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AMIS0164

Certified Reference Material

Platinum (PGM) Platreef Concentrate Bushveld Complex, South Africa

Certificate of Analysis

Recommended Concentrations and Limits¹. (at two Standard Deviations)

Certified Concentrations²

Pt Pb Collection	23.86	±	1.72	g/t
Pd Pb Collection	26.75	±	1.50	g/t
Au Pb Collection	2.97	±	0.16	g/t
Pt NIS	24.52	±	1.74	g/t
Pd NIS	27.32	±	3.06	g/t
Au NIS	2.89	±	0.18	g/t
Rh NiS	1.87	±	0.12	g/t
Co M/ICP	1126	±	65	ppm
Co P	1138	±	81	ppm
Cu M/ICP	2.55	±	0.170	%
Cu P	2.556	±	0.115	%
Ni M/ICP	3.555	±	0.167	%
Ni P	3.602	±	0.297	%
SiO ₂	31.31	±	1.40	%
Specific Gravity	3.34	±	0.10	

Provisional Concentrations

Ir NiS	0.48	±	0.14	g/t
Ru NiS	1.63	±	0.20	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.

$$4E = \text{Platinum} + \text{Palladium} + \text{Rhodium} + \text{Gold} = 56.68$$

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

Certified Concentrations

SiO₂ 31.31 ± 1.40 %

Uncertified major element statistics

Analyte	Method	Mean	2SD	RSD%	n
Co	XRF	1187	126	5.3	47
Cu	XRF	24211	2758	5.7	47
Al ₂ O ₃	XRF	4.4	0.3	3.9	51
CaO	XRF	6.5	0.3	2.2	47
Cr ₂ O ₃	XRF	0.1	0.0	5.4	46
Fe ₂ O ₃	XRF	25.3	1.1	2.2	48
K ₂ O	XRF	0.2	0.0	4.8	40
MgO	XRF	12.7	0.3	1.1	44
MnO	XRF	0.2	0.0	2.6	46
Na ₂ O	XRF	0.4	0.1	16.3	40
SiO ₂	XRF	31.3	1.4	2.2	55
TiO ₂	XRF	0.1	0.0	4.7	47
LOI		8.8	1.5	8.6	48
S	Combustion/LECO	11.6	0.7	3.2	24

1. Intended Use: AMIS0164 can be used to check analyses of PGE, Cu and Ni concentrate materials, derived from the Platreef or 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 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: AMIS0164 is a commissioned CRM made using Mogalakwena South Platreef (PPLP) concentrate material. This material has been supplied by Anglo Platinum Limited.

3. Mineral and Chemical Composition: The Platreef is a Pt/Pd/Ni/Cu ore from the northern limb of the Bushveld Complex. Mineralization comprises 2-5% disseminated or net textured magmatic sulphides, mainly pyrrhotite, pentlandite and chalcopyrite. The PGE's occur as micron-sized satellite grains around but rarely within the sulphides. Ore is finely ground and concentrated in a flotation process. Concentrate grades vary from 35 g/t to 110 g/t, and from this a PGM-rich nickel/copper matte is produced.

Major element chemistry data from 7 of the labs has been compiled in the table above. There was sufficient data received to certify the SiO₂ only. 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 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 <54µm. Wet sieve particle size analysis of random samples confirmed the material was 98.5% <54µm. 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. Co, Cu and Ni. Multi-acid total digestion, including HF, with ICP-OES finish.
4. Co, Cu and Ni. Aqua regia digestion with ICP-OES finish.
5. Cr, Co, Cu and Ni. Pressed pellet XRF.
6. S by LECO
7. Specific Gravity. Gas pycnometer.
8. XRF (major elements).
9. 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.

9. Method of Certification: Twenty four laboratories were each given eight randomly selected packages of sample. Seventeen 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 17 laboratories that provided results timeously were (not in same order as in the table of assays):

1. ALS Chemex Laboratory Group Brisbane Australia
2. ALS Chemex Laboratory Group Johannesburg SA
3. ALS Chemex Laboratory Group Lima (Peru)
4. ALS Chemex Laboratory Group Perth WA
5. ALS Chemex Laboratory Group Vancouver CA
6. Anglo Research (Crown Campus)
7. Barplats Laboratory SA
8. Genalysis Laboratory Services (South Africa) Pty
9. Genalysis Laboratory Services WA
10. Northam
11. Rappa Research Laboratory
12. Set Point Laboratories (Isando) SA
13. Set Point Laboratories (Mokopane) SA
14. SGS Mineral Services Callao (Peru)
15. SGS Mineral Services Lakefield (Canada)
16. SGS South Africa (Pty) Ltd - Booyens JHB
17. Zimplats Head Office Assay Laboratory

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

Lab Code	Pt Pb Coll g/t	Pd Pb Coll g/t	Au Pb Coll g/t	Pt NIS	Pd NIS	Au NIS	Ir NIS	Rh NIS	Ru NIS	Co M/ICP ppm	Co P ppm	Cu M/ICP ppm	Cu P ppm	Ni M/ICP ppm	Ni P ppm	SiO2 XRF %	SG pyc
A	23.30	26.20	2.96	24.14	26.29	2.74	0.64	1.83	1.80		1165.00		24947		37243		3.31
A	22.80	26.30	2.88	24.40	26.79	2.75	0.66	1.84	1.71		1172.00		25010		37452		3.30
A	23.60	26.90	2.81	24.44	26.93	2.75	0.61	1.85	1.78		1172.00		25082		37323		3.29
A	22.20	25.70	2.74	24.96	26.61	2.74	0.66	1.85	1.76		1178.00		25205		37464		3.29
A	23.10	26.80	2.92	24.17	26.28	2.75	0.62	1.82	1.74		1179.00		25116		37622		3.30
A	22.50	26.50	2.72	24.59	27.05	2.78	0.70	1.86	1.76		1183.00		25025		37572		3.31
A	23.60	27.30	2.99	23.77	25.63	2.70	0.68	1.83	1.72		1173.00		25055		37389		3.32
A	23.10	26.80	3.03	24.61	25.92	2.77	0.62	1.86	1.73		1170.00		25080		37354		3.29
C				24.43	28.02	3.18						24290		34800			
C				25.37	28.38	3.04						24330		34870			
C				25.10	28.87	3.00						23990		34550			
C				26.19	28.77	3.01						24020		32740			
C				25.94	28.86	2.98						24310		34100			
C				25.00	27.01	3.07						24130		33580			
C				26.94	29.92	3.27						24190		34090			
C				25.94	28.74	3.20						24520		33590			
D				25.95	26.56	2.99	0.38	1.35	1.50	1018.07		24422		36464		32.49	
D				24.07	25.66	2.87	0.43	1.21	1.49	900.50		21728		34829		29.63	
D				24.93	24.56	2.76	0.38	1.43	1.37	866.00		22296		35732		31.16	
D				25.21	26.15	2.98	0.46	1.28	1.50	1032.57		24942		36905		32.65	
D										969.00		21733		33062		29.74	
D				24.51	25.86	2.83	0.42	1.33	1.42	980.00		23133		32426		30.60	
D				24.98	25.38	2.85	0.44	1.47	1.39	954.50		27430		38355		32.13	
D										970.50		26810		34350		27.06	
E	24.07	27.69	3.07	23.65	26.82	2.98	0.44	1.93	1.62	1065.00	1105.00	24050	23710	32489	32697		3.19
E	24.39	27.37	3.04	23.48	26.61	2.86	0.44	1.95	1.67	1074.00	1064.00	24029	23217	32672	32158		3.37
E	24.24	27.67	3.12	23.67	26.52	2.85	0.43	1.93	1.64	1073.00	1123.00	23325	24253	31864	33426		3.32
E	23.87	26.85	2.96	23.43	26.70	2.93	0.45	1.95	1.68	1068.00	1130.00	23803	24777	32467	34102		3.34
E	23.95	26.95	3.06	23.42	26.92	2.91	0.43	1.94	1.63	1080.00	1096.00	24501	23844	33138	33198		3.16
E	23.74	27.25	2.96	23.10	26.59	2.91	0.43	1.93	1.65	1089.00	1107.00	24169	23910	32555	33338		3.22
E	24.13	27.31	3.01	23.48	26.77	3.03	0.44	1.92	1.66	1084.00	1081.00	23513	23685	31627	32421		3.40
E	24.19	27.14	3.06	24.19	27.09	2.96	0.45	1.95	1.65	1069.00	1098.00	23707	23581	32079	32413		3.27
F	23.64	26.53	2.88	22.97	26.29	2.88	0.44	1.85	1.69								3.36
F	24.73	26.80	2.95	23.50	26.62	2.90	0.44	1.81	1.69								3.34
F	24.47	26.66	2.98	23.44	26.62	2.82	0.43	1.75	1.66								3.41
F	24.67	27.34	2.98	23.41	27.15	2.91	0.44	1.84	1.68								3.37
F	24.72	26.85	3.02	23.72	26.76	2.81	0.43	1.82	1.65								3.30
F	24.50	27.52	2.90	23.52	26.83	2.99	0.43	1.79	1.64								3.38
F	23.95	27.94	3.08	23.15	26.32	2.82	0.43	1.80	1.65								3.42
F	24.99	27.23	3.02	24.03	26.69	2.91	0.43	1.81	1.67								3.39
K										1130.00	1110.00	25900	25800	35800	36500	32.00	3.28
K										1120.00	1080.00	25600	25400	35600	34800	32.10	3.29
K										1090.00	1100.00	25300	25600	35200	35200	32.40	3.29
K										1110.00	1080.00	25500	25300	35400	34900	32.00	3.27
K										1110.00	1070.00	25900	25100	35700	34400	32.00	3.28
K										1090.00	1080.00	25400	24900	35300	34100	32.00	3.27
K										1110.00	1090.00	25700	25500	35700	34800	32.10	3.29
K										1090.00	1100.00	25400	25900	35500	35000	32.10	3.27

Assay data (cont)

Lab Code	Pt Pb Coll g/t	Pd Pb Coll g/t	Au Pb Coll 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	Cu M/ICP ppm	Cu P ppm	Ni M/ICP ppm	Ni P ppm	SiO2 XRF %	SG pyc
L	24.60	26.10	3.14							1160.00	1130.00	25400	25200	35700	35600	30.50	
L	21.80	23.10	2.87							1170.00	1140.00	25800	25400	36700	35000	31.00	
L	21.80	23.50	2.80							1180.00	1130.00	25700	25300	36200	35700	31.30	
L	23.80	25.70	3.08							1160.00	1150.00	25600	25500	36000	35500	31.20	
L	24.40	25.70	3.04							1160.00	1120.00	25500	25200	35900	35700	31.10	
L	23.30	25.20	3.01							1170.00	1130.00	25700	25200	36600	35400	30.90	
L	23.60	25.30	3.03							1170.00	1130.00	25600	25300	35900	35300	30.80	
L	22.50	24.30	2.96							1180.00	1150.00	25800	25600	36000	36100	31.40	
M	24.30	26.40	2.89							1110.00	1120.00	25200	25100	35200	34700	31.71	3.43
M	23.60	25.90	2.92							1120.00	1120.00	25400	25200	34700	34800	31.69	3.38
M	24.10	26.50	2.93							1120.00	1150.00	25600	25800	36000	36100	31.77	3.32
M	23.80	26.10	2.82							1090.00	1130.00	24800	25700	34700	36000	31.69	3.33
M	24.80	27.30	3.03							1120.00	1120.00	25500	25100	35800	35700	31.75	3.42
M	24.70	27.00	2.98							1090.00	1120.00	24800	25000	34400	34700	31.72	3.31
M	23.50	26.10	2.84							1100.00	1110.00	25200	25100	35100	35300	31.73	3.45
M	24.50	26.90	2.95							1090.00	1110.00	25000	24800	34200	35200	31.63	3.20
N	23.50	27.40	3.01							1120.00	1160.00	24800	25800	34600	35900		3.38
N	22.90	26.70	3.12							1110.00	1200.00	25400	26700	35500	37200		3.38
N	23.10	27.00	3.05							1130.00	1170.00	26500	25700	36000	35800		3.35
N	23.10	26.50	3.08							1090.00	1190.00	25000	26400	34900	36800		3.40
N	20.40	24.10	2.72							1130.00	1200.00	25400	26300	35400	36600		3.40
N	22.00	25.90	2.92							1120.00	1210.00	25600	26700	35500	36900		3.40
N	23.00	27.10	3.14							1130.00	1240.00	25500	27200	35100	37500		3.39
N	24.10	27.90	3.22							1120.00	1170.00	25400	25800	34900	35900		3.38
O	23.40	26.10	2.89							1120.00	1120.00	25700	24600	35300	34800	31.70	
O	24.00	26.60	2.87							1130.00	1100.00	26300	24500	37100	34200	31.80	
O	24.50	27.00	2.98							1140.00	1130.00	25600	26200	36600	36500	31.70	
O	24.10	26.80	3.01							1130.00	1130.00	26100	24900	37200	35000	31.40	
O	23.50	26.10	2.93							1140.00	1130.00	25700	27000	36500	37900	31.20	
O	23.50	26.30	2.96							1120.00	1080.00	25400	23800	36200	35200	31.90	
O	24.10	26.80	2.94							1140.00	1120.00	26200	26800	36800	37200	31.80	
O	24.40	26.80	2.89							1110.00	1110.00	25500	24700	36300	34700	31.80	
P	24.16	27.53	2.90	23.75	26.63		0.50	1.82	1.68	979.00	910.00	26200	26200	38300	36000	30.30	3.33
P	24.11	28.21	3.00	24.18	24.92		0.48	1.85	1.64	981.00	900.00	26700	26400	39300	36500	30.30	3.33
P	23.74	27.20	2.96	24.49	26.81		0.48	1.85	1.67	991.00	912.00	26600	26100	39500	36200	30.30	3.29
P	24.38	27.62	2.96	24.20	26.19		0.48	1.86	1.65	969.00	920.00	26100	26100	39600	35600	30.40	
P	24.20	27.64	2.94	24.54	25.74		0.46	1.85	1.60	978.00	900.00	26600	26400	38100	35000	30.40	3.32
P	23.51	26.71	2.94	23.95	25.17		0.46	1.81	1.64	984.00	912.00	27000	26500	37900	36000	30.40	3.30
P	24.26	27.57	2.95	24.09	25.95		0.46	1.84	1.62	988.00	910.00	26500	26400	38500	36600	30.40	3.31
P	23.55	26.93	2.88	24.82	27.00		0.48	1.90	1.64	984.00	935.00	27000	26700	37400	37000	30.40	3.32
Q	24.00	26.00	2.90														
Q	24.00	27.00	2.99														
Q	24.00	27.00	2.95														
Q	24.00	26.00	2.93														
Q	23.00	26.00	2.82														
Q	24.00	26.00	2.95														
Q	23.00	26.00	2.93														
Q	24.00	26.00	2.89														
R				24.50	26.10	2.82	0.48	1.81	1.50		1200.00						
R				24.80	27.50	2.88	0.47	1.83	1.54		1200.00						
R				24.30	26.40	3.00	0.48	1.85	1.48		1100.00						
R				24.40	26.40	2.98	0.47	1.87	1.51		1200.00						
R				24.40	26.10	2.93	0.46	1.84	1.44		1200.00						
R				24.10	26.00	2.89	0.44	1.78	1.47		1200.00						
R				24.20	25.90	2.90	0.45	1.81	1.48		1200.00						
R				24.50	26.40	2.96	0.43	1.78	1.41		1200.00						
S	25.10	29.50	3.05	25.70	29.50	2.99	0.53	1.90	1.74	1120.00	1000.00	26000	20000	36000	30000	31.20	3.41
S	25.20	29.90	3.03	26.30	29.50	3.07	0.49	2.02	1.75	1180.00	1040.00	27000	20000	36000	30000	30.80	3.38
S	25.30	29.80	3.19	26.00	29.50	2.91	0.49	1.99	1.72	1160.00	1000.00	26000	21000	36000	30000	31.20	3.36
S	25.10	29.50	2.91	26.20	29.90	3.00	0.59	1.99	1.80	1150.00	1040.00	26000	20000	36000	30000	31.20	3.38
S	25.70	29.90	2.91	26.20	29.70	2.93	0.49	1.99	1.73	1140.00	1020.00	26000	20000	36000	30000	31.10	3.37
S	25.60	29.30	3.00	26.00	29.40	2.90	0.49	1.94	1.70	1180.00	1030.00	26000	20000	36000	31000	31.10	3.38
S	25.20	30.00	3.01	25.60	29.40	2.91	0.54	1.95	1.68	1130.00	1010.00	27000	20000	36000	30000	31.00	3.42
S	25.20	29.20	3.00	26.10	29.20	2.93	0.47	2.03	1.71	1140.00	1020.00	27000	21000	36000	30000	31.10	3.38
T										1157.00				25500		38800	
T										1172.00				25500		38700	
T										1152.00				25700		39500	
T										1132.00				25600		39200	
T										1160.00				25800		39000	
T										1155.00				25500		39400	
T										1170.00				25400		38600	
T										1151.00				25500		39100	
W				24.40	29.70	2.77	0.64	2.04	1.67								
W				24.70	30.30	2.85	0.53	1.91	1.51								
W				24.30	30.40	2.79	0.52	1.91	1.41								
W				24.60	29.40	2.79	0.70	1.95	1.52								
W				24.70	29.20	2.81	0.54	1.80	1.59								
W				23.70	29.10	2.75	0.52	1.85	1.77								
W				24.90	30.20	2.89	0.60	1.94	1.64								
W				24.50	30.60	2.83	0.54	1.91	1.50								
X	22.24	26.11	3.10														
X	22.63	27.35	2.92														
X	22.07	26.36	2.89														
X	22.51	27.49	2.91														
X	22.83	26.68	2.78														
X	22.18	26.34	2.75														
X	23.03	27.07	3.01														
X	23.36	27.38	3.06														

12. Measurement of Uncertainty: The samples used in the certification process were selected in such a way as to represent the entire batch of material and were taken from the final packaged units; therefore all possible sources of uncertainty (sample uncertainty and measurement uncertainty) are included in the final combined standard uncertainty determination.

The uncertainty measurement takes into consideration the between lab and the within lab variances and is calculated from the square roots of the variances of these components using the formula:

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

These uncertainty measurements may be used, by laboratories, as a component for calculating the total uncertainty for method validation according to the relevant ISO guidelines.

Analyte	Method	Unit	S ¹	σ_L ²	Sw ³	CSU ⁴
Pt	Pb Coll	g/t	0.859	0.627	0.473	0.196
Pd	Pb Coll	g/t	0.648	0.405	0.472	0.139
Au	Pb Coll	g/t	0.080	0.030	0.073	0.012
Pt	NIS	g/t	0.867	0.751	0.393	0.255
Pd	NIS	g/t	1.528	1.388	0.542	0.467
Au	NIS	g/t	0.094	0.077	0.056	0.028
Ir	NiS	g/t	0.067	0.062	0.026	0.022
Rh	NiS	g/t	0.060	0.058	0.031	0.022
Ru	NiS	g/t	0.105	0.094	0.051	0.034
Co	M/ICP	ppm	32.08	30.73	13.78	11.00
Co	P	ppm	40.67	37.86	18.96	13.60
Cu	M/ICP	ppm	852.0	765.7	337.8	258.4
Cu	P	ppm	574.1	435.6	390.5	161.9
Ni	M/ICP	ppm	1015.5	753.2	720.3	281.3
Ni	P	ppm	1485.0	1268.3	671.0	430.7
SiO ₂	XRF	%	0.698	0.579	0.477	0.228
SG	pyc		0.052	0.040	0.034	0.015

1. S - Std Dev for use on control charts.
2. σ_L - Betw Lab Std Dev, for use to calculate a measure of accuracy.
3. Sw - Within Lab Stc Dev, for use to calculate a measure of precision.
4. CSU - Combined Standard Uncertainty, a component for use to calculate the total uncertainty in method validation.

13. Certified values: The Certified, Provisional and Indicated values listed on p1 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: AMIS0164 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.

7 July 2010

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

See below the multi element trace element data submitted by five of the round robin laboratories, for informational use only.

Analyte	Method	Unit	Mean	2SD	RSD%	n
Ag	M/ICP	ppm	10.2	6.3	30.9	24
Al	M/ICP	%	2.36	0.09	1.9	29
As	M/ICP	ppm	19.4	5.0	12.8	24
Ba	M/ICP	ppm	32.9	16.4	24.9	24
Be	M/ICP	ppm	0.20	0.00	0.0	14
Bi	M/ICP	ppm	10.8	6.7	31.1	22
Ca	M/ICP	%	4.13	0.89	10.8	38
Cd	M/ICP	ppm	2.32	0.42	9.0	16
Ce	M/ICP	ppm	6.27	1.05	8.3	16
Cr	M/ICP	ppm	652	330	25.3	32
Cs	M/ICP	ppm	1.02	0.07	3.5	16
Dy	M/ICP	ppm	0.97			8
Er	M/ICP	ppm	0.60			8
Eu	M/ICP	ppm	0.22			8
Fe	M/ICP	%	17.8	2.0	5.5	30
Ga	M/ICP	ppm	4.98	0.54	5.5	16
Ge	M/ICP	ppm	1.02	0.30	14.9	16
Hf	M/ICP	ppm	1.16	1.27	54.5	16
Ho	M/ICP	ppm	0.20			8
In	M/ICP	ppm	0.10	0.02	8.4	16
K	M/ICP	ppm	0.20	0.02	4.0	32
La	M/ICP	ppm	2.91	0.75	13.0	16
Li	M/ICP	ppm	10.3	4.6	22.4	24
Lu	M/ICP	ppm	0.10	0.01	5.0	16
Mg	M/ICP	%	7.26	0.56	3.8	38
Mn	M/ICP	ppm	1358	125	4.6	38
Mo	M/ICP	ppm	5.53	3.53	31.9	24
Na	M/ICP	%	0.30	0.03	4.7	24
Nb	M/ICP	ppm	2.95	4.38	74.3	24
Nd	M/ICP	ppm	3.32			8
P	M/ICP	ppm	103	7	3.4	16
Pb	M/ICP	ppm	172	10	2.9	24
Pr	M/ICP	ppm	0.82			8
Rb	M/ICP	ppm	11.7	0.5	2.0	16
Re	M/ICP	ppm	0.09			8
S	M/ICP	ppm	11.2	0.6	2.7	16
Sb	M/ICP	ppm	14.5	1.4	4.8	23
Sc	M/ICP	ppm	15.8	5.9	18.6	16
Se	M/ICP	ppm	33.2	17.3	26.1	16
Si	M/ICP	%	14.3			8
Sm	M/ICP	ppm	0.83			8
Sn	M/ICP	ppm	1.17	0.16	7.0	15
Sr	M/ICP	ppm	32.0	5.1	7.9	24
Ta	M/ICP	ppm	5.42	10.72	98.9	16
Tb	M/ICP	ppm	0.14	0.01	2.6	15
Te	M/ICP	ppm	11.6	1.7	7.5	16
Th	M/ICP	ppm	3.97	0.57	7.2	16
Ti	M/ICP	%	0.08	0.01	5.3	39
Tl	M/ICP	ppm	2.12	0.40	9.3	16
Tm	M/ICP	ppm	0.09			7
U	M/ICP	ppm	7.88	0.88	5.6	16
V	M/ICP	ppm	74.8	7.6	5.1	24
W	M/ICP	ppm	0.85	0.26	15.3	15
Y	M/ICP	ppm	5.05	0.35	3.5	16
Yb	M/ICP	ppm	0.62	0.09	7.5	16
Zn	M/ICP	ppm	610	57	4.7	24
Zr	M/ICP	ppm	20.8	7.2	17.3	16