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CERTIFICATE OF ANALYSIS FOR

Primary Quartz Blank (Grey pigmented quartz, Australia)

CERTIFIED REFERENCE MATERIAL

OREAS 22i

Accredited for compliance with ISO 17034

COA-1743-OREAS22i-R1
BUP-70-10-01 Rev:2.0

21-March-2023

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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
Pb Fire Assay											
Au, ppb	< 1	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
4-Acid Digestion											
Al, wt.%	0.095	0.007	0.080	0.110	0.073	0.117	7.87%	15.74%	23.61%	0.090	0.100
Ba, ppm	4.94	1.05	2.85	7.03	1.80	8.08	21.17%	42.34%	63.51%	4.69	5.19
Be, ppm	0.065	0.006	0.052	0.078	0.046	0.084	9.85%	19.71%	29.56%	0.062	0.068
Ca, wt.%	0.011	0.001	0.009	0.012	0.008	0.013	8.37%	16.73%	25.10%	0.010	0.011
Cd, ppm	< 0.02	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Ce, ppm	1.89	0.142	1.61	2.18	1.47	2.32	7.50%	15.00%	22.49%	1.80	1.99
Co, ppm	0.70	0.08	0.53	0.87	0.45	0.95	11.93%	23.86%	35.79%	0.67	0.74
Cr, ppm	8.64	1.86	4.93	12.36	3.07	14.22	21.51%	43.01%	64.52%	8.21	9.08
Cs, ppm	0.093	0.009	0.076	0.111	0.067	0.120	9.37%	18.73%	28.10%	0.089	0.098
Cu, ppm	7.17	0.656	5.86	8.48	5.20	9.14	9.15%	18.30%	27.45%	6.81	7.53
Fe, wt.%	0.386	0.021	0.344	0.429	0.322	0.451	5.54%	11.08%	16.61%	0.367	0.406
Ga, ppm	0.21	0.02	0.16	0.25	0.14	0.27	10.30%	20.61%	30.91%	0.20	0.22
Hf, ppm	0.20	0.008	0.19	0.22	0.18	0.23	4.16%	8.32%	12.48%	0.19	0.21
In, ppm	< 0.005	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
K, wt.%	< 0.01	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
La, ppm	0.92	0.071	0.78	1.06	0.71	1.13	7.72%	15.43%	23.15%	0.87	0.96
Li, ppm	16.3	0.84	14.6	18.0	13.8	18.9	5.15%	10.31%	15.46%	15.5	17.1
Mg, wt.%	< 0.01	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Mn, wt.%	0.010	0.000	0.009	0.011	0.009	0.011	3.81%	7.63%	11.44%	0.010	0.011
Mo, ppm	0.65	0.07	0.50	0.79	0.43	0.87	11.23%	22.45%	33.68%	0.62	0.68
Nb, ppm	0.49	0.06	0.37	0.61	0.32	0.67	11.95%	23.91%	35.86%	0.47	0.52
Ni, ppm	4.35	0.306	3.74	4.96	3.43	5.27	7.04%	14.09%	21.13%	4.13	4.57
P, wt.%	< 0.005	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Rb, ppm	0.35	0.05	0.26	0.45	0.21	0.49	13.47%	26.94%	40.41%	0.33	0.37
Re, ppm	< 0.002	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
S, wt.%	< 0.01	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Sb, ppm	0.16	0.04	0.08	0.24	0.04	0.28	25.09%	50.17%	75.26%	0.15	0.17
Sc, ppm	0.15	0.05	0.05	0.25	0.00	0.30	34.39%	68.78%	103.17%	0.14	0.15
Se, ppm	< 1	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Sn, ppm	0.45	0.10	0.26	0.65	0.16	0.74	21.28%	42.57%	63.85%	0.43	0.48
Sr, ppm	0.82	0.08	0.65	0.99	0.56	1.07	10.30%	20.59%	30.89%	0.78	0.86
Ta, ppm	< 0.1	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Te, ppm	< 0.05	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Th, ppm	0.64	0.041	0.56	0.73	0.52	0.77	6.46%	12.92%	19.38%	0.61	0.67
Ti, wt.%	0.020	0.000	0.019	0.021	0.019	0.021	2.12%	4.25%	6.37%	0.019	0.021
Tl, ppm	< 0.02	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
U, ppm	0.11	0.02	0.07	0.15	0.05	0.17	17.58%	35.16%	52.74%	0.11	0.12
V, ppm	2.00	0.21	1.59	2.41	1.38	2.62	10.31%	20.63%	30.94%	1.90	2.10

SI unit equivalents: ppb (parts per billion; 1 x 10^{-9}) ≡ µg/kg; ppm (parts per million; 1 x 10^{-6}) ≡ mg/kg; wt.% (weight per cent) ≡ % (mass fraction).

IND: indeterminate; Note 1: intervals may appear asymmetric due to rounding; Note 2: the number of decimal places quoted does not imply accuracy of the certified value to this level but are given to minimise rounding errors when calculating 2SD and 3SD windows.

Table 1 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											
W, ppm	0.100	0.000	0.100	0.100	0.100	0.100	0.00%	0.00%	0.00%	0.095	0.105
Y, ppm	0.58	0.09	0.41	0.76	0.32	0.84	14.81%	29.62%	44.43%	0.56	0.61
Zn, ppm	6.28	0.74	4.79	7.77	4.05	8.51	11.84%	23.67%	35.51%	5.97	6.59
Zr, ppm	6.77	0.457	5.85	7.68	5.40	8.14	6.75%	13.50%	20.25%	6.43	7.11

SI unit equivalents: ppm (parts per million; 1 x 10^{-6}) ≡ mg/kg

IND: indeterminate; Note 1: intervals may appear asymmetric due to rounding; Note 2: the number of decimal places quoted does not imply accuracy of the certified value to this level but are given to minimise rounding errors when calculating 2SD and 3SD windows.

Table 2. Indicative Values for OREAS 22i.

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Pb Fire Assay								
Pd	ppb	*< 5*	Pt	ppb	*< 5*			
4-Acid Digestion								
Ag	ppm	*0.010*	Gd	ppm	*< 0.2*	Pb	ppm	*0.55*
As	ppm	*0.40*	Ge	ppm	*0.53*	Pr	ppm	*0.26*
Bi	ppm	*0.010*	Ho	ppm	*0.030*	Sm	ppm	*0.20*
Dy	ppm	*0.15*	Lu	ppm	*0.011*	Tb	ppm	*0.018*
Er	ppm	*0.088*	Na	wt.%	*0.008*	Tm	ppm	*< 0.02*
Eu	ppm	*< 0.05*	Nd	ppm	*0.91*	Yb	ppm	*0.085*
Borate Fusion XRF								
Al_2O_3	wt.%	*0.230*	MgO	wt.%	*0.030*	SiO_2	wt.%	*98.93*
CaO	wt.%	*0.010*	MnO	wt.%	*0.010*	SO_3	wt.%	*0.004*
Fe_2O_3	wt.%	*0.540*	Na_2O	wt.%	*0.025*	TiO_2	wt.%	*0.030*
K_2O	wt.%	*0.003*	P_2O_5	wt.%	*0.004*			
Thermogravimetry								
LOI^{1000}	wt.%	*0.050*						
Laser Ablation ICP-MS								
Ag	ppm	*< 0.1*	Hf	ppm	*0.48*	Sm	ppm	*0.18*
As	ppm	*0.40*	Ho	ppm	*0.040*	Sn	ppm	*0.40*
Ba	ppm	*4.50*	In	ppm	*< 0.05*	Sr	ppm	*0.80*
Be	ppm	*< 0.2*	La	ppm	*1.09*	Ta	ppm	*0.055*
Bi	ppm	*< 0.02*	Lu	ppm	*0.020*	Tb	ppm	*0.025*
Cd	ppm	*< 0.1*	Mn	wt.%	*0.011*	Te	ppm	*< 0.2*
Ce	ppm	*2.04*	Mo	ppm	*0.70*	Th	ppm	*0.70*
Co	ppm	*0.75*	Nb	ppm	*0.59*	Ti	wt.%	*0.019*
Cr	ppm	*9.00*	Nd	ppm	*0.88*	Tl	ppm	*< 0.2*
Cs	ppm	*0.095*	Ni	ppm	*7.00*	Tm	ppm	*0.020*
Cu	ppm	*8.00*	Pb	ppm	*< 1*	U	ppm	*0.15*
Dy	ppm	*0.16*	Pr	ppm	*0.26*	V	ppm	*2.25*
Er	ppm	*0.11*	Rb	ppm	*0.28*	W	ppm	*< 0.5*

SI unit equivalents: ppb (parts per billion; 1 x 10^{-9}) ≡ µg/kg; ppm (parts per million; 1 x 10^{-6}) ≡ mg/kg; wt.% (weight per cent) ≡ % (mass fraction).

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								
Eu	ppm	*0.013*	Re	ppm	*< 0.01*	Y	ppm	*0.97*
Ga	ppm	*0.20*	Sb	ppm	*0.10*	Yb	ppm	*0.13*
Gd	ppm	*0.13*	Sc	ppm	*< 0.1*	Zn	ppm	*3.75*
Ge	ppm	*0.63*	Se	ppm	*< 5*	Zr	ppm	*16.3*

SI unit equivalents: ppm (parts per million; 1 x 10^{-6}) ≡ mg/kg.
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 MATERIAL

OREAS 22i has been prepared from quartz sand to which 0.5% iron oxide (pigment) has been added to produce a pale grey pulp. This colouring gives the material an appearance of primary origin (i.e., non-oxide). It is characterised by extremely low background gold of less than 1 µg/kg (1 part per billion).

PERFORMANCE GATES

Table 1 above shows intervals 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 (also see 'Intended Use' section below). Westgard Rules extend the basics of single-rule QC monitoring using multi-rules (for more information visit www.westgard.com/mltirule.htm). 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. One approach used at commercial laboratories is to set the acceptance criteria at twice the detection level (DL) ± 10%.

i.e., Certified Value ± 10% ± 2DL (adapted from Govett, 1983, [1]).

PHYSICAL PROPERTIES

OREAS 22i was tested at ORE Research & Exploration Pty Ltd's onsite facility for various physical properties. Table 3 presents the bulk density, moisture percentage and Munsell colour code for OREAS 22i. These findings should be used for informational purposes only.

Table 3. Physical properties of OREAS 22i.

Bulk Density (g/L)	Moisture (%)	Munsell Notation‡	Munsell Color‡
908	0.21	N7	Light Gray

‡The Munsell Rock Colour Chart helps geologists and archeologists communicate with colour more effectively by cross-referencing ISCC-NBS colour names with unique Munsell alpha-numeric colour notations for rock colour samples.

COMMINUTION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 22i was prepared in the following manner:

- Drying to constant mass at 105°C;
- Preliminary blending of quartz sand with iron oxide pigment;
- Milling to approximately >99% less than 75 microns;
- Homogenisation using OREAS' novel processing technologies;
- Packaging in 10 and 60g units in laminated foil pouches and 1kg units in plastic jars.

ANALYTICAL PROGRAM

Ten commercial analytical laboratories participated in the program to characterise the elements reported in Table 1. The following methods were employed:

- Au by low level (1ppb reading resolution) fire assay with ICP-OES (7 labs) or ICP-MS (2 labs) finish;
- Full ICP-OES and ICP-MS elemental suites by 4-acid (HF-HNO_3-HCl-$HClO_4$) digestion.

Major and trace elements were also characterised by Bureau Veritas Geoanalytical (Perth, Australia) using borate fusion XRF (Al_2O_3 to P_2O_5), laser ablation with ICP-MS (Ag to Zr) and LOI at 1000°C (see Table 2 'Indicative Values').

For the round robin program ten 1kg samples were taken at 10 predetermined intervals during the bagging stage, immediately following homogenisation and are considered representative of the entire batch. The six samples received by each laboratory were obtained by taking a 110g split from every odd or even numbered test unit plus an additional opposite numbered test unit (E.g, from test units: 1, 3, 5, 7, 9 and 2).

Tabulated results of all elements 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 22i-DataPack.1.0.230213_134851.xlsx**).

STATISTICAL ANALYSIS

Certified Values and their uncertainty intervals (Table 4 below) 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. 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. However, while statistics are taken into account, the exercise of a statistician's prerogative plays a significant role in identifying outliers.

Certified Values are the means of accepted laboratory means after outlier filtering and are the present best estimate of the true value.

The 95% Expanded Uncertainty provides a 95% probability that the true value of the analyte under consideration lies between the upper and lower limits and is calculated according to the method in ISO Guides [6,16]. All known or suspected sources of bias have been investigated or taken into account.

Indicative (uncertified) values (Table 2) are present where the number of laboratories reporting a particular analyte is insufficient (< 5) to support certification. These major and trace element characterisation values are presented for informational purposes only.

Standard Deviation intervals (Table 1) 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.

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 (see 'Intended Use' section for more detail).

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.

Table 4. 95% Uncertainty & Tolerance Limits for OREAS 22i.

Constituent	Certified Value	95% Expanded Uncertainty		95% Tolerance Limits	
		Low	High	Low	High
Pb Fire Assay					
Au, Gold (ppb)	< 1	IND	IND	IND	IND
4-Acid Digestion					
Al, Aluminium (wt.%)	0.095	0.088	0.102	IND	IND
Ba, Barium (ppm)	4.94	3.44	6.44	IND	IND
Be, Beryllium (ppm)	0.065	0.053	0.077	IND	IND
Ca, Calcium (wt.%)	0.011	0.010	0.011	IND	IND
Cd, Cadmium (ppm)	< 0.02	IND	IND	IND	IND
Ce, Cerium (ppm)	1.89	1.69	2.10	1.70	2.09
Co, Cobalt (ppm)	0.70	0.61	0.80	IND	IND
Cr, Chromium (ppm)	8.64	6.24	11.04	IND	IND
Cs, Caesium (ppm)	0.093	0.082	0.105	IND	IND
Cu, Copper (ppm)	7.17	6.41	7.93	6.65	7.69
Fe, Iron (wt.%)	0.386	0.364	0.409	0.373	0.399
Ga, Gallium (ppm)	0.21	0.18	0.23	0.18	0.24
Hf, Hafnium (ppm)	0.20	0.20	0.21	IND	IND
In, Indium (ppm)	< 0.005	IND	IND	IND	IND
K, Potassium (wt.%)	< 0.01	IND	IND	IND	IND
La, Lanthanum (ppm)	0.92	0.77	1.07	IND	IND
Li, Lithium (ppm)	16.3	15.6	17.1	15.9	16.8
Mg, Magnesium (wt.%)	< 0.01	IND	IND	IND	IND
Mn, Manganese (wt.%)	0.010	0.010	0.011	0.010	0.010
Mo, Molybdenum (ppm)	0.65	0.54	0.75	0.57	0.73
Nb, Niobium (ppm)	0.49	0.43	0.56	IND	IND
Ni, Nickel (ppm)	4.35	4.05	4.65	3.98	4.72
P, Phosphorus (wt.%)	< 0.005	IND	IND	IND	IND
Rb, Rubidium (ppm)	0.35	0.28	0.43	IND	IND
Re, Rhenium (ppm)	< 0.002	IND	IND	IND	IND
S, Sulphur (wt.%)	< 0.01	IND	IND	IND	IND
Sb, Antimony (ppm)	0.16	0.12	0.19	IND	IND
Sc, Scandium (ppm)	0.15	0.04	0.25	IND	IND
Se, Selenium (ppm)	< 1	IND	IND	IND	IND

SI unit equivalents: ppb (parts per billion; 1 x 10^{-9}) ≡ µg/kg; ppm (parts per million; 1 x 10^{-6}) ≡ mg/kg; wt.% (weight per cent) ≡ % (mass fraction).

Note: intervals may appear asymmetric due to rounding; IND: indeterminate (for practical purposes the 95% Expanded Uncertainty can be set between zero and a two times multiple of the upper bound/non-detect limit value).

Table 4. continued.

Constituent	Certified Value	95% Expanded Uncertainty		95% Tolerance Limits	
		Low	High	Low	High
4-Acid Digestion continued					
Sn, Tin (ppm)	0.45	0.37	0.53	IND	IND
Sr, Strontium (ppm)	0.82	0.70	0.93	IND	IND
Ta, Tantalum (ppm)	< 0.1	IND	IND	IND	IND
Te, Tellurium (ppm)	< 0.05	IND	IND	IND	IND
Th, Thorium (ppm)	0.64	0.53	0.75	0.57	0.71
Ti, Titanium (wt.%)	0.020	0.019	0.021	IND	IND
Tl, Thallium (ppm)	< 0.02	IND	IND	IND	IND
U, Uranium (ppm)	0.11	0.10	0.13	IND	IND
V, Vanadium (ppm)	2.00	1.59	2.41	IND	IND
W, Tungsten (ppm)	0.100	0.100	0.100	IND	IND
Y, Yttrium (ppm)	0.58	0.48	0.69	IND	IND
Zn, Zinc (ppm)	6.28	5.47	7.09	IND	IND
Zr, Zirconium (ppm)	6.77	6.08	7.45	6.08	7.46

SI unit equivalents: ppb (parts per billion; 1 x 10^{-9}) ≡ µg/kg; ppm (parts per million; 1 x 10^{-6}) ≡ mg/kg; wt.% (weight per cent) ≡ % (mass fraction).

Note: intervals may appear asymmetric due to rounding; IND: indeterminate (for practical purposes the 95% Expanded Uncertainty can be set between zero and a two times multiple of the upper bound/non-detect limit value).

PARTICIPATING LABORATORIES

1. ALS, Lima, Peru
2. ALS, Perth, WA, Australia
3. ALS, Vancouver, BC, Canada
4. Bureau Veritas Commodities Canada Ltd, Vancouver, BC, Canada
5. Bureau Veritas Geoanalytical, Adelaide, SA, Australia
6. Bureau Veritas Geoanalytical, Perth, WA, Australia
7. Intertek Genalysis, Adelaide, SA, Australia
8. Intertek Genalysis, Perth, WA, Australia
9. MinAnalytical Services, Perth, WA, Australia
10. SGS Canada Inc., Vancouver, BC, Canada

PREPARER AND SUPPLIER

Certified reference material OREAS 22i was prepared, certified and supplied by:

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METROLOGICAL 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 undertaken by ORE Pty Ltd) 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.

Guide ISO/TR 16476:2016, section 5.3.1 describes metrological traceability in reference materials as it pertains to the transformation of the measurand. In this section it states, *“Although the determination of the property value itself can be made traceable to appropriate units through, for example, calibration of the measurement equipment used, steps like the transformation of the sample from one physical (chemical) state to another cannot. Such transformations may only be compared with a reference (when available), or among themselves. For some transformations, reference methods have been defined and may be used in certification projects to evaluate the uncertainty associated with such a transformation.* ***In other cases, only a comparison among different laboratories using the same procedure is possible. In this case, it is impossible to demonstrate absence of method bias; therefore, the result is an operationally defined measurand*** *(ISO Guide 35:2017, 9.2.4c).”* Certification takes place on the basis of agreement among operationally defined, independent measurement results.

COMMUTABILITY

The measurements of the results that underlie the certified values contained in this report were undertaken by methods involving pre-treatment (digestion/fusion) of the sample. This served to reduce the sample to a simple and well understood form permitting calibration using simple solutions of the CRM. Due to these methods being well understood and highly effective, commutability is not an issue for this CRM. All OREAS CRMs are sourced from naturally occurring rocks and sediments meaning they will display similar behaviour as routine ‘field’ samples in the relevant measurement process. Care should be taken to ensure ‘matrix matching’ as close as practically achievable. The matrix and mineralisation style of the CRM is described in the ‘Source Material’ section and users should select appropriate CRMs matching these attributes to their field samples.

INTENDED USE

OREAS 22i is intended to cover all activities needed to produce a measurement result. This includes extraction, possible separation steps and the actual measurement process (the signal producing step). OREAS 22i may be used to calibrate the entire procedure by producing a pure substance CRM transformed into a calibration solution.

OREAS 22i 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 22i has been prepared from barren quartz blended with a small amount of iron oxide (0.5%). 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.

Single-use sachets

Following analysis of the CRM subsample it is the manufacturers' expectation that any remaining material is discarded. The stability of the material after opening the sachet is not within the scope of proper use. However, if opened sachets are resealed after opening, then under ordinary* storage conditions the CRM will have a shelf-life beyond ten years.

**ordinary storage conditions: means storage not in direct sunlight in a dry, clean, well ventilated area at temperatures between -5° and 50°C.*

Repeat-use packaging (1kg unit)

After taking a subsample, users should replace the lid of the jar promptly and securely to prevent accidental spills and airborne contamination. OREAS 22i contains a non-hygroscopic* matrix with an indicative value for moisture provided to enable users to check for changes to stored material by determining moisture in the user's laboratory and comparing the result to the value in Table 3 in this certificate.

The stability of the CRM in regard to oxidation from the breakdown of sulphide minerals to sulphates is negligible given its low sulphur concentration (<0.01 wt.% S).

*A non-hygroscopic matrix means exposure to atmospheres significantly different, in terms of temperature and humidity, from the climate during manufacturing should have negligible impact on the precision of results. Hygroscopic moisture is the amount of adsorped moisture (weakly held H_2O- molecules on the surface of exposed material) following exposure to the local atmosphere. Usually, equilibration of material to the local atmosphere will only occur if the material is spread into a thin (~2mm thick) layer and left exposed for a period of 2 hours.

INSTRUCTIONS FOR CORRECT USE

The certified values for OREAS 22i refer to the concentration level in its packaged state. It should not be dried prior to weighing and analysis. 1kg jars permit repeated sampling as long as the lid is promptly re-secured to prevent airborne contamination.

Minimum sample size

As a practical guide, the minimum mass of sample used should match the typical mass that the laboratories used in the interlaboratory (round robin) certification program. This means that different sample masses should be used depending on the operationally defined methodology.

- Au by fire assay: ≥25g;
- 4-acid digestion with ICP-OES and/or MS finish: ≥0.25g.

QC monitoring using multiples of the Standard Deviation (SD)

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-laboratory 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.

The performance gates shown in Table 1 are intended only to be used as an initial guide as to what a laboratory may be able to achieve. Over a period of time monitoring your own laboratory's data for this CRM, SDs should be calculated directly from your own laboratory's process. This will enable you to establish more specific performance gates that are fit for purpose for your application as well as the ability to monitor bias. If your long-term trend analysis shows an average value that is within the 95% confidence interval then generally there is no cause for concern in regard to bias.

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.

DOCUMENT HISTORY

Revision No.	Date	Changes applied
1	14th June, 2023	Replaced references to '95% confidence limits' with '95% expanded uncertainty' (affected page 7 only).
0	23rd March, 2023	First publication.

QMS CERTIFICATION

ORE Pty Ltd is accredited for compliance with ISO 17034.

ORE Pty Ltd is ISO 9001:2015 certified by Lloyd's Register Quality Assurance Ltd for its quality management system including development, manufacturing, certification and supply of CRMs.

CERTIFYING OFFICER

23rd March, 2023

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

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