Certification Report

Certified Reference Materials

BAM-M386a

Pure Copper

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Summary

This report describes preparation, analysis and certification of the copper reference material BAM-M386a.
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	44.2	1.4
Al	26.9	2.3
As	20.8	0.8
Bi	9.5	0.5
Cd	5.4	0.5
Co	4.9	0.3
Cr	11.5	0.9
Fe	59.3	1.3
Mg	76.7	2.8
Mn	11.1	0.6
Ni	21.1	1.1
P	6.5	0.7
Pb	19.8	1.1
S	15.9	1.8
Sb	25.2	1.8
Se	9.7	0.9
Sn	21.6	0.9
Te	31.1	1.3
Ti	34.7	1.4
Zn	36.7	1.5

[1] Unweighted mean value of the means of accepted sets of data (consisting of at least 4 but usually 6 single results), each set being obtained by a different laboratory and/or a different method of measurement.

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

The certified values are based on the results of 11 laboratories which participated in the certification interlaboratory comparison. The mass fraction of Si is given for information.

Content

List of abbreviations
(if not explained elsewhere)

CRM	certified reference material
ETAAS	electrothermal atomic absorption spectrometry
ICP-OES	inductively coupled plasma optical emission spectrometry
ICP-MS	inductively coupled plasma mass spectrometry
GD-MS	glow discharge mass spectrometry
SOES	spark optical emission spectrometry
XRF	X-ray fluorescence spectrometry
M	mean value
n	number of accepted data sets
s	standard deviation of an individual data set
s_M	standard deviation of laboratory means
s_{rel}	relative standard deviation
$\bar{s}_i$	square root of mean of variances of data sets under repeatability conditions
M_i	single result
I	ICP-OES (Tables 2 – 22)
I(R)	ICP-OES, revised value (Tables 2 – 22)
IMS	ICP-MS (Tables 2 – 22)
EA	ETAAS (Tables 2 – 22)
V	Combustion/infrared absorption (Tables 2 – 22)
GD	GD-MS (Tables 2 – 22)

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-M386a is based on pure copper. It replaces the out of stock CRM ERM®-EB386. Certification of BAM-M386a 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-M386a 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

– Alfred H Knight International, Prescot, Knowsley, United Kingdom
– Aurubis AG, Hamburg, Germany
– Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany
– Diehl Metall Stiftung & Co KG, Röthenbach, Germany
– Forschungsinstitut Edelmetalle + Metallchemie, Schwäbisch Gmünd, Germany
– Heimerle + Meule GmbH, Pforzheim, Germany
– Inspectorate International Limited, Witham, United Kingdom
– Institut Glörfeld, Willich, Germany
– KM Europa Metal AG, Osnabrück, Germany
– KME Mansfeld GmbH, Hettstedt, Germany
– Montanwerke Brixlegg, Brixlegg, Austria

Statistical evaluation of the data

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

3. Candidate material

The candidate material foreseen for CRM BAM-M386a 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.

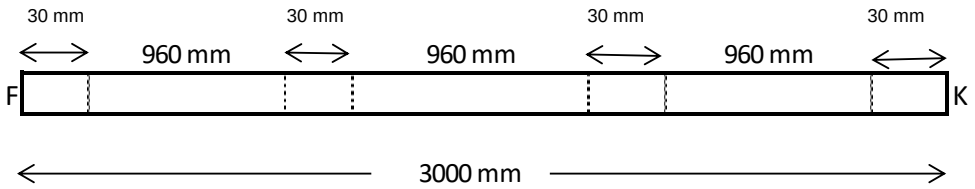


Figure 1: Cutting plan of pure copper reference material BAM-M386a

About 750 discs of BAM-M386a 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):

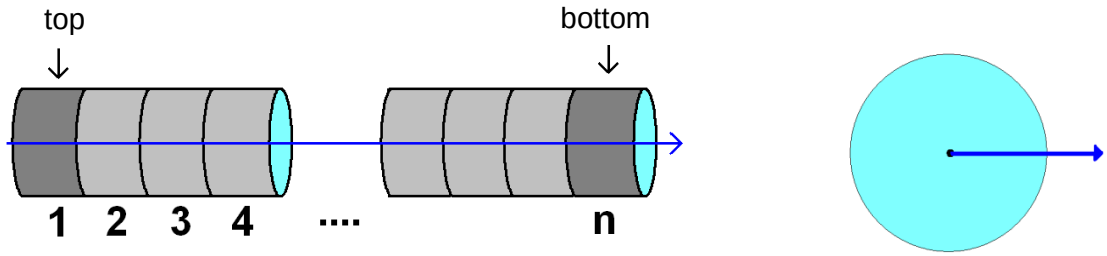


Fig. 2: Axial and radial composition gradient

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 32 discs were investigated, this corresponds to ca. 5 % 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 four 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). For some elements data from the accompanying spark emission round robin test was used because BAM-spectrometer was not sensitive enough for these elements (Al, As, Se, Sn). Calculation was done in the same way as for the other elements while the number of sparks were different (outer circle: 4 sparks, inner circle: 4 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. The higher component is used for the uncertainty calculation.

Annex 1 and 2 show the results of the calculations.

5. Characterisation study

5.1 Analytical procedures

Twelve 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 procedures 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 traceable commercial calibration solutions.

Table 1: Analytical procedures used by the participating laboratories

Lab-No.	Element.	Sample mass	Sample pretreatment	Analytical method
1*	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, Pb, Sb, Se, Sn, Te, Ti, Zn	10 mg	Dissolution with HNO_3	ICP-MS calibration with commercial solutions
2	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, Pb, Sb, Se, Sn, Te, Zn	1 g	Dissolution with HCl/HNO_3 (1 + 1)	ICP-MS, calibration with commercial solution (Spex Certi Prep, traceable to NIST)
	P	1 g	Dissolution with HCl/HNO_3 (1 + 1)	ICP-OES, matrix matched calibration with commercial solutions (Spex Certi Prep, traceable to NIST)
3*	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Se, Si, Sn, Te, Ti, Zn	2 g	Dissolution with $HCl/HNO_3/H_2O$ (2:1:1)	ICP-OES, matrix matched calibration with commercial solutions (Roth)
4	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Se, Si, Sn, Te, Ti, Zn	1 g	Dissolution with HNO_3/HCl	ICP-OES, calibration with commercial standard solutions (Bernd Kraft)
5*	Al, As, P, Si	1 g	Dissolution with HNO_3	ICP-OES, matrix matched calibration with commercial standard solutions
	Ag, Cd, Co, Cr, Fe, Mg, Mn, Ni, Pb, Sb, Se, Sn, Te, Zn	1 g	Dissolution with HNO_3	ICP-MS, matrix matched calibration with commercial solutions
6	Ag, As, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Sn, Te, Ti, Zn	1 g	Dissolution with HNO_3	ICP-OES, matrix matched calibration with commercial standard solutions (Alfa Aesar)
7	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, Pb, Sb, Se, Sn, Te, Ti, Zn	1 g	Dissolution with HNO_3/HCl	ICP-OES, matrix matched calibration with standard solutions prepared from pure metals
	S	2 g		Combustion/iodometric titration, calibration with $Na_2S_2O_3$
8	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Se, Si, Sn, Te, Ti, Zn	0.5 g	Dissolution with HNO_3/HCl	ICP-MS, matrix matched calibration with commercial solutions (Bernd Kraft)
9*	Ag, Cd, Co, Cr, Fe, Mg, Mn, Ni, Pb, Ti, Zn,	1 g	Dissolution with HCl/HNO_3	ICP-OES, matrix matched calibration with commercial standard solutions (Merck)
	As, Bi, Cd, Co, Cr, Pb	1 g	Dissolution with HNO_3	ETAAS (according to DIN 14935), matrix matched calibration with commercial standard solutions (Merck)
9*	S	1 g		Combustion/IR, Calibration with K_2SO_4
9	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Se, Si, Sn, Te, Ti, Zn			GDMS, calibration with ERM-EB383, ERM-EB384, BAM-M384b, BAM-M385a, ERM-EB386, ERM-EB074a and ERM-EB075a

*Laboratory accredited acc. to ISO/IEC 17025

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

Lab-No.	Element.	Sample mass	Sample pretreatment	Analytical method
10	Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Se, Si, Sn, Te, Ti, Zn	1 g	Dissolution with HNO_3/HF	ICP-OES (according to DIN EN 15605), matrix matched calibration with commercial mono-element solution (Merck Certipur)
11	Ag, Al, As, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, Se, Sn, Ti, Zn	1 g	Dissolution with HNO_3	ICP-OES, matrix matched calibration with commercial mono-element solution (Roth)
12	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Se, Si, Sn, Te, Ti, Zn	0.5 g	Dissolution with HNO_3/HF	ICP-MS, matrix matched calibration with commercial mono-element solutions (Merck)

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 ($\overline{s_l}$), 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 after discussion with the respective laboratories are highlighted in yellow. The results of one of the participating laboratories were removed completely because their results were outliers in more than 50 % of all analytes.

Table 2: Results for Ag in BAM-M386a

Lab./Meth.	11/I	1/IMS	8/IMS	3/I	7/I	5/IMS	6/I	2/IMS	9/GD	9/I	12/IMS		
M_i [mg/kg]	37.1	41.8	43.1	43.8	44.0	43.9	44.7	44.3	44.6	46.0	47.9		*n*
	37.0	41.8	42.5	43.2	44.1	44.0	43.7	44.4	45.4	45.5	47.8		10
	36.9	38.8	42.9	42.3	43.7	43.8	44.9	45.1	45.0	44.7	48.3		
	37.5	43.3	43.0	42.5	43.9	43.9	44.3	45.0	45.6	47.1	48.0		
	36.7	38.7	40.6	42.4	43.6	43.8	44.8	44.8	45.7	44.9	48.0		
	37.1	41.7	40.1	42.0	43.5	43.8	44.8	44.6	44.9	46.6	48.0		
									45.4	45.7			
									45.0				
M [mg/kg]	**37.0**	**41.0**	**42.0**	**42.7**	**43.8**	**43.9**	**44.5**	**44.7**	**45.2**	**45.8**	**48.0**		**44.2**
s [mg/kg]	0.3	1.9	1.3	0.7	0.2	0.1	0.4	0.3	0.4	0.9	0.2	s_M [mg/kg]	1.98
												$\overline{s}_i$ [mg/kg]	0.84
s_{rel}	0.0075	0.0459	0.0316	0.0158	0.0053	0.0016	0.0101	0.0071	0.0086	0.0192	0.0035		0.0449

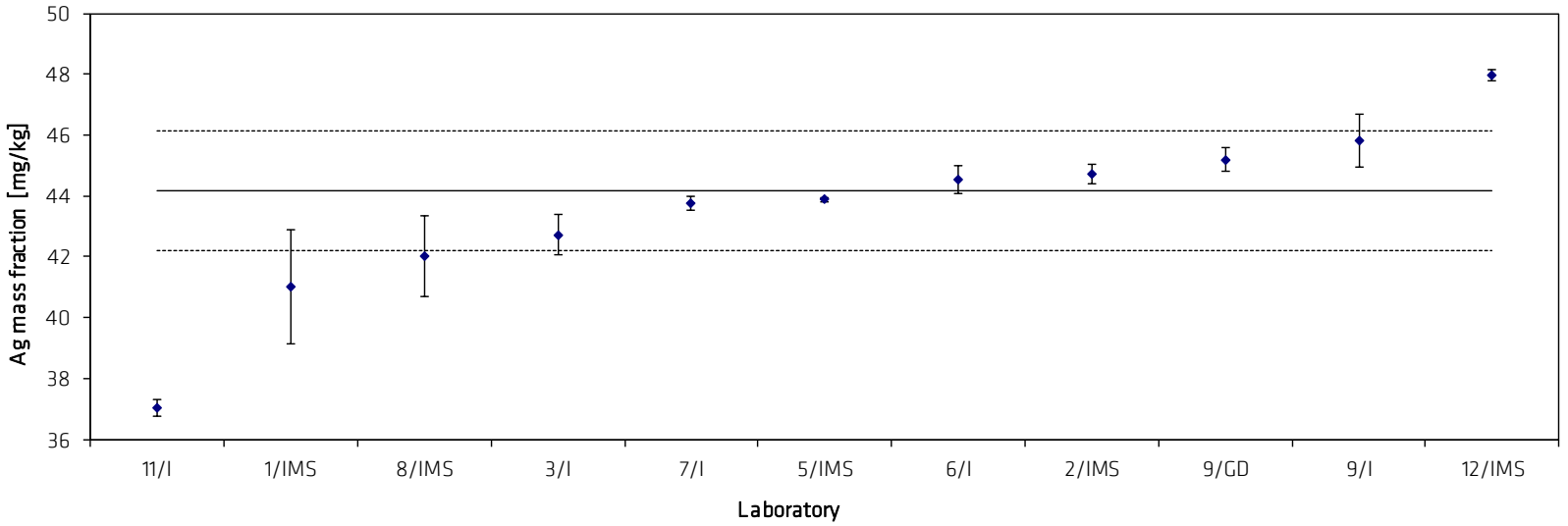


Table 3: Results for Al in BAM-M386a

Lab./Meth.	7/I	8/IMS	12/IMS	9/GD	3/I	11/I	1/IMS	5/I	2/IMS	10/I		
M_i [mg/kg]	24.4	24.3	26.5	25.2	27.8	27.1	26.9	28.5	29.7	34.1		*n*
	24.3	25.2	26.5	26.7	27.3	26.3	27.2	28.3	27.6	33.9		9
	24.5	23.4	26.8	26.8	27.2	27.0	26.9	28.1	30.3	31.3		
	24.2	25.5	26.4	26.7	27.2	29.2	27.7	27.8	30.0	32.9		
	24.5	27.1	26.4	28.7	27.0	26.7	28.7	28.2	26.0	31.3		
	24.6	26.8	26.1	25.7	26.5	27.2	28.7	27.8	29.7	32.4		
				28.2								
				27.4								
M [mg/kg]	**24.4**	**25.4**	**26.5**	**26.9**	**27.2**	**27.2**	**27.7**	**28.1**	**28.9**	**32.7**		**26.9**
s [mg/kg]	0.1	1.4	0.2	1.2	0.4	1.0	0.8	0.3	1.7	1.2	s_M [mg/kg]	1.36
											$\bar{s}_i$ [mg/kg]	0.97
s_{rel}	0.0058	0.0560	0.0086	0.0436	0.0161	0.0370	0.0307	0.0101	0.0595	0.0373		0.0507

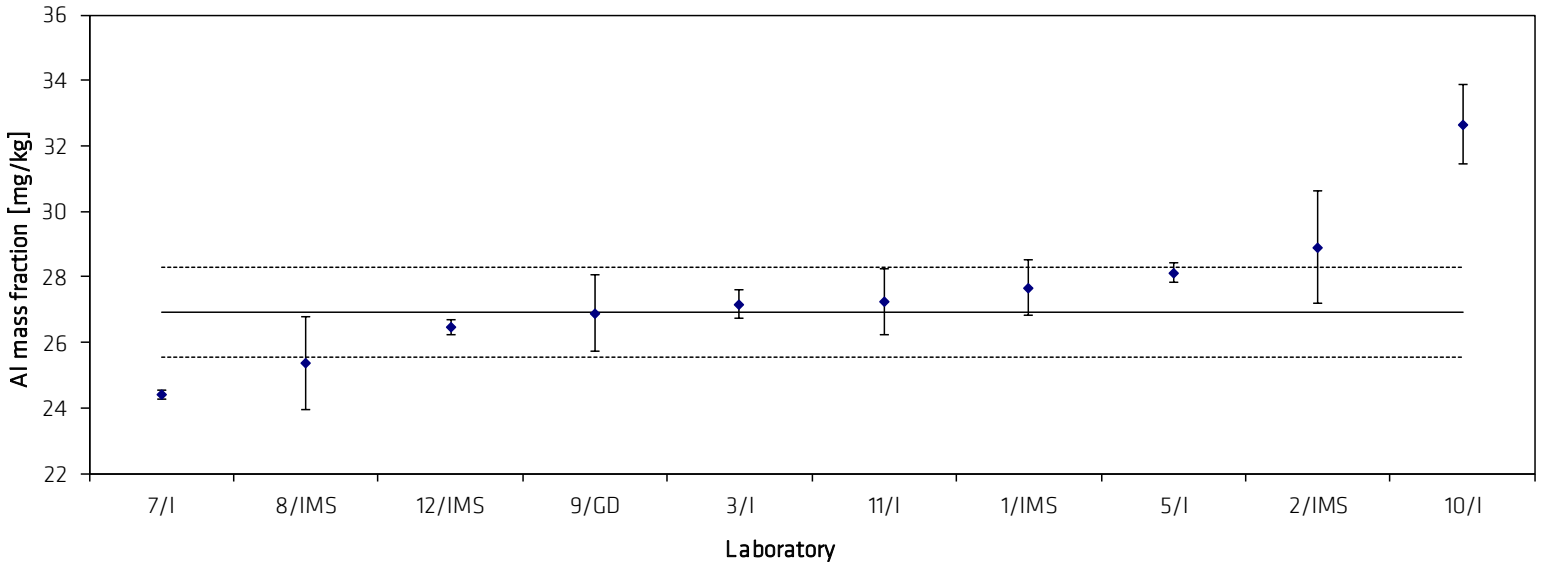


Table 4: Results for As in BAM-M386a

Lab./Meth.	6/I	12/IMS	3/I	7/I	10/I	8/IMS	9/EA	11/I	9/GD	1/IMS	2/IMS	5/I		
M_i [mg/kg]	18.1	19.4	20.3	20.7	20.8	21.4	22.3	20.9	21.3	21.6	23.2	29.1		*n*
	18.3	19.4	19.6	20.7	20.3	20.8	21.0	20.7	21.1	21.2	23.0	28.4		11
	19.2	19.8	19.8	20.6	20.4	21.3	20.0	21.1	20.8	21.8	24.1	28.7		
	19.0	19.5	19.9	20.5	20.8	21.0	18.7	21.4	21.1	21.7	23.7	29.0		
	18.3	19.4	19.8	20.7	20.8	20.1	21.5	20.9	21.0	21.5	24.1	28.7		
	21.5	19.3	19.8	20.5	20.8	19.7	21.4	21.2	21.6	21.7	23.9	29.0		
									21.1					
									21.0					
***M* [mg/kg]**	**19.1**	**19.5**	**19.9**	**20.6**	**20.7**	**20.7**	**20.8**	**21.0**	**21.1**	**21.6**	**23.7**	**28.8**		**20.8**
s [mg/kg]	1.3	0.2	0.3	0.1	0.2	0.7	1.3	0.2	0.3	0.2	0.4	0.2	s_M [mg/kg]	1.21
													$\bar{s}_i$ [mg/kg]	0.62
s_{rel}	0.0663	0.0089	0.0129	0.0054	0.0114	0.0328	0.0607	0.0110	0.0119	0.0099	0.0189	0.0084		0.0583

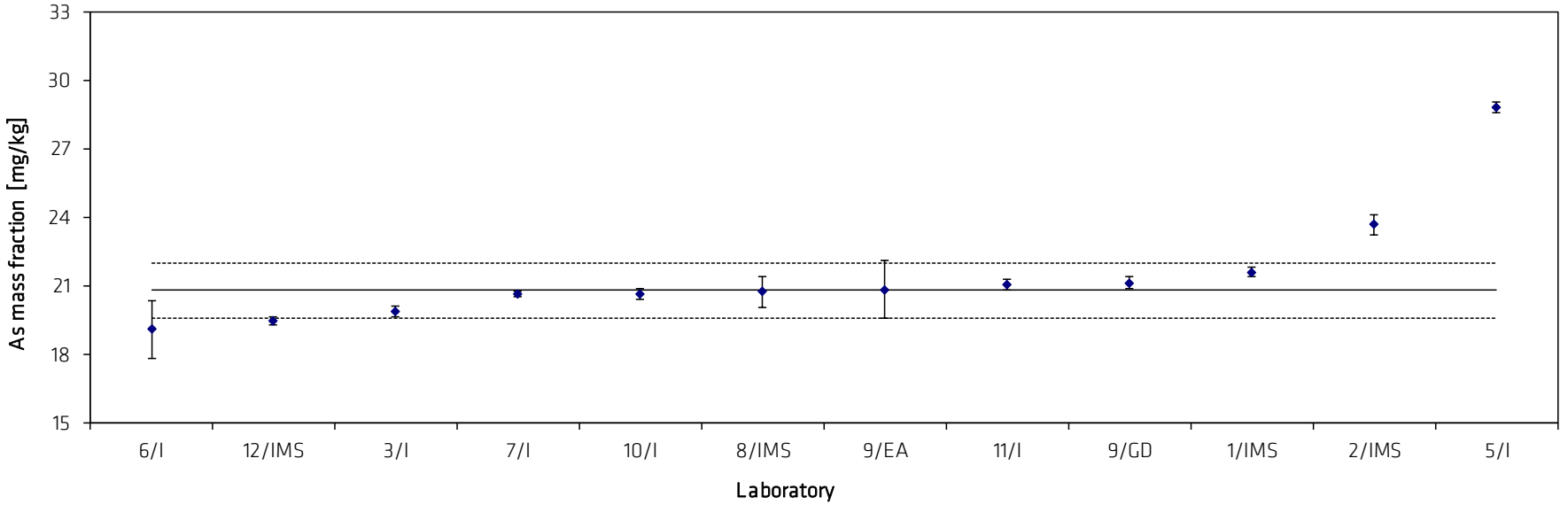


Table 5: Results for Bi in BAM-M386a

Lab./Meth.	7/I	8/IMS	12/IMS	3/I	1/IMS	2/IMS	9/GD	10/I	9/EA		
M_i [mg/kg]	7.13	7.93	9.14	9.22	9.34	9.32	8.99	10.0	9.99		*n*
	7.30	7.99	9.13	9.14	9.26	9.28	9.60	9.9	11.16		7
	7.22	8.01	9.29	9.22	9.32	9.52	10.06	9.6	10.27		
	7.14	7.86	9.19	9.02	9.24	9.35	9.99	10.3	9.61		
	7.36	7.70	9.22	9.35	9.42	9.55	9.72	9.4	9.72		
	7.41	7.68	9.17	9.13	9.34	9.44	8.83	9.8			
							9.57				
							9.46				
***M* [mg/kg]**	**7.26**	**7.86**	**9.19**	**9.18**	**9.32**	**9.41**	**9.53**	**9.83**	**10.15**		**9.52**
s [mg/kg]	0.12	0.14	0.06	0.11	0.06	0.11	0.44	0.31	0.62	s_M [mg/kg]	0.36
										$\bar{s}_i$ [mg/kg]	0.32
s_{rel}	0.0159	0.0182	0.0065	0.0121	0.0069	0.0120	0.0458	0.0319	0.0611		0.0377

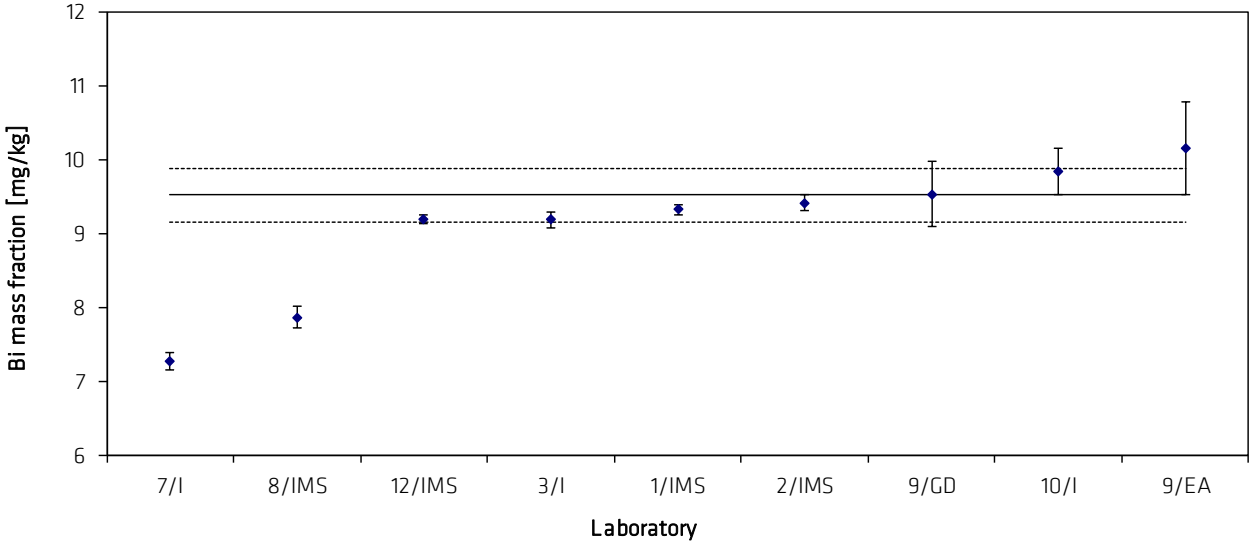


Table 6: Results for Cd in BAM-M386a

Lab./Meth.	6/I	2/IMS	5/IMS	11/I	10/I	9/I	9/GD	1/IMS	12/IMS	9/EA	8/IMS	3/I	7/I		
M_i [mg/kg]	5.13	5.19	5.23	5.29	4.95	5.34	5.24	5.35	5.40	5.51	5.61	5.58	5.66		*n*
	5.12	5.33	5.20	5.27	4.98	5.30	5.40	5.40	5.45	5.38	5.60	5.61	5.70		13
	5.09	5.07	5.21	5.27	5.48	5.34	5.34	5.37	5.51	5.51	5.60	5.62	5.69		
	5.14	5.11	5.21	5.27	5.45	5.35	5.46	5.43	5.45	5.63	5.49	5.58	5.79		
	5.13	5.31	5.22	5.17	5.47	5.28	5.53	5.49	5.48	5.46	5.54	5.60	5.60		
	5.23	5.12	5.16	5.33	5.47	5.51	5.36	5.44	5.44	5.52	5.50	5.51	5.77		
						5.37	5.50								
							5.47								
M [mg/kg]	**5.14**	**5.19**	**5.20**	**5.27**	**5.30**	**5.36**	**5.41**	**5.41**	**5.45**	**5.50**	**5.56**	**5.58**	**5.70**		**5.39**
s [mg/kg]	0.05	0.11	0.02	0.05	0.26	0.08	0.10	0.05	0.04	0.08	0.05	0.04	0.07	s_M [mg/kg]	0.17
														$\bar{s}_i$ [mg/kg]	0.10
s_{rel}	0.0092	0.0214	0.0046	0.0100	0.0490	0.0142	0.0176	0.0094	0.0067	0.0149	0.0097	0.0070	0.0123		0.0313

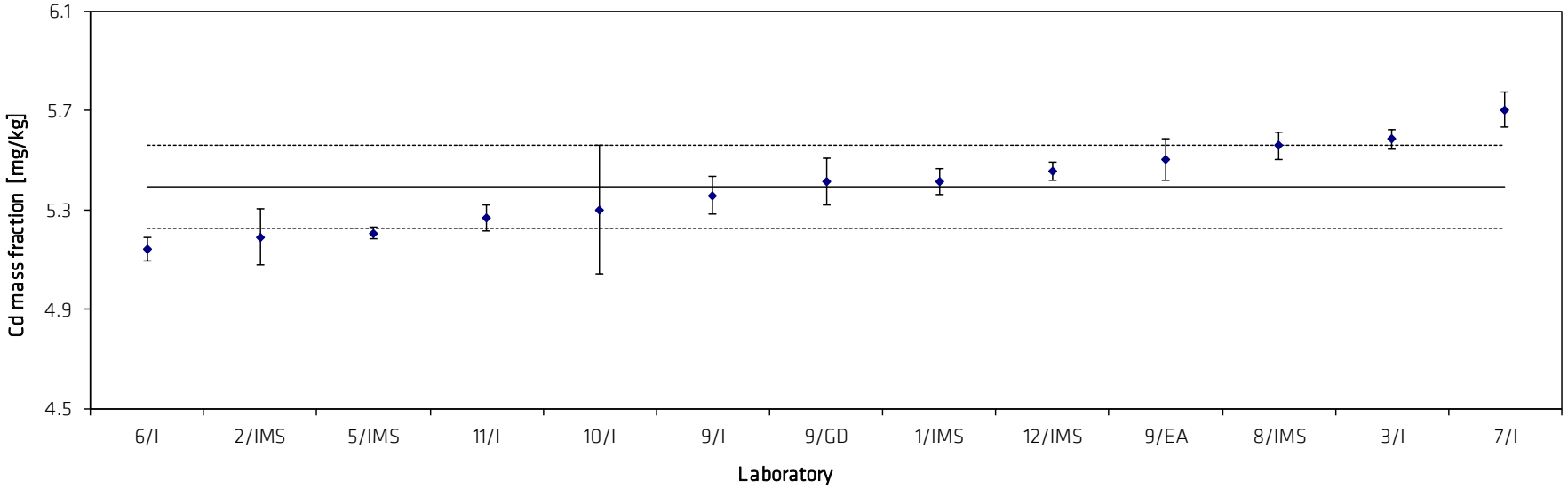


Table 7: Results for Co in BAM-M386a

Lab./Meth.	11/I	2/IMS	5/IMS	6/I	9/GD	3/I	1/IMS	8/IMS	9/I	12/IMS	10/I	9/EA	7/I		
M_i [mg/kg]	4.5	4.66	4.75	4.72	4.79	4.83	4.98	5.10	5.12	4.94	5.13	5.12	6.25		*n*
	4.6	4.57	4.72	4.64	4.64	4.83	4.91	4.93	5.17	4.94	5.34	5.35	6.11		12
	4.6	4.59	4.73	4.75	4.78	4.90	4.98	5.09	4.76	5.04	5.04	6.08	6.18		
	4.6	4.65	4.74	4.84	4.69	4.92	4.84	4.92	4.83	4.99	5.21	5.36	6.30		
	4.6	4.56	4.74	4.76	4.79	4.92	4.85	4.87	4.97	5.03	5.19	5.08	6.07		
	4.6	4.60	4.72	4.73	4.95	4.81	4.80	4.75	5.19	5.01	5.41	5.72	6.04		
					4.93				4.70						
					4.89										
***M* [mg/kg]**	**4.58**	**4.60**	**4.73**	**4.74**	**4.81**	**4.87**	**4.89**	**4.94**	**4.96**	**4.99**	**5.22**	**5.45**	**6.16**		**4.90**
s [mg/kg]	0.03	0.04	0.01	0.06	0.11	0.05	0.08	0.13	0.20	0.04	0.14	0.38	0.10	s_M [mg/kg]	0.25
														$\bar{s}_i$ [mg/kg]	0.15
s_{rel}	0.0071	0.0088	0.0025	0.0137	0.0229	0.0103	0.0155	0.0271	0.0410	0.0086	0.0260	0.0703	0.0167		0.0506

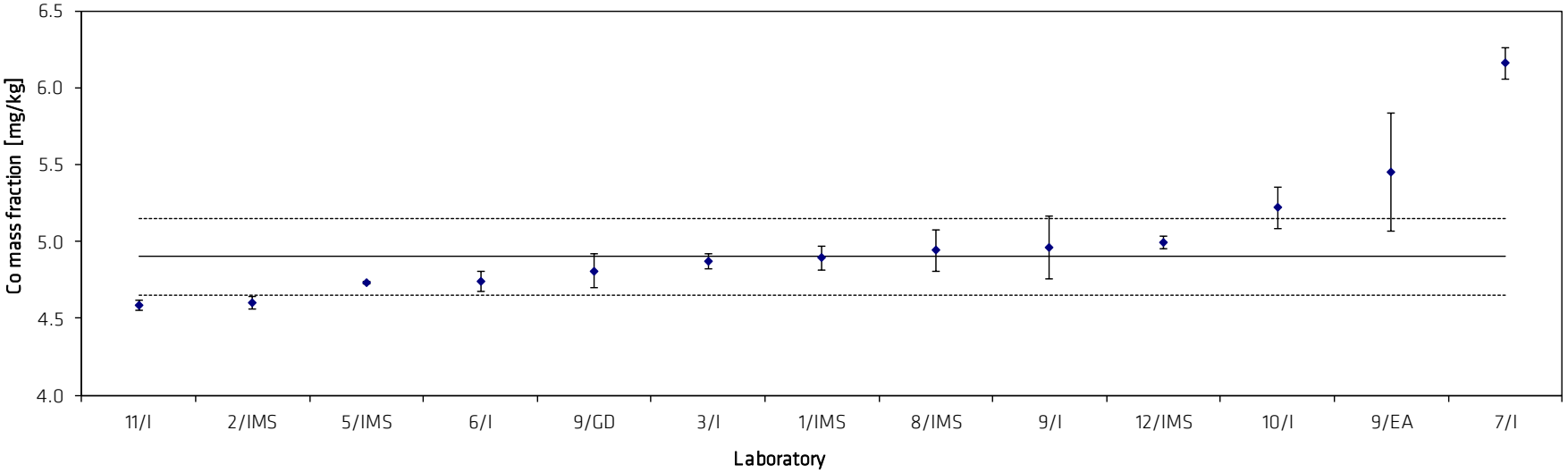


Table 8: Results for Cr in BAM-M386a

Lab./Meth.	9/GD	9/I	1/IMS	10/I	3/I	11/I	5/IMS	6/I	7/I	2/IMS	12/IMS	9/EA	8/IMS		
M_i [mg/kg]	10.6	10.9	11.36	11.2	11.44	11.46	11.52	11.4	11.44	11.49	11.89	12.66	12.4		*n*
	10.8	11.0	11.35	11.2	11.17	11.40	11.48	11.6	11.61	11.65	11.89	12.42	12.2		13
	11.1	10.7	11.42	11.2	11.30	11.18	11.48	11.4	11.46	11.85	12.14	12.26	12.8		
	10.8	11.0	10.55	11.0	11.38	11.40	11.49	11.5	11.54	11.70	12.08	12.23	12.1		
	11.2	10.7	10.65	11.1	11.51	11.35	11.49	11.6	11.74	11.63	12.14		12.9		
	10.7	11.0	10.70	11.2	11.14	11.30	11.52	11.6	11.51	11.74	11.98		12.1		
	11.1	10.8													
	10.9														
***M* [mg/kg]**	**10.9**	**10.9**	**11.0**	**11.2**	**11.3**	**11.3**	**11.5**	**11.5**	**11.6**	**11.7**	**12.0**	**12.4**	**12.4**		**11.5**
s [mg/kg]	0.2	0.1	0.4	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.4	s_M [mg/kg]	0.51
														$\bar{s}_i$ [mg/kg]	0.19
s_{rel}	0.0204	0.0118	0.0373	0.0075	0.0131	0.0087	0.0018	0.0069	0.0096	0.0104	0.0098	0.0159	0.0285		0.0444

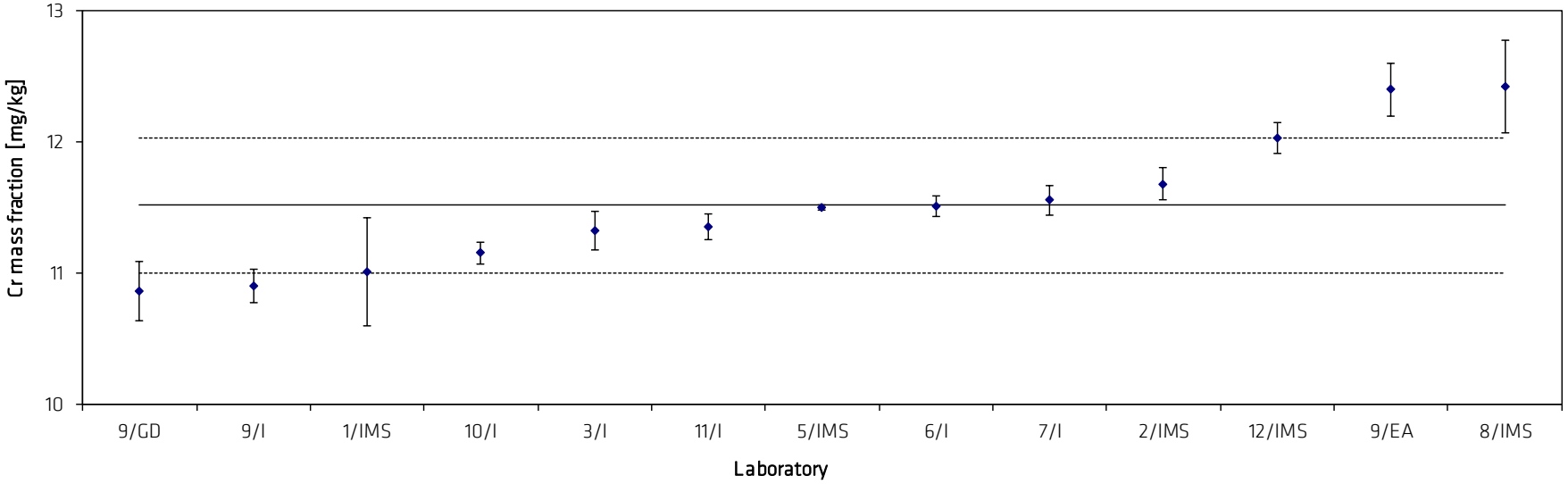


Table 9: Results for Fe in BAM-M386a

Lab./Meth.	7/I	5/IMS	11/I	10/I	9/GD	3/I	2/IMS	6/I	9/I	12/IMS	1/IMS		
M_i [mg/kg]	52.1	57.9	57.8	58.3	58.9	59.6	59.5	59.9	60.1	60.7	61.7		*n*
	52.3	57.3	58.0	58.0	58.3	57.9	58.6	59.9	59.7	60.8	61.9		10
	52.2	57.0	57.7	58.8	59.4	58.5	59.2	59.3	59.1	61.5	61.6		
	52.5	56.7	57.9	58.4	57.9	58.9	59.2	59.5	60.9	61.6	62.1		
	52.0	56.3	57.1	58.4	58.0	59.5	58.7	59.7	58.9	62.2	62.8		
	52.3	57.1	58.0	59.0	58.6	57.8	59.8	59.5	61.2	60.9	62.5		
					59.0				59.7				
					58.5								
M [mg/kg]	**52.2**	**57.0**	**57.8**	**58.5**	**58.6**	**58.7**	**59.2**	**59.6**	**59.9**	**61.3**	**62.1**		**59.3**
s [mg/kg]	0.2	0.5	0.4	0.4	0.5	0.7	0.5	0.2	0.9	0.6	0.5	s_M [mg/kg]	1.54
												$\bar{s}_i$ [mg/kg]	0.54
s_{rel}	0.0030	0.0094	0.0061	0.0062	0.0090	0.0128	0.0078	0.0038	0.0144	0.0095	0.0078		0.0260

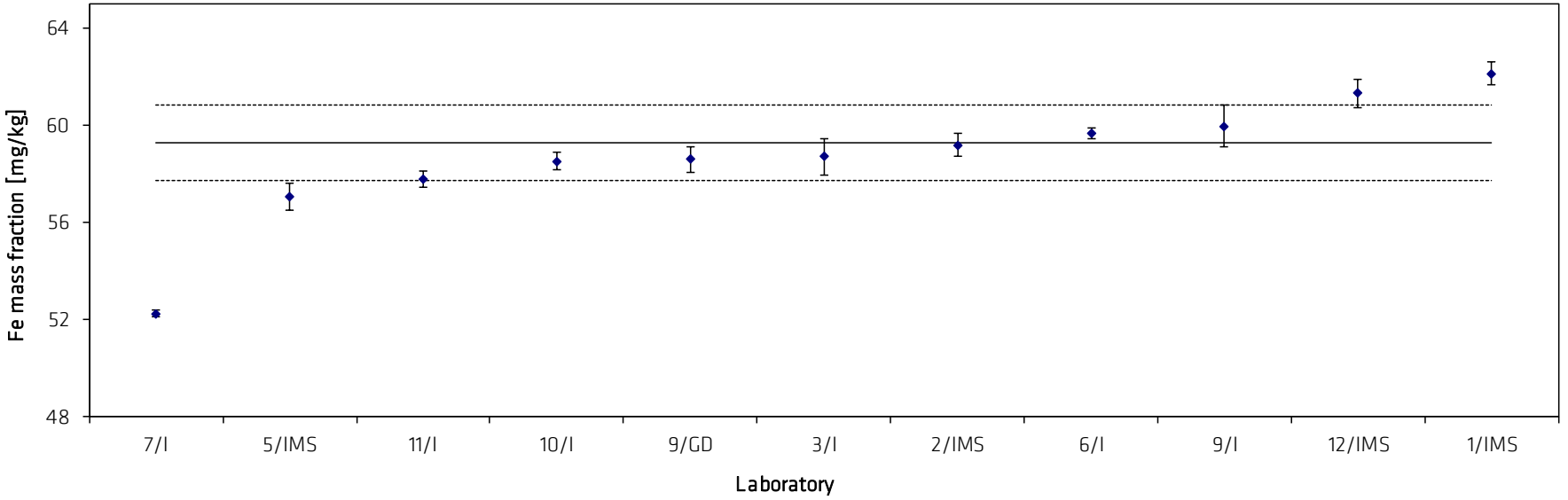


Table 10: Results for Mg in BAM-M386a

Lab./Meth.	12/IMS	11/I	3/I	5/IMS	9/GD	1/IMS	9/I	6/I	10/I	2/IMS	8/IMS	7/I		
M_i [mg/kg]	70.3	73.8	76.1	74.3	77.8	75.4	77.4	77.7	78.3	78.6	83.5	83.9		*n*
	70.8	74.0	75.8	74.6	74.8	76.1	77.3	78.0	77.4	78.8	84.0	84.4		12
	71.3	74.1	73.3	74.4	71.5	76.0	77.5	77.8	77.8	77.9	84.4	84.1		
	70.4	74.3	72.6	74.4	74.2	74.9	76.8	77.4	76.8	74.4	82.1	83.8		
	70.5	73.2	74.4	73.8	71.6	75.6	77.9	77.3	77.6	78.8	83.1	83.7		
	69.1	74.5	72.2	74.1	79.6	75.7	77.2	77.5	77.9	77.7	82.5	84.3		
					73.1		76.2							
					72.1									
***M* [mg/kg]**	**70.4**	**74.0**	**74.1**	**74.3**	**74.3**	**75.6**	**77.2**	**77.6**	**77.6**	**77.7**	**83.3**	**84.0**		**76.7**
s [mg/kg]	0.7	0.4	1.7	0.3	3.0	0.4	0.6	0.3	0.5	1.7	0.9	0.3	s_M [mg/kg]	3.89
													$\bar{s}_i$ [mg/kg]	1.19
s_{rel}	0.0103	0.0060	0.0224	0.0039	0.0403	0.0058	0.0072	0.0037	0.0066	0.0215	0.0105	0.0034		0.0507

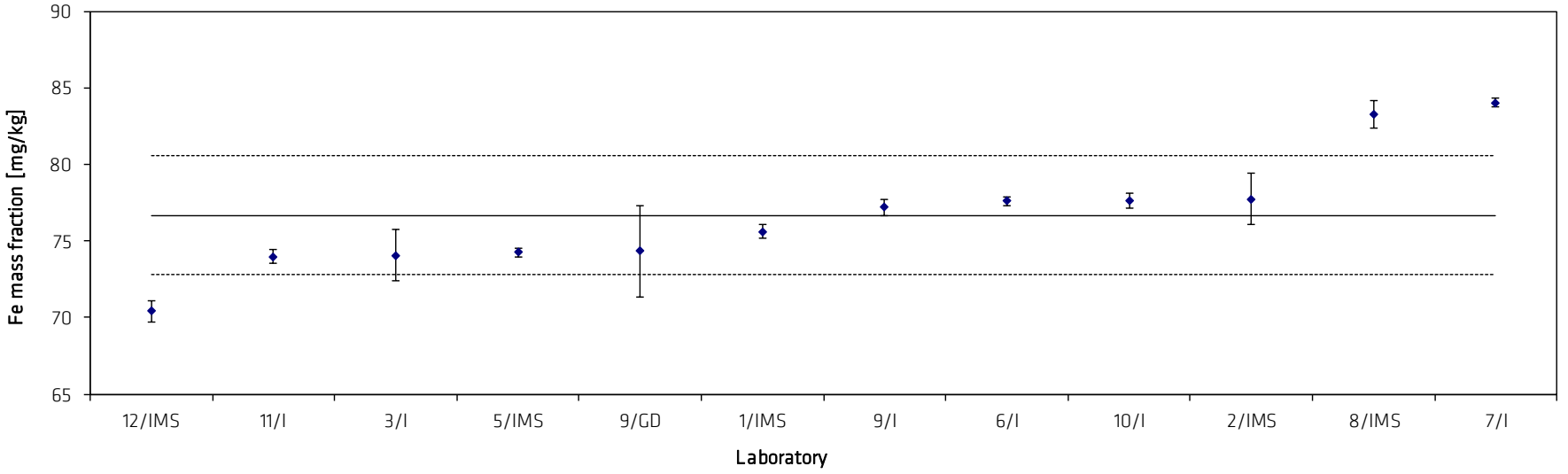


Table 11: Results for Mn in BAM-M386a

Lab./Meth.	3/I	2/IMS	6/I	1/IMS	5/IMS	12/IMS	9/I	11/I	10/I	9/GD	7/I	8/IMS		
M_i [mg/kg]	10.59	10.70	10.73	10.78	10.79	10.87	11.0	11.2	11.5	11.0	11.55	12.3		*n*
	10.30	10.39	10.71	10.53	10.76	10.91	10.9	11.2	11.4	11.1	11.69	12.4		12
	10.38	10.55	10.68	10.56	10.74	11.05	10.8	11.2	11.3	11.1	11.77	12.2		
	10.44	10.54	10.63	10.62	10.74	10.97	11.1	11.3	11.3	11.0	11.65	12.2		
	10.44	10.17	10.65	10.90	10.76	10.97	10.8	11.1	11.6	12.0	11.60	11.7		
	10.31	11.17	10.66	10.97	10.75	10.94	11.1	11.3	11.6	11.8	11.73	11.4		
							10.9			11.9				
										11.8				
***M* [mg/kg]**	**10.4**	**10.6**	**10.7**	**10.7**	**10.8**	**11.0**	**11.0**	**11.2**	**11.5**	**11.5**	**11.7**	**12.0**		**11.1**
s [mg/kg]	0.1	0.3	0.0	0.2	0.0	0.1	0.1	0.1	0.1	0.4	0.1	0.4	s_M [mg/kg]	0.49
													$\bar{s}_i$ [mg/kg]	0.22
s_{rel}	0.0103	0.0320	0.0035	0.0172	0.0017	0.0054	0.0105	0.0066	0.0120	0.0389	0.0070	0.0327		0.0446

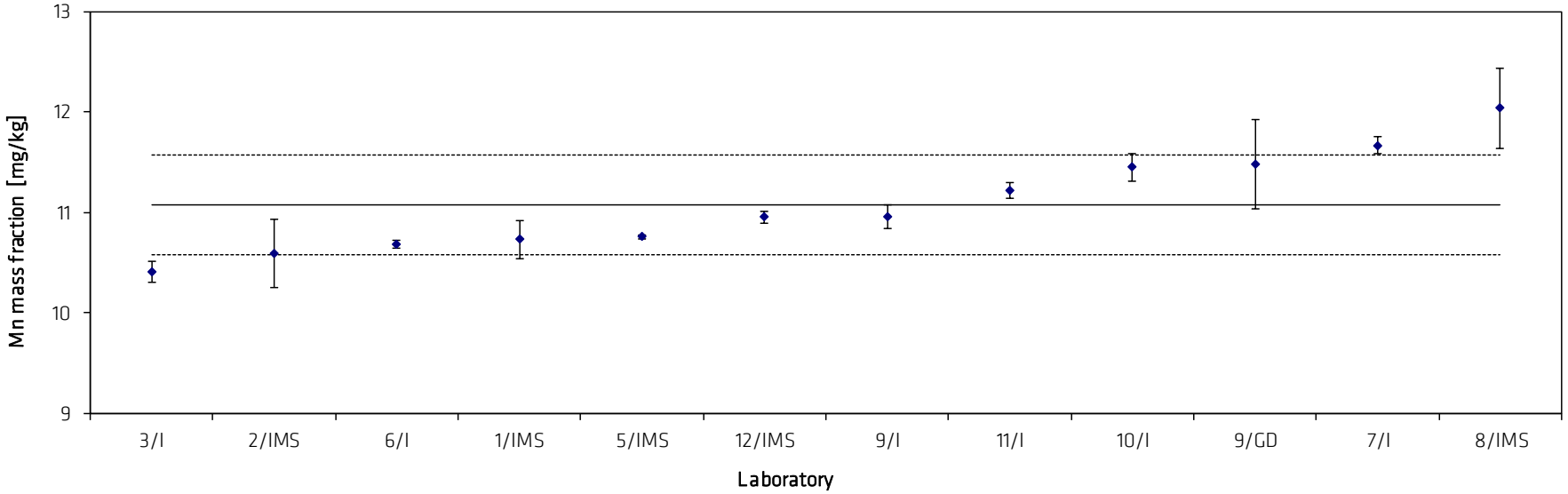


Table 12: Results for Ni in BAM-M386a

Lab./Meth.	7/I	5/IMS	6/I	10/I	2/IMS	3/I	9/GD	9/I	11/I	12/IMS	1/IMS	8/IMS		
M_i [mg/kg]	13.4	20.6	20.6	20.8	20.5	21.9	21.4	21.1	21.5	21.6	21.8	28.0		*n*
	13.3	20.3	20.8	20.6	20.7	20.6	20.5	20.9	21.7	21.7	21.7	26.5		10
	13.3	20.2	20.8	20.6	21.4	20.8	20.7	21.7	21.6	22.0	22.0	24.6		
	13.4	20.4	20.7	20.7	20.3	20.9	20.7	21.3	21.9	22.0	21.8	24.9		
	13.5	20.2	20.5	20.7	20.3	21.0	20.2	21.3	21.5	22.1	22.0			
	13.4	20.5	20.5	20.5	20.9	20.5	21.7	21.6	21.7	21.8	22.0			
							21.0	21.1						
							20.7							
M **[mg/kg]**	**13.4**	**20.4**	**20.6**	**20.7**	**20.7**	**20.9**	**20.9**	**21.3**	**21.6**	**21.9**	**21.9**	**26.0**		**21.1**
s [mg/kg]	0.1	0.2	0.1	0.1	0.4	0.5	0.5	0.3	0.2	0.2	0.1	1.6	s_M [mg/kg]	0.55
													$\bar{s}_i$ [mg/kg]	0.30
s_{rel}	0.0054	0.0080	0.0060	0.0051	0.0210	0.0230	0.0241	0.0126	0.0077	0.0081	0.0059	0.0605		0.0262

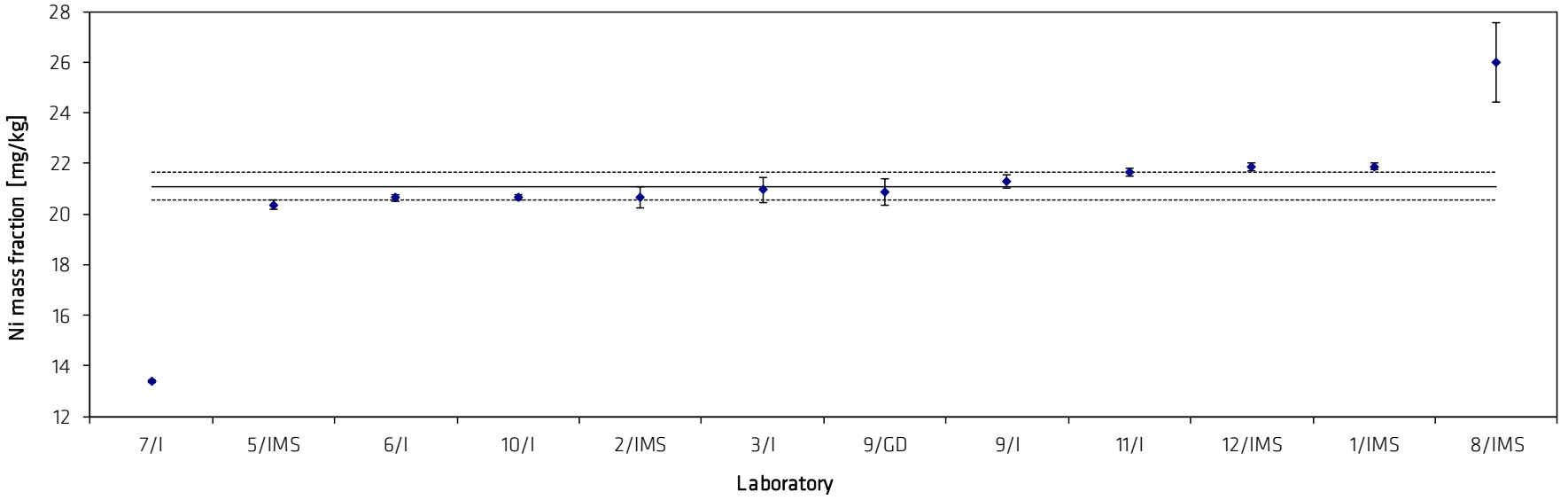


Table 13: Results for P in BAM-M386a

Lab./Meth.	11/I	3/I	9/GD	5/I	2/I	10/I	6/I		
M_i [mg/kg]	5.3	5.9	6.6	6.3	6.6	7.1	7.2		*n*
	5.5	5.7	5.9	7.4	6.5	7.9	8.0		7
	7.8	5.8	5.6	6.1	6.5	7.0	8.0		
	5.1	6.0	6.0	6.5	6.6	7.5	7.3		
	5.3	6.0	5.5	6.9	6.6	8.1	7.7		
	5.3	5.9	6.9	5.0	6.7	7.3	8.2		
			5.9						
			5.9						
M [mg/kg]	**5.7**	**5.9**	**6.0**	**6.4**	**6.6**	**7.5**	**7.7**		**6.5**
s [mg/kg]	1.0	0.1	0.5	0.8	0.1	0.4	0.4	s_M [mg/kg]	0.79
								$\bar{s}_i$ [mg/kg]	0.57
s_{rel}	0.1803	0.0203	0.0776	0.1261	0.0154	0.0564	0.0529		0.1207

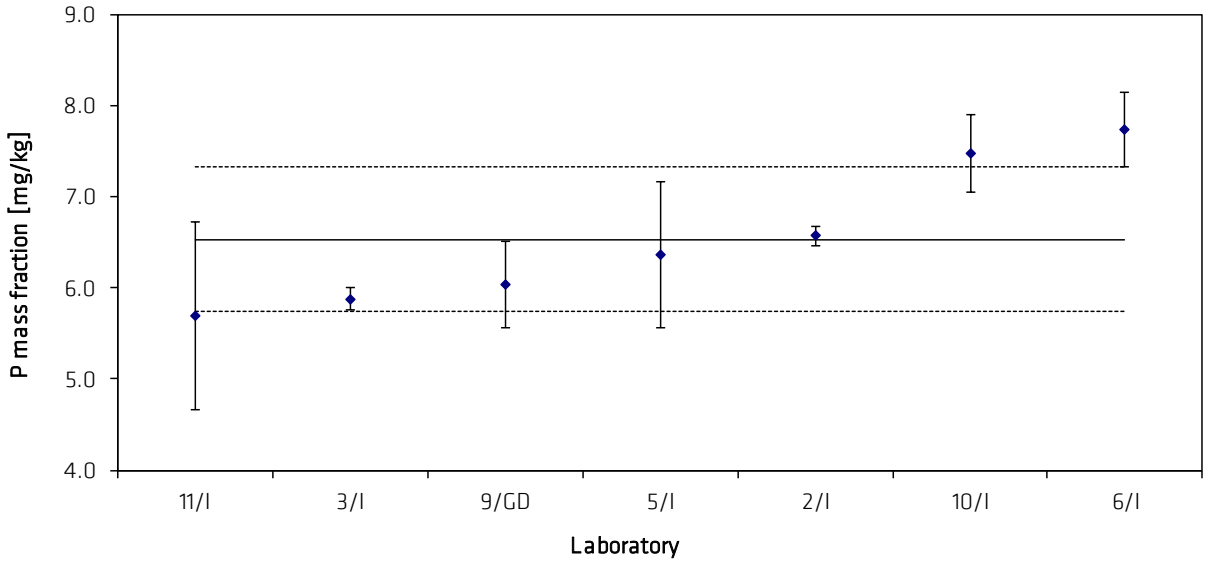


Table 14: Results for Pb in BAM-M386a

Lab./Meth.	7/I	11/I	8/IMS	9/GD	6/I	9/I	1/IMS	12/IMS	2/IMS	3/I	5/IMS	9/EA		
M_i [mg/kg]	17.8	18.9	19.3	17.3	20.3	19.4	19.6	20.4	20.3	20.7	21.0	21.1		*n*
	17.7	18.6	19.1	18.9	20.2	20.6	19.3	20.4	20.8	20.1	20.8	21.0		12
	17.6	18.3	19.3	20.1	20.0	18.4	19.5	20.8	20.7	21.3	20.9	21.4		
	17.9	18.5	16.7	19.4	19.9	20.5	20.6	20.5	20.6	20.4	20.7	21.3		
	17.9	18.0	18.6	20.2	19.1	19.6	20.8	20.5	20.8	20.7	20.9	20.7		
	17.7	18.6		17.5	19.3	20.9	21.0	20.4	20.7	21.9	20.9	21.5		
				19.8		20.2								
				19.4										
M [mg/kg]	**17.7**	**18.5**	**18.6**	**19.1**	**19.8**	**20.0**	**20.1**	**20.5**	**20.7**	**20.8**	**20.9**	**21.2**		**19.8**
s [mg/kg]	0.1	0.3	1.1	1.1	0.5	0.9	0.8	0.1	0.2	0.7	0.1	0.3	s_M [mg/kg]	1.10
													$\bar{s}_i$ [mg/kg]	0.63
s_{rel}	0.0067	0.0179	0.0591	0.0591	0.0247	0.0433	0.0379	0.0064	0.0092	0.0313	0.0047	0.0138		0.0557

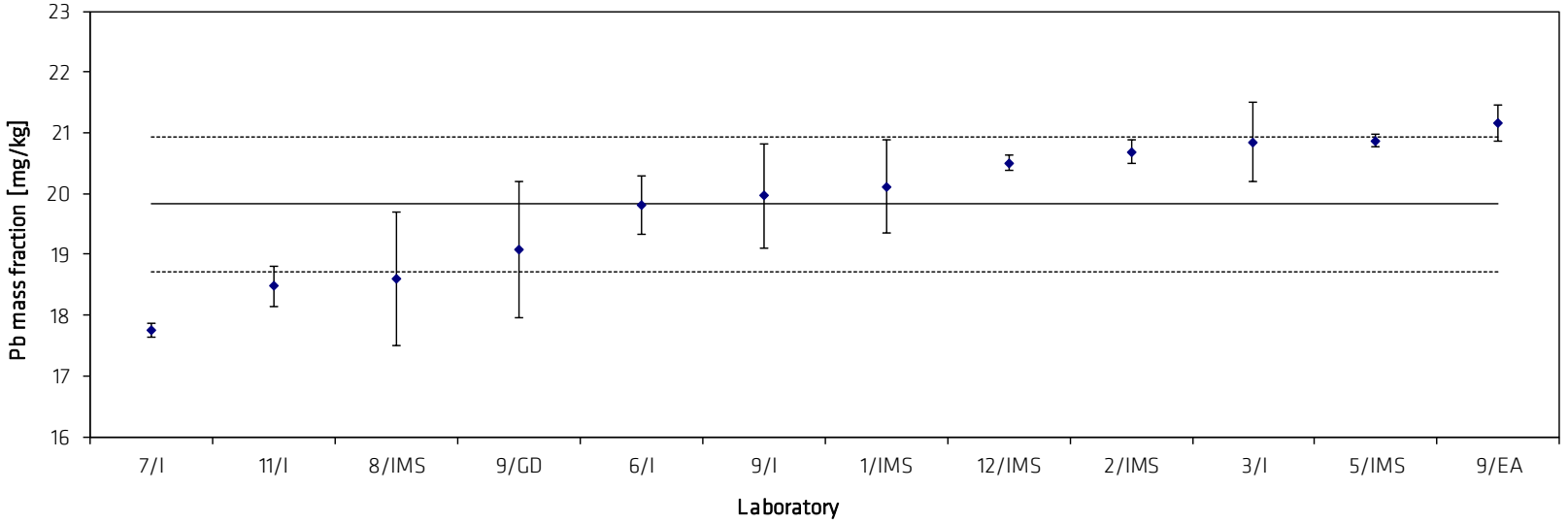


Table 15: Results for S in BAM-M386a

Lab./Meth.	10/I	6/I	3/I	7/V	9/GD	9/V		
M_i [mg/kg]	11.5	14.3	16.1	16.4	17.8	18.9		*n*
	12.8	16.6	15.5	16.4	16.7	18.4		6
	12.4	14.4	15.6	16.8	16.3	18.2		
	12.7	13.9	15.7	16.8	17.0	19.6		
	12.9	14.3	15.7	16.4	15.6	19.5		
	13.9	14.6	15.5	16.8	17.9	18.2		
					16.5			
					16.4			
M [mg/kg]	**12.7**	**14.7**	**15.7**	**16.6**	**16.8**	**18.8**		**15.9**
s [mg/kg]	0.8	1.0	0.2	0.2	0.8	0.6	s_M [mg/kg]	2.07
							$\bar{s}_i$ [mg/kg]	0.66
s_{rel}	0.0612	0.0649	0.0147	0.0132	0.0465	0.0338		0.1305

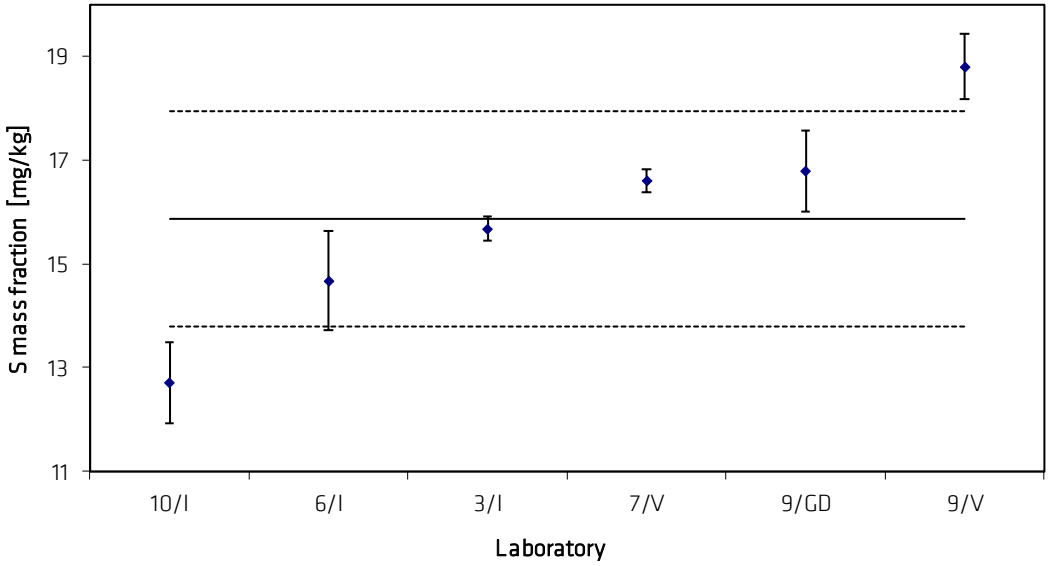


Table 16: Results for Sb in BAM-M386a

Lab./Meth.	6/I	7/I	5/IMS	8/IMS	3/I	1/IMS	9/GD	2/IMS	10/I	12/IMS		
M_i [mg/kg]	16.0	21.4	22.1	25.0	26.1	25.5	24.4	26.6	27.5	27.4		*n*
	15.8	21.7	22.5	24.3	25.2	25.2	25.8	26.8	26.6	27.7		9
	18.1	21.8	20.3	24.4	24.9	25.8	26.4	27.9	27.7	28.0		
	13.8	21.6	22.1	22.7	25.5	25.9	26.1	27.0	27.1	27.9		
	17.4	21.7	22.2		25.4	26.6	27.1	27.3	27.6	28.0		
	18.5	21.9	21.2		24.8	26.2	25.2	27.0	28.2	27.8		
							26.8					
							26.4					
***M* [mg/kg]**	**16.6**	**21.7**	**21.7**	**24.1**	**25.3**	**25.9**	**26.0**	**27.1**	**27.5**	**27.8**		**25.2**
s [mg/kg]	1.8	0.2	0.8	1.0	0.4	0.5	0.9	0.4	0.5	0.2	s_M [mg/kg]	2.3
											$\bar{s}_i$ [mg/kg]	0.6
s_{rel}	0.1060	0.0073	0.0384	0.0408	0.0176	0.0192	0.0334	0.0162	0.0199	0.0076		0.0911

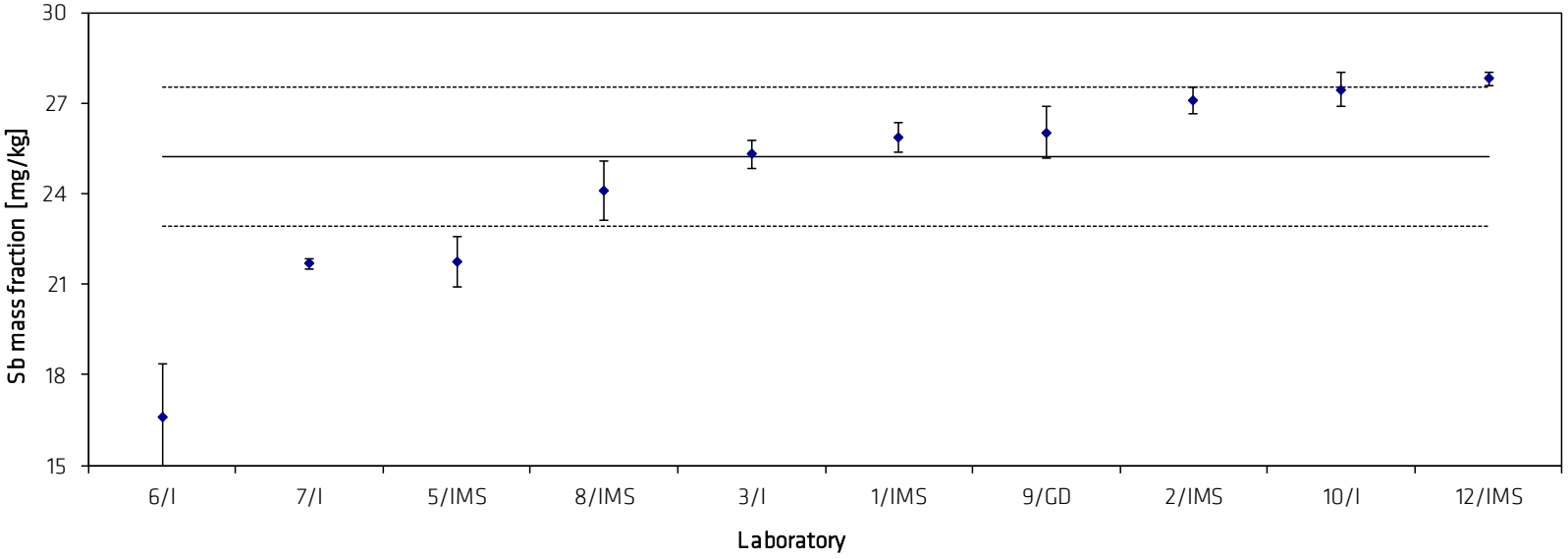


Table 17: Results for Se in BAM-M386a

Lab./Meth.	11/I	10/I	5/IMS	1/IMS	3/I	7/I	12/IMS	9/GD	2/IMS	9/EA		
M_i [mg/kg]	6.03	5.49	8.44	8.57	9.68	9.87	10.31	10.0	10.18	10.09		*n*
	5.28	5.85	7.80	9.12	9.22	9.62	10.68	10.1	10.16	10.25		8
	5.62	5.98	8.45	8.88	9.38	9.70	10.28	10.0	10.21	10.09		
	5.95	6.16	8.21	9.05	9.18	9.86	9.69	10.3	10.35	11.19		
	5.37	6.20	7.35	8.87	9.41	9.94	9.41	10.6	10.80	10.49		
	5.98	7.19	7.23	9.47	9.14	9.69	10.64	10.3	10.95	11.34		
								10.6				
								10.5				
M [mg/kg]	**5.7**	**6.1**	**7.9**	**9.0**	**9.3**	**9.8**	**10.2**	**10.3**	**10.4**	**10.6**		**9.7**
s [mg/kg]	0.3	0.6	0.5	0.3	0.2	0.1	0.5	0.2	0.3	0.6	s_M [mg/kg]	0.91
											$\bar{s}_i$ [mg/kg]	0.39
s_{rel}	0.0577	0.0932	0.0679	0.0335	0.0215	0.0129	0.0507	0.0229	0.0331	0.0526		0.0934

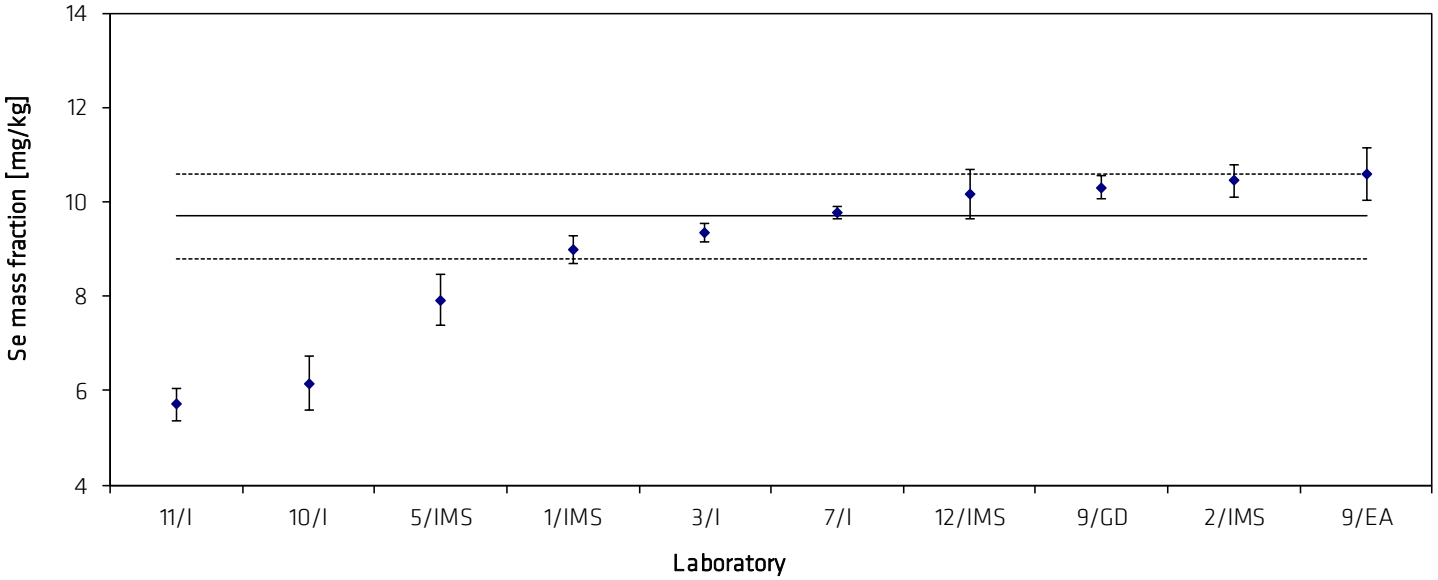


Table 18: Results for Si in BAM-M386a

Lab./Meth.	5/I	9/GD	3/I	10/I		
M_i [mg/kg]	9.73	11.2	13.1	14.7		*n*
	9.73	10.7	12.9	15.1		4
	8.88	10.6	12.6	15.3		
	9.58	10.7	11.7	14.2		
	9.42	10.3	12.7	15.1		
	9.02	11.1	12.6	14.6		
		10.8				
		10.4				
M [mg/kg]	**9.4**	**10.7**	**12.6**	**14.8**		**11.9**
s [mg/kg]	0.4	0.3	0.5	0.4	s_M [mg/kg]	2.36
					$\bar{s}_i$ [mg/kg]	0.39
s_{rel}	0.0388	0.0273	0.0386	0.0275		0.1989

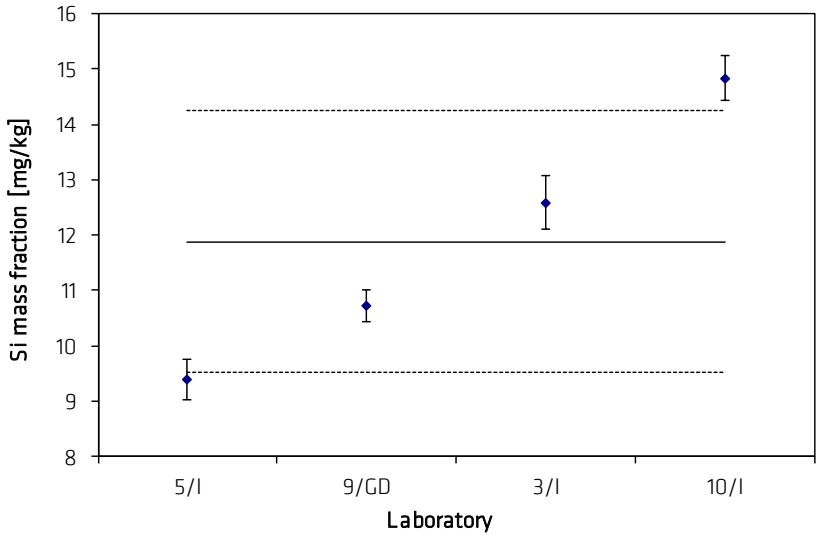


Table 19: Results for Sn in BAM-M386a

Lab./Meth.	7/I	6/I	3/I	5/IMS	1/IMS	9/GD	8/IMS	2/IMS	10/I	12/IMS	11/I		
M_i [mg/kg]	19.4	19.4	21.6	21.5	21.5	20.5	22.3	21.9	22.6	22.7	32.0		*n*
	19.3	20.3	21.0	21.6	21.3	21.7	21.8	21.8	22.8	22.8	31.6		10
	19.2	20.8	21.2	21.4	21.3	22.5	22.3	22.3	22.6	23.1	31.6		
	19.5	20.5	21.2	21.5	21.5	22.0	22.3	22.0	22.5	23.0	31.3		
	19.4	20.9	21.3	21.5	22.0	22.9	21.6	22.2	22.8	23.1	31.4		
	19.6	21.2	21.1	21.5	22.1	20.8	21.6	22.2	22.6	23.0	31.7		
						22.4							
						22.3							
***M* [mg/kg]**	**19.4**	**20.5**	**21.2**	**21.5**	**21.6**	**21.9**	**22.0**	**22.1**	**22.7**	**22.9**	**31.6**		**21.6**
s [mg/kg]	0.2	0.6	0.2	0.1	0.4	0.8	0.4	0.2	0.1	0.2	0.2	s_M [mg/kg]	1.03
												$\bar{s}_i$ [mg/kg]	0.39
s_{rel}	0.0086	0.0311	0.0100	0.0039	0.0168	0.0383	0.0161	0.0086	0.0054	0.0077	0.0078		0.0477

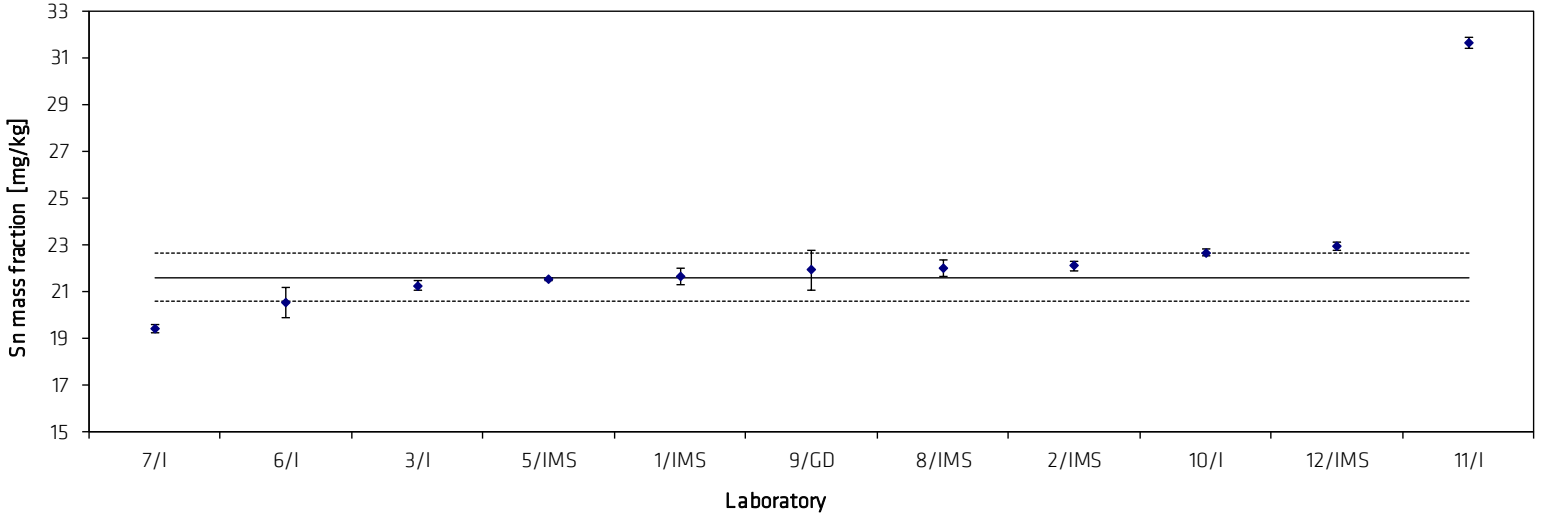


Table 20: Results for Te in BAM-M386a

Lab./Meth.	8/IMS	9/GD	3/I	12/IMS	5/IMS	7/I	10/I	1/IMS	6/I	2/IMS		
M_i [mg/kg]	29.5	29.5	30.6	30.9	30.6	31.1	32.9	31.3	23.4	32.2		*n*
	28.6	30.2	31.0	30.8	31.0	30.9	31.4	31.5	26.0	32.8		9
	28.6	30.5	29.5	31.2	30.3	31.2	35.0	31.5	37.7	34.3		
	31.9	30.5	29.0	30.9	30.4	31.4	30.2	31.2	31.3	32.5		
	31.8	31.8	31.1	31.0	31.0	31.0	27.2	31.3	34.8	34.5		
	31.6	30.2	32.3	30.6	32.8	31.1	30.1	31.0	43.2	33.0		
		31.7										
		31.1										
M **[mg/kg]**	**30.3**	**30.5**	**30.6**	**30.9**	**31.0**	**31.1**	**31.1**	**31.3**	**32.7**	**33.2**		**31.1**
s [mg/kg]	1.6	0.8	1.2	0.2	0.9	0.2	2.7	0.2	7.4	1.0	s_M [mg/kg]	0.9
											$\bar{s}_i$ [mg/kg]	1.2
s_{rel}	0.0530	0.0256	0.0389	0.0069	0.0299	0.0063	0.0857	0.0060	0.2263	0.0287		0.0274

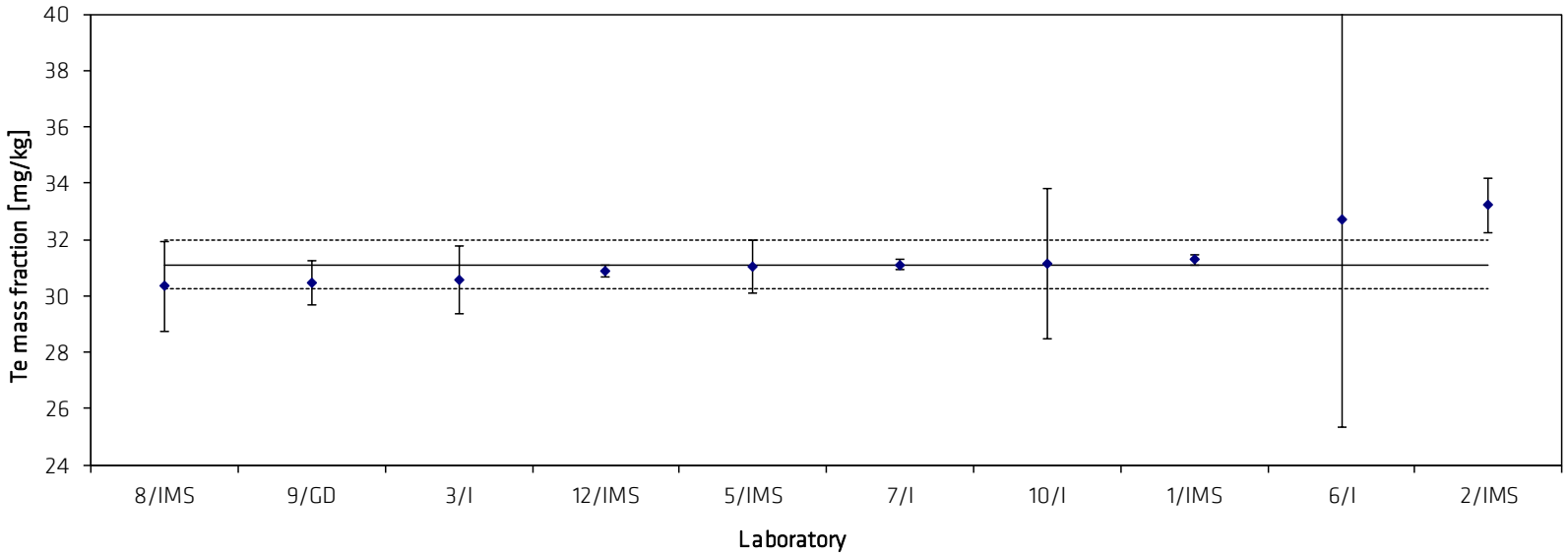


Table 21: Results for Ti in BAM-M386a

Lab./Meth.	7/I	9/GD	8/IMS	11/I	12/IMS	6/I	1/IMS	3/I	10/I	9/I		
M_i [mg/kg]	28.0	29.2	33.5	33.8	34.0	34.5	34.9	36.6	36.4	37.5		*n*
	28.3	32.1	32.4	34.6	34.2	34.7	33.8	35.0	36.5	36.7		9
	28.2	33.5	34.1	34.6	34.9	34.8	33.8	35.1	36.5	36.5		
	28.2	31.9	32.0	34.3	34.3	35.0	35.1	35.8	36.4	37.1		
	28.4	35.1	33.5	34.0	34.7	35.1	36.4	35.5	36.4	36.7		
	27.9	29.6	31.6	34.1	34.4	35.1	35.7		36.1	37.9		
		34.2										
		32.9										
***M* [mg/kg]**	**28.2**	**32.3**	**32.9**	**34.2**	**34.4**	**34.9**	**35.0**	**35.6**	**36.4**	**37.1**		**34.7**
s [mg/kg]	0.2	2.1	1.0	0.3	0.3	0.2	1.0	0.6	0.1	0.6	s_M [mg/kg]	1.53
											$\bar{s}_i$ [mg/kg]	0.91
s_{rel}	0.0073	0.0641	0.0301	0.0099	0.0098	0.0071	0.0297	0.0181	0.0040	0.0152		0.0441

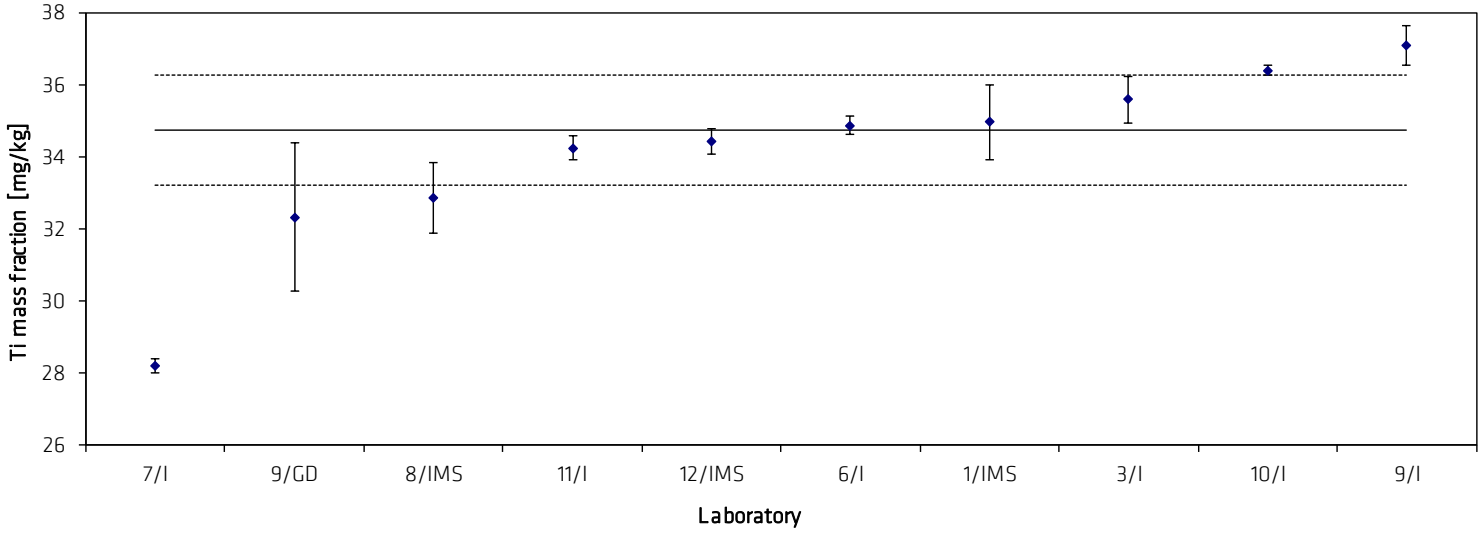
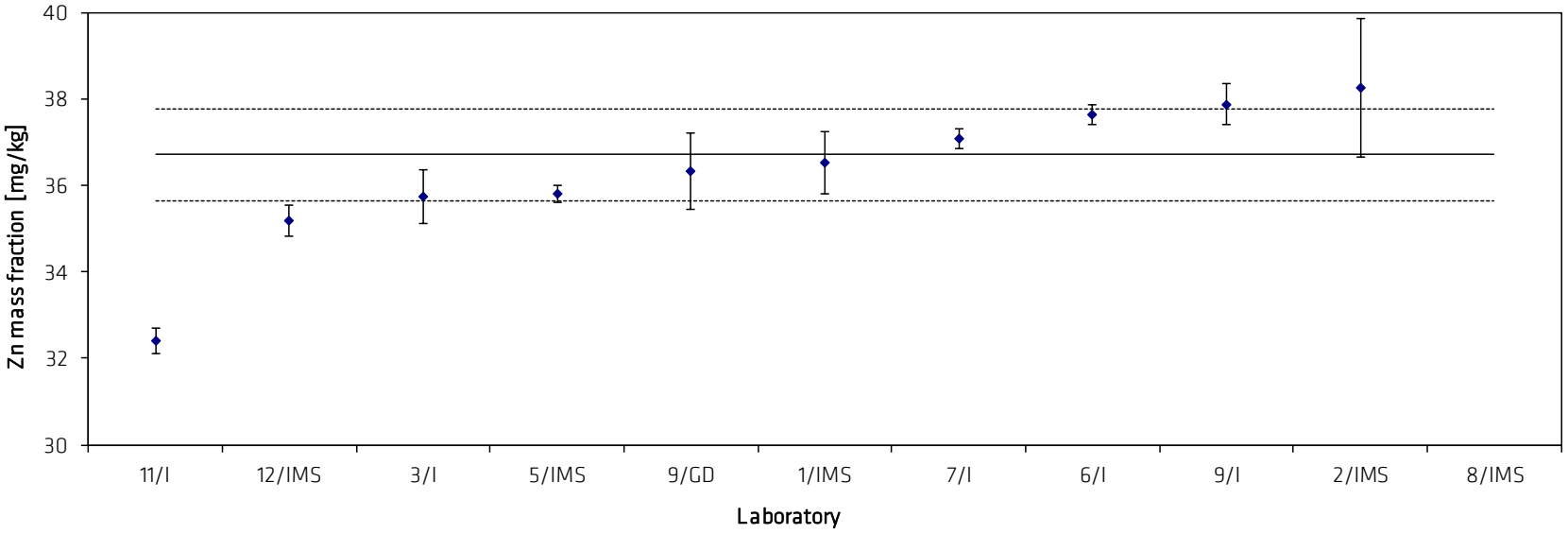


Table 22: Results for Zn in BAM-M386a

Lab./Meth.	11/I	12/IMS	3/I	5/IMS	9/GD	1/IMS	7/I	6/I	9/I	2/IMS	8/IMS		
M_i [mg/kg]	33	35.2	37.0	36.1	37.6	35.9	37.5	37.8	38.1	38.8	61.1		*n*
	32	35.3	35.6	35.8	37.3	36.3	37.0	37.6	37.9	37.1	58.7		9
	32	35.7	35.5	35.7	36.2	35.9	37.2	37.4	37.4	38.7	56.4		
	32	35.3	35.3	35.8	36.6	36.5	37.0	37.3	37.8	39.4	52.2		
	33	35.2	35.5	36.0	35.3	36.9	36.9	37.9	37.4	35.6			
	32	34.6	35.4	35.6	36.6	37.8	36.8	37.8	38.6	39.9			
					35.5								
					35.4								
M **[mg/kg]**	**32.4**	**35.2**	**35.7**	**35.8**	**36.3**	**36.5**	**37.1**	**37.6**	**37.9**	**38.3**	**57.1**		**36.7**
s [mg/kg]	0.3	0.4	0.6	0.2	0.9	0.7	0.2	0.2	0.5	1.6	3.8	s_M [mg/kg]	1.1
												$\bar{s}_i$ [mg/kg]	0.7
s_{rel}	0.0087	0.0102	0.0175	0.0054	0.0244	0.0196	0.0062	0.0063	0.0125	0.0417	0.0663		0.0288



The data was statistically evaluated to detect outlying values (Grubbs, Nalimov, Dixon, Cochran). The Cochran-test was performed only once. The following results were obtained:

Tab. 23: Outcome of statistical tests on the results obtained for Ag

	1st run	2nd run
Number of data sets	11	10
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 11	Lab. 12
Nalimov (α = 0.01)	Lab. 11	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	Lab. 1	Lab. 1
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outlier (Lab. 11, 1st run) was removed.

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

	1st run	2nd run
Number of data sets	10	9
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 10	Lab. 7
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	Distribution: normal	Distribution: normal

The outlier (Lab. 10) was removed.

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

	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. 5	Lab. 2
Dixon (α = 0.01)	Lab. 5	---
Nalimov (α = 0.05)	Lab. 5	Lab. 2
Nalimov (α = 0.01)	Lab. 5	Lab. 2
Grubbs (α = 0.05)	Lab. 5	Lab. 2
Grubbs (α = 0.01)	Lab. 5	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	Lab. 9/EA	Lab. 9/EA
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers (Lab. 5, 1st run) was removed.

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

	1st run	2nd run
Number of data sets	9	7
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 7	---
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	Labs. 7 and 8	---
Grubbs Pair (α = 0.01)	---	---
Cochran	Lab. 9/EA	Lab. 9/EA
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers (Labs. 7 and 8) were removed.

Tab. 27: Outcome of statistical tests on the results obtained for Cr and Cd

	Cr	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)	---	---
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	Lab. 1	Lab. 10
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers were not removed.

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

	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. 7	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 7	Lab. 9/EA
Nalimov (α = 0.01)	Lab. 7	---
Grubbs (α = 0.05)	Lab. 7	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	Lab. 9/EA	Lab. 9/EA
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outlier (Lab. 7, 1st run) was removed.

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

	1st run	2nd run
Number of data sets	11	10
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 7	---
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	Distribution: normal	Distribution: normal

The outlier (Lab. 7, 1st run) was removed.

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

	Mg	Mn
Number of data sets	12	12
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 7	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 7	Lab. 8
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	Labs. 7 and 8	---
Grubbs Pair (α = 0.01)	---	---
Cochran	Lab. 9/GD	Lab. 9/GD
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers were not removed.

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

	1st run	2nd run
Number of data sets	12	10
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Labs. 7 and 8	---
Dixon (α = 0.01)	Labs. 7 and 8	---
Nalimov (α = 0.05)	Labs. 7 and 8	---
Nalimov (α = 0.01)	Lab. 7	---
Grubbs (α = 0.05)	Lab. 7	---
Grubbs (α = 0.01)	Lab. 7	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	Lab. 8	---
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers (Labs. 7 and 8) were removed.

Tab. 32: Outcome of statistical tests on the results obtained for P and Pb

	P	Pb
Number of data sets	7	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. 7
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	Lab. 11	---
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers were not removed.

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

	1st run	2nd run
Number of data sets	10	8
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 11	Lab. 5
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	Labs. 11 and 10	---
Grubbs Pair (α = 0.01)	---	---
Cochran	---	---
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers (Labs. 10 and 11) were removed.

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

	1st run	2nd run
Number of data sets	10	9
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 6	---
Nalimov (α = 0.01)	Lab. 6	---
Grubbs (α = 0.05)	Lab. 6	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	Lab. 6	---
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outlier (Lab. 6) was removed.

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

	S	Si
Number of data sets	6	4
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. 10	---
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	---	---
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outlier was not removed.

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

	1st run	2nd run
Number of data sets	11	10
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 11	---
Dixon (α = 0.01)	Lab. 11	---
Nalimov (α = 0.05)	Lab. 11	Lab. 7
Nalimov (α = 0.01)	Lab. 11	---
Grubbs (α = 0.05)	Lab. 11	---
Grubbs (α = 0.01)	Lab. 11	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	Lab. 9/GD	Lab. 9/GD
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outlier (Lab. 11, 1st run) was removed.

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

	1st run	2nd run
Number of data sets	11	10
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 2	Lab. 2
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 2	Lab. 2
Nalimov (α = 0.01)	Lab. 2	Lab. 2
Grubbs (α = 0.05)	Lab. 2	Lab. 2
Grubbs (α = 0.01)	Lab. 2	Lab. 2
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	Lab. 6	Lab. 10
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outlier (Lab. 6, 1st run) was removed.

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

	1st run	2nd run
Number of data sets	10	9
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 7	---
Nalimov (α = 0.01)	Lab. 7	---
Grubbs (α = 0.05)	Lab. 7	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran	Lab. 9/GD	Lab. 9/GD
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outlier (Lab. 7) was removed.

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

	1st run	2nd run	3rd run
Number of data sets	11	10	10
Scheffe's test (data compatible?)	yes	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 8	Lab. 11	---
Dixon (α = 0.01)	Lab. 8	---	---
Nalimov (α = 0.05)	Lab. 8	Lab. 11	---
Nalimov (α = 0.01)	Lab. 8	Lab. 11	---
Grubbs (α = 0.05)	Lab. 8	Lab. 11	---
Grubbs (α = 0.01)	Lab. 8	---	---
Grubbs Pair (α = 0.05)	---	---	---
Grubbs Pair (α = 0.01)	---	---	---
Cochran	Lab. 8	Lab. 2	Lab. 2
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal	Distribution: normal

The outliers (Lab. 8, 1st run, Lab. 11, 2nd run) 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		Length	Area	
	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg						
Ag	44.2	10	1.9800	0.6261	0.0704	0.3031	0.6992	1.3984		0.1592	0.6857	
Al	26.9	9	1.3600	0.4533	0.9883	0.3412	1.1396	2.2792		3.6739	1.2685	*
As	20.8	11	1.2100	0.3648	0.1069	0.1205	0.3988	0.7977		0.5141	0.5795	*
Bi	9.52	7	0.3586	0.1355	0.0375	0.1529	0.2077	0.4154		0.3938	1.6058	
Cd	5.39	13	0.1687	0.0468	0.0440	0.1954	0.2057	0.4114		0.8160	3.6259	
Co	4.90	12	0.2477	0.0715	0.0358	0.1011	0.1289	0.2578		0.7308	2.0633	
Cr	11.50	13	0.5111	0.1418	0.3620	0.1699	0.4243	0.8485		3.1476	1.4776	
Fe	59.3	10	1.5413	0.4874	0.2115	0.3012	0.6108	1.2215		0.3567	0.5080	
Mg	76.7	12	3.8900	1.1229	0.6124	0.4598	1.3592	2.7184		0.7984	0.5994	
Mn	11.10	12	0.4939	0.1426	0.1856	0.1117	0.2593	0.5186		1.6718	1.0066	
Ni	21.1	10	0.5514	0.1744	0.4691	0.2206	0.5469	1.0938		2.2230	1.0455	
P	6.5	7	0.7883	0.2979	0.0744	0.1654	0.3488	0.6976		1.1443	2.5444	
Pb	19.8	12	1.1046	0.3189	0.3020	0.3051	0.5348	1.0696		1.5254	1.5410	
S	15.9	6	2.0721	0.8459	0.1394	0.1888	0.8779	1.7558		0.8770	1.1873	
Sb	25.2	9	2.2968	0.7656	0.1504	0.4429	0.8972	1.7943		0.5966	1.7574	
Se	9.7	8	0.9100	0.3217	0.2313	0.0995	0.4085	0.8171		2.3844	1.0257	*
Si	11.90	4	2.3639	1.1819	0.2474	0.9234	1.5202	3.8004		2.0790	7.7601	
Sn	21.6	10	1.0283	0.3252	0.2327	0.1493	0.4268	0.8537		1.0774	0.6911	*
Te	31.1	9	0.8510	0.2837	0.1868	0.5235	0.6241	1.2481		0.6007	1.6834	
Ti	34.7	9	1.5323	0.5108	0.2161	0.4181	0.6945	1.3891		0.6228	1.2048	
Zn	36.7	9	1.0584	0.3528	0.2589	0.5882	0.7331	1.4663		0.7054	1.6028	
										*ext. Laboratory		

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. 41 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 aluminium.

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	44.2	2.0	10	43.5	2.1	5
Al	26.9	1.4	9	23.2	1.7	4
As	20.8	1.3	11	19.9	1.3	5
Bi	9.5	0.4	7	9.0	0.6	5
Cd	5.39	0.17	13	5.7	0.6	5
Co	4.90	0.25	12	4.4	0.3	5
Cr	11.5	0.6	13	11.6	0.9	5
Fe	59.3	1.6	10	58.3	2.4	5
Mg	76.7	3.9	12	69.3	4.0	5
Mn	11.1	0.5	12	10.9	1.3	5
Ni	21.1	0.6	10	21.5	0.9	5
P	6.5	0.8	7	6.2	0.5	5
Pb	19.8	1.1	12	17.0	3.1	5
S	15.9	2.1	6	16.7	0.9	5
Sb	25.2	2.3	9	24.2	1.4	5
Se	9.7	1.0	8	10.2	1.7	5
Sn	21.6	1.1	10	23.2	3.4	5
Te	31.1	0.9	9	31.1	1.9	5
Ti	34.7	1.6	9	32.4	1.2	4
Zn	36.7	1.1	9	35.6	2.4	5
Si	*11.9*	*2.4*	*4*	*12.7*	*1.7*	5

6. Instructions for users and stability statement

The certified reference material BAM-M386a 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. Metrological Traceability

To ensure traceability of the certified mass fractions to the SI (Système International d'Unités) calibration was performed using standard solutions prepared from pure metals or stoichiometric compounds or traceable commercial calibration solutions.

8. References

[1] DIN EN ISO 17034, General requirements for the competence of reference material producers, 2017

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

[3] ISO Guide 35, Reference materials - Guidance for characterization and assessment of homogeneity and stability, 2017

[4] DIN 1333:1992-02 Zahlenangaben

9. Information on and purchase of the CRM

Certified reference material BAM-M386a 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-M386a:

	1	2	3	4	5
3ka1	0.00422	0.00420	0.00427	0.00427	0.00425
3ka2	0.00423	0.00422	0.00433	0.00429	0.00424
3ka3	0.00422	0.00420	0.00425	0.00431	0.00424
3ka4	0.00422	0.00426	0.00425	0.00430	0.00423
3ke1	0.00420	0.00423	0.00429	0.00428	0.00422
3ke2	0.00421	0.00413	0.00423	0.00425	0.00425
3ke4	0.00425	0.00423	0.00425	0.00428	0.00441
3ke4	0.00421	0.00426	0.00430	0.00425	0.00422
3sa1	0.00429	0.00422	0.00426	0.00429	0.00423
3sa2	0.00422	0.00425	0.00425	0.00428	0.00419
3sa3	0.00424	0.00424	0.00430	0.00431	0.00426
3sa4	0.00419	0.00419	0.00428	0.00421	0.00419
3se1	0.00420	0.00423	0.00412	0.00427	0.00424
3Se2	0.00423	0.00420	0.00424	0.00432	0.00422
3se3	0.00424	0.00429	0.00425	0.00426	0.00424
3se4	0.00419	0.00422	0.00429	0.00428	0.00426
4ka1	0.00423	0.00421	0.00426	0.00428	0.00426
4ka2	0.00422	0.00424	0.00434	0.00428	0.00426
4ka3	0.00423	0.00425	0.00424	0.00426	0.00422
4ka4	0.00423	0.00420	0.00426	0.00431	0.00418
4ke1	0.00422	0.00424	0.00429	0.00426	0.00415
4ke2	0.00420	0.00423	0.00426	0.00428	0.00424
4ke3	0.00419	0.00426	0.00429	0.00425	0.00423
4KE4	0.00424	0.00429	0.00428	0.00430	0.00420
4sa1	0.00422	0.00422	0.00430	0.00425	0.00429
4sa2	0.00427	0.00426	0.00428	0.00425	0.00424
4sa3	0.00418	0.00425	0.00422	0.00425	0.00422
4sa4	0.00423	0.00425	0.00423	0.00430	0.00426
4se1	0.00419	0.00422	0.00410	0.00432	0.00412
4se2	0.00425	0.00426	0.00427	0.00436	0.00422
4se3	0.00419	0.00427	0.00425	0.00430	0.00425
4Se4	0.00417	0.00421	0.00429	0.00425	0.00424

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	6.06964E-08	31	1.95795E-09	1.07248804	0.3799224	1.5410648
Within groups	2.33678E-07	128	1.82561E-09			
Total	2.94375E-07	159				
within-sd	4.27272E-05					
effective n	5.00					
s_bb	5.14461E-06					
s_bb_min	6.75576E-06					
u_bb	6.75576E-06					
u_bb(rel.)	0.159175853					

Al in BAM-M386a:

	1	2	3	4	5
3ka1	0.00281	0.00208	0.00302	0.00227	0.00347
3ka2	0.00254	0.00272	0.00278	0.00242	0.00349
3ka3	0.00270	0.00232	0.00260	0.00200	0.00351
3ka4	0.00292	0.00204	0.00258	0.00200	0.00384
3ke1	0.00324	0.00222	0.00274	0.00422	0.00315
3ke2	0.00317	0.00217	0.00296	0.00164	0.00348
3ke4	0.00259	0.00219	0.00259	0.00202	0.00348
3ke4	0.00294	0.00209	0.00265	0.00249	0.00386
3sa1	0.00341	0.00222	0.00287	0.00202	0.00306
3sa2	0.00254	0.00198	0.00284	0.00202	0.00377
3sa3	0.00284	0.00208	0.00245	0.00224	0.00364
3sa4	0.00268	0.00207	0.00262	0.00227	0.00362
3se1	0.00300	0.00214	0.00288	0.00261	0.00357
3Se2	0.00334	0.00251	0.00256	0.00197	0.00369
3se3	0.00258	0.00177	0.00276	0.00200	0.00368
3se4	0.00265	0.00218	0.00255	0.00275	0.00321
4ka1	0.00288	0.00258	0.00252	0.00188	0.00377
4ka2	0.00313	0.00244	0.00246	0.00258	0.00366
4ka3	0.00265	0.00258	0.00262	0.00194	0.00416
4ka4	0.00307	0.00272	0.00267	0.00264	0.00401
4ke1	0.00287	0.00221	0.00247	0.00220	0.00420
4ke2	0.00254	0.00208	0.00256	0.00197	0.00353
4ke3	0.00275	0.00201	0.00257	0.00251	0.00408
4KE4	0.00339	0.00199	0.00295	0.00228	0.00386
4sa1	0.00293	0.00244	0.00290	0.00256	0.00340
4sa2	0.00248	0.00212	0.00213	0.00238	0.00359
4sa3	0.00310	0.00200	0.00333	0.00225	0.00328
4sa4	0.00253	0.00213	0.00336	0.00218	0.00347
4se1	0.00286	0.00213	0.00285	0.00207	0.00334
4se2	0.00280	0.00220	0.00295	0.00268	0.00368
4se3	0.00300	0.00220	0.00246	0.00229	0.00337
4Se4	0.00351	0.00210	0.00263	0.00196	0.00331

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.62493E-06	31	8.46752E-08	0.208848246	0.999998	1.5410648
Within groups	5.18962E-05	128	4.05439E-07			
Total	5.45211E-05	159				
within-sd	0.000636741					
effective n	5.00					
s_bb	0					
s_bb_min	0.000100678					
u_bb	0.000100678					
u_bb(rel.)	3.673919703					

As in BAM-M386a:

	1	2	3	4	5
3ka1	0.00213	0.00212	0.00212	0.00218	0.00194
3ka2	0.00217	0.00210	0.00214	0.00210	0.00198
3ka3	0.00212	0.00214	0.00213	0.00211	0.00205
3ka4	0.00210	0.00202	0.00207	0.00213	0.00206
3ke1	0.00208	0.00219	0.00212	0.00216	0.00205
3ke2	0.00204	0.00210	0.00209	0.00216	0.00202
3ke4	0.00211	0.00211	0.00209	0.00209	0.00203
3ke4	0.00211	0.00205	0.00212	0.00218	0.00198
3sa1	0.00215	0.00202	0.00221	0.00214	0.00202
3sa2	0.00211	0.00201	0.00215	0.00212	0.00211
3sa3	0.00218	0.00214	0.00207	0.00211	0.00202
3sa4	0.00209	0.00204	0.00213	0.00217	0.00207
3se1	0.00214	0.00209	0.00210	0.00227	0.00203
3Se2	0.00208	0.00220	0.00210	0.00214	0.00200
3se3	0.00215	0.00204	0.00211	0.00208	0.00208
3se4	0.00210	0.00207	0.00216	0.00223	0.00197
4ka1	0.00209	0.00209	0.00211	0.00208	0.00207
4ka2	0.00210	0.00215	0.00213	0.00221	0.00208
4ka3	0.00217	0.00210	0.00210	0.00210	0.00200
4ka4	0.00210	0.00216	0.00209	0.00214	0.00205
4ke1	0.00211	0.00215	0.00216	0.00209	0.00203
4ke2	0.00213	0.00201	0.00211	0.00209	0.00200
4ke3	0.00207	0.00203	0.00210	0.00211	0.00202
4KE4	0.00212	0.00211	0.00208	0.00207	0.00206
4sa1	0.00211	0.00201	0.00216	0.00220	0.00199
4sa2	0.00215	0.00210	0.00209	0.00214	0.00199
4sa3	0.00211	0.00199	0.00221	0.00214	0.00201
4sa4	0.00206	0.00207	0.00221	0.00217	0.00190
4se1	0.00214	0.00203	0.00201	0.00211	0.00194
4se2	0.00207	0.00205	0.00223	0.00223	0.00201
4se3	0.00219	0.00214	0.00211	0.00215	0.00212
4Se4	0.00215	0.00222	0.00208	0.00214	0.00200

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	5.80282E-08	31	1.87188E-09	0.40231429	0.9978229	1.5410648
Within groups	5.95555E-07	128	4.65277E-09			
Total	6.53583E-07	159				
within-sd	6.82112E-05					
effective n	5.00					
s_bb	0					
s_bb_min	1.07851E-05					
u_bb	1.07851E-05					
u_bb(rel.)	0.514132126					

Bi in BAM-M386a:

	1	2	3	4	5
3ka1	0.000958	0.000977	0.001006	0.000995	0.000957
3ka2	0.000959	0.001040	0.001034	0.001023	0.000999
3ka3	0.001000	0.000996	0.001004	0.000991	0.000968
3ka4	0.000985	0.000965	0.000969	0.001007	0.000950
3ke1	0.001011	0.000989	0.001003	0.000992	0.000960
3ke2	0.001004	0.000991	0.001003	0.000989	0.000967
3ke4	0.000993	0.000967	0.000981	0.000979	0.001004
3ke4	0.000945	0.000980	0.000994	0.001057	0.000965
3sa1	0.000994	0.000996	0.000959	0.000994	0.000961
3sa2	0.000976	0.000999	0.001015	0.000972	0.000982
3sa3	0.000972	0.000975	0.001009	0.001014	0.000976
3sa4	0.000955	0.000941	0.000967	0.001012	0.000985
3se1	0.000993	0.000992	0.000968	0.001026	0.000988
3Se2	0.000979	0.000986	0.000979	0.001014	0.000963
3se3	0.000989	0.001006	0.000983	0.000980	0.000967
3se4	0.000939	0.000954	0.000967	0.001035	0.000949
4ka1	0.000983	0.001023	0.000955	0.000972	0.000999
4ka2	0.001001	0.001006	0.000984	0.001014	0.001011
4ka3	0.000959	0.001043	0.000962	0.001004	0.000955
4ka4	0.001008	0.001040	0.001001	0.000978	0.001000
4ke1	0.000992	0.001009	0.001006	0.000979	0.000981
4ke2	0.000991	0.000987	0.000948	0.001006	0.000958
4ke3	0.000966	0.001005	0.001011	0.001005	0.001014
4KE4	0.001012	0.000991	0.000995	0.000986	0.001008
4sa1	0.000957	0.000990	0.001051	0.001043	0.000979
4sa2	0.000970	0.000990	0.000978	0.001009	0.000945
4sa3	0.000983	0.000991	0.001016	0.001028	0.000968
4sa4	0.000995	0.001002	0.001035	0.001000	0.000980
4se1	0.000953	0.000995	0.000951	0.001015	0.000921
4se2	0.001005	0.001009	0.001017	0.001038	0.000973
4se3	0.000975	0.001012	0.000981	0.001012	0.000989
4Se4	0.001000	0.000985	0.000943	0.001001	0.000958

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.04563E-08	31	6.59882E-10	1.08714274	0.3616029	1.5410648
Within groups	7.76944E-08	128	6.06988E-10			
Total	9.81507E-08	159				
within-sd	2.46371E-05					
effective n	5.00					
s_bb	3.25252E-06					
s_bb_min	3.89547E-06					
u_bb	3.89547E-06					
u_bb(rel.)	0.393832401					

Cd in BAM-M386a:

	1	2	3	4	5
3ka1	0.000608	0.000590	0.000686	0.000622	0.000652
3ka2	0.000635	0.000628	0.000620	0.000607	0.000703
3ka3	0.000629	0.000586	0.000634	0.000600	0.000663
3ka4	0.000589	0.000613	0.000627	0.000647	0.000687
3ke1	0.000486	0.000610	0.000621	0.000582	0.000656
3ke2	0.000558	0.000618	0.000634	0.000613	0.000666
3ke4	0.000666	0.000626	0.000630	0.000636	0.000690
3ke4	0.000605	0.000642	0.000637	0.000618	0.000632
3sa1	0.000617	0.000612	0.000614	0.000645	0.000689
3sa2	0.000660	0.000592	0.000652	0.000613	0.000692
3sa3	0.000580	0.000610	0.000649	0.000613	0.000641
3sa4	0.000613	0.000573	0.000626	0.000640	0.000644
3se1	0.000572	0.000593	0.000628	0.000617	0.000701
3Se2	0.000551	0.000588	0.000618	0.000623	0.000648
3se3	0.000643	0.000627	0.000638	0.000668	0.000656
3se4	0.000599	0.000578	0.000665	0.000587	0.000659
4ka1	0.000626	0.000627	0.000633	0.000638	0.000699
4ka2	0.000609	0.000612	0.000669	0.000655	0.000642
4ka3	0.000595	0.000620	0.000615	0.000597	0.000659
4ka4	0.000587	0.000633	0.000647	0.000613	0.000650
4ke1	0.000670	0.000616	0.000635	0.000632	0.000645
4ke2	0.000593	0.000631	0.000650	0.000621	0.000640
4ke3	0.000613	0.000609	0.000640	0.000644	0.000666
4KE4	0.000557	0.000613	0.000632	0.000628	0.000675
4sa1	0.000612	0.000618	0.000654	0.000640	0.000664
4sa2	0.000627	0.000588	0.000656	0.000622	0.000648
4sa3	0.000561	0.000618	0.000618	0.000598	0.000660
4sa4	0.000645	0.000628	0.000648	0.000645	0.000680
4se1	0.000605	0.000618	0.000601	0.000620	0.000644
4se2	0.000628	0.000623	0.000650	0.000642	0.000701
4se3	0.000581	0.000602	0.000616	0.000604	0.000646
4Se4	0.000577	0.000615	0.000633	0.000618	0.000659

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.98999E-08	31	9.64514E-10	0.91895155	0.5937162	1.5410648
Within groups	1.34346E-07	128	1.04958E-09			
Total	1.64246E-07	159				
within-sd	3.23972E-05					
effective n	5.00					
s_bb	0					
s_bb_min	5.12245E-06					
u_bb	5.12245E-06					
u_bb(rel.)	0.816042796					

Co in BAM-M386a:

	1	2	3	4	5
3ka1	0.000428	0.000437	0.000451	0.000433	0.000461
3ka2	0.000417	0.000454	0.000451	0.000437	0.000462
3ka3	0.000426	0.000443	0.000448	0.000424	0.000475
3ka4	0.000434	0.000424	0.000437	0.000426	0.000476
3ke1	0.000450	0.000448	0.000456	0.000427	0.000454
3ke2	0.000445	0.000444	0.000459	0.000420	0.000472
3ke4	0.000421	0.000424	0.000440	0.000421	0.000487
3ke4	0.000429	0.000425	0.000448	0.000453	0.000478
3sa1	0.000459	0.000434	0.000451	0.000427	0.000450
3sa2	0.000419	0.000432	0.000455	0.000419	0.000471
3sa3	0.000427	0.000428	0.000439	0.000441	0.000472
3sa4	0.000418	0.000426	0.000448	0.000439	0.000480
3se1	0.000437	0.000426	0.000463	0.000453	0.000467
3Se2	0.000447	0.000441	0.000435	0.000427	0.000474
3se3	0.000416	0.000427	0.000450	0.000408	0.000475
3se4	0.000418	0.000428	0.000438	0.000448	0.000461
4ka1	0.000425	0.000450	0.000438	0.000428	0.000483
4ka2	0.000435	0.000440	0.000441	0.000443	0.000475
4ka3	0.000424	0.000447	0.000439	0.000419	0.000477
4ka4	0.000436	0.000446	0.000451	0.000437	0.000485
4ke1	0.000428	0.000441	0.000448	0.000423	0.000479
4ke2	0.000419	0.000427	0.000435	0.000431	0.000481
4ke3	0.000418	0.000421	0.000455	0.000435	0.000487
4KE4	0.000451	0.000423	0.000454	0.000433	0.000485
4sa1	0.000422	0.000439	0.000467	0.000439	0.000467
4sa2	0.000416	0.000441	0.000445	0.000444	0.000461
4sa3	0.000437	0.000428	0.000469	0.000433	0.000454
4sa4	0.000411	0.000440	0.000467	0.000426	0.000468
4se1	0.000426	0.000415	0.000455	0.000439	0.000466
4se2	0.000422	0.000427	0.000459	0.000449	0.000470
4se3	0.000431	0.000441	0.000450	0.000431	0.000459
4Se4	0.000447	0.000426	0.000445	0.000421	0.000461

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.06118E-09	31	6.64895E-11	0.1583862	0.9999999	1.5410648
Within groups	5.37336E-08	128	4.19794E-10			
Total	5.57948E-08	159				
within-sd	2.04889E-05					
effective n	5.00					
s_bb	0					
s_bb_min	3.23957E-06					
u_bb	3.23957E-06	0.003239575				
u_bb(rel.)	0.730806672					

Cr in BAM-M386a:

	1	2	3	4	5
3ka1	0.000887	0.000688	0.000612	0.000572	0.000710
3ka2	0.000863	0.000666	0.000629	0.000549	0.000641
3ka3	0.000869	0.000672	0.000590	0.000632	0.000613
3ka4	0.000911	0.000728	0.000655	0.000628	0.000608
3ke1	0.001063	0.000618	0.000555	0.000572	0.000608
3ke2	0.000961	0.000673	0.000750	0.000534	0.000631
3ke4	0.000866	0.000675	0.000632	0.000593	0.000794
3ke4	0.000902	0.000759	0.000588	0.000779	0.000678
3sa1	0.000945	0.000700	0.000620	0.000581	0.000691
3sa2	0.000930	0.000664	0.000653	0.000573	0.000687
3sa3	0.000913	0.000661	0.000585	0.000566	0.000620
3sa4	0.000951	0.000703	0.000622	0.000645	0.000701
3se1	0.000883	0.000733	0.000543	0.000747	0.000621
3Se2	0.001029	0.000629	0.000679	0.000548	0.000645
3se3	0.000933	0.000698	0.000572	0.000565	0.000669
3se4	0.000876	0.000671	0.000610	0.000840	0.000679
4ka1	0.000927	0.000721	0.000618	0.000610	0.000637
4ka2	0.000928	0.000663	0.000674	0.000643	0.000659
4ka3	0.000905	0.000707	0.000671	0.000556	0.000659
4ka4	0.000938	0.000722	0.000553	0.000527	0.000723
4ke1	0.000857	0.000731	0.000611	0.000570	0.000739
4ke2	0.000962	0.000645	0.000576	0.000523	0.000646
4ke3	0.000939	0.000715	0.000651	0.000617	0.000644
4KE4	0.001032	0.000719	0.000631	0.000614	0.000725
4sa1	0.000974	0.000698	0.000791	0.000711	0.000700
4sa2	0.000878	0.000664	0.000559	0.000742	0.000688
4sa3	0.000918	0.000698	0.000839	0.000561	0.000702
4sa4	0.000908	0.000624	0.000802	0.000589	0.000680
4se1	0.000884	0.000691	0.000597	0.000563	0.000659
4se2	0.000918	0.000672	0.000745	0.000567	0.000611
4se3	0.000893	0.000675	0.000604	0.000579	0.000690
4Se4	0.001048	0.000636	0.000624	0.000571	0.000685

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	8.86046E-08	31	2.85821E-09	0.144693966	1	1.5410648
Within groups	2.52845E-06	128	1.97535E-08			
Total	2.61705E-06	159				
within-sd	0.000140547					
effective n	5.00					
s_bb	0					
s_bb_min	2.22225E-05					
u_bb	2.22225E-05					
u_bb(rel.)	3.14762888					

Fe in BAM-M386a:

	1	2	3	4	5
3ka1	0.00597	0.00595	0.00614	0.00596	0.00617
3ka2	0.00591	0.00617	0.00605	0.00600	0.00616
3ka3	0.00595	0.00608	0.00604	0.00592	0.00627
3ka4	0.00603	0.00587	0.00602	0.00590	0.00630
3ke1	0.00610	0.00612	0.00612	0.00597	0.00614
3ke2	0.00605	0.00615	0.00618	0.00592	0.00622
3ke4	0.00592	0.00591	0.00602	0.00588	0.00631
3ke4	0.00595	0.00592	0.00606	0.00614	0.00625
3sa1	0.00615	0.00598	0.00614	0.00595	0.00608
3sa2	0.00593	0.00595	0.00615	0.00592	0.00627
3sa3	0.00600	0.00593	0.00601	0.00599	0.00626
3sa4	0.00587	0.00589	0.00605	0.00602	0.00631
3se1	0.00597	0.00593	0.00616	0.00609	0.00623
3Se2	0.00612	0.00607	0.00602	0.00597	0.00626
3se3	0.00591	0.00596	0.00610	0.00588	0.00619
3se4	0.00591	0.00593	0.00600	0.00607	0.00615
4ka1	0.00593	0.00606	0.00605	0.00591	0.00637
4ka2	0.00604	0.00603	0.00602	0.00605	0.00629
4ka3	0.00590	0.00608	0.00603	0.00592	0.00623
4ka4	0.00602	0.00605	0.00613	0.00602	0.00637
4ke1	0.00596	0.00604	0.00603	0.00588	0.00633
4ke2	0.00589	0.00591	0.00596	0.00597	0.00628
4ke3	0.00589	0.00593	0.00608	0.00600	0.00632
4KE4	0.00611	0.00592	0.00610	0.00602	0.00636
4sa1	0.00589	0.00602	0.00623	0.00603	0.00621
4sa2	0.00595	0.00602	0.00612	0.00600	0.00619
4sa3	0.00600	0.00592	0.00619	0.00597	0.00614
4sa4	0.00586	0.00596	0.00620	0.00598	0.00619
4se1	0.00593	0.00587	0.00617	0.00604	0.00616
4se2	0.00593	0.00588	0.00614	0.00614	0.00623
4se3	0.00596	0.00599	0.00605	0.00595	0.00614
4Se4	0.00605	0.00591	0.00601	0.00587	0.00613

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.53944E-07	31	4.96595E-09	0.266652737	0.9999659	1.5410648
Within groups	2.38378E-06	128	1.86233E-08			
Total	2.53773E-06	159				
within-sd	0.000136467					
effective n	5.00					
s_bb	0					
s_bb_min	2.15774E-05					
u_bb	2.15774E-05					
u_bb(rel.)	0.35668256					

Mg in BAM-M386a:

	1	2	3	4	5
3ka1	0.00651	0.00639	0.00613	0.00628	0.00564
3ka2	0.00647	0.00665	0.00623	0.00644	0.00584
3ka3	0.00647	0.00645	0.00620	0.00653	0.00570
3ka4	0.00646	0.00631	0.00617	0.00645	0.00571
3ke1	0.00642	0.00637	0.00607	0.00620	0.00563
3ke2	0.00639	0.00637	0.00616	0.00622	0.00561
3ke4	0.00636	0.00631	0.00609	0.00644	0.00570
3ke4	0.00648	0.00637	0.00609	0.00640	0.00566
3sa1	0.00646	0.00639	0.00624	0.00623	0.00569
3sa2	0.00645	0.00648	0.00617	0.00630	0.00575
3sa3	0.00647	0.00637	0.00619	0.00620	0.00572
3sa4	0.00642	0.00625	0.00620	0.00635	0.00575
3se1	0.00644	0.00633	0.00600	0.00632	0.00567
3Se2	0.00657	0.00635	0.00614	0.00636	0.00567
3se3	0.00647	0.00639	0.00616	0.00622	0.00573
3se4	0.00642	0.00651	0.00612	0.00629	0.00570
4ka1	0.00654	0.00656	0.00618	0.00638	0.00575
4ka2	0.00662	0.00654	0.00618	0.00637	0.00578
4ka3	0.00652	0.00657	0.00624	0.00637	0.00578
4ka4	0.00668	0.00647	0.00618	0.00641	0.00580
4ke1	0.00652	0.00637	0.00616	0.00629	0.00582
4ke2	0.00663	0.00648	0.00619	0.00628	0.00576
4ke3	0.00653	0.00645	0.00625	0.00644	0.00572
4KE4	0.00661	0.00652	0.00628	0.00632	0.00573
4sa1	0.00659	0.00648	0.00629	0.00643	0.00582
4sa2	0.00662	0.00649	0.00624	0.00643	0.00580
4sa3	0.00656	0.00648	0.00635	0.00634	0.00583
4sa4	0.00655	0.00647	0.00629	0.00636	0.00576
4se1	0.00651	0.00646	0.00601	0.00631	0.00563
4se2	0.00660	0.00650	0.00628	0.00639	0.00578
4se3	0.00658	0.00646	0.00622	0.00638	0.00583
4Se4	0.00659	0.00650	0.00617	0.00641	0.00583

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	5.16113E-07	31	1.66488E-08	0.167448595	0.9999999	1.5410648
Within groups	1.27266E-05	128	9.94264E-08			
Total	1.32427E-05	159				
within-sd	0.000315319					
effective n	5.00					
s_bb	0					
s_bb_min	4.98564E-05					
u_bb	4.98564E-05					
u_bb(rel.)	0.798416771					

Mn in BAM-M386a:

	1	2	3	4	5
3ka1	0.000993	0.000979	0.000991	0.000901	0.000915
3ka2	0.000982	0.001017	0.000898	0.000921	0.000906
3ka3	0.001057	0.001014	0.000926	0.000809	0.000952
3ka4	0.001052	0.000920	0.000913	0.000828	0.000923
3ke1	0.001105	0.000993	0.000932	0.000879	0.000913
3ke2	0.001092	0.001035	0.001044	0.000800	0.000865
3ke4	0.000972	0.000959	0.000915	0.000844	0.000879
3ke4	0.001072	0.000939	0.000903	0.001015	0.000959
3sa1	0.001097	0.000993	0.000984	0.000850	0.000869
3sa2	0.001012	0.000950	0.000997	0.000847	0.000980
3sa3	0.001035	0.000944	0.000897	0.000902	0.000913
3sa4	0.001035	0.000906	0.000950	0.000970	0.000990
3se1	0.001069	0.000976	0.000962	0.000998	0.000912
3Se2	0.001132	0.001000	0.000924	0.000830	0.000976
3se3	0.001033	0.000901	0.000978	0.000830	0.000934
3se4	0.001048	0.000982	0.000919	0.001024	0.000888
4ka1	0.001063	0.001094	0.000964	0.000916	0.001002
4ka2	0.001105	0.001040	0.000950	0.001024	0.001018
4ka3	0.001069	0.001073	0.000993	0.000870	0.000983
4ka4	0.001124	0.001114	0.000983	0.000938	0.001053
4ke1	0.001060	0.001053	0.000935	0.000878	0.001078
4ke2	0.001062	0.001002	0.000902	0.000888	0.000941
4ke3	0.001066	0.000994	0.000961	0.000971	0.001011
4KE4	0.001173	0.000970	0.001027	0.000988	0.001066
4sa1	0.001093	0.001076	0.001128	0.001043	0.000973
4sa2	0.001024	0.001008	0.000946	0.001072	0.000973
4sa3	0.001098	0.001030	0.001163	0.000946	0.000994
4sa4	0.001033	0.000984	0.001135	0.000941	0.000972
4se1	0.001100	0.000985	0.000979	0.000968	0.000962
4se2	0.001077	0.000997	0.001090	0.000984	0.000974
4se3	0.001124	0.001021	0.001002	0.000925	0.000962
4Se4	0.001216	0.000984	0.000991	0.000916	0.000981

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.20944E-07	31	7.12722E-09	1.235375072	0.2068885	1.5410648
Within groups	7.38468E-07	128	5.76928E-09			
Total	9.59411E-07	159				
within-sd	7.59558E-05					
effective n	5.00					
s_bb	1.648E-05					
s_bb_min	1.20097E-05					
u_bb	1.648E-05					
u_bb(rel.)	1.671808117					

Ni in BAM-M386a:

	1	2	3	4	5
3ka1	0.00205	0.00191	0.00176	0.00178	0.00137
3ka2	0.00200	0.00204	0.00168	0.00181	0.00136
3ka3	0.00203	0.00196	0.00167	0.00177	0.00140
3ka4	0.00204	0.00189	0.00163	0.00177	0.00141
3ke1	0.00213	0.00200	0.00173	0.00174	0.00133
3ke2	0.00208	0.00199	0.00177	0.00172	0.00139
3ke4	0.00203	0.00187	0.00165	0.00177	0.00156
3ke4	0.00204	0.00189	0.00167	0.00192	0.00143
3sa1	0.00218	0.00195	0.00172	0.00178	0.00133
3sa2	0.00200	0.00190	0.00176	0.00174	0.00143
3sa3	0.00204	0.00191	0.00165	0.00183	0.00142
3sa4	0.00200	0.00190	0.00167	0.00182	0.00146
3se1	0.00205	0.00191	0.00178	0.00190	0.00138
3Se2	0.00215	0.00198	0.00163	0.00178	0.00143
3se3	0.00203	0.00194	0.00170	0.00169	0.00140
3se4	0.00201	0.00189	0.00162	0.00192	0.00137
4ka1	0.00204	0.00202	0.00165	0.00177	0.00148
4ka2	0.00205	0.00197	0.00168	0.00186	0.00143
4ka3	0.00203	0.00201	0.00166	0.00176	0.00141
4ka4	0.00208	0.00202	0.00173	0.00179	0.00151
4ke1	0.00201	0.00198	0.00169	0.00175	0.00145
4ke2	0.00204	0.00189	0.00161	0.00178	0.00142
4ke3	0.00201	0.00189	0.00171	0.00182	0.00147
4KE4	0.00213	0.00192	0.00173	0.00183	0.00149
4sa1	0.00205	0.00196	0.00186	0.00187	0.00141
4sa2	0.00204	0.00198	0.00167	0.00188	0.00137
4sa3	0.00205	0.00192	0.00186	0.00181	0.00136
4sa4	0.00201	0.00193	0.00185	0.00177	0.00139
4se1	0.00203	0.00187	0.00175	0.00184	0.00140
4se2	0.00204	0.00190	0.00178	0.00190	0.00140
4se3	0.00203	0.00196	0.00171	0.00183	0.00137
4Se4	0.00214	0.00187	0.00168	0.00175	0.00138

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	6.21529E-08	31	2.00493E-09	0.031913864	1	1.5410648
Within groups	8.04137E-06	128	6.28232E-08			
Total	8.10353E-06	159				
within-sd	0.000250646					
effective n	5.00					
s_bb	0					
s_bb_min	3.96306E-05					
u_bb	3.96306E-05					
u_bb(rel.)	2.223008979					

P in BAM-M386a:

	1	2	3	4	5
3ka1	0.000687	0.000684	0.000802	0.000725	0.000788
3ka2	0.000733	0.000766	0.000696	0.000743	0.000748
3ka3	0.000731	0.000758	0.000650	0.000685	0.000769
3ka4	0.000708	0.000779	0.000663	0.000754	0.000745
3ke1	0.000610	0.000680	0.000742	0.000729	0.000697
3ke2	0.000642	0.000726	0.000738	0.000630	0.000677
3ke4	0.000790	0.000668	0.000739	0.000606	0.000899
3ke4	0.000695	0.000723	0.000677	0.000686	0.000741
3sa1	0.000725	0.000757	0.000670	0.000704	0.000670
3sa2	0.000819	0.000692	0.000829	0.000615	0.000776
3sa3	0.000710	0.000676	0.000736	0.000767	0.000693
3sa4	0.000775	0.000673	0.000736	0.000705	0.000760
3se1	0.000669	0.000698	0.000761	0.000693	0.000760
3Se2	0.000628	0.000727	0.000746	0.000695	0.000725
3se3	0.000668	0.000745	0.000790	0.000659	0.000801
3se4	0.000722	0.000747	0.000745	0.000643	0.000650
4ka1	0.000726	0.000710	0.000737	0.000656	0.000830
4ka2	0.000622	0.000664	0.000731	0.000680	0.000712
4ka3	0.000785	0.000743	0.000658	0.000694	0.000742
4ka4	0.000693	0.000665	0.000639	0.000739	0.000776
4ke1	0.000740	0.000666	0.000746	0.000647	0.000765
4ke2	0.000625	0.000726	0.000735	0.000711	0.000722
4ke3	0.000630	0.000612	0.000615	0.000657	0.000696
4KE4	0.000628	0.000708	0.000669	0.000687	0.000702
4sa1	0.000645	0.000707	0.000733	0.000754	0.000797
4sa2	0.000717	0.000710	0.000702	0.000601	0.000660
4sa3	0.000650	0.000747	0.000664	0.000731	0.000726
4sa4	0.000746	0.000725	0.000751	0.000730	0.000764
4se1	0.000667	0.000735	0.000675	0.000739	0.000704
4se2	0.000751	0.000692	0.000745	0.000709	0.000823
4se3	0.000675	0.000691	0.000699	0.000673	0.000782
4Se4	0.000612	0.000718	0.000637	0.000701	0.000727

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	9.10387E-08	31	2.93673E-09	1.108890518	0.3353511	1.5410648
Within groups	3.38989E-07	128	2.64835E-09			
Total	4.30028E-07	159				
within-sd	5.14622E-05					
effective n	5.00					
s_bb	7.59448E-06					
s_bb_min	8.13688E-06					
u_bb	8.13688E-06					
u_bb(rel.)	1.144296905					

Pb in BAM-M386a:

	1	2	3	4	5
3ka1	0.00208	0.00205	0.00208	0.00197	0.00192
3ka2	0.00215	0.00212	0.00200	0.00202	0.00196
3ka3	0.00208	0.00210	0.00202	0.00195	0.00197
3ka4	0.00220	0.00198	0.00198	0.00195	0.00199
3ke1	0.00217	0.00213	0.00203	0.00196	0.00215
3ke2	0.00217	0.00206	0.00204	0.00188	0.00203
3ke4	0.00229	0.00198	0.00197	0.00193	0.00211
3ke4	0.00208	0.00198	0.00202	0.00208	0.00200
3sa1	0.00232	0.00210	0.00203	0.00200	0.00192
3sa2	0.00206	0.00208	0.00206	0.00192	0.00199
3sa3	0.00225	0.00207	0.00215	0.00207	0.00199
3sa4	0.00206	0.00411	0.00203	0.00201	0.00204
3se1	0.00216	0.00207	0.00200	0.00210	0.00200
3Se2	0.00224	0.00213	0.00206	0.00207	0.00204
3se3	0.00208	0.00210	0.00203	0.00188	0.00201
3se4	0.00206	0.00206	0.00199	0.00209	0.00198
4ka1	0.00208	0.00206	0.00192	0.00189	0.00198
4ka2	0.00207	0.00204	0.00197	0.00196	0.00196
4ka3	0.00199	0.00210	0.00192	0.00188	0.00198
4ka4	0.00210	0.00203	0.00195	0.00197	0.00203
4ke1	0.00199	0.00205	0.00194	0.00185	0.00190
4ke2	0.00198	0.00196	0.00190	0.00191	0.00194
4ke3	0.00200	0.00199	0.00196	0.00193	0.00200
4KE4	0.00214	0.00197	0.00202	0.00195	0.00198
4sa1	0.00199	0.00201	0.00208	0.00199	0.00192
4sa2	0.00198	0.00205	0.00194	0.00201	0.00191
4sa3	0.00211	0.00200	0.00207	0.00192	0.00188
4sa4	0.00196	0.00201	0.00205	0.00191	0.00192
4se1	0.00206	0.00193	0.00187	0.00195	0.00182
4se2	0.00204	0.00196	0.00201	0.00200	0.00190
4se3	0.00222	0.00204	0.00197	0.00196	0.00191
4Se4	0.00231	0.00197	0.00195	0.00186	0.00189

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.21118E-06	31	3.90705E-08	1.139659814	0.3002231	1.5410648
Within groups	4.38817E-06	128	3.42826E-08			
Total	5.59935E-06	159				
within-sd	0.000185156					
effective n	5.00					
s_bb	3.09448E-05					
s_bb_min	2.92757E-05					
u_bb	3.09448E-05					
u_bb(rel.)	1.525401939					

S in BAM-M386a:

	1	2	3	4	5
3ka1	0.00160	0.00157	0.00161	0.00162	0.00150
3ka2	0.00158	0.00160	0.00150	0.00153	0.00161
3ka3	0.00162	0.00157	0.00154	0.00156	0.00160
3ka4	0.00159	0.00150	0.00161	0.00168	0.00152
3ke1	0.00167	0.00166	0.00159	0.00155	0.00146
3ke2	0.00160	0.00162	0.00162	0.00150	0.00154
3ke4	0.00160	0.00153	0.00154	0.00159	0.00162
3ke4	0.00159	0.00162	0.00154	0.00161	0.00153
3sa1	0.00171	0.00164	0.00165	0.00147	0.00152
3sa2	0.00163	0.00162	0.00162	0.00147	0.00165
3sa3	0.00162	0.00157	0.00157	0.00152	0.00150
3sa4	0.00158	0.00159	0.00160	0.00164	0.00163
3se1	0.00156	0.00159	0.00157	0.00166	0.00159
3Se2	0.00171	0.00158	0.00158	0.00168	0.00156
3se3	0.00153	0.00159	0.00159	0.00150	0.00165
3se4	0.00154	0.00161	0.00161	0.00166	0.00154
4ka1	0.00159	0.00156	0.00156	0.00152	0.00151
4ka2	0.00155	0.00164	0.00151	0.00161	0.00155
4ka3	0.00154	0.00162	0.00150	0.00145	0.00155
4ka4	0.00154	0.00155	0.00154	0.00153	0.00150
4ke1	0.00165	0.00157	0.00150	0.00158	0.00158
4ke2	0.00156	0.00151	0.00160	0.00151	0.00156
4ke3	0.00152	0.00150	0.00160	0.00159	0.00149
4KE4	0.00168	0.00158	0.00156	0.00160	0.00154
4sa1	0.00154	0.00152	0.00167	0.00159	0.00159
4sa2	0.00166	0.00153	0.00145	0.00159	0.00146
4sa3	0.00154	0.00149	0.00169	0.00152	0.00156
4sa4	0.00156	0.00153	0.00162	0.00154	0.00147
4se1	0.00155	0.00150	0.00148	0.00150	0.00144
4se2	0.00166	0.00156	0.00161	0.00160	0.00154
4se3	0.00161	0.00150	0.00155	0.00153	0.00154
4Se4	0.00152	0.00150	0.00152	0.00147	0.00158

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.25705E-07	31	4.05501E-09	1.30389588	0.1547532	1.5410648
Within groups	3.9807E-07	128	3.10992E-09			
Total	5.23775E-07	159				
within-sd	5.57667E-05					
effective n	5.00					
s_bb	1.37484E-05					
s_bb_min	8.81749E-06					
u_bb	1.37484E-05					
u_bb(rel.)	0.876996462					

Sb in BAM-M386a:

	1	2	3	4	5
3ka1	0.00223	0.00222	0.00232	0.00222	0.00209
3ka2	0.00231	0.00235	0.00226	0.00225	0.00213
3ka3	0.00223	0.00236	0.00227	0.00233	0.00214
3ka4	0.00225	0.00228	0.00220	0.00226	0.00222
3ke1	0.00221	0.00235	0.00229	0.00226	0.00211
3ke2	0.00226	0.00222	0.00231	0.00223	0.00211
3ke4	0.00226	0.00222	0.00218	0.00224	0.00230
3ke4	0.00222	0.00223	0.00220	0.00240	0.00218
3sa1	0.00234	0.00232	0.00229	0.00221	0.00212
3sa2	0.00228	0.00228	0.00229	0.00223	0.00215
3sa3	0.00223	0.00224	0.00214	0.00243	0.00213
3sa4	0.00217	0.00216	0.00223	0.00244	0.00218
3se1	0.00223	0.00234	0.00220	0.00246	0.00217
3Se2	0.00232	0.00236	0.00223	0.00226	0.00222
3se3	0.00226	0.00224	0.00220	0.00222	0.00219
3se4	0.00225	0.00224	0.00222	0.00230	0.00213
4ka1	0.00223	0.00243	0.00220	0.00234	0.00220
4ka2	0.00220	0.00230	0.00229	0.00229	0.00225
4ka3	0.00218	0.00233	0.00217	0.00220	0.00215
4ka4	0.00231	0.00244	0.00232	0.00225	0.00226
4ke1	0.00214	0.00232	0.00230	0.00213	0.00219
4ke2	0.00221	0.00225	0.00217	0.00224	0.00211
4ke3	0.00219	0.00229	0.00232	0.00219	0.00217
4KE4	0.00222	0.00226	0.00229	0.00225	0.00216
4sa1	0.00218	0.00224	0.00237	0.00244	0.00207
4sa2	0.00229	0.00229	0.00216	0.00229	0.00209
4sa3	0.00221	0.00219	0.00238	0.00232	0.00206
4sa4	0.00229	0.00232	0.00236	0.00226	0.00209
4se1	0.00221	0.00225	0.00214	0.00226	0.00210
4se2	0.00231	0.00220	0.00234	0.00228	0.00215
4se3	0.00222	0.00228	0.00223	0.00233	0.00217
4Se4	0.00233	0.00215	0.00226	0.00214	0.00212

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.11691E-07	31	3.60293E-09	0.503611538	0.9856487	1.5410648
Within groups	9.15735E-07	128	7.15418E-09			
Total	1.02743E-06	159				
within-sd	8.45824E-05					
effective n	5.00					
s_bb	0					
s_bb_min	1.33737E-05					
u_bb	1.33737E-05					
u_bb(rel.)	0.596635113					

Se in BAM-M386a:

	1	2	3	4	5
3ka1	0.000817	0.000720	0.000959	0.000778	0.000758
3ka2	0.000919	0.000951	0.000736	0.000811	0.000902
3ka3	0.000905	0.000869	0.000759	0.000778	0.000829
3ka4	0.000923	0.000726	0.000764	0.000935	0.000917
3ke1	0.000798	0.000873	0.000928	0.000666	0.000716
3ke2	0.000770	0.000748	0.000813	0.000842	0.000812
3ke4	0.001014	0.000782	0.000821	0.000776	0.001051
3ke4	0.000832	0.000797	0.000752	0.000846	0.000738
3sa1	0.001004	0.000904	0.000786	0.000767	0.000853
3sa2	0.000887	0.000911	0.000712	0.000877	0.000742
3sa3	0.000789	0.000847	0.000937	0.000779	0.000842
3sa4	0.000810	0.000676	0.000821	0.000962	0.000788
3se1	0.000781	0.000789	0.000891	0.000945	0.000844
3Se2	0.000790	0.000755	0.000769	0.000847	0.000830
3se3	0.000922	0.000847	0.000806	0.000967	0.000910
3se4	0.000960	0.000812	0.000942	0.000850	0.000954
4ka1	0.000857	0.000776	0.000765	0.000808	0.000919
4ka2	0.000835	0.000925	0.000938	0.000943	0.000772
4ka3	0.000737	0.000746	0.000856	0.000760	0.000829
4ka4	0.000762	0.000802	0.000815	0.000802	0.000834
4ke1	0.000903	0.000910	0.000905	0.000779	0.000808
4ke2	0.000736	0.000848	0.000799	0.000795	0.000744
4ke3	0.000806	0.000830	0.000758	0.000874	0.000758
4KE4	0.000891	0.000827	0.000764	0.000704	0.000687
4sa1	0.000897	0.000742	0.000826	0.000904	0.000890
4sa2	0.000741	0.000755	0.000793	0.000892	0.000800
4sa3	0.000750	0.000804	0.000845	0.000889	0.001021
4sa4	0.000909	0.000837	0.000852	0.000824	0.000897
4se1	0.000863	0.000772	0.000690	0.000731	0.000696
4se2	0.000896	0.000838	0.000765	0.000855	0.000862
4se3	0.000826	0.000717	0.000842	0.000774	0.000792
4Se4	0.000804	0.000844	0.000817	0.000888	0.000742

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.26962E-07	31	7.32137E-09	1.363109185	0.1187075	1.5410648
Within groups	6.87498E-07	128	5.37108E-09			
Total	9.1446E-07	159				
within-sd	7.32876E-05					
effective n	5.00					
s_bb	1.97499E-05					
s_bb_min	1.15878E-05					
u_bb	1.97499E-05					
u_bb(rel.)	2.384440665					

Si in BAM-M386a:

	1	2	3	4	5
3ka1	0.00135	0.00130	0.00155	0.00121	0.00143
3ka2	0.00117	0.00154	0.00121	0.00131	0.00138
3ka3	0.00138	0.00139	0.00139	0.00105	0.00154
3ka4	0.00143	0.00115	0.00138	0.00103	0.00158
3ke1	0.00159	0.00135	0.00133	0.00127	0.00133
3ke2	0.00151	0.00143	0.00164	0.00103	0.00130
3ke4	0.00128	0.00119	0.00120	0.00114	0.00138
3ke4	0.00148	0.00118	0.00127	0.00153	0.00166
3sa1	0.00154	0.00132	0.00150	0.00113	0.00135
3sa2	0.00135	0.00125	0.00155	0.00097	0.00170
3sa3	0.00148	0.00129	0.00119	0.00129	0.00151
3sa4	0.00133	0.00115	0.00134	0.00146	0.00167
3se1	0.00142	0.00132	0.00150	0.00159	0.00144
3Se2	0.00162	0.00141	0.00138	0.00115	0.00161
3se3	0.00130	0.00110	0.00139	0.00103	0.00153
3se4	0.00137	0.00125	0.00126	0.00155	0.00140
4ka1	0.00138	0.00157	0.00126	0.00116	0.00166
4ka2	0.00139	0.00133	0.00124	0.00137	0.00157
4ka3	0.00133	0.00150	0.00135	0.00105	0.00146
4ka4	0.00147	0.00149	0.00134	0.00123	0.00177
4ke1	0.00140	0.00137	0.00124	0.00105	0.00175
4ke2	0.00142	0.00123	0.00119	0.00107	0.00147
4ke3	0.00138	0.00114	0.00140	0.00134	0.00167
4KE4	0.00156	0.00118	0.00148	0.00136	0.00175
4sa1	0.00141	0.00137	0.00170	0.00151	0.00146
4sa2	0.00120	0.00123	0.00119	0.00151	0.00142
4sa3	0.00151	0.00124	0.00178	0.00123	0.00148
4sa4	0.00128	0.00118	0.00172	0.00132	0.00142
4se1	0.00139	0.00123	0.00134	0.00125	0.00148
4se2	0.00125	0.00120	0.00166	0.00133	0.00139
4se3	0.00140	0.00131	0.00135	0.00116	0.00136
4Se4	0.00161	0.00117	0.00131	0.00110	0.00139

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	5.4153E-07	31	1.74687E-08	0.539737359	0.9759159	1.5410648
Within groups	4.14275E-06	128	3.23652E-08			
Total	4.68428E-06	159				
within-sd	0.000179903					
effective n	5.00					
s_bb	0					
s_bb_min	2.84452E-05					
u_bb	2.84452E-05					
u_bb(rel.)	2.078996212					

Sn in BAM-M386a:

	1	2	3	4	5
3ka1	0.00197	0.00178	0.00193	0.00182	0.00182
3ka2	0.00211	0.00192	0.00179	0.00173	0.00190
3ka3	0.00208	0.00185	0.00191	0.00178	0.00180
3ka4	0.00207	0.00189	0.00180	0.00180	0.00197
3ke1	0.00198	0.00187	0.00176	0.00172	0.00191
3ke2	0.00202	0.00185	0.00205	0.00174	0.00192
3ke4	0.00201	0.00183	0.00183	0.00171	0.00190
3ke4	0.00194	0.00191	0.00181	0.00200	0.00174
3sa1	0.00208	0.00185	0.00181	0.00188	0.00191
3sa2	0.00215	0.00170	0.00202	0.00169	0.00198
3sa3	0.00205	0.00171	0.00192	0.00175	0.00181
3sa4	0.00201	0.00171	0.00188	0.00175	0.00202
3se1	0.00202	0.00175	0.00178	0.00199	0.00196
3Se2	0.00211	0.00188	0.00172	0.00184	0.00199
3se3	0.00213	0.00182	0.00199	0.00187	0.00176
3se4	0.00203	0.00169	0.00201	0.00187	0.00188
4ka1	0.00200	0.00190	0.00181	0.00187	0.00195
4ka2	0.00204	0.00174	0.00194	0.00187	0.00192
4ka3	0.00200	0.00193	0.00189	0.00178	0.00195
4ka4	0.00199	0.00193	0.00186	0.00177	0.00195
4ke1	0.00214	0.00176	0.00180	0.00181	0.00192
4ke2	0.00212	0.00173	0.00186	0.00178	0.00187
4ke3	0.00200	0.00189	0.00180	0.00189	0.00192
4KE4	0.00206	0.00189	0.00182	0.00174	0.00194
4sa1	0.00199	0.00185	0.00199	0.00197	0.00170
4sa2	0.00200	0.00176	0.00192	0.00189	0.00168
4sa3	0.00204	0.00168	0.00204	0.00177	0.00196
4sa4	0.00204	0.00174	0.00201	0.00180	0.00191
4se1	0.00193	0.00188	0.00172	0.00168	0.00171
4se2	0.00205	0.00184	0.00195	0.00175	0.00192
4se3	0.00201	0.00171	0.00189	0.00170	0.00189
4Se4	0.00209	0.00158	0.00185	0.00181	0.00179

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.40477E-07	31	4.53151E-09	0.275349263	0.9999515	1.5410648
Within groups	2.10654E-06	128	1.64573E-08			
Total	2.24701E-06	159				
within-sd	0.000128286					
effective n	5.00					
s_bb	0					
s_bb_min	2.02838E-05					
u_bb	2.02838E-05					
u_bb(rel.)	1.077442969					

Te in BAM-M386a:

	1	2	3	4	5
3ka1	0.00305	0.00319	0.00317	0.00308	0.00301
3ka2	0.00302	0.00334	0.00319	0.00287	0.00302
3ka3	0.00300	0.00321	0.00321	0.00314	0.00308
3ka4	0.00303	0.00304	0.00300	0.00331	0.00304
3ke1	0.00285	0.00300	0.00291	0.00305	0.00303
3ke2	0.00318	0.00339	0.00307	0.00304	0.00315
3ke4	0.00317	0.00298	0.00301	0.00306	0.00328
3ke4	0.00293	0.00300	0.00326	0.00320	0.00309
3sa1	0.00304	0.00299	0.00313	0.00304	0.00295
3sa2	0.00304	0.00304	0.00315	0.00309	0.00331
3sa3	0.00299	0.00319	0.00311	0.00324	0.00305
3sa4	0.00301	0.00299	0.00321	0.00320	0.00317
3se1	0.00307	0.00308	0.00325	0.00319	0.00294
3Se2	0.00301	0.00310	0.00317	0.00315	0.00297
3se3	0.00299	0.00315	0.00305	0.00292	0.00305
3se4	0.00296	0.00316	0.00289	0.00310	0.00316
4ka1	0.00303	0.00326	0.00322	0.00310	0.00304
4ka2	0.00324	0.00319	0.00333	0.00308	0.00319
4ka3	0.00313	0.00307	0.00320	0.00292	0.00316
4ka4	0.00302	0.00307	0.00341	0.00319	0.00300
4ke1	0.00299	0.00321	0.00326	0.00305	0.00309
4ke2	0.00308	0.00290	0.00311	0.00314	0.00314
4ke3	0.00288	0.00305	0.00315	0.00324	0.00313
4KE4	0.00317	0.00308	0.00312	0.00301	0.00295
4sa1	0.00304	0.00316	0.00324	0.00306	0.00306
4sa2	0.00316	0.00331	0.00303	0.00307	0.00286
4sa3	0.00297	0.00326	0.00307	0.00317	0.00304
4sa4	0.00317	0.00311	0.00337	0.00288	0.00297
4se1	0.00306	0.00307	0.00284	0.00308	0.00283
4se2	0.00307	0.00306	0.00316	0.00319	0.00308
4se3	0.00311	0.00323	0.00311	0.00328	0.00323
4Se4	0.00285	0.00312	0.00317	0.00303	0.00321

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.81294E-07	31	1.22998E-08	0.889655331	0.6363694	1.5410648
Within groups	1.76964E-06	128	1.38253E-08			
Total	2.15094E-06	159				
within-sd	0.000117581					
effective n	5.00					
s_bb	0					
s_bb_min	1.85912E-05					
u_bb	1.85912E-05					
u_bb(rel.)	0.600685805					

Ti in BAM-M386a:

	1	2	3	4	5
3ka1	0.00337	0.00342	0.00351	0.00342	0.00340
3ka2	0.00336	0.00355	0.00346	0.00351	0.00346
3ka3	0.00343	0.00345	0.00346	0.00349	0.00348
3ka4	0.00343	0.00334	0.00343	0.00338	0.00349
3ke1	0.00342	0.00342	0.00339	0.00334	0.00337
3ke2	0.00342	0.00338	0.00352	0.00330	0.00337
3ke4	0.00335	0.00332	0.00336	0.00340	0.00343
3ke4	0.00342	0.00334	0.00338	0.00359	0.00351
3sa1	0.00348	0.00341	0.00350	0.00337	0.00341
3sa2	0.00339	0.00340	0.00352	0.00335	0.00355
3sa3	0.00342	0.00339	0.00340	0.00341	0.00346
3sa4	0.00339	0.00333	0.00346	0.00353	0.00355
3se1	0.00345	0.00338	0.00342	0.00351	0.00344
3Se2	0.00351	0.00343	0.00345	0.00337	0.00353
3se3	0.00340	0.00336	0.00348	0.00334	0.00346
3se4	0.00341	0.00339	0.00339	0.00352	0.00341
4ka1	0.00336	0.00347	0.00337	0.00337	0.00346
4ka2	0.00345	0.00346	0.00335	0.00343	0.00346
4ka3	0.00337	0.00345	0.00337	0.00330	0.00346
4ka4	0.00379	0.00340	0.00341	0.00335	0.00352
4ke1	0.00333	0.00334	0.00330	0.00326	0.00353
4ke2	0.00346	0.00333	0.00329	0.00328	0.00336
4ke3	0.00335	0.00331	0.00345	0.00343	0.00349
4KE4	0.00343	0.00333	0.00339	0.00342	0.00348
4sa1	0.00334	0.00340	0.00349	0.00346	0.00348
4sa2	0.00331	0.00332	0.00336	0.00345	0.00341
4sa3	0.00340	0.00331	0.00352	0.00338	0.00342
4sa4	0.00332	0.00332	0.00352	0.00335	0.00339
4se1	0.00334	0.00331	0.00332	0.00336	0.00338
4se2	0.00335	0.00333	0.00348	0.00340	0.00339
4se3	0.00340	0.00334	0.00336	0.00334	0.00339
4Se4	0.00343	0.00331	0.00338	0.00333	0.00338

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.20656E-07	31	7.11794E-09	1.463750319	0.0736331	1.5410648
Within groups	6.2244E-07	128	4.86281E-09			
Total	8.43096E-07	159				
within-sd	6.97339E-05					
effective n	5.00					
s_bb	2.12374E-05					
s_bb_min	1.10259E-05					
u_bb	2.12374E-05					
u_bb(rel.)	0.622773					

Zn in BAM-M386a:

	1	2	3	4	5
3ka1	0.00336	0.00341	0.00346	0.00342	0.00332
3ka2	0.00346	0.00356	0.00337	0.00343	0.00333
3ka3	0.00322	0.00351	0.00341	0.00346	0.00303
3ka4	0.00324	0.00351	0.00341	0.00353	0.00306
3ke1	0.00312	0.00351	0.00340	0.00343	0.00334
3ke2	0.00306	0.00351	0.00340	0.00347	0.00331
3ke4	0.00350	0.00324	0.00334	0.00347	0.00343
3ke4	0.00315	0.00352	0.00332	0.00341	0.00304
3sa1	0.00309	0.00346	0.00342	0.00345	0.00336
3sa2	0.00344	0.00344	0.00344	0.00347	0.00306
3sa3	0.00308	0.00343	0.00341	0.00349	0.00328
3sa4	0.00310	0.00314	0.00337	0.00348	0.00313
3se1	0.00312	0.00344	0.00339	0.00348	0.00330
3Se2	0.00326	0.00349	0.00345	0.00341	0.00302
3se3	0.00345	0.00312	0.00336	0.00348	0.00367
3se4	0.00314	0.00345	0.00339	0.00348	0.00334
4ka1	0.00327	0.00346	0.00327	0.00341	0.00302
4ka2	0.00311	0.00339	0.00335	0.00340	0.00296
4ka3	0.00334	0.00341	0.00330	0.00335	0.00324
4ka4	0.00317	0.00341	0.00332	0.00332	0.00320
4ke1	0.00302	0.00339	0.00326	0.00341	0.00323
4ke2	0.00307	0.00333	0.00328	0.00338	0.00322
4ke3	0.00306	0.00323	0.00336	0.00341	0.00291
4KE4	0.00306	0.00302	0.00332	0.00335	0.00320
4sa1	0.00316	0.00339	0.00334	0.00340	0.00327
4sa2	0.00343	0.00334	0.00332	0.00338	0.00322
4sa3	0.00297	0.00331	0.00331	0.00334	0.00327
4sa4	0.00337	0.00340	0.00335	0.00333	0.00328
4se1	0.00303	0.00326	0.00325	0.00340	0.00316
4se2	0.00341	0.00309	0.00333	0.00345	0.00329
4se3	0.00310	0.00330	0.00334	0.00340	0.00329
4Se4	0.00320	0.00335	0.00331	0.00342	0.00321

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	5.8032E-07	31	1.872E-08	0.856612027	0.6837649	1.5410648
Within groups	2.79725E-06	128	2.18535E-08			
Total	3.37757E-06	159				
within-sd	0.000147829					
effective n	5.00					
s_bb	0					
s_bb_min	2.33739E-05					
u_bb	2.33739E-05					
u_bb(rel.)	0.705367306					

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

Ag in BAM-M386a:

r_0	43.09	45.79										
r_in	42.88	43.39	42.61	44.29	43.87	44.39	44.07	43.23				
r_out	43.18	43.87	44.11	44.31	43.70	44.39	44.03	44.73	44.40	44.84	44.34	44.14
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	2.065044318	2	1.032522159	2.19595724	0.138686573	3.521893261						
Within groups	8.933653474	19	0.470192288									
Total	10.99869779	21										
within-sd	0.685705686											
effective n	6.18											
s_bb	0.301604254											
s_bb_min	0.157090071											
u_bb	0.301604254											
u_bb(rel.)	0.685712147											

Al in BAM-M386a:

r_0	20.89	21.91					
r_in	20.70	21.10	20.90	21.00			
r_out	21.10	22.70	21.30	20.60			
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*	
Between groups	0.581	2	0.2905	0.669740634	0.541821842	4.737414128	
Within groups	3.03625	7	0.43375				
Total	3.61725	9					
within-sd	0.658596994						
effective n	3.20						
s_bb	0						
s_bb_min	0.269170675						
u_bb	0.269170675						
u_bb(rel.)	1.26847632						

As in BAM-M386a:

r_0	21.03	21.77					
r_in	21.40	21.10	21.50	21.70			
r_out	21.60	21.30	21.80	21.30			
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*	
Between groups	0.0175	2	0.00875	0.094594595	0.910884781	4.737414128	
Within groups	0.6475	7	0.0925				
Total	0.665	9					
within-sd	0.304138127						
effective n	3.20						
s_bb	0						
s_bb_min	0.124302215						
u_bb	0.124302215						
u_bb(rel.)	0.579497504						

Bi in BAM-M386a:

r_0	8.53	9.93										
r_in	9.11	10.22	10.05	10.03	9.86	9.59	9.66	9.75				
r_out	9.55	9.59	9.59	10.01	9.21	9.73	9.59	9.55	9.67	9.64	9.49	9.50
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	0.525241288	2	0.262620644	2.287616782	0.128773699	3.521893261						
Within groups	2.181218582	19	0.114800978									
Total	2.70645987	21										
within-sd	0.33882293											
effective n	6.18											
s_bb	0.15463507											
s_bb_min	0.077621812											
u_bb	0.15463507											
u_bb(rel.)	1.605839761											

Cd in BAM-M386a:

r_0	5.74	7.66										
r_in	7.19	6.37	6.37	6.18	6.75	7.10	6.03	5.93				
r_out	6.71	6.27	6.52	5.95	6.06	6.24	5.87	6.07	5.98	5.86	5.64	5.98
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	1.108240152	2	0.554120076	2.386806162	0.118920036	3.521893261						
Within groups	4.41103329	19	0.232159647									
Total	5.519273442	21										
within-sd	0.481829479											
effective n	6.18											
s_bb	0.228214448											
s_bb_min	0.110383549											
u_bb	0.228214448											
u_bb(rel.)	3.625852421											

Co in BAM-M386a:

r_0	3.84	4.24										
r_in	4.01	4.16	4.07	4.25	4.12	4.24	4.12	3.99				
r_out	4.08	4.21	4.30	4.30	4.19	4.36	4.24	4.34	4.27	4.29	4.18	4.15
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	0.114870455	2	0.057435227	5.011569774	0.017868476	3.521893261						
Within groups	0.21775	19	0.011460526									
Total	0.332620455	21										
within-sd	0.107053848											
effective n	6.18											
s_bb	0.08623853											
s_bb_min	0.02452524											
u_bb	0.08623853											
u_bb(rel.)	2.063347091											

Cr in BAM-M386a:

r_0	9.29	11.35										
r_in	11.15	10.80	10.47	10.47	10.31	11.03	9.76	9.98				
r_out	11.40	11.47	10.16	10.22	10.23	10.82	10.29	10.18	9.76	9.84	9.39	9.61

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.226757197	2	0.113378598	0.253795722	0.778438883	3.521893261
Within groups	8.487902608	19	0.446731716			
Total	8.714659805	21				

within-sd	0.668379919
effective n	6.18
s_bb	0
s_bb_min	0.153120867
u_bb	0.153120867
u_bb(rel.)	1.477611661

Fe in BAM-M386a:

r_0	57.85	63.65										
r_in	59.15	59.97	59.64	61.63	59.93	60.76	63.39	59.21				
r_out	60.06	60.58	61.19	61.38	60.93	61.55	60.74	61.69	61.03	62.12	61.09	60.80

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.961042424	2	0.980521212	0.538947135	0.592020385	3.521893261
Within groups	34.56721784	19	1.819327254			
Total	36.52826026	21				

within-sd	1.348824397
effective n	6.18
s_bb	0
s_bb_min	0.309005634
u_bb	0.309005634
u_bb(rel.)	0.507951936

Mg in BAM-M386a:

r_0	66.68	70.10										
r_in	69.10	66.91	68.62	66.57	67.96	67.51	68.01	68.34				
r_out	67.55	67.45	67.04	66.86	66.95	67.24	66.82	66.97	67.30	67.60	67.65	67.62
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	3.293890152	2	1.646945076	2.604538061	0.100084346	3.521893261						
Within groups	12.01439784	19	0.632336728									
Total	15.30828799	21										
within-sd	0.795196031											
effective n	6.18											
s_bb	0.40512692											
s_bb_min	0.182173494											
u_bb	0.40512692											
u_bb(rel.)	0.59944125											

Mn in BAM-M386a:

r_0	9.43	11.07										
r_in	11.06	11.16	10.45	10.05	10.86	10.80	10.29	10.36				
r_out	11.41	11.22	11.49	11.04	10.56	10.47	10.49	10.50	10.77	10.69	10.51	10.36
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	0.542396591	2	0.271198295	1.230798997	0.31431831	3.521893261						
Within groups	4.186522435	19	0.220343286									
Total	4.728919026	21										
within-sd	0.469407378											
effective n	6.18											
s_bb	0.090700307											
s_bb_min	0.107537738											
u_bb	0.107537738											
u_bb(rel.)	1.006564938											

Ni in BAM-M386a:

r_0	22.25	23.93										
r_in	22.67	22.29	23.00	22.99	22.83	22.92	23.66	23.19				
r_out	21.69	21.58	22.31	22.41	22.52	22.43	22.50	22.98	22.68	23.00	22.29	23.52
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	1.293569318	2	0.646784659	2.168755404	0.141788548	3.521893261						
Within groups	5.666341396	19	0.298228495									
Total	6.959910714	21										
within-sd	0.546103007											
effective n	6.18											
s_bb	0.237453333											
s_bb_min	0.125108136											
u_bb	0.237453333											
u_bb(rel.)	1.04554746											

P in BAM-M386a:

r_0	6.12	7.82										
r_in	6.35	7.46	6.68	6.76	6.93	6.86	7.31	6.90				
r_out	8.68	6.77	6.93	8.32	6.37	6.58	6.68	6.85	5.92	5.98	5.93	6.21
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	0.130323106	2	0.065161553	0.11301044	0.893737165	3.521893261						
Within groups	10.95535521	19	0.576597642									
Total	11.08567831	21										
within-sd	0.759340268											
effective n	6.18											
s_bb	0											
s_bb_min	0.173959206											
u_bb	0.173959206											
u_bb(rel.)	2.544446862											

Pb in BAM-M386a:

r_0	17.26	19.78										
r_in	19.69	19.98	19.79	20.41	19.48	19.80	18.51	18.93				
r_out	18.96	19.31	20.62	20.45	19.19	20.87	19.85	19.15	19.98	19.45	18.76	19.36
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	2.265896591	2	1.132948295	1.976427794	0.166039084	3.521893261						
Within groups	10.89137568	19	0.573230299									
Total	13.15727227	21										
within-sd	0.757119739											
effective n	6.18											
s_bb	0.300903003											
s_bb_min	0.173450499											
u_bb	0.300903003											
u_bb(rel.)	1.541008907											

S in BAM-M386a:

r_0	14.69	18.19										
r_in	15.29	16.89	16.93	16.57	16.71	16.57	15.41	17.99				
r_out	15.93	16.51	16.22	16.25	16.59	16.17	15.90	15.16	16.86	15.71	15.86	16.11
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	0.971440152	2	0.485720076	0.68095837	0.518062271	3.521893261						
Within groups	13.55248991	19	0.713288943									
Total	14.52393006	21										
within-sd	0.844564351											
effective n	6.18											
s_bb	0											
s_bb_min	0.193483409											
u_bb	0.193483409											
u_bb(rel.)	1.187312767											

Sb in BAM-M386a:

r_0	22.70	29.96										
r_in	27.53	26.90	27.79	24.62	29.85	25.60	24.74	25.87				
r_out	25.01	23.26	23.94	24.86	25.73	25.02	23.67	26.62	29.14	24.80	26.02	25.14
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	9.183502273	2	4.591751136	1.167388029	0.332523519	3.521893261						
Within groups	74.73373844	19	3.933354655									
Total	83.91724071	21										
within-sd	1.983268679											
effective n	6.18											
s_bb	0.326351518											
s_bb_min	0.454352099											
u_bb	0.454352099											
u_bb(rel.)	1.757432032											

Se in BAM-M386a:

r_0	8.94	9.46				
r_in	9.00	9.20	9.40	9.30		
r_out	9.20	8.70	9.10	9.00		
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.1135	2	0.05675	1.080952381	0.389845867	4.737414128
Within groups	0.3675	7	0.0525			
Total	0.481	9				
within-sd	0.229128785					
effective n	3.20					
s_bb	0.036443449					
s_bb_min	0.093645659					
u_bb	0.093645659					
u_bb(rel.)	1.025691777					

Si in BAM-M386a:

r_0	6.62	10.60										
r_in	12.59	11.80	10.73	9.68	11.76	11.24	10.37	10.30				
r_out	12.29	12.62	11.86	11.60	11.46	10.68	9.86	10.58	11.39	9.96	10.25	10.86
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	11.23521477	2	5.617607386	4.602421674	0.02344683	3.521893261						
Within groups	23.19095205	19	1.220576423									
Total	34.42616682	21										
within-sd	1.104797006											
effective n	6.18											
s_bb	0.843376796											
s_bb_min	0.253100774											
u_bb	0.843376796											
u_bb(rel.)	7.760054169											

Sn in BAM-M386a:

r_0	21.99	22.41					
r_in	22.60	22.70	22.50	22.70			
r_out	22.20	22.50	22.90	22.80			
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*	
Between groups	0.2735	2	0.13675	2.311267606	0.169546993	4.737414128	
Within groups	0.414166667	7	0.059166667				
Total	0.687666667	9					
within-sd	0.243241992						
effective n	3.20						
s_bb	0.155707391						
s_bb_min	0.099413772						
u_bb	0.155707391						
u_bb(rel.)	0.691111368						

Te in BAM-M386a:

r_0	25.31	33.61										
r_in	33.81	31.71	30.23	29.70	35.13	29.98	33.25	30.86				
r_out	32.20	33.97	33.53	31.26	32.80	32.61	34.42	31.57	30.47	28.22	29.00	32.77
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	10.62179583	2	5.310897917	0.981634676	0.392914966	3.521893261						
Within groups	102.7949225	19	5.410259078									
Total	113.4167183	21										
within-sd	2.325996362											
effective n	6.18											
s_bb	0											
s_bb_min	0.532868461											
u_bb	0.532868461											
u_bb(rel.)	1.683362694											

Ti in BAM-M386a:

r_0	30.15	33.67										
r_in	31.89	32.23	31.87	32.82	33.09	32.08	32.70	34.52				
r_out	33.27	33.03	33.84	33.04	32.96	33.29	32.87	32.99	32.98	33.15	33.04	33.48
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	3.249760606	2	1.624880303	2.477526596	0.110633432	3.521893261						
Within groups	12.46110771	19	0.655847774									
Total	15.71086831	21										
within-sd	0.80984429											
effective n	6.18											
s_bb	0.395923303											
s_bb_min	0.185529301											
u_bb	0.395923303											
u_bb(rel.)	1.204812531											

Zn in BAM-M386a:

r_0	36.10	38.98										
r_in	37.37	37.20	37.17	36.41	38.26	37.11	36.26	38.11				
r_out	36.85	37.08	36.56	37.11	36.31	36.07	35.86	36.20	36.28	36.27	35.32	35.86
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	5.416502652	2	2.708251326	4.817228959	0.020310192	3.521893261						
Within groups	10.68182053	19	0.562201081									
Total	16.09832318	21										
within-sd	0.749800694											
effective n	6.18											
s_bb	0.589198767											
s_bb_min	0.17177376											
u_bb	0.589198767											
u_bb(rel.)	1.60278617											