GEOSCIENCE AND MINES BRANCH

Stream Sediment Geochemical Survey over the Warwick Mountain Area, Eastern Cobequid Highlands, Nova Scotia: Data, Methods, and QA/QC

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Stream Sediment Geochemical Survey over the Warwick Mountain Area, Eastern Cobequid Highlands, Nova Scotia: Data, Methods, and QA/QC

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Introduction

A large-scale high-resolution stream sediment (silt) sampling survey across the northeastern Cobequid Highlands was conducted in 2016-2017 as a part of the larger Warwick Mountain Gold project, consisting of grassroots bedrock mapping, till sampling, and stream sediment sampling. This was driven by the recognition of widespread arsenic (As), antimony (Sb), and other base metal anomalies in bedrock samples associated with known gold occurrences in the Warwick Mountain area (MacHattie, 2013, 2017; Baldwin, 2016) and widespread gold-in-stream anomalies identified from recent and historical assessment reports (e.g. Hogg, 1990). During the 2016 field program, an unexplained disconnect between these geochemical anomalies in bedrock samples and the location of the historical gold-in-stream anomalies was observed (Baldwin, 2017; MacHattie 2017). This presented a geoscientific and mineral exploration problem that could not be solved strictly through further bedrock mapping and sampling. This, together with the recognition that the potential for low-sulphidation-type epithermal gold was across the entire Carboniferous volcanic belt, rather than just at Warwick and Nuttby mountains, necessitated an expansion of sampling programs (MacHattie 2013; Baldwin 2016). As a result, large-scale sampling programs in the area were initiated (Baldwin, 2017; Brushett, 2017; MacHattie 2017) to better locate and characterize the areas with the best potential. The pilot sampling program of autumn 2016 (Baldwin, 2017) had already demonstrated the utility of pXRF for detecting arsenic and base metals (e.g. Zn, Pb), allowing this inexpensive, fast in-house analytical method to be used on a much larger survey scale, and to better screen samples for the best candidates to send for full lab analyses. Between the 2016 and 2017 field campaigns, a total of 774 stream sediment samples were collected, of which 623 were collected from June to September 2017 (Fig. 1).

This paper contains the field methods and survey design notes for this stream sediment survey, the data (Appendices A and B), as well as the QA/QC on the lab and pXRF data collected as part of the survey (Appendix C). A GIS-compatible digital data release (Baldwin and MacMullen, 2018) accompanies this report; it contains sample location data, all field notes on the site, and all data acquired by pXRF and aqua regia ICP-MS as a GIS dataset (file geodatabase and shape files), complete with coded layer files with recommended symbology.

Survey Design

Initially designed as an experiment to test the utility of pXRF for reconnaissance geochemistry on stream sediment sampling (Baldwin, 2017), the early returns on the 2016 sampling program were sufficiently promising to expand this program to a high-density regional survey. Sampling in 2016 was done at extremely high resolution, with station spacing ranging from 50 to 150 m, depending the scale of gold-in-streams anomalies reported by Seabright in the late 1980s (Hogg, 1990). During this initial pilot campaign, the principal focus was placed on the Miller Brook–Munroe Brook–Sutherland Brook area near East New Annan and Central New Annan (Baldwin, 2017). This area was the original focus because of the large number of historical gold anomalies but an apparent absence of anomalous pathfinder elements (e.g. As, Sb) in bedrock samples (MacHattie, 2017). Additional focus was placed on the Baileys Brook–Cavanagh

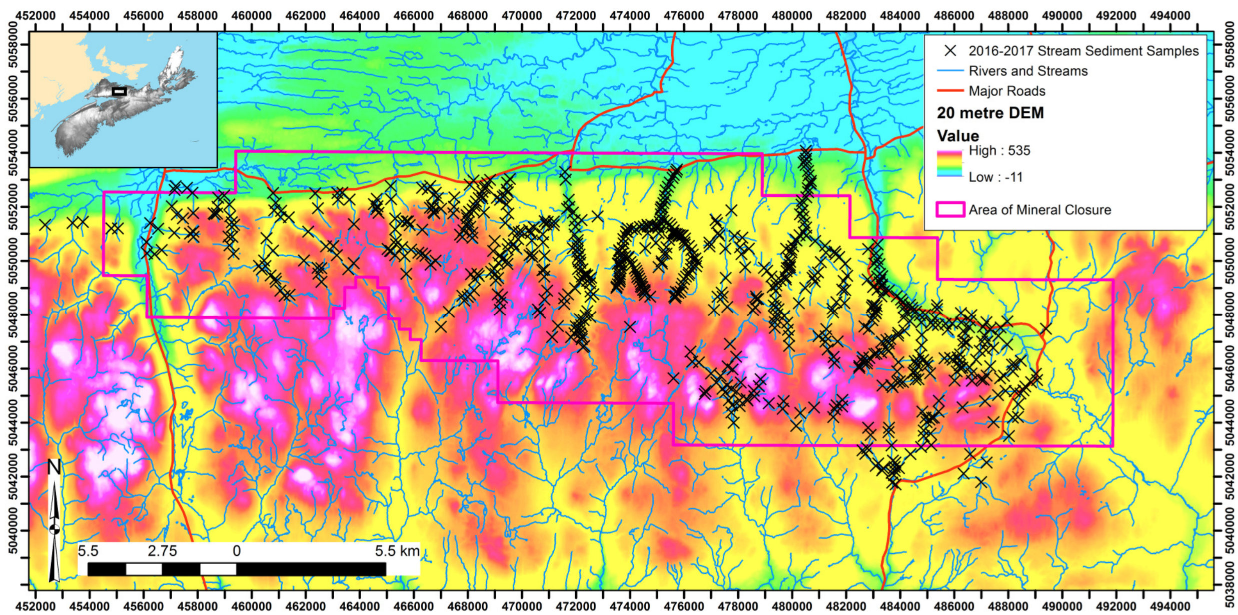

Figure 1. Sample locations of stream sediment (silt) samples collect in 2016 and 2017 in the Warwick Mountain mineral closure area (N=774). Background is 20 m DEM.

Brook system and McLeod Brook, areas of new mineral discoveries in 2016 (Baldwin, 2017; MacHattie, 2017). Total sampling in the fall 2016 pilot program resulted in 151 silt samples. Promising preliminary results resulted in the design of the full study presented herein. Using the 1 m lidar together with existing topographical maps, a total of 670 stream sample target sites were chosen, emphasizing sampling below, above, and up each visible drainage and tributary throughout the study area. Emphasis was placed on waterways draining from the Byers Brook and Diamond Brook formations. Riverways without visible tributaries had targets placed at intervals ranging from 200 to 500 m, as appropriate based on known bedrock lithology changes and the perceived prospectivity of the area. Not all targets proved sampleable, as some drainages visible on the lidar showed no or little evidence of even ephemeral water flow. However, if any evidence of seasonal or ephemeral flow was observed, the site was sampled. Many target areas also proved inaccessible, most commonly due to being in large swamps with severely overgrown alders. Due to time constraints on the program and the questionable value of stream sediments collected in swamps, large target areas (e.g. south of Clear Lake and Whippey Lake) lack sample coverage. The presence of swamps did not necessarily preclude sampling, however, as the upper headwaters of many streams in the area are swamps or bogs on top of the highlands (plateau). Consequently, many samples from the headwaters of streams were disproportionately high in organic matter.

Methods

Field and Sampling Methods

Stream sediment sampling protocol followed that of the National Geochemical Reconnaissance (NGR) (*see* Day et al., 2009), consisting of filling a kraft paper sample bag with the finest grained material available at the sample site. This resulted in samples ranging in overall composition from fine-grained sand, to pebbly silts and sands, to organic-rich mud, depending on the physiography and sedimentation patterns of the streams present. Field samples were then placed in individual Ziploc bags to prevent cross-contamination between samples. Collection of field duplicate samples commenced at 17GB0114/115 (first duplicate pair), and a duplicate pair was collected within every 20-sample interval for the remainder of the program, resulting in a total of 26 duplicate pairs. Kraft bags for sample duplicates were filled simultaneously, each receiving half of each handful of sampled material. Duplicates were primarily collected at sites with more abundant and thus often sandier sediment than the average site.

Upon return from the field, samples were laid out on plastic shelving to air dry for a minimum of 24 hours to remove excess moisture prior to being placed in a Thermo Scientific drying oven at 60˚C for 24 to 40 hours, depending on the level of dryness after 24 hours and the number of samples in the queue. Samples typically underwent an additional two weeks or longer air drying following the oven, partly to eliminate any remaining moisture and partly due to sample backlog and the amount of time dedicated to sample processing over the course of the field season. All samples were processed within a maximum of three weeks following collection. Once completely dry, samples were hand sieved for the <250 µm fraction (all coarser material was discarded). All samples passed through 500 µm and 250 µm screens; however, later samples were also passed through 2 mm and 1 mm screens to expedite the sieving process and increase sample yield. Samples collected during the 2016 field campaign were processed in old brass sieves, but upon the expansion of the sampling program, new stainless steel sieves were purchased and used for all 2017 samples. Sieve fraction yields for samples ranged from 5% to some rare samples with near total recovery. Sieved material was stored in 40 dram (147.9 mL) snap-top vials. For analysis, the lids were removed from the vials and the vials were covered with Prolene 4 µm Thin-Film, which was then secured with elastic. Following homogenization (shaking of vials), sample vials were inverted on a Innovex x5000 portable X-ray Fluorescence (pXRF) and analyzed for a suite of 38 elements; however, several (P, Cl, Co, Ag, La, Nd, Sm, Hg, and Bi) were not reported due either to very low numbers of detections, or due to very poor reproducibility of the data.

Field Notes

Sample site data were recorded using the standard NGR stream sediment sample forms. Collected information included stream width, depth, physiography, and surface expression; the stream's drainage, source, class, type, and flow; water colour and clarity; the vegetation type present; the bank material(s); possible contamination sources (detailed below); and sediment colour and grain size. Not all data were recorded at all sites, specifically stream width, depth, sampling time, and grain size percentages. This was generally due to sampler error or the sampler not wearing a watch. These have been recorded as zero in the digital product (Baldwin and MacMullen, 2018) as well as in the data tables in Appendix A, and are indicated so in the comments column. Such cases make up a small proportion of the 774 samples collected.

Most samples collected have as either definite or probable sources of contamination. This is in large part due to the long history of habitation, development, and land use in the study area. Although most of the area is currently heavily forested with generally low degrees of development, a variety of potential contamination sources where observed and identified:

1) Forestry: Most of the study area consists of forested lots used for timber harvesting, both at the small and industrial scale. Recently harvested areas are potentially subject to several types of contamination. The largest observed causes appeared to be increased erosion due to clear cutting and fuel and lubricant seepage into the streams, which occurs where heavy equipment was operated proximal to the stream and where barrels and bottles of grease, oil, and other fluids were discarded into the streams. Locally, further contamination results from slash and large volumes of sawdust being dumped in the streams. In some rare cases, areas marked as having potential for contamination by forestry are not at significant risk from harvesting, but rather from sylvicultural operations. Given the broad nature of forestry operations in this region of the Cobequid Highlands, all samples should be

considered at risk of contamination. This includes samples not marked as potentially contaminated in Appendix A and Baldwin and MacMullen (2018).

2) Domestic: Portions of the study area are inhabited, but generally sparsely. Many of the sources of potential domestic contamination are cottages and other seasonal homes, but year-round residences are also a source of contamination. In many areas, domestic contamination may be unrelated to the presence of any houses, as domestic garbage, ranging from modern household waste to old appliances and automobiles, are often found in even the most remote stream beds. Where houses and cottages are present, contamination from septic systems and outhouses is also a possibility.

3) Road runoff: An extensive network of roads, ranging from paved, numbered highways to overgrown woods roads and trails, is present in the study area, making the possibility of contamination from road runoff common. Potential contamination from petrochemicals, road salt, and other debris are present along paved and primary gravel roads in the area, but some contamination risk remains from even the smallest, least-used trail or track.

4) Agriculture: In parts of the study area, particularly those close to the Cumberland Basin, agriculture with diverse products is present. Most farms in the study area are dominated by hay, cultivated wild blueberries, or livestock (cattle, horses). These crops carry less risk of runoff from fertilizers and pesticides than other farmed products; however, many of the livestock farms in the area have open pasture access to the streams, creating some contamination risk from animal waste.

5) Mining: No active mining operations are present in the study area; however, numerous aggregate pits, both small and large, extracting both bedrock and overburden are present. Most are not active; however, areas with such risk have been recorded.

6) Industry: This designation is used to identify areas with contamination risk from one of two sources: either runoff from the trails at Ski Wentworth at the western end of the study area or drainage from the Nuttby Mountain Wind Farm in the east. The actual contamination risk from each of these is uncertain.

7) Iron seep: There are local cases of rusty iron seeps at or near a sample site. Some examples may be naturally occurring; however, all have been noted due to their likely influence on sediment composition.

8) Sugarbush: Numerous maple syrup operations are present along the north slope of the Cobequid Highlands in this area. Although this contamination designation is very specific, it was chosen because these operations have similarities to the forestry, agriculture, and industry categories. These operations, however, are fairly low impact and most carry minimal risk of contaminating the stream sediments.

Aqua Regia ICP-MS Sample Selection

Out of the total of 774 samples analyzed by pXRF, a subset of 292 samples was selected for analysis by aqua regia ICP-MS at Bureau Veritas in Vancouver for a suite of 35 elements, including Au and most pathfinder elements and base metals. To avoid any preconceived sample bias, geographic location was not used in selecting samples for lab analyses. Instead, samples were screened based primarily on their chemistry. By pXRF, As had proved to be the most promising pathfinder element, so samples were initially screened to include the 200 highest As values from the dataset. Additionally, all samples with greater than 300 ppm Zn were selected. Lastly, all samples with detectable Se, Hg, and Sb were selected (Hg data by pXRF has not been reported, due to unrealistic concentrations and a total lack of reproducibility by lab methods). The dataset was completed with the addition of all remaining field duplicate pairs for QA/QC purposes. Fifteen aliquots of the CANMET standard reference material Till-3 were also included as blind checks on data quality (all CANMET stream sediment standards had been discontinued at the time of survey design). Aliquots of Till-3 were inserted randomly within each 20-sample sequence, and assigned the sample designation of the number of the preceding sample with the suffix “C” added to the end (e.g., 17GB0030C). Certified values used in QA/QC are from Lynch (1996). Aliquots weighing between 4 and 45 g were measured from the sieved samples (contingent on the amount of sample recovery during sieving and the density of the sample material), placed in clean, screw-top plastic vials and sent to Bureau Veritas (formerly ACME Labs) for analysis by procedure AQ250. All diagrams related to QA/QC are included in Appendix C (C1-pXRF duplicates; C2-Till-3; C3-Field Duplicates by ICP-MSW; C4- Lab duplicates by ICP-MS; C4- pXRF vs ICP-MS data).

References

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Appendix A. Geochemical Results

Geochemical results are in the accompanying Microsoft Excel file “AppendixA_Geochem_V1.xlsx”.

Appendix B. Laboratory Certificates

In addition to the following text, the laboratory results are presented in the accompanying text file “VAN17002654.CSV”.

Editor’s note: Three samples have been redacted. These samples are outside the study area.

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Receiving Lab:	Canada-Vancouver
Received:	November 16, 2017
Report Date:	November 29, 2017
Page:	1 of 12

CERTIFICATE OF ANALYSIS VAN17002654.1

CLIENT JOB INFORMATION

Project:	None Given
Shipment ID:	
P.O. Number	
Number of Samples:	308

SAMPLE DISPOSAL

RTRN-PLP Return After 90 days

Bureau Veritas does not accept responsibility for samples left at the laboratory after 90 days without prior written instructions for sample storage or return.

SAMPLE PREPARATION AND ANALYTICAL PROCEDURES

Procedure Code	Number of Samples	Code Description	Test Wgt (g)	Report Status	Lab
SLBHP	307	Sorting, labeling and boxing samples received as pulps			VAN
AQ250	307	1:1:1 Aqua Regia digestion Ultratrace ICP-MS analysis	0.5	Completed	VAN
DRPLP	307	Warehouse handling / disposition of pulps			VAN

ADDITIONAL COMMENTS

Invoice To: Nova Scotia Dept. of Natural Resources
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CC:

MARCUS LAU
Production Manager

This report supersedes all previous preliminary and final reports with this file number dated prior to the date on this certificate. Signature indicates final approval; preliminary reports are unsigned and should be used for reference only.
All results are considered the confidential property of the client. Bureau Veritas assumes the liabilities for actual cost of analysis only. Results apply to samples as submitted.
"*" asterisk indicates that an analytical result could not be provided due to unusually high levels of interference from other elements.

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CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
	Unit	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
	MDL	0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
16GB0111	Sediment Pulp	0.36	34.66	17.07	84.4	21	16.3	11.1	555	2.49	2.1	0.6	2.9	2.1	12.1	0.26	0.17	0.16	51	0.28	0.046
16GB0111C	Sediment Pulp	0.57	20.10	17.02	37.9	1471	29.7	10.1	319	1.91	92.3	1.2	5.0	2.9	18.6	0.10	0.57	0.37	32	0.47	0.048
16GB0120	Sediment Pulp	0.41	43.95	19.69	101.7	58	24.4	16.8	969	3.45	2.6	0.7	4.1	1.4	23.6	0.31	0.15	0.12	65	0.48	0.054
[redacted]	Sediment Pulp	[redacted]																			
[redacted]	Sediment Pulp	[redacted]																			
[redacted]	Sediment Pulp	[redacted]																			
16GB0140	Sediment Pulp	0.33	25.12	18.48	110.6	41	15.9	10.3	554	2.32	2.5	0.6	4.8	1.6	18.6	0.75	0.18	0.11	44	0.41	0.049
16GB0144	Sediment Pulp	1.80	42.44	23.23	98.9	173	17.2	11.7	2378	2.25	8.7	2.2	2.4	0.4	33.8	1.27	0.20	0.15	53	0.59	0.089
16GB0145	Sediment Pulp	1.37	29.60	20.07	92.4	80	15.7	9.5	270	2.13	1.9	0.8	0.3	0.8	76.9	0.45	0.19	0.12	44	0.62	0.063
16GB0146	Sediment Pulp	0.38	27.75	19.84	91.0	64	15.8	10.4	759	2.24	2.0	0.7	0.5	0.9	23.0	0.60	0.17	0.12	49	0.51	0.059
16GB0148	Sediment Pulp	0.49	17.07	28.25	98.4	114	13.1	8.0	274	1.78	2.4	1.1	0.3	0.4	7.3	0.26	0.16	0.17	33	0.11	0.057
16GB0151	Sediment Pulp	0.62	51.27	48.35	301.2	161	24.4	18.7	2036	3.25	4.1	1.7	1.6	0.9	45.0	3.71	0.33	0.19	59	0.78	0.074
16GB0157	Sediment Pulp	0.56	19.60	38.38	124.7	55	15.1	11.5	756	2.37	5.1	0.7	0.4	1.1	10.3	0.30	0.21	0.17	42	0.21	0.049
16GB0158	Sediment Pulp	0.61	26.54	43.06	154.0	56	15.1	11.6	1208	2.19	4.8	0.7	0.4	0.8	19.3	0.86	0.23	0.19	42	0.44	0.053
16GB0162	Sediment Pulp	1.05	20.24	60.57	177.2	88	13.3	12.5	1383	2.16	7.0	0.8	0.2	0.5	8.7	1.06	0.22	0.21	39	0.18	0.059
16GB0163	Sediment Pulp	0.22	16.91	54.18	136.0	22	14.3	10.7	692	2.49	8.0	0.5	<0.2	2.9	10.4	0.38	0.22	0.11	50	0.28	0.043
16GB0164	Sediment Pulp	1.04	18.99	60.30	256.4	70	14.2	11.9	1003	2.05	6.0	0.8	0.4	0.6	12.9	1.89	0.20	0.17	43	0.36	0.050
16GB0165	Sediment Pulp	2.67	35.33	40.09	239.7	279	18.1	31.3	9122	2.71	3.5	0.8	18.6	0.4	23.7	1.80	0.27	0.21	54	0.48	0.090
16GB0167	Sediment Pulp	2.20	23.22	40.71	224.2	153	20.8	13.7	680	2.25	3.4	1.5	<0.2	0.4	19.8	1.24	0.20	0.17	51	0.42	0.075
16GB0168	Sediment Pulp	1.29	30.98	42.34	160.2	89	19.5	24.2	3858	4.12	6.8	0.6	2.3	0.5	34.7	1.48	0.23	0.20	85	0.75	0.104
16GB0174	Sediment Pulp	0.46	33.24	22.99	92.8	37	24.1	17.3	833	3.76	2.9	0.6	<0.2	1.9	18.9	0.31	0.14	0.12	80	0.47	0.073
16GB0181	Sediment Pulp	0.25	15.15	18.22	66.1	14	15.1	10.1	628	2.27	2.2	0.5	1.3	2.4	10.9	0.20	0.15	0.10	43	0.34	0.043
16GB0189	Sediment Pulp	0.50	28.98	52.95	100.3	70	16.7	14.7	1338	3.20	5.5	1.1	5.3	0.7	34.8	5.72	0.18	0.12	75	0.75	0.078
16GB0196	Sediment Pulp	1.19	36.58	215.26	311.4	94	15.2	15.8	2356	3.01	9.0	1.3	<0.2	0.5	37.8	13.76	0.27	0.12	72	0.78	0.085
16GB0200	Sediment Pulp	0.37	19.72	18.73	93.5	37	16.8	11.8	779	2.62	2.2	0.6	<0.2	1.0	14.6	0.45	0.12	0.09	60	0.37	0.048
16GB0204	Sediment Pulp	0.52	68.48	23.32	92.6	125	10.4	9.4	2555	1.77	1.7	0.8	0.4	0.1	31.9	0.82	0.17	0.13	40	0.69	0.084
16GB0212	Sediment Pulp	0.65	36.88	36.97	195.6	80	24.4	18.5	1486	3.47	3.0	0.7	1.7	1.0	22.8	0.99	0.13	0.11	76	0.57	0.067
16GB0216	Sediment Pulp	1.33	47.34	53.20	222.3	288	18.3	19.0	2564	2.91	4.5	0.7	<0.2	0.4	30.5	1.76	0.25	0.20	71	0.57	0.082
16GB0216C	Sediment Pulp	0.56	19.88	17.11	37.1	1518	29.2	9.8	307	1.85	90.1	1.2	2.2	2.6	18.9	0.10	0.56	0.35	32	0.46	0.043
16GB0217	Sediment Pulp	3.56	51.30	44.44	241.3	325	16.5	14.9	7873	2.05	3.5	1.0	0.2	<0.1	59.8	4.84	0.42	0.22	44	1.03	0.157

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	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
	Unit	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
	MDL	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
16GB0111	Sediment Pulp	15.6	20.7	0.50	60.1	0.147	<20	1.08	0.012	0.05	<0.1	2.7	0.07	<0.02	102	0.3	<0.02	3.9
16GB0111C	Sediment Pulp	15.2	60.2	0.56	37.7	0.063	<20	1.05	0.022	0.08	0.1	3.6	0.07	<0.02	99	0.2	<0.02	3.6
16GB0120	Sediment Pulp	12.4	28.4	0.76	67.8	0.183	<20	2.21	0.012	0.06	<0.1	3.9	0.12	0.02	179	0.7	<0.02	6.8
[redacted]	Sediment Pulp	[redacted]																
[redacted]	Sediment Pulp	[redacted]																
[redacted]	Sediment Pulp	[redacted]																
16GB0140	Sediment Pulp	14.9	17.4	0.50	61.8	0.130	<20	1.25	0.015	0.06	<0.1	2.7	0.09	0.03	79	0.3	<0.02	4.3
16GB0144	Sediment Pulp	23.1	20.5	0.42	106.2	0.070	<20	1.71	0.014	0.06	<0.1	3.8	0.36	0.07	171	0.9	<0.02	4.6
16GB0145	Sediment Pulp	20.2	19.3	0.49	36.9	0.145	<20	1.44	0.041	0.05	0.2	3.4	0.09	0.10	138	0.6	<0.02	4.9
16GB0146	Sediment Pulp	15.0	19.6	0.49	62.5	0.135	<20	1.35	0.016	0.05	<0.1	3.3	0.09	0.07	98	0.6	<0.02	4.6
16GB0148	Sediment Pulp	22.5	17.5	0.29	57.3	0.053	<20	1.50	0.006	0.05	<0.1	2.2	0.12	0.05	88	0.6	<0.02	4.9
16GB0151	Sediment Pulp	37.4	19.6	0.81	103.0	0.145	<20	2.79	0.015	0.07	<0.1	5.1	0.43	0.08	188	2.0	<0.02	6.2
16GB0157	Sediment Pulp	14.0	17.6	0.47	34.9	0.081	<20	1.18	0.009	0.06	<0.1	2.4	0.16	0.03	76	0.4	<0.02	4.3
16GB0158	Sediment Pulp	15.6	16.1	0.43	62.3	0.074	<20	1.15	0.010	0.06	<0.1	2.3	0.20	0.05	99	0.6	<0.02	3.7
16GB0162	Sediment Pulp	16.8	15.1	0.38	40.3	0.075	<20	1.18	0.007	0.05	<0.1	2.3	0.25	0.05	105	0.8	<0.02	4.2
16GB0163	Sediment Pulp	15.4	16.0	0.57	26.7	0.118	<20	0.98	0.006	0.05	<0.1	3.1	0.08	<0.02	24	0.1	<0.02	3.8
16GB0164	Sediment Pulp	16.0	15.1	0.41	41.4	0.120	<20	1.15	0.008	0.04	0.1	2.4	0.19	0.05	84	0.6	<0.02	4.1
16GB0165	Sediment Pulp	13.9	16.5	0.58	160.2	0.132	<20	1.57	0.009	0.06	<0.1	2.5	0.40	0.10	219	0.9	<0.02	6.4
16GB0167	Sediment Pulp	18.7	22.5	0.66	72.6	0.144	<20	2.15	0.011	0.04	0.6	3.2	0.26	0.10	139	1.0	<0.02	7.4
16GB0168	Sediment Pulp	11.7	23.0	0.64	101.0	0.170	<20	1.83	0.012	0.06	<0.1	3.1	0.36	0.10	160	0.9	<0.02	7.5
16GB0174	Sediment Pulp	13.0	28.3	0.81	85.4	0.272	<20	2.24	0.014	0.06	<0.1	4.0	0.11	0.03	77	0.4	<0.02	7.2
16GB0181	Sediment Pulp	10.0	16.6	0.49	83.8	0.121	<20	0.95	0.012	0.06	<0.1	2.4	0.07	<0.02	17	<0.1	<0.02	3.4
16GB0189	Sediment Pulp	13.1	22.1	0.60	78.2	0.207	<20	1.73	0.016	0.05	<0.1	4.1	0.30	0.08	116	0.7	<0.02	6.7
16GB0196	Sediment Pulp	15.3	21.8	0.54	75.9	0.175	<20	1.64	0.016	0.04	<0.1	3.7	0.40	0.09	153	1.0	<0.02	6.0
16GB0200	Sediment Pulp	12.2	20.3	0.57	59.7	0.188	<20	1.38	0.016	0.04	<0.1	3.0	0.09	0.03	52	0.4	<0.02	5.1
16GB0204	Sediment Pulp	13.2	16.6	0.32	72.6	0.062	<20	1.26	0.009	0.04	<0.1	1.7	0.14	0.11	184	1.2	<0.02	4.3
16GB0212	Sediment Pulp	14.9	26.5	0.89	73.5	0.253	<20	1.89	0.017	0.04	<0.1	3.8	0.28	0.05	79	0.6	<0.02	6.8
16GB0216	Sediment Pulp	19.4	19.4	0.52	89.9	0.195	<20	1.74	0.014	0.06	<0.1	2.7	0.41	0.11	201	1.3	<0.02	7.7
16GB0216C	Sediment Pulp	14.9	59.0	0.55	39.1	0.061	<20	1.03	0.021	0.08	0.1	3.2	0.07	<0.02	119	0.1	<0.02	3.7
16GB0217	Sediment Pulp	47.7	12.7	0.39	205.4	0.063	<20	1.54	0.015	0.06	<0.1	1.7	0.69	0.20	306	2.4	<0.02	4.3

Redacted samples
B/Ryan Feb 22/18
outside study Area

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Project: None Given
Report Date: November 29, 2017

Page: 3 of 12 Part: 1 of 2

CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
	Unit	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
	MDL	0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
16GB0218	Sediment Pulp	1.61	40.86	46.34	291.9	254	24.5	19.5	4137	2.92	4.7	0.9	0.5	0.3	32.0	3.05	0.26	0.17	57	0.73	0.098
16GB0235	Sediment Pulp	0.37	10.25	20.14	103.9	17	13.8	8.0	455	2.28	21.4	0.9	45.1	2.6	27.9	0.73	0.93	0.10	46	0.25	0.044
16GB0236	Sediment Pulp	0.34	10.36	19.23	95.8	13	13.1	7.8	415	2.10	22.9	0.8	<0.2	2.4	28.3	0.71	0.86	0.09	45	0.23	0.039
16GB0237	Sediment Pulp	0.36	10.82	21.48	106.3	23	14.1	8.4	453	2.14	32.5	0.9	0.8	2.2	26.4	0.88	0.93	0.10	40	0.25	0.044
16GB0240	Sediment Pulp	0.51	11.44	24.76	89.6	16	12.7	7.7	616	1.96	7.4	1.1	0.3	2.2	9.6	0.60	0.31	0.12	36	0.15	0.033
16GB0243	Sediment Pulp	0.67	12.64	24.91	96.5	20	11.9	7.6	699	1.94	8.7	1.1	2.3	2.1	9.4	0.77	0.40	0.12	37	0.22	0.042
16GB0245	Sediment Pulp	0.67	11.61	76.46	89.7	27	11.9	6.9	249	1.65	7.8	0.9	2.3	1.7	7.1	0.48	0.42	0.14	35	0.17	0.043
16DB194	Sediment Pulp	0.33	19.73	19.56	129.7	22	15.2	9.5	568	2.52	2.5	0.5	2.6	2.3	14.9	0.47	0.19	0.12	50	0.36	0.047
16DB201	Sediment Pulp	0.34	15.49	14.67	69.4	9	14.0	8.9	408	2.64	1.8	0.6	1.2	4.1	12.8	0.24	0.16	0.12	60	0.33	0.041
16DB204	Sediment Pulp	0.43	18.31	41.34	193.5	49	21.5	10.9	779	2.59	19.7	2.1	1.7	1.4	65.1	1.65	0.37	0.16	47	0.38	0.066
16DB205	Sediment Pulp	2.28	36.40	66.04	422.2	166	17.7	17.6	4098	2.63	20.0	12.0	2.8	0.6	23.2	3.49	0.50	0.14	52	0.52	0.129
17KG0001	Sediment Pulp	1.04	15.25	42.63	171.4	50	18.5	11.7	944	2.68	8.4	0.8	0.6	2.0	11.5	0.61	0.35	0.15	52	0.34	0.053
17KG0002	Sediment Pulp	2.78	18.29	79.05	334.6	170	17.7	13.1	3613	2.51	9.4	1.2	0.8	0.3	21.6	2.86	0.33	0.18	47	0.55	0.084
17KG0003	Sediment Pulp	1.98	21.79	72.32	257.0	76	21.2	15.7	1387	2.93	10.2	1.0	0.3	1.5	16.2	0.98	0.42	0.13	61	0.54	0.057
17KG0004	Sediment Pulp	3.74	16.23	50.54	255.7	107	12.9	10.8	1810	2.37	7.0	2.8	0.6	1.2	12.1	1.80	0.37	0.18	49	0.33	0.058
17KG0004C	Sediment Pulp	0.56	18.82	17.26	37.4	1445	29.3	9.5	297	1.85	87.4	1.2	1.4	2.8	18.3	0.10	0.56	0.33	31	0.47	0.044
17KG0005	Sediment Pulp	6.45	14.21	66.76	153.4	209	10.6	15.4	5927	2.48	3.8	1.6	0.6	0.6	14.5	1.48	0.31	0.37	52	0.29	0.082
17KG0009	Sediment Pulp	12.72	13.79	99.04	325.9	233	10.2	31.7	>10000	3.09	9.6	1.1	0.6	0.3	24.2	6.37	0.51	0.25	57	0.46	0.111
17KG0010	Sediment Pulp	5.23	26.50	90.52	163.4	418	6.2	7.0	728	1.22	<0.1	3.2	0.6	<0.1	13.8	2.24	0.40	0.24	26	0.22	0.116
17KG0011	Sediment Pulp	7.26	10.60	50.72	200.0	70	10.2	13.3	2131	2.86	6.9	1.1	0.2	1.6	12.1	1.74	0.32	0.22	53	0.33	0.050
17KG0012	Sediment Pulp	2.27	18.23	61.00	143.8	323	9.0	11.0	1037	2.02	9.1	3.1	0.3	0.3	29.9	2.26	0.53	0.18	43	0.68	0.085
17CS0003	Sediment Pulp	0.59	8.92	21.71	91.9	54	12.4	8.6	652	1.85	35.0	2.2	0.4	0.8	12.6	0.45	0.56	0.10	41	0.27	0.050
17CS0004	Sediment Pulp	0.81	9.35	32.21	150.8	59	9.6	7.3	809	2.06	21.0	3.5	0.6	1.1	15.9	1.35	0.42	0.15	42	0.29	0.044
17CS0005	Sediment Pulp	1.07	10.97	36.88	150.4	107	9.6	5.7	920	1.56	26.9	5.4	0.4	0.4	11.8	1.16	0.73	0.17	31	0.26	0.066
17GB0007	Sediment Pulp	0.94	12.98	21.89	128.9	52	15.2	9.3	789	2.09	6.7	0.9	0.3	1.2	13.9	0.66	0.33	0.12	37	0.28	0.048
17GB0008	Sediment Pulp	1.74	20.07	35.29	208.0	116	17.5	13.0	2745	2.58	13.7	2.2	0.4	0.5	20.1	2.19	0.44	0.17	45	0.64	0.077
17GB0009	Sediment Pulp	2.55	31.99	49.90	206.7	171	14.7	12.0	3121	2.19	9.4	1.2	1.0	0.3	27.4	2.13	0.46	0.21	44	0.96	0.103
17GB0010	Sediment Pulp	8.02	18.07	60.50	403.3	233	18.7	31.0	>10000	3.64	15.9	1.8	0.4	0.3	29.1	4.23	0.35	0.24	58	0.76	0.137
17GB0011	Sediment Pulp	7.33	22.34	76.09	253.9	260	9.8	9.2	2898	1.44	9.7	2.4	1.2	0.1	29.4	3.69	0.53	0.21	22	0.81	0.107
17GB0012	Sediment Pulp	3.07	36.03	29.56	165.1	183	13.7	12.3	3776	1.77	8.2	1.5	0.7	<0.1	40.4	2.30	0.58	0.13	39	1.60	0.118

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Project: None Given
Report Date: November 29, 2017

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CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
	Unit	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
	MDL	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
16GB0218	Sediment Pulp	31.4	18.4	0.77	109.1	0.144	<20	2.14	0.014	0.05	<0.1	3.3	0.72	0.14	190	1.9	<0.02	6.3
16GB0235	Sediment Pulp	18.3	15.5	0.43	57.1	0.077	<20	0.82	0.008	0.06	0.2	2.5	0.15	0.02	35	0.2	<0.02	3.3
16GB0236	Sediment Pulp	15.6	14.4	0.42	46.8	0.072	<20	0.79	0.009	0.06	0.2	2.4	0.14	0.03	31	0.2	<0.02	3.3
16GB0237	Sediment Pulp	16.1	15.1	0.42	58.1	0.067	<20	0.85	0.009	0.06	0.2	2.8	0.17	0.05	29	0.1	<0.02	3.1
16GB0240	Sediment Pulp	20.4	15.4	0.33	41.0	0.054	<20	0.81	0.007	0.06	0.1	2.1	0.20	<0.02	34	0.3	<0.02	3.1
16GB0243	Sediment Pulp	19.3	14.7	0.36	41.3	0.060	<20	0.80	0.005	0.06	0.1	2.2	0.25	<0.02	30	0.2	<0.02	2.9
16GB0245	Sediment Pulp	19.7	14.8	0.35	27.5	0.060	<20	0.82	0.005	0.06	0.2	2.4	0.18	0.04	26	0.4	<0.02	3.2
16DB194	Sediment Pulp	11.8	18.2	0.51	51.1	0.155	<20	1.00	0.013	0.05	<0.1	2.5	0.07	<0.02	32	0.1	<0.02	3.6
16DB201	Sediment Pulp	17.7	20.6	0.48	45.8	0.178	<20	0.84	0.013	0.05	<0.1	2.5	0.05	<0.02	22	<0.1	<0.02	3.3
16DB204	Sediment Pulp	27.0	23.3	0.50	109.9	0.067	<20	1.53	0.011	0.12	0.2	3.9	0.34	0.03	94	0.6	<0.02	4.6
16DB205	Sediment Pulp	83.4	18.0	0.48	83.3	0.059	<20	3.47	0.016	0.08	0.1	2.8	3.93	0.11	165	2.0	<0.02	4.5
17KG0001	Sediment Pulp	19.3	21.3	0.56	52.5	0.110	<20	1.38	0.010	0.06	0.1	3.3	0.19	0.03	45	0.4	<0.02	4.6
17KG0002	Sediment Pulp	27.2	21.5	0.46	83.2	0.076	<20	1.86	0.008	0.05	<0.1	2.5	0.43	0.10	131	1.5	<0.02	5.1
17KG0003	Sediment Pulp	21.0	25.2	0.72	53.9	0.168	<20	1.87	0.009	0.05	0.1	4.1	0.30	0.04	52	0.5	<0.02	6.2
17KG0004	Sediment Pulp	38.1	19.2	0.46	45.2	0.123	<20	1.43	0.008	0.04	0.2	3.6	0.33	0.06	85	1.1	<0.02	5.7
17KG0004C	Sediment Pulp	15.1	61.3	0.55	38.2	0.061	<20	1.03	0.019	0.08	0.2	3.4	0.08	<0.02	104	0.1	<0.02	3.7
17KG0005	Sediment Pulp	22.2	18.5	0.33	47.0	0.108	<20	1.70	0.007	0.04	0.1	2.1	0.54	0.11	175	2.2	<0.02	6.9
17KG0009	Sediment Pulp	62.5	17.4	0.19	167.0	0.075	<20	1.27	0.010	0.04	<0.1	2.7	1.45	0.17	198	2.6	<0.02	6.7
17KG0010	Sediment Pulp	202.6	17.2	0.16	34.1	0.046	<20	2.84	0.005	0.03	0.2	2.4	0.37	0.20	255	7.7	<0.02	3.8
17KG0011	Sediment Pulp	37.2	19.1	0.37	43.9	0.165	<20	1.16	0.007	0.04	0.1	3.4	0.40	0.05	54	0.8	<0.02	7.6
17KG0012	Sediment Pulp	83.5	29.7	0.25	44.5	0.094	<20	2.25	0.008	0.04	0.2	4.5	0.80	0.12	167	4.2	<0.02	5.2
17CS0003	Sediment Pulp	25.0	16.6	0.37	43.1	0.091	<20	1.26	0.008	0.04	0.2	2.6	0.21	0.03	50	0.5	<0.02	4.0
17CS0004	Sediment Pulp	49.5	15.4	0.22	44.1	0.081	<20	1.84	0.007	0.04	0.1	2.0	0.46	0.05	71	1.4	<0.02	5.6
17CS0005	Sediment Pulp	68.8	15.5	0.20	41.3	0.053	<20	2.28	0.007	0.05	0.2	1.9	0.57	0.09	100	2.0	<0.02	5.3
17GB0007	Sediment Pulp	23.4	17.0	0.41	43.6	0.052	<20	1.09	0.005	0.06	0.1	2.5	0.26	0.03	44	0.4	<0.02	3.9
17GB0008	Sediment Pulp	64.3	19.9	0.40	54.4	0.046	<20	1.40	0.005	0.06	0.1	3.1	0.66	0.07	100	1.0	<0.02	4.9
17GB0009	Sediment Pulp	52.5	18.9	0.42	54.2	0.068	<20	1.44	0.007	0.04	0.1	2.5	0.53	0.14	199	1.9	<0.02	4.5
17GB0010	Sediment Pulp	72.4	25.7	0.52	155.0	0.075	<20	1.94	0.007	0.05	<0.1	2.8	1.51	0.16	226	1.9	<0.02	6.2
17GB0011	Sediment Pulp	117.7	12.7	0.22	73.0	0.022	<20	1.63	0.008	0.05	0.3	1.0	1.18	0.16	192	3.0	<0.02	3.7
17GB0012	Sediment Pulp	30.0	29.2	0.30	62.5	0.040	<20	1.34	0.009	0.04	0.2	2.3	0.72	0.16	174	3.2	<0.02	3.7

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Report Date: November 29, 2017

CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
	Unit	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
	MDL	0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
17GB0013	Sediment Pulp	2.21	17.08	47.87	213.4	80	19.1	13.4	1489	2.77	10.1	1.1	0.6	0.8	15.9	1.19	0.40	0.18	55	0.48	0.068
17GB0014	Sediment Pulp	1.56	12.58	29.86	165.4	50	15.4	10.6	1236	2.30	8.1	0.8	0.3	1.0	14.3	1.22	0.37	0.12	43	0.43	0.056
17GB0017	Sediment Pulp	1.67	13.52	113.53	217.5	175	12.2	7.3	270	1.65	13.8	2.4	0.4	0.6	12.3	1.97	1.26	0.23	33	0.27	0.062
17GB0018	Sediment Pulp	0.87	13.73	99.66	244.8	77	15.1	9.0	461	2.13	21.1	1.7	0.2	1.3	16.8	3.85	1.11	0.18	45	0.34	0.053
17GB0019	Sediment Pulp	1.22	22.27	140.94	412.7	154	20.4	11.8	997	2.57	45.9	2.2	0.5	1.1	27.5	6.46	1.57	0.19	55	0.55	0.069
17GB0020	Sediment Pulp	0.45	17.61	65.76	193.2	59	20.5	11.6	706	2.54	16.0	1.3	<0.2	1.5	42.8	2.74	0.50	0.14	48	0.44	0.048
17GB0021	Sediment Pulp	0.45	15.00	58.60	163.8	56	18.9	10.6	1161	2.48	14.6	1.3	0.5	1.7	37.4	2.13	0.43	0.12	48	0.38	0.045
17GB0022	Sediment Pulp	1.63	14.10	57.99	321.0	149	19.6	13.0	2090	2.90	27.4	3.3	0.5	0.7	27.2	1.87	0.42	0.22	59	0.44	0.081
17GB0024	Sediment Pulp	0.41	21.66	23.75	95.2	46	28.6	16.3	803	3.69	6.2	1.0	0.5	1.6	37.0	0.45	0.31	0.13	86	0.69	0.074
17GB0025	Sediment Pulp	0.56	18.75	30.39	158.6	52	23.3	13.8	832	2.98	13.9	1.3	0.5	1.5	31.8	1.49	0.46	0.10	65	0.61	0.058
17GB0027	Sediment Pulp	0.45	13.67	21.60	118.6	52	20.3	13.6	813	2.63	7.6	1.0	0.4	1.0	34.5	0.93	0.28	0.11	53	0.57	0.053
17GB0028	Sediment Pulp	0.49	17.81	23.17	131.8	53	23.8	15.2	999	2.87	8.3	1.1	0.5	1.2	37.1	1.15	0.33	0.12	57	0.65	0.065
17GB0029	Sediment Pulp	0.42	14.20	21.19	114.3	30	20.9	12.7	677	2.65	6.8	0.8	2.7	1.8	26.6	0.89	0.31	0.14	54	0.45	0.050
17GB0030	Sediment Pulp	0.43	28.69	105.02	188.8	91	24.7	14.0	1119	3.15	9.0	1.0	1.1	1.3	34.7	0.81	0.44	0.17	67	0.82	0.100
17GB0030C	Sediment Pulp	0.50	19.63	16.96	38.5	1504	28.6	9.7	287	1.83	87.0	1.2	9.2	2.6	18.1	0.08	0.55	0.34	30	0.45	0.045
17GB0031	Sediment Pulp	0.58	14.20	36.10	188.3	71	16.2	9.7	813	2.06	18.5	1.4	0.3	0.7	17.2	2.09	0.55	0.13	44	0.40	0.048
17GB0032	Sediment Pulp	0.69	12.25	49.59	220.1	86	14.9	9.9	1043	2.00	23.3	1.8	0.3	0.6	15.2	2.49	0.64	0.12	41	0.37	0.047
17GB0033	Sediment Pulp	2.36	14.88	35.33	311.6	149	19.6	14.8	2054	2.95	18.9	2.4	0.4	0.4	19.9	1.64	0.73	0.15	61	0.51	0.088
17GB0034	Sediment Pulp	0.52	16.92	30.99	100.9	22	18.5	12.2	711	3.24	11.1	0.9	0.4	2.8	15.0	0.38	1.02	0.11	77	0.38	0.056
17GB0035	Sediment Pulp	2.39	14.79	41.81	187.1	133	22.8	14.7	3583	2.73	26.1	1.8	<0.2	0.4	26.2	1.39	0.46	0.22	58	0.44	0.090
17GB0036	Sediment Pulp	1.45	19.84	32.13	155.6	72	18.3	12.9	896	2.84	16.6	0.9	0.4	1.9	15.8	1.43	0.56	0.14	56	0.50	0.056
17GB0037	Sediment Pulp	2.51	23.78	69.49	253.9	237	14.5	12.3	1887	2.64	25.4	1.9	1.0	0.5	24.9	2.89	0.80	0.24	52	0.86	0.091
17GB0038	Sediment Pulp	2.86	15.95	60.42	154.7	228	9.2	6.3	533	1.74	11.0	1.4	0.8	0.1	20.9	1.07	0.55	0.31	37	0.67	0.093
17GB0039	Sediment Pulp	2.15	27.89	43.41	224.1	141	17.9	15.5	1210	3.46	19.8	1.3	0.6	2.2	14.9	1.42	0.67	0.22	61	0.48	0.077
17GB0040	Sediment Pulp	5.05	30.20	138.87	707.9	343	11.2	13.8	5766	2.82	16.7	2.3	0.7	0.4	25.3	7.23	0.62	0.28	49	0.69	0.095
17GB0041	Sediment Pulp	5.16	21.07	63.62	249.6	192	10.6	10.4	839	1.71	2.3	13.3	0.3	0.7	15.6	1.62	0.28	0.22	36	0.33	0.068
17GB0042	Sediment Pulp	15.79	18.18	89.64	206.4	170	12.0	33.7	5592	3.20	5.7	15.4	0.4	1.9	14.0	1.63	0.29	0.44	61	0.28	0.084
17GB0049	Sediment Pulp	0.55	13.09	33.12	83.8	21	18.0	11.3	751	2.39	6.4	1.0	<0.2	2.8	8.6	0.32	0.44	0.14	37	0.17	0.034
17GB0050	Sediment Pulp	1.68	11.98	35.11	117.1	54	14.4	9.6	592	2.29	6.7	1.4	<0.2	1.7	7.4	0.28	0.41	0.16	42	0.17	0.035
17GB0053	Sediment Pulp	2.60	17.49	49.17	251.2	65	15.0	11.7	1476	2.69	9.7	1.8	<0.2	2.0	12.4	1.41	0.44	0.18	53	0.32	0.049

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Project: None Given
Report Date: November 29, 2017

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CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
	Unit	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
	MDL	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
17GB0013	Sediment Pulp	31.6	24.4	0.56	49.6	0.107	<20	1.64	0.008	0.04	0.2	3.4	0.60	0.06	80	1.0	<0.02	5.6
17GB0014	Sediment Pulp	26.0	18.8	0.47	39.4	0.085	<20	1.14	0.006	0.05	0.2	2.6	0.42	0.04	44	0.5	<0.02	4.1
17GB0017	Sediment Pulp	40.6	16.4	0.34	37.9	0.057	<20	1.67	0.009	0.07	0.2	1.7	0.64	0.09	130	1.4	<0.02	5.6
17GB0018	Sediment Pulp	27.9	18.7	0.43	51.3	0.083	<20	1.40	0.007	0.06	0.2	2.6	0.54	0.05	78	0.7	<0.02	5.0
17GB0019	Sediment Pulp	44.8	26.7	0.57	80.0	0.093	<20	1.95	0.011	0.09	0.3	3.8	0.85	0.07	99	1.1	<0.02	6.8
17GB0020	Sediment Pulp	25.2	22.7	0.50	106.7	0.090	<20	1.53	0.008	0.09	0.1	3.8	0.35	0.03	55	0.3	<0.02	5.2
17GB0021	Sediment Pulp	22.1	22.7	0.46	109.7	0.081	<20	1.41	0.008	0.08	0.2	3.5	0.32	0.03	40	0.3	<0.02	5.0
17GB0022	Sediment Pulp	34.3	22.4	0.49	96.2	0.059	<20	2.14	0.007	0.10	0.1	3.0	1.28	0.09	139	1.0	<0.02	6.7
17GB0024	Sediment Pulp	15.9	33.7	0.84	66.1	0.254	<20	2.28	0.014	0.06	<0.1	5.4	0.09	0.03	45	0.4	<0.02	7.3
17GB0025	Sediment Pulp	19.8	27.0	0.73	64.4	0.171	<20	1.78	0.016	0.06	0.3	4.2	0.22	0.03	43	0.4	<0.02	5.6
17GB0027	Sediment Pulp	14.8	20.9	0.62	84.0	0.150	<20	1.59	0.013	0.05	0.1	3.5	0.15	0.04	64	0.4	<0.02	5.0
17GB0028	Sediment Pulp	17.4	24.4	0.69	84.6	0.167	<20	1.64	0.017	0.06	0.1	3.8	0.17	0.05	69	0.4	<0.02	5.5
17GB0029	Sediment Pulp	15.3	20.4	0.63	66.6	0.149	<20	1.41	0.014	0.05	0.1	3.4	0.13	0.03	37	0.2	<0.02	4.6
17GB0030	Sediment Pulp	15.9	29.2	0.69	88.2	0.187	<20	2.13	0.012	0.06	0.1	4.3	0.13	0.05	91	0.5	<0.02	6.7
17GB0030C	Sediment Pulp	14.6	57.7	0.55	37.8	0.059	<20	0.98	0.018	0.08	<0.1	3.2	0.06	<0.02	90	0.1	<0.02	3.4
17GB0031	Sediment Pulp	19.5	20.3	0.43	55.4	0.073	<20	1.19	0.008	0.05	0.2	2.7	0.27	0.04	51	0.5	<0.02	4.1
17GB0032	Sediment Pulp	23.9	19.0	0.41	59.7	0.061	<20	1.27	0.008	0.05	0.1	2.4	0.38	0.04	67	0.5	<0.02	4.2
17GB0033	Sediment Pulp	47.5	19.2	0.56	76.8	0.066	<20	2.15	0.009	0.07	<0.1	3.5	1.12	0.08	100	1.0	<0.02	5.2
17GB0034	Sediment Pulp	15.0	22.6	0.65	56.8	0.194	<20	1.33	0.013	0.05	0.2	4.1	0.14	<0.02	31	<0.1	<0.02	5.0
17GB0035	Sediment Pulp	25.0	21.6	0.50	188.2	0.037	<20	2.48	0.008	0.08	0.1	3.4	0.56	0.10	142	0.9	<0.02	6.2
17GB0036	Sediment Pulp	44.0	19.3	0.63	40.6	0.127	<20	1.39	0.011	0.05	0.2	3.4	0.31	0.03	47	0.6	<0.02	5.2
17GB0037	Sediment Pulp	121.8	18.6	0.43	45.1	0.055	<20	1.84	0.006	0.04	0.1	2.8	0.64	0.10	142	2.2	0.02	5.8
17GB0038	Sediment Pulp	45.3	13.6	0.27	54.7	0.026	<20	1.23	0.007	0.04	0.1	1.0	0.38	0.15	241	1.6	<0.02	5.6
17GB0039	Sediment Pulp	48.1	20.5	0.84	54.5	0.098	<20	1.83	0.007	0.06	0.1	4.3	0.32	0.04	50	0.8	<0.02	7.1
17GB0040	Sediment Pulp	86.1	16.1	0.24	76.9	0.085	<20	2.12	0.008	0.05	0.2	2.4	1.13	0.12	164	2.5	<0.02	7.9
17GB0041	Sediment Pulp	53.2	18.8	0.33	41.5	0.102	<20	1.72	0.009	0.04	0.9	2.7	0.15	0.18	123	2.5	<0.02	6.0
17GB0042	Sediment Pulp	52.6	20.0	0.30	64.5	0.088	<20	2.55	0.006	0.05	0.2	2.6	0.44	0.09	124	2.3	<0.02	8.2
17GB0049	Sediment Pulp	16.4	18.3	0.42	72.5	0.076	<20	1.13	0.004	0.07	<0.1	3.1	0.13	0.04	65	0.2	<0.02	4.2
17GB0050	Sediment Pulp	27.2	19.1	0.39	45.3	0.075	<20	1.06	0.006	0.05	0.2	2.7	0.19	<0.02	50	0.5	<0.02	4.3
17GB0053	Sediment Pulp	28.9	19.7	0.48	52.8	0.125	<20	1.21	0.006	0.05	0.2	3.3	0.26	0.03	49	0.7	<0.02	5.2

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Project: None Given
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CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
	Unit	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
	MDL	0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
17GB0054	Sediment Pulp	2.31	22.92	73.82	386.1	165	24.7	17.2	2009	3.64	20.0	1.7	0.3	1.2	19.2	3.01	0.51	0.18	75	0.56	0.082
17GB0055	Sediment Pulp	2.27	24.38	73.23	352.3	181	16.0	12.4	2471	2.20	9.3	1.6	<0.2	0.5	19.3	3.64	0.44	0.20	36	0.54	0.090
17GB0056	Sediment Pulp	4.02	29.57	57.47	441.0	290	16.8	12.9	1641	2.31	15.9	2.7	0.3	0.6	34.3	3.87	0.44	0.22	44	1.04	0.076
17GB0056C	Sediment Pulp	0.55	20.11	17.46	39.3	1554	30.4	10.5	293	1.88	88.8	1.2	1.4	2.8	19.0	0.10	0.55	0.56	32	0.48	0.047
17GB0057	Sediment Pulp	2.97	14.85	46.42	258.2	87	13.4	11.5	1542	2.39	6.8	1.9	0.2	1.5	11.8	1.55	0.35	0.15	47	0.32	0.049
17GB0058	Sediment Pulp	4.90	18.71	68.03	387.8	180	15.0	13.0	1643	2.54	9.6	3.9	0.5	1.1	14.3	1.58	0.40	0.21	52	0.40	0.063
17GB0059	Sediment Pulp	5.15	17.73	74.10	216.4	105	12.4	13.6	2068	2.12	5.6	1.2	<0.2	0.9	14.2	2.26	0.31	0.18	38	0.29	0.052
17GB0060	Sediment Pulp	5.37	23.50	141.94	365.3	186	12.6	13.4	3574	2.24	8.8	1.5	<0.2	0.3	21.4	4.48	0.43	0.21	42	0.46	0.089
17GB0061	Sediment Pulp	8.92	19.83	97.14	274.3	160	14.1	21.5	3546	2.34	4.3	1.7	<0.2	0.7	15.9	2.61	0.26	0.20	40	0.32	0.070
17GB0062	Sediment Pulp	14.12	21.48	142.71	223.7	274	11.2	27.2	4739	2.40	3.7	2.1	0.5	0.5	16.9	2.22	0.28	0.24	46	0.32	0.081
17GB0063	Sediment Pulp	41.79	19.28	128.54	203.8	304	9.6	38.2	>10000	2.88	6.9	2.2	0.3	0.3	20.5	2.70	0.43	0.33	50	0.34	0.122
17GB0064	Sediment Pulp	0.44	12.81	24.29	99.7	25	14.9	10.1	564	2.34	4.7	0.6	685.8	2.4	19.0	0.47	0.40	0.11	48	0.35	0.044
17GB0065	Sediment Pulp	15.77	26.66	216.78	203.5	507	8.9	15.9	3281	1.59	1.5	3.4	0.8	0.2	15.0	1.74	0.27	0.25	31	0.26	0.091
17GB0072	Sediment Pulp	1.04	19.53	35.98	171.7	66	14.6	10.7	1054	2.09	5.9	0.9	0.3	1.0	22.0	1.43	0.57	0.11	40	0.48	0.055
17GB0074	Sediment Pulp	0.44	19.63	43.51	112.1	90	18.6	15.4	1007	3.47	13.9	0.7	<0.2	1.1	35.1	0.67	1.80	0.10	82	0.92	0.081
17GB0075	Sediment Pulp	0.57	11.58	33.34	114.7	70	14.1	9.8	939	1.95	12.2	0.7	0.3	0.8	18.7	0.60	0.36	0.09	41	0.35	0.044
17GB0076	Sediment Pulp	0.72	17.68	62.32	117.4	145	15.3	12.6	1564	2.81	14.0	0.8	<0.2	0.5	32.3	0.71	0.62	0.13	65	0.77	0.085
17GB0078	Sediment Pulp	0.61	26.15	44.66	94.4	172	10.7	8.9	1218	1.69	10.8	1.0	4.2	0.2	54.9	1.24	0.66	0.16	42	1.35	0.101
17GB0080	Sediment Pulp	0.78	28.12	45.11	110.5	186	11.4	9.7	1987	1.76	17.1	1.5	3.1	0.2	45.5	1.58	0.45	0.18	42	1.12	0.113
17GB0082	Sediment Pulp	0.57	18.19	62.84	146.1	52	18.7	13.9	838	2.91	10.3	0.6	1.1	2.0	16.0	0.54	0.32	0.11	63	0.46	0.059
17GB0089	Sediment Pulp	0.21	18.04	19.50	73.0	10	29.9	15.0	658	3.24	3.6	1.0	0.6	7.4	20.4	0.09	0.17	0.25	41	0.96	0.053
17GB0090	Sediment Pulp	8.50	17.92	132.62	285.8	309	14.2	22.5	5803	2.57	5.8	1.0	11.5	0.4	18.1	3.09	0.45	0.21	50	0.42	0.097
17GB0091	Sediment Pulp	6.41	15.14	128.52	298.4	529	14.5	19.9	6671	2.68	7.9	1.1	2.0	0.3	15.2	2.72	0.55	0.23	51	0.30	0.122
17GB0092	Sediment Pulp	10.51	16.53	157.29	215.9	434	11.5	15.4	2030	2.03	3.4	1.3	3.1	0.3	12.2	2.48	0.39	0.25	39	0.25	0.108
17GB0097	Sediment Pulp	3.74	19.03	82.72	226.8	137	14.4	21.9	4572	2.37	7.6	0.9	10.0	0.9	15.6	2.15	0.35	0.18	39	0.31	0.069
17GB0098	Sediment Pulp	2.32	17.92	71.55	304.3	138	19.2	15.9	1907	2.48	11.7	0.9	1.2	0.9	14.0	1.23	0.42	0.16	44	0.35	0.072
17GB0099	Sediment Pulp	5.36	13.43	108.16	139.1	201	9.9	10.7	816	2.01	4.5	1.1	1.3	0.5	6.6	0.39	0.31	0.22	37	0.13	0.062
17GB0100	Sediment Pulp	18.41	20.43	268.70	290.1	453	12.9	63.9	>10000	3.53	10.1	1.2	14.0	0.3	17.5	4.09	0.55	0.29	61	0.31	0.126
17GB0100C	Sediment Pulp	0.55	20.45	18.60	41.7	1597	31.7	10.8	331	1.98	92.8	1.2	2.1	3.1	20.1	0.11	0.54	0.35	34	0.50	0.047
17GB0101	Sediment Pulp	17.86	23.74	192.72	107.7	339	6.8	51.4	9677	5.97	8.9	1.2	14.7	0.4	12.2	0.90	0.32	0.45	46	0.21	0.094

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Project: None Given
Report Date: November 29, 2017

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CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
	Unit	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
	MDL	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
17GB0054	Sediment Pulp	67.3	26.6	0.87	76.8	0.163	<20	2.28	0.008	0.06	0.1	5.4	0.47	0.06	83	1.1	<0.02	7.0
17GB0055	Sediment Pulp	56.0	18.6	0.39	70.5	0.053	<20	1.54	0.008	0.07	0.2	2.5	0.44	0.12	112	2.0	<0.02	4.6
17GB0056	Sediment Pulp	80.8	31.9	0.40	84.2	0.064	<20	1.55	0.010	0.06	0.2	4.0	0.38	0.13	146	2.3	<0.02	5.7
17GB0056C	Sediment Pulp	15.4	58.3	0.57	39.7	0.061	<20	1.05	0.019	0.08	0.1	3.4	0.07	<0.02	103	0.2	<0.02	3.8
17GB0057	Sediment Pulp	27.0	18.5	0.44	44.9	0.122	<20	1.24	0.007	0.04	0.2	3.2	0.24	0.04	45	0.7	<0.02	5.4
17GB0058	Sediment Pulp	50.1	22.5	0.46	47.0	0.126	<20	1.72	0.007	0.05	0.2	4.0	0.34	0.06	87	1.5	<0.02	7.2
17GB0059	Sediment Pulp	31.7	17.6	0.34	61.5	0.066	<20	1.19	0.004	0.05	0.2	2.3	0.32	0.05	89	1.3	<0.02	4.4
17GB0060	Sediment Pulp	57.6	20.1	0.36	77.9	0.064	<20	1.74	0.006	0.05	0.1	2.5	0.61	0.10	144	2.1	<0.02	6.1
17GB0061	Sediment Pulp	35.4	21.4	0.36	76.4	0.063	<20	1.59	0.006	0.06	0.2	2.7	0.46	0.07	98	1.8	<0.02	4.7
17GB0062	Sediment Pulp	41.2	21.0	0.32	71.8	0.082	<20	1.86	0.005	0.04	0.1	2.8	0.61	0.10	132	2.5	0.02	5.6
17GB0063	Sediment Pulp	27.9	21.6	0.20	86.9	0.047	<20	1.62	0.008	0.05	0.1	2.1	0.96	0.17	319	3.8	0.03	6.0
17GB0064	Sediment Pulp	15.4	18.3	0.47	40.8	0.134	<20	0.97	0.010	0.05	0.1	2.8	0.09	<0.02	23	0.2	<0.02	3.8
17GB0065	Sediment Pulp	52.5	17.1	0.20	59.1	0.050	<20	2.34	0.007	0.04	0.2	1.7	0.42	0.13	227	3.1	<0.02	4.7
17GB0072	Sediment Pulp	20.2	16.9	0.42	63.6	0.094	<20	1.17	0.009	0.06	0.1	3.0	0.17	0.05	71	1.0	<0.02	4.1
17GB0074	Sediment Pulp	14.9	23.5	0.65	56.4	0.233	<20	1.82	0.009	0.06	0.2	5.5	0.21	0.06	69	0.8	<0.02	6.4
17GB0075	Sediment Pulp	12.5	18.8	0.38	54.6	0.089	<20	1.16	0.006	0.04	0.2	3.4	0.35	0.04	43	0.5	<0.02	4.1
17GB0076	Sediment Pulp	19.6	21.2	0.48	61.9	0.132	<20	1.91	0.008	0.05	0.1	4.2	0.29	0.09	119	0.9	<0.02	5.9
17GB0078	Sediment Pulp	17.0	22.8	0.31	55.2	0.087	<20	1.36	0.010	0.05	0.2	3.0	0.25	0.15	136	2.3	<0.02	4.5
17GB0080	Sediment Pulp	23.3	29.7	0.34	77.3	0.058	<20	1.51	0.008	0.06	0.1	4.9	0.36	0.15	136	2.2	<0.02	4.7
17GB0082	Sediment Pulp	15.9	20.5	0.68	52.3	0.174	<20	1.40	0.009	0.05	0.1	4.2	0.16	<0.02	27	0.4	<0.02	5.2
17GB0089	Sediment Pulp	16.5	27.6	0.78	140.6	0.020	<20	1.42	0.010	0.23	<0.1	4.3	0.12	<0.02	7	<0.1	<0.02	5.0
17GB0090	Sediment Pulp	33.2	17.4	0.38	69.5	0.092	<20	1.90	0.006	0.05	<0.1	2.8	0.55	0.11	156	1.7	<0.02	5.9
17GB0091	Sediment Pulp	30.7	18.7	0.37	58.0	0.091	<20	2.18	0.006	0.05	<0.1	2.2	0.65	0.13	244	2.2	<0.02	7.1
17GB0092	Sediment Pulp	19.6	18.5	0.28	56.9	0.061	<20	1.67	0.006	0.05	0.1	1.7	0.40	0.18	238	2.2	<0.02	6.4
17GB0097	Sediment Pulp	21.6	16.3	0.37	76.4	0.068	<20	1.35	0.006	0.06	0.1	2.5	0.39	0.07	107	1.1	<0.02	4.9
17GB0098	Sediment Pulp	27.3	20.1	0.47	56.3	0.102	<20	1.79	0.006	0.06	0.1	3.3	0.31	0.06	97	1.1	<0.02	5.8
17GB0099	Sediment Pulp	25.8	15.9	0.30	26.4	0.060	<20	1.42	0.005	0.05	0.1	2.2	0.28	0.07	135	1.6	<0.02	4.8
17GB0100	Sediment Pulp	24.5	19.8	0.23	115.5	0.064	<20	2.00	0.008	0.06	0.1	1.9	1.02	0.16	283	2.5	0.04	7.8
17GB0100C	Sediment Pulp	16.9	62.1	0.60	40.6	0.065	<20	1.11	0.022	0.09	0.1	3.6	0.07	<0.02	115	0.2	<0.02	4.0
17GB0101	Sediment Pulp	23.4	14.0	0.14	69.3	0.031	<20	1.50	0.009	0.04	<0.1	1.7	0.44	0.20	249	2.5	0.02	4.5

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Project: None Given
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CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
	Unit	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
	MDL	0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
17GB0102	Sediment Pulp	18.42	17.58	169.41	172.7	226	10.5	68.7	>10000	3.80	7.0	1.0	39.7	0.4	14.7	2.19	0.48	0.45	59	0.23	0.103
17GB0103	Sediment Pulp	0.62	12.08	29.93	151.8	36	17.0	11.1	675	2.70	8.3	0.7	0.9	2.0	11.9	0.44	0.36	0.10	59	0.32	0.048
17GB0104	Sediment Pulp	1.27	17.97	67.87	205.2	100	19.6	14.7	909	3.15	12.0	0.8	1.5	1.3	13.6	0.72	0.43	0.14	69	0.39	0.050
17GB0105	Sediment Pulp	4.03	11.70	44.79	266.2	129	12.4	11.1	1140	1.95	3.4	4.3	3.3	1.0	13.3	1.27	0.22	0.16	42	0.34	0.048
17GB0106	Sediment Pulp	8.83	55.45	120.33	368.5	328	9.0	12.0	3462	1.43	2.6	3.3	15.5	<0.1	35.8	6.04	0.72	0.24	34	0.74	0.123
17GB0107	Sediment Pulp	3.01	42.52	76.19	316.7	299	12.6	11.8	4496	1.85	2.5	2.7	1.5	0.1	36.1	5.26	0.40	0.41	40	0.75	0.121
17GB0108	Sediment Pulp	3.32	33.23	61.16	307.6	501	9.5	10.3	2603	1.46	2.4	3.7	0.8	0.1	28.9	3.80	0.32	0.27	32	0.61	0.130
17GB0109	Sediment Pulp	6.11	28.48	64.98	227.7	305	9.6	10.6	1517	1.64	3.3	12.8	1.8	0.3	20.8	2.71	0.38	0.27	32	0.50	0.074
17GB0110	Sediment Pulp	7.47	20.53	86.93	465.2	159	11.9	17.3	4458	3.86	14.6	1.5	1.3	0.6	13.4	3.51	0.48	0.33	75	0.35	0.091
17GB0111	Sediment Pulp	12.85	20.07	110.09	820.0	233	12.4	67.0	>10000	6.06	29.8	1.0	0.6	0.3	35.6	12.74	0.49	0.41	78	0.84	0.150
17GB0111C	Sediment Pulp	0.58	20.40	18.72	41.0	1628	32.2	10.8	321	1.95	92.8	1.3	2.0	2.8	19.8	0.11	0.57	0.35	33	0.48	0.043
17GB0112	Sediment Pulp	0.31	201.51	706.26	456.0	298	24.6	16.6	3073	3.26	4.8	3.2	0.6	0.6	54.5	1.44	0.13	0.16	76	0.62	0.128
17GB0113	Sediment Pulp	0.68	18.02	69.56	153.5	64	15.4	9.4	926	2.38	23.6	1.9	0.9	1.1	18.0	1.41	0.40	0.18	45	0.24	0.047
17GB0114	Sediment Pulp	0.56	18.82	65.94	171.7	42	18.8	10.9	861	2.78	24.2	2.1	3.0	2.4	14.6	1.45	0.66	0.16	50	0.28	0.042
17GB0115	Sediment Pulp	0.49	17.76	61.82	156.9	31	17.3	10.6	806	2.73	22.8	1.9	0.7	2.5	13.5	1.42	0.64	0.16	49	0.27	0.040
17GB0116	Sediment Pulp	0.77	17.31	129.63	153.3	114	16.6	10.1	1386	2.33	12.5	2.3	<0.2	0.8	20.2	2.71	0.26	0.21	49	0.33	0.061
17GB0117	Sediment Pulp	0.79	14.80	37.74	195.5	68	14.7	9.9	1284	2.39	44.9	4.1	0.3	0.7	19.5	1.30	0.58	0.27	48	0.40	0.061
17GB0118	Sediment Pulp	0.74	20.41	84.93	181.3	58	15.0	10.2	1172	2.35	34.5	3.9	0.5	1.2	20.3	2.55	0.62	0.15	43	0.41	0.051
17GB0119	Sediment Pulp	1.01	21.11	38.88	271.7	104	17.4	12.8	2247	2.38	55.9	5.7	0.3	0.7	27.4	3.08	0.66	0.17	48	0.57	0.082
17GB0120	Sediment Pulp	1.39	17.58	40.62	203.8	110	13.7	10.2	2150	1.90	57.5	5.3	<0.2	0.4	20.0	2.31	0.44	0.16	40	0.41	0.075
17GB0121	Sediment Pulp	1.11	15.64	35.28	196.6	112	10.8	8.0	1902	1.65	32.4	7.1	<0.2	0.4	24.8	3.11	0.59	0.16	36	0.50	0.081
17GB0122	Sediment Pulp	1.40	15.23	55.81	252.4	59	19.1	13.4	1614	2.74	9.4	1.1	0.6	1.2	11.8	2.05	0.28	0.16	52	0.44	0.050
17GB0123	Sediment Pulp	0.91	19.07	45.47	207.5	85	19.0	12.8	1160	2.58	4.5	0.8	0.3	0.9	15.3	1.52	0.27	0.17	51	0.47	0.055
17GB0124	Sediment Pulp	1.84	15.46	41.58	177.9	129	16.0	11.7	1621	2.34	6.8	1.0	0.4	0.6	14.7	1.41	0.29	0.16	42	0.51	0.064
17GB0125	Sediment Pulp	1.03	21.16	42.06	220.6	109	25.9	17.6	1633	3.50	10.2	1.2	2.4	1.3	15.0	1.14	0.34	0.20	65	0.59	0.071
17GB0126	Sediment Pulp	2.10	18.01	57.29	208.7	135	13.8	10.7	2184	2.25	9.1	1.1	0.9	0.7	12.3	1.61	0.36	0.22	33	0.42	0.077
17GB0127A	Sediment Pulp	15.52	14.69	182.08	239.0	239	9.5	74.3	9833	3.47	8.8	1.0	0.8	1.3	10.0	2.03	0.41	0.23	62	0.20	0.053
17GB0128A	Sediment Pulp	0.43	15.80	31.10	163.0	45	15.3	10.3	891	2.25	3.1	0.6	0.4	1.5	14.7	0.81	0.18	0.13	42	0.33	0.049
17GB0129	Sediment Pulp	0.79	19.15	145.74	285.1	52	18.3	15.9	1422	3.54	6.3	0.9	<0.2	1.1	25.0	6.33	0.19	0.10	85	0.63	0.067
17GB0131	Sediment Pulp	0.90	29.65	82.31	180.8	172	15.7	12.3	2045	2.38	6.7	1.3	<0.2	0.3	31.2	3.31	0.27	0.15	48	0.63	0.089

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	Analyte	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
	Unit	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
	MDL	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
17GB0102	Sediment Pulp	39.1	15.7	0.14	102.9	0.037	<20	1.97	0.009	0.06	0.1	2.7	1.08	0.19	245	3.7	0.04	4.7
17GB0103	Sediment Pulp	14.0	20.5	0.58	42.1	0.125	<20	1.15	0.008	0.05	0.1	3.5	0.13	<0.02	46	0.2	<0.02	4.5
17GB0104	Sediment Pulp	17.1	25.9	0.64	41.6	0.186	<20	1.60	0.010	0.05	0.2	3.6	0.26	0.04	67	0.5	<0.02	6.3
17GB0105	Sediment Pulp	34.0	17.5	0.45	42.9	0.132	<20	1.41	0.008	0.03	0.3	3.3	0.22	0.06	65	1.1	<0.02	6.5
17GB0106	Sediment Pulp	144.8	17.5	0.23	89.8	0.046	<20	2.21	0.009	0.05	0.2	2.2	0.88	0.18	166	6.2	<0.02	5.1
17GB0107	Sediment Pulp	65.5	15.7	0.28	124.2	0.052	<20	2.19	0.008	0.05	0.1	1.3	0.71	0.17	207	3.5	0.03	5.3
17GB0108	Sediment Pulp	73.0	17.9	0.19	86.2	0.044	<20	3.15	0.007	0.04	0.1	1.5	0.55	0.17	205	4.8	0.02	4.7
17GB0109	Sediment Pulp	82.3	19.4	0.26	56.8	0.068	<20	1.62	0.008	0.03	0.7	2.7	0.25	0.22	159	3.4	<0.02	4.9
17GB0110	Sediment Pulp	45.7	19.0	0.38	53.9	0.109	<20	1.73	0.005	0.05	0.1	2.6	0.74	0.11	173	1.9	0.03	9.5
17GB0111	Sediment Pulp	66.8	14.9	0.21	289.0	0.047	<20	1.67	0.008	0.05	0.1	2.1	2.24	0.19	242	3.1	0.06	6.8
17GB0111C	Sediment Pulp	16.1	60.3	0.59	40.3	0.065	<20	1.09	0.021	0.09	0.1	3.6	0.08	<0.02	126	0.1	<0.02	4.2
17GB0112	Sediment Pulp	44.6	29.3	0.73	214.4	0.047	<20	2.50	0.007	0.11	<0.1	5.8	0.40	0.08	145	0.9	<0.02	7.7
17GB0113	Sediment Pulp	42.7	19.0	0.40	78.1	0.057	<20	1.45	0.009	0.08	0.2	2.5	0.54	0.04	58	0.6	<0.02	5.7
17GB0114	Sediment Pulp	30.6	20.8	0.51	72.3	0.086	<20	1.40	0.009	0.11	0.3	3.2	0.46	<0.02	45	0.3	<0.02	5.2
17GB0115	Sediment Pulp	27.3	18.8	0.51	65.6	0.081	<20	1.33	0.007	0.11	0.3	3.0	0.41	<0.02	25	0.4	<0.02	4.8
17GB0116	Sediment Pulp	37.5	22.3	0.39	130.4	0.049	<20	1.86	0.009	0.11	0.1	3.4	0.38	0.04	93	0.5	<0.02	6.5
17GB0117	Sediment Pulp	46.0	18.8	0.46	62.7	0.069	<20	1.71	0.007	0.13	0.2	2.7	0.47	0.05	80	0.8	<0.02	5.7
17GB0118	Sediment Pulp	53.7	18.4	0.41	73.1	0.074	<20	1.75	0.009	0.08	0.4	3.0	0.66	0.05	75	1.2	<0.02	5.1
17GB0119	Sediment Pulp	62.7	20.2	0.45	91.1	0.085	<20	2.65	0.014	0.10	0.2	3.4	1.05	0.08	97	1.8	<0.02	6.2
17GB0120	Sediment Pulp	50.2	16.8	0.32	69.7	0.066	<20	2.23	0.009	0.07	0.2	2.3	1.03	0.09	106	1.5	<0.02	5.2
17GB0121	Sediment Pulp	89.8	16.0	0.26	65.2	0.057	<20	2.45	0.010	0.06	0.2	2.3	0.81	0.10	122	2.7	<0.02	4.8
17GB0122	Sediment Pulp	27.7	19.4	0.63	60.8	0.169	<20	1.66	0.008	0.06	0.2	3.2	0.31	0.04	50	0.7	<0.02	6.2
17GB0123	Sediment Pulp	19.1	20.5	0.62	55.9	0.153	<20	1.59	0.009	0.05	0.1	3.3	0.22	0.06	79	1.0	<0.02	5.9
17GB0124	Sediment Pulp	27.6	17.2	0.50	52.3	0.119	<20	1.71	0.010	0.05	0.1	2.6	0.31	0.07	85	1.1	<0.02	5.1
17GB0125	Sediment Pulp	23.9	25.3	0.81	80.6	0.225	<20	2.49	0.012	0.06	0.2	5.3	0.26	0.06	73	1.1	<0.02	8.1
17GB0126	Sediment Pulp	35.8	16.1	0.34	76.2	0.070	<20	1.70	0.009	0.10	0.1	2.6	0.40	0.07	89	1.1	<0.02	4.8
17GB0127A	Sediment Pulp	23.5	17.9	0.25	60.3	0.099	<20	1.89	0.005	0.03	<0.1	2.6	0.62	0.08	148	1.6	0.02	6.4
17GB0128A	Sediment Pulp	13.8	17.0	0.47	45.1	0.093	<20	1.10	0.008	0.07	<0.1	2.4	0.13	0.04	50	0.4	<0.02	4.0
17GB0129	Sediment Pulp	12.3	23.5	0.70	54.2	0.252	<20	1.56	0.013	0.04	<0.1	3.6	0.24	0.05	73	0.6	<0.02	6.5
17GB0131	Sediment Pulp	19.9	19.0	0.42	76.7	0.087	<20	1.83	0.010	0.04	<0.1	3.3	0.42	0.09	125	1.3	<0.02	5.2

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Project: None Given
Report Date: November 29, 2017

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CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
	Unit	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
	MDL	0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
17GB0134	Sediment Pulp	1.74	17.73	46.48	228.0	90	15.1	11.7	1302	2.35	5.9	1.1	<0.2	1.0	21.2	1.84	0.34	0.14	47	0.44	0.058
17GB0135	Sediment Pulp	1.65	16.88	45.70	225.5	85	14.7	11.0	1336	2.30	6.0	1.1	<0.2	1.0	21.4	1.85	0.34	0.15	46	0.44	0.059
17GB0136	Sediment Pulp	1.77	15.07	43.36	200.4	71	13.0	10.5	1043	2.15	4.9	1.0	<0.2	0.9	18.0	1.48	0.35	0.11	43	0.37	0.048
17GB0137	Sediment Pulp	1.78	19.39	76.65	317.9	70	21.5	19.0	2513	3.28	14.2	0.8	<0.2	1.2	20.7	2.16	0.30	0.14	69	0.53	0.063
17GB0138	Sediment Pulp	2.19	16.97	48.60	209.2	76	14.6	11.1	1126	2.37	5.4	1.1	<0.2	1.1	20.2	1.83	0.31	0.13	49	0.42	0.048
17GB0139	Sediment Pulp	2.48	15.54	52.09	264.3	63	18.3	11.2	1116	2.39	8.3	1.4	0.3	1.4	13.5	1.53	0.34	0.12	48	0.30	0.048
17GB0140	Sediment Pulp	2.40	18.75	121.31	315.8	76	15.9	13.4	2172	2.89	15.8	0.6	0.7	2.1	13.9	2.71	0.41	0.16	54	0.36	0.062
17GB0141	Sediment Pulp	2.29	13.28	46.80	194.8	79	12.3	10.0	1282	1.90	3.5	1.4	<0.2	0.7	22.4	2.37	0.28	0.13	40	0.47	0.059
17GB0142	Sediment Pulp	5.32	14.07	100.92	434.6	154	16.1	14.4	2653	2.89	7.7	0.8	<0.2	0.7	19.1	4.53	0.37	0.18	56	0.43	0.070
17GB0144	Sediment Pulp	2.01	14.75	41.56	217.5	99	11.4	11.7	2011	1.63	3.2	1.4	<0.2	0.3	30.6	2.90	0.35	0.14	35	0.65	0.074
17GB0147	Sediment Pulp	3.70	14.79	50.35	257.0	180	10.5	11.0	2636	1.40	1.8	1.1	<0.2	<0.1	46.4	5.34	0.34	0.19	32	0.70	0.102
17GB0148	Sediment Pulp	3.29	9.18	35.10	149.9	105	9.5	9.6	1809	1.42	1.8	0.8	<0.2	0.3	23.1	2.81	0.25	0.13	30	0.34	0.057
17GB0148C	Sediment Pulp	0.52	19.70	17.49	38.3	1558	30.0	10.2	296	1.87	86.0	1.2	1.7	2.9	18.3	0.08	0.54	0.32	32	0.47	0.045
17GB0149	Sediment Pulp	2.09	9.07	40.39	133.5	120	9.3	6.9	687	1.34	1.5	0.8	<0.2	0.3	17.2	1.70	0.19	0.14	28	0.24	0.057
17GB0153	Sediment Pulp	2.73	12.37	50.39	194.4	208	12.0	15.3	3303	2.19	8.6	2.9	0.5	0.6	24.3	4.35	0.38	0.22	40	0.49	0.062
17GB0154	Sediment Pulp	1.68	16.31	53.97	234.2	173	17.2	12.8	2470	2.54	16.4	3.7	0.2	0.5	19.2	1.93	0.49	0.25	49	0.45	0.097
17GB0156	Sediment Pulp	1.57	9.75	25.68	124.8	39	9.5	6.4	733	1.55	3.0	0.8	<0.2	1.4	10.0	1.10	0.23	0.12	33	0.21	0.035
17GB0157	Sediment Pulp	1.52	7.78	25.08	119.4	43	9.4	5.9	607	1.54	2.7	0.8	1.6	1.2	9.7	0.98	0.24	0.12	27	0.21	0.033
17GB0165	Sediment Pulp	0.35	4.46	16.18	64.5	27	8.0	6.2	309	1.05	1.5	0.5	<0.2	0.9	12.0	0.73	0.13	0.04	23	0.28	0.031
17GB0166	Sediment Pulp	1.08	15.59	32.73	117.5	59	14.0	11.6	1818	2.57	4.0	0.9	<0.2	1.3	8.6	0.45	0.30	0.17	54	0.16	0.063
17GB0168	Sediment Pulp	0.33	12.58	43.41	103.0	58	19.3	12.1	720	2.66	24.4	0.8	<0.2	1.5	55.0	0.78	0.68	0.11	54	0.48	0.057
17GB0173	Sediment Pulp	0.52	11.61	23.19	108.9	16	16.0	10.1	597	2.26	6.1	0.7	<0.2	2.5	16.2	0.50	0.35	0.09	43	0.33	0.044
17GB0174	Sediment Pulp	0.48	11.44	21.94	103.7	14	16.3	10.2	559	2.24	5.1	0.6	<0.2	2.3	14.9	0.44	0.34	0.09	42	0.33	0.042
17GB0177	Sediment Pulp	3.07	11.28	44.04	197.5	83	8.9	7.7	1354	1.46	3.5	1.4	<0.2	0.5	14.7	2.64	0.29	0.14	31	0.29	0.048
17GB0179	Sediment Pulp	3.06	14.83	83.13	425.6	155	9.1	17.8	5845	2.27	12.2	0.7	<0.2	0.1	45.3	7.03	0.38	0.23	38	0.88	0.111
17GB0182	Sediment Pulp	2.12	24.72	147.55	523.1	241	7.7	7.8	2492	0.92	0.6	1.9	<0.2	<0.1	42.0	9.80	0.48	0.14	26	0.99	0.120
17GB0183	Sediment Pulp	10.33	40.26	641.01	542.2	502	12.5	25.9	5575	2.65	7.1	3.2	0.3	0.1	26.5	5.51	0.39	0.45	60	0.47	0.140
17GB0184	Sediment Pulp	3.29	16.77	182.78	202.0	401	6.6	7.4	361	1.37	0.7	2.1	<0.2	<0.1	19.3	3.12	0.26	0.18	30	0.41	0.083
17GB0185	Sediment Pulp	5.95	14.30	264.04	382.8	244	12.4	24.8	6366	2.66	3.7	1.7	<0.2	0.6	26.5	5.32	0.27	0.19	52	0.54	0.074
17GB0185C	Sediment Pulp	0.50	19.81	17.53	45.4	1497	29.9	10.1	295	1.83	84.4	1.1	4.0	2.6	19.2	0.11	0.55	0.32	31	0.46	0.043

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	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
	Unit	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
	MDL	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
17GB0134	Sediment Pulp	23.2	20.4	0.44	76.5	0.118	<20	1.31	0.008	0.05	0.1	2.9	0.19	0.06	66	1.1	<0.02	4.7
17GB0135	Sediment Pulp	22.1	19.1	0.43	73.9	0.111	<20	1.30	0.007	0.05	0.1	2.7	0.20	0.06	66	1.3	<0.02	4.7
17GB0136	Sediment Pulp	20.3	18.3	0.41	61.9	0.122	<20	1.17	0.008	0.04	0.2	2.5	0.17	0.05	58	1.0	<0.02	4.5
17GB0137	Sediment Pulp	17.2	20.9	0.75	72.4	0.196	<20	1.64	0.013	0.05	<0.1	3.6	0.24	0.07	79	0.7	<0.02	6.2
17GB0138	Sediment Pulp	21.9	21.3	0.44	62.4	0.138	<20	1.34	0.009	0.04	0.1	3.0	0.18	0.05	52	0.9	<0.02	5.0
17GB0139	Sediment Pulp	21.8	27.1	0.46	56.2	0.138	<20	1.37	0.006	0.04	0.1	3.7	0.20	0.03	51	0.7	<0.02	5.4
17GB0140	Sediment Pulp	23.3	20.1	0.52	59.0	0.130	<20	1.15	0.006	0.07	0.1	3.7	0.22	0.03	44	0.5	<0.02	5.1
17GB0141	Sediment Pulp	25.9	18.5	0.37	71.0	0.105	<20	1.24	0.007	0.04	0.1	2.5	0.20	0.08	58	1.5	<0.02	4.5
17GB0142	Sediment Pulp	23.8	21.6	0.48	72.6	0.125	<20	1.60	0.007	0.05	0.1	3.1	0.35	0.07	80	1.3	<0.02	6.5
17GB0144	Sediment Pulp	28.8	19.3	0.28	101.3	0.079	<20	1.17	0.009	0.04	0.1	2.1	0.23	0.11	94	2.5	<0.02	3.8
17GB0147	Sediment Pulp	45.3	16.3	0.23	164.3	0.062	<20	1.09	0.007	0.05	<0.1	1.4	0.34	0.14	121	3.4	<0.02	4.1
17GB0148	Sediment Pulp	28.1	13.4	0.26	85.1	0.075	<20	0.88	0.005	0.04	<0.1	1.5	0.26	0.07	75	1.7	<0.02	3.8
17GB0148C	Sediment Pulp	15.2	58.2	0.56	38.8	0.062	<20	1.05	0.021	0.08	0.1	3.2	0.07	<0.02	113	0.2	<0.02	3.7
17GB0149	Sediment Pulp	28.8	14.2	0.28	64.4	0.076	<20	0.96	0.005	0.04	<0.1	1.4	0.20	0.08	68	1.3	<0.02	4.3
17GB0153	Sediment Pulp	70.1	16.5	0.23	95.9	0.041	<20	2.39	0.008	0.06	0.1	2.7	0.84	0.09	157	2.4	<0.02	5.9
17GB0154	Sediment Pulp	62.9	19.7	0.43	76.8	0.060	<20	3.30	0.009	0.07	<0.1	3.1	0.87	0.11	120	2.2	<0.02	6.9
17GB0156	Sediment Pulp	21.3	13.3	0.23	45.3	0.060	<20	0.66	0.004	0.04	0.1	1.8	0.17	0.03	30	0.6	<0.02	3.1
17GB0157	Sediment Pulp	20.4	13.6	0.24	38.8	0.056	<20	0.68	0.003	0.04	0.1	1.8	0.15	0.03	28	0.7	<0.02	3.1
17GB0165	Sediment Pulp	9.7	13.4	0.29	43.5	0.101	<20	0.68	0.004	0.03	<0.1	1.7	0.08	0.04	27	0.5	<0.02	3.2
17GB0166	Sediment Pulp	45.7	18.8	0.39	35.0	0.138	<20	1.56	0.004	0.04	<0.1	2.5	0.17	0.04	58	0.9	<0.02	5.1
17GB0168	Sediment Pulp	14.6	23.1	0.56	70.8	0.150	<20	1.48	0.009	0.06	0.2	3.6	0.17	0.03	61	0.5	<0.02	5.3
17GB0173	Sediment Pulp	12.7	17.6	0.51	50.9	0.119	<20	1.01	0.011	0.06	0.1	2.6	0.10	<0.02	17	0.2	<0.02	4.0
17GB0174	Sediment Pulp	12.0	16.5	0.51	50.1	0.117	<20	1.00	0.012	0.06	<0.1	2.8	0.10	<0.02	16	0.2	<0.02	3.8
17GB0177	Sediment Pulp	34.9	15.9	0.22	66.9	0.056	<20	1.05	0.006	0.04	0.2	1.9	0.32	0.06	52	2.0	<0.02	4.0
17GB0179	Sediment Pulp	55.0	13.6	0.20	133.4	0.030	<20	1.01	0.012	0.05	0.1	1.6	0.67	0.16	127	2.8	<0.02	3.8
17GB0182	Sediment Pulp	88.4	23.0	0.20	69.8	0.040	<20	1.52	0.011	0.05	0.1	1.6	0.65	0.18	143	6.1	<0.02	3.4
17GB0183	Sediment Pulp	85.3	39.2	0.37	112.2	0.042	<20	2.65	0.007	0.07	0.3	3.6	1.11	0.17	187	4.8	0.04	8.7
17GB0184	Sediment Pulp	49.5	15.9	0.15	53.9	0.044	<20	1.35	0.007	0.03	0.2	1.7	0.23	0.29	177	3.3	<0.02	4.2
17GB0185	Sediment Pulp	34.4	19.3	0.32	114.0	0.105	<20	1.50	0.007	0.04	0.3	3.2	0.56	0.11	121	1.7	<0.02	6.9
17GB0185C	Sediment Pulp	14.7	56.7	0.55	39.6	0.062	<20	1.01	0.019	0.08	0.1	3.3	0.07	<0.02	104	0.3	<0.02	3.7

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	Analyte	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
	Unit	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
	MDL	0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
17GB0186	Sediment Pulp	3.33	20.44	89.06	430.6	103	14.0	19.4	4536	3.81	8.3	0.9	1.2	1.5	20.3	2.84	0.36	0.22	82	0.57	0.068
17GB0187	Sediment Pulp	3.79	16.62	142.17	318.1	160	12.1	17.9	3635	2.87	3.6	1.2	0.5	0.9	18.7	2.80	0.28	0.21	59	0.43	0.062
17GB0193	Sediment Pulp	4.41	16.24	65.62	328.5	178	11.9	7.9	3367	1.40	1.5	1.1	0.3	<0.1	37.7	7.35	0.28	0.22	29	0.81	0.111
17GB0195	Sediment Pulp	6.54	10.07	37.46	155.9	52	11.0	11.0	2436	2.11	3.0	1.6	0.5	1.9	11.1	1.16	0.22	0.18	42	0.25	0.039
17GB0196	Sediment Pulp	6.69	10.54	39.70	156.0	62	11.1	10.4	2529	2.14	3.1	1.7	<0.2	1.8	12.2	1.26	0.23	0.17	42	0.26	0.038
17GB0199	Sediment Pulp	13.85	15.78	78.76	226.5	351	8.0	18.4	3617	2.17	2.9	16.2	<0.2	0.2	32.7	5.36	0.25	0.29	34	0.56	0.118
17GB0205	Sediment Pulp	5.24	18.25	54.03	197.1	148	9.9	9.2	2113	1.76	3.0	10.8	<0.2	0.9	18.4	1.90	0.32	0.21	38	0.35	0.077
17GB0209	Sediment Pulp	17.12	16.63	500.45	487.1	428	12.0	32.9	>10000	3.13	9.8	6.6	0.4	0.2	27.7	9.66	0.32	0.34	58	0.50	0.147
17GB0213	Sediment Pulp	1.25	8.95	46.79	152.3	30	12.9	8.6	546	2.16	5.7	0.7	0.8	2.0	10.2	1.75	0.27	0.12	41	0.24	0.040
17GB0214	Sediment Pulp	1.33	11.44	50.46	156.1	32	13.6	9.2	669	2.22	6.0	0.7	2.3	1.8	10.9	1.97	0.29	0.12	41	0.26	0.037
17GB0221	Sediment Pulp	3.29	24.78	179.22	113.8	270	6.5	3.3	123	0.88	0.4	3.0	3.1	0.2	17.7	1.20	0.27	0.36	25	0.25	0.071
17GB0222	Sediment Pulp	6.77	24.87	168.16	261.4	201	12.7	25.1	3054	2.55	3.1	3.7	<0.2	1.3	19.1	1.54	0.32	0.32	60	0.38	0.074
17GB0223	Sediment Pulp	0.42	13.47	27.32	131.4	82	18.7	15.5	2476	2.74	2.2	0.8	<0.2	0.5	17.8	0.74	0.18	0.17	63	0.41	0.080
17GB0230	Sediment Pulp	26.32	44.50	692.16	408.5	554	7.5	38.7	>10000	1.02	2.4	5.1	0.3	0.1	5.3	2.35	0.56	0.26	32	0.07	0.192
17GB0234	Sediment Pulp	0.45	21.77	31.81	96.9	89	20.3	16.7	2484	2.95	3.3	0.9	<0.2	0.6	37.9	1.06	0.19	0.16	67	1.08	0.106
17GB0235	Sediment Pulp	0.43	21.65	32.21	97.0	83	20.4	17.1	2450	3.06	3.4	0.9	<0.2	0.6	36.2	1.00	0.18	0.15	69	1.09	0.103
17GB0235C	Sediment Pulp	0.57	21.05	18.19	47.5	1566	30.4	10.5	322	1.92	89.2	1.2	1.4	2.9	18.4	0.14	0.59	0.35	32	0.47	0.049
17GB0254	Sediment Pulp	0.27	19.54	16.93	89.1	51	27.8	19.0	800	3.54	1.6	0.5	<0.2	1.1	25.6	0.26	0.10	0.09	75	0.66	0.078
17GB0255	Sediment Pulp	0.29	20.59	18.61	93.8	66	29.2	20.1	802	3.65	1.4	0.5	<0.2	1.1	26.3	0.31	0.11	0.09	74	0.67	0.080
17GB0276	Sediment Pulp	0.33	21.30	17.52	91.5	48	28.2	19.2	1031	3.59	2.2	0.6	<0.2	1.4	25.9	0.35	0.11	0.10	77	0.67	0.083
17GB0277	Sediment Pulp	0.37	20.51	18.03	95.5	46	28.3	19.0	1050	3.66	2.1	0.6	<0.2	1.7	26.5	0.33	0.12	0.10	80	0.68	0.084
17GB0280	Sediment Pulp	0.53	23.87	40.75	193.2	154	18.6	16.8	2542	2.89	2.5	1.0	0.3	0.2	53.0	0.90	0.23	0.14	71	1.47	0.160
17GB0293	Sediment Pulp	0.28	17.53	15.61	93.3	27	27.3	17.7	585	3.47	1.8	0.5	<0.2	1.5	20.1	0.21	0.08	0.08	74	0.53	0.067
17GB0294	Sediment Pulp	0.26	17.64	16.26	90.5	33	27.0	18.5	634	3.41	1.8	0.5	<0.2	1.5	21.4	0.23	0.09	0.08	72	0.54	0.069
17GB0300	Sediment Pulp	0.37	20.06	16.51	89.5	196	10.2	9.1	2131	1.09	0.9	0.5	0.4	<0.1	60.8	0.94	0.30	0.10	30	1.52	0.154
17GB0301	Sediment Pulp	0.57	20.67	20.57	83.3	366	12.1	16.2	3240	1.74	2.2	1.1	<0.2	<0.1	35.7	0.84	0.23	0.13	46	0.85	0.191
17GB0314	Sediment Pulp	0.35	16.44	19.24	83.2	33	20.2	12.5	979	2.68	3.0	0.8	<0.2	1.9	14.6	0.26	0.21	0.17	45	0.37	0.052
17GB0315	Sediment Pulp	0.34	15.99	19.80	88.9	30	20.6	12.5	942	2.73	3.4	0.9	<0.2	2.2	15.0	0.31	0.21	0.17	46	0.38	0.051
17GB0328	Sediment Pulp	6.32	11.41	45.88	47.7	487	5.5	12.6	3441	1.34	1.0	0.8	0.9	<0.1	3.5	0.62	0.60	0.37	21	0.04	0.191
17GB0329	Sediment Pulp	4.69	26.88	68.66	447.0	337	15.8	18.1	6793	1.46	2.5	1.3	<0.2	<0.1	19.2	4.49	0.40	0.30	36	0.33	0.155

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Project: None Given
Report Date: November 29, 2017

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CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
	Unit	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
	MDL	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
17GB0186	Sediment Pulp	30.9	25.7	0.55	67.9	0.224	<20	1.52	0.005	0.04	0.2	4.7	0.56	0.05	55	0.9	<0.02	8.3
17GB0187	Sediment Pulp	28.0	22.6	0.41	81.1	0.158	<20	1.40	0.006	0.04	0.2	3.7	0.36	0.07	92	1.1	<0.02	6.7
17GB0193	Sediment Pulp	61.9	17.6	0.23	224.1	0.032	<20	1.19	0.010	0.05	0.1	1.6	0.36	0.15	137	2.5	<0.02	4.5
17GB0195	Sediment Pulp	21.0	15.7	0.29	55.8	0.097	<20	0.91	0.004	0.04	0.2	1.9	0.19	0.02	28	0.4	<0.02	4.1
17GB0196	Sediment Pulp	21.3	15.2	0.29	71.7	0.092	<20	0.93	0.005	0.04	0.2	2.1	0.18	0.03	33	0.4	<0.02	4.0
17GB0199	Sediment Pulp	90.5	14.4	0.17	105.5	0.031	<20	2.21	0.009	0.04	0.3	1.3	0.63	0.18	185	4.2	<0.02	4.8
17GB0205	Sediment Pulp	41.8	21.0	0.27	99.8	0.101	<20	1.42	0.008	0.03	0.3	3.1	0.30	0.06	64	1.9	<0.02	5.3
17GB0209	Sediment Pulp	31.3	28.2	0.19	182.7	0.038	<20	2.12	0.008	0.05	0.2	1.8	1.01	0.20	220	3.1	0.05	8.4
17GB0213	Sediment Pulp	18.0	19.0	0.33	62.0	0.081	<20	0.77	0.002	0.07	0.1	2.7	0.36	<0.02	19	0.3	<0.02	3.8
17GB0214	Sediment Pulp	18.4	18.7	0.35	62.8	0.078	<20	0.83	0.003	0.08	0.1	2.7	0.39	0.02	26	0.4	<0.02	3.8
17GB0221	Sediment Pulp	55.4	11.7	0.16	58.8	0.073	<20	1.16	0.007	0.03	0.2	1.7	0.12	0.32	152	2.6	<0.02	4.8
17GB0222	Sediment Pulp	43.8	21.8	0.44	54.7	0.148	<20	1.77	0.008	0.04	0.2	3.7	0.34	0.12	119	2.6	<0.02	6.4
17GB0223	Sediment Pulp	14.1	21.2	0.41	85.6	0.116	<20	2.12	0.008	0.05	<0.1	3.0	0.18	0.08	114	0.9	<0.02	6.4
17GB0230	Sediment Pulp	150.3	34.0	0.08	37.7	0.021	<20	4.58	0.002	0.04	0.1	1.8	0.63	0.18	300	5.4	0.02	5.7
17GB0234	Sediment Pulp	16.1	23.0	0.57	98.4	0.150	<20	2.33	0.019	0.07	<0.1	4.1	0.20	0.10	100	1.1	<0.02	6.5
17GB0235	Sediment Pulp	15.2	22.8	0.59	98.3	0.155	<20	2.33	0.021	0.07	<0.1	4.2	0.20	0.09	91	1.0	<0.02	6.6
17GB0235C	Sediment Pulp	16.5	58.9	0.57	42.5	0.063	<20	1.06	0.021	0.08	0.1	3.5	0.07	<0.02	115	0.2	<0.02	3.9
17GB0254	Sediment Pulp	11.4	30.1	1.00	50.7	0.251	<20	1.93	0.023	0.04	<0.1	3.8	0.06	0.05	50	0.4	<0.02	6.5
17GB0255	Sediment Pulp	11.6	31.8	1.03	53.9	0.244	<20	2.04	0.025	0.05	<0.1	3.9	0.07	0.06	57	0.5	<0.02	7.0
17GB0276	Sediment Pulp	14.1	28.3	0.97	63.9	0.256	<20	1.91	0.032	0.05	<0.1	4.2	0.08	0.04	46	0.5	<0.02	6.1
17GB0277	Sediment Pulp	15.6	29.6	0.97	66.9	0.251	<20	1.91	0.032	0.05	<0.1	4.1	0.08	0.04	40	0.4	<0.02	6.3
17GB0280	Sediment Pulp	16.9	27.0	0.53	91.7	0.124	<20	2.50	0.016	0.06	<0.1	4.6	0.15	0.14	138	2.5	<0.02	6.6
17GB0293	Sediment Pulp	11.1	27.2	1.01	53.5	0.260	<20	1.85	0.030	0.05	<0.1	3.8	0.06	<0.02	33	0.2	<0.02	6.2
17GB0294	Sediment Pulp	11.4	27.5	0.99	56.7	0.264	<20	1.86	0.030	0.05	<0.1	4.0	0.07	0.02	27	0.3	<0.02	6.3
17GB0300	Sediment Pulp	18.0	16.3	0.28	66.9	0.028	<20	1.76	0.014	0.05	<0.1	1.2	0.12	0.18	200	3.9	<0.02	3.0
17GB0301	Sediment Pulp	19.4	26.9	0.32	65.1	0.029	<20	2.74	0.008	0.05	<0.1	1.6	0.18	0.21	175	3.8	<0.02	5.2
17GB0314	Sediment Pulp	15.7	21.0	0.55	71.6	0.091	<20	1.35	0.009	0.09	<0.1	3.0	0.09	0.03	34	0.3	<0.02	5.0
17GB0315	Sediment Pulp	16.2	21.3	0.56	72.5	0.100	<20	1.34	0.011	0.09	<0.1	2.9	0.10	0.03	29	0.2	<0.02	5.2
17GB0328	Sediment Pulp	205.6	10.4	0.10	31.4	0.017	<20	1.88	0.004	0.08	0.1	0.5	0.59	0.22	410	5.0	<0.02	5.1
17GB0329	Sediment Pulp	183.6	26.9	0.18	158.2	0.026	<20	3.27	0.007	0.06	<0.1	1.4	0.78	0.19	241	8.0	0.02	6.0

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Project: None Given
Report Date: November 29, 2017

CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
	Unit	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
	MDL	0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
17GB0342	Sediment Pulp	13.29	18.12	63.83	299.7	152	16.4	22.4	3767	3.24	4.9	1.1	<0.2	0.7	19.0	2.04	0.37	0.23	42	0.29	0.078
17GB0345	Sediment Pulp	0.31	12.52	17.33	87.1	10	18.6	11.4	557	2.63	2.9	0.5	<0.2	2.4	12.9	0.25	0.17	0.11	52	0.29	0.035
17GB0346	Sediment Pulp	0.30	12.08	16.79	85.7	11	18.2	11.0	534	2.60	2.8	0.5	<0.2	2.4	12.8	0.27	0.17	0.11	52	0.30	0.038
17GB0363	Sediment Pulp	0.24	10.49	18.22	58.8	37	13.8	8.2	560	1.84	2.9	0.5	<0.2	1.6	10.1	0.18	0.17	0.11	31	0.22	0.034
17GB0364	Sediment Pulp	0.23	10.96	18.68	59.2	39	14.0	8.4	599	1.86	3.0	0.5	<0.2	1.3	11.1	0.22	0.16	0.11	30	0.24	0.037
17GB0381	Sediment Pulp	0.80	17.73	70.85	169.9	204	25.3	18.7	3995	1.98	5.0	1.2	0.5	0.1	23.0	1.57	0.24	0.17	43	0.50	0.135
17GB0382	Sediment Pulp	0.98	19.02	72.39	193.7	166	21.4	23.6	3891	2.46	11.3	1.0	2.0	0.2	22.8	1.75	0.29	0.30	45	0.37	0.121
17GB0384	Sediment Pulp	0.49	13.29	30.74	103.6	101	14.4	12.3	1052	1.97	3.6	0.9	<0.2	0.3	21.2	0.70	0.25	0.23	35	0.39	0.065
17GB0385	Sediment Pulp	0.51	12.84	33.82	100.3	97	13.9	13.3	997	2.14	3.5	0.9	0.6	0.4	18.1	0.66	0.26	0.22	35	0.29	0.063
17GB0403	Sediment Pulp	0.26	12.44	15.49	44.9	28	12.5	7.5	974	1.93	2.5	0.6	0.4	1.6	10.0	0.31	0.17	0.14	27	0.16	0.032
17GB0404	Sediment Pulp	0.27	12.93	16.55	45.8	22	13.1	7.7	965	1.88	2.5	0.7	<0.2	1.7	10.0	0.31	0.18	0.16	27	0.16	0.033
17GB0422	Sediment Pulp	0.35	13.11	17.80	82.5	18	16.0	10.4	694	2.20	2.4	0.5	<0.2	2.3	11.9	0.37	0.14	0.09	38	0.26	0.033
17GB0423	Sediment Pulp	0.38	13.55	17.91	81.0	17	16.0	10.5	740	2.25	2.6	0.5	0.3	2.3	12.1	0.37	0.14	0.13	40	0.24	0.033
17GB0434	Sediment Pulp	0.92	12.38	40.36	303.1	132	17.5	18.2	3314	2.74	3.8	0.9	<0.2	0.3	32.3	3.61	0.19	0.21	52	0.56	0.089
17GB0434C	Sediment Pulp	0.64	22.36	18.69	52.3	1666	31.4	10.9	336	2.13	95.2	1.3	2.2	3.0	21.8	0.11	0.54	0.36	35	0.54	0.049
17GB0436	Sediment Pulp	1.33	9.21	22.99	92.2	19	11.1	6.7	336	1.71	2.1	0.6	<0.2	2.0	11.8	0.87	0.20	0.12	37	0.28	0.034
17GB0439	Sediment Pulp	7.86	29.77	69.63	214.9	369	14.2	17.7	5214	2.10	4.0	2.4	0.4	<0.1	44.7	4.17	0.44	0.26	47	0.73	0.186
17GB0441	Sediment Pulp	17.74	26.69	91.42	403.7	277	11.4	11.2	>10000	1.47	6.0	1.5	<0.2	<0.1	34.6	31.96	0.75	0.29	31	0.53	0.157
17GB0442	Sediment Pulp	8.15	10.76	46.62	182.6	72	10.4	16.0	2792	1.83	3.5	0.9	<0.2	0.7	25.1	5.08	0.22	0.15	38	0.47	0.051
17GB0443	Sediment Pulp	9.45	12.01	51.62	192.8	82	10.7	18.2	2995	1.93	3.7	1.0	<0.2	0.7	24.9	5.44	0.27	0.17	38	0.46	0.054
17GB0446	Sediment Pulp	4.42	24.50	57.11	118.1	150	4.7	3.3	2604	0.37	4.8	6.4	<0.2	0.1	50.0	8.38	0.66	0.11	8	0.89	0.161
17GB0447	Sediment Pulp	3.47	34.42	41.12	150.5	183	9.7	6.2	5337	1.21	5.0	2.8	<0.2	<0.1	44.5	9.60	0.83	0.17	24	1.33	0.151
17GB0448	Sediment Pulp	4.17	14.66	29.01	227.3	56	10.2	8.4	2064	1.53	0.8	0.6	<0.2	0.2	22.4	18.14	0.28	0.12	31	0.36	0.067
17GB0450	Sediment Pulp	4.62	16.27	27.38	213.5	73	14.3	8.1	2011	1.64	3.1	1.3	<0.2	0.2	46.8	9.00	0.31	0.18	25	0.85	0.088
17GB0454	Sediment Pulp	0.37	15.37	21.65	111.7	75	20.9	13.1	1052	3.35	2.1	0.6	<0.2	0.5	18.5	0.35	0.12	0.13	73	0.56	0.080
17GB0455	Sediment Pulp	5.57	9.61	55.95	264.9	166	14.0	25.1	5454	3.21	7.3	1.1	<0.2	0.2	33.7	3.49	0.27	0.18	65	0.60	0.098
17GB0458	Sediment Pulp	1.45	14.44	21.12	105.0	54	19.3	12.9	2148	2.81	8.7	0.8	0.2	1.0	23.3	0.39	0.33	0.17	34	0.30	0.053
17GB0462	Sediment Pulp	4.73	18.36	135.96	439.0	324	15.0	17.8	>10000	2.09	11.4	2.5	0.4	0.1	33.8	4.69	0.24	0.29	29	0.51	0.127
17GB0463	Sediment Pulp	6.95	18.07	192.06	444.4	334	14.2	23.5	8088	2.36	18.0	2.8	1.0	<0.1	47.2	6.25	0.25	0.24	32	0.70	0.122
17GB0464	Sediment Pulp	2.96	17.81	143.82	392.1	223	19.8	15.5	1884	2.44	4.6	1.9	<0.2	0.3	30.7	2.37	0.15	0.19	31	0.33	0.071

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CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
	Unit	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
	MDL	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
17GB0342	Sediment Pulp	60.4	18.6	0.33	114.0	0.064	<20	1.96	0.012	0.06	0.5	2.7	0.42	0.13	158	2.1	0.02	6.6
17GB0345	Sediment Pulp	13.1	20.8	0.54	44.5	0.148	<20	1.02	0.009	0.06	<0.1	2.7	0.06	<0.02	12	0.2	<0.02	4.3
17GB0346	Sediment Pulp	12.4	19.7	0.54	43.4	0.150	<20	1.02	0.008	0.06	<0.1	2.5	0.06	<0.02	16	0.2	<0.02	4.0
17GB0363	Sediment Pulp	12.0	13.6	0.35	57.5	0.070	<20	0.82	0.006	0.05	<0.1	2.2	0.06	<0.02	24	0.3	<0.02	3.0
17GB0364	Sediment Pulp	11.5	14.2	0.35	61.5	0.068	<20	0.86	0.007	0.05	<0.1	2.2	0.07	<0.02	20	0.3	<0.02	3.1
17GB0381	Sediment Pulp	18.6	25.0	0.27	114.4	0.018	<20	2.71	0.006	0.07	<0.1	1.7	0.28	0.12	146	2.6	<0.02	4.2
17GB0382	Sediment Pulp	19.1	26.4	0.41	516.0	0.036	<20	2.25	0.009	0.09	<0.1	2.4	0.27	0.13	148	2.9	<0.02	5.8
17GB0384	Sediment Pulp	14.2	17.7	0.33	247.3	0.039	<20	1.41	0.009	0.08	<0.1	2.0	0.12	0.07	78	1.0	<0.02	4.3
17GB0385	Sediment Pulp	15.3	18.2	0.35	209.0	0.037	<20	1.42	0.007	0.07	<0.1	2.0	0.12	0.06	89	1.0	<0.02	4.7
17GB0403	Sediment Pulp	13.9	14.6	0.31	60.1	0.039	<20	0.88	0.009	0.06	<0.1	2.1	0.08	<0.02	23	0.2	<0.02	2.7
17GB0404	Sediment Pulp	13.3	14.3	0.30	63.4	0.042	<20	0.89	0.008	0.06	<0.1	2.3	0.08	<0.02	27	0.2	<0.02	2.8
17GB0422	Sediment Pulp	11.2	17.2	0.48	71.5	0.132	<20	0.96	0.009	0.05	<0.1	2.4	0.07	<0.02	6	0.1	<0.02	3.9
17GB0423	Sediment Pulp	11.5	16.9	0.48	83.9	0.124	<20	0.95	0.008	0.06	<0.1	2.5	0.07	<0.02	19	<0.1	<0.02	3.7
17GB0434	Sediment Pulp	22.1	21.5	0.43	153.7	0.103	<20	1.87	0.010	0.06	<0.1	2.9	0.67	0.11	118	1.8	<0.02	6.6
17GB0434C	Sediment Pulp	16.5	63.8	0.64	44.0	0.071	<20	1.19	0.023	0.09	0.1	4.0	0.08	<0.02	124	0.2	<0.02	4.1
17GB0436	Sediment Pulp	16.0	14.9	0.30	32.5	0.108	<20	0.70	0.005	0.04	0.2	2.1	0.19	<0.02	25	0.2	<0.02	3.7
17GB0439	Sediment Pulp	27.6	27.3	0.23	141.8	0.030	<20	2.65	0.012	0.06	0.1	1.6	0.61	0.24	288	5.0	0.03	4.7
17GB0441	Sediment Pulp	135.2	18.9	0.19	189.1	0.025	<20	1.77	0.010	0.08	0.3	1.5	6.72	0.20	215	8.9	0.03	6.6
17GB0442	Sediment Pulp	17.1	13.4	0.29	66.0	0.103	<20	0.84	0.007	0.04	0.1	2.4	0.84	0.06	56	0.9	<0.02	4.8
17GB0443	Sediment Pulp	18.1	14.5	0.30	70.2	0.111	<20	0.86	0.005	0.04	0.2	2.5	0.95	0.06	65	1.1	<0.02	5.1
17GB0446	Sediment Pulp	165.9	22.4	0.14	116.5	0.007	<20	2.49	0.016	0.05	0.1	1.5	2.62	0.17	156	7.9	<0.02	1.6
17GB0447	Sediment Pulp	90.1	19.4	0.24	114.9	0.028	<20	1.14	0.013	0.06	0.3	1.8	5.26	0.18	188	6.7	<0.02	3.6
17GB0448	Sediment Pulp	157.4	13.2	0.24	111.0	0.056	<20	0.90	0.009	0.04	0.2	1.8	1.04	0.09	67	3.1	<0.02	3.5
17GB0450	Sediment Pulp	65.9	17.0	0.32	223.2	0.022	<20	1.00	0.011	0.11	0.2	1.7	0.58	0.12	119	1.9	<0.02	3.3
17GB0454	Sediment Pulp	13.7	26.6	0.62	52.1	0.183	<20	2.27	0.008	0.06	<0.1	3.5	0.12	0.08	90	0.9	<0.02	7.5
17GB0455	Sediment Pulp	55.2	17.9	0.33	141.9	0.081	<20	1.84	0.008	0.04	<0.1	3.5	0.67	0.15	162	2.7	<0.02	5.8
17GB0458	Sediment Pulp	15.0	17.8	0.54	78.8	0.018	<20	1.21	0.006	0.07	<0.1	3.3	0.14	0.04	57	0.4	<0.02	4.4
17GB0462	Sediment Pulp	43.3	18.6	0.24	463.2	0.011	<20	1.91	0.010	0.07	0.4	1.4	0.37	0.18	202	2.7	0.02	5.5
17GB0463	Sediment Pulp	50.2	19.0	0.23	483.7	0.015	<20	1.86	0.011	0.07	0.5	1.7	0.41	0.20	199	3.5	<0.02	5.6
17GB0464	Sediment Pulp	33.3	22.9	0.42	217.1	0.020	<20	1.91	0.008	0.07	0.2	2.5	0.21	0.08	91	1.6	<0.02	6.1

This report supersedes all previous preliminary and final reports with this file number dated prior to the date on this certificate. Signature indicates final approval; preliminary reports are unsigned and should be used for reference only.

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Project: None Given
Report Date: November 29, 2017

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	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
	Unit	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
	MDL	0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
17GB0465	Sediment Pulp	3.07	17.33	166.49	275.9	320	11.5	8.1	667	1.35	3.4	2.6	<0.2	<0.1	30.0	3.89	0.27	0.21	26	0.52	0.110
17GB0466	Sediment Pulp	14.18	21.36	111.57	163.8	274	17.8	14.1	1892	2.79	11.5	6.7	0.4	0.3	24.1	1.23	0.39	0.36	45	0.38	0.120
17GB0467	Sediment Pulp	13.78	21.88	112.98	175.9	261	18.6	15.4	1809	2.93	12.2	6.2	0.3	0.3	21.5	1.15	0.37	0.33	46	0.36	0.116
17GB0468	Sediment Pulp	2.25	15.09	112.83	263.0	227	13.2	10.3	1825	1.92	7.5	1.4	<0.2	0.2	29.3	3.21	0.34	0.20	32	0.46	0.083
17GB0469	Sediment Pulp	3.57	41.45	268.86	484.5	249	21.8	35.3	4717	2.37	5.9	2.0	0.3	0.5	36.7	4.88	0.24	0.28	33	0.31	0.075
17GB0469C	Sediment Pulp	0.55	21.75	18.97	51.7	1619	32.1	10.9	345	2.02	93.5	1.3	1.4	3.1	22.2	0.13	0.55	0.35	35	0.51	0.045
17GB0470	Sediment Pulp	6.70	23.92	246.10	369.2	469	15.5	33.4	6121	1.98	22.0	2.9	<0.2	<0.1	34.1	5.46	0.43	0.39	39	0.52	0.169
17GB0472	Sediment Pulp	0.90	16.44	114.80	55.5	463	6.9	17.3	9122	1.62	6.2	0.7	0.6	<0.1	12.3	0.88	0.76	0.43	40	0.14	0.127
17GB0473	Sediment Pulp	7.66	15.43	77.61	146.8	209	11.9	7.9	1224	1.64	4.6	6.4	0.3	<0.1	27.1	1.38	0.33	0.28	27	0.51	0.157
17GB0474	Sediment Pulp	1.92	17.15	45.69	97.5	123	15.7	21.8	2503	3.25	4.5	1.7	<0.2	0.8	16.5	0.67	0.25	0.26	52	0.31	0.074
17GB0481	Sediment Pulp	2.28	13.76	31.94	126.8	74	20.1	18.1	5442	2.90	8.2	0.8	<0.2	1.0	17.7	1.14	0.29	0.27	46	0.20	0.047
17GB0482	Sediment Pulp	1.60	14.86	30.10	132.2	70	21.9	17.9	3017	3.17	11.7	0.8	0.2	1.1	19.5	0.69	0.19	0.21	33	0.21	0.049
17GB0483	Sediment Pulp	1.92	17.35	33.76	157.4	84	25.7	22.1	3661	3.71	14.2	0.9	1.3	1.2	23.8	0.83	0.23	0.29	37	0.24	0.060
17GB0484	Sediment Pulp	2.55	13.40	88.07	130.9	218	14.9	20.3	2089	1.29	1.5	1.3	0.2	0.1	18.0	1.81	0.20	0.27	17	0.24	0.133
17GB0486	Sediment Pulp	9.12	33.21	128.58	512.5	378	17.8	16.3	4917	1.70	16.0	2.2	0.6	0.1	67.8	8.23	0.48	0.39	23	1.20	0.148
17GB0503	Sediment Pulp	4.48	17.11	121.28	215.0	67	13.5	18.6	919	2.13	6.9	2.6	0.4	2.5	16.9	3.35	0.20	0.26	36	0.33	0.043
17GB0504	Sediment Pulp	5.39	21.61	154.11	244.7	89	14.5	22.7	1195	2.17	7.7	3.2	<0.2	1.7	20.2	4.64	0.23	0.27	37	0.35	0.054
17GB0505	Sediment Pulp	7.41	27.13	84.18	216.1	161	16.8	50.3	1940	2.30	7.5	7.2	0.3	2.7	27.1	4.90	0.33	0.30	41	0.48	0.069
17GB0511	Sediment Pulp	3.36	13.36	32.66	132.4	42	15.9	11.1	1206	3.14	7.5	1.4	<0.2	1.2	18.7	1.18	0.30	0.23	55	0.26	0.060
17GB0511C	Sediment Pulp	0.54	19.75	17.79	47.3	1523	29.5	9.7	304	1.92	88.3	1.2	1.4	3.2	18.6	0.13	0.56	0.35	32	0.47	0.047
17GB0519	Sediment Pulp	0.50	14.54	31.49	110.0	152	17.5	9.2	1867	2.66	6.8	1.0	0.2	0.4	12.3	0.54	0.18	0.23	47	0.22	0.086
17GB0523	Sediment Pulp	0.12	7.17	16.30	62.4	20	11.7	6.2	369	1.60	2.1	0.7	<0.2	2.6	8.0	0.22	0.12	0.09	26	0.16	0.026
17GB0524	Sediment Pulp	0.14	6.92	16.76	63.1	19	11.6	6.3	372	1.62	2.1	0.7	<0.2	2.4	7.3	0.22	0.14	0.10	26	0.16	0.027
17GB0535	Sediment Pulp	9.89	18.54	59.16	103.0	254	11.1	18.0	5003	1.71	3.1	1.7	<0.2	<0.1	10.3	0.92	0.45	0.25	28	0.14	0.128
17GB0536	Sediment Pulp	0.91	14.88	48.41	57.3	330	8.0	20.6	6918	2.24	2.8	1.2	0.5	<0.1	9.5	0.99	0.48	0.31	40	0.14	0.163
17GB0537	Sediment Pulp	9.23	16.70	81.74	121.1	324	10.6	25.8	>10000	1.84	3.8	1.9	0.4	<0.1	9.6	1.83	0.49	0.32	30	0.12	0.128
17GB0538	Sediment Pulp	6.91	37.56	83.69	163.7	900	5.7	29.2	>10000	1.18	5.5	5.5	1.3	0.3	2.6	1.45	0.55	0.17	15	0.03	0.221
17GB0541	Sediment Pulp	14.03	16.54	80.19	261.3	259	10.6	11.0	1495	1.81	3.5	1.0	<0.2	<0.1	19.4	3.00	0.39	0.27	43	0.34	0.147
17GB0542	Sediment Pulp	3.99	17.67	35.78	196.8	166	10.3	16.4	3922	0.90	2.0	1.6	<0.2	<0.1	40.7	3.17	0.35	0.15	18	0.88	0.103
17GB0543	Sediment Pulp	3.09	14.40	90.89	67.8	130	13.0	6.4	356	2.80	4.4	1.0	0.5	0.5	6.2	0.19	0.55	0.41	50	0.10	0.103

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Project: None Given
Report Date: November 29, 2017

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CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
	Unit	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
	MDL	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
17GB0465	Sediment Pulp	46.8	19.9	0.25	178.2	0.021	<20	1.71	0.014	0.06	0.3	1.4	0.20	0.22	171	3.6	<0.02	5.5
17GB0466	Sediment Pulp	70.9	28.9	0.40	148.2	0.031	<20	2.72	0.009	0.10	0.6	3.6	0.42	0.18	113	3.7	<0.02	10.8
17GB0467	Sediment Pulp	65.3	30.1	0.41	147.4	0.034	<20	2.84	0.006	0.10	0.5	4.0	0.46	0.15	122	3.4	<0.02	11.9
17GB0468	Sediment Pulp	37.1	19.2	0.29	194.1	0.039	<20	1.59	0.008	0.07	0.2	2.1	0.19	0.12	128	2.6	<0.02	5.5
17GB0469	Sediment Pulp	39.9	24.0	0.41	233.0	0.021	<20	2.29	0.007	0.07	<0.1	2.9	0.40	0.09	119	2.8	0.03	5.3
17GB0469C	Sediment Pulp	16.3	63.5	0.62	41.9	0.068	<20	1.18	0.023	0.10	0.1	3.9	0.08	<0.02	116	0.2	<0.02	4.3
17GB0470	Sediment Pulp	40.1	27.9	0.22	240.0	0.016	<20	2.34	0.015	0.07	0.4	1.3	0.56	0.19	291	6.9	0.05	5.3
17GB0472	Sediment Pulp	21.6	13.0	0.11	96.7	0.030	<20	1.46	0.005	0.07	<0.1	1.2	0.59	0.19	319	3.7	0.02	5.8
17GB0473	Sediment Pulp	68.7	23.0	0.22	162.6	0.013	<20	2.46	0.008	0.07	0.4	1.1	0.30	0.27	160	4.9	<0.02	11.5
17GB0474	Sediment Pulp	31.7	23.0	0.36	85.6	0.101	<20	2.26	0.007	0.07	<0.1	2.9	0.25	0.08	135	1.5	<0.02	9.8
17GB0481	Sediment Pulp	14.2	23.7	0.55	97.4	0.041	<20	1.64	0.005	0.09	<0.1	2.9	0.29	0.05	97	0.8	0.03	6.9
17GB0482	Sediment Pulp	17.0	20.7	0.49	110.9	0.014	<20	1.63	0.005	0.10	<0.1	3.2	0.36	0.05	78	0.7	<0.02	5.4
17GB0483	Sediment Pulp	18.9	23.5	0.50	134.0	0.014	<20	1.83	0.008	0.10	<0.1	3.6	0.39	0.05	81	0.9	0.03	5.9
17GB0484	Sediment Pulp	53.8	16.1	0.18	109.8	0.006	<20	2.36	0.010	0.06	<0.1	1.0	1.20	0.23	201	6.0	<0.02	3.1
17GB0486	Sediment Pulp	76.2	16.6	0.20	314.8	0.011	<20	1.81	0.007	0.06	0.1	1.3	0.67	0.17	203	4.7	0.05	3.8
17GB0503	Sediment Pulp	36.9	14.9	0.35	50.9	0.112	<20	1.05	0.006	0.04	0.1	3.1	0.86	0.04	42	0.8	0.09	5.1
17GB0504	Sediment Pulp	47.1	17.3	0.35	65.0	0.103	<20	1.15	0.007	0.05	0.1	3.4	1.09	0.07	66	1.2	0.09	5.8
17GB0505	Sediment Pulp	58.1	15.9	0.42	55.0	0.146	<20	1.63	0.007	0.04	0.3	4.7	2.36	0.06	62	2.4	0.08	6.4
17GB0511	Sediment Pulp	34.6	26.6	0.37	92.3	0.070	<20	1.18	0.007	0.09	0.4	2.9	0.76	0.04	60	0.6	0.03	5.5
17GB0511C	Sediment Pulp	15.7	57.8	0.57	38.8	0.061	<20	1.05	0.021	0.08	0.1	3.6	0.08	<0.02	110	0.1	<0.02	3.8
17GB0519	Sediment Pulp	18.3	26.3	0.31	124.3	0.027	<20	1.77	0.005	0.07	<0.1	2.2	0.22	0.06	89	0.8	<0.02	5.4
17GB0523	Sediment Pulp	16.1	13.4	0.33	68.2	0.059	<20	0.72	0.005	0.04	<0.1	1.8	0.07	<0.02	12	<0.1	<0.02	2.6
17GB0524	Sediment Pulp	15.0	14.0	0.32	69.6	0.060	<20	0.72	0.004	0.04	<0.1	1.9	0.07	<0.02	10	<0.1	<0.02	2.6
17GB0535	Sediment Pulp	137.9	20.2	0.20	60.4	0.018	<20	2.81	0.007	0.06	<0.1	1.4	0.61	0.18	208	7.5	<0.02	5.5
17GB0536	Sediment Pulp	17.9	20.2	0.16	48.6	0.032	<20	2.46	0.010	0.06	<0.1	1.3	0.52	0.20	361	5.0	0.04	7.9
17GB0537	Sediment Pulp	185.8	19.8	0.18	83.3	0.024	<20	2.80	0.008	0.06	<0.1	1.4	1.05	0.16	275	8.2	0.03	7.0
17GB0538	Sediment Pulp	409.1	27.6	0.07	32.0	0.009	<20	5.09	0.003	0.04	0.1	3.8	1.75	0.23	340	12.7	0.03	6.6
17GB0541	Sediment Pulp	35.1	18.0	0.17	139.5	0.028	<20	2.26	0.008	0.05	0.1	1.2	0.41	0.33	242	3.4	<0.02	7.7
17GB0542	Sediment Pulp	53.7	16.6	0.15	149.0	0.014	<20	1.72	0.016	0.05	0.1	0.8	0.40	0.17	195	5.3	<0.02	2.8
17GB0543	Sediment Pulp	67.4	18.9	0.35	45.1	0.083	<20	3.01	0.008	0.06	0.1	2.7	0.22	0.13	281	3.2	<0.02	9.7

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Project: None Given
Report Date: November 29, 2017

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CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
	Unit	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
	MDL	0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
17GB0544	Sediment Pulp	3.77	14.44	94.03	68.0	160	12.8	7.1	552	2.80	4.5	1.2	<0.2	0.5	6.0	0.21	0.64	0.45	50	0.10	0.100
17GB0546	Sediment Pulp	25.08	19.80	59.65	132.6	238	8.3	18.4	4248	2.40	24.4	6.6	<0.2	<0.1	35.1	2.61	0.41	0.23	22	1.02	0.127
17GB0556	Sediment Pulp	1.78	20.13	61.11	77.5	417	9.9	11.1	8418	1.75	3.0	1.2	<0.2	0.2	8.0	0.95	0.49	0.37	23	0.12	0.110
17GB0558	Sediment Pulp	6.21	12.07	51.55	142.8	147	13.2	26.0	3339	1.82	2.2	1.1	<0.2	0.3	10.4	0.87	0.22	0.22	27	0.18	0.061
17GB0561	Sediment Pulp	9.16	10.75	101.59	60.3	280	4.7	21.4	3560	1.65	1.7	1.1	<0.2	0.5	5.9	0.60	0.28	0.22	17	0.09	0.128
17GB0562	Sediment Pulp	3.89	10.49	79.71	81.1	317	3.5	7.0	300	0.92	1.1	1.1	<0.2	<0.1	11.1	1.00	0.23	0.16	11	0.35	0.140
17GB0563	Sediment Pulp	15.56	16.71	183.76	365.8	126	19.2	81.6	>10000	4.83	7.0	0.8	<0.2	1.9	9.4	1.22	0.30	0.29	47	0.16	0.072
17GB0564	Sediment Pulp	11.49	10.54	118.08	141.3	182	11.9	71.8	>10000	3.54	5.1	0.9	<0.2	0.5	9.3	0.85	0.24	0.28	45	0.12	0.085
17GB0565	Sediment Pulp	0.82	14.99	38.42	228.3	262	11.9	10.9	2330	1.34	1.6	0.9	<0.2	<0.1	62.1	3.84	0.26	0.18	29	1.07	0.143
17GB0566	Sediment Pulp	0.76	13.71	36.36	223.2	283	11.2	10.8	2399	1.35	1.9	0.8	<0.2	<0.1	58.7	3.55	0.27	0.17	28	1.02	0.138
17GB0567	Sediment Pulp	0.93	18.69	102.36	174.7	217	17.9	15.6	7100	2.48	3.8	0.9	<0.2	<0.1	38.3	2.62	0.41	0.32	46	0.64	0.155
17GB0570	Sediment Pulp	2.39	12.63	64.19	296.3	238	15.5	31.5	8766	2.23	5.4	0.6	<0.2	<0.1	59.9	6.57	0.35	0.28	50	0.97	0.158
17GB0570C	Sediment Pulp	0.57	21.26	18.80	49.9	1688	31.2	10.9	325	2.02	91.2	1.3	3.5	3.1	20.2	0.12	0.54	0.35	34	0.50	0.047
17GB0577	Sediment Pulp	1.15	17.94	53.12	239.5	203	14.9	11.3	2218	1.74	2.1	1.4	<0.2	<0.1	61.4	3.84	0.34	0.16	35	1.21	0.115
17GB0579	Sediment Pulp	4.27	32.72	285.27	208.1	253	16.2	15.5	8735	2.78	10.5	3.3	0.7	0.2	29.4	6.45	0.69	0.41	65	0.67	0.162
17GB0580	Sediment Pulp	0.84	21.95	81.45	358.9	167	17.1	9.7	2233	1.27	1.4	0.9	<0.2	<0.1	51.9	8.12	0.42	0.15	23	0.81	0.113
17GB0581	Sediment Pulp	0.87	20.55	113.40	241.8	250	11.0	8.1	1238	0.73	<0.1	1.1	<0.2	<0.1	43.5	5.17	0.34	0.16	14	0.64	0.144
17GB0582	Sediment Pulp	11.90	15.34	120.19	99.2	400	6.1	6.0	581	0.67	1.8	1.1	0.2	<0.1	11.1	1.26	0.36	0.23	14	0.15	0.150
17GB0583	Sediment Pulp	37.49	12.25	106.57	94.2	562	4.6	11.2	5981	2.37	3.7	1.0	0.6	0.2	2.8	0.49	0.46	0.31	23	0.04	0.196
17GB0584	Sediment Pulp	3.26	15.65	86.60	53.6	293	5.2	5.4	1852	0.79	0.9	1.5	0.5	<0.1	8.4	1.12	1.16	0.31	14	0.11	0.151
17GB0585	Sediment Pulp	13.24	18.94	216.64	267.0	338	8.2	6.4	1378	1.13	2.3	0.9	0.2	<0.1	11.2	4.14	0.35	0.25	19	0.19	0.133
17GB0586	Sediment Pulp	14.84	18.42	221.52	259.4	348	9.2	8.0	2008	1.37	3.4	0.9	6.4	<0.1	10.3	3.86	0.38	0.27	22	0.17	0.127
17GB0598	Sediment Pulp	2.79	16.88	68.82	136.1	181	10.9	20.5	4253	1.58	1.7	0.5	0.4	<0.1	23.8	2.85	0.32	0.21	31	0.21	0.122
17GB0600	Sediment Pulp	0.93	15.64	57.00	177.6	212	10.8	11.8	1616	1.33	1.7	0.8	<0.2	<0.1	48.8	2.97	0.23	0.19	30	0.54	0.104
17GB0601	Sediment Pulp	1.26	13.94	41.35	273.3	128	14.2	12.7	1916	2.20	2.8	0.9	<0.2	0.5	29.5	2.90	0.19	0.14	38	0.41	0.063
17GB0602	Sediment Pulp	1.36	12.77	40.61	262.5	114	15.0	13.3	2121	2.21	2.9	0.8	<0.2	0.6	27.5	2.85	0.18	0.13	38	0.40	0.058
17GB0610	Sediment Pulp	1.35	12.72	35.20	220.3	178	15.5	13.2	>10000	2.00	7.3	4.9	0.3	0.3	70.4	2.12	0.30	0.24	23	1.36	0.177
17GB0613	Sediment Pulp	1.54	13.23	60.84	175.6	653	10.7	13.0	1645	0.87	1.5	0.8	<0.2	<0.1	51.6	4.31	0.25	0.16	15	0.81	0.115
17GB0619	Sediment Pulp	5.78	19.05	218.22	277.5	309	11.2	22.5	4865	1.18	5.7	2.3	<0.2	0.2	20.8	2.31	0.32	0.20	20	0.37	0.121
17GB0620	Sediment Pulp	5.89	21.32	246.16	183.2	273	9.5	8.6	391	0.70	4.2	3.1	0.7	<0.1	16.4	1.42	0.35	0.20	17	0.28	0.135

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CERTIFICATE OF ANALYSIS VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
	Unit	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
	MDL	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
17GB0544	Sediment Pulp	69.1	19.2	0.34	47.9	0.077	<20	3.14	0.007	0.06	0.1	2.8	0.27	0.13	313	3.5	0.02	10.3
17GB0546	Sediment Pulp	111.2	24.1	0.12	130.1	0.011	<20	1.91	0.012	0.03	0.4	1.5	0.34	0.26	240	5.3	0.02	3.9
17GB0556	Sediment Pulp	142.1	21.5	0.14	99.5	0.027	<20	2.68	0.006	0.06	0.1	1.5	1.55	0.15	251	6.5	<0.02	11.8
17GB0558	Sediment Pulp	40.1	17.6	0.24	61.4	0.028	<20	2.26	0.007	0.05	<0.1	1.8	0.37	0.16	153	2.7	<0.02	5.3
17GB0561	Sediment Pulp	47.2	11.1	0.05	36.3	0.014	<20	3.34	0.006	0.03	<0.1	1.5	0.37	0.23	398	5.3	<0.02	5.7
17GB0562	Sediment Pulp	41.3	7.7	0.04	38.6	0.008	<20	2.70	0.005	0.02	0.1	0.4	0.22	0.39	304	4.5	<0.02	6.0
17GB0563	Sediment Pulp	38.8	22.3	0.32	57.3	0.057	<20	2.34	0.008	0.06	<0.1	2.9	0.69	0.08	161	2.2	0.04	10.7
17GB0564	Sediment Pulp	31.8	18.7	0.19	72.4	0.027	<20	2.27	0.009	0.07	<0.1	1.9	0.72	0.12	202	2.7	0.02	9.5
17GB0565	Sediment Pulp	31.8	16.6	0.23	117.7	0.034	<20	1.27	0.011	0.05	<0.1	1.2	0.24	0.22	176	3.2	<0.02	3.7
17GB0566	Sediment Pulp	30.6	15.3	0.22	113.7	0.032	<20	1.25	0.010	0.05	<0.1	1.1	0.23	0.21	176	3.1	<0.02	3.6
17GB0567	Sediment Pulp	24.0	21.6	0.30	134.4	0.048	<20	1.98	0.006	0.06	<0.1	2.3	0.42	0.16	262	3.1	0.04	6.5
17GB0570	Sediment Pulp	26.6	17.2	0.24	205.0	0.043	<20	1.14	0.010	0.05	<0.1	1.7	0.68	0.22	226	3.2	<0.02	4.0
17GB0570C	Sediment Pulp	16.1	61.8	0.60	43.5	0.067	<20	1.10	0.022	0.09	0.2	3.9	0.07	<0.02	114	0.1	<0.02	4.0
17GB0577	Sediment Pulp	42.6	19.4	0.37	130.0	0.062	<20	1.40	0.013	0.06	<0.1	2.3	0.28	0.17	141	3.0	<0.02	4.2
17GB0579	Sediment Pulp	100.4	31.2	0.33	140.8	0.105	<20	1.77	0.006	0.07	<0.1	4.2	1.68	0.16	194	3.4	0.04	8.3
17GB0580	Sediment Pulp	71.8	18.9	0.28	145.9	0.045	<20	1.59	0.010	0.05	<0.1	1.6	0.53	0.18	134	5.2	<0.02	3.4
17GB0581	Sediment Pulp	89.4	16.5	0.17	128.2	0.013	<20	1.62	0.009	0.05	<0.1	0.6	0.46	0.31	183	5.3	<0.02	2.7
17GB0582	Sediment Pulp	262.3	10.4	0.11	67.1	0.008	<20	1.85	0.006	0.04	0.1	0.4	0.84	0.37	219	5.7	<0.02	4.1
17GB0583	Sediment Pulp	80.1	12.3	0.09	22.7	0.019	<20	3.42	0.002	0.05	<0.1	0.8	0.70	0.19	378	6.5	0.03	8.8
17GB0584	Sediment Pulp	167.7	9.4	0.08	50.9	0.014	<20	2.06	0.005	0.05	<0.1	0.8	0.65	0.22	285	6.8	<0.02	3.6
17GB0585	Sediment Pulp	176.7	13.2	0.13	65.3	0.022	<20	2.46	0.005	0.03	<0.1	0.9	0.76	0.34	294	5.8	<0.02	5.2
17GB0586	Sediment Pulp	171.1	14.5	0.16	60.9	0.026	<20	2.49	0.005	0.03	<0.1	1.1	0.86	0.31	291	5.3	<0.02	5.7
17GB0598	Sediment Pulp	23.7	15.6	0.13	158.0	0.029	<20	1.43	0.011	0.11	<0.1	1.0	0.22	0.20	228	3.3	<0.02	3.6
17GB0600	Sediment Pulp	26.1	20.8	0.22	172.5	0.031	<20	1.72	0.009	0.05	0.1	1.1	0.14	0.17	167	3.4	<0.02	3.5
17GB0601	Sediment Pulp	16.4	20.7	0.40	183.0	0.082	<20	1.35	0.009	0.05	0.1	2.4	0.14	0.09	101	1.3	<0.02	4.5
17GB0602	Sediment Pulp	15.8	20.2	0.40	176.4	0.083	<20	1.32	0.009	0.04	0.2	2.3	0.13	0.07	75	1.1	<0.02	4.3
17GB0610	Sediment Pulp	13.0	18.7	0.17	660.8	0.006	<20	1.25	0.006	0.04	<0.1	1.8	0.18	0.24	326	3.1	0.03	2.9
17GB0613	Sediment Pulp	20.4	17.7	0.19	324.2	0.019	<20	1.02	0.008	0.04	<0.1	1.1	0.15	0.30	210	3.0	<0.02	2.7
17GB0619	Sediment Pulp	70.1	21.5	0.14	111.8	0.020	<20	3.49	0.006	0.05	0.3	2.2	0.96	0.20	239	6.8	<0.02	3.6
17GB0620	Sediment Pulp	90.6	25.6	0.14	84.6	0.012	<20	3.09	0.004	0.04	0.2	1.0	0.64	0.29	191	7.9	<0.02	3.3

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	Analyte	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
	Unit	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
	MDL	0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
17GB0621	Sediment Pulp	0.51	12.88	35.47	64.4	288	7.1	4.2	997	0.33	<0.1	0.6	<0.2	<0.1	39.8	2.06	0.20	0.15	9	0.73	0.109
17GB0622	Sediment Pulp	1.55	17.35	46.46	263.6	310	24.4	25.5	9903	3.36	5.0	1.1	<0.2	0.1	54.8	2.64	0.28	0.19	59	0.97	0.155
17GB0623	Sediment Pulp	1.42	15.81	44.22	244.1	288	25.0	23.3	9458	3.27	4.9	1.0	<0.2	0.1	49.5	2.56	0.25	0.19	57	0.88	0.142
17GB0631	Sediment Pulp	3.50	28.43	83.93	254.5	162	16.1	13.1	1273	4.03	8.6	2.9	<0.2	1.3	21.2	3.00	0.33	0.25	37	0.41	0.116
17GB0632	Sediment Pulp	6.41	29.67	126.73	507.5	186	18.7	31.5	8445	3.04	8.7	5.4	0.2	0.9	40.0	8.02	0.35	0.36	33	0.95	0.097
17GB0635	Sediment Pulp	6.08	23.51	74.09	205.7	159	26.3	63.5	1884	3.47	13.0	1.4	<0.2	1.5	14.7	1.70	0.34	0.26	48	0.17	0.067
17GB0635C	Sediment Pulp	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.
17GB0235C	Sediment Pulp	0.54	21.00	18.83	48.9	1709	31.0	11.1	325	1.94	91.1	1.3	6.4	3.0	20.6	0.12	0.56	0.35	34	0.50	0.045

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	Analyte	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
	Unit	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
	MDL	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
17GB0621	Sediment Pulp	22.7	13.5	0.13	174.1	0.013	<20	0.79	0.008	0.05	<0.1	0.4	0.06	0.39	141	3.1	<0.02	1.7
17GB0622	Sediment Pulp	24.1	25.4	0.42	184.1	0.057	<20	2.61	0.008	0.06	<0.1	2.2	0.40	0.21	259	2.5	0.02	6.9
17GB0623	Sediment Pulp	22.9	25.4	0.43	172.1	0.056	<20	2.53	0.008	0.06	<0.1	2.2	0.35	0.19	219	2.4	0.02	6.6
17GB0631	Sediment Pulp	39.1	21.7	0.29	157.2	0.039	<20	1.48	0.065	0.07	0.6	2.4	0.35	0.17	100	1.3	0.03	3.6
17GB0632	Sediment Pulp	63.4	16.3	0.28	207.1	0.027	<20	1.79	0.011	0.12	0.2	2.3	1.08	0.13	122	2.0	0.05	3.4
17GB0635	Sediment Pulp	20.3	19.9	0.33	64.2	0.056	<20	1.62	0.009	0.07	<0.1	3.3	1.32	0.05	90	1.2	0.02	5.1
17GB0635C	Sediment Pulp	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.	L.N.R.
17GB0235C	Sediment Pulp	15.6	61.6	0.59	42.8	0.066	<20	1.08	0.020	0.09	0.1	3.5	0.07	<0.02	119	0.3	0.02	3.9

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BUREAU VERITAS MINERAL LABORATORIES Canada

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Project: None Given
Report Date: November 29, 2017

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QUALITY CONTROL REPORT VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
	Unit	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
	MDL	0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
Pulp Duplicates																					
16GB0120	Sediment Pulp	0.41	43.95	19.69	101.7	58	24.4	16.8	969	3.45	2.6	0.7	4.1	1.4	23.6	0.31	0.15	0.12	65	0.48	0.054
REP 16GB0120	QC	0.41	44.49	19.27	98.5	51	25.5	17.1	951	3.36	2.3	0.6	3.3	1.3	23.4	0.29	0.14	0.11	65	0.47	0.057
16DB204	Sediment Pulp	0.43	18.31	41.34	193.5	49	21.5	10.9	779	2.59	19.7	2.1	1.7	1.4	65.1	1.65	0.37	0.16	47	0.38	0.066
REP 16DB204	QC	0.44	18.65	42.93	188.9	50	22.0	11.0	821	2.59	21.0	2.2	1.3	1.3	65.3	1.75	0.39	0.15	47	0.39	0.067
17GB0031	Sediment Pulp	0.58	14.20	36.10	188.3	71	16.2	9.7	813	2.06	18.5	1.4	0.3	0.7	17.2	2.09	0.55	0.13	44	0.40	0.048
REP 17GB0031	QC	0.59	14.06	36.98	196.5	72	15.9	9.7	814	2.06	19.2	1.5	1.0	0.8	17.2	2.32	0.58	0.12	48	0.41	0.050
17GB0090	Sediment Pulp	8.50	17.92	132.62	285.8	309	14.2	22.5	5803	2.57	5.8	1.0	11.5	0.4	18.1	3.09	0.45	0.21	50	0.42	0.097
REP 17GB0090	QC	8.66	18.39	135.70	289.0	315	15.0	22.5	5767	2.57	6.3	1.0	10.6	0.5	19.3	3.05	0.46	0.21	50	0.42	0.089
17GB0128A	Sediment Pulp	0.43	15.80	31.10	163.0	45	15.3	10.3	891	2.25	3.1	0.6	0.4	1.5	14.7	0.81	0.18	0.13	42	0.33	0.049
REP 17GB0128A	QC	0.42	15.80	31.39	156.4	37	15.5	10.4	907	2.30	3.4	0.6	0.3	1.4	14.8	0.81	0.19	0.12	42	0.34	0.049
17GB0195	Sediment Pulp	6.54	10.07	37.46	155.9	52	11.0	11.0	2436	2.11	3.0	1.6	0.5	1.9	11.1	1.16	0.22	0.18	42	0.25	0.039
REP 17GB0195	QC	7.06	11.00	39.66	169.4	56	11.7	11.5	2633	2.28	3.5	1.8	0.8	2.2	11.7	1.26	0.26	0.18	51	0.26	0.040
17GB0403	Sediment Pulp	0.26	12.44	15.49	44.9	28	12.5	7.5	974	1.93	2.5	0.6	0.4	1.6	10.0	0.31	0.17	0.14	27	0.16	0.032
REP 17GB0403	QC	0.26	12.43	16.48	46.1	23	12.5	7.4	989	1.89	2.5	0.6	<0.2	1.5	9.6	0.28	0.18	0.15	27	0.16	0.032
17GB0503	Sediment Pulp	4.48	17.11	121.28	215.0	67	13.5	18.6	919	2.13	6.9	2.6	0.4	2.5	16.9	3.35	0.20	0.26	36	0.33	0.043
REP 17GB0503	QC	4.42	16.53	116.63	211.1	61	12.8	18.2	884	2.20	7.2	2.6	<0.2	2.5	17.5	3.22	0.21	0.26	37	0.33	0.042
17GB0584	Sediment Pulp	3.26	15.65	86.60	53.6	293	5.2	5.4	1852	0.79	0.9	1.5	0.5	<0.1	8.4	1.12	1.16	0.31	14	0.11	0.151
REP 17GB0584	QC	3.59	15.45	89.41	53.4	315	5.3	5.6	1918	0.82	1.1	1.6	0.4	<0.1	8.7	1.18	1.21	0.31	15	0.11	0.150
Reference Materials																					
STD DS11	Standard	12.39	140.07	130.90	316.1	1677	70.1	12.0	971	2.87	42.6	2.5	45.4	6.9	66.8	2.40	7.31	11.90	46	0.97	0.070
STD DS11	Standard	11.93	150.65	133.27	320.8	1637	71.4	12.4	1006	3.03	45.7	2.5	99.3	7.3	66.9	2.47	7.35	12.82	49	1.04	0.076
STD DS11	Standard	13.88	146.65	142.80	346.1	1637	73.3	12.7	992	2.95	44.6	2.6	52.7	7.6	71.5	2.51	7.39	12.94	47	1.03	0.069
STD DS11	Standard	14.34	146.32	143.40	350.7	1641	77.8	13.9	1034	3.07	45.0	2.6	73.7	7.7	72.0	2.66	7.36	13.17	49	1.05	0.074
STD DS11	Standard	13.30	153.74	149.42	370.4	1820	76.7	13.9	1070	3.27	46.0	2.8	81.3	8.2	76.8	2.66	7.06	13.37	52	1.13	0.077
STD DS11	Standard	13.92	150.07	146.31	363.2	1527	76.5	14.0	1023	3.13	45.1	2.8	51.3	7.6	68.9	2.48	6.97	13.14	49	1.07	0.076
STD DS11	Standard	13.68	153.30	145.63	359.8	1783	77.2	14.0	1024	3.13	46.3	2.7	58.2	7.7	70.6	2.65	7.04	13.20	50	1.06	0.075
STD DS11	Standard	13.29	148.59	150.00	350.5	1782	73.2	13.0	1028	3.04	44.7	2.7	140.5	8.3	72.9	2.51	7.94	13.09	47	1.02	0.072
STD DS11	Standard	12.53	138.54	135.25	332.0	2392	69.9	12.8	972	2.91	42.4	2.4	144.4	7.3	66.3	2.44	6.85	12.35	48	0.99	0.070

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Project: None Given
Report Date: November 29, 2017

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QUALITY CONTROL REPORT VAN17002654.1

	Method	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
	Analyte	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
	Unit	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
	MDL	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
Pulp Duplicates																		
16GB0120	Sediment Pulp	12.4	28.4	0.76	67.8	0.183	<20	2.21	0.012	0.06	<0.1	3.9	0.12	0.02	179	0.7	<0.02	6.8
REP 16GB0120	QC	12.2	28.7	0.74	62.9	0.185	<20	2.15	0.011	0.06	<0.1	4.1	0.11	0.04	185	0.5	<0.02	6.8
16DB204	Sediment Pulp	27.0	23.3	0.50	109.9	0.067	<20	1.53	0.011	0.12	0.2	3.9	0.34	0.03	94	0.6	<0.02	4.6
REP 16DB204	QC	27.7	24.1	0.49	109.7	0.068	<20	1.55	0.010	0.11	0.2	3.9	0.35	0.03	90	0.6	<0.02	4.7
17GB0031	Sediment Pulp	19.5	20.3	0.43	55.4	0.073	<20	1.19	0.008	0.05	0.2	2.7	0.27	0.04	51	0.5	<0.02	4.1
REP 17GB0031	QC	21.4	20.2	0.42	54.6	0.073	<20	1.21	0.009	0.05	0.3	2.6	0.29	0.04	57	0.3	<0.02	4.0
17GB0090	Sediment Pulp	33.2	17.4	0.38	69.5	0.092	<20	1.90	0.006	0.05	<0.1	2.8	0.55	0.11	156	1.7	<0.02	5.9
REP 17GB0090	QC	35.3	18.0	0.38	71.4	0.096	<20	1.90	0.009	0.05	<0.1	2.8	0.56	0.11	168	1.7	<0.02	6.2
17GB0128A	Sediment Pulp	13.8	17.0	0.47	45.1	0.093	<20	1.10	0.008	0.07	<0.1	2.4	0.13	0.04	50	0.4	<0.02	4.0
REP 17GB0128A	QC	13.0	16.4	0.47	44.5	0.090	<20	1.11	0.009	0.06	<0.1	2.4	0.12	0.03	40	0.4	<0.02	4.0
17GB0195	Sediment Pulp	21.0	15.7	0.29	55.8	0.097	<20	0.91	0.004	0.04	0.2	1.9	0.19	0.02	28	0.4	<0.02	4.1
REP 17GB0195	QC	23.7	17.0	0.30	63.6	0.102	<20	0.97	0.005	0.04	0.2	2.1	0.19	0.03	31	0.5	<0.02	4.3
17GB0403	Sediment Pulp	13.9	14.6	0.31	60.1	0.039	<20	0.88	0.009	0.06	<0.1	2.1	0.08	<0.02	23	0.2	<0.02	2.7
REP 17GB0403	QC	11.9	13.9	0.30	58.7	0.041	<20	0.88	0.008	0.05	<0.1	2.1	0.08	<0.02	25	0.1	<0.02	2.8
17GB0503	Sediment Pulp	36.9	14.9	0.35	50.9	0.112	<20	1.05	0.006	0.04	0.1	3.1	0.86	0.04	42	0.8	0.09	5.1
REP 17GB0503	QC	35.5	14.3	0.36	50.1	0.110	<20	1.04	0.006	0.05	0.2	3.2	0.81	0.04	44	0.7	0.09	5.1
17GB0584	Sediment Pulp	167.7	9.4	0.08	50.9	0.014	<20	2.06	0.005	0.05	<0.1	0.8	0.65	0.22	285	6.8	<0.02	3.6
REP 17GB0584	QC	174.4	10.2	0.08	52.5	0.014	<20	2.08	0.004	0.05	<0.1	0.9	0.68	0.23	275	7.8	<0.02	3.5
Reference Materials																		
STD DS11	Standard	17.5	52.1	0.78	409.2	0.082	<20	1.07	0.066	0.38	2.7	3.0	4.75	0.27	243	2.0	4.30	4.4
STD DS11	Standard	17.6	54.8	0.82	409.8	0.087	<20	1.11	0.073	0.39	2.7	3.2	4.92	0.27	251	2.2	4.37	4.6
STD DS11	Standard	19.0	54.2	0.83	437.0	0.089	<20	1.10	0.071	0.40	2.6	3.0	5.05	0.27	259	2.4	4.56	4.9
STD DS11	Standard	19.4	56.1	0.84	437.2	0.091	<20	1.15	0.074	0.40	2.8	3.2	5.25	0.28	313	2.2	4.70	5.2
STD DS11	Standard	19.5	56.6	0.91	459.7	0.094	<20	1.19	0.077	0.44	2.9	3.5	5.49	0.31	264	2.3	5.03	5.2
STD DS11	Standard	20.0	55.8	0.84	470.6	0.092	<20	1.15	0.073	0.40	3.0	3.3	5.31	0.29	253	2.3	4.67	5.1
STD DS11	Standard	19.4	58.2	0.84	476.5	0.093	<20	1.13	0.074	0.40	3.1	3.1	5.30	0.28	264	2.2	4.89	4.7
STD DS11	Standard	18.6	55.3	0.82	417.7	0.090	<20	1.13	0.067	0.39	3.3	3.0	5.20	0.28	281	2.5	4.66	5.0
STD DS11	Standard	17.3	53.0	0.80	411.8	0.083	<20	1.09	0.067	0.38	3.5	3.1	4.90	0.28	270	2.1	4.58	4.7

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Project: None Given
Report Date: November 29, 2017

Page: 2 of 2 Part: 1 of 2

QUALITY CONTROL REPORT VAN17002654.1

		AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
		Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P
		ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%
		0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02	0.02	2	0.01	0.001
STD DS11	Standard	13.09	140.08	134.83	331.6	1755	72.4	13.1	983	2.94	42.1	2.4	99.8	7.8	65.5	2.44	7.51	12.35	47	1.02	0.066
STD OREAS45EA	Standard	1.39	684.48	15.22	31.4	243	365.7	50.1	409	21.08	11.4	1.9	48.3	10.6	4.0	0.03	0.23	0.29	290	0.04	0.028
STD OREAS45EA	Standard	1.39	646.07	13.80	29.0	230	374.8	48.0	394	20.10	10.7	1.8	61.8	10.1	3.7	0.02	0.28	0.29	290	0.03	0.028
STD OREAS45EA	Standard	1.49	697.21	15.74	32.2	262	382.6	54.8	453	22.42	11.6	2.0	59.0	11.9	4.1	0.03	0.22	0.31	303	0.04	0.031
STD OREAS45EA	Standard	1.54	691.29	15.72	33.3	261	392.5	54.4	421	22.35	11.8	2.0	58.6	11.2	4.2	0.03	0.27	0.29	309	0.03	0.030
STD OREAS45EA	Standard	1.37	679.13	14.64	30.7	257	382.1	49.1	402	21.02	11.0	1.8	51.0	10.4	4.1	0.02	0.21	0.38	300	0.04	0.030
STD OREAS45EA	Standard	1.52	697.18	16.33	34.5	273	401.1	57.3	459	24.33	12.3	2.1	64.0	11.8	4.3	0.03	0.30	0.31	310	0.03	0.033
STD OREAS45EA	Standard	1.38	666.77	14.52	30.5	252	380.6	51.8	410	21.11	10.5	1.9	60.3	10.6	3.8	0.04	0.30	0.28	299	0.03	0.032
STD OREAS45EA	Standard	1.44	707.09	15.37	32.1	257	383.7	52.4	420	21.79	12.0	1.9	62.4	11.2	4.1	0.02	0.26	0.29	302	0.04	0.030
STD OREAS45EA	Standard	1.42	649.37	14.78	30.1	250	353.5	49.6	383	19.73	11.1	1.9	56.0	10.7	3.9	0.02	0.27	0.28	283	0.04	0.028
STD OREAS45EA	Standard	1.76	683.86	15.66	35.6	298	395.0	53.8	447	24.03	10.5	1.9	54.6	11.3	4.2	0.03	0.34	0.21	301	0.03	0.031
STD OREAS45EA Expected		1.6	709	14.3	31.4	260	381	52	400	23.51	10.3	1.73	53	10.7	3.5	0.03	0.32	0.26	303	0.036	0.029
STD DS11 Expected		13.9	149	138	345	1710	77.7	14.2	1055	3.1	42.8	2.59	79	7.65	67.3	2.37	7.2	12.2	50	1.063	0.0701
BLK	Blank	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.1	3	<0.01	<0.1	<0.1	<0.2	<0.1	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001
BLK	Blank	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.1	<1	<0.01	<0.1	<0.1	<0.2	<0.1	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001
BLK	Blank	<0.01	<0.01	0.02	0.1	<2	<0.1	<0.1	1	<0.01	<0.1	<0.1	<0.2	<0.1	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001
BLK	Blank	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.1	3	<0.01	<0.1	<0.1	<0.2	<0.1	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001
BLK	Blank	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.1	<1	<0.01	<0.1	<0.1	<0.2	<0.1	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001
BLK	Blank	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.1	5	<0.01	<0.1	<0.1	<0.2	<0.1	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001
BLK	Blank	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.1	<1	<0.01	<0.1	<0.1	<0.2	<0.1	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001
BLK	Blank	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.1	<1	<0.01	<0.1	<0.1	<0.2	<0.1	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001
BLK	Blank	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.1	1	<0.01	<0.1	<0.1	<0.2	<0.1	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001
BLK	Blank	<0.01	0.48	0.02	0.1	4	<0.1	<0.1	<1	<0.01	<0.1	<0.1	<0.2	<0.1	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001

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BUREAU VERITAS MINERAL LABORATORIES Canada

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Bureau Veritas Commodities Canada Ltd.
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Client: Nova Scotia Dept. of Natural Resources
1701 Hollis St.
P.O. Box 698
Halifax Nova Scotia B3J 2T9 Canada

Project: None Given
Report Date: November 29, 2017

QUALITY CONTROL REPORT VAN17002654.1

		AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250	AQ250
		La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga
		ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	%	ppb	ppm	ppm	ppm
		0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	0.02	5	0.1	0.02	0.1
STD DS11	Standard	17.2	57.4	0.80	400.4	0.088	<20	1.11	0.073	0.39	2.4	3.0	4.94	0.28	241	2.3	4.63	4.9
STD OREAS45EA	Standard	7.2	820.9	0.10	145.3	0.095	<20	3.26	0.015	0.05	<0.1	77.1	0.07	0.03	16	1.1	0.07	12.2
STD OREAS45EA	Standard	7.0	764.9	0.09	139.1	0.091	<20	3.06	0.023	0.05	<0.1	71.6	0.07	0.04	13	0.9	0.07	11.7
STD OREAS45EA	Standard	7.7	839.9	0.11	153.9	0.100	<20	3.42	0.015	0.06	<0.1	81.7	0.07	0.04	15	1.1	0.10	13.8
STD OREAS45EA	Standard	7.6	820.0	0.11	152.5	0.102	<20	3.41	0.023	0.06	<0.1	79.8	0.07	0.04	11	1.1	0.09	13.6
STD OREAS45EA	Standard	7.2	786.1	0.11	146.4	0.093	<20	3.33	0.015	0.06	<0.1	80.2	0.05	0.04	12	1.2	0.08	12.8
STD OREAS45EA	Standard	8.1	880.0	0.11	167.8	0.110	<20	3.38	0.020	0.06	<0.1	89.0	0.08	0.04	14	1.1	0.09	11.4
STD OREAS45EA	Standard	7.1	768.8	0.10	147.6	0.097	<20	3.20	0.022	0.05	<0.1	76.5	0.06	0.04	14	0.9	0.08	12.4
STD OREAS45EA	Standard	7.3	837.7	0.10	152.5	0.099	<20	3.44	0.014	0.06	<0.1	80.3	0.07	0.04	9	1.3	0.09	12.5
STD OREAS45EA	Standard	7.3	777.7	0.10	142.8	0.095	<20	3.05	0.013	0.05	<0.1	75.9	0.07	0.03	12	1.0	0.08	12.1
STD OREAS45EA	Standard	7.6	934.3	0.10	162.8	0.100	<20	3.35	0.020	0.06	<0.1	78.9	0.06	0.04	21	1.8	0.15	13.5
STD OREAS45EA Expected		7.06	849	0.095	148	0.0984		3.13	0.02	0.053		78	0.072	0.036	10	0.78	0.07	12.4
STD DS11 Expected		18.6	61.5	0.85	417	0.0976		1.129	0.0694	0.4	2.9	3.1	4.9	0.2835	260	2.2	4.56	4.7
BLK	Blank	<0.5	<0.5	<0.01	<0.5	<0.001	<20	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.02	<5	<0.1	<0.02	<0.1
BLK	Blank	<0.5	<0.5	<0.01	<0.5	<0.001	<20	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.02	<5	<0.1	<0.02	<0.1
BLK	Blank	<0.5	<0.5	<0.01	<0.5	<0.001	<20	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.02	<5	<0.1	<0.02	<0.1
BLK	Blank	<0.5	<0.5	<0.01	<0.5	<0.001	<20	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.02	<5	<0.1	<0.02	<0.1
BLK	Blank	<0.5	<0.5	<0.01	<0.5	<0.001	<20	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.02	<5	<0.1	<0.02	<0.1
BLK	Blank	<0.5	<0.5	<0.01	<0.5	<0.001	<20	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.02	<5	<0.1	<0.02	<0.1
BLK	Blank	<0.5	<0.5	<0.01	<0.5	<0.001	<20	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.02	<5	<0.1	<0.02	<0.1
BLK	Blank	<0.5	<0.5	<0.01	<0.5	<0.001	<20	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.02	<5	<0.1	<0.02	<0.1
BLK	Blank	<0.5	<0.5	<0.01	<0.5	<0.001	<20	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.02	<5	<0.1	<0.02	<0.1
BLK	Blank	<0.5	<0.5	<0.01	<0.5	<0.001	<20	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.02	<5	<0.1	<0.02	<0.1

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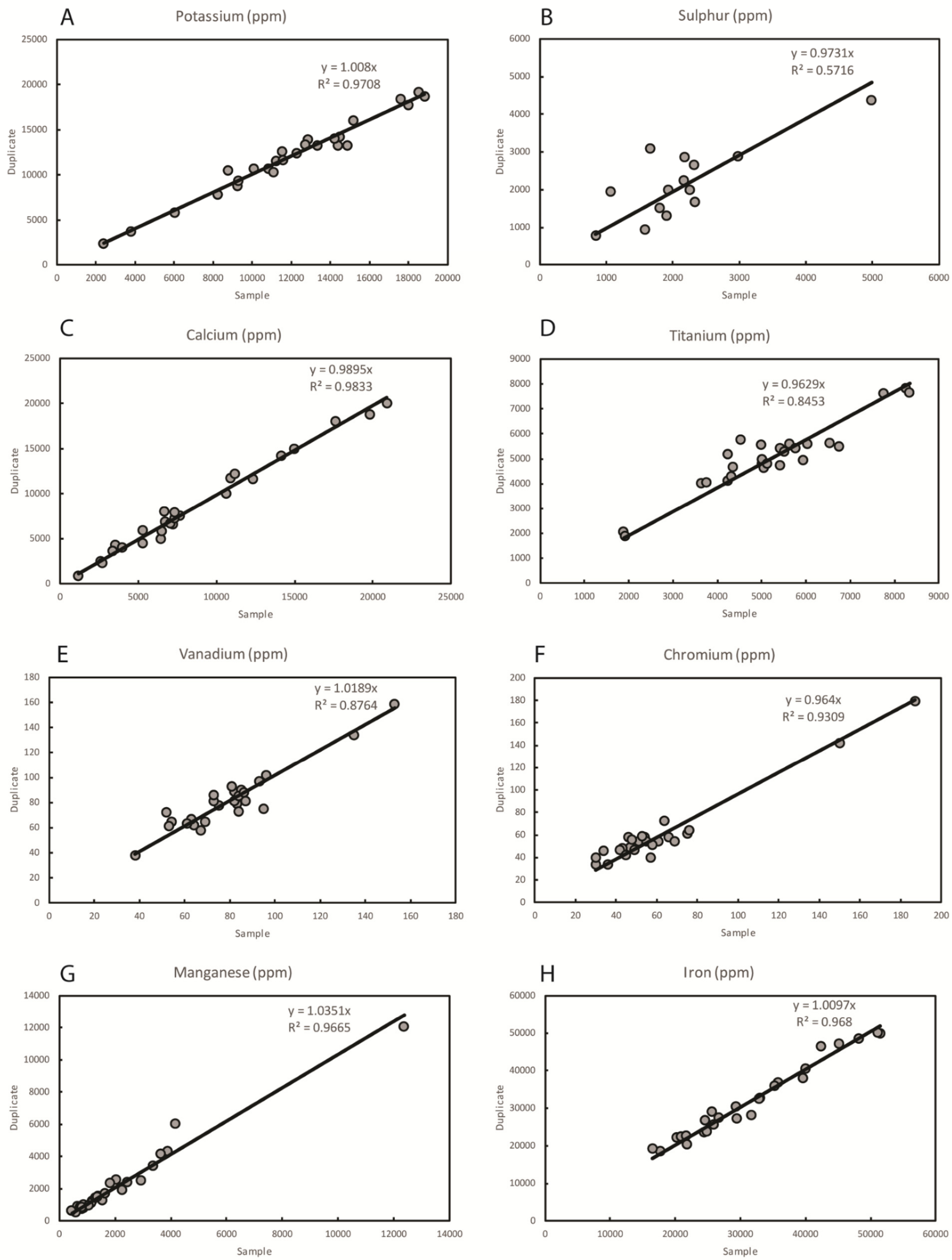
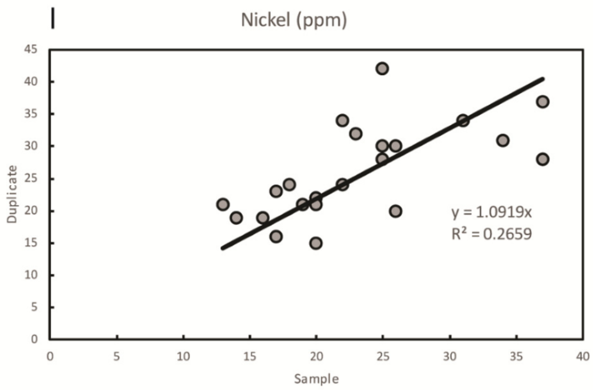
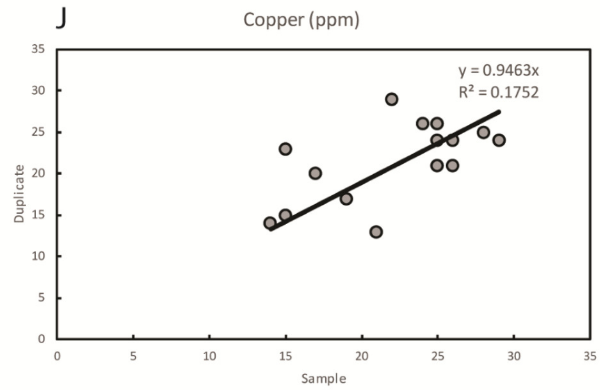
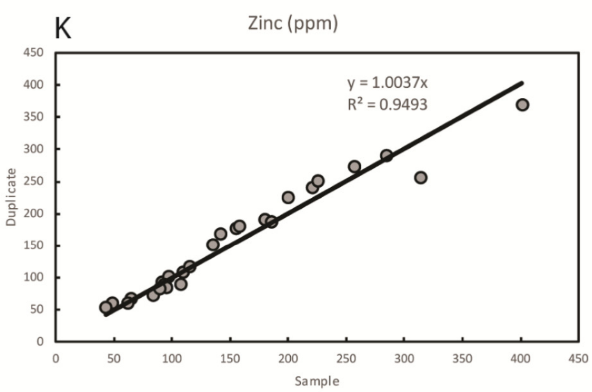
Appendix C. QA/QC Charts

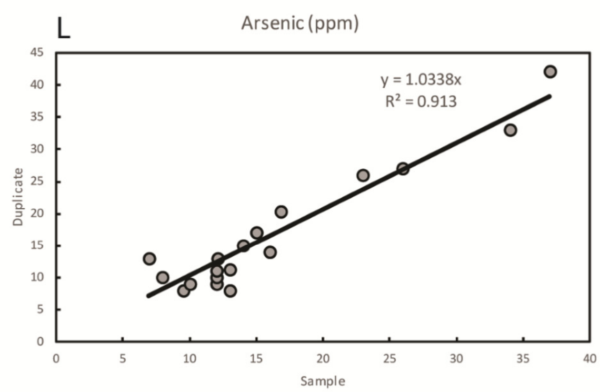
Figure C1. Duplicate sample cross-plots of XRF analyses demonstrating the reproducibility by pXRF for (A) potassium, (B) sulphur, (C) calcium, (D) titanium, (E) vanadium, (F) chromium, (G) manganese, (H) iron, (I) nickel, (J) copper, (K) zinc, (L) arsenic, (M) rubidium, (N) strontium, (O) yttrium, (P) zirconium, (Q) niobium, (R) molybdenum, (S) barium, and (T) lead. In all diagrams, the original sample is on the x-axis and the duplicate on the y-axis.

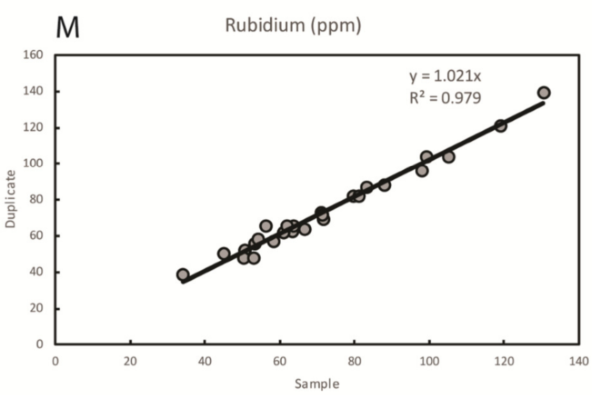

A
Potassium (ppm)
y = 1.008x
R² = 0.9708
Duplicate
Sample
B
Sulphur (ppm)
y = 0.9731x
R² = 0.5716
Duplicate
Sample
C
Calcium (ppm)
y = 0.9895x
R² = 0.9833
Duplicate
Sample
D
Titanium (ppm)
y = 0.9629x
R² = 0.8453
Duplicate
Sample
E
Vanadium (ppm)
y = 1.0189x
R² = 0.8764
Duplicate
Sample
F
Chromium (ppm)
y = 0.964x
R² = 0.9309
Duplicate
Sample
G
Manganese (ppm)
y = 1.0351x
R² = 0.9665
Duplicate
Sample
H
Iron (ppm)
y = 1.0097x
R² = 0.968
Duplicate
Sample

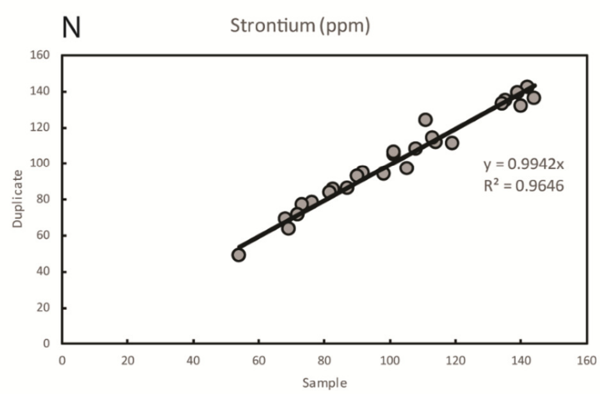

I
Nickel (ppm)
y = 1.0919x
R² = 0.2659
Duplicate
Sample

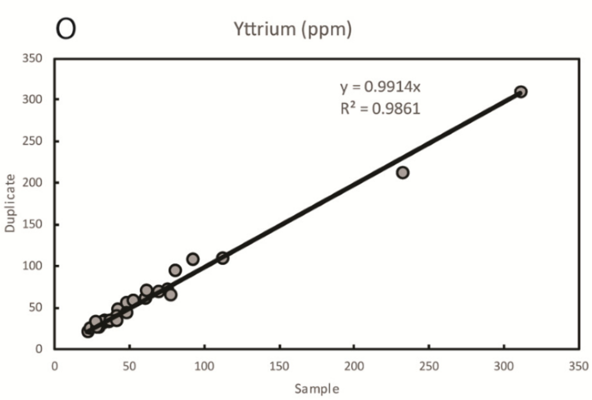

J
Copper (ppm)
y = 0.9463x
R² = 0.1752
Duplicate
Sample

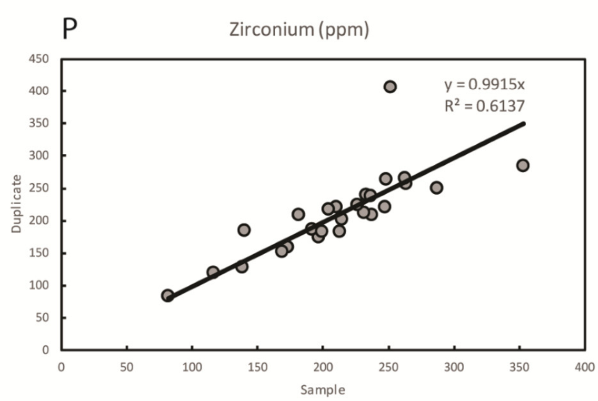

K
Zinc (ppm)
y = 1.0037x
R² = 0.9493
Duplicate
Sample


L
Arsenic (ppm)
y = 1.0338x
R² = 0.913
Duplicate
Sample


M
Rubidium (ppm)
y = 1.021x
R² = 0.979
Duplicate
Sample


N
Strontium (ppm)
y = 0.9942x
R² = 0.9646
Duplicate
Sample


O
Yttrium (ppm)
y = 0.9914x
R² = 0.9861
Duplicate
Sample


P
Zirconium (ppm)
y = 0.9915x
R² = 0.6137
Duplicate
Sample

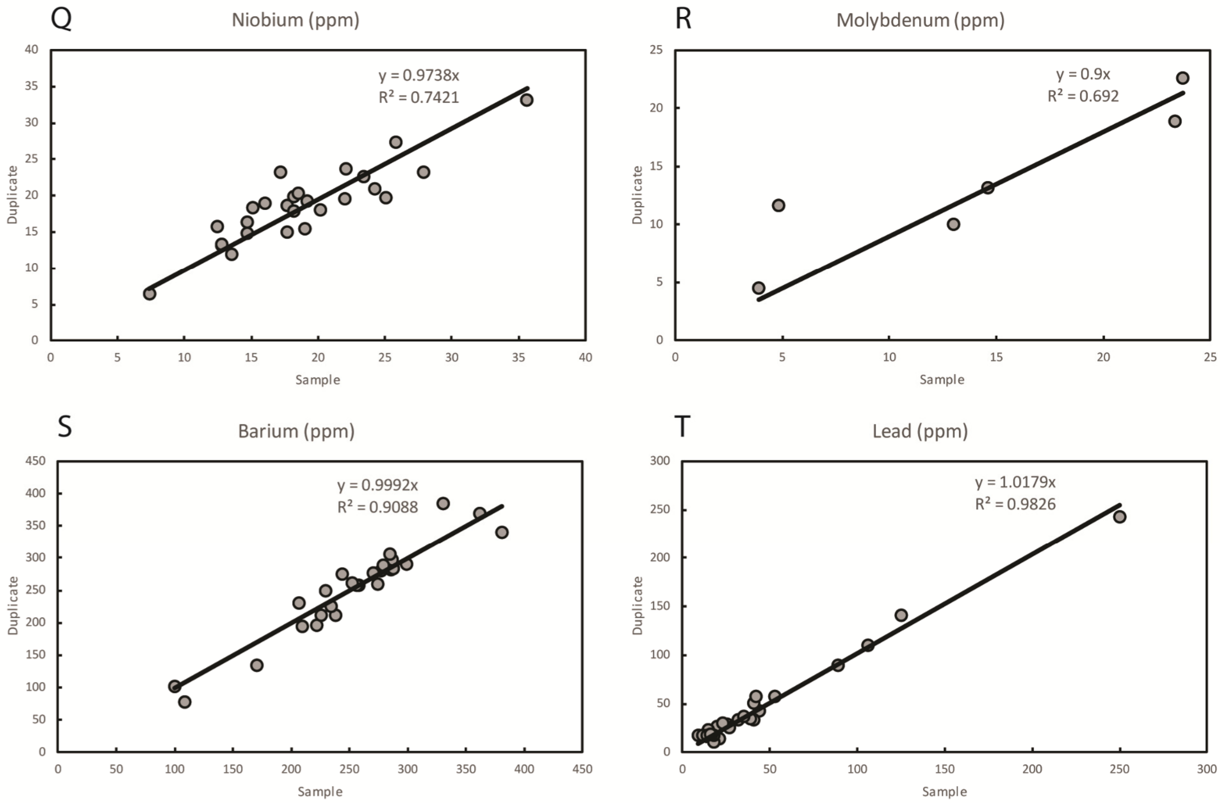
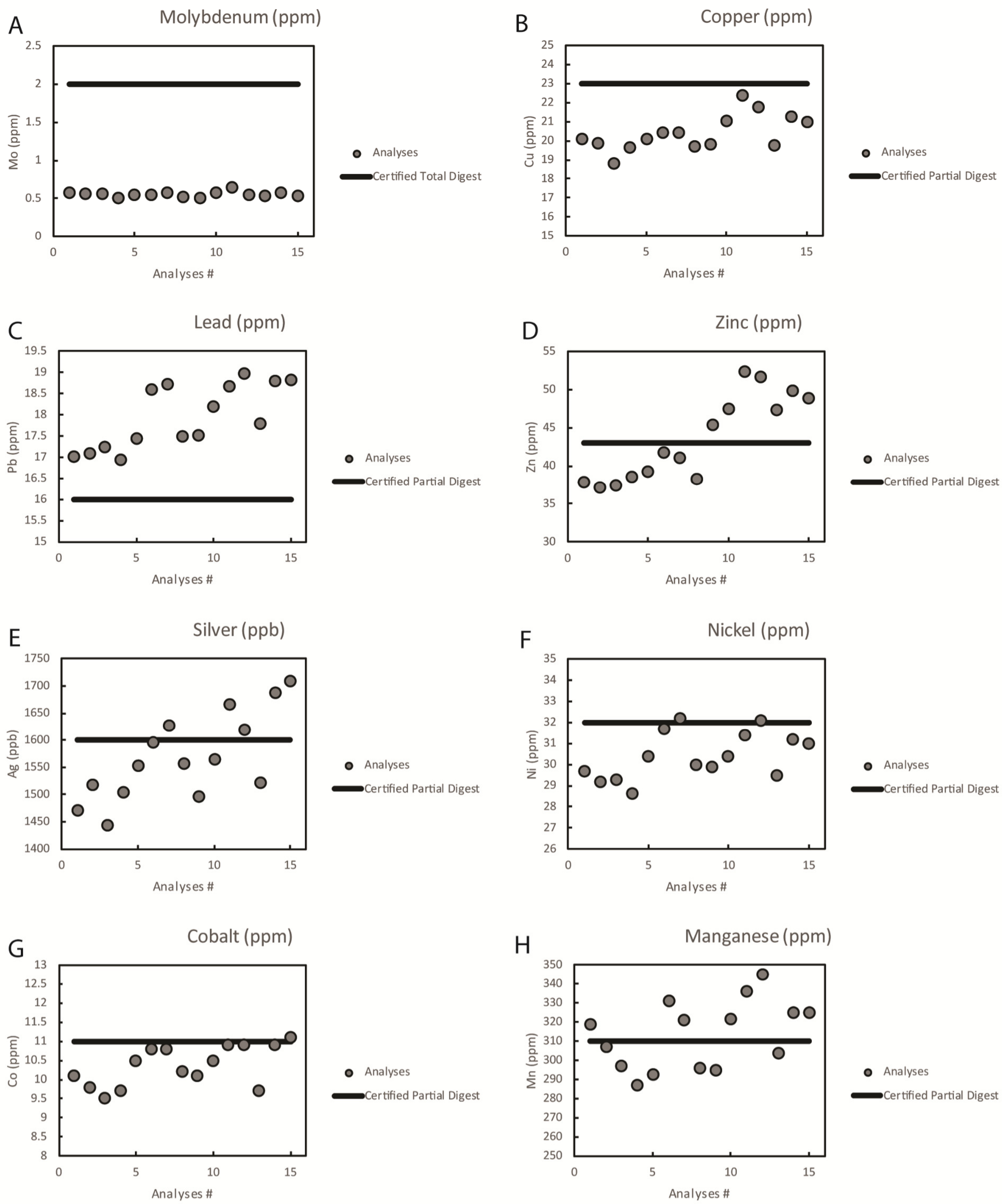
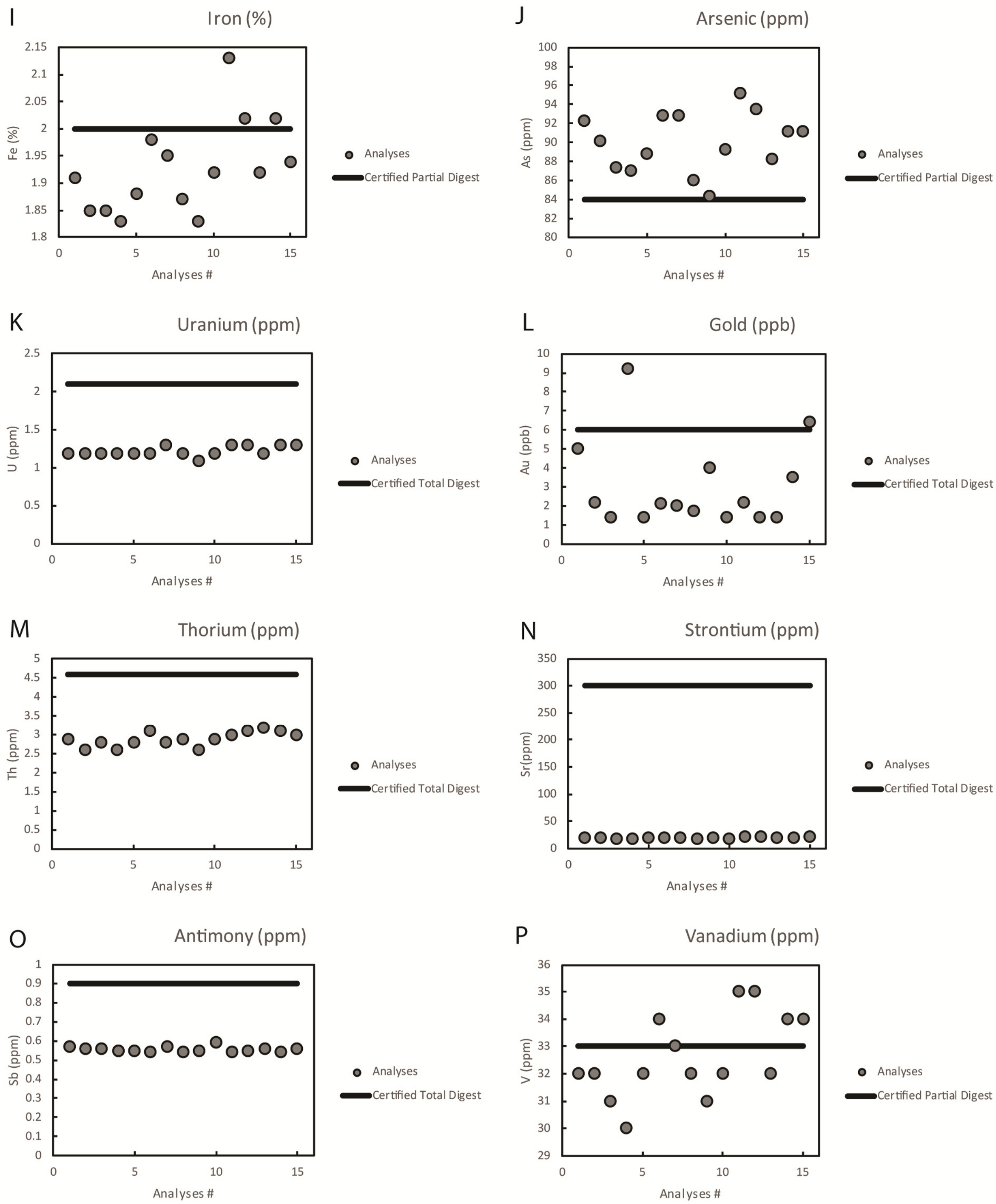
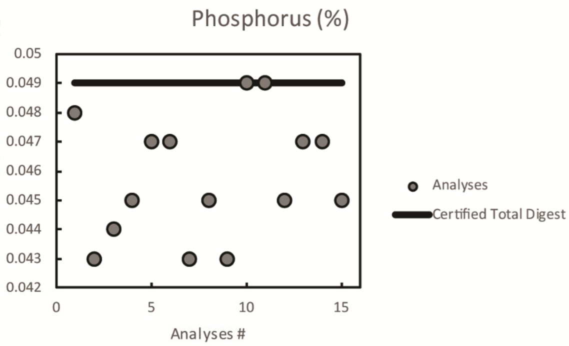

Q
Niobium (ppm)
y = 0.9738x
R² = 0.7421
Duplicate
Sample
R
Molybdenum (ppm)
y = 0.9x
R² = 0.692
Duplicate
Sample
S
Barium (ppm)
y = 0.9992x
R² = 0.9088
Duplicate
Sample
T
Lead (ppm)
y = 1.0179x
R² = 0.9826
Duplicate
Sample

Figure C2. Reproducibility charts for 15 repeat analyses of CANMET standard reference material Till-3 analyzed by aqua regia ICP-MS. Plots show the aliquots analyzed as unknowns in each plot as circles, whereas the solid line is the certified value (values from Lynch, 1996). Whenever possible, the certified values for partial digestion were used to maximize the match to the data from aqua regia digestion; however, for some elements the total digestion certified values were used. Elements that have not been plotted either lack certified values for Till-3 or had too many aliquots that were non-detectable. (A) Molybdenum, (B) copper, (C) lead, (D) zinc, (E) silver, (F) nickel, (G) cobalt, (H) manganese, (I) iron, (J) arsenic, (K) uranium, (L) gold, (M) thorium, (N) strontium, (O) antimony, (P) vanadium, (Q) phosphorus, (R) lanthanum, (S) chromium, (T) barium, (U) titanium, (V) scandium, (W) mercury.

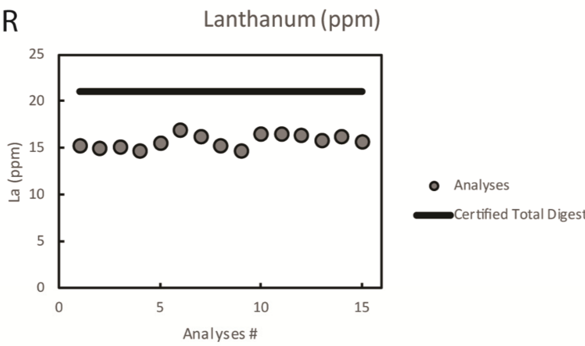

A
Molybdenum (ppm)
Mo (ppm)
Analyses #
Analyses
Certified Total Digest
B
Copper (ppm)
Cu (ppm)
Analyses #
Analyses
Certified Partial Digest
C
Lead (ppm)
Pb (ppm)
Analyses #
Analyses
Certified Partial Digest
D
Zinc (ppm)
Zn (ppm)
Analyses #
Analyses
Certified Partial Digest
E
Silver (ppb)
Ag (ppb)
Analyses #
Analyses
Certified Partial Digest
F
Nickel (ppm)
Ni (ppm)
Analyses #
Analyses
Certified Partial Digest
G
Cobalt (ppm)
Co (ppm)
Analyses #
Analyses
Certified Partial Digest
H
Manganese (ppm)
Mn (ppm)
Analyses #
Analyses
Certified Partial Digest


I
Iron (%)
Fe (%)
Analyses #
Analyses
Certified Partial Digest
J
Arsenic (ppm)
As (ppm)
Analyses #
Analyses
Certified Partial Digest
K
Uranium (ppm)
U (ppm)
Analyses #
Analyses
Certified Total Digest
L
Gold (ppb)
Au (ppb)
Analyses #
Analyses
Certified Total Digest
M
Thorium (ppm)
Th (ppm)
Analyses #
Analyses
Certified Total Digest
N
Strontium (ppm)
Sr(ppm)
Analyses #
Analyses
Certified Total Digest
O
Antimony (ppm)
Sb (ppm)
Analyses #
Analyses
Certified Total Digest
P
Vanadium (ppm)
V (ppm)
Analyses #
Analyses
Certified Partial Digest

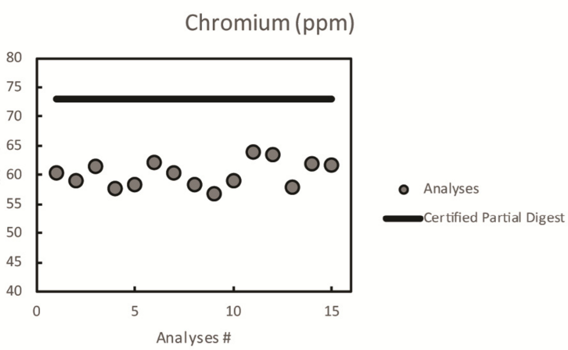
Q


Phosphorus (%)
P (%)
Analyses #
Analyses
Certified Total Digest

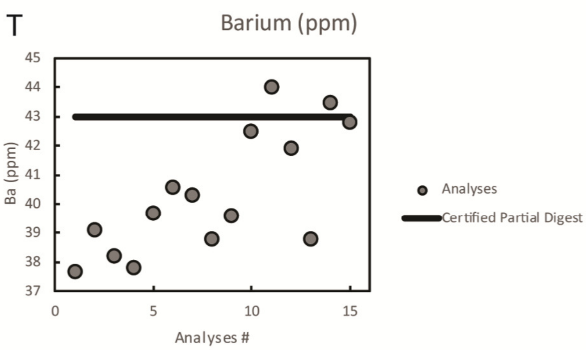
R


Lanthanum (ppm)
La (ppm)
Analyses #
Analyses
Certified Total Digest

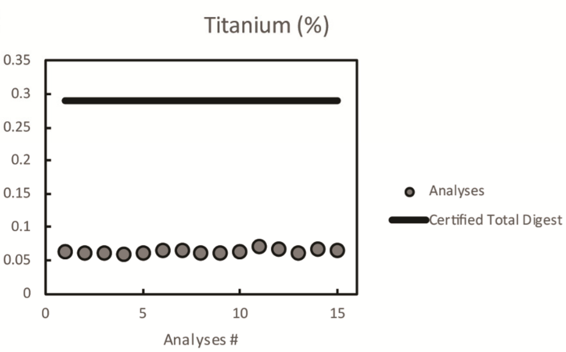
S


Chromium (ppm)
Cr (ppm)
Analyses #
Analyses
Certified Partial Digest

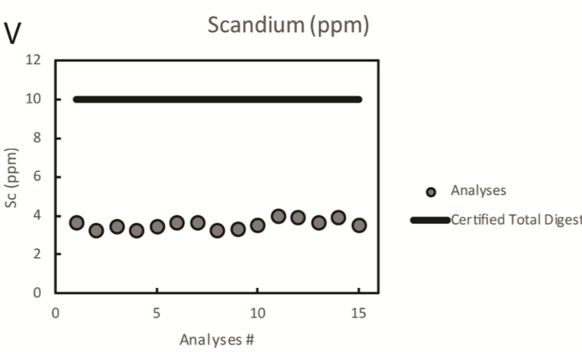
T


Barium (ppm)
Ba (ppm)
Analyses #
Analyses
Certified Partial Digest

U


Titanium (%)
Ti (%)
Analyses #
Analyses
Certified Total Digest

V


Scandium (ppm)
Sc (ppm)
Analyses #
Analyses
Certified Total Digest

W

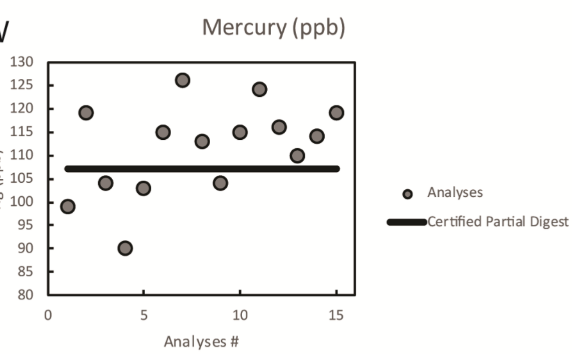
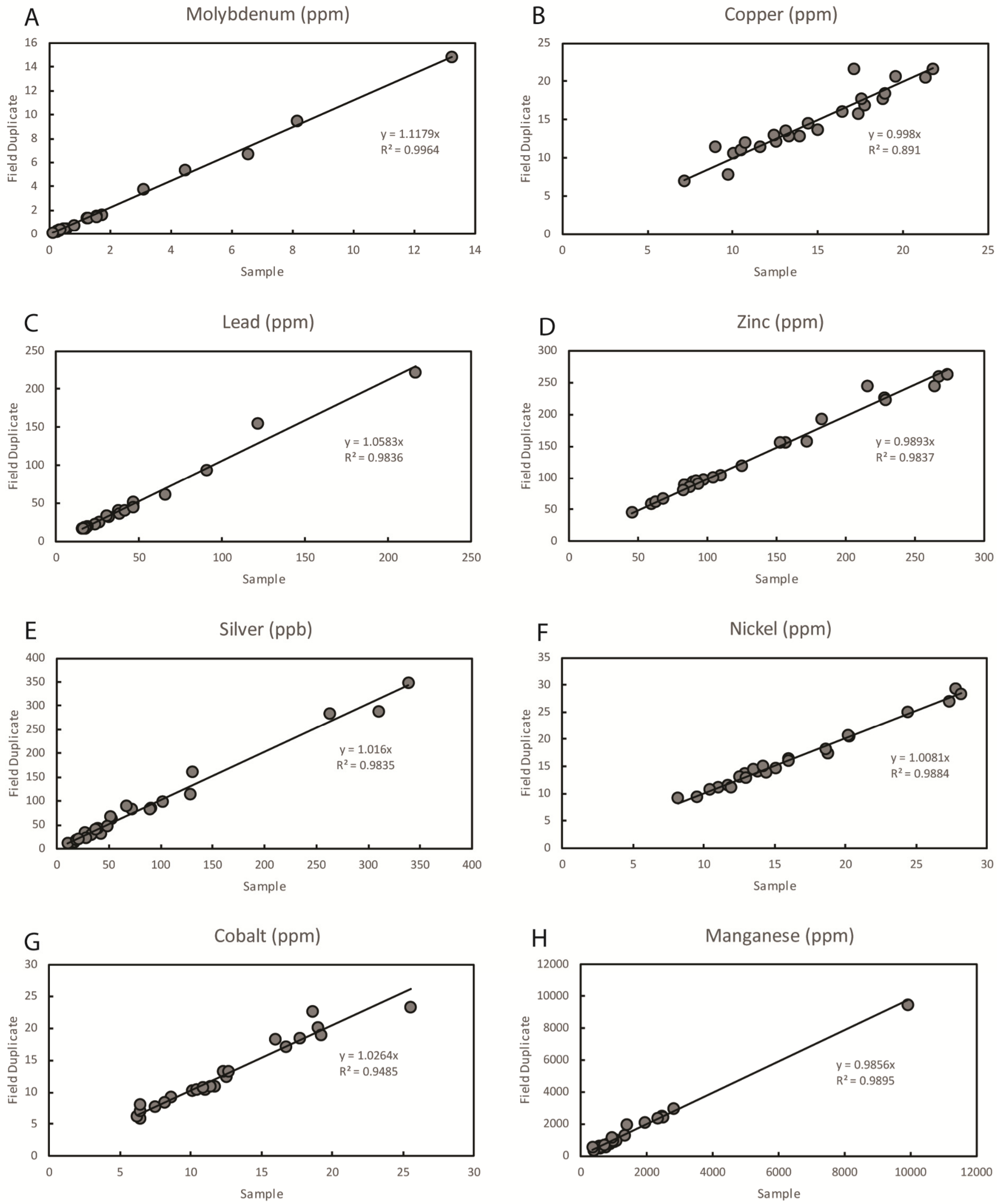
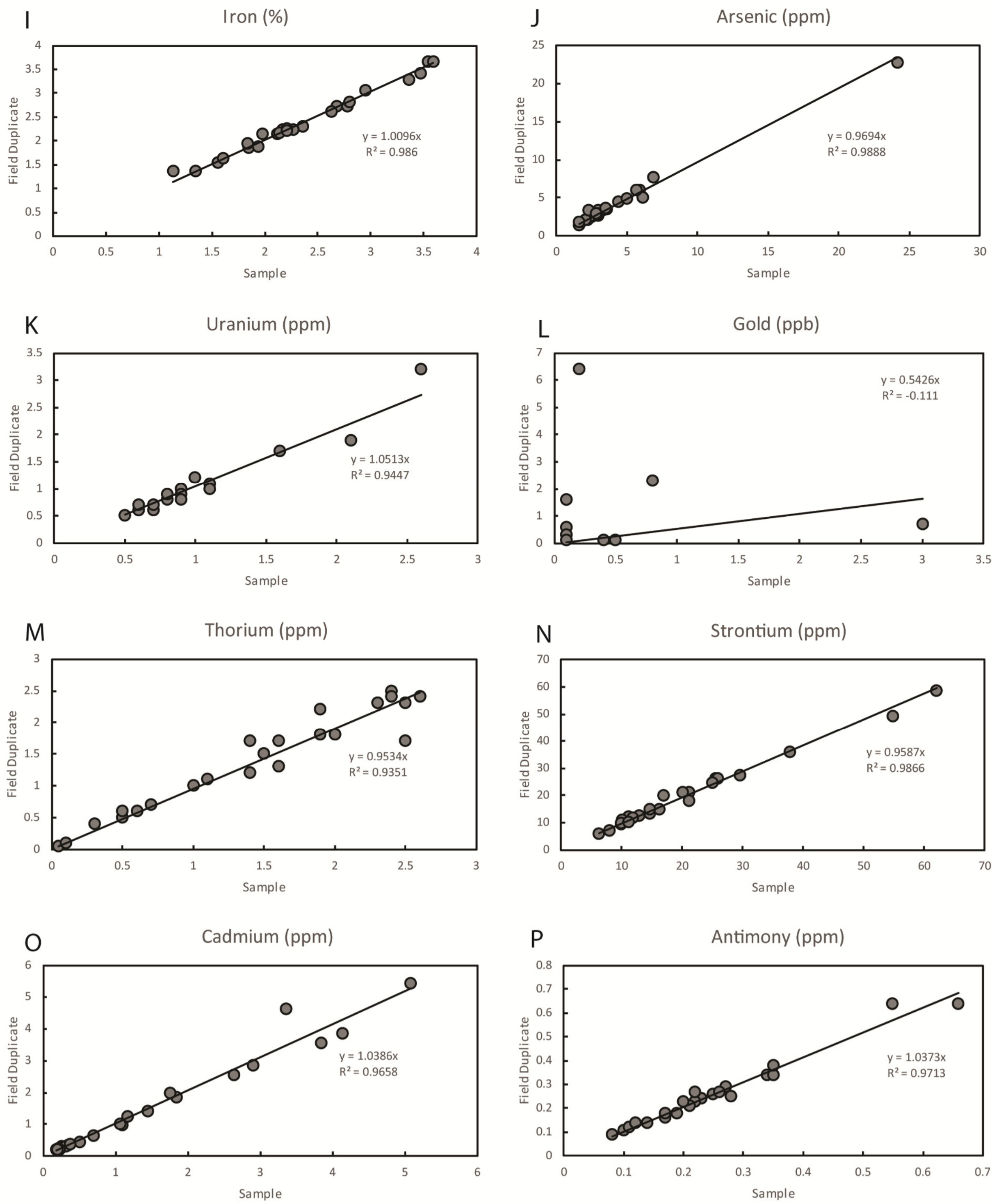
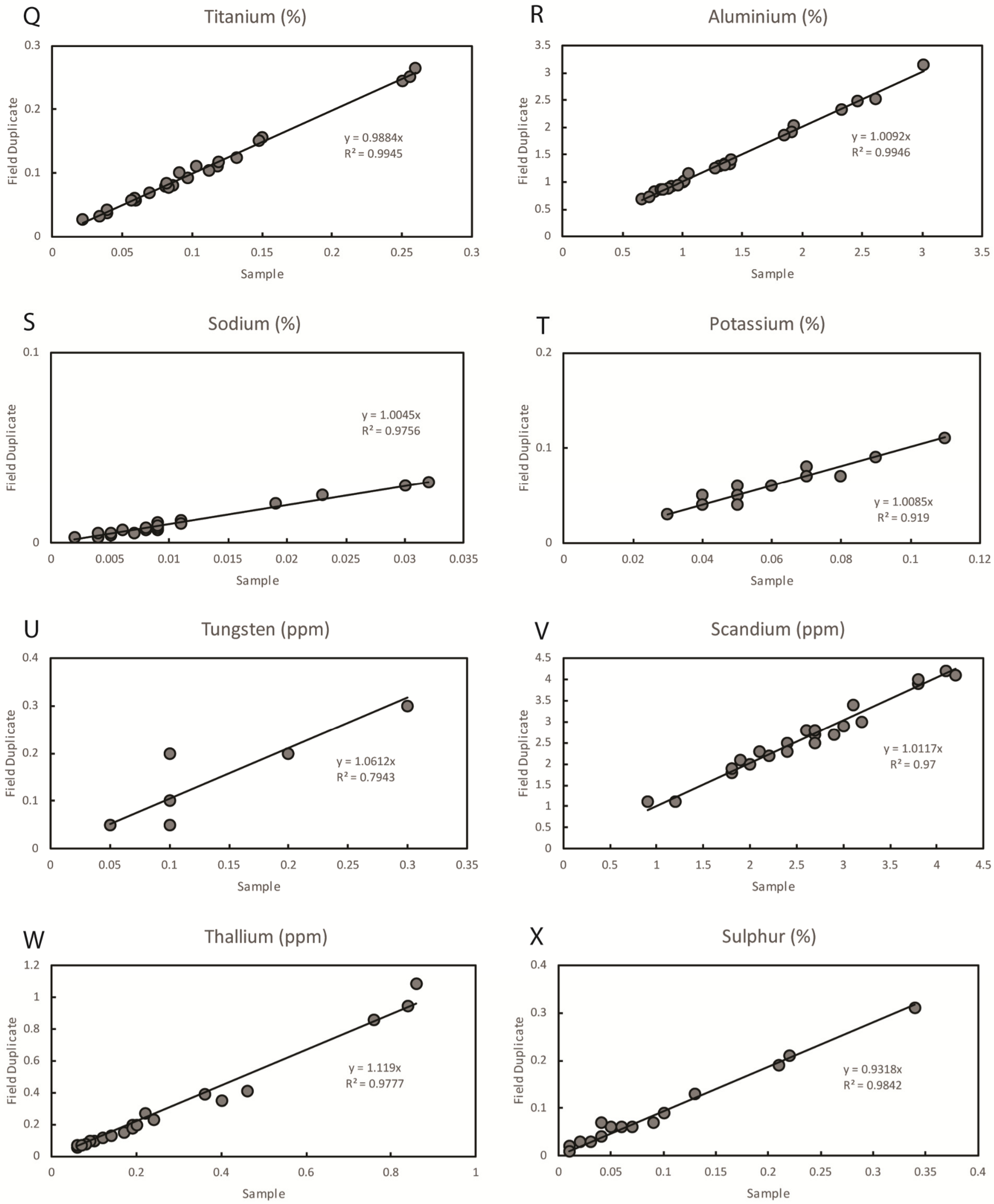

Mercury (ppb)
Hg (ppb)
Analyses #
Analyses
Certified Partial Digest

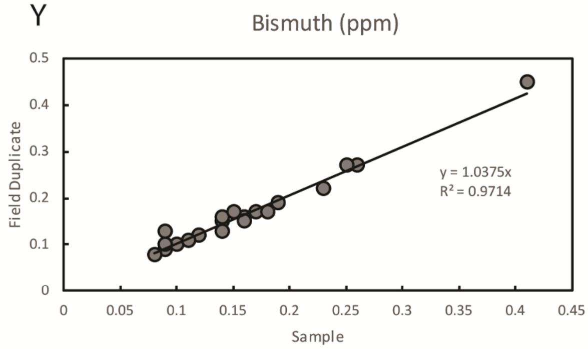
Figure C3. Field Duplicate cross-plots for samples analyzed by aqua regia ICP-MS. Most elements show excellent reproducibility except those subject to a strong nugget effect (e.g. gold) or those with a low number of detections (e.g. tungsten). On all plots, the original sample is plotted on the x-axis, and the duplicate on the y-axis. (A) Molybdenum, (B) copper, (C) lead, (D) zinc, (E) silver, (F) nickel, (G) cobalt, (H) manganese, (I) iron, (J) arsenic, (K) uranium, (L) gold, (M) thorium, (N) strontium, (O) cadmium, (P) antimony, (Q) titanium, (R) aluminium, (S) sodium, (T) potassium, (U) tungsten, (V) scandium, (W) thallium, (X) sulphur, (Y) bismuth, (Z) vanadium, (AA) calcium, (AB) phosphorus, (AC) lanthanum, (AD) chromium, (AE) magnesium, (AF) barium, (AG) mercury, (AH) selenium, (AI) tellurium, (AJ) gallium.


A
Molybdenum (ppm)
y = 1.1179x
R² = 0.9964
Field Duplicate
Sample
B
Copper (ppm)
y = 0.998x
R² = 0.891
Field Duplicate
Sample
C
Lead (ppm)
y = 1.0583x
R² = 0.9836
Field Duplicate
Sample
D
Zinc (ppm)
y = 0.9893x
R² = 0.9837
Field Duplicate
Sample
E
Silver (ppb)
y = 1.016x
R² = 0.9835
Field Duplicate
Sample
F
Nickel (ppm)
y = 1.0081x
R² = 0.9884
Field Duplicate
Sample
G
Cobalt (ppm)
y = 1.0264x
R² = 0.9485
Field Duplicate
Sample
H
Manganese (ppm)
y = 0.9856x
R² = 0.9895
Field Duplicate
Sample

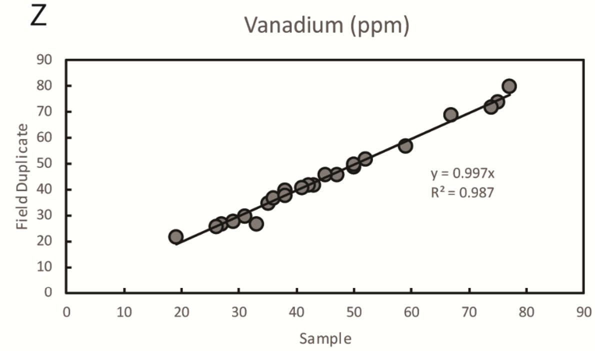

I
Iron (%)
y = 1.0096x
R² = 0.986
J
Arsenic (ppm)
y = 0.9694x
R² = 0.9888
K
Uranium (ppm)
y = 1.0513x
R² = 0.9447
L
Gold (ppb)
y = 0.5426x
R² = -0.111
M
Thorium (ppm)
y = 0.9534x
R² = 0.9351
N
Strontium (ppm)
y = 0.9587x
R² = 0.9866
O
Cadmium (ppm)
y = 1.0386x
R² = 0.9658
P
Antimony (ppm)
y = 1.0373x
R² = 0.9713
Field Duplicate
Sample


Q
Titanium (%)
y = 0.9884x
R² = 0.9945
Field Duplicate
Sample
R
Aluminium (%)
y = 1.0092x
R² = 0.9946
Field Duplicate
Sample
S
Sodium (%)
y = 1.0045x
R² = 0.9756
Field Duplicate
Sample
T
Potassium (%)
y = 1.0085x
R² = 0.919
Field Duplicate
Sample
U
Tungsten (ppm)
y = 1.0612x
R² = 0.7943
Field Duplicate
Sample
V
Scandium (ppm)
y = 1.0117x
R² = 0.97
Field Duplicate
Sample
W
Thallium (ppm)
y = 1.119x
R² = 0.9777
Field Duplicate
Sample
X
Sulphur (%)
y = 0.9318x
R² = 0.9842
Field Duplicate
Sample

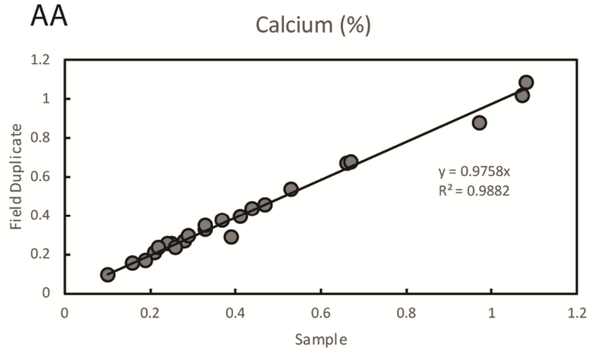
Y



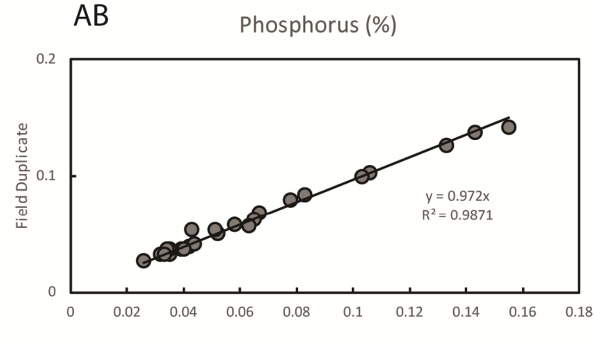
Z



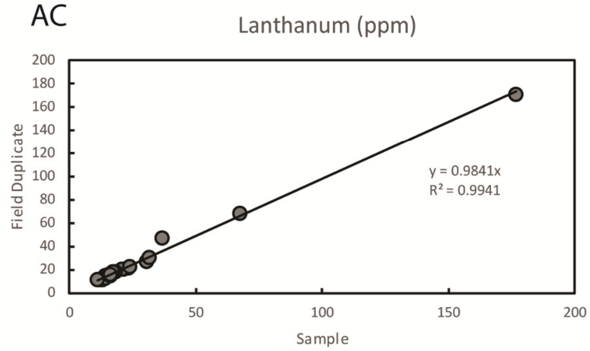
AA



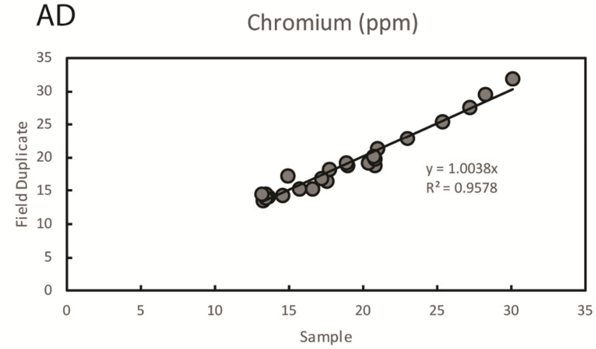
AB



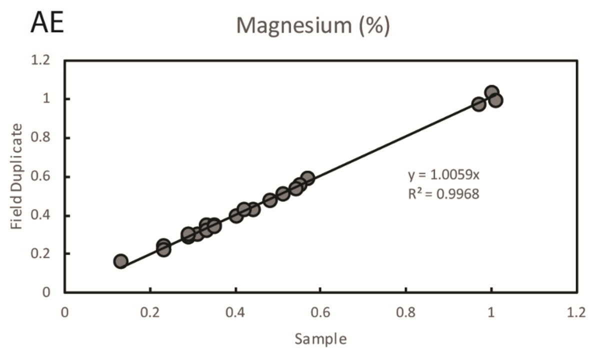
AC



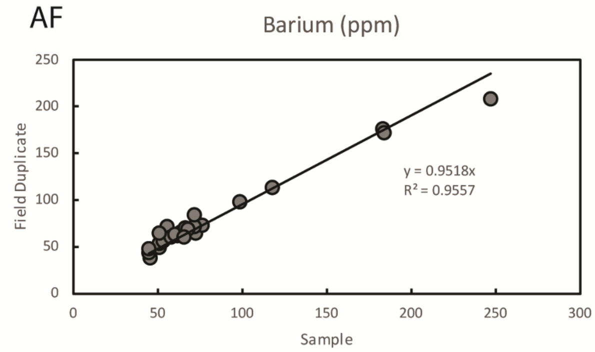
AD

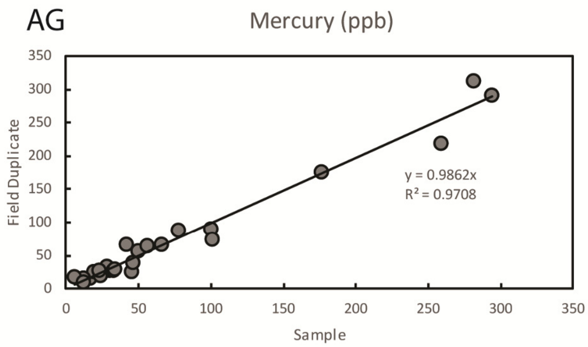


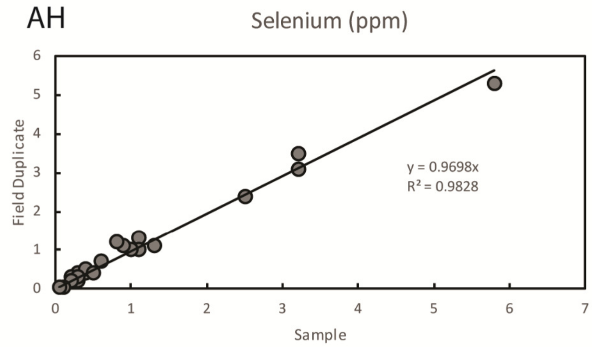
AE

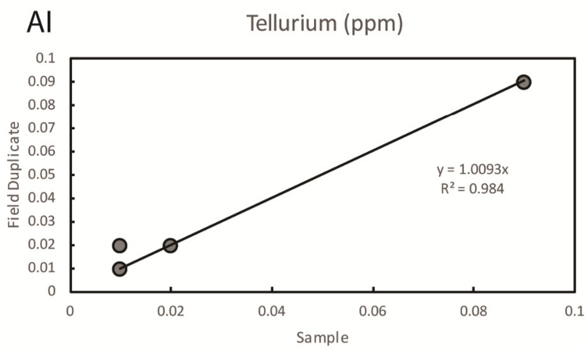


AF




AG
Mercury (ppb)
Field Duplicate
Sample
y = 0.9862x
R² = 0.9708


AH
Selenium (ppm)
Field Duplicate
Sample
y = 0.9698x
R² = 0.9828


AI
Tellurium (ppm)
Field Duplicate
Sample
y = 1.0093x
R² = 0.984

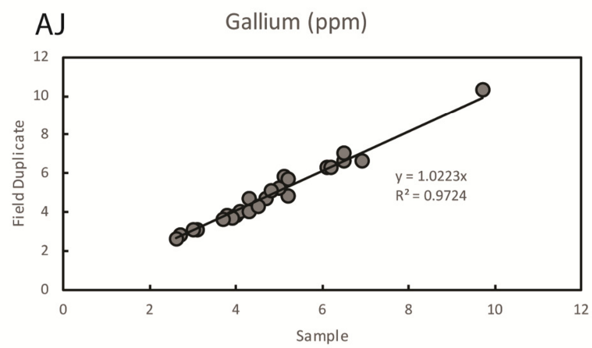
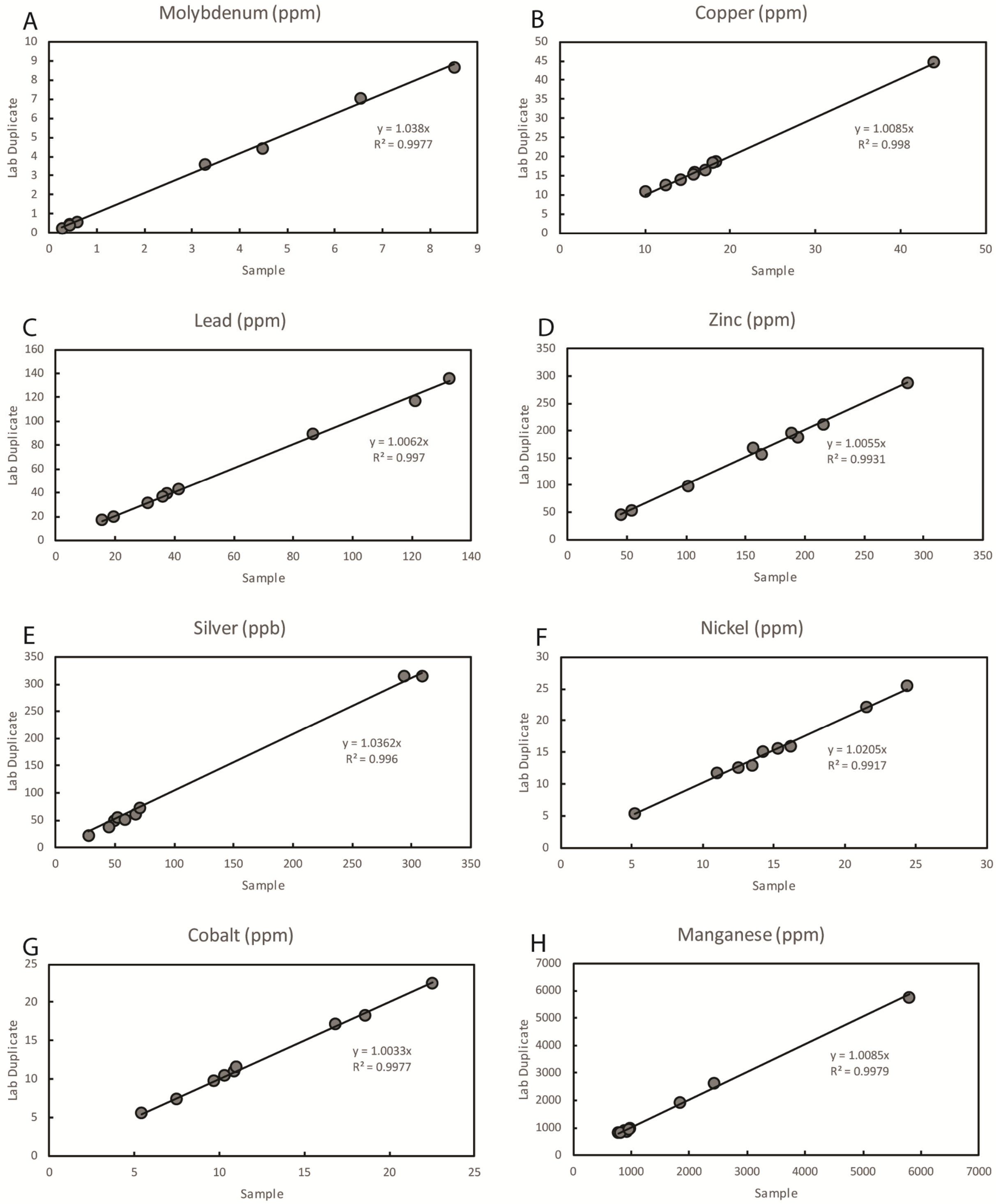
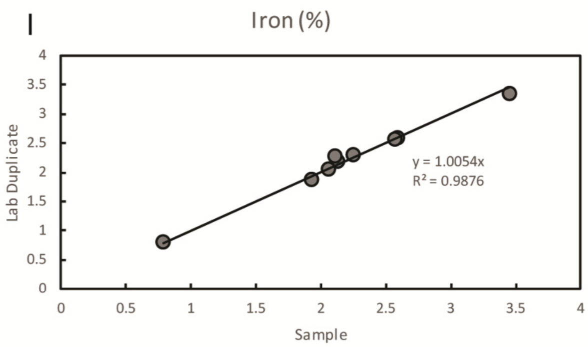
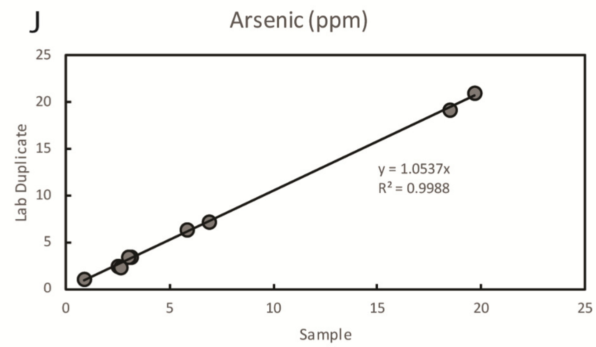
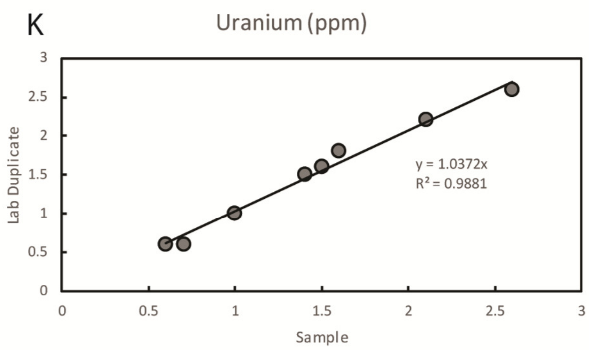

AJ
Gallium (ppm)
Field Duplicate
Sample
y = 1.0223x
R² = 0.9724

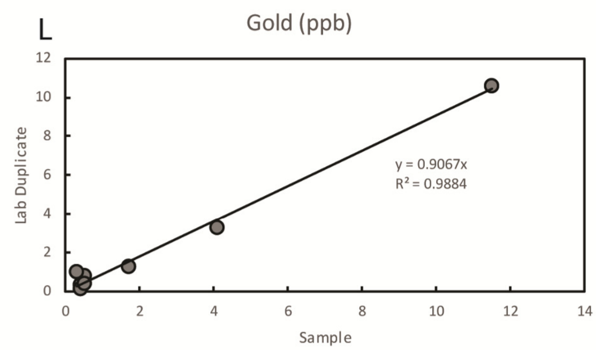
Figure C4. Lab Duplicate cross-plots for samples analyzed by aqua regia ICP-MS. These duplicate pairs are separate aliquots of randomly selected samples chosen by the lab. Almost all elements showed excellent reproducibility. On all plots, the original sample is plotted on the x-axis and the duplicate on the y-axis. (A) Molybdenum, (B) copper, (C) lead, (D) zinc, (E) silver, (F) nickel, (G) cobalt, (H) manganese, (I) iron, (J) arsenic, (K) uranium, (L) gold, (M) thorium, (N) strontium, (O) cadmium, (P) antimony, (Q) titanium, (R) aluminium, (S) sodium, (T) potassium, (U) tungsten, (V) scandium, (W) thallium, (X) sulphur, (Y) bismuth, (Z) vanadium, (AA) calcium, (AB) phosphorus, (AC) lanthanum, (AD) chromium, (AE) magnesium, (AF) barium, (AG) mercury, (AH) selenium, (AI) tellurium, (AJ) Gallium.

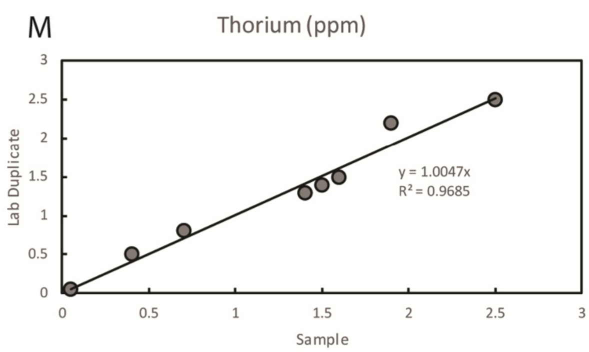

A
Molybdenum (ppm)
y = 1.038x
R² = 0.9977
Lab Duplicate
Sample
B
Copper (ppm)
y = 1.0085x
R² = 0.998
Lab Duplicate
Sample
C
Lead (ppm)
y = 1.0062x
R² = 0.997
Lab Duplicate
Sample
D
Zinc (ppm)
y = 1.0055x
R² = 0.9931
Lab Duplicate
Sample
E
Silver (ppb)
y = 1.0362x
R² = 0.996
Lab Duplicate
Sample
F
Nickel (ppm)
y = 1.0205x
R² = 0.9917
Lab Duplicate
Sample
G
Cobalt (ppm)
y = 1.0033x
R² = 0.9977
Lab Duplicate
Sample
H
Manganese (ppm)
y = 1.0085x
R² = 0.9979
Lab Duplicate
Sample

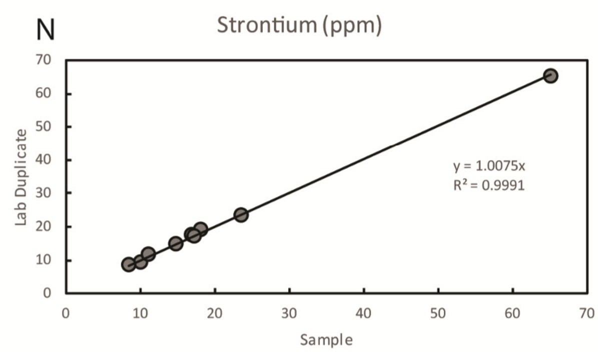

I
Iron (%)
y = 1.0054x
R² = 0.9876
Lab Duplicate
Sample

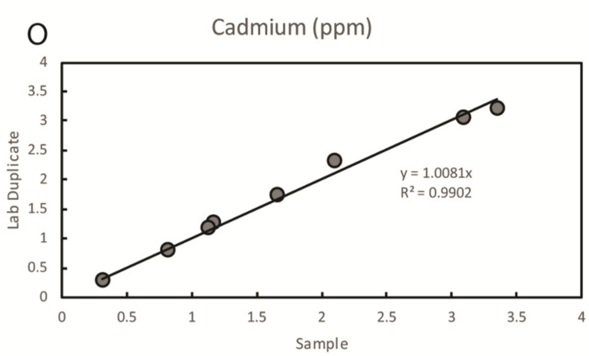

J
Arsenic (ppm)
y = 1.0537x
R² = 0.9988
Lab Duplicate
Sample

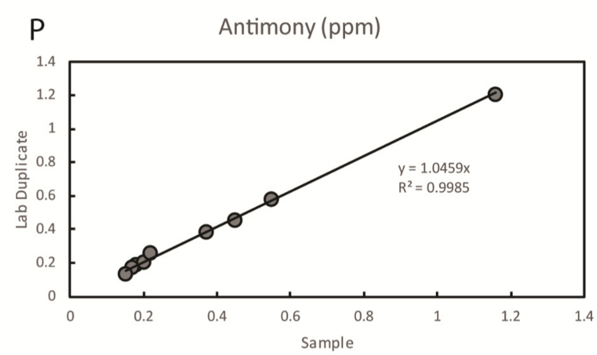

K
Uranium (ppm)
y = 1.0372x
R² = 0.9881
Lab Duplicate
Sample


L
Gold (ppb)
y = 0.9067x
R² = 0.9884
Lab Duplicate
Sample

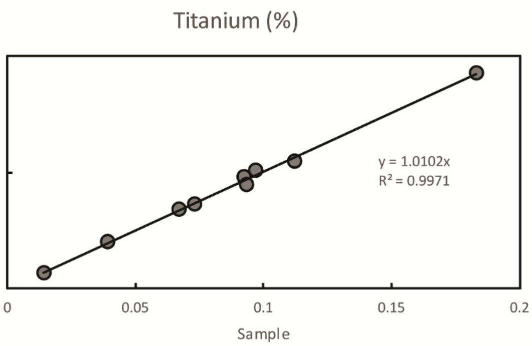

M
Thorium (ppm)
y = 1.0047x
R² = 0.9685
Lab Duplicate
Sample


N
Strontium (ppm)
y = 1.0075x
R² = 0.9991
Lab Duplicate
Sample

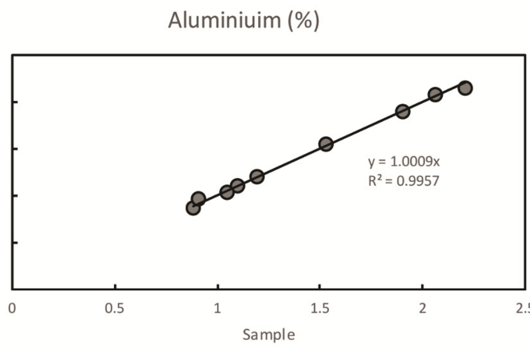

O
Cadmium (ppm)
y = 1.0081x
R² = 0.9902
Lab Duplicate
Sample


P
Antimony (ppm)
y = 1.0459x
R² = 0.9985
Lab Duplicate
Sample

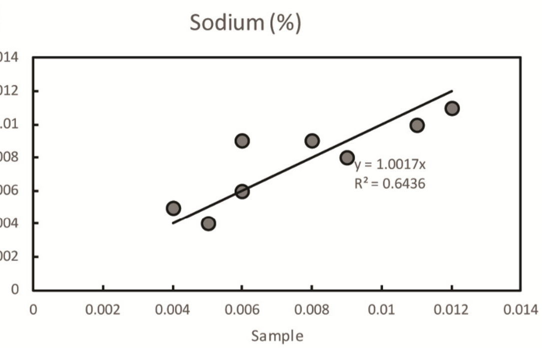
Q


Titanium (%)
Lab Duplicate
Sample
y = 1.0102x
R² = 0.9971

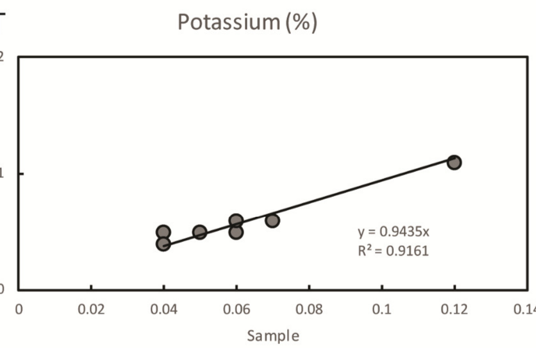
R


Aluminiuim (%)
Lab Duplicate
Sample
y = 1.0009x
R² = 0.9957

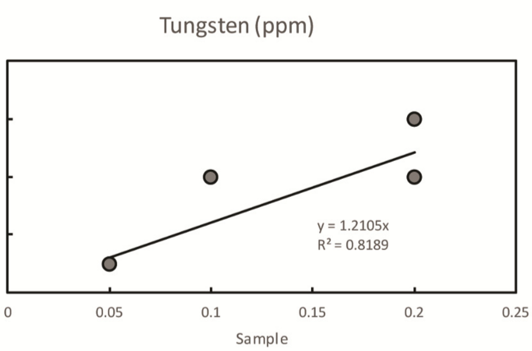
S


Sodium (%)
Lab Duplicate
Sample
y = 1.0017x
R² = 0.6436

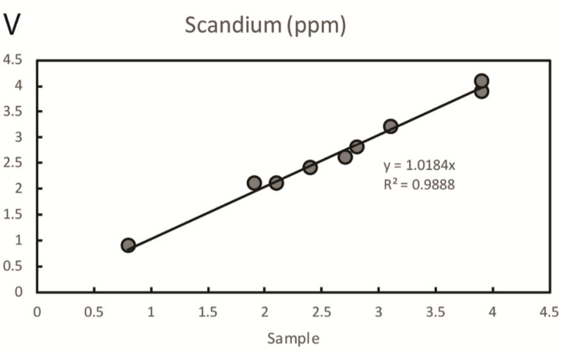
T


Potassium (%)
Lab Duplicate
Sample
y = 0.9435x
R² = 0.9161

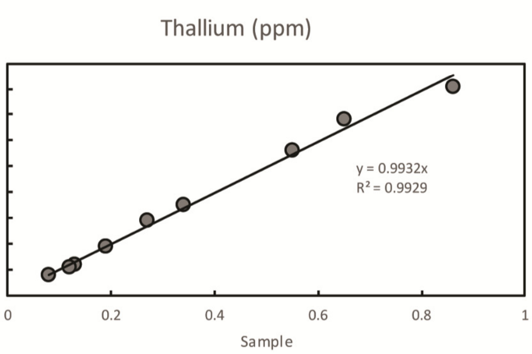
U


Tungsten (ppm)
Lab Duplicate
Sample
y = 1.2105x
R² = 0.8189

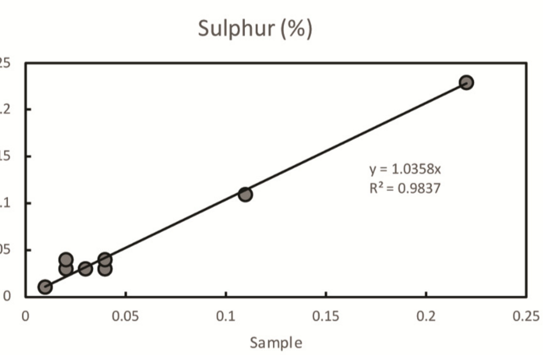
V

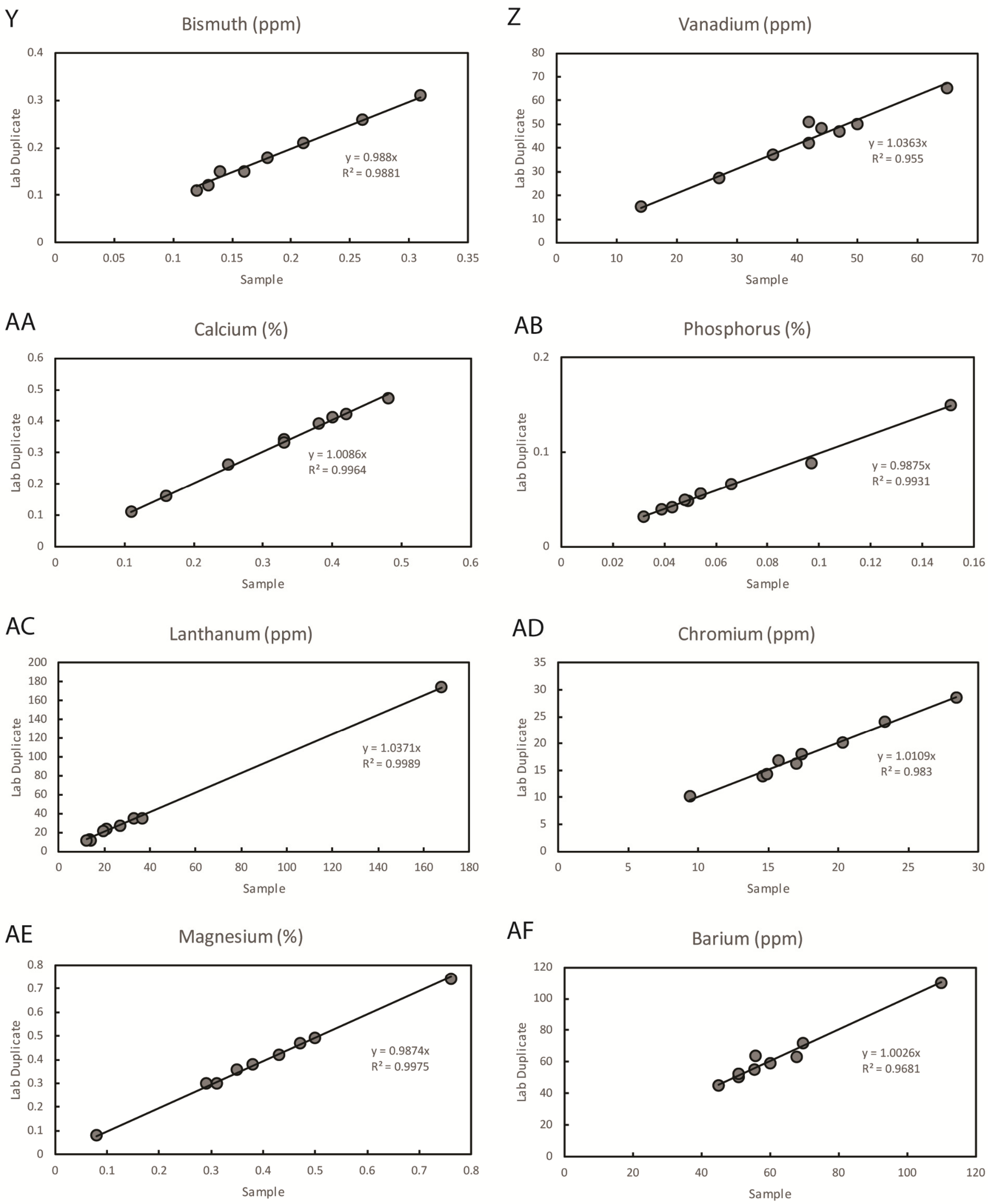

Scandium (ppm)
Lab Duplicate
Sample
y = 1.0184x
R² = 0.9888

W


Thallium (ppm)
Lab Duplicate
Sample
y = 0.9932x
R² = 0.9929

X


Sulphur (%)
Lab Duplicate
Sample
y = 1.0358x
R² = 0.9837


Y
Bismuth (ppm)
y = 0.988x
R² = 0.9881
Lab Duplicate
Sample
Z
Vanadium (ppm)
y = 1.0363x
R² = 0.955
Lab Duplicate
Sample
AA
Calcium (%)
y = 1.0086x
R² = 0.9964
Lab Duplicate
Sample
AB
Phosphorus (%)
y = 0.9875x
R² = 0.9931
Lab Duplicate
Sample
AC
Lanthanum (ppm)
y = 1.0371x
R² = 0.9989
Lab Duplicate
Sample
AD
Chromium (ppm)
y = 1.0109x
R² = 0.983
Lab Duplicate
Sample
AE
Magnesium (%)
y = 0.9874x
R² = 0.9975
Lab Duplicate
Sample
AF
Barium (ppm)
y = 1.0026x
R² = 0.9681
Lab Duplicate
Sample

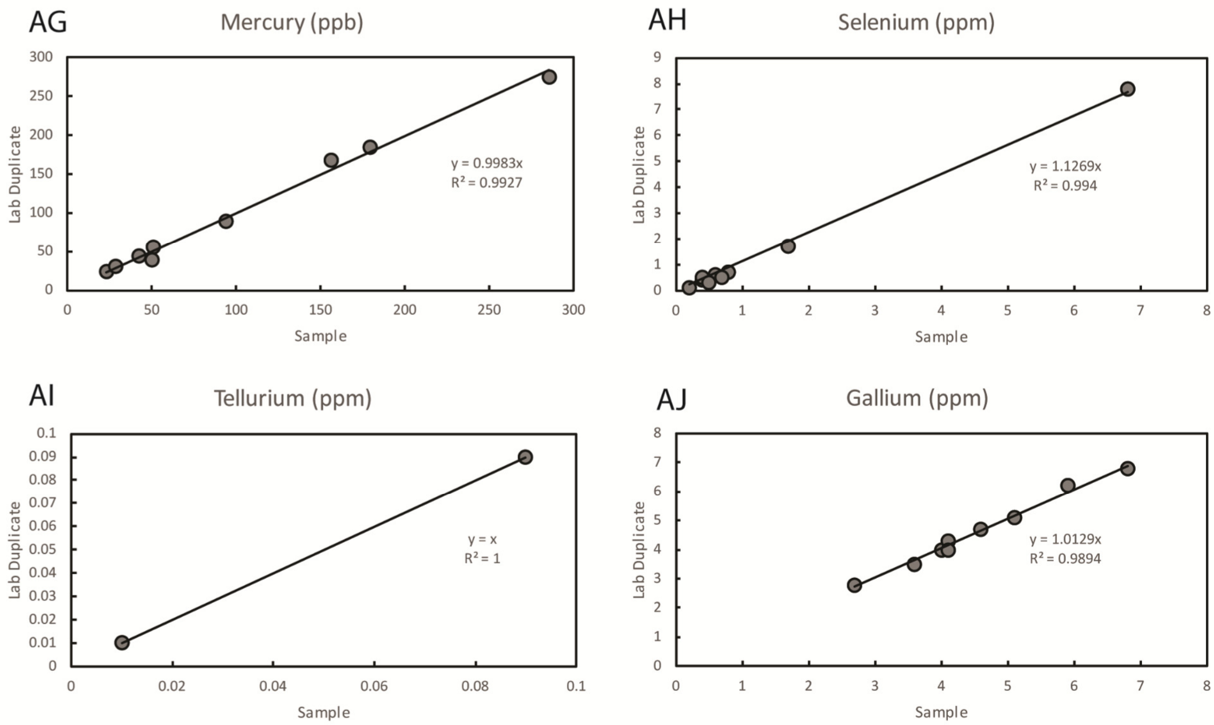
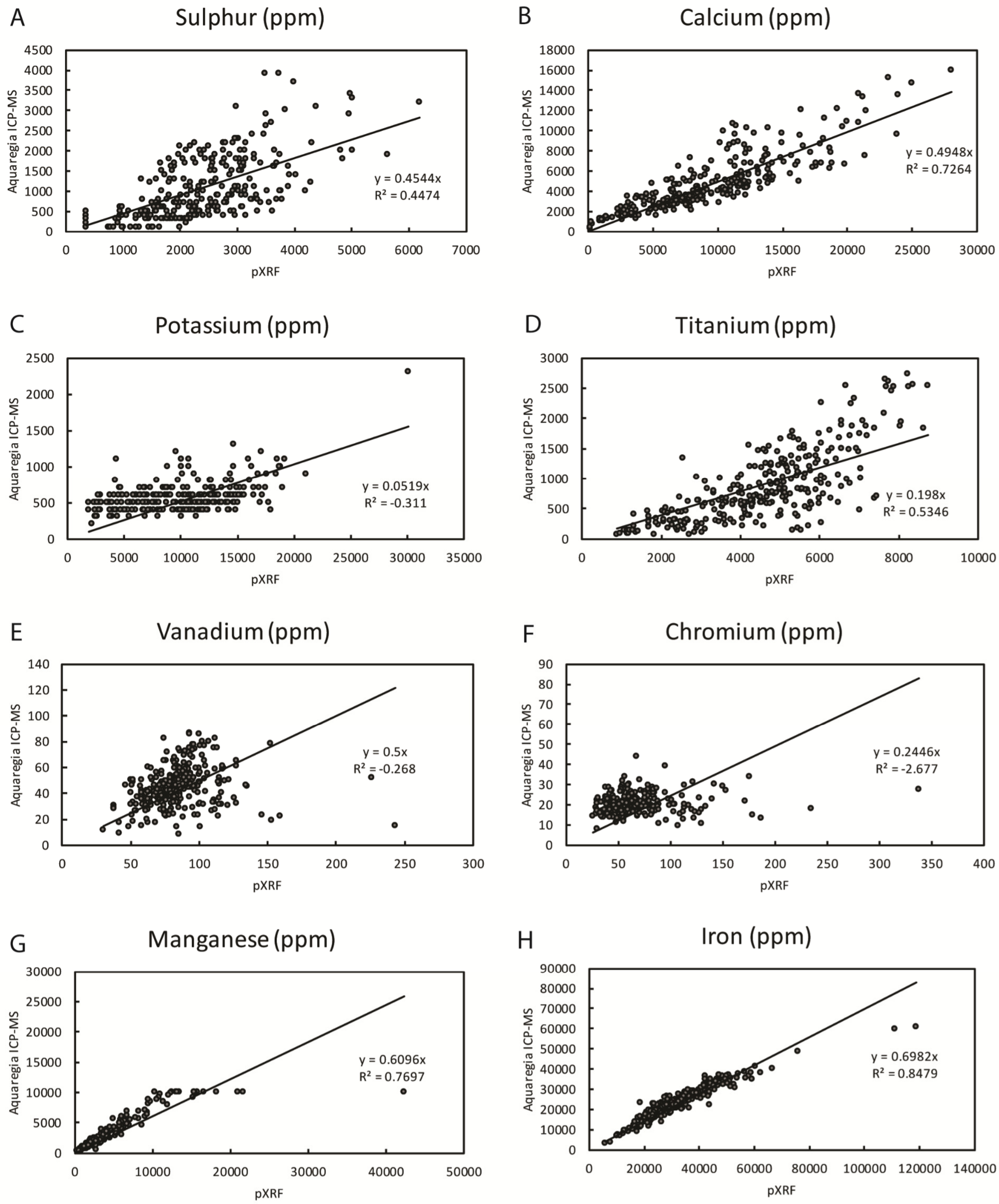
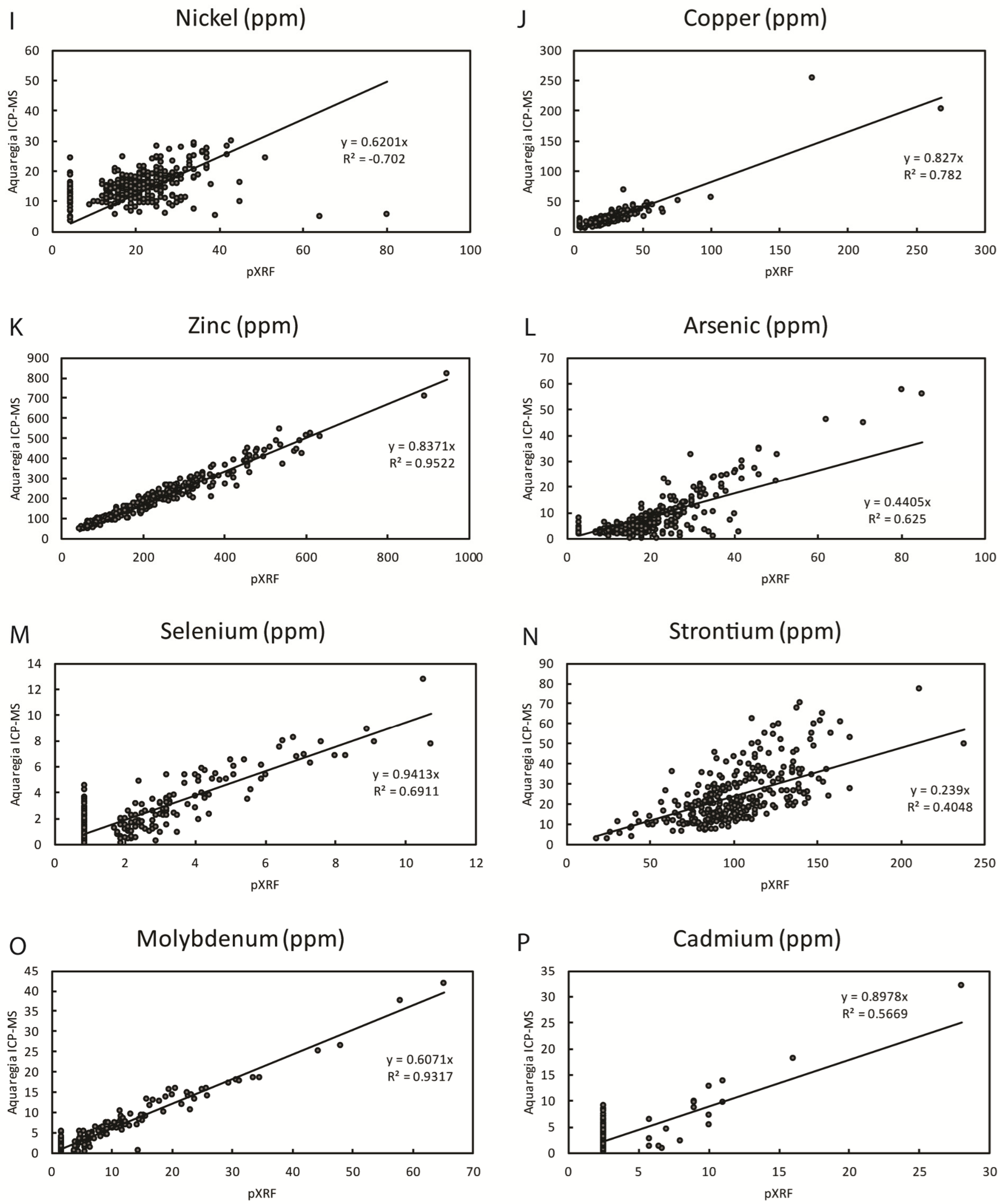
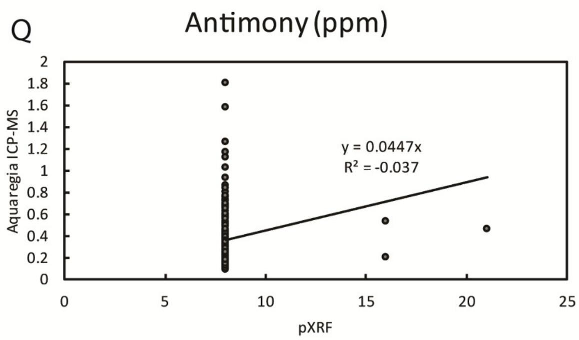
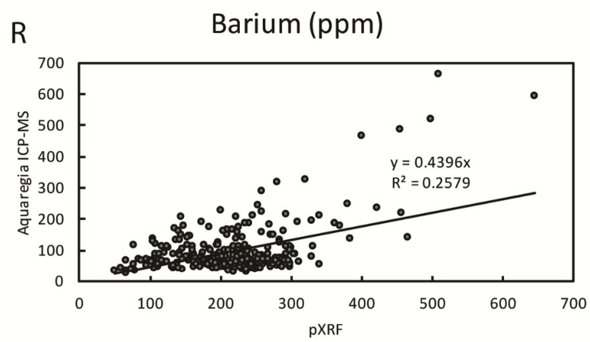

AG
Mercury (ppb)
Lab Duplicate
Sample
y = 0.9983x
R² = 0.9927
AH
Selenium (ppm)
Lab Duplicate
Sample
y = 1.1269x
R² = 0.994
AI
Tellurium (ppm)
Lab Duplicate
Sample
y = x
R² = 1
AJ
Gallium (ppm)
Lab Duplicate
Sample
y = 1.0129x
R² = 0.9894

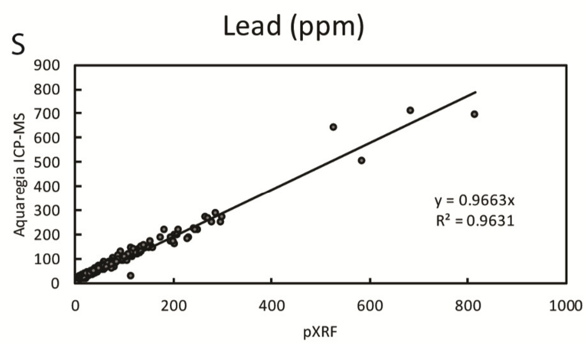
Figure C5. Cross-plots comparing the pXRF results with aqua regia ICP-MS analyses, when possible. Reproducibility of pXRF results by ICP-MS depends heavily on how readily the element in question digests in aqua regia, as many elements that occur in silicate or refractory mineral phases do not easily digest. However, most chalcophile elements (e.g. arsenic, the base metals, etc.) compare very favourably between the two methods, although not necessarily at a 1:1 relationship. On all plots the pXRF data are on the x-axis and the aqua regia ICP-MS data are on the y-axis. (A) Sulphur, (B) calcium, (C) potassium, (D) titanium, (E) vanadium, (F) chromium, (G) manganese, (H) iron, (I) nickel, (J) copper, (K) zinc, (L) arsenic, (M) selenium, (N) strontium, (O) molybdenum, (P) cadmium, (Q) antimony, (R) barium, (S) lead, (T) thorium, (U) uranium.

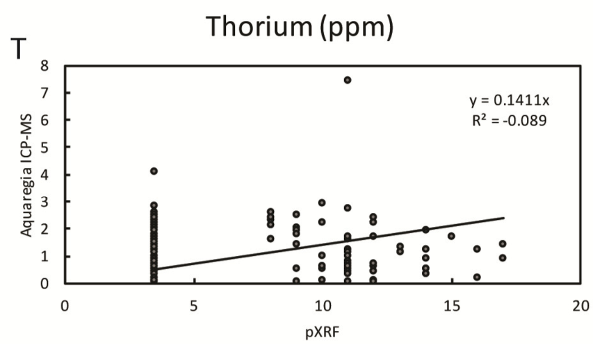

A
Sulphur (ppm)
y = 0.4544x
R² = 0.4474
B
Calcium (ppm)
y = 0.4948x
R² = 0.7264
C
Potassium (ppm)
y = 0.0519x
R² = -0.311
D
Titanium (ppm)
y = 0.198x
R² = 0.5346
E
Vanadium (ppm)
y = 0.5x
R² = -0.268
F
Chromium (ppm)
y = 0.2446x
R² = -2.677
G
Manganese (ppm)
y = 0.6096x
R² = 0.7697
H
Iron (ppm)
y = 0.6982x
R² = 0.8479
Aquaregia ICP-MS
pXRF

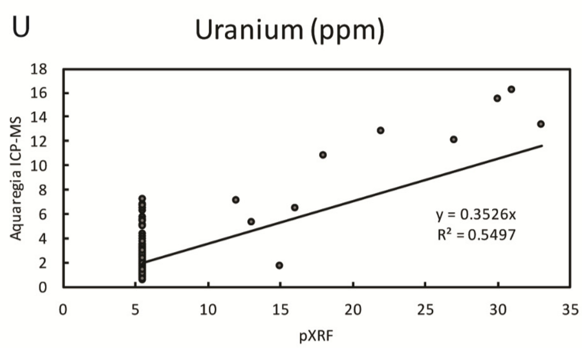

I
Nickel (ppm)
Aquaregia ICP-MS
pXRF
y = 0.6201x
R² = -0.702
J
Copper (ppm)
Aquaregia ICP-MS
pXRF
y = 0.827x
R² = 0.782
K
Zinc (ppm)
Aquaregia ICP-MS
pXRF
y = 0.8371x
R² = 0.9522
L
Arsenic (ppm)
Aquaregia ICP-MS
pXRF
y = 0.4405x
R² = 0.625
M
Selenium (ppm)
Aquaregia ICP-MS
pXRF
y = 0.9413x
R² = 0.6911
N
Strontium (ppm)
Aquaregia ICP-MS
pXRF
y = 0.239x
R² = 0.4048
O
Molybdenum (ppm)
Aquaregia ICP-MS
pXRF
y = 0.6071x
R² = 0.9317
P
Cadmium (ppm)
Aquaregia ICP-MS
pXRF
y = 0.8978x
R² = 0.5669


Q
Antimony (ppm)
Aquaregia ICP-MS
pXRF
y = 0.0447x
R² = -0.037


R
Barium (ppm)
Aquaregia ICP-MS
pXRF
y = 0.4396x
R² = 0.2579


S
Lead (ppm)
Aquaregia ICP-MS
pXRF
y = 0.9663x
R² = 0.9631


T
Thorium (ppm)
Aquaregia ICP-MS
pXRF
y = 0.1411x
R² = -0.089


U
Uranium (ppm)
Aquaregia ICP-MS
pXRF
y = 0.3526x
R² = 0.5497