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AMIS0082

Certified Reference Material ^{1.}

Zinc and lead SEDEX ore Mt Burgess

Certificate of Analysis

Recommended Concentrations and Limits^{2, 3.} **(at two Standard Deviations)**

Certified Concentrations

Zn M/ICP	7520	±	398	ppm
Zn P	7233	±	512	ppm
Zn XRF	7590	±	186	ppm
Pb M/ICP	3089	±	180	ppm
Pb P	3037	±	178	ppm
Cu M/ICP	125	±	10	ppm
Cu P	123	±	10	ppm
Specific Gravity	2.74	±	0.12	

Provisional Concentrations

Pb XRF	3326	±	480	ppm
Cu XRF	134	±	21.5	ppm
Ag M/ICP	4.7	±	0.7	ppm

Informational Concentration

Au Pb Collection 0.02 g/t

- 1. This product was originally certified in 2009. The certificate was been upgraded to modern convention in 2015, notably with the addition of CSU and Trace Element tables.*
- 2. 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.*
- 3. 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

(Mixed ICP and XRF)

Al ₂ O ₃	8.68	±	0.26	%
CaO	1.12	±	0.03	%
Fe ₂ O ₃	3.19	±	0.08	%
K ₂ O	3.23	±	0.08	%
MgO	1.38	±	0.08	%
MnO	0.05	±	0.004	%
P ₂ O ₅	0.10	±	0.01	%
SiO ₂	75.98	±	1.82	%
TiO ₂	0.46	±	0.02	%
S ICP	1.09	±	0.10	%
LOI	2.82	±	0.32	%

Provisional Concentrations

Cr ₂ O ₃	0.08	±	0.01	%
Na ₂ O	1.41	±	0.26	%

1. **Intended use:** AMIS0082 is suitable for monitoring the accuracy of a single analysis of SEDEX style lead-zinc ores hosted in siliceous rocks sedimentary rocks. The material can be used for routine quality control by inserting within a batch of samples. It can also be used for instrument calibration.

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 %.

2. **Origin of material:** This material was provided by Mt Burgess Mining (NL) from their Kihabe Base Metals Project is located on the border of Botswana and Namibia about 700km north-west of the capital, Gaborone, in Ngamiland. The Project is 350km by road from Maun and 50km from Tsumkwe, Namibia. The target is within a Proterozoic belt of metasedimentary rocks, with around one third of the prospective geology occurring in Botswana (PL 69/2003, area ~1,000km²) and two thirds in Namibia.

3. **Mineral and Chemical Composition:** The belt of Proterozoic sedimentary rocks composed primarily of carbonate and siliclastic rocks form a trapezoidal wedge of tightly to isoclinally folded metamorphosed sediments of the Damaran Supergroup, bounded by granites and gneisses of the Quanguwadum Complex and Kihabe Complex. The target mineralisation is primarily stratiform to stratabound sedimentary exhalative (SEDEX) sulphides occurring at a known stratigraphic level within the basin. The Company's geological model is that the Belt represents a re-closed rift basin with a fill of arkose, greywacke, quartzites and sabkha-facies stromatolitic dolomites. Mineralisation occurs between dolomite and quartzite for a combined strike length of 450km, within Namibia and Botswana.

The Kihabe Resource is located along a contact between the dolomite footwall and a sequence of rhythmically bedded sandstones, which have been folded and metamorphosed to, respectively, dolomitic marble and chloritic quartzite. The local geology of the deposit is known to be a west-

plunging syncline. Mineralisation is developed within the host quartzite within thick, coarse grained beds, and weakens upwards in the stratigraphy as the grain size reduces. Mineralisation forms a series of overlapping stacked horizons controlled by the beds within the quartzite.

4. Appearance: The material is a very fine powder coloured Light Blueish Grey (Corstor 10B 8/1).

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 100% <54µm. Wet sieve particle size analysis of random samples confirmed the material was 100% <54µm. It was then blended in a bi-conical mixer, systematically divided and then sealed into 1kg Laboratory Packs. Samples were scientifically selected for homogeneity testing and third party analysis. Statistical analysis for the consensus test results were carried out by an independent statistician. Explorer Packs are subdivided from the Laboratory packs as required.

7. Methods of analysis requested:

1. Au, Pb collection with Ag as a co-collector ICP-MS.
2. Multi element scan to include Zn, Pb, Cu, Ag. Multi-acid total digestion, including HF, ICP-OES or ICP-MS (M ICP).
3. Zn, Pb, Cu. Aqua regia digestion with ICP-OES or ICP-MS (P).
4. Zn, Pb, Cu. Pressed Pellet, XRF.
5. Majors (Al₂O₃, CaO, Cr₂O₃, Fe₂O₃, K₂O, MgO, MnO, Na₂O, SiO₂, TiO₂. LOI.) XRF fusion.
6. 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. All results for individual Au to be reported in ppb.
5. All results for base metals to be reported in ppm.
6. Report all QC data, to include replicates, blanks and certified reference materials used.

9. Method of certification: Twenty laboratories were each given eight scientifically selected packages of sample. Eighteen of the laboratories submitted results for the ore elements; seventeen laboratories submitted results for the major elements.

The 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 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 calculated using all remaining data. Any analysis that fell outside of the mean ± 2 standard deviations was removed from the ensuing data base. The mean and standard deviations were again calculated using the remaining data.

This method is different from that used by Government agencies 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 Confidence Limits published on other standards. Standards with an RSD of near or less than 5 % are certified, RSD's of between near 5 % and 15 % are Provisional, and RSD's over 15 % are Informational.

10. Participating laboratories: The 18 out of 20 laboratories that provided results timeously were (not in same order as in the table of assays):

1. ACME Analytical Laboratories Ltd CA
2. Activation Laboratories Pty Ltd (Actlabs Pacific) WA
3. ALS Chemex Laboratory Group Johannesburg SA
4. ALS Chemex Laboratory Group Perth WA
5. ALS Chemex Laboratory Group Vancouver CA
6. Ammtec Limited WA
7. Anglo Research (Crown Campus)
8. Assayers Canada
9. Genalysis Laboratory Services WA
10. Intertek Testing Services Ltd Shanghai (ITS Beijing)
11. Intertek Utama Services (Indonesia)
12. Labtium Inc Finland
13. OMAC Laboratories Limited (Ireland)
14. Set Point Laboratories (Isando) SA
15. SGS Australia Pty Ltd (Newburn) WA
16. SGS Lakefield Research Africa (Pty) Ltd (Booyens SA)
17. SGS Mineral Services Lakefield (Canada)
18. Ultra Trace (Pty) Ltd WA

11. Assay Data: Data as received from the laboratories is set out below. A proficiency report has been sent to the managers of the participating laboratories.

Lab Code	Zn M/ICP ppm	Zn P ppm	Zn XRF ppm	Pb M/ICP ppm	Pb P ppm	Pb XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ag M/ICP ppm	Au Pb Coll g/t
A	7500	6900	7600	3100	3000	3300	120	120		5.10	0.02
A	7500	7000	7600	3100	3000	3400	120	120		4.90	0.02
A	7500	6900	7700	3100	3100	3400	120	130		5.40	0.02
A	7600	7100	7600	3100	3000	3200	120	120		5.10	
A	7600	7100	7500	3100	3000	3300	120	120		5.30	0.02
A	7600	7000	7600	3100	3000	3300	120	120		5.00	0.02
A	7500	7000	7500	3100	3000	3300	130	120		5.10	
A	7400	6900	7500	3000	3100	3400	120	120		5.20	0.02
B	7390	7160		3110	2900		128	118		4.80	0.02
B	7280	7260		3080	2940		124	118		4.60	0.02
B	7160	7200		2990	2890		122	117		4.50	0.03
B	6800	7070		2900	2870		118	115		4.40	0.02
B	7100	7290		3000	2940		122	119		4.70	0.02
B	6930	7260		2970	2910		121	119		4.60	0.02
B	7060	7120		3000	2890		124	118		4.50	0.01
B	6550	7500		2850	3040		114	121		4.30	0.02
C	7600	7130		3000	3050		130	120		5.00	0.02
C	7600	7410		3000	3190		120	130		5.00	0.03
C	7300	7460		3100	3270		120	130		5.00	0.03
C	7600	7200		3000	3100		120	130		5.00	0.03
C	7600	7310		3000	3160		120	130		5.10	0.03
C	7600	7090		3000	3050		120	120		5.20	0.03
C	7400	7230		2900	3120		120	120		5.10	0.02
C	7500	7460		3000	3220		130	130		5.10	0.03
D	7310	7130		3000	3090		127	131		4.49	0.02
D	7160	7060		2940	3050		125	128		4.38	0.01
D	7510	7000		3090	3030		130	125		4.31	0.02
D	7360	7070		3000	3070		128	127		4.48	0.02
D	7340	7070		3030	3060		126	127		5.18	0.02
D	7330	7090		2990	3090		125	133		4.50	0.02
D	7180	7040		2990	3020		126	126		5.26	0.02
D	7400	7050		3030	3220		128	129		5.23	0.01
E	7030			3160	2890		123	122			0.02
E	7140			3120	2910		118	126			0.02
E	6800			2960	2970		114	128			0.02
E	7230			3220	2940		125	133			0.02
E	7150			3170	2910		125	131			0.02
E	7210			3250	2830		134	129			0.02
E	6970			3060	2920		120	137			0.02
E	7110			3140	2940		124	129			0.02

Assay Data (cont):

Lab Code	Zn M/ICP ppm	Zn P ppm	Zn XRF ppm	Pb M/ICP ppm	Pb P ppm	Pb XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ag M/ICP ppm	Au Pb Coll g/t
F	7520	6990	7730	3130	2950	3160	131	118	130	4.88	0.03
F	7730	6920	7720	3230	2830	3170	138	120	130	4.97	0.01
F	7510	7030	7730	3150	2970	3160	132	118	130	4.80	0.02
F	7570	6980	7730	3110	2930	3150	121	116	130	4.66	0.02
F	7610	6900	7730	3130	2890	3150	130	116	140	4.70	0.02
F	7930	6890	7730	3220	2900	3140	135	115	130	5.06	0.02
F	7430	6920	7730	3110	2910	3150	130	118	130	4.76	0.02
F	7940	6920	7730	3330	2900	3150	141	115	140	5.05	0.02
G	7700	7490	7560	3190	3090	3230	126	120	120	5.10	0.02
G	7790	7470	7540	3190	3100	3220	129	120	122	5.00	0.02
G	7600	7690	7580	3130	3140	3210	123	130	121	4.80	0.02
G	7640	7740	7580	3110	3170	3030	122	130	120	4.60	0.02
G	7770	7750	7540	3160	3190	3210	124	130	122	4.90	0.02
G	7630	7670	7570	3180	3160	3220	125	130	121	4.80	0.02
G	7710	8150	7560	3140	3370	3270	125	130	120	4.90	0.02
G	7830	7900	7520	3210	3280	3220	130	130	120	5.10	0.02
H	7353			3057			119			4.10	0.02
H	7655			3049			118			4.30	0.02
H	7694			3043			121			4.10	0.01
H	7458			3066			117			4.30	0.01
H	7125			2966			115			4.10	0.02
H	7276			3059			119			4.30	0.02
H	7456			3012			116			4.20	0.02
H	7528			2996			116			4.40	0.02
I	7300	7300		3000	3100		120	130		4.00	0.02
I	7400	7300		3100	3100		140	120		5.00	0.01
I	7400	7100		3000	3100		110	120		4.00	0.01
I	7300	7300		3000	3100		120	120		5.00	0.02
I	7400	7300		3000	3100		120	120		5.00	0.01
I	7500	7300		3100	3100		120	120		5.00	0.01
I	7500	7300		3100	3100		120	120		3.00	0.02
I	7500	7200		3100	3100		120	120		3.00	0.01
J	6886	6760		2839	2810		125	116		4.70	0.03
J	6854	6830		2808	2800		123	116		4.70	0.03
J	6864	6600		2857	2770		120	113		4.70	0.02
J	6963	6660		2848	2750		121	114		4.60	0.02
J	6965	6820		2864	2790		126	115		4.70	0.03
J	6954	6890		2805	2800		122	117		5.00	0.02
J	6987	6700		2892	2780		128	116		4.70	0.03
J	6856	6770		2847	2800		123	117		4.90	0.02
K									145		
K									144		
K									143		
K									145		
K									145		
K									141		
K									142		
K									145		
L	7879	7747	7505	3186	3132	2998	125	124	130	4.00	0.02
L	7535	7618	7476	3167	3102	2984	124	123	126	4.00	0.01
L	7586	7357	7514	3199	3040	3023	122	120	133	4.00	0.02
L	7577	7833	7555	3156	3173	3069	124	124	126	4.00	0.02
L	7656	7779	7387	3223	3136	3042	126	124	125	5.00	0.03
L	7499	7623	7418	3176	3147	3042	121	124	123	5.00	0.02
L	7530	7666	7441	3194	3133	3004	124	124	124	5.00	0.02
L	7665	7610	7429	3168	3127	3006	126	123	125	5.00	0.03
M	7569	7685		2994	3010		124	121		4.40	
M	7597	7461		3038	3017		121	123		4.20	
M	7563	7425		2998	2997		124	122		4.20	
M	7584	7673		2976	2966		124	123		4.80	
M	7591	7498		3006	2983		124	121		4.40	
M	7644	7609		2991	3004		122	123		4.20	
M	7631	7578		2984	2972		121	124		4.20	
M	7600	7554		2954	3011		122	125		4.40	
N	7610	7150		3140	2960		131	117		4.50	0.02
N	7630	7200		3180	2980		131	118		4.40	0.02
N	7670	7010		3140	3030		132	120		4.30	0.02
N	7670	7200		3120	3000		131	117		4.70	0.02
N	7650	7140		3160	3010		133	117		4.60	0.02
N	7540	7070		3160	3030		132	120		4.70	0.02
N	7650	7150		3180	3020		135	120		4.70	0.02
N	7480	7170		3130	3040		133	119		4.60	0.02

Assay Data (cont):

Lab Code	Zn M/ICP ppm	Zn P ppm	Zn XRF ppm	Pb M/ICP ppm	Pb P ppm	Pb XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ag M/ICP ppm	Au Pb Coll g/t
O	7814	7781		3235	3228		128	125		5.15	0.03
O	7732	7950		3250	3289		122	127		4.32	0.03
O	7745	8006		3206	3253		125	124		5.43	0.02
O	7753	7960		3279	3275		131	127		5.12	0.02
O	7796	7934		3222	3287		129	124		4.63	0.02
O	7823	7993		3209	3264		131	129		4.94	0.02
O	7978	8026		3224	3303		128	125		5.46	0.02
O	7778	7906		3263	3227		125	125		4.97	0.02
P	6440	7130	7551	2830	3110	3555		128	141		0.02
P	6500	7190	7666	2660	3110	3595		126	150		0.02
P	6530	7170	7579	2760	3120	3568		127	134		0.02
P	6510	7280	7688	2630	3160	3584		134	149		0.02
P	6320	7330	7604	2530	3180	3566		128	149		0.02
P	6460	7250	7545	2650	3140	3550		126	149		0.02
P	6410	7290	7566	2650	3160	3570		131	148		0.02
P	6530	7100	7587	2700	3060	3577		126	141		0.02
Q	7420	7200		3000	3000		128	129		4.50	0.02
Q	7540	7330		3010	3030		132	128		4.50	0.02
Q	7410	7350		3070	3030		126	126		4.00	0.02
Q	7510	7280		3100	3000		132	128		4.50	0.02
Q	7490	7380		3010	2910		126	124		4.50	0.02
Q	7520	7290		3010	2920		134	125		4.50	0.02
Q	7560	7460		3060	3010		126	128		4.50	0.02
Q	7530	7270		3080	3050		132	130		4.50	0.02
R	6705		8133	3200		3703	123		123		0.03
R	6869		7988	3400		3623	131		119		0.03
R	6905		7981	3300		3730	132		123		0.02
R	6770		8065	3300		3669	130		144		0.02
R	6468		8127	3100		3671	130		142		0.03
R	6833		7970	3200		3739	134		155		0.03
R	6646		8128	2900		3591	125		117		0.02
R	6773		8208	3100		3748	128		138		0.03

Major Element Assay Data:

Lab Code	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	LOI XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	P2O5 XRF %	SiO2 XRF %	TiO2 XRF %	S M/ICP %	SG pyc
A	8.75	1.14	0.08	3.21	3.24	2.87	1.41	0.06	1.56	0.11	77.30	0.46		2.67
A	8.60	1.13	0.09	3.18	3.20	2.83	1.41	0.05	1.50	0.10	76.80	0.45		2.67
A	8.80	1.14	0.09	3.16	3.22	2.87	1.36	0.05	1.55	0.09	77.20	0.46		2.67
A	8.74	1.14	0.08	3.17	3.20	2.87	1.39	0.06	1.58	0.12	76.80	0.45		2.74
A	8.70	1.13	0.08	3.16	3.21	2.93	1.40	0.06	1.52	0.11	76.40	0.44		2.71
A	8.77	1.15	0.12	3.18	3.22	2.91	1.39	0.05	1.58	0.11	77.30	0.46		2.72
A	8.72	1.15	0.09	3.20	3.19	2.87	1.36	0.05	1.48	0.11	77.30	0.45		2.73
A	8.74	1.13	0.07	3.21	3.21	2.86	1.40	0.05	1.53	0.11	77.30	0.45		2.71
B	8.53	1.11	0.08	3.17	3.24	2.06	1.22	0.05	1.25		74.80	0.42	1.11	2.59
B	8.59	1.13	0.09	3.22	3.27	2.01	1.24	0.05	1.27		74.70	0.44	1.10	2.54
B	8.53	1.13	0.09	3.20	3.28	2.25	1.22	0.05	1.25		74.60	0.44	1.07	2.56
B	8.55	1.12	0.09	3.18	3.24	2.16	1.22	0.05	1.23		74.70	0.44	1.06	2.57
B	8.58	1.13	0.08	3.25	3.28	2.06	1.23	0.05	1.27		74.60	0.45	1.08	2.59
B	8.54	1.14	0.09	3.17	3.27	2.02	1.22	0.06	1.25		74.80	0.45	1.07	2.57
B	8.57	1.10	0.08	3.11	3.28	1.98	1.22	0.05	1.26		74.90	0.45	1.07	2.56
B	8.52	1.12	0.08	3.14	3.26	2.13	1.22	0.05	1.24		74.80	0.46	1.02	2.54
C	8.43	1.10	0.09	3.05	3.18	3.03	1.40	0.04	1.51	0.08	74.90	0.47		2.73
C	8.50	1.10	0.08	3.16	3.18	3.02	1.41	0.05	1.51	0.09	74.70	0.45		2.73
C	8.56	1.10	0.08	3.21	3.17	3.20	1.40	0.05	1.57	0.08	74.40	0.46		2.69
C	8.49	1.10	0.08	3.20	3.19	3.01	1.41	0.04	1.50	0.08	75.30	0.48		2.71
C	8.62	1.10	0.09	3.22	3.19	3.00	1.36	0.04	1.52	0.09	74.90	0.47		2.70
C	8.48	1.10	0.08	2.88	3.16	3.04	1.37	0.04	1.55	0.08	74.50	0.46		2.72
C	8.54	1.09	0.15	3.18	3.18	3.03	1.34	0.04	1.52	0.09	74.90	0.46		2.74
C	8.76	1.09	0.11	3.13	3.18	2.92	1.32	0.04	1.55	0.09	75.40	0.46		2.72
D													1.24	2.80
D													1.21	2.79
D													1.27	2.79
D													1.24	2.80
D													1.14	2.78
D													1.23	2.79
D													1.12	2.79
D													1.24	2.77

Major Element Assay Data (cont):

Lab Code	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	LOI XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	P2O5 XRF %	SiO2 XRF %	TiO2 XRF %	S M/ICP %	SG pyc
E	8.55	1.10	0.08	3.14	3.21	2.81	1.35	0.05	1.30		74.60	0.44	1.15	
E	8.51	1.10	0.08	3.14	3.20	2.83	1.34	0.05	1.31		74.60	0.45	1.14	
E	8.53	1.10	0.09	3.13	3.19	2.83	1.36	0.05	1.32		74.70	0.45	1.08	
E	8.51	1.11	0.08	3.14	3.19	2.81	1.34	0.05	1.32		74.70	0.44	1.13	
E	8.51	1.11	0.08	3.16	3.20	2.85	1.33	0.05	1.30		74.60	0.44	1.14	
E	8.51	1.11	0.08	3.13	3.18	2.76	1.35	0.05	1.32		74.60	0.44	1.17	
E	8.52	1.11	0.09	3.15	3.20	2.76	1.35	0.05	1.32		74.60	0.44	1.13	
E	8.49	1.10	0.08	3.14	3.20	2.82	1.33	0.05	1.32		74.60	0.44	1.15	
F	8.95	1.10	0.08	3.15	3.28	2.96	1.43	0.05	1.33	0.11	76.27	0.46		2.74
F	8.96	1.09	0.08	3.16	3.31	2.94	1.43	0.05	1.34	0.11	76.49	0.47		2.67
F	9.00	1.11	0.08	3.16	3.30	2.94	1.44	0.05	1.35	0.11	76.50	0.47		2.70
F	8.95	1.10	0.08	3.14	3.26	2.92	1.42	0.05	1.33	0.11	76.18	0.46		2.73
F	8.94	1.09	0.08	3.14	3.29	2.92	1.43	0.05	1.34	0.11	76.37	0.48		2.60
F	8.97	1.10	0.08	3.15	3.28	2.93	1.43	0.05	1.33	0.11	76.31	0.47		2.68
F	8.97	1.10	0.08	3.15	3.32	2.93	1.43	0.05	1.34	0.11	76.20	0.48		2.67
F	8.95	1.09	0.08	3.15	3.28	2.91	1.43	0.05	1.33	0.11	75.98	0.48		2.63
G	8.74	1.10	0.08	3.23	3.29	2.60	1.36	0.05	1.22	0.10	76.05	0.46	1.14	2.64
G	8.68	1.11	0.08	3.24	3.28	2.59	1.36	0.05	1.22	0.10	75.95	0.47	1.16	2.65
G	8.72	1.11	0.08	3.23	3.30	2.63	1.34	0.05	1.23	0.10	75.72	0.47	1.11	2.69
G	8.67	1.18	0.08	3.23	3.29	2.65	1.33	0.05	1.24	0.10	76.31	0.47	1.11	2.65
G	8.66	1.09	0.08	3.23	3.29	2.67	1.32	0.05	1.22	0.10	75.80	0.47	1.14	2.67
G	8.73	1.09	0.08	3.23	3.29	2.65	1.34	0.05	1.19	0.10	75.53	0.47	1.14	2.63
G	8.70	1.16	0.08	3.23	3.28	2.71	1.35	0.05	1.20	0.10	76.02	0.47	1.13	2.62
G	8.66	1.10	0.08	3.22	3.30	2.71	1.37	0.05	1.21	0.10	75.41	0.46	1.16	2.63
K	8.22	1.06			3.11	1.90	1.24	0.06	1.32	0.10	70.30	0.43		2.81
K	8.29	1.06			3.10	1.89	1.24	0.06	1.34	0.10	70.60	0.43		2.80
K	8.24	1.05			3.08	1.90	1.24	0.05	1.32	0.10	70.20	0.43		2.81
K	8.25	1.06			3.10	1.90	1.24	0.05	1.34	0.10	70.60	0.43		2.82
K	8.32	1.06			3.12	1.91	1.25	0.05	1.32	0.10	70.60	0.43		2.82
K	8.31	1.06			3.11	1.91	1.27	0.05	1.32	0.10	70.80	0.44		2.83
K	8.32	1.06			3.13	1.94	1.26	0.05	1.34	0.10	71.10	0.44		2.83
K	8.27	1.06			3.10	1.92	1.24	0.05	1.31	0.10	70.60	0.43		2.84
L	8.73	1.12	0.08	3.03	3.21	2.96	1.46	0.04	1.04	0.11	76.82	0.44	1.06	2.85
L	8.70	1.11	0.08	3.02	3.21	2.95	1.46	0.04	1.05	0.11	76.69	0.44	1.07	2.77
L	8.80	1.12	0.07	3.06	3.24	2.99	1.49	0.04	1.07	0.10	77.21	0.45	1.07	2.75
L	8.84	1.11	0.07	3.29	3.28	2.99	1.47	0.04	1.08	0.10	77.56	0.45	1.08	2.76
L	8.78	1.12	0.08	3.05	3.21	3.03	1.45	0.04	1.05	0.10	76.95	0.45	1.06	2.78
L	8.72	1.11	0.08	3.02	3.22	3.02	1.45	0.04	1.05	0.10	76.83	0.44	1.06	2.80
L	8.72	1.11	0.08	3.02	3.21	2.97	1.45	0.04	1.06	0.11	76.53	0.44	1.06	2.77
L	8.70	1.08	0.08	3.02	3.20	3.01	1.46	0.04	1.06	0.09	76.64	0.44	1.07	2.75
N	8.75	1.13	0.08	3.18	3.23	2.60	1.39	0.05	1.41	0.10	75.92	0.44		
N	8.73	1.14	0.07	3.16	3.21	2.40	1.40	0.05	1.45	0.10	76.08	0.46		
N	8.68	1.12	0.08	3.15	3.21	2.50	1.38	0.05	1.39	0.10	75.48	0.44		
N	8.73	1.12	0.07	3.15	3.22	2.50	1.38	0.05	1.40	0.10	76.17	0.44		
N	8.72	1.14	0.07	3.19	3.24	2.50	1.40	0.06	1.46	0.10	76.49	0.45		
N	8.85	1.12	0.07	3.13	3.20	2.40	1.37	0.05	1.43	0.10	75.82	0.45		
N	8.65	1.14	0.06	3.14	3.23	2.50	1.35	0.05	1.41	0.10	75.81	0.44		
N	8.64	1.14	0.07	3.16	3.19	2.60	1.40	0.05	1.42	0.10	75.97	0.46		
O													1.06	
O													0.99	
O													1.04	
O													1.09	
O													1.07	
O													1.07	
O													1.07	
O													1.08	
P	8.87	1.10	0.09	3.22	3.23		1.36	0.05	0.93	0.11	77.10	0.47	1.02	2.75
P	8.92	1.12	0.09	3.26	3.28		1.38	0.05	0.93	0.11	77.50	0.48	1.02	2.75
P	8.86	1.11	0.09	3.23	3.24		1.38	0.05	0.92	0.11	77.00	0.48	1.01	2.75
P	8.92	1.12	0.09	3.28	3.29		1.38	0.05	0.93	0.11	77.60	0.48	1.02	2.76
P	8.85	1.11	0.09	3.24	3.26		1.36	0.05	0.95	0.11	77.40	0.48	1.02	2.76
P	8.90	1.11	0.08	3.23	3.24		1.38	0.05	0.92	0.11	77.10	0.48	1.01	2.75
P	8.87	1.11	0.09	3.23	3.25		1.38	0.05	0.95	0.10	77.10	0.48	1.01	2.75
P	8.84	1.11	0.09	3.23	3.25		1.37	0.05	0.91	0.11	77.00	0.48	1.02	2.75
Q	8.78	1.14	0.09	3.22	3.24	2.23	1.38	0.05	1.60		76.10	0.46	1.12	2.78
Q	8.76	1.14	0.09	3.21	3.24	2.26	1.37	0.05	1.59		76.05	0.46	1.13	2.81
Q	8.79	1.14	0.09	3.23	3.25	2.24	1.38	0.05	1.60		76.24	0.46	1.11	2.80
Q	8.78	1.14	0.09	3.24	3.24	2.27	1.38	0.05	1.59		76.10	0.46	1.12	2.79
Q	8.77	1.14	0.09	3.21	3.24	2.29	1.38	0.05	1.60		76.12	0.46	1.11	2.80
Q	8.76	1.13	0.09	3.20	3.24	2.19	1.37	0.05	1.59		76.08	0.46	1.15	2.81
Q	8.78	1.14	0.09	3.20	3.24	2.21	1.36	0.05	1.59		76.18	0.46	1.14	2.82
Q	8.77	1.14	0.09	3.22	3.25	2.25	1.37	0.05	1.60		76.18	0.46	1.15	2.82
R	8.88	1.23	0.07	3.41	3.24	2.73	1.70	0.05	1.55	0.08	75.73	0.46	0.86	2.70
R	8.48	1.18	0.05	3.32	3.14	2.67	1.60	0.05	1.54	0.08	76.59	0.44	0.86	2.71
R	8.72	1.23	0.06	3.39	3.24	2.72	1.70	0.05	1.56	0.08	75.94	0.46	0.85	2.72
R	8.63	1.22	0.06	3.38	3.24	2.73	1.70	0.05	1.56	0.08	76.03	0.46	0.85	2.71
R	8.49	1.19	0.05	3.32	3.15	2.77	1.70	0.05	1.53	0.08	76.38	0.44	0.85	2.72
R	8.69	1.23	0.06	3.39	3.24	2.72	1.70	0.05	1.61	0.08	75.86	0.46	0.90	2.71
R	8.46	1.18	0.05	3.31	3.14	2.72	1.60	0.05	1.58	0.08	76.55	0.44	0.86	2.72
R	8.66	1.23	0.07	3.40	3.25	2.78	1.70	0.05	1.59	0.08	75.82	0.47	0.90	2.71

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
Zn	M/ICP	ppm	382.756	201.130	116.388	51.340
Zn	P	ppm	335.186	217.696	99.186	58.967
Zn	XRF	ppm	207.437	173.795	47.465	71.312
Pb	M/ICP	ppm	148.670	69.652	58.446	17.660
Pb	P	ppm	129.891	82.700	45.314	21.764
Pb	XRF	ppm	240.271	294.399	49.073	120.397
Cu	M/ICP	ppm	6.505	2.725	3.255	0.722
Cu	P	ppm	5.220	3.108	2.786	0.842
Cu	XRF	ppm	10.736	10.669	6.527	4.456
Ag	M/ICP	ppm	0.487	0.236	0.269	0.066
Au	Pb Coll	g/t	0.004	0.002	0.003	0.001
Al ₂ O ₃	XRF	%	0.184	0.121	0.063	0.036
CaO	XRF	%	0.037	0.020	0.013	0.006
Cr ₂ O ₃	XRF	%	0.013	0.006	0.004	0.002
Fe ₂ O ₃	XRF	%	0.088	0.046	0.039	0.014
K ₂ O	XRF	%	0.053	0.031	0.021	0.009
LOI		%	0.370	0.326	0.050	0.099
MgO	XRF	%	0.110	0.062	0.016	0.018
MnO	XRF	%	0.005	0.002	0.001	0.001
Na ₂ O	XRF	%	0.200	0.141	0.019	0.041
P ₂ O ₅	XRF	%	0.010	0.008	0.004	0.003
SiO ₂	XRF	%	1.730	0.773	0.261	0.235
TiO ₂	XRF	%	0.015	0.011	0.007	0.003
S	M/ICP	%	0.096	0.060	0.026	0.020
SG	pyc		0.076	0.050	0.023	0.015

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. Uncertified values: The Certified, Provisional and Informational values listed on p1 and p2 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, who have maintained measurement traceability during the analytical process.

15. Certification: AMIS0082 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 50g to 250g) of material. The Laboratory Packs are sealed bottles delivered in sealed foil pouches. The Explorer Packs contain material in standard geochem envelopes, 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.

6 March 2009*

- *Note: Certification upgraded on 09 February 2015, notably with the addition of CSU and Trace Element Tables*

Certifying officers:



African Mineral Standards: _____
Mike McWha
BSc (Hons), FGSSA, MSAIMM, 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	%	4.5	0.54	5.9	70
As	M/ICP	ppm	101	13.9	6.9	70
B	M/ICP	ppm	35.0	18.5	26.5	8
Ba	M/ICP	ppm	620	50.5	4.1	72
Be	M/ICP	ppm	1.1	0.30	13.4	69
Bi	M/ICP	ppm	0.14	0.08	27.6	47
Ca	M/ICP	%	0.80	0.12	7.5	75
Cd	M/ICP	ppm	25.9	4.0	7.7	87
Ce	M/ICP	ppm	58.2	11.6	10.0	56
Co	M/ICP	ppm	14.0	4.2	14.9	81
Cr	M/ICP	ppm	407	213	26.2	69
Cs	M/ICP	ppm	2.0	0.18	4.6	40
Dy	M/ICP	ppm	2.4	0.81	16.8	31
Er	M/ICP	ppm	1.3	0.47	18.3	31
Eu	M/ICP	ppm	1.0	0.24	12.6	32
Fe	M/ICP	%	2.2	0.22	5.0	78
Ga	M/ICP	ppm	11.3	1.9	8.3	48
Gd	M/ICP	ppm	5.2	5.9	56.9	40
Ge	M/ICP	ppm	1.7	2.8	80.5	24
Hf	M/ICP	ppm	2.2	0.47	10.5	40
Ho	M/ICP	ppm	0.45	0.17	19.4	31
In	M/ICP	ppm	0.05	0.01	13.8	40
K	M/ICP	%	2.6	0.21	4.1	62
La	M/ICP	ppm	29.4	5.3	9.0	64
Li	M/ICP	ppm	15.0	1.4	4.7	54
Lu	M/ICP	ppm	0.19	0.06	15.3	31
Mg	M/ICP	%	0.8	0.1	6.7	77
Mn	M/ICP	ppm	374	43.7	5.8	76
Mo	M/ICP	ppm	2.6	0.75	14.2	72
Na	M/ICP	%	0.94	0.13	7.0	72
Nb	M/ICP	ppm	6.8	4.3	31.6	50
Nd	M/ICP	ppm	25.7	3.4	6.7	31
Ni	M/ICP	ppm	34.6	6.4	9.2	87
P	M/ICP	ppm	443	63.4	7.1	61
Pd	M/ICP	ppm	2.3	0.93	20.6	8
Pr	M/ICP	ppm	6.7	1.1	8.3	31
Pt	M/ICP	ppm	4.4	1.0	11.8	8
Rb	M/ICP	ppm	95.6	14.4	7.6	55
Sb	M/ICP	ppm	10.8	2.3	10.9	61
Sc	M/ICP	ppm	5.4	1.1	10.2	63
Si	M/ICP	%	35.7	0.61	0.85	8
Sm	M/ICP	ppm	4.8	0.65	6.8	30
Sn	M/ICP	ppm	2.3	0.61	13.4	48
Sr	M/ICP	ppm	63.9	5.5	4.3	76
Ta	M/ICP	ppm	0.55	0.35	32.2	39
Tb	M/ICP	ppm	0.48	0.12	12.2	32
Te	M/ICP	ppm	0.05	0.01	8.6	5
Th	M/ICP	ppm	8.6	1.7	10.0	51
Ti	M/ICP	%	0.21	0.12	27.5	80
Tl	M/ICP	ppm	0.79	0.15	9.7	48
Tm	M/ICP	ppm	0.19	0.07	18.6	31
U	M/ICP	ppm	2.7	0.53	9.9	47
V	M/ICP	ppm	46.5	7.4	7.9	87
W	M/ICP	ppm	0.91	0.42	22.9	40
Y	M/ICP	ppm	12.6	6.7	26.7	64
Yb	M/ICP	ppm	1.3	0.46	17.5	32
Zr	M/ICP	ppm	75.1	19.3	12.9	56