



African Mineral Standards

MATRIX REFERENCE MATERIALS

Tel: +27 (0) 11 923 0800 Fax: +27 (0) 11 392 4715 web: www.amis.co.za
11 Gewel Street (off Hulley Road), D1 Isando Business Park, Kempton Park, 1609
P.O. Box 856, Isando, 1600, Gauteng, South Africa, a division of the Set Point Group

AMIS0256

Certified Reference Material **Platinum (PGM), Merensky Ore** **Bushveld Complex, South Africa**

Certificate of Analysis

Recommended Concentrations and Limits¹ ***(at two Standard Deviations)***

Certified Concentrations²

Pt Pb Collection	4.86	±	0.22	g/t
Pd Pb Collection	2.50	±	0.12	g/t
Au Pb Collection	0.34	±	0.04	g/t
Pt NIS	4.81	±	0.32	g/t
Pd NIS	2.45	±	0.20	g/t
Au NIS	0.33	±	0.04	g/t
Cu M/ICP	1252	±	69	ppm
Cu P	1266	±	61	ppm
Ni M/ICP	2913	±	182	ppm
Ni P	2381	±	229	ppm
Specific Gravity	3.16	±	0.16	

Provisional Concentrations

Ir NiS	0.13	±	0.02	g/t
Rh	0.39	±	0.05	g/t
Ru NiS	0.70	±	0.09	g/t
Co M/ICP	125	±	18	ppm
Co P	65	±	9	ppm

4E (Pt, Pd, Au (all NiS) & Rh) = 7.98 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.

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

Certified Concentrations

Al ₂ O ₃	10.11	±	0.18	%
CaO	5.88	±	0.12	%
Cr ₂ O ₃	2.00	±	0.08	%
Fe ₂ O ₃	12.16	±	0.18	%
K ₂ O	0.15	±	0.01	%
MgO	18.87	±	0.32	%
MnO	0.17	±	0.01	%
Na ₂ O	0.78	±	0.04	%
SiO ₂	47.84	±	0.44	%
TiO ₂	0.26	±	0.02	%
S LECO	0.63	±	0.04	%

Informational Concentration

LOI 1.41 %

1. Intended Use: AMIS0256 is a certified reference material which may be used to demonstrate the validity of measurement results of a single analysis of PGE, Cu and Ni ores; derived from the Merensky Reef, or from other mafic rocks 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 Section 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: AMIS0256 was made from material supplied by Anglo Platinum, using Merensky Reef underground sample material from the Western Limb of the Bushveld complex.

3. Mineral and Chemical Composition: The Merensky Reef comprises components of feldspathic pyroxenite, pyroxenite and anorthosite. Peak PGE values are associated with a thin chromitite stringer. Mineralization in this Merensky Reef comprises 2-5% disseminated or net textured magmatic sulphides, predominantly pyrrhotite, pentlandite, chalcopyrite and pyrite. The PGE's occur as micron-sized satellite grains around but rarely within the sulphides.

Major element chemistry data from 13 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 very fine powder. It is colored a Medium Light Grey (Corstor 10Y 6/2).

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

9. Method of Certification: Twenty nine laboratories were each given eight randomly selected packages of sample. Twenty three 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 23 out of 29 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 Johannesburg SA
3. Anglo Research (Crown Campus)
4. Anglo Research (Germiston Campus)
5. Genalysis Laboratory Services (South Africa) Pty
6. Genalysis Laboratory Services W Australia
7. Inspectorate Metals & Minerals
8. Intertek Utama Services (Indonesia)
9. Northam Platinum LTD
10. Performance Laboratories SA (Randfontein)
11. Rappa Research Laboratory SA
12. Set Point Laboratories (Isando) SA
13. SGS Australia Pty Ltd (Newburn) WA
14. SGS Chelopech (Bulgaria)
15. SGS Geosol Laboratories Ltda (Brazil)
16. SGS Mineral Services Callao (Peru)
17. SGS Mineral Services Lakefield (Canada)
18. SGS South Africa (Pty) Ltd - Booyens JHB
19. SGS Toronto (Canada)
20. SGS Townsville (Australia)
21. Tati Nickel Mine Laboratory (Botswana)
22. Ultra Trace (Pty) Ltd WA
23. Zimplats Head Office Assay Laboratory

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

Economic element data

Lab Code	Pt PbColl g/t	Pd PbColl g/t	Au PbColl g/t	Pt NIS g/t	Pd NIS g/t	Au NIS g/t	Ir NIS g/t	Rh NIS g/t	Ru NIS 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	4.98	2.51	0.32	4.90	2.50	0.33	0.15	0.38	0.69	130	70.00		1310	1280		3100	2430	
A	4.90	2.48	0.37	4.95	2.54	0.33	0.15	0.37	0.69	135	73.00		1310	1310		3150	2410	
A	4.87	2.42	0.34	4.87	2.46	0.33	0.14	0.37	0.67	135	68.00		1320	1260		3130	2410	
A	4.69	2.48	0.32	4.86	2.41	0.33	0.14	0.36	0.67	130	69.00		1300	1310		3080	2340	
A	4.70	2.44	0.36	4.80	2.51	0.33	0.14	0.36	0.67	130	66.00		1320	1240		3130	2350	
A	4.87	2.50	0.34	4.84	2.39	0.33	0.14	0.36	0.67	135	68.00		1310	1230		3130	2350	
A	4.82	2.46	0.33	4.90	2.65	0.35	0.15	0.38	0.69	130	70.00		1300	1260		3080	2360	
A	4.85	2.49	0.33	4.79	2.48	0.33	0.14	0.36	0.67	140	73.00		1290	1290		3060	2450	
C													1100			2800		
C													1200			2900		
C													1200			2700		
C													1200			2800		
C													1300			2900		
C													1200			2900		
C													1200			2800		
C													1200			2900		
D				4.03	2.28	0.32	0.15	0.31	0.45									
D				4.02	2.24	0.30	0.15	0.31	0.51									
D				4.07	2.20	0.30	0.15	0.30	0.47									
D				4.11	2.30	0.31	0.15	0.32	0.53									
D				3.87	2.18	0.27	0.14	0.30	0.52									
D				4.06	2.30	0.32	0.15	0.31	0.54									
D				4.09	2.31	0.32	0.15	0.31	0.51									
D				4.00	2.32	0.29	0.15	0.31	0.52									
E	4.81	2.54	0.36							136	71.00		1270	1240		2660	2440	
E	4.96	2.55	0.34							135	75.00		1300	1240		2680	2390	
E	4.99	2.54	0.36							122	74.00		1310	1240		2680	2450	
E	5.12	2.56	0.34							121	65.00		1300	1220		2650	2400	
E	4.93	2.53	0.36							116	64.00		1240	1240		2550	2390	
E	4.86	2.49	0.35							128	67.00		1280	1250		2690	2440	
E	4.98	2.52	0.35							134	70.00		1290	1250		2670	2460	
E	4.86	2.49	0.33							127	72.00		1290	1280		2630	2490	
G	4.74	2.55	0.32							128	62.00		1260	1300		2950	2310	
G	4.74	2.52	0.34							124	63.00		1210	1230		2820	2250	
G	4.65	2.56	0.33							125	62.00		1220	1230		2810	2320	
G	4.71	2.55	0.33							123	65.00		1200	1250		2850	2280	
G	4.73	2.53	0.33							125	64.00		1230	1220		2850	2270	
G	5.04	2.59	0.34							124	64.00		1200	1250		2840	2250	
G	4.62	2.53	0.34							129	67.00		1200	1290		2940	2400	
G	4.96	2.59	0.39							125	64.00		1230	1260		2930	2280	
I	4.87	2.29	0.32							115	68.00		1248	1331		2977	2508	
I	5.16	2.36	0.34							111	66.00		1239	1268		2938	2423	
I	5.08	2.37	0.35							115	64.00		1231	1256		2893	2405	
I	4.93	2.44	0.34							117	67.00		1235	1297		2934	2486	
I	4.87	2.29	0.33							114	64.00		1228	1281		2876	2442	
I	4.62	2.40	0.31							117	63.00		1244	1253		2955	2380	
I	5.10	2.45	0.35							116	65.00		1230	1238		2898	2342	
I	5.00	2.39	0.33							116	66.00		1260	1244		2956	2413	

Economic element data (cont)

Lab Code	Pt PbColl g/t	Pd PbColl g/t	Au PbColl g/t	Pt NIS g/t	Pd NIS g/t	Au NIS g/t	Ir NIS g/t	Rh NIS g/t	Ru NIS 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
ZB	4.91	2.54	0.35	4.90	2.49	0.34	0.19	0.40	0.71	123	66.00	132	1330	1340	1251	2820	2410	2957
ZB	4.87	2.55	0.35	4.96	2.54	0.34	0.18	0.41	0.73	126	65.00	125	1250	1310	1255	2770	2340	2975
ZB	4.93	2.53	0.39	4.91	2.55	0.35	0.19	0.42	0.74	122	62.00	123	1250	1280	1255	2810	2360	2964
ZB	4.94	2.54	0.37	4.90	2.52	0.36	0.20	0.42	0.73	116	65.00	131	1210	1320	1257	2890	2550	2979
ZB	4.93	2.51	0.39	4.90	2.49	0.38	0.20	0.42	0.72	127	65.00	130	1260	1330	1248	2820	2420	2952
ZB	4.98	2.56	0.36	4.91	2.59	0.35	0.18	0.45	0.72	123	65.00	128	1200	1330	1250	2860	2470	2954
ZB	4.93	2.56	0.35	4.95	2.54	0.38	0.18	0.43	0.73	123	66.00	122	1290	1360	1258	2830	2440	2983
ZB	4.91	2.58	0.38	4.93	2.53	0.36	0.19	0.44	0.75	117	60.00	123	1310	1320	1245	2770	2530	2939
ZC	4.95	2.45	0.30															
ZC	5.03	2.47	0.29															
ZC	4.88	2.41	0.29															
ZC	4.95	2.46	0.31															
ZC	4.82	2.46	0.28															
ZC	4.85	2.44	0.29															
ZC	4.74	2.43	0.31															
ZC	4.65	2.46	0.32															

Major element data

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 pycnometer
A	10.14	5.90	1.99	12.10	0.15	18.79	0.18	0.78	48.04	0.26	1.27		3.19
A	10.16	5.89	1.98	12.07	0.15	18.77	0.18	0.77	48.01	0.26	1.28		3.20
A	10.15	5.87	1.98	12.04	0.15	18.73	0.18	0.77	47.89	0.26	1.26		3.19
A	10.15	5.87	1.97	12.05	0.15	18.74	0.18	0.78	47.99	0.26	1.29		3.17
A	10.11	5.86	1.97	12.02	0.15	18.70	0.18	0.77	47.89	0.26	1.29		3.19
A	10.15	5.90	1.98	12.08	0.15	18.80	0.18	0.78	47.96	0.27	1.26		3.19
A	10.12	5.87	1.97	12.04	0.15	18.75	0.18	0.78	47.94	0.26	1.30		3.20
A	10.11	5.89	1.99	12.06	0.15	18.81	0.18	0.78	48.02	0.26	1.29		3.20
E													3.19
E													3.18
E													3.14
E													3.19
E													3.21
E													3.17
E													3.15
E													3.21
I	10.10	5.81	1.95	12.10	0.15	18.70	0.17	0.79	47.90	0.26	1.16	0.60	
I	10.10	5.79	1.95	12.10	0.15	18.70	0.17	0.79	47.90	0.26	1.17	0.59	
I	10.10	5.79	1.98	12.10	0.15	18.70	0.17	0.79	48.00	0.26	1.15	0.56	
I	10.10	5.80	1.97	12.10	0.15	18.70	0.17	0.79	47.90	0.26	1.21	0.63	
I	10.10	5.80	1.98	12.00	0.15	18.80	0.17	0.79	47.90	0.26	1.16	0.61	
I	10.00	5.80	1.95	12.10	0.15	18.80	0.17	0.81	47.90	0.25	1.18	0.62	
I	10.10	5.79	1.96	12.10	0.15	18.70	0.17	0.81	47.90	0.26	1.20	0.64	
I	10.00	5.81	1.95	12.10	0.15	18.80	0.17	0.80	48.00	0.26	1.18	0.56	
J													3.14
J													3.13
J													3.13
J													3.14
J													3.13
J													3.14
J													3.13
J													3.13
L	10.00	5.90	1.98	12.00	0.14	18.70	0.17	0.77	47.50	0.26	1.75	0.61	
L	10.10	5.93	1.99	12.00	0.15	18.70	0.17	0.78	47.60	0.25	1.70	0.62	
L	10.00	5.94	1.99	12.00	0.16	18.70	0.17	0.77	47.60	0.25	1.78	0.61	
L	10.10	5.97	1.99	12.10	0.15	18.80	0.18	0.77	47.90	0.26	1.72	0.61	
L	10.00	5.91	1.98	12.00	0.14	18.70	0.17	0.77	47.50	0.26	1.67	0.61	
L	9.99	5.95	1.98	12.10	0.15	18.80	0.17	0.78	47.70	0.25	1.67	0.58	
L	10.10	5.92	1.98	12.00	0.15	18.80	0.17	0.76	47.50	0.26	1.64	0.60	
L	10.00	5.90	1.98	12.00	0.14	18.70	0.17	0.77	47.50	0.25	1.69	0.58	
M	10.19	5.80	2.07	12.20	0.15	19.10	0.17		47.79	0.25	1.21		3.11
M	10.24	5.84	2.07	12.24	0.16	19.30	0.17		48.00	0.25	1.23		3.10
M	10.18	5.81	2.06	12.22	0.15	19.10	0.17		47.90	0.25	1.25		3.12
M	10.22	5.83	2.07	12.18	0.15	19.20	0.17		47.97	0.25	1.26		3.11
M	10.18	5.84	2.08	12.21	0.15	19.20	0.17		47.90	0.25	1.23		3.09
M	10.20	5.82	2.07	12.18	0.15	19.10	0.17		47.87	0.25	1.26		3.10
M	10.21	5.82	2.08	12.21	0.15	19.10	0.17		47.84	0.25	1.22		3.09
M	10.21	5.81	2.07	12.17	0.16	19.20	0.17		47.91	0.25	1.24		3.11
N	10.00	5.91	2.04	12.30	0.15	18.90	0.18	0.82	48.10	0.25	1.33		
N	10.00	5.89	2.01	12.30	0.16	19.10	0.17	0.77	48.30	0.25	1.30		
N	10.10	5.98	2.05	12.50	0.16	19.30	0.18	0.83	48.80	0.26	1.26		
N	10.00	5.86	2.02	12.20	0.15	18.90	0.17	0.76	48.20	0.25	1.30		
N	9.97	5.89	2.03	12.30	0.15	18.90	0.18	0.78	48.30	0.26	1.24		
N	10.10	5.90	2.02	12.30	0.15	19.20	0.18	0.80	48.60	0.26	1.22		
N	10.10	5.93	2.01	12.40	0.16	19.00	0.18	0.82	48.40	0.25	1.25		
N	10.00	5.88	2.02	12.30	0.15	19.00	0.18	0.79	48.50	0.25	1.20		

Major element data (cont)

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 pycnometer
O	9.77	6.30	2.08	12.81		19.16			47.74			0.61	
O	9.86	6.40	2.09	12.92		19.25			48.36			0.63	
O	9.84	6.34	2.04	12.77		19.12			47.93			0.63	
O	9.75	6.21	2.05	12.67		18.88			47.77			0.62	
O	9.75	6.31	2.04	12.73		19.04			47.88			0.62	
O	9.72	6.33	2.05	12.76		19.08			47.96			0.62	
O	9.75	6.33	2.05	12.80		19.14			48.01			0.62	
O	9.77	6.34	2.05	12.81		19.16			48.12			0.62	
Q	9.28	6.03		11.66		19.93	0.20	0.91	47.50	0.24	1.59	0.61	
Q	9.38	6.02		11.66		19.91	0.22	0.95	47.35	0.24	1.59	0.62	
Q	9.24	5.97		11.63		19.85	0.21	0.95	47.54	0.24	1.61	0.61	
Q	9.25	5.95		11.62		19.90	0.19	0.95	47.24	0.24	1.58	0.62	
Q	9.40	5.98		11.66		20.10	0.19	0.93	47.43	0.24	1.60	0.61	
Q	9.22	5.94		11.60		19.85	0.19	0.94	47.22	0.24	1.61	0.66	
Q	9.28	5.96		11.57		19.95	0.19	0.91	47.37	0.24	1.55	0.62	
Q	9.37	5.98		11.76		19.82	0.20	0.91	47.45	0.24	1.58	0.62	
S												0.65	
S												0.66	
S												0.67	
S												0.65	
S												0.65	
S												0.64	
S												0.65	
S												0.65	
U												0.64	3.02
U												0.64	3.08
U												0.65	3.03
U												0.64	3.09
U												0.64	3.02
U												0.63	3.06
U												0.64	3.03
U												0.64	3.05
W	10.18	5.85	1.99	12.19	0.15	18.77	0.18	0.77	48.04	0.26	1.24	0.64	3.18
W	10.17	5.83	1.99	12.15	0.15	18.69	0.17	0.80	47.86	0.26	1.25	0.64	3.08
W	10.17	5.85	1.99	12.19	0.15	18.78	0.18	0.79	47.96	0.26	1.21	0.64	3.08
W	10.18	5.85	2.00	12.12	0.15	18.71	0.18	0.80	47.90	0.26	1.23	0.63	3.17
W	10.20	5.85	1.99	12.22	0.15	18.74	0.18	0.80	48.01	0.26	1.22	0.64	3.09
W	10.13	5.87	2.00	12.23	0.15	18.76	0.18	0.81	48.02	0.26	1.22	0.63	3.06
W	10.16	5.86	1.98	12.18	0.15	18.70	0.17	0.79	47.90	0.26	1.23	0.64	3.04
W	10.17	5.84	1.98	12.16	0.15	18.72	0.17	0.81	47.88	0.26	1.21	0.64	2.99
X	9.94	5.97		12.10	0.16	19.41	0.17	0.79					3.32
X	9.81	5.90		11.92	0.16	19.14	0.17	0.78					3.34
X	9.71	5.79		11.75	0.16	18.95	0.17	0.77					3.36
X	9.97	5.93		12.04	0.16	19.37	0.17	0.79					3.34
X	10.07	5.98		12.30	0.16	19.64	0.17	0.80					3.35
X	9.92	5.98		12.17	0.16	19.38	0.17	0.79					3.29
X	10.04	5.94		12.32	0.16	19.65	0.18	0.80					3.31
X	9.89	5.99		12.15	0.16	19.41	0.17	0.79					3.34
Y													3.30
Y													3.30
Y													3.32
Y													3.24
Y													3.28
Y													3.30
Y													3.29
Y													3.31
Z	10.06	5.78	1.97	12.21	0.15	18.96	0.17	0.76	47.57	0.26	1.20		
Z	10.08	5.80	1.99	12.25	0.16	19.01	0.17	0.78	47.71	0.26	1.20		
Z	10.07	5.80	1.96	12.23	0.16	18.99	0.17	0.78	47.63	0.26	1.30		
Z	10.04	5.80	1.99	12.25	0.16	18.97	0.17	0.79	47.62	0.27	1.30		
Z	10.09	5.80	1.94	12.25	0.15	18.99	0.18	0.78	47.70	0.25	1.30		
Z	10.06	5.79	1.96	12.24	0.15	18.95	0.17	0.76	47.59	0.25	1.30		
Z	10.05	5.80	1.96	12.24	0.15	18.97	0.18	0.77	47.62	0.26	1.20		
Z	10.08	5.81	1.98	12.27	0.15	19.01	0.18	0.79	47.73	0.25	1.30		
ZA	10.00	5.90	1.89	12.22	0.13	18.70	0.20	0.86	46.90	0.27	1.64	0.63	3.13
ZA	10.20	5.92	1.91	12.35	0.13	18.90	0.21	0.88	47.70	0.27	1.56	0.64	3.13
ZA													3.13
ZA	10.10	5.95	1.90	12.26	0.13	18.90	0.20	0.88	47.30	0.27	1.66	0.64	3.13
ZA	10.10	5.92	1.89	12.24	0.13	18.70	0.20	0.88	46.90	0.27	1.66	0.63	3.13
ZA	10.00	5.92	1.88	12.12	0.13	18.60	0.20	0.90	46.60	0.27	1.65	0.63	3.13
ZA	10.20	5.93	1.89	12.21	0.14	18.90	0.20	0.88	47.00	0.27	1.63	0.63	3.13
ZA	10.00	5.93	1.89	12.18	0.13	18.70	0.20	0.87	46.90	0.28	1.64	0.63	3.13
ZB	10.30	5.91	2.02	12.20	0.18	18.80	0.17	0.72	48.10	0.27	1.78	0.60	3.13
ZB	10.30	5.92	2.01	12.20	0.17	18.80	0.18	0.74	48.30	0.27	1.79	0.61	3.15
ZB	10.30	5.94	2.03	12.20	0.17	18.80	0.17	0.75	48.40	0.27	1.79	0.61	3.14
ZB	10.20	5.90	2.01	12.20	0.17	18.80	0.17	0.75	48.00	0.27	1.83	0.61	3.13
ZB	10.30	5.91	2.03	12.20	0.18	18.80	0.17	0.73	48.20	0.27	1.72	0.60	3.13
ZB	10.20	5.93	1.99	12.20	0.17	18.80	0.18	0.74	48.20	0.26	1.70	0.61	3.14
ZB	10.20	5.88	1.99	12.10	0.17	18.80	0.17	0.75	48.00	0.27	1.74	0.61	3.14
ZB	10.20	5.95	2.00	12.20	0.18	18.90	0.17	0.74	48.30	0.27	1.70	0.63	3.16

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 ISO guidelines.

Analyte	Method	unit	S ¹	σ_L ²	Sw ³	CSU ⁴
Pt	PbColl	g/t	0.114	0.039	0.102	0.016
Pd	PbColl	g/t	0.064	0.047	0.039	0.015
Au	PbColl	g/t	0.018	0.009	0.012	0.003
Pt	NIS	g/t	0.160	0.164	0.110	0.068
Pd	NIS	g/t	0.095	0.095	0.050	0.036
Au	NIS	g/t	0.018	0.015	0.009	0.006
Ir	NiS	g/t	0.011	0.013	0.004	0.005
Rh	NiS	g/t	0.024	0.025	0.011	0.010
Ru	NiS	g/t	0.047	0.050	0.020	0.021
Co	M/ICP	ppm	8.941	6.746	3.982	1.983
Co	P	ppm	4.264	3.939	1.770	1.259
Cu	M/ICP	ppm	34.649	25.625	17.274	7.580
Cu	P	ppm	30.727	12.245	23.269	4.815
Ni	M/ICP	ppm	101.713	89.379	46.164	28.658
Ni	P	ppm	114.249	100.534	37.262	30.538
Al ₂ O ₃	XRF	%	0.093	0.075	0.041	0.027
CaO	XRF	%	0.061	0.056	0.029	0.019
Cr ₂ O ₃	XRF	%	0.038	0.040	0.012	0.014
Fe ₂ O ₃	XRF	%	0.092	0.087	0.047	0.031
K ₂ O	XRF	%	0.004	0.002	0.003	0.001
LOI		%	0.219	0.205	0.032	0.073
MgO	XRF	%	0.163	0.166	0.064	0.059
MnO	XRF	%	0.005	0.004	0.003	0.002
Na ₂ O	XRF	%	0.019	0.011	0.012	0.004
SiO ₂	XRF	%	0.221	0.189	0.087	0.068
TiO ₂	XRF	%	0.008	0.006	0.004	0.002
S	Comb/LECO	%	0.016	0.014	0.011	0.006
SG	pyc		0.084	0.093	0.029	0.033

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. 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: AMIS0256 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. 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.

12 March 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
Ag	M/ICP	ppm	0.51	0.06	5.60	39
Al	M/ICP	%	5.37	0.39	3.62	84
As	M/ICP	ppm	4.50	7.02	78.03	43
Ba	M/ICP	ppm	50.49	9.67	9.58	95
Be	M/ICP	ppm	0.14	0.08	30.51	46
Bi	M/ICP	ppm	0.52	0.11	10.69	42
Ca	M/ICP	%	4.10	0.29	3.58	86
Cd	M/ICP	ppm	0.20	0.12	29.15	31
Ce	M/ICP	ppm	5.95	0.69	5.80	40
Cr	M/ICP	ppm	9022	7450	41.29	71
Cs	M/ICP	ppm	0.20	0.03	7.35	37
Dy	M/ICP	ppm	0.73	0.07	4.75	23
Er	M/ICP	ppm	0.50	0.03	2.90	21
Eu	M/ICP	ppm	0.23	0.03	6.93	23
Fe	M/ICP	%	8.38	0.63	3.78	80
Ga	M/ICP	ppm	10.40	2.33	11.19	56
Gd	M/ICP	ppm	0.68	0.13	9.85	24
Ge	M/ICP	ppm	0.67	0.97	72.97	16
Hf	M/ICP	ppm	0.37	0.09	12.84	47
Ho	M/ICP	ppm	0.16	0.02	7.04	23
In	M/ICP	ppm	0.03	0.02	27.33	28
K	M/ICP	%	0.13	0.01	4.23	82
La	M/ICP	ppm	2.91	0.98	16.84	69
Li	M/ICP	ppm	4.01	0.51	6.32	68
Lu	M/ICP	ppm	0.08	0.01	5.19	40
Mg	M/ICP	%	11.12	1.03	4.63	87
Mn	M/ICP	ppm	1303	98.79	3.79	83
Mo	M/ICP	ppm	2.59	0.80	15.49	55
Na	M/ICP	%	0.59	0.04	3.80	76
Nb	M/ICP	ppm	0.77	0.39	24.91	54
Nd	M/ICP	ppm	2.49	0.80	16.16	24
P	M/ICP	ppm	93.19	24.78	13.30	69
Pb	M/ICP	ppm	8.37	4.20	25.10	76
Pr	M/ICP	ppm	0.67	0.13	9.91	24
Rb	M/ICP	ppm	5.57	1.69	15.14	45
Re	M/ICP	ppm	0.01	0.01	46.23	15
S	M/ICP	%	0.64	0.06	4.52	85
Sb	M/ICP	ppm	0.91	0.25	13.92	38
Sc	M/ICP	ppm	19.37	2.41	6.23	66
Se	M/ICP	ppm	3.31	0.90	13.53	32
Si	M/ICP	%	22.54	0.34	0.75	8
Sm	M/ICP	ppm	0.61	0.05	3.85	22
Sn	M/ICP	ppm	0.67	0.33	24.70	37
Sr	M/ICP	ppm	131	9.71	3.71	77
Ta	M/ICP	ppm	0.27	0.37	69.64	30
Tb	M/ICP	ppm	0.11	0.02	7.72	40
Te	M/ICP	ppm	0.92	0.29	15.62	47
Th	M/ICP	ppm	0.74	0.15	10.45	45
Ti	M/ICP	%	0.14	0.03	9.60	69
Tl	M/ICP	ppm	0.10	0.07	34.92	37
Tm	M/ICP	ppm	0.07	0.01	9.57	24
U	M/ICP	ppm	0.35	0.13	18.50	54
V	M/ICP	ppm	191	41.05	10.76	70
W	M/ICP	ppm	0.31	0.24	39.42	31
Y	M/ICP	ppm	4.27	0.48	5.65	69
Yb	M/ICP	ppm	0.53	0.08	7.41	40
Zn	M/ICP	ppm	105	16.13	7.68	61