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

OREAS
Certified Reference Materials

CERTIFICATE OF ANALYSIS FOR

GOLD ORE

CERTIFIED REFERENCE MATERIAL

OREAS 200

Table 1. Certified Values, SDs, 95% Confidence and Tolerance Limits for OREAS 200

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Fire Assay						
Gold, Au (ppm)	0.340	0.012	0.336	0.345	*0.337	*0.344
Aqua Regia Digestion						
Ag, Silver (ppm)	0.085	0.013	0.080	0.090	0.072	0.098
As, Arsenic (ppm)	198	11.5	192	203	193	203
Au, Gold (ppm)	0.329	0.027	0.315	0.342	*0.326	*0.332
Ba, Barium (ppm)	87	4.1	84	89	84	89
Bi, Bismuth (ppm)	0.062	0.010	0.056	0.067	IND	IND
Ca, Calcium (wt.%)	0.926	0.124	0.861	0.990	0.900	0.952
Ce, Cerium (ppm)	32.8	1.31	32.1	33.5	31.7	33.9
Co, Cobalt (ppm)	27.0	2.67	25.7	28.3	26.2	27.8
Cr, Chromium (ppm)	38.0	2.56	36.6	39.3	36.5	39.4
Cs, Cesium (ppm)	1.25	0.044	1.23	1.28	1.21	1.29
Cu, Copper (ppm)	103	3.8	101	105	100	105
Fe, Iron (wt.%)	4.86	0.319	4.71	5.01	4.79	4.93
Ga, Gallium (ppm)	3.51	0.50	3.24	3.79	3.37	3.65
Gd, Gadolinium (ppm)	4.40	0.82	3.31	5.49	4.21	4.59
Ge, Germanium (ppm)	0.12	0.02	0.10	0.14	IND	IND
Hg, Mercury (ppm)	< 0.01	IND	IND	IND	IND	IND
In, Indium (ppm)	0.024	0.004	0.021	0.027	0.021	0.027
K, Potassium (wt.%)	0.115	0.011	0.110	0.120	0.109	0.121
La, Lanthanum (ppm)	16.7	0.60	16.4	17.0	16.3	17.2
Li, Lithium (ppm)	4.79	0.48	4.53	5.05	4.60	4.98
Mg, Magnesium (wt.%)	2.09	0.111	2.04	2.15	2.06	2.13
Mn, Manganese (wt.%)	0.086	0.004	0.084	0.088	0.085	0.088
Mo, Molybdenum (ppm)	4.46	0.71	4.13	4.80	4.29	4.64
Nb, Niobium (ppm)	0.86	0.12	0.76	0.96	0.74	0.98
Nd, Neodymium (ppm)	18.0	1.41	16.2	19.8	17.4	18.6
Ni, Nickel (ppm)	112	4.5	110	114	109	114
P, Phosphorus (wt.%)	0.137	0.008	0.132	0.142	0.134	0.141
Pb, Lead (ppm)	2.09	0.202	1.98	2.19	1.92	2.25
Rb, Rubidium (ppm)	10.4	0.73	10.0	10.8	10.0	10.7
S, Sulphur (wt.%)	0.271	0.020	0.260	0.282	0.262	0.280
Sb, Antimony (ppm)	0.21	0.020	0.20	0.22	0.19	0.22
Sc, Scandium (ppm)	2.68	0.47	2.43	2.94	2.57	2.80
Se, Selenium (ppm)	0.72	0.13	0.61	0.83	IND	IND
Sn, Tin (ppm)	0.74	0.10	0.68	0.80	IND	IND
Sr, Strontium (ppm)	55	11	49	60	53	57
Tb, Terbium (ppm)	0.52	0.051	0.45	0.59	IND	IND
Th, Thorium (ppm)	2.66	0.179	2.56	2.76	2.52	2.80
Ti, Titanium (wt.%)	0.158	0.025	0.144	0.173	0.152	0.164
Tl, Thallium (ppm)	0.063	0.012	0.056	0.070	IND	IND

*determined from RSD of INAA data for 30g analytical subsample weights for fire assay and aqua regia digestion methods; 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						
U, Uranium (ppm)	0.58	0.07	0.54	0.61	0.56	0.60
V, Vanadium (ppm)	33.4	3.11	31.9	35.0	32.1	34.7
W, Tungsten (ppm)	0.32	0.026	0.31	0.34	0.30	0.35
Y, Yttrium (ppm)	13.6	1.01	13.2	14.1	13.3	14.0
Yb, Ytterbium (ppm)	0.98	0.10	0.84	1.12	IND	IND
Zn, Zinc (ppm)	67	4.2	65	69	65	69

Note: intervals may appear asymmetric due to rounding.

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

Certified Reference Material (CRM) OREAS 200 was prepared from a blend of gold-bearing Magdala ore from the Stawell Gold Mine, west-central Victoria, Australia and barren tholeiitic basalt from Epping, Victoria, Australia. The Magdala lode is intimately associated with an intensely deformed package of volcanogenic sedimentary rocks. The ore samples were taken from basalt contact lodes and are strongly chlorite-altered (+/- silica, stilpnomelane) carbonaceous mudstones located directly on the western margin of the Magdala basalt dome. Mineralisation in the ore consists of a quartz-sericite-carbonate schist assemblage containing the sulphides arsenopyrite, pyrrhotite and pyrite. OREAS 200 is one of a suite of nine CRMs ranging in gold content from 0.340 to 9.25ppm.

COMMINUTION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 200 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 grade;
- packaging in 60g units sealed in laminated foil pouches and 1kg units in plastic jars.

ANALYTICAL PROGRAM

Twenty eight commercial analytical laboratories participated in the program to characterise gold by fire assay with AAS (15 labs), ICP-OES (9 labs), ICP-MS (3 labs) or solvent

extraction AAS (1 lab) finish. Seventeen of these laboratories also determined gold via aqua regia digestion with ICP-MS (10 labs), AAS (4 labs), graphite furnace AAS (2 labs) or solvent extraction AAS (1 lab) finish. Gold has been certified separately for the fire assay and aqua regia digestion methods.

For the round robin program the samples were taken at 20 predetermined sampling intervals during packaging and are considered representative of the entire batch of OREAS 200. Six 110g samples were submitted to each laboratory for analysis. Table 1 presents the certified values together with their associated 1SD's, 95% confidence and tolerance limits. Table 2 shows 153 indicative values for major and trace element composition. Gold homogeneity has been evaluated and confirmed by instrumental neutron activation analysis (INAA) on twenty ~1.4 gram sample portions (see Table 3) 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 associated standard deviations. Tabulated results of all elements (including Au INAA analyses) together with analytical method codes, uncorrected means, medians, standard deviations, relative standard deviations and per cent deviation of lab means from the corrected mean of means (PDM[3]) are presented in the detailed certification data for this CRM (**OREAS 200 Datapack.xlsx**).

Table 2. Approximate major and trace element data for OREAS 200

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Pb Fire Assay								
Pd	ppb	*4*	Pt	ppb	*4*			
Borate Fusion XRF								
Al_2O_3	wt.%	*14.25*	Fe_2O_3	wt.%	*11.85*	Pb	ppm	*25.0*
As	ppm	*190*	K_2O	wt.%	*0.971*	SiO_2	wt.%	*51.90*
Ba	ppm	*370*	MgO	wt.%	*6.42*	Sn	ppm	*12.5*
CaO	wt.%	*8.30*	MnO	wt.%	*0.200*	SO_3	wt.%	*0.664*
Co	ppm	*50*	Na_2O	wt.%	*3.03*	TiO_2	wt.%	*1.78*
Cr	ppm	*245*	Ni	ppm	*165*	U	ppm	*30.0*
Cu	ppm	*140*	P_2O_5	wt.%	*0.376*	Zn	ppm	*135*
Thermogravimetry								
LOI^{1000}	wt.%	*0.745*						
Laser Ablation ICP-MS								
Ag	ppm	*< 0.1*	Ho	ppm	*0.99*	Sn	ppm	*2.30*
As	ppm	*196*	In	ppm	*< 0.05*	Sr	ppm	*400*
Ba	ppm	*335*	La	ppm	*21.2*	Ta	ppm	*1.42*
Be	ppm	*0.90*	Lu	ppm	*0.25*	Tb	ppm	*0.83*
Bi	ppm	*0.050*	Mn	wt.%	*0.144*	Te	ppm	*0.25*
Cd	ppm	*0.075*	Mo	ppm	*5.70*	Th	ppm	*4.13*
Ce	ppm	*38.4*	Nb	ppm	*21.0*	Ti	wt.%	*1.06*
Co	ppm	*42.5*	Nd	ppm	*21.8*	Tl	ppm	*< 0.2*
Cr	ppm	*221*	Ni	ppm	*128*	Tm	ppm	*0.34*
Cs	ppm	*1.76*	Pb	ppm	*4.00*	U	ppm	*1.05*
Cu	ppm	*106*	Pr	ppm	*5.31*	V	ppm	*164*
Dy	ppm	*5.02*	Rb	ppm	*28.7*	W	ppm	*0.90*
Er	ppm	*2.40*	Re	ppm	*< 0.01*	Y	ppm	*25.0*
Eu	ppm	*1.88*	Sb	ppm	*0.075*	Yb	ppm	*1.90*

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.

Table 2 continued.

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Laser Ablation ICP-MS continued								
Ga	ppm	*19.8*	Sc	ppm	*18.0*	Zn	ppm	*110*
Gd	ppm	*5.08*	Se	ppm	*< 5*	Zr	ppm	*133*
Hf	ppm	*3.97*	Sm	ppm	*5.83*			
4-Acid Digestion								
Ag	ppm	*< 0.1*	Ho	ppm	*0.99*	Se	ppm	*< 2*
Al	wt.%	*7.63*	In	ppm	*0.075*	Sm	ppm	*5.85*
As	ppm	*201*	K	wt.%	*0.862*	Sn	ppm	*1.50*
Ba	ppm	*343*	La	ppm	*17.4*	Sr	ppm	*418*
Be	ppm	*1.70*	Li	ppm	*9.32*	Ta	ppm	*0.80*
Bi	ppm	*< 0.1*	Lu	ppm	*0.24*	Tb	ppm	*0.93*
Ca	wt.%	*5.61*	Mg	wt.%	*3.88*	Te	ppm	*< 0.1*
Cd	ppm	*0.15*	Mn	wt.%	*0.146*	Th	ppm	*3.93*
Ce	ppm	*45.4*	Mo	ppm	*4.93*	Ti	wt.%	*0.965*
Co	ppm	*40.8*	Na	wt.%	*2.32*	Tl	ppm	*< 0.2*
Cr	ppm	*208*	Nb	ppm	*22.9*	Tm	ppm	*0.34*
Cs	ppm	*1.58*	Nd	ppm	*25.7*	U	ppm	*1.09*
Cu	ppm	*113*	Ni	ppm	*137*	V	ppm	*161*
Dy	ppm	*5.42*	P	wt.%	*0.141*	W	ppm	*0.97*
Er	ppm	*2.65*	Pb	ppm	*3.83*	Y	ppm	*18.0*
Eu	ppm	*1.99*	Pr	ppm	*5.14*	Yb	ppm	*2.12*
Fe	wt.%	*8.19*	Rb	ppm	*22.1*	Zn	ppm	*116*
Ga	ppm	*23.5*	S	wt.%	*0.287*	Zr	ppm	*141*
Gd	ppm	*6.42*	Sb	ppm	*0.33*			
Hf	ppm	*4.07*	Sc	ppm	*18.7*			
Aqua Regia Digestion								
Al	wt.%	*1.05*	Hf	ppm	*0.37*	Re	ppm	*0.001*
B	ppm	*< 10*	Ho	ppm	*0.59*	Ru	ppm	*< 0.01*
Be	ppm	*0.29*	Lu	ppm	*0.14*	Sm	ppm	*3.98*
Cd	ppm	*0.045*	Na	wt.%	*0.186*	Ta	ppm	*0.019*
Dy	ppm	*3.29*	Pd	ppb	*< 10*	Te	ppm	*0.019*
Er	ppm	*1.53*	Pr	ppm	*4.47*	Tm	ppm	*0.19*
Eu	ppm	*0.78*	Pt	ppb	*2*	Zr	ppm	*14.6*

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 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 200.

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. They take into account errors attributable to measurement uncertainty and CRM variability. For an effective CRM the contribution of the latter should be negligible in comparison to measurement errors. The Standard Deviation values include all sources of measurement uncertainty: between-lab variance, within-run variance (precision errors) and CRM variability. 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 all individual, lab dataset (batch) and 3SD outliers (single iteration). These outliers can only be removed after the absolute homogeneity of the CRM has been independently established, i.e. the outliers must be confidently deemed to be analytical rather than arising from inhomogeneity of the CRM. The standard deviation is then calculated for each analyte from the pooled accepted analyses generated from the certification program.

Performance Gates (Table 4) are 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.

Tolerance Limits (ISO Guide 3207) for elements other than gold 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 via aqua regia digestion where 99% of the time ($1-\alpha=0.99$) at least 95% of subsamples ($\rho=0.95$) will have concentrations lying between 100 and 105 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 (ISO Guide 35).

Table 3. Neutron Activation Analysis of Au (ppm) on 20 x 1.4g subsamples.

Replicate No	NAA 1.4g
1	0.341
2	0.336
3	0.342
4	0.335
5	0.335
6	0.348
7	0.346
8	0.343
9	0.345
10	0.350
11	0.348
12	0.349
13	0.343
14	0.352
15	0.344
16	0.345
17	0.344
18	0.346
19	0.345
20	0.342
Mean	0.344
Median	0.345
Std Dev.	0.005
Rel.Std.Dev.	1.36%
PDM[3]	1.02%

Table 4. Performance Gates for OREAS 200

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											
Au, ppm	0.340	0.012	0.316	0.365	0.303	0.378	3.64%	7.27%	10.91%	0.323	0.357
Aqua Regia Digestion											
Ag, ppm	0.085	0.013	0.060	0.110	0.047	0.123	14.75%	29.51%	44.26%	0.081	0.089
As, ppm	198	12	175	221	163	232	5.82%	11.64%	17.46%	188	208
Au, ppm	0.329	0.027	0.274	0.383	0.247	0.410	8.28%	16.56%	24.84%	0.312	0.345
Ba, ppm	87	4.1	79	95	74	99	4.68%	9.35%	14.03%	82	91
Bi, ppm	0.062	0.010	0.041	0.082	0.031	0.092	16.37%	32.74%	49.10%	0.058	0.065
Ca, wt.%	0.926	0.124	0.679	1.173	0.555	1.296	13.34%	26.69%	40.03%	0.879	0.972
Ce, ppm	32.8	1.31	30.2	35.4	28.9	36.7	4.00%	7.99%	11.99%	31.2	34.4
Co, ppm	27.0	2.67	21.7	32.3	19.0	35.0	9.88%	19.75%	29.63%	25.6	28.3

Note: intervals may appear asymmetric due to rounding.

Table 4 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											
Cr, ppm	38.0	2.56	32.9	43.1	30.3	45.7	6.74%	13.48%	20.23%	36.1	39.9
Cs, ppm	1.25	0.044	1.16	1.34	1.12	1.38	3.50%	7.00%	10.50%	1.19	1.31
Cu, ppm	103	4	95	110	92	114	3.68%	7.35%	11.03%	98	108
Fe, wt.%	4.86	0.319	4.22	5.50	3.90	5.82	6.57%	13.13%	19.70%	4.62	5.10
Ga, ppm	3.51	0.50	2.51	4.51	2.02	5.01	14.19%	28.39%	42.58%	3.34	3.69
Gd, ppm	4.40	0.82	2.75	6.05	1.93	6.87	18.70%	37.40%	56.10%	4.18	4.62
Ge, ppm	0.12	0.02	0.08	0.16	0.06	0.17	15.35%	30.70%	46.05%	0.11	0.13
Hg, ppm	< 0.01	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
In, ppm	0.024	0.004	0.016	0.032	0.012	0.036	16.78%	33.56%	50.35%	0.023	0.025
K, wt.%	0.115	0.011	0.093	0.137	0.082	0.148	9.53%	19.06%	28.60%	0.109	0.121
La, ppm	16.7	0.60	15.5	17.9	14.9	18.5	3.58%	7.16%	10.74%	15.9	17.5
Li, ppm	4.79	0.48	3.82	5.76	3.34	6.24	10.11%	20.21%	30.32%	4.55	5.03
Mg, wt.%	2.09	0.111	1.87	2.32	1.76	2.43	5.32%	10.64%	15.95%	1.99	2.20
Mn, wt.%	0.086	0.004	0.078	0.095	0.074	0.099	4.94%	9.88%	14.82%	0.082	0.091
Mo, ppm	4.46	0.71	3.05	5.88	2.34	6.59	15.89%	31.77%	47.66%	4.24	4.69
Nb, ppm	0.86	0.12	0.61	1.10	0.49	1.23	14.39%	28.77%	43.16%	0.82	0.90
Nd, ppm	18.0	1.41	15.2	20.8	13.7	22.2	7.85%	15.71%	23.56%	17.1	18.9
Ni, ppm	112	4	103	121	98	125	3.99%	7.98%	11.96%	106	117
P, wt.%	0.137	0.008	0.121	0.153	0.113	0.161	5.87%	11.74%	17.61%	0.130	0.144
Pb, ppm	2.09	0.202	1.68	2.49	1.48	2.69	9.68%	19.36%	29.04%	1.98	2.19
Rb, ppm	10.4	0.73	8.9	11.8	8.2	12.5	7.02%	14.03%	21.05%	9.8	10.9
S, wt.%	0.271	0.020	0.231	0.311	0.211	0.331	7.36%	14.71%	22.07%	0.257	0.284
Sb, ppm	0.21	0.020	0.17	0.25	0.15	0.27	9.67%	19.35%	29.02%	0.20	0.22
Sc, ppm	2.68	0.47	1.75	3.62	1.28	4.08	17.39%	34.79%	52.18%	2.55	2.82
Se, ppm	0.72	0.13	0.45	0.99	0.32	1.12	18.54%	37.09%	55.63%	0.68	0.76
Sn, ppm	0.74	0.10	0.54	0.94	0.44	1.05	13.64%	27.27%	40.91%	0.70	0.78
Sr, ppm	55	11	33	76	22	87	19.67%	39.35%	59.02%	52	57
Tb, ppm	0.52	0.051	0.42	0.62	0.37	0.67	9.74%	19.48%	29.22%	0.50	0.55
Th, ppm	2.66	0.179	2.30	3.02	2.12	3.20	6.75%	13.51%	20.26%	2.52	2.79
Ti, wt.%	0.158	0.025	0.109	0.208	0.084	0.232	15.62%	31.23%	46.85%	0.150	0.166
Tl, ppm	0.063	0.012	0.040	0.086	0.029	0.098	18.26%	36.52%	54.78%	0.060	0.066

Note: intervals may appear asymmetric due to rounding.

Table 4 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											
U, ppm	0.58	0.07	0.44	0.71	0.37	0.78	11.75%	23.50%	35.25%	0.55	0.60
V, ppm	33.4	3.11	27.2	39.6	24.1	42.8	9.31%	18.63%	27.94%	31.7	35.1
W, ppm	0.32	0.026	0.27	0.38	0.25	0.40	8.13%	16.26%	24.38%	0.31	0.34
Y, ppm	13.6	1.01	11.6	15.6	10.6	16.6	7.39%	14.78%	22.18%	12.9	14.3
Yb, ppm	0.98	0.10	0.77	1.19	0.66	1.29	10.69%	21.39%	32.08%	0.93	1.03
Zn, ppm	67	4.2	58	75	54	79	6.27%	12.53%	18.80%	63	70

Note: intervals may appear asymmetric due to rounding

For gold, tolerance can be 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 latter parameter is substantially reduced to a point where most of the variability in replicate assays is due to inhomogeneity of the reference material and measurement error becomes negligible In this instance a subsample weight of 1.0 gram was employed and the 1RSD of 1.35% (or 0.29% at a 30g charge weight) confirms the high level of gold homogeneity in OREAS 200. The homogeneity is of a level such that ***sampling error is negligible*** for a conventional fire assay or aqua regia determination.

Please note that these RSD's and tolerance limits pertain to the homogeneity of the CRM only and should not be used as control limits for laboratory performance.

The meaning of tolerance limits may be illustrated for gold fire assay (at a conventional 30g charge weight) where 99% of the time (1-α=0.99) at least 95% of subsamples (ρ=0.95) will have concentrations lying between 0.337 and 0.344ppm.

The gold homogeneity of OREAS 200 has also been evaluated in a **nested ANOVA** for 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 200. The test was performed using the following parameters:

- Gold fire assay – 168 samples (28 laboratories each providing analyses on 3 pairs of samples);
- Gold aqua regia digestion – 102 samples (17 laboratories each providing analyses on 3 pairs of samples);
- 44 elements by aqua regia digestion from Ag to Zn – up to 120 samples depending on the element (20 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 no significant *p*-values and the Null Hypothesis is therefore retained.

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 200 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 200 is fit-for-purpose as a certified reference material (see 'Intended Use' below).

PARTICIPATING LABORATORIES

1. Accurassay, Thunder Bay, ON, Canada
2. Acme, Santiago, Chile
3. Acme, Vancouver, BC, Canada
4. Actlabs, Ancaster, ON, Canada
5. Actlabs, Thunder Bay, ON, Canada
6. ALS, Brisbane, QLD, Australia
7. ALS, La Serena, Chile
8. ALS, Lima, Peru
9. ALS, Perth, WA, Australia
10. ALS, Vancouver, BC, Canada
11. BV Amdel, Adelaide, SA, Australia
12. BV Ultra Trace, Perth, WA, Australia
13. Intertek Genalysis, Johannesburg, Gauteng, South Africa
14. Intertek Genalysis, Perth, WA, Australia
15. Intertek Testing Services, Beijing, China
16. Intertek Testing Services, Jakarta, Indonesia
17. Intertek Testing Services, Muntinlupa, Philippines
18. Newmont Metallurgical Services, Englewood, CO, USA
19. OMAC (ALS), Loughrea, County Galway, Ireland
20. PT Geoservices, Cikarang, Bekasi, Indonesia
21. SGS, Booysens, Gauteng, South Africa
22. SGS, Durango, Mexico
23. SGS, Lakefield, ON, Canada
24. SGS, Perth, WA, Australia
25. SGS, Townsville, QLD, Australia
26. SGS, Vancouver, BC, Canada
27. SGS, Vespasiano, MG, Brazil
28. Shiva Analyticals, Bangalore North, Karnataka, India

PREPARER AND SUPPLIER

Certified reference material OREAS 200 is prepared, certified and supplied by:

ORE RESEARCH & EXPLORATION

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

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

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

INTENDED USE

OREAS 200 is intended for the following uses:

- monitoring of laboratory performance in the analysis of geological samples for gold by fire assay and aqua regia digestion methods and for all analytes reported in Table 1;
- 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 200 has been prepared from gold ore diluted with barren tholeiitic basalt. In its unopened state under normal conditions of storage it has a shelf life beyond ten years.

INSTRUCTIONS FOR CORRECT USE

The certified values for OREAS 200 refer to the concentration level in its packaged state. It 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 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 3207 (1975), Statistical interpretation of data - Determination of a statistical tolerance interval.

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