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**CERTIFICATE OF ANALYSIS FOR**

**Pegmatite Li Ore**

**(Bynoe Pegmatite Field, Northern Territory, Australia)**

**CERTIFIED REFERENCE MATERIAL**

**OREAS 752**

**Summary Statistics for Key Analytes.**

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
<b>Peroxide Fusion ICP</b>						
Li, Lithium (wt.%)	0.707	0.021	0.697	0.716	0.693	0.720
Li <sub>2</sub> O, Lithium oxide (wt.%)	1.52	0.045	1.50	1.54	1.49	1.55
<b>4-Acid Digestion</b>						
Li, Lithium (wt.%)	0.695	0.024	0.684	0.705	0.680	0.709
Li <sub>2</sub> O, Lithium oxide (wt.%)	1.50	0.052	1.47	1.52	1.46	1.53

SI unit equivalents: ppm, parts per million  $\equiv$  mg/kg  $\equiv$   $\mu$ g/g  $\equiv$  0.0001 wt.%  $\equiv$  1000 ppb, parts per billion.  
Note: intervals may appear asymmetric due to rounding.



Document: COA-1422-OREAS752-R2 (Template:BUP-70-10-01 Rev:2.0)	22-February-2019
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Table 1. Certified Values, SDs, 95% Confidence & Tolerance Limits for OREAS 752.

Constituent	Certified Value	SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
<b>Peroxide Fusion ICP</b>						
Al, Aluminium (wt.%)	8.51	0.382	8.31	8.71	8.37	8.65
As, Arsenic (ppm)	14.1	2.4	12.1	16.1	IND	IND
Ba, Barium (ppm)	57	4.3	54	60	54	60
Be, Beryllium (ppm)	154	7	150	158	150	159
Bi, Bismuth (ppm)	2.55	0.29	2.32	2.78	2.38	2.72
Ca, Calcium (wt.%)	0.215	0.042	0.191	0.238	0.200	0.229
Cd, Cadmium (ppm)	1.57	0.43	1.29	1.86	IND	IND
Ce, Cerium (ppm)	3.48	0.255	3.28	3.69	3.28	3.69
Co, Cobalt (ppm)	1.28	0.16	1.18	1.38	IND	IND
Cs, Cesium (ppm)	66	3.8	64	68	64	68
Cu, Copper (ppm)	38.1	8.3	33.8	42.4	35.7	40.6
Dy, Dysprosium (ppm)	0.36	0.04	0.34	0.38	0.33	0.39
Er, Erbium (ppm)	0.14	0.03	0.11	0.17	IND	IND
Fe, Iron (wt.%)	0.865	0.037	0.849	0.880	0.844	0.886
Ga, Gallium (ppm)	17.8	1.00	17.0	18.6	16.7	18.9
Gd, Gadolinium (ppm)	0.36	0.05	0.33	0.38	0.33	0.39
Ge, Germanium (ppm)	6.37	0.492	6.02	6.71	5.71	7.03
Ho, Holmium (ppm)	0.054	0.011	0.051	0.057	IND	IND
K, Potassium (wt.%)	2.10	0.097	2.06	2.14	2.05	2.15
La, Lanthanum (ppm)	1.88	0.30	1.66	2.09	1.74	2.01
Li, Lithium (wt.%)	0.707	0.021	0.697	0.716	0.693	0.720
Li <sub>2</sub> O, Lithium oxide (wt.%)	1.52	0.045	1.50	1.54	1.49	1.55
Mg, Magnesium (wt.%)	0.047	0.006	0.045	0.049	0.044	0.050
Mn, Manganese (wt.%)	0.081	0.003	0.080	0.082	0.079	0.084
Mo, Molybdenum (ppm)	3.38	0.46	3.11	3.65	IND	IND
Nb, Niobium (ppm)	54	6	51	58	52	57
Nd, Neodymium (ppm)	1.49	0.098	1.43	1.55	1.21	1.77
P, Phosphorus (wt.%)	0.135	0.011	0.127	0.142	0.130	0.139
Pr, Praseodymium (ppm)	0.43	0.08	0.35	0.50	0.39	0.46
Rb, Rubidium (ppm)	659	20	646	671	638	679
Si, Silicon (wt.%)	34.18	0.640	33.72	34.63	33.59	34.76
Sm, Samarium (ppm)	0.40	0.07	0.35	0.44	IND	IND
Sn, Tin (ppm)	238	11	232	245	228	249
Sr, Strontium (ppm)	43.4	4.6	40.8	46.1	40.2	46.6
Ta, Tantalum (ppm)	41.0	1.80	39.5	42.6	39.5	42.5
Tb, Terbium (ppm)	0.078	0.018	0.063	0.093	IND	IND

SI unit equivalents: ppm, parts per million  $\equiv$  mg/kg  $\equiv$   $\mu$ g/g  $\equiv$  0.0001 wt.%  $\equiv$  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	SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
<b>Peroxide Fusion ICP continued</b>						
Th, Thorium (ppm)	0.97	0.080	0.93	1.01	IND	IND
Tl, Thallium (ppm)	3.84	0.235	3.67	4.01	3.66	4.03
U, Uranium (ppm)	8.44	0.784	7.83	9.04	8.17	8.70
W, Tungsten (ppm)	5.11	0.57	4.69	5.53	4.85	5.38
Y, Yttrium (ppm)	1.90	0.167	1.80	2.01	IND	IND
Zn, Zinc (ppm)	98	5.4	95	101	93	103
Zr, Zirconium (ppm)	29.6	3.6	25.9	33.3	28.0	31.2
<b>Borate Fusion XRF</b>						
Al <sub>2</sub> O <sub>3</sub> , Aluminium(III) oxide (wt.%)	16.30	0.087	16.27	16.34	16.20	16.41
CaO, Calcium oxide (wt.%)	0.287	0.006	0.284	0.289	0.281	0.293
Fe <sub>2</sub> O <sub>3</sub> , Iron(III) oxide (wt.%)	1.25	0.011	1.24	1.25	1.23	1.26
K <sub>2</sub> O, Potassium oxide (wt.%)	2.54	0.030	2.53	2.56	2.52	2.56
MgO, Magnesium oxide (wt.%)	0.087	0.013	0.081	0.093	0.082	0.093
MnO, Manganese oxide (wt.%)	0.107	0.004	0.105	0.108	0.104	0.109
Na <sub>2</sub> O, Sodium oxide (wt.%)	3.75	0.044	3.73	3.77	3.72	3.78
P <sub>2</sub> O <sub>5</sub> , Phosphorus(V) oxide (wt.%)	0.320	0.005	0.318	0.321	0.315	0.325
SiO <sub>2</sub> , Silicon dioxide (wt.%)	73.01	0.346	72.87	73.14	72.77	73.25
SO <sub>3</sub> , Sulphur trioxide (wt.%)	0.101	0.008	0.095	0.106	0.094	0.107
LOI <sup>1000</sup> , Loss on ignition @1000°C (wt.%)	0.681	0.097	0.633	0.730	0.623	0.740
<b>4-Acid Digestion</b>						
Al, Aluminium (wt.%)	7.94	0.485	7.76	8.13	7.73	8.16
As, Arsenic (ppm)	13.7	1.4	13.1	14.4	12.6	14.8
Ba, Barium (ppm)	58	2.8	57	60	56	61
Be, Beryllium (ppm)	154	11	148	159	147	160
Bi, Bismuth (ppm)	2.47	0.158	2.40	2.54	2.39	2.55
Ca, Calcium (wt.%)	0.199	0.011	0.196	0.203	0.192	0.207
Cd, Cadmium (ppm)	1.57	0.111	1.53	1.61	1.44	1.69
Ce, Cerium (ppm)	3.00	0.56	2.73	3.27	2.78	3.22
Co, Cobalt (ppm)	1.22	0.120	1.16	1.28	1.15	1.30
Cs, Cesium (ppm)	70	3.5	68	71	68	71
Cu, Copper (ppm)	36.4	2.79	35.2	37.6	35.1	37.6
Dy, Dysprosium (ppm)	0.34	0.04	0.30	0.38	0.29	0.40
Er, Erbium (ppm)	0.13	0.03	0.11	0.16	IND	IND
Fe, Iron (wt.%)	0.835	0.033	0.822	0.848	0.812	0.858
Ga, Gallium (ppm)	17.8	1.16	17.3	18.2	17.2	18.4

SI unit equivalents: ppm, parts per million  $\equiv$  mg/kg  $\equiv$   $\mu$ g/g  $\equiv$  0.0001 wt.%  $\equiv$  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	SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
<b>4-Acid Digestion continued</b>						
Hf, Hafnium (ppm)	2.05	0.116	2.00	2.09	1.95	2.15
Ho, Holmium (ppm)	0.050	0.006	0.048	0.052	IND	IND
K, Potassium (wt.%)	2.08	0.074	2.05	2.11	2.04	2.13
La, Lanthanum (ppm)	1.50	0.41	1.32	1.68	1.39	1.60
Li, Lithium (wt.%)	0.695	0.024	0.684	0.705	0.680	0.709
Li <sub>2</sub> O, Lithium oxide (wt.%)	1.50	0.052	1.47	1.52	1.46	1.53
Mg, Magnesium (wt.%)	0.044	0.005	0.042	0.045	0.042	0.045
Mn, Manganese (wt.%)	0.079	0.003	0.078	0.080	0.077	0.081
Mo, Molybdenum (ppm)	3.12	0.170	3.05	3.19	2.95	3.29
Na, Sodium (wt.%)	2.70	0.123	2.65	2.75	2.64	2.77
Nb, Niobium (ppm)	53	4.7	51	55	51	55
Nd, Neodymium (ppm)	1.42	0.25	1.27	1.58	1.34	1.51
Ni, Nickel (ppm)	10.4	0.64	10.1	10.6	10.0	10.8
P, Phosphorus (wt.%)	0.140	0.004	0.139	0.142	0.137	0.144
Pb, Lead (ppm)	16.2	1.24	15.7	16.8	15.5	17.0
Pr, Praseodymium (ppm)	0.38	0.05	0.33	0.44	0.36	0.41
Rb, Rubidium (ppm)	652	52	628	676	637	668
S, Sulphur (wt.%)	0.042	0.004	0.040	0.044	0.041	0.043
Sb, Antimony (ppm)	0.71	0.062	0.68	0.74	0.67	0.74
Sc, Scandium (ppm)	0.50	0.07	0.47	0.54	0.44	0.57
Sm, Samarium (ppm)	0.37	0.06	0.33	0.41	IND	IND
Sn, Tin (ppm)	79	9	75	83	76	82
Sr, Strontium (ppm)	36.3	2.76	35.1	37.5	34.5	38.1
Ta, Tantalum (ppm)	41.5	2.40	40.4	42.6	39.9	43.0
Tb, Terbium (ppm)	0.063	0.009	0.057	0.069	IND	IND
Th, Thorium (ppm)	0.95	0.11	0.91	1.00	0.87	1.03
Ti, Titanium (wt.%)	0.016	0.001	0.016	0.017	0.016	0.017
Tl, Thallium (ppm)	3.86	0.154	3.79	3.93	3.75	3.96
U, Uranium (ppm)	7.90	0.556	7.65	8.15	7.62	8.18
V, Vanadium (ppm)	3.94	0.193	3.84	4.04	3.50	4.38
W, Tungsten (ppm)	5.26	0.276	5.13	5.39	5.10	5.42
Y, Yttrium (ppm)	1.52	0.21	1.44	1.60	1.35	1.69
Zn, Zinc (ppm)	98	3.3	96	99	94	101
Zr, Zirconium (ppm)	24.5	2.5	23.4	25.6	23.0	26.1

SI unit equivalents: ppm, parts per million  $\equiv$  mg/kg  $\equiv$   $\mu$ g/g  $\equiv$  0.0001 wt.%  $\equiv$  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 2. Indicative Values for OREAS 752.**

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
<b>Peroxide Fusion ICP</b>								
Ag	ppm	< 1	Na	wt.%	2.37	Se	ppm	< 3
B	ppm	30.9	Ni	ppm	13.1	Te	ppm	0.76
Cr	ppm	48.4	Pb	ppm	17.5	Ti	wt.%	0.017
Eu	ppm	0.054	Re	ppm	< 0.01	Tm	ppm	0.028
Hf	ppm	2.09	S	wt.%	0.045	V	ppm	< 5
In	ppm	< 0.2	Sb	ppm	0.70	Yb	ppm	0.13
Lu	ppm	< 0.05	Sc	ppm	< 5			
<b>Borate Fusion XRF</b>								
As <sub>2</sub> O <sub>3</sub>	ppm	14.2	Nb <sub>2</sub> O <sub>5</sub>	ppm	134	TiO <sub>2</sub>	wt.%	0.027
BaO	ppm	112	NiO	ppm	14.0	V <sub>2</sub> O <sub>5</sub>	ppm	< 100
Cl	ppm	127	PbO	ppm	27.0	WO <sub>3</sub>	ppm	< 10
CoO	ppm	< 10	Sb <sub>2</sub> O <sub>3</sub>	ppm	< 10	ZnO	ppm	122
Cr <sub>2</sub> O <sub>3</sub>	ppm	< 100	SnO <sub>2</sub>	ppm	269	ZrO <sub>2</sub>	ppm	64
CuO	ppm	45.0	SrO	ppm	86			
MoO <sub>3</sub>	ppm	< 10	Ta <sub>2</sub> O <sub>5</sub>	ppm	56			
<b>Thermogravimetry</b>								
H <sub>2</sub> O-	wt.%	0.219						
<b>4-Acid Digestion</b>								
Ag	ppm	0.172	Ge	ppm	0.11	Se	ppm	0.51
B	ppm	7.17	Hg	ppm	< 2	Si	wt.%	34.42
Cr	ppm	20.4	In	ppm	0.022	Te	ppm	0.11
Eu	ppm	0.046	Lu	ppm	0.020	Tm	ppm	< 0.05
Gd	ppm	0.33	Re	ppm	< 0.002	Yb	ppm	0.12

SI unit equivalents: ppm, parts per million  $\equiv$  mg/kg  $\equiv$   $\mu$ g/g  $\equiv$  0.0001 wt.%  $\equiv$  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.

## INTRODUCTION

OREAS reference materials are intended to provide a low cost method of evaluating and improving the quality of analysis of geological samples. To the geologist they provide a means of implementing quality control in analytical data sets generated in exploration from the grass roots level through to prospect evaluation, and in grade control at mining operations. To the analyst they provide an effective means of calibrating analytical equipment, assessing new techniques and routinely monitoring in-house procedures.

OREAS reference materials enable users to successfully achieve process control of these tasks because the observed variance from repeated analysis has its origin almost exclusively in the analytical process rather than the reference material itself.

## SOURCE MATERIAL

OREAS 752 has been prepared from RC drill chip samples supplied from Core Lithium's Finnis Lithium Project located in the Northern Territory, Australia. The project area contains the Grants lithium pegmatite deposit, within the Bynoe Pegmatite Field. Lithium-Caesium-Tantalum (LCT) Type pegmatites in the Finnis area intrude Palaeoproterozoic metasediments

of the Burrell Creek Formation. Lithium mineralisation typically occurs as coarse spodumene and accessory amblygonite with muscovite, quartz, albite and k-feldspar gangue.

## COMMUNITION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 752 was prepared in the following manner:

- Drying to constant mass at 105°C;
- Milling 100% minus 30 microns;
- Homogenisation;
- Packaging in 10g units in laminated foil pouches and 500g units in plastic wide-mouth jars.

## ANALYTICAL PROGRAM

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

- Sodium peroxide fusion with full suite elemental package by ICP-OES and/or MS finish (20 laboratories);
- Lithium borate fusion whole rock analysis package by X-ray fluorescence (19 laboratories);
- Thermogravimetry: Moisture at 105°C (2 laboratories as a part of their fusion package) and Loss on Ignition (LOI) at 1000°C (8 laboratories used a thermogravimetric analyser, 4 laboratories used conventional muffle furnace and 9 laboratories included LOI with their fusion package);
- 4-acid digestion for full suite elemental package by ICP-OES and MS finish (up to 24 laboratories depending on the element).

For the round robin program twelve 200g test units were taken at predetermined intervals during the bagging stage, immediately following homogenisation and are considered representative of the entire prepared batch. The six samples received by each laboratory were obtained by taking two 10g scoop splits from each of three separate 200g 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 103 certified values (including Li in both elemental and oxide form for peroxide fusion and 4-acid digestion) together with their associated 1SD's, 95% confidence and tolerance limits, Table 2 shows 55 indicative values and Table 3 provides performance gate intervals for the certified values based on their pooled 1SD's. Tabulated results of all elements together with uncorrected means, medians, standard deviations, relative standard deviations and per cent deviation of lab means from the corrected mean of means (PDM<sup>3</sup>) are presented in the detailed certification data for this CRM (**OREAS 752 DataPack-1.0.190208\_103543.xlsx**).

Results are also presented in scatter plots for Li<sub>2</sub>O (wt.%) by peroxide fusion ICP and 4-acid digestion in Figure 1 and 2 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

**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.

**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 provided where i) the number of laboratories reporting a particular analyte is insufficient ( $< 5$ ) to support certification; ii) interlaboratory consensus is poor; or iii) a significant proportion of results are outlying or reported as less than detection limits.

**Standard Deviation** values (1SDs) are reported in Table 1. They 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.**

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-lab 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.

Table 3 shows **Performance Gates** 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 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)  $\pm$  10%.

*i.e. Certified Value  $\pm$  10%  $\pm$  2DL (adapted from Govett, 1983)*

**Table 3. Performance Gates for OREAS 752.**

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
<b>Peroxide Fusion ICP</b>											
Al, wt. %	8.51	0.382	7.75	9.27	7.36	9.66	4.49%	8.99%	13.48%	8.08	8.94
As, ppm	14.1	2.4	9.3	18.9	6.9	21.4	17.12%	34.24%	51.36%	13.4	14.8
Ba, ppm	57	4.3	49	66	44	70	7.44%	14.89%	22.33%	54	60
Be, ppm	154	7	141	168	134	174	4.34%	8.68%	13.02%	147	162
Bi, ppm	2.55	0.29	1.98	3.12	1.69	3.41	11.22%	22.45%	33.67%	2.42	2.68
Ca, wt. %	0.215	0.042	0.131	0.298	0.089	0.340	19.45%	38.90%	58.36%	0.204	0.225
Cd, ppm	1.57	0.43	0.71	2.43	0.28	2.86	27.34%	54.67%	82.01%	1.49	1.65
Ce, ppm	3.48	0.255	2.97	3.99	2.72	4.25	7.32%	14.64%	21.96%	3.31	3.66
Co, ppm	1.28	0.16	0.95	1.61	0.79	1.77	12.73%	25.46%	38.19%	1.22	1.35
Cs, ppm	66	3.8	59	74	55	77	5.70%	11.39%	17.09%	63	69
Cu, ppm	38.1	8.3	21.5	54.8	13.2	63.1	21.80%	43.61%	65.41%	36.2	40.0
Dy, ppm	0.36	0.04	0.29	0.43	0.25	0.47	10.19%	20.39%	30.58%	0.34	0.38
Er, ppm	0.14	0.03	0.08	0.20	0.05	0.23	20.55%	41.11%	61.66%	0.13	0.15
Fe, wt. %	0.865	0.037	0.791	0.939	0.754	0.976	4.29%	8.57%	12.86%	0.822	0.908
Ga, ppm	17.8	1.00	15.8	19.8	14.8	20.8	5.64%	11.28%	16.92%	16.9	18.7
Gd, ppm	0.36	0.05	0.25	0.47	0.20	0.52	14.98%	29.97%	44.95%	0.34	0.38
Ge, ppm	6.37	0.492	5.39	7.35	4.89	7.84	7.72%	15.44%	23.15%	6.05	6.69
Ho, ppm	0.054	0.011	0.032	0.076	0.021	0.087	20.48%	40.95%	61.43%	0.051	0.057
K, wt. %	2.10	0.097	1.91	2.30	1.81	2.39	4.61%	9.21%	13.82%	2.00	2.21
La, ppm	1.88	0.30	1.27	2.48	0.97	2.79	16.14%	32.29%	48.43%	1.78	1.97
Li, wt. %	0.707	0.021	0.664	0.749	0.643	0.770	2.98%	5.97%	8.95%	0.671	0.742
Li <sub>2</sub> O, wt. %	1.52	0.045	1.43	1.61	1.39	1.66	2.98%	5.97%	8.95%	1.45	1.60
Mg, wt. %	0.047	0.006	0.036	0.059	0.030	0.064	12.07%	24.14%	36.21%	0.045	0.050
Mn, wt. %	0.081	0.003	0.076	0.086	0.074	0.089	3.14%	6.28%	9.42%	0.077	0.085
Mo, ppm	3.38	0.46	2.46	4.31	1.99	4.77	13.67%	27.34%	41.01%	3.21	3.55
Nb, ppm	54	6	43	66	37	71	10.34%	20.69%	31.03%	52	57
Nd, ppm	1.49	0.098	1.29	1.69	1.19	1.79	6.61%	13.21%	19.82%	1.42	1.56
P, wt. %	0.135	0.011	0.112	0.157	0.101	0.168	8.27%	16.54%	24.82%	0.128	0.141
Pr, ppm	0.43	0.08	0.26	0.59	0.18	0.67	19.50%	39.00%	58.50%	0.40	0.45
Rb, ppm	659	20	619	698	599	718	3.01%	6.03%	9.04%	626	692

SI unit equivalents: ppm, parts per million  $\equiv$  mg/kg  $\equiv$   $\mu$ g/g  $\equiv$  0.0001 wt. %  $\equiv$  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 3. Performance Gates 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
<b>Peroxide Fusion ICP continued</b>											
Si, wt.%	34.18	0.640	32.90	35.45	32.26	36.09	1.87%	3.74%	5.61%	32.47	35.88
Sm, ppm	0.40	0.07	0.26	0.53	0.20	0.59	16.68%	33.37%	50.05%	0.38	0.42
Sn, ppm	238	11	217	260	207	270	4.42%	8.84%	13.26%	227	250
Sr, ppm	43.4	4.6	34.3	52.6	29.7	57.1	10.52%	21.03%	31.55%	41.3	45.6
Ta, ppm	41.0	1.80	37.4	44.6	35.6	46.4	4.39%	8.78%	13.18%	39.0	43.1
Tb, ppm	0.078	0.018	0.042	0.114	0.024	0.132	23.14%	46.27%	69.41%	0.074	0.082
Th, ppm	0.97	0.080	0.81	1.13	0.73	1.21	8.22%	16.43%	24.65%	0.93	1.02
Tl, ppm	3.84	0.235	3.37	4.31	3.14	4.55	6.12%	12.24%	18.36%	3.65	4.03
U, ppm	8.44	0.784	6.87	10.01	6.09	10.79	9.29%	18.59%	27.88%	8.02	8.86
W, ppm	5.11	0.57	3.97	6.25	3.40	6.82	11.13%	22.26%	33.39%	4.85	5.37
Y, ppm	1.90	0.167	1.57	2.24	1.40	2.40	8.76%	17.53%	26.29%	1.81	2.00
Zn, ppm	98	5.4	87	109	82	114	5.53%	11.06%	16.59%	93	103
Zr, ppm	29.6	3.6	22.4	36.9	18.7	40.5	12.24%	24.49%	36.73%	28.1	31.1
<b>Borate Fusion XRF</b>											
Al <sub>2</sub> O <sub>3</sub> , wt.%	16.30	0.087	16.13	16.48	16.04	16.57	0.53%	1.07%	1.60%	15.49	17.12
CaO, wt.%	0.287	0.006	0.275	0.299	0.269	0.305	2.07%	4.15%	6.22%	0.273	0.301
Fe <sub>2</sub> O <sub>3</sub> , wt.%	1.25	0.011	1.23	1.27	1.22	1.28	0.84%	1.68%	2.53%	1.18	1.31
K <sub>2</sub> O, wt.%	2.54	0.030	2.48	2.60	2.45	2.63	1.17%	2.33%	3.50%	2.42	2.67
MgO, wt.%	0.087	0.013	0.062	0.113	0.049	0.125	14.60%	29.19%	43.79%	0.083	0.092
MnO, wt.%	0.107	0.004	0.099	0.115	0.094	0.119	3.80%	7.60%	11.40%	0.101	0.112
Na <sub>2</sub> O, wt.%	3.75	0.044	3.66	3.84	3.62	3.88	1.16%	2.33%	3.49%	3.56	3.94
P <sub>2</sub> O <sub>5</sub> , wt.%	0.320	0.005	0.310	0.329	0.306	0.334	1.46%	2.92%	4.38%	0.304	0.336
SiO <sub>2</sub> , wt.%	73.01	0.346	72.32	73.70	71.97	74.05	0.47%	0.95%	1.42%	69.36	76.66
SO <sub>3</sub> , wt.%	0.101	0.008	0.086	0.116	0.078	0.123	7.46%	14.91%	22.37%	0.096	0.106
<b>Thermogravimetry</b>											
LOI <sup>1000</sup> , wt.%	0.681	0.097	0.486	0.876	0.389	0.973	14.29%	28.59%	42.88%	0.647	0.715
<b>4-Acid Digestion</b>											
Al, wt.%	7.94	0.485	6.97	8.91	6.49	9.40	6.11%	12.21%	18.32%	7.55	8.34
As, ppm	13.7	1.4	11.0	16.5	9.6	17.9	10.06%	20.13%	30.19%	13.0	14.4
Ba, ppm	58	2.8	53	64	50	67	4.89%	9.79%	14.68%	55	61
Be, ppm	154	11	132	175	121	186	7.11%	14.21%	21.32%	146	161
Bi, ppm	2.47	0.158	2.15	2.78	1.99	2.94	6.40%	12.80%	19.20%	2.34	2.59
Ca, wt.%	0.199	0.011	0.178	0.221	0.167	0.231	5.35%	10.69%	16.04%	0.189	0.209
Cd, ppm	1.57	0.111	1.34	1.79	1.23	1.90	7.09%	14.18%	21.27%	1.49	1.65
Ce, ppm	3.00	0.56	1.89	4.11	1.33	4.67	18.52%	37.04%	55.56%	2.85	3.15
Co, ppm	1.22	0.120	0.98	1.46	0.87	1.58	9.77%	19.53%	29.30%	1.16	1.28
Cs, ppm	70	3.5	63	77	59	80	4.96%	9.92%	14.89%	66	73
Cu, ppm	36.4	2.79	30.8	41.9	28.0	44.7	7.67%	15.34%	23.01%	34.5	38.2
Dy, ppm	0.34	0.04	0.26	0.42	0.22	0.46	11.58%	23.16%	34.74%	0.32	0.36
Er, ppm	0.13	0.03	0.08	0.19	0.05	0.21	19.75%	39.49%	59.24%	0.13	0.14
Fe, wt.%	0.835	0.033	0.769	0.900	0.736	0.933	3.92%	7.84%	11.77%	0.793	0.876

SI unit equivalents: ppm, parts per million  $\equiv$  mg/kg  $\equiv$   $\mu$ g/g  $\equiv$  0.0001 wt.%  $\equiv$  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 3. Performance Gates 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
<b>4-Acid Digestion continued</b>											
Ga, ppm	17.8	1.16	15.5	20.1	14.3	21.3	6.54%	13.07%	19.61%	16.9	18.7
Hf, ppm	2.05	0.116	1.82	2.28	1.70	2.39	5.65%	11.29%	16.94%	1.94	2.15
Ho, ppm	0.050	0.006	0.037	0.063	0.031	0.069	12.66%	25.31%	37.97%	0.048	0.053
K, wt. %	2.08	0.074	1.93	2.23	1.86	2.31	3.57%	7.14%	10.70%	1.98	2.19
La, ppm	1.50	0.41	0.68	2.31	0.27	2.72	27.25%	54.49%	81.74%	1.42	1.57
Li, wt. %	0.695	0.024	0.646	0.743	0.622	0.768	3.51%	7.01%	10.52%	0.660	0.729
Li <sub>2</sub> O, wt. %	1.50	0.052	1.39	1.60	1.34	1.65	3.51%	7.01%	10.52%	1.42	1.57
Mg, wt. %	0.044	0.005	0.034	0.053	0.029	0.058	11.01%	22.01%	33.02%	0.041	0.046
Mn, wt. %	0.079	0.003	0.072	0.086	0.069	0.089	4.23%	8.45%	12.68%	0.075	0.083
Mo, ppm	3.12	0.170	2.78	3.46	2.61	3.63	5.44%	10.89%	16.33%	2.97	3.28
Na, wt. %	2.70	0.123	2.46	2.95	2.33	3.07	4.55%	9.09%	13.64%	2.57	2.84
Nb, ppm	53	4.7	44	62	39	67	8.81%	17.61%	26.42%	50	56
Nd, ppm	1.42	0.25	0.92	1.92	0.68	2.17	17.51%	35.02%	52.52%	1.35	1.49
Ni, ppm	10.4	0.64	9.1	11.7	8.5	12.3	6.14%	12.29%	18.43%	9.9	10.9
P, wt. %	0.140	0.004	0.133	0.148	0.129	0.151	2.60%	5.19%	7.79%	0.133	0.147
Pb, ppm	16.2	1.24	13.7	18.7	12.5	20.0	7.65%	15.29%	22.94%	15.4	17.0
Pr, ppm	0.38	0.05	0.28	0.48	0.23	0.53	13.04%	26.08%	39.11%	0.36	0.40
Rb, ppm	652	52	548	756	496	809	7.99%	15.99%	23.98%	620	685
S, wt. %	0.042	0.004	0.035	0.049	0.031	0.053	8.48%	16.96%	25.44%	0.040	0.044
Sb, ppm	0.71	0.062	0.58	0.83	0.52	0.89	8.74%	17.49%	26.23%	0.67	0.74
Sc, ppm	0.50	0.07	0.37	0.64	0.30	0.70	13.23%	26.47%	39.70%	0.48	0.53
Sm, ppm	0.37	0.06	0.26	0.49	0.20	0.54	15.56%	31.11%	46.67%	0.35	0.39
Sn, ppm	79	9	62	97	53	106	11.14%	22.29%	33.43%	75	83
Sr, ppm	36.3	2.76	30.8	41.8	28.0	44.5	7.60%	15.19%	22.79%	34.5	38.1
Ta, ppm	41.5	2.40	36.7	46.3	34.3	48.7	5.79%	11.58%	17.37%	39.4	43.5
Tb, ppm	0.063	0.009	0.046	0.080	0.037	0.089	13.60%	27.19%	40.79%	0.060	0.066
Th, ppm	0.95	0.11	0.72	1.18	0.61	1.30	12.07%	24.14%	36.22%	0.90	1.00
Ti, wt. %	0.016	0.001	0.014	0.019	0.012	0.020	8.23%	16.47%	24.70%	0.016	0.017
Tl, ppm	3.86	0.154	3.55	4.17	3.40	4.32	3.99%	7.99%	11.98%	3.67	4.05
U, ppm	7.90	0.556	6.79	9.01	6.23	9.57	7.04%	14.08%	21.11%	7.51	8.30
V, ppm	3.94	0.193	3.55	4.33	3.36	4.52	4.90%	9.80%	14.70%	3.74	4.14
W, ppm	5.26	0.276	4.71	5.81	4.43	6.09	5.24%	10.48%	15.72%	5.00	5.52
Y, ppm	1.52	0.21	1.11	1.93	0.91	2.14	13.48%	26.96%	40.43%	1.45	1.60
Zn, ppm	98	3.3	91	104	88	107	3.36%	6.71%	10.07%	93	102
Zr, ppm	24.5	2.5	19.6	29.4	17.2	31.9	10.00%	20.01%	30.01%	23.3	25.7

SI unit equivalents: ppm, parts per million  $\equiv$  mg/kg  $\equiv$   $\mu$ g/g  $\equiv$  0.0001 wt. %  $\equiv$  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.

Figure 1. Li<sub>2</sub>O by PF ICP in OREAS 752

SPC.1422.RR1.OREAS 752.4.PF ICP.Li2O.Lab.190208.121607.SN

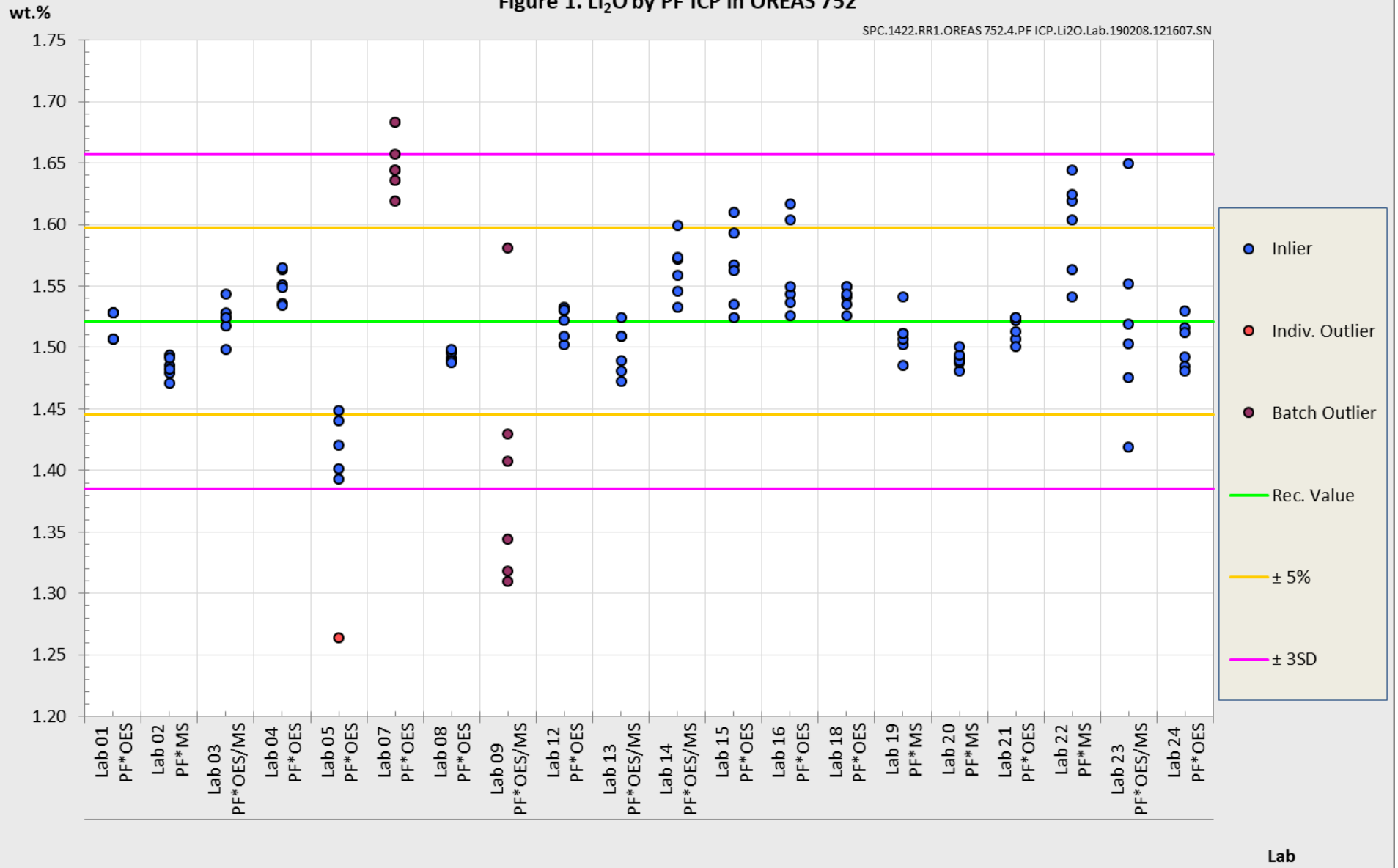
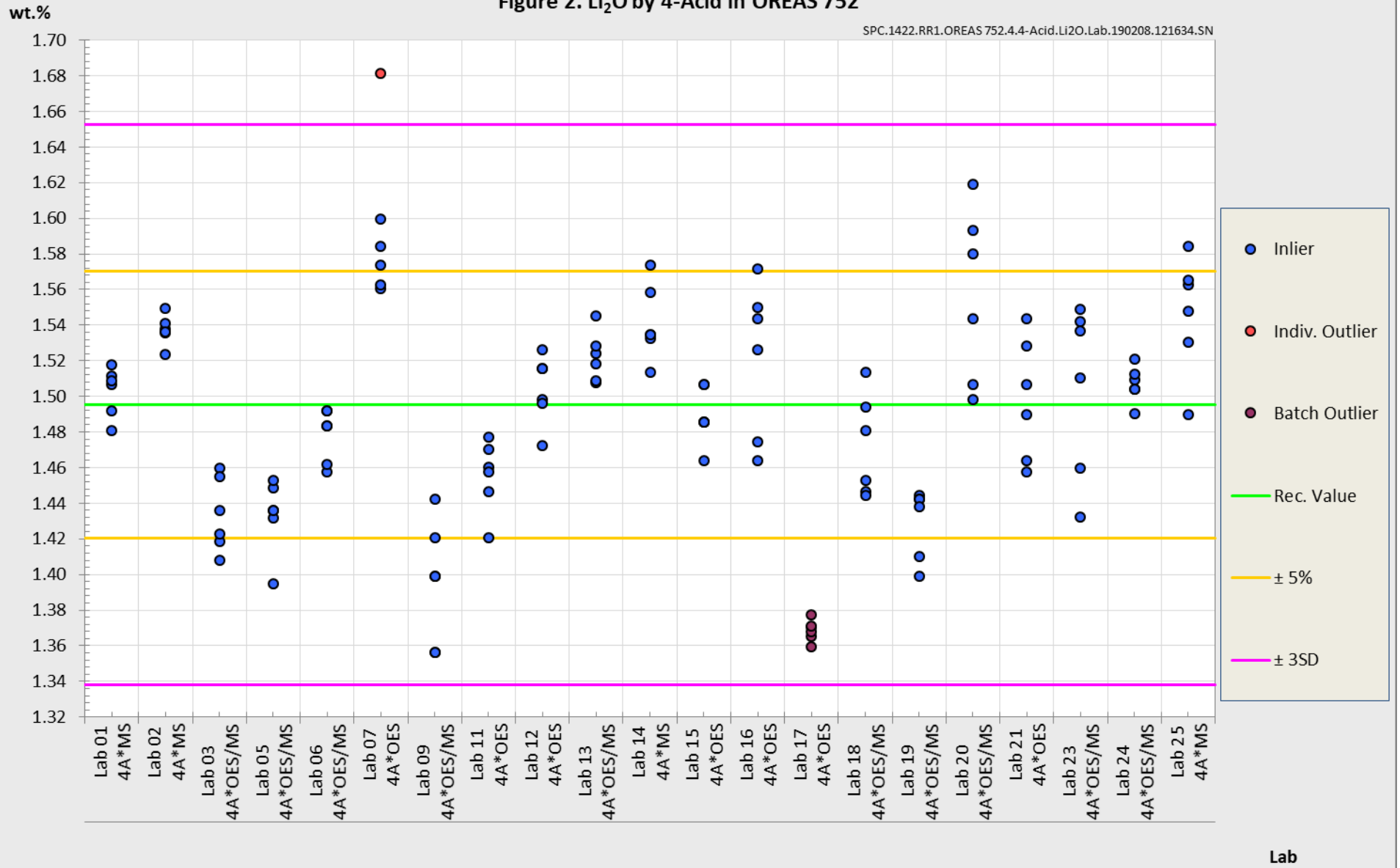


Figure 2. Li<sub>2</sub>O by 4-Acid in OREAS 752

SPC.1422.RR1.OREAS 752.4.4-Acid.Li2O.Lab.190208.121634.SN



**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 lithium oxide (Li<sub>2</sub>O) by peroxide fusion ICP, where 99% of the time (1- $\alpha$ =0.99) at least 95% of subsamples ( $\rho$ =0.95) will have concentrations lying between 1.49 and 1.55 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). *Please note that tolerance limits pertain to the homogeneity of the CRM only and should not be used as control limits for laboratory performance.*

### **ANOVA Study**

The homogeneity of OREAS 752 has also been evaluated in an ANOVA study for all certified analytes occurring at least 20 times the lower limit of detection. No significant  $p$ -values were found indicating that no evidence exists that between-unit variance is greater than within-unit variance.

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 752 and whether the variance between two subsamples from the same unit is statistically distinguishable to the variance from two subsamples taken from any two separate units. A reference material therefore, can possess poor absolute homogeneity yet still pass a relative homogeneity 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 752 is sufficiently homogenous and is fit-for-purpose as a certified reference material (see 'Intended Use' below).

## **PARTICIPATING LABORATORIES**

1. AGAT Laboratories, Mississauga, Ontario, Canada
2. Alex Stewart International, Mendoza, Argentina
3. ALS, Brisbane, QLD, Australia
4. ALS, Lima, Peru
5. ALS, Loughrea, Galway, Ireland
6. ALS, Perth, WA, Australia
7. ALS, Vancouver, BC, Canada
8. American Assay Laboratories, Sparks, Nevada, USA
9. Bureau Veritas Commodities Canada Ltd, Vancouver, BC, Canada
10. Bureau Veritas Geoanalytical, Adelaide, SA, Australia
11. Bureau Veritas Geoanalytical, Perth, WA, Australia
12. Inspectorate (BV), Lima, Peru
13. Intertek Genalysis, Perth, WA, Australia
14. Intertek Testing Services Philippines, Cupang, Muntinlupa, Philippines

15. Nagrom, Perth, WA, Australia
16. Ontario Geological Survey, Sudbury, Ontario, Canada
17. PT Geoservices Ltd, Cikarang, Jakarta Raya, Indonesia
18. Reminex Centre de Recherche, Marrakesh, Marrakesh-Safi, Morocco
19. Saskatchewan Research Council, Saskatoon, Saskatchewan, Canada
20. SGS, Randfontein, Gauteng, South Africa
21. SGS Australia Mineral Services, Perth, WA, Australia
22. SGS Canada Inc., Vancouver, BC, Canada
23. SGS Lakefield Research Ltd, Lakefield, Ontario, Canada
24. UIS Analytical Services, Centurion, South Africa

**Please note: Above numbered alphabetical list of participating laboratories does not reflect the Lab ID numbering on the scatter plots above.**

## PREPARER AND SUPPLIER

Certified reference material OREAS 752 was prepared, certified and supplied by:



ORE Research & Exploration Pty Ltd  
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 AUSTRALIA

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 Fax: +613-9729 8338  
 Web: [www.ore.com.au](http://www.ore.com.au)  
 Email: [info@ore.com.au](mailto:info@ore.com.au)

It is packaged in 10g units in laminated foil packets and in 500g units in wide-mouth plastic jars.

## METROLOGICAL TRACEABILITY

The analytical samples were selected in a manner to represent the entire batch of prepared CRM. This 'representivity' was maintained in each submitted laboratory sample batch and ensures the user that the data is traceable from sample selection through to the analytical results that underlie the consensus values. Each analytical data set has been validated by its assayer through the inclusion of internal reference materials and QC checks during analysis.

The laboratories were chosen on the basis of their competence (from past performance in inter-laboratory programs undertaken by ORE Pty Ltd) for a particular analytical method, analyte or analyte suite, and sample matrix. Most of these laboratories have and maintain ISO 17025 accreditation. The certified values presented in this report are calculated from the means of accepted data following robust statistical treatment as detailed in this report.

Guide ISO/TR 16476:2016, section 5.3.1 describes metrological traceability in reference materials as it pertains to the transformation of the measurand. In this section it states, *“Although the determination of the property value itself can be made traceable to appropriate units through, for example, calibration of the measurement equipment used, steps like the transformation of the sample from one physical (chemical) state to another cannot. Such transformations may only be compared with a reference (when available), or*



among themselves. For some transformations, reference methods have been defined and may be used in certification projects to evaluate the uncertainty associated with such a transformation. In other cases, **only a comparison among different laboratories using the same 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 752 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 752 may be used to calibrate the entire procedure by producing a pure substance CRM transformed into a calibration solution.

OREAS 752 is intended for the following uses:

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

## STABILITY AND STORAGE INSTRUCTIONS

OREAS 752 was sourced from Li-rich pegmatite ore and is low in reactive sulphides. In its unopened state and under normal conditions of storage it has a shelf life beyond ten years. Its stability will be monitored at regular intervals and purchasers notified if any changes are observed.

## INSTRUCTIONS FOR CORRECT USE

The certified values for lithium borate fusion XRF and for LOI are on a ‘dry sample’ basis whilst all other certified values are reported on a ‘sample as received’ basis.

## 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
2	22 <sup>nd</sup> February 2019	Table of content got 'QMS ACCREDITED' link added.
1	11 <sup>th</sup> February 2019	Minor change in the Source Material section.
0	11 <sup>th</sup> February 2019	First publication.

## QMS ACCREDITED

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



## CERTIFYING OFFICER

22<sup>nd</sup> February, 2019

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

## REFERENCES

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