

African Mineral Standards

Certificate of Analysis

Copper Oxide Ore
Reference Material from Lonshi
Democratic Republic of the Congo

AMIS0033

Recommended Concentration and two "Between
Laboratory" Standard Deviations

Certified Concentrations

Cu (P)	14.10	±	0.91	%
Cu (T/ICP)	14.05	±	1.07	%
Co (T/ICP)	71	±	8	ppm
Ni (P)	124	±	14	ppm
Ni (T/ICP)	130	±	18	ppm
Zn (P)	340	±	30	ppm
Au (Pb Collection)	7.75	±	0.92	g/t

Provisional Concentrations

Cu (F)	14.15	±	0.83	%
Ag (T)	31.7	±	5.3	ppm
Co (P)	69	±	14	ppm
Pb (P)	186	±	42	ppm
Zn (T/ICP)	337	±	76	ppm
U (T/ICP)	406	±	50	ppm
Specific Gravity	3.11	±	0.24	g/cc

Indicated Means

Cu (XRF)	14.82	%
As (T/ICP)	87	ppm
As (XRF)	118	ppm

Intended Use: AMIS0033 is suitable to monitor the accuracy of a single analysis of copper ore. 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 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 using oxide ore sourced from the Lonshi Copper Mine which is owned and operated by Compagnie Miniere du Sakania sprl (Comisa), a wholly owned Congolese subsidiary of First Quantum Minerals Ltd (FQM). The mine is situated in the Congo Pedicle region of the Province of Katanga, Democratic Republic of the Congo.

Lonshi is a sediment hosted, structurally controlled deposit of Copperbelt type. In contrast to other Copperbelt deposits, Lonshi is interpreted to occur at or near the upper contact of the Upper Roan Group where a sheared and tectonised clastic unit, the Lonshi Conglomerate, is in thrust contact with overlying carbonaceous, silty, dolomitic marbles. This folded and thrust contact is the locus for mineralization which occurs in both the conglomerate and the intensely weathered dolomite.

Primary sulphide mineralization, mainly chalcopyrite, occurs as carbonate clast replacement in the conglomerate, and as disseminations and rare veinlets in both conglomerate and dolomite. Supergene enrichment and subsequent deep oxidation, has resulted in complete carbonate destruction in the dolomite, within the weathering zone, and formation of chalcocite now largely oxidized to malachite and black Cu oxide minerals.

(for more information, refer to Form 43-101F1 Technical Report, The Lonshi Copper Mine, Katanga Province, Democratic Republic of the Congo, March 26th 2003, Alan J. Stephens Vice President, Exploration, and G. Clive Newall, President, First Quantum Minerals Ltd.)

Approximate Mineral and Chemical Composition:

The major element chemistry has been determined by analyses from 5 laboratories using a mixture of ICP and X-Ray Fluorescence techniques. The mean values, confidence limits at two standard deviations and number of analyses are presented below.

	Al ₂ O ₃	CaO	Fe ₂ O ₃	K ₂ O	LOI	MgO
	%	%	%	%	%	%
mean	8.34	0.83	8.59	2.23	12.93	1.85
2SD	0.70	0.08	0.28	0.37	0.99	0.14
RSD %	4.18	5.11	1.65	8.35	3.82	3.67
n	32	39	25	24	22	32
	MnO	Na ₂ O	P ₂ O ₅	SiO ₂	S	TiO ₂
	%	%	%	%	%	%
mean	2.96	0.22	0.20	43.60	0.44	0.57
2SD	0.23	0.02	0.03	2.20	0.016	0.04
RSD %	3.97	5.54	8.14	2.52	1.85	3.53
n	31	16	24	31	9	23

Appearance: The material is a very fine brown powder (Corstor Colour Gauge - 10YR 4/6).

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. 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 an independent statistician.

Methods of Analysis: Co, Cu, As, Ni, Pb, Zn and Ag; multi-acid digestion, including HF, with ICP-OES or ICP-MS (T). Cu; fusion ICP-OES or MS (F). Co, Cu, As, Ni, Pb, Zn by XRF. Co, Cu, As, Ni, Pb, Zn, aqua regia digestion with ICP-OES or ICP-MS (P). Pb collection for Au. Specific gravity either by gas pycnometer or by water displacement using a pycnometer bottle.

Method of Certification: Twenty laboratories were each given eight randomly selected packages of sample. Results from the sixteen laboratories that reported back were used for the determinations below:

	Ag (T) ppm	Au (Pb Collection) g/t	Co (P) ppm	Co (T/ICP) ppm	Cu (F) ppm	Cu (P) ppm	Cu (T/ICP) ppm	Ni (P) ppm	Ni (T/ICP) ppm	Pb (P) ppm	Specific Gravity g/cc	U (T/ICP) ppm	Zn (P) ppm	Zn (T/ICP) ppm
A	12.10						139000		169					454
A	5.50						136000		170					466
A	13.90						137000		158					464
A	13.90						135000		170					445
A	7.00						132000		192					432
A	7.60						139000		161					460
A	5.60						134000		193					475
A	9.50						123000		165					454
B	29.00		70	72			137000	128	123	160			362	355
B	30.00		70	70			141000	129	120	160			360	358
B	29.00		70	71			137000	127	121	150			357	354
B	29.00		70	74			142000	127	126	150			358	357
B	29.00		70	69			139000	130	120	160			358	360
B	29.00		80	76			138000	134	131	190			366	377
B	28.00		70	75			140000	130	128	180			354	369
B	28.00		80	76			141000	131	128	170			362	370
C	30.00		78		139300	135300	137598	117		170				307
C	30.00		74		141700	134400	140250	122		164				316
C	30.00		76		142400	137400	138516	124		179				319
C	30.00		78		144700	141300	140964	121		164				313
C	29.00		80		144000	137600	137598	122		170				307
C	29.00		74		143400	139300	140148	132		166				306
C	27.00		72		145600	137700	138924	117		171				297
C	29.00		74		145200	138000	138210	118		167				295
D		7.74	76			141000		122		190	2.71	411	346	
D		7.47	72			137000		126		190	2.88	398	344	
D		7.89	76			139000		126		205	2.93	408	346	
D		7.54	76			141000		126		205	2.78	412	342	
D		7.34	72			136000		126		190	2.78	382	342	
D		7.57	74			142000		120		200	2.95	392	346	
D		7.51	72			141000		126		190	2.94	409	342	
D		7.45	74			143000		120		195	2.97	411	338	
E														
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E														
F	30.20		53	80			149000	97	140	173			244	288
F	29.40		52	75			146000	96	134	168			247	275
F	29.20		52	77			145000	97	133	172			245	278
F	28.90		53	77			145000	97	133	179			250	279
F	29.30		52	76			149000	96	132	170			249	277
F	29.00		53	76			144000	97	132	169			250	282
F	29.40		53	77			150000	97	134	171			251	280
F	29.20		53	76			145000	98	134	179			249	279

	Ag (T) ppm	Au (Pb Collection) g/t	Co (P) ppm	Co (T/ICP) ppm	Cu (F) ppm	Cu (P) ppm	Cu (T/ICP) ppm	Ni (P) ppm	Ni (T/ICP) ppm	Pb (P) ppm	Specific Gravity g/cc	U (T/ICP) ppm	Zn (P) ppm	Zn (T/ICP) ppm
G														
G														
G														
G														
G														
G														
H	32.00	7.66	70	70	142400	142310	141630	130	120	200		450	300	400
H	31.00	7.66	70	70	136800	140950	143910	130	120	200		444	300	400
H	32.00	7.44	70	70	141300	143350	142640	130	120	200		396	300	400
H	31.00	8.41	70	70	137900	135860	139530	120	120	200		390	300	400
H	32.00	8.01	70	70	142600	138940	139460	120	120	200		386	300	400
H	31.00	8.11	70	70	141300	140860	141030	120	120	200		392	300	400
H	32.00	8.29	70	70	142500	140340	143300	120	120	200		455	300	400
H	31.00	8.28	70	70	139900	139640	138130	120	120	200		433	300	400
I	32.30	7.14	63	69	140000	141500	141500	113	126	187	3.19	390	305	331
I	31.70	7.38	63	65	138500	142500	142500	112	116	192	3.22	390	301	307
I	30.70	7.48	66	65	141500	143500	146500	115	123	201	3.09	380	311	326
I	31.00	7.03	66	69	139500	144500	149000	118	125	198	3.14	370	317	325
I	33.10	7.04	64	73	140000	145500	145500	114	132	187	2.91	410	309	347
I	31.30	7.51	66	70	147500	142500	144500	117	125	199	3.03	400	315	340
I	30.80	7.04	66	67	130000	143500	145500	115	121	191	3.04	370	318	325
I	31.10	7.26	64	69	140000	143000	146000	112	129	189	3.34	430	306	343
J		7.57	62			145000		113		156		398	331	
J		7.60	62			146000		116		153		406	322	
J		7.51	64			144000		114		164		365	320	
J		6.84	64			143000		115		154		379	320	
J		6.14	63			145000		115		157		418	326	
J		7.58	63			145000		115		163		398	323	
J		7.26	62			145000		116		159		437	320	
J		7.64	62			144000		115		155		424	321	
K	31.70	7.68	66	73	141483	124875	127924	130	129	208	3.20	381	343	343
K	32.50	7.67	67	74	140521	123034	126767	133	126	216	3.21	376	342	337
K	31.20	7.62	68	71	140336	125617	130021	137	132	219	3.17	365	354	354
K	31.80	7.71	67	73	139462	123390	126140	128	128	214	3.17	388	346	340
K	32.50	7.37	68	73	140210	125148	129499	130	131	224	3.21	377	356	346
K	31.50	7.43	70	72	140389	129999	128467	134	131	217	3.22	381	360	352
K	32.60	7.47	65	74	140659	122489	131055	124	135	203	3.26	385	336	362
K	32.10	7.56	71	75	141929	129515	127528	134	133	229	3.21	407	359	352
L	38.50	7.96	59	68	141000	132000	129000	122	118	410		331	332	374
L	38.40	7.69	64	67	139000	134000	130000	123	120	393		364	339	365
L	38.70	7.66	62	71	137000	133000	134000	119	122	383		387	339	382
L	39.50	7.75	63	73	143000	134000	137000	123	124	388		366	341	357
L	40.20	8.05	67	72	142000	136000	140000	132	126	417		381	347	349
L	40.70	8.06	65	73	109000	135000	141000	125	127	402		392	343	337
L	41.00	7.87	64	75	129000	139000	142000	125	130	415		382	345	332
L	41.10	8.04	64	74	132000	138000	144000	123	128	405		429	345	356
M	30.20			67	146000	142000	149000	132	118	200			341	294
M	34.60			77	146000	136000	148000	133	136	184			335	336
M	32.10			71	146000	149000	147000	142	125	202			364	313
M	30.80			68	147000	148000	148000	135	118	188			349	303
M	31.50			69	149000	142000	151000	131	123	180			339	316
M	33.10			72	147000	147000	149000	137	129	189			347	326
M	31.00			68	146000	133000	150000	125	121	178			334	307
M	31.00			69	146000	145000	148000	136	120	186			344	303
N	35.41		68	76	146899	158030	158030	122	156	241	3.00		747	427
N	34.97		89	74	148316	158375	158375	130	148	256	3.02		766	415
N	36.58		80	72	146895	155947	155947	129	136	249	3.01		754	400
N	39.68		82	76	147120	158204	158204	127	157	255	3.02		764	435
N	33.35		80	70	143758	150453	150453	125	194	244	3.02		740	395
N	33.50		82	74	149677	153146	153146	126	188	251	3.05		770	412
N	33.17		70	77	149474	158197	158197	124	143	252	3.05		733	426
N	36.63		81	71	151453	152623	152623	135	196	259	3.02		778	398
O	32.00	7.29		63					140		3.25	430		300
O	33.00	7.26		65					130		3.23	420		310
O	32.00	8.69		64					140		3.21	480		300
O	33.00	8.34		63					140		3.20	420		290
O	33.00	8.41		61					130		3.23	420		290
O	33.00	8.61		64					140		3.22	420		300
O	33.00	7.53		63					140		3.18	450		300
O	32.00	8.26		65					140		3.16	420		300
P														
P														
P														
P														
P														
P														
P														

	Ag (T) ppm	Au (Pb Collection) g/t	Co (P) ppm	Co (T/ICP) ppm	Cu (F) ppm	Cu (P) ppm	Cu (T/ICP) ppm	Ni (P) ppm	Ni (T/ICP) ppm	Pb (P) ppm	Specific Gravity g/cc	U (T/ICP) ppm	Zn (P) ppm	Zn (T/ICP) ppm
Q														
Q														
Q														
Q														
Q														
Q														
Q														
R														
R														
R														
R														
R														
R														
S	37.00			88		141220	137500		140					448
S	36.00			88		137100	142000		144					452
S	34.00			88		136300	140700		144					443
S	36.00			88		135700	140000		140					445
S	35.00			96		131500	138900		144					448
S	36.00			88		134000	139500		136					444
S	36.00			88		137700	140800		140					464
S	35.00			88		129200	138100		140					472
T	28.50	8.48		74		141000	136000		127			431		353
T	28.70	8.80		75		143000	138000		129			429		357
T	29.10	7.99		74		138500	138000		127			428		352
T	29.50	8.49		63		148500	137500		110			452		309
T	29.80	8.90		65		140000	138500		117			445		322
T	28.40	8.38		61		145000	139500		111			423		307
T	28.20	8.64		67		142500	139000		127			433		325
T	29.20	9.34		62		146000	139500		108			437		307

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. Total results from some laboratories that reported significant failures were also removed. 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 the same order as in the table of assays)

1. ACME Analytical Laboratories Ltd., (Canada).
2. Alex Stewart (Assayers) Limited, (ASA, Johannesburg, South Africa).
3. ALS Chemex South Africa (Pty) Ltd
4. ALS Chemex, (Vancouver, Canada).
5. Ammtec Ltd (Australia)
6. Assayers Canada, (Vancouver).
7. Genalysis Laboratory Services (Pty) Ltd., (Australia).
8. Geoscience Laboratories, (Geo Labs, Sudbury, Canada).
9. Geoservice Centre, Geolaboratory, (GTK. Finland).
10. Mintek (South Africa)
11. Pt Intertek Utama Services (Intertek, Indonesia)
12. Set Point Laboratories (Pty) Ltd (South Africa)
13. SGS Lakefield Research Africa (Pty) Ltd. (Joburg, South Africa)
14. SGS Welshpool (Australia)
15. SRC Labs., (Canada).
16. Ultra Trace (Pty) Ltd. (Australia)

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.

17 May 2007

Certifying Officers:



African Mineral Standards: _____

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



Geochemist: _____

Barry W. Smee
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