



African Mineral Standards

MATRIX REFERENCE MATERIALS

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AMIS0273

Certified Reference Material

**Gold, silver, epithermal vein ore, Palmarejo,
Mexico**

Certificate of Analysis

**Recommended Concentrations and Limits¹
(at two Standard Deviations)**

Certified Concentrations²

Au Pb Collection	2.49	±	0.28	g/t
Ag M/ICP	161	±	9	ppm
Ag P	158	±	7.6	ppm
Cu M/ICP	953	±	56	ppm
Cu P	947	±	48	ppm
Pb M/ICP	2639	±	148	ppm
Pb P	2615	±	186	ppm
Zn M/ICP	5001	±	356	ppm
Zn P	4792	±	234	ppm
Specific Gravity	2.76	±	0.08	

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	8.55	±	0.18	%
CaO	4.39	±	0.12	%
Cr ₂ O ₃	0.067	±	0.008	%
Fe ₂ O ₃	4.93	±	0.10	%
K ₂ O	3.35	±	0.04	%
MgO	1.54	±	0.04	%
MnO	0.73	±	0.02	%
SiO ₂	66.28	±	0.50	%
TiO ₂	0.52	±	0.02	%
S Comb / LECO	2.24	±	0.10	%

Indicated Means

Na ₂ O	0.41	%
LOI	6.44	%

1. Intended Use: AMIS0273 can be used to check analysis of samples of fissure hosted, low-sulphidation, epithermal gold-silver quartz vein 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 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: AMIS0273 is a commissioned CRM made from material supplied by SGS Minerals Services from the Palmajero Mine. Palmajero is wholly owned by Coeur d'Alene Mines Corporation. The mine is located about 420 kilometers by road southwest of the city of Chihuahua in the state of Chihuahua in northern Mexico and on the western edge of the Sierra Madre Occidental in the Témoris mining district.

The Palmarejo area ore bodies are hosted in northwest trending structures that cut through a late Cretaceous-Paleocene volcano-sedimentary sequence comprising ash-rich mudstones, sandstones, basalt and andesite.

3. Mineral and Chemical Composition: The economic silver-gold mineralization is hosted in epithermal, intermediate-sulfidation, quartz-carbonate tectonic-hydrothermal breccia veins and quartz-stockworks with strong vertical zoning. Precious and base-metal mineral assemblages are dominated by fine-grained pyrite, argentite (acanthite), sphalerite, galena, and electrum. Silver occurs as argentite, electrum and as native silver. Gold is present as native gold and electrum.

4. Appearance: The material is a very fine powder. It is colored 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 ore is crushed, then dry-milled and air classified to 100% <54 μ . This fine powder is mixed in a blender for 14 hours and then split down into numbered 1 kg tubs. These lots are sampled for quality control and for round robin analysis. Quality control will typically comprise sampling 30 tubs selected from the whole stream. Round robin samples are selected the same way, so that one laboratory will receive samples from the beginning, end, and from throughout the batch.

7. Methods of Analysis requested:

1. Au – Pb collection, ICP-OES or ICP-MS.
2. Multi-acid digest multi-element scan - (to include Ag, Cu, Pb, Zn) ICP-OES or ICP-MS.
3. Aqua regia digest multi-element scan - (to include Ag, Cu, Pb, Zn) ICP-OES or ICP-MS.
4. Majors (Al₂O₃, CaO, Cr₂O₃, Fe₂O₃, K₂O, MgO, MnO, Na₂O, SiO₂, TiO₂, LOI) XRF fusion.
5. SG Gas pycnometer.

8. Information requested:

1. State aliquots used for all determinations.
2. Report all results for gold 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. 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 24 laboratories that provided results timeously were (not in same order as in the table of assays):

1. Activation Laboratories Pty Ltd (ActLabs) CA
2. ALS Chemex Laboratory Group Johannesburg SA
3. ALS Chemex Laboratory Group Perth WA
4. Bureau Veritas (Namibia)
5. Genalysis Laboratory Services (W Australia P)
6. Intertek Utama Services (Indonesia)
7. OMAC Laboratories Limited (Ireland)
8. Set Point Laboratories (Mokopane) SA
9. SGS Australia Pty Ltd (Newburn) WA
10. SGS Chelopech (Bulgaria)
11. SGS Geosol Laboratories Ltda (Brazil)
12. SGS Mineral Services Lakefield (Canada)
13. SGS South Africa (Pty) Ltd - Booyens JHB
14. SGS Toronto (Canada)
15. SGS Townsville (Australia)
16. 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

Assay data- Economic elements

Lab Code	Au Pb Coll g/t	Ag M/ICP %	Ag P %	Cu M/ICP %	Cu P %	Pb M/ICP %	Pb P %	Zn M/ICP %	Zn P %
A	2.12	152.0	157.00	892		2500		5160	
A	2.42	153.0	154.00	893		2710		5250	
A	2.12	168.0	150.00	989		2750		5610	
A	2.36	158.0	163.00	928		2610		5300	
A	2.49	153.0	158.00	945		2600		5310	
A	2.67	160.0	158.00	937		2620		5160	
A	2.51	162.0	153.00	971		2690		5290	
A	2.30	158.0	155.00	980		2670		5440	
C	2.36	165.0		920	945	2480	2610	4660	4880
C	2.40	163.0		946	942	2520	2510	4720	4730
C	2.35	169.0		954	942	2560	2590	4800	4740
C	2.17	162.0		957	948	2550	2630	4780	4940
C	2.25	168.0		923	932	2470	2630	4640	4930
C	2.37	166.0		906	969	2620	2730	4910	5090
C	2.25	166.0		931	941	2550	2620	4760	4850
C	2.28	169.0		956	960	2630	2630	4910	4920
E	2.74		153.00	977		2730	2459	5001	4618
E	2.81		154.00	888		2729	2500	4762	4638
E	2.81		157.00	938		2688	2581	4925	4770
E	2.69		159.00	937		2712	2591	5029	4761
E	2.75		158.00	904		2653	2619	4914	4764
E	2.74		154.00	916		2737	2490	4923	4673
E	2.70		156.00	906		2686	2509	4939	4628
E	2.78		153.00	896		2999	2536	5317	4711

Assay data (cont) – Economic elements

Lab Code	Au Pb Coll g/t	Ag M/ICP %	Ag P %	Cu M/ICP %	Cu P %	Pb M/ICP %	Pb P %	Zn M/ICP %	Zn P %
F	2.65	152.0	161.00	972	939	2750	2570	5410	4900
F	2.60	157.0	162.00	978	990	2730	2590	5390	4920
F	2.21	159.0	152.00	893	993	2540	2610	4800	4920
F	2.56	163.0	161.00	929	947	2610	2560	5210	4750
F	2.51	167.0	154.00	907	1030	2560	2650	4890	5130
F	2.71	162.0	160.00	943	988	2650	2580	5070	4880
F	2.43	157.0	154.00	899	982	2560	2600	4840	4910
F	2.42	156.0	161.00	904	978	2570	2560	4870	4900
I		160.3							
I		165.8							
I		161.3							
I		163.5							
I		168.0							
I		158.3							
I		156.5							
I		158.3							
J	2.54	139.0		940	970	2550		4960	
J	2.63	149.0		930	980	2520		4940	
J	2.63	150.0		950	960	2510		5010	
J	2.57	165.0		950	970	2590		4990	
J	2.56	154.0		990	970	2590		5220	
J	2.60	168.0		910	980	2550		4810	
J	2.67	155.0		970	980	2530		5140	
J	2.72	167.0		950	980	2590		5030	
K	2.50	140.0		977	956	2570	2540	5310	5200
K	2.46	150.0		915	933	2380	2520	4860	4810
K	2.58	170.0		947	935	2410	2520	5030	4770
K	2.50	140.0		956	936	2510	2480	4980	5120
K	2.54	150.0		1000	1010	2600	2700	5610	5160
K	2.53	150.0		976	948	2540	2490	5220	4830
K	2.51	150.0		967	956	2500	2540	5140	4670
K	2.53	140.0		937	947	2400	2490	5130	4780
L	2.70	161.9	157.20	958	959	2872	2742	5190	4824
L	2.78	159.8	155.14	961	959	2877	2747	5171	4824
L	2.65	167.5	159.07	973	967	2922	2767	5254	4836
L	2.74	162.3	152.57	971	953	2879	2717	5141	4779
L	2.56	167.1	158.92	961	965	2883	2820	5160	4922
L	2.47	167.1	156.48	964	973	2917	2759	5254	4843
L	2.76	163.0	153.77	965	943	2913	2693	5231	4757
L	2.80	167.4	153.89	960	947	2894	2720	5180	4835
N	2.46	160.0	44.00	950	936	2650	2590	5062	
N	2.54	162.0	43.60	952	927	2640	2530	5060	
N	2.55	159.0	43.50	946	950	2650	2590	5072	
N	2.46	162.0	45.00	944	936	2650	2620	5126	
N	2.52	161.0	44.20	944	944	2640	2590	5114	
N	2.56	160.0	40.10	946	930	2650	2570	4992	
N	2.47	162.0	41.30	948	927	2640	2590	5010	
N	2.52	163.0	44.00	950	918	2640	2500	5118	
P	2.38			1026	914	2638	2716	5060	4695
P	2.45			976	907	2671	2645	4947	4662
P	2.45			955	910	2592	2660	4899	4623
P	2.42			982	940	2640	2736	5007	4780
P	2.43			958	1000	2636	2916	4934	5049
P	2.41			960	934	2662	2734	5047	4796
P	2.39			952	881	2653	2554	4889	4541
P	2.42			967	871	2620	2557	4969	4499
Q	2.47	155.0							
Q	2.26	161.0							
Q	2.47	162.0							
Q	2.32	159.0							
Q	2.34	167.0							
Q	2.45	160.0							
Q	2.36	158.0							
Q	2.41	160.7							
S	2.49	139.0		995	950	2750	2910	4710	
S	2.48	139.0		1060	954	2770	2880	4800	
S	2.48	134.0		1040	942	2700	2830	4830	4960
S	2.52	138.0		1060	957	2630	2900	4950	
S	2.50	145.0		1020	944	2650	2790	4660	
S	2.49	147.0		1000	968	2760	2730	4630	
S	2.52	143.0		1010	959	2690	2800	4650	
S	2.53	148.0		998	944	2630	2880	4640	

Assay data (cont) – Economic elements

Lab Code	Au Pb Coll g/t	Ag M/ICP %	Ag P %	Cu M/ICP %	Cu P %	Pb M/ICP %	Pb P %	Zn M/ICP %	Zn P %
T	2.39	162.0		946	955	2610	2540	5000	4560
T	2.43	161.0		999	960	2680	2600	5020	4720
T	2.34	158.0		1020	950	2810	2530	4970	4790
T	2.26	163.0		989	965	2700	2530	5000	4760
T	2.24	167.0		999	955	2930	2560	5050	4850
T	2.45	164.0		976	965	2640	2660	5080	4680
T	2.41	168.0		991	960	2770	2590	4980	4760
T	2.43	166.0		965	965	2610	2630	5000	4680
U	2.65	158.0	136.00	951	882	2700		5020	
U	2.67	156.0	140.00	944	892	2670		5080	
U	2.69	156.0	136.00	943	868	2680		5020	
U	2.66	160.0	139.00	962	892	2740		5090	
U	2.63	161.0	136.00	955	908	2750		5100	
U	2.68	162.0	139.00	955	887	2740		5110	
U	2.64	156.0	138.00	947	893	2680		5080	
U	2.66	162.0	134.00	956	903	2750		5120	
V	2.26		163.00	943	930	2644		5051	
V	2.24		163.00	942	936	2650		5050	
V	2.36		163.00	944	938	2648		5056	
V	2.30		161.00	945	934	2646		5047	
V	2.30		161.00	943	934	2647		5052	
V	2.33		163.00	945	932	2650		5057	
V	2.29		161.00	942	939	2656		5055	
V	2.27		163.00	945	930	2655		5047	
W	2.35	152.0		862		2560		4770	
W	2.45	157.0		872		2450		4770	
W	2.34	149.0		866		2380		4760	
W	2.47	156.0		846		2420		4660	
W	2.49	153.0		799		2410		4470	
W	2.37	149.0		825		2390		4590	
W	2.51	157.0		864		2470		4810	
W	2.62	156.0		846		2420		4750	

Assay data (cont) – Major Oxides

Lab Code	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %	LOI XRF %	S Comb / LECO %	SG pycnometer
A												2.33	2.79
A												2.16	2.79
A												2.27	2.82
A												2.30	2.80
A												2.30	2.80
A												2.15	2.80
A												2.15	2.79
A												2.27	2.80
C												2.24	
C												2.21	
C												2.26	
C												2.23	
C												2.26	
C												2.23	
C												2.21	
C												2.22	
F	8.69	4.34	0.07	4.92	3.37	1.59	0.75	0.35	66.40	0.52	5.01		2.56
F	8.65	4.32	0.07	4.92	3.37	1.56	0.74	0.36	66.50	0.52	5.71		2.55
F	8.61	4.31	0.07	4.89	3.35	1.56	0.74	0.35	66.00	0.52	5.90		2.56
F	8.61	4.30	0.07	4.90	3.35	1.55	0.74	0.35	66.20	0.52	5.41		2.58
F	8.60	4.30	0.07	4.88	3.34	1.54	0.74	0.34	66.20	0.51	5.50		2.56
F	8.60	4.30	0.07	4.89	3.34	1.54	0.74	0.34	66.10	0.51	5.46		2.50
F	8.60	4.29	0.07	4.88	3.34	1.55	0.74	0.34	66.10	0.51	6.28		2.56
F	8.40	4.18	0.06	4.74	3.24	1.50	0.72	0.34	64.30	0.50	5.70		2.57
I												2.28	
I												2.26	
I												2.26	
I												2.27	
I												2.26	
I												2.27	
I												2.27	
I												2.25	

Assay data (cont) – Major Oxides

Lab Code	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %	LOI XRF %	S Comb / LECO	SG pycnometer
J												2.21	2.72
J												2.19	2.72
J												2.19	2.68
J												2.22	2.69
J												2.21	2.69
J												2.21	2.76
J												2.16	2.74
J												2.27	2.71
K	8.62	4.37	0.06	4.86	3.29	1.56	0.73	0.37	66.10	0.52	4.48	2.34	2.70
K	8.71	4.37	0.06	4.98	3.24	1.58	0.73	0.38	66.20	0.53	4.65	2.27	2.70
K	8.70	4.42	0.07	4.94	3.36	1.57	0.74	0.37	66.50	0.54	4.74	2.36	2.72
K	8.77	4.35	0.07	4.85	3.24	1.58	0.72	0.47	66.20	0.53	4.57	2.29	2.70
K	8.69	4.36	0.07	4.86	3.29	1.55	0.72	0.36	65.90	0.53	4.73	2.28	2.67
K	8.54	4.40	0.07	4.91	3.23	1.54	0.74	0.37	66.00	0.54	4.71	2.31	2.73
K	8.62	4.35	0.07	4.85	3.30	1.56	0.73	0.39	66.10	0.52	4.72	2.35	2.72
K	8.62	4.35	0.07	4.91	3.25	1.57	0.73	0.36	66.00	0.52	4.64	2.34	2.72
L	8.49	4.32	0.07	4.76	3.31	1.51	0.72	0.30	65.91	0.51	8.14	2.29	
L	8.34	4.33	0.06	4.72	3.31	1.52	0.72	0.31	65.95	0.53	8.07	2.19	
L	8.42	4.31	0.07	4.65	3.29	1.53	0.71	0.33	66.11	0.52	8.15	2.32	
L	8.48	4.29	0.06	4.74	3.27	1.52	0.72	0.34	66.39	0.52	8.07	2.31	
L	8.52	4.34	0.07	4.84	3.33	1.53	0.73	0.30	66.54	0.51	8.07	2.31	
L	8.54	4.33	0.06	4.79	3.33	1.52	0.72	0.32	66.64	0.54	8.16	2.35	
L	8.40	4.34	0.07	4.82	3.30	1.52	0.72	0.30	66.01	0.52	8.16	2.20	
L	8.43	4.32	0.07	4.73	3.28	1.50	0.72	0.29	65.83	0.51	8.13	2.28	
N	8.69	4.46	0.07	5.01	3.41	1.62	0.72	0.36	66.50	0.53			
N	8.64	4.45	0.07	5.01	3.37	1.61	0.74	0.36	66.30	0.53			
N	8.60	4.45	0.07	4.98	3.27	1.58	0.73	0.36	67.20	0.53			
N	8.64	4.49	0.07	4.99	3.36	1.61	0.73	0.36	66.50	0.54			
N	8.56	4.48	0.07	4.99	3.29	1.59	0.73	0.36	66.70	0.54			
N	8.62	4.49	0.07	5.01	3.35	1.62	0.75	0.36	67.00	0.53			
N	8.54	4.48	0.07	5.01	3.34	1.59	0.74	0.36	67.40	0.53			
N	8.69	4.48	0.07	5.01	3.42	1.61	0.72	0.38	67.00	0.54			
P	8.58	4.37	0.07	4.98	3.36	1.53	0.73	0.37	66.32		5.64		2.74
P	8.52	4.37	0.07	4.98	3.35	1.53	0.73	0.37	66.23		5.63		2.78
P	8.48	4.37	0.07	4.97	3.34	1.53	0.73	0.37	66.40		5.46		2.77
P	8.51	4.39	0.07	4.97	3.36	1.55	0.73	0.37	66.28		5.91		2.79
P	8.47	4.37	0.07	4.97	3.34	1.53	0.73	0.37	66.15		5.77		2.79
P	8.54	4.36	0.07	4.97	3.34	1.53	0.73	0.38	66.14		5.80		2.75
P	8.56	4.37	0.07	4.97	3.36	1.54	0.73	0.37	66.39		5.32		2.75
P	8.57	4.38	0.07	4.98	3.35	1.55	0.73	0.38	66.34		5.83		2.72
Q	8.52	4.36	0.07	4.95	3.36	1.54	0.73	0.55	66.20	0.52	6.40	2.23	
Q	8.55	4.37	0.06	4.97	3.37	1.55	0.72	0.54	66.50	0.51	5.92	2.21	
Q	8.55	4.37	0.06	4.96	3.36	1.54	0.74	0.53	66.00	0.51	5.90	2.21	
Q	8.64	4.40	0.07	5.00	3.36	1.53	0.72	0.53	66.90	0.52	5.85	2.22	
Q	8.56	4.37	0.06	4.96	3.37	1.54	0.73	0.53	66.00	0.52	5.76	2.22	
Q	8.52	4.34	0.06	4.95	3.36	1.56	0.74	0.55	65.90	0.51	6.06	2.22	
Q	8.51	4.35	0.06	4.94	3.35	1.53	0.73	0.54	65.90	0.52	6.08	2.22	
Q	8.53	4.33	0.06	4.95	3.35	1.54	0.72	0.54	66.30	0.51	6.31	2.22	
S	8.47	4.35	0.07	4.96	3.33	1.51	0.74	0.40	66.10	0.52	4.26	2.13	
S	8.50	4.38	0.07	4.97	3.33	1.52	0.74	0.39	66.10	0.53	4.26	2.12	
S	8.50	4.37	0.07	4.98	3.34	1.53	0.74	0.39	66.10	0.52	4.28	2.19	
S	8.54	4.37	0.07	4.97	3.34	1.52	0.74	0.38	66.10	0.52	4.34	2.11	
S	8.49	4.35	0.07	4.97	3.35	1.53	0.74	0.38	66.10	0.52	4.37	2.13	
S	8.52	4.35	0.07	4.96	3.35	1.52	0.74	0.38	66.10	0.52	4.42	2.08	
S	8.46	4.36	0.07	4.95	3.33	1.53	0.74	0.39	66.10	0.53	4.36	2.25	
S	8.49	4.37	0.07	4.95	3.34	1.53	0.74	0.38	66.00	0.52	4.39	2.17	
T	8.64	4.42	0.07	4.94	3.36	1.54	0.73		66.34	0.52	7.20		2.84
T	8.66	4.43	0.07	4.94	3.36	1.54	0.74		66.31	0.53	7.24		2.87
T	8.65	4.42	0.07	4.93	3.36	1.55	0.74		66.29	0.53	7.25		2.82
T	8.66	4.43	0.07	4.94	3.37	1.55	0.74		66.34	0.52	7.21		2.84
T	8.68	4.44	0.07	4.94	3.37	1.55	0.74		66.29	0.52	7.22		2.88
T	8.67	4.43	0.07	4.94	3.36	1.55	0.74		66.31	0.53	7.24		2.88
T	8.66	4.44	0.07	4.95	3.36	1.55	0.74		66.25	0.52	7.27		2.86
T	8.68	4.44	0.07	4.96	3.37	1.55	0.74		66.26	0.53	7.21		2.82
U	8.61	4.50	0.07	4.85	3.34	1.85	0.72	0.49	66.37	0.52	7.20		
U	8.65	4.52	0.05	4.87	3.34	1.87	0.73	0.49	66.46	0.52	7.20		
U	8.61	4.50	0.06	4.87	3.34	1.87	0.73	0.49	66.39	0.52	7.20		
U	8.57	4.48	0.07	4.84	3.32	1.87	0.72	0.49	66.02	0.52	7.30		
U	8.66	4.50	0.07	4.85	3.34	1.86	0.72	0.49	66.44	0.52	7.30		
U	8.63	4.49	0.06	4.86	3.33	1.87	0.72	0.49	66.23	0.51	7.20		
U	8.66	4.49	0.08	5.07	3.35	1.85	0.75	0.50	66.42	0.52	7.40		
U	8.64	4.48	0.09	4.86	3.34	1.86	0.72	0.48	66.19	0.52	7.40		
V	8.49	4.43	0.07	4.87	3.37	1.54	0.80	0.53	66.20	0.53	7.05	2.23	2.74
V	8.49	4.44	0.08	4.88	3.37	1.56	0.80	0.52	66.40	0.53	6.90	2.22	2.76
V	8.50	4.42	0.07	4.88	3.36	1.56	0.80	0.52	66.60	0.53	6.94	2.24	2.75
V	8.40	4.41	0.07	4.86	3.36	1.54	0.80	0.52	66.10	0.53	7.07	2.22	2.75
V	8.41	4.40	0.07	4.85	3.37	1.54	0.80	0.53	66.70	0.52	7.02	2.22	2.75
V	8.44	4.41	0.07	4.89	3.36	1.52	0.80	0.51	66.30	0.53	6.95	2.25	2.76
V	8.39	4.44	0.07	4.86	3.38	1.56	0.80	0.52	66.10	0.53	6.79	2.25	2.74
V	8.46	4.43	0.08	4.88	3.36	1.56	0.80	0.51	66.80	0.53	6.98	2.26	2.76
W	8.58	4.37	0.07	4.92	3.26	1.56	0.75		66.28	0.51	8.49		2.77
W	8.36	4.39	0.06	4.91	3.27	1.47	0.75		66.34	0.54	8.52		2.79
W	8.41	4.41	0.08	4.91	3.29	1.41	0.73		66.61	0.53	8.45		2.78
W	8.51	4.35	0.06	4.87	3.24	1.52	0.73		66.47	0.55	8.46		2.75
W	8.46	4.34	0.08	4.93	3.27	1.47	0.74		66.30	0.51	8.48		2.73
W	8.36	4.37	0.08	4.91	3.26	1.44	0.74		66.45	0.55	8.48		2.74
W	8.28	4.44	0.07	4.96	3.27	1.53	0.74		66.75	0.52	8.43		2.78
W	8.46	4.43	0.06	4.89	3.26	1.51	0.74		66.29	0.54	8.40		2.76

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.

Analyte	Method	Unit	S ¹	σ_L ²	Sw ³	CSU ⁴
Au	Pb Coll	g/t	0.145	0.090	0.077	0.024
Ag	M/ICP	ppm	4.582	2.260	3.761	0.797
Ag	P	ppm	3.804	3.310	2.975	1.553
Cu	M/ICP	ppm	28.19	14.60	21.34	4.582
Cu	P	ppm	23.90	16.75	13.80	5.27
Pb	M/ICP	ppm	74.46	44.83	50.96	14.00
Pb	P	ppm	92.70	72.26	53.82	24.97
Zn	M/ICP	ppm	178.4	106.80	110.61	30.48
Zn	P	ppm	116.6	65.19	94.45	26.51
Al ₂ O ₃	XRF	%	0.091	0.065	0.052	0.020
CaO	XRF	%	0.057	0.047	0.019	0.014
Cr ₂ O ₃	XRF	%	0.004	0.002	0.003	0.001
Fe ₂ O ₃	XRF	%	0.049	0.041	0.021	0.013
K ₂ O	XRF	%	0.020	0.014	0.013	0.005
LOI	XRF	%	1.342	1.248	0.162	0.395
MgO	XRF	%	0.020	0.015	0.013	0.005
MnO	XRF	%	0.009	0.005	0.0069	0.002
Na ₂ O	XRF	%	0.079	0.077	0.0147	0.026
SiO ₂	XRF	%	0.249	0.113	0.212	0.041
TiO ₂	XRF	%	0.009	0.005	0.007	0.002
S	omb / LEC	%	0.053	0.035	0.039	0.013
SG	pycnometer		0.043	0.043	0.020	0.017

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 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.

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.

13. Certified values: The Certified, Provisional and Indicated values listed on p1 of each certificate fulfil the AMIS statistical criteria regarding agreement for certification and have been independently validated by Dr Barry Smee, BSc, PhD, P.Geo, (B.C.).

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: AMIS0273 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, 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.

29 June 2012

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	%	4.49	0.36	4.00	89
As	M/ICP	ppm	36.10	10.85	15.03	95
Ba	M/ICP	ppm	827	742	44.85	72
Be	M/ICP	ppm	1.34	0.21	7.90	72
Bi	M/ICP	ppm	0.63	0.70	55	59
Ca	M/ICP	%	3.13	0.21	3.43	90
Cd	M/ICP	ppm	43.40	3.89	4.48	81
Ce	M/ICP	ppm	30.96	5.47	8.83	67
Co	M/ICP	ppm	35.17	5.78	8.21	104
Cr	M/ICP	ppm	348	170	24.35	92
Cs	M/ICP	ppm	1.99	0.26	6.57	54
Dy	M/ICP	ppm	2.52	0.31	6.14	47
Er	M/ICP	ppm	1.40	0.36	12.83	48
Eu	M/ICP	ppm	0.86	0.13	7.81	47
Fe	M/ICP	%	3.39	0.24	3.53	99
Ga	M/ICP	ppm	10.84	1.86	8.58	76
Gd	M/ICP	ppm	3.06	0.46	7.43	47
Ge	M/ICP	ppm	0.16	0.07	22.00	15
Hf	M/ICP	ppm	2.34	1.23	26.28	54
Ho	M/ICP	ppm	0.50	0.10	10.22	50
In	M/ICP	ppm	0.13	0.03	12.30	64
K	M/ICP	%	2.68	0.40	7.48	91
La	M/ICP	ppm	14.85	1.49	5.03	81
Li	M/ICP	ppm	36.94	5.05	6.84	80
Lu	M/ICP	ppm	0.19	0.03	7.44	48
Mg	M/ICP	%	0.92	0.09	4.86	90
Mn	M/ICP	ppm	5515	513	4.65	90
Mo	M/ICP	ppm	5.39	0.83	7.69	82
Na	M/ICP	%	0.27	0.04	7.17	80
Nb	M/ICP	ppm	5.70	1.67	14.60	64
Nd	M/ICP	ppm	15.50	1.83	5.90	46
Ni	M/ICP	ppm	18.11	4.45	12.30	95
Pd	M/ICP	ppm	886	107	6.04	72
P	M/ICP	ppm	2705	61.16	1.13	7
Pr	M/ICP	ppm	3.96	0.39	4.90	44
Rb	M/ICP	ppm	90.72	14.54	8.02	68
Re	M/ICP	ppm	0.003	0.001	19.97	14
S	M/ICP	%	2.28	0.25	5.54	72
Sb	M/ICP	ppm	8.79	1.49	8.49	80
Sc	M/ICP	ppm	9.45	0.97	5.15	74
Se	M/ICP	ppm	1.60	0.82	25.42	25
Si	M/ICP	%	31.36	0.54	0.86	15
Sm	M/ICP	ppm	3.30	0.41	6.22	46
Sn	M/ICP	ppm	2.22	0.74	16.60	63
Sr	M/ICP	ppm	141	10.27	3.65	80
Ta	M/ICP	ppm	0.36	0.23	31.09	56
Tb	M/ICP	ppm	0.45	0.05	6.17	56
Te	M/ICP	ppm	1.42	1.67	58.74	62
Th	M/ICP	ppm	2.69	1.20	22.27	48
Ti	M/ICP	%	0.30	0.03	5.23	84
Tl	M/ICP	ppm	1.48	1.23	41.67	56
Tm	M/ICP	ppm	0.19	0.06	15.25	48
V	M/ICP	ppm	83.82	8.55	5.10	80
W	M/ICP	ppm	8.06	1.90	12	70
Y	M/ICP	ppm	12.99	2.32	8.91	80
Yb	M/ICP	ppm	1.23	0.38	15.43	46
Zr	M/ICP	ppm	76.51	51.74	33.81	88