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CERTIFICATE OF ANALYSIS FOR

PORPHYRY COPPER-GOLD-MOLYBDENUM REFERENCE MATERIAL

OREAS 502c

Summary Statistics for Key Analytes.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Fire Assay						
Au, Gold (ppm)	0.488	0.015	0.483	0.492	0.482*	0.494*
4-Acid Digestion						
Ag, Silver (ppm)	0.779	0.076	0.742	0.816	0.743	0.815
Cu, Copper (wt.%)	0.783	0.022	0.775	0.790	0.773	0.793
Mo, Molybdenum (ppm)	226	12	222	231	222	231

Note: intervals may appear asymmetric due to rounding; *Tolerance Limits are calculated for a 30g sample weight from 20 x INAA analyses on 1g subsamples using the reduced analytical subsample method which utilises the known relationship between SD and sample weight (Ingamells and Switzer, 1973).

Table 1. Fire Assay - Certified Values, SDs, 95% Confidence & Tolerance Limits for OREAS 502c.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Au, Gold (ppm)	0.488	0.015	0.483	0.492	0.482*	0.494*

Note: intervals may appear asymmetric due to rounding; *determined from RSD of gold INAA data for 30g analytical subsample weight.

Table 2. 4-Acid Digest - Certified Values, SDs, 95% Confidence & Tolerance Limits for OREAS 502c.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Ag, Silver (ppm)	0.779	0.076	0.742	0.816	0.743	0.815
Al, Aluminium (wt.%)	7.37	0.459	7.20	7.53	7.25	7.49
As, Arsenic (ppm)	57	4.0	56	59	55	60
Ba, Barium (ppm)	1028	49	1009	1047	1005	1051
Be, Beryllium (ppm)	2.75	0.191	2.67	2.82	2.65	2.85
Bi, Bismuth (ppm)	0.67	0.040	0.65	0.69	0.64	0.70
Ca, Calcium (wt.%)	2.61	0.149	2.55	2.66	2.55	2.67
Cd, Cadmium (ppm)	0.35	0.04	0.32	0.37	0.32	0.38
Ce, Cerium (ppm)	67	3.0	66	69	65	69
Co, Cobalt (ppm)	14.4	0.60	14.1	14.6	13.9	14.8
Cr, Chromium (ppm)	68	5.1	66	70	65	70
Cs, Cesium (ppm)	10.8	0.38	10.6	11.0	10.5	11.1
Cu, Copper (wt.%)	0.783	0.022	0.775	0.790	0.773	0.793
Dy, Dysprosium (ppm)	4.45	0.319	4.23	4.68	4.29	4.62
Er, Erbium (ppm)	2.49	0.147	2.39	2.60	2.40	2.59
Eu, Europium (ppm)	1.36	0.14	1.25	1.47	1.29	1.42
Fe, Iron (wt.%)	4.92	0.222	4.84	4.99	4.83	5.00
Ga, Gallium (ppm)	18.5	0.63	18.3	18.8	18.1	19.0
Gd, Gadolinium (ppm)	4.94	0.492	4.61	5.27	4.75	5.14
Hf, Hafnium (ppm)	2.48	0.135	2.42	2.53	2.36	2.59
Ho, Holmium (ppm)	0.88	0.041	0.85	0.91	0.83	0.93
In, Indium (ppm)	0.089	0.004	0.088	0.091	0.084	0.095
K, Potassium (wt.%)	3.17	0.156	3.11	3.23	3.10	3.24
La, Lanthanum (ppm)	33.1	2.32	32.3	33.9	32.0	34.2
Li, Lithium (ppm)	32.2	1.85	31.6	32.8	31.1	33.3
Lu, Lutetium (ppm)	0.35	0.020	0.34	0.36	0.33	0.38
Mg, Magnesium (wt.%)	1.50	0.088	1.47	1.53	1.47	1.53
Mn, Manganese (wt.%)	0.053	0.003	0.052	0.054	0.052	0.054
Mo, Molybdenum (ppm)	226	12	222	231	222	231
Na, Sodium (wt.%)	1.98	0.093	1.95	2.02	1.94	2.02
Nb, Niobium (ppm)	17.5	0.97	17.0	17.9	17.0	18.0
Nd, Neodymium (ppm)	29.4	1.66	28.2	30.6	28.5	30.4
Ni, Nickel (ppm)	38.1	2.77	37.2	39.0	36.9	39.3
P, Phosphorus (wt.%)	0.099	0.005	0.097	0.101	0.096	0.101
Pb, Lead (ppm)	23.5	1.46	22.9	24.0	22.6	24.4
Pr, Praseodymium (ppm)	7.66	0.263	7.48	7.83	7.43	7.88
Rb, Rubidium (ppm)	187	8	184	190	182	192

Note: intervals may appear asymmetric due to rounding.

Table 2. 4-Acid Digest continued.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Re, Rhenium (ppb)	4.54	0.68	4.23	4.86	IND	IND
S, Sulphur (wt.%)	0.826	0.040	0.811	0.841	0.806	0.846
Sb, Antimony (ppm)	6.37	0.378	6.23	6.52	6.17	6.57
Sc, Scandium (ppm)	12.9	1.3	12.3	13.5	12.5	13.3
Se, Selenium (ppm)	3.40	0.70	3.14	3.66	3.12	3.68
Sm, Samarium (ppm)	5.58	0.312	5.36	5.79	5.34	5.81
Sn, Tin (ppm)	3.40	0.125	3.37	3.43	3.23	3.57
Sr, Strontium (ppm)	327	12	323	331	319	336
Ta, Tantalum (ppm)	1.24	0.115	1.17	1.30	1.18	1.29
Tb, Terbium (ppm)	0.76	0.043	0.74	0.79	0.73	0.80
Te, Tellurium (ppm)	0.46	0.05	0.44	0.48	0.42	0.49
Th, Thorium (ppm)	17.6	1.39	17.1	18.2	17.0	18.3
Ti, Titanium (wt.%)	0.460	0.023	0.451	0.469	0.452	0.468
Tl, Thallium (ppm)	0.90	0.066	0.87	0.93	0.87	0.92
Tm, Thulium (ppm)	0.35	0.024	0.33	0.37	0.33	0.37
U, Uranium (ppm)	4.82	0.436	4.65	5.00	4.62	5.03
V, Vanadium (ppm)	120	6	118	122	117	123
W, Tungsten (ppm)	4.53	0.46	4.42	4.64	4.11	4.95
Y, Yttrium (ppm)	24.1	1.45	23.5	24.6	23.4	24.8
Yb, Ytterbium (ppm)	2.31	0.27	2.16	2.46	2.22	2.40
Zn, Zinc (ppm)	109	5	107	111	105	112
Zr, Zirconium (ppm)	78	6.3	76	81	76	81

Note: intervals may appear asymmetric due to rounding.

Table 3. Aqua Regia Digest - Certified Values, SDs, 95% Confidence & Tolerance Limits for OREAS 502c.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Ag, Silver (ppm)	0.796	0.053	0.767	0.825	0.758	0.834
Al, Aluminium (wt.%)	2.07	0.107	2.02	2.11	2.01	2.13
As, Arsenic (ppm)	59	3.5	57	60	56	61
Au, Gold (ppm)	0.477	0.018	0.470	0.485	0.471^	0.484^
Ba, Barium (ppm)	383	58	355	411	367	400
Be, Beryllium (ppm)	0.53	0.07	0.47	0.59	0.49	0.57
Bi, Bismuth (ppm)	0.68	0.037	0.66	0.70	0.65	0.71
Ca, Calcium (wt.%)	1.09	0.067	1.06	1.12	1.06	1.12
Ce, Cerium (ppm)	59	3.2	58	61	58	61
Co, Cobalt (ppm)	13.5	0.48	13.3	13.7	13.2	13.9
Cr, Chromium (ppm)	66	4.1	64	68	64	68
Cs, Cesium (ppm)	9.02	0.435	8.81	9.23	8.79	9.24
Cu, Copper (wt.%)	0.779	0.017	0.774	0.785	0.766	0.793
Dy, Dysprosium (ppm)	3.19	0.245	2.92	3.45	3.06	3.31
Er, Erbium (ppm)	1.66	0.25	1.32	2.00	1.59	1.73
Fe, Iron (wt.%)	4.45	0.169	4.38	4.52	4.37	4.52

^determined from RSD of gold INAA data for 25g analytical subsample weight.

Note: intervals may appear asymmetric due to rounding.

Table 3. Aqua Regia Digest continued.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Ga, Gallium (ppm)	8.67	0.567	8.38	8.95	8.38	8.96
Gd, Gadolinium (ppm)	3.82	0.43	3.39	4.25	3.71	3.93
Hf, Hafnium (ppm)	0.41	0.022	0.39	0.42	0.38	0.43
Ho, Holmium (ppm)	0.60	0.08	0.50	0.71	0.58	0.62
In, Indium (ppm)	0.061	0.005	0.057	0.066	0.058	0.065
K, Potassium (wt.%)	1.07	0.054	1.05	1.10	1.05	1.10
La, Lanthanum (ppm)	29.4	2.38	28.3	30.5	28.7	30.1
Li, Lithium (ppm)	30.9	1.45	30.3	31.5	30.2	31.7
Lu, Lutetium (ppm)	0.22	0.011	0.21	0.23	0.21	0.23
Mg, Magnesium (wt.%)	1.21	0.041	1.20	1.23	1.19	1.24
Mn, Manganese (wt.%)	0.038	0.002	0.038	0.039	0.037	0.040
Mo, Molybdenum (ppm)	223	12	218	228	218	228
Na, Sodium (wt.%)	0.192	0.021	0.181	0.202	0.181	0.202
Nd, Neodymium (ppm)	23.2	2.22	20.8	25.7	22.4	24.1
Ni, Nickel (ppm)	36.4	2.27	35.5	37.2	35.1	37.6
P, Phosphorus (wt.%)	0.096	0.004	0.094	0.098	0.093	0.098
Pb, Lead (ppm)	11.1	0.90	10.7	11.5	10.6	11.5
Pr, Praseodymium (ppm)	6.63	0.80	5.82	7.43	6.48	6.77
Rb, Rubidium (ppm)	124	5	122	127	121	127
Re, Rhenium (ppb)	3.50	0.59	3.28	3.73	IND	IND
S, Sulphur (wt.%)	0.821	0.040	0.803	0.839	0.804	0.839
Sb, Antimony (ppm)	4.78	0.91	4.35	5.21	4.55	5.01
Sc, Scandium (ppm)	7.28	0.531	7.05	7.51	7.07	7.48
Sm, Samarium (ppm)	4.34	0.211	4.08	4.60	4.21	4.47
Sn, Tin (ppm)	2.71	0.220	2.59	2.83	2.57	2.85
Sr, Strontium (ppm)	66	5.7	64	69	64	69
Ta, Tantalum (ppm)	0.009	0.002	0.008	0.010	IND	IND
Tb, Terbium (ppm)	0.58	0.030	0.55	0.61	0.55	0.60
Te, Tellurium (ppm)	0.47	0.05	0.45	0.49	0.43	0.51
Th, Thorium (ppm)	17.6	0.91	17.1	18.0	16.9	18.2
Ti, Titanium (wt.%)	0.340	0.012	0.335	0.345	0.331	0.350
Tl, Thallium (ppm)	0.67	0.053	0.64	0.70	0.64	0.70
U, Uranium (ppm)	4.53	0.327	4.37	4.68	4.31	4.74
V, Vanadium (ppm)	110	4	109	112	108	113
W, Tungsten (ppm)	2.98	0.49	2.75	3.21	2.79	3.17
Y, Yttrium (ppm)	16.1	0.94	15.6	16.6	15.7	16.5
Yb, Ytterbium (ppm)	1.51	0.053	1.48	1.54	1.46	1.56
Zn, Zinc (ppm)	102	5	100	104	99	106
Zr, Zirconium (ppm)	9.53	0.499	9.28	9.79	9.08	9.99

Note: intervals may appear asymmetric due to rounding.

Table 4. Copper Solubility in 5% H2SO4 Leach - Certified Values, SDs, 95% Confidence & Tolerance Limits for OREAS 502c.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Cu-Sol, wt.%	0.322	0.022	0.303	0.341	0.310	0.333

Table 5. Indicative Values for OREAS 502c.

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Fire Assay								
Pd	ppb	*< 5*	Pt	ppb	*< 5*			
4-Acid Digestion								
B	ppm	*< 20*	Ir	ppm	*< 0.01*	Rh	ppm	*0.55*
Ge	ppm	*0.20*	Pd	wt.%	*< 10*	Ru	ppm	*0.020*
Hg	ppm	*0.036*	Pt	ppb	*< 10*			
Aqua Regia Digestion								
B	ppm	*< 10*	Hg	ppm	*0.045*	Rh	ppm	*0.12*
Cd	ppm	*0.29*	Nb	ppm	*1.24*	Se	ppm	*3.08*
Eu	ppm	*0.43*	Pd	ppb	*< 10*	Tm	ppm	*0.23*
Ge	ppm	*0.19*	Pt	ppb	*< 5*			
Laser Ablation ICP-MS								
Ag	ppm	*0.850*	Hf	ppm	*7.12*	Sm	ppm	*6.16*
As	ppm	*56*	Ho	ppm	*0.93*	Sn	ppm	*4.10*
Ba	ppm	*1075*	In	ppm	*0.10*	Sr	ppm	*317*
Be	ppm	*2.50*	La	ppm	*35.4*	Ta	ppm	*1.34*
Bi	ppm	*0.67*	Lu	ppm	*0.41*	Tb	ppm	*0.77*
Cd	ppm	*0.40*	Mn	wt.%	*0.057*	Te	ppm	*0.40*
Ce	ppm	*65*	Mo	ppm	*231*	Th	ppm	*17.6*
Co	ppm	*14.6*	Nb	ppm	*17.3*	Ti	wt.%	*0.472*
Cr	ppm	*91*	Nd	ppm	*29.1*	Tl	ppm	*0.90*
Cs	ppm	*10.9*	Ni	ppm	*41.0*	Tm	ppm	*0.35*
Cu	wt.%	*0.751*	Pb	ppm	*23.5*	U	ppm	*5.03*
Dy	ppm	*4.46*	Pr	ppm	*8.08*	V	ppm	*129*
Er	ppm	*2.61*	Rb	ppm	*188*	W	ppm	*4.75*
Eu	ppm	*1.24*	Re	ppb	*12.5*	Y	ppm	*25.7*
Ga	ppm	*18.0*	Sb	ppm	*5.65*	Yb	ppm	*2.63*
Gd	ppm	*4.96*	Sc	ppm	*11.8*	Zn	ppm	*95*
Ge	ppm	*1.53*	Se	ppm	*< 5*	Zr	ppm	*246*
Borate Fusion XRF								
Al_2O_3	wt.%	*14.50*	MgO	wt.%	*2.59*	SiO_2	wt.%	*61.38*
CaO	wt.%	*3.79*	MnO	wt.%	*0.070*	TiO_2	wt.%	*0.780*
Cl	ppm	*115*	Na_2O	wt.%	*2.70*	Zn	ppm	*110*
Cu	wt.%	*0.778*	Ni	ppm	*40.0*	ZrO_2	ppm	*335*
Fe_2O_3	wt.%	*7.10*	P	wt.%	*0.101*			
K_2O	wt.%	*3.87*	S	wt.%	*0.804*			
Thermogravimetry								
LOI^{1000}	wt.%	*1.43*						

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.

OREAS reference materials enable users to successfully achieve process control of these tasks because the observed variance from repeated analysis has its origin almost exclusively in the analytical process rather than the reference material itself.

SOURCE MATERIALS

OREAS 502c was prepared from a blend of porphyry copper-gold ore, barren granodiorite and a minor quantity of Cu-Mo concentrate. The ore was sourced from the Ridgeway underground mine located in the Cadia Valley Operations (CVO) situated in central western New South Wales, Australia. The barren I-type hornblende-bearing granodiorite was sourced from the Late Devonian Lysterfield granodiorite complex located in eastern Melbourne, Australia.

Mineralisation in the CVO region is hosted by a sequence of late Ordovician to Early Silurian volcanics, intrusives and sediments that occur within the Bogan Gate Synclinorial Zone of the Lachlan Fold Belt. The western portion of this zone is dominated by volcanics and host to the Late Ordovician Goonumbla porphyry copper-gold deposits. These volcanics are interpreted to have erupted from shallow water to partly emergent volcanic centres and show a broad range in composition from shoshonite through to latite to trachyte. Coeval sub-volcanic quartz monzonite porphyries (and attendant mineralisation) have intruded the volcanics. They are generally small, sub-vertical, pipe-like intrusives. Typically the mineralised porphyries contain plagioclase and quartz phenocrysts in a matrix of fine-grained potassium feldspar and quartz with minor biotite and hornblende.

Copper-gold mineralisation occurs as stockwork quartz veins and disseminations associated with potassic alteration. This alteration is intimately associated spatially and temporally with the small finger-like quartz monzonite porphyries that intrude the Goonumbla Volcanics. Sulphides are zoned laterally from the centres of mineralisation. The central portions are bornite-rich with minor chalcopyrite, zoning outward through equal concentrations of bornite and chalcopyrite, to an outermost chalcopyrite-rich zone. Pyrite increases outward at the expense of bornite.

COMMINUTION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 502c was prepared in the following manner:

- Drying to constant mass at 105°C;
- Multi-stage milling of ore and concentrate to 100% minus 30 microns;
- Milling of barren granodiorite to 98% minus 75 microns;

- Combining ore, granodiorite and concentrate in appropriate proportions to achieve target grades;
- Homogenisation;
- Packaging into 10 and 60g units in laminated foil pouches and 1kg units in plastic jars.

ANALYTICAL PROGRAM

Thirty five commercial analytical laboratories participated in the program to characterise the elements reported in Tables 1 to 5. The following methods were employed:

- Gold via 25-40g fire assay with AAS (18 labs) or ICP-OES (12 labs) finish;
- Instrumental neutron activation analysis for Au on 1g subsamples to confirm homogeneity (1 laboratory);
- Gold via 15-50g aqua regia digestion with ICP-MS (13 labs), ICP-OES (2 labs) or AAS (6 labs) finish;
- Aqua regia digestion for full elemental suite ICP-OES and ICP-MS (25 laboratories depending on the element). 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;
- 4-Acid digestion for full elemental suite ICP-OES and ICP-MS (30 laboratories);
- Copper solubility by Sulphuric acid leach with AAS finish (10 labs) employing the following specified methodology:

  Steps -
  - Weigh 1.0 g of sample;
  - Add 50.0 mL of 5% H_2SO_4 acid to a flask;
  - Agitate the flask with solution (in automatic shaker) at room temperature for 60 minutes;
  - Filter the solution using filter paper (do not centrifuge);
  - Analyse copper content in the filtrate (may be diluted to volume with water and mixed) by AAS.

The approximate major and trace element composition of OREAS 152b is provided in Table 5 (indicative values).

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 100g 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. Tables 1-4 present the certified values together with their associated 1SD's, 95% confidence and tolerance limits and Table 5 shows 89 indicative values for major and trace element composition. Gold homogeneity has been evaluated and confirmed by instrumental neutron activation analysis (INAA) on twenty ~1 gram sample portions (see Table 6) and by a nested ANOVA program for both fire assay and aqua regia digestion (see '**nested ANOVA**' section). Tables 7-9 provide 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 percent deviation of lab means from the corrected mean of means (PDM^3) are presented in the detailed certification data for this CRM (**OREAS 502c DataPack-2.0.180524_102108.xlsx**).

STATISTICAL ANALYSIS

Certified Values, Confidence Limits, Standard Deviations and Tolerance Limits (Tables 1 to 4) 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 6) 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 502c.

Indicative (uncertified) values (Table 5) are provided for the major and trace elements determined by borate fusion XRF (Al_2O_3 to ZrO_2) 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.

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 1-4 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's 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 SD values thus include all sources of measurement uncertainty: between-lab variance, within-run variance (precision errors) and CRM variability. 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.

Tables 7-9 show **Performance Gates** calculated for two and three standard deviations. As a guide these intervals may be regarded as warning or rejection for multiple 2SD outliers, or rejection for individual 3SD outliers in QC monitoring, although their precise application should be at the discretion of the QC manager concerned. A second method utilises a 5% window calculated directly from the certified value. Standard deviation is also shown in relative percent for one, two and three relative standard deviations (1RSD, 2RSD and 3RSD) to facilitate an appreciation of the magnitude of these numbers and a comparison with the 5% window. Caution should be exercised when concentration levels approach lower limits of detection of the analytical methods employed as performance gates calculated from standard deviations tend to be excessively wide whereas those determined by the 5% method are too narrow.

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 ($1-\alpha=0.99$) at least 95% of subsamples ($\rho=0.95$) will have concentrations lying between 0.773 and 0.793 wt.%. 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 the tolerance has 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 gram was employed and a 1RSD of 0.391% can be calculated for a typical 30g fire assay or aqua regia sample analysis (based on the 2.08% RSD by INAA at 1g weights). This confirms the high level of gold homogeneity in OREAS 502c. The homogeneity is of a level such that ***sampling error is minor*** for a conventional fire assay or aqua regia determination.

Table 6. Neutron Activation Analysis of Au (ppm) on 20 x 1g subsamples.

Replicate No	Au ppm
1	0.496
2	0.465
3	0.478
4	0.480
5	0.484
6	0.486
7	0.467
8	0.484
9	0.482
10	0.499
11	0.473
12	0.480
13	0.468
14	0.486
15	0.487
16	0.495
17	0.469
18	0.474
19	0.494
20	0.483
Mean	0.482
Median	0.483
Std Dev.	0.010
Rel.Std.Dev.	2.08%
PDM[3]	-1.30%

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 gold homogeneity of OREAS 502c has also been evaluated in a **nested ANOVA** of the round robin program. Each of the thirty 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 502c. The test was performed using the following parameters:

- Gold fire assay – 164 samples (28 accepted laboratories each providing analyses on 3 pairs of samples);
- Gold aqua regia digestion – 107 samples (18 accepted 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 0.80 for Au by fire assay and 0.99 for Au by aqua regia digestion. Both *p*-values are insignificant and the Null Hypothesis is retained. Additionally, none of the other 116 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 502c 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 502c is fit-for-purpose as a certified reference material (see 'Intended Use' below).

Table 7. Fire Assay - Performance Gates for OREAS 502c.

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
Au, ppm	0.488	0.015	0.458	0.517	0.444	0.532	3.02%	6.03%	9.05%	0.463	0.512

Note: intervals may appear asymmetric due to rounding.

Table 8. 4-Acid Digestion - Performance Gates for OREAS 502c.

Constituent	Certified Value	Absolute Standard Deviations					Relative Standard Deviations			5% window	
		1SD	2SD Low	2SD High	3SD Low	3SD High	1RSD	2RSD	3RSD	Low	High
Ag, ppm	0.779	0.076	0.628	0.931	0.552	1.006	9.73%	19.45%	29.18%	0.740	0.818
Al, wt.%	7.37	0.459	6.45	8.29	5.99	8.75	6.23%	12.46%	18.69%	7.00	7.74
As, ppm	57	4.0	49	65	45	69	6.95%	13.89%	20.84%	54	60
Ba, ppm	1028	49	930	1126	881	1175	4.76%	9.51%	14.27%	977	1079
Be, ppm	2.75	0.191	2.37	3.13	2.17	3.32	6.95%	13.90%	20.85%	2.61	2.88
Bi, ppm	0.67	0.040	0.59	0.75	0.55	0.79	6.04%	12.08%	18.13%	0.64	0.70
Ca, wt.%	2.61	0.149	2.31	2.91	2.16	3.05	5.73%	11.46%	17.19%	2.48	2.74
Cd, ppm	0.35	0.04	0.27	0.43	0.22	0.47	11.79%	23.58%	35.37%	0.33	0.37

Note: intervals may appear asymmetric due to rounding.

Table 8. 4-Acid Digestion - Performance Gates for OREAS 502c 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
Ce, ppm	67	3.0	61	73	58	76	4.51%	9.03%	13.54%	64	71
Co, ppm	14.4	0.60	13.2	15.6	12.6	16.2	4.17%	8.34%	12.51%	13.7	15.1
Cr, ppm	68	5.1	57	78	52	83	7.50%	15.00%	22.49%	64	71
Cs, ppm	10.8	0.38	10.1	11.6	9.7	11.9	3.48%	6.95%	10.43%	10.3	11.3
Cu, wt.%	0.783	0.022	0.739	0.826	0.718	0.847	2.76%	5.52%	8.28%	0.744	0.822
Dy, ppm	4.45	0.319	3.82	5.09	3.50	5.41	7.17%	14.33%	21.50%	4.23	4.68
Er, ppm	2.49	0.147	2.20	2.79	2.05	2.93	5.88%	11.75%	17.63%	2.37	2.62
Eu, ppm	1.36	0.14	1.08	1.63	0.95	1.77	10.06%	20.11%	30.17%	1.29	1.43
Fe, wt.%	4.92	0.222	4.47	5.36	4.25	5.58	4.52%	9.03%	13.55%	4.67	5.16
Ga, ppm	18.5	0.63	17.3	19.8	16.7	20.4	3.39%	6.77%	10.16%	17.6	19.5
Gd, ppm	4.94	0.492	3.96	5.93	3.47	6.42	9.94%	19.89%	29.83%	4.70	5.19
Hf, ppm	2.48	0.135	2.21	2.75	2.07	2.88	5.45%	10.91%	16.36%	2.35	2.60
Ho, ppm	0.88	0.041	0.80	0.96	0.76	1.00	4.68%	9.36%	14.04%	0.84	0.92
In, ppm	0.089	0.004	0.081	0.098	0.077	0.102	4.66%	9.33%	13.99%	0.085	0.094
K, wt.%	3.17	0.156	2.86	3.48	2.70	3.64	4.93%	9.85%	14.78%	3.01	3.33
La, ppm	33.1	2.32	28.5	37.7	26.1	40.0	7.00%	14.01%	21.01%	31.4	34.7
Li, ppm	32.2	1.85	28.5	35.9	26.6	37.7	5.74%	11.48%	17.22%	30.6	33.8
Lu, ppm	0.35	0.020	0.31	0.39	0.29	0.41	5.70%	11.40%	17.10%	0.33	0.37
Mg, wt.%	1.50	0.088	1.32	1.67	1.23	1.76	5.87%	11.73%	17.60%	1.42	1.57
Mn, wt.%	0.053	0.003	0.047	0.059	0.044	0.062	5.55%	11.11%	16.66%	0.050	0.056
Mo, ppm	226	12	202	251	190	263	5.42%	10.84%	16.27%	215	238
Na, wt.%	1.98	0.093	1.79	2.17	1.70	2.26	4.71%	9.42%	14.14%	1.88	2.08
Nb, ppm	17.5	0.97	15.5	19.4	14.5	20.4	5.56%	11.11%	16.67%	16.6	18.3
Nd, ppm	29.4	1.66	26.1	32.7	24.4	34.4	5.66%	11.32%	16.98%	27.9	30.9
Ni, ppm	38.1	2.77	32.6	43.6	29.8	46.4	7.26%	14.53%	21.79%	36.2	40.0
P, wt.%	0.099	0.005	0.089	0.109	0.084	0.114	5.13%	10.25%	15.38%	0.094	0.104
Pb, ppm	23.5	1.46	20.6	26.4	19.1	27.9	6.24%	12.47%	18.71%	22.3	24.7
Pr, ppm	7.66	0.263	7.13	8.18	6.87	8.45	3.44%	6.88%	10.32%	7.27	8.04
Rb, ppm	187	8	171	203	163	211	4.34%	8.68%	13.02%	178	196
Re, ppb	4.54	0.68	3.18	5.91	2.49	6.59	15.04%	30.07%	45.11%	4.31	4.77
S, wt.%	0.826	0.040	0.746	0.906	0.707	0.946	4.82%	9.64%	14.46%	0.785	0.867
Sb, ppm	6.37	0.378	5.62	7.13	5.24	7.50	5.93%	11.85%	17.78%	6.05	6.69
Sc, ppm	12.9	1.3	10.2	15.5	8.9	16.9	10.29%	20.57%	30.86%	12.2	13.5
Se, ppm	3.40	0.70	2.01	4.79	1.31	5.49	20.49%	40.97%	61.46%	3.23	3.57
Sm, ppm	5.58	0.312	4.95	6.20	4.64	6.52	5.60%	11.20%	16.81%	5.30	5.86
Sn, ppm	3.40	0.125	3.15	3.65	3.02	3.77	3.67%	7.34%	11.01%	3.23	3.57
Sr, ppm	327	12	303	352	291	364	3.73%	7.46%	11.19%	311	344
Ta, ppm	1.24	0.115	1.01	1.47	0.89	1.58	9.27%	18.53%	27.80%	1.18	1.30

Note: intervals may appear asymmetric due to rounding.

Table 8. 4-Acid Digestion - Performance Gates for OREAS 502c 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
Tb, ppm	0.76	0.043	0.68	0.85	0.63	0.89	5.59%	11.18%	16.77%	0.72	0.80
Te, ppm	0.46	0.05	0.37	0.55	0.32	0.60	10.09%	20.17%	30.26%	0.44	0.48
Th, ppm	17.6	1.39	14.9	20.4	13.5	21.8	7.87%	15.73%	23.60%	16.7	18.5
Ti, wt.%	0.460	0.023	0.414	0.506	0.392	0.528	4.96%	9.91%	14.87%	0.437	0.483
Tl, ppm	0.90	0.066	0.77	1.03	0.70	1.10	7.38%	14.75%	22.13%	0.85	0.94
Tm, ppm	0.35	0.024	0.30	0.40	0.28	0.42	6.78%	13.55%	20.33%	0.33	0.37
U, ppm	4.82	0.436	3.95	5.69	3.52	6.13	9.03%	18.07%	27.10%	4.58	5.06
V, ppm	120	6	108	132	103	138	4.86%	9.72%	14.58%	114	126
W, ppm	4.53	0.46	3.62	5.44	3.16	5.90	10.07%	20.14%	30.21%	4.30	4.76
Y, ppm	24.1	1.45	21.1	27.0	19.7	28.4	6.04%	12.09%	18.13%	22.9	25.3
Yb, ppm	2.31	0.27	1.78	2.84	1.51	3.11	11.54%	23.08%	34.62%	2.19	2.43
Zn, ppm	109	5	98	119	93	124	4.84%	9.67%	14.51%	103	114
Zr, ppm	78	6.3	66	91	59	97	8.05%	16.11%	24.16%	74	82

Note: intervals may appear asymmetric due to rounding.

Table 9. Aqua Regia Digestion - Performance Gates for OREAS 502c.

Constituent	Certified Value	Absolute Standard Deviations					Relative Standard Deviations			5% window	
		1SD	2SD Low	2SD High	3SD Low	3SD High	1RSD	2RSD	3RSD	Low	High
Ag, ppm	0.796	0.053	0.689	0.903	0.636	0.956	6.71%	13.43%	20.14%	0.756	0.836
Al, wt.%	2.07	0.107	1.85	2.28	1.75	2.39	5.20%	10.40%	15.59%	1.96	2.17
As, ppm	59	3.5	52	66	48	69	5.91%	11.82%	17.73%	56	62
Au, ppm	0.477	0.018	0.441	0.513	0.423	0.531	3.76%	7.52%	11.28%	0.453	0.501
Ba, ppm	383	58	267	500	209	558	15.18%	30.37%	45.55%	364	402
Be, ppm	0.53	0.07	0.39	0.67	0.33	0.73	12.84%	25.68%	38.53%	0.50	0.56
Bi, ppm	0.68	0.037	0.60	0.75	0.56	0.79	5.50%	11.00%	16.50%	0.64	0.71
Ca, wt.%	1.09	0.067	0.95	1.22	0.89	1.29	6.12%	12.25%	18.37%	1.03	1.14
Ce, ppm	59	3.2	53	66	50	69	5.45%	10.90%	16.34%	56	62
Co, ppm	13.5	0.48	12.5	14.5	12.1	14.9	3.54%	7.09%	10.63%	12.8	14.2
Cr, ppm	66	4.1	58	74	54	79	6.24%	12.49%	18.73%	63	70
Cs, ppm	9.02	0.435	8.15	9.89	7.71	10.32	4.82%	9.64%	14.46%	8.57	9.47
Cu, wt.%	0.779	0.017	0.745	0.814	0.728	0.831	2.21%	4.43%	6.64%	0.740	0.818
Dy, ppm	3.19	0.245	2.70	3.68	2.45	3.92	7.68%	15.36%	23.04%	3.03	3.35
Er, ppm	1.66	0.25	1.16	2.16	0.90	2.41	15.15%	30.31%	45.46%	1.57	1.74
Fe, wt.%	4.45	0.169	4.11	4.79	3.94	4.96	3.80%	7.59%	11.39%	4.23	4.67
Ga, ppm	8.67	0.567	7.53	9.80	6.97	10.37	6.54%	13.08%	19.62%	8.23	9.10
Gd, ppm	3.82	0.43	2.96	4.68	2.53	5.11	11.29%	22.57%	33.86%	3.63	4.01
Hf, ppm	0.41	0.022	0.36	0.45	0.34	0.47	5.41%	10.81%	16.22%	0.39	0.43
Ho, ppm	0.60	0.08	0.45	0.76	0.37	0.83	12.91%	25.82%	38.73%	0.57	0.63
In, ppm	0.061	0.005	0.051	0.072	0.045	0.077	8.72%	17.44%	26.16%	0.058	0.064

Note: intervals may appear asymmetric due to rounding.

Table 9. Aqua Regia Digestion - Performance Gates for OREAS 502c 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
K, wt.%	1.07	0.054	0.96	1.18	0.91	1.23	5.06%	10.13%	15.19%	1.02	1.13
La, ppm	29.4	2.38	24.6	34.2	22.2	36.5	8.10%	16.21%	24.31%	27.9	30.9
Li, ppm	30.9	1.45	28.0	33.8	26.6	35.3	4.69%	9.37%	14.06%	29.4	32.5
Lu, ppm	0.22	0.011	0.20	0.24	0.19	0.26	5.14%	10.28%	15.41%	0.21	0.23
Mg, wt.%	1.21	0.041	1.13	1.30	1.09	1.34	3.40%	6.80%	10.20%	1.15	1.28
Mn, wt.%	0.038	0.002	0.035	0.042	0.033	0.044	5.07%	10.15%	15.22%	0.036	0.040
Mo, ppm	223	12	199	246	187	258	5.28%	10.55%	15.83%	212	234
Na, wt.%	0.192	0.021	0.150	0.233	0.130	0.253	10.72%	21.43%	32.15%	0.182	0.201
Nd, ppm	23.2	2.22	18.8	27.7	16.6	29.9	9.55%	19.09%	28.64%	22.1	24.4
Ni, ppm	36.4	2.27	31.8	40.9	29.5	43.2	6.25%	12.50%	18.75%	34.5	38.2
P, wt.%	0.096	0.004	0.088	0.104	0.084	0.108	4.16%	8.31%	12.47%	0.091	0.101
Pb, ppm	11.1	0.90	9.3	12.9	8.4	13.8	8.14%	16.28%	24.42%	10.5	11.6
Pr, ppm	6.63	0.80	5.02	8.23	4.22	9.03	12.11%	24.23%	36.34%	6.29	6.96
Rb, ppm	124	5	114	134	110	139	3.92%	7.85%	11.77%	118	130
Re, ppb	3.50	0.59	2.32	4.68	1.73	5.27	16.83%	33.65%	50.48%	3.33	3.68
S, wt.%	0.821	0.040	0.742	0.901	0.702	0.940	4.84%	9.68%	14.52%	0.780	0.862
Sb, ppm	4.78	0.91	2.97	6.59	2.06	7.50	18.95%	37.90%	56.86%	4.54	5.02
Sc, ppm	7.28	0.531	6.22	8.34	5.69	8.87	7.29%	14.59%	21.88%	6.91	7.64
Sm, ppm	4.34	0.211	3.92	4.76	3.71	4.97	4.85%	9.71%	14.56%	4.12	4.55
Sn, ppm	2.71	0.220	2.27	3.15	2.05	3.37	8.12%	16.24%	24.35%	2.58	2.85
Sr, ppm	66	5.7	55	78	50	83	8.50%	17.00%	25.50%	63	70
Ta, ppm	0.009	0.002	0.006	0.013	0.004	0.015	18.85%	37.69%	56.54%	0.009	0.010
Tb, ppm	0.58	0.030	0.52	0.64	0.49	0.67	5.12%	10.24%	15.36%	0.55	0.61
Te, ppm	0.47	0.05	0.37	0.57	0.33	0.61	10.23%	20.47%	30.70%	0.45	0.49
Th, ppm	17.6	0.91	15.7	19.4	14.8	20.3	5.21%	10.42%	15.63%	16.7	18.4
Ti, wt.%	0.340	0.012	0.316	0.365	0.304	0.377	3.60%	7.20%	10.80%	0.323	0.357
Tl, ppm	0.67	0.053	0.56	0.78	0.51	0.83	7.98%	15.97%	23.95%	0.64	0.70
U, ppm	4.53	0.327	3.87	5.18	3.54	5.51	7.23%	14.45%	21.68%	4.30	4.75
V, ppm	110	4	102	119	98	123	3.78%	7.55%	11.33%	105	116
W, ppm	2.98	0.49	2.00	3.96	1.51	4.44	16.41%	32.81%	49.22%	2.83	3.13
Y, ppm	16.1	0.94	14.2	18.0	13.3	18.9	5.82%	11.63%	17.45%	15.3	16.9
Yb, ppm	1.51	0.053	1.40	1.62	1.35	1.67	3.52%	7.03%	10.55%	1.43	1.59
Zn, ppm	102	5	92	112	87	117	4.98%	9.96%	14.94%	97	107
Zr, ppm	9.53	0.499	8.53	10.53	8.03	11.03	5.24%	10.48%	15.71%	9.06	10.01

Note: intervals may appear asymmetric due to rounding.

PREPARER AND SUPPLIER

Certified reference material OREAS 502c is prepared, certified and supplied by:

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

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10. ALS, Vancouver, BC, Canada
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17. Inspectorate (BV), Shanghai, Bao Shan District, China
18. Inspectorate America Corporation (BV), Sparks, Nevada, USA
19. Intertek Genalysis, Perth, WA, Australia
20. Intertek Testing Services, Townsville, QLD, Australia
21. Intertek Testing Services Philippines, Cupang, Muntinlupa, Philippines
22. MinAnalytical Services, Perth, WA, Australia
23. Newcrest Laboratory Services, Orange, NSW, Australia
24. PT Geoservices Ltd, Cikarang, Jakarta Raya, Indonesia
25. PT Intertek Utama Services, Jakarta Timur, DKI Jakarta, Indonesia
26. SGS, Ankara, Turkey
27. SGS, Randfontein, Gauteng, South Africa
28. SGS Australia Mineral Services, Perth, WA, Australia
29. SGS Canada Inc., Vancouver, BC, Canada
30. SGS del Peru, Lima, Peru
31. SGS Lakefield Research Ltd, Lakefield, Ontario, Canada
32. SGS Mineral Services, Townsville, QLD, Australia
33. SGS Mongolia, Ulan Bator, Mongolia
34. Shiva Analyticals Ltd, Bangalore North, Karnataka, India
35. Zarazma Mineral Studies Company, Tehran, Iran

INTENDED USE

OREAS 502c is intended for the following uses:

- For the monitoring of laboratory performance in the analysis of analytes reported in Tables 1-4 in geological samples;
- For the verification of analytical methods for analytes reported in Tables 1-4;
- For the calibration of instruments used in the determination of the concentration of analytes reported in Tables 1-4.

STABILITY AND STORAGE INSTRUCTIONS

OREAS 502c has been prepared from a blend of porphyry copper-gold ore, barren granodiorite and a minor quantity of Cu-Mo concentrate. It is low in reactive sulphide (S = 0.826 wt,%). In its unopened state and under normal conditions of storage it 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 of OREAS 502c refer to the concentration level of analytes in their packaged state. The CRM should therefore 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.

DOCUMENT HISTORY

Revision No	Date	Changes applied
2	16th January, 2019	Added missing certified value for Ag by aqua regia in Table 3.
1	14th June, 2018	Added Copper Solubility by Sulphuric Acid Leach.
0	23rd Jun, 2017	First publication

CERTIFYING OFFICER

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

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ISO Guide 30 (2015), Terms and definitions used in connection with reference materials.

ISO Guide 31 (2015), Reference materials – Contents of certificates and labels.

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