



African Mineral Standards

MATRIX REFERENCE MATERIALS

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AMIS0311

Certified Reference Material

**Gold and Copper final concentrate,
greenstone ore,
Buzwagi Mine, Tanzania**

Certificate of Analysis

**Recommended Concentrations and Limits^{1, 2}
(at two Standard Deviations)**

Certified Concentrations

Cu F	22.94	±	0.89	%
Cu M/ICP	23.25	±	0.57	%
Au Pb Collection	102	±	5.0	g/t
Ag M/ICP	129	±	5.7	g/t
Specific Gravity	3.79	±	0.10	

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, 10 and 13.
2. There is additional certified major element data presented on p2 and uncertified trace element data presented as an appendix.



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

Certified Concentrations

Al ₂ O ₃	2.18	±	0.20	%
CaO	1.62	±	0.10	%
Fe ₂ O ₃	35.02	±	1.76	%
K ₂ O	0.62	±	0.06	%
MgO	1.36	±	0.12	%
SiO ₂	15.21	±	0.74	%
S Comb / LECO	24.20	±	1.14	%

Provisional Concentrations

Cr ₂ O ₃	0.04	±	0.01	%
MnO	0.075	±	0.010	%
Na ₂ O	0.34	±	0.05	%
TiO ₂	0.11	±	0.03	%

1. Intended Use: AMIS0311 can be used to check the analysis of gold and copper concentrates, with a similar grade and matrix.

It is a matrix matched Certified Reference Material, fit for use as control samples in routine assay laboratory quality control when inserted within runs of samples and measured in parallel to the unknown. Its purpose is to monitor inter-laboratory or instrument bias and within lab precision. It can be used, indirectly, to establish the traceability of results to an SI system of units.

The recommended concentrations and limits for this material are property values based on a measurement campaign (round robin) and reflect consensus 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 (see 19). Good laboratories will report results within the two standard deviation levels with a failure rate of <10 %.

The material can also be used for method development and for the calibration of equipment.

2. Origin of Material: This material was supplied by the open pit Buzwagi Gold and Copper Mine which hosted in the Nzega Greenstone Belt in the Shinyanga Region of Tanzania, six kilometres southeast from the town of Kahama. The mine is operated by African Barrick Gold. The material supplied was described as “final concentrate”.

3. Approximate Mineral and Chemical Composition: The Nzega Belt is comprised of basalts and intermediate volcanics intruded by granitoid masses. Buzwagi is a shear hosted quartz-veined deposit, hosted in porphyritic granite. Gold mineralisation occurs in association with sulphides (pyrite) and quartz and as free grains, while copper mineralisation occurs as primary sulphides (chalcopyrite).

4. Appearance: The material is a very fine powder. It is colored a Grayish Brown (Corstor 5YR3/2).

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. Method of Preparation: The material was crushed, dry-milled and air-classified to <54um. Wet sieve particle size analysis of random samples confirmed the material was 98.5% <54um. It was then blended in a bi-conical mixer, systematically divided and then sealed into 1kg Laboratory Packs. Explorer Packs are subdivided from the Laboratory packs as required. Samples were randomly selected for homogeneity testing and third party analysis. Statistical analysis of both homogeneity and the consensus test results were carried out by independent statisticians.

7. Methods of Analysis requested:

1. Multi-acid digest multi-element scan - (to include Cu & Ag). ICP-OES or ICP-MS.
2. Pressed pellet multi-element scan - (to include Cu). XRF.
3. Au – Pb collection ICP-OES or ICP-MS
4. Majors (Al₂O₃, CaO, Cr₂O₃, Fe₂O₃, K₂O, MgO, MnO, Na₂O, SiO₂, TiO₂. LOI.) XRF fusion.
5. SG. Gas pycnometer

8. Information requested:

1. State aliquots used for all determinations.
2. Report all results for gold 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.

9. Method of Certification: Twenty two laboratories were each given eight randomly selected packages of sample. Sixteen of the laboratories submitted results in time for certification.

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”.

10. Participating Laboratories: The 16 out of 22 laboratories that provided results timeously were (not in same order as in the table of assays):

1. Activation Laboratories Pty Ltd (ActLabs) CA
2. ALS Chemex Laboratory Group Brisbane Australia
3. ALS Chemex Laboratory Group Johannesburg SA
4. ALS Chemex Laboratory Group Perth WA
5. ALS Chemex Laboratory Group Vancouver CA
6. Bureau Veritas (Namibia)
7. Genalysis Laboratory Services (W Australia P)
8. Intertek Utama Services (Indonesia)
9. 9..Set Point Laboratories (Isando) SA
10. SGS Australia Pty Ltd (Newburn) WA
11. SGS Geosol Laboratories Ltda (Brazil)
12. SGS Mineral Services Callao (Peru)
13. SGS Mineral Services Lakefield (Canada)
14. SGS Toronto (Canada)
15. SGS Townsville (Australia)
16. Ultra Trace (Pty) Ltd WA

11. Assay Data: Data as received from the laboratories for the important certified elements listed on p1 are set out below.

Lab Code	Cu F ppm	Cu M/ICP ppm	Cu XRF ppm	Au PbColl g/t	Ag M/ICP ppm	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %	LOI %	S Comb LECO %	SG pyc
A	224000				142												26.10	
A	219000				146												25.90	
A	224000				141												26.20	
A	223000				146												25.70	
A	226000				140												26.40	
A	220000				145												25.40	
A	225000				143												25.70	
A	223000				143												25.60	
B					122	2.23	1.60	0.04		0.64	1.38	0.08			0.13		24.10	3.82
B					121	2.27	1.54	0.04		0.63	1.35	0.08			0.12		24.00	3.80
B					120	2.21	1.57	0.04		0.63	1.35	0.08			0.13		24.10	3.84
B					123	2.29	1.53	0.04		0.61	1.32	0.08			0.12		23.90	3.84
B					115	2.23	1.53	0.04		0.61	1.32	0.08			0.12		24.10	3.74
B					124	2.40	1.69	0.04		0.67	1.47	0.08			0.13		24.10	3.81
B					111	2.29	1.62	0.04		0.65	1.40	0.08			0.13		24.00	3.80
B					116	2.34	1.61	0.04		0.64	1.39	0.08			0.13		24.10	3.81
C	229000	226000		107	125	2.16	1.68	0.04	35.27	0.63	1.38	0.07		15.32	0.13	12.45	25.00	3.80
C	234000	220000		104	121	2.18	1.67	0.04	35.29	0.63	1.37	0.07		15.27	0.12	12.52	24.70	3.81
C	231000	224000		102	122	2.17	1.68	0.05	35.24	0.63	1.38	0.08		15.26	0.12	12.55	24.70	3.82
C	223000	231000		101	123	2.16	1.68	0.04	35.32	0.63	1.37	0.08		15.34	0.12	12.58	24.60	3.79
C	232000	230000		102	123	2.19	1.68	0.05	35.35	0.63	1.37	0.07		15.32	0.12	12.49	24.70	3.78
C	230000	227000		101	126	2.17	1.68	0.04	35.29	0.63	1.37	0.08		15.28	0.12	12.47	24.60	3.82
C	228000	227000		105	127	2.17	1.68	0.05	35.31	0.63	1.38	0.08		15.36	0.12	12.50	24.60	3.80
C	230000	234000		102	121	2.19	1.68	0.05	35.24	0.63	1.38	0.07		15.31	0.12	12.52	24.70	3.79
D	235000	234000	229000		132	2.12	1.61	0.04	34.50	0.62	1.42	0.08	0.33	14.80	0.11	10.42		
D	233000	244000	232000		131	2.14	1.66	0.05	34.50	0.63	1.48	0.08	0.34	15.05	0.13	11.55		
D	245000	233000	232000		127	2.14	1.66	0.04	34.60	0.64	1.48	0.08	0.33	15.10	0.13	11.75		
D	245000	234000	232000		131	2.16	1.66	0.04	34.60	0.64	1.47	0.08	0.33	15.05	0.12	11.76		
D	249000	236000	232000		132	2.19	1.62	0.05	35.00	0.63	1.50	0.08	0.34	15.05	0.11	11.61		
D	240000	235000	229000		133	2.12	1.62	0.04	34.90	0.62	1.50	0.08	0.34	14.85	0.10	10.51		
D	241000	238000	229000		131	2.14	1.62	0.04	34.80	0.62	1.44	0.08	0.33	14.95	0.12	10.84		
D	245000	240000	229000		126	2.14	1.66	0.05	34.50	0.63	1.44	0.08	0.34	14.95	0.13	12.00		
E	225000	235000			127	2.30		0.04	35.80		1.37	0.08	0.32	15.90	0.11			
E	210000	235000			127	2.31		0.04	35.70		1.48	0.09	0.32	15.70	0.11			
E	202000	234000			123	2.13		0.04	34.30		1.37	0.09	0.31	15.00	0.10			
E	187500	231000			130	1.89		0.04	31.20		1.21	0.08	0.34	13.60	0.09			
E	210000	233000			130	2.26		0.04	34.40		1.47	0.08	0.34	15.70	0.10			
E	222000	238000			127	2.26		0.04	34.80		1.27	0.07	0.34	15.40	0.10			
E	201000	230000			126	2.04		0.04	32.70		1.33	0.08	0.32	14.50	0.10			
E	189000	234000			128	1.94		0.04	32.30		1.36	0.08	0.34	13.70	0.09			
F	229731	235872		99.61	123		1.56			0.65	1.25		0.34		0.09		23.99	3.74
F	230995	233881		98.84	128		1.57			0.65	1.25		0.34		0.09		24.23	3.68
F	230185	231626		100.00	127		1.56			0.65	1.26		0.34		0.09		24.25	3.73
F	228933	234756		99.80	128		1.58			0.65	1.28		0.34		0.09		24.11	3.64
F	235577	234413		99.90	126		1.59			0.65	1.25		0.34		0.09		24.16	3.76
F	234654	232110		100.10	127		1.56			0.66	1.26		0.34		0.09		24.19	3.68
F	233538	229646		98.83	126		1.58			0.65	1.23		0.34		0.09		24.00	3.77
F	230873	231436		98.91	127		1.58			0.66	1.26		0.34		0.09		23.98	3.76
H	233000			86.00	131	2.29	1.61	0.05	34.88	0.60	1.43	0.07	0.38		0.10		24.90	
H	233000			93.00	129	2.27	1.65	0.05	34.60	0.61	1.44	0.07	0.38		0.10		24.70	
H	233000			91.00	132	2.51	1.62	0.05	34.46	0.61	1.43	0.07	0.39		0.10		24.80	
H	232000			100.00	129	2.25	1.62	0.05	35.17	0.63	1.41	0.07	0.39		0.10		24.70	
H	232000			96.00	130	2.34	1.65	0.05	35.60	0.63	1.43	0.08	0.38		0.10		24.80	
H	228000			97.00	129	2.31	1.61	0.05	35.60	0.63	1.41	0.07	0.38		0.10		24.60	
H	232000			93.00	131	2.34	1.64	0.05	34.88	0.63	1.41	0.07	0.38		0.10		24.80	
H	225000			98.00	130	2.36	1.61	0.05	34.88	0.61	1.41	0.07	0.36		0.10		24.60	
N						2.15	1.64		35.30	0.62	1.33	0.08	0.29	15.20	0.12	11.30	24.60	
N						2.16	1.63		35.30	0.62	1.35	0.07	0.28	15.20	0.13	10.30	24.00	
N						2.16	1.63		35.20	0.62	1.33	0.08	0.28	15.20	0.12	10.20	24.20	
N						2.16	1.63		35.40	0.61	1.33	0.07	0.28	15.20	0.12	10.50	24.30	
N						2.13	1.64		35.30	0.63	1.32	0.07	0.29	15.20	0.11	11.10	24.50	
N						2.14	1.65		35.20	0.62	1.34	0.08	0.29	15.30	0.12	10.20	24.80	
N						2.14	1.65		35.30	0.61	1.35	0.08	0.09	15.30	0.13	10.40	24.60	
N						2.13	1.63		35.30	0.62	1.34	0.07	0.29	15.20	0.13	10.70	23.10	

Assay data (cont)

Lab Code	Cu F ppm	Cu M/ICP ppm	Cu XRF ppm	Au PbColl g/t	Ag M/ICP ppm	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %	LOI %	S Comb LECO %	SG pyc
O				101	130												23.20	
O				98	133												23.80	
O				101	129												23.90	
O				103	129												24.00	
O				102	131												23.20	
O				102	132												23.10	
O				104	130												23.30	
O				101	130												23.90	
P	231000	231000			134	2.25	1.64	0.04	35.90	0.64	1.38	0.07	0.32	15.40	0.11			3.86
P	231000	230000			132	2.23	1.62	0.04	35.60	0.64	1.38	0.07	0.31	15.60	0.11			3.85
P	233000	231000			130	2.21	1.62	0.04	36.00	0.65	1.36	0.07	0.35	15.80	0.11			3.86
P	231000	230000			131	2.21	1.64	0.04	36.50	0.61	1.36	0.07	0.34	16.00	0.10			3.85
P	231000	232000			132	2.19	1.64	0.04	35.50	0.61	1.34	0.07	0.32	15.70	0.11			3.88
P	233000	233000			131	2.21	1.62	0.04	35.50	0.64	1.38	0.07	0.34	15.40	0.11			3.86
P	234000	233000			131	2.23	1.65	0.04	35.00	0.64	1.38	0.07	0.34	15.40	0.11			3.83
P	234000	231000			133	2.19	1.64	0.04	35.60	0.61	1.36	0.07	0.32	15.80	0.11			3.86
Q	227000	260000		103	130	2.06	1.53	0.04	33.50	0.60	1.32	0.07	0.35	15.05	0.10	14.00		3.75
Q	223000	250000		105	127	2.00	1.52	0.04	33.50	0.58	1.28	0.07	0.34	14.95	0.10	13.65		3.76
Q	223000	251000		104	125	2.02	1.54	0.04	34.10	0.58	1.32	0.07	0.34	15.00	0.10	13.80		3.78
Q	214000	249000		102	125	1.96	1.48	0.04	32.70	0.56	1.27	0.06	0.33	14.45	0.10	13.75		3.88
Q	214000	251000		106	127	1.99	1.54	0.04	33.50	0.57	1.28	0.07	0.33	14.60	0.10	13.95		3.73
Q	224000	246000		105	130	1.95	1.50	0.04	32.90	0.56	1.27	0.06	0.33	14.35	0.10	14.05		3.74
Q	231000	254000		105	127	1.89	1.44	0.04	31.80	0.55	1.22	0.06	0.32	13.85	0.09	13.90		3.64
Q	222000	247000		105	125	2.03	1.56	0.04	33.80	0.58	1.33	0.07	0.34	14.85	0.10	13.80		3.78
R		230000		103	131	2.31	1.68	0.04	36.46	0.58	1.41	0.08					24.40	3.76
R		230000		104	127	2.25	1.65	0.05	35.74	0.58	1.38	0.08					24.40	3.79
R		232000		103	130	2.00	1.69	0.04	36.74	0.57	1.38	0.08					24.50	3.76
R		232000		105	130	2.10	1.68	0.04	36.60	0.58	1.39	0.08					24.10	3.76
R		217000		105	119	2.10	1.55	0.04	33.88	0.54	1.29	0.06					24.00	3.76
R		227000		106	128	2.21	1.65	0.04	35.74	0.57	1.36	0.08					24.20	3.76
R		227000		106	131	2.21	1.67	0.04	35.89	0.57	1.38	0.08					24.00	3.75
R		230000		106	127	2.19	1.67	0.06	36.03	0.58	1.38	0.08					24.30	3.75
S	231000				124													23.90
S	229000				128													23.40
S	231000				123													23.40
S	227000				120													23.10
S	228000				128													23.50
S	225000				127													23.10
S	228000				126													23.30
S	229000				125													23.20
T				121	130						1.34		0.35					
T				125	127						1.36		0.35					
T				122	122						1.34		0.35					
T				119	132						1.31		0.34					
T				121	130						1.31		0.34					
T				120	123						1.31		0.34					
T				122	126						1.34		0.35					
T				123	130						1.29		0.34					
U		235000		101	130												24.00	3.77
U		233000		100	133												23.90	3.78
U		231000		101	132												24.10	3.74
U		235000		102	133												24.00	3.77
U		231000		98.89	131												24.00	3.78
U		235000		99.74	133												24.10	3.75
U		235000		101	131												23.70	3.76
U		236000		102	133												23.40	3.76
V	230600	234600			132													25.17
V	230600	234300			130													25.05
V	231800	235100			130													25.16
V	230200	232100			130													25.10
V	231900	234500			131													25.16
V	230200	233600			130													25.17
V	230900	234300			131													25.11
V	230300	233200			131													25.00

12. 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:

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

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 ¹	σ_L ²	Sw ³	CSU ⁴
Cu	F	ppm	6141	5460	3285	1974
Cu	M/ICP	ppm	2857	1775	2185	648
Au	PbColl	g/t	2.52	2.29	1.44	0.887
Ag	M/ICP	ppm	2.84	1.72	1.83	0.51
Al ₂ O ₃	XRF	%	0.098	0.078	0.056	0.027
CaO	XRF	%	0.047	0.037	0.028	0.013
Cr ₂ O ₃	XRF	%	0.0030	0.0022	0.0020	0.0008
Fe ₂ O ₃	XRF	%	0.883	0.710	0.556	0.261
K ₂ O	XRF	%	0.027	0.024	0.011	0.008
MgO	XRF	%	0.059	0.043	0.032	0.014
MnO	XRF	%	0.0046	0.0029	0.0034	0.0011
Na ₂ O	XRF	%	0.025	0.024	0.008	0.009
SiO ₂	XRF	%	0.37	0.33	0.24	0.14
TiO ₂	XRF	%	0.014	0.013	0.006	0.004
S Comb/LECO		%	0.57	0.48	0.25	0.15
SG	pyc		0.046	0.041	0.028	0.016

1. *S* - Std Dev for use on control charts.
2. σ_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.

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

14. 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.

15. Certification: AMIS0311 is a new material.

16. 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 website.

17. 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.

18. Availability: This product is available in Laboratory Packs containing 1kg of material and Explorer Packs containing custom weights (from 50 to 250g) of material. The Laboratory Packs are sealed bottles delivered in sealed foil pouches. The Explorer Packs contain material in standard geochem envelopes, nitrogen flushed and vacuum sealed in foil pouches.

19. 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.

20. 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.

17 September 2012

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 – uncertified trace element statistics

Analyte	Method	Unit	Mean	2SD	RSD%	n
Al	M/ICP	%	1.16	0.16	6.74	80
As	M/ICP	ppm	16.4	11.2	34.4	76
Ba	M/ICP	ppm	125	98.1	39.3	64
Be	M/ICP	ppm	0.41	0.16	19.8	39
Bi	M/ICP	ppm	547	259	23.6	71
Ca	M/ICP	%	1.13	0.17	7.61	96
Cd	M/ICP	ppm	19.4	6.45	16.6	84
Ce	M/ICP	ppm	50.1	16.8	16.8	47
Co	M/ICP	ppm	23.0	5.49	11.9	74
Cr	M/ICP	ppm	273	71.6	13.1	94
Cs	M/ICP	ppm	1.34	0.42	15.8	32
Cu	XRF	ppm	230500	1604	0.70	8
Dy	M/ICP	ppm	1.13	0.12	5.36	31
Er	M/ICP	ppm	0.52	0.09	9.04	32
Eu	M/ICP	ppm	0.69	0.09	6.63	22
Fe	M/ICP	%	25.3	1.80	3.57	80
Ga	M/ICP	ppm	5.88	11.2	95.2	42
Gd	M/ICP	ppm	2.10	0.29	6.90	30
Ge	M/ICP	ppm	0.48	0.42	44.7	8
Hf	M/ICP	ppm	1.44	0.19	6.71	32
Ho	M/ICP	ppm	0.20	0.02	5.63	31
In	M/ICP	ppm	3.38	1.53	22.6	39
K	M/ICP	%	0.52	0.07	6.80	95
La	M/ICP	ppm	25.3	6.85	13.5	69
Li	M/ICP	ppm	8.13	2.80	17.2	64
LOI		%	12.1	0.30	2.68	32
Lu	M/ICP	ppm	0.07	0.03	18.3	32
Mg	M/ICP	%	0.82	0.07	4.40	96
Mn	M/ICP	ppm	584	63.7	5.46	83
Mo	M/ICP	ppm	2298	274	5.95	74
Na	M/ICP	%	0.26	0.07	13.1	80
Nb	M/ICP	ppm	7.42	8.35	56.3	41
Nd	M/ICP	ppm	20.7	3.80	9.17	32
Ni	M/ICP	ppm	164	29.3	8.94	103
P	M/ICP	ppm	154	234	76.3	64
Pb	M/ICP	ppm	441	30.0	3.40	91
Pr	M/ICP	ppm	5.92	1.25	10.5	32
Rb	M/ICP	ppm	28.7	5.08	8.84	48
Re	M/ICP	ppm	0.02	0.00	5.71	15
S	M/ICP	%	24.3	1.07	2.20	40
Sb	M/ICP	ppm	3.81	12.0	157	54
Sc	M/ICP	ppm	2.86	2.50	43.8	64
Se	M/ICP	ppm	4.64	0.70	7.50	16
Si	M/ICP	%	7.07	0.09	0.65	8
Sm	M/ICP	ppm	3.19	0.83	13.0	24
Sn	M/ICP	ppm	17.1	5.91	17.3	55
Sr	M/ICP	ppm	67.4	33.1	24.5	88
Ta	M/ICP	ppm	0.09	0.12	63.5	32
Tb	M/ICP	ppm	0.21	0.10	22.7	40
Te	M/ICP	ppm	403	149	18.5	45
Th	M/ICP	ppm	47.2	7.15	7.56	48
Ti	M/ICP	%	0.06	0.02	13.8	63
Tl	M/ICP	ppm	0.95	2.49	132	45
Tm	M/ICP	ppm	0.07	0.01	9.64	24
U	M/ICP	ppm	18.6	3.08	8.27	40
V	M/ICP	ppm	11.3	11.3	50.0	60
W	M/ICP	ppm	6.77	6.89	50.9	40
Y	M/ICP	ppm	6.12	0.75	6.09	67
Yb	M/ICP	ppm	0.46	0.09	9.99	39
Zn	M/ICP	ppm	1598	180	5.64	97
Zr	M/ICP	ppm	45.8	19.0	20.7	58