

AMIS0443

Certificate

Certified Reference Material

Platinum (PGM) Platreef Ore
Bushveld Complex, South Africa

Certificate of Analysis

Recommended Concentrations and Limits¹ (at two Standard Deviations)

Certified Concentration²

Pt Pb Collection	0.78	±	0.07	g/t
Pd Pb Collection	0.98	±	0.06	g/t
Pt NiS	0.78	±	0.55	g/t
Pd NiS	0.97	±	0.04	g/t
Au NiS	0.14	±	0.03	g/t
Rh NiS	0.07	±	0.01	g/t
Ru NiS	0.081	±	0.02	g/t
Ir NiS	0.021	±	0.008	g/t
Cu M/ICP	946	±	48	ppm
Cu P	935	±	43	ppm
Cu XRF	879	±	75	ppm
Ni M/ICP	1920	±	99	ppm
Ni P	1678	±	96	ppm
Specific Gravity	3.03	±	0.18	Dimensionless

Provisional Concentrations

Au Pb Collection	0.14	±	0.02	g/t
Co M/ICP	99.2	±	11.2	ppm
Co P	69.6	±	9.2	ppm
Ni XRF	1833	±	230	ppm

$$4E = \text{Platinum (NiS)} + \text{Palladium (NiS)} + \text{Rhodium} + \text{Gold (NiS)} = 1.96 \text{ g/t}$$

1. Manufacturers recommended limits for use of the material as control samples, based on two standard deviations, calculated using "Between Laboratory" statistics for treatment of the data for trivial, non-trivial and technically invalid results. See sections 1, 9 and 12.
2. There is additional certified major element data on p2 and uncertified trace element data as an appendix.

AMIS

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

Certified Concentrations

Al ₂ O ₃	8.10	±	0.12	%
CaO	7.08	±	0.08	%
Cr ₂ O ₃	1.72	±	0.06	%
Fe ₂ O ₃	11.61	±	0.13	%
K ₂ O	0.26	±	0.01	%
MgO	20.06	±	0.37	%
MnO	0.32	±	0.01	%
Na ₂ O	0.62	±	0.03	%
SiO ₂	44.67	±	0.36	%
TiO ₂	0.25	±	0.01	%

Provisional Concentration

LOI	4.87	±	0.99	%
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1. **Intended Use:** AMIS0443 is a certified reference material which may be used to demonstrate the validity of measurement results of a single analysis of low grade PGM, 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.

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:** AMIS0443 was made from material supplied by Anglo Platinum, using Platreef material from the Western Limb of the Bushveld complex.

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.

4. **Appearance:** The material is a very fine powder. It is colored a Light Grey (Corstor 5Y 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 scientifically 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. Pb collection with Ag as a co-collector, ICP-OES or ICP-MS
2. Pt, Pd, Au, Rh, Ru, Ir. NiS collection, ICP-OES or ICP-MS
3. Multi element scan to include Co, Cu and Ni. Multi-acid total digestion, including HF, ICP-OES or ICP-MS
4. Co, Cu and Ni. Aqua regia digestion with ICP-OES or ICP-MS
5. Co, Cu and Ni. Pressed pellet XRF
6. Majors (Al₂O₃, CaO, Cr₂O₃, Fe₂O₃, K₂O, MgO, MnO, Na₂O, SiO₂, TiO₂. LOI.) XRF fusion
7. SG – gas pycnometer

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 nine laboratories were each given eight scientifically selected packages of sample. Twenty seven 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 27 out of 29 laboratories that provided results timeously were (not in same order as in the table of assays):

- 1 ACME Analytical Laboratories Ltd CA
- 2 ALS Ammtec (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 (Germiston Campus)
- 8 Bureau Veritas (Namibia)

- 9 Genalysis Laboratory Services (W Australia P)
- 10 Intertek Testing Services Ltd Shanghai (Beijing)
- 11 Labtium Inc Finland
- 12 Mintek (South Africa)
- 13 Performance Laboratories SA (Randfontein)
- 14 Quality Laboratory Services (Rustenburg SA)
- 15 Set Point Laboratories (Isando) SA
- 16 SGS Ankara (Turkey)
- 17 SGS Geosol Laboratories Ltda (Brazil)
- 18 SGS Mineral Services Callao (Peru)
- 19 SGS Mineral Services Lakefield (Canada)
- 20 SGS Rustenburg (South Africa)
- 21 SGS South Africa (Pty) Ltd - Booyens JHB
- 22 SGS Vancouver (Canada)
- 23 Shiva Analyticals (India)
- 24 Suntech Geometallurgical SA
- 25 Ultra Trace (Pty) Ltd WA
- 26 Zimplats Ngezi Lab
- 27 Zimplats SMC Lab

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

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	Rh NiS g/t	Ru NiS g/t	Ir NiS g/t	Co M/ICP ppm	Co P ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm	SG pyc
0.79	0.98	0.14	0.69	0.96	0.13	0.07	0.08	0.02	104	76.00	958	955	826	1844	1629	1711	3.09
0.79	1.00	0.16	0.74	0.97	0.14	0.07	0.08	0.02	107	76.00	968	957	826	1853	1639	1711	3.05
0.79	1.03	0.16	0.76	0.97	0.15	0.07	0.08	0.02	105	76.00	961	947	816	1887	1628	1699	3.10
0.81	1.01	0.17	0.77	1.01	0.17	0.07	0.08	0.02	104	77.00	973	954	826	1877	1648	1722	3.08
0.80	1.03	0.20	0.75	0.97	0.13	0.07	0.08	0.02	103	78.00	955	964	826	1809	1670	1722	3.08
0.78	1.00	0.15	0.72	0.93	0.14	0.07	0.08	0.02	105	77.00	978	963	826	1893	1681	1722	3.06
0.76	0.94	0.14	0.67	0.95	0.13	0.07	0.08	0.02	104	76.00	969	958	816	1875	1648	1711	3.00
0.78	0.97	0.15	0.78	0.97	0.14	0.07	0.08	0.02	104	77.00	975	949	826	1846	1658	1733	3.05
0.83	1.09	0.15	0.75	1.01	0.15	0.08	0.08	0.07	110.00	66.00	915	871	910	1910	1470	1825	3.15
0.74	0.98	0.15	0.75	1.02	0.15	0.07	0.08	0.08	110.00	65.00	910	870	910	1910	1480	1825	3.13
0.79	1.04	0.15	0.74	1.08	0.14	0.08	0.09	0.10	105.00	66.00	920	881	890	1920	1480	1809	3.17
0.81	1.02	0.16	0.74	1.07	0.17	0.08	0.09	0.08	110.00	64.00	905	867	910	1910	1450	1825	3.14
0.79	0.98	0.16	0.72	1.03	0.15	0.08	0.09	0.05	110.00	65.00	915	871	90	1960	1470	1800	3.13
0.76	0.98	0.16	0.77	1.05	0.13	0.08	0.08	0.09	110.00	67.00	920	870	900	1940	1470	1825	3.12
0.76	0.98	0.16	0.73	1.03	0.15	0.08	0.09	0.13	110.00	67.00	910	868	90	1950	1480	1817	3.13
0.78	1.02	0.15	0.71	1.03	0.15	0.07	0.08	0.10	110.00	68.00	915	875	900	1930	1500	1817	3.14
0.56	0.89	0.14	0.61	0.85	0.06	0.08	0.21	0.02	112	74.60	966	965	856	1980	1757	1719	3.01
0.61	0.92	0.16	0.62	0.81	0.06	0.04	0.19	0.02	112	72.20	970	946	833	2010	1715	1700	3.01
0.57	1.00	0.16	0.74	0.89	0.09	0.05	0.22	0.02	113	74.70	961	953	911	1997	1739	1757	3.01
0.68	1.04	0.17	0.59	0.76	0.07	0.06	0.18	0.02	103	72.70	946	946	877	1973	1730		3.01
0.81	1.12	0.17	0.65	0.83	0.07	0.07	0.13	0.02	110	74.10	970	952	917	2010	1744	1717	3.01
0.79	1.18	0.20	0.59	0.81	0.07	0.06	0.16	0.02	110	73.80	967	975	910	1966	1779	1777	3.04
0.70	1.23	0.21	0.66	0.85	0.07	0.07	0.20	0.02	108	74.20	984	944	844	1999	1723	1737	3.01
0.67	1.22	0.21	0.64	0.81	0.07	0.07	0.18	0.02	107	74.50	987	959	885	2097	1751	1747	3.01
0.79	0.98	0.13	0.79	0.97	0.15	0.03	0.08	0.02	112	72.00	965	921	883	1910	1690	1875	3.19
0.80	0.98	0.14	0.79	0.99	0.14	0.03	0.08	0.02	112	74.00	937	938	883	1910	1705	1870	3.19
0.82	0.99	0.15	0.80	0.99	0.15	0.05	0.08	0.02	112	75.00	956	933	885	1950	1695	1870	2.99
0.82	1.01	0.13	0.80	0.97	0.14	0.03	0.08	0.02	114	75.00	951	939	881	1910	1695	1874	3.07
0.79	0.98	0.15	0.80	0.99	0.15	0.04	0.09	0.02	111	77.00	940	964	881	1910	1725	1863	3.19
0.82	0.98	0.14	0.79	0.99	0.15	0.03	0.08	0.02	113	76.00	954	946	878	1900	1700	1867	3.00
0.82	0.98	0.16	0.78	0.98	0.14	0.04	0.08	0.02	111	75.00	937	953	874	1880	1695	1871	3.06
0.82	0.99	0.13	0.79	0.98	0.14	0.03	0.08	0.02	113	75.00	939	951	949	1930	1705	1869	3.16
0.76	0.94	0.13	0.79	0.95	0.15	0.07	0.08	0.04	92.00	73.00	932	937	879	1930	1732	2020	3.18
0.76	0.94	0.14	0.79	0.99	0.14	0.07	0.08	0.06	95.00	72.00	927	941	971	1932	1747	2000	3.15
0.77	0.94	0.15	0.82	1.02	0.14	0.07	0.08	0.07	92.00	72.00	928	932	869	1928	1746	1950	3.23
0.74	0.91	0.13	0.82	0.99	0.14	0.07	0.08	0.07	94.00	73.00	922	927	904	1936	1718	2020	3.18
0.77	0.93	0.14	0.83	0.99	0.14	0.07	0.07	0.05	92.00	73.00	923	935	941	1962	1724	2010	3.18
0.74	0.90	0.13	0.78	1.01	0.14	0.07	0.08	0.03	94.00	72.00	936	934	831	1929	1729	2050	3.19
0.73	0.90	0.12	0.81	0.99	0.15	0.07	0.08	0.06	96.00	72.00	925	940	868	1917	1727	2010	3.23
0.74	0.89	0.13	0.80	0.99	0.15	0.07	0.08	0.06	97.00	72.00	928	943	863	1911	1716	2010	3.20
0.70	0.98	0.14	0.85	1.11	0.14	0.08	0.10	0.02	100.00	66.00	985	953	857	1980	1630	1709	2.93
0.77	0.95	0.17	0.79	0.98	0.21	0.08	0.09	0.02	100.00	67.00	980	927	850	1960	1660	1724	2.92
0.85	1.01	0.17	0.90	1.11	0.11	0.08	0.07	0.02	100.00	67.00	945	938	863	1900	1680	1687	2.91
0.61	0.91	0.19	0.96	1.12	0.09	0.07	0.10	0.02	100.00	67.00	1000	926	847	2000	1670	1712	2.95
0.71	1.02	0.17	0.82	1.01	0.12	0.04	0.08	0.02	100.00	67.00	980	932	863	1960	1660	1684	2.94
0.74	0.98	0.17	0.87	1.09	0.21	0.08	0.07	0.02	100.00	68.00	975	919	861	1920	1700	1706	2.93
0.68	0.99	0.17	0.73	0.99	0.11	0.08	0.09	0.02	100.00	66.00	1020	916	864	1900	1680	1707	2.93
0.74	0.93	0.17	0.84	1.07	0.13	0.07	0.07	0.02	100.00	67.00	975	934	949	1900	1680	1719	2.92
0.74	0.94	0.17	0.75	0.97	0.13	0.07	0.09	0.02	100.00	60.00	957	824	943	1920	1475	1981	3.03
0.63	0.90	0.17	0.79	0.99	0.12	0.08	0.09	0.02	99.00	61.00	946	857	918	1900	1549	1933	3.02
0.67	1.00	0.18	0.75	0.99	0.12	0.08	0.09	0.02	97.00	62.00	950	873	911	1870	1612	1957	3.03
0.65	0.93	0.19	0.78	0.98	0.13	0.07	0.09	0.02	98.00	63.00	924	887	924	1900	1595	1959	3.02

Assay Data (Economic Elements)

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	Rh NiS g/t	Ru NiS g/t	Ir NiS g/t	Co M/ICP ppm	Co P ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm	SG pyc
0.65	0.92	0.17	0.78	1.01	0.13	0.07	0.09	0.02	100.00	61.00	917	842	923	1820	1547	1977	3.03
0.70	0.94	0.17	0.79	1.00	0.11	0.07	0.09	0.02	98.00	61.00	940	894	916	1860	1613	1951	3.02
0.61	1.00	0.17	0.78	0.96	0.12	0.07	0.09	0.02	99.00	64.00	939	891	925	1790	1605	1958	3.02
0.73	0.96	0.17	0.82	1.05	0.17	0.06	0.09	0.02	99.00	63.00	957	860		1790	1610	1942	3.03
0.82	0.98	0.12	0.76	0.97	0.11	0.05	0.08	0.02	92.00	66.00	892	901		1767	1455		2.98
0.81	1.01	0.14	0.75	0.98	0.13	0.05	0.08	0.03	92.00	66.00	899	923		1805	1461		2.96
0.79	0.99	0.12	0.76	0.97	0.11	0.04	0.09	0.04	91.00	66.00	886	884		1682	1442		2.96
0.75	0.98	0.14	0.76	0.96	0.12	0.06	0.09	0.03	91.00	64.00	886	884		1735	1397		2.97
0.79	0.98	0.12	0.78	0.98	0.14	0.05	0.09	0.03	91.00	66.00	891	899		1799	1453		2.96
0.86	1.02	0.15	0.77	0.97	0.11	0.05	0.08		93.00	66.00	888	901		1778	1449		2.97
0.87	1.02	0.14	0.76	0.96	0.12	0.05	0.09		92.00	66.00	898	905		1768	1476		2.96
0.80	1.01	0.15	0.75	0.98	0.14	0.08	0.09		93.00	66.00	894	882		1868	1427		2.95
0.82	0.98	0.20	1.17	0.95		0.09	0.06		104	62.00	939	984		1947	1416		3.01
0.82	1.08	0.21	1.20	0.95		0.08	0.06		101	63.00	930	990		1924	1419		3.01
0.82	1.00	0.24	1.22	0.95		0.10	0.06		100	63.00	907	1018		1890	1447		3.02
0.84	1.03	0.22	1.18	0.96		0.08	0.06		99	64.00	915	1023		1900	1456		3.01
0.85	1.01	0.20	1.15	0.98		0.10	0.06		101	62.00	932	989		1914	1406		3.05
0.87	1.09	0.21	1.18	0.96		0.08	0.06		101	68.00	914	987		1902	1580		3.02
0.88	1.09	0.21	1.12	0.94		0.08	0.06		100	70.00	926	998		1915	1603		3.01
0.85	0.99	0.19	1.15	0.96		0.08	0.06		99	69.00	921	1002		1896	1614		3.02
0.84	1.09	0.16	0.81	0.99		0.07	0.10		117	75.00	1070	954		1640	1620		2.89
0.86	1.07	0.15	0.84	0.94		0.07	0.09		115	73.00	1084	945		1642	1620		2.91
0.85	1.08	0.16	0.79	0.86		0.07	0.08		118	72.00	1066	953		1608	1590		2.88
0.80	1.03	0.16	0.79	0.93		0.08	0.09		119	73.00	1090	951		1670	1600		2.90
0.81	1.07	0.16	0.81	0.92		0.08	0.09		115	73.00	1038	947		1618	1580		2.84
0.83	1.09	0.16	0.81	0.81		0.07	0.08		115	75.00	1066	965		1646	1630		2.87
0.87	1.12	0.17	0.81	0.92		0.08	0.09		117	75.00	1082	949		1653	1640		2.91
0.88	1.08	0.17	0.82	0.96		0.08	0.09		116	68.00	1062	958		1667	1610		2.89
0.76	0.93	0.14				0.07			90.00	72.00	918	852		1820	1595		2.95
0.78	0.95	0.13				0.08			86.00	72.00	917	940		1880	1680		2.93
0.79	0.97	0.14				0.08			91.00	73.00	922	920		1890	1710		2.93
0.79	0.96	0.14				0.07			93.00	70.00	916	913		1870	1685		2.93
0.78	0.96	0.13				0.08			88.00	72.00	903	909		1850	1650		2.94
0.78	0.94	0.14				0.08			87.00	70.00	906	907		1830	1680		2.93
0.75	0.91	0.13				0.07			88.00	69.00	895	918		1830	1680		2.93
0.75	0.92	0.14				0.07			88.00	70.00	903	891		1840	1640		2.94
0.76	0.99	0.13				0.07			97.00	71.00	969	919		1912	1690		3.14
0.75	0.98	0.13				0.07			91.00	72.00	957	933		2019	1710		3.09
0.71	0.91	0.14				0.07			95.00	71.00	966	930		1871	1720		3.09
0.78	0.99	0.14				0.07			96.00	70.00	933	930		1981	1720		3.13
0.76	0.97	0.13				0.08			95.00	71.00	966	925		1821	1700		3.12
0.72	0.93	0.14				0.08			93.00	71.00	962	929		1956	1690		3.11
0.73	0.93	0.13				0.08			97.00	70.00	985	938		1913	1700		3.07
0.72	0.93	0.13				0.08			101.00	64.00	981	895		1986	1670		3.07
0.79	0.99	0.15				0.08			96.00	63.00	926	1052		1681	1846		2.95
0.80	1.00	0.15				0.08			90.00	65.00	918	1024		1725	1753		2.90
0.78	1.01	0.13				0.08			96.00	66.00	920	1074		1705	1827		2.96
0.79	1.00	0.17				0.08			94.00	66.00	921	1068		1715	1818		2.88
0.82	1.03	0.14				0.12			94.00	65.00	915	1098		1734	1836		2.87
0.76	0.95	0.15				0.08			95.00	58.00	930	1044		1752	1787		2.91
0.82	1.03	0.15				0.07			95.00	66.00	924	996		1677	1634		3.02
0.77	1.00	0.15							94.00		920	1053		1702	1808		2.89
0.75	0.98	0.16							101		955			1955			2.82
0.74	0.94	0.15							101		942			1925			2.77
0.74	0.95	0.16							99		920			1885			2.70
0.76	0.96	0.16							103		962			1960			2.83

Assay Data Economic Elements (cont.)

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	Rh NiS g/t	Ru NiS g/t	Ir NiS g/t	Co M/ICP ppm	Co P ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm	SG pyc
0.76	0.95	0.16							103		960			1955			2.70
0.77	0.97	0.15							103		950			1940			2.81
0.75	0.94	0.15							103		971			1975			2.83
0.75	0.97	0.15							102		979			1980			2.73
1.15	0.96	0.13							73.20		925			1710			3.09
1.20	0.96	0.13							72.10		925			1720			3.10
1.11	0.97	0.13							72.10		931			1730			3.10
1.18	0.97	0.13							72.20		934			1730			3.09
1.17	0.97	0.13							72.90		937			1730			3.12
1.17	0.97	0.14							71.70		928			1700			3.11
1.17	0.97	0.12							72.30		933			1720			3.11
1.21	0.96	0.13							72.90		931			1730			3.09
0.79	0.98	0.16							102.00		974			2020			
0.81	1.01	0.14							99.00		959			1960			
0.79	1.00	0.14							98.00		942			1950			
0.78	1.01	0.15							101.00		971			1990			
0.79	0.99	0.20							100.00		935			1970			
0.81	1.01	0.15							100.00		975			2000			
0.78	1.01	0.14							100.00		967			2000			
0.79	0.99	0.14							98.00		942			1930			
0.77	0.98	0.14							105.61		991			1896			
0.77	1.00	0.14							104.88		982			1856			
0.61	0.80	0.11							99.10		946			1824			
0.75	0.98	0.14							103.56		959			1888			
0.74	0.99	0.16							102.23		972			1886			
0.74	0.99	0.15							107.19		977			1922			
0.76	0.99	0.15							105.95		979			1941			
0.76	0.99	0.15							102.94		965			1849			
0.80	0.97	0.14							94.00		944						
0.79	1.00	0.15							98.00		988						
0.78	0.97	0.14							100.00		964						
0.82	0.99	0.14							94.00		970						
0.82	0.98	0.15							96.00		950						
0.82	1.01	0.14							98.00		994						
0.81	0.98	0.14							98.00		974						
0.78	0.96	0.15							96.00		996						
1.03	1.00	0.13															
1.00	0.99	0.14															
0.96	0.94	0.13															
0.82	0.92	0.12															
0.81	0.95	0.13															
0.81	1.00	0.14															
0.83	0.95	0.14															
0.86	0.92	0.14															
0.76	0.94	0.12															
0.77	0.94	0.13															
0.80	0.95	0.14															
0.77	0.97	0.13															
0.83	1.02	0.17															
0.76	1.00	0.14															
0.81	1.00	0.14															
0.80	0.98	0.14															
0.76	0.74	0.14															
0.77	0.83	0.13															
0.74	0.82	0.11															
0.78	0.81	0.09															
0.74	0.83	0.09															
0.73	0.82	0.10															
0.83	0.82	0.08															
0.67	0.75	0.08															

Assay Data Major Oxides

Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	LOI XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %
8.17	7.09	1.73	11.57	0.27	4.36	20.19	0.32	0.61	44.82	0.24
8.03	7.13	1.73	11.57	0.26	4.42	20.29	0.32	0.61	44.86	0.25
8.06	7.08	1.73	11.49	0.26	4.42	20.22	0.32	0.62	44.84	0.25
8.11	7.10	1.72	11.61	0.26	4.42	20.20	0.32	0.61	44.78	0.24
8.15	7.10	1.72	11.57	0.26	4.37	20.23	0.32	0.61	44.85	0.24
8.13	7.08	1.73	11.54	0.26	4.37	20.29	0.32	0.61	44.86	0.24
8.11	7.06	1.73	11.58	0.27	4.43	20.24	0.32	0.61	44.88	0.25
8.13	7.13	1.73	11.50	0.26	4.42	20.32	0.32	0.61	44.97	0.24
8.13	7.12	1.72	11.55	0.27	5.29	20.10	0.31	0.59	44.89	0.25
8.12	7.13	1.72	11.62	0.27	5.33	20.10	0.31	0.61	44.89	0.25
8.13	7.12	1.71	11.61	0.26	5.34	20.00	0.31	0.60	44.84	0.25
8.11	7.13	1.72	11.57	0.26	5.34	20.10	0.32	0.61	44.83	0.26
8.12	7.13	1.72	11.60	0.26	5.35	20.10	0.32	0.60	44.85	0.25
8.15	7.13	1.71	11.61	0.26	5.34	20.10	0.31	0.59	44.81	0.25
8.14	7.13	1.72	11.54	0.27	5.31	20.10	0.31	0.61	44.87	0.25
8.10	7.12	1.71	11.56	0.26	5.31	20.00	0.31	0.60	44.83	0.25
8.07	7.01	1.76	11.34	0.27	4.34	20.16	0.31	0.56	44.60	0.25
8.06	7.03	1.76	11.41	0.27	4.35	20.22	0.32	0.57	44.56	0.25
8.05	7.05	1.76	11.35	0.26	4.46	20.22	0.32	0.57	44.66	0.25
8.05	7.00	1.76	11.36	0.27	4.36	20.12	0.32	0.56	44.50	0.25
8.06	7.02	1.76	11.36	0.26	4.49	20.16	0.32	0.58	44.62	0.25
8.05	7.00	1.75	11.37	0.27	4.34	20.17	0.32	0.56	44.55	0.24
8.03	7.05	1.75	11.37	0.27	4.35	20.22	0.32	0.58	44.50	0.27
8.03	7.03	1.76	11.41	0.26	4.52	20.17	0.32	0.57	44.60	0.26
8.32	7.00	1.71	11.73	0.26	4.34	19.95	0.30	0.63	45.12	0.24
8.21	7.10	1.75	11.56	0.26	4.45	19.70	0.32	0.61	44.61	0.24
8.42	7.00	1.73	11.70	0.26	4.57	19.85	0.33	0.63	44.52	0.25
8.32	7.01	1.70	11.67	0.26	4.63	19.85	0.32	0.62	44.44	0.24
8.36	7.18	1.70	11.72	0.27	4.50	19.90	0.31	0.63	44.64	0.25
8.30	7.02	1.72	11.73	0.26	4.38	19.85	0.32	0.63	44.51	0.25
8.17	7.10	1.70	11.70	0.26	4.39	19.90	0.31	0.62	44.73	0.25
8.32	7.14	1.73	11.72	0.27	4.44	19.90	0.33	0.63	44.75	0.25
8.12	7.10	1.78	11.60	0.26	4.65	19.80	0.32	0.59	44.90	0.24
8.04	7.02	1.78	11.60	0.27	4.78	19.80	0.32	0.58	44.40	0.24
8.11	7.08	1.80	11.60	0.26	5.00	19.80	0.32	0.58	44.80	0.24
8.11	7.06	1.78	11.60	0.26	4.67	19.80	0.32	0.59	44.70	0.24
8.13	7.10	1.78	11.60	0.26	4.59	19.80	0.32	0.59	44.90	0.24
8.13	7.10	1.78	11.60	0.26	4.79	19.80	0.32	0.60	44.90	0.24
8.12	7.09	1.78	11.60	0.26	4.61	19.90	0.32	0.59	44.80	0.24
8.11	7.09	1.78	11.60	0.26	4.75	19.80	0.32	0.59	44.80	0.24
8.03	7.10	1.71	11.70	0.26	4.78	20.10	0.32	0.57	44.50	0.25
8.06	7.09	1.71	11.70	0.26	4.76	20.00	0.32	0.62	44.70	0.25
8.03	7.09	1.71	11.70	0.27	4.95	20.00	0.32	0.62	44.50	0.25
8.01	7.06	1.70	11.70	0.26	4.89	20.00	0.32	0.66	44.50	0.26
8.04	7.08	1.70	11.70	0.26	4.96	20.00	0.32	0.64	44.60	0.25
8.01	7.07	1.70	11.30	0.26	5.12	19.30	0.31	0.60	44.60	0.24
8.00	7.08	1.71	11.40	0.26	5.09	19.40	0.31	0.55	44.50	0.24
8.01	7.07	1.71	11.70	0.26	4.90	20.00	0.32	0.63	44.50	0.25
8.17	6.99	1.68	11.60	0.27	4.73	19.60	0.32	0.65	44.50	0.26
8.10	7.05	1.66	11.60	0.27	4.82	19.50	0.32	0.64	44.90	0.26
8.15	7.06	1.68	11.50	0.27	4.70	19.40	0.32	0.62	44.90	0.26
8.18	7.04	1.68	11.70	0.26	4.75	19.60	0.31	0.62	45.00	0.27

Assay Data Major Oxides (Cont.)

Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	LOI XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %
8.08	7.03	1.70	11.60	0.27	4.72	19.50	0.32	0.62	44.80	0.26
7.88	6.74	1.61	11.60	0.27	4.68	19.50	0.30	0.63	42.80	0.25
7.84	6.86	1.64	11.60	0.26	4.65	19.60	0.31	0.65	43.50	0.25
8.17	7.05	1.68	11.50	0.27	4.71	19.60	0.32	0.64	44.80	0.26
8.22	7.05	1.73	11.50	0.25	5.64	20.20	0.32	0.59	44.50	0.26
8.14	7.06	1.73	11.60	0.27	5.60	19.80	0.32	0.59	44.70	0.25
8.04	7.01	1.76	11.50	0.27	5.64	20.00	0.32	0.60	44.30	0.25
8.06	7.12	1.74	11.60	0.26	5.73	20.20	0.32	0.62	44.70	0.25
8.10	7.08	1.72	11.60	0.26	5.59	20.20	0.32	0.62	44.50	0.25
8.11	7.09	1.74	11.40	0.25	5.64	19.80	0.32	0.62	44.60	0.25
8.09	7.03	1.75	11.50	0.27	5.59	20.20	0.32	0.64	44.40	0.25
8.25	7.03	1.74	11.40	0.25	5.70	20.20	0.32	0.61	44.60	0.26
8.27	7.09	1.68	11.60	0.27	4.75	20.00	0.32	0.62	44.80	0.24
8.02	7.08	1.68	11.60	0.27	5.78	20.00	0.31	0.60	44.80	0.24
8.13	7.08	1.67	11.60	0.26	5.50	19.90	0.32	0.61	45.00	0.25
8.12	7.19	1.68	11.60	0.26	4.75	20.00	0.32	0.60	44.80	0.24
8.11	7.18	1.72	11.60	0.27	4.79	20.10	0.32	0.61	45.50	0.24
7.91	6.96	1.68	11.60	0.26	4.82	20.00	0.31	0.61	44.30	0.24
8.24	7.15	1.73	11.60	0.27	5.05	19.90	0.32	0.62	45.20	0.24
8.05	7.03	1.68	11.60	0.26	4.77	19.90	0.31	0.61	44.40	0.25
8.08	7.11	1.75	11.60	0.26	4.48	19.80	0.32	0.63	44.80	0.25
8.05	7.12	1.76	11.50	0.26	4.53	19.70	0.32	0.63	44.60	0.24
8.02	7.09	1.72	11.40	0.26	4.48	19.60	0.32	0.63	44.80	0.24
7.98	7.12	1.75	11.60	0.26	4.53	19.90	0.32	0.63	44.40	0.25
8.11	7.16	1.75	11.60	0.26	4.42	19.90	0.31	0.62	44.80	0.25
8.14	7.10	1.76	11.60	0.26	4.46	19.80	0.32	0.63	44.60	0.25
8.04	7.08	1.74	11.60	0.26	4.40	19.80	0.31	0.64	44.50	0.25
8.07	7.08	1.75	11.60	0.26	4.50	19.90	0.33	0.63	44.60	0.25
8.20	7.10	1.69	11.60	0.27	4.23	20.20	0.33	0.61	44.10	0.25
8.00	7.00	1.66	11.58	0.27	4.22	20.30	0.33	0.63	43.60	0.25
8.30	7.05	1.67	11.62	0.27	4.22	20.30	0.33	0.61	43.70	0.25
8.20	7.10	1.69	11.66	0.27	4.23	20.40	0.33	0.61	44.20	0.25
8.10	7.07	1.68	11.45	0.26	4.23	20.10	0.33	0.65	44.20	0.25
8.40	7.04	1.68	11.52	0.27	4.23	20.20	0.33	0.61	44.00	0.25
8.10	7.08	1.68	11.62	0.27	4.24	20.30	0.33	0.61	44.00	0.25
8.10	7.06	1.68	11.48	0.26	4.22	20.10	0.33	0.60	44.20	0.25
8.13	7.10	1.70	11.67	0.27	4.98	20.30	0.31		44.70	0.25
8.14	7.09	1.70	11.70	0.27	5.10	20.30	0.31		44.70	0.24
8.15	7.11	1.69	11.70	0.27	5.50	20.30	0.31		44.80	0.25
8.20	7.14	1.70	11.70	0.27	5.68	20.20	0.31		45.00	0.24
8.04	7.01	1.68	11.66	0.28	5.38	20.30	0.31		44.20	0.24
8.10	7.06	1.68	11.72	0.27	4.99	20.40	0.31		44.40	0.25
8.15	7.11	1.70	11.73	0.27	5.18	20.40	0.31		44.80	0.25
8.05	7.02	1.68	11.62	0.27	5.10	20.20	0.31		44.30	0.24
8.16	7.10	1.70					0.31		44.60	
8.17	7.12	1.70					0.31		44.80	
8.11	7.11	1.70					0.31		44.40	
8.12	7.14	1.68					0.31		44.40	
8.14	7.09	1.68					0.31		44.60	
8.16	7.12	1.70					0.31		44.60	
8.17	7.12	1.69					0.31		44.70	
8.09	7.05	1.66					0.31		44.40	

12. Measurement of Uncertainty *:(ref Dr Hugh Bartlett, Hugh Bartlett Consulting CC.)*

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 the relevant ISO guidelines.

Analyte	Method	Unit	S ¹	σ_L ²	SW ³	CSU ⁴
Pt	Pb Coll	g/t	0.106	0.016	0.023	0.005
Pd	Pb Coll	g/t	0.056	0.012	0.022	0.004
Au	Pb Coll	g/t	0.017	0.007	0.008	0.002
Pt	NiS	g/t	0.137	0.02	0.019	0.008
Pd	NiS	g/t	0.069	0.012	0.016	0.005
Au	NiS	g/t	0.014	0.009	0.012	0.004
Rh		g/t	0.015	0.002	0.003	0.001
Ru	NiS	g/t	0.01	0.009	0.005	0.003
Ir	NiS	g/t	0.004	0.004	0.003	0.002
Co	M/ICP	ppm	9.845	4.13	1.803	1.117
Co	P	ppm	4.786	3.525	1.395	0.987
Cu	M/ICP	ppm	40.1	15.5	11.8	4.1
Cu	P	ppm	50.4	18.3	11.1	6.2
Cu	XRF	ppm	154.3	33.7	21.2	13.1
Ni	M/ICP	ppm	103.7	29.9	32.1	8.9
Ni	P	ppm	111.1	42.2	20.2	14.3
Ni	XRF	ppm	115.2	129.2	17.4	48.9
SG	pyc	Dimensionless	0.112	0.068	0.032	0.019
Al ₂ O ₃	XRF	%	0.096	0.027	0.047	0.009
CaO	XRF	%	0.06	0.02	0.032	0.006
Cr ₂ O ₃	XRF	%	0.035	0.024	0.012	0.007
Fe ₂ O ₃	XRF	%	0.103	0.043	0.044	0.014
K ₂ O	XRF	%	0.006	0.002	0.004	0.001
LOI	XRF	%	0.497	0.334	0.127	0.097
MgO	XRF	%	0.25	0.144	0.084	0.044
MnO	XRF	%	0.007	0.004	0.004	0.001
Na ₂ O	XRF	%	0.023	0.012	0.011	0.004
SiO ₂	XRF	%	0.351	0.086	0.147	0.029
TiO ₂	XRF	%	0.007	0.004	0.005	0.001

- 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 Std 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 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 Ms Margaret Fairhurst.

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: AMIS0443 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, Nozibele Mbangula, Margaret M. Fairhurst and Allan Fraser; accept no liability for any decisions or actions taken following the use of the reference material.

14 January 2015

Amended 25 July 2016

Amended 20 April 2017-Allan Fraser NiS (Au, Ir, Ru)

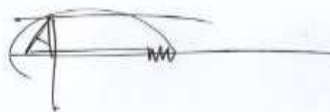
Certifying Officers:



African Mineral Standards: _____
Nozibele Mbangula



Geochemist: _____
Margaret M. Fairhurst, PG, MAusIMM
Oreval



Geochemist: _____

Allan Fraser
M.Sc. (Geology), N.D. (Analytical Chem.), Pr.Sci.Nat.

Appendix – uncertified element statistics

Analyte	Method	Unit	Mean	2SD	RSD%	n
Ag	M/ICP	ppm	0,53	0,17	16,5	42
Al	M/ICP	%	4,3	0,43	5,0	99
As	M/ICP	ppm	12,9	14,3	55,4	65
Ba	M/ICP	ppm	78,9	11,5	7,3	106
Be	M/ICP	ppm	0,60	0,0	0,0	7
Bi	M/ICP	ppm	2,4	6,6	134	33
Ca	M/ICP	ppm	4,8	0,40	4,1	102
Cd	M/ICP	ppm	0,60	0,85	70,2	44
Ce	M/ICP	ppm	8,4	7,5	44,9	24
Co	XRF	ppm	106	7,7	3,7	18
Cr	M/ICP	ppm	8237	3486	21,2	82
Cs	M/ICP	ppm	2,4	0,37	7,7	8
Fe	M/ICP	%	7,8	1,0	6,5	112
Ga	M/ICP	ppm	10,7	2,3	10,6	40
Gd	M/ICP	ppm	1,0	0,11	5,6	8
Ge	M/ICP	ppm	0,49	0,42	42,9	16
Hf	M/ICP	ppm	0,89	0,47	26,4	16
In	M/ICP	ppm	0,05	0,01	8,9	11
Ir	NiS	g/t	0,02	0,01	19,7	45
K	M/ICP	ppm	0,22	0,02	3,9	100
La	M/ICP	ppm	5,4	4,9	45,4	80
Li	M/ICP	ppm	57,3	7,0	6,2	74
Lu	M/ICP	ppm	0,15	0,01	4,2	8
Mg	M/ICP	ppm	12,0	0,8	3,3	104
Mn	M/ICP	ppm	2334	271	5,8	96
Mo	M/ICP	ppm	0,67	0,79	58,8	32
Na	M/ICP	ppm	0,44	0,06	6,9	88
Nb	M/ICP	ppm	1,5	0,25	8,2	16
P	M/ICP	ppm	92,4	23,3	12,6	61
Pb	M/ICP	ppm	12,0	3,0	12,4	86
Pr	M/ICP	ppm	15,1	0,79	2,6	8
Rb	M/ICP	ppm	12,2	1,2	5,0	15
Re	M/ICP	ppm	0,01	0,01	35,6	5
S	M/ICP	ppm	0,58	0,07	6,3	88
Sb	M/ICP	ppm	30,3	89,2	147	45
Sc	M/ICP	ppm	19,9	2,3	5,8	88
Se	M/ICP	ppm	2,9	2,4	41,2	14
Si	M/ICP	ppm	22,2	1,3	2,9	7
Sn	M/ICP	ppm	8,1	23,8	146	32
Sr	M/ICP	ppm	75,6	5,9	3,9	97
Ta	M/ICP	ppm	267	1047	196	40
Tb	M/ICP	ppm	0,25	0,01	2,6	8
Te	M/ICP	ppm	0,70	0,62	44,5	22
Th	M/ICP	ppm	1,2	0,85	34,7	23
Ti	M/ICP	%	0,14	0,01	4,4	72
Tl	M/ICP	ppm	0,30	0,07	11,5	16
U	M/ICP	ppm	0,76	0,15	10,1	23
V	M/ICP	ppm	143	27	9,4	104
W	M/ICP	ppm	1,5	6,1	200	27
Y	M/ICP	ppm	7,0	0,67	4,8	73
Yb	M/ICP	ppm	1,0	0,15	7,7	8
Zn	M/ICP	ppm	94,1	30,2	16,0	104
Zr	M/ICP	ppm	21,6	4,3	9,9	64