



AMIS0422

Certified Reference Material

**Cu Au Ag Zn Concentrate, epithermal
Marcapunta Norte Mine, Peru**

Certificate of Analysis

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

Certified Concentrations²

Cu Fus	23.82	±	2.68	%
Cu M/ICP	23.21	±	0.87	%
Cu Titration	23.08	±	0.44	%
As MICP	68822	±	5728	ppm
Sb MICP	4673	±	353	ppm
Au Pb Collection	3.47	±	0.34	g/t
Ag M/ICP	365	±	21	g/t
Zn Fus	1.58	±	0.05	ppm
Specific Gravity	4.32	±	0.08	Dimensionless
Pb 4A_MICP	6811	±	665	ppm

Provisional Concentrations

Bi M/ICP	689	±	143	ppm
Zn M/ICP	1.53	±	0.19	%

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.*

AMIS

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Major Element Recommended Concentrations and Limits (at two Standard Deviations)

Certified Concentrations

Fe ₂ O ₃	28.51	±	1.70	%
K ₂ O	0.11	±	0.01	%
MgO	0.48	±	0.04	%
MnO	0.06	±	0.006	%
S Comb/LECO	36.03	±	1.56	%

Provisional Concentrations

Al ₂ O ₃	0.53	±	0.06	%
CaO	1.67	±	0.20	%

Informational Mean

Cr ₂ O ₃	0.02	%
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1. Intended Use: AMIS0422 can be used to check analysis of samples of arsenical polymetallic 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.

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2. Origin of Material: The concentrate material for AMIS0422 was supplied by Namibia Custom Smelter (Dundee Precious Metals). The AMIS0422 concentrate is originally from the El Brocal - Marcapunta Norte copper mine located in Peru 285 kilometers east of the city of Lima and 10 kilometers south of the city of Cerro de Pasco. El Brocal (Sociedad Minera El Brocal S.A.A.) is a subsidiary of the Buenaventura Mining Company and is engaged in the extraction, concentration and sale of concentrates of polymetallic minerals—mainly zinc, copper, lead and silver.

3. Mineral and Chemical Composition: Marcapunta Norte is a high sulfidation epithermal polymetallic replacement vein Au-Cu deposit associated with a Miocene diatreme intrusion into Eocene limestone's and conglomerates. Marcapunta Norte Mine ore comprises gold mineralization in phreatomagmatic breccia's (vuggy silica) and arsenic copper enargite mineralization in mineralized mantles.

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 <54µm. Wet sieve particle size analysis of random samples confirmed the material was 98.5% <54µm. 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.

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9. Method of Certification: Twenty five laboratories were each given eight packages, comprising eight samples scientifically selected from throughout the batch. Eighteen 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 18 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 Vancouver CA
6. ALS OMAC (Ireland)
7. Bureau Veritas (Namibia)
8. Genalysis Laboratory Services (W Australia P)
9. Intertek Testing Services Ltd Shanghai (Beijing)
10. Intertek Testing Services (Philippines)
11. Mintek (South Africa)
12. Namibia Custom Smelters
13. Set Point Laboratories (Isando) SA
14. SGS Australia Pty Ltd (Newburn) WA
15. SGS Mineral Services Callao (Peru)
16. SGS Mineral Services Lakefield (Canada)
17. SGS South Africa (Pty) Ltd - Booyens JHB
18. Ultra Trace (Pty) Ltd WA

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11. Assay Data: Data as received from the laboratories for the important certified elements listed on p1 and 2 are set out below

Cu	Cu	Cu	Au	Au	Ag	Ag	As	Sb	Bi	Zn	Zn	Pb
FUS %	M/ICP %	Titration %	Pb Coll g/t	Pb Coll g/t	M/ICP g/t	M/ICP g/t	M/ICP ppm	M/ICP ppm	M/ICP ppm	FUS %	M/ICP %	M/ICP ppm
22.50	23.40	22.91	3.83	3.41	323	362	70200	4740	860	1.57	1.42	6540
22.60	23.10	23.02	3.84	3.46	340	365	69200	4670	620	1.57	1.41	6370
22.70	23.20	23.06	3.76	3.44	328	362	69100	4830	560	1.57	1.43	6500
22.60	23.50	22.91	3.77	3.30	349	363	68700	4710	790	1.58	1.42	6400
22.80	23.30	22.85	3.76	3.37	344	362	70900	4860	760	1.57	1.41	6490
22.70	22.90	22.90	3.77	3.40	330	365	71800	4940	800	1.57	1.39	6280
23.00	23.30	22.98	3.77	3.41	344	361	71100	4770	720	1.54	1.45	6340
22.70	23.70	22.89	3.79	3.47	330	365	70700	4670	670	1.54	1.44	6380
24.14	23.60	23.20	3.70	3.47	370	233	65900	4617	458	1.57	1.64	7150
24.41	23.50	23.00	3.63	3.61	369	227	65800	4614	472	1.58	1.62	7010
26.79	23.20	23.20	3.54	3.46	349	232	66900	4649	640	1.77	1.59	7000
27.11	23.20	23.20	3.50	3.52	363	233	64600	4608	605	1.76	1.61	7070
25.16	23.10	23.20	3.60	3.58	372	250	65400	4681	613	1.63	1.67	7140
24.42	22.80	23.30	3.59	3.46	369	237	67400	4727	658	1.57	1.66	7220
24.25	23.40	23.40	3.63	3.45	372	239	65200	4674	548	1.55	1.62	6990
24.95	23.30	23.20	3.53	3.45	374	240	65300	4693	656	1.60	1.62	7000
26.20	22.10	23.16	3.36	3.11	371	356	71088	4400	652	1.41	1.36	6010
25.80	22.40	23.15	3.35	3.21	368	364	72664	4500	597	1.40	1.37	5780
25.70	22.00	23.20	3.32	3.24	369	357	73559	4400	645	1.43	1.40	6430
26.20	22.40	23.17	3.34	3.22	367	357	72349	4460	601	1.43	1.39	6290
25.40	22.50	23.18	3.41	3.34	367	357	73019	4480	649	1.45	1.38	6330
26.20	22.40	23.17	3.38	3.29	365	353	71852	4440	634	1.47	1.42	6500
26.80	22.90	23.17	3.33	3.39	359	360	73158	4430	602	1.47	1.41	6320
27.00	22.90	23.16	3.37	3.12	361	358	72078	4470	645	1.43	1.39	6390
23.49	23.80	23.21	3.52	3.16	377	357	65980	4800	791	1.57	1.60	6624
22.63	24.30	23.25	3.54	2.99	363	360	66062	4800	822	1.50	1.60	6710
23.78	23.20	23.05	3.53	3.10	380	356	66371	4900	799	1.56	1.60	6663
24.23	23.50	23.09	3.51	3.25	371	357	65915	4700	743	1.71	1.59	6765
24.52	23.80	23.14	3.53	3.04	378	356	67012	4900	799	1.61	1.60	6709
23.55	23.90	23.23	3.49	3.09	379	358	67038	4900	757	1.54	1.62	6611
23.49	24.10	23.25	3.58	3.18	363	355	66728	4700	792	1.54	1.61	6756
23.98	24.40	23.35	3.61	3.66	363	356	66919	4800	765	1.55	1.60	6640
24.40	20.50	23.40	2.94	5.42	349		69700		670	1.57	1.58	7110
25.10	20.20	23.20	3.01	5.52	348		68800		700	1.57	1.58	6950
24.30	19.90	24.00	2.94	5.24	345		68800		690	1.59	1.56	6990
24.70	20.40	23.30	3.04	5.36	347		68600		640	1.57	1.57	6910
24.80	20.10	24.70	3.06	5.28	357		69300		670	1.61	1.57	7050
25.40	20.20	24.00	3.08	5.22	351		71000		680	1.59	1.57	7090
25.00	20.30	24.50	3.12	5.08	350		66900		680	1.61	1.58	7120
24.30	20.20	23.50	2.93	3.60	353		69800		730	1.58	1.58	6990
22.71	23.60	23.05	3.67	3.41	375				757	1.62	1.57	6810
22.65	23.60	23.01	3.58	3.63	375				757	1.63	1.56	6910
22.65	23.50	23.20	3.45	3.51	382				756	1.60	1.56	6830
22.68	23.50	24.08	3.41	3.64	383				755	1.59	1.54	6840
22.67	23.70	23.73	3.49	3.49	374				758	1.61	1.57	6860
22.49	24.20	23.97	3.52	3.51	376				754	1.63	1.60	6910
22.39	22.60	23.50	3.48	3.44	377				757	1.60	1.51	6820
22.91	23.30	23.40	3.62	3.84	378				760	1.61	1.57	6930
22.36	22.80	22.60	3.30	3.73	355				609	1.59		7238
22.37	23.10	22.70	3.36	3.77	360				638	1.59		7238
22.60	22.90	22.90	3.47	3.72	359				637	1.58		7238
22.56	22.90	22.90	3.33	3.73	365				648	1.61		7226
22.61	22.80	22.80	3.40	3.70	354				647	1.61		7244
22.50	23.10	22.80	3.28	3.72	357				639	1.63		7227
22.33	22.80	22.80	3.22	3.71	364				618	1.63		7244
22.36	23.10	22.80	3.43		355				621	1.66		7266
		23.00	3.55		347					1.57		7100
		23.00	3.56		352					1.55		7300
		23.00	3.56		352					1.56		7400
		23.10	3.60		356					1.58		7500
		23.00	3.57		358					1.54		7600
		23.10	3.54		362					1.55		7800
		23.00	3.62		361					1.54		7600
		23.00	3.61		358					1.58		7200
		23.15	3.16		355							
		23.18	3.21		357							
		23.09	3.07		342							
		23.06	3.55		349							
		22.92	3.40		355							
		23.04	3.31		359							
		23.10	3.22		361							
		23.07	3.54		351							
		23.04	3.76		380							
		23.41	3.63		375							
		23.39	3.58		380							
		23.37	3.59		375							
		23.45	3.60		385							
		23.42	3.63		375							
		23.41	3.58		375							
		23.42	3.59		385							

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Assay Data (Continued)

Al ₂ O ₃ XRF %	CaO XRF %	Cr ₂ O ₃ XRF %	Fe ₂ O ₃ XRF %	K ₂ O XRF %	MgO XRF %	MnO XRF %	S Comb/LECO %	S Comb/LECO %	SG pyc	SG pyc
0.53	1.72	0.03	28.11	0.11	0.52	0.06	35.80	31.00	4.33	4.35
0.53	1.72	0.03	28.12	0.11	0.50	0.06	36.30	31.10	4.35	4.34
0.54	1.73	0.03	28.07	0.11	0.51	0.06	35.60	30.70	4.35	4.36
0.53	1.73	0.03	28.09	0.11	0.50	0.06	35.70	31.90	4.29	4.35
0.54	1.72	0.03	28.15	0.11	0.51	0.06	35.50	31.90	4.28	4.34
0.54	1.71	0.03	28.19	0.11	0.52	0.06	36.30	30.80	4.32	4.37
0.54	1.71	0.03	28.02	0.11	0.51	0.06	35.90	30.90	4.34	4.38
0.55	1.72	0.03	28.18	0.11	0.51	0.06	35.30	31.10	4.32	4.33
0.50	1.68	0.02	28.74	0.11	0.56	0.06	36.85	35.31	4.45	4.38
0.50	1.66	0.03	28.38	0.11	0.57	0.06	36.65	35.20	4.49	4.37
0.51	1.66	0.03	26.81	0.10	0.57	0.06	36.14	35.26	4.37	4.36
0.49	1.68	0.02	28.02	0.11	0.56	0.06	36.64	34.65	4.47	4.36
0.51	1.68	0.02	28.59	0.11	0.59	0.06	36.27	35.18	4.46	4.37
0.49	1.67	0.02	28.74	0.11	0.59	0.06	36.41	35.20	4.23	4.36
0.51	1.67	0.02	28.09	0.11	0.57	0.06	36.94	35.23	4.30	4.35
0.50	1.66	0.03	28.09	0.11	0.55	0.06	38.11	35.66	4.23	4.35
0.57	1.75	0.03	24.33	0.11	0.48	0.06	36.40	32.20	4.30	4.21
0.55	1.75	0.03	24.92	0.11	0.48	0.06	36.80	32.17	4.33	4.01
0.60	1.62	0.03	25.04	0.13	0.45	0.06	36.60	32.32	4.33	4.23
0.55	1.75	0.03	25.50	0.11	0.46	0.06	36.70	32.22	4.30	4.08
0.57	1.76	0.03	24.91	0.11	0.48	0.06	36.70	31.90	4.33	4.15
0.57	1.76	0.03	24.83	0.11	0.48	0.06	36.80	32.31	4.35	4.24
0.55	1.74	0.03	25.22	0.11	0.48	0.06	35.90	32.41	4.30	4.29
0.55	1.75	0.03	25.17	0.11	0.48	0.06	37.10	32.12	4.34	4.26
0.50	1.45	0.01	27.88	0.09	0.42	0.05	37.00		4.35	4.60
0.51	1.52	0.01	28.17	0.10	0.44	0.05	36.30		4.35	4.60
0.53	1.53	0.01	27.88	0.10	0.46	0.05	37.00		4.35	4.65
0.54	1.51	0.01	28.17	0.10	0.45	0.05	36.90		4.34	4.69
0.51	1.50	0.01	27.74	0.10	0.44	0.05	36.30		4.36	4.68
0.51	1.47	0.01	27.59	0.10	0.44	0.05	36.90		4.34	4.65
0.52	1.49	0.01	27.88	0.10	0.44	0.05	36.90		4.35	4.68
0.51	1.49	0.01	27.74	0.10	0.44	0.05	36.90		4.34	4.69
0.47	1.79	0.04	30.45	0.12	0.46	0.06	34.70		4.38	
0.47	1.76	0.04	30.31	0.11	0.46	0.06	35.80		4.40	
0.45	1.76	0.04	30.31	0.12	0.46	0.08	35.60		4.38	
0.47	1.80	0.04	30.17	0.11	0.48	0.06	35.10		4.35	
0.49	1.76	0.03	30.74	0.12	0.46	0.06	35.00		4.38	
0.47	1.82	0.04	31.31	0.12	0.48	0.08	36.10		4.40	
0.47	1.78	0.04	29.45	0.11	0.46	0.06	35.80		4.36	
0.45	1.76	0.03	30.74	0.12	0.48	0.06	36.50		4.37	
0.59	1.74	0.01	28.38	0.11	0.48	0.07	35.90		4.27	
0.59	1.79	0.01	28.45	0.11	0.50	0.07	36.00		4.21	
0.57	1.72	0.01	28.17	0.11	0.48	0.07	35.60		4.31	
0.59	1.72	0.01	27.88	0.10	0.50	0.07	36.30		4.25	
0.59	1.75	0.01	28.02	0.10	0.48	0.07	35.90		4.22	
0.59	1.79	0.01	28.31	0.10	0.51	0.07	35.40		4.24	
0.57	1.74	0.01	28.09	0.10	0.46	0.07	35.60		4.19	
0.59	1.80	0.01	28.31	0.11	0.51	0.07	36.20		4.18	
0.55	1.69	0.02	28.31	0.12	0.48	0.06	35.12		4.08	
0.55	1.74	0.02	28.74	0.12	0.48	0.06	35.25		4.00	
0.55	1.72	0.03	28.02	0.11	0.48	0.06	36.02		3.96	
0.57	1.67	0.02	29.02	0.11	0.48	0.06	35.89		4.13	
0.55	1.72	0.03	29.31	0.12	0.48	0.06	35.77		3.96	
0.57	1.69	0.02	30.31	0.11	0.48	0.06	35.74		4.04	
0.55	1.64	0.02	30.45	0.11	0.48	0.06	35.65		4.13	
0.57	1.71	0.02	29.02	0.12	0.48	0.06	36.30		4.11	
0.51	1.48	0.01	29.92	0.11	0.50	0.06	37.52		2.53	
0.51	1.53	0.01	29.93	0.11	0.48	0.06	37.20		2.45	
0.49	1.57	0.01	30.38	0.11	0.48	0.06	37.28		2.61	
0.51	1.51	0.01	30.25	0.11	0.48	0.06	37.02		2.88	
0.53	1.55	0.01	30.26	0.11	0.48	0.06	37.47		2.88	
0.49	1.50	0.01	30.23	0.11	0.48	0.06	37.25		2.60	
0.53	1.50	0.01	30.41	0.11	0.48	0.06	37.44		2.42	
0.51	1.48	0.01	30.55	0.11	0.48	0.06	37.07		2.58	
0.61	1.92	0.03		0.30	0.46	0.06	34.80		4.31	
0.63	1.88	0.03		0.27	0.46	0.06	35.10		4.30	
0.62	1.93	0.03		0.28	0.47	0.06	34.90		4.30	
0.59	1.89	0.03		0.27	0.47	0.06	35.00		4.31	
0.60	2.05	0.03		0.28	0.48	0.06	34.80		4.29	
0.59	1.98	0.03		0.32	0.47	0.06	35.00		4.31	
0.61	1.98	0.03		0.33	0.47	0.06	35.00		4.29	
0.60	1.98	0.03		0.34	0.47	0.06	35.10		4.29	
							32.50		4.31	
							32.80		4.27	
							32.70		4.24	
							32.60		4.31	
							32.60		4.27	
							32.60		4.24	
							32.70		4.26	
							32.60		4.31	

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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:

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

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
Cu	Fus	%	14495	14138	4659	5381
Cu	M/ICP	%	11720	4312	2990	1816
Cu	Titration	%	3580	1487	997	510
Au	Pb Call	g/t	0.528	0.132	0.074	0.037
Ag	M/ICP	g/t	37.097	8.450	5.009	2.731
As	M/ICP	ppm	2864.000	3425.339	931.740	1538.926
Bi	M/ICP	ppm	84.699	66.256	39.709	25.630
Zn	Fus	ppm	685.867	201.171	187.475	80.440
Zn	M/ICP	%	926.038	1134.180	190.955	463.847
Pb	M/ICP	ppm	401.072	348.560	92.350	123.800
Sb	M/ICP	ppm	176.000	229.300	69.708	115.310
Al ₂ O ₃	XRF	%	0.036	0.033	0.010	0.012
CaO	XRF	%	0.105	0.104	0.028	0.037
Cr ₂ O ₃	XRF	%	0.009	0.007	0.001	0.003
Fe ₂ O ₃	XRF	%	1.605	0.844	0.486	0.352
K ₂ O	XRF	%	0.007	0.005	0.004	0.002
MgO	XRF	%	0.037	0.020	0.010	0.008
MnO	XRF	%	0.006	0.003	0.001	0.001
S	Comb/LECO	%	1.751	0.652	0.342	0.210
SG	pyc		0.480	0.032	0.025	0.010

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. 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 and Allan Fraser. The Certified values for Sb and As listed on p1 of this certificate fulfill the AMIS statistical criteria regarding agreement for certification and have been independently validated by Allan Fraser.

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.

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15. **Certification:** AMIS0422 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, Mike McWha, Dr Barry Smee and Smee and Associates Ltd and Allan Fraser; accept no liability for any decisions or actions taken following the use of the reference material.

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Reason for Version v2.00: Certification of Pb 4A_MICP by Allan Fraser

Version v2.00 replaces the original report of AMIS0422 Certification

Version v2.00

Date of Version v1.00: 28 November 2016

Reason for Version v1.00: Certification of Cu FUS, Zn FUS, As and Sb M/ICP

Version: v1.00

Date of Version 000: 07 May 2014

Version: 000

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Appendix - Uncertified trace element statistics

Analyte	Method	Unit	Mean	2SD	RSD%	n
Al	M/ICP	%	0.29	0.04	7.1	46
As	Fus	ppm	68560	6748	4.9	16
B	M/ICP	ppm	37.8	2.1	2.8	8
Ba	M/ICP	ppm	49.6	90.5	91.2	24
Be	M/ICP	ppm	0.10	0.0	0.0	8
Bi	Fus	ppm	739.4	109.6	7.4	24
Ca	M/ICP	%	1.2	0.21	8.7	45
Cd	M/ICP	ppm	46.6	9.0	9.6	47
Ce	M/ICP	ppm	30.8	2.7	4.4	23
Co	Fus	ppm	25.6	13.3	26.0	24
Co	M/ICP	ppm	21.0	4.6	11.0	45
Cr	M/ICP	ppm	148	82.4	27.8	48
Cs	M/ICP	ppm	0.37	0.06	8.3	23
Cu	Fus	%	24.3	27412	5.6	32
Cu	XRF	%	23.3	7707	1.7	22
Dy	M/ICP	ppm	1.2	0.19	7.8	24
Er	M/ICP	ppm	0.45	0.13	14.2	24
Eu	M/ICP	ppm	0.77	0.06	4.0	22
Fe	M/ICP	%	20.2	1.2	3.0	46
Ga	M/ICP	ppm	16.8	3.5	10.3	32
Gd	M/ICP	ppm	2.5	0.30	5.9	22
Hf	M/ICP	ppm	0.92	0.70	37.7	32
Ho	M/ICP	ppm	0.18	0.06	16.5	24
In	M/ICP	ppm	18.9	4.9	13.1	32
K	M/ICP	%	0.10	0.01	5.0	39
La	M/ICP	ppm	13.2	3.2	12.1	32
Li	M/ICP	ppm	2.3	0.35	7.6	14
LOI		%	30.1	3.7	6.2	24
Lu	M/ICP	ppm	0.05	0.03	30.9	16
Mg	M/ICP	%	0.29	0.02	3.3	38
Mn	M/ICP	ppm	498.9	41.7	4.2	38
Mo	M/ICP	ppm	12.1	7.9	32.5	44
Na	M/ICP	%	0.02	0.01	34.4	16
Na ₂ O	XRF	%	0.04	0.05	62.4	40
Nb	M/ICP	ppm	2.3	0.80	17.6	31
Nd	M/ICP	ppm	17.2	0.84	2.4	22
Ni	M/ICP	ppm	25.9	13.6	26.2	52
P	M/ICP	ppm	1366	175	6.4	40
Pr	M/ICP	ppm	4.1	0.25	3.0	23
Rb	M/ICP	ppm	3.0	2.2	37.5	32
S	M/ICP	%	34.6	1.9	2.7	16
Sb	Fus	ppm	4467	151	1.7	15
Sc	M/ICP	ppm	2.1	1.6	38.4	37
Se	M/ICP	ppm	23.2	9.7	20.8	16
Si	M/ICP	%	1.4	0.03	1.3	8
SiO ₂	XRF	%	2.8	0.21	3.8	31
Sm	M/ICP	ppm	3.3	0.23	3.4	22
Sn	Fus	ppm	4138	812	9.8	24
Sn	M/ICP	ppm	4076	860	10.5	32
Sr	M/ICP	ppm	253	97.6	19.3	39
Ta	M/ICP	ppm	1.3	1.4	50.5	32
Tb	M/ICP	ppm	0.28	0.06	10.5	30
Te	M/ICP	ppm	263	122	23.1	31
Th	M/ICP	ppm	3.4	2.4	35.4	32
Ti	M/ICP	%	0.05	0.03	31.2	24
TiO ₂	XRF	%	0.08	0.04	24.6	40
Tl	M/ICP	ppm	10.0	1.7	8.6	32
Tm	M/ICP	ppm	0.06	0.0	0.0	7
U	M/ICP	ppm	3.9	0.85	10.9	39
V	M/ICP	ppm	851	120	7.0	45
W	M/ICP	ppm	81.8	45.8	28.0	45
Y	M/ICP	ppm	4.3	2.0	23.2	32
Yb	M/ICP	ppm	0.34	0.11	15.9	30
Zn	Fus	ppm	15576	1132	3.6	37
Zr	M/ICP	ppm	83.5	121	72.3	24

End of Certificate

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