



**CERTIFICATE OF ANALYSIS FOR  
NICKEL SULPHIDE ORE REFERENCE  
MATERIAL OREAS 77a**

**SUMMARY STATISTICS**

Constituent	Recommended value	95% Confidence Interval		Tolerance limits 1- $\alpha$ =0.99, $\rho$ =0.95	
		Low	High	Low	High
<b><u>Lead fire assay</u></b>					
Gold, Au (ppb)	61	57	66	56	66
Palladium, Pd (ppb)	566	538	593	549	582
Platinum, Pt (ppb)	1088	1034	1142	1053	1123
<b><u>4 Acid digest</u></b>					
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	1.45	1.40	1.49	1.41	1.48
Arsenic, As (ppm)	154	146	161	149	158
Chromium, Cr (ppm)	709	661	757	661	758
Cobalt, Co (ppm)	1714	1669	1760	1688	1741
Copper, Cu (ppm)	4311	4225	4397	4259	4363
Iron, Fe (wt.%)	34.3	33.3	35.4	34.0	34.7
Magnesium oxide, MgO (wt.%)	7.25	7.03	7.47	7.10	7.41
Nickel, Ni (wt.%)	10.59	10.38	10.80	10.43	10.74
Sulphur, S (wt.%)	24.4	22.2	26.5	23.9	24.8
<b><u>Fusion</u></b>					
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	1.48	1.43	1.54	1.44	1.52
Arsenic, As (ppm)	162	146	179	152	173
Chromium, Cr (ppm)	840	812	868	789	891
Cobalt, Co (ppm)	1675	1578	1773	1625	1726
Copper, Cu (ppm)	4400	4247	4552	4202	4597
Iron, Fe (wt.%)	34.0	33.1	34.8	33.5	34.4
Magnesium oxide, MgO (wt.%)	7.27	7.17	7.36	7.17	7.36
Nickel, Ni (wt.%)	10.71	10.39	11.02	10.51	10.91
Silicon dioxide, SiO <sub>2</sub> (wt.%)	13.3	13.1	13.6	13.1	13.5
Sulphur, S (wt.%)	26.2	24.2	28.2	25.5	26.9
<b><u>IR Combustion</u></b>					
Sulphur, S (wt.%)	26.83	26.48	27.19	26.42	27.24

Intervals may appear asymmetric due to rounding

Prepared by:  
*Ore Research & Exploration Pty Ltd*  
November 2006

## INTRODUCTION

OREAS certified reference materials (CRMs) are intended to provide a low cost method of evaluating and improving the quality of precious and base metal analysis of geological samples. To the analyst they provide an effective means of calibrating analytical equipment, assessing new techniques and routinely monitoring in-house procedures. 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.

## SOURCE MATERIAL

Reference material OREAS 77a is one of a suite of six nickel sulphide CRMs (OREAS 72a to OREAS 77a) prepared from high grade massive nickel sulphide ore and barren ultramafic material from the Cosmos Nickel mine located in the Kathleen Valley area approximately 30km north of Leinster in Western Australia. Cosmos is situated within the Agnew-Wiluna portion of the Norseman-Wiluna greenstone belt. This portion of the belt is strongly attenuated and characterised by large scale faults, complex folding and typically steep dips. It is a typical Kambalda-style, komatiite associated, massive sulphide deposit representing an essentially in-situ accumulation of primary magmatic Ni-Fe sulphides with minor by-products including Cu, Co and platinum group elements (PGE's). The Cosmos deposit comprises one discrete zone of massive and semi-massive sulphides extending over a strike length of 240m. Mineralisation is strata bound between the overlying ultramafic unit and the underlying dolerite and felsic volcanic rocks. Continuity of grade and width of mineralisation are strong both along strike and down dip.

## COMMUNITION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 77a was prepared in the following manner:

- a) *drying to constant mass at 65 C (Ni ore) and 105<sup>0</sup>C (barren ultramafic);*
- b) *crushing;*
- c) *milling of the nickel ore to 100% minus 25 microns;*
- d) *milling of the barren ultramafic to 98% minus 75 microns;*
- e) *combining in appropriate proportions to achieve the desired grade;*
- f) *homogenisation;*
- g) *packaging into 10g units in laminated foil pouches.*

## ANALYTICAL PROGRAM FOR OREAS 77a

Fifteen commercial laboratories participated in the analytical program to certify Au, Pt, Pd, Al<sub>2</sub>O<sub>3</sub>, As, Cr, Co, Cu, Fe, MgO, Ni, SiO<sub>2</sub> and S by both total and partial methods. 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<sup>3</sup>) are presented in an appendix (Tables A2 – A24). 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.

Table 1. Approximate major and trace element composition of nickel sulphide reference material OREAS 77a; wt.% - weight percent; ppm - parts per million.

Constituent	wt. %	Constituent	ppm	Constituent	ppm	Constituent	ppm
TiO <sub>2</sub>	0.10	Ag	2.2	Ho	0.1	Sm	0.5
MnO	0.16	Ba	51	In	0.1	Sn	1
CaO	1.20	Be	0.5	La	5	Sr	15
K <sub>2</sub> O	0.20	Bi	1.3	Li	11	Ta	<1
P <sub>2</sub> O <sub>5</sub>	0.10	Cd	1	Lu	0.05	Tb	0.1
Na <sub>2</sub> O	0.2	Ce	9.0	Mo	2.5	Te	1.2
C	0.10	Cs	1.7	Nb	2.2	Th	1.9
		Dy	0.4	Nd	2.2	U	0.5
		Er	0.3	Pb	22	W	2
		Eu	0.10	Pr	0.8	Y	2.7
		Ga	2.1	Rb	9	Yb	0.3
		Gd	0.6	Sb	2.2	Zn	90
		Hf	0.5	Sc	2	Zr	16

The intent of the certification program was to characterise the analytes by a) fire assay ICP-MS, b) total acid digest methods (mainly HF-HCl-HNO<sub>3</sub>-HClO<sub>4</sub>) with ICP-OES, ICP-MS and AAS finish, and b) sodium peroxide or lithium borate fusion with ICP-OES, ICP-MS, AAS or XRF finish. S was also analysed by Leco IR combustion furnace. A batch of five dried and vacuum-packed samples were submitted to each of the participating laboratories for analysis. Each batch was composed of two 110g sub-samples scoop-split from each of two separate 1kg test units taken during the bagging stage and immediately following homogenisation. This two-stage nested design for the interlaboratory programme was amenable to analysis of variance (ANOVA) treatment and enables a comparative assessment of within- and between-unit homogeneity. A fifth randomly chosen sample was included from a third 1kg test unit to make up batches of five samples.

## STATISTICAL EVALUATION OF OREAS 77a

### Recommended Value and Confidence Limits

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

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

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

where

$x_{ij}$  is the  $j$ th result reported by laboratory  $i$ ;

$p$  is the number of participating laboratories;

$n_i$  is the number of results reported by laboratory  $i$ ;

$\bar{x}_i$  is the mean for laboratory  $i$ ;

$\bar{\bar{x}}$  is the mean of means.

Table 2. Recommended values and 95% confidence intervals for OREAS 77a

Constituent	Recommended value	95% Confidence Interval	
		Low	High
<b>Lead fire assay</b>			
Gold, Au (ppb)	61	57	66
Palladium, Pd (ppb)	566	538	593
Platinum, Pt (ppb)	1088	1034	1142
<b>4 Acid digest</b>			
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	1.45	1.40	1.49
Arsenic, As (ppm)	154	146	161
Chromium, Cr (ppm)	709	661	757
Cobalt, Co (ppm)	1714	1669	1760
Copper, Cu (ppm)	4311	4225	4397
Iron, Fe (wt.%)	34.3	33.3	35.4
Magnesium oxide, MgO (wt.%)	7.25	7.03	7.47
Nickel, Ni (wt.%)	10.59	10.38	10.80
Sulphur, S (wt.%)	24.4	22.2	26.5
<b>Fusion</b>			
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	1.48	1.43	1.54
Arsenic, As (ppm)	162	146	179
Chromium, Cr (ppm)	840	812	868
Cobalt, Co (ppm)	1675	1578	1773
Copper, Cu (ppm)	4400	4247	4552
Iron, Fe (wt.%)	34.0	33.1	34.8
Magnesium oxide, MgO (wt.%)	7.27	7.17	7.36
Nickel, Ni (wt.%)	10.71	10.39	11.02
Silicon dioxide, SiO <sub>2</sub> (wt.%)	13.3	13.1	13.6
Sulphur, S (wt.%)	26.2	24.2	28.2
<b>IR Combustion</b>			
Sulphur, S (wt.%)	26.83	26.48	27.19

Intervals may appear asymmetric due to rounding

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).

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

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

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

The distributions of the values are 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

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

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

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.

Individual outliers and, more rarely, laboratory means deemed to be outlying are shown in bold in the tabulated results (Appendix) and have been omitted in the determination of recommended 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 recommended value, i.e. the narrower the confidence interval the greater the certainty in the recommended value.

### 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 the component of error attributable to measurement inaccuracy was eliminated by transformation of the individual results of each data set to a common mean (the uncorrected grand mean) according to the formula:

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

where

$x_{ij}$  is the *j*th raw result reported by laboratory *i*;

$x'_{ij}$  is the *j*th transformed result reported by laboratory *i*;

$n_i$  is the number of results reported by laboratory *i*;

$p$  is the number of participating laboratories;

$\bar{x}_i$  is the raw mean for laboratory *i*.

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

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

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

where

$n$  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 4 acid digest, where 99% of the time at least 95% of subsamples will have concentrations lying between 10.4 and 10.7 percent (see Table 3). 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:

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

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. A weighting factor of zero was applied to those data sets where  $s_i / 2s_g' > 1$  (i.e. where the weighting factor  $1 - s_i / 2s_g' < 0$ ). 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. Outliers 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  $1 - s_l / 2s_g' < 0$ ).

Table 3. Recommended values and tolerance limits for OREAS 77a

Constituent	Recommended value	Tolerance limits 1- $\alpha$ =0.99, $\rho$ =0.95	
		Low	High
<b>Lead fire assay</b>			
Gold, Au (ppb)	61	56	66
Palladium, Pd (ppb)	566	549	582
Platinum, Pt (ppb)	1088	1053	1123
<b>4 Acid digest</b>			
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	1.45	1.41	1.48
Arsenic, As (ppm)	154	149	159
Chromium, Cr (ppm)	709	661	758
Cobalt, Co (ppm)	1714	1688	1741
Copper, Cu (ppm)	4311	4259	4363
Iron, Fe (wt.%)	34.3	34.0	34.7
Magnesium oxide, MgO (wt.%)	7.25	7.20	7.31
Nickel, Ni (wt.%)	10.59	10.43	10.74
Sulphur, S (wt.%)	24.4	23.9	24.8
<b>Fusion</b>			
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	1.48	1.44	1.52
Arsenic, As (ppm)	162	152	173
Chromium, Cr (ppm)	840	794	886
Cobalt, Co (ppm)	1675	1625	1726
Copper, Cu (ppm)	4400	4205	4595
Iron, Fe (wt.%)	34.0	33.5	34.4
Magnesium oxide, MgO (wt.%)	7.27	7.17	7.36
Nickel, Ni (wt.%)	10.71	10.51	10.91
Silicon dioxide, SiO <sub>2</sub> (wt.%)	13.3	13.1	13.5
Sulphur, S (wt.%)	26.2	25.5	26.9
<b>IR Combustion</b>			
Sulphur, S (wt.%)	26.83	26.42	27.24

Intervals may appear asymmetric due to rounding

## Performance Gates

Performance gates provide an indication of a level of performance that might reasonably be expected for a particular analyte from a laboratory being monitored by this standard in a QA/QC program. They incorporate errors attributable to measurement (analytical bias and precision) and standard variability. For an effective standard the contribution of the latter should be negligible in comparison to measurement errors. Two methods have been employed to calculate performance gates.

The first method uses the standard deviation of the pooled individual analyses generated from the certification program. All individual and lab dataset (batch) outliers are removed prior to determination of the standard deviation. These outliers can only be removed if they can be confidently deemed to be analytical rather than arising from inhomogeneity of the CRM. Performance gates have been calculated for one, two and three standard deviations (SDs) of the accepted pool of certification data and are presented in Table 4. As a guide these intervals may be regarded as informational (1SD), warning or rejection for multiple outliers (2SD), or rejection for individual outliers (3SD) in QC monitoring although their precise application should be at the discretion of the QC manager concerned.

Table 4. Proposed performance gates for OREAS 77a

Constituent	Recommended value	Performance Gates							
		1SD		2SD		3SD		5%	
		Low	High	Low	High	Low	High	Low	High
<b>Lead fire assay</b>									
Gold, Au (ppb)	61	54	69	47	76	39	83	58	64
Palladium, Pd (ppb)	566	521	611	475	656	430	702	538	594
Platinum, Pt (ppb)	1088	992	1183	897	1279	802	1374	1033	1142
<b>4 Acid digest</b>									
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	1.45	1.39	1.51	1.33	1.57	1.27	1.63	1.38	1.52
Arsenic, As (ppm)	154	142	165	131	176	120	187	146	161
Chromium, Cr (ppm)	709	647	772	584	834	522	897	674	745
Cobalt, Co (ppm)	1714	1638	1791	1562	1867	1486	1943	1629	1800
Copper, Cu (ppm)	4311	4167	4454	4024	4598	3881	4741	4095	4526
Iron, Fe (wt.%)	34.3	32.8	35.9	31.3	37.4	29.7	38.9	32.6	36.0
Magnesium oxide, MgO (wt.%)	7.25	6.92	7.58	6.59	7.91	6.26	8.24	6.89	7.62
Nickel, Ni (wt.%)	10.59	10.22	10.95	9.85	11.32	9.48	11.69	10.06	11.12
Sulphur, S (wt.%)	24.4	21.4	27.3	18.4	30.3	15.4	33.3	23.1	25.6
<b>Fusion</b>									
Aluminium oxide, Al <sub>2</sub> O <sub>3</sub> (wt.%)	1.48	1.38	1.59	1.27	1.70	1.16	1.81	1.41	1.56
Arsenic, As (ppm)	162	135	190	108	217	81	244	154	171
Chromium, Cr (ppm)	840	789	892	737	943	686	995	798	882
Cobalt, Co (ppm)	1675	1520	1831	1364	1986	1209	2142	1592	1759
Copper, Cu (ppm)	4400	4181	4618	3963	4836	3745	5054	4180	4620
Iron, Fe (wt.%)	34.0	32.3	35.6	30.7	37.2	29.1	38.9	32.3	35.7
Magnesium oxide, MgO (wt.%)	7.27	7.08	7.46	6.88	7.65	6.69	7.84	6.90	7.63
Nickel, Ni (wt.%)	10.71	10.24	11.17	9.77	11.64	9.30	12.11	10.17	11.24
Silicon dioxide, SiO <sub>2</sub> (wt.%)	13.3	12.8	13.9	12.3	14.4	11.7	14.9	12.7	14.0
Sulphur, S (wt.%)	26.2	25.5	26.9	24.8	27.7	24.0	28.4	24.9	27.5
<b>IR Combustion</b>									
Sulphur, S (wt.%)	26.8	26.3	27.4	25.7	28.0	25.2	28.5	25.5	28.2

Intervals may appear asymmetric due to rounding

For the second method a  $\pm 5\%$  error bar on the recommended value is used as the window of acceptability (refer Table 4).

Both methods should be used with caution 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.

## PARTICIPATING LABORATORIES

Acme Analytical Laboratories, Vancouver, BC, Canada  
 Activation Laboratories, Ancaster, ON, Canada  
 Actlabs Pacific, Redcliffe, WA, Australia  
 ALS Chemex, Malaga, WA, Australia  
 ALS Chemex, Stafford, QLD, Australia  
 ALS Chemex, North Vancouver, BC, Canada  
 Amdel Laboratories, Thebarton, SA, Australia  
 Amdel Laboratories, Wangara, WA, Australia  
 Genalysis Laboratory Services, Maddington, WA, Australia  
 Intertek Testing Services, Jakarta, Indonesia  
 Kalgoorlie Assay Laboratories, Kalgoorlie WA, Australia  
 McPhar Geoservices (Phil.) Inc., Makati, Philippines  
 SGS, Welshpool, WA, Australia  
 SGS Geosol, Brazil, Sth America  
 Ultra Trace Laboratories, Canning Vale, WA, Australia



## PREPARER AND SUPPLIER OF THE REFERENCE MATERIAL

The siltstone reference material OREAS 77a has been prepared and certified and is supplied by:

Ore Research & Exploration Pty Ltd  
6-8 Gatwick Road  
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AUSTRALIA

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Email	info @ore.com.au	Web	www.ore.com.au

It is available in unit sizes of 10g in laminated foil packets.

### INTENDED USE

OREAS 77a is a reference material intended for the following:

- i) for the calibration of instruments used in the determination of the concentration of Ni, Au, Pt, Pd, Fe, Cu, Cr, Co, MgO, Al<sub>2</sub>O<sub>3</sub>, As, SiO<sub>2</sub> and S;
- ii) for the verification of analytical methods for Ni, Au, Pt, Pd, Fe, Cu, Cr, Co, MgO, Al<sub>2</sub>O<sub>3</sub>, As, SiO<sub>2</sub> and S;
- iii) for the preparation of secondary reference materials of similar composition;

### STABILITY AND STORAGE INSTRUCTIONS

OREAS 77a has been prepared from high grade nickel sulphide ore and barren ultramafic. Packaging under nitrogen in robust foil laminate it is considered to provide long-term stability for this CRM under normal storage conditions.

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

The recommended values for OREAS 76a refer to the concentration levels of Ni, Au, Pt, Pd, Fe, Cu, Cr, Co, MgO, Al<sub>2</sub>O<sub>3</sub>, As, SiO<sub>2</sub> and S after removal of hygroscopic moisture (~0.42 wt.%) by drying in air to constant mass at 65<sup>0</sup> C. If the reference material is not dried prior to analysis, the recommended value should be corrected to the moisture-bearing basis.

### 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**

Dr Paul Hamlyn

## **CERTIFICATION DATE**

November 30, 2006

## **REFERENCES**

ISO Guide 35 (1985), Certification of reference materials - General and statistical principals.  
ISO Guide 3207 (1975), Statistical interpretation of data - Determination of a statistical tolerance interval.  
Kleeman, A. W. (1967), *J. Geol. Soc. Australia*,

## **APPENDIX**

### **Analytical Results for OREAS 77a**

Table A1. Explanation of abbreviations used in Tables A2 – A24.

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
4A	four acid (HF-HNO <sub>3</sub> -HClO <sub>4</sub> -HCl) digestion
AAS	atomic absorption spectrometry
OES	inductively coupled plasma optical emission spectrometry
MS	inductively coupled plasma mass spectrometry
PPP	inductively coupled plasma optical emission spectrometry
XRF	x-ray fluorescence
BF	lithium metaborate fusion
PF	sodium peroxide fusion
LECO	Leco infrared furnace
HG	hydride generation

Table A2. Analytical results for gold in OREAS 77a (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab A FA*MS	Lab B FA*MS	Lab C FA*MS	Lab D -	Lab E FA*MS	Lab F FA*MS	Lab G FA*MS	Lab H FA*MS	Lab I -	Lab J FA*MS	Lab K FA*MS	Lab L FA*OES	Lab M FA*MS	Lab N FA*MS	Lab O FA*MS
1	71	61	56	NR	66	58	59	71	NR	89	58	57	54	51	59
2	75	68	66	NR	69	56	57	51	NR	94	51	56	54	55	57
3	72	66	63	NR	73	58	57	77	NR	81	45	63	52	52	53
4	71	64	58	NR	68	55	61	68	NR	126	57	60	56	54	66
5	75	64	67	NR	43	57	61	66	NR	88	55	58	56	52	72
Mean	73	65	62		64	57	59	67		96	53	59	54	53	61
Median	72	64	63		68	57	59	68		89	55	58	54	52	59
Std.Dev.	2	3	5		12	1	2	10		18	5	3	2	2	8
Rel.Std.Dev.	2.65%	4.04%	7.82%		18.7%	2.30%	3.39%	14.5%		18.4%	9.98%	4.60%	3.08%	3.11%	12.3%
PDM <sup>3</sup>	18.6%	5.41%	1.17%		4.11%	-7.32%	-3.73%	8.89%		56.0%	-13.2%	-3.99%	-11.2%	-13.8%	0.19%

Table A3. Analytical results for palladium in OREAS 77a (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab A FA*MS	Lab B FA*MS	Lab C FA*MS	Lab D -	Lab E FA*MS	Lab F FA*MS	Lab G FA*MS	Lab H FA*MS	Lab I -	Lab J FA*MS	Lab K FA*MS	Lab L FA*OES	Lab M FA*MS	Lab N FA*MS	Lab O FA*MS
1	564	600	577	NR	640	555	559	<b>721</b>	NR	542	498	558	487	615	799
2	569	611	607	NR	590	560	534	<b>315</b>	NR	597	499	548	479	625	<b>765</b>
3	558	625	599	NR	610	566	547	582	NR	564	441	539	477	635	800
4	557	<b>479</b>	<b>561</b>	NR	620	554	551	557	NR	504	520	559	<b>517</b>	625	<b>865</b>
5	558	596	604	NR	<b>395</b>	570	576	594	NR	581	531	<b>506</b>	494	634	800
Mean	561	582	590		571	561	553	554		558	498	542	491	627	<b>806</b>
Median	558	600	599		610	560	551	582		564	499	548	487	625	800
Std.Dev.	5	59	20		100	7	16	148		36	35	22	16	8	36
Rel.Std.Dev.	0.92%	10.1%	3.37%		17.5%	1.24%	2.81%	26.7%		6.50%	6.98%	4.01%	3.29%	1.30%	4.51%
PDM <sup>3</sup>	-0.82%	2.89%	4.19%		0.91%	-0.90%	-2.20%	-2.14%		-1.46%	-12.0%	-4.22%	-13.3%	10.8%	42.4%

Table A4. Analytical results for platinum in OREAS 77a (abbreviations as in Table A1; values in ppb).

Replicate No.	Lab A FA*MS	Lab B FA*MS	Lab C FA*MS	Lab D -	Lab E FA*MS	Lab F FA*MS	Lab G FA*MS	Lab H FA*MS	Lab I -	Lab J FA*MS	Lab K FA*MS	Lab L FA*OES	Lab M FA*MS	Lab N FA*MS	Lab O FA*MS
1	1160	1153	1120	NR	1180	1115	991	1310	NR	1091	1041	1067	939	1059	1400
2	1120	1201	<b>1180</b>	NR	1200	1106	930	<b>617</b>	NR	1207	837	<b>1038</b>	917	1050	1300
3	1190	1187	<b>1040</b>	NR	1150	<b>1153</b>	956	1140	NR	1154	<b>603</b>	<b>1116</b>	921	<b>1028</b>	1430
4	1120	1169	1110	NR	1220	1112	960	1090	NR	1030	989	1077	982	1054	1300
5	1100	1145	1120	NR	<b>785</b>	1128	1030	1170	NR	1168	1010	1083	954	1062	1370
Mean	1138	1171	1114		1107	1123	973	1065		1130	896	1076	943	1051	<b>1360</b>
Median	1120	1169	1120		1180	1115	960	1140		1154	989	1077	939	1054	1370
Std.Dev.	36	23	50		182	18	38	264		70	182	28	27	13	59
Rel.Std.Dev.	3.19%	1.98%	4.47%		16.4%	1.65%	3.94%	24.8%		6.17%	20.3%	2.62%	2.82%	1.28%	4.32%
PDM <sup>3</sup>	4.62%	7.65%	2.41%		1.77%	3.21%	-10.5%	-2.06%		3.88%	-17.6%	-1.06%	-13.3%	-3.42%	25.0%

Table A5. Analytical results for 4 acid aluminium oxide in OREAS 77a (abbreviations as in Table A1; values in wt %).

Replicate No.	Lab A 4A*OES	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*MS	Lab E 4A*AAS	Lab F 4A*OES	Lab G 4A*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J -	Lab K -	Lab L -	Lab M 4A*OES	Lab N 4A*OES	Lab O 4A*OES
1	1.47	1.43	1.44	1.48	1.49	1.42	1.45	0.68	1.34	NR	NR	NR	1.11	1.69	1.46
2	1.47	1.42	1.42	1.50	1.50	1.42	1.52	0.68	1.36	NR	NR	NR	1.05	1.65	1.52
3	1.47	<b>1.35</b>	1.42	1.46	1.54	1.38	1.49	0.68	1.32	NR	NR	NR	1.08	1.68	1.51
4	1.49	1.42	1.42	1.46	1.56	1.40	1.53	0.70	1.34	NR	NR	NR	1.12	1.64	1.47
5	1.50	1.38	1.42	1.50	1.52	1.40	1.51	0.69	1.33	NR	NR	NR	1.08	1.67	1.48
Mean	1.48	1.40	1.42	1.48	1.52	1.40	1.50	<b>0.69</b>	1.34				<b>1.09</b>	<b>1.67</b>	1.49
Median	1.47	1.42	1.42	1.48	1.52	1.40	1.51	0.68	1.34				1.08	1.67	1.48
Std.Dev.	0.01	0.03	0.01	0.02	0.03	0.02	0.03	0.01	0.01				0.02	0.02	0.03
Rel.Std.Dev.	0.96%	2.35%	0.59%	1.35%	1.88%	1.13%	2.11%	1.30%	1.11%				2.29%	1.24%	1.76%
PDM <sup>3</sup>	2.13%	-3.46%	-1.94%	2.13%	5.03%	-3.25%	3.51%	-52.7%	-7.67%				-24.9%	15.0%	2.67%

Table A6. Analytical results for 4 acid arsenic in OREAS 77a (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*AAS	Lab F 4A*OES	Lab G 4A*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J HG*AAS	Lab K -	Lab L -	Lab M 4A*OES	Lab N 4A*OES	Lab O 4A*OES
1	165	149	140	<b>180</b>	160	<200	<b>159</b>	146	155	89	NR	NR	170	160	149
2	160	148	130	160	140	200	166	146	150	90	NR	NR	170	167	148
3	170	<b>139</b>	140	140	140	200	166	148	160	91	NR	NR	170	160	143
4	170	148	150	130	150	<200	164	146	155	87	NR	NR	170	160	148
5	165	148	140	140	160	<200	167	144	155	<b>109</b>	NR	NR	170	158	142
Mean	166	146	140	150	150	<b>200</b>	164	146	155	<b>93</b>			170	161	146
Median	165	148	140	140	150	200	166	146	155	90			170	160	148
Std.Dev.	4	4	7	20	10	0	3	1	4	9			0	3	3
Rel.Std.Dev.	2.52%	2.84%	5.05%	13.3%	6.67%	0.00%	1.95%	0.97%	2.28%	9.61%			0.00%	2.15%	2.22%
PDM <sup>3</sup>	8.02%	-4.74%	-8.90%	-2.40%	-2.40%	30.1%	6.97%	-5.00%	0.86%	-39.4%			10.6%	4.76%	-5.00%

Table A7. Analytical results for 4 acid chromium in OREAS 77a (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*AAS	Lab F 4A*OES	Lab G 4A*OES	Lab H -	Lab I 4A*OES	Lab J -	Lab K -	Lab L -	Lab M 4A*OES	Lab N 4A*OES	Lab O -
1	495	745	690	600	750	490	690	NR	750	NR	NR	NR	685	716	NR
2	435	743	690	<b>490</b>	740	480	<b>830</b>	NR	780	NR	NR	NR	685	716	NR
3	455	688	680	600	810	490	680	NR	790	NR	NR	NR	560	698	NR
4	440	727	680	630	800	520	740	NR	780	NR	NR	NR	745	758	NR
5	465	<b>560</b>	670	570	790	480	710	NR	790	NR	NR	NR	760	704	NR
Mean	<b>458</b>	693	682	578	778	<b>492</b>	730		778				687	718	
Median	455	727	680	600	790	490	710		780				685	716	
Std.Dev.	24	78	8	54	31	16	60		16				79	23	
Rel.Std.Dev.	5.21%	11.2%	1.23%	9.27%	4.00%	3.34%	8.28%		2.11%				11.5%	3.27%	
PDM <sup>3</sup>	-35.4%	-2.35%	-3.84%	-18.5%	9.69%	-30.6%	2.92%		9.69%				-3.14%	1.29%	

Table A8. Analytical results for 4 acid cobalt in OREAS 77a (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*AAS	Lab F 4A*OES	Lab G 4A*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*AAS	Lab K -	Lab L AR*OES	Lab M 4A*OES	Lab N 4A*OES	Lab O 4A*OES
1	1700	1674	1740	1620	1640	1840	1550	1730	1740	1387	NR	1794	1740	1820	1710
2	1700	1646	1740	1640	1630	1830	1630	1730	1760	1405	NR	1780	1740	1801	1700
3	1690	1566	1730	1620	1690	1800	1580	1710	1760	1410	NR	1770	1720	1825	1700
4	1670	1648	1740	1620	1700	1840	1520	1770	1790	1364	NR	1791	1720	1802	1700
5	1675	1603	1720	1640	1670	1830	1600	1760	1780	1389	NR	1785	1760	1816	1700
Mean	1687	1627	1734	1628	1666	1828	1576	1740	1766	<b>1391</b>		1784	1736	1813	1702
Median	1690	1646	1740	1620	1670	1830	1580	1730	1760	1389		1785	1740	1816	1700
Std.Dev.	14	43	9	11	30	16	43	24	19	18		10	17	11	4
Rel.Std.Dev.	0.83%	2.63%	0.52%	0.67%	1.83%	0.90%	2.71%	1.41%	1.10%	1.30%		0.53%	0.96%	0.60%	0.26%
PDM <sup>3</sup>	-1.60%	-5.07%	1.14%	-5.04%	-2.82%	6.63%	-8.07%	1.49%	3.01%	-18.9%		4.06%	1.26%	5.74%	-0.72%

Table A9. Analytical results for 4 acid copper in OREAS 77a (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*AAS	Lab F 4A*OES	Lab G 4A*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*AAS	Lab K -	Lab L AR*OES	Lab M 4A*OES	Lab N 4A*OES	Lab O 4A*OES
1	4380	4239	4320	4250	4240	4400	4110	2970	4400	4201	NR	4323	<b>4440</b>	4508	4020
2	4290	4263	4280	4300	4250	4380	4240	2980	4450	4055	NR	4345	4500	4506	4030
3	4290	<b>4099</b>	4290	4230	4360	<b>4310</b>	4280	2960	4430	4178	NR	4309	4520	4540	4070
4	4310	4231	4290	4220	4370	4390	4170	3050	4450	4113	NR	<b>4436</b>	4560	4552	4050
5	4360	4204	4260	4320	4360	4390	4280	3040	4410	4110	NR	4363	4530	4604	4050
Mean	4326	4207	4288	4264	4316	4374	4216	<b>3000</b>	4428	4131		4355	4510	4542	4044
Median	4310	4231	4290	4250	4360	4390	4240	2980	4430	4113		4345	4520	4540	4050
Std.Dev.	42	64	22	44	65	36	74	42	23	58		50	45	40	19
Rel.Std.Dev.	0.96%	1.52%	0.51%	1.03%	1.51%	0.83%	1.76%	1.39%	0.51%	1.41%		1.14%	0.99%	0.88%	0.48%
PDM <sup>3</sup>	0.35%	-2.41%	-0.53%	-1.09%	0.12%	1.46%	-2.20%	-30.4%	2.72%	-4.16%		1.03%	4.62%	5.36%	-6.19%

Table A10. Analytical results for 4 acid iron in OREAS 77a (abbreviations as in Table A1; values in wt %).

Replicate No.	Lab A 4A*OES	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*MS	Lab E 4A*AAS	Lab F 4A*OES	Lab G 4A*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J -	Lab K -	Lab L -	Lab M 4A*OES	Lab N 4A*OES	Lab O 4A*OES
1	33.3	33.5	>30.0	32.5	33.7	35.6	33.0	32.0	36.2	NR	NR	NR	34.5	36.7	<b>36.5</b>
2	32.7	33.6	>30.0	33.2	33.9	35.7	34.3	32.1	36.1	NR	NR	NR	34.8	36.3	<b>35.2</b>
3	32.6	<b>32.2</b>	>30.0	32.3	34.8	<b>34.4</b>	33.9	31.6	<b>35.8</b>	NR	NR	NR	34.4	36.2	35.9
4	32.9	33.5	>30.0	32.2	34.4	35.4	32.9	32.5	36.4	NR	NR	NR	34.6	36.5	36.1
5	33.2	<b>32.7</b>	>30.0	33.1	34.0	35.4	33.9	31.3	36.2	NR	NR	NR	34.9	36.5	36.0
Mean	32.9	33.1	>30.0	32.7	34.2	35.3	33.6	31.9	36.1				34.6	36.4	35.9
Median	32.9	33.5	>30.0	32.5	34.0	35.4	33.9	32.0	36.2				34.6	36.5	36.0
Std.Dev.	0.3	0.6	-	0.5	0.4	0.5	0.6	0.5	0.2				0.2	0.2	0.5
Rel.Std.Dev.	0.93%	1.95%	-	1.41%	1.29%	1.50%	1.83%	1.45%	0.61%				0.61%	0.56%	1.31%
PDM <sup>3</sup>	-4.04%	-3.60%	-	-4.86%	-0.49%	2.79%	-2.12%	-7.07%	5.28%				0.86%	6.15%	4.70%



Table A11. Analytical results for 4 acid magnesium oxide in OREAS 77a (abbreviations as in Table A1; values in wt %).

Replicate No.	Lab A 4A*OES	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*MS	Lab E 4A*AAS	Lab F 4A*OES	Lab G 4A*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J -	Lab K -	Lab L -	Lab M 4A*OES	Lab N 4A*OES	Lab O 4A*OES
1	7.43	7.14	6.83	6.93	6.84	7.89	7.41	8.07	7.15	NR	NR	NR	<b>7.17</b>	7.29	7.43
2	7.39	7.14	6.75	7.00	6.80	7.91	7.73	8.09	<b>7.31</b>	NR	NR	NR	7.33	7.22	7.43
3	7.43	<b>6.99</b>	6.70	6.85	7.06	<b>7.71</b>	7.63	8.02	7.21	NR	NR	NR	7.28	7.40	7.44
4	7.44	7.15	6.75	6.83	7.12	7.88	7.42	8.27	7.16	NR	NR	NR	7.30	7.15	7.41
5	<b>7.62</b>	7.14	6.65	6.96	6.87	7.91	7.63	8.22	7.14	NR	NR	NR	<b>7.43</b>	7.36	<b>7.49</b>
Mean	7.46	7.11	6.74	6.91	6.94	7.86	7.56	<b>8.13</b>	7.19				7.30	7.28	7.44
Median	7.43	7.14	6.75	6.93	6.87	7.89	7.63	8.09	7.16				7.30	7.29	7.43
Std.Dev.	0.09	0.07	0.07	0.07	0.14	0.08	0.14	0.11	0.07				0.09	0.10	0.03
Rel.Std.Dev.	1.21%	0.93%	1.01%	1.05%	2.05%	1.08%	1.88%	1.30%	0.98%				1.28%	1.40%	0.43%
PDM <sup>3</sup>	2.87%	-1.94%	-7.15%	-4.69%	-4.36%	8.35%	4.27%	12.1%	-0.83%				0.66%	0.41%	2.59%

Table A12. Analytical results for 4 acid nickel in OREAS 77a (abbreviations as in Table A1; values in wt %).

Replicate No.	Lab A 4A*OES	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*MS	Lab E 4A*AAS	Lab F 4A*OES	Lab G 4A*OES	Lab H 4A*OES	Lab I 4A*OES	Lab J 4A*AAS	Lab K -	Lab L AR*OES	Lab M 4A*OES	Lab N 4A*OES	Lab O 4A*OES
1	10.7	10.3	10.6	9.73	10.6	10.4	10.1	10.8	<b>10.8</b>	10.3	NR	10.8	10.4	11.1	10.9
2	10.7	<b>10.7</b>	10.6	10.3	10.2	10.4	10.2	11.1	11.0	10.2	NR	10.9	10.5	11.1	11.1
3	10.6	10.3	10.6	9.94	10.6	10.5	10.2	11.1	10.9	<b>10.7</b>	NR	10.8	10.4	11.1	11.2
4	10.6	10.0	10.5	9.86	10.5	10.4	10.4	11.1	11.1	<b>10.9</b>	NR	11.0	10.5	11.0	11.2
5	10.6	10.1	10.5	10.2	<b>9.96</b>	10.5	10.1	10.8	11.0	10.3	NR	10.9	10.7	<b>11.3</b>	11.0
Mean	10.6	10.3	10.5	10.0	10.4	10.4	10.2	11.0	11.0	10.5		10.9	10.5	11.1	11.1
Median	10.6	10.3	10.6	9.9	10.5	10.4	10.2	11.1	11.0	10.3		10.9	10.5	11.1	11.1
Std.Dev.	0.1	0.3	0.0	0.2	0.3	0.1	0.1	0.2	0.1	0.3		0.1	0.1	0.1	0.1
Rel.Std.Dev.	0.63%	2.47%	0.43%	2.23%	2.64%	0.55%	1.20%	1.50%	1.01%	2.65%		0.49%	1.07%	0.99%	1.18%
PDM <sup>3</sup>	0.41%	-2.80%	-0.63%	-5.57%	-2.12%	-1.51%	-3.65%	3.72%	3.57%	-1.17%		2.73%	-0.87%	5.10%	4.66%

Table A13. Analytical results for 4 acid sulphur in OREAS 77a (abbreviations as in Table A1; values in wt %).

Replicate No.	Lab A 4A*OES	Lab B 4A*OES	Lab C 4A*OES	Lab D 4A*MS	Lab E 4A*AAS	Lab F 4A*OES	Lab G -	Lab H 4A*OES	Lab I 4A*OES	Lab J -	Lab K -	Lab L AR*OES	Lab M 4A*OES	Lab N -	Lab O -
1	25.3	<b>24.0</b>	<b>27.0</b>	22.2	26.4	22.7	NR	17.9	23.8	NR	NR	26.4	30.3	NR	NR
2	25.3	22.7	26.5	22.9	26.6	22.8	NR	18.7	23.6	NR	NR	26.5	28.9	NR	NR
3	25.4	<b>21.2</b>	26.5	21.9	26.8	22.5	NR	18.6	24.0	NR	NR	26.6	28.3	NR	NR
4	25.5	22.4	26.6	21.5	<b>27.5</b>	22.7	NR	19.2	23.6	NR	NR	27.0	28.0	NR	NR
5	25.4	22.2	26.3	22.5	26.5	22.9	NR	18.2	23.6	NR	NR	26.9	29.0	NR	NR
Mean	25.4	22.5	26.6	22.2	26.8	22.7		18.5	23.7			26.7	28.9		
Median	25.4	22.4	26.5	22.2	26.6	22.7		18.6	23.6			26.6	28.9		
Std.Dev.	0.1	1.0	0.3	0.5	0.4	0.1		0.5	0.2			0.3	0.9		
Rel.Std.Dev.	0.33%	4.46%	0.97%	2.43%	1.64%	0.60%		2.68%	0.75%			1.01%	3.07%		
PDM <sup>3</sup>	4.18%	-7.70%	9.10%	-8.87%	9.84%	-6.70%		-24.0%	-2.64%			9.52%	18.6%		

Table A14. Analytical results for fusion aluminium oxide in OREAS 77a (abbreviations as in Table A1; values in wt %).

Replicate No.	Lab A BF*XRF	Lab B PF*OES	Lab C BF*OES	Lab D BF*OES	Lab E BF*XRF	Lab F BF*OES	Lab G BF*OES	Lab H BF*OES	Lab I BF*OES	Lab J BF*XRF	Lab K BF*OES	Lab L PF*OES	Lab M BF*OES	Lab N BF*OES	Lab O BF*OES
1	1.60	1.44	1.48	1.52	1.41	<b>1.34</b>	1.60	1.40	1.35	1.50	1.38	1.48	1.52	1.65	1.56
2	1.61	<b>1.55</b>	1.52	1.60	1.41	1.47	1.40	1.40	1.32	1.40	1.36	1.47	1.53	1.64	1.68
3	1.60	1.45	1.45	1.60	1.37	1.49	1.50	1.33	1.29	1.50	1.42	1.48	1.50	<b>1.59</b>	1.68
4	1.59	1.45	1.50	1.63	1.35	1.50	1.50	1.32	1.29	1.50	1.38	1.48	1.50	1.61	1.64
5	1.60	1.47	1.52	1.51	1.43	1.51	1.40	1.32	1.34	1.30	1.36	1.47	1.47	1.64	1.75
Mean	1.60	1.47	1.49	1.57	1.39	1.46	1.48	1.35	1.32	1.44	1.38	1.47	1.50	1.63	1.66
Median	1.60	1.45	1.50	1.60	1.41	1.49	1.50	1.33	1.32	1.50	1.38	1.48	1.50	1.64	1.68
Std.Dev.	0.01	0.04	0.03	0.05	0.03	0.07	0.08	0.04	0.03	0.09	0.02	0.00	0.02	0.03	0.07
Rel.Std.Dev.	0.44%	3.01%	1.99%	3.41%	2.36%	4.77%	5.65%	3.12%	2.11%	6.21%	1.68%	0.24%	1.53%	1.54%	4.18%
PDM <sup>3</sup>	7.85%	-0.66%	0.70%	5.96%	-6.04%	-1.45%	-0.24%	-8.73%	-11.2%	-2.9%	-7.03%	-0.67%	1.38%	9.60%	12.0%

Table A15. Analytical results for fusion arsenic in OREAS 77a (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A BF*XRF	Lab B PF*OES	Lab C BF*OES	Lab D BF*OES	Lab E BF*XRF	Lab F BF*OES	Lab G BF*OES	Lab H BF*OES	Lab I -	Lab J -	Lab K BF*OES	Lab L PF*MS	Lab M BF*OES	Lab N BF*OES	Lab O BF*OES
1	180	200	200	300	170	23	150	NR	NR	NR	144	176	NR	144	151
2	190	200	200	200	170	20	150	NR	NR	NR	146	174	NR	148	134
3	190	200	200	300	170	61	130	NR	NR	NR	146	176	NR	140	156
4	180	200	100	300	170	93	130	NR	NR	NR	139	177	NR	140	142
5	185	200	100	300	170	94	120	NR	NR	NR	142	178	NR	144	156
Mean	185	200	160	<b>280</b>	170	<b>58</b>	136				143	176		143	148
Median	185	200	200	300	170	61	130				144	176		144	151
Std.Dev.	5	0	55	45	0	36	13				3	1		3	10
Rel.Std.Dev.	2.70%	0.00%	34.2%	16.0%	0.00%	62.0%	9.87%				2.07%	0.74%		2.34%	6.50%
PDM <sup>3</sup>	13.9%	23.2%	-1.47%	72.4%	4.69%	-64.1%	-16.3%				-11.7%	8.44%		-11.8%	-8.98%

Table A16. Analytical results for fusion chromium in OREAS 77a (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A BF*XRF	Lab B PF*OES	Lab C BF*OES	Lab D BF*OES	Lab E BF*XRF	Lab F BF*OES	Lab G BF*OES	Lab H BF*OES	Lab I BF*OES	Lab J -	Lab K BF*OES	Lab L PF*OES	Lab M BF*OES	Lab N BF*OES	Lab O BF*OES
1	840	842	900	900	905	732	880	800	860	NR	700	819	690	833	1800
2	850	<b>957</b>	900	900	922	814	910	800	830	NR	700	815	820	827	1600
3	860	867	800	800	905	780	890	800	840	NR	700	831	780	835	1500
4	860	847	900	800	891	753	850	800	850	NR	600	824	850	828	2000
5	855	882	900	800	951	732	930	800	840	NR	700	821	790	827	2500
Mean	853	879	880	840	915	762	892	800	844		<b>680</b>	822	786	830	<b>1880</b>
Median	855	867	900	800	905	753	890	800	840		700	821	790	828	1800
Std.Dev.	8	46	45	55	23	35	30	0	11		45	6	60	4	396
Rel.Std.Dev.	0.98%	5.28%	5.08%	6.52%	2.52%	4.60%	3.40%	0.00%	1.35%		6.58%	0.73%	7.67%	0.45%	21.1%
PDM <sup>3</sup>	1.51%	4.61%	4.73%	-0.03%	8.87%	-9.30%	6.15%	-4.79%	0.44%		-19.1%	-2.18%	-6.46%	-1.22%	124%

Table A17. Analytical results for fusion cobalt in OREAS 77a (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A BF*XRF	Lab B PF*OES	Lab C BF*OES	Lab D BF*OES	Lab E BF*XRF	Lab F BF*OES	Lab G BF*OES	Lab H BF*OES	Lab I -	Lab J -	Lab K BF*OES	Lab L -	Lab M BF*OES	Lab N BF*OES	Lab O BF*OES
1	1690	1704	1700	1800	1370	1337	1720	1800	NR	NR	1662	NR	1870	1827	1500
2	1690	1792	1730	1900	1370	<b>1101</b>	1640	1800	NR	NR	1692	NR	1850	1864	1600
3	1700	1735	<b>1500</b>	1800	1350	1591	1710	1900	NR	NR	1624	NR	1880	1824	1600
4	1710	1723	1720	1700	1350	1481	1660	1800	NR	NR	1556	NR	1860	1838	1600
5	1715	1755	1670	1600	1340	1452	1630	1800	NR	NR	1579	NR	1840	1852	1500
Mean	1701	1742	1664	1760	1356	1392	1672	1820			1623		1860	1841	1560
Median	1700	1735	1700	1800	1350	1452	1660	1800			1624		1860	1838	1600
Std.Dev.	11	34	94	114	13	186	41	45			56		16	17	55
Rel.Std.Dev.	0.67%	1.93%	5.68%	6.48%	0.99%	13.4%	2.44%	2.46%			3.47%		0.85%	0.92%	3.51%
PDM <sup>3</sup>	1.53%	3.96%	-0.68%	5.05%	-19.1%	-16.9%	-0.20%	8.63%			-3.15%		11.0%	9.89%	-6.89%

Table A18. Analytical results for fusion copper in OREAS 77a (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A BF*XRF	Lab B PF*OES	Lab C BF*OES	Lab D BF*OES	Lab E BF*XRF	Lab F BF*OES	Lab G BF*OES	Lab H BF*OES	Lab I -	Lab J -	Lab K BF*OES	Lab L -	Lab M BF*OES	Lab N BF*OES	Lab O -
1	4130	4236	4340	4600	4190	2102	4930	4500	NR	NR	4521	NR	2850	4346	NR
2	4190	4357	4390	4900	4260	1556	4500	4400	NR	NR	4650	NR	2690	4494	NR
3	4160	4258	4180	4800	4070	1831	4740	4400	NR	NR	4479	NR	2690	4553	NR
4	4170	4191	4330	4800	4030	2258	4710	4400	NR	NR	4261	NR	3130	4427	NR
5	4140	4290	4410	4500	4180	2689	4350	4400	NR	NR	4350	NR	2870	4470	NR
Mean	4158	4266	4330	4720	4146	<b>2087</b>	4646	4420			4452		<b>2846</b>	4458	
Median	4160	4258	4340	4800	4180	2102	4710	4400			4479		2850	4470	
Std.Dev.	24	62	90	164	94	430	225	45			151		180	77	
Rel.Std.Dev.	0.57%	1.46%	2.08%	3.48%	2.27%	20.6%	4.84%	1.01%			3.40%		6.33%	1.74%	
PDM <sup>3</sup>	-5.49%	-3.03%	-1.58%	7.28%	-5.76%	-52.6%	5.60%	0.46%			1.20%		-35.3%	1.33%	

Table A19. Analytical results for fusion iron in OREAS 77a (abbreviations as in Table A1; values in wt %).

Replicate No.	Lab A BF*XRF	Lab B BF*XRF	Lab C BF*OES	Lab D BF*OES	Lab E BF*XRF	Lab F BF*OES	Lab G BF*OES	Lab H BF*OES	Lab I BF*OES	Lab J BF*XRF	Lab K BF*OES	Lab L PF*OES	Lab M BF*OES	Lab N BF*OES	Lab O BF*OES
1	32.2	33.6	33.0	37.6	32.0	<b>34.7</b>	35.7	33.9	36.1	<b>32.8</b>	33.2	32.5	33.0	36.3	34.7
2	32.5	34.9	33.9	38.6	32.2	33.9	34.0	33.4	36.2	32.5	32.7	32.5	32.6	36.4	34.8
3	32.4	33.9	32.4	36.7	31.6	33.7	34.3	34.0	35.8	32.5	<b>34.8</b>	32.8	32.6	36.7	35.7
4	32.5	33.5	33.3	36.3	31.5	33.6	36.9	33.7	36.2	32.6	33.5	33.0	32.8	36.4	35.6
5	32.4	34.4	33.8	33.6	31.9	33.7	35.1	33.6	35.8	32.5	33.2	32.8	32.5	36.7	34.4
Mean	32.4	34.0	33.3	36.6	31.8	34.0	35.2	33.7	36.0	32.6	33.5	32.7	32.7	36.5	35.0
Median	32.4	33.9	33.3	36.7	31.9	33.7	35.1	33.7	36.1	32.5	33.2	32.8	32.6	36.4	34.8
Std.Dev.	0.1	0.6	0.6	1.9	0.3	0.4	1.2	0.2	0.2	0.1	0.8	0.2	0.2	0.2	0.6
Rel.Std.Dev.	0.38%	1.72%	1.84%	5.13%	0.90%	1.32%	3.30%	0.71%	0.57%	0.41%	2.35%	0.71%	0.61%	0.47%	1.65%
PDM <sup>3</sup>	-4.60%	0.25%	-2.01%	7.65%	-6.25%	-0.01%	3.65%	-0.71%	6.06%	-4.07%	-1.45%	-3.70%	-3.71%	7.42%	3.18%

Table A20. Analytical results for fusion magnesium oxide in OREAS 77a (abbreviations as in Table A1; values wt %).

Replicate No.	Lab A BF*XRF	Lab B PF*OES	Lab C BF*OES	Lab D BF*OES	Lab E BF*XRF	Lab F BF*OES	Lab G BF*OES	Lab H BF*OES	Lab I BF*OES	Lab J BF*XRF	Lab K BF*OES	Lab L PF*OES	Lab M BF*OES	Lab N BF*OES	Lab O BF*OES
1	7.33	7.25	7.03	7.85	7.10	6.88	7.77	7.04	7.09	7.40	7.29	7.29	7.38	7.34	8.23
2	7.38	7.73	7.12	8.13	7.18	7.51	7.46	7.04	7.11	7.40	<b>7.21</b>	7.26	7.27	7.42	8.31
3	7.37	7.43	<b>6.84</b>	7.93	6.97	7.37	7.26	7.08	7.06	7.50	<b>7.58</b>	7.31	7.32	7.37	8.49
4	7.37	7.40	7.13	7.98	6.90	7.19	7.35	<b>6.97</b>	6.98	7.60	7.31	7.30	7.38	7.46	8.57
5	<b>7.43</b>	7.53	7.08	<b>7.31</b>	7.12	7.05	7.44	7.05	7.03	7.40	7.28	7.22	7.15	7.39	8.20
Mean	7.38	7.46	7.04	<b>7.84</b>	7.05	7.20	7.46	7.04	7.05	7.46	7.33	7.28	7.30	7.40	<b>8.36</b>
Median	7.37	7.43	7.08	7.93	7.10	7.19	7.44	7.04	7.06	7.40	7.29	7.29	7.32	7.39	8.31
Std.Dev.	0.04	0.18	0.12	0.31	0.12	0.25	0.19	0.04	0.05	0.09	0.14	0.04	0.10	0.05	0.16
Rel.Std.Dev.	0.49%	2.38%	1.68%	4.00%	1.63%	3.47%	2.58%	0.57%	0.73%	1.20%	1.94%	0.51%	1.31%	0.62%	1.95%
PDM <sup>3</sup>	1.51%	2.73%	-3.11%	7.90%	-2.92%	-0.91%	2.61%	-3.17%	-2.92%	2.67%	0.93%	0.15%	0.47%	1.79%	15.1%

Table A21. Analytical results for fusion nickel in OREAS 77a (abbreviations as in Table A1; values in wt %).

Replicate No.	Lab A BF*XRF	Lab B PF*OES	Lab C BF*OES	Lab D BF*OES	Lab E BF*XRF	Lab F BF*OES	Lab G BF*OES	Lab H BF*OES	Lab I -	Lab J -	Lab K BF*OES	Lab L -	Lab M BF*OES	Lab N BF*OES	Lab O BF*OES
1	10.7	10.6	10.8	9.73	10.2	<b>11.3</b>	NR	11.4	NR	NR	10.3	NR	10.4	11.1	11.0
2	10.8	11.0	11.1	10.3	10.3	11.0	NR	11.2	NR	NR	10.2	NR	10.0	11.3	11.1
3	10.8	10.8	10.5	9.94	10.1	11.0	NR	11.5	NR	NR	<b>10.7</b>	NR	10.2	11.2	11.3
4	10.8	10.6	11.0	9.86	<b>9.99</b>	11.1	NR	11.3	NR	NR	10.4	NR	10.0	11.0	11.3
5	10.8	10.9	10.9	10.2	10.2	11.0	NR	11.2	NR	NR	10.3	NR	10.5	11.3	11.1
Mean	10.8	10.8	10.8	10.0	10.1	11.1		11.3			10.4		10.2	11.2	11.2
Median	10.8	10.8	10.9	9.9	10.2	11.0		11.3			10.3		10.2	11.2	11.1
Std.Dev.	0.0	0.2	0.2	0.2	0.1	0.1		0.1			0.2		0.2	0.1	0.1
Rel.Std.Dev.	0.42%	1.71%	1.97%	2.23%	1.10%	1.35%		1.15%			2.02%		2.26%	1.11%	1.20%
PDM <sup>3</sup>	0.60%	0.74%	1.16%	-6.63%	-5.30%	3.57%		5.74%			-3.02%		-4.56%	4.54%	4.24%

Table A22. Analytical results for silicon dioxide in OREAS 77a (abbreviations as in Table A1; values in wt %).

Replicate No.	Lab A BF*XRF	Lab B PF*OES	Lab C BF*OES	Lab D BF*OES	Lab E BF*XRF	Lab F BF*OES	Lab G BF*OES	Lab H BF*OES	Lab I BF*OES	Lab J BF*XRF	Lab K -	Lab L PF*OES	Lab M BF*OES	Lab N BF*OES	Lab O BF*OES
1	13.1	13.3	13.6	14.2	12.7	<b>12.0</b>	13.5	13.1	13.6	13.4	NR	13.3	13.5	<b>12.3</b>	13.7
2	13.1	14.1	13.8	15.0	12.8	13.0	11.9	13.1	13.8	13.4	NR	13.2	<b>14.1</b>	12.9	13.8
3	13.0	13.3	<b>13.3</b>	14.1	12.4	13.1	12.5	13.2	13.8	13.6	NR	13.3	13.4	12.8	14.1
4	13.1	13.5	13.7	14.7	12.4	13.3	12.6	13.1	13.8	13.5	NR	13.3	13.4	<b>12.7</b>	14.0
5	13.1	13.7	13.9	13.5	12.7	13.3	<b>11.5</b>	13.2	13.8	13.4	NR	13.2	<b>13.1</b>	12.8	13.6
Mean	13.1	13.6	13.6	14.3	12.6	12.9	12.4	13.2	13.8	13.5		13.3	13.5	12.7	13.8
Median	13.1	13.5	13.7	14.2	12.7	13.1	12.5	13.1	13.8	13.4		13.3	13.4	12.8	13.8
Std.Dev.	0.0	0.4	0.2	0.6	0.2	0.6	0.8	0.1	0.1	0.1		0.1	0.4	0.2	0.2
Rel.Std.Dev.	0.34%	2.64%	1.79%	4.10%	1.55%	4.41%	6.14%	0.52%	0.65%	0.66%		0.40%	2.65%	1.83%	1.50%
PDM <sup>3</sup>	-1.95%	1.67%	2.10%	7.05%	-5.70%	-3.01%	-7.05%	-1.43%	3.15%	0.90%		-0.60%	1.11%	-4.78%	3.75%

Table A23. Analytical results for fusion sulphur in OREAS 77a (abbreviations as in Table A1; values in wt %)..

Replicate No.	Lab A BF*XRF	Lab B PF*OES	Lab C BF*OES	Lab D BF*OES	Lab E BF*XRF	Lab F -	Lab G -	Lab H -	Lab I -	Lab J -	Lab K -	Lab L -	Lab M -	Lab N -	Lab O -
1	26.9	<b>24.2</b>	25.1	29.9	>6.0	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
2	27.2	26.7	25.4	30.8	>6.0	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	26.9	26.4	<b>24.4</b>	30.2	>6.0	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
4	27.0	25.8	25.4	30.5	>6.0	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
5	26.9	26.2	25.6	<b>28.2</b>	>6.0	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mean	27.0	25.9	25.2	<b>29.9</b>	>6.0										
Median	26.9	26.2	25.4	30.2	>6.0										
Std.Dev.	0.1	1.0	0.5	1.0	-										
Rel.Std.Dev.	0.48%	3.87%	1.87%	3.40%	-										
PDM <sup>3</sup>	2.94%	-1.37%	-3.93%	14.2%	-										

Table A24. Analytical results for sulphur by LECO in OREAS 77a (abbreviations as in Table A1; values in wt %).

Replicate No.	Lab A LECO	Lab B LECO	Lab C LECO	Lab D LECO	Lab E LECO	Lab F LECO	Lab G LECO	Lab H LECO	Lab I LECO	Lab J LECO	Lab K LECO	Lab L LECO	Lab M LECO	Lab N LECO	Lab O LECO
1	<b>26.0</b>	27.0	26.2	25.9	27.8	26.4	27.1	30.0	NR	20.9	27.0	<b>26.9</b>	27.9	25.4	26.8
2	26.7	26.9	25.8	26.2	28.0	26.6	26.4	30.0	NR	22.8	26.8	27.1	28.1	25.6	26.7
3	26.6	27.1	27.5	26.1	28.0	27.0	26.6	30.7	NR	22.6	27.2	27.3	28.6	25.6	26.7
4	<b>27.2</b>	26.7	26.7	25.8	27.7	26.1	26.8	30.0	NR	21.2	27.2	27.2	27.4	25.2	27.0
5	26.6	27.3	<b>24.6</b>	25.8	27.7	26.5	27.3	30.5	NR	21.8	26.8	<b>27.5</b>	29.0	25.3	26.9
Mean	26.6	27.0	26.2	26.0	27.8	26.5	26.8	<b>30.2</b>		<b>21.9</b>	27.0	27.2	<b>28.2</b>	<b>25.4</b>	26.8
Median	26.6	27.0	26.2	25.9	27.8	26.5	26.8	30.0		21.8	27.0	27.2	28.1	25.4	26.8
Std.Dev.	0.4	0.2	1.1	0.2	0.2	0.3	0.4	0.3		0.8	0.2	0.2	0.6	0.2	0.1
Rel.Std.Dev.	1.61%	0.83%	4.12%	0.70%	0.54%	1.23%	1.36%	1.11%		3.82%	0.67%	0.87%	2.18%	0.73%	0.49%
PDM <sup>3</sup>	-0.83%	0.63%	-2.50%	-3.25%	3.76%	-1.22%	0.03%	12.7%		-18.53%	0.61%	1.37%	5.02%	-5.23%	-0.04%