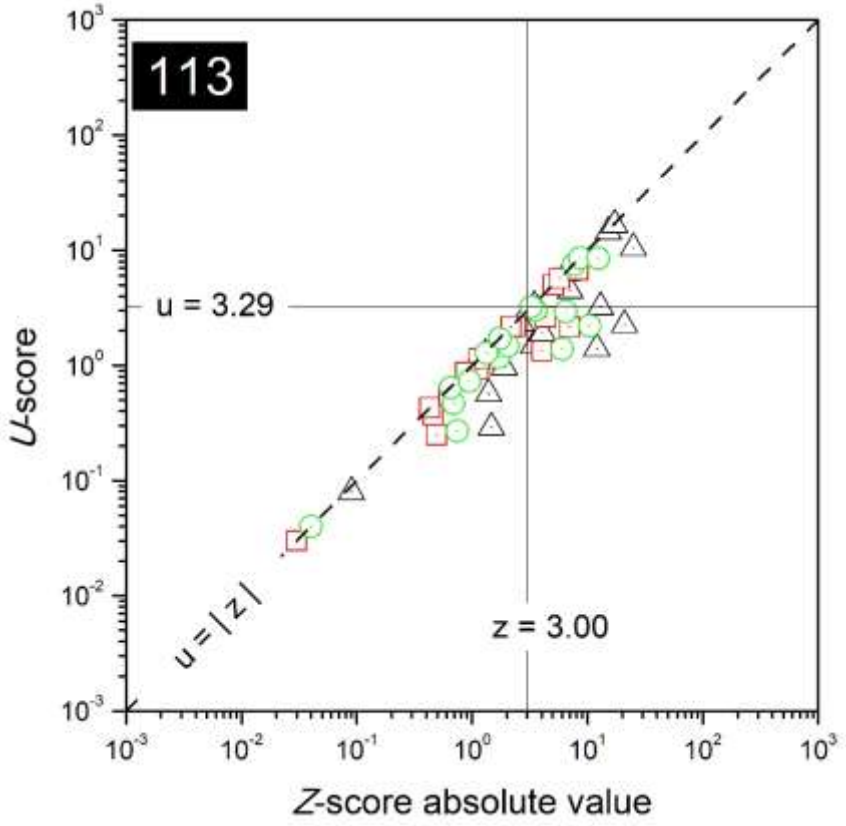

FIG. 73. Combined plots of z- and u-scores for the laboratory with code 113.

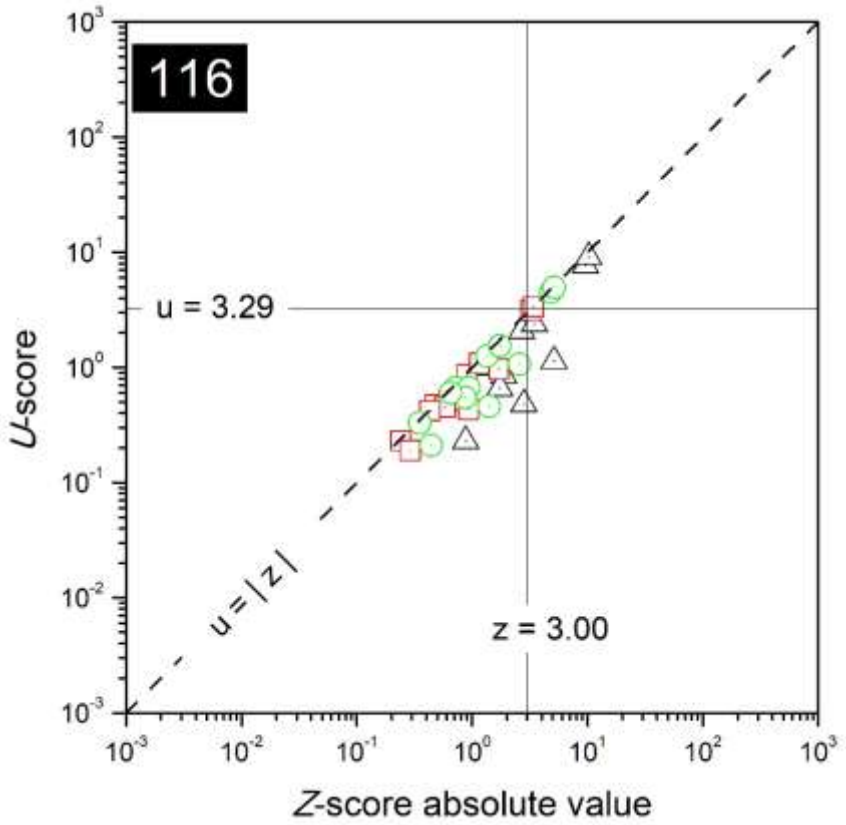

FIG. 74. Combined plots of z- and u-scores for the laboratory with code 116.

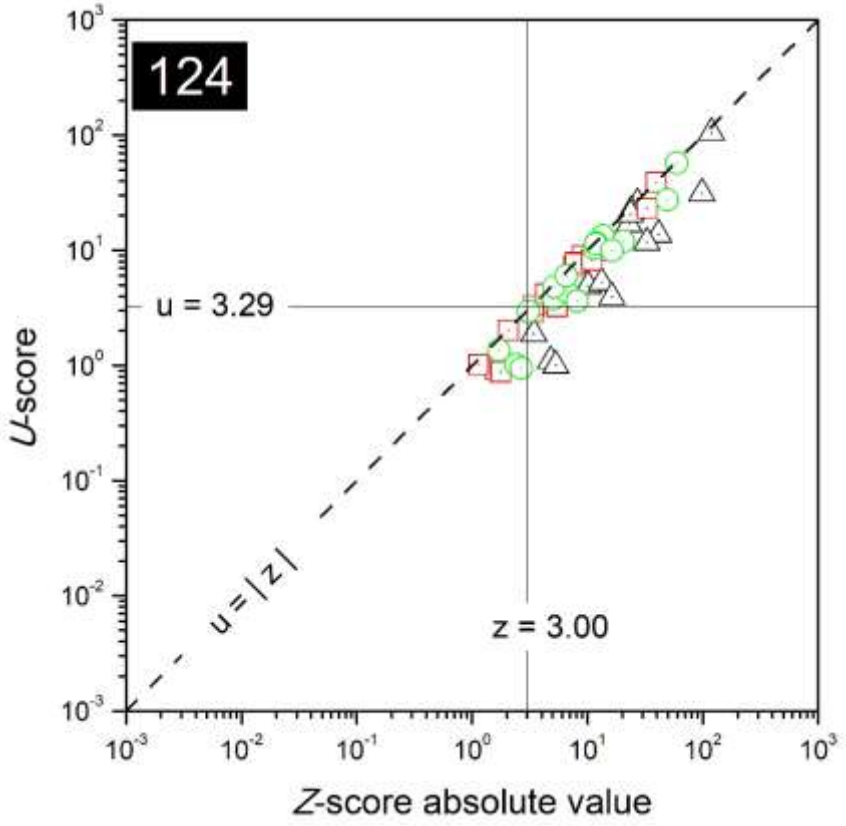

FIG. 75. Combined plots of z- and u-scores for the laboratory with code 124.

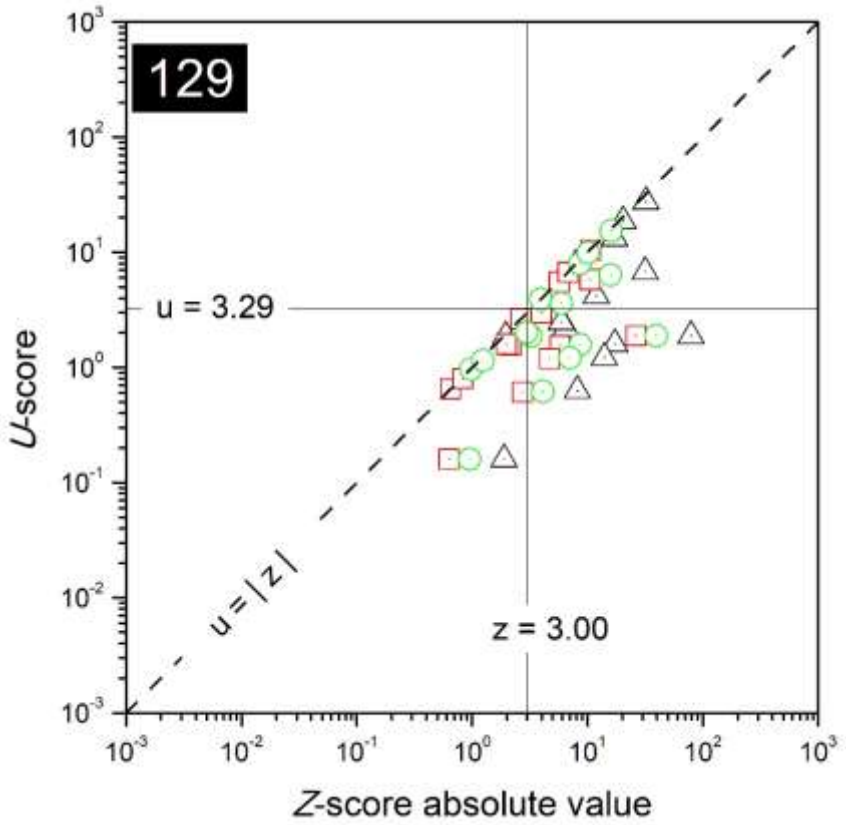

FIG. 76. Combined plots of z- and u-scores for the laboratory with code 129.

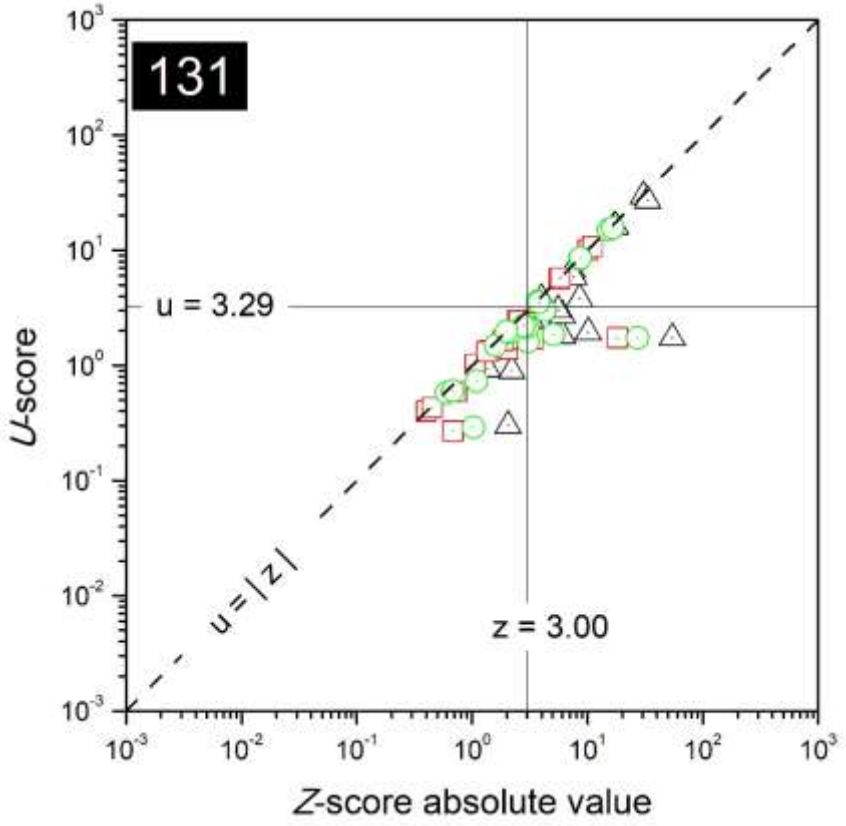

FIG. 77. Combined plots of z- and u-scores for the laboratory with code 131.

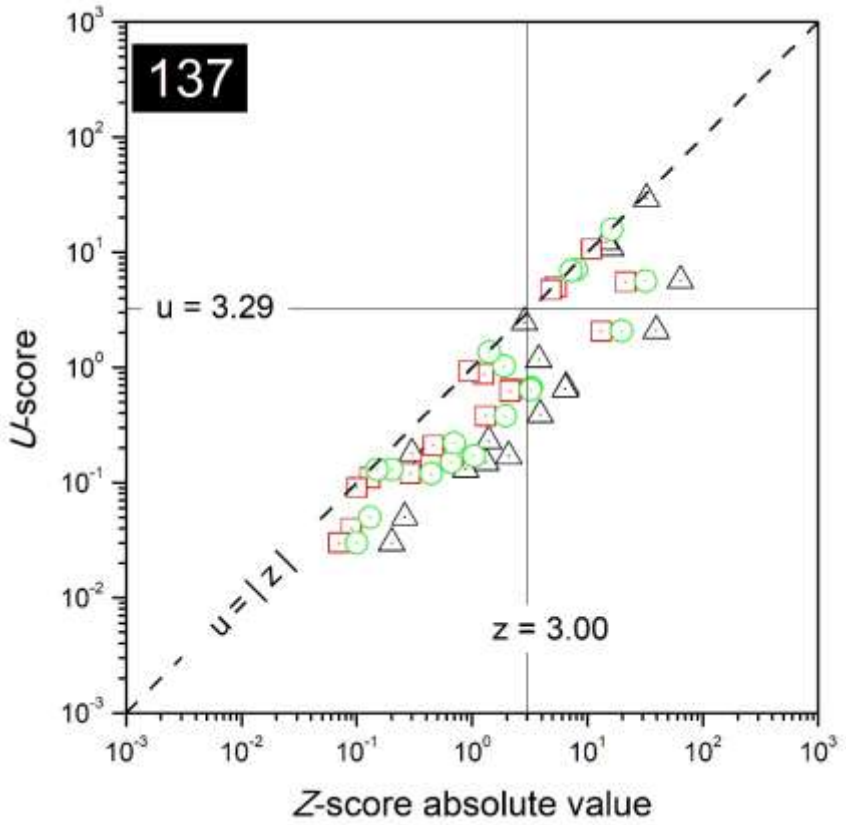

FIG. 78. Combined plots of z- and u-scores for the laboratory with code 137.

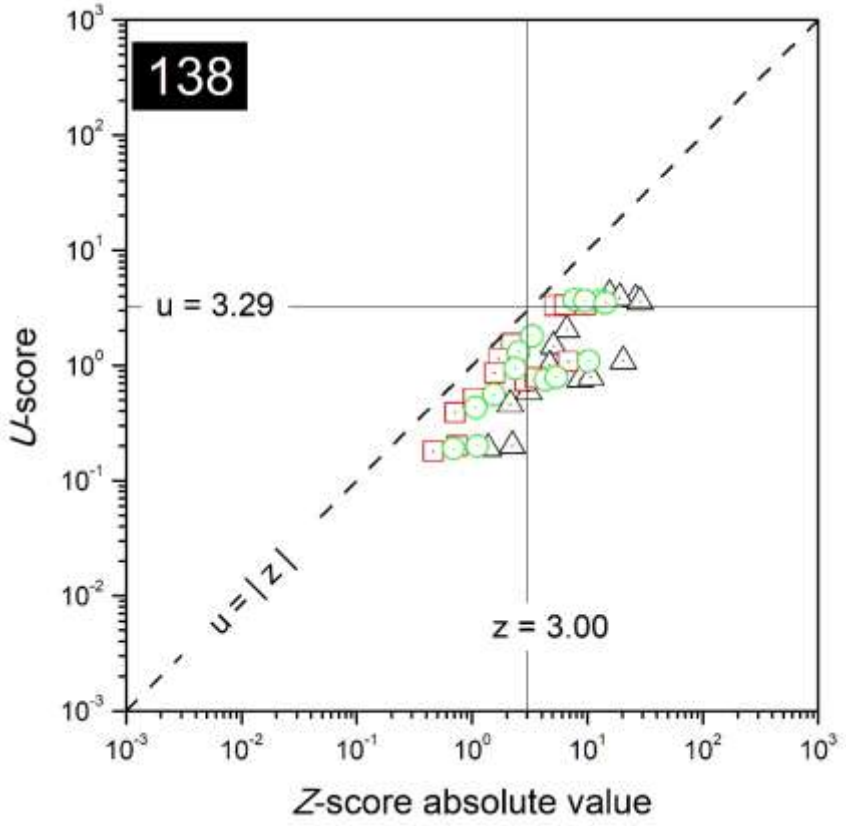

FIG. 79. Combined plots of z- and u-scores for the laboratory with code 138.

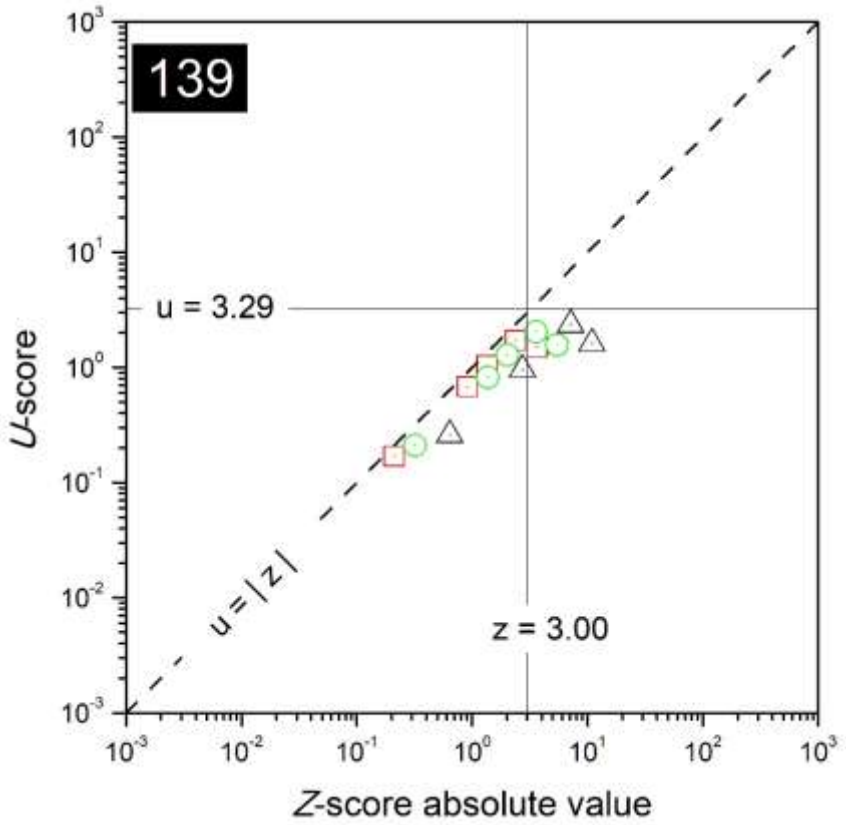

FIG. 80. Combined plots of z- and u-scores for the laboratory with code 139.

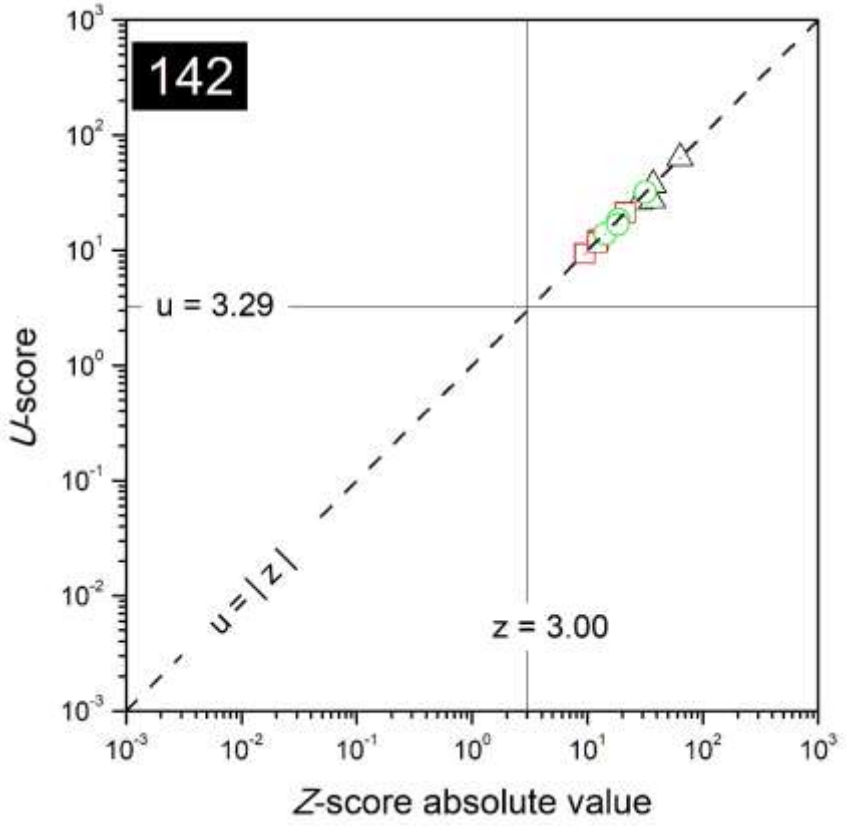

FIG. 81. Combined plots of z- and u-scores for the laboratory with code 142.

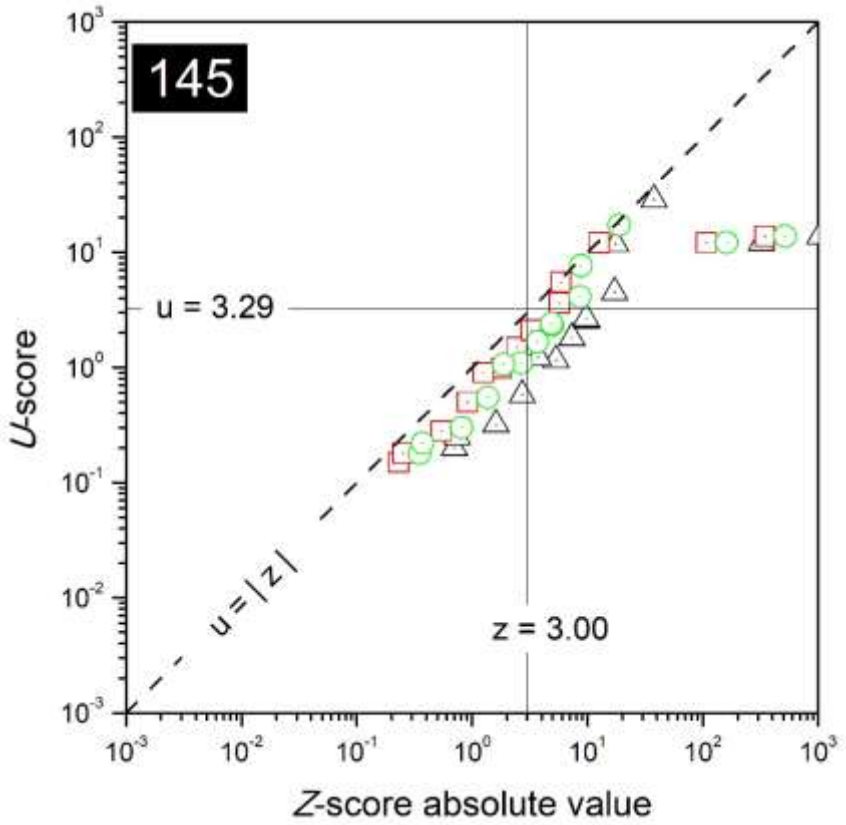

FIG. 82. Combined plots of z- and u-scores for the laboratory with code 145.

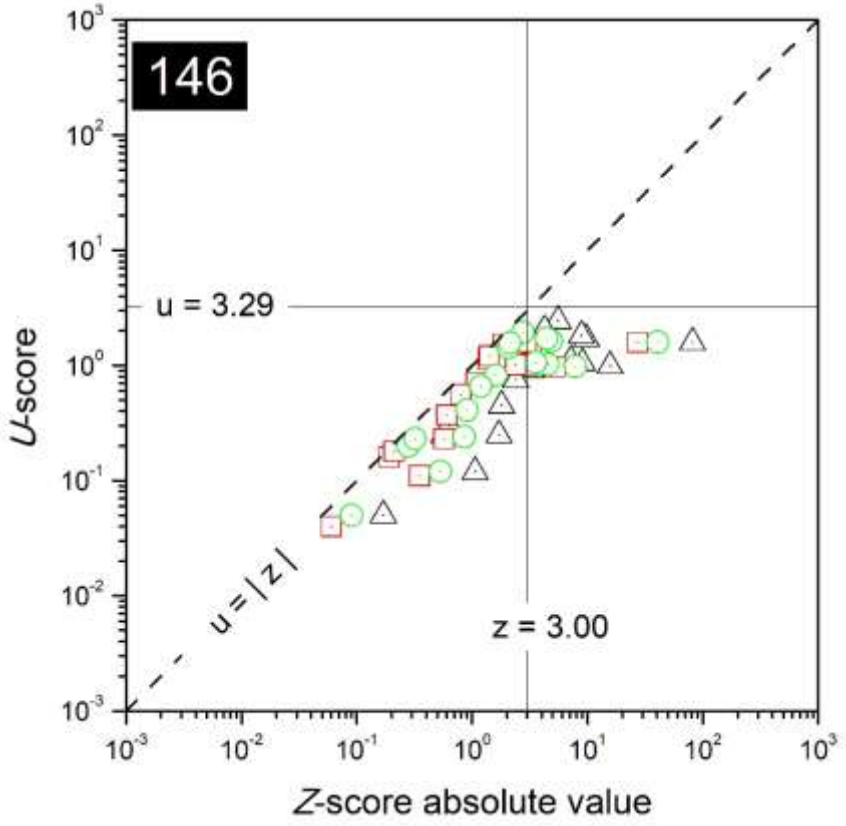

FIG. 83. Combined plots of z- and u-scores for the laboratory with code 146.

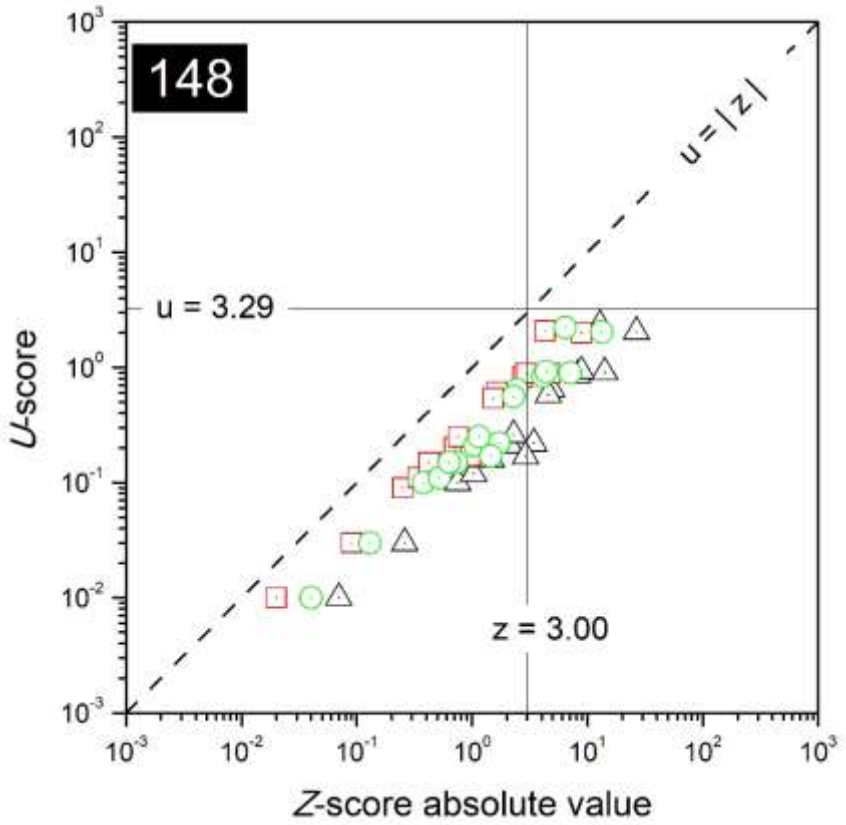

FIG. 84. Combined plots of z- and u-scores for the laboratory with code 148.

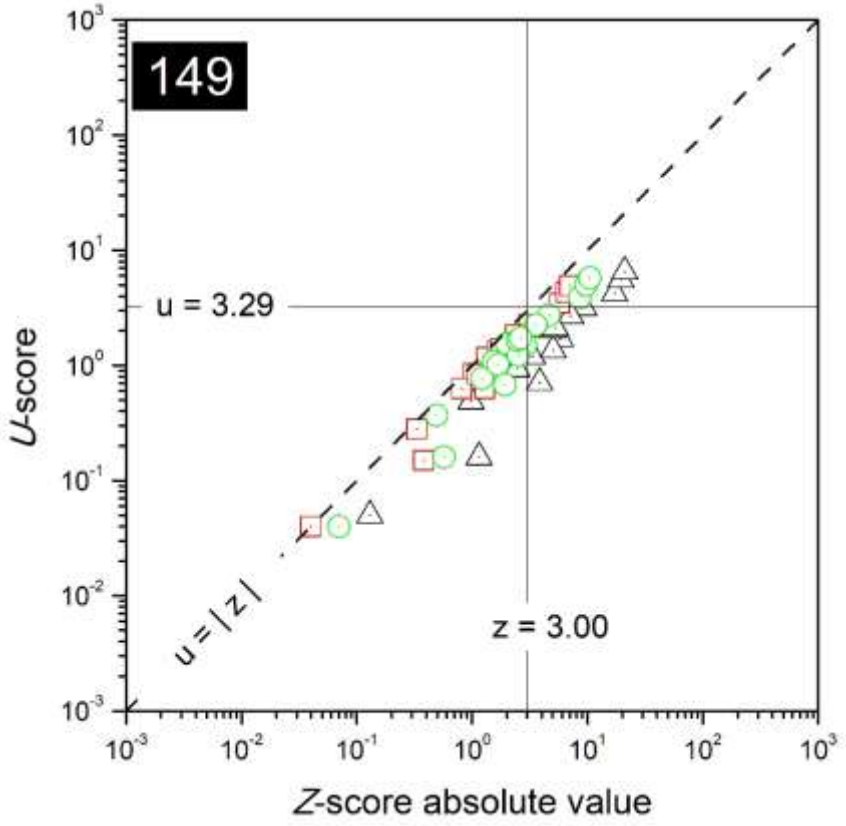

FIG. 85. Combined plots of z- and u-scores for the laboratory with code 149.

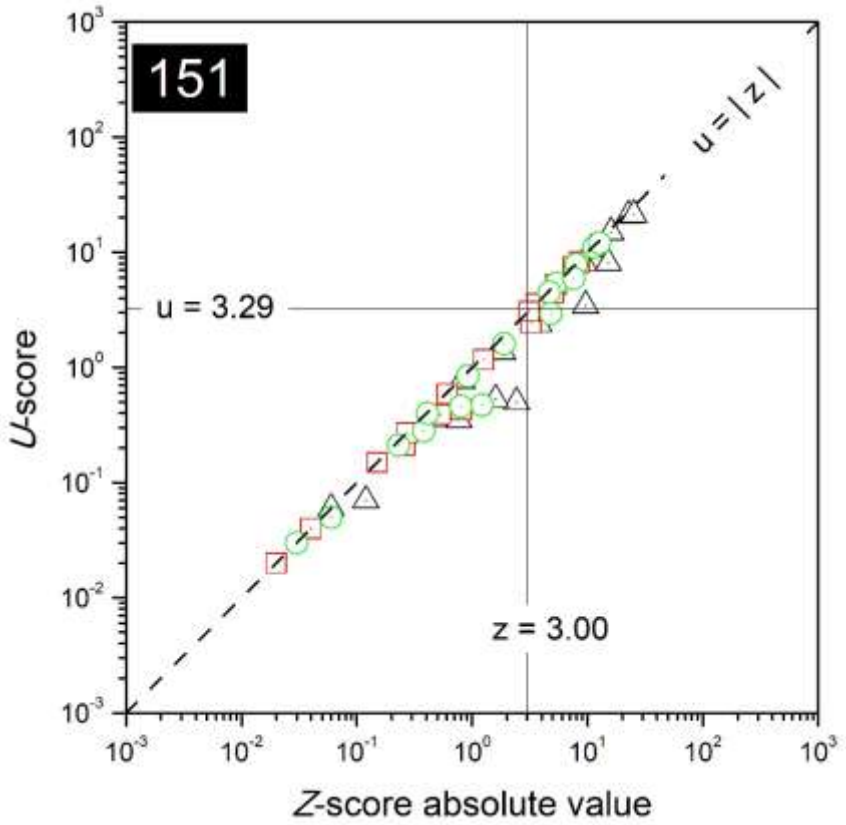

FIG. 86. Combined plots of z- and u-scores for the laboratory with code 151.

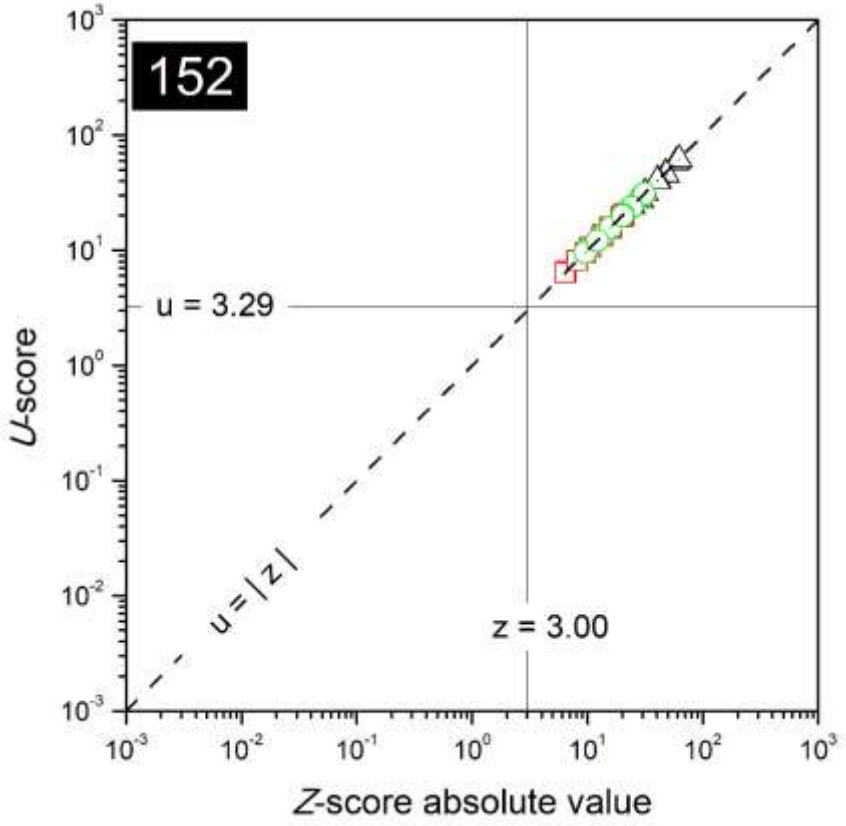

FIG. 87. Combined plots of z- and u-scores for the laboratory with code 152.

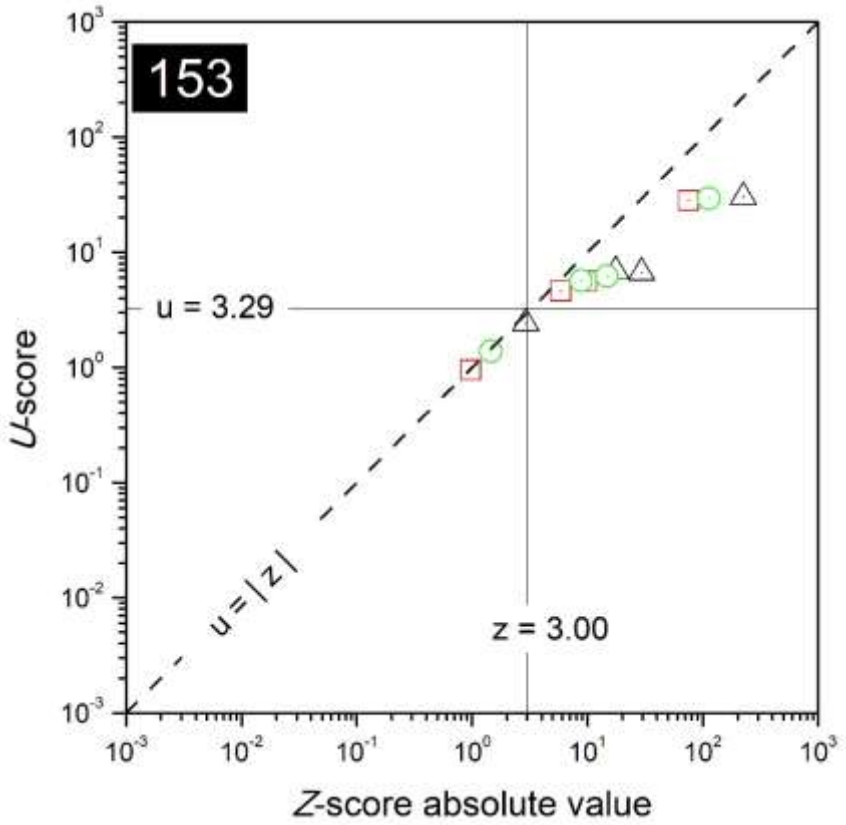

FIG. 88. Combined plots of z- and u-scores for the laboratory with code 153.

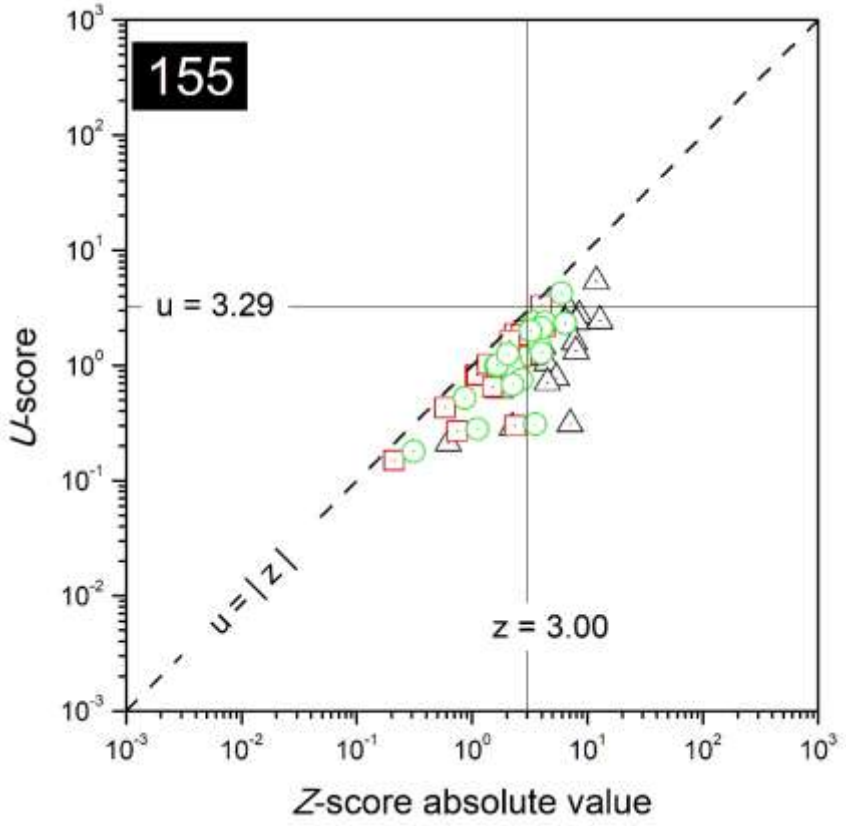

FIG. 89. Combined plots of z- and u-scores for the laboratory with code 155.

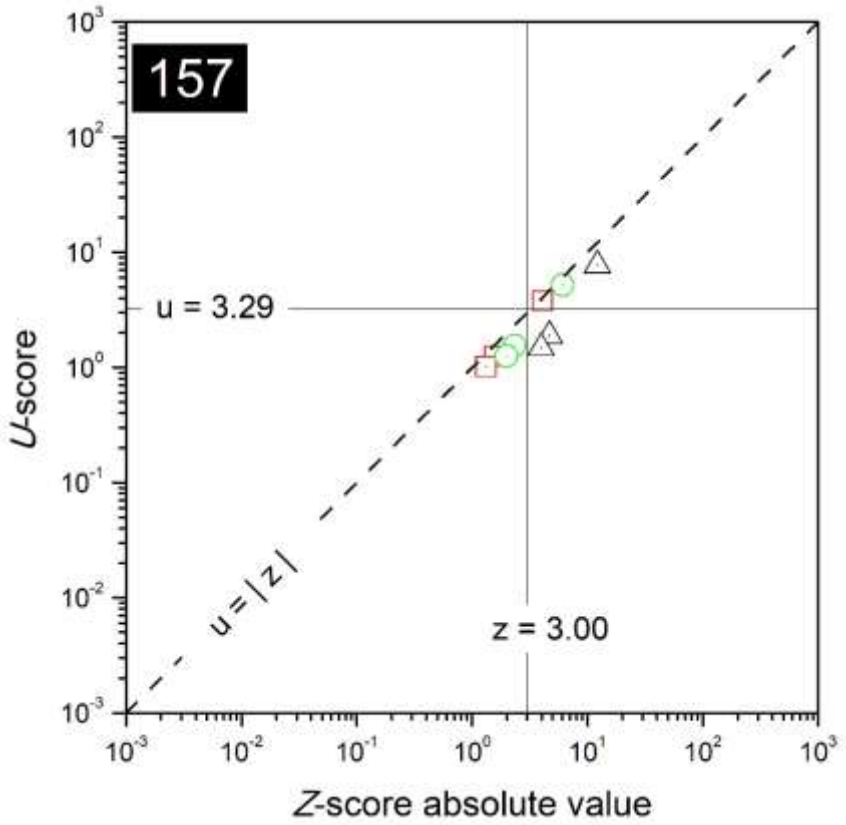

FIG. 90. Combined plots of z- and u-scores for the laboratory with code 157.

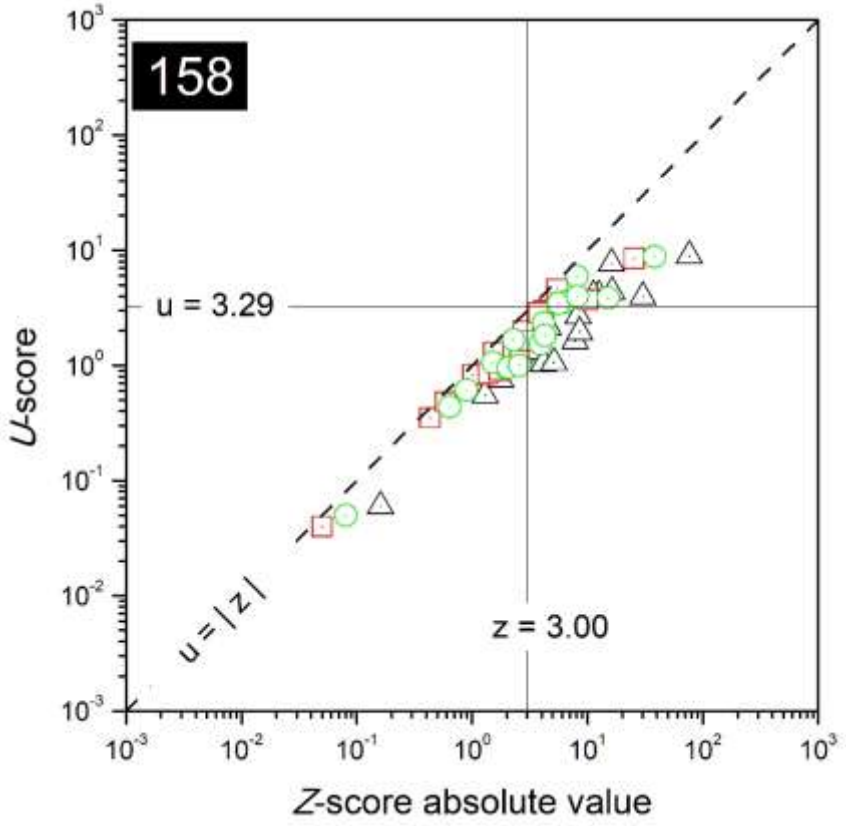

FIG. 91. Combined plots of z- and u-scores for the laboratory with code 158.

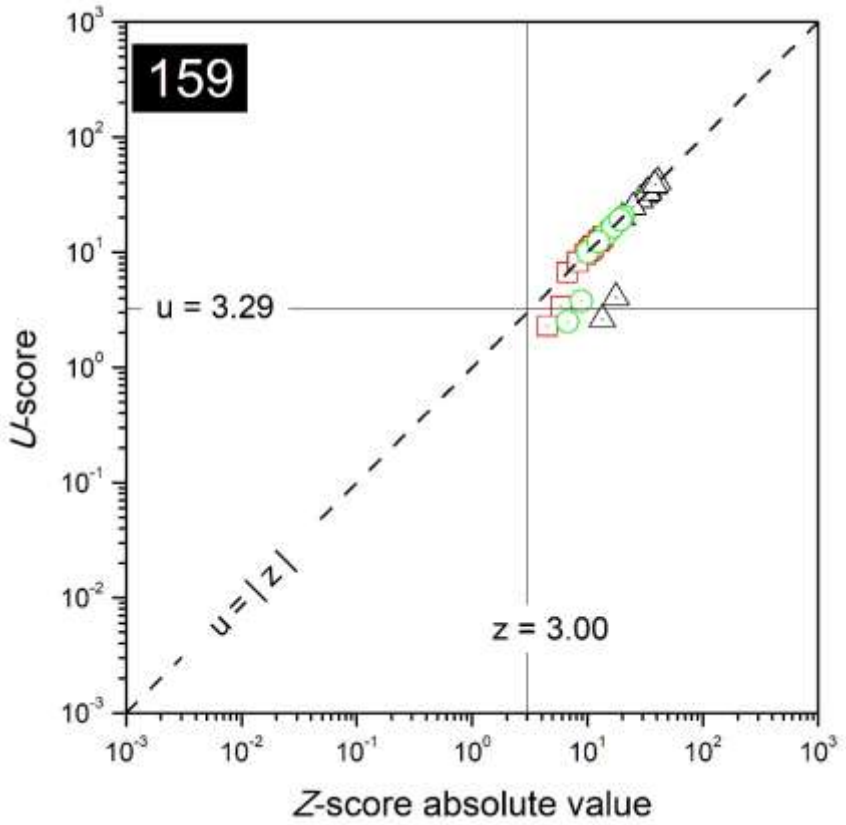

FIG. 92. Combined plots of z- and u-scores for the laboratory with code 159.

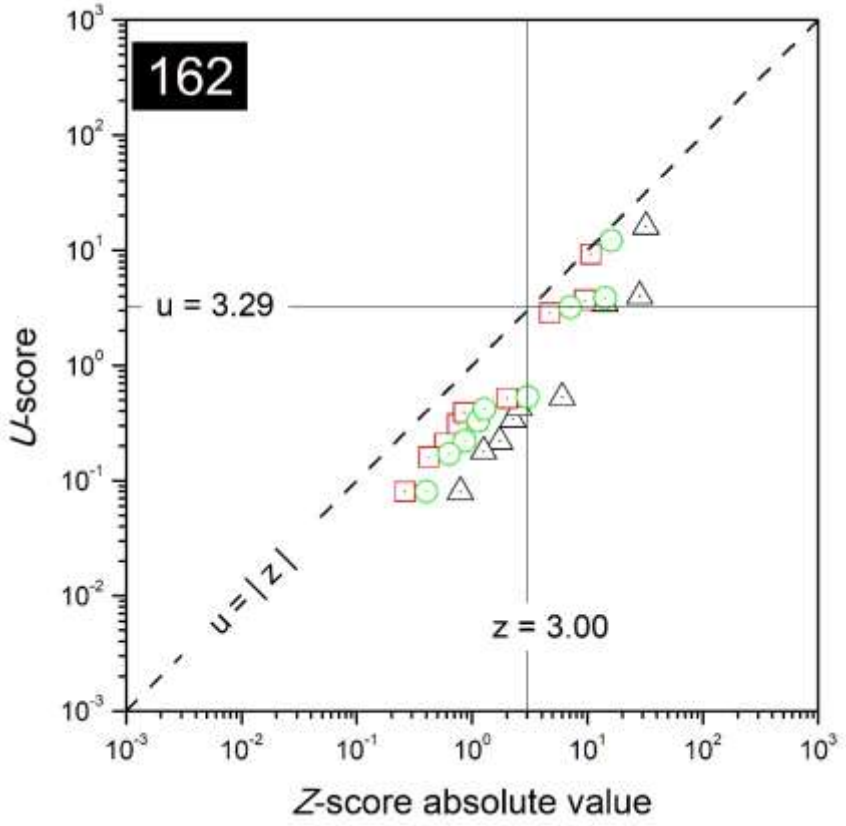

FIG. 93. Combined plots of z- and u-scores for the laboratory with code 162.

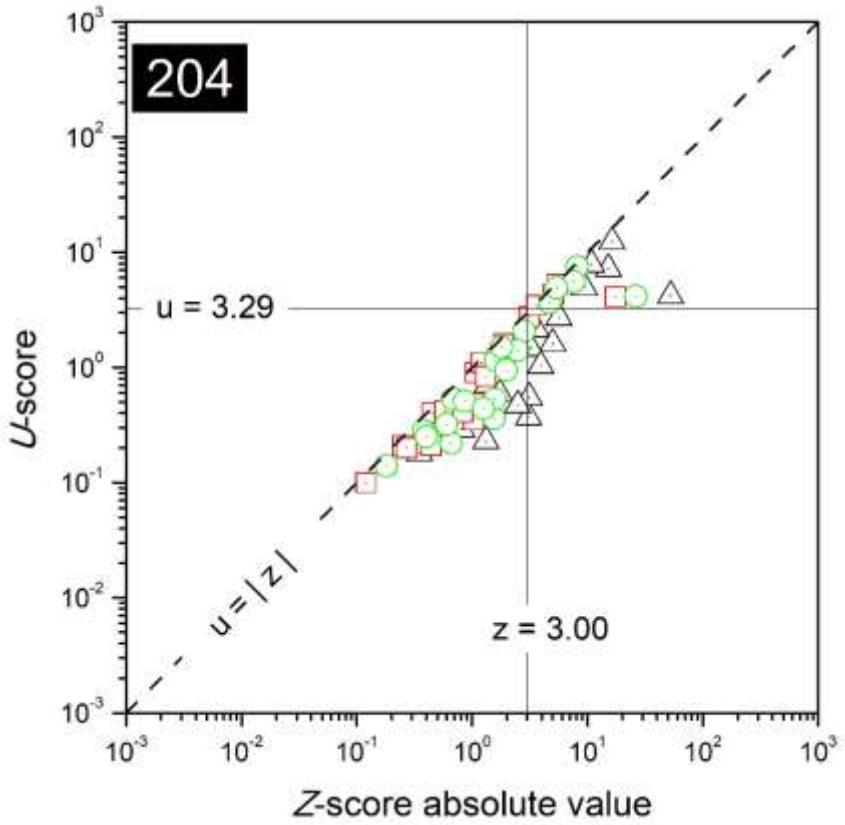

FIG. 94. Combined plots of z- and u-scores for the laboratory with code 204.

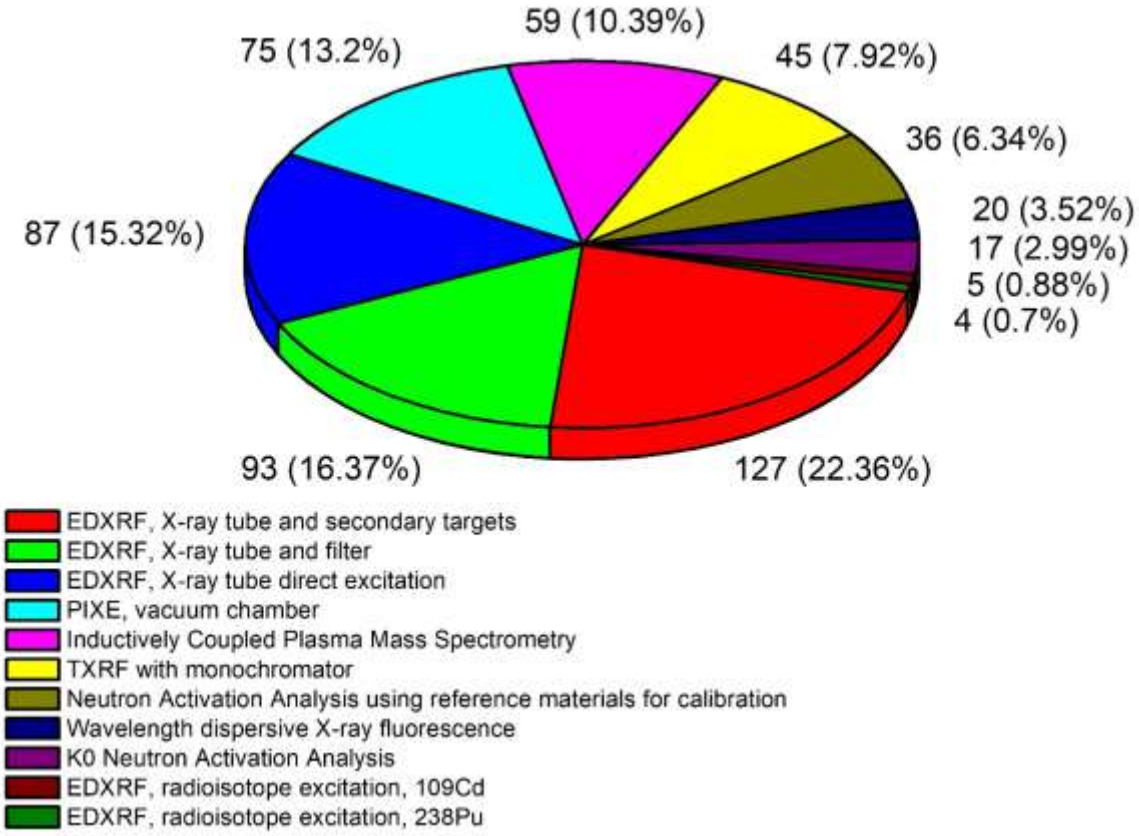

FIG. 95. Utilization of analytical techniques. For each analytical technique the number of submitted results is shown. The percent values relate to the total number of 568 submitted results.

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GLOSSARY

The definitions of terms used in the proficiency testing schemes are provided. Although this terminology might be known to the participants or can be found elsewhere [8-10] the terms used in this report are clearly defined to avoid any ambiguity.

Proficiency testing: evaluation of participant performance against pre-established criteria by means of interlaboratory comparisons.

True value: the actual concentration of the analyte in the matrix.

Assigned value: the value of the concentration of the analyte in the matrix used as the true value by the proficiency testing coordinator in the statistical treatment of results (or the best available estimate).

Target value for standard deviation: a numerical value for the standard deviation of a measurement result, which has been designated as a target for measurement quality.

Consensus value: the mean value of the reported laboratory results after the removal of outliers.

Standard deviation of the consensus value: the standard deviation of the mean value of the reported laboratory results after the removal of outliers.

Certified Reference Material: A reference material, accompanied by a certificate, one or more of whose property values are certified by a procedure which establishes traceability to an accurate realization of the unit in which the property values are expressed, and for which each certified value is accompanied by an uncertainty at a stated level of confidence.

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