



**CERTIFICATE OF ANALYSIS FOR  
NICKEL LATERITE ORE REFERENCE MATERIAL  
OREAS 189**

Constituent	Certified Value	1SD
<b>Fusion XRF</b>		
Nickel, Ni (wt.%)	1.48	0.03
Cobalt, Co (ppm)	326	13
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	2.09	0.02
Calcium oxide, CaO (wt.%)	0.326	0.007
<i>Chlorine, Cl (ppm)</i>	<50	IND
<i>Copper, Cu (ppm)</i>	<50	IND
Chromium oxide, Cr <sub>2</sub> O <sub>3</sub> (wt.%)	0.765	0.015
Iron oxide, Fe <sub>2</sub> O <sub>3</sub> (wt.%)	15.04	0.16
<i>Potassium oxide, K<sub>2</sub>O (wt.%)</i>	<0.01	IND
Magnesium oxide, MgO (wt.%)	23.09	0.24
Manganese oxide, MnO (wt.%)	0.227	0.004
<i>Sodium oxide, Na<sub>2</sub>O (wt.%)</i>	~0.03	IND
<i>Phosphorus oxide, P<sub>2</sub>O<sub>5</sub> (wt.%)</i>	<0.01	IND
Silicon dioxide, SiO <sub>2</sub> (wt.%)	46.20	0.36
<i>Sulphur oxide, SO<sub>3</sub> (wt.%)</i>	<0.01	IND
Titanium oxide, TiO <sub>2</sub> (wt.%)	0.029	0.008
Zinc, Zn (ppm)	125	9
Loss on ignition, LOI (wt.%)	10.13	0.27
<b>Fusion ICP</b>		
Nickel, Ni (wt.%)	1.47	0.03
Cobalt, Co (ppm)	327	21
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	2.08	0.06
Calcium oxide, CaO (wt.%)	0.328	0.036
<i>Copper, Cu (ppm)</i>	~30	IND
Chromium oxide, Cr <sub>2</sub> O <sub>3</sub> (wt.%)	0.764	0.023
Iron oxide, Fe <sub>2</sub> O <sub>3</sub> (wt.%)	14.94	0.39
<i>Potassium oxide, K<sub>2</sub>O (wt.%)</i>	~0.08	IND
Magnesium oxide, MgO (wt.%)	23.06	0.44
Manganese oxide, MnO (wt.%)	0.228	0.005
<i>Sodium oxide, Na<sub>2</sub>O (wt.%)</i>	0.021	0.004
<i>Phosphorus oxide, P<sub>2</sub>O<sub>5</sub> (wt.%)</i>	<0.02	IND
Silica dioxide, SiO <sub>2</sub> (wt.%)	46.08	1.02
<i>Sulphur oxide, SO<sub>3</sub> (wt.%)</i>	<0.05	IND
Titanium oxide, TiO <sub>2</sub> (wt.%)	0.026	0.004
Zinc, Zn (ppm)	103	23
<b>IR Combustion Furnace</b>		
Carbon, C (wt.%)	0.10	0.02
<i>Sulphur, S (wt.%)</i>	<0.01	IND

Note: italics - indicative values only; IND - indeterminate.

## INTRODUCTION

OREAS reference materials (RM) are intended to provide a low cost method of evaluating and improving the quality of 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 mine geologist, they provide a tool for grade control in routine mining operations. To the analyst, they provide an effective means of calibrating analytical equipment, assessing new techniques and routinely monitoring in-house procedures.

## SOURCE MATERIAL

Reference material OREAS 189 is one of a suite of thirteen nickel laterite CRMs (OREAS 182 to OREAS 195) prepared from saprolitic ore source materials. These were supplied by Anglo American Brazil Limitada from the Codemin Nickel Mine located in the state of Goiás and ~300 kms from the port of Santos, Brazil.

## COMMUNITION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 189 was prepared in the following manner:

- a) *drying to constant mass at 105°C;*
- b) *crushing;*
- c) *milling to 99.8% minus 75 microns;*
- d) *homogenisation and bagging into 20kg sublots;*
- e) *collection of 20 representative 300g samples during the bagging stage for the round robin program;*
- f) *packaging into 10g units in laminated foil pouches and 1kg units in wide mouth jars.*

## ANALYTICAL PROGRAM FOR OREAS 189

OREAS 189 is a nickel laterite reference material prepared by Ore Research & Exploration and has been certified for Ni, Co, Al<sub>2</sub>O<sub>3</sub>, C, CaO, Cl, Cu, Cr<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>O, MgO, MnO, Na<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub>, S, SO<sub>3</sub>, TiO<sub>2</sub>, Zn and LOI. Nineteen commercial analytical laboratories participated in the certification program with characterization of this suite of 20 analytes on a dry basis by the following methods:

- Ni, Co, Al<sub>2</sub>O<sub>3</sub>, CaO, Cl, Cu, Cr<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>O, MgO, MnO, Na<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub>, SO<sub>3</sub>, TiO<sub>2</sub> and Zn by lithium borate fusion with X-ray fluorescence (17 laboratories)
- Ni, Co, Al<sub>2</sub>O<sub>3</sub>, CaO, Cu, Cr<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>O, MgO, MnO, Na<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub>, SO<sub>3</sub>, TiO<sub>2</sub> and Zn by lithium borate or sodium peroxide fusion with ICP-OES (12 laboratories)\*
- carbon and sulphur by infra-red combustion furnace (11 laboratories)
- loss on ignition (LOI) at 1000°C (18 laboratories)

\*Departures from a fusion ICP method were Lab G, which used a modified aqua regia digestion with ICP to determine Ni, Co, Cu, SO<sub>3</sub> and Zn, and Lab H, which used 4-acid digestion ICP to determine Co and Cu.

Due to the hygroscopic nature of nickel laterites, the laboratories were instructed to dry all samples thoroughly at 105°C prior to analysis and place in a desiccator with fresh desiccant. The samples were then to be cooled to room temperature before weighing for analysis. Alternatively, all samples could be corrected to dry basis by allowing the samples to equilibrate to lab atmosphere before weighing for analysis and correction for moisture by determination at 105°C of this property on a separate portion.

For the evaluation program a total of twenty 300g test units were taken at predetermined intervals during the bagging stage and are considered representative of the entire batch. To evaluate and compensate for the effects of batch-to-batch variation at individual laboratories, samples were submitted to the laboratories in three batches of four 20g sample pulps at weekly intervals. The four samples received by each laboratory were obtained by taking two 20g scoop splits from each of two separate 300g test units.

All results, together with uncorrected means, medians, standard deviations, relative standard deviations and percent deviation of lab means from the corrected mean of means (PDM<sup>3</sup>) are presented in the Appendix (Tables A2 to A37). The analytical methods employed by each laboratory are given in the table captions and described in Table A1 of the Appendix. The parameter PDM<sup>3</sup> 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.

## STATISTICAL EVALUATION OF ANALYTICAL DATA FOR OREAS 189

### Certified Value and Confidence Interval

Each batch of results is treated as a separate data set in testing for outliers. The certified value is determined from the mean of lab means after filtering of individual and batch outliers. It is 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 are obtained by calculation of the variance ( $\hat{V}$ ) of the consensus value ( $\bar{\bar{x}}$ ) (mean of means) and reference to Student's- $t$  distribution with degrees of freedom ( $p-1$ ).

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

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

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 is 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.

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  $> 1.5\%$  (XRF) and  $> 3.0\%$  (other methods). 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 laboratory data set (batch) outliers have been eliminated a non-iterative 3 standard deviation filter is applied, with individual values lying outside this window also relegated to outlying status. Individual outliers and, more rarely, laboratory data sets (batches) 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 (see Table 1).

Table 1. Certified Values and 95% Confidence Intervals for OREAS 189.

Constituent	Certified Value	95% Confidence Interval	
		Low	High
<b>Fusion XRF</b>			
Nickel, Ni (wt.%)	1.48	1.47	1.49
Cobalt, Co (ppm)	326	320	333
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	2.09	2.08	2.10
Calcium oxide, CaO (wt.%)	0.326	0.323	0.329
<i>Chlorine, Cl (ppm)</i>	<50	IND	IND
<i>Copper, Cu (ppm)</i>	<50	IND	IND
Chromium oxide, Cr <sub>2</sub> O <sub>3</sub> (wt.%)	0.765	0.759	0.771
Iron oxide, Fe <sub>2</sub> O <sub>3</sub> (wt.%)	15.04	14.97	15.11
<i>Potassium oxide, K<sub>2</sub>O (wt.%)</i>	<0.01	IND	IND
Magnesium oxide, MgO (wt.%)	23.09	22.99	23.20
Manganese oxide, MnO (wt.%)	0.227	0.225	0.229
<i>Sodium oxide, Na<sub>2</sub>O (wt.%)</i>	~0.03	IND	IND
<i>Phosphorus oxide, P<sub>2</sub>O<sub>5</sub> (wt.%)</i>	<0.01	IND	IND
Silicon dioxide, SiO <sub>2</sub> (wt.%)	46.20	46.05	46.35
<i>Sulphur oxide, SO<sub>3</sub> (wt.%)</i>	<0.01	IND	IND
Titanium oxide, TiO <sub>2</sub> (wt.%)	0.029	0.026	0.032
Zinc, Zn (ppm)	125	121	129
Loss on ignition, LOI (wt.%)	10.13	9.98	10.27
<b>Fusion ICP</b>			
Nickel, Ni (wt.%)	1.47	1.45	1.48
Cobalt, Co (ppm)	327	315	339
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	2.08	2.05	2.11
Calcium oxide, CaO (wt.%)	0.328	0.306	0.351
<i>Copper, Cu (ppm)</i>	~30	IND	IND
Chromium oxide, Cr <sub>2</sub> O <sub>3</sub> (wt.%)	0.764	0.756	0.773
Iron oxide, Fe <sub>2</sub> O <sub>3</sub> (wt.%)	14.94	14.74	15.14
<i>Potassium oxide, K<sub>2</sub>O (wt.%)</i>	~0.08	IND	IND
Magnesium oxide, MgO (wt.%)	23.06	22.87	23.26
Manganese oxide, MnO (wt.%)	0.228	0.226	0.231
<i>Sodium oxide, Na<sub>2</sub>O (wt.%)</i>	0.021	0.019	0.024
<i>Phosphorus oxide, P<sub>2</sub>O<sub>5</sub> (wt.%)</i>	<0.02	IND	IND
Silica dioxide, SiO <sub>2</sub> (wt.%)	46.08	45.64	46.52
<i>Sulphur oxide, SO<sub>3</sub> (wt.%)</i>	<0.02	IND	IND
Titanium oxide, TiO <sub>2</sub> (wt.%)	0.026	0.023	0.028
Zinc, Zn (ppm)	103	85	120
<b>IR Combustion Furnace</b>			
Carbon, C (wt.%)	0.10	0.08	0.11
<i>Sulphur, S (wt.%)</i>	<0.01	IND	IND

Note - italics: indicative value; IND: indeterminate; intervals may appear asymmetric due to rounding.

## 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

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

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 ( $m, \alpha$  unknown);  
 $s_g''$  is the corrected grand standard deviation.

The meaning of these tolerance limits may be illustrated for nickel by lithium borate fusion XRF, where 99% of the time at least 95% of subsamples will have concentrations lying between 1.47 and 1.49 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).

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

$1 - (\frac{s_i}{2s_g'})$  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. Individual outliers (shown in bold in Tables A2 to A37) were removed prior to the calculation of tolerance intervals and a weighting factor of zero was applied to those data sets where  $s_i/2s_g' > 1$  (i.e. where the weighting factor  $1 - s_i/2s_g' < 0$ ). Data sets displaying poor resolution (i.e. where the ratio of the reading increment divided by the measured value is  $< 1/20$ ) were also omitted.

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. Despite the limitations of this method, the tolerance intervals presented in Table 2 are considered to confirm a high level of homogeneity for this CRM.

Table 2. Certified Values and Tolerance Limits for OREAS 189.

Constituent	Certified Value	Tolerance limits 1- $\alpha$ =0.99, $\rho$ =0.95	
		Low	High
<b>Fusion XRF</b>			
Nickel, Ni (wt.%)	1.48	1.47	1.49
Cobalt, Co (ppm)	326	322	330
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	2.09	2.08	2.11
Calcium oxide, CaO (wt.%)	0.326	0.325	0.327
<i>Chlorine, Cl (ppm)</i>	<50	IND	IND
<i>Copper, Cu (ppm)</i>	<50	IND	IND
Chromium oxide, Cr <sub>2</sub> O <sub>3</sub> (wt.%)	0.765	0.759	0.770
Iron oxide, Fe <sub>2</sub> O <sub>3</sub> (wt.%)	15.04	14.97	15.12
<i>Potassium oxide, K<sub>2</sub>O (wt.%)</i>	<0.01	IND	IND
Magnesium oxide, MgO (wt.%)	23.09	23.01	23.18
Manganese oxide, MnO (wt.%)	0.227	0.226	0.228
<i>Sodium oxide, Na<sub>2</sub>O (wt.%)</i>	~0.03	IND	IND
<i>Phosphorus oxide, P<sub>2</sub>O<sub>5</sub> (wt.%)</i>	<0.01	IND	IND
Silicon dioxide, SiO <sub>2</sub> (wt.%)	46.20	46.04	46.35
<i>Sulphur oxide, SO<sub>3</sub> (wt.%)</i>	<0.01	IND	IND
Titanium oxide, TiO <sub>2</sub> (wt.%)	0.029	0.025	0.032
Zinc, Zn (ppm)	125	117	133
Loss on ignition, LOI (wt.%)	10.13	10.07	10.18
<b>Fusion ICP</b>			
Nickel, Ni (wt.%)	1.47	1.44	1.49
Cobalt, Co (ppm)	327	317	338
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	2.08	2.04	2.12
Calcium oxide, CaO (wt.%)	0.328	0.318	0.338
<i>Copper, Cu (ppm)</i>	~30	IND	IND
Chromium oxide, Cr <sub>2</sub> O <sub>3</sub> (wt.%)	0.764	0.751	0.778
Iron oxide, Fe <sub>2</sub> O <sub>3</sub> (wt.%)	14.94	14.72	15.16
<i>Potassium oxide, K<sub>2</sub>O (wt.%)</i>	~0.08	IND	IND
Magnesium oxide, MgO (wt.%)	23.06	22.77	23.36
Manganese oxide, MnO (wt.%)	0.228	0.226	0.230
<i>Sodium oxide, Na<sub>2</sub>O (wt.%)</i>	0.021	IND	IND
<i>Phosphorus oxide, P<sub>2</sub>O<sub>5</sub> (wt.%)</i>	<0.02	IND	IND
Silica dioxide, SiO <sub>2</sub> (wt.%)	46.08	45.42	46.74
<i>Sulphur oxide, SO<sub>3</sub> (wt.%)</i>	<0.02	IND	IND
Titanium oxide, TiO <sub>2</sub> (wt.%)	0.026	0.025	0.026
Zinc, Zn (ppm)	103	93	112
<b>IR Combustion Furnace</b>			
Carbon, C (wt.%)	0.10	IND	IND
<i>Sulphur, S (wt.%)</i>	<0.01	IND	IND

Note - intervals may appear asymmetric due to rounding; IND = indeterminate; italics = indicative value



## ANOVA Study

All laboratories and all 3 rounds of sample submission were included in the ANOVA study for nickel, cobalt, iron oxide and magnesium oxide. The sampling format for OREAS 189 was structured to enable nested ANOVA treatment of the round robin results. During the bagging stage, immediately following homogenization, twenty 300g samples were taken at regular intervals representative of the entire batch of OREAS 189. For each round of sample submissions, each laboratory received paired samples from two different, non-adjacent 300g samples. For example, the samples that any one of the seventeen (XRF) laboratories could have received are:

Round 1 (week 1)	Round 2 (week 2)	Round 3 (week 3)
Sample 1: Unit 1	Sample 1: Unit 10	Sample 1: Unit 6
Sample 2: Unit 11	Sample 2: Unit 20	Sample 2: Unit 16
Sample 3: Unit 1	Sample 3: Unit 10	Sample 3: Unit 6
Sample 4: Unit 11	Sample 4: Unit 20	Sample 4: Unit 16

The purpose of the ANOVA investigation was to compare the within-unit variance with that of the between-unit variance. This approach permitted an assessment of homogeneity across the entire batch of OREAS 189. The test was performed using the following parameters:

- Significance Level  $\alpha = P$  (type I error) = 0.05
- Null Hypothesis,  $H_0$ : Between-unit variance is no greater than within-unit variance (reject  $H_0$  if p-value < 0.05)
- Alternative Hypothesis,  $H_1$ : Between-unit variance is greater than within-unit variance

P-values are a measure of probability whereby values less than 0.05 indicate a greater than 95% probability that the observed differences in within-unit and between-unit variances are real. The dataset was filtered for both individual and batch (lab round) outliers prior to the calculation of the p-value. This process derived p-values of 1.00 for nickel, 0.967 for cobalt, 1.00 for iron oxide and 1.00 for magnesium oxide and indicates no evidence that between-unit variance is greater than within-unit variance. Conclusion: do not reject  $H_0$ .

Note that ANOVA is not an absolute measure of homogeneity. Rather, it establishes that the metals are distributed in a similar manner throughout OREAS 189 and that the variance between two subsamples from the same unit is statistically indistinguishable to the variance from two subsamples taken from any two separate units.

## 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 (single iteration). 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.

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.

Table 3. Performance Gates for OREAS 189

Constituent	Certified Value	Absolute Standard Deviations					Relative Standard Deviations		
		1SD	2SD Low	2SD High	3SD Low	3SD High	1RSD	2RSD	3RSD
<b>Fusion XRF</b>									
Ni (wt.%)	1.48	0.03	1.42	1.54	1.39	1.57	1.93%	3.86%	5.79%
Co (ppm)	326	13	299	353	286	366	4.09%	8.17%	12.26%
Al <sub>2</sub> O <sub>3</sub> (wt.%)	2.09	0.02	2.05	2.14	2.02	2.16	1.12%	2.23%	3.35%
CaO (wt.%)	0.326	0.007	0.312	0.341	0.304	0.348	2.22%	4.44%	6.66%
Cl (ppm)	<50	IND	IND	IND	IND	IND	IND	IND	IND
Cu (ppm)	<50	IND	IND	IND	IND	IND	IND	IND	IND
Cr <sub>2</sub> O <sub>3</sub> (wt.%)	0.765	0.015	0.736	0.794	0.721	0.809	1.91%	3.83%	5.74%
Fe <sub>2</sub> O <sub>3</sub> (wt.%)	15.04	0.16	14.73	15.35	14.58	15.51	1.03%	2.07%	3.10%
K <sub>2</sub> O (wt.%)	<0.01	IND	IND	IND	IND	IND	IND	IND	IND
MgO (wt.%)	23.09	0.24	22.61	23.57	22.37	23.81	1.04%	2.08%	3.12%
MnO (wt.%)	0.227	0.004	0.219	0.235	0.215	0.240	1.82%	3.63%	5.45%
Na <sub>2</sub> O (wt.%)	~0.03	IND	IND	IND	IND	IND	IND	IND	IND
P <sub>2</sub> O <sub>5</sub> (wt.%)	<0.01	IND	IND	IND	IND	IND	IND	IND	IND
SiO <sub>2</sub> (wt.%)	46.20	0.36	45.47	46.92	45.11	47.29	0.78%	1.57%	2.35%
SO <sub>3</sub> (wt.%)	<0.01	IND	IND	IND	IND	IND	IND	IND	IND
TiO <sub>2</sub> (wt.%)	0.029	0.008	0.013	0.044	0.006	0.051	26.45%	52.91%	79.36%
Zn (ppm)	125	9	107	143	98	152	7.18%	14.37%	21.55%
LOI (wt.%)	10.13	0.27	9.58	10.67	9.31	10.95	2.70%	5.40%	8.10%
<b>Fusion ICP</b>									
Ni (wt.%)	1.47	0.03	1.41	1.52	1.38	1.55	1.90%	3.80%	5.70%
Co (ppm)	327	21	285	369	264	390	6.45%	12.90%	19.36%
Al <sub>2</sub> O <sub>3</sub> (wt.%)	2.08	0.06	1.97	2.20	1.91	2.25	2.74%	5.47%	8.21%
CaO (wt.%)	0.328	0.036	0.256	0.400	0.220	0.437	11.01%	22.02%	33.03%
Cu (ppm)	~30	IND	IND	IND	IND	IND	IND	IND	IND
Cr <sub>2</sub> O <sub>3</sub> (wt.%)	0.764	0.023	0.718	0.810	0.695	0.833	3.01%	6.03%	9.04%
Fe <sub>2</sub> O <sub>3</sub> (wt.%)	14.94	0.39	14.16	15.72	13.77	16.10	2.60%	5.21%	7.81%
K <sub>2</sub> O (wt.%)	~0.08	IND	IND	IND	IND	IND	IND	IND	IND
MgO (wt.%)	23.06	0.44	22.19	23.94	21.76	24.37	1.89%	3.78%	5.67%
MnO (wt.%)	0.228	0.005	0.219	0.238	0.214	0.243	2.16%	4.31%	6.47%
Na <sub>2</sub> O (wt.%)	0.021	0.004	0.013	0.030	0.009	0.034	18.97%	37.94%	56.92%
P <sub>2</sub> O <sub>5</sub> (wt.%)	<0.02	IND	IND	IND	IND	IND	IND	IND	IND
SiO <sub>2</sub> (wt.%)	46.08	1.02	44.03	48.13	43.01	49.15	2.22%	4.45%	6.67%
SO <sub>3</sub> (wt.%)	<0.05	IND	IND	IND	IND	IND	IND	IND	IND
TiO <sub>2</sub> (wt.%)	0.026	0.004	0.017	0.034	0.012	0.039	17.39%	34.78%	52.17%
Zn (ppm)	103	23	57	148	34	171	22.41%	44.82%	67.23%
<b>IR Combustion Furnace</b>									
C (wt.%)	0.10	0.02	0.05	0.14	0.03	0.16	22.66%	45.32%	67.98%
S (wt.%)	<0.01	IND	IND	IND	IND	IND	IND	IND	IND

Note - intervals may appear asymmetric due to rounding; IND = indeterminate; italics = indicative value

## PARTICIPATING LABORATORIES

Acme Analytical Laboratories, Vancouver, BC, Canada  
Activation Laboratories, Ancaster, Ontario, Canada  
ALS, Callao, Lima, Peru  
ALS, Malaga, WA, Australia  
ALS, Stafford, QLD, Australia  
ALS, Vancouver, BC, Canada  
BV Amdel, Cardiff, NSW, Australia  
BV Amdel, Stirling, SA, Australia  
BV Ultra Trace, Canning Vale, WA, Australia  
Inspectorate Kendari Laboratory, Kendari, Sulawesi, Indonesia  
Intertek Genalysis Laboratory Services, Maddington, WA, Australia  
Intertek Testing Services, Jakarta, Indonesia  
Ni Lab, Pouembout, New Caledonia  
SGS Geosol Laboratorios Ltda, Vespasiano, Minas Gerais, Brazil  
SGS Mineral Services, Lakefield, Ontario, Canada  
SGS Mineral Services, Don Mills, Ontario, Canada  
SGS Mineral Services, Welshpool, WA, Australia  
Société le Nickel SLN, Noumea, New Caledonia  
UIS Analytical Services, Centurion, South Africa

## PREPARER AND SUPPLIER OF THE REFERENCE MATERIAL

Nickel laterite ore reference material OREAS 189 has been prepared and certified and is supplied by:

*Ore Research & Exploration Pty Ltd  
6-8 Gatwick Road  
Bayswater North VIC 3153  
AUSTRALIA*

<i>Telephone</i>	<i>(03) 9729 0333</i>	<i>International</i>	<i>+613-9729 0333</i>
<i>Facsimile</i>	<i>(03) 9761 7878</i>	<i>International</i>	<i>+613-9761 7878</i>
<i>Email</i>	<i>info@ore.com.au</i>	<i>Web</i>	<i>www.ore.com.au</i>

OREAS 189 is packaged in unit sizes of 10g (single-use laminated foil pouches) and 1kg (wide mouthed plastic jars).

## INTENDED USE

OREAS 189 is intended for the following uses:

- i) for the monitoring of laboratory performance in the analysis of Ni, Co, Al<sub>2</sub>O<sub>3</sub>, CaO, Cl, Cu, Cr<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>O, MgO, MnO, Na<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub>, SO<sub>3</sub>, TiO<sub>2</sub>, Zn, LOI, C and S in geological samples
- ii) for the verification of analytical methods for Ni, Co, Al<sub>2</sub>O<sub>3</sub>, CaO, Cl, Cu, Cr<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>O, MgO, MnO, Na<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub>, SO<sub>3</sub>, TiO<sub>2</sub>, Zn, LOI, C and S
- iii) for the calibration of instruments used in the determination of the concentration of Ni, Co, Al<sub>2</sub>O<sub>3</sub>, CaO, Cl, Cu, Cr<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>O, MgO, MnO, Na<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub>, SO<sub>3</sub>, TiO<sub>2</sub>, Zn, LOI, C and S

## **STABILITY AND STORAGE INSTRUCTIONS**

OREAS 189 has been sourced from a sample of saprolitic nickel ore. It has been packaged in robust laminated foil pouches and plastic jars. In its unopened state and under normal conditions of storage it has a shelf life beyond ten years. Once opened the jars should be re-sealed after sampling and the contents consumed within two years.

## **INSTRUCTIONS FOR THE CORRECT USE OF THE REFERENCE MATERIAL**

All certified values are reported on a dry basis after removal of hygroscopic moisture by drying in air at 105°C to constant mass. Users departing from these conventions should correct for moisture content.

## **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), Technical Manager

## **REFERENCES**

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

ISO Guide 31 (2000), Reference materials – Contents of certificates and labels.

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

**APPENDIX**

**Analytical Data for OREAS 189**

Table A1. Key to abbreviations used in Tables A2 – A37.

Abbreviation	Explanation
Std.Dev.	one sigma standard deviation
Rel.Std.Dev.	one sigma relative standard deviation
PDM <sup>3</sup>	percent deviation of lab mean from corrected mean of means
NR	not reported
BF	lithium metaborate fusion
PF	sodium peroxide fusion
4A	four acid (HF–HNO <sub>3</sub> –HClO <sub>4</sub> –HCl) digestion
MAR	modified aqua regia digestion
ICP	inductively coupled plasma OES or MS (unspecified)
OES	inductively coupled plasma optical emission spectrometry
XRF	x-ray fluorescence
LOI	loss on ignition
IRC	infra-red combustion furnace

Individual and batch outliers are left justified and in bold. Replicates 1 – 4 correspond to the first batch of samples submitted to labs, replicates 5 – 8 correspond to the second batch and replicates 9 – 12 correspond to the third batch.

Table A2. Fusion XRF results for Ni in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	1.48	1.53	1.46	1.47	1.54	1.48	1.48	1.54	1.50	1.54	1.45	1.48	1.46	1.47	1.51	1.50	1.44
2	1.48	1.53	1.46	1.47	1.52	1.49	1.48	1.49	1.50	1.51	1.44	1.47	1.45	1.48	1.51	1.51	1.45
3	<b>1.53</b>	1.53	1.47	1.47	1.51	1.48	1.48	1.52	1.50	1.52	1.45	1.46	1.45	1.47	1.51	1.50	1.45
4	1.45	1.53	1.46	1.46	1.52	1.49	1.48	1.53	1.50	1.53	<b>1.48</b>	1.46	1.44	1.48	1.50	1.49	1.44
5	1.48	1.52	1.46	1.46	<b>1.53</b>	1.49	1.44	1.51	1.50	1.51	1.46	1.47	1.43	1.47	NR	NR	NR
6	1.47	1.52	1.47	1.47	1.50	1.48	1.44	1.49	1.48	1.51	1.45	1.46	1.42	1.47	NR	NR	NR
7	1.47	1.51	1.46	1.48	1.51	1.48	1.44	1.50	1.48	1.52	1.45	1.46	1.45	1.47	NR	NR	NR
8	1.46	1.52	1.46	1.47	1.51	1.48	1.44	1.50	1.49	1.51	1.45	1.46	1.48	1.46	NR	NR	NR
9	1.48	1.51	1.47	1.46	1.44	1.48	1.47	1.54	1.48	1.52	1.44	1.46	1.48	1.45	NR	NR	NR
10	1.49	1.51	1.47	1.45	1.43	1.47	1.47	1.53	1.49	1.52	1.44	1.46	1.46	1.45	NR	NR	NR
11	1.46	1.52	1.47	1.46	1.43	1.48	<b>1.52</b>	1.52	1.49	1.54	1.44	1.47	1.49	1.45	NR	NR	NR
12	1.51	1.52	1.47	1.46	1.44	1.47	1.46	1.54	1.49	1.53	1.45	1.47	1.47	1.45	NR	NR	NR
Mean	1.48	1.52	1.46	1.47	1.49	1.48	1.47	1.52	1.49	1.52	1.45	1.47	1.46	1.46	1.51	1.50	1.45
Median	1.48	1.52	1.46	1.47	1.51	1.48	1.47	1.52	1.49	1.52	1.45	1.46	1.46	1.47	1.51	1.50	1.45
Std.Dev.	0.02	0.01	0.01	0.01	0.04	0.00	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
Rel.Std.Dev.	1.39%	0.52%	0.37%	0.54%	2.80%	0.34%	1.65%	1.24%	0.56%	0.68%	0.68%	0.46%	1.37%	0.86%	0.33%	0.48%	0.40%
PDM <sup>3</sup>	-0.21%	2.75%	-1.12%	-0.99%	0.50%	-0.01%	-0.88%	2.50%	0.81%	2.86%	-2.12%	-0.99%	-1.66%	-1.16%	1.88%	1.25%	-2.35%

Table A3. Fusion XRF results for Co in OREAS 189 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	320	300	320	320	350	320	NR	<b>410</b>	340	<b>360</b>	320	300	340	350	300	322	300
2	310	300	320	330	330	320	NR	<b>400</b>	320	<b>410</b>	310	300	330	350	300	342	300
3	310	300	320	320	320	320	NR	<b>400</b>	340	<b>370</b>	320	300	340	340	300	322	300
4	310	300	310	320	340	320	NR	<b>400</b>	330	<b>360</b>	320	300	330	340	300	334	300
5	330	300	320	320	340	330	NR	<b>400</b>	330	300	320	300	320	340	NR	NR	NR
6	320	300	320	330	320	320	NR	<b>390</b>	330	340	320	300	320	340	NR	NR	NR
7	320	300	320	320	320	320	NR	<b>400</b>	320	320	320	300	330	350	NR	NR	NR
8	320	350	320	320	320	320	NR	<b>400</b>	320	330	320	300	340	350	NR	NR	NR
9	330	300	330	320	330	320	NR	<b>400</b>	320	340	320	300	340	360	NR	NR	NR
10	330	300	330	330	340	320	NR	<b>400</b>	320	340	320	300	340	360	NR	NR	NR
11	320	333	320	330	330	320	NR	<b>400</b>	330	<b>370</b>	320	300	340	350	NR	NR	NR
12	330	300	320	330	340	320	NR	<b>410</b>	330	<b>370</b>	320	300	340	360	NR	NR	NR
Mean	321	307	321	324	332	321		<b>401</b>	328	351	319	<b>300</b>	334	349	<b>300</b>	330	<b>300</b>
Median	320	300	320	320	330	320		400	330	350	320	300	340	350	300	328	300
Std.Dev.	8	17	5	5	10	3		5	8	29	3	0	8	8	0	10	0
Rel.Std.Dev.	2.47%	5.41%	1.60%	1.59%	3.11%	0.90%		1.28%	2.30%	8.19%	0.90%	0.00%	2.37%	2.27%	0.00%	2.97%	0.00%
PDM <sup>3</sup>	-1.63%	-5.88%	-1.63%	-0.60%	1.70%	-1.63%		22.90%	0.42%	7.57%	-2.14%	-8.01%	2.46%	7.06%	-8.01%	1.19%	-8.01%

Table A4. Fusion XRF results for Al<sub>2</sub>O<sub>3</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	2.10	<b>2.04</b>	2.07	2.11	2.11	2.09	2.04	2.08	<b>2.17</b>	2.09	2.09	2.10	2.08	2.10	2.07	2.08	2.11
2	2.09	<b>2.04</b>	2.09	2.09	2.13	2.10	2.05	2.09	<b>2.18</b>	2.11	2.10	2.11	2.06	2.09	2.08	2.13	2.11
3	2.10	<b>2.01</b>	2.09	2.10	2.13	2.08	2.02	2.09	<b>2.16</b>	2.03	2.09	2.11	2.08	2.09	2.09	2.11	2.13
4	2.10	<b>2.02</b>	2.08	2.10	2.11	2.08	2.05	2.12	<b>2.16</b>	<b>2.19</b>	2.11	2.12	2.04	2.09	2.09	2.12	2.11
5	2.10	<b>2.06</b>	2.08	2.09	2.10	2.08	<b>1.98</b>	2.14	<b>2.17</b>	2.13	2.08	2.10	<b>2.02</b>	2.08	NR	NR	NR
6	2.09	<b>2.05</b>	2.08	2.10	2.10	2.07	<b>1.97</b>	2.16	<b>2.25</b>	<b>2.26</b>	2.09	2.10	2.10	2.10	NR	NR	NR
7	2.09	<b>2.03</b>	2.10	2.08	2.08	2.07	<b>1.96</b>	<b>2.19</b>	<b>2.18</b>	2.11	2.08	2.08	2.10	2.11	NR	NR	NR
8	2.09	<b>2.00</b>	2.10	2.10	2.09	2.07	<b>1.98</b>	2.06	<b>2.20</b>	2.13	2.08	2.09	2.09	2.10	NR	NR	NR
9	2.08	<b>2.01</b>	2.11	2.11	<b>2.16</b>	2.08	<b>1.99</b>	2.15	2.13	<b>2.16</b>	2.08	2.11	2.10	2.10	NR	NR	NR
10	2.09	<b>2.02</b>	2.07	2.10	<b>2.20</b>	2.07	<b>2.01</b>	2.11	2.11	2.04	2.06	2.10	2.10	2.10	NR	NR	NR
11	2.08	<b>2.01</b>	2.07	2.10	<b>2.18</b>	2.08	<b>2.00</b>	2.08	2.15	2.04	2.07	2.12	<b>2.13</b>	2.09	NR	NR	NR
12	2.11	<b>2.02</b>	2.10	2.10	<b>2.19</b>	2.07	<b>1.99</b>	2.10	2.13	2.05	2.06	2.13	2.10	2.12	NR	NR	NR
Mean	2.09	<b>2.02</b>	2.09	2.10	2.13	2.08	2.00	2.11	2.17	2.11	2.08	2.11	2.08	2.10	2.08	2.11	2.12
Median	2.09	2.02	2.09	2.10	2.12	2.08	2.00	2.11	2.17	2.11	2.08	2.11	2.09	2.10	2.09	2.11	2.11
Std.Dev.	0.01	0.02	0.01	0.01	0.04	0.01	0.03	0.04	0.04	0.07	0.01	0.01	0.03	0.01	0.01	0.02	0.01
Rel.Std.Dev.	0.42%	0.87%	0.66%	0.40%	1.93%	0.43%	1.54%	1.83%	1.69%	3.26%	0.71%	0.65%	1.45%	0.50%	0.46%	1.16%	0.47%
PDM <sup>3</sup>	-0.01%	-3.31%	-0.32%	0.23%	1.83%	-0.67%	-4.30%	0.99%	3.46%	0.81%	-0.52%	0.59%	-0.59%	0.19%	-0.52%	0.68%	1.03%



Table A5. Fusion XRF results for CaO in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	0.320	<b>0.305</b>	0.320	0.330	0.310	0.326	0.320	0.310	<b>0.350</b>	0.332	0.330	0.330	0.329	0.330	0.320	<b>0.308</b>	0.320
2	0.320	<b>0.310</b>	0.320	0.330	0.320	0.329	0.330	0.320	<b>0.340</b>	0.335	0.330	0.330	0.333	0.330	0.330	<b>0.316</b>	0.320
3	0.320	<b>0.310</b>	0.320	0.330	0.310	0.325	0.320	0.320	<b>0.340</b>	0.332	0.330	0.320	0.327	0.330	0.330	<b>0.317</b>	0.320
4	0.320	<b>0.310</b>	0.320	0.330	0.310	0.329	0.320	0.320	<b>0.340</b>	0.337	0.330	0.330	0.325	0.330	0.320	<b>0.300</b>	0.320
5	0.330	<b>0.305</b>	0.330	0.330	0.330	0.326	0.310	0.320	<b>0.350</b>	0.339	0.330	0.330	0.326	0.320	NR	NR	NR
6	0.330	<b>0.305</b>	0.320	0.330	0.320	0.325	0.310	0.310	<b>0.340</b>	0.336	0.330	0.330	0.327	0.330	NR	NR	NR
7	0.330	<b>0.300</b>	0.330	0.330	0.320	0.327	0.310	0.310	<b>0.340</b>	0.317	0.320	0.340	0.330	0.320	NR	NR	NR
8	0.330	<b>0.300</b>	0.320	0.330	0.320	0.325	0.320	0.310	<b>0.340</b>	0.330	0.320	0.330	<b>0.336</b>	0.330	NR	NR	NR
9	0.330	<b>0.307</b>	0.320	0.330	0.320	0.325	0.320	0.320	0.340	0.340	0.330	0.330	0.336	0.330	NR	NR	NR
10	0.330	<b>0.305</b>	0.320	0.340	0.320	0.326	0.320	0.320	0.340	0.333	0.330	0.330	0.332	0.330	NR	NR	NR
11	0.330	<b>0.303</b>	0.320	0.340	0.320	0.327	0.320	0.320	0.340	0.312	0.330	0.320	0.337	0.330	NR	NR	NR
12	0.330	<b>0.300</b>	0.320	0.330	0.320	0.327	0.320	0.330	0.340	0.320	0.320	0.330	0.331	0.330	NR	NR	NR
Mean	0.327	<b>0.305</b>	0.322	0.332	0.318	0.326	0.318	0.318	0.342	0.330	0.328	0.329	0.331	0.328	0.325	0.310	0.320
Median	0.330	0.305	0.320	0.330	0.320	0.326	0.320	0.320	0.340	0.333	0.330	0.330	0.331	0.330	0.325	0.312	0.320
Std.Dev.	0.005	0.004	0.004	0.004	0.006	0.001	0.006	0.006	0.004	0.009	0.005	0.005	0.004	0.004	0.006	0.008	0.000
Rel.Std.Dev.	1.51%	1.23%	1.21%	1.17%	1.81%	0.44%	1.81%	1.96%	1.14%	2.74%	1.38%	1.56%	1.25%	1.19%	1.78%	2.64%	0.00%
PDM <sup>3</sup>	0.18%	-6.46%	-1.35%	1.72%	-2.37%	0.11%	-2.37%	-2.63%	4.78%	1.28%	0.44%	0.95%	1.43%	0.69%	-0.33%	-4.81%	-1.86%

Table A6. Fusion XRF results for Cl in OREAS 189 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	<50	NR	NR	<50	20	NR	NR	NR	NR	NR	<50	<50	NR	NR	<50	60	NR
2	<50	NR	NR	<50	10	NR	NR	NR	NR	NR	<50	<50	NR	NR	<50	60	NR
3	<50	NR	NR	<50	10	NR	NR	NR	NR	NR	<50	<50	NR	NR	<50	<50	NR
4	<50	NR	NR	<50	20	NR	NR	NR	NR	NR	<50	<50	NR	NR	<50	60	NR
5	<50	NR	NR	50	<b>110</b>	NR	NR	NR	NR	NR	<50	NR	NR	NR	NR	NR	NR
6	<50	NR	NR	<50	<b>110</b>	NR	NR	NR	NR	NR	<50	NR	NR	NR	NR	NR	NR
7	<50	NR	NR	50	<b>100</b>	NR	NR	NR	NR	NR	<50	NR	NR	NR	NR	NR	NR
8	<50	NR	NR	<50	<b>100</b>	NR	NR	NR	NR	NR	<50	NR	NR	NR	NR	NR	NR
9	<50	NR	NR	<50	70	NR	NR	NR	NR	NR	<50	NR	NR	NR	NR	NR	NR
10	<50	NR	NR	<50	20	NR	NR	NR	NR	NR	<50	NR	NR	NR	NR	NR	NR
11	<50	NR	NR	50	<10	NR	NR	NR	NR	NR	<50	NR	NR	NR	NR	NR	NR
12	<50	NR	NR	50	10	NR	NR	NR	NR	NR	<50	NR	NR	NR	NR	NR	NR
Mean				50	53											60	
Median				50	20											60	
Std.Dev.				0	45											0	
Rel.Std.Dev.				0.00%	84.85%											0.00%	
PDM <sup>3</sup>				12.90%	19.06%											35.48%	

Table A7. Fusion XRF results for Cu in OREAS 189 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	<50	<30	<50	20	30	26	10	70	60	<100	<10	70	NR	50	<100	<20	NR
2	<50	<30	<50	25	<10	29	20	<10	60	<100	<10	70	NR	50	<100	25	NR
3	<50	<30	<50	20	<10	26	40	<10	60	<100	10	50	NR	40	<100	<20	NR
4	<50	<30	<50	20	20	29	20	<10	60	<100	10	70	NR	50	<100	<20	NR
5	<50	<30	<50	15	30	26	10	<10	70	<100	<10	50	NR	40	NR	NR	NR
6	<50	<30	<50	15	10	27	10	<10	70	<100	<10	40	NR	40	NR	NR	NR
7	<50	<30	<50	20	<10	26	10	<10	60	<100	<10	50	NR	40	NR	NR	NR
8	<50	<30	<50	15	10	26	10	<10	60	<100	<10	50	NR	40	NR	NR	NR
9	<50	<30	<50	20	30	27	<10	20	<50	<100	10	30	NR	40	NR	NR	NR
10	<50	<30	<50	25	30	27	<10	<10	<50	<100	<10	30	NR	40	NR	NR	NR
11	<50	<30	<50	20	20	28	40	<10	<50	<100	10	30	NR	40	NR	NR	NR
12	<50	<30	<50	20	30	26	10	<10	<50	<100	10	20	NR	40	NR	NR	NR
Mean				20	23	27	18	45	63		10	47		43		25	
Median				20	30	27	10	45	60		10	50		40		25	
Std.Dev.				3	9	1	12	35	5		0	17		5			
Rel.Std.Dev.				17.07%	37.12%	3.43%	68.29%	78.57%	7.41%		0.00%	36.93%		10.64%			
PDM <sup>3</sup>				-20.97%	-5.83%	9.34%	-27.36%	81.61%	152.23%		-59.64%	88.33%		71.52%		0.89%	

Table A8. Fusion XRF results for Cr<sub>2</sub>O<sub>3</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	0.747	0.755	0.761	0.772	0.763	0.779	<b>1.125</b>	0.790	0.750	<b>0.829</b>	0.756	0.800	0.775	0.779	0.750	0.775	0.780
2	0.748	0.750	0.759	0.764	0.747	0.782	<b>1.125</b>	0.780	0.760	<b>0.815</b>	0.745	0.800	0.779	0.780	0.750	<b>0.791</b>	0.770
3	0.785	0.750	0.761	0.770	0.754	0.778	<b>1.125</b>	0.780	0.770	<b>0.809</b>	0.748	0.790	0.769	0.782	0.760	0.772	0.770
4	0.764	0.750	0.762	0.767	0.743	0.777	<b>1.125</b>	0.790	0.760	<b>0.814</b>	<b>0.773</b>	0.780	0.761	0.779	0.750	0.771	0.770
5	0.760	0.750	0.761	0.780	0.785	0.781	0.750	0.790	0.750	<b>0.797</b>	0.748	0.770	0.758	0.776	NR	NR	NR
6	0.767	0.750	0.759	0.784	0.770	0.780	0.747	0.780	0.740	<b>0.807</b>	0.749	0.760	0.751	0.776	NR	NR	NR
7	0.757	0.745	0.764	0.779	0.749	0.775	0.750	0.780	0.770	<b>0.811</b>	0.744	0.770	0.767	0.779	NR	NR	NR
8	0.760	0.745	0.761	0.786	0.766	0.782	0.747	0.770	0.740	<b>0.810</b>	0.742	0.770	0.774	0.782	NR	NR	NR
9	0.745	0.750	0.756	0.764	<b>0.781</b>	0.773	0.760	0.800	0.740	<b>0.816</b>	0.756	0.740	0.774	0.766	NR	NR	NR
10	0.758	0.755	0.766	0.764	0.768	0.774	0.760	0.790	0.750	<b>0.844</b>	0.736	0.760	0.783	0.770	NR	NR	NR
11	0.751	0.753	0.763	0.765	0.770	0.777	0.763	0.780	0.750	<b>0.927</b>	0.735	0.770	0.786	0.766	NR	NR	NR
12	<b>0.798</b>	0.750	0.768	0.762	0.767	0.777	0.750	0.800	0.750	<b>0.850</b>	0.748	0.750	0.789	0.767	NR	NR	NR
Mean	0.762	0.750	0.762	0.771	0.764	0.778	0.877	0.786	0.753	<b>0.827</b>	0.748	0.772	0.772	0.775	0.753	0.777	0.773
Median	0.759	0.750	0.761	0.769	0.767	0.778	0.760	0.785	0.750	0.815	0.748	0.770	0.774	0.778	0.750	0.774	0.770
Std.Dev.	0.016	0.003	0.003	0.009	0.013	0.003	0.183	0.009	0.011	0.035	0.010	0.019	0.012	0.006	0.005	0.009	0.005
Rel.Std.Dev.	2.07%	0.42%	0.42%	1.12%	1.71%	0.39%	20.89%	1.15%	1.40%	4.22%	1.35%	2.40%	1.49%	0.80%	0.66%	1.16%	0.65%
PDM <sup>3</sup>	-0.41%	-1.89%	-0.39%	0.87%	-0.16%	1.72%	14.72%	2.75%	-1.60%	8.19%	-2.15%	0.90%	0.97%	1.37%	-1.60%	1.63%	1.01%

Table A9. Fusion XRF results for Fe<sub>2</sub>O<sub>3</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	15.00	15.06	15.30	15.22	14.85	15.12	15.28	15.22	15.13	14.97	14.95	14.98	14.99	15.05	<b>15.50</b>	15.07	15.10
2	14.85	15.07	15.29	15.15	14.80	15.27	15.31	14.88	15.18	14.97	14.90	15.07	14.87	15.05	<b>15.60</b>	15.12	15.20
3	14.80	15.04	15.29	15.18	14.65	15.17	15.19	15.01	15.20	14.89	14.95	14.96	14.86	15.00	<b>15.50</b>	15.15	15.10
4	14.80	15.08	15.26	15.15	14.80	15.14	15.26	15.09	15.40	14.93	15.00	15.04	14.77	14.95	<b>15.50</b>	15.11	15.10
5	15.00	15.04	15.36	15.20	<b>14.75</b>	15.16	14.92	14.99	15.13	14.72	15.00	15.09	14.67	14.95	NR	NR	NR
6	14.95	15.03	15.35	15.21	<b>14.60</b>	15.10	14.87	14.77	15.04	14.82	15.00	15.03	14.70	15.05	NR	NR	NR
7	14.95	15.03	15.34	15.28	<b>14.65</b>	15.10	14.81	14.85	15.06	14.99	14.95	15.04	14.89	15.00	NR	NR	NR
8	14.90	15.13	15.29	15.20	<b>14.60</b>	15.03	14.85	14.80	15.10	14.86	14.95	15.00	15.04	15.00	NR	NR	NR
9	14.95	15.15	15.29	15.14	14.75	15.15	15.08	15.19	15.04	14.92	14.90	15.03	15.05	14.90	NR	NR	NR
10	14.95	15.13	15.31	15.17	14.75	15.03	15.13	15.20	15.06	15.00	14.85	15.04	14.98	14.95	NR	NR	NR
11	14.80	15.09	15.34	15.21	14.75	15.09	15.10	15.03	15.13	15.25	14.90	15.09	15.16	15.00	NR	NR	NR
12	15.10	15.16	15.33	15.17	14.80	15.06	15.00	15.21	15.16	15.08	14.90	15.12	15.05	15.00	NR	NR	NR
Mean	14.92	15.08	15.31	15.19	14.73	15.12	15.07	15.02	15.14	14.95	14.94	15.04	14.92	14.99	15.53	15.11	15.13
Median	14.95	15.08	15.31	15.19	14.75	15.11	15.09	15.02	15.13	14.95	14.95	15.04	14.93	15.00	15.50	15.12	15.10
Std.Dev.	0.09	0.05	0.03	0.04	0.08	0.07	0.18	0.17	0.10	0.13	0.05	0.05	0.15	0.05	0.05	0.03	0.05
Rel.Std.Dev.	0.63%	0.31%	0.20%	0.26%	0.57%	0.44%	1.17%	1.10%	0.65%	0.89%	0.32%	0.31%	1.01%	0.31%	0.32%	0.22%	0.33%
PDM <sup>3</sup>	-0.81%	0.27%	1.79%	0.97%	-2.09%	0.50%	0.16%	-0.16%	0.61%	-0.63%	-0.70%	-0.02%	-0.83%	-0.34%	3.20%	0.47%	0.54%

Table A10. Fusion XRF results for K<sub>2</sub>O in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	<0.01	<0.01	<0.01	0.01	0.01	NR	<0.001	0.01	0.01	<0.01	<0.01	<0.01	NR	0.01	<0.01	0.01	<0.01
2	<0.01	<0.01	<0.01	0.01	0.00	NR	<0.001	<0.01	0.01	<0.01	<0.01	<0.01	NR	0.01	<0.01	0.01	<0.01
3	<0.01	<0.01	<0.01	0.01	0.00	NR	<0.001	<0.01	0.01	0.01	<0.01	<0.01	NR	0.01	<0.01	0.01	<0.01
4	<0.01	<0.01	<0.01	0.01	0.00	NR	<0.001	0.01	0.01	<0.01	<0.01	<0.01	NR	0.01	<0.01	0.01	<0.01
5	<0.01	<0.01	<0.05	0.01	0.01	NR	<0.001	<0.01	0.01	<0.01	<0.01	<0.01	NR	0.01	NR	NR	NR
6	<0.01	<0.01	<0.05	0.01	0.01	NR	<0.001	<0.01	0.02	<0.01	<0.01	<0.01	NR	0.01	NR	NR	NR
7	<0.01	<0.01	<0.05	0.01	0.01	NR	<0.001	<0.01	0.01	<0.01	<0.01	<0.01	NR	0.01	NR	NR	NR
8	0.01	<0.01	<0.05	0.01	0.01	NR	<0.001	<0.01	0.03	<0.01	<0.01	<0.01	NR	0.01	NR	NR	NR
9	<0.01	<0.01	<0.01	0.01	0.00	NR	<0.001	0.01	0.02	<0.01	<0.01	<0.01	NR	0.01	NR	NR	NR
10	<0.01	<0.01	<0.01	0.01	0.00	NR	<0.001	<0.01	0.01	<0.01	<0.01	0.01	NR	0.01	NR	NR	NR
11	<0.01	<0.01	<0.01	0.01	0.00	NR	<0.001	<0.01	0.01	<0.01	<0.01	<0.01	NR	0.01	NR	NR	NR
12	<0.01	<0.01	<0.01	0.01	0.00	NR	<0.001	0.01	0.01	<0.01	<0.01	<0.01	NR	0.01	NR	NR	NR
Mean	0.01			0.01	0.00			0.01	0.01	0.01		0.01		0.01		0.01	
Median	0.01			0.01	0.00			0.01	0.01	0.01		0.01		0.01		0.01	
Std.Dev.				0.00	0.00			0.00	0.01					0.00		0.00	
Rel.Std.Dev.				12.04%	67.38%			0.00%	48.85%					0.00%		18.80%	
PDM <sup>3</sup>	4.58%			-31.15%	-52.07%			4.58%	39.44%	25.50%		4.58%		4.58%		-19.21%	

Table A11. Fusion XRF results for MgO in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	23.30	23.41	23.05	23.04	22.80	22.86	<b>22.35</b>	23.54	23.18	<b>23.77</b>	23.00	23.03	22.78	23.20	23.10	22.94	23.00
2	23.10	23.52	23.08	23.05	22.90	22.87	<b>22.44</b>	23.45	23.23	<b>23.84</b>	23.00	23.12	22.62	23.10	23.10	23.01	23.10
3	23.00	23.46	23.12	23.08	22.90	22.91	<b>22.72</b>	23.62	23.36	<b>23.83</b>	23.00	23.01	22.68	23.20	23.00	23.05	23.00
4	23.10	23.39	23.09	23.01	22.80	22.99	<b>22.35</b>	23.54	23.09	<b>23.61</b>	23.00	23.21	22.46	23.20	23.10	22.89	23.00
5	23.00	23.44	23.15	23.04	22.60	22.86	22.73	23.55	23.25	<b>23.66</b>	23.10	23.22	22.41	23.10	NR	NR	NR
6	23.00	23.42	23.14	23.06	22.70	22.87	22.62	23.47	23.04	<b>23.89</b>	23.00	23.10	22.53	23.20	NR	NR	NR
7	23.00	23.43	23.07	23.11	22.80	22.82	22.59	23.61	23.21	<b>24.09</b>	23.10	23.11	22.83	23.20	NR	NR	NR
8	22.90	23.40	23.08	23.03	22.70	22.82	22.67	23.28	23.16	<b>23.85</b>	23.10	23.12	22.98	23.30	NR	NR	NR
9	23.00	23.40	23.17	23.16	23.40	22.75	23.12	<b>23.71</b>	22.94	23.41	22.90	23.03	22.92	23.20	NR	NR	NR
10	23.10	23.44	23.13	23.13	23.50	22.72	23.15	<b>23.61</b>	23.04	23.38	22.90	23.05	22.82	23.20	NR	NR	NR
11	23.10	23.52	23.11	23.21	23.60	22.82	23.03	<b>23.45</b>	23.16	23.36	22.90	22.99	23.03	23.20	NR	NR	NR
12	23.30	23.49	23.12	23.16	23.40	22.83	23.01	<b>23.75</b>	23.05	23.54	22.80	23.07	22.92	23.30	NR	NR	NR
Mean	23.08	23.44	23.11	23.09	23.01	22.84	22.73	23.55	23.14	23.68	22.98	23.09	22.75	23.20	23.08	22.97	23.03
Median	23.05	23.44	23.12	23.07	22.85	22.84	22.70	23.55	23.16	23.71	23.00	23.09	22.80	23.20	23.10	22.97	23.00
Std.Dev.	0.12	0.05	0.04	0.06	0.36	0.07	0.29	0.13	0.12	0.23	0.09	0.07	0.21	0.06	0.05	0.07	0.05
Rel.Std.Dev.	0.53%	0.20%	0.15%	0.27%	1.56%	0.30%	1.26%	0.54%	0.50%	0.97%	0.41%	0.32%	0.92%	0.26%	0.22%	0.30%	0.22%
PDM <sup>3</sup>	-0.08%	1.51%	0.07%	-0.02%	-0.37%	-1.08%	-1.57%	1.97%	0.21%	2.55%	-0.48%	-0.02%	-1.50%	0.46%	-0.08%	-0.53%	-0.30%

Table A12. Fusion XRF results for MnO in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	0.230	0.225	0.230	0.230	0.229	0.224	0.230	0.230	0.230	<b>0.241</b>	0.224	<b>0.240</b>	0.226	0.230	0.230	0.224	0.230
2	0.226	0.220	0.230	0.230	0.225	0.226	0.230	0.230	0.228	<b>0.242</b>	0.225	<b>0.240</b>	0.221	0.231	0.230	0.225	0.230
3	0.226	0.220	0.230	0.230	0.222	0.225	0.230	0.230	0.230	<b>0.240</b>	0.224	<b>0.230</b>	0.227	0.231	0.230	0.224	0.220
4	0.223	0.225	0.230	0.230	0.228	0.226	0.230	0.230	<b>0.237</b>	<b>0.244</b>	0.227	<b>0.240</b>	0.222	0.231	0.230	0.226	0.230
5	0.229	0.225	0.230	0.230	0.227	0.225	0.230	0.220	0.230	0.236	0.225	0.230	0.218	0.230	NR	NR	NR
6	0.228	0.220	0.230	0.230	0.222	0.224	0.220	0.220	0.228	0.235	0.225	0.220	0.220	0.231	NR	NR	NR
7	0.227	0.225	0.230	0.230	0.223	0.225	0.220	0.220	0.230	0.236	0.225	0.230	0.225	0.232	NR	NR	NR
8	0.226	0.220	0.230	0.230	0.223	0.222	0.230	0.220	0.229	<b>0.243</b>	0.226	0.220	0.230	0.230	NR	NR	NR
9	0.224	0.223	0.230	0.230	0.222	0.224	0.230	0.230	0.230	<b>0.243</b>	0.224	0.220	0.227	0.232	NR	NR	NR
10	0.224	0.220	0.230	0.230	0.221	0.223	0.230	0.230	0.228	<b>0.243</b>	0.225	0.220	0.227	0.235	NR	NR	NR
11	0.220	0.223	0.230	0.230	0.220	0.224	0.230	0.230	0.228	<b>0.244</b>	0.226	0.220	0.231	0.235	NR	NR	NR
12	0.224	0.221	0.230	0.230	0.222	0.223	0.230	0.230	0.231	<b>0.242</b>	0.225	0.220	0.230	0.235	NR	NR	NR
Mean	0.226	0.222	0.230	0.230	0.224	0.224	0.228	0.227	0.230	0.241	0.225	0.228	0.225	0.232	0.230	0.225	0.228
Median	0.226	0.222	0.230	0.230	0.223	0.224	0.230	0.230	0.230	0.242	0.225	0.225	0.227	0.231	0.230	0.225	0.230
Std.Dev.	0.003	0.002	0.000	0.000	0.003	0.001	0.004	0.005	0.002	0.003	0.001	0.009	0.004	0.002	0.000	0.001	0.005
Rel.Std.Dev.	1.23%	1.06%	0.00%	0.00%	1.30%	0.54%	1.70%	2.17%	1.07%	1.36%	0.40%	3.81%	1.90%	0.87%	0.00%	0.45%	2.20%
PDM <sup>3</sup>	-0.73%	-2.19%	1.22%	1.22%	-1.57%	-1.32%	0.48%	-0.25%	1.18%	5.95%	-0.95%	0.11%	-0.85%	2.09%	1.22%	-1.00%	0.11%



Table A13. Fusion XRF results for Na<sub>2</sub>O in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	0.039	0.010	0.030	NR	<b>0.135</b>	NR	<0.01	0.020	0.030	<0.1	0.010	0.030	NR	0.030	0.030	0.022	0.010
2	0.049	0.010	0.040	NR	<b>0.120</b>	NR	<0.01	0.020	0.020	<0.1	0.014	0.020	NR	0.040	0.030	0.048	0.020
3	0.035	0.010	0.040	NR	<b>0.128</b>	NR	<0.01	0.020	0.020	<0.1	0.014	0.020	NR	0.040	0.030	0.040	0.020
4	0.032	0.015	0.040	NR	<b>0.133</b>	NR	<0.01	0.030	0.030	<0.1	0.014	0.030	NR	0.040	0.040	0.029	<0.01
5	0.051	0.010	0.030	NR	<b>0.137</b>	NR	<0.01	0.020	0.030	<0.1	0.009	0.040	NR	0.030	NR	NR	NR
6	0.049	0.010	0.030	NR	<b>0.137</b>	NR	<0.01	0.040	0.060	<0.1	0.013	0.020	NR	0.040	NR	NR	NR
7	0.052	0.010	0.020	NR	<b>0.126</b>	NR	<0.01	0.020	0.030	<0.1	0.013	0.030	NR	0.030	NR	NR	NR
8	0.057	0.010	0.030	NR	<b>0.131</b>	NR	<0.01	0.010	0.050	<0.1	0.013	0.020	NR	0.030	NR	NR	NR
9	0.061	0.010	0.030	NR	<b>0.176</b>	NR	<0.01	0.030	0.030	<0.1	0.019	0.050	NR	0.050	NR	NR	NR
10	0.060	0.010	0.030	NR	<b>0.179</b>	NR	<0.01	0.020	0.030	<0.1	0.017	0.050	NR	0.040	NR	NR	NR
11	0.062	0.010	0.030	NR	<b>0.178</b>	NR	<0.01	0.020	0.020	<0.1	<b>0.014</b>	0.040	NR	0.050	NR	NR	NR
12	0.063	0.010	0.040	NR	<b>0.178</b>	NR	<0.01	0.020	0.030	<0.1	0.019	0.030	NR	0.050	NR	NR	NR
Mean	0.051	0.010	0.033		<b>0.147</b>			0.023	0.032		0.014	0.032		0.039	0.033	0.035	0.017
Median	0.052	0.010	0.030		0.136			0.020	0.030		0.014	0.030		0.040	0.030	0.034	0.020
Std.Dev.	0.011	0.001	0.006		0.024			0.008	0.012		0.003	0.011		0.008	0.005	0.011	0.006
Rel.Std.Dev.	20.98%	13.86%	19.13%		16.09%			33.50%	37.69%		21.72%	35.20%		20.25%	15.38%	32.65%	34.64%
PDM <sup>3</sup>	76.57%	-63.82%	12.89%		408.87%			-21.85%	9.99%		-51.08%	9.99%		36.05%	12.89%	20.44%	-42.11%

Table A14. Fusion XRF results for P<sub>2</sub>O<sub>5</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	0.003	<0.01	0.004	0.005	0.001	NR	<0.01	<0.01	0.010	<b>0.018</b>	<0.001	<0.01	NR	<0.01	<0.01	0.002	<0.01
2	0.004	0.010	0.003	0.005	<0.001	NR	<0.01	<0.01	0.010	<b>0.015</b>	<0.001	<0.01	NR	<0.01	<0.01	0.002	<0.01
3	0.003	<0.01	0.003	0.005	0.001	NR	<0.01	<0.01	0.010	<b>0.020</b>	<0.001	<0.01	NR	<0.01	<0.01	<0.002	<0.01
4	0.003	<0.01	0.004	0.006	0.001	NR	<0.01	<0.01	0.010	<b>0.017</b>	<0.001	<0.01	NR	<0.01	<0.01	<0.002	<0.01
5	0.005	0.005	0.004	0.006	0.003	NR	<0.01	<0.01	0.010	<0.01	0.002	<0.01	NR	<0.01	NR	NR	NR
6	0.005	0.005	0.005	0.007	<0.001	NR	<0.01	<0.01	0.010	<0.01	0.002	<0.01	NR	<0.01	NR	NR	NR
7	0.005	<0.01	0.003	0.007	0.003	NR	<0.01	<0.01	0.010	<0.01	0.003	<0.01	NR	<0.01	NR	NR	NR
8	0.006	0.005	0.004	0.005	0.002	NR	<0.01	<0.01	0.010	0.012	0.002	<0.01	NR	<0.01	NR	NR	NR
9	0.006	<0.01	0.004	0.005	0.001	NR	<0.01	<0.01	0.010	<0.01	0.001	<0.01	NR	<0.01	NR	NR	NR
10	0.005	<0.01	0.004	0.007	<0.001	NR	<0.01	<0.01	0.010	<0.01	0.001	<0.01	NR	<0.01	NR	NR	NR
11	0.006	<0.01	0.003	0.006	<0.001	NR	<0.01	<0.01	0.010	<0.01	<0.001	<0.01	NR	<0.01	NR	NR	NR
12	0.006	0.005	0.004	0.006	<0.001	NR	<0.01	<0.01	0.010	<0.01	<0.001	<0.01	NR	<0.01	NR	NR	NR
Mean	0.005	0.006	0.004	0.006	0.002				0.010	0.016	0.002					0.002	
Median	0.005	0.005	0.004	0.006	0.001				0.010	0.017	0.002					0.002	
Std.Dev.	0.001	0.002	0.001	0.001	0.001				0.000	0.003	0.001					0.000	
Rel.Std.Dev.	25.59%	37.27%	16.58%	14.31%	55.49%				0.00%	18.60%	41.06%					0.00%	
PDM <sup>3</sup>	-10.72%	12.78%	-29.51%	9.65%	-67.78%				87.97%	208.26%	-65.54%					-62.41%	

Table A15. Fusion XRF results for SiO<sub>2</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	47.00	46.64	46.34	46.38	45.40	46.38	<b>47.33</b>	46.20	46.03	45.77	46.50	46.02	45.65	46.50	46.20	46.28	45.90
2	46.80	46.52	46.37	46.37	45.50	46.52	<b>47.52</b>	46.00	46.14	46.09	46.60	46.28	45.35	46.50	46.20	46.33	46.10
3	46.60	46.63	46.53	46.44	45.60	46.43	<b>47.06</b>	46.30	46.18	46.10	46.50	46.11	45.33	46.60	46.10	46.50	45.90
4	46.70	46.44	46.38	46.48	45.60	46.48	<b>47.37</b>	46.30	46.13	45.96	46.40	46.32	<b>44.93</b>	46.60	46.20	46.26	45.80
5	46.40	46.44	46.58	46.33	45.40	46.35	45.78	46.30	46.10	46.11	46.20	46.25	<b>44.65</b>	46.50	NR	NR	NR
6	46.20	46.59	46.46	46.37	45.60	46.32	45.48	46.20	45.97	45.64	46.20	46.12	45.09	46.40	NR	NR	NR
7	46.30	46.63	46.64	46.38	45.60	46.25	46.03	46.30	45.84	46.00	46.20	46.20	45.39	46.40	NR	NR	NR
8	46.10	46.46	46.35	46.25	45.70	46.14	45.61	45.90	45.81	45.93	46.30	46.10	45.88	46.40	NR	NR	NR
9	46.40	46.59	46.53	46.44	46.10	46.19	46.78	46.70	45.73	45.89	46.10	46.00	45.83	46.70	NR	NR	NR
10	46.50	46.69	46.50	46.39	46.00	46.00	46.83	46.30	45.81	45.81	46.00	46.04	45.64	46.80	NR	NR	NR
11	46.40	46.78	46.43	46.46	46.00	46.28	46.58	46.10	45.91	45.49	46.30	46.06	46.07	46.80	NR	NR	NR
12	47.00	46.75	46.50	46.48	46.10	46.25	46.51	46.60	45.94	45.67	46.10	46.15	45.82	47.00	NR	NR	NR
Mean	46.53	46.60	46.47	46.40	45.72	46.30	46.57	46.27	45.97	45.87	46.28	46.14	45.47	46.60	46.18	46.34	45.93
Median	46.45	46.61	46.48	46.39	45.60	46.30	46.68	46.30	45.96	45.91	46.25	46.12	45.52	46.55	46.20	46.30	45.90
Std.Dev.	0.29	0.12	0.10	0.07	0.26	0.15	0.71	0.22	0.15	0.20	0.19	0.10	0.43	0.19	0.05	0.11	0.13
Rel.Std.Dev.	0.63%	0.25%	0.21%	0.14%	0.57%	0.32%	1.52%	0.48%	0.33%	0.43%	0.40%	0.23%	0.94%	0.41%	0.11%	0.24%	0.27%
PDM <sup>3</sup>	0.72%	0.86%	0.58%	0.43%	-1.04%	0.22%	0.81%	0.15%	-0.50%	-0.71%	0.18%	-0.13%	-1.58%	0.87%	-0.05%	0.31%	-0.59%

Table A16. Fusion XRF results for SO<sub>3</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	0.01	<0.01	<0.002	0.00	<0.001	NR	<0.001	<0.002	NR	NR	0.01	NR	NR	NR	<0.01	0.00	NR
2	0.00	<0.01	<0.002	<0.001	<0.001	NR	<0.001	<0.002	NR	NR	0.00	NR	NR	NR	0.02	<0.002	NR
3	0.00	<0.01	0.00	<0.001	<0.001	NR	0.00	<0.002	NR	NR	0.01	NR	NR	NR	<0.01	<0.002	NR
4	0.00	<0.01	0.00	<0.001	<0.001	NR	<0.001	<0.002	NR	NR	0.01	NR	NR	NR	<0.01	<0.002	NR
5	<0.001	<0.01	<0.002	0.00	<0.001	NR	<0.001	<b>0.05</b>	NR	NR	0.00	NR	NR	NR	NR	NR	NR
6	<0.001	<0.01	<0.002	<0.001	<0.001	NR	<0.001	<b>0.06</b>	NR	NR	0.00	NR	NR	NR	NR	NR	NR
7	<0.001	<0.01	<0.002	0.00	<0.001	NR	<0.001	<b>0.07</b>	NR	NR	0.00	NR	NR	NR	NR	NR	NR
8	<0.001	<0.01	0.00	0.00	<0.001	NR	<0.001	<b>&lt;0.002</b>	NR	NR	0.00	NR	NR	NR	NR	NR	NR
9	0.01	<0.01	<0.002	0.00	0.01	NR	<0.001	<0.002	NR	NR	0.00	NR	NR	NR	NR	NR	NR
10	0.01	<0.01	<0.002	0.00	0.01	NR	<0.001	<0.002	NR	NR	0.01	NR	NR	NR	NR	NR	NR
11	0.01	<0.01	0.00	0.00	0.01	NR	0.01	<0.002	NR	NR	0.00	NR	NR	NR	NR	NR	NR
12	0.00	<0.01	<0.002	0.00	0.01	NR	0.01	<0.002	NR	NR	0.01	NR	NR	NR	NR	NR	NR
Mean	0.00		0.00	0.00	0.01		0.01	0.06			0.00				0.02	0.00	
Median	0.00		0.00	0.00	0.01		0.01	0.06			0.00				0.02	0.00	
Std.Dev.	0.00		0.00	0.00	0.00		0.01	0.01			0.00						
Rel.Std.Dev.	35.01%		0.00%	47.81%	4.26%		76.83%	13.52%			42.84%						
PDM <sup>3</sup>	63.64%		-22.99%	-3.74%	352.41%		233.69%	2184.49%			47.59%				670.05%	-22.99%	

Table A17. Fusion XRF results for TiO<sub>2</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	0.040	0.025	0.020	0.025	0.040	NR	0.020	0.010	0.030	0.029	0.030	0.040	NR	0.030	0.030	0.022	0.030
2	0.040	0.030	0.030	0.027	0.030	NR	0.020	0.050	0.030	0.025	0.040	0.030	NR	0.030	0.030	0.024	0.020
3	0.040	0.030	0.030	0.025	0.050	NR	0.020	0.050	0.030	0.028	0.030	0.030	NR	0.030	0.030	0.022	0.020
4	0.040	0.030	0.020	0.026	0.030	NR	0.020	0.030	0.030	0.026	0.030	0.040	NR	0.030	0.030	0.019	0.030
5	0.040	0.030	0.020	0.028	0.030	NR	0.020	<b>0.050</b>	0.030	0.030	0.030	0.040	NR	0.030	NR	NR	NR
6	0.040	0.030	0.020	0.027	0.020	NR	0.020	<b>0.100</b>	0.030	0.024	0.040	0.040	NR	0.030	NR	NR	NR
7	0.040	0.020	0.030	0.029	0.020	NR	0.020	<b>0.080</b>	0.030	0.027	0.030	0.040	NR	0.030	NR	NR	NR
8	0.040	0.025	0.030	0.028	0.020	NR	0.020	<b>0.070</b>	0.030	0.024	0.040	0.040	NR	0.020	NR	NR	NR
9	0.040	0.030	0.020	0.027	0.030	NR	0.020	0.020	0.030	0.029	0.030	0.050	NR	0.030	NR	NR	NR
10	0.040	0.020	0.030	0.026	0.030	NR	0.020	0.010	0.030	0.029	0.030	0.040	NR	0.030	NR	NR	NR
11	0.050	0.023	0.020	0.025	0.030	NR	0.020	0.030	0.030	0.024	0.030	0.030	NR	0.030	NR	NR	NR
12	0.040	0.025	0.020	0.025	0.030	NR	0.020	0.020	0.030	0.026	0.030	0.030	NR	0.040	NR	NR	NR
Mean	0.041	0.027	0.024	0.027	0.030		0.020	0.043	0.030	0.027	0.033	0.038		0.030	0.030	0.022	0.025
Median	0.040	0.028	0.020	0.027	0.030		0.020	0.040	0.030	0.027	0.030	0.040		0.030	0.030	0.022	0.025
Std.Dev.	0.003	0.004	0.005	0.001	0.009		0.000	0.029	0.000	0.002	0.005	0.006		0.004	0.000	0.002	0.006
Rel.Std.Dev.	7.07%	15.03%	21.31%	5.21%	28.43%		0.00%	66.25%	0.00%	8.30%	13.92%	16.58%		14.21%	0.00%	9.63%	23.09%
PDM <sup>3</sup>	42.81%	-7.22%	-15.48%	-7.32%	4.92%		-30.05%	51.55%	4.92%	-6.45%	13.66%	31.15%		4.92%	4.92%	-24.37%	-12.57%

Table A18. Fusion XRF results for Zn in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*XRF	Lab D BF*XRF	Lab E BF*XRF	Lab F BF*XRF	Lab G BF*XRF	Lab H BF*XRF	Lab I BF*XRF	Lab J BF*XRF	Lab K BF*XRF	Lab L BF*XRF	Lab N BF*XRF	Lab O BF*XRF	Lab P BF*XRF	Lab Q BF*XRF	Lab R BF*XRF
1	130	114	130	125	140	125	70	140	130	130	100	190	NR	140	<100	121	NR
2	120	125	130	125	120	125	60	120	120	150	100	190	NR	120	<100	118	NR
3	120	123	130	130	110	124	50	130	120	110	100	190	NR	130	<100	116	NR
4	120	115	130	125	140	124	70	140	140	130	100	190	NR	130	<100	121	NR
5	110	121	130	125	140	127	40	140	120	130	100	110	NR	130	NR	NR	NR
6	110	118	130	120	120	125	20	130	120	120	100	100	NR	140	NR	NR	NR
7	110	116	130	125	110	124	<10	130	140	140	100	100	NR	130	NR	NR	NR
8	100	116	130	125	120	122	<10	130	360	130	100	100	NR	130	NR	NR	NR
9	110	118	130	125	130	126	40	140	130	140	120	100	NR	120	NR	NR	NR
10	110	123	130	120	120	123	40	140	120	150	120	100	NR	130	NR	NR	NR
11	110	120	130	125	120	125	40	140	120	130	120	110	NR	120	NR	NR	NR
12	120	112	130	120	130	123	20	130	140	140	120	100	NR	130	NR	NR	NR
Mean	114	118	130	124	125	124	45	134	147	133	107	132		129		119	
Median	110	118	130	125	120	124	40	135	125	130	100	105		130		120	
Std.Dev.	8	4	0	3	11	1	18	7	68	12	10	43		7		2	
Rel.Std.Dev.	6.95%	3.42%	0.00%	2.32%	8.70%	1.11%	39.54%	4.98%	46.18%	8.66%	9.23%	32.84%		5.18%		2.06%	
PDM <sup>3</sup>	-8.59%	-5.29%	4.08%	-0.59%	0.08%	-0.52%	-63.97%	7.42%	17.43%	6.75%	-14.60%	5.42%		3.42%		-4.72%	

Table A19. Results for LOI at 1000°C in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A LOI	Lab B LOI	Lab C LOI	Lab D LOI	Lab E LOI	Lab F LOI	Lab G LOI	Lab H LOI	Lab I LOI	Lab J LOI	Lab K LOI	Lab L LOI	Lab M LOI	Lab O LOI	Lab P LOI	Lab Q LOI	Lab R LOI
1	10.00	10.17	10.05	10.05	9.73	10.47	NR	10.21	9.63	10.69	10.19	10.20	10.43	9.61	10.20	10.38	9.85
2	9.92	10.18	10.05	10.08	9.71	10.40	NR	10.32	9.71	10.56	10.20	9.90	10.57	9.50	10.00	10.39	9.80
3	9.98	10.15	10.06	10.04	9.85	10.35	NR	10.34	9.68	10.60	10.20	9.90	10.45	9.51	10.30	10.13	9.79
4	10.05	10.16	10.05	10.06	9.71	<b>10.81</b>	NR	10.30	9.73	10.68	10.16	9.90	10.51	9.50	10.30	10.16	9.60
5	9.95	10.26	10.00	10.09	10.00	<b>10.87</b>	10.12	10.04	9.92	<b>10.78</b>	10.38	9.90	<b>10.69</b>	9.60	NR	NR	NR
6	9.97	10.25	10.04	10.10	9.98	<b>11.09</b>	<b>10.89</b>	10.02	9.98	<b>10.79</b>	10.42	9.90	<b>10.71</b>	9.56	NR	NR	NR
7	10.00	10.26	9.99	10.06	9.97	<b>11.05</b>	10.21	9.92	9.90	<b>10.69</b>	10.38	9.80	<b>10.73</b>	9.57	NR	NR	NR
8	10.00	10.22	10.02	10.02	9.94	<b>11.12</b>	10.14	10.01	9.99	<b>10.80</b>	10.33	9.90	<b>10.84</b>	9.50	NR	NR	NR
9	10.10	10.19	10.06	10.04	9.84	10.63	10.43	10.57	<b>10.47</b>	<b>11.11</b>	<b>10.79</b>	10.10	<b>11.75</b>	9.50	NR	NR	NR
10	10.10	10.20	10.05	10.09	9.92	10.36	10.16	10.66	10.12	<b>11.15</b>	<b>10.90</b>	10.10	<b>11.73</b>	9.49	NR	NR	NR
11	10.10	10.19	10.08	10.00	9.81	10.43	10.14	10.66	10.03	<b>11.21</b>	<b>10.55</b>	10.00	<b>11.64</b>	9.54	NR	NR	NR
12	10.05	10.17	10.07	10.07	9.84	<b>11.15</b>	10.21	10.52	10.01	<b>11.26</b>	<b>10.86</b>	10.10	<b>11.72</b>	9.55	NR	NR	NR
Mean	10.02	10.20	10.04	10.06	9.86	10.73	10.29	10.30	9.93	10.86	10.45	9.98	10.98	9.54	10.20	10.27	9.76
Median	10.00	10.19	10.05	10.06	9.85	10.72	10.19	10.31	9.95	10.78	10.38	9.90	10.72	9.53	10.25	10.27	9.80
Std.Dev.	0.06	0.04	0.03	0.03	0.11	0.32	0.26	0.26	0.23	0.25	0.27	0.12	0.55	0.04	0.14	0.14	0.11
Rel.Std.Dev.	0.61%	0.38%	0.27%	0.30%	1.07%	3.01%	2.55%	2.56%	2.34%	2.31%	2.58%	1.22%	5.03%	0.44%	1.39%	1.36%	1.13%
PDM <sup>3</sup>	-1.06%	0.71%	-0.81%	-0.66%	-2.64%	5.95%	1.60%	1.70%	-1.92%	7.24%	3.17%	-1.49%	8.45%	-5.82%	0.74%	1.38%	-3.61%

Table A20. Fusion ICP results for Ni in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab G MAR*OES	Lab H BF*OES	Lab I PF*ICP	Lab J BF*OES	Lab M PF*OES	Lab O PF*OES	Lab P PF*OES	Lab S PF*OES
1	1.51	1.48	1.48	1.50	1.51	1.46	1.49	<b>1.30</b>	<b>1.57</b>	1.48	1.46	1.42
2	1.49	1.51	1.48	1.45	1.46	1.45	1.49	<b>1.17</b>	1.52	1.46	1.42	1.43
3	1.49	1.46	1.46	1.50	1.48	1.44	1.48	<b>1.37</b>	1.52	1.47	1.50	1.40
4	1.46	1.49	1.48	1.45	1.49	1.45	1.48	<b>1.22</b>	1.53	1.48	1.46	1.43
5	1.45	1.50	1.47	1.48	1.46	1.45	<b>1.54</b>	<b>1.21</b>	1.52	1.47	NR	NR
6	1.43	1.49	1.47	1.49	1.46	1.45	<b>1.53</b>	<b>1.49</b>	1.52	1.47	NR	NR
7	1.46	1.49	1.48	1.48	1.46	1.47	<b>1.53</b>	<b>1.23</b>	1.49	1.48	NR	NR
8	1.45	1.48	1.46	1.50	1.47	1.46	<b>1.54</b>	<b>1.24</b>	1.54	1.46	NR	NR
9	1.47	1.40	1.41	1.43	1.44	1.46	1.46	<b>1.36</b>	<b>1.55</b>	1.44	NR	NR
10	1.47	1.41	1.45	1.48	1.46	1.46	1.49	<b>1.35</b>	<b>1.56</b>	1.44	NR	NR
11	1.46	1.42	1.42	1.45	1.45	1.44	1.48	<b>1.31</b>	<b>1.50</b>	1.46	NR	NR
12	1.48	<b>1.36</b>	1.42	1.42	1.44	1.45	1.50	<b>1.29</b>	<b>1.54</b>	1.45	NR	NR
Mean	1.47	1.46	1.46	1.47	1.46	1.45	1.50	<b>1.30</b>	1.53	1.46	1.46	1.42
Median	1.47	1.48	1.47	1.48	1.46	1.45	1.49	1.29	1.52	1.46	1.46	1.42
Std.Dev.	0.02	0.05	0.03	0.03	0.02	0.01	0.03	0.09	0.02	0.01	0.03	0.01
Rel.Std.Dev.	1.41%	3.31%	1.79%	1.78%	1.42%	0.57%	1.81%	6.87%	1.58%	0.89%	2.24%	0.86%
PDM <sup>3</sup>	0.01%	-0.46%	-0.58%	0.13%	-0.09%	-0.72%	2.43%	-11.61%	4.37%	-0.30%	-0.36%	-3.18%



Table A21. Fusion ICP results for Co in OREAS 189 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab G MAR*OES	Lab H BF*OES	Lab I PF*ICP	Lab J BF*OES	Lab M PF*OES	Lab O PF*OES	Lab P PF*OES	Lab S PF*OES
1	290	316	340	290	328	300	330	<b>394</b>	305	330	303	331
2	280	324	340	320	319	320	340	<b>389</b>	301	330	315	330
3	300	323	320	300	327	310	330	<b>402</b>	311	330	307	321
4	280	316	320	280	323	300	330	<b>372</b>	320	320	311	324
5	320	350	320	340	330	310	320	359	342	340	NR	NR
6	340	350	320	330	320	310	330	385	342	340	NR	NR
7	330	360	340	360	328	320	340	379	342	330	NR	NR
8	320	351	320	320	327	300	330	378	342	330	NR	NR
9	300	331	340	330	359	310	300	<b>274</b>	322	330	NR	NR
10	300	352	360	360	354	310	290	<b>284</b>	325	320	NR	NR
11	270	343	340	330	350	310	300	<b>259</b>	306	330	NR	NR
12	300	322	360	340	362	300	300	<b>264</b>	318	320	NR	NR
Mean	303	337	335	325	336	308	320	345	323	329	309	326
Median	300	337	340	330	328	310	330	375	321	330	309	327
Std.Dev.	21	16	15	25	16	7	18	57	16	7	5	5
Rel.Std.Dev.	7.07%	4.77%	4.50%	7.71%	4.72%	2.33%	5.49%	16.39%	4.91%	2.03%	1.67%	1.55%
PDM <sup>3</sup>	-7.54%	2.85%	2.39%	-0.66%	2.57%	-5.76%	-2.19%	5.44%	-1.23%	0.61%	-5.55%	-0.21%

Table A22. Fusion ICP results for Al<sub>2</sub>O<sub>3</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A	Lab C	Lab D	Lab E	Lab G	Lab H	Lab I	Lab J	Lab M	Lab O	Lab P	Lab S
	PF*OES	PF*OES	PF*OES	PF*OES	MAR*OES	BF*OES	PF*ICP	BF*OES	PF*OES	PF*OES	PF*OES	PF*OES
1	2.10	2.05	2.08	<b>1.88</b>	2.14	2.11	2.16	2.03	<b>2.41</b>	2.07	1.93	2.18
2	2.08	2.07	2.02	<b>1.76</b>	2.12	2.10	2.19	1.99	<b>2.44</b>	2.06	2.08	<b>2.09</b>
3	2.12	2.04	2.02	<b>1.92</b>	2.12	2.08	2.20	2.04	<b>2.22</b>	2.10	<b>2.27</b>	2.15
4	2.11	2.07	2.04	<b>1.84</b>	2.17	2.10	2.19	2.00	<b>2.14</b>	2.07	2.26	2.17
5	2.07	2.07	2.08	2.00	2.08	2.14	2.12	2.02	2.10	2.05	NR	NR
6	2.05	2.09	2.04	1.95	2.10	2.12	2.08	2.00	2.08	2.07	NR	NR
7	2.09	2.06	2.12	<b>2.09</b>	2.13	2.15	2.09	1.99	2.10	2.04	NR	NR
8	2.07	2.07	2.10	1.97	2.08	2.12	2.08	<b>2.08</b>	2.09	2.02	NR	NR
9	2.08	1.97	2.12	1.97	2.15	2.10	2.12	<b>1.93</b>	2.05	2.07	NR	NR
10	2.05	1.99	2.17	2.11	2.14	2.11	2.03	<b>1.94</b>	2.07	2.05	NR	NR
11	2.03	2.00	2.17	2.07	2.14	2.06	2.02	<b>1.86</b>	2.08	2.04	NR	NR
12	2.07	<b>1.91</b>	2.10	2.01	2.15	2.11	2.09	<b>1.90</b>	2.10	2.07	NR	NR
Mean	2.08	2.03	2.09	1.96	2.13	2.11	2.11	1.98	2.16	2.06	2.14	2.15
Median	2.08	2.06	2.09	1.97	2.14	2.11	2.11	1.99	2.10	2.07	2.17	2.16
Std.Dev.	0.03	0.05	0.05	0.10	0.03	0.02	0.06	0.06	0.13	0.02	0.16	0.04
Rel.Std.Dev.	1.25%	2.65%	2.49%	5.28%	1.32%	1.14%	2.87%	3.17%	6.18%	1.00%	7.60%	1.97%
PDM <sup>3</sup>	-0.24%	-2.36%	0.32%	-5.64%	2.16%	1.28%	1.56%	-4.79%	3.58%	-1.08%	2.56%	3.28%

Table A23. Fusion ICP results for CaO in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A	Lab C	Lab D	Lab E	Lab G	Lab H	Lab I	Lab J	Lab M	Lab O	Lab P	Lab S
	PF*OES	PF*OES	PF*OES	PF*OES	MAR*OES	BF*OES	PF*ICP	BF*OES	PF*OES	PF*OES	PF*OES	PF*OES
1	0.340	0.350	0.300	0.250	0.340	0.330	0.340	0.356	0.266	0.290	<0.3	0.398
2	0.320	0.360	0.300	0.290	0.330	0.320	0.340	<b>0.394</b>	0.276	0.270	<0.3	0.392
3	0.370	0.310	0.300	0.240	0.330	0.320	0.340	0.361	0.277	0.380	<0.3	<b>0.445</b>
4	0.370	0.290	0.300	0.220	0.330	0.330	0.340	0.350	0.272	0.320	<0.3	0.400
5	<b>0.410</b>	0.320	0.300	<b>0.240</b>	0.330	0.330	0.340	0.342	0.332	0.290	NR	NR
6	<b>0.360</b>	0.310	0.300	<b>0.230</b>	0.330	0.320	0.330	<b>0.355</b>	0.384	<b>0.410</b>	NR	NR
7	<b>0.450</b>	0.360	0.300	<b>0.270</b>	0.330	0.330	0.340	0.343	0.332	0.320	NR	NR
8	<b>0.480</b>	0.330	0.300	<b>0.190</b>	0.330	0.320	0.330	0.344	0.332	0.300	NR	NR
9	<b>0.450</b>	0.310	0.400	0.240	0.320	0.320	0.340	0.327	0.297	0.390	NR	NR
10	<b>0.420</b>	0.290	0.400	0.310	0.320	0.320	0.330	0.326	0.287	0.350	NR	NR
11	<b>0.430</b>	0.300	0.400	0.270	0.330	0.320	0.330	0.318	0.297	0.320	NR	NR
12	<b>0.490</b>	0.280	0.400	0.240	0.330	0.320	0.340	0.333	0.287	<b>0.520</b>	NR	NR
Mean	0.408	0.318	0.333	0.249	0.329	0.323	0.337	0.346	0.303	0.347		0.409
Median	0.415	0.310	0.300	0.240	0.330	0.320	0.340	0.344	0.292	0.320		0.399
Std.Dev.	0.055	0.027	0.049	0.032	0.005	0.005	0.005	0.020	0.035	0.070		0.024
Rel.Std.Dev.	13.57%	8.61%	14.77%	12.86%	1.56%	1.52%	1.46%	5.83%	11.50%	20.15%		5.94%
PDM <sup>3</sup>	24.16%	-3.26%	1.56%	-24.08%	0.29%	-1.48%	2.58%	5.35%	-7.64%	5.63%		24.49%

Table A24. Fusion ICP results for Cu in OREAS 189 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab G MAR*OES	Lab H BF*OES	Lab I PF*ICP	Lab J BF*OES	Lab M PF*OES	Lab O PF*OES	Lab P PF*OES	Lab S PF*OES
1	<50	29	<50	<50	<50	20	<50	<10	33	<50	<b>15</b>	32
2	<50	30	<50	<50	<50	40	<50	<10	32	<50	<b>22</b>	25
3	<50	30	<50	<50	<50	30	<50	<10	30	<50	<b>11</b>	25
4	<50	30	<50	<50	<50	20	<50	<10	27	<50	<b>18</b>	25
5	<50	29	<50	<50	<50	20	<50	<10	33	<50	<b>15</b>	32
6	<50	30	<50	<50	<50	40	<50	<10	32	<50	<b>22</b>	25
7	<50	30	<50	<50	<50	30	<50	<10	30	<50	<b>11</b>	25
8	<50	30	<50	<50	<50	20	<50	<10	27	<50	<b>18</b>	25
9	<50	<20	<50	<50	<50	20	<50	<10	39	<50	NR	NR
10	<50	<20	<50	<50	<50	20	<50	<10	37	<50	NR	NR
11	<50	<20	<50	<50	<50	20	<50	<10	35	<50	NR	NR
12	<50	<20	<50	<50	<50	20	<50	<10	36	<50	NR	NR
Mean		30				25			32		17	27
Median		30				20			32		17	25
Std.Dev.		0				8			4		4	3
Rel.Std.Dev.		1.56%				31.91%			11.64%		26.12%	12.21%
PDM <sup>3</sup>		4.49%				-12.20%			13.98%		-42.05%	-6.27%

Table A25. Fusion ICP results for Cr<sub>2</sub>O<sub>3</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab G MAR*OES	Lab H BF*OES	Lab I PF*ICP	Lab J BF*OES	Lab M PF*OES	Lab O PF*OES	Lab P PF*OES	Lab S PF*OES
1	0.800	0.785	0.805	<b>0.690</b>	0.741	0.748	0.750	0.792	<b>0.674</b>	0.789	0.776	0.787
2	0.790	0.802	0.805	<b>0.640</b>	0.728	0.748	0.730	0.784	<b>0.690</b>	0.775	0.747	0.776
3	0.770	0.785	0.805	<b>0.690</b>	0.735	0.733	0.730	0.796	<b>0.693</b>	0.775	0.782	0.770
4	0.790	0.800	0.805	<b>0.670</b>	0.747	0.746	0.740	0.783	<b>0.724</b>	0.775	0.765	0.788
5	0.770	0.746	0.770	0.730	0.752	0.770	<b>0.850</b>	0.767	0.764	0.789	NR	NR
6	0.760	0.756	0.755	0.730	0.747	0.741	<b>0.850</b>	0.762	0.757	0.775	NR	NR
7	0.770	0.747	0.790	0.750	0.740	0.764	<b>0.850</b>	0.759	0.777	0.775	NR	NR
8	0.770	0.728	0.790	0.750	0.745	0.743	<b>0.840</b>	<b>0.796</b>	0.772	0.775	NR	NR
9	0.790	0.751	0.740	<b>0.690</b>	0.753	0.758	0.780	0.735	0.763	0.760	NR	NR
10	0.770	0.771	0.770	0.760	0.753	0.764	0.800	0.739	0.778	0.760	NR	NR
11	0.770	0.766	0.770	0.720	0.772	0.753	0.800	0.697	0.767	0.775	NR	NR
12	0.790	0.727	0.745	0.720	0.761	0.776	0.800	0.697	0.765	0.775	NR	NR
Mean	0.778	0.764	0.779	0.712	0.748	0.754	0.793	0.759	0.744	0.775	0.768	0.780
Median	0.770	0.761	0.780	0.720	0.747	0.751	0.800	0.765	0.763	0.775	0.771	0.782
Std.Dev.	0.013	0.026	0.024	0.036	0.012	0.013	0.048	0.035	0.038	0.009	0.015	0.009
Rel.Std.Dev.	1.63%	3.36%	3.11%	5.08%	1.57%	1.71%	5.99%	4.66%	5.08%	1.14%	2.00%	1.13%
PDM <sup>3</sup>	1.83%	-0.10%	1.94%	-6.89%	-2.13%	-1.39%	3.80%	-0.71%	-2.70%	1.35%	0.42%	2.07%

Table A26. Fusion ICP results for Fe<sub>2</sub>O<sub>3</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab G MAR*OES	Lab H BF*OES	Lab I PF*ICP	Lab J BF*OES	Lab M PF*OES	Lab O PF*OES	Lab P PF*OES	Lab S PF*OES
1	15.20	15.21	15.40	<b>13.60</b>	15.30	15.33	14.23	16.14	14.42	15.30	13.80	15.39
2	15.10	15.44	15.00	<b>12.85</b>	14.96	15.29	14.71	15.09	14.47	15.20	14.70	15.29
3	15.05	15.03	15.00	<b>13.55</b>	15.20	15.27	14.50	15.85	14.67	15.25	14.80	15.57
4	14.85	15.23	15.20	<b>13.45</b>	15.15	15.27	14.63	15.47	<b>15.07</b>	15.35	<b>16.40</b>	15.40
5	15.15	14.93	15.20	14.15	15.12	15.37	<b>13.61</b>	15.01	15.00	14.65	NR	NR
6	15.00	14.82	14.90	14.20	15.05	15.27	14.98	15.05	14.52	14.70	NR	NR
7	15.15	14.94	15.40	14.55	15.11	15.37	14.24	14.97	15.11	14.70	NR	NR
8	14.90	14.75	15.20	14.60	15.09	15.19	15.26	15.16	15.50	14.55	NR	NR
9	14.70	14.90	14.70	13.95	15.16	15.42	<b>13.69</b>	14.34	14.53	15.00	NR	NR
10	14.60	15.13	15.40	15.05	15.12	15.42	<b>13.11</b>	14.29	14.59	15.00	NR	NR
11	14.55	15.11	15.40	14.65	15.27	15.30	<b>14.43</b>	14.28	14.56	15.10	NR	NR
12	14.80	<b>14.46</b>	14.90	14.45	15.12	15.34	<b>14.27</b>	14.61	14.59	15.10	NR	NR
Mean	14.92	15.00	15.14	14.09	15.14	15.32	14.31	15.02	14.75	14.99	14.93	15.41
Median	14.95	14.99	15.20	14.18	15.12	15.32	14.35	15.03	14.59	15.05	14.75	15.39
Std.Dev.	0.22	0.26	0.24	0.63	0.09	0.07	0.60	0.59	0.33	0.28	1.08	0.12
Rel.Std.Dev.	1.49%	1.71%	1.58%	4.46%	0.60%	0.45%	4.21%	3.96%	2.27%	1.84%	7.24%	0.75%
PDM <sup>3</sup>	-0.11%	0.39%	1.37%	-5.69%	1.34%	2.56%	-4.23%	0.57%	-1.23%	0.36%	-0.08%	3.18%

Table A27. Fusion ICP results for K<sub>2</sub>O in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab G MAR*OES	Lab H BF*OES	Lab I PF*ICP	Lab J BF*OES	Lab M PF*OES	Lab O PF*OES	Lab P PF*OES	Lab S PF*OES
1	<0.1	<0.1	<0.02	<0.1	0.010	0.010	<0.01	<0.1	0.083	<0.1	<0.2	0.077
2	<0.1	<0.1	<0.02	<0.1	<0.01	0.010	<0.01	<0.1	0.041	0.120	<0.2	0.066
3	<0.1	<0.1	<0.02	<0.1	0.020	0.010	<0.01	<0.1	0.015	0.120	<0.2	0.101
4	<0.1	<0.1	<0.02	<0.1	0.020	<0.01	0.010	<0.1	0.011	0.120	<0.2	0.081
5	0.100	<0.1	<0.1	<0.1	0.010	<0.01	0.020	0.123	0.007	<0.1	NR	NR
6	0.100	<0.1	<0.1	<0.1	0.020	<0.01	<0.01	<0.1	0.008	0.120	NR	NR
7	0.200	<0.1	0.100	<0.1	0.010	<0.01	0.010	<0.1	0.008	0.120	NR	NR
8	0.200	<0.1	<0.1	<0.1	0.020	<0.01	<0.01	<0.1	0.008	0.120	NR	NR
9	<0.1	0.193	<0.1	<0.1	0.020	<0.01	0.010	0.106	0.008	<0.1	NR	NR
10	<0.1	0.145	<0.1	<0.1	<b>&lt;0.01</b>	<0.01	<0.01	0.107	0.008	0.120	NR	NR
11	<0.1	0.193	0.100	<0.1	0.010	<0.01	0.010	0.114	0.008	0.120	NR	NR
12	<0.1	0.193	<0.1	<0.1	0.010	<0.01	0.020	<0.1	0.007	0.120	NR	NR
Mean	0.150	0.181	0.100		0.015	0.010	0.013	0.113	0.018	0.120		0.081
Median	0.150	0.193	0.100		0.015	0.010	0.010	0.111	0.008	0.120		0.079
Std.Dev.	0.058	0.024	0.000		0.005	0.000	0.005	0.008	0.023	0.000		0.015
Rel.Std.Dev.	38.49%	13.33%	0.00%		35.14%	0.00%	38.73%	6.98%	127.88%	0.00%		18.00%
PDM <sup>3</sup>	87.26%	125.58%	24.84%		-81.27%	-87.52%	-83.35%	40.45%	-77.92%	50.39%		1.54%

Table A28. Fusion ICP results for MgO in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A	Lab C	Lab D	Lab E	Lab G	Lab H	Lab I	Lab J	Lab M	Lab O	Lab P	Lab S
	PF*OES	PF*OES	PF*OES	PF*OES	MAR*OES	BF*OES	PF*ICP	BF*OES	PF*OES	PF*OES	PF*OES	PF*OES
1	22.70	22.59	23.50	<b>20.40</b>	23.94	23.41	22.97	<b>24.83</b>	24.22	23.10	<b>18.40</b>	23.50
2	22.60	23.00	23.00	<b>20.10</b>	23.49	23.07	23.16	<b>24.15</b>	23.86	23.10	<b>19.90</b>	23.39
3	22.90	22.46	23.00	<b>20.80</b>	23.65	23.11	23.22	<b>25.25</b>	23.77	23.10	<b>20.10</b>	23.44
4	22.70	22.97	23.00	<b>20.10</b>	23.93	23.15	23.23	<b>24.85</b>	23.13	23.10	<b>22.30</b>	23.22
5	23.50	<b>24.74</b>	23.40	22.30	23.52	22.75	23.14	<b>24.61</b>	23.33	23.70	NR	NR
6	23.20	<b>24.58</b>	22.90	22.10	23.21	22.68	22.89	<b>24.79</b>	24.17	23.60	NR	NR
7	23.40	<b>24.62</b>	23.50	23.00	23.97	22.69	23.23	<b>24.55</b>	23.17	23.60	NR	NR
8	23.20	<b>24.39</b>	23.40	23.20	23.19	22.65	22.85	<b>24.63</b>	22.41	23.40	NR	NR
9	23.10	22.93	23.00	23.10	23.33	23.07	23.63	22.82	22.46	22.80	NR	NR
10	23.10	23.31	23.70	<b>24.80</b>	23.40	22.90	22.49	22.50	22.91	22.70	NR	NR
11	22.90	23.31	23.40	<b>24.60</b>	23.32	23.01	22.38	22.12	22.44	22.80	NR	NR
12	23.30	<b>22.24</b>	22.40	23.60	23.41	22.93	22.92	22.26	22.33	22.90	NR	NR
Mean	23.05	23.43	23.18	22.34	23.53	22.95	23.01	23.95	23.18	23.16	20.18	23.39
Median	23.10	23.16	23.20	22.65	23.45	22.97	23.06	24.58	23.15	23.10	20.00	23.41
Std.Dev.	0.29	0.91	0.36	1.67	0.28	0.23	0.34	1.16	0.70	0.34	1.61	0.12
Rel.Std.Dev.	1.26%	3.89%	1.56%	7.48%	1.20%	1.00%	1.48%	4.85%	3.01%	1.48%	7.97%	0.51%
PDM <sup>3</sup>	-0.06%	1.58%	0.52%	-3.13%	2.02%	-0.49%	-0.24%	3.83%	0.52%	0.41%	-12.52%	1.41%



Table A29. Fusion ICP results for MnO in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A	Lab C	Lab D	Lab E	Lab G	Lab H	Lab I	Lab J	Lab M	Lab O	Lab P	Lab S
	PF*OES	PF*OES	PF*OES	PF*OES	MAR*OES	BF*OES	PF*ICP	BF*OES	PF*OES	PF*OES	PF*OES	PF*OES
1	0.230	0.228	0.230	<b>0.190</b>	0.230	0.220	0.229	0.226	<b>0.210</b>	0.230	0.218	0.232
2	0.220	0.230	0.224	<b>0.210</b>	0.220	0.230	0.230	0.217	<b>0.207</b>	0.230	0.220	0.232
3	0.220	0.227	0.224	<b>0.190</b>	0.230	0.220	0.232	0.228	<b>0.210</b>	0.230	0.220	0.233
4	0.220	0.228	0.224	<b>0.190</b>	0.230	0.220	0.230	0.222	<b>0.221</b>	0.230	0.223	0.233
5	0.230	0.227	0.232	<b>0.210</b>	0.230	0.230	0.230	0.230	0.235	0.230	NR	NR
6	0.230	0.228	0.234	<b>0.210</b>	0.230	0.230	0.237	0.227	0.232	0.230	NR	NR
7	0.230	0.229	0.234	<b>0.220</b>	0.230	0.230	0.228	0.228	0.235	0.230	NR	NR
8	0.230	0.227	0.232	<b>0.200</b>	0.220	0.230	0.237	0.228	0.234	0.230	NR	NR
9	0.230	0.224	0.224	<b>0.210</b>	0.230	0.240	0.226	0.224	0.232	0.230	NR	NR
10	0.220	0.231	0.238	<b>0.230</b>	0.230	0.240	0.230	0.221	0.239	0.230	NR	NR
11	0.220	0.228	0.234	<b>0.220</b>	0.230	0.230	0.226	0.223	0.233	0.230	NR	NR
12	0.230	0.218	0.224	<b>0.210</b>	0.230	0.230	0.231	0.224	0.234	0.230	NR	NR
Mean	0.226	0.227	0.230	<b>0.208</b>	0.228	0.229	0.231	0.225	0.227	0.230	0.220	0.232
Median	0.230	0.228	0.231	0.210	0.230	0.230	0.230	0.225	0.233	0.230	0.220	0.232
Std.Dev.	0.005	0.003	0.005	0.013	0.004	0.007	0.004	0.004	0.012	0.000	0.002	0.001
Rel.Std.Dev.	2.28%	1.47%	2.26%	6.21%	1.70%	2.92%	1.53%	1.65%	5.17%	0.00%	0.94%	0.39%
PDM <sup>3</sup>	-1.12%	-0.60%	0.48%	-9.15%	-0.03%	0.33%	0.92%	-1.56%	-0.63%	0.70%	-3.57%	1.77%

Table A30. Fusion ICP results for Na<sub>2</sub>O in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab G MAR*OES	Lab H BF*OES	Lab I PF*ICP	Lab J BF*OES	Lab M PF*OES	Lab O PF*OES	Lab P PF*OES	Lab S PF*OES
1	NR	NR	NR	NR	0.020	0.030	0.030	<0.01	0.023	NR	NR	NR
2	NR	NR	NR	NR	0.020	0.030	0.020	<0.01	0.023	NR	NR	NR
3	NR	NR	NR	NR	0.020	0.020	0.020	<0.01	0.023	NR	NR	NR
4	NR	NR	NR	NR	0.020	0.020	0.030	<0.01	0.023	NR	NR	NR
5	NR	NR	NR	NR	<b>0.030</b>	0.020	0.020	0.013	0.026	NR	NR	NR
6	NR	NR	NR	NR	<b>0.030</b>	0.020	0.020	0.011	0.026	NR	NR	NR
7	NR	NR	NR	NR	<b>0.030</b>	0.020	0.020	0.017	0.026	NR	NR	NR
8	NR	NR	NR	NR	<b>0.030</b>	0.020	0.020	0.026	0.026	NR	NR	NR
9	NR	NR	NR	NR	0.020	0.020	0.020	0.016	0.027	NR	NR	NR
10	NR	NR	NR	NR	0.020	0.020	0.020	0.018	0.028	NR	NR	NR
11	NR	NR	NR	NR	0.020	0.020	0.020	0.023	0.027	NR	NR	NR
12	NR	NR	NR	NR	0.020	0.020	0.020	0.027	0.027	NR	NR	NR
Mean					0.023	0.022	0.022	0.019	0.025			
Median					0.020	0.020	0.020	0.018	0.026			
Std.Dev.					0.005	0.004	0.004	0.006	0.002			
Rel.Std.Dev.					21.10%	17.97%	17.97%	31.21%	7.28%			
PDM <sup>3</sup>					8.61%	0.86%	0.86%	-12.14%	17.33%			

Table A31. Fusion ICP results for P<sub>2</sub>O<sub>5</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab G MAR*OES	Lab H BF*OES	Lab I PF*ICP	Lab J BF*OES	Lab M PF*OES	Lab O PF*OES	Lab P PF*OES	Lab S PF*OES
1	NR	<0.03	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	0.047	NR	NR	0.006
2	NR	<0.03	0.020	<0.02	<0.01	<0.01	<0.01	<0.01	0.025	NR	NR	<0.001
3	NR	<0.03	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NR	NR	<0.01
4	NR	<0.03	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	0.016	NR	NR	0.021
5	NR	<0.03	<0.02	<0.02	<0.01	<0.01	0.010	<0.01	<0.01	NR	NR	NR
6	NR	<0.03	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NR	NR	NR
7	NR	<0.03	<0.02	<0.02	0.010	<0.01	<0.01	<0.01	<0.01	NR	NR	NR
8	NR	<0.03	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NR	NR	NR
9	NR	<0.03	<0.02	<b>&lt;0.02</b>	0.010	<0.01	<0.01	<0.01	<0.01	NR	NR	NR
10	NR	<0.03	<0.02	<b>0.050</b>	0.010	<0.01	<0.01	<0.01	<0.01	NR	NR	NR
11	NR	<0.03	0.020	<b>&lt;0.02</b>	0.010	0.010	0.020	<0.01	<0.01	NR	NR	NR
12	NR	<0.03	0.020	<b>&lt;0.02</b>	0.010	<0.01	<0.01	<0.01	0.007	NR	NR	NR
Mean			0.020	0.050	0.010	0.010	0.015		0.024			0.014
Median			0.020	0.050	0.010	0.010	0.015		0.020			0.014
Std.Dev.			0.000		0.000		0.007		0.017			0.011
Rel.Std.Dev.			0.00%		0.00%		47.14%		72.46%			78.57%
PDM <sup>3</sup>			29.95%	224.89%	-35.02%	-35.02%	-2.53%		54.90%			-12.28%

Table A32. Fusion ICP results for SiO<sub>2</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A	Lab C	Lab D	Lab E	Lab G	Lab H	Lab I	Lab J	Lab M	Lab O	Lab P	Lab S
	PF*OES	PF*OES	PF*OES	PF*OES	MAR*OES	BF*OES	PF*ICP	BF*OES	PF*OES	PF*OES	PF*OES	PF*OES
1	42.80	46.50	46.20	<b>41.00</b>	46.99	45.21	46.33	45.96	45.69	46.80	44.30	47.84
2	<b>42.10</b>	46.70	46.40	<b>39.60</b>	46.31	45.51	46.95	44.32	45.92	46.90	45.70	47.44
3	46.20	45.70	46.40	<b>41.60</b>	46.24	45.53	47.45	48.36	46.14	47.70	44.80	48.16
4	44.60	45.90	46.20	<b>39.90</b>	46.73	45.43	47.15	45.72	46.11	47.00	46.30	46.96
5	44.20	47.60	46.80	<b>42.40</b>	45.42	45.94	47.35	47.39	46.02	45.50	NR	NR
6	47.40	47.20	45.60	<b>42.10</b>	45.44	46.19	46.33	46.62	46.19	46.50	NR	NR
7	47.20	47.40	47.30	44.40	45.63	46.12	47.00	46.62	45.92	45.90	NR	NR
8	45.00	46.70	46.40	44.50	44.64	46.29	46.33	46.70	45.48	45.50	NR	NR
9	45.10	<b>49.40</b>	44.10	43.90	46.79	45.03	46.28	<b>37.10</b>	46.04	44.60	NR	NR
10	45.20	<b>51.60</b>	46.40	47.80	46.61	45.13	44.86	<b>36.73</b>	46.23	44.80	NR	NR
11	44.30	<b>51.30</b>	45.80	46.80	47.10	45.18	45.75	<b>36.41</b>	46.03	44.90	NR	NR
12	45.10	<b>49.00</b>	44.10	45.30	46.92	45.37	47.01	<b>37.08</b>	46.32	44.90	NR	NR
Mean	44.93	47.92	45.98	43.28	46.24	45.58	46.57	43.25	46.01	45.92	45.28	47.60
Median	45.05	47.30	46.30	43.15	46.46	45.47	46.64	45.84	46.03	45.70	45.25	47.64
Std.Dev.	1.55	1.98	0.98	2.61	0.78	0.44	0.74	4.84	0.24	1.04	0.90	0.52
Rel.Std.Dev.	3.46%	4.14%	2.12%	6.04%	1.69%	0.98%	1.60%	11.19%	0.51%	2.26%	1.98%	1.09%
PDM <sup>3</sup>	-2.49%	3.98%	-0.23%	-6.09%	0.34%	-1.09%	1.05%	-6.14%	-0.16%	-0.36%	-1.75%	3.30%

Table A33. Fusion ICP results for SO<sub>3</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab G MAR*OES	Lab H BF*OES	Lab I PF*ICP	Lab J BF*OES	Lab M PF*OES	Lab O PF*OES	Lab P PF*OES	Lab S PF*OES
1	0.020	<0.05	<0.1	<0.02	<0.01	NR	NR	NR	NR	0.025	<0.01	NR
2	<0.02	<0.05	<0.1	<0.02	<0.01	NR	NR	NR	NR	<b>0.100</b>	<b>0.125</b>	NR
3	<0.02	<0.05	<0.1	<0.02	<0.01	NR	NR	NR	NR	0.050	<b>0.100</b>	NR
4	0.020	<0.05	<0.1	<0.02	<0.01	NR	NR	NR	NR	0.025	<b>0.125</b>	NR
5	<b>&lt;0.02</b>	<0.05	<0.02	<0.02	NR	NR	NR	NR	NR	<0.01	NR	NR
6	<b>&lt;0.02</b>	<0.05	<0.02	<0.02	NR	NR	NR	NR	NR	0.025	NR	NR
7	<b>&lt;0.02</b>	<0.05	<0.02	<0.02	NR	NR	NR	NR	NR	<0.01	NR	NR
8	<b>0.060</b>	<0.05	<0.02	<0.02	NR	NR	NR	NR	NR	<0.01	NR	NR
9	0.020	<0.05	0.040	<0.02	<0.02	NR	NR	NR	NR	<0.01	NR	NR
10	<0.02	<0.05	0.040	0.020	<0.02	NR	NR	NR	NR	0.025	NR	NR
11	<0.02	<0.05	0.020	<0.02	<0.02	NR	NR	NR	NR	<0.01	NR	NR
12	<0.02	<0.05	0.040	<0.02	<0.02	NR	NR	NR	NR	<0.01	NR	NR
Mean	0.030		0.035	0.020						0.042	0.117	
Median	0.020		0.040	0.020						0.025	0.125	
Std.Dev.	0.020		0.010							0.030	0.014	
Rel.Std.Dev.	66.67%		28.57%							72.66%	12.37%	
PDM <sup>3</sup>	14.32%		33.38%	-23.78%						58.59%	344.06%	

Table A34. Fusion ICP results for TiO<sub>2</sub> in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab G MAR*OES	Lab H BF*OES	Lab I PF*ICP	Lab J BF*OES	Lab M PF*OES	Lab O PF*OES	Lab P PF*OES	Lab S PF*OES
1	<0.01	0.030	0.030	0.020	0.026	0.020	0.026	0.015	0.023	0.030	0.020	0.029
2	0.010	0.020	0.030	0.020	0.026	0.030	0.026	0.016	0.022	0.030	0.030	0.029
3	<0.01	0.020	0.030	0.020	0.026	0.020	0.026	0.016	0.022	0.030	0.020	0.029
4	<0.01	0.020	0.030	0.020	0.026	0.030	0.026	0.016	0.023	0.030	0.020	0.030
5	<0.01	0.030	0.030	0.020	0.027	0.020	0.026	0.027	0.025	0.030	NR	NR
6	<0.01	0.030	0.030	0.020	0.027	0.020	0.025	0.026	0.026	0.030	NR	NR
7	<0.01	0.030	0.030	0.020	0.027	0.030	0.026	0.026	0.025	0.030	NR	NR
8	<0.01	0.030	0.030	0.020	0.026	0.020	0.026	0.028	0.025	0.030	NR	NR
9	<0.01	0.020	0.030	0.020	0.027	0.020	0.026	0.024	0.034	0.030	NR	NR
10	<0.01	0.020	0.030	0.020	0.027	0.030	0.025	0.025	0.032	0.030	NR	NR
11	<0.01	0.020	0.030	0.020	0.027	0.020	0.024	0.026	0.031	0.030	NR	NR
12	<0.01	0.020	0.030	0.020	0.027	0.030	0.025	0.025	0.032	0.030	NR	NR
Mean	0.010	0.024	0.030	0.020	0.027	0.024	0.026	0.023	0.026	0.030	0.023	0.029
Median	0.010	0.020	0.030	0.020	0.027	0.020	0.026	0.025	0.025	0.030	0.020	0.029
Std.Dev.		0.005	0.000	0.000	0.001	0.005	0.001	0.005	0.004	0.000	0.005	0.001
Rel.Std.Dev.		21.31%	0.00%	0.00%	1.94%	21.31%	2.61%	22.62%	16.30%	0.00%	22.22%	2.33%
PDM <sup>3</sup>	-60.87%	-5.43%	17.39%	-21.74%	4.02%	-5.43%	0.11%	-11.95%	3.65%	17.39%	-11.95%	13.93%

Table A35. Fusion ICP results for Zn in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A PF*OES	Lab C PF*OES	Lab D PF*OES	Lab E PF*OES	Lab G MAR*OES	Lab H BF*OES	Lab I PF*ICP	Lab J BF*OES	Lab M PF*OES	Lab O PF*OES	Lab P PF*OES	Lab S PF*OES
1	100	<b>184</b>	100	100	70	NR	100	134	74	100	83	NR
2	100	124	150	100	70	NR	100	145	122	100	48	NR
3	100	124	100	100	70	NR	100	134	92	100	<b>156</b>	NR
4	100	124	150	100	80	NR	100	125	90	100	49	NR
5	<b>200</b>	<b>164</b>	150	100	<b>120</b>	NR	100	123	83	100	NR	NR
6	<b>200</b>	124	150	100	90	NR	100	127	93	100	NR	NR
7	<b>200</b>	129	150	100	90	NR	100	125	83	100	NR	NR
8	<b>200</b>	126	150	100	80	NR	<100	128	83	100	NR	NR
9	<b>200</b>	<b>164</b>	150	100	<b>120</b>	NR	100	123	83	100	NR	NR
10	<b>200</b>	124	150	100	90	NR	100	127	93	100	NR	NR
11	<b>200</b>	129	150	100	90	NR	100	125	83	100	NR	NR
12	<b>200</b>	126	150	100	80	NR	<100	128	83	100	NR	NR
Mean	167	137	142	100	88		100	129	88	100	84	
Median	200	126	150	100	85		100	127	83	100	66	
Std.Dev.	49	21	19	0	17		0	6	12	0	51	
Rel.Std.Dev.	29.54%	15.40%	13.74%	0.00%	19.57%		0.00%	4.76%	13.37%	0.00%	60.34%	
PDM <sup>3</sup>	62.54%	33.45%	38.16%	-2.47%	-14.66%		-2.47%	25.50%	-13.74%	-2.47%	-18.08%	

Table A36. Results for C in OREAS 189 (abbreviations as in Table A1; values in wt. %).

Replicate No.	Lab A IRC	Lab C IRC	Lab D IRC	Lab E IRC	Lab H IRC	Lab I IRC	Lab J IRC	Lab K IRC	Lab L IRC	Lab M IRC	Lab O IRC
1	0.100	0.100	0.090	0.060	0.150	0.110	0.135	0.070	0.140	0.088	0.080
2	0.100	0.100	0.070	0.060	0.140	0.080	0.122	0.060	0.130	0.101	0.090
3	0.090	0.100	0.090	0.070	0.110	0.080	0.114	0.070	0.140	0.100	0.090
4	0.090	0.130	0.050	0.070	0.130	0.100	0.132	0.070	0.130	0.101	0.090
5	0.080	0.110	0.080	0.060	0.130	0.070	0.094	0.080	0.130	0.114	0.120
6	0.080	0.140	0.090	0.060	0.120	0.080	0.115	0.080	0.130	0.094	0.100
7	0.090	0.110	0.090	0.070	0.110	0.110	0.109	0.080	0.110	0.101	0.090
8	0.080	0.120	0.080	0.070	0.110	0.090	<b>0.155</b>	0.070	0.120	<b>0.228</b>	0.090
9	0.090	0.100	0.060	0.080	0.120	0.080	0.106	0.070	0.120	0.113	0.080
10	0.100	0.100	0.060	0.080	0.110	0.090	0.105	0.070	0.120	0.099	0.080
11	0.090	0.090	0.070	0.080	0.100	0.080	0.104	0.070	0.110	0.095	0.070
12	0.100	0.110	0.070	0.080	0.110	0.090	0.106	0.080	0.130	0.098	0.070
Mean	0.091	0.109	0.075	0.070	0.120	0.088	0.116	0.073	0.126	0.111	0.088
Median	0.090	0.105	0.075	0.070	0.115	0.085	0.112	0.070	0.130	0.100	0.090
Std.Dev.	0.008	0.014	0.014	0.009	0.015	0.013	0.017	0.006	0.010	0.038	0.014
Rel.Std.Dev.	8.73%	13.22%	18.42%	12.18%	12.31%	14.35%	14.59%	8.57%	7.92%	33.88%	15.51%
PDM <sup>3</sup>	-5.06%	14.10%	-21.61%	-26.83%	25.43%	-7.67%	21.68%	-24.22%	31.52%	16.01%	-8.54%



Table A37. Results for S in OREAS 189 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A IRC	Lab C IRC	Lab D IRC	Lab E IRC	Lab H IRC	Lab I IRC	Lab J IRC	Lab K IRC	Lab L IRC	Lab M IRC	Lab O IRC
1	<0.01	<0.005	<0.01	<0.01	<0.02	<0.01	0.020	<0.01	<0.01	0.006	0.010
2	<0.01	<0.005	<0.01	<0.01	<0.02	<0.01	0.010	<0.01	<0.01	0.004	<0.01
3	0.010	<0.005	<0.01	<0.01	<0.02	<0.01	0.020	<0.01	<0.01	<0.003	<0.01
4	0.010	<0.005	<0.01	<0.01	<0.02	<0.01	0.010	<0.01	<0.01	<0.003	<0.01
5	<0.01	0.015	<0.01	0.020	<0.02	<0.01	0.010	0.010	<0.01	0.029	<0.01
6	0.010	<0.005	<0.01	0.010	<0.02	<0.01	0.010	0.010	<0.01	0.016	<0.01
7	<0.01	<0.005	<0.01	0.020	<0.02	<0.01	0.020	0.010	<0.01	0.016	<0.01
8	<0.01	0.021	<0.01	0.020	<0.02	<0.01	0.020	<0.01	<0.01	0.022	<0.01
9	<0.01	<0.005	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	0.017	0.010
10	<0.01	<0.005	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	0.020	<0.01
11	<0.01	<0.005	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	0.018	<0.01
12	<0.01	<0.005	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	0.012	<0.01
Mean	0.010	0.018		0.018			0.015	0.010		0.016	0.010
Median	0.010	0.018		0.020			0.015	0.010		0.016	0.010
Std.Dev.	0.000	0.004		0.005			0.005	0.000		0.007	0.000
Rel.Std.Dev.	0.00%	23.57%		28.57%			35.63%	0.00%		45.94%	0.00%
PDM <sup>3</sup>	-27.50%	30.50%		26.87%			8.75%	-27.50%		16.38%	-27.50%