



## AMIS0132

### *Certified Reference Material*

**Platinum (PGM) UG2 tailings  
Eastern Limb, Bushveld Complex, South Africa**

### *Certificate of Analysis*

**Recommended Concentrations and two “Between  
Laboratory” Standard Deviations**

#### *Certified Concentrations*

Pt Pb Coll	0.46	±	0.04	g/t
Pd Pb Coll	0.21	±	0.02	g/t
Pt NIS	0.49	±	0.04	g/t
Pd NIS	0.21	±	0.02	g/t
Cr XRF	13.31	±	0.72	%
Cu P	46.2	±	4.6	ppm
Ni XRF	707	±	43	ppm
SG	3.55	±	0.18	

#### *Provisional Concentrations*

Rh NiS	0.08	±	0.01	g/t
Ru NiS	0.22	±	0.05	g/t
Ir NiS	0.045	±	0.01	g/t
Ni P	104	±	17.5	ppm
Co P	14	±	2	ppm
Co M/ICP	160	±	29.1	ppm
Cu M/ICP	47.2	±	7.6	ppm
Cu XRF	50	±	5.8	ppm
Ni M/ICP	684	±	121	ppm

#### *Informational Means*

Au NIS	0.025	g/t
Au Pb Coll	0.028	g/t

$$4E = 0.780$$

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

## *Certified Concentrations*

Al <sub>2</sub> O <sub>3</sub>	16.20	±	0.38	%
CaO	4.83	±	0.12	%
Cr <sub>2</sub> O <sub>3</sub>	19.64	±	0.66	%
Fe <sub>2</sub> O <sub>3</sub>	18.63	±	0.44	%
MgO	10.08	±	0.24	%
MnO	0.18	±	0.02	%
Na <sub>2</sub> O	0.90	±	0.10	%
SiO <sub>2</sub>	28.39	±	0.46	%
TiO <sub>2</sub>	0.60	±	0.024	%

## *Provisional Concentration*

K <sub>2</sub> O	0.19	±	0.02	%
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## *Informational Mean*

P <sub>2</sub> O <sub>5</sub>	0.048	%
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**1. Intended Use:** AMIS0132 is a certified reference material which may be used to demonstrate the validity of measurement results of a single analysis of tails or low grade PGE, Cu and Ni ores, hosted by the UG2 Reef or other chromitite rich 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 Pt/Pd rich UG2 chromitite (UG2) material supplied by Aquarius Platinum's Everest mine, located on the southern portion of the eastern limb of the Bushveld Complex, near Lydenburg, in South Africa.

**3. Approximate Mineral and Chemical Composition:** AMIS0132 comprises approximately 50% UG2 Chromitite seam, 45% pegmatoidal pyroxenite footwall and 5% pyroxenite hanging wall. The UG2 Chromitite is composed of chromite (60-90% by volume), orthopyroxene (5-25%), plagioclase (5-15%) as well as accessory amounts of other minerals, of which the more important are clinopyroxene, base metal sulphides, platinum-group minerals, ilmenite and magnetite. The base metal sulphides are predominantly pentlandite, pyrrhotite, pyrite, chalcopyrite and to a lesser extent millerite. The Platinum Group Minerals identified in the UG2 are cooperite, laurite, braggite, Pt-Fe Alloy and sperrylite.

Trace element chemistry data from 12 of the labs has been compiled but has not been certified. Summary statistics for this data are set out in the appendix.

4. **Appearance:** The material is a very fine powder. It is colored a Pale Olive (Corstor 5Y 5/4).
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 <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. 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.

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 six laboratories were each given eight randomly selected packages of sample. Twenty five 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 laboratories that provided results timeously were (not in same order as in the table of assays):

1. ACME Analytical Laboratories Ltd CA
2. Activation Laboratories Pty Ltd (ActLabs) CA
3. ALS Chemex Laboratory Group Johannesburg SA
4. ALS Chemex Laboratory Group Perth WA
5. ALS Chemex Laboratory Group Vancouver CA
6. Ammtec Limited WA
7. Anglo Platinum - Eastern Bushveld Regional Laboratory
8. Anglo Research (Crown Campus)
9. Assayers Canada
10. Barplats Laboratory SA
11. Becquerel Laboratories Inc CA
12. Genalysis Laboratory Services (South Africa) Pty
13. Genalysis Laboratory Services WA
14. Geoscience Laboratories (GEO LABS) CA
15. Intertek Testing Services Ltd Shanghai (ITS Beijing)
16. Intertek Utama Services (Indonesia)
17. Labtium Inc Finland
18. OMAC Laboratories Limited (Ireland)
19. Set Point Laboratories (Isando) SA
20. Set Point Laboratories (Mokopane) SA
21. SGS Australia Pty Ltd (Newburn) WA
22. SGS Lakefield Research Africa (Pty) Ltd (Booyens SA)
23. SGS Mineral Services Lakefield (Canada)
24. Ultra Trace (Pty) Ltd WA
25. 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	Au NIS g/t	Ir NIS g/t	Pd NIS g/t	Pt NIS g/t	Rh NIS g/t	Ru NIS g/t	Au Pb Coll g/t	Pd Pb Coll g/t	Pt Pb Coll g/t	Co M/ICP ppm	Co P ppm	Cr XRF %	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm	SG
A							0.03	0.18	0.41	148	14	135431	53.0	49.0		769	120		
A							0.03	0.21	0.48	149	14	135431	51.0	51.0		769	120		
A							0.03	0.21	0.48	150	14	135431	51.0	49.0		739	121		
A							0.03	0.20	0.44	150	13	135431	52.0	50.0		755	125		
A							0.03	0.21	0.47	147	14	136115	51.0	48.0		775	120		
A							0.03	0.18	0.39	147	14	136799	52.0	49.0		799	124		
A							0.03	0.16	0.45	149	13	135431	51.0	48.0		782	122		
A							0.03	0.19	0.43	147	13	136115	50.0	47.0		762	120		
B							0.03	0.20	0.44	190	13	131231	43.0	44.0		730	92	678	3.56
B							0.04	0.20	0.44	180	13	130695	42.0	45.0		700	95	604	3.55
B							0.04	0.22	0.46	190	12	133911	44.0	42.0		740	88	725	3.55
B							0.05	0.20	0.48	190	13	130328	44.0	42.0		740	92	683	3.54
B							0.03	0.21	0.47	180	12	131528	44.0	45.0		710	93	684	3.56
B							0.03	0.21	0.44	190	13	128261	43.0	43.0		710	94	720	3.54
B							0.03	0.21	0.45	180	13	131533	44.0	44.0		740	93	709	3.55
B							0.03	0.20	0.44	180	13	128875	44.0	45.0		690	93	679	3.55
C	0.04		0.20	0.48	0.08	0.27	0.03	0.24	0.48	170	17	133379	47.0	43.0		720	120		3.53
C	0.03		0.21	0.48	0.08	0.26	0.03	0.21	0.45	170	17	127907	45.0	44.0		720	120		3.49
C	0.02		0.21	0.47	0.08	0.26	0.04	0.21	0.48	180	15	132011	45.0	44.0		720	120		3.53
C	0.02		0.21	0.48	0.08	0.26	0.03	0.22	0.47	170	16	127907	45.0	43.0		720	120		3.49
C	0.02		0.21	0.47	0.07	0.25	0.03	0.22	0.45	160	15	129959	46.0	44.0		720	110		3.49
C	0.03		0.21	0.48	0.08	0.26	0.03	0.22	0.47	170	15	136799	46.0	44.0		720	110		3.52
C	0.03		0.21	0.47	0.07	0.25	0.03	0.22	0.47	170	15	132011	44.0	44.0		720	110		3.49
C	0.03		0.21	0.48	0.07	0.25	0.03	0.24	0.47	170	15	134747	45.0	44.0		720	110		3.47
D	0.02	0.05	0.23	0.52	0.09	0.25	0.03	0.22	0.46	170	13	136115	55.0	47.0		715	104		3.71
D	0.02	0.05	0.22	0.50	0.08	0.24	0.03	0.22	0.46	165	14	136115	60.0	46.0		715	98		3.69
D	0.03	0.05	0.22	0.50	0.08	0.24	0.03	0.22	0.44	170	13	136799	60.0	48.0		705	104		3.67
D	0.03	0.05	0.22	0.51	0.08	0.25	0.03	0.20	0.44	170	15	136799	60.0	48.0		695	103		3.67
D	0.03	0.05	0.22	0.50	0.08	0.23	0.04	0.20	0.46	165	15	136115	60.0	47.0		705	101		3.66
D	0.04	0.05	0.22	0.50	0.08	0.24	0.03	0.20	0.44	165	15	136799	60.0	50.0		710	105		3.64
D	0.03	0.05	0.23	0.52	0.09	0.24	0.03	0.20	0.44	165	13	137483	55.0	46.0		700	97		3.68
D	0.03	0.05	0.22	0.50	0.08	0.24	0.03	0.22	0.46	170	13	136799	60.0	48.0		695	103		3.66
F							0.05	0.21	0.47				43.0			499			
F							0.03	0.20	0.45				43.0			508			
F							0.03	0.21	0.49				47.0			504			
F							0.02	0.21	0.46				42.0			499			
F							0.03	0.21	0.48				45.0			503			
F							0.03	0.21	0.46				41.0			474			
F							0.02	0.23	0.51				41.0			496			
F							0.03	0.22	0.50				42.0			491			

Assay data (cont)

Lab Code	Au NIS g/t	Ir NIS g/t	Pd NIS g/t	Pt NIS g/t	Rh NIS g/t	Ru NIS g/t	Au Pb Coll g/t	Pd Pb Coll g/t	Pt Pb Coll g/t	Co M/ICP ppm	Co P ppm	Cr XRF %	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm	SG
G							0.03	0.22	0.46						46.3			709	3.69
G							0.02	0.22	0.47						48.5			711	3.69
G							0.03	0.23	0.47						49.3			708	3.68
G							0.02	0.21	0.47						47.6			713	3.71
G							0.03	0.23	0.46						47.7			705	3.68
G							0.02	0.22	0.47						46.8			707	3.67
G							0.03	0.23	0.48						46.7			702	
G							0.03	0.22	0.45						47.3			704	3.68
H							0.04	0.20	0.49	174	14		60.1	47.0		733	120		
H							0.05	0.18	0.45	179	15		58.9	37.4		731	105		
H							0.03	0.17	0.43	178	15		58.0	42.2		766	116		
H							0.03	0.20	0.48	171	14		42.6	32.7		698	121		
H							0.03	0.20	0.47	180	15		53.8	40.2		743	108		
H							0.02	0.20	0.46	171	15		48.9	46.0		709	101		
H							0.04	0.19	0.43	174	12		47.7	42.7		711	118		
H							0.02	0.20	0.48	176	16		53.6	46.5		749	118		
I	0.00	0.05	0.20	0.50	0.07	0.20	0.02	0.18	0.46	156	15	135636	44.5	47.0	50.0	713		732	3.47
I	0.00	0.05	0.21	0.40	0.08	0.23	0.02	0.19	0.48	165	15	135499	48.4	50.0	50.0	744		723	3.43
I	0.00	0.04	0.22	0.41	0.08	0.23	0.03	0.19	0.47	157	15	135089	49.8	47.0	50.0	694		718	3.42
I	0.00	0.05	0.20	0.50	0.07	0.19	0.05	0.18	0.46	150	15	135773	49.4	49.0	50.0	703		720	3.45
I	0.00	0.06	0.19	0.50	0.07	0.20	0.03	0.20	0.49	160	14	135636	44.6	46.0	55.0	699		725	3.42
I		0.06	0.20	0.49	0.08	0.20	0.02	0.18	0.51	169	14	136594	48.0	45.0	53.0	751		725	3.43
I		0.06	0.20	0.50	0.08	0.20	0.03	0.17	0.48	175	14	135978	50.1	45.0	54.0	765		732	3.42
I	0.01	0.06	0.20	0.50	0.08	0.20	0.03	0.17	0.48	173	15	134747	48.4	48.0	53.0	761		725	3.46
J							0.02	0.20	0.45	147	12		48.8	49.0		606	104		3.11
J							0.02	0.20	0.46	148	12		44.1	48.0		607	102		3.14
J							0.02	0.20	0.45	152	12		44.0	49.0		631	106		3.16
J							0.02	0.21	0.47	157	12		47.4	49.0		648	105		3.16
J							0.02	0.21	0.46	150	12		43.7	49.0		617	106		3.20
J							0.01	0.17	0.38	147	12		44.6	49.0		607	104		3.13
J							0.02	0.20	0.44	148	13		46.8	49.0		619	106		3.19
J							0.02	0.20	0.46	155	12		45.0	49.0		648	108		3.23
K							0.06	0.25	0.62	120			50.0			470			
K							0.06	0.24	0.61	150			50.0			560			
K							0.05	0.28	0.66	150			50.0			540			
K							0.07	0.25	0.70	150			50.0			560			
K							0.07	0.28	0.69	160			50.0			600			
K							0.06	0.26	0.67	150			50.0			600			
K							0.06	0.23	0.67	130			50.0			520			
K							0.06	0.25	0.73	120			50.0			470			
L					0.05			0.09	0.43						36.9			783	3.75
L					0.04			0.12	0.54						44.6			791	3.67
L					0.06			0.12	0.50										
L					0.07			0.13	0.41										
L					0.07			0.11	0.37										3.66
L					0.06			0.13	0.51						53.6			776	3.75
L					0.07			0.13	0.46						51.3			792	3.79
L					0.06			0.13	0.51						43.8			750	
M							0.02	0.16	0.33	166	18		53.9	51.0		665	111		
M							0.02	0.15	0.33	153	19		52.5	51.0		645	122		
M							0.02	0.16	0.34	164	17		54.4	47.0		678	115		
M							0.03	0.17	0.34	168	17		55.1	47.0		658	110		
M							0.03	0.17	0.33	160	18		52.8	50.0		651	109		
M							0.02	0.15	0.33	164	20		51.2	50.0		683	122		
M							0.02	0.15	0.35	152	20		53.7	54.0		646	119		
M							0.02	0.15	0.35	179	19		51.1	48.0		637	116		
N	0.03	0.05	0.26	0.49	0.08	0.24				167			36.6			777			
N	0.03	0.04	0.22	0.48	0.12	0.24				171			36.8			793			
N	0.05	0.03	0.23	0.45	0.07	0.22				164			39.1			776			
N	0.04	0.07	0.23	0.44	0.09	0.22				164			42.4			782			
N	0.04	0.04	0.25	0.54	0.07	0.25				164			36.2			747			
N	0.04	0.03	0.21	0.48	0.08	0.23				167			39.3			823			
N	0.05	0.01	0.24	0.47	0.06	0.24				154			38.9			868			
N	0.04	0.04	0.22	0.50	0.09	0.24				160			45.5			840			
O	0.02	0.04	0.20	0.46	0.08	0.19	0.02			162						690			
O	0.03	0.04	0.23	0.46	0.08	0.18	0.03			154						670			
O	0.03	0.04	0.22	0.49	0.08	0.21	0.03			163						690			
O	0.02	0.05	0.18	0.41	0.07	0.17	0.02			161						680			
O	0.04	0.04	0.22	0.48	0.08	0.21	0.04			168						700			
O	0.03	0.04	0.23	0.53	0.08	0.21	0.03			175						710			
O	0.03	0.04	0.21	0.45	0.06	0.19	0.03			165						670			
O	0.02	0.04	0.18	0.46	0.07	0.19	0.02			163						690			
P	0.02	0.05	0.21	0.46	0.08	0.22				111	13		45.0	46.0		492	97		
P	0.02	0.05	0.21	0.47	0.08	0.23				112	13		46.0	46.0		502	93		
P	0.03	0.05	0.21	0.46	0.09	0.22				109	13		45.0	46.0		489	95		
P	0.03	0.05	0.21	0.48	0.08	0.22				119	14		45.0	47.0		533	97		
P	0.03	0.05	0.21	0.46	0.08	0.23				111	13		45.0	47.0		490	97		
P	0.03	0.05	0.21	0.47	0.08	0.23				104	12		47.0	46.0		484	93		
P	0.03	0.05	0.22	0.48	0.09	0.23				107	12		46.0	45.0		489	94		
P	0.02	0.05	0.21	0.48	0.09	0.22				113	13		46.0	46.0		498	95		
Q							0.04	0.21	0.45	240	13	13520	53.0	45.0		648	95		
Q							0.04	0.23	0.45	234	13	13570	51.0	44.0		635	94		
Q							0.04	0.21	0.47	240	13	13560	50.0	44.0		644	94		
Q							0.03	0.22	0.47	221	13	13560	48.0	44.0		622	95		
Q							0.04	0.22	0.47	240	13	13610	52.0	44.0		632	96		
Q							0.03	0.21	0.45	244	13	13660	49.0	46.0		632	94		
Q							0.03	0.20	0.44	236	13	13650	50.0	46.0		638	97		
Q							0.03	0.22	0.47	237	13	13650	51.0	45.0		646	96		
R	0.02	0.04	0.21	0.50	0.08	0.20	0.02	0.21	0.41	107	13	131943	43.9	46.4	94.0	482	108	747	3.52
R	0.02	0.04	0.22	0.50	0.08	0.22	0.03	0.20	0.42	127	14	128865	42.6	48.0	73.0	561	108	736	3.52
R	0.02	0.04	0.22	0.50	0.08	0.22	0.02	0.20	0.40	118	13	131806	41.3	45.7	83.0	524	107	773	3.52
R	0.05	0.04	0.22	0.51	0.08	0.22	0.03	0.20	0.43	136	15	132011	43.5	47.4	82.0	587	109	758	

**Assay data (cont)**

Lab Code	Au NIS g/t	Ir NIS g/t	Pd NIS g/t	Pt NIS g/t	Rh NIS g/t	Ru NIS g/t	Au Pb Coll g/t	Pd Pb Coll g/t	Pt Pb Coll g/t	Co M/ICP ppm	Co P ppm	Cr XRF %	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm	SG
T	0.02	0.04	0.19	0.40	0.07	0.19	0.04	0.22	0.51	97	14	128887	61.0	43.2	53.5	666	91	703	3.51
T	0.03	0.05	0.19	0.41	0.07	0.18	0.05	0.21	0.48	99	13	128631	55.0	43.6	52.7	654	91	701	3.51
T	0.03	0.04	0.21	0.46	0.07	0.20	0.03	0.21	0.47	97	15	128829	57.2	45.8	52.6	630	95	697	3.50
T	0.02	0.04	0.21	0.44	0.07	0.21	0.03	0.21	0.48	100	15	128755	50.9	44.4	53.5	659	94	692	3.51
T	0.02	0.04	0.20	0.43	0.07	0.20	0.04	0.20	0.47	99	14	128868	52.1	45.2	51.5	654	93	699	3.51
T	0.02	0.04	0.19	0.39	0.06	0.18	0.04	0.20	0.46	100	13	129220	53.8	45.6	52.0	645	96	681	3.51
T	0.03	0.04	0.19	0.40	0.06	0.18	0.04	0.22	0.50	100	14	128053	50.5	44.6	52.9	686	96	662	3.51
T	0.03	0.04	0.19	0.43	0.07	0.20	0.04	0.20	0.47	98	14	128400	60.0	43.2	52.8	609	93	673	3.51
U							0.03	0.21	0.47			128700			51.0			684	
U							0.04	0.21	0.47			128700			52.0			686	
U							0.04	0.22	0.42			129400			51.0			692	
U							0.03	0.22	0.45			129100			50.0			687	
U							0.03	0.22	0.45			128300			53.0			684	
U							0.03	0.22	0.47			129000			52.0			686	
U							0.04	0.22	0.46			128300			53.0			678	
U							0.04	0.21	0.47			129000			51.0			689	
V							0.03	0.21	0.51	141	14	131650	44.7	47.4	50.0	594	103	610	3.47
V							0.03	0.19	0.43	139	14	131600	46.9	48.9	50.0	607	102	610	3.37
V							0.03	0.20	0.48	139	14	131650	45.5	46.7	50.0	592	102	610	3.35
V							0.03	0.19	0.46	142	14	131700	44.3	47.4	50.0	593	102	610	3.40
V							0.02	0.21	0.49	162	13	131600	43.0	46.7	50.0	606	102	610	3.41
V							0.04	0.21	0.48	139	13	131500	43.7	45.8	50.0	593	105	600	3.45
V							0.02	0.17	0.42	137	14	131600	43.0	47.0	50.0	591	103	610	3.37
V							0.03	0.19	0.45	137	13	131650	42.1	44.2	50.0	598	97	610	3.54
W							0.03	0.18	0.43	132	14		50.8	48.2		667	102		3.59
W							0.03	0.26	0.53	129	15		48.6	47.0		648	100		3.58
W							0.03	0.19	0.42	126	14		70.8	48.4		673	99		3.58
W							0.02	0.23	0.45	128	15		49.8	48.1		676	99		3.59
W							0.03	0.24	0.51	134	14		58.2	50.2		707	99		3.58
W							0.02	0.21	0.45	128	13		42.8	44.7		688	99		3.60
W							0.03	0.21	0.43	128	14		41.6	45.6		675	99		3.57
W							0.02	0.21	0.48	121	14		37.4	47.3		617	102		3.55
X	0.02	0.05	0.21	0.49	0.09	0.21	0.02	0.20	0.48	155	16	138528	48.0	42.0	45.0	721	106	705	3.59
X	0.02	0.05	0.23	0.49	0.09	0.23	0.02	0.20	0.47	160	17	138765	50.0	44.0	45.0	740	112	698	3.66
X	0.02	0.04	0.21	0.47	0.08	0.20	0.03	0.20	0.49	161	16	139351	46.0	44.0	45.0	729	105	700	3.62
X	0.02	0.04	0.22	0.49	0.09	0.22	0.02	0.21	0.48	160	15	139397	49.0	42.0	45.0	739	103	700	3.66
X	0.02	0.05	0.22	0.49	0.08	0.21	0.03	0.20	0.49	163	14	139254	48.0	38.0	47.0	740	93	703	3.63
X	0.03	0.05	0.22	0.50	0.09	0.22	0.03	0.20	0.47	161	13	139875	49.0	38.0	42.0	738	91	700	3.61
X	0.03	0.05	0.21	0.50	0.09	0.23	0.02	0.20	0.47	159	15	139744	48.0	41.0	47.0	735	99	704	3.61
X	0.02	0.04	0.21	0.48	0.08	0.22	0.02	0.20	0.47	158	15	139438	48.0	42.0	46.0	731	99	704	3.67
Y	0.03	0.05	0.24	0.56	0.09	0.26	0.03	0.21	0.47										
Y	0.03	0.04	0.23	0.51	0.09	0.28	0.03	0.21	0.49										
Y	0.03	0.04	0.22	0.51	0.09	0.25	0.03	0.21	0.48										
Y	0.03	0.04	0.20	0.49	0.08	0.24	0.03	0.22	0.47										
Y	0.03	0.05	0.23	0.54	0.09	0.26	0.03	0.22	0.49										
Y	0.02	0.05	0.24	0.53	0.08	0.26	0.03	0.22	0.49										
Y	0.04	0.05	0.23	0.54	0.09	0.27	0.03	0.22	0.51										
Y	0.03	0.04	0.25	0.51	0.08	0.24	0.03	0.23	0.51										
Z	0.02		0.22	0.48	0.08			0.02											
Z	0.02		0.21	0.45	0.08			0.02											
Z	0.03		0.21	0.44	0.08			0.03											
Z	0.02		0.21	0.46	0.08			0.02											
Z	0.02		0.21	0.45	0.08			0.02											
Z	0.02		0.20	0.43	0.07			0.02											
Z	0.02		0.22	0.48	0.08			0.02											
Z	0.02		0.20	0.41	0.07			0.02											

**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	CSU*	unit	Analyte	CSU*	unit	Analyte	CSU*	unit
Au NIS	0.001	ppm	Co P	0.157	ppm	CaO	0.014	%
Ir NIS	0.001	ppm	Cr F	3023	ppm	Cr <sub>2</sub> O <sub>3</sub>	0.098	%
Pd NIS	0.002	ppm	Cu M/ICP	0.569	ppm	Fe <sub>2</sub> O <sub>3</sub>	0.060	%
Pt NIS	0.005	ppm	Cu P	0.357	ppm	K <sub>2</sub> O	0.002	%
Rh NIS	0.001	ppm	Cu XRF	1.000	ppm	MgO	0.035	%
Ru NIS	0.006	ppm	Ni M/ICP	9.71	ppm	MnO	0.003	%
Au Pb Coll	0.001	ppm	Ni P	1.654	ppm	Na <sub>2</sub> O	0.016	%
Pd Pb Coll	0.001	ppm	Ni XRF	8.148	ppm	P <sub>2</sub> O <sub>5</sub>	0.002	%
Pt Pb Coll	0.003	ppm	SG	0.025		SiO <sub>2</sub>	0.058	%
Co M/ICP	0.003	ppm	Al <sub>2</sub> O <sub>3</sub>	0.050	%	TiO <sub>2</sub>	0.003	%

\*CSU = Combined standard uncertainty

**13. Uncertified values:** The Certified, Provisional and Indicated values listed on p1 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:** AMIS0132 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](http://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.

7 May 2009

**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**

	Method	unit	mean	2SD	RSD%	n
Ag	M/ICP	ppm	0.14	0.23	23.1	23
Al	M/ICP	%	8.56	0.50	3.4	55
Ba	M/ICP	ppm	81.7	11.6	2.9	87
Be	M/ICP	ppm	0.25	0.11	12.8	40
Bi	M/ICP	ppm	0.02		16.2	20
Ca	M/ICP	ppm	3.42	0.48	2.4	87
Ce	M/ICP	ppm	9.62	0.99	3.4	67
Cs	M/ICP	ppm	0.37	0.15	8.3	56
Dy	M/ICP	ppm	0.88	0.13	4.9	38
Er	M/ICP	ppm	0.55	0.08	6.2	39
Eu	M/ICP	ppm	0.33	0.04	4.6	39
Fe	M/ICP	%	12.5	1.8	4.3	70
Ga	M/ICP	ppm	36.0	6.3	6.6	55
Gd	M/ICP	ppm	0.90	0.16	5.4	38
Ge	M/ICP	ppm	0.29	0.37	43.3	39
Hf	M/ICP	ppm	0.64	0.10	9.8	53
Ho	M/ICP	ppm	0.19	0.03	3.7	40
In	M/ICP	ppm	0.02	0.01	7.4	38
K	M/ICP	%	0.16	0.03	6.8	87
La	M/ICP	ppm	4.90	0.53	4.8	68
Li	M/ICP	ppm	5.42	2.22	10.5	72
Lu	M/ICP	ppm	0.08	0.02	4.8	31
Mg	M/ICP	ppm	5.84	0.48	3.0	77
Mn	M/ICP	ppm	1339	178	3.9	71
Mo	M/ICP	ppm	0.92	0.33	11.8	59
Na	M/ICP	%	0.64	0.10	2.3	88
Nb	M/ICP	ppm	1.13	0.18	9.3	61
Nd	M/ICP	ppm	4.42	0.40	4.3	32
P	M/ICP	ppm	189	57	5.3	71
Pb	M/ICP	ppm	4.49	0.80	13.9	49
Pr	M/ICP	ppm	1.11	0.08	4.5	38
Rb	M/ICP	ppm	6.03	1.70	11.0	63
Sb	M/ICP	ppm	4.89	1.18	9.8	78
Sc	M/ICP	ppm	14.4	2.0	5.0	55
Se	M/ICP	ppm	5.46	3.03	14.5	22
Sm	M/ICP	ppm	0.87	0.09	5.4	36
Sn	M/ICP	ppm	0.84	0.28	9.2	46
Sr	M/ICP	ppm	142	12	2.9	86
Ta	M/ICP	ppm	0.08	0.04	15.9	27
Tb	M/ICP	ppm	0.13	0.04	5.0	40
Th	M/ICP	ppm	0.84	0.17	6.9	70
Ti	M/ICP	%	0.32	0.05	7.9	69
Tm	M/ICP	ppm	0.08	0.03	7.4	40
U	M/ICP	ppm	0.44	0.10	10.2	64
V	M/ICP	ppm	1108	259	8.8	64
W	M/ICP	ppm	0.30	0.32	29.5	38
Y	M/ICP	ppm	4.62	0.49	3.5	69
Yb	M/ICP	ppm	0.52	0.07	7.1	32
Zn	M/ICP	ppm	373	53	5.0	75
Zr	M/ICP	ppm	21.6	5.0	5.2	69