



AMIS0055

Certified Reference Material

**Uraniferous phosphatic sandstone,
Bakouma, Central African Republic**

Certificate of Analysis

Recommended Concentrations and Limits¹ (at two Standard Deviations)

Certified Concentrations²

P ₂ O ₅	21.22	±	0.42	%
U M/ICP	3206	±	150	ppm
(or U ₃ O ₈ M/ICP	3781	±	177	ppm)
U XRF	3423	±	279	ppm
(or U ₃ O ₈ XRF	4037	±	329	ppm)
Ba M/ICP	431	±	41	ppm
Ce M/ICP	26	±	2.8	ppm
Co M/ICP	33	±	3.3	ppm
Cu M/ICP	272	±	27	ppm
Pb M/ICP	163	±	11	ppm
Sr M/ICP	1067	±	91	ppm
Y M/ICP	53.6	±	5.6	ppm
Zn M/ICP	187	±	20	ppm
Specific Gravity	2.98	±	0.14	

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	4.81	±	0.10	%
CaO	27.24	±	0.56	%
Fe ₂ O ₃	3.58	±	0.12	%
K ₂ O	0.67	±	0.02	%
MgO	0.62	±	0.03	%
MnO	0.09	±	0.004	%
Na ₂ O	0.33	±	0.03	%
SiO ₂	35.77	±	0.70	%
TiO ₂	0.21	±	0.012	%

Provisional Concentrations

Cr ₂ O ₃	0.07	±	0.01	%
LOI	4.05	±	0.88	%

1. Intended Use: AMIS0055 can be used to check analysis of samples of uraniferous phosphatic sandstone 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 20). 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: This material was supplied by Uramin Inc. from their Patricia prospect located 4 km north of the town of Bakouma in the Mbomou district of the Central African Republic, 550 km east of the capital Bangui and 100 km north of the district administrative centre of Bangassou. The mineralisation has been known since the early 1960s and was extensively explored throughout the 1960s and 1970s. It occurs in Late Cretaceous to Eocene Phosphatic karst sediments of the Mpatou Formation. These comprise thick black shales with pyrite and abundant organic matter, overlain by a 20-25 m thick succession with brown, reddish and yellow phosphatic lenses.

3. Mineral and Chemical Composition: Phosphates occur in the form of microcrystalline, carbonate-substituted fluorapatites that can make up as much as 50% of the rock. The phosphate lenses are highly weathered and contain secondary Al-phosphates.

The main uraniferous phosphate minerals appear to be autunite and torbernite. Autunite is bright yellow in colour and torbernite is bright green. These minerals have been observed as fracture

coatings, and fine-grained disseminations. White indurated masses of crandallite (alumina phosphate), have also been documented.

For more information refer: Sweeney, Mark and Chesher, Mark. (June 2007). Bakouma Resource Technical Report , Bakouma, Central African Republic, for URAMIN INC by AMC Consultants Pty Ltd., Amc Project 207009B.

(<http://www.sedar.com/CheckCode.do;jsessionid=0000NEUx3YBP3602KsGBFZLLf-G:-1>)

4. The uncertified major and trace element chemical composition data is presented in the appendix to this certificate.

5. **Appearance:** The material is a very fine Light Brown powder (Corstor 5YR 6/4).

6. **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.

7. **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.

8. **Methods of Analysis requested:**

1. Multi-acid digest, including HF, ICP- OES or ICP-MS. Multi element scan to include U.
2. U. XRF.
3. Majors (Al₂O₃, CaO, Cr₂O₃, Fe₂O₃, K₂O, MgO, MnO, Na₂O, P₂O₅, SiO₂, TiO₂. LOI.) XRF fusion.
4. SG (gas pycnometer).

9. **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 multi-element scans to be reported in ppm.
5. All results for major elements to be reported in %.
6. Report all QC data, to include replicates, blanks and certified reference materials used.

10. **Method of Certification:** Twenty laboratories were each given eight packages, comprising eight samples scientifically selected from throughout the batch. Seventeen 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 t_{test} 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**; RSDs of between near 5 % and 15 % are termed **Provisional**; and RSDs over 15 % are termed **Informational**.

11. Participating Laboratories: (Not in same order as in the table of assays):

1. ALS Chemex Laboratory Group Brisbane Australia
2. ALS Chemex Laboratory Group Johannesburg SA
3. ALS Chemex Laboratory Group Lima (Peru)
4. ALS Chemex Laboratory Group Perth WA
5. ALS Chemex Laboratory Group Vancouver CA
6. Anglo Gold Ashanti - Vaal River Laboratory SA
7. Genalysis Laboratory Services (South Africa) Pty
8. Genalysis Laboratory Services WA
9. Performance Labs (Welkom)
10. Reptile Uranium Namibia
11. Rossing Uranium Limited
12. Set Point Laboratories (Isando) SA
13. SGS Australia Pty Ltd (Newburn) WA
14. SGS Geosol Laboratories Ltda (Brazil)
15. SGS Mineral Services Lakefield (Canada)
16. SGS South Africa (Pty) Ltd - Booyens
17. Ultra Trace (Pty) Ltd WA

12. 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 Codes	P2O5 XRF %	U M/ICP ppm	U XRF ppm	SG pyc	Ba M/ICP %	Ce M/ICP ppm	Co M/ICP ppm	Cu M/ICP %	Pb M/ICP %	Sr M/ICP %	Y M/ICP %	Zn M/ICP %	Al2O3 XRF %	CaO XRF %	Cl2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %	LOI %	
C			3830																					
C			3773																					
C			3759																					
C			3744																					
C			3760																					
C			3727																					
C			3750																					
C			3754																					
D			3283										2.83	24.26		3.10	0.67		0.13	0.54				
D			3304										2.97	25.88		3.10	0.67		0.13	0.40				
D			3283										3.10	25.21		3.24	0.81		0.13	0.67				
D			3311										3.10	24.40		2.97	0.81		0.13	0.54				
D			3304										0.67	25.61		3.10	0.94		0.13	0.40				
D			3355										2.97	25.61		3.10	0.67		0.13	0.54				
D			3294										3.10	26.82		3.24	0.81		0.00	0.67				
D			3311										2.97	26.69		3.24	0.81		0.00	0.54				
E	21.30	3290	3390		440	26.30	34.30	266	156	1070	54.40	190	4.78	26.90	0.07	3.53	0.67	0.59	0.11	0.32	35.70	0.21		
E	21.20	3180	3430		400	25.80	32.60	258	153	1030	53.20	186	4.77	26.90	0.07	3.52	0.66	0.60	0.11	0.32	36.00	0.20		
E	21.20	3290	3410		430	27.30	33.20	267	158	1060	56.60	190	4.76	26.90	0.07	3.53	0.66	0.59	0.11	0.32	35.70	0.20		
E	21.20	3230	3380		430	27.00	32.70	262	157	1060	55.10	191	4.79	26.90	0.07	3.53	0.67	0.59	0.11	0.32	35.70	0.20		
E	21.10	3090	3360		400	25.50	31.00	246	150	1010	51.90	176	4.75	26.80	0.07	3.49	0.66	0.59	0.11	0.32	35.90	0.20		
E	21.20	3090	3400		390	25.50	31.90	252	150	1010	52.40	182	4.75	26.80	0.07	3.51	0.66	0.59	0.11	0.32	35.90	0.20		
E	21.20	3280	3390		420	27.30	35.10	268	159	1070	56.20	192	4.78	26.90	0.07	3.54	0.67	0.59	0.11	0.32	35.60	0.20		
E	21.20	3180	3400		410	27.00	32.80	256	154	1040	54.70	186	4.75	26.90	0.07	3.51	0.66	0.59	0.11	0.32	36.00	0.21		
F		3180	3220	2.71	430	25.90	32.60	283	163	1140	52.20	202	4.79	27.60	0.07	3.54	0.66	0.60	0.09	0.35	36.10	0.20	3.71	
F		3200	3220	2.75	430	26.10	33.50	291	167	1155	52.50	205	4.82	27.70	0.10	3.58	0.66	0.61	0.09	0.35	36.10	0.20	3.31	
F		3210	3220	2.75	430	26.80	33.00	287	166	1155	53.60	202	4.82	27.70	0.06	3.52	0.66	0.60	0.09	0.35	36.30	0.21	3.26	
F		3290	3190	2.76	440	26.90	33.10	291	169	1180	54.20	204	4.80	27.60	0.07	3.55	0.67	0.61	0.09	0.36	36.10	0.22	3.57	
F		3200	3220	2.73	430	26.40	34.40	282	168	1155	53.80	198	4.80	27.70	0.06	3.57	0.67	0.61	0.09	0.36	36.00	0.22	3.57	
F		3230	3190	2.73	430	27.10	33.20	281	167	1155	54.00	199	4.82	27.60	0.06	3.52	0.66	0.61	0.09	0.35	36.20	0.22	3.64	
F		3260	3230	2.78	440	27.60	34.00	290	169	1180	55.40	206	4.80	27.70	0.07	3.51	0.66	0.61	0.09	0.34	36.20	0.21	3.45	
F		3350	3200	2.74	450	28.20	35.00	303	172	1200	56.60	216	4.82	27.70	0.07	3.56	0.66	0.61	0.09	0.35	36.10	0.21	3.38	
G	20.85	3060	3200	3.05									4.95	26.84	0.06	3.53	0.65	0.62	0.09	0.34	36.62	0.19	4.67	
G	20.87	3120	3300	3.06									4.93	26.80	0.06	3.53	0.66	0.62	0.09	0.34	36.55	0.19	4.65	
G	20.91	3170	3200	2.98									4.98	26.75	0.06	3.54	0.66	0.63	0.09	0.34	36.41	0.19	4.65	
G	20.87	2980	3200	3.06									4.96	26.88	0.06	3.54	0.66	0.62	0.09	0.35	36.49	0.19	4.61	
G	20.84	2920	3200	3.07									4.97	26.86	0.06	3.53	0.66	0.62	0.09	0.35	36.55	0.20	4.61	
G	20.91	2970	3300	2.98									4.95	26.85	0.06	3.51	0.65	0.63	0.09	0.34	36.62	0.19	4.61	
G	20.88	3030	3200	3.09									4.96	26.93	0.06	3.52	0.66	0.63	0.09	0.34	36.40	0.19	4.64	
G	20.89	3170	3300	2.98									4.96	26.90	0.06	3.53	0.65	0.62	0.09	0.34	36.35	0.20	4.62	
H	20.50	3090		2.85	400	27.90	35.90	269	171	1110	53.90	192	4.81	26.90	0.06	3.53	0.63	0.60	0.09	0.33	35.70	0.21	3.93	
H	20.40	3160		2.82	400	27.30	35.90	274	170	1120	54.20	194	4.76	26.90	0.06	3.49	0.63	0.60	0.09	0.33	35.60	0.21	3.93	
H	20.40	3190		2.85	410	28.40	38.10	275	173	1135	55.10	193	4.79	26.90	0.06	3.51	0.63	0.60	0.09	0.32	35.50	0.21	3.97	
H	20.50	3210		2.82	400	27.60	35.40	274	172	1130	54.80	193	4.82	27.10	0.06	3.52	0.63	0.61	0.09	0.32	35.70	0.21	3.99	
H	20.60	3240		2.78	410	28.20	36.60	280	174	1160	55.00	200	4.85	27.20	0.06	3.54	0.63	0.61	0.09	0.34	35.70	0.21	4.03	
H	20.30	3250		2.80	410	27.50	36.30	276	171	1150	53.70	196	4.76	26.70	0.07	3.48	0.63	0.59	0.09	0.32	35.30	0.21	4.56	
H	20.50	3160		2.81	400	27.10	34.10	273	169	1115	53.20	191	4.81	27.00	0.07	3.52	0.63	0.61	0.09	0.34	35.60	0.21	4.03	
H	20.50	3200		2.82	400	27.60	35.10	275	171	1130	53.70	192	4.82	26.90	0.06	3.52	0.63	0.60	0.09	0.33	35.70	0.21	4.03	
I		3290		3.07	420	24.80	34.10	289	164	1120	57.40	202												
I		3260		3.13	410	24.00	33.10	288	161	1110	57.30	198												
I		3240		3.10	410	23.50	33.20	288	159	1105	56.30	197												
I		3230		3.06	410	24.30	33.10	286	156	1105	56.70	197												
I		3240		3.12	410	24.30	33.30	284	162	1105	57.50	195												
I		3190		3.01	410	23.60	33.30	283	158	1085	55.90	193												
I		3200		3.13	410	23.70	34.60	279	160	1095	57.20	192												
I		3250		3.09	410	23.90	33.10	286	162	1110	55.90	200												
J	21.14	3228	3582	2.94	430	24.63	31.00	255	163	1038	49.95	173	4.77	27.16	0.06	3.52	0.67	0.62	0.09	0.29	35.57	0.21	3.48	
J	21.21	3233	3459	3.05	434	24.86	30.00	253	164	1028	49.52	170	4.79	27.19	0.06	3.53	0.66	0.63	0.08	0.29	35.76	0.20	3.49	
J	21.31	3166	3581		432	24.99	32.00	262	163	1050	50.91	178	4.78	27.25	0.07	3.50	0.68	0.64	0.09	0.29	35.61	0.20	3.47	
J	21.25	3219	3525	3.05	430	24.96	31.00	259	161	1060	50.94	173	4.76	27.17	0.07	3.53	0.67	0.64	0.08	0.30	35.85	0.21	3.48	
J	21.21	3156	3544	3.03	434	24.85	31.00	258	160	1038	49.18	171	4.78	27.15	0.06	3.50	0.66	0.63	0.08	0.30	35.70	0.20	3.55	
J	21.19	3174	3487	2.88	430	24.23	30.00	247	161	1029	49.82	169	4.80	27.21	0.06	3.54	0.68	0.64	0.09	0.29	35.98	0.21	3.55	
J	21.23	3217	3579		433	24.78	31.00	251	163	1046	50.34	173	4.77	27.10	0.07	3.51	0.65	0.63	0.09	0.29	35.68	0.21	3.57	
J</																								

Assay data (cont)

Lab Codes	P2O5 XRF %	U M/ICP ppm	U XRF ppm	SG pyc	Ba M/ICP %	Ce M/ICP ppm	Co M/ICP ppm	Cu M/ICP %	Pb M/ICP %	Sr M/ICP %	Y M/ICP %	Zn M/ICP %	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	SiO2 XRF %	TiO2 XRF %	LOI %		
K				3.01																					
K				3.02																					
K				3.01																					
K				3.00																					
K				3.03																					
K				3.01																					
K				3.03																					
K				3.04																					
L	21.81	3306	3449	2.94	433		34.41	282	197	1021	36.51	184	4.57	27.39	0.07	3.63	0.67	0.40	0.09	0.28	36.03	0.23	4.22		
L	21.72	3338	3371	2.95	445		33.20	285	199	990	36.51	184	4.59	27.22	0.06	3.86	0.66	0.38	0.09	0.28	36.12	0.22	4.19		
L	21.61	3200	3479	2.94	419		32.27	277	188	998	35.40	176	4.48	27.18	0.04	3.89	0.67	0.40	0.09	0.28	35.86	0.21	4.26		
L	21.72	3237	3372	2.95	423		33.13	276	188	1011	36.51	180	4.41	27.27	0.04	3.87	0.67	0.39	0.09	0.28	35.60	0.21	4.26		
L	21.67	3325	3425	2.96	440		34.47	284	196	1011	37.62	184	4.51	27.16	0.04	3.91	0.66	0.39	0.09	0.27	35.48	0.21	4.28		
L	21.57	3321	3439	2.95	440		32.96	273	195	1024	37.62	176	4.47	27.04	0.04	3.89	0.66	0.40	0.09	0.28	35.55	0.21	4.25		
L	21.47	3341	3411	2.95	436		34.34	277	195	1026	38.72	180	4.49	26.86	0.03	3.92	0.66	0.39	0.10	0.27	35.41	0.21	4.27		
L	21.75	3360	3387	2.96	437		34.95	285	200	998	38.72	183	4.49	27.23	0.04	3.85	0.66	0.39	0.09	0.28	35.87	0.21	4.26		
N	21.40	3190	3580	3.01	454	27.80	35.00	278	156	1040	54.60	200	4.81	27.40	0.07	3.63	0.67	0.63	0.09	0.34	35.70	0.22	3.59		
N	21.40	3260	3590	3.03	462	27.20	35.00	280	162	1060	56.70	196	4.82	27.50	0.07	3.65	0.67	0.64	0.09	0.34	35.71	0.22	3.59		
N	21.40	3230	3580	3.00	451	26.80	30.00	274	160	1060	55.10	194	4.81	27.50	0.07	3.64	0.67	0.63	0.09	0.34	35.74	0.22	3.60		
N	21.40	3170	3560	2.98	465	26.40	35.00	280	157	1070	55.80	194	4.81	27.50	0.07	3.64	0.67	0.64	0.09	0.34	35.69	0.22	3.56		
N	21.40	3140	3560	2.98	447	27.20	35.00	280	156	1070	56.30	198	4.81	27.40	0.07	3.64	0.67	0.63	0.09	0.33	35.67	0.22	3.53		
N	21.40	3020	3580	2.97	459	26.20	35.00	278	153	1050	55.90	194	4.82	27.50	0.07	3.65	0.67	0.64	0.09	0.34	35.79	0.22	3.52		
N	21.40	3150	3590	2.99	448	25.90	35.00	280	156	1060	57.00	196	4.82	27.50	0.07	3.65	0.67	0.64	0.09	0.34	35.69	0.22	3.56		
N	21.40	3290	3580	2.99	484	27.30	35.00	280	165	1090	57.90	200	4.80	27.40	0.07	3.64	0.66	0.64	0.09	0.34	35.70	0.22	3.57		
P				3859																					
P				3873																					
P				3877																					
P				3890																					
P				3890																					
P				3880																					
P				3907																					
P				3881																					
Q	21.10	3180	3650		423		33.00	262		1070		182	4.87	27.40	0.07	3.67	0.68	0.61	0.09	0.34	36.10	0.21	3.78		
Q	21.20	3240	3610		432		33.00	263		1080		191	4.85	27.40	0.07	3.67	0.68	0.63	0.09	0.34	36.10	0.21	3.75		
Q	21.20	3150	3640		426		33.00	258		1050		200	4.85	27.40	0.07	3.67	0.68	0.62	0.09	0.32	36.10	0.21	3.77		
Q	21.10	3100	3610		419		33.00	255		1030		196	4.86	27.40	0.07	3.67	0.68	0.62	0.09	0.34	36.10	0.21	3.77		
Q	21.10	3110	3640		412		32.00	255		1040		193	4.85	27.40	0.07	3.66	0.68	0.63	0.09	0.33	36.20	0.21	3.74		
Q	21.20	3110	3630		415		30.00	255		1040		183	4.84	27.50	0.07	3.67	0.68	0.62	0.09	0.34	36.00	0.21	3.72		
Q	21.20	3120	3640		409		31.00	252		1030		176	4.85	27.40	0.07	3.66	0.69	0.62	0.09	0.34	35.90	0.21	3.74		
Q	21.10	3180	3610		420		32.00	259		1070		185	4.83	27.20	0.07	3.63	0.68	0.62	0.09	0.35	36.20	0.21	3.77		
R		3341	3485	3.05									4.57	27.91	0.08	3.66	0.69	0.58	0.09	0.30	35.29	0.20	4.10		
R		3310	3479	3.21									4.53	27.46	0.07	3.64	0.69	0.60	0.09	0.35	35.70	0.21	4.09		
R		3430	3514	3.26									4.62	27.68	0.08	3.66	0.69	0.61	0.08	0.32	34.93	0.21	4.17		
R		3401	3424	2.67									4.79	27.43	0.08	3.64	0.68	0.61	0.09	0.31	34.76	0.22	4.10		
R		3401	3479	2.71									4.74	27.39	0.08	3.61	0.69	0.60	0.09	0.31	35.03	0.22	4.10		
R		3558	3328	2.87									4.83	27.62	0.08	3.66	0.69	0.60	0.09	0.29	34.91	0.21	4.02		
R		3536	3538	2.69									4.77	27.33	0.07	3.64	0.70	0.60	0.08	0.39	35.17	0.21	4.05		
R		3627	3381	2.66									4.52	27.63	0.08	3.62	0.69	0.60	0.09	0.32	35.27	0.21	4.00		
S	21.20		3417	2.93	440		33.00	280	190	1100	53.00	180	4.81	27.30	0.07	3.60	0.66	0.63	0.09	0.32	35.40	0.20	4.69		
S	21.30		3484	2.97	460		34.00	300	180	1100	56.00	180	4.79	27.40	0.07	3.60	0.66	0.64	0.09	0.31	35.70	0.21	4.59		
S	21.00		3510	2.91	440		32.00	280	180	1000	52.00	180	4.83	27.10	0.07	3.56	0.65	0.62	0.09	0.31	35.30	0.21	4.60		
S	21.10		3394	2.89	430		35.00	290	190	1000	53.00	180	4.80	27.10	0.07	3.55	0.66	0.64	0.09	0.32	35.30	0.20	4.66		
S	21.20		3482	2.95	470		36.00	310	180	1100	56.00	190	4.82	27.20	0.07	3.56	0.66	0.64	0.08	0.32	35.30	0.21	4.76		
S	21.10		3468	2.92	450		33.00	280	190	1100	55.00	180	4.78	27.00	0.07	3.55	0.67	0.64	0.09	0.32	35.40	0.20	4.68		
S	21.20		3449	2.91	430		34.00	300	190	1000	54.00	180	4.81	27.20	0.07	3.58	0.66	0.64	0.09	0.32	35.50	0.21	4.66		
S	21.20		3491	2.93	450		34.00	280	190	1000	54.00	180	4.84	27.20	0.07	3.59	0.65	0.63	0.08	0.32	35.40	0.20	4.52		
T	21.20	3479		2.97	456		29.00	257	165	1020	48.70	177	4.82	27.40	0.05	3.69	0.73	0.63	0.09	0.30	35.70	0.21	4.52		
T	21.20	3514		2.94	459		28.00	259	161	1060	48.80	179	4.82	27.50	0.04	3.61	0.74	0.63	0.09	0.31	35.40	0.21	4.53		
T	21.00	3488		2.94	461		28.00	258	161	1070	49.40	179	4.75	27.20	0.04	3.58	0.73	0.62	0.09	0.30	35.10	0.21	4.46		
T	21.10	3477		2.96	467		28.00	260	160	1050	49.00	177	4.74	27.30	0.04	3.59	0.72	0.63	0.09	0.30	35.30	0.21	4.48		
T	21.10	3507		2.94	471		27.00	253	163	1040	48.30	178	4.76	27.30	0.04	3.67	0.72	0.63	0.09	0.30	35.20	0.21	4.47		
T	21.40	3499		2.94	463		29.00	257	161	1080	48.70	179	4.84	27.70	0.05	3.70	0.75	0.63	0.09	0.31	36.10	0.21	4.42		
T	21.20	3512		2.94	476		28.00	257	164	1070	49.30	180	4.79	27.50	0.04	3.62	0.74	0.63	0.09	0.32	35.50	0.21	4.46		
T	21.10	3528		2.96	468		28.00	255	159	1050	48.70	174	4.77	27.30	0.09	3.64	0.73	0.64	0.09	0.30	35.30	0.21	4.61		

13. 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	S _w ³	CSU ⁴
P ₂ O ₅	XRF	%	0.21	0.21	0.07	0.08
U	M/ICP	ppm	74.99	44.99	58.99	16.59
U	XRF	ppm	138.40	124.64	38.15	39.65
Ba	M/ICP	%	20.26	16.67	9.25	5.38
Ce	M/ICP	ppm	1.41	1.59	0.60	0.66
Co	M/ICP	ppm	1.65	1.21	1.09	0.42
Cu	M/ICP	%	13.68	11.76	5.05	3.76
Pb	M/ICP	%	5.41	5.40	2.48	2.07
Sr	M/ICP	%	45.52	35.92	23.33	11.67
Y	M/ICP	%	2.79	2.72	1.10	0.97
Zn	M/ICP	%	9.91	8.40	4.09	2.70
SG	pyc		0.07	0.06	0.03	0.02
Al ₂ O ₃	XRF	%	0.05	0.04	0.02	0.01
CaO	XRF	%	0.28	0.23	0.11	0.07
Cr ₂ O ₃	XRF	%	0.00	0.00	0.00	0.00
Fe ₂ O ₃	XRF	%	0.06	0.05	0.02	0.02
K ₂ O	XRF	%	0.01	0.01	0.01	0.00
MgO	XRF	%	0.02	0.01	0.01	0.00
MnO	XRF	%	0.00	0.00	0.00	0.00
Na ₂ O	XRF	%	0.02	0.01	0.01	0.00
SiO ₂	XRF	%	0.35	0.26	0.18	0.08
TiO ₂	XRF	%	0.01	0.00	0.00	0.00
LOI		%	0.44	0.41	0.09	0.13

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.

14. 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.

15. 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.

16. Certification: AMIS0055 is a new material.

17. 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.

18. Minimum sample size: The majority of laboratories reporting used a 0.5g sample size for the ICP and 10g for the XRF. These are the recommended minimum sample sizes for the use of this material.

19. 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.

20. 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.

21. 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.

10 March 2010

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. – Certified and uncertified trace element statistics

Eleven of the laboratories reported multi-element scan data. This data has been iterated and is presented below for informational use.

AMIS0055 Trace						
Analyte	Method	Unit	Mean	2SD	RSD %	n
Ag	M/ICP	ppm	0.341	0.07	10.7	32
Al	M/ICP	ppm	2.63	0.14	2.6	53
As	M/ICP	ppm	35.6	6.58	9.2	61
Ba	M/ICP	ppm	431	40.5	4.7	78
Be	M/ICP	ppm	4.24	1.15	13.6	71
Bi	M/ICP	ppm	0.296	0.03	4.4	47
Ca	M/ICP	%	18.0	2.62	7.3	64
Cd	M/ICP	ppm	0.634	0.14	11.0	48
Ce	M/ICP	ppm	26.1	2.81	5.4	48
Co	M/ICP	ppm	33.4	3.29	4.9	71
Cr	M/ICP	ppm	419	72.6	8.7	62
Cs	M/ICP	ppm	0.899	0.12	6.8	47
Cu	M/ICP	ppm	272	27.4	5.0	78
Dy	M/ICP	ppm	3.98	0.23	2.9	15
Er	M/ICP	ppm	8.34	0.58	3.5	15
Eu	M/ICP	ppm	0.621	0.05	4.0	15
Fe	M/ICP	%	2.43	0.26	5.3	72
Ga	M/ICP	ppm	8.86	1.15	6.5	47
Gd	M/ICP	ppm	2.95	0.14	2.3	14
Ge	M/ICP	ppm	0.108	0.06	27.6	24
Hf	M/ICP	ppm	0.080	0.09	53.6	25
Ho	M/ICP	ppm	1.50	0.14	4.8	16
In	M/ICP	ppm	0.035	0.007	10.5	46
K	M/ICP	ppm	0.557	0.05	4.8	69
La	M/ICP	ppm	16.0	2.13	6.7	48
Li	M/ICP	ppm	11.5	1.63	7.1	65
Lu	M/ICP	ppm	2.39	3.45	72.3	24
Mg	M/ICP	%	0.324	0.05	8.0	71
Mn	M/ICP	ppm	627	44.1	3.5	68
Mo	M/ICP	ppm	0.575	0.13	11.3	42
Na	M/ICP	%	0.234	0.02	4.0	70
Nb	M/ICP	ppm	2.63	1.06	20.1	39
Nd	M/ICP	ppm	13.8	0.52	1.9	15
Ni	M/ICP	ppm	59.6	6.39	5.4	70
P	M/ICP	%	8.83	1.00	5.6	31
Pb	M/ICP	ppm	163	10.8	3.3	54
Pr	M/ICP	ppm	3.55	0.31	4.4	16
Rb	M/ICP	ppm	23.5	2.59	5.5	40
S	M/ICP	%	0.078	0.008	5.0	60
Sb	M/ICP	ppm	3.02	2.81	46.6	51
Sc	M/ICP	ppm	17.1	1.83	5.4	24
Si	M/ICP	%	22.2	11.5	25.8	16
Sm	M/ICP	ppm	2.81	0.19	3.4	16
Sn	M/ICP	ppm	0.918	0.33	18.1	38
Sr	M/ICP	ppm	1067	91.0	4.3	77
Ta	M/ICP	ppm	0.121	0.24	97.3	29
Tb	M/ICP	ppm	0.483	0.04	4.3	16
Te	M/ICP	ppm	0.156	0.11	36.1	40
Th	M/ICP	ppm	5.91	0.67	5.7	44
Ti	M/ICP	%	0.049	0.01	12.8	54
Tl	M/ICP	ppm	0.391	0.05	5.8	43
Tm	M/ICP	ppm	1.99	0.21	5.4	16
V	M/ICP	ppm	45.3	3.28	3.6	60
W	M/ICP	ppm	0.945	0.11	5.9	38
Y	M/ICP	ppm	53.6	5.58	5.2	64
Yb	M/ICP	ppm	16.8	4.27	12.7	24
Zn	M/ICP	ppm	187	19.8	5.3	79
Zr	M/ICP	ppm	4.18	3.89	46.6	53