



CERTIFICATE OF ANALYSIS FOR

MEDIUM GRADE COPPER ORE

REFERENCE MATERIAL

OREAS 163

Summary Statistics for OREAS 163

Constituent	Certified Value	Absolute Standard Deviations					Relative Standard Deviations			5% window	
		1SD	2SD Low	2SD High	3SD Low	3SD High	1RSD	2RSD	3RSD	Low	High
SP Fusion ICP											
Cu (wt.%)	1.71	0.08	1.55	1.86	1.48	1.94	4.51%	9.01%	13.5%	1.62	1.79
Fe (wt.%)	11.1	0.4	10.3	11.9	9.88	12.28	3.61%	7.22%	10.8%	10.5	11.6
S (wt.%)	9.98	0.25	9.48	10.47	9.24	10.71	2.46%	4.93%	7.39%	9.48	10.47
CaO (wt.%)	0.92	0.12	0.68	1.16	0.55	1.29	13.2%	26.5%	39.7%	0.87	0.97
MgO (wt.%)	5.34	0.21	4.92	5.76	4.70	5.98	3.97%	7.95%	11.9%	5.07	5.61
Al ₂ O ₃ (wt.%)	3.16	0.08	3.01	3.32	2.93	3.40	2.47%	4.94%	7.41%	3.00	3.32
SiO ₂ (wt.%)	63.4	1.8	59.9	66.9	58.1	68.7	2.77%	5.55%	8.32%	60.3	66.6
Ag (ppm)	5	1	3	7	2	8	17.5%	35.0%	52.4%	5	5
Pb (ppm)	461	65	330	591	265	656	14.2%	28.3%	42.5%	438	484
Zn (ppm)	102	12	79	125	67	137	11.4%	22.8%	34.3%	97	107
Co (ppm)	230	10	210	251	200	261	4.45%	8.91%	13.4%	219	242
4-Acid ICP											
Cu (wt.%)	1.76	0.07	1.62	1.90	1.56	1.97	3.91%	7.81%	11.7%	1.67	1.85
Fe (wt.%)	11.07	0.15	10.76	11.38	10.60	11.53	1.40%	2.80%	4.20%	10.51	11.62
S (wt.%)	10.4	0.5	9.4	11.4	8.8	11.9	4.95%	9.89%	14.8%	9.9	10.9
CaO (wt.%)	0.860	0.015	0.830	0.890	0.815	0.905	1.74%	3.49%	5.23%	0.817	0.903
MgO (wt.%)	5.42	0.12	5.18	5.66	5.06	5.78	2.24%	4.48%	6.72%	5.15	5.69
Al ₂ O ₃ (wt.%)	3.24	0.10	3.04	3.43	2.94	3.53	3.02%	6.04%	9.05%	3.07	3.40
Ag (ppm)	4.3	0.6	3.0	5.5	2.4	6.1	14.5%	28.9%	43.4%	4.0	4.5
Pb (ppm)	492	14	464	520	450	534	2.84%	5.67%	8.51%	467	516
Zn (ppm)	108	9	89	126	80	135	8.62%	17.2%	25.9%	102	113
Co (ppm)	230	11	208	252	197	263	4.81%	9.61%	14.4%	218	241

Note - intervals may appear asymmetric due to rounding; IND – indeterminate

Prepared by:
Ore Research & Exploration Pty Ltd
May 2009

INTRODUCTION

OREAS reference materials (RM) are intended to provide a low cost method of evaluating and improving the quality of precious and base metal analysis of geological samples. To the explorationist, they provide an important control in analytical data sets related to exploration from the grass roots level through to resource definition. To the analyst, they provide an effective means of calibrating analytical equipment, assessing new techniques and routinely monitoring in-house procedures.

OREAS 163 is a medium grade copper ore certified reference material (CRM) prepared and certified by Ore Research & Exploration Pty Ltd. The material was sourced from Xstrata's Mt Isa copper ore deposits located near the township of Mt Isa in north-west Queensland. The ore deposits are hosted by brecciated siliceous and dolomitic rock masses within the Urquhart Shale comprising complex and dissociated veins with chalcopyrite, pyrite and pyrrhotite with grades of 3-4% copper. OREAS 163 is one of a suite of seven CRMs characterised for Cu, Fe, S, CaO, MgO, Al₂O₃, SiO₂, Ag, Pb, Zn and Co by both sodium peroxide fusion ICP and 4-acid ICP methods.

COMMINUTION AND HOMOGENISATION PROCEDURES

The material was prepared in the following manner:

- a) *drying at 65^o C to constant mass;*
- b) *crushing and screening;*
- c) *multi-stage milling to 100% minus 50 microns;*
- d) *preliminary blending;*
- e) *check assaying;*
- f) *adjustment of grades as necessary;*
- g) *final homogenisation;*
- h) *packaging into 10g units sealed under nitrogen in laminated foil pouches.*

ANALYSIS OF OREAS 163

Ten commercial laboratories participated in the analytical program to characterise Cu, Fe, S, CaO, MgO, Al₂O₃, SiO₂, Ag, Pb, Zn and Co by both sodium peroxide fusion ICP and 4-acid ICP methods. To maintain anonymity laboratories were randomly designated the letter codes A through J. In some instances laboratories determined one or more analytes using an alternative method to sodium peroxide fusion. These instances include: Lab J where a pyrosulfate fusion for Fe was used, Lab D and Lab H used infra red combustion furnace to determine sulphur and Lab H used lithium borate fusion to determine all analytes except Cu and Zn. Other exceptions include instances where laboratories used an alternative method to 4-acid digest. These include Lab G where a modified aqua regia digest was used to determine all analytes and Lab J where an acid digest (non specified) with AAS finish was used for Ag only. All results together with uncorrected means, medians, one sigma standard deviations, relative standard deviations and percent deviation of lab means from the corrected mean of means (PDM³) are presented in Tables A2 and A22 (Appendix). The parameter PDM³ is a measure of laboratory accuracy while the relative standard deviation is an effective measure of analytical precision where homogeneity of the test material has been confirmed.

The analytical methods employed by each laboratory are explained, together with other abbreviations used, in Table A1 (Appendix). Each participating laboratory received 5 samples of 50g each. Each set of subsamples submitted to each laboratory was taken at regular intervals during packaging of the standard in order to maximise their representation. Laboratories were instructed to assay samples as received.

STATISTICAL EVALUATION OF ANALYTICAL DATA FOR OREAS 163

Certified Value and Confidence Intervals

The certified value is the mean of means of accepted replicate values of accepted participating laboratories computed according to the formulae

$$\bar{x}_i = \frac{1}{n_i} \sum_{j=1}^{n_i} x_{ij}$$

$$\bar{\bar{x}} = \frac{1}{p} \sum_{i=1}^p \bar{x}_i$$

where

x_{ij} is the j th result reported by laboratory i ;
 p is the number of participating laboratories;
 n_i is the number of results reported by laboratory i ;
 \bar{x}_i is the mean for laboratory i ;
 $\bar{\bar{x}}$ is the mean of means.

The confidence intervals were obtained by calculation of the variance of the consensus value (mean of means) and reference to Student's- t distribution with degrees of freedom $(p-1)$.

$$\hat{V}(\bar{\bar{x}}) = \frac{1}{p(p-1)} \sum_{i=1}^p (\bar{x}_i - \bar{\bar{x}})^2$$

$$\text{Confidence Interval} = \bar{\bar{x}} \pm t_{1-x/2}(p-1) (\hat{V}(\bar{\bar{x}}))^{1/2}$$

where

$t_{1-x/2}(p-1)$ is the $1-x/2$ fractile of the t -distribution with $(p-1)$ degrees of freedom.

The distribution of the values is assumed to be symmetrical about the mean in the calculation of the confidence interval.

The test for rejection of individual outliers from each laboratory data set was primarily based on z scores (rejected if $|z_i| > 2.5$) computed from the robust estimators of location and scale, T and S , respectively, according to the formulae:

$$S = 1.483 \frac{\text{median } |x_j - \text{median}(x_i)|}{j=1 \dots n \quad i=1 \dots n}$$

$$z_i = \frac{x_i - T}{S}$$

where

T is the median value in a data set;
 S is the median of all absolute deviations from the sample median multiplied by 1.483, a correction factor to make the estimator consistent with the usual parameter of a normal distribution.

Table 1. Certified values and 95% confidence intervals for OREAS 163

Constituent	Certified Value	95% Confidence Interval	
		Low	High
<u>Sodium Peroxide Fusion ICP</u>			
Copper, Cu (wt.%)	1.71	1.65	1.76
Iron, Fe (wt.%)	11.1	10.8	11.4
Sulphur, S (wt.%)	9.98	9.80	10.15
Calcium oxide, CaO (wt.%)	0.92	0.82	1.02
Magnesium oxide, MgO (wt.%)	5.34	5.18	5.50
Aluminium oxide, Al ₂ O ₃ (wt.%)	3.16	3.11	3.22
Silicon dioxide, SiO ₂ (wt.%)	63.4	62.1	64.7
Silver, Ag (ppm)	5	3	7
Lead, Pb (ppm)	461	411	511
Zinc, Zn (ppm)	102	95	109
Cobalt, Co (ppm)	230	224	237
<u>4-Acid* ICP</u>			
Copper, Cu (wt.%)	1.76	1.71	1.81
Iron, Fe (wt.%)	11.07	10.99	11.15
Sulphur, S (wt.%)	10.4	9.9	10.9
Calcium oxide, CaO (wt.%)	0.860	0.849	0.871
Magnesium oxide, MgO (wt.%)	5.42	5.34	5.50
Aluminium oxide, Al ₂ O ₃ (wt.%)	3.24	3.17	3.30
Silver, Ag (ppm)	4.3	4.0	4.5
Lead, Pb (ppm)	492	483	501
Zinc, Zn (ppm)	108	101	115
Cobalt, Co (ppm)	230	222	238

*Lab G used a modified aqua regia digest. Note - intervals may appear asymmetric due to rounding; IND – indeterminate

The z-score test is used in combination with a second method of individual outlier detection that determines the percent deviation of the individual value from the median. Outliers in general are selected on the basis of z-scores > 2.5 and with percent deviations > 1.5%. In certain instances statistician's prerogative has been employed in discriminating outliers.

Each laboratory data set is tested for outlying status based on z-score discrimination and rejected if $|z_i| > 2.5$. After individual and lab data set outliers have been eliminated a non-iterative 3 standard deviation filter is applied, with those values lying outside this window also relegated to outlying status.

Individual outliers and, more rarely, laboratory means deemed to be outlying are shown left justified and in bold in the tabulated results (see Appendix) and have been omitted in the determination of certified values. The magnitude of the confidence interval is inversely proportional to the number of participating laboratories and interlaboratory agreement. It is a measure of the reliability of the certified value, i.e. the narrower the confidence interval the greater the certainty in the certified value. A 95% confidence interval indicates a 95% probability that the interval includes the true value of the analyte under consideration.

Statement of Homogeneity

The standard deviation of each laboratory data set includes error due to both the imprecision of the analytical method employed and to possible inhomogeneity of the material analysed. The standard deviation of the pooled individual analyses of all participating laboratories includes error due to the imprecision of each analytical method, to possible inhomogeneity of the material analysed and, in particular, to deficiencies in accuracy of each analytical method.

In determining tolerance intervals that component of error attributable to measurement inaccuracy was eliminated by transformation of the individual results of each data set to a common mean (the uncorrected grand mean) according to the formula

$$x'_{ij} = x_{ij} - \bar{x}_i + \frac{\sum_{i=1}^p \sum_{j=1}^{n_i} x_{ij}}{\sum_{i=1}^p n_i}$$

where

- x_{ij} is the j th raw result reported by laboratory i ;
- x'_{ij} is the j th transformed result reported by laboratory i ;
- n_i is the number of results reported by laboratory i ;
- p is the number of participating laboratories;
- \bar{x}_i is the raw mean for laboratory i .

The homogeneity of each constituent was determined from tables of factors for two-sided tolerance limits for normal distributions (ISO 3207) in which

$$\text{Lower limit is } \bar{x} - k'_2(n, p, 1 - \alpha) s_g''$$

$$\text{Upper limit is } \bar{x} + k'_2(n, p, 1 - \alpha) s_g''$$

where

- n is the number of results;
- $1 - \alpha$ is the confidence level;
- p is the proportion of results expected within the tolerance limits;
- k'_2 is the factor for two-sided tolerance limits (m, α unknown);
- s_g'' is the corrected grand standard deviation.

The meaning of these tolerance limits may be illustrated for Cu by 4-acid digest, where 99% of the time at least 95% of subsamples will have concentrations lying between 1.73 and 1.79 wt.%. Put more precisely, this means that if the same number of subsamples were taken and analysed in the same manner repeatedly, 99% of the tolerance intervals so constructed would cover at least 95% of the total population, and 1% of the tolerance intervals would cover less than 95% of the total population (ISO Guide 35).

Table 2. Certified values and tolerance intervals for OREAS 163.

Constituent	Certified Value	Tolerance Interval 1- α =0.99, ρ =0.95	
		Low	High
Sodium Peroxide Fusion ICP			
Copper, Cu (wt.%)	1.71	1.67	1.74
Iron, Fe (wt.%)	11.1	10.8	11.3
Sulphur, S (wt.%)	9.98	9.66	10.29
Calcium oxide, CaO (wt.%)	0.92	0.88	0.96
Magnesium oxide, MgO (wt.%)	5.34	5.23	5.45
Aluminium oxide, Al ₂ O ₃ (wt.%)	3.16	3.09	3.23
Silicon dioxide, SiO ₂ (wt.%)	63.4	62.2	64.7
Silver, Ag (ppm)	5	IND	IND
Lead, Pb (ppm)	461	445	476
Zinc, Zn (ppm)	102	88	116
Cobalt, Co (ppm)	230	225	236
4-Acid* ICP			
Copper, Cu (wt.%)	1.76	1.73	1.79
Iron, Fe (wt.%)	11.07	10.84	11.30
Sulphur, S (wt.%)	10.4	10.3	10.4
Calcium oxide, CaO (wt.%)	0.860	0.846	0.874
Magnesium oxide, MgO (wt.%)	5.42	5.33	5.51
Aluminium oxide, Al ₂ O ₃ (wt.%)	3.24	3.16	3.32
Silver, Ag (ppm)	4.3	4.0	4.5
Lead, Pb (ppm)	492	472	512
Zinc, Zn (ppm)	108	102	113
Cobalt, Co (ppm)	230	223	236

*Lab G used a modified aqua regia digest. Note - intervals may appear asymmetric due to rounding; IND – indeterminate

The corrected grand standard deviation, s_g'' , used to compute the tolerance intervals is the weighted means of standard deviations of all data sets for a particular constituent according to the formula:

$$s_g'' = \frac{\sum_{i=1}^p (s_i (1 - \frac{S_i}{s_g'}))}{\sum_{i=1}^p (1 - \frac{S_i}{s_g'})}$$

where

$1 - (\frac{S_i}{s_g'})$ is the weighting factor for laboratory i ;

s_g' is the grand standard deviation computed from the transformed (i.e. means - adjusted) results

according to the formula

$$S'_g = \left[\frac{\sum_{i=1}^p \sum_{j=i}^{n_i} (x'_{ij} - \bar{x}'_i)^2}{\sum_{i=1}^p n_i - 1} \right]^{1/2}$$

where \bar{x}'_i is the transformed mean for laboratory i

The weighting factors were applied to compensate for the considerable variation in analytical precision amongst participating laboratories. Hence, weighting factors for each data set have been constructed so as to be inversely proportional to the standard deviation of that data set. It should be noted that estimates of tolerance by this method are considered conservative as a significant proportion of the observed variance, even in those laboratories exhibiting the best analytical precision, can presumably be attributed to measurement error.

Performance Gates

Performance gates provide an indication of a level of performance that might reasonably be expected from a laboratory being monitored by this CRM in a QA/QC program. They take into account errors attributable to measurement and CRM variability. For an effective CRM the contribution of the latter should be negligible in comparison to measurement errors. Sources of measurement error include inter-lab bias, analytical precision (repeatability) and inter-batch bias (reproducibility).

Two methods have been employed to calculate performance gates. The first method uses the same filtered data set used to determine the certified value, i.e. after removal of all individual, lab dataset (batch) and 3SD outliers. These outliers can only be removed after the absolute homogeneity of the CRM has been independently established, i.e. the outliers must be confidently deemed to be analytical rather than arising from inhomogeneity of the CRM. The standard deviation is then calculated for each analyte from the pooled individual analyses generated from the certification program. Table 3 shows performance gates calculated for two and three standard deviations. As a guide these intervals may be regarded as warning or rejection for multiple 2SD outliers, or rejection for individual 3SD outliers in QC monitoring, although their precise application should be at the discretion of the QC manager concerned. A second method utilises a 5% window calculated directly from the certified value. Standard deviation is also shown in relative percent for one, two and three relative standard deviations (1RSD, 2RSD and 3RSD) to facilitate an appreciation of the magnitude of these numbers and a comparison with the 5% window. Caution should be exercised when concentration levels approach lower limits of detection of the analytical methods employed as performance gates calculated from standard deviations tend to be excessively wide whereas those determined by the 5% method are too narrow.

Table 3. Performance Gates for OREAS 163

Constituent	Certified Value	Absolute Standard Deviations					Relative Standard Deviations			5% window	
		1SD	2SD Low	2SD High	3SD Low	3SD High	1RSD	2RSD	3RSD	Low	High
SP Fusion ICP											
Cu (wt.%)	1.71	0.08	1.55	1.86	1.48	1.94	4.51%	9.01%	13.5%	1.62	1.79
Fe (wt.%)	11.1	0.4	10.3	11.9	9.88	12.28	3.61%	7.22%	10.8%	10.5	11.6
S (wt.%)	9.98	0.25	9.48	10.47	9.24	10.71	2.46%	4.93%	7.39%	9.48	10.47
CaO (wt.%)	0.92	0.12	0.68	1.16	0.55	1.29	13.2%	26.5%	39.7%	0.87	0.97
MgO (wt.%)	5.34	0.21	4.92	5.76	4.70	5.98	3.97%	7.95%	11.9%	5.07	5.61
Al ₂ O ₃ (wt.%)	3.16	0.08	3.01	3.32	2.93	3.40	2.47%	4.94%	7.41%	3.00	3.32
SiO ₂ (wt.%)	63.4	1.8	59.9	66.9	58.1	68.7	2.77%	5.55%	8.32%	60.3	66.6
Ag (ppm)	5	1	3	7	2	8	17.5%	35.0%	52.4%	5	5
Pb (ppm)	461	65	330	591	265	656	14.2%	28.3%	42.5%	438	484
Zn (ppm)	102	12	79	125	67	137	11.4%	22.8%	34.3%	97	107
Co (ppm)	230	10	210	251	200	261	4.45%	8.91%	13.4%	219	242
4-Acid* ICP											
Cu (wt.%)	1.76	0.07	1.62	1.90	1.56	1.97	3.91%	7.81%	11.7%	1.67	1.85
Fe (wt.%)	11.07	0.15	10.76	11.38	10.60	11.53	1.40%	2.80%	4.20%	10.51	11.62
S (wt.%)	10.4	0.5	9.4	11.4	8.8	11.9	4.95%	9.89%	14.8%	9.9	10.9
CaO (wt.%)	0.860	0.015	0.830	0.890	0.815	0.905	1.74%	3.49%	5.23%	0.817	0.903
MgO (wt.%)	5.42	0.12	5.18	5.66	5.06	5.78	2.24%	4.48%	6.72%	5.15	5.69
Al ₂ O ₃ (wt.%)	3.24	0.10	3.04	3.43	2.94	3.53	3.02%	6.04%	9.05%	3.07	3.40
Ag (ppm)	4.3	0.6	3.0	5.5	2.4	6.1	14.5%	28.9%	43.4%	4.0	4.5
Pb (ppm)	492	14	464	520	450	534	2.84%	5.67%	8.51%	467	516
Zn (ppm)	108	9	89	126	80	135	8.62%	17.2%	25.9%	102	113
Co (ppm)	230	11	208	252	197	263	4.81%	9.61%	14.4%	218	241

*Lab G used a modified aqua regia digest. Note - intervals may appear asymmetric due to rounding; IND – indeterminate

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PREPARER AND SUPPLIER OF THE REFERENCE MATERIAL

Reference material OREAS 163 has been prepared and certified and is supplied by:

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OREAS 163 is available in 10g units sealed in nitrogen-purged laminated foil pouches.

INTENDED USE

OREAS 163 is a reference material intended for the following:

- i) for the monitoring of laboratory performance in the analysis of Cu, Fe, S, CaO, MgO, Al₂O₃, SiO₂, Ag, Pb, Zn and Co in geological samples;
- ii) for the calibration of instruments used in the determination of the concentration of Cu, Fe, S, CaO, MgO, Al₂O₃, SiO₂, Ag, Pb, Zn and Co;
- iii) for the verification of analytical methods for Cu, Fe, S, CaO, MgO, Al₂O₃, SiO₂, Ag, Pb, Zn and Co.

STABILITY AND STORAGE INSTRUCTIONS

OREAS 163 is a reference material made from medium grade copper ore material from the Mt Isa Copper Operations. In its unopened state in the nitrogen-purged laminated foil pouches and under normal conditions of storage it has a shelf life beyond five years.

INSTRUCTIONS FOR THE CORRECT USE OF THE REFERENCE MATERIAL

The certified values for OREAS 163 refer to the concentration level of Cu, Fe, S, CaO, MgO, Al₂O₃, SiO₂, Ag, Pb, Zn and Co in its packaged state. The CRM should not be dried prior to weighing and analysis.

LEGAL NOTICE

Ore Research & Exploration Pty Ltd has prepared and statistically evaluated the property values of this reference material to the best of its ability. The Purchaser by receipt hereof releases and indemnifies Ore Research & Exploration Pty Ltd from and against all liability and costs arising from the use of this material and information.

CERTIFYING OFFICER:

Craig Hamlyn (B.Sc. Hons - Geology)

REFERENCES

ISO Guide 35 (2006), Certification of reference materials - General and statistical principals.

ISO Guide 3207 (1975), Statistical interpretation of data - Determination of a statistical tolerance interval.

APPENDIX

Analytical Data for OREAS 163

Table A1. Explanation of abbreviations used in Tables A2 – A11.

Abbreviation	Explanation
Std.Dev.	one standard deviation
Rel.Std.Dev.	one relative standard deviation (%)
PDM ³	percent deviation of lab mean from corrected mean of means
NR	not reported
AD	acid digest (unspecified)
4A	four acid digest (HF-HNO ₃ -HClO ₄ -HCl)
MAR	modified aqua regia digest
PF	sodium peroxide fusion
PSF	pyrosulfate fusion
XRF	X-ray fluorescence
AAS	atomic absorption spectrometry
OES	inductively coupled plasma optical emission spectrometry
MS	inductively coupled plasma mass spectrometry
ICP	unspecified/combination of ICP-OES and ICP-MS

Table A2. Fusion results for Cu in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J
	PF*ICP	PF*OES	PF*OES	PF*OES	PF*OES	PF*OES	PF*OES	PF*OES	PF*ICP	PF*OES
1	1.81	1.77	1.74	1.63	1.75	1.67	1.59	1.68	1.83	1.70
2	1.86	1.78	1.71	1.60	1.79	1.71	1.59	1.66	1.85	1.60
3	1.76	1.76	1.73	1.67	1.68	1.61	1.57	1.68	1.80	1.70
4	1.80	1.81	1.73	1.67	1.69	1.65	1.55	1.62	1.78	1.70
5	1.79	1.84	1.72	1.61	1.72	1.69	1.59	1.67	1.81	1.60
Mean	1.80	1.79	1.73	1.64	1.73	1.67	1.58	1.66	1.81	1.66
Median	1.80	1.78	1.73	1.63	1.72	1.67	1.59	1.67	1.81	1.70
Std.Dev.	0.04	0.03	0.01	0.03	0.05	0.04	0.02	0.02	0.03	0.05
Rel.Std.Dev.	2.02%	1.68%	0.66%	2.01%	2.61%	2.42%	1.26%	1.50%	1.55%	3.30%
PDM ³	5.64%	4.90%	1.08%	-4.19%	1.08%	-2.50%	-7.51%	-2.67%	6.11%	-2.79%

Table A3. Fusion results for Fe in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J
	PF*ICP	PF*OES	PF*OES	PF*OES	PF*OES	PF*OES	PF*OES	BF*OES	PF*ICP	PSF*XRF
1	10.6	11.5	11.2	11.1	10.8	10.9	11.3	11.0	11.1	10.9
2	10.5	11.7	11.3	11.7	11.3	10.9	11.3	10.9	10.9	10.7
3	10.5	11.7	11.5	11.5	11.2	10.6	11.4	11.0	11.2	10.7
4	10.5	11.9	11.1	11.5	10.8	10.7	11.1	11.0	11.1	10.8
5	10.3	12.0	11.3	11.4	10.6	10.7	11.3	11.2	10.9	10.6
Mean	10.5	11.8	11.3	11.4	10.9	10.7	11.3	11.0	11.0	10.7
Median	10.5	11.7	11.3	11.5	10.8	10.7	11.3	11.0	11.1	10.7
Std.Dev.	0.11	0.22	0.15	0.22	0.30	0.11	0.13	0.09	0.14	0.11
Rel.Std.Dev.	1.05%	1.87%	1.31%	1.92%	2.71%	1.01%	1.16%	0.80%	1.26%	1.06%
PDM ³	-5.44%	6.05%	1.78%	3.22%	-1.29%	-3.10%	1.68%	-0.66%	-0.39%	-3.10%

Table A4. Fusion results for S in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*ICP	Lab B PF*OES	Lab C PF*OES	Lab D IRC	Lab E PF*OES	Lab F PF*OES	Lab G PF*OES	Lab H IRC	Lab I PF*ICP	Lab J PF*OES
1	9.9	10.7	10.2	10.2	11.1	9.8	9.7	9.8	11.0	9.9
2	10.0	10.1	10.1	10.0	11.5	10.1	10.4	9.8	10.7	10.2
3	9.9	10.1	9.7	9.8	11.4	9.5	10.0	9.7	10.7	9.9
4	9.9	10.7	10.0	10.0	11.0	9.8	9.7	10.0	10.7	10.2
5	9.8	11.1	10.3	10.2	10.9	9.9	9.7	9.8	11.0	10.0
Mean	9.9	10.5	10.1	10.0	11.2	9.8	9.9	9.8	10.8	10.0
Median	9.9	10.7	10.1	10.0	11.1	9.8	9.7	9.8	10.7	10.0
Std.Dev.	0.1	0.4	0.2	0.2	0.3	0.2	0.3	0.1	0.1	0.2
Rel.Std.Dev.	0.62%	3.81%	2.13%	1.54%	2.52%	1.94%	3.11%	1.29%	1.29%	1.67%
PDM ³	-0.81%	5.54%	0.93%	0.71%	11.9%	-1.58%	-1.03%	-1.64%	8.65%	0.47%

Table A5. Fusion results for CaO in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*ICP	Lab B PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab F PF*OES	Lab G PF*OES	Lab H BF*OES	Lab I PF*ICP	Lab J PF*OES
1	0.82	0.90	1.00	1.00	0.92	0.82	0.63	0.90	1.15	NR
2	0.81	0.90	0.80	1.10	0.90	0.88	0.62	0.87	1.10	NR
3	0.82	0.90	0.80	1.10	0.95	0.73	0.61	0.87	1.12	NR
4	0.81	0.90	0.80	1.10	0.89	0.77	0.61	0.87	1.13	NR
5	0.80	1.00	0.80	1.10	0.89	0.82	0.60	0.89	1.11	NR
Mean	0.81	0.92	0.84	1.08	0.91	0.80	0.61	0.88	1.12	
Median	0.81	0.90	0.80	1.10	0.90	0.82	0.61	0.87	1.12	
Std.Dev.	0.01	0.04	0.09	0.04	0.03	0.06	0.01	0.01	0.02	
Rel.Std.Dev.	1.03%	4.86%	10.6%	4.14%	2.80%	7.07%	1.92%	1.61%	1.71%	
PDM ³	-11.7%	0.03%	-8.67%	17.4%	-1.06%	-12.6%	-33.1%	-4.32%	22.0%	

Table A6. Fusion results for MgO in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*ICP	Lab B PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab F PF*OES	Lab G PF*OES	Lab H BF*OES	Lab I PF*ICP	Lab J PF*OES
1	5.19	5.42	5.50	5.44	5.10	5.08	6.24	5.37	5.20	5.50
2	5.16	5.52	5.36	5.64	5.33	5.04	6.16	5.34	4.96	5.40
3	5.20	5.52	5.50	5.47	5.25	5.02	6.27	5.28	5.28	5.50
4	5.18	5.64	5.41	5.78	5.13	5.03	6.20	5.39	5.18	5.50
5	5.12	5.67	5.54	5.85	5.29	5.05	5.88	5.44	5.12	5.40
Mean	5.17	5.55	5.46	5.64	5.22	5.04	6.15	5.36	5.15	5.46
Median	5.18	5.52	5.50	5.64	5.25	5.04	6.20	5.37	5.18	5.50
Std.Dev.	0.03	0.10	0.07	0.18	0.10	0.02	0.16	0.06	0.12	0.05
Rel.Std.Dev.	0.61%	1.80%	1.36%	3.23%	1.93%	0.46%	2.57%	1.11%	2.32%	1.00%
PDM ³	-3.18%	4.02%	2.29%	5.55%	-2.24%	-5.54%	15.2%	0.45%	-3.59%	2.25%

Table A7. Fusion results for Al₂O₃ in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*ICP	Lab B PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab F PF*OES	Lab G PF*OES	Lab H BF*OES	Lab I PF*ICP	Lab J PF*OES
1	3.27	3.19	3.21	3.70	3.19	3.08	3.01	3.28	3.18	3.20
2	3.29	3.19	3.14	4.00	3.23	3.16	3.03	3.25	3.12	3.10
3	3.21	3.17	3.23	3.80	3.16	3.00	3.00	3.26	3.17	3.20
4	3.23	3.23	3.08	4.00	3.06	3.06	2.75	3.26	3.14	3.10
5	3.18	3.27	3.16	4.00	3.22	3.13	3.07	3.34	3.14	3.10
Mean	3.24	3.21	3.16	3.90	3.17	3.09	2.97	3.28	3.15	3.14
Median	3.23	3.19	3.16	4.00	3.19	3.08	3.01	3.26	3.14	3.10
Std.Dev.	0.04	0.04	0.06	0.14	0.07	0.06	0.12	0.04	0.02	0.05
Rel.Std.Dev.	1.38%	1.18%	1.88%	3.63%	2.15%	2.02%	4.20%	1.11%	0.78%	1.74%
PDM ³	2.32%	1.57%	0.05%	23.3%	0.30%	-2.42%	-6.02%	3.65%	-0.40%	-0.71%

Table A8. Fusion results for SiO₂ in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*ICP	Lab B PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab F PF*OES	Lab G PF*OES	Lab H BF*OES	Lab I PF*ICP	Lab J PF*OES
1	63.9	64.0	61.0	73.1	64.8	63.3	60.4	62.9	63.3	64.0
2	64.0	64.9	58.0	78.1	66.0	65.7	61.8	62.9	63.5	62.0
3	62.4	64.3	61.4	74.2	65.0	61.1	58.0	63.2	63.2	64.0
4	62.5	65.9	59.7	73.1	63.0	63.5	56.3	63.3	63.0	66.0
5	63.5	65.8	60.3	76.5	65.2	64.7	59.8	63.1	63.6	63.0
Mean	63.2	65.0	60.1	75.0	64.8	63.7	59.3	63.1	63.3	63.8
Median	63.5	64.9	60.3	74.2	65.0	63.5	59.8	63.1	63.3	64.0
Std.Dev.	0.8	0.9	1.3	2.2	1.1	1.7	2.2	0.2	0.2	1.5
Rel.Std.Dev.	1.25%	1.32%	2.22%	2.96%	1.70%	2.72%	3.66%	0.31%	0.39%	2.32%
PDM ³	-0.28%	2.46%	-5.27%	18.3%	2.17%	0.38%	-6.53%	-0.59%	-0.17%	0.60%

Table A9. Fusion results for Ag in OREAS 163 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A PF*ICP	Lab B -	Lab C PF*MS	Lab D PF*MS	Lab E -	Lab F -	Lab G PF*OES	Lab H -	Lab I -	Lab J -
1	<10	NR	<5	4.0	NR	NR	5.9	NR	NR	NR
2	<10	NR	5.0	5.0	NR	NR	5.9	NR	NR	NR
3	<10	NR	5.0	5.0	NR	NR	6.7	NR	NR	NR
4	<10	NR	<5	4.0	NR	NR	4.7	NR	NR	NR
5	<10	NR	<5	5.0	NR	NR	6.8	NR	NR	NR
Mean			5.0	4.6			6.0			
Median			5.0	5.0			5.9			
Std.Dev.			0.0	0.5			0.8			
Rel.Std.Dev.			0.00%	11.9%			14.0%			
PDM ³			-3.85%	-11.5%			15.4%			

Table A10. Fusion results for Pb in OREAS 163 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A PF*ICP	Lab B PF*OES	Lab C PF*MS	Lab D PF*OES	Lab E PF*MS	Lab F PF*OES	Lab G PF*OES	Lab H -	Lab I PF*ICP	Lab J PF*OES
1	500	457	510	570	453	400	397	NR	500	410
2	500	453	490	560	451	400	423	NR	500	420
3	500	450	480	570	458	300	363	NR	500	410
4	500	460	480	600	455	400	445	NR	500	410
5	500	458	470	590	456	300	380	NR	500	400
Mean	500	456	486	578	455	360	402		500	410
Median	500	457	480	570	455	400	397		500	410
Std.Dev.	0	4	15	16	3	55	33		0	7
Rel.Std.Dev.	0.00%	0.89%	3.12%	2.84%	0.59%	15.2%	8.18%		0.00%	1.72%
PDM ³	8.54%	-1.10%	5.50%	25.5%	-1.31%	-21.8%	-12.8%		8.54%	-11.0%

Table A11. Fusion results for Zn in OREAS 163 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A PF*ICP	Lab B PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*MS	Lab F PF*OES	Lab G PF*OES	Lab H PF*OES	Lab I PF*ICP	Lab J PF*OES
1	<100	117	100	110	107	100	119	100	100	100
2	200	114	100	110	102	100	81	100	100	100
3	200	119	100	130	100	100	70	100	100	94
4	<100	120	100	110	104	100	<50	100	100	110
5	<100	111	150	120	131	100	68	100	100	93
Mean	200	116	110	116	109	100	85	100	100	99
Median	200	117	100	110	104	100	76	100	100	100
Std.Dev.	0	4	22	9	13	0	24	0	0	7
Rel.Std.Dev.	0.00%	3.19%	20.3%	7.71%	11.7%	0.00%	28.0%	0.00%	0.00%	6.81%
PDM ³	95.8%	13.8%	7.68%	13.6%	6.51%	-2.10%	-17.3%	-2.10%	-2.10%	-2.69%

Table A12. Fusion results for Co in OREAS 163 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A PF*ICP	Lab B PF*MS	Lab C PF*OES	Lab D PF*OES	Lab E PF*MS	Lab F PF*OES	Lab G PF*OES	Lab H PF*OES	Lab I PF*ICP	Lab J PF*OES
1	240	223	220	220	226	230	282	242	230	230
2	240	223	260	210	229	230	291	234	240	230
3	240	225	240	240	224	220	284	234	250	220
4	240	222	240	210	228	220	249	232	240	220
5	240	220	240	220	226	230	NR	236	240	220
Mean	240	223	240	220	227	226	277	236	240	224
Median	240	223	240	220	226	230	283	234	240	220
Std.Dev.	0	2	14	12	2	5	19	4	7	5
Rel.Std.Dev.	0.00%	0.82%	5.89%	5.57%	0.86%	2.42%	6.78%	1.69%	2.95%	2.45%
PDM ³	4.19%	-3.37%	4.19%	-4.49%	-1.63%	-1.89%	20.0%	2.30%	4.19%	-2.76%

Table A13. 4-acid results for Cu in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A 4A*OES	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*AAS	Lab E 4A*OES	Lab F 4A*OES	Lab G MAR*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES
1	1.72	1.83	1.74	1.63	1.78	1.74	1.77	1.80	1.86	1.80
2	1.72	1.98	1.68	1.60	1.76	1.73	1.76	1.85	1.87	1.80
3	1.71	1.84	1.73	1.58	1.78	1.72	1.76	1.78	1.85	1.80
4	1.69	1.79	1.75	1.67	1.77	1.74	1.75	1.84	1.85	1.70
5	1.70	1.87	1.73	1.68	1.76	1.69	1.75	1.77	1.89	1.80
Mean	1.71	1.86	1.73	1.63	1.77	1.72	1.76	1.81	1.86	1.78
Median	1.71	1.84	1.73	1.63	1.77	1.73	1.76	1.80	1.86	1.80
Std.Dev.	0.01	0.07	0.03	0.04	0.01	0.02	0.01	0.04	0.02	0.04
Rel.Std.Dev.	0.76%	3.90%	1.57%	2.65%	0.51%	1.11%	0.33%	2.01%	0.90%	2.51%
PDM ³	-3.06%	5.78%	-2.04%	-7.37%	0.29%	-2.32%	-0.19%	2.70%	5.80%	1.03%

Table A14. 4-acid results for Fe in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A 4A*OES	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*OES	Lab E 4A*MS	Lab F 4A*OES	Lab G MAR*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES
1	11.1	11.8	11.2	11.1	11.0	11.0	10.4	10.7	11.0	11.0
2	11.2	12.9	10.9	11.0	10.8	11.0	10.6	10.9	11.2	11.0
3	11.1	11.9	11.1	11.2	11.5	10.8	10.4	10.7	11.0	11.0
4	11.1	11.6	11.3	11.1	10.9	11.0	10.5	11.5	11.0	11.0
5	11.2	12.0	11.3	11.1	11.4	10.8	10.5	10.4	11.2	11.0
Mean	11.1	12.1	11.2	11.1	11.1	10.9	10.5	10.8	11.1	11.0
Median	11.1	11.9	11.2	11.1	11.0	11.0	10.5	10.7	11.0	11.0
Std.Dev.	0.1	0.5	0.2	0.1	0.3	0.1	0.1	0.4	0.1	0.0
Rel.Std.Dev.	0.49%	4.25%	1.50%	0.64%	2.70%	0.94%	0.81%	3.75%	0.99%	0.00%
PDM ³	0.66%	8.88%	0.84%	0.30%	0.12%	-1.42%	-5.45%	-2.27%	0.12%	-0.61%

Table A15. 4-acid results for S in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A 4A*OES	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*OES	Lab E 4A*MS	Lab F 4A*OES	Lab G MAR*OES	Lab H -	Lab I 4A*OES	Lab J -
1	11.3	10.4	10.1	>5	9.8	10.0	10.4	NR	10.7	NR
2	11.3	10.4	9.8	>5	9.6	10.0	10.6	NR	10.7	NR
3	11.3	10.3	10.0	>5	>10.0	9.9	10.7	NR	10.7	NR
4	11.2	9.7	10.2	>5	9.7	9.9	10.6	NR	10.7	NR
5	11.3	9.9	10.1	>5	>10.0	9.8	10.7	NR	10.7	NR
Mean	11.3	10.1	10.0		9.7	9.9	10.6		10.7	
Median	11.3	10.3	10.1		9.7	9.9	10.6		10.7	
Std.Dev.	0.0	0.3	0.2		0.1	0.1	0.1		0.0	
Rel.Std.Dev.	0.40%	3.06%	1.51%		0.82%	0.84%	0.97%		0.00%	
PDM ³	8.70%	-2.21%	-3.25%		-6.33%	-4.40%	2.23%		3.11%	

Table A16. 4-acid results for CaO in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A 4A*OES	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*OES	Lab E 4A*MS	Lab F 4A*OES	Lab G MAR*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES
1	0.850	0.854	0.920	0.883	0.900	0.870	0.852	0.854	0.923	0.790
2	0.850	0.854	0.870	0.845	0.870	0.850	0.850	0.881	0.923	0.810
3	0.850	0.868	0.880	0.869	0.920	0.840	0.853	0.854	0.923	0.810
4	0.850	0.868	0.900	0.863	0.880	0.850	0.848	0.881	0.895	0.780
5	0.860	0.854	0.880	0.844	0.920	0.830	0.846	0.868	0.923	0.820
Mean	0.852	0.859	0.890	0.861	0.898	0.848	0.850	0.868	0.918	0.802
Median	0.850	0.854	0.880	0.863	0.900	0.850	0.850	0.868	0.923	0.810
Std.Dev.	0.004	0.008	0.020	0.017	0.023	0.015	0.003	0.014	0.013	0.016
Rel.Std.Dev.	0.52%	0.89%	2.25%	1.92%	2.54%	1.75%	0.34%	1.61%	1.36%	2.05%
PDM ³	-0.93%	-0.10%	3.49%	0.09%	4.42%	-1.39%	-1.16%	0.87%	6.73%	-6.74%

Table A17. 4-acid results for MgO in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A 4A*OES	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*OES	Lab E 4A*MS	Lab F 4A*OES	Lab G MAR*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES
1	5.24	5.42	5.49	5.39	5.41	4.87	4.56	5.39	5.57	5.30
2	5.21	5.37	5.29	5.25	5.32	4.86	4.57	5.42	5.55	5.50
3	5.24	5.52	5.45	5.44	5.65	4.79	4.59	5.44	5.55	5.40
4	5.22	5.52	5.49	5.39	5.41	4.86	4.56	5.46	5.37	5.20
5	5.29	5.47	5.52	5.30	5.65	4.77	4.57	5.34	5.62	5.50
Mean	5.24	5.46	5.45	5.35	5.49	4.83	4.57	5.41	5.53	5.38
Median	5.24	5.47	5.49	5.39	5.41	4.86	4.57	5.42	5.55	5.40
Std.Dev.	0.03	0.06	0.09	0.08	0.15	0.05	0.01	0.05	0.09	0.13
Rel.Std.Dev.	0.59%	1.19%	1.68%	1.44%	2.78%	0.96%	0.24%	0.85%	1.71%	2.42%
PDM ³	-3.31%	0.78%	0.53%	-1.21%	1.27%	-10.9%	-15.7%	-0.20%	2.13%	-0.73%

Table A18. 4-acid results for Al₂O₃ in OREAS 163 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A 4A*OES	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*OES	Lab E 4A*MS	Lab F 4A*OES	Lab G MAR*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES
1	3.22	3.21	3.21	3.30	3.21	3.11	2.79	3.25	3.33	3.20
2	3.18	3.17	3.10	3.22	3.16	3.09	2.83	3.46	3.33	3.10
3	3.16	3.27	3.19	3.34	3.36	3.06	2.81	3.31	3.31	3.20
4	3.16	3.25	3.21	3.32	3.21	3.10	2.81	3.38	3.27	3.40
5	3.18	3.21	3.21	3.25	3.36	3.04	2.81	3.38	3.36	3.30
Mean	3.18	3.22	3.18	3.29	3.26	3.08	2.81	3.36	3.32	3.24
Median	3.18	3.21	3.21	3.30	3.21	3.09	2.81	3.38	3.33	3.20
Std.Dev.	0.02	0.04	0.05	0.05	0.09	0.03	0.02	0.08	0.03	0.11
Rel.Std.Dev.	0.77%	1.14%	1.50%	1.52%	2.87%	0.95%	0.57%	2.38%	1.03%	3.52%
PDM ³	-1.74%	-0.40%	-1.62%	1.53%	0.73%	-4.83%	-13.2%	3.69%	2.52%	0.11%

Table A19. 4-acid results for Ag in OREAS 163 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A 4A*OES	Lab B 4A*MS	Lab C 4A*MS	Lab D 4A*OES	Lab E 4A*MS	Lab F 4A*OES	Lab G MAR*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 3A*AAS
1	4.0	4.0	4.0	4.3	4.5	3.0	4.1	4.0	5.4	4.3
2	4.1	4.0	4.5	4.7	4.5	11.0	3.8	5.0	5.2	3.9
3	4.0	4.0	4.0	4.5	4.6	4.0	4.2	4.0	5.4	4.0
4	4.1	6.0	4.0	4.6	4.4	3.0	4.0	6.0	5.1	4.1
5	3.8	4.0	4.0	4.2	4.6	5.0	4.5	6.0	5.2	3.9
Mean	4.0	4.4	4.1	4.5	4.5	5.2	4.1	5.0	5.3	4.0
Median	4.0	4.0	4.0	4.5	4.5	4.0	4.1	5.0	5.2	4.0
Std.Dev.	0.1	0.9	0.2	0.2	0.1	3.3	0.3	1.0	0.1	0.2
Rel.Std.Dev.	3.06%	20.3%	5.45%	4.65%	1.64%	64.4%	6.28%	20.0%	2.55%	4.14%
PDM ³	-5.97%	3.43%	-3.62%	4.85%	6.02%	22.2%	-3.15%	17.5%	23.7%	-5.03%

Table A20. 4-acid results for Pb in OREAS 163 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A 4A*OES	Lab B 4A*MS	Lab C 4A*MS	Lab D 4A*OES	Lab E 4A*MS	Lab F 4A*OES	Lab G MAR*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES
1	500	487	493	503	473	460	490	500	503	480
2	490	479	502	498	464	450	470	500	518	470
3	500	488	483	502	492	440	470	500	509	490
4	510	480	493	514	470	450	490	400	504	500
5	490	467	483	482	489	440	470	500	512	500
Mean	498	480	491	500	478	448	478	480	509	488
Median	500	480	493	502	473	450	470	500	509	490
Std.Dev.	8	8	8	12	12	8	11	45	6	13
Rel.Std.Dev.	1.68%	1.75%	1.63%	2.32%	2.57%	1.87%	2.29%	9.32%	1.21%	2.67%
PDM ³	1.26%	-2.36%	-0.20%	1.63%	-2.88%	-8.90%	-2.80%	-2.40%	3.54%	-0.77%

Table A21. 4-acid results for Zn in OREAS 163 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A 4A*OES	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*OES	Lab E 4A*MS	Lab F 4A*OES	Lab G MAR*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES
1	111	145	118	107	110	100	90	100	122	100
2	112	155	114	125	108	100	100	100	120	95
3	110	141	118	115	114	100	90	100	112	120
4	113	137	118	110	108	100	100	100	120	110
5	107	159	116	114	114	100	90	100	122	100
Mean	111	147	117	114	111	100	94	100	119	105
Median	111	145	118	114	110	100	90	100	120	100
Std.Dev.	2	9	2	7	3	0	5	0	4	10
Rel.Std.Dev.	2.08%	6.32%	1.53%	5.98%	2.74%	0.00%	5.83%	0.00%	3.48%	9.52%
PDM ³	2.76%	37.0%	8.52%	6.11%	2.95%	-7.09%	-12.7%	-7.09%	10.8%	-2.44%

Table A22. 4-acid results for Co in OREAS 163 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A 4A*OES	Lab B 4A*MS	Lab C 4A*OES	Lab D 4A*OES	Lab E 4A*MS	Lab F 4A*OES	Lab G MAR*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES
1	240	240	248	229	226	220	219	230	216	230
2	240	240	242	224	221	220	219	240	214	220
3	240	241	244	230	238	220	216	240	212	230
4	240	235	248	229	227	220	217	240	210	240
5	240	232	246	224	235	210	217	240	217	240
Mean	240	238	246	227	229	218	218	238	214	232
Median	240	240	246	229	227	220	217	240	214	230
Std.Dev.	0	4	3	3	7	4	1	4	3	8
Rel.Std.Dev.	0.00%	1.65%	1.06%	1.30%	3.03%	2.05%	0.62%	1.88%	1.34%	3.61%
PDM ³	4.38%	3.34%	6.82%	-1.18%	-0.23%	-5.18%	-5.36%	3.51%	-7.01%	0.90%