

CERTIFICATE OF ANALYSIS FOR

CERTIFIED REFERENCE MATERIAL

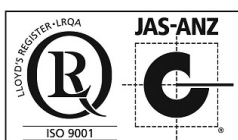
OREAS 84

Ni–Cu–Co–PGE Ore

Cosmos/Mt Keith Mines, Western Australia



Accredited for compliance with ISO 17034



COA-1767-OREAS 84-R0

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Table 1. Certified Values, Uncertainty & Tolerance Intervals in OREAS 84.

Constituent	Certified Value	95% Expanded Uncertainty		95% Tolerance Limits	
		Low	High	Low	High
Pb Fire Assay					
Au, Gold (ppb)	179	169	189	177*	180*
Pd, Palladium (ppb)	581	548	614	569	593
Pt, Platinum (ppb)	517	486	548	505	529
NiS Fire Assay					
Pd, Palladium (ppb)	556	494	618	540	573
Pt, Platinum (ppb)	487	392	581	418	555
Infrared Combustion					
S, Sulphur (wt.%)	24.21	23.74	24.69	23.95	24.48
4-Acid Digestion					
Ag, Silver (ppm)	2.38	2.28	2.47	2.27	2.48
Al, Aluminium (wt.%)	2.20	2.13	2.27	2.15	2.25
As, Arsenic (ppm)	167	161	174	163	172
Ba, Barium (ppm)	161	151	171	157	165
Be, Beryllium (ppm)	0.45	0.39	0.50	0.42	0.47
Bi, Bismuth (ppm)	1.56	1.48	1.64	1.51	1.61
Ca, Calcium (wt.%)	2.03	1.97	2.10	2.00	2.07
Cd, Cadmium (ppm)	2.43	2.25	2.61	2.29	2.56
Ce, Cerium (ppm)	15.8	15.0	16.6	15.3	16.3
Co, Cobalt (ppm)	1578	1519	1637	1543	1613
Cr, Chromium (wt.%)	0.559	0.486	0.631	0.535	0.583
Cs, Caesium (ppm)	1.85	1.73	1.97	1.77	1.93
Cu, Copper (wt.%)	0.400	0.387	0.412	0.393	0.406
Dy, Dysprosium (ppm)	0.94	0.88	1.00	0.90	0.98
Er, Erbium (ppm)	0.53	0.47	0.58	0.50	0.55
Eu, Europium (ppm)	0.34	0.29	0.38	0.32	0.36
Fe, Iron (wt.%)	31.51	30.61	32.42	31.06	31.96
Ga, Gallium (ppm)	6.58	6.06	7.10	6.32	6.85
Gd, Gadolinium (ppm)	1.16	1.03	1.29	1.11	1.21
Hf, Hafnium (ppm)	0.84	0.75	0.93	0.79	0.89
Ho, Holmium (ppm)	0.18	0.16	0.21	0.16	0.21
In, Indium (ppm)	0.13	0.12	0.15	0.12	0.14
K, Potassium (wt.%)	0.368	0.355	0.380	0.359	0.376
La, Lanthanum (ppm)	8.15	7.64	8.66	7.86	8.44
Li, Lithium (ppm)	10.3	9.6	11.0	9.9	10.6
Lu, Lutetium (ppm)	0.073	0.061	0.085	IND	IND
Mg, Magnesium (wt.%)	1.51	1.46	1.57	1.49	1.53
Mn, Manganese (wt.%)	0.064	0.062	0.066	0.063	0.065
Mo, Molybdenum (ppm)	5.05	4.65	5.45	4.70	5.40

SI unit equivalents: ppb (parts per billion; 1×10^{-9}) $\equiv$ $\mu\text{g/kg}$; ppm (parts per million; 1×10^{-6}) $\equiv$ mg/kg ; wt.% (weight per cent) $\equiv$ % (mass fraction).

*Gold Tolerance Limits for typical 30 g lead fire assay are determined from 20 x 85 mg INAA results and the Sampling Constant (Ingamells & Switzer, 1973).

Note: intervals may appear asymmetric due to rounding.

IND = indeterminate (due to limited reading resolution of the methods employed).

Table 1 continued.

Constituent	Certified Value	95% Expanded Uncertainty		95% Tolerance Limits	
		Low	High	Low	High
4-Acid Digestion continued					
Na, Sodium (wt.%)	0.446	0.433	0.459	0.436	0.456
Nb, Niobium (ppm)	2.37	2.17	2.56	2.23	2.50
Nd, Neodymium (ppm)	6.72	6.33	7.11	6.49	6.95
Ni, Nickel (wt.%)	10.47	10.18	10.75	10.25	10.68
P, Phosphorus (wt.%)	0.022	0.021	0.023	0.021	0.022
Pb, Lead (ppm)	74	71	78	73	76
Pr, Praseodymium (ppm)	1.82	1.67	1.97	1.72	1.92
Rb, Rubidium (ppm)	21.4	20.1	22.8	20.9	22.0
Re, Rhenium (ppm)	0.029	0.023	0.035	0.025	0.034
S, Sulphur (wt.%)	22.14	20.98	23.31	21.69	22.59
Sb, Antimony (ppm)	1.52	1.38	1.66	1.41	1.63
Sc, Scandium (ppm)	5.21	4.85	5.57	4.99	5.43
Se, Selenium (ppm)	10.7	9.5	11.9	9.9	11.5
Sm, Samarium (ppm)	1.31	1.14	1.48	1.24	1.38
Sn, Tin (ppm)	1.49	1.33	1.66	IND	IND
Sr, Strontium (ppm)	87	83	91	85	89
Ta, Tantalum (ppm)	0.21	0.17	0.24	0.19	0.23
Tb, Terbium (ppm)	0.17	0.16	0.19	IND	IND
Te, Tellurium (ppm)	1.27	1.11	1.42	1.12	1.41
Th, Thorium (ppm)	3.14	2.92	3.36	2.99	3.29
Ti, Titanium (wt.%)	0.117	0.110	0.124	0.114	0.120
Tl, Thallium (ppm)	1.24	1.19	1.29	1.20	1.28
Tm, Thulium (ppm)	0.069	0.050	0.087	IND	IND
U, Uranium (ppm)	0.82	0.75	0.89	0.79	0.85
V, Vanadium (ppm)	100	95	105	97	103
W, Tungsten (ppm)	1.31	1.18	1.44	IND	IND
Y, Yttrium (ppm)	4.71	4.36	5.06	4.53	4.89
Yb, Ytterbium (ppm)	0.47	0.42	0.52	0.44	0.50
Zn, Zinc (ppm)	814	782	845	801	826
Zr, Zirconium (ppm)	28.6	26.3	30.9	27.0	30.1
Borate / Peroxide Fusion ICP					
Al2O3, Aluminium(III) oxide (wt.%)	4.17	4.01	4.33	4.08	4.26
As, Arsenic (ppm)	175	165	186	168	183
Ba, Barium (ppm)	175	167	184	170	180
Bi, Bismuth (ppm)	1.39	1.19	1.59	IND	IND
CaO, Calcium oxide (wt.%)	2.93	2.79	3.07	2.86	3.00
Cd, Cadmium (ppm)	< 10	IND	IND	IND	IND
Ce, Cerium (ppm)	15.8	14.4	17.2	15.3	16.3
Co, Cobalt (ppm)	1654	1581	1727	1622	1686
Cr, Chromium (wt.%)	0.747	0.724	0.769	0.731	0.763

SI unit equivalents: ppm (parts per million; $1 \times 10^{-6} \equiv \text{mg/kg}$; wt.% (weight per cent) $\equiv \%$ (mass fraction).

Note: intervals may appear asymmetric due to rounding.

IND = indeterminate (due to limited reading resolution of the methods employed. For practical purposes the 95% Expanded Uncertainty can be set between zero and a two times multiple of the upper bound/non-detect limit value).

Table 1 continued.

Constituent	Certified Value	95% Expanded Uncertainty		95% Tolerance Limits	
		Low	High	Low	High
Borate / Peroxide Fusion ICP continued					
Cs, Caesium (ppm)	1.73	1.44	2.02	1.53	1.92
Cu, Copper (wt.%)	0.405	0.395	0.415	0.396	0.413
Dy, Dysprosium (ppm)	0.93	0.81	1.06	0.86	1.01
Er, Erbium (ppm)	0.50	0.42	0.58	0.44	0.56
Eu, Europium (ppm)	0.30	0.27	0.33	0.27	0.33
Fe ₂ O ₃ , Iron(III) oxide (wt.%)	44.64	43.40	45.89	43.81	45.48
Ga, Gallium (ppm)	7.05	6.18	7.93	6.59	7.51
Gd, Gadolinium (ppm)	1.12	0.99	1.25	1.00	1.24
Ho, Holmium (ppm)	0.18	0.15	0.20	IND	IND
K ₂ O, Potassium oxide (wt.%)	0.453	0.423	0.484	0.432	0.475
La, Lanthanum (ppm)	8.30	7.66	8.95	7.86	8.75
Li, Lithium (ppm)	12.8	10.0	15.7	10.7	15.0
Lu, Lutetium (ppm)	0.075	0.047	0.103	IND	IND
MgO, Magnesium oxide (wt.%)	2.64	2.55	2.73	2.59	2.70
MnO, Manganese oxide (wt.%)	0.085	0.082	0.088	0.084	0.087
Mo, Molybdenum (ppm)	5.62	4.25	7.00	IND	IND
Nd, Neodymium (ppm)	6.67	6.17	7.17	6.17	7.18
Ni, Nickel (wt.%)	10.53	10.24	10.81	10.33	10.72
P ₂ O ₅ , Phosphorus(V) oxide (wt.%)	0.057	0.045	0.070	0.056	0.059
Pb, Lead (ppm)	74	66	81	69	78
Pr, Praseodymium (ppm)	1.81	1.64	1.97	1.68	1.93
Rb, Rubidium (ppm)	22.0	20.7	23.3	21.4	22.6
S, Sulphur (wt.%)	24.08	23.07	25.08	23.65	24.50
Sb, Antimony (ppm)	1.55	1.15	1.96	IND	IND
Sc, Scandium (ppm)	5.01	4.77	5.26	IND	IND
Se, Selenium (ppm)	< 20	IND	IND	IND	IND
SiO ₂ , Silicon dioxide (wt.%)	16.27	15.55	16.98	15.92	16.62
Sm, Samarium (ppm)	1.26	1.13	1.40	1.14	1.38
Sn, Tin (ppm)	1.40	0.90	1.91	IND	IND
Sr, Strontium (ppm)	89	84	94	86	91
Tb, Terbium (ppm)	0.16	0.14	0.18	IND	IND
Th, Thorium (ppm)	3.04	2.71	3.37	2.82	3.26
TiO ₂ , Titanium dioxide (wt.%)	0.200	0.190	0.210	0.196	0.204
Tl, Thallium (ppm)	1.20	1.07	1.32	IND	IND
Tm, Thulium (ppm)	0.075	0.062	0.089	IND	IND
U, Uranium (ppm)	0.78	0.65	0.92	0.66	0.90
V, Vanadium (ppm)	100	94	106	96	104
Y, Yttrium (ppm)	4.90	4.55	5.24	4.67	5.12
Yb, Ytterbium (ppm)	0.46	0.36	0.56	IND	IND
Zn, Zinc (ppm)	820	780	860	802	838

SI unit equivalents: ppm (parts per million; $1 \times 10^{-6} \equiv \text{mg/kg}$; wt.% (weight per cent) $\equiv$ % (mass fraction).

Note: intervals may appear asymmetric due to rounding.

IND = indeterminate (due to limited reading resolution of the methods employed. For practical purposes the 95% Expanded Uncertainty can be set between zero and a two times multiple of the upper bound/non-detect limit value).

Table 1 continued.

Constituent	Certified Value	95% Expanded Uncertainty		95% Tolerance Limits	
		Low	High	Low	High
Borate / Peroxide Fusion ICP continued					
Zr, Zirconium (ppm)	34.7	30.8	38.7	32.0	37.5
Borate Fusion XRF					
Al ₂ O ₃ , Aluminium(III) oxide (wt.%)	4.15	4.06	4.25	4.11	4.20
CaO, Calcium oxide (wt.%)	2.91	2.84	2.97	2.88	2.94
Co, Cobalt (ppm)	1615	1470	1760	IND	IND
Cr ₂ O ₃ , Chromium(III) oxide (wt.%)	1.10	1.06	1.14	1.08	1.11
Cu, Copper (wt.%)	0.398	0.376	0.419	0.383	0.412
Fe ₂ O ₃ , Iron(III) oxide (wt.%)	44.93	44.21	45.64	44.67	45.19
Hf, Hafnium (ppm)	< 80	IND	IND	IND	IND
K ₂ O, Potassium oxide (wt.%)	0.433	0.417	0.448	0.423	0.443
MgO, Magnesium oxide (wt.%)	2.70	2.61	2.79	2.67	2.73
MnO, Manganese oxide (wt.%)	0.087	0.079	0.095	0.082	0.091
Na ₂ O, Sodium oxide (wt.%)	0.461	0.349	0.574	0.444	0.479
Ni, Nickel (wt.%)	10.37	10.08	10.66	10.29	10.45
P ₂ O ₅ , Phosphorus(V) oxide (wt.%)	0.061	0.049	0.072	IND	IND
S, Sulphur (wt.%)	22.63	20.51	24.76	22.45	22.82
SiO ₂ , Silicon dioxide (wt.%)	16.07	15.80	16.33	15.92	16.21
TiO ₂ , Titanium dioxide (wt.%)	0.199	0.185	0.213	0.187	0.210
V ₂ O ₅ , Vanadium(V) oxide (ppm)	250	131	368	IND	IND
Zn, Zinc (ppm)	805	771	838	785	824
Thermogravimetry					
LOI ¹⁰⁰⁰ , Loss on ignition @1000 °C (wt.%)	12.31	12.01	12.62	12.22	12.40

SI unit equivalents: ppm (parts per million; 1×10^{-6}) $\equiv$ mg/kg; wt.% (weight per cent) $\equiv$ % (mass fraction).

Note: intervals may appear asymmetric due to rounding.

IND = indeterminate (due to limited reading resolution of the methods employed. For practical purposes the 95% Expanded Uncertainty can be set between zero and a two times multiple of the upper bound/non-detect limit value).

Table 2. Indicative Values for OREAS 84.

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Pb Fire Assay								
Ir	ppb	179	Rh	ppb	243	Ru	ppb	420
NiS Fire Assay								
Au	ppb	154	Os	ppb	119	Ru	ppb	306
Ir	ppb	123	Rh	ppb	120			
Infrared Combustion								
C	wt. %	0.125						
4-Acid Digestion								
B	ppm	216	Ge	ppm	0.50	Hg	ppm	0.043
Borate / Peroxide Fusion ICP								
Ag	ppm	1.63	Hg	ppm	0.77	Ta	ppm	0.28
B	ppm	24.8	In	ppm	0.14	Te	ppm	1.05
Be	ppm	1.08	Na ₂ O	wt. %	0.636	W	ppm	1.21
Ge	ppm	1.35	Nb	ppm	1.99			
Hf	ppm	0.93	Re	ppm	< 0.1			
Borate Fusion XRF								
As	ppm	123	Nb	ppm	146	Sr	ppm	84
BaO	ppm	249	Pb	ppm	177	W	ppm	22.5
Bi	ppm	< 100	Rb	ppm	50	Y	ppm	41.7
Ce	ppm	112	Sb	ppm	49.8	Zr	ppm	272
La	ppm	94	Sc	ppm	< 1			
Mo	ppm	< 50	Sn	ppm	< 50			
Thermogravimetry								
H ₂ O-	wt. %	0.212						

SI unit equivalents: ppb (parts per billion; 1×10^{-9}) $\equiv$ $\mu\text{g/kg}$; ppm (parts per million; 1×10^{-6}) $\equiv$ mg/kg ; wt. % (weight per cent) $\equiv$ % (mass fraction).

Note: the number of significant figures reported is not a reflection of the level of certainty of stated values. They are instead an artefact of ORE's in-house CRM-specific LIMS.

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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 'Instructions for handling and correct use' should be read carefully.

Table 1 presents the certified values together with their associated 95 % expanded uncertainty and tolerance intervals. Table 2 provides indicative values, including major and trace element characterisation, Table 3 lists indicative physical properties, while Table 4 reports indicative mineralogy determined by semi-quantitative XRD analysis, Gold homogeneity, assessed by INAA, is shown in Table 5 and is further demonstrated through a nested ANOVA (see *Homogeneity Evaluation* section). Finally, Table 6 presents the performance gate intervals for all certified values.

Tabulated results of all analytes together with uncorrected means, medians, standard deviations, relative standard deviations and per cent deviation of laboratory means from the corrected mean of means (PDM³) are presented in the detailed certification data for this CRM (**OREAS 84-DataPack.1.0.260730_140824.xlsx**). The certified values and uncertainties in this Certificate are the sole authoritative figures. Any additional significant figures in the DataPack are provided for reference only and do not affect the certified results.

Results are also presented as scatter plots for Ni, Cu and Co by 4-acid digestion and Au by Pb fire assay in Figures 1–4, respectively. The plots include the certified value (green line), ± 3 SD control limits (magenta), and ± 5 % control limits (yellow). Accepted individual results are shown in blue, while individual outliers and dataset outliers are highlighted in red and violet, respectively.

INTENDED USE

OREAS 84 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 84 may be used to calibrate the entire procedure by producing a pure substance CRM transformed into a calibration solution.

OREAS 84 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/ validation 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. When a value provided in this certificate is used to calibrate a measurement process, the uncertainty associated with that value should be appropriately propagated into the user's uncertainty calculation. Users can determine an approximation of the standard uncertainty by calculating one fourth of

the width of the Expanded Uncertainty interval given in this certificate (Expanded Uncertainty intervals are provided in Table 1).

SOURCE MATERIAL

OREAS 84 was prepared from a blend of high-grade, komatiite-hosted nickel-copper-cobalt sulphide ores sourced from the Leinster district, Western Australia, supplemented with PGE-bearing Merensky Reef ore and Cr-rich, PGE-bearing UG2 Reef ore from the Dishaba Mine, South Africa, and fresh gabbro-norite sourced from the Black Hill Norite Complex, South Australia.

MINIMUM SAMPLE SIZE

To relate analytical determinations to the values in this certificate, the minimum mass of sample used should match the typical mass that the laboratories used in the interlaboratory (round robin) certification program. This means that different minimum sample masses should be used depending on the operationally defined methodology as follows:

- Lead collection fire assay: ≥ 25 g;
- Nickel sulphide collection fire assay: ≥ 10 g;
- S by infrared combustion furnace / CS analyser: ≥ 0.1 g;
- 4-acid digestion with ICP-OES and/or MS finish: ≥ 0.25 g;
- Borate fusion /Sodium peroxide with ICP-OES and/or MS finish: ≥ 0.2 g;
- Borate fusion with X-ray fluorescence finish: ≥ 0.2 g.

INSTRUCTIONS FOR HANDLING, STORAGE & CORRECT USE

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

Pre-homogenisation of the CRM prior to subsampling and analysis is not necessary as there is no particle segregation under transport [12].

As per routine analysis at commercial laboratories, the certified values derived by borate fusion with XRF finish are on a dry sample basis.

Analytes by all other methods refer to the concentration levels in the packaged state. There is no need for drying prior to weighing and analysis for these methods.

Single-Use Sachets

OREAS 84 is available in single-use, 10 g and 60 g laminated foil sachets. Following analysis, it is the manufacturer's expectation that any remaining material is discarded. It is the user's responsibility to prevent contamination and avoid prolonged exposure of the sample to the atmosphere prior to analysis.

Authoritative Source of Information

This Certificate of Analysis constitutes the primary and authoritative document for the certified values, associated expanded uncertainties, and their correct use. While the

accompanying DataPack provides supporting information, including raw data and uncertainty estimates with additional significant figures, these extended figures are provided solely for transparency, convenience and statistical reference. Users must rely exclusively on the values stated in this Certificate, rounded to an appropriate number of significant figures, for all metrological and analytical purposes. Any discrepancy between values presented in the DataPack and those in this Certificate shall be resolved in favour of the information provided herein.

Notice on Certificate Updates

The version of the Certificate of Analysis (COA) available on the OREAS website is considered the official and most current version. As COAs may be revised following periodic reviews, re-evaluation of data, or the availability of new information, users are strongly advised to refer to the latest online version prior to each use.

It is the user's responsibility to ensure that the most recent and applicable certificate is used to support the traceability, validity, and fitness-for-purpose of the certified reference material (CRM).

Any significant changes to the sections of this certificate will be clearly documented in the revised certificate.

QC Monitoring Using Multiples of the Standard Deviation (SD)

When applying SDs to monitor performance, it is important to recognise that laboratories differ in proficiency, and that different methods have differing levels of precision. Each laboratory has its own inherent SD (specific to an analyte–method–concentration combination), which is not directly comparable to SDs derived from a round robin.

As most data in this round robin came from world-class laboratories, the interlaboratory SDs are narrower than would be expected across a broader mix. To provide more realistic benchmarks, this report presents pooled interlaboratory SDs, incorporating both within-lab variation and between-lab bias. These should be treated as a starting point only, with QC managers refining them against their own control charts.

The performance gates shown in Table 5 are intended only to be used as an initial guide as to what a laboratory may be able to achieve. Over a period of time monitoring your own laboratory's data for this CRM, SDs should be calculated directly from your own laboratory's process. This will enable you to establish more specific performance gates that are fit for purpose for your application as well as the ability to monitor bias. If your long-term trend analysis shows an average value that differs from the certified value, the significance of this bias should be assessed against the combined standard uncertainty of the certified value and the laboratory's own measurement uncertainty. Where the observed difference lies within this combined uncertainty, the bias is generally not considered significant.

PERIOD OF VALIDITY

The certification of OREAS 84 remains valid, within the specified measurement uncertainties, until at least November 2040, provided the CRM is handled and stored in accordance with the instructions given below. This certification is nullified if the CRM is any way changed or contaminated.

Store in a clean and cool dry place away from direct sunlight.

Long-term stability will be monitored at appropriate intervals and purchasers notified if any changes are observed. The period of validity may well be indefinite and will be reassessed prior to expiry with the aim of extending the validity if possible.

COMMINUTION AND HOMOGENISATION PROCEDURES

The materials constituting OREAS 84 was prepared in the following manner:

- Drying of sulphide-rich ores to constant mass at 85 °C
- Drying of low-sulphide ores and barren material to constant mass at 105 °C
- Crushing and multi-stage milling of the barren material to >98 % minus 75 microns
- Crushing and multi-stage milling of the ores to 100 % minus 30 microns
- Blending the ores and barren material in appropriate proportions to achieve desired grades
- Homogenisation using OREAS' novel processing technologies
- Packaging in 10 g and 60 g units under nitrogen in laminated foil pouches

PHYSICAL PROPERTIES

OREAS 84 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 84.

Bulk Density (kg/m ³)	Moisture (wt.%)	Munsell Notation [‡]	Munsell Color [‡]
1077	0.46	N2	Grayish Black

[‡]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.

MINERALOGY

Table 4. Indicative mineralogy of OREAS 84 by semi-quantitative XRD analysis.

Mineral / Mineral Group	% (mass ratio)
Chalcopyrite	2
Pyrrhotite	29
Pentlandite	26
Pyrite	4
Spinel group	3
Chlorite	6
Annite - biotite - phlogopite	1
Ca amphibole	1
Orthopyroxene	10
Plagioclase	10
K-feldspar	2
Quartz	3
*Jarosite group	2

The semi-quantitative XRD results shown in Table 4 above were undertaken by ALS Metallurgy in Balcatta, Western Australia. The results have been normalised to 100 % and represent the relative proportion of crystalline material. Totals greater or less than 100 % are due to rounding errors.

Some amorphous material may be present. 'Spinel group' appears to include mainly chromite and/or magnetite. A trace of stilpnomelane and/or sepiolite may be present.

*indicates a larger than usual uncertainty in regard to the quantity of the phase reported.

ANALYTICAL PROGRAM

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

- Instrumental neutron activation analysis (INAA) for Au on 20 x 85 mg subsamples to confirm homogeneity (1 laboratory)
- Au, Pd and Pt by Pb collection fire assay (25-50 g charge weight) with ICP-OES (12 laboratories), ICP-MS (5 laboratories) finish and AAS finish (2 laboratories)
- Au, Pt, Pd, Ir, Os, Rh and Ru by nickel sulphide (NiS) collection fire assay with ICP-OES and/or ICP-MS finish and INAA finish (up to 6 laboratories depending on the element)
- Total S by IR combustion furnace (21 laboratories)
- Full ICP-OES and ICP-MS elemental suites by 4-acid ($\text{HNO}_3\text{-HF-HClO}_4\text{-HCl}$) digestion (up to 22 laboratories depending on the element)
- Sodium peroxide fusion with full suite ICP-OES and ICP-MS elemental packages (up to 21 laboratories depending on the element)
- Lithium borate fusion whole rock analysis package by X-ray fluorescence (up to 19 laboratories depending on the element)
- Thermogravimetry: Loss on Ignition (LOI) at 1000 °C (8 laboratories used a thermogravimetric analyser, 6 laboratories included LOI with their fusion package and 6 laboratories used a conventional muffle furnace)

For the round robin program, twelve 2.5 kg test units were collected at predetermined intervals during the bagging stage, immediately after homogenisation. Each participating laboratory received six test portions. The samples received by each laboratory were obtained by taking samples from six different 2.5 kg test units to maximise representation (i.e., from either the odd or even sampling (lot) intervals).

The 20 individual INAA results upon which much of the homogeneity evaluation is based, included paired 10 g samples taken from 10 of the 12 different sampling units. This format enabled a nested ANOVA treatment of the INAA results to evaluate homogeneity (see 'Homogeneity Evaluation' section below).

PARTICIPATING LABORATORIES

1. Actlabs, Ancaster, Ontario, Canada
2. AGAT Laboratories, Calgary, Alberta, Canada
3. AGAT Laboratories, Thunder Bay, Ontario, Canada
4. Alex Stewart International, Mendoza, Argentina
5. ALS, Johannesburg, South Africa
6. ALS, Lima, Peru
7. ALS, Loughrea, Galway, Ireland
8. ALS, Malaga, WA, Australia
9. ALS, Vancouver, BC, Canada
10. American Assay Laboratories, Sparks, Nevada, USA
11. ANSTO, Lucas Heights, NSW, Australia
12. Inspectorate (BV), Shanghai, Bao Shan District, China
13. Intertek, Cupang, Muntinlupa, Philippines
14. Intertek, Perth, WA, Australia
15. MINTEK Analytical Services, Randburg, South Africa
16. PT Geoservices Ltd, Cikarang, Jakarta Raya, Indonesia
17. PT Intertek Utama Services, Jakarta Timur, DKI Jakarta, Indonesia
18. Saskatchewan Research Council, Saskatoon, Saskatchewan, Canada
19. SGS, Ankara, Anatolia, Turkey
20. SGS Australia Mineral Services, Perth, WA, Australia
21. SGS Canada Inc., Vancouver, BC, Canada
22. SGS Geosol Laboratorios Ltda, Vespasiano, Minas Gerais, Brazil
23. Shiva Analyticals Ltd, Bangalore North, Karnataka, India
24. Stewart Assay & Environmental Laboratories LLC, Kara-Balta, Chüy, Kyrgyzstan

Please note: To maintain anonymity of participating laboratories, the alphabetical list above does not correspond to the Lab ID numbers shown in the scatter plots below.

STATISTICAL ANALYSIS

Certified Values and their uncertainty intervals (Table 1) have been determined for each analyte following removal of individual, laboratory dataset (batch) and 3SD outliers (single iteration). Outlier evaluation was conducted in accordance with ISO 17034:2016 and ISO 33405:2024. While formal statistical tests were applied, professional statistical judgment was also exercised in determining the validity of potential outliers. Assessment of systematic bias and performance using independent control materials (CRMs) was incorporated to ensure compliance with the referenced standards and to establish metrological traceability of the certified values.

95% Expanded Uncertainty provides a 95 % probability that the true value of the analyte under consideration lies between the upper and lower limits and is calculated according to the method outlined in [6] and [15]. All known or suspected sources of bias have been investigated or taken into account.

Indicative (uncertified) values (Table 2) are present where the number of laboratories reporting a particular analyte is insufficient (< 5) to support certification or where interlaboratory consensus is poor. This data is intended for 'informational purposes' only.

Standard Deviation intervals (see Table 6, 'Performance Gates') 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.***

Homogeneity Evaluation

For analytes other than gold, the tolerance limits (ISO 16269:2014) shown in Table 1 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 Ni by 4-acid digestion, where 99 % of the time ($1-\alpha=0.99$) at least 95 % of subsamples ($p=0.95$) will have concentrations lying between 10.25 and 10.68 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. ***Please note that tolerance limits pertain to the homogeneity of the CRM only and should not be used as control limits for laboratory performance.***

The homogeneity of gold has been determined by INAA at ANSTO using the reduced analytical subsample method which utilises the known relationship between standard deviation and analytical subsample weight (Ingamells and Switzer, 1973 [2]). In this approach the sample aliquot is substantially reduced to a point where most of the variability in replicate assays should be due to inhomogeneity of the reference material and measurement error becomes negligible. Table 5 below shows the gold INAA data determined on 20 x 85 mg subsamples of OREAS 84. An equivalent scaled version of the results is also provided to demonstrate an appreciation of what this data means if 30 g fire assays were undertaken without the normal measurement error associated with this methodology. In this instance, the 1RSD of 0.22 % calculated for a 30 g fire assay sample (4.06 % at 85 mg weights) confirms the high level of gold homogeneity in OREAS 84.

The homogeneity of OREAS 84 has also been evaluated in an Analysis of Variance (**ANOVA**) of the INAA data. The 20 samples were comprised of paired samples from each of 10 sampling lot intervals (representative of the prepared batch) and were randomised prior to assigning sample numbers. The duplicate samples enabled an ANOVA by comparison of within- and between-unit variances across the 10 pairs. The purpose of the ANOVA 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 84. The test was performed using the following parameters:

- Gold INAA – 20 results (1 laboratory providing duplicate analyses on 10 samples where each sample can be viewed as a 'unit');

- 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.

The data were not filtered for outliers before p -value calculation, which yielded 0.84 — statistically insignificant, so the Null Hypothesis is accepted. ANOVA does not measure absolute homogeneity; it evaluates whether analytes are similarly distributed across the packaging run and whether variance between subsamples from the same unit differs from that between separate units. A reference material may show poor absolute homogeneity yet still meet a relative homogeneity (ANOVA) criterion if within-unit heterogeneity is substantial and consistent. Based on ANOVA and interlaboratory certification results, OREAS 84 is fit-for-purpose as a certified reference material (see ‘Intended Use’ below).

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

Replicate No	Au 85 mg actual	Au 30 g equivalent*
1	194	192
2	193	192
3	201	192
4	198	192
5	180	191
6	176	191
7	189	191
8	191	191
9	190	191
10	202	192
11	186	191
12	195	192
13	186	191
14	194	192
15	187	191
16	182	191
17	200	192
18	189	191
19	207	192
20	190	191
Mean	191	191
Median	190	191
Std Dev.	7.8	0.4
Rel.Std.Dev.	4.06%	0.22%

*Results calculated for a 30 g 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 30 g sample mass

(x^{INAA}) = raw INAA result at 85 mg

$\bar{X}$ = mean of 85 mg INAA results

METROLOGICAL TRACEABILITY

The interlaboratory results that underpin the certified values are metrologically traceable to the international measurement scale (SI) of mass (either as a % mass fraction, as milligrams per kilogram (mg/kg) or micrograms per kilogram ($\mu\text{g/kg}$)) [14]. In line with popular use, all data within tables in this certificate are expressed as the mass fraction in either weight percent (wt.%) or parts per million (ppm) or parts per billion (ppb).

The analytical samples sent to participating laboratories were selected in a manner to be representative of the entire prepared batch of CRM. This representativeness 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. The systematic sampling method was chosen due to the low risk of overlooking repetitive effects or trends in the batch due to the way the CRM was processed. In line with ISO 17025 [8], each analytical data set received from the participating laboratories has been validated by its assayer through the inclusion of internal reference materials and QC checks during and post analysis.

Participating laboratories were selected based on demonstrated analytical competence, including prior performance in interlaboratory comparison programs conducted by ORE Pty Ltd, with consideration given to their expertise in relevant analytical methods, measurands, and sample matrices. For the measurands reported in this certificate (Table 1), data were sourced from laboratories accredited to ISO/IEC 17025. Where formal accreditation was not held for specific operationally defined measurands, metrological traceability was verified through the use of well-characterised, independently certified reference materials (CRMs) included as control samples in the round robin study.

In accordance with ISO 33405:2024 [5], clause 9.2.5, and ISO 17034:2016 [9], clause 7.12.4b), the use of such control samples provides an acceptable means of demonstrating traceability in the absence of formal accreditation. In this certification program, traceability was further supported by the agreement of measured values for control samples with their known certified values, thereby offering additional confidence in the calibration and validity of measurement results across participating laboratories.

Operationally Defined Measurands

In accordance with ISO 33405:2024, Clause 9.2.4, measurands (analytes) may be certified as operationally defined. For these measurands, traceability to the SI may not be achievable because the analytical procedure involves sample transformations (e.g., leaching or extraction). While instrument calibration can be traceable to appropriate units, the transformation steps themselves are not directly traceable and can only be evaluated through reference comparisons or harmonised procedures.

Accordingly, characterisation of these measurands has been based on the concordance of results obtained from multiple laboratories using a common, well-defined procedure. This approach ensures fitness-for-purpose, fulfilling the requirements for metrological traceability as specified in ISO 17034:2016 and ISO 33405:2024 for operationally defined measurands.

COMMUTABILITY

The certified values reported herein are derived from measurements performed using analytical methods involving sample pre-treatment steps, such as fusion or acid digestion. These processes convert the sample matrix into a chemically simplified and stable form,

facilitating calibration traceable to primary standards via solution-based calibration protocols. Due to the established robustness and effectiveness of these pre-treatment methods, issues related to commutability are not expected to impact the suitability of this Certified Reference Material (CRM) for its intended use.

OREAS CRMs are prepared from natural ore materials, ensuring the presence of matrix and mineralogical characteristics representative of typical exploration, mine and process samples. Consistent with ISO 17034:2016 and ISO Guide 30, users are advised to select CRMs with matrix and mineralisation styles closely matching those of their routine samples to minimize matrix effects and enhance analytical comparability. Detailed descriptions of the CRM's source material and mineralogical characteristics are provided in the 'Source Material' section to guide appropriate CRM selection.

PERFORMANCE GATES

Table 6 below 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 % $\pm 2DL$ [1].

Table 6. Performance Gates for OREAS 84.

Constituent	Certified Value	Absolute Standard Deviations					Relative Standard Deviations			5 % window	
		1SD	2SD Low	2SD High	3SD Low	3SD High	1RSD	2RSD	3RSD	Low	High
Pb Fire Assay											
Au, ppb	179	21.4	136	222	114	243	11.98%	23.96%	35.93%	170	188
Pd, ppb	581	35	511	652	475	687	6.07%	12.13%	18.20%	552	610
Pt, ppb	517	19	479	555	461	573	3.64%	7.28%	10.92%	491	543
NiS Fire Assay											
Pd, ppb	556	31	495	618	464	649	5.54%	11.07%	16.61%	528	584
Pt, ppb	487	47	392	581	345	628	9.69%	19.39%	29.08%	463	511
Infrared Combustion											
S, wt. %	24.21	0.705	22.80	25.62	22.10	26.33	2.91%	5.83%	8.74%	23.00	25.42
4-Acid Digestion											
Ag, ppm	2.38	0.071	2.23	2.52	2.16	2.59	2.99%	5.99%	8.98%	2.26	2.50
Al, wt. %	2.20	0.099	2.00	2.40	1.90	2.50	4.52%	9.04%	13.56%	2.09	2.31
As, ppm	167	9	149	185	140	194	5.37%	10.73%	16.10%	159	176
Ba, ppm	161	14	134	189	120	203	8.57%	17.13%	25.70%	153	169
Be, ppm	0.45	0.05	0.36	0.54	0.31	0.58	10.10%	20.21%	30.31%	0.42	0.47
Bi, ppm	1.56	0.095	1.37	1.75	1.28	1.85	6.08%	12.16%	18.25%	1.48	1.64
Ca, wt. %	2.03	0.079	1.88	2.19	1.80	2.27	3.87%	7.75%	11.62%	1.93	2.14
Cd, ppm	2.43	0.207	2.01	2.84	1.81	3.05	8.53%	17.06%	25.59%	2.31	2.55
Ce, ppm	15.8	0.47	14.9	16.7	14.4	17.2	2.98%	5.96%	8.93%	15.0	16.6
Co, ppm	1578	58	1462	1694	1404	1752	3.68%	7.35%	11.03%	1499	1657
Cr, wt. %	0.559	0.107	0.345	0.773	0.238	0.880	19.13%	38.27%	57.40%	0.531	0.587
Cs, ppm	1.85	0.133	1.58	2.11	1.45	2.25	7.19%	14.37%	21.56%	1.76	1.94
Cu, wt. %	0.400	0.014	0.372	0.427	0.358	0.441	3.46%	6.93%	10.39%	0.380	0.420
Dy, ppm	0.94	0.045	0.85	1.03	0.80	1.07	4.77%	9.55%	14.32%	0.89	0.99
Er, ppm	0.53	0.036	0.45	0.60	0.42	0.63	6.78%	13.56%	20.34%	0.50	0.55
Eu, ppm	0.34	0.04	0.25	0.42	0.21	0.47	12.77%	25.54%	38.31%	0.32	0.35
Fe, wt. %	31.51	1.021	29.47	33.55	28.45	34.58	3.24%	6.48%	9.72%	29.94	33.09
Ga, ppm	6.58	0.658	5.27	7.90	4.61	8.55	9.99%	19.98%	29.98%	6.25	6.91
Gd, ppm	1.16	0.079	1.00	1.32	0.92	1.40	6.84%	13.68%	20.52%	1.10	1.22
Hf, ppm	0.84	0.073	0.69	0.99	0.62	1.06	8.74%	17.48%	26.22%	0.80	0.88
Ho, ppm	0.18	0.02	0.14	0.23	0.12	0.25	11.41%	22.83%	34.24%	0.18	0.19
In, ppm	0.13	0.013	0.11	0.16	0.09	0.17	9.71%	19.41%	29.12%	0.13	0.14
K, wt. %	0.368	0.012	0.344	0.391	0.332	0.403	3.23%	6.47%	9.70%	0.349	0.386
La, ppm	8.15	0.583	6.98	9.32	6.40	9.90	7.15%	14.30%	21.45%	7.74	8.56
Li, ppm	10.3	0.67	8.9	11.6	8.3	12.3	6.51%	13.03%	19.54%	9.8	10.8
Lu, ppm	0.073	0.008	0.057	0.089	0.048	0.097	11.18%	22.36%	33.54%	0.069	0.077
Mg, wt. %	1.51	0.078	1.36	1.67	1.28	1.75	5.15%	10.31%	15.46%	1.44	1.59
Mn, wt. %	0.064	0.004	0.056	0.071	0.053	0.075	5.73%	11.46%	17.19%	0.061	0.067
Mo, ppm	5.05	0.326	4.40	5.70	4.07	6.03	6.45%	12.90%	19.36%	4.80	5.30
Na, wt. %	0.446	0.013	0.419	0.473	0.406	0.486	2.99%	5.98%	8.97%	0.424	0.468
Nb, ppm	2.37	0.160	2.05	2.69	1.89	2.84	6.74%	13.49%	20.23%	2.25	2.48
Nd, ppm	6.72	0.304	6.11	7.33	5.81	7.63	4.52%	9.05%	13.57%	6.38	7.06
Ni, wt. %	10.47	0.204	10.06	10.87	9.85	11.08	1.95%	3.90%	5.85%	9.94	10.99

SI unit equivalents: ppb (parts per billion; 1×10^{-9}) $\equiv$ $\mu\text{g/kg}$; ppm (parts per million; 1×10^{-6}) $\equiv$ mg/kg ; wt. % (weight per cent) $\equiv$ % (mass fraction).

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 6 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											
P, wt. %	0.022	0.001	0.019	0.024	0.018	0.026	5.92%	11.83%	17.75%	0.021	0.023
Pb, ppm	74	4.3	66	83	62	87	5.74%	11.49%	17.23%	71	78
Pr, ppm	1.82	0.116	1.59	2.05	1.47	2.17	6.36%	12.72%	19.08%	1.73	1.91
Rb, ppm	21.4	1.62	18.2	24.7	16.6	26.3	7.57%	15.15%	22.72%	20.3	22.5
Re, ppm	0.029	0.005	0.019	0.040	0.014	0.045	17.74%	35.49%	53.23%	0.028	0.031
S, wt. %	22.14	1.218	19.71	24.58	18.49	25.80	5.50%	11.00%	16.50%	21.03	23.25
Sb, ppm	1.52	0.129	1.26	1.78	1.13	1.91	8.49%	16.98%	25.47%	1.44	1.60
Sc, ppm	5.21	0.438	4.33	6.09	3.89	6.53	8.42%	16.83%	25.25%	4.95	5.47
Se, ppm	10.7	1.4	7.8	13.6	6.4	15.0	13.46%	26.92%	40.38%	10.2	11.2
Sm, ppm	1.31	0.076	1.16	1.46	1.08	1.54	5.76%	11.53%	17.29%	1.25	1.38
Sn, ppm	1.49	0.15	1.19	1.80	1.03	1.96	10.29%	20.58%	30.87%	1.42	1.57
Sr, ppm	87	5.8	75	98	70	104	6.64%	13.27%	19.91%	83	91
Ta, ppm	0.21	0.04	0.12	0.29	0.07	0.34	21.18%	42.36%	63.55%	0.19	0.22
Tb, ppm	0.17	0.015	0.14	0.21	0.13	0.22	8.76%	17.53%	26.29%	0.17	0.18
Te, ppm	1.27	0.15	0.96	1.57	0.81	1.72	12.09%	24.18%	36.27%	1.20	1.33
Th, ppm	3.14	0.218	2.70	3.57	2.49	3.79	6.94%	13.88%	20.82%	2.98	3.30
Ti, wt. %	0.117	0.006	0.106	0.129	0.100	0.135	4.96%	9.91%	14.87%	0.111	0.123
Tl, ppm	1.24	0.062	1.11	1.36	1.05	1.42	5.00%	9.99%	14.99%	1.18	1.30
Tm, ppm	0.069	0.015	0.039	0.098	0.025	0.113	21.40%	42.79%	64.19%	0.065	0.072
U, ppm	0.82	0.047	0.73	0.92	0.68	0.96	5.68%	11.36%	17.05%	0.78	0.86
V, ppm	100	5	90	111	84	116	5.26%	10.52%	15.77%	95	105
W, ppm	1.31	0.114	1.08	1.53	0.96	1.65	8.72%	17.45%	26.17%	1.24	1.37
Y, ppm	4.71	0.434	3.84	5.58	3.41	6.01	9.21%	18.42%	27.63%	4.47	4.94
Yb, ppm	0.47	0.031	0.41	0.53	0.38	0.56	6.69%	13.37%	20.06%	0.45	0.49
Zn, ppm	814	46	723	905	677	950	5.60%	11.19%	16.79%	773	854
Zr, ppm	28.6	2.60	23.4	33.8	20.8	36.4	9.09%	18.18%	27.27%	27.1	30.0
Borate / Peroxide Fusion ICP											
Al ₂ O ₃ , wt. %	4.17	0.139	3.89	4.44	3.75	4.58	3.33%	6.65%	9.98%	3.96	4.37
As, ppm	175	13	150	201	138	213	7.20%	14.40%	21.60%	167	184
Ba, ppm	175	11	153	198	142	209	6.36%	12.72%	19.07%	167	184
Bi, ppm	1.39	0.19	1.02	1.76	0.83	1.95	13.34%	26.69%	40.03%	1.32	1.46
CaO, wt. %	2.93	0.075	2.78	3.08	2.71	3.16	2.56%	5.12%	7.68%	2.78	3.08
Cd, ppm	< 10	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Ce, ppm	15.8	1.6	12.6	19.0	11.0	20.6	10.11%	20.21%	30.32%	15.0	16.6
Co, ppm	1654	95	1464	1844	1369	1939	5.74%	11.48%	17.21%	1571	1737
Cr, wt. %	0.747	0.030	0.686	0.807	0.656	0.837	4.04%	8.09%	12.13%	0.709	0.784
Cs, ppm	1.73	0.159	1.41	2.05	1.25	2.20	9.20%	18.40%	27.60%	1.64	1.81
Cu, wt. %	0.405	0.012	0.380	0.429	0.368	0.441	3.01%	6.01%	9.02%	0.385	0.425
Dy, ppm	0.93	0.11	0.72	1.15	0.61	1.26	11.67%	23.34%	35.01%	0.89	0.98
Er, ppm	0.50	0.06	0.37	0.62	0.31	0.68	12.33%	24.66%	37.00%	0.47	0.52
Eu, ppm	0.30	0.04	0.23	0.37	0.19	0.41	12.16%	24.33%	36.49%	0.28	0.31
Fe ₂ O ₃ , wt. %	44.64	1.736	41.17	48.12	39.44	49.85	3.89%	7.78%	11.67%	42.41	46.88

SI unit equivalents: ppm (parts per million; 1×10^{-6}) $\equiv$ mg/kg; wt. % (weight per cent) $\equiv$ % (mass fraction).

Note 1: intervals may appear asymmetric due to rounding; IND = indeterminate.

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 6 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
Borate / Peroxide Fusion ICP continued											
Ga, ppm	7.05	0.75	5.55	8.56	4.79	9.31	10.68%	21.36%	32.05%	6.70	7.41
Gd, ppm	1.12	0.095	0.93	1.31	0.84	1.41	8.49%	16.98%	25.46%	1.06	1.18
Ho, ppm	0.18	0.02	0.13	0.22	0.10	0.25	13.81%	27.61%	41.42%	0.17	0.18
K ₂ O, wt.%	0.453	0.036	0.382	0.525	0.347	0.560	7.83%	15.67%	23.50%	0.431	0.476
La, ppm	8.30	0.525	7.25	9.35	6.73	9.88	6.33%	12.65%	18.98%	7.89	8.72
Li, ppm	12.8	2.0	8.8	16.9	6.8	18.9	15.75%	31.51%	47.26%	12.2	13.5
Lu, ppm	0.075	0.014	0.048	0.103	0.034	0.117	18.38%	36.75%	55.13%	0.072	0.079
MgO, wt.%	2.64	0.066	2.51	2.77	2.45	2.84	2.48%	4.96%	7.45%	2.51	2.77
MnO, wt.%	0.085	0.004	0.076	0.094	0.072	0.098	5.13%	10.27%	15.40%	0.081	0.089
Mo, ppm	5.62	0.80	4.03	7.22	3.23	8.02	14.19%	28.38%	42.58%	5.34	5.91
Nd, ppm	6.67	0.509	5.66	7.69	5.15	8.20	7.62%	15.24%	22.86%	6.34	7.01
Ni, wt.%	10.53	0.261	10.01	11.05	9.74	11.31	2.48%	4.97%	7.45%	10.00	11.06
P ₂ O ₅ , wt.%	0.057	0.009	0.038	0.076	0.029	0.086	16.54%	33.08%	49.62%	0.054	0.060
Pb, ppm	74	7.0	60	88	53	95	9.55%	19.10%	28.65%	70	77
Pr, ppm	1.81	0.128	1.55	2.06	1.42	2.19	7.09%	14.17%	21.26%	1.72	1.90
Rb, ppm	22.0	1.04	19.9	24.1	18.9	25.1	4.72%	9.43%	14.15%	20.9	23.1
S, wt.%	24.08	0.711	22.65	25.50	21.94	26.21	2.95%	5.91%	8.86%	22.87	25.28
Sb, ppm	1.55	0.25	1.05	2.05	0.80	2.30	16.05%	32.11%	48.16%	1.47	1.63
Sc, ppm	5.01	0.100	4.81	5.21	4.71	5.31	2.00%	3.99%	5.99%	4.76	5.26
Se, ppm	< 20	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
SiO ₂ , wt.%	16.27	0.742	14.78	17.75	14.04	18.49	4.56%	9.12%	13.68%	15.45	17.08
Sm, ppm	1.26	0.089	1.08	1.44	1.00	1.53	7.04%	14.07%	21.11%	1.20	1.33
Sn, ppm	1.40	0.34	0.73	2.08	0.39	2.42	24.09%	48.19%	72.28%	1.33	1.47
Sr, ppm	89	3.7	82	96	78	100	4.15%	8.30%	12.45%	84	93
Tb, ppm	0.16	0.02	0.12	0.20	0.10	0.22	12.46%	24.92%	37.39%	0.15	0.17
Th, ppm	3.04	0.285	2.47	3.61	2.18	3.89	9.38%	18.76%	28.14%	2.89	3.19
TiO ₂ , wt.%	0.200	0.006	0.188	0.212	0.182	0.218	3.00%	6.00%	8.99%	0.190	0.210
Tl, ppm	1.20	0.091	1.01	1.38	0.92	1.47	7.63%	15.27%	22.90%	1.14	1.26
Tm, ppm	0.075	0.017	0.041	0.109	0.025	0.126	22.50%	45.00%	67.50%	0.072	0.079
U, ppm	0.78	0.10	0.59	0.98	0.49	1.07	12.44%	24.88%	37.33%	0.74	0.82
V, ppm	100	8	84	116	76	124	8.01%	16.02%	24.03%	95	105
Y, ppm	4.90	0.317	4.26	5.53	3.94	5.85	6.48%	12.96%	19.44%	4.65	5.14
Yb, ppm	0.46	0.05	0.36	0.56	0.31	0.61	11.08%	22.17%	33.25%	0.44	0.48
Zn, ppm	820	40	741	899	701	939	4.83%	9.65%	14.48%	779	861
Zr, ppm	34.7	3.8	27.1	42.4	23.3	46.2	10.99%	21.97%	32.96%	33.0	36.5
Borate Fusion XRF											
Al ₂ O ₃ , wt.%	4.15	0.091	3.97	4.34	3.88	4.43	2.18%	4.36%	6.55%	3.95	4.36
CaO, wt.%	2.91	0.068	2.77	3.04	2.70	3.11	2.35%	4.70%	7.05%	2.76	3.05
Co, ppm	1615	84	1447	1783	1363	1867	5.20%	10.40%	15.60%	1534	1696
Cr ₂ O ₃ , wt.%	1.10	0.041	1.01	1.18	0.97	1.22	3.77%	7.54%	11.31%	1.04	1.15
Cu, wt.%	0.398	0.027	0.343	0.452	0.316	0.479	6.86%	13.71%	20.57%	0.378	0.417
Fe ₂ O ₃ , wt.%	44.93	0.761	43.40	46.45	42.64	47.21	1.69%	3.39%	5.08%	42.68	47.17
Hf, ppm	< 80	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND

SI unit equivalents: ppm (parts per million; 1×10^{-6}) $\equiv$ mg/kg; wt. % (weight per cent) $\equiv$ % (mass fraction).

Note 1: intervals may appear asymmetric due to rounding; IND = indeterminate.

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 6 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
Borate Fusion XRF continued											
K ₂ O, wt. %	0.433	0.014	0.405	0.460	0.391	0.474	3.20%	6.40%	9.59%	0.411	0.454
MgO, wt. %	2.70	0.104	2.49	2.91	2.39	3.01	3.85%	7.70%	11.56%	2.56	2.83
MnO, wt. %	0.087	0.010	0.067	0.107	0.057	0.117	11.59%	23.18%	34.78%	0.082	0.091
Na ₂ O, wt. %	0.461	0.096	0.270	0.653	0.174	0.749	20.78%	41.56%	62.35%	0.438	0.484
Ni, wt. %	10.37	0.432	9.51	11.24	9.07	11.67	4.17%	8.33%	12.50%	9.85	10.89
P ₂ O ₅ , wt. %	0.061	0.013	0.035	0.086	0.022	0.099	21.24%	42.47%	63.71%	0.057	0.064
S, wt. %	22.63	2.090	18.45	26.81	16.36	28.90	9.24%	18.47%	27.71%	21.50	23.76
SiO ₂ , wt. %	16.07	0.198	15.67	16.46	15.47	16.66	1.23%	2.47%	3.70%	15.26	16.87
TiO ₂ , wt. %	0.199	0.018	0.163	0.234	0.145	0.252	8.93%	17.87%	26.80%	0.189	0.209
V ₂ O ₅ , ppm	250	85	79	420	0	506	34.21%	68.42%	102.6%	237	262
Zn, ppm	805	18	768	841	750	860	2.28%	4.56%	6.84%	764	845
Thermogravimetry											
LOI ¹⁰⁰⁰ , wt. %	12.31	0.414	11.49	13.14	11.07	13.56	3.36%	6.72%	10.08%	11.70	12.93

SI unit equivalents: ppm (parts per million; 1×10^{-6}) $\equiv$ mg/kg; wt. % (weight per cent) $\equiv$ % (mass fraction).

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

Figure 1. Ni by 4-Acid Digestion in OREAS 84

SPC.1767.RR.OREAS 84.2.4-Acid.Ni.Lab.260729.214914.SS

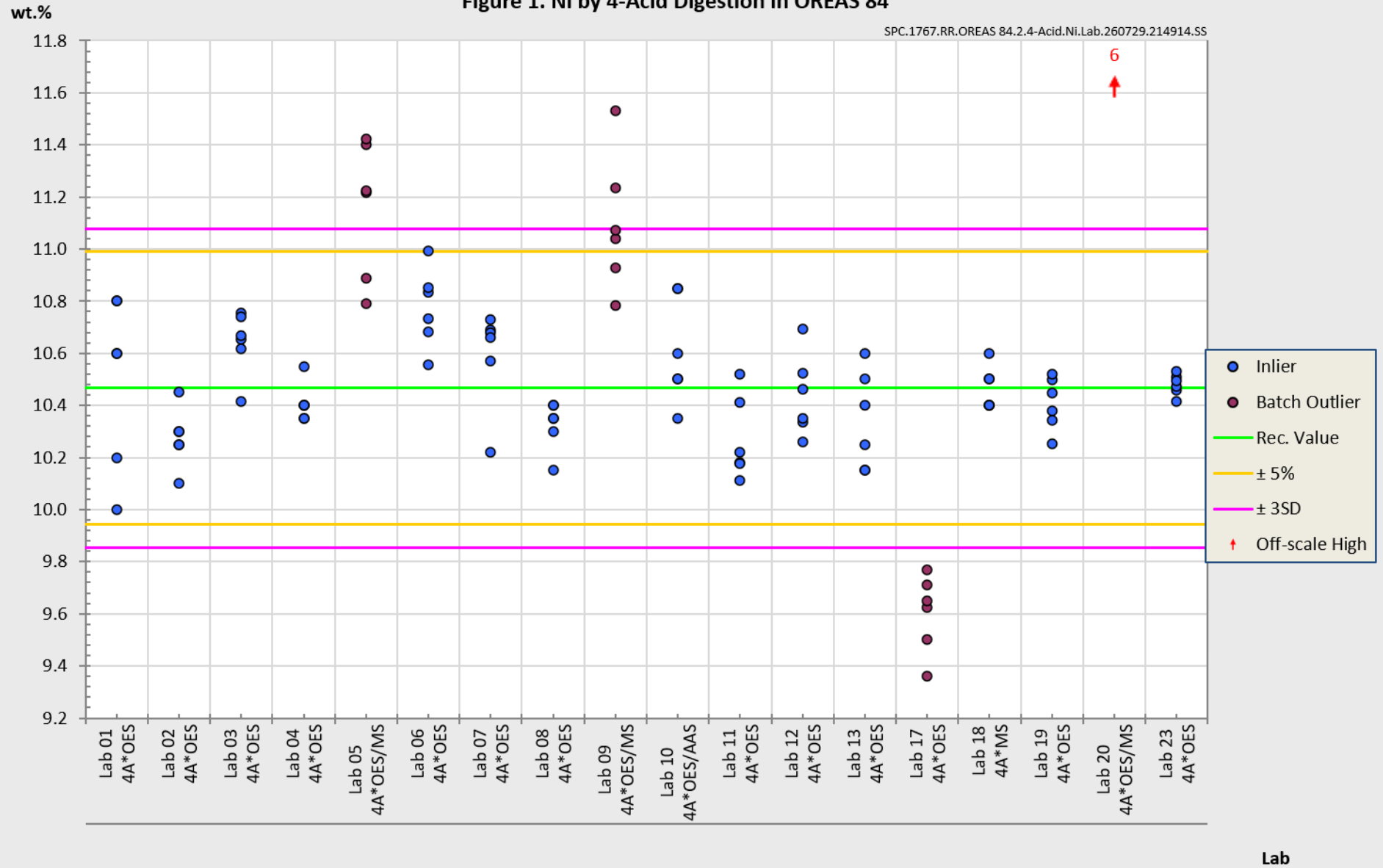


Figure 3. Co by 4-Acid Digestion in OREAS 84

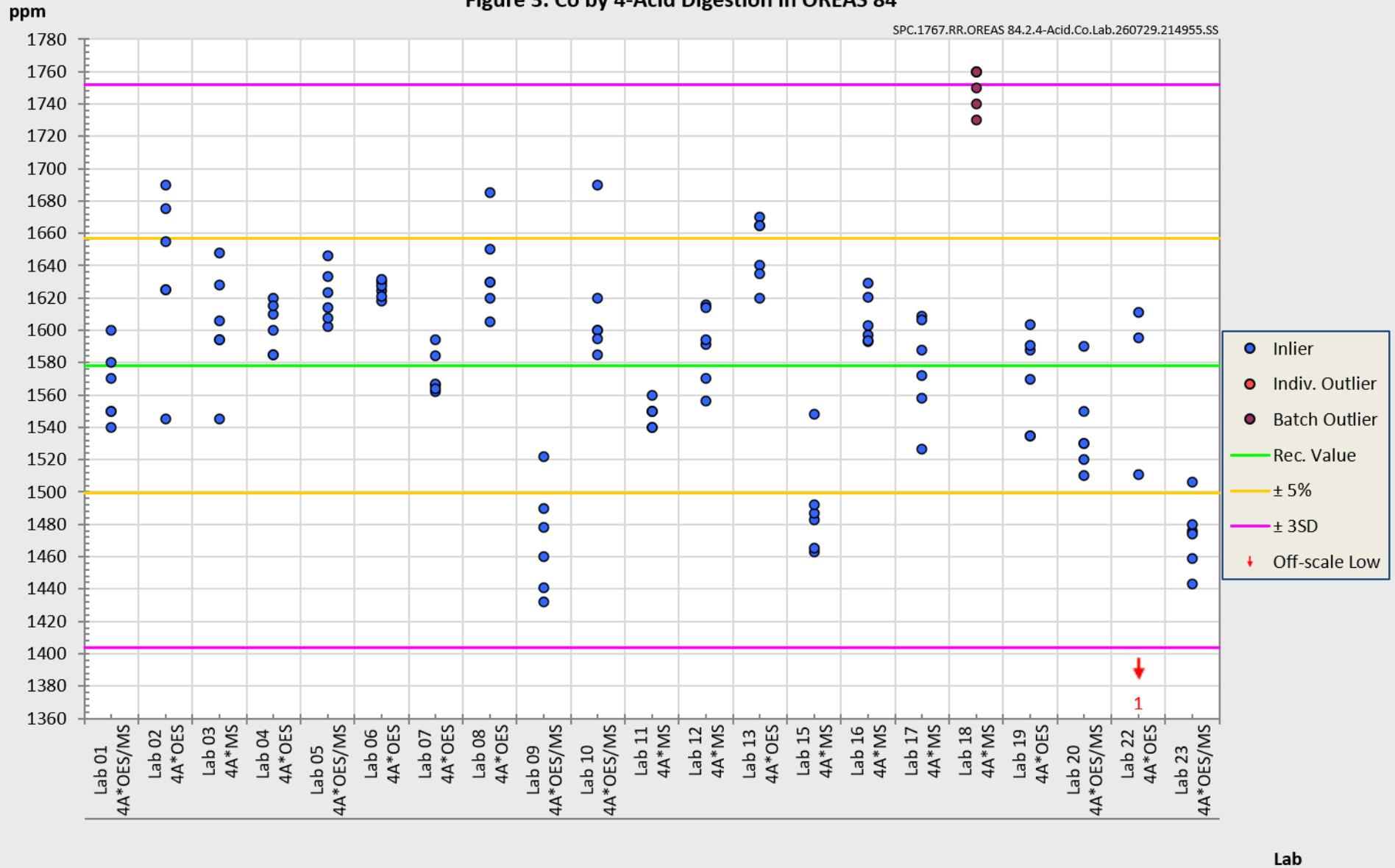
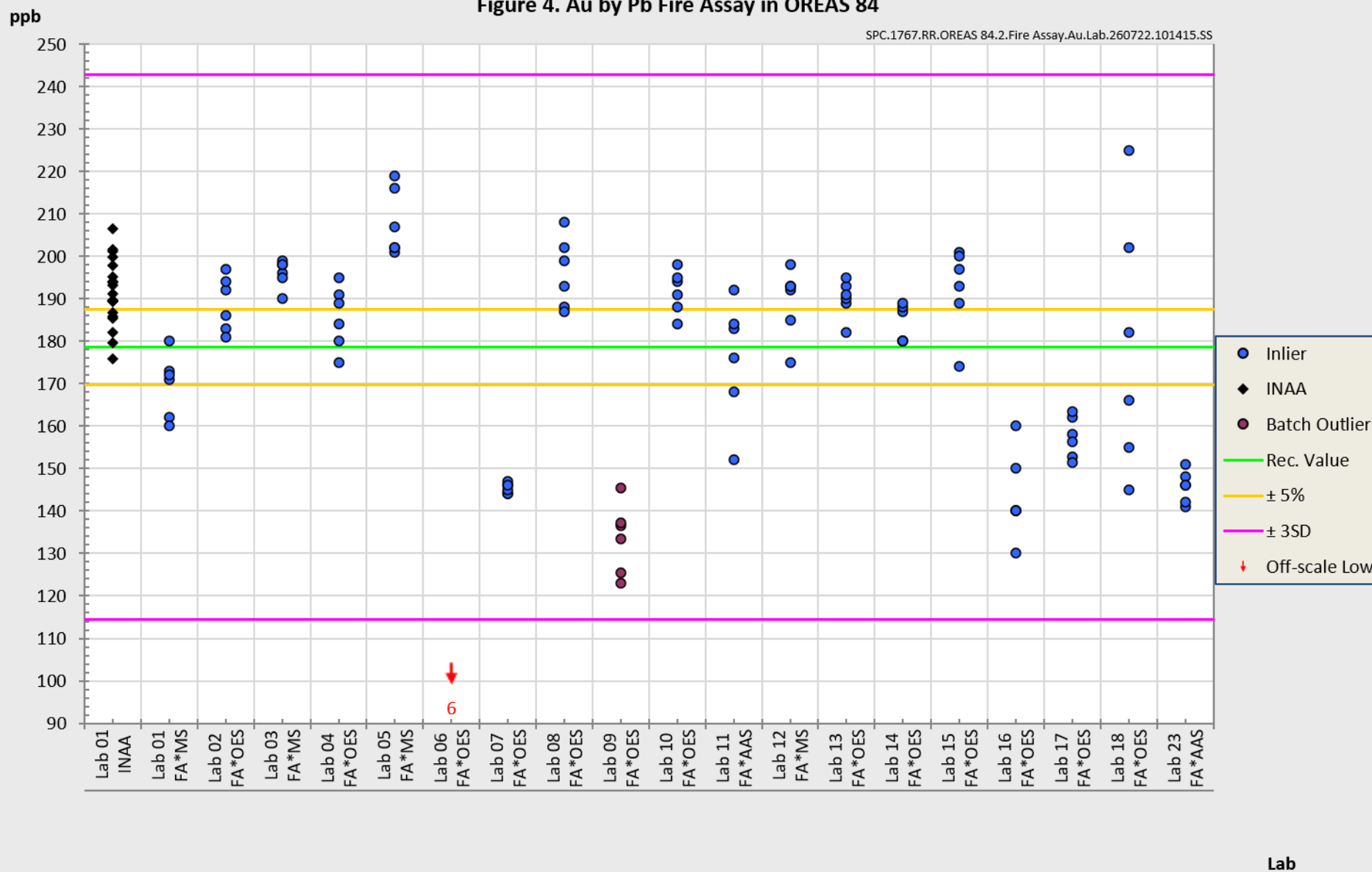


Figure 4. Au by Pb Fire Assay in OREAS 84

SPC.1767.RR.OREAS 84.2.Fire Assay.Au.Lab.260722.101415.SS



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