

African Mineral Standards

Certificate of Analysis

Platreef Feed Grade
PGE Ore Reference Material AMIS0015

Recommended Concentrations and two "Between Laboratory" Standard Deviations

Certified Concentrations

Pt (NIS)	1.47	±	0.16	g/t
Pt (Pb Collection)	1.45	±	0.11	g/t
Pd (NIS)	1.80	±	0.17	g/t
Pd (Pb Collection)	1.78	±	0.14	g/t
Au (Pb Collection)	0.15	±	0.02	g/t
Rh	0.14	±	0.02	g/t
Cr (XRF)	377	±	33	ppm
Cu (P)	915	±	86	ppm
Cu (T)	910	±	120	ppm
Cu (F)	925	±	106	ppm
Ni (P)	1477	±	112	ppm
Ni (T)	1537	±	163	ppm
Ni (XRF)	1561	±	142	ppm
Co (P)	42.6	±	4.5	ppm
Specific Gravity	3.23	±	0.14	g/cc

Provisional Concentrations

Au (NIS)	0.14	±	0.02	g/t
Ru (NiS)	0.14	±	0.03	g/t
Cu (XRF)	940	±	141	ppm
Ni (F)	1600	±	278	ppm
Co (T)	49	±	8.4	ppm

Indicated Means

Ir (NiS)	0.04	g/t
Cr (F)	423	ppm
Co (XRF)	46	ppm
Co (F)	56	ppm

Intended Use: AMIS0015 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 open pit, PPRust Mine.

Approximate Mineral and Chemical Composition: AMIS0015 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.

SiO2 %	CaO %	MgO %	Fe2O3 %	AL2O3 %	LOI %	S %	MnO %
44.50	18.74	15.00	8.36	7.05	3.19	0.44	0.37
Na2O %	TiO2 %	K2O %	Cr2O3 %	P2O5 %	CL %	V2O5 %	
0.37	0.31	0.18	0.04	0.01	<0.01	<0.01	

Appearance: The material is a very fine powder coloured light grey (Munsell N7) to medium light grey (Corstor 10Y 6/7).

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, Au and Ru. Nickel sulphide collection, ICP-OES or ICP-MS.
2. Pt, Pd and Au. Pb collection with Ag as a co-collector, ICP-OES or ICP-MS.
3. Pt, Pd, Au, Rh, Ru, Ir. NiS collection, ICP-OES or ICP-MS.
4. Co, Cu and Ni. Multi-acid total digestion, including HF, ICP-OES or ICP-MS.
5. Cr, Co, Cu and Ni. Fusion, ICP-OES or ICP-MS
6. Co, Cu and Ni. Aqua regia digestion with ICP-OES or ICP-MS.
7. Cr, Co, Cu and Ni. Fusion or Pressed Pellet, XRF.
8. SG. Gas pycnometer.

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: Twenty eight laboratories were each given nine samples including eight randomly selected packages of sample with one sample of certified reference material for QC purposes. Various results from the twenty four laboratories that reported back timeously were used for the determinations. The following round robin results are displayed:

- Pt and Pd analyses by the Pb collection method;
- Rh analyses by NiS and Fire Assay;
- Cr, Cu, Ni and Co by XRF;
- Ni by the multi-acid (total -T) digestion method;
- Cu, Ni and Co by the aqua regia (partial- P) digestion method.
- Cr, Cu and Ni by the Fusion (F) method.
- Specific gravity by water or gas Pycnometer.

The mean and standard deviation for all data was calculated. Outliers were defined as samples beyond the mean \pm 2 Standard Deviations from all data. These outliers were removed from the data 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.

The tables below represent raw data received from the laboratories.

Lab code	Pt (NiS)	Pt (Pb)	Pd (NiS)	Pd (Pb)	Au (Pb)	Rh (NiS)	Cr (XRF)	Cu (P)	Cu (T)	Cu (F)	Ni (P)	Ni (T)	Ni (XRF)	Co (P)	SG
A		1.470		1.750	0.146			880	831		1470	1450		39	
A		1.410		1.730	0.140			894	859		1440	1490		39	
A		1.480		1.780	0.151			882	858		1450	1490		39	
A		1.470		1.750	0.145			889	875		1460	1520		38	
A		1.440		1.750	0.146			871	887		1440	1540		38	
A		1.400		1.720	0.141			885	852		1460	1480		39	
A		1.490		1.770	0.143			883	887		1450	1550		38	
A		1.480		1.800	0.146			880	838		1440	1480		39	
B		1.670		1.970	0.140	0.260				780					
B		1.610		1.950	0.130	0.260				790					
B		1.600		1.920	0.130	0.290				770					
B		1.590		1.930	0.140	0.280				780					
B		1.660		1.880	0.150	0.280				750					
B		1.600		1.950	0.150	0.270				770					
B		1.700		1.900	0.160	0.300				790					
B		1.660		1.970	0.140	0.280				780					
C		1.350		1.750	0.140			840		851	1475			49	
C		1.370		1.770	0.140			870		882	1509			46	
C		1.380		1.730	0.150			845		892	1453			45	
C		1.320		1.770	0.140			835		842	1474			46	
C		1.350		1.760	0.130			856		866	1493			41	
C		1.380		1.720	0.140			859		871	1513			45	
C		1.400		1.720	0.140			858		831	1503			44	
C		1.360		1.720	0.150			853		869	1506			43	

Lab code	Pt (NiS)	Pt (Pb)	Pd (NiS)	Pd (Pb)	Au (Pb)	Rh (NiS)	Cr (XRF)	Cu (P)	Cu (T)	Cu (F)	Ni (P)	Ni (T)	Ni (XRF)	Co (P)	SG
D		1.390		1.810	0.160			926	951	1000	1508	1632		43	
D		1.440		1.820	0.160			943	970	1000	1494	1640		44	
D		1.420		1.810	0.160			907	930	1000	1485	1634		43	
D		1.450		1.760	0.130			906	980	900	1484	1654		43	
D		1.420		1.830	0.130			922	952	1000	1480	1679		44	
D		1.440		1.860	0.140			927	985	1000	1497	1690		45	
D		1.450		1.840	0.130			929	970	900	1552	1688		46	
D		1.440		1.880	0.140			970	969	900	1536	1706		47	
E		1.464		1.826	0.141			1002	965		1730	1493			
E		1.426		1.769	0.134			960	947		1717	1544			
E		1.480		1.816	0.138			958	949		1707	1494			
E		1.516		1.849	0.141			964	971		1699	1544			
E		1.489		1.837	0.138			958	976		1721	1541			
E		1.499		1.828	0.140			972	956		1677	1538			
E		1.500		1.842	0.139			964	959		1752	1557			
E		1.468		1.822	0.136			973	953		1714	1535			
F	1.683	1.462	1.799	1.341		0.151				1340					
F	1.433	1.442	1.708	1.593		0.123				1382					
F	1.379	1.494	1.826	1.590		0.109				1242					
F	1.142	1.417	1.646	1.658		0.107				1140					
F	1.420	1.528	1.650	1.742		0.092				1416					
F	1.425	1.404	1.646	1.469		0.110				1342					
F	1.389	1.433	1.638	1.689		0.089				1111					
F	1.343	1.329	1.630	1.581		0.089				1144					
G		2.440		1.670	0.212		746		1110	895	1800	1810			
G		2.490		1.666	0.211		741		1054	988	1900	1788			
G		1.940		1.356	0.172		737		1098	927	1800	1783			
G		2.440		1.673	0.212		749		1112	1109	1800	1813			
G		2.350		1.533	0.220		753		1121	914	1800	1822			
G		2.300		1.584	0.199		743		1119	885	1800	1802			
G		2.340		1.570	0.209		744		969	827	1800	1792			
G		2.230		1.600	0.201		741		1121	953	1900	1796			
H		1.330		1.745	0.138		556	949	917		1435	1375	1390	38	2.86
H		1.450		1.775	0.147		394	956	986		1460	1510	1480	39	2.88
H		1.410		1.750	0.141		362	945	946		1450	1450	1490	39	2.76
H		1.450		1.815	0.141		359	937	963		1440	1450	1470	39	2.99
H		1.465		1.840	0.148		365	944	955		1455	1425	1460	40	2.96
H		1.405		1.770	0.135		362	932	886		1455	1335	1480	39	3.12
H		1.490		1.870	0.150		362	931	991		1425	1475	1470	38	3.04
H		1.425		1.740	0.139		361	929	953		1430	1450	1470	39	2.98
I		1.310		1.630	0.150										
I		1.270		1.610	0.140										
I		1.310		1.640	0.130										
I		1.260		1.640	0.140										
I		1.260		1.660	0.150										
I		1.250		1.700	0.150										
I		1.240		1.630	0.140										
I		1.220		1.640	0.150										
J	1.530	1.428	1.840	1.715	0.227	0.137	384	854	883		1386	1606	1510	43	
J	1.490	1.464	1.860	1.740	0.168	0.137	384	861	892		1414	1638	1540	44	
J	1.500	1.471	1.850	1.751	0.175	0.137	385	865	866		1413	1663	1520	44	
J	1.500	1.477	1.860	1.742	0.165	0.137	380	849	885		1395	1639	1480	43	
J	1.510	1.442	1.830	1.736	0.200	0.137	385	816	883		1368	1614	1490	43	
J	1.520	1.469	1.850	1.784	0.150	0.137	385	828	858		1367	1587	1500	43	
J	1.520	1.436	1.840	1.770	0.145	0.136	382	844	883		1391	1615	1500	43	
J	1.530	1.505	1.840	1.774	0.147	0.136	387	827	882		1368	1621	1510	43	
K	1.541	1.430	1.861	1.823	0.148	0.146		957	985	951	1562	1650		43	3.32
K	1.441	1.441	1.755	1.796	0.149	0.136		985	974	943	1598	1635		43	3.28
K	1.573	1.493	1.883	1.831	0.151	0.147		1001	984	988	1610	1639		43	3.29
K	1.539	1.476	1.867	1.902	0.147	0.147		972	987	963	1570	1644		42	3.32
K	1.549	1.436	1.851	1.803	0.143	0.146		989	990	961	1585	1647		43	3.23
K	1.497	1.463	1.841	1.840	0.153	0.142		968	990	939	1558	1634		42	3.35
K	1.558	1.452	1.890	1.853	0.150	0.148		991	978	949	1592	1591		43	3.34
K	1.570	1.443	1.898	1.837	0.149	0.148		984	982	959	1584	1589		43	3.32
L	1.480	1.490	1.890	1.880	0.157	0.134	370	926	952	940	1410	1500	1610	42	3.10
L	1.450	1.520	1.840	1.900	0.159	0.129	370	926	948	960	1390	1550	1610	42	3.10
L	1.510	1.520	1.880	1.920	0.159	0.135	370	928	954	940	1400	1500	1600	42	3.09
L	1.440	1.480	1.830	1.910	0.154	0.130	370	920	950	940	1420	1470	1600	44	3.08
L	1.490	1.530	1.910	1.840	0.149	0.135	380	918	972	960	1400	1550	1610	42	3.08
L	1.520	1.480	1.870	1.840	0.148	0.133	380	940	952	980	1420	1590	1610	44	2.98
L	1.490	1.490	1.860	1.880	0.157	0.136	370	952	960	980	1440	1540	1610	44	3.11
L	1.490	1.480	1.910	1.870	0.154	0.131	390	940	946	960	1440	1480	1620	42	3.10

Lab code	Pt (NiS)	Pt (Pb)	Pd (NiS)	Pd (Pb)	Au (Pb)	Rh (NiS)	Cr (XRF)	Cu (P)	Cu (T)	Cu (F)	Ni (P)	Ni (T)	Ni (XRF)	Co (P)	SG
M		1.490		1.810	0.160	0.140		933	849		1580	1550	1700	41	3.30
M		1.560		1.830	0.160	0.120		900	914		1530	1590	1600	41	3.27
M		1.530		1.840	0.170	0.130		923	875		1560	1620	1600	41	3.22
M		1.480		1.830	0.160	0.140		909	883		1550	1610	1600	40	3.23
M		1.500		1.840	0.170	0.130		892	858		1530	1580	1600	42	3.30
M		1.490		1.840	0.170	0.140		903	877		1530	1630	1600	41	3.28
M		1.560		1.820	0.180	0.130		904	887		1530	1620	1600	40	3.20
M		1.540		1.850	0.170	0.140		867	898		1530	1630	1700	41	3.30
N	1.520	1.430	1.840	1.760	0.152	0.141	362	892	810	886	1480	1430	1642	43	
N	1.530	1.490	1.840	1.830	0.153	0.141	354	888	805	887	1470	1420	1625	42	
N	1.400	1.470	1.670	1.800	0.147	0.131	357	885	805	888	1470	1420	1654	42	
N	1.530	1.510	1.920	1.800	0.151	0.147	357	877	805	888	1450	1420	1641	42	
N	1.570	1.480	1.880	1.800	0.152	0.148	366	882	810	882	1450	1430	1653	41	
N	1.480	1.430	1.790	1.790	0.147	0.139	366	878	816	895	1450	1440	1634	41	
N	1.490	1.490	1.830	1.780	0.161	0.142	362	875	816	887	1450	1430	1638	42	
N	1.430	1.500	1.760	1.810	0.152	0.139	361	878	817	888	1450	1430	1677	42	
O		1.550		1.700		0.140							1591		
O		1.450		1.730		0.140									
O		1.450		1.710		0.120							1587		
O		1.680		1.720		0.140							1602		
O		1.530		1.720		0.130							1611		
O		1.440		1.770		0.140							1612		
O		1.420		1.690		0.140									
O		1.630		1.740		0.130									
P	1.490	1.470	1.770	1.800	0.150	0.160	384		810			1500	1564		3.25
P	1.470	1.470	1.800	1.810	0.150	0.150	366		830			1400	1548		3.22
P	1.410	1.470	1.810	1.810	0.150	0.150	361		830			1600	1547		3.21
P	1.460	1.480	1.753	1.830	0.150	0.150	359		810			1600	1538		3.21
P	1.510	1.430	1.800	1.760	0.150	0.140	383		850			1500	1547		3.21
P	1.470	1.450	1.790	1.780	0.140	0.150	369		830			1500	1555		3.22
P	1.450	1.480	1.780	1.830	0.150	0.150	365		840			1500	1554		3.21
P	1.440	1.460	1.770	1.820	0.150	0.160	355		810			1600	1551		3.21
Q		1.430		1.715	0.158			1105	998	940	1680	1675		46	3.25
Q		1.525		1.815	0.157			1085	949	950	1665	1585		43	3.22
Q		1.445		1.725	0.136			1110	1000	970	1670	1670		42	3.21
Q		1.455		1.715	0.138			1060	843	940	1645	1430		42	3.21
Q		1.430		1.695	0.138			1075	950	940	1670	1615		43	3.21
Q		1.480		1.755	0.152			1075	992	970	1665	1680		43	3.21
Q		1.470		1.755	0.142			1110	1025	940	1725	1720		43	3.21
Q		1.380		1.645	0.144			1085	985	970	1665	1640		43	3.21
R	1.320	1.430	1.770	1.850	0.140	0.130	421		900				1410		3.16
R	1.350	1.450	1.730	1.830	0.140	0.130	401		900				1396		3.15
R	1.340	1.450	1.720	1.830	0.140	0.130	407		900				1468		3.15
R	1.320	1.460	1.680	1.830	0.140	0.130	430		900				1448		3.17
R	1.370	1.470	1.740	1.850	0.140	0.140	399			1000			1502		3.16
R	1.360	1.440	1.740	1.810	0.140	0.140	409			900			1392		3.16
R	1.320	1.440	1.720	1.830	0.140	0.140	401			1000			1431		3.18
R	1.320	1.420	1.700	1.810	0.140	0.130	383			1000			1409		3.17
S	1.6		2.01			0.160							1450		
S	1.6		1.900			0.150							1400		
S	1.6		2.000			0.140							1540		
S	1.7		2.010			0.180							1500		
S	1.6		2.080			0.160							1580		
S	1.4		1.800			0.140							1470		
S	1.6		2.000			0.160							1550		
S	1.7		2.090			0.160							1610		
T	1.461		1.804			0.152				970					
T	1.483		1.860			0.144				970					
T	1.452		1.820			0.146				940					
T	1.419		1.775			0.143				990					
T	1.529		1.910			0.141				930					
T	1.449		1.838			0.153				950					
T	1.409		1.754			0.144				950					
T	1.415		1.741			0.135				990					
U		1.372		1.753	0.129		373	1060	1060		1438	1528	1530	45	3.23
U		1.390		1.790	0.129		362	1060	1060		1459	1505	1541	46	3.24
U		1.405		1.773	0.127		350	1080	1080		1521	1548	1530	45	3.24
U		1.434		1.799	0.130		368	1060	1060		1486	1574	1510	45	3.24
U		1.397		1.794	0.126		366	1070	1070		1466	1555	1531	43	3.24
U		1.380		1.760	0.133		380	1080	1080		1489	1541	1527	43	3.24
U		1.385		1.783	0.128		371	1060	1060		1506	1553	1500	48	3.24
U		1.397		1.781	0.130		359	1070	1070		1470	1515	1490	45	3.24

Lab code	Pt (NiS)	Pt (Pb)	Pd (NiS)	Pd (Pb)	Au (Pb)	Rh (NiS)	Cr (XRF)	Cu (P)	Cu (T)	Cu (F)	Ni (P)	Ni (T)	Ni (XRF)	Co (P)	SG
V	1.492	1.500	1.788	1.820	0.150	0.150	299	915	930		1510	1559	1516	51	3.23
V	1.507	1.510	1.827	1.820	0.150	0.150	289	934	928		1539	1587	1514	48	3.22
V	1.587	1.510	1.817	1.820	0.150	0.150	295	930	902		1525	1556	1535	45	3.22
V	1.489	1.510	1.859	1.830	0.150	0.150	276	941	920		1534	1561	1508	47	3.21
V	1.656	1.510	1.880	1.820	0.140	0.160	291	934	939		1531	1583	1508	45	3.22
V	1.495	1.510	1.785	1.840	0.150	0.140	289	936	938		1533	1572	1517	47	3.22
V	1.472	1.560	1.890	1.890	0.150	0.150	281	941	943		1542	1560	1514	46	3.22
V	1.656	1.520	1.851	1.860	0.150	0.140	291	915	919		1499	1572	1500	45	3.22
W		1.420		1.800	0.141		380	918	875		1430	1410	1670	43	3.38
W		1.400		1.770	0.138		390	929	860		1430	1400	1670	44	3.35
W		1.400		1.760	0.140		400	917	866		1430	1410	1670	43	3.33
W		1.410		1.770	0.137		380	923	889		1430	1450	1640	43	3.39
W		1.390		1.750	0.138		390	948	867		1470	1410	1660	44	3.41
W		1.400		1.760	0.140		380	951	873		1480	1420	1650	44	3.36
W		1.430		1.810	0.139		380	933	873		1440	1430	1640	43	3.37
W		1.360		1.730	0.138		390	924	864		1450	1400	1650	43	3.45
X	1.417		1.706			0.149				824					3.21
X	1.446		1.807			0.151				950					3.20
X	1.390		1.668			0.118				963					3.25
X	1.472		1.771			0.147				809					3.23
X	1.455		1.741			0.138				842					3.25
X	1.380		1.691			0.135				838					3.25
X	1.399		1.644			0.122				808					3.23
X	1.420		1.698			0.134				809					3.28

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

1. ACME Analytical Laboratories Ltd. (Canada).
2. ALS Chemex (Canada).
3. ALS Chemex South Africa (Pty) Ltd.
4. Ammtec Ltd (Australia).
5. Anglo Research, Crown Campus. (ex AARL, South Africa).
6. Anglo Research, Germiston Campus. (ex ARC, South Africa).
7. Anglo Platinum PPL (South Africa).
8. Anglo Platinum RPM Union (South Africa).
9. Assayers Canada.
10. Barplats (South Africa).
11. Becquerrel Laboratories Inc. (Canada).
12. Eastern Bushveld Research Laboratory (EBRL, Anglo Platinum, South Africa).
13. Genalysis Laboratory Services (Pty) Ltd. (Australia).
14. Geoscience Laboratories (Geo Labs, Canada).
15. Geological Survey of Finland (GTK) Geoservices, Assay Laboratory.
16. Mintek (South Africa).
17. Quality Laboratory Services International (South Africa).
18. Set Point Laboratories (Pty) Ltd (South Africa).
19. SGS Lakefield Research Africa (Pty) Ltd. (South Africa).
20. SGS Welshpool Minerals (Australia).
21. SGS Lakefield Research (Canada).
22. Tati Nickel Laboratory (Botswana).
23. TSL Laboratories (Canada).
24. Ultra Trace (Pty) Ltd. (Australia).

Availability: This product is available in Laboratory Packs containing 1kg of material and Explorer Packs containing custom weights (of <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.

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.

10 September 2006

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