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A Division of Set Point Industrial Technology (Pty) Ltd. Reg.No. 1989/000201/07.

African Mineral Standards

Certificate of Analysis

Uranium standard made from
calcretized fluvial sediment,
Langer Heinrich, Namibia

AMIS0115

Recommended Concentration and two “Between Laboratory”
Standard Deviations

Certified Concentrations

U (M/ICP)	606	±	69	ppm
U (XRF)	640	±	43	ppm
Ba (M/ICP)	287	±	28	ppm
Mn (M/ICP)	500	±	48	ppm
Sr (M/ICP)	196	±	11	ppm
V (M/ICP)	177	±	18	ppm
Specific Gravity	2.66	±	0.16	g/cc

Provisional Concentrations

Co (M/ICP)	6.0	±	1.3	ppm
Cr (M/ICP)	117	±	32	ppm
Cu (M/ICP)	31	±	6	ppm
Ni (M/ICP)	271	±	55	ppm
P (M/ICP)	408	±	70	ppm
S (M/ICP)	0.037	±	0.006	%
Zn (M/ICP)	46	±	9	ppm
Zr (M/ICP)	48	±	14	ppm

**** Or, by applying a chemical conversion factor of U x 1.1793 = U₃O₈
U₃O₈ by multi acid digestion: 715 ± 81 ppm
U₃O₈ by XRF: 755 ± 51 ppm**

Intended use: AMIS0115 is suitable for monitoring the accuracy of a single analysis of uraniferous calcareous grit. The material can be used for routine quality control by inserting within a batch of samples.

Additional geochemical data is presented for this material that will enable its use for method development and for the calibration of equipment.

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 Paladin Energy from their Langer Heinrich Mine, 80km east of Swakopmund in Namibia. This deposit is a "calcrete deposit"; one of the surficial uranium occurrences discovered in Southern Africa during the 1970's.

Uranium mineralization is associated with calcretization of valley-fill fluvial sediments in an extensive tertiary palaeo-channel drainage system. These sediments, also known as the Langer Heinrich Formation, comprise mainly grits and conglomerates. Detrital components include quartz- and feldspar granules, minor mica flakes as well as rock fragments derived from surrounding Proterozoic country rock.

Uranium mineralization occurs in the form of carnotite, which is a secondary uranium and vanadium mineral and has been precipitated from groundwater. Uranium as well as vanadium originates from the Proterozoic country rock, the former was most likely sourced from granites, whereas the latter was probably sourced from mafic schists.

Mineral and chemical composition:

The AMIS0115 major element chemistry for this material has also been determined by predominantly XRF analyses from fifteen of the laboratories. Statistics for the iterated data are set out in a table below. This data has not been independently certified (except the S). Additional trace element chemistry for this product is available on request.

	Mean %	2SD %	RSD%	n
Al ₂ O ₃	8.68	0.35	1.99	110
CaO	14.95	0.36	1.22	98
Cr ₂ O ₃	0.020	0.004	8.99	77
Fe ₂ O ₃	2.09	0.12	2.78	100
K ₂ O	2.67	0.08	1.41	88
MgO	1.16	0.07	2.91	95
MnO	0.067	0.008	5.75	80
Na ₂ O	1.64	0.18	5.42	108
P ₂ O ₅	0.095	0.010	5.39	76
SiO ₂	54.79	1.02	0.93	93
TiO ₂	0.31	0.02	2.57	94
S (Prov.conc)	0.037	0.006	8.32	54
LOI	13.52	0.69	2.55	94

Appearance: The material is a very fine powder. It is coloured a Yellowish Grey (Corstor 5Y 8/2).

Radioactivity: Shipments of this material do not require special marking, labeling or placarding. AMIS0115 does contain U (8.0 Bq/g) and Th (0.03 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: Sixteen laboratories were each given eight randomly selected packages of sample. The results from the thirteen 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. ALS Chemex South Africa (Pty) Ltd.
3. ALS Chemex, (Perth, Australia).
4. ALS Chemex, (Vancouver, Canada).
5. Assayers Canada, (Vancouver).
6. Genalysis Laboratory Services (Pty) Ltd., (Australia).
7. Geoscience Laboratories, (Geo Labs, Sudbury, Canada).
8. Labtium Inc. (Finland)
9. Langer Heinrich Mine Laboratory (Namibia)
10. OMAC Laboratories (Ireland).
11. Pt Intertek Utama Services (Intertek, Indonesia)
12. Set Point Laboratories (Pty) Ltd (South Africa)
13. SGS Lakefield Research (Canada)
14. SGS Lakefield Research Africa (Pty) Ltd. (Joburg, South Africa)
15. SGS Welshpool (Australia).
16. Ultra Trace (Pty) Ltd. (Australia)

Assay Data (cont):

Lab Code	Ba (M/ICP) ppm	Co (M/ICP) ppm	Cr (M/ICP) ppm	Cu (M/ICP) ppm	Mn (M/ICP) ppm	Ni (M/ICP) ppm	P (M/ICP) ppm	S (M/ICP) %	SG gas g/cc	Sr (M/ICP) ppm	U (M/ICP) ppm	U (XRF) ppm	V (M/ICP) ppm	Zn (M/ICP) ppm	Zr (M/ICP) ppm
L	298	5.60	112	80	496	406	400			198	629		179	44	41
L	296	4.90	107	30	480	242	360			192	616		177	44	43
L	320	6.00	109	34	488	270	370			190	630		183	44	43
L	296	5.20	112	30	466	270	370			191	604		179	44	44
L	300	4.80	116	33	491	245	380			189	630		187	49	40
L	315	5.80	161	45	540	436	390			193	645		177	46	37
L	308	6.10	108	50	499	266	400			205	618		179	43	36
L	299	5.10	106	28	480	248	380			193	610		176	44	34
M	300	6.00	108	33	532	246	460	0.040	2.59	212	660		179	44	52
M	300	6.30	107	29	531	323	460	0.050	2.73	212	660		191	43	57
M	310	6.10	110	35	553	261	490	0.040	2.58	224	700		183	46	52
M	310	6.20	108	40	548	267	480	0.040	2.59	221	690		173	43	64
M	300	6.30	110	29	527	272	450	0.020	2.59	210	650		184	42	55
M	300	6.30	110	38	535	244	470	0.040	2.59	217	680		178	44	53
M	290	5.80	110	30	521	311	460	0.040	2.59	210	660		172	43	51
M	280	6.40	114	33	507	293	440	0.040	2.58	205	630		181	54	54
N	270	6.10	100	29	476	297	410	0.030	2.64	198	570	600	165	42	43
N	270	6.00	101	28	483	277	420	0.040	2.62	200	580	600	169	41	48
N	270	6.20	93	29	480	228	430	0.040	2.68	205	620	600	165	42	50
N	270	6.40	98	39	486	253	420	0.040	2.61	205	590	600	171	43	51
N	270	6.50	98	29	483	259	420	0.040	2.65	209	610	600	167	42	51
N	270	6.20	94	32	483	243	420	0.030	2.54	201	590	600	165	41	48
N	260	5.90	89	34	460	248	400	0.030	2.59	196	570	600	160	41	46
N	270	6.40	100	29	493	287	420	0.040	2.59	209	610	600	177	44	51
O	270	6.90	104	40	512	284	420	0.040	2.53	208	590	580	180	44	55
O	260	6.60	104	32	495	235	390	0.040	2.51	201	570	580	174	43	52
O	260	6.80	103	33	494	345	400	0.040	2.53	202	580	580	177	47	55
O	260	6.50	102	30	484	257	390	0.040	2.54	197	560	580	170	46	53
O	260	6.50	104	31	483	249	390	0.040	2.51	198	560	580	171	41	53
O	260	7.10	101	32	492	265	400	0.040	2.52	202	570	570	174	43	52
O	260	6.50	105	31	480	296	390	0.040	2.52	196	560	580	169	41	52
O	260	6.40	98	30	483	260	390	0.040	2.54	195	550	580	172	41	52
P	293	6.00	77	31	542	295	400	0.050	2.34	202	676		181	56	43
P	286	6.00	80	35	545	277	500	0.040	2.34	202	689		186	54	44
P	285	6.00	83	35	549	324	400	0.040	2.36	197	651		185	47	44
P	285	7.00	84	35	578	333	500	0.050	2.4	198	651		184	51	45
P	291	7.00	84	47	583	331	500	0.040	2.4	198	681		188	48	44
P	286	6.00	85	39	556	312	400	0.050	2.44	193	681		188	46	43
P	288	6.00	80	34	548	333	500	0.050	2.51	196	667		181	47	41
P	288	6.00	91	34	576	292	500	0.050	2.37	196	675		187	52	46

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.

14 May 2008

Certifying officers:



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