AMIS0434

Certified Reference Material

Ferralsol tropical soil, Kipushi mine area Zambia

Certificate of Analysis

AMIS
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Recommended Concentrations and two "Between Laboratory" Standard Deviations[1]

Certified Concentrations[2]

Ag P	0.2	±	0.02	ppm
Co M/ICP	54.4	±	5.6	ppm
Co P	42.7	±	2.6	ppm
Cu M/ICP	315	±	16	ppm
Cu P	254	±	19	ppm
Ni M/ICP	74	±	6	ppm
Fe XRF	8.03	±	0.19	%
K XRF	0.52	±	0.01	%
Mn XRF	0.0503	±	0.002	%
Pb P	23.7	±	2.6	ppm
Pt Pb Collection	2.0	±	0.1	ppb
Zn M/ICP	251	±	16	ppm
Zn P	231	±	19	ppm
Specific Gravity	2.66	±	0.16	%

Provisional Concentrations

Ag M/ICP	0.25	±	0.06	ppm
As M/ICP	18.4	±	3.3	ppm
As P	14.7	±	1.9	ppm
Au Pb Collection	8.4	±	2.3	ppb
Ni P	37	±	4.7	ppm
Pb M/ICP	25.0	±	3.9	ppm

Informational Means

Au P	6.2	ppb
Pd Pb Collection	2.3	ppb
Cu XRF	265	ppm
Ni XRF	76	ppm
S Combustion / LECO	0.03	%

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, 9 and 12.

2. There is additional certified major element data presented on p2 and uncertified trace element data presented as an appendix.

Major Element
Recommended Concentrations and
two “Between Laboratory” Standard Deviations

Certified Concentrations

Al_2O_3	19.61	±	0.22	%
CaO	0.11	±	0.01	%
Cr_2O_3	0.05	±	0.002	%
Fe_2O_3	11.49	±	0.32	%
K2O	0.63	±	0.02	%
MgO	0.57	±	0.02	%
P_2O_5	0.16	±	0.002	%
SiO_2	54.82	±	0.48	%
TiO_2	1.75	±	0.04	%
LOI	10.34	±	0.32	%
C	1.58	±	0.10	%

Provisional Concentration

MnO	0.06	±	0.01	%

Informational Means

Na_2O	0.04	%
S Comb/LECO	0.03	%

1. Intended Use: AMIS0434 is a matrix matched certified reference material (CRM) specifically made for use as control samples to monitor analyses of soil samples, if used in parallel to samples with the unknown chemical characteristics, and which should demonstrate the validity of the measurement results. Good laboratories will report results for this CRM within the two standard deviation levels with a failure rate of <10 %.

The CRM’s purpose is primarily to monitor inter-laboratory or instrument bias and within-lab precision. It can be used, indirectly, also to establish the traceability of results to an SI system of units. The material can also be used for method development and for the calibration of equipment.

The recommended concentrations and limits for this material are property values based on a measurement campaign (round robin) and which reflect consensus results from the participating laboratories.

Slight variations in analytical procedures between laboratories will reflect in use of this CRM as slight biases to the recommended concentrations (see 19).

2. Origin of Material: This standard was made using soil material collected from the Kipushi Mine locality and was supplied by First Quantum Minerals Limited. The Kipushi Mine is in Democratic Republic of the Congo, 28 km east south east of Lubumbashi on the Zambian border.

3. Mineral and Chemical Composition. This CRM is made from a tropical ferralsol soil. These are the classical deeply weathered red or yellow soils of the humid tropics. They are dominated by low activity clays, mainly kaolinite and sesquioxides. Globally large contiguous areas of Ferralsols are found on old geomorphic surfaces, such as the Congo Basin and the Amazon Shield, on peneplained surfaces that typically comprise mid to end-Tertiary deposits. This ferralsol has an elevated metals content, particularly copper, reflecting its origin in a copper rich environment.

4. Appearance: The material is a very fine powder. It is colored Strong Brown (Corstor 5YR 4/6).

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. Storage information: The material should be stored in a cool dry place, in such a way that it does not compromise the integrity of the CRM. The material should be stored in conditions which will ensure it does not absorb moisture.

7. Method of Preparation: The material was crushed, dry-milled and air-classified to <54um. Wet sieve parti**c**le 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.

8. Methods of Analysis requested:

a) Multi-acid digest, multi element scan, to include Ag, As, Co, Cu, Pb, Ni, Zn; ICP-OES or ICP-MS (M/ICP).
b) 1 gram aliquot - Aqua regia digest, multi element scan to include Ag, As, Co, Cu, Pb, Ni, Zn; ICP-OES or ICP-MS (P).
c) 25- or 30-gram aliquot - Aqua regia digest multi element, scan to include Ag, As, Au, Co, Cu, Pb, Ni, Zn; ICP-OES or ICP-MS (P1).
d) Au, Pt, Pd, 50g aliquot, Pb collection, 1 ppb detection limit (trace levels) ICP-OES/ICP-MS.
e) Major elements by XRF fusion (Al_2O_3, CaO, Cr_2O_3, Fe_2O_3, K2O, MgO, MnO, Na_2O, SiO_2, TiO_2, LOI.).
f) C and S – Combustion/LECO
g) SG – Gas Pycnometer
h) XRF-Cu; Ni; Fe; Mn; K

9. Information requested:

a) State and provide brief description of analytical techniques used.
b) State aliquots used for all determinations.
c) Results for individual analyses to be reported, with units of measure clearly marked.
d) Report all QC data, to include replicates, blanks and certified reference materials used.

9. Method of Certification: Twenty-six laboratories were each given eight scientifically selected packages of sample. Twenty-two of the laboratories submitted results. Five laboratories were each given eight scientifically selected packages of samples. Two of the laboratories submitted results.

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 12), 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".

Participating Laboratories: The laboratories that provided timeous results are:

1 ACME Vancouver
2 ALS Chemex Laboratory Group Brisbane Australia
3 ALS Chemex Laboratory Group Johannesburg SA
4 ALS Chemex Laboratory Group Perth WA
5 ALS Chemex Laboratory Group Vancouver CA
6 ALS OMAC (Ireland)
7 Bureau Veritas Minerals Ultra Trace Pty Ltd
8 Bureau Veritas (USA)
9 Genalysis Laboratory Services (South Africa) Pty
10 Genalysis Laboratory Services (W Australia P)
11 Intertek Mineral Laboratory (Townsville)
12 Intertek Testing Services (Philippines)
13 Intertek Testing Services Ltd Shanghai (Beijing)
14 Intertek Utama Services (Indonesia)
15 Scrooby's Lab
16 Set Point Laboratories (Isando) SA
17 SGS Australia Pty Ltd (Newburn) WA
18 SGS Geosol Laboratories Ltda (Brazil)
19 SGS Mineral Services Callao (Peru)
20 SGS Mineral Services Lakefield (Canada)
21 SGS South Africa (Pty) Ltd - Booysens JHB
22 SGS Tianjin (China)
23 SGS Vancouver (Canada)
24 UIS Analytical Services (Pty) Ltd

10. Assay Data: Data as received from the laboratories for the important certified elements are set out below – Economic elements.

Assay data – Important geochem level elements

Lab code	Pt PbColl ppb	Pd PbColl ppb	Au PbColl ppb	Au P ppb	Ag M/ICP ppm	Ag P ppm	As M/ICP ppm	As P ppm	Co M/ICP ppm	Co P ppm	Cu M/ICP ppm	Cu P ppm	Ni M/ICP ppm	Ni P ppm	Pb M/ICP ppm	Pb P ppm	Zn M/ICP ppm	Zn P ppm
A							21.00		65.00		340		80.00		26.00		260	
A							20.00		65.00		340		80.00		25.00		265	
A							21.00		60.00		340		80.00		25.00		265	
A							20.00		65.00		335		85.00		26.00		260	
A							19.00		60.00		335		80.00		24.00		265	
A							19.00		60.00		335		85.00		23.00		265	
A							20.00		65.00		340		85.00		23.00		265	
A							21.00		60.00		335		80.00		24.00		265	
C			13.00		0.22	0.24	18.00	14.00	53.50	43.00	307	270	71.80	36.60	25.90	22.20	248	242
C		2.00	12.00		0.19	0.22	17.00	14.00	52.70	42.80	292	269	68.50	35.30	25.00	21.70	240	241
C		2.00	13.00		0.20	0.22	19.00	14.00	53.40	43.10	308	268	71.60	36.10	24.60	21.80	250	244
C		2.00	12.00		0.23	0.21	18.00	14.00	51.30	42.30	298	272	68.60	36.70	24.60	21.40	242	242
C		2.00	11.00		0.19	0.23	19.00	15.00	52.40	42.50	301	268	70.10	36.10	25.30	21.70	247	240
C		2.00	11.00		0.18	0.25	19.00	15.00	53.80	42.80	306	271	72.40	36.00	24.20	22.10	248	242
C			11.00		0.20	0.22	18.00	15.00	51.40	43.10	296	265	69.10	35.80	23.80	23.00	239	242
C		2.00	13.00		0.22	0.22	19.00	15.00	53.60	42.30	308	265	72.00	35.60	25.60	22.30	248	242
E			9.00		1.44				52.95		304		72.67		22.81		250	
E			9.00		1.72				56.51		329		77.16		23.69		290	
E			8.00		1.44				55.00		306		74.31		23.46		273	
E			8.00		1.47				55.20		307		73.61		23.56		263	
E			7.00		1.75				54.27		321		74.74		23.40		270	
E			9.00		1.66				55.72		313		76.11		24.45		300	
E			8.00		1.84				56.21		325		76.82		24.01		295	
E			9.00		1.67				55.45		311		74.78		23.50		281	
F			9.00				21.00	17.00	49.00	39.00	303	255	70.00	39.00	20.00	21.00	242	232
F			9.00				22.00	13.00	49.00	40.00	302	255	69.00	40.00	22.00	23.00	243	234
F			10.00				23.00	15.00	50.00	40.00	304	266	71.00	41.00	21.00	24.00	231	239
F			10.00				30.00	15.00	49.00	42.00	309	264	70.00	43.00	22.00	24.00	230	234
F			9.00				21.00	16.00	49.00	42.00	306	264	71.00	42.00	19.00	22.00	241	236
F			10.00				25.00	18.00	50.00	43.00	303	273	70.00	43.00	21.00	23.00	235	240
F			9.00				22.00	14.00	50.00	39.00	313	260	72.00	41.00	21.00	22.00	232	235
F			9.00				26.00	15.00	49.00	40.00	306	259	71.00	39.00	21.00	23.00	240	234
G			10.00				18.00	12.00	50.00	42.00	324	259	80.00	40.00	22.00	17.00	266	228
G			8.00				17.00	11.00	50.00	43.00	323	261	78.00	41.00	22.00	17.00	266	230
G			10.00				15.00	11.00	50.00	43.00	321	258	78.00	40.00	22.00	17.00	265	229
G			10.00				16.00	12.00	50.00	43.00	322	268	78.00	42.00	21.00	17.00	263	238
G			9.00				15.00	11.00	50.00	42.00	319	259	75.00	40.00	21.00	15.00	273	228
G			10.00				16.00	11.00	50.00	42.00	326	254	74.00	38.00	21.00	15.00	267	225
G			10.00				16.00	12.00	48.00	41.00	321	250	76.00	37.00	21.00	17.00	265	226
G			10.00				16.00	12.00	48.00	42.00	315	260	73.00	39.00	19.00	18.00	265	229
H			7.00				19.00	16.00	61.40	48.00	317	263	75.50	39.73	27.00	24.00	250	262
H			8.00				19.00	16.00	61.60	48.80	317	267	75.60	36.48	24.00	24.00	251	249
H			8.00				19.00	16.00	60.80	49.60	312	275	73.80	39.10	24.00	24.00	244	253
H			7.00				19.00	16.00	61.50	50.90	312	272	74.00	40.05	26.00	25.00	247	253
H			7.00				19.00	16.00	59.70	50.80	311	276	73.10	42.55	26.00	24.00	241	254
H			8.00				19.00	17.00	62.40	51.00	315	273	75.20	41.75	26.00	26.00	249	263
H			7.00				18.00	17.00	60.40	52.30	307	280	73.30	41.53	24.00	24.00	241	267
H			7.00				19.00	17.00	60.10	51.60	312	277	74.70	40.93	25.00	25.00	252	253

Assay data (continued) – Important geochem level elements

Lab code	Pt PbColl ppb	Pd PbColl ppb	Au PbColl ppb	Au P ppb	Ag M/ICP ppm	Ag P ppm	As M/ICP ppm	As P ppm	Co M/ICP ppm	Co P ppm	Cu M/ICP ppm	Cu P ppm	Ni M/ICP ppm	Ni P ppm	Pb M/ICP ppm	Pb P ppm	Zn M/ICP ppm	Zn P ppm
I	2.00	3.00	8.00	7.00	0.30	0.20	20.00	13.00	57.50	42.90	321	249	76.00	38.00	28.00	23.00	264	213
I	2.00	3.00	10.00	6.00	0.30	0.20	21.00	12.00	57.80	43.10	322	255	76.00	39.00	27.00	22.90	263	217
I	2.00	3.00	9.00	6.00	0.30	0.21	20.00	13.00	58.70	44.20	323	255	75.00	40.00	28.00	22.90	254	217
I	2.00	3.00	8.00	6.00	0.30	0.19	20.00	13.00	58.30	42.50	328	255	77.00	39.00	27.00	23.00	260	216
I	2.00	3.00	6.00	6.00	0.20	0.19	21.00	13.00	58.00	42.20	325	256	78.00	40.00	27.00	22.60	262	220
I	2.00	3.00	9.00	7.00	0.30	0.20	20.00	13.00	57.80	43.60	315	254	76.00	39.00	27.00	23.00	255	215
I	2.00	3.00	7.00	7.00	0.30	0.20	21.00	13.00	56.90	43.30	324	245	77.00	39.00	27.00	22.90	258	214
I	2.00	3.00	9.00	8.00	0.20	0.20	20.00	12.00	59.00	42.70	330	247	76.00	39.00	27.00	22.60	259	212
J			11.00		1.60		22.00	14.00	55.00	42.00	339	217	79.00	30.00	27.00	25.00	286	224
J			10.00		1.60		22.00	12.00	51.00	41.00	322	216	73.00	29.00	22.00	25.00	270	221
J			16.00		1.80		23.00	16.00	50.00	40.00	312	208	72.00	29.00	29.00	24.00	267	211
J			7.00		1.50		24.00	13.00	53.00	44.00	324	228	75.00	32.00	22.00	25.00	275	233
J			9.00		1.60		21.00	14.00	54.00	44.00	329	225	76.00	31.00	24.00	27.00	278	235
J			5.00		1.50		24.00	14.00	54.00	44.00	339	228	76.00	31.00	28.00	26.00	281	237
J			11.00		1.70		20.00	13.00	52.00	45.00	320	233	73.00	32.00	22.00	25.00	270	241
J			10.00		2.30		24.00	14.00	50.00	44.00	310	228	71.00	32.00	22.00	26.00	263	235
K			9.00	7.40	0.30	0.20	16.00	14.10	54.40	41.30	306	236	74.60	31.80	26.60	21.80	244	217
K			8.00	5.10	0.30	0.20	17.00	14.40	57.30	42.60	310	259	79.30	35.40	28.20	23.10	256	242
K			11.00	7.40	0.30	0.20	16.00	14.00	56.30	43.50	311	248	75.20	34.90	26.40	22.60	248	227
K			7.00	3.50	0.30	0.20	16.00	14.80	54.70	43.00	301	244	73.00	34.90	25.90	23.30	234	233
K			9.00	6.20	0.30	0.20	17.00	14.00	55.20	43.90	308	242	75.30	31.20	26.10	22.50	246	230
K			8.00	4.20	0.20	0.20	17.00	14.20	58.90	41.60	308	237	74.10	30.70	27.30	21.60	253	227
K			9.00	4.60	0.30	0.20	16.00	13.10	56.20	41.00	303	235	77.30	29.90	26.40	22.40	237	217
K			10.00		0.20	0.20	15.00	13.70	55.00	42.60	306	236	74.80	31.80	27.10	22.10	248	225
L	1.90	2.00	8.00	5.70	0.25	0.21	17.60	14.70	52.70	47.10	314	252	71.80	38.90	29.50	26.90	247	227
L	1.90	2.00	8.00	6.40	0.25	0.21	17.70	14.90	52.10	46.50	311	261	72.60	38.30		26.30	255	236
L	1.90	2.00	8.00	7.20	0.27	0.21	17.70	14.20	52.60	44.50	320	242	76.90	36.50	23.70	25.60	246	219
L	1.90	3.00	8.00	8.40	0.26	0.21	17.80	13.60	53.80	42.40	326	243	74.60	35.40	23.50	24.70	248	219
L	2.00	2.00	9.00	7.80	0.27	0.20	18.00	13.60	52.40	42.80	311	244	71.90	34.90	27.20	25.30	243	224
L	2.10	2.00	7.00	8.20	0.31	0.21	17.90	13.60	53.10	43.40	331	241	72.80	36.20	26.00	25.60	259	221
L	2.20	2.00	8.00	6.70	0.37	0.19	18.90	13.00	55.10	41.00	318	240	74.60	32.70	28.40	24.00	246	217
L	1.90	2.00	8.00	6.10	0.28	0.20	18.20	13.50	54.50	41.70	319	235	74.20	34.50	23.40	24.70	243	215
M		2.00	8.00		0.35	0.21	20.40	15.80	52.10	43.10	325	253	76.70	36.80	28.70	24.80	255	234
M		1.00	7.00		0.24	0.24	18.30	16.10	50.50	45.00	323	262	73.50	39.00	27.40	32.90	250	247
M		2.00	9.00		0.30	0.22	19.40	15.70	51.00	43.40	326	258	74.30	36.50	28.10	27.10	251	240
M		2.00	7.00		0.25	0.23	19.10	15.60	52.20	43.40	326	255	75.30	36.20	26.90	25.60	254	237
M		3.00	11.00		0.24	0.20	18.60	16.00	51.80	43.20	328	255	74.20	36.30	28.20	25.60	254	239
M		3.00	9.00		0.23	0.20	18.40	15.40	50.20	42.30	314	251	70.60	35.80	26.50	25.10	242	236
M		2.00	9.00		0.24	0.20	18.40	16.10	50.10	41.40	322	249	71.40	34.70	26.80	24.80	251	234
M		2.00	11.00		0.27	0.19	19.20	15.20	52.70	41.30	328	247	75.70	34.40	27.80	24.40	253	232
N		2.00	15.00				8.00		51.00		297		71.00		23.00		245	
N		3.00	12.00						53.00		302		71.00		24.00		237	
N		3.00	11.00						52.00		306		72.00		21.00		244	
N		3.00	11.00				5.00		52.00		301		72.00		23.00		239	
N		3.00	10.00				7.00		52.00		299		71.00		23.00		242	
N		3.00	10.00				4.00		53.00		291		72.00		25.00		246	
N		2.00	11.00				5.00		53.00		297		74.00		23.00		241	
N		2.00	11.00				4.00		54.00		310		74.00		24.00		244	
O			6.73		0.21		16.00		59.00		320		79.90		37.10		255	
O			6.97		0.20		16.00		57.10		313		76.60		36.30		240	
O			7.41		0.24		16.40		58.00		314		78.20		36.60		246	
O			7.47		0.23		16.60		58.50		321		78.90		39.10		251	
O			7.68		0.24		16.10		60.20		319		81.30		37.40		252	
O			7.97		0.19		16.10		58.40		317		79.30		39.10		250	
O			6.82		0.23		16.50		60.70		320		82.40		35.20		253	
O			8.09		0.22		16.20		59.40		314		81.10		34.90		247	
P	2.00	2.20	8.00	4.00		0.20	21.00	14.00	55.00	48.00	308	248	82.00	37.00	31.00	25.00	290	236
P	2.00	2.20	8.00	5.00		0.20	22.00	15.00	55.00	48.00	308	253	83.00	37.00	33.00	25.00	295	242
P	2.00	2.30	9.00	6.00		0.20	20.00	16.00	56.00	45.00	314	254	86.00	39.00	33.00	28.00	303	214
P	1.90	2.20	10.00	5.00		0.20	20.00	15.00	57.00	45.00	314	246	87.00	38.00	33.00	26.00	305	219
P	2.10	2.20	9.00	7.00		0.20	22.00	15.00	57.00	42.00	328	251	84.00	37.00	32.00	24.00	303	212
P	2.00	2.30	9.00	7.00		0.20	20.00	15.00	57.00	44.00	331	251	85.00	37.00	34.00	26.00	303	220
P	2.20	2.30	9.00	5.00		0.20	21.00	15.00	56.00	42.00	303	258	82.00	38.00	30.00	26.00	298	219
P	2.00	2.20	9.00	6.00		0.20	21.00	15.00	57.00	43.00	324	250	84.00	38.00	31.00	25.00	301	223
Q			8.00				18.00		57.10		307		70.40		26.00		237	
Q			8.00				18.00		57.30		305		70.40		24.70		235	
Q			12.00				18.00		56.10		293		67.00		24.60		225	
Q			8.00				19.00		59.60		314		73.20		26.10		237	
Q			11.00				19.00		58.80		325		72.70		29.80		263	
Q			9.00				19.00		59.10		310		70.60		30.30		250	
Q			7.00				18.00		59.10		312		71.40		25.30		239	
Q			9.00				19.00		59.10		304		68.40		25.30		230	
S			12.00						41.00	38.00	257	229	52.00	35.00				
S			10.00						45.00	36.00	262	227	59.00	34.00				
S			15.00						41.00	36.00	256	229	52.00	33.00				
S			10.00						43.00	37.00	260	223	56.00	34.00				
S			7.00						43.00	36.00	264	224	55.00	32.00				
S			11.00						41.00	36.00	252	225	52.00	32.00				
S			8.00						48.00	38.00	256	228	61.00	36.00				
S			14.00						42.00	38.00	257	225	53.00	36.00				
T	2.00	2.00	7.00				16.00	14.00	54.00	49.00	309	303	72.00	59.00	26.00	17.00	257	247
T	2.00	2.00	7.00				22.00	12.00	53.00	50.00	316	305	71.00	62.00	28.00	16.00	259	251
T	2.00	3.00	8.00				17.00	12.00	53.00	49.00	315	308	71.00	60.00	27.00	17.00	256	252
T	2.00	3.00	9.00				19.00	11.00	52.00	48.00	311	304	70.00	60.00	28.00	16.00	252	244
T	2.00	3.00	7.00				17.00	15.00	51.00	50.00	314	305	71.00	63.00	26.00	16.00	243	251
T	2.00	3.00	7.00				20.00	9.00	53.00	49.00	313	308	71.00	60.00	26.00	16.00	254	250
T	2.00	3.00	8.00				20.00	12.00	54.00	48.00	313	299	71.00	58.00	26.00	16.00	257	243
T	2.00	2.00	7.00				15.00	9.00	54.00	50.00	313	306	71.00	61.00	26.00	16.00	257	251
U	3.00	2.00	8.00	8.00	0.25	0.27	15.20	15.00	54.60	47.80	317	291	58.30	50.60	25.50	22.50	242	230
U	3.00	4.00	9.00	6.00	0.25	0.22	16.20	14.00	54.70	48.20	311	285	57.00	53.10	25.00	21.80	242	228
U	1.00	4.00	8.00	6.00	0.25	0.21	15.60	15.00	53.00	45.80	317	270	59.30	54.50	24.70	22.40	247	234
U	1.00	2.00	8.00	6.00	0.25	0.24	15.30	14.00	54.40	47.70	312	281	61.30	53.00	24.30	23.60	245	232
U	2.00	2.00	8.00	8.00	0.22	0.24	14.80	14.00	51.70	46.70	312	276	57.90	52.40	23.90	21.70	243	234
U	4.00		9.00	4.00	0.27	0.20	17.30	15.00	52.90	47.40	312	279	59.80	52.40	24.80	22.50	244	233
U	2.00	4.00	9.00	5.00	0.24	0.22	16.20	14.00	53.60	46.70	315	275	59.30	52.40	24.10	21.50	243	236
U	3.00	3.00	8.00	4.00	0.25	0.26	14.20	14.00	53.90	47.30	314	279	59.40	55.70	24.10	21.50	244	232
V	2.00	2.00							57.00	41.00		253	77.00	29.00		24.00	253	238
V	2.00	2.00							56.00		324	242	76.00	28.00		25.00	253	231
V	2.00	2.00							53.00	40.00	325	239	70.00	28.00			250	227
V	2.00	2.00								43.00	351	248	71.00	29.00		25.00	258	240
V	2.00	2.00							57.00	42.00	324	264	71.00	31.00		24.00	250	244
V		1.00							55.00	42.00	339	263				25.00	250	243
V	2.00	2.00							52.00	40.00	342	258				24.00	252	244
V	2.00	2.00							54.00	41.00	326	248	71.00			24.00	256	239

Assay data (continued) – Important geochem level elements

Lab code	Pt PbColl ppb	Pd PbColl ppb	Au PbColl ppb	Au P ppb	Ag M/ICP ppm	Ag P ppm	As M/ICP ppm	As P ppm	Co M/ICP ppm	Co P ppm	Cu M/ICP ppm	Cu P ppm	Ni M/ICP ppm	Ni P ppm	Pb M/ICP ppm	Pb P ppm	Zn M/ICP ppm	Zn P ppm
X	2.10	2.00	8.00		0.24	0.19	19.60	15.50	56.10	43.10	323	250	77.30	36.20	27.70	23.80	256	227
X	2.10	2.00	7.00		0.24	0.19	19.00	15.50	54.60	42.70	310	238	73.70	36.10	26.30	23.40	247	218
X	2.10	2.00	7.00		0.26	0.19	19.00	15.30	54.70	42.70	313	241	73.70	36.30	25.30	23.70	248	219
X	2.10	2.00	7.00		0.26	0.19	19.70	15.30	55.80	43.70	322	249	75.60	37.90	25.80	23.80	257	225
X	2.10	2.00	8.00		0.25	0.19	18.80	15.30	55.10	43.80	315	250	75.10	36.90	25.50	23.60	252	226
X	2.10	2.00	7.00		0.23	0.18	19.80	15.50	55.50	43.10	317	246	74.80	36.50	25.80	23.60	252	224
X	2.00	2.00	6.00		0.25	0.20	19.80	16.00	57.00	45.50	328	254	77.70	38.40	26.60	24.70	262	234
X	2.10	2.00	8.00		0.26	0.19	20.00	15.40	55.70	42.80	323	235	75.90	36.20	26.40	23.10	258	212
Y		3.00	9.00	5.40	0.23	0.21	18.90	14.80	54.20	43.30	320	248	72.90	35.80	24.90	22.00	250	228
Y		3.00	9.00	5.60	0.25	0.18	20.00	15.30	58.20	44.00	323	249	74.80	36.50	25.50	23.30	251	231
Y		4.00	7.00	6.10	0.25	0.18	18.90	15.80	53.60	44.30	324	252	72.70	36.90	24.70	23.20	253	232
Y		3.00	8.00	5.90	0.23	0.17	19.30	15.00	58.30	44.10	323	252	75.00	36.40	24.90	23.00	252	234
Y		4.00	9.00	6.90	0.24	0.19	20.10	15.90	59.70	44.00	325	258	76.80	37.10	25.00	23.00	255	235
Y		2.00	9.00	7.20	0.24	0.20	19.20	15.70	56.10	45.70	323	257	75.10	38.70	25.30	24.20	252	236
Y		2.00	7.00	7.00	0.25	0.19	19.30	14.60	56.80	42.70	321	255	74.20	35.30	25.40	22.50	251	235
Y		2.00	9.00	6.30	0.25	0.19	18.70	14.90	56.70	43.80	325	249	75.70	36.30	25.50	22.70	255	229
Z			7.90		0.27	0.21	19.20	14.70	55.50	40.20	319	248	76.60	33.80	25.40	23.70	256	229
Z			7.70		0.27	0.21	19.30	14.60	55.70	40.40	319	249	78.70	34.00	25.70	24.20	257	231
Z			7.90		0.32	0.21	19.40	15.00	56.50	40.40	314	251	77.50	34.40	26.00	24.00	253	231
Z			5.70		0.28	0.21	19.40	15.10	56.80	42.60	317	258	77.30	36.50	25.40	24.00	255	238
Z			6.30		0.29	0.23	19.50	15.20	56.40	42.50	320	259	77.80	36.70	27.00	24.40	256	237
Z			6.40		0.28	0.20	19.60	15.20	56.30	42.90	317	255	77.30	36.80	27.10	23.70	255	234
Z			8.40		0.30	0.20	18.90	15.50	55.00	42.70	313	256	75.50	36.70	25.70	24.20	250	235
Z			7.80		0.29	0.20	19.40	15.30	55.30	42.60	307	254	75.40	37.20	25.10	24.00	246	232

Assay data – Major Oxides

Lab Code	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	P2O5 XRF %	SiO2 XRF %	TiO2 XRF %	LOI %	C Comb/LECO %	S Comb/LECO %	SG pyc
A	19.55	0.11	0.05	11.26	0.63	0.56	0.06			54.42	1.76	10.50			
A	19.56	0.11	0.05	11.26	0.63	0.56	0.06			54.42	1.76	10.40			
A	19.58	0.11	0.05	11.22	0.63	0.56	0.06			54.38	1.75	10.40			
A	19.56	0.11	0.05	11.24	0.63	0.56	0.06			54.41	1.75	10.40			
A	19.60	0.11	0.05	11.30	0.63	0.56	0.06			54.50	1.76	10.40			
A	19.61	0.11	0.05	11.30	0.63	0.56	0.06			54.62	1.76	10.40			
A	19.66	0.11	0.05	11.31	0.63	0.56	0.06			54.63	1.77	10.50			
A	19.59	0.11	0.05	11.29	0.63	0.56	0.06			54.49	1.76	10.40			
C													1.63	0.03	2.66
C													1.64	0.03	2.64
C													1.63	0.03	2.64
C													1.63	0.02	2.64
C													1.63	0.03	2.64
C													1.64	0.03	2.66
C													1.63	0.03	2.65
C													1.63	0.02	2.66
E	19.87	0.11	0.05	11.61	0.62	0.55	0.08			55.58	1.76	10.34	1.54	0.02	2.54
E	19.86	0.12	0.05	11.52	0.63	0.55	0.08			55.02	1.73	10.36	1.57	0.02	2.57
E	19.39	0.11	0.05	11.71	0.62	0.55	0.08			55.31	1.77	10.40	1.53	0.02	2.58
E	19.76	0.12	0.05	11.53	0.61	0.55	0.08			55.22	1.75	10.35	1.54	0.02	2.56
E	19.44	0.12	0.05	11.60	0.61	0.55	0.08			55.82	1.75	10.45	1.55	0.02	2.60
E	19.81	0.11	0.05	11.55	0.61	0.55	0.07			55.11	1.75	10.46	1.53	0.02	2.54
E	19.77	0.12	0.05	11.45	0.62	0.54	0.08			54.95	1.73	10.41	1.53	0.02	2.58
E	19.68	0.12	0.05	11.54	0.62	0.55	0.08			55.02	1.72	10.38	1.49	0.02	2.56
F	19.20	0.13	0.05	11.10	0.63	0.62	0.07	0.10		53.00	1.71	10.46	1.59	0.02	2.71
F	19.00	0.13	0.04	11.70	0.62	0.61	0.06	0.09		53.00	1.71	10.49	1.58	0.02	2.70
F	19.10	0.13	0.05	11.10	0.62	0.61	0.07	0.11		53.30	1.72	10.53	1.58	0.01	2.70
F	19.20	0.13	0.04	11.40	0.61	0.65	0.07	0.11		53.10	1.71	10.49	1.56	0.02	2.71
F	19.00	0.13	0.04	11.00	0.61	0.64	0.06	0.11		52.90	1.71	10.42	1.57	0.02	2.71
F	19.20	0.13	0.05	11.30	0.64	0.61	0.06	0.10		53.70	1.74	10.48	1.58	0.02	2.73
F	19.20	0.13	0.05	11.20	0.63	0.61	0.07	0.10		53.50	1.73	10.47	1.56	0.02	2.70
F	19.10	0.13	0.06	11.20	0.63	0.61	0.06	0.10		53.70	1.72	10.41	1.59	0.02	2.71
G	19.40	0.16	0.05	11.34	0.62	0.58	0.06	0.04	0.16	54.96	1.73	10.10	1.52	0.03	2.56
G	19.47	0.16	0.05	11.41	0.63	0.58	0.06	0.03	0.16	55.24	1.76	10.20	1.50	0.03	2.57
G	19.53	0.16	0.05	11.39	0.63	0.59	0.06	0.03	0.16	55.30	1.73	10.30	1.51	0.03	2.56
G	19.45	0.16	0.06	11.41	0.62	0.58	0.06	0.04	0.16	55.07	1.74	10.30	1.52	0.03	2.55
G	19.53	0.16	0.05	11.43	0.62	0.58	0.06	0.04	0.16	55.20	1.75	10.40	1.52	0.03	2.58
G	19.53	0.16	0.05	11.47	0.62	0.59	0.06	0.04	0.16	55.21	1.76	10.30	1.53	0.03	2.59
G	19.56	0.16	0.05	11.44	0.62	0.59	0.06	0.03	0.16	55.18	1.73	10.30	1.52	0.03	2.53
G	19.51	0.16	0.05	11.44	0.64	0.58	0.06	0.04	0.16	54.99	1.74	10.40	1.52	0.03	2.54
H															2.63
H															2.64
H															2.61
H															2.61
H															2.59
H															2.61
H															2.62
H															2.63
I	19.80	0.11	0.05	11.56	0.63	0.59	0.06	0.03	0.17	54.79	1.76	10.21	1.53	0.03	
I	19.69	0.11	0.05	11.52	0.62	0.58	0.06	0.04	0.17	54.81	1.76	10.21	1.53	0.03	2.78
I	19.70	0.11	0.05	11.53	0.63	0.57	0.06	0.03	0.17	54.83	1.77	10.21	1.53	0.03	2.74
I	19.77	0.11	0.05	11.55	0.62	0.57	0.06	0.04	0.17	54.81	1.77	10.23	1.52	0.04	2.77
I	19.72	0.11	0.05	11.51	0.63	0.57	0.06	0.05	0.17	54.83	1.76	10.20	1.50	0.03	2.78
I	19.80	0.11	0.05	11.54	0.62	0.59	0.06	0.04	0.17	54.78	1.77	10.22	1.54	0.03	2.78
I	19.70	0.11	0.05	11.55	0.62	0.58	0.06	0.04	0.16	54.79	1.77	10.20	1.53	0.03	2.81
I	19.73	0.11	0.05	11.58	0.62	0.58	0.06	0.04	0.17	54.82	1.77	10.23	1.51	0.03	2.75
J													1.64	0.24	
J													1.64	0.21	
J													1.65	0.21	
J													1.70	0.29	
J													1.66	0.20	
J													1.66	0.24	
J													1.66	0.25	
J													1.64	0.20	

Assay data (continued) – Major Oxides

Lab Code	Al2O3 XRF %	CaO XRF %	Cr2O3 XRF %	Fe2O3 XRF %	K2O XRF %	MgO XRF %	MnO XRF %	Na2O XRF %	P2O5 XRF %	SiO2 XRF %	TiO2 XRF %	LOI %	C Comb/LECO %	S Comb/LECO %	SG pyc
K	19.63	0.11	0.05	11.22	0.64	0.56	0.07		0.16	55.11	1.75	10.07	1.64	0.03	2.58
K	19.68	0.11	0.05	11.34	0.64	0.56	0.07		0.16	55.23	1.75	10.06	1.68	0.03	
K	19.71	0.11	0.05	11.33	0.65	0.56	0.06		0.16	55.21	1.75	10.05	1.69	0.03	2.58
K	19.77	0.11	0.05	11.32	0.64	0.55	0.07		0.16	55.27	1.74	10.07	1.68	0.03	2.58
K	19.66	0.11	0.05	11.29	0.64	0.55	0.06		0.16	55.13	1.75	10.06	1.69	0.03	2.59
K	19.73	0.11	0.05	11.37	0.65	0.56	0.06		0.16	55.39	1.76	10.08	1.66	0.03	2.59
K	19.73	0.11	0.05	11.38	0.64	0.56	0.06		0.16	55.32	1.75	10.11	1.66		2.59
K	19.67	0.10	0.05	11.31	0.64	0.56	0.06		0.16	55.10	1.75	10.09	1.65	0.02	2.58
L	19.40	0.11	0.05	11.44	0.62	0.56	0.06	0.01		54.90	1.72	10.10			
L	19.60	0.11	0.05	11.44	0.63	0.56	0.06	0.01		54.90	1.74	10.08			
L	19.65	0.11	0.05	11.46	0.63	0.56	0.06	0.01		54.90	1.74	10.06			
L	19.60	0.11	0.05	11.45	0.63	0.57	0.06	0.02		54.80	1.74	10.11			
L	19.45	0.11	0.05	11.40	0.62	0.56	0.06	0.01		54.90	1.72	10.07			
L	19.65	0.11	0.05	11.48	0.63	0.56	0.06	0.01		54.80	1.74	10.10			
L	19.60	0.11	0.05	11.43	0.63	0.56	0.06	0.01		54.70	1.74	10.11			
L	19.50	0.11	0.05	11.42	0.63	0.56	0.06	0.01		54.80	1.73	10.05			
N	19.60	0.10	0.05	11.60	0.63	0.55	0.07	0.09	0.16	55.00	1.80	9.98	1.60	0.05	2.33
N	19.60	0.11	0.05	11.60	0.63	0.59	0.06	0.07	0.16	55.20	1.79	10.30	1.61	0.05	2.47
N	19.60	0.11	0.05	11.60	0.64	0.59	0.07	0.03	0.17	55.00	1.81	10.20	1.59	0.05	2.37
N	19.50	0.11	0.05	11.60	0.62	0.60	0.07	0.05	0.16	55.00	1.80	10.10	1.58	0.05	2.40
N	19.50	0.10	0.05	11.60	0.62	0.59	0.07	0.09	0.16	54.80	1.81	10.40	1.54	0.05	2.52
N	19.60	0.11	0.04	11.60	0.63	0.57	0.07	0.04	0.17	55.00	1.80	10.30	1.59	0.05	2.56
N	19.60	0.10	0.05	11.60	0.63	0.58	0.06	0.08	0.16	54.90	1.82	10.30	1.58	0.05	2.44
N	19.60	0.11	0.05	11.60	0.63	0.56	0.06	0.06	0.16	54.80	1.80	10.40	1.59	0.05	2.45
O	19.06	0.10	0.03	11.23	0.59	0.58	0.07	0.13		53.36	1.77	11.49			
O	19.10	0.10	0.03	11.31	0.63	0.59	0.07	0.12		53.45	1.78	11.41			
O	18.91	0.10	0.03	11.09	0.59	0.58	0.07	0.13		53.32	1.76	11.38			
O	19.14	0.10	0.03	11.28	0.61	0.59	0.07	0.13		53.51	1.77	11.47			
O	19.06	0.10	0.03	11.24	0.62	0.59	0.07	0.11		53.48	1.77	11.35			
O	19.09	0.10	0.03	11.23	0.61	0.59	0.07	0.13		53.32	1.76	11.50			
O	19.08	0.11	0.03	11.26	0.60	0.60	0.07	0.14		53.48	1.79	11.29			
O	18.95	0.10	0.04	11.18	0.61	0.58	0.07	0.12		53.38	1.77	11.40			
P	19.70	0.11	0.05	11.60	0.63	0.57	0.07	0.05		54.70	1.77	10.30			
P	19.70	0.11	0.05	11.60	0.63	0.56	0.07	0.05		54.70	1.78	10.30			
P	19.70	0.12	0.05	11.60	0.63	0.57	0.07	0.05		54.80	1.77	10.30			
P	19.70	0.12	0.05	11.60	0.63	0.57	0.07	0.05		54.70	1.78	10.30			
P	19.60	0.11	0.07	11.50	0.63	0.56	0.07	0.06		54.80	1.77	10.30			
P	19.80	0.11	0.05	11.60	0.63	0.57	0.07	0.05		54.70	1.78	10.40			
P	19.80	0.12	0.05	11.60	0.63	0.56	0.07	0.05		54.80	1.78	10.30			
P	19.70	0.12	0.06	11.60	0.63	0.57	0.07	0.06		54.80	1.78	10.30			
Q	19.60	0.11	0.05	11.60	0.63	0.61	0.06	0.02	0.16	54.70	1.76	11.00	1.59	0.04	
Q	19.70	0.12	0.05	11.60	0.64	0.57	0.06	0.03	0.16	54.80	1.78	11.00	1.60	0.04	
Q	19.70	0.10	0.04	11.60	0.64	0.58	0.06	0.03	0.16	54.60	1.77	10.90	1.57	0.03	
Q	19.60	0.11	0.04	11.60	0.63	0.57	0.06	0.03	0.16	54.20	1.75	10.80	1.57	0.03	
Q	19.70	0.11	0.05	11.60	0.64	0.60	0.06	0.03	0.16	54.40	1.78	10.80	1.56	0.03	
Q	19.50	0.11	0.05	11.60	0.63	0.57	0.06	0.03	0.16	54.20	1.75	11.00	1.58	0.03	
Q	19.60	0.11	0.06	11.60	0.63	0.58	0.05	0.03	0.16	54.80	1.76	11.10	1.56	0.03	
Q	19.70	0.11	0.05	11.70	0.64	0.56	0.05	0.03	0.16	54.70	1.77	10.90	1.56	0.03	
S	19.00	0.09		11.75	0.61	0.50			0.19	53.10	1.65		1.57	0.03	2.68
S	19.10	0.09		11.72	0.61	0.50			0.20	53.10	1.64		1.54	0.03	2.68
S	19.40	0.12		11.93	0.62	0.50			0.20	53.90	1.67		1.54	0.03	2.67
S	19.00	0.09		11.73	0.61	0.50			0.19	52.70	1.65		1.56	0.03	2.67
S	19.00	0.09		11.66	0.61	0.50			0.20	52.60	1.64		1.55	0.03	2.68
S	19.00	0.10		11.78	0.61	0.50			0.19	53.20	1.66		1.55	0.03	2.68
S	19.00	0.11		11.74	0.61	0.50			0.19	52.90	1.65		1.56	0.03	2.67
S	19.10	0.09		11.76	0.61	0.50			0.19	52.80	1.65		1.56	0.03	2.66
U	19.36	0.12	0.05	11.52	0.62	0.56	0.06	0.07		54.43	1.73	10.29	1.62	0.03	2.78
U	19.33	0.12	0.05	11.64	0.62	0.57	0.06	0.07		54.41	1.76	10.21	1.61	0.03	2.79
U	19.29	0.12	0.05	11.57	0.62	0.57	0.06	0.06		54.32	1.75	10.38	1.61	0.03	2.79
U	19.66	0.12	0.05	11.69	0.62	0.57	0.06	0.07		55.30	1.76	10.28	1.59	0.03	2.79
U	19.76	0.12	0.06	11.73	0.63	0.58	0.07	0.07		55.53	1.77	10.22	1.59	0.03	2.79
U	19.48	0.12	0.05	11.66	0.62	0.57	0.06	0.07		55.00	1.75	10.43	1.59	0.03	2.79
U	19.49	0.12	0.05	11.71	0.62	0.57	0.07	0.06		55.18	1.75	10.30	1.60	0.03	2.78
U	19.53	0.12	0.05	11.68	0.63	0.57	0.07	0.07		55.19	1.75	10.38	1.59	0.03	2.78
V	19.17	0.09	0.05	11.77	0.62	0.59	0.04			53.89	1.74	10.30		0.02	2.85
V	19.18	0.09		11.65	0.62	0.56	0.04			53.59	1.74	10.30		0.02	2.68
V	19.21	0.09	0.06	11.68	0.62	0.57				53.82	1.74	10.31		0.02	2.72
V	19.27	0.09	0.05	11.69	0.62	0.59	0.04			53.81	1.74	10.32		0.02	2.66
V	19.32	0.09		11.72	0.62	0.58	0.04			53.80	1.74	10.30		0.02	2.73
V	19.23	0.09	0.05	11.67	0.61	0.58	0.04			53.80	1.74	10.30			2.78
V	19.16	0.09	0.06	11.65	0.62	0.57	0.04			53.90	1.74	10.27		0.02	2.69
V	19.27	0.09	0.05	11.62	0.62	0.58	0.04			53.73	1.74	10.32			2.73
X	19.55	0.11	0.05	11.40	0.62	0.56	0.06	0.03	0.16	54.60	1.74	10.68		0.03	2.72
X	19.65	0.11	0.05	11.46	0.63	0.58	0.06	0.04	0.16	54.90	1.76	10.62		0.03	2.76
X	19.50	0.11	0.05	11.36	0.63	0.57	0.06	0.03	0.16	54.50	1.74	10.63		0.03	2.72
X	19.60	0.11	0.05	11.44	0.63	0.57	0.06	0.03	0.16	54.70	1.74	10.58		0.03	2.85
X	19.55	0.11	0.05	11.39	0.63	0.56	0.06	0.03	0.16	54.50	1.74	10.60		0.03	2.72
X	19.55	0.11	0.05	11.41	0.63	0.57	0.06	0.03	0.16	54.60	1.74	10.63		0.03	2.88
X	19.65	0.11	0.05	11.46	0.63	0.57	0.06	0.03	0.16	54.80	1.75	10.65		0.03	2.74
X	19.40	0.11	0.05	11.34	0.63	0.57	0.06	0.03	0.16	54.30	1.73	10.64		0.03	2.68
Y	19.50	0.11	0.06	11.35	0.63	0.57	0.06	0.05	0.16	55.10	1.78	10.55		0.03	2.57
Y	19.95	0.12	0.05	11.53	0.64	0.59	0.06	0.06	0.16	55.00	1.82	10.56		0.03	2.64
Y	19.70	0.11	0.05	11.36	0.63	0.58	0.06	0.05	0.16	54.80	1.74	10.61		0.03	2.62
Y	19.75	0.11	0.05	11.40	0.63	0.59	0.06	0.05	0.16	55.00	1.76	10.62		0.03	2.61
Y	19.55	0.11	0.05	11.30	0.63	0.57	0.06	0.05	0.16	54.40	1.74	10.64		0.03	2.64
Y	19.55	0.11	0.05	11.21	0.63	0.57	0.06	0.05	0.16	54.00	1.76	10.78		0.03	2.62
Y	19.20	0.10	0.05	11.18	0.62	0.56	0.06	0.05	0.16	54.40	1.75	10.73		0.03	2.65
Y	19.55	0.11	0.05	11.30	0.62	0.58	0.06	0.05	0.16	54.40	1.74	10.73		0.03	2.56
Z	19.50	0.11	0.05	11.44	0.63	0.56	0.06	0.04	0.16	54.70	1.73	10.56		0.03	2.63
Z	19.60	0.11	0.05	11.51	0.63	0.56	0.06	0.04	0.16	54.80	1.74	10.53		0.03	2.61
Z	19.50	0.11	0.05	11.47	0.63	0.56	0.06	0.03	0.16	54.70	1.74	10.37		0.03	2.63
Z	19.45	0.11	0.05	11.42	0.63	0.56	0.06	0.03	0.16	54.40	1.73	10.43		0.03	2.56
Z	19.65	0.11	0.05	11.55	0.64	0.56	0.06	0.04	0.16	54.90	1.75	10.45		0.03	2.60
Z	19.55	0.11	0.05	11.49	0.63	0.56	0.06	0.04	0.16	54.60	1.74	10.41		0.03	2.56
Z	19.50	0.11	0.05	11.45	0.63	0.56	0.06	0.03	0.16	54.40	1.73	10.40		0.03	2.63
Z	19.55	0.11	0.05	11.46	0.63	0.56	0.06	0.04	0.16	54.60	1.73	10.53		0.03	2.56

Assay data (continued)

XRF Fe ppm	XRF K ppm	XRF K ppm	XRF K ppm	XRF Mn ppm
8.14	0.52	0.53	0.51	0.05
8.10	0.52	0.53	0.51	0.05
8.11	0.52	0.53	0.51	0.05
8.15	0.52	0.51	0.51	0.05
8.18	0.52	0.52	0.51	0.05
8.12	0.52	0.52	0.51	0.05
8.12	0.52	0.52	0.51	0.05
8.09	0.52	0.51	0.51	0.05
7.94	0.51	0.52	0.51	0.05
7.98	0.52	0.52	0.52	0.05
7.94	0.51	0.52	0.51	0.05
7.98	0.51	0.52	0.51	0.05
7.94	0.51	0.52	0.52	0.05
7.97	0.51	0.53	0.51	0.05
7.96	0.51	0.51	0.51	0.05
7.98	0.52	0.51	0.51	0.05
8.08	0.52	0.52	0.51	0.05
8.05	0.51	0.52	0.51	0.05
7.95	0.51	0.52	0.51	0.05
7.98	0.51	0.52	0.51	0.05
7.92	0.51	0.51	0.51	0.05
7.72	0.53	0.52	0.51	0.05
8.07	0.52	0.51	0.52	0.05
8.02	0.52	0.50	0.52	0.05
	0.51	0.52	0.52	
	0.52	0.52	0.52	
	0.52	0.52	0.52	
	0.51	0.52	0.52	
	0.51	0.52	0.52	
	0.51	0.52	0.52	
	0.51	0.52	0.53	
	0.53	0.52	0.52	
	0.52	0.52	0.52	
	0.51	0.53	0.52	
	0.52	0.53	0.52	
	0.51	0.52	0.51	
	0.52	0.53	0.51	
	0.51	0.52	0.52	
	0.51	0.52	0.52	
	0.51	0.53	0.52	
	0.53	0.51	0.52	
	0.53	0.51	0.53	
	0.53	0.51	0.52	
			0.52	
			0.52	

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]
Pt	PbColl	ppb	0.408	0.037	0.062	0.018
Pd	PbColl	ppb	0.628	0.245	0.352	0.084
Au	PbColl	ppb	1.828	0.449	0.955	0.134
Au	P	ppb	1.213	0.437	1.102	0.241
Ag	M/ICP	ppm	0.535	0.022	0.026	0.007
Ag	P	ppm	0.018	0.005	0.007	0.002
As	M/ICP	ppm	3.527	1.033	0.753	0.267
As	P	ppm	1.599	0.584	0.599	0.173
Co	M/ICP	ppm	4.351	1.674	1.188	0.396
Co	P	ppm	3.298	0.540	1.103	0.187
Cu	M/ICP	ppm	16.18	3.86	5.31	0.97
Cu	P	ppm	19.49	6.84	5.92	1.98
Fe	XRF	%	0.094	0.136	0.039	0.079
K	XRF	%	0.01	0.004	0.005	0.001
Mn	XRF	%	0.001	0.001	0.001	0.001
Ni	M/ICP	ppm	6.516	1.449	1.680	0.370
Ni	P	ppm	7.523	1.518	1.343	0.442
Pb	M/ICP	ppm	3.667	1.072	1.132	0.271
Pb	P	ppm	2.947	0.856	0.633	0.237
Zn	M/ICP	ppm	15.523	4.363	4.625	1.101
Zn	P	ppm	11.473	5.871	5.467	1.597
Al_2O_3	XRF	%	0.242	0.054	0.086	0.017
CaO	XRF	%	0.015	0.003	0.002	0.001
Cr_2O_3	XRF	%	0.006	0.001	0.001	0.000
Fe_2O_3	XRF	%	0.173	0.099	0.063	0.025
K_2O	XRF	%	0.010	0.005	0.005	0.001
MgO	XRF	%	0.025	0.008	0.007	0.002
MnO	XRF	%	0.008	0.003	0.003	0.001
Na_2O	XRF	%	0.032	0.014	0.006	0.004
P_2O_5	XRF	%	0.011	0.001	0.001	0.000
SiO_2	XRF	%	0.704	0.170	0.190	0.051
TiO_2	XRF	%	0.033	0.010	0.010	0.003
LOI		%	0.333	0.119	0.055	0.032
C	Comb/LECO	%	0.051	0.040	0.014	0.012
S	Comb/LECO	%	0.052	0.003	0.002	0.001
SG	pyc		0.100	0.058	0.022	0.016

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 Stc 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. Uncertified values: The Certified, Provisional and Indicated values listed on p1 and p2 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: AMIS0434 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: Most 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.

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 therefore set their own limits based on their own data quality objectives and control measurements, after determining the performance characteristics of their own 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, Melesha Gopi Mungaroo; Daishnee Padayachee ; and Allan Fraser; accept no liability for any decisions or actions taken following the use of the reference material.

Date of Version v1.00: 23 February 2021

Version: v2.00

Reason for Version v2.00: Amendment of number of laboratories

Version v2.00: Replaces the original report of AMIS0434 Certification.

Date of Version v1.00: 09 January 2017

Version: v1.00

Reason for Version v1.00: Certification of Fe (XRF), Mn (XRF), K (XRF)

Date of Version 000: 14 April 2014

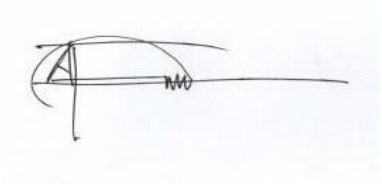
Version: *000*

Approving Officer:

African Mineral Standards: _____

Melesha Gopi Mungaroo (Senior Quality Specialist)

Certifying Officer:



Geochemist:_____

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

Appendix – uncertified trace element statistics

Analyte	Method	Unit	Mean	2SD	RSD%	n
Ag	P1	ppm	0.20	0.02	6.2	30
Al	M/ICP	%	9.9	0.65	3.3	98
As	P1	ppm	14.0	2.3	8.4	32
Ba	M/ICP	ppm	81.2	9.5	5.9	115
Be	M/ICP	ppm	1.1	0.12	5.5	64
Bi	M/ICP	ppm	0.46	0.07	8.1	86
Ca	M/ICP	%	0.08	0.01	5.4	113
Cd	M/ICP	ppm	1.6	0.20	6.0	82
Ce	M/ICP	ppm	112	11.6	5.2	55
Co	P1	ppm	44.4	2.7	3.1	29
Cs	M/ICP	ppm	3.8	0.29	3.8	63
Cu	P1	ppm	254	30.2	5.9	31
Dy	M/ICP	ppm	5.0	0.22	2.2	7
Er	M/ICP	ppm	2.9	0.27	4.6	8
Eu	M/ICP	ppm	1.7	0.08	2.5	8
Fe	M/ICP	%	7.5	0.49	3.3	114
Ga	M/ICP	ppm	28.5	2.9	5.2	80
Gd	M/ICP	ppm	5.8	0.33	2.9	8
Ge	M/ICP	ppm	0.25	0.10	19.1	31
Hf	M/ICP	ppm	5.2	0.87	8.4	86
Ho	M/ICP	ppm	1.0	0.09	4.5	8
In	M/ICP	ppm	0.17	0.03	9.2	86
K	M/ICP	%	0.50	0.03	3.3	107
La	M/ICP	ppm	29.9	6.3	10.6	85
Li	M/ICP	ppm	26.0	2.3	4.3	99
Lu	M/ICP	ppm	0.42	0.20	23.4	32
Mg	M/ICP	%	0.30	0.04	6.3	109
Mn	M/ICP	ppm	478	44.6	4.7	116
Mo	M/ICP	ppm	3.5	0.59	8.4	94
Na	M/ICP	%	0.03	0.01	23.6	112
Nb	M/ICP	ppm	18.3	5.4	14.8	78
Nd	M/ICP	ppm	30.9	1.7	2.7	8
Ni	P1	ppm	38.2	6.9	9.1	32
P	M/ICP	ppm	664	70.0	5.3	103
Pb	P1	ppm	22.8	2.3	5.1	32
Pr	M/ICP	ppm	8.2	0.44	2.6	8
Rb	M/ICP	ppm	37.8	2.9	3.8	61
S	M/ICP	%	0.03	0.0	2.0	91
Sb	M/ICP	ppm	1.0	0.19	9.3	74
Sc	M/ICP	ppm	24.7	3.0	6.2	99
Se	M/ICP	ppm	2.1	0.30	7.3	35
Si	M/ICP	%	25.1	0.24	0.47	8
Sm	M/ICP	ppm	7.0	0.30	2.1	8
Sn	M/ICP	ppm	3.9	0.42	5.4	71
Sr	M/ICP	ppm	9.0	1.3	7.2	110
Ta	M/ICP	ppm	1.2	0.33	13.1	56
Tb	M/ICP	ppm	1.0	0.63	32.3	40
Te	M/ICP	ppm	0.06	0.03	22.6	38
Th	M/ICP	ppm	16.1	2.1	6.6	70
Ti	M/ICP	%	0.66	0.19	14.1	111
Tl	M/ICP	ppm	0.31	0.03	4.6	69
Tm	M/ICP	ppm	0.44	0.03	2.9	8
U	M/ICP	ppm	3.8	0.56	7.4	84
V	M/ICP	ppm	202	19.3	4.8	115
W	M/ICP	ppm	1.4	0.61	21.6	79
Y	M/ICP	ppm	18.8	3.5	9.2	97
Yb	M/ICP	ppm	2.5	0.74	15.0	24
Zn	P1	ppm	223	15.2	3.4	31
Zr	M/ICP	ppm	175	32.2	9.2	95

Element	Method	Unit	Mean	2SD	RSD_%	n
Cu	XRF	ppm	264.52	119.49	22.59	31
Ni	XRF	ppm	75.914	28.175	18.56	31