African Mineral Standards

REFERENCE MATERIAL FOR AFRICAN ORES

Witwatersrand High Ore Grade Multi Element Reference Material *Supplementary Certification for the Rare Earth Elements*

AMIS0029

Certificate of Analysis

Recommended Concentration and two "Between Laboratory" Standard Deviations

Certified Concentrations

Gd	8.98	+-	1.02 ppm
La	42.93	+-	4.82 ppm
Nd	32.88	+-	3.75 ppm
Pr	8.77	+-	1.03 ppm
Sm	8.46	+-	0.90 ppm

Provisional Concentrations

Ce	82.77	+-	13.76 ppm
Dy	10.45	+-	1.51 ppm
Er	5.57	+-	0.87 ppm
Eu	1.29	+-	0.17 ppm
Ho	1.96	+-	0.36 ppm
Lu	0.57	+-	0.09 ppm
Tb	1.66	+-	0.25 ppm
Tm	0.77	+-	0.16 ppm
Yb	4.74	+-	0.77 ppm

Tel:+ 27(0)11 923 7000 **Fax:**+27(0)11 923 7027
E-mail: info@amis.co.za **Web:**www.amis.co.za 30 Electron Avenue, Isando, 1600, PO Box 856, Isando, 1600, South Africa

Intended use: AMIS0029 is suitable for monitoring the accuracy of a single analysis for the rare earth elements in siliceous material. The material can be used for instrument calibration.

AMIS0029, has at the time of preparation of this certificate, also been certified for Au, Ag, U, Specific Gravity and the major elements. This data is available on two separate certificates.

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 standard was made from grade-sorted pulp rejects sourced from Anglo Gold Ashanti mine assay laboratories in South Africa. It represents sample material from the basal contacts of the Vaal Reef and the Carbon Leader Reef collected during routine underground sampling. This is primarily a multi-element gold standard, but at the request of customers and because of it's unusual character, it has also been certified for other elements.

Mineral and chemical composition: The major element chemical composition of this material (below), is based on predominantly XRF analyses, from 12 selected laboratories each analyising 8 samples.

The other currently certified values for this material are:

Certified Concentrations*

Au (Pb Collection)	15.79	+-	0.80 g/t
U (T/ICP)	867	+-	72 ppm
U (XRF)	890	+-	28 ppm
Specific Gravity	2.78	+-	0.18 g/cc
Al2O3	5.42	+-	0.22%
CaO	0.316	+-	0.016%
Fe2O3	5.252	+-	0.212%
K2O	0.695	+-	0.042%
MgO	0.74	+-	0.04%
SiO2	84.08	+-	1.36%
S03	3.78	+-	0.39%
TiO2	0.237	+-	0.018%

Provisional Concentrations*

Ag (T)	2.1	+-	0.6 ppm
MnO	0.038	+-	0.006 ppm
LOI	2.37	+-	0.24 ppm

Indicated Mean*

Na2O	0.16 ppm
P2O5	0.042 ppm

****Data for these other elements is available on separate certificates.***

Method of preparation: The material was crushed, dry-milled and air-classified to 100% <54um. Wet sieve particle size analysis of random samples confirmed the material was 100% <54um. 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 element scan, multi-acid total digestion, including HF, ICP- OES or ICP-MS.

Method of certification: Thirteen laboratories were each given eight randomly selected packages of sample. The results from the twelve laboratories that issued results timeously were used.

The 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 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 calculated using all remaining data. Any analysis that fell outside of the mean ±2 standard deviations was removed from the ensuing data base. The mean and standard deviations were again calculated using the remaining data. This method is different from that used by Government agencies 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 Confidence Limits published on other standards. Standards with an RSD of near or less than 5 % are certified, RSD’s of between near 5 % and 15 % are Provisional, and RSD’s over 15 % are Indicated.

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. ALS Chemex South Africa (Pty) Ltd.
4. ALS Chemex, (Vancouver, Canada).
5. Assayers Canada, (Vancouver).
6. Genalysis Laboratory Services (Pty) Ltd., (Australia).
7. Geoservice Centre, Geolaboratory, (GTK. Finland).
8. Pt Intertek Utama Services (Intertek, Indonesia)
9. Set Point Laboratories (Pty) Ltd (South Africa)
10. SGS Lakefield Research (Canada)
11. SGS Welshpool (Australia).
12. Ultra Trace (Pty) Ltd. (Australia)

Assay Data: Data as received from the laboratories is set out below. A proficiency report has been sent to the managers of the participating laboratories.

AMIS0029 Rare Earth Elements

Lab Code	Ce ppm	Dy ppm	Er ppm	Eu ppm	Gd ppm	Ho ppm	La ppm	Lu ppm	Nd ppm	Pr ppm	Sm ppm	Tb ppm	Tm ppm	Yb ppm
A														
A														
A														
A														
A														
A														
A														
A														
B	99.6	11.0	6.0	1.4	9.5	2.2	41.2	0.7	37.1	10.2	9.0	1.8	0.8	5.2
B	93.4	10.2	5.3	1.3	8.7	1.9	40.0	0.6	33.0	9.3	8.1	1.6	0.8	4.8
B	101.3	11.4	5.9	1.3	9.2	2.1	42.9	0.6	36.2	10.0	8.9	1.8	0.8	5.3
B	101.7	11.4	5.8	1.4	9.8	2.2	45.0	0.6	37.0	10.2	9.2	1.7	0.9	5.1
B	44.0	10.3	5.8	1.0	8.6	2.1	54.0	0.6	19.3	6.5	6.5	1.7	0.8	5.1
B	84.7	9.8	5.5	1.3	8.3	2.0	42.1	0.6	28.8	8.4	7.6	1.6	0.8	4.9
B	91.4	10.3	5.2	1.2	8.5	1.9	44.1	0.6	31.5	9.0	7.9	1.7	0.8	4.8
B	91.7	10.5	5.8	1.3	9.1	2.1	41.6	0.6	32.2	9.1	8.6	1.8	0.8	5.1
C	88.1	11.9	6.4	1.4	9.6	2.3	45.7	0.6	34.0	9.4	8.7	1.9	0.9	5.5
C	86.2	11.8	6.3	1.4	9.6	2.3	45.1	0.6	33.1	9.2	8.6	1.8	0.9	5.4
C	87.3	12.0	6.4	1.4	9.6	2.3	45.3	0.6	33.8	9.2	8.6	1.8	0.9	5.4
C	84.8	11.6	6.4	1.4	9.4	2.3	44.9	0.6	32.7	9.1	8.5	1.9	0.9	5.4
C	87.4	12.2	6.6	1.4	9.8	2.4	45.5	0.6	33.8	9.3	8.8	1.9	0.9	5.4
C	86.3	11.8	6.3	1.4	9.6	2.3	44.9	0.6	33.7	9.2	8.8	1.8	0.9	5.4
C	84.4	11.8	6.3	1.4	9.6	2.3	44.9	0.6	32.9	9.1	8.8	1.8	0.9	5.2
C	84.0	11.5	6.2	1.3	9.4	2.2	44.8	0.6	32.8	9.1	8.6	1.8	0.9	5.3
D	89.5	12.8	6.8	1.5	9.6	2.4	44.0	0.7	34.1	9.2	8.3	2.0	1.0	5.7
D	89.7	13.0	6.9	1.5	9.8	2.4	43.4	0.7	34.6	9.3	8.4	2.1	1.0	5.8
D	89.7	12.9	6.8	1.5	9.6	2.4	43.8	0.7	34.6	9.1	8.6	2.1	1.0	5.9
D	88.8	12.6	6.7	1.5	9.3	2.3	44.1	0.7	33.9	9.2	8.5	2.0	1.0	5.9
D	87.2	12.5	6.7	1.5	9.2	2.3	42.9	0.7	32.7	8.9	8.2	2.0	1.0	5.8
D	89.2	12.9	6.8	1.5	9.3	2.4	44.1	0.7	34.7	9.2	8.6	2.1	1.0	5.8
D	89.9	12.6	6.8	1.5	9.1	2.4	43.8	0.7	34.3	9.3	8.5	2.0	1.0	5.8
D	87.5	12.5	6.6	1.5	9.0	2.3	42.8	0.7	33.5	8.9	8.4	2.0	1.0	5.7
E	84.5	10.5	5.9	1.3	9.4	2.0	44.2	0.6	32.7	8.7	8.3	1.7	0.8	4.7
E	83.1	10.3	5.6	1.3	9.1	1.9	42.8	0.6	32.1	8.5	8.2	1.7	0.8	4.6
E	88.5	10.6	5.8	1.4	9.4	2.0	45.5	0.6	34.5	9.1	8.8	1.7	0.8	4.8
E	83.6	10.2	5.6	1.3	9.1	1.9	43.5	0.6	32.4	8.5	8.3	1.7	0.7	4.6
E	86.6	10.6	5.8	1.3	9.5	2.0	44.9	0.6	33.6	8.9	8.5	1.7	0.8	4.8
E	85.0	10.5	5.6	1.3	9.3	2.0	44.2	0.6	33.0	8.7	8.5	1.7	0.8	4.7
E	82.2	9.8	5.3	1.2	8.8	1.8	42.5	0.5	32.2	8.4	8.1	1.6	0.7	4.4
E	85.1	10.1	5.5	1.3	9.1	1.9	43.9	0.5	33.1	8.7	8.3	1.7	0.7	4.5
F	77.9	10.0	5.3	1.3	9.1	1.9	38.9	0.5	34.2	8.7	8.9	1.5	0.7	4.7
F	78.7	10.1	5.5	1.3	9.1	1.9	39.0	0.5	34.6	8.8	9.0	1.6	0.7	4.8
F	76.6	9.9	5.2	1.3	8.9	1.9	38.2	0.5	33.9	8.6	8.7	1.6	0.7	4.7
F	79.5	10.2	5.4	1.3	9.2	1.9	39.2	0.5	34.9	8.9	9.0	1.6	0.8	4.8
F	77.5	10.0	5.3	1.3	8.9	1.9	37.7	0.5	34.1	8.6	8.7	1.6	0.7	4.7
F	78.7	10.1	5.3	1.3	9.1	1.9	39.0	0.5	34.6	8.8	8.9	1.5	0.7	4.8
F	77.7	10.1	5.2	1.3	8.8	1.8	38.6	0.5	34.1	8.7	8.8	1.5	0.7	4.7
F	83.7	10.7	5.6	1.4	9.4	2.0	41.4	0.5	37.0	9.4	9.5	1.7	0.8	5.0
G	79.6	10.7	5.1	1.3	8.1	1.9	40.8	0.5	31.8	8.5	8.2	1.5	0.7	4.5
G	79.4	10.6	5.1	1.3	7.9	1.9	40.0	0.5	32.1	8.6	8.2	1.5	0.7	4.5
G	80.5	10.9	5.4	1.3	8.3	1.9	40.9	0.6	32.0	8.8	8.3	1.6	0.7	4.6
G	81.7	11.0	5.4	1.3	8.6	1.9	41.5	0.5	32.6	9.0	8.3	1.6	0.7	4.7
G	79.5	10.9	5.2	1.3	8.3	1.9	40.0	0.5	32.2	8.7	8.2	1.6	0.7	4.5
G	82.1	10.8	5.4	1.3	8.5	1.9	41.3	0.5	32.3	8.8	8.3	1.6	0.7	4.6
G	79.2	10.7	5.2	1.3	8.3	1.9	40.1	0.5	31.9	8.6	8.1	1.6	0.7	4.5
G	80.2	10.8	5.2	1.3	8.2	1.9	40.4	0.5	32.1	8.6	8.2	1.6	0.7	4.5
H	77.7	10.1	5.0	1.2	9.0	1.9	38.4	0.6	34.1	8.6	7.7	1.7	0.7	4.2
H	69.7	8.4	4.2	1.2	7.8	1.7	35.7	0.5	29.7	7.6	6.8	1.4	0.7	3.5
H	71.4	9.5	4.8	1.1	7.0	1.7	35.1	0.5	29.5	7.7	7.1	1.5	0.6	3.8
H	72.1	8.5	4.6	1.2	9.1	1.8	35.0	0.5	29.7	8.0	7.5	1.5	0.6	5.0
H	69.7	9.5	4.4	1.1	8.6	1.7	34.2	0.6	30.2	7.6	6.9	1.5	0.6	3.9
H	70.2	9.2	4.9	1.2	7.9	1.7	34.3	0.4	31.6	7.7	7.5	1.6	0.7	3.7
H	71.9	8.8	4.6	1.3	8.3	1.8	34.7	0.6	29.5	7.5	7.1	1.5	0.7	4.1
H	60.6	7.5	3.8	1.0	6.9	1.4	29.7	0.4	26.9	6.2	6.1	1.2	0.6	3.1
I	84.0	10.0	5.1	1.3	8.5	1.8	40.0		32.0	8.9	8.4	1.6		4.2
I	86.0	10.0	5.1	1.3	8.5	1.8	41.0		34.0	9.1	8.6	1.6		4.2
I	85.0	10.0	5.1	1.3	8.5	1.8	41.0		34.0	9.1	8.5	1.6		4.2
I	87.0	10.0	5.2	1.4	8.6	1.8	42.0		34.0	9.3	8.8	1.6		4.3
I	83.0	10.0	5.0	1.3	8.3	1.8	40.0		33.0	8.9	8.4	1.5		4.1
I	87.0	10.0	5.0	1.3	8.4	1.8	41.0		34.0	9.3	8.7	1.5		4.1
I	86.0	10.0	5.0	1.3	8.3	1.8	41.0		34.0	9.2	8.7	1.6		4.2
I	87.0	10.0	5.1	1.4	8.5	1.8	42.0		34.0	9.4	8.8	1.6		4.2

Lab Code	Ce ppm	Dy ppm	Er ppm	Eu ppm	Gd ppm	Ho ppm	La ppm	Lu ppm	Nd ppm	Pr ppm	Sm ppm	Tb ppm	Tm ppm	Yb ppm
J	94.1	13.2	5.9	1.3	11.8	2.0	45.0	0.6	36.4	10.6	8.7	1.9	0.9	4.7
J	90.7	10.7	6.2	1.4	10.9	2.1	43.7	0.6	37.9	10.3	8.9	1.8	0.9	5.4
J	90.5	10.8	6.2	1.4	14.2	2.2	44.5	0.6	34.6	10.0	8.9	1.8	0.9	4.7
J	104.6	12.0	6.7	2.3	13.7	2.4	47.6	0.6	54.0	13.7	13.8	2.0	1.2	5.3
J	97.4	10.6	6.2	1.8	12.7	2.1	44.9	0.5	44.3	11.9	11.7	1.9	1.0	4.5
J	92.2	10.5	6.0	1.5	11.1	2.1	44.4	0.6	37.1	10.4	9.2	1.8	0.9	5.1
J	91.1	10.9	6.4	1.4	11.2	2.1	44.2	0.6	37.6	10.1	8.9	1.8	0.8	4.8
J	89.7	10.1	6.0	1.3	10.6	2.0	43.7	0.6	32.3	9.5	8.5	1.7	0.8	4.9
K	68.7	10.2	5.4	1.3	9.6	2.0	35.7	0.7	29.7	8.3	7.8	1.7	0.8	4.6
K	79.1	11.2	5.9	1.4	10.7	2.2	40.4	0.7	33.8	9.4	8.7	1.9	0.9	5.1
K	69.5	9.6	5.1	1.2	9.2	1.9	35.6	0.6	29.1	8.2	7.5	1.6	0.7	4.5
K	65.5	9.4	5.2	1.2	8.9	1.8	33.6	0.5	29.3	7.8	7.3	1.7	0.7	4.2
K	70.8	9.8	5.4	1.3	9.6	1.9	37.2	0.6	31.7	8.4	7.8	1.7	0.8	4.4
K	69.3	9.4	5.2	1.2	9.1	1.9	35.9	0.5	30.6	8.2	7.5	1.9	0.7	4.3
K	68.4	9.4	5.2	1.2	9.1	1.8	35.9	0.5	30.4	8.1	7.4	1.5	0.7	4.3
K	68.9	9.5	5.2	1.2	9.2	1.9	36.5	0.5	30.6	8.2	7.5	1.7	0.7	4.2
L	83.6						42.8							
L	86.6						43.6							
L	86.2						44.2							
L	88.2						44.9							
L	87.1						43.9							
L	88.7						44.0							
L	89.0						45.0							
L	84.8						42.9							
M							46.0							
M							49.0							
M							50.0							
M							49.0							
M							50.0							
M							50.0							
M							50.0							
M							51.0							

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.

6 June 2007

Certifying officers:

African Mineral Standards:_____

Mike McWha
BSc (Hons), FGSSA, MSAIMM, Pr.Sci.Nat

Geochemist:_____

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