African Mineral Standards

REFERENCE MATERIAL FOR AFRICAN ORES

African Mineral Standards

Certificate of Analysis

PGE Ore Reference Material AMIS0002

Recommended Concentrations and two "Between Laboratory" Standard Deviations

NIS Collection
Platinum: 0.86 ± 0.106 g/t
Palladium: 0.87 ± 0.098 g/t
Rhodium: 0.045 ± 0.011 g/t
Ruthenium: 0.044 ± 0.012 g/t

Pb Collection
Platinum: 0.82 ± 0.112 g/t
Palladium: 0.89 ± 0.066 g/t
Gold: 0.155 ± 0.016 g/t

Total Acid Digestion
Nickel: 0.197 ± 0.015 %
Copper: 0.131 ± 0.013 %

Aqua Regia Partial Digestion
Nickel: 0.186 ± 0.023 %
Copper: 0.130 ± 0.012 %

Indicative Values

NIS Collection
Iridium: 0.012 g/t

Specific Gravity: 3.01

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SET POINT TECHNOLOGY

Intended Use: AMIS-2 is suitable for monitoring the accuracy of a single analysis of PGE, Cu and Ni ores hosted by Platreef or other similar mafic rocks. 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 standard reflect the average 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 and this is acceptable. Good laboratories however will report results within the two standard deviation levels with a failure of <10 %.

Origin of Material: This standard was made using Platreef material from the northern limb of the Bushveld Complex supplied by Anglo Platinum Limited. Platreef is a Pt/Pd/Ni/Cu ore. This specific material was obtained from the 150/80 bench at the northern end of the Sandsloot open pit, PPRust Mine.

Approximate Mineral and Chemical Composition: AMIS-2 comprises approximately 65% B-Pyroxenite, 30% A-Pyroxenite and <5% Serpentinite. 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.

Fe2O3 %	MnO %	Cr2O3 %	TiO2 %	CaO %	SiO2 %	Al2O3 %	MgO %	Na2 O%	K2O %	Co ppm
10.0	0.18	0.17	0.25	11.7	46.1	6.9	18.0	0.8	0.15	96

Appearance: The material is a very fine powder coloured medium grey (Munsell N5) to medium dark grey (Corstor).

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 99.7% <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.

Method of Analysis:

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. Specific Gravity

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.

Method of Certification: Twelve laboratories were each given eight randomly selected packages of sample and various results from eleven of those laboratories were used for the determinations below. The round robin results for Pt, Pd, Rh, Ru, Au, Cu and Ni are displayed:

	NIS Collection					Pb Collection			Total Digestion		Aqua Regia		
Lab Code	Pt, g/t	Pd, g/t	Rh, ppm	Ru, ppm	Ir, ppm	Pt, g/t	Pd, g/t	Au, g/t	Cu, ppm	Ni ppm	Cu, ppm	Ni ppm	SG
A													
A													
A													
A													
A													
A													
A													
A													
B	0.888	0.937	0.050	0.040	0.013	0.900	0.931	0.160	1311	1901	1177	1775	3.06
B	0.877	0.944	0.049	0.041	0.012	0.931	0.946	0.164	1317	1907	1186	1783	3.12
B	0.867	0.916	0.048	0.037	0.012	0.914	0.918	0.161	1354	1964	1176	1773	3.1
B	0.862	0.924	0.048	0.038	0.012	0.882	0.923	0.161	1332	1940	1174	1785	3.13
B	0.873	0.919	0.049	0.040	0.013	0.871	0.892	0.159	1340	1933	1198	1810	3.07
B	0.862	0.921	0.048	0.040	0.012	0.912	0.924	0.159	1345	1952	1201	1817	3.04
B	0.816	0.881	0.046	0.037	0.012	0.899	0.904	0.160	1300	1871	1177	1769	3.09
B	0.846	0.895	0.047	0.039	0.012	0.915	0.953	0.161	1311	1901	1172	1773	3.08
C						0.804	0.861	0.156	1430	2020	1380	1875	
C						0.799	0.842	0.152	1350	1945	1365	1845	
C						0.819	0.869	0.160	1325	1905	1335	1830	
C						0.808	0.861	0.158	1360	1940	1355	1850	
C						0.840	0.883	0.163	1405	2010	1345	1825	
C						0.790	0.832	0.150	1385	1970	1350	1840	
C						0.809	0.839	0.156	1360	1940	1355	1860	
C						0.848	0.889	0.164	1405	1980	1335	1830	
D	0.893	0.870	0.041	0.043		0.823	0.880	0.140	1310	2070	1300	1880	2.94
D	0.896	0.830	0.040	0.043		0.813	0.866	0.150	1310	2100	1290	1880	2.92
D	0.952	0.823	0.039	0.040	0.017	0.880	0.900	0.150	1290	2030	1270	1890	2.89
D	0.896	0.823	0.040	0.046	0.016	0.859	0.856	0.150	1330	2080	1300	1930	2.92
D	0.847	0.870		0.045	0.017	0.839	0.859	0.150	1310	2070	1270	1870	2.94
D	0.866	0.866	0.042	0.047		0.836	0.876	0.160	1280	2000	1270	1850	2.93
D	0.849	0.856	0.043	0.045		0.870	0.863	0.150	1300	2040	1270	1890	2.93
D	0.879	0.879	0.043	0.048		0.843	0.856	0.150	1300	2030	1300	1870	2.94
E			0.038			0.872	0.905	0.157		2096	1330	2040	3.2
E			0.038			0.864	0.904	0.151		2101	1359	2090	3.23
E			0.033			0.854	0.895	0.147		2095	1350	2080	3.22
E			0.032			0.855	0.890	0.153		2052	1359	2100	3.24
E			0.036			0.851	0.889	0.148		2091	1350	2080	3.22
E			0.036			0.880	0.920	0.155		2099	1359	2100	3.24
E			0.034			0.853	0.903	0.153		2060	1350	2080	3.23
E			0.036			0.863	0.908	0.149		2090	1350	2090	3.25

	NIS Collection					Pb Collection			Total Digestion		Aqua Regia		
Lab Code	Pt, g/t	Pd, g/t	Rh, ppm	Ru, ppm	Ir, ppm	Pt, g/t	Pd, g/t	Au, g/t	Cu, ppm	Ni ppm	Cu, ppm	Ni ppm	SG
F	0.773	0.844	0.051	0.041	0.014	0.785	0.815	0.145	1270	1940	1331	1627	
F	0.782	0.845	0.051	0.046	0.014	0.785	0.820	0.145	1225	1986	1293	1685	
F	0.808	0.856	0.054	0.043	0.013	0.775	0.830	0.150	1280	1966	1326	1640	
F	0.793	0.822	0.052	0.048	0.014	0.790	0.835	0.150	1330	1997	1340	1675	
F	0.752	0.829		0.045	0.013	0.780	0.825	0.145	1265	1986	1302	1630	
F	0.776	0.836		0.042	0.014	0.775	0.825	0.150	1250	1966	1326	1755	
F	0.772	0.825	0.056	0.042	0.014	0.800	0.840	0.150	1345	2012	1349	1660	
F	0.767	0.828	0.056	0.047	0.014	0.765	0.815	0.145	1275	1976	1293	1650	
G	0.895	0.793	0.051	0.042	0.013								
G	0.923	0.829	0.048	0.042	0.014								
G	0.949	0.836	0.051	0.042	0.012								
G	0.908	0.787		0.059	0.017								
G	0.929	0.796	0.046	0.040	0.012								
G	0.932	0.804	0.046	0.040	0.012								
G	0.941	0.815	0.053	0.049	0.015								
G	0.902	0.776	0.049	0.043	0.014								
H	0.850	0.890	0.043	0.051	0.012	0.838	0.885	0.161	1410	2090	1310	1820	2.8
H	0.852	0.893	0.042	0.048	0.013	0.837	0.874	0.162	1370	1980	1330	1800	2.8
H	0.861	0.882	0.041	0.053	0.013	0.862	0.906	0.162	1350	2000	1350	1900	2.8
H	0.868	0.884	0.043	0.049	0.012	0.851	0.894	0.165	1360	1980	1360	1910	2.8
H	0.862	0.908	0.043	0.054	0.013	0.836	0.894	0.165	1380	1980	1350	1880	2.8
H	0.858	0.907	0.041	0.051	0.012	0.855	0.907	0.167	1350	1980	1370	1900	2.8
H	0.854	0.893	0.041	0.051	0.011	0.842	0.878	0.163	1380	1960	1370	1850	2.8
H	0.856	0.904	0.041	0.048	0.012	0.865	0.902		1360	1970	1360	1860	2.8
I		0.812	0.041			0.735			1190	1830			3.04
I		0.806	0.041		0.008	0.727		0.170	1260	1910			3.09
I		0.829	0.048		0.008	0.726		0.170	1180	1820			3.12
I		0.836	0.046	0.030		0.708		0.170	1210	1860			3.07
I		0.854	0.052		0.009			0.160	1170	1820			3.14
I		0.853	0.048	0.028	0.008	0.736			1120				3.02
I		0.824	0.047		0.015			0.150	1210	1840			3.07
I		0.878	0.047	0.030	0.008	0.769		0.170	1280	1920			2.83
J						0.855	0.954	0.163	1360	1970	1360	1950	3.03
J						0.812	0.905	0.154	1340	1970	1320	1890	3.03
J						0.823	0.919	0.156	1350	1980	1320	1910	3.05
J						0.870	0.876	0.162	1340	1980	1350	1950	3.03
J						0.852	0.958	0.163	1340	1980	1310	1890	3.08
J						0.840	0.938	0.162	1370	2020	1330	1920	3.08
J						0.810	0.885	0.145	1340	1970	1330	1930	3.08
J						0.788	0.886	0.156	1360	2000	1320	1900	3.06

	NIS Collection					Pb Collection			Total Digestion		Aqua Regia		
Lab Code	Pt, g/t	Pd, g/t	Rh, ppm	Ru, ppm	Ir, ppm	Pt, g/t	Pd, g/t	Au, g/t	Cu, ppm	Ni ppm	Cu, ppm	Ni ppm	SG
K	0.871	0.911	0.043	0.043	0.011	0.755							
K	0.846	0.888	0.041	0.041	0.010	0.721							
K	0.850	0.878	0.042	0.042	0.011	0.706							
K	0.867	0.888	0.040	0.040	0.011	0.713							
K	0.879	0.911	0.043	0.043	0.011	0.730							
K	0.862	0.914	0.043	0.043	0.011	0.722							
K	0.856	0.917	0.044	0.044	0.011	0.706							
K	0.876	0.918	0.045	0.045	0.011	0.722							
L	0.790	0.900	0.040	0.040		0.840	0.910	0.150	1200	1900	1200	1800	2.92
L	0.760	0.850	0.040	0.040		0.820	0.880	0.150	1200	2000	1200	1800	3.05
L	0.970		0.050	0.050		0.840	0.920	0.150	1200	1900	1300	1800	2.94
L	0.900	0.990	0.050	0.050		0.830	0.910	0.150	1300	2000	1200	1800	3.01
L	0.910	0.990	0.050	0.050		0.790	0.860	0.140	1200	1800	1200	1800	2.83
L	0.770		0.040	0.040		0.810	0.870	0.140	1300	2000	1300	1800	2.98
L	0.840	0.980	0.050	0.050		0.850	0.920	0.150	1300	1900	1300	1800	2.91
L	0.930		0.050	0.050		0.870	0.930	0.160	1200	1800	1300	1800	2.92

The mean and standard deviation for all data was calculated. Outliers were defined as samples beyond the mean ± 2 Standard Deviations from all data. These outliers were removed from the data (shown in red) and a new mean and standard deviation was determined. This method is different from that used to calculate the Confidence Interval shown on many Government-produced standards 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 Certified Limits published on other standards which quote a Confidence Interval.

Participating Laboratories: (Not in same order as in the table of assays)

Anglo American Research Laboratories (Pty) Ltd
ALS Chemex South Africa (Pty) Ltd
Amdal Laboratories Perth
Anglo Platinum Research Center
Genalysis Laboratory Services (Pty) Ltd
Geoscience Laboratories (Geo Labs) Ontario
Set Point Laboratories (Pty) Ltd
SGS Lakefield Research Africa (Pty) Ltd
SGS Welshpool Minerals Western Australia
SGS Lakefield Research Ontario Canada
Ultra Trace (Pty) Ltd

Availability: This product is available in Laboratory Packs containing 1kg of material and Explorer Packs containing 110g or 160g 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. Other packaging is available on application.

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.

21 July 2005

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