ORE RESEARCH & EXPLORATION

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CERTIFICATE OF ANALYSIS FOR

COPPER ORE REFERENCE MATERIAL

OREAS 928

Table 1. Certified Values, SDs, 95% Confidence and Tolerance Limits for OREAS 928

Constituent	Certified Value	95% Confidence Limits		95% Tolerance Limits	
		Low	High	Low	High
4-Acid Digestion					
Ag, Silver (ppm)	5.49	5.16	5.83	4.65	6.34
Al, Aluminium (wt.%)	6.28	5.89	6.66	6.01	6.55
As, Arsenic (ppm)	9.70	9.18	10.21	8.27	11.12
Ba, Barium (ppm)	299	237	361	282	315
Bi, Bismuth (ppm)	79	76	83	72	86
Ca, Calcium (wt.%)	0.444	0.410	0.479	0.424	0.465
Co, Cobalt (ppm)	31.3	30.4	32.2	30.4	32.2
Cr, Chromium (ppm)	59	55	63	54	64
Cu, Copper (wt.%)	1.53	1.51	1.55	1.46	1.60
Fe, Iron (wt.%)	8.79	8.61	8.98	8.63	8.96
K, Potassium (wt.%)	1.91	1.67	2.15	1.82	1.99
La, Lanthanum (ppm)	35.2	30.1	40.2	33.4	36.9
Li, Lithium (ppm)	28.3	23.7	32.8	26.6	29.9
Mg, Magnesium (wt.%)	1.68	1.55	1.81	1.62	1.74
Mn, Manganese (wt.%)	0.108	0.103	0.114	0.104	0.112
Na, Sodium (wt.%)	0.188	0.175	0.202	IND	IND
Nb, Niobium (ppm)	11.4	9.5	13.4	10.8	12.1
Ni, Nickel (ppm)	29.6	26.0	33.2	28.5	30.8
P, Phosphorus (wt.%)	0.055	0.047	0.063	0.052	0.059
Pb, Lead (ppm)	122	118	126	117	126
S, Sulphur (wt.%)	1.91	1.86	1.96	1.85	1.97
Sb, Antimony (ppm)	1.39	1.31	1.47	1.29	1.49
Se, Selenium (ppm)	18.8	18.0	19.7	17.1	20.6
Sn, Tin (ppm)	26.2	25.1	27.3	24.8	27.5
Sr, Strontium (ppm)	32.6	27.9	37.4	31.4	33.9
Th, Thorium (ppm)	13.1	11.6	14.6	12.7	13.5
Ti, Titanium (wt.%)	0.299	0.269	0.329	0.288	0.310
Tl, Thallium (ppm)	0.72	0.52	0.92	IND	IND
V, Vanadium (ppm)	79	76	82	76	82
W, Tungsten (ppm)	10.6	9.6	11.7	IND	IND

Table 1 continued.

Constituent	Certified Value	95% Confidence Limits		95% Tolerance Limits	
		Low	High	Low	High
4-Acid Digestion continued					
Y, Yttrium (ppm)	20.4	17.8	22.9	18.9	21.8
Zn, Zinc (ppm)	436	424	448	421	451
Aqua Regia Digestion					
Ag, Silver (ppm)	5.13	4.89	5.36	4.43	5.82
Al, Aluminium (wt.%)	3.00	2.74	3.26	2.86	3.14
As, Arsenic (ppm)	9.23	8.77	9.69	8.28	10.18
Ba, Barium (ppm)	41.5	38.2	44.7	38.0	45.0
Bi, Bismuth (ppm)	80	77	84	75	86
Ca, Calcium (wt.%)	0.343	0.318	0.367	0.321	0.365
Cd, Cadmium (ppm)	< 1	IND	IND	IND	IND
Co, Cobalt (ppm)	30.6	29.7	31.4	29.6	31.6
Cr, Chromium (ppm)	38.2	37.0	39.4	36.4	39.9
Cu, Copper (wt.%)	1.52	1.49	1.55	1.47	1.57
Fe, Iron (wt.%)	8.27	8.14	8.39	8.07	8.46
K, Potassium (wt.%)	0.232	0.202	0.262	0.215	0.249
Mg, Magnesium (wt.%)	1.54	1.44	1.65	1.49	1.60
Mn, Manganese (wt.%)	0.100	0.094	0.105	0.096	0.103
Ni, Nickel (ppm)	28.1	26.6	29.7	26.3	30.0
P, Phosphorus (wt.%)	0.058	0.053	0.064	0.055	0.061
Pb, Lead (ppm)	122	119	125	117	127
S, Sulphur (wt.%)	1.85	1.77	1.93	1.79	1.91
Sb, Antimony (ppm)	0.65	0.52	0.77	0.56	0.73
Se, Selenium (ppm)	17.9	17.0	18.7	16.3	19.4
Sn, Tin (ppm)	15.7	15.0	16.4	15.0	16.4
Sr, Strontium (ppm)	16.1	14.8	17.5	IND	IND
Th, Thorium (ppm)	12.1	10.3	14.0	11.3	12.9
Ti, Titanium (wt.%)	0.063	0.040	0.085	0.058	0.067
V, Vanadium (ppm)	32.7	28.1	37.2	30.8	34.6
W, Tungsten (ppm)	5.48	4.37	6.60	IND	IND
Zn, Zinc (ppm)	429	422	436	418	441
Infrared Combustion					
S, Sulphur (wt.%)	1.98	1.95	2.01	1.90	2.05
Borate Fusion XRF					
Co, Cobalt (ppm)	< 100	IND	IND	IND	IND
Cu, Copper (wt.%)	1.52	1.48	1.56	1.46	1.58
Fe_2O_3, Iron(III) oxide (wt.%)	12.87	12.71	13.03	12.70	13.05
Pb, Lead (ppm)	133	115	151	IND	IND
S, Sulphur (wt.%)	1.98	1.91	2.04	1.89	2.07
SiO_2, Silicon dioxide (wt.%)	61.50	61.07	61.94	60.83	62.18
Zn, Zinc (ppm)	435	419	452	417	454
Peroxide Fusion ICP					
As, Arsenic (ppm)	< 20	IND	IND	IND	IND

Table 1 continued.

Constituent	Certified Value	95% Confidence Limits		95% Tolerance Limits	
		Low	High	Low	High
Peroxide Fusion ICP continued					
Bi, Bismuth (ppm)	83	81	85	77	89
Co, Cobalt (ppm)	33.5	30.5	36.5	30.9	36.1
Cu, Copper (wt.%)	1.52	1.49	1.54	1.44	1.60
Fe, Iron (wt.%)	9.02	8.87	9.18	8.86	9.19
Pb, Lead (ppm)	112	101	122	105	118
S, Sulphur (wt.%)	1.96	1.91	2.00	1.83	2.09
Sb, Antimony (ppm)	< 2	IND	IND	IND	IND
Se, Selenium (ppm)	< 20	IND	IND	IND	IND
Si, Silicon (wt.%)	28.79	28.35	29.23	27.60	29.99
Sn, Tin (ppm)	27.8	25.1	30.4	24.6	31.0
Zn, Zinc (ppm)	432	419	445	408	456

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 928 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 928 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 eight 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 (21 laboratories);
- Aqua regia digestion with ICP-OES, ICP-MS or AAS finish (20 laboratories);
- Infrared combustion furnace for sulphur (19 laboratories);
- Borate or pyro-sulphate fusion with XRF (12 laboratories);
- Peroxide fusion with ICP-OES, ICP-MS or AAS finish (16 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 928-DataPack.1.1.250703_134202.xlsx**).

Table 2. Indicative Values for OREAS 928

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
4-Acid Digestion								
Au	ppb	*< 100*	Ge	ppm	*0.15*	Sc	ppm	*11.0*
Be	ppm	*1.97*	Hf	ppm	*2.57*	Sm	ppm	*5.45*
Cd	ppm	*0.64*	Ho	ppm	*0.66*	Ta	ppm	*1.04*
Ce	ppm	*68*	In	ppm	*1.36*	Tb	ppm	*0.64*
Cs	ppm	*5.31*	Lu	ppm	*0.31*	Te	ppm	*< 0.05*
Dy	ppm	*3.38*	Mo	ppm	*1.00*	Tm	ppm	*0.27*
Er	ppm	*1.89*	Nd	ppm	*29.9*	U	ppm	*2.44*
Eu	ppm	*1.05*	Pr	ppm	*7.84*	Yb	ppm	*1.89*
Ga	ppm	*17.9*	Rb	ppm	*116*	Zr	ppm	*94*
Gd	ppm	*4.09*	Re	ppb	*< 5*			
Aqua Regia Digestion								
Au	ppb	*5.6*	La	ppm	*23.9*	Ta	ppm	*0.013*
B	ppm	*51*	Li	ppm	*26.5*	Tb	ppm	*0.46*

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Table 2 continued.

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Aqua Regia Digestion continued								
Be	ppm	*1.02*	Lu	ppm	*0.17*	Te	ppm	*0.068*
Ce	ppm	*46.9*	Mo	ppm	*0.98*	Tl	ppm	*0.092*
Cs	ppm	*1.53*	Na	wt.%	*0.012*	U	ppm	*1.59*
Ga	ppm	*9.23*	Nb	ppm	*0.35*	Y	ppm	*11.8*
Ge	ppm	*0.17*	Rb	ppm	*14.8*	Yb	ppm	*1.10*
Hf	ppm	*0.57*	Re	ppb	*0.667*	Zr	ppm	*19.9*
Hg	ppm	*0.061*	Sc	ppm	*3.59*			
In	ppm	*1.29*	Si	wt.%	*15.88*			
Infrared Combustion								
C	wt.%	*0.040*						
Borate Fusion XRF								
Al_2O_3	wt.%	*12.40*	MgO	wt.%	*2.99*	Sr	ppm	*48.3*
BaO	ppm	*447*	MnO	wt.%	*0.147*	TiO_2	wt.%	*0.547*
CaO	wt.%	*0.628*	Na_2O	wt.%	*0.247*	V_2O_5	ppm	*158*
Cr_2O_3	ppm	*115*	Ni	ppm	*20.8*	Zr	ppm	*108*
K_2O	wt.%	*2.31*	P_2O_5	wt.%	*0.127*			
LOI^{1000}	wt.%	*3.91*	Sn	ppm	*30.0*			
Peroxide Fusion ICP								
Ag	ppm	*6.16*	Ho	ppm	*0.89*	Sm	ppm	*6.23*
Al	wt.%	*6.45*	In	ppm	*1.47*	Sr	ppm	*30.0*
Ba	ppm	*318*	K	wt.%	*2.02*	Ta	ppm	*1.12*
Be	ppm	*< 5*	La	ppm	*38.7*	Tb	ppm	*0.79*
Ca	wt.%	*0.466*	Li	ppm	*30.7*	Th	ppm	*15.0*
Cd	ppm	*0.67*	Lu	ppm	*0.39*	Ti	wt.%	*0.356*
Ce	ppm	*79*	Mg	wt.%	*1.77*	Tl	ppm	*0.76*
Cr	ppm	*106*	Mn	wt.%	*0.117*	Tm	ppm	*0.39*
Cs	ppm	*5.39*	Mo	ppm	*< 2*	U	ppm	*2.93*
Dy	ppm	*4.72*	Nb	ppm	*12.6*	V	ppm	*80*
Er	ppm	*2.53*	Nd	ppm	*33.5*	W	ppm	*9.93*
Eu	ppm	*1.30*	Ni	ppm	*37.6*	Y	ppm	*21.9*
Ga	ppm	*18.5*	P	wt.%	*0.067*	Yb	ppm	*2.31*
Gd	ppm	*5.33*	Pr	ppm	*9.14*	Zr	ppm	*141*
Ge	ppm	*2.42*	Rb	ppm	*127*			
Hf	ppm	*4.50*	Sc	ppm	*6.12*			

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.

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.

Table 3. Performance Gates for OREAS 928

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	5.49	1.00	3.49	7.49	2.49	8.49	18.20%	36.40%	54.61%	5.22	5.77
Al, wt.%	6.28	0.327	5.63	6.93	5.30	7.26	5.20%	10.41%	15.61%	5.97	6.59
As, ppm	9.70	1.13	7.44	11.95	6.32	13.07	11.61%	23.21%	34.82%	9.21	10.18
Ba, ppm	299	55	189	409	134	464	18.39%	36.79%	55.18%	284	314
Bi, ppm	79	9	60	98	51	108	11.94%	23.89%	35.83%	75	83
Ca, wt.%	0.444	0.029	0.387	0.501	0.359	0.530	6.42%	12.83%	19.25%	0.422	0.467
Co, ppm	31.3	1.99	27.3	35.3	25.3	37.3	6.37%	12.74%	19.11%	29.7	32.9
Cr, ppm	59	4.3	50	68	46	72	7.33%	14.67%	22.00%	56	62
Cu, wt.%	1.53	0.071	1.39	1.67	1.31	1.74	4.64%	9.28%	13.92%	1.45	1.60
Fe, wt.%	8.79	0.418	7.96	9.63	7.54	10.05	4.75%	9.51%	14.26%	8.35	9.23
K, wt.%	1.91	0.184	1.54	2.28	1.36	2.46	9.62%	19.24%	28.86%	1.81	2.00
La, ppm	35.2	4.0	27.1	43.2	23.1	47.3	11.47%	22.95%	34.42%	33.4	36.9
Li, ppm	28.3	3.5	21.2	35.3	17.7	38.8	12.44%	24.89%	37.33%	26.8	29.7
Mg, wt.%	1.68	0.131	1.42	1.94	1.29	2.08	7.82%	15.63%	23.45%	1.60	1.76
Mn, wt.%	0.108	0.005	0.098	0.118	0.093	0.124	4.77%	9.54%	14.31%	0.103	0.114
Na, wt.%	0.188	0.013	0.163	0.214	0.150	0.226	6.80%	13.61%	20.41%	0.179	0.198

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											
Nb, ppm	11.4	1.5	8.4	14.5	6.9	16.0	13.34%	26.69%	40.03%	10.9	12.0
Ni, ppm	29.6	3.0	23.7	35.6	20.7	38.5	10.06%	20.12%	30.17%	28.1	31.1
P, wt.%	0.055	0.006	0.043	0.067	0.037	0.073	10.95%	21.89%	32.84%	0.053	0.058
Pb, ppm	122	9	103	140	94	150	7.60%	15.21%	22.81%	116	128
S, wt.%	1.91	0.104	1.70	2.12	1.60	2.22	5.45%	10.90%	16.35%	1.81	2.00
Sb, ppm	1.39	0.15	1.08	1.70	0.93	1.85	11.06%	22.11%	33.17%	1.32	1.46
Se, ppm	18.8	1.88	15.1	22.6	13.2	24.5	9.97%	19.94%	29.91%	17.9	19.8
Sn, ppm	26.2	2.38	21.4	30.9	19.0	33.3	9.10%	18.19%	27.29%	24.9	27.5
Sr, ppm	32.6	3.8	25.1	40.2	21.3	44.0	11.59%	23.19%	34.78%	31.0	34.3
Th, ppm	13.1	1.4	10.4	15.9	9.0	17.3	10.50%	21.01%	31.51%	12.5	13.8
Ti, wt.%	0.299	0.024	0.252	0.346	0.228	0.370	7.88%	15.75%	23.63%	0.284	0.314
Tl, ppm	0.72	0.14	0.44	1.00	0.30	1.14	19.38%	38.76%	58.15%	0.69	0.76
V, ppm	79	2.6	74	84	71	87	3.26%	6.51%	9.77%	75	83
W, ppm	10.6	1.3	8.0	13.3	6.6	14.6	12.52%	25.03%	37.55%	10.1	11.2
Y, ppm	20.4	2.2	16.0	24.7	13.8	26.9	10.67%	21.34%	32.01%	19.4	21.4
Zn, ppm	436	27	382	490	356	517	6.16%	12.33%	18.49%	414	458
Aqua Regia Digestion											
Ag, ppm	5.13	0.66	3.81	6.44	3.15	7.10	12.87%	25.74%	38.60%	4.87	5.38
Al, wt.%	3.00	0.196	2.61	3.39	2.41	3.59	6.55%	13.09%	19.64%	2.85	3.15
As, ppm	9.23	1.10	7.04	11.42	5.94	12.52	11.88%	23.76%	35.63%	8.77	9.69
Ba, ppm	41.5	2.68	36.1	46.8	33.4	49.5	6.45%	12.90%	19.35%	39.4	43.5
Bi, ppm	80	9	63	98	54	107	10.92%	21.84%	32.76%	76	84
Ca, wt.%	0.343	0.020	0.303	0.383	0.282	0.403	5.89%	11.77%	17.66%	0.326	0.360
Cd, ppm	< 1	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Co, ppm	30.6	1.95	26.7	34.5	24.7	36.4	6.38%	12.77%	19.15%	29.1	32.1
Cr, ppm	38.2	1.36	35.5	40.9	34.1	42.3	3.55%	7.10%	10.65%	36.3	40.1
Cu, wt.%	1.52	0.077	1.37	1.67	1.29	1.75	5.04%	10.07%	15.11%	1.45	1.60
Fe, wt.%	8.27	0.265	7.74	8.80	7.47	9.06	3.21%	6.41%	9.62%	7.85	8.68
K, wt.%	0.232	0.023	0.185	0.279	0.162	0.302	10.10%	20.20%	30.29%	0.220	0.243
Mg, wt.%	1.54	0.079	1.39	1.70	1.31	1.78	5.10%	10.21%	15.31%	1.47	1.62
Mn, wt.%	0.100	0.005	0.090	0.109	0.085	0.114	4.86%	9.72%	14.58%	0.095	0.105
Ni, ppm	28.1	1.31	25.5	30.8	24.2	32.1	4.66%	9.32%	13.98%	26.7	29.6

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
Aqua Regia Digestion continued											
P, wt.%	0.058	0.005	0.049	0.068	0.044	0.072	8.13%	16.26%	24.39%	0.055	0.061
Pb, ppm	122	7	107	137	100	144	5.99%	11.97%	17.96%	116	128
S, wt.%	1.85	0.164	1.52	2.18	1.36	2.34	8.89%	17.77%	26.66%	1.76	1.94
Sb, ppm	0.65	0.16	0.33	0.96	0.17	1.12	24.49%	48.98%	73.47%	0.61	0.68
Se, ppm	17.9	1.69	14.5	21.2	12.8	22.9	9.49%	18.98%	28.47%	17.0	18.8
Sn, ppm	15.7	1.19	13.4	18.1	12.2	19.3	7.55%	15.09%	22.64%	14.9	16.5
Sr, ppm	16.1	1.02	14.1	18.2	13.1	19.2	6.34%	12.67%	19.01%	15.3	16.9
Th, ppm	12.1	1.5	9.2	15.0	7.8	16.5	11.99%	23.98%	35.98%	11.5	12.7
Ti, wt.%	0.063	0.017	0.029	0.097	0.012	0.114	26.88%	53.77%	80.65%	0.060	0.066
V, ppm	32.7	3.3	26.0	39.3	22.7	42.7	10.21%	20.41%	30.62%	31.0	34.3
W, ppm	5.48	1.02	3.44	7.52	2.43	8.54	18.59%	37.18%	55.77%	5.21	5.76
Zn, ppm	429	16	398	461	382	476	3.66%	7.32%	10.97%	408	451
Infrared Combustion											
S, wt.%	1.98	0.089	1.80	2.16	1.71	2.25	4.51%	9.01%	13.52%	1.88	2.08
Borate Fusion XRF											
Co, ppm	< 100	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Cu, wt.%	1.52	0.073	1.37	1.67	1.30	1.74	4.80%	9.61%	14.41%	1.44	1.60
Fe_2O_3, wt.%	12.87	0.255	12.36	13.38	12.11	13.64	1.98%	3.96%	5.94%	12.23	13.51
Pb, ppm	133	25	82	184	57	209	19.08%	38.15%	57.23%	126	140
S, wt.%	1.98	0.072	1.84	2.12	1.76	2.19	3.62%	7.23%	10.85%	1.88	2.08
SiO_2, wt.%	61.50	0.478	60.55	62.46	60.07	62.94	0.78%	1.56%	2.33%	58.43	64.58
Zn, ppm	435	26	384	486	359	512	5.86%	11.72%	17.58%	414	457
Peroxide Fusion ICP											
As, ppm	< 20	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Bi, ppm	83	5.1	73	93	68	99	6.11%	12.21%	18.32%	79	87
Co, ppm	33.5	5.6	22.2	44.8	16.6	50.4	16.84%	33.68%	50.53%	31.8	35.2
Cu, wt.%	1.52	0.066	1.38	1.65	1.32	1.71	4.33%	8.67%	13.00%	1.44	1.59
Fe, wt.%	9.02	0.291	8.44	9.61	8.15	9.90	3.23%	6.45%	9.68%	8.57	9.48
Pb, ppm	112	16	80	143	64	159	14.18%	28.36%	42.54%	106	117
S, wt.%	1.96	0.084	1.79	2.13	1.70	2.21	4.31%	8.63%	12.94%	1.86	2.06
Sb, ppm	< 2	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Se, ppm	< 20	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											
Si, wt.%	28.79	0.592	27.61	29.98	27.02	30.57	2.06%	4.12%	6.17%	27.35	30.23
Sn, ppm	27.8	3.3	21.1	34.4	17.8	37.8	11.99%	23.97%	35.96%	26.4	29.2
Zn, ppm	432	29	374	490	345	518	6.67%	13.34%	20.01%	410	454

Note: intervals may appear asymmetric due to rounding

Tolerance Limits (ISO Guide 3207) were determined using an analysis of precision errors method and are considered a conservative estimate of true homogeneity. The meaning of tolerance limits may be illustrated for copper by 4-acid digestion, where 99% of the time ($1-\alpha=0.99$) at least 95% of subsamples ($\rho=0.95$) will have concentrations lying between between 1.46 and 1.60 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 928 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 84 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 928 is fit-for-purpose as a certified reference material (see 'Intended Use' below).

PREPARER AND SUPPLIER OF THE REFERENCE MATERIAL

Reference material OREAS 928 has been prepared and certified by:

ORE Research & Exploration Pty Ltd
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AUSTRALIA

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

PARTICIPATING LABORATORIES

1. Accurassay, Thunder Bay, Ontario, Canada
2. Acme (BV), Santiago, Chile

3. Acme (BV), Vancouver, BC, Canada
4. Actlabs, Ancaster, Ontario, Canada
5. Actlabs, Kamloops, BC, Canada
6. Actlabs, Thunder Bay, Ontario, Canada
7. ALS, Brisbane, QLD, Australia
8. ALS, Burnie, TAS, Australia
9. ALS, Vancouver, BC, Canada
10. Amdel (BV), Cardiff, NSW, Australia
11. Intertek Genalysis, Adelaide, SA, Australia
12. Intertek Genalysis, Johannesburg, South Africa
13. Intertek Genalysis, Perth, WA, Australia
14. Intertek Testing Services, Cupang, Muntinlupa, Philippines
15. Intertek Testing Services, Jakarta, Indonesia
16. Intertek Testing Services, Shunyi, Beijing, China
17. Labtium Oy, Saarenkylä, Rovaniemi, Finland
18. MINTEK Analytical Services, Randburg, South Africa
19. OMAC, Loughrea, Galway, Ireland
20. PT Geoservices Ltd, Cikarang, Jakarta Raya, Indonesia
21. SGS Canada Inc., Vancouver, BC, Canada
22. SGS Didipio , Makati City, Quirino, Philippines
23. SGS Geosol Laboratorios Ltda, Vespasiano, Minas Gerais, Brazil
24. SGS Lakefield Research Ltd, Lakefield, Ontario, Canada
25. SGS Nui Phao, Ba Dinh District, Ha Noi, Vietnam
26. SGS South Africa Pty Ltd, Booysens, Gauteng, South Africa
27. Shiva Analyticals Ltd, Bangalore North, Karnataka, India
28. Ultra Trace Pty Ltd (BV), Perth, WA, Australia

INTENDED USE

OREAS 928 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 928 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 928 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.