



## AMIS0122

### *Certified Reference Material*

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

### *Certificate of Analysis*

**Recommended Concentrations and Limits<sup>1</sup>  
(at two Standard Deviations)**

#### ***Certified Concentrations<sup>2</sup>***

Pt NIS	2.67	±	0.20	g/t
Pd NIS	3.22	±	0.22	g/t
Rh NiS	0.55	±	0.02	g/t
Ru NiS	0.87	±	0.10	g/t
Pt Pb Collection	2.61	±	0.21	g/t
Pd Pb Collection	3.17	±	0.24	g/t
Cr XRF	14.37	±	0.54	%
Cu M/ICP	506	±	47.3	ppm
Cu P	514	±	38	ppm
Cu XRF	535	±	52	ppm
Ni XRF	1387	±	78	ppm
Specific Gravity	3.49	±	0.22	

#### ***Provisional Concentrations***

Au NIS	0.111	±	0.022	g/t
Au Pb Collection	0.115	±	0.016	g/t
Ir NiS	0.19	±	0.04	g/t
Co M/ICP	172	±	40	ppm
Co P	25	±	3.5	ppm
Ni M/ICP	1351	±	196	ppm
Ni P	714	±	88	ppm

*4E = 6.44 g/t (Pt, Pd, Rh plus Au)*

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 Limits (at two Standard Deviations)

## *Certified Concentrations*

Al <sub>2</sub> O <sub>3</sub>	11.62	±	0.30	%
CaO	1.33	±	0.04	%
Cr <sub>2</sub> O <sub>3</sub>	21.05	±	0.82	%
Fe <sub>2</sub> O <sub>3</sub>	18.10	±	0.40	%
MgO	8.03	±	0.20	%
MnO	0.91	±	0.04	%
SiO <sub>2</sub>	37.52	±	0.38	%
TiO <sub>2</sub>	0.52	±	0.02	%

## *Provisional Concentrations*

K <sub>2</sub> O	0.14	±	0.02	%
Na <sub>2</sub> O	0.28	±	0.06	%
S	0.13	±	0.02	%

## *Informational Means*

LOI	-0.21	%
P <sub>2</sub> O <sub>5</sub>	0.04	%

1. **Intended Use:** AMIS0122 can be used to check analysis of samples of PGE, Cu and Ni ores hosted by the UG2 Reef or other chromitite rich 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 and 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:** AMIS0122 was supplied by Anglo Platinum. This material is from a UG2 reef stockpile of ore transported from the Middlepunt Hill Section, Lebowa Platinum Mine, situated in the Eastern Limb of the Bushveld Complex, approximately 60km NW of Steelpoort, in Mpumalanga Province, South Africa.

3. **Mineral and Chemical Composition:** AMIS0122 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. The uncertified trace element chemistry is presented as an appendix to this certificate.

**4. Appearance:** The material is a very fine olive brown powder (Corstor colour chart – 2.5Y 4/4).

**5. Handling instructions:** The material is packaged in Laboratory Packs and Explorer Packs that must be shaken or otherwise agitated before use. Normal safety precautions for handling fine particulate matter are suggested, such as the use of safety glasses, breathing protection, gloves and a laboratory coat.

**6. Method of Preparation:** The material was crushed, dry-milled and air-classified to <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 consensus test results were carried out by an independent statistician.

**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. State and provide brief description of analytical techniques used.
2. State aliquots used for all determinations.
3. Results for individual analyses to be reported.
4. All results for individual PGM's to be reported in ppb.
5. All results for base metals to be reported in ppm.
6. Report all QC data, to include replicates, blanks and certified reference materials used.

**9. Method of Certification:** Twenty six laboratories were each given eight packages, comprising eight samples scientifically selected from throughout the batch. Twenty three laboratories reported results in time for certification of the economic elements. Eleven of these laboratories reported results for the major elements.

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:** (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. Intertek Utama Services (Indonesia)
15. Labtium Inc Finland
16. OMAC Laboratories Limited (Ireland)
17. Set Point Laboratories (Isando) SA
18. Set Point Laboratories (Mokopane) SA
19. SGS Australia Pty Ltd (Newburn) WA
20. SGS Lakefield Research Africa (Pty) Ltd (Booyens SA)
21. SGS Mineral Services Lakefield (Canada)
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 listed on p1 is set out below. A proficiency report has been sent to the managers of the participating laboratories. Additional digital data from this round robin is available on request.

Lab Code	Au NIS ppm	Ir NIS ppm	Pd NIS ppm	Pt NIS ppm	Rh NIS ppm	Ru NIS ppm	Au PbColl ppm	Pd PbColl ppm	Pt PbColl ppm	Co M/ICP ppm	Co P ppm	Cr XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm	SG	
A	0.12	0.12	3.28	2.66	0.55	0.94	0.12	3.26	2.64	170	28	145007	544	566		1440	765		3.32	
A	0.12	0.12	3.22	2.68	0.55	0.92	0.12	3.24	2.60	180	28	145007	570	553		1510	745		3.34	
A	0.12	0.12	3.30	2.60	0.54	0.91	0.12	3.26	2.68	170	27	145007	554	562		1480	762		3.32	
A	0.12	0.12	3.28	2.72	0.56	0.94	0.11	3.26	2.60	200	25	144323	572	531		1500	731		3.30	
A	0.12	0.12	3.20	2.65	0.55	0.92	0.13	3.26	2.64	170	26	144323	542	545		1500	743		3.31	
A	0.12	0.12	3.22	2.62	0.54	0.92	0.11	3.26	2.62	175	25	144323	554	549		1480	740		3.33	
A	0.12	0.12	3.22	2.64	0.54	0.91	0.12	3.30	2.68	170	26	145007	544	555		1470	753		3.33	
A	0.12	0.12	3.29	2.62	0.55	0.93	0.12	3.26	2.56	180	27	145007	542	547		1480	745		3.34	
B							0.11	3.31	2.70	192	25		523	503					696	
B							0.18	3.12	2.60	199	25		534	510					703	
B							0.13	3.06	2.48	188	27		535	522					710	
B							0.13	3.02	2.41	203	25		534	514					705	
B							0.10	3.23	2.60	199	25		528	519					708	
B							0.14	2.92	2.40	200	25		548	515					700	
B							0.13	3.27	2.64	200	26		546	510					697	
C	0.07	0.20	3.25	2.80	0.54	0.92	0.10	2.68	2.32	165	29	144938	528	524	525	1260	893	1550	3.31	
C	0.06	0.19	2.91	2.31	0.52	0.77	0.11	3.09	2.60	175	28	146306	499	509	524	1410	849	1560	3.30	
C	0.08	0.21	3.36	2.87	0.55	0.94	0.10	2.98	2.60	178	28	144460	516	537	533	1450	882	1560	3.32	
C	0.08	0.21	3.37	2.87	0.56	0.99	0.10	2.91	2.48	181	30	145212	528	566	532	1470	918	1560	3.35	
C	0.07	0.21	3.37	2.86	0.56	0.95	0.12	3.11	2.63	181	29	145964	526	539	520	1470	886	1540	3.28	
C	0.07	0.20	3.01	2.45	0.54	0.82	0.10	2.84	2.39	169	30	145486	497	548	526	1400	929	1540	3.33	
C	0.07	0.21	3.28	2.85	0.54	0.96	0.11	2.80	2.40	185	30	147127	534	569	532	1500	938	1550	3.32	
C	0.07	0.20	3.19	2.73	0.52	0.90	0.10	3.00	2.55	182	29	146238	527	537	515	1480	883	1520	3.36	
D							0.10	2.76	2.26	162	25		512	505					1320	703
D							0.12	3.16	2.57	163	25		507	504					1320	691
D							0.11	2.98	2.52	161	25		503	507					1300	705
D							0.11	2.87	2.34	158	25		506	506					1260	697
D							0.11	2.94	2.37	157	25		495	507					1250	716
D							0.11	2.99	2.44	153	24		483	503					1230	683
D							0.10	2.62	2.15	158	25		502	505					1260	698
D							0.10	3.08	2.54	158	24		510	509					1290	700
E							0.12	3.26	2.71	145	25	141561	481	533	490	1220	716	1230	3.43	
E							0.13	3.27	2.74	145	24	141629	485	537	490	1240	723	1250	3.38	
E							0.12	3.15	2.59	146	24	141766	483	537	490	1240	714	1250	3.54	
E							0.11	3.15	2.62	143	24	141698	480	538	490	1230	716	1240	3.42	
E							0.11	3.11	2.63	143	24	141903	476	536	480	1220	716	1240	3.51	
E							0.10	2.98	2.48	189	25	141561	524	542	490	1290	726	1240	3.40	
E							0.12	3.27	2.75	159	24	141766	516	529	480	1315	710	1230	2.18	
E							0.12	2.97	2.54	153	24	141698	485	537	480	1235	722	1240	3.15	
F							0.12	2.90	2.45	141	23		517	512					1275	680
F							0.13	3.10	2.65	134	22		462	520					1225	694
F							0.11	2.89	2.48	131	24		455	521					1170	698
F							0.11	3.12	2.66	130	23		486	507					1260	682
F							0.12	3.13	2.65	131	23		496	516					1275	687
F							0.11	2.93	2.50	131	22		471	517					1225	690
F							0.11	3.10	2.62	132	23		489	517					1235	694
F							0.12	3.23	2.74	128	25		472	517					1230	675
G	0.10	0.19	3.31	2.79	0.49	0.84	0.13	2.99	2.30	103	27	139850	484	513	561	1060	737	1444	3.45	
G	0.09	0.17	3.12	2.48	0.45	0.79	0.12	3.22	2.46	101	26	140193	462	514	549	1020	728	1500	3.41	
G	0.11	0.21	3.37	2.91	0.51	0.86	0.11	3.13	2.33	94	25	139782	484	512	571	1000	725	1455	3.42	
G	0.10	0.18	3.34	2.60	0.48	0.86	0.11	3.15	2.29	112	26	140329	462	513	545	1060	727	1499	3.45	
G	0.10	0.18	3.33	2.84	0.50	0.83	0.12	3.12	2.38	103	27	140398	455	508	572	1020	731	1485	3.41	
G	0.10	0.19	3.28	2.82	0.48	0.82	0.11	3.11	2.43	111	27	140193	491	511	554	1090	727	1444	3.45	
G	0.09	0.19	3.28	2.83	0.49	0.81	0.12	3.23	2.52	114	26	140056	490	510	566	1110	729	1456	3.41	
G	0.10	0.19	3.22	2.76	0.48	0.80	0.12	3.19	2.41	101	25	139987	464	513	569	1010	734	1456	3.46	

Assay data (cont)

Lab Code	Au NIS ppm	Ir NIS ppm	Pd NIS ppm	Pt NIS ppm	Rh NIS ppm	Ru NIS ppm	Au PbColl ppm	Pd PbColl ppm	Pt PbColl ppm	Co M/ICP ppm	Co P ppm	Cr XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm	SG
H							0.14	3.38	2.81	100	29		523	510		1102	759		
H							0.14	3.15	2.67	110	28		527	505		1154	754		
H							0.13	3.26	2.74	126	28		528	504		1241	754		
H							0.13	3.22	2.69	129	28		528	508		1255	759		
H							0.12	3.34	2.75	114	28		525	510		1182	763		
H							0.12	3.07	2.59	100	28		525	506		1106	757		
H							0.12	3.16	2.65	136	28		530	507		1286	752		
H							0.13	3.29	2.76	133	28		533	511		1275	749		
I	0.10	0.16	3.14	2.71	0.46	0.77	0.13	3.23	2.71	104	24	141400	523	509	560	869	711	1357	3.49
I	0.10	0.16	3.12	2.70	0.45	0.77	0.13	3.15	2.77	108	25	141600	521	505	546	890	720	1354	3.49
I	0.10	0.16	3.00	2.59	0.45	0.76	0.11	3.24	2.66	111	25	141700	518	505	552	863	724	1358	3.48
I	0.10	0.16	3.05	2.64	0.45	0.76	0.12	3.16	2.62	109	24	141600	523	514	559	885	717	1369	3.49
I	0.09	0.16	3.03	2.62	0.44	0.74	0.11	3.15	2.50	111	24	141600	523	505	552	892	715	1352	3.48
I	0.10	0.16	3.00	2.59	0.42	0.76	0.11	3.15	2.40	109	24	142100	528	509	562	924	702	1359	3.48
I	0.09	0.16	3.04	2.63	0.44	0.76	0.12	3.28	2.72	112	25	141600	519	509	556	927	711	1357	3.48
I	0.10	0.16	3.03	2.71	0.45	0.76	0.11	3.02	2.49	101	24	141500	529	514	547	894	712	1356	3.48
J							0.12	3.07	2.54				141300			548			1344
J							0.12	3.05	2.53				141500			556			1345
J							0.11	3.13	2.63				141800			549			1344
J							0.12	3.03	2.70				141800			555			1352
J							0.12	3.18	2.57				142000			554			1354
J							0.11	3.05	2.45				141300			550			1358
J							0.11	3.10	2.71				141800			551			1353
J							0.12	3.17	2.63				141700			556			1350
K	0.10	0.18	3.33	2.76	0.53	0.85				149			445			1407			
K	0.10	0.19	3.39	2.73	0.47	0.87				234			449			1431			
K	0.10	0.12	3.25	2.71	0.50	0.89				244			455			1501			
K	0.09	0.26	3.14	2.95	0.57	0.95				163			467			1481			
K	0.10	0.21	2.77	2.50	0.56	0.84				161			465			1495			
K	0.10	0.11	3.39	2.61	0.55	0.85				161			508			1468			
K	0.10	0.23	3.06	2.62	0.54	0.88				136			483			1499			
K	0.10	0.13	3.00	2.59	0.57	0.83				162			471			1458			
L	0.13	0.20		2.87	0.54	0.78				191									1340
L	0.13	0.17		3.32	0.60	0.91				177									1310
L	0.13	0.18		3.20	0.63	0.89				181									1330
L	0.13	0.18		2.82	0.51	0.78				179									1330
L	0.13	0.18		2.97	0.60	0.84				183									1370
L	0.13	0.18		2.63	0.55	0.72				185									1350
L	0.13	0.17		3.04	0.57	0.83				186									1400
L	0.13	0.19		3.09	0.62	0.85				187									1400
M	0.12	0.21	3.30	2.68	0.56	0.86	0.11	3.20	2.64	164	26	148773	512	499	443	1425	710	1372	3.52
M	0.12	0.21	3.22	2.72	0.56	0.89	0.12	3.23	2.68	161	24	149190	492	466	450	1370	662	1369	3.56
M	0.13	0.21	3.27	2.69	0.56	0.85	0.12	3.22	2.68	164	26	148478	513	502	452	1422	709	1377	3.56
M	0.12	0.21	3.32	2.69	0.57	0.92	0.11	3.18	2.71	161	26	147110	502	473	445	1389	671	1380	3.48
M	0.12	0.21	3.30	2.69	0.56	0.88	0.11	3.18	2.58	165	24	148205	510	461	448	1439	652	1370	3.48
M	0.12	0.22	3.32	2.75	0.58	0.89	0.12	3.26	2.68	163	25	148123	502	465	439	1422	656	1361	3.54
M	0.12	0.22	3.28	2.73	0.57	0.82	0.11	3.27	2.72	164	26	148725	513	480	444	1440	689	1388	3.55
M	0.12	0.21	3.33	2.74	0.58	0.89	0.11	3.19	2.72	163	24	149142	509	441	441	1429	634	1364	3.47
N	0.11	0.20	3.11	2.64	0.52	0.82	0.11	3.06	2.42										
N	0.11	0.21	3.29	2.64	0.56	0.87	0.12	3.16	2.55										
N	0.11	0.19	3.09	2.55	0.53	0.80	0.13	3.15	2.62										
N	0.12	0.20	3.23	2.62	0.55	0.83	0.12	3.18	2.71										
N	0.11	0.19	3.17	2.62	0.55	0.80	0.11	3.24	2.65										
N	0.12	0.20	3.20	2.66	0.55	0.85	0.12	3.14	2.60										
N	0.12	0.19	3.26	2.61	0.54	0.81	0.11	3.25	2.58										
N	0.11	0.20	3.07	2.52	0.53	0.84	0.13	3.26	2.55										
O							0.11	3.18	2.64	217	24	142681	542	473		1320	633		
O							0.12	3.24	2.62	208	24	142681	540	474		1340	636		
O							0.12	3.34	2.60	215	25	141587	540	476		1320	639		
O							0.12	3.18	2.64	217	27	142134	537	478		1340	638		
O							0.12	3.18	2.56	213	25	141660	533	470		1310	639		
O							0.12	3.16	2.64	202	25	142408	538	475		1300	641		
O							0.12	3.10	2.65	202	25	142134	534	471		1300	635		
O							0.11	3.29	2.63	202	24	141518	533	472		1310	634		
R							0.14	3.44	2.63				479						
R							0.13	3.44	2.67				483						
R							0.11	3.45	2.60				486						
R							0.13	3.57	2.71				452						
R							0.11	3.56	2.75				481						
R							0.12	3.61	2.83				468						
R							0.11	3.55	2.79				479						
R							0.11	3.48	2.73				482						
S					0.55		0.11	3.31	2.63						538			1420	3.62
S					0.51		0.12	3.25	2.63						534			1420	3.64
S					0.54		0.12	3.25	2.65						536			1420	3.63
S					0.53		0.12	3.25	2.53						539			1430	3.63
S					0.54		0.12	3.34	2.68						533			1420	3.64
S					0.54		0.12	3.28	2.58						534			1420	3.64
S					0.54		0.12	3.34	2.57						533			1420	3.65
S					0.54		0.12	3.28	2.51						537			1430	3.63
T					0.50			2.97	2.61						547			1421	3.65
T					0.50			3.08	2.46						538			1376	3.58
T					0.50			3.07	2.65						515			1338	
T					0.47			2.91	2.44						549			1444	3.65
T					0.44			2.73	2.41						533			1407	3.58
T					0.51			3.11	2.70						521			1350	
T					0.50			3.02	2.58						542			1396	3.64
T					0.48			2.97	2.42										
V								2.38		179	40		497	489		1250	789		
V								2.28		173	38		499	486		1240	778		
V								2.41		179	39		499	484		1230	783		
V								2.43		179	39		487	482		1250	792		
V								2.52		189	40		495	483		1240			

## Assay data (cont)

Lab Code	Au NIS ppm	Ir NIS ppm	Pd NIS ppm	Pt NIS ppm	Rh NIS ppm	Ru NIS ppm	Au PbColl ppm	Pd PbColl ppm	Pt PbColl ppm	Co M/ICP ppm	Co P ppm	Cr XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm	SG
Y	0.11	0.16	3.27	2.61	0.54	0.91	0.11	3.19	2.59	176	23	147059	496	497		1420	724		3.52
Y	0.12	0.17	3.26	2.68	0.56	0.92	0.12	3.22	2.65	180	24	147059	499	495		1420	723		3.55
Y	0.11	0.17	3.27	2.66	0.55	0.91	0.11	3.23	2.60	182	23	147743	500	492		1460	721		3.56
Y	0.12	0.16	3.17	2.60	0.54	0.91	0.11	3.25	2.60	186	24	146375	495	497		1470	722		3.55
Y	0.11	0.17	3.20	2.65	0.54	0.91	0.11	3.24	2.62	182	23	149111	496	495		1460	726		3.55
Y	0.10	0.16	3.22	2.57	0.54	0.92	0.12	3.25	2.67	181	23	147059	496	491		1470	719		3.53
Y	0.12	0.18	3.20	2.58	0.55	0.93	0.11	3.25	2.61	183	23	145691	497	500		1470	722		3.45
Y	0.10	0.18	3.23	2.57	0.55	0.92	0.11	3.26	2.63	184	24	147743	496	495		1470	719		3.56
Z							0.14	3.21	2.56	190			550			1400			
Z							0.14	3.33	2.70	160			560			1350			
Z							0.12	3.37	2.70	120			560			1400			
Z							0.13	3.23	2.56	140			570			1220			
Z							0.13	3.29	2.88	150			520			1210			
Z							0.11	3.25	2.87	150			570			1280			
Z							0.15	3.03	2.69	160			550			1240			
Z							0.13	2.90	2.49	150			670			1250			

**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 <sup>1</sup>	σ <sub>L</sub> <sup>2</sup>	S <sub>w</sub> <sup>3</sup>	CSU <sup>4</sup>
Au	NIS	g/t	0.011	0.011	0.004	0.004
Ir	NiS	g/t	0.019	0.020	0.007	0.008
Pd	NIS	g/t	0.109	0.071	0.085	0.027
Pt	NIS	g/t	0.096	0.049	0.083	0.020
Rh	NiS	g/t	0.015	0.008	0.012	0.003
Ru	NiS	g/t	0.050	0.035	0.037	0.013
Au	Pb Coll	g/t	0.008	0.003	0.007	0.001
Pd	Pb Coll	g/t	0.121	0.055	0.088	0.015
Pt	Pb Coll	g/t	0.105	0.041	0.083	0.012
Co	M/ICP	ppm	19.7	13.2	8.2	3.5
Co	P	ppm	1.74	1.21	0.73	0.33
Cr	XRF	ppm	2681	2143	1146	658
Cu	M/ICP	ppm	23.6	14.6	10.5	3.7
Cu	P	ppm	19.1	14.5	5.5	4.1
Cu	XRF	ppm	26.2	22.7	14.2	8.2
Ni	M/ICP	ppm	97.9	68.5	42.1	18.7
Ni	P	ppm	44.0	33.3	9.9	9.0
Ni	XRF	ppm	39.2	34.8	19.3	12.5
SG	pycnometer		0.11	0.09	0.04	12.55

1. S - Std Dev for use on control charts.

2. σ<sub>L</sub> - Betw Lab Std Dev, for use to calculate a measure of accuracy.

3. S<sub>w</sub> - 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 Informational 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, who have maintained measurement traceability during the analytical process.

**15. Certification:** AMIS0122 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 50g to 250g) of material. The Laboratory Packs are sealed bottles delivered in sealed foil pouches. The Explorer Packs contain material in standard geochem envelopes, 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 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.

24 August 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 1. – Uncertified trace element statistics

AMIS0122 Trace

Element	Method	Unit	Mean	2SD	RSD%	n
Ag	M/ICP	ppm	0.212	0.03	6.8	38
Al	M/ICP	ppm	6.00	0.48	4.0	76
As	M/ICP	ppm	4.09	2.7	33.0	52
Ba	M/ICP	ppm	425	45	5.3	85
Be	M/ICP	ppm	0.114	0.07	28.6	41
Bi	M/ICP	ppm	0.119	0.09	35.9	62
Ca	M/ICP	ppm	0.940	0.14	7.6	93
Cd	M/ICP	ppm	0.243	0.39	79.5	30
Ce	M/ICP	ppm	10.9	1.3	6.1	76
Cs	M/ICP	ppm	0.162	0.14	43.0	56
Dy	M/ICP	ppm	0.461	0.10	11.0	38
Er	M/ICP	ppm	0.281	0.05	9.0	39
Eu	M/ICP	ppm	0.155	0.05	17.5	39
Fe	M/ICP	ppm	11.4	3.1	13.7	76
Ga	M/ICP	ppm	35.4	4.1	5.8	60
Gd	M/ICP	ppm	0.505	0.15	14.8	40
Ge	M/ICP	ppm	0.173	0.10	27.5	40
Hf	M/ICP	ppm	0.488	0.19	19.2	76
Ho	M/ICP	ppm	0.094	0.02	10.9	38
In	M/ICP	ppm	0.025	0.01	29.9	45
K	M/ICP	ppm	0.114	0.02	6.7	94
La	M/ICP	ppm	3.69	0.40	5.4	83
Li	M/ICP	ppm	2.08	0.38	9.1	50
Lu	M/ICP	ppm	0.041	0.005	5.7	15
Mg	M/ICP	ppm	4.60	0.36	3.9	76
Mn	M/ICP	ppm	6774	707	5.2	77
Mo	M/ICP	ppm	2.03	0.61	15.0	77
Na	M/ICP	ppm	0.205	0.02	5.3	78
Nb	M/ICP	ppm	1.02	0.31	15.4	69
Nd	M/ICP	ppm	3.15	0.36	5.7	38
P	M/ICP	%	0.015	0.005	17.6	77
Pb	M/ICP	ppm	4.06	1.5	18.8	60
Pr	M/ICP	ppm	0.819	0.07	4.1	38
Rb	M/ICP	ppm	4.65	0.93	10.0	67
Re	M/ICP	ppm	0.005	0.007	64.8	23
Sb	M/ICP	ppm	2.75	0.42	7.6	60
Sc	M/ICP	ppm	7.78	1.6	10.0	55
Se	M/ICP	ppm	9.23	9.8	52.8	41
Sm	M/ICP	ppm	0.566	0.13	11.4	38
Sn	M/ICP	ppm	1.00	0.30	14.8	62
Sr	M/ICP	ppm	42.1	6.0	7.2	99
Ta	M/ICP	ppm	0.075	0.03	22.4	42
Tb	M/ICP	ppm	0.082	0.03	16.4	40
Te	M/ICP	ppm	0.355	0.11	14.8	52
Th	M/ICP	ppm	0.987	0.14	7.2	69
Ti	M/ICP	%	0.283	0.03	4.9	55
Tl	M/ICP	ppm	0.069	0.04	25.4	40
Tm	M/ICP	ppm	0.040	0.000	0.0	14
U	M/ICP	ppm	0.615	0.17	13.8	77
V	M/ICP	ppm	675	318	23.6	72
W	M/ICP	ppm	0.316	0.13	20.2	45
Y	M/ICP	ppm	2.32	0.26	5.6	74
Yb	M/ICP	ppm	0.251	0.09	17.3	39
Zn	M/ICP	ppm	359	26	3.6	55
Zr	M/ICP	ppm	18.8	5.1	13.5	84