Certification Report

Certified Reference Materials

BAM-M384a, BAM-M384b

Pure Copper

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Summary

This report describes preparation, analysis and certification of the pure copper reference materials BAM-M384a and -384b. They both replace ERM®-EB-384.
The certified reference materials are available in the form of discs (38 mm diameter and 30 mm height). They are intended for establishing and checking the calibration of optical emission and X-ray spectrometers for the analysis of samples of similar matrix composition.
The following mass fractions and uncertainties have been certified:

BAM-M384a:

Element	Mass fraction in mg/kg	Uncertainty in mg/kg
Ag	10.7	0.4
As	5.4	0.8
Bi	6.16	0.25
Cd	4.1	0.2
Co	3.64	0.16
Fe	2.7	0.5
Mn	0.22	0.03
Ni	6.1	0.5
Pb	11.7	1.1
Sb	5.4	0.5
Se	5.8	0.6
Sn	2.6	0.5
Te	9.3	0.7
Zn	5.3	0.5

BAM-M384b:

Element	Mass fraction in mg/kg	Uncertainty in mg/kg
Ag	11.3	0.4
As	6.6	1.1
Bi	7.0	0.4
Cd	4.0	0.2
Co	10.4	0.5
Mg	3.3	0.5
Mn	8.1	0.9
Ni	4.7	0.6
Pb	1.6	0.4
Sb	5.8	0.4
Sn	2.1	0.4
Te	7.2	0.7
Ti	2.9	0.6
Zn	2.6	0.5
Zr	1.3	0.4

This report contains detailed information on the preparation of the CRMs as well as on homogeneity investigations and on the analytical methods used for certification analysis.
The certified values are based on the results of 11 laboratories which participated in the certification interlaboratory comparisons.

Content

List of abbreviations

(if not explained elsewhere)

Combustion/IR	infrared-spectrometry after combustion in a ceramic crucible
CRM	certified reference material
ERM	European reference material
ETAAS	electrothermal atomic absorption spectrometry
ETV-ICP-OES	inductively coupled plasma optical emission spectrometry after electrothermal vaporisation
FAAS	flame atomic absorption spectrometry
GDMS	glow discharge mass spectrometry
ICP-OES	inductively coupled plasma optical emission spectrometry
ICP-MS	inductively coupled plasma mass spectrometry
SOES	spark optical emission spectrometry
XRF	X-ray fluorescence spectrometry
M	mean value
n	number of accepted data sets
s	standard deviation of an individual data set
s_M	standard deviation of of laboratory means
s_{rel}	relative standard deviation
$\bar{s}_i$	mean of standard deviations of data sets under repeatability conditions
M_i	single result
I	ICP-OES (Tables 37 – 80)
I(R)	ICP-OES, revised value (Tables 37 – 80)
IMS	ICP-MS (Tables 37 – 80)
A	FAAS (Tables 37 – 80)
GD	GDMS (Tables 37 – 80)
P	spectrophotometry (Tables 37 – 80)
EA	electrothermal atomic absorption spectrometry (Tables 37 – 80)
ETV-I	ICP-OES after electrothermal vaporisation (Tables 37 – 80)
V	combustion/IR (Tables 37 – 80)
r_0	measure from spark emission of the centre of the disc (see Annex 4)
r_in	measure from spark emission of the inner circle of the disc (see Annex 4)
r_out	measure from spark emission of the outer circle of the disc (see Annex 4)

1. Introduction

In the metal-producing and metal-working industry mainly spark emission spectrometry (SOES) and X-ray fluorescence spectrometry (XRF) are used for reception inspection of raw materials, e.g. scrap, for quality control of end products and production control. These time saving analytical techniques require suitable reference materials for calibration and recalibration. The certified reference materials BAM-M384a and BAM-M384b are based on pure copper. These reference materials both replace the exhausted CRM ERM®-EB384. The reason why there are two succeeding CRMs replacing ERM®-EB384 is that the raw material has been cast in two batches which are slightly different in their composition.

Both CRMs were produced in close cooperation with the working group „Copper“ of the Committee of Chemists of the German Gesellschaft der Metallurgen und Bergleute e.V. (GDMB). Since all of the laboratories are highly experienced with copper analysis and participated in earlier interlaboratory comparisons, there was no preceding round robin test for qualification.

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

2. Companies/laboratories involved

Preparation of the material:

Wieland Werke AG, Vöhringen

Test for homogeneity:

BAM Bundesanstalt für Materialforschung und -prüfung, Division 1.6

Participants in the certification interlaboratory comparisons:

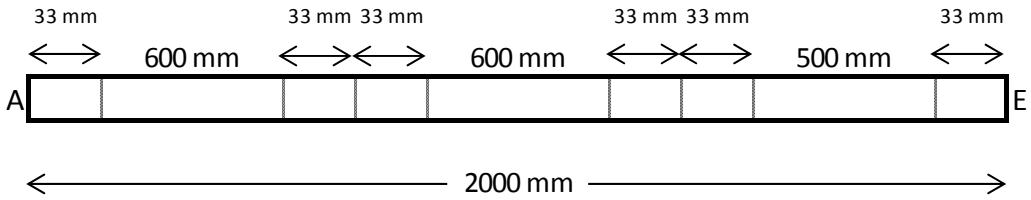
Allgemeine Gold- und Silberscheideanstalt, Pforzheim, Germany
Aurubis AG, Hamburg, Germany
BAM Bundesanstalt für Materialforschung und -prüfung, Berlin, Germany
Codelco, Chuquicamata, Chile
Diehl Metall Stiftung & Co. KG, Röthenbach, Germany
Institut Glörfeld, Willich, Germany
Johannes-Gutenberg-Universität Mainz, Institut für Kernchemie, Mainz, Germany
Montanwerke Brixlegg, Brixlegg, Austria
Outokumpu VDM, Werdohl, Germany
Umicore Precious Metals, Hoboken, Belgium
Wieland Werke AG, Vöhringen, Germany

Statistical evaluation of the data

BAM Bundesanstalt für Materialforschung und -prüfung, Divisions 1.4 and 1.6

3. Candidate materials

Both batches of the two CRMs were cast by Wieland-Werke AG, Vöhringen starting with pure copper which was doped with the desired impurities. After solidification the materials were pressed to rods with a diameter of ca. 40 mm which were cut into five rods of 2 m lengths each. From these rods several samples were cut for homogeneity testing and chemical analysis, see Figure 1.



384a	mm	A No. to No.	mm	mm	No. to No.	mm	mm	No. to No. E	mm	
rod	33	ca. 600 mm	33	33	ca. 600 mm	33	33	ca. 500 mm	33	
3.1	1	2-18	19	20	21-37	38	39	40-52	53	sample number
3.2	54	55-69	70	71	72-88	89	90	91-103	104	sample number
3.3	105	106-122	123	124	125-141	142	143	144-156	157	sample number
3.4	161	162-178	179	180	181-197	198	199	200-212	213	sample number
3.5	214	215-230	232	233	233-249	251	252	252-264	267	sample number

384b	mm	A No. to No.	mm	mm	No. to No.	mm	mm	No. to No. E	mm	
rod	33	ca. 600 mm	33	33	ca. 600 mm	33	33	ca. 500 mm	33	
4.1	1	2-18	19	20	21-37	38	39	40-50	51	sample number
4.2	52	53-69	70	71	72-88	89	90	91-103	104	sample number
4.3	105	106-122	123	124	125-141	142	143	144-156	157	sample number
4.4	158	159-175	176	177	178-184	185	186	187-201	202	sample number
4.5	203	204-220	221	222	223-239	240	241	241-255	256	sample number

Figure 1: Cutting plans of pure copper reference materials

4. Homogeneity testing

Possible reasons for an inhomogeneous distribution of elements in the raw material may be a change of the composition of the melt during the casting procedure because some elements may volatise during casting or segregate during the solidification of the material.
Homogeneity testing of the raw material was performed on the discs listed in Table 1 using spark emission spectrometry. All tests were carried out with a Spectrolab spark emission spectrometer.

Tab. 1a: Discs analysed for homogeneity testing of BAM-M384a

axial	1	20	39	161	180	199
	214	233	252	267		
radial	38	198	251			

Tab. 1b: Discs analysed for homogeneity testing of BAM-M384b

axial	1	20	39	52	71	90	105	124
	143	158	177	186	203	222	241	256
radial	19	70	123	176	221			

All samples were analysed 5 times (2 sparks per run) in a randomly chosen order.
The estimates of inhomogeneity contributions u_{bb} potentially hidden by the measurement uncertainty and to be included into the total uncertainty budget were estimated according to ISO Guide 35 [3] as the maximum of the values obtained from Eq. (1) and (2).

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

$$s_{bb\,min} = \sqrt{\frac{MS_{within}}{n}} \times \sqrt[4]{\frac{2}{N(n-1)}} \qquad (2)$$

with

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

s_{bb} signifies the between-disc standard deviation (inhomogeneities within the total batch) as well as the within-disc standard deviation (inhomogeneities over the area of one disc), whereas $s_{bb'min}$ 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}. Eq. (1) does not apply if MS_{within} is larger than MS_{among}.

The results of the statistical evaluation of the inhomogeneity data over the total batch can be seen in Annex 3.

As mentioned in Tables 1a and 1b several 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: 12 sparks, inner circle: 6 sparks; centre: 1 spark).

The estimates of inhomogeneity contributions were calculated in the same way as for the total batch. To calculate the necessary data an unbalanced ANOVA was carried out taking into account that the number of single measurements is different for the centre, the inner and the outer circle. For technical reasons, at r_0 (centre) only one measurement per height position is possible. An ANOVA requires minimum two measurements per factor value. Thus, the value for r_0 should be replaced by a dummy. This dummy is defined as follows:

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

Annex 4 shows the results of the calculations.

For some of the analysed elements the instrument used for homogeneity testing was not sensitive enough to get results suitable for an estimation of inhomogeneity. In these cases the inhomogeneity contribution to the total uncertainty was estimated taking the value of another element which is present in the material with a similar content. This estimation is justified since all impurities are present only in small quantities. Segregation effects are normally only occurring in case elements are present in higher quantities, but not for traces. The elements concerned are highlighted yellow in the resp. Tables 36a and b.

5. Characterisation study

5.1 Analytical methods

11 laboratories participated in the certification interlaboratory comparisons. For some elements part of the laboratories used more than one analytical method reporting more than one dataset. 10 laboratories received a randomly chosen disc; one external laboratory received chips prepared by BAM.

The laboratories were asked to analyse six subsamples. They were free to choose any suitable analytical method for analysis. Table 2 shows the analytical methods used by the participating laboratories.

For all analytical methods where a calibration was necessary this calibration was performed using liquid standard solutions. All participating laboratories were instructed to use only standard solutions prepared from pure metals or stoichiometric compounds or well checked commercial calibration solutions.

Table 2: Analytical procedures used by the participating laboratories*

Lab-No.	Element.	Sample mass	Sample pre-treatment	Analytical method
1	Ag, Co, Cr, Fe, Sb, Se, Te	30 – 40 mg		INAA
	P	40 – 50 mg		ETV-ICP-OES, Calibration with BAM-M390 and ERM-EB385
	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, Pb, Sb, Sn, Te, Ti, Zn, Zr	1 g	Dissolution with acid mixture HF/HNO_3 (2,5+10)	High resolution ICP-MS, calibration with commercial solutions (Merck)
	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Se, Si, Sn, Te, Ti, Zn, Zr			GDMS, calibration with doped pressed powder samples
2	Ag, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, Pb, Sb, Se, Sn, Te, Ti, Zn, Zr			ICP-OES, calibration with commercial solutions (Merck, NIST-traceable)
3 (384)	Ag, As, Bi, Cd, Co, Cr, Fe, Mn, Ni, Pb, Sb, Se, Sn, Ti, Zr	1 g	Dissolution with acid mixture HNO_3/HF	ICP-OES, calibration with certified commercial solutions, matrix matching with pure copper
3 (383)	Al, Cd, Co, Cr, Fe, Mn, Ni, P, Sb, Se, Si, Ti, Zr	1 g	Dissolution with acid mixture HCl/HNO_3/HF	ICP-OES, calibration with certified commercial solutions, matrix matching with pure copper
3 (383)	As, Pb, Sn	1 g	Dissolution with acid mixture HCl/HNO_3/HF	ETAAS, calibration with certified commercial solutions, matrix matching with pure copper
3 (383)	Bi, Te	0.5 g	Dissolution with HNO_3	ETAAS, calibration with certified commercial solutions, matrix matching with pure copper
3 (383)	Ag, Fe, Se	0.5 g	Dissolution with HNO_3	ICP-OES, calibration with certified commercial solutions, matrix matching with pure copper
3 (383)	Zn	0.5 g	Dissolution with HNO_3	FAAS, calibration with certified commercial solutions, matrix matching with pure copper
4	Ag, As, Bi, Cd, Co, Cr, Fe, Mn, Ni, Pb, S, Sb, Se, Sn, Te, Zn			ICP-OES
5	As, Pb, Sn	1 g	Dissolution with acid mixture HCl/HNO_3/HF	ETAAS, calibration with certified commercial solutions, matrix matching with pure copper

Lab-No.	Element.	Sample mass	Sample pre-treatment	Analytical method
	Bi, Te	0.5 g	Dissolution with HNO_3	ETAAS, calibration with certified commercial solutions, matrix matching with pure copper
	Ag, Fe, Se	0.5 g	Dissolution with HNO_3	ICP-OES, calibration with certified commercial solutions, matrix matching with pure copper
	Zn	0.5 g	Dissolution with HNO_3	FAAS, calibration with certified commercial solutions, matrix matching with pure copper
6	As ,Al, Bi, Co, Cr, Fe, Mg, Mn, Ni, Pb, Cd, Se, Te	1 g	Dissolution with HNO_3	ICP-OES with matrix matched standards
	Sb, Sn, Ti, Zn, Zr, Mg, Mn	1 g	Dissolution with $HCl/HNO_3/HF$	ICP-OES with matrix matched standards
	Ni, Se, Te	1 g	Dissolution with HNO_3	ETAAS
	As, Bi, Ni, Pb, Sb, Se, Sn	20 mg		ETV-ICP-OES
7	Ag	1 g	Dissolution with HNO_3/HF (DIN EN 15605)	ICP-OES, calibration with matrix matched standards
	Bi (383a)	0.4 g	Dissolution with HNO_3/HF under pressure	ETAAS, calibration with matrix matched standards
	As, Co, Mn, Ni, Pb, Sb (383a)	1 g	Dissolution with HNO_3	ETAAS, calibration with matrix matched standards
	Cd, Fe, Zn (383a)	1 g	Dissolution with $HCl/HNO_3/H_3BO_3$/HF under pressure (DIN EN 15605)	ICP-OES, calibration with matrix matched standards
	Te (383b,c)	0.2 g	Dissolution with HNO_3/HF under pressure	ETAAS, calibration with matrix matched standards
	Fe, Ni, Zn (383b)	1 g	Dissolution with $HCl/HNO_3/H_3BO_3$/HF under pressure (DIN EN 15605)	ICP-OES, calibration with matrix matched standards
	As, Bi, Cd, Co, Mn, Ni, Pb, Sb (383b)	1 g	Dissolution with HNO_3	ETAAS, calibration with matrix matched standards
	Sb (383c)	0.4 g	Dissolution with HNO_3/HF under pressure	ETAAS, calibration with matrix matched standards
	As, Bi, Mn, Pb (383c)	1 g	Dissolution with HNO_3/HF under pressure	ETAAS, calibration with matrix matched standards
	Al, Cd, Co, Cr, Mn, Ni, Ti, Zn, Zr (383c)	1 g	Dissolution with $HCl/HNO_3/H_3BO_3$/HF under pressure (DIN EN 15605)	ICP-OES, calibration with matrix matched standards
	As, Cd, Co, Fe, Ni, Pb, Zn (384a)	1 g	Dissolution with $HCl/HNO_3/H_3BO_3$/HF under pressure (DIN EN 15605)	ICP-OES, calibration with matrix matched standards
	Mn (384a)	1 g	Dissolution with HNO_3	ETAAS, calibration with matrix matched standards
	Bi, Sb, Se, Te (384a)	0.2 g	Dissolution with HNO_3/HF under pressure	ETAAS, calibration with matrix matched standards
	P (384a,b)	5 g	Dissolution with H_2SO_4/H_2O_2	Spectrophotometry (ammonium molybdate) after extraction with methyisobutylketone, calibration with matrix matched standard

Lab-No.	Element.	Sample mass	Sample pre-treatment	Analytical method
	Al, As, Cd, Co, Mg, Mn, Ni, Si, Ti, Zn, Zr (384b)	1 g	Dissolution with $HCl/HNO_3/H_3BO_3$/HF under pressure (DIN EN 15605)	ICP-OES, calibration with matrix matched standards
	Bi, Sb, Te (384b)	0.2 g	Dissolution with HNO_3/HF under pressure	ETAAS, calibration with matrix matched standards
	Pb (384b)	1 g	Dissolution with HNO_3	ETAAS, calibration with matrix matched standards
8	Ag, Co, Sb, Zn	5 g	Dissolution with HNO_3	INAA
9	Ag, Al, As, Bi, Cd, Co, Cr, Fe, Mg, Mn, Ni, P, Pb, S, Sb, Se, Si, Sn, Te, Ti, Zn, Zr		Dissolution with HCl/HNO_3	ICP-OES
10	Ag, Al, Bi, Cd, Co, Mg, Mn, Ni, Pb, Se, Sn, Te, Ti, Zn, Zr			GDMS, calibration with doped pressed powder samples
11	Ag, Cd, Co, Fe, Mg, Mn, Ni, Zn, Zr	1 g	Dissolution with HNO3	ICP-OES calibration with pure metals/pure substances
	P	5 g	Dissolution with H_2SO_4/H_2O_2	Spectrophotometry, calibration with pure substance KH_2PO_4
	S			Combustion/iodometric titration

* The certification interlaboratory comparison was carried out simultaneously for BAM-M384a and b as well as for BAM-M383a-c. Therefore the table shows the analytical methods used for all five samples.

5.2 Analytical results and statistical evaluation

The analytical results of the certification interlaboratory comparison are listed in Tables 37 to 80. These tables show the single results (M_i) of each laboratory, the respective laboratory mean (M) together with the relative intralaboratory standard deviation (s_{rel}) and in addition the mean repeatability standard deviation ($\bar{s}_i$) over all laboratories. 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.

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

Table 3a: Outcome of statistical tests of results obtained for Ag in BAM-M384a

Number of data sets	13
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 4
Dixon (α = 0.01)	Laboratory 4
Nalimov (α = 0.05)	Laboratory 4
Nalimov (α = 0.01)	Laboratory 4
Grubbs (α = 0.05)	Laboratory 4
Grubbs (α = 0.01)	Laboratory 4
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 4) was removed.

Table 3b: Outcome of statistical tests of results obtained for Ag in BAM-M384a (after removal of outlier)

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 1/GD
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 1/GD
Nalimov (α = 0.01)	Laboratory 1/GD
Grubbs (α = 0.05)	Laboratory 1/GD
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 1/GD) was not removed.

Table 4: Outcome of statistical tests of results obtained for As in BAM-M384a

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

Table 5a: Outcome of statistical tests of results obtained for Bi in BAM-M384a

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 4
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 4
Nalimov (α = 0.01)	Laboratory 4
Grubbs (α = 0.05)	Laboratory 4
Grubbs (α = 0.01)	Laboratory 4
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 4) was removed.

Table 5b: Outcome of statistical tests of results obtained for Bi in BAM-M384a (after removal of outliers)

Number of data sets	9
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 1/IMS
Nalimov (α = 0.01)	Laboratory 1/IMS
Grubbs (α = 0.05)	Laboratory 1/IMS
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 1/IMS) was not removed.

Table 6a: Outcome of statistical tests of results obtained for Cd in BAM-M384a

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 10
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 10
Nalimov (α = 0.01)	Laboratory 10
Grubbs (α = 0.05)	Laboratory 10
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 10) was removed.

Table 6b: Outcome of statistical tests of results obtained for Cd in BAM-M384a (after removal of outliers)

Number of data sets	9
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 1/IMS
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 1/IMS) was not removed.

Table 7a: Outcome of statistical tests of results obtained for Co in BAM-M384a

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 8
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 8
Nalimov (α = 0.01)	Laboratory 8
Grubbs (α = 0.05)	Laboratory 8
Grubbs (α = 0.01)	Laboratory 8
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 8) was removed.

Table 7b: Outcome of statistical tests of results obtained for Co in BAM-M384a (after removal of outliers)

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 4
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 4) was not removed.

Table 8a: Outcome of statistical tests of results obtained for Fe in BAM-M384a

Number of data sets	9
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 5
Dixon (α = 0.01)	Laboratory 5
Nalimov (α = 0.05)	Laboratory 5
Nalimov (α = 0.01)	Laboratory 5
Grubbs (α = 0.05)	Laboratory 5
Grubbs (α = 0.01)	Laboratory 5
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 5) was removed.

Table 8b: Outcome of statistical tests of results obtained for Fe in BAM-M384a (after removal of outliers)

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

The outlying value (Lab. 7) was not removed.

Table 9a: Outcome of statistical tests of results obtained for Mn in BAM-M384a

Number of data sets	7 (11*)
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 4
Dixon (α = 0.01)	Laboratory 4
Nalimov (α = 0.05)	Laboratory 4
Nalimov (α = 0.01)	Laboratory 4
Grubbs (α = 0.05)	Laboratory 4
Grubbs (α = 0.01)	Laboratory 4
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

*Four laboratories reported 6 times < 1, these values were not included into the statistical evaluation.

The outlying value (Lab. 4) was removed.

Table 9b: Outcome of statistical tests of results obtained for Mn in BAM-M384a (after removal of outlier)

Number of data sets	6
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	---
Skewness & Kurtosis Test (α = 0.01)	---

Table 10a: Outcome of statistical tests of results obtained for Ni in BAM-M384a

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 10
Dixon (α = 0.01)	Laboratory 10
Nalimov (α = 0.05)	Laboratory 10
Nalimov (α = 0.01)	Laboratory 10
Grubbs (α = 0.05)	Laboratory 10
Grubbs (α = 0.01)	Laboratory 10
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 10) was removed.

Table 10b: Outcome of statistical tests of results obtained for Ni in BAM-M384a (after removal of outlier)

Number of data sets	6
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 4
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 4) was not removed.

Table 11: Outcome of statistical tests of results obtained for Pb in BAM-M384a

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 4
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 4) was not removed.

Table 12a: Outcome of statistical tests of results obtained for Sb in BAM-M384a

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 9
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 9
Nalimov (α = 0.01)	Laboratory 9
Grubbs (α = 0.05)	Laboratory 9
Grubbs (α = 0.01)	Laboratory 9
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 9) was removed.

Table 12b: Outcome of statistical tests of results obtained for Sb in BAM-M384a (after removal of outlier)

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 10
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 10) was not removed.

Table 13a: Outcome of statistical tests of results obtained for Se in BAM-M384a

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 4
Dixon (α = 0.01)	Laboratory 4
Nalimov (α = 0.05)	Laboratory 4
Nalimov (α = 0.01)	Laboratory 4
Grubbs (α = 0.05)	Laboratory 4
Grubbs (α = 0.01)	Laboratory 4
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 4) was removed.

Table 13b: Outcome of statistical tests of results obtained for Se in BAM-M384a (after removal of outlier)

Number of data sets	9
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 6/I
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 6/I) was not removed.

Table 14: Outcome of statistical tests of results obtained for Sn in BAM-M384a

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 1/GD
Nalimov (α = 0.01)	Laboratory 1/GD
Grubbs (α = 0.05)	Laboratory 1/GD
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 1/GD) was not removed.

Table 15: Outcome of statistical tests of results obtained for Te in BAM-M384a

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

Table 16a: Outcome of statistical tests of results obtained for Zn in BAM-M384a

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 6
Dixon (α = 0.01)	Laboratory 6
Nalimov (α = 0.05)	Laboratories 6 and 4**
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

**Laboratories 6 and 4 were detected as Grubbs Pair outliers and removed.

Table 16b: Outcome of statistical tests of results obtained for Zn in BAM-M384a (after removal of outliers)

Number of data sets	9
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 8
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 8
Nalimov (α = 0.01)	Laboratory 8
Grubbs (α = 0.05)	Laboratory 8
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 8) was not removed.

Table 17a: Outcome of statistical tests of results obtained for Ag in BAM-M384b

Number of data sets	13
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 4
Dixon (α = 0.01)	Laboratory 4
Nalimov (α = 0.05)	Laboratory 4
Nalimov (α = 0.01)	Laboratory 4
Grubbs (α = 0.05)	Laboratory 4
Grubbs (α = 0.01)	Laboratory 4
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 4) was removed.

Table 17b: Outcome of statistical tests of results obtained for Ag in BAM-M384b (after removal of outlier)

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratories 1/GD and 11
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 1/GD and 11
Nalimov (α = 0.01)	Lab. 1/GD
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying values (Labs. 1/GD and 11) were not removed.

Table 18: Outcome of statistical tests of results obtained for Al in BAM-384b

Number of data sets	8
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 9
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 9) was not removed.

Table 19: Outcome of statistical tests of results obtained for As in BAM-384b

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

Table 20a: Outcome of statistical tests of results obtained for Bi in BAM-384b

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratories 4 and 9
Dixon (α = 0.01)	Laboratory 4
Nalimov (α = 0.05)	Laboratory 4
Nalimov (α = 0.01)	Laboratory 4
Grubbs (α = 0.05)	Laboratory 4
Grubbs (α = 0.01)	Laboratory 4
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 4) was removed.

Table 20b: Outcome of statistical tests of results obtained for Bi in BAM-M384b (after removal of outlier)

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

The outlying value (Lab. 9) was removed.

Table 20c: Outcome of statistical tests of results obtained for Bi in BAM-M384b (after removal of outlier)

Number of data sets	8
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 2
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 2) was not removed.

Table 21a: Outcome of statistical tests of results obtained for Cd in BAM-384b

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 10
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 10
Nalimov (α = 0.01)	Laboratory 10
Grubbs (α = 0.05)	Laboratory 10
Grubbs (α = 0.01)	Laboratory 10
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 10) was removed.

Table 21b: Outcome of statistical tests of results obtained for Cd in BAM-M384b (after removal of outlier)

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

Table 22a: Outcome of statistical tests of results obtained for Co in BAM-384b

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 4
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	Laboratories 4 and 2**
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

**Laboratories 4 and 2 were detected as Grubbs Pair outliers and removed.

Table 22b: Outcome of statistical tests of results obtained for Co in BAM-384b (after removal of outliers)

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

Table 23: Outcome of statistical tests of results obtained for Cr in BAM-M384b

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

*One laboratory reported < 2, these values were not included into the statistical evaluation.

Table 24: Outcome of statistical tests of results obtained for Fe in BAM-M384b

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

Table 25a: Outcome of statistical tests of results obtained for Mg in BAM-M384b

Number of data sets	9
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 10
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	Laboratory 10
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 10) was removed.

Table 25b: Outcome of statistical tests of results obtained for Mg in BAM-M384b (after removal of outlier)

Number of data sets	8
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 2
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 2) was not removed.

Table 26a: Outcome of statistical tests of results obtained for Mn in BAM-M384b

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 4
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 4
Nalimov (α = 0.01)	Laboratory 4
Grubbs (α = 0.05)	Laboratory 4
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 4) was removed.

Table 26b: Outcome of statistical tests of results obtained for Mn in BAM-M384b (after removal of outlier)

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

Table 27: Outcome of statistical tests of results obtained for Ni in BAM-M384b

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

The outlying value (Lab. 10) was not removed.

Table 28a: Outcome of statistical tests of results obtained for Pb in BAM-384b

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 4
Dixon (α = 0.01)	Laboratory 4
Nalimov (α = 0.05)	Laboratory 4
Nalimov (α = 0.01)	Laboratory 4
Grubbs (α = 0.05)	Laboratory 4
Grubbs (α = 0.01)	Laboratory 4
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 4) was removed.

Table 28b: Outcome of statistical tests of results obtained for Pb in BAM-M384b (after removal of outlier)

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

Table 29a: Outcome of statistical tests of results obtained for Sb in BAM-384b

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 6
Dixon (α = 0.01)	Laboratory 6
Nalimov (α = 0.05)	Laboratory 6
Nalimov (α = 0.01)	Laboratory 6
Grubbs (α = 0.05)	Laboratory 6
Grubbs (α = 0.01)	Laboratory 6
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: not normal

The outlying value (Lab. 6) was removed.

Table 29b: Outcome of statistical tests of results obtained for Sb in BAM-M384b (after removal of outlier)

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

Table 30: Outcome of statistical tests of results obtained for Se in BAM-M384b

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

Table 31: Outcome of statistical tests of results obtained for Sn in BAM-M384b

Number of data sets	9
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 1/GD
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 1/GD) was not removed.

Table 32: Outcome of statistical tests of results obtained for Te in BAM-M384b

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

Table 33a: Outcome of statistical tests of results obtained for Ti in BAM-M384b

Number of data sets	9
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 1/IMS
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 1/IMS
Nalimov (α = 0.01)	Laboratory 1/IMS
Grubbs (α = 0.05)	Laboratory 1/IMS
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 1/IMS) was removed.

Table 33b: Outcome of statistical tests of results obtained for Ti in BAM-M384b (after removal of outlier)

Number of data sets	8
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 2
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 2
Nalimov (α = 0.01)	Laboratory 2
Grubbs (α = 0.05)	Laboratory 2
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 2) was removed.

Table 33c: Outcome of statistical tests of results obtained for Ti in BAM-M384b (after removal of outlier)

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

Table 34: Outcome of statistical tests of results obtained for Zn in BAM-M384b

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

Table 35: Outcome of statistical tests of results obtained for Zr in BAM-M384b

Number of data sets	6
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: insufficient data
Skewness & Kurtosis Test (α = 0.01)	Distribution: insufficient data

The certified mass fractions of all elements were calculated as mean of the accepted data sets. These values are given in Tables 36a and b.
The respective combined uncertainties were calculated from the contribution resulting from the certification interlaboratory 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 interlaboratory comparison

$u_{bb}(1)$ = inhomogeneity contribution due to a possible composition gradient over the length of the rod

$u_{bb}(2)$ = inhomogeneity contribution due to a possible composition gradient from the outer part of the disc to its centre

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 respective expanded uncertainties are given on Page 3-4 of this report.

Table 36a: Uncertainty calculation for BAM-M384a (all values in mg/kg)

	M	***n***	s_M	u_{bb} (1)	u_{bb} (2)	$u_{combined}$	Estimation*
Ag	10.68	12	0.53	0.024	0.038	0.158	
As	5.42	10	0.79	0.082	0.252	0.364	
Bi	6.16	9	0.24	0.048	0.078	0.121	
Cd	4.06	10	0.12	0.021	0.027	0.051	Co
Co	3.64	11	0.24	0.021	0.027	0.079	
Fe	2.70	8	0.35	0.073	0.152	0.210	Fe 384b
Mn	0.22	6	0.010	0.011	0.0054	0.013	Co 383a
Ni	6.13	10	0.48	0.161	0.105	0.244	
Pb	11.65	10	1.48	0.126	0.255	0.547	
Sb	5.37	11	0.26	0.161	0.105	0.207	Ni
Se	5.93	9	0.65	0.161	0.105	0.288	Ni
Sn	2.60	9	0.36	0.073	0.152	0.208	Fe 384b
Te	9.36	10	0.74	0.024	0.331	0.237	Ag
Zn	5.32	9	0.36	0.126	0.135	0.220	

* Inhomogeneity contribution estimated from data for the mentioned element

Table 36b: Uncertainty calculation for BAM-M384b (all values in mg/kg)

	M	*n*	s_M	u_{bb} (1)	u_{bb} (2)	$u_{combined}$	Estimation*
Ag	11.30	12	0.56	0.022	0.045	0.169	
Al	2.9	8	1.00	0.110	0.076	0.376	Zn
As	6.56	10	0.71	0.080	0.453	0.511	
Bi	6.81	8	0.20	0.049	0.074	0.113	
Cd	4.00	10	0.14	0.021	0.027	0.055	Co 384a
Co	10.44	10	0.68	0.056	0.075	0.234	
Fe	5.07	10	1.81	0.073	0.152	0.597	
Mn	8.11	10	1.09	0.146	0.184	0.417	
Ni	4.66	12	0.68	0.161	0.059	0.259	Ni 384a
Pb	1.56	9	0.37	0.110	0.076	0.180	
Sb	5.78	11	0.23	0.073	0.152	0.182	Fe
Se	2.94	10	1.02	0.110	0.076	0.347	Zn
Sn	2.08	9	0.33	0.110	0.076	0.172	Zn
Te	7.16	10	0.81	0.146	0.184	0.347	Mn
Zn	2.55	11	0.66	0.110	0.076	0.220	
Ti	2.93	7	0.31	0.214	0.110	0.267	
Cr	2.26	9	0.77	0.138	0.029	0.291	
Mg	3.29	8	0.45	0.057	0.123	0.207	
Zr	1.30	6	0.34	0.110	0.076	0.193	Zn

* Inhomogeneity contribution estimated from data for the mentioned element

6. Instructions for users and stability

The certified reference materials BAM-M384a and -384b are intended for the calibration and quality control of spark emission and X-ray fluorescence spectrometers used for the analysis of similar materials.
Before analysis the surface of the material should be cleaned by turning or milling.

If chips prepared from the compact material are used for wet chemical analysis, a minimum sample intake of 0.5 g has to be used.
The material will remain stable provided that it is not subjected to excessive heat (e.g., during preparation of the working surface).

7. Literature

[1] ISO Guide 31, Contents of certificates of reference materials, 1981

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

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

[4] Guidelines for the production of BAM Reference Materials, 2006

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

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

[7] ISO/IEC Guide 98-1:2009, Uncertainty of measurement -- Part 1: Introduction to the expression of uncertainty in measurement

8. Information on and purchase of the CRM

Certified reference materials BAM-M384a and -384b are supplied by

BAM Bundesanstalt für Materialforschung und -prüfung
Fachbereich 1.6: Anorganische Referenzmaterialien
Richard-Willstätter-Str. 11, D-12489 Berlin
Phone +49 (0)30 - 8104 2061 or 1119
Fax: +49 (0)30 - 8104 1117
E-Mail: sales.crm@bam.de

Each disc of BAM-M384a and -384b 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,

http://www.bam.de/en/fachthemen/referenzmaterialien/index.htm
www.webshop.bam.de

Annex 1: Results BAM-M384a

Lab./Meth.	1/GD	7/I	1/NAA	1/IMS	10/GD	6/I	3/I	5/I	9/I	2/I	8/NAA	11/I	4/I		Ges.
M_i [mg/kg]	10.08	10.22	9.92	10.75	10.40	10.6	10.97	11.0	11	10.60	11.10	11.10	14.51		N
	9.78	10.15	10.78	10.40	10.80	10.8	10.94	11.0	11	11.00	11.07	11.40	14.63		12
	9.88	10.07	10.05	10.65	10.50	10.9	11.00	11.0	11	11.70	11.04	11.50	14.64		
	9.14	10.19	10.73	10.34	10.60	11.0	10.87	11.0	11	10.90	11.04	11.40	14.44		
	8.70	10.22	10.21	10.38		10.5	10.81	11.0			10.91	11.60	14.49		
	9.13	10.14	10.23	10.35		10.3	10.82	11.0			11.27	11.50	14.63		
M [mg/kg]	**9.45**	**10.17**	**10.32**	**10.48**	**10.58**	**10.68**	**10.90**	**11.00**	**11.00**	**11.05**	**11.07**	**11.42**	**14.56**		**10.68**
s_M [mg/kg]	0.537	0.058	0.353	0.175	0.171	0.264	0.080	0.000	0.000	0.465	0.117	0.172	0.087		0.526
$\bar{s}_i$ [mg/kg]															0.260
s_{rel}	0.057	0.006	0.034	0.017	0.016	0.025	0.007	0.000	0.000	0.042	0.011	0.015	0.006		0.049

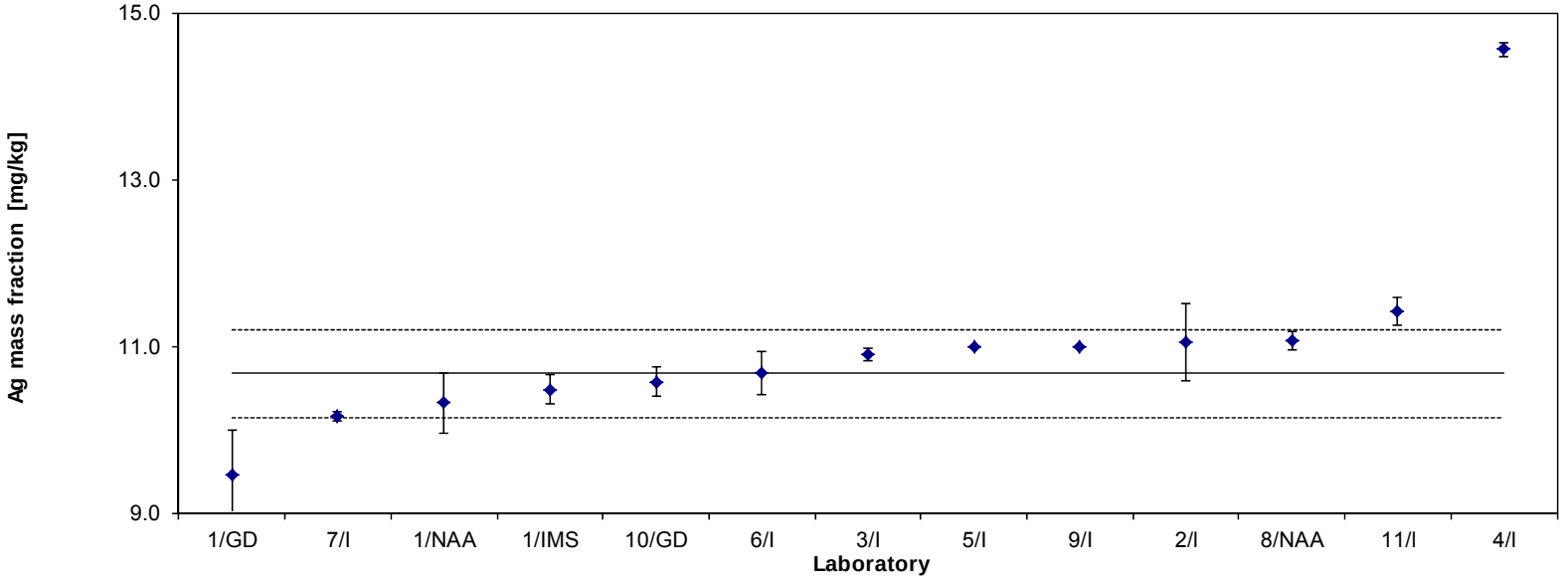


Table 37: Results for Ag in BAM-M384a

Lab./Meth.	10/GD	1/GD	1/IMS	9/I	3/I	5/EA	7/I	2/I	4/I	6/I		Ges.
M_i [mg/kg]	4.78	5.07	4.86	5	5.03	6.0	5.30	6.00	5.93	6.6		N
	4.60	4.82	4.94	5	5.32	6.0	5.94	6.00	5.86	6.6		10
	4.70	4.75	4.80	5	5.62	6.0	5.96	5.90	5.97	6.5		
	3.65	4.57	4.80	5	5.15	5.0	6.25	5.70	5.86	6.7		
	4.32	4.25	4.67		5.33	5.0	5.68		6.06	6.9		
	4.32	4.35	4.64		5.23	6.0	6.10		5.86	6.9		
$\bar{M}$ [mg/kg]	**4.40**	**4.63**	**4.79**	**5.00**	**5.28**	**5.67**	**5.87**	**5.90**	**5.92**	**6.70**		**5.42**
s_M [mg/kg]	0.412	0.308	0.113	0.000	0.201	0.516	0.338	0.141	0.081	0.167		0.719
$\bar{s}_i$ [mg/kg]												0.274
s_{rel}	0.094	0.066	0.024	0.000	0.038	0.091	0.058	0.024	0.014	0.025		0.133

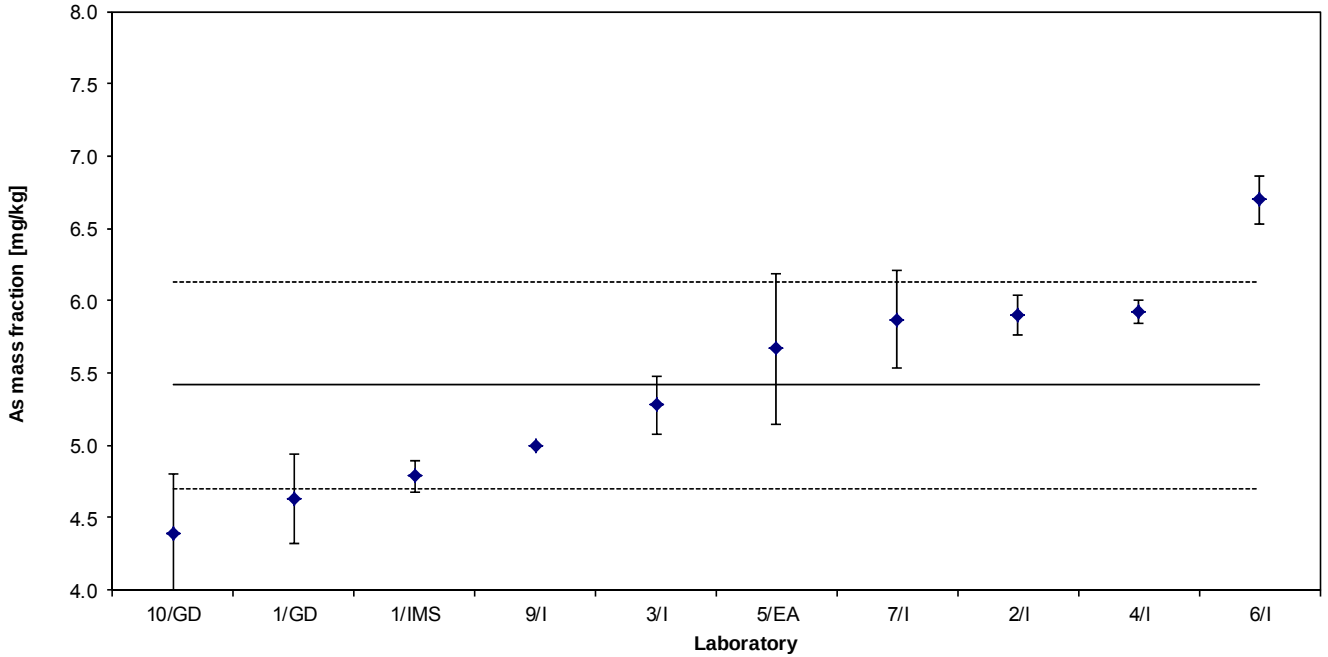


Table 38: Results for As in BAM-M384a

Lab./Meth.	4/I	1/IMS	9/I	7/EA	1/GD	2/I	3/I	10/GD	5/EA	6/I		Ges.
M_i [mg/kg]	4.68	5.68	6	5.98	5.99	6.00	5.96	5.90	7.0	6.7		N
	4.70	5.68	6	6.02	6.47	6.00	6.39	5.60	7.0	5.3		9
	4.74	5.73	6	6.23	6.81	6.30	5.37	5.62	7.0	6.4		
	4.71	5.77	6	5.84	5.63	6.40	6.44	6.13	6.0	6.4		
	4.67	5.48		6.36	5.78		6.91	7.29	6.0	6.8		
	4.73	5.55		6.09	6.23		6.82	7.41	5.0	7.1		
***M* [mg/kg]**	**4.71**	**5.65**	**6.00**	**6.09**	**6.15**	**6.18**	**6.32**	**6.33**	**6.33**	**6.45**		**6.16**
s_M [mg/kg]	0.027	0.108	0.000	0.185	0.441	0.206	0.574	0.819	0.816	0.622		0.239
$\bar{s}_i$ [mg/kg]												0.509
s_{rel}	0.006	0.019	0.000	0.030	0.072	0.033	0.091	0.129	0.129	0.096		0.039

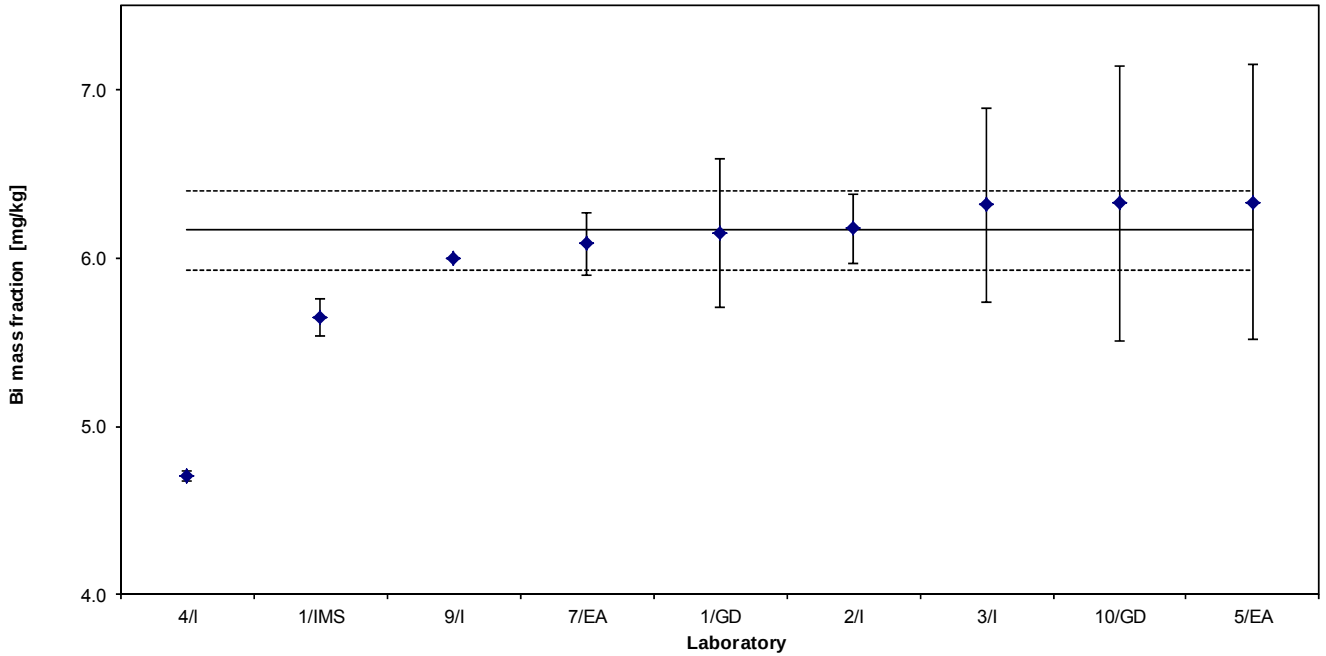


Table 39: Results for Bi in BAM-M384a

Lab./Meth.	6/I	4/I	9/I	5/I	3/I	2/I	11/I	1/GD	7/I	1/IMS	10/GD		Ges.
M_i [mg/kg]	3.8	3.95	4	4.0	4.08	3.90	4.25	4.39	4.20	4.39	4.47		N
	4.0	3.88	4	4.0	4.04	4.40	4.11	4.24	4.16	4.28	4.87		10
	3.9	3.93	4	4.0	4.01	3.90	4.02	4.27	4.30	4.27	4.43		
	3.9	3.98	4	4.0	4.00	4.00	3.96	3.93	4.16	4.18			
	4.0	3.88		4.0	4.05		3.97	3.81	4.18	4.32			
	3.9	4.00		4.0	4.03		4.06	3.99	4.31	4.37			
***M* [mg/kg]**	**3.92**	**3.94**	**4.00**	**4.00**	**4.04**	**4.05**	**4.06**	**4.11**	**4.22**	**4.30**	**4.59**		**4.06**
s_M [mg/kg]	0.075	0.050	0.000	0.000	0.029	0.029	0.238	0.227	0.069	0.076	0.243		0.120
$\bar{s}_i$ [mg/kg]													0.113
s_{rel}	0.019	0.013	0.000	0.000	0.007	0.007	0.059	0.055	0.016	0.018	0.053		0.029

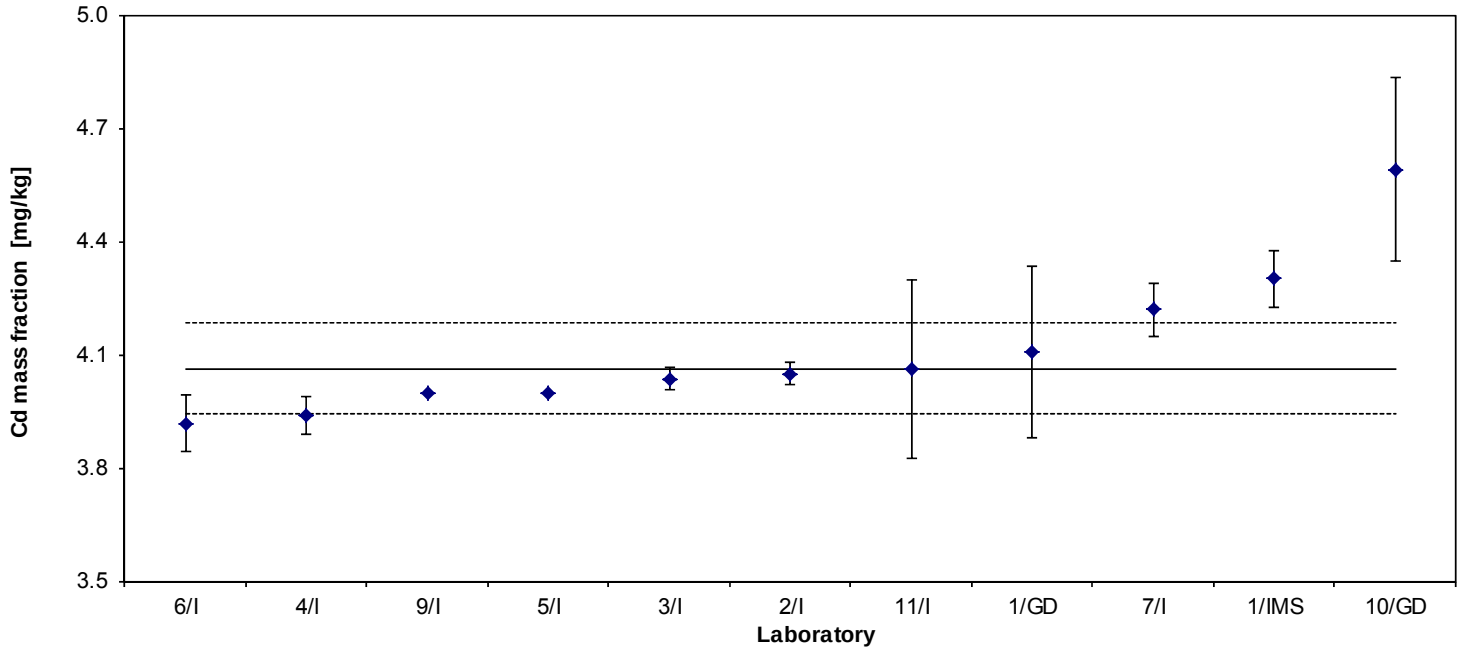


Table 40: Results for Cd in BAM-M384a

Lab./Meth.	4/I	3/I	9/I	2/I	7/I	10/GD	1/IMS	11/I	6/I	1/GD	5/I	8/NAA		Ges.
M_i [mg/kg]	3.16	3.40	3.5	3.50	3.55	3.60	3.56	3.69	3.8	4.13	4.0	4.78		N
	3.15	3.38	3.5	3.50	3.60	3.76	3.76	3.66	3.8	4.20	4.0	4.82		11
	3.18	3.43	3.5	3.60	3.64	3.74	3.69	3.71	3.9	4.11	4.0	4.77		
	3.26	3.46	3.5	3.50	3.52	3.65	3.68	3.74	3.8	3.73	4.0	4.85		
	3.18	3.40			3.60		3.73	3.70	3.8	3.86	4.0	4.82		
	3.12	3.44			3.62		3.71	3.64	3.8	3.66	4.0	4.80		
M [mg/kg]	**3.18**	**3.42**	**3.50**	**3.53**	**3.59**	**3.69**	**3.69**	**3.69**	**3.82**	**3.95**	**4.00**	**4.81**		**3.64**
s_M [mg/kg]	0.047	0.030	0.000	0.050	0.045	0.075	0.068	0.036	0.041	0.229	0.000	0.029		0.238
s_I [mg/kg]														0.082
s_{rel}	0.015	0.009	0.000	0.014	0.013	0.020	0.018	0.010	0.011	0.058	0.000	0.006		0.065

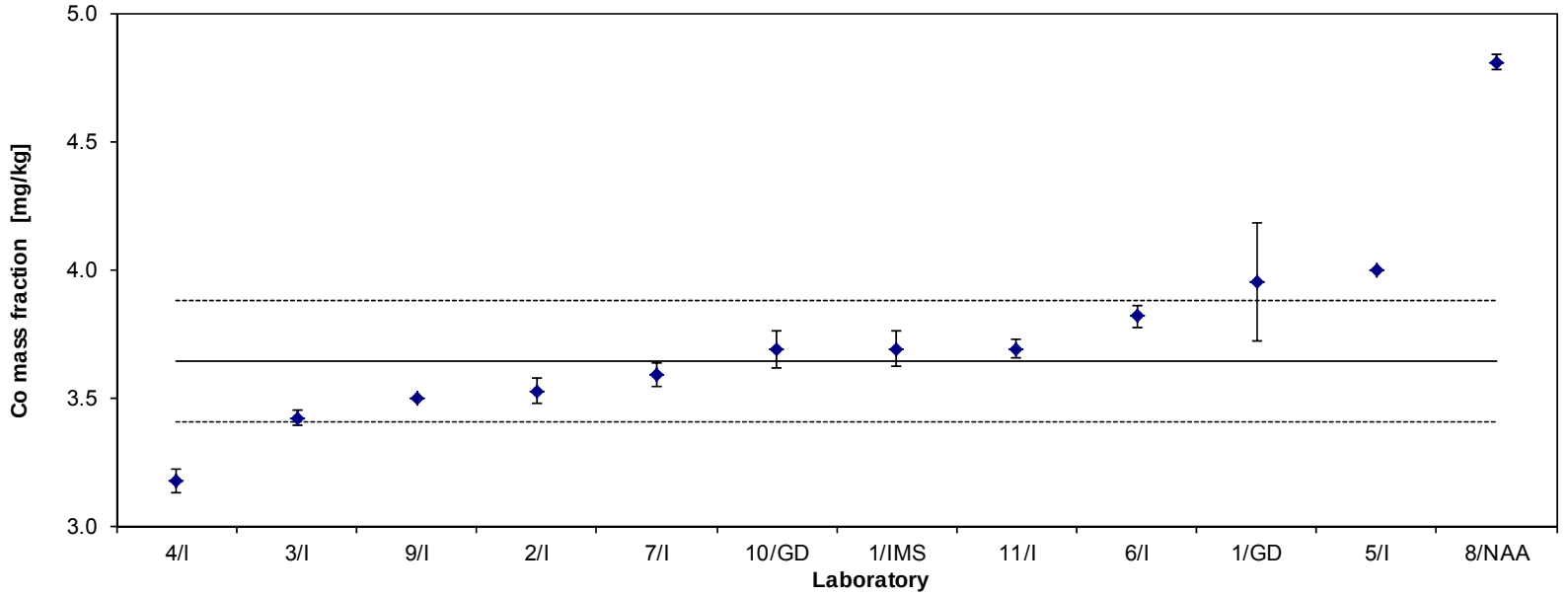


Table 41: Results for Co in BAM-M384a

Lab./Meth.	10/GD	3/I	1/IMS	1/GD	4/I	9/I	5/I	6/I	2/I		Ges.
M_i [mg/kg]	0.014	0.030	0.026	0.023	0.21	< 1	< 1	< 1			N
	0.020	0.030	0.019	0.033	0.18	< 1	< 1	< 1			5
	0.010	0.010	0.017	0.020	0.19	< 1	< 1	< 1			
		0.020	0.025	0.031	0.19	< 1	< 1	< 1			
		0.000	0.011	0.025	0.20		< 1	< 1			
		0.020	0.032	0.025	0.19		< 1	< 1			
M [mg/kg]	**0.015**	**0.018**	**0.022**	**0.026**	**0.193**	**< 1**	**< 1**	**< 1**	**< 1**		**0.05**
s_M [mg/kg]	0.005	0.012	0.007	0.007	0.005						0.078
$\bar{s}_i$ [mg/kg]											0.007
s_{rel}	0.340	0.638	0.345	0.284	0.026						1.412

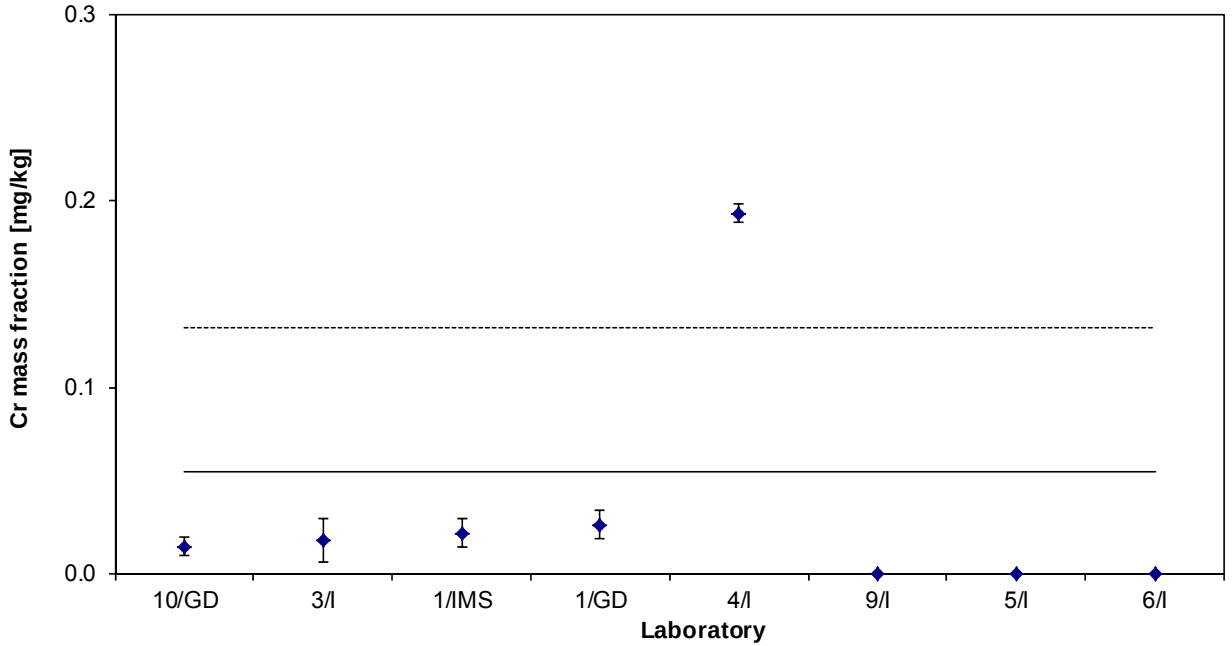


Table 42: Results for Cr in BAM-M384a

Lab./Meth.	7/I	9/I	6/I	4/I	11/I	2/I	1/GD	1/IMS	5/I		Ges.
M_i [mg/kg]	1.70	3	4.5	2.75	2.66	2.80	3.09	3.53	5.0		N
	2.71	2	1.9	2.62	2.64	3.00	3.21	3.11	4.0		8
	1.46	3	2.3	2.75	2.51	2.70	3.18	2.96	4.0		
	2.37	2	2.8	2.77	2.94	2.60	2.89	3.14	5.0		
	1.47		1.7	2.71	3.08		2.99	3.14	5.0		
	2.20		2.8	2.81	2.68		2.83	2.97	5.0		
M [mg/kg]	**1.99**	**2.50**	**2.67**	**2.74**	**2.75**	**2.78**	**3.03**	**3.14**	**4.67**		**2.70**
s_M [mg/kg]	0.518	0.577	1.005	0.065	0.213	0.171	0.154	0.206			0.352
$\bar{s}_i$ [mg/kg]											0.469
s_{rel}	0.261	0.231	0.377	0.024	0.078	0.062	0.051	0.066	0.000		0.130

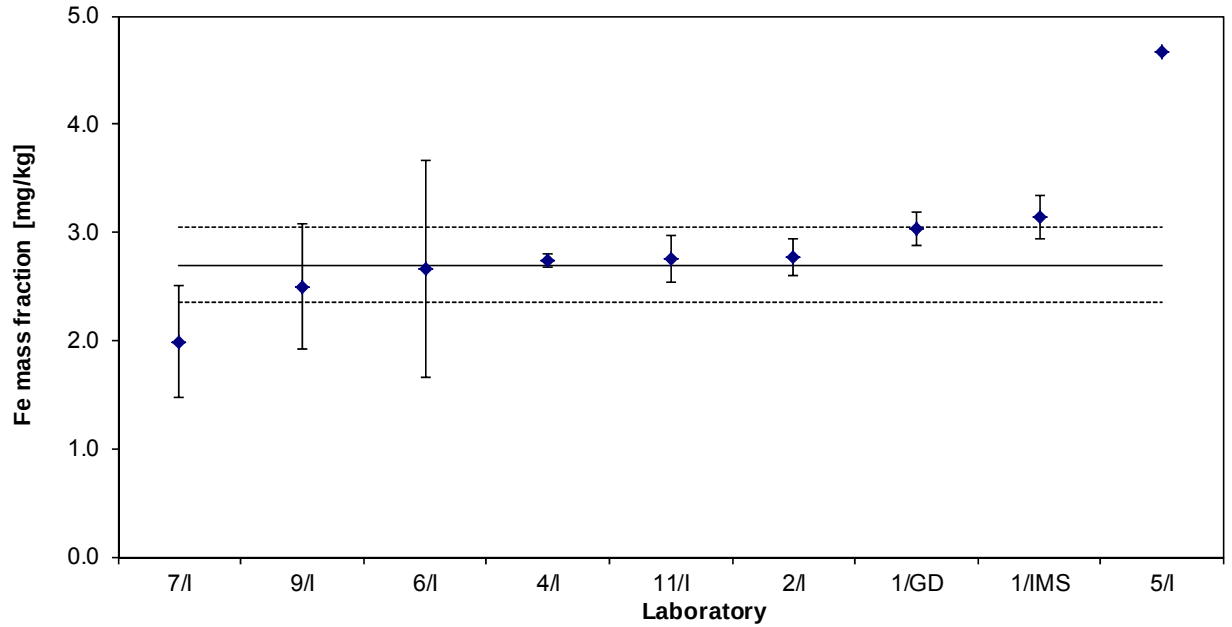


Table 43: Results for Fe in BAM-M384a

Lab./Meth.	1/GD	10/GD	1/IMS	11/I	5/I	9/I	2/I	6/I		Ges.
M_i [mg/kg]	0.030	0.052	0.058	0.1	< 1	< 1	< 1	< 1		N
	0.030	0.030	0.094	0.1	< 1	< 1	< 1	< 1		4
	0.028	0.010	0.097	0.1	< 1	< 1	< 1	< 1		
	0.026		0.068	0.3	< 1	< 1	< 1	< 1		
	0.023		0.094	0.1	< 1			< 1		
	0.022			0.1	< 1			< 1		
M [mg/kg]	**0.03**	**0.03**	**0.08**	**0.15**	**< 1**	**< 1**	**< 1**	**< 1**		**0.07**
s_M [mg/kg]	0.003	0.021	0.018	0.098						0.055
$\bar{s}_i$ [mg/kg]										0.035
s_{rel}	0.128	0.688	0.219	0.678						0.778

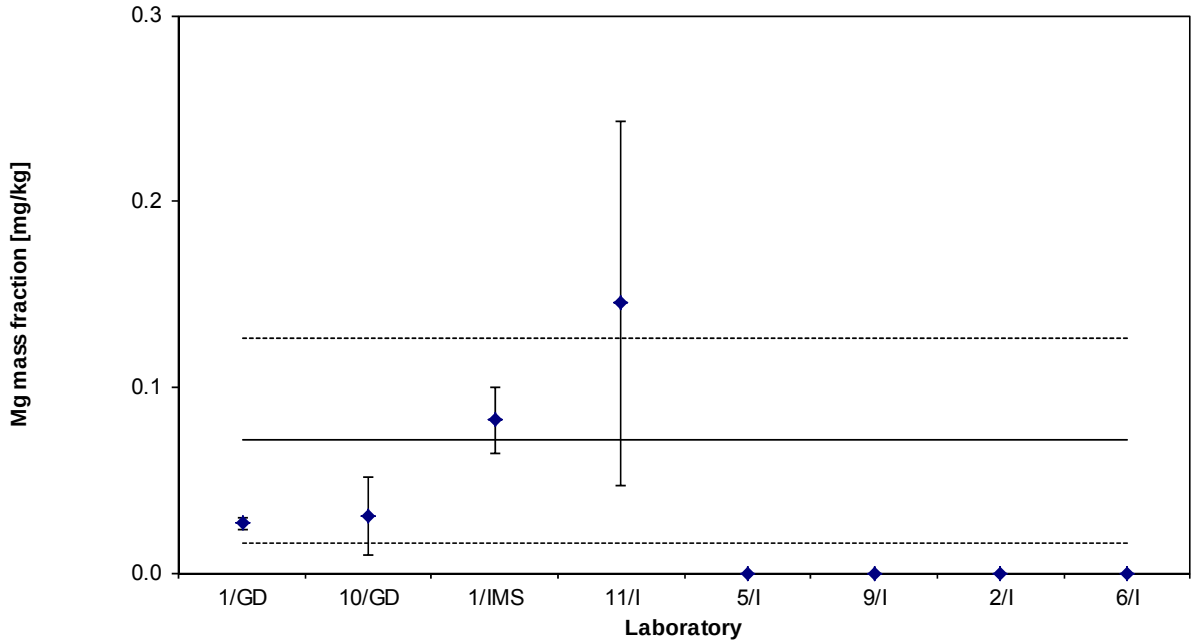


Table 44: Results for Mg in BAM-M384a

Lab./Meth.	1/GD	11/I	3/I	10/GD	7/EA	1/IMS	4/I	9/I	5/I	6/I	2/I		Ges.
M_i [mg/kg]	0.21	0.20	0.25	0.23	0.18	0.27	0.46	< 1	< 1	< 1	< 1		N
	0.21	0.21	0.22	0.20	0.21	0.22	0.46	< 1	< 1	< 1	< 1		6
	0.22	0.21	0.29	0.20	0.25	0.21	0.47	< 1	< 1	< 1	< 1		
	0.19	0.22	0.28	0.26	0.23	0.21	0.49	< 1	< 1	< 1	< 1		
	0.20	0.20	0.12	0.22	0.24	0.22	0.46		< 1	< 1			
	0.19	0.21	0.10	0.22	0.24	0.23	0.47		< 1	< 1			
M [mg/kg]	**0.20**	**0.21**	**0.21**	**0.22**	**0.23**	**0.23**	**0.47**	**< 1**	**< 1**	**< 1**	**< 1**		**0.22**
s_M [mg/kg]	0.010	0.008	0.081	0.022	0.026	0.021	0.012						0.010
$\bar{s}_i$ [mg/kg]													0.037
s_{rel}	0.050	0.036	0.388	0.101	0.115	0.091	0.025						0.046

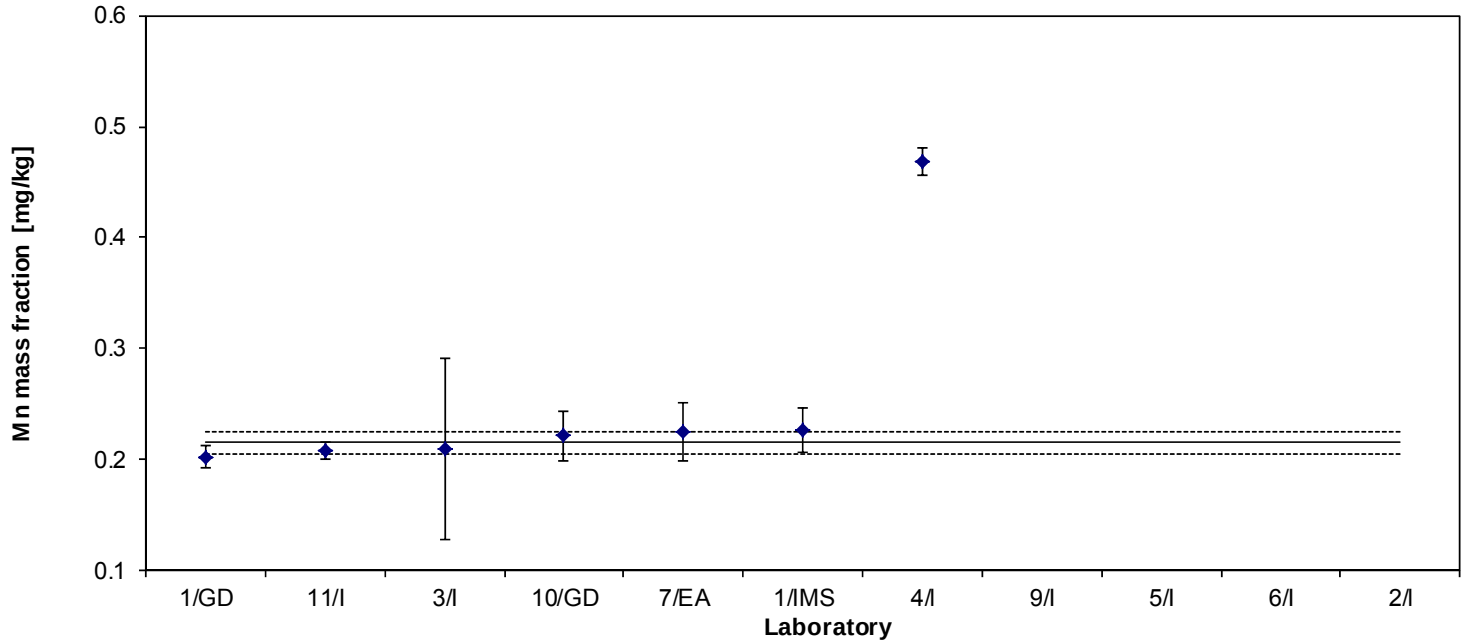


Table 45: Results for Mn in BAM-M384a

Lab./Meth.	10/GD	4/I	5/I	2/I	3/I	11/I	1/GD	1/IMS	6/I	7/EA	9/I		Ges.
M_i [mg/kg]	3.45	5.17	6.0	5.80	6.27	6.20	6.80	6.35	6.5	6.47	7		N
	3.72	5.24	6.0	6.00	6.15	6.35	6.63	6.16	6.3	6.46	7		10
	3.67	5.18	6.0	6.00	6.21	6.22	6.42	6.16	6.6	6.47	7		
	3.55	5.20	5.0	5.80	6.31	6.39	5.92	6.24	6.5	6.60	6		
		5.10	5.0		6.16	6.19	6.10	6.40	6.4	6.40			
		5.15	5.0		6.29	6.18	5.78	6.34	6.5	6.46			
***M* [mg/kg]**	**3.60**	**5.17**	**5.50**	**5.90**	**6.23**	**6.26**	**6.27**	**6.28**	**6.47**	**6.48**	**6.75**		**6.13**
s_M [mg/kg]	0.121	0.047	0.548	0.115	0.068	0.091	0.405	0.102	0.103	0.066	0.500		0.477
$\bar{s}_i$ [mg/kg]													0.277
s_{rel}	0.034	0.009	0.100	0.020	0.011	0.015	0.064	0.016	0.016	0.010	0.074		0.078

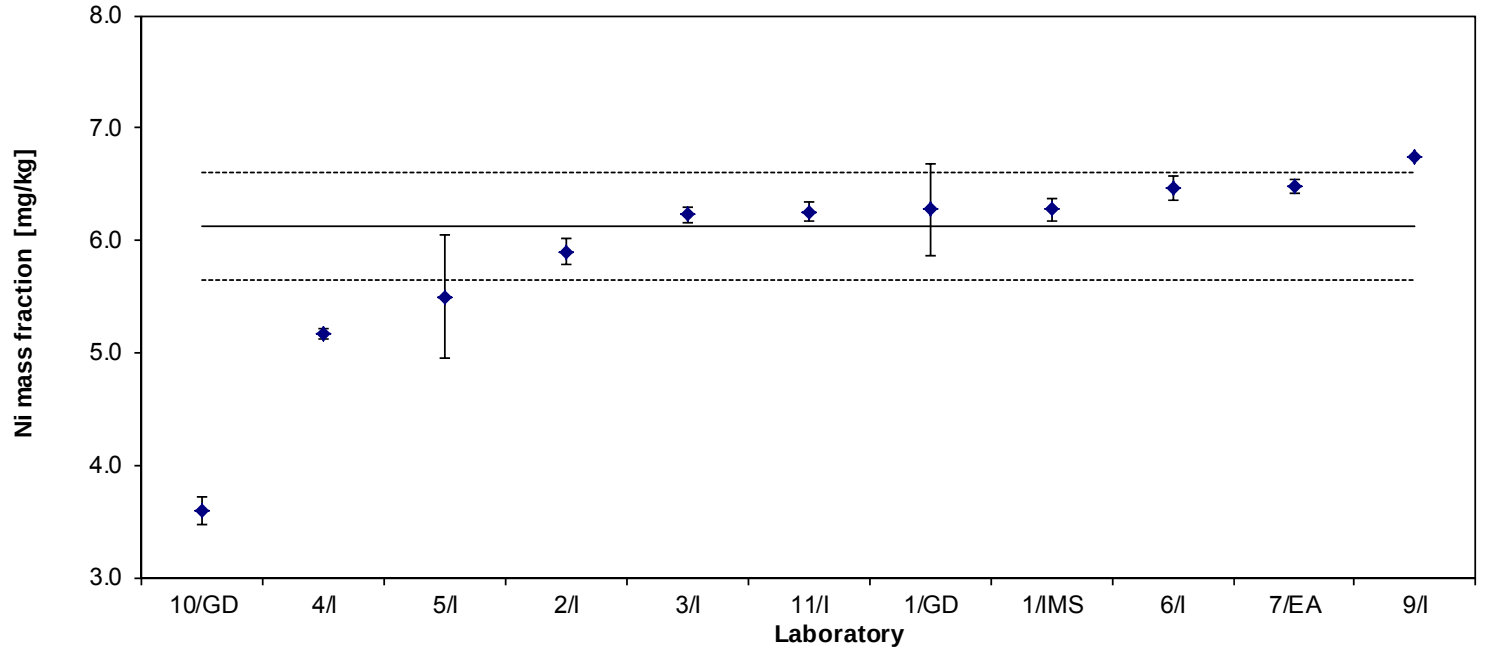


Table 46: Results for Ni in BAM-M384a

Lab./Meth.	4/I	10/GD	9/I	1/IMS	6/I	3/I	2/I	1/GD	7/I	5/EA		Ges.
M_i [mg/kg]	8.82	10.63	11	11.61	11.4	10.67	12.00	12.09	13.00	14.0		N
	8.64	10.97	10	11.44	11.7	11.90	12.00	13.66	12.61	14.0		10
	8.61	9.77	11	11.48	11.8	11.29	12.70	14.49	14.07	14.0		
	8.60	9.97	11	11.63	11.5	12.15	13.00	11.84	13.66	12.0		
	8.51			11.29	11.6	11.90		12.46	13.73	13.0		
	8.62			11.49	11.5	12.28		13.28	12.87	13.0		
M [mg/kg]	**8.63**	**10.34**	**10.75**	**11.49**	**11.58**	**11.70**	**12.43**	**12.97**	**13.32**	**13.33**		**11.65**
s_M [mg/kg]	0.102	0.561	0.500	0.123	0.147	0.608	0.506	1.018	0.575	0.816		1.477
$\bar{s}_i$ [mg/kg]												0.572
s_{rel}	0.012	0.054	0.047	0.011	0.013	0.052	0.041	0.079	0.043	0.061		0.127

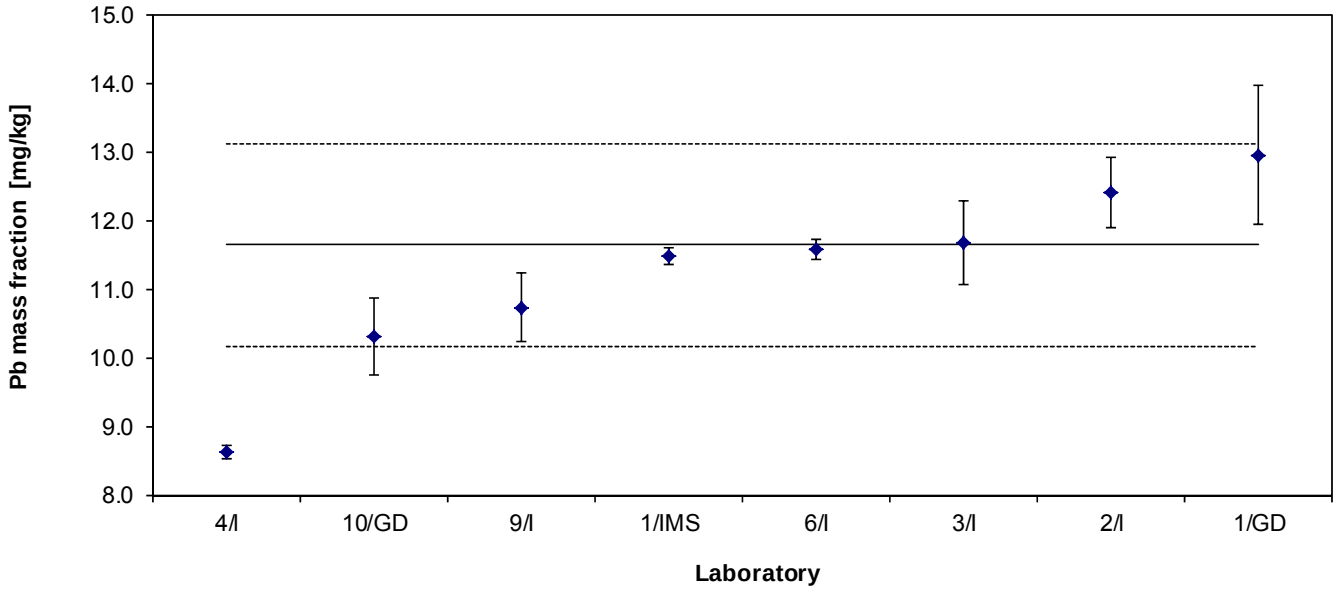


Table 47: Results for Pb in BAM-M384a

Lab./Meth.	9/I	5/I	3/I	8/NAA	4/I	1/IMS	1/NAA	6/I	1/GD	7/EA	2/I	10/GD		Ges.
M_i [mg/kg]	4	5.0	5.39	5.18	5.24	5.42	5.08	5.3	5.44	5.06	5.50	4.16		N
	4	5.0	4.57	5.23	5.33	5.30	5.38	5.5	5.70	5.63	5.90	6.95		11
	4	5.0	5.89	5.17	5.25	5.22	5.36	5.2	5.93	5.45	5.70	6.45		
	4	5.0	5.01	5.20	5.23	5.23	5.58	5.5	5.11	5.41	5.80			
		5.0	4.55	5.18	5.21	5.13	5.16	5.4	5.19	5.82				
		5.0	5.05	5.19	5.20	5.22	5.16	5.6	5.43	5.82				
***M* [mg/kg]**	**4.00**	**5.00**	**5.08**	**5.19**	**5.24**	**5.25**	**5.29**	**5.42**	**5.47**	**5.53**	**5.73**	**5.85**		**5.37**
s_M [mg/kg]	0.000	0.000	0.510	0.021	0.046	0.101	0.189	0.147	0.308	0.290	0.171	1.488		0.262
$\bar{s}_i$ [mg/kg]														0.479
s_{rel}	0.000	0.000	0.100	0.004	0.009	0.019	0.036	0.027	0.056	0.052	0.030	0.254		0.049

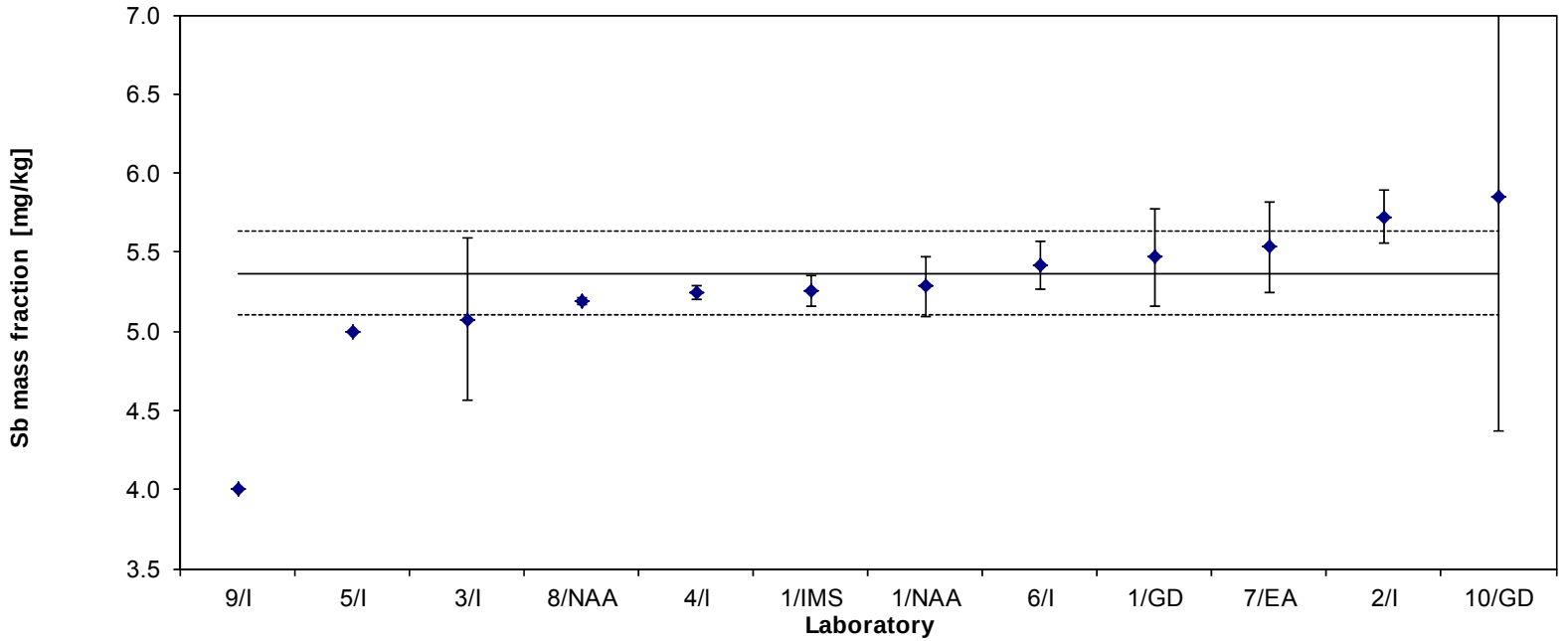


Table 48: Results for Sb in BAM-M384a

Lab./Meth.	4/I	10/GD	7/EA	9/I	1/NAA	6/EA	1/GD	5/I(R)	2/I	6/I		Ges.
M_i [mg/kg]	1.93	4.96	5.37	6	5.3	5.6	6.13	6.0	6.50	7.2		N
	1.90	4.62	5.57	5	5.7	5.8	6.12	6.0	6.20	7.1		9
	1.74	4.65	5.08	6	5.5	5.6	6.19	6.0	6.00	6.7		
	2.12	5.00	5.31	5	5.8	6.1	5.76	6.0	6.40	7.6		
	1.95		5.11		5.4	5.5	5.49	6.0		6.8		
	1.81		6.00		5.4	5.7	5.76	6.0		7.3		
M [mg/kg]	**1.91**	**4.81**	**5.41**	**5.50**	**5.52**	**5.70**	**5.91**	**6.00**	**6.28**	**7.12**		**5.80**
s_M [mg/kg]	0.130	0.200	0.342	0.577	0.214	0.227	0.279	0.000	0.222	0.331		0.645
s_i [mg/kg]												0.303
s_{rel}	0.068	0.042	0.063	0.105	0.039	0.040	0.047	0.000	0.035	0.047		0.111

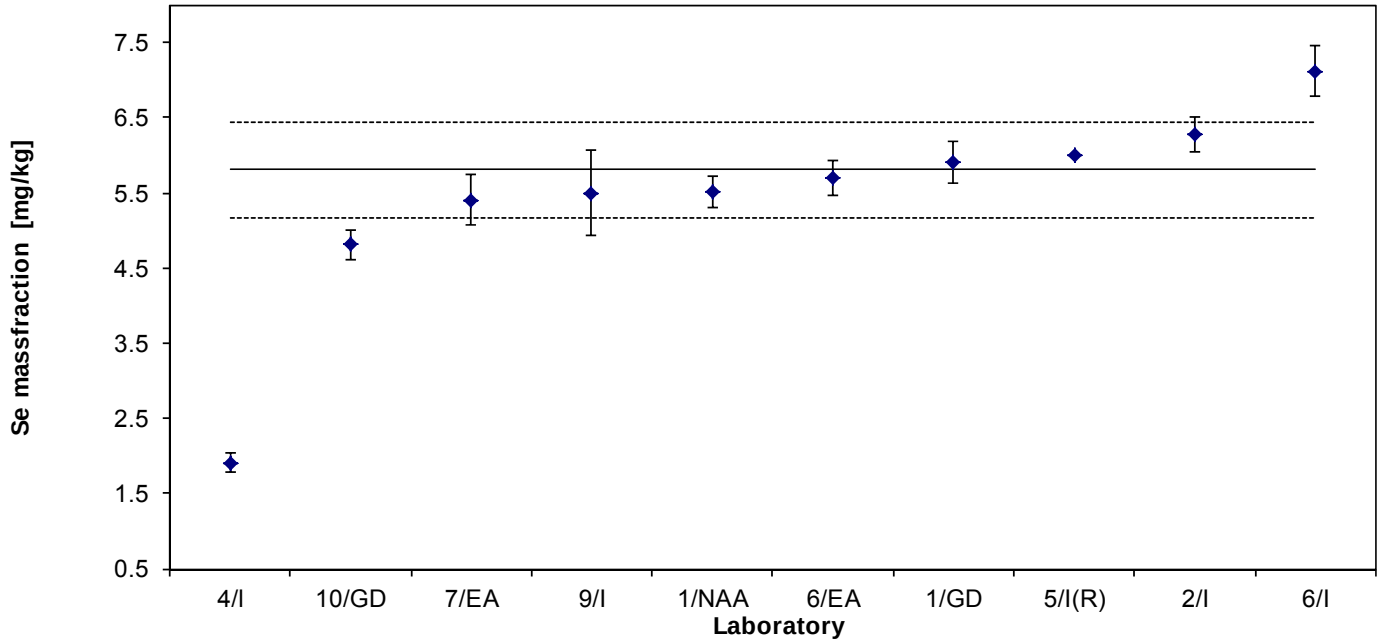


Table 49: Results for Se in BAM-M384a

Lab./Meth.	1/GD	6/I	5/EA	2/I	9/I	1/IMS	3/I	10/GD	4/I		Ges.
M_i [mg/kg]	1.72	1.8	3.0	2.60	3.0	2.89	2.86	2.83	2.96		N
	1.90	2.0	3.0	2.50	2.5	2.81	2.96	2.70	2.99		9
	1.96	2.2	3.0	2.70	2.5	2.78	2.84	2.88	3.01		
	1.69	2.1	2.0	2.70	2.6	2.76	2.92	2.98	2.91		
	1.76	2.3	2.0			2.67	2.82		3.35		
	1.79	3.7	2.0			2.74	2.60		3.00		
M [mg/kg]	**1.80**	**2.35**	**2.50**	**2.63**	**2.65**	**2.77**	**2.83**	**2.85**	**3.04**		**2.60**
s_M [mg/kg]	0.105	0.683	0.548	0.096	0.238	0.075	0.126	0.116	0.158		0.363
$\bar{s}_i$ [mg/kg]											0.317
s_{rel}	0.058	0.291	0.219	0.036	0.090	0.027	0.044	0.041	0.052		0.139

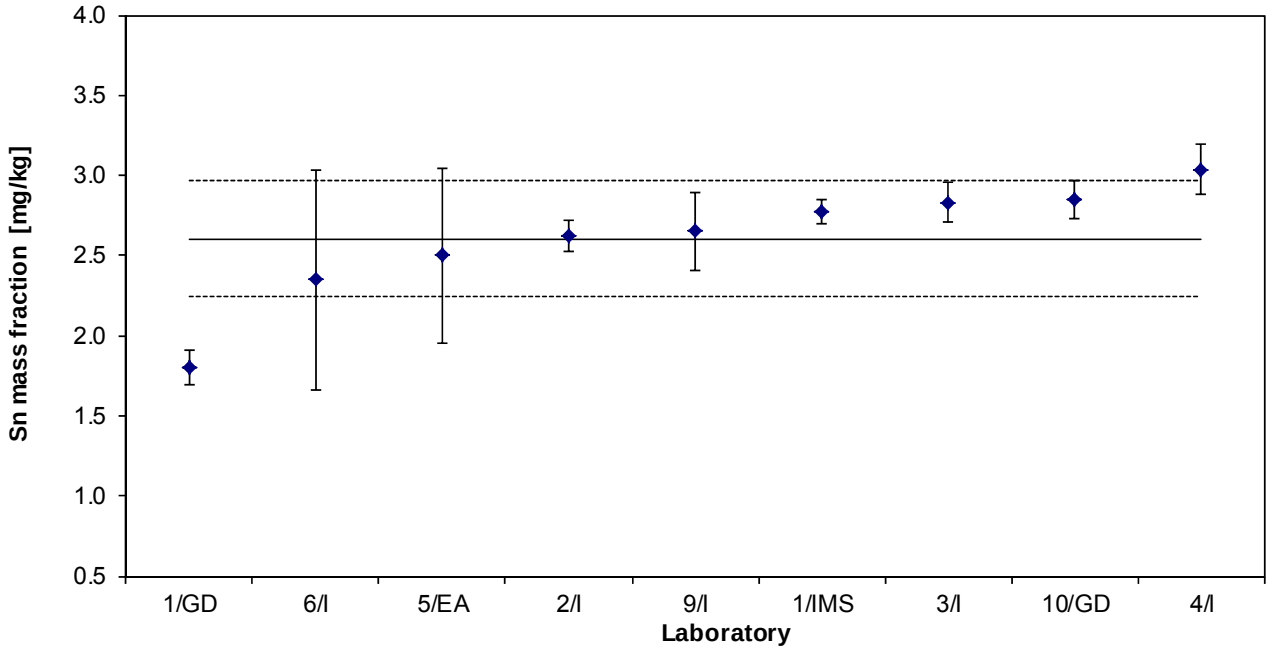


Table 50: Results for Sn in BAM-M384a

Lab./Meth.	10/GD	1/NAA	4/I	9/I	6/I	5/I	1/IMS	1/GD	6/EA	7/I		Ges.
M_i [mg/kg]	8.04	8.37	8.90	8	8.7	10.0	10.16	10.46	10.1	9.55		N
	7.87	9.52	8.85	9	10.4	10.0	9.83	10.22	9.8	10.22		10
	8.09	7.58	8.68	11	9.6	10.0	9.91	10.61	10.2	10.26		
	8.41	8.51	9.00	8	8.9	10.0	9.08	9.71	10.4	10.33		
		8.18	8.70		10.2	9.0	9.85	9.00	10.4	10.16		
		8.2	8.85		9.2	9.0	9.53	10.02	10.1	10.50		
***M* [mg/kg]**	**8.10**	**8.40**	**8.83**	**9.00**	**9.50**	**9.67**	**9.73**	**10.00**	**10.17**	**10.17**		**9.36**
s_M [mg/kg]	0.226	0.638	0.122	1.414	0.693	0.516	0.375	0.587	0.225	0.325		0.737
$\bar{s}_i$ [mg/kg]												0.621
s_{rel}	0.028	0.076	0.014	0.157	0.073	0.053	0.039	0.059	0.022	0.032		0.079

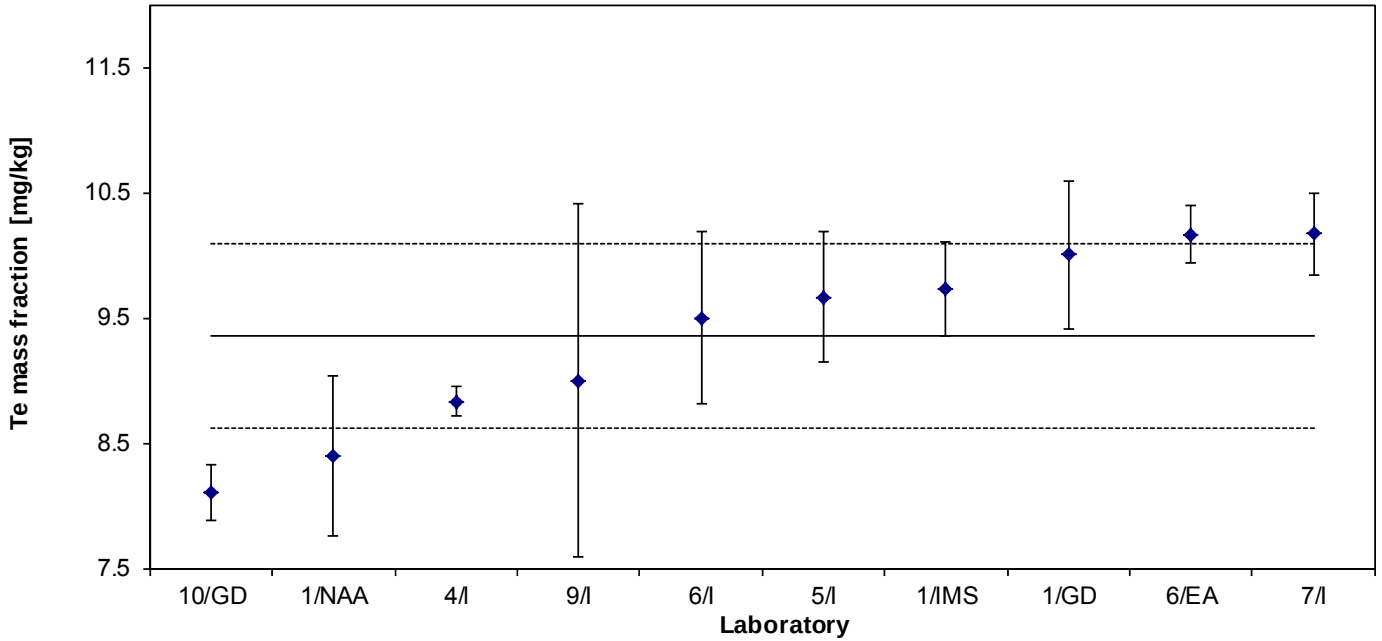


Table 51: Results for Te in BAM-M384a

Lab./Meth.	3/I	1/GD	1/IMS	10/GD	9/I	2/I	5/I		Ges.
M_i [mg/kg]	0.050	0.051	0.059	1.170	< 1	< 1	< 1		N
	0.060	0.062	0.073	1.280	< 1	< 1	< 1		4
	0.080	0.064	0.091	1.150	< 1	< 1	< 1		
	0.060	0.056	0.063		< 1	< 1	< 1		
	0.030	0.056	0.104				< 1		
	0.040	0.054					< 1		
M [mg/kg]	**0.05**	**0.06**	**0.08**	**1.20**	**< 1**	**< 1**	**< 1**		**0.06**
s_M [mg/kg]	0.018	0.005	0.019	0.070					0.013
$\bar{s}_i$ [mg/kg]									0.028
s_{rel}	0.328	0.090	0.243	0.058					0.213

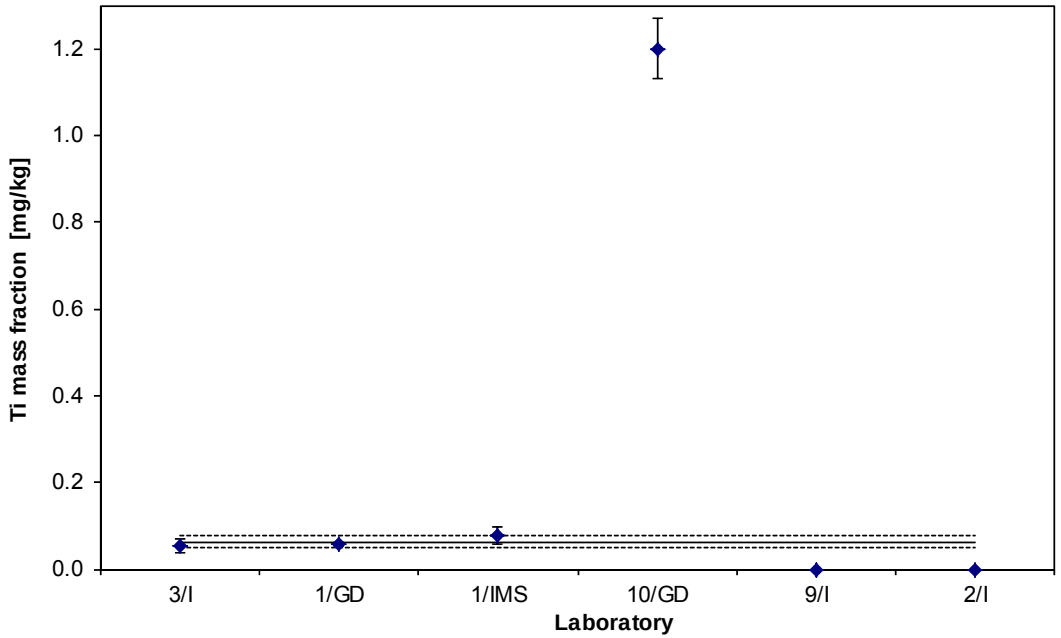


Table 52: Results for Ti in BAM-M384a

Lab./Meth.	6/I	4/I	2/I	9/I	1/GD	5/A	7/I	11/I	1/IMS	10/GD	8/NAA		Ges.
M_i [mg/kg]	2.0	2.10	4.90	5	5.61	5.0	5.28	5.28	5.47	5.66	5.62		N
	2.0	2.08	4.70	5	5.24	5.0	5.35	5.29	5.44	5.11	6.09		9
	2.1	2.03	5.30	5	5.21	5.0	5.50	5.16	5.39	5.60	5.82		
	2.4	2.44	5.00	5	4.94	6.0	5.16	5.53	5.60	5.59	6.40		
	2.4	2.58			4.73	5.0	5.20	5.27	5.24		6.48		
	2.2	2.42			4.78	5.0	5.21	5.14	5.69		6.46		
***M* [mg/kg]**	**2.18**	**2.28**	**4.98**	**5.00**	**5.08**	**5.17**	**5.28**	**5.28**	**5.47**	**5.49**	**6.15**		**5.32**
s_M [mg/kg]	0.183	0.232	0.250	0.000	0.336	0.408	0.126	0.139	0.160	0.255	0.364		0.360
$s_{\bar{i}}$ [mg/kg]													0.258
s_{rel}	0.084	0.102	0.050	0.000	0.066	0.079	0.024	0.026	0.029	0.046	0.059		0.068

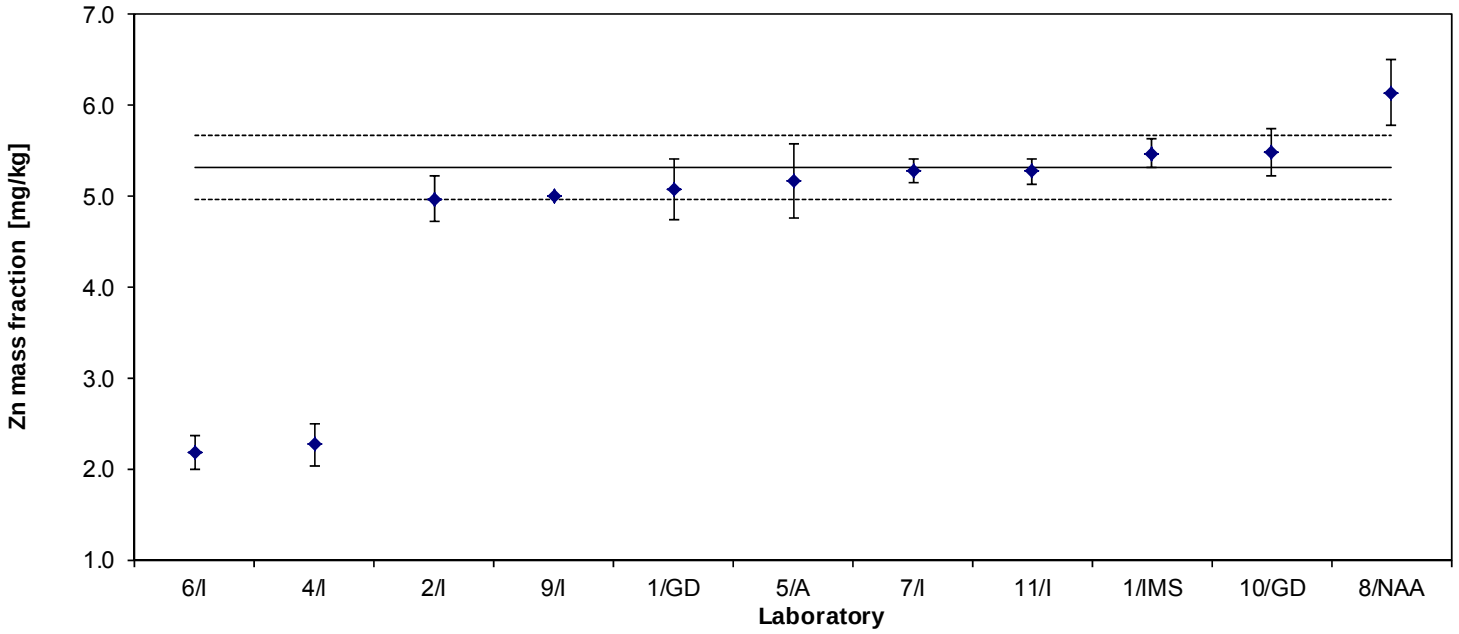


Table 53: Results for Zn in BAM-M384a

Lab./Meth.	3/I	1/IMS	1/NAA	11/I	1/GD	10/GD	9/I	5/I	6/I		Ges.
M_i [mg/kg]	0.010	0.024	0.100	0.1	0.051	< 0.05	< 1	< 1	< 1		N
	0.030	0.034	0.200	0.2	0.041	< 0.05	< 1	< 1	< 1		5
	0.010	0.026	0.100	0.1	0.289	< 0.05	< 1	< 1	< 1		
	0.010	0.020	0.100	0.1	0.112		< 1	< 1	< 1		
	0.010	0.026	0.200	0.2	0.100			< 1	< 1		
	0.020	0.035	0.200	0.2	0.401			< 1	< 1		
$\bar{M}$ [mg/kg]	**0.02**	**0.03**	**0.15**	**0.15**	**0.17**	**< 0.05**	**< 1**	**< 1**	**< 1**		**0.10**
s_M [mg/kg]	0.008	0.006	0.055	0.055	0.146						0.074
$\bar{s}_i$ [mg/kg]											0.064
s_{rel}	0.558	0.216	0.365	0.365	0.880						0.726

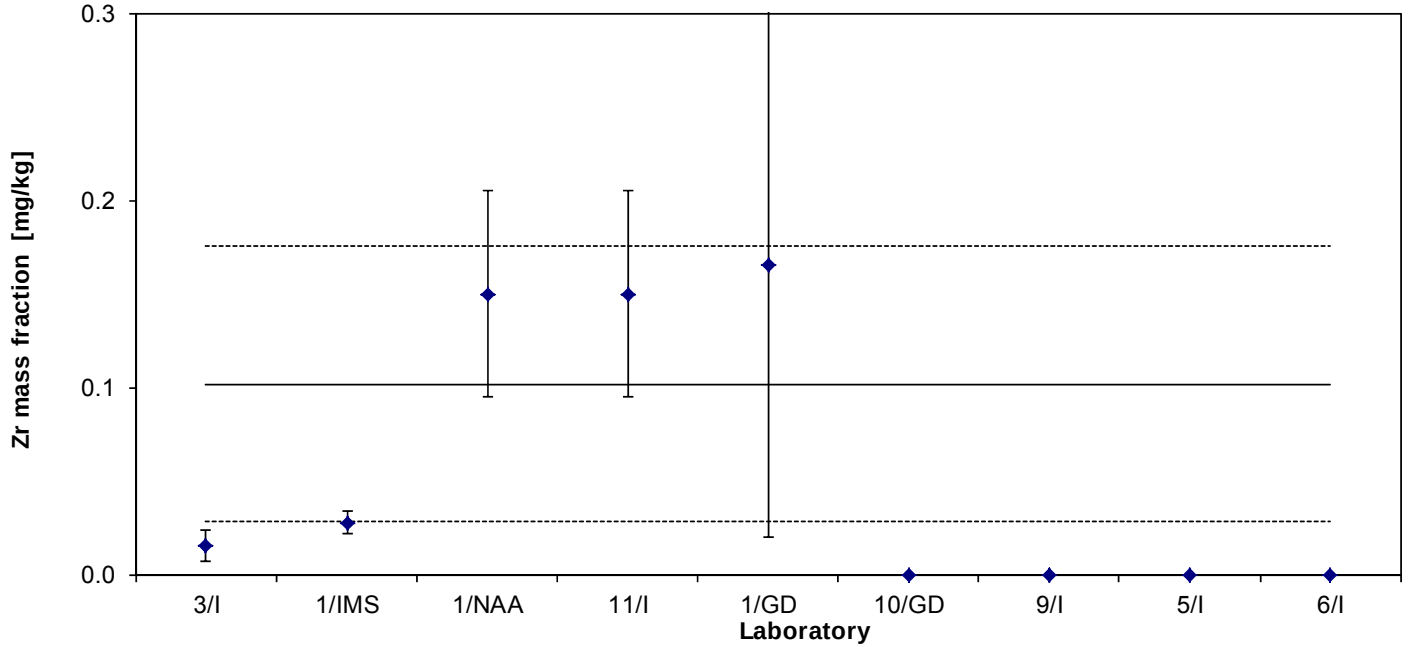


Table 54: Results for Zr in BAM-M384a

Lab./Meth.	1/GD	3/I	6/I	5/I	9/I		Ges.
M_i [mg/kg]	0.029	0.020	1.1	< 1	< 1		N
	0.035	0.070	1.2	< 1	< 1		3
	0.037	0.790	1.4	< 1	< 1		
	0.034	0.070	0.5	< 1	< 1		
	0.037	0.240	0.9	< 1			
	0.029	0.730	2.7	< 1			
M [mg/kg]	**0.03**	**0.32**	**1.30**	**< 1**	**< 1**		**0.55**
s_M [mg/kg]	0.004	0.349	0.751				0.664
$\bar{s}_i$ [mg/kg]							0.3680
s_{rel}	0.108	1.092	0.578				1.205

Table 55: Results for Al in BAM-M384a

Lab./Meth.	10/GD	1/GD	1/ETV-I	11/P	7/P	9/I	5/I		Ges.
M_i [mg/kg]	0.070	0.151		1.4	1.49	< 1	< 1		N
	0.060	0.126		1.4	1.44	< 1	< 1		5
	0.050	0.148		1.4	1.76	< 1	< 1		
		0.124		1.4	1.39	< 1	< 1		
		0.106		1.3	1.62		< 1		
		0.109		1.4	1.40		< 1		
M [mg/kg]	**0.06**	**0.13**	**0.21**	**1.37**	**1.52**	**< 1**	**< 1**		**0.66**
s_M [mg/kg]	0.010	0.019		0.029	0.146				0.722
$\bar{s}_i$ [mg/kg]									0.051
s_{rel}	0.167	0.147	0.000	0.021	0.096				1.099

Table 56: Results for P in BAM-M384a

Lab./Meth.	1/GD	4/I	11/V	9/I		Ges.
M_i [mg/kg]	3.79	4.32	4.8	< 1		N
	3.47	4.21	5.6	< 1		3
	3.25	4.09	4.8	< 1		
	3.46	4.27	4.8	< 1		
	3.17	4.10	4.8			
	2.90	4.19	4.0			
M [mg/kg]	**3.34**	**4.20**	**4.80**	**< 1**		**4.11**
s_M [mg/kg]	0.303	0.091	0.506			0.734
$\bar{s}_i$ [mg/kg]						0.345
s_{rel}	0.091	0.022	0.105			0.179

Table 57: Results for S in BAM-M384a

Lab./Meth.	1/GD	5/I	9/I		Ges.
M_i [mg/kg]	0.095	2.0	< 1		N
	0.082	2.0	< 1		2
	0.137	2.0	< 1		
	0.105	1.0	< 1		
	0.100	2.0			
	0.077	2.0			
M [mg/kg]	**0.10**	**1.83**	**< 1**		**0.97**
s_M [mg/kg]	0.021	0.408			1.226
$\bar{s}_i$ [mg/kg]					0.215
s_{rel}	0.213	0.223			1.269

Table 58: Results for Si in BAM-M384a

Annex 2: Results BAM-M384b

Lab./Meth.	1/GD	1/NAA	9/I	7/I	10/GD	1/IMS	8/NAA	5/I	3/I	2/I	6/I	11/I	4/I		Ges.
M_i [mg/kg]	10.95	10.73	11	10.90	10.90	10.72	11.41	12.0	11.64	11.50	11,1	12.20	15.20		N
	10.61	10.77	11	11.11	11.91	11.29	11.19	12.0	11.42	11.30	11.7	12.40	15.27		12
	10.21	10.77	11	11.08	11.10	11.73	11.35	12.0	11.58	11.60	11.4	12.30	15.38		
	9.31	11.41	11	11.09	10.80	11.80	11.43	11.0	11.45	11.90	11.7	12.20	15.22		
	9.49	11.08		11.00		11.23	11.61	11.0	11.48		12.2	12.30	15.07		
	9.62	10.67		11.17		11.00	11.60	11.0	11.58		11.6	12.80	15.02		
M [mg/kg]	**10.03**	**10.90**	**11.00**	**11.06**	**11.18**	**11.30**	**11.43**	**11.50**	**11.53**	**11.58**	**11.72**	**12.37**	**15.19**		**11.30**
s_M [mg/kg]	0.663	0.287	0.000	0.095	0.504	0.415	0.159	0.548	0.087	0.250	0.295	0.225	0.132		0.558
$\bar{s}_i$ [mg/kg]															0.352
s_{rel}	0.066	0.026	0.000	0.009	0.045	0.037	0.014	0.048	0.008	0.022	0.025	0.018	0.009		0.049

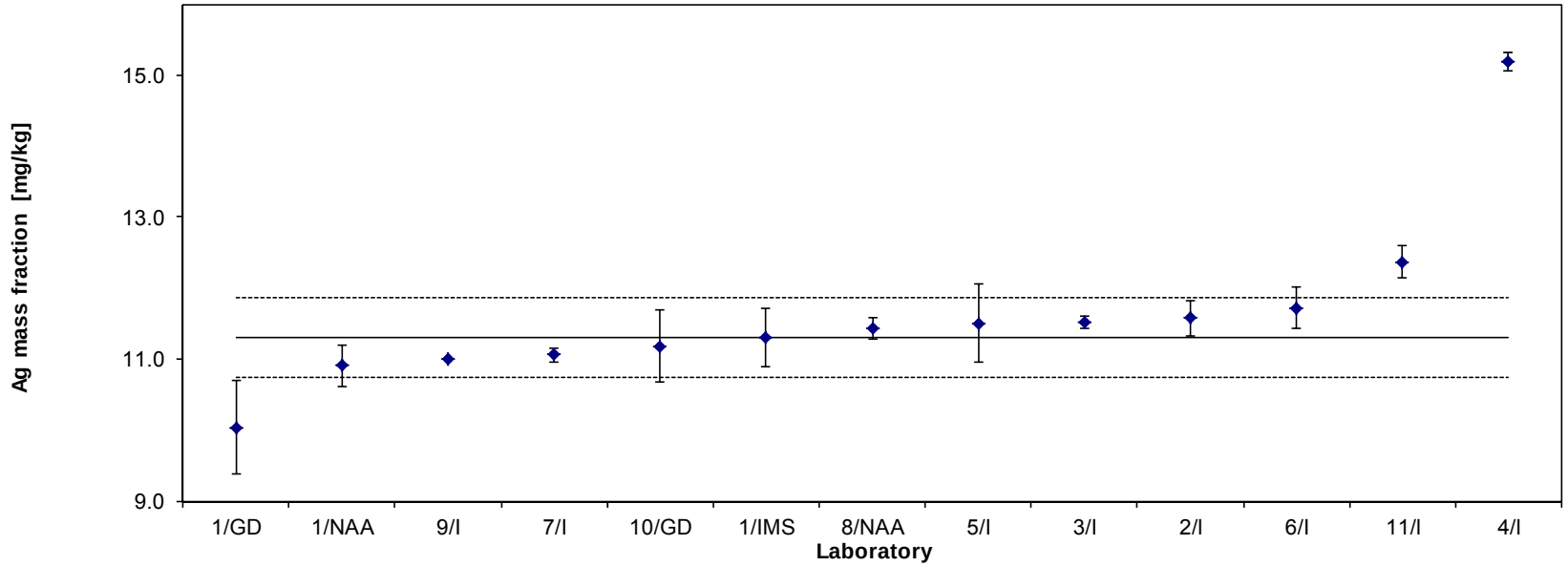


Table 59: Results for Ag in BAM-M384b

Lab./Meth.	9/I	3/I	7/I	5/I	6/I	10/GD	1/GD	1/IMS		Ges.
M_i [mg/kg]	1	2.35	2.87	3.0	2,5	4.13	4.10	4.09		N
	1	1.95	2.80	4.0	2.5	3.16	4.34	4.37		8
	1	2.26	2.71	3.0	2.6	3.36	4.23	4.20		
	1	2.34	3.08	2.0	3.7	3.17	3.54	3.94		
		2.25	2.88	3.0	2.6		3.27	4.30		
		2.19	2.47	2.0	3.0		3.52			
***M* [mg/kg]**	**1.00**	**2.22**	**2.80**	**2.83**	**2.88**	**3.46**	**3.83**	**4.18**		**2.90**
s_M [mg/kg]	0.000	0.147	0.203	0.753	0.497	0.459	0.443	0.171		0.993
s_i [mg/kg]										0.405
s_{rel}	0.000	0.066	0.073	0.266	0.173	0.133	0.116	0.041		0.342

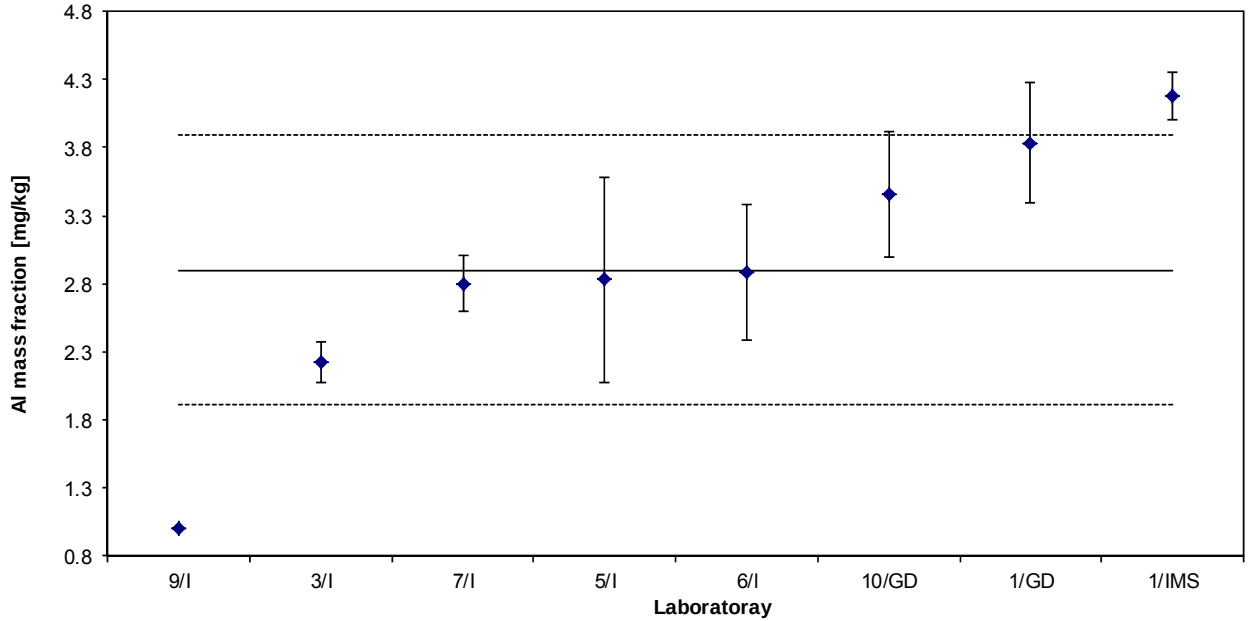


Table 60: Results for Al in BAM-M384b

Lab./Meth.	10/GD	1/GD	9/I	1/IMS	3/I	6/I-R	5/EA	4/I	7/I	2/I		Ges.
M_i [mg/kg]	5.89	6.21	6	6.10	6.36	6.51	7.0	7.38	6.82	7.60		N
	5.71	6.04	6	6.14	6.80	6.43	7.0	7.25	6.92	7.60		10
	6.11	6.06	6	6.10	6.41	7.28	7.0	7.22	7.50	7.30		
	4.46	5.35	6	6.06	6.63	6.84	7.0	7.26	7.50	7.30		
	5.30	5.43		5.91	6.82	6.62	7.0	7.37	7.50			
	5.47	5.44		5.97	6.60	6.44	7.0	7.21	7.53			
***M* [mg/kg]**	**5.49**	**5.76**	**6.00**	**6.05**	**6.60**	**6.69**	**7.00**	**7.28**	**7.30**	**7.45**		**6.56**
s_M [mg/kg]	0.581	0.389	0.000	0.087	0.191	0.328	0.000	0.075	0.331	0.173		0.702
$\bar{s}_i$ [mg/kg]												0.280
s_{rel}	0.106	0.068	0.000	0.014	0.029	0.049	0.000	0.010	0.045	0.023		0.107

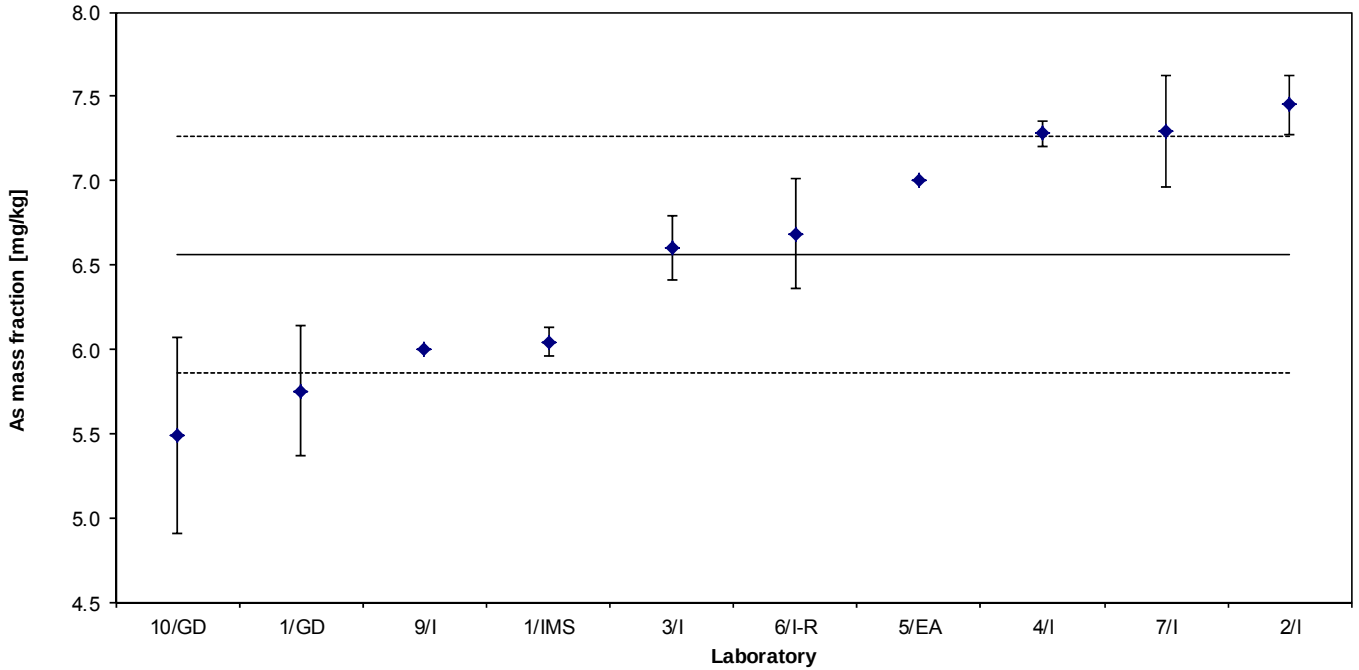


Table 61: Results for As in BAM-M384b

Lab./Meth.	4/I	10/GD	5/EA	7/EA	6/I	3/I	1/IMS	1/GD	2/I	9/I		Ges.
M_i [mg/kg]	3.94	7.02	7.0	6.4	7.2	6.90	6.90	7.67	7.00	8		N
	3.90	6.28	7.0	6.5	6.9	6.90	6.69	7.66	7.00	9		9
	3.96	6.47	8.0	6.9	6.3	6.27	6.89	6.84	7.30	8		
	4.05		6.0	6.7	6.5	6.70	6.77	6.60	7.50	8		
	3.88		6.0	6.5	6.7	7.05	6.90	6.47				
	3.94		6.0	7.0	6.9	6.77	6.89	6.81				
M [mg/kg]	**3.95**	**6.59**	**6.67**	**6.69**	**6.75**	**6.77**	**6.84**	**7.01**	**7.20**	**8.25**		**6.81**
s_M [mg/kg]	0.059	0.384	0.816	0.248	0.321	0.271	0.091	0.526	0.245	0.500		0.201
$\bar{s}_i$ [mg/kg]												0.418
s_{rel}	0.015	0.058	0.122	0.037	0.048	0.040	0.013	0.075	0.034	0.061		0.029

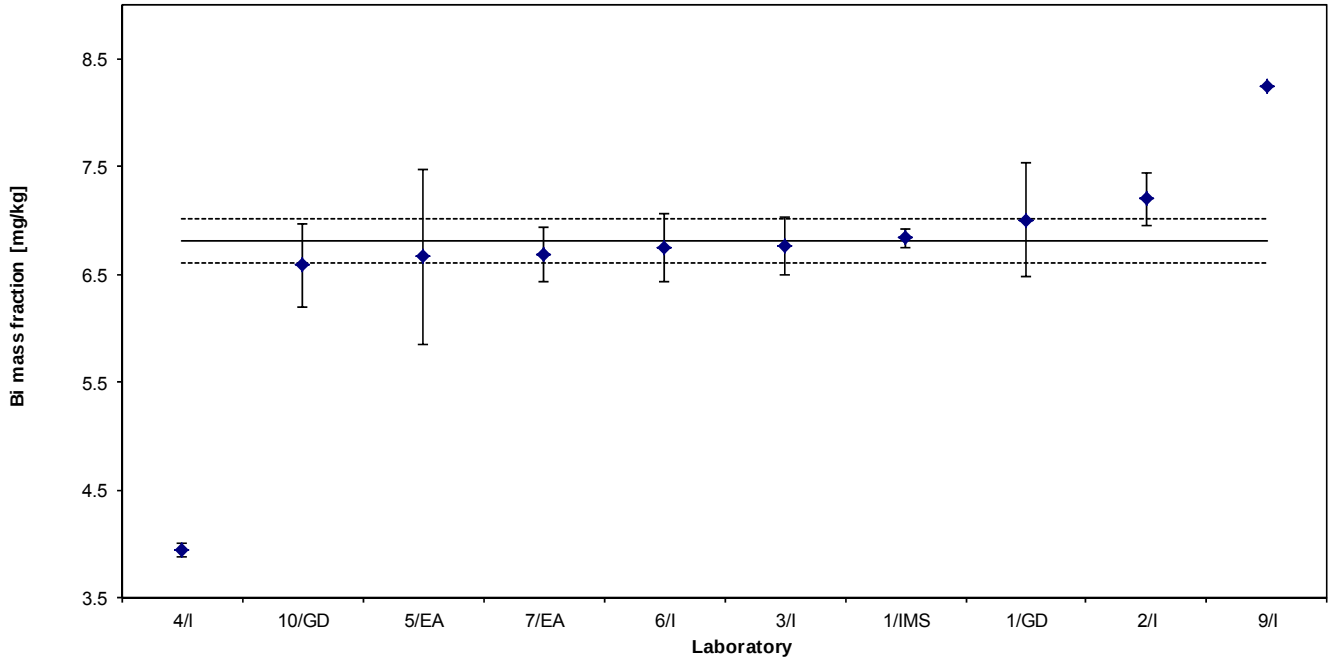


Table 62: Results for Bi in BAM-M384b

Lab./Meth.	4/I	9/I	6/I-R	3/I	2/I	1/IMS	11/I	5/I	7/I	1/GD	10/GD		Ges.
M_i [mg/kg]	3.25	3.8	3.83	3.92	3.80	3.74	3.92	4.0	4.04	4.58	4.65		N
	3.81	3.8	3.90	3.90	4.00	3.90	3.97	4.0	4.19	4.37	4.29		10
	3.78	3.8	3.95	3.87	3.90	4.08	4.03	4.0	4.03	4.17	4.82		
	3.68	3.8	3.93	3.93	4.00	3.90	4.00	4.0	4.34	3.83			
	3.93		3.84	3.88		4.01	4.03	4.0	4.19	3.95			
	3.94		3.80	3.82		3.98	3.96	4.0	4.10	3.98			
***M* [mg/kg]**	**3.73**	**3.80**	**3.88**	**3.89**	**3.93**	**3.93**	**3.99**	**4.00**	**4.15**	**4.15**	**4.59**		**4.00**
s_M [mg/kg]	0.255	0.000	0.060	0.060	0.096	0.096	0.043	0.043	0.117	0.286	0.271		0.135
$\bar{s}_i$ [mg/kg]													0.138
s_{rel}	0.068	0.000	0.016	0.016	0.024	0.024	0.011	0.011	0.028	0.069	0.059		0.034

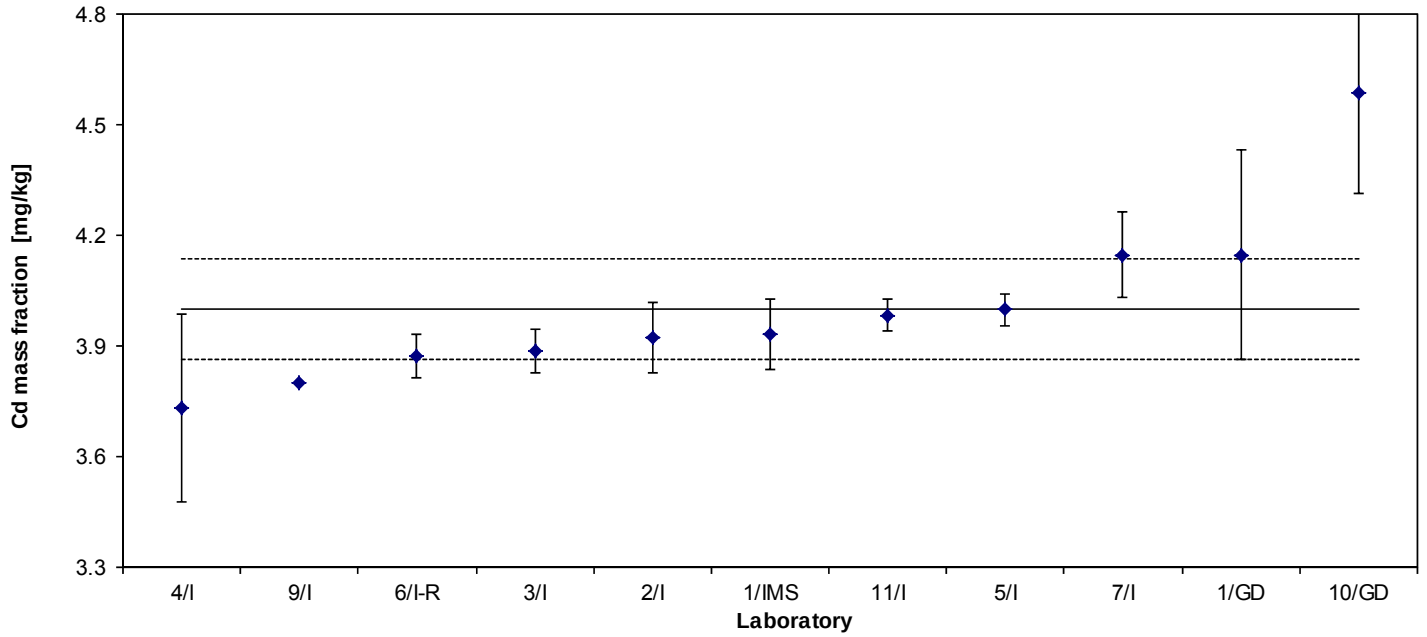


Table 63: Results for Cd in BAM-M384b

Lab./Meth.	4/I	2/I	3/I	9/I	6/I	11/I	8/NAA	5/I	10/GD	1/GD	1/IMS	7/I		Ges.
M_i [mg/kg]	7.37	8.80	9.49	9.60	9.8	10.1	10.29	11.0	10.8	11.22	11.27	11.26		N
	7.32	9.00	9.56	9.60	9.9	9.9	10.83	11.0	10.8	11.29	11.35	11.39		10
	7.91	7.80	9.49	9.60	9.9	10.0	10.50	11.0	11.0	11.47	11.30	11.05		
	7.86	8.20	9.42	9.60	9.9	10.3	10.38	10.0	10.7	10.89	11.15	11.55		
	7.62		9.05		9.8	10.0	10.73	11.0		10.39	11.24	11.37		
	7.19		9.01		9.9	10.3	10.72	10.0		10.37	10.92	11.06		
M [mg/kg]	**7.55**	**8.45**	**9.34**	**9.60**	**9.87**	**10.10**	**10.58**	**10.67**	**10.83**	**10.94**	**11.20**	**11.28**		**10.44**
s_M [mg/kg]	0.298	0.551	0.242	0.000	0.052	0.165	0.217	0.516	0.128	0.470	0.156	0.197		0.677
$\bar{s}_i$ [mg/kg]														0.265
s_{rel}	0.040	0.065	0.026	0.000	0.005	0.016	0.020	0.048	0.012	0.043	0.014	0.017		0.065

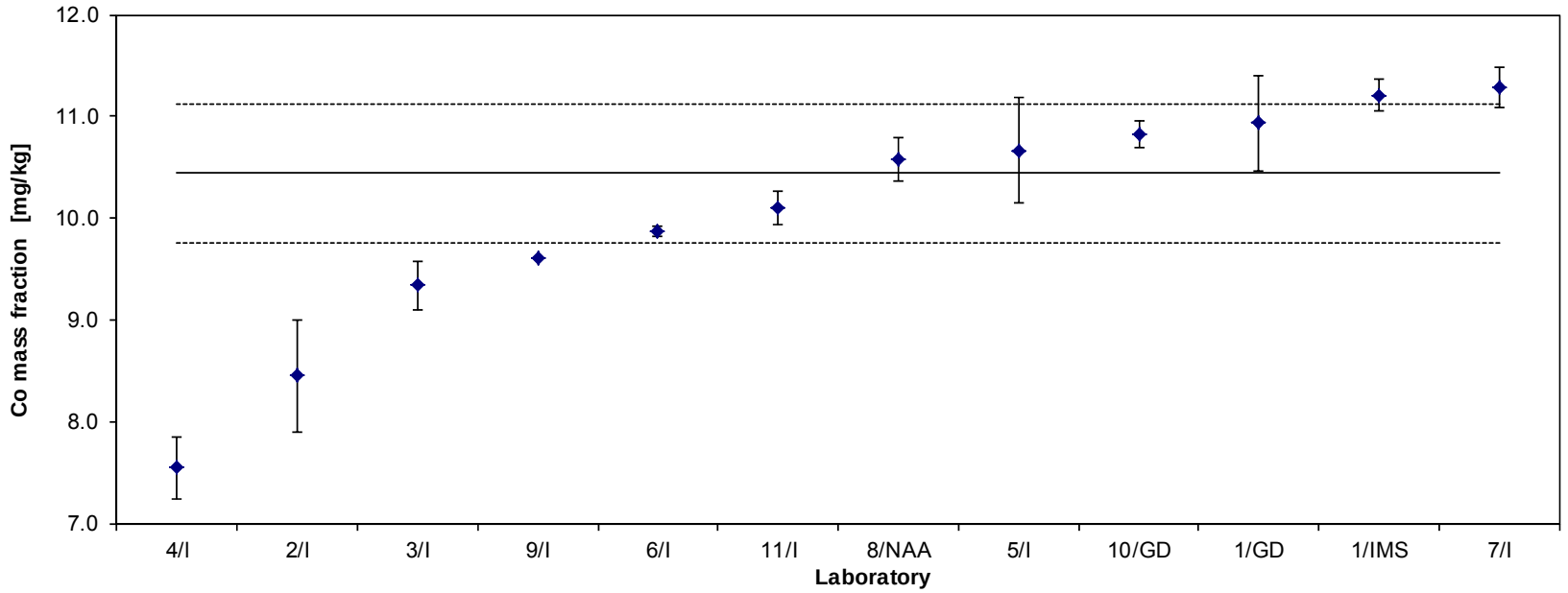


Table 64: Results for Co in BAM-M384b

Lab./Meth.	4/I	6/I	9/I	3/I	5/I	10/GD	1/NAA	1/GD	1/IMS	2/I		Ges.
M_i [mg/kg]	1.04	1.4	1.7	1.90	2.0	2.87	2.9	3.21	3.09	1.9		N
	1.29	1.5	1.7	1.65	2.0	2.96	3.0	3.35	3.06	1.3		9
	1.51	1.5	1.6	1.69	2.0	2.79	2.9	3.25	3.20	<1		
	1.43	1.5	1.6	1.71	2.0		3.2	2.94	3.11	<1		
	1.12	1.4		1.67	2.0		3.1	2.78	3.16			
	1.07	1.5		1.64	3.0		2.9	2.91	3.19			
M [mg/kg]	**1.24**	**1.47**	**1.65**	**1.71**	**2.17**	**2.87**	**2.99**	**3.07**	**3.13**	**< 2**		**2.26**
s_M [mg/kg]	0.197	0.052	0.052	0.058	0.097	0.408	0.408	0.136	0.227	0.055		0.765
$\bar{s}_i$ [mg/kg]												0.215
s_{rel}	0.159	0.035	0.031	0.034	0.045	0.142	0.137	0.044	0.072			0.339

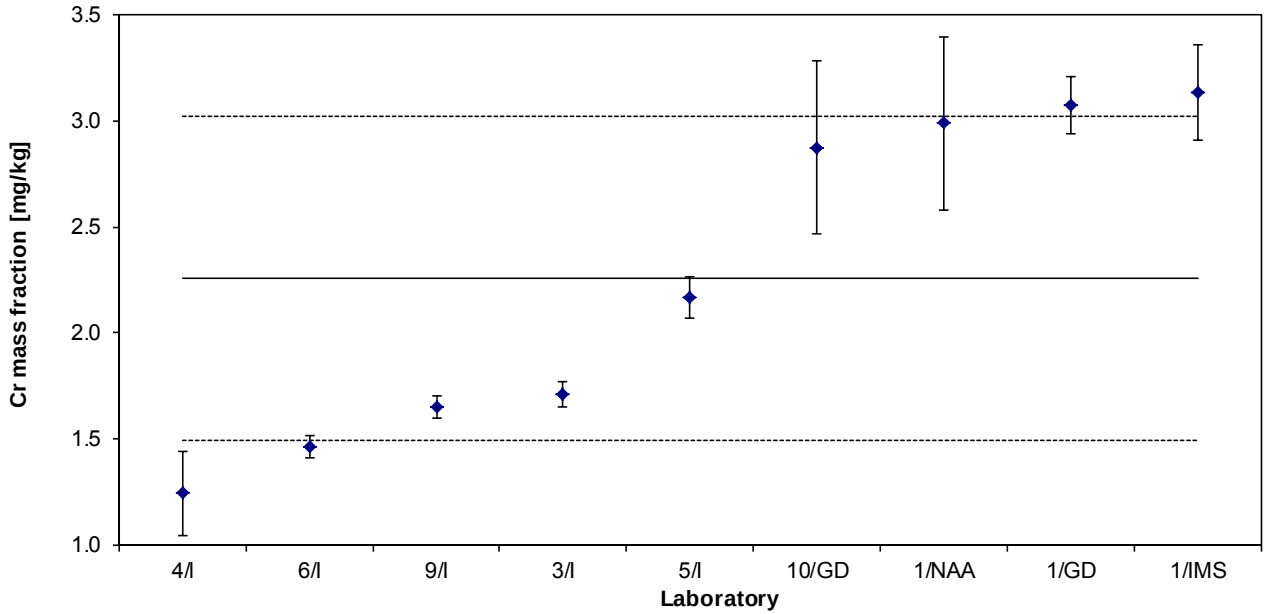


Table 65: Results for Cr in BAM-M384b

Lab./Meth.	4/I	3/I	6/I	9/I	5/I	11/I	2/I	1/GD	1/IMS	1/NAA		Ges.
M_i [mg/kg]	1.98	3.58	3.6	4.5	5.0	5.02	4.10	6.79	7.52	10.6		N
	2.01	3.23	3.7	4.3	5.0	4.98	6.00	6.82	7.27	7.5		10
	2.02	3.50	3.9	4.2	5.0	4.80		6.85	7.45	7.0		
	1.97	3.62	5.6	4.9	4.0	5.17		6.25	7.07	10.0		
	1.95	3.16	5.8		4.0	4.75		6.01	7.10	5.2		
	1.96	3.35	3.7		4.0	5.13		6.19	8.26	7.5		
M [mg/kg]	**1.98**	**3.41**	**4.38**	**4.48**	**4.50**	**4.98**	**5.05**	**6.48**	**7.45**	**7.96**		**5.07**
s_M [mg/kg]	0.028	0.189	1.026	0.310	0.548	0.170	1.344	0.375	0.437	2.015		1.809
$\bar{s}_i$ [mg/kg]												0.878
s_{rel}	0.014	0.056	0.234	0.069	0.122	0.034	0.266	0.058	0.059	0.253		0.357

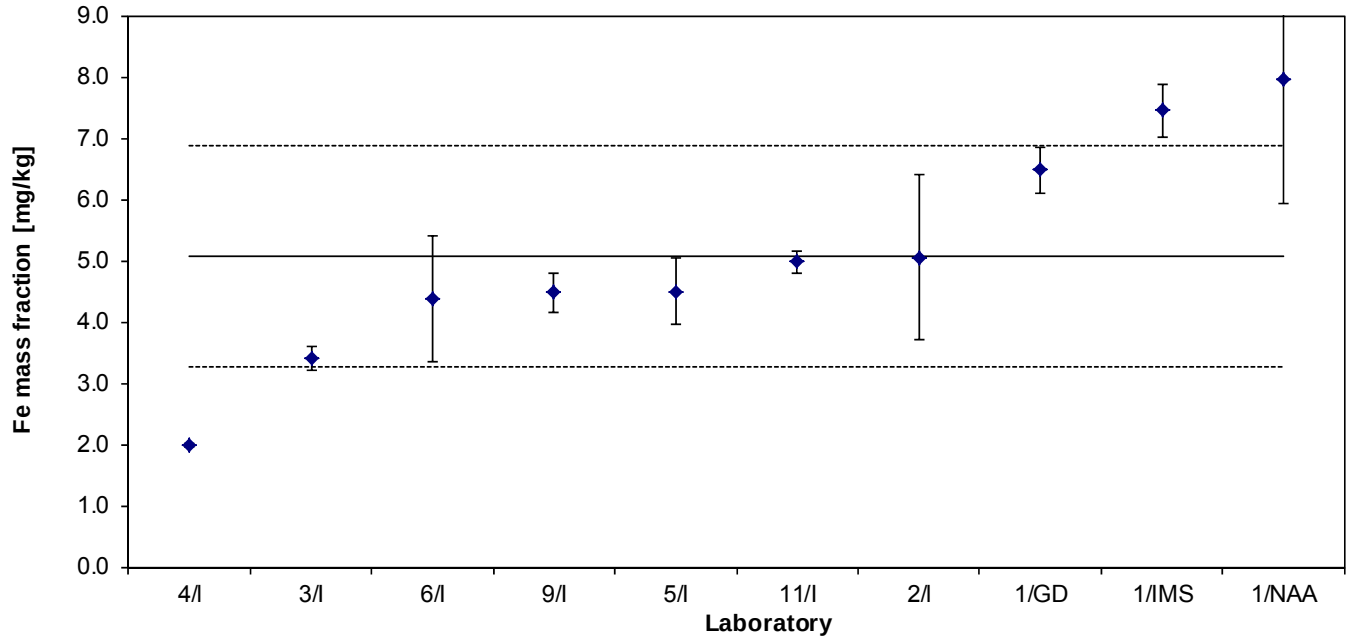


Table 66: Results for Fe in BAM-M384b

Lab./Meth.	10/GD	2/I	9/I	7/I	1/GD	6/I	11/I	5/I	1/IMS		Ges.
M_i [mg/kg]	1.84	3.00	3	3.02	3.42	3.2	3.5	4.0	3.76		N
	1.63	3.00	3	3.25	3.43	3.5	3.6	4.0	4.09		8
	1.55	2.00	3	2.94	3.68	3.4	3.5	4.0	3.87		
		2.00	3	3.26	2.85	3.3	3.5	3.0	4.21		
				3.36	2.83	3.3	3.5	4.0	3.90		
				3.06	2.87	3.5	3.6	3.0	3.85		
M [mg/kg]	**1.67**	**2.50**	**3.00**	**3.15**	**3.18**	**3.37**	**3.54**	**3.67**	**3.95**		**3.29**
s_M [mg/kg]	0.150	0.577	0.000	0.164	0.374	0.121	0.056	0.516	0.169		0.444
$\bar{s}_i$ [mg/kg]											0.319
s_{rel}	0.090	0.231	0.000	0.052	0.118	0.036	0.016	0.141	0.043		0.135

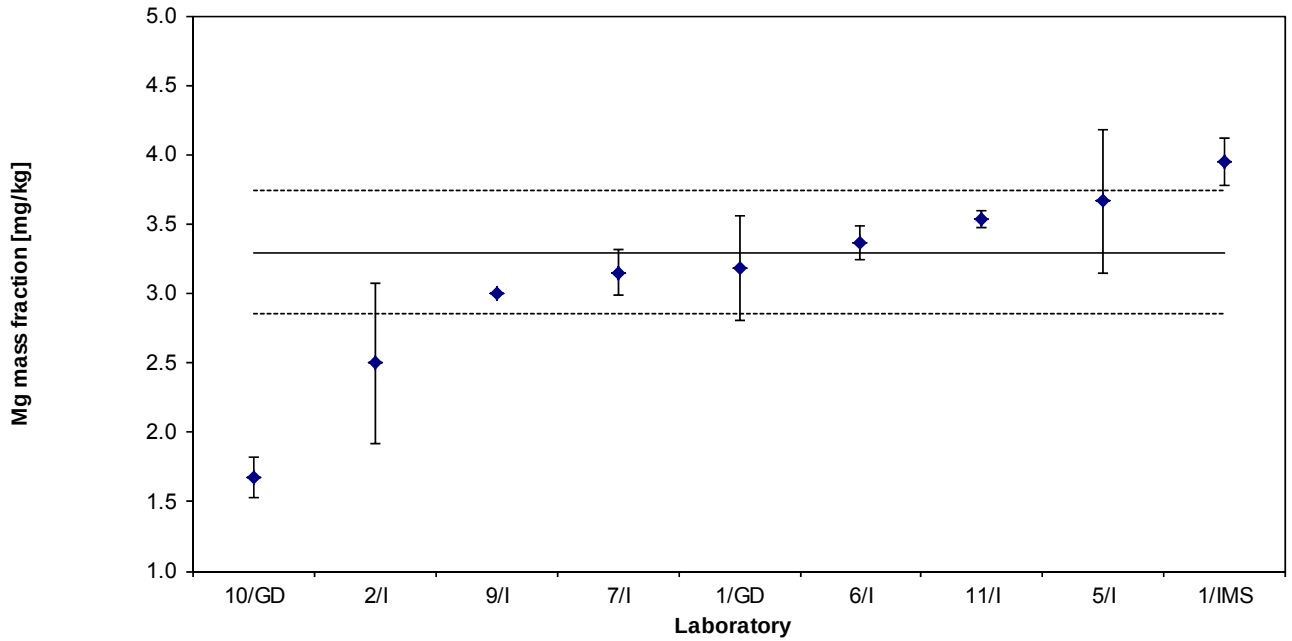


Table 67: Results for Mg in BAM-M384b

Lab./Meth.	4/I	2/I	6/I	9/I	3/I	11/I	5/I	1/GD	10/GD	1/IMS	7/I		Ges.
M_i [mg/kg]	3.64	6.70	7.1	7.3	7.81	7.70	9.0	9.07	9.50	9.33	9.55		N
	3.26	6.00	7.1	7.4	7.53	7.83	9.0	9.03	9.23	9.30	9.77		10
	3.51	8.10	7.2	7.3	7.66	7.71	9.0	9.13	8.94	9.26	9.47		
	3.61	4.30	7.1	7.0	7.60	7.97	8.0	7.98	8.21	9.00	10.01		
	3.66		7.0		7.63	7.61	8.0	7.86	9.01	9.13	10.25		
	3.86		7.1		7.61	8.13	8.0	8.11	8.78	9.15	10.12		
M [mg/kg]	**3.59**	**6.28**	**7.10**	**7.25**	**7.64**	**7.83**	**8.50**	**8.53**	**8.95**	**9.20**	**9.86**		**8.11**
s_M [mg/kg]	0.198	1.580	0.063	0.173	0.094	0.194	0.548	0.603	0.438	0.124	0.316		1.090
s_i [mg/kg]													0.596
s_{rel}	0.055	0.252	0.009	0.024	0.012	0.025	0.064	0.071	0.049	0.013	0.032		0.134

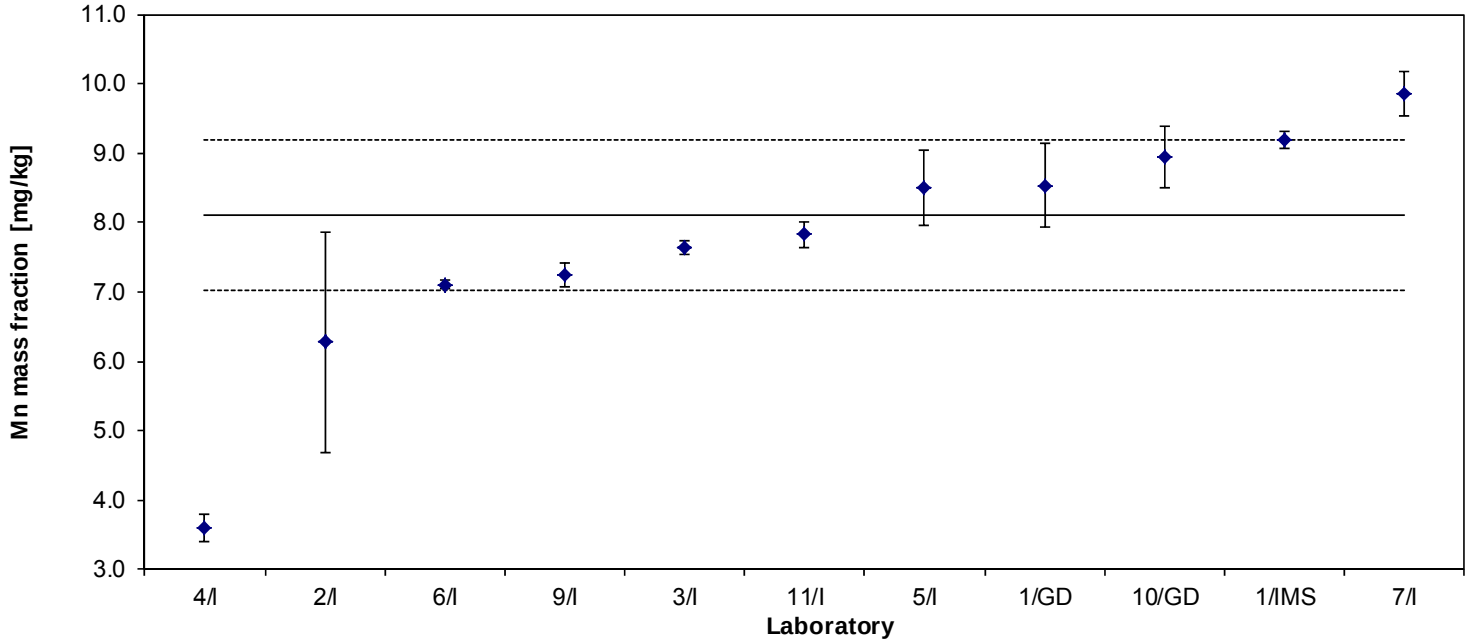


Table 68: Results for Mn in BAM-M384b

Lab./Meth.	10/GD	6/EA	4/I	5/I	2/I	1/GD	3/I	1/IMS	11/I	9/I	6/I	7/I		Ges.
M_i [mg/kg]	3.79	3.6	4.19	5.0	4.60	5.04	4.93	4.88	4.70	5	5.1	4.96		N
	3.17	3.5	4.12	5.0	4.60	5.04	4.94	5.16	4.99	5	5.2	5.22		12
	3.24	3.5	4.16	5.0	4.70	5.13	4.82	4.99	4.92	5	5.2	5.05		
		3.5	4.10	4.0	4.70	4.65	4.95	4.76	5.08	5	5.2	5.51		
		3.6	4.28	4.0		4.53	5.01	5.11	5.18		5.2	6.86		
		3.5	4.09	4.0		4.48	5.02	4.87	4.96		5.2	6.87		
M [mg/kg]	**3.40**	**3.54**	**4.16**	**4.50**	**4.65**	**4.81**	**4.95**	**4.96**	**4.97**	**5.00**	**5.18**	**5.75**		**4.66**
s_M [mg/kg]	0.340	0.047	0.071	0.548	0.058	0.291	0.072	0.152	0.163	0.000	0.041	0.888		0.673
$\bar{s}_i$ [mg/kg]														0.336
s_{rel}	0.100	0.013	0.017	0.122	0.012	0.061	0.015	0.031	0.033	0.000	0.008	0.154		0.145

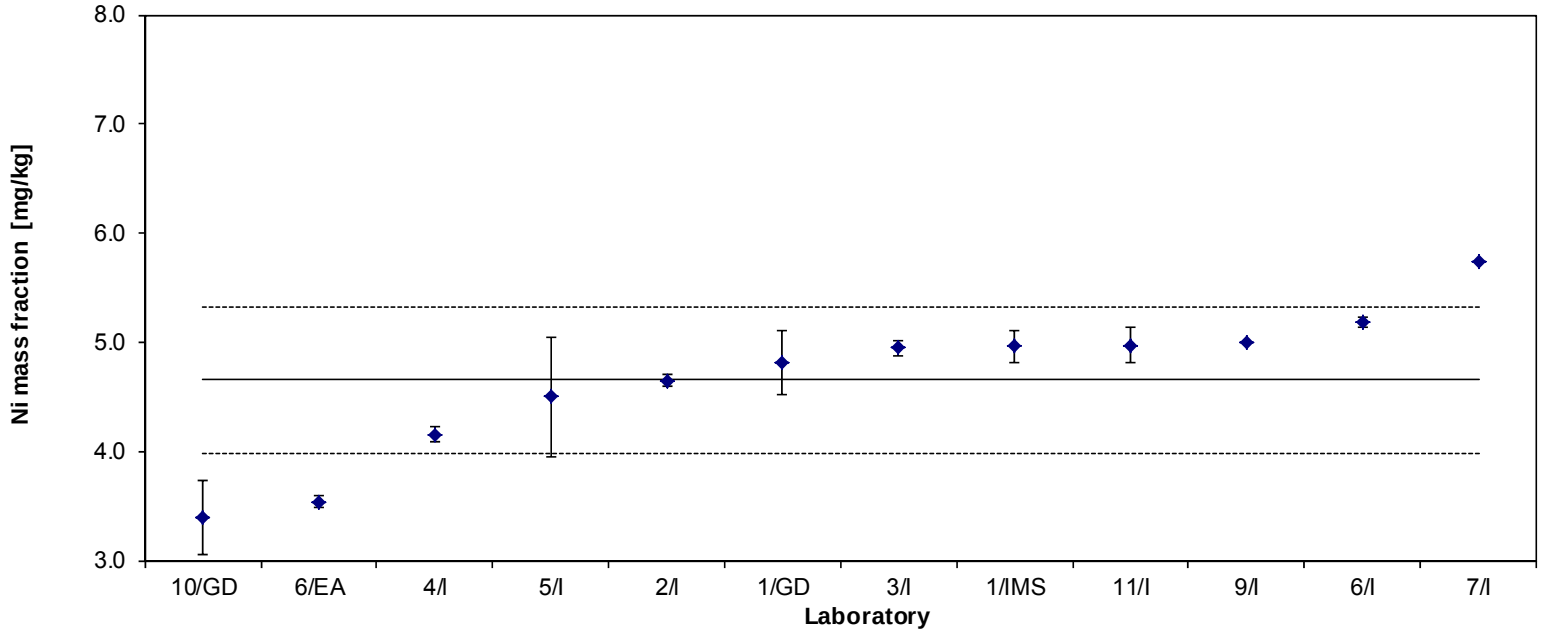


Table 69: Results for Ni in BAM-M384b

Lab./Meth.	9/I	6/I	10/GD	7/EA	1/IMS	1/GD	5/EA	2/I	3/I	4/I		Ges.
M_i [mg/kg]	1	1.1	1.42	1.43	1.57	1.72	2.0	2.00	1.14	6.86		N
	1	1.4	1.60	1.41	1.51	1.74	2.0	2.00	1.35	6.99		9
	1	1.1	1.22	1.42	1.52	1.54	2.0	2.20	2.32	7.04		
	1	1.3	1.22	1.41	1.55	1.52	2.0	2.00	2.09	6.68		
		1.2		1.52	1.54	1.46	1.0		3.21	6.62		
		1.3		1.47	1.59	1.55	1.0		2.70	6.59		
***M* [mg/kg]**	**1.00**	**1.23**	**1.37**	**1.44**	**1.55**	**1.59**	**1.67**	**2.05**	**2.14**	**6.80**		**1.56**
s_M [mg/kg]	0.000	0.121	0.183	0.044	0.030	0.114	0.516	0.100	0.790	0.194		0.363
$\bar{s}_i$ [mg/kg]												0.327
s_{rel}	0.000	0.098	0.134	0.030	0.019	0.072	0.310	0.049	0.370	0.029		0.233

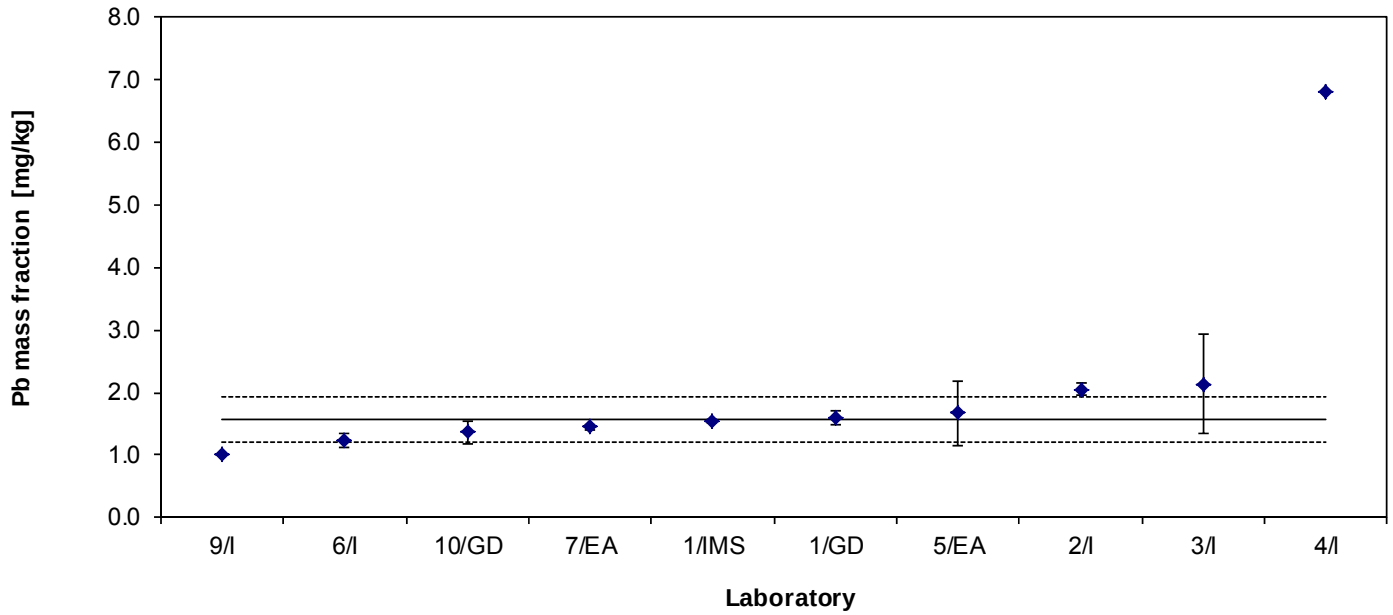


Table 70: Results for Pb in BAM-M384b

Lab./Meth.	6/I-R	3/I	5/I	8/NAA	1/NAA	1/GD	4/I	1/IMS	9/I	2/I	10/GD	7/EA		Ges.
M_i [mg/kg]	3.14	5.45	6.0	5.63	5.57	6.25	5.74	5.79	6	6.00	4.20	5.72		N
	2.88	5.73	5.0	5.60	5.60	6.16	5.66	5.76	6	6.00	6.73	6.49		11
	2.95	5.48	6.0	5.48	5.74	5.66	5.61	5.88	6	6.00	7.19	6.35		
	3.12	5.05	6.0	5.64	5.94	5.37	5.91	5.77	6	6.00		6.03		
	3.31	5.99	5.0	5.49	5.7	5.35	5.77	5.81				6.11		
	2.89	5.08	5.0	5.60	5.5	5.50	5.79	5.52				5.83		
M [mg/kg]	**3.05**	**5.46**	**5.50**	**5.57**	**5.68**	**5.72**	**5.75**	**5.76**	**6.00**	**6.00**	**6.04**	**6.09**		**5.78**
s_M [mg/kg]	0.170	0.365	0.548	0.070	0.149	0.397	0.105	0.123	0.000	0.000	1.610	0.295		0.223
$\bar{s}_i$ [mg/kg]														0.550
s_{rel}	0.056	0.067	0.100	0.013	0.026	0.069	0.018	0.021	0.000	0.000	0.267	0.049		0.039

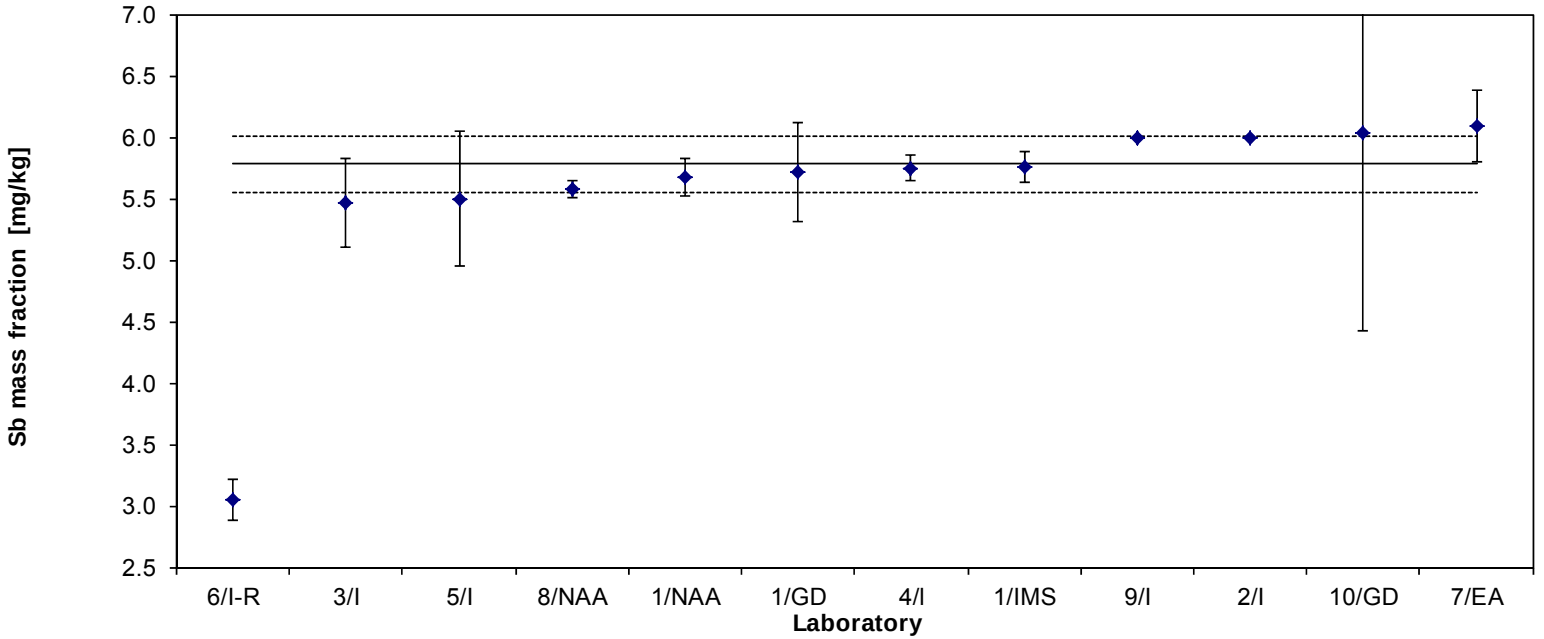


Table 71: Results for Sb in BAM-M384b

Lab./Meth.	4/I	3/I	6/I	5/I	6/EA	10/GD	1/NAA	1/GD	9/I	2/I		Ges.
M_i [mg/kg]	1.26	1.60	2.0	2.0	3.0	3.23	3.3	3.95	4	4.50		N
	1.21	1.60	2.2	3.0	2.8	2.67	3.3	3.88	5	4.50		10
	1.14	1.71	3.2	3.0	2.8	2.97	3.3	3.73	4	4.30		
	1.22	1.57	2.4	3.0	2.9	2.78	3.4	3.41	4	4.10		
	1.13	1.89	2.3	3.0	2.9		3.4	3.44				
	1.24	1.86	2.7	2.0	2.9		3.3	3.52				
M [mg/kg]	**1.20**	**1.71**	**2.47**	**2.67**	**2.87**	**2.91**	**3.31**	**3.65**	**4.25**	**4.35**		**2.94**
s_M [mg/kg]	0.053	0.140	0.427	0.516	0.062	0.245	0.075	0.230	0.500	0.191		1.012
$\bar{s}_i$ [mg/kg]												0.297
s_{rel}	0.044	0.082	0.173	0.194	0.022	0.084	0.023	0.063	0.118	0.044		0.344

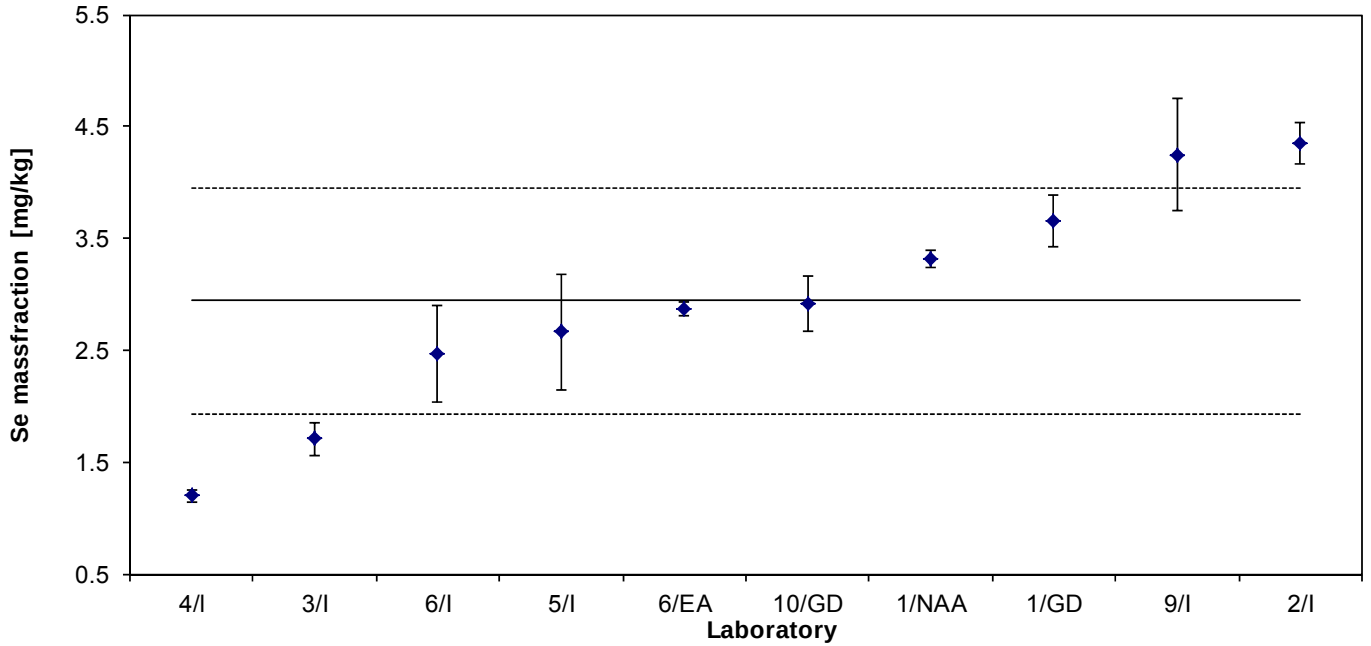


Table 72: Results for Se in BAM-M384b

Lab./Meth.	1/GD	9/I	2/I	6/I	1/IMS	3/I	10/GD	4/I	5/EA		Ges.
M_i [mg/kg]	1.59	1.8	2.00	1.8	2.11	2.31	2.36	2.33	4.0		N
	1.60	1.8	2.00	2.8	2.15	2.32	2.40	2.29	4.0		9
	1.47	2.0	1.70	1.7	2.25	2.30	2.26	2.32	3.0		
	1.41	1.5	1.80	1.8	2.26	2.44	2.11	2.53	2.0		
	1.37			1.7	2.22	2.14		2.40	1.0		
	1.42			2.4	2.02	2.11		2.28	1.0		
M [mg/kg]	**1.48**	**1.78**	**1.88**	**2.03**	**2.17**	**2.27**	**2.28**	**2.36**	**2.50**		**2.08**
s_M [mg/kg]	0.097	0.206	0.150	0.459	0.095	0.124	0.129	0.094	1.378		0.324
$\bar{s}_i$ [mg/kg]											0.498
s_{rel}	0.066	0.116	0.080	0.226	0.044	0.054	0.057	0.040	0.551		0.156

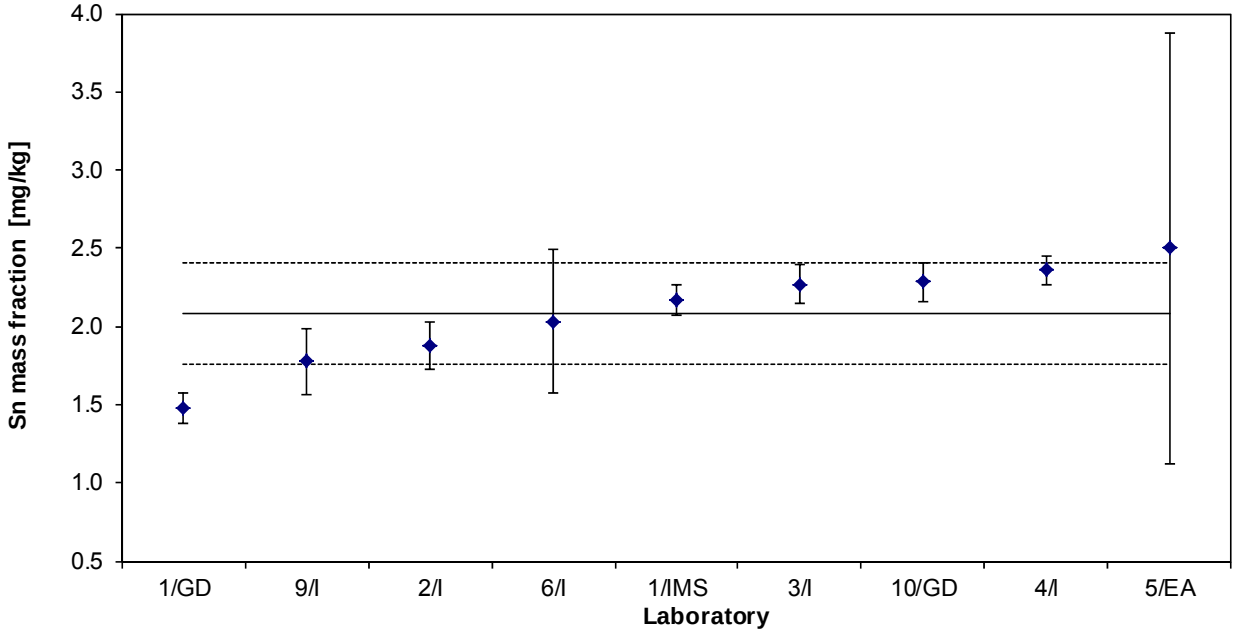


Table 73: Results for Sn in BAM-M384b

Lab./Meth.	10/GD	4/I	1/NAA	9/I	1/IMS	5/I	1/GD	7/EA	6/EA	2/A		Ges.
M_i [mg/kg]	5.86	6.22	6.48	7.0	7.55	7.0	8.18	7.68	8.1	9.00		N
	6.35	6.23	6.61	6.0	7.40	8.0	8.09	7.39	7.6	8.00		10
	5.78	6.28	6.19	6.6	7.46	8.0	7.56	7.41	7.9	7.80		
	5.94	6.12	6.70	6.3	7.49	8.0	7.07	8.21	8.0	9.30		
		6.11	6.48		7.69	7.0	7.12	7.51	7.1			
		6.82	6.18		7.41	7.0	7.30	7.27	7.8			
M [mg/kg]	**5.98**	**6.30**	**6.44**	**6.48**	**7.50**	**7.50**	**7.55**	**7.58**	**7.74**	**8.53**		**7.16**
s_M [mg/kg]	0.254	0.265	0.214	0.427	0.109	0.548	0.482	0.338	0.363	0.737		0.808
s_i [mg/kg]												0.412
s_{rel}	0.042	0.042	0.033	0.066	0.014	0.073	0.064	0.045	0.047	0.086		0.113

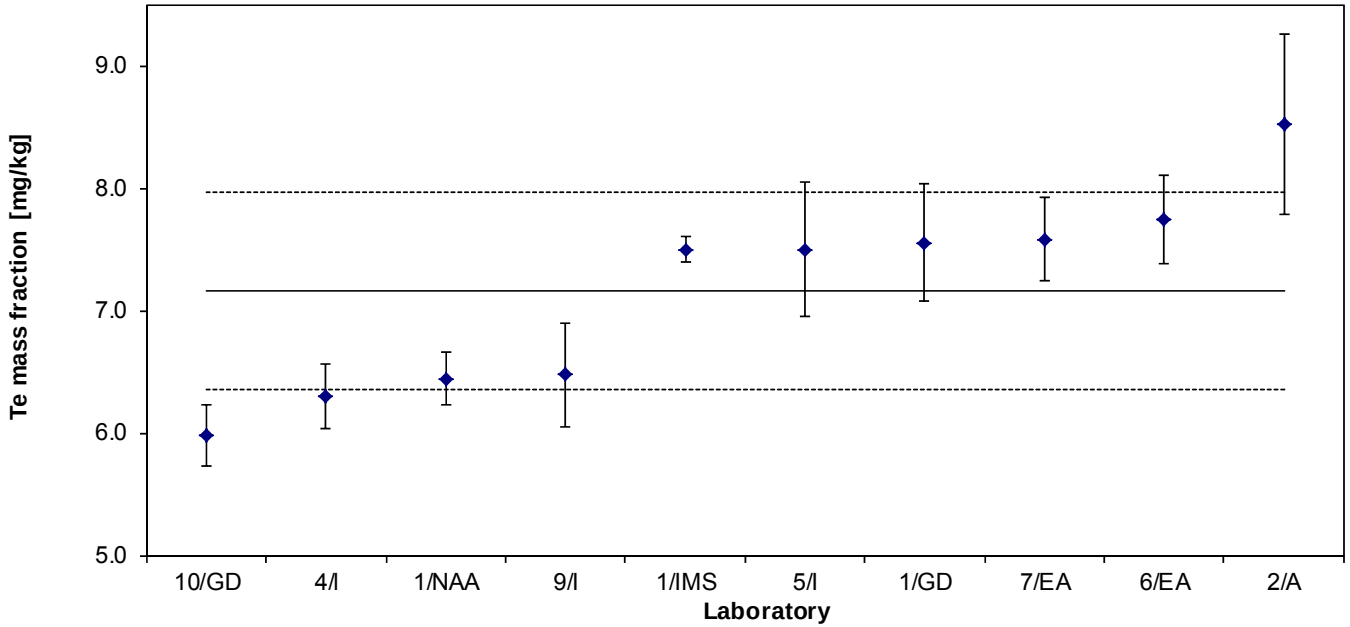


Table 74: Results for Te in BAM-M384b

Lab./Meth.	2/I	9/I	3/I	10/GD	7/I	5/I	1/GD	6/I	1/IMS		Ges.
M_i [mg/kg]	2.00	2.7	2.66	3.51	2.78	3.0	3.49	3.2	5.23		N
	2.00	2.0	2.70	2.91	2.85	3.0	3.72	3.3	4.81		7
	1.00	2.8	2.63	2.48	2.77	3.0	3.50	3.4	4.41		
	1.00	2.6	2.65	2.38	2.98	3.0	3.15	3.5	5.06		
			2.73		2.87	3.0	2.88	3.3	4.64		
			2.69		2.80	3.0	3.16	3.3	5.28		
M [mg/kg]	**1.50**	**2.53**	**2.68**	**2.82**	**2.84**	**3.00**	**3.32**	**3.33**	**4.90**		**2.93**
s_M [mg/kg]	0.577	0.359	0.037	0.514	0.078	0.000	0.308	0.103	0.345		0.307
$\bar{s}_i$ [mg/kg]											0.269
s_{rel}	0.385	0.142	0.014	0.182	0.028	0.000	0.093	0.031	0.070		0.105

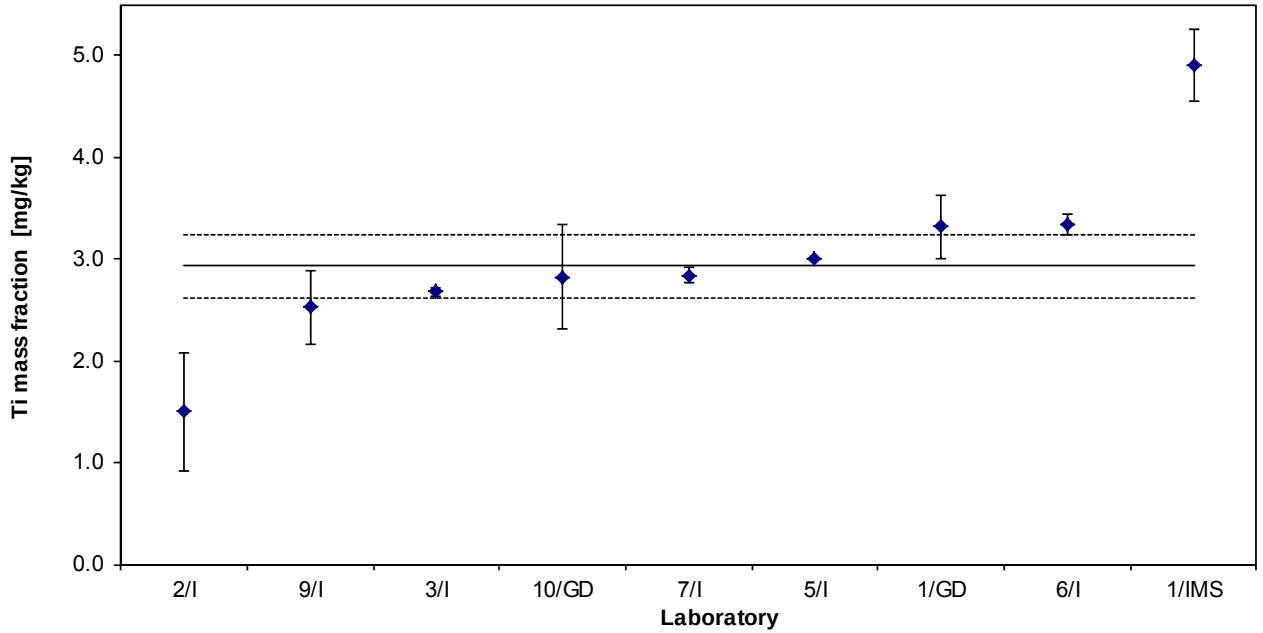


Table 75: Results for Ti in BAM-M384b

Lab./Meth.	6/I	5/A	2/I	9/I	11/I	8/NAA	1/GD	10/GD	1/IMS	7/I	4/I		Ges.
M_i [mg/kg]	1.4	1.0	2.20	2.3	2.49	2.75	3.16	3.08	3.28	2.92	3.21		N
	1.6	1.0	2.20	1.8	2.38	3.17	3.04	2.96	2.89	3.68	2.68		11
	1.2	1.0	1.30	1.6	2.23	2.18	3.03	2.93	3.19	2.75	3.27		
	1.2	2.0	1.30	1.5	2.36	2.98	2.68	3.02	2.91	3.36	3.44		
	1.3	2.0			2.66	1.77	2.78		3.12	3.31	3.75		
	1.6	2.0			2.34	3.14	2.76		2.76	2.98	3.52		
M [mg/kg]	**1.38**	**1.50**	**1.75**	**1.80**	**2.41**	**2.67**	**2.91**	**3.00**	**3.02**	**3.17**	**3.31**		**2.55**
s_M [mg/kg]	0.183	0.548	0.520	0.356	0.148	0.570	0.194	0.067	0.201	0.344	0.364		0.654
$\bar{s}_i$ [mg/kg]													0.358
s_{rel}	0.133	0.365	0.297	0.198	0.061	0.214	0.067	0.022	0.066	0.109	0.110		0.256

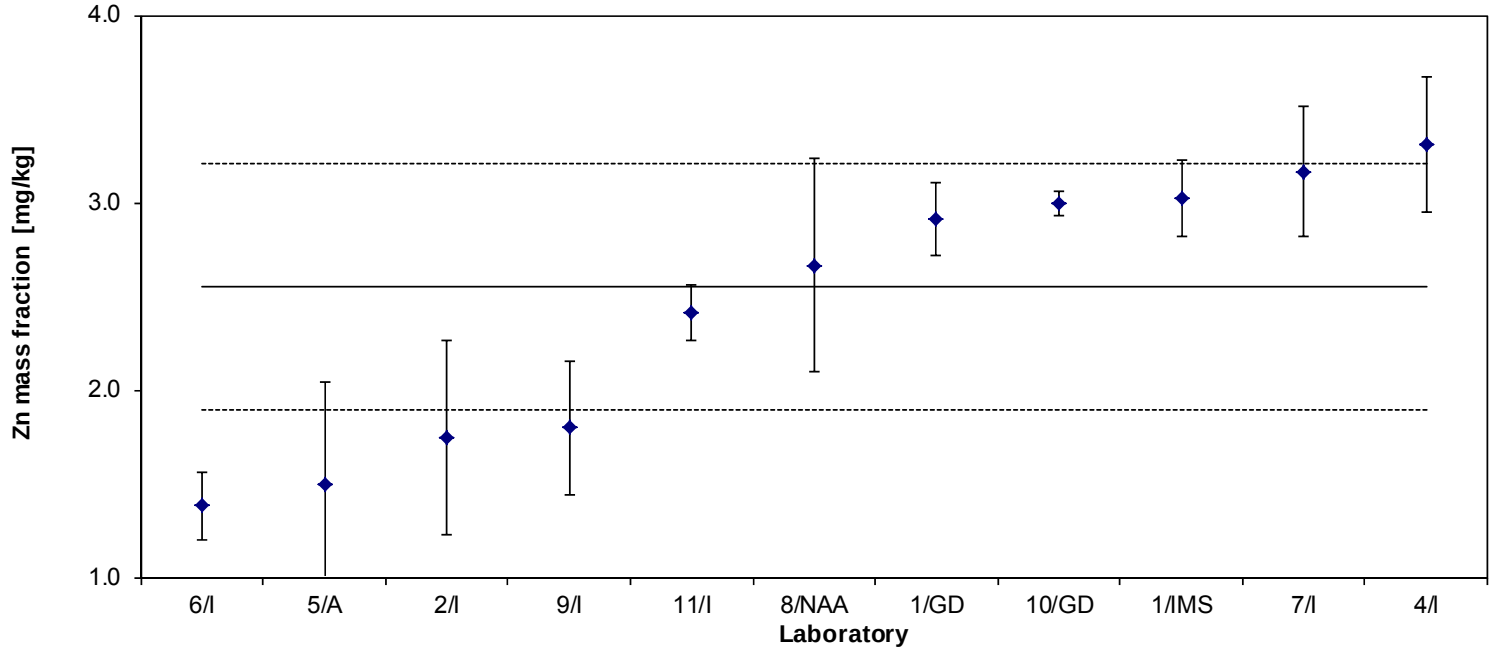


Table 76: Results for Zn in BAM-M384b

Lab./Meth.	11/I	5/I	10/GD	1/GD	1/IMS	7/I	9/I	6/I		Ges.
M_i [mg/kg]	0.50	1.0	1.54	1.62	1.53	1.59	< 1	<1		N
	0.60	1.0	1.26	1.74	1.57	1.64	< 1	<1		6
	0.60	1.0	1.05	1.54	1.67	1.58	< 1	<1		
	1.20	1.0	1.06	1.52	1.55	1.75	< 1	<1		
	1.00	1.0		1.37	1.54	1.67		<1		
	1.10	1.0		1.53	1.53	1.63		<1		
M [mg/kg]	**0.83**	**1.00**	**1.23**	**1.55**	**1.57**	**1.64**	**< 1**	**<1**		**1.30**
s_M [mg/kg]	0.301	0.000	0.230	0.124	0.053	0.062				0.336
$\bar{s}_i$ [mg/kg]										0.166
s_{rel}	0.361	0.000	0.187	0.080	0.034	0.038				0.258

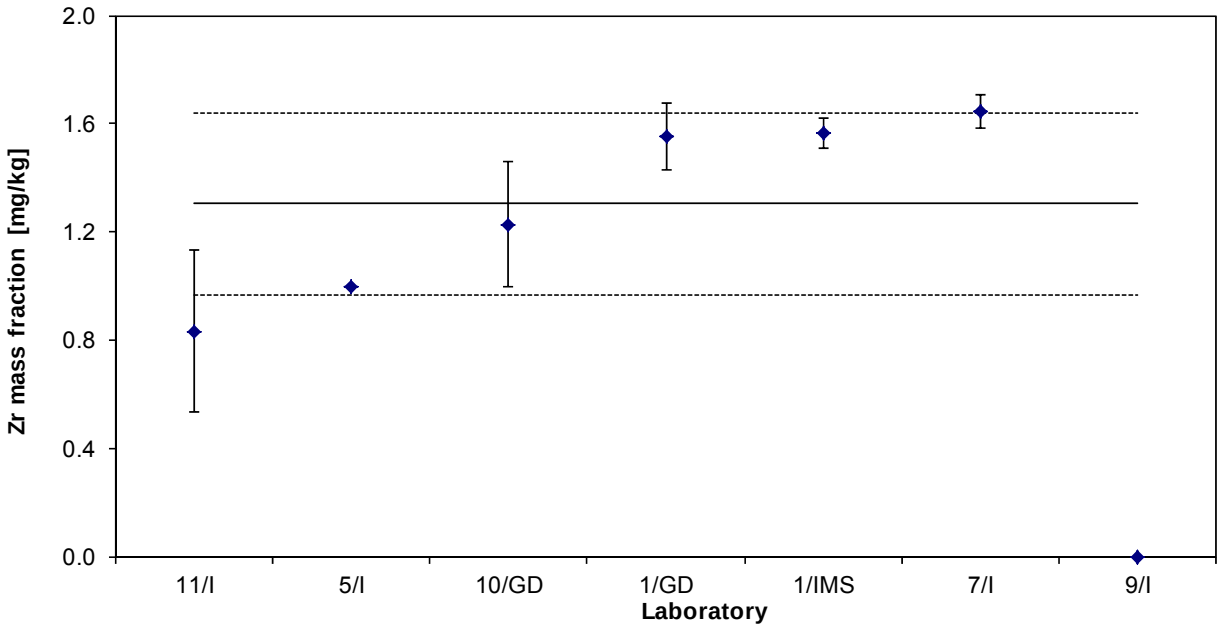


Table 77: Results for Zr in BAM-M384b

Lab./Meth.	10/GD	1/GD	1/ETV-I	11/P	7/P	9/I	5/I		Ges.
M_i [mg/kg]	0.060	0.099		1.7	1.660	< 1	< 1		N
	0.030	0.098		1.7	1.640	< 1	< 1		3
	0.040	0.114		1.7	1.740	< 1	< 1		
		0.088		1.7	1.640	< 1	< 1		
		0.090		1.5	1.660		< 1		
		0.092		1.6	1.750		< 1		
M [mg/kg]	**0.04**	**0.10**	**0.15**	**1.65**	**1.68**	**< 1**	**< 1**		**0.72**
s_M [mg/kg]	0.015	0.010		0.068	0.050				0.860
$\bar{s}_i$ [mg/kg]									0.036
s_{rel}	0.353	0.100	0.000	0.041	0.030				1.188

Table 78: Results for P in BAM-M384b

Lab./Meth.	1/GD	4/I	11/V	9/I		Ges.
M_i [mg/kg]	3.21	3.78	4.80	< 1		N
	3.09	3.73	4.00	< 1		3
	3.48	3.58	4.80	< 1		
	2.68	3.82	4.80	< 1		
	2.70	3.87	4.00			
	2.64	3.97	4.80			
M [mg/kg]	**2.97**	**3.79**	**4.53**	**< 1**		**3.76**
s_M [mg/kg]	0.346	0.132	0.413			0.784
$\bar{s}_i$ [mg/kg]						0.320
s_{rel}	0.117	0.035	0.091			0.208

Table 79: Results for S in BAM-M384b

Lab./Meth.	9/I	1/GD	5/I	7/I		Ges.
M_i [mg/kg]	1	1.79	3.0	5.5		N
	1	1.81	3.0	3.6		3
	1	1.94	3.0	2.3		
	1	1.59	2.0	4.5		
		1.52	6.0	4.0		
		1.53	2.0	<2		
M [mg/kg]	**1.00**	**1.70**	**3.17**	**3.95**		**1.95**
s_M [mg/kg]	0.000	0.173	1.472	1.189		1.106
$\bar{s}_i$ [mg/kg]						0.856
s_{rel}	0.000	0.102	0.465	0.301		0.566

Table 80: Results for Si in BAM-M384b

Annex 3: Calc. of uncertainty contribution of potential inhomogeneity (batch)

Ag in BAM-M384a:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 3.1	0.001031	0.001046	0.00103	0.001023	0.001021
020 3.1	0.00105	0.001052	0.001033	0.001024	0.001023
039 3.1	0.001047	0.001041	0.001035	0.001019	0.001038
161 3.4	0.001043	0.001043	0.001023	0.001035	0.001031
180 3.4	0.001042	0.00104	0.001035	0.001026	0.001006
199 3.4	0.001052	0.001039	0.001032	0.001025	0.001023
214 3.5	0.001032	0.001048	0.001031	0.001022	0.001037
233 3.5	0.001028	0.001035	0.001029	0.001023	0.001028
252 3.5	0.001024	0.001053	0.001038	0.001018	0.001039
267 3.5	0.00104	0.001039	0.001027	0.001024	0.001033

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.3208E-10	9	3.68978E-11	0.31421083	0.96566308	2.12402926
Within groups	4.6972E-09	40	1.1743E-10			
Total	5.02928E-09	49				
within-sd	1.0837E-05			status:	homogeneous	
effective n	5.00					
s_bb	0					
s_bb_min	2.2916E-06					
u_bb	2.2916E-06	0.00229164				
u_bb(rel.)	0.221817732					

As in BAM-M384a:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 3.1	0.000392	0.000456	0.000408	0.000357	0.00037
020 3.1	0.000391	0.000408	0.000388	0.000347	0.000402
039 3.1	0.000406	0.00041	0.000392	0.000414	0.00038
161 3.4	0.000364	0.000394	0.00043	0.000369	0.000354
180 3.4	0.000368	0.000418	0.000411	0.000393	0.000388
199 3.4	0.000402	0.000431	0.000324	0.000364	0.000349
214 3.5	0.000364	0.000398	0.000354	0.000353	0.000363
233 3.5	0.000409	0.000395	0.000389	0.000351	0.000355
252 3.5	0.000413	0.000398	0.000382	0.000396	0.00037
267 3.5	0.000392	0.000424	0.000349	0.000378	0.000355

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	5.32432E-09	9	5.91591E-10	0.78125683	0.63456621	2.12402926
Within groups	3.02892E-08	40	7.5723E-10			
Total	3.56135E-08	49				
within-sd	2.75178E-05			status:	homogeneous	
effective n	5.00					
s_bb	0					
s_bb_min	5.81931E-06					
u_bb	5.81931E-06	0.00581931				
u_bb(rel.)	1.510096745					

Bi in BAM-M384a:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 3.1	0.000302	0.000334	0.000343	0.000318	0.000324
020 3.1	0.000337	0.00035	0.000346	0.000323	0.000329
039 3.1	0.00034	0.000323	0.00033	0.000321	0.000354
161 3.4	0.000324	0.000343	0.000319	0.000328	0.000337
180 3.4	0.00033	0.000324	0.000335	0.000331	0.000325
199 3.4	0.000325	0.00035	0.00032	0.000319	0.000318
214 3.5	0.000302	0.000336	0.000343	0.000321	0.000322
233 3.5	0.000316	0.000337	0.000319	0.000306	0.000335
252 3.5	0.00033	0.000334	0.00034	0.000335	0.00034
267 3.5	0.000341	0.00032	0.000316	0.000342	0.000326

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.10282E-09	9	1.22536E-10	0.85171026	0.57441291	2.12402926
Within groups	5.7548E-09	40	1.4387E-10			
Total	6.85762E-09	49				
within-sd	1.1995E-05			status:	homogeneous	
effective n	5.00					
s_bb	0					
s_bb_min	2.5365E-06					
u_bb	2.5365E-06	0.00253655				
u_bb(rel.)	0.770377601					

Co in BAM-M384a:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 3.1	0.000313	0.000323	0.000318	0.000323	0.000305
020 3.1	0.000327	0.000323	0.000309	0.000309	0.000307
039 3.1	0.000314	0.00032	0.000317	0.00032	0.000301
161 3.4	0.000315	0.000324	0.000315	0.000306	0.000306
180 3.4	0.000324	0.000321	0.000325	0.00032	0.000301
199 3.4	0.000314	0.000323	0.000317	0.000299	0.000303
214 3.5	0.000309	0.00032	0.000318	0.000326	0.000301
233 3.5	0.000315	0.00032	0.000316	0.000309	0.000295
252 3.5	0.000315	0.000317	0.000314	0.000312	0.000301
267 3.5	0.000321	0.000316	0.000313	0.000313	0.000312

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.421E-10	9	2.69E-11	0.382048	0.93686961	2.12402926
Within groups	2.8164E-09	40	7.041E-11			
Total	3.0585E-09	49				
within-sd	8.391E-06			status:	homogeneous	
effective n	5.00					
s_bb	0					
s_bb_min	1.774E-06					
u_bb	1.774E-06	0.0017745				
u_bb(rel.)	0.564945735					

Ni in BAM-M384a:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 3.1	0.000271	0.000246	0.000241	0.000321	0.000297
020 3.1	0.000287	0.000237	0.000221	0.000241	0.000275
039 3.1	0.000246	0.00021	0.000221	0.000297	0.000276
161 3.4	0.000259	0.000223	0.000227	0.000252	0.00029
180 3.4	0.000264	0.000223	0.00025	0.000294	0.000245
199 3.4	0.000247	0.000266	0.000227	0.000188	0.000258
214 3.5	0.000215	0.000228	0.00025	0.000315	0.000278
233 3.5	0.000229	0.000256	0.000227	0.00024	0.000255
252 3.5	0.000254	0.000201	0.000235	0.000303	0.000274
267 3.5	0.000265	0.000218	0.000251	0.000271	0.000303

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.94912E-09	9	5.49902E-10	0.55533899	0.82471065	2.12402926
Within groups	3.96084E-08	40	9.9021E-10			
Total	4.45575E-08	49				
within-sd	3.1468E-05			status:	homogeneous	
effective n	5.00					
s_bb	0					
s_bb_min	6.6546E-06					
u_bb	6.6546E-06	0.00665459				
u_bb(rel.)	2.626534456					

Pb in BAM-M384a:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 3.1	0.001041	0.001149	0.001105	0.001209	0.001245
020 3.1	0.00119	0.001051	0.001028	0.001068	0.001154
039 3.1	0.001107	0.001095	0.001165	0.001241	0.001156
161 3.4	0.001074	0.001097	0.00108	0.001171	0.001251
180 3.4	0.001187	0.001054	0.00115	0.001186	0.001048
199 3.4	0.001104	0.001099	0.00111	0.001064	0.001136
214 3.5	0.001049	0.00116	0.001093	0.001145	0.001186
233 3.5	0.001085	0.001118	0.001037	0.001092	0.001162
252 3.5	0.001153	0.001199	0.001163	0.001198	0.001196
267 3.5	0.001119	0.001091	0.001107	0.001135	0.001191

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.19505E-08	9	3.55005E-09	1.07109338	0.40448705	2.12402926
Within groups	1.32577E-07	40	3.31442E-09			
Total	1.64527E-07	49				
within-sd	5.7571E-05			status:	homogeneous	
effective n	5.00					
s_bb	6.8649E-06					
s_bb_min	1.2175E-05					
u_bb	1.2175E-05	0.01217478				
u_bb(rel.)	1.077528952					

Zn in BAM-M384a:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 3.1	0.000383	0.000364	0.00045	0.000341	0.000383
020 3.1	0.000433	0.000392	0.000381	0.000345	0.000379
039 3.1	0.00039	0.000372	0.000363	0.000339	0.000361
161 3.4	0.000409	0.000392	0.000424	0.000453	0.000507
180 3.4	0.000478	0.000369	0.00041	0.000364	0.000378
199 3.4	0.000388	0.000373	0.00038	0.000335	0.000368
214 3.5	0.000513	0.000377	0.000384	0.000345	0.000358
233 3.5	0.000387	0.00043	0.000403	0.000354	0.000371
252 3.5	0.000425	0.000381	0.000439	0.000386	0.000361
267 3.5	0.00038	0.000387	0.000445	0.00036	0.000366

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.76153E-08	9	1.95725E-09	1.28029654	0.27747359	2.12402926
Within groups	6.115E-08	40	1.52875E-09			
Total	7.87653E-08	49				
within-sd	3.9099E-05			status:	homogeneous	
effective n	5.00					
s_bb	9.2575E-06					
s_bb_min	8.2685E-06					
u_bb	9.2575E-06	0.0092575				
u_bb(rel.)	2.366911806					

Ag in BAM-M384b:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 4.1	0.001055	0.001073	0.001063	0.00106	0.001089
020 4.1	0.001065	0.001082	0.001067	0.001065	0.001075
039 4.1	0.001071	0.001063	0.001061	0.001076	0.001073
052 4.2	0.001053	0.001081	0.001053	0.00108	0.001065
071 4.2	0.001062	0.001063	0.001024	0.001066	0.001066
090 4.2	0.001055	0.00108	0.001064	0.00106	0.001062
105 4.3	0.00105	0.00107	0.001058	0.001059	0.001061
124 4.3	0.00106	0.00106	0.001049	0.001062	0.001069
143 4.3	0.001052	0.001074	0.001069	0.001054	0.00106
158 4.4	0.001055	0.00107	0.001054	0.001068	0.001069
177 4.4	0.001052	0.001058	0.001044	0.001062	0.001072
186 4.4	0.001076	0.001062	0.001046	0.001057	0.001051
203 4.5	0.001055	0.001068	0.00105	0.001077	0.001057
222 4.5	0.00107	0.001079	0.00105	0.001069	0.001062
241 4.5	0.001058	0.00106	0.001061	0.001074	0.001061
256 4.5	0.001053	0.001062	0.001066	0.001079	0.00107

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.3552E-09	15	9.03467E-11	0.82348563	0.64841887	1.82558574
Within groups	7.0216E-09	64	1.09713E-10			
Total	8.3768E-09	79				
within-sd	1.0474E-05			status:	homogeneous	
effective n	5.00					
s_bb	0					
s_bb_min	1.9695E-06					
u_bb	1.9695E-06	0.0019695				
u_bb(rel.)	0.185242482					

As in BAM-M384b:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 4.1	0.000433	0.000411	0.00045	0.000439	0.000448
020 4.1	0.000478	0.000427	0.000468	0.000432	0.000457
039 4.1	0.000508	0.000416	0.000461	0.000455	0.000427
052 4.2	0.000473	0.000417	0.000411	0.000473	0.000474
071 4.2	0.000506	0.000432	0.000414	0.000455	0.000424
090 4.2	0.000448	0.000445	0.00046	0.00045	0.000466
105 4.3	0.00045	0.000403	0.000458	0.000444	0.000435
124 4.3	0.00046	0.000383	0.000464	0.000429	0.000417
143 4.3	0.000486	0.000434	0.000471	0.000434	0.000445
158 4.4	0.000494	0.000429	0.000463	0.000435	0.000442
177 4.4	0.000514	0.000426	0.000447	0.000423	0.000431
186 4.4	0.000506	0.000432	0.000466	0.000439	0.000475
203 4.5	0.000533	0.000475	0.00044	0.000504	0.000446
222 4.5	0.000429	0.000451	0.00045	0.000452	0.000436
241 4.5	0.000499	0.000427	0.000514	0.000488	0.000465
256 4.5	0.000493	0.000449	0.000455	0.000397	0.000473

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.32168E-08	15	8.81119E-10	1.02643698	0.4410642	1.82558574
Within groups	5.49392E-08	64	8.58425E-10			
Total	6.8156E-08	79				
within-sd	2.92989E-05			status:	homogeneous	
effective n	5.00					
s_bb	2.13045E-06					
s_bb_min	5.50907E-06					
u_bb	5.50907E-06	0.005509075				
u_bb(rel.)	1.218518612					

Bi in BAM-M384b:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 4.1	0.000413	0.00039	0.000398	0.000414	0.000439
020 4.1	0.000406	0.000423	0.00041	0.000395	0.000425
039 4.1	0.000432	0.000402	0.000408	0.000405	0.000432
052 4.2	0.000395	0.000408	0.000395	0.00041	0.000427
071 4.2	0.000413	0.000381	0.000364	0.000407	0.0004
090 4.2	0.000401	0.000385	0.000391	0.000402	0.000413
105 4.3	0.000388	0.000413	0.000376	0.000411	0.000413
124 4.3	0.000413	0.000383	0.000381	0.000398	0.000432
143 4.3	0.000404	0.000408	0.000398	0.000377	0.000401
158 4.4	0.000411	0.0004	0.000392	0.000402	0.000416
177 4.4	0.000403	0.000381	0.000405	0.0004	0.000424
186 4.4	0.000416	0.000395	0.000379	0.000409	0.000417
203 4.5	0.000379	0.000401	0.000395	0.000403	0.000393
222 4.5	0.000406	0.000398	0.000391	0.0004	0.000417
241 4.5	0.000407	0.000379	0.000382	0.000418	0.000423
256 4.5	0.000414	0.000402	0.0004	0.000416	0.000418

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.0308E-09	15	2.02053E-10	0.90313257	0.56443134	1.82558574
Within groups	1.43184E-08	64	2.23725E-10			
Total	1.73492E-08	79				
within-sd	1.4957E-05			status:	homogeneous	
effective n	5.00					
s_bb	0					
s_bb_min	2.8124E-06					
u_bb	2.8124E-06	0.00281245				
u_bb(rel.)	0.697186337					

Co in BAM-M384b:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 4.1	0.000854	0.000822	0.000836	0.000869	0.00083
020 4.1	0.000838	0.00086	0.000837	0.000855	0.000846
039 4.1	0.000866	0.000841	0.000841	0.000868	0.000819
052 4.2	0.000864	0.000856	0.000897	0.000857	0.000849
071 4.2	0.000855	0.000864	0.000843	0.000864	0.000824
090 4.2	0.000858	0.000843	0.000846	0.000869	0.000853
105 4.3	0.000854	0.00086	0.000832	0.000867	0.00085
124 4.3	0.000856	0.000851	0.000841	0.000861	0.000842
143 4.3	0.000844	0.000838	0.000851	0.000904	0.00086
158 4.4	0.00085	0.000851	0.000845	0.000859	0.000841
177 4.4	0.000859	0.000856	0.000849	0.000858	0.000842
186 4.4	0.000875	0.000853	0.000851	0.000861	0.000843
203 4.5	0.000848	0.000844	0.000833	0.00086	0.000834
222 4.5	0.000841	0.000837	0.000866	0.000844	0.000824
241 4.5	0.000827	0.00082	0.000827	0.000835	0.000819
256 4.5	0.000908	0.000832	0.000818	0.000838	0.000826

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	5.77349E-09	15	3.84899E-10	1.35976742	0.19508744	1.82558574
Within groups	1.8116E-08	64	2.83063E-10			
Total	2.38895E-08	79				
within-sd	1.68245E-05			status:	homogeneous	
effective n	5.00					
s_bb	4.51302E-06					
s_bb_min	3.16351E-06					
u_bb	4.51302E-06	0.00451302				
u_bb(rel.)	0.531654798					

Fe in BAM-M384b:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 4.1	0.000409	0.000361	0.000388	0.00045	0.00044
020 4.1	0.000395	0.000425	0.000403	0.000449	0.000416
039 4.1	0.000498	0.000382	0.000389	0.000399	0.000371
052 4.2	0.000445	0.000395	0.000492	0.000446	0.000429
071 4.2	0.000442	0.000441	0.000435	0.000402	0.000401
090 4.2	0.000438	0.000399	0.000419	0.000421	0.000413
105 4.3	0.000458	0.00045	0.000401	0.000427	0.000437
124 4.3	0.000409	0.000418	0.00042	0.00043	0.000466
143 4.3	0.000384	0.000399	0.000415	0.000466	0.00046
158 4.4	0.000401	0.000412	0.000407	0.000423	0.00043
177 4.4	0.000445	0.000423	0.000402	0.000506	0.000421
186 4.4	0.000472	0.000439	0.000444	0.000422	0.000456
203 4.5	0.000402	0.000407	0.000442	0.000432	0.00041
222 4.5	0.000384	0.000447	0.000452	0.000391	0.000467
241 4.5	0.00041	0.000363	0.000443	0.000386	0.000415
256 4.5	0.000509	0.000415	0.000361	0.000378	0.000422

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.1672E-08	15	7.78133E-10	0.74626323	0.72897485	1.82558574
Within groups	6.67332E-08	64	1.04271E-09			
Total	7.84052E-08	79				
within-sd	3.229E-05			status:	homogeneous	
effective n	5.00					
s_bb	0					
s_bb_min	6.072E-06					
u_bb	6.072E-06	0.0060717				
u_bb(rel.)	1.434028022					

Mn in BAM-M384b:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 4.1	0.001003	0.000877	0.00094	0.001025	0.001037
020 4.1	0.000917	0.000923	0.000972	0.000947	0.001063
039 4.1	0.00103	0.000943	0.000966	0.000967	0.000997
052 4.2	0.000986	0.000993	0.001092	0.000948	0.001159
071 4.2	0.000981	0.00095	0.001032	0.000961	0.001015
090 4.2	0.000947	0.000856	0.000987	0.001003	0.001068
105 4.3	0.001028	0.000957	0.001012	0.001039	0.001198
124 4.3	0.000968	0.001038	0.001015	0.001023	0.001066
143 4.3	0.000989	0.00093	0.001018	0.001072	0.001127
158 4.4	0.001071	0.000963	0.001091	0.001032	0.001145
177 4.4	0.001058	0.000978	0.001072	0.001063	0.001194
186 4.4	0.001041	0.000989	0.001047	0.001001	0.001155
203 4.5	0.000936	0.000945	0.000952	0.000918	0.001054
222 4.5	0.000916	0.000897	0.001101	0.000926	0.001114
241 4.5	0.001001	0.000948	0.000951	0.000943	0.001087
256 4.5	0.00109	0.000992	0.000884	0.000892	0.001064

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.0084E-07	15	6.72269E-09	1.32361561	0.21491477	1.82558574
Within groups	3.25058E-07	64	5.07904E-09			
Total	4.25899E-07	79				
within-sd	7.127E-05			status:	homogeneous	
effective n	5.00					
s_bb	1.813E-05					
s_bb_min	1.34E-05					
u_bb	1.813E-05	0.01813095				
u_bb(rel.)	1.800133539					

Zn in BAM-M384b:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 4.1	0.000191	0.000139	0.00015	0.000176	0.000195
020 4.1	0.00016	0.000123	0.000147	0.000165	0.00021
039 4.1	0.00031	0.000159	0.000153	0.000181	0.000161
052 4.2	0.000213	0.000146	0.000204	0.000173	0.000262
071 4.2	0.000301	0.000163	0.00016	0.00021	0.000182
090 4.2	0.000182	0.000147	0.000152	0.000181	0.00018
105 4.3	0.000205	0.000158	0.000178	0.000186	0.000178
124 4.3	0.000176	0.000151	0.000154	0.000164	0.000177
143 4.3	0.000169	0.000141	0.000177	0.000239	0.000182
158 4.4	0.000249	0.00015	0.000161	0.000215	0.000165
177 4.4	0.000306	0.000144	0.000136	0.000169	0.000218
186 4.4	0.000258	0.000187	0.000171	0.000215	0.000188
203 4.5	0.000156	0.000138	0.000153	0.000237	0.000197
222 4.5	0.000203	0.000139	0.000183	0.000156	0.000194
241 4.5	0.000196	0.000219	0.000143	0.000199	0.000196
256 4.5	0.000299	0.000125	0.000183	0.000187	0.000226

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.5751E-08	15	1.05007E-09	0.58992924	0.87201417	1.82558574
Within groups	1.13919E-07	64	1.77999E-09			
Total	1.2967E-07	79				
within-sd	4.219E-05			status:	homogeneous	
effective n	5.00					
s_bb	0					
s_bb_min	7.933E-06					
u_bb	7.933E-06	0.007932973				
u_bb(rel.)	4.296221533					

Ti in BAM-M384b:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 4.1	0.000207	0.000147	0.000167	0.000174	0.000151
020 4.1	0.000164	0.000171	0.000149	0.000163	0.00017
039 4.1	0.000206	0.000159	0.000151	0.000156	0.000154
052 4.2	0.000216	0.000191	0.000228	0.000156	0.000202
071 4.2	0.000176	0.000178	0.00017	0.00017	0.000166
090 4.2	0.000178	0.000146	0.000163	0.000182	0.000191
105 4.3	0.000225	0.000199	0.000188	0.000213	0.000228
124 4.3	0.000187	0.000212	0.00019	0.000191	0.00019
143 4.3	0.000185	0.000156	0.000177	0.000209	0.000202
158 4.4	0.000222	0.000188	0.000195	0.000201	0.000214
177 4.4	0.000218	0.000196	0.000194	0.000198	0.000209
186 4.4	0.000224	0.000181	0.000196	0.000178	0.0002
203 4.5	0.000167	0.000178	0.000162	0.000136	0.000192
222 4.5	0.000177	0.000144	0.000206	0.000153	0.000195
241 4.5	0.000188	0.000156	0.00016	0.000145	0.000165
256 4.5	0.000247	0.000194	0.000131	0.000127	0.000172

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.03145E-08	15	1.3543E-09	2.85807569	0.00180391	1.82558574
Within groups	3.03264E-08	64	4.7385E-10			
Total	5.06409E-08	79				
within-sd	2.1768E-05			status:	inhomogeneous	
effective n	5.00					
s_bb	1.327E-05					
s_bb_min	4.0931E-06					
u_bb	1.327E-05	0.01326988				
u_bb(rel.)	7.289643316					

Cr in BAM-M384b:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 4.1	0.003431	0.003335	0.002975	0.003337	0.005976
020 4.1	0.00338	0.003184	0.003099	0.003054	0.005713
039 4.1	0.003176	0.003457	0.003226	0.002946	0.005959
052 4.2	0.003543	0.003299	0.003219	0.003045	0.006169
071 4.2	0.003225	0.00329	0.00348	0.003128	0.005746
090 4.2	0.003259	0.003215	0.002912	0.003151	0.005594
105 4.3	0.00345	0.003364	0.003595	0.003298	0.005946
124 4.3	0.003142	0.003434	0.003316	0.003584	0.005979
143 4.3	0.003388	0.003439	0.003201	0.002944	0.005883
158 4.4	0.003453	0.00338	0.00339	0.003629	0.006089
177 4.4	0.003407	0.003323	0.003206	0.003369	0.00638
186 4.4	0.003638	0.003416	0.003041	0.00326	0.00623
203 4.5	0.00308	0.003401	0.002866	0.0028	0.006187
222 4.5	0.003424	0.003301	0.003011	0.003099	0.005844
241 4.5	0.003333	0.003645	0.003041	0.003403	0.006334
256 4.5	0.003699	0.003562	0.002798	0.002904	0.005995

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between grc	9.15202E-07	15	6.10135E-08	0.03977345	0.99999999	1.82558574
Within group	9.81776E-05	64	1.53402E-06			
Total	9.90928E-05	79				
within-sc	0.00123856			status:	homogeneous	
effective	5.00					
s_bb	0					
s_bb_min	0.00023289					
u_bb	0.00023289	0.23288618				
u_bb(rel	6.100009982					

Mg in BAM-M384b:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
001 4.1	0.000406	0.000358	0.000387	0.000414	0.000414
020 4.1	0.000383	0.00039	0.000378	0.000393	0.000431
039 4.1	0.000417	0.000382	0.000371	0.000389	0.000406
052 4.2	0.000418	0.000402	0.000449	0.000383	0.000456
071 4.2	0.000399	0.000394	0.00041	0.000403	0.000417
090 4.2	0.000378	0.000368	0.000385	0.000413	0.000441
105 4.3	0.00041	0.000407	0.000402	0.000425	0.000486
124 4.3	0.00039	0.000423	0.000418	0.000417	0.000446
143 4.3	0.000402	0.000386	0.000398	0.000425	0.000467
158 4.4	0.000412	0.000403	0.000412	0.000432	0.000457
177 4.4	0.000416	0.000413	0.000409	0.000428	0.000464
186 4.4	0.000421	0.00041	0.000416	0.000411	0.000457
203 4.5	0.000388	0.000396	0.000381	0.000376	0.000422
222 4.5	0.000394	0.000381	0.000438	0.000399	0.00044
241 4.5	0.000389	0.00037	0.000375	0.000395	0.000426
256 4.5	0.000451	0.000413	0.000357	0.000367	0.000426

ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.34668E-08	15	8.97783E-10	1.38542802	0.18195362	1.82558574
Within groups	4.14732E-08	64	6.48019E-10			
Total	5.494E-08	79				
within-sd	2.54562E-05			status:	homogeneous	
effective n	5.00					
s_bb	7.06774E-06					
s_bb_min	4.78654E-06					
u_bb	7.06774E-06	0.007067738				
u_bb(rel.)	1.730062477					

Annex 4: Calc. of uncertainty contribution of potential inhomogeneity (area)

Ag in 384a

r_0	0.001059477	0.001110523										
r_in	0.001097	0.00109	0.001087	0.001108	0.001123							
r_out	0.001075	0.001081	0.001095	0.001092	0.001093	0.001089	0.001083	0.001095	0.001104	0.001101	0.001104	0.001109

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.0582E-10	2	2.0291E-10	0.977373791	0.397672381	3.633723468
Within groups	3.32172E-09	16	2.07607E-10			
Total	3.72754E-09	18				

within-sd	1.44086E-05			status:	homogeneous	
effective n	4.95					
s_bb	0					
s_bb_min	3.85178E-06					
u_bb	3.85178E-06			0.001094526		
u_bb(rel.)	0.35191327					

As in 384a

r_0	0.000256477	0.000307523										
r_in	0.000396	0.000367	0.000273	0.0003	0.000338							
r_out	0.000391	0.00033	0.000284	0.000272	0.000327	0.000298	0.000253	0.000307	0.000324	0.000292	0.000279	0.000273
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	5.29273E-09	2	2.64636E-09	1.623996311	0.227969272	3.633723468						
Within groups	2.60726E-08	16	1.62954E-09									
Total	3.13653E-08	18										
within-sd	4.03675E-05			status:	homogeneous							
effective n	4.95											
s_bb	1.43363E-05											
s_bb_min	1.07913E-05											
u_bb	1.43363E-05			0.000308842								
u_bb(rel.)	4.641940637											

Bi in 384a

r_0	0.000315477	0.000366523										
r_in	0.000352	0.000324	0.00035	0.00034	0.00036							
r_out	0.000366	0.000367	0.000354	0.000362	0.000371	0.00034	0.000349	0.000372	0.000359	0.000365	0.000325	0.000351

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	7.43897E-10	2	3.71949E-10	1.422415999	0.270036022	3.633723468
Within groups	4.18385E-09	16	2.61491E-10			
Total	4.92775E-09	18				

within-sd	1.61707E-05			status:	homogeneous	
effective n	4.95					
s_bb	4.7251E-06					
s_bb_min	4.32283E-06					
u_bb	4.7251E-06					
u_bb(rel.)	1.216076775					

Co in 384a

r_0	0.000292477	0.000343523										
r_in	0.000328	0.000332	0.000314	0.000321	0.000324							
r_out	0.00032	0.000316	0.000319	0.000322	0.000317	0.000316	0.000311	0.000325	0.000324	0.00032	0.000331	0.000338
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	4.94412E-11	2	2.47206E-11	0.19066095	0.828263084	3.633723468						
Within groups	2.07452E-09	16	1.29657E-10									
Total	2.12396E-09	18										
within-sd	1.13867E-05			status:	homogeneous							
effective n	4.95											
s_bb	0											
s_bb_min	3.04396E-06											
u_bb	3.04396E-06											
u_bb(rel.)	0.740976526											

Ni in 384a

r_0	0.000769477	0.000820523										
r_in	0.000794	0.000823	0.00078	0.000769	0.000773							
r_out	0.000751	0.000744	0.000758	0.000741	0.00075	0.000741	0.000728	0.000737	0.000796	0.000762	0.000815	0.000822
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	3.48439E-09	2	1.74219E-09	1.984485134	0.169869144	3.633723468						
Within groups	1.40465E-08	16	8.77907E-10									
Total	1.75309E-08	18										
within-sd	2.96295E-05			status:	homogeneous							
effective n	4.95											
s_bb	1.32173E-05											
s_bb_min	7.92072E-06											
u_bb	1.32173E-05											
u_bb(rel.)	1.698010952											

Pb in 384a

r_0	0.001113477	0.001164523										
r_in	0.001237	0.001239	0.001152	0.001272	0.001268							
r_out	0.001202	0.001193	0.001196	0.001211	0.001245	0.001151	0.001107	0.001191	0.001305	0.001265	0.001313	0.001307
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	1.41019E-08	2	7.05094E-09	1.991168411	0.168962241	3.633723468						
Within groups	5.66577E-08	16	3.5411E-09									
Total	7.07595E-08	18										
within-sd	5.95072E-05			status:	homogeneous							
effective n	4.95											
s_bb	2.66352E-05											
s_bb_min	1.59078E-05											
u_bb	2.66352E-05			0.001217474								
u_bb(rel.)	2.187743381											

Zn in 384a

r_0	0.000345477	0.000396523										
r_in	0.000389	0.000392	0.000377	0.000417	0.000376							
r_out	0.00041	0.000378	0.000384	0.00035	0.000385	0.000362	0.000351	0.000359	0.000355	0.000385	0.000357	0.00034
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	1.76173E-09	2	8.80863E-10	2.041515313	0.162302742	3.633723468						
Within groups	6.9036E-09	16	4.31475E-10									
Total	8.66533E-09	18										
within-sd	2.0772E-05			status:	homogeneous							
effective n	4.95											
s_bb	9.53067E-06											
s_bb_min	5.55288E-06											
u_bb	9.53067E-06			0.000374158								
u_bb(rel.)	2.547233116											

Ag in 384b

r_0	0.001099477	0.001150523										
r_in	0.001144	0.001132	0.001104	0.00113	0.001148	0.001135						
r_out	0.001113	0.001124	0.001114	0.001119	0.001129	0.001127	0.00111	0.001118	0.001135	0.001127	0.001134	0.001128
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	1.84054E-09	11	1.67321E-10	0.771414564	0.663396132	3.312950657						
Within groups	1.73522E-09	8	2.16902E-10									
Total	3.57575E-09	19										
within-sd	1.47276E-05			status:	homogeneous							
effective n	5.40											
s_bb	0											
s_bb_min	4.48146E-06											
u_bb	4.48146E-06			0.00112605								
u_bb(rel.)	0.397980989											

As in 384b

r_0	0.000350228	0.000393772									
r_in	0.000481	0.000482	0.000502	0.000446	0.000409	0.000448					
r_out	0.000519	0.000462	0.000422	0.000403	0.000431	0.000452	0.000479	0.000435	0.000397	0.000444	0.000432
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	1.20552E-08	2	6.02761E-09	5.194109595	0.018267503	3.633723468					
Within groups	1.85675E-08	16	1.16047E-09								
Total	3.06227E-08	18									
within-sd	3.40657E-05			status:	inhomogeneous						
This data set now can be handled according to ISO G35. The result for u_bb is:											
effective n	5.26										
s_bb	3.04098E-05										
s_bb_min	8.8292E-06										
u_bb	3.04098E-05			0.000441474							
u_bb(rel.)	6.888250229										

Bi in 384b

r_0	0.000399228	0.000442772									
r_in	0.000422	0.000424	0.000453	0.000433	0.000432	0.000429					
r_out	0.000452	0.000435	0.000443	0.000419	0.000436	0.000427	0.000439	0.000416	0.000442	0.000454	0.00043
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	1.6799E-09	10	1.6799E-10	0.773676347	0.654856366	3.34716312					
Within groups	1.73706E-09	8	2.17132E-10								
Total	3.41696E-09	18									
within-sd	1.47354E-05			status:	homogeneous						
This data set now can be handled according to ISO G35. The result for u_bb is:											
effective n	5.26										
s_bb	0										
s_bb_min	4.54176E-06										
u_bb	4.54176E-06			0.000433053							
u_bb(rel.)	1.048777474										

Co in 384b

r_0	0.000839477	0.000890523										
r_in	0.000873	0.000852	0.000889	0.000888	0.000896	0.000878						
r_out	0.000898	0.000846	0.000865	0.000875	0.000896	0.000889	0.00087	0.000867	0.000877	0.000874	0.000883	0.000887
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	1.88039E-09	11	1.70944E-10	0.411298415	0.913287736	3.312950657						
Within groups	3.32497E-09	8	4.15621E-10									
Total	5.20535E-09	19										
within-sd	2.03868E-05			status:	homogeneous							
effective n	5.40											
s_bb	0											
s_bb_min	6.2035E-06											
u_bb	6.2035E-06			0.00087665								
u_bb(rel.)	0.707637004											

Fe in 384b

r_0	0.000337477	0.000388523										
r_in	0.000418	0.000379	0.000409	0.000427	0.000473	0.000394						
r_out	0.00043	0.000387	0.000386	0.000404	0.000426	0.000423	0.000556	0.000394	0.0004	0.00038	0.000415	0.000404
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	5.2387E-09	2	2.61935E-09	1.456477065	0.260712851	3.591530568						
Within groups	3.05731E-08	17	1.79841E-09									
Total	3.58118E-08	19										
within-sd	4.24077E-05			status:	homogeneous							
effective n	5.40											
s_bb	1.23298E-05											
s_bb_min	1.06879E-05											
u_bb	1.23298E-05			0.00041155								
u_bb(rel.)	2.99595259											

Mn in 384b

r_0	0.000924477	0.000975523										
r_in	0.001019	0.000973	0.000984	0.001003	0.00102	0.000949						
r_out	0.000997	0.000993	0.00101	0.000999	0.000979	0.001092	0.000999	0.001024	0.001047	0.000955	0.001097	0.001002
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	8.4988E-09	2	4.2494E-09	2.848594723	0.08571427	3.591530568						
Within groups	2.53598E-08	17	1.49175E-09									
Total	3.38586E-08	19										
within-sd	3.86232E-05			status:	homogeneous							
effective n	5.40											
s_bb	2.25981E-05											
s_bb_min	9.73412E-06											
u_bb	2.25981E-05			0.0010021								
u_bb(rel.)	2.255077057											

Zn in 384b

r_0	0.000129477	0.000180523											
r_in	0.000197	0.000174	0.000176	0.00018	0.000184	0.000168							
r_out	0.000206	0.000185	0.000174	0.000168	0.000165	0.000158	0.000141	0.000168	0.000145	0.000188	0.000132	0.000195	0.000162

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.06914E-09	2	5.34572E-10	1.300321005	0.296842274	3.554557146
Within groups	7.39994E-09	18	4.11108E-10			
Total	8.46909E-09	20				

within-sd	2.02758E-05			status:	homogeneous								
effective n	5.40												
s_bb	4.78161E-06												
s_bb_min	5.03756E-06												
u_bb	5.03756E-06			0.0001707									
u_bb(rel.)	2.951120386												

Ti in 384b

r_0	0.000230284	0.000271716											
r_in	0.000242	0.000244	0.00016	0.000191	0.000189	0.000195							
r_out	0.000224	0.000198	0.000208	0.000207	0.000215	0.000246	0.000238	0.000208	0.000254	0.000255	0.000226	0.000223	0.000241
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*							
Between groups	8.75739E-09	12	7.29782E-10	0.996598363	0.519441516	3.283939006							
Within groups	5.85819E-09	8	7.32273E-10										
Total	1.46156E-08	20											
within-sd	2.70605E-05			status:	homogeneous								
effective n	5.40												
s_bb	0												
s_bb_min	8.23426E-06												
u_bb	8.23426E-06			0.00022125									
u_bb(rel.)	3.721700635												

Cr in 384b

r_0	0.002386228	0.002429772									
r_in	0.002622	0.002676	0.002453	0.002527	0.002397	0.002354					
r_out	0.002521	0.002655	0.002606	0.002513	0.002542	0.002357	0.002453	0.002334	0.002602	0.002267	0.002466
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	1.40975E-08	2	7.04876E-09	0.485804825	0.623987064	3.633723468					
Within groups	2.32151E-07	16	1.45094E-08								
Total	2.46249E-07	18									
within-sd	0.000120455			status:	homogeneous						
This data set now can be handled according to ISO G35. The result for u_bb is:											
effective n	5.26										
s_bb	0										
s_bb_min	3.12198E-05										
u_bb	3.12198E-05			0.002482158							
u_bb(rel.)	1.25776705										

Mg in 384b

r_0	0.000417477	0.000468523										
r_in	0.000481	0.000455	0.000501	0.000463	0.000483	0.000464						
r_out	0.000484	0.000482	0.000499	0.000479	0.000461	0.000538	0.000492	0.000495	0.000506	0.000455	0.000504	0.0005
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	4.39905E-09	2	2.19953E-09	4.68772998	0.023911976	3.591530568						
Within groups	7.97655E-09	17	4.69209E-10									
Total	1.23756E-08	19										
within-sd	2.16612E-05			status:	inhomogeneous							
effective n	5.40											
s_bb	1.79005E-05											
s_bb_min	5.45923E-06											
u_bb	1.79005E-05			0.0004814								
u_bb(rel.)	3.718431184											