African Mineral Standards
MATRIX REFERENCE MATERIALS

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AMIS0421

Certified Reference Material

Cu Co Zn Au Ag concentrate, epithermal, Chelopech Mine, Bulgaria

Certificate of Analysis

Recommended Concentrations and Limits[1.]
(at two Standard Deviations)

Certified Concentrations[2.]

Cu M/ICP	15.88	±	0.59	%
Cu Titration	15.82	±	0.30	%
Au Pb Collection	26.31	±	1.86	g/t
Ag M/ICP	67.1	±	2.9	g/t
As M/ICP	5.13	±	0.59	%
Bi M/ICP	588	±	60	ppm
Zn M/ICP	9323	±	820	ppm
Specific Gravity	4.43	±	0.10	

Provisional Concentration

Co M/ICP	148	±	19	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
(Mixed ICP and XRF)

Al_2O_3	0.88	±	0.06	%
CaO	0.23	±	0.02	%
Fe_2O_3	38.09	±	1.76	%
S Comb/LECO	39.98	±	2.00	%

Provisional Concentrations

K_2O	0.07	±	0.01	%
MgO	0.11	±	0.01	%
MnO	0.04	±	0.006	%

Informational Means

Cr_2O_3	0.02	%
Na_2O	0.04	%
TiO_2	0.09	%

1. Intended Use: AMIS0421 can be used to check analysis of samples of epithermal arsenical copper cobalt silver gold concentrates with a similar grade and matrix.

It is a matrix matched Certified Reference Material (CRM) 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: The concentrate material for AMIS0421 was supplied by Namibia Custom Smelter (Dundee Precious Metals). The AMIS0421 concentrate is originally from Chelopech Mine located in central-western Bulgaria approximately 70 kilometres east of Sofia.

3. Mineral and Chemical Composition: Chelopech can be classified as a “gold-enargite high-sulphidation epithermal mineralizing system” similar to the deposits mined at Lepanto in the Philippines, El Indio in Chile, Freda River in Papua-New Guinea and Nansatsu in Japan. A cupriferous massive pyrite deposit is hosted in Upper Cretaceous andesitic to rhyodacitic pyroclastics and sub-volcanic intrusives. Massive pyrite predates the economic mineralization and is thought to be related to a phase of dacitic volcanism; whilst Cu, Cu-Au, Cu-Au-Pb-Zn and Pb-Zn mineralisation is later and related to a phase of injection of subvolcanic rhyodacites during the late Cretaceous. Mineralization shows a complex paragenesis with the main minerals comprising pyrite, quartz, chalcopyrite, tennantite and bornite whilst enargite, luzonite, tetrahedrite, gold, bournonite, chalcocite, sphalerite, galena, gypsum and barite are subordinate.

4. Appearance: The material is a very fine powder. It is colored Dark Grey.

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 <54um. Wet sieve parti**c**le size analysis of random samples confirmed the material was 98.5% <54um. It was then homogenized in a double cone blender, systematically divided and sealed into 1kg Laboratory Packs. Explorer Packs are subdivided from the Laboratory packs as required. Samples were scientifically selected for homogeneity testing and third party analysis. Statistical analysis of both homogeneity and consensus test results were carried out by an independent statistician.

7. Methods of Analysis requested:

1. Au – Pb collection AAS or ICP-OES.
2. Ag – AAS.
3. Multi-element scan to include Cu, As, Co, Bi, Sb, Sn, Zn. Fusion AAS or ICP-OES.
4. Cu Titration.
5. S combustion IR.
6. Fusion XRF -Majors (Al_2O_3, CaO, Cr_2O_3, Fe_2O_3, K_2O, MgO, MnO, Na_2O, SiO_2, TiO_2. LOI.).
7. SG. Gas pycnometer.

8. Information requested:

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

9. Method of Certification: Twenty three laboratories were each given eight packages, comprising eight samples scientifically selected from throughout the batch. Seventeen laboratories reported results in time for 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 17 out of 23 laboratories that provided results timeously were (not in same order as in the table of assays):

1. Acme Analytical Laboratories Chile
2. Activation Laboratories Pty Ltd (ActLabs) CA
3. Afghan Geological Services
4. ALS Chemex Laboratory Group Johannesburg SA
5. ALS Chemex Laboratory Group Perth WA
6. ALS Chemex Laboratory Group Vancouver CA
7. ALS OMAC (Ireland)
8. Bureau Veritas (Namibia)
9. Genalysis Laboratory Services (W Australia P)
10. Mintek (South Africa)
11. Namibia Custom Smelters
12. Set Point Laboratories (Isando) SA
13. SGS Australia Pty Ltd (Newburn) WA
14. SGS Mineral Services Callao (Peru)
15. SGS Mineral Services Lakefield (Canada)
16. SGS South Africa (Pty) Ltd - Booysens JHB
17. 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.

Lab Code	Co M/ICP ppm	Cu M/ICP %	Cu Titration %	Au Pb Coll g/t	Ag M/ICP ppm	As M/ICP ppm	Bi M/ICP ppm	Zn M/ICP %	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	TiO2 XRF %	S Comb/LECO %	SG pyc
A			15.61	26.00	66.00				0.90	0.23	0.04	38.73	0.07	0.10	0.04	0.03	0.11		4.37
A			15.62	26.20	66.00				0.87	0.23	0.04	38.60	0.07	0.11	0.04	0.03	0.11		4.40
A			15.61	25.60	68.00				0.92	0.23	0.03	38.48	0.07	0.09	0.04	0.03	0.11		4.43
A			15.57	26.40	70.00				0.89	0.23	0.03	38.67	0.07	0.10	0.04	0.03	0.11		4.38
A			15.59	26.60	70.00				0.86	0.23	0.04	38.84	0.07	0.10	0.04	0.03	0.11		4.40
A			15.58	26.30	66.00				0.89	0.24	0.03	38.67	0.07	0.10	0.04	0.03	0.11		4.39
A			15.53	26.40	68.00				0.88	0.23	0.03	38.54	0.07	0.10	0.04	0.03	0.11		4.41
A			15.55	26.60	68.00				0.87	0.23	0.03	38.55	0.07	0.10	0.04	0.03	0.11		4.37
B			15.90	28.80					0.84	0.24			0.07	0.18		0.08	0.16	39.20	
B			16.20	27.40					0.86	0.23			0.07	0.19		0.09	0.14	39.10	
B			16.10	26.40					0.84	0.23			0.07	0.20		0.08	0.15	38.20	
B			16.00	26.80					0.85	0.23			0.07	0.19		0.11	0.13	39.00	
B			15.80	28.40					0.84	0.23			0.07	0.17		0.08	0.14	39.10	
B			15.90	26.60					0.85	0.23			0.07	0.20		0.08	0.14	39.30	
B			15.70	27.70					0.86	0.23			0.07	0.19		0.07	0.16		
B			16.20	29.30					0.85	0.23			0.07	0.20		0.08	0.14	39.00	
C	150	16.00		26.10	67.00	51300	600	9150	0.93	0.22	0.02	37.17	0.07	0.11	0.04	0.04		39.70	
C	140	16.10		25.60	67.00	51700	580	9180	0.93	0.24	0.02	37.32	0.07	0.11	0.04	0.04		40.30	
C	140	15.90		25.40	67.00	51600	640	9110	0.93	0.22	0.02	37.03	0.07	0.11	0.04	0.05		39.70	
C	140	16.15		25.30	68.00	52000	620	9310	0.94	0.24	0.02	37.60	0.07	0.11	0.04	0.05		40.60	
C	140	16.15		26.30	68.00	52100	620	9280	0.93	0.24	0.02	37.46	0.07	0.11	0.04	0.04		40.20	
C	140	16.00		25.60	67.00	51500	610	9060	0.93	0.22	0.02	37.03	0.07	0.11	0.04	0.04		40.10	
C	140	15.75		25.20	67.00	50600	560	9040	0.91	0.24	0.02	36.74	0.07	0.11	0.04	0.04		39.70	
C	150	16.10		25.10	67.00	51800	620	9160	0.93	0.24	0.02	37.17	0.07	0.11	0.04	0.05		39.80	
D		15.60	15.86	26.98	69.00	55300												39.13	
D		16.10	15.88	26.90	68.00	55100												39.32	
D		16.20	15.85	26.68	68.00	59200												40.71	
D		15.90	15.84	26.75	68.00	54900												39.33	
D		15.90	15.86	26.47	69.00	56700												41.23	
D		16.00	15.81	26.67	68.00	54200												40.32	
D		15.90	15.85	26.55	68.00	55700												44.07	
D		15.70	15.86	26.39	68.00	53700												41.71	
E		15.80	15.87	27.00	68.00													41.80	4.54
E		15.95	15.90	27.20	67.00													41.20	4.45
E		15.90	15.91	26.50	67.00													41.70	4.55
E		15.75	15.98	27.00	68.00													41.60	4.50
E		16.15	16.01	26.80	67.00													41.60	4.31
E		16.15	15.94	27.00	69.00													41.30	4.57
E		15.95	15.96	27.20	68.00													41.40	4.41
E		15.65	15.97	27.10	67.00													41.40	4.32
H	154	16.27	15.90	22.00														38.80	4.42
H	159	16.00	15.90	23.00														38.10	4.41
H	155	15.66	15.90	22.00														38.00	4.43
H	155	16.08	15.90	23.00														38.90	4.43
H	167	16.14	15.90	23.00														38.80	4.40
H	169	16.30	15.70	24.00														38.70	4.45
H	167	15.80	15.90	23.00														38.70	4.43
H	161	16.03	15.90	23.00														38.60	4.39
I	140	16.10	16.04	27.30	64.00	49500	690	9710	0.93	0.22	0.02	37.17	0.10	0.12	0.04			39.90	4.45
I	170	16.00	15.85	26.80	68.00	48800	600	9810	0.91	0.24	0.02	37.46	0.07	0.12	0.04			40.20	4.46
I	200	15.85	15.57	27.00	65.00	48600	590	9600	0.89	0.22	0.02	37.17	0.24	0.12	0.04			40.00	4.46
I	150	16.45	15.68	26.80	67.00	49900	770	9850	0.91	0.21	0.02	38.03	0.07	0.10	0.04			39.90	4.45
I	160	16.85	15.48	27.50	68.00	51300	620	9960	0.93	0.24	0.02	38.74	0.07	0.12	0.04			40.50	4.46
I	150	16.85	15.68	26.60	67.00	51100	770	10250	0.91	0.22	0.02	39.17	0.06	0.10	0.04			39.60	4.51
I	150	16.60	15.42	26.80	69.00	50200	670	9840	0.91	0.21	0.02	38.60	0.07	0.12	0.04			40.10	4.45
I	150	16.30	15.52	26.80	67.00	50000	470	9770	0.89	0.21	0.02	37.89	0.07	0.10	0.04			40.50	4.45
J	136	14.50	15.40	25.80	73.10	29000	528	8510	0.85		0.03	34.49	0.07		0.04	0.02	0.12	40.20	4.58
J	134	14.50	15.70	26.00	82.20	29400	529	8430	0.82		0.03	33.55	0.06	0.11	0.04	0.02	0.11	40.00	4.55
J	139	14.60	15.70	25.60	85.00	31000	545	8610	0.85		0.03	34.40	0.06	0.11	0.04	0.02	0.12	40.20	4.55
J	138	14.60	15.80	27.70	83.70	32200	552	8550	0.80		0.03	32.43	0.06	0.10	0.04	0.02	0.11	38.90	4.52
J	136	14.60	15.60	25.50	83.00	31100	574	8640	0.86		0.03	34.85	0.07	0.11	0.04	0.02	0.12	39.70	4.52
J	136	14.60	15.70	26.40	85.00	30200	586	8740	0.86		0.03	34.44	0.07	0.10	0.04	0.02	0.12	40.10	4.55
J	138	14.90	15.70	26.70	85.00	31100	594	8700	0.84		0.03	33.75	0.07	0.10	0.04	0.02	0.11	40.10	4.53
J	142	14.60	15.30	25.80	88.30	30700	618	9020	0.87		0.03	34.76	0.07	0.10	0.04	0.02	0.12	40.30	4.60
K			15.90	26.70	69.00													40.87	4.24
K			15.80	26.95	68.00													41.02	4.34
K			16.00	27.18	67.00													40.16	4.24
K			15.90	26.02	68.00													40.24	4.28
K			16.00	26.40	67.00													40.16	4.29
K			15.90	26.24	67.00													39.90	4.24
K			15.90	27.08	67.00													39.02	4.28
K			15.90	27.69	68.00													40.20	4.23

Assay data (cont)

Lab Code	Co M/ICP ppm	Cu M/ICP %	Cu Titration %	Au Pb Coll g/t	Ag M/ICP ppm	As M/ICP ppm	Bi M/ICP ppm	Zn M/ICP %	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	TiO2 XRF %	S Comb/LECO %	SG pyc
M	120	15.44	15.68		61.60	52000	574	9523		0.21	0.01		0.07	0.12	0.03	0.03	0.08	41.47	4.21
M	116	15.41	15.69		62.30	52600	565	9581		0.21	0.01		0.07	0.12	0.03	0.03	0.08	41.52	4.22
M	117	15.37	15.67		62.80	52400	566	9589		0.21	0.01		0.07	0.12	0.03	0.03	0.08	41.57	4.27
M	120	15.35	15.60		63.00	52300	562	9550		0.21	0.01		0.07	0.12	0.03	0.03	0.08	41.83	4.20
M	115	15.48	15.71		62.70	52600	558	9539		0.21	0.01		0.07	0.12	0.03	0.03	0.08	41.57	4.22
M	116	15.35	15.74		62.20	52600	557	9684		0.21	0.01		0.06	0.12	0.03	0.03	0.08	41.33	4.22
M	119	15.42	15.83		62.80	52300	561	9679		0.21	0.01		0.07	0.12	0.03	0.03	0.08	41.83	4.22
M	120	15.43	15.75		61.80	52600	572	9552		0.21	0.01		0.06	0.12	0.03	0.03	0.08	41.47	4.18
N				25.29	67.00														4.18
N				26.52	66.00														4.04
N				25.18	66.00														4.21
N				26.28	68.00														4.08
N				25.93	67.00														4.35
N				25.41	66.00														4.17
N				25.89	69.00														4.12
N				25.32	68.00														4.12
O			16.03	27.00	65.80						0.03	38.46			0.05			39.70	
O			15.91	27.20	65.90						0.03	37.89			0.05			40.00	
O			16.01	27.30	64.50						0.03	37.03			0.05			39.90	
O			16.05	27.20	65.10						0.04	37.17			0.05			39.50	
O			15.95	26.70	64.90						0.03	38.17			0.05			39.80	
O			15.90	27.00	63.40						0.04	37.89			0.05			39.80	
O			16.00	27.40	64.10						0.03	38.17			0.05			39.80	
O			15.97	27.00	64.90						0.03	38.17			0.05			39.60	
P	154	16.00		23.90	70.00	53000			0.96	0.24	0.01	40.46	0.07	0.13	0.03		0.06		4.41
P	150	15.70		24.60	65.00	51400			0.89	0.24	0.01	39.46	0.06	0.12	0.03		0.06		4.39
P	158	16.20		24.70	70.00	54100			0.93	0.24	0.01	40.75	0.06	0.12	0.03		0.06		4.41
P	158	16.20		24.40	65.00	52600			0.91	0.24	0.01	39.75	0.06	0.12	0.03		0.06		4.44
P	156	15.70		24.10	65.00	51800			0.89	0.24	0.01	39.75	0.06	0.12	0.03		0.06		4.42
P	160	16.80		24.70	70.00	54300			0.96	0.24	0.01	41.03	0.07	0.13	0.03		0.06		4.39
P	150	16.00		23.90	65.00	52600			0.91	0.22	0.01	40.17	0.06	0.12	0.03		0.06		4.40
P	152	16.10		24.50	65.00	52300			0.91	0.22	0.01	40.03	0.06	0.12	0.03		0.06		4.38
R	150	15.90		27.30	67.00	47200	580	9820	0.93	0.24	0.02	36.03	0.07	0.12	0.04			33.10	4.39
R	140	15.35		27.10	66.00	42400	570	9420	0.87	0.21	0.02	36.60	0.07	0.10	0.04			33.20	4.41
R	150	15.80		27.00	68.00	44900	570	9780	0.89	0.22	0.02	37.60	0.08	0.10	0.04			33.00	4.37
R	140	15.70		27.80	68.00	45300	610	9630	0.93	0.22	0.02	37.03	0.08	0.10	0.04			33.10	4.39
R	150	15.80		26.70	68.00	46400	600	9790	0.91	0.22	0.02	37.46	0.08	0.10	0.04			33.00	4.35
R	150	15.70		26.90	68.00	45300	610	9680	0.89	0.22	0.02	37.46	0.08	0.10	0.04			33.00	4.38
R	150	15.40		26.30	67.00	44600	600	9580	0.87	0.21	0.02	36.89	0.07	0.10	0.04			33.10	4.34
R	150	15.85		26.70	67.00	46400	610	9820	0.93	0.24	0.02	37.74	0.07	0.12	0.04			33.10	4.37
U	135			23.70			626	9011	0.85	0.22	0.01		0.06	0.10	0.03	0.07	0.08	39.90	4.44
U	135			23.00			627	9012	0.85	0.24	0.01		0.06	0.12	0.03	0.07	0.08	39.90	4.45
U	136			23.80			627	8936	0.85	0.22	0.01		0.07	0.12	0.03	0.07	0.07	40.00	4.45
U	136			19.30			629	8974	0.85	0.24	0.01		0.07	0.12	0.03	0.08	0.07	38.60	4.46
U	135			21.40			626	8973	0.85	0.22	0.01		0.06	0.10	0.03	0.07	0.08	40.30	4.45
U	135			23.00			631	9013	0.87	0.22	0.01		0.07	0.12	0.03	0.07	0.07	40.90	4.43
U	136			23.30			630	9091	0.85	0.24	0.01		0.06	0.12	0.03	0.07	0.07	39.20	4.44
U	135			21.20			628	9047	0.85	0.22	0.01		0.06	0.12	0.03	0.08	0.07	38.50	4.45
V	147			25.30	61.90		551					37.46						39.50	4.42
V	153			24.90	65.00		562					38.03						39.47	4.41
V	154			24.80	65.10		552					38.60						38.55	4.43
V	153			24.50	61.40		567					38.32						36.32	4.44
V	159			24.70	64.60		560					38.17						38.67	4.41
V	157			24.50	65.80		562					38.89						37.79	4.40
V	158			24.30	63.80		570					39.03						38.98	4.44
V	163			21.70	61.10		578					38.60						38.30	4.42
W				22.57															
W				23.87															
W				23.20															
W				23.60															
W				23.03															
W				24.07															
W				22.50															
W				22.60															

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:

Combined standard uncertainty=sqrt((between lab.var/no of labs) + (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.

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Analyte	Method	Unit	S [1]	σ_L [2]	Sw [3]	CSU [4]
Co	M/ICP	ppm	14.863	8.540	4.335	3.070
Cu	M/ICP	%	5330	2297	1915	848
Cu	Titration	%	1817	1130	877	371
Au	Pb Coll	g/t	1.760	0.648	0.439	0.185
Ag	M/ICP	ppm	5.059	0.690	1.204	0.247
As	M/ICP	ppm	7941	3451	820	1414
Bi	M/ICP	ppm	50.384	29.393	22.247	11.522
Zn	M/ICP	%	442.79	482.98	111.58	197.86
Al_2O_3	XRF	%	0.036	0.029	0.015	0.010
CaO	XRF	%	0.010	0.008	0.007	0.003
Cr_2O_3	XRF	%	0.009	0.008	0.001	0.003
Fe_2O_3	XRF	%	1.726	0.828	0.461	0.319
K_2O	XRF	%	0.021	0.003	0.004	0.001
MgO	XRF	%	0.027	0.005	0.006	0.002
MnO	XRF	%	0.006	0.004	0.000	0.001
Na_2O	XRF	%	0.025	0.028	0.004	0.012
TiO_2	XRF	%	0.030	0.034	0.004	0.014
S	Comb/LECO	%	2.160	0.772	0.568	0.230
SG	pyc		0.116	0.040	0.031	0.014

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. *S_W - 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 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: AMIS0421 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.

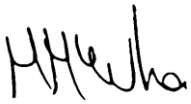
18. Availability: This product is available in Laboratory Packs containing 1kg of material and Explorer Packs containing custom weights (from 50g to 250g) of material. The Laboratory Packs are sealed bottles delivered in sealed foil pouches. The Explorer Packs contain material in standard geochem envelopes, 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.

06 May 2014

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	%	0.48	0.04	4.1	45
As	Fus	ppm	52082	5147	4.9	16
Ba	M/ICP	ppm	1103	2239	101	16
Be	M/ICP	ppm	0.12	0.08	34.2	20
Bi	Fus	ppm	636	64.9	5.1	23
Ca	M/ICP	%	0.16	0.02	7.5	54
Cd	M/ICP	ppm	52.8	7.7	7.3	64
Ce	M/ICP	ppm	5.2	0.75	7.2	24
Co	Fus	ppm	162	32.8	10.1	24
Co	XRF	ppm	150	103	34.4	16
Cr	M/ICP	ppm	129	87.4	33.9	48
Cs	M/ICP	ppm	0.21	0.06	13.0	30
Cu	Fus	ppm	158914	9121	2.9	30
Cu	XRF	ppm	155792	6071	1.9	24
Dy	M/ICP	ppm	0.26	0.12	23.4	23
Er	M/ICP	ppm	0.18	0.07	20.9	23
Eu	M/ICP	ppm	0.10	0.0	0.0	15
Fe	M/ICP	%	26.7	1.5	2.8	54
Ga	M/ICP	ppm	10.1	1.6	7.7	32
Gd	M/ICP	ppm	0.28	0.17	29.8	24
Hf	M/ICP	ppm	0.51	0.14	13.9	32
Ho	M/ICP	ppm	0.06	0.0	0.0	7
In	M/ICP	ppm	3.0	0.82	13.8	32
K	M/ICP	%	0.07	0.03	21.9	52
La	M/ICP	ppm	3.3	1.1	17.3	24
Li	M/ICP	ppm	14.0	2.3	8.3	23
LOI		%	31.5	5.6	8.8	24
Lu	M/ICP	ppm	0.04	0.01	11.2	14
Mg	M/ICP	%	0.07	0.01	7.4	45
Mn	M/ICP	ppm	300	44.0	7.3	54
Mo	M/ICP	ppm	25.3	8.1	16.0	61
Na	M/ICP	ppm	0.02	0.01	19.5	21
Nb	M/ICP	ppm	2.6	0.57	11.2	31
Nd	M/ICP	ppm	1.9	0.47	12.7	22
Ni	M/ICP	ppm	23.9	9.9	20.8	60
P	M/ICP	ppm	0.01	0.01	30.4	40
Pb	M/ICP	ppm	5956	378	3.2	64
Pr	M/ICP	ppm	0.48	0.22	23.2	24
Rb	M/ICP	ppm	2.4	0.5	9.7	31
Re	M/ICP	ppm	0.01	0.01	23.6	8
S	M/ICP	%	37.6	7.7	10.2	24
Sb	Fus	ppm	2493	539	10.8	32
Sb	M/ICP	ppm	2515	408	8.1	39
Sc	M/ICP	ppm	1.4	1.1	38.9	46
Se	M/ICP	ppm	139	28.7	10.3	24
Si	M/ICP	%	21.3	39.1	91.9	16
SiO_2	XRF	%	4.7	0.39	4.1	31
Sm	M/ICP	ppm	0.36	0.10	13.4	24
Sn	Fus	ppm	755	118	7.8	30
Sn	M/ICP	ppm	703	163	11.6	32
Sr	M/ICP	ppm	102	18.8	9.2	30
Ta	M/ICP	ppm	2.5	2.3	46.2	32
Tb	M/ICP	ppm	0.05	0.02	21.8	8
Te	M/ICP	ppm	762.8	268.1	17.6	24
Th	M/ICP	ppm	1.1	0.46	21.2	31
Ti	M/ICP	%	0.06	0.02	18.0	24
Tl	M/ICP	ppm	22.2	2.5	5.7	23
U	M/ICP	ppm	1.0	0.14	7.0	30
V	M/ICP	ppm	145	66.1	22.8	48
W	M/ICP	ppm	32.8	3.4	5.1	32
Y	M/ICP	ppm	1.5	0.65	22.4	32
Yb	M/ICP	ppm	0.23	0.08	17.5	32
Zn	Fus	ppm	10271	2109	10.3	23
Zn	XRF	ppm	9550	355	1.9	8
Zr	M/ICP	ppm	44.8	86.2	96.3	24