



AMIS0151

Certified Reference Material

Platinum (PGM) Reference Material Ore Grade UG2 Reef

Certificate of Analysis

Recommended Concentrations and Limits¹ (at two Standard Deviations)

Certified Concentrations²

Pt Pb Collection	4.64	±	0.36	g/t
Pd Pb Collection	3.15	±	0.28	g/t
Pt NIS	4.77	±	0.40	g/t
Pd NIS	3.26	±	0.18	g/t
Cr XRF	21.64	±	0.23	%
Cu M/ICP	150	±	14	ppm
Ni XRF	1314	±	134	ppm
Specific Gravity	4.03	±	0.10	

Provisional Concentrations

Au Pb Collection	0.072	±	0.014	g/t
Au NIS	0.066	±	0.012	g/t
Ir NiS	0.34	±	0.080	g/t
Rh NiS	1.04	±	0.12	g/t
Ru NiS	1.33	±	0.24	g/t
Co M/ICP	221	±	47	ppm
Cu P	149	±	19	ppm
Ni M/ICP	1281	±	195	ppm

Informational Mean

Cu XRF 151 ppm

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.

$$4E = \text{Platinum} + \text{Palladium} + \text{Rhodium} + \text{Gold} = 8.924 \text{ g/t}$$

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

Certified Concentrations

Al ₂ O ₃	15.09	±	0.52	%
CaO	1.80	±	0.06	%
Cr ₂ O ₃	31.63	±	0.34	%
Fe ₂ O ₃	24.76	±	0.72	%
MgO	11.25	±	0.40	%
MnO	0.210	±	0.012	%
SiO ₂	14.34	±	0.36	%
TiO ₂	0.81	±	0.04	%

Provisional Concentrations

K ₂ O	0.071	±	0.012	%
Na ₂ O	0.32	±	0.06	%
S LECO	0.086	±	0.016	%

1. Intended Use: AMIS0151 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 concentrate materials; derived from the UG2 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 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: This standard was made using Pt/Pd UG2 rich chromitite material supplied by Anglo Platinum Limited from the Western limb of the Bushveld Complex. This specific material was made from a bulk sample collected underground from East shaft section of the Waterval Mine.

3. Mineral and Chemical Composition: The UG2 chromitite ore consists of fine to medium size cumulus chromite grains with substantial amounts of post-cumulus orthopyroxene crystals. The footwall is a coarse grained pegmatoidal pyroxenite with sporadic occurrences of chromitite blebs, lenses and stringers. The hanging wall is predominantly fine to medium grained orthopyroxenite with three or more chromitite stringers referred to as the UG2 leaders. The concentrates produced have had most of the chromitite and some of the silicates removed

Major element chemistry data from twelve 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 Light Brownish Grey (Corstor 5YR 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. 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. Twenty two 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 22 out of 24 laboratories that provided results timeously were (not in same order as in the table of assays):

1. Activation Laboratories Pty Ltd (ActLabs) CA
2. ALS Chemex Laboratory Group Brisbane Australia
3. ALS Chemex Laboratory Group Johannesburg SA
4. ALS Chemex Laboratory Group Perth WA
5. ALS Chemex Laboratory Group Vancouver CA
6. Anglo Platinum – Eastern Bushveld Regional Laboratory
7. Anglo Research (Crown Campus)
8. Barplats Laboratory SA
9. Genalysis Laboratory Services (South Africa) Pty
10. Genalysis Laboratory Services WA
11. Northam
12. OMAC Laboratories Limited (Ireland)
13. Performance Laboratories SA
14. Rappa Research Laboratory
15. Set Point Laboratories (Isando) SA
16. Set Point Laboratories (Mokopane) SA
17. SGS Australia Pty Ltd (Newburn) WA
18. SGS Mineral Services Callao (Peru)
19. SGS Mineral Services Lakefield (Canada)
20. SGS South Africa (Pty) Ltd - Booyens JHB
21. Ultra Trace (Pty) Ltd WA
22. 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. A proficiency report has been sent to the managers of the participating laboratories. Additional digital data from this round robin is available on request.

Economical elements assay data

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	Co XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm
A	5.00	3.08	0.08	4.59	3.22	0.07	0.33	1.09	1.37	235	22.00		143	147	152	1303	378	1381
A	5.02	3.32	0.08	4.64	3.33	0.07	0.33	1.12	1.43	237	24.00		144	154	151	1324	394	1383
A	4.84	3.22	0.08	4.80	3.32	0.07	0.33	1.10	1.17	233	23.00		144	151	150	1309	382	1378
A	4.94	3.22	0.08	4.92	3.41	0.07	0.34	1.11	1.40	230	24.00		145	153	148	1321	389	1379
A	4.96	3.26	0.08	4.51	3.35	0.07	0.31	1.10	1.37	239	22.00		145	147	149	1313	374	1387
A	4.36	3.41	0.08	4.57	3.32	0.08	0.32	1.01	1.30	232	24.00		141	148	147	1272	384	1385
A	4.76	3.19	0.08	4.51	3.18	0.07	0.31	1.07	1.34	233	22.00		144	145	148	1308	372	1385
A	4.78	3.29	0.08	4.92	3.32	0.07	0.34	1.12	1.13	234	24.00		143	138	148	1295	364	1396
B	4.47	3.14	0.07	4.76	3.21	0.07	0.35	1.05	1.36									
B	4.69	3.19	0.08	4.70	3.23	0.07	0.35	1.08	1.30									
B	4.68	3.04	0.07	4.69	3.25	0.08	0.35	1.05	1.37									
B	4.70	3.08	0.07	4.73	3.26	0.07	0.35	1.08	1.29									
B	4.41	3.18	0.08	4.72	3.27	0.08	0.35	1.08	1.33									
B	4.66	3.20	0.07	4.65	3.24	0.07	0.33	1.05	1.29									
B	4.68	3.16	0.07	4.72	3.29	0.08	0.35	1.07	1.33									
B	4.41	2.99	0.07	4.66	3.26	0.07	0.35	1.07	1.34									
C	4.67	3.26	0.07	4.13		0.06	0.28	0.71	1.16	201	20.00	241	156	133	156	1223	346	1354
C	4.59	3.29	0.07	4.13		0.06	0.29	0.70	1.15	200	20.00	239	155	132	155	1230	338	1352
C	4.68	3.24	0.07	4.13		0.06	0.30	0.72	1.17	201	20.00	244	154	135	156	1216	353	1354
C	4.43	3.17	0.07	4.13		0.06	0.29	0.73	1.17	201	21.00	244	157	133	156	1230	346	1350
C	4.59	3.21	0.07	4.10		0.06	0.28	0.71	1.18	207	20.00	249	156	133	155	1230	347	1354
C	4.60	3.23	0.07	4.12		0.06	0.28	0.73	1.17	201	22.00	233	153	134	155	1228	346	1350
C	4.59	3.25	0.07	4.11		0.06	0.28	0.72	1.17	201	20.00	237	156	132	156	1230	343	1361
C	4.59	3.23	0.07	4.13		0.06	0.29	0.72	1.17	201	20.00	245	157	134	156	1231	350	1350
D	4.63	3.19	0.07									230			157			1343
D	4.50	3.09	0.07									224			158			1348
D	4.75	3.31	0.07									244			160			1354
D	4.58	3.19	0.07									238			162			1358
D	4.60	3.21	0.08									239			165			1357
D	4.50	3.10	0.07									246			167			1349
D	4.70	3.23	0.07									236			158			1348
D	4.70	3.23	0.07									225			162			1348

Economical elements 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	Co XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm
E				5.33	3.50	0.06	0.40	1.15	1.87									
E				4.74	3.26	0.05	0.36	1.02	1.67									
E				5.11	3.41	0.07	0.39	1.12	1.89									
E				5.16	3.40	0.06	0.38	1.11	1.91									
E				5.19	3.43	0.06	0.41	1.12	1.87									
E				5.20	3.46	0.06	0.40	1.13	1.83									
E				5.17	3.45	0.05	0.42	1.14	1.79									
E				5.17	3.48	0.05	0.40	1.13	1.85									
F	4.93	3.16	0.07							270			160			1230		
F	4.86	3.10	0.06							270			160			1160		
F	4.72	3.05	0.07							260			150			1210		
F	4.78	3.04	0.07							260			160			1250		
F	4.58	2.89	0.06							260			120			1160		
F										260			160			1240		
F													150			1030		
F	4.88	3.26								260			150			1170		
G	4.62	3.13	0.07							89		280	159		150			1520
G	4.56	3.04	0.07							101		290	152		160			1550
G	4.56	3.05	0.07							76		220	138		220			1530
G	4.48	3.01	0.07							96		320	159		200			1520
G	4.54	3.04	0.07							106		240	157		140			1510
G	4.57	3.04	0.07							96		240	159		170			1510
G	4.55	3.05	0.07							101		230	157		190			1470
G	4.53	3.05	0.07							82		230	149		150			1470
H	4.77	3.22	0.08												103			1340
H	4.76	3.15	0.08												103			1330
H	4.77	3.21	0.08												100			1320
H	4.75	3.20	0.07												100			1310
H	4.70	3.21	0.08												101			1330
H	4.73	3.31	0.07												100			1340
H	4.76	3.24	0.08												102			1340
H	4.75	3.15	0.07												102			1330
I	4.50	2.88											181			1422		
I	4.36	2.86																
I	4.17	2.79											156			1411		
I	4.66	2.91											185			1433		
I	4.39	2.65											176			1431		
I	4.81	2.93											179			1439		
I	4.20	3.01											177			1392		
I	4.53	2.90											164			1434		
J		2.15	0.07							247	247.00		144	142		1400		
J		2.07	0.08							250	251.00		146	135		1414		
J		2.24	0.08							254	263.00		142	144		1413		
J		2.28	0.08							249	239.00		149	141		1415		
J		2.29	0.09							244	245.00		142	135		1409		
J		2.32	0.07							242	248.00		145	142		1408		
J		2.23	0.07							257	245.00		148	145		1415		
J		2.06	0.07							250	246.00		142	143		1417		
K																		
K				4.81	3.38	0.02	0.19	1.16	1.55	254			152			1206		
K				4.39	3.14	0.03	0.86	1.12	1.44	255			146			1197		
K				4.48	3.20	0.02	0.99	1.12	1.41	252			135			1181		
K				4.78	3.16	0.06	0.30	1.03	1.42	257			142			1218		
K				4.68	3.11	0.06	0.30	1.02	1.40									
K				4.70	3.13	0.06	0.35	1.00	1.38	229			105			1112		
K				4.66	3.11	0.06	0.34	1.00	1.39	284			189			1055		
L	4.73	3.25	0.08							200	18.00		144	157		1215	373	
L	4.89	3.35	0.08							199	18.00		141	156		1212	379	
L	4.59	3.28	0.06							208	17.00		144	154		1249	366	
L	4.81	3.34	0.10							211	16.00		151	160		1271	377	
L	4.59	3.20	0.07							215	16.00		156	157		1283	352	
L	4.48	3.13	0.08							216	17.00		156	154		1280	350	
L	4.57	3.18	0.07							214	18.00		154	159		1265	352	
L	4.65	3.30	0.07							215	17.00		152	159		1285	350	
M	4.30	2.97										200						1400
M	4.00	2.69										200						1400
M	4.30	2.90										200						1300
M	4.38	2.91										200						1300
M	4.64	3.22										200						1400
M	4.52	3.12										200						1300
M	4.66	3.15										200						1300
M	4.50	3.00										200						1300
O	4.62	3.07	0.08	4.73	3.02	0.07	0.27	0.93	1.26	143			155	164	100			1200
O	4.69	3.13	0.09	4.61	3.09	0.07	0.30	0.95	1.29	146			157	157	300			1300
O	4.59	3.01	0.08	4.69	3.20	0.07	0.32	0.94	1.31	151			162	160	200			1200
O	4.62	3.07	0.08	4.69	3.15	0.06	0.28	0.95	1.28	145			164	164	200			1200
O	4.75	3.15	0.08	4.65	3.29	0.07	0.30	0.96	1.29	152			164	163	200			1200
O	4.75	3.04	0.08	4.69	3.00	0.07	0.27	0.94	1.29	141			167	165	200			1100
O	4.68	3.11	0.09	4.65	3.02	0.07	0.28	0.98	1.33	151			165	164	200			1200
O	4.68	3.17	0.08	4.72	3.01	0.07	0.31	0.98	1.30	146			167	157	100			1200
P	4.70	3.29	0.08							226			148			1366		
P	4.78	3.39	0.07							233			150			1372		
P	4.59	3.32	0.06							223			144			1352		
P	4.51	3.14	0.06							237			153			1366		
P	4.45	3.23	0.06							240			158			1334		
P	4.68	3.38	0.07							224			149			1366		
P	4.42	3.19	0.06							235			153			1353		
P	4.76	3.42	0.07							235			152			1357		
Q	4.76	3.20	0.09	4.90	3.22	0.06	0.37	1.01	1.24	230	21.00		144	146		1440	372	
Q	4.60	3.16	0.09	4.92	3.34	0.07	0.36	1.06	1.34	230	23.00		146	151		1410	370	
Q	4.60	3.20	0.07	4.87	3.29	0.07	0.36	1.05	1.45	230	20.00		154	148		1420	368	
Q	4.64	3.12	0.08	4.85	3.32	0.07	0.35	1.03	1.42	225	20.00		152	148		1430	368	
Q	4.68	3.08	0.08	4.75	3.21	0.06	0.35	0.99	1.35	240	19.00		150	150		1420	378	
Q	4.60	3.16	0.06	4.95	3.24	0.06	0.37	0.99	1.25	225	22.00		146	151		1440	375	
Q	4.50	3.12	0.07	4.76	3.29	0.07	0.35	1.04	1.40	210	22.00		146	151		1410	371	
Q	4.68	3.16	0.08	4.77	3.21	0.06	0.36	1.01	1.23	235	20.00		150	153		1410	373	
R	2.16			4.78	3.26	0.00	0.58	0.92	1.54	222	22.74		146	153		1388	395	
R	2.20			4.68	3.19	0.00	0.55	0.98	1.56	212	23.00		147	154		1366	400	
R	2.29			4.73	3.21	0.00	0.57	0.86	1.54	224	25.69		141	151		1368	396	
R	2.45			4.86	3.29	0.00	0.71	1.00	1.67	224	28.34		142	151		1341	411	
R	2.13			5.10	3.31	0.00	0.87	0.96	1.57	211	23.89		147	152		1336	419	
R	2.34			5.15	3.34	0.00	0.61	0.										

Economical elements 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	Co XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm
S	4.00	2.45	0.06							158			125			1190		
S	4.04	2.49	0.06							155			121			1190		
S	4.02	2.46	0.06							155			122			1190		
S	4.54	2.83	0.07							153			121			1200		
S	4.66	3.19	0.08							155			120			1200		
S	4.27	2.65	0.06							155			120			1180		
S	4.21	2.57	0.06							158			122			1230		
S	4.53	2.81	0.06							162			124			1240		
T										189		240	145		150	1170		1260
T										182		240	148		150	1175		1240
T										185		240	148		160	1200		1320
T										181		240	146		150	1155		1260
T										184		240	148		150	1175		1400
T										182		240	147		130	1155		1340
T										180		240	145		150	1130		1340
T										183		240	145		150	1165		1340
U	4.94	3.24	0.07							203			129			1210		
U	4.24	2.76	0.06							205			130			1225		
U	4.28	2.81	0.06							211			135			1265		
U	3.68	2.41	0.05							203			129			1220		
U	4.34	2.81	0.06							204			132			1240		
U	3.24	2.13	0.05							204			131			1245		
U	4.79	3.14	0.07							202			135			1220		
U	4.96	3.28	0.07							201			131			1225		
V																		
V	4.67	3.08	0.12							201			146		150	1160		1210
V	4.98	3.28	0.07							195			144		150	1155		1200
V	5.00	3.28	0.07							194			141		150	1120		1200
V	4.97	3.28	0.08							197			144		150	1145		1200
V	4.94	3.25	0.07							192			139		150	1100		1210
V	4.84	3.24	0.10							194			143		150	1130		1200
V	4.78	3.27	0.09							201			148		150	1195		1200
X				4.74	3.33	0.07	0.35	1.03	1.38									
X				4.60	3.41	0.06	0.35	0.95	1.28									
X				4.67	3.23	0.08	0.37	1.01	1.36									
X				4.61	3.18	0.07	0.36	0.98	1.30									
X				4.60	3.25	0.07	0.37	1.02	1.14									
X				4.53	3.23	0.07	0.36	0.99	1.20									
X				4.61	3.24	0.07	0.37	1.03	1.25									
X				4.60	3.24	0.06	0.38	1.00	1.27									

Major element assay data

Lab Code	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %	SG pyc
A	14.82	1.80	31.78	24.63	0.07	11.24	0.22	0.30	14.39	0.81	3.93
A	15.17	1.83	31.80	24.74	0.07	11.29	0.22	0.30	14.31	0.82	3.96
A	14.99	1.81	31.93	24.76	0.07	11.32	0.22	0.31	14.30	0.82	3.94
A	14.99	1.80	32.10	24.90	0.07	11.28	0.21	0.28	14.48	0.78	3.99
A	14.97	1.82	31.50	24.54	0.08	11.32	0.22	0.32	14.27	0.81	4.03
A	15.20	1.83	31.89	24.65	0.08	11.51	0.22	0.32	14.48	0.83	4.01
A	14.97	1.82	31.86	24.66	0.07	11.26	0.22	0.30	14.30	0.81	4.05
A	14.78	1.80	31.67	24.57	0.07	11.23	0.22	0.32	14.31	0.82	4.02
B											4.07
B											4.06
B											4.06
B											4.06
B											4.09
B											4.02
B											4.04
B											4.08
C	15.40	1.75	31.60	25.36	0.07	12.10	0.31	0.34	14.10	0.83	4.04
C	15.40	1.76	31.60	25.31	0.07	12.00	0.32	0.34	14.10	0.83	4.05
C	15.40	1.75	31.70	25.36	0.07	12.00	0.31	0.34	14.10	0.83	4.04
C	15.30	1.75	31.60	25.45	0.07	12.00	0.31	0.34	14.10	0.83	4.01
C	15.40	1.74	31.60	25.45	0.07	12.00	0.32	0.34	14.10	0.83	4.05
C	15.40	1.76	31.70	25.38	0.07	12.00	0.31	0.34	14.10	0.83	4.01
C	15.50	1.76	31.70	25.44	0.07	12.00	0.31	0.34	14.10	0.83	4.02
C	15.40	1.75	31.60	25.45	0.07	12.00	0.31	0.34	14.10	0.83	4.04
D											
D											
D											
D											
D											
D											
D											
D											

Major element assay data

Lab Code	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %	SG pyc
E											
E											
E											
E											
E											
E											
E											
F											
F											
F											
F											
F											
F											
G	15.43	1.78	31.50	24.64	0.06	11.41	0.17	0.21	14.30	0.82	3.88
G	15.12	1.79	31.71	25.01	0.05	11.51	0.17		14.37	0.83	3.94
G	15.36	1.77	31.69	24.75	0.07	11.37	0.17		14.30	0.81	3.88
G	15.24	1.77	31.47	24.63	0.06	11.38	0.17	0.23	14.34	0.82	3.87
G	15.22	1.77	31.61	24.85	0.07	11.37	0.17	0.21	14.32	0.82	3.97
G	15.17	1.85	31.27	24.42	0.07	11.24	0.18	0.31	14.16	0.81	3.94
G	15.24	1.73	31.33	24.57	0.06	11.32	0.17		14.13	0.81	3.88
G	15.45	1.82	32.00	25.25	0.06	11.60	0.18	0.20	14.59	0.84	3.87
H			32.40	24.20							4.05
H			32.40	24.10							4.03
H			32.30	24.00							4.05
H			32.10	23.90							4.05
H			32.30	24.00							4.04
H			32.40	24.10							4.06
H			32.50	24.30							4.06
H			32.20	24.10							4.06
I											4.07
I											4.09
I											4.08
I											4.08
I											4.11
I											4.12
I											4.09
J											
J											
J											
J											
J											
J											
K											
K											
K											
K											
K											
K											
L	14.70	1.82	31.50	24.70	0.07	11.30	0.21	0.37	14.20	0.82	
L	14.70	1.83	31.50	24.80	0.07	11.30	0.20	0.35	14.30	0.82	
L	14.80	1.82	31.60	24.90	0.08	11.30	0.20	0.37	14.20	0.83	
L	14.70	1.82	31.60	24.90	0.07	11.30	0.21	0.35	14.20	0.82	
L	14.80	1.82	31.70	24.90	0.07	11.30	0.21	0.34	14.20	0.83	
L	14.70	1.82	31.60	24.90	0.08	11.30	0.20	0.37	14.20	0.84	
L	14.80	1.82	31.60	24.80	0.07	11.30	0.20	0.35	14.20	0.83	
L	14.80	1.81	31.70	24.90	0.07	11.30	0.20	0.35	14.20	0.83	
M	14.70	1.81	31.50	24.80	0.08	11.20	0.21	0.28	14.20	0.79	
M	14.60	1.78	31.40	24.80	0.07	11.30	0.20	0.29	14.20	0.80	
M	14.70	1.82	31.20	24.60	0.07	11.10	0.21	0.30	14.10	0.77	
M	14.80	1.80	31.50	24.90	0.06	11.20	0.22	0.29	14.20	0.78	
M	14.50	1.79	31.40	24.60	0.07	11.20	0.21	0.27	14.10	0.79	
M	14.80	1.81	31.30	24.70	0.07	11.20	0.21	0.28	14.10	0.80	
M	14.60	1.80	31.20	24.50	0.07	11.20	0.21	0.31	14.10	0.79	
M	14.70	1.81	31.20	24.50	0.06	11.20	0.20	0.30	14.10	0.79	
O	15.40	1.83	28.20	25.10	0.08	11.50	0.21	0.27	14.60	0.79	3.17
O	15.30	1.83	30.10	25.70	0.08	11.60	0.21	0.27	14.40	0.80	3.98
O	15.20	1.77	27.90	24.40	0.07	11.30	0.22	0.27	14.40	0.80	3.99
O	15.40	1.72	31.10	25.20	0.07	10.10	0.21	0.24	14.70	0.78	3.96
O	15.40	1.82	27.50	24.90	0.08	11.50	0.21	0.28	14.60	0.79	3.96
O	15.30	1.84	30.50	25.20	0.07	11.40	0.21	0.24	14.60	0.79	3.97
O	15.60	1.83	31.30	26.40	0.07	11.70	0.21	0.27	14.90	0.81	3.58
O	15.40	1.82	29.90	25.10	0.08	11.50	0.21	0.26	14.70	0.80	3.97
P											
P											
P											
P											
P											
P											
P											
Q	15.00	1.80	31.80	24.80	0.07	11.30	0.21		14.30	0.81	4.07
Q	15.00	1.80	31.90	24.80	0.07	11.40	0.21		14.30	0.81	4.06
Q	15.00	1.81	31.90	24.80	0.07	11.30	0.21		14.30	0.81	4.03
Q	15.00	1.81	31.80	24.90	0.06	11.30	0.21		14.20	0.81	4.03
Q	15.00	1.80	31.80	24.80	0.07	11.30	0.21		14.30	0.81	4.05
Q	15.00	1.81	31.80	24.80	0.07	11.30	0.21		14.30	0.81	4.10
Q	15.00	1.82	31.80	24.80	0.07	11.30	0.21		14.20	0.80	4.06
Q	15.00	1.81	31.80	24.80	0.07	11.30	0.21		14.30	0.81	4.05
R											
R											
R											
R											
R											
R											
R											

Analyte	Method	Unit	S ¹	σ_L ²	Sw ³	CSU ⁴
Pt	Pb Coll	g/t	0.185	0.077	0.148	0.024
Pd	Pb Coll	g/t	0.138	0.074	0.093	0.021
Au	Pb Coll	g/t	0.007	0.004	0.005	0.001
Pt	NiS	g/t	0.198	0.158	0.127	0.058
Pd	NiS	g/t	0.088	0.056	0.067	0.022
Au	NiS	g/t	0.006	0.005	0.004	0.002
Ir	NiS	g/t	0.038	0.040	0.012	0.015
Rh	NiS	g/t	0.065	0.057	0.035	0.021
Ru	NiS	g/t	0.118	0.103	0.063	0.037
Co	M/ICP	ppm	23.67	18.94	5.85	5.50
Cu	M/ICP	ppm	6.969	4.387	4.197	1.289
Cu	P	ppm	9.398	10.166	3.064	3.864
Cu	XRF	ppm	28.003	21.015	19.461	7.830
Ni	M/ICP	ppm	97.572	72.138	22.369	19.402
Ni	XRF	ppm	66.921	62.274	30.304	22.351
Al ₂ O ₃	XRF	%	0.265	0.228	0.088	0.073
CaO	XRF	%	0.026	0.020	0.017	0.007
Cr ₂ O ₃	XRF	%	0.170	0.134	0.119	0.053
Fe ₂ O ₃	XRF	%	0.358	0.270	0.205	0.089
K ₂ O	XRF	%	0.006	0.004	0.004	0.001
MgO	XRF	%	0.197	0.173	0.087	0.059
MnO	XRF	%	0.008	0.008	0.004	0.003
Na ₂ O	XRF	%	0.030	0.032	0.010	0.012
SiO ₂	XRF	%	0.184	0.152	0.079	0.049
TiO ₂	XRF	%	0.016	0.014	0.008	0.005
SG	pyc		0.054	0.031	0.043	0.011

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: AMIS0151 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.

20 April 2011

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 twelve of the round robin laboratories, for informational use only.

Analyte	Method	Unit	Mean	2SD	RSD%	n
Ag	M/ICP	ppm	0.25	0.07	13.82	34
Al	M/ICP	%	7.75	0.55	3.54	69
As	M/ICP	ppm	3.53	1.24	17.55	40
Ba	M/ICP	ppm	63.00	6.85	5.43	68
Be	M/ICP	ppm	0.07	0.05	31.16	27
Bi	M/ICP	ppm	0.10	0.02	10.97	46
Ca	M/ICP	%	1.21	0.13	5.34	78
Cd	M/ICP	ppm	1.00	0.05	2.65	43
Ce	M/ICP	ppm	3.05	0.85	13.94	47
Cr	M/ICP	ppm	210548	8170	1.94	43
Cs	M/ICP	ppm	0.10	0.02	8.07	31
Dy	M/ICP	ppm	0.30	0.05	7.66	30
Er	M/ICP	ppm	0.19	0.04	9.58	30
Eu	M/ICP	ppm	0.12	0.05	19.25	31
Fe	M/ICP	%	16.20	2.57	7.92	80
Ga	M/ICP	ppm	45.40	3.97	4.37	53
Gd	M/ICP	ppm	0.30	0.17	28.95	39
Ge	M/ICP	ppm	0.44	0.13	14.70	23
Hf	M/ICP	ppm	0.27	0.12	22.93	39
Ho	M/ICP	ppm	0.06	0.01	7.88	24
In	M/ICP	ppm	0.04	0.01	7.40	45
K	M/ICP	%	0.06	0.01	10.07	79
La	M/ICP	ppm	1.51	0.45	14.88	55
Li	M/ICP	ppm	2.55	0.89	17.55	53
Lu	M/ICP	ppm	0.03	0.01	11.91	16
Mg	M/ICP	ppm	6.44	0.59	4.62	71
Mn	M/ICP	ppm	1475	143	4.85	84
Mo	M/ICP	ppm	1.90	0.26	6.92	54
Na	M/ICP	%	0.20	0.02	5.71	77
Nb	M/ICP	ppm	0.66	0.14	10.57	44
Nd	M/ICP	ppm	1.21	0.13	5.29	23
P	M/ICP	ppm	32.98	16.33	24.76	46
Pb	M/ICP	ppm	59.06	4.05	3.43	52
Pr	M/ICP	ppm	0.32	0.03	5.28	22
Rb	M/ICP	ppm	2.63	0.57	10.83	54
Re	M/ICP	ppm	0.002	0.001	20.70	16
S	M/ICP	%	0.09	0.01	4.79	62
Sb	M/ICP	ppm	3.07	0.31	5.09	53
Sc	M/ICP	ppm	11.25	2.22	9.85	55
Se	M/ICP	ppm	11.90	3.03	12.74	30
Si	M/ICP	%	6.35	0.99	7.81	14
Sm	M/ICP	ppm	0.27	0.07	13.00	30
Sn	M/ICP	ppm	0.38	0.09	11.32	39
Sr	M/ICP	ppm	45.62	5.34	5.85	69
Ta	M/ICP	ppm	0.10	0.07	34.68	15
Tb	M/ICP	ppm	0.05	0.01	15.61	24
Te	M/ICP	ppm	0.20	0.04	9.42	30
Th	M/ICP	ppm	0.29	0.03	4.41	47
Ti	M/ICP	%	0.43	0.04	4.32	69
Tl	M/ICP	ppm	0.07	0.02	12.37	31
Tm	M/ICP	ppm	0.03	0.02	26.28	16
U	M/ICP	ppm	0.21	0.04	9.32	51
V	M/ICP	ppm	1463	223	7.62	69
W	M/ICP	ppm	0.30	0.00	0.00	34
Y	M/ICP	ppm	1.59	0.26	8.21	56
Yb	M/ICP	ppm	0.20	0.01	3.11	29
Zn	M/ICP	ppm	894	89.61	5.01	70
Zr	M/ICP	ppm	7.81	0.90	5.74	45