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CERTIFICATE OF ANALYSIS FOR

CERTIFIED REFERENCE MATERIAL

WON14

Phosphate Ore (Wonarah Project, NT, Australia)

Summary Statistics

Constituent	Certified Value	1SD
Phosphorus oxide, P_2O_5 (wt.%)	12.97	0.21
Silicon dioxide, SiO_2 (wt.%)	52.82	0.36
Titanium dioxide, TiO_2 (wt.%)	0.420	0.013
Aluminium oxide, Al_2O_3 (wt.%)	7.08	0.08
Iron oxide, Fe_2O_3 (wt.%)	3.484	0.024
Calcium oxide, CaO (wt.%)	17.60	0.14
Magnesium oxide, MgO (wt.%)	0.678	0.032
Manganese oxide, MnO (wt.%)	0.047	0.007
Potassium oxide, K_2O (wt.%)	0.600	0.012
Sodium oxide, Na_2O (wt.%)	0.183	0.020
LOI at 1000°C (wt.%)	3.08	0.20

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

INTRODUCTION

WON14 was prepared from phosphate ore sourced from the Wonarah Phosphate Project located in the Barkly Tableland of Northern Territory, Australia. The project consists of two sites known as 'Arruwurra' and 'Main Zone'. WON14 is one from a suite of four phosphate CRMs (the others being WON20, WON25 and WON30). All four CRMs have been characterised for P_2O_5, SiO_2, TiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, MnO, K_2O, Na_2O and LOI at 1000°C.

COMMINUTION AND HOMOGENISATION PROCEDURES

The material was prepared in the following manner:

- drying at 105°C to constant mass;
- crushing and first stage milling;
- preliminary homogenisation;
- second stage milling to 100% minus 40 microns;
- final homogenisation;
- packaging into 10g units sealed in laminated foil pouches.

ANALYSIS OF WON14

Ten commercial laboratories participated in the analytical program to characterise P_2O_5, SiO_2, TiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, MnO, K_2O, Na_2O by lithium borate fusion XRF and LOI at 1000°C by thermogravimetry. All results together with uncorrected means, medians, one sigma standard deviations, relative standard deviations and percent deviation of lab means from the corrected mean of means (PDM^3) are presented in Tables A2 and A12 (Appendix). The parameter PDM^3 is a measure of laboratory accuracy while the relative standard deviation is an effective measure of analytical precision where homogeneity of the test material has been confirmed.

Results for P_2O_5 are also presented in a scatter plot (Figure 1) 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 (where present). The analytical methods employed by each laboratory are explained, together with other abbreviations used, in Table A1 (Appendix).

Each participating laboratory received 5 samples of 10g each. Each set of subsamples submitted to each laboratory was taken at regular intervals during packaging of the standard in order to maximise their representation.

STATISTICAL EVALUATION OF ANALYTICAL DATA FOR WON14

Certified Value and Confidence Intervals

The certified value is the mean of means of accepted replicate values of accepted participating laboratories computed according to the formulae

$$\bar{x}_i = \frac{1}{n_i} \sum_{j=1}^{n_i} x_{ij}$$

$$\ddot{x} = \frac{1}{p} \sum_{i=1}^{p} \bar{x}_i$$

where

x_{ij} *is the jth result reported by laboratory i;*
p is the number of participating laboratories;
n_i *is the number of results reported by laboratory i;*
$\bar{x}_i$ *is the mean for laboratory i;*
$\ddot{x}$ *is the mean of means.*

The confidence intervals were obtained by calculation of the variance of the consensus value (mean of means) and reference to Student's-*t* distribution with degrees of freedom (*p*-1).

$$\hat{V}(\ddot{x}) = \frac{1}{p(p-1)} \sum_{i=1}^{p} (\bar{x}_i - \ddot{x})^2$$

$$\text{Confidence Interval} = \ddot{x} \pm t_{1-x/2}(p-1)(\hat{V}(\ddot{x}))^{1/2}$$

where

$t_{1-x/2}(p-1)$ *is the 1-x/2 fractile of the t-distribution with (p-1) degrees of freedom.*

The distribution of the values is assumed to be symmetrical about the mean in the calculation of the confidence interval.
The test for rejection of individual outliers from each laboratory data set was primarily based on *z* scores (rejected if $|z_i| > 2.5$) computed from the robust estimators of location and scale, *T* and *S*, respectively, according to the formulae:

$$S = 1.483 \underset{j=1.....n}{\text{median}} / x_j - \underset{i=1.....n}{\text{median}} (x_i) /$$

$$z_i = \frac{x_i - T}{S}$$

where

T is the median value in a data set;
S is the median of all absolute deviations from the sample median multiplied by 1.483, a correction factor to make the estimator consistent with the usual parameter of a normal distribution.

Table 1. Certified values and 95% confidence intervals for WON14.

Constituent	Certified Value	95% Confidence Interval	
		Low	High
Phosphorus oxide, P_2O_5 (wt.%)	12.97	12.82	13.13
Silicon dioxide, SiO_2 (wt.%)	52.82	52.55	53.10
Titanium dioxide, TiO_2 (wt.%)	0.420	0.411	0.429
Aluminium oxide, Al_2O_3 (wt.%)	7.08	7.02	7.13
Iron oxide, Fe_2O_3 (wt.%)	3.484	3.466	3.502
Calcium oxide, CaO (wt.%)	17.60	17.49	17.71
Magnesium oxide, MgO (wt.%)	0.678	0.656	0.701
Manganese oxide, MnO (wt.%)	0.047	0.042	0.052
Potassium oxide, K_2O (wt.%)	0.600	0.592	0.608
Sodium oxide, Na_2O (wt.%)	0.183	0.168	0.198
LOI at 1000°C (wt.%)	3.08	2.90	3.27

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

The z-score test is used in combination with a second method of individual outlier detection that determines the percent deviation of the individual value from the median. Outliers in general are selected on the basis of z-scores > 2.5 and with percent deviations > 1.5%. In certain instances, statistician's prerogative has been employed in discriminating outliers.
Each laboratory data set is tested for outlying status based on z-score discrimination and rejected if $|z_i| > 2.5$. After individual and lab data set outliers have been eliminated a non-iterative 3 standard deviation filter is applied, with any values lying outside this window also relegated to outlying status.

Individual outliers and, more rarely, laboratory means deemed to be outlying are shown left justified and in bold in the tabulated results (see Appendix) and have been omitted in the determination of certified values. The magnitude of the confidence interval is inversely proportional to the number of participating laboratories and interlaboratory agreement. It 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. A 95% confidence interval indicates a 95% probability that the interval includes the true value of the analyte under consideration.

Statement of Homogeneity
The standard deviation of each laboratory data set includes error due to both the imprecision of the analytical method employed and to possible inhomogeneity of the material analysed. The standard deviation of the pooled individual analyses of all participating laboratories includes error due to the imprecision of each analytical method, to possible inhomogeneity of the material analysed and, in particular, to deficiencies in accuracy of each analytical method.

In determining tolerance intervals that component of error attributable to measurement inaccuracy was eliminated by transformation of the individual results of each data set to a common mean (the uncorrected grand mean) according to the formula

$$x'_{ij} = x_{ij} - \bar{x}_i + \frac{\sum_{i=1}^{p}\sum_{j=1}^{n_i} x_{ij}}{\sum_{i=1}^{p} n_i}$$

where

x_{ij} *is the* j*th raw result reported by laboratory* i;

x'_{ij} *is the* j*th transformed result reported by laboratory* i;

n_i *is the number of results reported by laboratory* i;

p *is the number of participating laboratories*;

$\bar{x}_i$ *is the raw mean for laboratory* i.

The homogeneity of each constituent was determined from tables of factors for two-sided tolerance limits for normal distributions (ISO 3207) in which

$$\text{Lower limit is } \ddot{x} - k'_2(n, p, 1-\alpha)s''_g$$
$$\text{Upper limit is } \ddot{x} + k'_2(n, p, 1-\alpha)s''_g$$

where

n *is the number of results*;

$1-\alpha$ *is the confidence level*;

p *is the proportion of results* expected *within the tolerance* limits;

k'_2 *is the factor for two-sided tolerance* limits $(m, \alpha$ *unknown*$)$;

s''_g *is the corrected grand standard deviation.*

The meaning of these tolerance limits (Table 2) may be illustrated for P_2O_5, where 99% of the time at least 95% of subsamples will have concentrations lying between 12.95 and 13.00 wt.%. Put more precisely, this means that if the same number of subsamples were taken and analysed in the same manner repeatedly, 99% of the tolerance intervals so constructed would cover at least 95% of the total population, and 1% of the tolerance intervals would cover less than 95% of the total population (ISO Guide 35).

The corrected grand standard deviation, s_g'', used to compute the tolerance intervals is the weighted means of standard deviations of all data sets for a particular constituent according to the formula:

$$s''_g = \frac{\sum_{i=1}^{p}\left(s_i\left(1 - \frac{s_i}{s'_g}\right)\right)}{\sum_{i=1}^{p}\left(1 - \frac{s_i}{s'_g}\right)}$$

where

$$1 - \left(\frac{s_i}{2s'_g} \right) \text{ is the weighting factor for laboratory } i \text{ ;}$$

$$s'_g \text{ is the grand standard deviation computed from the transformed (i.e. means - adjusted) results}$$

according to the formula

$$s'_g = \left[\frac{\sum_{i=j}^{p} \sum_{j=i}^{n_i} (x'_{ij} - \bar{x}'_i)^2}{\sum_{i=1}^{p} n_i - 1} \right]^{1/2}$$

$$\text{where } \bar{x}'_i \text{ is the transformed mean for laboratorty } i$$

The weighting factors were applied to compensate for the considerable variation in analytical precision amongst participating laboratories. Hence, weighting factors for each data set have been constructed so as to be inversely proportional to the standard deviation of that data set. It should be noted that estimates of tolerance by this method are considered conservative as a significant proportion of the observed variance, even in those laboratories exhibiting the best analytical precision, can presumably be attributed to measurement error.

Table 2. Certified values and tolerance intervals for WON14.

Constituent	Certified Value	Tolerance Interval 1-α=0.99, ρ=0.95	
		Low	High
Phosphorus oxide, P_2O_5 (wt.%)	12.97	12.95	13.00
Silicon dioxide, SiO_2 (wt.%)	52.82	52.63	53.02
Titanium dioxide, TiO_2 (wt.%)	0.420	0.420	0.420
Aluminium oxide, Al_2O_3 (wt.%)	7.08	7.03	7.12
Iron oxide, Fe_2O_3 (wt.%)	3.484	3.466	3.503
Calcium oxide, CaO (wt.%)	17.60	17.55	17.64
Magnesium oxide, MgO (wt.%)	0.678	0.665	0.692
Manganese oxide, MnO (wt.%)	0.047	IND	IND
Potassium oxide, K_2O (wt.%)	0.600	IND	IND
Sodium oxide, Na_2O (wt.%)	0.183	IND	IND
LOI at 1000°C (wt.%)	3.08	3.02	3.15

SI unit equivalents: ppm (parts per million) ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.%.
Note - intervals may appear asymmetric due to rounding; IND – indeterminate.

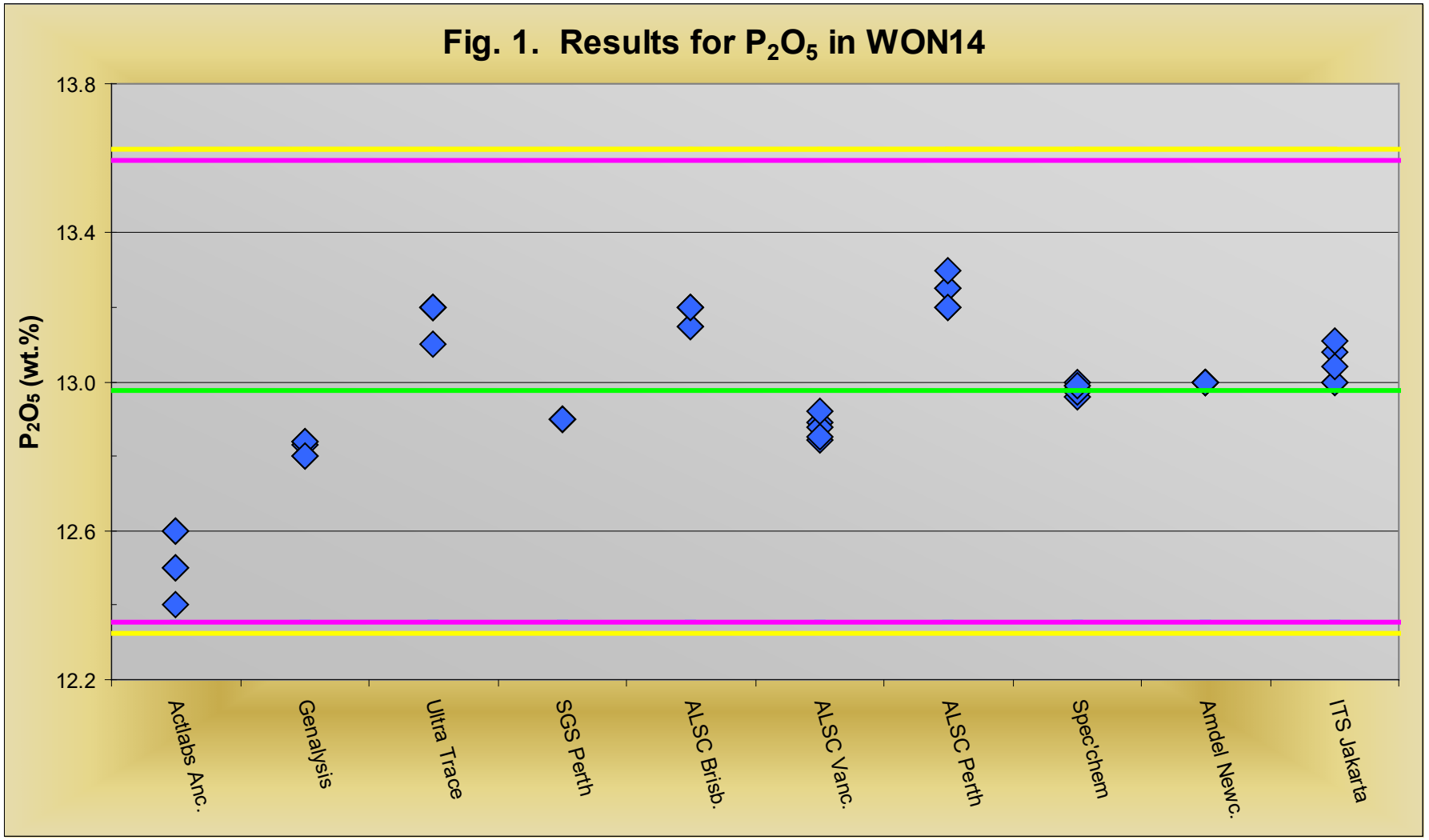
Fig. 1. Results for P_2O_5 in WON14
P_2O_5 (wt.%)
13.8
13.4
13.0
12.6
12.2
Actlabs Anc.
Genalysis
Ultra Trace
SGS Perth
ALSC Brisb.
ALSC Vanc.
ALSC Perth
Spec'chem
Amdel Newc.
ITS Jakarta

Performance Gates

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 and CRM variability. For an effective CRM the contribution of the latter should be negligible in comparison to measurement errors. Sources of measurement error include inter-lab bias, analytical precision (repeatability) and inter-batch bias (reproducibility).

Two methods have been employed to calculate performance gates. The first method uses the same filtered data set used to determine the certified value, i.e., after removal of all individual, lab dataset (batch) and 3SD outliers. 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 individual analyses generated from the certification program.

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.

Table 3. Performance Gates for WON14.

Constituent	Certified Value	Absolute Standard Deviation					Relative Standard Deviation			5% window	
		1SD	2SD Low	2SD High	3SD Low	3SD High	1RSD	2RSD	3RSD	Low	High
P_2O_5 (wt.%)	12.97	0.21	12.56	13.39	12.35	13.59	1.59%	3.18%	4.78%	12.33	13.62
SiO_2 (wt.%)	52.82	0.36	52.11	53.54	51.75	53.90	0.68%	1.36%	2.04%	50.18	55.47
TiO_2 (wt.%)	0.420	0.013	0.394	0.446	0.380	0.460	3.15%	6.31%	9.46%	0.399	0.441
Al_2O_3 (wt.%)	7.08	0.08	6.91	7.24	6.83	7.32	1.14%	2.28%	3.42%	6.72	7.43
Fe_2O_3 (wt.%)	3.484	0.024	3.437	3.532	3.413	3.555	0.68%	1.36%	2.03%	3.310	3.659
CaO (wt.%)	17.60	0.14	17.31	17.88	17.17	18.02	0.80%	1.61%	2.41%	16.72	18.48
MgO (wt.%)	0.678	0.032	0.615	0.741	0.584	0.773	4.65%	9.29%	13.94%	0.644	0.712
MnO (wt.%)	0.047	0.007	0.034	0.061	0.027	0.067	14.06%	28.13%	42.19%	0.045	0.050
K_2O (wt.%)	0.600	0.012	0.577	0.624	0.565	0.636	1.97%	3.93%	5.90%	0.570	0.630
Na_2O (wt.%)	0.183	0.020	0.142	0.223	0.122	0.244	11.14%	22.27%	33.41%	0.174	0.192
LOI (wt.%)	3.08	0.20	2.68	3.49	2.47	3.69	6.60%	13.21%	19.81%	2.93	3.24

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

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.

PARTICIPATING LABORATORIES

1. Actlabs, Ancaster, ON, Canada
2. ALS, Brisbane, QLD, Australia
3. ALS, Perth, WA, Australia
4. ALS, Vancouver, BC, Canada
5. Amdel Limited (currently Bureau Veritas), Newcastle, NSW, Australia
6. Genalysis (currently Intertek), Perth, WA, Australia
7. Intertek Testing Services, Jakarta, Indonesia
8. SGS, Perth, WA, Australia
9. SpectraChem Analytical, Lower Hutt, New Zealand
10. Ultra Trace (currently Bureau Veritas), Perth, WA, Australia

PREPARER AND SUPPLIER

Certified reference material WON14 was prepared, certified and supplied by:

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INTENDED USE

WON14 is a reference material intended for the following:

- for the monitoring of laboratory performance in the analysis of P_2O_5, SiO_2, TiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, MnO, K_2O, Na_2O and LOI in geological samples;
- for the calibration of instruments used in the determination of the concentration of P_2O_5, SiO_2, TiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, MnO, K_2O, Na_2O and LOI;
- for the verification of analytical methods for P_2O_5, SiO_2, TiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, MnO, K_2O, Na_2O and LOI.

STABILITY AND STORAGE INSTRUCTIONS

In its unopened state in the laminated foil pouches and under normal conditions of storage it has a shelf life beyond ten years.

INSTRUCTIONS FOR CORRECT USE

The certified values for WON14 refer to the concentration of P_2O_5, SiO_2, TiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, MnO, K_2O, Na_2O and LOI after removal of hygroscopic moisture by drying to constant mass at 105°C. It should therefore be dried prior to weighing and analysis. Alternatively, the samples can be equilibrated to the lab atmosphere and all analytes corrected to a dry basis after moisture analysis at 105°C.

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.

CERTIFYING OFFICER

October, 2009

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

REFERENCES

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

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

APPENDIX

Analytical Data for WON14

Table A1. Explanation of abbreviations used in Tables A2 – A12.

Abbreviation	Explanation
Std.Dev.	one standard deviation
Rel.Std.Dev.	one relative standard deviation (%)
PDM[3]	percent deviation of lab mean from corrected mean of means
BF	lithium borate fusion
XRF	x-ray fluorescence
LOI	loss on ignition

Table A2. Results for P_2O_5 in WON14 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Actlabs Ancaster BF*XRF	Genalysis Perth BF*XRF	UltraTrace Perth BF*XRF	SGS Perth BF*XRF	ALSC Brisbane BF*XRF	ALSC Vancouver BF*XRF	ALSC Perth BF*XRF	Spect'Chem Lower Hutt BF*XRF	Amdel Newcastle BF*XRF	ITS Jakarta BF*XRF
1	12.40	12.84	13.20	12.90	13.15	12.84	13.25	12.96	13.00	13.00
2	12.50	12.80	13.20	12.90	13.20	12.89	13.20	13.00	13.00	13.00
3	12.60	12.83	13.20	12.90	13.15	12.88	13.25	12.98	13.00	13.08
4	12.60	12.84	13.20	12.90	13.20	12.85	13.20	12.97	13.00	13.04
5	12.50	12.80	13.10	12.90	13.20	12.92	13.30	12.99	13.00	13.11
Mean	12.52	12.82	13.18	12.90	13.18	12.88	13.24	12.98	13.00	13.05
Median	12.50	12.83	13.20	12.90	13.20	12.88	13.25	12.98	13.00	13.04
Std.Dev.	0.08	0.02	0.04	0.00	0.03	0.03	0.04	0.02	0.00	0.05
Rel.Std.Dev.	0.67%	0.16%	0.34%	0.00%	0.21%	0.24%	0.32%	0.12%	0.00%	0.37%
PDM[3]	-3.50%	-1.18%	1.58%	-0.57%	1.58%	-0.75%	2.05%	0.04%	0.20%	0.55%

Table A3. Results for SiO_2 in WON14 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Actlabs Ancaster BF*XRF	Genalysis Perth BF*XRF	UltraTrace Perth BF*XRF	SGS Perth BF*XRF	ALSC Brisbane BF*XRF	ALSC Vancouver BF*XRF	ALSC Perth BF*XRF	Spect'Chem Lower Hutt BF*XRF	Amdel Newcastle BF*XRF	ITS Jakarta BF*XRF
1	51.46	53.06	52.80	52.30	52.70	53.13	53.40	52.28	52.70	52.43
2	52.07	53.12	52.90	52.50	52.90	53.20	53.40	52.35	52.90	52.48
3	51.85	52.89	52.90	52.20	52.70	53.09	53.40	52.29	53.00	52.87
4	51.97	52.97	52.80	52.40	52.80	53.24	53.30	52.41	52.90	52.72
5	51.83	52.78	52.80	52.20	52.90	53.11	53.60	52.28	53.10	52.92
Mean	**51.84**	52.96	52.84	52.32	52.80	53.15	53.42	52.32	52.92	52.68
Median	51.85	52.97	52.80	52.30	52.80	53.13	53.40	52.29	52.90	52.72
Std.Dev.	0.23	0.14	0.05	0.13	0.10	0.06	0.11	0.06	0.15	0.22
Rel.Std.Dev.	0.45%	0.25%	0.10%	0.25%	0.19%	0.12%	0.21%	0.11%	0.28%	0.42%
PDM[3]	-1.87%	0.26%	0.03%	-0.96%	-0.05%	0.62%	1.13%	-0.95%	0.18%	-0.27%

Table A4. Results for TiO_2 in WON14 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Actlabs Ancaster BF*XRF	Genalysis Perth BF*XRF	UltraTrace Perth BF*XRF	SGS Perth BF*XRF	ALSC Brisbane BF*XRF	ALSC Vancouver BF*XRF	ALSC Perth BF*XRF	Spect'Chem Lower Hutt BF*XRF	Amdel Newcastle BF*XRF	ITS Jakarta BF*XRF
1	0.410	0.420	0.430	0.410	0.410	0.400	0.430	0.440	0.420	0.430
2	0.420	0.410	0.430	0.420	0.410	0.400	0.450	0.440	0.410	0.420
3	0.420	0.420	0.430	0.410	0.410	0.400	0.450	0.440	0.410	0.430
4	0.410	0.410	0.430	0.410	0.410	0.400	0.430	0.440	0.410	0.420
5	0.420	0.420	0.420	0.410	0.410	0.400	0.440	0.440	0.420	0.420
Mean	0.416	0.416	0.428	0.412	0.410	0.400	0.440	0.440	0.414	0.424
Median	0.420	0.420	0.430	0.410	0.410	0.400	0.440	0.440	0.410	0.420
Std.Dev.	0.005	0.005	0.004	0.004	0.000	0.000	0.010	0.000	0.005	0.005
Rel.Std.Dev.	1.32%	1.32%	1.04%	1.09%	0.00%	0.00%	2.27%	0.00%	1.32%	1.29%
PDM[3]	-0.95%	-0.95%	1.90%	-1.90%	-2.38%	-4.76%	4.76%	4.76%	-1.43%	0.95%

Table A5. Results for Al_2O_3 in WON14 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Actlabs Ancaster BF*XRF	Genalysis Perth BF*XRF	UltraTrace Perth BF*XRF	SGS Perth BF*XRF	ALSC Brisbane BF*XRF	ALSC Vancouver BF*XRF	ALSC Perth BF*XRF	Spect'Chem Lower Hutt BF*XRF	Amdel Newcastle BF*XRF	ITS Jakarta BF*XRF
1	7.01	6.89	7.06	7.03	7.07	7.21	7.14	7.02	7.10	7.08
2	7.03	6.93	7.10	7.07	7.09	7.14	7.18	7.00	7.20	7.08
3	6.95	6.94	7.09	7.06	7.06	7.16	7.16	7.02	7.20	7.12
4	7.00	6.94	7.10	7.06	7.08	7.15	7.19	7.02	7.10	7.09
5	7.02	6.94	7.10	7.06	7.09	7.17	7.20	6.98	7.20	7.13
Mean	7.00	6.93	7.09	7.06	7.08	7.17	7.17	7.01	7.16	7.10
Median	7.01	6.94	7.10	7.06	7.08	7.16	7.18	7.02	7.20	7.09
Std.Dev.	0.03	0.02	0.02	0.02	0.01	0.03	0.02	0.02	0.05	0.02
Rel.Std.Dev.	0.44%	0.31%	0.24%	0.21%	0.18%	0.38%	0.34%	0.26%	0.76%	0.33%
PDM[3]	-1.05%	-2.09%	0.20%	-0.29%	0.03%	1.27%	1.38%	-0.96%	1.18%	0.34%

Table A6. Results for Fe_2O_3 in WON14 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Actlabs Ancaster BF*XRF	Genalysis Perth BF*XRF	UltraTrace Perth BF*XRF	SGS Perth BF*XRF	ALSC Brisbane BF*XRF	ALSC Vancouver BF*XRF	ALSC Perth BF*XRF	Spect'Chem Lower Hutt BF*XRF	Amdel Newcastle BF*XRF	ITS Jakarta BF*XRF
1	3.49	3.44	3.51	3.48	3.48	3.45	3.49	3.56	3.50	3.37
2	3.50	3.44	3.51	3.48	3.50	3.44	3.51	3.56	3.50	3.34
3	3.52	3.42	3.49	3.48	3.48	3.44	3.53	3.57	3.50	3.43
4	3.49	3.45	3.48	3.47	3.49	3.44	3.46	3.55	3.50	3.41
5	**3.57**	3.41	3.49	3.46	3.49	3.46	3.44	3.57	3.50	3.43
Mean	3.51	**3.43**	3.50	3.47	3.49	3.45	3.49	**3.56**	3.50	**3.40**
Median	3.50	3.44	3.49	3.48	3.49	3.44	3.49	3.56	3.50	3.41
Std.Dev.	0.03	0.02	0.01	0.01	0.01	0.01	0.04	0.01	0.00	0.04
Rel.Std.Dev.	0.96%	0.48%	0.38%	0.26%	0.24%	0.26%	1.05%	0.23%	0.00%	1.17%
PDM[3]	0.85%	-1.50%	0.34%	-0.30%	0.11%	-1.10%	0.05%	2.23%	0.45%	-2.53%

Table A7. Results for CaO in WON14 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Actlabs Ancaster BF*XRF	Genalysis Perth BF*XRF	UltraTrace Perth BF*XRF	SGS Perth BF*XRF	ALSC Brisbane BF*XRF	ALSC Vancouver BF*XRF	ALSC Perth BF*XRF	Spect'Chem Lower Hutt BF*XRF	Amdel Newcastle BF*XRF	ITS Jakarta BF*XRF
1	17.30	17.54	17.80	17.50	17.60	16.76	17.70	17.50	17.70	17.51
2	17.36	17.50	17.80	17.50	17.65	16.75	17.75	17.51	17.70	17.50
3	17.47	17.50	17.80	17.50	17.60	16.72	17.75	17.54	17.80	17.62
4	17.49	17.42	17.80	17.40	17.65	16.69	17.75	17.53	17.80	17.58
5	17.46	17.46	17.80	17.40	17.65	16.81	17.70	17.50	17.80	17.70
Mean	17.42	17.48	17.80	17.46	17.63	**16.75**	17.73	17.52	17.76	17.58
Median	17.46	17.50	17.80	17.50	17.65	16.75	17.75	17.51	17.80	17.58
Std.Dev.	0.08	0.05	0.00	0.05	0.03	0.05	0.03	0.02	0.05	0.08
Rel.Std.Dev.	0.47%	0.26%	0.00%	0.31%	0.16%	0.27%	0.15%	0.10%	0.31%	0.47%
PDM[3]	-1.03%	-0.65%	1.15%	-0.78%	0.18%	-4.84%	0.75%	-0.46%	0.92%	-0.09%

Table A8. Results for MgO in WON14 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Actlabs Ancaster BF*XRF	Genalysis Perth BF*XRF	UltraTrace Perth BF*XRF	SGS Perth BF*XRF	ALSC Brisbane BF*XRF	ALSC Vancouver BF*XRF	ALSC Perth BF*XRF	Spect'Chem Lower Hutt BF*XRF	Amdel Newcastle BF*XRF	ITS Jakarta BF*XRF
1	0.680	0.710	0.670	0.650	0.670	0.740	0.650	0.680	0.630	0.690
2	0.700	0.720	0.680	0.660	0.670	0.730	0.650	0.700	0.630	0.690
3	0.690	0.720	0.680	0.650	0.670	0.730	0.660	0.650	0.630	0.700
4	0.690	0.710	0.670	0.660	0.670	0.730	0.640	0.640	0.630	0.690
5	0.700	0.720	0.670	0.640	0.680	0.740	0.640	0.670	0.640	0.710
Mean	0.692	0.716	0.674	0.652	0.672	0.734	0.648	0.668	0.632	0.696
Median	0.690	0.720	0.670	0.650	0.670	0.730	0.650	0.670	0.630	0.690
Std.Dev.	0.008	0.005	0.005	0.008	0.004	0.005	0.008	0.024	0.004	0.009
Rel.Std.Dev.	1.21%	0.76%	0.81%	1.28%	0.67%	0.75%	1.29%	3.57%	0.71%	1.29%
PDM[3]	2.00%	5.54%	-0.65%	-3.89%	-0.94%	8.20%	-4.48%	-1.53%	-6.84%	2.59%

Table A9. Results for MnO in WON14 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Actlabs Ancaster BF*XRF	Genalysis Perth BF*XRF	UltraTrace Perth BF*XRF	SGS Perth BF*XRF	ALSC Brisbane BF*XRF	ALSC Vancouver BF*XRF	ALSC Perth BF*XRF	Spect'Chem Lower Hutt BF*XRF	Amdel Newcastle BF*XRF	ITS Jakarta BF*XRF
1	0.049	0.045	0.050	0.040	0.049	0.040	0.022	0.050	0.040	0.060
2	0.053	0.040	0.050	0.050	0.049	0.040	0.020	0.050	0.050	0.060
3	0.052	0.040	0.050	0.040	0.049	0.040	0.023	0.050	0.050	0.060
4	0.051	0.040	0.040	0.040	0.049	0.040	0.017	0.050	0.040	0.060
5	0.055	0.040	0.050	0.040	0.049	0.040	0.018	0.050	0.040	0.060
Mean	0.052	0.041	0.048	0.042	0.049	0.040	**0.020**	0.050	0.044	0.060
Median	0.052	0.040	0.050	0.040	0.049	0.040	0.020	0.050	0.040	0.060
Std.Dev.	0.002	0.002	0.004	0.004	0.000	0.000	0.003	0.000	0.005	0.000
Rel.Std.Dev.	4.30%	5.45%	9.32%	10.65%	0.00%	0.00%	12.75%	0.00%	12.45%	0.00%
PDM[3]	9.87%	-13.37%	1.42%	-11.26%	3.45%	-15.5%	-57.74%	5.64%	-7.03%	26.77%

Table A10. Results for K_2O in WON14 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Actlabs Ancaster BF*XRF	Genalysis Perth BF*XRF	UltraTrace Perth BF*XRF	SGS Perth BF*XRF	ALSC Brisbane BF*XRF	ALSC Vancouver BF*XRF	ALSC Perth BF*XRF	Spect'Chem Lower Hutt BF*XRF	Amdel Newcastle BF*XRF	ITS Jakarta BF*XRF
1	0.590	0.630	0.600	0.600	0.600	0.580	0.601	0.610	0.590	0.600
2	0.600	0.620	0.600	0.600	0.600	0.580	0.600	0.600	0.580	0.600
3	0.600	0.620	0.600	0.600	0.600	0.580	0.600	0.610	0.590	0.600
4	0.600	0.620	0.600	0.600	0.600	0.580	0.601	0.610	0.580	0.600
5	0.600	0.620	0.600	0.600	0.600	0.580	0.604	0.630	0.600	0.600
Mean	0.598	0.622	0.600	0.600	0.600	0.580	0.601	0.612	0.588	0.600
Median	0.600	0.620	0.600	0.600	0.600	0.580	0.601	0.610	0.590	0.600
Std.Dev.	0.004	0.004	0.000	0.000	0.000	0.000	0.002	0.011	0.008	0.000
Rel.Std.Dev.	0.75%	0.72%	0.00%	0.00%	0.00%	0.00%	0.27%	1.79%	1.42%	0.00%
PDM[3]	-0.35%	3.65%	-0.02%	-0.02%	-0.02%	-3.35%	0.18%	1.98%	-2.02%	-0.02%

Table A11. Results for Na_2O in WON14 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Actlabs Ancaster BF*XRF	Genalysis Perth BF*XRF	UltraTrace Perth BF*XRF	SGS Perth BF*XRF	ALSC Brisbane BF*XRF	ALSC Vancouver BF*XRF	ALSC Perth BF*XRF	Spect'Chem Lower Hutt BF*XRF	Amdel Newcastle BF*XRF	ITS Jakarta BF*XRF
1	0.180	0.160	0.200	0.150	0.170	0.200	0.188	0.170	0.260	0.220
2	0.170	0.180	0.210	0.160	0.170	0.190	0.190	0.180	0.260	0.200
3	0.160	0.180	0.200	0.170	0.170	0.190	0.202	0.140	0.260	0.230
4	0.180	0.170	0.210	0.170	0.170	0.190	0.178	0.170	0.260	0.210
5	0.170	0.180	0.210	0.160	0.170	0.190	0.176	0.160	0.270	0.230
Mean	0.172	0.174	0.206	0.162	0.170	0.192	0.187	0.164	**0.262**	0.218
Median	0.170	0.180	0.210	0.160	0.170	0.190	0.188	0.170	0.260	0.220
Std.Dev.	0.008	0.009	0.005	0.008	0.000	0.004	0.010	0.015	0.004	0.013
Rel.Std.Dev.	4.86%	5.14%	2.66%	5.16%	0.00%	2.33%	5.59%	9.25%	1.71%	5.98%
PDM[3]	-5.89%	-4.79%	12.72%	-11.36%	-6.98%	5.06%	2.21%	-10.26%	43.36%	19.29%

Table A12. Results for LOI in WON14 (abbreviations as in Table A1; values in wt.%).

Replicate No.	Actlabs Ancaster BF*XRF	Genalysis Perth BF*XRF	UltraTrace Perth BF*XRF	SGS Perth BF*XRF	ALSC Brisbane BF*XRF	ALSC Vancouver BF*XRF	ALSC Perth BF*XRF	Spect'Chem Lower Hutt BF*XRF	Amdel Newcastle BF*XRF	ITS Jakarta BF*XRF
1	4.45	3.13	2.99	3.35	**2.90**	4.45	2.72	3.10	3.10	3.30
2	4.49	3.12	3.11	3.41	**2.86**	3.49	2.61	3.05	3.10	3.30
3	4.47	3.10	3.13	3.25	2.98	3.81	2.65	3.10	3.10	3.30
4	4.44	3.11	3.07	3.33	2.98	4.04	**2.94**	3.13	3.10	3.40
5	4.47	3.11	3.10	3.38	2.99	3.54	2.57	3.05	3.10	3.30
Mean	**4.46**	3.11	3.08	3.34	2.94	**3.87**	2.70	3.09	3.10	3.32
Median	4.47	3.11	3.10	3.35	2.98	3.81	2.65	3.10	3.10	3.30
Std.Dev.	0.02	0.01	0.05	0.06	0.06	0.39	0.15	0.04	0.00	0.04
Rel.Std.Dev.	0.44%	0.37%	1.78%	1.81%	1.99%	10.20%	5.42%	1.14%	0.00%	1.35%
PDM[3]	44.79%	1.00%	-0.10%	8.46%	-4.58%	25.39%	-12.49%	0.09%	0.55%	7.68%