MATRIX REFERENCE MATERIALS
A Part of Torre Industries

AMIS0496

Certified Reference Material

Gold Ore, Greenstone, Nyankanga, Tanzania

Certificate of Analysis

Recommended Concentrations and Limits[1. 2.]
(at two Standard Deviations)

Certified Concentration

Au Pb Collection	2.34	±	0.14	g/t
Ag 4A_MICP	0.58	±	0.2	ppm
Cu 4A_MICP	84.8	±	2.2	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, 10 and 13.*
2. *There is additional uncertified element data presented as an appendix.*

AMIS
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(Reg. No. 1989/000201/07)
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Directors: C E Pettit (British), R Naidoo, N N Robinson, K V Gerber, M Padayachee

Torre Industries

Provisional Concentrations

Al_2O_3 XRF	13.83	±	0.07	%
CaO XRF	3.81	±	0.04	%
Cr_2O_3 XRF	0.11	±	0.02	%
Fe_2O_3 XRF	6.05	±	0.05	%
K_2O XRF	3.78	±	0.04	%
MgO XRF	2.31	±	0.15	%
MnO XRF	0.08	±	0.01	%
Na_2O XRF	3.82	±	0.65	%
P_2O_5 XRF	0.20	±	0.004	%
S Comb/LECO	0.96	±	0.08	%
SiO_2 XRF	60.99	±	0.40	%
TiO_2 XRF	0.37	±	0.03	%
U 4A_MICP	10.6	±	1.9	ppm
SG	2.78	±	0.05	No unit

Informational Concentrations

U XRF	12.43	±	12.79	ppm
LOI	4.09	±	1.28	%

1. **Intended Use:** AMIS0496 can be used to check the analysis BIF hosted gold 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 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:** AMIS0496 is an Anglo Gold commissioned CRM made from Nyankanga deposit. The Nyankanga Deposit is hosted in a package of BIF, shales and greywackes forming a roof-pendant next to the top of Nyankanga Intrusive Complex. The Nyankanga Intrusive Complex is composed of several facies of diorite bodies. Sets of quartz-feldspar-porphyry and quartz-porphyry dykes strike northeast and dipping northwest, cross cutting both BIF and diorite.

3. **Approximate Mineral and Chemical Composition:** At mineral scale, gold mineralization is associated to chlorite-carbonate+hematite+albite-silica-pyrite/pyrrhotite-alteration in the damage zones. The latter comprise a variety of structural features, including veins and veinlets of variable composition, thickness and shapes; hydrothermal breccias; quartz+albite+carbonate veins forming local feeders spreading sulphides and gold outwards to replacing magnetite rich layers forming banded sulphide facies; and massive replacements and disseminations. Barren tourmaline-carbonate-quartz veins have been observed at places hosted in diorites

4. **Appearance:** The material is a very fine powder. It is colored Blueish Grey (5B 7/I)

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 <54um. Wet sieve particle size analysis of random samples confirmed the material was 98.5% <54um. 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. Au – Pb collection ICP-OES or ICP-MS
2. Multi-acid digest, including HF, ICP- OES or ICP-MS. Multi element scan to include U (M/ICP)
3. U XRF
4. Majors (Al_2O_3, CaO, Cr_2O_3, Fe_2O_3, K_2O, MgO, MnO, Na_2O, SiO_2, TiO_2, P_2O_5,U_3O_8, LOI.) XRF fusion
5. SG (gas pycnometer)

8. **Information requested**

1. State aliquots used for all determinations.
2. All results for major elements to be reported as oxides in percentages.
3. All results for multi-element scans to be reported in ppm.
4. All results for Au to be reported in ppb.
5. Report all QC data, to include replicates, blanks and certified reference materials used.
6. State and provide brief description of analytical techniques used.

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9. Method of Certification: Twenty six laboratories were each given eight scientifically selected packages of sample. Twenty laboratories of the twenty six laboratories submitted results in time for certification.

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 analyses (see 13), 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 20 laboratories that provided results timeously were (not in same order as in the table of assays):

1. ALS Ireland
2. ALS SA
3. ALS Vancouver
4. Antech Zimbabwe
5. Argetest Ankara Turkey
6. BV Namibia
7. BV Ultra Trace Australia
8. Genalysis Perth
9. Gumustas Mad. Ve Tic A.S Testing Laboratory (Turkey)
10. Chemical and Physical Laboratory (CPAL) Jordan (JAEC)
11. Nesch Mintec
12. Quality LabTanzania
13. Ready Lead Assay Lab
14. Set point Lab Isando
15. SGS Lakefield
16. SGS Newburne Aus
17. SGS Townsville
18. SGS Vancouver Canada
19. Shiva Analyticals
20. Sibanya Gold

11. Assay Data: Data as received from the laboratories for the important certified elements listed on p1 are set out below.

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Assay data:

Pb Coll Au g/t	Pb Coll Au g/t	Pb Coll Au g/t	LOI LOI %	M/ICP U ppm	XRF U ppm	4A_MICP Ag ppm	4A_MICP Cu ppm	Comb/LECO S %	SG SG No unit
2.36	2.49	2.95	3.39	11.23	19.00	0.54	84.80	1.00	2.82
2.33	2.56	2.53	3.32	11.22	16.00	0.62	84.80	1.00	2.87
2.33	2.46	2.20	3.46	11.32	20.00	0.53	85.60	1.00	2.83
2.32	2.54	2.41	3.45	11.11	26.00	0.57	86.20	0.98	2.78
2.39	2.60	2.09	3.43	11.17	18.00	0.55	86.80	0.98	2.81
2.34	2.52	2.39	3.42	11.50	33.00	0.58	84.70	1.00	2.82
2.34	2.56	2.25	3.44	11.13	-5.00	0.49	88.90	0.98	2.75
2.41	2.59	2.01	3.42	11.64	15.00	0.53	86.50	1.01	2.79
2.43	2.36	2.28	3.66	8.68	7.00	0.50	83.38	0.92	2.76
2.37	2.36	2.32	3.63	9.98	7.00	0.42	82.68	0.92	2.76
2.49	2.33	2.40	3.66	9.70	8.00	0.59	84.75	0.92	2.77
2.47	2.35	2.32	3.54	8.85	8.00	0.52	82.65	0.92	2.77
2.48	2.36	2.26	3.69	9.63	7.00	0.58	82.91	0.92	2.76
2.36	2.29	2.38	3.71	8.22	7.00	0.46	83.73	0.92	2.77
2.39	2.27	2.20	3.70	9.18	8.00	0.47	84.58	0.92	2.77
2.48	2.32	2.36	3.70	8.94	8.00	0.52	83.87	0.92	2.76
2.35	2.24	2.48	4.18	10.91		0.65	87.00		
2.41	2.30	2.49	4.27	11.25		0.70	87.00		
2.42	2.35	2.34	4.38	10.91		0.68	86.00		
2.35	2.24	2.63	4.37	11.27		0.73	85.00		
2.35	2.51	2.37	4.07	11.13		0.62	86.00		
2.39	2.34	2.35	4.10	11.19		0.62	88.00		
2.37	2.32	2.36	4.21	11.07		0.75	87.00		
2.40	2.39	2.44	4.18	11.48		0.66	82.50		
2.28	2.31	2.24	5.08				81.30		
2.27	2.36	2.20	5.07				82.10		
2.26	2.31	2.35	5.06				80.20		
2.26	2.37	2.34	5.07				81.80		
2.36	2.26	2.34	5.06				84.30		
2.33	2.37	2.34	5.06				81.80		
2.41	2.45	2.40	4.97				86.00		
2.25	2.25	2.31	5.05				86.00		
		2.38					87.00		
		2.37					86.00		
		2.48					85.00		
		2.24					86.00		
		2.38					86.00		
		2.27					86.00		
		2.22							
		2.28							

XRF Al_2O_3 %	XRF CaO %	XRF Cr_2O_3 %	XRF Fe_2O_3 %	XRF K_2O %	XRF MgO %	XRF MnO %	XRF Na_2O %	XRF P_2O_5 %	XRF SiO_2 %	XRF TiO_2 %
13.87	3.81	0.10	6.03	3.79	2.37	0.08	4.08	0.20	60.87	0.38
13.90	3.83	0.10	6.04	3.79	2.38	0.08	4.09	0.20	60.88	0.37
13.85	3.83	0.10	6.04	3.78	2.38	0.08	4.08	0.20	60.82	0.38
13.82	3.81	0.10	6.03	3.77	2.38	0.08	4.06	0.20	60.71	0.38
13.82	3.81	0.10	6.00	3.76	2.37	0.08	4.06	0.20	60.66	0.37
13.84	3.81	0.10	6.03	3.78	2.37	0.08	4.07	0.20	60.84	0.38
13.85	3.80	0.10	5.99	3.77	2.36	0.07	4.07	0.20	60.70	0.37
13.79	3.80	0.10	6.02	3.77	2.37	0.08	4.07	0.21	60.67	0.38
13.87	3.83	0.12	6.06	3.78	2.35	0.08	4.04	0.20	61.24	0.36
13.88	3.83	0.12	6.05	3.75	2.34	0.08	4.03	0.20	61.13	0.35
13.79	3.83	0.12	6.06	3.72	2.34	0.08	3.99	0.21	61.25	0.36
13.82	3.84	0.12	6.09	3.75	2.34	0.08	4.00	0.20	61.21	0.36
13.85	3.84	0.12	6.04	3.74	2.36	0.08	4.04	0.20	61.01	0.36
13.85	3.83	0.12	6.07	3.71	2.38	0.08	3.98	0.20	61.09	0.36
13.74	3.84	0.12	6.07	3.75	2.36	0.08	4.00	0.20	60.96	0.36
13.85	3.82	0.12	6.06	3.77	2.35	0.08	4.00	0.21	61.00	0.36
13.80	3.78	0.10	6.07	3.82	2.20	0.09	3.36		61.10	0.38
13.80	3.79	0.10	6.07	3.79	2.20	0.09	3.41		61.10	0.39
14.00	3.79	0.10	6.07	3.78	2.20	0.09	3.37		61.30	0.39
13.70	3.76	0.10	6.03	3.78	2.20	0.09	3.32		60.40	0.39
13.80	3.77	0.10	6.08	3.79	2.20	0.09	3.39		61.00	0.39
13.80	3.80	0.10	6.09	3.81	2.20	0.09	3.40		61.30	0.39
13.80	3.79	0.10	6.06	3.79	2.20	0.09	3.34		61.00	0.39
13.80	3.78	0.10	6.07	3.79	2.10	0.09	3.35		60.90	0.39

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:

Combined standard uncertainty=sqrt((between lab.var/no of labs) + (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.

Analyte	Method	Unit	S [1]	σL [2]	SW [3]	CSU [4]
Au	Pb Coll	g/t	0.070	0.036	0.064	0.012
Ag	4A_MICP	ppm	0.100	0.140	0.049	0.082
Cu	4A_MICP	ppm	35.400	2.326	1.041	1.054

1 *S - Std Dev for use on control charts.*
2 *σL - 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 Indicated values listed on p1 of this certificate fulfill the AMIS statistical criteria regarding agreement for certification and have been independently validated by Mr Allan W. 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: AMIS0496 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.

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.

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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.

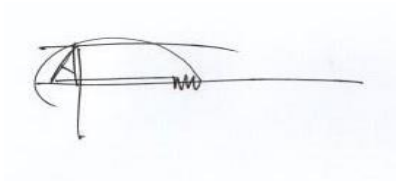
20. Legal Notice: This certificate and the reference material described in it have been prepared with due care and attention. However AMIS, a division of Torre Analytical Services (Pty) Ltd, Nozibele Mbangula, and Allan W. Fraser; accept no liability for any decisions or actions taken following the use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

01 September 2016
Amended 25 October 2016-Certification of Cu_4A_MICP
Amended 27 October 2016-Certification of Ag_4A_MICP

Certifying Officers:

African Mineral Standards: _____

Nozibele Mbangula



Geochemist:_____

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

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Appendix – uncertified element statistics

Element	Gen Method	Std_Mean	N	SD	2SD	RSD_%	Unit
Ag	4A_MICP	0.61	16	0.08	0.15	12.58	ppm
Al	4A_MICP	69392.25	32	4884	9768	7.04	ppm
Al2O3	4A_MICP	14.21	7	0.17	0.34	1.18	%
Al2O3	XRF	13.83	22	0.04	0.07	0.27	%
Ar	4A_MICP	23.83	16	13.86	27.72	58.18	ppm
Au	4A_MICP	2.46	8	0.14	0.27	5.55	g/t
Ba	4A_MICP	1225.22	22	38.66	77.32	3.16	ppm
Be	4A_MICP	1.37	23	0.14	0.27	10.06	ppm
Bi	4A_MICP	0.46	16	0.03	0.06	6.94	ppm
Ca	4A_MICP	26229.39	31	1060.05	2120.1	4.04	ppm
CaO	4A_MICP	3.84	8	0.17	0.34	4.39	%
CaO	XRF	3.81	23	0.02	0.04	0.56	%
Cd	4A_MICP	0.16	16	0.04	0.08	26.34	ppm
Ce	4A_MICP	109.50	15	1.99	3.97	1.81	ppm
Co	4A_MICP	17.89	23	0.57	1.13	3.16	ppm
Cr	4A_MICP	568.63	16	88.52	177.05	15.57	ppm
Cr2O3	XRF	0.11	24	0.01	0.02	8.2	%
Cs	4A_MICP	3.33	15	0.06	0.12	1.76	ppm
Cu	4A_MICP	86.19	23	1.03	2.06	1.19	ppm
Dy	4A_MICP	2.29	16	0.13	0.25	5.5	ppm
Er	4A_MICP	1.00	15	0.04	0.09	4.48	ppm
Eu	4A_MICP	2.00	16	0.14	0.29	7.14	ppm
Fe	4A_MICP	42043.17	23	970.24	1940.48	2.31	ppm
Fe2O3	XRF	6.05	23	0.02	0.05	0.38	%
Ga	4A_MICP	17.94	16	0.91	1.81	5.05	ppm
Gd	4A_MICP	4.95	16	0.63	1.25	12.68	ppm
Ge	4A_MICP	0.92	16	0.77	1.54	84.22	ppm
Hf	4A_MICP	3.21	15	0.05	0.1	1.48	ppm
Ho	4A_MICP	0.39	16	0.01	0.02	2.31	ppm
In	4A_MICP	0.03	8	0	0.01	16.83	ppm
K	4A_MICP	30718.09	23	640.48	1280.96	2.09	ppm
K2O	XRF	3.78	22	0.02	0.04	0.52	%
La	4A_MICP	56.95	16	0.81	1.63	1.43	ppm
Li	4A_MICP	15.94	22	1.03	2.06	6.47	ppm
LOI	LOI	4.09	32	0.64	1.28	15.71	%
Lu	4A_MICP	0.12	16	0.02	0.04	14.44	ppm
Mg	4A_MICP	13901.05	22	417.49	834.99	3	ppm
MgO	XRF	2.31	23	0.08	0.15	3.35	%
Mn	4A_MICP	579.25	24	17.67	35.34	3.05	ppm
MnO	XRF	0.08	23	0	0.01	5.83	%
Mo	4A_MICP	12.16	24	0.47	0.93	3.84	ppm
Na	4A_MICP	28532.96	23	1056.84	2113.68	3.7	ppm
Na2O	XRF	3.82	24	0.33	0.65	8.55	%
Nb	4A_MICP	3.86	16	0.44	0.88	11.37	ppm
Nd	4A_MICP	44.91	16	2.03	4.07	4.53	ppm
Ni	4A_MICP	102.70	24	9.2	18.39	8.95	ppm
P	4A_MICP	831.63	16	18.68	37.35	2.25	ppm
P2O5	XRF	0.20	14	0	0	0.95	%
Pb	4A_MICP	15.69	16	2.34	4.68	14.92	ppm
Pr	4A_MICP	13.04	16	0.94	1.88	7.21	ppm
Rb	4A_MICP	86.10	16	3.81	7.61	4.42	ppm
Re	4A_MICP	0.01	8	0	0	16.64	ppm
S	4A_MICP	1.08	16	0.16	0.31	14.34	%
S	4A_MICP	1.08	16	0.16	0.31	14.34	%
S	Comb/LECO	0.96	16	0.04	0.08	4.07	%
Sb	4A_MICP	17.43	15	0.88	1.77	5.08	ppm
Sc	4A_MICP	6.10	16	0.35	0.7	5.72	ppm
Se	4A_MICP	0.81	8	0.06	0.13	7.89	ppm
SG	SG	2.78	15	0.03	0.05	0.94	g/cm3
Si	4A_MICP	28.25	8	0.63	1.26	2.22	%
SiO2	4A_MICP	60.43	8	1.34	2.68	2.22	%
SiO2	XRF	60.99	23	0.2	0.4	0.33	%
Sm	4A_MICP	7.15	16	0.31	0.62	4.37	ppm
Sn	4A_MICP	1.18	8	0.05	0.09	3.94	ppm
Sr	4A_MICP	1129.04	24	66.16	132.33	5.86	ppm
Ta	4A_MICP	0.25	8	0.02	0.04	7.28	ppm
Tb	4A_MICP	0.55	16	0.05	0.11	9.55	ppm
Te	4A_MICP	0.62	16	0.08	0.17	13.31	ppm
Th	4A_MICP	11.19	16	0.12	0.24	1.09	ppm
Ti	4A_MICP	0.15	24	0.02	0.05	15.48	%
TiO2	XRF	0.37	24	0.01	0.03	3.52	%
Tl	4A_MICP	0.71	16	0.04	0.09	6.09	ppm
Tm	4A_MICP	0.13	15	0.01	0.01	5.66	ppm
U	4A_MICP	10.63	23	0.96	1.92	9.05	ppm
U	XRF	12.43	14	6.39	12.79	51.44	ppm
V	4A_MICP	57.78	23	1.35	2.69	2.33	ppm
W	4A_MICP	7.02	16	0.36	0.72	5.11	ppm
Y	4A_MICP	9.91	16	0.1	0.21	1.04	ppm
Yb	4A_MICP	0.80	16	0.04	0.09	5.49	ppm
Zn	4A_MICP	60.14	21	0.85	1.71	1.42	ppm
Zr	4A_MICP	129.81	24	9.38	18.77	7.23	ppm

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