



AMIS0144

Certified Reference Material

Zinc oxide ore
Skorpion Mine, Namibia

Certificate of Analysis

Recommended Concentrations and Limits¹ (at two Standard Deviations)

Certified Concentrations²

Zn M/ICP	17.36	±	0.78	%
Zn P	16.96	±	1.04	%
Zn F	17.36	±	0.58	%
Cu M/ICP	801	±	54	ppm
Cu P	796	±	48	ppm
Fe M/ICP	2.42	±	0.12	%
Fe P	2.39	±	0.12	%
Mn M/ICP	7881	±	396	ppm
Mn P	7806	±	613	ppm
Specific Gravity	2.92	±	0.10	

Informational means

Ag M/ICP	0.87	ppm
Ag P	0.72	ppm
As M/ICP	14	ppm
As P	13	ppm
Pb M/ICP	25	ppm
Pb P	22	ppm

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	7.35	±	0.38	%
CaO	1.45	±	0.08	%
Fe ₂ O ₃	3.41	±	0.32	%
K ₂ O	2.74	±	0.24	%
MgO	1.16	±	0.08	%
MnO	1.02	±	0.08	%
SiO ₂	49.86	±	2.24	%
TiO ₂	0.34	±	0.03	%

Informational means

Cr ₂ O ₃	0.016	%
LOI	8.72	%
S Combustion	0.03	%

1. Intended Use: AMIS0144 can be used to check analysis of samples of Zinc oxide 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: AMIS0144 was supplied by Anglo American Plc from their Skorpion mine situated 800km south of Windhoek in Namibia. The Skorpion Zinc deposit occurs associated with the Rosh Pinah Formation of the Late Proterozoic Gariep Belt, which is an arcuate north trending tectonic unit some 400km long by 80km wide. This belt consists of sediments deposited in association with late pre-Cambrian continental rifting, which resulted in the formation of sedimentary basins. These basins are commonly sites for sedimentary exhalative ("SEDEX") base metal mineralisation, which involves hot, metal-rich brines from depth rising along the extensional faults before emerging from the sea floor and interacting with the cold seawater. This results in the deposition of metal sulphides into topographic lows along with other sediments. Compressive tectonic processes resulted in the obliteration of the extensional features, folding of the strata and the development of thrust faulting.

The Skorpion ore body is unique in that it comprises an oxide deposit created during intense weathering of previous zinc sulphide ore minerals. The ore accumulated as alluvial accumulations of supergene zinc oxide minerals, of detrital nature, deposited within a palaeochannel and interfingering with limestone, forming a very complex orebody, up to 180m thick and containing 21.6Mt ore grading 10.6% zinc.

3. Mineral and Chemical Composition: The unusual mineralisation comprises the clays saunconite, smithsonite, hemimorphite and hydrozincite. There is no evidence of sulphide mineralization below the orebody, but there is a thin polymetallic sulphide occurrence 400km to the west that might be the source of the zinc in the silicate-carbonate ore.

4. Appearance: The material is a very fine Pale Yellowish Brown powder (Corstor colour chart – 10YR 6/4).

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 consensus test results were carried out by an independent statistician.

7. Methods of Analysis requested:

1. 4 acid digest-ICP finish for Zn, Ag, As, Cu, Fe, Mn, Pb.
2. Aqua regia digest-ICP for As, Cu, Fe, Mn, Pb.
3. 4 acid digest-ICP finish, multi-element scan.
4. Aqua regia digest-ICP, multi-element scan.
5. Fusion-ICP – Zn.
6. Fusion-XRF - Al₂O₃, CaO, Cr₂O₃, Fe₂O₃, K₂O, MgO, MnO, Na₂O, SiO₂, TiO₂, LOI.
7. Total S.
8. SG by 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 (not averages)
4. All results for Zn and major elements to be reported in %.
5. All results for multi-element scans 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 packages, comprising eight samples scientifically selected from throughout the batch. Fifteen laboratories reported results in time for certification of the economic elements. Eight of these laboratories reported results for the major elements.

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

1. ALS Chemex Laboratory Group Brisbane Australia
2. ALS Chemex Laboratory Group Guangzhou (China)
3. ALS Chemex Laboratory Group Johannesburg SA
4. ALS Chemex Laboratory Group La Serena (Chile)
5. ALS Chemex Laboratory Group Lima (Peru)
6. ALS Chemex Laboratory Group Perth WA
7. ALS Chemex Laboratory Group Vancouver CA
8. Anglo Research (Crown Campus)
9. Set Point Laboratories (Isando) SA
10. SGS Australia Pty Ltd (Newburn) WA
11. SGS Geosol Laboratories Ltda (Brazil)
12. SGS Lakefield Research Africa (Pty) Ltd (Booysens SA)
13. SGS Mineral Services Callao (Peru)
14. SGS Mineral Services Lakefield (Canada)
15. SGS Toronto (Canada)
16. Ultra Trace (Pty) Ltd WA

11. Assay Data: Data as received from the laboratories for the important certified elements listed on p1 is 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	Zn M/ICP %	Zn P %	Zn F %	Ag M/ICP g/t	Ag P g/t	As M/ICP ppm	As P ppm	Cu M/ICP ppm	Cu P ppm	Fe M/ICP %	Fe P %	Mn M/ICP ppm	Pb M/ICP ppm	Pb P ppm	SG
A				1.10		1.10	11.0	827	836	2.43	2.30	8980	19.00	15.00	
A				1.20		1.20	12.0	833	840	2.38	2.26	8700	21.00	15.00	
A				1.20		1.20	12.0	839	824	2.40	2.21	8840	22.00	14.00	
A				1.30		1.30	12.0	842	842	2.39	2.29	8910	19.00	14.00	
A				1.30		1.30	12.0	822	824	2.39	2.31	8860	19.00	15.00	
A				1.10		1.10	11.0	848	832	2.36	2.24	8750	18.00	14.00	
A				1.00		1.00	12.0	842	823	2.45	2.30	8950	18.00	14.00	
A				1.00		1.00	12.0	831	820	2.47	2.26	9010	21.00	14.00	
B	17.94		18.13					895	898	2.45	2.44	8305	26.88	23.76	2.98
B	17.73		18.02					879	895	2.40	2.38	8290	33.71	30.54	2.82
B	18.70		19.32					921	913	2.44	2.42	8473	32.64	21.91	2.85
B	18.05		18.10					882	906	2.46	2.43	8171	39.76	24.41	2.95
B	17.71		17.55					909	879	2.52	2.44	8483	33.49	23.90	2.85
B	17.05		17.76					916	912	2.56	2.47	8568	30.98	23.95	2.89
B	17.29		19.87					889	909	2.49	2.46	8384	40.96	23.57	2.85
B	17.73		16.19					848	903	2.47	2.48	8009	44.31	20.62	2.87
C	17.30	17.30	17.20	0.71	0.52	0.71	15.0	763	792	2.34	2.45	7650	22.10	18.20	2.91
C	17.10	17.10	16.90	0.66	0.51	0.66	14.0	765	777	2.29	2.44	7450	22.90	20.70	2.92
C	17.10	17.00	17.30	0.69	0.52	0.69	15.0	783	788	2.43	2.42	7940	24.30	20.10	2.93
C	17.20	17.10	17.10	0.68	0.42	0.68	15.0	768	790	2.36	2.39	7710	22.80	22.60	2.91
C	17.40	16.50	17.30	0.68	0.53	0.68	14.0	776	764	2.34	2.40	7670	23.40	21.60	2.96
C	17.30	16.60	17.30	0.68	0.46	0.68	14.0	767	786	2.38	2.45	7830	21.60	21.90	2.91
C	17.10	16.90	17.10	0.67	0.50	0.67	15.0	757	778	2.34	2.38	7670	23.60	20.50	2.92
C	16.70	17.10	17.20	0.68	0.62	0.68	15.0	769	792	2.40	2.61	7850	23.80	18.90	2.90
D	17.50		17.00				11.0	776	811	2.41	2.44	7870	32.00	18.00	
D	17.60		17.10				12.0	771	846	2.34	2.33	8070	27.00	18.00	
D	17.10		17.00				11.0	792	772	2.32	2.33	7880	35.00	18.00	
D	17.60		17.20				12.0	802	805	2.45	2.36	7940	34.00	17.00	
D	16.90		17.00				14.0	752	814	2.30	2.44	7890	29.00	18.00	
D	17.10		17.10				12.0	765	794	2.36	2.37	7750	23.00	19.00	
D	17.10		16.90				10.0	785	825	2.43	2.49	7860	26.00	18.00	
D	17.40		16.90				11.0	793	791	2.39	2.40	7750	38.00	18.00	
E			17.19	0.70		0.70	13.0	781	775	2.15	2.09	7966	21.00	21.00	
E			17.12	0.60		0.60	14.0	765	758	2.09	2.04	7811	22.00	18.00	
E			17.04	0.70		0.70	18.0	773	779	2.12	2.13	7737	20.00	19.00	
E			17.07	0.70		0.70	17.0	757	767	2.11	2.10	7678	18.00	20.00	
E			17.37	0.70		0.70	13.0	750	761	2.12	2.06	7958	18.00	21.00	
E			17.27	0.70		0.70	12.0	760	767	2.08	2.09	7811	18.00	18.00	
E			17.15	0.60		0.60	14.0	777	772	2.07	2.09	7863	19.00	20.00	
E			17.45	0.60		0.60	12.0	785	783	2.15	2.13	7954	17.00	21.00	
F															2.92
F															2.90
F															2.93
F															2.91
F															2.89
F															2.92
F															2.92
F															2.91
L	17.74	17.70	18.24				19.0	841	832	2.46	2.45	8595	27.00	24.00	2.91
L	18.13	17.92	18.43				19.0	850	842	2.47	2.44	8563	26.00	24.00	2.89
L	17.63	17.64	18.49				19.0	880	863	2.54	2.45	8646	23.00	23.00	2.89
L	17.96	17.58	18.10				19.0	866	854	2.45	2.46	8610	24.00	24.00	2.89
L	17.78	17.59	18.26				19.0	847	848	2.43	2.47	8600	27.00	23.00	2.93
L	18.09	17.59	18.48				18.0	864	848	2.48	2.39	8586	24.00	22.00	2.89
L	17.78	17.90	18.04				19.0	871	845	2.48	2.46	8439	24.00	23.00	2.92
L	17.94	17.98	18.21				19.0	877	842	2.45	2.43	8403	24.00	25.00	2.90

Assay data (cont)

Lab Code	Zn M/ICP %	Zn P %	Zn F %	Ag M/ICP g/t	Ag P g/t	As M/ICP ppm	As P ppm	Cu M/ICP ppm	Cu P ppm	Fe M/ICP %	Fe P %	Mn M/ICP ppm	Pb M/ICP ppm	Pb P ppm	SG
M	17.70	17.70	17.90	1.00	0.40	1.00	17.4	805	815	2.45	2.44	8060	20.00	22.00	2.65
M	17.90	17.70	17.60	1.00	0.50	1.00	16.8	835	798	2.48	2.41	8210	22.00	22.00	2.64
M	17.50	17.70	17.80	1.00	0.40	1.00	17.4	820	820	2.48	2.46	8140	21.00	22.00	3.02
M	17.80	17.70	17.70	1.00	0.40	1.00	16.8	815	803	2.45	2.47	7900	20.00	21.00	2.16
M	17.50	17.70	17.80	0.50	0.40	0.50	17.2	805	790	2.48	2.42	7980	21.00	23.00	2.15
M	17.60	17.80	17.80	0.50	0.40	0.50	17.0	815	825	2.48	2.47	8060	21.00	22.00	3.07
M	17.80	17.80	17.50	1.00	0.50	1.00	17.8	830	800	2.46	2.43	7980	22.00	22.00	3.04
M	17.60	17.70	17.50	0.50	0.50	0.50	17.0	845	805	2.47	2.42	8060	21.00	20.00	3.06
N	16.75	16.55	17.60	1.00		1.00	11.0	800	780	2.37	2.30	7600	30.00	20.00	
N	16.95	16.45	17.60	2.00	1.00	2.00	12.0	810	780	2.39	2.27	7700	30.00	20.00	
N	16.75	16.65	17.65		1.00		11.0	800	790	2.35	2.33	7600	30.00	30.00	
N	16.70	16.75	17.75	1.00	1.00	1.00	10.0	790	790	2.36	2.35	7600	20.00	30.00	
N	16.95	16.30	17.50	1.00	1.00	1.00	9.0	800	770	2.36	2.26	7600	30.00	30.00	
N	16.95	16.60	17.60	1.00	1.00	1.00	12.0	800	780	2.38	2.31	7700	30.00	20.00	
N	16.90	16.40	17.65	1.00	1.00	1.00	11.0	800	780	2.37	2.28	7700	40.00	30.00	
N	16.75	16.40	17.65	1.00	1.00	1.00	13.0	790	780	2.37	2.27	7600	30.00	40.00	
O	17.35		17.70	1.00	0.70	1.00	9.0	790	766	2.42		7900	30.00	37.00	
O	17.65		17.85	1.00	0.60	1.00	10.0	800	754	2.46		8100	20.00	28.00	
O	17.75		17.85	1.00	0.70	1.00	12.0	810	761	2.49		8100	20.00	24.00	
O	17.45		17.70	1.00	0.60	1.00	9.0	790	766	2.43		7900		47.00	
O	17.40		17.80	1.00	0.70	1.00	11.0	780	771	2.44		8000	10.00	29.00	
O	17.55		17.65	1.00	0.80	1.00	11.0	790	763	2.44		8000	10.00	25.00	
O	17.15		17.40		0.60		9.0	780	763	2.41		7900	10.00	23.00	
O	17.30		17.75		0.60		10.0	780	763	2.42		7900	20.00	22.00	
P	16.55	16.30	17.15	1.00	1.10	1.00	16.0	790	780	2.31	2.29	7500	80.00	30.00	2.93
P	16.90	16.70	16.95	1.00	1.00	1.00	11.0	790	790	2.38	2.36	7700	50.00	20.00	2.98
P	16.90	16.25	17.20	1.00	1.20	1.00	13.0	790	790	2.39	2.36	7700	30.00	20.00	3.01
P	17.10	17.00	16.95	2.00	1.10	2.00	14.0	810	800	2.39	2.40	7700	70.00	20.00	2.97
P	16.40	16.85	17.55	1.00	0.90	1.00	13.0	770	800	2.31	2.37	7400	50.00	20.00	2.81
P	17.30	16.30	17.35	1.00	1.00	1.00	14.0	810	770	2.42	2.30	7800	40.00	20.00	2.93
P	16.70	17.00	17.35	1.00	1.00	1.00	18.0	790	800	2.35	2.40	7600	50.00	10.00	2.90
P	16.55	16.75	17.00	1.00	0.90	1.00	15.0	770	790	2.32	2.37	7500	30.00	20.00	2.93
Q	17.50	17.25		1.00	1.00	1.00	6.0	830	816	2.43	2.40	8170	40.00	40.00	
Q	17.45	15.40		1.00	1.00	1.00	6.0	850	825	2.60	2.44	8550	40.00	50.00	
Q	17.45	17.05		1.00	1.00	1.00	5.0	810	806	2.50	2.38	8230	30.00	50.00	
Q	17.35	16.90		1.00	1.00	1.00	8.0	780	797	2.44	2.41	7980	30.00	40.00	
Q	17.45	16.85		1.00	1.00	1.00	8.0	790	810	2.54	2.44	8340	30.00	40.00	
Q	17.60	16.90			1.00		7.0	770	814	2.41	2.48	7950	30.00	40.00	
Q	17.30	17.00			1.00		7.0	810	813	2.53	2.46	8290	30.00	30.00	
Q	17.60	17.30		1.00	1.00	1.00	3.0	770	819	2.46	2.46	8070	30.00	30.00	
R	16.85	16.40		1.00		1.00	13.0	800	790	2.37	2.33	7700	20.00	30.00	
R	16.85	16.35					13.0	780	780	2.40	2.35	7600	10.00	30.00	
R	17.05	16.35		1.00		1.00	13.0	790	780	2.42	2.34	7800	10.00	30.00	
R	17.30	16.40		1.00		1.00	12.0	800	780	2.45	2.34	7800	10.00	30.00	
R	17.35	16.50					12.0	800	790	2.49	2.35	7900	10.00	20.00	
R	17.20	16.55		2.00		2.00	13.0	800	790	2.42	2.37	7700	10.00	40.00	
R	15.90	16.45		1.00		1.00	13.0	730	790	2.26	2.35	7200	10.00	40.00	
R	16.90	17.70		1.00		1.00	12.0	780	850	2.42	2.54	7700	20.00	30.00	
S	17.15	16.90	17.20	0.60	0.60	0.60	11.0	820	820	2.45	2.43	8100	50.00	100.00	2.90
S	17.35	16.80	17.20	0.50	0.50	0.50	11.0	830	780	2.45	2.43	8100	50.00	40.00	2.86
S	17.60	17.25	17.35	0.80	0.50	0.80	13.0	840	790	2.45	2.48	8100	30.00	40.00	2.88
S	17.75	16.85	17.20	0.60	0.60	0.60	13.0	840	790	2.48	2.45	8100	40.00	30.00	2.87
S	17.65	17.00	17.15	0.50	0.60	0.50	14.0	840	790	2.48	2.45	8100	40.00	30.00	2.88
S	17.70	17.15	17.35	0.60	0.50	0.60	14.0	840	800	2.48	2.47	8200	30.00	30.00	2.88
S	17.75	16.80	17.30	0.60	0.60	0.50	16.0	850	780	2.50	2.43	8200	40.00	30.00	2.91
S	17.85	16.50	17.20		0.60		13.0	850	770	2.47	2.42	8100	50.00	20.00	2.89
T	18.25	17.25		0.60	0.70	0.60	14.0	800	800	2.34	2.47	7800	10.00	17.00	3.01
T	18.05	16.80		0.80	0.60	0.80	14.0	800	870	2.34	2.43	7800		20.00	3.00
T	18.45	16.40		0.80	0.60	0.80	13.0	820	790	2.52	2.41	8000	60.00	35.00	3.00
T	18.60	16.35		0.70	0.70	0.70	14.0	840	780	2.39	2.34	7900	50.00	28.00	3.00
T	18.90	16.40		0.90	0.60	0.90	14.0	840	810	2.44	2.31	8000	40.00	23.00	3.01
T	18.95	16.20		0.80	0.60	0.80	13.0	840	780	2.44	2.36	8000	50.00	22.00	3.00
T	18.70	16.45		0.70	0.60	0.70	14.0	830	790	2.41	2.36	7900	60.00	20.00	3.00
T	18.70	16.25		0.80	0.60	0.80	12.0	830	780	2.42	2.34	7900	120.00	16.00	2.99

12. Measurement of Uncertainty: The samples used in the certification process were 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:

$$\text{Combined standard uncertainty} = \sqrt{(\text{between lab.var}/\text{no of labs}) + (\text{mean square within lab.var}/\text{no of assays})}$$

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	%	0.39	0.28	0.22	0.09
Zn	P	%	0.52	0.44	0.27	0.15
Zn	F	%	0.29	0.27	0.14	0.10
Ag	M/ICP	g/t	0.20	0.15	0.10	0.05
Ag	P	g/t	0.23	0.23	0.05	0.08
As	M/ICP	ppm	2.45	1.74	1.59	0.58
As	P	ppm	2.07	1.53	1.11	0.48
Cu	M/ICP	ppm	27.1	19.4	14.4	5.8
Cu	P	ppm	24.2	16.5	12.8	4.7
Fe	M/ICP	%	0.06	0.03	0.04	0.01
Fe	P	%	0.06	0.04	0.03	0.01
Mn	M/ICP	ppm	197.8	147.3	103.4	45.8
Pb	M/ICP	ppm	8.0	5.7	4.1	1.7
Pb	P	ppm	4.6	2.8	3.1	0.9
SG	pycnometer		0.05	0.04	0.03	0.02

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.

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: AMIS0144 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. This is the recommended minimum sample size 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.

5 October 2009

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 1. – Uncertified trace element statistics

Although requested, very few of the laboratories reported multi-element scan data. The data below is for informational use only.

AMIS0144 Trace

Analyte	Method	Unit	Mean	2SD	RSD%	n
Al	M/ICP	%	3.8	0.3	3.4	64
Au	PbColl	ppm	0.34	0.06	8.5	24
Ba	M/ICP	ppm	3475	226	3.2	55
Be	M/ICP	ppm	7.6	0.7	4.3	56
Bi	M/ICP	ppm	2.2	2.3	53.1	34
Ca	M/ICP	%	1.00	0.09	4.6	56
Cd	M/ICP	ppm	209	13	3.0	52
Ce	M/ICP	ppm	59.7	2.5	2.1	8
Co	M/ICP	ppm	18.6	2.2	5.8	55
Cr	M/ICP	ppm	85.1	16.6	9.7	62
Cs	M/ICP	ppm	4.7	0.3	3.2	8
Dy	M/ICP	ppm	4.0	0.2	2.4	8
Er	M/ICP	ppm	2.3	0.2	3.5	8
Eu	M/ICP	ppm	1.04	0.06	3.1	8
Ga	M/ICP	ppm	10.0	0.2	0.9	61
Gd	M/ICP	ppm	4.5	0.3	3.4	8
Hf	M/ICP	ppm	1.15	0.28	12.3	8
Ho	M/ICP	ppm	0.81	0.03	1.9	7
In	M/ICP	ppm	0.04	0.03	30.2	8
K	M/ICP	%	2.1	0.2	3.9	56
La	M/ICP	ppm	27.8	8.0	14.4	64
Li	M/ICP	ppm	19.1	0.8	2.2	8
Lu	M/ICP	ppm	0.33	0.02	2.8	8
Mg	M/ICP	%	0.63	0.04	3.5	61
Mo	M/ICP	ppm	2.0	3.1	77.9	28
Na	M/ICP	%	0.25	0.15	29.7	64
Nb	M/ICP	ppm	7.9	0.7	4.5	8
Nd	M/ICP	ppm	26.7	0.4	0.7	7
Ni	M/ICP	ppm	162	9	2.7	60
P	M/ICP	ppm	2773	197	3.6	52
Pr	M/ICP	ppm	6.9	0.4	3.2	8
Rb	M/ICP	ppm	149	8	2.6	8
S	ICP	%	0.04	0.01	16.9	52
Sb	M/ICP	ppm	8.2	7.3	44.1	26
Sc	M/ICP	ppm	4.7	1.0	10.3	58
Se	M/ICP	ppm	5.0	0.0	0.0	8
Si	M/ICP	%	23.5	0.3	0.6	8
Sm	M/ICP	ppm	5.4	0.1	1.3	8
Sn	M/ICP	ppm	2.0	0.00	0.0	8
Sr	M/ICP	ppm	306	19	3.1	62
Ta	M/ICP	ppm	0.78	0.09	6.0	8
Tb	M/ICP	ppm	0.67	0.04	3.1	8
Th	M/ICP	ppm	14.6	10.4	35.6	15
Ti	M/ICP	%	0.19	0.02	4.4	63
Tl	M/ICP	ppm	3.62	7.93	2.1	33
Tl	P	ppm	0.76	0.09	6.1	24
Tm	M/ICP	ppm	0.34	0.04	5.8	8
U	M/ICP	ppm	9.3	2.2	11.6	26
V	M/ICP	ppm	37.6	2.7	3.5	62
W	M/ICP	ppm	9.4	2.6	13.9	43
Y	M/ICP	ppm	29.3	2.1	3.5	8
Yb	M/ICP	ppm	2.2	0.2	4.8	8
Zn	XRF	%	17.62	0.63	1.8	38
Zr	M/ICP	ppm	158	28	8.8	8