

AMIS0459

Certified Reference Material

Platinum (PGM) Pulps Bushveld Complex, South Africa

Certificate of Analysis

Recommended Concentrations and Limits¹ (at two Standard Deviations)

Certified Concentrations²

Pt Pb Collection	0.431	±	0.047	g/t
Pd Pb Collection	0.241	±	0.021	g/t
Co M/ICP	74.8	±	7.9	ppm
Co P	50.79	±	4.51	ppm
Cu P	193.1	±	17.2	ppm
Ni M/ICP	686	±	58	ppm
Ni P	547	±	38	ppm
Specific Gravity	2.95	±	0.09	

Provisional Concentrations

Au Pb Collection	0.119	±	0.014	g/t
Rh	0.037	±	0.010	g/t
Cu M/ICP	200.6	±	24.3	ppm

Informational Concentration

Cr M/ICP 501 ppm

4E = Platinum (Pb Coll)+ Palladium (Pb Coll)+ Rhodium + Gold (Pb Coll) = 0.828 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 presented on p2 and uncertified trace element data presented as an appendix.

Major Element

Recommended Concentrations and Limits (at two Standard Deviations)

Certified Concentrations

Al ₂ O ₃	14.00	±	0.13	%
CaO	8.34	±	0.12	%
Cr ₂ O ₃	0.10	±	0.01	%
Fe ₂ O ₃	9.08	±	0.13	%
K ₂ O	0.19	±	0.01	%
MgO	13.40	±	0.24	%
MnO	0.14	±	0.01	%
Na ₂ O	1.50	±	0.12	%
SiO ₂	49.19	±	0.48	%
TiO ₂	0.14	±	0.01	%

Provisional Concentration

LOI	3.67	±	0.48	%
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1. Intended Use: AMIS0459 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.

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 Section 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: AMIS0459 was made using Bushveld Complex material from the Waterberg area 85km North of Mokopane. This specific material was supplied by Platinum Group Metals (RSA) (Pty) Ltd and consists of pulp reject material obtained from exploration diamond drillhole samples.

3. Mineral and Chemical Composition: The material is a Pt/Pd/Au/Ni/Cu ore that occurs within Main Zone stratigraphic units. Ore rock types vary from leuconorite to pyroxenite or troctolite with interstitial sulphides and PGE's. Mineralogically, the rocks consist of clinopyroxene (~20%), orthopyroxenite (4 – 10%), plagioclase (17 – 45%), serpentine replacing olivine (10 – 40%), chalcopyrite (3 – 6%), talc (~10%) and chlorochlore (2 – 6%) in varying amounts.

4. Appearance: The material is a very fine powder. It is colored Light Grey (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 <54µm. Wet sieve particle size analysis of random samples confirmed the material was 98.5% <54µm. 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. State and provide brief description of analytical techniques used.
2. State aliquots used for all determinations.
3. Results for individual analyses to be reported.
4. Report all QC data, to include replicates, blanks and certified reference materials used.

9. Method of Certification: Eighteen laboratories were each given eight scientifically selected packages of sample. Sixteen 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 16 out of 18 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. Bureau Veritas (Namibia)
4. BV Rustenburg (South Africa)
5. Genalysis Laboratory Services (W Australia P)
6. Intertek Utama Services (Indonesia)
7. Mintek (South Africa)
8. Set Point Laboratories (Isando) SA
9. SGS Geosol Laboratories Ltda (Brazil)
10. SGS Mineral Services Lakefield (Canada)
11. SGS South Africa (Pty) Ltd - Booyens JHB
12. SGS Vancouver (Canada)
13. Suntech Geometallurgical SA

- 14. BV- Ultra Trace (Pty) Ltd WA
- 15. Zimplats Ngezi Lab
- 16. Zimplats SMC Lab

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

Assay Data - Economic Elements

Lab Code	Pt PbColl g/t	Pd PbColl g/t	Au PbColl g/t	Rh g/t	Co M/ICP ppm	Co P ppm	Cr M/ICP ppm	Cu M/ICP ppm	Cu P ppm	Ni M/ICP ppm	Ni P ppm
A	0.28	0.14	0.06					190		730	
A	0.25	0.14	0.06					185		700	
A	0.25	0.15	0.06					195		705	
A	0.25	0.14	0.06					180		705	
A	0.28	0.18	0.06					190		710	
A	0.29	0.19	0.08					190		705	
A	0.27	0.18	0.08					190		705	
A	0.28	0.18	0.08					190		705	
B				0.48	74.4			189		665	
B				1.26	73.0			184		667	
B				0.77	70.7			184		647	
B				0.57	74.1			184		661	
B				0.86	72.4			190		646	
B				0.64	73.4			192		657	
B				0.33	73.1			181		654	
B				1.43	73.0			184		665	
C	0.47	0.26			92.5	50.3	277	223	223	595	575
C	0.47	0.27			98.8	50.8	296	237	222	633	579
C	0.47	0.26			92.4	51.5	292	217	229	583	583
C	0.48	0.27			94.9	51.1	287	223	223	596	572
C	0.49	0.27			89.3	50.1	278	218	228	579	569
C	0.47	0.27			94.9	49.7	294	225	220	599	570
C	0.48	0.26			92.9	49.4	277	223	217	595	559
C	0.45	0.24			90.1	50.6	263	209	224	570	567
D	0.44	0.25	0.14		72.0	47.0		196	189	703	524
D	0.45	0.25	0.14		74.0	49.0		195	195	692	539
D	0.45	0.25	0.12		75.0	47.0		191	191	680	524
D	0.48	0.26	0.12		72.0	49.0		190	202	676	548
D	0.47	0.26	0.13		71.0	48.0		188	183	674	524
D	0.46	0.26	0.15		72.0	48.0		191	190	691	526
D	0.46	0.25	0.12		73.0	49.0		189	194	685	537
D	0.45	0.25	0.12		73.0	48.0		192	183	700	523
F	0.32	0.21	0.13		80.0			225		700	
F	0.39	0.23	0.12		80.0			225		720	
F	0.40	0.20	0.13		80.0			225		700	
F	0.35	0.21	0.13		80.0			230		720	
F	0.38	0.21	0.12		60.0			220		680	
F	0.26	0.22	0.12		80.0			225		700	
F	0.36	0.20	0.12		80.0			220		700	
F	0.33	0.20	0.12		80.0			225		700	
G	0.43	0.24	0.12	0.04	67.0	50.0		208	202	619	535
G	0.46	0.25	0.11	0.05	65.0	51.0		206	199	611	531
G	0.42	0.24	0.13	0.05	68.0	48.0		210	202	604	516
G	0.44	0.25	0.12	0.04	66.0	49.0		210	203	599	530
G	0.45	0.25	0.12	0.04	68.0	50.0		206	201	606	537
G	0.46	0.25	0.12	0.04	67.0	51.0		206	199	608	532
G	0.46	0.25	0.12	0.04	68.0	49.0		207	200	608	532
G	0.44	0.25	0.13	0.04	67.0	50.0		212	201	612	531

Assay Data (Cont.) - Economic Elements

Lab Code	Pt PbColl g/t	Pd PbColl g/t	Au PbColl g/t	Rh g/t	Co M/ICP ppm	Co P ppm	Cr M/ICP ppm	Cu M/ICP ppm	Cu P ppm	Ni M/ICP ppm	Ni P ppm
H	0.43	0.23	0.11	0.04	73.4		426	214		726	
H	0.42	0.24	0.11	0.04	71.4	53.1	386	198	193	686	533
H	0.43	0.24	0.11	0.04	72.8	55.1	438	205	197	697	542
H	0.41	0.23	0.11	0.04	72.2	55.6	399	203	198	699	534
H	0.41	0.24	0.12	0.04	72.8	55.2	425	216	189	710	522
H	0.43	0.24	0.11	0.03	72.6	54.4	432	196	192	692	531
H	0.42	0.24	0.11	0.04	72.1	53.2	407	197	197	690	533
H	0.42	0.24	0.11	0.04	72.1	57.3	457	198	201	690	550
J	0.42	0.24	0.10								
J	0.40	0.23	0.10								
J	0.40	0.23	0.10								
J	0.41	0.24	0.10								
J	0.41	0.22	0.10								
J	0.40	0.24	0.10								
J	0.41	0.24	0.10								
J	0.42	0.24	0.10								
K	0.48	0.24	0.12	0.03				215		690	
K	0.45	0.25	0.13	0.03				210		685	
K	0.47	0.25	0.13	0.03				210		680	
K	0.41	0.26	0.11	0.03				210		670	
K	0.44	0.23	0.13	0.03				205		660	
K	0.45	0.24	0.12	0.03				205		655	
K	0.41	0.23	0.11	0.03				200		660	
K	0.40	0.23	0.12	0.03				200		670	
L	0.40	0.22	0.12		76.0		652	199		688	
L	0.40	0.23	0.12		76.0		639	199		678	
L	0.42	0.22	0.12		76.0		659	203		683	
L	0.41	0.22	0.12		76.0		641	201		682	
L	0.40	0.22	0.12		76.0		654	204		686	
L	0.39	0.22	0.12		77.0		643	201		682	
L	0.40	0.22	0.12		77.0		615	204		682	
L	0.41	0.22	0.12		78.0		633	206		695	
M	0.41	0.24	0.12	0.06	84.0	48.0	429	174	185	631	550
M	0.42	0.24	0.11	0.04	83.0	54.0	413	179	183	641	552
M	0.41	0.23	0.12	0.04	78.0	50.0	397	181	178	638	531
M	0.40	0.23	0.12	0.04	73.0	53.0	409	182	180	648	543
M	0.41	0.24	0.13	0.04	75.0	47.0	397	177	179	635	536
M	0.42	0.24	0.11	0.04	75.0	53.0	399	185	183	659	547
M	0.40	0.23	0.11	0.04	70.0	48.0	421	181	180	639	536
M	0.41	0.24	0.12	0.04	77.0	49.0	396	188	179	669	534
N	0.45	0.26	0.12	0.04	75.0	50.0	750	200	198	720	522
N	0.45	0.25	0.11	0.05	80.0	51.0	700	200	201	720	556
N	0.45	0.26	0.12	0.04	80.0	52.0	700	205	200	710	551
N	0.45	0.25	0.12	0.04	75.0	50.0	700	200	201	720	544
N	0.44	0.25	0.12	0.04	80.0	51.0	700	200	206	715	552
N	0.44	0.25	0.12	0.04	80.0	52.0	700	200	202	725	546
N	0.45	0.25	0.11	0.04	80.0	51.0	700	200	200	725	540
N	0.45	0.25	0.12	0.04	80.0	50.0	700	200	199	720	531
O	0.58	0.24	0.14								
O	0.58	0.24	0.13								
O	0.58	0.26	0.13								
O	0.58	0.25	0.14								
O	0.59	0.24	0.13								
O	0.59	0.23	0.13								
O	0.59	0.24	0.14								
O	0.59	0.24	0.13								
P	0.46	0.25	0.11	0.04	62.0	60.3	598	198	175	635	637
P	0.40	0.23	0.11	0.04	63.0	60.0	565	190	184	631	635
P	0.42	0.25	0.11	0.04	63.0	60.3	567	191	183	635	634
P	0.43	0.25	0.13	0.06	61.0	61.0	553	200	183	641	640
P	0.41	0.24	0.11	0.04	64.0	58.8	541	200	184	622	626
P	0.40	0.23	0.12	0.05	62.0	60.5	593	194	184	635	639
P	0.39	0.22	0.11	0.04	64.0	59.7	588	198	184	645	638
P	0.41	0.26	0.12	0.03	62.0	61.5	545	194	183	633	651
Q	0.42	0.24	0.11							694	
Q	0.42	0.24	0.11							694	
Q	0.43	0.24	0.12							690	
Q	0.44	0.25	0.13							708	
Q	0.43	0.25	0.12							694	
Q	0.45	0.25	0.12							678	
Q	0.44	0.24	0.12							686	
Q	0.41	0.24	0.12							704	
R	0.43	0.24	0.12		75.9	52.9	486	196	208	735	561
R	0.44	0.24	0.11		75.5	52.2	489	204	197	724	577
R	0.43	0.24	0.11		74.5	52.6	482	199	204	718	588
R	0.44	0.24	0.12		76.9	52.2	483	206	204	727	572
R	0.43	0.24	0.12		76.7	54.7	467	206	198	714	577
R	0.44	0.24	0.11		78.0	53.6	454	206	195	734	575
R	0.43	0.24	0.13		78.7	53.1	474	205	197	732	578
R	0.44	0.24	0.12		76.6	49.2	471	203	186	725	553

Assay data – Major Oxides

Lab Code	Al ₂ O ₃ XRF %	CaO XRF %	Cr ₂ O ₃ XRF %	Fe ₂ O ₃ XRF %	K ₂ O XRF %	MgO XRF %	MnO XRF %	Na ₂ O XRF %	SiO ₂ XRF %	TiO ₂ XRF %	LOI %	SG pyc
A												
A												
A												
A												
A												
A												
A												
B	11.7	8.15		8.79	0.14	11.1	0.13	1.31	51.9	0.12	3.49	2.85
B	12.0	8.11		8.80	0.14	11.0	0.13	1.30	51.8	0.12	3.42	2.86
B	12.1	8.16		8.78	0.14	11.0	0.13	1.29	51.9	0.13	3.51	2.86
B	12.3	8.15		8.75	0.14	11.1	0.13	1.31	51.6	0.12	3.45	2.86
B	12.6	8.12		8.72	0.14	11.0	0.13	1.31	51.7	0.12	3.30	2.86
B	12.4	8.12		8.70	0.14	11.2	0.13	1.29	51.6	0.12		2.86
B	11.7	8.26		8.85	0.14	11.2	0.13	1.27	52.3	0.13	3.15	2.86
B	12.1	8.17		8.76	0.14	11.0	0.13	1.30	52.1	0.13	3.37	2.86
C	14.2	8.46	0.11	8.90	0.19	13.7	0.13	1.47	49.3	0.15	3.89	
C	14.1	8.27	0.10	8.98	0.19	13.4	0.13	1.56	49.1	0.14	3.84	
C	14.2	8.41	0.11	9.11	0.19	13.6	0.14	1.52	49.7	0.14	3.73	
C	14.3	8.40	0.11	9.06	0.19	13.6	0.14	1.60	49.5	0.14	3.66	
C	14.0	8.32	0.11	9.13	0.19	13.5	0.14	1.53	49.1	0.13	3.64	
C	14.1	8.39	0.11	9.08	0.19	13.6	0.14	1.58	49.2	0.13	3.75	
C	14.1	8.39	0.11	9.09	0.19	13.6	0.14	1.61	49.3	0.13	3.69	
C	14.2	8.44	0.10	9.12	0.19	13.6	0.14	1.55	49.7	0.14	3.76	
D	14.3	8.36	0.10	9.16	0.19	13.5	0.14	1.53	49.5	0.14	3.75	
D	14.1	8.36	0.10	9.15	0.19	13.4	0.14	1.52	49.4	0.14	3.82	
D	14.2	8.35	0.10	9.20	0.19	13.5	0.14	1.51	49.6	0.14	3.67	
D	14.0	8.27	0.10	9.09	0.18	13.3	0.14	1.41	48.8	0.14	3.59	
D	14.1	8.40	0.10	9.19	0.19	13.4	0.15	1.51	49.5	0.14	3.59	
D	14.2	8.37	0.10	9.19	0.19	13.4	0.15	1.51	49.6	0.14	3.75	
D	14.1	8.37	0.11	9.17	0.19	13.4	0.15	1.56	49.5	0.14	3.65	
D	14.0	8.37	0.10	9.20	0.19	13.5	0.14	1.54	49.5	0.14	3.66	
F	13.9	8.33	0.10	9.13	0.19	13.3	0.14	1.51	49.1	0.14	3.56	2.96
F	14.0	8.30	0.10	9.14	0.19	13.4	0.14	1.49	49.2	0.14	3.59	2.95
F	14.0	8.34	0.10	9.17	0.19	13.4	0.15	1.50	49.3	0.14	3.51	2.96
F	14.0	8.29	0.11	9.17	0.19	13.4	0.15	1.51	49.4	0.14	3.74	2.95
F	14.0	8.30	0.11	9.14	0.18	13.3	0.14	1.51	49.3	0.14	3.52	2.96
F	14.0	8.28	0.11	9.11	0.19	13.3	0.14	1.50	49.1	0.13	3.58	2.94
F	14.0	8.30	0.10	9.13	0.19	13.3	0.14	1.50	49.3	0.14	3.62	2.98
F	14.0	8.31	0.10	9.16	0.18	13.3	0.14	1.51	49.3	0.14	3.40	2.98
G	14.0	8.54	0.10	9.03	0.19	13.3	0.14	1.46	49.2	0.14	3.75	
G	14.0	8.54	0.11	9.06	0.18	13.4	0.15	1.46	49.1	0.13	3.72	
G	14.1	8.54	0.09	9.06	0.18	13.4	0.15	1.45	49.2	0.13	3.81	
G	13.9	8.49	0.10	9.07	0.19	13.4	0.15	1.48	49.3	0.14	3.68	
G	14.0	8.52	0.10	9.04	0.18	13.5	0.14	1.47	49.1	0.13	3.64	
G	14.1	8.55	0.11	9.12	0.19	13.5	0.15	1.47	49.4	0.14	3.69	
G	14.0	8.45	0.11	9.05	0.19	13.4	0.15	1.48	49.2	0.13	3.71	
G	14.0	8.53	0.11	9.09	0.19	13.5	0.14	1.47	49.4	0.14	3.70	
H	14.0	8.29	0.10	9.13	0.18	13.3	0.14	1.54	49.3	0.13	3.37	
H	14.0	8.30	0.10	9.09	0.18	13.3	0.14	1.51	49.4	0.15	3.44	3.01
H	14.0	8.31	0.10	9.09	0.18	13.3	0.14	1.56	49.3	0.14	3.47	2.93
H	14.1	8.32	0.10	9.13	0.18	13.3	0.14	1.53	49.4	0.14	3.46	3.05
H	14.0	8.36	0.11	9.12	0.18	13.3	0.14	1.54	49.4	0.14	3.43	3.00
H	14.1	8.30	0.11	9.14	0.19	13.3	0.14	1.54	49.3	0.14	3.46	2.97
H	14.0	8.31	0.10	9.15	0.19	13.2	0.14	1.52	49.4	0.14	3.46	3.02
H	14.1	8.32	0.10	9.13	0.18	13.3	0.14	1.56	49.5	0.14	3.47	2.96
J	13.8	8.34		8.98	0.18	13.6	0.15	1.39	48.8	0.14	3.92	
J	13.8	8.38		8.99	0.18	13.6	0.15	1.40	48.8	0.14	3.94	
J	13.8	8.38		8.99	0.18	13.6	0.15	1.39	48.9	0.13	3.80	
J	13.7	8.32		8.93	0.18	13.6	0.15	1.41	48.6	0.14	3.84	
J	13.8	8.37		8.95	0.18	13.6	0.15	1.40	48.8	0.13	3.91	
J	13.9	8.39		9.01	0.19	13.6	0.15	1.40	49.1	0.13	3.86	
J	13.8	8.36		9.05	0.18	13.6	0.16	1.39	48.7	0.14	3.70	
J	13.8	8.39		9.00	0.18	13.6	0.15	1.39	48.9	0.13	3.86	
K												
K												
K												
K												
K												
K												
K												
L	14.0	8.32	0.11	9.13	0.20	13.3	0.14	1.46	49.3	0.14	3.50	
L	14.0	8.31	0.11	9.09	0.20	13.3	0.14	1.44	49.2	0.14	3.50	
L	14.0	8.31	0.11	9.09	0.20	13.3	0.14	1.45	49.2	0.14	3.50	
L	14.0	8.31	0.11	9.12	0.20	13.3	0.14	1.45	49.3	0.14	3.50	
L	14.0	8.32	0.11	9.14	0.20	13.3	0.14	1.46	49.3	0.15	3.50	
L	14.0	8.30	0.11	9.07	0.20	13.3	0.14	1.44	49.4	0.14	3.50	
L	14.0	8.29	0.10	9.07	0.19	13.3	0.14	1.44	49.3	0.14	3.70	
L	14.0	8.31	0.11	9.10	0.20	13.3	0.14	1.45	49.3	0.14	3.60	
M	13.5	8.28	0.11	9.09	0.18	13.2	0.15	1.20	48.9	0.14	3.33	2.98
M	13.6	8.32	0.12	9.06	0.19	13.4	0.15	1.20	48.8	0.14	3.13	3.00
M	13.5	8.36	0.14	9.15	0.19	13.4	0.15	1.20	48.9	0.14	3.10	2.99
M	13.5	8.30	0.13	9.07	0.19	13.3	0.15	1.20	48.8	0.14	3.10	2.97
M	13.5	8.31	0.15	9.08	0.19	13.4	0.15	1.20	49.1	0.14	3.29	3.01
M	13.6	8.36	0.12	9.17	0.19	13.4	0.15	1.20	49.4	0.14	3.39	2.99
M	13.7	8.31	0.11	9.12	0.19	13.3	0.15	1.20	49.2	0.14	3.27	3.00
M	13.6	8.35	0.12	9.07	0.19	13.4	0.15	1.20	48.9	0.14	3.34	2.99

Assay data (Cont.) – Major Oxides

Lab Code	Al ₂ O ₃ XRF %	CaO XRF %	Cr ₂ O ₃ XRF %	Fe ₂ O ₃ XRF %	K ₂ O XRF %	MgO XRF %	MnO XRF %	Na ₂ O XRF %	SiO ₂ XRF %	TiO ₂ XRF %	LOI %	SG pyc
N	13.9	8.45	0.10	9.10	0.19	13.3	0.15		49.3	0.14	3.46	2.96
N	14.0	8.46	0.10	9.09	0.19	13.2	0.15		49.3	0.14	3.48	2.97
N	13.9	8.45	0.11	9.11	0.19	13.2	0.15		49.3	0.14	3.51	2.98
N	13.9	8.46	0.10	9.12	0.19	13.3	0.15		49.3	0.14	3.45	2.97
N	13.9	8.47	0.10	9.13	0.19	13.3	0.15		49.3	0.14	3.47	2.97
N	13.9	8.46	0.10	9.13	0.19	13.3	0.15		49.3	0.14	3.51	2.97
N	13.9	8.46	0.10	9.11	0.19	13.2	0.15		49.3	0.14	3.45	2.96
N	13.9	8.45	0.10	9.10	0.19	13.3	0.15		49.3	0.14	3.44	2.98
O												
O												
O												
O												
O												
O												
O												
O												
P	14.1	8.39	0.09	9.02	0.19	13.4	0.14	1.57	49.2	0.15	4.02	2.95
P	14.0	8.36	0.10	9.01	0.20	13.3	0.15	1.59	49.0	0.14	4.10	2.96
P	14.1	8.34	0.10	9.00	0.19	13.4	0.15	1.59	49.1	0.15	4.01	2.94
P	14.1	8.35	0.09	9.00	0.19	13.4	0.15	1.57	49.1	0.14	4.02	2.94
P	14.0	8.39	0.10	8.97	0.19	13.3	0.15	1.57	49.1	0.14	4.04	2.94
P	14.0	8.40	0.09	9.06	0.20	13.4	0.14	1.59	49.2	0.15	4.05	2.95
P	14.1	8.36	0.09	9.00	0.19	13.4	0.15	1.57	49.0	0.15	4.07	2.97
P	14.0	8.31	0.10	8.95	0.19	13.3	0.15	1.56	49.0	0.14	4.02	2.94
Q												
Q												
Q												
Q												
Q												
Q												
Q												
Q												
R	14.0	8.20	0.10	8.96	0.19	13.5	0.14	1.47	48.9	0.13	4.09	2.91
R	14.0	8.22	0.11	9.02	0.19	13.5	0.14	1.47	48.9	0.12	4.08	2.92
R	13.9	8.23	0.11	8.90	0.19	13.5	0.14	1.45	48.9	0.16	4.09	2.90
R	14.0	8.26	0.11	9.00	0.19	13.5	0.14	1.47	48.9	0.12	4.09	2.91
R	13.9	8.20	0.10	8.86	0.19	13.4	0.14	1.45	48.8	0.18	4.06	2.91
R	14.0	8.22	0.10	8.97	0.18	13.5	0.14	1.47	48.8	0.12	4.08	2.91
R	13.9	8.25	0.11	8.92	0.18	13.5	0.14	1.48	48.7	0.14	4.07	2.92
R	13.9	8.25	0.11	8.94	0.19	13.5	0.14	1.48	48.8	0.15	4.06	2.91

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	PbColl	g/t	0.024	0.016	0.014	0.005
Pd	PbColl	g/t	0.01	0.01	0.01	0.00
Au	PbColl	g/t	0.007	0.003	0.006	0.001
Rh		g/t	0.005	0.005	0.003	0.002
Co	M/ICP	ppm	3.93	3.430	1.738	1.162
Co	P	ppm	2.26	1.963	1.427	0.767
Cr	M/ICP	ppm	138.3	157.2	16.6	59.4
Cu	M/ICP	ppm	12.16	9.14	4.17	2.57
Cu	P	ppm	8.59	8.45	4.15	3.24
Ni	M/ICP	ppm	29.1	23.2	9.9	6.8
Ni	P	ppm	19.1	19.1	9.1	7.3
Al ₂ O ₃	XRF	%	0.062	0.042	0.043	0.015
CaO	XRF	%	0.060	0.047	0.031	0.015
Cr ₂ O ₃	XRF	%	0.004	0.002	0.004	0.001
Fe ₂ O ₃	XRF	%	0.066	0.050	0.031	0.015
K ₂ O	XRF	%	0.0044	0.002	0.004	0.001
MgO	XRF	%	0.118	0.093	0.053	0.029
MnO	XRF	%	0.006	0.005	0.003	0.001
Na ₂ O	XRF	%	0.058	0.053	0.023	0.018
SiO ₂	XRF	%	0.238	0.166	0.145	0.052
TiO ₂	XRF	%	0.004	0.002	0.003	0.001
LOI		%	0.240	0.191	0.069	0.056
SG	pyc		0.044	0.046	0.015	0.018

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 fulfil 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: AMIS0459 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 (a part of Torre Industries), Nozibele Mbangula, and Margaret M. Fairhurst; accept no liability for any decisions or actions taken following the use of the reference material.

08 October 2015

Certifying Officers:



African Mineral Standards: _____

Nozibele Mbangula



Geochemist: _____

**Margaret M. Fairhurst, PG, MAusIMM
Oreval**

Appendix – uncertified element statistics

Analyte	Method	Unit	Mean	2SD	RSD%	n
Al	M/ICP	%	7.4	0.59	4.0	68
As	M/ICP	ppm	10.8	3.5	16.0	56
Au	NiS	g/t	0.11	0.01	3.4	15
Ba	M/ICP	ppm	102	14.0	6.9	76
Be	M/ICP	ppm	0.55	0.17	15.6	16
Bi	M/ICP	ppm	0.13	0.06	23.2	30
Ca	M/ICP	%	5.8	0.45	3.9	67
Cd	M/ICP	ppm	0.11	0.03	14.3	21
Ce	M/ICP	ppm	62.7	19.9	15.9	24
Co	XRF	ppm	76.7	30.5	19.9	22
Cr	P	ppm	196	23.0	5.9	22
Cs	M/ICP	ppm	0.45	0.10	11.5	16
Cu	XRF	ppm	197	13.5	3.4	27
Fe	M/ICP	%	6.3	0.39	3.1	67
Ga	M/ICP	ppm	13.9	7.4	26.8	32
Hf	M/ICP	ppm	0.49	0.14	13.9	24
In	M/ICP	ppm	0.03	0.01	24.3	16
K	M/ICP	%	0.16	0.01	4.2	71
La	M/ICP	ppm	27.3	4.7	8.6	50
Li	M/ICP	ppm	9.9	1.2	6.2	55
Lu	M/ICP	ppm	0.07	0.02	12.0	16
Mg	M/ICP	%	7.9	0.37	2.3	63
Mn	M/ICP	ppm	1065	130	6.1	63
Mo	M/ICP	ppm	0.58	0.19	16.6	15
Na	M/ICP	%	1.1	0.10	4.5	72
Nb	M/ICP	ppm	43.9	7.4	8.4	46
Ni	XRF	ppm	698	111	7.9	32
P	M/ICP	ppm	530	109	10.3	62
Pd	NiS	g/t	0.28	0.20	34.8	37
Pt	NiS	g/t	0.43	0.10	12.1	39
Pb	M/ICP	ppm	6.9	4.7	34.2	50
Rb	M/ICP	ppm	4.9	1.0	10.0	31
Ru	NiS	g/t	0.17	0.51	150	38
S	M/ICP	%	0.11	0.02	9.0	57
Sb	M/ICP	ppm	0.68	0.17	12.2	32
Sc	M/ICP	ppm	19.6	2.1	5.4	59
Sn	M/ICP	ppm	44.5	170	191	39
Tb	M/ICP	ppm	0.30	0.05	8.0	16
Te	M/ICP	ppm	0.37	0.69	92.8	23
Th	M/ICP	ppm	4.5	1.6	17.3	32
Ti	M/ICP	%	0.08	0.01	7.06	63
Tl	M/ICP	ppm	0.05	0.0	0.0	13
Tm	M/ICP	ppm	0.08	0.0	2.9	15
U	M/ICP	ppm	1.4	0.55	20.0	32
V	M/ICP	ppm	78.5	8.4	5.3	66
W	M/ICP	ppm	0.20	0.0	0.0	16
Y	M/ICP	ppm	5.9	0.79	6.7	59
Yb	M/ICP	ppm	0.54	0.10	9.1	16
Zn	M/ICP	ppm	61.4	11.5	9.4	72
Zr	M/ICP	ppm	17.5	4.5	13.0	68