ORE RESEARCH & EXPLORATION

OREAS Reference Materials ABN 28006859856
37A Hosie Street · Bayswater North · Vic 3153 · Australia
61 3 9729 0333 61 3 9729 8338
info@ore.com.au www.ore.com.au

CERTIFICATE OF ANALYSIS FOR

COPPER ORE REFERENCE MATERIAL

OREAS 926

Table 1. Certified Values, SDs, 95% Confidence and Tolerance Limits for OREAS 926

Constituent	Certified Value	95% Confidence Limits		95% Tolerance Limits	
		Low	High	Low	High
4-Acid Digestion					
Ag, Silver (ppm)	3.02	2.88	3.15	2.62	3.41
Al, Aluminium (wt.%)	7.30	7.11	7.49	7.14	7.46
As, Arsenic (ppm)	8.64	8.34	8.94	7.78	9.50
Ba, Barium (ppm)	427	414	439	413	440
Be, Beryllium (ppm)	2.23	2.13	2.33	2.08	2.38
Bi, Bismuth (ppm)	41.0	40.0	42.0	38.3	43.6
Ca, Calcium (wt.%)	0.477	0.466	0.488	0.463	0.492
Cd, Cadmium (ppm)	0.51	0.49	0.53	0.48	0.53
Ce, Cerium (ppm)	84	81	86	82	86
Co, Cobalt (ppm)	26.1	25.3	26.9	25.2	26.9
Cr, Chromium (ppm)	70	66	74	67	74
Cs, Caesium (ppm)	6.55	6.29	6.81	6.40	6.69
Cu, Copper (wt.%)	0.813	0.801	0.826	0.798	0.829
Dy, Dysprosium (ppm)	4.94	4.72	5.16	4.80	5.07
Er, Erbium (ppm)	2.78	2.62	2.94	2.69	2.87
Eu, Europium (ppm)	1.36	1.29	1.43	1.32	1.40
Fe, Iron (wt.%)	7.13	6.91	7.34	7.01	7.24
Ga, Gallium (ppm)	20.0	19.5	20.4	19.5	20.4
Gd, Gadolinium (ppm)	5.71	5.49	5.92	5.59	5.83
Ge, Germanium (ppm)	< 2	IND	IND	IND	IND
Hf, Hafnium (ppm)	3.12	3.02	3.23	3.02	3.22
Ho, Holmium (ppm)	0.92	0.90	0.95	0.89	0.96
In, Indium (ppm)	0.84	0.81	0.86	0.81	0.86
K, Potassium (wt.%)	2.49	2.45	2.53	2.41	2.56
La, Lanthanum (ppm)	41.8	40.9	42.8	40.7	43.0
Li, Lithium (ppm)	31.1	30.3	31.8	30.1	32.0
Lu, Lutetium (ppm)	0.38	0.36	0.40	0.36	0.41
Mg, Magnesium (wt.%)	1.73	1.70	1.77	1.70	1.77
Mn, Manganese (wt.%)	0.099	0.097	0.101	0.097	0.101
Mo, Molybdenum (ppm)	1.04	1.00	1.09	0.92	1.17

Table 1 continued.

Constituent	Certified Value	95% Confidence Limits		95% Tolerance Limits	
		Low	High	Low	High
4-Acid Digestion continued					
Na, Sodium (wt.%)	0.278	0.269	0.288	0.270	0.286
Nb, Niobium (ppm)	13.5	13.0	14.0	13.0	14.0
Nd, Neodymium (ppm)	35.3	33.8	36.8	34.5	36.1
Ni, Nickel (ppm)	34.9	33.8	36.0	33.7	36.1
P, Phosphorus (wt.%)	0.062	0.060	0.063	0.059	0.065
Pb, Lead (ppm)	98	95	100	96	100
Pr, Praseodymium (ppm)	9.61	9.16	10.06	9.46	9.76
Rb, Rubidium (ppm)	166	162	171	160	172
Re, Rhenium (ppb)	< 5	IND	IND	IND	IND
S, Sulphur (wt.%)	1.16	1.14	1.19	1.12	1.20
Sb, Antimony (ppm)	1.32	1.28	1.36	1.26	1.37
Sc, Scandium (ppm)	13.1	12.5	13.8	12.8	13.5
Se, Selenium (ppm)	10.7	10.0	11.5	9.8	11.7
Sm, Samarium (ppm)	6.60	6.29	6.92	6.43	6.78
Sn, Tin (ppm)	16.9	16.4	17.3	16.3	17.4
Sr, Strontium (ppm)	36.2	35.2	37.2	35.2	37.2
Ta, Tantalum (ppm)	1.03	0.93	1.14	0.99	1.07
Tb, Terbium (ppm)	0.84	0.81	0.88	0.81	0.88
Te, Tellurium (ppm)	< 0.1	IND	IND	IND	IND
Th, Thorium (ppm)	16.1	15.4	16.7	15.7	16.5
Ti, Titanium (wt.%)	0.391	0.379	0.403	0.380	0.402
Tl, Thallium (ppm)	0.86	0.84	0.88	0.83	0.88
Tm, Thulium (ppm)	0.39	0.38	0.40	0.37	0.41
U, Uranium (ppm)	2.93	2.84	3.02	2.86	3.01
V, Vanadium (ppm)	90	87	93	87	93
W, Tungsten (ppm)	6.60	6.25	6.96	6.08	7.12
Y, Yttrium (ppm)	25.0	24.3	25.7	24.3	25.7
Yb, Ytterbium (ppm)	2.46	2.37	2.56	2.35	2.57
Zn, Zinc (ppm)	398	394	403	386	410
Zr, Zirconium (ppm)	107	102	112	104	110
Aqua Regia Digestion					
Ag, Silver (ppm)	3.07	2.92	3.21	2.63	3.51
Al, Aluminium (wt.%)	2.84	2.78	2.90	2.76	2.92
As, Arsenic (ppm)	7.98	7.71	8.25	7.34	8.63
Au, Gold (ppb)	< 10	IND	IND	IND	IND
B, Boron (ppm)	< 10	IND	IND	IND	IND
Ba, Barium (ppm)	52	50	54	49	54
Be, Beryllium (ppm)	0.60	0.57	0.63	0.55	0.64
Bi, Bismuth (ppm)	40.9	39.9	41.9	37.7	44.1
Ca, Calcium (wt.%)	0.334	0.328	0.339	0.321	0.347
Cd, Cadmium (ppm)	0.50	0.48	0.51	0.47	0.53
Ce, Cerium (ppm)	57	53	61	55	58
Co, Cobalt (ppm)	25.3	24.9	25.7	24.3	26.4

Table 1 continued.

Constituent	Certified Value	95% Confidence Limits		95% Tolerance Limits	
		Low	High	Low	High
Aqua Regia Digestion continued					
Cr, Chromium (ppm)	38.7	38.1	39.2	37.5	39.8
Cs, Caesium (ppm)	1.51	1.36	1.67	1.46	1.57
Cu, Copper (wt.%)	0.820	0.813	0.827	0.803	0.837
Dy, Dysprosium (ppm)	< 3	IND	IND	IND	IND
Er, Erbium (ppm)	< 2.5	IND	IND	IND	IND
Eu, Europium (ppm)	0.88	0.72	1.04	0.80	0.96
Fe, Iron (wt.%)	6.64	6.49	6.79	6.51	6.77
Ga, Gallium (ppm)	8.18	7.86	8.51	7.97	8.39
Gd, Gadolinium (ppm)	< 5	IND	IND	IND	IND
Ge, Germanium (ppm)	< 0.3	IND	IND	IND	IND
Hf, Hafnium (ppm)	0.67	0.58	0.76	0.64	0.70
Hg, Mercury (ppm)	< 0.06	IND	IND	IND	IND
Ho, Holmium (ppm)	< 0.8	IND	IND	IND	IND
In, Indium (ppm)	0.76	0.72	0.79	0.73	0.78
K, Potassium (wt.%)	0.309	0.287	0.331	0.298	0.319
La, Lanthanum (ppm)	28.7	27.3	30.0	27.9	29.4
Li, Lithium (ppm)	23.6	22.6	24.6	22.8	24.5
Lu, Lutetium (ppm)	< 0.3	IND	IND	IND	IND
Mg, Magnesium (wt.%)	1.48	1.44	1.53	1.45	1.52
Mn, Manganese (wt.%)	0.089	0.087	0.090	0.087	0.091
Mo, Molybdenum (ppm)	0.96	0.91	1.01	0.90	1.01
Na, Sodium (wt.%)	< 0.02	IND	IND	IND	IND
Nb, Niobium (ppm)	< 0.5	IND	IND	IND	IND
Nd, Neodymium (ppm)	24.6	20.8	28.5	23.7	25.6
Ni, Nickel (ppm)	32.3	31.9	32.7	31.2	33.4
P, Phosphorus (wt.%)	0.060	0.058	0.062	0.058	0.062
Pb, Lead (ppm)	97	95	98	93	100
Pr, Praseodymium (ppm)	6.57	5.55	7.59	6.33	6.81
Rb, Rubidium (ppm)	19.9	18.1	21.6	19.2	20.5
Re, Rhenium (ppb)	< 1	IND	IND	IND	IND
S, Sulphur (wt.%)	1.14	1.11	1.17	1.11	1.18
Sb, Antimony (ppm)	0.59	0.52	0.66	0.54	0.65
Sc, Scandium (ppm)	3.29	2.99	3.59	3.14	3.44
Se, Selenium (ppm)	10.4	9.8	11.0	9.9	10.9
Sm, Samarium (ppm)	4.51	3.73	5.29	4.30	4.72
Sn, Tin (ppm)	9.55	9.24	9.85	9.26	9.83
Sr, Strontium (ppm)	13.0	12.6	13.3	12.5	13.4
Ta, Tantalum (ppm)	< 0.05	IND	IND	IND	IND
Tb, Terbium (ppm)	< 0.8	IND	IND	IND	IND
Te, Tellurium (ppm)	< 0.08	IND	IND	IND	IND
Th, Thorium (ppm)	14.0	13.3	14.7	13.6	14.4
Ti, Titanium (wt.%)	< 0.15	IND	IND	IND	IND
Tl, Thallium (ppm)	0.13	0.12	0.15	IND	IND

Table 1 continued.

Constituent	Certified Value	95% Confidence Limits		95% Tolerance Limits	
		Low	High	Low	High
Aqua Regia Digestion continued					
Tm, Thulium (ppm)	< 0.4	IND	IND	IND	IND
U, Uranium (ppm)	1.90	1.75	2.05	1.84	1.96
V, Vanadium (ppm)	30.0	28.9	31.1	28.9	31.1
W, Tungsten (ppm)	2.92	2.67	3.17	2.69	3.15
Y, Yttrium (ppm)	13.6	12.1	15.1	13.2	14.0
Yb, Ytterbium (ppm)	< 2	IND	IND	IND	IND
Zn, Zinc (ppm)	390	383	397	379	402
Zr, Zirconium (ppm)	22.1	19.4	24.7	21.0	23.1
Peroxide Fusion ICP					
Ag, Silver (ppm)	< 3	IND	IND	IND	IND
Al, Aluminium (wt.%)	7.49	7.29	7.70	7.36	7.63
As, Arsenic (ppm)	< 10	IND	IND	IND	IND
Ba, Barium (ppm)	438	423	452	425	450
Be, Beryllium (ppm)	< 3	IND	IND	IND	IND
Bi, Bismuth (ppm)	43.0	41.8	44.3	39.6	46.5
Ca, Calcium (wt.%)	0.514	0.462	0.565	0.479	0.548
Cd, Cadmium (ppm)	< 1	IND	IND	IND	IND
Ce, Cerium (ppm)	84	80	88	81	87
Co, Cobalt (ppm)	27.3	26.2	28.4	25.8	28.8
Cr, Chromium (ppm)	89	79	99	81	97
Cs, Caesium (ppm)	6.79	6.62	6.97	6.60	6.99
Cu, Copper (wt.%)	0.843	0.836	0.849	0.823	0.862
Dy, Dysprosium (ppm)	5.28	5.13	5.44	5.08	5.48
Er, Erbium (ppm)	3.00	2.81	3.19	2.92	3.08
Eu, Europium (ppm)	1.40	1.36	1.43	IND	IND
Fe, Iron (wt.%)	7.49	7.37	7.61	7.34	7.64
Ga, Gallium (ppm)	20.6	19.5	21.7	19.9	21.4
Gd, Gadolinium (ppm)	6.11	5.71	6.51	5.92	6.30
Hf, Hafnium (ppm)	< 10	IND	IND	IND	IND
Ho, Holmium (ppm)	1.07	1.02	1.12	IND	IND
In, Indium (ppm)	0.88	0.84	0.91	IND	IND
K, Potassium (wt.%)	2.60	2.56	2.64	2.53	2.67
La, Lanthanum (ppm)	44.6	42.8	46.4	43.1	46.1
Li, Lithium (ppm)	29.9	27.6	32.2	28.6	31.2
Lu, Lutetium (ppm)	0.44	0.37	0.52	IND	IND
Mg, Magnesium (wt.%)	1.78	1.75	1.80	1.73	1.83
Mn, Manganese (wt.%)	0.107	0.104	0.110	0.104	0.110
Mo, Molybdenum (ppm)	< 1	IND	IND	IND	IND
Nb, Niobium (ppm)	14.3	13.3	15.3	13.7	14.9
Nd, Neodymium (ppm)	36.8	35.7	38.0	35.7	38.0
Ni, Nickel (ppm)	36.6	33.1	40.2	35.0	38.2
P, Phosphorus (wt.%)	0.066	0.060	0.072	0.057	0.074
Pb, Lead (ppm)	101	96	107	94	109

Table 1 continued.

Constituent	Certified Value	95% Confidence Limits		95% Tolerance Limits	
		Low	High	Low	High
Peroxide Fusion ICP continued					
Pr, Praseodymium (ppm)	10.1	9.8	10.4	9.8	10.4
Rb, Rubidium (ppm)	169	165	172	165	172
S, Sulphur (wt.%)	1.17	1.16	1.18	1.12	1.22
Sb, Antimony (ppm)	< 1.5	IND	IND	IND	IND
Sc, Scandium (ppm)	< 15	IND	IND	IND	IND
Si, Silicon (wt.%)	29.35	28.78	29.92	28.68	30.02
Sm, Samarium (ppm)	6.74	6.50	6.97	6.51	6.97
Sn, Tin (ppm)	19.0	17.5	20.6	17.2	20.9
Sr, Strontium (ppm)	35.2	32.3	38.1	32.1	38.3
Ta, Tantalum (ppm)	1.22	1.04	1.39	IND	IND
Tb, Terbium (ppm)	0.92	0.86	0.98	IND	IND
Th, Thorium (ppm)	16.0	15.4	16.6	15.6	16.3
Ti, Titanium (wt.%)	0.404	0.393	0.415	0.394	0.414
Tl, Thallium (ppm)	0.92	0.85	1.00	IND	IND
Tm, Thulium (ppm)	0.43	0.39	0.47	IND	IND
U, Uranium (ppm)	3.11	2.99	3.24	3.00	3.23
V, Vanadium (ppm)	91	90	93	87	95
W, Tungsten (ppm)	< 8	IND	IND	IND	IND
Y, Yttrium (ppm)	27.9	27.0	28.8	27.2	28.6
Yb, Ytterbium (ppm)	2.79	2.61	2.97	2.61	2.97
Zn, Zinc (ppm)	414	401	428	400	429

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 MATERIAL

OREAS 926 is one of a suite of sixteen copper CRMs (OREAS 920 to OREAS 935) prepared from material from the CSA mine located near the town of Cobar in central western New South Wales, Australia. The copper ore body is hosted by the Early Devonian CSA Siltstone, a thinly bedded turbiditic sequence of carbonaceous siltstones and mudstones with minor coarser units. The CSA Siltstone is part of the Cobar Supergroup, consisting of lower syn-rift sediments and upper post-rift sag phase sediments. The mineralisation is structurally controlled and confined to a number of steeply dipping bodies within a major shear zone on the eastern margin of the Early Devonian Cobar Basin. It is characterised by low-grade greenschist alteration and

epigenetic low-grade mineralisation enveloping higher-grade shoots of vein complexes or sub-massive to massive sulphides. The sulphides include chalcopyrite, pyrrhotite, pyrite, sphalerite, galena, bornite and cubanite. Iron-rich chlorite and silica are prominent alterations in the siltstone host.

COMMINUTION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 926 was prepared in the following manner:

- drying to constant mass at 105°C;
- preliminary blending of copper ores and barren siltstone materials;
- multi-stage milling to approximately 99% less than 75 microns;
- final homogenisation;
- packaging in 10g units in laminated foil pouches.

ANALYTICAL PROGRAM

Twenty two commercial analytical laboratories participated in the program to characterise the analytes reported in Table 1. The following methods were employed for method specific certification:

- Four acid (HCl-HNO_3-HF-$HClO_4$) digestion with ICP-OES, ICP-MS or AAS finish (19 laboratories);
- Aqua regia digestion with ICP-OES, ICP-MS or AAS finish (19 laboratories);
- Peroxide fusion with ICP-OES, ICP-MS or AAS finish (12 laboratories).

For the round robin program ten 300g test units were taken at predetermined intervals during the bagging stage, immediately following final homogenisation, and are considered representative of the entire batch. The six samples received by each laboratory were obtained by taking two 20g scoop splits from each of three separate 300g test units. This format enabled nested ANOVA treatment of the results to evaluate homogeneity, i.e. to ascertain whether between-unit variance is greater than within-unit variance. Table 1 presents the certified values together with their associated 1SD's, 95% confidence and tolerance limits and Table 2 shows indicative values. Table 3 provides performance gate intervals for the certified values of each analytical method group based on their pooled 1SD's. Tabulated results of all elements 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 926-DataPack.1.1.250703_132813.xlsx**).

STATISTICAL ANALYSIS

Certified Values, Standard Deviations, Confidence and Tolerance Limits have been determined for each analytical method following removal of individual and laboratory outliers (Table 1). Certified Values are the mean of means after outlier filtering. The 95% Confidence Limit is a measure of the reliability of the certified value, i.e. the narrower the Confidence Interval the greater the certainty in the Certified Value. It should not be used as a control limit for laboratory performance. Indicative values (Table 2) are provided

where i) the number of laboratories reporting a particular analyte is insufficient (< 5) to support certification; ii) interlaboratory consensus is poor; or iii) a significant proportion of results are outlying or results are multimodal.

Table 2. Indicative Values for OREAS 926

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
4-Acid Digestion								
B	ppm	*7.42*	Hg	ppm	*< 1*	Ru	ppm	*< 0.1*
Aqua Regia Digestion								
Pd	ppb	*17.0*	Pt	ppb	*< 5*	Ru	ppb	*< 5*
Infrared Combustion								
S	wt.%	*1.19*						
Peroxide Fusion ICP								
B	ppm	*21.1*	Re	ppm	*< 0.1*	Te	ppm	*< 6*
Ge	ppm	*2.67*	Se	ppm	*7.35*	Zr	ppm	*157*

Standard Deviation values (1SDs) are reported in Table 1 and provide an indication of a level of performance that might reasonably be expected from a laboratory being monitored by this CRM in a QA/QC program. They take into account errors attributable to measurement uncertainty and CRM variability. For an effective CRM the contribution of the latter should be negligible in comparison to measurement errors. The Standard Deviation values include all sources of measurement uncertainty: between-lab variance, within-run variance (precision errors) and CRM variability. The SD for each analyte's certified value is calculated from the same filtered data set used to determine the certified value, i.e. after removal of all individual, lab dataset (batch) and 3SD outliers (single iteration). These outliers can only be removed after the absolute homogeneity of the CRM has been independently established, i.e. the outliers must be confidently deemed to be analytical rather than arising from inhomogeneity of the CRM. The standard deviation is then calculated for each analyte from the pooled accepted analyses generated from the certification program.

Performance Gates (Table 3) are calculated for two and three standard deviations. As a guide these intervals may be regarded as warning or rejection for multiple 2SD outliers, or rejection for individual 3SD outliers in QC monitoring, although their precise application should be at the discretion of the QC manager concerned.

A second method utilises a 5% window calculated directly from the certified value. Standard deviation is also shown in relative per cent for one, two and three relative standard deviations (1RSD, 2RSD and 3RSD) to facilitate an appreciation of the magnitude of these numbers and a comparison with the 5% window. Caution should be exercised when concentration levels approach lower limits of detection of the analytical methods employed as performance gates calculated from standard deviations tend to be excessively wide whereas those determined by the 5% method are too narrow.

Tolerance Limits (ISO Guide 3207) 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 between 0.798 and 0.829 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).

The homogeneity of OREAS 926 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 178 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 926 is fit-for-purpose as a certified reference material (see 'Intended Use' below).

PARTICIPATING LABORATORIES

1. Accurassay, Thunder Bay, Ontario, Canada
2. Acme (BV), Santiago, Chile
3. Actlabs, Ancaster, Ontario, Canada
4. Actlabs, Kamloops, BC, Canada
5. Actlabs, Thunder Bay, Ontario, Canada
6. ALS, Brisbane, QLD, Australia
7. ALS, Vancouver, BC, Canada
8. Intertek Genalysis, Adelaide, SA, Australia
9. Intertek Genalysis, Johannesburg, South Africa
10. Intertek Genalysis, Perth, WA, Australia
11. Intertek Testing Services, Cupang, Muntinlupa, Philippines
12. Intertek Testing Services, Jakarta, Indonesia
13. Intertek Testing Services, Shunyi, Beijing, China
14. Labtium Oy, Saarenkylä, Rovaniemi, Finland
15. OMAC, Loughrea, Galway, Ireland
16. PT Geoservices Ltd, Cikarang, Jakarta Raya, Indonesia
17. SGS Canada Inc., Vancouver, BC, Canada
18. SGS Lakefield Research Ltd, Lakefield, Ontario, Canada
19. SGS South Africa Pty Ltd, Booysens, Gauteng, South Africa
20. Shiva Analyticals Ltd, Bangalore North, Karnataka, India
21. Ultra Trace Pty Ltd (BV), Perth, WA, Australia

Table 3. Performance Gates for OREAS 926

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											
Ag, ppm	3.02	0.35	2.31	3.72	1.96	4.08	11.71%	23.42%	35.13%	2.87	3.17
Al, wt.%	7.30	0.372	6.56	8.04	6.19	8.42	5.09%	10.19%	15.28%	6.94	7.67
As, ppm	8.64	0.826	6.99	10.29	6.16	11.12	9.56%	19.11%	28.67%	8.21	9.07
Ba, ppm	427	24	378	475	354	499	5.67%	11.35%	17.02%	405	448
Be, ppm	2.23	0.182	1.86	2.59	1.68	2.78	8.19%	16.37%	24.56%	2.12	2.34
Bi, ppm	41.0	2.61	35.8	46.2	33.1	48.8	6.37%	12.75%	19.12%	38.9	43.0
Ca, wt.%	0.477	0.023	0.430	0.524	0.407	0.547	4.91%	9.81%	14.72%	0.453	0.501
Cd, ppm	0.51	0.043	0.42	0.59	0.38	0.64	8.52%	17.03%	25.55%	0.48	0.53
Ce, ppm	84	4.5	75	93	70	97	5.44%	10.88%	16.31%	79	88
Co, ppm	26.1	1.80	22.5	29.7	20.7	31.4	6.89%	13.79%	20.68%	24.8	27.4
Cr, ppm	70	8	54	87	46	95	11.67%	23.34%	35.00%	67	74
Cs, ppm	6.55	0.466	5.62	7.48	5.15	7.95	7.12%	14.23%	21.35%	6.22	6.87
Cu, wt.%	0.813	0.027	0.759	0.868	0.731	0.895	3.36%	6.72%	10.08%	0.773	0.854
Dy, ppm	4.94	0.294	4.35	5.53	4.05	5.82	5.96%	11.92%	17.89%	4.69	5.18
Er, ppm	2.78	0.203	2.37	3.19	2.17	3.39	7.32%	14.64%	21.96%	2.64	2.92
Eu, ppm	1.36	0.092	1.17	1.54	1.08	1.63	6.81%	13.62%	20.43%	1.29	1.42
Fe, wt.%	7.13	0.428	6.27	7.98	5.84	8.41	6.01%	12.02%	18.03%	6.77	7.48
Ga, ppm	20.0	1.05	17.9	22.1	16.8	23.1	5.28%	10.56%	15.84%	19.0	21.0
Gd, ppm	5.71	0.269	5.17	6.25	4.90	6.52	4.72%	9.43%	14.15%	5.42	5.99
Ge, ppm	< 2	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Hf, ppm	3.12	0.192	2.74	3.51	2.55	3.70	6.16%	12.32%	18.49%	2.97	3.28
Ho, ppm	0.92	0.034	0.85	0.99	0.82	1.03	3.69%	7.39%	11.08%	0.88	0.97
In, ppm	0.84	0.047	0.74	0.93	0.70	0.97	5.57%	11.14%	16.71%	0.79	0.88
K, wt.%	2.49	0.096	2.30	2.68	2.20	2.78	3.84%	7.68%	11.53%	2.36	2.61
La, ppm	41.8	1.75	38.3	45.3	36.6	47.1	4.18%	8.35%	12.53%	39.7	43.9
Li, ppm	31.1	1.36	28.3	33.8	27.0	35.1	4.39%	8.78%	13.16%	29.5	32.6
Lu, ppm	0.38	0.022	0.34	0.42	0.32	0.45	5.65%	11.30%	16.95%	0.36	0.40
Mg, wt.%	1.73	0.073	1.59	1.88	1.51	1.95	4.21%	8.41%	12.62%	1.65	1.82
Mn, wt.%	0.099	0.005	0.090	0.109	0.085	0.114	4.89%	9.77%	14.66%	0.094	0.104
Mo, ppm	1.04	0.092	0.86	1.23	0.77	1.32	8.85%	17.69%	26.54%	0.99	1.10
Na, wt.%	0.278	0.018	0.243	0.314	0.225	0.331	6.33%	12.67%	19.00%	0.264	0.292
Nb, ppm	13.5	0.91	11.7	15.3	10.8	16.2	6.72%	13.44%	20.15%	12.8	14.2

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											
Nd, ppm	35.3	2.00	31.3	39.3	29.3	41.3	5.66%	11.32%	16.97%	33.5	37.1
Ni, ppm	34.9	2.52	29.9	40.0	27.4	42.5	7.21%	14.42%	21.64%	33.2	36.7
P, wt.%	0.062	0.004	0.055	0.069	0.051	0.073	5.84%	11.68%	17.52%	0.059	0.065
Pb, ppm	98	6.0	86	110	80	116	6.15%	12.31%	18.46%	93	103
Pr, ppm	9.61	0.578	8.45	10.77	7.88	11.34	6.01%	12.03%	18.04%	9.13	10.09
Rb, ppm	166	9	149	184	140	192	5.24%	10.48%	15.71%	158	174
Re, ppb	< 5	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
S, wt.%	1.16	0.056	1.05	1.27	1.00	1.33	4.81%	9.61%	14.42%	1.10	1.22
Sb, ppm	1.32	0.087	1.14	1.49	1.06	1.58	6.61%	13.21%	19.82%	1.25	1.38
Sc, ppm	13.1	1.18	10.8	15.5	9.6	16.7	8.97%	17.95%	26.92%	12.5	13.8
Se, ppm	10.7	1.5	7.7	13.8	6.1	15.3	14.28%	28.57%	42.85%	10.2	11.2
Sm, ppm	6.60	0.412	5.78	7.43	5.37	7.84	6.24%	12.48%	18.72%	6.27	6.93
Sn, ppm	16.9	1.04	14.8	18.9	13.7	20.0	6.19%	12.37%	18.56%	16.0	17.7
Sr, ppm	36.2	1.79	32.6	39.8	30.8	41.6	4.94%	9.87%	14.81%	34.4	38.0
Ta, ppm	1.03	0.19	0.66	1.40	0.47	1.59	18.01%	36.02%	54.03%	0.98	1.08
Tb, ppm	0.84	0.058	0.73	0.96	0.67	1.02	6.86%	13.72%	20.58%	0.80	0.89
Te, ppm	< 0.1	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Th, ppm	16.1	1.22	13.6	18.5	12.4	19.7	7.58%	15.17%	22.75%	15.3	16.9
Ti, wt.%	0.391	0.023	0.345	0.437	0.323	0.459	5.82%	11.64%	17.47%	0.371	0.411
Tl, ppm	0.86	0.041	0.77	0.94	0.73	0.98	4.80%	9.59%	14.39%	0.81	0.90
Tm, ppm	0.39	0.015	0.36	0.42	0.35	0.43	3.72%	7.44%	11.16%	0.37	0.41
U, ppm	2.93	0.175	2.58	3.28	2.41	3.46	5.97%	11.94%	17.91%	2.79	3.08
V, ppm	90	5.5	79	101	74	106	6.06%	12.11%	18.17%	86	95
W, ppm	6.60	0.83	4.95	8.26	4.12	9.09	12.54%	25.08%	37.62%	6.27	6.93
Y, ppm	25.0	1.37	22.2	27.7	20.9	29.1	5.49%	10.99%	16.48%	23.7	26.2
Yb, ppm	2.46	0.139	2.18	2.74	2.04	2.88	5.67%	11.33%	17.00%	2.34	2.58
Zn, ppm	398	11	377	419	366	430	2.65%	5.30%	7.96%	378	418
Zr, ppm	107	11	86	128	75	139	9.86%	19.73%	29.59%	102	112
Aqua Regia Digestion											
Ag, ppm	3.07	0.52	2.03	4.10	1.51	4.62	16.92%	33.85%	50.77%	2.91	3.22
Al, wt.%	2.84	0.119	2.60	3.08	2.48	3.20	4.20%	8.40%	12.60%	2.70	2.98
As, ppm	7.98	0.90	6.17	9.79	5.27	10.70	11.33%	22.66%	33.98%	7.58	8.38

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											
Au, ppb	< 10	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
B, ppm	< 10	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Ba, ppm	52	3.4	45	59	42	62	6.50%	13.00%	19.50%	49	54
Be, ppm	0.60	0.055	0.49	0.71	0.43	0.76	9.19%	18.38%	27.57%	0.57	0.63
Bi, ppm	40.9	2.67	35.6	46.3	32.9	48.9	6.53%	13.06%	19.58%	38.9	43.0
Ca, wt.%	0.334	0.010	0.313	0.355	0.303	0.365	3.12%	6.24%	9.36%	0.317	0.350
Cd, ppm	0.50	0.037	0.42	0.57	0.38	0.61	7.55%	15.10%	22.65%	0.47	0.52
Ce, ppm	57	7	43	70	37	77	11.68%	23.36%	35.03%	54	59
Co, ppm	25.3	1.07	23.2	27.5	22.1	28.5	4.22%	8.45%	12.67%	24.1	26.6
Cr, ppm	38.7	1.23	36.2	41.1	35.0	42.3	3.18%	6.36%	9.54%	36.7	40.6
Cs, ppm	1.51	0.27	0.97	2.05	0.70	2.32	17.85%	35.70%	53.55%	1.44	1.59
Cu, wt.%	0.820	0.017	0.786	0.854	0.769	0.871	2.07%	4.13%	6.20%	0.779	0.861
Dy, ppm	< 3	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Er, ppm	< 2.5	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Eu, ppm	0.88	0.15	0.59	1.17	0.44	1.32	16.73%	33.46%	50.20%	0.84	0.92
Fe, wt.%	6.64	0.290	6.06	7.22	5.77	7.51	4.36%	8.72%	13.08%	6.31	6.97
Ga, ppm	8.18	0.554	7.07	9.29	6.52	9.84	6.77%	13.54%	20.31%	7.77	8.59
Gd, ppm	< 5	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Ge, ppm	< 0.3	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Hf, ppm	0.67	0.13	0.41	0.93	0.28	1.06	19.42%	38.85%	58.27%	0.64	0.71
Hg, ppm	< 0.06	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Ho, ppm	< 0.8	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
In, ppm	0.76	0.056	0.64	0.87	0.59	0.92	7.42%	14.84%	22.27%	0.72	0.79
K, wt.%	0.309	0.041	0.227	0.390	0.186	0.431	13.23%	26.45%	39.68%	0.293	0.324
La, ppm	28.7	2.29	24.1	33.2	21.8	35.5	7.98%	15.96%	23.94%	27.2	30.1
Li, ppm	23.6	1.92	19.8	27.5	17.9	29.4	8.14%	16.28%	24.42%	22.4	24.8
Lu, ppm	< 0.3	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Mg, wt.%	1.48	0.086	1.31	1.66	1.23	1.74	5.81%	11.62%	17.43%	1.41	1.56
Mn, wt.%	0.089	0.003	0.082	0.095	0.079	0.098	3.59%	7.17%	10.76%	0.084	0.093
Mo, ppm	0.96	0.10	0.75	1.16	0.65	1.27	10.82%	21.65%	32.47%	0.91	1.00
Na, wt.%	< 0.02	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Nb, ppm	< 0.5	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											
Nd, ppm	24.6	4.4	15.8	33.5	11.4	37.9	17.98%	35.96%	53.94%	23.4	25.9
Ni, ppm	32.3	0.87	30.6	34.1	29.7	34.9	2.70%	5.41%	8.11%	30.7	33.9
P, wt.%	0.060	0.004	0.053	0.068	0.049	0.072	6.20%	12.41%	18.61%	0.057	0.063
Pb, ppm	97	4.4	88	106	84	110	4.54%	9.07%	13.61%	92	102
Pr, ppm	6.57	1.06	4.46	8.68	3.40	9.74	16.07%	32.15%	48.22%	6.24	6.90
Rb, ppm	19.9	2.9	14.0	25.7	11.1	28.7	14.76%	29.51%	44.27%	18.9	20.9
Re, ppb	< 1	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
S, wt.%	1.14	0.059	1.03	1.26	0.97	1.32	5.13%	10.26%	15.39%	1.09	1.20
Sb, ppm	0.59	0.11	0.37	0.82	0.25	0.94	19.14%	38.29%	57.43%	0.57	0.62
Sc, ppm	3.29	0.49	2.32	4.26	1.83	4.75	14.76%	29.52%	44.28%	3.13	3.46
Se, ppm	10.4	1.3	7.8	13.0	6.5	14.3	12.61%	25.22%	37.83%	9.9	10.9
Sm, ppm	4.51	0.89	2.73	6.29	1.84	7.18	19.72%	39.43%	59.15%	4.28	4.73
Sn, ppm	9.55	0.556	8.43	10.66	7.88	11.21	5.82%	11.64%	17.46%	9.07	10.02
Sr, ppm	13.0	0.55	11.9	14.1	11.3	14.6	4.28%	8.56%	12.84%	12.3	13.6
Ta, ppm	< 0.05	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Tb, ppm	< 0.8	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Te, ppm	< 0.08	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Th, ppm	14.0	1.27	11.5	16.6	10.2	17.9	9.06%	18.13%	27.19%	13.3	14.7
Ti, wt.%	< 0.15	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Tl, ppm	0.13	0.03	0.08	0.18	0.06	0.21	19.44%	38.88%	58.32%	0.13	0.14
Tm, ppm	< 0.4	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
U, ppm	1.90	0.26	1.37	2.43	1.11	2.69	13.87%	27.73%	41.60%	1.81	2.00
V, ppm	30.0	1.96	26.1	33.9	24.1	35.9	6.54%	13.07%	19.61%	28.5	31.5
W, ppm	2.92	0.51	1.91	3.93	1.40	4.44	17.37%	34.75%	52.12%	2.77	3.07
Y, ppm	13.6	2.7	8.3	18.9	5.6	21.6	19.52%	39.04%	58.56%	12.9	14.3
Yb, ppm	< 2	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Zn, ppm	390	16	359	421	343	437	4.00%	7.99%	11.99%	371	410
Zr, ppm	22.1	3.8	14.4	29.7	10.6	33.5	17.31%	34.62%	51.92%	20.9	23.2
Peroxide Fusion ICP											
Ag, ppm	< 3	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Al, wt.%	7.49	0.295	6.90	8.08	6.61	8.38	3.94%	7.87%	11.81%	7.12	7.87
As, 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
Peroxide Fusion ICP continued											
Ba, ppm	438	20	398	478	378	498	4.58%	9.16%	13.74%	416	460
Be, ppm	< 3	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Bi, ppm	43.0	3.03	37.0	49.1	33.9	52.1	7.04%	14.08%	21.12%	40.9	45.2
Ca, wt.%	0.514	0.072	0.369	0.658	0.297	0.730	14.07%	28.14%	42.22%	0.488	0.539
Cd, ppm	< 1	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Ce, ppm	84	4.6	75	93	70	98	5.52%	11.04%	16.57%	80	88
Co, ppm	27.3	1.54	24.2	30.4	22.7	31.9	5.65%	11.30%	16.95%	25.9	28.6
Cr, ppm	89	15	59	120	43	135	17.14%	34.28%	51.41%	85	94
Cs, ppm	6.79	0.221	6.35	7.24	6.13	7.46	3.26%	6.51%	9.77%	6.46	7.13
Cu, wt.%	0.843	0.016	0.812	0.874	0.796	0.889	1.84%	3.68%	5.52%	0.801	0.885
Dy, ppm	5.28	0.220	4.84	5.72	4.62	5.94	4.16%	8.33%	12.49%	5.02	5.55
Er, ppm	3.00	0.244	2.51	3.48	2.27	3.73	8.13%	16.26%	24.39%	2.85	3.15
Eu, ppm	1.40	0.054	1.29	1.51	1.24	1.56	3.88%	7.75%	11.63%	1.33	1.47
Fe, wt.%	7.49	0.240	7.01	7.97	6.77	8.21	3.20%	6.40%	9.61%	7.12	7.87
Ga, ppm	20.6	1.75	17.1	24.1	15.3	25.9	8.51%	17.01%	25.52%	19.6	21.6
Gd, ppm	6.11	0.476	5.16	7.06	4.68	7.54	7.79%	15.58%	23.37%	5.80	6.41
Hf, ppm	< 10	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Ho, ppm	1.07	0.070	0.93	1.21	0.86	1.28	6.53%	13.05%	19.58%	1.01	1.12
In, ppm	0.88	0.054	0.77	0.98	0.71	1.04	6.14%	12.29%	18.43%	0.83	0.92
K, wt.%	2.60	0.065	2.47	2.73	2.40	2.80	2.51%	5.02%	7.53%	2.47	2.73
La, ppm	44.6	2.09	40.4	48.8	38.3	50.9	4.69%	9.37%	14.06%	42.4	46.8
Li, ppm	29.9	2.58	24.7	35.0	22.2	37.6	8.62%	17.23%	25.85%	28.4	31.4
Lu, ppm	0.44	0.06	0.33	0.56	0.27	0.62	13.26%	26.52%	39.78%	0.42	0.47
Mg, wt.%	1.78	0.041	1.69	1.86	1.65	1.90	2.34%	4.67%	7.01%	1.69	1.86
Mn, wt.%	0.107	0.004	0.098	0.115	0.094	0.120	4.01%	8.02%	12.03%	0.101	0.112
Mo, ppm	< 1	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Nb, ppm	14.3	1.04	12.2	16.4	11.2	17.4	7.29%	14.57%	21.86%	13.6	15.0
Nd, ppm	36.8	1.45	34.0	39.7	32.5	41.2	3.93%	7.85%	11.78%	35.0	38.7
Ni, ppm	36.6	4.6	27.4	45.8	22.9	50.4	12.52%	25.04%	37.57%	34.8	38.4
P, wt.%	0.066	0.008	0.050	0.082	0.042	0.090	12.05%	24.11%	36.16%	0.062	0.069
Pb, ppm	101	7	86	116	79	124	7.36%	14.72%	22.09%	96	106
Pr, ppm	10.1	0.41	9.3	10.9	8.8	11.3	4.08%	8.16%	12.24%	9.6	10.6

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											
Rb, ppm	169	4	161	177	156	181	2.43%	4.85%	7.28%	160	177
S, wt.%	1.17	0.025	1.12	1.22	1.10	1.25	2.13%	4.26%	6.39%	1.11	1.23
Sb, ppm	< 1.5	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Sc, ppm	< 15	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Si, wt.%	29.35	0.612	28.13	30.57	27.52	31.18	2.08%	4.17%	6.25%	27.88	30.82
Sm, ppm	6.74	0.346	6.04	7.43	5.70	7.78	5.14%	10.28%	15.42%	6.40	7.07
Sn, ppm	19.0	2.2	14.6	23.5	12.3	25.7	11.74%	23.47%	35.21%	18.1	20.0
Sr, ppm	35.2	3.42	28.4	42.1	24.9	45.5	9.72%	19.43%	29.15%	33.4	37.0
Ta, ppm	1.22	0.19	0.84	1.59	0.66	1.77	15.30%	30.60%	45.91%	1.16	1.28
Tb, ppm	0.92	0.082	0.75	1.08	0.67	1.16	8.94%	17.89%	26.83%	0.87	0.96
Th, ppm	16.0	0.69	14.6	17.4	13.9	18.1	4.31%	8.62%	12.93%	15.2	16.8
Ti, wt.%	0.404	0.017	0.369	0.439	0.352	0.456	4.29%	8.58%	12.87%	0.384	0.424
Tl, ppm	0.92	0.09	0.73	1.11	0.64	1.21	10.27%	20.54%	30.81%	0.88	0.97
Tm, ppm	0.43	0.042	0.35	0.52	0.30	0.56	9.83%	19.67%	29.50%	0.41	0.45
U, ppm	3.11	0.168	2.78	3.45	2.61	3.62	5.41%	10.82%	16.22%	2.96	3.27
V, ppm	91	3.3	85	98	81	101	3.59%	7.18%	10.77%	87	96
W, ppm	< 8	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Y, ppm	27.9	1.14	25.6	30.2	24.5	31.3	4.07%	8.14%	12.22%	26.5	29.3
Yb, ppm	2.79	0.221	2.35	3.23	2.13	3.45	7.93%	15.85%	23.78%	2.65	2.93
Zn, ppm	414	22	370	459	347	481	5.39%	10.78%	16.16%	394	435

Note: intervals may appear asymmetric due to rounding

PREPARER AND SUPPLIER OF THE REFERENCE MATERIAL

Reference material OREAS 926 has been prepared and certified by:

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

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

It has been packaged in 10g units in laminated foil pouches.

INTENDED USE

OREAS 926 is intended for the following uses:

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

STABILITY AND STORAGE INSTRUCTIONS

OREAS 926 has been prepared from mineralised and altered carbonaceous siltstones and mudstones from the CSA mine located near the town of Cobar in central western New South Wales, Australia. It has been packaged in robust foil laminate pouches and under normal storage conditions has long-term stability beyond 10 years.

INSTRUCTIONS FOR THE CORRECT USE OF THE REFERENCE MATERIAL

The certified values for OREAS 926 refer to the concentration level in its packaged state. It should not be dried prior to weighing and analysis.

HANDLING INSTRUCTIONS

Fine powders pose a risk to eyes and lungs and therefore standard precautions such as the use of safety glasses and dust masks are advised.

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	4th July, 2025	Revision of selected certified values for silver and some trace elements.
0	8th April, 2014	First publication.

CERTIFYING OFFICER

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

REFERENCES

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

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