

AMIS0377

Certified Reference Material

Multi element Au 0.25g/t Cu 1.08% Fe 25.31% IOCG AU Certificate of Analysis

Recommended Concentrations and Limits¹ (at two Standard Deviations)

Certified Concentrations²

Cu M/ICP	1.08	±	0.08	%
Cu XRF	1.06	±	0.08	%
Au Pb Collection	0.25	±	0.03	g/t
Fe M/ICP per	23.48	±	2.64	%
Fe XRF	25.31	±	0.28	%
Mn XRF ppm	309	±	13	ppm
S M/ICP	0.60	±	0.06	%
U M/ICP	45	±	5	ppm
Specific Gravity	3.30	±	0.12	

Provisional Concentrations

Ag M/ICP	2.8	±	0.4	ppm
Ba M/ICP	2497	±	365	ppm
Co M/ICP	28	±	4	ppm
F ISE	2600	±	414	ppm
U XRF	49	±	13	ppm

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.

AMIS

(A Division of Torre Analytical Services (Pty) Limited)
 (Reg. No. 1989/000201/07)

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Directors: C E Pettit (British), R Naidoo, N N Robinson, K V Gerber, M Padayachee

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

Certified Concentrations

Al ₂ O ₃	4.60	±	0.10	%
CaO	0.94	±	0.02	%
K ₂ O	1.44	±	0.04	%
MgO	0.51	±	0.04	%
SiO ₂	50.33	±	0.70	%
TiO ₂	0.56	±	0.03	%
S Comb / LECO	0.61	±	0.03	%

Provisional Concentration

LOI	2.67	±	0.34	%
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Indicated Mean

Na ₂ O	0.05	%
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1. Intended Use: AMIS0377 is a certified reference material which may be used to demonstrate the validity of measurement results of a single analysis of iron oxide copper gold ores 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 standard was made using ore provided by SGS Mineral Services sourced from the Prominent Hill mine which is owned and operated by Oz Minerals Limited. The mine is located 650 kilometres North West of Adelaide, 130 kilometres North West of BHP Billiton's Olympic Dam and 130 kilometres south east of the town of Coober Pedy in the Gawler Craton of South Australia. Prominent Hill, together with Carrapateena, Olympic Dam, Moonta-Wallaroo and Hillside, are all iron oxide copper gold

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(IOCG) mineralised systems hosted within Palaeo- to Mesoproterozoic rocks and distributed along the eastern edge of the currently preserved Gawler Craton. Mineralization was synchronous with volcanism and sedimentation within a narrow east-west-trending graben that developed at approximately 1600 Ma. The copper and gold bearing hematite rich breccia's were formed by repetitive hydrothermal brecciation, milling and explosive venting within a volcanic setting.

3. Mineral and Chemical Composition: The host sequence rocks are intensely altered by hematite-sericite-chlorite-carbonate (\pm quartz \pm barite \pm fluorite \pm REE phosphates). Copper mineralisation occurs as fine grained disseminations of chalcocite, bornite and chalcopyrite in the breccia matrices and (to a lesser extent) within clasts of hematite-rich breccia's. The copper sulphides display a variety of intergrowth, replacement and infill textures including chalcocite-bornite and replacement of early formed pyrite.

4. Appearance: The material is a very fine weak red powder (Corstor 5R 4/4).

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 <54 μ m. Wet sieve particle size analysis of random samples confirmed the material was 98.5% <54 μ m. It was then homogenized in a double cone blender, systematically divided and then sealed into 1kg Laboratory Packs. 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. Explorer Packs are subdivided from the Laboratory packs as required.

7. Methods of Analysis requested:

1. Au – Pb collection ICP-OES or ICP-MS.
2. Multi acid digest, ICP-OES multi element scan to include; Cu, Fe, Ba, Co, U, S and Ag.
3. 3 acid digest (HCl, HNO₃ and HClO₄) ICP-MS for U and Ag.
4. S combustion IR.
5. Cl by sodium carbonate leach and then titration with AgNO₃.
6. F by ISE.
7. U by pressed powder method.
8. Majors, to include: Cu, Fe, Ba, Co, U, S, SiO₂, Al₂O₃, CaO, MgO, K₂O, Na₂O, TiO₂, and Mn by borate fusion XRF.
9. SG. Gas pycnometer.

8. Information requested:

1. Aliquots used for all determinations.
2. Results for individual PGM's reported in ppb.
3. Results for base metals reported in ppm.
4. QC data, to include replicates, blanks and certified reference materials used.
5. Analytical techniques used.

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9. Method of Certification: Twenty five laboratories were each given eight randomly selected packages of sample. Twenty two 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”.

10. Participating Laboratories: The 22 out of 25 laboratories that provided results timeously were (not in same order as in the table of assays):

1. Acme Analytical Laboratories Chile
2. ACME Analytical Laboratories Ltd CA
3. Activation Laboratories Pty Ltd (ActLabs) CA
4. ALS Chemex Laboratory Group Brisbane Australia
5. ALS Chemex Laboratory Group Johannesburg SA
6. ALS Chemex Laboratory Group Lima (Peru)
7. ALS Chemex Laboratory Group Perth WA
8. ALS Chemex Laboratory Group Vancouver CA
9. ALS OMAC (Ireland)
10. Genalysis Laboratory Services (South Africa) Pty
11. Genalysis Laboratory Services (W Australia P)
12. Intertek Utama Services (Indonesia)
13. Set Point Laboratories (Isando) SA
14. Set Point Laboratories Botswana
15. SGS Australia Pty Ltd (Newburn) WA
16. SGS Geosol Laboratories Ltda (Brazil)
17. SGS Mineral Services Callao (Peru)
18. SGS Mineral Services Lakefield (Canada)
19. SGS South Africa (Pty) Ltd - Booyens JHB
20. SGS Townsville (Australia)
21. SGS Vancouver (Canada)
22. 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.

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Assay Data Economic Elements

Lab Code	Au Pb Coll g/t	Ag M/ICP ppm	Ba M/ICP ppm	Co M/ICP ppm	Cu M/ICP %	Cu XRF %	F ISE ppm	Fe M/ICP %	Fe XRF %	Mn XRF ppm	S M/ICP %	U M/ICP ppm	U XRF ppm
A	0.25	2.70		28.5	1.01		2311	19.9			0.55	41.2	
A	0.24	2.71		28.0	1.01		2424	20.5			0.55	41.5	
A	0.24	2.80		28.4	1.00		2375	20.0			0.54	40.8	
A	0.25	2.73		28.3	1.01		2391	21.7			0.55	42.4	
A	0.24	2.60		28.1	1.02		2366	20.9			0.56	41.5	
A	0.24	2.73		28.8	1.00		2405	21.5			0.55	41.7	
A	0.25	2.70		27.9	1.01		2451	21.4			0.55	41.1	
A	0.24	2.66		28.1	1.02		2322	20.2			0.56	42.1	
B	0.25						2500		25.5	300			47.0
B	0.24						2500		25.4	300			45.0
B	0.22						2700		25.4	400			47.0
B	0.25						2600		25.4	300			46.0
B	0.24						2500		25.4	300			48.0
B	0.24						2600		25.4	300			48.0
B	0.26						2700		25.4	300			47.0
B	0.24						2500		25.4	400			46.0
C	0.23	2.98	148	30.0			2300	23.7		310	0.52	48.2	
C	0.26	3.11	387	30.0			2200	23.7		330	0.51	51.6	
C	0.24	2.97	146	26.0			2400	23.3		320	0.50	49.4	
C	0.23	3.14	505	28.0			2300	23.8		320	0.52	51.0	
C	0.25	2.98	145	27.0			2500	23.7		320	0.51	49.5	
C	0.21	3.06	145	26.0			2300	23.7		330	0.50	49.5	
C	0.18	2.96	151	29.0			2300	23.4		310	0.50	48.3	
C	0.24	2.46	161	27.0			2500	23.7		310	0.51	46.8	
D	0.23	3.00	2660	30.0	1.14			23.8	25.3	310	0.62		
D	0.22	3.00	2630	30.0	1.12			23.7	25.3	310	0.61		
D	0.24	4.00	2680	30.0	1.15			24.1	25.3	310	0.62		
D	0.23	4.00	2710	30.0	1.15			24.3	25.3	310	0.63		
D	0.25	3.00	2620	30.0	1.11			23.7	25.5	310	0.62		
D	0.25	4.00	2640	30.0	1.13			23.8	25.3	310	0.63		
D	0.24	3.00	2640	30.0	1.13			23.7	25.5	310	0.62		
D	0.25	3.00	2680	30.0	1.13			24.0	25.3	310	0.63		
E	0.26	2.72	2310	30.0	1.05		2360	25.4			0.59	47.3	
E	0.24	2.64	2170	30.0	1.05		2420	25.5			0.59	46.6	
E	0.25	2.74	2210	30.0	1.05		2410	25.4			0.59	46.9	
E	0.23	2.75	2230	31.0	1.06		2380	25.3			0.60	48.0	
E	0.22	2.78	2230	30.0	1.05		2240	25.4			0.59	47.7	
E	0.24	2.74	2270	29.0	1.05		2150	25.3			0.58	51.4	
E	0.23	2.72	2340	30.0	1.12		2160	27.3			0.60	47.9	
E	0.23	2.77	2140	30.0	0.98		1680	23.7			0.58	47.3	
F	0.25	3.00	2440	35.0	1.08	1.07	2800	25.5	25.2	310	0.61	43.8	50.0
F	0.26	2.50	2400	35.0	1.07	1.06	2800	25.6	25.1	310	0.62	44.9	50.0
F	0.26	2.50	2480	35.0	1.08	1.06	2700	25.5	25.1	310	0.60	45.2	40.0
F	0.26	2.50	2370	30.0	1.08	1.07	2800	25.3	25.1	310	0.59	43.0	40.0
F	0.26	2.50	2400	35.0	1.08	1.07	2700	25.7	25.0	310	0.59	44.9	40.0
F	0.27	3.00	2320	30.0	1.07	1.07	2800	25.8	25.1	310	0.59	43.9	50.0
F	0.25	2.50	2370	30.0	1.09	1.06	2800	25.7	25.0	310	0.60	43.2	40.0
F	0.25	2.50	2390	30.0	1.07	1.06	2600	25.8	25.1	310	0.61	45.3	40.0
G	0.24										0.60		
G	0.24										0.56		
G	0.23										0.56		
G	0.23										0.57		
G	0.22										0.55		
G	0.24										0.53		
G	0.22										0.58		
H	0.27	2.60		45.0	1.09			24.6			0.59		
H	0.27	2.80		48.0	1.09			24.7			0.58		
H	0.27	2.80		48.0	1.09			24.8			0.58		
H	0.27	2.60		47.0	1.08			24.7			0.60		
H	0.27	2.60		45.0	1.08			24.9			0.58		
H	0.27	2.70		43.0	1.09			24.8			0.60		
H	0.27	2.50		44.0	1.07			24.3			0.57		
H	0.27	2.70		43.0	1.07			24.9			0.58		
I	2.30				1.05								
I	2.30				1.04								
I	2.30				1.04								
I	2.40				1.01								
I	2.50				1.04								
I	2.40				1.03								
I	2.30				1.03								
I	2.40				1.04								
J	0.26	5.00		30.0	1.11	1.00	2600	21.8	25.4	465	0.42	47.4	47.0
J	0.27	4.00		30.0	1.13	0.99	2500	22.5	25.3	465	0.56	46.6	48.0
J	0.27	3.00		30.0	1.10	0.98	2900	21.5	25.2	310	0.54	48.7	47.0
J	0.26	4.00		30.0	1.10	1.00	2700	21.2	25.5	310	0.55	46.6	46.0
J	0.27	5.00		30.0	1.11	1.03	2700	22.5	25.5	310	0.57	49.0	51.0
J	0.26	4.00		30.0	1.11	0.98	2700	22.2	25.2	310	0.55	47.6	51.0
J	0.26	4.00		30.0	1.10	1.03	2600	21.9	25.5	310	0.55	46.6	49.0
J	0.26	5.00		30.0	1.11	1.03	2600	21.8	25.3	310	0.56	46.0	
K	0.25			24.0	1.05			21.9			0.51		
K	0.23			25.0	1.03			16.0			0.58		
K	0.24			25.0	1.07			16.1			0.58		
K	0.24			27.0	1.06			17.1			0.56		
K	0.22			25.0	1.07			17.4			0.57		
K	0.23			25.0	1.09			19.6			0.56		
K	0.23			25.0	1.08			18.2			0.57		
K	0.23			25.0	1.08			16.4			0.57		

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Assay data. Economic Elements (Cont)

Lab Code	Au Pb Coll g/t	Ag M/ICP ppm	Ba M/ICP ppm	Co M/ICP ppm	Cu M/ICP %	Cu XRF %	F ISE ppm	Fe M/ICP %	Fe XRF %	Mn XRF ppm	S M/ICP %	U M/ICP ppm	U XRF ppm	
L	0.24	2.73	1620	27.0	0.95			21.1	25.2	310	0.54	46.6		
L	0.22	2.72	1730	27.0	0.94			20.8	25.4	310	0.54	45.6		
L	0.24	2.74	1860	26.8	0.97			21.1	24.9	310	0.55	46.5		
L	0.24	2.83	1750	27.2				21.9	25.2	310	0.56	46.9		
L	0.26	2.68	1930	26.9	0.98			21.4	25.3	310	0.56	46.4		
L	0.25	2.78	1920	27.1	0.98			21.5	25.3	310	0.56	46.7		
L	0.27	2.75	1810	27.8	0.98			21.6	25.0	310	0.56	46.3		
L	0.25	2.71	1920	27.9	1.00			21.6	25.2	310	0.57	48.1		
M	0.24	3.02	2610	30.0	1.09			23.9			0.63	44.3		
M	0.25	3.07	2580	30.0	1.07			23.8			0.63	43.6		
M	0.25	3.26	2600	30.0	1.07			24.0			0.64	46.5		
M	0.25	3.21	2590	30.0	1.08			24.0			0.63	46.2		
M	0.24	3.35	2600	30.0	1.08			24.1			0.62	44.8		
M	0.22	3.37	2590	30.0	1.08			24.0			0.62	45.0		
M	0.24	3.25	2610	30.0	1.07			24.1			0.63	44.8		
M	0.24	3.19	2600	30.0	1.08			24.0			0.63	43.9		
N	0.24		3331			1.01							46.0	
N	0.24		3301			1.01							43.0	
N	0.22		3306			1.03							46.0	
N	0.24		3348			1.01							44.0	
N	0.24		3371			1.01							43.0	
N	0.24		3361			1.01							42.0	
N	0.23		3396			1.02							42.0	
N	0.23		3359			1.01							48.0	
O		2.64	2861	29.9	1.15			22.4			0.61		45.9	
O		2.71	2798	29.3	1.18			23.0			0.63		46.4	
O		2.66	2872	29.7	1.18			23.5			0.62		46.3	
O		2.62	2774	28.3	1.14			23.1			0.63		45.2	
O		2.59	2749	28.5	1.16			23.3			0.63		45.7	
O		2.56	2853	28.8	1.15			23.4			0.63		45.7	
O		2.61	2765	28.2	1.17			22.5			0.63		45.6	
O		2.72	2798	29.4	1.16			22.8			0.63		45.3	
P	0.36	2.93	2162	21.0	0.96		2700		25.0	300	0.68	42.5	55.0	
P	0.32	2.66	2192	22.0	0.94		2400		24.8	300	0.68	41.1	59.0	
P	0.30	2.75	2347	22.0	0.99		2700		24.8	300	0.68	41.9	55.0	
P	0.31	2.80	2282	23.0	0.97		3700		24.8	300	0.68	43.8	54.0	
P	0.37	2.77	2377	22.0	0.96		2600		24.6	300	0.69	42.1	53.0	
P	0.33	2.72	2247	21.0	0.94		3200		24.7	300	0.68	42.9	55.0	
P	0.32	2.94	2212	21.0	0.92		2800		24.9	300	0.68	43.3	53.0	
P	0.29	2.65	2344	22.0	0.96		2900		25.2	300	0.68	41.3	55.0	
R	0.27		2541	25.1	0.99		2831		25.2	310		52.6	41.0	
R	0.26		2496	24.4	0.96		2911		25.2	310		51.9	42.0	
R	0.26		2502	23.6	0.96		2732		25.4	295		55.2	44.0	
R	0.26		2514	24.8	0.98		2947		25.2	318		52.6	43.0	
R	0.25		2527	23.9	1.00		2826		25.2	318		53.3	42.0	
R	0.27		2522	29.3	0.91		2802		25.2	302		52.1	44.0	
R	0.25		2558	27.4	0.94		2915		25.4	295		53.1	42.0	
R	0.26		2514	28.5	0.94		2976		25.1	310		52.4	44.0	
S	0.24					1.09	2710						60.0	
S	0.24					1.08	2760						50.0	
S	0.24					1.11	2800						60.0	
S	0.25					1.09	2770						60.0	
S	0.26					1.09	2760						50.0	
S	0.26					1.11	2770						60.0	
S	0.28					1.10	2730						60.0	
S	0.25					1.10	2750						60.0	
T	0.29						2760							
T	0.28						2660							
T	0.28						2680							
T	0.29						2350							
T	0.26						2620							
T	0.28						2730							
T	0.25						2730							
T	0.25						2750							
U	0.26	2.93	2220	27.3	1.08			22.9	25.4	310	0.63	46.4		
U	0.25	2.86	1860	26.4	1.09			22.3	25.6	388	0.60	48.9		
U	0.24	2.73	2280	31.0	1.10			22.4	25.2	310	0.59	48.4		
U	0.27	2.85	2230	27.2	1.10			22.9	25.3	310	0.62	50.4		
U	0.24	3.23	1960	27.1	1.09			22.4	25.8	388	0.61	51.4		
U	0.25	2.80	2480	30.6	1.08			22.0	25.8	388	0.59	47.0		
U	0.28	2.95	2290	26.2	1.07			22.6	25.4	310	0.62	48.9		
U	0.25	3.00	2300	28.0	1.07			22.2	24.8	310	0.61	49.3		
W		2.71	2670	30.0	1.13	1.09	1720		24.7	25.5	310	0.65	46.9	
W		2.79	2620	30.0	1.11	1.10	1550		24.3	25.4	310	0.63	46.3	
W		2.85	2610	30.0	1.10	1.08	1520		24.2	25.3	310	0.63	49.1	
W		2.77	2560	30.0	1.09	1.09	1610		23.7	25.4	310	0.62	46.2	
W		2.87	2570	30.0	1.09	1.08	1710		23.8	25.3	310	0.62	48.9	
W		2.86	2620	30.0	1.11	1.08	1570		24.3	25.4	310	0.63	46.8	
W		2.80	2590	30.0	1.10	1.09	1700		24.0	25.5	310	0.63	48.3	
W		2.80	2560	30.0	1.10	1.08	1780		23.8	25.3	310	0.62	46.3	
X	0.25	2.96	2390	25.7	1.09			21.7			0.63	43.0		
X	0.24	2.91	2610	25.5	1.10			21.9			0.63	40.7		
X	0.27	2.95	2540	25.8	1.10			22.2			0.64	43.6		
X	0.24	2.90	2520	26.1	1.13			22.5			0.65	44.4		
X	0.25	2.90	2520	24.6	1.09			21.6			0.63	41.3		
X	0.25	2.90	2520	24.0	1.13			22.0			0.64	42.8		
X	0.25	3.08	2560	25.7	1.14			22.9			0.66	43.4		
X	0.24	3.11	2570	25.4	1.10			22.6			0.65	42.6		

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Directors: C E Pettit (British), R Naidoo, N N Robinson, K V Gerber, M Padayachee

Assay data. Major Oxide

Lab Code	Al2O3 XRF %	CaO XRF %	K2O XRF %	MgO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %	LOI %	S Comb/LECO %	SG pyc
A									0.65	3.33
A									0.66	3.37
A									0.66	3.30
A									0.67	3.28
A									0.67	3.29
A									0.66	3.32
A									0.66	3.33
A									0.67	3.38
B	4.58	0.94	1.44	0.51	0.06	50.0	0.57	2.69	0.88	
B	4.59	0.94	1.44	0.51	0.07	50.2	0.59	2.63	0.90	
B	4.55	0.94	1.43	0.51	0.06	50.1	0.57	2.73	0.87	
B	4.57	0.94	1.43	0.50	0.06	50.3	0.56	2.72	0.91	
B	4.58	0.94	1.44	0.51	0.07	50.1	0.57	2.67	0.88	
B	4.57	0.94	1.44	0.52	0.07	50.2	0.57	2.72	0.89	
B	4.57	0.94	1.45	0.52	0.07	50.1	0.57	2.69	0.88	
B	4.58	0.94	1.44	0.52	0.08	50.2	0.57	2.62	0.89	
C	4.54	0.96	1.44	0.48		50.8	0.56		0.61	3.35
C	4.40	0.98	1.44	0.50		50.8	0.56		0.61	3.34
C	4.58	0.96	1.44	0.51		50.7	0.57		0.59	3.35
C	4.44	0.96	1.44	0.45		50.6	0.57		0.62	3.32
C	4.59	0.96	1.43	0.53		50.5	0.56		0.58	3.34
C	4.49	0.95	1.44	0.48		50.5	0.55		0.60	3.34
C	4.47	0.96	1.45	0.49		50.7	0.56		0.57	3.31
C	4.52	0.96	1.44	0.50		50.6	0.56		0.53	3.31
D	4.62	0.94	1.44	0.50	0.04	50.3	0.55	2.39		
D	4.65	0.96	1.47	0.52	0.04	50.6	0.57	2.38		
D	4.62	0.96	1.48	0.53	0.05	50.7	0.57	2.39		
D	4.62	0.94	1.44	0.51	0.04	50.1	0.55	2.40		
D	4.65	0.96	1.45	0.52	0.05	50.5	0.56	2.41		
D	4.61	0.95	1.44	0.50	0.04	50.6	0.55	2.40		
D	4.67	0.96	1.46	0.52	0.05	50.7	0.57	2.42		
D	4.61	0.95	1.43	0.50	0.04	50.6	0.55	2.43		
E									0.62	3.27
E									0.62	3.27
E									0.62	3.28
E									0.62	3.27
E									0.61	3.28
E									0.61	3.28
E									0.62	3.27
E									0.62	3.28
F	4.58	0.95	1.43	0.53		50.2	0.55		0.62	3.39
F	4.58	0.94	1.43	0.52		50.1	0.55		0.62	3.43
F	4.60	0.94	1.43	0.53		50.2	0.55		0.61	3.42
F	4.61	0.95	1.43	0.52		50.2	0.55		0.62	3.39
F	4.58	0.95	1.43	0.53		50.1	0.55		0.61	3.39
F	4.59	0.95	1.43	0.52		50.1	0.55		0.61	3.37
F	4.59	0.95	1.43	0.52		50.1	0.55		0.61	3.38
F	4.59	0.95	1.43	0.52		50.2	0.55		0.61	3.38
G										3.19
G										3.27
G										3.28
G										3.25
G										3.26
G										3.24
G										3.32
G										3.32
H									0.60	
H									0.60	
H									0.60	
H									0.60	
H									0.60	
H									0.60	
H									0.60	
H									0.60	
I									0.58	
I									0.58	
I									0.59	
I									0.59	
I									0.60	
I									0.60	
I									0.62	
I									0.61	
J	4.58	0.93	1.42	0.50	0.04	50.0	0.54	2.91	0.68	3.21
J	4.54	0.93	1.42	0.49	0.04	49.8	0.54	2.92	0.69	3.21
J	4.54	0.92	1.42	0.50	0.03	49.9	0.56	2.91	0.68	3.18
J	4.58	0.92	1.43	0.50	0.03	50.1	0.54	2.92	0.69	3.16
J	4.59	0.93	1.43	0.51	0.04	50.0	0.54	2.91	0.67	3.17
J	4.57	0.92	1.43	0.48	0.04	49.8	0.54	2.92	0.67	3.18
J	4.57	0.99	1.44	0.52	0.04	49.9	0.55	2.81	0.65	3.15
J	4.57	0.93	1.43	0.50	0.03	49.8	0.55	2.85	0.68	3.15

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Assay data. Major Oxide (Cont)

Lab Code	Al2O3 XRF %	CaO XRF %	K2O XRF %	MgO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %	LOI %	S Comb/LECO %	SG pyc
K										3.06
K										3.03
K										3.08
K										3.05
K										2.97
K										2.93
K										2.84
K										2.88
L	4.58	0.99	1.42	0.49	0.06	50.5	0.58	2.58	0.61	3.29
L	4.62	1.00	1.44	0.50	0.08	50.8	0.59	2.60	0.60	3.22
L	4.56	0.98	1.42	0.48	0.06	49.9	0.58	2.64	0.60	3.41
L	4.60	1.00	1.43	0.49	0.07	50.5	0.58	2.62	0.61	3.42
L	4.61	1.00	1.44	0.49	0.07	50.7	0.59	2.60	0.60	3.33
L	4.60	1.00	1.43	0.49	0.07	50.5	0.58	2.59	0.60	3.43
L	4.57	0.99	1.42	0.49	0.07	50.3	0.59	2.63	0.60	3.41
L	4.62	1.02	1.43	0.49	0.08	50.5	0.59	2.63	0.60	3.21
N	4.42	1.04	1.46	0.48		49.6	0.59	2.79	0.61	3.35
N	4.51	1.04	1.45	0.54		49.9	0.59	2.79	0.61	3.37
N	4.53	1.06	1.46	0.49		50.2	0.58	2.78	0.61	3.36
N	4.59	1.02	1.44	0.47		49.4	0.57	2.81	0.61	3.36
N	4.35	1.03	1.46	0.42		50.1	0.58	2.81	0.61	3.37
N	4.54	1.02	1.46	0.43		49.8	0.58	2.78	0.61	3.37
N	4.44	1.02	1.46	0.43		49.9	0.58	2.76	0.61	3.36
N	4.49	1.07	1.45	0.49		49.7	0.58	2.79	0.61	3.38
O										0.63
O										0.63
O										0.63
O										0.63
O										0.63
O										0.63
O										0.63
O										0.63
O										0.63
P	4.65	0.93	1.37	0.57	0.17	50.1	0.56	2.84	0.68	3.33
P	4.66	0.92	1.39	0.57	0.17	49.8	0.57	2.88	0.61	3.33
P	4.68	0.95	1.39	0.59	0.18	50.1	0.55	2.89	0.66	3.31
P	4.66	0.92	1.41	0.55	0.17	50.3	0.55	2.84	0.70	3.30
P	4.60	0.91	1.36	0.56	0.23	49.7	0.55	2.89	0.69	3.33
P	4.61	0.93	1.37	0.58	0.17	49.9	0.55	2.88	0.67	3.31
P	4.71	0.94	1.41	0.56	0.16	50.7	0.56	2.88	0.68	3.29
P	4.83	0.93	1.41	0.59	0.17	50.4	0.56	2.85	0.67	3.33
R	4.64	0.95	1.44	0.50		50.7	0.58	2.40	0.60	3.39
R	4.70	0.94	1.44	0.50		50.9	0.59	2.48	0.60	3.26
R	4.70	0.94	1.44	0.49		50.9	0.58	2.55	0.59	3.31
R	4.65	0.95	1.43	0.48		50.9	0.58	2.53	0.59	3.20
R	4.65	0.93	1.44	0.45		50.8	0.57	2.51	0.59	3.20
R	4.63	0.95	1.44	0.48		51.0	0.55	2.51	0.60	3.21
R	4.63	0.94	1.48	0.48		50.7	0.56	2.59	0.58	3.22
R	4.65	0.93	1.51	0.50		50.6	0.60	2.60	0.57	3.21
S										0.60
S										0.60
S										0.60
S										0.60
S										0.60
S										0.60
S										0.60
S										0.60
S										0.60
U	4.63	0.94	1.46	0.54	0.04	50.0	0.56	3.24	0.62	3.28
U	4.63	0.95	1.47	0.55	0.11	50.3	0.56	3.53	0.63	3.33
U	4.67	0.96	1.48	0.54	0.11	49.2	0.56	3.29	0.63	3.29
U	4.61	0.95	1.46	0.54	0.05	49.9	0.56	3.31	0.62	3.26
U	4.65	0.95	1.48	0.54	0.12	50.6	0.57	3.35	0.63	3.27
U	4.68	0.95	1.48	0.55	0.13	50.7	0.56	3.34	0.61	3.28
U	4.64	0.93	1.46	0.54	0.04	50.0	0.56	3.24	0.62	3.26
U	4.53	0.91	1.41	0.51	0.08	49.2	0.55	3.21	0.63	3.26
W	4.63	0.94	1.48	0.55		50.6	0.57	2.45	0.58	3.23
W	4.58	0.95	1.48	0.54		50.7	0.57	2.54	0.58	3.29
W	4.58	0.95	1.46	0.54		50.7	0.56	2.76	0.59	3.24
W	4.59	0.94	1.46	0.52		50.6	0.57	2.51	0.58	3.28
W	4.62	0.95	1.46	0.55		50.4	0.56	2.51	0.59	3.28
W	4.61	0.94	1.46	0.52		50.7	0.56	2.50	0.60	3.28
W	4.64	0.95	1.47	0.54		50.9	0.58	2.22	0.60	3.26
W	4.58	0.95	1.46	0.54		50.4	0.57	2.10	0.60	3.26
X										0.62
X										0.64
X										0.63
X										0.62
X										0.62
X										0.63
X										0.63
X										0.63

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12. Measurement of Uncertainty: (ref Dr Hugh Bartlett, Hugh Bartlett Consulting CC.)

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	S _w ³	CSU ⁴
Au	Pb Coll	g/t	0.01	0.007	0.009	0.002
Ag	M/ICP	ppm	0.20	0.13	0.12	0.04
Ba	M/ICP	ppm	185	163	54.4	52.0
Co	M/ICP	ppm	1.97	1.31	0.96	0.36
Cu	M/ICP	%	0.037	0.027	0.014	0.008
Cu	XRF	%	0.037	0.044	0.011	0.018
F	ISE	ppm	207	165	102	53.6
Fe	M/ICP	%	1.32	1.07	0.35	0.31
Fe	XRF	%	0.14	0.11	0.10	0.04
Mn	XRF	ppm	6.50	4.48	4.14	1.50
S	M/ICP	%	0.03	0.02	0.01	0.006
U	M/ICP	ppm	2.53	1.81	1.13	0.52
U	XRF	ppm	6.31	6.78	3.14	2.81
Al ₂ O ₃	XRF	%	0.048	0.033	0.029	0.010
CaO	XRF	%	0.011	0.009	0.007	0.003
K ₂ O	XRF	%	0.017	0.012	0.012	0.004
LOI		%	0.173	0.174	0.047	0.062
MgO	XRF	%	0.022	0.016	0.013	0.005
Na ₂ O	XRF	%	0.016	0.018	0.008	0.008
SiO ₂	XRF	%	0.35	0.25	0.20	0.08
TiO ₂	XRF	%	0.014	0.010	0.007	0.003
Scomb	LECO	%	0.015	0.010	0.007	0.003
SG	pyc		0.061	0.038	0.036	0.011

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 S_w - 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 and p2 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.

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Directors: C E Pettit (British), R Naidoo, N N Robinson, K V Gerber, M Padayachee

15. **Certification:** AMIS0377 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.

25 July 2013

Revision: 002

Date of revision: 27 January 2020

Reason for new report: Amendment of COA name

Certifying Officers:



African Mineral Standards: _____

Michael McWha
BSc (Hons), FGSSA, FSAIMM, Pr.Sci.Nat



Geochemist: _____

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

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Appendix – uncertified trace element statistics

Analyte	Method	Unit	Mean	2SD	RSD%	n
Al	M/ICP	%	2.4	0.31	6.4	96
As	M/ICP	ppm	43.9	20.7	23.5	73
Ba	XRF	ppm	2788	670	12.0	32
Be	M/ICP	ppm	0.65	0.21	16.6	63
Bi	M/ICP	ppm	2.3	0.20	4.4	48
Ca	M/ICP	%	0.65	0.07	5.4	101
Cd	M/ICP	ppm	2.0	6.5	163.6	29
Ce	M/ICP	ppm	650	237	18.2	24
Cl	Leach	ppm	230	177	38.6	24
Co	XRF	ppm	50.0	37.8	37.8	15
Cr	M/ICP	ppm	273	53.4	9.8	95
Cs	M/ICP	ppm	1.3	0.27	10.5	44
Dy	M/ICP	ppm	4.3	1.2	14.2	16
Er	M/ICP	ppm	1.8	0.71	20.3	16
Eu	M/ICP	ppm	6.0	0.6	5.3	16
Ga	M/ICP	ppm	16.3	3.7	11.3	48
Gd	M/ICP	ppm	7.7	1.1	7.4	16
Ge	M/ICP	ppm	0.75	0.72	47.5	36
Hf	M/ICP	ppm	3.8	2.6	34.0	47
Ho	M/ICP	ppm	0.76	0.33	21.4	16
In	M/ICP	ppm	0.12	0.02	8.1	46
K	M/ICP	%	1.2	0.15	6.5	96
La	M/ICP	ppm	438	166	18.9	88
Li	M/ICP	ppm	7.5	2.6	17.4	74
Lu	M/ICP	ppm	0.28	0.14	24.2	24
Mg	M/ICP	%	0.30	0.05	7.9	96
Mn	M/ICP	ppm	297	30.3	5.1	101
Mo	M/ICP	ppm	28.9	7.2	12.4	100
Na	M/ICP	%	0.04	0.02	24.0	80
Nb	M/ICP	ppm	14.2	9.2	32.3	56
Nd	M/ICP	ppm	164	51.3	15.7	16
Ni	M/ICP	ppm	22.5	4.7	10.3	99
P	M/ICP	ppm	1380	270	9.8	93
Pb	M/ICP	ppm	25.3	10.5	20.7	72
Pr	M/ICP	ppm	59.5	21.6	18.1	16
Rb	M/ICP	ppm	50.7	18.4	18.2	43
S	XRF	%	0.61	0.01	1.1	15
Sb	M/ICP	ppm	7.5	6.4	42.5	66
Sc	M/ICP	ppm	6.4	3.6	28.3	80
Se	M/ICP	ppm	5.9	2.0	17.1	37
Si	M/ICP	%	23.8	0.24	0.5	7
Sm	M/ICP	ppm	15.3	2.3	7.5	16
Sn	M/ICP	ppm	7.6	1.8	11.6	48
Sr	M/ICP	ppm	169	39.1	11.6	96
Ta	M/ICP	ppm	0.67	0.27	20.2	40
Tb	M/ICP	ppm	0.85	0.32	18.7	24
Te	M/ICP	ppm	0.85	0.20	11.7	45
Th	M/ICP	ppm	16.5	2.9	8.6	44
Ti	M/ICP	%	0.28	0.07	12.9	80
Tl	M/ICP	ppm	0.30	0.05	8.2	43
Tm	M/ICP	ppm	0.32	0.25	40.3	16
V	M/ICP	ppm	96.1	19.0	9.9	84
W	M/ICP	ppm	14.3	5.9	20.5	56
Y	M/ICP	ppm	18.9	5.1	13.4	78
Yb	M/ICP	ppm	1.8	0.86	24.0	24
Zn	M/ICP	ppm	20.1	18.5	45.8	72
Zr	M/ICP	ppm	153	37.5	12.2	72

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