ORE RESEARCH & EXPLORATION P/L ABN 28 006 859 856
37A Hosie Street · Bayswater North · VIC 3153 · AUSTRALIA
61 3 9729 0333 Fax 61 3 9729 8338
info@ore.com.au www.ore.com.au

CERTIFICATE OF ANALYSIS FOR

PGE-Cu-Ni Ore (Merensky Reef, Sth Africa)

CERTIFIED REFERENCE MATERIAL

OREAS 13b

Summary Statistics for Key Analytes.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Pb Collection Fire Assay						
Pt, Platinum (ppb)	197	13	189	204	185	208
Pd, Palladium (ppb)	131	9	125	136	126	135
Au, Gold (ppb)	211	13	204	218	209	213
Ni-S Collection Fire Assay						
Platinum, Pt (ppb)	204	13	194	214	196	212
Palladium, Pd (ppb)	134	4	131	136	130	137
Rhodium, Rh (ppb)	43	2	41	45	40	46
Ruthenium, Ru (ppb)	78	6	70	85	74	82
Iridium, Ir (ppb)	17.9	1.3	16.5	19.4	16.5	19.4
Osmium, Os (ppb)	12	2	9	15	IND	IND
Gold, Au (ppb)	201	7	195	207	194	208
4-Acid Digestion						
Co, Cobalt (ppm)	75	8	70	80	72	78
Cu, Copper (ppm)	2327	48	2292	2361	2284	2370
Ni, Nickel (ppm)	2247	155	2156	2339	2191	2304

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note: intervals may appear asymmetric due to rounding.

Table 1. Certified Values, SDs, 95% Confidence and Tolerance Limits for OREAS 13b.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Fusion						
Aluminium, Al (wt.%)	8.41	0.14	8.33	8.50	8.33	8.50
Calcium, Ca (wt.%)	5.57	0.09	5.51	5.63	5.55	5.60
Chromium, Cr (wt.%)	1.08	0.04	1.06	1.11	1.07	1.10
Iron, Fe (wt.%)	8.41	0.11	8.33	8.49	8.37	8.45
Potassium, K (wt.%)	2.30	0.02	2.29	2.31	2.29	2.32
Magnesium, Mg (wt.%)	3.01	0.04	2.99	3.04	2.99	3.04
Manganese, Mn (wt.%)	0.130	0.006	0.127	0.134	0.128	0.132
Sodium, Na (wt.%)	1.67	0.05	1.63	1.71	1.65	1.69
Silicon, Si (wt.%)	22.9	0.3	22.7	23.1	22.8	23.0
Titanium, Ti (wt.%)	0.711	0.009	0.705	0.716	0.699	0.722
Phosphorus, P (wt.%)	0.189	0.008	0.184	0.193	0.184	0.193
Sulphur, S (wt.%)	1.19	0.03	1.15	1.22	1.16	1.21
LOI (wt.%)	0.64	0.19	0.53	0.76	0.59	0.70
Barium, Ba (ppm)	694	6	687	701	678	710
Strontium, Sr (ppm)	537	8	533	541	526	548
Vanadium, V (ppm)	330	32	305	355	319	341
Zirconium, Zr (ppm)	108	8	101	116	98	118
4-Acid Digest						
Silver, Ag (ppm)	0.86	0.10	0.79	0.93	0.81	0.91
Arsenic, As (ppm)	57	7	53	62	55	60
Chromium, Cr (wt.%)	0.865	0.099	0.801	0.928	0.827	0.903
Cobalt, Co (ppm)	75	8	70	80	72	78
Copper, Cu (ppm)	2327	48	2292	2361	2284	2370
Molybdenum, Mo (ppm)	9.0	0.6	8.6	9.5	8.6	9.5
Nickel, Ni (ppm)	2247	155	2156	2339	2191	2304
Sulphur, S (wt.%)	1.20	0.05	1.16	1.23	1.17	1.22
Zinc, Zn (ppm)	133	12	126	140	128	138
Pb Fire Assay						
Platinum, Pt (ppb)	197	13	189	204	185	208
Palladium, Pd (ppb)	131	9	125	136	126	135
Gold, Au (ppb)	211	13	204	218	209	213
Ni-S Fire Assay						
Platinum, Pt (ppb)	204	13	194	214	196	212
Palladium, Pd (ppb)	134	4	131	136	130	137
Rhodium, Rh (ppb)	43	2	41	45	40	46
Ruthenium, Ru (ppb)	78	6	70	85	74	82
Iridium, Ir (ppb)	17.9	1.3	16.5	19.4	16.5	19.4
Osmium, Os (ppb)	12	2	9	15	IND	IND
Gold, Au (ppb)	201	7	195	207	194	208

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note: intervals may appear asymmetric due to rounding

Table 2. Indicative Values for OREAS 13b

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Borate Fusion XRF								
Al_2O_3	wt.%	*16.06*	Fe_2O_3	wt.%	*12.21*	SnO_2	ppm	*12.7*
As	ppm	*80*	K_2O	wt.%	*2.81*	SO_3	wt.%	*3.03*
BaO	ppm	*748*	MgO	wt.%	*5.07*	SrO	ppm	*668*
CaO	wt.%	*7.63*	MnO	wt.%	*0.171*	TiO_2	wt.%	*1.17*
Cl	ppm	*295*	NiO	ppm	*3054*	V_2O_5	ppm	*616*
CoO	ppm	*95*	P_2O_5	wt.%	*0.433*	ZnO	ppm	*174*
Cr_2O_3	ppm	*15718*	PbO	ppm	*21.5*	ZrO_2	ppm	*142*
CuO	ppm	*3048*	SiO_2	wt.%	*50.06*			
Thermogravimetry								
LOI^{1000}	wt.%	*0.555*						
Laser Ablation ICP-MS								
Ag	ppm	*1.05*	Hf	ppb	*3020*	Sn	ppm	*6.10*
As	ppm	*57*	Ho	ppb	*835*	Sr	ppm	*513*
Ba	ppm	*672*	In	ppm	*0.23*	Ta	ppb	*645*
Be	ppm	*2.50*	La	ppm	*26.5*	Tb	ppb	*740*
Bi	ppm	*1.65*	Lu	ppb	*290*	Te	ppb	*200*
Cd	ppm	*0.10*	Mo	ppm	*9.40*	Th	ppm	*11.0*
Ce	ppm	*54*	Nb	ppm	*8.43*	Tl	ppm	*1.10*
Co	ppm	*74*	Nd	ppm	*27.6*	Tm	ppb	*300*
Cr	ppm	*11600*	Ni	ppm	*2320*	U	ppm	*2.58*
Cs	ppm	*6.23*	Pb	wt.%	*0.002*	V	ppm	*325*
Cu	ppm	*2425*	Pr	ppm	*6.98*	W	ppm	*3.40*
Dy	ppm	*4.09*	Rb	ppm	*128*	Y	ppm	*22.3*
Er	ppm	*2.31*	Re	ppb	*20.0*	Yb	ppb	*2100*
Eu	ppb	*1495*	Sb	ppm	*1.70*	Zn	ppm	*123*
Ga	ppm	*19.9*	Sc	ppm	*23.8*	Zr	ppm	*107*
Gd	ppm	*5.17*	Se	ppm	*5.00*			
Ge	ppb	*1175*	Sm	ppm	*5.75*			

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note: the number of significant figures reported is not a reflection of the level of certainty of stated values. They are instead an artefact of ORE's in-house CRM-specific LIMS.

INTRODUCTION

OREAS reference materials are intended to provide a low-cost method of evaluating and improving the quality of analysis of geological samples. To the geologist they provide a means of implementing quality control in analytical data sets generated in exploration from the grass roots level through to prospect evaluation, and in grade control at mining operations. To the analyst they provide an effective means of calibrating analytical equipment, assessing new techniques and routinely monitoring in-house procedures.

OREAS reference materials enable users to successfully achieve process control of these tasks because the observed variance from repeated analysis has its origin almost exclusively in the analytical process rather than the reference material itself.

SOURCE MATERIALS

OREAS 13b was prepared from ores of platinum group elements (PGEs), copper, nickel and gold dispersed in a gabbro matrix.

The Gabbronorite was obtained from a mafic to ultramafic intrusion complex (Giles Complex) within Mesoproterozoic granulites of the Musgrave Province, about 120km west of Warburton, WA (Australia).

The nickel concentrate was sourced from Xstrata's Cosmos mine (Western Australia), the copper concentrate from Glencore's CSA Mine (New South Wales, Australia), the PGE ore from one of Anglo Platinum's Merensky Reef mines (South Africa) and the gold ore from Newcrest's Lihir mine (Papa New Guinea).

COMMINUTION AND HOMOGENISATION PROCEDURES

OREAS 13b was prepared in the following manner:

- Jaw crushing to minus 3mm;
- Drying of the various components to constant mass at 65 – 105^{0}c depending on sulphide content;
- Multi-stage milling to 100% minus 30 microns (ore components) and 98% minus 75 microns (gabbro component);
- Bagging into 25kg sublots;
- Packaging into 10g and 60g units under nitrogen in laminated foil pouches and 1kg units in plastic jars.

ANALYTICAL PROGRAM

Seventeen commercial analytical laboratories participated in the program to certify the 36 elements reported in Table 1. Sixteen laboratories participated in the analytical program to characterise Ag, Al, As, Au, Ba, Ca, Co, Cr, Cu, Fe, Ir, K, LOI, Mg, Mn, Mo, Na, Ni, Os, P, Pd, Pt, Rh, Ru, S, Si, Sr, Ti, V, Zn and Zr.

The approximate major and trace element composition of OREAS 13b is provided in Table 2. The non-certified values contained in this table are the means of duplicate assays from one laboratory.

Laboratory names are listed in the section headed 'Participating Laboratories'. Their 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 (PDM^3) are presented in an appendix (Tables A2 – A37). The parameter PDM^3 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 intent of the certification program was to obtain total concentration values for the elements of interest, hence borate or alkali fusion methods were employed for the lithophile elements, fire assay (lead and nickel sulphide collection) for the precious metals and four acid (including HF) digest for the base metals. Chromium was under-reported by 4 acid digest compared to fusion methods, presumably due to the presence of refractory host

phases and/or volatilisation during digestion, and method dependent values are provided for this element.

The analytical methods employed by each laboratory are indicated as codes at the head of each laboratory data set and explained in Table A1 of the appendix. To maintain anonymity laboratories have been randomly designated the letter codes A through Q. With the exception of Laboratory Q each laboratory received two scoop-split 110g subsamples from each of three of the twenty 1kg test units (6 samples total) taken at regular intervals during the bagging stage. The samples were selected in a manner designed to maximise the CRM's representation within each laboratory sample batch and across the twenty 1kg test units whilst adhering to a nested design amenable to analysis of variance (ANOVA). This enabled a comparative assessment of within- and between-unit homogeneity. The assessment has been undertaken for the principle constituents Cu, Ni, Pt and Pd (see 'ANOVA study' section).

Laboratories were requested to dry the samples thoroughly at 105ºC and desiccate prior to weighing and analysis. Al, Ca, Cr, Fe, K, Mg, Mn, Na, Si, Ti, P, S, LOI, Ba, Sr, V and Zr were determined by lithium borate fusion XRF or ICP or by sodium peroxide fusion ICP (12 labs, see 'Appendix' Tables A2 – A18). Four of this group of labs determined S by infrared combustion furnace. Ag, As, Cr, Co, Cu, Mo, Ni, S and Zn were determined by 4-acid digest ICP (13 labs, see 'Appendix' Tables A19 – A27). For gold and the PGEs lead fire assay (25 – 40g charge weight) was used for gold, platinum and palladium (see 'Appendix' Tables A28 – A30) and nickel sulphide fire assay (25 – 40g charge weight) for gold and the six PGEs Pt, Pd, Rh, Ru, Ir and Os (see 'Appendix' Tables A31 – A37) with ICP-MS as the reading method. Good agreement was observed for Au, Pt and Pd between both methods.

For the determination of a statistical tolerance interval, a 10g scoop split was taken from each of the twenty test units and submitted to 'Lab Q' for gold assay via instrumental neutron activation analysis on a reduced analytical subsample weight averaging 1.7 gram. The tolerance is 2ppb (see Table 1) and confirms the excellent repeatability of gold assays in OREAS 13b (see Appendix Table A30a).

STATISTICAL EVALUATION

Certified Value and Confidence Limits

The certified value was determined from the mean of means of accepted replicate values of accepted laboratory data sets A to R according to the formulae:

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

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

where,

x_{ij} *is the jth 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;*

$\ddot{x}$ *is the mean of means.*

The confidence limits 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):

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

$$\textit{Confidence limits} = \ddot{x} \pm t_{1-x/2}(p-1)\left(\hat{V}(\ddot{x})\right)^{1/2}$$

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 limits.

The test for rejection of individual outliers from each laboratory data set was 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:

$$S = 1.483 \underset{j=1.....n}{\text{median}} / x_j - \underset{i=1.....n}{\text{median}} (x_i) /$$

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

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%. 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 entire 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 (Appendix Tables A2 to A37) 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 inter-laboratory 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).

Indicative (uncertified) values

The indicative (uncertified) values (Table 2) are provided for the major and trace elements determined by borate fusion XRF (Al_2O_3 to ZrO_2), LOI at 1000°C and laser ablation with ICP-MS (Ag to Zr) and are the means of duplicate assays from Bureau Veritas, Perth. Additional indicative values by other analytical methods are present where the number of laboratories reporting a particular analyte is insufficient (< 5) to support certification or where inter-laboratory consensus is poor.

Statement of Homogeneity

The variability of replicate assays from each laboratory is a result of both measurement and subsampling errors. In the determination of a statistical tolerance interval it is therefore necessary to eliminate, or at least substantially minimise, those errors attributable to measurement. One way of achieving this is by substantially reducing the analytical subsample weight to a point where most of the variability in replicate assays is due to inhomogeneity of the reference material and measurement error becomes negligible. This approach was adopted in the INAA gold data set (Appendix Table A30) where a ~1.7g subsample weight was employed.

The homogeneity was determined from tables of factors for two-sided tolerance limits for normal distributions (ISO Guide 3207) in which no individual outliers were removed from the results prior to the calculation of tolerance intervals.

$$\textit{Lower limit is } \ddot{x} - k_2'(n, p, 1-\alpha)s$$
$$\textit{Upper limit is } \ddot{x} + k_2'(n, p, 1-\alpha)s$$

where,

n is the number of results reported by laboratory Q;

1 - α 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, σ unknown);

and *s* is computed according to the formula

$$s = \left[\frac{\sum_{j=1}^{n} \left(x_j - \bar{x} \right)^2}{n-1} \right]^{1/2}$$

From the INAA data set an estimated tolerance interval of ± 1.8 ppb at an analytical subsample weight of 40 gram was obtained (using the sampling constant relationship of Ingamells and Switzer, 1973) and is considered to reflect the actual homogeneity of the material under test. The meaning of this tolerance interval may be illustrated for gold (refer Table 1), where 99% of the time at least 95% of 40g-sized subsamples will have concentrations lying between 209 and 213 ppb. 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 (IS0 Guide 35).

A different approach was used in estimating tolerance for all other constituents. 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 under test and, in particular, to deficiencies in accuracy of each analytical method. In determining tolerance intervals for silver 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 jth raw result reported by laboratory i*;

x'_{ij} *is the jth 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:

$$\text{Lower limit is } \ddot{x} - k'_2(n, p, 1-\alpha)s''_g$$
$$\text{Upper limit is } \ddot{x} + k'_2(n, p, 1-\alpha)s''_g$$

where,

n the number of results
1-α is the confidence level;
p is the proportion of results expected within tolerance limits;
k'₂ is the factor for two-sided tolerance limits (m, α unknown);
s''g is the corrected grand standard deviation.

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:

$$s''_g = \frac{\sum_{i=1}^{p}\left(s_i\left(1 - \frac{s_i}{s'_g}\right)\right)}{\sum_{i=1}^{p}\left(1 - \frac{s_i}{s'_g}\right)}$$

where,

$1 - \left(\frac{s_i}{2s'_g}\right)$ *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:

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

where $\bar{x}'_i$ *is the transformed mean for laboratorty 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. Outliers (shown in bold in Appendix Tables A2 – A37) were removed prior to the calculation of tolerance intervals and a weighting factor of zero was applied to those data sets where $s_l / 2s_g' > 1$ (i.e. where the weighting factor $1 - s_l / 2s_g' < 0$). 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.

ANOVA Study – Cu, Ni, Pt and Pd

The sampling program for OREAS 13b was structured to enable a nested ANOVA treatment of the round robin results. During the bagging stage immediately following final homogenization, 1kg samples (test units) were taken at 20 intervals representative of the entire batch of OREAS 13b. Thirteen labs were used for the ANOVA study (Labs A to P) of Cu and Ni (4-acid data) and twelve labs were used for the ANOVA study of Pt and Pd (lead collection fire assay data). As mentioned earlier each lab received paired samples of three different, non-adjacent, test units. For example, the six samples that any one of the participating labs could have received were:

- Sample 1 (from sampling interval 4)
- Sample 2 (from sampling interval 11)
- Sample 3 (from sampling interval 17)
- Sample 4 (from sampling interval 4)
- Sample 5 (from sampling interval 11)
- Sample 6 (from sampling interval 17)

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 13b. The test was performed using the following parameters:

- Significance Level α = 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 laboratory outliers prior to calculation of the p-value.

For copper a p-value of 0.25 was calculated which indicates no evidence that between-unit variance is greater than within-unit variance. Conclusion: do not reject H_0. For nickel a p-value of 0.92 was calculated after removal of the data from Lab I. This was required due to its extreme RSD value of 8.4% (see Table A25) where it exerted a disproportional influence over the p-value. Conclusion: do not reject H_0.

For platinum via lead collection fire assay a p-value of 0.62 was calculated after removal of the data from Lab A. This was required due to its extreme RSD value of 9.6% (see Table A28) where it exerted a disproportional influence over the p-value. Conclusion: do not reject H_0.

For palladium via lead collection fire assay a p-value of 0.82 was calculated after removal of the data from Lab A and Lab F. This was required due to their extreme RSD values of 6.4% and 14.2% respectively (see Table A29) causing these labs to exert a disproportional

influence over the p-value. In the case for Lab F, the high RSD is due to its poor reading resolution of 10ppb. Conclusion: do not reject H_0.

Note that the study of ANOVA is not an absolute measure of homogeneity. Rather, it establishes that Cu, Ni, Pt and Pd are distributed in a similar manner throughout OREAS 13b 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 and analytical precision (repeatability). 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 13b.

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
Fusion											
Al (wt.%)	8.41	0.14	8.14	8.69	8.01	8.82	1.61%	3.22%	4.83%	7.99	8.84
Ca (wt.%)	5.57	0.09	5.39	5.76	5.30	5.85	1.66%	3.33%	4.99%	5.30	5.85
Cr (wt.%)	1.08	0.04	1.01	1.16	0.98	1.19	3.34%	6.68%	10.0%	1.03	1.14
Fe (wt.%)	8.41	0.11	8.19	8.64	8.07	8.75	1.34%	2.69%	4.03%	7.99	8.83
K (wt.%)	2.30	0.02	2.27	2.34	2.25	2.35	0.74%	1.48%	2.23%	2.19	2.42
Mg (wt.%)	3.01	0.04	2.93	3.10	2.89	3.14	1.42%	2.84%	4.25%	2.86	3.16
Mn (wt.%)	0.130	0.006	0.118	0.143	0.112	0.149	4.70%	9.40%	14.1%	0.124	0.137
Na (wt.%)	1.67	0.05	1.56	1.78	1.51	1.83	3.25%	6.51%	9.76%	1.59	1.75
Si (wt.%)	22.9	0.3	22.4	23.4	22.1	23.7	1.16%	2.33%	3.49%	21.7	24.0
Ti (wt.%)	0.711	0.009	0.692	0.730	0.682	0.739	1.33%	2.66%	3.98%	0.675	0.746

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note: intervals may appear asymmetric due to rounding

Table 3. Performance Gates for OREAS 13b continued.

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
Fusion											
P (wt.%)	0.189	0.008	0.173	0.204	0.166	0.212	4.05%	8.10%	12.2%	0.179	0.198
S (wt.%)	1.19	0.03	1.12	1.25	1.09	1.28	2.71%	5.41%	8.12%	1.13	1.25
LOI (wt.%)	0.64	0.19	0.27	1.02	0.08	1.21	29.1%	58.3%	87.4%	0.61	0.68
Ba (ppm)	694	6	681	707	674	713	0.93%	1.87%	2.80%	659	728
Sr (ppm)	537	8	522	552	514	560	1.43%	2.87%	4.3%	510	564
V (ppm)	330	32	266	394	234	426	9.65%	19.3%	29.0%	313	346
Zr (ppm)	108	8	93	123	0	131	7.0%	14.1%	21%	103	113
4-Acid Digestion											
Ag (ppm)	0.86	0.10	0.66	1.06	0.56	1.16	11.6%	23.1%	34.7%	0.82	0.90
As (ppm)	57	7	43	71	37	78	12.1%	24.2%	36.2%	54	60
Cr (wt.%)	0.865	0.099	0.667	1.063	0.568	1.162	11.5%	22.9%	34.4%	0.822	0.908
Co (ppm)	75	8	60	90	52	97	10.1%	20.2%	30.3%	71	78
Cu (ppm)	2327	48	2230	2423	2182	2471	2.07%	4.14%	6.21%	2210	2443
Mo (ppm)	9.0	0.6	7.8	10.3	7.1	11.0	7.11%	14.2%	21.3%	8.6	9.5
Ni (ppm)	2247	155	1938	2556	1784	2711	6.88%	13.8%	20.6%	2135	2360
S (wt.%)	1.20	0.05	1.09	1.30	1.04	1.35	4.40%	8.80%	13.2%	1.14	1.26
Zn (ppm)	133	12	110	156	98	168	8.69%	17.4%	26.1%	127	140
Pb Fire Assay											
Pt (ppb)	197	13	170	224	156	237	6.83%	13.7%	20.5%	187	206
Pd (ppb)	131	9	112	149	103	159	7.15%	14.3%	21.4%	124	137
Au (ppb)	211	13	186	236	173	249	5.99%	12.0%	18.0%	200	221
Ni-S Fire Assay											
Pt (ppb)	204	13	178	230	165	243	6.38%	12.8%	19.1%	194	214
Pd (ppb)	134	4	126	141	123	145	2.74%	5.49%	8.23%	127	140
Rh (ppb)	43	2	39	47	37	49	4.79%	9.57%	14.4%	41	45
Ru (ppb)	78	6	65	91	59	97	8.10%	16.2%	24.3%	74	82
Ir (ppb)	17.9	1.3	15.3	20.6	13.9	22.0	7.51%	15.0%	22.5%	17.0	18.8
Os (ppb)	12	2	8	16	5	19	18.6%	37.1%	55.7%	11	13
Au (ppb)	201	7	186	216	179	223	3.70%	7.39%	11.1%	191	211

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note: intervals may appear asymmetric due to rounding

PARTICIPATING LABORATORIES

1. Acme Analytical Laboratories Ltd, Vancouver, British Columbia, Canada
2. Activation Laboratories, Ancaster, Ontario, Canada
3. Amdel Laboratories Ltd, Adelaide, South Australia, Australia
4. ALS Chemex, Brisbane, Queensland, Australia
5. ALS Chemex, Modderfontein, Johannesburg, South Africa
6. ALS Chemex, Perth, Western Australia, Australia
7. ALS Chemex, Vancouver, British Columbia, Canada
8. Bureau Veritas Geoanalytical, Perth, WA, Australia
9. Genalysis Laboratory Services Pty Ltd, Perth, Western Australia, Australia
10. Geoscience Laboratories, Sudbury, Ontario, Canada

11. Intertek Testing Services, Beijing, PR China
12. Intertek Testing Services, Jakarta, Indonesia
13. Set Point Laboratories, Isando, Gauteng, South Africa
14. SGS Lakefield Research Africa, Johannesburg, Gauteng, South Africa
15. SGS Lakefield Research Ltd, Lakefield, ON, Canada
16. SGS Australia, Perth, Western Australia, Australia
17. Ultra Trace Pty Ltd, Perth, Western Australia, Australia

PREPARER AND SUPPLIER

Certified reference material OREAS 13b is prepared, certified and supplied by:

ORE RESEARCH & EXPLORATION

ORE Research & Exploration Pty Ltd
37A Hosie Street
Bayswater North VIC 3153
AUSTRALIA

Tel: +613-9729 0333
Fax: +613-9729 8338
Web: www.ore.com.au
Email: info@ore.com.au

It is available in unit sizes of 10g and 60g foil packets sealed under nitrogen and in 1kg units in plastic jars.

INTENDED USE

OREAS 13b is a reference material intended for the following:

i) For the monitoring of laboratory performance in the analysis of Ag, Al, As, Au, Ba, Ca, Co, Cr, Cu, Fe, Ir, K, LOI, Mg, Mn, Mo, Na, Ni, Os, P, Pd, Pt, Rh, Ru, S, Si, Sr, Ti, V, Zn and Zr in geological samples;

ii) For the calibration of instruments used in the determination of the concentration of Ag, Al, As, Au, Ba, Ca, Co, Cr, Cu, Fe, Ir, K, LOI, Mg, Mn, Mo, Na, Ni, Os, P, Pd, Pt, Rh, Ru, S, Si, Sr, Ti, V, Zn and Zr;

iii) For the verification of analytical methods for Ag, Al, As, Au, Ba, Ca, Co, Cr, Cu, Fe, Ir, K, LOI, Mg, Mn, Mo, Na, Ni, Os, P, Pd, Pt, Rh, Ru, S, Si, Sr, Ti, V, Zn and Zr;

STABILITY AND STORAGE INSTRUCTIONS

OREAS 13b has been prepared from ores of platinum group elements, copper, nickel and gold dispersed in a gabbro matrix. It contains minor disseminated sulphides (~1.2% S) and has been packaged under nitrogen in 10 and 60 gram units in laminated foil pouches. The robust foil laminate film is an effective barrier to oxygen and moisture and the sealed CRM is considered to have long-term stability (>10 years) under normal storage conditions.

INSTRUCTIONS FOR THE CORRECT USE

The certified values for OREAS 13b refer to the concentration level of Ag, Al, As, Au, Ba, Ca, Co, Cr, Cu, Fe, Ir, K, LOI, Mg, Mn, Mo, Na, Ni, Os, P, Pd, Pt, Rh, Ru, S, Si, Sr, Ti, V, Zn and Zr after removal of hygroscopic moisture by drying in air to constant mass at 105°C. If the reference material is not dried by the user prior to analysis, the recommended value should be corrected to the moisture-bearing basis.

HANDLING INSTRUCTIONS

Fine powders pose a risk to eyes and lungs and therefore standard precautions such as the use of safety glasses and dust masks are advised.

TRACEABILITY

The analytical samples were selected in a manner to represent the entire batch of prepared CRM. This 'representivity' was maintained in each submitted laboratory sample batch and ensures the user that the data is traceable from sample selection through to the analytical results that underlie the consensus values. Each analytical data set has been validated by its assayer through the inclusion of internal reference materials and QC checks during analysis. The laboratories were chosen on the basis of their competence (from past performance in inter-laboratory programs) for a particular analytical method, analyte or analyte suite, and sample matrix. Most of these laboratories have and maintain ISO 17025 accreditation. The certified values presented in this report are calculated from the means of accepted data following robust statistical treatment as detailed in this report.

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.

DOCUMENT HISTORY

Revision No	Date	Changes applied
2	3rd Dec, 2020	Corrected units of measure for Cu and Ni on page 1.
1	3rd Sep, 2018	Added major and trace element characterization.
0	7th Jun, 2012	First publication.

QMS ACCREDITED

ORE Pty Ltd is accredited to ISO 9001:2015 by Lloyd's Register Quality Assurance Ltd for its quality management system including development, manufacturing, certification and supply of CRMs.

CERTIFYING OFFICER

3rd December, 2020

Craig Hamlyn (B.Sc. Hons - Geology), Technical Manager - ORE P/L

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APPENDIX

Analytical Results for OREAS 13b

Table A1. Explanation of abbreviations used in Tables A2 – A37.

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
PF	sodium peroxide fusion
BF	lithium metaborate fusion
XRF	x-ray fluorescence
4A	four acid ($HF–HNO_3–HClO_4–HCl$) digest
ICP	inductively coupled plasma OES or MS (unspecified)
OES	inductively coupled plasma optical emission spectrometry
MS	inductively coupled plasma mass spectrometry
IRC	infra-red combustion furnace
FA	fire assay (Pb collection)
NiS	fire assay (nickel-sulphide collection)

Table A2. Fusion results for Al in OREAS 13b (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*ICP	Lab E BF*OES	Lab F BF*XRF	Lab G BF*XRF	Lab I BF*ICP	Lab J BF*XRF	Lab K PF*OES	Lab L BF*XRF	Lab M BF*MS
1	8.47	8.43	8.47	8.31	8.23	8.41	8.35	8.41	8.41	8.52	8.47	8.20
2	8.36	8.36	8.47	8.28	8.23	8.36	8.31	8.41	**7.89**	8.56	8.47	8.20
3	8.47	8.42	8.47	8.29	8.20	8.57	8.32	8.36	8.75	8.73	8.41	8.20
4	8.52	8.44	8.52	8.39	8.28	8.47	8.30	8.46	**8.90**	8.76	8.47	8.20
5	8.41	8.39	8.47	8.35	**8.07**	8.47	8.34	8.30	**7.86**	8.72	8.41	8.20
6	8.41	8.49	8.47	8.39	8.26	8.47	8.30	8.39	8.52	8.76	8.47	8.20
Mean	8.44	8.42	8.48	8.34	8.21	8.46	8.32	8.39	8.39	8.68	8.45	8.20
Median	8.44	8.42	8.47	8.33	8.23	8.47	8.32	8.40	8.47	8.72	8.47	8.20
Std.Dev.	0.06	0.04	0.02	0.05	0.07	0.07	0.02	0.05	0.43	0.11	0.03	0.00
Rel.Std.Dev.	0.66%	0.51%	0.25%	0.58%	0.90%	0.83%	0.22%	0.64%	5.14%	1.24%	0.32%	0.00%
PDM[3]	0.32%	0.08%	0.74%	-0.94%	-2.40%	0.53%	-1.09%	-0.31%	-0.31%	3.10%	0.43%	-2.51%

Table A3. Fusion results for Ca in OREAS 13b (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*ICP	Lab E BF*OES	Lab F BF*XRF	Lab G BF*XRF	Lab I BF*ICP	Lab J BF*XRF	Lab K PF*OES	Lab L BF*XRF	Lab M BF*MS
1	5.65	5.52	5.67	5.66	5.55	5.64	5.52	5.72	5.48	5.55	5.58	5.40
2	5.60	5.45	5.67	5.67	5.50	5.65	5.50	5.72	5.50	5.60	5.57	5.41
3	5.58	5.49	5.67	5.67	5.50	5.75	5.52	5.70	5.48	5.58	5.58	5.40
4	5.63	5.50	5.66	5.65	5.55	5.68	5.52	5.73	5.49	5.59	5.56	5.40
5	5.63	5.50	5.65	5.62	5.45	5.65	5.52	5.69	5.45	5.56	5.57	5.39
6	5.62	5.52	5.65	5.65	5.60	5.64	5.51	5.74	5.50	5.55	5.57	5.41
Mean	5.62	5.50	5.66	5.65	5.52	5.67	5.52	5.72	5.48	5.57	5.57	5.40
Median	5.63	5.50	5.66	5.66	5.53	5.65	5.52	5.72	5.49	5.57	5.57	5.40
Std.Dev.	0.02	0.03	0.01	0.02	0.05	0.04	0.01	0.02	0.02	0.02	0.01	0.01
Rel.Std.Dev.	0.42%	0.49%	0.12%	0.31%	0.96%	0.74%	0.20%	0.35%	0.32%	0.40%	0.16%	0.15%
PDM[3]	0.83%	-1.40%	1.57%	1.44%	-0.88%	1.68%	-1.06%	2.58%	-1.62%	-0.03%	-0.03%	-3.09%

Table A4. Fusion results for Cr in OREAS 13b (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*ICP	Lab E BF*OES	Lab F BF*XRF	Lab G BF*XRF	Lab I BF*ICP	Lab J BF*XRF	Lab K PF*OES	Lab L BF*XRF	Lab M BF*MS
1	1.12	1.07	1.13	1.08	1.16	1.05	1.03	1.07	1.02	<0.002	1.10	1.09
2	1.10	1.06	1.12	1.07	1.15	**1.11**	1.04	1.07	1.03	<0.002	1.10	1.09
3	1.10	1.07	1.14	1.08	1.13	1.06	1.05	1.08	1.02	<0.002	1.11	1.11
4	1.11	1.08	1.13	1.07	1.14	1.07	1.05	1.08	1.02	<0.002	1.10	1.12
5	1.10	1.07	1.12	**1.11**	1.14	1.07	1.04	1.06	1.02	<0.002	1.11	1.11
6	1.11	1.08	1.12	1.09	1.16	1.06	1.05	1.08	1.01	<0.002	1.10	1.08
Mean	1.11	1.07	1.13	1.08	1.15	1.07	1.04	1.07	1.02		1.10	1.10
Median	1.10	1.07	1.13	1.08	1.14	1.06	1.04	1.08	1.02		1.10	1.10
Std.Dev.	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01		0.00	0.01
Rel.Std.Dev.	0.51%	0.72%	0.50%	1.32%	1.29%	1.84%	0.69%	0.76%	0.57%		0.32%	1.30%
PDM[3]	1.95%	-1.20%	3.84%	-0.05%	5.62%	-1.42%	-3.83%	-1.07%	-5.90%		1.74%	1.53%

Table A5. Fusion results for Fe in OREAS 13b (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*ICP	Lab E BF*OES	Lab F BF*XRF	Lab G BF*XRF	Lab I BF*ICP	Lab J BF*XRF	Lab K PF*OES	Lab L BF*XRF	Lab M BF*MS
1	8.46	8.20	8.53	8.54	8.32	8.53	8.25	8.49	8.04	8.46	8.46	8.18
2	8.39	8.13	8.53	8.46	8.22	8.46	8.36	8.42	8.07	8.50	8.46	8.15
3	8.46	8.22	8.46	8.41	8.22	8.60	8.32	8.41	8.09	8.58	8.46	8.15
4	8.39	8.23	8.53	8.49	8.32	8.53	8.31	8.48	8.07	8.53	8.46	8.11
5	8.46	8.23	8.46	8.42	8.18	8.46	8.28	8.38	8.04	8.47	8.46	8.11
6	8.46	8.25	8.53	8.34	8.32	8.53	8.37	8.48	8.07	8.48	8.46	8.15
Mean	8.44	8.21	8.51	8.44	8.27	8.52	8.31	8.44	**8.06**	8.50	8.46	**8.14**
Median	8.46	8.23	8.53	8.44	8.27	8.53	8.32	8.45	8.07	8.49	8.46	8.15
Std.Dev.	0.04	0.04	0.04	0.07	0.07	0.05	0.05	0.05	0.02	0.05	0.00	0.03
Rel.Std.Dev.	0.43%	0.54%	0.42%	0.83%	0.79%	0.62%	0.55%	0.54%	0.24%	0.55%	0.00%	0.32%
PDM[3]	0.34%	-2.38%	1.17%	0.38%	-1.74%	1.31%	-1.16%	0.39%	-4.14%	1.09%	0.61%	-3.20%

Table A6. Fusion results for K in OREAS 13b (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*ICP	Lab E BF*OES	Lab F BF*XRF	Lab G BF*XRF	Lab I BF*ICP	Lab J BF*XRF	Lab L BF*XRF	Lab M BF*MS
1	2.30	2.30	2.31	2.29	2.32	2.29	2.29	2.23	2.43	2.33	2.21
2	**2.24**	2.28	2.30	2.32	2.32	2.31	2.28	2.21	2.43	2.32	2.21
3	**2.25**	2.29	2.30	2.33	2.31	2.30	2.30	2.22	2.42	2.32	2.22
4	2.28	2.30	2.31	2.32	2.34	2.26	2.28	**2.33**	2.43	2.32	**2.27**
5	2.30	2.29	2.31	**2.37**	2.27	2.28	2.29	2.21	2.43	2.31	2.23
6	2.30	2.32	2.30	2.32	2.31	2.28	2.28	2.24	2.42	2.32	2.21
Mean	2.28	2.30	2.30	2.33	2.31	2.29	2.29	**2.24**	**2.43**	2.32	**2.22**
Median	2.29	2.30	2.30	2.32	2.31	2.29	2.29	2.22	2.43	2.32	2.22
Std.Dev.	0.03	0.01	0.00	0.02	0.02	0.02	0.01	0.05	0.00	0.01	0.02
Rel.Std.Dev.	1.17%	0.49%	0.20%	1.04%	0.93%	0.75%	0.30%	2.11%	0.18%	0.38%	1.03%
PDM[3]	-1.03%	-0.25%	0.05%	1.01%	0.35%	-0.67%	-0.61%	-2.71%	5.46%	0.77%	-3.37%

Table A7. Fusion results for Mg in OREAS 13b (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*ICP	Lab E BF*OES	Lab F BF*XRF	Lab G BF*XRF	Lab I BF*ICP	Lab J BF*XRF	Lab K PF*OES	Lab L BF*XRF	Lab M BF*MS
1	2.93	3.00	3.02	3.05	3.05	3.05	2.99	2.97	2.52	3.00	3.02	3.09
2	2.97	2.97	3.02	3.02	3.03	3.05	2.98	2.97	2.57	3.03	3.02	3.09
3	2.99	3.01	3.00	3.01	3.04	**3.10**	2.99	2.97	2.51	**3.10**	3.03	3.08
4	2.93	3.02	3.02	3.00	3.06	3.06	2.98	2.96	2.50	3.01	3.02	3.06
5	2.91	2.99	3.00	3.09	3.02	3.08	2.98	2.96	2.53	3.01	3.02	3.07
6	2.91	3.03	3.02	3.05	3.08	3.05	2.96	3.00	2.54	3.01	3.02	3.08
Mean	2.94	3.00	3.01	3.04	3.04	3.06	2.98	2.97	**2.53**	3.03	3.02	3.08
Median	2.93	3.01	3.02	3.04	3.04	3.05	2.98	2.97	2.53	3.01	3.02	3.08
Std.Dev.	0.03	0.02	0.01	0.03	0.02	0.02	0.01	0.02	0.02	0.04	0.01	0.01
Rel.Std.Dev.	1.11%	0.67%	0.40%	1.06%	0.73%	0.67%	0.34%	0.57%	0.91%	1.25%	0.20%	0.32%
PDM[3]	-2.49%	-0.39%	-0.06%	0.78%	1.01%	1.65%	-1.16%	-1.42%	-16.08%	0.41%	0.28%	2.11%

Table A8. Fusion results for Mn in OREAS 13b (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*ICP	Lab E BF*OES	Lab F BF*XRF	Lab G BF*XRF	Lab I BF*ICP	Lab J BF*XRF	Lab K PF*OES	Lab L BF*XRF	Lab M BF*MS
1	0.132	0.128	0.138	0.124	0.139	0.132	0.124	0.129	0.124	0.132	0.132	0.124
2	0.139	**0.125**	0.138	0.124	0.139	0.139	0.132	0.129	0.124	**0.134**	0.132	0.124
3	0.139	0.128	0.136	0.124	0.139	0.132	0.132	0.129	0.124	**0.136**	0.132	0.124
4	0.132	0.128	0.139	0.124	0.139	0.132	0.132	0.129	0.124	0.132	0.132	0.124
5	0.124	**0.126**	0.137	0.124	0.139	0.132	0.124	0.128	0.124	0.132	0.132	0.116
6	0.124	0.129	0.139	0.124	0.139	0.147	0.132	0.129	0.124	0.131	0.132	0.124
Mean	0.132	0.127	0.138	0.124	0.139	0.136	0.129	0.129	0.124	0.133	0.132	0.123
Median	0.132	0.128	0.138	0.124	0.139	0.132	0.132	0.129	0.124	0.132	0.132	0.124
Std.Dev.	0.007	0.001	0.001	0.000	0.000	0.006	0.004	0.000	0.000	0.002	0.000	0.003
Rel.Std.Dev.	5.26%	0.92%	0.79%	0.00%	0.00%	4.78%	3.10%	0.38%	0.00%	1.35%	0.00%	2.58%
PDM[3]	1.04%	-2.33%	5.79%	-4.90%	6.98%	4.01%	-0.94%	-1.34%	-4.90%	1.73%	1.04%	-5.89%

Table A9. Fusion results for Na in OREAS 13b (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*ICP	Lab E BF*OES	Lab F BF*XRF	Lab G BF*XRF	Lab I BF*ICP	Lab J BF*XRF	Lab K PF*OES	Lab L BF*XRF	Lab M BF*MS
1	1.68	1.62	1.68	1.65	1.77	1.71	1.59	1.66	1.45	1.79	1.71	1.59
2	1.70	1.62	1.68	1.63	1.78	1.69	1.60	1.65	1.46	1.80	1.73	1.59
3	**1.74**	1.62	1.68	1.65	1.77	1.71	1.62	1.65	1.44	1.83	1.72	1.59
4	1.65	1.62	1.68	1.64	1.80	**1.65**	1.61	1.68	1.45	1.87	1.71	1.59
5	1.68	1.63	1.69	1.68	1.75	**1.77**	1.60	1.65	1.46	1.85	1.71	1.59
6	1.67	1.63	1.69	1.68	1.77	1.71	1.61	1.67	1.46	1.87	1.73	1.59
Mean	1.69	1.62	1.68	1.65	1.77	1.71	1.61	1.66	**1.45**	**1.83**	1.72	1.59
Median	1.68	1.62	1.68	1.65	1.77	1.71	1.61	1.66	1.46	1.84	1.72	1.59
Std.Dev.	0.03	0.01	0.01	0.02	0.01	0.04	0.01	0.01	0.01	0.04	0.01	0.00
Rel.Std.Dev.	1.66%	0.41%	0.39%	1.27%	0.81%	2.38%	0.48%	0.80%	0.66%	1.94%	0.60%	0.19%
PDM[3]	1.07%	-2.71%	0.85%	-0.93%	6.25%	2.18%	-3.82%	-0.49%	-12.9%	9.81%	2.85%	-4.56%

Table A10. Fusion results for Si in OREAS 13b (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*ICP	Lab E BF*OES	Lab F BF*XRF	Lab G BF*XRF	Lab I BF*ICP	Lab J BF*XRF	Lab K PF*OES	Lab L BF*XRF	Lab M BF*MS
1	22.90	22.73	22.86	23.04	23.14	22.86	22.76	23.01	23.87	23.13	23.00	22.34
2	22.67	22.56	22.86	23.07	23.23	22.95	22.65	22.97	24.01	23.26	23.00	22.34
3	22.67	22.72	22.81	23.06	23.70	23.23	22.70	22.89	23.72	23.05	22.95	22.34
4	22.81	22.77	22.90	22.90	23.33	22.86	22.67	23.26	23.88	23.16	22.95	22.30
5	22.86	22.63	22.86	22.85	**23.75**	22.95	22.73	22.78	23.86	23.16	23.00	22.30
6	22.81	22.84	22.90	22.96	23.19	22.72	22.63	22.93	24.09	23.17	23.00	22.34
Mean	22.79	22.71	22.87	22.98	23.39	22.93	22.69	22.97	**23.91**	23.15	22.98	22.33
Median	22.81	22.73	22.86	23.00	23.28	22.90	22.68	22.95	23.88	23.16	23.00	22.34
Std.Dev.	0.10	0.10	0.04	0.09	0.27	0.17	0.05	0.16	0.13	0.07	0.02	0.02
Rel.Std.Dev.	0.43%	0.44%	0.15%	0.39%	1.14%	0.75%	0.22%	0.71%	0.53%	0.29%	0.11%	0.11%
PDM[3]	-0.42%	-0.76%	-0.08%	0.42%	2.21%	0.20%	-0.85%	0.40%	4.47%	1.19%	0.44%	-2.42%

Table A11. Fusion results for Ti in OREAS 13b (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*ICP	Lab E BF*OES	Lab F BF*XRF	Lab G BF*XRF	Lab I BF*ICP	Lab J BF*XRF	Lab K PF*OES	Lab L BF*XRF	Lab M BF*MS
1	0.707	0.695	0.719	0.713	0.743	0.725	0.701	0.713	0.703	**0.701**	0.713	0.695
2	0.707	0.683	0.719	0.701	0.725	0.707	0.713	0.711	0.712	0.713	0.707	0.695
3	0.695	0.701	0.707	0.701	0.719	0.725	0.713	0.701	0.706	0.725	0.707	0.695
4	0.713	0.701	0.713	0.707	0.725	0.707	0.707	0.724	0.706	0.731	0.713	0.695
5	0.707	0.695	0.713	0.725	0.731	0.725	0.701	0.700	0.712	0.725	0.707	0.689
6	0.707	0.701	0.713	0.713	0.737	0.725	0.713	0.710	**0.725**	0.725	0.707	0.671
Mean	0.706	0.696	0.714	0.710	**0.730**	0.719	0.708	0.710	0.711	0.720	0.709	**0.690**
Median	0.707	0.698	0.713	0.710	0.728	0.725	0.710	0.711	0.709	0.725	0.707	0.695
Std.Dev.	0.006	0.007	0.005	0.009	0.009	0.009	0.006	0.009	0.008	0.011	0.003	0.010
Rel.Std.Dev.	0.83%	1.01%	0.63%	1.28%	1.21%	1.29%	0.83%	1.25%	1.13%	1.53%	0.44%	1.39%
PDM[3]	-0.60%	-2.01%	0.52%	-0.04%	2.77%	1.22%	-0.32%	-0.11%	0.04%	1.36%	-0.18%	-2.85%

Table A12. Fusion results for P in OREAS 13b (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*ICP	Lab E BF*OES	Lab F BF*XRF	Lab G BF*XRF	Lab I BF*ICP	Lab J BF*XRF	Lab K PF*OES	Lab L BF*XRF	Lab M BF*MS
1	0.183	0.193	0.195	0.183	0.196	0.192	0.188	0.196	0.176	0.185	0.192	0.183
2	0.188	0.190	0.194	0.183	0.192	0.205	0.188	0.192	0.175	0.178	0.188	0.188
3	0.183	0.192	0.195	0.183	0.201	0.201	0.192	0.196	0.178	0.190	0.192	0.183
4	0.188	0.193	0.195	0.188	0.201	0.196	0.188	0.196	0.183	0.169	0.188	**0.166**
5	0.188	0.192	0.194	0.183	0.201	0.188	0.188	0.188	0.171	0.177	0.188	0.192
6	0.179	0.194	0.196	0.183	0.196	0.196	0.188	0.192	0.179	0.166	0.192	0.192
Mean	0.185	0.192	0.195	0.184	0.198	0.196	0.188	0.193	0.177	0.178	0.190	0.184
Median	0.185	0.193	0.195	0.183	0.199	0.196	0.188	0.194	0.177	0.178	0.190	0.185
Std.Dev.	0.004	0.001	0.001	0.002	0.004	0.006	0.002	0.004	0.004	0.009	0.002	0.010
Rel.Std.Dev.	1.93%	0.75%	0.38%	0.97%	1.80%	3.14%	0.95%	1.84%	2.29%	5.12%	1.26%	5.29%
PDM[3]	-2.08%	1.96%	3.16%	-2.47%	4.86%	4.08%	-0.16%	2.54%	-6.19%	-5.78%	0.62%	-2.47%

Table A13. Fusion results for S in OREAS 13b (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab B BF*XRF	Lab C BF*XRF	Lab F IRC	Lab G BF*XRF	Lab I IRC	Lab J BF*XRF	Lab L BF*XRF	Lab M IRC
1	1.18	1.13	1.21	1.10	1.17	1.57	1.21	1.20
2	1.17	1.13	1.21	1.11	1.18	**1.61**	1.23	1.22
3	1.18	1.13	1.19	1.07	1.23	1.57	1.21	1.22
4	1.19	1.14	1.20	1.08	1.20	1.57	1.21	1.21
5	1.18	1.12	1.17	1.08	1.22	1.57	1.22	1.23
6	1.20	1.12	1.18	1.10	1.18	1.54	1.21	1.19
Mean	1.18	1.13	1.19	**1.09**	1.20	**1.57**	1.22	1.21
Median	1.18	1.13	1.20	1.09	1.19	1.57	1.21	1.22
Std.Dev.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01
Rel.Std.Dev.	0.67%	0.67%	1.37%	1.42%	2.02%	1.33%	0.69%	1.21%
PDM[3]	-0.41%	-5.02%	0.45%	-8.25%	0.73%	32.3%	2.27%	1.99%

Table A14. Fusion results for LOI in OREAS 13b (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 I	Lab J	Lab K	Lab L	Lab M
1	0.85	0.84	0.60	0.70	0.92	0.64	0.50	0.55	0.28	0.93	0.60	0.51
2	0.80	0.83	0.59	0.80	0.78	0.59	0.50	0.55	0.30	0.94	0.55	0.52
3	0.79	0.84	0.61	0.80	0.73	0.64	0.50	0.52	0.28	0.89	0.60	0.52
4	0.85	0.87	0.62	0.90	0.61	0.59	0.50	0.52	0.32	0.93	0.61	0.53
5	0.84	**0.94**	0.61	0.90	0.44	0.62	0.50	0.51	0.25	0.87	0.58	0.53
6	0.83	0.90	**0.56**	0.90	0.46	0.66	0.40	**0.61**	0.30	0.87	0.57	0.51
Mean	0.83	0.87	0.60	0.83	0.66	0.62	0.48	0.54	0.29	0.91	0.59	0.52
Median	0.84	0.86	0.61	0.85	0.67	0.63	0.50	0.54	0.29	0.91	0.59	0.52
Std.Dev.	0.03	0.04	0.02	0.08	0.19	0.03	0.04	0.04	0.02	0.03	0.02	0.01
Rel.Std.Dev.	3.12%	4.93%	3.57%	9.80%	28.7%	4.61%	8.45%	6.75%	8.04%	3.41%	3.86%	1.72%
PDM[3]	28.5%	35.3%	-6.96%	29.6%	2.11%	-3.07%	-24.8%	-15.5%	-54.8%	40.9%	-9.03%	-19.1%

Table A15. Fusion results for Ba in OREAS 13b (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab B PF*OES	Lab D BF*ICP	Lab E BF*MS	Lab I BF*ICP	Lab K PF*OES	Lab M BF*MS
1	697	683	674	703	693	700
2	693	684	695	697	701	700
3	692	688	714	690	700	700
4	690	694	741	**745**	691	700
5	701	677	747	686	696	700
6	688	**655**	750	695	695	700
Mean	694	680	**720**	703	696	700
Median	693	684	728	696	696	700
Std.Dev.	5	14	31	22	4	0
Rel.Std.Dev.	0.69%	1.99%	4.32%	3.07%	0.56%	0.00%
PDM[3]	-0.04%	-1.96%	3.80%	1.28%	0.32%	0.90%

Table A16. Fusion results for Sr in OREAS 13b (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab B PF*OES	Lab D BF*ICP	Lab E BF*MS	Lab I BF*ICP	Lab K PF*OES	Lab M BF*MS
1	534	535	516	520	542	500
2	531	546	531	519	538	500
3	534	537	546	514	546	500
4	537	535	554	**533**	541	500
5	533	531	**587**	512	535	500
6	534	**521**	**594**	517	540	500
Mean	534	534	555	**519**	540	**500**
Median	534	535	550	518	541	500
Std.Dev.	2	8	31	7	4	0
Rel.Std.Dev.	0.36%	1.56%	5.54%	1.43%	0.69%	0.00%
PDM[3]	-0.59%	-0.51%	3.29%	-3.32%	0.62%	-6.89%

Table A17. Fusion results for V in OREAS 13b (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab B PFOES	Lab C PF*OES	Lab D BF*ICP	Lab E BF*MS	Lab F BF*XRF	Lab G BF*XRF	Lab I BF*ICP	Lab J BF*XRF	Lab K PF*OES	Lab M BF*MS
1	372	350	339	<5	**280**	280	279	310	330	300
2	366	350	344	<5	392	336	279	305	335	300
3	363	350	340	<5	**280**	336	274	317	335	300
4	365	350	345	129	392	336	**290**	305	334	300
5	369	350	333	10	336	280	276	310	333	300
6	367	350	328	<5	392	336	279	**333**	328	300
Mean	367	350	338	**70**	345	317	280	313	333	300
Median	367	350	340	70	364	336	279	310	334	300
Std.Dev.	3	0	7	84	55	29	6	11	3	0
Rel.Std.Dev.	0.86%	0.00%	1.94%	121%	15.9%	9.11%	1.98%	3.37%	0.87%	0.00%
PDM[3]	11.2%	6.06%	2.48%	-78.9%	4.68%	-3.81%	-15.3%	-5.08%	0.76%	-9.09%

Table A18. Fusion results for Zr in OREAS 13b (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab B PF*OES	Lab D BF*ICP	Lab E BF*MS	Lab F BF*XRF	Lab I BF*ICP	Lab K PF*OES	Lab M BF*MS
1	102	111	110	20	108	116	100
2	118	105	117	<10	100	113	100
3	**177**	110	117	<10	**137**	110	100
4	98	109	122	20	**78**	115	100
5	97	105	**137**	<10	101	117	100
6	103	111	128	<10	105	112	100
Mean	116	108	122	**20**	105	114	100
Median	103	109	120	20	103	114	100
Std.Dev.	31	3	10	0	19	3	0
Rel.Std.Dev.	26.7%	2.58%	7.83%	0.00%	18.1%	2.32%	0.00%
PDM[3]	7.22%	0.39%	12.8%	-81.5%	-2.96%	5.37%	-7.43%

Table A19. 4-acid results for Ag in OREAS 13b (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A AR*AAS	Lab B 4A*MS	Lab C 4A*MS	Lab D 4A*MS	Lab E 4A*MS	Lab F 4A*AAS	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES	Lab K 4A*MS	Lab L 4A*MS	Lab M 4A*OES	Lab O 4A*MS
1	<1	0.90	1.00	0.80	0.86	0.80	0.90	1.00	<3	0.82	1.00	0.60	0.90
2	<1	0.90	1.00	0.70	0.86	0.80	0.80	0.90	<3	0.82	1.10	<0.5	0.89
3	<1	0.90	1.00	0.80	**0.93**	0.80	0.80	1.00	<3	0.77	1.00	<0.5	0.89
4	<1	0.90	1.00	0.80	0.86	0.80	0.80	0.90	<3	0.75	1.00	0.60	0.92
5	<1	0.90	1.00	0.80	0.88	0.80	0.90	1.00	<3	0.77	1.00	<0.5	0.88
6	<1	0.90	1.00	0.80	0.88	0.80	0.90	0.80	<3	0.75	0.90	0.80	**0.85**
Mean		0.90	1.00	0.78	0.88	0.80	0.85	0.93		0.78	1.00	0.67	0.89
Median		0.90	1.00	0.80	0.87	0.80	0.85	0.95		0.77	1.00	0.60	0.89
Std.Dev.		0.00	0.00	0.04	0.03	0.00	0.05	0.08		0.03	0.06	0.12	0.02
Rel.Std.Dev.		0.00%	0.00%	5.21%	3.09%	0.00%	6.44%	8.75%		4.13%	6.32%	17.3%	2.61%
PDM[3]		4.46%	16.1%	-9.08%	1.94%	-7.15%	-1.34%	8.33%		-9.47%	16.1%	-22.6%	3.11%

Table A20. 4-acid results for As in OREAS 13b (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A AR*AAS	Lab B 4A*MS	Lab C 4A*MS	Lab D 4A*MS	Lab E 4A*MS	Lab F 4A*MS	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES	Lab K 4A*MS	Lab L 4A*MS	Lab M 4A*OES	Lab O 4A*MS
1	100.0	64.0	58.0	48.0	58.3	43.0	65.0	65.0	43.3	56.4	78.0	66.0	59.6
2	100.0	62.0	57.0	48.0	58.8	45.0	65.0	52.0	48.7	56.7	75.0	59.0	58.4
3	100.0	63.0	57.0	46.0	57.9	50.0	65.0	53.0	37.1	57.7	76.0	58.0	60.5
4	100.0	63.0	55.0	47.0	59.0	44.0	71.0	64.0	43.8	56.7	76.0	55.0	58.8
5	100.0	62.0	57.0	47.0	60.2	46.0	68.0	58.0	39.9	57.3	73.0	63.0	59.5
6	100.0	64.0	57.0	49.0	59.1	48.0	68.0	43.0	33.0	56.8	72.0	66.0	**56.1**
Mean	**100.0**	63.0	56.8	47.5	58.9	46.0	67.0	55.8	**41.0**	56.9	**75.0**	61.2	58.8
Median	100.0	63.0	57.0	47.5	58.9	45.5	66.5	55.5	41.6	56.8	75.5	61.0	59.2
Std.Dev.	0.0	0.9	1.0	1.0	0.8	2.6	2.4	8.3	5.5	0.5	2.2	4.5	1.5
Rel.Std.Dev.	0.00%	1.42%	1.73%	2.21%	1.34%	5.67%	3.66%	14.8%	13.5%	0.84%	2.92%	7.41%	2.57%
PDM[3]	74.7%	10.0%	-0.73%	-17.0%	2.85%	-19.7%	17.0%	-2.48%	-28.4%	-0.55%	31.0%	6.84%	2.73%

Table A21. 4-acid results for Cr in OREAS 13b (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*MS	Lab E 4A*MS	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES	Lab K 4A*OES	Lab L 4A*OES	Lab M 4A*OES	Lab O 4A*MS
1	0.961	0.756	0.981	0.839	0.934	1.110	0.710	0.780	0.936	0.835	0.847
2	0.983	0.784	0.966	0.835	0.995	0.982	0.759	0.790	0.909	0.827	0.811
3	**0.887**	0.762	0.956	**0.867**	0.887	1.000	0.740	0.720	0.925	0.822	0.849
4	0.910	0.790	0.986	0.847	1.025	1.030	0.753	0.750	0.893	0.828	0.838
5	0.967	0.777	0.969	0.838	0.795	**1.190**	0.770	0.720	0.912	0.850	0.832
6	0.959	0.763	0.992	0.847	0.724	0.980	0.695	0.710	0.873	**0.869**	0.815
Mean	0.944	0.772	0.975	0.846	0.893	1.049	0.738	0.745	0.908	0.839	0.832
Median	0.960	0.770	0.975	0.843	0.910	1.015	0.747	0.735	0.911	0.832	0.835
Std.Dev.	0.037	0.014	0.014	0.012	0.116	0.084	0.030	0.034	0.023	0.018	0.016
Rel.Std.Dev.	3.96%	1.77%	1.40%	1.37%	13.0%	8.05%	4.01%	4.55%	2.48%	2.13%	1.92%
PDM[3]	9.20%	-10.7%	12.7%	-2.23%	3.29%	21.3%	-14.7%	-13.9%	4.99%	-3.04%	-3.80%

Table A22. 4-acid results for Co in OREAS 13b (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*MS	Lab E 4A*MS	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES	Lab K 4A*OES	Lab L 4A*OES	Lab M 4A*OES	Lab O 4A*MS
1	61.0	81.5	85.0	79.2	71.6	68.0	93.0	53.6	90.0	74.0	70.0	72.0
2	62.0	78.4	80.0	75.7	73.2	68.0	77.0	58.2	90.0	74.0	68.0	69.3
3	63.0	80.7	85.0	76.8	**68.9**	68.0	80.0	50.6	80.0	73.0	67.0	72.4
4	63.0	79.9	80.0	77.6	73.3	67.0	85.0	55.2	90.0	73.0	68.0	70.8
5	60.0	78.5	80.0	77.5	74.0	68.0	89.0	55.4	80.0	72.0	71.0	70.8
6	62.0	80.8	75.0	78.0	73.2	69.0	76.0	52.4	80.0	70.0	70.0	67.1
Mean	61.8	80.0	80.8	77.5	72.4	68.0	83.3	**54.2**	85.0	72.7	69.0	70.4
Median	62.0	80.3	80.0	77.6	73.2	68.0	82.5	54.4	85.0	73.0	69.0	70.8
Std.Dev.	1.2	1.3	3.8	1.2	1.9	0.6	6.8	2.7	5.5	1.5	1.5	1.9
Rel.Std.Dev.	1.89%	1.60%	4.66%	1.51%	2.59%	0.93%	8.20%	4.89%	6.44%	2.07%	2.25%	2.77%
PDM[3]	-17.2%	7.07%	8.23%	3.72%	-3.11%	-8.95%	11.6%	-27.4%	13.8%	-2.71%	-7.61%	-5.74%

Table A23. 4-acid results for Cu in OREAS 13b (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*MS	Lab E 4A*MS	Lab F 4A*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES	Lab K 4A*OES	Lab M 4A*OES	Lab O 4A*MS
1	2100	2346	**2400**	2326	2220	2600	2343	2890	**2503**	2314	2350	**2580**
2	2100	2359	2300	2332	2230	2700	2358	2360	**2647**	**2368**	2320	2340
3	2200	2342	2320	2320	**2330**	2700	2351	2420	2589	2311	2330	2420
4	2100	2364	2310	**2407**	2250	2700	2362	2530	2566	2304	2340	2450
5	2000	2327	2290	2333	2230	2700	2388	2850	2577	2297	2380	2390
6	2200	2367	2310	2347	2280	2700	2377	2120	2592	2303	**2490**	2250
Mean	**2117**	2351	2322	2344	2257	**2683**	2363	**2528**	**2579**	2316	2368	2405
Median	2100	2353	2310	2332	2240	2700	2360	2475	2583	2308	2345	2405
Std.Dev.	75	15	40	32	42	41	17	297	47	26	63	111
Rel.Std.Dev.	3.56%	0.65%	1.71%	1.36%	1.85%	1.52%	0.71%	11.7%	1.81%	1.13%	2.66%	4.61%
PDM[3]	-9.03%	1.04%	-0.21%	0.75%	-3.01%	15.3%	1.57%	8.67%	10.8%	-0.45%	1.79%	3.37%

Table A24. 4-acid results for Mo in OREAS 13b (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*MS	Lab E 4A*MS	Lab F 4A*MS	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES	Lab K 4A*MS	Lab L 4A*MS	Lab M 4A*OES	Lab O 4A*MS
1	<10	9.70	9.50	9.50	10.10	8.40	8.00	9.00	2.89	8.48	12.00	9.00	9.32
2	<10	9.60	9.50	9.20	9.87	8.80	8.00	8.00	2.56	8.82	11.70	9.00	9.03
3	<10	9.90	9.50	9.10	**9.44**	8.60	8.00	8.00	2.89	8.61	11.40	9.00	9.36
4	<10	9.90	9.50	9.30	10.10	8.80	8.00	9.00	2.57	8.46	11.30	9.00	9.33
5	<10	9.60	9.50	9.10	10.30	8.90	8.00	8.00	<2.5	8.44	11.20	9.00	9.36
6	<10	9.70	9.50	**8.70**	10.25	8.70	8.00	**6.00**	<2.5	8.47	11.00	9.00	8.78
Mean		9.73	9.50	9.15	10.01	8.70	8.00	8.00	**2.73**	8.55	**11.43**	9.00	9.20
Median		9.70	9.50	9.15	10.10	8.75	8.00	8.00	2.73	8.48	11.35	9.00	9.33
Std.Dev.		0.14	0.00	0.27	0.32	0.18	0.00	1.10	0.19	0.15	0.36	0.00	0.24
Rel.Std.Dev.		1.40%	0.00%	2.91%	3.17%	2.06%	0.00%	13.7%	6.82%	1.72%	3.16%	0.00%	2.61%
PDM[3]		7.62%	5.04%	1.17%	10.7%	-3.80%	-11.5%	-11.5%	-69.8%	-5.50%	26.4%	-0.49%	1.69%

Table A25. 4-acid results for Ni in OREAS 13b (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*MS	Lab E 4A*MS	Lab F 4A*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES	Lab K 4A*OES	Lab L 4A*OES	Lab M 4A*OES	Lab O 4A*MS
1	2100	2259	2420	2440	2020	2500	2195	2670	**2115**	2430	2340	2100	2200
2	2100	2231	2390	2392	2010	2700	2215	2230	2251	2470	2350	2110	2060
3	2100	2230	2360	2438	2080	2600	2215	2340	2194	2420	2320	2170	2180
4	2100	2222	2380	2469	2040	2700	2207	2440	2223	2460	2330	2080	2150
5	2000	2231	2330	2446	2020	2600	2210	2550	2225	2390	2310	2110	2090
6	2100	2239	2390	2460	2020	2600	2177	2130	2209	2410	**2230**	**2210**	1970
Mean	2083	2235	2378	2441	2032	**2617**	2203	2393	2203	2430	2313	2130	2108
Median	2100	2231	2385	2443	2020	2600	2209	2390	2216	2425	2325	2110	2120
Std.Dev.	41	13	31	27	26	75	15	201	47	30	43	49	86
Rel.Std.Dev.	1.96%	0.57%	1.29%	1.10%	1.26%	2.88%	0.67%	8.40%	2.13%	1.25%	1.87%	2.32%	4.08%
PDM[3]	-7.30%	-0.54%	5.83%	8.61%	-9.6%	16.4%	-1.97%	6.49%	-1.98%	8.13%	2.93%	-5.22%	-6.19%

Table A26. 4-acid results for S in OREAS 13b (abbreviations as in Table A1; values in wt.%).

Replicate No.	Lab A IRC	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*MS	Lab E 4A*MS	Lab H 4A*OES	Lab J 4A*OES	Lab K 4A*OES	Lab L 4A*OES	Lab M 4A*OES	Lab O 4A*MS
1	1.21	1.26	**1.26**	1.20	1.13	1.14	1.06	1.04	1.24	1.28	1.26
2	1.21	1.26	1.22	1.20	1.11	1.16	1.14	1.07	**1.29**	1.24	1.18
3	1.21	1.24	1.23	1.20	**1.20**	1.16	1.14	1.04	1.25	1.24	1.26
4	1.20	1.23	1.22	1.20	1.12	1.16	1.11	1.04	1.25	1.25	1.25
5	1.21	1.23	1.22	1.20	1.11	1.14	1.11	1.04	1.24	1.25	1.21
6	1.20	1.23	1.24	1.20	1.13	1.15	1.11	1.04	1.22	1.27	1.14
Mean	1.21	1.24	1.23	1.20	1.13	1.15	1.11	**1.05**	1.25	1.26	1.22
Median	1.21	1.24	1.23	1.20	1.13	1.16	1.11	1.04	1.25	1.25	1.23
Std.Dev.	0.01	0.01	0.02	0.00	0.03	0.01	0.03	0.01	0.02	0.02	0.05
Rel.Std.Dev.	0.43%	1.09%	1.30%	0.00%	2.99%	0.85%	2.72%	1.17%	1.86%	1.31%	4.05%
PDM[3]	0.83%	3.66%	2.92%	0.27%	-5.30%	-3.77%	-7.16%	-12.7%	4.31%	4.87%	1.66%

Table A27. 4-acid results for Zn in OREAS 13b (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*MS	Lab E 4A*MS	Lab F 4A*MS	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*OES	Lab K 4A*MS	Lab L 4A*MS	Lab M 4A*OES	Lab O 4A*MS
1	120	**139**	136	137	124	120	140	164	119	148	173	145	149
2	120	131	136	143	124	120	138	137	**127**	152	167	141	134
3	120	131	128	139	**135**	120	134	142	**114**	155	170	138	141
4	120	129	126	140	127	120	138	149	120	152	167	138	141
5	110	130	128	141	123	120	136	156	121	153	163	143	136
6	120	132	130	138	125	120	135	128	119	151	161	147	128
Mean	118	132	131	140	126	120	137	146	120	152	**167**	142	138
Median	120	131	129	140	125	120	137	146	120	152	167	142	139
Std.Dev.	4	4	4	2	4	0	2	13	4	2	4	4	7
Rel.Std.Dev.	3.45%	2.71%	3.31%	1.55%	3.53%	0.00%	1.63%	8.95%	3.58%	1.46%	2.64%	2.60%	5.21%
PDM[3]	-11.2%	-0.91%	-1.91%	4.85%	-5.16%	-9.91%	2.72%	9.60%	-9.94%	14.0%	25.2%	6.60%	3.72%

Table A28. Fire assay results for Pt in OREAS 13b (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab A FA*OES	Lab B FA*MS	Lab C FA*MS	Lab D FA*OES	Lab E FA*OES	Lab F FA*OES	Lab I FA*MS	Lab J FA*ICP	Lab K FA*OES	Lab L FA*MS	Lab N FA*MS	Lab O FA*MS
1	203	203	212	190	185	200	186	193	197	179	221	195
2	191	192	199	190	174	190	182	194	193	185	212	208
3	207	188	207	190	169	200	**162**	**213**	191	188	226	218
4	**243**	192	214	190	176	**140**	188	200	**185**	186	215	207
5	240	200	205	190	177	190	185	200	192	190	213	209
6	220	202	208	190	182	190	175	199	190	191	216	200
Mean	217	196	208	190	177	185	180	200	191	187	217	206
Median	214	196	208	190	177	190	184	200	192	187	216	208
Std.Dev.	21	6	5	0	6	23	10	7	4	4	5	8
Rel.Std.Dev.	9.62%	3.20%	2.56%	0.00%	3.22%	12.2%	5.44%	3.58%	2.06%	2.32%	2.46%	3.85%
PDM[3]	10.5%	-0.25%	5.52%	-3.38%	-9.91%	-5.93%	-8.64%	1.60%	-2.70%	-5.16%	10.4%	4.84%

Table A29. Fire assay results for Pd in OREAS 13b (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab A FA*OES	Lab B FA*MS	Lab C FA*MS	Lab D FA*OES	Lab E FA*OES	Lab F FA*OES	Lab I FA*MS	Lab J FA*ICP	Lab K FA*OES	Lab L FA*MS	Lab N FA*MS	Lab O FA*MS
1	151	122	133	130	118	140	128	138	**129**	135	141	**126**
2	155	118	126	140	111	130	124	132	126	136	138	135
3	138	115	129	130	110	130	**113**	145	125	138	**145**	139
4	130	119	136	130	116	**90**	128	136	**121**	141	142	135
5	143	123	132	130	114	120	123	132	126	134	141	135
6	139	122	131	130	117	120	123	134	125	140	141	131
Mean	143	120	131	132	114	122	123	136	125	137	141	134
Median	141	121	132	130	115	125	124	135	126	137	141	135
Std.Dev.	9	3	3	4	3	17	5	5	3	3	2	4
Rel.Std.Dev.	6.40%	2.55%	2.62%	3.10%	2.86%	14.2%	4.46%	3.39%	2.06%	2.04%	1.59%	3.34%
PDM[3]	9.21%	-8.27%	0.41%	0.79%	-12.5%	-6.87%	-5.72%	4.35%	-4.06%	5.13%	8.19%	2.19%

Table A30. Fire assay results for Au in OREAS 13b (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab A FA*OES	Lab B FA*MS	Lab C FA*MS	Lab D FA*OES	Lab E FA*OES	Lab F FA*OES	Lab I FA*MS	Lab J FA*ICP	Lab K FA*OES	Lab L FA*MS	Lab N FA*MS	Lab O FA*MS
1	213	205	210	210	196	**260**	198	219	231	**214**	233	**234**
2	206	196	196	210	190	220	193	218	228	220	**224**	220
3	203	191	202	210	186	220	**175**	**239**	226	225	**237**	219
4	200	195	211	210	196	**160**	196	222	221	225	230	**201**
5	199	203	202	210	194	210	190	218	224	223	231	219
6	**185**	208	202	210	199	210	193	217	222	225	232	212
Mean	201	200	204	210	194	213	191	222	225	222	231	218
Median	202	200	202	210	195	215	193	219	225	224	232	219
Std.Dev.	9	7	6	0	5	32	8	9	4	4	4	11
Rel.Std.Dev.	4.64%	3.32%	2.78%	0.00%	2.44%	15.0%	4.31%	3.84%	1.68%	1.97%	1.84%	4.98%
PDM[3]	-4.72%	-5.35%	-3.37%	-0.45%	-8.27%	1.13%	-9.54%	5.40%	6.82%	5.24%	9.58%	3.11%

Table A30a. INAA results for Au in OREAS 13b
(abbreviations as in Table A1; values in ppb);
average sample weight is 1.7g.

Replicate No.	Lab Q INAA
1	206
2	203
3	206
4	**196**
5	203
6	206
7	205
8	205
9	205
10	204
11	205
12	**201**
13	204
14	206
15	205
16	208
17	206
18	205
19	205
20	208
Mean	205
Median	205
Std.Dev.	2.58
Rel.Std.Dev.	1.26%
PDM[3]	-3.01%

Table A31. Ni-S Fire Assay results for Pt in OREAS 13b (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab A NiS*ICP	Lab B NiS*MS	Lab C NiS*MS	Lab H NiS*MS	Lab I NiS*ICP	Lab J NiS*MS	Lab P NiS*MS
1	203	194	211	192	186	221	208
2	191	**204**	219	193	190	218	208
3	207	**189**	207	192	190	208	206
4	243	195	211	194	196	210	207
5	240	196	202	188	201	**179**	210
6	220	194	215	194	194	207	206
Mean	217	195	211	192	193	207	208
Median	214	195	211	193	192	209	208
Std.Dev.	21	5	6	2	5	15	2
Rel.Std.Dev.	9.62%	2.50%	2.82%	1.16%	2.75%	7.25%	0.73%
PDM[3]	6.53%	-4.26%	3.34%	-5.81%	-5.48%	1.48%	1.71%

Table A32. Ni-S Fire Assay results for Pd in OREAS 13b (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab A NiS*ICP	Lab B NiS*MS	Lab C NiS*MS	Lab H NiS*MS	Lab I NiS*ICP	Lab J NiS*MS	Lab P NiS*MS
1	151	129	133	132	133	140	132
2	155	131	136	132	133	**147**	134
3	138	**124**	135	132	138	145	132
4	130	131	136	131	133	130	132
5	143	130	129	133	140	135	133
6	139	130	130	**127**	135	141	133
Mean	**143**	129	133	131	135	140	133
Median	141	130	134	132	134	141	133
Std.Dev.	9	3	3	2	3	6	1
Rel.Std.Dev.	6.40%	2.04%	2.30%	1.63%	2.22%	4.59%	0.62%
PDM[3]	6.80%	-3.30%	-0.31%	-1.80%	1.31%	4.54%	-0.68%

Table A33. Ni-S Fire Assay results for Rh in OREAS 13b (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab A NiS*ICP	Lab B NiS*MS	Lab C NiS*MS	Lab H NiS*MS	Lab I NiS*ICP	Lab J NiS*MS	Lab P NiS*MS
1	39.0	43.0	40.0	40.0	43.9	41.5	45.0
2	50.0	44.0	44.0	42.0	43.2	45.9	45.0
3	31.0	**41.0**	40.0	41.0	44.5	43.5	45.0
4	35.0	42.0	44.0	42.0	44.3	40.0	44.0
5	24.0	43.0	38.0	41.0	44.1	44.5	44.0
6	25.0	43.0	40.0	40.0	43.5	46.7	45.0
Mean	**34.0**	42.7	41.0	41.0	43.9	43.7	44.7
Median	33.0	43.0	40.0	41.0	44.0	44.0	45.0
Std.Dev.	9.7	1.0	2.4	0.9	0.5	2.6	0.5
Rel.Std.Dev.	28.6%	2.42%	5.97%	2.18%	1.12%	5.86%	1.16%
PDM[3]	-20.7%	-0.49%	-4.38%	-4.38%	2.43%	1.86%	4.18%

Table A34. Ni-S Fire Assay results for Ru in OREAS 13b (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab A NiS*ICP	Lab B NiS*MS	Lab C NiS*MS	Lab H NiS*MS	Lab I NiS*ICP	Lab J NiS*MS	Lab P NiS*MS
1	107.0	74.0	75.0	73.0	86.0	77.6	49.3
2	98.0	77.0	81.0	71.0	87.0	82.2	48.8
3	93.0	65.0	75.0	73.0	86.0	81.8	56.4
4	86.0	71.0	85.0	72.0	87.0	80.0	54.7
5	89.0	76.0	69.0	72.0	**84.0**	84.4	56.4
6	103.0	**45.0**	78.0	73.0	87.0	**71.0**	55.1
Mean	**96.0**	68.0	77.2	72.3	86.2	79.5	**53.5**
Median	95.5	72.5	76.5	72.5	86.5	80.9	54.9
Std.Dev.	8.1	12.1	5.5	0.8	1.2	4.7	3.5
Rel.Std.Dev.	8.49%	17.7%	7.16%	1.13%	1.36%	5.96%	6.51%
PDM[3]	23.1%	-12.8%	-1.04%	-7.24%	10.5%	1.95%	-31.5%

Table A35. Ni-S Fire Assay results for Ir in OREAS 13b (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab A NiS*ICP	Lab B NiS*MS	Lab C NiS*MS	Lab H NiS*MS	Lab I NiS*ICP	Lab J NiS*MS	Lab P NiS*MS
1	32.0	18.0	19.0	18.0	16.2	19.3	17.3
2	30.0	20.0	20.0	17.0	15.3	**22.3**	17.5
3	47.0	18.0	19.0	17.0	15.3	19.0	17.1
4	**62.0**	18.0	19.0	18.0	16.2	20.0	17.5
5	36.0	18.0	18.0	17.0	16.2	19.9	17.5
6	38.0	18.0	19.0	17.0	16.2	20.4	17.4
Mean	**40.8**	18.3	19.0	17.3	15.9	20.2	17.4
Median	37.0	18.0	19.0	17.0	16.2	20.0	17.5
Std.Dev.	11.9	0.8	0.6	0.5	0.5	1.2	0.2
Rel.Std.Dev.	29.2%	4.45%	3.33%	2.98%	2.92%	5.83%	0.92%
PDM[3]	128%	2.15%	5.87%	-3.42%	-11.4%	12.4%	-3.14%

Table A36. Ni-S Fire Assay results for Os in OREAS 13b (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab B NiS*MS	Lab C NiS*MS	Lab H NiS*MS	Lab I NiS*ICP
1	12.0	8.0	11.0	16.0
2	13.0	9.0	12.0	11.0
3	11.0	9.0	12.0	17.0
4	13.0	10.0	13.0	14.0
5	13.0	9.0	12.0	14.0
6	**8.0**	10.0	13.0	12.0
Mean	11.7	9.2	12.2	14.0
Median	12.5	9.0	12.0	14.0
Std.Dev.	2.0	0.8	0.8	2.3
Rel.Std.Dev.	16.9%	8.21%	6.19%	16.3%
PDM[3]	-2.23%	-23.2%	1.96%	17.3%

Table A37. Ni-S Fire Assay results for Au in OREAS 13b (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab A NiS*ICP	Lab B NiS*MS	Lab C NiS*MS	Lab H NiS*MS	Lab I NiS*ICP	Lab J NiS*MS	Lab P NiS*MS
1	213	**200**	202	208	190	203	208
2	206	213	204	195	**180**	194	**202**
3	203	207	201	202	192	190	209
4	200	204	197	206	195	180	205
5	199	208	**193**	202	196	186	207
6	**185**	208	201	195	195	198	208
Mean	201	207	200	201	191	192	207
Median	202	208	201	202	194	192	208
Std.Dev.	9	4	4	5	6	8	3
Rel.Std.Dev.	4.64%	2.11%	1.99%	2.70%	3.13%	4.32%	1.25%
PDM[3]	-0.03%	2.79%	-0.70%	0.13%	-4.84%	-4.55%	2.70%