



AMIS0088

Certified Reference Material

Copper Sulphide Ore Omitiomire Project, Namibia

Certificate of Analysis

Recommended Concentrations and two “Between Laboratory” Standard Deviations

Certified Concentrations

Cu F	3226	±	262	ppm
Cu M/ICP	3216	±	222	ppm
Cu P	3165	±	254	ppm
Cu XRF	3187	±	120	ppm
Ni M/ICP	244	±	22	ppm
Zn M/ICP	97.0	±	7.6	ppm
SG	2.81	±	0.10	

Provisional Concentrations

Co M/ICP	29.2	±	4.3	ppm
Pb M/ICP	12.6	±	3.8	ppm
U M/ICP	13.1	±	3.8	ppm

Informational Means

Ag M/ICP	0.8	ppm
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Major Element Recommended Concentrations and two “Between Laboratory” Standard Deviations

Certified Concentrations

Al ₂ O ₃	14.01	±	0.34	%
CaO	4.74	±	0.07	%
Fe ₂ O ₃	5.69	±	0.12	%
K ₂ O	2.12	±	0.04	%
MgO	3.82	±	0.14	%
MnO	0.46	±	0.02	%
Na ₂ O	3.48	±	0.26	%
P ₂ O ₅	0.23	±	0.01	%
S	0.06	±	0.006	%
SiO ₂	62.67	±	0.94	%
TiO ₂	0.67	±	0.04	%

Provisional Concentrations

Cr ₂ O ₃	0.11	±	0.02	%
LOI	1.44	±	0.40	%

1. **Intended Use:** AMIS0088 is a certified reference material which may be used to demonstrate the validity of measurement results of a single analysis of Cu ores hosted by siliceous rocks with a similar grade and matrix; when measured in parallel to the unknown to be characterised. The material can be used for routine quality control by inserting within a batch of samples, method development and for the calibration of equipment.

The recommended mean and "Between Lab" standard deviations for this material property values based on a measurement campaign (round robin) and reflect the average results from the laboratories that participated in the round robin, after examination of the data set and removal of technically and statistically invalid results (see Clause 9 - this certificate). 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 %.

2. **Origin of Material:** This standard was made using RC chips supplied by Craton Mining and Exploration Pty Ltd from the Omitiomire copper sulphide project, situated about 130 km NW of Windhoek. Craton is a wholly-owned Namibian subsidiary of International Base Metals of Australia (www.interbasemetals.com).

Omitiomire is a copper occurrence hosted in a Mesoproterozoic basement gneiss inlier within the Damara orogen of central Namibia. The host rocks consist mainly of banded quartz-feldspar gneiss, biotite-amphibole-feldspar gneiss and amphibolite. Mineralisation is broadly sheet-like, striking N-S and dipping moderately to the east. Intersections above cut-off grade are typically about 20m thick and the widest intersection was 106 m @ 0.48% Cu.

3. **Mineral and Chemical composition:** Chalcocite is the only sulphide commonly seen and is preferentially hosted in mafic gneiss. The chalcocite is finely disseminated but coarser grained in biotite-epidote-rich rock, where the chalcocite is enriched/remobilized during late Damaran tectonism. Subordinate bornite and traces of chalcopyrite occur. Minor magnetite is

spatially associated with mineralisation. Malachite and other copper “oxides” are present near surface and form a minor constituent of the standard.

Trace element chemistry data from 14 of the labs has been compiled but has not been certified. Summary statistics for this data are set out as an appendix.

4. Appearance: The material is a very fine powder. It is coloured a Light Greenish Grey (Corstor 5GY 8/1).

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 <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 the consensus test results were carried out by independent statisticians.

7. Methods of Analysis requested:

1. Cu, Fusion AAS or ICP-OES.
2. Multi-acid digest multi-element scan - (to include Cu). ICP-OES or ICP-MS.
3. Aqua regia digest - Cu. ICP-OES or ICP-MS.
4. Pressed pellet multi-element scan - (to include Cu). XRF.
5. Fusion (Majors). XRF.
6. SG. Gas pycnometer.

Additionally, XRF analyses were requested for the major elements and a multi-element multi acid digest and ICP scan was requested for the trace elements.

8. Information requested:

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

9. Method of Certification: Eighteen laboratories were each given eight randomly selected packages of sample. Seventeen of the laboratories submitted results.

The final limits were calculated after a three step examination of the data, first removing incompatible data outside a spread normally expected for similar analytical methods done by reputable laboratories. Then, data from any one laboratory was removed from further calculations, if the mean of all analyses from that laboratory failed a t-test of the global means of the other laboratories. Next, data that fell outside of the 2 standard deviations were removed. The mean and standard deviations were then re-calculated.

Analytes with an RSD of near or less than 5 % are reported as “Certified Concentrations” with limits at two “Between Laboratory” standard deviations. Those with RSD’s of between near 5 % and 15 % are reported as “Provisional Concentrations” with limits at two “Between Laboratory” standard deviations. Those with RSD’s over 15 % are reported as “Informational Values”.

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.

10. Participating Laboratories: The 23 laboratories that provided results timeously were (not in same order as in the table of assays):

1. ACME Analytical Laboratories Ltd CA
2. Activation Laboratories Pty Ltd (ActLabs) CA
3. ALS Chemex Laboratory Group Johannesburg SA
4. ALS Chemex Laboratory Group Perth WA
5. ALS Chemex Laboratory Group Vancouver CA
6. Anglo Research (Crown Campus)
7. Assayers Canada
8. Intertek Testing Services Ltd Shanghai (ITS Beijing)
9. Intertek Utama Services (Indonesia)
10. Labtium Inc Finland
11. Nkomati JV Laboratory SA
12. OMAC Laboratories Limited (Ireland)
13. Set Point Laboratories (Isando) SA
14. SGS Australia Pty Ltd (Newburn) WA
15. SGS Lakefield Research Africa Pty Ltd (Booyens) SA
16. SGS Mineral Services Lakefield (Canada)
17. Ultra Trace (Pty) Ltd WA

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

Lab Code	Ag M/ICP ppm	Co M/ICP ppm	Cu F ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Pb M/ICP ppm	U M/ICP ppm	Zn M/ICP ppm	SG
A	0.60	26.82		3303	3226		254	10.54	17.98	100.6	
A	0.87	26.98		3240	3278		254	10.88	24.84	101.2	
A	0.79	26.87		3323	3271		257	12.02	19.76	99.6	
A	0.74	26.30		3284	3280		250	11.28	20.08	101.8	
A	0.76	27.53		3191	3321		257	9.69	18.80	100.4	
A	0.73	26.80		3363	3235		259	10.32	19.80	101.7	
A	0.75	26.57		3202	3266		254	10.79	17.33	102.0	
A	0.50	25.90		3245	3232		252	11.02	18.27	101.9	
B	0.66	28.70		3120	3090		233	14.30	13.00	96.0	2.71
B	0.75	29.20		3220	3110		236	14.80	13.70	100.0	2.73
B	0.84	29.10		3250	3120		242	15.30	11.50	101.0	2.72
B	0.68	28.80		3190	3140		234	14.80	12.40	99.0	2.74
B	0.72	28.60		3150	3080		234	14.70	12.10	99.0	2.73
B	0.66	28.70		3140	3130		236	14.20	12.70	97.0	2.73
B	0.68	28.20		3030	3130		225	14.80	12.70	95.0	2.72
B	0.71	27.60		3090	3020		230	13.90	11.50	96.0	2.76
C	0.50	24.00	3150	3030	3180		234	12.00	10.00	100.0	2.69
C	0.50	26.00	3120	3070	3250		237	14.00	10.00	100.0	2.64
C	0.50	24.00	3090	2970	3200		235	12.00	10.00	96.0	2.61
C		23.00	3040	3040	3340		234	12.00	10.00	98.0	2.68
C		24.00	3320	3050	3210		238	9.00	10.00	98.0	2.69
C		24.00	3000	3130	3180		236	11.00	10.00	99.0	2.73
C	0.90	24.00	2990	3050	3240		238	15.00	10.00	98.0	2.66
C	0.60	24.00	2990	3010	3150		234	10.00	10.00	95.0	2.71
D	0.50	26.00		3020	2880		232	11.00		90.0	2.80
D		27.00		3200	3140		247	11.00		95.0	2.79
D		31.00		3700	3210		252	13.00		102.0	2.78
D		27.00		3050	3000		235	10.00		95.0	2.80
D		30.00		3580	3050		256	14.00		102.0	2.78
D	0.60	27.00		3060	2920		236	12.00		95.0	2.78
D		27.00		3270	2950		249	10.00		98.0	2.79
D	1.00	24.00		3040	2910		232	7.00		93.0	2.78
F		25.00	3100	3220	3100	3247	259	11.30	12.70	98.0	
F		24.90	3080	3260	3120	3271	259	11.10	12.60	101.0	
F		25.70	3100	3320	3090	3277	253	11.40	13.40	101.0	
F		25.20	3060	3250	3110	3298	255	10.80	13.00	98.8	
F		24.70	3060	3160	3130	3234	255	11.10	13.10	96.7	
F		25.60	3090	3210	3080	3256	251	11.70	12.40	103.0	
F		25.70	3090	3220	3070	3245	256	11.40	13.10	99.0	
F		25.30	3110	3230	3080	3251	255	12.20	12.80	99.6	
G	1.00	26.00		3210	3000		224	13.00		100.0	
G	0.90	29.00		3220	2980		228	12.00		109.0	
G	1.00	31.00		3250	3030		220	11.00		98.0	
G	0.90	27.00		3150	3080		222	10.00		97.0	
G	1.00	27.00		3150	2980		223	11.00		97.0	
G	1.10	27.00		3230	2920		229	13.00		101.0	
G	1.00	27.00		3190	2870		226	10.00		100.0	
G	1.00	27.00		3130	2980		225	12.00		105.0	
H		30.00	3048	3240	3056		246	15.00	15.13	106.0	
H		30.00	3086	3275	3038		244	13.00	15.84	101.0	
H		31.00	3061	3407	3052		244	13.00	15.15	102.0	
H		31.00	2924	3395	3076		248	14.00	15.87	104.0	
H		31.00	3009	3312	3106		245	13.00	15.52	104.0	
H		31.00	3030	3285	3115		248	12.00	15.05	103.0	
H		31.00	3100	3323	3014		244	13.00	15.92	103.0	
H		31.00	2990	3313	3119		244	15.00	15.66	102.0	
I	1.50	30.00	3200	3190	3170	3139	258	15.00	12.90	98.0	2.88
I	1.00	30.00	3200	3200	3090	3131	248	15.00	12.20	98.0	2.91
I	1.00	30.00	3200	3190	3090	3131	246	15.00	13.20	96.0	2.87
I	1.50	30.00	3200	3190	3030	3131	252	15.00	12.10	96.0	2.88
I	1.00	35.00	3300	3200	3080	3171	252	15.00	12.40	98.0	2.89
I	1.00	30.00	3300	3190	3070	3139	252	15.00	12.80	96.0	2.88
I	1.00	30.00	3300	3270	3100	3171	252	15.00	12.20	96.0	2.88
I	1.00	35.00	3200	3230	3080	3171	258	15.00	12.90	98.0	2.89

Assay data (cont)

Lab Code	Ag M/ICP ppm	Co M/ICP ppm	Cu F ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Pb M/ICP ppm	U M/ICP ppm	Zn M/ICP ppm	SG
J		30.00	3200	3200	3150		240			92.0	2.79
J		30.00	3200	3200	3140		250			91.0	2.78
J		30.00	3300	3300	3300		240			92.0	2.77
J		30.00	3200	3200	3200		250			90.0	2.79
J		30.00	3200	3300	3220		250			90.0	2.78
J		30.00	3200	3300	3180		250			92.0	2.80
J		30.00	3300	3300	3180		240			90.0	2.79
J		30.00	3200	3300	3190		250			91.0	2.78
K		32.00	3300	3100	2900	3200	220			86.0	2.81
K		31.00	3300	3100	3200	3100	220			86.0	2.80
K		30.00	3300	3000	3000	3300	210			83.0	2.83
K		31.00	3300	3000	3000	3200	220			83.0	2.82
K		30.00	3200	3100	3100	3300	220			84.0	2.80
K		31.00	3200	3100	3000	3100	220			84.0	2.81
K		31.00	3300	3000	3100	3300	210			83.0	2.84
K		32.00	3200	3100	3100	3100	220			81.0	2.80
L	0.70	29.00		3580	3410	3400	276	30.00	14.20	93.0	
L	0.80	30.00		3410	3270	3400	273	30.00	13.70	99.0	
L	0.90	30.00		3330	3330	3400	267	30.00	13.60	95.0	
L	0.70	30.00		3440	3360	3400	270	30.00	14.30	98.0	
L	0.70	29.00		3460	3440	3400	270	30.00	14.10	93.0	
L	0.70	30.00		3360	3330	3300	268	30.00	13.80	96.0	
L	0.70	29.00		3380	3380	3400	268	30.00	13.60	96.0	
L	0.70	29.00		3400	3340	3400	266	30.00	13.60	91.0	
M	1.00	31.00	3250	3200			250	10.60	15.30	94.0	
M	1.00	32.70	3340	3163			256	10.70	15.40	95.0	
M	1.10	31.80	3380	3189			251	10.90	15.60	96.0	
M	1.30	32.70	3490	3261			258	11.50	15.80	99.0	
M	1.00	33.60	3310	3260			261	12.00	15.90	97.0	
M	1.00	33.50	3340	3229			261	11.50	15.80	97.0	
M	1.10	33.70	3420	3176			252	10.50	15.20	95.0	
M	1.00	32.60	3220	3266			255	11.20	15.60	100.0	
N					3229						
N					3307						
N					3424						
N					3429						
N					3382						
N					3338						
N					3218						
N					3305						
O	8.70	15.15	3081	3242	3150	3221	228	20.60	11.70	93.6	2.79
O	9.90	19.30	3476	3192	3150	3276	226	17.30	8.14	94.1	2.81
O		17.65	3634	3259	3255	3255	222	17.20	9.58	91.8	2.80
O		24.10	3239	3220	3360	3180	224	19.70	9.41	93.2	2.81
O	7.60	21.45	3318	3248	3255	3157	227	20.20	11.45	95.1	2.81
O	6.90	17.50	3476	3222	3255	3166	229	20.40	10.52	94.1	2.80
O	8.00	18.00	3318	3230	3150	3114	227	16.40	9.24	92.2	2.81
O	7.40	18.45	3476	3254	3150	3189	228	19.30	11.79	94.9	2.81
P			3300			3210	252				2.84
P			3200			3150	247				2.86
P			3300			3220	250				2.87
P			3300			3230	251				2.88
P			3200			3140	245				2.87
P			3200			3190	250				2.87
P			3300			3120	248				2.88
P			3300			3170	247				2.88
Q				40			20				
Q				40			20				
Q				40			20				
Q				40			20				
Q				40			20				
Q				40			20				
Q				40			20				
Q				40			30				
R	1.10	29.00	3350	3600	3420	3140	255	15.00	10.00	92.0	2.84
R	1.00	29.00	3260	3390	3280	3140	248	15.00	20.00	90.0	2.78
R	0.80	31.00	3430	3390	3360	3140	254	14.00	10.00	94.0	2.84
R	0.90	30.00	3380	3360	3290	3120	247	14.00	10.00	93.0	2.81
R	1.00	31.00	3410	3320	3500	3160	265	23.00	20.00	95.0	2.83
R	0.80	30.00	3670	3440	3350	3140	251	15.00	10.00	91.0	2.76
R	0.80	29.00	3400	3180	3320	3140	235	17.00	10.00	88.0	2.85
R	0.80	30.00	3420	3360	3190	3160	242	21.00	20.00	91.0	2.82

12. Measurement of Uncertainty:

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:

$$\text{Combined standard uncertainty} = \sqrt{(\text{between lab.var/no of labs}) + (\text{mean square within lab.var /no of assays})}$$

These uncertainty measurements may be used by laboratories as a component for calculating the total uncertainty for method validation according to ISO guidelines.

Analyte	CSU	unit	Analyte	CSU	unit
Ag M/ICP	0.045	ppm	Al ₂ O ₃	0.047	%
Co M/ICP	0.483	ppm	CaO	0.008	%
Cu F	32.303	ppm	Cr ₂ O ₃	0.003	%
Cu M/ICP	20.338	ppm	Fe ₂ O ₃	0.014	%
Cu P	23.423	ppm	K ₂ O	0.005	%
Cu XRF	19.718	ppm	LOI	0.095	%
Ni M/ICP	2.279	ppm	MgO	0.019	%
Pb M/ICP	0.470	ppm	MnO	0.003	%
S	0.001	%	Na ₂ O	0.037	%
U M/ICP	0.669	ppm	P ₂ O ₅	0.002	%
Zn M/ICP	0.734	ppm	SiO ₂	0.124	%
SG	0.016		TiO ₂	0.005	%
			V ₂ O ₅	0.002	%

*CSU = Combined standard uncertainty

13. Uncertified 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 Dr Barry Smee.

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: AMIS0088 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. 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.

19. 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 April 2009

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 – AMIS0088 uncertified trace element statistics

	Method	Unit	Mean	2SD	RSD%	n
Al	M/ICP	%	7.11	0.75	5.26	84
As	M/ICP	ppm	2.34	2.80	59.97	31
Ba	M/ICP	ppm	552	38	3.48	77
Be	M/ICP	ppm	1.04	0.24	11.29	61
Bi	M/ICP	ppm	0.32	0.09	13.23	45
Ca	M/ICP	%	3.31	0.40	6.11	78
Ce	M/ICP	ppm	36.0	3.0	4.17	39
Cr	M/ICP	ppm	650	214	16.46	96
Cs	M/ICP	ppm	3.23	0.51	7.88	47
Dy	M/ICP	ppm	2.30	0.28	6.03	23
Er	M/ICP	ppm	0.99	0.20	10.21	23
Eu	M/ICP	ppm	1.13	0.14	6.43	24
Fe	M/ICP	%	3.97	0.30	3.79	83
Ga	M/ICP	ppm	20.2	3.4	8.30	55
Gd	M/ICP	ppm	3.61	0.28	3.89	23
Hf	M/ICP	ppm	1.15	0.26	11.27	47
Ho	M/ICP	ppm	0.39	0.07	8.69	24
K	M/ICP	%	1.73	0.16	4.56	86
La	M/ICP	ppm	20.1	1.3	3.18	47
Li	M/ICP	ppm	20.3	4.7	11.46	54
Lu	M/ICP	ppm	0.10	0.01	6.29	14
Mg	M/ICP	%	2.22	0.24	5.36	85
Mn	M/ICP	ppm	3486	351	5.04	83
Mo	M/ICP	ppm	2.23	0.75	16.87	55
Na	M/ICP	%	2.54	0.24	4.77	86
Nb	M/ICP	ppm	8.47	1.25	7.38	55
Nd	M/ICP	ppm	18.1	2.5	6.89	24
P	M/ICP	%	0.10	0.01	7.08	71
Pr	M/ICP	ppm	4.49	0.77	8.61	24
Rb	M/ICP	ppm	90.5	11.8	6.54	55
Sb	M/ICP	ppm	2.59	0.60	11.53	45
Sc	M/ICP	ppm	14.7	2.1	7.01	70
Sm	M/ICP	ppm	3.81	0.62	8.15	24
Sn	M/ICP	ppm	1.71	0.53	15.43	46
Sr	M/ICP	ppm	263	17	3.25	85
Ta	M/ICP	ppm	0.82	0.22	13.63	37
Tb	M/ICP	ppm	0.46	0.05	4.98	24
Te	M/ICP	ppm	0.43	0.08	9.57	28
Th	M/ICP	ppm	7.38	1.39	9.39	47
Ti	M/ICP	%	0.40	0.03	3.80	79
Tl	M/ICP	ppm	0.36	0.07	10.09	40
Tm	M/ICP	ppm	0.12	0.03	13.31	23
V	M/ICP	ppm	120	11	4.80	69
W	M/ICP	ppm	2.03	0.91	22.42	48
Y	M/ICP	ppm	10.0	1.2	6.19	86
Yb	M/ICP	ppm	0.79	0.22	13.93	24
Zr	M/ICP	ppm	34.1	5.9	8.69	60