Certification Report

Certified Reference Materials

BAM-M394/-394a

CuZn40Pb2

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Summary

This report describes preparation, analysis and certification of two copper based reference materials (alloy CuZn40Pb2) BAM-M394 and BAM-M394a.
The certified reference materials (CRM) are available in the form of discs (40 mm diameter and 30 mm height). They are intended for establishing and checking the calibration of spark optical emission and X-ray fluorescence spectrometers for the analysis of samples of similar materials. They are also suitable for wet chemical analysis.

The following mass fractions and uncertainties have been certified:

BAM-M394

Element	Mass fraction [1)] in %	Uncertainty [2)] in %
Cu	57.70	0.19
Pb	1.93	0.04
Fe	0.1191	0.0024
Sn	0.232	0.006
	in mg/kg	**in mg/kg**
As	100.1	2.6
Bi	8.1	0.9
Cd	7.0	0.4
Mn	14.1	0.7
Ni	399	8
P	15.7	1.2
Sb	23.8	1.3

1) Unweighted mean value of the means of accepted sets of data (consisting of at least 5 but usually 6 single results), each set being obtained by a different laboratory and/or a different method of measurement.

2) Estimated expanded uncertainty *U* with a coverage factor of k = 2, corresponding to a level of confidence of approx. 95 %, as defined in the Guide to the expression of uncertainty in measurement, (GUM, ISO/IEC Guide 98-3:2008).

BAM-M394a

Element	Mass fraction [1)] in %	Uncertainty [2)] in %
Cu	57.64	0.17
Pb	1.92	0.04
Fe	0.1323	0.0026
Sn	0.174	0.006
	in mg/kg	**in mg/kg**
As	95.9	1.6
Bi	8.3	1.0
Cd	7.3	0.6
Cr	1.3	0.3
Mn	12.5	0.7
Ni	386	7
P	17.2	1.6
Sb	24.1	1.0

1) Unweighted mean value of the means of accepted sets of data (consisting of at least 5 but usually 6 single results), each set being obtained by a different laboratory and/or a different method of measurement.

2) Estimated expanded uncertainty *U* with a coverage factor of *k* = 2, corresponding to a level of confidence of approx. 95 %, as defined in the Guide to the expression of uncertainty in measurement, (GUM, ISO/IEC Guide 98-3:2008).

The certified values are based on the results of 11 laboratories which participated in the certification interlaboratory comparison.

Content

List of abbreviations
(if not explained elsewhere)

CRM	certified reference material
ETAAS	electrothermal atomic absorption spectrometry
FAAS	flame atomic absorption spectrometry
ICP-OES	inductively coupled plasma optical emission spectrometry
ICP-MS	inductively coupled plasma mass spectrometry
GD-MS	glow discharge 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
I	ICP-OES (Tables 3 – 31)
I(R)	ICP-OES, revised value (Tables 3 – 31)
IMS	ICP-MS (Tables 3 – 31)
A	FAAS (Tables 3 – 31)
EA	ETAAS (Tables 3 – 31)
EG	electrogravimetry (Tables 3 – 31)
P	spectrophotometry (Tables 3 – 31)
G	gravimetry (Tables 3 – 31)
GD	GD-MS (Tables 3 – 31)

1. Introduction

In the metal-producing and metal-working industry mainly spark optical 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 alloy CuZn40Pb2 is still used in drinking water applications. The idea to produce a corresponding reference material was the outcome of discussions within the German Gesellschaft der Metallurgen und Bergleute e.V. (GDMB), especially of the working group „Copper" of the Committee of Chemists within GDMB. The needs are defined by this working group, since the members are potential users of the prepared CRMs. Participating laboratories were recruited from this group. Since all of these laboratories are highly experienced with copper and brass analysis and had participated in earlier inter-laboratory comparisons, there was no preceding round for qualification.

Certification of reference materials BAM-M394 and BAM-M394a was carried out on the basis of the relevant ISO-Guides [1-3], and the „Guidelines for the development and production of BAM Reference Materials" [4].

2. Companies/laboratories involved

Manufacturing of the material

- Wieland-Werke AG, Vöhringen, Germany

Test for homogeneity

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

Participants in the certification inter-laboratory comparison

- Aurubis AG, Hamburg, Germany
- Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany
- Diehl Metall Stiftung & Co KG, Röthenbach, Germany
- Institut für Materialprüfung Glörfeld GmbH, Willich, Germany
- Institute of Non-Ferrous Metals, Gliwice, Poland
- KM Europa Metal AG, Osnabrück, Germany
- KME Brass Germany GmbH, Berlin, Germany
- TU Bergakademie Freiberg, Freiberg, Germany
- Umicore AG & Co KG., Hanau, Germany
- VDM-Metals GmbH, Werdohl, Germany
- Wieland-Werke AG, Vöhringen, Germany

Statistical evaluation of the data

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

3. Candidate material

CuZn40Pb2 was taken from the routine production process within Wieland-Werke AG, Vöhringen. From the raw material rods were cast by Wieland-Werke. After solidification the material was pressed to rods with a diameter of ca. 40 mm. In total eight rods of 4 m length each were produced. These rods were investigated for homogeneity. As a result, it was decided to use rods 1 and 6 as future CRM 394a and rods 4 and 5 as future CRM 394 because for the content of some elements the eight rods were not identical. Rods 2, 3, 7 and 8 were discarded. Rods 1 and 4 were cut in discs (33 mm high) completely (Rod 1: discs 1 to 111, Rod 4: discs 1 to 114). Rods 5 and 6 were cut in 60 cm segments, samples for homogeneity testing were taken between the segments.

About 240 discs of BAM-M394 and 240 discs of BAM-M394a with a diameter of approx. 40 mm and 30 mm were obtained from the total batch.

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 rods, concentration gradients can occur over the length of the rod (axial) as well as over the area of the rod (radial, see Figures 1 and 2):

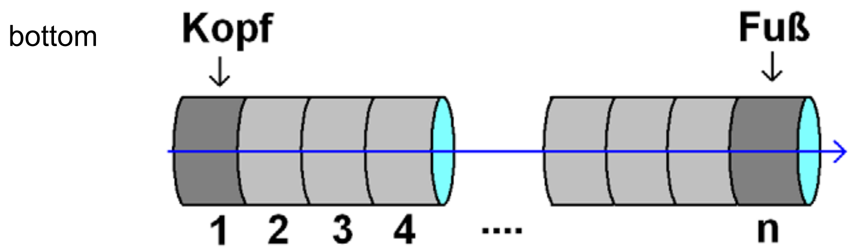

Figure 1: Axial composition gradient

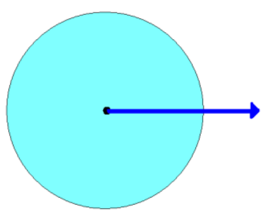

Figure 2: Radial composition gradient

Therefore it is necessary to investigate the raw material for both axial and radial inhomogeneities.

Homogeneity testing of the raw material was performed using SOES and XRF on the discs listed in Tables 1a-d. XRF can only be used for homogeneity testing over the length of the rods because the area used for measurement is too big to investigate possible segregation over the area of the discs. Therefore only SOES was used for homogeneity testing over the area of the discs. For some trace elements XRF was not sensitive enough, therefore only main and minor elements (Cu, Pb, Fe, Sn, Ni and As) were investigated using this technique. The advantage of XRF is the possibility to distinguish between the spread of results coming from inhomogeneity of the material and spread coming from the analytical method. This is done by subtracting the variance of the instrumental spread from the variances resulting from inhomogeneities. The contribution coming from the analytical method was determined by measuring ten times the same sample. This approach was used for inhomogeneity investigation over the length of the rods for the elements mentioned above. The results of these measurements are given in Annex 1 and Annex 2.

Tab. 1a: Discs analysed for homogeneity testing of BAM-M394 (XRF)

4-1	4-20	4-21	4-40	4-41	4-60	4-61	4-80	4-97	4-114
5F	5A-B	5B-C	5C-D	5D-E	5E-F	5K			

Tab. 1b: Discs analysed for homogeneity testing of BAM-M394a (XRF)

1-1	1-18	1-19	1-38	1-39	1-60	1-61	1-80	1-97	1-111
6F	6A-B	6B-C	6C-D	6D-E	6E-F	6K			

Tab. 1c: Discs analysed for homogeneity testing of BAM-M394 (SOES)

4-1	4-41	4-62	4-80	4-113
5A-B	5B-C	5C-D	5K	5-2

Tab. 1d: Discs analysed for homogeneity testing of BAM-M394a (SOES)

1-1	1-19	1-38	1-79	1-110
6A-B	6C-D	6D-E	6F	6-2

After evaluation of the homogeneity data it was decided to remove rod 8 since the Fe-content in rod 8 was slightly lower than in rods 4 and 5.
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):

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

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

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} 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, two discs from the whole batch (1-60, 4-60) 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: 12 sparks, inner circle: 8 sparks; centre: 1 spark). These investigations showed that the lead mass fractions in the centre of the discs were lower than in other regions. Therefore the centres of the discs are not suitable for spark emission. It is mentioned on the certificates that sparking in the centre has to be avoided.

The analyte-specific within-disc 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) and r_out (outer circle). As results from these calculations an inhomogeneity factor for the radius and one for the height 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 3 shows the results of the calculations.

For the element lead an inhomogeneity in the centre of the discs was observed. Therefore the centres of the discs are not suitable for analysis. A respective note is given in the certificates of BAM-M394 and BAM-M394a.

5. Characterisation study

5.1 Analytical methods

11 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 their determinations. Table 2 shows the analytical methods used by the participating laboratories.
For all analytical methods where a calibration was necessary this 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 2: Analytical procedures used by the participating laboratories

Lab-No.	Element.	Sample mass	Sample pretreatment	Analytical method
1	Al, As, Cd, Fe, Mn, Ni, P, Si, Sn	1 g	Dissolution with HCl, HNO_3, H_3BO_3, HF (microwave)	ICP-OES, calibration with commercial solutions (Merck)
	Cu, Pb	1 g	Dissolution with HNO_3	Electrogravimetry
	Bi	0.2 g	Dissolution with HNO_3, HF	ETAAS, calibration with commercial solutions (Merck)
	Cr	1 g	Dissolution with HNO_3, HF	ETAAS, calibration with commercial solutions (Merck)
2	Sb	1 g	Dissolution with HCl/H_2O_2	Spectrophotometry, calibration with monoelemental solution prepared from pure metal
	Ni	0.5 g	Dissolution with HNO_3/H_2SO_4	Spectrophotometry, calibration with monoelemental solution prepared from pure metal
	As	0.2 g	Dissolution with HNO_3	ICP-OES, calibration with commercial solution (Merck)
	Bi, Cd, Sb	0.5 g	Dissolution with HNO_3	ETAAS acc. to DIN EN 14935:2006, calibration with commercial solutions (Merck)
	Mn, Ni, Sb, Sn	1 g	Dissolution with HNO_3, HCl	ICP-OES, calibration with monoelemental solutions prepared from pure metals
	Pb, Fe	1 g	Dissolution with HNO_3/HCl	FAAS, calibration with monoelemental solutions prepared from pure metal (Fe) or commercial (Pb, Alfa Aesar)
	Al, Cr, Mn, Ni, As, Cd, Sb, Bi	0.2 g	Dissolution with HNO_3, HCl	ICP-MS, , calibration with commercial solution (Merck)
3	Cu, Pb	1 g	Dissolution with HNO_3	FAAS, calibration with commercial standard solutions
	Ni	1 g	Dissolution with HNO_3/tartaric acid	FAAS, calibration with commercial standard solutions
	Sn	1 g	Dissolution with HNO_3/tartaric acid	ICP-OES, calibration with commercial standard solutions
	P, Fe, Cr, As	1 g	Dissolution with HNO_3	ICP-OES, calibration with commercial standard solutions
	Cd, Bi	1 g	Dissolution with HNO_3	ETAAS, calibration with commercial solutions
	Mn	1 g	Dissolution with HNO_3/tartaric acid	FAAS, calibration with commercial standard solutions
4	Cu			Electrogravimetry
	Pb			Gravimetry
	P, Fe, Sn, Cr, Mn, Ni, Al, As, Cd, Si, Bi			ICP-OES
6	Cu	0.5 g	Dissolution with HNO_3	Electrogravimetry
	Pb, P, Fe, Sn, Al, Cr, Mn, Ni, As, Cd	1 g	Dissolution with HNO_3/HCl	ICP-OES, mono-element solutions prepared from pure metals
	P, Fe, Sn, Al, Cr, Mn, Ni, As, Cd, Sb, Bi	0,5 g		GD-MS, calibration with pressed powder pellets, prepared from pure powders doped with monoelemental solutions
7	Cu, Zn, Pb, Fe, Sn, Ni	0.25 g	Dissolution with HNO_3	ICP-OES

Table 2 (cont.): Analytical procedures used by the participating laboratories

8	Cu	1 g	Dissolution with HNO_3/H_2SO_4	Electrogravimetry
	P, Fe, Sn, Cr, Mn, Ni, Al, Sb	0.5 g	Dissolution with HCl/ HNO_3/HF	ICP-OES with matrix matched standards (Cu, Zn, Pb), commercial mono-element solutions (NIST)
	Si	1 g	Dissolution with HNO_3/HF	ICP-OES with matrix matched standards (Cu, Zn, Pb), commercial mono-element solutions (NIST)
	Bi	1 g	Dissolution with HNO_3/HCl/HF	ETAAS, calibration with matrix matched standards (Cu, Zn), commercial mono-element solutions (NIST)
	Cd, As	1 g	Dissolution with HNO_3/HCl/HF	ICP-OES, calibration with matrix matched standards (Cu, Zn), commercial mono-element solutions (NIST)
9	Cu	1 g	Dissolution with HNO_3, addition of NH_4NO_3	Electrogravimetry
	Pb, Fe, Sn, Ni, As, Sb	1 g	Dissolution with HCl/H_2O_2	ICP-OES, calibration with commercial mono-element solutions and matrix matching (Cu, Zn)
10	Cu	1 g	Dissolution with HNO_3	Electrogravimetry (DIN EN 16117-1)
	Si, P, Pb, Fe, Sn, Al, Cr, Mn, Ni, As, Cd, Sb, Bi	1 g	Dissolution with HNO_3/HF	ICP-OES, calibration with commercial mono-element solution, matrix matching
11	Cu	1 g	Dissolution with HNO_3/HF	Electrogravimetry
	Pb, Sn, Fe, Mn, Ni, As, Cd	1 g	Dissolution with HCl/H_2O_2	ICP-OES, calibration with commercial mono-element solution, matrix matching (Cu, Zn)
12	Cu	2 g	Dissolution with HNO_3/HF	Electrogravimetry
	P, Cr, Mn, Al, Cd, Sb, Bi	2 g	Dissolution with Aqua regia/HF	ICP-OES, calibration with commercial mono-element solution, matrix matching (Cu)
	Fe, Sn, Ni	1 g	Dissolution with HNO_3/HF	ICP-OES, calibration with commercial mono-element solution, matrix matching (Cu)
	Pb	0.5 g	Dissolution with Aqua regia/HF	ICP-OES, calibration with commercial mono-element solution

5.2 Analytical results and statistical evaluation

The analytical results of the certification inter-laboratory comparison are listed in Tables 3 to 31. These tables show the single results (M_i) of each laboratory, the respective laboratories' mean values (M), absolute and relative intra-laboratory 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 ($\bar{s}_i$), where 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.

Lab./Meth.	11/EG	8/EG	4/EG	9/EG	12/EG	7/I	6/EG	1/EG	10/EG		
M_i [%]	57.65	57.65	57.64	57.63	57.67	57.65	57.78	57.83	57.79		*n*
	57.64	57.66	57.65	57.65	57.73	57.73	57.77	57.75	57.85		9
	57.64	57.64	57.68	57.67	57.66	57.65	57.74	57.81	57.86		
	57.64	57.65	57.63	57.65	57.69	57.72	57.77	57.77	57.77		
	57.65	57.64	57.68	57.71	57.67	57.77	57.66	57.78	57.83		
	57.65	57.66	57.66	57.71	57.69	57.68	57.71	57.78	57.78		
M [%]	**57.65**	**57.65**	**57.66**	**57.67**	**57.69**	**57.70**	**57.74**	**57.79**	**57.81**		**57.70**
s [%]	0.0055	0.0084	0.0229	0.0335	0.0251	0.0470	0.0462	0.0288	0.0383	s_M [%]	0.0614
										$\bar{s}_i$ [%]	0.0317
s_{rel}	0.00010	0.00015	0.00040	0.00058	0.00044	0.00081	0.00080	0.00050	0.00066		0.00106

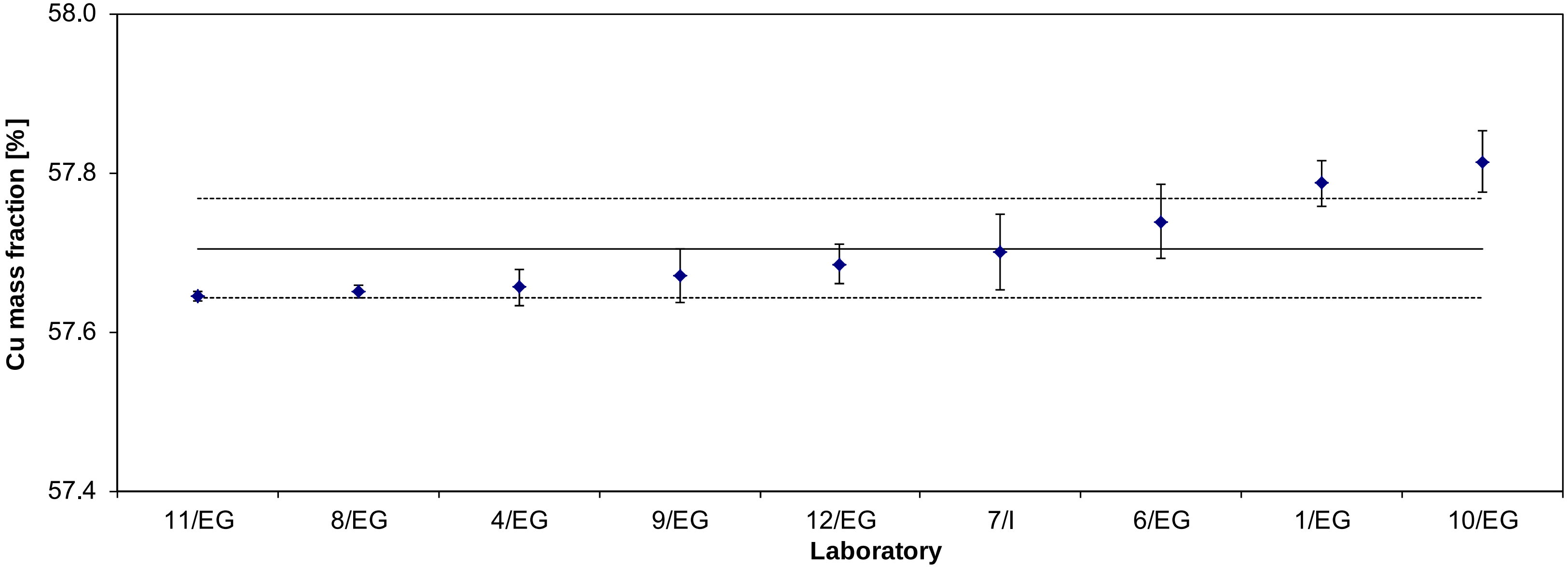

Table 3: Results for Cu in BAM-M394

Lab./Meth.	**11/I**	**7/I**	**8/I**	**3/A**	**6/I**	**10/I**	**9/I**	**12/I(R)**	**1/EG**	**2/A**	**4/G**	**4/IMS**	**4/I**		
M_i [%]	1.875	1.890	1.892	1.91	1.908	1.905	1.951	1.940	1.940	1.956	1.985	2.019	1.999		*n*
	1.867	1.880	1.891	1.90	1.892	1.911	1.906	1.930	1.930	1.923	1.985	2.020	2.016		13
	1.850	1.890	1.891	1.91	1.901	1.920	1.939	1.910	1.940	1.911	1.986	1.999	2.009		
	1.878	1.890	1.899	1.91	1.920	1.909	1.915	1.920	1.910	1.937	1.984	1.986	1.999		
	1.880	1.890	1.891	1.91	1.932	1.938	1.907	1.920	1.910	1.941	1.985	2.029	2.013		
	1.894	1.890	1.899	1.92	1.918	1.922	1.911	1.920	1.910	1.942	1.987	2.005	2.027		
***M* [%]**	**1.874**	**1.888**	**1.894**	**1.910**	**1.912**	**1.918**	**1.922**	**1.923**	**1.923**	**1.935**	**1.985**	**2.010**	**2.010**		**1.931**
s [%]	0.015	0.004	0.004	0.006	0.014	0.012	0.019	0.010	0.015	0.016	0.001	0.016	0.011	s_M [%]	0.044
														$\bar{s}_i$ [%]	0.0123
s_{rel}	0.008	0.002	0.002	0.003	0.008	0.006	0.010	0.005	0.008	0.008	0.001	0.008	0.005		0.023

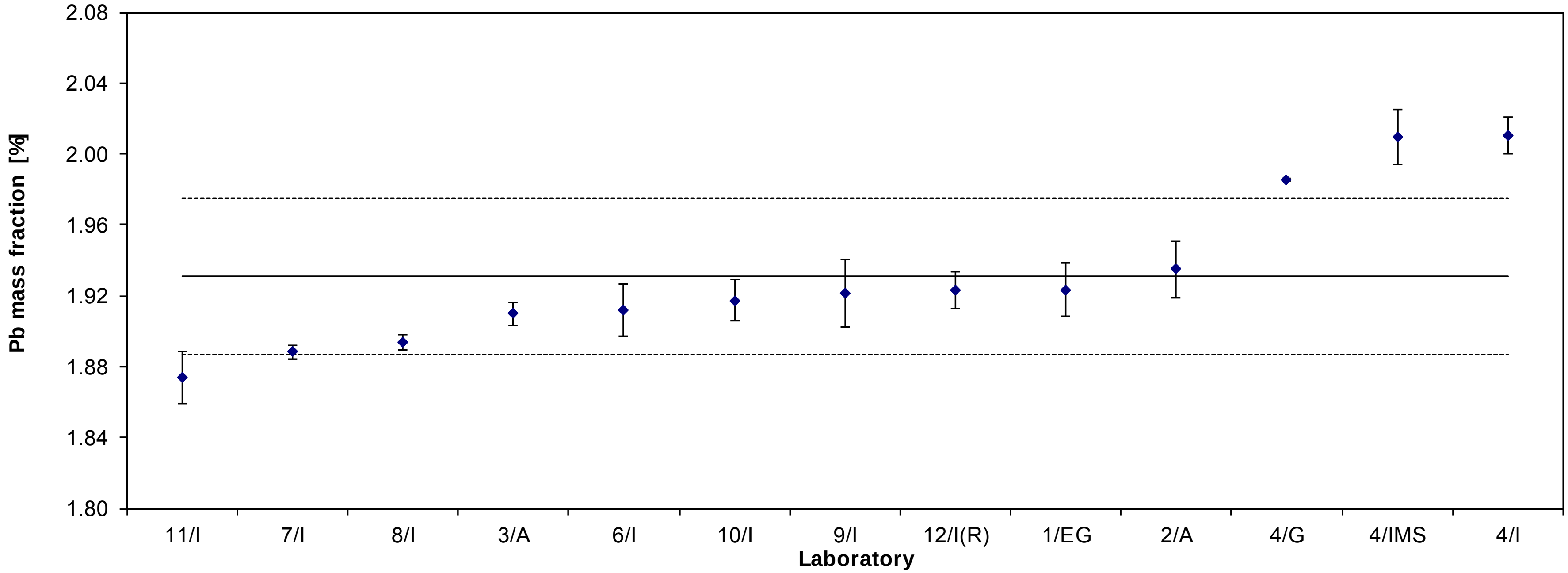

Table 4: Results for Pb in BAM-M394

Lab./Meth.	10/I	4/I	11/I	6/GD	1/I	7/I(R)	9/I	2/A	12/I	8/I		
M_i [%]	0.1170	0.1187	0.1177	0.1195	0.1193	0.1180	0.1203	0.1226	0.1200	0.1247		*n*
	0.1166	0.1176	0.1166	0.1192	0.1186	0.1180	0.1185	0.1219	0.1200	0.1222		10
	0.1151	0.1162	0.1155	0.1172	0.1204	0.1200	0.1198	0.1194	0.1200	0.1216		
	0.1157	0.1165	0.1196	0.1159	0.1171	0.1200	0.1215	0.1223	0.1200	0.1236		
	0.1133	0.1183	0.1172	0.1174	0.1169	0.1210	0.1194	0.1213	0.1200	0.1218		
	0.1140	0.1165	0.1192	0.1170	0.1155	0.1170	0.1181	0.1209	0.1300	0.1242		
***M* [%]**	**0.1153**	**0.1173**	**0.1176**	**0.1177**	**0.1180**	**0.1190**	**0.1196**	**0.1214**	**0.1217**	**0.1230**		**0.1191**
s [%]	0.0014	0.0011	0.0016	0.0014	0.0018	0.0015	0.0012	0.0012	0.0041	0.0013	s_M [%]	0.0024
											$\bar{s}_i$ [%]	0.0019
s_{rel}	0.01255	0.00897	0.01351	0.01175	0.01520	0.01302	0.01034	0.00958	0.03355	0.01074		0.020

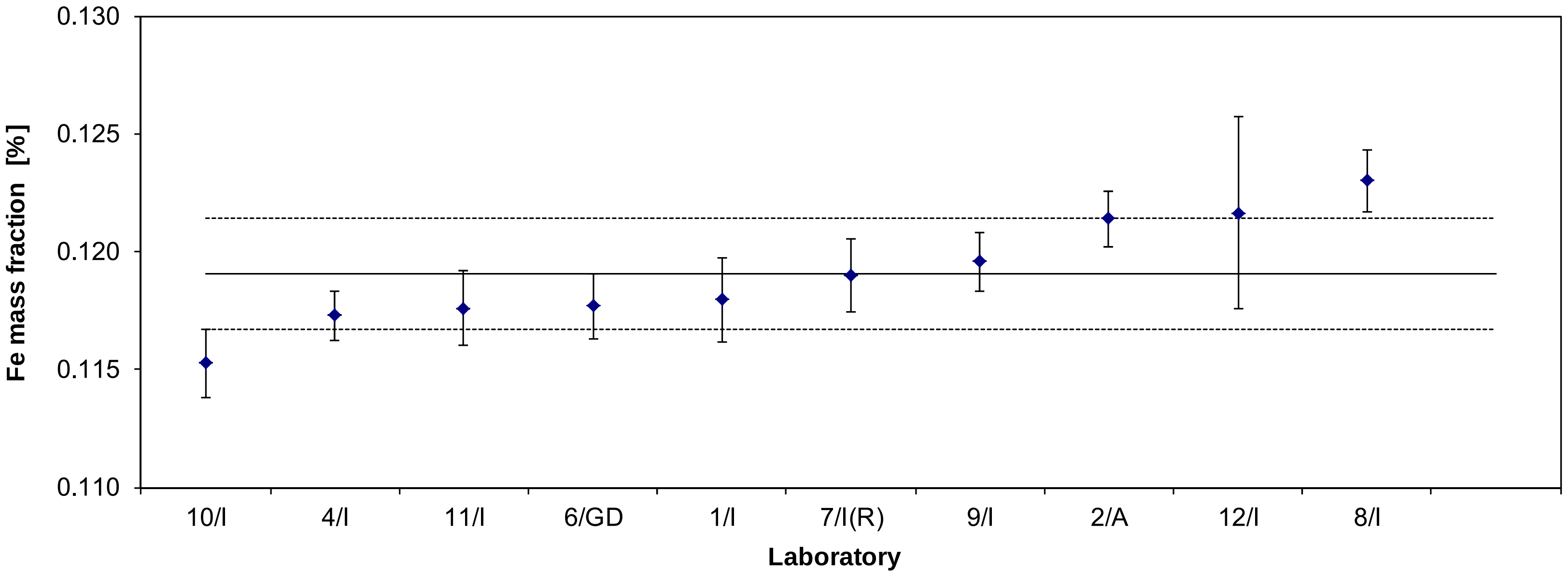

Table 5: Results for Fe in BAM-M394

Lab./Meth.	3/I	12/I	11/I	1/I	7/I	4/I(R)	4/IMS	10/I	6/GD	6/I	9/I	2/I	8/I		
M_i [%]	0.2196	0.22	0.2263	0.2311	0.23	0.2327	0.2324	0.2303	0.2304	0.2334	0.2371	0.2393	0.2428		*n*
	0.2177	0.22	0.2214	0.2299	0.23	0.2325	0.2307	0.2305	0.2351	0.2335	0.2423	0.2402	0.2428		13
	0.2217	0.22	0.2213	0.2302	0.23	0.2327	0.2308	0.2324	0.2324	0.2384	0.2382	0.2404	0.2422		
	0.2187	0.22	0.2289	0.2267	0.23	0.2305	0.2329	0.2367	0.2289	0.2384	0.2396	0.2399	0.2433		
	0.2189	0.22	0.2225	0.2276	0.23	0.2327	0.2359	0.2354	0.2443	0.2359	0.2416	0.2411	0.2438		
	0.2154	0.23	0.2256	0.2234	0.23	0.2336	0.2338	0.2359	0.2364	0.2361	0.2407	0.2414	0.2427		
***M* [%]**	**0.2187**	**0.2217**	**0.2243**	**0.2282**	**0.2300**	**0.2325**	**0.2328**	**0.2335**	**0.2346**	**0.2360**	**0.2399**	**0.2404**	**0.2429**		**0.2319**
s [%]	0.0021	0.0041	0.0031	0.0029	0.0000	0.0010	0.0020	0.0028	0.0055	0.0022	0.0020	0.0008	0.0006	s_M [%]	0.0073
														$\bar{s}_i$ [%]	0.0027
s_{rel}	0.00953	0.01842	0.01376	0.01254	0.00000	0.00444	0.00841	0.01212	0.02355	0.00939	0.00836	0.00322	0.00236		0.031

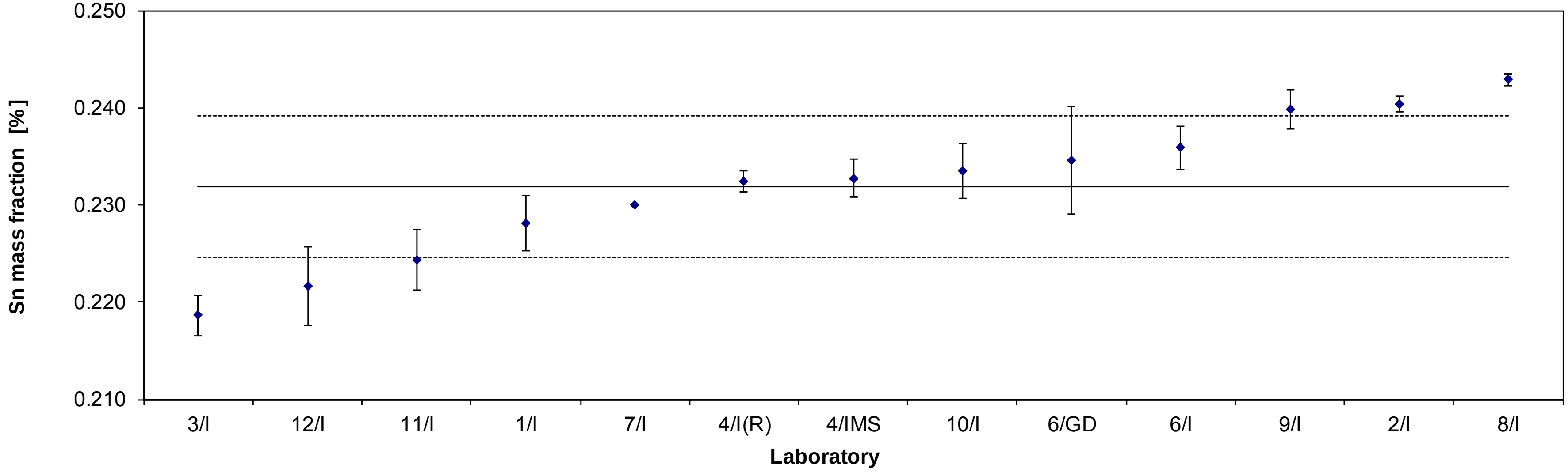

Table 6: Results for Sn in BAM-M394

Lab./Meth.	2/IMS	2/I	4/I	11/I	12/I	8/I	6/I	6/GD	3/I	10/I	9/I		
M_i [mg/kg]	95.0	99.86	97.08	96.1	100.0	101.0	101.0	103.0	104.10	102.0	104.0		*n*
	94.2	96.42	96.96	99.1	99.0	101.2	99.0	103.0	102.00	104.0	106.0		11
	90.8	97.53	96.84	98.5	99.0	100.1	101.0	103.0	102.50	104.0	104.0		
	92.9	95.44	97.12	99.9	100.0	100.1	100.0	102.0	104.30	105.0	103.0		
	90.3	97.32	96.85	97.9	99.0	99.9	105.0	102.0	102.00	106.0	106.0		
	95.4	95.09	97.05	97.8	99.0	100.2	102.0	103.0	104.40	104.0	106.0		
	92.3												
***M* [mg/kg]**	**93.0**	**96.9**	**97.0**	**98.2**	**99.3**	**100.4**	**101.3**	**102.7**	**103.2**	**104.2**	**104.8**		**100.1**
s [mg/kg]	2.00	1.73	0.12	1.31	0.52	0.54	2.07	0.52	1.17	1.33	1.33	s_M [mg/kg]	3.63
												$\bar{s}_i$ [mg/kg]	1.30
s_{rel}	0.021	0.018	0.001	0.013	0.005	0.005	0.020	0.005	0.011	0.013	0.013		0.036

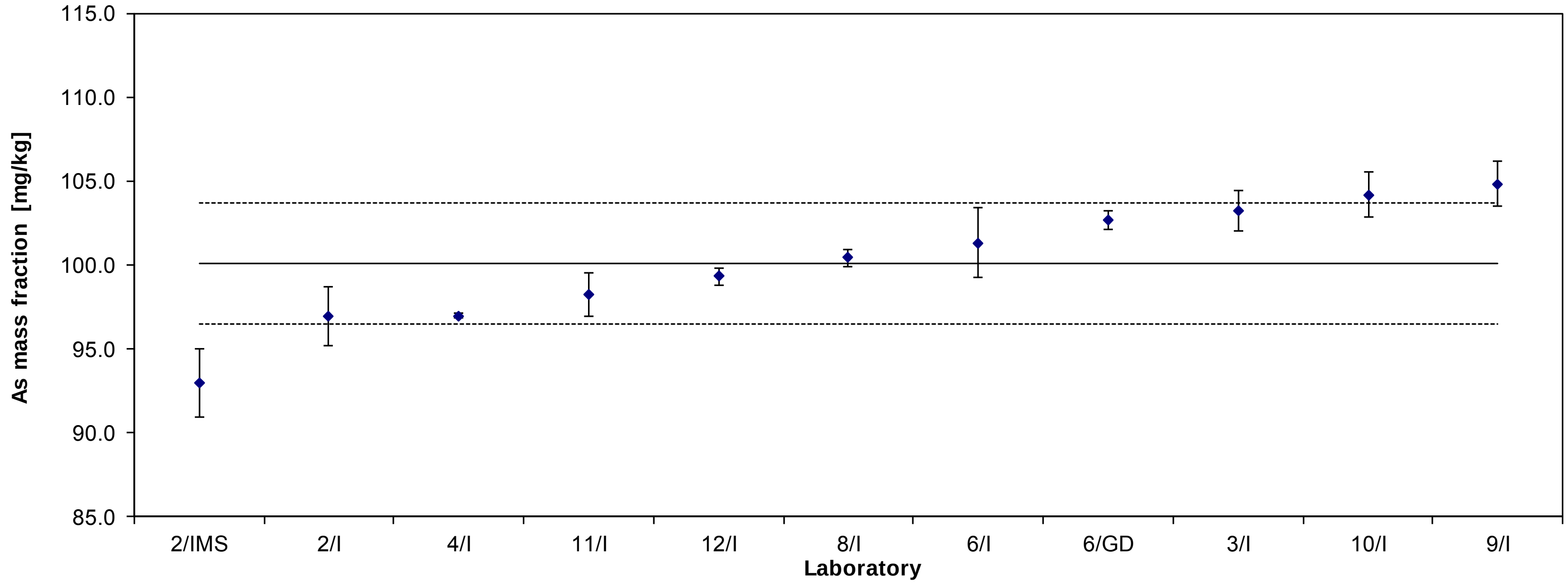

Table 7: Results for As in BAM-M394

Lab./Meth.	2/EA	4/I	3/EA	8/EA	10/I	12/I	6/GD	2/IMS	1/EA		
M_i [mg/kg]	7.250	6.996	7.5	7.6	8.9	9.30	8.7	9.0	9.3		*n*
	6.870	6.991	7.1	7.7	7.7	8.57	8.9	9.0	9.9		9
	6.715	6.994	6.4	7.9	7.4	8.97	8.8	9.1	9.7		
	6.870	6.989	7.0	7.5	7.2	9.10	8.8	9.2	9.3		
	7.070	6.991	7.5	7.5	8.8	8.76	9.5	9.1	9.7		
	6.505	6.998	6.7	7.7	7.5	8.80	9.2	9.1	9.4		
								9.2			
***M* [mg/kg]**	**6.88**	**6.99**	**7.03**	**7.65**	**7.92**	**8.92**	**8.96**	**9.09**	**9.55**		**8.11**
s [mg/kg]	0.261	0.003	0.437	0.152	0.741	0.261	0.296	0.086	0.251	s_M [mg/kg]	1.035
										$\bar{s}_i$ [mg/kg]	0.3428
s_{rel}	0.038	0.000	0.062	0.020	0.094	0.029	0.033	0.009	0.026		0.128

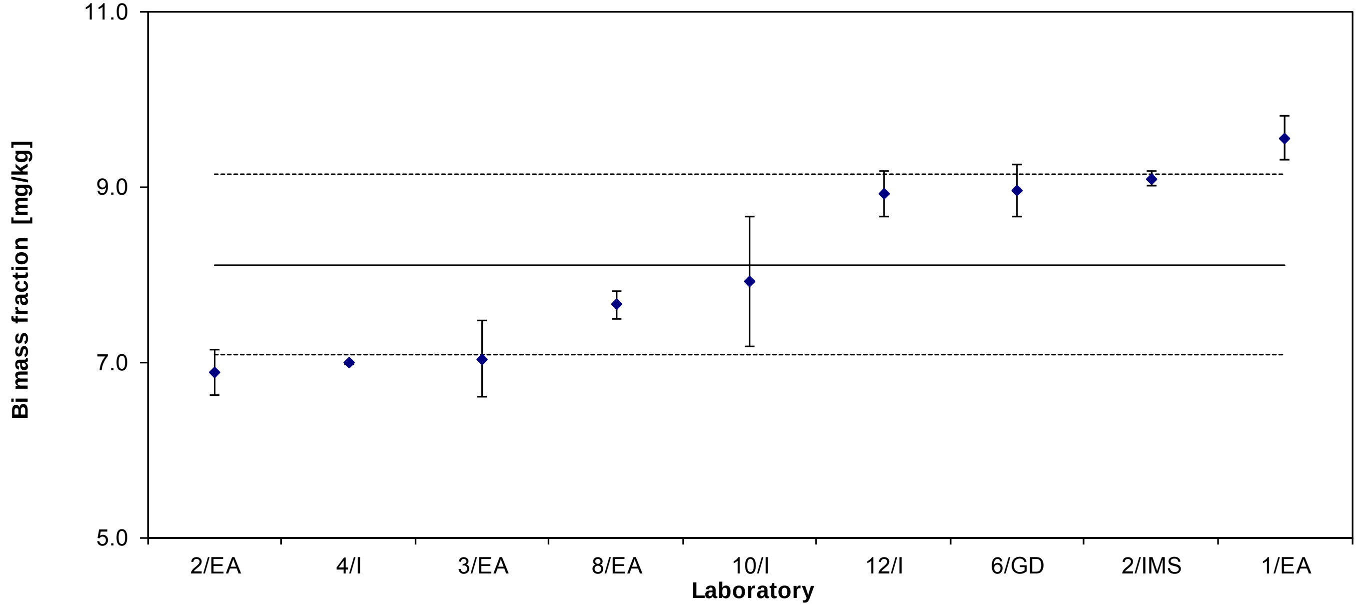

Table 8: Results for Bi in BAM-M394

Lab./Meth.	2/EA	12/I	11/I	10/I	6/I	4/IMS	6/GD	4/I(R)	3/EA	8/I	1/I		
M_i [mg/kg]	6.65	6.60	6.56	6.90	7.00	7.1	6.90	7.6	7.1	7.4	8.0		n
	6.15	6.59	6.60	6.80	7.00	7.0	7.20	7.4	7.0	7.4	8.0		11
	5.87	6.60	6.75	6.80	7.00	6.9	7.00	6.6	7.2	7.6	8.0		
	6.19	6.60	6.59	6.90	7.10	7.1	7.10	6.9	7.3	7.4	7.0		
	5.90	6.60	6.80	6.70	7.10	7.2	7.20	7.3	7.1	7.4	7.0		
	6.16	6.70	6.53	6.90	6.90	7.2	7.20	7.1	7.3	7.5	7.0		
M [mg/kg]	**6.15**	**6.62**	**6.64**	**6.83**	**7.02**	**7.08**	**7.10**	**7.15**	**7.17**	**7.45**	**7.50**		**6.97**
s [mg/kg]	0.2796	0.0418	0.1122	0.0816	0.0753	0.1169	0.1265	0.3619	0.1211	0.0837	0.5477	s_M [mg/kg]	0.3921
												$\bar{s}_i$ [mg/kg]	0.2310
s_{rel}	0.04545	0.00632	0.01690	0.01195	0.01073	0.01650	0.01782	0.05062	0.01690	0.01123	0.07303		0.056

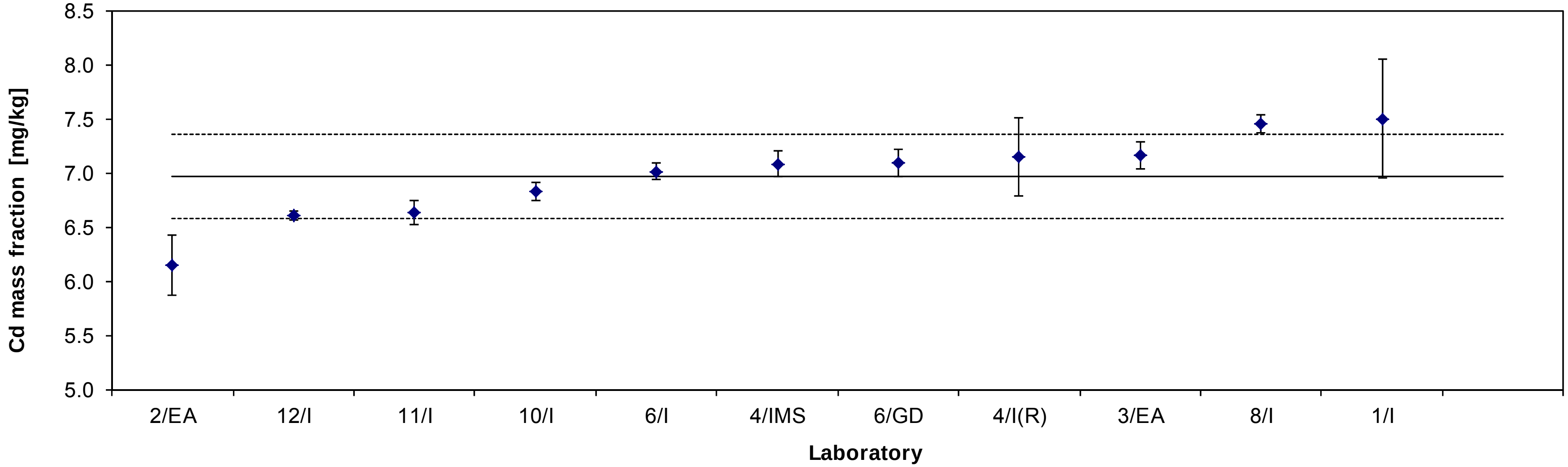

Table 9: Results for Cd in BAM-M394

Lab./Meth.	2/IMS	10/I	6/GD	3/I	1/EA	4/IMS	12/I	6/I	4/I	8/I		
M_i [mg/kg]	0.39	0.20	0.46	1.40	< 0,1	<1	<1	<1	<2	<5		n
	0.16	0.20	0.44	1.40	< 0,1	<1	<1	<1	<2	<5		10
	0.08	0.30	0.45	1.50	< 0,1	<1	<1	<1	<2	<5		
	0.32	0.50	0.45	1.40	< 0,1	<1	<1	<1	<2	<5		
	0.37	0.40	0.47	1.50	< 0,1	<1	<1	<1	<2	<5		
	0.34	0.30	0.45	1.50	< 0,1	<1	<1	<1	<2	<5		
M [mg/kg]	**0.28**	**0.32**	**0.45**	**1.45**	**< 0,1**	**<1**	**<1**	**<1**	**<2**	**<5**		**0.6241**
s [mg/kg]	0.1268	0.1169	0.0103	0.0548							s_M [mg/kg]	0.5558
											$\bar{s}_i$ [mg/kg]	0.0906
s_{rel}	0.45835	0.36917	0.02278	0.03777								0.890

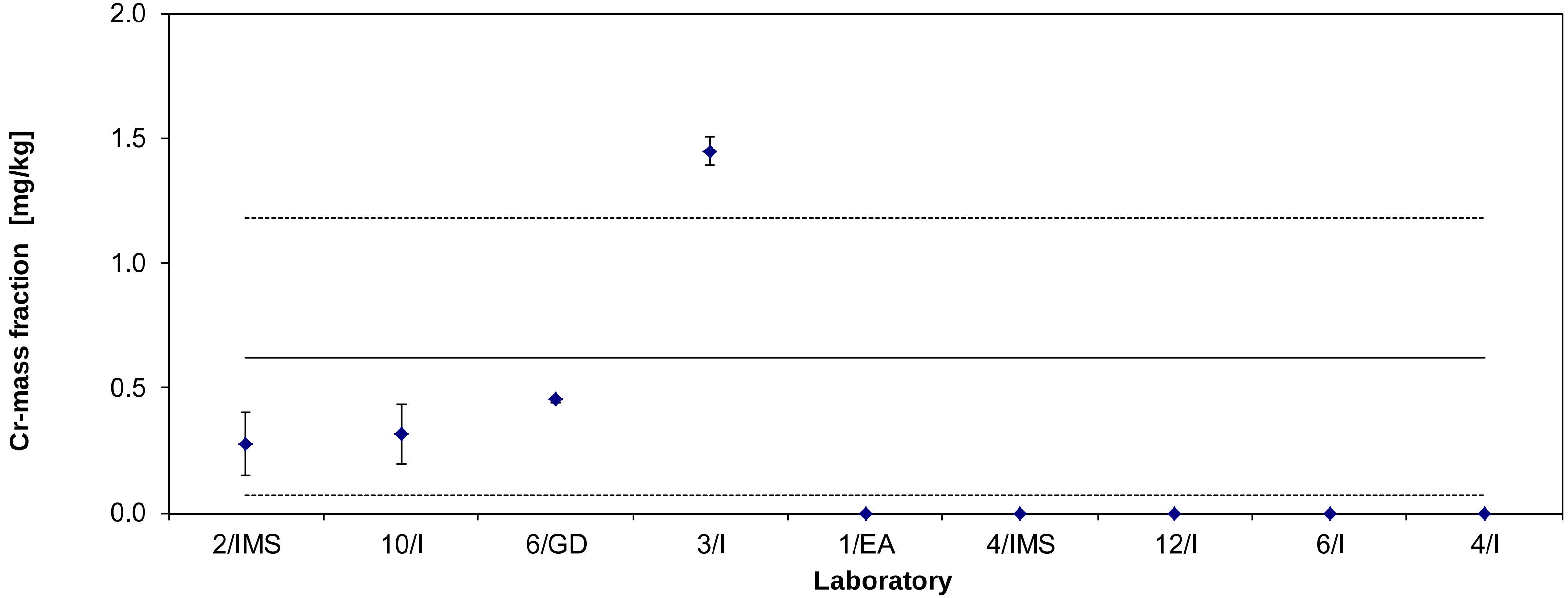

Table 10: Results for Cr in BAM-M394

Lab./Meth.	2/IMS	6/I	4/IMS	10/I	12/I	11/I	4/I(R)	3/A	2/I	8/I	1/I	6/GDMS		
M_i [mg/kg]	12.9	14.4	14.1	14.0	14.0	14.2	14.9	14.2	14.4	14.5	15.0	15.8		*n*
	13.5	12.0	13.0	14.0	14.0	14.2	13.6	14.6	14.4	14.5	15.0	15.8		12
	12.3	14.9	13.7	13.0	14.0	14.1	14.4	14.1	14.4	14.5	15.0	15.4		
	12.3	12.6	13.7	14.0	14.0	14.2	14.5	14.4	14.3	14.5	15.0	15.3		
	12.2	12.4	13.8	14.0	14.0	14.4	13.4	14.4	14.4	14.5	15.0	15.4		
	13.0	13.4	13.5	13.0	14.0	14.1	14.6	14.5	14.4	14.5	15.0	15.4		
	12.7													
***M* [mg/kg]**	**12.72**	**13.28**	**13.63**	**13.67**	**14.00**	**14.21**	**14.23**	**14.37**	**14.38**	**14.50**	**15.00**	**15.51**		**14.12**
s [mg/kg]	0.4638	1.1635	0.3670	0.5164	0.0000	0.1175	0.5955	0.1862	0.0408	0.0000	0.0000	0.2130	s_M [mg/kg]	0.7452
													$\bar{s}_i$ [mg/kg]	0.4657
s_{rel}	0.03647	0.08759	0.02692	0.03779	0.00000	0.00827	0.04184	0.01296	0.00284	0.00000	0.00000	0.01373		0.053

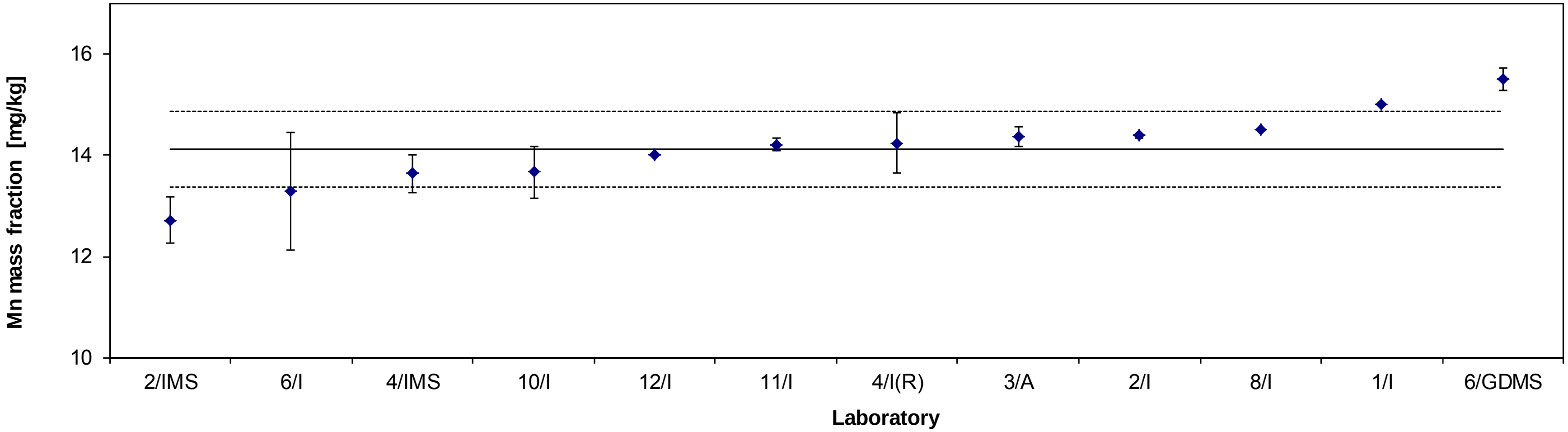

Table 11: Results for Mn in BAM-M394

Lab./Meth.	11/I	3/A	4/I	2/P	2/I	1/I	9/I	6/GD	10/I	6/I	12/I	8/I	7/I(R)		
M_i [mg/kg]	378.7	386.0	388.3	393.0	395.0	402.0	390.0	406.0	401.0	395.0	420.0	414.0	400.0		*n*
	381.8	388.0	387.1	394.0	395.0	400.0	403.0	403.0	405.0	403.0	420.0	413.0	400.0		13
	379.5	386.0	386.8	372.0	396.0	401.0	391.0	400.0	403.0	403.0	420.0	422.0	440.0		
	384.4	387.0	387.5	381.0	395.0	393.0	398.0	394.0	398.0	407.0	410.0	412.0	420.0		
	392.9	386.0	388.1	401.0	396.0	395.0	402.0	397.0	402.0	406.0	400.0	412.0	440.0		
	382.5	385.0	387.9	397.0	397.0	389.0	399.0	402.0	399.0	403.0	400.0	414.0	420.0		
***M* [mg/kg]**	**383.3**	**386.3**	**387.6**	**389.7**	**395.7**	**396.7**	**397.2**	**400.3**	**401.3**	**402.8**	**411.7**	**414.5**	**420.0**		**399.0**
s [mg/kg]	5.12	1.03	0.59	10.95	0.82	5.16	5.49	4.32	2.58	4.22	9.83	3.78	17.89	s_M [mg/kg]	11.21
														$\bar{s}_i$ [mg/kg]	7.52
s_{rel}	0.01337	0.00267	0.00152	0.02810	0.00206	0.01302	0.01383	0.01079	0.00643	0.01046	0.02388	0.00912	0.04259		0.028

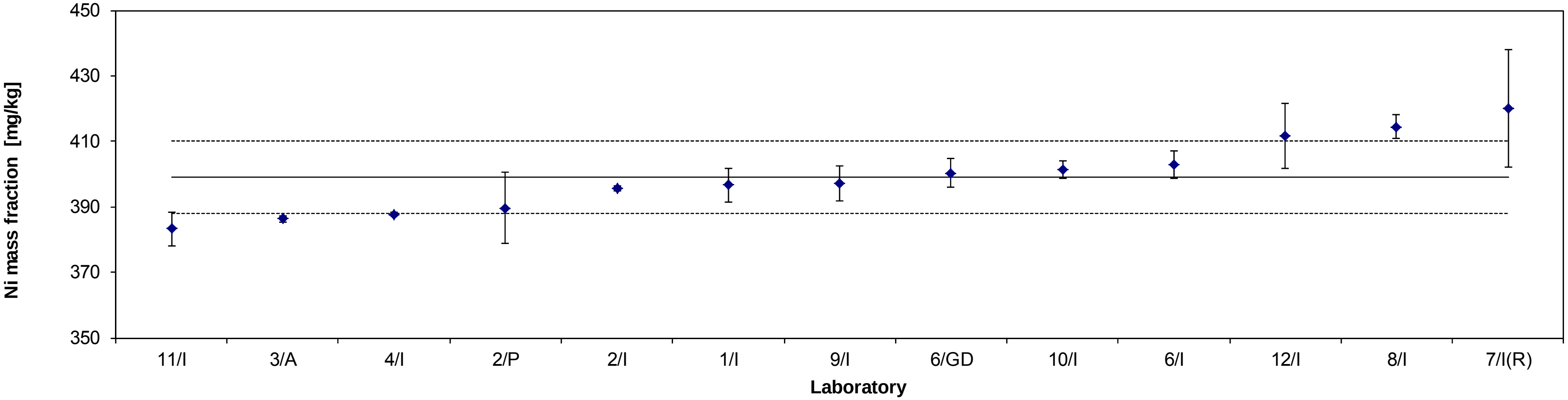

Table 12: Results for Ni in BAM-M394

Lab./Meth.	10/I	2/P	3/I	12/I	1/I	8/I	6/I	6/GD	4/I		
M_i [mg/kg]	12.0	13.3	15.0	14.6	17.0	17.1	18.5	17.7	17.6		*n*
	13.0	13.6	13.3	15.0	17.0	16.8	17.3	17.3	17.8		9
	14.0	13.1	14.7	15.0	17.0	16.9	16.1	17.5	17.3		
	13.0	13.6	15.0	15.0	16.0	17.2	17.8	17.4	17.2		
	14.0	13.4	13.7	15.0	17.0	16.9	[23]	16.4	17.7		
	13.0		15.3	15.0	17.0	16.9	16.1	16.8	16.9		
***M* [mg/kg]**	**13.2**	**13.4**	**14.5**	**14.9**	**16.8**	**17.0**	**17.2**	**17.2**	**17.4**		**15.73**
s [mg/kg]	0.753	0.187	0.807	0.163	0.408	0.151	1.057	0.488	0.343	s_M [mg/kg]	1.728
										$\bar{s}_i$ [mg/kg]	0.572
s_{rel}	0.057	0.014	0.056	0.011	0.024	0.009	0.062	0.028	0.020		0.110

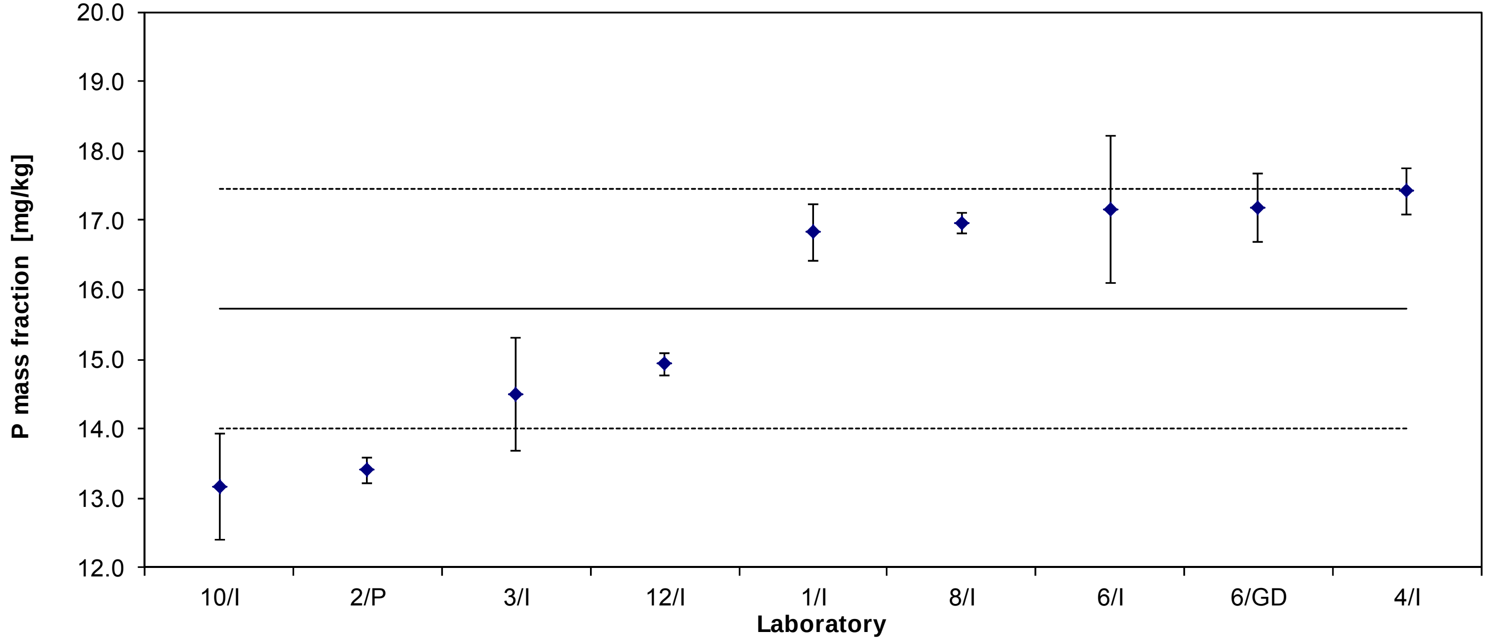

Table 13: Results for P in BAM-M394

Lab./Meth.	**12/I**	**1/I**	**8/I**	**2/IMS**	**6/GD**	**4/IMS**	**4/I(R)**	**2/P**	**10/I**	**2/EA**	**2/I**	**9/I**		
M_i [mg/kg]	20.0	21.0	22.5	23.4	23.60	23.90	24.4	24.4	25.00	25.1	27.0	28.0		*n*
	21.0	21.0	21.8	23.8	23.98	23.70	24.1	24.4	26.00	25.5	26.5	25.0		12
	20.0	21.0	22.8	23.7	23.68	24.10	23.9	24.8	24.00	25.4	23.0	26.0		
	20.0	20.0	22.3	23.8	23.40	24.20	23.8	23.9	26.00	26.7	25.2	27.0		
	21.0	20.0	22.8	23.7	24.80	24.10	24.3	24.4	25.00	25.4	24.0	25.0		
	19.0	20.0	22.2	24.1	24.30	24.20	24.2	24.2	26.00	24.6	27.8	23.0		
				23.7										
***M* [mg/kg]**	**20.17**	**20.50**	**22.40**	**23.73**	**23.96**	**24.03**	**24.12**	**24.35**	**25.33**	**25.45**	**25.58**	**25.67**		**23.77**
s [mg/kg]	0.753	0.548	0.385	0.204	0.518	0.197	0.232	0.295	0.816	0.694	1.849	1.751	s_M [mg/kg]	1.865
													$\bar{s}_i$ [mg/kg]	0.8726
s_{rel}	0.037	0.027	0.017	0.009	0.022	0.008	0.010	0.012	0.032	0.027	0.072	0.068		0.078

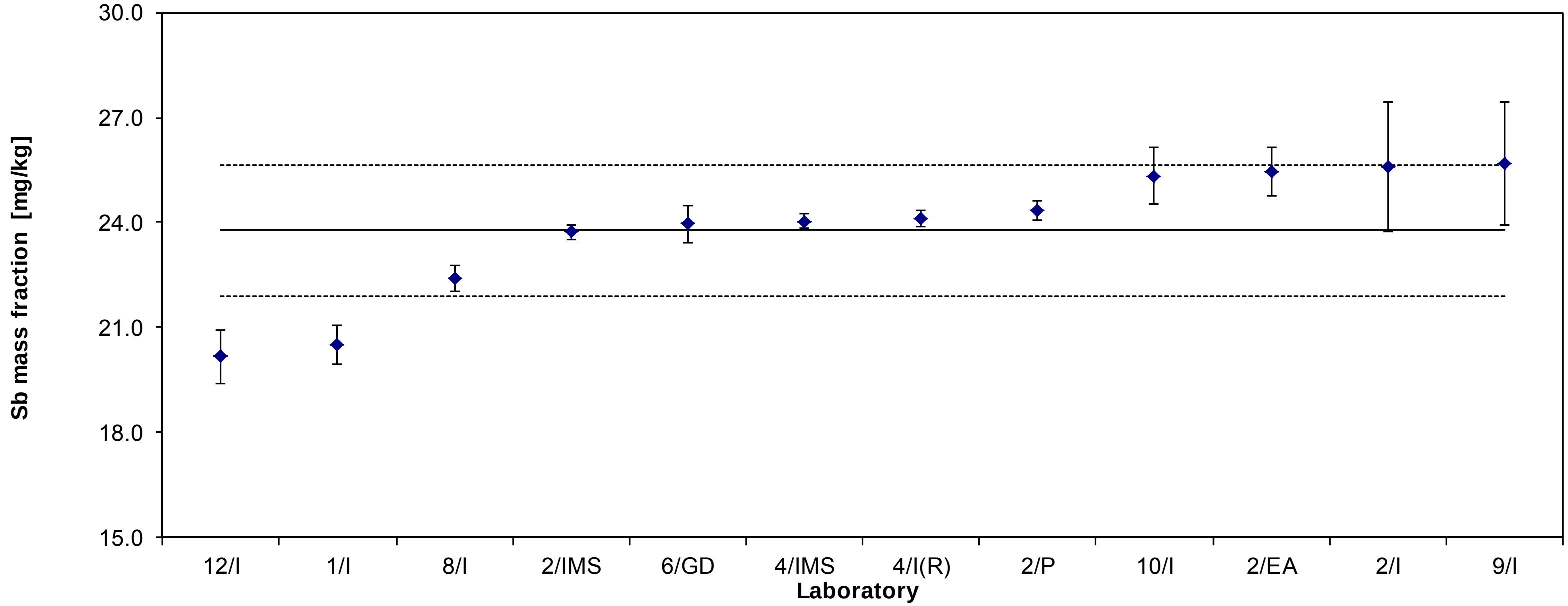

Table 14: Results for Sb in BAM-M394

Lab./Meth.	6/GD	2/IMS	10/I	8/I	4/I	12/I	6/I		
M_i [mg/kg]	0.19	0.14	0.30	1.20	2.60	<1	1.30		*n*
	0.22	0.94	0.50	1.50	2.60	<1	2.70		7
	0.43	0.22	0.60	1.20	2.60	<1	<1		
	0.15	0.64	0.40	1.30	2.58	<1	<1		
	0.50	0.33	0.30	1.20	2.59	<1	<1		
	0.32	0.08	0.50	1.20	2.59	<1	<1		
		0.28							
***M* [mg/kg]**	**0.30**	**0.37**	**0.43**	**1.27**	**2.59**	**<1**	**<3**		**0.99**
s [mg/kg]	0.140	0.306	0.121	0.121	0.005			s_M [mg/kg]	0.976
								$\bar{s}_i$ [mg/kg]	0.1690
s_{rel}	0.465	0.817	0.279	0.096	0.002				0.982

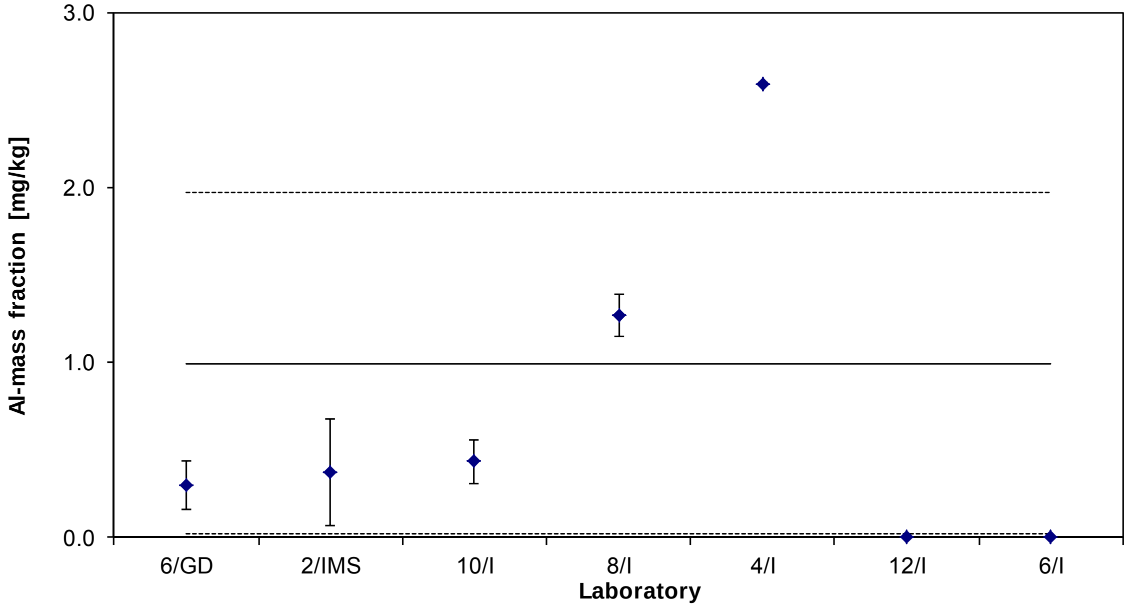

Table 15: Results for Al in BAM-M394

Lab./Meth.	10/I	8/I	4/I		
M_i [mg/kg]	2.0	5.7	8.965		*n*
	3.0	4.5	8.959		3
	2.0	5.7	8.963		
	2.0	4.8	8.961		
	1.0	5.1	8.958		
	1.0	4.7	8.965		
M [mg/kg]	**1.833**	**5.083**	**8.962**		**5.293**
s [mg/kg]	0.7528	0.5154	0.0030	s_M [mg/kg]	3.569
				$\bar{s}_i$ [mg/kg]	0.259
s_{rel}	0.4106	0.1014	0.0003		0.674

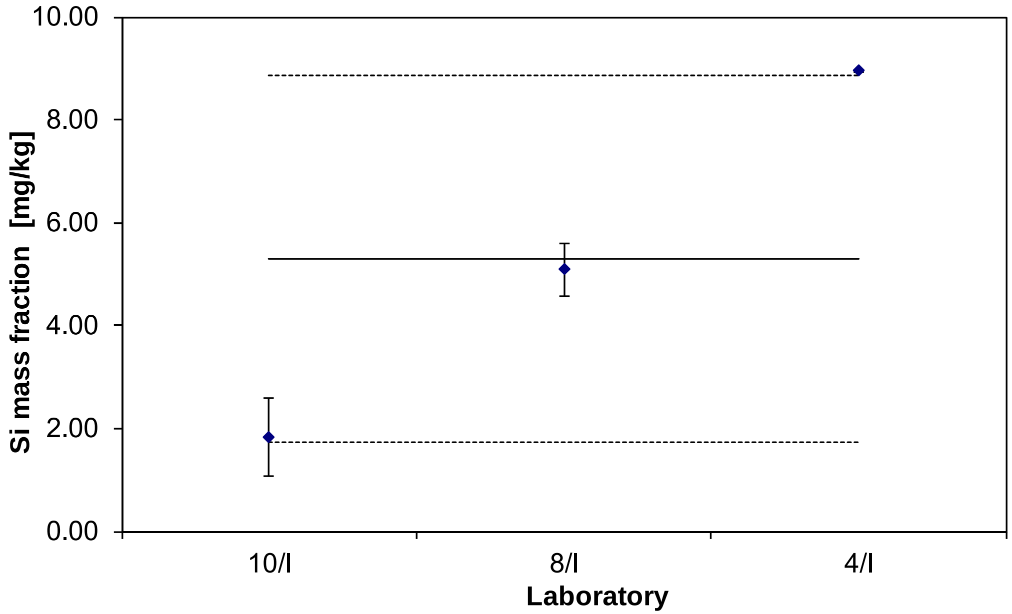

Table 17: Results for Si in BAM-M394

Lab./Meth.	6/EG	9/EG	11/EG	12/EG	8/EG	4/EG	7/I	1/EG	3/A	10/EG		
EW [%]	57.60	57.59	57.59	57.62	57.63	57.63	57.65	57.68	57.63	57.74		*n*
	57.62	57.54	57.59	57.63	57.63	57.65	57.69	57.74	57.75	57.78		10
	57.63	57.57	57.60	57.60	57.64	57.62	57.69	57.67	57.89	57.72		
	57.55	57.60	57.60	57.62	57.63	57.63	57.59	57.63	57.52	57.70		
	57.60	57.59	57.60	57.61	57.62	57.63	57.63	57.66	57.71	57.69		
	57.33	57.59	57.60	57.56	57.63	57.67	57.66	57.65	57.75	57.75		
MW [%]	**57.56**	**57.58**	**57.60**	**57.61**	**57.63**	**57.64**	**57.65**	**57.67**	**57.71**	**57.73**		**57.64**
s[%]	0.1136	0.0219	0.0052	0.0250	0.0067	0.0194	0.0382	0.0376	0.1250	0.0335	s_M [%]	0.0555
											$\bar{s}_i$ [%]	0.0584
s_{rel}	0.00197	0.00038	0.00009	0.00043	0.00012	0.00034	0.00066	0.00065	0.00217	0.00058		0.00096

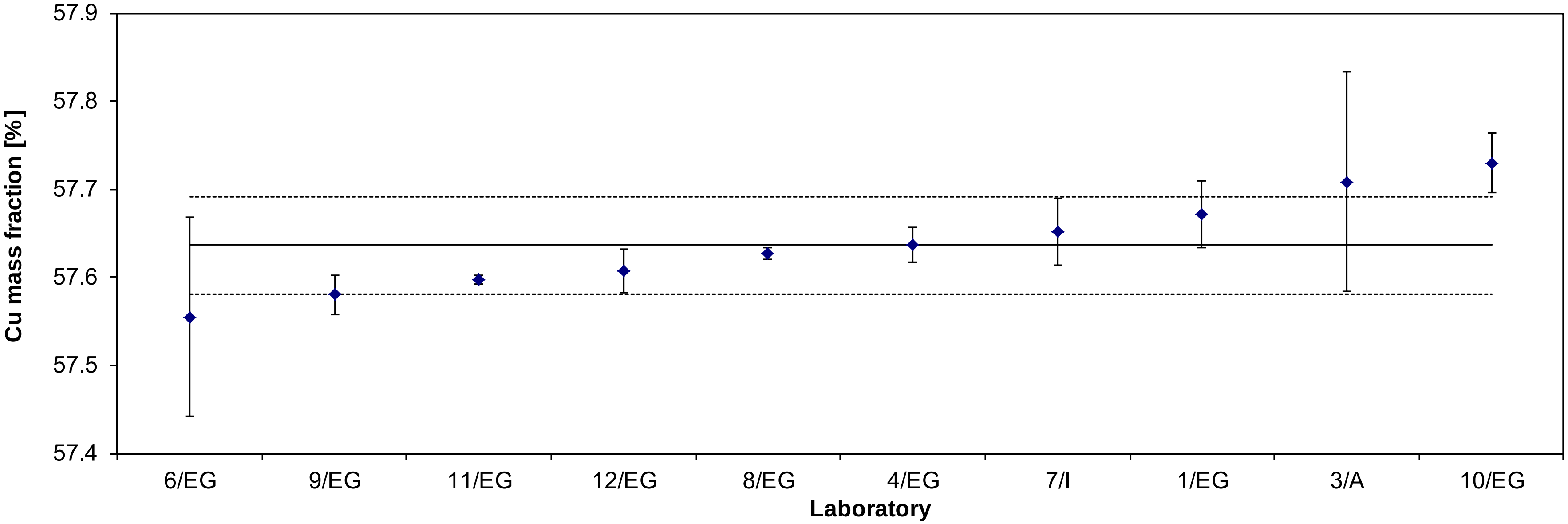

Table 18: Results for Cu in BAM-M394a

Lab./Meth.	7/I	9/I	3/A	8/I	10/I	12/I(R)	1/EG	6/I	2/A	11/I	4/IMS	4/I	4/G		
M_i [%]	1.850	1.907	1.890	1.880	1.895	1.900	1.940	1.900	1.936	1.924	2.001	2.000	1.996		*n*
	1.860	1.890	1.880	1.887	1.892	1.900	1.930	1.887	1.946	1.932	1.995	1.988	1.996		13
	1.870	1.881	1.890	1.899	1.886	1.880	1.920	1.910	1.915	1.902	1.971	2.000	1.996		
	1.860	1.893	1.900	1.898	1.902	1.910	1.860	1.926	1.894	1.898	1.976	2.000	1.996		
	1.870	1.896	1.900	1.902	1.915	1.900	1.890	1.919	1.905	1.923	2.027	1.997	1.998		
	1.880	1.887	1.900	1.909	1.907	1.930	1.880	1.910	1.914	1.933	1.972	1.973	1.996		
M [%]	**1.865**	**1.892**	**1.893**	**1.896**	**1.900**	**1.903**	**1.903**	**1.909**	**1.918**	**1.918**	**1.990**	**1.993**	**1.996**		**1.921**
s[%]	0.010	0.009	0.008	0.011	0.011	0.016	0.031	0.014	0.019	0.015	0.022	0.011	0.001	s_M [%]	0.043
														$\bar{s}_i$ [%]	0.0155
s_{rel}	0.006	0.005	0.004	0.006	0.006	0.009	0.017	0.007	0.010	0.008	0.011	0.005	0.000		0.022

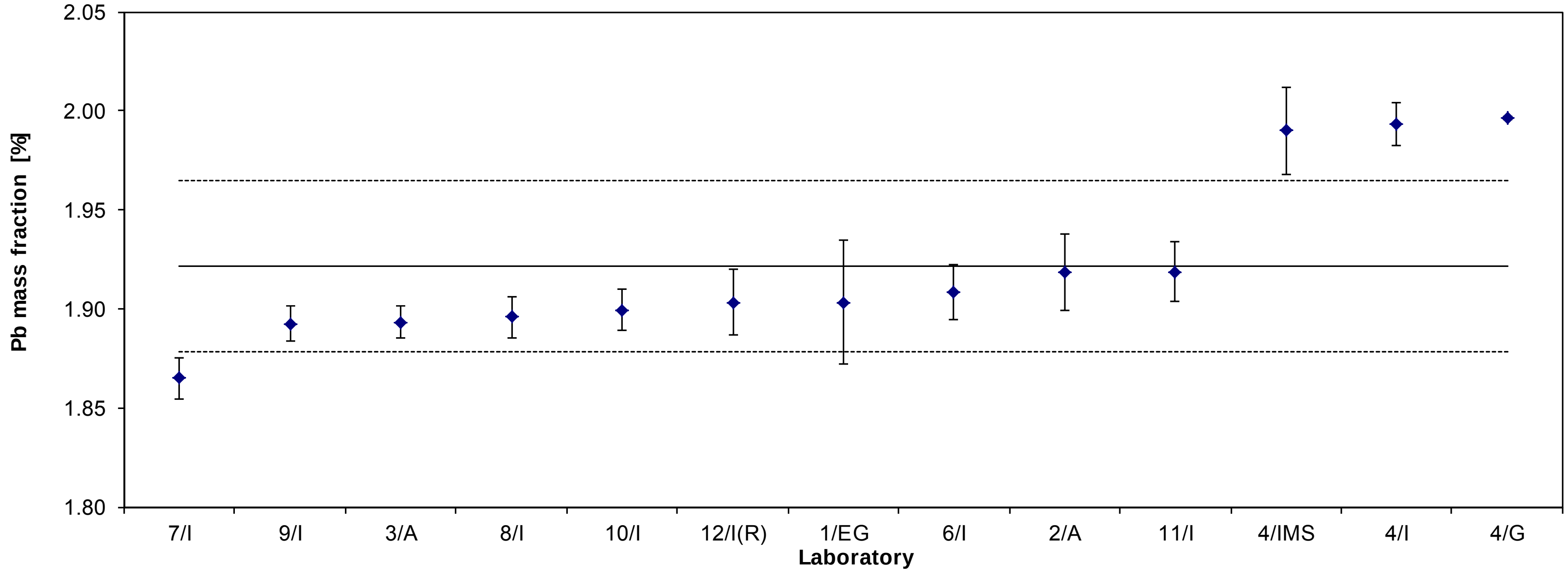

Table 19: Results for Pb in BAM-M394a

Lab./Meth.	4/I	10/I	3/I	12/I	6/I	1/I	6/GD	9/I	7/I(R)	11/I	2/A	8/I		
M_i [%]	0.1286	0.1290	0.1286	0.13	0.1309	0.1339	0.1307	0.1327	0.134	0.1342	0.1348	0.1368		*n*
	0.1287	0.1292	0.1296	0.13	0.1314	0.1342	0.1313	0.1329	0.134	0.1359	0.1360	0.1360		12
	0.1280	0.1285	0.1297	0.13	0.1304	0.1332	0.1347	0.1336	0.134	0.1345	0.1362	0.1354		
	0.1286	0.1296	0.1291	0.13	0.1331	0.1327	0.1355	0.1345	0.135	0.1327	0.1348	0.1375		
	0.1289	0.1278	0.1296	0.13	0.1287	0.1292	0.1332	0.1353	0.135	0.1358	0.1367	0.1373		
	0.1283	0.1289	0.1292	0.13	0.1283	0.1286	0.1327	0.1351	0.133	0.1356	0.1357	0.1369		
M [%]	**0.1285**	**0.1288**	**0.1293**	**0.1300**	**0.1305**	**0.1320**	**0.1330**	**0.1340**	**0.1342**	**0.1348**	**0.1357**	**0.1367**		**0.1323**
s[%]	0.0003	0.0006	0.0004	0.0000	0.0018	0.0024	0.0019	0.0011	0.0008	0.0012	0.0008	0.0008	s_M [%]	0.0028
													$\bar{s}_i$ [%]	0.0012
s_{rel}	0.00248	0.00483	0.00324	0.00000	0.01363	0.01849	0.01404	0.00831	0.00561	0.00904	0.00567	0.00587		0.021

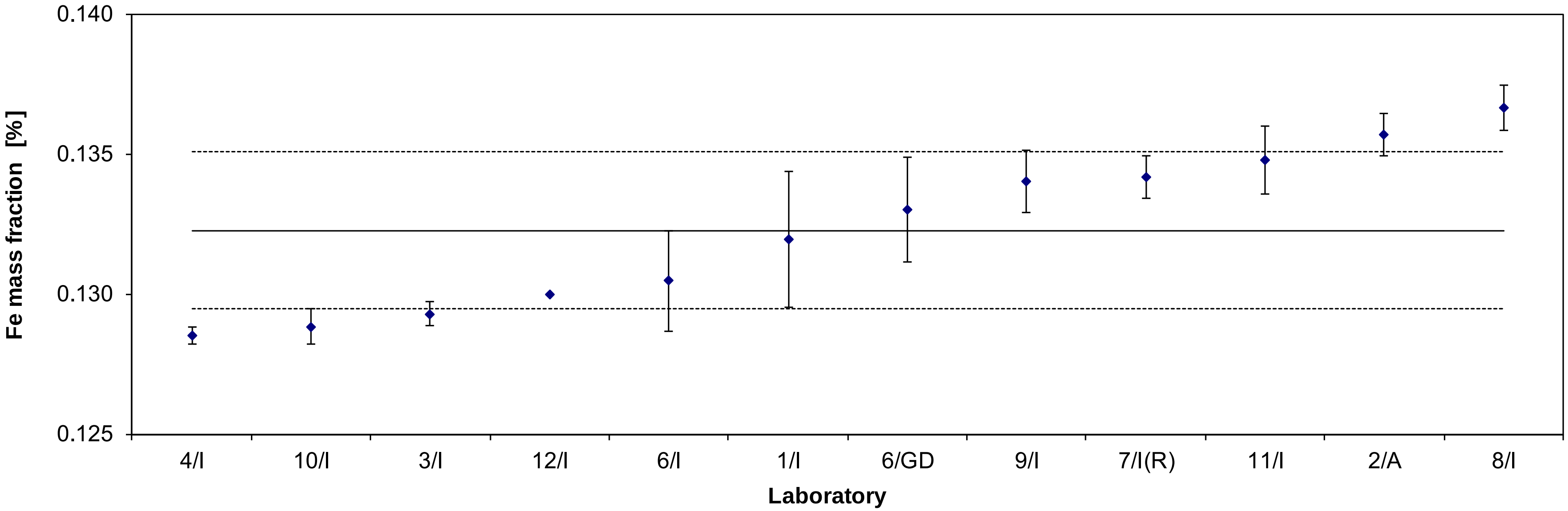

Table 20: Results for Fe in BAM-M394a

Lab./Meth.	12/I	7/I	3/I	1/I	6/GD	11/I	4/I(R)	6/I	4/IMS	10/I	9/I	2/I	8/I		
M_i [%]	0.16	0.16	0.1717	0.1723	0.1687	0.1786	0.1779	0.1786	0.1784	0.1776	0.1782	0.1817	0.1855		*n*
	0.16	0.16	0.1595	0.1726	0.1717	0.1768	0.1761	0.1792	0.1811	0.1790	0.1812	0.1805	0.1854		13
	0.16	0.16	0.1666	0.1724	0.1654	0.1737	0.1795	0.1780	0.1797	0.1781	0.1793	0.1806	0.1861		
	0.16	0.16	0.1655	0.1717	0.1719	0.1798	0.1756	0.1812	0.1776	0.1788	0.1796	0.1810	0.1842		
	0.16	0.16	0.1660	0.1669	0.1754	0.1761	0.1796	0.1749	0.1765	0.1789	0.1824	0.1802	0.1864		
	0.16	0.16	0.1695	0.1669	0.1772	0.1763	0.1758	0.1743	0.1736	0.1771	0.1827	0.1798	0.1858		
M [%]	**0.1600**	**0.1600**	**0.1665**	**0.1705**	**0.1717**	**0.1769**	**0.1774**	**0.1777**	**0.1778**	**0.1783**	**0.1806**	**0.1806**	**0.1856**		**0.1741**
s[%]	0.0000	0.0000	0.0042	0.0028	0.0043	0.0021	0.0018	0.0026	0.0026	0.0008	0.0018	0.0007	0.0008	s_M [%]	0.0079
														$\bar{s}_i$ [%]	0.0023
s_{rel}	0.00000	0.00000	0.02496	0.01630	0.02507	0.01193	0.01039	0.01485	0.01471	0.00439	0.01005	0.00365	0.00413		0.046

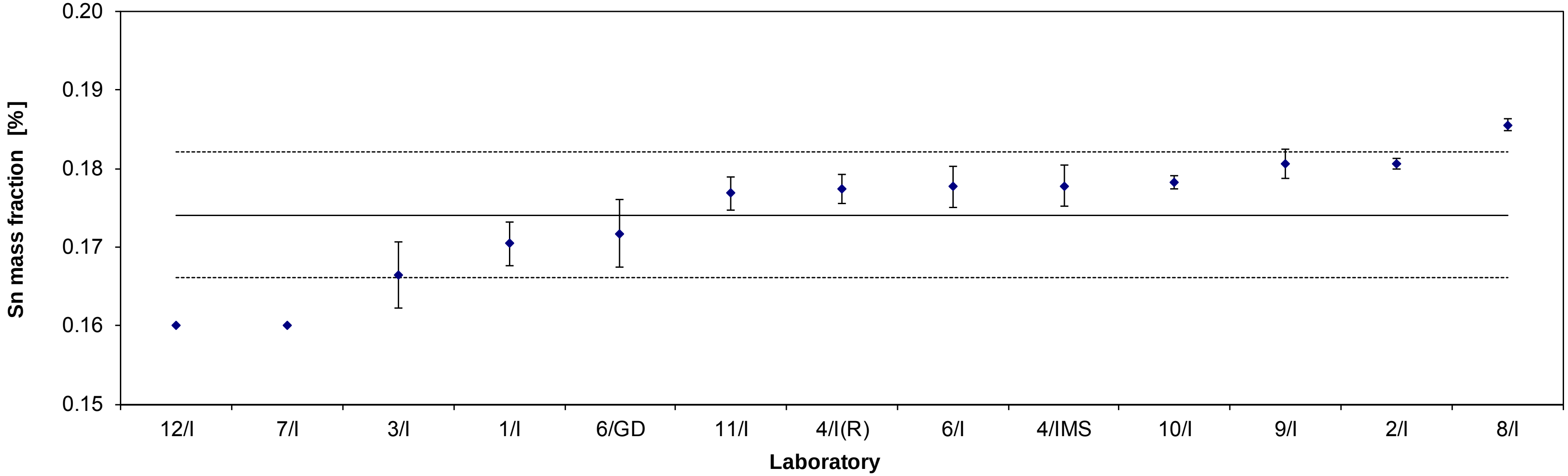

Table 21: Results for Sn in BAM-M394a

Lab./Meth.	11/I	6/I	12/I	2/I	3/I	6/GD	1/I	4/I	8/I	10/I	9/I		
M_i [mg/kg]	92.6	92.1	95.00	93.07	96.10	94.70	99.0	97.3	97.5	98.00	99.0		*n*
	91.8	92.4	94.00	97.49	92.90	96.50	99.0	97.3	98.1	98.00	98.0		11
	91.3	96.3	95.00	95.62	95.50	95.30	98.0	97.3	98.8	99.00	99.0		
	91.2	95.2	94.00	96.32	96.30	95.40	97.0	97.3	97.9	97.00	99.0		
	91.2	94.4	95.00	93.43	95.70	96.00	94.0	97.4	97.5	99.00	100.0		
	92.3	92.3	94.00	92.29	97.00	95.70	94.0	97.3	95.7	97.00	101.0		
***M* [mg/kg]**	**91.74**	**93.78**	**94.50**	**94.70**	**95.58**	**95.60**	**96.83**	**97.31**	**97.58**	**98.00**	**99.33**		**95.91**
s [mg/kg]	0.598	1.770	0.548	2.066	1.415	0.620	2.317	0.028	1.040	0.894	1.033	s_M [mg/kg]	2.174
												$\bar{s}_i$ [mg/kg]	1.3059
s_{rel}	0.007	0.019	0.006	0.022	0.015	0.006	0.024	0.000	0.011	0.009	0.010		0.023

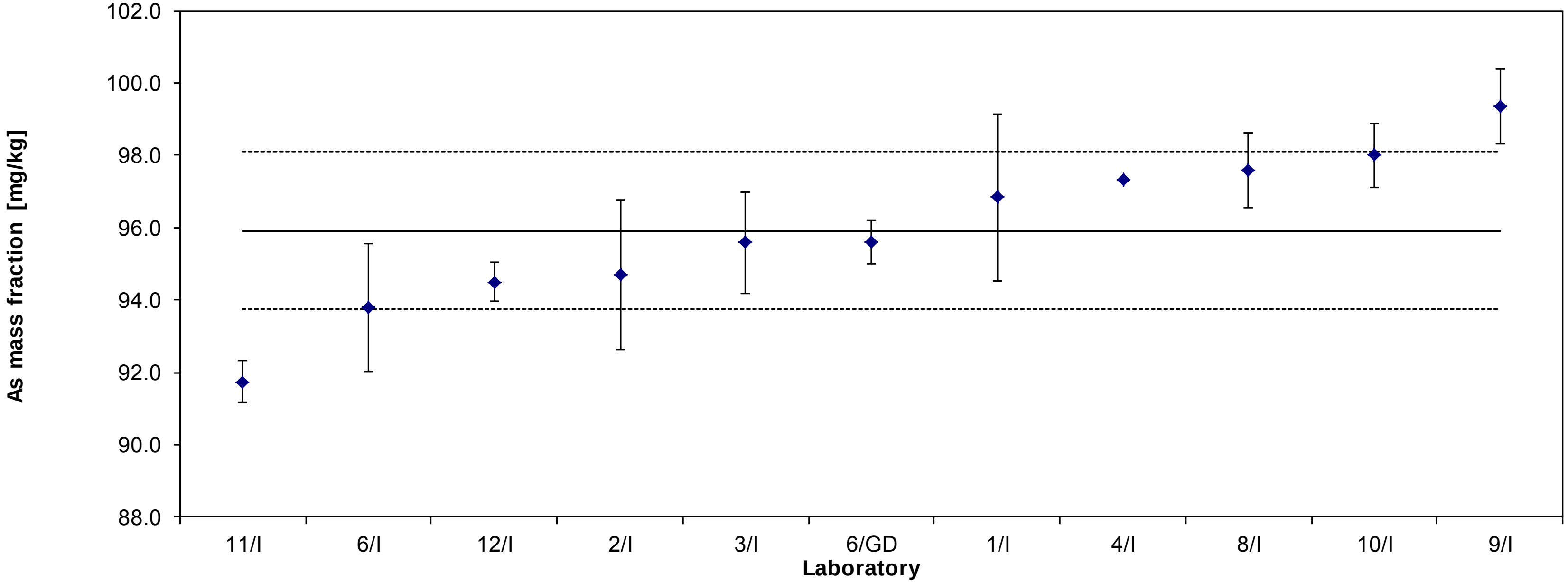

Table 22: Results for As in BAM-M394a

Lab./Meth.	3/EA	2/EA	4/I	10/I	12/I	6/GD	2/IMS	8/EA	1/EA		
M_i [mg/kg]	6.8	7.0	7.0	8.6	9.10	8.4	9.2	9.2	10.1		*n*
	7.1	6.3	7.0	7.9	8.40	8.4	9.4	9.2	9.6		9
	7.2	7.0	7.0	7.7	8.60	8.6	9.5	10.0	9.2		
	6.2	6.8	7.0	8.6	8.40	8.9	9.4	9.8	9.4		
	6.6	7.2	7.0	7.2	8.70	9.0	9.3	9.3	9.6		
	6.8	7.1	7.0	7.7	8.45	9.2	9.5	9.0	9.8		
							9.5				
M [mg/kg]	**6.78**	**6.89**	**6.97**	**7.95**	**8.61**	**8.75**	**9.41**	**9.42**	**9.62**		**8.27**
s [mg/kg]	0.360	0.318	0.003	0.554	0.269	0.333	0.111	0.392	0.313	s_M [mg/kg]	1.154
										$\bar{s}_i$ [mg/kg]	0.3377
s_{rel}	0.053	0.046	0.000	0.070	0.031	0.038	0.012	0.042	0.032		0.140

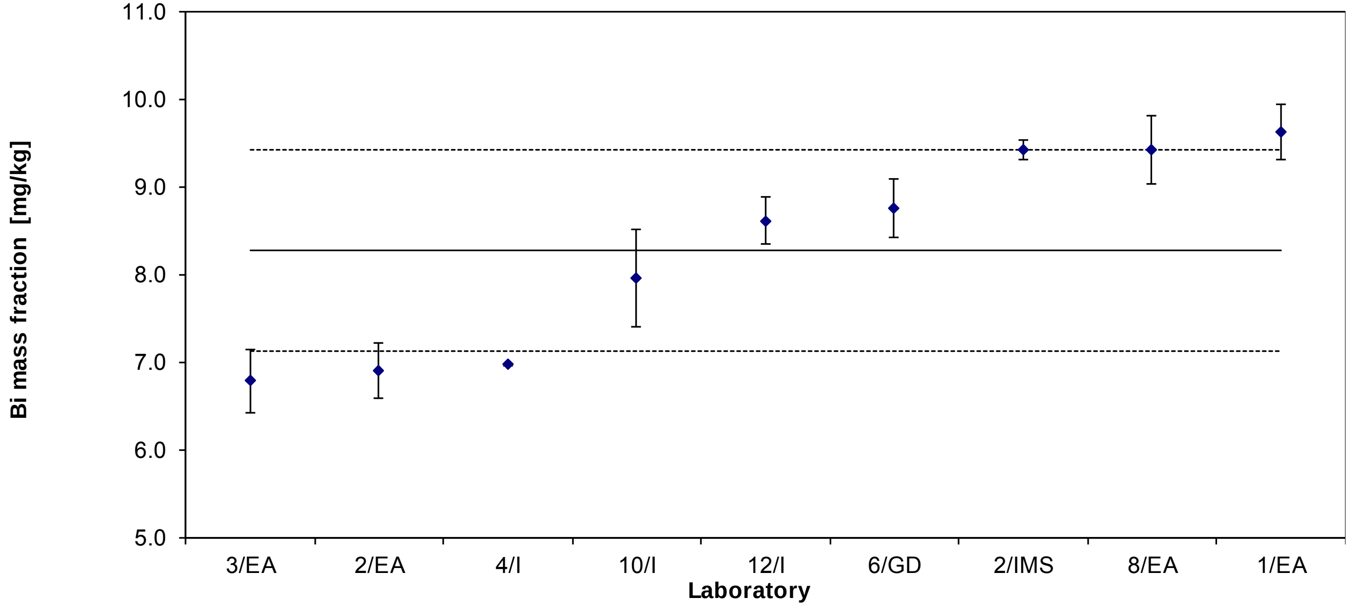

Table 23: Results for Bi in BAM-M394a

Lab./Meth.	10/I	2/IMS	2/EA	4/I(R)	4/IMS	11/I	6/I	6/GD	12/I	3/EA	1/I	8/I		
M_i [mg/kg]	5.90	6.10	6.48	7.1	7.3	7.61	7.5	7.40	7.70	7.8	8.0	8.6		*n*
	5.80	5.99	6.33	7.1	6.5	7.31	7.4	7.50	7.80	8.1	8.0	8.6		12
	5.80	6.20	6.28	7.1	7.2	7.32	7.3	7.70	7.80	8.0	8.0	8.6		
	5.70	6.47	6.30	7.1	7.8	7.11	7.4	8.00	8.00	7.9	8.0	8.6		
	5.70	5.95	6.11	7.1	7.3	7.29	7.4	8.00	7.70	7.9	8.0	8.6		
	5.90	5.99	6.32	7.1	7.6	7.42	7.4	7.90	7.60	8.0	8.0	8.5		
		6.15												
***M* [mg/kg]**	**5.80**	**6.12**	**6.30**	**7.13**	**7.28**	**7.34**	**7.40**	**7.75**	**7.77**	**7.95**	**8.00**	**8.58**		**7.29**
s [mg/kg]	0.0894	0.1802	0.1181	0.0031	0.4446	0.1651	0.0632	0.2588	0.1366	0.1049	0.0000	0.0408	s_M [mg/kg]	0.8339
													$\bar{s}_i$ [mg/kg]	0.1783
s_{rel}	0.01542	0.02944	0.01874	0.00043	0.06104	0.02248	0.00855	0.03340	0.01759	0.01319	0.00000	0.00476		0.114

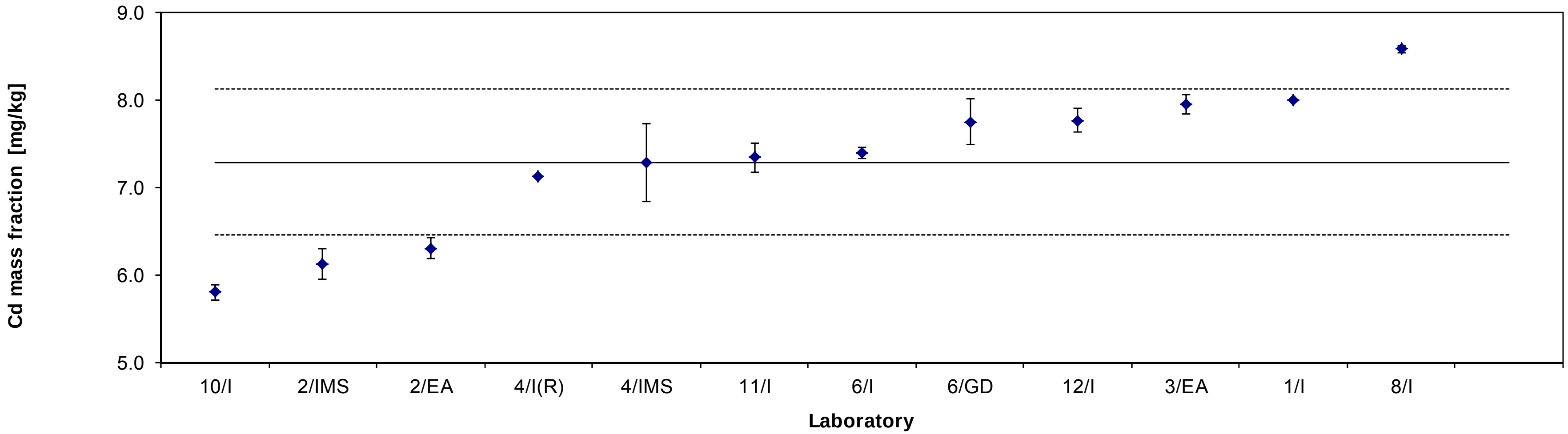

Table 24: Results for Cd in BAM-M394a

Lab./Meth.	6/GD	10/I	1/EA	4/IMS	12/I	2/IMS	4/I(R)	3/I	6/I	8/I		
M_i [mg/kg]	1.04	1.10	1.10	1.10	1.30	1.50	2.10	2.20	< 1	<5		*n*
	1.06	1.10	1.09	1.10	1.30	2.18	2.00	2.20	< 1	<5		10
	1.03	1.00	1.08	1.10	1.20	1.04	2.20	2.10	< 1	<5		
	1.18	1.20	1.10	1.00	1.50	1.08	2.00	2.20	< 1	<5		
	1.09	1.00	1.08	1.10	1.29	1.12	2.00	2.10	< 1	<5		
	1.05	1.10	1.06	1.20	1.24	1.18	2.20	2.20	< 1	<5		
***M* [mg/kg]**	**1.08**	**1.08**	**1.09**	**1.10**	**1.31**	**1.35**	**2.08**	**2.17**	**< 1**	**<5**		**1.2974**
s [mg/kg]	0.0554	0.0753	0.0152	0.0632	0.1035	0.4405	0.0983	0.0516			s_M [mg/kg]	0.3651
											$\bar{s}_i$ [mg/kg]	0.1905
s_{rel}	0.05154	0.06949	0.01398	0.05750	0.07930	0.32622	0.04719	0.02383				0.281

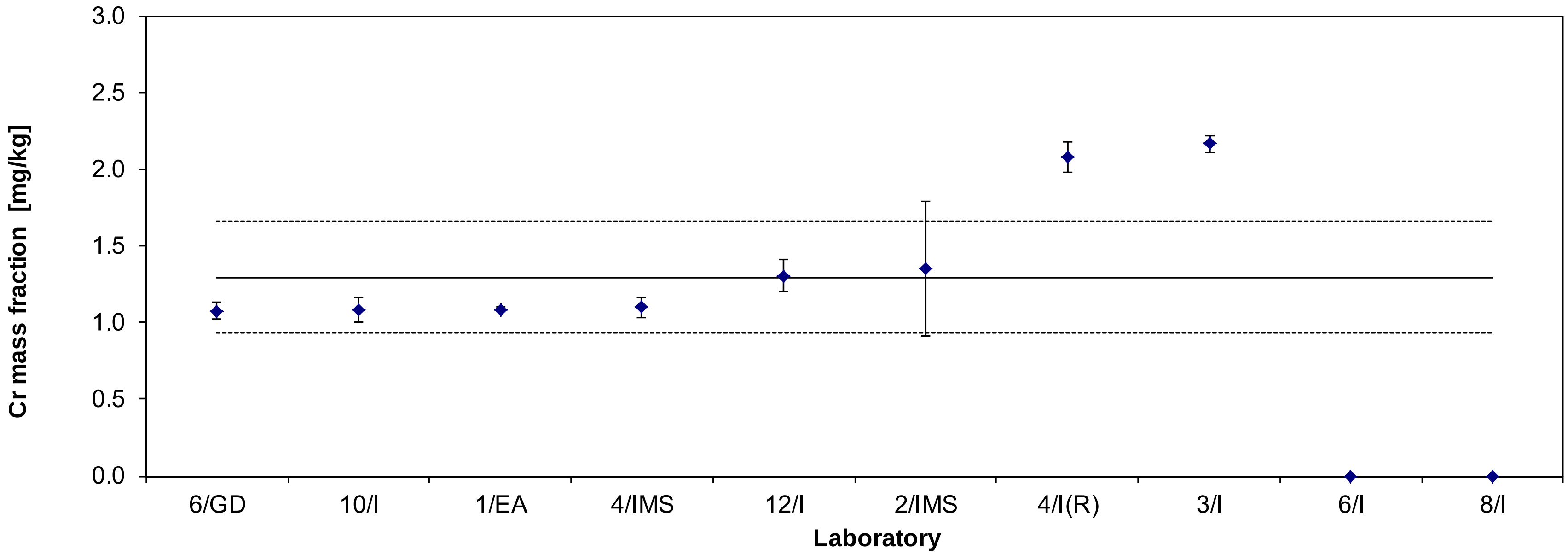

Table 25: Results for Cr in BAM-M394a

Lab./Meth.	2/IMS	6/I	12/I	10/I	4/I(R)	11/I	2/I	4/IMS	1/I	8/I	3/A	6/GD		
M_i [mg/kg]	10.9	12.2	12.1	12.0	12.3	12.8	12.9	13.2	13.0	13.1	13.1	13.0		n
	10.1	10.2	12.0	12.0	12.4	12.3	12.8	13.0	13.0	13.1	13.0	13.1		12
	12.0	10.6	11.9	13.0	12.5	12.6	12.8	12.6	13.0	13.0	12.9	13.2		
	11.7	10.8	11.9	13.0	12.2	12.4	12.9	12.8	13.0	13.0	13.0	13.5		
	12.2	13.1	11.9	12.0	12.3	12.8	12.8	13.2	13.0	13.0	13.2	13.4		
	12.3	13.1	11.9	12.0	12.4	12.8	12.8	13.1	13.0	13.0	13.0	13.4		
	10.9				12.4			13.0						
M [mg/kg]	**11.45**	**11.67**	**11.95**	**12.33**	**12.35**	**12.61**	**12.83**	**12.98**	**13.00**	**13.03**	**13.03**	**13.27**		**12.54**
s [mg/kg]	0.8092	1.2987	0.0837	0.5164	0.0957	0.2352	0.0516	0.2192	0.0000	0.0516	0.1033	0.1966	s_M [mg/kg]	0.5950
													$\bar{s}_i$ [mg/kg]	0.4815
s_{rel}	0.07068	0.11132	0.00700	0.04187	0.00775	0.01865	0.00402	0.01688	0.00000	0.00396	0.00792	0.01482		0.047

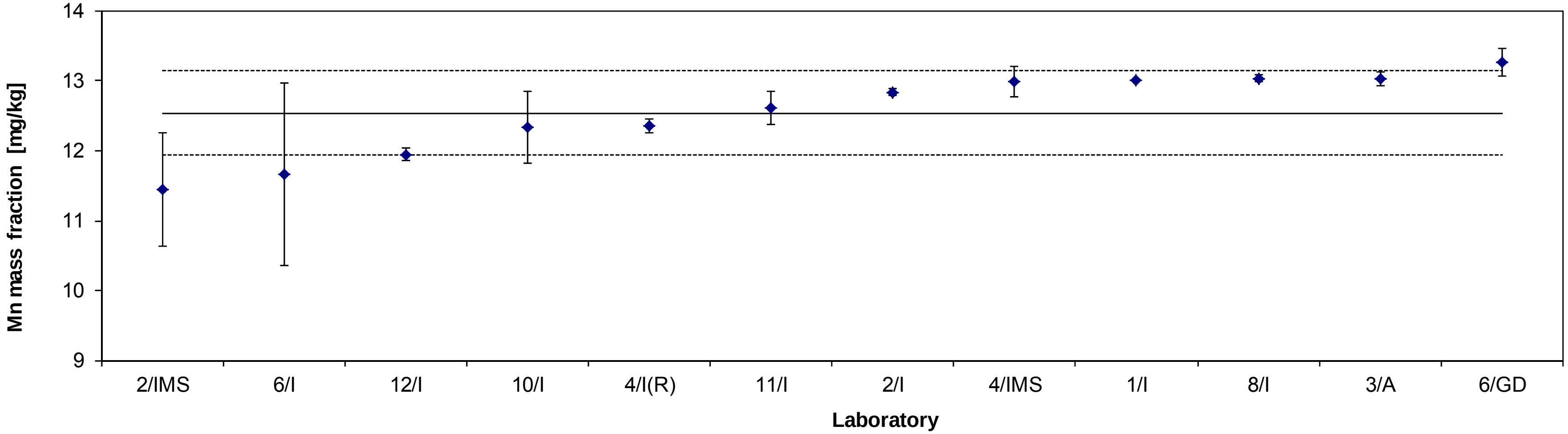

Table 26: Results for Mn in BAM-M394a

Lab./Meth.	11/I	12/I	3/A	2/P	1/I	2/I	4/I	9/I	10/I	6/I	6/GD	7/I(R)	8/I		
M_i [mg/kg]	380.0	380.0	381.0	381.0	387.0	383.0	379.9	386.0	386.0	394.0	405.0	390.0	403.0		*n*
	362.6	380.0	379.0	382.0	387.0	381.0	386.1	379.0	383.0	393.0	404.0	390.0	405.0		13
	372.2	380.0	377.0	379.0	384.0	380.0	384.8	383.0	385.0	394.0	398.0	390.0	402.0		
	366.8	370.0	381.0	379.0	383.0	383.0	385.1	388.0	386.0	399.0	389.0	400.0	402.0		
	380.1	370.0	380.0	379.0	372.0	381.0	384.5	389.0	392.0	393.0	389.0	410.0	406.0		
	381.9	370.0	377.0	378.0	371.0	381.0	384.2	390.0	395.0	389.0	387.0	410.0	402.0		
***M* [mg/kg]**	**373.9**	**375.0**	**379.2**	**379.7**	**380.7**	**381.5**	**384.1**	**385.8**	**387.8**	**393.7**	**395.3**	**398.3**	**403.3**		**386.0**
s [mg/kg]	8.01	5.48	1.83	1.51	7.28	1.22	2.16	4.17	4.62	3.20	8.07	9.83	1.75	s_M [mg/kg]	9.16
														$\bar{s}_i$ [mg/kg]	5.36
s_{rel}	0.02143	0.01461	0.00484	0.00397	0.01914	0.00321	0.00562	0.01080	0.01192	0.00814	0.02040	0.02468	0.00434		0.024

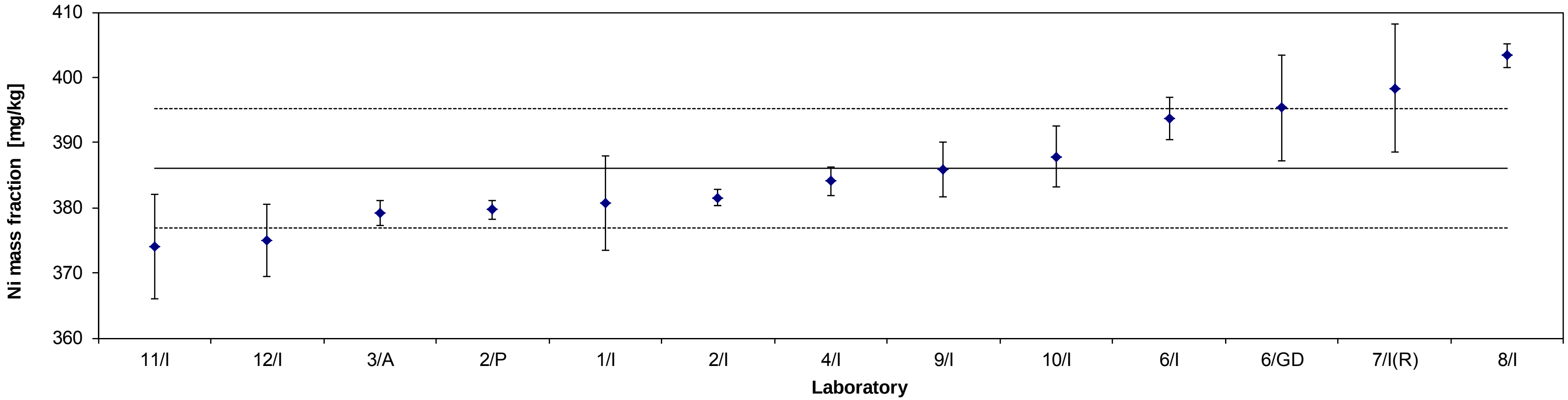

Table 27: Results for Ni in BAM-M394a

Lab./Meth.	3/I	10/I	2/P	12/I	1/I	8/I	6/GD	4/I	6/I		
M_i [mg/kg]	16.3	15.0	14.8	16.1	17.0	17.1	19.6	21.2	19.6		*n*
	14.6	15.0	15.1	16.0	17.0	16.8	19.8	20.9	19.6		9
	15.3	16.0	15.9	16.0	17.0	16.9	19.1	19.5	21.2		
	15.4	15.0	14.6	16.0	16.0	17.2	18.4	20.2	21.6		
	14.5	14.0	15.7	16.0	16.0	16.9	18.1	20.1	20.8		
	14.0	16.0		16.0	16.0	16.9	17.8	19.8	21.6		
***M* [mg/kg]**	**15.0**	**15.2**	**15.2**	**16.0**	**16.5**	**17.0**	**18.8**	**20.3**	**20.7**		**17.19**
s [mg/kg]	0.818	0.753	0.552	0.041	0.548	0.151	0.822	0.649	0.927	s_M [mg/kg]	2.218
										$\bar{s}_i$ [mg/kg]	0.652
s_{rel}	0.054	0.050	0.036	0.003	0.033	0.009	0.044	0.032	0.045		0.129

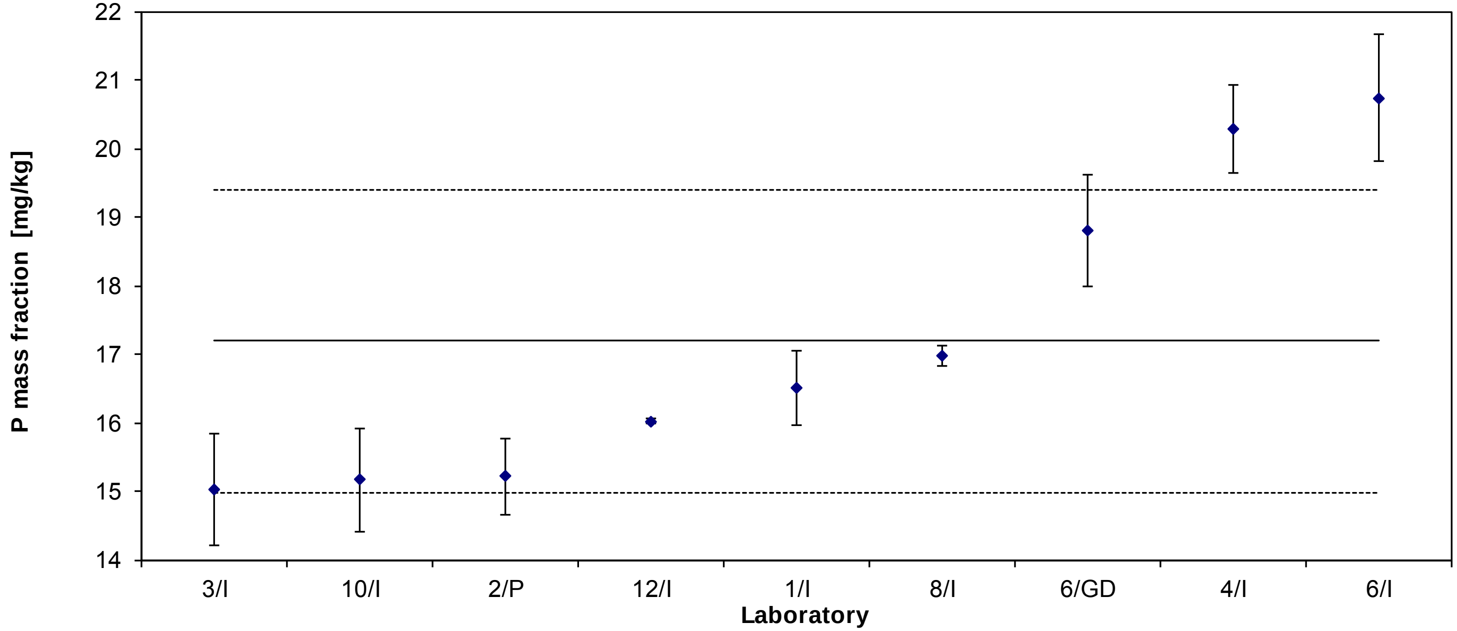

Table 28: Results for P in BAM-M394a

Lab./Meth.	12/I(R)	1/I	8/I	6/GD	4/IMS	2/EA	2/P	4/I(R)	2/IMS	9/I	10/I	2/I		
M_i [mg/kg]	18.0	20.0	23.1	22.00	23.4	24.69	23.8	23.4	24.0	27.0	27.0	27.9		*n*
	18.0	20.0	22.1	22.20	23.4	23.24	23.4	24.3	23.8	24.0	25.0	24.8		10
	18.0	20.0	23.1	22.29	23.5	23.10	23.6	23.5	24.2	24.0	26.0	27.0		
	18.0	20.0	21.8	23.50	24.2	23.93	23.6	24.6	24.3	24.0	25.0	25.5		
	18.0	19.0	23.8	23.76	23.4	23.88	23.7	23.1	24.8	24.0	27.0	25.5		
	17.0	19.0	23.4	23.81	23.5	23.18	24.0	24.6	24.5	24.0	25.0	26.4		
									23.5					
***M* [mg/kg]**	**17.83**	**19.67**	**22.88**	**22.93**	**23.57**	**23.67**	**23.68**	**23.92**	**24.16**	**24.50**	**25.83**	**26.18**		**24.13**
s [mg/kg]	0.408	0.516	0.773	0.848	0.314	0.618	0.204	0.662	0.435	1.225	0.983	1.141	s_M [mg/kg]	1.107
													$\bar{s}_i$ [mg/kg]	0.7895
s_{rel}	0.023	0.026	0.034	0.037	0.013	0.026	0.009	0.028	0.018	0.050	0.038	0.044		0.046

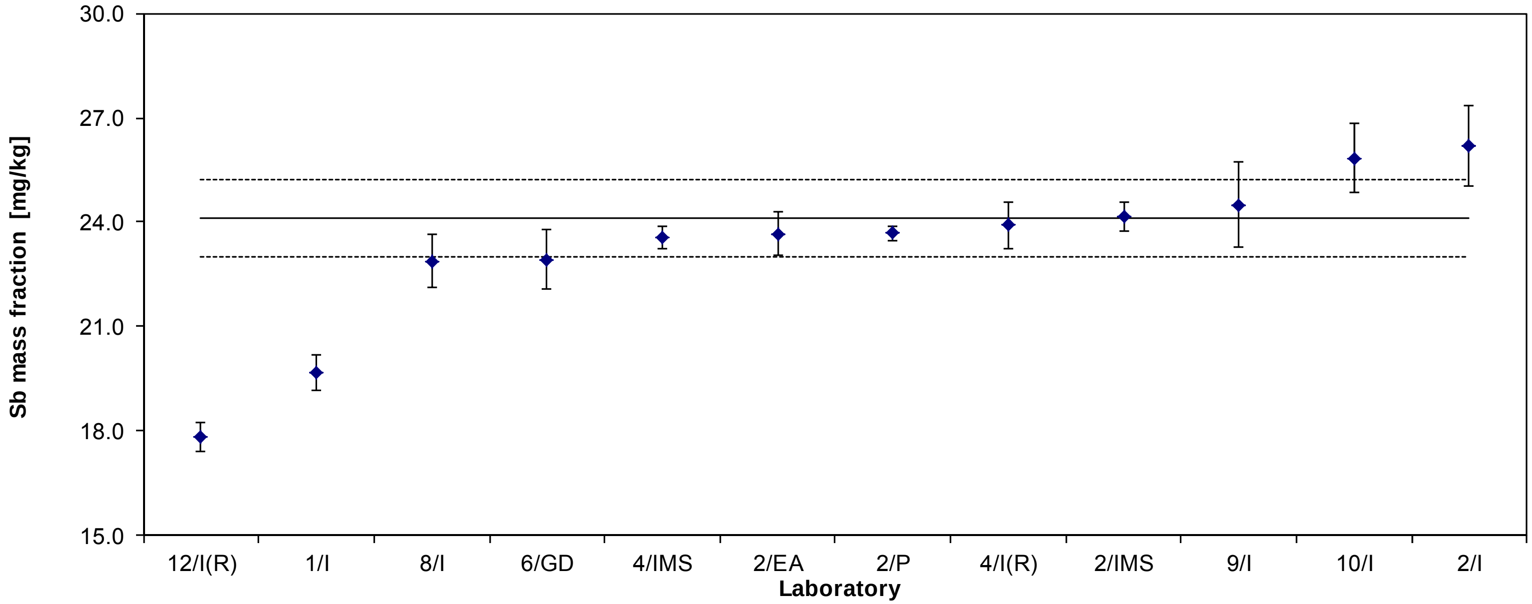

Table 29: Results for Sb in BAM-M394a

Lab./Meth.	12/I	4/I	10/I	1/I	2/IMS	6/GD	8/I	6/I		
M_i [mg/kg]	1.00	2.77	6.60	7.00	6.97	7.00	8.80	7.70		*n*
	1.00	2.78	6.30	7.00	7.24	7.70	8.60	7.50		8
	1.00	2.77	6.60	7.00	6.79	7.50	8.60	10.90		
	1.00	2.77	6.50	7.00	7.21	8.30	8.60	12.40		
	1.00	2.78	7.40	7.00	7.38	8.90	8.60	11.90		
	1.00	2.77	6.30	7.00	6.82	8.30	8.50	10.10		
***M* [mg/kg]**	**1.00**	**2.77**	**6.62**	**7.00**	**7.07**	**7.95**	**8.62**	**10.08**		**7.89**
s [mg/kg]	0.000	0.003	0.407	0.000	0.244	0.680	0.098	2.083	s_M [mg/kg]	1.299
									$\bar{s}_i$ [mg/kg]	0.0887
s_{rel}	0.000	0.001	0.062	0.000	0.035	0.086	0.011	0.207		0.165

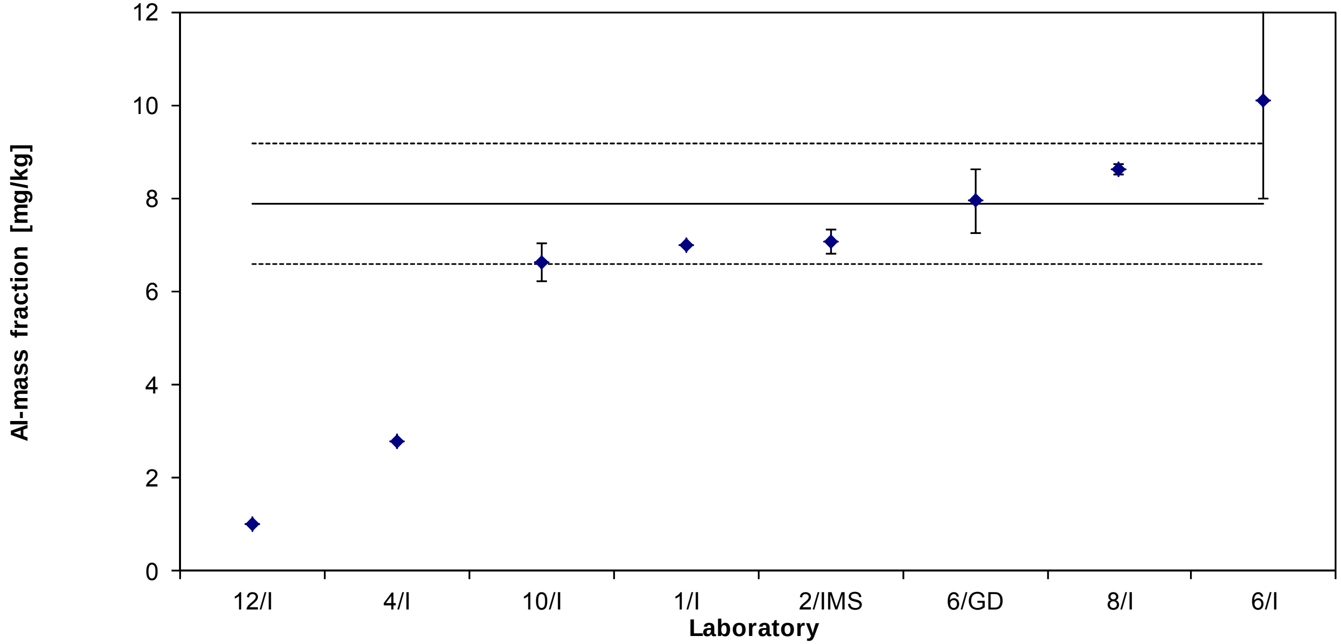

Table 30: Results for Al in BAM-M394a

Lab./Meth.	10/I	8/I	4/I		
M_i [mg/kg]	4.0	4.6	8.786		*n*
	3.0	5.2	8.783		3
	4.0	5.2	8.785		
	3.0	5.8	8.791		
	2.0	6.1	8.780		
	3.0	5.8	8.787		
M [mg/kg]	**3.167**	**5.450**	**8.785**		**5.801**
s [mg/kg]	0.7528	0.5505	0.0037	s_M [mg/kg]	2.826
				$\bar{s}_i$ [mg/kg]	0.277
s_{rel}	0.2377	0.1010	0.0004		0.487

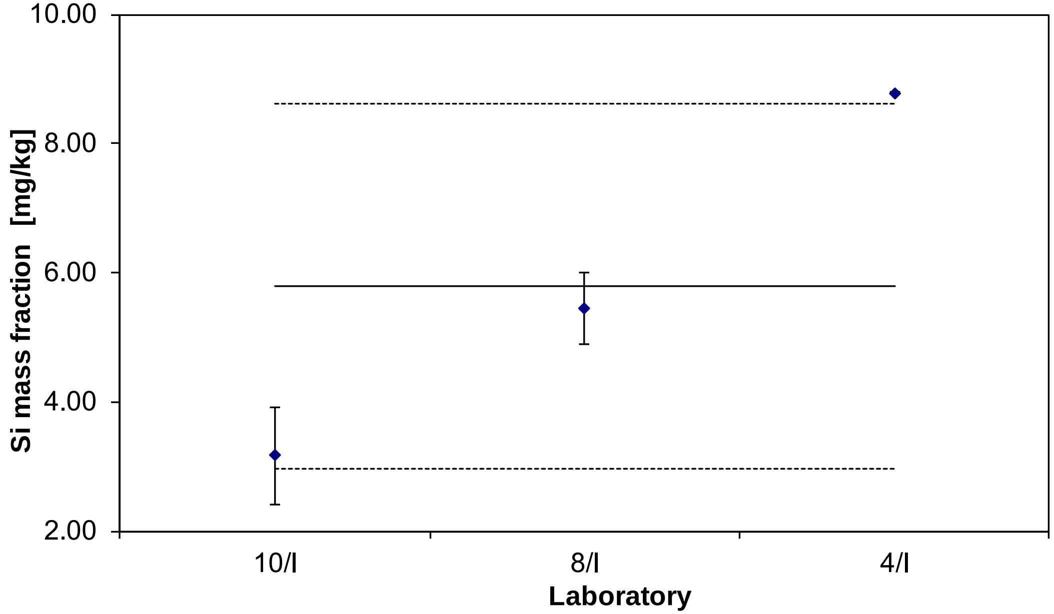

Table 31: Results for Si in BAM-M394a

The statistical evaluation of the data was performed using the software program SoftCRM 1.2.2. [5]. The following results were obtained:

Tab. 32: Outcome of statistical tests on the results obtained for Cu

	BAM-M394	BAM-M394a
Number of data sets	9	10
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	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	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

Tab. 33: Outcome of statistical tests on the results obtained for Pb

	BAM-M394	BAM-M394a
Number of data sets	13	13
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	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: not normal	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: not normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

Tab. 34: Outcome of statistical tests on the results obtained for Fe

	BAM-M394	BAM-M394a
Number of data sets	10	12
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	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	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

Tab. 35: Outcome of statistical tests on the results obtained for Sn

	BAM-M394	BAM-M394a
Number of data sets	13	13
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	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	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

Tab. 36: Outcome of statistical tests on the results obtained for As

	BAM-M394	BAM-M394a
Number of data sets	11	11
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Laboratory 2/IMS	Laboratory 11
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	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

The stragglers (Lab. 2 in case of 394 and Lab. 11 in case of 394a) were not removed.

Tab. 37: Outcome of statistical tests on the results obtained for Bi

	BAM-M394	BAM-M394a
Number of data sets	9	9
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	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	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

Tab. 38: Outcome of statistical tests on the results obtained for Cd

	BAM-M394	BAM-M394a
Number of data sets	11	12
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Laboratory 2/EA	---
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	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

The straggler (Lab. 2) was not removed.

Tab. 39: Outcome of statistical tests on the results obtained for Cr ("less than" values were not included into the statistical evaluation)

	BAM-M394a
Number of data sets	8
Scheffe's test (data compatible?)	yes
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

Tab. 40: Outcome of statistical tests on the results obtained for Mn

	BAM-M394	BAM-M394a
Number of data sets	12	12
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Labs. 2/IMS and 6/GD	Lab. 2/IMS
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	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

The stragglers (Labs. 2/IMS and 6/GD) were not removed.

Tab. 41: Outcome of statistical tests on the results obtained for Ni

	BAM-M394	BAM-M394a
Number of data sets	13	13
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 7	Lab. 8
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	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

The stragglers (Lab. 7 in case of 394 and Lab. 8 in case of 394a) were not removed.

Tab. 42: Outcome of statistical tests on the results obtained for P

	BAM-M394	BAM-M394a
Number of data sets	9	9
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	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: not normal	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

Tab. 43a: Outcome of statistical tests on the results obtained for Sb

	BAM-M394	BAM-M394a
Number of data sets	12	12
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	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)	Labs. 12 and 1	Labs. 12 and 1
Grubbs Pair (α = 0.01)	---	Labs. 12 and 1
Cochran	---	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

The outliers (Lab. 12 and 1 in case of 394a) were removed.
The stragglers (Lab. 12 and 1 in case of 394) were not removed.

Tab. 43b: Outcome of statistical tests on the results obtained for Sb (after removal of outliers)

	BAM-M394	BAM-M394a
Number of data sets	12	10
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	---	Lab. 2/I
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	Labs. 12 and 1	---
Grubbs Pair (α = 0.01)	---	---
Cochran	---	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

The straggler (Lab. 2/I in case of 394a) was not removed.

Tab. 44a: Outcome of statistical tests on the results obtained for Al ("less than" values were not included into the statistical evaluation)

	BAM-M394	BAM-M394a
Number of data sets	5	8
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 4	---
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	Labs. 12 and 4
Grubbs Pair (α = 0.01)	---	Labs. 12 and 4
Cochran	---	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Insufficient data	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Insufficient data	Distribution: normal

The outliers (Lab. 12 and 4 in case of 394a) were removed.
The straggler (Lab. 4 in case of 394) was not removed.

Tab. 44b: Outcome of statistical tests on the results obtained for Al (after removal of outliers, "less than" values were not included into the statistical evaluation)

	BAM-M394	BAM-M394a
Number of data sets	5	6
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 4	---
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: not normal	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Insufficient data	Insufficient data
Skewness & Kurtosis Test (α = 0.01)	Insufficient data	Insufficient data

The straggler (Lab. 4 in case of 394) was not removed.

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 of the material using Equation 3.

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

with

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

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

Table 33: Uncertainty calculation

394			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
	%		%	%	%	%	%	%			
Cu	57.70	9	0.0614	0.0205	0.0864	0.0159	0.0902	0.1805		0.1498	0.0275
Pb	1.9310	13	0.0440	0.0122	0.0046	0.0120	0.0177	0.0354		0.2378	0.6199
Fe	0.1191	10	0.0024	0.0008	0.0002	0.0009	0.0012	0.0024		0.1741	0.7448
Sn	0.2319	13	0.0073	0.0020	0.0003	0.0015	0.0026	0.00513		0.1427	0.6626
	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg					
As	100.10	11	3.630	1.0945	0.5694	0.3862	1.2928	2.5856		0.5688	0.3858
Bi	8.11	9	1.035	0.3450	0.0587	0.2482	0.4290	0.8580		0.7236	3.0600
Cd	6.97	11	0.392	0.1182	0.0428	0.1289	0.1800	0.3601		0.6145	1.8489
Mn	14.12	12	0.746	0.2154	0.1975	0.1900	0.3486	0.6971		1.3986	1.3459
Ni	399.0	13	11.210	3.1091	0.6984	1.8590	3.6892	7.3784		0.1750	0.4659
P	15.73	9	1.728	0.5760	0.0621	0.1355	0.5950	1.1899		0.3946	0.8611
Sb	23.77	12	1.865	0.5384	0.0871	0.2675	0.6075	1.2149		0.3666	1.1255
Al	0.99	5	0.976	0.4365	0.0173		0.4368	1.0921		1.7524	
Si	5.29	3	3.569	2.0606	0.0713		2.0618	5.1545		1.3476	

394a			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
	%		%	%	%	%	%	%			
Cu	57.64	10	0.0555	0.0176	0.0791	0.0149	0.0823	0.1647		0.1372	0.0258
Pb	1.9210	13	0.0430	0.0119	0.0056	0.0119	0.0178	0.0355		0.2940	0.6199
Fe	0.1323	12	0.0028	0.0008	0.0003	0.0010	0.0013	0.0026		0.2184	0.7448
Sn	0.1741	13	0.0079	0.0022	0.0009	0.0012	0.0026	0.00526		0.5124	0.6626
	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg					
As	95.91	11	2.174	0.6555	0.1861	0.3701	0.7754	1.5508		0.1940	0.3858
Bi	8.27	9	1.154	0.3847	0.0604	0.2531	0.4644	0.9288		0.7307	3.0600
Cd	7.29	12	0.834	0.2408	0.0325	0.1348	0.2778	0.5556		0.4456	1.8489
Cr	1.30	8	0.365	0.1291	0.0197	0.0694	0.1479	0.2958		1.5205	5.3528
Mn	12.54	12	0.595	0.1718	0.2061	0.1688	0.3169	0.6339		1.6434	1.3459
Ni	386.0	13	9.160	2.5405	1.5425	1.7984	3.4739	6.9478		0.3996	0.4659
P	17.19	9	2.218	0.7393	0.0685	0.1636	0.7603	1.5206		0.3982	0.9517
Sb	24.13	10	1.107	0.3501	0.0969	0.2716	0.4535	0.9071		0.4016	1.1255
Al	7.89	6	1.300	0.5307	0.1263		0.5455	1.3639		1.6010	
Si	5.80	3	2.830	1.6339	0.1050		1.6373	4.0932		1.8100	
									red: XRF-data		

The expanded uncertainties U are calculated by multiplication of $u_{combined}$ with a coverage factor of k = 2 using Equation 4.

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

The calculated mass fractions and their resp. expanded uncertainties are given on Pages 3 and 4 of this report.
Rounding was done according to DIN 1333.

6. Instructions for users and stability statement

The certified reference materials BAM-M394 and BAM-M394a are intended for the calibration and quality control of spark emission and X-ray fluorescence spectrometry used for the analysis of similar materials. They can also be used for wet chemical analysis.
Before analysis the surface of the materials should be cleaned by turning or milling. The preparation of the surface has to be done slowly to avoid heating of the disc.
If chips prepared from the compact materials are used for wet chemical analysis, a minimum sample intake of 0.2 g should be used.
The materials will remain stable provided that they are not subjected to excessive heat (e.g., 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] 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 materials BAM-M394 and BAM-M394a are 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 72061
E-Mail: sales.crm@bam.de
https://www.webshop.bam.de

Each disc 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, https://www.bam.de

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

BAM-M394:

	Fe	Ni	Zn	As	Sn	Pb	Cu
4-1	0.1200	0.04002	39.020	0.01002	0.20069	1.996	58.681
4-20	0.1199	0.03995	39.003	0.00997	0.20103	1.991	58.684
4-21	0.1199	0.03995	39.008	0.00994	0.20075	1.986	58.670
4-40	0.1200	0.03999	39.003	0.01001	0.20055	2.000	58.621
4-41	0.1199	0.03993	38.919	0.01012	0.20044	2.018	58.605
4-60	0.1197	0.03987	39.017	0.01000	0.20116	1.993	58.639
4-61	0.1197	0.03993	39.032	0.00996	0.20066	1.987	58.674
4-80	0.1199	0.03995	39.015	0.00994	0.20087	1.985	58.642
4-97	0.1191	0.03975	38.754	0.00994	0.19979	1.982	58.292
4-114	0.1199	0.04004	39.001	0.01002	0.20091	2.001	58.630
5 F	0.1200	0.03999	39.006	0.01005	0.20064	2.006	58.695
5 A-B	0.1207	0.03992	38.970	0.01011	0.20027	2.013	58.639
5 B-C	0.1198	0.03992	38.971	0.01009	0.20064	2.013	58.657
5 C-D	0.1202	0.04008	38.952	0.01001	0.20002	2.001	58.648
5 D-E	0.1199	0.04010	39.077	0.00997	0.20083	1.990	58.656
5 E-F	0.1198	0.04003	38.963	0.01006	0.20046	2.005	58.613
5 K	0.1198	0.04003	38.991	0.01004	0.20029	2.002	58.586
M	0.1199	0.03997	38.983	0.01001	0.20059	1.998	58.625
s	0.00030	0.00008	0.06849	0.00006	0.00035	0.01070	0.09078
RSD	0.25271	0.20943	0.17571	0.57915	0.17629	0.53558	0.15485
variance	0.00000	0.00000	0.00469	0.00000	0.00000	0.00011	0.00824
4-1	0.1201	0.04002	39.019	0.01000	0.20031	1.998	58.679
4-1	0.1200	0.04001	39.036	0.00999	0.20049	1.998	58.714
4-1	0.1201	0.04007	39.024	0.01001	0.20063	1.998	58.666
4-1	0.1200	0.04013	39.003	0.01002	0.20065	1.996	58.648
4-1	0.1199	0.03998	39.021	0.01000	0.20047	1.995	58.649
4-1	0.1199	0.04005	39.034	0.01002	0.20030	1.996	58.693
4-1	0.1200	0.04001	39.021	0.01002	0.20057	1.997	58.666
4-1	0.1202	0.04010	39.004	0.01001	0.20094	1.998	58.667
4-1	0.1202	0.04005	39.049	0.01002	0.20028	1.997	58.710
4-1	0.1200	0.04002	39.020	0.01002	0.20069	1.997	58.681
M	0.1200	0.04004	39.023	0.01001	0.20053	1.996	58.677
s	0.00009	0.00005	0.01409	0.00001	0.00021	0.00105	0.02272
s_{rel}	0.07515	0.11426	0.03611	0.10993	0.10362	0.05281	0.03871
variance	8.13778E-09	2.09333E-09	0.000198599	1.21111E-10	4.31789E-08	1.11111E-06	0.000515995
Difference of variance	8.36637E-08	4.91328E-09	0.004492896	3.24286E-09	8.18616E-08	0.000113418	0.007725634
s_{eff}	0.00029	0.00007	0.06703	0.00006	0.00029	0.01065	0.08790
$s_{eff, rel}$	0.24097	0.17504	0.17177	0.56884	0.14268	0.53356	0.14979

BAM-M394a:

	Fe	Ni	Zn	As	Sn	Pb	Cu
1-1	0.13470	0.03879	39.165	0.00991	0.14890	1.973	58.659
1-18	0.13468	0.03892	39.204	0.00993	0.14917	1.980	58.649
1-19	0.13470	0.03888	39.188	0.00997	0.14896	1.987	58.640
1-38	0.13498	0.03875	39.128	0.00988	0.14924	1.971	58.677
1-39	0.13462	0.03882	39.197	0.00979	0.14962	1.954	58.669
1-60	0.13467	0.03846	39.154	0.00988	0.14976	1.968	58.636
1-61	0.13495	0.03846	39.176	0.00994	0.14963	1.985	58.617
1-80	0.13459	0.03876	39.277	0.00974	0.14972	1.941	58.647
1-97	0.13492	0.0387	39.167	0.00992	0.15008	1.975	58.669
1-111	0.13480	0.03872	39.199	0.00990	0.14986	1.973	58.652
6 F	0.13528	0.03903	39.184	0.00993	0.15194	1.978	58.634
6 A-B	0.13529	0.03903	39.185	0.00987	0.15170	1.968	58.661
6 B-C	0.13518	0.03897	39.154	0.00992	0.15172	1.978	58.655
6 C-D	0.13525	0.03891	39.077	0.01000	0.15141	1.991	58.605
6 D-E	0.13523	0.03892	39.119	0.00997	0.15107	1.986	58.601
6 E-F	0.13522	0.03891	39.122	0.00992	0.15092	1.979	58.620
6 K	0.13537	0.03883	39.177	0.00993	0.15118	1.982	58.652
M	0.13497	0.03882	39.169	0.00991	0.15029	1.975	58.644
s	0.00028	0.00017	0.04386	0.00006	0.00105	0.01236	0.02231
s_{rel}	0.20540	0.42879	0.11198	0.63952	0.69756	0.62614	0.03805
variance	7.68493E-08	2.7701E-08	0.00192367	4.0132E-09	1.099E-06	0.00015287	0.00049788
	0.002053969						
4-1	0.12010	0.04002	39.019	0.01000	0.20031	1.998	58.679
4-1	0.11997	0.04001	39.036	0.00999	0.20049	1.998	58.714
4-1	0.12005	0.04007	39.024	0.01001	0.20063	1.998	58.666
4-1	0.11997	0.04013	39.003	0.01002	0.20065	1.996	58.648
4-1	0.11994	0.03998	39.021	0.01000	0.20047	1.995	58.649
4-1	0.11993	0.04005	39.034	0.01002	0.20030	1.996	58.693
4-1	0.12004	0.04001	39.021	0.01002	0.20057	1.997	58.666
4-1	0.12019	0.0401	39.004	0.01001	0.20094	1.998	58.667
4-1	0.12016	0.04005	39.049	0.01002	0.20028	1.997	58.710
4-1	0.12001	0.04002	39.020	0.01002	0.20069	1.997	58.681
M	0.12004	0.04004	39.023	0.01001	0.20053	1.996	58.677
s	0.00009	0.00005	0.01409	0.00001	0.00021	0.00105	0.02272
s_{rel}	0.07515	0.11426	0.03611	0.10993	0.10362	0.05281	0.03871
variance	8.13778E-09	2.0933E-09	0.0001986	1.2111E-10	4.3179E-08	1.1111E-06	0.00051599
Difference of variances	6.87115E-08	2.5608E-08	0.00172507	3.8921E-09	1.0558E-06	0.00015176	
S_{eff}	0.00026	0.00016	0.04153	0.00006	0.00103	0.01232	
$S_{eff, rel}$	0.21838	0.39962	0.10643	0.62318	0.51241	0.61718	*0.13716*

Annex 2: Calculation of uncertainty contribution of potential inhomogeneity (length) using SOES

Cu in BAM-M394:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
4-1	6	345.4	57.5667	0.0067		
4-113	6	345.3	57.5500	0.0070		
4-41	6	345.3	57.5500	0.0070		
4-62	6	345.3	57.5500	0.0030		
4-80	6	345.5	57.5833	0.0057		
5 B-A	6	345.5	57.5833	0.0097		
5 B-C	6	345.2	57.5333	0.0027		
5 C-D	6	345.3	57.5500	0.0070		
5 K	6	345.4	57.5667	0.0067		
5-2	6	345.3	57.5500	0.0070		
			57.5583333			

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.01416667	9	0.00157407	0.25252525	0.98406016	2.07335116
Within groups	0.31166667	50	0.00623333			
Total	0.32583333	59				
within-sd	0.0789515					
effective n	5.00					
s_bb	0					
s_bb_min	0.0157903					
u_bb	0.0157903	15.790292				
u_bb(rel.)	0.02743355					

Pb in BAM-M394:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
4-1	6	12.248	2.0413	0.00080867		
4-113	6	12.29	2.0483	0.00027227		
4-41	6	12.325	2.0542	0.00024377		
4-62	6	12.232	2.0387	0.00051387		
4-80	6	12.171	2.0285	0.0005567		
5 B-A	6	12.246	2.0410	0.0002416		
5 B-C	6	12.251	2.0418	0.00072857		
5 C-D	6	12.208	2.0347	0.00143667		
5 K	6	12.263	2.0438	0.00015937		
5-2	6	12.256	2.0427	0.00093227		
			2.0415			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.00262833	9	0.00029204	0.49550433	0.87057927	2.07335116
Within groups	0.02946867	50	0.00058937			
Total	0.032097	59				
within-sd	0.024277					
effective n	5.00					
s_bb	0					
s_bb_min	0.0048554					
u_bb	0.0048554	4.8554025				
u_bb(rel.)	0.23783505					

Fe in BAM-M394:

Sample	Number	Sum	Mean	Variance		
4-1	6	0.7056	0.1176	1.168E-06		
4-113	6	0.7051	0.11751667	9.6167E-07		
4-41	6	0.703	0.11716667	1.7907E-06		
4-62	6	0.7062	0.1177	1.2E-06		
4-80	6	0.7039	0.11731667	1.2937E-06		
5 B-A	6	0.7034	0.11723333	1.2547E-06		
5 B-C	6	0.7033	0.11721667	5.4567E-07		
5 C-D	6	0.7083	0.11805	9.83E-07		
5 K	6	0.7053	0.11755	3.63E-07		
5-2	6	0.7051	0.11751667	8.9767E-07		
			0.11748667			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.8993E-06	9	4.3326E-07	0.41428501	0.92150111	2.07335116
Within groups	5.229E-05	50	1.0458E-06			
Total	5.6189E-05	59				
within-sd	0.0010226			status:	homogeneous	
effective n	5.00					
s_bb	0					
s_bb_min	0.0002045					
u_bb	0.0002045	0.2045287				
u_bb(rel.)	0.17408676					

Sn in BAM-M394:

Sample	*Anzahl*	*Summe*	*Mittelwert*	*Varianz*		
4-1	6	1.7393	0.2899	3.1937E-06		
4-113	6	1.7461	0.2910	7.5977E-06		
4-41	6	1.7461	0.2910	1.2446E-05		
4-62	6	1.7381	0.2897	6.9337E-06		
4-80	6	1.736	0.2893	3.8587E-06		
5 B-A	6	1.7299	0.2883	2.2598E-05		
5 B-C	6	1.743	0.2905	2.9932E-05		
5 C-D	6	1.7392	0.2899	8.7227E-06		
5 K	6	1.739	0.2898	3.3107E-06		
5-2	6	1.739	0.2898	2.6471E-05		
			0.2899			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.4387E-05	9	3.8208E-06	0.30550677	0.96958992	2.07335116
Within groups	0.00062532	50	1.2506E-05			
Total	0.0006597	59				
within-sd	0.0035364					
effective n	5.00					
s_bb	0					
s_bb_min	0.0007073					
u_bb	0.0007073	0.7072849				
u_bb(rel.)	0.24395165					

As in BAM-M394:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
4-1	6	0.0843	0.01405	2.7E-08		
4-113	6	0.0844	0.01407	1.8667E-08		
4-41	6	0.0846	0.01410	2.8E-08		
4-62	6	0.0845	0.01408	2.1667E-08		
4-80	6	0.0841	0.01402	9.6667E-09		
5 B-A	6	0.0839	0.01398	5.6667E-09		
5 B-C	6	0.0841	0.01402	3.7667E-08		
5 C-D	6	0.0844	0.01407	3.8667E-08		
5 K	6	0.0846	0.01410	8E-09		
5-2	6	0.0839	0.01398	5.6667E-09		
			0.01405			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.06E-07	9	1.1778E-08	0.58693245	0.80148341	2.07335116
Within groups	1.0033E-06	50	2.0067E-08			
Total	1.1093E-06	59				
within-sd	0.0001417					
effective n	5.00					
s_bb	0					
s_bb_min	2.833E-05					
u_bb	2.833E-05	0.0283314				
u_bb(rel.)	0.20169463					

Bi in BAM-M394:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
4-1	6	0.01285	0.002142	8.6167E-09		
4-113	6	0.01311	0.002185	2.55E-09		
4-41	6	0.01274	0.002123	1.0507E-08		
4-62	6	0.01288	0.002147	4.9867E-09		
4-80	6	0.01263	0.002105	8.11E-09		
5 B-A	6	0.01294	0.002157	5.3867E-09		
5 B-C	6	0.0127	0.002117	7.4667E-09		
5 C-D	6	0.01279	0.002132	5.3367E-09		
5 K	6	0.01282	0.002137	2.7067E-09		
5-2	6	0.01322	0.002203	4.5467E-09		
			0.00214			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.9627E-08	9	5.5141E-09	0.91575632	0.51939259	2.07335116
Within groups	3.0107E-07	50	6.0213E-09			
Total	3.5069E-07	59				
within-sd	7.76E-05					
effective n	5.00					
s_bb	0					
s_bb_min	1.552E-05					
u_bb	1.552E-05	0.0155195				
u_bb(rel.)	0.72362994					

Cd in BAM-M394:

Sample	Number	Sum	Mean	Variance		
4-001	2	0.002114	0.001057	3.38E-10		
4-020	2	0.002095	0.001048	1.1045E-09		
4-021	2	0.002073	0.001037	4.205E-10		
4-040	2	0.002103	0.001052	2.645E-10		
4-041	2	0.002045	0.001023	4.05E-11		
4-060	6	0.006224	0.001037	1.57467E-10		
4-061	2	0.002111	0.001056	8.405E-10		
4-080	2	0.002051	0.001026	2.205E-10		
4-097	2	0.002102	0.001051	6.48E-10		
4-114	2	0.002114	0.001057	5E-11		
5-F-001	4	0.004237	0.001059	1.95583E-10		
5-K-E	4	0.004255	0.001064	3.00917E-10		
			0.00105			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	5.2337E-09	11	4.7579E-10	1.53385126	0.19544604	2.30999121
Within groups	6.2038E-09	20	3.1019E-10			
Total	1.1438E-08	31				
within-sd	1.76E-05					
effective n	4.00					
s_bb	6.43E-06			0.6145214		
s_bb_min	4.95E-06			0.4729627		
u_bb	6.43E-06	0.006434				
u_bb(rel.)	0.61452138					

Mn in BAM-M394:

Sample	Number	Sum	Mean	Variance		
4-1	6	0.0073	0.001217	4.9467E-09		
4-113	6	0.00744	0.001240	5E-09		
4-41	6	0.00729	0.001215	3.23E-09		
4-62	6	0.00716	0.001193	4.1867E-09		
4-80	6	0.00719	0.001198	7.5767E-09		
5 B-A	6	0.0073	0.001217	1.3707E-08		
5 B-C	6	0.00701	0.001168	1.2817E-08		
5 C-D	6	0.00713	0.001188	2.8167E-09		
5 K	6	0.00706	0.001177	5.1467E-09		
5-2	6	0.00713	0.001188	1.1017E-08		
			0.001200			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.5482E-08	9	2.8313E-09	0.40192537	0.92819013	2.07335116
Within groups	3.5222E-07	50	7.0443E-09			
Total	3.777E-07	59				
within-sd	8.393E-05					
effective n	5.00					
s_bb	0					
s_bb_min	1.679E-05					
u_bb	1.679E-05	0.0167861				
u_bb(rel.)	1.39864786					

Ni in BAM-M394:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
4-1	6	0.2543	0.04238	7.2567E-07		
4-113	6	0.2539	0.04232	6.5367E-07		
4-41	6	0.2502	0.04170	6E-07		
4-62	6	0.254	0.04233	2.1467E-07		
4-80	6	0.2516	0.04193	5.5867E-07		
5 B-A	6	0.2532	0.04220	3.56E-07		
5 B-C	6	0.2535	0.04225	6.59E-07		
5 C-D	6	0.252	0.04200	5.52E-07		
5 K	6	0.2506	0.04177	4.8667E-07		
5-2	6	0.2479	0.04132	2.1367E-07		
			0.04202			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	6.436E-06	9	7.1511E-07	1.42452413	0.20318166	2.07335116
Within groups	0.0000251	50	5.02E-07			
Total	3.1536E-05	59				
within-sd	0.0007085					
effective n	5.00					
s_bb	0.0002065					
s_bb_min	0.0001417					
u_bb	0.0002065	0.2064515				
u_bb(rel.)	0.49131723					

P in BAM-M394:

Sample	Number	Sum	Mean	Variance		
4-1	6	0.03033	0.005055	1.059E-08		
4-113	6	0.03036	0.005060	7.36E-09		
4-41	6	0.03051	0.005085	1.099E-08		
4-62	6	0.03047	0.005078	8.8567E-09		
4-80	6	0.03013	0.005022	1.0857E-08		
5 B-A	6	0.03011	0.005018	1.4167E-09		
5 B-C	6	0.03016	0.005027	2.0707E-08		
5 C-D	6	0.03024	0.005040	1.868E-08		
5 K	6	0.03058	0.005097	4.3867E-09		
5-2	6	0.03015	0.005025	5.47E-09		
			0.005051			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.4407E-08	9	4.9341E-09	0.4968189	0.86966442	2.07335116
Within groups	4.9657E-07	50	9.9313E-09			
Total	5.4097E-07	59				
within-sd	9.966E-05					
effective n	5.00					
s_bb	0					
s_bb_min	1.993E-05					
u_bb	1.993E-05	0.0199312				
u_bb(rel.)	0.39462543					

Sb in BAM-M394:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
4-1	6	0.0817	0.01362	2.9667E-08		
4-113	6	0.0812	0.01353	5.8667E-08		
4-41	6	0.0821	0.01368	8.1667E-08		
4-62	6	0.0823	0.01372	4.1667E-08		
4-80	6	0.0812	0.01353	4.2667E-08		
5 B-A	6	0.0802	0.01337	1.8667E-08		
5 B-C	6	0.0811	0.01352	1.5767E-07		
5 C-D	6	0.0811	0.01352	1.3367E-07		
5 K	6	0.0813	0.01355	1.1E-08		
5-2	6	0.0809	0.01348	4.1667E-08		
			0.01355			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	5.4483E-07	9	6.0537E-08	0.98115133	0.46698786	2.07335116
Within groups	3.085E-06	50	6.17E-08			
Total	3.6298E-06	59				
within-sd	0.0002484					
effective n	5.00					
s_bb	0					
s_bb_min	4.968E-05					
u_bb	4.968E-05	0.049679				
u_bb(rel.)	0.36658937					

Al in BAM-M394:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
4-1	6	0.00521	0.000868	1.2167E-09		
4-113	6	0.00542	0.000903	2.1467E-09		
4-41	6	0.00539	0.000898	2.2377E-08		
4-62	6	0.0053	0.000883	5.0267E-09		
4-80	6	0.00533	0.000888	1.2977E-08		
5 B-A	6	0.00535	0.000892	2.7367E-09		
5 B-C	6	0.00544	0.000907	6.3467E-09		
5 C-D	6	0.00511	0.000852	1.1367E-09		
5 K	6	0.00515	0.000858	9.3667E-10		
5-2	6	0.00524	0.000873	4.8667E-09		
			0.00088			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.924E-08	9	2.1378E-09	0.3576873	0.94960354	2.07335116
Within groups	2.9883E-07	50	5.9767E-09			
Total	3.1807E-07	59				
within-sd	7.731E-05					
effective n	5.00					
s_bb	0					
s_bb_min	1.546E-05					
u_bb	1.546E-05	0.0154618				
u_bb(rel.)	1.7523741					

Cr in BAM-M394:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
4-1	6	0.00245	0.00041	8.5667E-10		
4-113	6	0.00241	0.00040	2.1667E-10		
4-41	6	0.00235	0.00039	3.3667E-10		
4-62	6	0.00241	0.00040	1.7667E-10		
4-80	6	0.00242	0.00040	3.4667E-10		
5 B-A	6	0.00241	0.00040	8.9667E-10		
5 B-C	6	0.00238	0.00040	3.4667E-10		
5 C-D	6	0.00244	0.00041	9.4667E-10		
5 K	6	0.00243	0.00041	3.5E-10		
5-2	6	0.00242	0.00040	1.3867E-09		
			0.00040			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.26E-09	9	1.4E-10	0.23890785	0.98687902	2.07335116
Within groups	2.93E-08	50	5.86E-10			
Total	3.056E-08	59				
within-sd	2.421E-05					
effective n	5.00					
s_bb	0					
s_bb_min	4.841E-06					
u_bb	4.841E-06	0.0048415				
u_bb(rel.)	1.20435009					

Si in BAM-M394:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
4-001	2	0.0019	0.00095	5.202E-09		
4-020	2	0.001942	0.000971	2.738E-09		
4-021	2	0.001819	0.0009095	3.125E-10		
4-040	2	0.00196	0.00098	3.2E-11		
4-041	2	0.001798	0.000899	1.62E-10		
4-060	6	0.005312	0.0008853	3.14227E-09		
4-061	2	0.001893	0.0009465	8.8445E-09		
4-080	2	0.001818	0.000909	0		
4-097	2	0.00184	0.00092	1.458E-09		
4-114	2	0.001859	0.0009295	1.125E-10		
5-F-001	4	0.003708	0.000927	1.098E-09		
5-K-E	4	0.003836	0.000959	6.84667E-10		
			0.0009322			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.8746E-08	11	2.6133E-09	1.309245097	0.2888234	2.30999121
Within groups	3.9921E-08	20	1.996E-09			
Total	6.8667E-08	31				
within-sd	4.47E-05					
effective r	4.00					
s_bb	1.24E-05			1.3326593		
s_bb_min	1.26E-05			1.3476208		
u_bb	1.26E-05	0.012562				
u_bb(rel.)	1.34762081					

Cu in BAM-M394a:

Sample	*Number*	*Sum*	*Mean*	*Variance*
1-1	6	345.4	57.567	0.00266667
1-110	6	344.9	57.483	0.00566667
1-19	6	345	57.500	0.008
1-38	6	344.9	57.483	0.00166667
1-79	6	345	57.500	0.004
6 A-B	6	345.3	57.550	0.011
6 C-D	6	345.2	57.533	0.00666667
6 D-E	6	345.1	57.517	0.00566667
6 F-1xx	6	345.1	57.517	0.00566667
6-2	6	345	57.500	0.004
			57.515	

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.0415	9	0.00461111	0.83838384	0.58465757	2.07335116
Within groups	0.275	50	0.0055			
Total	0.3165	59				

within-sd	0.074162	
effective n	5.00	
s_bb	0	
s_bb_min	0.0148324	
u_bb	0.0148324	14.832397
u_bb(rel.)	0.02578875	

Pb in BAM-M394a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1-1	6	12.245	2.0408	0.00087737		
1-110	6	12.23	2.0383	0.00056507		
1-19	6	12.349	2.0582	0.00116617		
1-38	6	12.196	2.0327	0.00140867		
1-79	6	12.24	2.0400	9.08E-05		
6 A-B	6	12.291	2.0485	0.0004807		
6 C-D	6	12.219	2.0365	0.0002291		
6 D-E	6	12.174	2.0290	0.0009008		
6 F-1xx	6	12.174	2.0290	0.0012452		
6-2	6	12.149	2.0248	0.00200497		
			2.0378			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.00536802	9	0.00059645	0.66502105	0.73606735	2.07335116
Within groups	0.04484417	50	0.00089688			
Total	0.05021218	59				
within-sd	0.029948					
effective n	5.00					
s_bb	0					
s_bb_min	0.0059896					
u_bb	0.0059896	5.9896021				
u_bb(rel.)	0.29392733					

Fe in BAM-M394a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1-1	6	0.799	0.13317	1.0427E-06		
1-110	6	0.8011	0.13352	2.5297E-06		
1-19	6	0.7914	0.13190	2.132E-06		
1-38	6	0.8007	0.13345	4.531E-06		
1-79	6	0.8005	0.13342	5.2567E-07		
6 A-B	6	0.7999	0.13332	1.8377E-06		
6 C-D	6	0.8021	0.13368	4.4167E-07		
6 D-E	6	0.8043	0.13405	2.867E-06		
6 F-1xx	6	0.803	0.13383	3.1027E-06		
6-2	6	0.8042	0.13403	1.4947E-06		
			0.13344			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.0436E-05	9	2.2707E-06	1.10739019	0.37499309	2.07335116
Within groups	0.00010252	50	2.0505E-06			
Total	0.00012296	59				
within-sd	0.0014319					
effective n	5.00					
s_bb	0.0002099					
s_bb_min	0.0002864					
u_bb	0.0002864	0.286389				
u_bb(rel.)	0.21462542					

Sn in BAM-M394a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1-1	6	1.2866	0.2144	8.0987E-06		
1-110	6	1.2957	0.2160	8.291E-06		
1-19	6	1.3032	0.2172	2.988E-06		
1-38	6	1.2994	0.2166	7.4147E-06		
1-79	6	1.2935	0.2156	8.7937E-06		
6 A-B	6	1.3078	0.2180	1.2923E-05		
6 C-D	6	1.3153	0.2192	1.461E-05		
6 D-E	6	1.3095	0.2183	9.147E-06		
6 F-1xx	6	1.3072	0.2179	6.0707E-06		
6-2	6	1.3143	0.2191	3.943E-06		
			0.2172			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.00013113	9	1.457E-05	1.77081547	0.09763862	2.07335116
Within groups	0.0004114	50	8.2279E-06			
Total	0.00054253	59				
within-sd	0.0028684					
effective n	5.00					
s_bb	0.0011262					
s_bb_min	0.0005737					
u_bb	0.0011262	1.1262498				
u_bb(rel.)	0.5185113					

As in BAM-M394a:

Sample	*Number*	*Sum*	*Mean*	*Variance*			
1-1	6	0.0807	0.01345	1.9E-08			
1-110	6	0.0807	0.01345	1.1E-08			
1-19	6	0.0808	0.01347	1.4667E-08			
1-38	6	0.0804	0.01340	1.2E-08			
1-79	6	0.0808	0.01347	4.2667E-08			
6 A-B	6	0.0809	0.01348	1.7667E-08			
6 C-D	6	0.0812	0.01353	1.4667E-08			
6 D-E	6	0.0811	0.01352	1.6667E-09			
6 F-1xx	6	0.0808	0.01347	2.2667E-08			
6-2	6	0.0812	0.01353	1.4667E-08			
			0.01348				
ANOVA							
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*	
Between groups	9.4E-08	9	1.0444E-08	0.61197917	0.78097813	2.07335116	
Within groups	8.5333E-07	50	1.7067E-08				
Total	9.4733E-07	59					
within-sd	0.0001306						
effective n	5.00						
s_bb	0						
s_bb_min	2.613E-05						
u_bb	2.613E-05	0.0261279					
u_bb(rel.)	0.19387502						

Bi in BAM-M394a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1-1	6	0.01345	0.002242	1.5457E-08		
1-110	6	0.01328	0.002213	3.1867E-09		
1-19	6	0.01355	0.002258	1.6967E-09		
1-38	6	0.01335	0.002225	4.27E-09		
1-79	6	0.0135	0.002250	9.28E-09		
6 A-B	6	0.01362	0.002270	1.76E-09		
6 C-D	6	0.01341	0.002235	6.55E-09		
6 D-E	6	0.01345	0.002242	1.2577E-08		
6 F-1xx	6	0.01299	0.002165	4.19E-09		
6-2	6	0.01325	0.002208	7.4567E-09		
			0.002231			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.8542E-08	9	5.3935E-09	0.81199155	0.6075115	2.07335116
Within groups	3.3212E-07	50	6.6423E-09			
Total	3.8066E-07	59				
within-sd	8.15E-05					
effective n	5.00					
s_bb	0					
s_bb_min	1.63E-05					
u_bb	1.63E-05	0.0163001				
u_bb(rel.)	0.73067324					

Cd in BAM-M394a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1-001	6	0.006558	0.001093	1.748E-10		
1-018	2	0.002212	0.001106	3.38E-10		
1-019	2	0.002173	0.0010865	3.125E-10		
1-038	2	0.002131	0.0010655	8.405E-10		
1-039	2	0.002218	0.001109	2.88E-10		
1-060	2	0.002204	0.001102	3.2E-11		
1-061	2	0.002193	0.0010965	2.45E-11		
1-080	2	0.002208	0.001104	4.5E-10		
1-097	2	0.002205	0.0011025	8.45E-11		
1-111	2	0.002162	0.001081	9.68E-10		
6-F-001	4	0.004431	0.0011078	4.7625E-10		
6-K-E	4	0.004368	0.001092	1.28667E-10		
			0.0010955			

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.9817E-09	11	3.6197E-10	1.201225974	0.34668767	2.30999121
Within groups	6.0267E-09	20	3.0134E-10			
Total	1.0008E-08	31				
within-sd	1.74E-05					
effective n	4.00					
s_bb	3.89E-06			0.355414		
s_bb_min	4.88E-06			0.4455459		
u_bb	4.88E-06	0.004881				
u_bb(rel.)	0.44554592					

Mn in BAM-M394a:

Sample	Number	Sum	Mean	Variance		
1-1	6	0.0065	0.001083	1.3387E-08		
1-110	6	0.00643	0.001072	3.8967E-09		
1-19	6	0.00649	0.001082	4.6167E-09		
1-38	6	0.00657	0.001095	8.27E-09		
1-79	6	0.00684	0.001140	5.56E-09		
6 A-B	6	0.00664	0.001107	4.4267E-09		
6 C-D	6	0.00643	0.001072	1.0217E-08		
6 D-E	6	0.0066	0.001100	8.16E-09		
6 F-1xx	6	0.00634	0.001057	1.0547E-08		
6-2	6	0.00635	0.001058	1.0617E-08		
			0.00109			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.4082E-08	9	3.7869E-09	0.47515812	0.88439543	2.07335116
Within groups	3.9848E-07	50	7.9697E-09			
Total	4.3257E-07	59				
within-sd	8.927E-05					
effective n	5.00					
s_bb	0					
s_bb_min	1.785E-05					
u_bb	1.785E-05	0.0178546				
u_bb(rel.)	1.6433132					

Ni in BAM-M394a:

Sample	Number	Sum	Mean	Variance		
1-1	6	0.2446	0.04077	1.0267E-07		
1-110	6	0.2411	0.04018	5.1367E-07		
1-19	6	0.2424	0.04040	8.56E-07		
1-38	6	0.245	0.04083	1.7387E-06		
1-79	6	0.2457	0.04095	9.23E-07		
6 A-B	6	0.2483	0.04138	2.2167E-07		
6 C-D	6	0.2444	0.04073	2.1867E-07		
6 D-E	6	0.2445	0.04075	7.15E-07		
6 F-1xx	6	0.2432	0.04053	4.1067E-07		
6-2	6	0.2439	0.04065	1.283E-06		
			0.04072			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	5.6348E-06	9	6.2609E-07	0.89659544	0.53526533	2.07335116
Within groups	3.4915E-05	50	6.983E-07			
Total	4.055E-05	59				
within-sd	0.0008356					
effective n	5.00					
s_bb	0					
s_bb_min	0.0001671					
u_bb	0.0001671	0.1671287				
u_bb(rel.)	0.41045072					

P in BAM-M394a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1-1	6	0.03136	0.00523	6.9867E-09		
1-110	6	0.03131	0.00522	5.6567E-09		
1-19	6	0.03126	0.00521	6.72E-09		
1-38	6	0.03101	0.00517	2.6167E-09		
1-79	6	0.03144	0.00524	1.128E-08		
6 A-B	6	0.0316	0.00527	2.9107E-08		
6 C-D	6	0.03152	0.00525	1.3707E-08		
6 D-E	6	0.03161	0.00527	6.2967E-09		
6 F-1xx	6	0.03113	0.00519	1.1897E-08		
6-2	6	0.03184	0.00531	1.4347E-08		
			0.00523			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	9.1227E-08	9	1.0136E-08	0.93324604	0.50509793	2.07335116
Within groups	5.4307E-07	50	1.0861E-08			
Total	6.3429E-07	59				
within-sd	0.0001042					
effective n	5.00					
s_bb	0					
s_bb_min	2.084E-05					
u_bb	2.084E-05	0.0208435				
u_bb(rel.)	0.39818284					

Sb in BAM-M394a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1-1	6	0.0814	0.01357	4.2667E-08		
1-110	6	0.0807	0.01345	6.7E-08		
1-19	6	0.0811	0.01352	2.9667E-08		
1-38	6	0.0804	0.01340	0.00000002		
1-79	6	0.0809	0.01348	2.4967E-07		
6 A-B	6	0.0811	0.01352	1.4167E-07		
6 C-D	6	0.0813	0.01355	9.5E-08		
6 D-E	6	0.0811	0.01352	2.5667E-08		
6 F-1xx	6	0.0808	0.01347	3.8667E-08		
6-2	6	0.0817	0.01362	2.5667E-08		
			0.01351			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.075E-07	9	2.3056E-08	0.31339677	0.96693813	2.07335116
Within groups	3.6783E-06	50	7.3567E-08			
Total	3.8858E-06	59				
within-sd	0.0002712					
effective n	5.00					
s_bb	0					
s_bb_min	5.425E-05					
u_bb	5.425E-05	0.0542464				
u_bb(rel.)	0.40157694					

Al in BAM-M394a:

Sample	*Number*	*Sum*	*Mean*	*Variance*
1-1	6	0.00897	0.001495	2.59E-09
1-110	6	0.0088	0.001467	4.4267E-09
1-19	6	0.00927	0.001545	4.19E-09
1-38	6	0.0088	0.001467	2.7867E-09
1-79	6	0.00893	0.001488	1.1367E-09
6 A-B	6	0.00932	0.001553	6.0667E-09
6 C-D	6	0.00896	0.001493	1.1067E-09
6 D-E	6	0.00881	0.001468	5.0167E-09
6 F-1xx	6	0.00879	0.001465	1.87E-09
6-2	6	0.00891	0.001485	3.67E-09
			0.001493	

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	5.5273E-08	9	6.1415E-09	1.86898402	0.07874414	2.07335116
Within groups	1.643E-07	50	3.286E-09			
Total	2.1957E-07	59				

within-sd	5.732E-05	
effective n	5.00	
s_bb	2.39E-05	
s_bb_min	1.146E-05	
u_bb	2.39E-05	0.0238976
u_bb(rel.)	1.60100186	

Cr in BAM-M394a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1-1	6	0.0025	0.000417	1.3467E-09		
1-110	6	0.0025	0.000417	1.0267E-09		
1-19	6	0.00232	0.000387	5.4667E-10		
1-38	6	0.00249	0.000415	1.75E-09		
1-79	6	0.00251	0.000418	2.9667E-10		
6 A-B	6	0.00245	0.000408	1.1767E-09		
6 C-D	6	0.00254	0.000423	5.0667E-10		
6 D-E	6	0.00254	0.000423	1.3067E-09		
6 F-1xx	6	0.00248	0.000413	1.0667E-09		
6-2	6	0.00254	0.000423	9.0667E-10		
			0.000415			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	6.435E-09	9	7.15E-10	0.72004028	0.68815282	2.07335116
Within groups	4.965E-08	50	9.93E-10			
Total	5.6085E-08	59				
within-sd	3.151E-05					
effective n	5.00					
s_bb	0					
s_bb_min	6.302E-06					
u_bb	6.302E-06	0.0063024				
u_bb(rel.)	1.52047781					

Si in BAM-M394a:

Sample	Number	Sum	Mean	Variance		
1-001	6	0.007017	0.0011695	1.547E-10		
1-018	2	0.002291	0.0011455	1.20125E-08		
1-019	2	0.002308	0.001154	3.2E-11		
1-038	2	0.002219	0.0011095	1.20125E-08		
1-039	2	0.002282	0.001141	6.48E-10		
1-060	2	0.002288	0.001144	9.68E-10		
1-061	2	0.002301	0.0011505	1.125E-10		
1-080	2	0.002397	0.0011985	1.125E-10		
1-097	2	0.002202	0.001101	1.922E-09		
1-111	2	0.002307	0.0011535	1.02245E-08		
6-F-001	4	0.004418	0.0011045	8.79E-10		
6-K-E	4	0.004281	0.0010703	9.95833E-11		
			0.0011368			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.1649E-08	11	3.7862E-09	1.813608195	0.11918382	2.30999121
Within groups	4.1754E-08	20	2.0877E-09			
Total	8.3402E-08	31				
within-sd	4.57E-05					
effective n	4.00					
s_bb	2.06E-05			1.8126818		
s_bb_min	1.28E-05			1.1300923		
u_bb	2.06E-05	0.020607				
u_bb(rel.)	1.81268177					

Annex 3: Calculation of uncertainty contribution of potential inhomogeneity (area)

Copper:

r_0	57.34996462	57.49939738										
r_in	57.601697	57.542003	57.525611	57.455358	57.358692	57.384986	57.659022	57.5172				
r_out	57.646264	57.727194	57.69298	57.703875	57.63676	57.50543	57.677798	57.486733	57.394315	57.570614	57.473826	57.5504

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.064422374	2	0.032211187	2.894484856	0.079928871	3.521893261
Within groups	0.211440925	19	0.01112847			
Total	0.275863299	21				

within-sd	0.105491562			
This data set now can be handled according to ISO G35. The result for u_bb is:				
effective n	6.18			
s_bb	0.058398969		u_bb(rel.)	0.101486398
s_bb_min	0.024167332			
u_bb	0.058398969		57.54364164	

Lead:

r_0												
r_in	1.803226	1.69289	1.691748	1.814315	1.813383	1.820587	1.804868	1.827775				
r_out	1.812647	1.808272	1.80027	1.679045	1.813298	1.689342	1.805749	1.802356	1.806436	1.804643	1.682459	1.687592

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.001485145	1	0.001485145	0.426891598	0.521777497	4.413873419
Within groups	0.062621534	18	0.003478974			
Total	0.064106678	19				

within-sd	0.058982829		status:	
effective n	9.60			
s_bb	0		u_bb(rel.)	0.619882795
s_bb_min	0.010990801			
u_bb	0.010990801		1.77304505	

Iron:

r_0	0.104768275	0.105147725										
r_in	0.103024	0.103392	0.102633	0.103072	0.1022	0.103178	0.103031	0.102964				
r_out	0.103013	0.103	0.103028	0.10268	0.103129	0.102881	0.102992	0.102963	0.103041	0.103056	0.103015	0.102395
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	7.44582E-06	2	3.72291E-06	48.43474413	3.47099E-08	3.521893261						
Within groups	1.46042E-06	19	7.68645E-08									
Total	8.90625E-06	21										
within-sd	0.000277244											
effective n	6.18											
s_bb	0.000767985			u_bb(rel.)	0.744761366							
s_bb_min	6.35146E-05											
u_bb	0.000767985			0.103118318								

Tin:

r_0	0.177045426	0.179118574										
r_in	0.184893	0.180657	0.182896	0.180528	0.18228	0.179977	0.180983	0.180135				
r_out	0.179993	0.179332	0.181734	0.182229	0.18142	0.179401	0.177973	0.179568	0.179813	0.179704	0.178629	0.181642
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	2.2091E-05	2	1.10455E-05	5.005470467	0.017939981	3.521893261						
Within groups	4.1927E-05	19	2.20668E-06									
Total	6.4018E-05	21										
within-sd	0.001485491											
effective n	6.18											
s_bb	0.001195745			u_bb(rel.)	0.662637763							
s_bb_min	0.000340315											
u_bb	0.001195745			0.180452318								

Bismuth:

0.000745945	0.000778055										
0.000833	0.000802	0.000795	0.000833	0.000875	0.000852	0.00083	0.000862				
0.000835	0.000802	0.000787	0.000817	0.000831	0.000826	0.000821	0.000835	0.000785	0.000824	0.000786	0.000829
sums of squares (SS)	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
8.76629E-09	2	4.38314E-09	8.29254897	0.002576983	3.521893261						
1.00427E-08	19	5.28564E-10									
1.8809E-08	21										
2.29905E-05											
t now can be handled according to ISO G35. The result for u_bb is:											
6.18											
2.49707E-05			u_bb(rel.)	3.054687545							
5.26696E-06											
2.49707E-05			0.000817455								

Cadmium:

r_0	0.000594976	0.000613024										
r_in	0.000626	0.000619	0.000642	0.000649	0.000632	0.000631	0.00065	0.000604				
r_out	0.000635	0.00064	0.000635	0.000646	0.000635	0.000653	0.000636	0.000659	0.000632	0.000616	0.000633	0.000639
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	2.02624E-09	2	1.01312E-09	6.062747234	0.009195064	3.521893261						
Within groups	3.17501E-09	19	1.67106E-10									
Total	5.20125E-09	21										
within-sd	1.29269E-05											
This data set now can be handled according to ISO G35. The result for u_bb is:												
effective n	6.18											
s_bb	1.16985E-05			u_bb(rel.)	1.84890255							
s_bb_min	2.96146E-06											
u_bb	1.16985E-05			0.000632727								

Manganese:

r_0	0.002156679	0.002183321										
r_in	0.002202	0.002217	0.002195	0.002204	0.002187	0.002179	0.002225	0.002199				
r_out	0.002251	0.002228	0.00227	0.002234	0.002251	0.002246	0.002258	0.002247	0.002224	0.002195	0.002213	0.002239
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	1.17171E-08	2	5.85855E-09	16.83776827	6.20689E-05	3.521893261						
Within groups	6.61087E-09	19	3.47941E-10									
Total	1.8328E-08	21										
within-sd	1.86532E-05											
This data set now can be handled according to ISO G35. The result for u_bb is:												
effective n	6.18											
s_bb	2.98567E-05			u_bb(rel.)	1.345887559							
s_bb_min	4.2733E-06											
u_bb	2.98567E-05			0.002218364								

Nickel:

r_0	0.038056702	0.038247298										
r_in	0.037809	0.037846	0.037622	0.037542	0.03747	0.037475	0.037765	0.037634				
r_out	0.03749	0.037604	0.03763	0.037764	0.037664	0.037841	0.037641	0.037541	0.037821	0.037819	0.037826	0.037854
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	4.18875E-07	2	2.09437E-07	11.35205927	0.000570767	3.521893261						
Within groups	3.50536E-07	19	1.84493E-08									
Total	7.69411E-07	21										
within-sd	0.000135828											
effective n	6.18											
s_bb	0.00017577			u_bb(rel.)	0.465917965							
s_bb_min	3.11172E-05											
u_bb	0.00017577			0.037725545								

Phosphor:

r_0	0.001527932	0.001610068										
r_in	0.001626	0.001561	0.001629	0.001464	0.001506	0.001515	0.00163	0.001541				
r_out	0.001581	0.00149	0.001506	0.001538	0.001482	0.001499	0.001647	0.001627	0.001606	0.001573	0.001573	0.001538

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.56364E-10	2	1.78182E-10	0.051969469	0.949492321	3.521893261
Within groups	6.51431E-08	19	3.42859E-09			
Total	6.54995E-08	21				

within-sd	5.85541E-05				
effective n	6.18				
s_bb	0			u_bb(rel.)	0.861146646
s_bb_min	1.34143E-05				
u_bb	1.34143E-05			0.001557727	

Antimony:

r_0	0.064440041	0.065681959										
r_in	0.067637	0.067643	0.066284	0.067765	0.067796	0.067507	0.068323	0.065967				
r_out	0.068517	0.067364	0.068403	0.067201	0.066452	0.066388	0.067152	0.066464	0.066233	0.067989	0.065851	0.066057

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	8.55152E-06	2	4.27576E-06	5.590235382	0.012324296	3.521893261
Within groups	1.45324E-05	19	7.64862E-07			
Total	2.30839E-05	21				

within-sd	0.000874564				

This data set now can be handled according to ISO G35. The result for u_bb is:

effective n	6.18				
s_bb	0.000753618			u_bb(rel.)	1.125478085
s_bb_min	0.000200356				
u_bb	0.000753618			0.066959773	

Chromium

r_0	0.000397054	0.000420946										
r_in	0.000414	0.00039	0.000394	0.000385	0.000365	0.000381	0.00035	0.000345				
r_out	0.000361	0.000368	0.000347	0.000378	0.000365	0.000353	0.000364	0.000334	0.000339	0.000355	0.000364	0.000361
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	5.4504E-09	2	2.7252E-09	8.914562977	0.001859263	3.521893261						
Within groups	5.80834E-09	19	3.05702E-10									
Total	1.12587E-08	21										
within-sd	1.74843E-05											
effective n	6.18											
s_bb	1.97836E-05			u_bb(rel.)	5.352828108							
s_bb_min	4.00553E-06											
u_bb	1.97836E-05			0.000369591								