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OREAS
Certified Reference Materials

CERTIFICATE OF ANALYSIS FOR

TIN ORE

CERTIFIED REFERENCE MATERIAL

OREAS 140

Table 1. Certified Values, SD's, 95% Confidence and Tolerance Limits for OREAS 140

Constituent	Certified Value	SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Silver, Ag (ppm)	1.03	0.11	0.94	1.11	0.95	1.10
Arsenic, As (ppm)	149	6	144	154	144	154
Bismuth, Bi (ppm)	318	12	308	328	308	328
Copper, Cu (ppm)	1529	82	1463	1596	1500	1559
Indium, In (ppm)	10.7	1.8	9.2	12.2	10.2	11.2
Molybdenum, Mo (ppm)	1.68	0.23	1.51	1.84	1.62	1.73
Lead, Pb (ppm)	26.7	0.8	26.3	27.0	26.0	27.4
Zinc, Zn (ppm)	1706	123	1617	1795	1678	1734
Tin via fusion, Sn (ppm)	1755	122	1655	1855	1699	1811
Tin via PPP, Sn (ppm)	1777	42	1704	1849	1748	1806

Note - intervals may appear asymmetric due to rounding; “PPP” = pressed powder pellet with X-ray fluorescence.

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.

SOURCE MATERIAL

OREAS 140 is a low grade Sn oxide ore certified reference material (CRM) prepared by Ore Research & Exploration. The material was sourced from the Doradilla Project located in north central NSW. The project area consists of a large Sn laterite deposit underlain by Sn silicate skarn with potential for copper, nickel, indium and zinc mineralisation. The skarn horizon has a strike length of 16km with zones of oxide, supergene and primary Sn mineralization. Compositionally OREAS 140 is dominated by smectite clay with minor quartz, kaolin and goethite. Sn mineralization occurs as varlamoffite [$(Sn,Fe)(O,OH)_2$] with some relict cassiterite. OREAS 140 is one of three tin CRMs prepared from oxide material and characterised for Ag, As, Bi, Cu, In, Mo, Pb, Zn and Sn.

COMMINUTION AND HOMOGENISATION PROCEDURES

The material was prepared in the following manner:

a) drying at 105° C to constant mass;
b) crushing and screening;
c) multi-stage milling to 100% minus 35 microns;
d) final homogenisation;
e) packaging into 10g units sealed in laminated foil pouches.

ANALYSIS OF OREAS 140

Ten commercial laboratories participated in the analytical program to characterise Ag, As, Bi, Cu, In, Mo, Pb, Zn and Sn. 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 Tables A2 and A11 (Appendix). 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 analytical methods employed by each laboratory are explained, together with other abbreviations used, in Table A1 (Appendix).

Each participating laboratory received 5 samples of 50g each. Each set of subsamples submitted to each laboratory was taken at regular intervals during packaging of the standard in order to maximise their representation. Tin was characterised via fusion methods (sodium peroxide, lithium borate and iodide) with ICP-OES, ICP-MS or AAS finish and via pressed powder pellet with XRF. The other elements were characterised by 4-acid (including HF) digest with ICP-OES, ICP-MS or AAS finish.

Table 1 (above) presents the certified values together with their associated 1SD's, 95% confidence and tolerance limits. Indicative (uncertified) values are provided in Table 2 for the major and trace elements determined by borate fusion XRF (Al_2O_3 to Zn) and laser ablation with ICP-MS (Ag to Zr) and are the means of duplicate assays from Bureau Veritas, Perth. Table 3 provides performance gate intervals for the certified values based on their associated standard deviations. The summary statistics are also available in Excel format (**OREAS 140 DataPack.xlsx**).

Table 2. Indicative Values for OREAS 140.

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Laser Ablation ICP-MS								
Ag	ppm	*0.950*	Ho	ppm	*2.61*	Sn	ppm	*1605*
As	ppm	*151*	In	ppm	*8.68*	Sr	ppm	*221*
Ba	ppm	*416*	La	ppm	*98*	Ta	ppm	*1.52*
Be	ppm	*3.90*	Lu	ppm	*0.92*	Tb	ppm	*2.13*
Bi	ppm	*315*	Mn	wt.%	*0.086*	Te	ppm	*1.20*
Cd	ppm	*0.30*	Mo	ppm	*1.70*	Th	ppm	*19.3*
Ce	ppm	*118*	Nb	ppm	*16.2*	Ti	wt.%	*0.507*
Co	ppm	*19.0*	Nd	ppm	*84*	Tl	ppm	*0.40*
Cr	ppm	*85*	Ni	ppm	*51*	Tm	ppm	*1.07*
Cs	ppm	*4.54*	Pb	ppm	*24.5*	U	ppm	*4.71*
Cu	ppm	*1435*	Pr	ppm	*22.7*	V	ppm	*82*
Dy	ppm	*13.2*	Rb	ppm	*136*	W	ppm	*14.3*
Er	ppm	*7.35*	Re	ppm	*< 0.01*	Y	ppm	*81*
Eu	ppm	*3.58*	Sb	ppm	*28.5*	Yb	ppm	*6.67*
Ga	ppm	*20.2*	Sc	ppm	*14.8*	Zn	ppm	*1600*
Gd	ppm	*14.0*	Se	ppm	*< 5*	Zr	ppm	*285*
Hf	ppm	*9.05*	Sm	ppm	*16.5*			
Borate Fusion XRF								
Al_2O_3	wt.%	*16.22*	Fe_2O_3	wt.%	*11.08*	Pb	ppm	*30.0*
As	ppm	*160*	K_2O	wt.%	*2.51*	SiO_2	wt.%	*53.10*
Ba	ppm	*460*	MgO	wt.%	*1.14*	Sn	ppm	*1770*
CaO	wt.%	*7.88*	MnO	wt.%	*0.130*	SO_3	wt.%	*0.071*
Co	ppm	*30.0*	Na_2O	wt.%	*0.650*	TiO_2	wt.%	*0.882*
Cr	ppm	*100*	Ni	ppm	*60*	U	ppm	*12.5*
Cu	ppm	*1525*	P_2O_5	wt.%	*0.113*	Zn	ppm	*1675*
Thermogravimetry								
LOI^{1000}	wt.%	*5.30*						

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.

STATISTICAL EVALUATION OF OREAS 140

Certified Value and Confidence Intervals

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

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

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

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

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

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

where

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

The distribution of the values is assumed to be symmetrical about the mean in the calculation of the confidence interval.
The test for rejection of individual outliers from each laboratory data set was primarily based on *z* scores (rejected if $|z_i| > 2.5$) computed from the robust estimators of location and scale, *T* and *S*, respectively, according to the formulae:

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

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

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 lab data set outliers have been eliminated a non-iterative 3 standard deviation filter is applied, with those values lying outside this window also relegated to outlying status.

Individual outliers and, more rarely, laboratory means deemed to be outlying are shown left justified and in bold in the tabulated results (see Appendix) and have been omitted in the determination of certified values.

The magnitude of the confidence interval is inversely proportional to the number of participating laboratories and interlaboratory agreement. It is a measure of the reliability of the certified value, i.e. the narrower the confidence interval the greater the certainty in the certified value. A 95% confidence interval indicates a 95% probability that the interval includes the true value of the analyte under consideration.

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

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

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

where

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

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

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

p *is the number of participating laboratories*;

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

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

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

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, α *unknown*);

s_g'' *is the corrected grand standard deviation*.

The meaning of these tolerance limits may be illustrated for tin by fusion, where 99% of the time at least 95% of subsamples will have concentrations lying between 1699 and 1811 ppm. 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).

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 laboratory* i

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

Performance Gates

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

Two methods have been employed to calculate performance gates. The first method uses the same filtered data set used to determine the certified value, i.e. after removal of all individual, lab dataset (batch) and 3SD outliers. These outliers can only be removed after the absolute homogeneity of the CRM has been independently established, i.e. the outliers must be confidently deemed to be analytical rather than arising from inhomogeneity of the CRM. The standard deviation is then calculated for each analyte from the pooled individual analyses (excluding the INAA data for gold) 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 140.

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
Ag (ppm)	1.03	0.11	0.80	1.26	0.68	1.37	11.2%	22.3%	33.5%	0.98	1.08
As (ppm)	149	6	136	162	130	168	4.30%	8.61%	12.9%	141	156
Bi (ppm)	318	12	294	342	282	355	3.82%	7.65%	11.5%	302	334
Cu (ppm)	1529	82	1365	1693	1283	1776	5.37%	10.7%	16.1%	1453	1606
In (ppm)	10.7	1.8	7.1	14.3	5.3	16.1	16.7%	33.4%	50.1%	10.2	11.2
Mo (ppm)	1.68	0.23	1.22	2.13	0.99	2.36	13.6%	27.2%	40.8%	1.59	1.76
Pb (ppm)	26.7	0.8	25.0	28.4	24.1	29.2	3.18%	6.36%	9.54%	25.3	28.0
Zn (ppm)	1706	123	1459	1952	1336	2076	7.23%	14.5%	21.7%	1620	1791
Sn-fusion (ppm)	1755	122	1511	1999	1389	2121	6.96%	13.9%	20.9%	1667	1843
Sn-PP (ppm)	1777	42	1693	1861	1650	1903	2.37%	4.75%	7.12%	1688	1866

Note - intervals may appear asymmetric due to rounding; “PP” – pressed pellet X-ray fluorescence

PARTICIPATING LABORATORIES

Acme Analytical Laboratories Ltd, Vancouver, BC, Canada
Activation Laboratories, Ancaster, ONtario, Canada
ALS Chemex, Brisbane, QLD, Australia
ALS Chemex, Vancouver, BC, Canada

Genalysis Laboratory Services Pty Ltd, Perth, WA, Australia
Intertek Testing Services, Jakarta, Indonesia
OMAC Laboratories Ltd, Loughrea, County Galway, Ireland
SGS Lakefield Research Ltd, Lakefield, ON, Canada
SGS Australia, Perth, WA, Australia
Ultra Trace Pty Ltd, Perth, WA, Australia

PREPARER AND SUPPLIER OF THE REFERENCE MATERIAL

Certified reference material OREAS 140 is prepared, certified and supplied by:

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It is available in unit sizes of 10g (single-use laminated foil pouches).

INTENDED USE

OREAS 140 is a reference material intended for the following:

i) for the monitoring of laboratory performance in the analysis of Ag, As, Bi, Cu, In, Mo, Pb, Zn and Sn in geological samples;
ii) for the calibration of instruments used in the determination of the concentration of Ag, As, Bi, Cu, In, Mo, Pb, Zn and Sn;
iii) for the verification of analytical methods for Ag, As, Bi, Cu, In, Mo, Pb, Zn and Sn.

STABILITY AND STORAGE INSTRUCTIONS

OREAS 140 is a reference material made from tin oxide ore from the Doradilla Project. In its unopened state in the laminated foil pouches and under normal conditions of storage it has a shelf life beyond ten years.

INSTRUCTIONS FOR CORRECT USE

The certified values for OREAS 140 refer to the concentration level of Ag, As, Bi, Cu, In, Mo, Pb, Zn and Sn in its packaged state. The CRM should not be dried prior to weighing and analysis.

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 and non-certified (indicative) 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.

QMS ACCREDITED

ORE Pty Ltd is accredited to ISO 9001:2008 by Lloyd's Register Quality Assurance Ltd for its quality management system including development, manufacturing, certification and supply of CRMs.

CERTIFYING OFFICER

September, 2008

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

REFERENCES

ISO Guide 30 (1992), Terms and definitions used in connection with reference materials.

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

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

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

APPENDIX

Analytical Data for OREAS 140

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

Abbreviation	Explanation
Std.Dev.	one standard deviation
Rel.Std.Dev.	one relative standard deviation (%)
PDM[3]	percent deviation of lab mean from corrected mean of means
NR	not reported
4A	four acid digest (HF-HNO_3-$HClO_4$-HCl)
PF	sodium peroxide fusion
BF	lithium metaborate fusion
IF	iodide fusion
AAS	atomic absorption spectrometry
OES	inductively coupled plasma optical emission spectrometry
MS	inductively coupled plasma mass spectrometry
PPP	pressed powder pellet
XRF	x-ray fluorescence

Table A2. Results for Ag in OREAS 140 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A 4A*MS	Lab B 4A*MS	Lab C 4A*MS	Lab D 4A*MS	Lab E 4A*MS	Lab F 4A*MS	Lab G 4A*MS	Lab H 4A*MS	Lab I 4A*MS	Lab J 4A*OES
1	**1.07**	<0.5	0.80	1.00	0.90	**0.67**	1.02	1.10	1.16	1.10
2	1.00	<0.5	0.90	1.10	0.90	0.90	0.95	1.10	1.08	1.20
3	0.97	<0.5	0.90	1.10	1.00	0.94	1.04	1.10	1.12	1.30
4	0.99	<0.5	0.90	1.10	0.90	0.94	1.01	1.10	1.10	1.20
5	0.99	<0.5	1.00	1.20	0.80	0.93	0.99	1.10	1.17	1.20
Mean	1.00		0.90	1.10	0.90	0.88	1.00	1.10	1.12	1.20
Median	0.99		0.90	1.10	0.90	0.93	1.01	1.10	1.12	1.20
Std.Dev.	0.04		0.07	0.07	0.07	0.12	0.03	0.00	0.04	0.07
Rel.Std.Dev.	3.83%		7.86%	6.43%	7.86%	13.3%	3.41%	0.00%	3.36%	5.89%
PDM[3]	-2.22%		-12.3%	7.13%	-12.3%	-14.7%	-2.41%	7.13%	9.45%	16.9%

Table A3. Results for As in OREAS 140 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A 4A*MS	Lab B 4A*MS	Lab C 4A*MS	Lab D 4A*MS	Lab E 4A*MS	Lab F 4A*MS	Lab G 4A*MS	Lab H 4A*MS	Lab I 4A*MS	Lab J 4A*OES
1	141	174	137	156	143	**115**	181	150	150	152
2	153	178	142	155	147	159	175	150	145	151
3	146	185	142	156	145	157	179	140	147	152
4	**125**	171	139	156	147	157	176	140	149	148
5	164	174	**166**	156	146	153	173	140	146	149
Mean	146	**176**	145	156	146	148	**177**	144	147	150
Median	146	174	142	156	146	157	176	140	147	151
Std.Dev.	14	5	12	0	2	19	3	5	2	2
Rel.Std.Dev.	9.93%	3.07%	8.14%	0.29%	1.15%	12.7%	1.69%	3.80%	1.42%	1.21%
PDM[3]	-2.01%	18.6%	-2.42%	4.71%	-2.15%	-0.67%	18.6%	-3.22%	-0.91%	1.08%

Table A4. Results for Bi in OREAS 140 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A 4A*MS	Lab B 4A*MS	Lab C 4A*MS	Lab D 4A*MS	Lab E 4A*MS	Lab F 4A*MS	Lab G 4A*MS	Lab H 4A*MS	Lab I 4A*MS	Lab J 4A*OES
1	362	309	326	287	333	**228**	384	310	312	331
2	382	316	346	301	335	314	377	320	319	327
3	381	315	332	297	332	314	385	310	311	327
4	369	309	328	305	339	318	379	310	319	317
5	371	312	**382**	306	326	308	380	310	316	327
Mean	**373**	312	343	299	333	296	**381**	312	316	326
Median	371	312	332	301	333	314	380	310	316	327
Std.Dev.	8	3	23	8	5	38	3	4	4	5
Rel.Std.Dev.	2.27%	1.05%	6.72%	2.57%	1.38%	13.0%	0.89%	1.43%	1.23%	1.60%
PDM[3]	17.3%	-1.84%	7.81%	-5.93%	4.70%	-6.81%	19.8%	-1.90%	-0.80%	2.44%

Table A5. Results for Cu in OREAS 140 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A 4A*MS	Lab B 4A*MS	Lab C 4A*AAS	Lab D 4A*MS	Lab E 4A*MS	Lab F 4A*MS	Lab G 4A*MS	Lab H 4A*MS	Lab I 4A*MS	Lab J 4A*OES
1	1670	1470	**1350**	1260	1511	**1040**	**1720**	1600	1534	1500
2	1690	1490	1424	1230	1509	1440	1660	1600	1543	1490
3	1620	1530	1430	1250	**1551**	1440	1680	1600	1522	1470
4	1570	1480	1413	1250	1503	1450	1670	1600	1545	1430
5	1600	1510	**1592**	1250	1494	1420	1660	1600	1542	1450
Mean	1630	1496	1442	**1248**	1513	1358	1678	1600	1537	1468
Median	1620	1490	1424	1250	1509	1440	1670	1600	1542	1470
Std.Dev.	49	24	90	11	22	178	25	0	9	29
Rel.Std.Dev.	3.04%	1.61%	6.23%	0.88%	1.44%	13.1%	1.48%	0.00%	0.60%	1.95%
PDM[3]	6.59%	-2.17%	-5.71%	-18.4%	-1.03%	-11.2%	9.73%	4.63%	0.52%	-4.00%

Table A6. Results for In in OREAS 140 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A 4A*MS	Lab B 4A*MS	Lab C 4A*MS	Lab D 4A*MS	Lab E 4A*MS	Lab F 4A*MS	Lab G 4A*MS	Lab H 4A*MS	Lab I -	Lab J -
1	12.7	9.8	12.9	11.2	7.4	**7.4**	**12.0**	9.3	NR	NR
2	12.9	10.2	13.7	11.6	8.4	10.2	11.2	9.4	NR	NR
3	11.8	10.1	13.4	11.6	7.8	10.2	11.8	9.1	NR	NR
4	11.7	10.0	13.3	11.9	7.3	10.1	11.3	9.0	NR	NR
5	12.3	10.0	**15.3**	12.2	7.0	10.0	11.3	9.0	NR	NR
Mean	12.3	10.0	13.7	11.7	7.6	9.6	11.5	9.2		
Median	12.3	10.0	13.4	11.6	7.4	10.1	11.3	9.1		
Std.Dev.	0.5	0.2	0.9	0.4	0.5	1.2	0.4	0.2		
Rel.Std.Dev.	4.32%	1.50%	6.69%	3.20%	7.17%	12.8%	3.20%	1.98%		
PDM[3]	14.8%	-6.39%	28.4%	9.40%	-29.1%	-10.7%	7.62%	-14.4%		

Table A7. Results for Mo in OREAS 140 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A 4A*MS	Lab B 4A*MS	Lab C 4A*MS	Lab D 4A*MS	Lab E 4A*MS	Lab F 4A*MS	Lab G 4A*MS	Lab H 4A*MS	Lab I 4A*MS	Lab J 4A*OES
1	1.10	1.50	1.90	**2.70**	1.50	**1.61**	1.79	2.00	1.70	<1
2	1.30	1.50	1.60	2.10	1.60	1.72	1.73	1.80	**1.61**	<1
3	1.30	1.50	1.80	2.00	1.60	1.70	1.75	1.90	1.70	<1
4	1.10	1.50	1.60	2.00	1.60	1.69	1.69	1.90	1.71	<1
5	1.60	1.50	1.80	2.00	1.40	1.70	1.65	1.80	**1.77**	<1
Mean	1.28	1.50	1.74	2.16	1.54	1.68	1.72	1.88	1.70	
Median	1.30	1.50	1.80	2.00	1.60	1.70	1.73	1.90	1.70	
Std.Dev.	0.20	0.00	0.13	0.30	0.09	0.04	0.05	0.08	0.06	
Rel.Std.Dev.	16.0%	0.00%	7.71%	14.1%	5.81%	2.54%	3.14%	4.45%	3.48%	
PDM[3]	-23.7%	-10.6%	3.75%	28.8%	-8.17%	0.41%	2.68%	12.1%	1.29%	

Table A8. Results for Pb in OREAS 140 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A 4A*MS	Lab B 4A*MS	Lab C 4A*MS	Lab D 4A*MS	Lab E 4A*MS	Lab F 4A*MS	Lab G 4A*MS	Lab H 4A*MS	Lab I 4A*MS	Lab J 4A*OES
1	31.2	27.0	26.0	29.0	25.3	**19.5**	27.2	26.0	**31.6**	24.0
2	**34.1**	28.0	28.0	30.0	26.6	27.2	25.9	26.0	28.5	25.0
3	29.9	28.0	27.0	30.0	27.9	26.9	27.1	26.0	26.4	23.0
4	30.0	26.0	27.0	30.0	27.0	27.2	26.4	26.0	25.5	24.0
5	30.5	25.0	**31.0**	30.0	26.2	26.7	26.1	26.0	26.2	23.0
Mean	**31.1**	26.8	27.8	**29.8**	26.6	25.5	26.5	26.0	27.7	**23.8**
Median	30.5	27.0	27.0	30.0	26.6	26.9	26.4	26.0	26.4	24.0
Std.Dev.	1.7	1.3	1.9	0.4	1.0	3.4	0.6	0.0	2.5	0.8
Rel.Std.Dev.	5.56%	4.87%	6.92%	1.50%	3.62%	13.2%	2.21%	0.00%	8.99%	3.52%
PDM[3]	16.8%	0.54%	4.29%	11.8%	-0.21%	-4.34%	-0.44%	-2.46%	3.73%	-10.7%

Table A9. Results for Zn in OREAS 140 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A 4A*MS	Lab B 4A*MS	Lab C 4A*AAS	Lab D 4A*MS	Lab E 4A*MS	Lab F 4A*MS	Lab G 4A*MS	Lab H 4A*MS	Lab I 4A*MS	Lab J 4A*OES
1	1630	1720	**1462**	1580	1699	**1210**	1930	1900	1848	1750
2	1610	1750	1569	1530	**1733**	1680	1900	1800	1827	1740
3	1570	1720	1550	1540	1687	1680	1950	1800	1811	1720
4	1520	1670	1529	1540	1697	1690	1920	1800	1817	1710
5	1550	1720	**1733**	1570	1701	**1630**	1910	1800	1802	1690
Mean	1576	1716	1569	1552	1703	1578	1922	1820	1821	1722
Median	1570	1720	1550	1540	1699	1680	1920	1800	1817	1720
Std.Dev.	44	29	100	22	17	207	19	45	18	24
Rel.Std.Dev.	2.82%	1.68%	6.40%	1.40%	1.02%	13.1%	1.00%	2.46%	0.98%	1.39%
PDM[3]	-7.61%	0.60%	-8.04%	-9.01%	-0.14%	-7.49%	12.7%	6.70%	6.74%	0.95%

Table A10. Results for Sn via fusion in OREAS 140 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A PF*OES	Lab B PF*MS	Lab C PF*MS	Lab D -	Lab E PF*MS	Lab F PF*MS	Lab G BF*MS	Lab H PF*OES	Lab I IF*AA/ICP	Lab J -
1	1760	1740	1678	1700	1927	1800	**1780**	1600	2987	NR
2	1820	1800	1738	1800	1981	1830	1590	1500	2962	NR
3	1780	1790	1705	1800	2014	1790	1660	1500	2955	NR
4	1780	1720	1725	1700	2004	1820	1640	1700	2967	NR
5	1740	1790	1662	1800	2043	1770	1660	1700	**2882**	NR
Mean	1776	1768	1702	1760	1994	1802	1666	1600	**2950**	
Median	1780	1790	1705	1800	2004	1800	1660	1600	2962	
Std.Dev.	30	36	32	55	43	24	70	100	40	
Rel.Std.Dev.	1.67%	2.02%	1.86%	3.11%	2.18%	1.32%	4.19%	6.25%	1.36%	
PDM[3]	1.20%	0.75%	-3.04%	0.29%	13.6%	2.69%	-5.06%	-8.82%	68.1%	

Table A11. Results for Sn via PPP*XRF in OREAS 140 (abbreviations as in Table A1; values in ppm).

Replicate No.	Lab A PPP*XRF	Lab B -	Lab C PPP*XRF	Lab D PPP*XRF	Lab E -	Lab F PPP*XRF	Lab G PPP*XRF	Lab H -	Lab I -	Lab J PPP*XRF
1	1770	NR	1730	NR	NR	**2610**	1780	NR	NR	1840
2	1750	NR	1711	NR	NR	2090	1765	NR	NR	1830
3	1760	NR	1706	NR	NR	2050	1775	NR	NR	1850
4	1770	NR	1758	NR	NR	2020	1780	NR	NR	1840
5	1770	NR	1738	NR	NR	2030	1785	NR	NR	1830
Mean	1764		1729			**2160**	1777			1838
Median	1770		1730			2050	1780			1840
Std.Dev.	9		21			253	8			8
Rel.Std.Dev.	0.51%		1.22%			11.7%	0.43%			0.46%
PDM[3]	-0.73%		-2.72%			21.6%	0.01%			3.44%