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

HIGH SULPHIDATION EPITHERMAL Ag-Cu-Au ORE CERTIFIED REFERENCE MATERIAL

OREAS 605

Table 1. Certified Values, SD's, 95% Confidence and Tolerance Limits for OREAS 605.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Fire Assay						
Ag, Silver (ppm)	965	25.2	948	982	943	987
Au, Gold (ppm)	1.67	0.086	1.63	1.70	1.64*	1.69*
4-Acid Digestion						
Ag, Silver (ppm)	972	27.8	958	986	960	985
Al, Aluminium (wt.%)	5.43	0.149	5.35	5.51	5.33	5.53
As, Arsenic (ppm)	1602	101.8	1553	1651	1564	1640
Be, Beryllium (ppm)	0.67	0.08	0.64	0.71	0.65	0.70
Bi, Bismuth (ppm)	16.3	2.7	15.3	17.3	15.6	17.0
Ca, Calcium (wt.%)	0.276	0.009	0.272	0.281	0.267	0.286
Cd, Cadmium (ppm)	12.5	0.97	12.0	13.0	12.2	12.9
Ce, Cerium (ppm)	21.4	4.0	17.5	25.3	20.4	22.4
Co, Cobalt (ppm)	90	6.0	87	93	88	93
Cr, Chromium (ppm)	30.4	4.2	28.4	32.5	27.3	33.6
Cs, Cesium (ppm)	1.57	0.107	1.50	1.65	1.47	1.67
Cu, Copper (wt.%)	5.02	0.152	4.95	5.09	4.94	5.09
Dy, Dysprosium (ppm)	1.02	0.083	0.93	1.11	0.96	1.08
Er, Erbium (ppm)	0.39	0.037	0.35	0.43	0.35	0.43
Fe, Iron (wt.%)	3.76	0.260	3.64	3.88	3.67	3.85
Ga, Gallium (ppm)	30.3	2.29	29.1	31.6	29.4	31.2
Gd, Gadolinium (ppm)	1.60	0.094	1.50	1.70	1.50	1.70
Ge, Germanium (ppm)	< 5	IND	IND	IND	IND	IND
Hf, Hafnium (ppm)	2.58	0.174	2.47	2.70	2.45	2.71

*Gold Tolerance Limits for typical 30g fire assay charge weight determined from 20 x 1g NAA results and the Sampling Constant (Ingamells & Switzer, 1973).
Please note: intervals may appear asymmetric due to rounding.

Table 1 continued.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
4-Acid Digestion continued						
Ho, Holmium (ppm)	0.15	0.03	0.12	0.18	IND	IND
In, Indium (ppm)	3.78	0.346	3.52	4.04	3.65	3.92
K, Potassium (wt.%)	1.04	0.055	1.01	1.06	1.01	1.07
La, Lanthanum (ppm)	< 20	IND	IND	IND	IND	IND
Li, Lithium (ppm)	21.7	2.13	20.5	23.0	20.9	22.5
Lu, Lutetium (ppb)	54	5	49	60	IND	IND
Mg, Magnesium (ppm)	476	41.9	456	495	466	485
Mn, Manganese (ppm)	91	5.3	89	94	89	94
Mo, Molybdenum (ppm)	4.82	0.70	4.52	5.13	4.53	5.12
Na, Sodium (wt.%)	0.580	0.022	0.570	0.591	0.567	0.594
Nb, Niobium (ppm)	6.92	0.557	6.53	7.30	6.66	7.17
Nd, Neodymium (ppm)	10.7	1.7	8.8	12.5	10.1	11.2
Ni, Nickel (ppm)	1522	65.0	1491	1552	1489	1555
P, Phosphorus (ppm)	507	35.9	488	527	479	536
Pb, Lead (ppm)	1297	136	1235	1358	1250	1343
Pr, Praseodymium (ppm)	2.97	0.38	2.56	3.38	2.77	3.18
Rb, Rubidium (ppm)	29.2	3.3	26.8	31.6	28.4	30.0
S, Sulphur (wt.%)	8.34	0.571	8.05	8.62	8.15	8.52
Sb, Antimony (ppm)	294	15.8	286	302	283	305
Sc, Scandium (ppm)	5.03	0.66	4.70	5.36	4.79	5.27
Se, Selenium (ppm)	76	7.2	71	82	74	79
Sm, Samarium (ppm)	2.09	0.138	1.93	2.24	1.96	2.22
Sn, Tin (ppm)	2.73	0.29	2.49	2.97	2.52	2.94
Sr, Strontium (ppm)	373	73	338	409	356	390
Ta, Tantalum (ppm)	< 1	IND	IND	IND	IND	IND
Tb, Terbium (ppm)	0.20	0.02	0.18	0.23	0.19	0.22
Te, Tellurium (ppm)	31.8	4.8	27.2	36.4	30.1	33.5
Th, Thorium (ppm)	5.12	0.82	4.50	5.74	4.78	5.45
Ti, Titanium (wt.%)	0.177	0.012	0.170	0.183	0.171	0.182
Tl, Thallium (ppm)	15.0	1.22	14.2	15.7	14.6	15.4
U, Uranium (ppm)	2.79	0.167	2.69	2.90	2.68	2.91
V, Vanadium (ppm)	39.9	1.81	39.0	40.7	38.4	41.3
W, Tungsten (ppm)	27.0	3.2	24.8	29.2	26.0	27.9
Y, Yttrium (ppm)	4.26	0.320	4.07	4.46	4.13	4.40
Yb, Ytterbium (ppm)	0.37	0.05	0.32	0.43	0.32	0.43
Zn, Zinc (wt.%)	0.216	0.009	0.212	0.220	0.212	0.220
Zr, Zirconium (ppm)	84	6.0	81	87	82	86
Aqua Regia Digestion						
Ag, Silver (ppm)	984	29.2	967	1000	966	1002
Al, Aluminium (wt.%)	0.730	0.123	0.674	0.786	0.707	0.753
As, Arsenic (ppm)	1613	130.7	1552	1674	1583	1644

Please note: intervals may appear asymmetric due to rounding.

Table 1 continued.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Aqua Regia Digestion continued						
Au, Gold (ppm)	1.66	0.081	1.61	1.70	1.63†	1.68†
B, Boron (ppm)	< 10	IND	IND	IND	IND	IND
Be, Beryllium (ppm)	0.16	0.03	0.13	0.18	IND	IND
Bi, Bismuth (ppm)	16.7	3.0	15.4	17.9	15.8	17.5
Ca, Calcium (wt.%)	0.182	0.013	0.177	0.188	0.174	0.190
Cd, Cadmium (ppm)	12.9	1.5	12.2	13.6	12.5	13.3
Co, Cobalt (ppm)	93	6.9	90	96	91	95
Cr, Chromium (ppm)	27.5	3.1	26.2	28.8	25.8	29.2
Cs, Cesium (ppm)	0.48	0.07	0.42	0.54	0.45	0.51
Cu, Copper (wt.%)	4.98	0.157	4.90	5.06	4.92	5.04
Dy, Dysprosium (ppm)	0.52	0.051	0.46	0.58	0.49	0.55
Er, Erbium (ppm)	0.15	0.03	0.11	0.19	IND	IND
Eu, Europium (ppm)	0.21	0.04	0.16	0.26	0.19	0.24
Fe, Iron (wt.%)	3.75	0.181	3.67	3.83	3.67	3.83
Ga, Gallium (ppm)	6.66	0.86	6.07	7.26	6.31	7.01
Gd, Gadolinium (ppm)	0.87	0.17	0.69	1.06	0.83	0.92
Hf, Hafnium (ppm)	0.55	0.11	0.45	0.64	0.52	0.57
Hg, Mercury (ppm)	< 4	IND	IND	IND	IND	IND
Ho, Holmium (ppb)	73	12	62	84	IND	IND
In, Indium (ppm)	3.75	0.51	3.35	4.15	3.59	3.90
K, Potassium (wt.%)	0.134	0.024	0.123	0.145	0.118	0.150
La, Lanthanum (ppm)	3.95	0.86	3.29	4.62	3.72	4.19
Li, Lithium (ppm)	5.17	0.99	4.59	5.75	4.98	5.36
Lu, Lutetium (ppb)	11	1	10	13	IND	IND
Mg, Magnesium (ppm)	289	52	268	310	IND	IND
Mn, Manganese (ppm)	86	4.8	83	88	83	88
Mo, Molybdenum (ppm)	4.75	0.424	4.57	4.93	4.37	5.13
Na, Sodium (ppm)	328	60	298	358	IND	IND
Nb, Niobium (ppm)	0.45	0.06	0.39	0.51	0.40	0.50
Nd, Neodymium (ppm)	6.10	1.15	4.82	7.38	5.83	6.37
Ni, Nickel (ppm)	1538	63.5	1509	1568	1504	1572
P, Phosphorus (ppm)	116	24	105	126	108	123
Pb, Lead (ppm)	856	40.3	837	874	836	876
Pr, Praseodymium (ppm)	1.74	0.24	1.42	2.06	1.62	1.86
Rb, Rubidium (ppm)	5.75	0.96	5.00	6.49	5.41	6.09
S, Sulphur (wt.%)	7.86	0.491	7.57	8.15	7.68	8.04
Sb, Antimony (ppm)	228	46	206	250	223	233
Sc, Scandium (ppm)	1.05	0.12	0.99	1.11	1.00	1.09
Se, Selenium (ppm)	75	11	68	82	72	78
Sm, Samarium (ppm)	1.16	0.20	0.95	1.37	1.10	1.22
Sn, Tin (ppm)	1.92	0.22	1.73	2.11	1.82	2.01

†Gold Tolerance Limits for typical 25g aqua regia sample weight determined as above.
Please note: intervals may appear asymmetric due to rounding.

Table 1 continued.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Aqua Regia Digestion continued						
Sr, Strontium (ppm)	28.1	5.5	25.2	30.9	26.7	29.5
Tb, Terbium (ppm)	0.11	0.02	0.09	0.13	0.10	0.12
Te, Tellurium (ppm)	33.1	2.60	30.7	35.4	31.8	34.4
Th, Thorium (ppm)	< 3	IND	IND	IND	IND	IND
Ti, Titanium (ppm)	100	12	93	107	IND	IND
Tl, Thallium (ppm)	15.3	1.6	14.3	16.2	14.7	15.8
U, Uranium (ppm)	0.95	0.13	0.85	1.05	0.89	1.01
V, Vanadium (ppm)	8.33	1.08	7.80	8.86	7.69	8.97
W, Tungsten (ppm)	5.90	1.16	4.94	6.85	5.61	6.18
Y, Yttrium (ppm)	1.91	0.34	1.67	2.15	1.82	2.00
Yb, Ytterbium (ppm)	0.099	0.017	0.077	0.121	IND	IND
Zn, Zinc (wt.%)	0.217	0.010	0.212	0.221	0.211	0.222
Zr, Zirconium (ppm)	19.0	2.7	17.3	20.6	18.5	19.5
Infrared Combustion						
S, Sulphur (wt.%)	8.79	0.330	8.60	8.99	8.68	8.91

Please note: intervals may appear asymmetric due to rounding.

Table 2. Indicative Values for OREAS 605.

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Pb Fire Assay								
Pd	ppm	*13.4*	Pt	ppm	*2.21*			
Borate Fusion XRF								
Al_2O_3	wt.%	*10.80*	Fe_2O_3	wt.%	*5.54*	Pb	ppm	*1430*
As	ppm	*1620*	K_2O	wt.%	*1.31*	SiO_2	wt.%	*59.57*
Ba	ppm	*13700*	MgO	wt.%	*0.100*	Sn	ppm	*12.5*
CaO	wt.%	*0.400*	MnO	wt.%	*0.020*	SO_3	wt.%	*21.00*
Co	ppm	*110*	Na_2O	wt.%	*0.810*	TiO_2	wt.%	*0.303*
Cr	ppm	*30.0*	Ni	ppm	*1515*	U	ppm	*20.0*
Cu	ppm	*50850*	P_2O_5	wt.%	*0.128*	Zn	ppm	*2080*
Thermogravimetry								
LOI^{1000}	wt.%	*11.82*						
Laser Ablation ICP-MS								
Ag	ppm	*989*	Ho	ppm	*0.20*	Sn	ppm	*3.10*
As	ppm	*1615*	In	ppm	*3.75*	Sr	ppm	*548*
Ba	ppm	*13150*	La	ppm	*19.4*	Ta	ppm	*0.61*
Be	ppm	*0.90*	Lu	ppm	*0.050*	Tb	ppm	*0.19*
Bi	ppm	*16.6*	Mn	wt.%	*0.009*	Te	ppm	*36.7*
Cd	ppm	*13.9*	Mo	ppm	*4.90*	Th	ppm	*6.78*
Ce	ppm	*31.4*	Nb	ppm	*7.22*	Ti	wt.%	*0.182*
Co	ppm	*94*	Nd	ppm	*12.1*	Tl	ppm	*16.0*
Cr	ppm	*35.0*	Ni	ppm	*1415*	Tm	ppm	*0.040*
Cs	ppm	*1.61*	Pb	ppm	*1390*	U	ppm	*2.69*
Cu	ppm	*47800*	Pr	ppm	*3.70*	V	ppm	*39.4*
Dy	ppm	*1.11*	Rb	ppm	*31.6*	W	ppm	*25.8*

Table 2 continued.

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Laser Ablation ICP-MS continued								
Er	ppm	*0.44*	Re	ppm	*0.013*	Y	ppm	*4.99*
Eu	ppm	*0.38*	Sb	ppm	*272*	Yb	ppm	*0.42*
Ga	ppm	*31.8*	Sc	ppm	*4.50*	Zn	ppm	*2130*
Gd	ppm	*1.70*	Se	ppm	*< 5*	Zr	ppm	*120*
Hf	ppm	*3.40*	Sm	ppm	*1.94*			
4-Acid Digestion								
B	ppm	*< 20*	Eu	ppm	*0.43*	Re	ppb	*2*
Ba	ppm	*5557*	Hg	ppm	*< 1*	Tm	ppm	*0.052*
Aqua Regia Digestion								
Ba	ppm	*25.3*	Pd	ppm	*11.8*	Ru	ppb	*< 2*
Ce	ppm	*12.3*	Pt	ppm	*2.22*	Ta	ppm	*< 0.01*
Ge	ppm	*0.41*	Re	ppb	*1*	Tm	ppm	*0.018*
Infrared Combustion								
C	wt.%	*0.043*						

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.

SOURCE MATERIALS

OREAS 605 was prepared from gold-silver-copper bearing ore from Evolution Mining's Mount Carlton Operation in Queensland, Australia and blended with argillic rhyodacite waste rock to achieve the desired grades. The mineralisation assemblage consists of pyrite, enargite/tennantite, tetrahedrite, digenite, covellite, sphalerite, galena, alunite, dickite, kaolinite and vuggy silica, hosted in advanced argillic altered rhyodacite containing sulphur-salts. OREAS 605 is one of a suite of six CRMs ranging in grades from 24ppm Ag, 0.2 ppm Au and 0.05% Cu to 980ppm Ag, 1.7ppm Au and 5.0% Cu.

COMMINUTION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 605 was prepared in the following manner:

- drying to constant mass at 105°C;
- crushing and milling of the barren material to 95% minus 75 microns;
- crushing and milling of the ore material to 100% minus 30 microns;
- blending in appropriate proportions to achieve the desired grades;
- packaging in 60g and 10g units sealed under nitrogen in laminated foil pouches.

ANALYTICAL PROGRAM

Twenty eight commercial analytical laboratories participated in the program to certify the 116 elements reported in Table 1. The following methods were employed:

- Silver via 30-40g fire assay with gravimetric (12 labs) or ICP-OES (1 lab) finish;
- Gold via 20-40g* fire assay with AAS (20 labs), ICP-OES (4 labs) or gravimetric (3 labs) finish;
- Instrumental neutron activation analysis for Au on 1g subsamples to confirm homogeneity (1 laboratory);
- Gold via 15-40g* aqua regia digestion with ICP-MS (7 labs) or AAS (5 labs) finish;
- 4-Acid digestion for full elemental suite ICP-OES and ICP-MS (up to 21 laboratories depending on the element).
- Aqua regia digestion (see note below) for full elemental suite ICP-OES and ICP-MS (up to 22 laboratories depending on the element).
- Sulphur via Infrared Combustion Analysis (16 labs).

*The certified values (and 95% Confidence Interval and SD) for Au are also applicable to 50g charge weights.

It is important to note that in the analytical industry there is no standardisation of the aqua regia digestion process. Aqua regia is a partial empirical digest and differences in recoveries for various analytes are commonplace. These are caused by variations in the digest conditions which can include the ratio of nitric to hydrochloric acids, acid strength, temperatures, leach times and secondary digestions. Recoveries for sulphide-hosted base metal sulphides approach total values, however, other analytes, in particular the lithophile elements, show greater sensitivity to method parameters. This can result in lack of consensus in an inter-laboratory certification program for these elements. The approach applied here is to report certified values in those instances where reasonable agreement exists amongst a majority of participating laboratories. The results of specific laboratories may differ significantly from the certified values, but will, nonetheless, be valid and reproducible in the context of the specifics of the aqua regia method in use. Users of this reference material should, therefore, be mindful of this limitation when applying the certified values in a quality control program.

For the round robin program twenty 1kg test units were taken at predetermined intervals during the bagging stage, immediately following final blending, and are considered representative of the entire batch. The six samples received by each laboratory were obtained by taking two 110g scoop splits from each of three separate 1kg test units. This format enabled nested ANOVA treatment of the results to evaluate homogeneity, i.e. to ascertain whether between-unit variance is greater than within-unit variance. Table 1 presents the certified values together with their associated 1SD's, 95% confidence and tolerance limits and Table 2 shows 90 indicative values for major and trace element composition. Gold homogeneity has been evaluated and confirmed by instrumental neutron activation analysis (INAA) on twenty ~1g sample portions (see Table 3 below) and by a nested ANOVA program for both fire assay and aqua regia digestion (see '**nested ANOVA**' section). Table 4 provides performance gate intervals for the certified values based on their pooled 1SD's. Tabulated results of all elements (including Au INAA analyses) together with uncorrected means, medians, standard deviations, relative standard deviations and percent deviation of lab means from the corrected mean of means (PDM[3]) are presented in the detailed certification data for this CRM (**OREAS 605 DataPack.xlsx**).

Table 3. Neutron Activation Analysis of Au (ppm) on 20 x 1g subsamples.

Replicate No	NAA 1g
1	1.67
2	1.68
3	1.68
4	1.69
5	1.68
6	1.66
7	1.60
8	1.59
9	1.66
10	1.61
11	1.64
12	1.64
13	1.58
14	1.56
15	1.62
16	1.66
17	1.66
18	1.68
19	1.63
20	1.67
Mean	1.64
Median	1.66
Std Dev.	0.038
Rel.Std.Dev.	2.32%
PDM[3]	-1.44%

STATISTICAL ANALYSIS

Certified Values, Confidence Limits, Standard Deviations and Tolerance Limits (Table 1) have been determined for each analyte following removal of individual, laboratory dataset (batch) and 3SD outliers (single iteration). For individual outliers within a laboratory batch the z-score test is used in combination with a second method that determines the per cent deviation of the individual value from the batch median. Outliers in general are selected on the basis of z-scores > 2.5 and with per cent deviations (i) > 3 and (ii) more than three times the average absolute per cent deviation for the batch. In certain instances statistician's prerogative has been employed in discriminating outliers. Each laboratory data set mean is tested for outlying status based on z-score discrimination and rejected if > 2.5. After individual and laboratory data set (batch) 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.

Certified Values are the means of accepted laboratory means after outlier filtering. The INAA data (see Table 3) is omitted from determination of the certified value for Au and is used solely for the calculation of Tolerance Limits and homogeneity evaluation of OREAS 605.

95% Confidence Limits are inversely proportional to the number of participating laboratories and inter-laboratory agreement. It is a measure of the reliability of the certified value. A 95% confidence interval indicates a 95% probability that the true value of the analyte under consideration lies between the upper and lower limits. *95% Confidence Limits should not be used as control limits for laboratory performance.*

Indicative (uncertified) values (Table 2) are provided 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. 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.

Standard Deviation values (1SDs) are reported in Table 1 and 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. The SD values include all sources of measurement uncertainty: between-lab variance, within-run variance (precision errors) and CRM variability. For an effective CRM the contribution of the latter should be negligible in comparison to measurement errors. OREAS reference materials have a level of homogeneity such that the observed variance from repeated analysis has its origin almost exclusively in the analytical process rather than the reference material itself.

The SD for each analyte's certified value is calculated from the same filtered data set used to determine the certified value, i.e. after removal of any individual, lab dataset (batch) and 3SD outliers (single iteration). These outliers can only be removed after the absolute homogeneity of the CRM has been independently established, i.e. the outliers must be confidently deemed to be analytical rather than arising from inhomogeneity of the CRM. **The standard deviation is then calculated for each analyte from the pooled accepted analyses generated from the certification program.**

In the application of SD's in monitoring performance it is important to note that not all laboratories function at the same level of proficiency and that different methods in use at a particular laboratory have differing levels of precision. Each laboratory has its own inherent SD (for a specific concentration level and analyte-method pair) based on the analytical process and this SD is not directly related to the round robin program.

The majority of data generated in the round robin program was produced by a selection of world class laboratories. The SD's thus generated are more constrained than those that would be produced across a randomly selected group of laboratories. To produce more generally achievable SD's the 'pooled' SD's provided in this report include inter-lab bias. This 'one size fits all' approach may require revision at the discretion of the QC manager concerned following careful scrutiny of QC control charts.

Table 4 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 per cent 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 605.

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
Fire Assay											
Ag, ppm	965	25	915	1015	889	1041	2.61%	5.22%	7.84%	917	1013
Au, ppm	1.67	0.086	1.49	1.84	1.41	1.93	5.18%	10.36%	15.54%	1.58	1.75
4-Acid Digestion											
Ag, ppm	972	28	917	1028	889	1055	2.86%	5.72%	8.57%	923	1021
Al, wt.%	5.43	0.149	5.13	5.73	4.98	5.87	2.74%	5.49%	8.23%	5.16	5.70
As, ppm	1602	102	1398	1806	1297	1908	6.35%	12.71%	19.06%	1522	1682
Be, ppm	0.67	0.08	0.52	0.82	0.45	0.90	11.13%	22.27%	33.40%	0.64	0.71
Bi, ppm	16.3	2.7	10.9	21.7	8.2	24.4	16.60%	33.20%	49.79%	15.5	17.1
Ca, wt.%	0.276	0.009	0.258	0.295	0.249	0.304	3.36%	6.73%	10.09%	0.263	0.290
Cd, ppm	12.5	0.97	10.6	14.5	9.6	15.4	7.75%	15.50%	23.25%	11.9	13.1
Ce, ppm	21.4	4.0	13.4	29.4	9.3	33.4	18.78%	37.55%	56.33%	20.3	22.5
Co, ppm	90	6.0	78	102	72	108	6.62%	13.23%	19.85%	86	95
Cr, ppm	30.4	4.2	22.1	38.8	18.0	42.9	13.65%	27.29%	40.94%	28.9	32.0
Cs, ppm	1.57	0.107	1.36	1.79	1.25	1.90	6.81%	13.62%	20.43%	1.49	1.65
Cu, wt.%	5.02	0.152	4.71	5.32	4.56	5.47	3.03%	6.05%	9.08%	4.77	5.27
Dy, ppm	1.02	0.083	0.86	1.19	0.77	1.27	8.12%	16.24%	24.36%	0.97	1.07
Er, ppm	0.39	0.037	0.32	0.46	0.28	0.50	9.37%	18.75%	28.12%	0.37	0.41
Fe, wt.%	3.76	0.260	3.24	4.28	2.98	4.54	6.93%	13.86%	20.79%	3.57	3.95
Ga, ppm	30.3	2.29	25.7	34.9	23.4	37.2	7.56%	15.12%	22.68%	28.8	31.8
Gd, ppm	1.60	0.094	1.41	1.79	1.32	1.88	5.87%	11.75%	17.62%	1.52	1.68
Ge, ppm	< 5	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Hf, ppm	2.58	0.174	2.23	2.93	2.06	3.10	6.73%	13.46%	20.18%	2.45	2.71
Ho, ppm	0.15	0.03	0.10	0.20	0.07	0.23	17.44%	34.89%	52.33%	0.14	0.16
In, ppm	3.78	0.346	3.09	4.48	2.75	4.82	9.14%	18.28%	27.43%	3.60	3.97
K, wt.%	1.04	0.055	0.93	1.15	0.87	1.20	5.29%	10.57%	15.86%	0.99	1.09
La, ppm	< 20	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Li, ppm	21.7	2.13	17.5	26.0	15.3	28.1	9.81%	19.61%	29.42%	20.7	22.8
Lu, ppb	54	5	45	64	40	69	8.83%	17.66%	26.50%	52	57
Mg, ppm	476	42	392	559	350	601	8.82%	17.64%	26.45%	452	499

Note: intervals may appear asymmetric due to rounding.

Table 3 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
4-Acid Digestion continued											
Mn, ppm	91	5.3	81	102	75	107	5.83%	11.66%	17.49%	87	96
Mo, ppm	4.82	0.70	3.43	6.21	2.74	6.91	14.42%	28.85%	43.27%	4.58	5.06
Na, wt.%	0.580	0.022	0.536	0.625	0.514	0.647	3.82%	7.64%	11.46%	0.551	0.609
Nb, ppm	6.92	0.557	5.80	8.03	5.24	8.59	8.05%	16.11%	24.16%	6.57	7.26
Nd, ppm	10.7	1.7	7.3	14.0	5.7	15.6	15.56%	31.12%	46.69%	10.1	11.2
Ni, ppm	1522	65	1392	1652	1327	1717	4.27%	8.54%	12.81%	1446	1598
P, ppm	507	36	436	579	400	615	7.08%	14.16%	21.23%	482	533
Pb, ppm	1297	136	1024	1569	888	1705	10.50%	21.00%	31.50%	1232	1361
Pr, ppm	2.97	0.38	2.22	3.73	1.84	4.10	12.68%	25.37%	38.05%	2.82	3.12
Rb, ppm	29.2	3.3	22.6	35.9	19.2	39.2	11.42%	22.85%	34.27%	27.8	30.7
S, wt.%	8.34	0.571	7.19	9.48	6.62	10.05	6.85%	13.69%	20.54%	7.92	8.75
Sb, ppm	294	16	262	325	246	341	5.37%	10.74%	16.12%	279	309
Sc, ppm	5.03	0.66	3.71	6.36	3.04	7.02	13.17%	26.34%	39.51%	4.78	5.28
Se, ppm	76	7.2	62	91	55	98	9.44%	18.89%	28.33%	73	80
Sm, ppm	2.09	0.138	1.81	2.36	1.67	2.50	6.62%	13.25%	19.87%	1.98	2.19
Sn, ppm	2.73	0.29	2.15	3.30	1.87	3.59	10.50%	21.00%	31.51%	2.59	2.86
Sr, ppm	373	73	227	520	153	593	19.65%	39.30%	58.94%	355	392
Ta, ppm	< 1	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Tb, ppm	0.20	0.02	0.16	0.25	0.13	0.27	11.74%	23.48%	35.22%	0.19	0.21
Te, ppm	31.8	4.8	22.2	41.4	17.3	46.3	15.15%	30.30%	45.46%	30.2	33.4
Th, ppm	5.12	0.82	3.48	6.75	2.67	7.56	15.94%	31.89%	47.83%	4.86	5.37
Ti, wt.%	0.177	0.012	0.152	0.201	0.140	0.214	6.94%	13.89%	20.83%	0.168	0.186
Tl, ppm	15.0	1.22	12.5	17.4	11.3	18.6	8.18%	16.36%	24.54%	14.2	15.7
U, ppm	2.79	0.167	2.46	3.13	2.30	3.29	5.96%	11.91%	17.87%	2.66	2.93
V, ppm	39.9	1.81	36.3	43.5	34.5	45.3	4.53%	9.07%	13.60%	37.9	41.9
W, ppm	27.0	3.2	20.5	33.5	17.2	36.7	12.02%	24.04%	36.06%	25.6	28.3
Y, ppm	4.26	0.320	3.62	4.90	3.30	5.22	7.50%	15.01%	22.51%	4.05	4.48
Yb, ppm	0.37	0.05	0.27	0.48	0.21	0.54	14.44%	28.88%	43.32%	0.36	0.39
Zn, wt.%	0.216	0.009	0.198	0.234	0.189	0.243	4.17%	8.34%	12.51%	0.205	0.227
Zr, ppm	84	6.0	72	96	66	102	7.18%	14.35%	21.53%	80	88
Aqua Regia Digestion											
Ag, ppm	984	29	925	1042	896	1071	2.97%	5.94%	8.91%	934	1033

Note: intervals may appear asymmetric due to rounding.

Table 3 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
Aqua Regia Digestion continued											
Al, wt.%	0.730	0.123	0.485	0.975	0.362	1.098	16.80%	33.60%	50.40%	0.694	0.767
As, ppm	1613	131	1352	1875	1221	2005	8.10%	16.21%	24.31%	1533	1694
Au, ppm	1.66	0.081	1.49	1.82	1.41	1.90	4.89%	9.79%	14.68%	1.57	1.74
B, ppm	< 10	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Be, ppm	0.16	0.03	0.09	0.22	0.06	0.25	19.92%	39.84%	59.76%	0.15	0.17
Bi, ppm	16.7	3.0	10.6	22.7	7.5	25.8	18.27%	36.54%	54.82%	15.8	17.5
Ca, wt.%	0.182	0.013	0.157	0.208	0.145	0.220	6.92%	13.83%	20.75%	0.173	0.192
Cd, ppm	12.9	1.5	9.9	15.8	8.5	17.3	11.42%	22.83%	34.25%	12.2	13.5
Co, ppm	93	6.9	79	107	72	114	7.42%	14.85%	22.27%	88	98
Cr, ppm	27.5	3.1	21.3	33.7	18.2	36.8	11.27%	22.55%	33.82%	26.1	28.9
Cs, ppm	0.48	0.07	0.34	0.62	0.26	0.69	15.01%	30.01%	45.02%	0.45	0.50
Cu, wt.%	4.98	0.157	4.67	5.29	4.51	5.45	3.15%	6.30%	9.45%	4.73	5.23
Dy, ppm	0.52	0.051	0.42	0.62	0.37	0.67	9.87%	19.74%	29.61%	0.49	0.55
Er, ppm	0.15	0.03	0.09	0.21	0.06	0.24	19.45%	38.90%	58.35%	0.14	0.16
Eu, ppm	0.21	0.04	0.13	0.29	0.09	0.33	18.38%	36.75%	55.13%	0.20	0.22
Fe, wt.%	3.75	0.181	3.39	4.11	3.21	4.29	4.83%	9.66%	14.50%	3.56	3.94
Ga, ppm	6.66	0.86	4.95	8.38	4.09	9.23	12.87%	25.74%	38.60%	6.33	7.00
Gd, ppm	0.87	0.17	0.54	1.21	0.37	1.38	19.40%	38.80%	58.19%	0.83	0.92
Hf, ppm	0.55	0.11	0.33	0.77	0.21	0.88	20.31%	40.63%	60.94%	0.52	0.58
Hg, ppm	< 4	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Ho, ppb	73	12	49	97	37	109	16.43%	32.87%	49.30%	69	76
In, ppm	3.75	0.51	2.72	4.78	2.20	5.29	13.73%	27.46%	41.19%	3.56	3.93
K, wt.%	0.134	0.024	0.086	0.181	0.062	0.205	17.82%	35.65%	53.47%	0.127	0.140
La, ppm	3.95	0.86	2.24	5.67	1.38	6.53	21.68%	43.35%	65.03%	3.76	4.15
Li, ppm	5.17	0.99	3.19	7.15	2.20	8.14	19.14%	38.28%	57.42%	4.91	5.43
Lu, ppb	11	1	8	14	7	16	13.15%	26.30%	39.45%	11	12
Mg, ppm	289	52	185	394	132	446	18.08%	36.16%	54.24%	275	304
Mn, ppm	86	4.8	76	95	71	100	5.65%	11.30%	16.95%	81	90
Mo, ppm	4.75	0.424	3.90	5.60	3.48	6.02	8.93%	17.87%	26.80%	4.51	4.99
Na, ppm	328	60	209	448	149	507	18.18%	36.37%	54.55%	312	345
Nb, ppm	0.45	0.06	0.34	0.56	0.28	0.62	12.49%	24.97%	37.46%	0.43	0.47
Nd, ppm	6.10	1.15	3.80	8.40	2.65	9.55	18.83%	37.67%	56.50%	5.80	6.41

Note: intervals may appear asymmetric due to rounding.

Table 3 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
Aqua Regia Digestion continued											
Ni, ppm	1538	64	1411	1665	1348	1729	4.13%	8.26%	12.38%	1461	1615
P, ppm	116	24	68	163	44	187	20.57%	41.14%	61.71%	110	121
Pb, ppm	856	40	775	937	735	977	4.71%	9.42%	14.13%	813	899
Pr, ppm	1.74	0.24	1.25	2.22	1.01	2.46	13.93%	27.86%	41.80%	1.65	1.82
Rb, ppm	5.75	0.96	3.83	7.67	2.87	8.63	16.72%	33.43%	50.15%	5.46	6.04
S, wt.%	7.86	0.491	6.88	8.84	6.39	9.34	6.25%	12.50%	18.75%	7.47	8.25
Sb, ppm	228	46	137	319	92	365	19.94%	39.89%	59.83%	217	240
Sc, ppm	1.05	0.12	0.81	1.28	0.70	1.39	11.01%	22.03%	33.04%	0.99	1.10
Se, ppm	75	11	53	97	42	108	14.52%	29.03%	43.55%	71	79
Sm, ppm	1.16	0.20	0.77	1.55	0.57	1.75	16.88%	33.77%	50.65%	1.10	1.22
Sn, ppm	1.92	0.22	1.47	2.37	1.25	2.59	11.69%	23.37%	35.06%	1.82	2.01
Sr, ppm	28.1	5.5	17.0	39.1	11.5	44.6	19.65%	39.30%	58.96%	26.7	29.5
Tb, ppm	0.11	0.02	0.06	0.15	0.04	0.17	20.34%	40.67%	61.01%	0.10	0.11
Te, ppm	33.1	2.60	27.9	38.3	25.3	40.9	7.87%	15.74%	23.61%	31.4	34.7
Th, ppm	< 3	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Ti, ppm	100	12	75	125	63	137	12.29%	24.58%	36.87%	95	105
Tl, ppm	15.3	1.6	12.0	18.5	10.4	20.1	10.51%	21.02%	31.53%	14.5	16.0
U, ppm	0.95	0.13	0.69	1.21	0.56	1.34	13.71%	27.41%	41.12%	0.90	1.00
V, ppm	8.33	1.08	6.17	10.49	5.10	11.56	12.94%	25.88%	38.82%	7.91	8.75
W, ppm	5.90	1.16	3.57	8.22	2.41	9.38	19.71%	39.43%	59.14%	5.60	6.19
Y, ppm	1.91	0.34	1.24	2.58	0.90	2.91	17.61%	35.23%	52.84%	1.81	2.00
Yb, ppm	0.099	0.017	0.065	0.133	0.047	0.151	17.39%	34.77%	52.16%	0.094	0.104
Zn, wt.%	0.217	0.010	0.197	0.236	0.187	0.246	4.56%	9.12%	13.67%	0.206	0.228
Zr, ppm	19.0	2.7	13.6	24.3	11.0	27.0	14.04%	28.08%	42.11%	18.0	19.9
Infrared Combustion											
S, wt.%	8.79	0.330	8.13	9.45	7.81	9.78	3.75%	7.50%	11.25%	8.35	9.23

Note: intervals may appear asymmetric due to rounding

Tolerance Limits (ISO Guide 3207) were determined using an analysis of precision errors method and are considered a conservative estimate of true homogeneity. The meaning of tolerance limits may be illustrated for copper by 4-Acid digestion, where 99% of the time (1-α=0.99) at least 95% of subsamples (ρ=0.95) will have concentrations lying between 4.94 and 5.09wt.%. 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).

For gold by fire assay and by aqua regia digestion, the tolerance limits have been determined by INAA using the reduced analytical subsample method which utilises the known relationship between standard deviation and analytical subsample weight (Ingamells and Switzer, 1973). In this approach the sample aliquot is substantially reduced to a point where most of the variability in replicate assays should be due to inhomogeneity of the reference material and measurement error becomes negligible. In this instance a subsample weight of 1g was employed and the 1RSD of 0.43% calculated at a 30g charge weight (2.32% at 1g weights) confirms the high level of gold homogeneity in OREAS 605.

Au by fire assay is reported by 27 laboratories and the charge weights range from 20-40g. The most common charge weight used in this round robin was 30g (19 labs) and tolerance intervals have been calculated at this sample weight. For Au by aqua regia digestion, tolerance limits have been calculated at a 25g sample weight (mode from the 25-50g sample weights used at 13 laboratories).

The gold homogeneity of OREAS 605 has also been evaluated in a **nested ANOVA** of the round robin program. Each of the twenty-eight round robin laboratories received six samples per CRM and these samples were made up of paired samples from three different, non-adjacent sampling intervals. The purpose of the ANOVA evaluation is to test that no statistically significant difference exists in the variance between-units to that of the variance within-units. This allows an assessment of homogeneity across the entire prepared batch of OREAS 605. The test was performed using the following parameters:

- Gold fire assay – 162 samples (27 laboratories each providing analyses on 3 pairs of samples);
- Gold aqua regia digestion – 78 samples (13 laboratories each providing analyses on 3 pairs of samples);
- 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 where 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 data set (batch) outliers prior to the calculation of the *p*-value. This process derived *p*-values of 0.99 for Au by fire assay and 0.26 for Au by aqua regia digestion. Both p-values are insignificant and the Null Hypothesis is retained. Additionally, none of the other 114 certified values showed significant *p*-values.

It is important to note that ANOVA is not an absolute measure of homogeneity. Rather, it establishes whether or not the analytes are distributed in a similar manner throughout the packaging run of OREAS 605 and whether the variance between two subsamples from the same unit is statistically distinguishable to the variance from two subsamples taken from any two separate units. A reference material therefore, can possess poor absolute homogeneity yet still pass a relative homogeneity test if the within-unit heterogeneity is large and similar across all units.

Based on the statistical analysis of the results of the inter-laboratory certification program it can be concluded that OREAS 605 is fit-for-purpose as a certified reference material (see ‘Intended Use’ below).

PARTICIPATING LABORATORIES

1. Accurassay, Thunder Bay, Ontario, Canada
2. Acme (BV), Santiago, Chile
3. Actlabs, Ancaster, Ontario, Canada
4. AH Knight, Spartanburg, SC, USA
5. ALS, Johannesburg, South Africa
6. ALS, Lima, Peru
7. ALS, Reno, Nevada, USA
8. ALS, Townsville, QLD, Australia
9. ALS, Val-d'or, Quebec, Canada
10. ALS, Vancouver, BC, Canada
11. Bureau Veritas Geoanalytical, Adelaide, SA, Australia
12. Bureau Veritas Geoanalytical, Kalgoorlie, WA, Australia
13. Bureau Veritas Geoanalytical, Perth, WA, Australia
14. Bureau Veritas Kalassay, Kalgoorlie, WA, Australia
15. Inspectorate (BV), Lima, Peru
16. Inspectorate (BV), Sparks, Nevada, USA
17. Intertek Genalysis, Adelaide, SA, Australia
18. Intertek Genalysis, Perth, WA, Australia
19. Intertek Testing Services, Cupang, Muntinlupa, Philippines
20. Intertek Testing Services, Shunyi, Beijing, China
21. MINTEK Analytical Services, Randburg, South Africa
22. PT Geoservices Ltd, Cikarang, Jakarta Raya, Indonesia
23. SGS de Mexico, Durango, Mexico
24. SGS Geosol Laboratorios Ltda, Vespasiano, Minas Gerais, Brazil
25. SGS Lakefield Research Ltd, Lakefield, Ontario, Canada
26. SGS South Africa Pty Ltd, Booysens, Gauteng, South Africa
27. Shiva Analyticals Ltd, Bangalore North, Karnataka, India
28. SRL (Bureau Veritas), Perth, WA, Australia

PREPARER AND SUPPLIER

Certified reference material OREAS 605 is prepared, certified and supplied by:

ORE RESEARCH & EXPLORATION

ORE Research & Exploration Pty Ltd	Tel:	+613-9729 0333
37A Hosie Street	Fax:	+613-9729 8338
Bayswater North VIC 3153	Web:	www.ore.com.au
AUSTRALIA	Email:	info@ore.com.au

It is available in unit sizes of 10 and 60g (single-use laminated foil pouches) and 1kg (plastic jars).

INTENDED USE

OREAS 605 is intended for the following uses:

- for the monitoring of laboratory performance in the analysis of analytes reported in Table 1 in geological samples;
- for the verification of analytical methods for analytes reported in Table 1;
- for the calibration of instruments used in the determination of the concentration of analytes reported in Table 1.

STABILITY AND STORAGE INSTRUCTIONS

OREAS 605 has been prepared from gold-silver-copper bearing ore from Evolution Mining's Mount Carlton Operation in Queensland, Australia and blended with argillic altered rhyodacite waste rock. It contains elevated levels of reactive sulphide (8.79% S) and has been packaged under a nitrogen environment (single use laminated foil pouches only). In its unopened state and under normal conditions of storage the CRM has a shelf life beyond ten years. Its stability will be monitored at regular intervals and purchasers notified if any changes are observed.

INSTRUCTIONS FOR CORRECT USE

The certified values for OREAS 605 refer to the concentration level in its packaged state. It should not be dried prior to weighing and analysis. The certified values for gold by fire assay and aqua regia digestion are applicable to charge/sample weights ranging 20-50g.

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.

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

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

REFERENCES

Ingamells, C. O. and Switzer, P. (1973), Talanta 20, 547-568.

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.