

AMIS0376

Certified Reference Material

**Multi element IOCG,
Prominent Hill, South Australia**

Certificate of Analysis

Recommended Concentrations and Limits¹ (at two Standard Deviations)

Certified Concentrations²

Cu M/ICP	0.525	±	0.024	%
Ba M/ICP	576	±	26	ppm
F ISE	2060	±	163	ppm
Fe XRF	13.19	±	0.12	%
Mn XRF ppm	535	±	61	ppm
S M/ICP	0.38	±	0.03	%
U M/ICP	21.4	±	2.3	ppm
Specific Gravity	2.97	±	0.12	

Provisional Concentrations

Au Pb Collection	0.27	±	0.04	g/t
Co M/ICP	33	±	8	ppm
Fe M/ICP per	12.06	±	1.44	%
U XRF	21.6	±	4.8	ppm

Indicated Means

Ag M/ICP	1.4	ppm
Ba XRF	614	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	9.48	±	0.12	%
CaO	1.31	±	0.04	%
K ₂ O	3.05	±	0.06	%
MgO	1.06	±	0.04	%
SiO ₂	59.71	±	0.68	%
TiO ₂	0.72	±	0.02	%
S Comb / LECO	0.37	±	0.02	%

Provisional Concentration

LOI	4.27	±	0.64	%
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1. Intended Use: AMIS0376 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 (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.

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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. 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. 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 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”.

10. Participating Laboratories: The 21 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. Activation Laboratories Pty Ltd (ActLabs) CA
3. ALS Chemex Laboratory Group Brisbane Australia
4. ALS Chemex Laboratory Group Johannesburg SA
5. ALS Chemex Laboratory Group Lima (Peru)
6. ALS Chemex Laboratory Group Perth WA
7. ALS Chemex Laboratory Group Vancouver CA
8. ALS OMAC (Ireland)
9. Genalysis Laboratory Services (South Africa) Pty
10. Genalysis Laboratory Services (W Australia P)
11. Intertek Utama Services (Indonesia)
12. Set Point Laboratories (Isando) SA
13. Set Point Laboratories Botswana
14. SGS Australia Pty Ltd (Newburn) WA
15. SGS Geosol Laboratories Ltda (Brazil)
16. SGS Mineral Services Callao (Peru)
17. SGS Mineral Services Lakefield (Canada)
18. SGS Prominent Hill Australia (AU)
19. SGS South Africa (Pty) Ltd - Booyens JHB
20. SGS Townsville (Australia)
21. 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	Ba XRF ppm	Co M/ICP ppm	Cu M/ICP %	F ISE ppm	Fe M/ICP %	Fe XRF %	Mn XRF ppm	S M/ICP %	U M/ICP ppm	U XRF ppm
A	0.24				28.0	0.52		11.1			0.16		
A	0.27				28.0	0.53		11.2			0.38		
A	0.25				30.0	0.53		10.6			0.38		
A	0.26				29.0	0.52		10.0			0.37		
A	0.26				28.0	0.50		10.6			0.35		
A	0.24				27.0	0.50		11.0			0.35		
A	0.25				29.0	0.53		11.2			0.37		
A	0.27				27.0	0.52		11.0			0.37		
B	0.26					0.54	2140		13.2	388			20.0
B	0.29					0.54	2180		13.1	465			20.0
B	0.32					0.52	2180		13.1	388			30.0
B	0.30					0.55	2140		13.2	388			30.0
B	0.30					0.54	2160		13.2	388			20.0
B	0.29					0.54	2230		13.2	388			30.0
B	0.26					0.54	2120		13.2	310			20.0
B	0.29					0.53	2140		13.2	388			20.0
D	0.28	1.75	570		30.0	0.52		12.2			0.39	20.9	
D	0.30	1.65	560		30.0	0.51		11.8			0.38	20.1	
D	0.28	1.60	570		30.0	0.52		12.1			0.39	22.1	
D	0.29	1.65	570		30.0	0.52		12.2			0.39	22.2	
D	0.27	1.72	570		30.0	0.51		12.0			0.39	21.3	
D	0.27	1.74	570		30.0	0.52		11.7			0.39	22.8	
D	0.29	1.68	570		30.0	0.52		12.0			0.39	22.2	
D	0.30	1.87	570		30.0	0.51		11.4			0.39	22.0	
E	0.25						1990						
E	0.25						2030						
E	0.26						2030						
E	0.26						2140						
E	0.23						2030						
E	0.25						2090						
E	0.25						2120						
E	0.24						1990						
F	0.28	1.46	580		31.6	0.53		11.8	13.2	620	0.39	21.0	
F	0.26	1.50	580		32.3	0.52		11.8	13.3	620	0.39	21.6	
F	0.26	1.39	590		36.2	0.53		12.1	13.1	543	0.38	22.7	
F	0.28	1.47	580		36.8	0.52		12.0	13.1	543	0.38	22.8	
F	0.26	1.46	590		30.5	0.53		12.0	12.9	543	0.39	22.6	
F	0.27	1.36	570		30.0	0.52		11.5	13.1	543	0.38	21.5	
F	0.25	1.51	580		28.3	0.52		11.7	13.2	543	0.39	20.3	
F	0.26	1.39	590		28.3	0.53		12.0	13.2	543	0.39	21.5	
H		1.35	570		30.0	0.52	1590	12.8	13.2	543	0.39	20.2	
H		1.37	560		30.0	0.52	1720	12.2	13.2	543	0.38	19.8	
H		1.36	560		30.0	0.52	1700	12.6	13.2	543	0.38	19.7	
H		1.31	580		30.0	0.52	1620	13.0	13.2	543	0.39	19.7	
H		1.46	590		40.0	0.54	1670	13.3	13.1	543	0.40	19.6	
H		1.36	570		30.0	0.53	1640	12.9	13.1	543	0.39	20.4	
H		1.31	570		30.0	0.53	1680	13.0	13.1	543	0.39	19.7	
H		1.34	580		40.0	0.54	1630	13.2	13.2	543	0.40	19.7	
I	0.27	1.39	560		33.3	0.49		11.3			0.41	22.3	
I	0.28	1.42	560		32.9	0.49		11.5			0.40	22.7	
I	0.25	1.38	560		34.1	0.49		11.5			0.40	22.9	
I	0.28	1.34	560		34.7	0.50		11.4			0.40	23.1	
I	0.29	1.34	550		32.9	0.48		11.2			0.39	21.9	
I	0.24	1.42	550		33.5	0.48		11.4			0.40	22.7	
I	0.25	1.37	560		34.7	0.49		11.4			0.40	22.8	
I	0.28	1.36	590		33.4	0.52		12.0			0.43	22.1	
J	0.27						2120						
J	0.23						2140						
J	0.29						2170						
J	0.21						2090						
J	0.21						2120						
J	0.25						2150						
J	0.30						2200						
J	0.21						2210						
K	0.29	1.31	434		30.3	0.50	2064	10.6			0.37	17.7	
K	0.28	1.45	433		30.5	0.51	2058	10.1			0.38	16.9	
K	0.26	1.45	446		31.1	0.53	2074	10.9			0.39	17.7	
K	0.26	1.40	452		30.8	0.52	2013	11.3			0.38	18.0	
K	0.28	1.42	455		30.5	0.50	2020	11.1			0.38	18.1	
K	0.26	1.58	478		31.9	0.54	2008	12.3			0.40	19.2	
K	0.27	1.46	452		30.8	0.52	2004	12.2			0.39	18.0	
K	0.26	1.47	452		30.5	0.50	2020	11.1			0.37	17.9	
L	0.27			600			1990		13.2	500			23.0
L	0.28			600			2130		13.3	500			23.0
L	0.27			600			1890		13.4	600			21.0
L	0.24			600			2070		13.3	500			23.0
L	0.23			600			2060		13.2	600			22.0
L	0.25			600			2070		13.3	600			20.0
L	0.22			600			2000		13.3	600			23.0
L	0.25			600			2080		13.3	500			24.0
M	0.25	1.94	453		34.0	0.49	1300	12.0		510	0.36	19.6	
M	0.25	2.33	336		32.0	0.48	1400	11.5		510	0.36	18.0	
M	0.25	2.25	352		34.0	0.50	1200	11.9		500	0.37	18.8	
M	0.29	2.07	436		35.0	0.52	1400	12.5		500	0.38	19.9	
M	0.29	2.15	493		38.0	0.56	1300	13.5		490	0.41	21.5	
M	0.24	2.06	505		39.0	0.56	1300	13.7		510	0.42	20.7	
M	0.32	1.97	498		36.0	0.54	1300	13.2		490	0.40	20.3	
M	0.27	1.91	495		37.0	0.53	1400	13.2		490	0.40	20.8	

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Assay data. Economic Elements (Cont)

Lab Code	Au Pb Coll g/t	Ag M/ICP ppm	Ba M/ICP ppm	Ba XRF ppm	Co M/ICP ppm	Cu M/ICP %	F ISE ppm	Fe M/ICP %	Fe XRF %	Mn XRF ppm	S M/ICP %	U M/ICP ppm	U XRF ppm
N	0.26		570		30.0	0.53		11.8	13.3	620	0.37		
N	0.28	1.00	580		40.0	0.53		11.9	13.2	543	0.38		
N	0.25	1.00	570		30.0	0.53		11.9	13.3	620	0.38		
N	0.27	1.00	580		40.0	0.54		12.1	13.2	620	0.38		
N	0.28	1.00	580		40.0	0.53		12.1	13.2	620	0.38		
N	0.25	1.00	580		40.0	0.53		12.0	13.2	620	0.38		
N	0.25	1.00	570		30.0	0.53		11.8	13.3	620	0.38		
N	0.28	1.00	580		40.0	0.53		11.9	13.2	543	0.38		
P	0.29	1.00	596	500	35.0	0.54	2000	13.4	13.2	500	0.38	19.5	20.0
P	0.28	1.00	591	500	40.0	0.54	1900	13.1	13.2	500	0.38	19.6	20.0
P	0.29	1.00	578	600	35.0	0.54	1900	13.3	13.2	500	0.39	20.1	30.0
P	0.30	1.50	583	600	35.0	0.54	2000	13.3	13.2	600	0.38	19.3	30.0
P	0.30	1.00	592	500	40.0	0.53	2000	13.2	13.2	500	0.39	19.6	30.0
P	0.28	1.00	594	500	40.0	0.54	2000	13.3	13.2	500	0.38	19.8	20.0
P	0.29	1.00	596	600	40.0	0.54	1700	13.2	13.2	500	0.38	19.4	20.0
P	0.28	1.00	572	500	40.0	0.54	2000	13.2	13.2	500	0.37	20.3	20.0
Q	1.74										0.36		
Q	1.72										0.39		
Q	1.74										0.40		
Q	1.65										0.36		
Q	1.84										0.36		
Q	1.76										0.36		
Q	1.78										0.36		
Q	1.68										0.35		
R	0.29		617		39.0	0.52		12.8	12.9	566	0.36		
R	0.29		599		36.0	0.53		12.9	12.8	589	0.37		
R	0.29		594		38.0	0.52		12.7	12.9	574	0.37		
R	0.28		593		35.0	0.53		12.8	12.8	558	0.37		
R	0.29		600		38.0	0.52		12.7	12.9	566	0.38		
R	0.30		630		39.0	0.52		12.9	12.9	581	0.38		
R	0.28		624		37.0	0.53		12.9	12.9	566	0.38		
R	0.29		596		38.0	0.53		12.9	12.8	566	0.37		
S	0.28	1.10				0.60		11.5					
S	0.28	1.10				0.60		12.8					
S	0.30	1.10				0.60		12.1					
S	0.28	1.10				0.59		10.9					
S	0.28	1.20				0.58		10.8					
S	0.31	1.10				0.59		12.3					
S	0.26	1.20				0.59		12.8					
S	0.25	1.10				0.58		12.9					
T	0.28			726						543			23.0
T	0.32			748						543			20.0
T	0.30			745						543			22.0
T	0.30			754						543			20.0
T	0.29			749						543			22.0
T	0.31			739						543			23.0
T	0.29			738						543			23.0
T	0.31			750						543			24.0
U		1.36	573		35.6	0.52		12.7			0.39	21.8	
U		1.33	566		34.7	0.52		12.8			0.38	21.3	
U		1.42	571		35.5	0.52		12.7			0.39	21.8	
U		1.37	554		34.0	0.53		13.0			0.40	21.5	
U		1.35	571		34.2	0.52		12.7			0.39	21.5	
U		1.43	552		34.8	0.52		12.8			0.38	21.6	
U		1.38	568		34.1	0.52		13.0			0.40	21.3	
U		1.42	560		35.2	0.53		12.8			0.39	21.7	
V	0.26	1.69	592	600	26.0	0.51	2000	11.5	12.9	500		21.4	25.0
V	0.30	1.64	611	600	26.0	0.51	1700	12.4	12.9	500		21.7	25.0
V	0.30	1.72	566	600	25.0	0.52	2000	11.5	12.9	500		21.8	26.0
V	0.25	1.72	593	500	27.0	0.52	2000	12.1	12.9	500		21.9	25.0
V	0.28	1.66	580	500	26.0	0.51	1800	11.6	13.0	500		22.1	25.0
V	0.26	1.97	599	700	27.0	0.52	1900	12.1	13.1	600		22.3	25.0
V	0.29	1.57	586	500	25.0	0.50	2000	12.0	12.5	500		21.6	25.0
V	0.25	1.73	597	600	25.0	0.51	1900	11.6	13.0	500		21.0	25.0
X	0.27	1.26	580		31.9	0.50		11.4	12.8	543	0.36	22.2	
X	0.27	1.32	550		31.9	0.46		10.8	13.1	543	0.34	21.9	
X	0.27	1.31	570		32.3	0.48		11.2	13.2	543	0.36	23.0	
X	0.27	1.35	570		32.5	0.48		11.1	13.1	543	0.35	22.7	
X	0.28	1.28	570		32.0	0.48		11.3	13.3	543	0.36	22.3	
X	0.28	1.36	570		32.4	0.48		11.1	13.2	543	0.36	23.0	
X	0.27	1.33	570		32.9	0.48		11.2	13.1	543	0.35	22.8	
X	0.27	1.35	570		32.4	0.48		11.1	13.1	543	0.36	22.1	
Y	0.29		662	700	28.8	0.55	2035	14.4	13.2	543		21.4	19.0
Y	0.29		634	500	29.6	0.56	2108	14.1	13.1	535		22.5	18.0
Y	0.29		631	700	28.6	0.53	2141	13.8	13.1	550		19.8	21.0
Y	0.29		633	600	29.9	0.52	2028	14.0	13.1	527		23.0	18.0
Y	0.29		647	500	28.6	0.54	2034	14.9	13.1	543		22.9	19.0
Y	0.29		638	600	29.7	0.56	2146	14.4	13.1	535		23.2	21.0
Y	0.30		641	600	28.7	0.54	2075	14.4	13.2	527		22.7	19.0
Y	0.29		624	700	28.9	0.52	2032	14.1	13.1	535		22.4	16.0

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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 %	SiO2 XRF %	TiO2 XRF %	LOI %	S Comb/LECO %	SG pyc
A									2.68
A									2.68
A									2.61
A									2.69
A									2.70
A									2.73
A									2.73
A									2.78
B	9.52	1.34	3.07	1.07	59.5	0.73	4.36	0.36	
B	9.51	1.33	3.11	1.06	59.0	0.73	4.40	0.36	
B	9.44	1.34	3.12	1.05	59.3	0.72	4.36	0.36	
B	9.48	1.34	3.08	1.07	59.7	0.74	4.33	0.36	
B	9.49	1.35	3.12	1.07	59.7	0.75	4.39	0.37	
B	9.40	1.34	3.11	1.06	59.6	0.72	4.37	0.37	
B	9.40	1.35	3.11	1.07	59.7	0.73	4.33	0.36	
B	9.54	1.33	3.14	1.07	59.8	0.74	4.31	0.36	
E									0.39
E									0.39
E									0.39
E									0.39
E									0.39
E									0.39
E									0.39
F	9.46	1.31	3.08	1.06	59.3	0.71	4.75	0.38	2.92
F	9.48	1.32	3.07	1.07	59.6	0.71	4.60	0.38	2.92
F	9.45	1.26	3.05	1.06	58.9	0.70	5.02	0.38	2.98
F	9.38	1.30	3.07	1.05	59.0	0.70	4.85	0.36	2.92
F	9.43	1.30	3.03	1.06	58.4	0.70	4.90	0.37	2.93
F	9.50	1.28	3.06	1.06	59.3	0.71	4.87	0.36	2.98
F	9.44	1.30	3.04	1.06	58.6	0.71	4.86	0.37	2.94
F	9.53	1.28	3.06	1.07	59.3	0.71	4.95	0.37	2.93
H	9.50	1.30	3.10	1.05	60.4	0.72	3.93	0.36	2.91
H	9.46	1.32	3.10	1.08	60.3	0.72	3.45	0.36	2.90
H	9.51	1.32	3.08	1.06	60.3	0.72	3.41	0.36	2.90
H	9.49	1.30	3.10	1.08	60.4	0.71	3.77	0.35	2.90
H	9.51	1.30	3.08	1.06	60.0	0.72	3.88	0.37	2.90
H	9.47	1.29	3.07	1.06	60.0	0.71	3.96	0.37	2.89
H	9.45	1.30	3.08	1.05	60.0	0.72	4.00	0.36	2.87
H	9.49	1.30	3.09	1.06	59.9	0.72	3.95	0.36	2.87
I									0.37
I									0.38
I									0.37
I									0.38
I									0.38
I									0.38
I									0.37
I									0.36
I									0.36
J									0.37
J									0.36
J									0.35
J									0.35
J									0.36
J									0.35
J									0.35
J									0.35
K									0.36
K									0.36
K									0.34
K									0.36
K									0.36
K									0.35
K									0.35
K									0.37
L	9.40	1.30	3.02	1.03	59.5	0.74	4.24		
L	9.40	1.31	3.03	1.04	59.7	0.73	4.11		
L	9.39	1.32	3.05	1.03	59.5	0.73	4.16		
L	9.37	1.30	3.00	1.03	59.6	0.72	4.19		
L	9.37	1.30	3.02	1.03	59.5	0.72	4.20		
L	9.41	1.31	3.04	1.03	59.6	0.72	4.02		
L	9.36	1.31	3.04	1.03	59.5	0.73	4.05		
L	9.38	1.31	3.02	1.04	59.7	0.73	4.16		
M	9.73	1.32	3.04	1.11	60.1	0.72		0.38	3.01
M	9.51	1.31	3.02	1.10	59.6	0.73		0.38	3.01
M	9.69	1.32	3.07	1.12	59.8	0.72		0.38	3.00
M	9.63	1.32	3.02	1.11	59.9	0.72		0.38	3.01
M	9.73	1.33	3.03	1.12	60.2	0.73		0.38	3.00
M	9.66	1.33	3.03	1.11	60.0	0.73		0.38	3.00
M	9.70	1.30	3.04	1.10	60.0	0.72		0.38	2.98

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Assay data. Major Oxide (Cont)

Lab Code	Al2O3 XRF %	CaO XRF %	K2O XRF %	MgO XRF %	SiO2 XRF %	TiO2 XRF %	LOI %	S Comb/LECO %	SG pyc
N	9.62	1.31	3.06	1.08	59.9	0.72	3.90	0.38	
N	9.61	1.29	3.04	1.06	59.3	0.71	3.98	0.38	
N	9.59	1.31	3.05	1.08	59.7	0.72	3.97	0.39	
N	9.55	1.30	3.04	1.08	59.4	0.71	3.95	0.38	
N	9.53	1.29	3.04	1.07	59.6	0.71	3.97	0.39	
N	9.55	1.30	3.03	1.06	59.3	0.72	3.96	0.39	
N	9.53	1.30	3.04	1.08	59.5	0.72	3.86	0.38	
N	9.53	1.30	3.05	1.06	59.7	0.71	3.84	0.38	
P	9.51	1.30	3.03	1.06	59.9	0.71		0.37	3.02
P	9.49	1.30	3.02	1.04	59.9	0.72		0.38	3.04
P	9.50	1.30	3.04	1.05	59.9	0.71		0.37	3.03
P	9.51	1.31	3.03	1.05	59.9	0.71		0.37	3.01
P	9.52	1.31	3.04	1.06	59.8	0.71		0.38	3.02
P	9.53	1.31	3.05	1.06	59.9	0.71		0.37	3.07
P	9.51	1.30	3.03	1.04	59.9	0.71		0.37	3.05
P	9.52	1.30	3.03	1.06	59.9	0.71		0.37	3.04
Q									2.96
Q									3.07
Q									3.01
Q									3.02
Q									3.01
Q									2.97
Q									3.04
Q									3.01
R	9.47	1.28	3.05	1.07	59.9	0.72	4.00	0.37	
R	9.43	1.28	3.04	1.07	59.8	0.72	4.00	0.37	
R	9.44	1.29	3.06	1.08	59.8	0.73	4.00	0.38	
R	9.46	1.28	3.05	1.07	59.7	0.72	4.00	0.37	
R	9.43	1.29	3.06	1.08	59.8	0.73	4.00	0.37	
R	9.46	1.28	3.06	1.07	59.8	0.72	3.90	0.37	
R	9.46	1.28	3.06	1.07	59.8	0.72	4.00	0.38	
R	9.44	1.29	3.05	1.08	59.8	0.72	4.00	0.38	
S								0.38	
S								0.38	
S								0.38	
S								0.38	
S								0.38	
S								0.38	
S								0.38	
S								0.38	
T	9.56	1.27	2.97	0.93	58.6	0.74	4.59	0.36	3.02
T	9.48	1.27	2.98	0.94	58.7	0.74	4.59	0.36	3.01
T	9.41	1.29	2.98	0.91	58.5	0.74	4.57	0.36	3.01
T	9.49	1.31	2.99	0.94	58.9	0.74	4.60	0.36	3.01
T	9.51	1.32	2.97	0.93	58.4	0.73	4.59	0.36	3.03
T	9.43	1.34	3.00	0.92	58.7	0.74	4.61	0.36	3.02
T	9.51	1.37	3.01	0.93	58.6	0.74	4.61	0.36	3.02
T	9.64	1.36	2.98	1.00	58.6	0.74	4.57	0.36	3.02
U								0.39	2.87
U								0.38	2.85
U								0.40	2.87
U								0.39	2.89
U								0.39	2.86
U								0.38	2.89
U								0.39	2.86
U								0.40	2.89
V	9.30	1.31	2.92	1.06	59.1	0.71	4.68	0.39	2.98
V	9.41	1.32	2.93	1.02	59.1	0.71	4.70	0.38	2.97
V	9.31	1.30	2.93	1.01	59.2	0.72	4.77	0.37	2.95
V	9.37	1.29	2.93	1.07	59.0	0.72	4.75	0.40	2.98
V	9.32	1.32	2.96	1.06	59.3	0.72	4.67	0.33	2.97
V	9.37	1.31	2.95	1.03	59.4	0.72	4.70	0.36	2.95
V	9.10	1.27	2.86	1.07	56.7	0.68	4.70	0.34	2.98
V	9.48	1.30	2.97	1.09	59.6	0.73	4.73	0.32	2.95
X	9.26	1.38	2.97	1.07	60.7	0.72	4.12	0.37	2.95
X	9.45	1.36	3.03	1.08	59.9	0.73	4.15	0.37	2.88
X	9.47	1.38	3.04	1.08	60.3	0.74	4.16	0.37	3.04
X	9.44	1.41	3.01	1.08	59.9	0.73	4.15	0.37	2.97
X	9.47	1.38	3.06	1.08	60.3	0.74	4.10	0.37	3.06
X	9.47	1.42	3.03	1.08	60.3	0.74	4.20	0.37	3.06
X	9.45	1.36	3.03	1.08	59.9	0.74	4.20	0.37	2.89
X	9.42	1.36	3.00	1.07	59.9	0.74	4.18	0.38	3.03
Y	9.58	1.33	3.10	1.03	59.8	0.72	4.13	0.37	2.92
Y	9.61	1.30	3.03	1.04	59.6	0.72	4.02	0.38	2.92
Y	9.51	1.30	3.02	1.03	59.5	0.72	4.14	0.38	2.89
Y	9.52	1.31	3.08	1.02	59.6	0.73	3.99	0.35	2.87
Y	9.59	1.32	3.05	1.02	59.6	0.73	3.95	0.37	2.90
Y	9.57	1.29	3.05	1.04	59.4	0.72	4.08	0.39	2.88
Y	9.60	1.30	3.04	1.01	59.8	0.72	4.14	0.38	2.88
Y	9.47	1.29	3.00	1.00	59.4	0.73	4.16	0.35	2.89

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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	0.02	0.008	0.014	0.002
Ag	M/ICP	ppm	0.22	0.18	0.07	0.05
Ba	M/ICP	ppm	13.18	9.16	8.54	3.06
Ba	XRF	ppm	87.42	95.71	54.26	43.65
Co	M/ICP	ppm	4.13	2.66	2.33	0.75
Cu	M/ICP	%	0.012	0.006	0.008	0.002
F	ISE	ppm	81.6	66.7	50.0	24.4
Fe	M/ICP	%	0.77	0.51	0.39	0.14
Fe	XRF	%	0.065	0.041	0.052	0.016
Mn	XRF	ppm	30.3	17.1	24.0	6.1
S	M/ICP	%	0.014	0.008	0.010	0.002
U	M/ICP	ppm	1.16	0.90	0.64	0.29
U	XRF	ppm	2.41	2.48	1.14	1.03
Al ₂ O ₃	XRF	%	0.060	0.044	0.036	0.014
CaO	XRF	%	0.017	0.010	0.013	0.003
K ₂ O	XRF	%	0.030	0.021	0.017	0.007
LOI		%	0.319	0.288	0.061	0.091
MgO	XRF	%	0.021	0.016	0.010	0.005
SiO ₂	XRF	%	0.343	0.248	0.190	0.078
TiO ₂	XRF	%	0.011	0.008	0.006	0.002
Scomb	LECO	%	0.012	0.007	0.006	0.002
SG	pyc		0.060	0.045	0.029	0.013

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.

15. Certification: AMIS0376 is a new material.

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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.

26 July 2013

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	%	4.8	0.34	3.6	80
As	M/ICP	ppm	24.5	8.0	16.3	59
Be	M/ICP	ppm	1.1	0.39	17.6	56
Bi	M/ICP	ppm	1.5	0.13	4.3	46
Ca	M/ICP	%	0.91	0.06	3.5	85
Cd	M/ICP	ppm	0.1	0.0	29.0	38
Ce	M/ICP	ppm	375	98.0	13.1	47
Cl	Leach	ppm	173	101	29.1	35
Co	XRF	ppm	45.0	28.3	31.4	16
Cr	M/ICP	ppm	246	72.1	14.7	82
Cs	M/ICP	ppm	3.6	0.69	9.4	42
Cu	XRF	%	0.52	0.05	4.7	40
Dy	M/ICP	ppm	3.9	1.8	22.7	16
Er	M/ICP	ppm	1.8	1.1	31.2	16
Eu	M/ICP	ppm	3.5	0.87	12.5	16
Ga	M/ICP	ppm	19.1	11.5	30.1	54
Gd	M/ICP	ppm	6.1	2.3	18.6	16
Ge	M/ICP	ppm	0.45	0.40	44.3	37
Hf	M/ICP	ppm	5.2	0.78	7.5	40
Ho	M/ICP	ppm	0.73	0.44	30.2	16
In	M/ICP	ppm	0.10	0.02	8.6	43
K	M/ICP	%	2.5	0.35	7.2	80
La	M/ICP	ppm	225	71.0	15.8	79
Li	M/ICP	ppm	13.3	4.9	18.3	68
Lu	M/ICP	ppm	0.28	0.18	32.2	24
Mg	M/ICP	%	0.58	0.08	6.5	81
Mn	M/ICP	ppm	523	65.1	6.2	85
Mo	M/ICP	ppm	13.4	4.6	17.1	87
Na	M/ICP	%	0.10	0.04	21.1	80
Na ₂ O	XRF	%	0.14	0.01	4.1	40
Nb	M/ICP	ppm	10.6	3.0	14.1	48
Nd	M/ICP	ppm	84.1	24.9	14.8	16
Ni	M/ICP	ppm	25.0	5.6	11.3	86
P	M/ICP	ppm	1197	135	5.7	76
Pb	M/ICP	ppm	20.9	9.3	22.2	75
Pr	M/ICP	ppm	30.3	11.9	19.7	16
Rb	M/ICP	ppm	115	30.0	13.1	42
S	XRF	%	0.38	0.01	1.3	15
Sb	M/ICP	ppm	3.9	3.9	49.9	63
Sc	M/ICP	ppm	10.6	2.1	10.0	64
Se	M/ICP	ppm	3.5	1.9	26.6	38
Si	M/ICP	%	28.1	0.32	0.6	8
Sm	M/ICP	ppm	9.6	2.2	11.5	16
Sn	M/ICP	ppm	4.4	1.1	12.8	43
Sr	M/ICP	ppm	109	24.6	11.3	80
Ta	M/ICP	ppm	0.73	0.16	10.9	40
Tb	M/ICP	ppm	0.73	0.32	22.1	24
Te	M/ICP	ppm	0.58	0.26	22.7	44
Th	M/ICP	ppm	17.7	4.2	11.9	48
Ti	M/ICP	%	0.36	0.08	11.5	72
Tl	M/ICP	ppm	0.56	0.14	12.4	44
Tm	M/ICP	ppm	0.33	0.33	49.8	16
V	M/ICP	ppm	97.3	8.4	4.3	72
W	M/ICP	ppm	7.2	0.88	6.1	40
Y	M/ICP	ppm	22.4	4.0	9.0	64
Yb	M/ICP	ppm	1.9	1.2	31.8	24
Zn	M/ICP	ppm	29.9	20.9	35.0	72
Zr	M/ICP	ppm	183	25.0	6.8	64

AMIS

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