



Tel: +2711 923 8000 Fax: +2711 923 3924715 web: [www.amis.co.za](http://www.amis.co.za), D1 Isando Business Park,  
11 Gewel St (off Hulley Rd), Kempton Park, Johannesburg 1609. P.O. Box 856,  
Isando, 1600, South Africa, a division of the Set Point Group

## AMIS0278

### ***Certified Reference Material***

**Platinum (PGM) Platreef Ore  
Bushveld Complex, South Africa**

### ***Certificate of Analysis***

**Recommended Concentrations and two “Between  
Laboratory” Standard Deviations<sup>1,2</sup>.**

#### ***Certified Concentrations<sup>3</sup>.***

Pt Pb Collection	1.70	±	0.10	g/t
Pd Pb Collection	2.12	±	0.14	g/t
Au Pb Collection	0.26	±	0.02	g/t
Pt NIS	1.69	±	0.16	g/t
Pd NIS	2.10	±	0.02	g/t
Co P	60.0	±	5.0	ppm
Cu M/ICP	1294	±	80	ppm
Cu P	1283	±	85	ppm
Ni M/ICP	2026	±	236	ppm
Ni P	1960	±	186	ppm
Specific Gravity	3.10	±	0.10	

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

Au NIS	0.26	±	0.03	g/t
Ir NiS	0.036	±	0.006	g/t
Rh NiS	0.15	±	0.02	g/t
Ru	0.15	±	0.04	g/t
Co M/ICP	76.5	±	14.1	ppm

$$4E \text{ (Pt, Pd, Au (all NiS) + Rh) = 4.192 g/t}$$

1. AMIS0278 was originally certified on 18 August 2011. This recertification incorporates some new data. Ruthenium and iridium concentrations can both now be promoted to “Provisional” status.
2. 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.
3. There is additional certified major element data presented on p2 and uncertified trace element data presented as an appendix.

# Major Element Recommended Concentrations and two "Between Laboratory" Standard Deviations

## *Certified Concentrations*

Al <sub>2</sub> O <sub>3</sub>	7.23	±	0.12	%
CaO	12.32	±	0.20	%
Cr <sub>2</sub> O <sub>3</sub>	0.50	±	0.02	%
Fe <sub>2</sub> O <sub>3</sub>	10.06	±	0.16	%
K <sub>2</sub> O	0.19	±	0.01	%
MgO	18.90	±	0.36	%
MnO	0.29	±	0.01	%
Na <sub>2</sub> O	0.42	±	0.05	%
SiO <sub>2</sub>	43.52	±	0.38	%
TiO <sub>2</sub>	0.24	±	0.01	%
LOI	5.78	±	0.94	%
S Comb/LECO	0.75	±	0.11	%

1. **Intended Use:** AMIS0278 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 Platreef or other 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 Platreef material from the northern limb of the Bushveld Complex. This specific material was supplied by Anglo Platinum Limited and was obtained from the open pit Mogalakwena Mine (previously named PPRust Mine).

3. **Mineral and Chemical Composition:** Platreef is a Pt/Pd/Ni/Cu ore. Mineralization in this Platreef 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.

Major element chemistry data from 12 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 Blueish Grey (Corstor 5B 7/1).

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 <54um. Wet sieve particle size analysis of random samples confirmed the material was 98.5% <54um. It was then blended in a bi-conical mixer, systematically divided and then sealed into 1kg Laboratory Packs. Explorer Packs are subdivided from the Laboratory packs as required. Samples were randomly selected for homogeneity testing and third party analysis. Statistical analysis of both homogeneity and the consensus test results were carried out by independent statisticians.

**7. Methods of Analysis requested:**

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

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 seven laboratories were each given eight randomly selected packages of sample. Twenty one 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 21 out of 27 laboratories that provided results timeously were (not in same order as in the table of assays):

1. Activation Laboratories Pty Ltd (ActLabs) CA
2. ALS Chemex Laboratory Group Johannesburg SA
3. ALS Chemex Laboratory Group Vancouver CA
4. Anglo Platinum - Eastern Bushveld Regional Laboratory SA
5. Anglo Research (Crown Campus)
6. Anglo Research (Germiston Campus)
7. Genalysis Laboratory Services (South Africa) Pty
8. Genalysis Laboratory Services WA
9. Northam Platinum LTD
10. Performance Laboratories SA
11. Set Point Laboratories (Isando) SA
12. SGS Australia Pty Ltd (Newburn) WA
13. SGS Chelopech (Bulgaria)
14. SGS Durango (Mexico)
15. SGS Geosol Laboratories Ltda (Brazil)
16. SGS Mineral Services Callao (Peru)
17. SGS Mineral Services Lakefield (Canada)
18. SGS South Africa (Pty) Ltd - Booyens JHB
19. SGS Toronto (Canada)
20. SGS Townsville (Australia)
21. Ultra Trace (Pty) Ltd WA

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

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
B	1.75	2.13	0.28							80.60			1360			2110		
B	1.75	2.17	0.27							81.10			1325			2090		
B	1.75	2.15	0.27							83.40			1435			2200		
B	1.77	2.16	0.27							78.80			1315			2060		
B	1.78	2.17	0.27							77.20			1310			2060		
B	1.78	2.15	0.26							79.30			1325			2030		
B	1.78	2.21	0.27							78.00			1300			2040		
B	1.77	2.17	0.27							80.70			1330			2070		
D	1.60	1.98	0.23							77.40	59.90		1350	1320		2060	1935	
D	1.69	2.08	0.25							77.10	60.80		1400	1360		2110	1950	
D	1.62	2.04	0.25							81.60	60.00		1490	1350		2240	1950	
D	1.69	2.08	0.26							76.90	59.90		1360	1355		2070	1915	
D	1.63	2.01	0.24							76.20	59.80		1380	1365		2080	1995	
D	1.68	2.16	0.25							75.10	59.60		1340	1350		2030	1955	
D	1.72	2.20	0.26							76.40	60.10		1370	1330		2070	1950	
D	1.74	2.23	0.26							75.80	57.80		1300	1310		1970	1910	
E	1.28	1.48	0.21							78.33	60.00	200	1304	1267	1400	1903	1859	2000
E	1.38	1.57	0.22							80.67	62.00	200	1324	1241	1400	1905	1928	2200
E	0.97	1.16	0.16							80.10	64.00		1340	1242	1500	1916	1984	2200
E	1.33	1.47	0.20							79.77	61.00	200	1363	1294	1400	1881	1927	2400
E	1.11	1.24	0.19							78.94	62.00		1272	1238	1400	1927	2000	2300
E	1.05	1.20	0.16							78.12	60.00	100	1279	1253	1600	1911	1916	2200
E	1.25	1.34	0.18							78.15	62.00		1299	1277	1300	1894	1921	2400
E	1.06	1.26	0.18							77.19	63.00	100	1290	1235	1500	1858	1864	2200
F	1.69	2.08	0.25							69.00	56.00		1280	1320		2050	1830	
F	1.75	2.09	0.28							66.00	63.00		1270	1350		1950	2040	
F	1.59	1.93	0.25							66.00	57.00		1250	1310		1970	1870	
F	1.77	2.15	0.28							67.00	54.00		1260	1310		2000	1720	
F	1.64	1.98	0.24							66.00	57.00		1250	1510		1950	1870	
F	1.74	2.17	0.28							66.00	56.00		1240	1270		1940	1860	
F	1.68	2.03	0.26							67.00	57.00		1250	1300		2010	1870	
F	1.56	1.92	0.26							67.00	58.00		1220	1300		1920	1870	
G	1.71	2.21	0.26							79.00	54.00		1330	1320		1940	1780	
G	1.65	2.17	0.27							75.00	56.00		1300	1390		1970	1880	
G	1.72	2.18	0.29							68.00	57.00		1280	1420		1970	1920	
G	1.73	2.20	0.27							69.00	57.00		1330	1440		1950	1900	
G	1.61	2.19	0.27							74.00	56.00		1310	1420		1970	1880	
G	1.76	2.20	0.28							76.00	56.00		1290	1420		1990	1880	
G	1.69	2.11	0.26							79.00	56.00		1280	1370		1960	1840	
G	1.71	2.13	0.26							80.00	57.00		1310	1400		2000	1890	
H			0.31							80.00	50.00		1175	1196		2186	2251	
H			0.32							80.00	50.00		1168	1182		2202	2201	
H			0.29							81.00	51.00		1181	1197		2151	2247	
H			0.29							81.00	52.00		1164	1196		2125	2235	
H			0.32							81.00	51.00		1193	1222		2257	2186	
H			0.31							81.00	51.00		1185	1213		2230	2275	
H			0.29							59.00	50.00		1163	1166		2227	2127	
H			0.30							59.00	53.00		1174	1219		2297	2154	
I				1.78	2.11	0.25	0.03	0.12	0.12	64.00	54.00		1350	1240	1300	1860	1890	2100
I				1.70	1.98	0.25	0.04	0.14	0.14	66.00	52.00		1340	1200	1300	1900	1860	2200
I				1.68	2.02	0.27	0.02	0.09	0.09	65.00	55.00		1370	1170	1300	1860	1900	2100
I				1.75	2.10	0.24	0.03	0.10	0.10	64.00	59.00		1330	1270	1400	1840	2030	2100
I				1.83	2.14	0.25	0.03	0.10	0.09	65.00	64.00		1340	1370	1300	1830	2220	2100
I				1.83	2.17	0.28	0.02	0.09	0.09	64.00	58.00		1340	1250	1300	1840	2030	2200
I				1.69	1.99	0.26	0.03	0.13	0.14	65.00	60.00		1360	1330	1200	1900	2130	2100
I				1.75	2.10	0.25	0.02	0.09	0.08	67.00	57.00		1420	1200	1200	1920	1920	2100
J	1.67	2.08	0.25							66.00	52.00		1234	1300		1984	1842	
J	1.69	2.05	0.26							68.00	49.00		1225	1295		1990	1834	
J	1.71	2.12	0.26							69.00	53.00		1237	1285		1998	1836	
J	1.75	2.09	0.25							66.00	53.00		1240	1288		1979	1832	
J	1.71	2.08	0.25							66.00	48.00		1230	1297		1988	1831	
J	1.74	2.11	0.27							69.00	53.00		1242	1281		2011	1828	
J	1.69	2.02	0.25							70.00	47.00		1244	1297		2005	1834	
J	1.67	2.04	0.25							69.00	53.00		1237	1292		2004	1845	

## Assay data (cont) – Economic elements

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	
K	1.71	2.20	0.25	1.75	2.17	0.28		0.18	0.13	82.80	62.00	75.00	1290	1240	1188	1960	2100	2051	
K	1.74	2.17	0.25	1.71	2.16	0.29		0.16	0.11	82.40	65.00	81.00	1280	1240	1146	1960	2120	1979	
K	1.75	2.25	0.28	1.72	2.13	0.29		0.17	0.12	80.20	58.00	81.00	1310	1110	1203	1760	2140	2085	
K	1.79	2.22	0.25	1.73	2.10	0.25		0.17	0.12	82.80	59.00	78.00	1300	1120	1190	1760	2170	2052	
K	1.75	2.08	0.24	1.70	2.16	0.27		0.17	0.12	82.20	57.00	78.00	1250	1130	1181	1780	2160	2040	
K	1.72	2.20	0.26	1.70	2.17	0.26		0.16	0.12	82.20	62.00	80.00	1360	1230	1226	1930	2020	2121	
K	1.70	2.16	0.24	1.72	2.14	0.26		0.17	0.13	81.90	58.00	81.00	1300	1120	1185	1770	2090	2049	
K	1.69	2.11	0.25	1.68	2.19	0.24		0.18	0.13	82.30	62.00	82.00	1260	1250	1164	1970	2160	2010	
L			0.27																
L			0.26																
L			0.27																
L			0.28																
L			0.28																
L			0.27																
L			0.27																
L			0.27																
M			0.28									61.00			1300			1880	
M			0.27									59.00			1290			1840	
M			0.29									61.00			1320			1920	
M			0.26									60.00			1310			1860	
M			0.28									60.00			1310			1870	
M			0.28									57.00			1240			1750	
M			0.28									61.00			1320			1930	
M			0.27									61.00			1310			1920	
N	1.71	2.14	0.27	1.69	2.10	0.27	0.04	0.15	0.15	75.00	60.00		1320	1280	1217	2180	1990		
N	1.69	2.21	0.27	1.75	2.19	0.27	0.04	0.15	0.16	80.00	61.00		1290	1270		2180	2010		
N	1.74	2.21	0.28	1.69	2.13	0.27	0.04	0.15	0.16	85.00	62.00		1270	1290		2160	2020		
N	1.70	2.17	0.27	1.68	2.09	0.26	0.04	0.15	0.16	80.00	60.00		1260	1270		2150	2020		
N	1.72	2.13	0.28	1.72	2.17	0.28	0.04	0.15	0.16	75.00	61.00		1260	1270		2150	2000		
N	1.74	2.16	0.27	1.73	2.15	0.26	0.04	0.15	0.16	75.00	61.00		1250	1300		2170	1990		
N	1.71	2.10	0.27	1.69	2.15	0.27	0.04	0.15	0.15	80.00	60.00		1260	1290		2170	2000		
N	1.76	2.15	0.28	1.66	2.11	0.27	0.04	0.15	0.15	75.00	58.00		1250	1280		2120	1980		
P	1.80	2.28	0.29																
P	1.73	2.25	0.28																
P	1.76	2.27	0.26																
P	1.77	2.23	0.26																
P	1.76	2.23	0.28																
P	1.78	2.26	0.28																
P	1.76	2.18	0.27																
P	1.75	2.20	0.28																
Q	1.65	2.07	0.25																
Q	1.63	2.03	0.25																
Q	1.66	2.05	0.25																
Q	1.68	2.08	0.25																
Q	1.67	2.07	0.25																
Q	1.65	2.01	0.25																
Q	1.63	2.02	0.26																
Q	1.65	2.09	0.25																
S	1.60	2.04						0.14								1230			2087
S	1.47	2.12						0.15								1292			2135
S	1.67	2.09						0.15								1277			2103
S	1.88	2.36						0.16								1216			2075
S	1.73	2.10						0.14								1222			2094
S	1.80	2.13						0.15								1205			2094
S	1.71	2.09						0.14								1230			2105
S																1203			2087
T	1.70	2.15	0.28	1.57	2.11	0.25	0.04	0.15	0.14	85.00	63.10		1281	1241	1217	1951	1999	2172	
T	1.69	2.11	0.27	1.60	2.08	0.26	0.04	0.15	0.14	85.10	63.60		1270	1319	1228	2033	2119	2178	
T	1.70	2.16	0.27	1.42	1.90	0.22	0.03	0.15	0.13	86.30	63.00		1281	1277	1227	2007	2054	2181	
T	1.74	2.15	0.27	1.61	2.13	0.28	0.04	0.15	0.14	85.50	64.70		1261	1244	1235	1969	1994	2196	
T	1.73	2.14	0.27	1.53	2.11	0.25	0.04	0.15	0.14	84.60	65.10		1262	1278	1230	2004	2050	2180	
T	1.73	2.16	0.28	1.56	2.07	0.25	0.04	0.15	0.14	87.30	63.90		1259	1296	1224	1981	2090	2176	
T	1.72	2.14	0.28	1.59	2.09	0.28	0.04	0.15	0.14	86.90	62.90		1264	1294	1222	2041	2062	2182	
T	1.67	2.10	0.26	1.61	2.11	0.25	0.04	0.15	0.14	88.00	63.80		1286	1231	1232	2026	1985	2178	
U	1.73	2.03	0.25	1.63	2.08	0.27	0.04	0.16	0.15										
U	1.70	2.07	0.27	1.65	2.11	0.27	0.04	0.15	0.15										
U	1.66	2.06	0.26	1.69	2.11	0.28	0.04	0.15	0.15										
U	1.71	2.08	0.24	1.67	2.07	0.25	0.04	0.15	0.15										
U	1.69	2.09	0.26	1.65	2.11	0.26	0.04	0.15	0.15										
U	1.67	2.06	0.27	1.61	2.10	0.25	0.04	0.15	0.15										
U	1.69	2.08	0.25	1.63	2.08	0.26	0.03	0.16	0.15										
U	1.69	2.04	0.26	1.61	2.08	0.27	0.04	0.15	0.15										
X	1.62	2.10	0.27	1.72	2.03	0.28	0.04	0.15	0.16	75.50	60.40	90.00	1340	1300	1280	2137	2026	2111	
X	1.63	2.06	0.27	1.65	2.03	0.27	0.04	0.14	0.15	75.80	60.50	82.00	1330	1301	1282	2142	2022	2124	
X	1.64	2.11	0.26	1.70	2.00	0.26	0.04	0.15	0.15	75.80	60.60	75.00	1327	1297	1273	2122	2023	2110	
X	1.65	2.11	0.27	1.71	1.97	0.26	0.04	0.15	0.16	76.50	60.40	80.00	1318	1290	1277	2137	2011	2114	
X	1.63	2.11	0.27	1.75	2.07	0.27	0.04	0.16	0.16	76.80	59.90	83.00	1338	1297	1284	2154	2009	2110	
X	1.65	2.06	0.27	1.71	2.10	0.27	0.04	0.16	0.16	76.50	60.20	87.00	1322	1288	1281	2138	2007	2124	
X	1.64	2.10	0.26	1.72	2.03	0.27	0.04	0.15	0.16	77.40	60.50	79.00	1313	1288	1281	2126	2026	2123	
X	1.67	2.10	0.27	1.75	2.02	0.27	0.04	0.15	0.16	76.50	60.30	85.00	1333	1300	1289	2121	2035	2123	
Y			1.42	2.00	0.24	0.03	0.12	0.12											
Y			1.43	1.98	0.24	0.03	0.12	0.12											
Y			1.44	2.08	0.22	0.03	0.13	0.12											
Y			1.43	1.96	0.22	0.03	0.12	0.12											
Y			1.45	1.99	0.23	0.03	0.13	0.13											
Y			1.40	2.02	0.24	0.03	0.13	0.13											
Y			1.37	2.00	0.23	0.03	0.12	0.13											
Y			1.39	1.94	0.23	0.03	0.12	0.12											
Z			1.87	2.26	0.25	0.11	0.15	0.16											
Z			1.89	2.31	0.26	0.17	0.16	0.19											
Z			1.69	1.96	0.24	0.14	0.12	0.21											
Z			1.67	2.05	0.24	0.14	0.13	0.15											
Z			1.77	2.21	0.25	0.14	0.14	0.17											
Z			2.43	2.57	0.27</														

### Assay data (cont) – Major Oxides

Lab Code	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %	LOI %	S Comb/LECO %	SG pyc
B	7.34	12.11	0.49	9.61	0.19	18.74	0.26	0.41	43.20	0.25	6.28		3.11
B	7.29	12.18	0.49	9.61	0.18	18.68	0.25	0.41	43.20	0.25	6.23		3.09
B	7.26	12.11	0.49	9.58	0.18	18.65	0.25	0.40	43.18	0.26	6.27		3.02
B	7.35	12.18	0.50	9.71	0.19	18.84	0.26	0.41	43.37	0.26	6.25		3.04
B	7.38	12.20	0.51	9.71	0.19	18.86	0.26	0.42	43.41	0.24	6.25		3.00
B	7.28	12.05	0.49	9.59	0.18	18.56	0.25	0.41	43.17	0.27	6.33		3.09
B	7.26	12.13	0.48	9.62	0.18	18.61	0.26	0.41	42.99	0.25	6.35		2.92
B	7.32	12.20	0.49	9.65	0.19	18.80	0.26	0.42	43.30	0.27	6.38		2.94
D													3.07
D													3.04
D													3.04
D													3.05
D													3.08
D													3.09
D													3.10
D													3.09
E	7.25	12.30	0.53	10.20	0.17	19.60	0.30	0.44	43.40	0.24	5.43		
E	7.14	12.30	0.51	10.10	0.17	19.60	0.29	0.45	43.60	0.25	5.68		
E	7.24	12.20	0.51	10.10	0.17	19.60	0.29	0.44	43.70	0.24	5.42		
E	7.26	12.40	0.53	10.20	0.18	19.80	0.29	0.44	44.00	0.24	5.62		
E	7.22	12.40	0.52	10.20	0.17	19.70	0.29	0.46	43.80	0.24	5.63		
E	7.30	12.30	0.52	10.10	0.19	19.70	0.29	0.45	43.80	0.24	5.41		
E	7.11	12.10	0.51	9.98	0.17	19.40	0.28	0.43	43.30	0.23	5.69		
E	7.30	12.30	0.52	10.10	0.18	19.70	0.29	0.47	43.60	0.24	5.70		
G													3.05
G													3.08
G													3.02
G													3.04
G													3.05
G													3.08
G													3.13
G													3.02
H	7.17	12.30	0.51	10.00	0.18	18.90	0.29	0.40	43.50	0.24	4.27	0.76	
H	7.14	12.30	0.52	10.00	0.18	18.90	0.28	0.44	43.40	0.24	4.33	0.73	
H	7.15	12.30	0.51	10.00	0.19	18.90	0.28	0.40	43.50	0.24	4.28	0.70	
H	7.13	12.30	0.51	9.99	0.18	19.00	0.29	0.39	43.40	0.24	4.28	0.78	
H	7.14	12.30	0.51	10.00	0.19	18.90	0.28	0.40	43.50	0.24	4.25	0.78	
H	7.15	12.30	0.51	10.00	0.18	18.90	0.29	0.40	43.40	0.24	4.25	0.79	
H	7.12	12.30	0.51	10.00	0.18	18.90	0.28	0.42	43.40	0.24	4.25	0.79	
H	7.12	12.30	0.51	10.00	0.18	18.90	0.28	0.42	43.50	0.24	4.21	0.70	
I	7.21	12.40	0.50	10.10	0.19	19.10	0.29	0.40	43.90	0.24	5.40	0.68	
I	7.23	12.40	0.50	10.10	0.18	19.10	0.29	0.41	43.60	0.24	5.32	0.68	
I	7.24	12.40	0.50	10.10	0.18	19.10	0.30	0.40	43.60	0.23	5.40	0.68	
I	7.21	12.40	0.50	10.10	0.19	19.10	0.29	0.41	43.70	0.23	5.37	0.69	
I	7.29	12.40	0.50	10.10	0.19	19.00	0.30	0.40	43.60	0.24	5.37	0.70	
I	7.24	12.40	0.49	10.10	0.19	19.10	0.30	0.40	43.50	0.23	5.34	0.69	
I	7.19	12.40	0.50	10.10	0.18	18.90	0.30	0.41	43.60	0.24	5.38	0.69	
I	7.22	12.40	0.49	10.10	0.19	19.00	0.29	0.40	43.70	0.23	5.39	0.68	
J												0.77	2.92
J												0.78	2.95
J												0.75	2.94
J												0.72	2.93
J												0.74	2.95
J												0.74	2.95
J												0.75	2.95
J												0.76	2.93
K	7.14	12.20	0.49	9.92	0.22	18.60	0.29	0.37	42.60	0.23	6.47	0.75	3.17
K	7.19	12.30	0.50	10.00	0.22	18.70	0.29	0.38	42.80	0.23	6.44	0.75	3.10
K	7.18	12.30	0.49	10.00	0.22	18.70	0.29	0.38	42.70	0.23	6.35	0.73	3.10
K	7.23	12.30	0.49	9.98	0.22	18.70	0.29	0.38	42.80	0.23	6.43	0.75	3.08
K	7.25	12.30	0.49	9.98	0.22	18.70	0.30	0.38	42.80	0.23	6.40	0.75	3.06
K	7.22	12.30	0.50	10.10	0.22	18.80	0.29	0.39	43.00	0.23	6.38	0.75	3.15
K	7.18	12.10	0.48	9.81	0.22	18.50	0.29	0.37	42.30	0.22	6.42	0.76	3.09
K	7.04	11.90	0.47	9.67	0.21	18.00	0.29	0.37	41.50	0.22	6.38	0.73	3.05
L												0.72	
L												0.70	
L												0.68	
L												0.68	
L												0.71	
L												0.69	
L												0.68	
L												0.67	
N	7.32	12.44	0.51	10.11	0.19	19.09	0.30	0.44	43.63	0.24	5.26		3.15
N	7.29	12.40	0.51	10.05	0.19	19.05	0.30	0.43	43.53	0.24	5.36		3.17
N	7.30	12.41	0.51	10.10	0.19	19.13	0.30	0.44	43.54	0.24	5.34		3.15
N	7.30	12.44	0.52	10.10	0.19	19.09	0.30	0.43	43.59	0.24	5.34		3.13
N	7.31	12.41	0.51	10.08	0.19	19.06	0.30	0.43	43.60	0.24	5.31		3.12
N	7.31	12.47	0.51	10.12	0.19	19.09	0.30	0.43	43.66	0.24	5.29		3.15
N	7.30	12.40	0.51	10.05	0.19	19.04	0.30	0.43	43.51	0.24	5.34		3.17
N	7.31	12.44	0.51	10.10	0.19	19.06	0.30	0.43	43.66	0.24	5.31		3.14

## Assay data (cont) – Major Oxides

Lab Code	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %	LOI %	S Comb/LECO %	SG pyc
S													3.14
S													3.17
S													3.14
S													3.21
S													3.07
S													3.15
S													3.18
S													3.10
T	7.18	12.34	0.51	10.14	0.19	19.01	0.29	0.42	43.60	0.24	5.31	0.79	3.12
T	7.18	12.39	0.52	10.14	0.19	19.00	0.29	0.43	43.62	0.24	5.28	0.76	3.13
T	7.21	12.36	0.51	10.15	0.19	19.01	0.29	0.44	43.74	0.24	5.24	0.78	3.10
T	7.23	12.42	0.51	10.18	0.19	19.04	0.30	0.44	43.82	0.24	5.28	0.78	3.12
T	7.19	12.40	0.51	10.17	0.19	18.99	0.30	0.44	43.65	0.24	5.33	0.77	3.18
T	7.20	12.39	0.51	10.15	0.19	18.99	0.29	0.43	43.73	0.24	5.28	0.78	3.12
T	7.21	12.37	0.51	10.17	0.19	18.99	0.30	0.43	43.72	0.24	5.34	0.78	3.11
T	7.25	12.42	0.52	10.18	0.19	19.09	0.30	0.43	43.85	0.23	5.32	0.75	3.16
U													3.15
U													3.14
U													3.13
U													3.11
U													3.15
U													3.14
U													3.14
U													3.12
X	6.95	12.42	0.49	10.00	0.20	18.82	0.29	0.50	43.28	0.25	6.28	0.88	3.04
X	6.77	12.17	0.49	9.88	0.19	18.61	0.29	0.50	43.14	0.24	6.16	0.88	3.04
X	6.76	12.01	0.48	9.93	0.19	18.54	0.29	0.49	43.30	0.24	6.16	0.88	3.02
X	7.07	12.42	0.49	9.96	0.20	19.06	0.29	0.49	43.23	0.25	6.25	0.87	3.04
X	7.09	12.47	0.49	9.93	0.20	19.11	0.29	0.48	43.42	0.25	6.22	0.86	3.06
X	6.93	12.34	0.49	9.95	0.19	18.89	0.29	0.50	43.30	0.24	6.16	0.87	3.02
X	6.69	12.27	0.48	9.93	0.19	18.80	0.29	0.50	43.62	0.23	6.24	0.87	3.03
X	7.12	12.38	0.49	9.99	0.20	18.91	0.29	0.49	42.90	0.25	6.34	0.86	3.05

## 12. Measurement of Uncertainty:

The samples used in this certification process have been selected in such a way as to represent the entire batch of material and were taken from the final packaged units; therefore all possible sources of uncertainty (sample uncertainty and measurement uncertainty) are included in the final combined standard uncertainty determination. The uncertainty measurement takes into consideration the between lab and the within lab variances and is calculated from the square roots of the variances of these components using the formula:

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

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

Analyte	Method	Unit	S <sup>1</sup>	$\sigma_L$ <sup>2</sup>	Sw <sup>3</sup>	CSU <sup>4</sup>
Pt	Pb Coll	g/t	0.050	0.027	0.036	0.008
Pd	Pb Coll	g/t	0.066	0.039	0.044	0.012
Au	Pb Coll	g/t	0.012	0.006	0.008	0.002
Pt	NiS	g/t	0.085	0.075	0.049	0.029
Pd	NiS	g/t	0.079	0.054	0.060	0.020
Au	NiS	g/t	0.016	0.010	0.012	0.004
Ir	NiS	g/t	0.003	0.004	0.001	0.002
Rh	NiS	g/t	0.012	0.011	0.006	0.004
Ru	NiS	g/t	0.018	0.019	0.007	0.007
Co	M/ICP	ppm	7.045	5.669	2.155	1.723
Co	P	ppm	2.478	1.667	1.675	0.561
Cu	M/ICP	ppm	39.807	30.361	21.269	9.419
Cu	P	ppm	42.670	30.472	26.855	10.110
Ni	M/ICP	ppm	117.994	83.524	43.569	23.542
Ni	P	ppm	92.805	72.887	48.182	23.694
Al <sub>2</sub> O <sub>3</sub>	XRF	%	0.064	0.059	0.037	0.023
CaO	XRF	%	0.100	0.082	0.060	0.030
Cr <sub>2</sub> O <sub>3</sub>	XRF	%	0.012	0.011	0.005	0.004
Fe <sub>2</sub> O <sub>3</sub>	XRF	%	0.083	0.081	0.040	0.031
K <sub>2</sub> O	XRF	%	0.007	0.006	0.005	0.003
LOI		%	0.473	0.536	0.064	0.203
MgO	XRF	%	0.176	0.164	0.100	0.064
MnO	XRF	%	0.006	0.005	0.004	0.002
Na <sub>2</sub> O	XRF	%	0.023	0.023	0.009	0.009
SiO <sub>2</sub>	XRF	%	0.192	0.170	0.116	0.066
TiO <sub>2</sub>	XRF	%	0.006	0.004	0.004	0.002
S Comb/LECO		%	0.053	0.055	0.019	0.021
SG	pyc		0.049	0.037	0.030	0.013

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

**13. Uncertified values:** The Certified, Provisional and Indicated values listed on p1 and p2 of this certificate fulfill the AMIS statistical criteria regarding agreement for certification and have been independently validated by Dr Barry Smee.

**14. Metrological Traceability:** The values quoted herein are based on the consensus values derived from statistical analysis of the data from an inter laboratory measurement program. Traceability to SI units is via the standards used by the individual laboratories the majority of which are accredited and who have maintained measurement traceability during the analytical process.

**15. Certification:** AMIS0278 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.

12 February 2012  
(Originally certified 22 November 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

Analyte	Method	Unit	Mean	2SD	RSD%	n
Ag	M/ICP	ppm	0.61	0.17	13.85	45
Al	M/ICP	%	3.89	0.24	3.09	77
As	M/ICP	ppm	3.57	3.89	54.42	47
Ba	M/ICP	ppm	54.09	7.35	6.79	87
Be	M/ICP	ppm	0.27	0.08	14.04	47
Bi	M/ICP	ppm	0.62	0.10	8.02	45
Ca	M/ICP	%	8.40	0.78	4.64	80
Cd	M/ICP	ppm	0.19	0.06	16.98	39
Ce	M/ICP	ppm	9.91	1.36	6.88	45
Cr	M/ICP	ppm	2340	703	15.02	48
Cs	M/ICP	ppm	1.07	0.12	5.46	31
Dy	M/ICP	ppm	1.36	0.34	12.67	16
Er	M/ICP	ppm	0.85	0.17	9.97	16
Eu	M/ICP	ppm	0.34	0.07	9.97	16
Fe	M/ICP	%	6.76	0.65	4.78	80
Ga	M/ICP	ppm	9.21	1.13	6.12	32
Gd	M/ICP	ppm	1.25	0.15	5.96	23
Hf	M/ICP	ppm	1.05	0.11	5.24	38
Ho	M/ICP	ppm	0.26	0.04	7.16	15
In	M/ICP	ppm	0.04	0.01	7.65	37
Ir	M/ICP	ppm	0.04	0.009	12.30	38
K	M/ICP	%	0.16	0.01	4.48	78
La	M/ICP	ppm	4.42	0.78	8.88	46
Li	M/ICP	ppm	18.66	2.47	6.62	68
Lu	M/ICP	ppm	0.11	0.02	8.41	23
Mg	M/ICP	%	11.44	0.67	2.92	71
Mn	M/ICP	ppm	2192	189	4.31	79
Mo	M/ICP	ppm	0.93	0.22	11.97	40
Na	M/ICP	%	0.33	0.02	2.51	61
Nb	M/ICP	ppm	1.09	0.15	7.03	39
Nd	M/ICP	ppm	5.30	1.32	12.46	16
P	M/ICP	ppm	86.57	21.33	12.32	46
Pb	M/ICP	ppm	14.43	1.55	5.39	54
Pr	M/ICP	ppm	1.25	0.25	9.81	16
Rb	M/ICP	ppm	9.13	1.02	5.57	30
Re	M/ICP	ppm	0.01	0.003	19.36	22
S	M/ICP	%	0.80	0.07	4.26	69
Sb	M/ICP	ppm	1.05	0.21	9.94	45
Sc	M/ICP	ppm	16.92	1.94	5.74	61
Se	M/ICP	ppm	3.63	0.93	12.89	23
Si	M/ICP	%	20.83	0.54	1.30	8
Sm	M/ICP	ppm	1.24	0.22	9.03	16
Sn	M/ICP	ppm	0.94	0.16	8.29	29
Sr	M/ICP	ppm	60.05	5.36	4.47	76
Ta	M/ICP	ppm	0.13	0.11	40.67	23
Tb	M/ICP	ppm	0.19	0.02	5.70	23
Te	M/ICP	ppm	0.88	0.27	15.48	32
Th	M/ICP	ppm	0.87	0.18	10.57	40
Ti	M/ICP	%	0.14	0.01	5.14	70
Tl	M/ICP	ppm	0.28	0.03	5.86	39
Tm	M/ICP	ppm	0.10	0.01	3.78	15
U	M/ICP	ppm	0.69	0.12	8.89	40
V	M/ICP	ppm	97.06	13.14	6.77	63
W	M/ICP	ppm	1.31	0.43	16.58	39
Y	M/ICP	ppm	6.81	1.31	9.65	63
Yb	M/ICP	ppm	0.78	0.17	11.18	24
Zn	M/ICP	ppm	62.01	13.53	10.91	72
Zr	M/ICP	ppm	30.85	4.57	7.41	55