

AMIS0283

Certified Reference Material

**Multi element-PGM ore
Sudbury Basin, Canada**

Certificate of Analysis

Recommended Concentrations and two “Between Laboratory” Standard Deviations¹

Certified Concentrations²

Pt Pb Collection	0.82	±	0.08	g/t
Au Pb Collection	0.092	±	0.010	g/t
Co M/ICP	900	±	90	ppm
Cu M/ICP	2.741	±	0.181	%
Cu P	2.727	±	0.153	%
Ni M/ICP	2.257	±	0.198	%
Ni P	2.248	±	0.176	%
S Comb/ LECO	14.76	±	0.11	%
Specific Gravity	3.43	±	0.14	

Provisional Concentrations

Pd Pb Collection	0.49	±	0.06	g/t
Co P	843	±	191	ppm

$$PGM\ 3E\ (Pt + Pd + Au) = 1.40\ g/t$$

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)

A: 11 Avalon Road, West Lake View Ext 11, Modderfontein, South Africa

P: PO Box 856, Isando, 1600, Gauteng, South Africa

T: +27 (0) 11 923-0800

W: www.amis.co.za

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

Major Element Recommended Concentrations and two “Between Laboratory” Standard Deviations

Certified Concentrations

Al ₂ O ₃	8.10	±	0.28	%
CaO	3.10	±	0.06	%
Fe ₂ O ₃	35.97	±	0.96	%
K ₂ O	1.40	±	0.04	%
MgO	2.08	±	0.16	%
MnO	0.15	±	0.01	%
SiO ₂	32.51	±	0.40	%
TiO ₂	0.48	±	0.02	%
LOI	6.73	±	0.66	%

Provisional Concentrations

Na ₂ O	1.92	±	0.26	%
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Indicated Mean

Cr ₂ O ₃	0.03	%
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1. Intended Use: AMIS0283 is a certified reference material which may be used to demonstrate the validity of measurement results of a single analysis Nickel-Copper-PGM ores, hosted by mafic rocks, with a similar grade and matrix; when measured in parallel to the unknown to be characterised. The material can be used for routine quality control by inserting within a batch of samples, method development and for the calibration of equipment. The recommended mean and "Between Lab" standard deviations for this material property values based on a measurement campaign (round robin) and reflect the average results from the laboratories that participated in the round robin, after examination of the data set and removal of technically and statistically invalid results (see Clause 9 - this certificate). 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 was made using material provided by Quandra FNX Mining Ltd and SGS Minerals Services. The material is from project areas within the confines or peripheral to the Sudbury Structure and the associated 1.85 billion year old Sudbury Igneous Complex; located approximately 400 km north of Toronto, in close proximity to the City of Greater Sudbury, northeastern Ontario, Canada.

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3. Mineral and Chemical Composition: The vast bulk of sulphides in the Sudbury ores consist essentially of varying proportions of pyrrhotite, chalcopyrite and pentlandite with varying amounts of other Cu-, Ni-, Co-, PGM-bearing minerals and gold.

Major element chemistry data from 12 of the labs has been compiled and certified. Uncertified summary statistics for trace element data are set out in the appendix.

4. Appearance: The material is a Dark Blueish Grey (Corstor 5PB 4/1).

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. 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. Pt, Pd and Au. ICP-OES or ICP-MS, Pb collection with Ag as a co-collector.
2. Cu and Ni. Multi-acid total digestion, including HF, with ICP-OES finish.
3. Cu and Ni. Aqua regia digestion with ICP-OES finish.
4. Cr, Co, Cu and Ni. Pressed pellet XRF.
5. Cr, Co, Cu and Ni. Fusion, ICP-OES or ICP-MS
6. Specific Gravity. Gas pycnometer.
7. XRF (major elements).
8. Multi acid digest ICP scan – trace elements.

Additionally, XRF analyses were requested for the major elements and a multi-element multi acid digest and ICP scan was requested for the trace elements.

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 two laboratories were each given eight randomly selected packages of sample. Eighteen of the laboratories submitted results.

The final limits were calculated after a three step examination of the data, first removing incompatible data outside a spread normally expected for similar analytical methods done by reputable laboratories. Then, data from any one laboratory was removed from further calculations, if the mean of all analyses from that laboratory failed a t-test of the global means of the other laboratories. Next, data that fell outside of the 2 standard deviations were removed. The mean and standard deviations were then re-calculated.

Analytes with an RSD of near or less than 5 % are reported as “Certified Concentrations” with limits at two “Between Laboratory” standard deviations. Those with RSD’s of between near 5 % and 15 % are reported as “Provisional Concentrations” with limits at two “Between Laboratory” standard deviations. Those with RSD’s over 15 % are reported as “Informational Values”.

This method is different from that used by Government agencies 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 Confidence Limits published on other standards.

10. Participating Laboratories: The 18 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. Genalysis Laboratory Services (W Australia P)
7. Intertek Utama Services (Indonesia)
8. Set Point Laboratories (Isando) SA
9. SGS Australia Pty Ltd (Newburn) WA
10. SGS Chelopech (Bulgaria)
11. SGS Durango (Mexico)
12. SGS Geosol Laboratories Ltda (Brazil)
13. SGS Mineral Services Callao (Peru)
14. SGS Mineral Services Lakefield (Canada)
15. SGS South Africa (Pty) Ltd - Booyens JHB
16. SGS Toronto (Canada)
17. SGS Townsville (Australia)
18. Ultra Trace (Pty) Ltd WA

11. Assay Data: Data as received from the laboratories for the important certified elements are set out below – Economic elements.

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Assay data – Economic elements

Lab Code	Pt Pb Coll g/t	Pd Pb Coll g/t	Au Pb Coll g/t	Co M/ICP ppm	Co P ppm	Co XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm
A	0.83	0.50	0.09	856	744.00	1048.51	27000	26300	27500			
A	0.83	0.50	0.09	855	742.00	1018.79	26900	26100	27300			
A	0.81	0.50	0.09	854	743.00	1051.66	26900	26400	27100			
A	0.82	0.50	0.09	856	744.00	1036.65	26900	26300	26900			
A	0.82	0.51	0.09	855	744.00	1069.89	27100	27000	27100			
A	0.82	0.51	0.09	854	742.00	1060.05	27100	26500	27000			
A	0.82	0.50	0.09	854	743.00	1030.08	27200	26500	26900			
A	0.81	0.49	0.09	855	745.00	1037.02	26900	26900	26900			
B	0.79	0.51	0.09	995			27807	25396		21259		
B	0.81	0.51	0.09	953			27487	25546		22384		
B	0.84	0.51	0.09	963			27101	24028		21162		
B	0.83	0.50	0.09	974			27271	24887		21726		
B	0.81	0.51	0.10	954			27454	26577		21336		
B	0.82	0.51	0.10	963			27159	25038		21058		
B	0.82	0.50	0.09	1007			27629	24997		21493		
B	0.85	0.52	0.09	1011			27355	24626		21307		
C				875		1000.00	26400	27000	28000	24100	22300	22900.00
C				879		1000.00	26200	27000	28500	24100	21500	22800.00
C				856		1000.00	23800	26300	27900	22300	22000	22800.00
C				884		1000.00	23500	26000	27900	22300	22200	22800.00
C				887		1000.00	24000	27000	27500	22300	21800	22800.00
C				882		1000.00	25000	26300	27900	22900	21500	22700.00
C				881		1000.00	25600	25900	27900	22400	22600	22900.00
C				894		1000.00	27600	26900	27300	26200	22400	22500.00
D	0.89	0.54	0.09									
D	0.91	0.55	0.10									
D	0.91	0.55	0.10									
D	0.91	0.55	0.10									
D	0.91	0.54	0.10									
D	0.93	0.55	0.09									
D	0.91	0.55	0.09									
D	0.92	0.55	0.10									
E				890	747.00		28000	27600		24000	23700	
E				882	743.00		27800	28100		24300	24000	
E				874	749.00		27900	28100		23900	24200	
E				869	746.00		28100	28000		24200	24200	
E				871	743.00		28000	28200		24400	23900	
E				876	747.00		27800	28000		24500	24100	
E				887	753.00		27700	27900		24200	24100	
E				877	757.00		28500	28200		24400	24200	
G							29300	29000	27100	22900	21200	22900.00
G							28800	27600	27900	22100	20700	23100.00
G							29900	27500	27400	23300	20100	22700.00
G							29600	28400	27700	23200	20800	23000.00
G							29200	28000	28100	22900	20100	23100.00
G							28800	28600	27100	22900	21700	22600.00
G							26500	27400	27500	21600	20500	22700.00
G							28100	27400	27500	22000	20400	22900.00
I				883	928.00		25900					
I				848	922.00		24200					
I				869	1010.00		26300					
I				862	939.00		26200					
I				830	943.00		26000					
I				852	979.00		26100					
I				879	989.00		26000					

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Assay data (cont) – Economic elements

Lab Code	Pt Pb Coll g/t	Pd Pb Coll g/t	Au Pb Coll g/t	Co M/CP ppm	Co P ppm	Co XRF ppm	Cu M/CP ppm	Cu P ppm	Cu XRF ppm	Ni M/CP ppm	Ni P ppm	Ni XRF ppm
J	0.78	0.44	0.09	774			30156			21886		
J	0.80	0.44	0.09	770			29541			21981		
J	0.81	0.45	0.09	772			30679			22060		
J	0.80	0.45	0.10	767			29390			22202		
J	0.82	0.45	0.09	759			30571			21464		
J	0.81	0.45	0.10	803			30074			21609		
J	0.81	0.45	0.10	800			29893			21832		
J	0.81	0.45	0.09	776			29079			21491		
K	0.86	0.52	0.10	872	865.00		25700	28200		22100	23700	
K	0.86	0.52	0.10	876	898.00		25800	27200		22800	23400	
K	0.86	0.52	0.10	874	868.00		26700	27700		23600	23000	
K	0.92	0.55	0.09	882	888.00		24900	27600		21700	23300	
K	0.89	0.54	0.10	858	869.00		26100	26900		23200	24100	
K	0.87	0.52	0.10	874	889.00		26900	26700		24000	23100	
K	0.85	0.52	0.10	861	871.00		25900	27600		22400	23000	
K	0.86	0.52	0.10	861	886.00		26000	27600		22900	23600	
L	0.67	0.43	0.10	849			29700				21500	
L	0.69	0.43	0.09	872				29500			21800	
L	0.81	0.50	0.12	879				29200			21300	
L	0.81	0.47	0.10	873				29200			21600	
L	0.70	0.44	0.09	819				30200			22500	
L	0.81	0.51	0.10	897				29100			22200	
L	0.75	0.47	0.10	885				31100			22400	
L	0.39	0.23	0.05	872				29100			20400	
M	0.81	0.49	0.10	980	895.00		27300	26200		22800	23100	
M	0.81	0.48	0.10	975	907.00		27600	26500		23000	23300	
M	0.83	0.48	0.10	980	891.00		27400	26200		23000	22900	
M	0.81	0.49	0.10	970	899.00		27000	26600		22800	23200	
M	0.83	0.48	0.09	955	893.00		26600	26300		22200	22900	
M	0.83	0.50	0.10	985	856.00		27300	24900		23100	23100	
M	0.82	0.48	0.09	980	914.00		27400	26500		23200	22900	
M	0.81	0.48	0.10	975	914.00		27800	26500		23000	23100	
N	0.60	0.46	0.09	884			27500	27100		21600	21900	
N	0.60	0.47	0.09	869			27500	27300		21900	22100	
N	0.63	0.45	0.08	867			27700	27300		22000	22000	
N	0.63	0.47	0.09	874			27100	27300		21600	22200	
N	0.65	0.44	0.09	872			27500	27100		21900	21900	
N	0.61	0.47	0.09	872			27400	27100		22000	21900	
N	0.63	0.46	0.09	861			27300	27100		21600	21800	
N	0.60	0.47	0.09	876			27300	27300		21800	21900	
O	0.82	0.50	0.09				28800	28100	27600	22100	22700	23200.00
O	0.78	0.48	0.08		725.00		28600	28000	27300	21800	22200	23300.00
O	0.78	0.48	0.09		750.00		29100	26700	27500	22000	22800	23100.00
O	0.82	0.50	0.09		738.00		28200	28000	27600	22800	22900	23100.00
O	0.83	0.50	0.09		717.00		28500	26700	27700	21800	23300	23200.00
O	0.82	0.49	0.09		722.00		29200	27100	27700	22800	22300	23200.00
O	0.76	0.46	0.08		762.00		28300	28600	27300	21600	23100	23100.00
O	0.80	0.49	0.09		739.00		28600	26800	27700	21500	22800	23200.00
Q				950			26500	27600		22300	21500	
Q				960			27800	27600		22600	21500	
Q				950			27000	27800		23000	21600	
Q				970			26900	27200		22800	21200	
Q				950			26900	28300		22600	22100	
Q				920			27500	27500		23000	21200	
Q				950			26900	28200		22600	21700	
Q				960			26900	28100		22600	21800	
S	0.79	0.49	0.09	810	950.00		25400	25500		22700	22300	
S	0.78	0.48	0.09	910	930.00		28300	25800		25100	22500	
S	0.78	0.48	0.11	870	950.00		26900	25400		23700	22000	
S	0.76	0.47	0.09	900	970.00		28100	26300		24700	23600	
S	0.79	0.48	0.09	830	950.00		26100	25600		23500	21900	
S	0.77	0.48	0.09	870	1050.00		27100	28000		24500	24300	
S	0.81	0.50	0.09	860	960.00		26600	24900		24000	21900	
S	0.84	0.50	0.09	920	990.00		28500	27000		25600	23600	
T				930			27500	26700	27900	21000	21800	22400.00
T				900			26500	26800	27800	20300	21900	22100.00
T				920			27200	27400	27800	21100	21800	22100.00
T				910			27200	27600	27700	20400	22400	22100.00
T				940			27700	27600	27600	21600	22100	22200.00
T				880			27900	27300	28000	22100	22400	22200.00
T				920			27100	26900	27700	20700	22500	22100.00
T				890			26500	27900	28000	20700	22800	22300.00
U				960			28300	28800		23300	23000	
U				940			27900	28900		23000	23100	
U				960			28500	28100		23300	22400	
U				960			28400	28300		23600	22500	
U				950			28200	27500		22900	21600	
U				970			28700	28200		23700	22500	
U				950			28200	27500		23200	21900	
U				950			28500	27600		23400	22200	

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Assay data (cont) – Major Oxides

Lab Code	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	7.41	3.13	0.04	35.36	1.36	2.22	0.15	2.82	32.10	0.48	5.09	10.10	3.51
A	7.56	3.12	0.03	35.45	1.36	2.24	0.15	2.84	32.43	0.48	5.31	10.10	3.45
A	7.69	3.15	0.03	35.44	1.38	2.24	0.15	2.81	32.52	0.48	5.36	10.20	3.45
A	7.64	3.16	0.03	35.63	1.39	2.24	0.15	2.86	32.56	0.48	5.44	10.00	3.47
A	7.41	3.17	0.03	35.50	1.37	2.20	0.15	2.84	32.50	0.47	5.25	10.10	3.47
A	7.67	3.16	0.03	35.78	1.39	2.26	0.15	2.86	32.74	0.49	5.53	10.30	3.43
A	7.58	3.15	0.03	35.53	1.36	2.26	0.15	2.86	32.67	0.48	5.49	10.20	3.42
A	7.63	3.17	0.04	35.50	1.39	2.25	0.15	2.86	32.86	0.49	5.32	10.30	3.46
B													3.32
B													3.38
B													3.40
B													3.53
B													3.48
B													3.22
B													3.36
B													3.30
C	8.01	3.11	0.04	36.20	1.41	2.10	0.15	1.95	32.40	0.48	6.43	14.10	
C	7.94	3.10	0.03	36.10	1.39	2.09	0.15	1.94	32.20	0.48	6.54	14.10	
C	7.97	3.11	0.03	36.20	1.40	2.09	0.15	1.95	32.30	0.47	6.57	14.10	
C	7.98	3.11	0.04	36.20	1.40	2.09	0.15	1.97	32.30	0.48	6.52	14.00	
C	7.99	3.11	0.03	36.20	1.41	2.10	0.15	1.95	32.30	0.48	6.64	14.00	
C	7.94	3.10	0.04	36.00	1.40	2.08	0.15	1.95	32.20	0.48	6.60	14.20	
C	7.94	3.11	0.04	36.10	1.41	2.09	0.14	1.95	32.10	0.49	6.68	14.10	
C	7.97	3.08	0.03	35.80	1.40	2.08	0.15	1.95	32.60	0.49	6.63	14.10	
D													14.60
D													14.50
D													14.50
D													14.60
D													14.50
D													14.50
D													14.60
D													14.40
E													14.85
E													3.33
E													14.80
E													3.32
E													14.85
E													3.32
E													14.80
E													3.35
E													14.85
E													3.34
E													14.85
E													3.33
E													14.95
E													3.35
E													14.90
E													3.32
G	8.04	3.07		35.70	1.37	2.06	0.14	1.91	32.50	0.46	7.17	15.20	3.43
G	8.30	3.16	0.03	36.30	1.42	2.11	0.14	1.95	32.70	0.48	7.19	15.30	3.44
G	8.17	3.11	0.03	36.40	1.40	2.08	0.15	1.90	32.70	0.48	7.21	15.40	3.41
G	8.32	3.14	0.04	36.30	1.44	2.11	0.15	2.15	32.60	0.47	7.22	15.30	3.43
G	8.18	3.12	0.03	35.60	1.41	2.07	0.14	1.92	32.40	0.48	7.18	15.00	3.43
G	8.00	3.08	0.04	35.30	1.37	2.02	0.14	1.93	32.50	0.48	7.21	15.00	3.42
G	8.06	3.07	0.03	35.30	1.35	2.04	0.14	1.91	32.50	0.46	7.24	15.00	3.43
G	8.14	3.14	0.02	36.00	1.39	2.07	0.14	1.96	32.60	0.47	7.22	14.60	3.39
H													15.02
H													15.01
H													15.14
H													15.19
H													15.22
H													15.22
H													15.15
H													15.08
J													15.60
J													15.60
J													15.70
J													15.70
J													15.80
J													15.80
J													15.50
J													15.50

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Assay data (cont) – Major Oxides

Lab Code	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
K												13.80	
K												13.80	
K												13.50	
K												13.60	
K												13.80	
K												13.50	
K												13.70	
K												13.50	
L												14.70	
L												14.60	
L												14.40	
L												14.40	
L												14.40	
L												14.80	
L												14.70	
L												14.70	
M	8.18	3.12	0.03	35.91	1.39	2.13	0.14		32.54	0.48	6.86	14.90	3.54
M	8.19	3.11	0.03	36.06	1.39	2.12	0.14		32.56	0.48	6.85	14.90	3.54
M	8.21	3.12	0.03	35.95	1.41	2.13	0.14		32.60	0.49	6.87	14.90	3.51
M	8.20	3.12	0.03	35.96	1.40	2.13	0.14		32.55	0.48	6.89	14.80	3.49
M	8.22	3.12	0.03	35.98	1.40	2.13	0.14		32.64	0.49	6.85	14.70	3.52
M	8.21	3.12	0.03	35.94	1.40	2.12	0.14		32.62	0.49	6.87	14.70	3.55
M	8.20	3.12	0.03	35.98	1.40	2.13	0.15		32.59	0.48	6.87	14.80	3.51
M	8.22	3.11	0.03	35.97	1.39	2.12	0.14		32.55	0.48	6.85	14.60	3.50
O	8.21	3.06	0.05	36.49	1.44	1.90	0.15	1.65	32.76		7.00		
O	8.16	3.07	0.04	36.42	1.42	1.89	0.15	1.69	32.85		6.98		
O	8.31	3.08	0.04	36.27	1.45	1.90	0.15	1.66	32.66		6.96		
O	8.20	3.08	0.04	36.45	1.42	1.91	0.15	1.74	32.77		6.95		
O	8.22	3.08	0.04	36.24	1.41	1.88	0.15	1.64	32.50		6.97		
O	8.24	3.06	0.05	36.43	1.43	1.90	0.15	1.69	32.69		7.01		
O	8.25	3.08	0.04	36.42	1.44	1.87	0.15	1.71	32.72		6.96		
O	8.25	3.06	0.05	36.41	1.43	1.87	0.15	1.66	32.65		6.95		
Q	7.88	3.11	0.02	36.71	1.41	2.03	0.15	2.01	32.55	0.47	6.40		3.55
Q	7.89	3.09	0.02	36.69	1.39	2.03	0.15	2.01	32.61	0.46	6.42		3.42
Q	7.86	3.10	0.02	36.75	1.42	2.03	0.15	2.00	32.67	0.46	6.40		3.55
Q	7.91	3.09	0.02	36.77	1.41	2.03	0.15	1.99	32.55	0.46	6.32		3.41
Q	7.88	3.11	0.02	36.94	1.42	2.05	0.15	2.02	32.52	0.46	6.29		3.42
Q	7.86	3.08	0.02	36.76	1.41	2.04	0.15	2.03	32.75	0.47	6.25		3.41
Q	7.89	3.10	0.02	36.71	1.40	2.03	0.15	2.01	32.68	0.47	6.50		3.41
Q	7.90	3.10	0.02	36.78	1.41	2.04	0.15	2.03	32.69	0.47	6.53		3.41
S													3.50
S													3.49
S													3.48
S													3.46
S													3.45
S													3.45
S													3.45
S													3.41
T	8.07	3.09	0.04	35.70	1.40	2.06	0.15	1.85	32.30	0.48	6.35		
T	8.13	3.09	0.03	35.50	1.38	2.05	0.15	1.82	32.20	0.49	6.57		
T	8.08	3.09	0.03	35.60	1.39	2.07	0.15	1.83	32.30	0.47	6.17		
T	8.06	3.09	0.03	35.60	1.40	2.08	0.15	1.82	32.30	0.47	6.27		
T	8.11	3.09	0.03	35.50	1.38	2.06	0.15	1.91	32.20	0.49	6.72		
T	8.08	3.09	0.03	35.60	1.38	2.07	0.15	1.80	32.30	0.47	6.31		
T	8.06	3.08	0.03	35.50	1.38	2.06	0.14	1.82	32.20	0.48	6.07		
T	8.11	3.08	0.04	35.60	1.39	2.06	0.15	1.81	32.30	0.47	6.04		
U	8.12	3.06	0.04	35.10	1.38	2.05	0.14	2.04	32.20	0.47			
U	8.23	3.10	0.04	35.60	1.40	2.09	0.14	2.07	32.70	0.48			
U	8.15	3.05	0.04	34.30	1.38	2.06	0.15	2.03	32.30	0.46			
U	8.38	3.13	0.03	35.80	1.42	2.11	0.14	2.09	33.30	0.48			
U	8.08	3.05	0.04	35.10	1.38	2.05	0.14	2.03	32.30	0.47			
U	8.41	3.17	0.03	36.60	1.44	2.14	0.15	2.13	33.50	0.49			
U	8.24	3.10	0.04	35.30	1.40	2.08	0.14	2.08	32.90	0.47			
U	8.22	3.07	0.04	35.20	1.40	2.07	0.14	2.07	32.70	0.47			

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.

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Analyte	Method	Unit	S ¹	σ _L ²	Sw ³	CSU ⁴
Pt	Pb Coll	g/t	0.038	0.035	0.017	0.013
Pd	Pb Coll	g/t	0.032	0.027	0.013	0.009
Au	Pb Coll	g/t	0.005	0.003	0.003	0.001
Co	M/ICP	ppm	45.189	33.676	17.041	9.491
Co	P	ppm	95.331	106.307	17.269	40.248
Cu	M/ICP	ppm	980	663	537	191
Cu	P	ppm	800	515	510	158
Ni	M/ICP	ppm	988	681	496	195
Ni	P	ppm	879	633	439	188
Al ₂ O ₃	XRF	%	0.137	0.139	0.061	0.053
CaO	XRF	%	0.027	0.021	0.018	0.008
Cr ₂ O ₃	XRF	%	0.007	0.005	0.004	0.002
Fe ₂ O ₃	XRF	%	0.483	0.432	0.255	0.156
K ₂ O	XRF	%	0.019	0.014	0.014	0.005
LOI		%	0.329	0.387	0.102	0.159
MgO	XRF	%	0.083	0.084	0.019	0.030
MnO	XRF	%	0.004	0.003	0.003	0.001
Na ₂ O	XRF	%	0.130	0.152	0.042	0.062
SiO ₂	XRF	%	0.201	0.144	0.147	0.054
TiO ₂	XRF	%	0.009	0.006	0.007	0.003
S Comb	LECO	%	0.528	0.497	0.129	0.166
SG	pyc		0.068	0.061	0.043	0.024

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.

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 ISO guidelines.

13. Uncertified 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: AMIS0283 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.

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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 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.

29 June 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.)

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Appendix – uncertified trace element statistics

Analyte	Method	Unit	Mean	RSD%	n
Ag	M/ICP	ppm	14.3	5.41	87
Al	M/ICP	%	4.18	6.08	90
As	M/ICP	ppm	885	4.09	88
Ba	M/ICP	ppm	204	61.6	73
Be	M/ICP	ppm	0.85	18.3	67
Bi	M/ICP	ppm	39.8	19.1	80
Ca	M/ICP	%	2.17	3.85	90
Cd	M/ICP	ppm	4.14	52.6	87
Ce	M/ICP	ppm	63.4	9.49	38
Cr	M/ICP	ppm	168	13.0	90
Cs	M/ICP	ppm	0.93	23.2	32
Dy	M/ICP	ppm	2.36	7.42	24
Er	M/ICP	ppm	1.28	13.8	24
Eu	M/ICP	ppm	1.00	10.2	24
Fe	M/ICP	%	25.3	2.45	75
Ga	M/ICP	ppm	11.1	14.3	45
Gd	M/ICP	ppm	3.49	7.09	24
Ge	M/ICP	ppm	1.22	34.7	16
Hf	M/ICP	ppm	1.34	11.6	37
Ho	M/ICP	ppm	0.44	7.69	24
In	M/ICP	ppm	0.90	14.7	40
K	M/ICP	%	1.15	6.18	93
La	M/ICP	ppm	31.7	7.26	66
Li	M/ICP	ppm	8.23	11.1	80
Lu	M/ICP	ppm	0.13	18.3	32
Mg	M/ICP	%	1.19	5.72	91
Mn	M/ICP	ppm	1084	3.53	88
Mo	M/ICP	ppm	2.06	56.0	48
Na	M/ICP	%	1.47	7.20	90
Nb	M/ICP	ppm	4.44	17.1	47
Nd	M/ICP	ppm	26.5	7.52	24
P	M/ICP	ppm	653	23.0	72
Pb	M/ICP	ppm	198	6.22	107
Pr	M/ICP	ppm	7.60	8.15	24
Rb	M/ICP	ppm	42.9	10.9	41
Re	M/ICP	ppm	0.05	26.8	16
S	M/ICP	%	13.6	8.67	32
Sb	M/ICP	ppm	38.5	20.7	70
Sc	M/ICP	ppm	9.91	28.4	88
Se	M/ICP	ppm	32.4	21.2	40
Si	M/ICP	%	15.4	0.59	8
Sm	M/ICP	ppm	4.44	9.95	24
Sn	M/ICP	ppm	42.3	13.7	76
Sr	M/ICP	ppm	250	10.8	96
Ta	M/ICP	ppm	0.25	40.3	36
Tb	M/ICP	ppm	0.41	16.0	32
Te	M/ICP	ppm	5.09	19.8	39
Th	M/ICP	ppm	6.02	4.23	38
Ti	M/ICP	%	0.28	4.56	67
Tl	M/ICP	ppm	1.14	3.93	37
Tm	M/ICP	ppm	0.18	11.1	24
U	M/ICP	ppm	1.24	6.35	38
V	M/ICP	ppm	93.5	5.30	90
W	M/ICP	ppm	1.43	23.1	40
Y	M/ICP	ppm	11.0	6.66	79
Yb	M/ICP	ppm	0.99	7.21	30
Zn	M/ICP	ppm	450	4.78	100
Zr	M/ICP	ppm	40.3	26.7	77

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