



Geochemical Laboratory Services

Schedule of Services - v2



WE DELIVER A FULL RANGE OF GEOCHEMICAL LABORATORY SERVICES SPECIFICALLY FOR THE EXPLORATION AND MINING INDUSTRIES. MINERALS TESTING IS OUR CORE BUSINESS AND WE ARE EXPERTS AT IT.

We understand how vital your results are to critical decision making and will target a three week turn-around-time, providing 24/7 access to track your sample progress at any time.

At MSALABS, we take the time to understand your unique needs as they differ across every stage of the mining cycle and create tailored analytical and testing programs specifically for your project.

We then provide analytical results you can rely on with a faster turn-around-time than you are used to. Our average three week turn-around-time means you can make decisions sooner and your project stays on schedule.

Importantly, if your timelines change, we have the flexibility in most cases to reschedule partial batches to meet your new timelines or prioritise specific sample results.

Our global laboratory network means we provide services to many of the key mining regions around the world with minimal lead times for sample shipments.

Our full range of analytical services is suitable from greenfields exploration through to mine closure and includes sample preparation, a complete range of analytical techniques and construction and management of on-site laboratories. We also provide franchise opportunities for high-quality partners across the world.

Our company maintains the highest quality standards and follows the guidelines of ISO17025 accreditation and ISO9001, ISO14001 and ISO45001 certification. Certificates are available for download from our website.

TABLE OF CONTENTS

SAMPLE PREPARATION, STORAGE AND DISPOSAL	04	WHOLE ROCK BY XRF	17
SAMPLE PREPARATION	05	- Whole Rock Analysis - Lithium Borate Fusion and XRF Finish (14 Parameters + LOI)	17
- Rocks and Drill Core	05	- Resistive Minerals - Lithium Borate Fusion and XRF Finish	17
- Soil and Sediment	05	- Rare Earth Elements (REE's) - Lithium Borate Fusion and XRF Finish	17
- Vegetation	05	- Whole Rock Analysis - Lithium Metaborate/Tetraborate Fusion and XRF Finish (Iron Ore)	17
- Other Individual Preparation Methods	06	- Other	18
SAMPLE RECEIVING AND LOGISTICS	07	- Volumetric Methods - Classical Titration	18
- Submitting Samples	07	- Copper Analysis	18
- Packaging and Shipping	07	- Instrument Neutron Activation Analysis (INAA)	19
- International Shipments	07	ORE GRADE	20
ADMINISTRATION FEES	08	AQUA REGIA DIGESTION	21
SAMPLE STORAGE AND DISPOSAL	08	- Aqua Regia Digestion	21
PRECIOUS METALS ANALYSIS	09	- 4-ACID Digestion	21
PRECIOUS METALS ANALYSIS	09	SPECIALTY ASSAY	22
- Gold	10	GRASSROOTS EXPLORATION	23
- Silver	10	- Biogeochemistry	23
- Gold and Silver	10	- Preparation	23
- Gold, Platinum and Palladium	10	- Multi-Element In Vegetation ICP-MS Ultra Trace Level (51 Elements)	23
- Rhodium, Ruthenium and Iridium	11	- Hydrogeochemistry	24
- Metallic Screening - Gold	11	- Multi-Element By Direct Read, ICP-MS Ultra Trace Level (65 Elements)	24
- Concentrate	11	ANALYTICAL SERVICES	25
- Bullion	11	- Bulk Leach Extractable Gold (BLEG)	26
GEOCHEMICAL ANALYSIS	12	- Precious Metals in Metallurgical Samples	26
AQUA REGIA DIGESTION	12	MULTI-ELEMENT PACKAGES FOR METALLURGICAL SAMPLES	27
- Multi-Element ICP-MS And ICP-ES (39 Elements)	13	- Multi-Element ICP-ES (33 Elements)	27
- Multi-Element ICP-MS And ICP-ES (51 Elements)	13	- Multi-Element ICP-ES (29 Elements)	27
- Multi-Element ICP-ES (35 Elements)	13	- Peroxide Fusion ICP-ES Finish (18 Elements)	27
4-ACID DIGESTION	14	- Direct Read From Solution ICP-ES Finish (30 Elements)	27
- Multi-Element ICP-MS (48 Elements)	14	- Carbon And Sulfur Analysis	27
- Multi-Element ICP-ES (34 Elements)	14	OTHER SERVICES	28
FUSION AND ICP-ES / ICP- MS FINISH	15	LABORATORY CONSTRUCTION AND MANAGEMENT	29
- Whole Rock Analysis - Lithium Borate Fusion and ICP-ES Finish (13 Parameters + LOI)	15	METALLURGICAL SERVICES	30
- LOI Analysis	15	USEFUL INFORMATION	31
- Peroxide Fusion With ICP-ES Finish (18 Elements)	15	PERIODIC TABLE	31
- Single Elements	15	GRAVIMETRIC FACTORS	32
- Refractories And Rare Earth Elements (REE's) - Lithium Borate Fusion and ICP-MS	15	CONVERSION FACTORS	32
- IMS-130 Add On Aqua Regia Digestion and ICP-MS	16	SIEVE SIZES	32
- IMS-230 Add On 4-Acid Digestion and ICP-MS	16	TERMS AND CONDITIONS	33
- Complete Whole Rock Package	16	QUOTATION AND ACCOUNT PAYMENT	34
CARBON AND SULFUR ANALYSIS	16	SAMPLE SUBMITTAL FORM	35

SAMPLE PREPARATION

Every step, from sample receipt until the laboratory begins the analysis, must be suitable for the specific needs of your project and sample matrix and completed with meticulous care to minimise contamination.

Our expertise and state-of-the-art equipment ensures sample preparation that will provide results you can trust. Our team can also provide advice on the most suitable sample preparation methods to meet your needs and will work closely with you to understand exactly what answers you want and how best to get them.

Our sample preparation services cover rock and drill core, soil and sediment and vegetation.

SAMPLE PREPARATION

Sample preparation includes all steps from sample receipt until delivery to the assay department. The purpose of sample preparation is to ensure that the laboratory processes a pulp representative of the whole sample. Sample preparation needs vary according to the project and the sample matrix. If you would like a specific sample preparation method, please let us know and we can tailor a package to your needs.

ROCKS AND DRILL CORE PACKAGES

Preparation of rock samples and drill core require meticulous care to produce a homogeneous sub-sample for analysis. MSALABS's Quality System is as comprehensive in Sample Preparation as in any other area of our business.

Rocks and drill core samples are crushed to 70% passing 2mm, then a representative split is taken and pulverized to 85% passing 75µm.

DESCRIPTION	CODE
Dry, crush to 2mm, split 250g sub-sample and pulverize to 85% passing 75µm	PRP-910
Dry, crush to 2mm, split 500g sub-sample and pulverize to 85% passing 75µm	PRP-915
Dry, crush to 2mm, split 1000g sub-sample and pulverize to 85% passing 75µm	PRP-920
Surcharge for samples > 1kg, per kg	PRP-950

SOIL AND SEDIMENT

Soil and sediment samples are dried and then screened to the desired mesh size. The undersized (-) fraction is analyzed and the oversized (+) fraction is discarded unless otherwise specified.

DESCRIPTION	CODE
Dry, screen to 80 mesh, discard plus fraction	PRP-757
Surcharge for samples >500g, per 500g	PSC-100
Extra drying for excessively wet samples, per 500g	DRI-100
Screen at other sieve size	PSC-999
Save all soil reject	PSC-110

VEGETATION

Depending on requirements, vegetation samples are either dried and macerated to 1mm, OR, dried then ashed at 475°C, prior to analysis.

DESCRIPTION	CODE
Dry and macerate to 1mm, per 100g	PRP-VG1
Dry and ash at 475°C	PRP-VG2
Save all or part of reject fraction	PSC-115





OTHER INDIVIDUAL PREPARATION METHODS

CORE SAWING

MSALABS uses state-of-the-art computerized core saws for precision cutting of drill core. The core saws are semi-automatic and totally enclosed thus very safe to operate. We are experts at core cutting and deliver the highest quality core cutting services. Our staff are highly experienced and trained in every step from the actual core cutting process to sampling of the cut core by following customer-provided instructions.

DESCRIPTION	CODE
Sawing of drill core with semi-automatic core saw	SAW-100

DRYING

DESCRIPTION	CODE
Drying at 60°C	DRI-060
Drying at 90°C	DRI-090
Extra drying time for excessively wet samples, per kg	DRI-100
Air drying of samples	DRI-200
Drying to customer specification	DRI-300

CRUSHING

DESCRIPTION	CODE
Crush up to 1kg to 70% passing 2mm	CRU-220
Crush up to 1kg to 90% passing 2mm	CRU-240
Crush up to 1kg to 70% passing 6mm (1/4")	CRU-260
Oversize surcharge, per kg	CRU-200
Crush to customer specification	CRU-999

SPLITTING

DESCRIPTION	CODE
Split pulp for various uses (Riffle Split), per kg	SPL-400
Split 250g crushed material (Riffle Split)	SPL-410
Split 250g crushed material (Rotary Split)	SPL-415
Split 1000g crushed material (Riffle Split)	SPL-420
Split 1000g crushed material (Rotary Split)	SPL-425

PULVERIZING

DESCRIPTION	CODE
Pulverize 250g to 85% passing 75µm	PPU-510
Pulverize 500g to 85% passing 75µm	PPU-520
Pulverize 1000g to 85% passing 75µm	PPU-530
Pulverize 500g to 85% passing 106µm	PPU-620
Pulverize 1000g to 85% passing 106µm	PPU-630

MISCELLANEOUS

DESCRIPTION	CODE
Wash crusher with barren material between each sample	PWA-200
Wash pulverizer with barren material between each sample	PWA-500
Homogenizing and pulverizing composite, per 250g	PPU-560
Homogenizing pulp by mat rolling	PRO-100
Homogenizing pulp by light pulverizing	PRO-200

SAMPLING SUPPLIES

Shipping Sacks (Rice Bags)	10
Plastic Bags, 6 mil 8" x 13"	100
Plastic Bags, 6 mil 12" x 18"	100
Tin-Tie Bags	1,000
Cable Ties, 7"	100
Assay Tags, 50 tags/booklet	Per booklet

SAMPLE RECEIVING AND LOGISTICS

SUBMITTING SAMPLES

Please ensure that all samples are labeled and the Sample Submittal Form (SSF) is properly filled out and name printed out and/or signed. If you have any questions about the submittal form, do not hesitate to contact us. If the form is not filled out properly or is unclear, it can result in a delay.

The minimum details that we require before we can process your samples are:

- Your company name and contact name(s)
- List or range of sample IDs
- Prep and analytical code(s)
- Result destination(s)
- Invoice destination(s)
- Sample return / Disposition instructions
- Printed name or signature

PACKAGING AND SHIPPING

Ensure that your samples are well packed and guarded against any leakage or breakage. International soils require special permit. Please contact us at Customer.service@msalabs.com to obtain a copy. Samples may be sent via Canada Post, Reputable Courier or Freight company. Advise courier used and waybill number of incoming shipments to aid in ease of tracking.

INTERNATIONAL SHIPMENTS

All shipments should be labeled as:

**“Geological (specify Rock or Soil) Samples for Analysis only.
No Commercial Value”**

Customs Broker (if required):

Cole International

Tel. +1 604-273-5161

If you have any questions, please call or e-mail us at:

Tel. +1 604-888-0875

Email. contact@msalabs.com

You may also visit our website at: www.msalabs.com

Shipping Address:

MSALABS

Attn: Sample Receiving

Unit 1, 20120 102nd Avenue

Langley, BC V1M 4B4

Canada





ADMINISTRATION FEES

DESCRIPTION	CODE
Batch charge for shipments less than 20 samples	ADM-100
Log sample received as pulp	PLG-100
Sample pick up service available at any MSALABS	PIC-100

Please contact us for more information.

SAMPLE STORAGE AND DISPOSAL

All pulps and rejects will be stored at our facility free of charge for 90 days. The free storage period starts on the day that the Test Report is released. At the end of this free storage period, the samples will either continue to be stored, disposed or returned to you. Please inform if you would like your samples returned to you sooner (that is, as soon as analysis is complete).

For samples to be returned, our staff will contact you to arrange shipment. You will be invoiced for the shipment cost. If there is any change of sample storage information, please contact us within the 90-day free period.

DESCRIPTION	CODE
Handling and retrieval of pulp or reject from storage, per hour	STO-100
Storage of reject after 90-day free period, per sample/month	STO-200
Storage of pulp after 90-day free period, per sample/month	STO-300
Reject disposition, per sample (≤ 3 kg, > 3 kg by quotation)	DIS-100
Pulp disposition, per sample	DIS-200
Disposition of sample solutions, per sample	DIS-300
Heat treatment and disposal of International soils	DIS-400
Special handling, per hour	HAN-200
Return shipment of reject / pulp	DIS-500
Environmental Levy – for safe disposal of fire assay spent materials	DIS-600*

* Per sample



PRECIOUS METALS ANALYSIS

We offer gold, platinum group and precious metal analyses suitable for grassroots exploration through to resource estimation and grade control.

Our methods are suitable for ultra-trace to bullions, low and high grade material, through to precious metals forming a component of a trace element, finely disseminated grains or nuggets.





Sample pulp is mixed with a combination of chemical reagents. The mixture is heated at high temperature resulting in the formation of a lead button and slag. The lead button which contains the precious metals is cupelled at high temperature. The lead is absorbed by the cupel and leaves behind a bead that contains the precious metals. The bead is acid digested and analyzed by instrumental or gravimetric method. In order to optimize the precious metals recovery, the lab reserves the right to reduce the sample weight.

GOLD

DESCRIPTION	DETECTION RANGE(PPM)	FUSION SIZE	CODE
TRACE LEVEL			
Fire Assay/AAS finish	0.005 – 10	30g	FAS-111
		50g	FAS-121
Fire Assay/ICP-ES finish	0.002 – 10	30g	FAS-114
		50g	FAS-124
ORE GRADE			
Fire Assay/AAS finish	0.01 – 100	30g	FAS-211
		50g	FAS-221
Fire Assay/ICP-ES finish	0.01 – 100	30g	FAS-214
		50g	FAS-224
GRAVIMETRIC			
Fire Assay/Gravimetric finish	0.9 - 10,000	30g	FAS-415
		50g	FAS-425

SILVER

DESCRIPTION	DETECTION RANGE(PPM)	FUSION SIZE	CODE
TRACE LEVEL			
Aqua regia digestion/ICP-ES finish	0.2 – 100	N/A	ICA-5Ag
<i>Note: See the Multi-Element Packages section of the guide for methods that include Ag in the suite of metals reported.</i>			
ORE GRADE			
Aqua regia digestion/ICP-ES finish	1 – 1,500	N/A	ICA-6Ag
<i>Note: See the Multi-Element Packages section of the guide for methods that include Ag in the suite of metals reported.</i>			
GRAVIMETRIC			
Fire Assay/Gravimetric finish	50 – 10,000	30g	FAS-418
		50g	FAS-428
Environmental Levy – for safe disposal of fire assay spent materials			DIS-600

GOLD AND SILVER

DESCRIPTION	DETECTION RANGE(PPM)	FUSION SIZE	CODE
TRACE LEVEL			
Gold – Fire Assay/AAS finish	Au: 0.005 – 10	30g	AuAg-12
Silver – Aqua regia/ICP-ES finish	Ag: 0.2 – 100	50g	AuAg-22
GRAVIMETRIC			
Fire Assay/Gravimetric finish	Au: 0.9 - 10,000	30g	FAS-413
		50g	FAS-423
	Ag: 50 – 10,000	50g	FAS-423

GOLD, PLATINUM AND PALLADIUM

DESCRIPTION	DETECTION RANGE(PPM)	FUSION SIZE	CODE
TRACE LEVEL			
Fire Assay/ICP-ES finish	Au, Pd: 0.002 – 10	30g	FAS-113
	Pt: 0.005 – 10	50g	FAS-123
ORE GRADE			
Fire Assay/ICP-ES finish	Au, Pt, Pd: 0.01-100	30g	FAS-213
		50g	FAS-223

RHENIUM, RHODIUM, RUTHENIUM AND IRIIDIUM

(contact us for more information)

DESCRIPTION	DETECTION RANGE (PPM)	FUSION SIZE	CODE
NiS Fire Assay/INAA	matrix dependent	on request	FAS-611

METALLIC SCREENING - GOLD

When samples are known to or suspected to contain metallic grains, it is preferable to analyze by metallic screening. 500g or 1kg of sample will be screened to 106µm. The entire plus (+) fraction is assayed while the minus (-) fraction is assayed in duplicate. Both fractions use fire assay techniques with gravimetric or instrumental finish. Other screen sizes are also available upon request.

DESCRIPTION	DETECTION RANGE (PPM)	FUSION SIZE	CODE
500g Screened	0.9 - 10,000	30g	MSC-530
Plus fraction and duplicate minus fractions analyzed	0.9 - 10,000	50g	MSC-550
1000g Screened	0.9 - 10,000	30g	MSC-130
Plus fraction and duplicate minus fractions analyzed	0.9 - 10,000	50g	MSC-150

CONCENTRATE

DESCRIPTION	DETECTION RANGE (PPM)	CODE
Gold	5 - 800,000	CON-9Au
Silver	5 - 800,000	CON-9Ag
Platinum	5 - 800,000	CON-9Pt
Palladium	5 - 800,000	CON-9Pd

BULLION

DESCRIPTION	DETECTION RANGE (FINENESS)	CODE
Gold	0.01 - 1,000	FAS-501
Silver	0.01 - 1,000	FAS-502



GEOCHEMICAL ANALYSIS

When you are making vital and costly decisions based on data provided from your geochemical analysis, you need consistent, reliable results and fast turn-around.

Our team will provide advice on the most appropriate method for your project, both technically and economically, to ensure your decisions are based on accurate data.

Our range of services will meet project needs from greenfields and brownfields exploration through to ore body definition, grade control and concentrate analysis. Our multi-element packages ensure that each method presents an optimal solution for different sample matrices, target commodity and detection limits.

Please note some detection limits may vary depending on the sample matrix.



AQUA REGIA DIGESTION

MSLABS offers various types of Aqua Regia digestion: a true 3:1 mixture of hydrochloric and nitric acids and dilute mixtures (equal portion) of hydrochloric, nitric, and deionized water. Aqua Regia acts as an oxidizing agent to dissolve most oxide, sulfide and carbonate minerals and is an excellent trace level exploration tool.

This is a partial digestion ideal for greenfields exploration since more resistant minerals including silicates are not significantly digested. By leaving the matrix undissolved, mobile pathfinder elements produce greater anomaly to background contrast enhancing confidence during target generation.

MULTI-ELEMENT ICP-MS AND ICP-ES (39 ELEMENTS)

TRACE LEVEL – Aqua Regia

DETECTION RANGE (IN PPM UNLESS OTHERWISE NOTED)				CODE		
Ag	0.05 – 100	Ga	0.1 - 10,000	Sb	0.05 - 10,000	
Al	0.01% - 25%	Hg	0.005 - 10,000	Sc	0.1 - 10,000	
As	0.1 - 10,000	K	0.01% - 10%	Se	0.2 - 1,000	
Au	0.5 ppb - 25	La	0.5 - 10,000	Sr	0.5 - 10,000	
B	10 - 10,000	Mg	0.01% - 25%	Te	0.05 – 500	True aqua regia
Ba	10 - 10,000	Mn	5 - 50,000	Th	0.2 - 10,000	IMS-127 0.5g
Bi	0.01 - 10,000	Mo	0.05 - 10,000	Ti	0.005% - 10%	IMS-128 20g
Ca	0.01% - 25%	Na	0.01% - 10%	Tl	0.02 - 10,000	IMS-129 40g
Cd	0.05 - 1,000	Ni	0.02 - 10,000	U	0.05 - 10,000	
Co	0.1 - 10,000	P	10 - 10,000	V	1 - 10,000	Dilute aqua regia
Cr	1 - 10,000	Pb	0.2 - 10,000	W	0.05 - 10,000	IMS-116 0.5g
Cu	0.2 - 10,000	Re	0.005 - 50	Y	0.5 - 500	IMS-117 20g
Fe	0.01% - 50%	S	0.01% - 10%	Zn	2 - 10,000	IMS-118 40g

MULTI-ELEMENT ICP-MS AND ICP-ES (51 ELEMENTS)

ULTRA TRACE LEVEL – Aqua Regia

DETECTION RANGE (IN PPM UNLESS OTHERWISE NOTED)							CODE			
Ag	0.01 – 100	Co	0.1 – 10,000	La	0.2 – 10,000	Re	0.001 – 50	Tl	0.02 – 10,000	
Al	0.01% - 25%	Cr	1 – 10,000	Li	0.1 – 10,000	S	0.01% - 10%	U	0.05 – 10,000	True aqua regia
As	0.1 – 10,000	Cs	0.05 – 500	Mg	0.01% - 25%	Sb	0.05 – 10,000	V	1 – 10,000	IMS-130 0.5g
Au ^{*1}	0.5ppb – 25	Cu	0.2 – 10,000	Mn	5 – 50,000	Sc	0.1 – 10,000	W	0.05 – 10,000	IMS-131 20g
B	10 – 10,000	Fe	0.01% - 50%	Mo	0.05 – 10,000	Se	0.2 – 1,000	Y	0.05 – 500	IMS-132 40g
Ba	10 – 10,000	Ga	0.05 – 10,000	Na	0.01% - 10%	Sn	0.2 – 500	Zn	1 – 10,000	
Be	0.05 – 1,000	Ge	0.05 – 500	Nb	0.05 – 500	Sr	0.2 – 10,000	Zr	0.5 – 500	Dilute aqua regia
Bi	0.01 – 10,000	Hf	0.02 – 500	Ni	0.2 – 10,000	Ta	0.01 – 500			IMS-110 0.5g
Ca	0.01% - 25%	Hg	0.005 – 10,000	P	10 – 10,000	Te	0.01 – 500			IMS-111 20g
Cd	0.01 – 1,000	In	0.005 – 500	Pb	0.2 – 10,000	Th	0.2 – 10,000			IMS-112 40g
Ce	0.02 – 500	K	0.01% - 10%	Rb	0.1 – 10,000	Ti	0.005% – 10%			

Individual elements available upon request

True aqua regia IMA-5xx^{*2} (0.5g), IMA-2xx^{*2} (20g), IMA-4xx^{*2} (40g)

Dilute aqua regia IMD-5xx^{*2} (0.5g), IMD-2xx^{*2} (20g), IMD-4xx^{*2} (40g)

^{*1} Gold is semi-quantitative due to the small sample size (0.5g), sample matrix and acid strength.

^{*2} Insert element symbol for (xx). REEs available upon request.

MULTI-ELEMENT ICP-ES (35 ELEMENTS)

BASIC LEVEL – Aqua Regia

DETECTION RANGE (IN PPM UNLESS OTHERWISE NOTED)				CODE		
Ag	0.2 – 100	Fe	0.01% – 50%	S	0.01% – 10%	
Al	0.01% - 25%	Ga	10 – 10,000	Sb	2 – 10,000	
As	2 – 10,000	Hg	1 – 10,000	Sc	2 – 10,000	
B	10 – 10,000	K	0.01% - 10%	Sr	1 – 10,000	
Ba	10 – 10,000	La	10 – 10,000	Th	8 – 2,000	
Be	0.5 – 1,000	Mg	0.01% - 25%	Ti	0.01% – 10%	True aqua regia
Bi	2 – 10,000	Mn	5 – 50,000	Tl	10 – 10,000	ICP-130
Ca	0.01% - 25%	Mo	1 – 10,000	V	1 – 10,000	
Cd	0.5 – 2,000	Na	0.01% - 10%	W	10 – 10,000	
Co	1 – 10,000	Ni	1 – 10,000	Zn	1 – 10,000	
Cr	1 – 10,000	P	10 – 10,000	Zr	5 – 2,000	
Cu	1 – 10,000	Pb	2 – 10,000			

ICP-130 Multi-element package + Hg by ICP-MS 0.005 – 100 ICP-135

Individual elements available upon request

ICA-5xx*

4 - ACID DIGESTION

4-Acid or 'near total' digestion uses a combination of hydrochloric, nitric, perchloric and hydrofluoric acids. Only the most highly resistant minerals will not be dissolved. Mercury is volatilized in this type of digestion; however, it can be added by using aqua regia digestion at an additional cost.

Minimum weight requirement is 1g pulp.

MULTI-ELEMENT ICP-MS (48 ELEMENTS)

ULTRA TRACE LEVEL – 4-Acid

DETECTION RANGE (IN PPM UNLESS OTHERWISE NOTED)				CODE		
Ag	0.01 – 100	Hf	0.1 – 500	Sb	0.5 – 10,000	
Al	0.01% – 50%	In	0.005 – 500	Sc	0.1 – 10,000	
As	0.2 – 10,000	K	0.01% – 10%	Se	1 – 1,000	
Ba	10 – 10,000	La	0.5 – 10,000	Sn	0.2 – 500	
Be	0.05 – 1,000	Li	0.2 – 10,000	Sr	0.2 – 10,000	
Bi	0.01 – 10,000	Mg	0.01% – 50%	Ta	0.05 – 100	
Ca	0.01% – 50%	Mn	5 – 100,000	Te	0.05 – 500	
Cd	0.02 – 1,000	Mo	0.05 – 10,000	Th	0.2 – 10,000	IMS-230
Ce	0.02 – 500	Na	0.01% – 10%	Ti	0.01% – 10%	
Co	0.1 – 10,000	Nb	0.1 – 500	Tl	0.02 – 10,000	
Cr	1 – 10,000	Ni	0.2 – 10,000	U	0.1 – 10,000	
Cs	0.05 – 500	P	10 – 10,000	V	1 – 10,000	
Cu	0.2 – 10,000	Pb	0.5 – 10,000	W	0.1 – 10,000	
Fe	0.01% – 50%	Rb	0.1 – 10,000	Y	0.1 – 500	
Ga	0.05 – 10,000	Re	0.002 – 50	Zn	2 – 10,000	
Ge	0.05 – 500	S	0.01% – 10%	Zr	0.5 – 500	
IMS-230 Multi-element package + Hg by ICP-MS				0.005 – 100	IMS-235	

Individual elements available upon request

IMF-5xx*

* insert element symbol for (xx).

REE's available upon request.

MULTI-ELEMENT ICP-ES (34 ELEMENTS)

BASIC LEVEL – 4-Acid

DETECTION RANGE (IN PPM UNLESS OTHERWISE NOTED)				CODE		
Ag	0.5 – 100	Ga	10 – 10,000	S	0.01% – 10%	
Al	0.01% – 50%	K	0.01% – 10%	Sb	5 – 10,000	
As	5 – 10,000	La	10 – 10,000	Sc	2 – 10,000	
Ba	10 – 10,000	Li	10 – 10,000	Sr	1 – 10,000	
Be	0.5 – 1,000	Mg	0.01% – 50%	Th	8 – 10,000	
Bi	2 – 10,000	Mn	5 – 100,000	Ti	0.01% – 10%	ICP-230
Ca	0.01% – 50%	Mo	1 – 10,000	Tl	10 – 10,000	
Cd	0.5 – 1,000	Na	0.01% – 10%	V	1 – 10,000	
Co	1 – 10,000	Ni	1 – 10,000	W	10 – 10,000	
Cr	1 – 10,000	P	10 – 10,000	Zn	2 – 10,000	
Cu	1 – 10,000	Pb	2 – 10,000	Zr	5 – 2,000	
Fe	0.01% – 50%					
ICP-230 Multi-element package + Hg by ICP-MS				0.005 – 100	ICP-235	

Individual elements available upon request

ICF-5xx*



FUSION AND ICP-ES / ICP-MS FINISH

WHOLE ROCK ANALYSIS – LITHIUM BORATE FUSION AND ICP-ES FINISH (13 PARAMETERS + LOI)

DETECTION RANGE (%)					CODE	
Al ₂ O ₃	0.01 – 100	K ₂ O	0.01 – 100	SiO ₂	0.01 – 100	
BaO	0.01 – 100	MgO	0.01 – 100	SrO	0.01 – 100	
CaO	0.01 – 100	MnO	0.01 – 100	TiO ₂	0.01 – 100	WRA-310
Cr ₂ O ₃	0.01 – 100	Na ₂ O	0.01 – 100	LOI	0.01 – 100	
Fe ₂ O ₃	0.01 – 100	P ₂ O ₅	0.01 – 100			
WRA-310 + C&S	C	0.01 – 50	S	0.01 – 50		WRA-311
Any one or more parameters available upon request					WRA-3xx*	
*insert element symbol for (xx).						

LOI ANALYSIS

DESCRIPTION	DETECTION RANGE (%)	CODE
Loss on Ignition @ 550°C	0.01 – 100	LOI-550
Loss on Ignition @ 1000°C	0.01 – 100	LOI-1000

PEROXIDE FUSION WITH ICP-ES FINISH (18 ELEMENTS)

DETECTION RANGE (%)					CODE	
Al	0.01 – 50	Fe	0.05 – 70	Pb	0.01 – 30	
As	0.01 – 10	K	0.1 – 30	S	0.01 – 60	
Ca	0.05 – 50	Li	0.005 – 30	Si	0.1 – 50	PER-700
Co	0.002 – 30	Mg	0.01 – 30	Sn	0.01 – 30	
Cr	0.01 – 30	Mn	0.01 – 50	Ti	0.01 – 30	
Cu	0.005 – 30	Ni	0.005 – 30	Zn	0.01 – 30	

Specify element-of-interest

First element + Each additional element available

PER-7xx*

*insert element symbol for (xx).

SINGLE ELEMENTS

DETECTION RANGE (%)	CODE
B 0.005 – 10	PER-7xx*
Ge 10 - 10,000ppm	IMS-7xx*

*insert element symbol for (xx).

REFRACTORIES AND RARE EARTH ELEMENTS (REE'S) – LITHIUM BORATE FUSION AND ICP-MS

DETECTION RANGE (PPM)					CODE	
Ba	0.5 – 10,000	Ho	0.01 – 1,000	Ta	0.1 – 2,500	
Ce	0.1 – 10,000	La	0.1 – 10,000	Tb	0.01 – 1,000	
Cr	10 – 10,000	Lu	0.01 – 1,000	Th	0.05 – 1,000	
Cs	0.01 – 10,000	Nb	0.1 – 2,500	Tm	0.01 – 1,000	
Dy	0.05 – 1,000	Nd	0.1 – 10,000	U	0.05 – 1,000	IMS-300
Er	0.03 – 1,000	Pr	0.03 – 1,000	V	10 – 10,000	
Eu	0.03 – 1,000	Rb	0.2 – 10,000	W	1 – 10,000	
Ga	0.2 – 1,000	Sm	0.03 – 1,000	Y	0.5 – 10,000	
Gd	0.05 – 1,000	Sn	5 – 10,000	Yb	0.03 – 1,000	
Hf	0.2 – 10,000	Sr	0.1 – 10,000	Zr	2 – 10,000	



**IMS-130 ADD ON
AQUA REGIA DIGESTION AND ICP-MS**

**IMS-230 ADD ON
4 ACID DIGESTION AND ICP-MS**

DETECTION RANGE (in PPM)		DETECTION RANGE (in PPM)	
As	0.1 - 10,000	Ag	0.01 - 100
Au	0.5 ppb - 25	Cd	0.02 - 1,000
Bi	0.01 - 10,000	Cu	0.2 - 10,000
Hg	0.005 - 10,000	Mo	0.05 - 10,000
Sb	0.05 - 10,000	Ni	0.2 - 10,000
Se	0.2 - 1,000	Pb	0.5 - 10,000
Tl	0.02 - 10,000	Zn	2 - 10,000

COMPLETE WHOLE ROCK PACKAGE

DESCRIPTION	CODE
Whole Rock + C&S + Refractories and REE's	WRA-330
Complete Package: Whole Rock + C&S (WRA-311)	WRA-360

- + Refractories and REE's (IMS-300)
- + Aqua regia digestion add-on
- + 4-acid digestion add-on

CARBON AND SULFUR ANALYSIS

Total Carbon and Total Sulfur are analyzed directly by induction.
All Carbon and Sulfur methods are available separately or as packages.

DESCRIPTION	DETECTION RANGE (%)	CODE
Total C	0.01 – 50	SPM-110
Overlimit C (>50%)	– 100	SPM-115
Total Inorganic C – ashed, residue by induction, with graphite C correction	0.02 – 50	SPM-120
Total Inorganic C – ashed, residue by induction	0.02 – 50	SPM-125
Total Organic C – measured as the difference between total and ashed C content	0.02 – 50	SPM-130
Graphite C – ashed, leached, residue measured by induction	0.02 – 50	SPM-140
Complete C Package (Total, Inorganic, Organic, Graphite)		SPM-511
Total C + Total S C: 0.01 – 50		SPM-512
S: 0.01 – 50		
Total S	0.01 – 50	SPM-210
Overlimit S (>50%)	– 100	SPM-215
Sulfide-S: Total S-Sulfate S-Elemental S	0.01 – 100	SPM-220
Sulfate-S by HCl leach, ICP-ES finish	0.01 – 40	SPM-230
Elemental-S by Solvent extraction, gravimetric finish	0.01 – 100	SPM-240
Complete S Package (Total up to 50%, Sulfide, Sulfate)		SPM-522



WHOLE ROCK BY XRF

MSALABS uses new generation XRF instruments to give the explorationist more choices in the analysis of whole rock, REE's and refractory elements. Its key feature is a reproducible XRF elemental analysis across the periodic table. It is the preferred method for higher mineralized samples.

MSALABS also has the ability to remove mineralogical matrix effects by fusing the samples with high purity X-Ray flux at high temperatures using fully automated fusion equipment, producing a homogeneous glass disk.

The results obtained using this method are far more reliable than any other methods for refractory and high concentration elements.

Minimum weight requirement is 5g pulp.

WHOLE ROCK ANALYSIS – LITHIUM BORATE FUSION & XRF FINISH (14 PARAMETERS + LOI)

DETECTION RANGE (%)				CODE
Al ₂ O ₃	0.01 – 100	K ₂ O	0.01 – 15	SiO ₂ 0.01 – 100
BaO	0.01 – 66	MgO	0.01 – 45	SO ₃ 0.01 – 30
CaO	0.01 – 55	MnO	0.01 – 40	SrO 0.01 – 1.5
Cr ₂ O ₃	0.01 – 10	Na ₂ O	0.01 – 10	TiO ₂ 0.01 – 30
Fe ₂ O ₃	0.01 – 100	P ₂ O ₅	0.01 – 45	LOI 0.01 – 100
WRX-310 + C&S	C	0.01 – 50	S	0.01 – 50

Any one or more elements are available. WRX-3xx*

* insert element symbol for (xx).

RESISTIVE MINERALS – LITHIUM BORATE FUSION AND XRF FINISH

DETECTION RANGE (%)				CODE
Ba	0.01 – 40	Sb	0.01 – 45	U 0.01 – 13
Ga	0.01 – 10	Sn	0.01 – 55	W 0.01 – 50
Ge	0.01 – 10	Ta	0.01 – 45	Zr 0.01 – 50
Nb	0.01 – 10	Th	0.01 – 13	

Any one element WRX-4xx*

Additional element available upon request

* insert element symbol for (xx).

RARE EARTH ELEMENTS (REE'S) – LITHIUM BORATE FUSION AND XRF FINISH

DETECTION RANGE (%)				CODE
CeO ₂	0.1 – 50	Ho ₂ O ₂	0.1 – 10	Sm ₂ O ₃ 0.1 – 10
Dy ₂ O ₃	0.1 – 10	La ₂ O ₃	0.1 – 50	Tb ₄ O ₇ 0.1 – 10
Er ₂ O ₃	0.1 – 10	Lu ₂ O ₃	0.1 – 10	Tm ₂ O ₃ 0.1 – 10
Eu ₂ O ₃	0.1 – 10	Nd ₂ O ₃	0.1 – 10	Y ₂ O ₃ 0.1 – 10
Gd ₂ O ₃	0.1 – 10	Pr ₆ O ₁₁	0.1 – 10	Yb ₂ O ₃ 0.1 – 10

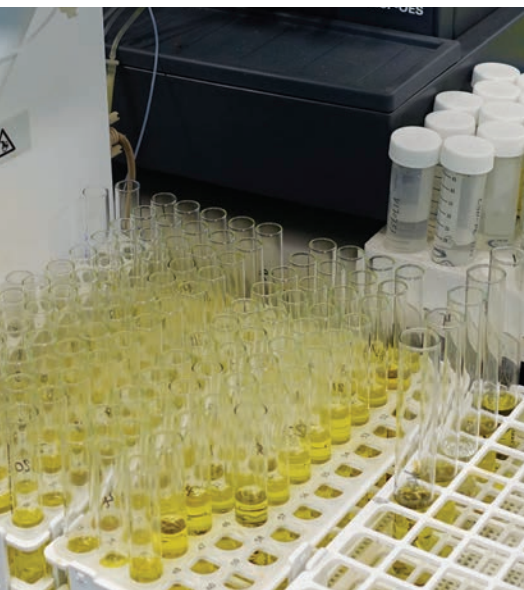
Any one element WRX-5xx*

* insert element symbol for (xx).

WHOLE ROCK ANALYSIS - LITHIUM METABORATE/TETRABORATE FUSION AND XRF FINISH (IRON ORE)

DETECTION RANGE (%)				CODE
Al ₂ O ₃	0.01 – 100 %	K ₂ O	0.01 – 7 %	Sn 0.01 – 2 %
As	0.01 - 2 %	MgO	0.01 – 40 %	Sr 0.01 – 2 %
Ba	0.01 - 10%	Mn	0.01 – 25 %	TiO ₂ 0.01 – 50 %
CaO	0.01 – 40 %	Na ₂ O	0.01 – 10 %	V 0.01 – 5 %
Cl	0.01 – 6 %	Ni	0.01 – 10 %	Zn 0.01 – 2 %
Co	0.01 – 5 %	P	0.01 – 10 %	Zr 0.01 – 1 %
Cr ₂ O ₃	0.01 – 10 %	Pb	0.01 – 2 %	LOI 0.01 – 100 %
Cu	0.01 – 2 %	S	0.01 – 5 %	
Fe	0.01 – 75 %	SiO ₂	0.01 – 100%	





OTHER

DESCRIPTION	DETECTION RANGE (%)	CODE
Specific gravity by weight on core		SPG-410
Specific gravity by weight on pulp		SPG-411
Specific gravity by weight on waxed core		SPG-415
Acid insoluble content	0.01 – 100	SPE-INS
Moisture determination	0.01 – 100	PMO-200

VOLUMETRIC METHODS – CLASSICAL TITRATION

DESCRIPTION	DETECTION RANGE (%)	CODE
Copper by titration	0.01 – 100	STI-8Cu
Lead by titration	0.01 – 100	STI-8Pb
Zinc by titration	0.01 – 100	STI-8Zn
Iron by titration	0.01 – 100	STI-8Fe
Ferrous Iron (FeO) by titration	0.01 – 100	STI-8FeO

COPPER ANALYSIS

DESCRIPTION	DETECTION RANGE (%)	CODE
Citric acid leach, AAS/ICP-ES finish	0.001 – 10	SQL-CA1
Sulfuric acid leach, AAS/ICP-ES finish	0.001 – 10	SQL-AS1
Sulfuric acid/sodium sulfite leach, AAS finish	0.001 – 10	SQL-AS2
Sodium cyanide leach, AAS finish	0.001 – 10	SQL-CN1
Residue, 4-Acid, ICP-ES finish	0.001 – 10	SQL-RE1
Residue, by calculation	0.001 – 10	SQL-RE2
Total Cu, 4-Acid, ICP-ES finish	0.001 – 40	ICF-6Cu
Sequential leach package includes ICF-6Cu, SQL-AS1, SQL-CN1, SQL-RE2	0.001 – 10	SQL-PK1



INSTRUMENT NEUTRON ACTIVATION ANALYSIS (INAA)

Instrumental neutron activation analysis (INAA) is used to determine the concentration of elements in a variety of matrices. A sample is irradiated and as it decays, it produces radioactive nuclides which emits gamma rays whose energies are characteristic to each element. Contact us for more information.

Minimum weight requirement is 25g.

DESCRIPTION	CODE
Au + 34 elements	NAA-110
Au + 33 elements	NAA-120

ELEMENT	UNITS	NAA-120	NAA-110	UPPER LIMIT
Au	ppb	5	5	10000
Ag	ppm	5	5	10000
As	ppm	1	2	20000
Ba	ppm	100	200	50000
Br	ppm	1	1	1000
Ca	%	--	1	100
Cd	ppm	10	--	1000
Ce	ppm	10	3	10000
Co	ppm	10	5	20000
Cr	ppm	50	10	20000
Cs	ppm	1	3	10000
Eu	ppm	2	0.2	5000
Fe	%	0.5	0.1	100
Hf	ppm	2	1	10000
Hg	ppm	--	1	1000
Ir	ppb	100	20	10000
K	%	--	0.2	100
La	ppm	5	1	10000
Lu	ppm	1	0	5000
Mo	ppm	2	5	10000
Na	%	0.05	0.05	100
Nd	ppm	--	10	5000
Ni	ppm	20	200	20000
Rb	ppm	10	30	20000
Sb	ppm	0.2	0.2	10000
Sc	ppm	0.5	1	10000
Se	ppm	10	5	5000
Sm	ppm	0.2	0.5	5000
Sn	ppm	200	--	20000
Sr	ppm	--	500	20000
Ta	ppm	1	1	5000
Tb	ppm	1	1	5000
Te	ppm	20	--	10000
Th	ppm	0.5	0.5	10000
U	ppm	0.5	0.5	10000
W	ppm	2	4	10000
Yb	ppm	5	0.5	5000
Zn	ppm	200	50	20000
Zr	ppm	500	--	50000

ORE GRADE

Analysis techniques are suitable where the elemental concentrations exceed trace geochemical limits. They are primarily suitable for projects at an advanced exploration stage or where identification of specific targets is required.



AQUA REGIA DIGESTION

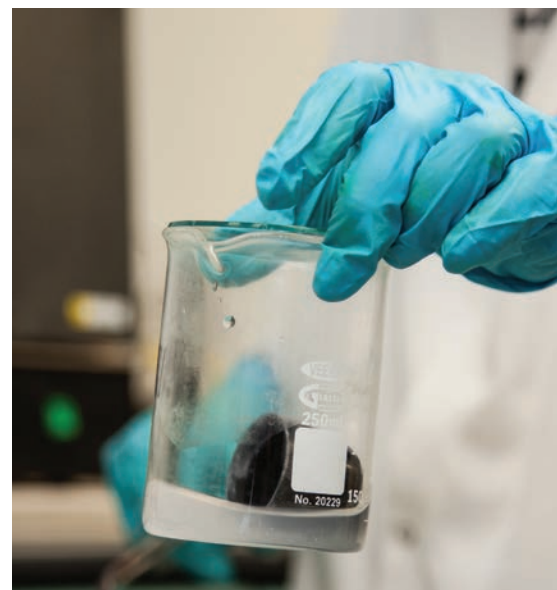
MULTI-ELEMENT ICP-ES (33 ELEMENTS)

DETECTION RANGE (IN % UNLESS OTHERWISE NOTED)				CODE			
Ag	1 – 1,500ppm	Fe	0.05 - 50	Pb	0.001 – 5		
Al	0.05 - 50	Ga	0.005 – 5	S	0.05 – 10		
As	0.001 – 10	Hg	0.001 – 5	Sb	0.001 – 5		
Ba	0.005 - 5	K	0.05 – 50	Sc	0.001 – 5		
Be	0.001 – 5	La	0.005 - 5	Sr	0.001 – 5	True aqua regia	
Bi	0.001 – 5	Mg	0.05 – 50	Ti	0.05 – 50	ICP-140	
Ca	0.05 – 50	Mn	0.01 – 25	Tl	0.005 – 5		
Cd	0.001 – 1	Mo	0.001 – 5	V	0.001 – 5		
Co	0.001 – 5	Na	0.05 – 50	W	0.005 – 5		
Cr	0.001 – 5	Ni	0.001 – 5	Zn	0.001 – 15		
Cu	0.001 – 10	P	0.005 – 25	Zr	0.001 – 2		

Individual elements available upon request

ICA-6xx*

*insert element symbol for (xx).



4-ACID DIGESTION

MULTI-ELEMENT ICP-ES (30 ELEMENTS)

DETECTION RANGE (IN % UNLESS OTHERWISE NOTED)				CODE			
Ag	1 – 1,000 ppm	Cu	0.001 – 40	P	0.01 – 10		
Al	0.05 – 30	Fe	0.05 – 50	Pb	0.01 – 20		
As	0.005 – 10	K	0.1 – 30	S	0.05 – 10		
Ba	0.005 – 5	La	0.005 – 5	Sb	0.005 – 5		
Be	0.001 – 1	Li	0.005 – 5	Sr	0.01 – 10		
Bi	0.005 – 5	Mg	0.05 – 50	Ti	0.05 – 30	ICP-240	
Ca	0.05 – 50	Mn	0.01 – 10	Tl	0.005 – 5		
Cd	0.001 – 1	Mo	0.001 – 5	V	0.001 – 10		
Co	0.001 – 5	Na	0.05 – 30	W	0.01 – 5		
Cr	0.001 – 10	Ni	0.001 – 10	Zn	0.01 – 40		

Individual elements

ICF-6xx*

*insert element symbol for (xx).

SPECIALTY ASSAY

Our range of specialty assay services enable you to go deeper in the search for geochemical knowledge. Whether it be downstream concentrate analyses, or upstream low level multielement determinations, we have a solution to suit your needs. Our Geochemists are available to advise on the best methods to quantify your sample composition.



GRASSROOTS EXPLORATION

Here you will find analytical packages to determine low grade elemental occurrence in waters and vegetation. These methods are an invaluable tool to provide you with geochemical information in the hunt for hidden mineralization

BIOGEOCHEMISTRY

Vegetation and trees can absorb mineral-rich nutrients via root systems from their environments – soil, bedrock, water – and provide the explorationist with significant geochemical information. Vegetation surveys can provide an effective complementary data for deeply buried deposits when establishing geochemical signatures. Macerated or ashed sample analyses are available. The default sample weight for macerated samples is 1g and for ashed samples is 0.25g.

Other sample weights are available on request.

PREPARATION

DESCRIPTION	CODE
Dry and macerate to 1mm, per 100g	PRP-VG1
Dry and ash at 475°C	PRP-VG2
Save all or part of reject fraction	PSC-115

MULTI-ELEMENT IN VEGETATION ICP-MS ULTRA TRACE LEVEL (51 ELEMENTS)

DETECTION RANGE (IN PPM UNLESS OTHERWISE NOTED)				CODE		
Ag	0.01 – 100	Ge	0.05 – 500	S	0.01% - 10%	
Al	0.01% - 25%	Hf	0.02 – 500	Sb	0.05 – 10,000	
As	0.1 – 10,000	Hg	0.005 – 10,000	Sc	0.1 – 10,000	
Au*	0.5ppb – 25	In	0.005 – 500	Se	0.2– 1,000	
B	10 – 10,000	K	0.01% - 10%	Sn	0.2 – 500	
Ba	10 – 10,000	La	0.2 – 10,000	Sr	0.2 – 10,000	
Be	0.05 – 1,000	Li	0.1 – 10,000	Ta	0.01 – 500	
Bi	0.01 – 10,000	Mg	0.01% - 25%	Te	0.01 – 500	
Ca	0.01% - 25%	Mn	5 – 50,000	Th	0.2 – 10,000	IMS-330
Cd	0.01 – 1,000	Mo	0.05 – 10,000	Ti	0.005% – 10%	
Ce	0.02 – 500	Na	0.01% - 10%	Tl	0.02 – 10,000	
Co	0.1 – 10,000	Nb	0.05 – 500	U	0.05 – 10,000	
Cr	1 – 10,000	Ni	0.2 – 10,000	V	1 – 10,000	
Cs	0.05 – 500	P	10 – 10,000	W	0.05 – 10,000	
Cu	0.2 – 10,000	Pb	0.2 – 10,000	Y	0.05 – 500	
Fe	0.01% - 50%	Rb	0.1 – 10,000	Zn	1 – 10,000	
Ga	0.05 – 10,000	Re	0.001 – 50	Zr	0.5 – 500	



HYDROGEOCHEMISTRY

Surface and groundwater surveys can be an effective tool in mineral exploration. As water comes in contact with rocks containing ore deposits, minerals may dissolve in the water emulating the chemical composition of the rock. Ultra trace analysis by ICP-MS provides the sensitivity required between background levels and anomalous levels.

Water sampling bottles, 0.45 µm filters, environmental grade nitric acid, and deionized water for field blanks can be provided at cost. Please notify the lab in advance for the supplies prior to sampling.

Minimum sample volume requirement is 25 mls.

MULTI-ELEMENT BY DIRECT READ, ICP-MS ULTRA TRACE LEVEL (65 ELEMENTS)

ANALYTES AND DETECTION LIMITS (IN PPB)										CODE
Ag	0.01	Eu	0.01	Na	20	Sm	0.01			
Al	20	Fe	30	Nb	0.01	Sn	0.01			
As	0.05	Ga	0.01	Nd	0.01	Sr	0.01			
Au	0.02	Gd	0.01	Ni	0.1	Ta	0.01			
B	10	Ge	0.05	P	100	Tb	0.01			
Ba	0.01	Hf	0.01	Pd	0.05	Te	0.05			
Be	0.05	Hg	0.1	Pb	0.5	Th	0.01			
Bi	0.01	Ho	0.01	Pr	0.01	Tl	0.01			
Ca	20	In	0.01	Pt	0.05	Tm	0.01			DIR-IMS
Cd	0.01	K	10	Rb	0.01	U	0.01			
Ce	0.01	La	0.01	Re	0.004	V	0.1			
Co	0.02	Li	1	S	50	W	0.01			
Cr	0.05	Lu	0.01	Sb	0.05	Y	0.01			
Cs	0.01	Mg	20	Sc	4	Yb	0.01			
Cu	0.05	Mn	0.05	Se	0.5	Zn	0.5			
Dy	0.01	Mo	0.05	Si	10	Zr	0.02			
Er	0.01									
Dilution of samples containing >1% solids										DIL-IMS

Detection Limits are based on samples containing low levels of total dissolved solids (less than 0.1%). Samples containing high levels of total dissolved solids will be diluted prior to analysis and as a result, the cost and detection limits will change.



ANALYTICAL SERVICES

For your high-grade materials, we have methods to accurately determine the level of metals of economic interest. Speak with one of our chemists to coordinate the analytic technique best suited for your material.





BULK LEACH EXTRACTABLE GOLD (BLEG) - Cyanide Leach

Test uses cyanide to extract gold into solution. These procedures can be applied to geological samples in which fine gold may be present or where gold may be heterogeneously distributed. Advanced BLEG test is also available where it uses multiple sampling periods as well as analysis of the leached solution and the residue to better understand the leachability of the ore.

DESCRIPTION	DETECTION RANGE (PPM)	CODE
BLEG Quick cyanide test, leached solution by AAS	0.01 – 100	AU-CN00
BLEG Leached solution by AAS, Residue by fire assay	0.01 – 100	
500g		AU-CN01
1kg		AU-CN04
ADVANCED BLEG 2hr, 6hr, 24hr, 48hr sampling of cyanide liquor with AAS finish Fire assay of residue before leaching and after 48 hours	0.01 – 100	AU-CN02
METALLURGICAL BLEG		AU-CN03

Multiple sampling periods to determine leach kinetics.

Detailed metallurgical balance including head and leach residue assays.

Additional options include:

- Examination of the effect of additional reagents,
- Modification of test parameters such as oxygen levels, temperature and particle size,
- In conjunction with other mineral beneficiation processes.

PRECIOUS METALS IN METALLURGICAL SAMPLES

DESCRIPTION	DETECTION RANGE (PPM)	CODE
GOLD		
Trace level – Fire Assay/AAS finish	0.005 - 10	MET-FA1
Ore grade – Fire Assay/AAS finish	0.01 - 100	MET-FA2
Concentrate – Fire Assay/ Gravimetric finish	0.9 - 10,000	MET-FA3
SILVER		
Concentrate – Fire Assay/ Gravimetric finish	50 - 10,000	MET-FA5
GOLD AND SILVER		
Ore grade – Fire Assay/Gravimetric Finish	Au: 0.9 - 10,000 / Ag: 50 - 10,000	MET-FA7
Gold medium grade – Fire Assay/AAS finish and		
Silver medium grade – Aqua Regia digestion/ICP-ES finish	Au: 0.01 - 100 / Ag: 1 - 1,500	MET-FA8
GOLD, PLATINUM AND PALLADIUM		
Trace Level – Fire Assay/ICP-ES finish	Au, Pd: 0.002 – 10 / Pt: 0.005 - 10	PGM-133
Ore Grade – Fire Assay/ICP-ES finish	Au, Pt, Pd: 0.01 - 100	PGM-233

MULTI-ELEMENT PACKAGES FOR METALLURGICAL SAMPLES

MULTI-ELEMENT ICP-ES (33 ELEMENTS)

ORE GRADE – Aqua Regia

DETECTION RANGE (IN % UNLESS OTHERWISE NOTED)				CODE			
Ag	1 – 1,500ppm	Fe	0.05 - 50	Pb	0.001 – 5		
Al	0.05 - 50	Ga	0.01 – 5	S	0.05 – 10		
As	0.001 – 10	Hg	0.001 – 5	Sb	0.001 – 5		
Ba	0.01 - 5	K	0.05 – 50	Sc	0.001 – 5		
Be	0.01 – 5	La	0.005 – 5	Sr	0.001 – 5		
Bi	0.01 – 5	Mg	0.05 – 25	Ti	0.05 – 50	MET-420	
Ca	0.05 – 50	Mn	0.01 – 25	Tl	0.005 – 5		
Cd	0.001 – 1	Mo	0.001 – 5	V	0.001 – 5		
Co	0.001 – 1	Na	0.05 – 50	W	0.005 – 5		
Cr	0.001 – 5	Ni	0.001 – 5	Zn	0.001 – 15		
Cu	0.001 – 10	P	0.005 – 25	Zr	0.001 – 2		

Individual elements available upon request INA-8xx
 *insert element symbol for (xx).

MULTI-ELEMENT ICP-ES (29 ELEMENTS)

ORE GRADE – 4 Acid

DETECTION RANGE (IN % UNLESS OTHERWISE NOTED)				CODE			
Ag	1 – 1,000 ppm	Cu	0.001 – 40	Pb	0.01 – 20		
Al	0.05 – 30	Fe	0.05 – 50	S	0.05 – 10		
As	0.005 – 10	K	0.1 – 30	Sb	0.005 – 5		
Ba	0.005 – 5	La	0.005 – 5	Sr	0.01 – 10		
Be	0.001 – 1	Mg	0.05 – 50	Ti	0.05 – 30	MET-440	
Bi	0.005 – 5	Mn	0.01 – 10	Tl	0.005 – 5		
Ca	0.05 – 50	Mo	0.001 – 5	V	0.001 – 10		
Cd	0.001 – 1	Na	0.05 – 30	W	0.01 – 5		
Co	0.001 – 5	Ni	0.001 -10	Zn	0.01 – 40		
Cr	0.001 – 10	P	0.01 – 10				

Individual elements INF-8xx
 * insert element symbol for (xx).

PEROXIDE FUSION WITH ICP-ES FINISH (18 ELEMENTS)

DETECTION RANGE (IN %)				CODE			
Al	0.01 – 50	Fe	0.05 – 70	Pb	0.01 – 30		
As	0.01 – 10	K	0.1 – 30	S	0.01 – 60		
Ca	0.05 – 50	Li	0.05 – 30	Si	0.1 – 50	MET-510	
Co	0.002 – 30	Mg	0.01 – 30	Sn	0.01 – 30		
Cr	0.01 – 30	Mn	0.01 – 50	Ti	0.01 – 30		
Cu	0.005 – 30	Ni	0.005 – 30	Zn	0.01 – 30		

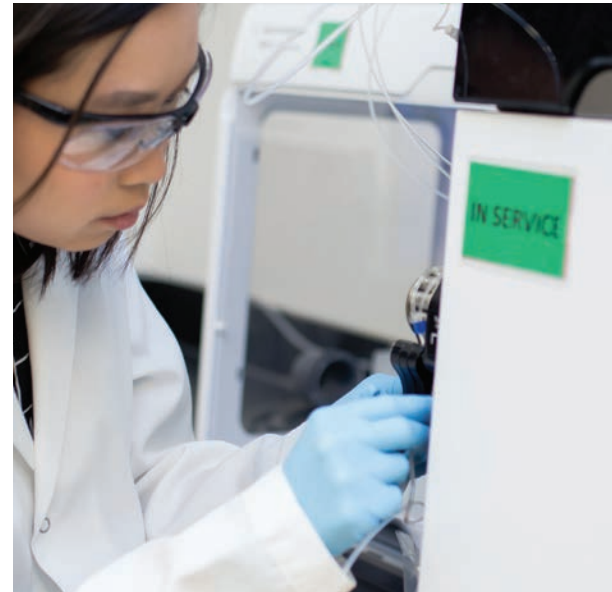
DIRECT READ FROM SOLUTION, ICP-ES FINISH (30 ELEMENTS)

DETECTION RANGE (IN PPM)					CODE				
Ag	0.05 - 10	Ca	5 - 10,000	K	5 - 10,000	Ni	0.05 - 1,000	Ti	5 - 10,000
Al	5 - 10,000	Cd	0.05 - 100	La	1 - 1,000	P	0.5 - 10,000	Tl	0.5 - 1,000
As	0.2 - 1,000	Co	0.05 - 1,000	Mg	5 - 10,000	Pb	0.5 - 1,000	V	0.05 - 1,000
Ba	1 - 1,000	Cr	0.05 - 1,000	Mn	0.5 - 2,000	S	5 - 10,000	W	0.5 - 1,000
Be	0.05 - 100	Cu	0.05 - 1,000	Mo	0.05 - 1,000	Sb	0.2 - 1,000	Zn	0.2 - 1,000
Bi	0.2 - 1,000	Fe	5 - 10,000	Na	5 - 10,000	Sn	0.05 - 1,000	Zr	0.5 - 1,000

CARBON AND SULFUR ANALYSIS

C&S	MET-750
-----	---------

Review parameters under Specialty Assay. (page 17)



OTHER SERVICES

MSALABS provides a range of other services including Laboratory Construction and Management and a range of Metallurgical Services.



LABORATORY CONSTRUCTION AND MANAGEMENT

ON-SITE LABORATORIES

MSALABS provides high-quality and cost efficient modular laboratory facilities.

Our team will work with your specific space and technical requirements to deliver a customized on-site laboratory for your project success.

Our customised on-site laboratories reduce the lead-time for results, meaning you get your data faster and your project stays on plan.

MSALABS offers the following:

TURNKEY CAPABILITIES:

One point of contact for your laboratory design, engineering and installation needs.

CUSTOM DESIGNED UNITS:

All units are built to ensure efficient work flow in the laboratory and meet your technical specifications.

INSTRUMENT/EQUIPMENT EVALUATION:

Our technical laboratory staff ensures each instrument has ample space and proper utilities for operation.

TECHNICAL SUPPORT:

Our technical team can provide short-term support during method development or long-term on-going support during operation.

STAFFING SOLUTIONS:

Our team offers flexible staffing solutions. From training your staff on current methodologies to our assayers operating an on-site laboratory, we can develop a package that suits your project needs.





METALLURGICAL SERVICES

MSALABS is pleased to partner with one of the leading metallurgical laboratories. Our partner laboratory works on the principle that effective process development in extractive metallurgy requires more than just a set of lab tests. It recognizes that every customer and project require support at numerous levels of process development.

The team will help identify the best testing methodologies at each stage of the process development cycle: whether it be mineral beneficiation or metal production. Testing services include:

GRAVITY CONCENTRATION

Centrifugal gravity concentration, Shaking tables, Spirals, MAT table.

Mathematical modelling of full size gravity concentration circuits.

FROTH FLOTATION

Preliminary scoping, detail optimization, closed circuit (locked-cycle) and column options on sulphide, oxide, and industrial minerals.

DENSE MEDIA SEPARATION

Bench-scale and pilot-scale options, heavy liquid, ferrosilicon or magnetite-based media.

CLASSIFICATION

Crushing, grinding, screening, de-sliming and particle size analysis, Bond Ball Mill Work Index.

HYDROMETALLURGY

Cyanide leach test work, including bottle roll, reactor and column leaches, acid and caustic leach testing, Ion exchange and solvent extraction.

PILOT-SCALE ROTARY SCRUBBER TESTING, USED FOR DEPOSITS WITH POTENTIAL CLAY ISSUES

To break up agglomerates or lumps in clay-like deposits to liberate encased target minerals prior to beneficiation.

SETTLING TESTS

Coagulant & flocculent selection, column settling rate measurement.

GRAVIMETRIC FACTORS

ELEMENT	OXIDE	CONVERSION FACTOR
Al	Al ₂ O ₃	1.889
Ba	BaSO ₄	1.669
Ba	BaO	1.116
Be	BeO	2.775
C	CO ₂	3.666
Ca	CaO	1.399
Ca	CaCO ₃	2.497
Cr	Cr ₂ O ₃	1.461
F	CaF ₂	2.055
Fe	FeO	1.286
Fe	Fe ₂ O ₃	1.430
K	K ₂ O	1.205
Mg	MgO	1.658
Mg	MgCO ₃	3.468
Mn	MnO	1.291
Na	Na ₂ O	1.348
Nb	Nb ₂ O ₅	1.431
Ni	NiO	1.273
P	P ₂ O ₅	2.291
Rb	Rb ₂ O	1.094
Si	SiO ₂	2.139
Sn	SnO ₂	1.270
Sr	SrO	1.185
Ta	Ta ₂ O ₅	1.221
Th	ThO ₂	1.138
Ti	TiO ₂	1.668
U	U ₃ O ₈	1.179
V	V ₂ O ₅	1.785
W	WO ₃	1.261
Y	Y ₂ O ₃	1.270
Zr	ZrO ₂	1.351

CONVERSION FACTORS

1 ppm	1,000 ppb
1 ppm	1 g/tonne
1 oz/ton	34.286 g/tonne
1 g/tonne	0.0292 oz/ton
1%	10,000 ppm

SIEVE SIZES

TYLER MESH	OPENING (µm)
4	4760
10	1680
20	841
35	420
48	297
60	250
80	177
100	149
150	105
200	74
250	63
270	53
325	44
400	37

TERMS AND CONDITIONS

Services provided by MSALABS will be subject to these terms and conditions unless otherwise agreed in writing by MSALABS.

PRICING

Prices are subject to change by MSALABS without prior notice. Requests for services will be invoiced at the prices in effect at the time samples and a completed Sample Submittal Form (SSF) are received at MSALABS. Prices on MSALABS's website or quoted by an Account Manager are for the analysis of geological or metallurgical samples only and do not include applicable taxes. A batch charge applies to each work-order less than 20 samples.

PAYMENT

MSALABS accepts cash, cheques, bank drafts, wire transfers, PayPal and major credit cards as a form of payment. Payment terms are net 30 days. Overdue accounts are subject to an interest charge of 1.5% per month. MSALABS reserves the right to discontinue work or withhold results if the customer fails to observe these payment terms.

LIABILITY

MSALABS is responsible for performing analysis of customer samples in accordance with accepted professional standards using accepted and where applicable, accredited testing methodologies unless specific less stringent methods or procedures are requested by the customer. MSALABS's liability in connection with the performance or non-performance of the analysis is only to the customer and does not extend to the customers' or MSALABS's successors, assigns, associates, affiliates, officers, employees, directors, contractors, customers to any other third party and is limited to the cost of the specific analysis. MSALABS has no liability for indirect, exemplary, consequential, incidental or punitive damages, including loss of profits.

CONFIDENTIAL INFORMATION

All results and information obtained by MSALABS will be held in strict confidence unless (a) the customer has directed MSALABS Services to do so in writing or b) required by law or the rules of relevant stock exchange. MSALABS will only use Confidential Information for the purpose of supply of the requested Services.

SAMPLE SUBMITTAL FORMS (SSF)

A completed and signed SSF with instructions for analysis, reporting requirements and invoicing information must be provided at the time of sample submission. Sample submissions received without SSF may result in turn-around time delays.

SAMPLE QUALITY

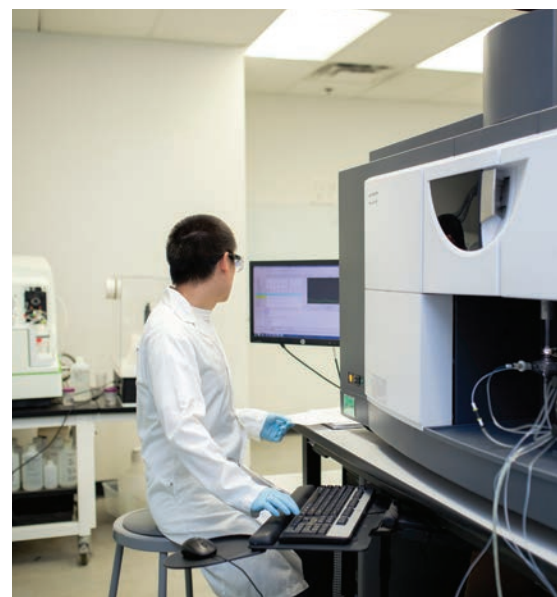
The customer bears the sole responsibility for the quality of its samples as received by MSALABS. MSALABS will not be responsible for the loss, degradation, or contamination of samples that may occur in shipping to or from its Laboratory. MSALABS is not obligated to assess and report on the fitness of samples for the requested analysis.

TURN-AROUND TIME

MSALABS Services offers regular service and rush service for an additional cost. All samples received after 2:00 pm will be recognized as received the next day.

STORAGE AND DISPOSAL

All pulps and rejects will be stored at our facility free of charge for 90 days. The free storage period starts on the day that the Test Report is released. At the end of this storage period, materials will be disposed unless otherwise instructed. Disposal fees may apply.



QUOTATION AND ACCOUNT PAYMENT

Services provided by MSALABS will be subject to these terms and conditions unless otherwise agreed in writing by MSALABS.

QUOTATIONS

MSALABS would be pleased to provide a comprehensive quotation for your project needs, from analysis required in early exploration to metallurgical testing. We offer a full suite of services that can be customized to your unique requirements. Please contact MSALABS at Tel: +1 604-888-0875 or Email: customer.service@msalabs.com to speak to an Account Manager.

PAYMENTS

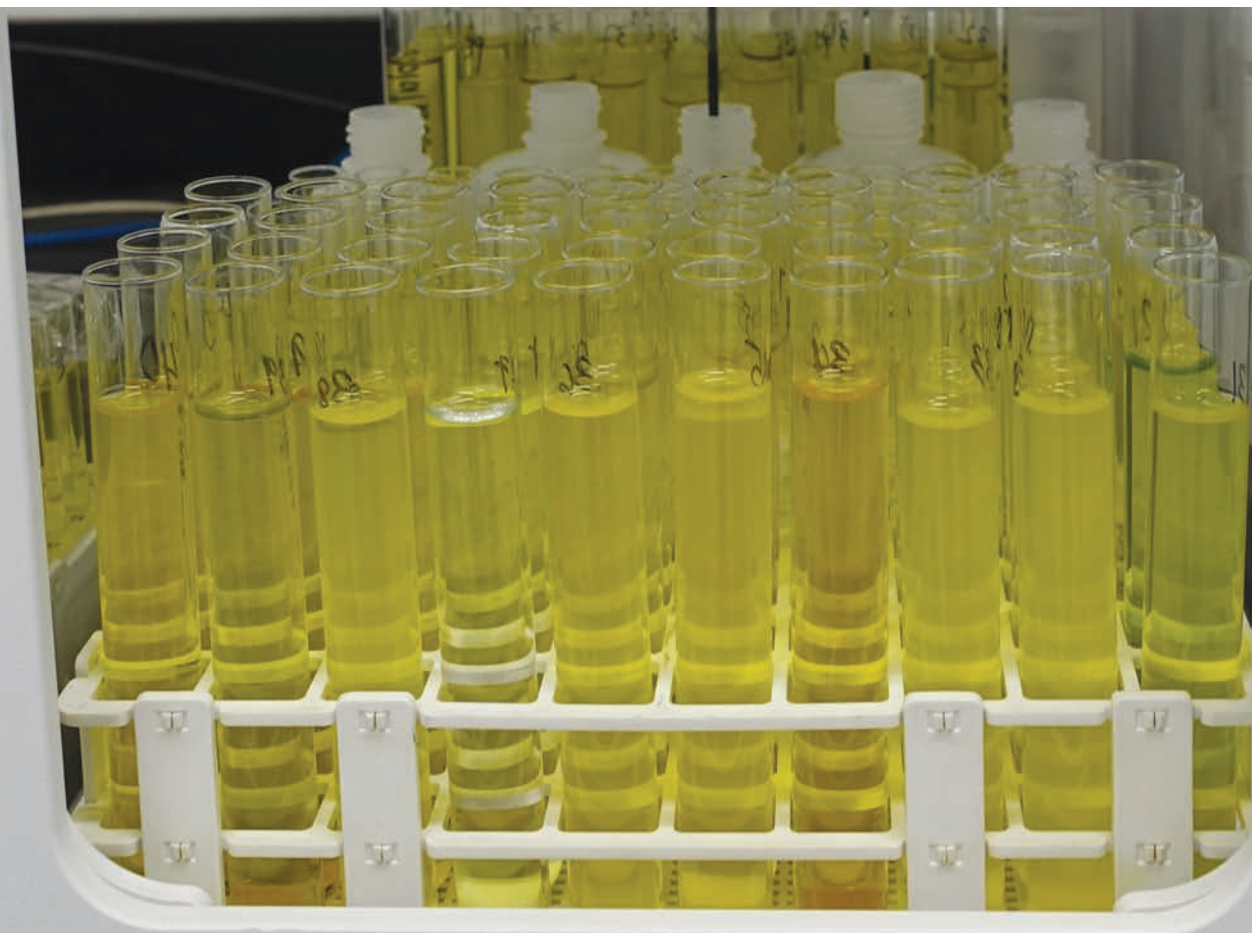
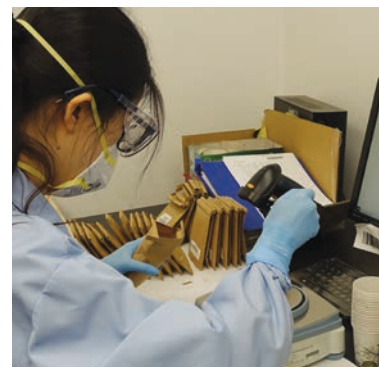
MSALABS accepts cash, cheques, bank drafts, wire transfers, PayPal and major credit cards as a form of payment. Please contact our Customer Services Department at Tel. +1 604-888-0875 or email: accounts@msalabs.com for information.

CREDIT ACCOUNT

If you would like to set up a credit account, please contact MSALABS at +1 604-888-0875 or Email: accounts@msalabs.com and we will send you a credit application form.

NON CREDIT ACCOUNTS

Customers without a credit account are required to pay prior to the start of analysis. Payment may be included with sample submission or by credit card pre-authorisation.



Corporate Head Office

Head Office

Unit 1, 20120 102nd Avenue,
Langley, BC V1M 4B4
Canada
T: +1 604-888-0875
E: customer.service@msalabs.com



Regional Offices

Canada

107-4816 HWY 16 W
Terrace, BC V8G 1L6
Canada
T: +1 250-631-0758
E: customer.service@msalabs.com

757 Algonquin Boulevard E
Timmins
Ontario P4N 7E4
Email: customer.service@msalabs.com

13 Rue Turgeon
Val-D'Or
Quebec, J9P 0A6
Tel: tel:+819-355-2561
Email: val-d-or@msalabs.com

951 Great St.
Prince George
British Columbia, V2N 5R7
Email: customer.service@msalabs.com

Unit 305 19358 96 Avenue
Surrey, BC, V4N 4C1, Canada
Email: customer.service@msalabs.com

Egypt

Industrian Zone Street 103
Marsa Alam
Red Sea Governate
Egypt
Email: customer.service@msalabs.com

Ghana

N217 Kweku Pipim St,
Obuasi, Ashanti Region,
GHANA
Email: customer.service@msalabs.com

Guyana

Lot 14 Coldingen Industrial Estate
East Coast Demerara
Georgetown
T: +592-691-6861
E: contact@msalabs.com

Mali

Sotuba Bougouba, derrière DNGM
Bamako
Mali
Email: customer.service@msalabs.com

Mauritania

75 Ilot V, Hangar 3,
Route de l'ancien aéroport,
Le Ksar, (200m left of SOGECO building)
Zone ZGE, Nouakchott, Mauritania
T: + 222-524-5757

Nigeria

PW Nigeria Ltd. Compound
Plot 9, Outer Northern Expressway,
Maitama District, Abuja
T: +234-809-600-8161/
+234-807-400-5632

Tanzania

Gold Mines Road
PO Box 558
Geita
Tanzania
Email: customer.service@msalabs.com

United States

355 West River Street
Elko, 89801
Nevada
Email: customer.service@msalabs.com

2075 Griffin Street
Carlin, 89822
Nevada
Email: customer.service@msalabs.com

Franchises

Argentina

Boulevard Sarmiento 742 Oeste
Villa Krause, San Juan
Argentina
T: +54-264-401-3245
E: contact@msalabs.com

Canada

(Drop off depot only)
ALX Exploration & Mining Services
33 Levich Drive, Whitehorse, YT
Y1A 0A8, Canada
T: +867 668 6096
E: administration@alx.ca

Ecuador

Lac y Asociados Cia. Ltda.
Panamericana Sur Km 1
Cuenca, Azuay
Ecuador
T: +593-99-725-3459
E: Lacyasociados@gmail.com

Carlos Puig & Asociados
Av. Eloy Alfaro N73-93 y A. Basantes
Quito
Ecuador
Email: customer.service@msalabs.com

Finland

CRS Laboratories Oy
Takatie 6, 90440 Kempele, Finland
T: +358-40-5132015
E: Ville.anttila@crs.fi

Sweden

MS Analytical AB
Timmervägen 15
SE-923 41
Stensele
T: +46-70-608-6130
E: Contact.scandinavia@msanalytical.net