



African Mineral Standards
REFERENCE MATERIALS FOR AFRICAN ORES

Tel: +2711 923 7000 Fax: +2711 923 7027 e-mail: info@amis.co.za web: www.amis.co.za
30 Electron Avenue, Isando, 1600. P.O. Box 856, Isando, 1600, South Africa.
A Division of Set Point Industrial Technology (Pty) Ltd. Reg.No. 1989/000201/07.

African Mineral Standards

Certificate of Analysis

Uraniferous Alaskite Reference Material Goanikontes, Namibia

AMIS0086

Recommended Concentration and two “Between Laboratory”
Standard Deviations

Certified Concentrations*

U (M/ICP)	127	±	9.5	ppm
U (XRF)	128	±	13	ppm
Specific Gravity	2.7	±	0.16	g/cc

* Or, by applying a chemical conversion factor of $U \times 1.1793 = U_3O_8$
 U_3O_8 by multi acid digestion: 150 ± 11.2 ppm
 U_3O_8 by XRF: 151 ± 15 ppm

Intended use: AMIS0086 is suitable for monitoring the accuracy of a single analysis of uraniferous alaskite ore. This material can be used for routine quality control by inserting within a batch of samples.

Additional geochemical data is presented for the material that will enable its use for method development and for the calibration of equipment. This comprises the uncertified major element data (p1) and the trace element data in the Appendix.

The recommended mean and "Between Lab" standard deviations for this standard reflect the average 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 and this is acceptable. Good laboratories however will report results within the two standard deviation levels with a failure of <10 %.

Origin of material: This material was supplied by Bannerman Resources Ltd from their Goanikontes Project 30km east of Swakopmund in Namibia. This deposit represents one of the uraniferous alaskite occurrences first actively explored in the Namib Desert during the 1970's. The most significant of these deposits is Rössing Uranium, mined by Rio Tinto since the late 1970's.

The uranium is associated with Lower Palaeozoic age alaskite granites emplaced, predominantly along S_3 foliation planes, into heavily folded biotite-amphibole-pyroxene schists of the lower Khan Formation. The term "alaskite" is applied locally to a leucocratic variety of granite, often with a pegmatitic texture.

The most abundant primary uranium mineral is uraninite, but betafite is also present. The uraninite is commonly associated with chloritised biotite in the alaskite. Titanium bearing oxides, ilmenite and magnetite are also present. The Goanikontes uranium deposit does not show any fundamental qualitative differences compared to the Rössing uranium deposit situated 40 km to the North East.

This deposit is described in detail in Mouillac, J.L., Valois, J-P. and Walgenwitz, F. (1986). *The Goanikontes uranium occurrence in South West Africa/Namibia*, in Mineral Deposits of Southern Africa, 1833-1843, Anhauser, C.R., and Maske, S. (Eds) (1986). Geol. Soc.S.Africa., Johannesburg.

Mineral and chemical composition:

The major and trace element chemistry for this material has been determined through results from seventeen of the laboratories participating in the round robin. This data has not been certified but useful statistics have been calculated and are presented below (major elements) and in the appendix (trace elements).

Major Element Chemistry

AMIS0086	%	2SD	RSD%	n
Al ₂ O ₃	11.3	0.3	1.12	110
CaO	4.06	0.12	1.53	110
Cr ₂ O ₃	0.87	0.03	1.67	104
Fe ₂ O ₃	5.18	0.14	1.33	101
K ₂ O	4.52	0.19	2.15	109
MgO	2.37	0.06	1.30	84
MnO	0.10	0.01	4.82	118
Na ₂ O	1.64	0.06	1.80	109
P ₂ O ₅	0.10	0.01	4.20	81
S	0.55	0.02	1.54	53
SiO ₂	66.7	1.0	0.75	99
TiO ₂	0.39	0.02	2.29	109
V ₂ O ₅	0.01	0.01	32.59	24
LOI	2.06	0.48	11.52	103

Appearance: The material is a very fine powder. It is coloured a Light Grey (Corstor 5Y 7/1).

Radioactivity: Shipments of this material do not require special marking, labeling or placarding. AMIS0085 does contain U (1.9 Bq/g) and Th (0.04 Bq/g), but due to low activity concentrations it is classified as EXEMPT MATERIAL in terms of "Safety Standards Series No. TS-R-1: Regulations for the Safe Transport of Radioactive Material, International Atomic Energy Agency, 2005, para 403, Table 1".

Method of preparation: The material was crushed, dry-milled and air-classified to 100% <54µm. Wet sieve particle size analysis of random samples confirmed the material was 100% <54µm. It was then blended in a bi-conical mixer, systematically divided and then sealed into 1kg Laboratory Packs. Samples were randomly selected for homogeneity testing and third party analysis. Statistical analysis for the consensus test results were carried out by an independent statistician. Explorer Packs are subdivided from the Laboratory packs as required.

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, SiO₂, TiO₂. LOI.) XRF fusion.
4. SG (gas pycnometer).

Method of certification: Twenty one laboratories were each given eight randomly selected packages of sample. The results from the twenty laboratories that issued results timeously were used for the certification.

The mean and standard deviation for all data was calculated. Outliers were defined as samples beyond the mean $\pm$ 2 Standard Deviations from all data. These outliers were removed from the data and a new mean and standard deviation was determined.

Standards with an RSD of near or less than 5 % are then certified, RSD's of between near 5 % and 15 % are given Provisional Concentrations and limits, those with RSD's over 15 % are given Indicated Concentrations.

This method is different from that used to calculate the Confidence Interval shown on many Government-produced standards in that the actual "between-laboratory" standard deviation is used in the calculations. This produces upper and lower limits that reflect actual individual analyses rather than a grouped set of analyses. The limits can therefore be used to monitor accuracy from individual analyses, unlike the Certified Limits published on other standards which quote a Confidence Interval.

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

1. ACME Analytical Laboratories Ltd., (Canada).
2. Activation Laboratories Ltd., (ActLabs, Ancaster, ON, Canada).
3. AGA - Vaal River Laboratory (South Africa).
4. ALS Chemex South Africa (Pty) Ltd.
5. ALS Chemex, (Perth, Australia).
6. ALS Chemex, (Vancouver, Canada).
7. Ammtec Ltd., (Western Australia).
8. Anglo Research (Crown Campus, South Africa).
9. Assayers Canada, (Vancouver).
10. Genalysis Laboratory Services (Pty) Ltd., (Australia).
11. Geoscience Laboratories, (Geo Labs, Sudbury, Canada).
12. Labtium Inc. (Finland).
13. OMAC Laboratories (Ireland).

14. Performance Laboratories, (South Africa).
15. Pt Intertek Utama Services (Intertek, Indonesia).
16. Set Point Laboratories (Pty) Ltd (South Africa).
17. SGS Lakefield Research (Canada).
18. SGS Lakefield Research Africa (Pty) Ltd. (Joburg, South Africa).
19. SGS Welshpool (Australia).
20. Ultra Trace (Pty) Ltd. (Australia).

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 data from this round robin on the other elements is available on request.

Lab Code	U ppm (M/ICP)	U ppm (XRF)	SG g/cc
A	146	139	
A	137	141	
A	139	140	
A	142	138	
A	135	145	
A	135	133	
A	142	134	
A	139	133	
B		140	2.73
B		140	2.71
B		140	2.72
B		140	2.72
B		150	2.75
B		140	2.72
B		140	2.74
B		150	2.73
C	125	138	2.75
C	121	138	2.73
C	121	138	2.73
C	128	137	2.80
C	124	137	2.73
C	126	137	2.72
C	118	137	2.72
C	121	137	2.74
D	124	140	2.85
D	128	140	2.86
D	123	140	2.86
D	123	140	2.85
D	124	140	2.86
D	121	140	2.90
D	124	140	2.85
D	126	130	2.86
E	128	125	
E	128	124	
E	126	123	
E	127	124	
E	125	123	
E	121	125	
E	131	124	
E	130	123	
F		131	
F		131	
F		132	
F		131	
F		132	
F		133	
F		133	
F		132	
G			
G			
G			
G			
G			
G			
G			

Lab Code	U ppm (M/ICP)	U ppm (XRF)	SG g/cc
H	142	122	
H	146	121	
H	136	116	
H	137	116	
H	129	122	
H	132	120	
H	134	119	
H	130	119	
I			
I			
I			
I			
I			
I			
I			
I			
J	141		2.65
J	137		2.63
J	137		2.65
J	139		2.66
J	137		2.58
J	139		2.68
J	139		2.70
J	135		2.67
K		103	
K		107	
K		120	
K		128	
K		122	
K		123	
K		127	
K		118	
L	131		
L	128		
L	125		
L	128		
L	133		
L	132		
L	133		
L	129		
M	131	137	2.75
M	126	136	2.76
M	132	132	2.65
M	126	133	2.66
M	134	137	2.70
M	131	133	2.73
M	130	136	2.73
M	127	134	2.77
N	122		2.55
N	117		2.58
N	119		2.56
N	125		2.57
N	120		2.64
N	120		2.63
N	119		2.61
N	117		2.61

Lab Code	U ppm (M/ICP)	U ppm (XRF)	SG g/cc
O	126	129	2.58
O	127	129	2.54
O	117	129	2.62
O	127	126	2.64
O	126	129	2.62
O	128	127	2.51
O	121	129	2.54
O	128	129	2.69
P	128		2.62
P	130		2.73
P	131		2.72
P	123		2.64
P	134		2.76
P	124		2.66
P	130		2.70
P	132		2.63
Q	128		
Q	125		
Q	121		
Q	127		
Q	136		
Q	125		
Q	123		
Q	128		
R		126	3.32
R		120	
R		133	
R		123	3.31
R		125	3.34
R		129	3.35
R		126	3.36
R		121	3.37
S		120	
S		122	
S		122	
S		121	
S		120	
S		120	
S		119	
S		122	
T	127		
T	125		
T	125		
T	125		
T	126		
T	124		
T	127		
T	124		
U	119	128	2.74
U	129	131	2.78
U	131	130	2.77
U	135	129	2.73
U	133	131	2.78
U	128	128	2.77
U	124	134	2.77
U	137	128	2.74

Availability: This product is available in Laboratory Packs containing 1kg of material or in Explorer Packs containing client specified weights of material from 50g up to 250g. Laboratory Packs are sealed bottles delivered in sealed foil pouches. Explorer Packs contain material in standard geochem envelopes placed into foil pouches that are nitrogen flushed and vacuum sealed.

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.

21 July 2008

Certifying officers:



African Mineral Standards: _____
Mike McWha
BSc (Hons), FGSSA, MSAIMM, Pr.Sci.Nat



Geochemist: _____
Barry W. Smee
BSc, PhD, P.Geo, (B.C.)

APPENDIX

Additional useful trace element results were provided by seventeen laboratories. Summary statistics are provided below. This data has not been certified.

AMIS0086	unit	method	value	2SD	RSD%	n
Ag	ppm	M/ICP	0.189	0.040	10.7	31
Al	%	M/ICP	5.89	0.452	3.8	84
As	ppm	M/ICP	28.5	3.71	6.5	79
Ba	ppm	M/ICP	507	35.4	3.5	113
Be	ppm	M/ICP	2.62	0.386	7.4	76
Bi	ppm	M/ICP	0.321	0.045	6.9	69
Ca	%	M/ICP	2.91	0.202	3.5	78
Cd	ppm	M/ICP	0.107	0.035	16.2	48
Ce	ppm	M/ICP	76.1	7.49	4.9	91
Co	ppm	M/ICP	36.7	4.44	6.0	133
Cr	ppm	M/ICP	4982	1452	14.6	96
Cs	ppm	M/ICP	4.99	0.493	4.9	78
Cu	ppm	M/ICP	2759	212	3.8	127
Dy	ppm	M/ICP	6.39	0.714	5.6	38
Er	ppm	M/ICP	4.19	1.30	15.5	48
Eu	ppm	M/ICP	1.03	0.088	4.3	45
Fe	%	M/ICP	3.63	0.231	3.2	77
Ga	ppm	M/ICP	15.6	1.37	4.4	77
Gd	ppm	M/ICP	5.59	0.561	5.0	45
Hf	ppm	M/ICP	2.20	0.558	12.7	67
Ho	ppm	M/ICP	1.29	0.380	14.7	56
In	ppm	M/ICP	0.151	0.017	5.8	69
K	ppm	M/ICP	3.66	0.347	4.7	78
La	ppm	M/ICP	40.6	3.50	4.3	94
Li	ppm	M/ICP	20.6	1.88	4.6	78
Lu	ppm	M/ICP	0.504	0.135	13.4	49
Mg	%	M/ICP	1.38	0.081	2.9	83
Mn	ppm	M/ICP	783	61.4	3.9	88
Mo	ppm	M/ICP	7.34	1.20	8.2	105
Na	%	M/ICP	1.17	0.141	6.0	100
Nb	ppm	M/ICP	13.3	2.67	10.0	100
Nd	ppm	M/ICP	31.0	1.29	2.1	39
Ni	ppm	M/ICP	113	15.8	7.0	105
P	ppm	M/ICP	430	40.0	4.7	63
Pb	ppm	M/ICP	58.4	11.1	9.5	103
Pr	ppm	M/ICP	8.57	0.648	3.8	45
Rb	ppm	M/ICP	214	32.9	7.7	92
Sb	ppm	M/ICP	12.9	2.02	7.8	84
Sc	ppm	M/ICP	6.85	0.904	6.6	78
Se	ppm	M/ICP	5.31	0.910	8.6	39
Sm	ppm	M/ICP	6.30	0.932	7.4	55
Sn	ppm	M/ICP	4.46	0.510	5.7	93
Sr	ppm	M/ICP	97.3	6.57	3.4	116
Ta	ppm	M/ICP	1.51	0.347	11.5	69
Tb	ppm	M/ICP	0.987	0.079	4.0	53
Te	ppm	M/ICP	1.22	0.165	6.8	58
Th	ppm	M/ICP	34.3	3.91	5.7	94
Ti	ppm	M/ICP	2242	198	4.4	71
Tl	ppm	M/ICP	0.959	0.141	7.3	79
Tm	ppm	M/ICP	0.625	0.234	18.8	56
V	ppm	M/ICP	78.7	13.5	8.6	93
W	ppm	M/ICP	1.77	0.458	13.0	91
Y	ppm	M/ICP	30.5	4.87	8.0	107
Yb	ppm	M/ICP	3.74	0.853	11.4	47
Zn	ppm	M/ICP	86.0	16.6	9.6	121
Zr	ppm	M/ICP	60.7	18.7	15.4	94