Certification Report

Certified Reference Materials

BAM-M385a

Pure Copper

April 2018

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Summary

This report describes preparation, analysis and certification of the copper reference material BAM-M385a.
The certified reference material (CRM) is available in the form of discs (40 mm diameter and 30 mm height). It is intended for establishing and checking the calibration of spark optical emission and X-ray fluorescence spectrometers for the analysis of samples of similar materials. It is also suitable for wet chemical analysis.

The following mass fractions and uncertainties have been certified:

Element	Mass fraction [1] in mg/kg	Uncertainty [2] in mg/kg
Ag	25.4	0.5
Al	13.3	3.2
As	9.4	2.0
Bi	5.64	0.28
Cd	2.75	0.28
Co	7.4	0.4
Cr	10.4	0.8
Fe	44.2	1.2
Mn	9.9	0.9
Ni	10.8	0.6
P	10.0	1.3
Pb	10.8	1.0
Sb	14.9	0.8
Se	5.0	0.7
Si	7.3	0.8
Sn	16.1	1.1
Te	8.1	1.2
Ti	6.6	1.1
Zn	9.2	0.7

[1] Unweighted mean value of the means of accepted sets of data (consisting of at least 3 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 $k = 2$ (Si: $k = 2.5$), 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 12 laboratories which participated in the certification interlaboratory comparison. The mass fractions of Mg, S and Zr are given for information.

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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
INAA	instrumental neutron activation analysis
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 2 – 23)
I(R)	ICP-OES, revised value (Tables 2 – 23)
IMS	ICP-MS (Tables 2 – 23)
A	FAAS (Tables 2 – 23)
EA	ETAAS (Tables 2 – 23)
P	spectrophotometry (Tables 2 – 23)
GD	GD-MS (Tables 2 – 23)
NAA	INAA (Tables 2 – 23)

1. Introduction

In the metal-producing and metal-processing 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 certified reference material BAM-M385a is based on pure copper. It replaces the out of stock CRM ERM®-EB385. Certification of BAM-M385a was carried out in cooperation with the working group „Copper" of the Committee of Chemists within the Society of Metallurgists und Miners (GDMB). The needs were 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 them are highly experienced with copper analysis and had participated in earlier inter-laboratory comparisons, there was no preceding round for qualification necessary.

Certification of reference material BAM-M385a 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

– Allgemeine Gold- und Silberscheideanstalt AG, Pforzheim, Germany
– Aurubis AG, Hamburg, Germany
– Aurubis AG, Olen, Belgium
– Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany
– Diehl Metall Stiftung & Co KG, Röthenbach, Germany
– Inspectorate International Limited, Witham, United Kingdom
– Institut für Materialprüfung Glörfeld GmbH, Willich, Germany
– Johannes-Gutenberg-Universität, Mainz, Germany
– KM Europa Metal AG, Osnabrück, 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

The candidate material foreseen for CRM BAM-M385a was cast by Wieland-Werke AG, Vöhringen starting with pure copper which was doped with the desired impurities. After solidification, the material was pressed to rods with a diameter of ca. 40 mm which were cut into eight rods of 3 m lengths each. These rods were delivered to BAM and then cut into 24 segments of approx. 960 mm length, see Figure 1. Discs taken between these 1 m rods were taken for homogeneity testing.

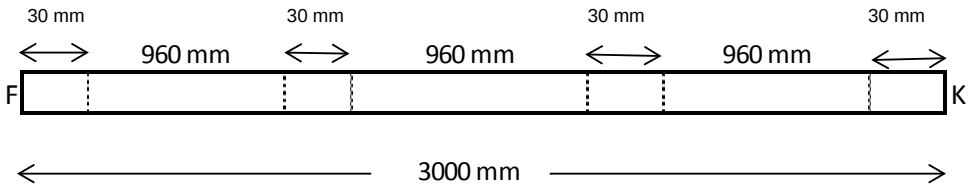


Figure 1: Cutting plan of pure copper reference material BAM-M385a

About 750 discs of BAM-M385a with a diameter of approx. 40 mm and 30 mm height 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 volatize 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 2 and 3):

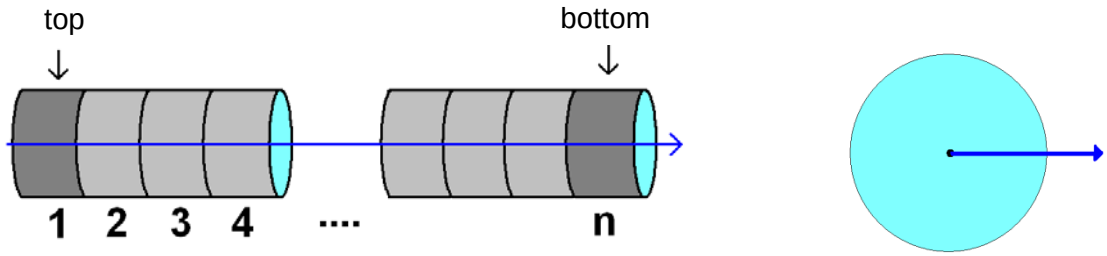


Fig. 2: Axial and radial composition gradient

Therefore, it is necessary to investigate the raw material for both axial and radial inhomogeneities.
Axial homogeneity testing of the candidate material using spark emission spectrometry was performed at BAM on the discs taken from the rods as shown in Fig. 1. In total 23 discs were investigated, this corresponds to 3 % of the whole batch.
The estimate of analyte-specific inhomogeneity contribution u_{bb} to be included into the total uncertainty budget was calculated according to ISO Guide 35 [4] using Eq. (1) and Eq. (2):

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

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

where:

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

s_{bb} 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 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: 8 sparks, inner circle: 8 sparks; centre: 1 spark).

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

Annex 2 shows the results of the calculations.

5. Characterisation study

5.1 Analytical methods

Twelf 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 1 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 1: Analytical procedures used by the participating laboratories

Lab-No.	Element.	Sample mass	Sample pretreatment	Analytical method
1	Ag, As, Bi, Cd, Co, Cr, Fe, Mn, Ni, Pb, S, Sb, Se, Sn, Te	1 g	Dissolution with HNO_3	ICP-OES (according to DIN 15915), matrix matched calibration with commercial and self-prepared solutions
	Al, Mg, Ti	1 g	Dissolution with HCl, HNO_3, H_3BO_3, HF	ICP-OES, matrix matched calibration with commercial and self-prepared solutions
	Ag, Al, Bi, Cd, Fe, Mg, Mn, P, Pb, S, Se, Sn, Te, Ti, Zn, Zr			GDMS, calibration with doped pressed powder pellets
	As, Co, Ni, Sb			GDMS, calibration with doped pressed powder pellets, correction with ERM-EB385
	Sb	1 g	Dissolution with HCl/H_2O_2	Spectrophotometry, calibration with commercial solution (Merck)
2	Ag, Al, Fe, Mg, Mn, Si	2 g	Dissolution with HCl/HNO_3	ICP-OES, calibration with commercial solution (Merck)
	As, Bi, Cd, Co, Cr, Ni, Pb, Sb, Se, Sn, Te, Ti, Zn, Zr	2 g	Dissolution with HCl/HNO_3	ICP-MS, calibration with commercial solution (Merck)
	Zr	2 g	Dissolution with HCl/HNO_3/HF	ICP-MS, calibration with commercial solution (Merck)
3	Ag, Al, As, Cd, Co, Cr, Fe, Mn, Mg, Ni, P, S, Sb, Se, Si, Ti, Zn, Zr	2 g	Dissolution with HNO_3/HF	ICP-OES, calibration with commercial standard solutions
	Bi, Pb, Sn, Te	0.4 g	Dissolution with HNO_3	ETAAS, calibration with commercial standard solutions
	Ag	1 g	Dissolution with HNO_3/HCl	FAAS, calibration with commercial standard solutions
4	Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Se, Si, Sn, Te, Ti, Zn, Zr	1 g	Dissolution with HNO_3/HF	ICP-OES, matrix matched calibration with commercial standard solutions
5	Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, Sb, Se, Si, Sn, Te, Ti, Zn, Zr	1 g	Dissolution with HNO_3	ICP-MS, matrix matched calibration with commercial solution
	P	1 g	Dissolution with HNO_3/HCl	ICP-MS, matrix matched calibration with commercial solution
	S	1 g		Combustion/Infrared-detection
6	Al, Cd, Cr, Mn, Ni, Zn, Zr, Fe	1 g	Dissolution with HNO_3/HF	ICP-OES, matrix matched calibration with commercial standard solutions (Spex)
	Ag, As, Bi, Co, Mg, Pb, P, Sn, Sb, S, Ti	1 g	Dissolution with HCl/H_2O_2	ICP-OES, matrix matched calibration with commercial standard solutions (Spex)
	Se, Te	1 g	Dissolution with HCl/ HNO3/H2O2	ICP-OES, calibration with commercial standard solutions (Spex)

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

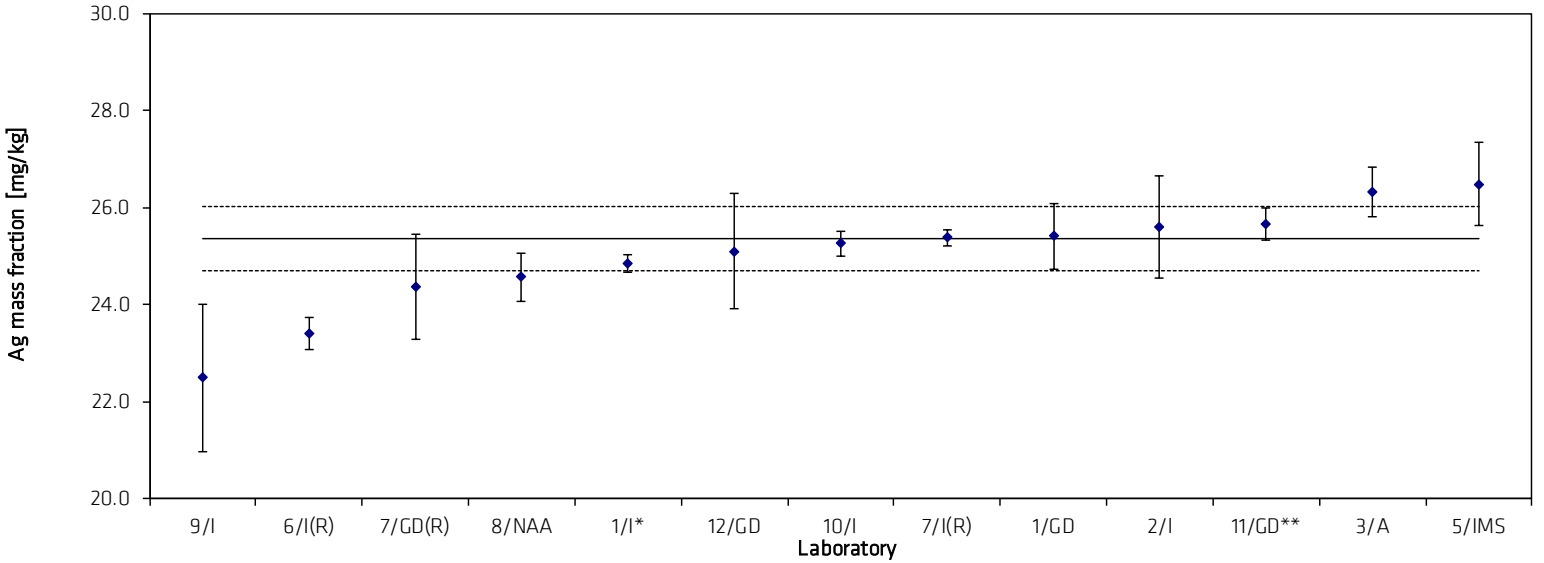
Lab-No.	Element.	Sample mass	Sample pretreatment	Analytical method
7	Al, Fe, Mg, P, Si, Sn, Ti, Zn, Zr	1 g	Dissolution with HCl, HNO3, H_3BO_3, HF	ICP-OES (according to DIN 15605), matrix matched calibration with commercial standard solutions (Merck)
	Ag	1 g	Dissolution with HNO_3/HF	ICP-OES, matrix matched calibration with commercial standard solutions (Merck)
	Cr	0.1 g	Dissolution with HNO_3/HF	ETAAS (according to DIN 14935), matrix matched calibration with commercial standard solutions (Merck)
	As, Mn, Ni, Sb	0.1 g	Dissolution with HNO_3	ETAAS (according to DIN 14935), matrix matched calibration with commercial standard solutions (Merck)
	Bi, Cd, Co, Se, Te, Pb	0.2 g	Dissolution with HNO_3	ETAAS (according to DIN 14935), matrix matched calibration with commercial standard solutions (Merck)
	O	1 g		Carrier gas hot extraction, calibration against a copper standard
8	Ag, Cr, Co, Sb, Zn	5 g	Dissolution with HNO_3	INAA, calibration with metal foil (Ag, Zn) or metal powder (Co, Sb, Cr)
9	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Se, Si, Sn, Te, Ti, Zn, Zr	1.25 g	Dissolution with HCL/HNO_3	ICP-OES, matrix matched calibration with commercial standard solutions
	O	1.25 g		Carrier gas hot extraction
	S	1.25 g		Combustion/Infrared-detection
10	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Se, Sn, Te, Ti, Zn	1 g	Dissolution with HCl/H_2O_2	ICP-OES, matrix matching calibration with commercial mono-element solution (Spectropure)
	O	1.5 g		Carrier gas hot extraction
11	Ag, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Se, Si, Sn, Te, Ti, Zn			GDMS, calibration with ERM-EB385 and BCR-075
12	Ag, Al, Bi, Cd, Fe, Mg, Mn, P, Pb, S, Se, Sn, Te, Ti, Zn			GDMS, calibration with doped pressed powder pellets

5.2 Analytical results and statistical evaluation

The analytical results of the certification inter-laboratory comparison are listed in Tables 2 to 23. These tables show the single results (M_i) of each laboratory, the respective laboratories' mean values (M), absolute and relative 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.

Table 2: Results for Ag in BAM-M385a

Lab./Meth.	9/I	6/I(R)	7/GD(R)	8/NAA	1/I*	12/GD	10/I	7/I(R)	1/GD	2/I	11/GD**	3/A	5/IMS		
M_i [mg/kg]	24	23.8	23.7	24.11	24.6	23.7	25.14	25.2	25.79	24.7	25.3	26	25.8		*n*
	24	23.8	25.9	24.55	25.0	23.7	25.43	25.2	25.97	24.7	25.9	27	26.4		11
	20	23.3	24.5	25.16	24.7	24.9	25.30	25.4	26.39	24.7	25.4	26	27.3		
	22	23.2	25.4	24.97	25.0	26.4	25.64	25.6	25.57	26.0	25.4	26	26.0		
	22	23.1	23.8	24.05	24.8	26.0	25.22	25.4	25.52	26.6	26.1	27	27.8		
	23	23.2	23.0		25.1	25.9	24.88	25.5	24.78	27.0	25.9	26	25.6		
									24.81						
									24.45						
M [mg/kg]	**22.5**	**23.4**	**24.4**	**24.6**	**24.9**	**25.1**	**25.3**	**25.4**	**25.4**	**25.6**	**25.7**	**26.3**	**26.5**		**25.4**
s [mg/kg]	1.52	0.33	1.09	0.50	0.19	1.19	0.26	0.16	0.67	1.05	0.33	0.52	0.86	s_M [mg/kg]	0.66
														$\bar{s}_i$ [mg/kg]	0.669
s_{rel}	0.067	0.014	0.045	0.020	0.007	0.047	0.010	0.006	0.026	0.041	0.013	0.020	0.033		0.026



*corrected with ERM-EB385

**calibrated with ERM-EB385 and BCR-075

Table 3: Results for Al in BAM-M385a

Lab./Meth.	1/GD	10/I	9/I	5/IMS	1/I	12/GD	2/I	3/I	7/GD	7/I	6/I	4/I		
M_i [mg/kg]	13.2	11.1	11.6	10.8	12.1	12.7	13.2	14	16.3	16	15.5	16.4		*n*
	11.8	11.6	11.6	10.2	12.9	12.8	13.3	14	13.5	16	15.8	16.6		12
	13.1	10.9	11.6	14.4	12.3	13.3	13.5	14	10.9	16	15.2	16.2		
	11.2	11.4	11.6	10.4	12.6	13.7	13.4	14	15.3	14	16.0	17.0		
	11.2	11.4	10.9	12.9	14.2	12.7	13.4	14	16.6	13	15.5	16.6		
	9.8	11.1	11.0	11.4	12.3	13.9	13.1	14	14.2	14	15.1	16.6		
	9.3													
	9.6													
M **[mg/kg]**	**11.2**	**11.3**	**11.4**	**11.7**	**12.7**	**13.2**	**13.3**	**14.0**	**14.5**	**14.8**	**15.5**	**16.6**		**13.3**
s [mg/kg]	1.52	0.28	0.34	1.66	0.78	0.53	0.15	0.00	2.11	1.33	0.35	0.27	s_M [mg/kg]	1.78
													$\bar{s}_i$ [mg/kg]	1.064
s_{rel}	0.136	0.024	0.030	0.142	0.061	0.040	0.011	0.000	0.146	0.090	0.022	0.016		0.134

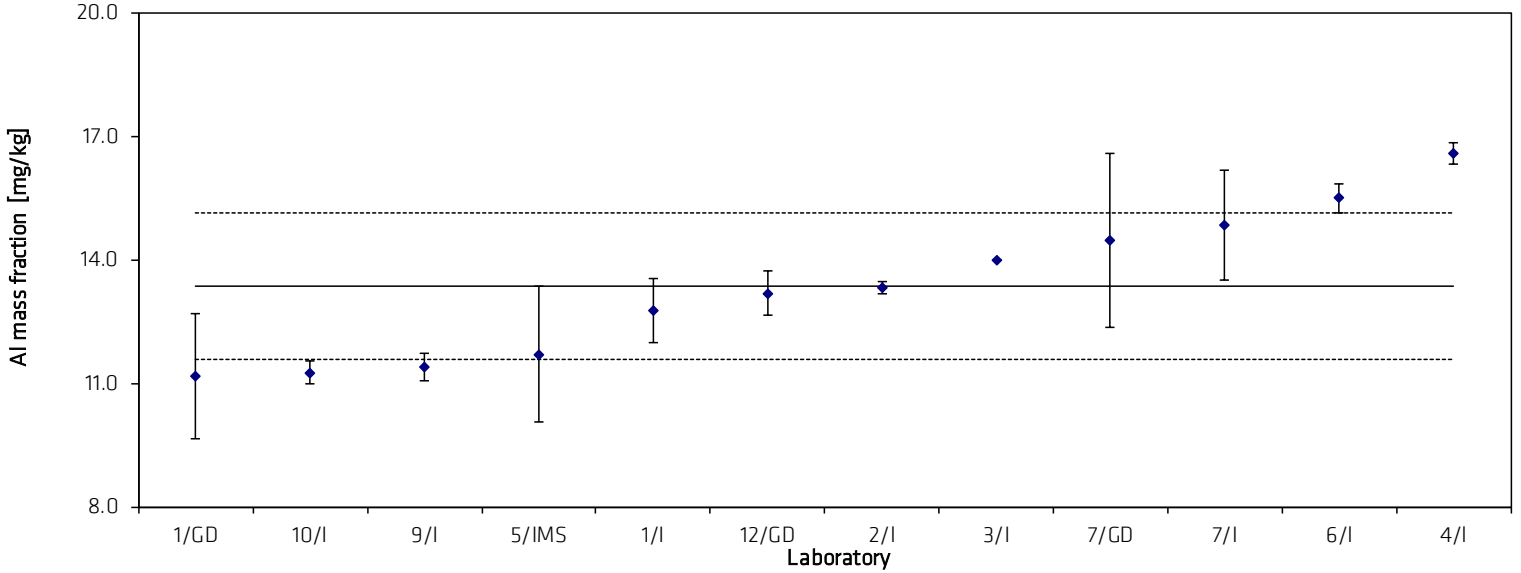
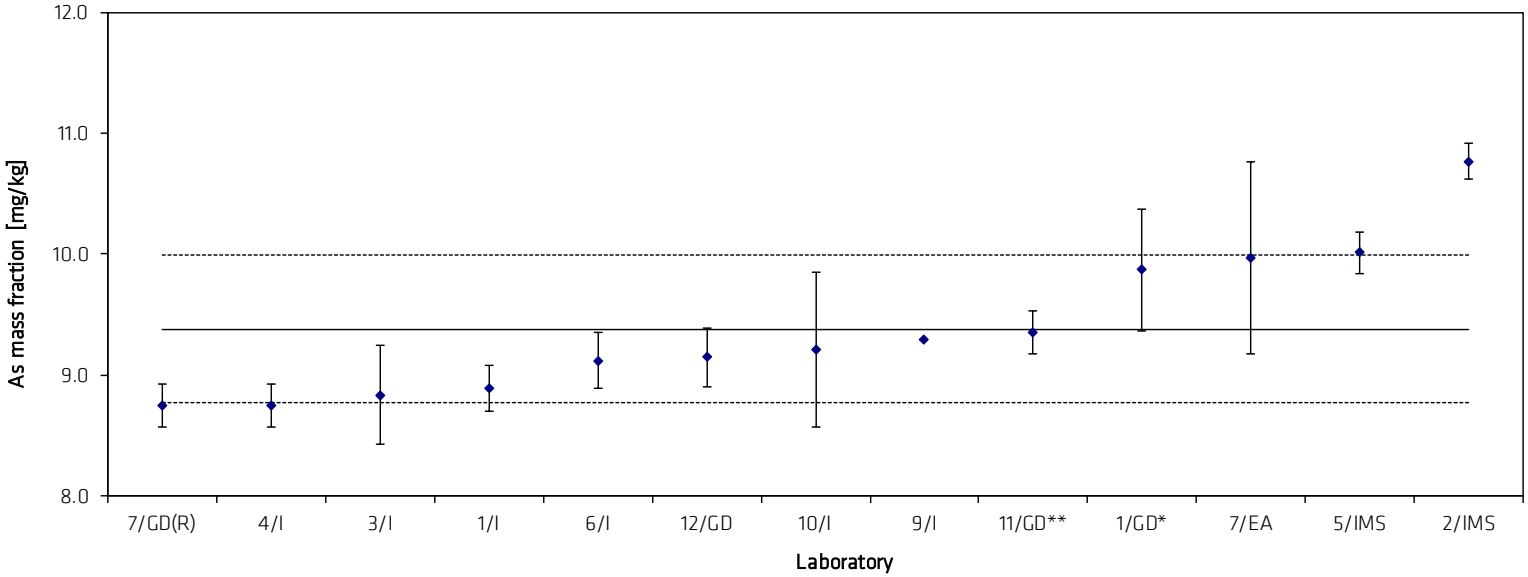


Table 4: Results for As in BAM-M385a

Lab./Meth.	7/GD(R)	4/I	3/I	1/I	6/I	12/GD	10/I	9/I	11/GD**	1/GD*	7/EA	5/IMS	2/IMS		
M_i [mg/kg]	8.8	8.5	9	8.8	9.0	9.1	9.9	9.3	9.19	9.9	11.1	9.9	10.9		*n*
	8.6	8.7	9	8.8	9.4	9.0	9.3	9.3	9.30	10.5	10.7	10.3	10.9		13
	8.9	8.9	8	8.6	9.4	9.2	8.7	9.3	9.21	10.1	9.6	9.9	10.6		
	8.5	8.9	9	9.0	9.2	9.5	8.8	9.3	9.32	10.6	9.2	10.1	10.6		
	8.9	8.6	9	9.1	8.8	9.3	10.0	9.3	9.65	9.4	9.2	9.8	10.9		
	8.7	8.9	9	9.1	9.0	8.8	8.5	9.3	9.47	9.4	10.0	10.0	10.7		
										9.6					
										9.4					
***M* [mg/kg]**	**8.75**	**8.75**	**8.83**	**8.90**	**9.12**	**9.15**	**9.21**	**9.30**	**9.36**	**9.87**	**9.97**	**10.01**	**10.77**		**9.38**
s [mg/kg]	0.179	0.176	0.408	0.189	0.232	0.243	0.641	0.000	0.175	0.501	0.792	0.168	0.151	s_M [mg/kg]	0.605
														$\bar{s}_i$ [mg/kg]	0.367
s_{rel}	0.020	0.020	0.046	0.021	0.025	0.027	0.070	0.000	0.019	0.051	0.079	0.017	0.014		0.065

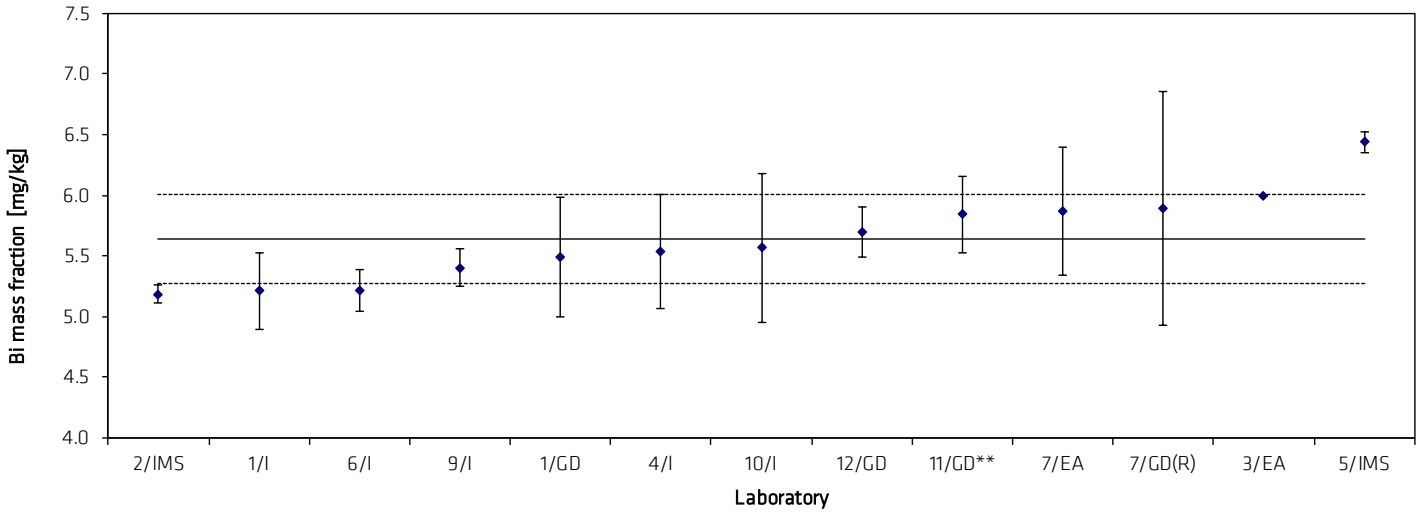


*corrected with ERM-EB385

**calibrated with ERM-EB385 and BCR-075

Table 5: Results for Bi in BAM-M385a

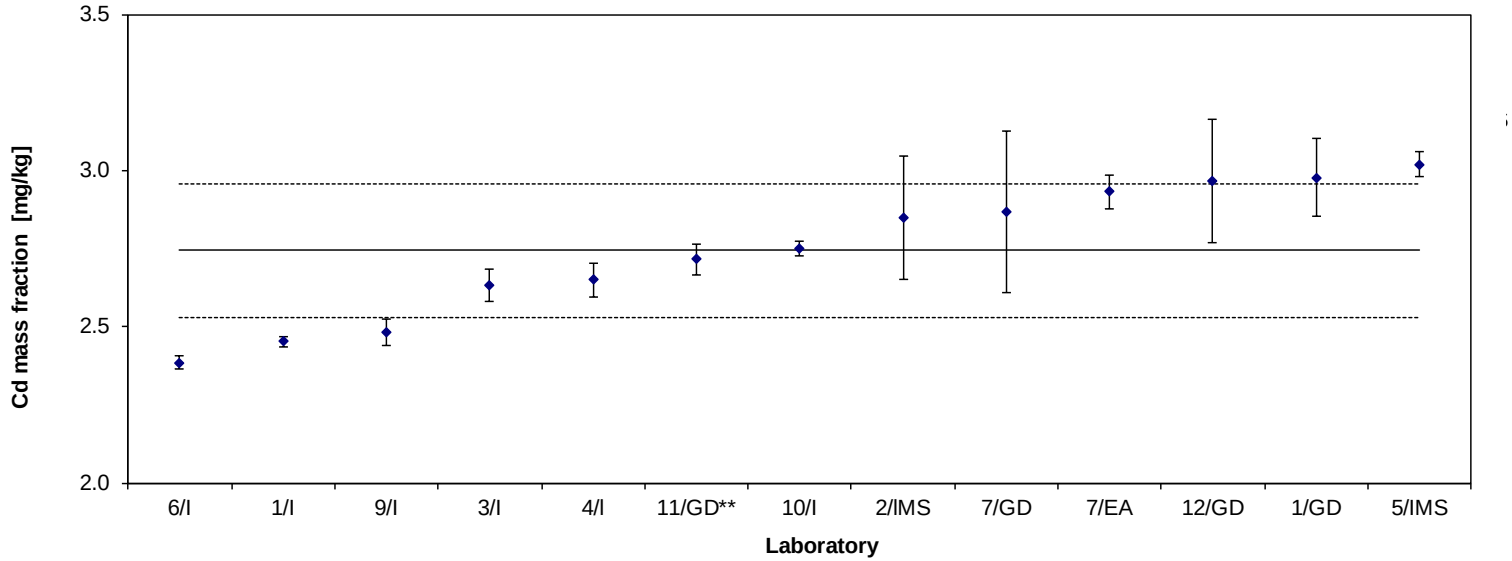
Lab./Meth.	2/IMS	1/I	6/I	9/I	1/GD	4/I	10/I	12/GD	11/GD**	7/EA	7/GD(R)	3/EA	5/IMS		
M_i [mg/kg]	5.2	5.0	5.2	5.5	6.06	5.2	6.2	5.6	6.13	6.5	5.6	6	6.3		*n*
	5.2	4.8	5.0	5.5	5.68	6.2	5.3	5.5	6.13	5.6	7.0	6	6.6		13
	5.1	5.6	5.5	5.2	6.32	5.0	5.5	5.5	5.45	5.6	5.5	6	6.4		
	5.1	5.6	5.2	5.5	5.29	5.2	6.2	6.0	5.48	6.5	7.1	6	6.5		
	5.3	5.0	5.1	5.2	5.42	5.9	4.6	5.9	5.82	5.2	5.2	6	6.4		
	5.2	5.2	5.4	5.5	5.26	5.7	5.7	5.7	6.07	5.8	4.9	6	6.5		
					5.01										
					4.90										
M **[mg/kg]**	**5.18**	**5.21**	**5.22**	**5.40**	**5.49**	**5.53**	**5.57**	**5.70**	**5.84**	**5.87**	**5.89**	**6.00**	**6.44**		**5.64**
s [mg/kg]	0.075	0.315	0.175	0.155	0.497	0.472	0.613	0.210	0.316	0.528	0.964	0.000	0.087	s_M [mg/kg]	0.365
														$\bar{s}_i$ [mg/kg]	0.427
s_{rel}	0.015	0.061	0.034	0.029	0.090	0.085	0.110	0.037	0.054	0.090	0.164	0.000	0.013		0.065



**calibrated with ERM-EB385 and BCR-075

Table 6: Results for Cd in BAM-M385a

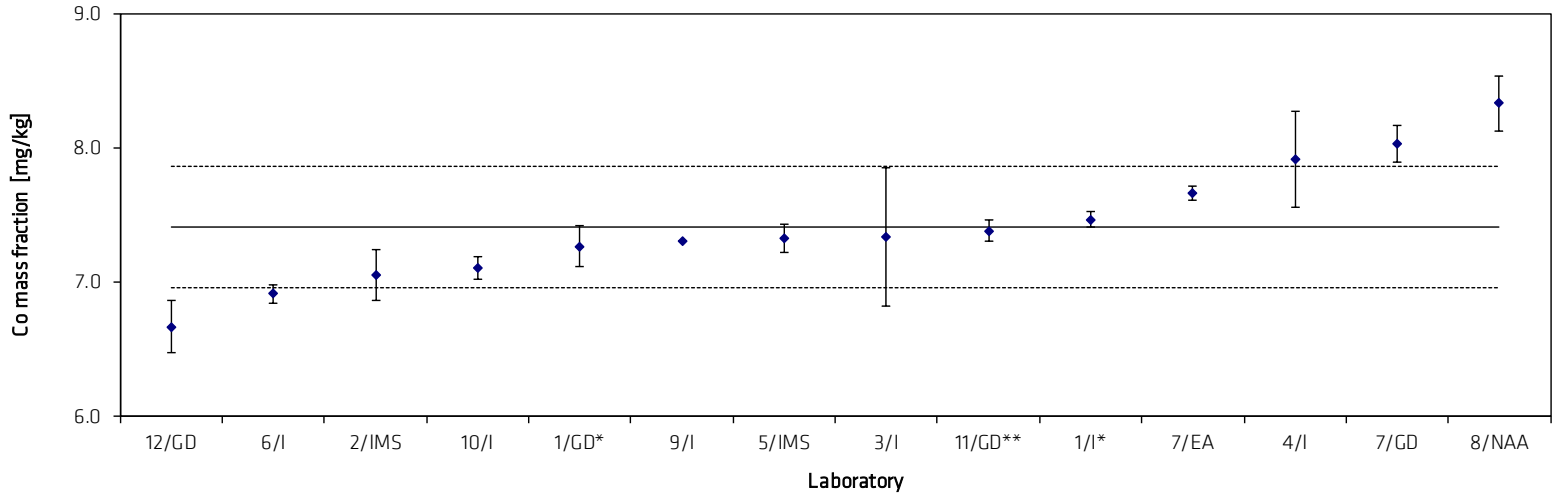
Lab./Meth.	6/I	1/I	9/I	3/I	4/I	11/GD**	10/I	2/IMS	7/GD	7/EA	12/GD	1/GD	5/IMS		
M_i [mg/kg]	2.4	2.43	2.5	2.6	2.6	2.77	2.7	2.7	3.1	2.93	2.80	2.92	2.99		*n*
	2.4	2.46	2.5	2.6	2.6	2.76	2.8	2.7	2.8	3.02	2.90	2.89	3.08		13
	2.4	2.45	2.5	2.6	2.7	2.68	2.8	3.1	2.4	2.96	3.10	3.00	2.99		
	2.4	2.44	2.4	2.7	2.7	2.65	2.8	3.1	2.9	2.93	2.90	2.78	3.06		
	2.4	2.46	2.5	2.7	2.6	2.74	2.7	2.7	3.1	2.86	2.80	3.21	2.98		
	2.4	2.48	2.5	2.6	2.7	2.70	2.7	2.8	2.9	2.90	3.30	3.03	3.03		
												3.03			
												2.97			
M **[mg/kg]**	**2.39**	**2.45**	**2.48**	**2.63**	**2.65**	**2.72**	**2.75**	**2.85**	**2.87**	**2.93**	**2.97**	**2.98**	**3.02**		**2.75**
s [mg/kg]	0.021	0.017	0.041	0.052	0.055	0.048	0.023	0.197	0.258	0.054	0.197	0.125	0.040	s_M [mg/kg]	0.213
														$\bar{s}_i$ [mg/kg]	0.116
s_{rel}	0.009	0.007	0.016	0.020	0.021	0.018	0.008	0.069	0.090	0.019	0.066	0.042	0.013		0.078



**calibrated with ERM-EB385 and BCR-075

Table 7: Results for Co in BAM-M385a

Lab./Meth.	12/GD	6/I	2/IMS	10/I	1/GD*	9/I	5/IMS	3/I	11/GD**	1/I*	7/EA	4/I	7/GD	8/NAA		
M_i [mg/kg]	6.5	6.9	7.2	7.16	7.03	7.3	7.3	8	7.38	7.4	7.6	7.9	8.0	8.0		*n*
	6.7	7.0	7.3	7.07	7.23	7.3	7.5	8	7.34	7.5	7.7	7.9	8.0	8.2		14
	6.7	6.9	6.9	7.11	7.15	7.3	7.3	7	7.33	7.4	7.7	7.4	8.0	8.4		
	6.4	6.8	7.0	7.10	7.14	7.3	7.4	7	7.34	7.5	7.7	8.2	8.0	8.4		
	6.7	6.9	7.1	7.23	7.36	7.3	7.2	7	7.37	7.5	7.7	7.7	7.9	8.5		
	7.0	7.0	6.8	6.97	7.44	7.3	7.3	7	7.53	7.6	7.6	8.4	8.3	8.5		
					7.46											
					7.31											
M [mg/kg]	**6.67**	**6.91**	**7.05**	**7.11**	**7.26**	**7.30**	**7.33**	**7.33**	**7.38**	**7.47**	**7.67**	**7.92**	**8.03**	**8.33**		**7.41**
s [mg/kg]	0.193	0.064	0.187	0.087	0.153	0.000	0.104	0.516	0.077	0.058	0.052	0.354	0.137	0.201	s_M [mg/kg]	0.450
															$\bar{s}_i$ [mg/kg]	0.204
s_{rel}	0.029	0.009	0.027	0.012	0.021	0.000	0.014	0.070	0.010	0.008	0.007	0.045	0.017	0.024		0.061



*corrected with ERM-EB385

**calibrated with ERM-EB385 and BCR-075

Table 8: Results for Cr in BAM-M385a

Lab./Meth.	1/I	9/I	5/IMS	6/I	11/GD**	7/GD(R)	10/I	8/NAA	2/IMS	7/EA	4/I	12/GD	3/I		
M_i [mg/kg]	9.5	10.1	10.0	10.3	10.1	10.6	10.5	10.2	10.2	10.7	10.7	10.7	11		*n*
	9.5	10.1	10.2	10.2	10.1	10.6	10.5	10.1	10.1	10.8	11.1	10.9	11		12
	9.5	10.1	10.1	10.1	10.4	10.3	10.4	10.5	10.8	10.8	10.7	10.8	13		
	10.0	10.1	10.0	10.2	10.1	10.4	10.5	10.4	10.7	10.7	10.6	11.0	13		
	9.5	10.1	10.2	10.1	10.2	10.2	10.4	10.9	10.8	10.6	10.7	11.3	12		
	9.6	10.1	10.4	10.1	10.3	9.9	10.6	10.9	10.7	10.7	10.7	11.1	11		
M [mg/kg]	**9.61**	**10.10**	**10.14**	**10.16**	**10.20**	**10.34**	**10.46**	**10.48**	**10.55**	**10.72**	**10.75**	**10.97**	**11.83**		**10.37**
s [mg/kg]	0.181	0.000	0.163	0.099	0.117	0.252	0.075	0.334	0.315	0.075	0.176	0.216	0.983	s_M [mg/kg]	0.364
														$\bar{s_i}$ [mg/kg]	0.193
s_{rel}	0.019	0.000	0.016	0.010	0.011	0.024	0.007	0.032	0.030	0.007	0.016	0.020	0.083		0.035

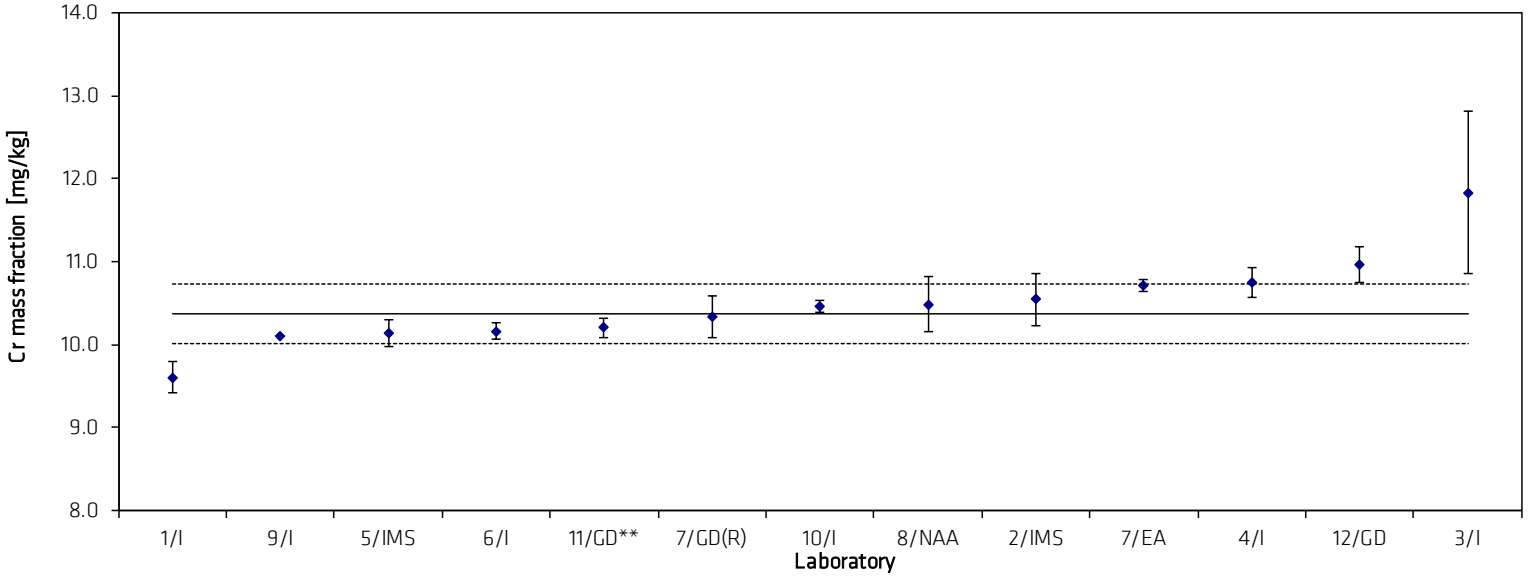
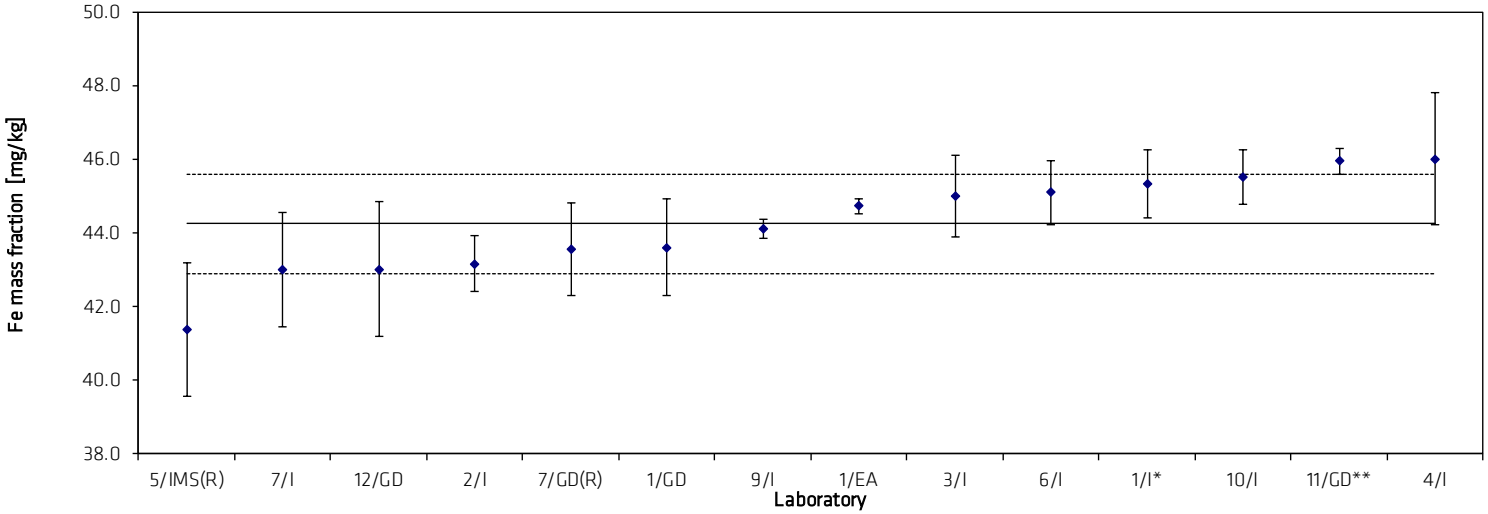


Table 9: Results for Fe in BAM-M385a

Lab./Meth.	5/IMS(R)	7/I	12/GD	2/I	7/GD(R)	1/GD	9/I	1/EA	3/I	6/I	1/I*	10/I	11/GD**	4/I		
M_i [mg/kg]	42.1	44	42.9	43.0	45.9	42.3	44.4	44.7	44	45.8	44.7	44.5	[51.7]	48		*n*
	42.8	45	43.8	42.2	43.4	42.9	44.4	44.9	46	43.9	44.9	45.2	45.4	47		14
	42.2	44	43.7	42.9	42.8	43.2	43.7	44.8	46	46.1	44.8	45.5	46.3	45		
	43.0	42	39.4	43.7	43.7	41.7	44.0	44.4	44	45.0	47.2	46.2	45.8	43		
	39.2	42	43.8	44.4	43.3	45.2	44.1		44	45.4	45.0	46.6	46.0	46		
	38.9	41	44.5	42.8	42.2	44.9	44.1		46	44.3	45.3	45.1	46.2	47		
						44.9										
						43.9										
M **[mg/kg]**	**41.38**	**43.00**	**43.02**	**43.17**	**43.56**	**43.60**	**44.12**	**44.73**	**45.00**	**45.09**	**45.32**	**45.52**	**45.95**	**46.00**		**44.25**
s [mg/kg]	1.815	1.549	1.843	0.771	1.240	1.311	0.264	0.214	1.095	0.870	0.928	0.753	0.351	1.789	s_M [mg/kg]	1.348
															$\bar{s}_i$ [mg/kg]	1.188
s_{rel}	0.044	0.036	0.043	0.018	0.028	0.030	0.006	0.005	0.024	0.019	0.020	0.017	0.008	0.039		0.030

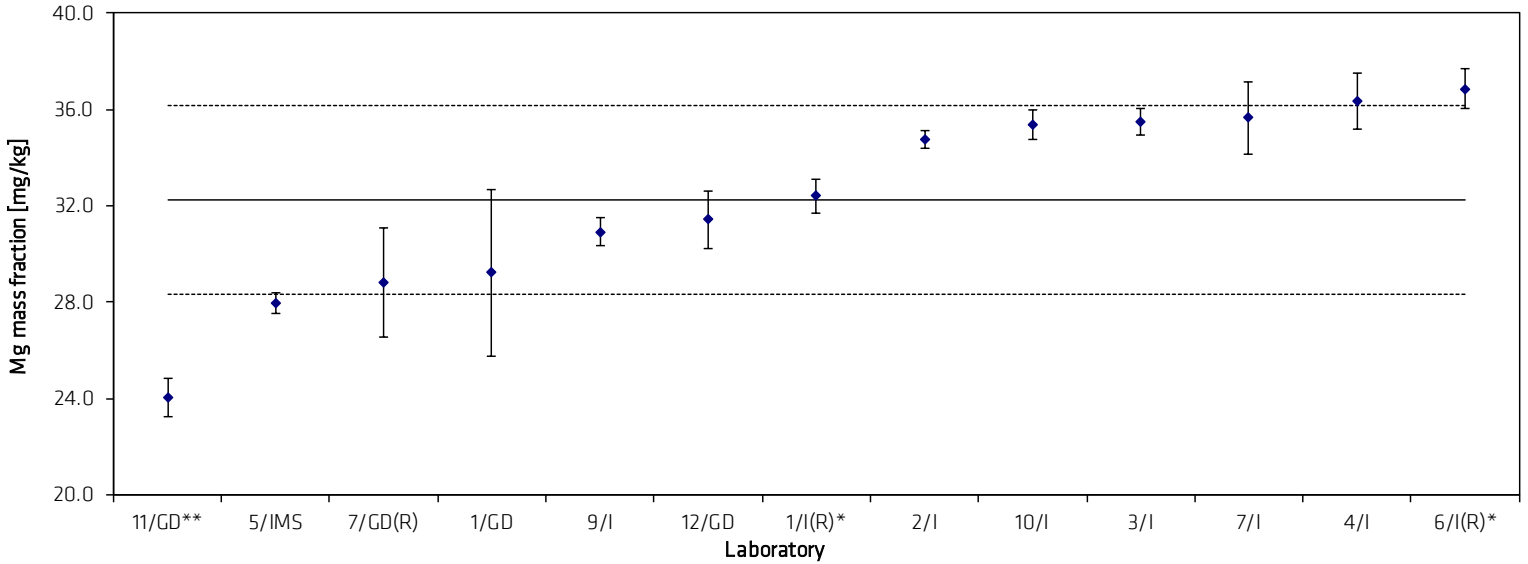


*corrected with ERM-EB385

**calibrated with ERM-EB385 and BCR-075

Table 10: Results for Mg in BAM-M385a

Lab./Meth.	11/GD**	5/IMS	7/GD(R)	1/GD	9/I	12/GD	1/I(R)*	2/I	10/I	3/I	7/I	4/I	6/I(R)*		
M_i [mg/kg]	23.4	28.4	30.0	28.7	30.8	31.5	31.9	34.3	34.6	35	37	36.4	37.2		*n*
	22.8	27.8	26.5	31.0	30.8	29.5	32.0	34.7	35.1	35	37	38.5	36.7		13
	24.8	27.5	30.1	28.3	31.9	32.1	33.2	34.7	35.2	35	37	36.6	38.4		
	23.9	28.0	25.5	32.1	30.1	31.4	31.8	35.2	35.6	36	35	35.3	36.2		
	24.8	28.5	31.2	26.0	30.9	33.1	33.4	35.2	36.4	36	34	35.9	36.6		
	24.4	27.6	29.5	*22.8*	31.0	30.9	32.1	34.4	35.1	36	34	35.5	36.2		
				23.5											
				24.4											
M **[mg/kg]**	**24.02**	**27.96**	**28.80**	**29.23**	**30.92**	**31.42**	**32.40**	**34.75**	**35.34**	**35.50**	**35.67**	**36.37**	**36.86**		**32.25**
s [mg/kg]	0.790	0.420	2.267	3.466	0.578	1.204	0.719	0.383	0.613	0.548	1.506	1.159	0.842	s_M [mg/kg]	3.937
														$\bar{s}_i$ [mg/kg]	1.397
s_{rel}	0.033	0.015	0.079	0.119	0.019	0.038	0.022	0.011	0.017	0.015	0.042	0.032	0.023		0.122

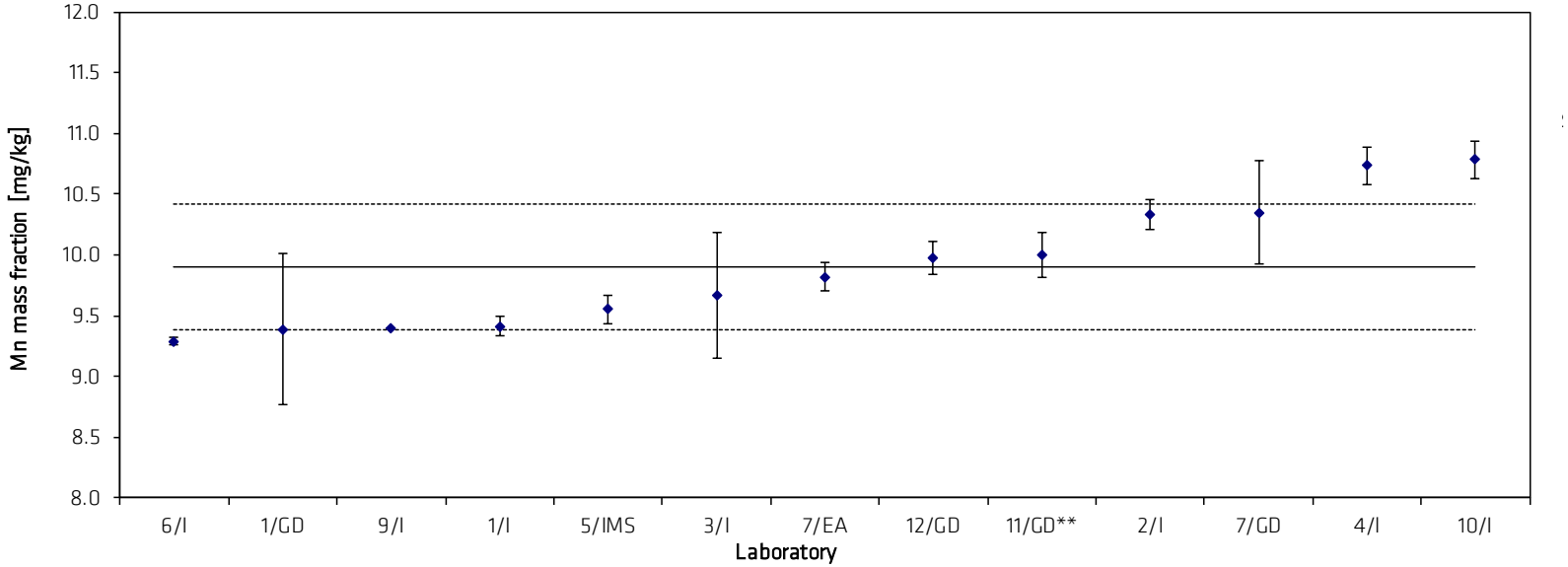


**calibrated with ERM-EB385 and BCR-075

*Decomposition with HF

Table 11: Results for Mn in BAM-M385a

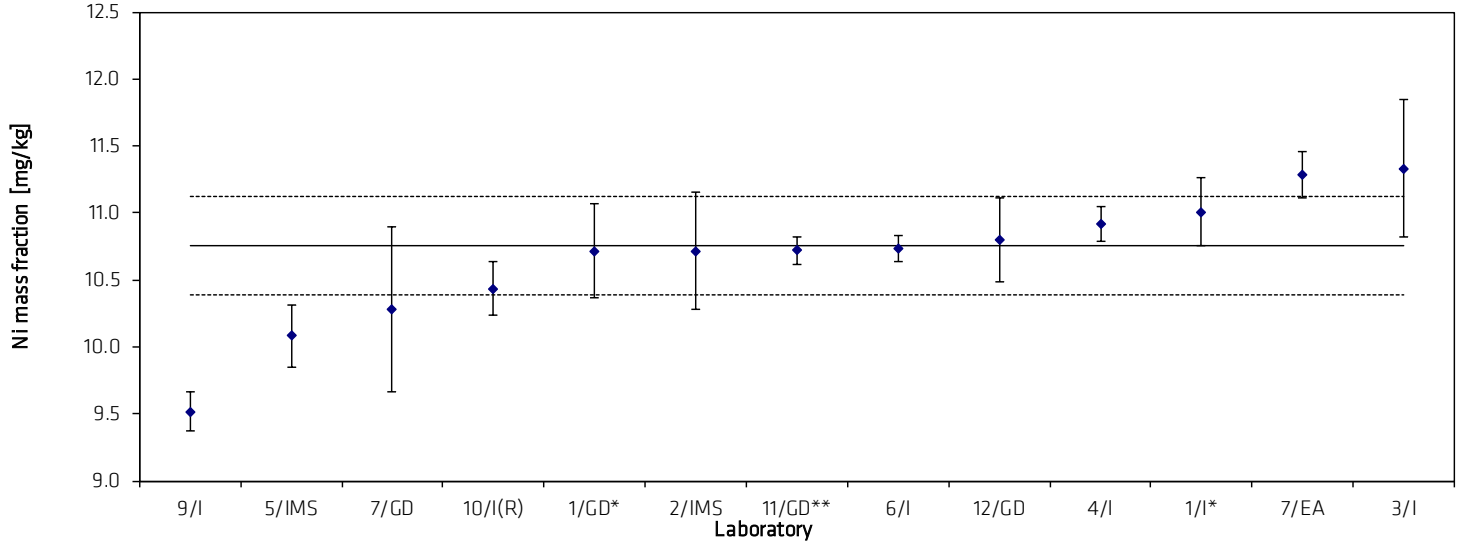
Lab./Meth.	6/I	1/GD	9/I	1/I	5/IMS	3/I	7/EA	12/GD	11/GD**	2/I	7/GD	4/I	10/I		
M_i [mg/kg]	9.3	10.06	9.4	9.38	9.52	9	9.9	10.0	9.97	10.2	10.9	10.6	10.77		*n*
	9.3	10.10	9.4	9.44	9.64	9	9.8	10.0	10.05	10.5	10.3	10.7	10.86		13
	9.3	9.94	9.4	9.42	9.42	10	9.6	10.2	10.23	10.2	9.6	10.6	11.00		
	9.3	9.63	9.4	9.42	9.74	10	9.8	10.0	9.93	10.4	10.4	10.8	10.79		
	9.3	9.17	9.4	9.28	9.45	10	9.9	9.8	9.70	10.4	10.5	10.7	10.54		
	9.3	8.79	9.4	9.53	9.53	10	9.9	9.9	10.14	10.3	10.4	11.0	10.73		
		8.75													
		8.63													
M **[mg/kg]**	**9.29**	**9.39**	**9.40**	**9.41**	**9.55**	**9.67**	**9.82**	**9.98**	**10.00**	**10.33**	**10.35**	**10.73**	**10.78**		**9.90**
s [mg/kg]	0.032	0.622	0.000	0.081	0.119	0.516	0.117	0.139	0.185	0.121	0.423	0.151	0.152	s_M [mg/kg]	0.515
														$\bar{s}_i$ [mg/kg]	0.275
s_{rel}	0.003	0.066	0.000	0.009	0.012	0.053	0.012	0.014	0.018	0.012	0.041	0.014	0.014		0.052



**calibrated with ERM-EB385 and BCR-075

Table 12: Results for Ni in BAM-M385a

Lab./Meth.	9/I	5/IMS	7/GD	10/I(R)	1/GD*	2/IMS	11/GD**	6/I	12/GD	4/I	1/I*	7/EA	3/I		
M_i [mg/kg]	9.4	10.4	9.9	10.4	10.3	11.1	10.79	10.7	10.9	10.7	10.8	11.6	11		*n*
	9.4	10.2	10.4	10.7	11.1	11.2	10.71	10.7	11.1	10.9	10.9	11.3	11		12
	9.4	10.2	11.3	10.5	10.4	10.5	10.67	10.8	11.2	11.1	11.0	11.1	11		
	9.7	10.0	9.9	10.5	11.2	10.8	10.89	10.8	10.3	11.0	10.9	11.2	12		
	9.7	9.9	9.6	10.5	10.3	10.0	10.67	10.8	10.7	10.9	10.9	11.3	12		
	9.5	9.8	10.6	10.1	10.7	10.7	10.59	10.6	10.7	10.9	11.5	11.2	11		
					10.9										
					10.8										
M [mg/kg]	**9.52**	**10.08**	**10.28**	**10.43**	**10.72**	**10.72**	**10.72**	**10.73**	**10.80**	**10.92**	**11.01**	**11.28**	**11.33**		**10.75**
s [mg/kg]	0.147	0.234	0.618	0.201	0.351	0.436	0.106	0.096	0.313	0.133	0.253	0.172	0.516	s_M [mg/kg]	0.368
														$\bar{s}_i$ [mg/kg]	0.327
s_{rel}	0.015	0.023	0.060	0.019	0.033	0.041	0.010	0.009	0.029	0.012	0.023	0.015	0.046		0.034

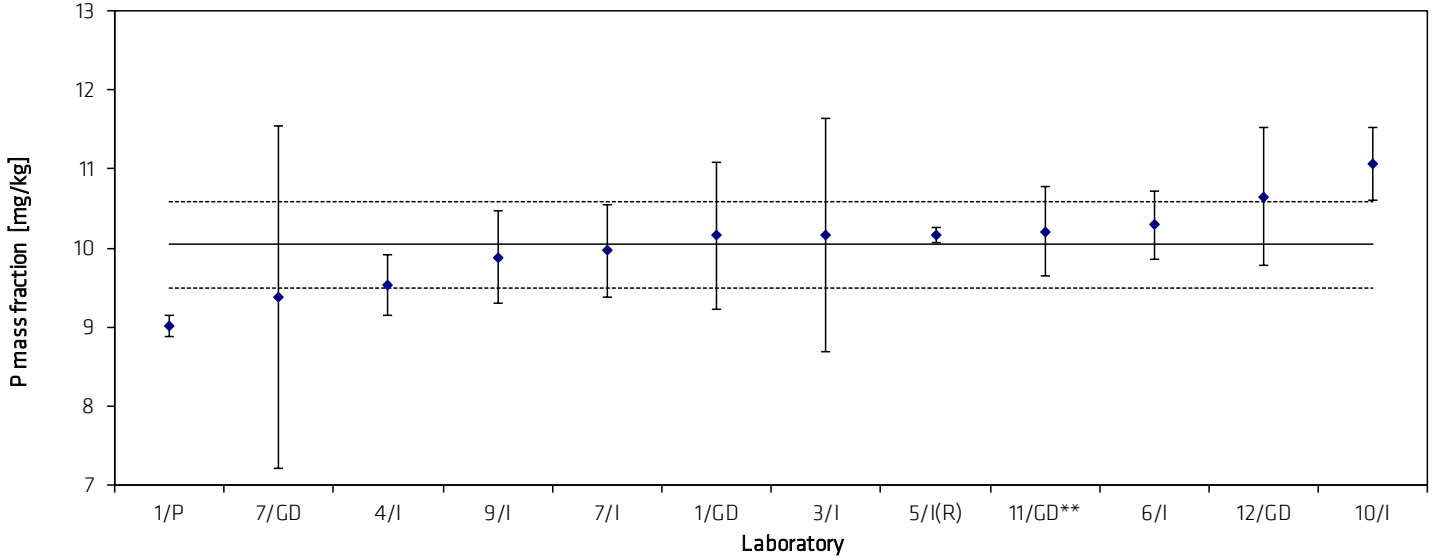


*corrected with ERM-EB385

**calibrated with ERM-EB385 and BCR-075

Table 13: Results for P in BAM-M385a

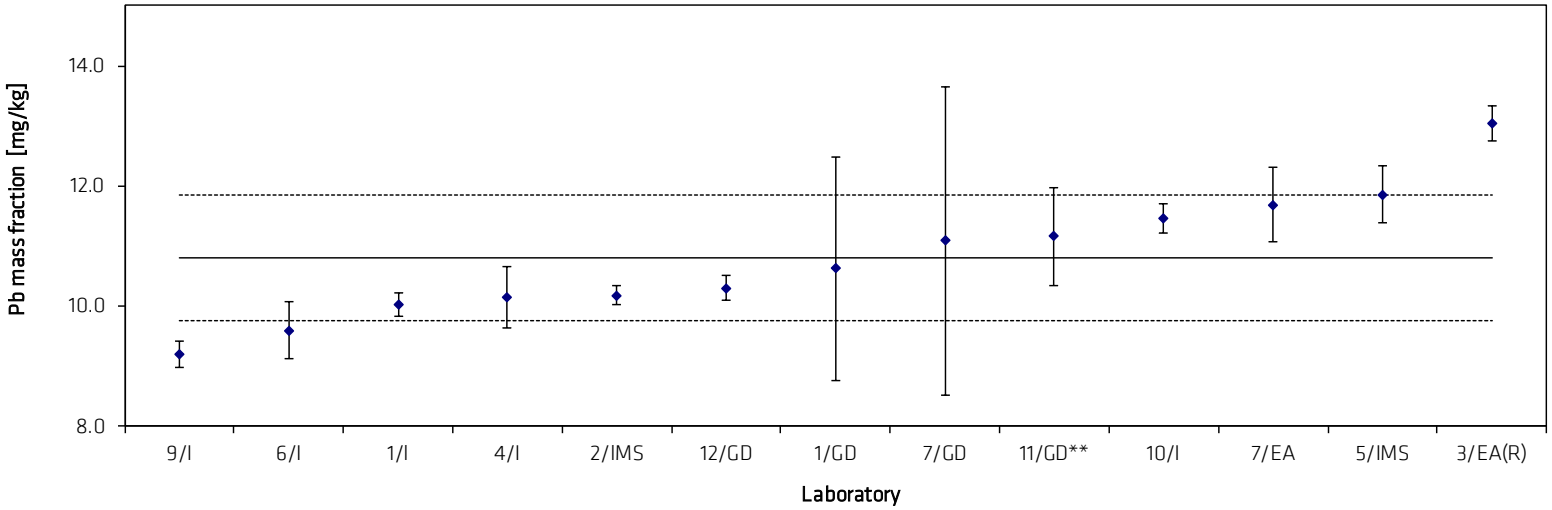
Lab./Meth.	1/P	7/GD	4/I	9/I	7/I	1/GD	3/I	5/I(R)	11/GD**	6/I	12/GD	10/I		
M_i [mg/kg]	8.9	8.5	9.9	9.5	9.4	9.0	9	10.2	9.8	10.4	9.9	10.9		*n*
	9.0	10.1	9.7	9.5	9.7	10.7	9	10.3	9.8	10.3	9.7	10.3		12
	9.2	13.4	9.1	11.0	9.3	9.2	9	10.2	10.7	10.8	10.4	11.5		
	9.0	8.3	9.0	9.9	10.5	11.6	10	10.0	10.8	9.5	11.0	11.4		
	8.9	7.3	9.8	9.5	10.2	9.6	12	10.2	10.7	10.4	12.1	11.4		
		8.7	9.7	9.9	10.7	9.6	12	10.1	9.5	10.4	10.8	10.9		
						10.9								
						10.5								
M **[mg/kg]**	**9.01**	**9.38**	**9.53**	**9.88**	**9.97**	**10.16**	**10.17**	**10.17**	**10.21**	**10.29**	**10.65**	**11.07**		**10.04**
s [mg/kg]	0.136	2.164	0.383	0.581	0.585	0.930	1.472	0.100	0.563	0.439	0.869	0.459	s_M [mg/kg]	0.551
													$\bar{s}_i$ [mg/kg]	0.915
s_{rel}	0.015	0.231	0.040	0.059	0.059	0.092	0.145	0.010	0.055	0.043	0.082	0.041		0.055



**calibrated with ERM-EB385 and BCR-075

Table 14: Results for Pb in BAM-M385a

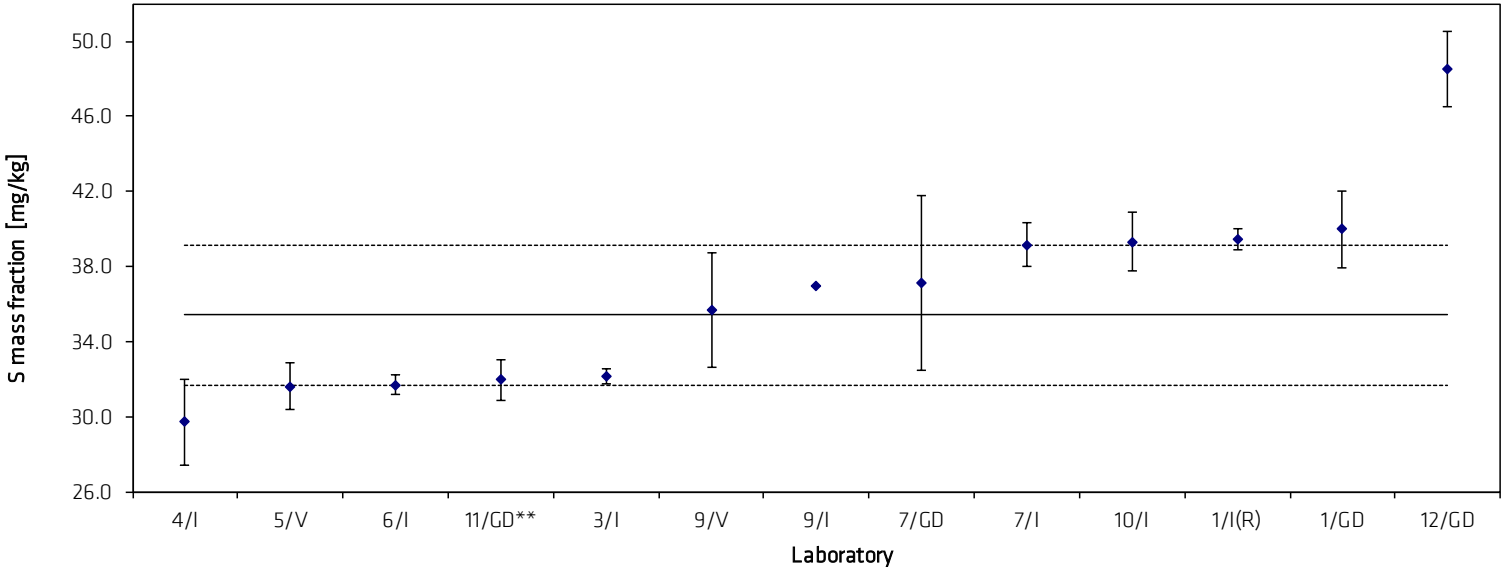
Lab./Meth.	9/I	6/I	1/I	4/I	2/IMS	12/GD	1/GD	7/GD	11/GD**	10/I	7/EA	5/IMS	3/EA(R)		
M_i [mg/kg]	9.4	10.3	9.81	9.8	10.2	10.14	13.11	12.8	12.0	11.49	12.2	12.67	13.1		*n*
	9.4	9.4	9.87	10.5	10.1	10.11	11.47	9.4	11.9	11.00	12.1	11.73	12.9		13
	9.0	10.1	10.05	10.2	10.0	10.13	13.40	6.9	10.4	11.64	11.9	11.79	12.6		
	9.0	9.4	10.29	9.3	10.2	10.47	10.32	12.4	10.3	11.66	11.7	12.12	13.0		
	9.4	9.2	9.88	10.6	10.4	10.63	9.90	13.9	10.5	11.47	10.5	11.35	13.1		
	9.0	9.2	10.21	10.5		10.31	9.48	11.1	11.7	11.51	11.7	11.49	13.5		
							8.69								
							8.61								
M [mg/kg]	**9.20**	**9.59**	**10.02**	**10.15**	**10.18**	**10.30**	**10.62**	**11.08**	**11.16**	**11.46**	**11.68**	**11.86**	**13.03**		**10.80**
s [mg/kg]	0.219	0.477	0.196	0.509	0.148	0.214	1.864	2.567	0.814	0.240	0.615	0.477	0.294	s_M [mg/kg]	1.051
														$\bar{s}_i$ [mg/kg]	0.965
s_{rel}	0.024	0.050	0.020	0.050	0.015	0.021	0.175	0.232	0.073	0.021	0.053	0.040	0.023		0.097



**calibrated with ERM-EB385 and BCR-075

Table 15: Results for S in BAM-M385a

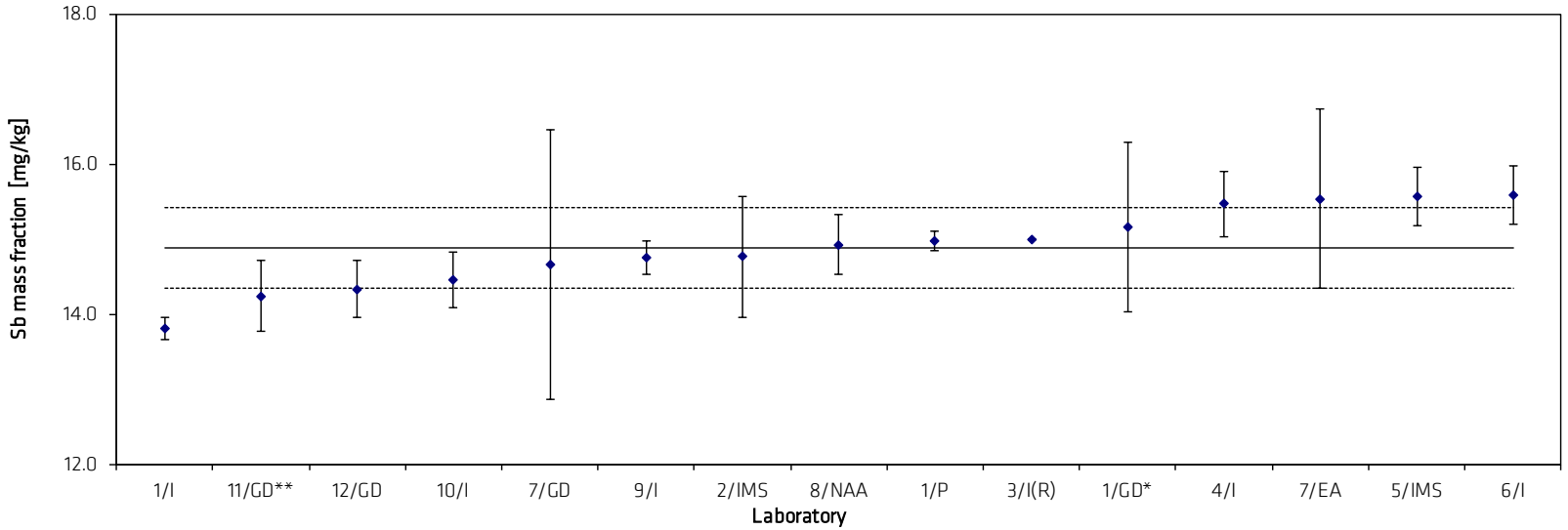
Lab./Meth.	4/I	5/V	6/I	11/GD**	3/I	9/V	9/I	7/GD	7/I	10/I	1/I(R)	1/GD	12/GD		
M_i [mg/kg]	29.7	30.2	32.0	31.3	33	35	37	35.5	39	40.1	38.3	37.2	48.1		*n*
	26.1	32.1	32.6	30.6	32	39	37	38.8	40	41.8	39.9	41.2	46.3		12
	31.7	32.8	31.1	32.7	32	33	37	45.7	40	37.6	39.9	37.1	48.2		
	28.3	32.0	31.8	32.1	32		37	34.7	37	38.1	40.0	42.9	46.6		
	30.0	30.0	31.1	33.7	32			32.4	39	40.1	39.6	40.5	51.2		
	32.5	32.7	31.7	31.6	32			35.8	40	38.5	39.2	39.0	50.6		
											39.2	41.4			
											39.7	40.6			
***M* [mg/kg]**	**29.72**	**31.63**	**31.71**	**31.99**	**32.17**	**35.67**	**37.00**	**37.15**	**39.17**	**39.33**	**39.47**	**39.99**	**48.50**		**35.42**
s [mg/kg]	2.317	1.231	0.550	1.088	0.408	3.055	0.000	4.668	1.169	1.590	0.583	2.071	2.020	s_M [mg/kg]	3.756
														$\bar{s}_i$ [mg/kg]	2.004
s_{rel}	0.078	0.039	0.017	0.034	0.013	0.086	0.000	0.126	0.030	0.040	0.015	0.052	0.042		0.106



**calibrated with ERM-EB385 and BCR-075

Table 16: Results for Sb in BAM-M385a

Lab./Meth.	1/I	11/GD**	12/GD	10/I	7/GD	9/I	2/IMS	8/NAA	1/P	3/I(R)	1/GD*	4/I	7/EA	5/IMS	6/I		
M_i [mg/kg]	13.70	14.53	14.0	14.7	16.2	14.7	14.3	14.2	14.92	15	16.39	14.9	15.3	15.3	15.0		*n*
	13.76	14.55	14.1	14.3	13.7	14.8	14.5	14.7	15.22	15	15.99	16.0	17.5	16.1	16.2		15
	13.61	13.66	13.9	14.2	11.7	14.5	14.0	15.0	14.89	15	16.80	15.4	14.7	15.1	15.5		
	14.01	13.60	14.8	15.1	15.2	14.5	14.4	14.9	14.90	15	15.25	15.1	15.0	15.8	15.5		
	13.92	14.44	14.6	14.3	16.6	15.0	15.2	15.4	14.96	15	14.75	15.5	16.4	15.3	15.7		
	13.80	14.66	14.6	14.1	14.5	15.0	16.2	15.2	14.96	15	14.28	15.9	14.3	15.8	15.6		
											14.12						
											13.73						
M [mg/kg]	**13.80**	**14.24**	**14.33**	**14.46**	**14.65**	**14.75**	**14.77**	**14.92**	**14.98**	**15.00**	**15.16**	**15.47**	**15.53**	**15.56**	**15.58**		**14.88**
s [mg/kg]	0.145	0.480	0.378	0.377	1.796	0.226	0.807	0.400	0.124	0.000	1.131	0.432	1.198	0.387	0.389	s_M [mg/kg]	0.533
																$\bar{s}_i$ [mg/kg]	0.723
s_{rel}	0.010	0.034	0.026	0.026	0.123	0.015	0.055	0.027	0.008	0.000	0.075	0.028	0.077	0.025	0.025		0.036

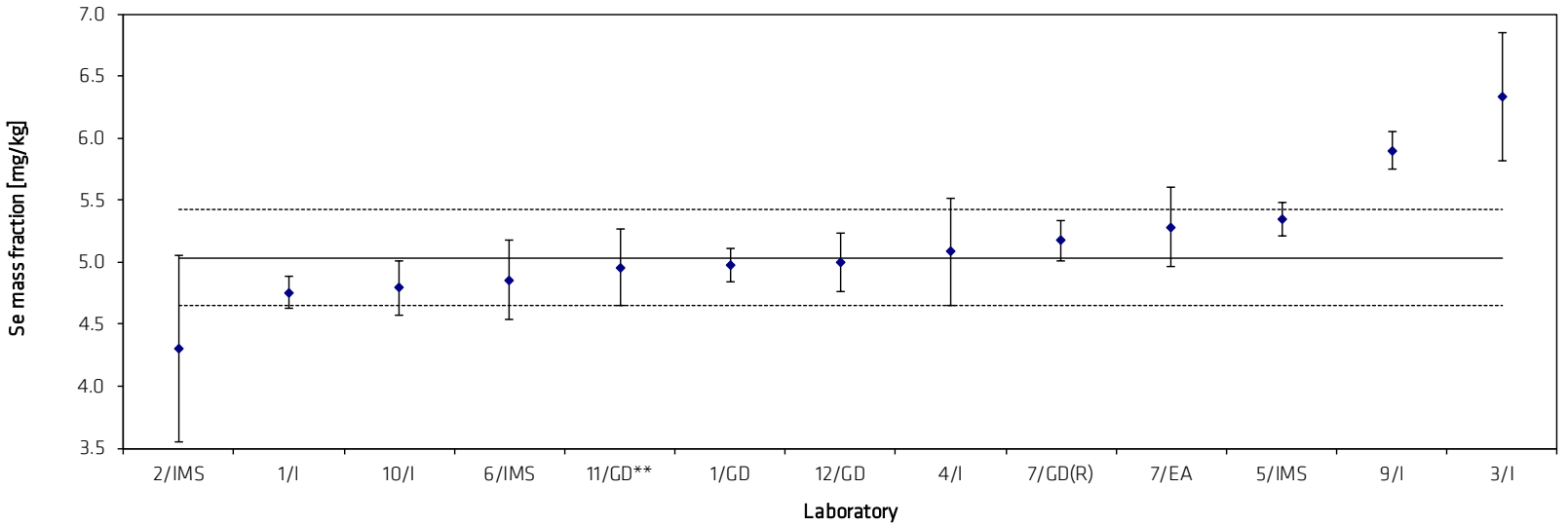


*corrected with ERM-EB385

**calibrated with ERM-EB385 and BCR-075

Table 17: Results for Se in BAM-M385a

Lab./Meth.	2/IMS	1/I	10/I	6/IMS	11/GD**	1/GD	12/GD	4/I	7/GD(R)	7/EA	5/IMS	9/I	3/I		
M_i [mg/kg]	4.0	4.6	4.5	5.3	4.89	5.12	4.90	5.0	5.3	5.6	5.3	6.0	7		*n*
	3.8	4.9	4.7	4.4	4.49	5.03	5.30	4.7	5.2	5.0	5.3	6.0	6		12
	4.7	4.7	4.6	4.9	4.76	5.16	4.60	4.9	5.2	4.9	5.3	5.7	6		
	5.1	4.6	5.1	4.6	5.25	4.90	5.00	4.7	5.3	5.2	5.5	5.7	6		
	5.0	4.9	4.9	5.0	5.05	5.07	5.10	5.8	5.0	5.7	5.2	6.0	6		
	3.2	4.8	4.8	4.9	5.29	4.87	5.10	5.4	5.0	5.3	5.5	6.0	7		
						4.84									
						4.79									
M **[mg/kg]**	**4.30**	**4.75**	**4.79**	**4.85**	**4.96**	**4.97**	**5.00**	**5.08**	**5.18**	**5.28**	**5.35**	**5.90**	**6.33**		**5.03**
s [mg/kg]	0.754	0.130	0.217	0.319	0.305	0.138	0.237	0.436	0.162	0.319	0.130	0.155	0.516	s_M [mg/kg]	0.387
														$\bar{s}_i$ [mg/kg]	0.324
s_{rel}	0.175	0.027	0.045	0.066	0.062	0.028	0.047	0.086	0.031	0.060	0.024	0.026	0.082		0.077



**calibrated with ERM-EB385 and BCR-075

Table 18: Results for Si in BAM-M385a

Lab./Meth.	9/I	7/GD(R)	2/I	5/IMS	11/GD**	12/GD	4/I		
M_i [mg/kg]	3.0	6.8	7.0	7.7	7.42	7.9	9.1		*n*
	4.0	6.0	6.4	6.6	7.26	7.8	8.0		6
	3.0	6.7	6.8	7.9	8.41	8.0	7.4		
	4.0	5.8	6.4	7.1	7.83	7.6	6.8		
	4.0	6.7	6.7	6.7	7.58	7.2	8.4		
	3.0	6.7	7.1	6.8	7.34	8.1	7.8		
M **[mg/kg]**	**3.50**	**6.44**	**6.73**	**7.13**	**7.64**	**7.77**	**7.92**		**7.27**
s [mg/kg]	0.548	0.446	0.294	0.547	0.428	0.327	0.796	s_M [mg/kg]	0.599
								$\bar{s}_i$ [mg/kg]	0.501
s_{rel}	0.156	0.069	0.044	0.077	0.056	0.042	0.101		0.082

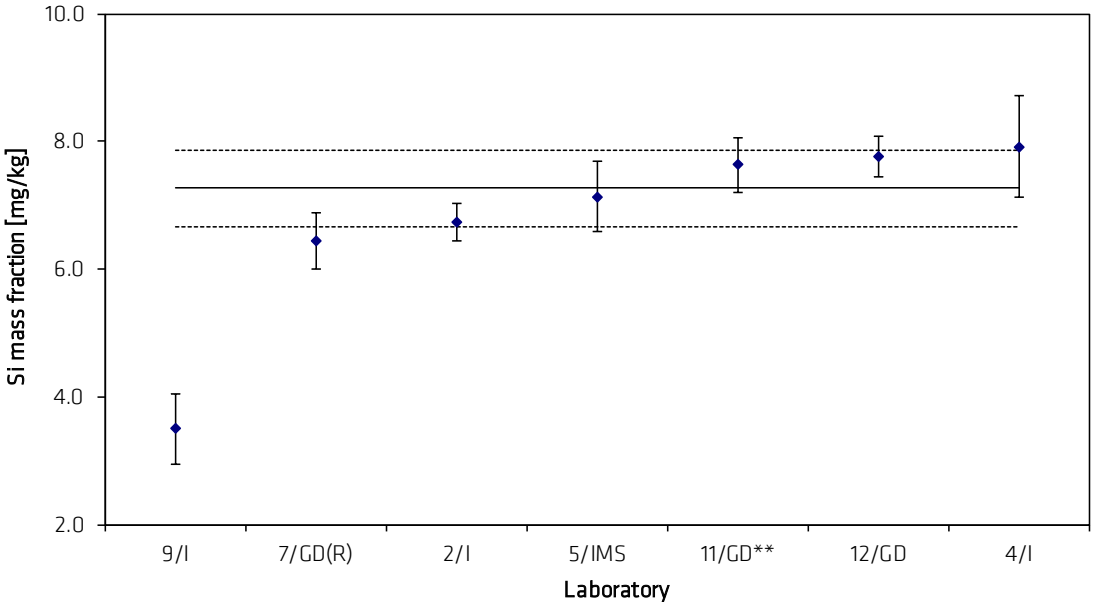
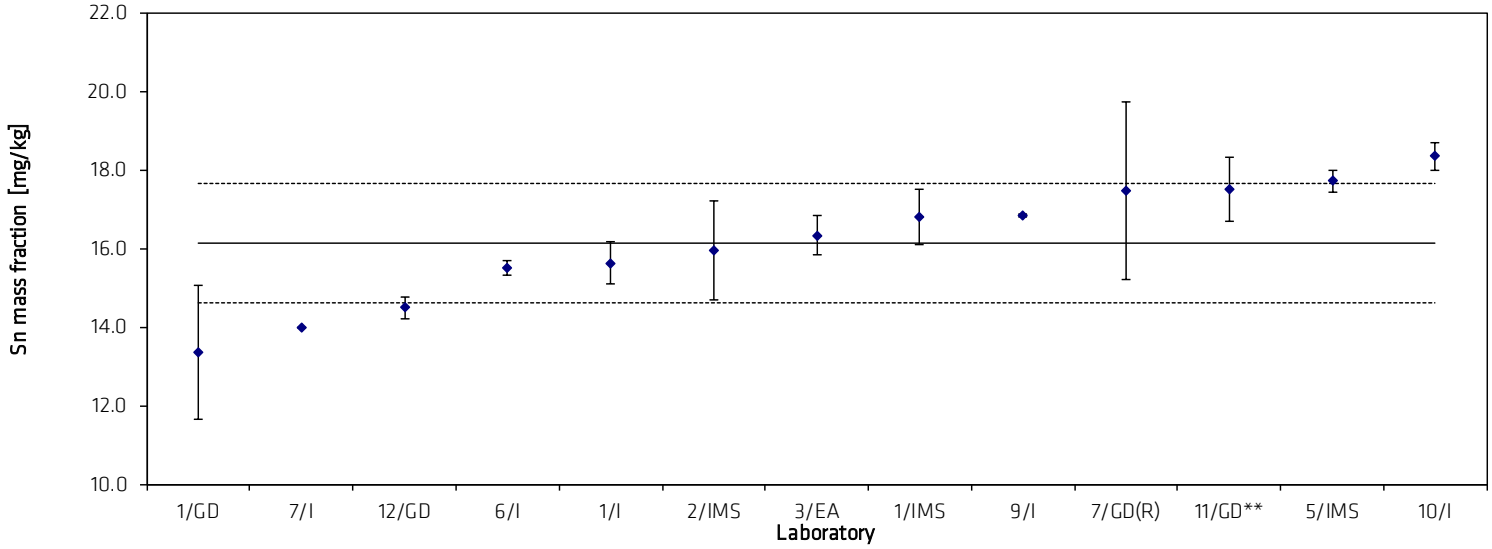


Table 19: Results for Sn in BAM-M385a

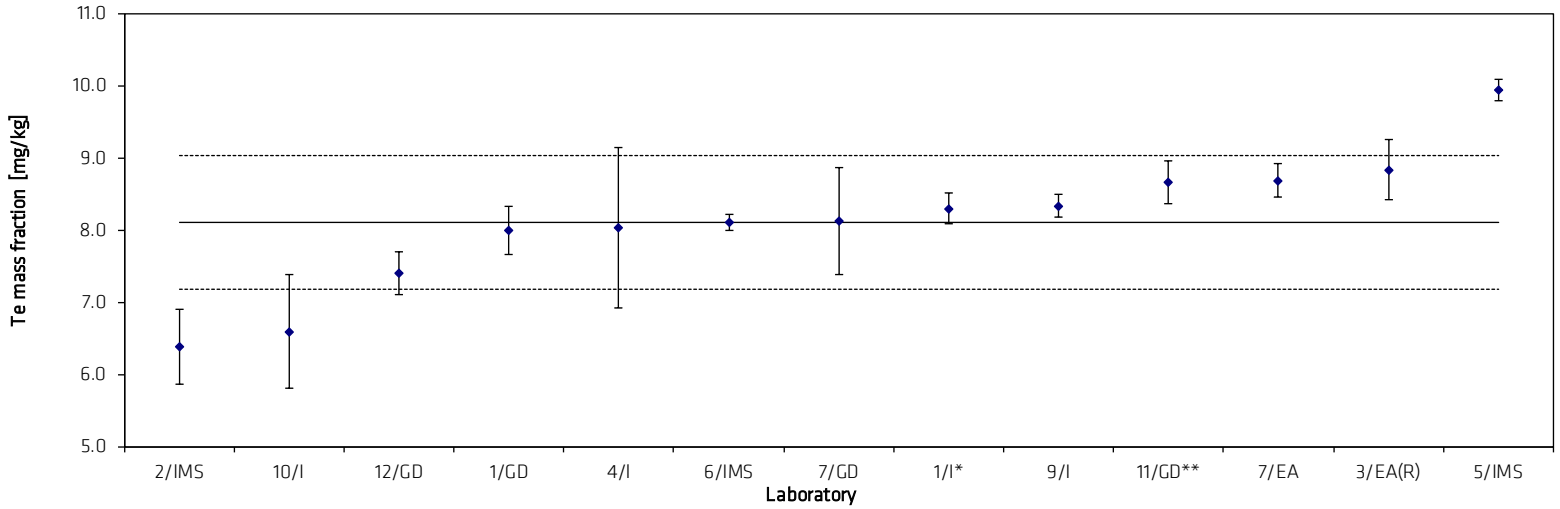
Lab./Meth.	1/GD	7/I	12/GD	6/I	1/I	2/IMS	3/EA	1/IMS	9/I	7/GD(R)	11/GD**	5/IMS	10/I		
M_i [mg/kg]	15.5	14	14.3	15.4	15.2	16.5	16	16.4	16.8	17.2	17.6	17.7	18.0		*n*
	14.3	14	14.6	15.7	15.4	16.8	16	16.5	16.8	20.0	17.7	17.5	18.8		13
	15.8	14	14.4	15.7	15.3	16.2	17	16.3	16.8	16.4	16.7	17.5	18.0		
	13.3	14	14.8	15.4	16.7	16.2	17	16.2	16.8	20.4	16.6	17.6	18.6		
	12.7	14	14.7	15.4	15.4	16.5	16	17.5	16.9	15.7	17.6	17.8	18.6		
	12.1	14	14.1	15.3	15.8	13.4	16	17.9	16.9	15.0	18.9	18.2	18.1		
	11.6														
	11.4														
M **[mg/kg]**	**13.35**	**14.00**	**14.48**	**15.50**	**15.63**	**15.93**	**16.33**	**16.80**	**16.83**	**17.45**	**17.51**	**17.71**	**18.34**		**16.14**
s [mg/kg]	1.701	0.000	0.264	0.175	0.553	1.261	0.516	0.716	0.052	2.254	0.812	0.277	0.354	s_M [mg/kg]	1.519
														$\bar{s}_i$ [mg/kg]	0.945
s_{rel}	0.127	0.000	0.018	0.011	0.035	0.079	0.032	0.043	0.003	0.129	0.046	0.016	0.019		0.094



**calibrated with ERM-EB385 and BCR-075

Table 20: Results for Te in BAM-M385a

Lab./Meth.	2/IMS	10/I	12/GD	1/GD	4/I	6/IMS	7/GD	1/I*	9/I	11/GD**	7/EA	3/EA(R)	5/IMS		
M_i [mg/kg]	5.4	5.7	7.6	8.22	7.4	8.1	8.8	8.04	8.2	8.78	8.8	9	9.8		*n*
	6.4	6.2	7.7	8.11	8.0	8.2	7.7	8.62	8.2	8.84	8.9	9	10.2		13
	6.4	7.3	7.4	8.52	9.4	8.1	6.9	8.35	8.3	8.29	8.8	8	9.8		
	6.5	6.6	7.6	7.82	9.0	8.3	8.3	8.10	8.6	8.25	8.5	9	10.1		
	6.8	7.7	7.1	8.00	8.1	8.0	8.9	8.22	8.3	8.85	8.8	9	9.9		
	6.8	6.0	7.0	7.59	6.3	8.0	8.1	8.40	8.4	8.89	8.3	9	9.9		
				7.66											
M [mg/kg]	**6.38**	**6.59**	**7.40**	**7.99**	**8.03**	**8.10**	**8.12**	**8.29**	**8.33**	**8.65**	**8.68**	**8.83**	**9.94**		**8.10**
s [mg/kg]	0.515	0.789	0.290	0.329	1.115	0.118	0.744	0.213	0.151	0.298	0.232	0.408	0.149	s_M [mg/kg]	0.930
														$\bar{s}_i$ [mg/kg]	0.503
s_{rel}	0.081	0.120	0.039	0.041	0.139	0.015	0.092	0.026	0.018	0.034	0.027	0.046	0.015		0.115

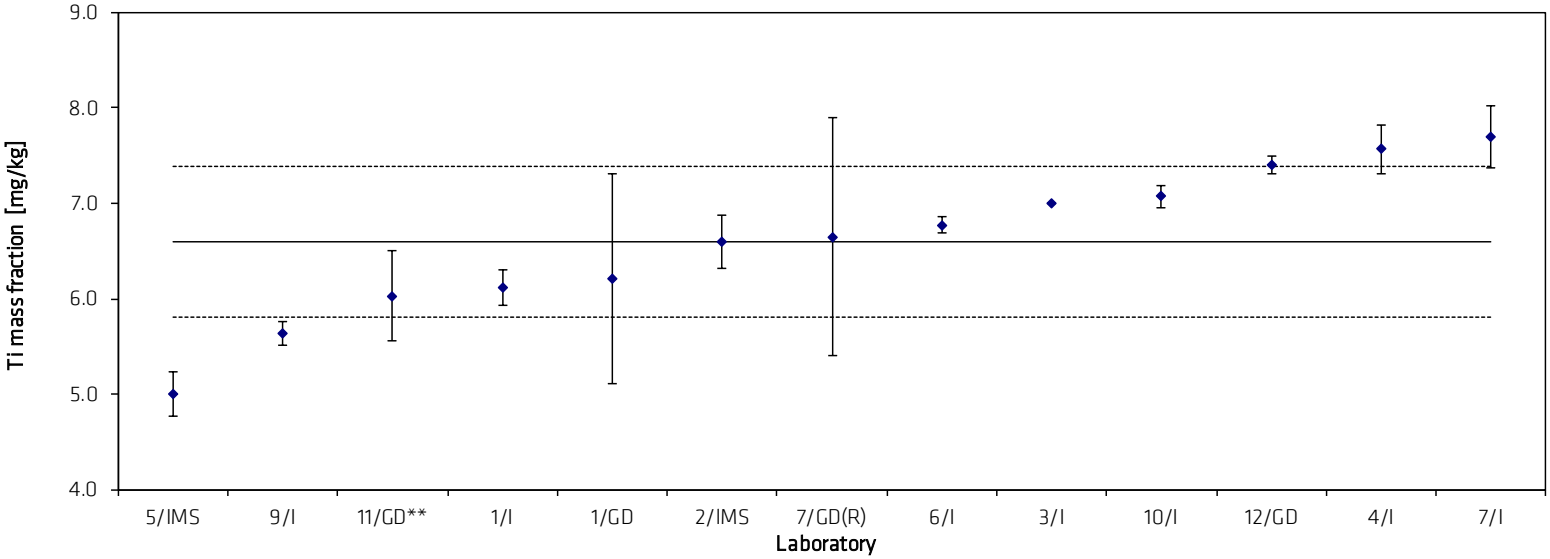


*corrected with ERM-EB385

**calibrated with ERM-EB385 and BCR-075

Table 21: Results for Ti in BAM-M385a

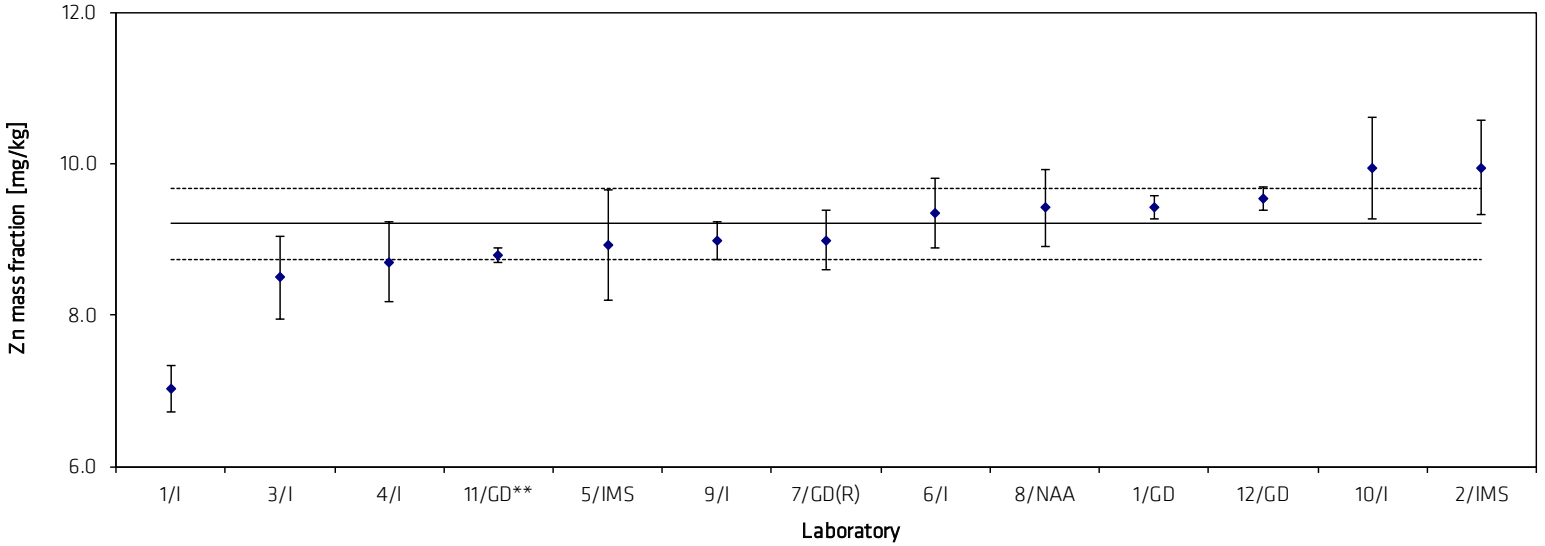
Lab./Meth.	5/IMS	9/I	11/GD**	1/I	1/GD	2/IMS	7/GD(R)	6/I	3/I	10/I	12/GD	4/I	7/I		
M_i [mg/kg]	5.24	5.7	5.92	5.9	7.07	6.5	7.1	6.6	7	7.0	7.4	7.3	7.6		*n*
	5.12	5.7	5.92	6.0	5.95	6.6	7.9	6.8	7	7.1	7.5	7.5	7.6		13
	4.97	5.8	6.01	6.2	7.07	7.0	6.0	6.8	7	7.1	7.3	7.3	7.5		
	4.72	5.5	5.50	6.1	5.38	6.5	8.2	6.7	7	7.0	7.3	7.6	7.4		
	5.23	5.5	5.92	6.4	5.58	6.8	5.8	6.9	7	7.3	7.4	7.9	7.8		
	4.74	5.6	6.93	6.1	4.73	6.2	5.0	6.9	7	7.0	7.5	7.8	8.3		
					4.31										
					4.41										
***M* [mg/kg]**	**5.00**	**5.63**	**6.03**	**6.12**	**6.21**	**6.60**	**6.65**	**6.78**	**7.00**	**7.07**	**7.40**	**7.57**	**7.70**		**6.60**
s [mg/kg]	0.233	0.121	0.477	0.189	1.092	0.276	1.244	0.090	0.000	0.121	0.089	0.250	0.322	s_M [mg/kg]	0.785
														$\bar{s}_i$ [mg/kg]	0.507
s_{rel}	0.047	0.021	0.079	0.031	0.176	0.042	0.187	0.013	0.000	0.017	0.012	0.033	0.042		0.119



**calibrated with ERM-EB385 and BCR-075

Table 22: Results for Zn in BAM-M385a

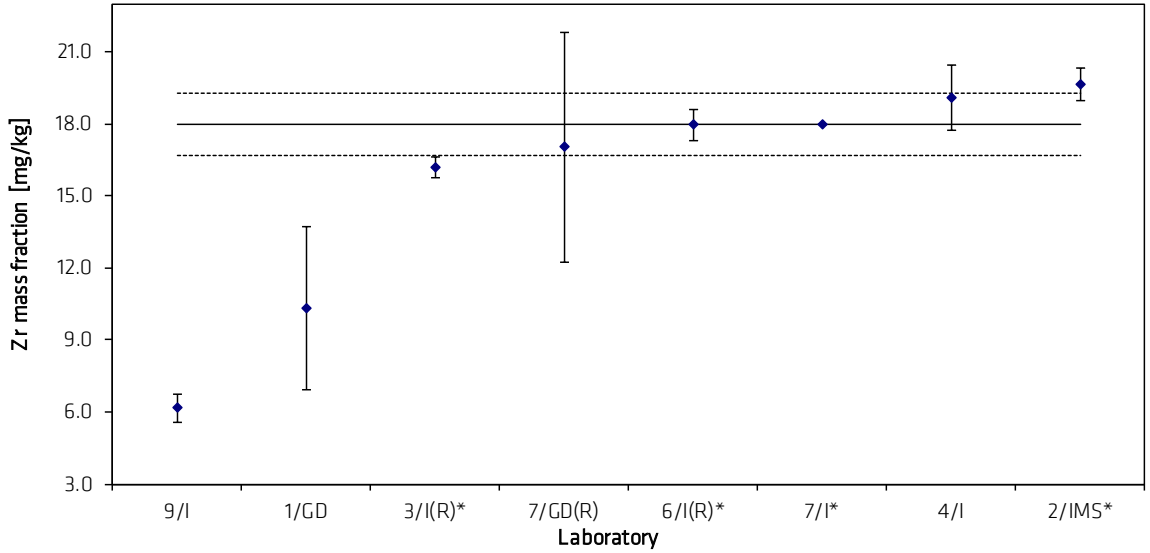
Lab./Meth.	1/I	3/I	4/I	11/GD**	5/IMS	9/I	7/GD(R)	6/I	8/NAA	1/GD	12/GD	10/I	2/IMS		
M_i [mg/kg]	6.96	8	8.1	8.7	8.9	8.9	9.0	9.2	8.9	9.38	9.4	9.8	9.9		*n*
	6.75	9	8.4	8.8	8.4	8.9	9.2	8.9	8.8	9.58	9.4	10.6	10.8		12
	6.74	8	9.6	8.9	8.2	8.8	9.5	10.1	9.5	9.52	9.6	10.0	9.6		
	7.13	9	9.0	8.8	9.0	9.5	9.1	9.7	9.7	9.46	9.8	8.8	9.8		
	7.02	8	8.6	8.7	8.9	8.9	8.7	9.0	10.1	9.64	9.5	10.0	10.5		
	7.56	9	8.5	8.9	10.2	8.9	8.4	9.1	9.7	9.24	9.5	10.6	9.1		
										9.39					
										9.18					
M **[mg/kg]**	**7.03**	**8.50**	**8.70**	**8.79**	**8.93**	**8.98**	**8.99**	**9.34**	**9.42**	**9.43**	**9.53**	**9.94**	**9.95**		**9.21**
s [mg/kg]	0.302	0.548	0.529	0.096	0.724	0.256	0.391	0.464	0.508	0.159	0.151	0.664	0.616	s_M [mg/kg]	0.469
														$\bar{s}_i$ [mg/kg]	0.472
s_{rel}	0.043	0.064	0.061	0.011	0.081	0.029	0.044	0.050	0.054	0.017	0.016	0.067	0.062		0.051



**calibrated with ERM-EB385 and BCR-075

Table 23: Results for Zr in BAM-M385a

Lab./Meth.	9/I	1/GD	3/I(R)*	7/GD(R)	6/I(R)*	7/I*	4/I	2/IMS*		
M_i [mg/kg]	6.2	15.00	15.5	17.3	19.0	18	16.4	19.1		*n*
	6.2	11.76	15.9	21.6	18.2	18	20.1	20.3		6
	7.1	15.02	16.8	14.2	17.2	18	19.0	20.2		
	5.3	10.14	16.5	23.8	18.0	18	19.2	19.0		
	6.1	9.67	16.4	13.7	18.2	18	19.9			
	6.0	7.51	16.0	11.5	17.2	18	19.8			
		6.53	16.2							
		6.93								
M **[mg/kg]**	**6.15**	**10.32**	**16.18**	**17.02**	**17.94**	**18.00**	**19.07**	**19.65**		**17.98**
s [mg/kg]	0.575	3.387	0.430	4.807	0.663	0.000	1.374	0.695	s_M [mg/kg]	1.275
									$\bar{s}_i$ [mg/kg]	2.086
s_{rel}	0.094	0.328	0.027	0.282	0.037	0.000	0.072	0.035		0.071



*Decomposition with HF

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

Tab. 24: Outcome of statistical tests on the results obtained for Ag

	1st run	2nd run
Number of data sets	13	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)	Lab. 9	---
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	Labs. 9 and 6	---
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 outliers (Labs. 9 and 6) were removed.

Tab. 25: Outcome of statistical tests on the results obtained for Al and As

	Al	As
Number of data sets	12	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. 2
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 in case of As) was not removed.

Tab. 26 Outcome of statistical tests on the results obtained for Bi and Cd

	Bi	Cd
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. 5	---
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	---	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

The straggler (Lab. 5 for Bi) was not removed.

Tab. 27: Outcome of statistical tests on the results obtained for Co and Fe

	Co	Fe
Number of data sets	14	14
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. 8	Lab. 5
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	---	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal	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 were not removed.

Tab. 28: Outcome of statistical tests on the results obtained for Cr

	1st run	2nd run
Number of data sets	12	11
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 3	---
Dixon (α = 0.01)	Lab. 3	---
Nalimov (α = 0.05)	Lab. 3	Lab. 1
Nalimov (α = 0.01)	Lab. 3	---
Grubbs (α = 0.05)	Lab. 3	---
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: not normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

The outlier (Lab. 3, 1st run) was removed, the straggler (Lab. 1, 2nd run) was not removed.

Tab. 29: Outcome of statistical tests on the results obtained for and Mg

	Mg
Number of data sets	13
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)	Lab. 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
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 11) was not removed.

Tab. 30: Outcome of statistical tests on the results obtained for Mn and Pb

	Mn	Pb
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. 3
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. 3 for Pb) was not removed.

Tab. 31: Outcome of statistical tests on the results obtained for Ni

	1st run	2nd run
Number of data sets	13	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)	Lab. 9	---
Nalimov (α = 0.01)	Lab. 9	---
Grubbs (α = 0.05)	Lab. 9	---
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

The outlier (Lab. 9) was removed.

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

	1st run	2nd run
Number of data sets	13	12
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 12	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 12	---
Nalimov (α = 0.01)	Lab. 12	---
Grubbs (α = 0.05)	Lab. 12	---
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: not normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

The outlier (Lab. 12) was removed.

Tab. 33: Outcome of statistical tests on the results obtained for P and Sb

	P	Sb
Number of data sets	12	15
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. 1/I
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. 1/I in case of Sb) was not removed.

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

	1st run	2nd run
Number of data sets	13	12
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 3	Lab. 9
Dixon (α = 0.01)	Lab. 3	
Nalimov (α = 0.05)	Lab. 3	Labs. 9 and 2
Nalimov (α = 0.01)	Lab. 3	
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: not normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

The outlier (Lab. 3, 1st run) was removed. The stragglers (2nd run) were not removed.

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

	1st run	2nd run
Number of data sets	7	6
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 9	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 9	---
Nalimov (α = 0.01)	Lab. 9	---
Grubbs (α = 0.05)	Lab. 9	---
Grubbs (α = 0.01)	Lab. 9	---
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: not normal	Insufficient data
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Insufficient data

The outlier (Lab. 9, 1st run) was removed.

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

	Sn
Number of data sets	13
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. 37: Outcome of statistical tests on the results obtained for Te and Ti

	Te	Ti
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)	Labs. 2 and 5	Lab. 5
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	---	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: not 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 and 5 for Te and Lab. 5 for Ti) were not removed.

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

	1st run	2nd run
Number of data sets	13	12
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 1/I	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 1/I	---
Nalimov (α = 0.01)	Lab. 1/I	---
Grubbs (α = 0.05)	Lab. 1/I	---
Grubbs (α = 0.01)	Lab. 1/I	---
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: not normal	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Distribution: normal

The outlier (Lab. 1/I) was removed.

Tab. 39: Outcome of statistical tests on the results obtained for Zr

	1st run	2nd run
Number of data sets	8	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. 9	---
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	Labs. 9 and 1/GD	---
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	Insufficient data
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal	Insufficient data

The outliers (Lab. 9 and 1/GD) were 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

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

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

Table 40: Uncertainty calculation

			uncertainty contribution from					
	M	n	s_M	u_{ilc}	u_{bb} (1) Length	u_{bb} (2) Area	u(comb)	U
	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg		
Ag	25.4	11	0.6600	0.1990	0.0937	0.1173	0.2493	0.4986
Al	13.3	12	1.7832	0.5148	0.3482	1.4420	1.5702	3.1404
As	9.38	13	0.6050	0.1678	0.7494	0.6146	0.9836	1.9672
Bi	5.64	13	0.3650	0.1012	0.0505	0.0784	0.1376	0.2753
Cd	2.75	13	0.2130	0.0591	0.0569	0.1109	0.1380	0.2759
Co	7.41	14	0.4500	0.1203	0.0413	0.0818	0.1512	0.3023
Cr	10.37	12	0.3640	0.1051	0.3771	0.0375	0.3932	0.7864
Fe	44.2	14	1.3480	0.3603	0.2799	0.3395	0.5687	1.1373
Mg	32.3	13	3.9370	1.0919	2.7047	1.0449	3.0983	6.1966
Mn	9.90	13	0.5150	0.1428	0.3687	0.1928	0.4399	0.8799
Ni	10.8	12	0.3680	0.1062	0.2116	0.1166	0.2639	0.5278
P	10.0	12	0.5510	0.1591	0.5975	0.0380	0.6194	1.2389
Pb	10.8	13	1.0510	0.2915	0.3280	0.2375	0.4989	0.9979
S	35.4	12	3.7560	1.0843	0.1859	0.4921	1.2051	2.4103
Sb	14.9	15	0.5330	0.1376	0.3281	0.1615	0.3907	0.7815
Se	5.0	12	0.3870	0.1117	0.1773	0.2435	0.3212	0.6424
Si	7.27	6	0.5990	0.2445	0.0955	0.1794	0.3179	0.7949
Sn	16.1	13	1.5190	0.4213	0.1298	0.2468	0.5052	1.0104
Te	8.10	13	0.9300	0.2579	0.4301	0.2260	0.5501	1.1002
Ti	6.60	13	0.7850	0.2177	0.4382	0.2195	0.5363	1.0727
Zn	9.21	12	0.4690	0.1354	0.2402	0.1886	0.3340	0.6681
Zr	18.0	6	1.2750	0.5205	2.9705	1.0520	3.1940	6.3880

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 Page 3 of this report.

Rounding was done according to DIN 1333.

In addition to the wet chemical characterization some of the laboratories analysed the material with spark emission to check if there is agreement between SOES and wet chemistry. Tab. 39 shows the mean values of wet chemical and spark emission results as well as their standard deviations. The agreement between wet chemistry and SOES is good for all elements except of magnesium, sulfur, silicon and zirconium.

Tab. 41: Comparison wet chemistry vs. SOES

Element	**Wet chemical analysis**			**Spark emission**		
	Mass fraction in mg/kg	**Std.-dev.** in mg/kg	***n***	**Mass fraction** in mg/kg	**Std.-dev.** in mg/kg	***n***
Ag	25.4	0.5	11	25.3	1.3	5
Al	13.3	1.8	12	15.1	1.47	4
As	9.38	0.61	13	9.05	0.49	5
Bi	5.64	0.37	13	5.60	0.76	5
Cd	2.75	0.22	13	2.88	0.28	5
Co	7.41	0.45	14	7.29	0.80	4
Cr	10.4	0.4	12	11.5	2.3	5
Fe	44.2	1.4	14	46.2	1.8	5
Mn	9.90	0.52	13	10.13	0.88	5
Ni	10.75	0.37	13	10.67	0.80	5
P	10.04	0.56	12	10.30	0.93	5
Pb	10.8	1.1	13	10.8	0.6	5
Sb	14.9	0.6	15	13.6	1.4	5
Se	5.03	0.39	12	4.77	0.32	5
Si	7.27	0.60	6	9.42	1.4	4
Sn	16.1	1.6	13	15.2	2.5	5
Te	8.10	0.93	13	7.47	0.79	5
Ti	6.60	0.79	13	7.87	1.2	4
Zn	9.21	0.47	12	9.63	1.18	5
Mg	32.2	4.0	13	35.7	1.8	4
S	*35.4*	*3.8*	*12*	*39.4*	*2.5*	*5*
Zr	18.0	1.3	6	11.7	5.1	4

6. Instructions for users and stability statement

The certified reference material BAM-M385a is intended for the calibration and quality control of spark emission and X-ray fluorescence spectrometry used for the analysis of similar materials. It can also be used for wet chemical analysis.
Before analysis the surface of the material 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 material are used for wet chemical analysis, a minimum sample intake of 0.2 g should be used.
The material will remain stable if it is 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 material BAM-M385a is supplied by
Bundesanstalt für Materialforschung und -prüfung (BAM)
Fachbereich 1.6: Anorganische Referenzmaterialien
Richard-Willstätter-Str. 11, D-12489 Berlin, Germany
Phone +49 (0)30 - 8104 2061
Fax: +49 (0)30 - 8104 72061
Email: 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 SOES

Ag in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.010462	0.0020924	1.1818E-09		
1.1_A_2	5	0.010504	0.0021008	2.4242E-09		
1.1_A_3	5	0.010424	0.0020848	1.6582E-09		
1.1_E_1	5	0.010431	0.0020862	5.872E-10		
1.1_E_2	5	0.010397	0.0020794	1.3593E-09		
1.1_E_3	5	0.010486	0.0020972	3.1767E-09		
1.2_A_1	5	0.0105	0.0021	1.636E-09		
1.2_A_2	5	0.01051	0.002102	1.8275E-09		
1.2_A_3	5	0.01049	0.002098	1.8365E-09		
1.2_E_1	5	0.010501	0.0021002	2.5917E-09		
1.2_E_2	5	0.010489	0.0020978	2.0057E-09		
1.2_E_3	5	0.01054	0.002108	2.3445E-09		
2.1_A_1	5	0.010478	0.0020956	1.1063E-09		
2.1_A_2	5	0.010481	0.0020962	5.932E-10		
2.1_A_3	5	0.010546	0.0021092	1.5902E-09		
2.1_E_1	5	0.010408	0.0020816	8.593E-10		
2.1_E_2	5	0.010381	0.0020762	7.222E-10		
2.1_E_3	5	0.010311	0.0020622	1.7947E-09		
2.2_A_1	5	0.010583	0.0021166	1.1053E-09		
2.2_A_2	5	0.010515	0.002103	1.4715E-09		
2.2_A_3	5	0.010577	0.0021154	1.6573E-09		
2.2_E_1	5	0.010548	0.0021096	1.6998E-09		
2.2_E_2	5	0.010559	0.0021118	2.0987E-09		
			0.0020967			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.9723E-08	22	8.9649E-10	0.55238285	0.94328068	1.65913354
Within groups	1.4931E-07	92	1.6229E-09			
Total	1.6903E-07	114				
within-sd	4.03E-05					
effective n	4.00					
s_bb	0					
s_bb_min	7.73E-06					
u_bb	7.73E-06	0.007735				
u_bb(rel.)	0.36888894					

Al in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.02564	0.005128	5.5955E-07		
1.1_A_2	5	0.025836	0.0051672	9.1632E-07		
1.1_A_3	5	0.026727	0.0053454	3.8784E-07		
1.1_E_1	5	0.025215	0.005043	1.9592E-07		
1.1_E_2	5	0.02583	0.005166	3.9733E-07		
1.1_E_3	5	0.024789	0.0049578	7.999E-07		
1.2_A_1	5	0.026108	0.0052216	3.6953E-07		
1.2_A_2	5	0.025424	0.0050848	3.9308E-07		
1.2_A_3	5	0.026148	0.0052296	5.9335E-07		
1.2_E_1	5	0.026263	0.0052526	7.6721E-07		
1.2_E_2	5	0.026185	0.005237	4.7193E-07		
1.2_E_3	5	0.026098	0.0052196	6.0259E-07		
2.1_A_1	5	0.02563	0.005126	4.1276E-07		
2.1_A_2	5	0.025912	0.0051824	1.9167E-07		
2.1_A_3	5	0.025961	0.0051922	4.571E-07		
2.1_E_1	5	0.026345	0.005269	3.1354E-07		
2.1_E_2	5	0.027166	0.0054332	6.7786E-07		
2.1_E_3	5	0.027461	0.0054922	3.5197E-07		
2.2_A_1	5	0.02542	0.005084	5.9724E-07		
2.2_A_2	5	0.025986	0.0051972	6.6486E-07		
2.2_A_3	5	0.025828	0.0051656	4.564E-07		
2.2_E_1	5	0.026272	0.0052544	3.1491E-07		
2.2_E_2	5	0.02622	0.005244	6.1865E-07		
			0.00520403			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.5027E-06	22	6.8304E-08	0.13647251	0.99999875	1.65913354
Within groups	4.6046E-05	92	5.005E-07			
Total	4.7549E-05	114				
within-sd	0.000707					
effective n	4.00					
s_bb	0					
s_bb_min	0.000136					
u_bb	0.000136	0.135826				
u_bb(rel.)	2.61000952					

As in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.000531	0.0001062	2.6557E-09		
1.1_A_2	5	0.000474	0.0000948	1.7252E-09		
1.1_A_3	5	0.000565	0.000113	3.055E-10		
1.1_E_1	5	0.000562	0.0001124	3.9418E-09		
1.1_E_2	5	0.00044	0.000088	1.601E-09		
1.1_E_3	5	0.000434	0.0000868	1.2167E-09		
1.2_A_1	5	0.000478	0.0000956	2.1793E-09		
1.2_A_2	5	0.000536	0.0001072	1.3942E-09		
1.2_A_3	5	0.000476	0.0000952	1.0032E-09		
1.2_E_1	5	0.000433	0.0000866	1.4823E-09		
1.2_E_2	5	0.000515	0.000103	5.585E-10		
1.2_E_3	5	0.000556	0.0001112	4.857E-10		
2.1_A_1	5	0.000513	0.0001026	2.5103E-09		
2.1_A_2	5	0.000595	0.000119	1.854E-09		
2.1_A_3	5	0.000553	0.0001106	2.8043E-09		
2.1_E_1	5	0.000504	0.0001008	1.5012E-09		
2.1_E_2	5	0.000435	0.000087	1.7095E-09		
2.1_E_3	5	0.000478	0.0000956	9.053E-10		
2.2_A_1	5	0.000563	0.0001126	2.2288E-09		
2.2_A_2	5	0.000466	0.0000932	2.5017E-09		
2.2_A_3	5	0.000459	0.0000918	1.8497E-09		
2.2_E_1	5	0.000619	0.0001238	1.1367E-09		
2.2_E_2	5	0.000505	0.000101	3.604E-09		
			0.00010165			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between group	1.2804E-08	22	5.8199E-10	0.32525338	0.998031	1.65913354
Within groups	1.6462E-07	92	1.7893E-09			
Total	1.7742E-07	114				
within-sd	4.23E-05					
effective r	4.00					
s_bb	0					
s_bb_min	8.12E-06					
u_bb	8.12E-06	0.008121				
u_bb(rel.)	7.98930774					

Bi in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.001821	0.0003642	3.412E-10		
1.1_A_2	5	0.00178	0.000356	3.75E-11		
1.1_A_3	5	0.001769	0.0003538	1.837E-10		
1.1_E_1	5	0.001813	0.0003626	3.583E-10		
1.1_E_2	5	0.001789	0.0003578	4.982E-10		
1.1_E_3	5	0.001794	0.0003588	2.822E-10		
1.2_A_1	5	0.00186	0.000372	9.7E-11		
1.2_A_2	5	0.001843	0.0003686	2.338E-10		
1.2_A_3	5	0.001813	0.0003626	1.133E-10		
1.2_E_1	5	0.001832	0.0003664	2.623E-10		
1.2_E_2	5	0.001842	0.0003684	2.698E-10		
1.2_E_3	5	0.001826	0.0003652	5.757E-10		
2.1_A_1	5	0.001825	0.000365	2.365E-10		
2.1_A_2	5	0.001842	0.0003684	3.933E-10		
2.1_A_3	5	0.001831	0.0003662	3.747E-10		
2.1_E_1	5	0.001777	0.0003554	2.783E-10		
2.1_E_2	5	0.001803	0.0003606	1.783E-10		
2.1_E_3	5	0.001773	0.0003546	4.308E-10		
2.2_A_1	5	0.001835	0.000367	1.205E-10		
2.2_A_2	5	0.001789	0.0003578	7.37E-11		
2.2_A_3	5	0.00177	0.000354	2.485E-10		
2.2_E_1	5	0.001814	0.0003628	7.532E-10		
2.2_E_2	5	0.001837	0.0003674	2.423E-10		
			0.00036242			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.2556E-09	22	1.4798E-10	0.51701257	0.96028875	1.65913354
Within groups	2.6332E-08	92	2.8622E-10			
Total	2.9588E-08	114				

within-sd	1.69E-05	
effective n	4.00	
s_bb	0	
s_bb_min	3.25E-06	
u_bb	3.25E-06	0.003248
u_bb(rel.)	0.89623691	

Cd in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.001863	0.0003726	1.8203E-09		
1.1_A_2	5	0.001871	0.0003742	3.4452E-09		
1.1_A_3	5	0.001806	0.0003612	2.557E-10		
1.1_E_1	5	0.001797	0.0003594	2.1963E-09		
1.1_E_2	5	0.001836	0.0003672	1.7567E-09		
1.1_E_3	5	0.001848	0.0003696	1.6703E-09		
1.2_A_1	5	0.00191	0.000382	2.295E-09		
1.2_A_2	5	0.001877	0.0003754	1.1543E-09		
1.2_A_3	5	0.001902	0.0003804	1.0688E-09		
1.2_E_1	5	0.001907	0.0003814	1.2418E-09		
1.2_E_2	5	0.001888	0.0003776	4.123E-10		
1.2_E_3	5	0.001931	0.0003862	1.1497E-09		
2.1_A_1	5	0.001872	0.0003744	1.1803E-09		
2.1_A_2	5	0.001868	0.0003736	1.8713E-09		
2.1_A_3	5	0.001832	0.0003664	2.7663E-09		
2.1_E_1	5	0.001838	0.0003676	2.3263E-09		
2.1_E_2	5	0.001947	0.0003894	8.38E-11		
2.1_E_3	5	0.001893	0.0003786	1.1093E-09		
2.2_A_1	5	0.001924	0.0003848	3.4922E-09		
2.2_A_2	5	0.001979	0.0003958	2.0797E-09		
2.2_A_3	5	0.001896	0.0003792	1.5337E-09		
2.2_E_1	5	0.001896	0.0003792	1.0627E-09		
2.2_E_2	5	0.001877	0.0003754	1.8193E-09		
			0.00037616			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	8.332E-09	22	3.7873E-10	0.23049509	0.9998681	1.65913354
Within groups	1.5117E-07	92	1.6431E-09			
Total	1.595E-07	114				
within-sd	4.05E-05					
effective n	4.00					
s_bb	0					
s_bb_min	7.78E-06					
u_bb	7.78E-06	0.007782				
u_bb(rel.)	2.06892119					

Co in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.004537	0.0009074	4.268E-10		
1.1_A_2	5	0.004481	0.0008962	8.332E-10		
1.1_A_3	5	0.004519	0.0009038	6.292E-10		
1.1_E_1	5	0.004551	0.0009102	5.227E-10		
1.1_E_2	5	0.0045	0.0009	7.635E-10		
1.1_E_3	5	0.004458	0.0008916	1.2948E-09		
1.2_A_1	5	0.004575	0.000915	2.285E-10		
1.2_A_2	5	0.004525	0.000905	4.95E-10		
1.2_A_3	5	0.004546	0.0009092	5.832E-10		
1.2_E_1	5	0.004536	0.0009072	6.347E-10		
1.2_E_2	5	0.004546	0.0009092	8.137E-10		
1.2_E_3	5	0.004564	0.0009128	3.962E-10		
2.1_A_1	5	0.004524	0.0009048	5.867E-10		
2.1_A_2	5	0.004559	0.0009118	5.077E-10		
2.1_A_3	5	0.00448	0.000896	6.835E-10		
2.1_E_1	5	0.004523	0.0009046	1.0253E-09		
2.1_E_2	5	0.004546	0.0009092	7.562E-10		
2.1_E_3	5	0.004572	0.0009144	5.258E-10		
2.2_A_1	5	0.00447	0.000894	5.64E-10		
2.2_A_2	5	0.004523	0.0009046	9.083E-10		
2.2_A_3	5	0.004481	0.0008962	6.407E-10		
2.2_E_1	5	0.004472	0.0008944	1.5383E-09		
2.2_E_2	5	0.004476	0.0008952	4.597E-10		
			0.00090403			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	5.6811E-09	22	2.5823E-10	0.37548385	0.99454987	1.65913354
Within groups	6.3271E-08	92	6.8773E-10			
Total	6.8952E-08	114				

within-sd	2.62E-05	
effective n	4.00	
s_bb	0	
s_bb_min	5.03E-06	
u_bb	5.03E-06	0.005035
u_bb(rel.)	0.55693326	

Cr in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.00824	0.001648	1.214E-07		
1.1_A_2	5	0.009123	0.0018246	7.4491E-08		
1.1_A_3	5	0.008697	0.0017394	1.0492E-07		
1.1_E_1	5	0.00803	0.001606	6.4581E-08		
1.1_E_2	5	0.008324	0.0016648	4.5333E-08		
1.1_E_3	5	0.008737	0.0017474	1.1548E-07		
1.2_A_1	5	0.007858	0.0015716	1.3335E-07		
1.2_A_2	5	0.008161	0.0016322	9.7502E-08		
1.2_A_3	5	0.008649	0.0017298	9.3072E-08		
1.2_E_1	5	0.008384	0.0016768	9.2052E-08		
1.2_E_2	5	0.00857	0.001714	1.1127E-07		
1.2_E_3	5	0.008407	0.0016814	1.1199E-07		
2.1_A_1	5	0.008538	0.0017076	7.3208E-08		
2.1_A_2	5	0.007667	0.0015334	3.9961E-08		
2.1_A_3	5	0.008197	0.0016394	1.5242E-07		
2.1_E_1	5	0.00854	0.001708	5.7621E-08		
2.1_E_2	5	0.007938	0.0015876	1.9915E-07		
2.1_E_3	5	0.008989	0.0017978	8.8932E-08		
2.2_A_1	5	0.008601	0.0017202	1.4707E-07		
2.2_A_2	5	0.008403	0.0016806	7.5874E-08		
2.2_A_3	5	0.009046	0.0018092	7.6948E-08		
2.2_E_1	5	0.008544	0.0017088	1.0871E-07		
2.2_E_2	5	0.00811	0.001622	1.5638E-07		
			0.00168481			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	6.1233E-07	22	2.7833E-08	0.27337483	0.99947482	1.65913354
Within groups	9.3668E-06	92	1.0181E-07			
Total	9.9791E-06	114				
within-sd	0.000319					
effective n	4.00					
s_bb	0					
s_bb_min	6.13E-05					
u_bb	6.13E-05	0.061261				
u_bb(rel.)	3.63606721					

Fe in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.023136	0.0046272	3.0342E-09		
1.1_A_2	5	0.0233	0.00466	8.746E-09		
1.1_A_3	5	0.023191	0.0046382	2.3342E-09		
1.1_E_1	5	0.023134	0.0046268	3.9222E-09		
1.1_E_2	5	0.023127	0.0046254	3.9888E-09		
1.1_E_3	5	0.022921	0.0045842	1.053E-08		
1.2_A_1	5	0.023165	0.004633	4.466E-09		
1.2_A_2	5	0.02312	0.004624	1.0667E-08		
1.2_A_3	5	0.023146	0.0046292	4.0632E-09		
1.2_E_1	5	0.023221	0.0046442	4.3477E-09		
1.2_E_2	5	0.023158	0.0046316	2.9083E-09		
1.2_E_3	5	0.023224	0.0046448	3.6677E-09		
2.1_A_1	5	0.022804	0.0045608	1.0091E-08		
2.1_A_2	5	0.023002	0.0046004	1.2163E-09		
2.1_A_3	5	0.022791	0.0045582	5.2342E-09		
2.1_E_1	5	0.023048	0.0046096	6.7183E-09		
2.1_E_2	5	0.023146	0.0046292	4.4292E-09		
2.1_E_3	5	0.023027	0.0046054	8.9828E-09		
2.2_A_1	5	0.022564	0.0045128	1.0096E-08		
2.2_A_2	5	0.022641	0.0045282	9.8357E-09		
2.2_A_3	5	0.022726	0.0045452	4.4917E-09		
2.2_E_1	5	0.022799	0.0045598	5.3477E-09		
2.2_E_2	5	0.02267	0.004534	6.635E-09		
			0.00460053			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.0437E-07	22	9.2897E-09	1.57390756	0.0702597	1.65913354
Within groups	5.4301E-07	92	5.9023E-09			
Total	7.4739E-07	114				

within-sd	7.68E-05	
effective n	4.00	
s_bb	2.91E-05	
s_bb_min	1.47E-05	
u_bb	2.91E-05	0.029101
u_bb(rel.)	0.63254926	

Mg in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.020193	0.0040386	2.0435E-08		
1.1_A_2	5	0.020149	0.0040298	9.4003E-08		
1.1_A_3	5	0.020941	0.0041882	2.3541E-07		
1.1_E_1	5	0.019086	0.0038172	1.6442E-08		
1.1_E_2	5	0.019143	0.0038286	4.0238E-09		
1.1_E_3	5	0.019335	0.003867	6.6677E-08		
1.2_A_1	5	0.020494	0.0040988	4.1225E-08		
1.2_A_2	5	0.020829	0.0041658	8.8642E-08		
1.2_A_3	5	0.020205	0.004041	9.7642E-08		
1.2_E_1	5	0.020195	0.004039	1.3056E-07		
1.2_E_2	5	0.020465	0.004093	5.5507E-08		
1.2_E_3	5	0.020306	0.0040612	5.7689E-08		
2.1_A_1	5	0.020465	0.004093	2.7112E-08		
2.1_A_2	5	0.01916	0.003832	1.3604E-08		
2.1_A_3	5	0.019963	0.0039926	3.1043E-08		
2.1_E_1	5	0.021243	0.0042486	3.8805E-08		
2.1_E_2	5	0.021275	0.004255	2.4266E-08		
2.1_E_3	5	0.019861	0.0039722	1.3355E-08		
2.2_A_1	5	0.016942	0.0033884	5.8395E-08		
2.2_A_2	5	0.016459	0.0032918	3.0977E-08		
2.2_A_3	5	0.015787	0.0031574	4.8508E-08		
2.2_E_1	5	0.017529	0.0035058	2.6592E-08		
2.2_E_2	5	0.017703	0.0035406	2.4115E-08		
			0.00389329			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.0573E-05	22	4.8059E-07	8.87822542	1.4789E-14	1.65913354
Within groups	4.9801E-06	92	5.4131E-08			
Total	1.5553E-05	114				

within-sd	0.000233	
effective n	4.00	
s_bb	0.000327	
s_bb_min	4.47E-05	
u_bb	0.000327	0.326519
u_bb(rel.)	8.38672097	

Mn in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.005831	0.0011662	2.2327E-09		
1.1_A_2	5	0.00581	0.001162	2.1987E-08		
1.1_A_3	5	0.005767	0.0011534	7.2488E-09		
1.1_E_1	5	0.00585	0.00117	4.8095E-09		
1.1_E_2	5	0.005901	0.0011802	5.4907E-09		
1.1_E_3	5	0.005774	0.0011548	2.7498E-08		
1.2_A_1	5	0.006335	0.001267	2.8465E-09		
1.2_A_2	5	0.006368	0.0012736	5.0508E-09		
1.2_A_3	5	0.006435	0.001287	9.0905E-09		
1.2_E_1	5	0.006071	0.0012142	7.6272E-09		
1.2_E_2	5	0.006115	0.001223	5.394E-09		
1.2_E_3	5	0.006166	0.0012332	6.2102E-09		
2.1_A_1	5	0.006528	0.0013056	3.6158E-09		
2.1_A_2	5	0.006357	0.0012714	3.2068E-09		
2.1_A_3	5	0.006533	0.0013066	3.7833E-09		
2.1_E_1	5	0.006499	0.0012998	2.1297E-08		
2.1_E_2	5	0.006611	0.0013222	6.1457E-09		
2.1_E_3	5	0.006555	0.001311	3.5155E-09		
2.2_A_1	5	0.005915	0.001183	1.927E-08		
2.2_A_2	5	0.005924	0.0011848	1.9134E-08		
2.2_A_3	5	0.005676	0.0011352	2.0035E-08		
2.2_E_1	5	0.005905	0.001181	2.6283E-08		
2.2_E_2	5	0.006139	0.0012278	3.4827E-09		
			0.00122665			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.0871E-07	22	1.8578E-08	1.81630454	0.02607916	1.65913354
Within groups	9.4101E-07	92	1.0228E-08			
Total	1.3497E-06	114				

within-sd	0.000101	
effective n	4.00	
s_bb	4.57E-05	
s_bb_min	1.94E-05	
u_bb	4.57E-05	0.045688
u_bb(rel.)	3.72459286	

Ni in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.008819	0.0017638	3.0501E-08		
1.1_A_2	5	0.008651	0.0017302	5.8292E-08		
1.1_A_3	5	0.00847	0.001694	9.147E-09		
1.1_E_1	5	0.008665	0.001733	2.7865E-09		
1.1_E_2	5	0.008451	0.0016902	4.7317E-09		
1.1_E_3	5	0.008684	0.0017368	6.3829E-08		
1.2_A_1	5	0.009018	0.0018036	2.5506E-08		
1.2_A_2	5	0.009133	0.0018266	3.9673E-08		
1.2_A_3	5	0.008974	0.0017948	5.1138E-08		
1.2_E_1	5	0.008866	0.0017732	5.9736E-08		
1.2_E_2	5	0.009024	0.0018048	5.1716E-08		
1.2_E_3	5	0.008982	0.0017964	4.8142E-08		
2.1_A_1	5	0.009197	0.0018394	4.0221E-08		
2.1_A_2	5	0.008786	0.0017572	2.9527E-09		
2.1_A_3	5	0.008969	0.0017938	3.673E-08		
2.1_E_1	5	0.008546	0.0017092	1.6476E-08		
2.1_E_2	5	0.008725	0.001745	6.327E-09		
2.1_E_3	5	0.008779	0.0017558	6.5847E-09		
2.2_A_1	5	0.008786	0.0017572	5.1763E-08		
2.2_A_2	5	0.008694	0.0017388	3.6715E-08		
2.2_A_3	5	0.008573	0.0017146	4.2995E-08		
2.2_E_1	5	0.008415	0.001683	2.5963E-08		
2.2_E_2	5	0.008958	0.0017916	3.5075E-08		
			0.00175796			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.104E-07	22	9.5635E-09	0.2944586	0.99906545	1.65913354
Within groups	2.988E-06	92	3.2478E-08			
Total	3.1984E-06	114				
within-sd	0.00018					
effective n	4.00					
s_bb	0					
s_bb_min	3.46E-05					
u_bb	3.46E-05	0.0346				
u_bb(rel.)	1.96819859					

P in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.001161	0.0002322	4.8092E-09		
1.1_A_2	5	0.001185	0.000237	7.776E-09		
1.1_A_3	5	0.001016	0.0002032	2.6777E-09		
1.1_E_1	5	0.001174	0.0002348	1.6242E-09		
1.1_E_2	5	0.001106	0.0002212	2.1022E-09		
1.1_E_3	5	0.001152	0.0002304	5.1968E-09		
1.2_A_1	5	0.001156	0.0002312	6.0432E-09		
1.2_A_2	5	0.000948	0.0001896	3.3043E-09		
1.2_A_3	5	0.00108	0.000216	5.593E-09		
1.2_E_1	5	0.001049	0.0002098	8.6577E-09		
1.2_E_2	5	0.001119	0.0002238	3.4332E-09		
1.2_E_3	5	0.000993	0.0001986	3.2763E-09		
2.1_A_1	5	0.000945	0.000189	1.2775E-09		
2.1_A_2	5	0.000836	0.0001672	2.0172E-09		
2.1_A_3	5	0.000994	0.0001988	6.6407E-09		
2.1_E_1	5	0.000973	0.0001946	6.2048E-09		
2.1_E_2	5	0.000897	0.0001794	4.173E-10		
2.1_E_3	5	0.00114	0.000228	2.1635E-09		
2.2_A_1	5	0.001115	0.000223	4.6485E-09		
2.2_A_2	5	0.001002	0.0002004	5.3388E-09		
2.2_A_3	5	0.001045	0.000209	4.6725E-09		
2.2_E_1	5	0.001015	0.000203	3.517E-09		
2.2_E_2	5	0.000955	0.000191	5.295E-09		
			0.00020918			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.0997E-08	22	1.8635E-09	0.44329053	0.9839071	1.65913354
Within groups	3.8675E-07	92	4.2038E-09			
Total	4.2774E-07	114				

within-sd	6.48E-05	
effective n	4.00	
s_bb	0	
s_bb_min	1.24E-05	
u_bb	1.24E-05	0.012448
u_bb(rel.)	5.95078415	

Pb in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.011068	0.0022136	2.0066E-08		
1.1_A_2	5	0.010691	0.0021382	4.7561E-08		
1.1_A_3	5	0.010887	0.0021774	2.9156E-08		
1.1_E_1	5	0.01112	0.002224	1.8493E-08		
1.1_E_2	5	0.010797	0.0021594	2.4555E-08		
1.1_E_3	5	0.010678	0.0021356	6.304E-08		
1.2_A_1	5	0.011469	0.0022938	7.8457E-09		
1.2_A_2	5	0.011258	0.0022516	1.372E-08		
1.2_A_3	5	0.01139	0.002278	4.0655E-08		
1.2_E_1	5	0.011153	0.0022306	1.2018E-08		
1.2_E_2	5	0.012655	0.002531	3.3383E-07		
1.2_E_3	5	0.011405	0.002281	1.4299E-08		
2.1_A_1	5	0.010834	0.0021668	7.4237E-09		
2.1_A_2	5	0.010786	0.0021572	8.5432E-09		
2.1_A_3	5	0.010679	0.0021358	1.9337E-08		
2.1_E_1	5	0.010477	0.0020954	5.8564E-08		
2.1_E_2	5	0.010861	0.0021722	1.4951E-08		
2.1_E_3	5	0.010764	0.0021528	1.1334E-08		
2.2_A_1	5	0.010246	0.0020492	4.1922E-08		
2.2_A_2	5	0.010353	0.0020706	3.9382E-08		
2.2_A_3	5	0.010186	0.0020372	5.2892E-08		
2.2_E_1	5	0.01017	0.002034	7.0051E-08		
2.2_E_2	5	0.010418	0.0020836	1.4267E-08		
			0.00217691			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.3066E-06	22	5.9391E-08	1.41715254	0.1275042	1.65913354
Within groups	3.8556E-06	92	4.1909E-08			
Total	5.1622E-06	114				

within-sd	0.000205			status:	homogeneous
effective n	4.00				
s_bb	6.61E-05				
s_bb_min	3.93E-05				
u_bb	6.61E-05	0.066111			
u_bb(rel.)	3.0368959				

S in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.01548	0.003096	1.495E-08		
1.1_A_2	5	0.015316	0.0030632	1.5979E-08		
1.1_A_3	5	0.014941	0.0029882	1.6237E-09		
1.1_E_1	5	0.015161	0.0030322	2.737E-10		
1.1_E_2	5	0.015191	0.0030382	7.6867E-09		
1.1_E_3	5	0.015013	0.0030026	1.5983E-09		
1.2_A_1	5	0.015308	0.0030616	2.8673E-09		
1.2_A_2	5	0.015452	0.0030904	2.0698E-09		
1.2_A_3	5	0.014941	0.0029882	1.017E-08		
1.2_E_1	5	0.015077	0.0030154	8.5403E-09		
1.2_E_2	5	0.015079	0.0030158	3.5067E-09		
1.2_E_3	5	0.015297	0.0030594	4.0633E-09		
2.1_A_1	5	0.015323	0.0030646	6.5733E-09		
2.1_A_2	5	0.015291	0.0030582	4.7522E-09		
2.1_A_3	5	0.0156	0.00312	9.2815E-09		
2.1_E_1	5	0.015224	0.0030448	6.0777E-09		
2.1_E_2	5	0.015366	0.0030732	2.5057E-09		
2.1_E_3	5	0.01512	0.003024	3.335E-09		
2.2_A_1	5	0.015476	0.0030952	4.6587E-09		
2.2_A_2	5	0.015432	0.0030864	1.1037E-08		
2.2_A_3	5	0.014978	0.0029956	8.1208E-09		
2.2_E_1	5	0.015548	0.0031096	6.7478E-09		
2.2_E_2	5	0.015403	0.0030806	2.3962E-08		
			0.00305232			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.6984E-07	22	7.7198E-09	1.10708862	0.3543899	1.65913354
Within groups	6.4152E-07	92	6.973E-09			
Total	8.1136E-07	114				
within-sd	8.35E-05					
effective n	4.00					
s_bb	1.37E-05					
s_bb_min	1.6E-05					
u_bb	1.6E-05	0.016032				
u_bb(rel.)	0.52524439					

Sb in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	70.22	14.044	0.00623		
1.1_A_2	5	70.54	14.108	0.26082		
1.1_E_1	5	71.03	14.206	0.22343		
1.1_E_C	5	72.77	14.554	0.21193		
1.2_A_A	5	74.52	14.904	0.05168		
2.1_A_C	5	74.58	14.916	0.12823		
2.1_A_3	5	74.88	14.976	0.02743		
2.1_A_2	5	74.32	14.864	0.10288		
2.1_A_A	5	74.15	14.83	0.0111		
1.2_E_C	5	74.12	14.824	0.17628		
1.2_E_2	5	76.62	15.324	0.20393		
2.2_A_3	5	73.3	14.66	0.05835		
2.2_A_B	5	74.21	14.842	0.07292		
2.2_A_A	5	72.88	14.576	0.09308		
2.2_E_1	5	73.54	14.708	0.03077		
2.1_E_2	5	73.1	14.62	0.107		
2.2_E_C	5	74.35	14.87	0.1021		
2.1_E_1	5	71.93	14.386	0.03573		
2.2_E_2	5	74.59	14.918	0.04487		
			14.6910526			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between group	9.38125474	18	0.52118082	5.08140333	2.2679E-07	1.74118919
Within groups	7.79504	76	0.10256632			
Total	17.1762947	94				
within-sd	0.32026					
effective r	4.00					
s_bb	0.323502					
s_bb_min	0.064495					
u_bb	0.323502	323.5021				
u_bb(rel.)	2.20203504					

Se in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.004412	0.0008824	2.7635E-08		
1.1_A_2	5	0.004046	0.0008092	3.0174E-08		
1.1_A_3	5	0.004146	0.0008292	2.1282E-08		
1.1_E_1	5	0.004231	0.0008462	1.805E-08		
1.1_E_2	5	0.004364	0.0008728	1.6151E-08		
1.1_E_3	5	0.003924	0.0007848	1.9806E-08		
1.2_A_1	5	0.004519	0.0009038	2.3659E-08		
1.2_A_2	5	0.00386	0.000772	3.7718E-08		
1.2_A_3	5	0.004297	0.0008594	1.9358E-08		
1.2_E_1	5	0.004227	0.0008454	1.4456E-08		
1.2_E_2	5	0.004236	0.0008472	3.7092E-08		
1.2_E_3	5	0.004313	0.0008626	5.4085E-08		
2.1_A_1	5	0.003861	0.0007722	2.5554E-08		
2.1_A_2	5	0.004236	0.0008472	6.7487E-09		
2.1_A_3	5	0.004078	0.0008156	2.3765E-08		
2.1_E_1	5	0.004238	0.0008476	2.2821E-08		
2.1_E_2	5	0.003916	0.0007832	1.1546E-08		
2.1_E_3	5	0.003846	0.0007692	1.9801E-08		
2.2_A_1	5	0.004293	0.0008586	1.875E-08		
2.2_A_2	5	0.004195	0.000839	1.9928E-08		
2.2_A_3	5	0.004218	0.0008436	2.8559E-08		
2.2_E_1	5	0.00394	0.000788	1.2233E-08		
2.2_E_2	5	0.003995	0.000799	2.3981E-08		
			0.00082949			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between group	1.6215E-07	22	7.3706E-09	0.31796347	0.99833394	1.65913354
Within groups	2.1326E-06	92	2.3181E-08			
Total	2.2948E-06	114				
within-sd	0.000152					
effective r	4.00					
s_bb	0					
s_bb_min	2.92E-05					
u_bb	2.92E-05	0.029231				
u_bb(rel.)	3.52397346					

Si in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.015475	0.003095	3.2701E-08		
1.1_A_2	5	0.015204	0.0030408	9.9204E-08		
1.1_A_3	5	0.015689	0.0031378	4.974E-08		
1.1_E_1	5	0.015708	0.0031416	1.506E-08		
1.1_E_2	5	0.01566	0.003132	4.3956E-08		
1.1_E_3	5	0.014935	0.002987	1.1904E-07		
1.2_A_1	5	0.016012	0.0032024	2.0186E-08		
1.2_A_2	5	0.015564	0.0031128	1.7005E-08		
1.2_A_3	5	0.015541	0.0031082	3.6417E-08		
1.2_E_1	5	0.015665	0.003133	3.587E-08		
1.2_E_2	5	0.015846	0.0031692	2.1913E-08		
1.2_E_3	5	0.015688	0.0031376	2.7409E-08		
2.1_A_1	5	0.015859	0.0031718	1.05E-08		
2.1_A_2	5	0.01582	0.003164	1.8006E-08		
2.1_A_3	5	0.015871	0.0031742	5.3291E-08		
2.1_E_1	5	0.015608	0.0031216	5.9506E-08		
2.1_E_2	5	0.016007	0.0032014	2.172E-08		
2.1_E_3	5	0.01604	0.003208	1.4279E-08		
2.2_A_1	5	0.015082	0.0030164	6.21E-08		
2.2_A_2	5	0.015598	0.0031196	8.1382E-08		
2.2_A_3	5	0.015032	0.0030064	6.8138E-08		
2.2_E_1	5	0.015233	0.0030466	1.0026E-07		
2.2_E_2	5	0.015584	0.0031168	3.9652E-08		
			0.00311931			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.3174E-07	22	1.9625E-08	0.43096576	0.98650833	1.65913354
Within groups	4.1894E-06	92	4.5537E-08			
Total	4.6211E-06	114				
within-sd	0.000213					
effective n	4.00					
s_bb	0					
s_bb_min	4.1E-05					
u_bb	4.1E-05	0.04097				
u_bb(rel.)	1.31341443					

Sn in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.016892	0.0033784	3.8313E-08		
1.1_A_2	5	0.016783	0.0033566	1.7347E-08		
1.1_A_3	5	0.016686	0.0033372	1.0301E-08		
1.1_E_1	5	0.017269	0.0034538	1.0398E-08		
1.1_E_2	5	0.016796	0.0033592	2.419E-08		
1.1_E_3	5	0.017035	0.003407	6.1735E-09		
1.2_A_1	5	0.016977	0.0033954	1.921E-08		
1.2_A_2	5	0.017296	0.0034592	5.2487E-09		
1.2_A_3	5	0.016589	0.0033178	3.2872E-08		
1.2_E_1	5	0.016693	0.0033386	3.2961E-08		
1.2_E_2	5	0.016936	0.0033872	4.4173E-08		
1.2_E_3	5	0.016506	0.0033012	2.8643E-08		
2.1_A_1	5	0.01736	0.003472	1.3113E-08		
2.1_A_2	5	0.017045	0.003409	8.8685E-09		
2.1_A_3	5	0.017249	0.0034498	3.3765E-08		
2.1_E_1	5	0.016893	0.0033786	1.336E-08		
2.1_E_2	5	0.01654	0.003308	2.3875E-09		
2.1_E_3	5	0.016836	0.0033672	1.7368E-08		
2.2_A_1	5	0.016801	0.0033602	1.2757E-08		
2.2_A_2	5	0.016897	0.0033794	3.2112E-08		
2.2_A_3	5	0.016782	0.0033564	1.8737E-08		
2.2_E_1	5	0.01688	0.003376	1.4489E-08		
2.2_E_2	5	0.017395	0.003479	2.5413E-08		
			0.00338379			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.8653E-07	22	1.3024E-08	0.64811134	0.87677005	1.65913354
Within groups	1.8488E-06	92	2.0096E-08			
Total	2.1353E-06	114				

within-sd	0.000142	
effective n	4.00	
s_bb	0	
s_bb_min	2.72E-05	
u_bb	2.72E-05	0.027216
u_bb(rel.)	0.8043181	

Te in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	31.97	6.394	0.05383		
1.1_A_2	5	31.81	6.362	0.21797		
1.1_E_1	5	30.36	6.072	0.03392		
1.1_E_C	5	30.07	6.014	0.15628		
1.2_A_A	5	34.45	6.89	0.07745		
2.1_A_C	5	35.21	7.042	0.42662		
2.1_A_3	5	35.02	7.004	0.14233		
2.1_A_2	5	34.81	6.962	0.10567		
2.1_A_A	5	33.65	6.73	0.07295		
1.2_E_C	5	31.7	6.34	0.09055		
1.2_E_2	5	31.93	6.386	0.14853		
2.2_A_3	5	32.65	6.53	0.15735		
2.2_A_B	5	30.34	6.068	0.06967		
2.2_A_A	5	33.22	6.644	0.19923		
2.2_E_1	5	32.71	6.542	0.05667		
2.1_E_2	5	32.34	6.468	0.02332		
2.2_E_C	5	32.38	6.476	0.27308		
2.1_E_1	5	29.84	5.968	0.07577		
2.2_E_2	5	29.9	5.98	0.2614		
			6.466947368			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	10.9938547	18	0.610769708	4.39138286	2.5194E-06	1.74118919
Within groups	10.57036	76	0.139083684			
Total	21.5642147	94				
within-sd	0.372939					
effective n	4.00					
s_bb	0.343397					
s_bb_min	0.075104					
u_bb	0.343397	343.397				
u_bb(rel.)	5.31003253					

Ti in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.004263	0.0008526	6.453E-10		
1.1_A_2	5	0.004265	0.000853	3.735E-10		
1.1_A_3	5	0.004512	0.0009024	3.4258E-09		
1.1_E_1	5	0.004138	0.0008276	3.043E-10		
1.1_E_2	5	0.004169	0.0008338	5.332E-10		
1.1_E_3	5	0.004157	0.0008314	8.253E-10		
1.2_A_1	5	0.004385	0.000877	5.165E-10		
1.2_A_2	5	0.004377	0.0008754	3.023E-10		
1.2_A_3	5	0.004364	0.0008728	3.292E-10		
1.2_E_1	5	0.004337	0.0008674	1.473E-10		
1.2_E_2	5	0.004382	0.0008764	2.573E-10		
1.2_E_3	5	0.004366	0.0008732	4.622E-10		
2.1_A_1	5	0.004244	0.0008488	6.077E-10		
2.1_A_2	5	0.004105	0.000821	2.13E-10		
2.1_A_3	5	0.004189	0.0008378	4.327E-10		
2.1_E_1	5	0.00442	0.000884	3.865E-10		
2.1_E_2	5	0.004414	0.0008828	7.637E-10		
2.1_E_3	5	0.004256	0.0008512	3.642E-10		
2.2_A_1	5	0.003754	0.0007508	4.847E-10		
2.2_A_2	5	0.003712	0.0007424	7.708E-10		
2.2_A_3	5	0.003598	0.0007196	9.88E-11		
2.2_E_1	5	0.003846	0.0007692	3.192E-10		
2.2_E_2	5	0.003868	0.0007736	4.433E-10		
			0.00083583			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.8351E-07	22	1.2887E-08	22.7875671	3.9787E-28	1.65913354
Within groups	5.2027E-08	92	5.6551E-10			
Total	3.3553E-07	114				
within-sd	2.38E-05					
effective n	4.00					
s_bb	5.55E-05					
s_bb_min	4.57E-06					
u_bb	5.55E-05	0.0555				
u_bb(rel.)	6.64010957					

Zn in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.003321	0.0006642	1.0957E-09		
1.1_A_2	5	0.003251	0.0006502	8.527E-10		
1.1_A_3	5	0.00325	0.00065	8.9E-11		
1.1_E_1	5	0.003396	0.0006792	2.1252E-09		
1.1_E_2	5	0.003371	0.0006742	1.3982E-09		
1.1_E_3	5	0.003348	0.0006696	7.453E-10		
1.2_A_1	5	0.003196	0.0006392	1.7032E-09		
1.2_A_2	5	0.003184	0.0006368	6.037E-10		
1.2_A_3	5	0.003129	0.0006258	1.957E-10		
1.2_E_1	5	0.003181	0.0006362	4.537E-10		
1.2_E_2	5	0.003183	0.0006366	7.353E-10		
1.2_E_3	5	0.003169	0.0006338	3.607E-10		
2.1_A_1	5	0.003201	0.0006402	4.847E-10		
2.1_A_2	5	0.003138	0.0006276	1.3208E-09		
2.1_A_3	5	0.00318	0.000636	1.91E-09		
2.1_E_1	5	0.003194	0.0006388	5.377E-10		
2.1_E_2	5	0.003148	0.0006296	2.453E-10		
2.1_E_3	5	0.003155	0.000631	9.075E-10		
2.2_A_1	5	0.003093	0.0006186	6.038E-10		
2.2_A_2	5	0.003051	0.0006102	5.072E-10		
2.2_A_3	5	0.003034	0.0006068	1.597E-10		
2.2_E_1	5	0.00305	0.00061	1.405E-10		
2.2_E_2	5	0.003166	0.0006332	8.667E-10		
			0.00063817			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.1633E-08	22	1.8924E-09	2.41238947	0.00186726	1.65913354
Within groups	7.2169E-08	92	7.8445E-10			
Total	1.138E-07	114				

within-sd	2.8E-05	
effective n	4.00	
s_bb	1.66E-05	
s_bb_min	5.38E-06	
u_bb	1.66E-05	0.016643
u_bb(rel.)	2.60793127	

Zr in BAM-M385a:

Sample	*Number*	*Sum*	*Mean*	*Variance*		
1.1_A_1	5	0.009758	0.0019516	2.1453E-09		
1.1_A_2	5	0.009928	0.0019856	1.5843E-08		
1.1_A_3	5	0.010717	0.0021434	1.0687E-07		
1.1_E_1	5	0.009331	0.0018662	3.1162E-09		
1.1_E_2	5	0.009337	0.0018674	2.3103E-09		
1.1_E_3	5	0.009543	0.0019086	6.4208E-09		
1.2_A_1	5	0.009541	0.0019082	6.1317E-09		
1.2_A_2	5	0.009689	0.0019378	1.0145E-08		
1.2_A_3	5	0.009492	0.0018984	1.0228E-08		
1.2_E_1	5	0.009503	0.0019006	1.7507E-08		
1.2_E_2	5	0.00946	0.001892	6.6485E-09		
1.2_E_3	5	0.009706	0.0019412	7.4157E-09		
2.1_A_1	5	0.009076	0.0018152	2.0347E-09		
2.1_A_2	5	0.0084	0.00168	2.306E-09		
2.1_A_3	5	0.008664	0.0017328	4.0867E-09		
2.1_E_1	5	0.010554	0.0021108	1.7177E-08		
2.1_E_2	5	0.01017	0.002034	2.0337E-08		
2.1_E_3	5	0.009008	0.0018016	7.1033E-09		
2.2_A_1	5	0.006627	0.0013254	4.9063E-09		
2.2_A_2	5	0.006319	0.0012638	3.4157E-09		
2.2_A_3	5	0.006132	0.0012264	7.6993E-09		
2.2_E_1	5	0.007115	0.001423	1.639E-08		
2.2_E_2	5	0.007025	0.001405	4.799E-09		
			0.00178343			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	7.8955E-06	22	3.5888E-07	28.95927	4.2186E-32	1.65913354
Within groups	1.1401E-06	92	1.2393E-08			
Total	9.0356E-06	114				
within-sd	0.000111					
effective n	4.00					
s_bb	0.000294					
s_bb_min	2.14E-05					
u_bb	0.000294	0.294318				
u_bb(rel.)	16.5028532					

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

Ag in BAM-M385a:

r_0	0.002180079	0.002237921						
r_middle	0.002195	0.002202	0.00221	0.002225	0.002193	0.00221	0.002222	0.002231
r_out	0.002181	0.002183	0.002172	0.002184	0.002199	0.002214	0.002193	0.002204
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	1.6705E-09	2	8.3525E-10	2.852421027	0.089154861	3.682320344		
Within groups	4.39232E-09	15	2.92821E-10					
Total	6.06282E-09	17						
within-sd	1.7112E-05							
effective n	5.33							
s_bb	1.00849E-05							
s_bb_min	4.47751E-06							
u_bb	1.00849E-05			0.002202				
u_bb(rel.)	0.457988528							

Al in BAM-M385a:

r_0	0.002705718	0.003978282						
r_middle	0.003585	0.003954	0.003279	0.003398	0.002982	0.003257	0.00334	0.00308
r_out	0.004808	0.004161	0.004123	0.004038	0.003926	0.003835	0.003948	0.003439
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	2.04865E-06	2	1.02432E-06	6.172394759	0.011069425	3.682320344		
Within groups	2.48929E-06	15	1.65953E-07					
Total	4.53794E-06	17						
within-sd	0.000407373							
effective n	5.33							
s_bb	0.000401179							
s_bb_min	0.000106593							
u_bb	0.000401179			0.003657611				
u_bb(rel.)	10.96833894							

As in BAM-M385a:

r_0	0.000105614	0.000208386						
r_middle	0.00016	0.000156	0.000115	0.0002	0.000176	0.000161	0.000144	0.000156
r_out	0.000212	0.000197	0.000214	0.000185	0.000194	0.000217	0.00013	0.000144
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	3.59463E-09	2	1.79731E-09	1.591762017	0.236101655	3.682320344		
Within groups	1.6937E-08	15	1.12913E-09					
Total	2.05316E-08	17						
within-sd	3.36026E-05							
effective n	5.33							
s_bb	1.1193E-05							
s_bb_min	8.79241E-06							
u_bb	1.1193E-05			0.000170833				
u_bb(rel.)	6.552006096							

Bi in BAM-M385a:

r_0	0.000320621	0.000393379						
r_middle	0.000354	0.000383	0.000385	0.000367	0.000375	0.000375	0.00036	0.000412
r_out	0.000392	0.000376	0.000402	0.00036	0.000383	0.000378	0.000381	0.000374
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	9.03125E-10	2	4.51563E-10	1.131887561	0.348470618	3.682320344		
Within groups	5.9842E-09	15	3.98946E-10					
Total	6.88732E-09	17						
within-sd	1.99736E-05							
effective n	5.33							
s_bb	3.14094E-06							
s_bb_min	5.22628E-06							
u_bb	5.22628E-06			0.000376167				
u_bb(rel.)	1.389352037							

Cd in BAM-M385a:

r_0	0.000327831	0.000410169						
r_in	0.000378	0.000405	0.000426	0.000416	0.000412	0.000415	0.000377	0.000376
r_out	0.000409	0.000427	0.000417	0.000404	0.000424	0.000435	0.000408	0.000408
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	3.79063E-09	2	1.89531E-09	3.966422512	0.041423799	3.682320344		
Within groups	7.16759E-09	15	4.77839E-10					
Total	1.09582E-08	17						
within-sd	2.18595E-05							
effective n	5.33							
s_bb	1.63026E-05							
s_bb_min	5.71974E-06							
u_bb	1.63026E-05			0.000404167				
u_bb(rel.)	4.033644076							

Co in BAM-M385a:

r_0	0.000862555	0.000895445						
r_middle	0.000891	0.000884	0.000895	0.0009	0.000884	0.000879	0.000882	0.000879
r_out	0.000917	0.000913	0.000904	0.000889	0.000905	0.000887	0.000892	0.000905
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	1.27694E-09	2	6.38472E-10	5.261101301	0.018569418	3.682320344		
Within groups	1.82036E-09	15	1.21357E-10					
Total	3.0973E-09	17						
within-sd	1.10162E-05							
effective n	5.33							
s_bb	9.84678E-06							
s_bb_min	2.88249E-06							
u_bb	9.84678E-06			0.000892444				
u_bb(rel.)	1.103349358							

Cr in BAM-M385a:

r_0	10.46185756	10.73814244				
r_in	10.8	10.6	10.6	10.7		
r_out	10.6	10.6	10.5	10.6	10.5	
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.029590909	2	0.014795455	1.523995318	0.274932929	4.458970108
Within groups	0.077666667	8	0.009708333			
Total	0.107257576	10				
within-sd	0.098530875					
effective n	3.45					
s_bb	0.038374311					
s_bb_min	0.037485377					
u_bb	0.038374311			10.60909091		
u_bb(rel.)	0.361711583					

Fe in BAM-M385a:

r_0	0.004384624	0.004771376						
r_middle	0.004627	0.004496	0.004602	0.004675	0.004641	0.004568	0.004649	0.004807
r_out	0.004607	0.004618	0.004531	0.004598	0.004583	0.00464	0.004989	0.004568
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	6.57813E-09	2	3.28906E-09	0.178386893	0.838367706	3.682320344		
Within groups	2.76567E-07	15	1.84378E-08					
Total	2.83145E-07	17						
within-sd	0.000135786							
effective n	5.33							
s_bb	0							
s_bb_min	3.55296E-05							
u_bb	3.55296E-05			0.004630833				
u_bb(rel.)	0.76723916							

Mg in BAM-M385a:

r_0	0.003369495	0.003760505						
r_middle	0.003893	0.003896	0.00384	0.003615	0.003838	0.00377	0.003716	0.003772
r_out	0.003937	0.003827	0.003791	0.00408	0.003843	0.003935	0.003901	0.003899
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	1.89072E-07	2	9.45359E-08	7.260744672	0.006232287	3.682320344		
Within groups	1.95302E-07	15	1.30201E-08					
Total	3.84374E-07	17						
within-sd	0.000114106							
effective n	5.33							
s_bb	0.000123629							
s_bb_min	2.98568E-05							
u_bb	0.000123629			0.003815722				
u_bb(rel.)	3.23999699							

Mn in BAM-M385a:

r_0	0.000931556	0.001030444						
r_middle	0.001019	0.001028	0.00105	0.001042	0.00102	0.001064	0.001065	0.000997
r_out	0.001037	0.001	0.000984	0.000982	0.001033	0.001038	0.001014	0.000977
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	5.99525E-09	2	2.99762E-09	3.317365743	0.064128063	3.682320344		
Within groups	1.35542E-08	15	9.03616E-10					
Total	1.95495E-08	17						
within-sd	3.00602E-05							
effective n	5.33							
s_bb	1.98148E-05							
s_bb_min	7.86552E-06							
u_bb	1.98148E-05			0.001017333				
u_bb(rel.)	1.947720458							

Ni in BAM-M385a:

r_0	0.001432533	0.001687467						
r_middle	0.001601	0.001609	0.001634	0.001557	0.001568	0.001543	0.001742	0.001574
r_out	0.001575	0.001593	0.001602	0.00159	0.001609	0.001631	0.001658	0.001582
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	3.49E-09	2	1.745E-09	0.397158278	0.679091286	3.682320344		
Within groups	6.59057E-08	15	4.39371E-09					
Total	6.93957E-08	17						
within-sd	6.62851E-05							
effective n	5.33							
s_bb	0							
s_bb_min	1.73441E-05							
u_bb	1.73441E-05			0.001599333				
u_bb(rel.)	1.084456753							

P in BAM-M385a:

r_0	11.057405	11.342595				
r_in	11.3	11.2	11.4	11.2		
r_out	11.3	11.3	11.3	11.3	11.1	
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.007772727	2	0.003886364	0.310391771	0.741605574	4.458970108
Within groups	0.100166667	8	0.012520833			
Total	0.107939394	10				
within-sd	0.11189653					
effective n	3.45					
s_bb	0					
s_bb_min	0.042570246					
u_bb	0.042570246			11.25454545		
u_bb(rel.)	0.378249362					

Pb in BAM-M385a:

r_0	0.001389287	0.001984713						
r_middle	0.001734	0.001826	0.001819	0.00175	0.002157	0.001716	0.001959	0.001771
r_out	0.001754	0.001747	0.001721	0.001764	0.001746	0.001751	0.00182	0.00174
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	5.17471E-08	2	2.58735E-08	1.148724613	0.343414762	3.682320344		
Within groups	3.37856E-07	15	2.25237E-08					
Total	3.89603E-07	17						
within-sd	0.000150079							
effective n	5.33							
s_bb	2.50618E-05							
s_bb_min	3.92695E-05							
u_bb	3.92695E-05			0.001786056				
u_bb(rel.)	2.198671138							

S in BAM-M385a:

r_0	0.002702475	0.003219525						
r_middle	0.00296	0.003107	0.003215	0.003212	0.003025	0.003123	0.003057	0.003345
r_out	0.003322	0.003218	0.003212	0.003322	0.003007	0.003008	0.00296	0.003338
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	7.21657E-08	2	3.60829E-08	1.304211695	0.300456014	3.682320344		
Within groups	4.14996E-07	15	2.76664E-08					
Total	4.87162E-07	17						
within-sd	0.000166332							
effective n	5.33							
s_bb	3.97251E-05							
s_bb_min	4.35223E-05							
u_bb	4.35223E-05			0.003130722				
u_bb(rel.)	1.390167926							

Sb in BAM-M385a:

r_0	11.83553692	12.56446308				
r_in	12.1	12.5	12	12.3		
r_out	12.1	12.7	11.7	12.3	12	
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.009590909	2	0.004795455	0.039748199	0.961219962	4.458970108
Within groups	0.965166667	8	0.120645833			
Total	0.974757576	10				
within-sd	0.347341091					
effective n	3.45					
s_bb	0					
s_bb_min	0.132143471					
u_bb	0.132143471			12.19090909		
u_bb(rel.)	1.083950918					

Se in BAM-M385a:

r_0	0.000510052	0.000903948						
r_middle	0.000684	0.000684	0.000811	0.000917	0.000761	0.000906	0.000897	0.000753
r_out	0.000682	0.000766	0.000623	0.000732	0.000606	0.000775	0.00083	0.000651
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	3.90437E-08	2	1.95218E-08	1.561581581	0.242063573	3.682320344		
Within groups	1.8752E-07	15	1.25013E-08					
Total	2.26564E-07	17						
within-sd	0.000111809							
effective n	5.33							
s_bb	3.62815E-05							
s_bb_min	2.92559E-05							
u_bb	3.62815E-05			0.000749556				
u_bb(rel.)	4.840401113							

Si in BAM-M385a:

r_0	0.002285223	0.002678777						
r_middle	0.002613	0.002581	0.002732	0.002699	0.002639	0.002494	0.002619	0.002451
r_out	0.002689	0.002848	0.002619	0.002706	0.002729	0.002758	0.002496	0.002638
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	7.37224E-08	2	3.68612E-08	2.548077984	0.111515952	3.682320344		
Within groups	2.16994E-07	15	1.44663E-08					
Total	2.90717E-07	17						
within-sd	0.000120276							
effective n	5.33							
s_bb	6.48001E-05							
s_bb_min	3.14712E-05							
u_bb	6.48001E-05			0.002626389				
u_bb(rel.)	2.467268454							

Sn in BAM-M385a:

r_0	0.002652764	0.002889236						
r_middle	0.002844	0.002946	0.002991	0.002986	0.002881	0.002904	0.002914	0.002859
r_out	0.003017	0.002822	0.003029	0.002867	0.002924	0.002806	0.002909	0.002831
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	3.4328E-08	2	1.7164E-08	2.550546107	0.111310728	3.682320344		
Within groups	1.00943E-07	15	6.72954E-09					
Total	1.35271E-07	17						
within-sd	8.20338E-05							
effective n	5.33							
s_bb	4.42319E-05							
s_bb_min	2.14649E-05							
u_bb	4.42319E-05			0.002892889				
u_bb(rel.)	1.528987955							

Te in BAM-M385a:

r_0	6.701042572	7.898957428				
r_in	7.6	7.9	7	7.5		
r_out	7.8	7.8	6.5	7.7	7.7	
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.065454545	2	0.032727273	0.109204664	0.897860521	4.458970108
Within groups	2.3975	8	0.2996875			
Total	2.462954545	10				
within-sd	0.547437211					
effective n	3.45					
s_bb	0					
s_bb_min	0.20826863					
u_bb	0.20826863			7.463636364		
u_bb(rel.)	2.790444499					

Ti in BAM-M385a:

r_0	0.000689267	0.000814733						
r_middle	0.000779	0.000835	0.000793	0.000791	0.000792	0.00081	0.000873	0.000802
r_out	0.000815	0.000852	0.000792	0.000879	0.00084	0.000831	0.000825	0.00082
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	1.03596E-08	2	5.17978E-09	4.043265977	0.039399817	3.682320344		
Within groups	1.92163E-08	15	1.28109E-09					
Total	2.95759E-08	17						
within-sd	3.57923E-05							
effective n	5.33							
s_bb	2.70371E-05							
s_bb_min	9.36537E-06							
u_bb	2.70371E-05			0.000812944				
u_bb(rel.)	3.325825229							

Zn in BAM-M385a:

r_0	0.000599061	0.000666939						
r_middle	0.000591	0.000592	0.000587	0.000593	0.000601	0.000601	0.000639	0.000598
r_out	0.000598	0.000596	0.000589	0.000573	0.000595	0.000575	0.000628	0.000598
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	2.44428E-09	2	1.22214E-09	2.950499128	0.083067612	3.682320344		
Within groups	6.21321E-09	15	4.14214E-10					
Total	8.65749E-09	17						
within-sd	2.03523E-05							
effective n	5.33							
s_bb	1.2308E-05							
s_bb_min	5.32535E-06							
u_bb	1.2308E-05			0.000601111				
u_bb(rel.)	2.047534825							

Zr in BAM-M385a:

r_0	0.00156154	0.00184646						
r_middle	0.001846	0.002002	0.001879	0.001762	0.0019	0.001883	0.001872	0.001846
r_out	0.001984	0.001957	0.001873	0.00221	0.001933	0.002024	0.001975	0.001993
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*		
Between groups	1.51269E-07	2	7.56346E-08	8.125828907	0.004065711	3.682320344		
Within groups	1.39619E-07	15	9.30792E-09					
Total	2.90888E-07	17						
within-sd	9.64776E-05							
effective n	5.33							
s_bb	0.000111518							
s_bb_min	2.52442E-05							
u_bb	0.000111518			0.001908167				
u_bb(rel.)	5.844243991							