



## AMIS0182

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

#### **Porphyry Gold Ore Colosa Project, Columbia**

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

#### **Recommended Concentrations and Limits<sup>1</sup> (at two Standard Deviations)**

#### ***Certified Concentrations<sup>2</sup>***

Au Pb Collection	0.55	±	0.06	g/t
S Combustion / LECO	1.54	±	0.06	%
Specific Gravity	2.83	±	0.08	

#### ***Provisional Concentration***

Ag M/ICP	0.39	±	0.10	ppm
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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 Elements Recommended Concentrations and Limits (at two Standard Deviations)

## Certified Concentrations

Al <sub>2</sub> O <sub>3</sub>	15.53	±	0.22	%
CaO	4.07	±	0.08	%
Fe <sub>2</sub> O <sub>3</sub>	8.27	±	0.02	%
K <sub>2</sub> O	2.57	±	0.06	%
MgO	4.08	±	0.08	%
MnO	0.060	±	0.002	%
Na <sub>2</sub> O	3.04	±	0.12	%
SiO <sub>2</sub>	57.68	±	0.72	%
TiO <sub>2</sub>	1.16	±	0.03	%

## Provisional Concentrations

Cr <sub>2</sub> O <sub>3</sub>	0.031	±	0.004	%
LOI	3.05	±	0.048	%

**1. Intended Use:** AMIS0182 can be used to check analysis of samples of porphyry hosted gold ores, 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 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:** AMIS0182 is a commissioned CRM made from material supplied by AngloGold Ashanti Ltd from their Colosa Project; situated 150 km west Bogota and 30 km west of the major town, Ibaguè in the department of Tolima, Columbia. The La Colosa copper-poor porphyry gold system is genetically associated with Miocene (8 m.y.) porphyritic intrusive centers intruded into Paleozoic schists

**3. Mineral and Chemical Composition:** The highest grade gold mineralization is closely associated with a suite of early porphyry intrusions/breccias with potassic and sodic-calcic alteration.

The early porphyry stage is divided into three phases; crowded, coarse-grained and fine-grained; which with their associated intrusion breccias appear to have been altered and mineralized at the same time. The alteration/mineralization mineral assemblage observed at Colosa starts with pervasive sodic-

calcic alteration overprinted by potassic alteration and in turn cut by a sodic-calcic event. Ca-Na and K alteration with or without chloritic alteration has the best gold grades.

The gold content of the three early porphyry phases is similar. Gold grains vary from almost pure gold to a much lesser amount of gold-silver telluride. The gold grains are generally fine grained around 15µm. Gold grains occur both liberated and "locked" in sulphides and silicates. Sulphide minerals associated with gold are dominantly 5% pyrite and in a much lesser amount pyrrhotite and arsenopyrite; and traces of chalcopyrite and molybdenite.

**4. Appearance:** The material is a very fine powder. It is colored a Med Dark Grey (Corstor).

**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 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. Au – Pb collection ICP-OES or ICP-MS.
2. Multi-acid digest, including HF, ICP- OES or ICP-MS. Multi element scan to include Ag.
3. Majors ( Al<sub>2</sub>O<sub>3</sub>, CaO, Cr<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>O, MgO, MnO, Na<sub>2</sub>O, S, SiO<sub>2</sub>, TiO<sub>2</sub>. LOI. ) XRF fusion.
4. S – Total Combustion.
5. SG ( gas pycnometer )

**8. Information requested:**

1. State aliquots used for all determinations.
2. Report all results for gold and uranium in ppm.
3. All results for major elements to be reported as oxides in percentages.
4. All results for multi-element scans to be reported in ppm.
5. Report all QC data, to include replicates, blanks and certified reference materials used.
6. State and provide brief description of analytical techniques used.

**9. Method of Certification:** Twenty four laboratories were each given eight randomly selected packages of sample. Twenty of the laboratories submitted results in time for the certification.

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 20 out of 24 laboratories that provided results timeously were (not in same order as in the table of assays):

1. ALS Chemex Laboratory Group Johannesburg SA
2. ALS Chemex Laboratory Group Lima (Peru)
3. ALS Chemex Laboratory Group Perth Australia
4. ALS Chemex Laboratory Group Vancouver CA
5. Anglo Gold Ashanti - Navachab Gold Mine Laboratory Namibia
6. Anglo Gold Ashanti - Vaal River Laboratory SA
7. Genalysis Laboratory Services (South Africa) Pty
8. Genalysis Laboratory Services W Australia
9. Harmony Assay Laboratories
10. Intertek Utama Services (Indonesia)
11. OMAC Laboratories Limited (Ireland)
12. Ready Lead Assay Laboratory
13. Set Point Laboratories (Isando) SA
14. SGS Geosol Laboratories Ltda (Brazil)
15. SGS Mineral Services Callao (Peru)
16. SGS Mineral Services Lakefield (Canada)
17. SGS Mwanza
18. SGS South Africa (Pty) Ltd - Barberton
19. SGS South Africa (Pty) Ltd - Booyens JHB
20. Ultra Trace (Pty) Ltd WA

**11. Assay Data:** Data as received from the laboratories for the important certified elements listed on p1 and 2 are set out below. A proficiency report has been sent to the managers of the participating laboratories. Additional digital data from this round robin is available on request.

Lab Code	Au Pb Coll g/t	Ag M/ICP ppm	Al2O3 XRF %	Cr2O3 XRF %	CaO XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	S XRF %	SiO2 XRF %	TiO2 XRF %	LOI %	S LECO %	SG
A	0.52	0.40	15.33	4.02		8.41	2.58	4.07	0.06	3.09	1.56	57.97	1.16	2.68	1.79	2.85
A	0.59	0.40	15.40	4.06		8.43	2.61	4.08	0.06	3.09	1.57	58.22	1.16	2.70	1.79	2.89
A	0.54	0.40	15.38	4.04		8.46	2.62	4.07	0.06	3.09	1.61	58.27	1.16	2.70	1.74	2.88
A	0.50	0.40	15.43	4.04		8.43	2.61	4.09	0.06	3.09	1.59	58.06	1.16	2.69	1.71	2.87
A	0.50	0.30	15.41	4.04		8.43	2.60	4.08	0.06	3.10	1.61	58.03	1.17	2.70	1.72	2.89
A	0.50	0.40	15.44	4.04		8.45	2.59	4.08	0.06	3.07	1.57	58.11	1.16	2.70	1.68	2.84
A	0.55	0.40	15.46	4.05		8.46	2.62	4.09	0.06	3.10	1.56	58.22	1.17	2.69	1.69	2.88
A	0.56	0.40	15.37	4.03		8.39	2.62	4.08	0.06	3.09	1.61	58.27	1.17	2.68	1.71	2.86
B	0.56															2.87
B	0.54															2.88
B	0.55															2.88
B	0.53															2.86
B	0.54															2.86
B	0.54															2.87
B	0.56															2.88
B	0.53															2.87
C	0.56		15.47	4.06		8.29	2.57	4.12	0.06	3.01		57.74	1.16	2.80	1.53	
C	0.59		15.48	4.08		8.25	2.59	4.09	0.06	3.12		57.69	1.16	2.80	1.55	
C	0.58		15.54	4.07		8.33	2.58	4.12	0.06	3.05		57.84	1.16	2.80	1.54	
C	0.59		15.50	4.07		8.30	2.58	4.06	0.06	3.04		57.87	1.16	2.80	1.54	
C	0.56		15.50	4.08		8.27	2.57	4.11	0.06	3.06		57.73	1.16	3.00	1.52	
C	0.56		15.45	4.04		8.22	2.57	4.05	0.06	3.02		57.59	1.15	3.00	1.54	
C	0.59		15.54	4.07		8.28	2.58	4.11	0.06	3.05		58.01	1.16	2.90	1.54	
C	0.56		15.50	4.07		8.27	2.58	4.08	0.06	3.00		57.87	1.16	3.00	1.52	

## Assay data (cont)

Lab Code	Au Pb Coll	Ag M/ICP	Al2O3 XRF	Cr2O3 XRF	CaO XRF	Fe2O3 XRF	K2O XRF	MgO XRF	MnO XRF	Na2O XRF	S XRF	SiO2 XRF	TiO2 XRF	LOI	S LECCO	SG
	g/t	ppm	%	%	%	%	%	%	%	%	%	%	%	%	%	
D	0.54	0.34													1.51	
D	0.53	0.37													1.44	
D	0.54	0.33													1.56	
D	0.53	0.26													1.46	
D	0.53	0.35													1.53	
D	0.54	0.29													1.55	
D	0.57	0.31													1.58	
D	0.54	0.34													1.57	
E	0.54															
E	0.57															
E	0.53															
E	0.55															
E	0.54															
E	0.56															
E	0.56															
F	0.51		15.00	4.13	0.02	8.02	2.51	4.00	0.05	3.08		57.20	1.15	3.28	1.57	2.82
F	0.50		15.00	4.12	0.02	8.15	2.54	4.10	0.06	3.08		57.70	1.17	3.28	1.57	2.81
F	0.52		15.00	4.12	0.02	8.14	2.53	4.10	0.06	3.09		57.90	1.15	3.26	1.52	2.81
F	0.50		15.00	4.11	0.02	8.10	2.50	4.00	0.06	3.08		57.10	1.14	3.27	1.54	2.82
F	0.52		14.90	4.13	0.02	8.14	2.54	4.10	0.06	3.06		57.80	1.16	3.25	1.56	2.82
F	0.52		15.00	4.10	0.02	8.13	2.55	4.10	0.06	3.07		57.80	1.15	3.23	1.55	2.81
F	0.53		14.90	4.12	0.02	8.10	2.54	4.10	0.06	3.04		57.80	1.16	3.24	1.57	2.82
F	0.51		15.00	4.12	0.02	8.03	2.50	4.00	0.05	3.08		57.20	1.16	3.26	1.58	2.82
G	0.58	0.44													1.56	2.80
G	0.55	0.52													1.54	2.78
G	0.56	0.39													1.51	2.79
G	0.59	0.38													1.53	2.79
G	0.53	0.41													1.54	2.78
G	0.57	0.38													1.50	2.79
G	0.57	0.43													1.52	2.79
G	0.58	0.41													1.52	2.80
H	0.57		15.55	4.06	0.03	8.28	2.59	4.10	0.07	3.04	1.55	57.89	1.16	2.88	1.62	2.94
H	0.56		15.52	4.06	0.03	8.26	2.58	4.08	0.06	3.05	1.57	57.79	1.15	2.92	1.57	2.93
H	0.58		15.58	4.05	0.03	8.28	2.59	4.09	0.06	3.05	1.56	57.79	1.17	2.90	1.56	2.89
H	0.59		15.56	4.06	0.03	8.26	2.59	4.08	0.06	3.05	1.56	57.77	1.16	2.90	1.55	2.86
H	0.55		15.49	4.06	0.03	8.25	2.58	4.09	0.06	3.03	1.57	57.79	1.16	2.90	1.57	2.91
H	0.58		15.53	4.06	0.03	8.27	2.58	4.09	0.06	3.04	1.56	57.83	1.16	2.88	1.58	2.90
H	0.59		15.56	4.06	0.03	8.26	2.59	4.09	0.06	3.04	1.57	57.81	1.16	2.92	1.54	2.87
H	0.58		15.56	4.06	0.03	8.28	2.59	4.10	0.06	3.04	1.56	57.86	1.16	2.92	1.55	2.85
J	0.52		15.60	4.15	0.03	8.33		4.07	0.06	3.10		57.90	1.15	3.41	1.51	
J	0.52		15.50	4.10	0.03	8.28		4.06	0.06	3.07		57.70	1.15	3.40	1.47	
J	0.54		15.50	4.11	0.03	8.26		4.06	0.06	3.09		57.50	1.15	3.39	1.53	
J	0.52		15.50	4.07	0.03	8.20		4.04	0.06	3.08		57.20	1.14	3.38	1.50	
J	0.53		15.50	4.08	0.03	8.09		4.05	0.06	3.07		57.30	1.14	3.36	1.51	
J	0.54		15.40	4.06	0.03	8.14		4.03	0.06	3.06		56.90	1.13	3.39	1.55	
J	0.54		15.50	4.11	0.03	8.32		4.06	0.06	3.09		57.80	1.16	3.38	1.50	
J	0.53		15.60	4.07	0.03	8.19		4.26	0.05	3.06		57.00	1.14	3.39	1.53	
K	0.52	0.42	15.60	4.04	0.03	8.13	2.57	4.05	0.06	3.16		58.60	1.18	2.81	1.59	
K	0.57	0.39	15.60	4.02	0.04	8.13	2.57	4.04	0.06	3.16		58.60	1.16	2.72	1.58	
K	0.55	0.45	15.30	3.99	0.03	8.21	2.53	4.03	0.06	3.16		57.40	1.14	2.77	1.59	
K	0.53	0.43	15.45	4.01	0.03	8.25	2.55	4.03	0.06	3.18		57.70	1.14	2.80	1.59	
K	0.54	0.43	15.40	4.01	0.03	8.20	2.54	4.02	0.06	3.16		57.50	1.13	2.81	1.59	
K	0.54	0.45	15.40	4.06	0.03	8.31	2.55	4.04	0.06	3.18		57.40	1.15	2.73	1.54	
K	0.54	0.40	15.20	3.98	0.03	8.13	2.52	3.99	0.06	3.14		56.70	1.13	2.88	1.57	
K	0.55	0.48	15.20	3.96	0.02	8.09	2.51	3.97	0.06	3.14		56.60	1.13	2.83	1.58	
M	0.63															
M	0.66															
M	0.66															
M	0.65															
M	0.48															
M	0.64															
M	0.56															
M	0.63															
N	0.58	0.34	15.70	4.06	0.03	8.30	2.60	4.23	0.06	2.93		57.90	1.18	3.05		
N	0.61	0.33	15.50	4.09	0.03	8.28	2.61	4.19	0.06	2.99		57.60	1.15	3.21		
N	0.60	0.35	15.60	4.02	0.03	8.15	2.58	4.27	0.05	2.95		57.50	1.18	3.24		
N	0.51	0.34	15.40	4.11	0.03	8.26	2.63	4.14	0.06	2.97		57.80	1.19	2.90		
N	0.53	0.36	15.40	4.10	0.03	8.21	2.59	4.13	0.06	2.91		57.70	1.15	2.95		
N	0.53	0.31	15.40	4.10	0.03	8.24	2.60	4.21	0.06	2.98		57.70	1.18	2.93		
N	0.50	0.37	15.60	4.07	0.03	8.23	2.62	4.22	0.05	2.94		57.60	1.18	2.95		
N	0.49	0.36	15.70	4.07	0.02	8.21	2.59	4.22	0.05	2.98		57.70	1.20	2.97		
O	0.54	0.34	15.57	3.91	0.03	7.95	2.45	4.10	0.06	2.95		57.15	1.13	3.23	1.57	2.83
O	0.56	0.35	15.67	3.92	0.03	7.94	2.48	4.11	0.06	2.96		57.25	1.15	3.18	1.60	2.85
O	0.56	0.38	15.71	3.95	0.03	7.98	2.48	4.11	0.06	3.00		57.35	1.14	3.22	1.60	2.90
O	0.61	0.37	15.64	3.93	0.03	7.96	2.46	4.10	0.06	2.97		57.24	1.14	3.23	1.57	2.80
O	0.54	0.32	15.71	3.91	0.03	7.94	2.44	4.11	0.06	2.95		57.41	1.14	3.23	1.58	2.82
O	0.55	0.40	15.71	3.92	0.03	7.96	2.46	4.10	0.06	2.95		57.20	1.14	3.16	1.57	2.96
O	0.59	0.35	15.58	3.95	0.03	7.98	2.45	4.11	0.06	2.95		57.35	1.13	3.23	1.58	2.84
O	0.55	0.34	15.74	3.95	0.03	7.98	2.48	4.12	0.06	2.98		57.50	1.14	3.22	1.55	2.85
P	0.55		15.50	4.11	0.03	8.31	2.69	4.01	0.10	2.98		57.60	1.16	3.50	1.54	2.83
P	0.55		16.00	4.11	0.03	8.45	2.62	4.14	0.06	3.03		58.30	1.19	3.22	1.51	2.82
P	0.54		15.90	4.16	0.06	8.42	2.63	4.12	0.06	3.08		58.50	1.18	3.22	1.54	2.81
P	0.52		15.60	4.13	0.03	8.36	2.62	4.06	0.08	3.01		58.20	1.18	3.18	1.52	2.82
P	0.52		15.50	4.11	0.05	8.35	2.70	4.04	0.07	3.01		57.60	1.17	3.23	1.53	2.82
P	0.52		15.70	4.09	0.03	8.34	2.67	4.02	0.09	2.98		58.40	1.18	3.20	1.50	2.81
P	0.52		15.60	4.12	0.03	8.39	2.64	4.06	0.09	3.03		57.80	1.17	3.22	1.55	2.82
P	0.56		15.60	4.06	0.02	8.34	2.66	4.04	0.10	2.98		57.40	1.16	3.21	1.54	2.81

**Assay data (cont)**

Lab Code	Au Pb Coll	Ag M/ICP	Al2O3 XRF	Cr2O3 XRF	CaO XRF	Fe2O3 XRF	K2O XRF	MgO XRF	MnO XRF	Na2O XRF	S XRF	SiO2 XRF	TiO2 XRF	LOI	S LECO	SG
	g/t	ppm	%	%	%	%	%	%	%	%	%	%	%	%	%	
Q	0.57															
Q	0.54															
Q	0.59															
Q	0.57															
Q	0.60															
Q	0.58															
Q	0.59															
S	0.52															
S	0.60															
S	0.76															
S	0.68															
S	0.72															
S	0.68															
S	0.76															
S	0.60															
U	0.58															
U	0.60															
U	0.60															
U	0.57															
U	0.56															
U	0.53															
U	0.40															
U	0.54															
V	0.54		15.44	4.10	0.03	8.37	2.56	4.44	0.06	2.95		57.98	1.16	3.32	1.56	2.77
V	0.59		15.39	4.05	0.03	8.33	2.59	4.43	0.06	3.03		57.70	1.16	3.35	1.56	2.76
V	0.52		15.17	3.97	0.03	8.17	2.57	4.37	0.06	2.96		56.85	1.13	3.27	1.56	2.83
V	0.58		15.43	4.07	0.03	8.31	2.55	4.40	0.06	3.00		57.64	1.16	3.36	1.57	2.81
V	0.52		15.23	4.08	0.03	8.31	2.56	4.38	0.06	2.93		57.69	1.15	3.46	1.56	2.76
V	0.52		15.58	4.14	0.03	8.40	2.61	4.44	0.06	3.02		58.00	1.16	3.26	1.50	2.76
V	0.51		15.46	4.06	0.03	8.34	2.58	4.44	0.06	3.01		57.74	1.15	3.26	1.56	2.83
V	0.50		15.15	3.99	0.03	8.19	2.54	4.39	0.06	2.94		56.74	1.14	3.43	1.57	2.76
W	0.52															
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W	0.53															
W	0.55															
W	0.55															
X	0.50	0.48	15.50	4.00	0.03	8.14	2.51	4.09	0.06	2.69		56.40	1.16	2.82	1.46	
X	0.57	0.49	15.90	4.11	0.03	8.35	2.58	4.19	0.06	2.76		58.00	1.18	2.83	1.49	
X	0.56	0.48	15.50	4.01	0.04	8.10	2.52	4.09	0.06	2.71		56.50	1.15	2.81	1.49	
X	0.52	0.46	15.70	4.07	0.03	8.31	2.56	4.14	0.06	2.72		57.30	1.18	2.80	1.48	
X	0.59	0.47	15.90	4.10	0.03	8.36	2.57	4.18	0.06	2.75		57.90	1.18	2.81	1.44	
X	0.53	0.44	15.70	4.06	0.03	8.22	2.54	4.14	0.06	2.72		57.30	1.16	2.96	1.53	
X	0.53	0.46	15.55	4.02	0.03	8.09	2.52	4.11	0.06	2.70		56.80	1.14	2.83	1.50	
X	0.61	0.46	15.85	4.10	0.03	8.34	2.57	4.19	0.06	2.76		57.80	1.20	2.84	1.51	

**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 the relevant ISO guidelines.

Analyte	Method	Unit	S <sup>1</sup>	$\sigma_L$ <sup>2</sup>	Sw <sup>3</sup>	CSU <sup>4</sup>
Au	Pb Coll	ppm	0.027	0.011	0.021	0.003
Ag	M/ICP	ppm	0.052	0.051	0.026	0.019
S	Comb/LECO	%	0.030	0.020	0.019	0.006
SG	pycnometer		0.039	0.036	0.019	0.013
Al <sub>2</sub> O <sub>3</sub>	XRF	%	0.115	0.067	0.087	0.024
CaO	XRF	%	0.037	0.023	0.027	0.008
Cr <sub>2</sub> O <sub>3</sub>	XRF	%	0.002	0.000	0.002	0.000
Fe <sub>2</sub> O <sub>3</sub>	XRF	%	0.102	0.073	0.064	0.024
K <sub>2</sub> O	XRF	%	0.031	0.027	0.018	0.010
LOI	XRF	%	0.242	0.207	0.068	0.063
MgO	XRF	%	0.036	0.022	0.028	0.008
MnO	XRF	%	0.002	0.001	0.002	0.000
Na <sub>2</sub> O	XRF	%	0.062	0.052	0.025	0.017
SiO <sub>2</sub>	XRF	%	0.359	0.190	0.282	0.065
TiO <sub>2</sub>	XRF	%	0.015	0.009	0.011	0.003

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. Certified values:** The Certified, Provisional and Indicated values listed on p1 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:** AMIS0182 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. 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, 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.

02 December 2010

**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
Al	M/ICP	%	8.01	0.65	4.06	62
As	M/ICP	ppm	23.41	3.33	7.11	61
Ba	M/ICP	ppm	483	45.34	4.70	61
Be	M/ICP	ppm	1.47	0.42	14.23	56
Bi	M/ICP	ppm	2.12	0.21	5.06	39
Ca	M/ICP	%	2.87	0.24	4.10	64
Cd	M/ICP	ppm	0.22	0.03	7.36	39
Ce	M/ICP	ppm	44.43	12.57	14.14	56
Co	M/ICP	ppm	24.51	3.81	7.77	71
Cr	M/ICP	ppm	183	38.53	10.53	70
Cs	M/ICP	ppm	4.51	0.52	5.78	47
Cu	M/ICP	ppm	146	20.61	7.06	73
Dy	M/ICP	ppm	4.62	0.30	3.24	16
Er	M/ICP	ppm	2.49	0.15	2.97	15
Eu	M/ICP	ppm	1.35	0.08	3.06	16
Fe	M/ICP	%	5.64	0.63	5.63	68
Ga	M/ICP	ppm	19.88	1.59	4.01	56
Gd	M/ICP	ppm	5.06	0.26	2.60	15
Ge	M/ICP	ppm	0.96	2.65	137	38
Hf	M/ICP	ppm	0.44	0.46	52.62	46
Ho	M/ICP	ppm	0.90	0.05	3.05	16
In	M/ICP	ppm	0.11	0.02	7.46	46
K	M/ICP	%	2.11	0.21	5.02	72
La	M/ICP	ppm	22.34	4.42	9.89	64
Li	M/ICP	ppm	17.66	4.69	13.29	75
Lu	M/ICP	ppm	0.24	0.04	7.25	24
Mg	M/ICP	%	2.36	0.41	8.68	67
Mn	M/ICP	ppm	451	62.37	6.91	72
Mo	M/ICP	ppm	11.47	1.44	6.28	78
Na	M/ICP	%	2.19	0.21	4.74	72
Nb	M/ICP	ppm	11.23	2.77	12.34	66
Nd	M/ICP	ppm	24.47	1.56	3.20	14
Ni	M/ICP	ppm	63.59	9.80	7.70	73
P	M/ICP	ppm	858	98.65	5.75	71
Pb	M/ICP	ppm	3.38	2.05	30.34	56
Pd	M/ICP	ppm	0.01	0.00	37.03	8
Pr	M/ICP	ppm	5.92	0.35	2.99	14
Pt	M/ICP	ppm	0.01	0.01	35.63	8
Rb	M/ICP	ppm	97.00	26.37	13.59	55
Re	M/ICP	ppm	0.02	0.00	9.60	31
S	M/ICP	%	1.53	0.18	5.90	73
Sb	M/ICP	ppm	1.24	0.32	12.71	45
Sc	M/ICP	ppm	21.89	6.07	13.86	64
Se	M/ICP	ppm	4.39	1.51	17.17	38
Si	M/ICP	%	27.13	0.26	0.47	8
Sm	M/ICP	ppm	5.26	0.42	3.95	16
Sn	M/ICP	ppm	2.91	0.32	5.49	45
Sr	M/ICP	ppm	175	19.77	5.66	72
Ta	M/ICP	ppm	0.87	0.36	20.37	48
Tb	M/ICP	ppm	0.73	0.15	10.16	23
Te	M/ICP	ppm	1.34	0.23	8.46	47
Th	M/ICP	ppm	6.15	1.40	11.40	48
Ti	M/ICP	%	0.64	0.08	6.01	72
Tl	M/ICP	ppm	0.89	0.15	8.62	47
Tm	M/ICP	ppm	0.33	0.02	3.64	15
U	M/ICP	ppm	1.18	0.29	12.06	47
V	M/ICP	ppm	212	33.91	8.00	68
W	M/ICP	ppm	10.53	1.18	5.61	54
Y	M/ICP	ppm	23.36	5.42	11.61	64
Yb	M/ICP	ppm	1.94	0.42	10.92	24
Zn	M/ICP	ppm	50.75	11.81	11.63	74
Zr	M/ICP	ppm	14.75	23.64	80.10	78