Certification Report

Certified Reference Material

BAM-S005c

Multielement Glass

August 2020

Coordinator: Dr. Sebastian Recknagel
Bundesanstalt für Materialforschung und -prüfung (BAM)
Division 1.6 „Inorganic Reference Materials“
Richard-Willstätter-Str. 11
D-12489 Berlin
Phone: +49 30 8104 1111
Fax: +49 30 8104 71111
E-mail: sebastian.recknagel@bam.de

Summary

This report describes preparation, analysis and certification of the multielement glass reference material BAM-S005c. The certified reference material (CRM) is available in the form of discs (38 mm diameter and approx. 4 mm height). It replaces the two CRM BAM-S005a and BAM-S005b which are no longer available. BAM-S005c is intended for establishing and checking the calibration of X-ray spectrometers for the analysis of samples of similar matrix composition. It is also suitable for validation and quality control of wet chemical analysis methods. The following mass fractions and uncertainties have been certified:

Element		**Mass fraction [1] in %**		**Uncertainty [2] in %**
Al	(Al_2O_3)	0.587	(1.109)	0.018
Ca	(CaO)	7.43	(10.39)	0.12
K	(K_2O)	0.595	(0.717)	0.014
Mg	(MgO)	1.37	(2.28)	0.04
Na	(Na_2O)	10.33	(13.92)	0.24
Si	(SiO_2)	33.1	(70.8)	0.5
		in mg/kg		**in mg/kg**
As	(As_2O_3)	81	(107)	4
Ba	(BaO)	102	(114)	4
Cd	(CdO)	47	(54)	4
Ce	(CeO_2)	80	(98)	5
Co	(CoO)	33.2	(42.3)	1.9
Cr	(Cr_2O_3)	10.8	(15.8)	1.0
Cu	(CuO)	86	(107)	5
Fe	(Fe_2O_3)	295	(422)	7
Mn	(MnO)	69.6	(89.9)	2.5
Mo	(MoO_3)	215	(323)	7
Ni	(NiO)	41.3	(52.6)	1.7
Pb	(PbO)	182	(196)	8
Sb	(Sb_2O_3)	103	(123)	4
Sn	(SnO_2)	72.9	(92.5)	2.3
Sr	(SrO)	134	(158)	6
Ti	(TiO_2)	101	(169)	6
V	(V_2O_5)	189	(337)	8
Zn	(ZnO)	157	(196)	6
Zr	(ZrO_2)	544	(735)	26

[1] Unweighted mean value of the means of accepted sets of data (consisting of at least 2 single results), each set being obtained by a different laboratory and/or a different method of measurement. Values in brackets are calculated from the elemental mass fractions using the molar masses of the elements.

[2] Estimated expanded uncertainty U with a coverage factor of $k = 2$, corresponding to a level of confidence of approx. 95 %, as defined in the Guide to the Expression of Uncertainty in Measurement, (GUM, ISO/IEC Guide

This report contains detailed information on the preparation of the CRM as well as on homogeneity investigations and on the analytical methods used for certification analysis.

The certified values are based on the results of sixteen laboratories which participated in the certification interlaboratory comparison. Mass fractions for P and Se are given as values for information. One laboratory additionally determined Ag and Li, two laboratories B.

Content

List of abbreviations
(if not explained elsewhere)

CRM	certified reference material
FAAS	flame atomic absorption spectrometry
ETV	Electrothermal vaporisation
ICP-OES	inductively coupled plasma optical emission spectrometry
ICP-MS	inductively coupled plasma mass spectrometry
XRF	X-ray fluorescence spectrometry
ICG	International Commission on Glass
M	mean value
n	number of accepted data sets
s	standard deviation of an individual data set
s_M	standard deviation of laboratory means
s_{rel}	relative standard deviation
$\bar{s}_i$	square root of mean of variances of data sets under repeatability conditions
M_i	single result
I	ICP-OES (Tables 3 – 29)
I(R)	ICP-OES, revised value (Tables 3 – 29)
IMS	ICP-MS (Tables 3 – 29)
A	FAAS (Tables 3 – 29)
G	Gravimetry (Tables 3 – 29)
LMS	Laser ablation coupled with ICP-MS (Tables 3 – 29)
P	spectrophotometry (Tables 3 – 29)
RFA	X-ray fluorescence spectrometry (Tables 3 – 29)
S-I	Electrothermal vaporisation coupled with ICP-OES (Tables 3 – 29)

1. Introduction

Soda-lime glass is one of the worldwide mostly distributed mass-produced articles and is of enormous technical and economic importance. The impurities in soda-lime glasses come from the intake by raw materials and from production process. They influence the properties of the glass and, therefore, their mass fractions must not exceed defined limit values. The analytical method of X-ray fluorescence spectrometry (XRF) is a powerful tool of effective determination of trace contents of most elements in soda-lime glass at the relevant level of mass fractions. The advantage of this method is that the samples can be measured directly without applying time consuming chemical procedures of sample digestion, but it requires reference materials with similar composition as the samples to be analysed. The aim of the certification process described here was to prepare a succeeding material to the soda-lime glass CRMs BAM-S005a and -S005b which are not available anymore. The CRM can be used to support the XRF-evaluation program basing on fundamental parameter approach by a definite calibration point for each of the relevant trace elements. Thus, the semi-quantitative character of the evaluation procedure can be improved and changed to a quantitative one. In total 21 trace elements and six main components were analysed in the certification interlaboratory comparison organised to characterise BAM-S005c. Their mass fractions were certified in a batch of doped soda-lime glass, especially prepared for this purpose.

The CRM was characterised in cooperation with the working group „UA-Glasanalyse" within Deutsche Glastechnische Gesellschaft e.V. (DGG) and the Technical Committee 02 "Durability & Analysis" of the International Commission on Glass (ICG). Since all the laboratories participating in this certification project are highly experienced with glass analysis and had already participated in earlier interlaboratory comparisons, there was no preceding round robin for qualification necessary.
Certification was carried out on the basis of ISO 17034 [1] and the relevant ISO-Guides [2, 3].

2. Companies/laboratories involved

Manufacturing of the material:

Fraunhofer Institute for Silicate Research ISC, Würzburg, Germany

Test for homogeneity:

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

Participants in the certification interlaboratory comparison:

Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany
Cetim Grand Est, Schiltigheim, France
Corning European Technology Center (CETC), S&T European Laboratory, Fontainebleau, France
Dorfner Anzaplan GmbH, Hirschau, Germany
Forschungsinstitut für Anorganische Werkstoffe -Glas/Keramik- GmbH, Höhr-Grenzhausen, Germany
Fraunhofer Institute for Silicate Research ISC, Würzburg, Germany
Glass Technology Services Ltd, Sheffield, South Yorkshire, United Kingdom
TU Bergakademie Freiberg, Institut für Energieverfahrenstechnik und Chemieingenieurswesen, Freiberg, Germany
IGR Institut für Glas- und Rohstofftechnologie GmbH, Göttingen, Germany
INISMa (Institut Interuniversitaire des Silicates, Sols et Matériaux), Mons, Belgium
NSG, Lathom, United Kingdom
Schott AG, Mainz, Germany

Stazione Sperimentale del Vetro, Murano, Italy
T. Şişe ve Cam Fab. A.Ş. Science and Technology Center, Gebze Kocaeli, Turkey
TU Bergakademie Freiberg, Institut für Analytische Chemie, Freiberg, Germany
Zentrum für Glas- und Umweltanalytik GmbH, Ilmenau, Germany

Statistical evaluation of the data:

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

3. Candidate material

The candidate material was produced by Fraunhofer Institute for Silicate Research ISC, Würzburg, Germany. The raw materials available at the Fraunhofer ISC were used to produce a powder mixture containing the desired elements with contents similar to those contained in BAM-S005b.
This powder mixture was melted in a PtRh crucible with a volume of 5 litres using the shaft casting plant available at the Fraunhofer ISC, and then processed into a glass rod with a diameter of approximately 39 mm by stirring with a PtRh stirrer and additional homogenisation by bubbling. Due to the apparatus, the usable melting volume was approx. 4 - 4.5 litres. Therefore, the casting was done in two passes on two different days. The glass rods were subsequently cut into discs with a diameter of approx. 39 mm and a thickness of 4 to 5 mm using and polished on one side. In total 454 discs were produced. The cutting residues were taken for wet chemical analysis within the certification interlaboratory comparison.

4. Homogeneity testing

The glass discs were tested for homogeneity using wavelength dispersive X-ray fluorescence. In total 30 randomly taken discs (see Table 1) were analysed on two different days. One additional disc was used as drift control sample and to determine the spread coming from the analytical method. This is easily possible because XRF is a non-destructive method. The results of the second day measurement were normalised via the results of the drift control sample (e.g. "Al_{korr}", see Annex 1). The drift control sample was measured fourteen times in the beginning and then after every five discs. For none of the elements a drift correction was necessary. For the elements As, Ce, P, Se, and Sn the used instrument was not sensitive enough. Therefore, the uncertainty contribution due to possible inhomogeneities was estimated from the elements determined.

Table 1: Samples chosen for homogeneity testing

220016-1	22-06-16-1-1	29-06-16-6-1	29-06-16-5-2
220016-3, 4.6 mm	22-06-16-1-2	29-06-16-7-1	29-06-16-5-3
220016-3, 4 mm	22-06-16-9-1	29-06-16-8-1	29-06-16-6-2
220016-5	22-06-16-9-2	29-06-16-8-2	29-06-16-7-2
220016-6, 4 mm		29-06-16-2-2	29-06-16-9-1
220016-6, 5 mm	29-06-16-2-1	29-06-16-3-2	29-06-16-9-2
220016-7	29-06-16-3-1	29-06-16-4-2	
220016-8	29-06-16-4-1	29-06-16-5-1	220616-5-1

As a measure for the inhomogeneity of the samples the standard deviation (s_{sample}) of all mean values (in total 37 values, some of the discs were analysed on both days) was used.

The standard deviation (s_{sample}) is the sum of spread deriving from inhomogeneities and spread deriving from the analytical method. In principle s_{eff} as defined in Equation (1) contributes to the total uncertainty. Therefore, the spread of the analytical method (s_{method}) must be determined.

$$s_{eff} = \sqrt{s_{sample}^2 - s_{method}^2} \quad (1)$$

The standard deviation of 14 single measurements of the drift control sample was taken as s_{method}. For the elements Co, Mn, and Ni s_{method} was higher than s_{sample}, i.e. Equation 1 does not give a nominal value. For these elements the uncertainty contribution due to possible inhomogeneities was estimated from other elements determined.

Possible reasons for an inhomogeneous distribution of elements in the raw material may be a change of the composition of the melt during the casting procedure because some elements may volatize or because of possible segregation during the solidification of the material. Since the raw material was produced by casting of a rod, concentration gradients can occur over the length of the rod (axial) as well as over the area of the rod (radial). Since the samples are intended to be used for XFR a big part of the area of the discs is used for analysis. Slight gradients over the area are therefore not relevant for the determination and were not investigated.

Annex 1 shows the results of the homogeneity calculations.

5. Characterisation study

5.1 Analytical methods

Sixteen laboratories participated in the certification interlaboratory comparison. All laboratories were highly experienced in the analysis of glass and participated successfully in former interlaboratory comparisons carried out by ICG. For some elements part of the laboratories used more than one analytical method reporting more than one data set.

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

For wet chemical methods where a calibration was necessary this calibration was performed using liquid standard solutions. All participating laboratories were asked to use only standard solutions prepared from pure metals or stoichiometric compounds or well checked commercial calibration solutions. Calibration of solid sampling methods were not in all cases performed with pure metals or stoichiometric compounds or well checked commercial calibration solutions but also with matrix CRMs (e.g. BAM-S005a/b).

Table 2: Analytical procedures used by the participating laboratories

Lab-No.	Element	Sample mass	Sample pretreatment	Analytical method
1	As, Ba, Cd, Ce, Co, Cr, Cu, Fe, Mn, Mo, Ni, P, Pb, Sb, Sn, Sr, Ti, V, Zn, Zr	0.4 mg	Grinding with impact mill, solid sampling	ETV ICP-OES, axial plasma view, calibration with commercial calibration solutions (Merck)
	Ca, K, Mg, Na	0.4 mg	Grinding with impact mill, solid sampling	ETV ICP-OES, radial plasma view, commercial calibration solutions (Merck)
2	Ca, Mg, Si	1 g	Dissolution with acid	Gravimetry
	K, Na	0.5 g	Dissolution with HF/$HClO_4$ to dryness, reacidified in 1% HCl	Spectrophotometry, calibration with commercial calibration solutions (certified; VWR, Fisher, QMX)
	Fe	0.5 g	Dissolution with HF to dryness, reacidified in 1:1 HCl	Spectrophotometry, calibration with Fe-powder
	Cd, Co, Cr, Cu, Mn, Ni, V, Zn	1 g	Dissolution with HF/HNO_3 to dryness, reacidified in 5% HCl	ICP-OES, calibration with commercial calibration solutions (certified; VWR, Fisher, QMX)
	Mo	2 g	Dissolution with HF/$HClO_4$ to dryness, reacidified in 5% HNO_3	ICP-OES, calibration with commercial calibration solutions (certified; VWR, Fisher, QMX)
	Cd, Pb	1 g	Dissolution with acid	ICP-OES, calibration with commercial calibration solutions (certified; VWR, Fisher, QMX)
3*	Al, Ca, K, Mg, Na, As, Ba, Cd, Ce, Co, Cr, Cu, Fe, Mn, Mo, Ni, P, Pb, Sb, Se, Sn, Sr, Ti, V, Zn, Zr	0.2 g	Dissolution with HF/$HClO_4$	ICP-OES, calibration with commercial calibration solutions (Merck)
	Si	0.5 g	Dissolution with acid	Gravimetry
4*	Al, Ca, K, Mg, Na, As, Ba, Cd, Ce, Co, Cr, Cu, Fe, Mn, Mo, Ni, P, Pb, Sb, Se, Sn, Sr, Ti, V, Zn, Zr	0.5 g	Dissolution with HF/HNO_3	ICP-OES, calibration with commercial calibration solutions
	Si	1 g	Decomposition with Na_2CO_3/H_3BO_3	Gravimetry
5	As, Ce, Co, Cr, Cu, Fe, Mn, Pb, Se, Sn, Sr, Zn	0.3 mg	Crushing in an agate mortar, solid sampling	ETV ICP-OES with CHF_3 as modifier, axial plasma view, calibration with commercial calibration solutions (Merck) and Spex Mix 1000 (Spex Industries Inc., Metuchen, NJ, USA)
	Al, K, Ba, Ce, Mo, Ni, P, Ti, V, Ag, Li	0.4 mg	Crushing in an agate mortar, solid sampling	ETV ICP-OES with CHF_3 as modifier, radial plasma view, calibration with commercial calibration solutions (Merck) and Spex Mix 1000
	Ca, Na, Si, Cd, Sb, Zr, B	0.4 mg	Crushing in an agate mortar, solid sampling	ETV ICP-OES with CHF_3 as modifier, radial plasma view, calibration with CRMs (BAM-S005A/B, NIST 610, NIST 612, NIST 614, NIST 2711, NSC DC 73310, USGS MAG 1)
6	As, Ba, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se, V, Zn	1 g	Dissolution with HF/$HClO_4$/HNO_3	ICP-OES, calibration with commercial calibration solutions (High Purity standards and SPC Science, traceable to NIST)

*Laboratory accredited acc. to ISO/IEC 17025

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

Lab-No.	Element	Sample mass	Sample pretreatment	Analytical method
7*	Ba, Cd, Co, Cr, Cu, Fe, Ni, Pb	1 g	Dissolution with $NaOH/Na_2O_2$ acc. DIN 51086-1	ICP-OES (acc. DIN 51086-2), calibration with commercial multi-element standard solutions (Merck)
8*	Al, Ca, K, Mg, Na, Si		Polishing of the compact glass sample	XRF (acc. to DIN 51001) against several glass standards
	As, Ba, Cd, Ce, Co, Cr, Cu, Fe, Mn, Mo, Ni, P, Pb, Sb, Se, Sn, Sr, Ti, V, Zn, Zr	0.5 g	Dissolution with HF/HNO_3	ICP-OES calibration with commercial mono-element solutions (Bernd Kraft)
9	Al, K, Mg	2 g	Hot digestion (HF/HCl-HCl/HNO_3-HCl) - Digiblock	ICP-MS, calibration with commercial mono-element solutions (Merck)
	Ba, Cd, Ce, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Ti, V, Zn, Zr	2 g	Hot digestion (HF/HCl-HCl/HNO_3-HCl) - Digiblock	ICP-MS, calibration with commercial mono-element solutions and internal standard (Y) (Merck)
	As, P	2 g	Cold digestion (HF/HNO_3)	ICP-MS, calibration with commercial mono-element solutions and internal standard (Y) (Merck)
	Ca, Na, Si	0.1 g	Cold digestion (HF/HNO_3)	ICP-OES, calibration with commercial mono-element solutions (Merck)
10	Al, Ca, K, Mg, Na, Ba, Cd, Ce, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sn, Sr, Ti, V, Zn, Zr	0.1 g	Dissolution with HF/HNO_3	ICP-OES, calibration with commercial certified mono-element solutions (SPC Science, traceable to NIST)
	As, Sb	0.5 g	Dissolution with HF/HNO_3 (autoclave)	ICP-OES, calibration with commercial certified mono-element solutions (SPC Science, traceable to NIST)
11	Al, Ca, K, Mg, As, Ba, Cd, Ce, Co, Cr, Cu, Fe, Mn, Mo, Ni, P, Pb, Sb, Sr, Se, Sn, Ti, V, Zn, Zr	1 g	Dissolution with $HClO_4/HF/HNO_3$, fuming with $HClO_4$	ICP-OES, calibration with commercial mono-element solutions (Merck certipur)
12*	Al, Ca, K, Mg, Si, As, Ba, Cd, Ce, Co, Cr, Cu, Mn, Mo, Ni, P, Pb, Sb, Sr, Se, Sn, Ti, V, Zn, Zr	0.1 g	Dissolution with Hf acc. to DIN 52340-3	ICP-OES acc. to DIN 51086-2, calibration with matrix matched standards, commercial standard solutions
	Fe	0.5 g	Dissolution with Hf	Spectrophotometry acc. to DIN 52340-6 and DIN EN ISO 14719
13*	Al, Ca, K, Mg, Na, As, Ba, Cd, Ce, Co, Cr, Cu, Mn, Mo, Ni, P, Pb, Sb, Sr, Se, Sn, Ti, V, Zn, Zr	0.3 g	Dissolution with acid	ICP-OES, calibration with matrix matched standards, commercial mono-element solutions (NIST traceable)
14*	Al, Ca, K, Mg, Na, Si			XRF, Calibration with BAM-S005b
	As, Ba, Cd, Ce, Co, Cr, Cu, Mn, Mo, Ni, P, Pb, Sb, Sr, Se, Sn, Ti, V, Zn, Zr	1 g	Dissolution with HF/HNO_3 (microwave)	ICP-OES, calibration with commercial standard solutions

*Laboratory accredited acc. to ISO/IEC 17025

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

Lab-No.	Element	Sample mass	Sample pretreatment	Analytical method
15*	Al, Ca, K, Mg, Na, As, Ba, Cd, Ce, Co, Cr, Cu, Mn, Ni, P, Pb, Sb, Sr, Se, Sn, Ti, V, Zn, Zr			Laser ablation ICP-MS, calibration against CRMs and PT-samples
	Al, Ca, K, Mg, Na, Si, As, Ba, Cr, Fe, Sb, Sn, Sr, Ti, Zn			XRF, calibration against CRMs and PT-samples
16*	Al, Ca, K, Mg, Na	1 g	Dissolution with $HClO_4$/HF/HNO_3	FAAS, calibration with commercial standard solutions. Addition of CsCl
	Si	1 g	Melting with Na_2CO_3, dissolution with HCl/HF	Gravimetry
	As. Sb	0.1 g	Dissolution with HF/HNO_3 (microwave)	ICP-OES, calibration with commercial standard solutions
	Se	0.1 g	Dissolution with HNO_3 (microwave)	ICP-MS, calibration with commercial standard solutions
	As, Ba, Cd, Ce, Co, Cr, Cu, Mn, Ni, Pb, Sn, Sr, Ti, V, Zn	1 g	Dissolution with $HClO_4$/HF/HNO_3	ICP-OES, calibration with commercial standard solutions

*Laboratory accredited acc. to ISO/IEC 17025

5.2 Analytical results and statistical evaluation

The analytical results of the interlaboratory certification comparison are listed in Tables 3 to 29. These tables show the single results (M_i) of each laboratory, the respective laboratories' mean values (M), absolute and relative intra-laboratory standard deviation (s and s_{rel}, respectively), the standard deviation of laboratory means (s_M), and in addition the square root of mean of variances of data sets under repeatability conditions ($\bar{s}_i$) where n is the number of accepted data sets. The continuous line marks the certified value (mean of the laboratories' means), the broken lines mark the standard deviation, calculated from the laboratories' means.
In the related figures for each laboratory its mean value and single standard deviation is given. Outliers, detected by either Grubbs-, Dixon- or Nalimov-test, which have been excluded are highlighted in yellow. Outlier exclusion was done after discussion of the outlying values with the resp. laboratories.

Table 3: Results for Al

Lab./Meth.	12/I	1/S-I	4/I	11/I	15/LMS	16/A	10/I	3/I	8/RFA	15/RFA	9/IMS	5/S-I	14/RFA	13/I		
M_i [%]	0.5418	0.5390	0.5355	0.5550	0.5604	0.57	0.5878	0.5888	0.600	0.6034	0.6112	0.6069	0.610	0.61		*n*
	0.5353	0.5791	0.5488	0.5543	0.5665	0.57	0.5869	0.5871	0.602	0.6034	0.6220	0.6102	0.620	0.61		13
	0.5377	0.5602	0.5657	0.5584	0.5749	0.58	0.5874	0.5879	0.603	0.6034	0.6060	0.6207	0.620	0.65		
	0.4778	0.5458	0.5192	0.5633	0.5713	0.57	0.5758	0.5875	0.605	0.6034	0.6080	0.5775		0.62		
	0.4769	0.5306	0.5904	0.5616	0.5742		0.5838	0.5871	0.601	0.6034	0.5890	0.6198		0.62		
	0.4754	0.5341	0.5854	0.5623	0.5726		0.5878	0.5873	0.601	0.5981	0.5940	0.6089		0.61		
***M* [%]**	**0.507**	**0.548**	**0.558**	**0.559**	**0.570**	**0.573**	**0.585**	**0.588**	**0.602**	**0.603**	**0.605**	**0.607**	**0.617**	**0.620**		**0.587**
s [%]	0.0338	0.0184	0.0281	0.0039	0.0056	0.0050	0.0047	0.0006	0.0018	0.0022	0.0120	0.0157	0.0058	0.0155	s_M [%]	0.024
															$\bar{s}_i$ [%]	0.012
s_{rel}	0.0666	0.0336	0.0504	0.0069	0.0098	0.0087	0.0081	0.0011	0.0030	0.0036	0.0198	0.0259	0.0094	0.0250		0.0406

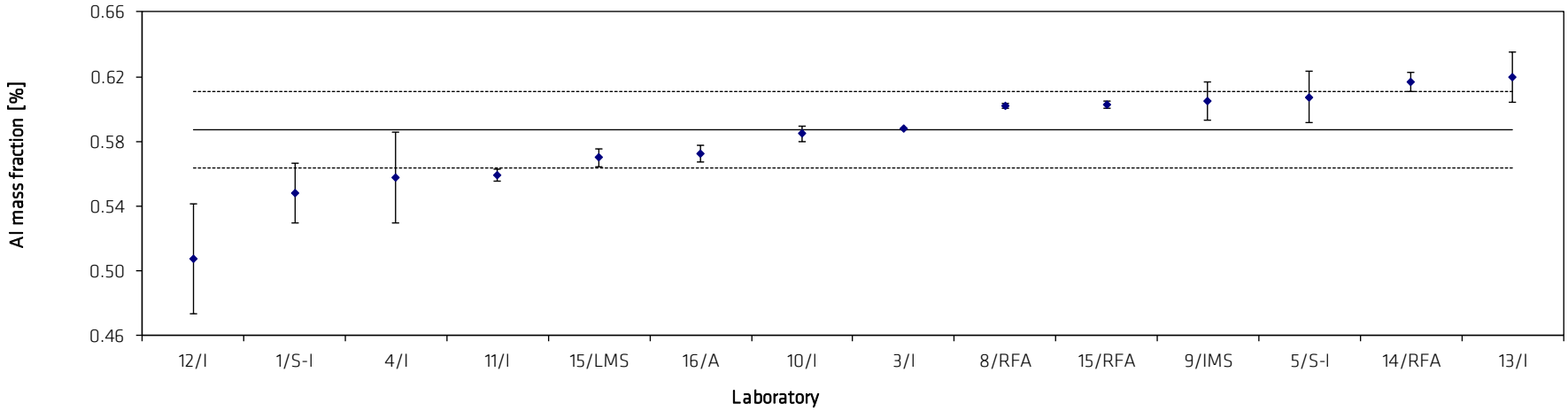


Table 4: Results for Ca

Lab./Meth.	4/I	12/I	9/I	15/LMS	2/G	3/I	13/I	11/I	10/I	8/RFA	15/RFA	5/S-I	14/RFA	16/A	1/S-I		
M_i [%]	6.606	7.330	7.210	7.145	7.299	7.368	7.40	7.425	7.486	7.478	7.489	7.624	7.51	7.51	7.790		*n*
	6.657	7.060	7.230	7.254	7.253	7.362	7.45	7.404	7.447	7.481	7.496	7.602	7.49	7.47	7.490		13
	7.164	6.990	7.215	7.306	7.179	7.365	7.38	7.452	7.486	7.481	7.486	7.250	7.50	7.54	7.887		
	6.995	7.258	7.190	7.280	7.268	7.377	7.28	7.535	7.497	7.486	7.493	7.581		7.52	7.886		
	6.741	7.091	7.175	7.385	7.488	7.403	7.42	7.531	7.551	7.488	7.494	7.550			7.770		
	7.085	7.010	7.245	7.317	7.414	7.390	7.50	7.524	7.420	7.487	7.502	7.363			6.464		
***M* [%]**	**6.875**	**7.123**	**7.211**	**7.281**	**7.317**	**7.378**	**7.405**	**7.478**	**7.481**	**7.484**	**7.493**	**7.495**	**7.500**	**7.510**	**7.548**		**7.429**
s [%]	0.237	0.139	0.026	0.080	0.114	0.016	0.074	0.059	0.045	0.004	0.006	0.152	0.010	0.029	0.551	s_M [%]	0.103
																$\bar{s}_i$ [%]	0.166
s_{rel}	0.0344	0.0195	0.0035	0.0110	0.0155	0.0021	0.0100	0.0078	0.0060	0.0005	0.0008	0.0203	0.0013	0.0039	0.0730		0.0139

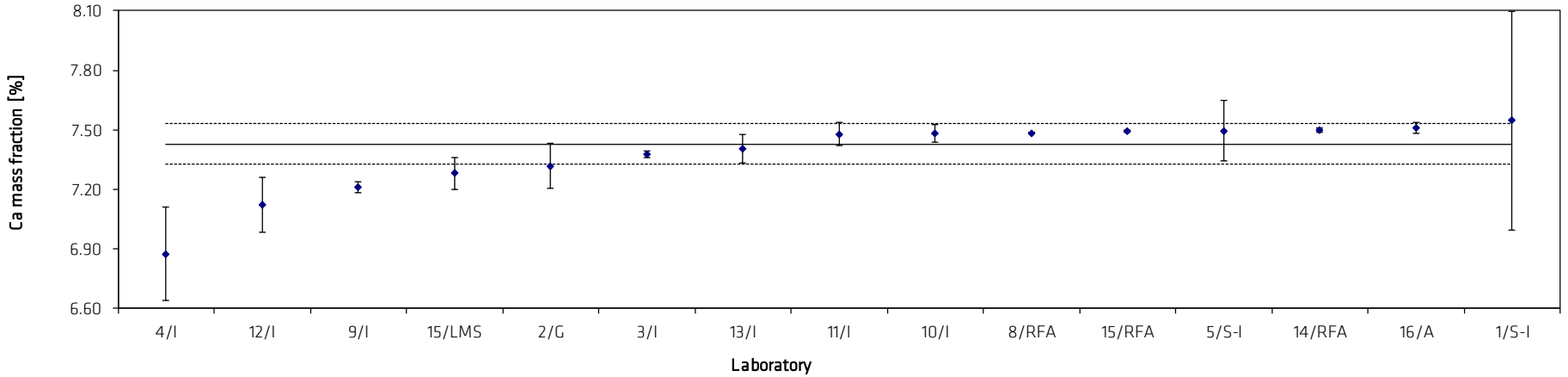


Table 5: Results for K

Lab./Meth.	4/I	3/I	9/IMS	11/I	2/P	13/I	15/LMS	16/A	12/I	1/S-I	15/RFA	14/RFA	5/S-I	8/RFA	10/I		
M_i [%]	0.5326	0.5680	0.584	0.5739	0.59	0.58	0.603	0.598	0.5955	0.5977	0.605	0.61	0.6170	0.626	0.7902		*n*
	0.5493	0.5615	0.597	0.5767	0.59	0.59	0.605	0.597	0.5947	0.6031	0.604	0.61	0.5913	0.625	0.7816		14
	0.5595	0.5647	0.577	0.5872	0.58	0.63	0.615	0.612	0.5952	0.6013	0.605	0.61	0.6154	0.625	0.7873		
	0.5056	0.5646	0.573	0.5917	0.58	0.56	0.604	0.608	0.6077	0.6038	0.606		0.6169	0.625	0.7683		
	0.6215	0.5608	0.571	0.5850	0.59	0.57	0.596		0.6097	0.6126	0.604		0.6183	0.621	0.7830		
	0.5921	0.5627	0.572	0.5864	0.58	0.59	0.591		0.6195	0.6085	0.607		0.6179	0.623	0.8009		
M [%]	**0.560**	**0.564**	**0.579**	**0.583**	**0.585**	**0.587**	**0.602**	**0.604**	**0.604**	**0.604**	**0.605**	**0.610**	**0.613**	**0.624**	**0.785**		**0.595**
s [%]	0.0416	0.0026	0.0100	0.0068	0.0055	0.0242	0.0082	0.0074	0.0102	0.0053	0.0010	0.0000	0.0106	0.0018	0.0108	s_M [%]	0.0187
																$\bar{s}_i$ [%]	0.0143
s_{rel}	0.0742	0.0046	0.0173	0.0116	0.0094	0.0413	0.0137	0.0123	0.0169	0.0087	0.0016	0.0000	0.0173	0.0029	0.0137		0.0315

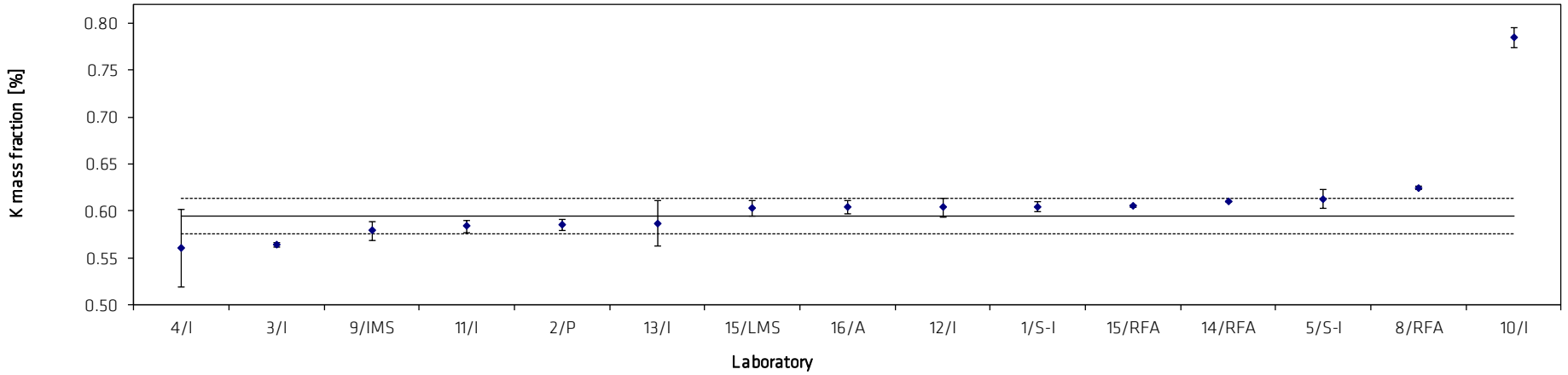


Table 6: Results for Mg

Lab./Meth.	10/I	4/I	13/I	15/LMS	9/IMS	16/A	8/RFA	3/I	15/RFA	12/I	2/G	5/S-I	14/RFA	1/S-I	11/I		
M_i [%]	1.210	1.246	1.327	1.356	1.371	1.350	1.361	1.360	1.369	1.375	1.399	1.388	1.40	1.440	1.439		*n*
	1.234	1.273	1.339	1.356	1.402	1.344	1.360	1.359	1.374	1.359	1.373	1.361	1.39	1.427	1.435		14
	1.220	1.317	1.327	1.362	1.357	1.370	1.361	1.359	1.369	1.373	1.393	1.453	1.41	1.446	1.461		
	1.209	1.397	1.315	1.346	1.335	1.370	1.361	1.361	1.374	1.385	1.440	1.317		1.392	1.469		
	1.201	1.312	1.327	1.345	1.335		1.358	1.365	1.374	1.370	1.377	1.429		1.418	1.460		
	1.212	1.318	1.339	1.346	1.338		1.363	1.363	1.369	1.378	1.383	1.424		1.407	1.474		
***M* [%]**	**1.214**	**1.311**	**1.329**	**1.352**	**1.356**	**1.359**	**1.361**	**1.361**	**1.371**	**1.373**	**1.394**	**1.395**	**1.400**	**1.422**	**1.456**		**1.374**
s [%]	0.011	0.051	0.009	0.007	0.027	0.014	0.002	0.002	0.002	0.009	0.024	0.050	0.010	0.020	0.016	s_M [%]	0.037
																$\overline{s}_i$ [%]	0.023
s_{rel}	0.0094	0.0391	0.0068	0.0053	0.0196	0.0099	0.0012	0.0018	0.0018	0.0063	0.0175	0.0359	0.0071	0.0143	0.0110		0.0271

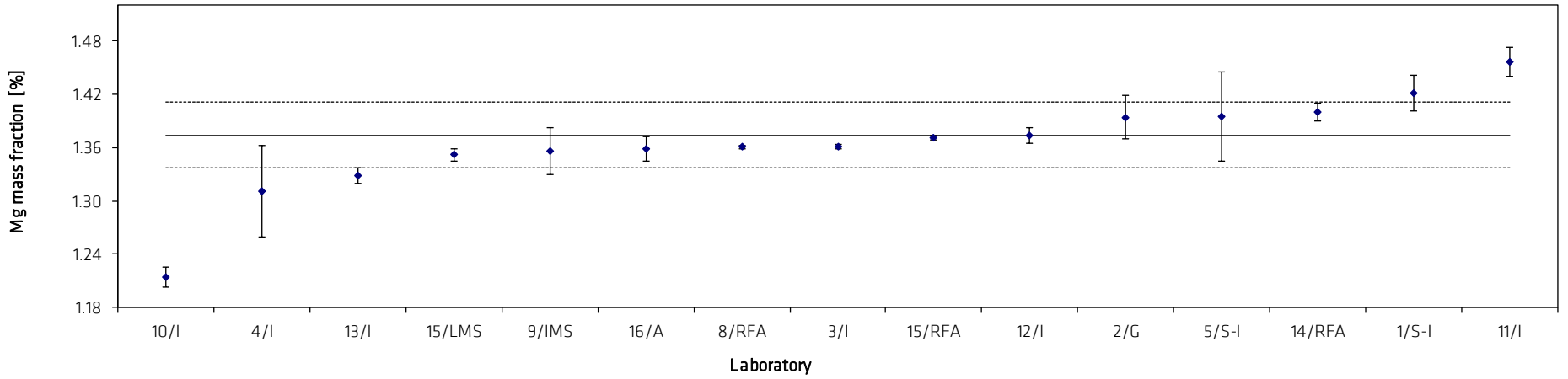


Table 7: Results for Na

Lab./Meth.	4/I	10/I	12/I	2/P	15/LMS	3/I	15/RFA	13/I	14/RFA	9/I	16/A	5/S-I	1/S-I	8/RFA		
M_i [%]	8.855	9.411	9.58	9.94	10.18	10.305	10.27	10.36	10.35	10.490	10.42	10.194	10.633	10.62		*n*
	9.151	9.465	9.61	9.93	10.16	10.216	10.29	10.32	10.38	10.365	10.40	10.530	10.500	10.62		11
	9.154	9.426	9.59	9.88	10.23	10.260	10.28	10.18	10.34	10.375	10.38	10.122	10.484	10.64		
	9.560	9.450	9.32	9.96	10.09	10.268	10.28	10.17		10.305	10.40	10.631	10.237	10.63		
	9.370	9.552	10.85	9.97	10.06	10.196	10.27	10.40		10.240		10.599	10.481	10.62		
	9.060	9.358	10.32	9.87	10.40	10.232	10.27	10.40		10.380		10.600	10.388	10.63		
***M* [%]**	**9.19**	**9.44**	**9.88**	**9.93**	**10.19**	**10.25**	**10.28**	**10.31**	**10.36**	**10.36**	**10.40**	**10.45**	**10.45**	**10.63**		**10.33**
s [%]	0.245	0.065	0.583	0.041	0.122	0.039	0.006	0.105	0.021	0.084	0.016	0.227	0.132	0.008	s_M [%]	0.178
															$\bar{s}_i$ [%]	0.098
s_{rel}	0.0267	0.0069	0.0590	0.0042	0.0120	0.0039	0.0006	0.0102	0.0020	0.0081	0.0016	0.0217	0.0126	0.0008		0.0173

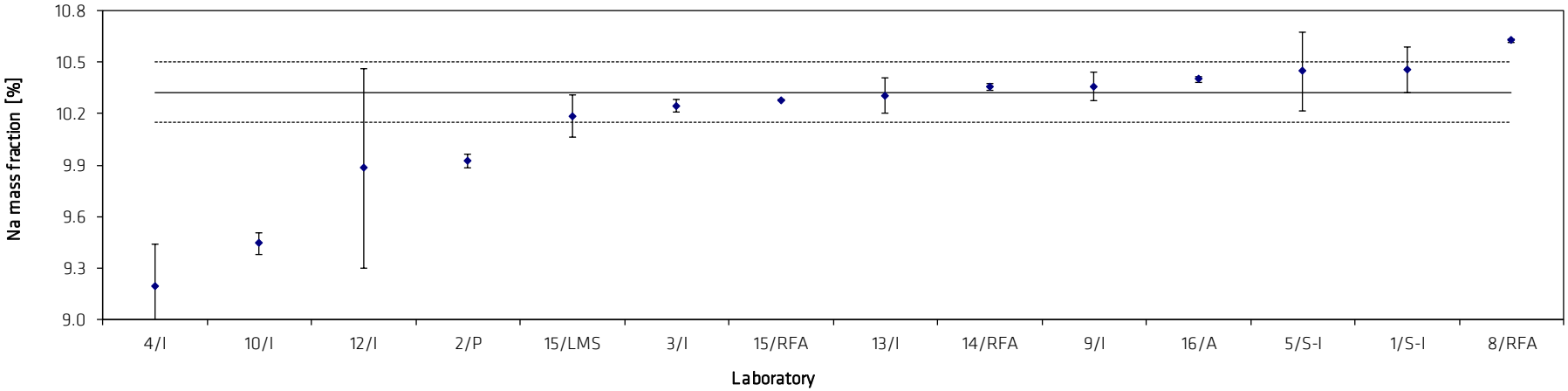


Table 8: Results for Si

Lab./Meth.	4/G	2/G	8/RFA	5/S-I	16/G	3/I	14/RFA	12/RFA	15/RFA	9/I		
M_i [%]	32.76	32.79	32.83	32.641	33.17	33.190	33.18	33.27	33.28	33.400		*n*
	32.87	32.83	32.78	32.330	33.13	33.178	33.15	33.25	33.26	33.525		10
	32.77	32.88	32.78	33.617	33.19	33.150	33.20	33.25	33.28	33.770		
	32.22	32.56	32.81	32.795	33.15	33.189		33.25	33.27	33.530		
	32.67	32.60	32.84	33.335		33.114			33.28	33.385		
	32.86	32.76	32.86	33.885		33.210			33.27	34.050		
M [%]	**32.69**	**32.74**	**32.82**	**33.10**	**33.16**	**33.17**	**33.18**	**33.26**	**33.27**	**33.61**		**33.10**
s [%]	0.242	0.128	0.033	0.606	0.026	0.034	0.025	0.010	0.007	0.256	s_M [%]	0.281
											$\bar{s}_i$ [%]	0.223
s_{rel}	0.0074	0.0039	0.0010	0.0183	0.0008	0.0010	0.0008	0.0003	0.0002	0.0076		0.0085

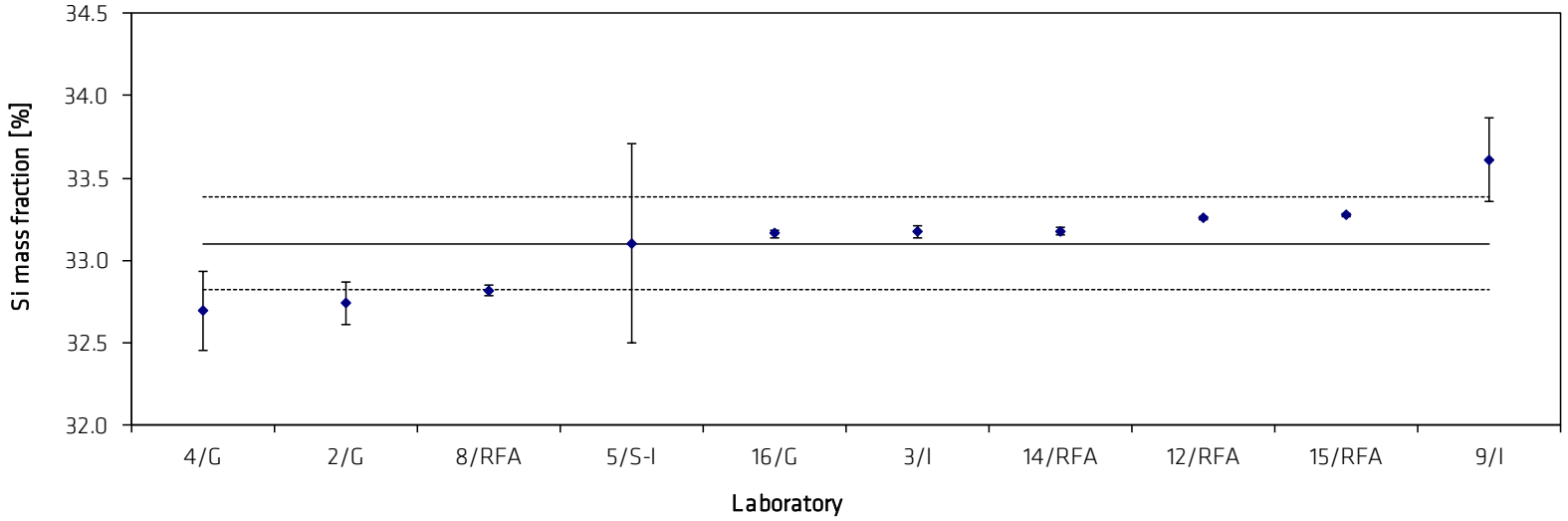


Table 9: Results for As

Lab./Meth.	12/I	13/I	6/I	4/I	15/RFA	10/I	1/S-I	8/I	5/S-I	9/IMS	16/I	14/I	15/LMS	11/I		
$M_{i\,[}$mg/kg]	68.66	70	78.2	81	76.5	78.64	82	79.6	83.95	83.97	85.01	86.50	89.1	89.50		*n*
	70.67	70	76.7	85	76.5	76.53	82	85.2	85.21	82.77	85.81	86.00	90.1	89.53		14
	70.86	70	73.7	87	76.5	77.72	82	86.8	84.20	85.04		86.78	91.6	91.17		
	68.05	70	76.2	68	78.0	76.32	82	81.1	82.64	82.67			89.8	91.88		
	69.35	70	72.6	70	75.7	76.98	82	79.8	83.25	82.71			88.4	91.25		
	68.54	70	75.5	67	76.5	74.85	82	81.4	79.79	84.95			87.0	91.27		
M [mg/kg]	**69.36**	**70.00**	**75.48**	**76.33**	**76.62**	**76.84**	**81.80**	**82.32**	**83.17**	**83.69**	**85.41**	**86.43**	**89.32**	**90.76**		**80.54**
s [%]	1.17	0.00	2.04	9.03	0.74	1.29	0.30	2.98	1.87	1.13	0.57	0.40	1.55	1.00	s_M [mg/kg]	6.62
															$\bar{s}_i$ [mg/kg]	2.76
s_{rel}	0.0169	0.0000	0.0271	0.1182	0.0097	0.0168	0.0037	0.0362	0.0225	0.0135	0.0066	0.0046	0.0174	0.0110		0.0822

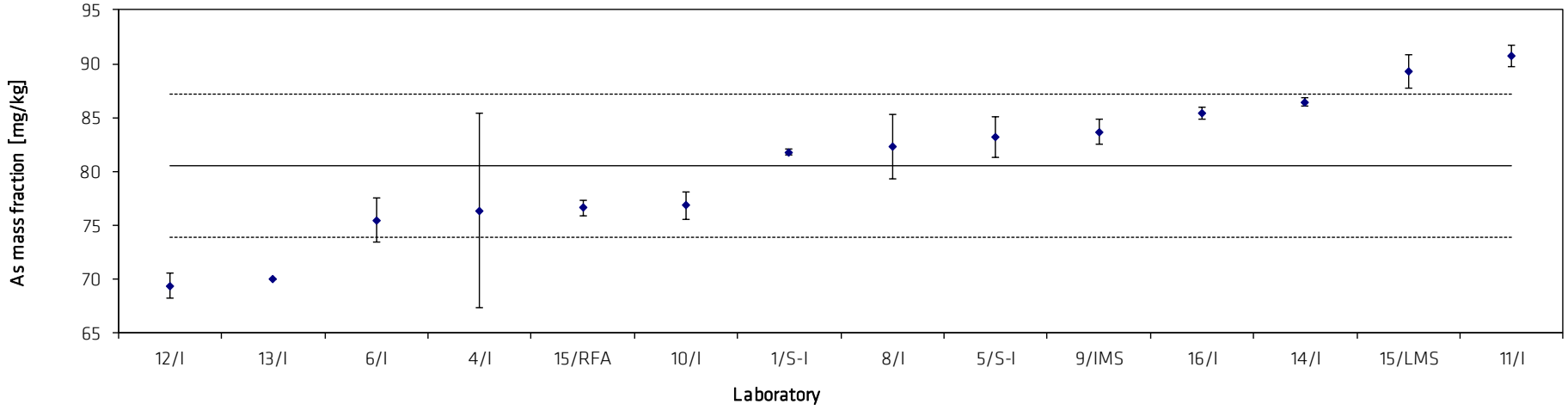


Table 10: Results for Ba

Lab./Meth.	12/I	10/I	6/I	8/I	4/I	5/S-I	9/IMS	13/I	11/I	16/I	1/S-I	7/I	3/I	14/I	15/LMS		
$M_{i\,[}$mg/kg]	94.2	90.5	95.5	94.8	97.0	100.6	100.3	110.0	101.0	103.3	111.6	108.0	109.5	112.1	113.0		*n*
	88.5	99.7	95.3	92.6	101.0	98.0	102.6	100.0	100.9	101.6	106.8	109.4	108.9	112.5	114.2		15
	87.0	94.7	95.2	94.8	95.0	100.2	100.2	120.0	102.3	107.0	108.9	107.8	109.2	111.9	117.5		
	93.8	94.7	95.0	91.6	90.0	95.4	99.0	80.0	102.9	104.1	108.2		108.6		113.3		
	90.2	95.1	93.3	98.4	100.0	99.5	99.1	110.0	102.5		107.4		109.0		115.5		
	90.2	92.2	92.8	96.3	99.0	94.6	99.2	90.0	102.3		103.7		108.8		112.7		
M [mg/kg]	**90.6**	**94.5**	**94.5**	**94.8**	**97.0**	**98.1**	**100.1**	**101.7**	**102.0**	**104.0**	**107.8**	**108.4**	**109.0**	**112.2**	**114.4**		**101.9**
s [%]	2.86	3.12	1.16	2.46	4.05	2.53	1.36	14.72	0.82	2.30	2.60	0.87	0.32	0.31	1.83	s_M [mg/kg]	7.18
																$\bar{s}_i$ [mg/kg]	4.35
s_{rel}	0.0315	0.0331	0.0122	0.0260	0.0417	0.0258	0.0136	0.1448	0.0080	0.0221	0.0241	0.0080	0.0029	0.0027	0.0160		0.0705

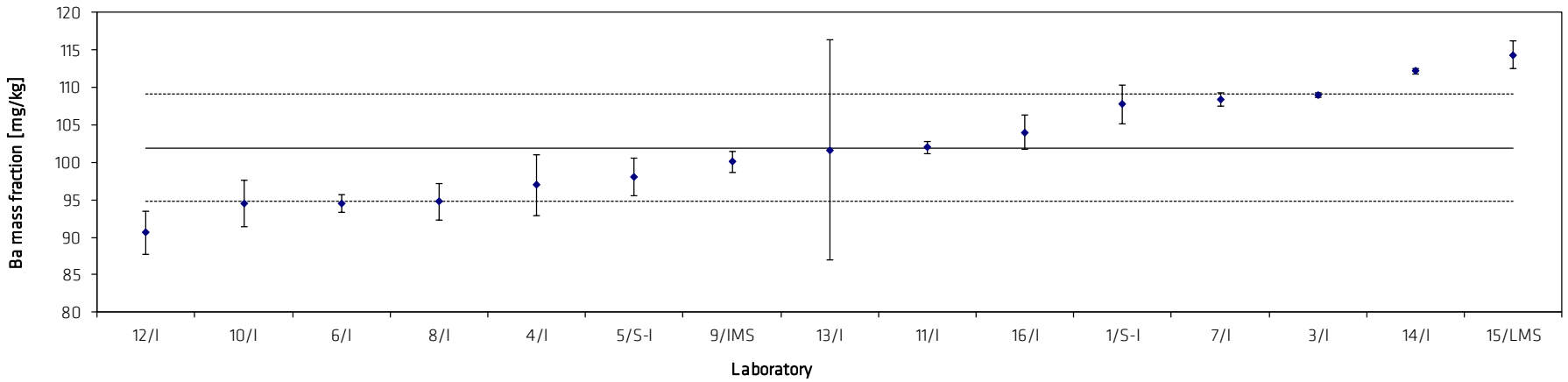


Table 11: Results for Cd

Lab./Meth.	8/I	6/I	4/I	14/I	9/IMS	2/I	10/I	13/I	15/LMS	5/S-I	12/I	1/S-I	7/I	16/I	11/I		
$M_{i\,[}$mg/kg]	37.1	42.2	39	44.7	45.53	45.9	44.01	47.0	49.95	51.26	50.75	52.1	52.15	52.37	52.78		*n*
	36.6	42.1	41	44.3	46.16	46.2	48.44	46.0	48.73	49.30	51.19	48.9	52.70	51.27	52.76		15
	37.5	41.8	42	44.9	45.09	45.6	46.39	47.0	45.92	45.46	51.26	52.6	52.00	54.27	53.64		
	36.3	41.9	43		44.67	45.0	46.21	46.0	47.28	49.90	50.03	50.2		51.80	54.10		
	38.0	41.2	44		44.68	43.7	46.42	46.0	45.99	46.07	49.57	50.5			53.60		
	37.6	41.5	44		44.23	44.8	45.26	46.0	45.06	46.92	49.89	49.9			53.64		
M [mg/kg]	**37.18**	**41.78**	**42.17**	**44.63**	**45.06**	**45.20**	**46.12**	**46.33**	**47.16**	**48.15**	**50.45**	**50.70**	**52.28**	**52.43**	**53.42**		**46.87**
s [%]	0.64	0.38	1.94	0.31	0.70	0.91	1.46	0.52	1.88	2.33	0.72	1.40	0.37	1.31	0.54	s_M [mg/kg]	4.52
																$\bar{s}_i$ [mg/kg]	1.20
s_{rel}	0.0173	0.0090	0.0460	0.0068	0.0154	0.0200	0.0318	0.0111	0.0398	0.0484	0.0142	0.0275	0.0070	0.0249	0.0100		0.0964

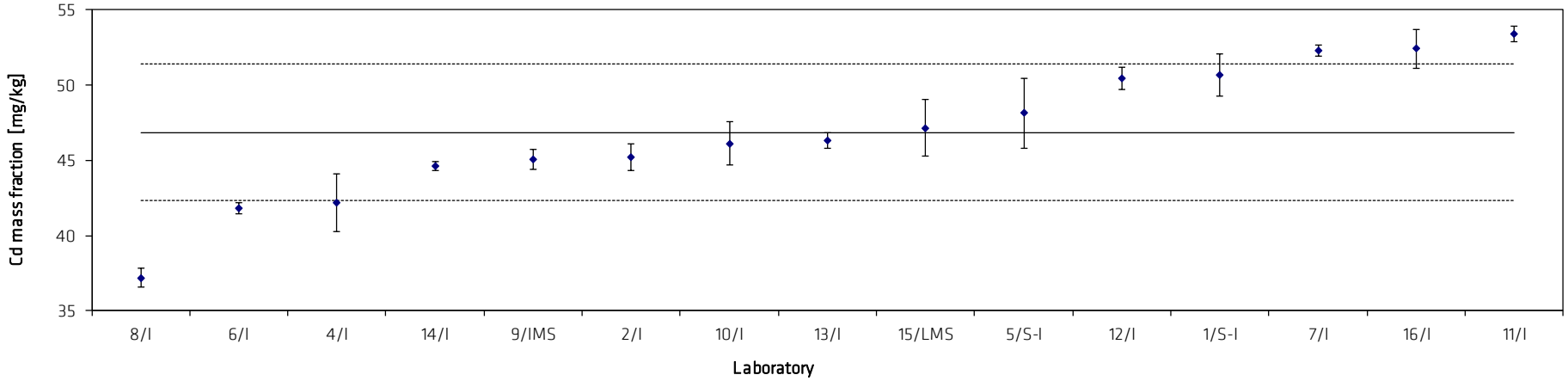


Table 12: Results for Ce

Lab./Meth.	12/I	1/S-I	8/I	15/LMS	13/I	9/IMS	10/I	11/I	4/I	5/S-I	14/I	16/I		
$M_{i\,[}$mg/kg]	69.49	69.9	78.4	77.4	80	80.71	76.22	80.22	86	89.21	103	118.49		*n*
	67.65	70.3	75.3	80.4	80	82.23	85.54	80.49	88	91.55	102	114.00		10
	68.11	81.8	78.1	85.6	80	80.65	81.47	81.27	87	91.99	103	113.73		
	68.43	70.3	75.8	77.5	80	80.23	81.22	81.92	87	88.18				
	67.37	68.3	80.1	78.5	80	78.66	80.02	81.66	91	90.70				
	68.25	70.2	78.8	76.7	80	80.40	79.48	81.19	88	93.68				
M [mg/kg]	**68.22**	**71.80**	**77.75**	**79.33**	**80.00**	**80.48**	**80.66**	**81.12**	**87.83**	**90.89**	**102.67**	**115.41**		**79.81**
s [%]	0.74	4.96	1.84	3.32	0.00	1.14	3.04	0.66	1.72	1.98	0.58	2.67	s_M [mg/kg]	6.61
													$\overline{s}_i$ [mg/kg]	2.40
s_{rel}	0.0108	0.0691	0.0237	0.0418	0.0000	0.0142	0.0377	0.0081	0.0196	0.0218	0.0056	0.0232		0.0828

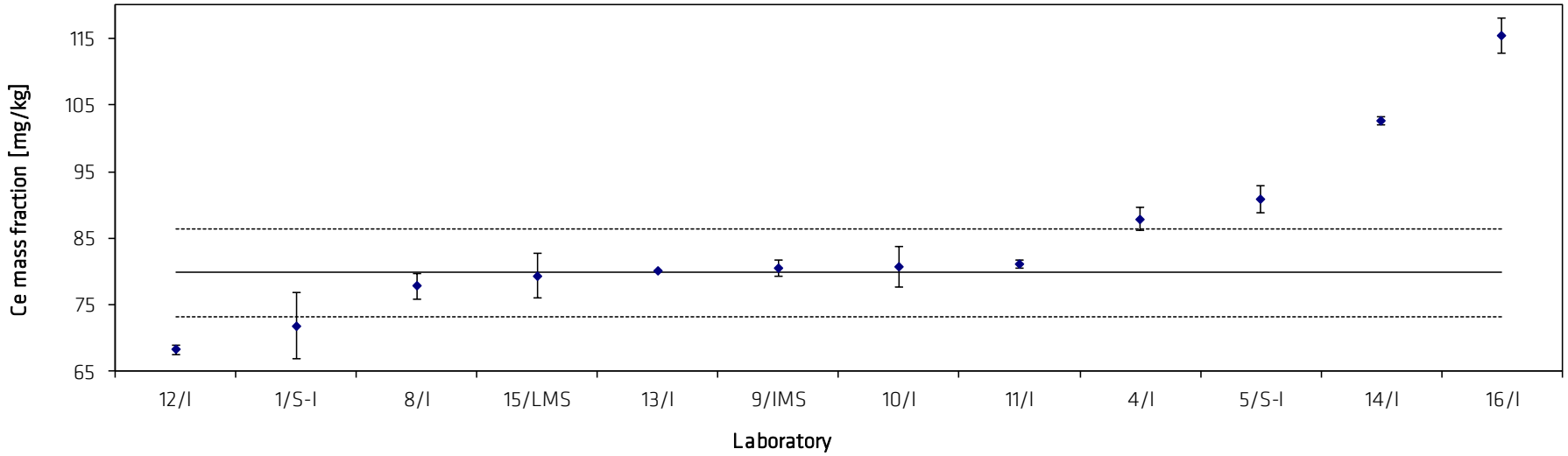


Table 13: Results for Co

Lab./Meth.	8/I	6/I	1/S-I	14/I	10/I	12/I	2/I	9/IMS	4/I	5/S-I	15/LMS	13/I	7/I	11/I	16/I		
$M_{i\,[}$mg/kg]	26.9	28.9	29.5	30.5	29.57	31.54	32.2	33.97	33	33.38	35.67	37	35.63	37.76	39.40		*n*
	29.4	29.1	30.0	30.5	32.53	31.81	32.9	34.56	35	37.02	35.84	35	36.13	37.60	39.33		15
	27.5	28.8	30.2	30.5	32.09	31.56	32.4	33.48	35	35.39	35.87	36	35.88	38.25	39.33		
	27.6	29.3	28.9		30.29	31.00	31.9	33.25	33	34.13	35.26	36		38.51	40.34		
	27.6	28.7	29.3		31.15	30.81	32.4	33.53	34	34.78	34.81	36		38.20			
	27.4	28.5	29.5		30.67	30.95	32.8	32.93	33	33.47	34.85	35		38.20			
M [mg/kg]	**27.73**	**28.88**	**29.57**	**30.50**	**31.05**	**31.28**	**32.43**	**33.62**	**33.83**	**34.69**	**35.38**	**35.83**	**35.88**	**38.09**	**39.60**		**33.23**
s [%]	0.86	0.29	0.47	0.03	1.11	0.41	0.37	0.57	0.98	1.37	0.48	0.75	0.25	0.34	0.49	s_M [mg/kg]	3.43
																$\bar{s}_i$ [mg/kg]	0.68
s_{rel}	0.0309	0.0099	0.0160	0.0008	0.0358	0.0131	0.0115	0.0171	0.0291	0.0396	0.0136	0.0210	0.0070	0.0089	0.0125		0.1031

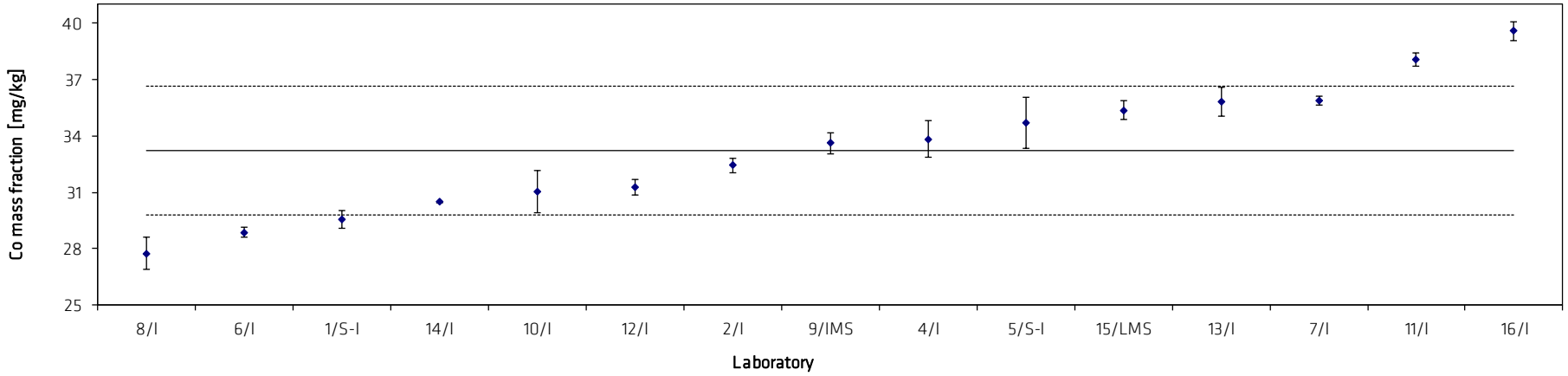


Table 14: Results for Cr

Lab./Meth.	1/S-I	16/I	6/I	3/I	8/I	9/IMS	2/I	11/I	5/S-I	4/I	12/I	15/LMS	10/I	13/I	7/I	14/I		
M_i [mg/kg]	3.74	7.98	8.98	10.48	9.52	9.96	9.9	10.04	10.36	10	10.89	11.44	11.82	15	13.13	13.70		*n*
	3.84	8.46	9.10	8.60	9.44	10.00	10.3	10.07	11.17	11	11.12	11.61	12.61	10	12.00	13.81		15
	3.79	7.97	8.90	9.54	9.44	10.65	10.0	10.27	10.84	10	10.93	10.89	11.95	11	14.00	13.68		
	3.68	8.47	8.90	9.11	9.04	9.45	9.7	10.41	11.32	11	10.88	11.26	12.27	11				
	3.76		8.90	9.39	9.64	9.58	9.9	10.20	10.92	11	10.88	10.81	12.70	15				
	3.67		8.80	9.25	9.90	9.33	10.1	10.32	10.12	12	12.08	11.18	11.98	13				
M [mg/kg]	**3.75**	**8.22**	**8.93**	**9.40**	**9.50**	**9.83**	**9.98**	**10.22**	**10.79**	**10.83**	**11.13**	**11.20**	**12.22**	**12.50**	**13.04**	**13.73**		**10.77**
s [%]	0.065	0.283	0.101	0.623	0.282	0.485	0.204	0.142	0.465	0.753	0.475	0.309	0.367	2.168	1.003	0.070	s_M [mg/kg]	1.571
																	$\bar{s}_i$ [mg/kg]	0.721
s_{rel}	0.0174	0.0344	0.0113	0.0663	0.0297	0.0493	0.0204	0.0139	0.0431	0.0695	0.0427	0.0276	0.0300	0.1734	0.0769	0.0051		0.1459

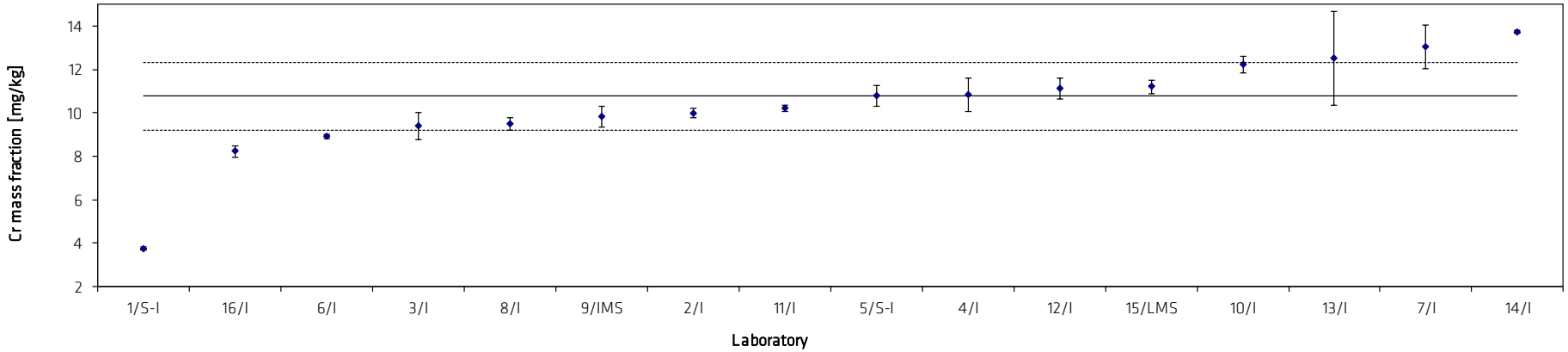


Table 15: Results for Cu

Lab./Meth.	12/I	10/I	8/I	4/I	9/IMS	2/I	6/I	13/I	14/I	15/LMS	11/I	16/I	7/I	5/S-I	1/S-I		
$M_{i\,[}$mg/kg]	72.2	71.53	74.9	82	84.21	85.2	85.4	80	86.1	86.1	86.04	90.28	93.3	95.9	104.3		*n*
	72.7	77.35	73.3	84	84.08	85.8	87.6	80	86.5	88.9	85.77	89.61	93.9	97.0	103.5		15
	74.5	73.55	75.1	81	82.81	83.3	85.6	90	86.0	87.6	86.93	88.12	91.9	107.7	97.4		
	74.1	75.05	73.0	80	81.70	82.7	84.0	90		85.9	87.23	90.15		98.7	99.4		
	74.2	73.01	77.3	83	81.43	84.5	83.7	90		85.1	87.16			96.9	99.4		
	74.3	74.44	77.1	81	81.28	86.6	83.5	80		84.2	86.62			98.9	100.8		
M [mg/kg]	**73.66**	**74.16**	**75.12**	**81.83**	**82.59**	**84.68**	**84.97**	**85.00**	**86.20**	**86.30**	**86.62**	**89.54**	**93.03**	**99.17**	**100.80**		**85.58**
s [%]	0.98	1.98	1.82	1.47	1.32	1.49	1.56	5.48	0.26	1.70	0.60	0.99	1.03	4.33	2.65	s_M [mg/kg]	8.00
																$\bar{s}_i$ [mg/kg]	2.28
s_{rel}	0.0133	0.0267	0.0242	0.0180	0.0160	0.0176	0.0184	0.0644	0.0031	0.0196	0.0069	0.0111	0.0110	0.0437	0.0263		0.0935

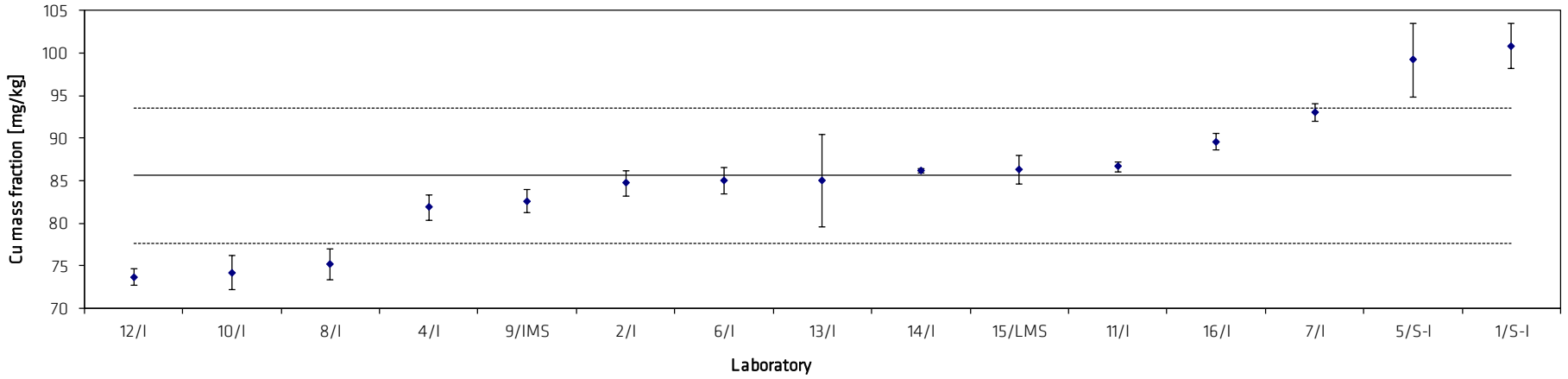


Table 16: Results for Fe

Lab./Meth.	1/S-I	8/I	6/I	10/I	5/S-I	9/IMS	7/I	11/I	12/P	13/I	4/I	15/RFA	15/LMS	16/I	2/P	14/I	3/I		
$M_{i\,[}$mg/kg]	229.1	252	285.7	280.4	287.0	289.9	283.8	301.4	299.3	310	284	301	301.5	302.3	300	309	328.8		*n*
	258.9	248	283.3	294.2	289.2	302.5	283.4	283.5	295.9	290	297	301	309.2	307.7	309	307	322.2		14
	222.9	255	279.5	277.8	275.0	286.9	297.7	288.8	298.5	310	326	301	299.8	305.7	308	305	325.5		
	239.4	247	285.0	278.7	276.4	282.7		289.6		290	280	301	300.7	306.8	303		332.6		
	229.9	261	278.5	285.7	276.4	281.6		282.2		300	296	301	298.5		314		331.7		
	220.7	258	283.0	282.0	300.5	282.4		295.1		290	307	301	300.8		301		332.1		
M [mg/kg]	**233.5**	**253.5**	**282.5**	**283.1**	**284.1**	**287.7**	**288.3**	**290.1**	**297.9**	**298.3**	**298.3**	**300.7**	**301.8**	**305.6**	**305.8**	**307.0**	**328.8**		**295.1**
s [%]	14.1	5.5	2.9	6.1	10.0	7.9	8.1	7.2	1.8	9.8	16.7	0.0	3.8	2.4	5.4	2.0	4.2	s_M [mg/kg]	8.9
																		$\bar{s}_i$ [mg/kg]	7.4
s_{rel}	0.0602	0.0219	0.0103	0.0215	0.0353	0.0276	0.0282	0.0249	0.0060	0.0330	0.0559	0.0000	0.0125	0.0077	0.0177	0.0065	0.0128		0.0300

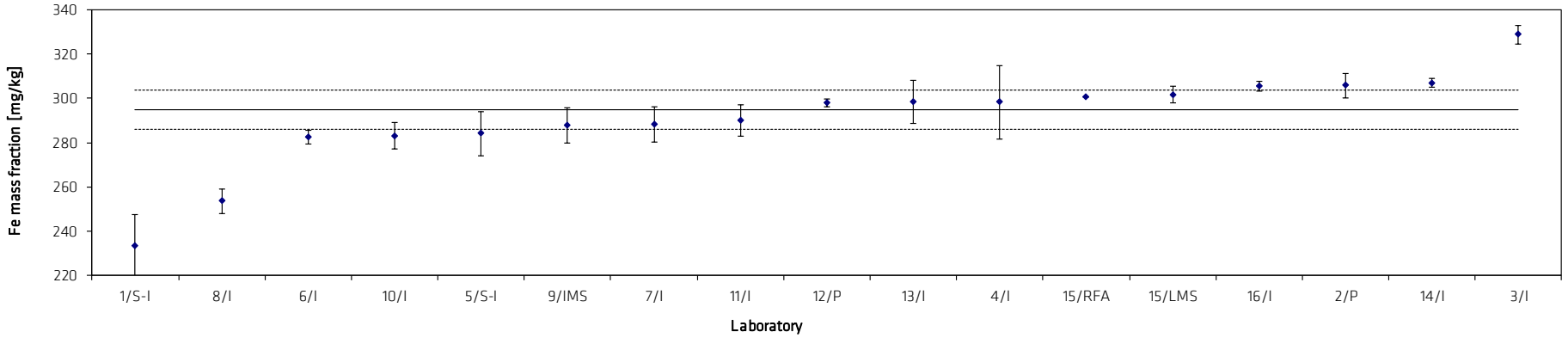


Table 17: Results for Mn

Lab./Meth.	8/I	12/I	15/LMS	10/I	1/S-I	5/S-I	16/I	6/I	9/IMS	14/I	2/I	13/I	3/I	4/I	15/RFA	11/I		
$M_{i,l}$ [mg/kg]	62.6	64.64	65.20	63.30	67.8	72.47	69.34	69.8	71.64	71.70	72.0	70	72.58	73	77.5	92.96		*n*
	61.6	64.59	65.60	69.96	68.8	64.75	69.20	70.2	72.03	72.10	72.5	70	71.85	77	77.5	92.91		15
	63.2	65.46	65.39	66.60	67.8	71.93	67.71	70.4	70.68	70.85	71.2	80	72.21	76	77.5	93.72		
	61.0	64.66	65.69	66.54	64.7	68.72	70.72	69.8	69.88		69.8	70	72.36	74	77.5	93.74		
	64.3	64.08	65.46	66.79	64.8	67.75		69.8	70.28		71.1	70	72.79	77	77.5	93.80		
	64.1	64.53	64.52	65.30	65.8	65.99		69.9	69.29		72.8	70	72.57	75	77.5	93.76		
M [mg/kg]	**62.80**	**64.66**	**65.31**	**66.41**	**66.62**	**68.60**	**69.24**	**69.98**	**70.63**	**71.55**	**71.57**	**71.67**	**72.39**	**75.33**	**77.47**	**93.48**		**69.62**
s [%]	1.33	0.45	0.42	2.18	1.74	3.11	1.23	0.26	1.05	0.64	1.10	4.08	0.33	1.63	0.00	0.42	s_M [mg/kg]	4.01
																	$\bar{s}_i$ [mg/kg]	1.70
s_{rel}	0.0211	0.0069	0.0064	0.0328	0.0262	0.0454	0.0178	0.0037	0.0148	0.0089	0.0154	0.0570	0.0046	0.0217	0.0000	0.0045		0.0576

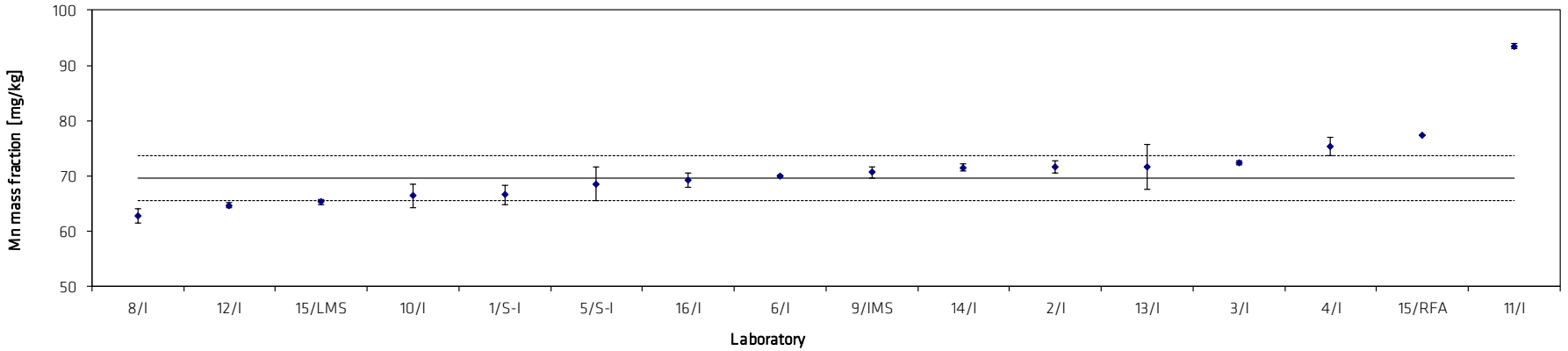


Table 18: Results for Mo

Lab./Meth.	8/I	4/I	6/I	16/I(R)	11/I	12/I	5/S-I	2/I	10/I	13/I	9/IMS	14/I	15/LMS	1/S-I		
$M_{i\,[}$mg/kg]	177	195	205.2	203.2	204.9	214.2	223.3	213	205.7	220	227.1	227.9	235	275.0		*n*
	174	203	207.0	209.4	205.4	214.3	208.4	213	228.4	210	231.1	228.1	232	277.3		12
	179	203	205.2	206.3	208.7	215.5	203.1	217	217.4	230	225.9	225.8	235	272.1		
	174	206	206.3		209.9	205.7	218.8	219	218.7	220	222.8		235	236.9		
	182	214	203.4		210.3	201.9	198.5	216	220.1	210	223.3		232	279.7		
	181	208	207.0		208.6	205.9	231.4	214	212.8	220	221.9		230	275.5		
M **[mg/kg]**	**177.8**	**204.8**	**205.7**	**206.3**	**208.0**	**209.6**	**213.9**	**215.3**	**217.2**	**218.3**	**225.4**	**227.3**	**233.5**	**269.4**		**215.4**
s [%]	3.4	6.3	1.4	3.1	2.3	5.8	12.7	2.4	7.6	7.5	3.4	1.3	2.2	16.1	s_M [mg/kg]	9.3
															$\bar{s}_i$ [mg/kg]	5.7
s_{rel}	0.0193	0.0308	0.0067	0.0151	0.0110	0.0275	0.0593	0.0112	0.0349	0.0345	0.0153	0.0056	0.0094	0.0599		0.0433

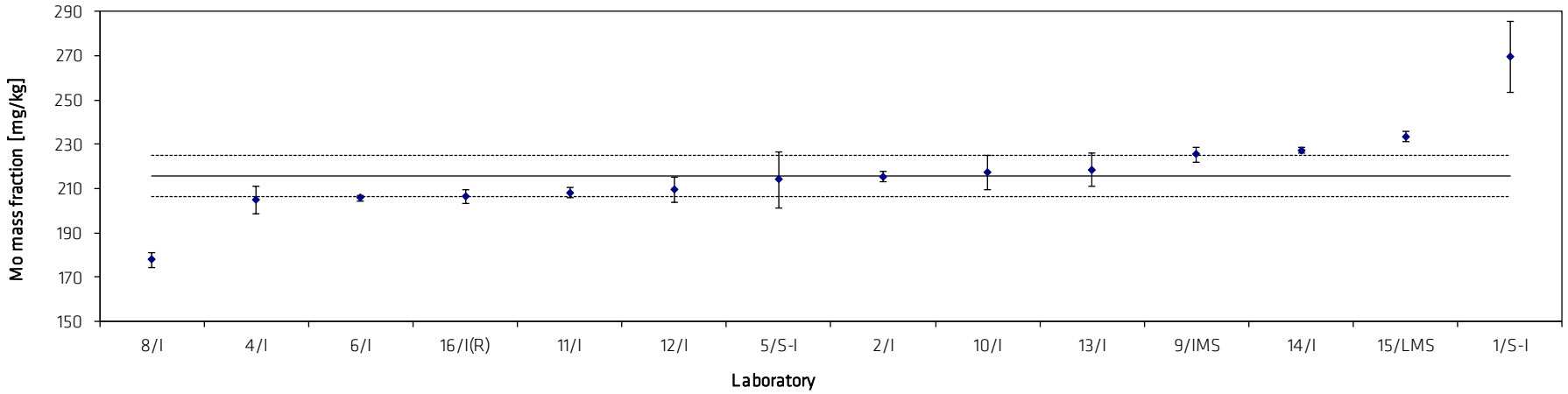


Table 19: Results for Ni

Lab./Meth.	8/I	12/I	6/I	9/IMS	4/I	10/I	1/S-I	5/S-I	2/I	13/I	15/LMS	14/I(R)	16/I	11/I	7/I		
$M_{i\,[}$mg/kg]	35.6	36.83	37.8	40.76	39	38.40	41.0	41.86	41.6	43	43.0	43.30	44.39	44.80	44.5		*n*
	35.3	37.62	38.4	41.15	41	41.81	43.5	42.95	42.2	40	42.5	43.14	43.31	44.82	44.6		15
	36.2	38.14	37.9	40.51	41	39.83	40.5	40.55	41.4	44	43.5	43.40	42.82	45.53	48.6		
	35.0	37.38	39.3	39.50	38	40.32	42.4	39.74	40.6	42	42.7		44.33	45.96			
	36.9	37.54	37.7	39.74	42	41.27	40.0	40.92	41.5	44	42.9			45.56			
	36.1	38.13	39.5	39.01	40	40.76	40.1	41.93	41.9	40	42.1			45.92			
***M* [mg/kg]**	**35.85**	**37.61**	**38.43**	**40.11**	**40.17**	**40.40**	**41.25**	**41.32**	**41.53**	**42.17**	**42.78**	**43.28**	**43.71**	**45.43**	**45.92**		**41.33**
s [%]	0.69	0.49	0.79	0.82	1.47	1.20	1.41	1.15	0.54	1.83	0.48	0.13	0.77	0.52	2.35	s_M [mg/kg]	2.75
																$\bar{s}_i$ [mg/kg]	1.13
s_{rel}	0.0192	0.0131	0.0205	0.0205	0.0366	0.0297	0.0341	0.0277	0.0131	0.0435	0.0113	0.0030	0.0177	0.0113	0.0511		0.0666

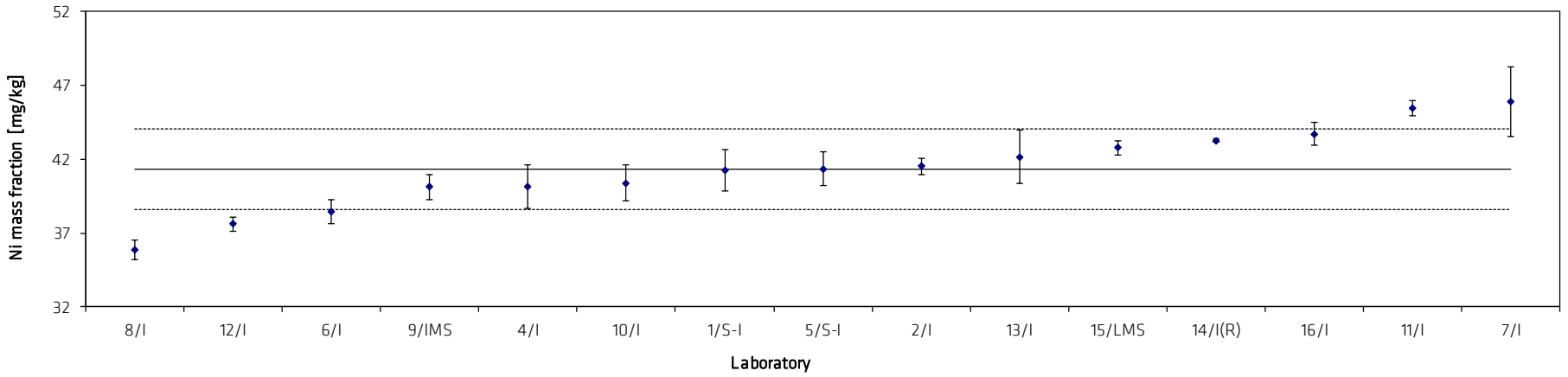


Table 20: Results for P

Lab./Meth.	12/I	8/I	4/I	3/I	11/I	1/S-I	14/I(R)	5/S-I	9/IMS		
M_i [mg/kg]	3.10	4.26	3	5.22	9.12	10.10	11.24	11.80	12.82		*n*
	2.90	4.44	3	[0]	8.66	10.10	12.02	11.65	13.01		9
	3.08	4.16	4	[0]	9.09	8.94	9.91	12.93	13.80		
	3.58	3.88	4	6.15	9.01	10.10		11.74	12.67		
	3.25	3.93	5	10.91	8.80	11.30		12.06	12.50		
	2.94	4.22	6	8.53	9.20	10.70		12.70	14.33		
M [mg/kg]	**3.14**	**4.15**	**4.17**	**7.70**	**8.98**	**10.21**	**11.06**	**12.15**	**13.19**		**8.30**
s [%]	0.25	0.21	1.17	2.55	0.21	0.78	1.07	0.54	0.72	s_M [mg/kg]	3.74
										$\bar{s}_i$ [mg/kg]	1.09
s_{rel}	0.0793	0.0508	0.2806	0.3317	0.0230	0.0769	0.0965	0.0443	0.0544		0.4499

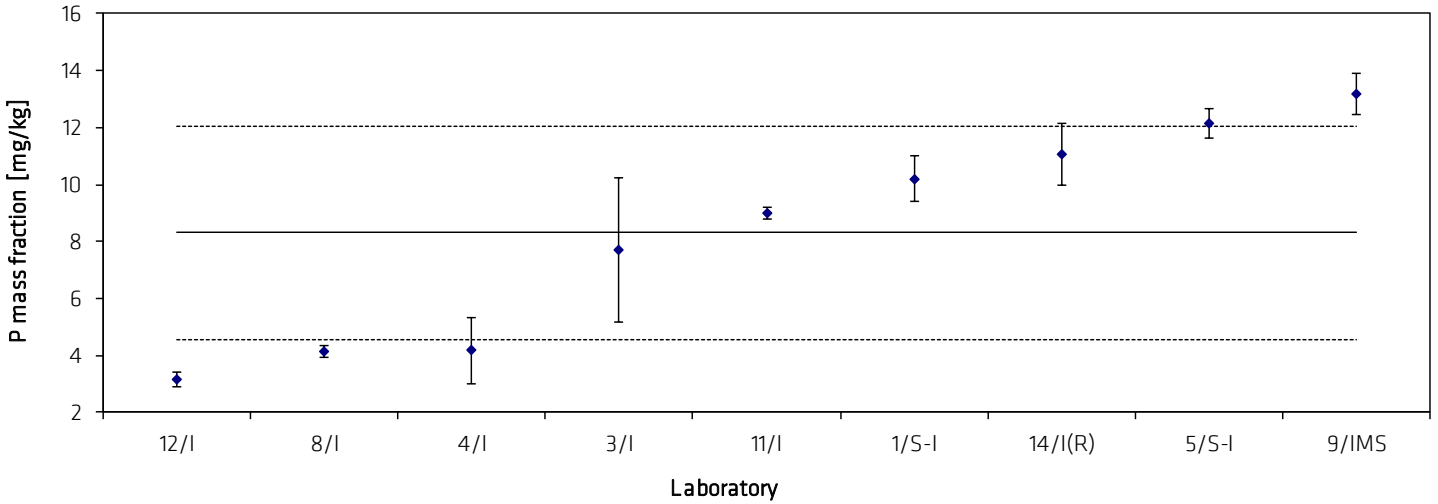


Table 21: Results for Pb

Lab./Meth.	8/I	10/I	4/I	9/IMS	15/RFA	6/I	15/LMS	2/I	1/S-I	5/S-I	11/I	13/I	16/I	14/I	3/I	7/I	12/I		
$M_{i,l}$ [mg/kg]	154	152.8	162	175.2	175.5	177.1	178.1	184	182.8	181.4	181.7	186	187.1	185	202.7	205.0	204.5		*n*
	151	169.2	171	178.9	175.5	180.1	176.8	184	194.2	187.5	183.8	186	184.7	188	193.2	202.8	205.2		17
	157	160.5	173	175.2	175.5	174.8	178.2	182	178.3	187.3	184.7	187	187.2	190	197.9	196.6	205.0		
	151	160.9	174	173.7	176.4	178.5	177.2	183	182.7	183.3	188.7	187	189.3		199.3		201.4		
	159	160.5	182	174.7	175.5	175.0	176.0	178	181.6	182.1	186.6	188			191.4		199.4		
	157	159.7	178	174.6	176.4	176.7	176.7	184	176.2	179.2	187.1	185			195.4		200.3		
M [mg/kg]	**154.8**	**160.6**	**173.3**	**175.4**	**175.8**	**177.0**	**177.2**	**182.5**	**182.6**	**183.5**	**185.4**	**186.5**	**187.1**	**187.7**	**196.7**	**201.5**	**202.6**		**181.8**
s [%]	3.4	5.2	6.8	1.8	0.5	2.0	0.9	2.3	6.2	3.3	2.5	1.0	1.9	2.5	4.1	4.4	2.6	s_M [mg/kg]	12.5
																		$\bar{s}_i$ [mg/kg]	3.5
s_{rel}	0.0218	0.0324	0.0392	0.0104	0.0027	0.0115	0.0049	0.0129	0.0342	0.0180	0.0136	0.0056	0.0100	0.0134	0.0211	0.0216	0.0126		0.0689

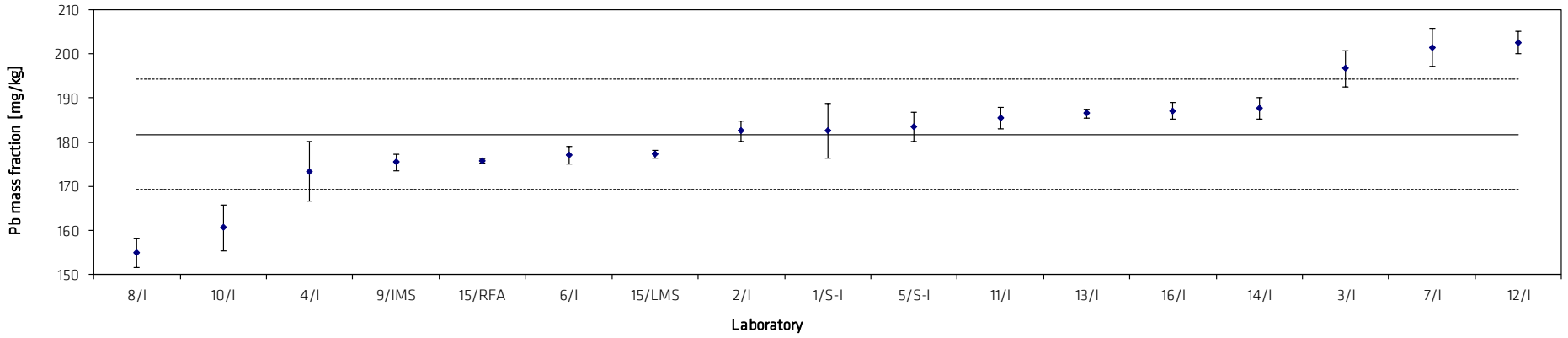


Table 22: Results for Sb

Lab./Meth.	8/I	16/I	10/I	6/I	5/S-I	4/I	12/I	9/IMS	15/RFA	11/I	13/I	15/LMS	14/I	1/S-I		
$M_{i\,[}$mg/kg]	89.1	96.4	95.7	99.3	103.4	98	106.7	105.3	106.1	107.8	90	108.7	109.9	185.1		*n*
	86.9	96.2	97.0	99.8	100.1	103	105.6	107.6	106.1	106.2	110	108.0	109.0	188.3		13
	98.0		97.5	96.0	104.2	102	106.3	105.1	105.2	108.5	120	108.7	108.5	177.0		
	84.1		96.9	104.8	101.2	105	103.8	105.0	106.9	107.9	110	108.7		183.8		
			98.0	95.8	97.0	108	103.1	103.1	106.1	106.7	110	108.7		191.7		
			96.5	98.9	103.8	107	103.4	104.3	105.2	106.0	110	108.7		188.2		
M **[mg/kg]**	**89.5**	**96.3**	**96.9**	**99.1**	**101.6**	**103.8**	**104.8**	**105.1**	**105.9**	**107.2**	**108.3**	**108.6**	**109.1**	**185.7**		**102.8**
s [%]	6.0	0.1	0.8	3.3	2.8	3.7	1.6	1.5	0.6	1.0	9.8	0.3	0.7	5.1	s_M [mg/kg]	5.9
															$\overline{s}_i$ [mg/kg]	3.6
s_{rel}	0.0671	0.0012	0.0079	0.0330	0.0271	0.0352	0.0150	0.0141	0.0059	0.0095	0.0908	0.0027	0.0065	0.0273		0.0569

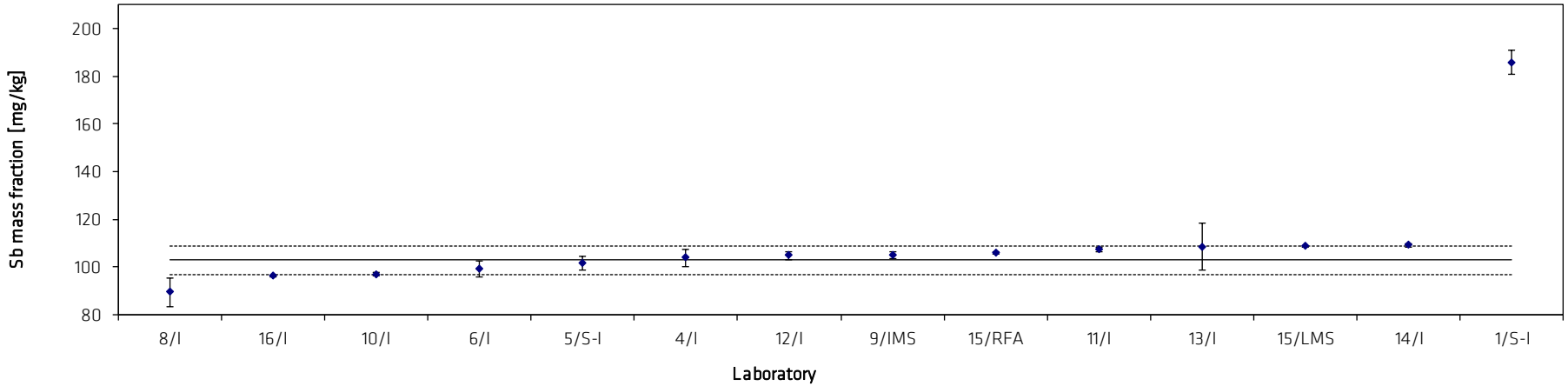


Table 23: Results for Se

Lab./Meth.	16/I	12/I	5/S-I	4/I	9/IMS	8/I	6/I	14/IMS	11/I		
$M_{i\,[}$mg/kg]	1.07	1.29	2.351	3	2.753	3.01	3.34	4.00	19.09		*n*
	1.08	1.30	1.495	4	3.128	2.88	3.29	3.72	19.61		8
		1.40	1.877	2	3.104	3.31	3.25	4.65	19.67		
		1.85	1.753	1	2.907	3.02	3.20		19.88		
		0.83	2.348	2	2.952	3.15	3.18		20.04		
		1.39	1.714	1	3.075	3.15	3.37		19.85		
M **[mg/kg]**	**1.078**	**1.342**	**1.923**	**2.167**	**2.987**	**3.087**	**3.272**	**4.123**	**19.688**		**2.497**
s [%]	0.006	0.326	0.352	1.169	0.144	0.149	0.076	0.477	0.333	s_M [mg/kg]	1.043
										$\bar{s}_i$ [mg/kg]	0.484
s_{rel}	0.0059	0.2426	0.1833	0.5396	0.0482	0.0483	0.0232	0.1157	0.0169		0.4178

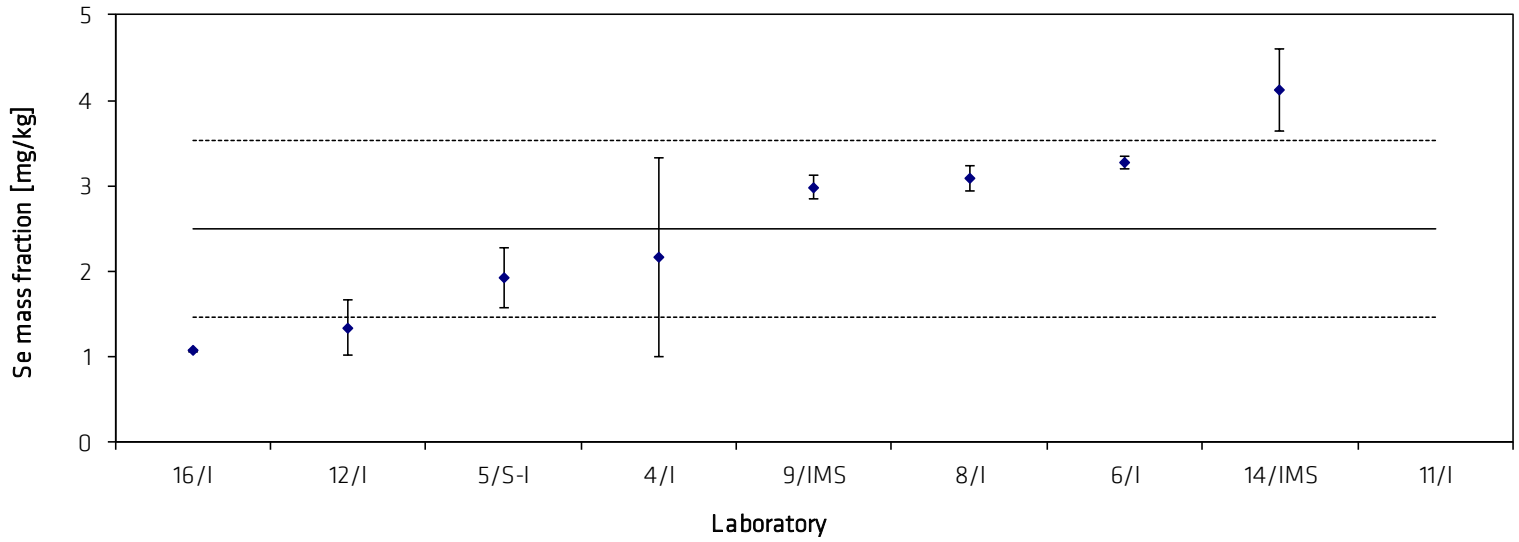


Table 24: Results for Sn

Lab./Meth.	4/I	16/I	13/I	12/I	15/RFA	14/I	5/S-I	10/I	11/I	1/S-I	8/I	9/IMS	15/LMS		
$M_{i\,[}$mg/kg]	62	69	70	71.14	63.02	71.40	73.50	70.38	71.35	76.0	71.9	78.03	78.13		*n*
	66	70	70	70.73	70.89	71.35	75.33	76.14	72.35	72.6	80.8	79.44	77.82		13
	67		60	71.40	78.77	72.00	72.47	72.55	72.70	73.1	83.1	76.22	78.26		
	71		70	70.27	70.89		72.13	69.63	74.04	79.1	74.3	77.24	78.36		
	74		80	70.32	70.89		69.14	72.77	73.13	79.4	73.0	76.14	78.65		
	73		70	70.41	70.89		69.72	74.65	73.44	76.3	76.6	76.59	77.48		
***M* [mg/kg]**	**68.83**	**69.40**	**70.00**	**70.71**	**70.89**	**71.58**	**72.05**	**72.69**	**72.83**	**76.08**	**76.62**	**77.28**	**78.12**		**72.85**
s [%]	4.62	0.88	6.32	0.47	4.98	0.36	2.32	2.47	0.93	2.87	4.48	1.28	0.41	s_M [mg/kg]	3.15
														$\bar{s}_i$ [mg/kg]	3.16
s_{rel}	0.0672	0.0127	0.0904	0.0066	0.0703	0.0051	0.0322	0.0340	0.0128	0.0377	0.0584	0.0165	0.0053		0.0432

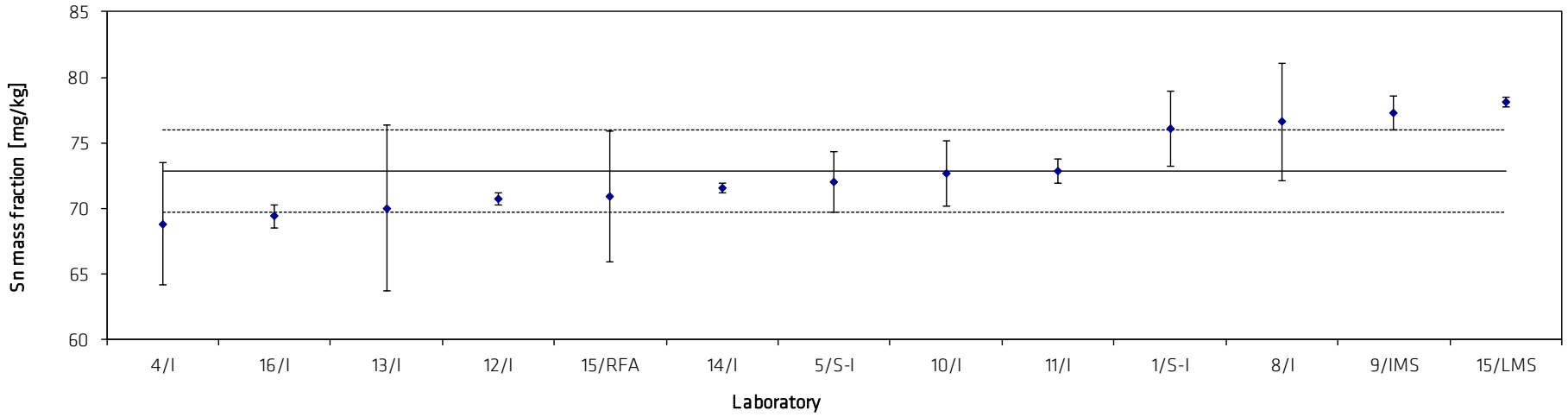


Table 25: Results for Sr

Lab./Meth.	15/LMS	12/I	1/S-I	11/I	10/I	15/RFA	8/I	5/S-I	9/IMS	3/I	14/I	4/I	16/I	13/I		
$M_{i\,[}$mg/kg]	118.0	120.4	112.7	124.2	119.7	129.4	133	139.5	135.5	140.7	139.0	142	143.7	160		*n*
	118.0	121.1	111.3	124.2	131.5	129.4	130	133.0	139.1	140.0	144.2	146	143.4	150		14
	121.7	120.8	138.1	125.2	125.6	129.4	132	137.3	136.7	140.3	140.5	138	144.9	160		
	117.8	121.4	123.7	125.8	125.6	129.4	128	131.3	133.8	140.2		137	143.9	150		
	119.1	123.0	121.5	125.6	125.4	129.4	137	135.3	133.5	140.6		149		160		
	118.5	121.3	132.7	126.2	126.5	129.4	135	131.1	132.9	140.4		145		150		
***M* [mg/kg]**	**118.9**	**121.3**	**123.3**	**125.2**	**125.7**	**129.4**	**132.5**	**134.6**	**135.2**	**140.4**	**141.2**	**142.8**	**144.0**	**155.0**		**133.5**
s [%]	1.5	0.9	10.7	0.8	3.8	0.0	3.3	3.4	2.4	0.2	2.7	4.7	0.6	5.5	s_M [mg/kg]	10.3
															$\bar{s}_i$ [mg/kg]	4.0
s_{rel}	0.0124	0.0074	0.0864	0.0068	0.0300	0.0000	0.0247	0.0252	0.0174	0.0018	0.0190	0.0330	0.0045	0.0353		0.0772

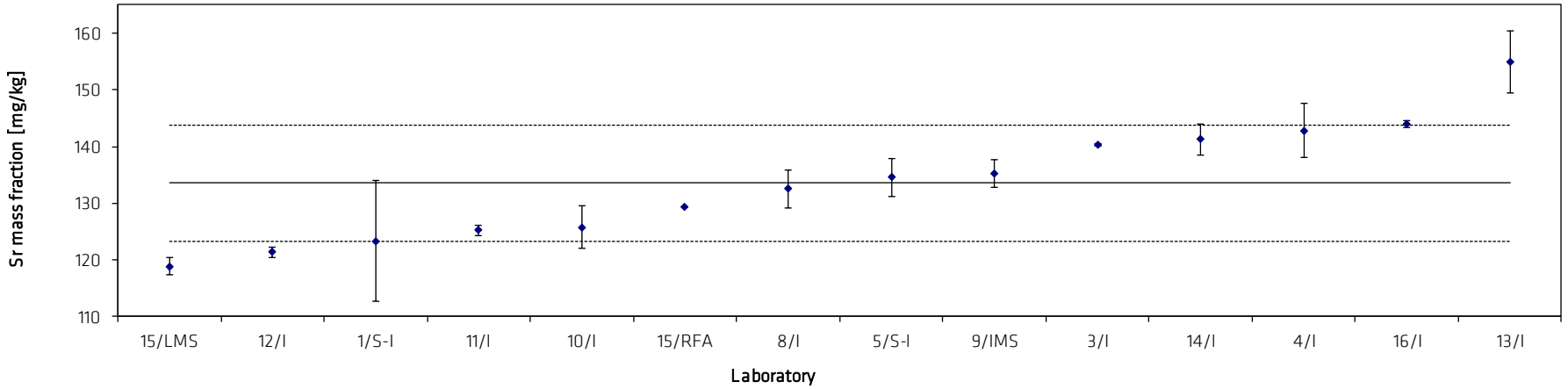


Table 26: Results for Ti

Lab./Meth.	3/I	8/I	16/I	11/I	10/I	12/I	4/I	13/I	15/RFA	15/LMS	5/S-I	9/IMS	1/S-I	14/I		
$M_{i\,[}$mg/kg]	76.3	88.9	89.1	92.8	89.7	96.3	96	100	101.9	103.8	99.9	109.0	106.4	119.9		*n*
	72.6	87.3	93.1	93.1	99.5	96.2	99	100	101.9	104.1	112.8	111.3	109.1	120.5		13
	74.5	90.8	87.8	94.4	94.8	97.1	101	100	101.9	106.0	98.6	107.8	104.0	119.0		
	72.9	87.9		95.0	94.6	94.5	98	110	101.9	106.5	112.8	106.3	108.2			
	76.2	92.9		95.1	94.9	93.7	102	100	101.9	107.0	107.9	104.9	114.1			
	74.5	91.4		94.4	95.8	94.4	100	100	101.9	105.0	108.6	104.6	112.3			
M **[mg/kg]**	**74.5**	**89.9**	**90.0**	**94.1**	**94.9**	**95.4**	**99.3**	**101.7**	**101.9**	**105.4**	**106.8**	**107.3**	**109.0**	**119.8**		**101.2**
s [%]	1.5	2.2	2.8	1.0	3.1	1.3	2.2	4.1	0.0	1.3	6.2	2.6	3.7	0.8	s_M [mg/kg]	8.5
															$\overline{s}_i$ [mg/kg]	2.9
s_{rel}	0.0206	0.0243	0.0306	0.0102	0.0331	0.0140	0.0217	0.0402	0.0000	0.0126	0.0580	0.0241	0.0342	0.0065		0.0843

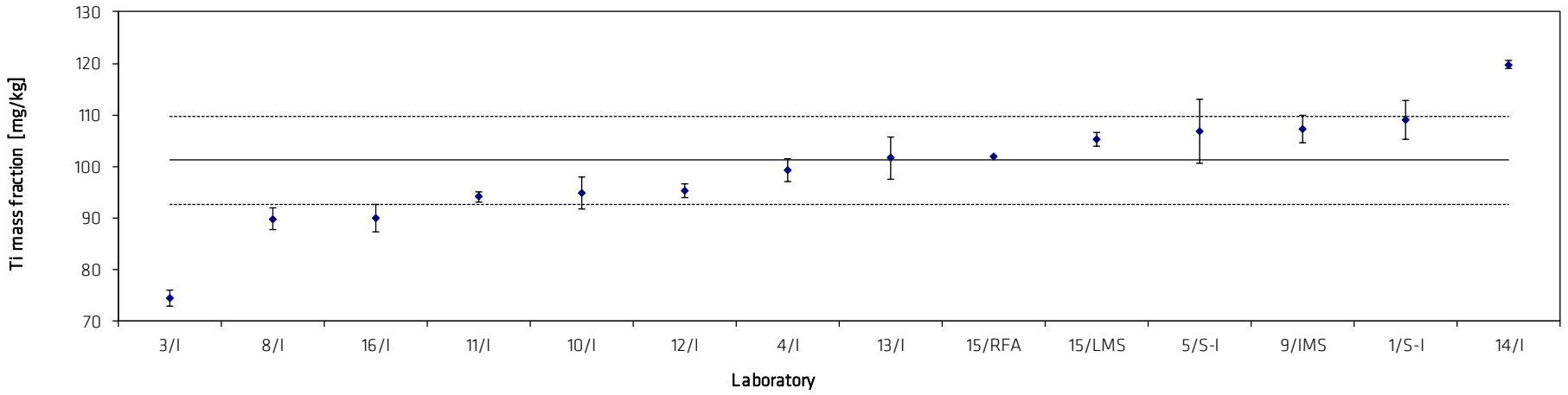


Table 27: Results for V

Lab./Meth.	8/I	12/I	11/I	6/I	4/I	2/I	13/I	10/I	5/S-I	9/IMS	15/LMS	16/I	1/S-I	14/I		
$M_{i\,[}$mg/kg]	170	178	176.2	181.8	177	183	190	178.5	191.7	196.1	196.2	205.1	200.4	209.0		*n*
	167	178	176.5	181.5	184	184	180	197.3	199.6	201.5	197.7	204.1	202.2	207.7		14
	170	177	178.6	180.8	180	181	180	188.7	193.8	194.4	198.0	201.5	194.5	211.0		
	165	173	179.9	179.1	179	177	190	189.1	202.1	193.1	197.9		209.9			
	174	171	179.3	175.7	185	179	180	189.9	183.4	192.0	197.3		215.0			
	174	173	178.8	178.0	181	185	180	191.2	192.7	194.3	195.6		210.4			
M **[mg/kg]**	**170.0**	**174.9**	**178.2**	**179.5**	**181.0**	**181.5**	**183.3**	**189.1**	**193.9**	**195.2**	**197.1**	**203.6**	**205.4**	**209.2**		**188.7**
s [%]	3.6	2.9	1.5	2.4	3.0	3.1	5.2	6.1	6.6	3.4	1.0	1.9	7.6	1.7	s_M [mg/kg]	12.2
															$\bar{s}_i$ [mg/kg]	4.1
s_{rel}	0.0214	0.0164	0.0085	0.0131	0.0168	0.0170	0.0282	0.0322	0.0339	0.0172	0.0051	0.0091	0.0372	0.0080		0.0647

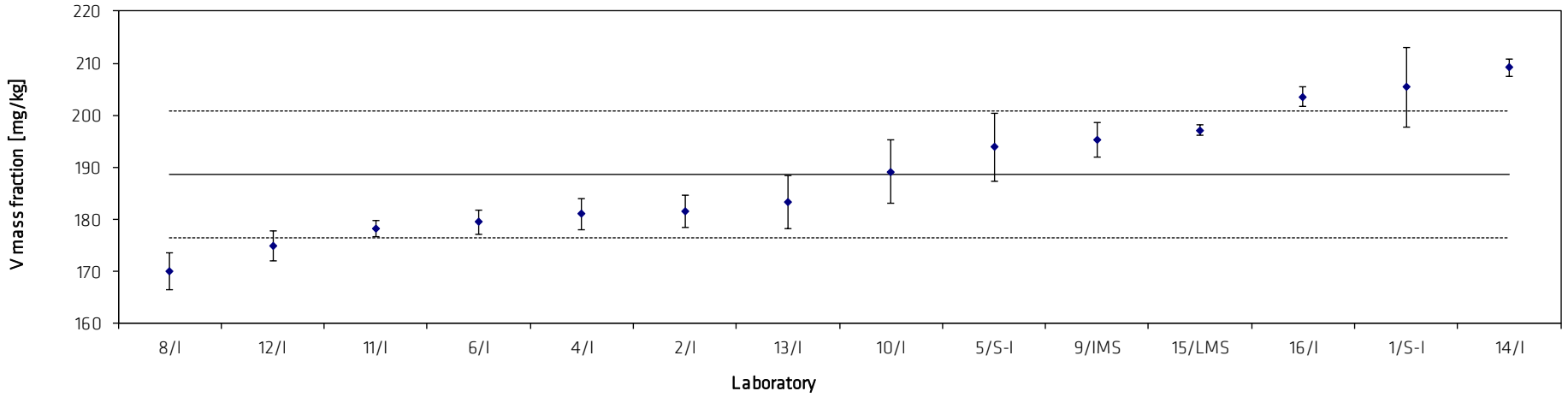


Table 28: Results for Zn

Lab./Meth.	8/I	15/LMS	10/I	4/I	12/I	13/I	2/I	5/S-I	6/I	9/IMS	14/I	11/I	1/S-I	15/RFA	16/I	3/I		
$M_{i\,l}$ [mg/kg]	126	145.2	139.0	140	148.8	150	153	160.9	157.0	157.4	160.5	159.5	159.6	168.7	178.6	176.1		*n*
	125	149.0	152.0	147	151.3	150	156	155.1	158.3	159.3	161.0	159.2	166.0	167.9	167.8	173.4		15
	129	138.0	145.8	152	153.0	160	153	150.3	154.9	156.3	159.9	162.1	165.4	168.7	166.3	174.8		
	123	134.8	148.2	151	150.9	150	152	155.7	154.8	156.0		163.2	170.0	167.9	170.4	171.6		
	130	136.1	145.8	151	149.0	160	155	151.9	153.7	154.7		164.0	166.5	167.9		176.5		
	129	134.0	144.7	155	148.7	150	157	158.0	156.1	151.9		165.0	161.6	168.7		174.1		
M [mg/kg]	**127.0**	**139.5**	**145.9**	**149.3**	**150.3**	**153.3**	**154.3**	**155.3**	**155.8**	**155.9**	**160.5**	**162.2**	**164.9**	**168.3**	**170.7**	**174.4**		**157.4**
s [%]	2.8	6.1	4.3	5.2	1.7	5.2	2.0	3.9	1.7	2.5	0.6	2.4	3.7	0.4	5.5	1.8	s_M [mg/kg]	9.6
																	$\bar{s}_i$ [mg/kg]	3.6
s_{rel}	0.0217	0.0439	0.0293	0.0351	0.0115	0.0337	0.0127	0.0251	0.0107	0.0161	0.0035	0.0147	0.0225	0.0026	0.0321	0.0103		0.0607

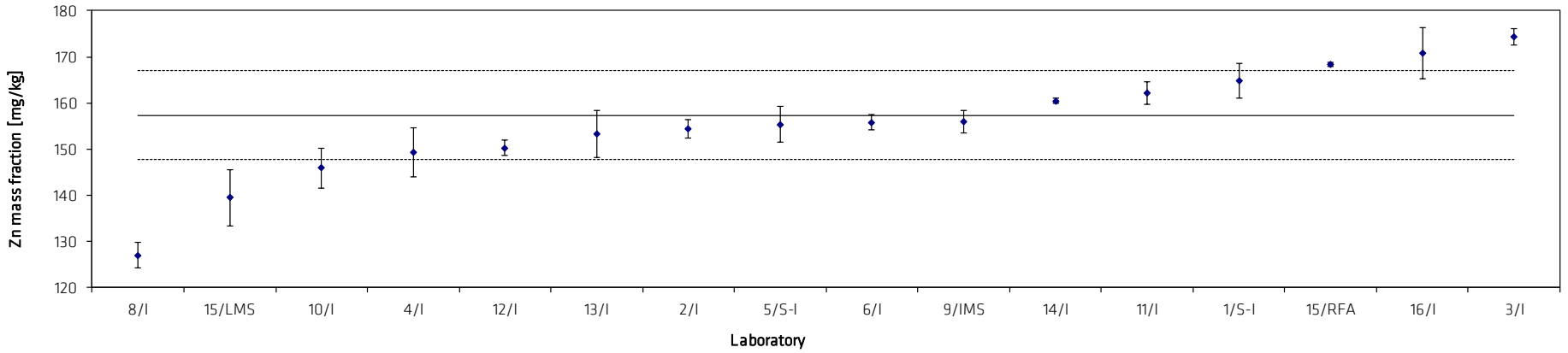
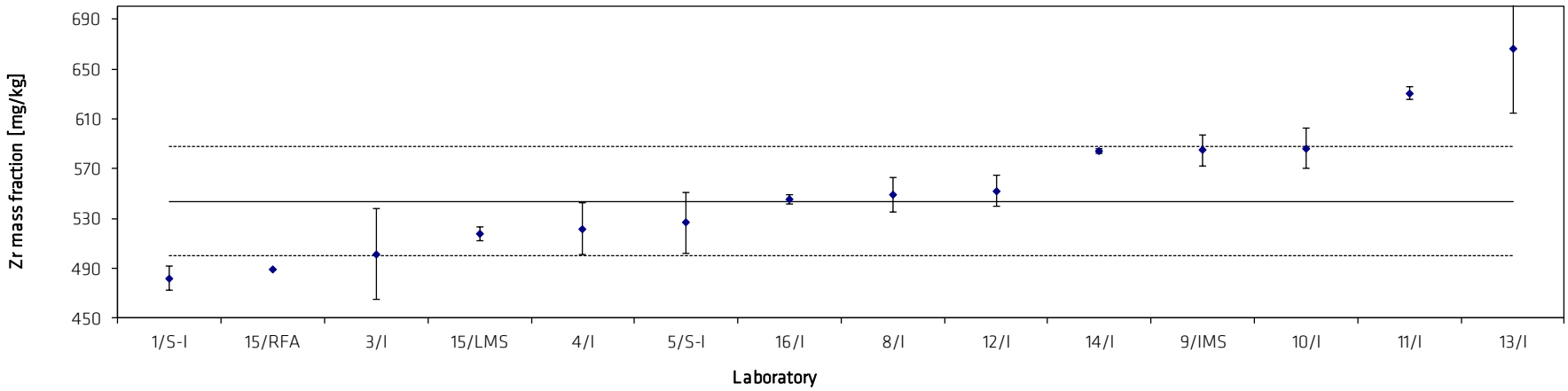


Table 29: Results for Zr

Lab./Meth.	1/S-I	15/RFA	3/I	15/LMS	4/I	5/S-I	16/I	8/I	12/I	14/I	9/IMS	10/I	11/I	13/I		
$M_{i\,[}$mg/kg]	486.2	488.6	490.6	513.2	508	498.5	549.1	551	562.7	585	585.3	559.8	625.2	700		*n*
	485.9	488.6	452.7	514.3	551	536.3	542.1	536	562.7	582	605.4	611.3	624.2	600		13
	489.7	488.6	471.6	526.8	536	513.9	544.7	549	564.0	585	588.9	585.4	633.2	700		
	475.0	488.6	549.4	514.3	491	557.8		531	542.8		584.3	584.6	636.4	700		
	465.3	488.6	512.7	522.0	519	548.3		569	538.2		569.7	586.5	633.7	700		
	489.4	488.6	531.1	514.2	525	505.1		558	542.2		575.4	590.5	631.3	600		
***M* [mg/kg]**	**481.9**	**488.6**	**501.3**	**517.5**	**521.7**	**526.7**	**545.3**	**549.0**	**552.1**	**584.0**	**584.8**	**586.3**	**630.7**	**666.7**		**543.8**
s [%]	9.7	0.0	36.6	5.6	21.0	24.3	3.6	14.0	12.2	1.7	12.3	16.4	4.9	51.6	s_M [mg/kg]	43.7
															$\bar{s}_i$ [mg/kg]	15.9
s_{rel}	0.0202	0.0000	0.0729	0.0108	0.0403	0.0461	0.0065	0.0255	0.0221	0.0030	0.0211	0.0280	0.0078	0.0775		0.0803



The statistical evaluation of the data was performed using the software program BAM-ecerto [4]. The Cochran-test was only performed once. The following results were obtained:

Tab. 30: Outcome of statistical tests on the results obtained for Al

	1st run	2nd run
Number of data sets	14	13
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 12	---
Nalimov (α = 0.01)	Lab. 12	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	Lab. 12	Lab. 4
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outlier (Lab. 12, 1st run) was removed.

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

	1st run	2nd run
Number of data sets	15	13
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 4	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 4	---
Nalimov (α = 0.01)	Lab. 4	---
Grubbs (α = 0.05)	Lab. 4	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	Labs. 4 and 12	---
Grubbs Pair (α = 0.01)	Labs. 4 and 12	---
Cochran (α = 0.01)	Lab. 1	Lab. 1
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers (Labs. 4 and 12, 1st run) were removed.

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

	1st run	2nd run
Number of data sets	15	14
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 10	---
Dixon (α = 0.01)	Lab. 10	---
Nalimov (α = 0.05)	Lab. 10	---
Nalimov (α = 0.01)	Lab. 10	---
Grubbs (α = 0.05)	Lab. 10	---
Grubbs (α = 0.01)	Lab. 10	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	Labs. 10 and 8	---
Cochran (α = 0.01)	Lab. 4	Lab. 4
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outlier (Lab. 10, 1st run) was removed.

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

	1st run	2nd run
Number of data sets	15	11
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 10	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 10	Lab. 11
Nalimov (α = 0.01)	Lab. 10	---
Grubbs (α = 0.05)	Lab. 10	---
Grubbs (α = 0.01)	Lab. 10	---
Grubbs Pair (α = 0.05)	Labs. 10 and 4	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	Lab. 4	---
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outlier (Lab. 10, 1st run) was removed.

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

	1st run	2nd run
Number of data sets	14	11
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 4	Labs. 2
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 4	Labs. 2
Nalimov (α = 0.01)	Lab. 4	Labs. 2
Grubbs (α = 0.05)	---	Labs. 2
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	Labs. 4 and 10	---
Grubbs Pair (α = 0.01)	Labs. 4 and 10	---
Cochran (α = 0.01)	Lab. 12	Lab. 5
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers (Labs. 4, 10 and 12, 1st run) were removed.

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

	Si	As
Number of data sets	10	14
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 9	---
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	Lab. 5	Lab. 4
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers were not removed.

Tab. 36: Outcome of statistical tests on the results obtained for Ba and Cd

	Ba	Cd
Number of data sets	15	15
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	---	Lab. 8
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	Lab. 13	---
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers were not removed.

Tab. 37: Outcome of statistical tests on the results obtained for Co and Cu

	Co	Cu
Number of data sets	15	15
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 16	---
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	---	Lab. 13
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers were not removed.

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

	1st run	2nd run
Number of data sets	12	11
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	Lab. 14
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 16	Lab. 14
Nalimov (α = 0.01)	---	Lab. 14
Grubbs (α = 0.05)	---	Lab. 14
Grubbs (α = 0.01)	---	Lab. 14
Grubbs Pair (α = 0.05)	---	Labs. 14 and 5
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	Lab. 1	Lab. 2
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The data of Labs. 14 and 16 were removed for technical reasons.

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

	1st run	2nd run
Number of data sets	16	15
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 1	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 1	Lab. 14
Nalimov (α = 0.01)	Lab. 1	---
Grubbs (α = 0.05)	Lab. 1	---
Grubbs (α = 0.01)	Lab. 1	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	Lab. 13	Lab. 13
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

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

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

	1st run	2nd run
Number of data sets	17	15
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 1	---
Dixon (α = 0.01)	Lab. 1	---
Nalimov (α = 0.05)	Lab. 1	Lab.3
Nalimov (α = 0.01)	Lab. 1	Lab.3
Grubbs (α = 0.05)	Lab. 1	Lab.3
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	Labs. 1 and 8	---
Grubbs Pair (α = 0.01)	Labs. 1 and 8	---
Cochran (α = 0.01)	Lab. 15	Lab. 15
Kolmogorov-Smirnov-Lilliefors Test	Distribution: not normal	Distribution: normal

The outliers (Labs. 1, 8 and 3) were removed.

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

	1st run	2nd run
Number of data sets	16	15
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 11	---
Dixon (α = 0.01)	Lab. 11	---
Nalimov (α = 0.05)	Lab. 11	Lab. 15
Nalimov (α = 0.01)	Lab. 11	---
Grubbs (α = 0.05)	Lab. 11	---
Grubbs (α = 0.01)	Lab. 11	---
Grubbs Pair (α = 0.05)	Labs. 11 and 15	---
Grubbs Pair (α = 0.01)	Labs. 11 and 15	---
Cochran (α = 0.01)	Lab. 13	Lab. 13
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outlier (Lab. 11) was removed.

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

	1st run	2nd run
Number of data sets	14	13
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 1	Lab. 8
Dixon (α = 0.01)	Lab. 1	---
Nalimov (α = 0.05)	Lab. 1	Lab. 8
Nalimov (α = 0.01)	Lab. 1	Lab. 8
Grubbs (α = 0.05)	Lab. 1	Lab. 8
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	Labs. 1 and 15	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	Lab. 1	Lab. 5
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers (Lab. 1, 1st run and Lab. 8, 2nd run) were removed.

Tab. 43: Outcome of statistical tests on the results obtained for Ni and P

	Ni	P
Number of data sets	15	9
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 8	---
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	Lab. 7	Lab. 3
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers were not removed.

Tab. 44: Outcome of statistical tests on the results obtained for Pb and Sn

	Pb	Sn
Number of data sets	17	13
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 8	---
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	---	Lab. 13
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers were not removed.

Tab. 45: Outcome of statistical tests on the results obtained for Sb

	1st run	2nd run
Number of data sets	14	13
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 1	---
Dixon (α = 0.01)	Lab. 1	---
Nalimov (α = 0.05)	Lab. 1	Lab. 8
Nalimov (α = 0.01)	Lab. 1	---
Grubbs (α = 0.05)	Lab. 1	---
Grubbs (α = 0.01)	Lab. 1	---
Grubbs Pair (α = 0.05)	Labs. 1 and 14	---
Grubbs Pair (α = 0.01)	Labs. 1 and 14	---
Cochran (α = 0.01)	Lab. 13	Lab. 13
Kolmogorov-Smirnov-Lilliefors Test	Distribution: not normal	Distribution: normal

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

Tab. 46: Outcome of statistical tests on the results obtained for Se

	1st run	2nd run
Number of data sets	9	8
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	Lab. 11	---
Dixon (α = 0.01)	Lab. 11	---
Nalimov (α = 0.05)	Lab. 11	---
Nalimov (α = 0.01)	Lab. 11	---
Grubbs (α = 0.05)	Lab. 11	---
Grubbs (α = 0.01)	Lab. 11	---
Grubbs Pair (α = 0.05)	Labs. 11 and 14	---
Grubbs Pair (α = 0.01)	Labs. 11 and 14	---
Cochran (α = 0.01)	Lab. 4	Lab. 4
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

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

Tab. 47: Outcome of statistical tests on the results obtained for Sr and V

	Sr	V
Number of data sets	14	14
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 13	---
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	Lab. 1	---
Kolmogorov-Smirnov-Lilliefors Test	Distribution: normal	Distribution: normal

The outliers were not removed.

Tab. 48: Outcome of statistical tests on the results obtained for Ti

	1st run	2nd run
Number of data sets	14	13
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 3	Lab. 14
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	Lab. 5	Lab. 5
Kolmogorov-Smirnov-Lilliefors Test	Distribution: not normal	Distribution: normal

The outlier (Lab. 3, 1st run) was removed.

Tab. 49: Outcome of statistical tests on the results obtained for Zn

	1st run	2nd run
Number of data sets	16	15
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 8	Lab. 15
Nalimov (α = 0.01)	Lab. 8	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	---	---
Kolmogorov-Smirnov-Lilliefors Test	Distribution: not normal	Distribution: normal

The outlier (Lab. 8, 1st run) was removed.

Tab. 50: Outcome of statistical tests on the results obtained for Zr

	1st run	2nd run
Number of data sets	14	13
Scheffe's test (data compatible?)	yes	yes
Snedecor-F-Test and Bartlett-Test	Pooling not allowed	Pooling not allowed
Dixon (α = 0.05)	---	---
Dixon (α = 0.01)	---	---
Nalimov (α = 0.05)	Lab. 13	Lab. 11
Nalimov (α = 0.01)	---	---
Grubbs (α = 0.05)	---	---
Grubbs (α = 0.01)	---	---
Grubbs Pair (α = 0.05)	---	---
Grubbs Pair (α = 0.01)	---	---
Cochran (α = 0.01)	Lab. 13	Lab. 3
Kolmogorov-Smirnov-Lilliefors Test	Distribution: not normal	Distribution: normal

The outlier (Lab. 13, 1st run) was removed.

The certified mass fractions of all elements were calculated as mean of the accepted data sets. These values are given in Table 51. The mass fractions of P and Se are given for information only because the spread of results was too wide. In addition, one laboratory determined Ag and Li and two laboratories B. These elements are also mentioned on the certificate.
The resp. combined uncertainties were calculated from the spread resulting from the certification interlaboratory comparison (u_{ilc}) and the uncertainty contribution from possible inhomogeneity over the length (s_{eff}) of the material using Equation 2.

$$u_c = \sqrt{u_{ilc}^2 + s_{eff}^2} \qquad (2)$$

with

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

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

Table 50: Uncertainty calculation

		uncertainty contribution from							s_{eff} (rel)	
	M	n	s_M	u_{ilc}	s_{eff} Length	u (comb)	U		Length	
	%		%	%	%	%	%			
Al	0.5870	13	0.0239	0.0066	0.0059	0.0089	0.01774		1.0040	
Ca	7.4290	13	0.1031	0.0286	0.0495	0.0572	0.11438		0.6667	
K	0.5950	14	0.0187	0.0050	0.0042	0.0065	0.01307		0.7077	
Mg	1.3740	14	0.0373	0.0100	0.0117	0.0153	0.03068		0.8488	
Na	10.3260	11	0.1783	0.0538	0.1069	0.1197	0.23934		1.0354	
Si	33.1000	10	0.2810	0.0889	0.2214	0.2385	0.47708		0.6688	
	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg			
As	80.5400	14	6.6215	1.7697	0.8054	1.9443	3.88865		1.0000	*
Ba	101.9000	15	7.1800	1.8539	0.2534	1.8711	3.74222		0.2487	
Cd	46.8700	15	4.5200	1.1671	1.4673	1.8748	3.74968		3.1306	
Ce	79.8100	10	6.6100	2.0903	0.7981	2.2374	4.47490		1.0000	*
Co	33.2300	15	3.4300	0.8856	0.3323	0.9459	1.89182		1.0000	**
Cr	10.7700	15	1.5710	0.4056	0.2110	0.4572	0.91444		1.9590	
Cu	85.5800	15	8.0000	2.0656	0.8506	2.2339	4.46778		0.9940	
Fe	295.10	14	8.90	2.3786	2.0651	3.1500	6.3000		0.6998	
Mn	69.62	15	4.01	1.0354	0.6962	1.2477	2.4954		1.0000	**
Mo	215.40	12	9.30	2.6847	1.9784	3.3349	6.6699		0.9185	
Ni	41.33	15	2.75	0.7100	0.4133	0.8216	1.6431		1.0000	**
P	8.30	9	3.74	1.2467	0.0830	1.2494	2.4989		1.0000	*
Pb	181.80	17	12.50	3.0317	2.4343	3.8881	7.7761		1.3390	
Sb	102.80	13	5.90	1.6364	1.1337	1.9907	3.9814		1.1028	
Se	2.50	8	1.04	0.3689	0.0250	0.3697	0.7394		1.0000	*
Sn	72.85	13	3.15	0.8737	0.7285	1.1375	2.2751		1.0000	*
Sr	133.50	14	10.30	2.7528	1.1478	2.9825	5.9650		0.8598	
Ti	101.20	13	8.50	2.3575	1.3991	2.7414	5.4828		1.3825	
V	188.70	14	12.20	3.2606	1.5913	3.6282	7.2564		0.8433	
Zn	157.40	15	9.60	2.4787	1.3209	2.8087	5.6174		0.8392	
Zr	543.80	13	43.70	12.1202	4.0948	12.7932	25.5865		0.7530	
						*estimated from other elements				
						**estimated because Std.-deviation of method				
						higher than Std.-deviation from samples				

The expanded uncertainties U are calculated by multiplication of u_{combined} with a coverage factor of k = 2 using Equation 3.

$$U = k \cdot u_{\text{combined}} \qquad (3)$$

The calculated mass fractions and their resp. expanded uncertainties are given on Page 3 of this report. Rounding was done according to DIN 1333 [5]. The figures in brackets (Page 3) were calculated using the molar masses of the elements.

6. Instructions for users and stability

The certified reference material BAM-S005c is intended for the calibration and quality control of X-ray fluorescence spectrometers used for the analysis of similar materials. It is also suitable for validation and quality control of wet chemical analysis methods.
The surface of the material should be cleaned carefully before analysis.
For wet chemical analysis, a minimum sample intake of 0.2 g has to be used.
The material will remain stable provided that it is not subjected to excessive heat or X-Ray radiation over long time. It should be stored in a dry and clean environment at room temperature.

7. Metrological Traceability

To ensure traceability of the certified mass fractions to the SI (Système International d'Unités) calibration for most of the data sets was performed using standard solutions prepared from pure metals or stoichiometric compounds or well checked commercial calibration solutions. Some of the datasets are traceable to other certified reference materials or reference materials (e.g. BAM-S005a/b).

8. Information on and purchase of the CRM

Certified reference material BAM-S005c is supplied by

Bundesanstalt für Materialforschung und -prüfung (BAM)
Division 1.6 „Inorganic Reference Materials"
Richard-Willstätter-Str. 11, D-12489 Berlin, Germany
Phone +49 (0)30 - 8104 2061
Fax: +49 (0)30 – 8104 72061
E-Mail: sales.crm@bam.de

Each disc of BAM-S005c will be distributed together with a detailed certificate containing the certified values and their uncertainties, the mean values and standard deviations of all accepted data sets and information on the analytical methods used and the names of the participating laboratories.
Information on certified reference materials can be obtained from BAM:
https://www.bam.de.
Tel. +49 30 8104 1111.

9. References

[1] DIN EN ISO 17034, General requirements for the competence of reference material producers, 2016

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

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

[4] Lisec, J.: BAM ecerto Softwaretool (BAM 2019)

[5] DIN 1333:1992-02 Zahlenangaben

Annex 1: Calculation of uncertainty contribution of potential inhomogeneity (data corrected for drift)

Sample name (1-4	Meas. date/time	F	Al	Al Korr	Ca	Ca korr	Cd	Cd korr	Co	Co korr	Cr	Cr korr	Cu	Cu korr
			Al1		Ca		Cd		Co1		Cr1		Cu1	
			(%)		(%)		(%)		(%)		(%)		(%)	
220016-1	16.05.2018 15:00	K	0.6099	0.6099	7.4697	7.4697	0.0064	0.0064	0.006	0.006	0.0028	0.0028	0.0116	0.0116
220016-3 4,6mm	16.05.2018 15:20	K	0.6134	0.6134	7.4834	7.4834	0.0068	0.0068	0.006	0.006	0.003	0.003	0.0114	0.0114
220016-4 4mm	16.05.2018 15:39	K	0.6069	0.6069	7.4852	7.4852	0.0062	0.0062	0.0062	0.0062	0.003	0.003	0.0113	0.0113
220016-5	16.05.2018 15:58	K	0.6085	0.6085	7.4781	7.4781	0.0064	0.0064	0.0061	0.0061	0.0029	0.0029	0.0112	0.0112
220016-6 4mm	16.05.2018 16:18	K	0.6134	0.6134	7.4852	7.4852	0.0063	0.0063	0.006	0.006	0.003	0.003	0.0114	0.0114
220016-6 5mm	16.05.2018 16:56	K	0.613	0.613	7.4806	7.4806	0.0067	0.0067	0.0061	0.0061	0.003	0.003	0.0116	0.0116
220016-7	16.05.2018 17:16	K	0.6094	0.6094	7.4862	7.4862	0.0066	0.0066	0.0058	0.0058	0.0029	0.0029	0.0118	0.0118
220016-8	16.05.2018 17:35	K	0.6188	0.6188	7.4798	7.4798	0.0067	0.0067	0.006	0.006	0.003	0.003	0.0116	0.0116
220616-5/1 Drift	16.05.2018 17:55	K	0.6083	0.6083	7.3996	7.3996	0.0067	0.0067	0.0061	0.0061	0.0031	0.0031	0.0114	0.0114
220616-5/1 Drift	16.05.2018 16:37	K	0.6065	0.6065	7.4072	7.4072	0.0065	0.0065	0.0062	0.0062	0.003	0.003	0.0111	0.0111
220616-5/1 Drift	16.05.2018 14:21	K	0.6092	0.6092	7.4125	7.4125	0.0064	0.0064	0.0059	0.0059	0.0028	0.0028	0.0112	0.0112
220616-5-1 Drift	16.05.2018 12:05	K	0.608	0.608	7.4048	7.4048	0.0066	0.0066	0.006	0.006	0.003	0.003	0.0111	0.0111
220616-5-1 Drift	16.05.2018 11:47	K	0.6072	0.6072	7.4073	7.4073	0.0067	0.0067	0.006	0.006	0.0031	0.0031	0.0111	0.0111
220616-5-1 Drift	16.05.2018 11:28	K	0.6078	0.6078	7.4008	7.4008	0.0066	0.0066	0.0058	0.0058	0.0029	0.0029	0.0111	0.0111
220616-5-1 Drift	16.05.2018 11:09	K	0.608	0.608	7.4146	7.4146	0.0067	0.0067	0.0058	0.0058	0.0028	0.0028	0.0111	0.0111
220616-5-1 Drift	16.05.2018 10:50	K	0.6086	0.6086	7.4074	7.4074	0.0066	0.0066	0.006	0.006	0.0029	0.0029	0.0112	0.0112
220616-5-1 Drift	16.05.2018 10:32	K	0.6086	0.6086	7.4062	7.4062	0.0063	0.0063	0.0058	0.0058	0.0029	0.0029	0.0113	0.0113
220616-5-1 Drift	16.05.2018 10:13	K	0.6075	0.6075	7.4103	7.4103	0.0065	0.0065	0.0058	0.0058	0.0029	0.0029	0.0113	0.0113
220616-5-1 Drift	16.05.2018 09:54	K	0.6088	0.6088	7.408	7.408	0.0067	0.0067	0.006	0.006	0.003	0.003	0.0112	0.0112
220616-5-1 Drift	16.05.2018 09:35	K	0.6088	0.6088	7.4147	7.4147	0.0068	0.0068	0.0058	0.0058	0.0028	0.0028	0.0114	0.0114
220616-5-1 Drift	16.05.2018 09:17	K	0.6085	0.6085	7.4144	7.4144	0.0066	0.0066	0.0061	0.0061	0.003	0.003	0.0113	0.0113
220616-5-1 Drift	16.05.2018 08:53	K	0.6085	0.6085	7.4212	7.4212	0.0073	0.0073	0.0062	0.0062	0.003	0.003	0.0114	0.0114
290616-2-1	16.05.2018 12:25	K	0.608	0.608	7.4848	7.4848	0.0066	0.0066	0.006	0.006	0.0031	0.0031	0.0115	0.0115
290616-3-1	16.05.2018 12:44	K	0.6064	0.6064	7.4892	7.4892	0.0065	0.0065	0.0062	0.0062	0.0033	0.0033	0.0116	0.0116
290616-4-1	16.05.2018 13:04	K	0.6111	0.6111	7.4922	7.4922	0.0065	0.0065	0.0059	0.0059	0.0031	0.0031	0.0114	0.0114
290616-6-1	16.05.2018 13:23	K	0.6043	0.6043	7.4809	7.4809	0.0068	0.0068	0.0061	0.0061	0.0031	0.0031	0.0116	0.0116
290616-7-1	16.05.2018 13:43	K	0.6153	0.6153	7.4761	7.4761	0.0069	0.0069	0.006	0.006	0.0029	0.0029	0.0117	0.0117
290616-8-1	16.05.2018 14:02	K	0.6084	0.6084	7.4832	7.4832	0.0065	0.0065	0.0061	0.0061	0.003	0.003	0.0116	0.0116
290616-8-2	16.05.2018 14:41	K	0.6179	0.6179	7.4856	7.4856	0.0066	0.0066	0.006	0.006	0.003	0.003	0.0116	0.0116
22-06-2016-5-1	12.10.2016 08:07	K	0.6264	0.6046	7.4619	7.3656	0.0059	0.0063	0.0057	0.0057	0.003	0.0030	0.0112	0.0112
220616-5-1 Drift	12.10.2016 09:06	K	0.6273	0.6054	7.4755	7.3790	0.0061	0.0065	0.0056	0.0056	0.0028	0.0028	0.0112	0.0112
220616-5-1 Drift	12.10.2016 09:25	K	0.6285	0.6066	7.4816	7.3850	0.0061	0.0065	0.0062	0.0062	0.003	0.0030	0.0111	0.0111
220616-5-1 Drift	12.10.2016 09:43	K	0.6295	0.6076	7.4906	7.3939	0.0063	0.0067	0.0059	0.0059	0.0028	0.0028	0.0112	0.0112
220616-5-1 Drift	12.10.2016 10:02	K	0.6298	0.6079	7.4986	7.4018	0.006	0.0064	0.0058	0.0058	0.003	0.0030	0.0113	0.0113
220616-5-1 Drift	12.10.2016 10:21	K	0.6299	0.6080	7.5092	7.4123	0.0062	0.0066	0.0059	0.0059	0.003	0.0030	0.0112	0.0112
220616-5-1 Drift	12.10.2016 10:40	K	0.63	0.6080	7.5214	7.4243	0.0063	0.0067	0.0058	0.0058	0.0029	0.0029	0.0113	0.0113
220616-5-1 Drift	12.10.2016 10:58	K	0.6314	0.6094	7.5164	7.4194	0.0061	0.0065	0.006	0.0060	0.003	0.0030	0.0112	0.0112
220616-5-1 Drift	12.10.2016 11:17	K	0.6321	0.6101	7.5228	7.4257	0.0063	0.0067	0.0061	0.0061	0.003	0.0030	0.0113	0.0113
220616-5-1 Drift	12.10.2016 11:36	K	0.6309	0.6089	7.5214	7.4243	0.0063	0.0067	0.0062	0.0062	0.003	0.0030	0.0112	0.0112
220616-5-1 Drift	12.10.2016 11:55	K	0.6318	0.6098	7.5236	7.4265	0.0064	0.0068	0.006	0.0060	0.0028	0.0028	0.0113	0.0113
220616-1-1	12.10.2016 12:14		0.6379	0.6157	7.5443	7.4469	0.0062	0.0066	0.0059	0.0059	0.003	0.0030	0.0114	0.0114
220616-1-2	12.10.2016 12:34	K	0.6474	0.6248	7.6821	7.5829	0.0064	0.0068	0.006	0.0060	0.0027	0.0027	0.0117	0.0117
220616-9-1	12.10.2016 12:53	K	0.6383	0.6161	7.5834	7.4855	0.0061	0.0065	0.0062	0.0062	0.0031	0.0031	0.0114	0.0114
220616-9-2	12.10.2016 13:12	K	0.638	0.6158	7.6906	7.5913	0.0059	0.0063	0.0061	0.0061	0.0032	0.0032	0.0117	0.0117
290616-1-1	12.10.2016 13:32	K	0.644	0.6216	7.6818	7.5826	0.0067	0.0072	0.0061	0.0061	0.0029	0.0029	0.0116	0.0116
220616-5-1 Drift	12.10.2016 13:51	K	0.634	0.6119	7.5383	7.4410	0.0067	0.0072	0.0061	0.0061	0.003	0.0030	0.0112	0.0112
290616-1-2	12.10.2016 14:11	K	0.6384	0.6162	7.6944	7.5951	0.007	0.0075	0.0061	0.0061	0.0031	0.0031	0.0117	0.0117
290616-2-1	12.10.2016 14:30	K	0.6362	0.6140	7.6816	7.5824	0.0064	0.0068	0.006	0.0060	0.0029	0.0029	0.0119	0.0119
290616-2-2	12.10.2016 14:49	K	0.6487	0.6261	7.6868	7.5876	0.0064	0.0068	0.0061	0.0061	0.003	0.0030	0.0117	0.0117
290616-3-1	12.10.2016 15:09	K	0.6375	0.6153	7.6803	7.5812	0.0062	0.0066	0.0062	0.0062	0.0031	0.0031	0.0117	0.0117
290616-3-2	12.10.2016 15:28	K	0.6463	0.6238	7.6796	7.5805	0.0067	0.0072	0.006	0.0060	0.0031	0.0031	0.0118	0.0118
220616-5-1 Drift	12.10.2016 15:48	K	0.6338	0.6117	7.5436	7.4462	0.0064	0.0068	0.0061	0.0061	0.003	0.0030	0.0112	0.0112
290616-4-1	12.10.2016 16:07	K	0.6426	0.6202	7.6933	7.5940	0.0067	0.0072	0.0062	0.0062	0.003	0.0030	0.0116	0.0116
290616-4-2	12.10.2016 16:26	K	0.642	0.6196	7.6789	7.5798	0.0066	0.0071	0.006	0.0060	0.0031	0.0031	0.0117	0.0117
290616-5-1	12.10.2016 16:46	K	0.6391	0.6168	7.5885	7.4905	0.0062	0.0066	0.0058	0.0058	0.003	0.0030	0.0114	0.0114
290616-5-2	12.10.2016 17:05	K	0.6444	0.6219	7.6746	7.5755	0.0067	0.0072	0.0062	0.0062	0.003	0.0030	0.0116	0.0116
290616-5-3	12.10.2016 17:25	K	0.6422	0.6198	7.6836	7.5844	0.0066	0.0071	0.0059	0.0059	0.0029	0.0029	0.0115	0.0115
220616-5-1 Drift	12.10.2016 17:44	K	0.6334	0.6113	7.5417	7.4443	0.0063	0.0067	0.006	0.0060	0.0028	0.0028	0.0114	0.0114
290616-6-1	12.10.2016 18:03	K	0.6376	0.6154	7.6837	7.5845	0.0066	0.0071	0.0061	0.0061	0.003	0.0030	0.0116	0.0116
290616-6-2	12.10.2016 18:23	K	0.6458	0.6233	7.6792	7.5801	0.0063	0.0067	0.0062	0.0062	0.003	0.0030	0.0116	0.0116
290616-7-1	12.10.2016 18:42	K	0.646	0.6235	7.6369	7.5383	0.0062	0.0066	0.0062	0.0062	0.0032	0.0032	0.0116	0.0116
290616-7-2	12.10.2016 19:02	K	0.6399	0.6176	7.6792	7.5801	0.0062	0.0066	0.0062	0.0062	0.0029	0.0029	0.0117	0.0117
290616-8-1	12.10.2016 19:21	K	0.6432	0.6208	7.6795	7.5804	0.0062	0.0066	0.0059	0.0059	0.0029	0.0029	0.0118	0.0118
220616-5-1 Drift	12.10.2016 19:40	K	0.6335	0.6114	7.5346	7.4373	0.0066	0.0071	0.0062	0.0062	0.0032	0.0032	0.0112	0.0112
290616-8-2	12.10.2016 20:00	K	0.6496	0.6270	7.6727	7.5737	0.0061	0.0065	0.006	0.0060	0.0031	0.0031	0.0118	0.0118
290616-9-1	12.10.2016 20:19	K	0.6519	0.6292	7.6789	7.5798	0.0064	0.0068	0.006	0.0060	0.0029	0.0029	0.0117	0.0117
290616-9-2	12.10.2016 20:38	K	0.6463	0.6238	7.6902	7.5909	0.006	0.0064	0.0059	0.0059	0.0029	0.0029	0.0118	0.0118
220616-5-1 Drift	12.10.2016 20:58	K	0.6328	0.6108	7.5255	7.4284	0.0064	0.0068	0.006	0.0060	0.003	0.0030	0.0113	0.0113
		F	1.03610162		1.01307773		0.93483871		0.99760479		0.99563107		1.00012723	
			Mittelwert Ko	0.6167		7.5339		0.0067		0.0061		0.0030		0.0116
			Min. Konzentr	0.6043		7.4469		0.0062		0.0058		0.0027		0.0112
			Max. Konzent	0.6292		7.5951		0.0075		0.0062		0.0033		0.0119
			RMS Konzentr	0.0063		0.0517		0.0003		0.0001		0.0001		0.0002
			RMS rel. Konz	1.0188		0.6864		4.2804		1.9279		3.8316		1.3340
			Verwendet fü	37		37		37		37		37		37
			Mittelwert Ko	0.6082		7.4092		0.0066		0.0060		0.0029		0.0112
			Min. Konzentr	0.6054		7.3790		0.0063		0.0056		0.0028		0.0111
			Max. Konzent	0.6101		7.4265		0.0073		0.0062		0.0031		0.0114
			RMS Konzentr	0.0011		0.0121		0.0002		0.0002		0.0001		0.0001
			RMS rel. Konz	0.1734		0.1634		2.9190		2.7499		3.2930		0.8897
			Verwendet fü	24		24		24		24		24		24
			s_{eff}, rel.	1.00394086		0.66670496		3.13063349		#ZAHL!		1.95899443		0.99396808
			Al	Al Korr	Ca	Ca korr	Cd	Cd korr	Co	Co korr	Cr	Cr korr	Cu	Cu korr

Sample name (1-4	Meas. date/time	F	Fe	Fe korr	K	K Korr	Mg	Mg Korr	Mn	Mn korr	Mo	Mo korr	Na	Na korr	Ni	Ni korr
			Fe1		K		Mg		Mn1		Mo1		Na		Ni1	
			(%)		(%)		(%)		(%)		(%)		(%)		(%)	
220016-1	16.05.2018 15:00	K	0.0335	0.0335	0.6518	0.6518	1.4072	1.4072	0.0092	0.0092	0.0225	0.0225	9.917	9.917	0.0062	0.0062
220016-3 4,6mm	16.05.2018 15:20	K	0.0338	0.0338	0.6546	0.6546	1.4099	1.4099	0.009	0.009	0.0228	0.0228	9.9225	9.9225	0.0061	0.0061
220016-4 4mm	16.05.2018 15:39	K	0.0335	0.0335	0.6496	0.6496	1.413	1.413	0.0095	0.0095	0.0227	0.0227	9.9896	9.9896	0.0061	0.0061
220016-5	16.05.2018 15:58	K	0.0335	0.0335	0.6569	0.6569	1.4111	1.4111	0.009	0.009	0.0228	0.0228	9.9872	9.9872	0.006	0.006
220016-6 4mm	16.05.2018 16:18	K	0.0337	0.0337	0.6489	0.6489	1.4123	1.4123	0.009	0.009	0.0228	0.0228	9.9217	9.9217	0.006	0.006
220016-6 5mm	16.05.2018 16:56	K	0.0337	0.0337	0.65	0.65	1.41	1.41	0.0092	0.0092	0.0228	0.0228	9.9913	9.9913	0.006	0.006
220016-7	16.05.2018 17:16	K	0.0337	0.0337	0.6522	0.6522	1.4081	1.4081	0.0091	0.0091	0.0228	0.0228	9.9647	9.9647	0.0059	0.0059
220016-8	16.05.2018 17:35	K	0.0338	0.0338	0.6511	0.6511	1.4088	1.4088	0.0091	0.0091	0.0225	0.0225	9.8724	9.8724	0.0061	0.0061
220616-5/1 Drift	16.05.2018 17:55	K	0.0331	0.0331	0.6518	0.6518	1.3844	1.3844	0.0089	0.0089	0.0225	0.0225	9.5588	9.5588	0.006	0.006
220616-5/1 Drift	16.05.2018 16:37	K	0.0332	0.0332	0.6443	0.6443	1.3853	1.3853	0.0091	0.0091	0.0225	0.0225	9.5494	9.5494	0.006	0.006
220616-5/1 Drift	16.05.2018 14:21	K	0.0333	0.0333	0.6431	0.6431	1.3845	1.3845	0.009	0.009	0.0225	0.0225	9.5533	9.5533	0.006	0.006
220616-5-1 Drift	16.05.2018 12:05	K	0.0332	0.0332	0.6478	0.6478	1.3887	1.3887	0.0089	0.0089	0.0225	0.0225	9.5752	9.5752	0.0059	0.0059
220616-5-1 Drift	16.05.2018 11:47	K	0.033	0.033	0.6458	0.6458	1.3864	1.3864	0.0091	0.0091	0.0225	0.0225	9.5726	9.5726	0.0057	0.0057
220616-5-1 Drift	16.05.2018 11:28	K	0.0332	0.0332	0.6453	0.6453	1.3891	1.3891	0.0088	0.0088	0.0225	0.0225	9.5531	9.5531	0.0059	0.0059
220616-5-1 Drift	16.05.2018 11:09	K	0.0333	0.0333	0.6455	0.6455	1.3871	1.3871	0.0088	0.0088	0.0226	0.0226	9.5641	9.5641	0.006	0.006
220616-5-1 Drift	16.05.2018 10:50	K	0.0331	0.0331	0.6475	0.6475	1.3872	1.3872	0.0089	0.0089	0.0225	0.0225	9.5629	9.5629	0.0061	0.0061
220616-5-1 Drift	16.05.2018 10:32	K	0.0333	0.0333	0.6485	0.6485	1.39	1.39	0.0091	0.0091	0.0225	0.0225	9.5598	9.5598	0.006	0.006
220616-5-1 Drift	16.05.2018 10:13	K	0.0334	0.0334	0.6464	0.6464	1.3874	1.3874	0.0091	0.0091	0.0225	0.0225	9.5639	9.5639	0.006	0.006
220616-5-1 Drift	16.05.2018 09:54	K	0.0334	0.0334	0.6461	0.6461	1.3879	1.3879	0.009	0.009	0.0225	0.0225	9.5728	9.5728	0.006	0.006
220616-5-1 Drift	16.05.2018 09:35	K	0.0334	0.0334	0.644	0.644	1.3884	1.3884	0.0091	0.0091	0.0225	0.0225	9.5766	9.5766	0.006	0.006
220616-5-1 Drift	16.05.2018 09:17	K	0.0336	0.0336	0.6496	0.6496	1.3869	1.3869	0.0091	0.0091	0.0225	0.0225	9.5656	9.5656	0.006	0.006
220616-5-1 Drift	16.05.2018 08:53	K	0.0333	0.0333	0.648	0.648	1.3865	1.3865	0.0091	0.0091	0.0224	0.0224	9.5613	9.5613	0.0059	0.0059
290616-2-1	16.05.2018 12:25	K	0.0337	0.0337	0.6486	0.6486	1.4149	1.4149	0.0091	0.0091	0.0226	0.0226	9.9352	9.9352	0.0061	0.0061
290616-3-1	16.05.2018 12:44	K	0.0338	0.0338	0.6484	0.6484	1.4126	1.4126	0.0093	0.0093	0.0227	0.0227	9.946	9.946	0.0061	0.0061
290616-4-1	16.05.2018 13:04	K	0.0335	0.0335	0.6524	0.6524	1.4101	1.4101	0.0093	0.0093	0.0227	0.0227	9.9329	9.9329	0.0061	0.0061
290616-6-1	16.05.2018 13:23	K	0.0338	0.0338	0.6543	0.6543	1.4128	1.4128	0.0091	0.0091	0.0227	0.0227	9.9268	9.9268	0.0061	0.0061
290616-7-1	16.05.2018 13:43	K	0.0339	0.0339	0.6501	0.6501	1.41	1.41	0.0093	0.0093	0.0226	0.0226	9.8745	9.8745	0.0062	0.0062
290616-8-1	16.05.2018 14:02	K	0.034	0.034	0.6549	0.6549	1.4074	1.4074	0.0092	0.0092	0.0225	0.0225	9.8911	9.8911	0.0062	0.0062
290616-8-2	16.05.2018 14:41	K	0.034	0.034	0.6522	0.6522	1.4084	1.4084	0.0091	0.0091	0.0225	0.0225	9.8584	9.8584	0.0062	0.0062
22-06-2016-5-1	12.10.2016 08:07	K	0.0326	0.0327	0.6612	0.6454	1.4348	1.3787	0.0088	0.0087	0.0221	0.0223	10.2844	9.5076	0.0059	0.0060
220616-5-1 Drift	12.10.2016 09:06	K	0.0329	0.0331	0.6637	0.6478	1.4349	1.3788	0.009	0.0089	0.0222	0.0224	10.2993	9.5214	0.0059	0.0060
220616-5-1 Drift	12.10.2016 09:25	K	0.0331	0.0333	0.6627	0.6468	1.4401	1.3838	0.0092	0.0091	0.0222	0.0224	10.3002	9.5222	0.0057	0.0058
220616-5-1 Drift	12.10.2016 09:43	K	0.0333	0.0335	0.6579	0.6421	1.4407	1.3844	0.0092	0.0091	0.0222	0.0224	10.3315	9.5511	0.0059	0.0060
220616-5-1 Drift	12.10.2016 10:02	K	0.033	0.0332	0.6607	0.6449	1.4425	1.3861	0.0092	0.0091	0.0223	0.0225	10.3381	9.5572	0.0059	0.0060
220616-5-1 Drift	12.10.2016 10:21	K	0.033	0.0332	0.6631	0.6472	1.4448	1.3883	0.0091	0.0090	0.0223	0.0225	10.3548	9.5727	0.0058	0.0059
220616-5-1 Drift	12.10.2016 10:40	K	0.0332	0.0334	0.6627	0.6468	1.4452	1.3887	0.009	0.0089	0.0223	0.0225	10.3804	9.5963	0.006	0.0061
220616-5-1 Drift	12.10.2016 10:58	K	0.0333	0.0335	0.6639	0.6480	1.4464	1.3899	0.0087	0.0086	0.0223	0.0225	10.3616	9.5790	0.006	0.0061
220616-5-1 Drift	12.10.2016 11:17	K	0.0332	0.0334	0.6647	0.6488	1.4464	1.3899	0.0089	0.0088	0.0223	0.0225	10.3678	9.5847	0.0059	0.0060
220616-5-1 Drift	12.10.2016 11:36	K	0.033	0.0332	0.6629	0.6470	1.4474	1.3908	0.0092	0.0091	0.0224	0.0226	10.3512	9.5693	0.006	0.0061
220616-5-1 Drift	12.10.2016 11:55	K	0.0332	0.0334	0.6633	0.6474	1.4471	1.3905	0.0091	0.0090	0.0223	0.0225	10.3642	9.5814	0.0059	0.0060
220616-1-1	12.10.2016 12:14		0.0334	0.0336	0.6632	0.6473	1.457	1.4001	0.0092	0.0091	0.0224	0.0226	10.4389	9.6504	0.0059	0.0060
220616-1-2	12.10.2016 12:34	K	0.0339	0.0341	0.6746	0.6584	1.4754	1.4177	0.009	0.0089	0.023	0.0232	10.4747	9.6835	0.0061	0.0062
220616-9-1	12.10.2016 12:53	K	0.0336	0.0338	0.6648	0.6489	1.4664	1.4091	0.0093	0.0092	0.0223	0.0225	10.467	9.6764	0.0059	0.0060
220616-9-2	12.10.2016 13:12	K	0.0343	0.0345	0.6768	0.6606	1.4924	1.4341	0.0093	0.0092	0.0225	0.0227	10.7082	9.8994	0.0061	0.0062
290616-1-1	12.10.2016 13:32	K	0.0341	0.0343	0.6777	0.6615	1.4912	1.4329	0.0093	0.0092	0.0228	0.0230	10.6336	9.8304	0.0061	0.0062
220616-5-1 Drift	12.10.2016 13:51	K	0.0334	0.0336	0.6656	0.6497	1.4517	1.3950	0.0091	0.0090	0.0224	0.0226	10.3854	9.6010	0.006	0.0061
290616-1-2	12.10.2016 14:11	K	0.0338	0.0340	0.6735	0.6574	1.4937	1.4353	0.0095	0.0094	0.0229	0.0231	10.6584	9.8533	0.0061	0.0062
290616-2-1	12.10.2016 14:30	K	0.0339	0.0341	0.6734	0.6573	1.4893	1.4311	0.0092	0.0091	0.0229	0.0231	10.6734	9.8672	0.0062	0.0063
290616-2-2	12.10.2016 14:49	K	0.034	0.0342	0.6723	0.6562	1.4891	1.4309	0.0091	0.0090	0.0229	0.0231	10.5956	9.7953	0.0061	0.0062
290616-3-1	12.10.2016 15:09	K	0.0338	0.0340	0.6756	0.6594	1.4985	1.4399	0.0093	0.0092	0.0228	0.0230	10.7224	9.9125	0.0062	0.0063
290616-3-2	12.10.2016 15:28	K	0.034	0.0342	0.6739	0.6578	1.4921	1.4338	0.0094	0.0093	0.0228	0.0230	10.6909	9.8834	0.0061	0.0062
220616-5-1 Drift	12.10.2016 15:48	K	0.0333	0.0335	0.668	0.6520	1.4508	1.3941	0.009	0.0089	0.0224	0.0226	10.3909	9.6060	0.006	0.0061
290616-4-1	12.10.2016 16:07	K	0.0343	0.0345	0.6803	0.6640	1.4938	1.4354	0.0091	0.0090	0.0228	0.0230	10.699	9.8909	0.0061	0.0062
290616-4-2	12.10.2016 16:26	K	0.0344	0.0346	0.6771	0.6609	1.4854	1.4273	0.0093	0.0092	0.0229	0.0231	10.5945	9.7943	0.0061	0.0062
290616-5-1	12.10.2016 16:46	K	0.0336	0.0338	0.6647	0.6488	1.4661	1.4088	0.009	0.0089	0.0224	0.0226	10.4915	9.6990	0.0061	0.0062
290616-5-2	12.10.2016 17:05	K	0.0339	0.0341	0.6774	0.6612	1.4763	1.4186	0.0094	0.0093	0.0228	0.0230	10.5017	9.7085	0.0062	0.0063
290616-5-3	12.10.2016 17:25	K	0.034	0.0342	0.6773	0.6611	1.4923	1.4340	0.0092	0.0091	0.0228	0.0230	10.6807	9.8740	0.0061	0.0062
220616-5-1 Drift	12.10.2016 17:44	K	0.0334	0.0336	0.6628	0.6469	1.4494	1.3927	0.0091	0.0090	0.0224	0.0226	10.3791	9.5951	0.0059	0.0060
290616-6-1	12.10.2016 18:03	K	0.034	0.0342	0.6792	0.6629	1.4968	1.4383	0.0092	0.0091	0.0228	0.0230	10.7448	9.9332	0.006	0.0061
290616-6-2	12.10.2016 18:23	K	0.0338	0.0340	0.6755	0.6593	1.4974	1.4389	0.0093	0.0092	0.0228	0.0230	10.7093	9.9004	0.006	0.0061
290616-7-1	12.10.2016 18:42	K	0.0337	0.0339	0.6798	0.6635	1.4829	1.4249	0.0092	0.0091	0.0227	0.0229	10.5914	9.7914	0.0061	0.0062
290616-7-2	12.10.2016 19:02	K	0.0339	0.0341	0.6779	0.6617	1.4894	1.4312	0.009	0.0089	0.0228	0.0230	10.6075	9.8063	0.0062	0.0063
290616-8-1	12.10.2016 19:21	K	0.0341	0.0343	0.6769	0.6607	1.4925	1.4342	0.0091	0.0090	0.0226	0.0228	10.6936	9.8859	0.0061	0.0062
220616-5-1 Drift	12.10.2016 19:40	K	0.0332	0.0334	0.6609	0.6451	1.4512	1.3945	0.0092	0.0091	0.0224	0.0226	10.3774	9.5936	0.006	0.0061
290616-8-2	12.10.2016 20:00	K	0.0342	0.0344	0.6774	0.6612	1.463	1.4058	0.0093	0.0092	0.0226	0.0228	10.3026	9.5244	0.006	0.0061
290616-9-1	12.10.2016 20:19	K	0.0339	0.0341	0.6698	0.6538	1.4942	1.4358	0.009	0.0089	0.0227	0.0229	10.6407	9.8370	0.0061	0.0062
290616-9-2	12.10.2016 20:38	K	0.034	0.0342	0.6754	0.6592	1.4919	1.4336	0.0092	0.0091	0.0224	0.0226	10.6548	9.8500	0.006	0.0061
220616-5-1 Drift	12.10.2016 20:58	K	0.0334	0.0336	0.66	0.6442	1.4495	1.3928	0.0091	0.0090	0.0224	0.0226	10.3854	9.6010	0.0059	0.0060
		F	0.99544869		1.02453583		1.04067498		1.00666667		0.99022222		1.0817043		0.98922156	
			Mittelwert Kc	0.0339		0.6558		1.4207		0.0092		0.0228		9.8547		0.0061
			Min. Konzentr	0.0335		0.6473		1.4001		0.0089		0.0225		9.5244		0.0059
			Max. Konzent	0.0346		0.6640		1.4399		0.0095		0.0232		9.9913		0.0063
			RMS Konzentr	0.0003		0.0051		0.0124		0.0001		0.0002		0.1036		0.0001
			RMS rel. Konz	0.8250		0.7804		0.8709		1.4974		0.9446		1.0509		1.4543
			Verwendet fü	37		37		37		37		37		37		37
			Mittelwert Kc	0.0333		0.6467		1.3871		0.0090		0.0225		9.5635		0.0060
			Min. Konzentr	0.0330		0.6421		1.3788		0.0086		0.0224		9.5214		0.0057
			Max. Konzent	0.0336		0.6518		1.3908		0.0091		0.0226		9.5963		0.0061
			RMS Konzentr	0.0001		0.0021		0.0027		0.0001		0.0000		0.0172		0.0001
			RMS rel. Konz	0.4370		0.3290		0.1951		1.5029		0.2207		0.1800		1.5394
			Verwendet fü	24		24		24		24		24		24		24
			s_{eff}, rel.	0.69980241		0.70767034		0.84876919		#ZAHL!		0.91847986		1.03541328		#ZAHL!
			Fe	Fe korr	K	K Korr	Mg	Mg Korr	Mn	Mn korr	Mo	Mo korr	Na	Na korr	Ni	Ni korr

Sample name (1-4	Meas. date/time	F	Pb	Pb korr	Sb	Sb korr	Si	Si korr	Sr	Sr korr
			Pb		Sb		Si		Sr	
			(%)		(%)		(%)		(%)	
220016-1	16.05.2018 15:00	K	0.021	0.021	0.0093	0.0093	33.036	33.036	0.0165	0.0165
220016-3 4,6mm	16.05.2018 15:20	K	0.0206	0.0206	0.0091	0.0091	33.0892	33.0892	0.0165	0.0165
220016-4 4mm	16.05.2018 15:39	K	0.0207	0.0207	0.0092	0.0092	33.0654	33.0654	0.0165	0.0165
220016-5	16.05.2018 15:58	K	0.0211	0.0211	0.0093	0.0093	33.0849	33.0849	0.0166	0.0166
220016-6 4mm	16.05.2018 16:18	K	0.021	0.021	0.0092	0.0092	33.0443	33.0443	0.0165	0.0165
220016-6 5mm	16.05.2018 16:56	K	0.0207	0.0207	0.0093	0.0093	33.0512	33.0512	0.0166	0.0166
220016-7	16.05.2018 17:16	K	0.0211	0.0211	0.0091	0.0091	33.0894	33.0894	0.0165	0.0165
220016-8	16.05.2018 17:35	K	0.021	0.021	0.0093	0.0093	33.0916	33.0916	0.0165	0.0165
220616-5/1 Drift	16.05.2018 17:55	K	0.0207	0.0207	0.0091	0.0091	32.6569	32.6569	0.0164	0.0164
220616-5/1 Drift	16.05.2018 16:37	K	0.0206	0.0206	0.0093	0.0093	32.6454	32.6454	0.0163	0.0163
220616-5/1 Drift	16.05.2018 14:21	K	0.0207	0.0207	0.0094	0.0094	32.6422	32.6422	0.0163	0.0163
220616-5-1 Drift	16.05.2018 12:05	K	0.0207	0.0207	0.0095	0.0095	32.6659	32.6659	0.0164	0.0164
220616-5-1 Drift	16.05.2018 11:47	K	0.0206	0.0206	0.0094	0.0094	32.6654	32.6654	0.0164	0.0164
220616-5-1 Drift	16.05.2018 11:28	K	0.0206	0.0206	0.0092	0.0092	32.6305	32.6305	0.0164	0.0164
220616-5-1 Drift	16.05.2018 11:09	K	0.0205	0.0205	0.0093	0.0093	32.651	32.651	0.0164	0.0164
220616-5-1 Drift	16.05.2018 10:50	K	0.0208	0.0208	0.0093	0.0093	32.6401	32.6401	0.0164	0.0164
220616-5-1 Drift	16.05.2018 10:32	K	0.0207	0.0207	0.0093	0.0093	32.6532	32.6532	0.0164	0.0164
220616-5-1 Drift	16.05.2018 10:13	K	0.0206	0.0206	0.0092	0.0092	32.6375	32.6375	0.0164	0.0164
220616-5-1 Drift	16.05.2018 09:54	K	0.0206	0.0206	0.0092	0.0092	32.6712	32.6712	0.0164	0.0164
220616-5-1 Drift	16.05.2018 09:35	K	0.0207	0.0207	0.0092	0.0092	32.6672	32.6672	0.0164	0.0164
220616-5-1 Drift	16.05.2018 09:17	K	0.0206	0.0206	0.009	0.009	32.6744	32.6744	0.0164	0.0164
220616-5-1 Drift	16.05.2018 08:53	K	0.0206	0.0206	0.0092	0.0092	32.6381	32.6381	0.0164	0.0164
290616-2-1	16.05.2018 12:25	K	0.0208	0.0208	0.0094	0.0094	33.0816	33.0816	0.0166	0.0166
290616-3-1	16.05.2018 12:44	K	0.0211	0.0211	0.0091	0.0091	33.1098	33.1098	0.0166	0.0166
290616-4-1	16.05.2018 13:04	K	0.021	0.021	0.009	0.009	33.0349	33.0349	0.0165	0.0165
290616-6-1	16.05.2018 13:23	K	0.021	0.021	0.0091	0.0091	33.0621	33.0621	0.0165	0.0165
290616-7-1	16.05.2018 13:43	K	0.0207	0.0207	0.0092	0.0092	33.0548	33.0548	0.0166	0.0166
290616-8-1	16.05.2018 14:02	K	0.0211	0.0211	0.0092	0.0092	33.0665	33.0665	0.0166	0.0166
290616-8-2	16.05.2018 14:41	K	0.021	0.021	0.0091	0.0091	33.0774	33.0774	0.0165	0.0165
22-06-2016-5-1	12.10.2016 08:07	K	0.0201	0.0205	0.0089	0.0090	33.5784	32.4569	0.0161	0.0164
220616-5-1 Drift	12.10.2016 09:06	K	0.0201	0.0205	0.0091	0.0092	33.648	32.5242	0.016	0.0163
220616-5-1 Drift	12.10.2016 09:25	K	0.0202	0.0206	0.009	0.0091	33.6685	32.5440	0.0161	0.0164
220616-5-1 Drift	12.10.2016 09:43	K	0.0201	0.0205	0.0092	0.0093	33.7303	32.6037	0.0161	0.0164
220616-5-1 Drift	12.10.2016 10:02	K	0.0201	0.0205	0.0094	0.0095	33.7581	32.6306	0.0161	0.0164
220616-5-1 Drift	12.10.2016 10:21	K	0.0203	0.0207	0.0093	0.0094	33.8185	32.6890	0.0161	0.0164
220616-5-1 Drift	12.10.2016 10:40	K	0.0203	0.0207	0.0092	0.0093	33.7906	32.6620	0.0161	0.0164
220616-5-1 Drift	12.10.2016 10:58	K	0.0203	0.0207	0.0091	0.0092	33.8253	32.6955	0.0161	0.0164
220616-5-1 Drift	12.10.2016 11:17	K	0.0204	0.0208	0.009	0.0091	33.8609	32.7299	0.0162	0.0165
220616-5-1 Drift	12.10.2016 11:36	K	0.0202	0.0206	0.0094	0.0095	33.8697	32.7385	0.0162	0.0165
220616-5-1 Drift	12.10.2016 11:55	K	0.0202	0.0206	0.0091	0.0092	33.8408	32.7105	0.0161	0.0164
220616-1-1	12.10.2016 12:14		0.0203	0.0207	0.0092	0.0093	33.9897	32.8544	0.0161	0.0164
220616-1-2	12.10.2016 12:34	K	0.0205	0.0209	0.0094	0.0095	34.4568	33.3059	0.0165	0.0168
220616-9-1	12.10.2016 12:53	K	0.0207	0.0211	0.0094	0.0095	34.1838	33.0421	0.0163	0.0166
220616-9-2	12.10.2016 13:12	K	0.0214	0.0218	0.0094	0.0095	34.6933	33.5345	0.0165	0.0168
290616-1-1	12.10.2016 13:32	K	0.0208	0.0212	0.0095	0.0096	34.658	33.5004	0.0166	0.0169
220616-5-1 Drift	12.10.2016 13:51	K	0.0204	0.0208	0.0091	0.0092	33.9158	32.7830	0.0161	0.0164
290616-1-2	12.10.2016 14:11	K	0.0207	0.0211	0.0091	0.0092	34.6836	33.5252	0.0166	0.0169
290616-2-1	12.10.2016 14:30	K	0.0208	0.0212	0.0093	0.0094	34.6651	33.5073	0.0165	0.0168
290616-2-2	12.10.2016 14:49	K	0.021	0.0214	0.0095	0.0096	34.6076	33.4517	0.0165	0.0168
290616-3-1	12.10.2016 15:09	K	0.0208	0.0212	0.0095	0.0096	34.7375	33.5773	0.0165	0.0168
290616-3-2	12.10.2016 15:28	K	0.0208	0.0212	0.0092	0.0093	34.6828	33.5244	0.0165	0.0168
220616-5-1 Drift	12.10.2016 15:48	K	0.0204	0.0208	0.0091	0.0092	33.9345	32.8011	0.0162	0.0165
290616-4-1	12.10.2016 16:07	K	0.0207	0.0211	0.0092	0.0093	34.7348	33.5747	0.0166	0.0169
290616-4-2	12.10.2016 16:26	K	0.0208	0.0212	0.0094	0.0095	34.6071	33.4512	0.0165	0.0168
290616-5-1	12.10.2016 16:46	K	0.0203	0.0207	0.0092	0.0093	34.194	33.0519	0.0163	0.0166
290616-5-2	12.10.2016 17:05	K	0.0208	0.0212	0.0092	0.0093	34.5097	33.3571	0.0165	0.0168
290616-5-3	12.10.2016 17:25	K	0.0208	0.0212	0.0094	0.0095	34.6528	33.4954	0.0165	0.0168
220616-5-1 Drift	12.10.2016 17:44	K	0.0205	0.0209	0.0093	0.0094	33.9303	32.7970	0.0162	0.0165
290616-6-1	12.10.2016 18:03	K	0.0208	0.0212	0.0094	0.0095	34.7181	33.5585	0.0166	0.0169
290616-6-2	12.10.2016 18:23	K	0.0209	0.0213	0.0094	0.0095	34.698	33.5391	0.0165	0.0168
290616-7-1	12.10.2016 18:42	K	0.0206	0.0210	0.0091	0.0092	34.5138	33.3610	0.0165	0.0168
290616-7-2	12.10.2016 19:02	K	0.0209	0.0213	0.0094	0.0095	34.6223	33.4659	0.0165	0.0168
290616-8-1	12.10.2016 19:21	K	0.0211	0.0215	0.0091	0.0092	34.6871	33.5286	0.0165	0.0168
220616-5-1 Drift	12.10.2016 19:40	K	0.0203	0.0207	0.009	0.0091	33.926	32.7929	0.0162	0.0165
290616-8-2	12.10.2016 20:00	K	0.0212	0.0216	0.0091	0.0092	34.3341	33.1873	0.0166	0.0169
290616-9-1	12.10.2016 20:19	K	0.021	0.0214	0.0096	0.0097	34.7224	33.5627	0.0165	0.0168
290616-9-2	12.10.2016 20:38	K	0.0214	0.0218	0.0094	0.0095	34.6663	33.5084	0.0166	0.0169
220616-5-1 Drift	12.10.2016 20:58	K	0.0204	0.0208	0.0093	0.0094	33.9222	32.7892	0.0162	0.0165
		F	0.97951557		0.99166667		1.034554		0.9831735	
			Mittelwert Ko	0.0211		0.0093		33.2764		0.0167
			Min. Konzentr	0.0206		0.0090		32.8544		0.0164
			Max. Konzent	0.0218		0.0097		33.5773		0.0169
			RMS Konzentr	0.0003		0.0002		0.2279		0.0002
			RMS rel. Konz	1.4038		1.8206		0.6850		0.9031
			Verwendet fü	37		37		37		37
			Mittelwert Ko	0.0206		0.0093		32.6528		0.0164
			Min. Konzentr	0.0205		0.0090		32.5242		0.0163
			Max. Konzent	0.0208		0.0095		32.7385		0.0165
			RMS Konzentr	0.0001		0.0001		0.0484		0.0000
			RMS rel. Konz	0.4218		1.4486		0.1481		0.2763
			Verwendet fü	24		24		24		24
			s_{eff}, rel.	1.3389257		1.10280812		0.66879999		0.85981001
			Pb	Pb korr	Sb	Sb korr	Si	Si korr	Sr	Sr korr

Sample name (1-4	Meas. date/time	F	Ti	Ti korr	V	V korr	Zn	Zn korr	Zr	Zr korr
			Ti1		V		Zn		Zr1	
			(%)		(%)		(%)		(%)	
220016-1	16.05.2018 15:00	M	0.0127	0.0127	0.0224	0.0224	0.0167	0.0167	0.0566	0.0566
220016-3 4,6mm	16.05.2018 15:20	M	0.013	0.013	0.0223	0.0223	0.016	0.016	0.0567	0.0567
220016-4 4mm	16.05.2018 15:39	M	0.0131	0.0131	0.0227	0.0227	0.0161	0.0161	0.0568	0.0568
220016-5	16.05.2018 15:58	M	0.0129	0.0129	0.0224	0.0224	0.0164	0.0164	0.0566	0.0566
220016-6 4mm	16.05.2018 16:18	M	0.0131	0.0131	0.0226	0.0226	0.0162	0.0162	0.0567	0.0567
220016-6 5mm	16.05.2018 16:56	M	0.0126	0.0126	0.0221	0.0221	0.0164	0.0164	0.0569	0.0569
220016-7	16.05.2018 17:16	M	0.0127	0.0127	0.0225	0.0225	0.0166	0.0166	0.0567	0.0567
220016-8	16.05.2018 17:35	M	0.013	0.013	0.0222	0.0222	0.0166	0.0166	0.0567	0.0567
220616-5/1 Drift	16.05.2018 17:55	M	0.013	0.013	0.0222	0.0222	0.0166	0.0166	0.056	0.056
220616-5/1 Drift	16.05.2018 16:37	M	0.0129	0.0129	0.0223	0.0223	0.0162	0.0162	0.0561	0.0561
220616-5/1 Drift	16.05.2018 14:21	M	0.013	0.013	0.0221	0.0221	0.0165	0.0165	0.0561	0.0561
220616-5-1 Drift	16.05.2018 12:05	M	0.0131	0.0131	0.0223	0.0223	0.0163	0.0163	0.0561	0.0561
220616-5-1 Drift	16.05.2018 11:47	M	0.0126	0.0126	0.0225	0.0225	0.0162	0.0162	0.0561	0.0561
220616-5-1 Drift	16.05.2018 11:28	M	0.0128	0.0128	0.0222	0.0222	0.0163	0.0163	0.056	0.056
220616-5-1 Drift	16.05.2018 11:09	M	0.0131	0.0131	0.0223	0.0223	0.0163	0.0163	0.0562	0.0562
220616-5-1 Drift	16.05.2018 10:50	M	0.0129	0.0129	0.0222	0.0222	0.0161	0.0161	0.0561	0.0561
220616-5-1 Drift	16.05.2018 10:32	M	0.0129	0.0129	0.023	0.023	0.0164	0.0164	0.056	0.056
220616-5-1 Drift	16.05.2018 10:13	M	0.0129	0.0129	0.022	0.022	0.0163	0.0163	0.0561	0.0561
220616-5-1 Drift	16.05.2018 09:54	M	0.0127	0.0127	0.0222	0.0222	0.0164	0.0164	0.0561	0.0561
220616-5-1 Drift	16.05.2018 09:35	M	0.0128	0.0128	0.0223	0.0223	0.0165	0.0165	0.0562	0.0562
220616-5-1 Drift	16.05.2018 09:17	M	0.0131	0.0131	0.0221	0.0221	0.0165	0.0165	0.0561	0.0561
220616-5-1 Drift	16.05.2018 08:53	M	0.0127	0.0127	0.0222	0.0222	0.0166	0.0166	0.0561	0.0561
290616-2-1	16.05.2018 12:25	M	0.0133	0.0133	0.0225	0.0225	0.0162	0.0162	0.0566	0.0566
290616-3-1	16.05.2018 12:44	M	0.0131	0.0131	0.0223	0.0223	0.0162	0.0162	0.0567	0.0567
290616-4-1	16.05.2018 13:04	M	0.0131	0.0131	0.0226	0.0226	0.0164	0.0164	0.0567	0.0567
290616-6-1	16.05.2018 13:23	M	0.013	0.013	0.0223	0.0223	0.0164	0.0164	0.0567	0.0567
290616-7-1	16.05.2018 13:43	M	0.0133	0.0133	0.0221	0.0221	0.0163	0.0163	0.0568	0.0568
290616-8-1	16.05.2018 14:02	M	0.0133	0.0133	0.0225	0.0225	0.0164	0.0164	0.0568	0.0568
290616-8-2	16.05.2018 14:41	M	0.0129	0.0129	0.0228	0.0228	0.0163	0.0163	0.0569	0.0569
22-06-2016-5-1	12.10.2016 08:07	M	0.0129	0.0128	0.0221	0.0222	0.016	0.0162	0.0551	0.0559
220616-5-1 Drift	12.10.2016 09:06	M	0.0133	0.0132	0.0223	0.0224	0.0161	0.0163	0.055	0.0558
220616-5-1 Drift	12.10.2016 09:25	M	0.0133	0.0132	0.022	0.0221	0.0161	0.0163	0.0552	0.0560
220616-5-1 Drift	12.10.2016 09:43	M	0.0131	0.0130	0.0222	0.0223	0.0162	0.0164	0.0553	0.0561
220616-5-1 Drift	12.10.2016 10:02	M	0.0129	0.0128	0.0221	0.0222	0.0162	0.0164	0.0554	0.0562
220616-5-1 Drift	12.10.2016 10:21	M	0.0126	0.0125	0.0218	0.0219	0.016	0.0162	0.0553	0.0561
220616-5-1 Drift	12.10.2016 10:40	M	0.0129	0.0128	0.0221	0.0222	0.0162	0.0164	0.0553	0.0561
220616-5-1 Drift	12.10.2016 10:58	M	0.0128	0.0127	0.022	0.0221	0.0161	0.0163	0.0554	0.0562
220616-5-1 Drift	12.10.2016 11:17	M	0.0131	0.0130	0.0222	0.0223	0.0161	0.0163	0.0554	0.0562
220616-5-1 Drift	12.10.2016 11:36	M	0.013	0.0129	0.0225	0.0226	0.0162	0.0164	0.0554	0.0562
220616-5-1 Drift	12.10.2016 11:55	M	0.013	0.0129	0.0227	0.0228	0.0162	0.0164	0.0556	0.0564
220616-1-1	12.10.2016 12:14		0.0131	0.0130	0.0224	0.0225	0.0161	0.0163	0.0555	0.0563
220616-1-2	12.10.2016 12:34	M	0.0134	0.0133	0.0226	0.0227	0.0165	0.0167	0.0568	0.0576
220616-9-1	12.10.2016 12:53	M	0.013	0.0129	0.0226	0.0227	0.0162	0.0164	0.056	0.0568
220616-9-2	12.10.2016 13:12	M	0.0131	0.0130	0.0225	0.0226	0.0164	0.0166	0.0568	0.0576
290616-1-1	12.10.2016 13:32	M	0.013	0.0129	0.0228	0.0229	0.0164	0.0166	0.0567	0.0575
220616-5-1 Drift	12.10.2016 13:51	M	0.0128	0.0127	0.0222	0.0223	0.0162	0.0164	0.0555	0.0563
290616-1-2	12.10.2016 14:11	M	0.013	0.0129	0.0223	0.0224	0.0163	0.0165	0.0567	0.0575
290616-2-1	12.10.2016 14:30	M	0.0128	0.0127	0.0227	0.0228	0.0164	0.0166	0.0567	0.0575
290616-2-2	12.10.2016 14:49	M	0.0135	0.0134	0.0229	0.0230	0.0164	0.0166	0.0568	0.0576
290616-3-1	12.10.2016 15:09	M	0.013	0.0129	0.0233	0.0234	0.0164	0.0166	0.0569	0.0577
290616-3-2	12.10.2016 15:28	M	0.0134	0.0133	0.0229	0.0230	0.0163	0.0165	0.0569	0.0577
220616-5-1 Drift	12.10.2016 15:48	M	0.0134	0.0133	0.0219	0.0220	0.0163	0.0165	0.0556	0.0564
290616-4-1	12.10.2016 16:07	M	0.013	0.0129	0.0229	0.0230	0.0165	0.0167	0.0567	0.0575
290616-4-2	12.10.2016 16:26	M	0.0133	0.0132	0.0229	0.0230	0.0163	0.0165	0.0567	0.0575
290616-5-1	12.10.2016 16:46	M	0.0128	0.0127	0.0222	0.0223	0.0161	0.0163	0.0558	0.0566
290616-5-2	12.10.2016 17:05	M	0.0131	0.0130	0.0228	0.0229	0.0163	0.0165	0.0567	0.0575
290616-5-3	12.10.2016 17:25	M	0.0138	0.0137	0.0226	0.0227	0.0163	0.0165	0.0568	0.0576
220616-5-1 Drift	12.10.2016 17:44	M	0.0132	0.0131	0.0223	0.0224	0.0161	0.0163	0.0557	0.0565
290616-6-1	12.10.2016 18:03	M	0.013	0.0129	0.0233	0.0234	0.0164	0.0166	0.0567	0.0575
290616-6-2	12.10.2016 18:23	M	0.0134	0.0133	0.0227	0.0228	0.0164	0.0166	0.0568	0.0576
290616-7-1	12.10.2016 18:42	M	0.0133	0.0132	0.0229	0.0230	0.0163	0.0165	0.0565	0.0573
290616-7-2	12.10.2016 19:02	M	0.0135	0.0134	0.0226	0.0227	0.0164	0.0166	0.0568	0.0576
290616-8-1	12.10.2016 19:21	M	0.0135	0.0134	0.0226	0.0227	0.0164	0.0166	0.0568	0.0576
220616-5-1 Drift	12.10.2016 19:40	M	0.0129	0.0128	0.022	0.0221	0.0162	0.0164	0.0554	0.0562
290616-8-2	12.10.2016 20:00	M	0.0137	0.0136	0.0226	0.0227	0.0164	0.0166	0.0568	0.0576
290616-9-1	12.10.2016 20:19	M	0.0133	0.0132	0.0227	0.0228	0.0165	0.0167	0.0568	0.0576
290616-9-2	12.10.2016 20:38	M	0.0129	0.0128	0.0229	0.0230	0.0163	0.0165	0.0568	0.0576
220616-5-1 Drift	12.10.2016 20:58	M	0.0129	0.0128	0.0222	0.0223	0.0162	0.0164	0.0556	0.0564
		F	1.00831025		0.99602437		0.98586387		0.9864001	
		Mittelwert Ko	0.0131		0.0227		0.0165			0.0571
		Min. Konzentı	0.0126		0.0221		0.0160			0.0563
		Max. Konzent	0.0137		0.0234		0.0167			0.0577
		RMS Konzentr	0.0003		0.0003		0.0002			0.0004
		RMS rel. Konz	1.9629		1.3785		1.1306			0.7780
		Verwendet fü	37		37		37			37
		Mittelwert Ko	0.0129		0.0223		0.0164			0.0561
		Min. Konzentı	0.0125		0.0219		0.0161			0.0558
		Max. Konzent	0.0132		0.0230		0.0166			0.0564
		RMS Konzentr	0.0002		0.0002		0.0001			0.0001
		RMS rel. Konz	1.3935		1.0905		0.7576			0.1954
		Verwendet fü	24		24		24			24
		s_{eff}, rel.	1.3824579		0.84331728		0.83921806			0.7530141
		Ti	Ti korr	V	V korr	Zn	Zn korr	Zr	Zr korr	