

AMIS0338

Certified Reference Material

Li 0.168% Ta 43ppm Pegmatite AU

Certificate of Analysis

Recommended Concentrations and Limits¹ (at two Standard Deviations)

Certified Concentrations²

Li M/ICP	1682	±	182	ppm
Li FUS	1707	±	318	ppm
Nb FUS	20.3	±	1.9	ppm
Nb M/ICP	19	±	5	ppm
Ta FUS	43	±	10	ppm
Th FUS	1.4	±	0.3	ppm
Th MICP	1.3	±	0.4	ppm
U FUS	2.1	±	0.7	ppm
U M/ICP	1.9	±	0.3	ppm
Specific Gravity	2.7	±	0.07	Dimensionless

Provisional Concentrations

As M/ICP	11	±	2	ppm
Sn M/ICP	35.6	±	7	ppm
F ISE	941	±	152	ppm

Informational Concentrations

Nb XRF	18	ppm
Ta M/ICP	40.1	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.

AMIS

(A Division of Torre Analytical Services (Pty) Limited)
 (Reg. No. 1989/000201/07)

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Directors: JT Botes, R Naidoo, NN Robinson, M Padayachee

Major Elements

Certified Concentrations **(at two Standard Deviations)**

Al ₂ O ₃	13.05	±	0.18	%
CaO	0.59	±	0.02	%
Fe ₂ O ₃	1.63	±	0.09	%
K ₂ O	3.71	±	0.06	%
MgO	0.41	±	0.03	%
MnO	1.00	±	0.03	%
Na ₂ O	3.30	±	0.08	%
P ₂ O ₅	0.16	±	0.01	%
SiO ₂	73.93	±	0.78	%

Provisional Concentrations

Cr ₂ O ₃	0.70	±	0.01	%
LOI	0.88	±	0.18	%

Informational Concentration

TiO ₂	0.040	%
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1. Intended Use: AMIS0338 can be used to check analysis of samples of pegmatitic lithium tantalum ores, with a similar grade and matrix.

It is a matrix matched Certified Reference Material, fit for use as control samples in routine assay laboratory quality control when inserted within runs of samples and measured in parallel to the unknown. Its purpose is to monitor inter-laboratory or instrument bias and within lab precision. It can be used, indirectly, to establish the traceability of results to an SI system of units.

The recommended concentrations and limits for this material are property values based on a measurement campaign (round robin) and reflect consensus results from the laboratories that participated in the round robin.

Slight variations in analytical procedures between laboratories will reflect as slight biases to the recommended concentrations (see Section 19). Good laboratories will report results within the two standard deviation levels with a failure rate of <10 %.

The material can also be used for method development and for the calibration of equipment

2. Origin of Material: AMIS0338 is a commissioned CRM made using ore sourced from the Mt Cattlin Spodumene Mine situated at Ravensthorpe 430km east south east of Perth in Western Australia. The ore was supplied by Galaxy Resources through SGS Mineral Services Ltd. The Mt Cattlin project is located in the Phillips River Mineral Field, within the Ravensthorpe Terrain, which forms part of the Archaean greenstone belt. The pegmatite's which comprise the orebodies comprise sub-horizontal dykes, hosted by both volcanic and intrusive rocks.

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3. Mineral and Chemical Composition: The pegmatite's comprise quartz, albite, microcline, perthite, spodumene, muscovite and lepidolite. The predominant lithium mineral is spodumene. There are economically significant grades of tantalum present as columbite, tantalite and microlite.

4. Appearance: The material is a very fine powder. It is colored Brownish Grey (5YR 6/2)

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 scientifically selected for homogeneity testing and third party analysis. Statistical analysis of both homogeneity and the consensus test results were carried out by independent statisticians.

7. Methods of Analysis requested:

1. Multi element scan to include Li, Ta, Nb, As, Bi, Sb, Sn, U, Th. Fusion, ICP-OES or ICP-MS.
2. Multi element scan. Multi-acid digest ICP-OES or ICP-MS.
3. F by ISE.
4. Ta, Nb, U, Th. XRF.
5. Majors (Al₂O₃, CaO, Cr₂O₃, Fe₂O₃, K₂O, MgO, MnO, Na₂O, P₂O₅, SiO₂, TiO₂, V₂O₅. 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. Report all QC data, to include replicates, blanks and certified reference materials used.

9. Method of Certification: Twenty two laboratories were each given eight scientifically selected packages of sample. Seventeen of the laboratories submitted results.

Final limits were calculated after first determining if all data was compatible within a spread normally expected for similar analytical methods done by reputable laboratories. Data from any one laboratory was then removed from further calculations when the mean of all analyses from that laboratory failed a "t test" of the global means of the other laboratories. The means and standard deviations were then re-calculated using all remaining data. Any analysis that fell outside of the new two standard deviations was removed from the ensuing data base. The mean and standard deviations were again calculated using the remaining data.

The "between-laboratory" standard deviation is used in the calculation to eliminate technically and statistically invalid data. Upper and lower limits are based on the standard deviation of the remaining data, which reflect individual analyses and can be used to monitor accuracy in routine laboratory quality control. This is different to limits based on standard deviations derived from grouped set of

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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 22 laboratories that provided results timeously and 2 laboratories that provided results for re-certification were (not in same order as in the table of assays):

1. Acme Analytical Laboratories Chile
2. ACME Analytical Laboratories Ltd CA
3. Activation Laboratories Pty Ltd (ActLabs) CA
4. ALS Chemex Laboratory Group Vancouver CA
5. ALS OMAC (Ireland)
6. Genalysis Laboratory Services (W Australia P)
7. Intertek Testing Services Ltd Shanghai (Beijing)
8. Intertek Utama Services (Indonesia)
9. Labtium Inc Finland
10. Set Point Laboratories (Isando) SA
11. SGS Australia Pty Ltd (Newburn) WA
12. SGS Geosol Laboratories Ltda (Brazil)
13. SGS Mineral Services Callao (Peru)
14. SGS Mineral Services Lakefield (Canada)
15. SGS South Africa (Pty) Ltd - Booyens JHB
16. SGS Vancouver (Canada)
17. Shiva Analyticals India
18. UIS Analytical Services (pty) Ltd
19. 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 P2 are set out below.

Li FUS ppm	Li M/CP ppm	Ta FUS ppm	Ta M/CP ppm	Th FUS ppm	Th M/CP ppm	U FUS ppm	U M/CP ppm	As M/CP ppm	Nb FUS ppm	Nb M/CP ppm	Nb XRF ppm	Sn M/CP ppm	F ISE ppm
1767	1519	40.0	42.8	1.2	1.3	1.8	1.9	10.0	20.0	16.7	16.0	31.1	900
1767	1578	40.0	42.8	1.3	1.3	1.9	1.7	10.0	20.0	17.7	15.0	32.8	900
1814	1561	30.0	40.1	1.5	1.3	1.8	1.8	10.0	20.0	17.8	15.0	31.9	900
1767	1478	30.0	40.7	1.3	1.3	1.8	1.6	10.0	10.0	17.0	16.0	31.6	1000
1767	1656	40.0	43.6	1.2	1.2	1.7	1.9	11.0	20.0	17.4	16.0	34.3	900
1597	1585	40.0	40.7	1.9	1.3	1.9	1.7	10.0	10.0	17.2	15.0	31.6	900
1648	1592	40.0	44.4	1.2	1.3	1.7	1.9	10.0	10.0	18.8	15.0	33.8	900
1682	1564	40.0	43.2	1.3	1.2	1.7	1.9	12.0	10.0	17.2	15.0	32.2	900
1594	1760	45.4	46.7	1.6	1.1	2.1	1.7	9.0	20.3	22.6	16.0	37.5	950
1620	1810	42.4	45.8	1.6	1.0	2.1	1.7	10.0	18.7	22.0	16.0	37.7	950
1671	1790	46.4	45.8	1.5	1.1	2.1	1.9	11.0	21.5	22.0	16.0	37.1	955
1628	1780	43.4	45.6	1.5	1.1	2.1	1.6	11.0	18.7	21.9	16.0	37.8	965
1626	1800	44.2	45.0	1.6	1.1	2.2	2.0	10.0	18.9	21.9	16.0	37.2	980
1710	1830	52.6	46.4	1.6	1.2	2.1	1.8	11.0	23.3	22.0	17.0	36.8	900
1710	1780	43.4	47.1	1.5	1.3	2.1	1.7	11.0	18.5	22.1	16.0	38.6	1030
1710	1790	42.7	46.1	1.5	1.3	2.2	1.7	10.0	18.5	21.8	16.0	37.9	935
1700	1448	41.4	29.6	1.5	1.4	2.0	1.9	12.0	21.0	15.8	20.0	36.0	860
1740	1442	40.1	25.1	1.5	1.4	2.5	1.8	11.0	22.0	15.2	20.0	35.8	780
1760	1543	43.5	19.3	1.5	1.4	2.5	1.9	12.0	22.0	14.6	20.0	35.1	840
1750	1567	39.8	30.1	1.5	1.4	2.0	2.0	11.0	21.0	17.1	20.0	35.3	780
1780	1549	41.5	28.5	1.5	1.5	2.0	2.0	11.0	22.0	15.7	20.0	35.1	830
2093	1643	41.5	30.5	1.5	1.4	2.5	1.9	12.0	22.0	17.8	10.0	34.9	820
2133	1690	40.0	25.2	1.5	1.6	2.5	1.9	11.0	20.0	14.8	20.0	34.6	810
2180	1661	41.4	27.9	1.5	1.4	2.0	1.9	11.0	20.0	16.1	20.0	34.5	840
2161	1640	50.0	70.0	1.1	1.4	2.0	2.1	12.9	20.0	22.5	20.0	35.0	1010
2266	1700	50.0	80.0	1.3	1.4	2.0	1.9	11.4	20.0	20.8	10.0	35.0	1000
2257	1730	50.0	70.0	1.1	1.3	1.9	1.9	11.5	20.0	20.5	10.0	34.0	970
2009	1680	50.0	80.0	1.3	1.3	2.0	1.9	11.8	20.0	20.2	20.0	35.0	980
2164	1660	50.0	70.0	1.2	1.0	1.9	2.0	11.9	20.0	20.6	10.0	35.0	970
1449	1720	60.0	80.0	1.3	1.2	1.9	1.8	11.7	20.0	19.9	25.0	35.0	880
1389	1710	50.0	80.0	1.2	1.5	2.0	1.8	10.6	20.0	20.2	25.0	35.0	862
1397	1700	50.0	80.0	1.3	1.5	1.9	1.9	11.4	20.0	20.7	24.0	35.0	909
1343	1704	47.5	55.8	1.6	1.5	2.1	2.0	12.0	20.0	16.9	25.0	50.0	920
1323	1720	49.0	55.9	1.3	1.5	2.2	2.0	10.0	20.0	17.6	25.0	40.0	864
1417	1750	47.5	52.6	1.4	1.5	2.1	1.9	10.0	20.0	17.0	26.0	50.0	896
1438	1739	47.0	56.6	1.4	1.5	2.3	2.1	10.0	20.0	16.8	25.0	40.0	816
1519	1871	48.5	52.6	1.7	1.5	2.8	2.0	10.0	20.0	16.5	27.0	50.0	964
1803	1811	47.0	54.9	1.5	1.4	2.7	1.9	12.0	20.0	16.5	17.0	50.0	1000
1931	1767	47.5	54.6	1.3	1.4	3.3	2.2	10.0	20.0	17.6	14.0	40.0	1000
1871	1753	47.0	54.1	1.4	1.4	2.7	2.0	12.0	20.0	16.0	17.0	40.0	900
1925	1640	33.7	43.5		1.4			52.0	21.0	19.0	18.0	40.0	1000
1835	1610	28.1	44.0		1.5			55.3	22.0	18.0	16.0	40.0	1000
1816	1660	23.0	44.2		1.6			56.7	20.0	18.0	12.0	40.0	1000
1847	1640	33.4	46.6		1.4			53.7	22.0	17.0	15.0	40.0	1000
1885	1680	26.2	46.0		1.5			64.0	19.0	18.0	13.0	42.0	1000
	1650	27.8	43.1		1.4			57.7	21.0	17.0		41.0	1100
	1660	24.2	43.4					60.2	19.0	18.0		39.0	1600
	1640	28.1	43.8					55.3	22.0	18.0		40.0	2100
		39.0	26.2					11.0	23.3			30.0	1400
		37.0	27.9					12.0	24.2			30.0	1800
		39.0	25.9					11.0	20.7			30.0	1300
		42.0	22.1					10.0	19.7			30.0	1800
		43.0	26.8					13.0	21.5			40.0	1400
		42.0	28.9					10.0	21.3			30.0	1130
		43.0	23.1					11.0	19.7			30.0	1103
		42.0	28.1					10.0	23.0			30.0	1071
			42.0					13.0	21.0				1022
			41.0					13.0	21.0				1020
			39.0					10.0	20.0				1129
			40.0					15.0	20.0				985
			40.0					15.0	20.0				1036
			39.0					12.0	21.0				
			41.0					16.0	20.0				
			41.0										

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Assay data (Cont)

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 %	Na ₂ O XRF %	P ₂ O ₅ XRF %	SiO ₂ XRF %	TiO ₂ XRF %	LOI %	LOI %	SG pyc	SG pyc
12.9	0.59	0.08	1.65	3.72	0.39	1.00	3.28	0.16	73.6	0.06	1.00	0.70	2.62	2.72
12.9	0.59	0.08	1.63	3.70	0.40	0.99	3.28	0.15	73.8	0.03	1.01	0.70	2.62	2.69
12.9	0.59	0.07	1.61	3.72	0.39	1.01	3.31	0.15	73.4	0.03	1.01	0.80	2.62	2.70
12.8	0.59	0.07	1.63	3.71	0.40	0.99	3.28	0.16	73.3	0.03	1.02	0.70	2.62	2.72
12.9	0.58	0.07	1.61	3.69	0.39	0.99	3.29	0.15	73.6	0.04	1.02	0.80	2.60	2.69
12.9	0.58	0.07	1.62	3.72	0.39	0.99	3.32	0.16	73.6	0.05	0.98	0.90	2.62	2.70
12.9	0.58	0.07	1.60	3.73	0.40	0.98	3.30	0.15	73.4	0.06	1.00	0.80	2.62	2.71
12.9	0.58	0.07	1.59	3.71	0.40	0.99	3.28	0.15	73.3	0.03	1.00	0.80	2.61	2.70
13.0	0.59	0.07	1.62	3.73	0.41	1.01	3.34	0.16	73.9	0.05	0.79	0.88	2.77	2.69
13.0	0.59	0.08	1.63	3.71	0.41	1.00	3.33	0.16	73.9	0.04	0.79	0.86	2.78	2.69
13.0	0.59	0.07	1.63	3.73	0.41	1.02	3.33	0.16	73.9	0.04	0.79	0.92	2.72	2.72
13.0	0.59	0.08	1.62	3.71	0.41	1.03	3.36	0.16	73.9	0.04	0.79	0.87	2.80	2.69
13.0	0.60	0.07	1.64	3.73	0.41	1.00	3.35	0.16	73.9	0.04	0.79	0.88	2.78	2.69
13.0	0.59	0.07	1.63	3.74	0.41	1.02	3.32	0.16	73.9	0.04	0.80	0.85	2.63	2.72
13.0	0.60	0.07	1.62	3.74	0.43	1.02	3.35	0.16	73.8	0.05	0.79	0.93	2.79	2.71
13.0	0.59	0.07	1.63	3.71	0.40	1.02	3.34	0.16	73.9	0.04	0.79	0.90	2.70	2.67
13.0	0.58	0.07	1.60	3.71	0.42	1.01	3.28	0.16	73.9	0.04	0.85		2.71	2.65
13.0	0.57	0.07	1.60	3.68	0.42	1.00	3.25	0.16	73.6	0.04	0.83		2.71	2.65
13.0	0.58	0.07	1.60	3.70	0.42	1.01	3.28	0.16	73.9	0.04	0.90		2.69	2.66
13.0	0.57	0.06	1.60	3.69	0.42	1.01	3.26	0.16	73.6	0.04	0.86		2.73	2.64
13.0	0.58	0.07	1.60	3.71	0.42	1.01	3.28	0.16	73.9	0.04	0.88		2.78	2.65
13.1	0.58	0.07	1.61	3.73	0.42	1.02	3.29	0.16	74.2	0.04	0.83		2.74	2.63
13.0	0.57	0.06	1.59	3.68	0.41	1.00	3.26	0.16	73.5	0.04	0.90		2.70	2.62
13.0	0.58	0.07	1.60	3.70	0.42	1.01	3.27	0.16	73.9	0.04	0.85		2.73	
13.0	0.59	0.07	1.63	3.77	0.40	1.01	3.23	0.16	73.6	0.03	0.84		2.69	
12.9	0.59	0.07	1.64	3.75	0.41	1.01	3.25	0.16	73.8	0.04	0.83		2.71	
13.0	0.59	0.07	1.64	3.76	0.39	1.02	3.26	0.16	74.1	0.05	0.84		2.69	
13.0	0.59	0.08	1.62	3.76	0.39	1.03	3.23	0.16	74.0	0.04	0.84		2.70	
12.8	0.59	0.07	1.64	3.77	0.41	1.02	3.23	0.16	73.7	0.04	0.84		2.69	
13.1	0.60	0.07	1.64	3.76	0.41	1.03	3.25	0.16	74.3	0.04	0.83		2.68	
13.1	0.60	0.06	1.62	3.78	0.41	1.02	3.26	0.16	74.1	0.03	0.85		2.67	
13.0	0.59	0.06	1.63	3.78	0.39	1.01	3.23	0.16	73.7	0.04	0.84		2.72	
13.2	0.60	0.07	1.61	3.71	0.42	1.02	3.30	0.16	74.3	0.04	1.00		2.73	
13.1	0.59	0.07	1.61	3.71	0.42	1.02	3.31	0.17	74.2	0.04	1.00		2.72	
13.1	0.59	0.07	1.62	3.69	0.41	1.02	3.31	0.17	74.4	0.04	1.00		2.74	
13.1	0.59	0.07	1.63	3.71	0.41	1.02	3.31	0.16	74.4	0.04	1.00		2.72	
13.1	0.59	0.07	1.62	3.70	0.42	1.02	3.33	0.17	74.5	0.04	1.00		2.73	
13.1	0.59	0.07	1.64	3.72	0.41	1.02	3.30	0.17	74.4	0.04	1.00		2.72	
13.1	0.59	0.07	1.63	3.69	0.42	1.02	3.33	0.17	74.6	0.04	1.00		2.72	
13.1	0.59	0.07	1.62	3.72	0.42	1.02	3.32	0.16	74.4	0.04	1.00		2.71	
13.0	0.60	0.07	1.73	3.72	0.40	1.03	3.29	0.17	74.9	0.05	0.91		2.66	
13.1	0.60	0.06	1.74	3.76	0.41	1.03	3.33	0.17	75.2	0.05	0.90		2.63	
13.0	0.61	0.06	1.75	3.73	0.40	1.03	3.34	0.17	75.3	0.05	0.93		2.64	
13.1	0.61	0.08	1.75	3.71	0.39	1.02	3.32	0.16	75.1	0.05	0.94		2.62	
13.0	0.60	0.07	1.74	3.76	0.41	1.02	3.32	0.17	75.2	0.05	0.92		2.67	
13.0	0.59	0.06	1.72	3.70	0.39	1.02	3.26	0.16	74.9	0.05	0.96		2.62	
13.1	0.60	0.06	1.77	3.72	0.40	1.02	3.28	0.16	75.1	0.05	0.94		2.64	
13.1	0.62	0.06	1.77	3.74	0.39	1.02	3.32	0.16	75.1	0.05	0.95		2.65	
13.1	0.59	0.07	1.62	3.69	0.44	0.99	3.52	0.17	73.5	0.05	0.88		2.60	
13.1	0.58	0.07	1.62	3.69	0.45	0.99	3.51	0.17	73.5	0.04	0.87		2.63	
13.1	0.58	0.07	1.62	3.71	0.45	1.00	3.48	0.17	73.5	0.04	0.86		2.57	
13.1	0.58	0.07	1.62	3.69	0.45	1.00	3.53	0.17	73.6	0.04	0.85		2.58	
13.2	0.59	0.07	1.63	3.72	0.44	1.00	3.51	0.17	73.6	0.05	0.86		2.61	
13.1	0.59	0.07	1.63	3.72	0.46	1.00	3.52	0.16	73.5	0.05	0.88		2.59	
13.2	0.59	0.07	1.63	3.72	0.45	1.00	3.50	0.17	73.6	0.04	0.86		2.63	
13.1	0.59	0.07	1.62	3.72	0.45	1.00	3.50	0.17	73.6	0.05	0.84		2.58	
13.2	0.58	0.07	1.58	3.72	0.37	0.99	3.23	0.16	74.8	0.04	1.04		2.73	
13.1	0.57	0.07	1.56	3.64	0.39	0.97	3.30	0.16	73.7	0.04	1.06		2.74	
13.1	0.58	0.06	1.55	3.66	0.40	0.98	3.28	0.17	74.1	0.04	1.05		2.73	
13.2	0.57	0.07	1.65	3.70	0.39	0.98	3.26	0.16	74.7	0.04	1.05		2.72	
13.2	0.57	0.07	1.58	3.69	0.40	0.97	3.23	0.16	74.3	0.04	1.09		2.72	

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Assay data (Cont)

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 %	Na ₂ O XRF %	P ₂ O ₅ XRF %	SiO ₂ XRF %	TiO ₂ XRF %	LOI %	LOI %	SG pyc	SG pyc
13.2	0.57	0.07	1.58	3.72	0.38	0.98	3.22	0.16	74.7	0.04	1.08		2.73	
13.1	0.58	0.07	1.69	3.69	0.38	0.98	3.22	0.16	74.4	0.04	1.04		2.73	
13.1	0.57	0.06	1.57	3.66	0.39	0.97	3.39	0.16	74.2	0.04	1.09		2.73	
13.1	0.58	0.06	1.56	3.69	0.41	1.01	3.36	0.18	73.5	0.04	0.82		2.67	
13.2	0.59	0.07	1.63	3.76	0.42	0.99	3.32	0.18	75.0	0.04	0.80		2.67	
13.2	0.58	0.07	1.58	3.71	0.43	1.02	3.35	0.18	73.9	0.05	0.82		2.68	
13.2	0.59	0.07	1.60	3.73	0.42	1.00	3.34	0.18	74.3	0.05	0.80		2.66	
13.1	0.57	0.07	1.56	3.68	0.42	1.00	3.36	0.18	73.3	0.04	0.84		2.68	
13.1	0.57	0.07	1.56	3.66	0.41	1.00	3.29	0.17	73.3	0.04	0.80		2.66	
13.1	0.58	0.08	1.59	3.65	0.42	1.02	3.36	0.18	73.6	0.04	0.80		2.67	
13.1	0.59	0.06	1.57	3.65	0.43	1.01	3.35	0.18	73.2	0.04	0.80		2.67	
13.2	0.59	0.06	1.91	3.70	0.30	1.10		0.17	73.6	0.03	0.82		2.71	
13.2	0.59	0.05	1.75	3.73	0.28	1.11		0.17	74.1	0.03	0.74		2.71	
13.2	0.59	0.05	1.77	3.67	0.28	1.10		0.17	73.6	0.03	0.79		2.71	
13.3	0.60	0.05	1.74	3.75	0.32	1.11		0.16	74.3	0.03	0.72		2.71	
13.1	0.58	0.05	1.74	3.71	0.26	1.11		0.16	73.8	0.03	0.77		2.71	
13.3	0.56	0.05	1.76	3.71	0.32	1.11		0.17	74.4	0.03	0.77		2.72	
13.3	0.59	0.05	1.81	3.79	0.29	1.11		0.16	75.1	0.03	0.81		2.71	
13.3	0.59	0.05	1.77	3.72	0.27	1.11		0.16	74.7	0.03	0.79		2.71	
13.0	0.63	0.04	1.67	3.65	0.43	0.97			74.1	0.05	0.94		2.72	
13.0	0.63	0.05	1.70	3.68	0.43	0.98			74.2	0.05	0.95		2.71	
13.0	0.63	0.05	1.68	3.67	0.44	0.98			74.0	0.05	0.94		2.72	
13.0	0.62	0.04	1.67	3.67	0.42	0.98			74.0	0.05	0.92		2.71	
13.0	0.63	0.03	1.67	3.68	0.42	0.98			74.4	0.04	0.93		2.67	
13.0	0.63	0.03	1.68	3.67	0.44	0.99			74.3	0.04	0.92		2.71	
13.0	0.63	0.04	1.67	3.66	0.43	0.99			74.3	0.04	0.96		2.71	
13.0	0.62	0.03	1.68	3.66	0.42	0.98			74.0	0.04	0.95		2.70	

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.

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Analyte	Method	Unit	S ¹	σ L ²	SW ³	CSU ⁴
Li	FUS	ppm	159	177	36	72
Li	M/ICP	ppm	91	99	43	41
Ta	FUS	ppm	4.84	4.41	2.47	2.15
Ta	M/ICP	ppm	9.8	10.98	1.99	4.16
Th	FUS	ppm	0.17	0.20	0.09	0.10
Th	M/ICP	ppm	0.18	0.17	0.06	0.08
U	FUS	ppm	0.36	0.34	0.23	0.16
U	M/ICP	ppm	0.14	0.13	0.10	0.06
As	M/ICP	ppm	0.98	0.51	0.87	0.23
Nb	FUS	ppm	0.96	0.48	0.83	0.20
Nb	M/ICP	ppm	2.32	2.83	0.61	1.27
Nb	XRF	ppm	4.22	4.30	2.40	1.79
Sn	M/ICP	ppm	3.51	3.47	1.54	1.33
F	ISE	ppm	75.8	76.0	34.1	29.1
Al ₂ O ₃	XRF	%	0.091	0.067	0.047	0.021
CaO	XRF	%	0.009	0.006	0.005	0.002
Cr ₂ O ₃	XRF	%	0.004	0.002	0.004	0.001
Fe ₂ O ₃	XRF	%	0.048	0.040	0.020	0.013
K ₂ O	XRF	%	0.029	0.018	0.020	0.006
MgO	XRF	%	0.013	0.011	0.007	0.004
MnO	XRF	%	0.017	0.015	0.007	0.005
Na ₂ O	XRF	%	0.040	0.037	0.020	0.013
P ₂ O ₅	XRF	%	0.005	0.004	0.004	0.001
SiO ₂	XRF	%	0.392	0.280	0.249	0.093
TiO ₂	XRF	%	0.006	0.004	0.004	0.001
LOI		%	0.089	0.068	0.027	0.019
SG	pyc		0.035	0.024	0.021	0.007

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. Certified values: The Certified, Provisional and Informational values listed on p1 and p2 of this certificate fulfil the AMIS statistical criteria regarding agreement for certification and have been independently validated by Ms Margaret Fairhurst. The Certified values listed on p1 M/ICP (Nb, Th, U), FUS (Th, U, Li, Ta) of this certificate fulfil 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 and who have maintained measurement traceability during the analytical process.

15. Certification: AMIS0338 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.

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17. Minimum sample size: The majority of laboratories reporting used a 0.5g sample size for the ICP and a 30g sample size for the fire assay. These are the recommended minimum sample sizes for the use of this material.

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

19. Recommended use: The data used to characterize this CRM has been scrutinized using outlier treatment techniques. This, together with the number of participating laboratories, should overcome any “inter-laboratory issues” and should lead to a very accurate measure for the given methods, notwithstanding the underlying assumption that what the good inter-laboratory labs reported was accurate. However an amount of bad data might have had an effect, resulting in limits which in some situations might be too broad for the effective monitoring of a single analytical method, laboratory or production process. Users should set their own limits based on their own data quality objectives and control measurements, after determining the performance characteristics of their own particular method, using a minimum of 20 analyses using this CRM. User set limits should normally be within the limits recommended on p1 and 2 of this certificate.

20. Legal Notice: This certificate and the reference material described in it have been prepared with due care and attention. However AMIS a Division of Torre Analytical Services (Pty) Ltd, Nozibele Mbangula, Margaret M. Fairhurst, Thivhafuni Matodzi and Allan Fraser; accept no liability for any decisions or actions taken following the use of the reference material.

21 September 2015

Amended – 06 January 2017-Certified by Allan Fraser M/ICP (Nb, Th, U), FUS (Th, U)

Amended – 06 June 2017-Certified by Allan Fraser FUS (Li,Ta)

Amended- 24 January 2020- Amendment of Certificate name

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Certifying Officers:



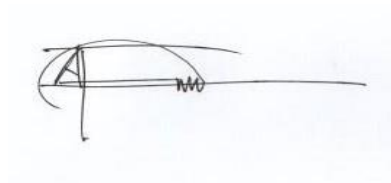
African Mineral Standards: _____
Nozibele Mbangula



Geochemist: _____
Margaret M. Fairhurst, PG, MAusIMM
Oreval



African Mineral Standards: _____
Thivhafuni Matodzi



Geochemist: _____
Allan Fraser
M.Sc. (Geology), N.D. (Analytical Chem.), Pr.Sci.Nat.

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Appendix – uncertified element statistics

Analyte	Method	Unit	Mean	2SD	RSD%	n
Ag	M/ICP	ppm	3.3	0.70	10.5	57
Al	M/ICP	%	6.0	1.5	12.8	55
As	M/ICP	ppm	10.7	1.8	8.3	54
Ba	M/ICP	ppm	203	30.9	7.6	55
Be	M/ICP	ppm	109	16.4	7.6	47
Bi	FUS	ppm	10.1	1.0	5.1	23
Bi	FUS	ppm	10.1	2.8	13.7	44
Ca	M/ICP	%	0.40	0.07	9.2	54
Cd	M/ICP	ppm	0.11	0.04	20.5	11
Ce	M/ICP	ppm	3.0	0.55	9.2	38
Co	M/ICP	ppm	4.8	1.3	13.9	51
Cr	M/ICP	ppm	316	139	22.0	60
Cs	M/ICP	ppm	264	34.0	6.4	32
Cu	M/ICP	ppm	1948	170	4.4	60
Dy	M/ICP	ppm	0.39	0.12	15.9	32
Er	M/ICP	ppm	0.20	0.0	0.0	29
Eu	M/ICP	ppm	0.10	0.03	17.9	29
Fe	M/ICP	%	1.1	0.13	5.8	53
Ga	M/ICP	ppm	33.2	1.7	2.6	38
Gd	M/ICP	ppm	0.40	0.10	12.7	32
Hf	M/ICP	ppm	0.93	0.18	9.6	47
Ho	M/ICP	ppm	0.07	0.02	13.4	16
K	M/ICP	%	2.9	0.25	4.3	54
La	M/ICP	ppm	1.4	0.59	20.7	48
Lu	M/ICP	ppm	0.03	0.01	18.6	15
Mg	M/ICP	%	0.24	0.04	8.4	53
Mn	M/ICP	ppm	7345	941	6.4	63
Mo	M/ICP	ppm	4.2	0.89	10.7	55
Na	M/ICP	%	2.4	0.18	3.9	53
Nd	M/ICP	ppm	1.3	0.43	15.9	32
Ni	M/ICP	ppm	14.0	4.4	15.9	60
P	M/ICP	ppm	697	60.0	4.3	37
Pb	M/ICP	ppm	15.2	4.5	14.7	45
Pr	M/ICP	ppm	0.36	0.11	14.5	32
Rb	M/ICP	ppm	3318	708	10.7	16
S	M/ICP	%	0.06	0.01	9.8	37
Sb	FUS	ppm	4.2	0.90	10.8	24
Sb	M/ICP	ppm	4.0	0.87	11.0	43
Sc	M/ICP	ppm	1.0	<0.0001	<0.0001	35
Si	M/ICP	%	34.2	0.35	0.5	8
Sm	M/ICP	ppm	0.36	0.12	16.2	29
Sr	M/ICP	ppm	43.7	23.1	26.5	55
Ta	XRF	ppm	48.1	13.5	14.0	22
Tb	M/ICP	ppm	0.07	0.02	10.7	16
Ti	M/ICP	%	0.03	0.01	12.2	40
Ti	M/ICP	ppm	26.0	2.7	5.1	46
U	XRF	ppm	7.3	1.9	13.2	15
V	M/ICP	ppm	9.7	2.5	12.9	40
W	M/ICP	ppm	1.4	0.64	22.6	48
Y	M/ICP	ppm	2.2	0.59	13.5	52
Yb	M/ICP	ppm	0.21	0.03	7.4	30
Zn	M/ICP	ppm	50.2	9.0	9.0	54
Zr	M/ICP	ppm	12.1	2.4	9.9	54

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