Certification Report

Certified Reference Material

ERM®-EB307a

AlMg4,5Mn

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Summary

This report describes preparation, analysis and certification of the aluminium alloy reference materials ERM®-EB307a.
The certified reference material (CRM) is available in the form of discs (65 mm diameter and 30 mm height). It is intended for establishing and checking the calibration of optical emission and X-ray spectrometers (excluding micro-analysis) for the analysis of samples of similar matrix composition. It is also suitable for wet chemical analysis.

The following mass fractions and uncertainties have been certified:

Element	**Mass fraction**[1] in %	**Uncertainty**[2] in %
Si	0.152	0.005
Fe	0.345	0.007
Cu	0.0939	0.0026
Mn	0.811	0.010
Mg	4.80	0.09
Cr	0.1536	0.0026
Ni	0.0097	0.0005
Zn	0.0690	0.0016
Ti	0.0595	0.0016
Pb	0.0084	0.0004
Sn	0.0075	0.0004
Ga	0.0124	0.0005
V	0.0119	0.0004
	in mg/kg	in mg/kg
Be	5.37	0.16
Ca	19.2	2.8
Cd	32.6	1.4
Co	5.1	0.5
Li	8.1	0.5
Sb	46	6
Zr	31.9	1.2

1 Unweighted mean value of the means of accepted sets of data, each set being obtained by at least 5 laboratories and/or with different methods of measurement. The values are traceable to the SI (Système International d'Unités) by the use of pure substances of known stoichiometry for calibration.

2 Estimated expanded uncertainty U with a coverage factor of $k = 2$ (Ca: $k = 3$; Co, Li: $k = 2.5$), corresponding to a level of confidence of about 95 %, as defined in the ISO/IEC Guide 98-3:2008 [Uncertainty of measurement -- Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)].

This report contains detailed information on the preparation of the CRM as well as on homogeneity investigations and on the analytical methods used for certification analysis.
The certified values are based on the results of 9 laboratories which participated in the certification inter-laboratory comparison.

Content

Page

List of abbreviations
(if not explained elsewhere)

CRM	certified reference material
ERM	European reference material
FAAS	flame atomic absorption spectrometry
ICP-OES	inductively coupled plasma optical emission spectrometry
ICP-MS	inductively coupled plasma mass spectrometry
SOES	spark optical emission spectrometry
XRF	X-ray fluorescence spectrometry
M	mean value
n	number of accepted data sets
s	standard deviation of an individual data set
s_M	standard deviation of laboratory means
s_{rel}	relative standard deviation
$\bar{s}_i$	square root of mean of variances of data sets under repeatability conditions
M_i	single result
CVAAS	cold vapour atomic absorption spectrometry
I	ICP-OES (Tables 2 – 23)
I(R)	ICP-OES, revised value (Tables 2 – 23)
IMS	ICP-MS (Tables 2 – 23)
A	FAAS (Tables 2 – 23)
P	spectrophotometry (Tables 2 – 23)
G	gravimetry (Tables 2 – 23)
-s	dissolution in acid (Tables 2 – 23)
-a	dissolution in base (Tables 2 – 23)

1. Introduction

In the metal-producing and metal-working industry mainly spark emission spectrometry (SOES) and X-ray fluorescence spectrometry (XRF) are used for reception inspection of raw materials, e.g. scrap, for quality control of end products and production control. These time saving analytical techniques require suitable reference materials for calibration and recalibration. The certified reference material ERM®-EB307a is based on the aluminium alloy AlMg4,5Mn. It replaces the exhausted CRM BAM-307.

The CRM was produced in close cooperation with the working group „Aluminium" of the Committee of Chemists of GDMB Society of Metallurgists und Miners. Since all of the laboratories are highly experienced with aluminium analysis and had already participated in earlier inter-laboratory comparisons, there was no preceding round for qualification.

Certification of reference materials is carried out on the basis of the relevant ISO-Guides [1-3], the „Guidelines for the development and production of BAM Reference Materials" [4] and the "Technical Guidelines for the Production and Acceptance of a European Reference Material" [5].

2. Companies/laboratories involved

Manufacturing of the material:

– Constellium, Centre de Recherches de Voreppe, Voreppe, France

Test for homogeneity:

– Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany
– Constellium, Centre de Recherches de Voreppe, Voreppe, France

Participants in the certification inter-laboratory comparison:

AMAG Austria Metall AG, Ranshofen, Austria
Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany
Constellium, Centre de Recherches de Voreppe, Voreppe, France
Hydro Aluminium Rolled Products GmbH, R&D, Bonn, Germany
Hydro Aluminium Rolled Products GmbH, Hamburg, Germany
Institute of Non-Ferrous Metals, Gliwice, Poland
Leichtmetall Aluminium Giesserei Hannover GmbH, Hannover, Germany
Otto Fuchs KG, Meinerzhagen, Germany
TRIMET Aluminium SE, Essen, Germany

Statistical evaluation of the data:

– Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany

3. Candidate material

The candidate material was produced by Constellium, Centre de Recherches de Voreppe, Voreppe, France. About 500 kg of an aluminium melt were doped with the desired elements. The melt was casted into six rods with a length of 3775 mm each. 250 mm on both ends of each rod were discarded. The rods were cut into segments of 800 mm length. Between the segments a 15 mm disc was taken for homogeneity testing (see Fig. 1).

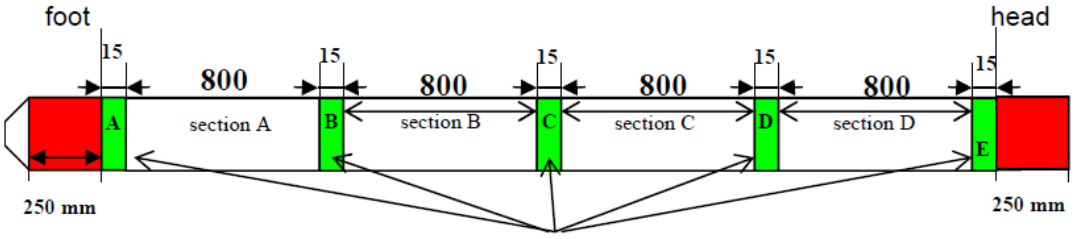

Fig.1: Preparation of the rods casted

In total approx. 500 discs with a diameter of ca. 65 mm and 30 mm height were obtained.

4. Homogeneity testing

Possible reasons for an inhomogeneous distribution of elements in the raw material may be a change of the composition of the melt during the casting procedure because some elements may volatise or segregate during the solidification of the material. Since the raw material was produced by casting of a rod, concentration gradients can occur over the length of the rod (axial) as well as over the area of the rod (radial, see Figures 2 and 3):

bottom

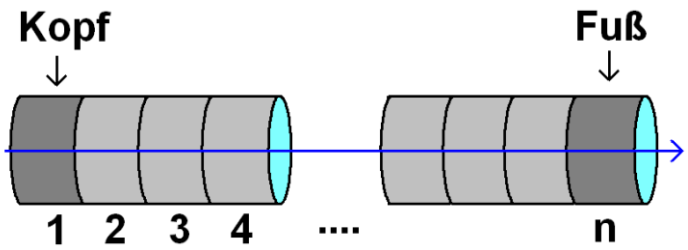

Fig. 2: Axial composition gradient

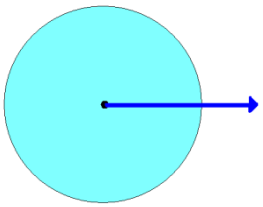

Fig. 3: Radial composition gradient

Therefore it is necessary to investigate the raw material for both axial and radial inhomogeneities. Radial homogeneity testing of the candidate material using spark emission spectrometry was performed by Constellium, Centre de Recherches de Voreppe on the discs taken from the rods as shown in Fig. 1. In total 30 discs were investigated, this corresponds to 6 % of the whole batch.

The estimate of analyte-specific inhomogeneity contribution u_{bb} to be included into the total uncertainty budget was calculated according to ISO Guide 35 [4] using Eq. (1) and Eq. (2):

$$s_{bb} = \sqrt{\frac{MS_{among} - MS_{within}}{n}} \qquad (1)$$

$$u^*_{bb} = \sqrt{\frac{MS_{within}}{n}} \sqrt[4]{\frac{2}{N(n-1)}} \qquad (2)$$

where:

MS_{among}	mean of squared deviations between discs (from 1-way ANOVA, see Annex 1)
MS_{within}	mean of squared deviations within one disc (from 1-way ANOVA)
n	number of replicate measurements per disc
N	number of discs selected for homogeneity study

$s_{bb}(1)$ signifies the between-discs standard deviation whereas u^*_{bb} denotes the maximum heterogeneity that can potentially be hidden by an insufficient repeatability of the applied measurement method (which has to be considered as the minimum uncertainty contribution). In any case the larger of the two values was used as $u_{bb}(1)$. Eq. (1) does not apply if MS_{within} is larger than MS_{among}.

In addition to the tests performed over the length of the rods three discs were tested for homogeneity over the area (possible segregation from the outer part to the centre). To perform this test SOES analysis was carried out in circles (outer circle: 16 sparks, mean circle: 11 sparks, inner circle: 8 sparks; centre: 1 spark).

The analyte-specific within-disc standard deviation $s_{bb}(2)$ as an additional uncertainty component $u_{bb}(2)$ was calculated in the same way as for the total batch. To calculate the necessary data an unbalanced ANOVA was carried out taking into account that the number of single measurements is different for the centre, the inner and the outer circle. For technical reasons, at r_0 (centre) only one measurement is possible. An ANOVA requires a minimum of two measurements per factor value. Thus, the value for r_0 should be replaced by a dummy. This dummy is defined as follows:

The two values replacing the one measured have a mean equal to the value measured, and a standard deviation equal to the average within-variation. This resembles the situation were one could take two independent measurements at the same place, with values deviating by the average standard deviation (non-destructive testing method). A first guess for the average standard deviation may be calculated from the data for r_in (inner circle), r_mean (mean circle) and r_out (outer circle). As results from these calculations an inhomogeneity factor for the radius of the disc is obtained. From these values a combined inhomogeneity factor is calculated. This factor is compared with the within standard deviation calculated from the ANOVA-data. The higher factor is used for uncertainty calculation.

Annex 2 shows the results of the calculations.

5. Characterisation study

5.1 Analytical methods

9 laboratories participated in the certification inter-laboratory comparison. For some elements part of the laboratories used more than one analytical method reporting more than one data set.
The laboratories were asked to analyse six subsamples. They were free to choose any suitable analytical method for analysis. Table 1 shows the analytical methods used by the participating laboratories.
For all analytical methods where a calibration was necessary this calibration was performed using liquid standard solutions. All participating laboratories were asked to use only standard solutions prepared from pure metals or stoichiometric compounds or well checked commercial calibration solutions.

Table 1: Analytical procedures used by the participating laboratories

Lab-No.	Element.	Sample mass	Sample pretreatment	Analytical method
1	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, Ga	0.5 g	Dissolution with NaOH	ICP-OES, calibration with commercial solutions (Merck)
	Zr, Be, Ca, Cd, Na, Li, Hg, Sb, V, Co	0.5 g	Dissolution with HNO_3/HCl	ICP-OES, calibration with commercial solutions (Merck)
2	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, Ga	0.5 g	Dissolution with NaOH	ICP-OES, calibration with pure metals or pure chemicals, matrix matching with pure Al (5N5)
	Be, Ca, Na, Li	0.5 g	Dissolution with HNO_3/HF	ICP-OES, calibration with pure metals or pure chemicals, matrix matching with pure Al (5N5)
	Zr, B, Cd, V, Co	0.5 g	Dissolution with HNO_3/HF	ICP-MS, calibration with pure metals or pure chemicals, matrix matching with pure Al (5N5)
4	Si	0.5 g	Dissolution with NaOH	Photometry with matrix matched standards (pure Al), commercial mono-element solution
	Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, Ga, Be, Ca, Cd, Co, Na, Li, Sb, V, Zr	1 g	Dissolution with HNO_3/HCl	ICP-OES with matrix matched standards (pure Al), commercial mono-element solutions
5	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, Ga, Be, Ca, Cd, Co, Na, Li, Sb, V, Zr	0.5 g	Dissolution with NaOH	ICP-OES, commercial mono-element solutions (NIST)
6	Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, Ga, Be, Ca, Cd, Co, Na, Li, Sb, V, Zr	0.5 g	Dissolution with HCl (DIN EN 14242)	ICP-OES, calibration with pure metals (Fe, Cu, Mn, Mg, Ni, Zn, Sn) or commercial multi-element solutions
	Si	0.5 g	Dissolution with NaOH	ICP-OES, calibration with pure substance
	Be, Co, Li, Pb, Sn, Sb, V	0.5 g	Dissolution with HCl/ HNO3/HF	ICP-MS with matrix matched standards (pure Al), commercial multi-element standard solutions

Table 1 (cont.): Analytical procedures used by the participating laboratories

7	Si	1 – 2.5 g	Dissolution with HCl/ HNO3	Gravimetry
	Cu, Cd	0.5 g	Dissolution with HCl/H2O2	FAAS
	Fe, Mn, Mg, Cr, Ni, Zn, Ti, Ga, Zr	0.5 g	Dissolution with HCl/ HNO3/HF	ICP-OES with matrix matched standards (pure Al), commercial multi-element standard solutions
8	Si	0.5 g	Dissolution with NaOH	ICP-OES with matrix matched standards, commercial mono-element solutions
	Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, Cd, Ga, Sb, V, Zr	0.5 g	Dissolution with HCl	ICP-OES with matrix matched standards, commercial mono-element solutions
	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, Ga, V, Zr			XRF
9	Si	0.1 g	Dissolution with NaOH	Spectrophotometry
	Zr	0.5 g	Dissolution with $HCl/HNO_3/H_2O_2$	Spectrophotometry
	Fe	0.5 g	Dissolution with HCl/H_2O_2	Spectrophotometry
	Ti	0.1 g	Dissolution with HCl	ICP-MS, calibration with commercial mono-element solutions
	Fe, Cu, Cr, Co, Ni, Zn, Ga, Li, Be, Ti, V	0.5 g	Dissolution with HCl/HNO_3	ICP-MS, calibration with commercial mono-element solutions
	Cu, Fe, Mg, Cr, Ni, Sn, Ti, V, Zn	0.5 g	Dissolution with HNO_3	ICP-OES, calibration with commercial mono-element solution
	Mn	20 mg	Dissolution with HNO_3/HCl	ICP-OES, calibration with commercial mono-element solution
	Zr	0.5 g	Dissolution with NaOH	Spectrophotometry
	Fe, Mn, Cr, Ni, Sn, Ti	0.5 g	Dissolution with NaOH	ICP-OES, calibration with commercial mono-element solution
	Fe, Cu, Mg, Mn, Cr, Zn			XRF, reconstitution
10	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Zr, Be V	0.5 g	Dissolution with NaOH	ICP-OES, calibration with pure chemicals

5.2 Analytical results and statistical evaluation

The analytical results of the certification inter-laboratory comparison are listed in Tables 2 to 23. These tables show the single results (M_i) of each laboratory, the respective laboratories' mean values (M), absolute and relative intralaboratory standard deviation (s and s_{rel}, respectively), the standard deviation of laboratory means (s_M), and in addition the square root of mean of variances of data sets under repeatability conditions ($\overline{s}_i$). n is the number of accepted data sets. The continuous line marks the certified value (mean of the laboratories' means), the broken lines mark the standard deviation, calculated from the laboratories' means.
In the related figures for each laboratory its mean value and single standard deviation is given. Outliers which have been excluded are highlighted in yellow.

Lab./Meth.	8/XRF	10/I-a	2/I-a	1/I-a	4/P	6/I-a(R)	7/G	9/P	8/I-a	9/I-a	5/I-a		
M_i [%]	0.143	0.149	0.148	0.148	0.150	0.152	0.156	0.155	0.155	0.156	0.158		*n*
	0.144	0.148	0.147	0.149	0.151	0.150	0.151	0.155	0.160	0.153	0.157		11
	0.143	0.146	0.146	0.148	0.151	0.155	0.155	0.155	0.155	0.159	0.157		
	0.143	0.147	0.148	0.148	0.152	0.152	0.152	0.153	0.154	0.156	0.158		
	0.143	0.147	0.149	0.150	0.152	0.152	0.153	0.155	0.153	0.158	0.157		
	0.144	0.146	0.148	0.149	0.158	0.154	0.155	0.153	0.154		0.157		
***M* [%]**	**0.143**	**0.147**	**0.148**	**0.149**	**0.152**	**0.153**	**0.154**	**0.154**	**0.155**	**0.156**	**0.157**		**0.152**
s[%]	0.0005	0.0012	0.0011	0.0008	0.0029	0.0018	0.0020	0.0009	0.0027	0.0023	0.0003	s_M [%]	0.0044
												$\bar{s}_i$ [%]	0.0017
s_{rel}	0.00376	0.00794	0.00752	0.00549	0.01887	0.01155	0.01280	0.00572	0.01727	0.01472	0.00199		0.02914

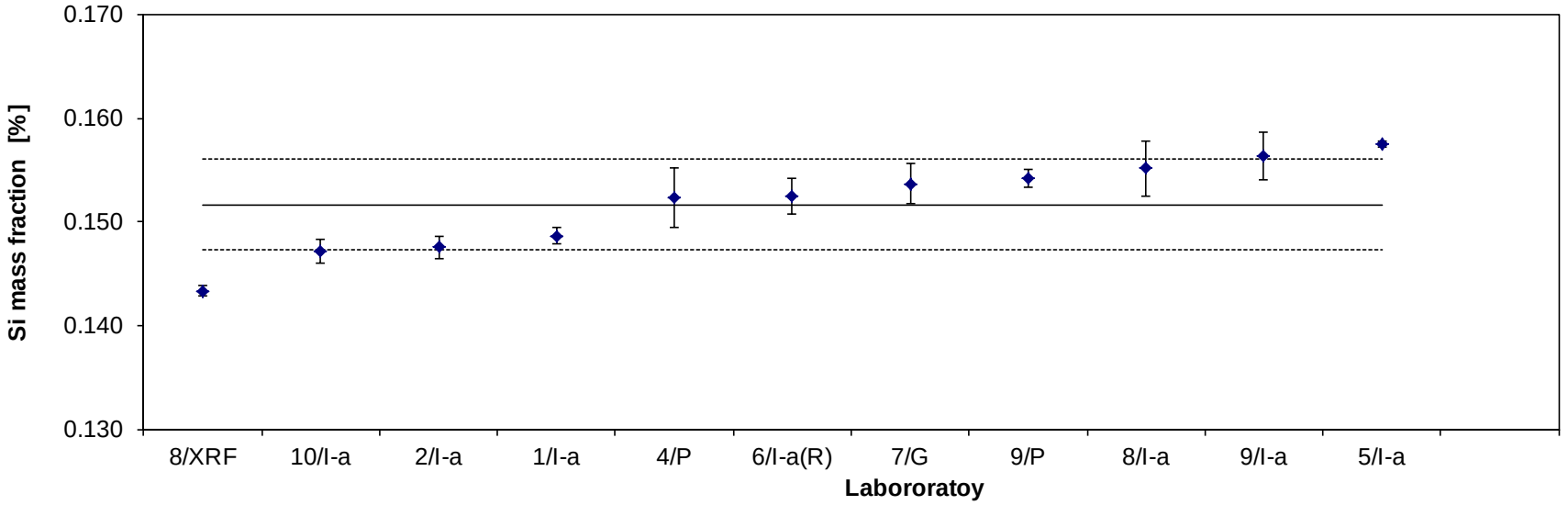

Table 2: Results for Si

Lab./Meth.	1/I-a	9/IMS-s	5/I-a	9/I-s	9/P	2/I-a	9/I-a	6/I-s	9/XRF	8/XRF	8/I-s(R)	10/I-a	4/I-s	7/I-s		
M_i [%]	0.3380	0.3428	0.3412	0.3418	0.3402	0.3445	0.3440	0.3430	0.3501	0.3475	0.3486	0.3530	0.3470	0.3519		*n*
	0.3380	0.3424	0.3425	0.3444	0.3463	0.3439	0.3430	0.3524	0.3543	0.3469	0.3476	0.3490	0.3490	0.3527		14
	0.3370	0.3433	0.3397	0.3418	0.3484	0.3437	0.3430	0.3449	0.3450	0.3468	0.3487	0.3510	0.3500	0.3524		
	0.3380	0.3337	0.3407	0.3422	0.3443	0.3447	0.3460	0.3428	0.3331	0.3474	0.3472	0.3500	0.3530	0.3521		
	0.3410	0.3361	0.3365	0.3438	0.3427	0.3434	0.3460	0.3432	0.3602	0.3472	0.3480	0.3490	0.3520	0.3527		
	0.3390	0.3329	0.3391	0.3446	0.3396	0.3437		0.3433	0.3354	0.3469	0.3482	0.3480	0.3520	0.3522		
***M* [%]**	**0.3385**	**0.3385**	**0.3400**	**0.3431**	**0.3436**	**0.3440**	**0.3444**	**0.3450**	**0.3464**	**0.3471**	**0.3480**	**0.3500**	**0.3505**	**0.3523**		**0.3451**
s[%]	0.0014	0.0048	0.0021	0.0013	0.0034	0.0005	0.0015	0.0037	0.0106	0.0003	0.0006	0.0018	0.0023	0.0003	s_M [%]	0.0043
															$\bar{s}_i$ [%]	0.0036
s_{rel}	0.00407	0.01425	0.00607	0.00383	0.01001	0.00148	0.00440	0.01076	0.03073	0.00080	0.00167	0.00511	0.00644	0.00093		0.01247

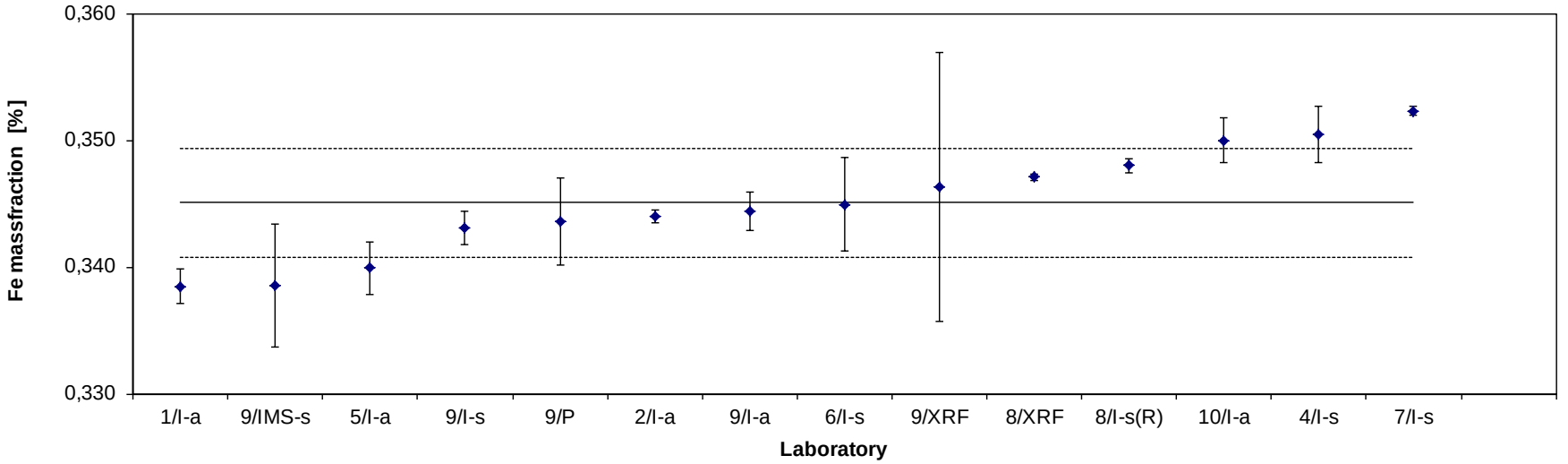

Table 3: Results for Fe

Lab./Meth.	9/IMS-s	8/XRF	10/I-a(R)	6/I-s	9/XRF	7/A-s	4/I-s(R)	9/I-s	1/I-a	2/I-a	8/I-s(R)	5/I-a		
M_i [%]	0.0921	0.0919	0.093	0.0937	0.0982	0.092	0.0935	0.0940	0.0950	0.095	0.0963	0.0970		*n*
	0.0921	0.0918	0.093	0.0937	0.0960	0.092	0.0930	0.0940	0.0940	0.095	0.0966	0.0971		12
	0.0908	0.0919	0.093	0.0940	0.0958	0.092	0.0940	0.0945	0.0940	0.095	0.0966	0.0966		
	0.0917	0.0918	0.092	0.0929	0.0911	0.093	0.0955	0.0945	0.0940	0.095	0.0963	0.0969		
	0.0916	0.0919	0.092	0.0925	0.0914	0.094	0.0950	0.0945	0.0950	0.095	0.0953	0.0965		
	0.0905	0.0920	0.092	0.0930	0.0891	0.100	0.0940	0.0945	0.0950	0.095	0.0964	0.0968		
***M* [%]**	**0.0914**	**0.0919**	**0.0925**	**0.0933**	**0.0936**	**0.0938**	**0.0942**	**0.0943**	**0.0945**	**0.0948**	**0.0963**	**0.0968**		**0.0939**
s[%]	0.0007	0.0001	0.0003	0.0006	0.0035	0.0031	0.0009	0.0003	0.0005	0.0001	0.0005	0.0002	s_M [%]	0.0016
													$\bar{s}_i$ [%]	0.0014
s_{rel}	0.00731	0.00077	0.00354	0.00623	0.03793	0.03331	0.00989	0.00274	0.00580	0.00140	0.00484	0.00239		0.01706

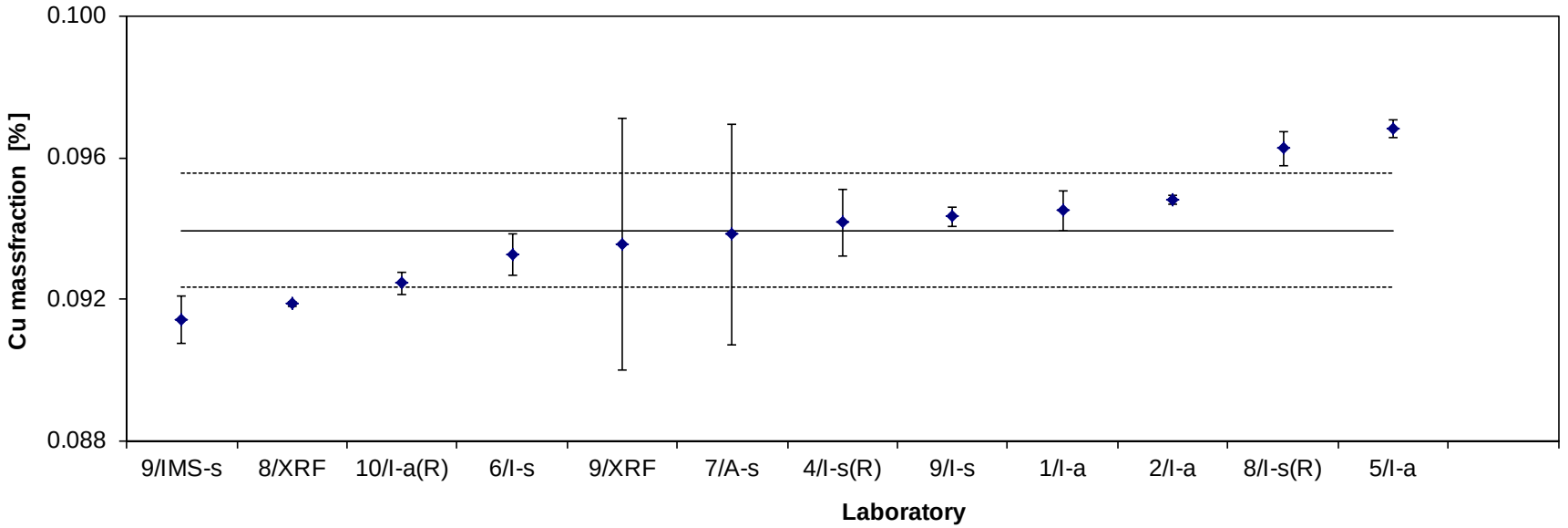

Table 4: Results for Cu

Lab./Meth.	7/I-s	9/I-s	6/I-s	4/I-s	5/I-a	1/I-a	10/I-a	8/XRF	2/I-a	9/I-a	8/I-s(R)	9/XRF		
M_i [%]	0.7948	0.7685	0.7982	0.7890	0.8031	0.8100	0.8190	0.8136	0.8221	0.8220	0.8305	0.8501		*n*
	0.7951	0.8145	0.7995	0.8040	0.8015	0.8100	0.8120	0.8141	0.8204	0.8180	0.8309	0.8540		12
	0.7942	0.8135	0.7937	0.8100	0.8011	0.8100	0.8070	0.8135	0.8194	0.8220	0.8363	0.8357		
	0.7945	0.8140	0.8015	0.7920	0.8031	0.8100	0.8170	0.8131	0.8190	0.8210	0.8287	0.8119		
	0.7955	0.7863	0.7994	0.7970	0.8022	0.8100	0.8130	0.8138	0.8174	0.8210	0.8296	0.8256		
	0.7950	0.7773	0.7906	0.8080	0.8038	0.8100	0.8130	0.8139	0.8191		0.8304	0.8169		
***M* [%]**	**0.7949**	**0.7957**	**0.7971**	**0.8000**	**0.8025**	**0.8100**	**0.8135**	**0.8137**	**0.8196**	**0.8208**	**0.8311**	**0.8324**		**0.8109**
s[%]	0.0005	0.0209	0.0041	0.0086	0.0010	0.0000	0.0042	0.0004	0.0016	0.0016	0.0027	0.0173	s_M [%]	0.0132
													$\bar{s}_i$ [%]	0.0085
s_{rel}	0.00058	0.02621	0.00519	0.01081	0.00130	0.00000	0.00514	0.00045	0.00189	0.00200	0.00325	0.02079		0.01632

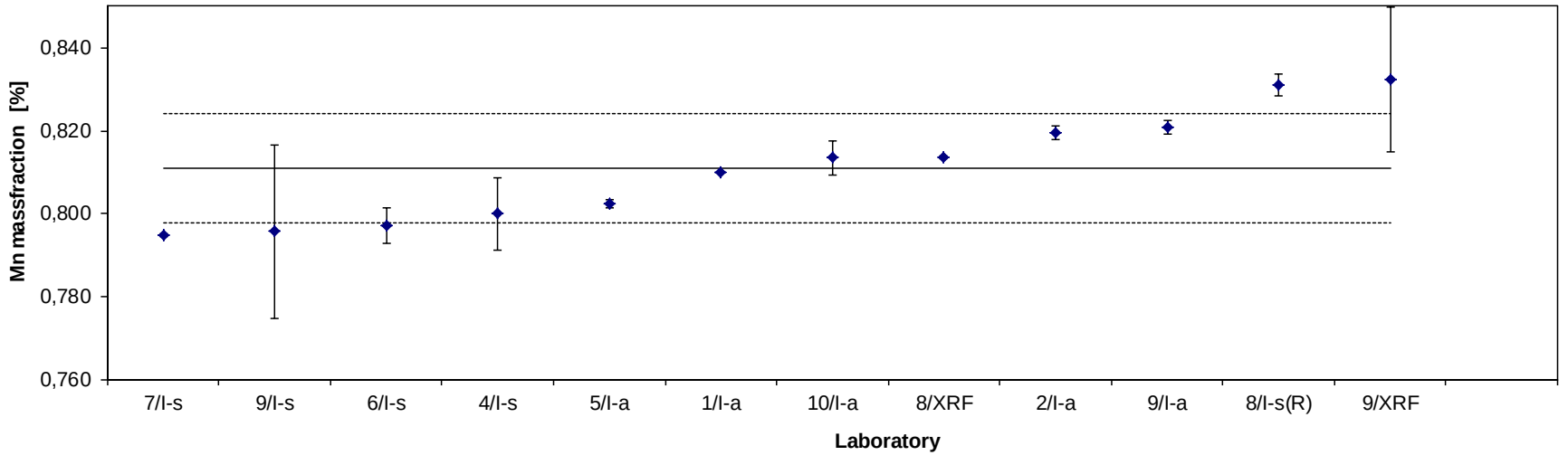

Table 5: Results for Mn

Lab./Meth.	8/XRF	10/I-a	9/XRF	1/I-a	7/I-s	5/I-a	4/I-s	2/I-a	9/I-s	6/I-s	9/I-s(II)	8/I-s(R)		
M_i [%]	4.745	4.804	4.995	4.770	4.802	4.808	4.750	4.830	4.802	4.855	4.850	4.870		*n*
	4.747	4.754	4.860	4.770	4.798	4.800	4.930	4.821	4.834	4.889	4.790	4.879		12
	4.745	4.753	4.820	4.770	4.799	4.795	4.860	4.821	4.813	4.885	4.910	4.859		
	4.743	4.748	4.590	4.770	4.802	4.798	4.800	4.828	4.818	4.850	4.850	4.900		
	4.748	4.734	4.637	4.770	4.798	4.811	4.750	4.800	4.849	4.786	4.830	4.852		
	4.750	4.752	4.672	4.760	4.803	4.811	4.790	4.786	4.860	4.771		4.882		
***M* [%]**	**4.747**	**4.758**	**4.762**	**4.768**	**4.800**	**4.804**	**4.813**	**4.814**	**4.829**	**4.839**	**4.846**	**4.874**		**4.805**
s[%]	0.0026	0.0239	0.1553	0.0041	0.0023	0.0069	0.0700	0.0177	0.0222	0.0499	0.0434	0.0172	s_M [%]	0.0395
													$\bar{s}_i$ [%]	0.0541
s_{rel}	0.00054	0.00503	0.03261	0.00086	0.00047	0.00144	0.01455	0.00368	0.00460	0.01031	0.00895	0.00353		0.00822

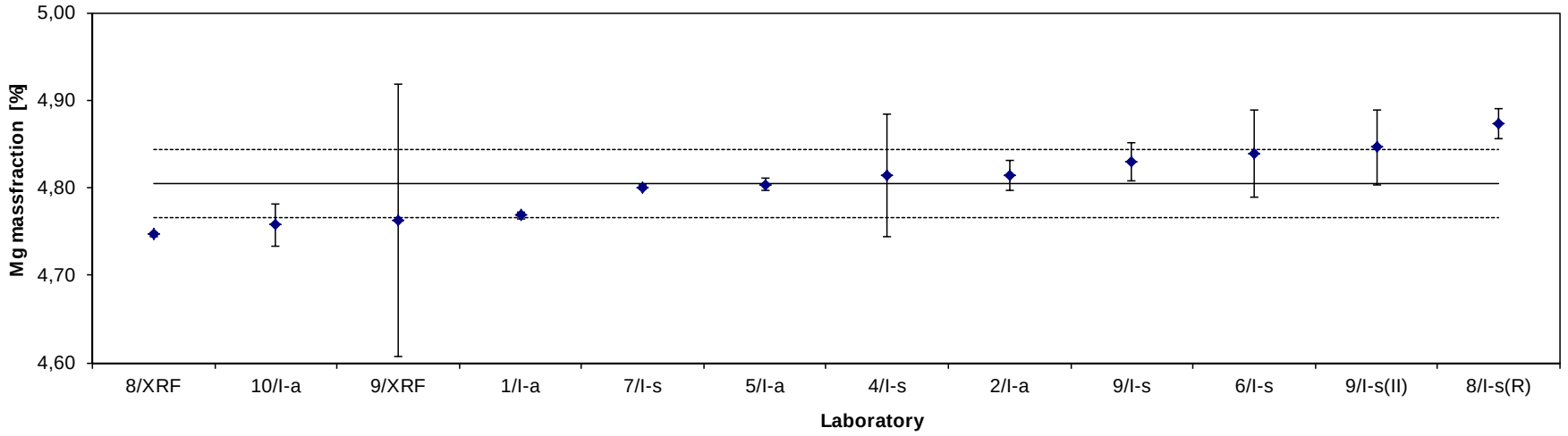

Table 6: Results for Mg

Lab./Meth.	8/XRF	7/I-s(R)	5/I-a	9/I-s	6/I-s	9/I-a	8/I-s(R)	2/I-a	10/I-a	9/IMS-s	4/I-s	9/XRF		
M_i [%]	0,1516	0,1520	0,1518	0,1530	0,1529	0,1529	0,1544	0,1554	0,1561	0,1565	0,1560	0,1597		*n*
	0,1511	0,1518	0,1521	0,1510	0,1530	0,1529	0,1536	0,1543	0,1552	0,1558	0,1570	0,1595		11
	0,1512	0,1517	0,1519	0,1500	0,1524	0,1520	0,1540	0,1542	0,1538	0,1547	0,1480	0,1581		
	0,1518	0,1521	0,1524	0,1520	0,1533	0,1552	0,1545	0,1545	0,1526	0,1541	0,1540	0,1553		
	0,1515	0,1518	0,1520	0,1540	0,1529	0,1546	0,1536	0,1545	0,1548	0,1535	0,1540	0,1502		
	0,1517	0,1519	0,1526	0,1540	0,1520		0,1536	0,1542	0,1551	0,1552	0,1640	0,1524		
***M* [%]**	**0,1515**	**0,1519**	**0,1521**	**0,1523**	**0,1527**	**0,1535**	**0,1539**	**0,1545**	**0,1546**	**0,1550**	**0,1555**	**0,1559**		**0,1538**
s[%]	0,0003	0,0001	0,0003	0,0016	0,0004	0,0013	0,0004	0,0005	0,0012	0,0011	0,0052	0,0039	s_M [%]	0,0014
													$\bar{s}_i$ [%]	0,0021
s_{rel}	0,00173	0,00097	0,00202	0,01072	0,00291	0,00866	0,00260	0,00297	0,00794	0,00702	0,03348	0,02523		0,00908
	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2		
	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2		
	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2		

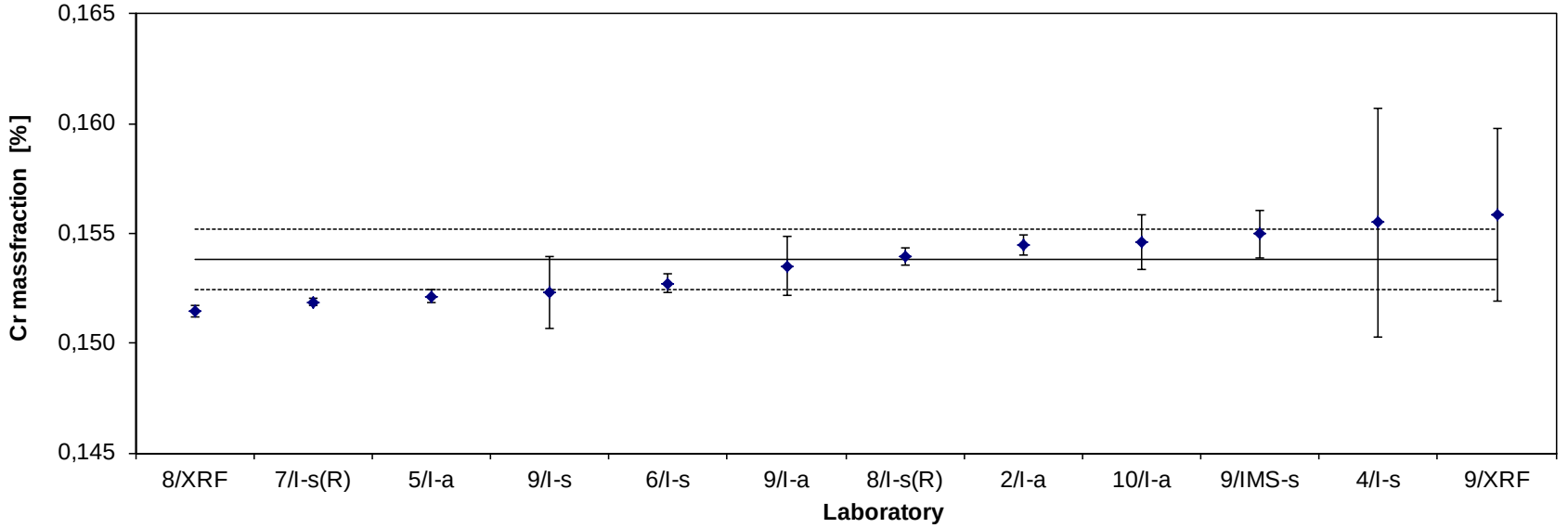

Table 7: Results for Cr

Lab./Meth.	6/I-s	8/XRF	10/I-a	9/IMS-s	1/I-a	4/I-s	2/I-a	7/I-s	5/I-a	9/I-s	9/I-a	8/I-s(R)		
M_i [%]	0.0093	0.0093	0.0096	0.0096	0.0095	0.0097	0.0097	0.0100	0.0100	0.0100	0.0103	0.0101		*n*
	0.0094	0.0094	0.0093	0.0095	0.0095	0.0097	0.0096	0.0097	0.0100	0.0100	0.0098	0.0101		12
	0.0096	0.0095	0.0095	0.0095	0.0094	0.0093	0.0096	0.0101	0.0099	0.0100	0.0100	0.0103		
	0.0096	0.0093	0.0093	0.0095	0.0095	0.0096	0.0097	0.0098	0.0100	0.0100	0.0100	0.0100		
	0.0091	0.0094	0.0095	0.0095	0.0096	0.0097	0.0097	0.0100	0.0100	0.0100	0.0100	0.0100		
	0.0091	0.0094	0.0091	0.0094	0.0102	0.0098	0.0097	0.0101	0.0100	0.0100		0.0101		
***M* [%]**	**0.0093**	**0.0094**	**0.0094**	**0.0095**	**0.0096**	**0.0096**	**0.0097**	**0.0100**	**0.0100**	**0.0100**	**0.0100**	**0.0101**		**0.0097**
s[%]	0.0002	0.0000	0.0002	0.0001	0.0003	0.0002	0.0001	0.0002	0.0000	0.0000	0.0002	0.0001	s_M [%]	0.0003
													$\bar{s}_i$ [%]	0.0002
s_{rel}	0.02454	0.00518	0.01955	0.00901	0.03044	0.01818	0.00711	0.01651	0.00409	0.00000	0.01785	0.01033		0.02967

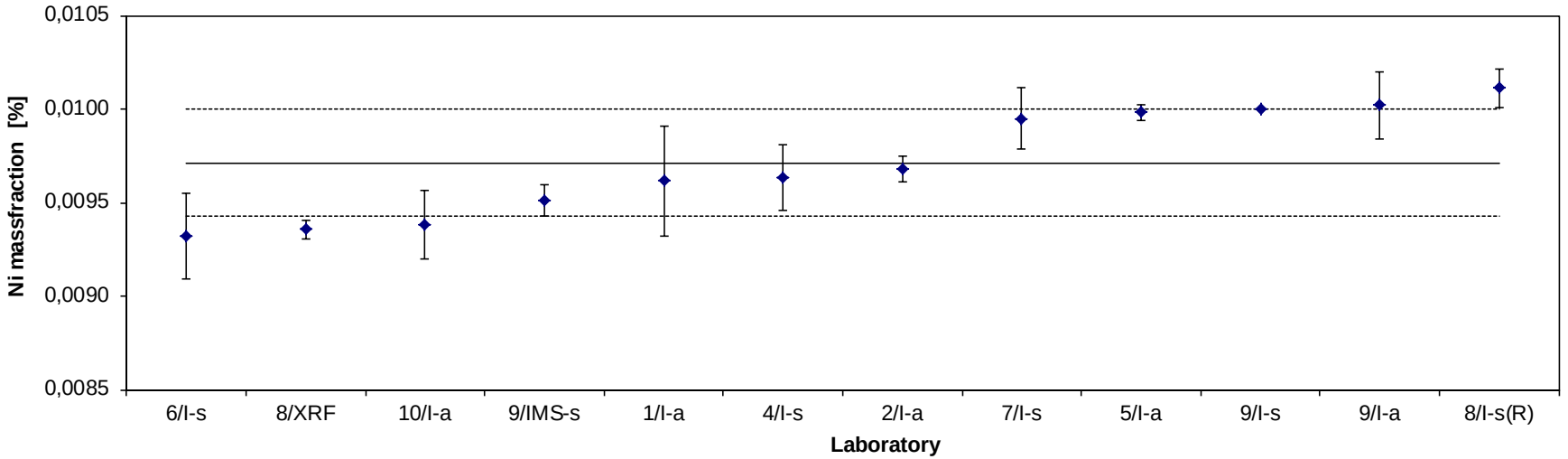

Table 8: Results for Ni

Lab./Meth.	10/I-a	8/XRF	9/I-s	1/I-a	9/IMS-s	7/I-s	5/I-a	9/XRF	2/I-a	8/I-s(R)	6/I-s	4/I-s		
M_i [%]	0.068	0.068	0.0675	0.0680	0.0686	0.069	0.0692	0.0716	0.070	0.0701	0.0698	0.0700		*n*
	0.068	0.068	0.0685	0.0680	0.0686	0.069	0.0696	0.0715	0.070	0.0702	0.0700	0.0710		12
	0.068	0.068	0.0675	0.0680	0.0681	0.069	0.0692	0.0702	0.070	0.0702	0.0699	0.0680		
	0.067	0.068	0.0680	0.0680	0.0690	0.069	0.0696	0.0667	0.070	0.0701	0.0699	0.0700		
	0.067	0.068	0.0685	0.0690	0.0687	0.069	0.0690	0.0695	0.070	0.0699	0.0703	0.0710		
	0.067	0.068	0.0685	0.0690	0.0676	0.069	0.0695	0.0683	0.070	0.0699	0.0706	0.0730		
***M* [%]**	**0.0673**	**0.0676**	**0.0681**	**0.0683**	**0.0685**	**0.0688**	**0.0694**	**0.0696**	**0.0698**	**0.0701**	**0.0701**	**0.0705**		**0.0690**
s[%]	0.0004	0.0001	0.0005	0.0005	0.0005	0.0002	0.0003	0.0019	0.0002	0.0001	0.0003	0.0016	s_M [%]	0.0011
													$\bar{s}_i$ [%]	0.0008
s_{rel}	0.00548	0.00085	0.00722	0.00756	0.00723	0.00337	0.00362	0.02756	0.00346	0.00194	0.00450	0.02331		0.01530

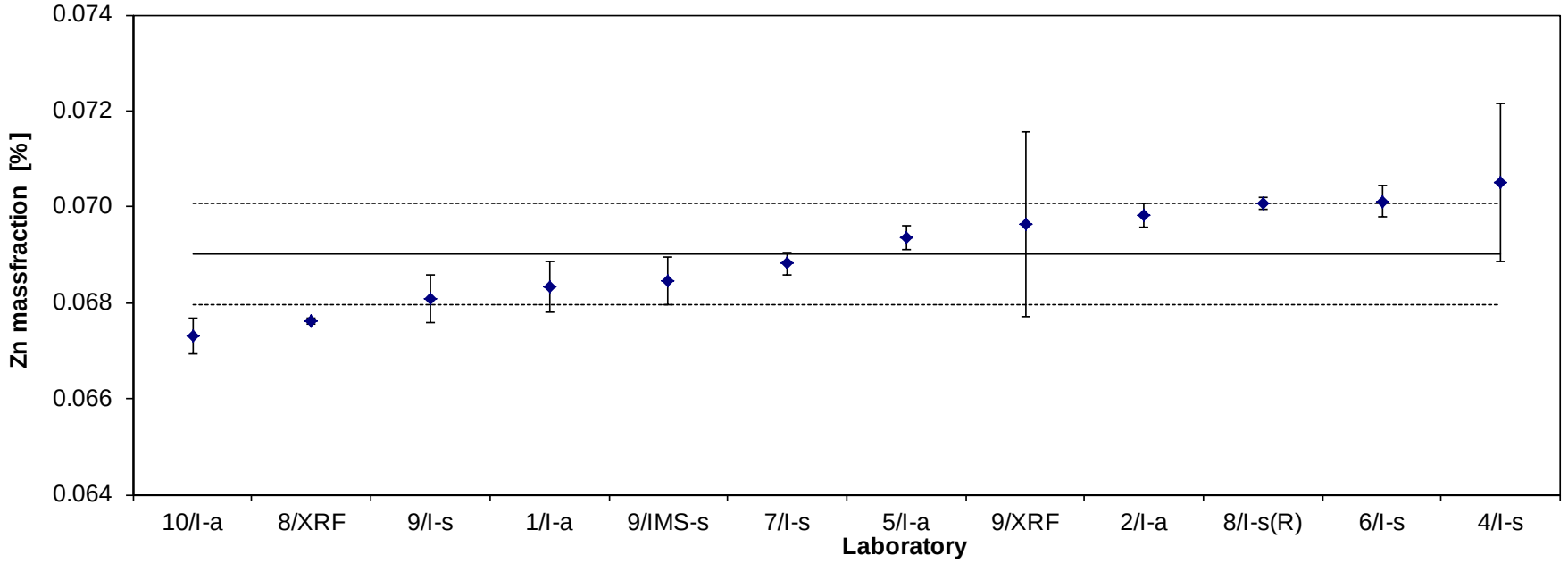

Table 9: Results for Zn

Lab./Meth.	9/I-s	1/I-a	10/I-a	7/I-s	9/P	6/I-s	2/I-a	9/I-a	5/I-a	8/I-s(R)	8/XRF	9/IMS-s	4/I-s		
M_i [%]	0.0563	0.0570	0.0586	0.0584	0.0588	0.0597	0.0597	0.0610	0.0604	0.0607	0.0608	0.0613	0.0630		*n*
	0.0567	0.0560	0.0586	0.0587	0.0588	0.0597	0.0595	0.0600	0.0607	0.0605	0.0613	0.0621	0.0620		13
	0.0563	0.0560	0.0581	0.0583	0.0594	0.0596	0.0592	0.0600	0.0604	0.0610	0.0613	0.0617	0.0620		
	0.0563	0.0560	0.0583	0.0585	0.0591	0.0593	0.0594	0.0600	0.0608	0.0608	0.0613	0.0607	0.0600		
	0.0567	0.0570	0.0580	0.0587	0.0583	0.0590	0.0595	0.0600	0.0606	0.0603	0.0609	0.0608	0.0610		
	0.0563	0.0570	0.0586	0.0589	0.0588	0.0588	0.0595		0.0606	0.0609	0.0608	0.0606	0.0640		
***M* [%]**	**0.0564**	**0.0565**	**0.0584**	**0.0586**	**0.0589**	**0.0593**	**0.0595**	**0.0602**	**0.0606**	**0.0607**	**0.0611**	**0.0612**	**0.0620**		**0.0595**
s[%]	0.0002	0.0005	0.0003	0.0002	0.0004	0.0004	0.0002	0.0004	0.0002	0.0002	0.0002	0.0006	0.0014	s_M [%]	0.0017
														$\bar{s}_i$ [%]	0.0005
s_{rel}	0.00305	0.00969	0.00468	0.00380	0.00623	0.00630	0.00270	0.00743	0.00264	0.00372	0.00366	0.00989	0.02281		0.02893

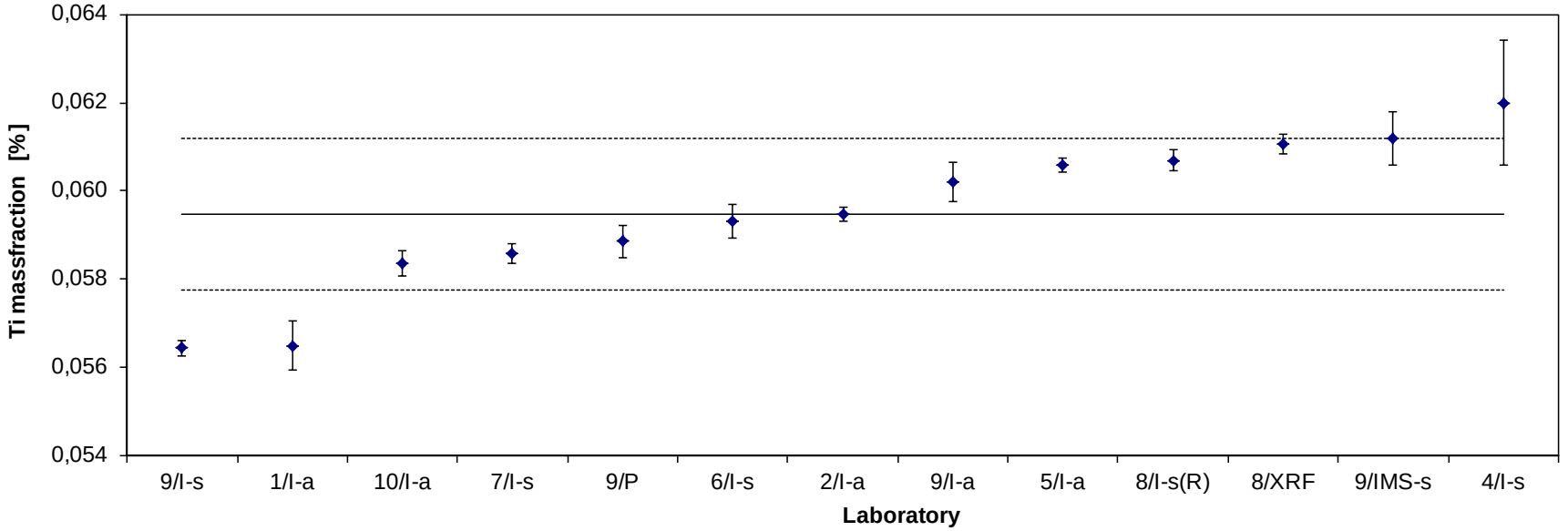

Table 10: Results for Ti

Lab./Meth.	8/XRF	1/I-s(R)	7/IMS	2/I-a	4/I-s	8/I-s(R)	9/IMS-s	5/I-a	6/I-s	10/I-a(R)		
M_i [%]	0.0078	0.0082	0.0084	0.0082	0.0084	0.0084	0.0087	0.0085	0.0085	0.0089		*n*
	0.0078	0.0081	0.0083	0.0082	0.0084	0.0086	0.0085	0.0085	0.0084	0.0082		10
	0.0078	0.0082	0.0084	0.0083	0.0081	0.0085	0.0086	0.0086	0.0088	0.0090		
	0.0077	0.0081	0.0085	0.0086	0.0083	0.0085	0.0084	0.0085	0.0085	0.0092		
	0.0079	0.0083	0.0082	0.0085	0.0085	0.0082	0.0084	0.0084	0.0087	0.0098		
	0.0078	0.0082	0.0082	0.0084	0.0087	0.0083	0.0083	0.0084	0.0086	0.0080		
***M* [%]**	**0.0078**	**0.0082**	**0.0083**	**0.0084**	**0.0084**	**0.0084**	**0.0085**	**0.0085**	**0.0086**	**0.0089**		**0.0084**
s[%]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	s_M [%]	0.0003
											$\bar{s}_i$ [%]	0.0001
s_{rel}	0.008	0.009	0.015	0.020	0.024	0.017	0.015	0.009	0.019	0.075		0.0332

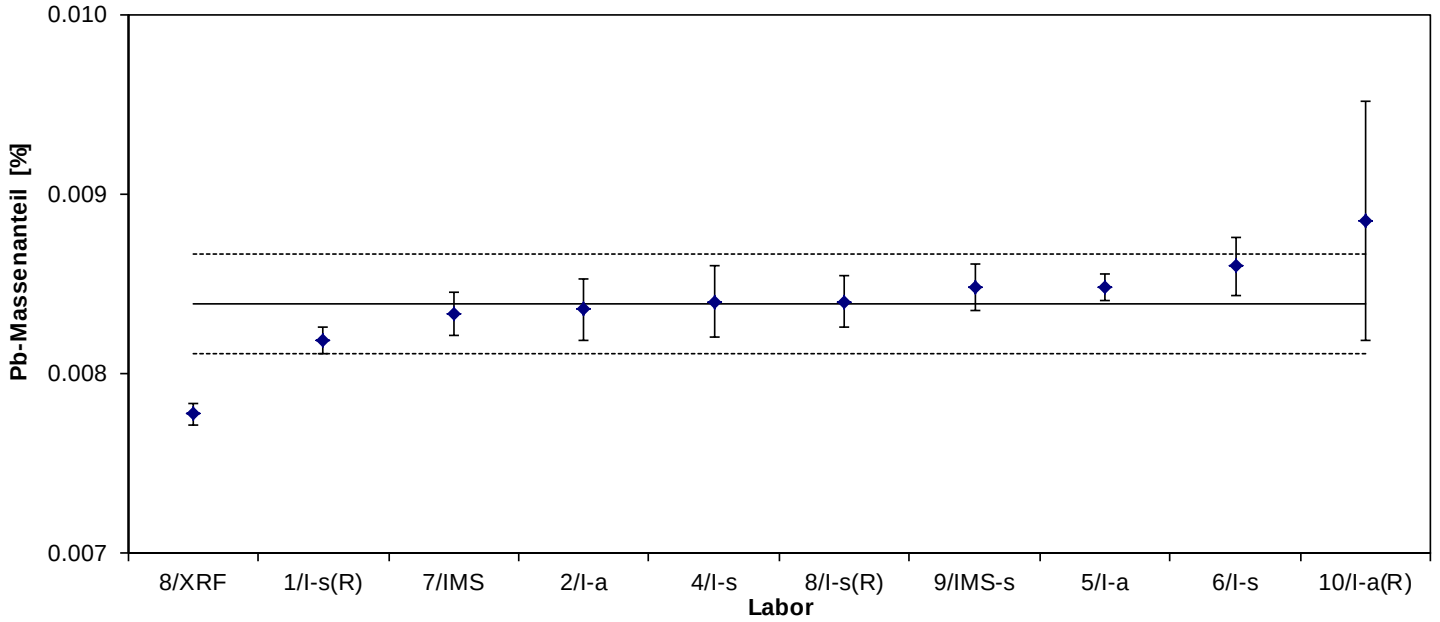

Table 11: Results for Pb

Lab./Meth.	9/I-s	9/IMS-s	2/I-a	5/I-a	4/I-s	6/I-s	1/I-s	8/I-s(R)	7/IMS	8/XRF	9/I-a		
M_i [%]	0.0070	0.0071	0.0070	0.0072	0.0076	0.0076	0.0076	0.0077	0.0077	0.0079	0.0089		*n*
	0.0070	0.0069	0.0072	0.0072	0.0073	0.0074	0.0076	0.0077	0.0080	0.0079	0.0082		11
	0.0070	0.0069	0.0070	0.0073	0.0070	0.0078	0.0077	0.0077	0.0078	0.0079	0.0079		
	0.0070	0.0070	0.0073	0.0072	0.0074	0.0075	0.0075	0.0077	0.0076	0.0078	0.0079		
	0.0070	0.0069	0.0072	0.0071	0.0073	0.0079	0.0077	0.0077	0.0079	0.0079			
	0.0065	0.0069	0.0071	0.0072	0.0074	0.0072	0.0075	0.0077	0.0074	0.0079			
***M* [%]**	**0.0069**	**0.0069**	**0.0071**	**0.0072**	**0.0073**	**0.0076**	**0.0076**	**0.0077**	**0.0077**	**0.0079**	**0.0082**		**0.0075**
s[%]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	s_M [%]	0.0004
												$\bar{s_i}$ [%]	0.0002
s_{rel}	0.030	0.011	0.013	0.009	0.027	0.031	0.012	0.003	0.030	0.005	0.057		0.0548

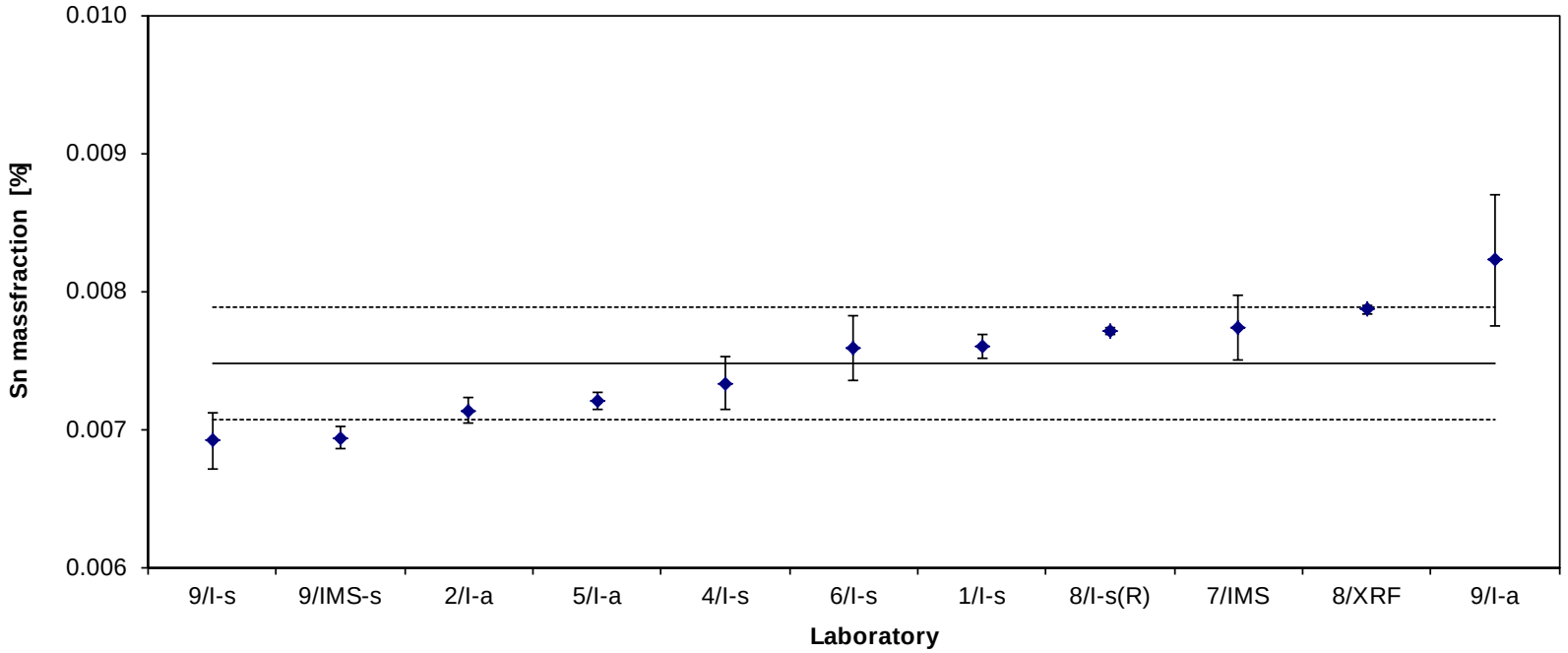

Table 12: Results for Sn

Lab./Meth.	7/I-s(R)	2/I-s	1/I-a	9/IMS-s	8/I-s(R)	5/I-a	4/I-s	6/I-s(R)		
M_i [%]	0.0119	0.0119	0.0119	0.0122	0.0126	0.0127	0.0130	0.0131		*n*
	0.0118	0.0121	0.0122	0.0123	0.0126	0.0126	0.0130	0.0134		8
	0.0116	0.0120	0.0122	0.0123	0.0125	0.0127	0.0130	0.0128		
	0.0118	0.0121	0.0122	0.0122	0.0125	0.0126	0.0120	0.0130		
	0.0119	0.0121	0.0123	0.0122	0.0124	0.0127	0.0130	0.0128		
	0.0118	0.0120	0.0123	0.0122	0.0124	0.0127	0.0130	0.0128		
***M* [%]**	**0.0118**	**0.0120**	**0.0122**	**0.0122**	**0.0125**	**0.0127**	**0.0128**	**0.0130**		**0.0124**
s[%]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	s_M [%]	0.0004
									$\bar{s}_i$ [%]	0.0002
s_{rel}	0.009	0.007	0.012	0.004	0.008	0.004	0.032	0.018		0.033

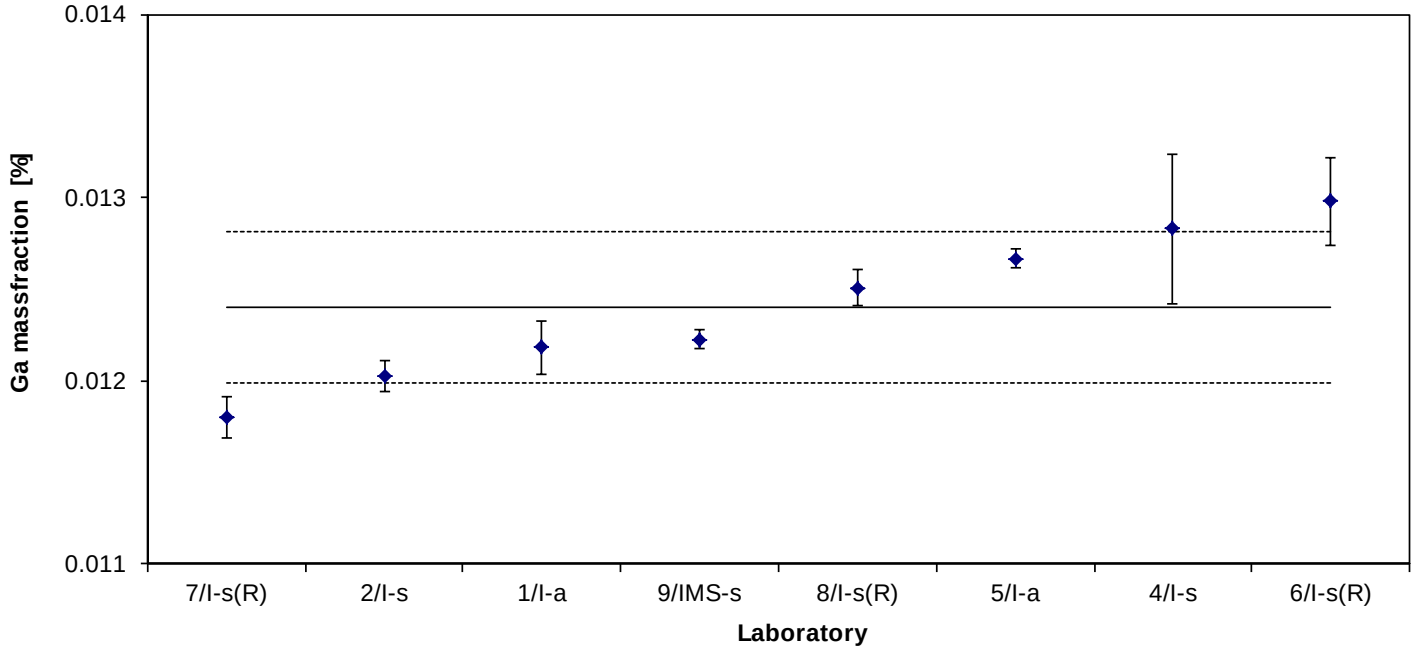

Table 13: Results for Ga

Lab./Meth.	10/I-a	7/IMS	9/I-s	9/P	4/I-s	6/I-a(R)	5/I-a	1/I-a	2/IMS-s	8/I-s(R)	9/IMS-s	8/XRF		
M_i [%]	0.0115	0.0120	0.0115	0.0116	0.0118	0.0119	0.0119	0.0120	0.0122	0.0122	0.0123	0.0121		*n*
	0.0113	0.0117	0.0115	0.0114	0.0117	0.0120	0.0119	0.0120	0.0122	0.0121	0.0123	0.0124		12
	0.0114	0.0114	0.0115	0.0117	0.0116	0.0119	0.0120	0.0120	0.0122	0.0121	0.0121	0.0122		
	0.0114	0.0111	0.0115	0.0119	0.0118	0.0119	0.0120	0.0120	0.0120	0.0122	0.0121	0.0122		
	0.0116	0.0120	0.0115	0.0114	0.0115	0.0120	0.0119	0.0120	0.0121	0.0122	0.0121	0.0122		
	0.0113	0.0106	0.0115		0.0117	0.0120	0.0120	0.0120	0.0121	0.0123	0.0122	0.0123		
***M* [%]**	**0.0114**	**0.0115**	**0.0115**	**0.0116**	**0.0117**	**0.0120**	**0.0120**	**0.0120**	**0.0121**	**0.0122**	**0.0122**	**0.0122**		**0.0119**
s[%]	0.00012	0.00055	0.00000	0.00022	0.00012	0.00003	0.00003	0.00000	0.00008	0.00005	0.00008	0.00008	s_M [%]	0.00031
													$\bar{s}_i$ [%]	0.00009
s_{rel}	0.010	0.048	0.000	0.019	0.010	0.003	0.003	0.000	0.007	0.004	0.007	0.007		0.026

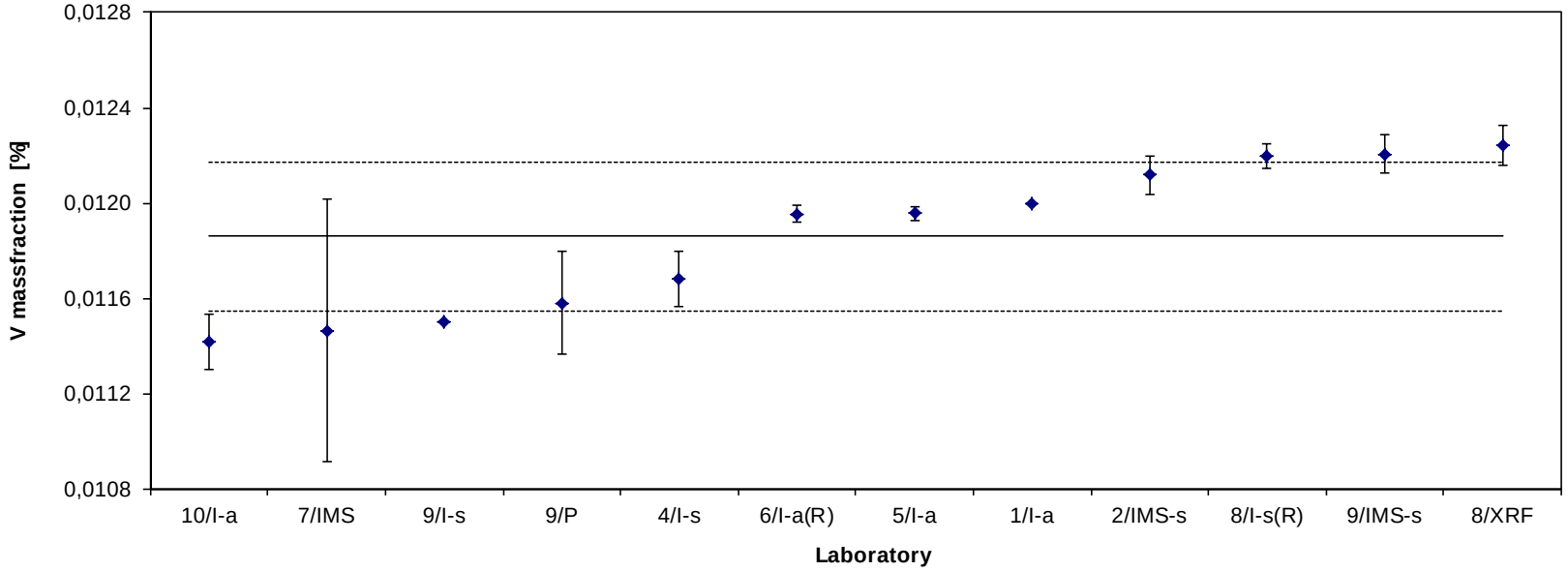

Table 14: Results for V

Lab./Meth.	6/I-s	9/IMS	1/I-s(R)	4/I-s	5/I-a	10/I-a	2/IMS-s		
M_i [mg/kg]	5,3	5,2	5,3	5,5	5,4	5,4	5,5		*n*
	5,3	5,2	5,3	5,4	5,4	5,4	5,4		6
	5,3	5,4	5,3	5,3	5,4	5,4	5,4		
	5,3	5,2	5,3	5,5	5,4	5,5	5,6		
	5,3	5,3	5,4	5,2	5,4	5,5	5,6		
	5,3	5,4	5,3	5,4	5,4	5,4	5,6		
***M* [mg/kg]**	**5,29**	**5,29**	**5,32**	**5,38**	**5,40**	**5,43**	**5,49**		**5,38**
s [mg/kg]	0,034	0,086	0,041	0,117	0,000	0,052	0,096	s_M [mg/kg]	0,072
								$\bar{s}_i$ [mg/kg]	0,076
s_{rel}	0,006	0,016	0,008	0,022	0,000	0,010	0,017		0,013

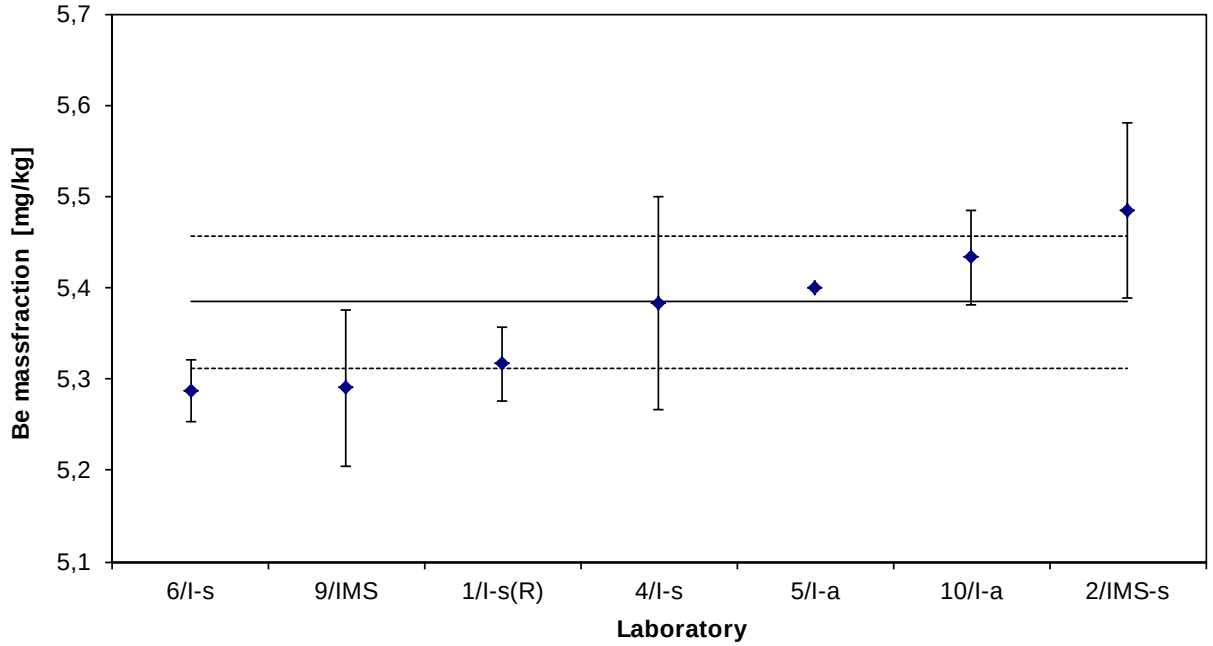

Table 15: Results for Be

Lab./Meth.	1/I-s	4/I-s	5/I-a	6/I-s	2/I-s		
M_i [mg/kg]	18.0	18.7	20.4	20.2	22.7		*n*
	16.0	18.6	18.4	20.7	22.3		5
	16.0	18.3	19.3	20.0	21.3		
	15.0	18.3	17.8	17.6	21.2		
	18.0	18.6	19.8	24.4	21.0		
	16.0	18.0	18.4	18.4	21.2		
***M* [mg/kg]**	**16.50**	**18.42**	**19.02**	**20.21**	**21.60**		**19.15**
s [mg/kg]	1.225	0.264	0.985	2.360	0.715	s_M [mg/kg]	1.918
						$\bar{s}_i$ [mg/kg]	1.313
s_{rel}	0.074	0.014	0.052	0.117	0.033		0.100

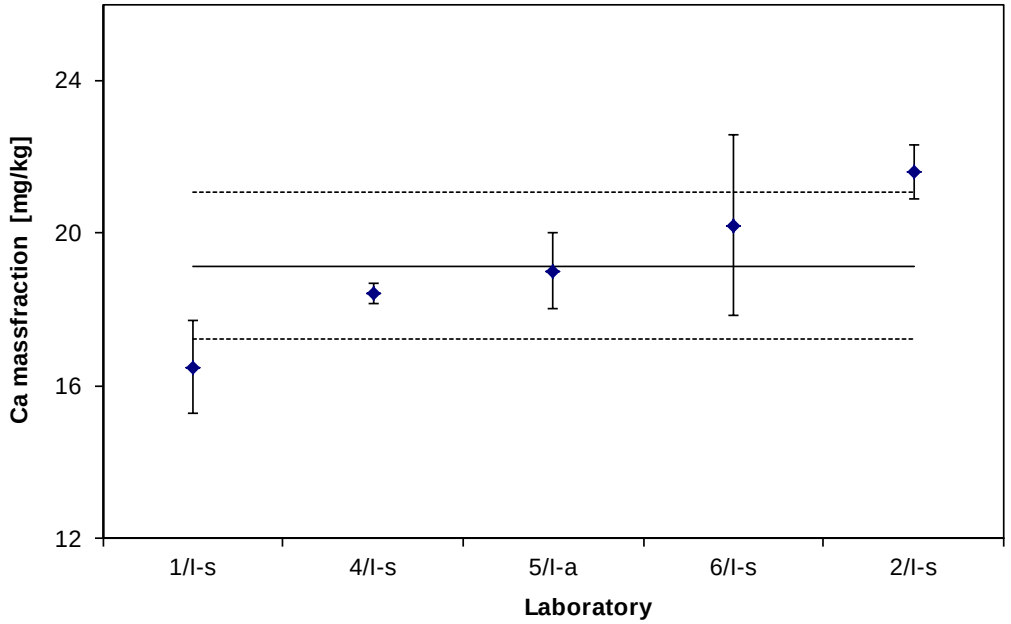

Table 16: Results for Ca

Lab./Meth.	9/IMS-s	4/I-s	8/I-s(R)	1/I-a	2/IMS-s	6/I-s(R)	5/I-a	7/IMS-s		
M_i [mg/kg]	31.8	32.7	32.1	32.0	32.38	33.3	33.9	34.2		*n*
	31.8	32.6	32.3	32.0	32.45	32.8	34.0	34.0		7
	31.3	31.7	32.3	32.0	32.35	33.1	33.6	34.3		
	31.2	31.5	32.1	32.0	32.55	32.8	33.7	34.4		
	31.8	31.1	32.0	33.0	32.50	33.1	33.8	33.2		
	31.6	31.5	32.1	33.0	32.39	32.8	33.5	33.5		
***M* [mg/kg]**	**31.57**	**31.85**	**32.15**	**32.33**	**32.44**	**32.98**	**33.75**	**33.93**		**32.63**
s [mg/kg]	0.275	0.650	0.093	0.516	0.077	0.214	0.187	0.480	s_M [mg/kg]	0.859
									$\bar{s}_i$ [mg/kg]	0.369
s_{rel}	0.009	0.020	0.003	0.016	0.002	0.006	0.006	0.014		0.026

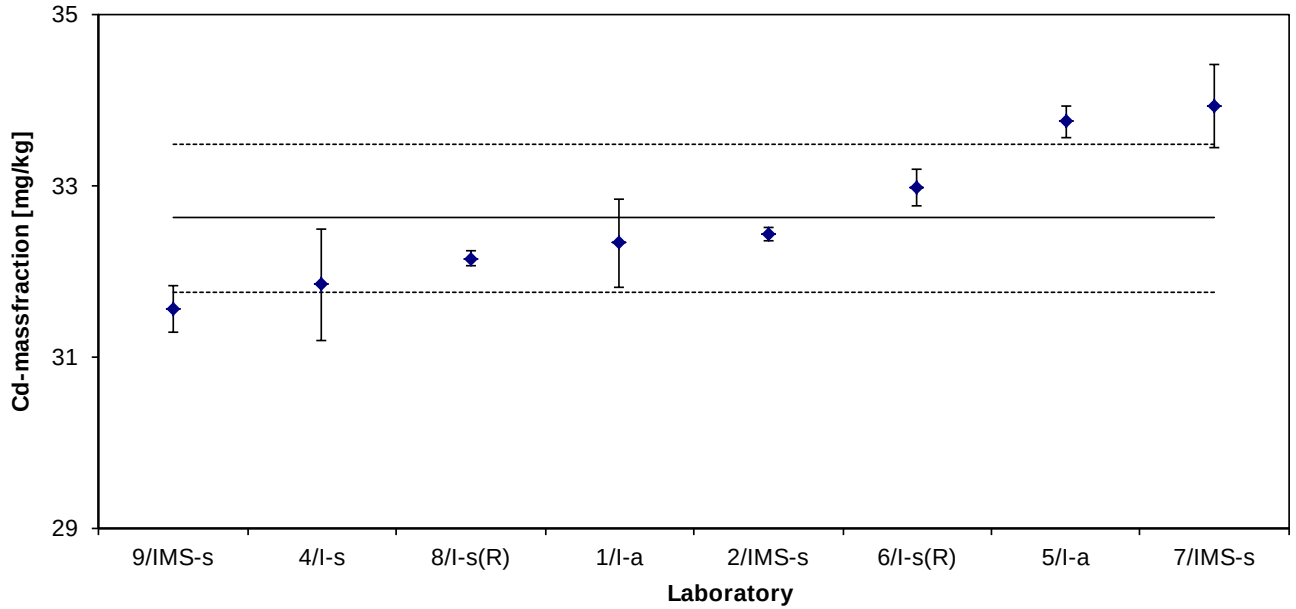

Table 17: Results for Cd

Lab./Meth.	1/I-a	7/IMS-s	9/IMS-s	2/IMS-s	5/I-s	6/I-a	4/I-s		
M_i [mg/kg]	4.8	4.8	5.03	5.0	5.1	5.4	5.7		*n*
	4.6	4.8	5.01	5.0	5.1	5.4	5.7		7
	4.7	4.8	5.02	5.1	5.1	5.4	5.6		
	4.9	4.8	4.97	5.0	5.1	5.5	5.5		
	4.7	4.8	4.96	5.0	5.1	5.3	5.4		
	4.7	4.8	4.96	5.0	5.1	5.4	5.4		
M [mg/kg]	**4.73**	**4.80**	**4.99**	**5.01**	**5.10**	**5.40**	**5.55**		**5.08**
s [mg/kg]	0.103	0.002	0.033	0.037	0.000	0.074	0.138	s_M [mg/kg]	0.299
								$\bar{s}_i$ [mg/kg]	0.073
s_{rel}	0.022	0.000	0.007	0.007	0.000	0.014	0.025		0.059

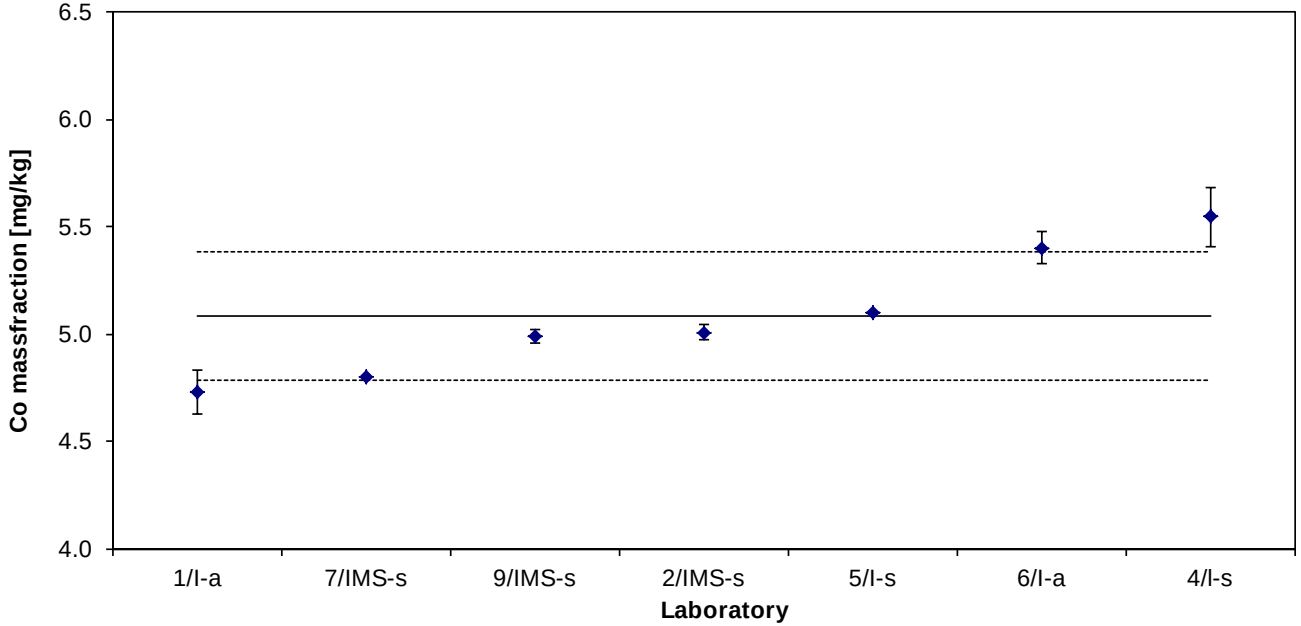

Table 18: Results for Co

Lab./Meth.	6/I-s	9/IMS-s	1/I-a	7/IMS-s	4/I-s	2/I-s	5/I-a		
M_i [mg/kg]	7.8	7.82	8.0	8.1	8.0	8.7	9.0		*n*
	7.7	8.13	8.0	8.0	8.2	8.6	9.0		7
	7.8	7.78	8.0	7.9	8.0	8.4	8.9		
	7.3	7.80	8.0	7.9	8.4	8.4	8.9		
	7.2	7.95	8.0	8.0	7.9	8.3	8.9		
	7.4	7.98	8.0	8.4	8.1	8.4	8.8		
***M* [mg/kg]**	**7.52**	**7.91**	**8.00**	**8.05**	**8.10**	**8.45**	**8.92**		**8.14**
s [mg/kg]	0.253	0.135	0.000	0.187	0.179	0.142	0.075	s_M [mg/kg]	0.440
								$\bar{s}_i$ [mg/kg]	0.158
s_{rel}	0.034	0.017	0.000	0.023	0.022	0.017	0.008		0.054

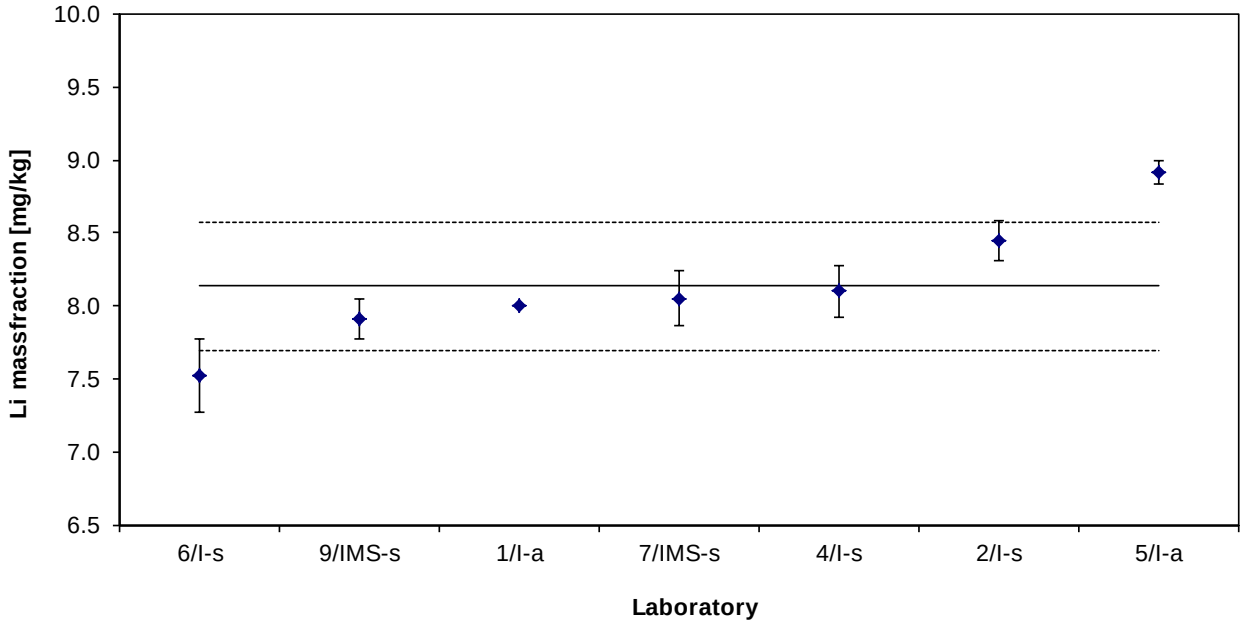

Table 19: Results for Li

Lab./Meth.	4/I-s	6/I-s	1/I-s	2/IMS-s	7/IMS	5/I-a	8/I-s(R)		
M_i [mg/kg]	44.2	38.5	45.0	45.3	47.3	50.4	46.3		*n*
	45.3	41.1	44.0	45.2	47.7	46.6	48.4		7
	43.9	46.5	45.0	45.5	47.0	46.1	49.1		
	43.5	46.9	46.0	45.1	46.3	47.7	50.3		
	43.0	46.5	45.0	44.8	48.7	48.1	49.9		
	43.1	47.5	45.0	45.5	44.4	48.4	46.7		
***M* [mg/kg]**	**43.83**	**44.52**	**45.00**	**45.25**	**46.90**	**47.88**	**48.46**		**45.98**
s [mg/kg]	0.852	3.752	0.632	0.283	1.460	1.517	1.662	s_M [mg/kg]	1.773
								$\bar{s}_i$ [mg/kg]	1.792
s_{rel}	0.019	0.084	0.014	0.006	0.031	0.032	0.034		0.039

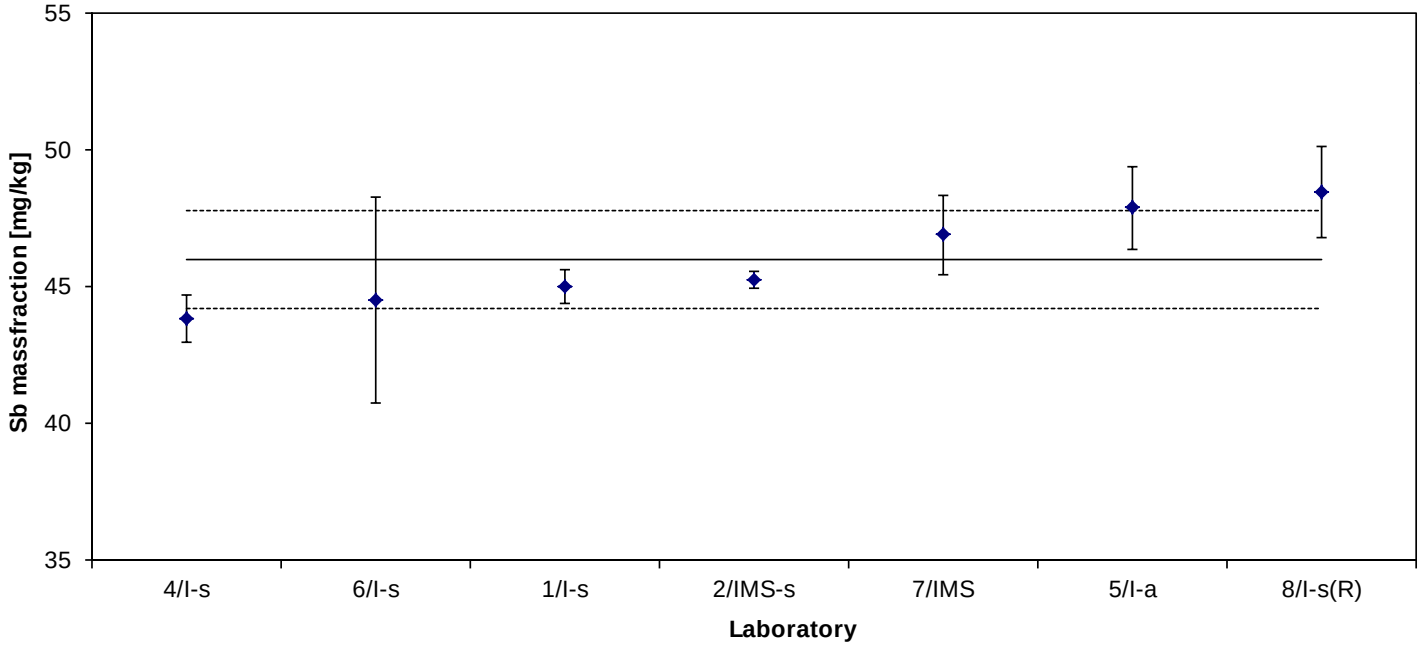

Table 20: Results for Sb

Lab./Meth.	8/XRF	9/P	4/l-s	1/l-a	5/l-a	8/l-s(R)	10/l-a	2/l-s	7/l-s	9/IMS-s	6/l-s		
M_i [mg/kg]	30.6	31.3	32.5	34.0	31.6	32.1	33.6	32.2	32.5	35.7	32.8		*n*
	30.7	32.0	32.2	31.0	32.1	31.3	34.5	32.4	32.4	36.9	31.8		11
	30.6	30.4	31.5	32.0	31.7	32.7	30.5	32.2	32.4	29.4	33.4		
	30.7	30.9	31.1	31.0	31.9	32.9	30.9	32.1	32.5	29.8	30.3		
	30.7	30.6	30.9	31.0	31.8	32.0	30.9	32.1	32.4	31.5	33.9		
	30.7	31.1	30.9	31.0	31.9	30.9	32.3	32.0	32.5	31.9	33.3		
***M* [mg/kg]**	**30.7**	**31.1**	**31.5**	**31.7**	**31.8**	**32.0**	**32.1**	**32.2**	**32.4**	**32.5**	**32.6**		**31.87**
s [mg/kg]	0.0516	0.5683	0.6882	1.2111	0.1751	0.7766	1.6425	0.1277	0.0294	3.0635	1.3283	s_M [mg/kg]	0.6090
												$\bar{s}_i$ [mg/kg]	1.234
s_{rel}	0.00168	0.01830	0.02184	0.03824	0.00550	0.02427	0.05114	0.00397	0.00091	0.09418	0.04076		0.01911

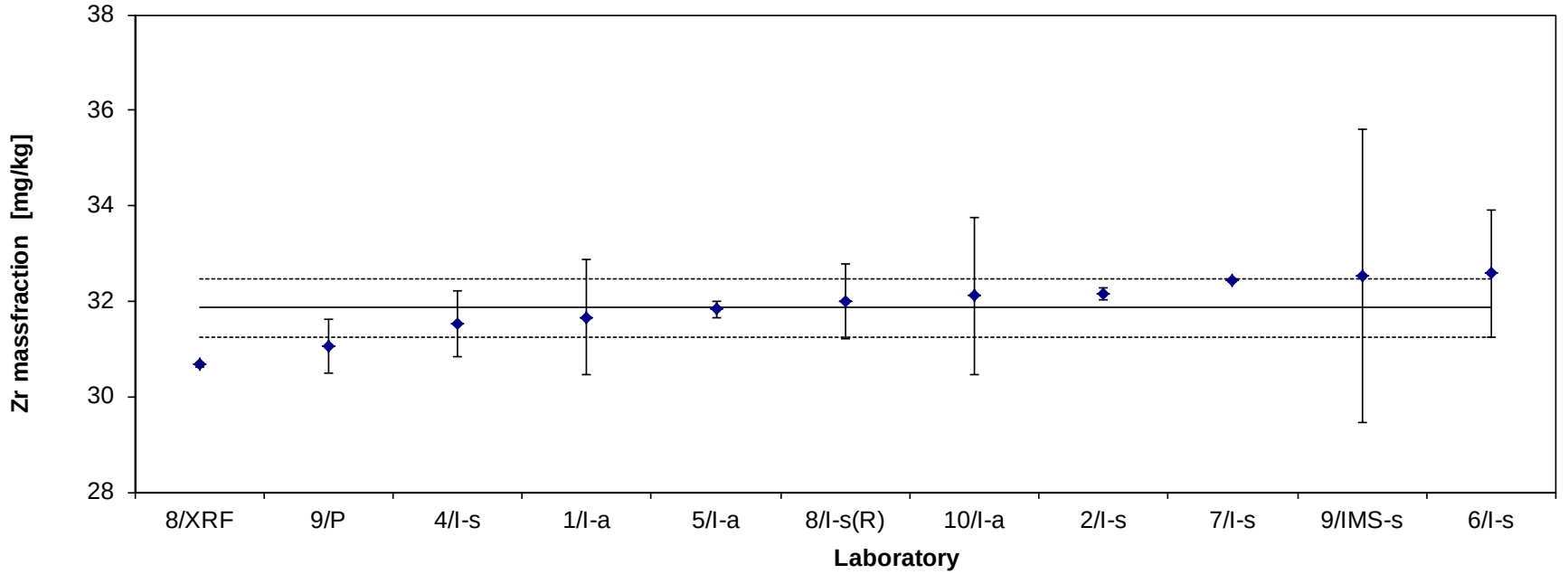

Table 21: Results for Zr

Lab./Meth.	9/CVAAS-s	9/IMS-s	1/I-a	2/IMS-s		
M_i [mg/kg]	31.8	33.20	29.0	36.50		*n*
	33.4	31.80	34.0	36.76		4
	33.2	33.40	35.0	36.64		
	32.6	32.60	35.0	36.99		
	31.8	31.80	35.0	37.21		
	31.7	31.70	35.0	37.17		
M [mg/kg]	**32.40**	**32.42**	**33.83**	**36.88**		**33.88**
s [mg/kg]	0.742	0.760	2.401	0.291	s_M [mg/kg]	2.107
					$\bar{s}_i$ [mg/kg]	1.321
s_{rel}	0.023	0.023	0.071	0.008		0.062

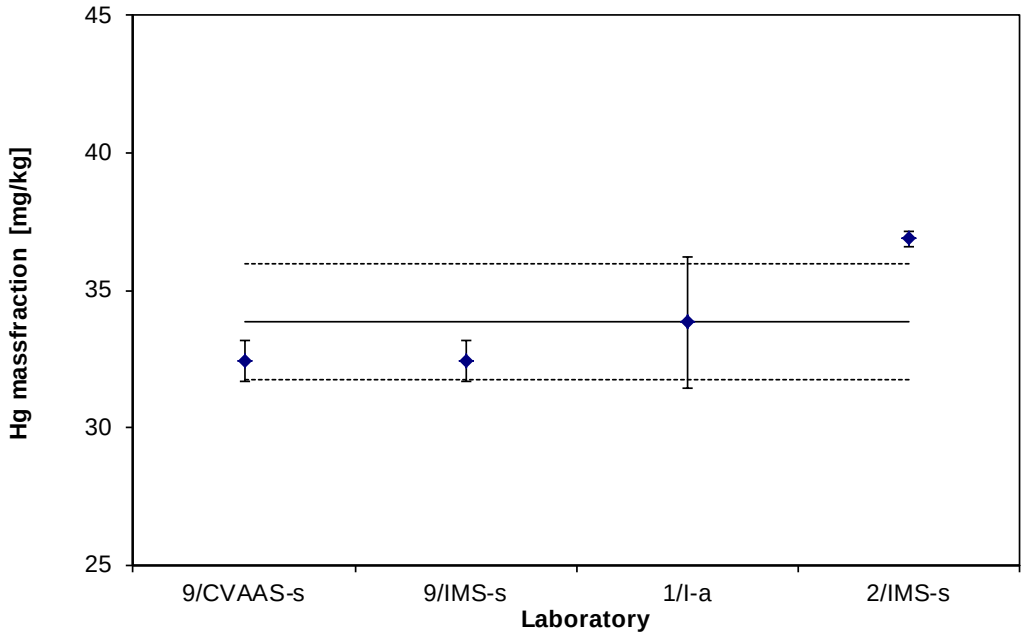

Table 22: Results for Hg

Lab./Meth.	9/IMS-s	4/I-s	1/I-s	2/I-s	6/I-s		
M_i [mg/kg]	6.3	7.8	8.0	10.4	11.0		*n*
	6.6	8.0	8.0	10.4	10.8		5
	6.5	7.2	8.0	9.8	10.8		
	6.0	7.7	8.0	9.8	9.3		
	5.5	7.2	8.0	9.8	8.9		
	6.5	7.7	9.0	9.7	9.9		
***M* [mg/kg]**	**6.24**	**7.60**	**8.17**	**9.97**	**10.11**		**8.42**
s [mg/kg]	0.401	0.329	0.408	0.303	0.871	s_M [mg/kg]	1.642
						$\bar{s}_i$ [mg/kg]	0.507
s_{rel}	0.064	0.043	0.050	0.030	0.086		0.195

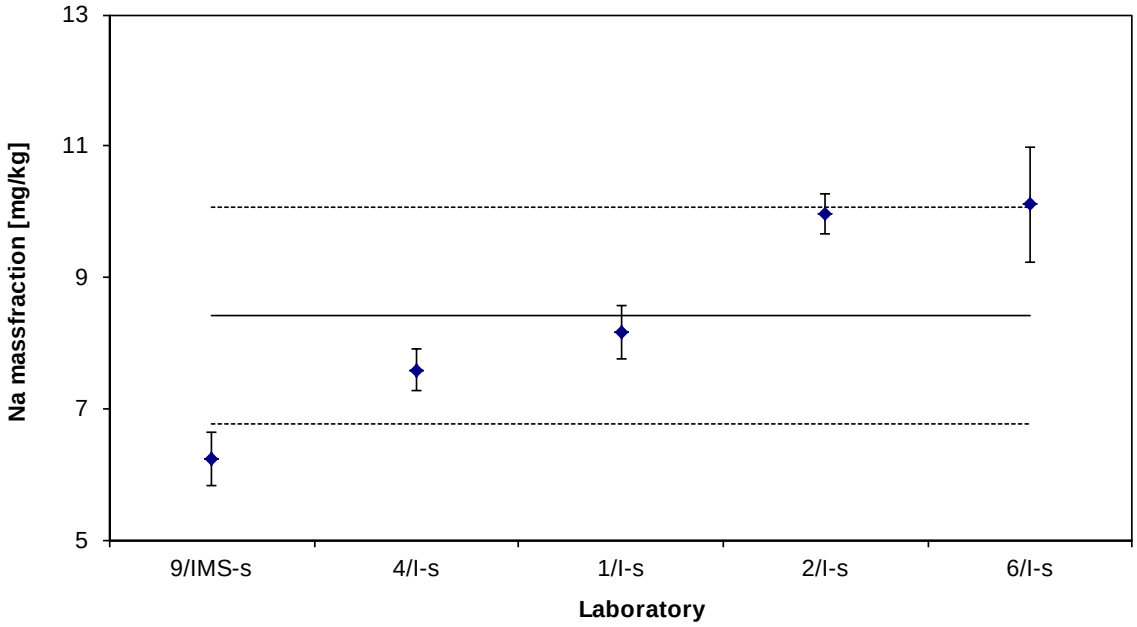

Table 23: Results for Na

The statistical evaluation of the data was performed using the software program SoftCRM 1.2.2. [6]. The following results were obtained:

Table 24: Outcome of statistical tests of results obtained for Si

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 8/XRF
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 8/XRF) was not removed.

Table 25: Outcome of statistical tests of results obtained for Fe

Number of data sets	14
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 26: Outcome of statistical tests of results obtained for Cu

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 10
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 10) was not removed.

Table 27: Outcome of statistical tests of results obtained for Mn

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 28: Outcome of statistical tests of results obtained for Mg

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 29a: Outcome of statistical tests of results obtained for Cr

Number of data sets	13
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Lab. 1
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 1
Nalimov (α = 0.01)	Lab. 1
Grubbs (α = 0.05)	Lab. 1
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlier (Lab. 1) was removed.

Table 29b: Outcome of statistical tests of results obtained for Cr (after removal of oulier)

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 30: Outcome of statistical tests of results obtained for Ni

Number of data sets	13
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 31: Outcome of statistical tests of results obtained for Zn

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 32: Outcome of statistical tests of results obtained for Ti

Number of data sets	13
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 33: Outcome of statistical tests of results obtained for Pb

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Labs. 8/XRF and 10
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The stragglers (Labs. 8/XRF and 10) were not removed.

Table 34: Outcome of statistical tests of results obtained for Sn

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 9/I-a
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 9/I-a) was not removed.

Table 35: Outcome of statistical tests of results obtained for Ga

Number of data sets	8
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 36: Outcome of statistical tests of results obtained for V

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 37a: Outcome of statistical tests of results obtained for Be

Number of data sets	8
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 7
Dixon (α = 0.01)	Laboratory 7
Nalimov (α = 0.05)	Laboratory 7
Nalimov (α = 0.01)	Laboratory 7
Grubbs (α = 0.05)	Laboratory 7
Grubbs (α = 0.01)	Laboratory 7
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 7) was removed (the lab withdrew the result).

Table 37b: Outcome of statistical tests of results obtained for Be (after removal of outlier)

Number of data sets	7
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 38: Outcome of statistical tests of results obtained for Ca

Number of data sets	5
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran (α = 0.01)	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: insufficient data
Skewness & Kurtosis Test (α = 0.01)	Distribution: insufficient data

Table 39: Outcome of statistical tests of results obtained for Cd

Number of data sets	8
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 40: Outcome of statistical tests of results obtained for Co

Number of data sets	7
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 41: Outcome of statistical tests of results obtained for Li

Number of data sets	7
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 5
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 5) was not removed.

Table 42: Outcome of statistical tests of results obtained for Sb

Number of data sets	7
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 43: Outcome of statistical tests of results obtained for Zr

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 8/XRF
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 8/XRF) was not removed.

Table 44: Outcome of statistical tests of results obtained for Na

Number of data sets	5
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: insufficient data
Skewness & Kurtosis Test (α = 0.01)	Distribution: insufficient data

Table 45: Outcome of statistical tests of results obtained for Hg

Number of data sets	4
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: insufficient data
Skewness & Kurtosis Test (α = 0.01)	Distribution: insufficient data

The certified mass fractions of all elements were calculated as mean of the accepted data sets. These values are given in Table 46.
The resp. combined uncertainties were calculated from the spread resulting from the certification inter-laboratory comparison (u_{ilc}) and the uncertainty contributions from possible inhomogeneity over the length ($u_{bb}(1)$) and over area ($u_{bb}(2)$) of the material using Equation 3.

$$u_{\text{combined}} = \sqrt{u_{ilc}^2 + u_{bb}^2(1) + u_{bb}^2(2)} \qquad (3)$$

with

$u_{ilc} = \sqrt{\frac{s_M^2}{n}}$: uncertainty contribution resulting from inter-laboratory comparison

n : number of data sets used for calculating the certified mass fraction of each element

Table 46: Uncertainty calculation

	uncertainty contribution from									u_{bb} (rel)	
	M	n	s_M	u_{ilc}	u_{bb} (1) Length	u_{bb} (2) Area	u(comb)	U		Length	Area
	%		%	%	%	%	%	%			
Si	0.1520	11	0.0044	0.0013	0.0004	0.0021	0.0025	0.00498		0.2785	1.3590
Fe	0.3451	14	0.0043	0.0011	0.0010	0.0031	0.0034	0.00690		0.2910	0.8965
Cu	0.0939	12	0.0016	0.0005	0.0006	0.0010	0.0013	0.00259		0.6450	1.1180
Mn	0.8109	12	0.0132	0.0038	0.0014	0.0023	0.0047	0.00933		0.1665	0.2873
Mg	4.8050	12	0.0395	0.0114	0.0227	0.0321	0.0409	0.08187		0.4725	0.6680
Cr	0.1536	12	0.0015	0.0004	0.0010	0.0006	0.0013	0.00260		0.6807	0.4196
Ni	0.0097	12	0.0003	0.0001	0.0001	0.0002	0.0002	0.00043		0.7863	1.8873
Zn	0.0690	12	0.0011	0.0003	0.0004	0.0006	0.0008	0.00160		0.5480	0.9150
Ti	0.0595	13	0.0017	0.0005	0.0003	0.0006	0.0008	0.00160		0.5047	0.9648
Pb	0.0084	10	0.0003	0.0001	0.0001	0.0001	0.0002	0.00036		0.6178	1.7200
Ga	0.0124	8	0.0004	0.0001	0.0001	0.0001	0.0002	0.00046		0.9370	1.1160
Sn	0.0075	11	0.0004	0.0001	0.0001	0.0001	0.0002	0.00035		0.7650	1.5520
	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg			
Ca	19.2000	5	1.9200	0.8587	0.2605	0.2074	0.9210	2.7629		1.3570	1.0800
Be	5.3700	7	0.0760	0.0287	0.0520	0.0518	0.0788	0.1576		0.9680	0.9650
Li	8.1400	7	0.4400	0.1663	0.0540	0.0130	0.1753	0.4384		0.6640	0.1592
Na	8.4200	5	1.6420	0.7343	0.5364	0.1810	0.9272	2.3180		6.3700	2.1500
Cd	32.6300	7	0.8590	0.3247	0.4395	0.3883	0.6704	1.3407		1.3470	1.1900
Hg	34.4000	4	2.2900	1.1450	1.6065	0.5298	2.0427	4.0853		4.6700	1.5400
Co	5.0800	7	0.2990	0.1130	0.0387	0.1397	0.1838	0.4595		0.7620	2.7500
Sb	46.3200	7	2.4300	0.9185	0.8987	2.4661	2.7808	5.5616		1.9403	5.3240
V	118.6000	12	3.1300	0.9036	0.7887	0.9246	1.5144	3.0288		0.6650	0.7796
Zr	31.8700	11	0.6100	0.1839	0.4647	0.2834	0.5745	1.1490		1.4580	0.8892

The expanded uncertainties U are calculated by multiplication of u_{combined} with a coverage factor of $k = 2$ (Ca: $k = 3$, Co, Li, Na: $k = 2.5$) using Equation 4.

$$U = k \cdot u_{\text{combined}} \qquad (4)$$

The calculated mass fractions and their resp. expanded uncertainties are given on Page 3 of this report.

In addition to the wet chemical characterization some of the laboratories analysed the material with spark emission to check if there is agreement between FOES and wet chemistry. Tab. 47 shows the mean values of wet chemical and spark emission results as well as their standard deviations. It can be seen that only for Sb there is a certain difference between the wet chemical and the spark emission results.

Tab. 47: Comparison wet chemistry (incl. XRF) vs. SOES

Element	Wet chemical analysis			Spark emission		
	Mass fraction in %	**Std.-dev.** in %	***n***	**Mass fraction** in %	**Std.-dev.** in %	***n***
Si	0.152	0.0044	11	0.154	0.0035	8
Fe	0.345	0.0043	14	0.349	0.0066	7
Cu	0.0939	0.0016	12	0.0980	0.0031	8
Mn	0.811	0.0016	12	0.811	0.012	8
Mg	4.805	0.040	11	4.801	0.036	7
Cr	0.154	0.0015	13	0.152	0.0051	8
Ni	0.0097	0.0003	12	0.0090	0.0005	8
Zn	0.0690	0.0011	12	0.0695	0.0020	8
Ti	0.0595	0.0017	13	0.0585	0.0022	8
Pb	0.0084	0.0003	10	0.0088	0.0011	8
Sn	0.0075	0.0004	11	0.0082	0.0015	8
Ga	0.0124	0.0004	8	0.0130	0.0009	8
V	0.0119	0.0004	12	0.0121	0.0004	8
	in mg/kg	in mg/kg		in mg/kg	in mg/kg	
Be	5.37	0.08	7	5.58	0.21	8
Ca	19.2	2.0	5	20.1	3.2	8
Cd	32.1	1.1	7	33.1	0.7	6
Co	5.1	0.3	7	5.1	1.2	6
Li	8.1	0.5	7	8.4	1.3	8
Na	8.4	1.7	5	11.3	1.8	8
Sb	46.0	1.8	7	36.9	8.0	4
Zr	31.9	0.6	11	34.5	3.6	8

6. Instructions for users and stability

The certified reference material ERM®-EB307a is intended for the calibration and quality control of spark emission and X-ray fluorescence spectrometers used for the analysis of similar materials. It is also suitable for wet chemical analysis.
The surface of the material should be cleaned by turning or milling before analysis.
If chips prepared from the compact material are used for wet chemical analysis, a minimum sample intake of 0.1 g has to be used.
The material will remain stable provided that it is not subjected to excessive heat (eg, during preparation of the working surface).

7. References

[1] ISO Guide 31, Reference materials - Contents of certificates, labels and accompanying documentation, 2015

[2] ISO Guide 34, General requirements for the competence of reference material producers, 2009

[3] ISO Guide 35, Reference materials - General and statistical principles for certification. Third edition, 2006

[4] Guidelines for the development and production of BAM Reference Materials, 2016

[5] Technical Guidelines for the Production and Acceptance of a European Reference Material (www.erm-crm.org)

[6] Bonas G, Zervou M, Papaeoannou T, Lees M: Accred Qual Assur (2003) 8:101-107

8. Information on and purchase of the CRM

Certified reference material ERM®-EB307a is supplied by

Bundesanstalt für Materialforschung und -prüfung (BAM)
Fachbereich 1.6: Anorganische Referenzmaterialien
Richard-Willstätter-Str. 11, D-12489 Berlin, Germany
Phone: +49 (0)30 - 8104 2061
Fax: +49 (0)30 - 8104 1117
E-mail: sales.crm@bam.de

Each disc of ERM®-EB307a will be distributed together with a detailed certificate containing the certified values and their uncertainties, the mean values and standard deviations of all accepted data sets and information on the analytical methods used and the names of the participating laboratories.
Information on certified reference materials can be obtained from BAM,
Internet: www.bam.de.
www.webshop.bam.de
Tel. +49 30 8104 1111.

Annex 1: Calculation of uncertainty contribution of potential inhomogeneity (length)

Silicon:

	mass fraction in %				
Sample	1	2	3	4	5
AA	0.1459	0.1464	0.1456	0.1457	0.1454
AB	0.1454	0.146	0.1466	0.1461	0.1464
AC	0.1471	0.1463	0.1449	0.1458	0.1457
AD	0.1452	0.1458	0.145	0.146	0.1462
AE	0.1456	0.1465	0.1456	0.1451	0.1453
BA	0.1458	0.1466	0.1461	0.1459	0.1456
BB	0.1469	0.1462	0.1461	0.1468	0.1459
BC	0.1472	0.1468	0.1461	0.1464	0.1456
BD	0.146	0.1463	0.146	0.1467	0.1457
BE	0.1467	0.1468	0.1463	0.1473	0.1461
CA	0.1463	0.147	0.146	0.1466	0.1471
CB	0.1469	0.1469	0.146	0.1463	0.1462
CC	0.1464	0.1466	0.1472	0.147	0.1468
CD	0.1474	0.1474	0.1473	0.1466	0.1471
CE	0.1465	0.1473	0.1466	0.1464	0.1463
DA	0.1451	0.1468	0.1458	0.1467	0.1454
DB	0.1474	0.1472	0.1467	0.1463	0.147
DC	0.1463	0.1468	0.1463	0.1459	0.1463
DD	0.1463	0.147	0.1469	0.147	0.1469
DE	0.146	0.1468	0.1467	0.1464	0.1457
EA	0.1458	0.1453	0.1448	0.1455	0.1453
EB	0.1462	0.1458	0.1462	0.1459	0.1451
EC	0.1454	0.1461	0.146	0.1457	0.1454
ED	0.1455	0.1456	0.1462	0.1454	0.1457
EE	0.1456	0.146	0.1461	0.1464	0.1458
FA	0.1454	0.1461	0.1457	0.1463	0.1457
FB	0.1468	0.1461	0.1457	0.1455	0.145
FC	0.1463	0.1465	0.1461	0.1464	0.1451
FD	0.1465	0.1473	0.1461	0.1463	0.1469
FE	0.1462	0.1475	0.1474	0.1464	0.1465

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.0541E-05	29	1.0531E-06	4.69946196	8.2675E-10	1.56207098
Within groups	2.6892E-05	120	2.241E-07			
Total	5.7433E-05	149				
within-sd	0.000473					
effective n	4.00					
s_bb	0.000455					
s_bb_min	8.5E-05					
u_bb	0.000455					
u_bb(rel.)	0.31136747					

Iron:

	mass fraction in %				
Sample	1	2	3	4	5
AA	0.3528	0.3569	0.353	0.3524	0.3515
AB	0.3524	0.3524	0.3568	0.3549	0.3556
AC	0.3558	0.3555	0.3526	0.3549	0.3503
AD	0.3517	0.3513	0.3509	0.3526	0.356
AE	0.3525	0.3575	0.3532	0.3498	0.3527
BA	0.353	0.3559	0.3565	0.354	0.353
BB	0.3564	0.3535	0.3555	0.3582	0.3563
BC	0.3577	0.3541	0.3545	0.3554	0.3553
BD	0.3552	0.3578	0.3532	0.359	0.3527
BE	0.3567	0.3575	0.3555	0.3575	0.3531
CA	0.3555	0.3568	0.3537	0.3569	0.3582
CB	0.3552	0.3587	0.3551	0.3562	0.3561
CC	0.3562	0.3558	0.3602	0.3564	0.3569
CD	0.3584	0.3594	0.3578	0.3563	0.3563
CE	0.3554	0.3539	0.3546	0.3552	0.3543
DA	0.3539	0.3607	0.3522	0.3552	0.3521
DB	0.3583	0.3572	0.3554	0.3529	0.3586
DC	0.3553	0.3564	0.3587	0.3542	0.3558
DD	0.3545	0.355	0.3544	0.3608	0.3581
DE	0.3563	0.3599	0.3554	0.3556	0.3561
EA	0.3553	0.355	0.3531	0.3549	0.3522
EB	0.3524	0.3569	0.3556	0.3529	0.3541
EC	0.3538	0.3562	0.3549	0.3547	0.3545
ED	0.3524	0.355	0.3549	0.3524	0.3526
EE	0.3518	0.3551	0.355	0.3528	0.3519
FA	0.3529	0.353	0.3564	0.3547	0.3539
FB	0.3558	0.3557	0.3549	0.3544	0.3533
FC	0.3563	0.3564	0.3565	0.358	0.3522
FD	0.3549	0.3589	0.3556	0.3574	0.3585
FE	0.3526	0.3597	0.3601	0.3555	0.3552

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.0002694	29	9.2895E-06	2.35018756	0.00067293	1.56207098
Within groups	0.00047432	120	3.9527E-06			
Total	0.00074372	149				
within-sd	0.001988					
effective n	4.00					
s_bb	0.001155					
s_bb_min	0.000357					
u_bb	0.001155					
u_bb(rel.)	0.32519639					

Copper:

	mass fraction in %				
Sample	1	2	3	4	5
AA	0.0892	0.0901	0.0896	0.0889	0.0888
AB	0.0882	0.0888	0.0896	0.0895	0.0893
AC	0.0897	0.0882	0.0878	0.0886	0.0881
AD	0.09	0.0896	0.0899	0.0901	0.0903
AE	0.0892	0.0903	0.0891	0.0886	0.0893
BA	0.0896	0.0899	0.0902	0.0899	0.0895
BB	0.0888	0.0878	0.0882	0.089	0.0883
BC	0.089	0.0886	0.0885	0.0885	0.0879
BD	0.09	0.0902	0.0896	0.0908	0.0893
BE	0.0888	0.0885	0.0884	0.089	0.0882
CA	0.0888	0.0893	0.0881	0.0894	0.0898
CB	0.0899	0.0902	0.0901	0.0902	0.0899
CC	0.0885	0.0885	0.09	0.0889	0.0887
CD	0.0892	0.0895	0.0889	0.0888	0.0892
CE	0.0905	0.0905	0.0899	0.09	0.0896
DA	0.0894	0.0902	0.0896	0.0905	0.0894
DB	0.0887	0.0888	0.0884	0.0882	0.0887
DC	0.0889	0.0888	0.0897	0.0881	0.0889
DD	0.0894	0.0894	0.0893	0.0905	0.0898
DE	0.0902	0.0913	0.09	0.0902	0.0898
EA	0.0901	0.0902	0.0889	0.0892	0.0895
EB	0.0901	0.0906	0.09	0.0897	0.0896
EC	0.0895	0.0901	0.0899	0.09	0.0899
ED	0.0884	0.0891	0.0891	0.0881	0.0885
EE	0.088	0.0887	0.0885	0.0883	0.0881
FA	0.0896	0.0902	0.0898	0.09	0.0898
FB	0.09	0.0898	0.0901	0.0897	0.0895
FC	0.0902	0.0903	0.0896	0.0903	0.089
FD	0.0887	0.0898	0.089	0.0891	0.0896
FE	0.0881	0.0895	0.0894	0.0887	0.0882

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	5.4577E-05	29	1.882E-06	8.44062047	1.0967E-17	1.56207098
Within groups	2.6756E-05	120	2.2297E-07			
Total	8.1333E-05	149				
within-sd	0.000472					
effective n	4.00					
s_bb	0.000644					
s_bb_min	8.48E-05					
u_bb	0.000644					
u_bb(rel.)	0.72090994					

Manganese:

	mass fraction in %				
Sample	1	2	3	4	5
AA	0.8435	0.8418	0.841	0.8399	0.8398
AB	0.8362	0.8401	0.8389	0.8375	0.8388
AC	0.8391	0.8418	0.8332	0.8329	0.8352
AD	0.8369	0.8398	0.8377	0.8404	0.8348
AE	0.8339	0.8355	0.8327	0.8361	0.8384
BA	0.8393	0.8385	0.8431	0.8393	0.8359
BB	0.8341	0.8363	0.8374	0.8412	0.8406
BC	0.8411	0.8378	0.8409	0.839	0.8386
BD	0.8349	0.8382	0.8361	0.8354	0.8342
BE	0.8375	0.8372	0.8414	0.8388	0.8388
CA	0.8396	0.8378	0.8361	0.8369	0.8384
CB	0.8359	0.8322	0.8383	0.8319	0.834
CC	0.8377	0.8383	0.8386	0.8341	0.8396
CD	0.8354	0.8369	0.8388	0.8336	0.837
CE	0.8369	0.8344	0.8381	0.8333	0.8374
DA	0.8394	0.8376	0.8381	0.8346	0.8363
DB	0.8371	0.8377	0.8398	0.8359	0.8401
DC	0.8362	0.8347	0.8401	0.84	0.8357
DD	0.8371	0.8384	0.8388	0.839	0.8422
DE	0.8345	0.8351	0.8352	0.8386	0.8354
EA	0.84	0.8415	0.8395	0.838	0.8371
EB	0.837	0.8368	0.8374	0.8369	0.8345
EC	0.8326	0.8395	0.8408	0.838	0.8383
ED	0.8392	0.8391	0.8349	0.8363	0.8339
EE	0.8355	0.8396	0.8348	0.8373	0.8337
FA	0.8342	0.8363	0.8323	0.8384	0.8331
FB	0.839	0.8393	0.8373	0.8359	0.8406
FC	0.8416	0.8401	0.8434	0.8413	0.8416
FD	0.8376	0.8351	0.8372	0.8375	0.8358
FE	0.8403	0.8345	0.8353	0.8389	0.8386

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.00041383	29	1.427E-05	3.13440656	6.558E-06	1.56207098
Within groups	0.00054633	120	4.5527E-06			
Total	0.00096016	149				
within-sd	0.002134					
effective n	4.00					
s_bb	0.001559					
s_bb_min	0.000383					
u_bb	0.001559					
u_bb(rel.)	0.18610178					

Magnesium:

	mass fraction in %				
Sample	1	2	3	4	5
AA	4.8998	4.9337	4.9023	4.8838	4.8954
AB	4.8683	4.8984	4.9262	4.9261	4.9404
AC	4.8995	4.8635	4.8813	4.9198	4.8991
AD	4.8449	4.8424	4.8698	4.8725	4.893
AE	4.839	4.895	4.8445	4.8425	4.8697
BA	4.8338	4.8746	4.8738	4.8798	4.8818
BB	4.9026	4.9008	4.9109	4.9414	4.9043
BC	4.9158	4.9077	4.9166	4.9169	4.9051
BD	4.8409	4.8792	4.8518	4.8739	4.864
BE	4.9197	4.9333	4.9213	4.9112	4.9059
CA	4.8908	4.9141	4.8689	4.9215	4.9445
CB	4.8707	4.881	4.8909	4.88	4.8799
CC	4.8903	4.9021	4.9563	4.9189	4.9273
CD	4.913	4.9385	4.9296	4.921	4.9116
CE	4.8881	4.879	4.8871	4.8944	4.8895
DA	4.8659	4.9084	4.861	4.8839	4.8552
DB	4.906	4.9228	4.9232	4.9238	4.9267
DC	4.8938	4.9206	4.9446	4.8918	4.9173
DD	4.9109	4.9049	4.9264	4.976	4.945
DE	4.8669	4.9124	4.8651	4.8868	4.8637
EA	4.8509	4.845	4.8398	4.8409	4.8598
EB	4.8787	4.8804	4.875	4.8867	4.8544
EC	4.8308	4.8715	4.8696	4.8756	4.8791
ED	4.8754	4.9172	4.8973	4.8863	4.8875
EE	4.8481	4.892	4.8897	4.8872	4.8662
FA	4.84	4.8865	4.8723	4.8724	4.8603
FB	4.8364	4.8442	4.8788	4.872	4.8532
FC	4.8525	4.8737	4.8585	4.8686	4.8382
FD	4.8758	4.9246	4.905	4.9239	4.9242
FE	4.8835	4.9012	4.9154	4.9104	4.9119

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.08735856	29	0.00301236	8.75097421	2.9643E-18	1.56207098
Within groups	0.04130782	120	0.00034423			
Total	0.12866639	149				
within-sd	0.018553					
effective n	4.00					
s_bb	0.025827					
s_bb_min	0.003333					
u_bb	0.025827					
u_bb(rel.)	0.52817451					

Chromium:

	mass fraction in %				
Sample	1	2	3	4	5
AA	0.1554	0.1565	0.1573	0.1549	0.1556
AB	0.1559	0.1554	0.1568	0.157	0.1571
AC	0.156	0.1554	0.1564	0.1568	0.1558
AD	0.1546	0.1534	0.1541	0.1547	0.155
AE	0.1544	0.1557	0.1551	0.1538	0.1553
BA	0.1537	0.1548	0.1552	0.1545	0.1542
BB	0.1568	0.1569	0.1566	0.1574	0.1573
BC	0.1573	0.1564	0.1576	0.1574	0.157
BD	0.1551	0.1556	0.1542	0.1568	0.1536
BE	0.1582	0.1577	0.1581	0.1568	0.1563
CA	0.156	0.1558	0.1545	0.1564	0.1577
CB	0.1537	0.1544	0.1546	0.1546	0.1544
CC	0.1562	0.1556	0.1596	0.1567	0.1574
CD	0.1566	0.157	0.1563	0.1567	0.1561
CE	0.1549	0.1538	0.1543	0.1545	0.1539
DA	0.1545	0.1547	0.1536	0.1536	0.154
DB	0.1562	0.1564	0.1559	0.156	0.1572
DC	0.1565	0.1564	0.1591	0.1553	0.1569
DD	0.1556	0.1563	0.1557	0.157	0.1576
DE	0.1547	0.1575	0.1536	0.1542	0.1545
EA	0.1553	0.156	0.1545	0.1533	0.1539
EB	0.1546	0.1574	0.1548	0.1544	0.1546
EC	0.1537	0.1549	0.1536	0.1547	0.1548
ED	0.1564	0.1573	0.1569	0.1554	0.1555
EE	0.1555	0.1574	0.1569	0.1552	0.1558
FA	0.154	0.1547	0.1548	0.1539	0.1533
FB	0.1531	0.1539	0.155	0.1546	0.1537
FC	0.1545	0.1547	0.1539	0.1552	0.1534
FD	0.1559	0.158	0.1569	0.157	0.158
FE	0.1549	0.1567	0.1568	0.157	0.1553

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.00018506	29	6.3814E-06	8.25043245	2.4773E-17	1.56207098
Within groups	9.2816E-05	120	7.7347E-07			
Total	0.00027788	149				
within-sd	0.000879					
effective n	4.00					
s_bb	0.001184					
s_bb_min	0.000158					
u_bb	0.001184					
u_bb(rel.)	0.76094279					

Nickel:

	mass fraction in %				
Sample	1	2	3	4	5
AA	0.0105	0.0106	0.0106	0.0106	0.0105
AB	0.0105	0.0105	0.0106	0.0106	0.0106
AC	0.0106	0.0106	0.0106	0.0106	0.0106
AD	0.0104	0.0104	0.0104	0.0105	0.0105
AE	0.0104	0.0106	0.0104	0.0104	0.0105
BA	0.0104	0.0105	0.0105	0.0105	0.0105
BB	0.0106	0.0106	0.0106	0.0107	0.0106
BC	0.0107	0.0107	0.0107	0.0107	0.0106
BD	0.0104	0.0105	0.0104	0.0105	0.0105
BE	0.0106	0.0106	0.0106	0.0107	0.0106
CA	0.0105	0.0106	0.0106	0.0107	0.0107
CB	0.0105	0.0106	0.0105	0.0105	0.0105
CC	0.0106	0.0106	0.0107	0.0106	0.0107
CD	0.0106	0.0107	0.0107	0.0107	0.0107
CE	0.0105	0.0105	0.0104	0.0105	0.0106
DA	0.0104	0.0105	0.0104	0.0105	0.0104
DB	0.0106	0.0107	0.0106	0.0106	0.0107
DC	0.0106	0.0106	0.0107	0.0106	0.0107
DD	0.0106	0.0106	0.0106	0.0107	0.0107
DE	0.0105	0.0105	0.0104	0.0104	0.0105
EA	0.0104	0.0104	0.0104	0.0105	0.0105
EB	0.0105	0.0105	0.0105	0.0105	0.0105
EC	0.0104	0.0104	0.0104	0.0104	0.0104
ED	0.0105	0.0106	0.0106	0.0106	0.0106
EE	0.0106	0.0106	0.0106	0.0106	0.0106
FA	0.0104	0.0105	0.0104	0.0104	0.0105
FB	0.0104	0.0105	0.0105	0.0105	0.0104
FC	0.0105	0.0106	0.0105	0.0105	0.0104
FD	0.0105	0.0106	0.0106	0.0107	0.0107
FE	0.0106	0.0107	0.0107	0.0106	0.0106

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.0824E-06	29	3.7324E-08	12.7241379	1.1866E-24	1.56207098
Within groups	3.52E-07	120	2.9333E-09			
Total	1.4344E-06	149				
within-sd	5.42E-05					
effective n	4.00					
s_bb	9.27E-05					
s_bb_min	9.73E-06					
u_bb	9.27E-05					
u_bb(rel.)	0.87906513					

Zinc:

	mass fraction in mg/kg				
Sample	1	2	3	4	5
AA	0.0554	0.0557	0.0559	0.0543	0.0545
AB	0.0546	0.0545	0.0551	0.0552	0.0537
AC	0.0541	0.0542	0.053	0.054	0.0533
AD	0.0544	0.0534	0.054	0.0542	0.0542
AE	0.0545	0.0552	0.0547	0.0537	0.0541
BA	0.0544	0.0537	0.0549	0.0553	0.0539
BB	0.0554	0.0542	0.0543	0.0543	0.054
BC	0.0555	0.055	0.055	0.055	0.0547
BD	0.0554	0.0549	0.0548	0.0556	0.0548
BE	0.0548	0.0542	0.0543	0.0552	0.0538
CA	0.0542	0.0544	0.0533	0.0541	0.0542
CB	0.0545	0.0543	0.0545	0.0549	0.054
CC	0.0552	0.0545	0.0566	0.0546	0.0545
CD	0.0547	0.0549	0.0553	0.0557	0.055
CE	0.0561	0.0558	0.0552	0.0543	0.0541
DA	0.0544	0.0562	0.0542	0.0549	0.0545
DB	0.0548	0.0549	0.0541	0.0545	0.0539
DC	0.055	0.0548	0.0558	0.0544	0.0542
DD	0.0554	0.0547	0.0546	0.0552	0.0549
DE	0.0548	0.0563	0.0549	0.055	0.0547
EA	0.0552	0.0553	0.0537	0.0533	0.0536
EB	0.0547	0.0555	0.0537	0.0539	0.0543
EC	0.0543	0.0558	0.0542	0.0548	0.055
ED	0.0547	0.0543	0.0544	0.0535	0.0543
EE	0.0552	0.055	0.0552	0.0548	0.055
FA	0.0542	0.0545	0.0539	0.0549	0.054
FB	0.0549	0.0542	0.0543	0.0543	0.0546
FC	0.0556	0.0551	0.055	0.0556	0.0545
FD	0.0543	0.0552	0.0535	0.0536	0.0552
FE	0.0542	0.0561	0.0557	0.0545	0.0542

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.3358E-05	29	8.0545E-07	2.25530888	0.00116605	1.56207098
Within groups	4.2856E-05	120	3.5713E-07			
Total	6.6214E-05	149				
within-sd	0.000598					
effective n	4.00					
s_bb	0.000335					
s_bb_min	0.000107					
u_bb	0.000335					
u_bb(rel.)	0.6126205					

Titanium:

	mass fraction in %				
Sample	1	2	3	4	5
AA	0.0585	0.058	0.0583	0.0582	0.0583
AB	0.0587	0.0581	0.058	0.0579	0.0577
AC	0.0581	0.0585	0.0585	0.0582	0.0587
AD	0.0579	0.0581	0.0577	0.0581	0.0574
AE	0.058	0.0577	0.0582	0.058	0.0579
BA	0.058	0.0582	0.0578	0.0578	0.0579
BB	0.0585	0.0591	0.0585	0.0583	0.0584
BC	0.0587	0.0588	0.0585	0.0584	0.0583
BD	0.0579	0.0581	0.0578	0.0574	0.0577
BE	0.0587	0.0583	0.0588	0.0584	0.0584
CA	0.0585	0.0582	0.0582	0.0579	0.058
CB	0.0576	0.0574	0.0575	0.0576	0.0576
CC	0.0582	0.0583	0.0584	0.0583	0.0583
CD	0.0586	0.0582	0.0584	0.0583	0.0582
CE	0.0577	0.0578	0.0575	0.0574	0.0575
DA	0.0579	0.0579	0.0577	0.0576	0.0581
DB	0.0587	0.0583	0.0584	0.0583	0.0585
DC	0.0585	0.0584	0.0582	0.0583	0.0582
DD	0.0582	0.0582	0.0581	0.0579	0.0579
DE	0.058	0.0578	0.0577	0.0574	0.0575
EA	0.0584	0.0583	0.0584	0.058	0.0579
EB	0.0579	0.0581	0.0578	0.0576	0.0574
EC	0.0581	0.0581	0.0579	0.058	0.058
ED	0.0586	0.0583	0.0586	0.0585	0.0583
EE	0.0592	0.0587	0.0586	0.0585	0.0586
FA	0.058	0.0579	0.0578	0.058	0.0577
FB	0.0582	0.058	0.0578	0.0581	0.0577
FC	0.0582	0.058	0.058	0.0582	0.058
FD	0.0586	0.0583	0.0581	0.0578	0.0586
FE	0.0586	0.0582	0.0582	0.0584	0.0583

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.3942E-05	29	4.8077E-07	10.4895799	3.0696E-21	1.56207098
Within groups	5.5E-06	120	4.5833E-08			
Total	1.9442E-05	149				
within-sd	0.000214					
effective n	4.00					
s_bb	0.00033					
s_bb_min	3.85E-05					
u_bb	0.00033					
u_bb(rel.)	0.56728179					

Lead:

	mass fraction in %				
Sample	1	2	3	4	5
AA	0.0104	0.0105	0.0104	0.0105	0.0104
AB	0.0103	0.0104	0.0105	0.0104	0.0104
AC	0.0104	0.0104	0.0104	0.0104	0.0104
AD	0.0103	0.0104	0.0103	0.0104	0.0103
AE	0.0103	0.0104	0.0102	0.0103	0.0103
BA	0.0102	0.0103	0.0104	0.0104	0.0104
BB	0.0104	0.0104	0.0104	0.0105	0.0105
BC	0.0105	0.0105	0.0105	0.0106	0.0104
BD	0.0103	0.0104	0.0103	0.0104	0.0103
BE	0.0103	0.0104	0.0105	0.0104	0.0104
CA	0.0102	0.0103	0.0104	0.0105	0.0104
CB	0.0103	0.0104	0.0105	0.0105	0.0104
CC	0.0103	0.0104	0.0105	0.0105	0.0106
CD	0.0104	0.0106	0.0105	0.0105	0.0105
CE	0.0103	0.0104	0.0103	0.0103	0.0105
DA	0.0102	0.0103	0.0103	0.0103	0.0103
DB	0.0104	0.0105	0.0104	0.0104	0.0105
DC	0.0104	0.0103	0.0105	0.0105	0.0105
DD	0.0103	0.0106	0.0104	0.0105	0.0105
DE	0.0103	0.0104	0.0103	0.0103	0.0103
EA	0.0102	0.0103	0.0102	0.0103	0.0104
EB	0.0104	0.0104	0.0105	0.0104	0.0103
EC	0.0101	0.0102	0.0103	0.0102	0.0103
ED	0.0103	0.0104	0.0105	0.0104	0.0104
EE	0.0102	0.0104	0.0104	0.0104	0.0105
FA	0.0102	0.0104	0.0104	0.0104	0.0104
FB	0.0102	0.0102	0.0104	0.0103	0.0103
FC	0.0102	0.0104	0.0103	0.0103	0.0102
FD	0.0103	0.0105	0.0105	0.0105	0.0106
FE	0.0103	0.0105	0.0106	0.0105	0.0104

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	7.8693E-07	29	2.7136E-08	4.13232977	1.9697E-08	1.56207098
Within groups	7.88E-07	120	6.5667E-09			
Total	1.5749E-06	149				
within-sd	8.1E-05					
effective n	4.00					
s_bb	7.17E-05					
s_bb_min	1.46E-05					
u_bb	7.17E-05					
u_bb(rel.)	0.69066479					

Tin:

	mass fraction in %				
Sample	1	2	3	4	5
AA	0.0078	0.0079	0.0079	0.0079	0.0078
AB	0.0078	0.0079	0.0079	0.008	0.0079
AC	0.0079	0.0079	0.0079	0.0079	0.0079
AD	0.0078	0.0078	0.0078	0.0078	0.0077
AE	0.0077	0.0079	0.0077	0.0078	0.0078
BA	0.0078	0.0078	0.0079	0.0078	0.0079
BB	0.0079	0.0079	0.008	0.0079	0.0079
BC	0.008	0.008	0.0079	0.008	0.0079
BD	0.0078	0.0079	0.0078	0.0078	0.0078
BE	0.0078	0.0079	0.0079	0.0079	0.0079
CA	0.0079	0.0079	0.0079	0.008	0.0079
CB	0.0078	0.0079	0.0079	0.0079	0.0078
CC	0.0079	0.0079	0.008	0.0079	0.008
CD	0.008	0.008	0.008	0.0079	0.008
CE	0.0078	0.0079	0.0078	0.0078	0.0079
DA	0.0078	0.0079	0.0078	0.0079	0.0077
DB	0.0079	0.008	0.0079	0.0079	0.008
DC	0.0079	0.0079	0.008	0.008	0.008
DD	0.0079	0.0079	0.0079	0.008	0.008
DE	0.0078	0.0079	0.0079	0.0078	0.0078
EA	0.0078	0.0078	0.0077	0.0078	0.0078
EB	0.0078	0.0078	0.0078	0.0078	0.0078
EC	0.0078	0.0078	0.0078	0.0077	0.0078
ED	0.0079	0.0079	0.0079	0.0078	0.0079
EE	0.0078	0.0079	0.0079	0.0079	0.008
FA	0.0078	0.0079	0.0078	0.0078	0.0078
FB	0.0078	0.0078	0.0078	0.0078	0.0078
FC	0.0078	0.0079	0.0078	0.0079	0.0077
FD	0.0079	0.0079	0.008	0.008	0.0081
FE	0.0079	0.008	0.008	0.0079	0.0079

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	6.1393E-07	29	2.117E-08	6.97915877	7.5646E-15	1.56207098
Within groups	3.64E-07	120	3.0333E-09			
Total	9.7793E-07	149				
within-sd	5.51E-05					
effective n	4.00					
s_bb	6.73E-05					
s_bb_min	9.89E-06					
u_bb	6.73E-05					
u_bb(rel.)	0.85531926					

Gallium:

	mass fraction in %				
Sample	1	2	3	4	5
AA	0.0171	0.0173	0.0172	0.0173	0.0172
AB	0.0171	0.0173	0.0174	0.0173	0.0173
AC	0.0173	0.0173	0.0173	0.0174	0.0173
AD	0.0169	0.017	0.0169	0.0171	0.017
AE	0.017	0.0172	0.017	0.0171	0.017
BA	0.0169	0.017	0.0171	0.0172	0.0171
BB	0.0173	0.0174	0.0174	0.0175	0.0175
BC	0.0174	0.0175	0.0174	0.0176	0.0174
BD	0.017	0.0172	0.017	0.0172	0.017
BE	0.0172	0.0175	0.0174	0.0174	0.0174
CA	0.0171	0.0172	0.0173	0.0174	0.0174
CB	0.0171	0.0172	0.0172	0.0173	0.0172
CC	0.0172	0.0174	0.0176	0.0174	0.0175
CD	0.0173	0.0175	0.0174	0.0174	0.0175
CE	0.017	0.0171	0.0171	0.017	0.0172
DA	0.0169	0.0171	0.0169	0.017	0.0169
DB	0.0173	0.0174	0.0173	0.0174	0.0175
DC	0.0173	0.0173	0.0175	0.0174	0.0175
DD	0.0171	0.0174	0.0173	0.0175	0.0174
DE	0.017	0.0172	0.0171	0.017	0.017
EA	0.0169	0.017	0.0169	0.017	0.0171
EB	0.0171	0.0172	0.0172	0.0172	0.017
EC	0.0169	0.0169	0.0171	0.017	0.0171
ED	0.0172	0.0173	0.0174	0.0172	0.0174
EE	0.0172	0.0173	0.0174	0.0173	0.0174
FA	0.017	0.0172	0.017	0.0171	0.0171
FB	0.0169	0.0169	0.0171	0.017	0.017
FC	0.017	0.0172	0.0171	0.0172	0.017
FD	0.0172	0.0174	0.0174	0.0174	0.0177
FE	0.0173	0.0174	0.0175	0.0173	0.0173

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.0696E-06	29	1.40331E-07	13.6686073	5.6514E-26	1.56207098
Within groups	0.000001232	120	1.02667E-08			
Total	5.3016E-06	149				
within-sd	0.0001013					
effective n	4.00					
s_bb	0.0001803					
s_bb_min	1.82E-05					
u_bb	0.0001803					
u_bb(rel.)	1.047410486					

Vanadium:

	mass fraction in mg/kg				
Sample	1	2	3	4	5
AA	143.6	144.97	145.04	144.65	143.98
AB	144	143.98	145.07	144.67	144.75
AC	143.41	145.08	145.47	145.79	145.35
AD	142.24	143.77	142.9	144.37	142.36
AE	142.74	144.5	143.64	143.98	143.44
BA	141.59	142.7	142.84	144.13	142.89
BB	144.8	145.83	145.05	145.17	146.05
BC	145.7	145.69	145.92	146.96	144.94
BD	142.86	144.53	143.15	143.98	142.36
BE	144.37	145.33	145.49	144.57	145.4
CA	143.53	143.61	144.92	144.7	145.52
CB	142.18	143.26	143.83	144.42	143.41
CC	143.33	144.17	146.36	144.33	146.64
CD	143.76	144.7	145.32	145.14	144.64
CE	142.55	142.01	142.27	142.17	142.93
DA	142.28	144	142.63	142.47	142.85
DB	143.67	144.19	143.64	144.71	145.85
DC	144.13	143.89	146.31	145	145.66
DD	143.18	144.94	144.14	145.92	145.66
DE	142.27	144.66	143.14	141.46	142.38
EA	142.74	143.44	142.6	143.29	143.23
EB	142.68	145.09	144.79	143.87	142.37
EC	142.52	142.48	143.17	142.3	143.72
ED	143.82	144.87	145.86	143.99	145.27
EE	144.21	144.58	145.24	144.36	145.38
FA	142.54	143.67	143.21	142.76	142.33
FB	141.24	142.44	143.18	143.22	142.38
FC	142.3	143.39	142.71	144.27	142.33
FD	143.99	145.23	145.03	144.97	147.77
FE	144.03	144.8	145.16	145.15	144.01

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	149.517256	29	5.15576745	7.2006115	2.6938E-15	1.56207098
Within groups	85.92216	120	0.716018			
Total	235.439416	149				
within-sd	0.846178					
effective n	4.00					
s_bb	1.053536					
s_bb_min	0.152018					
u_bb	1.053536					
u_bb(rel.)	0.7315285					

Beryllium:

	mass fraction in mg/kg				
Sample	1	2	3	4	5
AA	4.88	4.86	4.82	4.87	4.84
AB	4.82	4.88	4.86	4.86	4.87
AC	4.9	4.86	4.85	4.82	4.85
AD	4.76	4.73	4.78	4.76	4.77
AE	4.81	4.77	4.74	4.77	4.76
BA	4.83	4.81	4.78	4.75	4.81
BB	4.91	4.87	4.9	4.89	4.87
BC	4.92	4.91	4.89	4.85	4.91
BD	4.82	4.76	4.76	4.78	4.79
BE	4.91	4.88	4.89	4.92	4.9
CA	4.89	4.89	4.84	4.85	4.85
CB	4.86	4.81	4.76	4.77	4.83
CC	4.93	4.88	4.88	4.86	4.84
CD	4.92	4.92	4.88	4.84	4.88
CE	4.82	4.81	4.8	4.81	4.8
DA	4.78	4.76	4.78	4.83	4.8
DB	4.95	4.93	4.97	4.92	4.88
DC	4.88	4.88	4.87	4.88	4.85
DD	4.91	4.85	4.86	4.83	4.85
DE	4.79	4.76	4.77	4.8	4.78
EA	4.81	4.76	4.77	4.78	4.78
EB	4.79	4.77	4.76	4.77	4.81
EC	4.82	4.8	4.78	4.79	4.75
ED	4.86	4.87	4.81	4.87	4.84
EE	4.9	4.85	4.85	4.87	4.86
FA	4.81	4.76	4.78	4.79	4.78
FB	4.83	4.81	4.78	4.78	4.76
FC	4.83	4.83	4.82	4.78	4.78
FD	4.87	4.84	4.86	4.88	4.84
FE	4.89	4.92	4.9	4.84	4.88

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.33570933	29	0.01157618	18.1444889	1.7691E-31	1.56207098
Within groups	0.07656	120	0.000638			
Total	0.41226933	149				
within-sd	0.025259					
effective n	4.00					
s_bb	0.052293					
s_bb_min	0.004538					
u_bb	0.052293					
u_bb(rel.)	1.08171291					

Calcium:

	mass fraction in mg/kg				
Sample	1	2	3	4	5
AA	19.41	19.76	19.54	19.74	19.85
AB	19.39	19.75	19.96	19.8	19.96
AC	19.58	20.04	19.7	19.89	19.57
AD	18.96	19.46	19.19	19.39	19.18
AE	19.28	19.53	19.21	19.4	19.21
BA	19.21	19.29	19.41	19.49	19.4
BB	19.87	19.88	19.93	20.19	20.18
BC	19.75	19.92	20.04	20.27	19.84
BD	19.18	19.67	19.45	19.51	19.35
BE	19.58	20.01	19.87	20.13	19.94
CA	19.39	19.6	20.06	19.7	19.98
CB	19.73	19.62	19.63	19.73	19.95
CC	19.96	19.93	20.36	21.83	20.03
CD	19.65	19.96	20.72	20	19.98
CE	19.37	19.87	20.09	19.42	19.63
DA	19.06	19.5	19.6	19.47	19.26
DB	19.82	19.76	19.91	19.96	19.84
DC	19.89	20.21	19.91	20.08	20.31
DD	19.7	19.77	20.12	19.9	19.77
DE	19.2	19.63	19.26	19.17	19.26
EA	19.01	19.28	19.48	19.28	19.74
EB	19.5	19.61	19.64	19.47	19.31
EC	19.23	19.05	19.39	19.23	19.45
ED	19.66	19.79	20.29	19.44	19.69
EE	20.07	19.69	19.69	19.72	19.86
FA	19.2	19.5	19.92	19.35	19.4
FB	19.21	19.33	19.66	19.48	19.42
FC	19.32	19.54	19.55	19.49	19.32
FD	19.48	19.95	19.93	19.83	20
FE	19.63	19.81	20.09	19.83	19.74

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	12.1763793	29	0.41987515	6.59182605	4.7837E-14	1.56207098
Within groups	7.64356	120	0.06369633			
Total	19.8199393	149				
within-sd	0.252381					
effective n	4.00					
s_bb	0.298404					
s_bb_min	0.045341					
u_bb	0.298404					
u_bb(rel.)	1.5166843					

Cadmium:

	mass fraction in mg/kg				
Sample	1	2	3	4	5
AA	38.53	38.68	38.71	38.78	38.6
AB	38.18	38.08	38.52	38.77	38.77
AC	38.25	38.47	38.54	38.56	38.38
AD	36.96	37.37	37.21	37.52	37.52
AE	36.93	37.56	36.92	37.42	37.34
BA	37.74	38.06	38.32	38.43	38.27
BB	38.66	38.59	38.57	38.81	38.71
BC	38.51	38.78	38.87	38.78	38.6
BD	37.06	37.2	36.99	37.32	37.34
BE	38.21	38.68	38.78	38.73	38.94
CA	38.56	38.59	38.87	39.16	38.89
CB	37.45	38.16	37.99	38.15	37.92
CC	38.22	38.74	38.89	38.73	39.19
CD	38.22	38.79	38.61	38.86	38.82
CE	37.2	37.43	37.41	37.49	37.85
DA	37.51	38.13	37.72	38.34	37.83
DB	38.44	38.64	38.53	38.95	38.91
DC	38.33	38.29	38.64	38.42	38.4
DD	38.08	38.35	38.54	38.56	38.63
DE	37.17	37.18	36.97	37.18	37.38
EA	37.79	37.76	37.6	38.03	38.14
EB	37.75	37.99	38.21	38	37.52
EC	37.65	37.35	37.48	37.48	37.53
ED	38.15	38.29	38.56	38.29	38.3
EE	37.8	38.13	38.1	38.08	38.38
FA	37.89	38.1	38.12	37.97	38.03
FB	37.29	37.77	37.67	37.82	37.63
FC	37.71	37.62	37.53	37.63	37.74
FD	37.84	38.28	38.26	38.51	38.92
FE	38.07	38.43	38.69	38.16	38.16

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	39.7496273	29	1.3706768	25.8009751	7.5326E-39	1.56207098
Within groups	6.375	120	0.053125			
Total	46.1246273	149				
within-sd	0.230489					
effective n	4.00					
s_bb	0.573923					
s_bb_min	0.041408					
u_bb	0.573923					
u_bb(rel.)	1.50582548					

Cobalt:

	mass fraction in mg/kg				
Sample	1	2	3	4	5
AA	9.22	9.36	9.28	9.43	9.31
AB	9.2	9.42	9.49	9.42	9.33
AC	9.44	9.49	9.34	9.43	9.45
AD	9.25	9.35	9.25	9.43	9.27
AE	9.13	9.35	9.08	9.27	9.11
BA	9.32	9.34	9.33	9.38	9.33
BB	9.45	9.36	9.45	9.49	9.4
BC	9.35	9.33	9.39	9.4	9.41
BD	9.06	9.27	9.18	9.21	9.11
BE	9.31	9.48	9.34	9.36	9.36
CA	9.42	9.34	9.51	9.44	9.46
CB	9.28	9.34	9.39	9.34	9.26
CC	9.36	9.38	9.44	9.44	9.33
CD	9.48	9.36	9.43	9.46	9.37
CE	9.39	9.14	9.12	9.2	9.24
DA	9.28	9.36	9.21	9.29	9.07
DB	9.32	9.34	9.37	9.33	9.53
DC	9.37	9.35	9.42	9.41	9.51
DD	9.31	9.34	9.43	9.47	9.41
DE	9.3	9.38	9.27	9.26	9.25
EA	9.31	9.19	9.27	9.36	9.42
EB	9.29	9.2	9.23	9.14	9.31
EC	9.18	9.33	9.36	9.29	9.22
ED	9.31	9.39	9.32	9.41	9.38
EE	9.34	9.35	9.39	9.32	9.41
FA	9.25	9.37	9.28	9.26	9.31
FB	9.21	9.33	9.25	9.23	9.27
FC	9.18	9.38	9.27	9.36	9.16
FD	9.39	9.52	9.54	9.41	9.54
FE	9.22	9.43	9.38	9.37	9.28

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.886424	29	0.03056634	5.75637379	3.0386E-12	1.56207098
Within groups	0.6372	120	0.00531			
Total	1.523624	149				
within-sd	0.07287					
effective n	4.00					
s_bb	0.079461					
s_bb_min	0.013091					
u_bb	0.079461					
u_bb(rel.)	0.85141892					

Lithium:

	mass fraction in mg/kg				
Sample	1	2	3	4	5
AA	7.37	7.43	7.45	7.24	7.39
AB	7.35	7.33	7.41	7.41	7.4
AC	7.31	7.48	7.37	7.37	7.32
AD	7.21	7.29	7.25	7.32	7.23
AE	7.21	7.29	7.25	7.28	7.24
BA	7.37	7.43	7.44	7.5	7.44
BB	7.37	7.41	7.42	7.43	7.44
BC	7.32	7.41	7.41	7.42	7.4
BD	7.2	7.25	7.23	7.3	7.26
BE	7.27	7.39	7.38	7.37	7.41
CA	7.4	7.38	7.45	7.45	7.51
CB	7.31	7.37	7.37	7.43	7.4
CC	7.29	7.37	7.49	7.37	7.46
CD	7.26	7.37	7.38	7.41	7.39
CE	7.26	7.27	7.25	7.23	7.32
DA	7.48	7.43	7.39	7.39	7.35
DB	7.37	7.33	7.37	7.49	7.44
DC	7.35	7.33	7.41	7.36	7.39
DD	7.27	7.31	7.35	7.41	7.34
DE	7.24	7.31	7.22	7.24	7.27
EA	7.33	7.35	7.42	7.38	7.45
EB	7.33	7.39	7.41	7.38	7.36
EC	7.34	7.28	7.33	7.32	7.31
ED	7.29	7.28	7.38	7.27	7.33
EE	7.3	7.32	7.32	7.29	7.38
FA	7.32	7.4	7.44	7.36	7.35
FB	7.24	7.32	7.38	7.39	7.35
FC	7.27	7.34	7.36	7.33	7.33
FD	7.27	7.34	7.35	7.33	7.48
FE	7.32	7.33	7.37	7.35	7.32

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.414904	29	0.014307034	5.95134546	1.1285E-12	1.56207098
Within groups	0.28848	120	0.002404			
Total	0.703384	149				
within-sd	0.0490306					
effective n	4.00					
s_bb	0.05455051					
s_bb_min	0.00880845					
u_bb	0.05455051					
u_bb(rel.)	0.742062716					

Sodium:

	mass fraction in mg/kg				
Sample	1	2	3	4	5
AA	11.7	11.82	11.83	11.42	11.68
AB	11.29	11.23	11.52	11.46	11.41
AC	10.82	11.11	10.89	10.87	10.81
AD	10.14	10.39	10.26	10.26	10.37
AE	9.68	9.8	9.62	9.78	9.67
BA	11.59	11.64	11.6	11.68	11.31
BB	10.87	11.07	10.92	11	11.03
BC	10.7	11.02	11.05	10.98	10.8
BD	9.56	9.62	9.56	9.58	9.65
BE	10.26	10.47	10.59	10.62	10.63
CA	11.61	11.65	11.83	11.86	11.99
CB	11.32	11.29	11.24	11.44	11.44
CC	10.66	10.88	11.17	10.95	11.01
CD	10.28	10.54	10.82	10.54	10.61
CE	9.65	9.82	9.61	9.63	9.72
DA	11.37	11.81	11.87	11.83	11.54
DB	11.31	11.26	11.2	11.5	11.35
DC	10.89	10.96	10.96	10.87	11.29
DD	10.33	10.37	10.58	10.66	10.5
DE	9.58	9.77	9.44	9.54	9.59
EA	11.46	11.46	11.56	11.56	11.84
EB	11.21	11.45	11.5	11.28	11.4
EC	10.85	10.66	10.75	10.74	10.74
ED	10.34	10.25	10.7	10.46	10.41
EE	10.16	9.65	9.62	9.66	9.94
FA	11.53	11.62	11.96	11.54	11.5
FB	11.04	11.3	11.26	11.3	11.14
FC	10.73	10.91	10.88	10.77	10.85
FD	10.35	10.49	10.56	10.6	10.87
FE	9.81	9.88	9.98	9.87	9.87

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	69,106024	29	2,38296634	117,514861	1,0017E-74	1,56207098
Within groups	2,43336	120	0,020278			
Total	71,539384	149				
within-sd	0,142401					
effective n	4,00					
s_bb	0,768552					
s_bb_min	0,025583					
u_bb	0,768552	768,5519				
u_bb(rel.)	7,11701246					

Antimony:

	mass fraction in mg/kg				
Sample	1	2	3	4	5
AA	111.08	111.88	113.56	113.03	114.1
AB	112.8	111.55	113.78	114.81	114.47
AC	113.65	115.85	113.88	115.16	112.48
AD	108.46	111.79	108.91	107.83	109.3
AE	108.83	108.93	107.6	110.03	110.05
BA	111.06	110.13	111.93	110.99	109.02
BB	115.69	115.43	114.68	115.54	114.62
BC	114.73	114.21	113.63	115.37	115.74
BD	108.17	109.17	109.76	107.64	110.09
BE	112.45	115.13	115.1	116.07	115.14
CA	112.41	113.35	115.63	113.54	112.2
CB	108.12	111.49	111.76	113.63	110.12
CC	114.61	113.89	111.88	115.68	115.8
CD	115.02	115.07	115.73	115.35	114.89
CE	106.67	110.67	110.25	112.89	109.76
DA	108.46	108.34	111.11	111.71	109.4
DB	112.73	115.21	115.78	114.51	116.05
DC	113.27	115.47	113.3	115.35	114.4
DD	113.24	114.88	113.86	112.5	113.28
DE	109.81	107.24	111.21	110.28	111.91
EA	112.26	108.12	112.64	111.7	112.49
EB	109.03	107.54	108.3	109.42	107.71
EC	109.34	110.55	111.75	109.67	111.87
ED	112.72	114.46	114.89	112.32	115.11
EE	115.66	115.6	113.53	112.51	116.71
FA	109.2	110.2	111	109.09	112
FB	109.33	111.32	111.08	108.94	112.4
FC	109.73	108.38	110	109.76	111.58
FD	112.04	114.75	113.75	113.66	113.58
FE	113.22	111.95	113.99	116.25	115.07

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	741.200037	29	25.558622	13.8705863	3.0038E-26	1.56207098
Within groups	221.11788	120	1.842649			
Total	962.317917	149				
within-sd	1.357442					
effective n	4.00					
s_bb	2.434952					
s_bb_min	0.243867					
u_bb	2.434952					
u_bb(rel.)	2.16926387					

Zirconium:

	mass fraction in %				
Sample	1	2	3	4	5
AA	0.0031	0.0031	0.0031	0.0031	0.0031
AB	0.0031	0.0031	0.0031	0.003	0.003
AC	0.0031	0.0031	0.0031	0.0031	0.0031
AD	0.003	0.003	0.003	0.003	0.003
AE	0.0031	0.0031	0.0031	0.003	0.003
BA	0.003	0.003	0.003	0.003	0.003
BB	0.0031	0.0031	0.0031	0.0031	0.0031
BC	0.0031	0.0032	0.0031	0.0031	0.0031
BD	0.0031	0.003	0.003	0.003	0.003
BE	0.0031	0.0031	0.0031	0.0031	0.0031
CA	0.0031	0.0031	0.003	0.003	0.003
CB	0.003	0.003	0.003	0.003	0.003
CC	0.0031	0.0031	0.0031	0.0031	0.0031
CD	0.0031	0.0031	0.0031	0.0031	0.0031
CE	0.0031	0.003	0.003	0.003	0.003
DA	0.003	0.003	0.003	0.003	0.003
DB	0.0031	0.0031	0.0031	0.0031	0.0031
DC	0.0031	0.0031	0.0031	0.0031	0.0031
DD	0.0031	0.0031	0.003	0.0031	0.0031
DE	0.003	0.003	0.003	0.003	0.003
EA	0.003	0.003	0.003	0.003	0.003
EB	0.003	0.0031	0.003	0.003	0.003
EC	0.003	0.003	0.003	0.003	0.003
ED	0.0031	0.0031	0.0031	0.0031	0.0031
EE	0.0031	0.0031	0.0031	0.0031	0.0031
FA	0.003	0.003	0.003	0.003	0.003
FB	0.003	0.003	0.003	0.003	0.003
FC	0.003	0.003	0.003	0.0031	0.003
FD	0.0031	0.0031	0.0031	0.0031	0.0031
FE	0.0031	0.0031	0.0031	0.0031	0.0031

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Unterschied	3.07733E-07	29	1.06115E-08	15.1592775	6.1627E-28	1.56207098
Innerhalb de	8.4E-08	120	7E-10			
Gesamt	3.91733E-07	149				
within-s	2.64575E-05					
effective	4.00					
s_bb	4.97782E-05					
s_bb_min	4.75315E-06					
u_bb	4.97782E-05					
u_bb(rel	1.629580223					

Annex 2: Calculation of uncertainty contribution of potential inhomogeneity (area)

Silicon:

r_0	0.146750275	0.153249725														
r_in	0.149	0.149	0.149	0.147	0.15	0.149	0.149	0.149								
r_middle	0.149	0.152	0.151	0.152	0.151	0.153	0.153	0.153	0.151	0.152	0.151	0.152				
r_out	0.147	0.146	0.148	0.147	0.149	0.146	0.148	0.149	0.149	0.147	0.146	0.149	0.148	0.148	0.149	0.147

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.000111231	3	3.70771E-05	20.97520118	7.16703E-08	2.882604204
Within groups	6.01006E-05	34	1.76766E-06			
Total	0.000171332	37				

within-sd	0.001329535
effective n	8.56
s_bb	0.002030827
s_bb_min	0.000223777
u_bb	0.002030827
u_bb(rel.)	1.358680312

Iron:

r_0	0.389096219	0.412903781														
r_in	0.407	0.408	0.405	0.408	0.402	0.412	0.398	0.407								
r_middle	0.407	0.408	0.402	0.404	0.413	0.414	0.408	0.406	0.415	0.412	0.411	0.409				
r_out	0.407	0.399	0.404	0.4	0.404	0.4	0.4	0.402	0.403	0.406	0.401	0.406	0.404	0.399	0.394	0.399

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.000406787	3	0.000135596	6.048683093	0.002048007	2.882604204
Within groups	0.000762192	34	2.24174E-05			
Total	0.001168979	37				

within-sd	0.004734702
effective n	8.56
s_bb	0.003635877
s_bb_min	0.000796908
u_bb	0.003635877
u_bb(rel.)	0.896445441

Copper:

r_0	0.103263356	0.108536644														
r_in	0.106	0.1063	0.1059	0.1073	0.1077	0.107	0.1066	0.1061								
r_middle	0.1093	0.1075	0.1081	0.1076	0.1084	0.1078	0.1078	0.1068	0.1092	0.1086	0.109	0.108				
r_out	0.1064	0.1047	0.1042	0.1053	0.1062	0.1061	0.1057	0.1072	0.1063	0.1062	0.106	0.105	0.106	0.1051	0.1078	0.1049

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.98299E-05	3	1.32766E-05	12.46996952	1.17091E-05	2.882604204
Within groups	3.61994E-05	34	1.06469E-06			
Total	7.60293E-05	37				

within-sd	0.001031837
effective n	8.56
s_bb	0.001194318
s_bb_min	0.000173671
u_bb	0.001194318
u_bb(rel.)	1.117998087

Manganese:

r_0	0.786694255	0.813305745														
r_in	0.807	0.81	0.803	0.806	0.809	0.81	0.807	0.8								
r_middle	0.801	0.805	0.811	0.804	0.803	0.805	0.804	0.813	0.807	0.808	0.812	0.811				
r_out	0.807	0.804	0.801	0.803	0.806	0.8	0.801	0.802	0.802	0.795	0.804	0.804	0.81	0.809	0.796	0.794

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.000219513	3	7.31711E-05	2.669800858	0.063073573	2.882604204
Within groups	0.000931836	34	2.74069E-05			
Total	0.001151349	37				

within-sd	0.005235163
effective n	8.56
s_bb	0.002312012
s_bb_min	0.000881141
u_bb	0.002312012
u_bb(rel.)	0.28725893

Magnesium:

r_0	4.886219196	5.089780804														
r_in	5.091	5.075	5.082	5.085	5.159	5.134	5.121	5.08								
r_middle	5.059	5.155	5.153	5.114	5.116	5.112	5.109	5.087	5.169	5.166	5.101	5.123				
r_out	5.108	5.068	5.09	5.089	5.108	5.133	5.1	5.074	5.09	5.128	5.046	5.023	5.082	5.107	5.032	5.041

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.03471703	3	0.011572343	7.029771613	0.00083924	2.882604204
Within groups	0.055970477	34	0.00164619			
Total	0.090687506	37				

within-sd	0.040573273
effective n	8.56
s_bb	0.034050069
s_bb_min	0.006828972
u_bb	0.034050069
u_bb(rel.)	0.667941161

Chromium:

r_0	0.13951883	0.14528117														
r_in	0.1421	0.1404	0.1405	0.1397	0.1409	0.141	0.1423	0.1414								
r_middle	0.1413	0.1411	0.1406	0.1396	0.1403	0.1401	0.1401	0.141	0.142	0.1407	0.1404	0.141				
r_out	0.1433	0.1422	0.1426	0.1425	0.1416	0.1425	0.1417	0.1397	0.1413	0.1422	0.1405	0.142	0.1428	0.1425	0.1408	0.1416

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.2521E-05	3	4.17368E-06	3.580277281	0.023691996	2.882604204
Within groups	3.96352E-05	34	1.16574E-06			
Total	5.21562E-05	37				

within-sd	0.001079695
effective n	8.56
s_bb	0.000592737
s_bb_min	0.000181726
u_bb	0.000592737
u_bb(rel.)	0.419557946

Nickel:

r_0	0.009378735	0.010221265														
r_in	0.01	0.0097	0.0098	0.0098	0.0099	0.01	0.0098	0.0098								
r_middle	0.0101	0.0101	0.0102	0.0101	0.0101	0.0103	0.0101	0.0103	0.0098	0.0098	0.01	0.0101				
r_out	0.0097	0.0096	0.0096	0.0097	0.0101	0.0098	0.0098	0.0097	0.0097	0.0097	0.0096	0.0095	0.0095	0.0097	0.0099	0.0097

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	9.84748E-07	3	3.28249E-07	10.72122404	4.14291E-05	2.882604204
Within groups	1.04097E-06	34	3.06168E-08			
Total	2.02572E-06	37				

within-sd	0.000174976
effective n	8.56
s_bb	0.000186452
s_bb_min	2.94507E-05
u_bb	0.000186452
u_bb(rel.)	1.887281159

Zinc:

r_0	0.070263997	0.075736003														
r_in	0.075	0.075	0.074	0.074	0.076	0.076	0.075	0.074								
r_middle	0.075	0.075	0.077	0.076	0.075	0.075	0.076	0.075	0.077	0.076	0.076	0.075				
r_out	0.075	0.074	0.074	0.075	0.075	0.077	0.075	0.075	0.075	0.075	0.073	0.074	0.074	0.075	0.074	0.074

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.54715E-05	3	5.15716E-06	4.582576662	0.00845201	2.882604204
Within groups	3.82631E-05	34	1.12539E-06			
Total	5.37346E-05	37				

within-sd	0.001060842
effective n	8.56
s_bb	0.00068624
s_bb_min	0.000178552
u_bb	0.00068624
u_bb(rel.)	0.914986298

Titanium:

r_0	0.055489723	0.057710277														
r_in	0.057	0.0559	0.0561	0.0564	0.0558	0.0562	0.0561	0.0563								
r_middle	0.0554	0.0556	0.056	0.0561	0.0555	0.0556	0.0554	0.0555	0.0555	0.0556	0.056	0.0561				
r_out	0.0566	0.0568	0.057	0.0568	0.0566	0.0572	0.0566	0.0572	0.0563	0.0569	0.0559	0.0569	0.0565	0.057	0.057	0.0569

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	8.08807E-06	3	2.69602E-06	15.36171146	1.73976E-06	2.882604204
Within groups	5.9671E-06	34	1.75503E-07			
Total	1.40552E-05	37				

within-sd	0.000418931
effective n	8.56
s_bb	0.000542591
s_bb_min	7.05111E-05
u_bb	0.000542591
u_bb(rel.)	0.964808136

Lead:

r_0	0.01020025	0.01119975														
r_in	0.0112	0.0111	0.0113	0.0113	0.0111	0.0111	0.0109	0.0114								
r_middle	0.0111	0.0113	0.0114	0.0114	0.0112	0.0113	0.0111	0.0113	0.0113	0.0114	0.0112	0.0114				
r_out	0.0109	0.0108	0.0108	0.0108	0.0108	0.0109	0.011	0.0109	0.0109	0.0112	0.0113	0.0111	0.011	0.0109	0.011	0.0112

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.0437E-06	3	3.47898E-07	9.97733412	7.30027E-05	2.882604204
Within groups	1.18554E-06	34	3.48689E-08			
Total	2.22924E-06	37				

within-sd	0.000186732
effective n	8.56
s_bb	0.000191214
s_bb_min	3.14293E-05
u_bb	0.000191214
u_bb(rel.)	1.721738121

Tin:

r_0	0.010273875	0.012926125														
r_in	0.0122	0.0117	0.0121	0.0119	0.0123	0.0124	0.0124	0.0126								
r_middle	0.0118	0.0127	0.0129	0.0127	0.0122	0.0133	0.0123	0.0123	0.0125	0.0124	0.0119	0.0131				
r_out	0.0125	0.0121	0.0121	0.0125	0.0125	0.0128	0.0122	0.0117	0.0124	0.0127	0.0114	0.0112	0.0125	0.0122	0.0114	0.0123

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.8062E-06	3	6.02065E-07	2.062332792	0.123586021	2.882604204
Within groups	9.92576E-06	34	2.91934E-07			
Total	1.1732E-05	37				

within-sd	0.000540309
effective n	8.56
s_bb	0.000190327
s_bb_min	9.09406E-05
u_bb	0.000190327
u_bb(rel.)	1.551825952

Gallium:

r_0	0.01416922	0.01503078														
r_in	0.0149	0.0148	0.0148	0.0149	0.015	0.0149	0.0148	0.0152								
r_middle	0.0149	0.0148	0.015	0.015	0.0148	0.0149	0.015	0.0148	0.015	0.0148	0.0147	0.0147				
r_out	0.0145	0.0146	0.0147	0.0146	0.0147	0.0148	0.0145	0.0142	0.0146	0.0146	0.0146	0.0148	0.0146	0.0146	0.0146	0.0146

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	7.79583E-07	3	2.59861E-07	9.535574942	0.000103108	2.882604204
Within groups	9.2656E-07	34	2.72518E-08			
Total	1.70614E-06	37				

within-sd	0.000165081
effective n	8.56
s_bb	0.000164832
s_bb_min	2.77851E-05
u_bb	0.000164832
u_bb(rel.)	1.116168614

Vanadium:

r_0	0.01138735	0.01201265														
r_in	0.0117	0.0116	0.0116	0.0116	0.0117	0.0117	0.0118	0.0117								
r_middle	0.0118	0.0118	0.0116	0.0116	0.0117	0.0117	0.0116	0.0117	0.0119	0.0117	0.0118	0.0118				
r_out	0.0118	0.0118	0.0119	0.0118	0.0118	0.0118	0.0118	0.0117	0.0119	0.0119	0.0118	0.0118	0.0121	0.0121	0.0119	0.012

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.61809E-07	3	8.72697E-08	5.626302067	0.003048266	2.882604204
Within groups	5.27375E-07	34	1.5511E-08			
Total	7.89184E-07	37				

within-sd	0.000124543
effective n	8.56
s_bb	9.15514E-05
s_bb_min	2.09621E-05
u_bb	9.15514E-05
u_bb(rel.)	0.77955081

Beryllium:

r_0	0.000604405	0.000635595														
r_in	0.00061	0.00062	0.00061	0.00062	0.00062	0.00062	0.00062	0.00062								
r_middle	0.00062	0.00062	0.00063	0.00063	0.00063	0.00063	0.00063	0.00062	0.00063	0.00063	0.00063	0.00063				
r_out	0.00062	0.00061	0.00061	0.00061	0.00061	0.00062	0.00061	0.00062	0.00062	0.00062	0.00062	0.00062	0.00062	0.00061	0.00062	0.00061

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.03125E-09	3	3.4375E-10	9.3114241	0.000123173	2.882604204
Within groups	1.25518E-09	34	3.6917E-11			
Total	2.28643E-09	37				

within-sd	6.07594E-06
effective n	8.56
s_bb	5.98658E-06
s_bb_min	1.02265E-06
u_bb	5.98658E-06
u_bb(rel.)	0.96466162

Calcium:

r_0	0.001880379	0.002019621														
r_in	0.00198	0.00197	0.00196	0.00199	0.00199	0.00197	0.00197	0.00197								
r_middle	0.00201	0.002	0.00199	0.002	0.002	0.002	0.00201	0.00199	0.00203	0.00199	0.00202	0.002				
r_out	0.00202	0.00197	0.00191	0.00193	0.00196	0.00197	0.00199	0.00198	0.00197	0.00196	0.00196	0.00195	0.00195	0.00193	0.00199	0.00194

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.37794E-08	3	4.59313E-09	6.749943624	0.001077676	2.882604204
Within groups	2.3136E-08	34	6.80469E-10			
Total	3.69153E-08	37				

within-sd	2.60858E-05
effective n	8.56
s_bb	2.13778E-05
s_bb_min	4.39056E-06
u_bb	2.13778E-05
u_bb(rel.)	1.079848599

Cadmium:

r_0	33.28202784	47.53797216														
r_in	39.69	36.48	40.76	37.47	42.69	41.19	41.49	42.9								
r_middle	39.32	38.6	38.33	37.45	41.14	43.42	36.13	41.91	38.03	42.49	38.82	38.61				
r_out	40.94	39.45	33.19	39.06	37.68	37.23	38.21	40.51	42.05	37.21	38.27	41.62	40.52	37.56	37.45	37.33

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	18.33477873	3	6.111592909	0.780017024	0.5133391	2.882604204
Within groups	266.3969535	34	7.835204513			
Total	284.7317322	37				

within-sd	2.799143532
effective n	8.56
s_bb	0
s_bb_min	0.47112967
u_bb	0.47112967
u_bb(rel.)	1.19259126

Cobalt:

r_0	6.902484465	18.93751554														
r_in	12.69	16.18	14.3	16.82	15.86	10.84	16.31	13.35								
r_middle	16.46	16.94	13.22	16.57	14.45	13.72	14.99	12.08	17.56	12.93	15.31	13.3				
r_out	14.46	15.91	13.94	12.51	13.89	13.54	14.73	10.96	10.91	14.49	17.53	12.63	14.7	12.01	14.54	12.52

reuungsursac	*dratsummen (*	*heitsgrade (e*	*Quadratsum*	*rüfgröße (F)*	*P-Wert*	*tischer F-Wert*
Unterschiede	12.37903498	3	4.126344993	0.759078023	0.52487993	2.882604204
Innerhalb de	184.8238593	34	5.435995863			
Gesamt	197.2028943	37				

within-sd	2.33152222
effective n	8.56
s_bb	0
s_bb_min	0.392423354
u_bb	0.392423354
u_bb(rel.)	2.749761765

Lithium:

r_0	0.000889333	0.000930667														
r_in	0.00091	0.00091	0.00092	0.00092	0.00092	0.00092	0.00092	0.00091								
r_middle	0.00091	0.00091	0.00091	0.00093	0.0009	0.00092	0.00091	0.00091	0.00092	0.00092	0.00092	0.00091				
r_out	0.00091	0.0009	0.00092	0.00091	0.00091	0.0009	0.0009	0.00091	0.00092	0.00092	0.00091	0.00091	0.0009	0.00092	0.00091	0.00091

reuungsursac	*dratsummen (*	*heitsgrade (e*	*Quadratsum*	*rüfgröße (F)*	*P-Wert*	*tischer F-Wert*
Unterschiede	2.57675E-10	3	8.58918E-11	1.152704373	0.342005522	2.882604204
Innerhalb de	2.53345E-09	34	7.45133E-11			
Gesamt	2.79113E-09	37				

within-sd	8.63211E-06
effective n	8.56
s_bb	1.15284E-06
s_bb_min	1.45289E-06
u_bb	1.45289E-06
u_bb(rel.)	0.159143683

Sodium:

r_0	0.001229289	0.001370711														
r_in	0.0012	0.0012	0.0012	0.0012	0.0012	0.0013	0.0012	0.0012								
r_middle	0.0012	0.0012	0.0012	0.0013	0.0012	0.0012	0.0013	0.0012	0.0012	0.0013	0.0012	0.0013				
r_out	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.16886E-08	3	7.22953E-09	5.412200225	0.003741239	2.882604204
Within groups	4.54167E-08	34	1.33578E-09			
Total	6.71053E-08	37				

within-sd	3.65484E-05
effective n	8.56
s_bb	2.62376E-05
s_bb_min	6.15153E-06
u_bb	2.62376E-05
u_bb(rel.)	2.149582476

Antimony:

r_0	0.002182511	0.007217489														
r_in	0.0044	0.0049	0.0042	0.0037	0.0028	0.0039	0.0038	0.0045								
r_middle	0.0033	0.0029	0.0048	0.0049	0.0036	0.0029	0.002	0.0051	0.0033	0.0037	0.003	0.002				
r_out	0.0034	0.0044	0.0031	0.0058	0.0025	0.0046	0.0043	0.0042	0.0048	0.0046	0.0053	0.0036	0.0045	0.0033	0.0031	0.0046

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.57514E-06	3	1.52505E-06	1.326330389	0.281911801	2.882604204
Within groups	3.9094E-05	34	1.14982E-06			
Total	4.36692E-05	37				

within-sd	0.001072299
effective n	8.56
s_bb	0.00020935
s_bb_min	0.000180481
u_bb	0.00020935
u_bb(rel.)	5.323774029

Zirconium:

r_0	0.00343656	0.00456344														
r_in	0.0036	0.0038	0.0038	0.0039	0.0038	0.0038	0.0042	0.0041								
r_middle	0.0038	0.0039	0.0039	0.0039	0.0039	0.004	0.0037	0.0041	0.0041	0.0038	0.004	0.0039				
r_out	0.0038	0.0041	0.0038	0.004	0.0043	0.0042	0.0038	0.0041	0.0039	0.004	0.0041	0.004	0.004	0.0037	0.0042	0.0041

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.13958E-07	3	3.79861E-08	0.875036464	0.463621824	2.882604204
Within groups	1.47597E-06	34	4.34109E-08			
Total	1.58993E-06	37				

within-sd	0.000208353
effective n	8.56
s_bb	0
s_bb_min	3.50683E-05
u_bb	3.50683E-05
u_bb(rel.)	0.889128983

Mercury:

r_0	35.32956735	40.97043265														
r_in	37.93	39.17	38.78	37.76	39.88	39.41	40.19	40.04								
r_middle	38.26	40.96	37.77	38.31	39.24	38.8	40.58	40.65	39.12	38.79	39.88	39.1				
r_out	36.63	37.28	38.42	37.46	37.04	38.37	38.22	38.19	37.5	38.25	36.66	39.58	39.04	38.84	38.72	38.63

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	13.04487643	3	4.348292142	3.303605497	0.031770263	2.882604204
Within groups	44.75169113	34	1.31622621			
Total	57.79656756	37				

within-sd	1.147269022
effective n	8.56
s_bb	0.595109437
s_bb_min	0.193099235
u_bb	0.595109437
u_bb(rel.)	1.539247852