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CERTIFICATE OF ANALYSIS FOR

Gold Oxide Ore (Andy Well Gold Mine, Western Australia)

CERTIFIED REFERENCE MATERIAL

OREAS 257b

Table 1. Certified Values and Performance Gates for OREAS 257b.

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, ppm	14.22	0.373	13.47	14.96	13.10	15.34	2.63%	5.25%	7.88%	13.51	14.93
Aqua Regia Digestion (sample weights 10-50g)											
Au, ppm	14.17	0.447	13.27	15.06	12.83	15.51	3.16%	6.32%	9.47%	13.46	14.88
Cyanide Leach											
Au, ppm	13.96	0.460	13.04	14.88	12.58	15.34	3.30%	6.59%	9.89%	13.26	14.66
4-Acid Digestion											
Ag, ppm	2.36	0.189	1.98	2.74	1.79	2.93	8.01%	16.02%	24.03%	2.24	2.48
Al, wt.%	5.14	0.180	4.78	5.50	4.60	5.68	3.51%	7.01%	10.52%	4.89	5.40
As, ppm	65	3.9	58	73	54	77	5.96%	11.92%	17.89%	62	69
Ba, ppm	293	11	272	314	262	325	3.59%	7.18%	10.77%	279	308
Be, ppm	0.61	0.07	0.47	0.75	0.40	0.82	11.54%	23.08%	34.62%	0.58	0.64
Bi, ppm	0.88	0.038	0.81	0.96	0.77	1.00	4.26%	8.51%	12.77%	0.84	0.93
Ca, wt.%	0.579	0.024	0.531	0.627	0.507	0.651	4.14%	8.28%	12.42%	0.550	0.608
Cd, ppm	0.084	0.015	0.053	0.114	0.038	0.129	17.98%	35.95%	53.93%	0.079	0.088
Ce, ppm	13.7	0.83	12.1	15.4	11.2	16.2	6.04%	12.08%	18.13%	13.0	14.4
Co, ppm	26.2	1.52	23.1	29.2	21.6	30.7	5.81%	11.62%	17.43%	24.8	27.5

SI unit equivalents: ppm (parts per million) ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb (parts per billion).

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											
Cr, ppm	302	51	200	403	150	454	16.78%	33.56%	50.33%	287	317
Cs, ppm	0.62	0.034	0.56	0.69	0.52	0.72	5.43%	10.85%	16.28%	0.59	0.65
Cu, ppm	148	7	134	163	126	170	4.89%	9.78%	14.67%	141	155
Dy, ppm	1.34	0.064	1.22	1.47	1.15	1.53	4.75%	9.50%	14.25%	1.28	1.41
Er, ppm	0.84	0.056	0.73	0.95	0.67	1.01	6.68%	13.36%	20.04%	0.80	0.88
Eu, ppm	0.38	0.020	0.34	0.42	0.32	0.44	5.24%	10.48%	15.72%	0.36	0.40
Fe, wt.%	3.16	0.124	2.91	3.41	2.79	3.53	3.94%	7.87%	11.81%	3.00	3.32
Ga, ppm	11.9	0.74	10.5	13.4	9.7	14.1	6.19%	12.38%	18.57%	11.3	12.5
Gd, ppm	1.32	0.083	1.15	1.48	1.07	1.57	6.34%	12.69%	19.03%	1.25	1.38
Hf, ppm	1.24	0.067	1.11	1.37	1.04	1.44	5.36%	10.72%	16.08%	1.18	1.30
Ho, ppm	0.29	0.014	0.26	0.32	0.24	0.33	5.02%	10.05%	15.07%	0.27	0.30
In, ppm	0.030	0.006	0.018	0.041	0.013	0.047	19.17%	38.34%	57.50%	0.028	0.031
K, wt.%	1.15	0.042	1.06	1.23	1.02	1.27	3.66%	7.31%	10.97%	1.09	1.20
La, ppm	7.19	0.384	6.43	7.96	6.04	8.34	5.33%	10.67%	16.00%	6.83	7.55
Li, ppm	23.4	1.34	20.7	26.0	19.4	27.4	5.73%	11.46%	17.19%	22.2	24.5
Lu, ppm	0.11	0.01	0.09	0.14	0.08	0.15	11.05%	22.10%	33.15%	0.11	0.12
Mg, wt.%	2.13	0.087	1.96	2.30	1.87	2.39	4.08%	8.17%	12.25%	2.02	2.24
Mn, wt.%	0.034	0.001	0.031	0.037	0.030	0.038	4.03%	8.07%	12.10%	0.032	0.036
Mo, ppm	9.96	0.530	8.90	11.02	8.37	11.55	5.32%	10.65%	15.97%	9.46	10.46
Na, wt.%	0.231	0.012	0.206	0.255	0.194	0.268	5.31%	10.62%	15.93%	0.219	0.242
Nb, ppm	1.58	0.107	1.36	1.79	1.25	1.90	6.82%	13.64%	20.46%	1.50	1.65
Nd, ppm	5.78	0.229	5.32	6.24	5.09	6.47	3.97%	7.94%	11.91%	5.49	6.07
Ni, ppm	123	6	111	135	105	141	4.97%	9.95%	14.92%	117	129
P, wt.%	0.015	0.001	0.013	0.017	0.012	0.018	6.21%	12.43%	18.64%	0.015	0.016
Pb, ppm	15.8	1.8	12.2	19.4	10.4	21.2	11.35%	22.71%	34.06%	15.0	16.6
Pr, ppm	1.56	0.066	1.42	1.69	1.36	1.76	4.25%	8.50%	12.76%	1.48	1.64
Rb, ppm	44.9	2.32	40.3	49.6	38.0	51.9	5.16%	10.32%	15.48%	42.7	47.2
S, wt.%	0.111	0.006	0.098	0.123	0.092	0.129	5.45%	10.91%	16.36%	0.105	0.116
Sc, ppm	19.2	1.44	16.3	22.1	14.9	23.5	7.50%	15.01%	22.51%	18.2	20.2
Sm, ppm	1.21	0.093	1.03	1.40	0.94	1.49	7.64%	15.27%	22.91%	1.15	1.28
Sn, ppm	0.50	0.041	0.41	0.58	0.37	0.62	8.26%	16.51%	24.77%	0.47	0.52
Sr, ppm	32.0	1.86	28.3	35.7	26.4	37.6	5.83%	11.65%	17.48%	30.4	33.6
Ta, ppm	0.10	0.008	0.09	0.12	0.08	0.13	8.03%	16.06%	24.09%	0.10	0.11
Tb, ppm	0.21	0.02	0.16	0.26	0.14	0.28	10.91%	21.82%	32.72%	0.20	0.22
Te, ppm	0.41	0.06	0.29	0.54	0.23	0.60	15.11%	30.21%	45.32%	0.39	0.43
Th, ppm	1.85	0.126	1.59	2.10	1.47	2.23	6.85%	13.70%	20.55%	1.75	1.94
Ti, wt.%	0.198	0.009	0.180	0.215	0.171	0.224	4.42%	8.83%	13.25%	0.188	0.207
Tl, ppm	0.35	0.019	0.31	0.39	0.29	0.41	5.47%	10.94%	16.42%	0.33	0.37
Tm, ppm	0.11	0.01	0.09	0.14	0.07	0.15	11.05%	22.09%	33.14%	0.11	0.12
U, ppm	0.52	0.036	0.45	0.59	0.41	0.62	6.86%	13.73%	20.59%	0.49	0.54

SI unit equivalents: ppm (parts per million) ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb (parts per billion).

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											
V, ppm	139	6	126	152	120	158	4.59%	9.18%	13.77%	132	146
W, ppm	15.3	1.17	13.0	17.7	11.8	18.8	7.66%	15.32%	22.98%	14.6	16.1
Y, ppm	7.38	0.262	6.85	7.90	6.59	8.16	3.55%	7.10%	10.65%	7.01	7.75
Yb, ppm	0.80	0.048	0.70	0.89	0.66	0.94	5.95%	11.90%	17.85%	0.76	0.84
Zn, ppm	57	3.6	50	65	47	68	6.28%	12.56%	18.84%	55	60
Zr, ppm	45.5	2.36	40.8	50.3	38.4	52.6	5.19%	10.38%	15.56%	43.3	47.8

SI unit equivalents: ppm (parts per million) ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb (parts per billion).

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.

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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. In evaluating laboratory performance with this CRM, the section headed 'Intended Use' should be read carefully.

SOURCE MATERIAL

Certified Reference Material (CRM) OREAS 257b was prepared from gold-bearing Wilber Lode oxide ore from the Andy Well Gold Project. The Wilber Lode is a shear- hosted, narrow vein, quartz lode-style gold deposit situated within the Meekatharra-Wydgee greenstone belt in the Archaean Yilgarn Craton of Western Australia. The common primary mineral assemblage as stated by Mason and Harris (2011, 2012, cited in Hingston et al, 2014) is quartz, calcite, chlorite, fuchsite, pyrite, galena, sphalerite, chalcopyrite and gold. The host rock consists of a complex sequence of weathered Archaean meta-basalt and meta-porphyritic rocks derived from a primary mineralogy of albite, actinolite, chlorite, sericite, biotite, calcite, zoisite, muscovite, quartz and titanate. The Andy Well deposit is located approximately 45km north of Meekatharra in the Murchison region of Western Australia.

The approximate major and trace element composition of OREAS 257b is provided in Table 2.

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).

Table 2. Indicative Values for OREAS 257b.

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Pb Fire Assay								
Pd	ppb	*10.0*	Pt	ppb	*3.33*			
X-ray Photon Assay								
Au	ppm	*14.15*						
Aqua Regia Digestion								
Ag	ppm	*2.31*	In	ppm	*0.017*	Rh	ppm	*< 0.003*
As	ppm	*60*	Ir	ppm	*< 0.003*	Sb	ppm	*5.88*
Bi	ppm	*0.77*	Mo	ppm	*8.48*	Se	ppm	*0.51*
Cd	ppm	*0.085*	Ni	ppm	*111*	Sn	ppm	*0.21*
Co	ppm	*25.2*	Pb	ppm	*13.6*	Te	ppm	*0.36*
Cu	ppm	*138*	Pd	ppb	*< 20*	Tl	ppm	*0.13*
Hg	ppm	*0.29*	Pt	ppb	*7.63*	Zn	ppm	*52*
Borate Fusion XRF								
Al_2O_3	wt.%	*9.85*	K_2O	wt.%	*1.38*	P_2O_5	wt.%	*0.037*
CaO	wt.%	*0.800*	MgO	wt.%	*3.54*	SiO_2	wt.%	*74.48*
Cl	ppm	*30.0*	MnO	wt.%	*0.040*	SO_3	wt.%	*0.264*
Fe_2O_3	wt.%	*4.48*	Na_2O	wt.%	*0.310*	TiO_2	wt.%	*0.335*
4-Acid Digestion								
Ge	ppm	*0.82*	Re	ppm	*0.002*	Se	ppm	*0.97*
Hg	ppm	*0.23*	Sb	ppm	*7.05*			
Thermogravimetry								
LOI^{1000}	wt.%	*4.17*						
Infrared Combustion								
C	wt.%	*0.210*	S	wt.%	*0.085*			
Laser Ablation ICP-MS								
Ag	ppm	*2.85*	Hf	ppm	*1.39*	Sm	ppm	*1.24*
As	ppm	*60*	Ho	ppm	*0.29*	Sn	ppm	*0.50*
Ba	ppm	*297*	In	ppm	*< 0.05*	Sr	ppm	*31.2*
Be	ppm	*0.70*	La	ppm	*7.55*	Ta	ppm	*0.085*
Bi	ppm	*0.94*	Lu	ppm	*0.12*	Tb	ppm	*0.22*
Cd	ppm	*0.075*	Mn	wt.%	*0.034*	Te	ppm	*0.50*
Ce	ppm	*13.8*	Mo	ppm	*9.70*	Th	ppm	*1.90*
Co	ppm	*26.9*	Nb	ppm	*1.66*	Ti	wt.%	*0.210*
Cr	ppm	*385*	Nd	ppm	*5.87*	Tl	ppm	*0.40*
Cs	ppm	*0.63*	Ni	ppm	*130*	Tm	ppm	*0.14*
Cu	ppm	*151*	Pb	ppm	*16.0*	U	ppm	*0.53*
Dy	ppm	*1.50*	Pr	ppm	*1.60*	V	ppm	*145*
Er	ppm	*0.86*	Rb	ppm	*44.8*	W	ppm	*15.7*
Eu	ppm	*0.38*	Re	ppm	*< 0.01*	Y	ppm	*7.92*
Ga	ppm	*11.6*	Sb	ppm	*8.10*	Yb	ppm	*0.90*
Gd	ppm	*1.29*	Sc	ppm	*20.2*	Zn	ppm	*65*
Ge	ppm	*1.28*	Se	ppm	*< 5*	Zr	ppm	*47.3*

SI unit equivalents: ppm (parts per million) ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb (parts per billion).
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.

COMMINUTION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 257b was prepared in the following manner:

- Drying to constant mass at 105°C;
- Crushing and milling of the ore material to 100% minus 30 microns;
- Homogenisation;
- Packaging in 60g units sealed in laminated foil pouches and 500g units in plastic jars.

PHYSICAL PROPERTIES

OREAS 257b was tested at ORE Research & Exploration Pty Ltd's onsite facility for various physical properties. Table 3 presents these findings that should be used for informational purposes only.

Table 3. Physical properties of OREAS 257b.

Bulk Density (g/L)	Moisture%	Munsell Notation‡	Munsell Color‡
584	0.85	10YR 8/2	Very Pale Orange

‡The Munsell Rock Color 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.

ANALYTICAL PROGRAM

Thirty-five commercial analytical laboratories participated in the program to certify the elements reported in Table 1. The following methods were employed:

- Gold by fire assay (25-50g charge weight) with gravimetric (16 laboratories), AAS (12 laboratories), ICP-OES (3 laboratories) and ICP-MS (1 laboratory) finish;
- Full ICP-OES and ICP-MS elemental suites by 4-acid (HNO_3-HF-$HClO_4$-HCl) digestion (up to 26 laboratories depending on the element);
- Gold by 15-50g aqua regia digestion with ICP-MS (12 laboratories) and AAS (8 laboratories) finish;
- Gold by cyanide leach; a variety of cyanide leach methods were undertaken by the participating laboratories including the use of LeachWELL tablets, alkaline added sodium cyanide solution as well as sodium cyanide liquor with LeachWELL powder. The sample weights included: 5g (1 laboratory by AAS finish), 10g (1 laboratory by ICP-OES finish), 15g (1 laboratory by AAS finish), 30g (6 laboratories by AAS finish), 50g (2 laboratory by ICP-MS and 1 laboratory by AAS finish), 60g (1 laboratory by AAS finish) and 200g (5 laboratories by AAS and 1 laboratory by ICP-MS finish).

To confirm homogeneity, gold by instrumental neutron activation analysis (INAA) was undertaken on 20 x 85mg subsamples by the Australian Nuclear Science and Technology Organisation (ANSTO) located in Lucas Heights, NSW, Australia (see Table 5 in the 'Homogeneity Evaluation' section below).

For the round robin program twenty 3kg test units were taken at predetermined intervals during the bagging stage, immediately following homogenisation and are considered representative of the entire prepared batch. Six pulp samples were submitted to each laboratory for analysis (the weight provided depended on whether the laboratory was anticipated to undertake assays by gold cyanide leach). The samples received by each laboratory were obtained by taking two samples from each of three separate 3kg test units. This format enabled a 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 provides performance gate intervals for the 59 certified values based on their pooled 1SD's. Table 2 shows 95 indicative values including gold by Photon Assay (undertaken at 4 laboratories) and major and trace element characterisation by Bureau Veritas in Perth, Western Australia which includes:

- Major oxides by lithium borate fusion with X-ray fluorescence;
- LOI at 1000°C by thermogravimetric analyser;
- Total Carbon and Sulphur by Infrared combustion furnace;
- Trace element characterisation by laser ablation with ICP-MS finish.

Table 3 provides some indicative physical properties and Table 4 presents the 95% confidence and tolerance limits for all certified values. Gold homogeneity (via INAA) is shown in Table 5 and is also demonstrated by a nested ANOVA program using fire assay (see '**nested ANOVA**' section).

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 257b-DataPack.1.0.200311_132000.xlsx**).

Results are also presented in scatter plots for gold by fire assay, aqua regia digestion and cyanide leach (Figures 1 to 3, respectively) together with ±3SD (magenta) and ±5% (yellow) control lines and certified value (green line). Accepted individual results are coloured blue and individual and dataset outliers are identified in red and violet, respectively.

STATISTICAL ANALYSIS

Standard Deviation intervals (see 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.***

Certified Values, Standard Deviations, Confidence Limits and Tolerance Limits (Table 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 5) 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 257b (see 'Homogeneity Evaluation' section below).

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.***

Indicative (uncertified) values (Table 2) are present where the number of laboratories reporting a particular analyte is insufficient (< 5) to support certification or where inter-laboratory consensus is poor.

Table 4. 95% Confidence & Tolerance Limits for OREAS 257b.

Constituent	Certified	95% Confidence Limits		95% Tolerance Limits	
	Value	Low	High	Value	Low
Pb Fire Assay					
Au, Gold (ppm)	14.22	14.09	14.34	14.16*	14.27*
Aqua Regia Digestion (sample weights 10-50g)					
Au, Gold (ppm)	14.17	13.97	14.37	14.11*	14.23*
Cyanide Leach					
Au, Gold (ppm)	13.96	13.71	14.20	13.94*	13.98*
4-Acid Digestion					
Ag, Silver (ppm)	2.36	2.27	2.44	2.29	2.43
Al, Aluminium (wt.%)	5.14	5.07	5.22	5.05	5.24
As, Arsenic (ppm)	65	64	67	63	68
Ba, Barium (ppm)	293	289	297	287	300
Be, Beryllium (ppm)	0.61	0.58	0.64	0.58	0.65
Bi, Bismuth (ppm)	0.88	0.87	0.90	0.85	0.92
Ca, Calcium (wt.%)	0.579	0.570	0.589	0.568	0.590
Cd, Cadmium (ppm)	0.084	0.077	0.090	IND	IND
Ce, Cerium (ppm)	13.7	13.3	14.1	13.4	14.0
Co, Cobalt (ppm)	26.2	25.5	26.8	25.5	26.8
Cr, Chromium (ppm)	302	280	324	290	313
Cs, Caesium (ppm)	0.62	0.61	0.63	0.60	0.65
Cu, Copper (ppm)	148	145	151	144	152
Dy, Dysprosium (ppm)	1.34	1.31	1.38	1.28	1.41
Er, Erbium (ppm)	0.84	0.81	0.87	0.80	0.88
Eu, Europium (ppm)	0.38	0.36	0.40	0.36	0.40
Fe, Iron (wt.%)	3.16	3.11	3.21	3.10	3.22
Ga, Gallium (ppm)	11.9	11.6	12.3	11.6	12.3
Gd, Gadolinium (ppm)	1.32	1.27	1.37	1.24	1.39
Hf, Hafnium (ppm)	1.24	1.22	1.26	1.19	1.30
Ho, Holmium (ppm)	0.29	0.28	0.30	0.27	0.30
In, Indium (ppm)	0.030	0.028	0.031	0.027	0.032
K, Potassium (wt.%)	1.15	1.13	1.16	1.12	1.17
La, Lanthanum (ppm)	7.19	7.01	7.38	7.00	7.38
Li, Lithium (ppm)	23.4	22.9	23.9	22.5	24.2
Lu, Lutetium (ppm)	0.11	0.11	0.12	IND	IND
Mg, Magnesium (wt.%)	2.13	2.10	2.17	2.09	2.17
Mn, Manganese (wt.%)	0.034	0.034	0.035	0.033	0.035
Mo, Molybdenum (ppm)	9.96	9.74	10.18	9.71	10.21
Na, Sodium (wt.%)	0.231	0.225	0.237	0.223	0.239

SI unit equivalents: ppm (parts per million) ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb (parts per billion).

*Gold Tolerance Limits for typical 30g fire assay, 25g aqua regia digestion and 200g cyanide leach methods are determined from 20 x 85mg INAA results and the Sampling Constant (Ingamells & Switzer, 1973).

Note: intervals may appear asymmetric due to rounding.

Table 4 continued.

Constituent	Certified	95% Confidence Limits		95% Tolerance Limits	
	Value	Low	High	Value	Low
4-Acid Digestion continued					
Nb, Niobium (ppm)	1.58	1.53	1.62	1.50	1.65
Nd, Neodymium (ppm)	5.78	5.67	5.89	5.53	6.03
Ni, Nickel (ppm)	123	120	125	120	126
P, Phosphorus (wt.%)	0.015	0.015	0.016	0.015	0.016
Pb, Lead (ppm)	15.8	14.9	16.7	15.3	16.3
Pr, Praseodymium (ppm)	1.56	1.52	1.59	1.50	1.62
Rb, Rubidium (ppm)	44.9	44.0	45.9	43.5	46.4
S, Sulphur (wt.%)	0.111	0.108	0.113	0.100	0.121
Sc, Scandium (ppm)	19.2	18.6	19.8	18.6	19.8
Sm, Samarium (ppm)	1.21	1.17	1.26	1.16	1.27
Sn, Tin (ppm)	0.50	0.48	0.51	IND	IND
Sr, Strontium (ppm)	32.0	31.2	32.8	30.9	33.1
Ta, Tantalum (ppm)	0.10	0.10	0.11	IND	IND
Tb, Terbium (ppm)	0.21	0.20	0.22	0.19	0.23
Te, Tellurium (ppm)	0.41	0.39	0.44	0.36	0.47
Th, Thorium (ppm)	1.85	1.79	1.90	1.78	1.91
Ti, Titanium (wt.%)	0.198	0.194	0.201	0.192	0.203
Tl, Thallium (ppm)	0.35	0.34	0.36	0.33	0.37
Tm, Thulium (ppm)	0.11	0.10	0.12	IND	IND
U, Uranium (ppm)	0.52	0.51	0.53	0.49	0.54
V, Vanadium (ppm)	139	136	141	136	142
W, Tungsten (ppm)	15.3	14.8	15.8	14.9	15.8
Y, Yttrium (ppm)	7.38	7.28	7.47	7.17	7.59
Yb, Ytterbium (ppm)	0.80	0.77	0.82	0.76	0.84
Zn, Zinc (ppm)	57	56	59	55	59
Zr, Zirconium (ppm)	45.5	44.6	46.4	44.0	47.0

SI unit equivalents: ppm (parts per million) ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb (parts per billion).
Note: intervals may appear asymmetric due to rounding.

Homogeneity Evaluation

For analytes other than gold the tolerance limits (ISO 16269:2014) shown in Table 4 were determined using an analysis of precision errors method and are considered a conservative estimate of true homogeneity. The meaning of tolerance limits may be illustrated for copper by 4-acid digestion, where 99% of the time (1-α=0.99) at least 95% of subsamples (ρ=0.95) will have concentrations lying between 144 and 152 ppm. 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). ***Please note that tolerance limits pertain to the homogeneity of the CRM only and should not be used as control limits for laboratory performance.***

Table 5 below shows the gold INAA data determined on 20 x 85mg subsamples of OREAS 257b. An equivalent scaled version of the results is also provided to demonstrate the level of repeatability that would be achieved if 30g fire assay determinations were undertaken without the normal measurement error associated with this methodology. The homogeneity of gold 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 (i.e. sampling error) and measurement error becomes negligible. In this instance a subsample weight of 85 milligrams was employed and the 1RSD of 0.116% was calculated for a 30g fire assay sample (2.19% at 85mg weights) and confirms the high level of gold homogeneity in OREAS 257b.

Table 5. Neutron Activation Analysis of Au (in ppm) on 20 x 85mg subsamples and showing the equivalent results scaled to a 30g sample mass typical of fire assay determination.

Replicate No	Au 85mg actual	Au 30g equivalent*
1	14.300	14.590
2	14.245	14.587
3	14.626	14.607
4	14.151	14.582
5	14.596	14.605
6	14.595	14.605
7	14.182	14.583
8	14.339	14.592
9	14.852	14.619
10	14.426	14.596
11	15.002	14.627
12	15.051	14.629
13	15.297	14.642
14	14.960	14.625
15	14.676	14.610
16	14.420	14.596
17	14.770	14.615
18	14.317	14.591
19	14.501	14.600
20	14.811	14.617
Mean	14.606	14.606
Median	14.596	14.605
Std Dev.	0.319	0.017
Rel.Std.Dev.	**2.186%**	**0.116%**

*Results calculated for a 30g equivalent sample mass using the formula: $x^{30g\ Eq} = \frac{(x^{INAA} - \bar{X}) \times RSD@30g}{RSD@85mg} + \bar{X}$

where $x^{30g\ Eq}$ = equivalent result calculated for a 30g sample mass
(x^{INAA}) = raw INAA result at 85mg
$\bar{X}$ = mean of 85mg INAA results

The homogeneity of OREAS 257b has also been evaluated in a **nested ANOVA** of the round robin program. Each of the forty-two 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 257b. The test was performed using the following parameters:

- Gold fire assay – 192 samples (32 laboratories each providing analyses on 3 pairs of samples);
- Gold aqua regia digestion – 96 samples (16 laboratories each providing analyses on 3 pairs of samples);
- Gold cyanide leach – 102 samples (17 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 datasets were filtered for both individual and laboratory data set (batch) outliers prior to the calculation of the *p*-value.

This process derived *p*-values of 0.58 for Au by fire assay, 0.29 for Au by aqua regia digestion and 0.15 for Au by cyanide leach.. Both *p*-values are insignificant and the Null Hypothesis is retained. Additionally, none of the other certified values showed significant *p*-values except for Cu by 4-acid digestion (p-value = 0.01). This isolated case is most likely due to random* statistical probability as there is no other supporting evidence to suspect greater between-unit variance compared with within-unit variance. Furthermore, this analyte has a low associated 1RSD of 4.80% meaning the data is well constrained. The null hypothesis is therefore retained.

**p-values are calculated at the 95% probability level. Therefore by definition 5% of p-values calculated will naturally fall as 'significant' (<0.05). For every 100 p-values calculated, 5 will 'fail' naturally meaning a significant difference is detected (a false positive) where, in reality, none exists.*

Only results for constituents present in concentrations well above the detection levels (i.e. >20 x Lower Limit of Detection) for the various methods undertaken were considered for the objective of evaluating homogeneity. 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 257b and whether the variance between two subsamples from the same unit is statistically distinguishable from the variance of two subsamples taken from any two separate units. A reference material therefore can possess poor absolute homogeneity yet still pass a relative homogeneity (ANOVA) 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 257b is fit-for-purpose as a certified reference material (see 'Intended Use' below).

PARTICIPATING LABORATORIES

1. Actlabs, Ancaster, Ontario, Canada
2. AGAT Laboratories, Mississauga, Ontario, Canada
3. ALS, Lima, Peru
4. ALS, Loughrea, Galway, Ireland
5. ALS, Perth, WA, Australia
6. ALS, Vancouver, BC, Canada
7. American Assay Laboratories, Sparks, Nevada, USA
8. ANSTO, Lucas Heights, NSW, Australia
9. ARGETEST Mineral Processing, Ankara, Central Anatolia, Turkey
10. Bureau Veritas Commodities Canada Ltd, Vancouver, BC, Canada
11. Bureau Veritas Geoanalytical, Adelaide, SA, Australia
12. Bureau Veritas Geoanalytical, Perth, WA, Australia
13. Chrysos Corporation, Perth, WA, Australia
14. Gekko Assay Labs, Ballarat, VIC, Australia
15. Inspectorate (BV), Lima, Peru
16. Inspectorate America Corporation (BV), Sparks, Nevada, USA
17. Intertek Genalysis, Perth, WA, Australia
18. Intertek Tarkwa, Tarkwa, Ghana
19. Intertek Testing Services, Townsville, QLD, Australia
20. Intertek Testing Services Philippines, Cupang, Muntinlupa, Philippines
21. MinAnalytical Services, Kalgoorlie, WA, Australia
22. MinAnalytical Services, Perth, WA, Australia
23. Nagrom, Perth, WA, Australia
24. On Site Laboratory Services, Bendigo, VIC, Australia
25. Ontario Geological Survey, Sudbury, Ontario, Canada
26. PT Geoservices Ltd, Cikarang, Jakarta Raya, Indonesia
27. PT Intertek Utama Services, Jakarta Timur, DKI Jakarta, Indonesia
28. Reminex Centre de Recherche, Marrakesh, Marrakesh-Safi, Morocco
29. Saskatchewan Research Council, Saskatoon, Saskatchewan, Canada
30. SGS, Randfontein, Gauteng, South Africa
31. SGS Canada Inc., Vancouver, BC, Canada
32. SGS del Peru, Lima, Peru
33. SGS Tarkwa, Tarkwa, Western Region, Ghana
34. Shiva Analyticals Ltd, Bangalore North, Karnataka, India
35. Skyline Assayers & Laboratories, Tucson, Arizona, USA

Please note: To preserve anonymity, the above numbered alphabetical list of participating laboratories <u>does not</u> correspond with the Lab ID numbering on the scatter plots below.

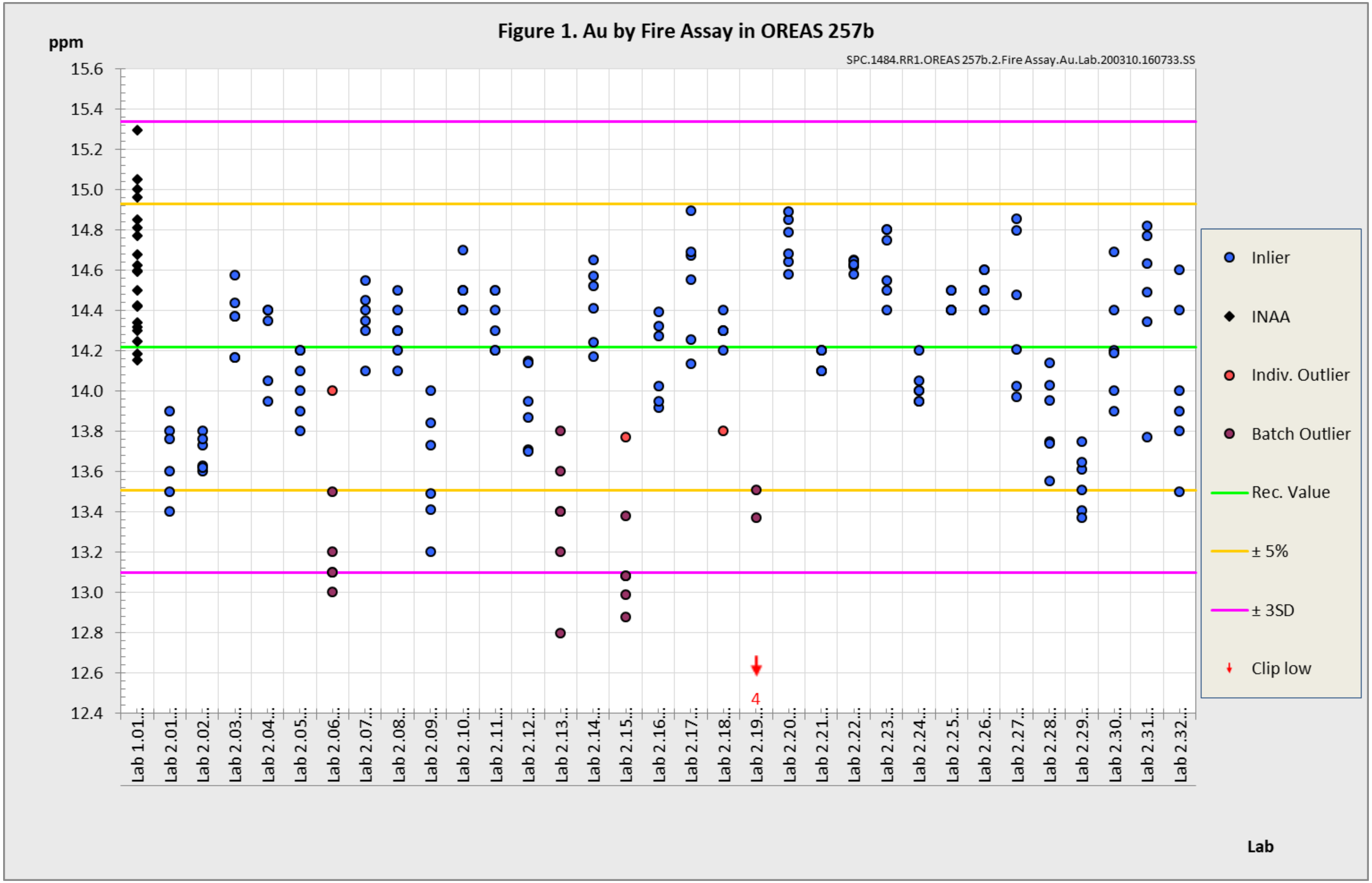
Figure 1. Au by Fire Assay in OREAS 257b
ppm
SPC.1484.RR1.OREAS 257b.2.Fire Assay.Au.Lab.200310.160733.SS
15.6
15.4
15.2
15.0
14.8
14.6
14.4
14.2
14.0
13.8
13.6
13.4
13.2
13.0
12.8
12.6
12.4
4
Lab 1.01...
Lab 2.01...
Lab 2.02...
Lab 2.03...
Lab 2.04...
Lab 2.05...
Lab 2.06...
Lab 2.07...
Lab 2.08...
Lab 2.09...
Lab 2.10...
Lab 2.11...
Lab 2.12...
Lab 2.13...
Lab 2.14...
Lab 2.15...
Lab 2.16...
Lab 2.17...
Lab 2.18...
Lab 2.19...
Lab 2.20...
Lab 2.21...
Lab 2.22...
Lab 2.23...
Lab 2.24...
Lab 2.25...
Lab 2.26...
Lab 2.27...
Lab 2.28...
Lab 2.29...
Lab 2.30...
Lab 2.31...
Lab 2.32...
Inlier
INAA
Indiv. Outlier
Batch Outlier
Rec. Value
± 5%
± 3SD
Clip low
Lab

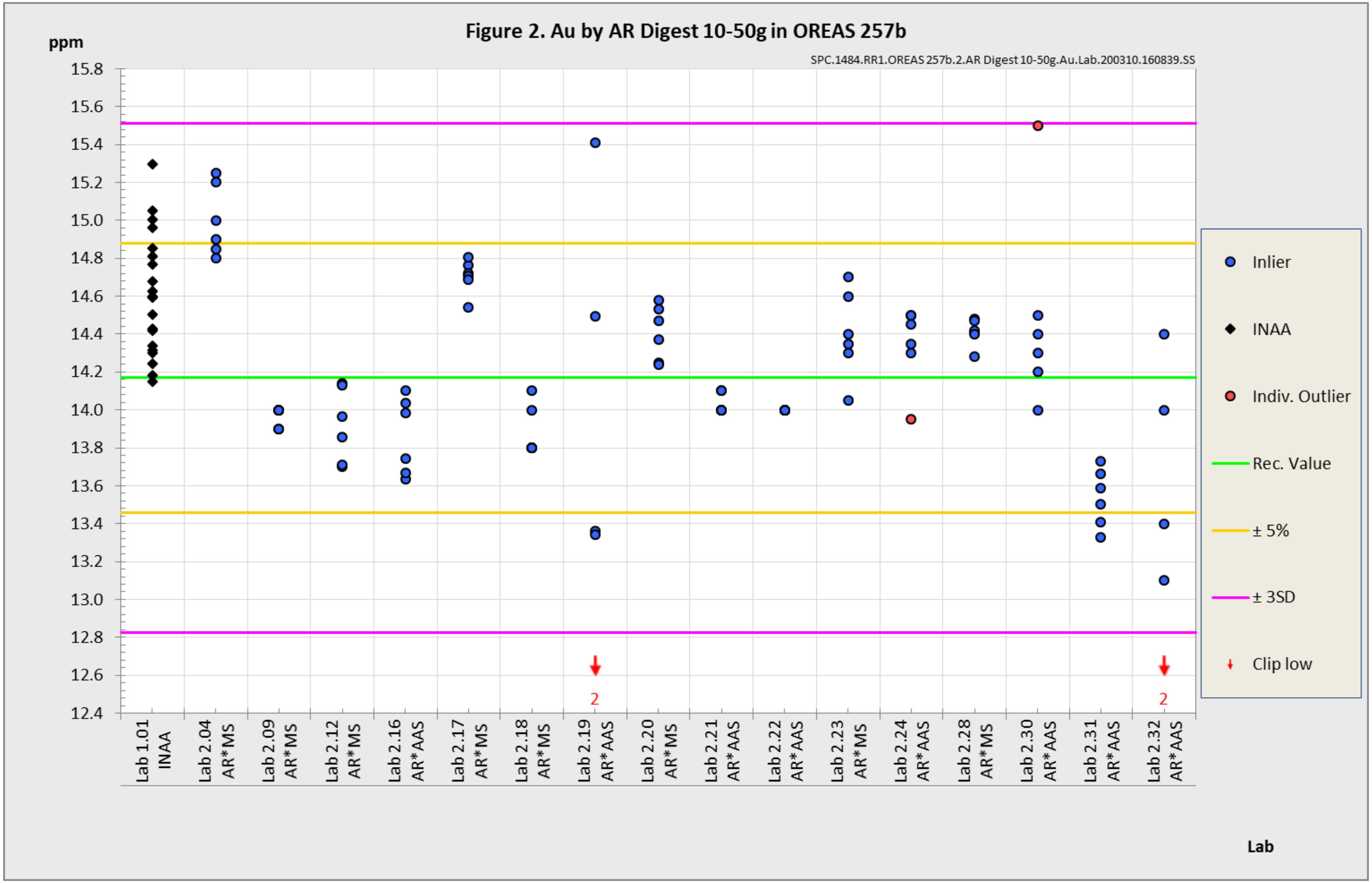

Figure 2. Au by AR Digest 10-50g in OREAS 257b
ppm
SPC.1484.RR1.OREAS 257b.2.AR Digest 10-50g.Au.Lab.200310.160839.SS
15.8
15.6
15.4
15.2
15.0
14.8
14.6
14.4
14.2
14.0
13.8
13.6
13.4
13.2
13.0
12.8
12.6
12.4
2
2
Lab 1.01 INAA
Lab 2.04 AR*MS
Lab 2.09 AR*MS
Lab 2.12 AR*MS
Lab 2.16 AR*AAS
Lab 2.17 AR*MS
Lab 2.18 AR*MS
Lab 2.19 AR*AAS
Lab 2.20 AR*MS
Lab 2.21 AR*AAS
Lab 2.22 AR*AAS
Lab 2.23 AR*MS
Lab 2.24 AR*AAS
Lab 2.28 AR*MS
Lab 2.30 AR*AAS
Lab 2.31 AR*AAS
Lab 2.32 AR*AAS
Inlier
INAA
Indiv. Outlier
Rec. Value
± 5%
± 3SD
Clip low
Lab

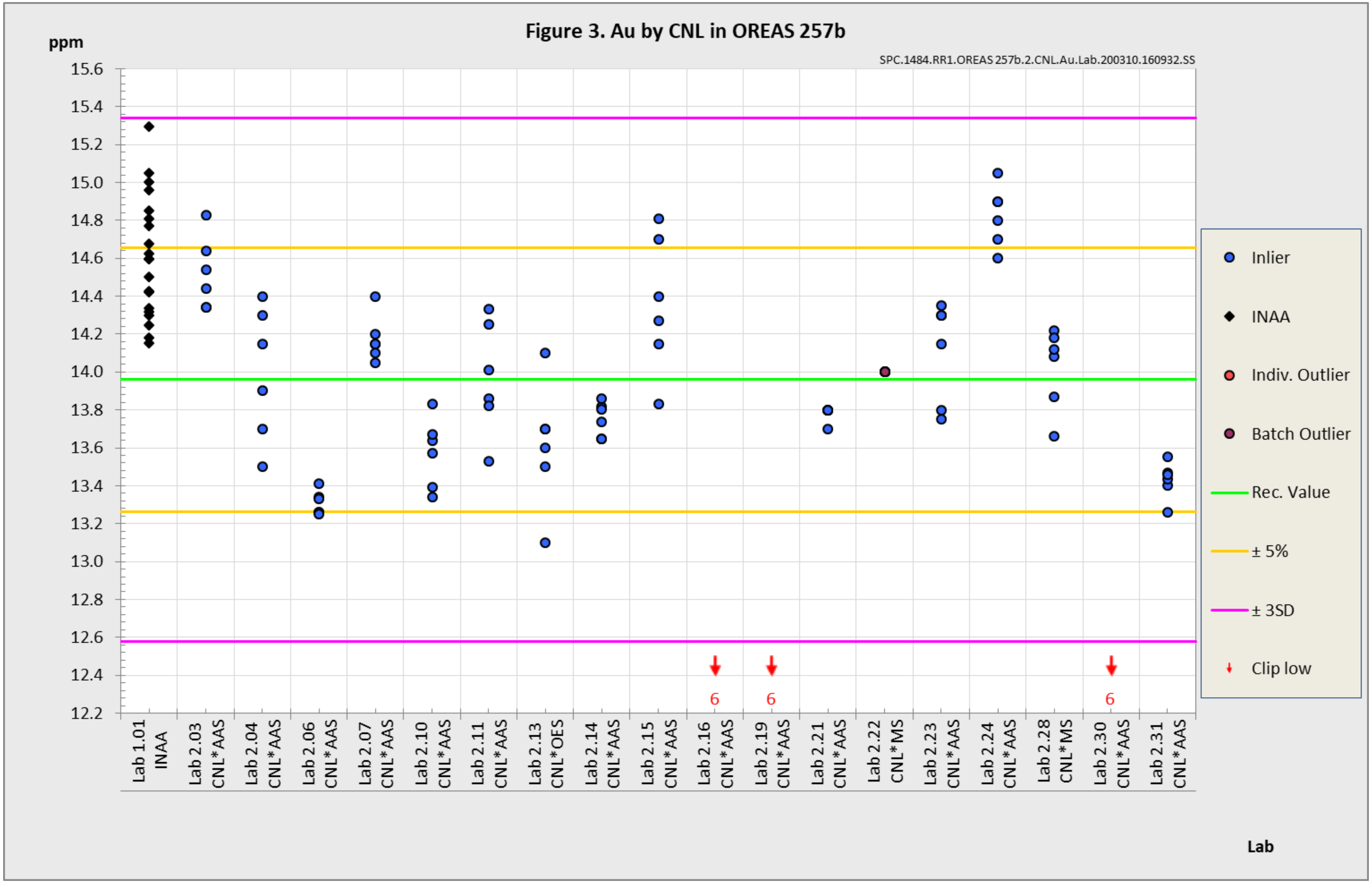
Figure 3. Au by CNL in OREAS 257b
ppm
SPC.1484.RR1.OREAS 257b.2.CNL.Au.Lab.200310.160932.SS
15.6
15.4
15.2
15.0
14.8
14.6
14.4
14.2
14.0
13.8
13.6
13.4
13.2
13.0
12.8
12.6
12.4
12.2
6
6
6
Lab 1.01 INAA
Lab 2.03 CNL*AAS
Lab 2.04 CNL*AAS
Lab 2.06 CNL*AAS
Lab 2.07 CNL*AAS
Lab 2.10 CNL*AAS
Lab 2.11 CNL*AAS
Lab 2.13 CNL*OES
Lab 2.14 CNL*AAS
Lab 2.15 CNL*AAS
Lab 2.16 CNL*AAS
Lab 2.19 CNL*AAS
Lab 2.21 CNL*AAS
Lab 2.22 CNL*MS
Lab 2.23 CNL*AAS
Lab 2.24 CNL*AAS
Lab 2.28 CNL*MS
Lab 2.30 CNL*AAS
Lab 2.31 CNL*AAS
Inlier
INAA
Indiv. Outlier
Batch Outlier
Rec. Value
± 5%
± 3SD
Clip low
Lab

PREPARER AND SUPPLIER

Certified reference material OREAS 257b was prepared, certified and supplied by:

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METROLOGICAL TRACEABILITY

The analytical samples were selected in a manner representative of the entire batch of the 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 method is possible. In this case, certification takes place on the basis of agreement among independent measurement results*** *(see ISO Guide 35:2006, Clause 10)."*

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 natural ore minerals 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 257b 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 257b may be used to calibrate the entire procedure by producing a pure substance CRM transformed into a calibration solution.

OREAS 257b 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.

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.

STABILITY AND STORAGE INSTRUCTIONS

OREAS 257b has been prepared from gold oxide ore. It is low in reactive sulphide (0.11 wt.% S) and in its unopened state and under normal conditions of storage has a shelf life beyond ten years. Its stability will be monitored at regular intervals and purchasers notified if any changes are observed.

INSTRUCTIONS FOR CORRECT USE

The certified values for OREAS 257b 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 including the use of safety glasses and dust masks are advised.

LEGAL NOTICE

DOCUMENT HISTORY

Revision No.	Date	Changes applied
0	12th March, 2020	First publication.

QMS CERTIFICATION

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

12th March, 2020

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

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