



## AMIS0167

### *Certified Reference Material*

### Gold and Uranium Ore, Witwatersrand reference material Ore Grade

### *Certificate of Analysis*

### Recommended Concentrations and Limits<sup>1</sup> (at two Standard Deviations)

### *Certified Concentrations<sup>2</sup>*

Au Pb Collection	7.29	±	0.38	g/t
U M/ICP <sup>3</sup>	452	±	54	ppm
Specific Gravity	2.72	±	0.12	

1. Manufacturers recommended limits for use of the material as control samples, based on two standard deviations, calculated using "Between Laboratory" statistics for treatment of the data for trivial, non-trivial and technically invalid results. See sections 1, 9 and 12.
2. There is additional certified major element data presented on p2 and uncertified trace element data presented as an appendix.
3. Or, by applying a chemical conversion factor of  $U \times 1.1793 = U_3O_8$   
 $U_3O_8$  by M/ICP:  $533 \pm 64$  ppm)

**Major Element  
Recommended Concentrations and Limits  
(at two Standard Deviations)**

***Certified Concentrations***

Al <sub>2</sub> O <sub>3</sub>	2.42	±	0.08	%
CaO	0.130	±	0.014	%
Cr <sub>2</sub> O <sub>3</sub>	0.058	±	0.006	%
Fe <sub>2</sub> O <sub>3</sub>	3.45	±	0.06	%
K <sub>2</sub> O	0.50	±	0.02	%
MgO	0.24	±	0.02	%
P <sub>2</sub> O <sub>5</sub>	0.031	±	0.004	%
SiO <sub>2</sub>	91.45	±	0.50	%
TiO <sub>2</sub>	0.15	±	0.01	%

***Provisional Concentrations***

LOI 1.20 ± 0.14 %

***Informational Mean***

MnO 0.02 %  
Na<sub>2</sub>O 0.09 %

**1. Intended use:** Intended use: AMIS0167 is suitable for monitoring the accuracy of a single analysis of gold or uranium ores hosted by siliceous rocks. The material can be used for routine quality control by inserting within a batch of samples.

The recommended mean and "Between Lab" standard deviations for this standard reflect the average results from the laboratories that participated in the round robin. Slight variations in analytical procedures between laboratories will reflect as slight biases to the recommended concentrations and this is acceptable. Good laboratories however will report results within the two standard deviation levels with a failure of <10 %.

The additional geochemical data gathered however also enables its use as a uranium standard.

It can also be used by laboratories for method development and for the calibration of equipment.

The recommended mean and "Between Lab" standard deviations for this standard reflect the average results from the laboratories that participated in the round robin. Slight variations in analytical procedures between laboratories will reflect as slight biases to the recommended concentrations and this is acceptable. Good laboratories however will report results within the two standard deviation levels with a failure of <10 %.

**2. Origin of Material:** This standard is a blend of Ventersdorp Contact Reef, Carbon Leader Reef and Vaal Reef material provided by Anglo Gold Ashanti in South Africa. It was made from a mixture of pulp reject sample material, collected during routine underground sampling, sourced from mine assay laboratories and blended down to a required grade with silica.

**3. Mineral and chemical composition:** The major gangue mineral is quartz with minor pyrite, uraninite and thucolite. Gold occurs primarily as discrete grains.

The chemical composition of this material is set out in the appendix.

**4. Appearance:** The material is a fine Light Grey powder (Corstor 5Y 7/1).

**5. Handling instructions:** The material is packaged in Laboratory Packs and Explorer Packs that must be shaken or otherwise agitated before use. Normal safety precautions for handling fine particulate matter are suggested, such as the use of safety glasses, breathing protection, gloves and a laboratory coat.

**6. Radioactivity:** Shipments of this material do not require special marking, labeling or placarding. AMIS0167 does contain U (5.65 Bq/g) and Th (0.18 Bq/g) but due to low activity concentrations it is classified as EXEMPT MATERIAL in terms of "Safety Standards Series No. TS-R-1: Regulations for the Safe Transport of Radioactive Material, International Atomic Energy Agency, 2005, para 403, Table 1".

**7. Method of preparation:** The material was crushed, dry-milled and air-classified to 100% <54um. Wet sieve particle size analysis of random samples confirmed the material was 100% <54um. It was then blended in a bi-conical mixer, systematically divided and then sealed into 1kg Laboratory Packs. Samples were randomly selected for homogeneity testing and third party analysis. Statistical analysis for the consensus test results were carried out by an independent statistician. Explorer Packs are subdivided from the Laboratory packs as required.

**8. Methods of analysis requested:**

1. Au Pb collection ICP-OES or ICP-MS.
2. Multi-acid digest U ICP-OES or ICP-MS.
3. U XRF.
4. Majors ( Al<sub>2</sub>O<sub>3</sub>, CaO, Cr<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>O, MgO, MnO, Na<sub>2</sub>O, SiO<sub>2</sub>, TiO<sub>2</sub>. LOI. ) XRF fusion.
5. SG ( gas pycnometer )

**9. Information requested:**

1. State aliquots used for all determinations.
2. Report all results for gold and uranium in ppm.
3. All results for major elements to be reported as oxides in percentages.
4. All results for multi-element scans to be reported in ppm.
5. Report all QC data, to include replicates, blanks and certified reference materials used.
6. State and provide brief description of analytical techniques used.

**10. Method of Certification:** Twenty six laboratories were each given eight randomly selected packages of sample. Twenty one of the laboratories submitted results.

Final limits were calculated after first determining if all data was compatible within a spread normally expected for similar analytical methods done by reputable laboratories. Data from any one laboratory was then removed from further calculations when the mean of all analyses from that laboratory failed a "t test" of the global means of the other laboratories. The means and standard deviations were then re-calculated using all remaining data. Any analysis that fell outside of the new two standard deviations was removed from the ensuing data base. The mean and standard deviations were again calculated using the remaining data.

The “between-laboratory” standard deviation is used in the calculation to eliminate technically and statistically invalid data. Upper and lower limits are based on the standard deviation of the remaining data, which reflect individual analyses and can be used to monitor accuracy in routine laboratory quality control. This is different to limits based on standard deviations derived from grouped set of analyses (see 12), which provide important measures for precision and trueness, but which are less useful for routine QC.

Standards with an RSD of near or less than 5 % are termed “Certified”, RSD’s of between near 5 % and 15 % are termed “Provisional”, and RSD’s over 15 % are termed “Informational”.

**Assay data**

Lab Code	Au g/t	U ppm	Al2O3 %	CaO %	Cr2O3 %	Fe2O3 %	K2O %	MgO %	MnO %	Na2O %	P2O5 %	SiO2 %	TiO2 %	LOI %	SG
A	7.15	423.00	2.39	0.13	0.06	3.45	0.50	0.25	0.03	0.12		91.20	0.15	1.18	
A	7.38	424.00	2.39	0.13	0.06	3.42	0.51	0.24	0.03	0.12		91.30	0.15	1.17	
A	7.40	421.00	2.40	0.13	0.06	3.44	0.51	0.24	0.03	0.12		91.30	0.15	1.17	
A	7.15	414.00	2.39	0.13	0.06	3.45	0.50	0.24	0.03	0.13		91.30	0.16	1.18	
A	7.07	427.00	2.40	0.13	0.06	3.41	0.50	0.24	0.03	0.11		91.30	0.15	1.19	
A	7.45	421.00	2.38	0.13	0.06	3.47	0.51	0.25	0.03	0.12		91.20	0.15	1.17	
A	7.30	426.00	2.40	0.13	0.06	3.43	0.50	0.25	0.03	0.11		91.30	0.15	1.18	
A	7.42	429.00	2.39	0.13	0.06	3.45	0.50	0.25	0.03	0.11		91.40	0.15	1.18	
B	7.01		2.44	0.13	0.06	3.41	0.51	0.26	0.03	0.08	0.03	91.80	0.15	1.36	
B	6.75		2.44	0.13	0.06	3.44	0.51	0.27	0.02	0.08	0.03	91.40	0.15	1.26	
B	7.24		2.42	0.13	0.06	3.48	0.51	0.26	0.02	0.07	0.03	91.80	0.15	1.41	
B	7.34		2.45	0.13	0.06	3.45	0.51	0.26	0.02	0.08	0.04	91.50	0.15	1.31	
B	7.34		2.45	0.14	0.06	3.46	0.51	0.26	0.02	0.08	0.03	91.70	0.15	1.14	
B	7.28		2.44	0.13	0.06	3.46	0.51	0.27	0.02	0.07	0.03	91.40	0.14	1.53	
B	7.32		2.47	0.14	0.06	3.45	0.51	0.27	0.03	0.08	0.04	91.60	0.15	1.38	
B	7.36		2.62	0.14	0.06	3.47	0.51	0.26	0.02	0.07	0.03	91.40	0.14	1.52	
C	7.30	430.80													2.60
C	7.25	424.70													2.62
C	7.45	422.20													2.58
C	7.35	431.80													2.57
C	7.20	425.80													2.60
C	7.45	421.60													2.61
C	7.45	431.50													2.64
C	7.45	437.90													2.66
E	7.00														
E	7.18														
E	7.44														
E	7.50														
E	7.44														
E	7.28														
E	7.16														
E	7.11														
F	7.41														
F	7.34														
F	7.06														
F	7.31														
F	7.39														
F	7.42														
F	7.29														
F	7.37														
G	5.73	436.80	2.37	0.14	0.06	3.48	0.49	0.23	0.02		0.03	91.40	0.14	1.24	
G	7.20	441.10	2.36	0.14	0.06	3.47	0.50	0.23	0.02		0.03	90.90	0.16	1.20	
G	6.02	412.20	2.51	0.14	0.07	3.49	0.49	0.23	0.02		0.03	91.80	0.15	1.19	
G	7.42	441.90	2.34	0.13	0.06	3.54	0.49	0.23	0.02		0.03	92.20	0.15	1.21	
G	7.30	424.30	2.38	0.14	0.06	3.49	0.48	0.22	0.02		0.03	92.00	0.15	1.28	
G	5.90	440.70	2.52	0.12	0.07	3.49	0.49	0.23	0.02		0.03	91.20	0.15	1.16	
G	5.92	438.00	2.28	0.13	0.07	3.55	0.49	0.23	0.02		0.03	91.80	0.15	1.07	
G	5.90	431.30	2.30	0.15	0.07	3.57	0.50	0.23	0.02		0.03	92.50	0.17	1.13	
H	6.97														
H	6.98														
H	6.95														
H	5.78														
H	6.87														
H	7.01														
H	7.03														
H	7.01														
K	7.29														
K	7.22														
K	6.79														
K	6.28														
K	6.23														
K	6.59														
K	5.16														
K	6.47														
L	7.42	441.00													2.80
L	7.52	434.00													2.84
L	7.39	409.00													2.76
L	7.65	419.00													2.82
L	7.60	401.00													2.80
L	7.62	411.00													2.82
L	7.47	418.00													2.82
L	7.54	372.00													2.80

Assay data (cont)

Lab Code	Au g/t	U ppm	Al2O3 %	CaO %	Cr2O3 %	Fe2O3 %	K2O %	MgO %	MnO %	Na2O %	P2O5 %	SiO2 %	TiO2 %	LOI %	SG
M	7.28														
M	7.29														
M	7.09														
M	7.23														
M	7.16														
M	7.25														
M	6.93														
M	6.90														
N	7.45	492.00	2.43	0.13	0.06	3.43	0.50	0.24	0.03	0.09		91.55	0.15	1.12	2.70
N	7.21	497.00	2.42	0.13	0.06	3.44	0.50	0.24	0.03	0.08		91.46	0.15	1.13	2.69
N	7.05	492.00	2.42	0.13	0.06	3.42	0.50	0.24	0.03	0.08		91.45	0.15	1.17	2.68
N	7.23	491.00	2.43	0.13	0.06	3.46	0.51	0.23	0.03	0.08		91.56	0.15	1.16	2.67
N	7.19	485.00	2.43	0.13	0.06	3.43	0.50	0.24	0.03	0.09		91.51	0.15	1.12	2.67
N	7.08	483.00	2.44	0.13	0.06	3.44	0.50	0.24	0.03	0.09		91.48	0.15	1.14	2.69
N	7.30	482.00	2.43	0.13	0.06	3.44	0.50	0.24	0.03	0.08		91.51	0.15	1.13	2.69
N	7.31	494.00	2.42	0.13	0.06	3.43	0.50	0.24	0.03	0.08		91.47	0.15	1.14	2.69
O	6.77														
O	6.70														
O	6.98														
O	6.76														
O	7.01														
O	6.90														
O	6.89														
O	7.10														
Q	6.40	436.00	2.46	0.12	0.05	3.25	0.49	0.23	0.02	0.03		88.90	0.14	1.21	
Q	6.32	446.00	2.44	0.12	0.06	3.26	0.49	0.23	0.02	0.03		88.90	0.15	1.20	
Q	6.62	437.00	2.44	0.12	0.05	3.24	0.49	0.24	0.02	0.03		88.90	0.15	1.24	
Q	7.12	460.00	2.46	0.13	0.05	3.27	0.49	0.24	0.02	0.04		88.90	0.16	1.13	
Q	7.14	446.00	2.43	0.13	0.05	3.33	0.49	0.25	0.03	0.04		88.70	0.16	1.18	
Q	6.60	447.00	2.44	0.13	0.06	3.33	0.49	0.24	0.03	0.05		88.70	0.16	1.14	
Q	6.50	446.00	2.46	0.13	0.05	3.30	0.49	0.25	0.03	0.05		88.70	0.16	1.20	
Q	6.61	460.00	2.44	0.13	0.06	3.32	0.49	0.25	0.03	0.05		88.70	0.16	1.18	
R	7.31	447.00													2.70
R	7.21	440.00													2.73
R	7.22	437.00													2.70
R	6.96	449.00													2.73
R	7.11	450.00													2.73
R	6.77	449.00													2.72
R	6.65	437.00													2.71
R	7.05	449.00													2.72
T	7.15	485.00	2.45	0.12		3.42	0.48	0.19	0.02	0.10	0.03	90.26	0.14	1.35	
T	7.55	490.00	2.68	0.13		3.57	0.52	0.23	0.02	0.10	0.04	93.68	0.14	1.36	
T	7.40	490.00	2.42	0.12		3.47	0.49	0.18	0.02	0.10	0.03	91.41	0.14	1.26	
T	7.55	490.00	2.43	0.12		3.47	0.49	0.20	0.02	0.10	0.03	91.64	0.14	1.25	
T	7.20	500.00	2.41	0.12		3.48	0.50	0.19	0.02	0.10	0.03	91.45	0.14	1.23	
T	7.55	500.00	2.42	0.12		3.48	0.49	0.19	0.02	0.10	0.03	91.74	0.14	1.26	
T	7.50	480.00	2.44	0.12		3.50	0.50	0.19	0.02	0.11	0.03	91.42	0.14	1.37	
T	7.25	475.00	2.40	0.12		3.48	0.49	0.19	0.02	0.10	0.03	91.31	0.14	1.33	
U	7.43	443.38	2.40	0.13	0.06	3.47	0.50	0.23	0.02	0.08	0.03	91.60	0.14	1.16	2.86
U	7.51	449.30	2.37	0.13	0.06	3.46	0.50	0.23	0.03	0.09	0.03	91.33	0.15	1.16	2.77
U	7.57	445.21	2.39	0.13	0.06	3.48	0.51	0.23	0.03	0.09	0.03	91.84	0.15	1.17	2.82
U	7.49	444.95	2.38	0.13	0.06	3.46	0.51	0.23	0.02	0.08	0.03	91.52	0.15	1.16	2.77
U	7.36	448.90	2.37	0.13	0.06	3.48	0.51	0.24	0.03	0.11	0.03	91.59	0.15	1.14	2.79
U	7.61	444.99	2.38	0.13	0.06	3.46	0.50	0.23	0.02	0.08	0.03	91.29	0.14	1.18	2.78
U	7.57	457.23	2.37	0.13	0.06	3.47	0.50	0.23	0.03	0.08	0.03	91.44	0.15	1.16	2.68
U	7.49	449.18	2.41	0.13	0.06	3.46	0.50	0.23	0.02	0.08	0.03	91.40	0.15	1.16	2.76
V	7.53														2.70
V	7.50														2.71
V	7.49														2.72
V	7.44														2.74
V	7.40														2.72
V	7.33														2.74
V	7.55														2.68
V	7.57														2.74
W	7.28	457.00													
W	7.38	446.00													
W	7.38	449.00													
W	7.28	452.00													
W	7.46	450.00													
W	7.59	447.00													
W	7.28	451.00													
W	7.46	450.00													
X	7.28														
X	7.41														
X	7.34														
X	6.63														
X	7.16														
X	7.33														
X	7.20														
X	7.25														
Z	7.38	488.00	2.90	0.16	0.05	3.32	0.49	0.10	0.01	0.10	0.03	91.30	0.09	1.40	2.70
Z	7.33	500.00	2.80	0.12	0.05	3.41	0.51	0.10	0.02	0.10	0.03	91.40	0.09	1.34	2.71
Z	7.31	488.00	2.80	0.15	0.05	3.44	0.51	0.20	0.02	0.10	0.03	91.30	0.10	1.32	2.71
Z	7.31	493.00	2.80	0.14	0.05	3.37	0.50	0.10	0.01	0.10	0.03	91.20	0.09	1.64	2.70
Z	7.35	498.00	2.70	0.20	0.06	3.45	0.50	0.10	0.02	0.10	0.03	90.80	0.09	1.91	2.72
Z	7.38	492.00	2.80	0.14	0.07	3.35	0.50	0.10	0.01	0.10	0.03	91.40	0.09	1.35	2.71
Z	7.40	500.00	2.80	0.12	0.06	3.41	0.51	0.20	0.02	0.10	0.03	91.20	0.10	1.49	2.70
Z	7.36	488.00	2.80	0.11	0.05	3.45	0.51	0.10	0.02	0.10	0.04	91.20	0.10	1.47	2.70
ZA	7.48														
ZA	7.22														
ZA	7.32														
ZA	7.16														
ZA	7.29														
ZA	7.51														
ZA	7.25														
ZA	7.44														

The mean and standard deviation for all data was calculated. Outliers were defined as samples beyond the mean  $\pm 2$  Standard Deviations from all data. These outliers were removed from the data and a new mean and standard deviation was determined. Total results from some laboratories that reported significant failures were also removed. This method is different from that used to calculate the Confidence Interval shown on many Government-produced standards in that the actual “between-laboratory” standard deviation is used in the calculations. This produces upper and lower limits that reflect actual individual analyses rather than a grouped set of analyses. The limits can therefore be used to monitor accuracy from individual analyses, unlike the Certified Limits published on other standards which quote a Confidence Interval.

#### **11. Participating laboratories:** (Not in same order as in the table of assays)

1. ALS Chemex Laboratory Group (Brisbane Australia).
2. ALS Chemex Laboratory Group (Johannesburg, South Africa).
3. Amdel Limited Adelaide (South Australia)
4. Anglo Gold Ashanti - Navachab Gold Mine Laboratory, (Namibia).
5. Chromatech Services
6. Genalysis Laboratory Services (South Africa) Pty
7. Genalysis Laboratory Services (Western Australia).
8. Performance Laboratories ( Alanridge, South Africa )
9. Ready Lead Assay Laboratory
10. Set Point Laboratories (Isando) SA
11. SGS Australia Pty Ltd (Newburn, Western Australia)
12. SGS Geosol Laboratories Ltda (Brazil)
13. SGS Mineral Services Lakefield (Canada)
14. SGS Chelopech (Bulgaria)
15. SGS Mwanza (Tanzania)
16. SGS Mineral Services Callao (Peru)
17. SGS Mineral Services (Barberton, South Africa).
18. SGS Toronto (Canada)
19. SGS Townsville (Australia)
20. SGS Waihi (New Zealand)
21. Ultra Trace (Pty) Ltd (Western Australia)

#### **13. Measurement of Uncertainty:**

The samples used in this certification process have been selected in such a way as to represent the entire batch of material and were taken from the final packaged units; therefore all possible sources of uncertainty (sample uncertainty and measurement uncertainty) are included in the final combined standard uncertainty determination.

The uncertainty measurement takes into consideration the between lab and the within lab variances and is calculated from the square roots of the variances of these components using the formula:

*Combined standard uncertainty* =  $\sqrt{(\text{between lab.var/no of labs}) + (\text{mean square within lab.var /no of assays})}$

These uncertainty measurements may be used, by laboratories, as a component for calculating the total uncertainty for method validation according to the relevant ISO guidelines.

Analyte	Method	Unit	S <sup>1</sup>	$\sigma_L$ <sup>2</sup>	Sw <sup>3</sup>	CSU <sup>4</sup>
Au	Pb Coll	ppm	0.193	0.105	0.123	0.028
U	M/ICP	ppm	26.931	22.870	7.502	6.942
Al <sub>2</sub> O <sub>3</sub>	XRF	%	0.039	0.024	0.033	0.010
CaO	XRF	%	0.007	0.004	0.006	0.002
Cr <sub>2</sub> O <sub>3</sub>	XRF	%	0.003	0.003	0.002	0.001
Fe <sub>2</sub> O <sub>3</sub>	XRF	%	0.029	0.022	0.021	0.009
K <sub>2</sub> O	XRF	%	0.008	0.007	0.004	0.002
LOI	XRF	%	0.073	0.062	0.047	0.024
MgO	XRF	%	0.013	0.014	0.005	0.006
MnO	XRF	%	0.005	0.004	0.003	0.001
Na <sub>2</sub> O	XRF	%	0.019	0.020	0.006	0.008
P <sub>2</sub> O <sub>5</sub>	XRF	%	0.002	0.002	0.001	0.001
SiO <sub>2</sub>	XRF	%	0.323	0.153	0.294	0.070
TiO <sub>2</sub>	XRF	%	0.007	0.005	0.005	0.002
SG	pycnometer		0.057	0.058	0.023	0.022

1. S - Std Dev for use on control charts.
2.  $\sigma_L$  - Betw Lab Std Dev, for use to calculate a measure of accuracy.
3. Sw - Within Lab Stc Dev, for use to calculate a measure of precision.
4. CSU - Combined Standard Uncertainty, a component for use to calculate the total uncertainty in method validation.

**14. Certified values:** The Certified, Provisional and Indicated values listed on p1 and p2 of this certificate fulfill the AMIS statistical criteria regarding agreement for certification and have been independently validated by Dr Barry Smee.

**15. Metrological Traceability:** The values quoted herein are based on the consensus values derived from statistical analysis of the data from an inter laboratory measurement program. Traceability to SI units is via the standards used by the individual laboratories the majority of which are accredited and who have maintained measurement traceability during the analytical process.

**16. Certification:** AMIS0167 is a new material.

**17. Period of validity:** The certified values are valid for this product, while still sealed in its original packaging, until notification to the contrary. The stability of the material will be subject to continuous testing for the duration of the inventory. Should product stability become an issue, all customers will be notified and notification to that effect will be placed on the [www.amis.co.za](http://www.amis.co.za) website.

**18. Minimum sample size:** The majority of laboratories reporting used a 0.5g sample size for the ICP and a 30g sample size for the fire assay. These are the recommended minimum sample sizes for the use of this material.

**19. Availability:** This product is available in Laboratory Packs containing 1kg of material or in Explorer Packs containing client specified weights of material from 50g up to 250g. Laboratory Packs are sealed bottles delivered in sealed foil pouches. Explorer Packs contain material in standard geochem envelopes placed into foil pouches that are nitrogen flushed and vacuum sealed.

**20. Recommended use:** The data used to characterize this CRM has been scrutinized using outlier treatment techniques. This, together with the number of participating laboratories, should overcome any "inter-laboratory issues" and should lead to a very accurate measure for the given methods, notwithstanding the underlying assumption that what the good inter-laboratory labs reported was accurate. However an amount of bad data might have had an effect, resulting in limits which in some situations might be too broad for the effective monitoring of a single analytical method, laboratory or production process. Users should set their own limits based on their own data quality objectives and

control measurements, after determining the performance characteristics of their own particular method, using a minimum of 20 analyses using this CRM. User set limits should normally be within the limits recommended on p1 and 2 of this certificate.

**21. Legal notice:** This certificate and the reference material described in it have been prepared with due care and attention. However AMIS, Set Point Technology (Pty) Ltd, Mike McWha, Dr Barry Smee and Smee and Associates Ltd; accept no liability for any decisions or actions taken following the use of the reference material.

**24 December 2010**

**Certifying Officers:**



**African Mineral Standards:** \_\_\_\_\_

**Mike McWha**  
**BSc (Hons), FGSSA, MAusIMM, Pr.Sci.Nat**



**Geochemist:** \_\_\_\_\_

**Barry W. Smee**  
**BSc, PhD, P.Geo, (B.C.)**  
**APPENDIX**

### Appendix – uncertified trace element statistics

Analyte	Method	Unit	Mean	2SD	RSD%	n
Ag	M/ICP	ppm	0.89	0.18	10.11	62
Al	M/ICP	%	1.24	0.10	4.18	70
As	M/ICP	ppm	156	18.12	5.81	79
Ba	M/ICP	ppm	86.19	15.83	9.18	71
Be	M/ICP	ppm	0.43	0.09	10.11	30
Bi	M/ICP	ppm	1.00	0.19	9.72	62
Ca	M/ICP	%	0.09	0.00	2.71	51
Cd	M/ICP	ppm	0.42	0.04	4.70	39
Ce	M/ICP	ppm	44.77	3.35	3.74	56
Co	M/ICP	ppm	39.80	5.22	6.56	78
Cr	M/ICP	ppm	352	88.58	12.57	61
Cs	M/ICP	ppm	1.07	0.11	5.10	39
Cu	M/ICP	ppm	60.07	4.62	3.84	63
Dy	M/ICP	ppm	5.60	0.35	3.15	15
Er	M/ICP	ppm	2.84	0.18	3.09	15
Eu	M/ICP	ppm	0.78	0.04	2.56	15
Fe	M/ICP	%	2.44	0.16	3.36	69
Ga	M/ICP	ppm	3.22	0.36	5.58	55
Gd	M/ICP	ppm	4.93	0.16	1.62	15
Ge	M/ICP	ppm	0.10	0.06	28.37	24
Hf	M/ICP	ppm	1.80	0.20	5.55	54
Ho	M/ICP	ppm	1.01	0.05	2.57	15
In	M/ICP	ppm	0.01	0.01	27.57	16
K	M/ICP	%	0.42	0.03	3.36	64
La	M/ICP	ppm	23.45	2.56	5.45	48
Li	M/ICP	ppm	4.37	1.05	12.03	55
Lu	M/ICP	ppm	0.27	0.05	8.57	31
Mg	M/ICP	%	0.14	0.02	7.12	71
Mn	M/ICP	ppm	184	19.85	5.40	64
Mo	M/ICP	ppm	3.49	0.49	7.07	61
Na	M/ICP	%	0.06	0.02	13.23	71
Nb	M/ICP	ppm	3.30	0.54	8.10	56
Nd	M/ICP	ppm	20.16	0.73	1.81	15
Ni	M/ICP	ppm	92.61	8.65	4.67	71
P	M/ICP	ppm	138	21.73	7.86	55
Pb	M/ICP	ppm	227	23.18	5.11	55
Pd	M/ICP	ppm	0.06	0.01	7.41	8
Pr	M/ICP	ppm	5.25	0.22	2.10	15
Pt	M/ICP	ppm	0.09	0.000	0.000	7
Rb	M/ICP	ppm	16.09	3.16	9.81	56
Re	M/ICP	ppm	0.002	0.000	0.000	13
S	M/ICP	%	0.74	0.04	2.70	74
Sb	M/ICP	ppm	6.49	0.60	4.64	63
Sc	M/ICP	ppm	2.83	0.54	9.49	39
Se	M/ICP	ppm	2.00	0.000	0.000	15
Si	M/ICP	%	42.56	0.45	0.53	8
Sm	M/ICP	ppm	4.79	0.18	1.86	15
Sn	M/ICP	ppm	1.32	0.34	12.87	48
Sr	M/ICP	ppm	18.66	1.73	4.63	54
Ta	M/ICP	ppm	1.34	0.21	7.91	45
Tb	M/ICP	ppm	0.87	0.13	7.31	31
Te	M/ICP	ppm	0.15	0.08	25.35	40
Th	M/ICP	ppm	44.83	9.27	10.34	62
Ti	M/ICP	%	0.07	0.013	9.26	64
Tl	M/ICP	ppm	0.16	0.04	13.84	47
Tm	M/ICP	ppm	0.38	0.03	3.86	15
V	M/ICP	ppm	56.71	11.18	9.86	64
W	M/ICP	ppm	0.92	0.24	13.17	55
Y	M/ICP	ppm	20.46	3.34	8.16	79
Yb	M/ICP	ppm	2.33	0.18	3.76	23
Zn	M/ICP	ppm	155	11.00	3.54	62
Zr	M/ICP	ppm	60.16	8.49	7.05	62