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CERTIFICATE OF ANALYSIS FOR

VOLCANIC HOSTED MASSIVE SULPHIDE Zn-Pb-Cu-Ag-Au ORE

CERTIFIED REFERENCE MATERIAL

OREAS 622

Summary Statistics for Key Analytes (additional certified values below).

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Fire Assay						
Au, Gold (ppm)	1.85	0.066	1.82	1.88	1.83*	1.87*
Infrared Combustion						
S, Sulphur (wt.%)	7.95	0.147	7.89	8.00	7.86	8.04
4-Acid Digestion						
Ag, Silver (ppm)	102	3.3	101	104	100	104
Cu, Copper (wt.%)	0.486	0.008	0.483	0.489	0.475	0.496
Pb, Lead (wt.%)	2.21	0.067	2.19	2.24	2.17	2.26
Zn, Zinc (wt.%)	10.24	0.182	10.17	10.30	10.06	10.42

*Gold Tolerance Limits generated from results of 20 x 1.0g INAA samples using the reduced subsample method.
Please 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

OREAS 622 was prepared from Zn and Cu VHMS ores sourced from the Gossan Hill deposit at Golden Grove located 338km NNE of Perth in the Murchison Province of the Archaen Yilgarn Craton, Western Australia. The VHMS deposits are hosted within and underlain by a layered rhyodacitic volcanoclastic succession. The Gossan Hill ores have been blended with fresh, barren rhyodacite material sourced from a quarry approximately 30km east of Melbourne, Australia to achieve the desired grades. The main mineralisation assemblage consists of sphalerite, chalcopyrite and lesser galena with a gangue of pyrite, pyrrhotite and magnetite. Smith *et al*. (as cited in Smith, 2003) noted the ore shoots contain many chalcophile, or partly chalchophile elements namely Fe, S, Cu, Pb, Zn, Co, As, Sb, Bi, Cd, In, Mo, Ag, Sn, Ge, Se, Te, Hg and Au. OREAS 622 is one of a suite of five CRMs ranging in grades from 0.18-3.10% Cu, 1.0-10.2% Zn, 0.25-2.21% Pb, 22-103ppm Ag and 0.68-1.85ppm Au.

COMMINUTION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 622 was prepared in the following manner:

- drying of sulphide bearing ore materials to constant mass at 90°C;
- drying of rhyodacite material to constant mass at 105°C;
- crushing and milling of the ore material to 100% minus 35 microns;
- crushing and milling of the barren material to 98% minus 75 microns;
- blending in appropriate proportions to achieve the desired grades;
- packaging in 10g and 60g units sealed under nitrogen in laminated foil pouches.

ANALYTICAL PROGRAM

Twenty eight commercial analytical laboratories participated in the program to certify the 148 elements reported in Table 1. The following methods were employed:

- Gold via 20-40g* fire assay with AAS (20 labs), ICP-OES (3 labs) finish;
- Instrumental neutron activation analysis for Au on 1g subsamples to confirm homogeneity (1 laboratory);
- Sulphur by Infrared Combustion Analysis (21 labs).
- Peroxide fusion for full elemental suite ICP-OES and ICP-MS (up to 14 laboratories depending on the element).

- 4-Acid digestion (HF-HNO_3-$HClO_4$-HCl) for full elemental suite ICP-OES and ICP-MS or AAS finish (up to 22 laboratories depending on the element).
- 3-Acid digestion (HNO_3-$HClO_4$-HCl) for a limited suite by ICP-OES and AAS (up to 10 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).
- Gold via 15-50g* aqua regia digestion with ICP-MS (11 labs), AAS (5 labs) or graphite furnace AAS (1 lab) finish;

*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 lot samples 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 lots. 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 148 certified values together with their associated 1SD's, 95% confidence and tolerance limits and Table 2 shows 60 indicative values. Table 3 provides performance gate intervals for the certified values of each method group 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 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 622 Datapack.xlsx**).

Table 1. Certified Values, SD's, 95% Confidence and Tolerance Limits for OREAS 622.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Fire Assay						
Au, Gold (ppm)	1.85	0.066	1.82	1.88	1.83*	1.87*
Infrared Combustion						
S, Sulphur (wt.%)	7.95	0.147	7.89	8.00	7.86	8.04
Peroxide Fusion ICP						
Ag, Silver (ppm)	103	10.0	93	113	97	108
Al, Aluminium (wt.%)	5.83	0.147	5.73	5.92	5.71	5.94
As, Arsenic (ppm)	110	8.9	105	116	104	117
Ba, Barium (ppm)	2311	55.9	2271	2352	2238	2385
Bi, Bismuth (ppm)	4.96	0.52	4.40	5.52	4.64	5.28
Ca, Calcium (wt.%)	2.14	0.107	2.07	2.20	2.05	2.22
Cd, Cadmium (ppm)	454	13.8	443	465	440	469
Ce, Cerium (ppm)	34.8	2.83	31.0	38.6	33.5	36.1
Co, Cobalt (ppm)	37.7	6.0	34.1	41.3	35.5	39.8
Cr, Chromium (ppm)	48.1	5.5	44.1	52.0	IND	IND
Cs, Cesium (ppm)	1.88	0.26	1.61	2.16	1.73	2.03
Cu, Copper (wt.%)	0.484	0.016	0.476	0.491	0.470	0.498
Fe, Iron (wt.%)	4.26	0.195	4.15	4.37	4.13	4.39
Ga, Gallium (ppm)	26.9	1.73	24.7	29.0	25.7	28.0
In, Indium (ppm)	4.85	0.467	4.42	5.29	4.65	5.06
K, Potassium (wt.%)	1.78	0.131	1.71	1.86	1.72	1.84
La, Lanthanum (ppm)	18.8	2.4	15.5	22.1	18.1	19.5
Li, Lithium (ppm)	9.56	1.40	8.30	10.83	IND	IND
Mg, Magnesium (wt.%)	0.571	0.018	0.560	0.581	0.551	0.591
Mn, Manganese (wt.%)	0.061	0.004	0.059	0.063	0.059	0.063
Mo, Molybdenum (ppm)	19.4	0.92	18.5	20.4	IND	IND
Nb, Niobium (ppm)	6.24	0.90	5.09	7.38	IND	IND
Nd, Neodymium (ppm)	15.7	1.6	13.6	17.9	14.9	16.6
Ni, Nickel (ppm)	< 40	IND	IND	IND	IND	IND
Pb, Lead (wt.%)	2.11	0.117	2.03	2.19	2.06	2.16
Pr, Praseodymium (ppm)	4.29	0.323	3.87	4.72	4.07	4.52
Rb, Rubidium (ppm)	58	2.0	56	60	55	60
S, Sulphur (wt.%)	7.68	0.328	7.46	7.89	7.52	7.83
Sb, Antimony (ppm)	198	16.7	182	214	190	206
Sc, Scandium (ppm)	< 10	IND	IND	IND	IND	IND
Si, Silicon (wt.%)	25.09	0.825	24.51	25.66	24.37	25.81
Sn, Tin (ppm)	62	8	54	69	IND	IND
Sr, Strontium (ppm)	63	8	58	69	59	67
Th, Thorium (ppm)	5.47	0.282	5.19	5.75	5.21	5.74
Ti, Titanium (wt.%)	0.187	0.008	0.184	0.191	0.179	0.196
Tl, Thallium (ppm)	3.62	0.42	3.25	4.00	3.46	3.79
U, Uranium (ppm)	1.55	0.19	1.34	1.77	IND	IND
V, Vanadium (ppm)	45.4	3.64	42.0	48.7	42.8	47.9
W, Tungsten (ppm)	2.93	0.253	2.60	3.26	IND	IND

Table 1 continued.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Peroxide Fusion ICP continued						
Y, Yttrium (ppm)	12.4	1.04	11.3	13.4	11.8	12.9
Yb, Ytterbium (ppm)	1.17	0.15	1.05	1.29	IND	IND
Zn, Zinc (wt.%)	9.90	0.391	9.65	10.14	9.65	10.15
4-Acid Digestion						
Ag, Silver (ppm)	102	3.3	101	104	100	104
Al, Aluminium (wt.%)	5.77	0.291	5.61	5.92	5.58	5.96
As, Arsenic (ppm)	109	5.6	106	111	106	112
Be, Beryllium (ppm)	1.05	0.11	0.99	1.11	IND	IND
Bi, Bismuth (ppm)	5.05	0.220	4.92	5.18	4.90	5.20
Ca, Calcium (wt.%)	2.14	0.080	2.10	2.17	2.08	2.19
Cd, Cadmium (ppm)	460	18.4	452	467	451	468
Ce, Cerium (ppm)	30.1	3.7	27.5	32.7	28.5	31.6
Co, Cobalt (ppm)	36.0	3.9	34.6	37.3	34.6	37.3
Cr, Chromium (ppm)	33.9	5.9	31.4	36.4	31.4	36.4
Cs, Cesium (ppm)	1.72	0.070	1.67	1.78	1.66	1.78
Cu, Copper (wt.%)	0.486	0.008	0.483	0.489	0.475	0.496
Fe, Iron (wt.%)	4.31	0.251	4.20	4.42	4.21	4.41
Ga, Gallium (ppm)	24.5	1.08	23.8	25.2	23.5	25.5
Hf, Hafnium (ppm)	3.25	0.311	3.04	3.46	3.15	3.35
In, Indium (ppm)	4.63	0.229	4.47	4.80	4.49	4.78
K, Potassium (wt.%)	1.72	0.130	1.67	1.78	1.68	1.77
La, Lanthanum (ppm)	14.1	2.8	12.2	16.0	13.4	14.8
Li, Lithium (ppm)	8.67	0.93	8.11	9.22	8.33	9.00
Lu, Lutetium (ppm)	0.18	0.009	0.17	0.18	IND	IND
Mg, Magnesium (wt.%)	0.562	0.041	0.541	0.584	0.544	0.580
Mn, Manganese (wt.%)	0.060	0.003	0.059	0.061	0.059	0.061
Mo, Molybdenum (ppm)	17.4	1.63	16.6	18.2	17.0	17.8
Na, Sodium (wt.%)	0.729	0.054	0.705	0.753	0.712	0.745
Nb, Niobium (ppm)	4.62	0.56	4.25	4.98	4.28	4.96
Ni, Nickel (ppm)	27.9	2.62	27.0	28.9	26.3	29.6
P, Phosphorus (wt.%)	0.033	0.004	0.031	0.035	0.032	0.035
Pb, Lead (wt.%)	2.21	0.067	2.19	2.24	2.17	2.26
Rb, Rubidium (ppm)	55	3.7	52	57	53	56
S, Sulphur (wt.%)	7.71	0.201	7.62	7.81	7.58	7.85
Sb, Antimony (ppm)	195	12.9	189	201	190	200
Sc, Scandium (ppm)	6.82	0.627	6.45	7.18	6.61	7.02
Se, Selenium (ppm)	7.81	1.32	6.69	8.92	IND	IND
Sn, Tin (ppm)	7.01	1.05	6.42	7.59	6.43	7.58
Sr, Strontium (ppm)	52	7	49	55	50	54
Ta, Tantalum (ppm)	0.42	0.09	0.35	0.49	0.38	0.47
Tb, Terbium (ppm)	0.32	0.05	0.28	0.37	0.31	0.34
Te, Tellurium (ppm)	< 0.1	IND	IND	IND	IND	IND
Th, Thorium (ppm)	4.71	0.55	4.36	5.06	4.49	4.93

Table 1 continued.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
4-Acid Digestion continued						
Ti, Titanium (wt.%)	0.147	0.028	0.134	0.159	0.139	0.154
Tl, Thallium (ppm)	3.65	0.42	3.36	3.95	3.54	3.76
U, Uranium (ppm)	1.57	0.095	1.51	1.63	1.52	1.62
V, Vanadium (ppm)	40.0	1.38	39.4	40.6	38.4	41.6
W, Tungsten (ppm)	2.48	0.28	2.29	2.67	2.28	2.69
Y, Yttrium (ppm)	9.76	0.634	9.40	10.12	9.47	10.05
Yb, Ytterbium (ppm)	1.11	0.12	1.00	1.21	IND	IND
Zn, Zinc (wt.%)	10.24	0.182	10.17	10.30	10.06	10.42
Zr, Zirconium (ppm)	124	5.1	121	127	121	128
3-Acid Digestion (no HF)						
Ag, Silver (ppm)	102	3.7	99	104	99	104
As, Arsenic (ppm)	106	6.9	101	110	100	111
Cu, Copper (wt.%)	0.481	0.008	0.478	0.484	0.467	0.495
Fe, Iron (wt.%)	4.15	0.077	4.10	4.20	4.04	4.25
Mo, Molybdenum (ppm)	17.1	2.7	15.4	18.9	IND	IND
Pb, Lead (wt.%)	2.21	0.051	2.17	2.25	2.15	2.27
Zn, Zinc (wt.%)	10.25	0.185	10.08	10.42	10.06	10.45
Aqua Regia Digestion						
Ag, Silver (ppm)	101	3.5	99	102	99	103
Al, Aluminium (wt.%)	1.75	0.138	1.70	1.81	1.70	1.81
As, Arsenic (ppm)	106	8.7	103	109	102	109
Au, Gold (ppm)	1.78	0.071	1.75	1.82	1.76*	1.81*
B, Boron (ppm)	< 10	IND	IND	IND	IND	IND
Be, Beryllium (ppm)	0.38	0.06	0.31	0.45	IND	IND
Bi, Bismuth (ppm)	4.81	0.51	4.52	5.09	4.66	4.95
Ca, Calcium (wt.%)	1.80	0.081	1.77	1.83	1.76	1.85
Cd, Cadmium (ppm)	450	25.2	438	462	438	462
Ce, Cerium (ppm)	26.6	3.8	24.0	29.2	25.5	27.8
Co, Cobalt (ppm)	36.2	2.78	35.0	37.5	34.5	38.0
Cr, Chromium (ppm)	25.8	1.86	25.1	26.5	24.0	27.7
Cs, Cesium (ppm)	0.65	0.08	0.58	0.71	0.62	0.67
Cu, Copper (wt.%)	0.484	0.013	0.480	0.489	0.473	0.495
Fe, Iron (wt.%)	4.05	0.179	3.98	4.12	3.93	4.16
Ga, Gallium (ppm)	9.97	0.613	9.59	10.35	9.62	10.31
Hf, Hafnium (ppm)	1.20	0.20	1.02	1.37	1.13	1.26
Hg, Mercury (ppm)	5.37	0.347	5.20	5.54	5.21	5.52
In, Indium (ppm)	4.23	0.201	4.07	4.40	4.06	4.40
K, Potassium (wt.%)	0.293	0.042	0.274	0.312	0.279	0.307
La, Lanthanum (ppm)	12.9	1.9	11.8	14.0	12.6	13.3
Li, Lithium (ppm)	5.42	0.73	4.86	5.98	5.07	5.77
Lu, Lutetium (ppm)	0.087	0.015	0.074	0.099	IND	IND
Mg, Magnesium (wt.%)	0.506	0.041	0.487	0.524	0.489	0.523
Mn, Manganese (wt.%)	0.057	0.003	0.056	0.058	0.055	0.059

Table 1 continued.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Aqua Regia Digestion continued						
Mo, Molybdenum (ppm)	15.8	1.8	15.1	16.6	15.2	16.5
Na, Sodium (wt.%)	0.162	0.025	0.151	0.174	0.157	0.168
Nb, Niobium (ppm)	< 0.5	IND	IND	IND	IND	IND
Ni, Nickel (ppm)	26.3	2.39	25.5	27.1	24.6	28.1
P, Phosphorus (wt.%)	0.032	0.003	0.031	0.034	0.031	0.033
Pb, Lead (wt.%)	2.19	0.060	2.17	2.22	2.14	2.24
S, Sulphur (wt.%)	7.50	0.636	7.06	7.94	7.19	7.81
Sb, Antimony (ppm)	152	26	140	164	145	159
Sc, Scandium (ppm)	2.12	0.202	1.99	2.25	1.99	2.25
Se, Selenium (ppm)	9.19	1.83	7.77	10.61	8.31	10.07
Sn, Tin (ppm)	3.37	0.260	3.16	3.58	3.16	3.59
Sr, Strontium (ppm)	15.6	1.7	14.9	16.3	14.8	16.3
Ta, Tantalum (ppm)	< 0.05	IND	IND	IND	IND	IND
Tb, Terbium (ppm)	0.24	0.04	0.20	0.27	IND	IND
Th, Thorium (ppm)	3.94	0.262	3.74	4.13	3.77	4.11
Ti, Titanium (wt.%)	0.020	0.003	0.018	0.022	0.019	0.021
Tl, Thallium (ppm)	1.90	0.20	1.75	2.04	1.84	1.95
U, Uranium (ppm)	0.91	0.12	0.81	1.00	0.85	0.96
V, Vanadium (ppm)	12.3	1.5	11.6	12.9	IND	IND
W, Tungsten (ppm)	1.19	0.14	1.09	1.30	IND	IND
Y, Yttrium (ppm)	5.92	0.75	5.37	6.46	5.62	6.21
Yb, Ytterbium (ppm)	0.59	0.11	0.49	0.68	IND	IND
Zn, Zinc (wt.%)	10.01	0.258	9.90	10.12	9.81	10.21
Zr, Zirconium (ppm)	48.2	5.0	44.5	51.8	46.5	49.8

Note: intervals may appear asymmetric due to rounding; *determined from RSD of gold INAA data for 30g and 25g analytical subsample weights for gold fire assay and gold aqua regia, respectively.

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 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 622. Indicative

(uncertified) values (Table 2) are provided where i) the number of laboratories reporting a particular analyte is insufficient (< 5) to support certification; ii) inter-laboratory consensus is poor; or iii) a significant proportion of results are outlying.

Table 2. Indicative Values for OREAS 622.

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Fire Assay								
Pd	ppb	*< 5*	Pt	ppb	*< 5*			
Infrared Combustion								
C	wt.%	*0.421*						
Peroxide Fusion ICP								
B	ppm	*33.3*	Hf	ppm	*3.64*	Ta	ppm	*0.71*
Be	ppm	*0.85*	Ho	ppm	*0.43*	Tb	ppm	*0.39*
Dy	ppm	*2.20*	Lu	ppm	*0.21*	Te	ppm	*< 1*
Er	ppm	*1.21*	P	wt.%	*0.040*	Tm	ppm	*0.18*
Eu	ppm	*1.13*	Re	ppm	*< 0.1*	Zr	ppm	*135*
Gd	ppm	*2.57*	Se	ppm	*< 50*			
Ge	ppm	*5.61*	Sm	ppm	*3.00*			
4-Acid Digestion								
B	ppm	*< 1*	Gd	ppm	*2.41*	Pr	ppm	*3.71*
Ba	ppm	*1831*	Ge	ppm	*4.16*	Re	ppb	*< 50*
Dy	ppm	*2.02*	Hg	ppm	*0.90*	Sm	ppm	*2.79*
Er	ppm	*1.14*	Ho	ppm	*0.39*	Tm	ppm	*0.17*
Eu	ppm	*0.96*	Nd	ppm	*14.1*			
3-Acid Digestion (no HF)								
Bi	ppm	*< 10*	Co	ppm	*30.0*	Ni	ppm	*28.3*
Aqua Regia Digestion								
Ba	ppm	*948*	Ho	ppm	*0.28*	Re	ppb	*< 50*
Dy	ppm	*1.45*	Nd	ppm	*11.1*	Sm	ppm	*2.15*
Er	ppm	*0.74*	Pd	ppb	*< 10*	Te	ppm	*0.060*
Eu	ppm	*0.71*	Pr	ppm	*3.07*	Tm	ppm	*0.11*
Gd	ppm	*1.87*	Pt	ppb	*< 5*			
Ge	ppm	*0.14*	Rb	ppm	*10.2*			

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.*

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 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 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 622.

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	1.85	0.066	1.72	1.98	1.65	2.05	3.56%	7.12%	10.68%	1.76	1.94
Infrared Combustion											
S, wt.%	7.95	0.147	7.65	8.24	7.51	8.39	1.85%	3.70%	5.54%	7.55	8.34
Peroxide Fusion ICP											
Ag, ppm	103	10	83	123	73	133	9.73%	19.46%	29.19%	98	108
Al, wt.%	5.83	0.147	5.53	6.12	5.38	6.27	2.53%	5.05%	7.58%	5.53	6.12
As, ppm	110	9	92	128	83	137	8.11%	16.22%	24.33%	105	116
Ba, ppm	2311	56	2200	2423	2144	2479	2.42%	4.84%	7.25%	2196	2427
Bi, ppm	4.96	0.52	3.93	5.99	3.41	6.51	10.41%	20.81%	31.22%	4.71	5.21
Ca, wt.%	2.14	0.107	1.92	2.35	1.82	2.46	5.01%	10.02%	15.03%	2.03	2.24

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
Peroxide Fusion ICP continued											
Cd, ppm	454	14	427	482	413	496	3.05%	6.09%	9.14%	432	477
Ce, ppm	34.8	2.83	29.1	40.5	26.3	43.3	8.14%	16.29%	24.43%	33.1	36.5
Co, ppm	37.7	6.0	25.6	49.8	19.5	55.8	16.04%	32.09%	48.13%	35.8	39.6
Cr, ppm	48.1	5.5	37.0	59.1	31.4	64.7	11.53%	23.07%	34.60%	45.7	50.5
Cs, ppm	1.88	0.26	1.36	2.41	1.10	2.67	13.92%	27.85%	41.77%	1.79	1.98
Cu, wt.%	0.484	0.016	0.453	0.515	0.437	0.530	3.21%	6.43%	9.64%	0.459	0.508
Fe, wt.%	4.26	0.195	3.87	4.65	3.67	4.84	4.57%	9.14%	13.71%	4.05	4.47
Ga, ppm	26.9	1.73	23.4	30.3	21.7	32.0	6.44%	12.87%	19.31%	25.5	28.2
In, ppm	4.85	0.467	3.92	5.79	3.45	6.25	9.61%	19.23%	28.84%	4.61	5.10
K, wt.%	1.78	0.131	1.52	2.05	1.39	2.18	7.37%	14.73%	22.10%	1.69	1.87
La, ppm	18.8	2.4	14.0	23.6	11.6	26.0	12.71%	25.43%	38.14%	17.9	19.7
Li, ppm	9.56	1.40	6.77	12.36	5.37	13.76	14.61%	29.22%	43.83%	9.09	10.04
Mg, wt.%	0.571	0.018	0.536	0.606	0.518	0.623	3.07%	6.13%	9.20%	0.542	0.599
Mn, wt.%	0.061	0.004	0.054	0.069	0.050	0.072	5.93%	11.86%	17.79%	0.058	0.064
Mo, ppm	19.4	0.92	17.6	21.3	16.7	22.2	4.72%	9.44%	14.17%	18.5	20.4
Nb, ppm	6.24	0.90	4.43	8.04	3.52	8.95	14.49%	28.98%	43.48%	5.92	6.55
Nd, ppm	15.7	1.6	12.5	19.0	10.9	20.6	10.30%	20.59%	30.89%	14.9	16.5
Ni, ppm	< 40	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Pb, wt.%	2.11	0.117	1.87	2.34	1.75	2.46	5.56%	11.11%	16.67%	2.00	2.21
Pr, ppm	4.29	0.323	3.65	4.94	3.32	5.26	7.53%	15.05%	22.58%	4.08	4.51
Rb, ppm	58	2.0	54	62	52	64	3.50%	7.01%	10.51%	55	60
S, wt.%	7.68	0.328	7.02	8.33	6.69	8.66	4.28%	8.55%	12.83%	7.29	8.06
Sb, ppm	198	17	164	231	148	248	8.44%	16.87%	25.31%	188	208
Sc, ppm	< 10	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Si, wt.%	25.09	0.825	23.44	26.74	22.61	27.56	3.29%	6.58%	9.87%	23.83	26.34
Sn, ppm	62	8	45	78	37	87	13.54%	27.07%	40.61%	59	65
Sr, ppm	63	8	47	79	39	87	12.52%	25.05%	37.57%	60	66
Th, ppm	5.47	0.282	4.91	6.04	4.63	6.32	5.15%	10.30%	15.45%	5.20	5.75
Ti, wt.%	0.187	0.008	0.172	0.202	0.165	0.210	4.01%	8.01%	12.02%	0.178	0.197
Tl, ppm	3.62	0.42	2.78	4.47	2.35	4.90	11.70%	23.40%	35.10%	3.44	3.80
U, ppm	1.55	0.19	1.17	1.93	0.98	2.12	12.22%	24.44%	36.65%	1.48	1.63
V, ppm	45.4	3.64	38.1	52.6	34.5	56.3	8.02%	16.03%	24.05%	43.1	47.6
W, ppm	2.93	0.253	2.42	3.43	2.17	3.69	8.62%	17.25%	25.87%	2.78	3.08

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
Peroxide Fusion ICP continued											
Y, ppm	12.4	1.04	10.3	14.4	9.2	15.5	8.42%	16.83%	25.25%	11.7	13.0
Yb, ppm	1.17	0.15	0.87	1.47	0.72	1.62	12.80%	25.60%	38.39%	1.11	1.23
Zn, wt.%	9.90	0.391	9.12	10.68	8.73	11.07	3.95%	7.89%	11.84%	9.40	10.39
4-Acid Digestion											
Ag, ppm	102	3	96	109	93	112	3.20%	6.40%	9.59%	97	108
Al, wt.%	5.77	0.291	5.19	6.35	4.89	6.64	5.05%	10.09%	15.14%	5.48	6.06
As, ppm	109	6	98	120	92	126	5.16%	10.32%	15.48%	104	114
Be, ppm	1.05	0.11	0.82	1.27	0.71	1.39	10.72%	21.44%	32.16%	1.00	1.10
Bi, ppm	5.05	0.220	4.61	5.49	4.39	5.71	4.35%	8.71%	13.06%	4.80	5.30
Ca, wt.%	2.14	0.080	1.98	2.29	1.90	2.37	3.73%	7.45%	11.18%	2.03	2.24
Cd, ppm	460	18	423	496	404	515	4.00%	7.99%	11.99%	437	482
Ce, ppm	30.1	3.7	22.7	37.4	19.0	41.1	12.23%	24.47%	36.70%	28.6	31.6
Co, ppm	36.0	3.9	28.1	43.8	24.2	47.7	10.91%	21.81%	32.72%	34.2	37.8
Cr, ppm	33.9	5.9	22.1	45.7	16.2	51.6	17.42%	34.84%	52.26%	32.2	35.6
Cs, ppm	1.72	0.070	1.58	1.86	1.51	1.93	4.06%	8.12%	12.18%	1.64	1.81
Cu, wt.%	0.486	0.008	0.469	0.502	0.461	0.511	1.72%	3.43%	5.15%	0.461	0.510
Fe, wt.%	4.31	0.251	3.81	4.81	3.56	5.06	5.82%	11.64%	17.47%	4.10	4.53
Ga, ppm	24.5	1.08	22.3	26.6	21.3	27.7	4.39%	8.78%	13.17%	23.3	25.7
Hf, ppm	3.25	0.311	2.63	3.87	2.32	4.18	9.56%	19.12%	28.68%	3.09	3.41
In, ppm	4.63	0.229	4.17	5.09	3.94	5.32	4.95%	9.90%	14.85%	4.40	4.86
K, wt.%	1.72	0.130	1.47	1.98	1.34	2.11	7.51%	15.02%	22.53%	1.64	1.81
La, ppm	14.1	2.8	8.6	19.6	5.9	22.4	19.50%	38.99%	58.49%	13.4	14.8
Li, ppm	8.67	0.93	6.81	10.52	5.89	11.45	10.69%	21.38%	32.06%	8.23	9.10
Lu, ppm	0.18	0.009	0.16	0.19	0.15	0.20	5.10%	10.20%	15.30%	0.17	0.18
Mg, wt.%	0.562	0.041	0.480	0.645	0.439	0.686	7.33%	14.67%	22.00%	0.534	0.590
Mn, wt.%	0.060	0.003	0.054	0.066	0.051	0.069	4.80%	9.59%	14.39%	0.057	0.063
Mo, ppm	17.4	1.63	14.2	20.7	12.5	22.3	9.36%	18.72%	28.08%	16.5	18.3
Na, wt.%	0.729	0.054	0.620	0.837	0.566	0.891	7.43%	14.87%	22.30%	0.692	0.765
Nb, ppm	4.62	0.56	3.50	5.74	2.94	6.30	12.11%	24.21%	36.32%	4.39	4.85
Ni, ppm	27.9	2.62	22.7	33.2	20.1	35.8	9.38%	18.75%	28.13%	26.6	29.3
P, wt.%	0.033	0.004	0.025	0.041	0.021	0.045	12.05%	24.11%	36.16%	0.032	0.035
Pb, wt.%	2.21	0.067	2.08	2.35	2.01	2.42	3.03%	6.07%	9.10%	2.10	2.32
Rb, ppm	55	3.7	47	62	44	66	6.72%	13.43%	20.15%	52	57

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											
S, wt.%	7.71	0.201	7.31	8.12	7.11	8.32	2.60%	5.21%	7.81%	7.33	8.10
Sb, ppm	195	13	169	221	156	234	6.64%	13.28%	19.93%	185	205
Sc, ppm	6.82	0.627	5.56	8.07	4.94	8.70	9.19%	18.38%	27.57%	6.48	7.16
Se, ppm	7.81	1.32	5.16	10.46	3.84	11.78	16.96%	33.92%	50.88%	7.42	8.20
Sn, ppm	7.01	1.05	4.91	9.11	3.86	10.16	14.99%	29.98%	44.97%	6.66	7.36
Sr, ppm	52	7	38	66	31	73	13.38%	26.75%	40.13%	49	54
Ta, ppm	0.42	0.09	0.24	0.61	0.14	0.70	22.16%	44.31%	66.47%	0.40	0.44
Tb, ppm	0.32	0.05	0.23	0.42	0.18	0.47	15.31%	30.62%	45.93%	0.31	0.34
Te, ppm	< 0.1	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Th, ppm	4.71	0.55	3.62	5.80	3.07	6.35	11.61%	23.22%	34.83%	4.47	4.95
Ti, wt.%	0.147	0.028	0.092	0.202	0.064	0.229	18.80%	37.61%	56.41%	0.139	0.154
Tl, ppm	3.65	0.42	2.80	4.50	2.38	4.93	11.62%	23.25%	34.87%	3.47	3.83
U, ppm	1.57	0.095	1.38	1.76	1.28	1.86	6.07%	12.14%	18.20%	1.49	1.65
V, ppm	40.0	1.38	37.2	42.8	35.9	44.1	3.45%	6.90%	10.35%	38.0	42.0
W, ppm	2.48	0.28	1.92	3.04	1.64	3.32	11.27%	22.55%	33.82%	2.36	2.61
Y, ppm	9.76	0.634	8.49	11.03	7.86	11.66	6.49%	12.98%	19.47%	9.27	10.25
Yb, ppm	1.11	0.12	0.87	1.34	0.76	1.46	10.56%	21.12%	31.67%	1.05	1.16
Zn, wt.%	10.24	0.182	9.87	10.60	9.69	10.79	1.78%	3.56%	5.34%	9.73	10.75
Zr, ppm	124	5	114	134	109	140	4.12%	8.24%	12.36%	118	130
3-Acid Digestion (no HF)											
Ag, ppm	102	4	94	109	91	113	3.61%	7.23%	10.84%	96	107
As, ppm	106	7	92	119	85	126	6.52%	13.05%	19.57%	100	111
Cu, wt.%	0.481	0.008	0.466	0.497	0.458	0.504	1.61%	3.22%	4.84%	0.457	0.505
Fe, wt.%	4.15	0.077	4.00	4.30	3.92	4.38	1.85%	3.70%	5.55%	3.94	4.36
Mo, ppm	17.1	2.7	11.8	22.5	9.1	25.1	15.57%	31.14%	46.71%	16.3	18.0
Pb, wt.%	2.21	0.051	2.11	2.31	2.06	2.36	2.29%	4.58%	6.88%	2.10	2.32
Zn, wt.%	10.25	0.185	9.88	10.62	9.70	10.80	1.80%	3.61%	5.41%	9.74	10.76
Aqua Regia Digestion											
Ag, ppm	101	4	94	108	90	111	3.48%	6.96%	10.44%	96	106
Al, wt.%	1.75	0.138	1.48	2.03	1.34	2.17	7.89%	15.78%	23.67%	1.67	1.84
As, ppm	106	9	89	123	80	132	8.20%	16.40%	24.60%	101	111
Au, ppm	1.78	0.071	1.64	1.92	1.57	2.00	3.96%	7.93%	11.89%	1.69	1.87
B, ppm	< 10	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND

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											
Be, ppm	0.38	0.06	0.26	0.50	0.20	0.56	15.61%	31.21%	46.82%	0.36	0.40
Bi, ppm	4.81	0.51	3.78	5.83	3.27	6.34	10.66%	21.32%	31.98%	4.57	5.05
Ca, wt.%	1.80	0.081	1.64	1.97	1.56	2.05	4.49%	8.99%	13.48%	1.71	1.89
Cd, ppm	450	25	399	500	374	526	5.61%	11.22%	16.83%	427	472
Ce, ppm	26.6	3.8	19.0	34.2	15.2	38.0	14.33%	28.65%	42.98%	25.3	27.9
Co, ppm	36.2	2.78	30.7	41.8	27.9	44.6	7.68%	15.37%	23.05%	34.4	38.0
Cr, ppm	25.8	1.86	22.1	29.5	20.3	31.4	7.19%	14.37%	21.56%	24.5	27.1
Cs, ppm	0.65	0.08	0.49	0.80	0.41	0.88	12.03%	24.06%	36.09%	0.61	0.68
Cu, wt.%	0.484	0.013	0.458	0.511	0.444	0.524	2.75%	5.50%	8.26%	0.460	0.508
Fe, wt.%	4.05	0.179	3.69	4.40	3.51	4.58	4.42%	8.84%	13.26%	3.84	4.25
Ga, ppm	9.97	0.613	8.74	11.19	8.13	11.80	6.15%	12.30%	18.44%	9.47	10.46
Hf, ppm	1.20	0.20	0.79	1.60	0.59	1.80	16.84%	33.69%	50.53%	1.14	1.26
Hg, ppm	5.37	0.347	4.67	6.06	4.32	6.41	6.47%	12.94%	19.41%	5.10	5.63
In, ppm	4.23	0.201	3.83	4.64	3.63	4.84	4.75%	9.50%	14.25%	4.02	4.44
K, wt.%	0.293	0.042	0.210	0.376	0.169	0.418	14.15%	28.30%	42.46%	0.279	0.308
La, ppm	12.9	1.9	9.2	16.6	7.4	18.5	14.35%	28.70%	43.05%	12.3	13.6
Li, ppm	5.42	0.73	3.97	6.87	3.24	7.60	13.39%	26.78%	40.17%	5.15	5.69
Lu, ppm	0.087	0.015	0.058	0.116	0.043	0.131	16.77%	33.54%	50.31%	0.083	0.091
Mg, wt.%	0.506	0.041	0.424	0.588	0.383	0.629	8.11%	16.21%	24.32%	0.480	0.531
Mn, wt.%	0.057	0.003	0.051	0.063	0.049	0.065	4.92%	9.85%	14.77%	0.054	0.060
Mo, ppm	15.8	1.8	12.3	19.4	10.5	21.2	11.23%	22.46%	33.68%	15.1	16.6
Na, wt.%	0.162	0.025	0.113	0.212	0.088	0.237	15.29%	30.59%	45.88%	0.154	0.171
Nb, ppm	< 0.5	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Ni, ppm	26.3	2.39	21.6	31.1	19.2	33.5	9.06%	18.12%	27.19%	25.0	27.7
P, wt.%	0.032	0.003	0.025	0.039	0.022	0.042	10.61%	21.22%	31.83%	0.030	0.034
Pb, wt.%	2.19	0.060	2.07	2.31	2.01	2.37	2.73%	5.46%	8.19%	2.08	2.30
S, wt.%	7.50	0.636	6.23	8.77	5.59	9.41	8.48%	16.97%	25.45%	7.12	7.87
Sb, ppm	152	26	100	204	74	230	17.17%	34.33%	51.50%	144	160
Sc, ppm	2.12	0.202	1.72	2.52	1.51	2.73	9.54%	19.07%	28.61%	2.01	2.23
Se, ppm	9.19	1.83	5.53	12.86	3.70	14.69	19.93%	39.86%	59.80%	8.73	9.65
Sn, ppm	3.37	0.260	2.85	3.89	2.59	4.15	7.70%	15.40%	23.11%	3.21	3.54
Sr, ppm	15.6	1.7	12.1	19.0	10.4	20.8	11.12%	22.23%	33.35%	14.8	16.3
Ta, ppm	< 0.05	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND

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											
Tb, ppm	0.24	0.04	0.16	0.31	0.12	0.35	16.44%	32.88%	49.32%	0.22	0.25
Th, ppm	3.94	0.262	3.41	4.46	3.15	4.72	6.66%	13.33%	19.99%	3.74	4.13
Ti, wt.%	0.020	0.003	0.014	0.027	0.010	0.030	16.00%	32.00%	48.00%	0.019	0.021
Tl, ppm	1.90	0.20	1.50	2.29	1.31	2.48	10.36%	20.71%	31.07%	1.80	1.99
U, ppm	0.91	0.12	0.67	1.14	0.56	1.25	12.78%	25.56%	38.35%	0.86	0.95
V, ppm	12.3	1.5	9.4	15.2	7.9	16.6	11.85%	23.70%	35.55%	11.7	12.9
W, ppm	1.19	0.14	0.91	1.47	0.77	1.61	11.67%	23.34%	35.02%	1.13	1.25
Y, ppm	5.92	0.75	4.42	7.41	3.68	8.16	12.63%	25.25%	37.88%	5.62	6.21
Yb, ppm	0.59	0.11	0.37	0.80	0.26	0.91	18.68%	37.37%	56.05%	0.56	0.61
Zn, wt.%	10.01	0.258	9.49	10.53	9.24	10.79	2.58%	5.16%	7.74%	9.51	10.51
Zr, ppm	48.2	5.0	38.1	58.2	33.1	63.2	10.42%	20.83%	31.25%	45.8	50.6

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 0.475 and 0.496wt.%. 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 1.0 gram was employed and the 1RSD of 1.94% (or 0.36% at a 30g charge weight) confirms the high level of gold homogeneity in OREAS 622. Au by fire assay is reported by 23 laboratories and the charge weights range from 20-40g. The most common charge weight used in this round robin was 30g (18 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) where the sample catch weights ranged from 15-50g at 17 laboratories.

The homogeneity of OREAS 622 has also been evaluated in an ANOVA study for all certified analytes. This study tests the null hypothesis that no statistically significant difference exists between the *between-unit variance* and the *within-unit variance* (i.e. p-

values <0.05 indicate rejection of the null hypothesis). Of the 148 certified values, no failures were observed indicating no evidence to reject the null hypothesis.
Based on the statistical analysis of the results of the inter-laboratory certification program it can be concluded that OREAS 622 is fit-for-purpose as a certified reference material (see 'Intended Use' below).

PARTICIPATING LABORATORIES

Acme Analytical Laboratories S.A. (BV), Santiago, Chile
Actlabs, Ancaster, Ontario, Canada
ALS, Brisbane, QLD, Australia
ALS, Johannesburg, South Africa
ALS, Lima, Peru
ALS, Loughrea, Galway, Ireland
ALS, Orange, NSW, Australia
ALS, Perth, WA, Australia
ALS, Vancouver, BC, Canada
Bureau Veritas Commodities Canada Ltd, Vancouver, BC, Canada
Bureau Veritas Geoanalytical, Adelaide, SA, Australia
Bureau Veritas Geoanalytical, Perth, WA, Australia
Intertek Genalysis, Adelaide, SA, Australia
Intertek Genalysis, Perth, WA, Australia
Intertek Minerals (IMI), Jakarta, Indonesia
Intertek Testing Services, Cupang, Muntinlupa, Philippines
PT Geoservices Ltd, Cikarang, Jakarta Raya, Indonesia
SGS Australia Mineral Services, Perth (Newburn), WA, Australia
SGS Canada Inc., Vancouver, BC, Canada
SGS del Peru, Lima, Peru
SGS Geosol Laboratorios Ltda, Vespasiano, Minas Gerais, Brazil
SGS Lakefield Research Ltd, Lakefield, Ontario, Canada
SGS Mineral Services, Townsville, QLD, Australia

PREPARER AND SUPPLIER OF THE REFERENCE MATERIAL

Reference material OREAS 622 has been prepared, certified and is supplied by:

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

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It is available in unit sizes of 10g and 60g (single-use laminated foil pouches sealed under nitrogen).

INTENDED USE

OREAS 622 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 622 has been prepared from Zn and Cu VHMS ores sourced from the Gossan Hill deposit at Golden Grove and blended with argillic altered rhyodacite waste rock. It contains reactive sulphide (7.95% 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 622 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 15-50g.

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.

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

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