

# GEOCHEMISTRY

2024 SCHEDULE  
OF SERVICES &  
FEES \$ USD



BUREAU  
VERITAS

# SHAPING A WORLD OF TRUST

Bureau Veritas Minerals (BVM) is the leading global provider of geochemistry, geoanalytical, mineral processing and environmental services to the exploration and mining community. We are by your side throughout the mining value chain: exploration, extraction, processing and transportation. Our services are structured to support the life cycle of your assets, from planning and design through procurement of components and equipment to construction, operation and closure.

## UNDERSTANDING YOUR CHALLENGES

### IN EXPLORATION

Mining is among the world's highest-risk businesses: projects are often operated in remote, and sometimes, conflict-afflicted areas. The supply chain—which is both global and highly local—is complex. Environmental regulations are becoming more stringent. And works are often carried out under risky conditions in which safety can be compromised. As a mine operator, you need to ensure the quality, safety, and cost-effectiveness of your mining project. At the same time, you want to ensure your assets' future reliability and comply with regulations.

### IN OPERATIONS

Mining and exploration companies face one priority above all: to ensure their projects' commercial, technical and operational viability. They must also ensure shipment quality. For traders, certainty in the value of commercial settlements is a key concern. Across the entire life cycle, from early stage exploration through trading to smelting and recycling, companies seek to minimize risk while attaining high industry standards.

## PROVIDING YOU SUPPORT

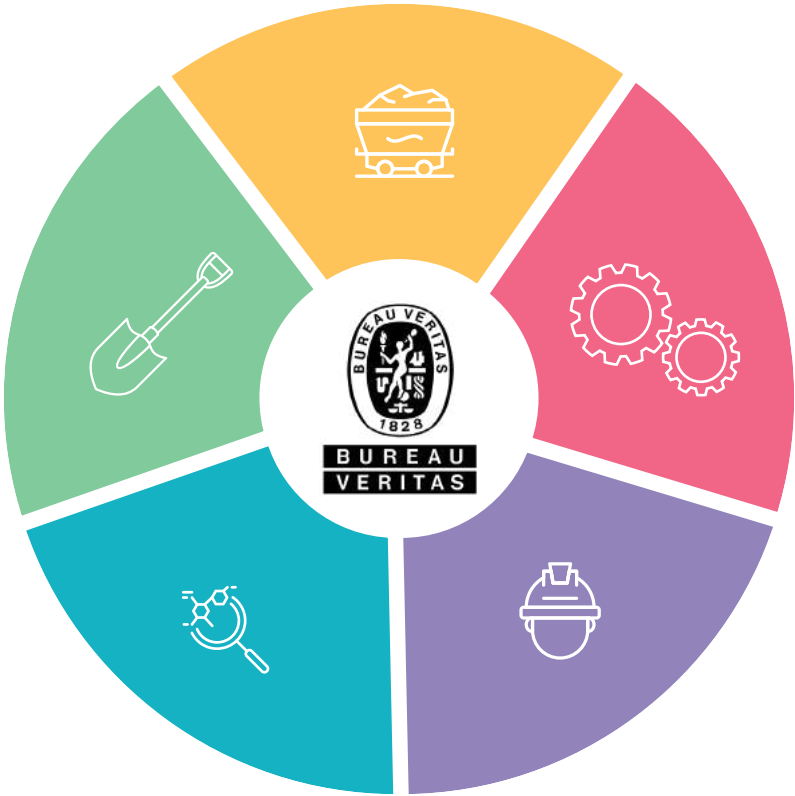
*"Bureau Veritas is a Business to Business to Society service company that contributes to positively transforming the world we live in. We work closely with our clients to address the critical challenges they face and to link these to the emerging aspirations of society. We play a pivotal role in building and protecting companies' reputations, supporting them as they forge the foundations of trust that is built to last."*



**Hinda Gharbi**  
CEO Bureau Veritas

Since 1828, we have acted as trust-makers between companies, governments and society, independent, impartial guarantors of our client's word. We provide support throughout your mining project's lifecycle—from exploration and procurement, to construction and operation—with services that cover products, assets, facilities, and processes. Working in major world ports and global mining and refining locations, Bureau Veritas has the infrastructure and expertise to minimize your commercial risk through upstream and trade services.

# FULL MINING LIFE CYCLE



**EXPLORATION**

- + Ultra-Trace Geochemistry
- + Trace and Ore Grade Assays
- + Lithogeochemistry
- + Environmental Chemistry

**DEVELOPMENT**

- + Ore Characterization
- + Mineralogy & Petrography
- + Pilot Plant Assessment

**FEASIBILITY**

- + Environmental Chemistry
- + Industrial Hygiene
- + Metallurgy & Mineralogy Testing

**OPERATION**

- + Environmental Chemistry
- + On-Site Lab Services
- + Trade and Settlement Testing
- + Used Oil Analysis

**REMEDIATION**

- + Static and Kinetic ARD Testing
- + Environmental Chemistry
- + Geochemistry



# RAPID GOLD BY PXRF

We now offer the opportunity to obtain Rapid low level gold results throughout our lab network using pXRF. BV has partnered with the Portable PPB group to offer the detectORE™ technology, a greener, cleaner assay solution to measure very low concentrations of gold in samples with pXRF. This can be made available throughout our network without a large upfront capital commitment for customers looking for rapid results.



# SPECTRAL SERVICES & MACHINE LEARNING

Using BV's unique solution, harness the power of spectroscopy (NIR, SWIR, and FTIR) and machine learning to uncover hidden patterns and associations in ore samples, creating a valuable digital record for future use.

Cost-effective and rapid prediction of critical variables, including metallurgical performance, mineralogical characteristics, chemistry, and physical properties.

Informed decision-making and enhancing orebody knowledge.

Fe	As	Sr	Cd	Sb	Bi	Ca
%	%	%	%	%	%	%
0.001	0.001	0.001	0.001	0.001	0.01	0.01
<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	18.15
0.002	<0.001	<0.001	<0.001	<0.001	<0.01	21.03
0.002	<0.001	<0.001	<0.001	<0.001	<0.01	1.81
0.002	<0.001	<0.001	<0.001	<0.001	<0.01	1.24
0.002	0.008	0.001	<0.001	<0.001	<0.01	0.49
0.001	0.001	0.001	<0.001	<0.001	<0.01	2.51
<0.001	0.001	0.001	<0.001	<0.001	<0.01	0.29
<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	



# CRITICAL MINERALS / METALS

Bureau Veritas is recognized as a global leader in innovative laboratory testing, inspection, and certification solutions, which serve the businesses that are shaping our changing world.

3

6.938

Li

Lithium

**LITHIUM**  
Analytical methods suggested: PF370, MA370, ICPTV-W (Solution), Metallurgical and mineralogical services  
Ore grade lithium is most commonly found in pegmatites, hectorite clays, and lithium brines. Most of the world's lithium production is in South America, where lithium-containing brine is extracted from underground pools and concentrated by solar evaporation.

6

12.0096

C

Carbon

**GRAPHITE**  
Analytical methods suggested: TC005, TC006, TC007, QEMSCAN & XRD  
High purity graphite (> 99.95%) is a very important aspect of Li-ion batteries. Currently, approximately 2/3 of all graphite for Li-ion batteries is sourced from natural deposits. The remaining 1/3 is sourced from synthetic processes.

27

58.933

Co

Cobalt

**COBALT**  
Analytical methods suggested: XF720, PF370, MA370, AQ270-As  
Currently, the largest cobalt deposits are the stratiform copper/cobalt deposits of the Central African Copper Belt within the Democratic Republic of Congo (DRC). Outside of the DRC, cobalt is typically recovered as a co-product from the mining of magmatic Ni/Cu sulphide and Ni-laterite deposits. The element can also be found in cobalt-silver vein deposits, where it commonly forms Co arsenides. While cobalt grades can be very high in these deposits, so too can arsenic content.

25

54.938

Mn

Manganese

**MANGANESE**  
Analytical methods suggested: PF370  
Manganese ores are generally found in either sedimentary hosted, volcanogenic hosted massive sulphides (VHMS), or karst hosted deposits. Of these 3 types, the sedimentary hosted type is the most common and represents the largest deposits. The majority of Mn ore is mined in South Africa and Australia. Minerals mined are typically braunite, bixbyite, pyrolusite, or hausmannite. Due to the highly refractory nature of these minerals we recommend a very aggressive digestion method.

28

58.6934

Ni

Nickel

**NICKEL**  
Analytical methods suggested: XF720, MA370, MA270, AQ270-As  
Nickel is generally associated with cobalt. The most common Ni deposits are either magmatic sulphide, or Ni laterites.

Bureau Veritas | Schedule of Services & Fees 2024

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# ONSITE LABORATORY SERVICES

BVM Mine Site Laboratory Services provides high quality customized laboratories supported by our global network of professionals. Our goal is to provide you with a solution that meets your project needs, ranging from a remote mobile prep lab to a full service analytical laboratory at the mine. All labs meet the requirements of ISO 9001 Quality Management Systems and use validated methods and processes which comply with global OH&S standards. As we are the global leader in analytical geochemistry, we will provide you with a customized lab that will minimize costs and liability so your focus can be on mining and exploration.



### ONSITE LABORATORY SERVICES

- + Sample Prep Lab
- + Containerized Lab
- + Full Service Lab



### QUALITY & INTEGRITY

- + ISO accredited laboratories
- + Training and onsite laboratory support by qualified BVM Staff
- + Latest production scheduling
- + Auditing of laboratory procedures and management systems



### MINERAL TESTING SERVICES

- + Assaying and geochemical analysis
- + Metallurgical testing services
- + Mineralogical analysis
- + Environmental requirements



### OUTSOURCING

- + Custom designed facilities to improve sample processing efficiency
- + Technical diagnosis and service repair of existing equipment to reduce costs



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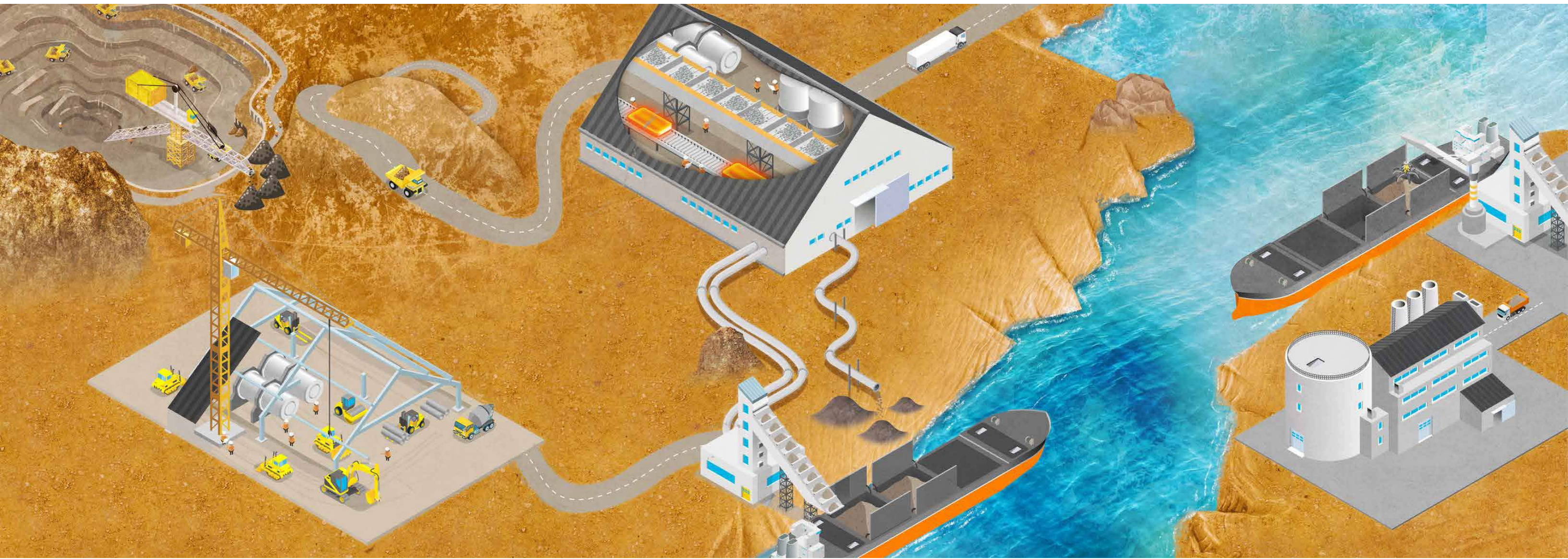
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 **VERIFY CONFORMITY TESTING & ANALYSIS**  
+ Construction material testing  
+ Geotechnical services


 **IDENTIFY ISSUES IN ADVANCE DESIGN & TECHNICAL SERVICES**  
+ Design review  
+ Technical diagnosis

 **CONFIRM THE QUALITY OF COMMODITIES LABORATORY TESTING SERVICES**  
+ Testing of exploration samples  
+ Grade control  
+ Mineral processing testing  
+ Outsourcing of laboratories at mining sites

 **ACCESS EXPERTISE COMMISSIONING SERVICES**  
+ Technical assistance to precommissioning and commissioning

 **GAIN REASSURANCE CONSTRUCTION SERVICES**  
+ QA/QC  
+ Project management supervisory services  
+ Site safety management

 **CONTROL QUALITY PROCUREMENT SERVICES**  
+ Vendor assessment  
+ Expediting  
+ Shop inspection  
+ Pre-shipment inspection

 **AVOID UNPLANNED SHUTDOWNS SERVICES FOR OPERATIONS**  
+ Operational reliability  
+ Shutdown inspection services  
+ Noise & vibration

 **PRESERVE ASSET LIFE INTEGRITY & RELIABILITY INSPECTION SERVICES**  
+ Non-destructive testing  
+ Condition monitoring  
+ Structural integrity inspection  
+ Non-intrusive & risk-based inspection  
+ Mechanical testing

 **VERIFY SHIPPED COMMODITIES TESTING AND INSPECTION SERVICES**  
+ Sample testing  
+ Quantity and quality inspections

 **DEMONSTRATE BEST PRACTICE CERTIFICATION SERVICES**  
+ Quality  
+ Health & Safety  
+ Environmental management





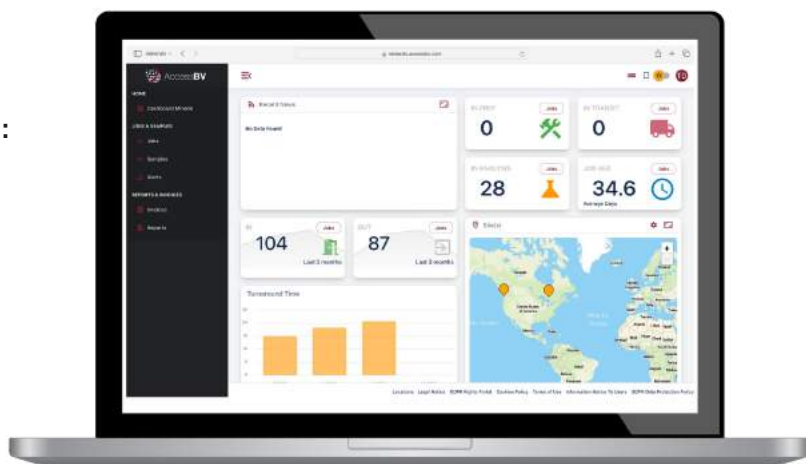
# ACCESS BV

## MANAGING YOUR EXPLORATION PROGRAM RESULTS HAS NEVER BEEN EASIER.

The Access BV Portal provides access to real-time information from the convenience of your laptop, tablet or smartphone. With the portal in your pocket, you can stay up to speed, order, submit and review while on the move.

### ACCESS BV PORTAL PROVIDES UNLIMITED **GLOBAL** ONLINE ACCESS, ENABLING YOU TO:

- See all your data in one place
- Create re-usable submission templates
- Work offline and upload later
- Collaborate with your team
- Integrate with your system via APIs
- Provide feedback and notify the laboratory



*To find out more about how Access BV can help, please contact your client services account manager.*

## STAY AHEAD OF THE CURVE: EXCITING NEW TECH ON THE HORIZON!

Cutting-edge technology is set to transform geochemistry, preserving the benefits of traditional methods with faster Turnaround Times (TAT), rigorous ESG compliance, improved safety, cost-effectiveness, and unparalleled precision—ushering in a sustainable, responsible future.







# SAMPLE PREPARATION STORAGE & DISPOSAL

## THE BUREAU VERITAS MINERALS SAMPLE PREPARATION PROCESS INCORPORATES SEVERAL IMPORTANT STEPS. THESE STEPS LAY THE GROUNDWORK FOR ALL ANALYSES

- Sample log-in and reconciliation against the client-supplied list. An electronic reconciliation is sent out for each job, which indicates methods, any potential missing samples, TAT, etc.
- Sample drying.
- Crushing and pulverizing rock, core or other solid media, or sieving soils and sediments. The lab typically crushes the entire sample and the sample mass to be pulverized can be varied based on client preference.
- Most importantly, our labs undertake a rigorous QAQC program to ensure consistent results. A sieve test is used to monitor the process on select and random samples at the primary crushing and pulverizing stage, as well as monitor the wear surfaces of plates, bowls and other equipment problems.

These tests are recorded and produced for your review. If there is a non-conformance in the quality standard, the process is reviewed and corrected. This rigorous policy applies to any material that is reported or used in the analytical process.



## SAMPLE PREPARATION, STORAGE & DISPOSAL

The packages listed here are the most common methods applied in our industry. If you require custom sample preparation techniques please contact your local account manager or lab nearest to your project to discuss in more detail. You will find our team of professionals and technical group second to none in our ability to provide support.

### ROCK AND CORE PREPARATION

CODE	DESCRIPTION	USD
<b>PRP70-250</b>	Crush to ≥70% passing 2mm - Pulverize 250 g ≥85% 75µm per kg*	\$10.75 + \$1.10
<b>PRP70-500</b>	Crush to ≥70% passing 2mm - Pulverize 500 g ≥85% 75µm per kg*	\$11.80 + \$1.10
<b>PRP70-1Kg</b>	Crush to ≥70% passing 2mm - Pulverize 1 kg ≥85% 75µm per kg*	\$13.35 + \$1.10
<b>PRP80-250</b>	Crush to ≥80% passing 2mm - Pulverize 250 g ≥85% 75µm per kg*	\$11.65 + \$1.80
<b>PRP90-250</b>	Crush to ≥90% passing 2mm - Pulverize 250 g ≥85% 75µm per kg*	\$12.10 \$2.30
<b>CRU70</b>	Crush to ≥70% passing 2mm per kg*	\$5.05 + \$1.10
<b>CRUPR</b>	Primary Crushing for large samples, (eg. whole core), per kg	\$1.50
<b>PUL85</b>	Dry and pulverize to ≥85% passing 75 µm Extra pulverizing over 250 g, per 250 g	\$5.20 + \$1.30
<b>DY105</b>	Dry pulp at 105°C, per sample	\$0.90
<b>HOMG</b>	Homogenizing of pulps by light pulverizing	\$4.80
<b>SPTRF</b>	Split by riffle splitter up to 5 kg of –2 mm sample, per sample	\$3.10
<b>WGHT</b>	Weigh sample	\$0.95
<b>CRUBW</b>	Extra wash with barren material – crushing	\$3.60
<b>PULSW</b>	Extra wash – silica – pulverizing	\$4.80
<b>SPTRS</b>	Rotary split up to 5 kg	\$6.30

\*Charged in units of 100g unless otherwise quoted

Other size fractions / preparation requirements available upon request. For example ceramic bowl pulverizing, different size crushing and bowl sizes, etc.



## SAMPLE PREPARATION, STORAGE & DISPOSAL

### SOILS

CODE	DESCRIPTION	USD
SS80	Dry at 60°C, sieve to depletion to -180 µm (80 mesh) up to 1 kg sample (discard plus fraction)	\$3.70
	Overweight sieving per 500 g - extra sieving over 1 kg	\$1.85
SS230	Dry at 60°C, sieve 100 g to -63 µm (230 mesh), up to 1 kg sample	\$5.90
	Overweight sieving per 500 g	\$2.95
	Other sieve sizes available upon request	By quote
PULSL	Pulverize soils in mild steel pulverizer, per 100 g	\$4.55
SVRJT	Saving all or part of soil reject	\$1.40
CLYSP	Clay separation up to 500 g (for other weight requirements please contact us)	\$34.65
DISP2	Heat treatment of soils and sediments prior to disposal, per sample (All international soil shipments to Canada)	\$0.75

Important note regarding soils: Importation regulations may apply; contact lab prior to shipment for details and shipment requirements. For soil shipments to Canada: No soil, till, sediment pulps or rejects can be returned and must be incinerated prior to disposal. A disposal fee (DISP2) is charged for these samples. Soil rejects are discarded immediately after preparation unless SVRJT is requested.



## SAMPLE PREPARATION, STORAGE & DISPOSAL

### SUBMITTING SAMPLES FOR ANALYSIS

#### SHIPPING INSTRUCTIONS

Go to our website and download our Analysis Request Form (english or spanish available)

- Fill in the form clearly by following step by step instructions (do not alter form format)
- Company information, quote number, project, Shipment ID, name, email and phone number
- Client details, invoice & report
- Mode of data transmittal (CSV, PDF, email)
- Method of analysis desired or package requested
- Special instructions
- Rush service needed
- Storage and disposal (reject or pulps) after analysis
- Don't forget to sign

#### PACKAGING INSTRUCTIONS

- Pack the samples securely, ensuring that each sample is clearly labeled with a sample number.
- Please identify any high grade samples – this helps us to reduce the risk of cross contamination.

#### SOILS INSTRUCTIONS (TO AND WITHIN) CANADA

Bureau Veritas will provide a CFIA Permit needed to clear soil samples expeditiously through Canada Customs. Permits are specific for the country of sample shipment origin and valid for one year. A copy of the permit must accompany each shipment and must be packaged in sturdy, leak-proof containers. Please contact laboratory prior to shipment for details and documentation requirements. Shipments cleared through Canada Customs for no charge.

#### ENVIRONMENTAL FEE

As part of our commitment to minimizing the environmental impact of our business activities, Bureau Veritas Minerals has migrated to a single green fee charge to cover all waste charges incurred by the laboratories. This fee, EN004, covers charges for cardboard and plastic recycling, hazardous waste disposal, emissions testing and monitoring, permitting fees and ongoing sustainability initiatives.

CODE	DESCRIPTION	USD
EN004	Environmental fee charge	\$1.20



## SAMPLE PREPARATION, STORAGE & DISPOSAL

### SAMPLE SUBMISSION ANALYSIS

#### SPECIFIC GRAVITY

CODE	DESCRIPTION	USD
<b>SPG02</b>	Specific Gravity on core by water displacement Surcharge over 2 kg	\$18.85 \$6.80
<b>SPG03</b>	Specific Gravity on waxed core (wax removal not included)	\$28.70
<b>SPG04</b>	Density on pulps or rock chips by gas pycnometer	\$20.15

#### MISCELLANEOUS CHARGES

CODE	DESCRIPTION	USD
<b>BAT01</b>	Administrative fee per batch	\$52.25
<b>PULHP</b>	Hand pulverize by mortar and pestle	\$11.90
<b>QCCHK</b>	Additional QC checks	\$4.55
<b>HAND</b>	Handling of special projects, per hour	\$84.55
<b>SHP-01</b>	Shipping charge (pulps), per sample — from branch (varies by country)	From \$2.85
<b>SPTPL</b>	Extra splitting of pulp	\$1.40
<b>PULSW</b>	Extra wash with silica-pulverizing	\$4.80
<b>DYAIR</b>	Air Dry samples, (<40°C), per 2 kg	\$3.45
<b>DYXS</b>	Drying surcharge for excessively wet samples Surcharge over 1 kg, per kg	\$3.35 + \$1.35
<b>SLBHP</b>	Sorting, Labeling, Boxing and Handling samples received as Pulps	\$1.40
<b>VAC01</b>	Vacuum seal samples, nitrogen purge	\$14.25
<b>CRCUT</b>	Core Cutting	By quote
<b>PICKUP</b>	Shipping charges for samples pick up	By quote

## SAMPLE PREPARATION, STORAGE & DISPOSAL

### SAMPLE SUBMISSION ANALYSIS *(continued)*

#### WAREHOUSE CHARGES

CODE	DESCRIPTION	USD
SPRTRN	Cost of shipping returns	At cost
DISRJ	Dispose of reject	\$1.00
DISPL	Dispose of pulps	\$0.25
WHRJT	Monthly storage of reject after 60 days	\$0.95
WHPLP	Monthly storage of pulps after 90 days (up to 250 g sample)	\$0.50
WHS01	Warehouse handling	By quote
WHSRT	Monthly storage of soil rejects after 60 days	\$0.50

Storage information: All samples rejects are stored for 2 months and pulps for 3 months at no charge and will be disposed of without notification unless storage is requested at the time of submission. A minimum charge of \$45/quarter will apply to all clients with samples in storage. When storage is requested on receipt, storage will be charged up front to cover the first 6 months. All disposal, handling or shipping charges for concentrates, high norm samples and samples containing hazardous materials will be borne by the client.







**BUREAU  
VERITAS**

# PRECIOUS METALS & LEACHES

**METHODS IN THIS SECTION INCLUDE INDUSTRY STANDARD FIRE ASSAY OPTIONS FOR GOLD, SILVER, PLATINUM AND PALLADIUM. FROM A BASIC 30 GRAM CHARGE TO FULL METALLIC SCREEN FIRE ASSAY, RELIABLE DATA IS ACHIEVED FOR ALL SAMPLE TYPES INCLUDING THOSE WITH COARSE GOLD.**

Bulk leaching of gold bearing materials using cyanide is also available and provides an additional tool to evaluate systems with unevenly distributed gold and to test for extractability. Selective and sequential leaches are also included in this section to provide information on the distribution of copper within various phases in the sample.

## PRECIOUS METALS & LEACHES

### AQUA REGIA GOLD

Recommended for soils, sediments, vegetation or reconnaissance rock samples. Samples are digested in 1:1:1 aqua regia then analyzed by ICP-MS. Refractory, massive sulphide and graphitic samples can limit Au solubility.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	DESCRIPTION	USD
<b>AQ115</b>	<b>Au</b>	0.5 ppb	10 ppm	15 g Aqua regia ICP-MS	\$18.10
<b>AQ130</b>	<b>Au</b>	0.5 ppb	10 ppm	30 g Aqua regia ICP-MS	\$21.40
<b>AQ115-IGN</b>	<b>Au</b>	0.5 ppb	10 ppm	Ignited 15 g Aqua regia ICP-MS Rock samples are ignited at 550°C before aqua regia digestion	\$20.30
<b>AQ130-IGN</b>	<b>Au</b>	0.5 ppb	10 ppm	Ignited 30 g Aqua regia ICP-MS Rock samples are ignited at 550°C before aqua regia digestion	\$23.95

### FIRE ASSAY

Lead collection fire assay fusion is a classic method for total sample decomposition. Total Au content is determined by digesting an Ag dore bead and then analysing by AAS, ICP-ES, or ICP-MS. The Lab reserves the right to reduce sample weight to 15 g or less for proper fusion.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	DESCRIPTION	USD
<b>ICP-MS</b>					
<b>FA130</b>	<b>Au</b>	1 ppb	1 ppm	30 g / Fire Assay / ICP-MS	\$29.65
<b>FA150</b>	<b>Pt</b>	0.1 ppb	1 ppm	50 g / Fire Assay / ICP-MS	\$33.65
	<b>Pd</b>	0.5 ppb	1 ppm		
<b>ICP-ES</b>					
<b>FA330-Au*</b>	<b>Au</b>	2 ppb	10 ppm	30 g / Fire Assay / ICP-ES	\$23.25
<b>FA350-Au*</b>	<b>Au</b>	2 ppb	10 ppm	50 g / Fire Assay / ICP-ES	\$27.60
<b>FA330*</b>	<b>Au</b>	2 ppb	10 ppm	30 g / Fire Assay / ICP-ES	\$27.80
<b>FA350*</b>	<b>Pt</b>	3 ppb	10 ppm	50 g / Fire Assay / ICP-ES	\$29.70
	<b>Pd</b>	2 ppb	10 ppm		
<b>AAS</b>					
<b>FA430*</b>	<b>Au</b>	0.005 ppm	10 ppm	30 g / Fire Assay / AAS	\$22.65
<b>FA450*</b>	<b>Au</b>	0.005 ppm	10 ppm	50 g / Fire Assay / AAS	\$26.15
<b>GRAVIMETRIC</b>					
<b>FA530-Ag</b>	<b>Ag</b>	20 ppm	10,000 ppm	30 g / Fire Assay / Gravimetric	\$31.65
<b>FA550-Ag</b>	<b>Ag</b>	20 ppm	10,000 ppm	50 g / Fire Assay / Gravimetric	\$36.20
<b>FA530-Au</b>	<b>Au</b>	0.9 ppm	1,000 ppm	30 g / Fire Assay / Gravimetric	\$31.65
<b>FA550-Au</b>	<b>Au</b>	0.9 ppm	1,000 ppm	50 g / Fire Assay / Gravimetric	\$36.20
<b>FA530</b>	<b>Au, Ag</b>	as above	as above	30 g / Fire Assay / Gravimetric	\$31.65
<b>FA550</b>	<b>Au, Ag</b>	as above	as above	50 g / Fire Assay / Gravimetric	\$36.20

Require at least 15 g sample weight.

\*Au>10 ppm are automatically analyzed by gravimetric method.



## PRECIOUS METALS & LEACHES

### METALLIC SCREEN FIRE ASSAY

Metallic screen fire assay prices include screening of sample to 106 µm. Additional preparation charges for crushing and pulverizing may apply. Alternative screen sizes/weights available upon request. Pricing is based on gravimetric analysis of the plus fraction and instrumentation on the minus fraction. Additional charges for gravimetric analysis on the minus fraction may apply. Please contact your local office to develop the right package for your project.

CODE	ELEMENT	DETECTION LIMIT	DESCRIPTION	USD
<b>FS632</b>	<b>Au</b>	0.05 ppm	Metallic Fire Assay duplicate minus fraction analyzed, 30 g - 500 g screen	\$73.40
<b>FS632-1Kg</b>	<b>Au</b>	0.05 ppm	Metallic Fire Assay duplicate minus fraction analyzed, 30 g - 1 kg screen	\$88.85
<b>FS652</b>	<b>Au</b>	0.05 ppm	Metallic Fire Assay duplicate minus fraction analyzed, 50 g – 500 g screen	\$83.30
<b>FS652-1Kg</b>	<b>Au</b>	0.05 ppm	Metallic Fire Assay duplicate minus fraction analyzed, 50 g – 1 kg screen	\$94.45

### OTHER CHARGES

CODE	DESCRIPTION	USD
<b>EN004</b>	Environmental fee charge	\$1.20
<b>CHPOT</b>	Stipulate new crucible for fire assay fusion	\$2.15

### WET ASSAY SILVER - ORE GRADE

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	DESCRIPTION	USD
<b>AR401-Ag</b>	<b>Ag</b>	1 ppm	800 ppm	Aqua Regia Digestion AAS Finish	\$16.60
<b>MA401-Ag</b>	<b>Ag</b>	1 ppm	800 ppm	Multi-acid Digestion AAS Finish	\$20.10



## PRECIOUS METALS & LEACHES

### PACKAGES FOR REGIONAL NEEDS — CONTACT BEFORE SHIPMENT

#### CARBONS, CONCENTRATES & HIGH GRADE

This method is ideal for the determination of Au and Ag when higher levels of precision are required. Our stringent quality control protocols involve the use of replicate assays and reference materials suited to the analysis to confirm accuracy. Results are not for commercial settlement purposes. Contact Bureau Veritas Commodities – Metals & Minerals Trade for commercial sampling and testing services where results are to be used for commercial settlement and/or financial transactions.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	DESCRIPTION	USD
FA501-Au	Au	10 ppm	100000 ppm	2 g sample Fire Assay for concentrates, duplicate analyses	\$118.25
FA501-Ag	Ag	100 ppm	100000 ppm	2 g sample Fire Assay for concentrates, duplicate analyses	\$118.25
FA501	Au, Ag	as above	as above	2 g sample Fire Assay for concentrates, duplicate analyses	\$139.75

Note: Additional base metal elements may be added for an additional analytical charge

#### GOLD BASE METAL LEACHES

Cyanide leaching can offer an alternative to classic fire assay methods with a comparable low detection limit. However, cyanidation analytical tests provide a more realistic estimation of gold and silver recovery from a rock pulp. Gold recovery can be impacted by organic carbon, graphite, and some sulphide minerals.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	DESCRIPTION	USD
BL001	Au			Please call to discuss	By quote
CN400	Au, Ag, Cu	0.03 ppm	50 ppm	Cyanide leach (various options)	By quote
CN401	Au	0.03 ppm	50 ppm	15 g, 1 hour room temperature cyanide shake, AAS finish	\$20.05
CN403	Au	0.03 ppm	50 ppm	30 g, 1 hour room temperature cyanide shake, AAS finish	\$21.90
CN401H	Au	0.03 ppm	50 ppm	15 g, 1 hour hot cyanide shake, AAS finish	\$23.30
CN403H	Au	0.03 ppm	50 ppm	30 g, 1 hour hot cyanide shake, AAS finish	\$24.95
PL415	Au	0.03 ppm	50 ppm	Preg rob leach-2 cyanide leaches with and without Au spiked solution < 15 g sample	Each leach \$16.05

Note: Additional base metal elements (Fe, Zn, Pb) may be added to some leaches for an additional analytical charge. Please contact the laboratory regarding your specific analytical requirements.



## PRECIOUS METALS & LEACHES

### PACKAGES FOR REGIONAL NEEDS — CONTACT BEFORE SHIPMENT *(continued)*

#### COPPER LEACHES

The following methods are used for the determination of Cu leachability, mineralogy and mineral solubility. These methods utilize laboratory standard leach conditions; however client specific conditions can be negotiated upon request.

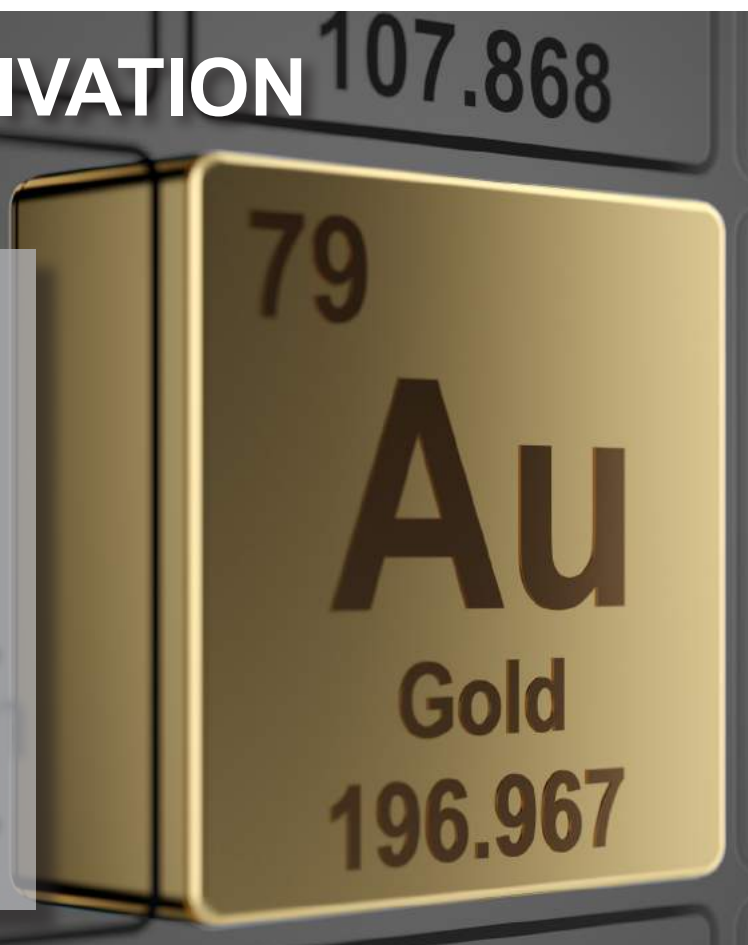
CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	DESCRIPTION	USD
LH401	CuS	0.001 %	10 %	1M Citric acid leach with AAS finish - Cu oxides	\$18.00
LH402	CuSH	0.001 %	10 %	Sulphuric acid leach with AAS finish - nonsulphide Cu	\$18.00
LH403	CuCN	0.01 %	10 %	Cyanide leach with AAS finish (30g)	\$19.30
LH425	CuSAP	0.01 %	100 %	Quick ferric sulphate leach for 1hr Cu by AAS	\$21.30
LHSQ2	CuSH CuCN CuRes*			Sample is sequentially leached in H <sub>2</sub> SO <sub>4</sub> (LH402), CN (LH403) with Cu from each leach reported. *Add Total Cu analysis by MA404 to calculate residue Cu	\$43.50

## NEUTRON ACTIVATION ANALYSIS

- Gold + 33 elements
- Superior detections and range of elements to Photon Assay
- 17025 Accredited Method
- Rapid Turn Around for Fast Decision Making in Eastern Canada
- Capacity Available, Competitive Pricing for Projects of Scale

#### ESG BENEFITS

Non-destructive test with no waste  
Reduced Carbon Footprint





# ORE & HIGH GRADE ANALYSIS

**BUREAU VERITAS' METHODS ARE DESIGNED TO PROVIDE THE EXTREMELY HIGH PRECISION AND ACCURACY REQUIRED TO QUANTIFY COMMODITY ELEMENTS FOR RESOURCE EVALUATION.**

Methods in this section are designed to provide the high precision and accuracy required to quantify commodity elements for resource evaluation. Digestion methods and reagents are chosen to effectively deal with high analyte concentrations. They are coupled with the most stable and matrix tolerant analytical platforms available to produce data of the highest quality. A variety of classical wet assay methods are also available for samples that exceed the maximum concentrations that can be determined instrumentally.



## ORE & HIGH GRADE ANALYSIS

### AAS ANALYSIS

Aqua regia and multi-acid digestions with AAS analysis are optimized for moderate to high grade ore samples and select target elements. These methods can be set up to be triggered automatically or selected as standalone packages.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
MA401	Ag	1 ppm	800 ppm	
	Cu	0.001 %	10 %	
	Fe	0.01 %	10 %	
	Pb	0.01 %	10 %	
	Zn	0.01 %	10 %	
MA401-Mo	Mo	0.001 %	10 %	\$16.35 +\$3.75 per element
	Cu	0.001 %	10 %	
MA404	Ag	2 ppm	1500 ppm	
	Cu	0.01 %	30 %	
	Fe	0.01 %	30 %	
	Ni	0.01 %	30 %	
	Pb	0.01 %	20 %	
	Zn	0.01 %	30 %	

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
AR401	Ag	1 ppm	800 ppm	
	Cu	0.001 %	10 %	
AR402	Ag	2 ppm	1000 ppm	\$12.85 +\$3.75 per element
	Cu	0.001 %	10 %	
	Pb	0.01 %	10 %	
	Zn	0.01 %	10 %	
AR404	Ag	2 ppm	1500 ppm	
	Cu	0.001 %	20 %	
	Pb	0.01 %	20 %	
	Zn	0.01 %	20 %	



## ORE & HIGH GRADE ANALYSIS

### ICP ANALYSIS

The following multi-element assays provide optimum precision and accuracy for high grade rock and drill core samples with a selection of digestion methods to best suit the ore type. AQ370, MA370 and PF370 report percent level concentrations as determined by ICP-ES.

#### AQUA REGIA ICP-ES

Modified aqua regia digestion for base-metal sulphide and precious metal ores. Aqua regia digestion is considered a partial digestion. Solubility of some elements will be limited by the mineral species present.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>AQ370</b>	Aqua Regia ICP-ES, 24 elements			\$24.95
	<b>Ag</b>	2 ppm	1000 ppm	
	<b>Al</b>	0.01 %	40 %	
	<b>As</b>	0.01 %	10 %	
	<b>Bi</b>	0.01 %	1 %	
	<b>Ca</b>	0.01 %	40 %	
	<b>Cd</b>	0.001 %	1 %	
	<b>Co</b>	0.001 %	1 %	
	<b>Cr</b>	0.001 %	5 %	
	<b>Cu</b>	0.001 %	10 %	
	<b>Fe</b>	0.01 %	40 %	
	<b>Hg</b>	0.001 %	1 %	
	<b>K</b>	0.01 %	40 %	
	<b>Mg</b>	0.01 %	40 %	
	<b>Mn</b>	0.01 %	20 %	
	<b>Mo</b>	0.001 %	5 %	
	<b>Na</b>	0.01 %	25 %	
	<b>Ni</b>	0.001 %	10 %	
	<b>P</b>	0.001 %	25 %	
	<b>Pb</b>	0.01 %	4 %	
	<b>S</b>	0.05 %	30 %	
	<b>Sb</b>	0.001 %	5 %	
	<b>Sr</b>	0.001 %	1 %	
	<b>W</b>	0.001 %	1 %	
	<b>Zn</b>	0.01 %	20 %	

**AQ370-X** Aqua Regia ICP-ES, any 1 element \$18.05

#### MULTI-ACID ICP-ES

Multi-acid digestion for sulphide and silicate ores. This digest approximates a 'total' digest in most samples. Some refractory minerals may not be fully attacked.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>MA370</b>	Multi-acid ICP-ES, 23 elements			\$28.55
	<b>Ag</b>	2 ppm	1500 ppm	
	<b>Al</b>	0.01 %	40 %	
	<b>As</b>	0.02 %	10 %	
	<b>Bi</b>	0.01 %	2 %	
	<b>Ca</b>	0.01 %	50 %	
	<b>Cd</b>	0.001 %	2 %	
	<b>Co</b>	0.001 %	2 %	
	<b>Cr</b>	0.001 %	5 %	
	<b>Cu</b>	0.001 %	10 %	
	<b>Fe</b>	0.01 %	60 %	
	<b>K</b>	0.01 %	40 %	
	<b>Mg</b>	0.01 %	40 %	
	<b>Mn</b>	0.01 %	20 %	
	<b>Mo</b>	0.001 %	5 %	
	<b>Na</b>	0.01 %	25 %	
	<b>Ni</b>	0.001 %	10 %	
	<b>P</b>	0.01 %	25 %	
	<b>Pb</b>	0.02 %	10 %	
	<b>S</b>	0.05 %	30 %	
	<b>Sb</b>	0.01 %	1 %	
	<b>Sr</b>	0.01 %	1 %	
	<b>W</b>	0.01 %	1 %	
	<b>Zn</b>	0.01 %	40 %	

**MA370-X** Multi-acid ICP-ES, any 1 element \$21.40

**Requires at least 1 g per sample.**

Digestion is partial for some Cr and Ba minerals and oxides of Al, Fe, Hf, Mn, Sn, Ta, Zr and REEs. Volatilization during fuming may result in loss of As, S, Se and Sb.



## ORE & HIGH GRADE ANALYSIS

### PHOSPHORIC ACID ICP-ES

Phosphoric acid digestion for select elements.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
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**KP300** Phosphoric Acid, ICP-ES, 5 elements \$25.00

<b>Mo</b>	0.001 %	40 %
<b>Nb</b>	0.001 %	40 %
<b>Ta</b>	0.001 %	60 %
<b>U</b>	0.001 %	60 %
<b>W</b>	0.005 %	40 %

**KP300-X** Phosphoric Acid, ICP-ES, any 1 element \$19.65

Requires at least 2 g per sample.

### PEROXIDE FUSION ICP-ES

Sodium peroxide fusion for refractory mineral ores. This process provides complete dissolution of most minerals including silicates. Volatile elements are lost at the high fusion temperatures.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
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**PF370** Peroxide Fusion ICP-ES, 17 elements \$55.05

<b>Al</b>	0.01 %	50 %
<b>As</b>	0.01 %	10 %
<b>Ca</b>	0.05 %	50 %
<b>Co</b>	0.002 %	30 %
<b>Cr</b>	0.01 %	30 %
<b>Cu</b>	0.005 %	30 %
<b>Fe</b>	0.05 %	70 %
<b>K</b>	0.01 %	30 %
<b>Li</b>	0.001 %	50 %
<b>Mg</b>	0.01 %	30 %
<b>Mn</b>	0.01 %	70 %
<b>Ni</b>	0.005 %	30 %
<b>Pb</b>	0.03 %	30 %
<b>S</b>	0.01 %	60 %
<b>Sn</b>	0.005 %	50 %
<b>Ti</b>	0.01 %	30 %
<b>Zn</b>	0.01 %	30 %

**PF370-X** Peroxide Fusion ICP-ES, any 1 element \$25.60

Requires at least 2 g per sample.

## ORE & HIGH GRADE ANALYSIS

### MERCURY

CODE	DESCRIPTION	DETECTION LIMIT	UPPER LIMIT	USD
<b>AQ200-Hg</b>	Hg – ICP-MS	0.01 ppm	50 ppm	\$16.65
<b>CV400</b>	Trace Hg – CVAA	0.01 ppm	100 ppm	\$13.15

### WATER AND GENERAL CHEMISTRY

CODE	DESCRIPTION	DETECTION LIMIT	UPPER LIMIT	USD
<b>GC002</b>	pH and conductivity on solids			\$23.70
<b>GC002-COND</b>	Conductivity of solids	3 µS/cm		\$17.75
<b>GC002-pH</b>	pH of solids	0.1 units		\$14.10
<b>GC901</b>	Moisture (105°C)			\$18.10
<b>GC902</b>	Lattice water			\$38.20
<b>TG001</b>	LOI	0.1 %	100 %	\$12.90





## ORE & HIGH GRADE ANALYSIS

### OTHER TRACE AND ORE GRADE ANALYSES

CODE	DESCRIPTION	DETECTION LIMIT	UPPER LIMIT	USD
<b>BR405</b>	Select elements by HBr digestion, AAS Additional Element	Please call to discuss		\$37.95 + \$6.30
<b>GC204</b>	Ge or Ga by ICP-MS Second element	1 ppm	2000 ppm	\$29.95 + \$5.30
<b>GC304</b>	Ge or Ga by ICP-ES Second element	0.01 %	100 %	\$24.55 + \$5.30
<b>GC320</b>	Ba by Na <sub>2</sub> CO <sub>3</sub> /K <sub>2</sub> CO <sub>3</sub> fusion, ICP-ES	0.01 %	30 %	\$38.50
<b>GC410</b>	NiS	0.001 %	100 %	\$38.20
<b>GC519</b>	SiO <sub>2</sub> gravimetric	0.1 %	100 %	\$36.65
<b>GC520</b>	Ba by Na <sub>2</sub> CO <sub>3</sub> /K <sub>2</sub> CO <sub>3</sub> fusion, gravity	0.1 %	100 %	\$38.50
<b>GC806</b>	FeO Titration	0.2 %	100 %	\$33.45
<b>GC816</b>	Zn Titration	1.00 %	100 %	\$41.80
<b>GC817</b>	Pb Titration	2.00 %	100 %	\$57.40
<b>GC818</b>	Fe Titration	1.00 %	100 %	\$62.20
<b>GC819</b>	Mn Titration	1.00 %	100 %	\$44.70
<b>GC820</b>	Cu Titration	1.00 %	100 %	\$66.15
<b>GC840</b>	F – Trace Level	10 ppm	1000 ppm	\$26.25
<b>GC841</b>	F – Ore Grade Surcharge samples > 15%	0.01 % 10 %	15 % 50 %	\$27.55 \$27.55
<b>GC923</b>	Pb or Zn Oxide Additional element	0.01 %	10 %	\$34.90 + \$5.25
<b>PF100-B</b>	B	3 ppm	2000 ppm	\$25.40

### OTHER CHARGES

CODE	DESCRIPTION	USD
<b>EN004</b>	Environmental fee charge	\$1.20



# EXPLORATION GEOCHEMISTRY

**BUREAU VERITAS LABORATORIES ARE RENOWNED FOR THE USE OF CUTTING EDGE TECHNOLOGIES TO OBTAIN THE LOW LEVELS OF DETECTION NEEDED TO MEET EXPLORATION GEOCHEMICAL REQUIREMENTS.**

Methods in this section are designed for nonmineralized to weakly mineralized material. They have been optimized to provide trace to ultra-trace detection limits and maximum anomaly to background contrast. Modified aqua regia (1:1:1 HNO<sub>3</sub>:HCl:H<sub>2</sub>O) packages target labile elements in soil, to more aggressive multiacid digestions that are near total for almost all matrices. For projects with a gold focus, larger sample sizes are available to provide the most representative sample possible and mitigate nugget effects. This section also includes methods designed specifically for other media including biogeochemical exploration and natural water.



## EXPLORATION GEOCHEMISTRY

### AQUA REGIA

Using a modified aqua regia digestion (1:1:1 HNO<sub>3</sub>:HCl:H<sub>2</sub>O), a partial digest can provide valuable information regarding mobile and easily soluble species, such as sulphides. Economically priced ICP-ES (AQ300) or ICP-ES/MS (AQ200) analyses are designed to complement your exploration project. Sample splits of 0.5 g, 15 g or 30 g are leached in modified aqua regia. Select a larger split size for more representative Au analysis. Refractory and graphitic samples can limit Au solubility.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>AQ300</b>	<b>Aqua Regia ICP-ES, 34 elements, 0.5 g</b>			<b>\$15.80</b>
	<b>Ag</b>	0.3 ppm	100 ppm	
	<b>Al</b>	0.01 %	10 %	
	<b>As</b>	2 ppm	10000 ppm	
	<b>B</b>	20 ppm	2000 ppm	
	<b>Ba</b>	1 ppm	10000 ppm	
	<b>Bi</b>	3 ppm	2000 ppm	
	<b>Ca</b>	0.01 %	40 %	
	<b>Cd</b>	0.5 ppm	2000 ppm	
	<b>Co</b>	1 ppm	2000 ppm	
	<b>Cr</b>	1 ppm	10000 ppm	
	<b>Cu</b>	1 ppm	10000 ppm	
	<b>Fe</b>	0.01 %	40 %	
	<b>Ga</b>	5 ppm	1000 ppm	
	<b>Hg</b>	1 ppm	50 ppm	
	<b>K</b>	0.01 %	10 %	
	<b>La</b>	1 ppm	10000 ppm	
	<b>Mg</b>	0.01 %	30 %	
	<b>Mn</b>	2 ppm	10000 ppm	
	<b>Mo</b>	1 ppm	2000 ppm	
	<b>Na</b>	0.01 %	5 %	
	<b>Ni</b>	1 ppm	10000 ppm	
	<b>P</b>	0.001 %	5 %	
	<b>Pb</b>	3 ppm	10000 ppm	
	<b>S</b>	0.05 %	10 %	
	<b>Sb</b>	3 ppm	2000 ppm	
	<b>Sc</b>	5 ppm	100 ppm	
	<b>Sr</b>	1 ppm	2000 ppm	
	<b>Th</b>	2 ppm	2000 ppm	
	<b>Ti</b>	0.001 %	5 %	
	<b>Tl</b>	5 ppm	1000 ppm	
	<b>U</b>	8 ppm	2000 ppm	
	<b>V</b>	1 ppm	10000 ppm	
	<b>W</b>	2 ppm	100 ppm	
	<b>Zn</b>	1 ppm	10000 ppm	

Aqua Regia digestion is considered a partial digestion. Solubility of some elements will be limited by mineral species present.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>AQ200</b>	<b>Aqua Regia ICP-ES/MS, 37 elements, 0.5 g</b>			<b>\$22.65</b>
<b>AQ201</b>	<b>Aqua Regia ICP-ES/MS, 37 elements, 15 g</b>			<b>\$28.70</b>
<b>AQ202</b>	<b>Aqua Regia ICP-ES/MS, 37 elements, 30 g</b>			<b>\$34.65</b>
	<b>Ag</b>	0.1 ppm	100 ppm	
	<b>Al</b>	0.01 %	10 %	
	<b>As</b>	0.5 ppm	10000 ppm	
	<b>Au</b>	0.5 ppb	100000 ppb	
	<b>B *</b>	20 ppm	2000 ppm	
	<b>Ba</b>	1 ppm	10000 ppm	
	<b>Bi</b>	0.1 ppm	2000 ppm	
	<b>Ca</b>	0.01 %	40 %	
	<b>Cd</b>	0.1 ppm	2000 ppm	
	<b>Co</b>	0.1 ppm	2000 ppm	
	<b>Cr</b>	1 ppm	10000 ppm	
	<b>Cu</b>	0.1 ppm	10000 ppm	
	<b>Fe</b>	0.01 %	40 %	
	<b>Ga</b>	1 ppm	1000 ppm	
	<b>Hg</b>	0.01 ppm	50 ppm	
	<b>K</b>	0.01 %	10 %	
	<b>La</b>	1 ppm	10000 ppm	
	<b>Mg</b>	0.01 %	30 %	
	<b>Mn</b>	1 ppm	10000 ppm	
	<b>Mo</b>	0.1 ppm	2000 ppm	
	<b>Na</b>	0.001 %	5 %	
	<b>Ni</b>	0.1 ppm	10000 ppm	
	<b>P</b>	0.001 %	5 %	
	<b>Pb</b>	0.1 ppm	10000 ppm	
	<b>S</b>	0.05 %	10 %	
	<b>Sb</b>	0.1 ppm	2000 ppm	
	<b>Sc</b>	0.1 ppm	100 ppm	
	<b>Se</b>	0.5 ppm	100 ppm	
	<b>Sr</b>	1 ppm	2000 ppm	
	<b>Te</b>	0.2 ppm	1000 ppm	
	<b>Th</b>	0.1 ppm	2000 ppm	
	<b>Ti</b>	0.001 %	5 %	
	<b>Tl</b>	0.1 ppm	1000 ppm	
	<b>U</b>	0.1 ppm	2000 ppm	
	<b>V**</b>	1 ppm	10000 ppm	
	<b>W</b>	0.1 ppm	100 ppm	
	<b>Zn</b>	1 ppm	10000 ppm	

\*Detection limit = 1 ppm for 15/30 g analysis

\*\*Soils = 2 ppm

# EXPLORATION GEOCHEMISTRY

## ULTRA-TRACE BY ICP-MS

ICP-MS analysis of a 0.5, 15 or 30 g sample after modified aqua regia digestion (1:1:1 HNO<sub>3</sub>:HCl:H<sub>2</sub>O) for low to ultra-low determination on soils, sediments and lean rocks. Larger splits (15 or 30 g) give a more representative analysis of elements subject to nugget effect (e.g., Au). Gold solubility can be limited in refractory and graphitic samples. The lead isotope method adds <sup>204</sup>Pb, <sup>206</sup>Pb, <sup>207</sup>Pb, <sup>208</sup>Pb. This data is suitable for geochemical exploration of U and other commodities where gross differences in non-radiogenic to radiogenic Pb ratios are of benefit.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
AQ250	Aqua Regia ICP-ES/MS, 37 elements, 0.5 g			\$27.95
AQ251	Aqua Regia ICP-ES/MS, 37 elements, 15 g			\$33.95
AQ252	Aqua Regia ICP-ES/MS, 37 elements, 30 g			\$40.00
	Ag	2 ppb	100000 ppb	
	Al	0.01 %	10 %	
	As	0.1 ppm	10000 ppm	
	Au	0.2 ppb	100000 ppb	
	B *	20 ppm	2000 ppm	
	Ba	0.5 ppm	10000 ppm	
	Bi	0.02 ppm	2000 ppm	
	Ca	0.01 %	40 %	
	Cd	0.01 ppm	2000 ppm	
	Co	0.1 ppm	2000 ppm	
	Cr	0.5 ppm	10000 ppm	
	Cu	0.01 ppm	10000 ppm	
	Fe	0.01 %	40 %	
	Ga	0.1 ppm	1000 ppm	
	Hg	5 ppb	50000 ppb	
	K	0.01 %	10 %	
	La	0.5 ppm	10000 ppm	
	Mg	0.01 %	30 %	
	Mn	1 ppm	10000 ppm	
	Mo	0.01 ppm	2000 ppm	
	Na	0.001 %	5 %	
	Ni	0.1 ppm	10000 ppm	
	P	0.001 %	5 %	
	Pb	0.01 ppm	10000 ppm	
	S	0.02 %	10 %	
	Sb	0.02 ppm	2000 ppm	
	Sc	0.1 ppm	100 ppm	
	Se	0.1 ppm	100 ppm	
	Sr	0.5 ppm	2000 ppm	
	Te	0.02 ppm	1000 ppm	
	Th	0.1 ppm	2000 ppm	
	Ti	0.001 %	5 %	
	Tl	0.02 ppm	1000 ppm	
	U	0.1 ppm	2000 ppm	
	V	1 ppm	10000 ppm	
	W	0.1 ppm	100 ppm	
	Zn	0.1 ppm	10000 ppm	
+ PGM	Pt Pd, Add on			\$3.05

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
AQ250-EXT	Extended Pkg, 53 elements, 0.5 g			\$32.70
AQ251-EXT	Extended Pkg, 53 elements, 15 g			\$38.70
AQ252-EXT	Extended Pkg, 53 elements, 30 g			\$44.75
	Be	0.1 ppm	1000 ppm	
	Ce	0.1 ppm	2000 ppm	
	Cs	0.02 ppm	2000 ppm	
	Ge	0.1 ppm	100 ppm	
	Hf	0.02 ppm	1000 ppm	
	In	0.02 ppm	1000 ppm	
	Li	0.1 ppm	2000 ppm	
	Nb	0.02 ppm	2000 ppm	
	Pd	10 ppb	100000 ppb	
	Pt	2 ppb	100000 ppb	
	Rb	0.1 ppm	2000 ppm	
	Re	1 ppb	100000 ppb	
	Sn	0.1 ppm	100 ppm	
	Ta	0.05 ppm	2000 ppm	
	Y	0.01 ppm	2000 ppm	
	Zr	0.1 ppm	2000 ppm	

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
+ REE	Rare Earth, Add on			\$9.15
	Dy	0.02 ppm	2000 ppm	
	Er	0.02 ppm	2000 ppm	
	Eu	0.02 ppm	2000 ppm	
	Gd	0.02 ppm	2000 ppm	
	Ho	0.02 ppm	2000 ppm	
	Lu	0.02 ppm	2000 ppm	
	Nd	0.02 ppm	2000 ppm	
	Pr	0.02 ppm	2000 ppm	
	Sm	0.02 ppm	2000 ppm	
	Tb	0.02 ppm	2000 ppm	
	Tm	0.02 ppm	2000 ppm	
	Yb	0.02 ppm	2000 ppm	
+ ISO	Lead Isotope, Add on			\$18.90

\*Detection limit = 1 ppm for 15/30 g analysis

## EXPLORATION GEOCHEMISTRY

### MULTI-ACID

Multi-acid digestion packages are capable of dissolving most minerals. We offer a choice of ICP-ES (MA300), ICP-ES/MS (MA200) or Ultra-trace ICP-ES/MS (MA250) analysis to give near total values for most elements. A 0.25 g split is heated in HNO<sub>3</sub>, HClO<sub>4</sub> and HF to fuming and taken to dryness. The residue is dissolved in HCl.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>MA300</b>	<b>Multi-Acid ICP-ES, 35 elements, 0.25 g</b>			<b>\$20.90</b>
	<b>Ag</b>	0.5 ppm	200 ppm	
	<b>Al</b>	0.01 %	20 %	
	<b>As</b>	5 ppm	10000 ppm	
	<b>Ba</b>	1 ppm	10000 ppm	
	<b>Be</b>	1 ppm	1000 ppm	
	<b>Bi</b>	5 ppm	4000 ppm	
	<b>Ca</b>	0.01 %	40 %	
	<b>Cd</b>	0.4 ppm	4000 ppm	
	<b>Co</b>	2 ppm	4000 ppm	
	<b>Cr</b>	2 ppm	10000 ppm	
	<b>Cu</b>	2 ppm	10000 ppm	
	<b>Fe</b>	0.01 %	60 %	
	<b>K</b>	0.01 %	10 %	
	<b>La</b>	2 ppm	2000 ppm	
	<b>Mg</b>	0.01 %	30 %	
	<b>Mn</b>	5 ppm	10000 ppm	
	<b>Mo</b>	2 ppm	4000 ppm	
	<b>Na</b>	0.01 %	10 %	
	<b>Nb</b>	2 ppm	2000 ppm	
	<b>Ni</b>	2 ppm	10000 ppm	
	<b>P</b>	0.002 %	5 %	
	<b>Pb</b>	5 ppm	10000 ppm	
	<b>S</b>	0.1 %	10 %	
	<b>Sb</b>	5 ppm	4000 ppm	
	<b>Sc</b>	1 ppm	200 ppm	
	<b>Sn</b>	2 ppm	2000 ppm	
	<b>Sr</b>	2 ppm	10000 ppm	
	<b>Th</b>	2 ppm	4000 ppm	
	<b>Ti</b>	0.01 %	10 %	
	<b>U</b>	20 ppm	4000 ppm	
	<b>V</b>	2 ppm	10000 ppm	
	<b>W</b>	4 ppm	200 ppm	
	<b>Y</b>	2 ppm	2000 ppm	
	<b>Zn</b>	2 ppm	10000 ppm	
	<b>Zr</b>	2 ppm	2000 ppm	
<b>AQ200-Hg</b>	<b>Aqua Regia ICP-MS, add-on</b>			<b>\$16.65</b>
	<b>Hg</b>	0.01 ppm	50 ppm	

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>MA200</b>	<b>Multi-Acid ICP-ES/MS, 45 elements, 0.25 g</b>			<b>\$43.30</b>
	<b>Ag</b>	0.1 ppm	200 ppm	
	<b>Al</b>	0.01 %	20 %	
	<b>As</b>	1 ppm	10000 ppm	
	<b>Ba</b>	1 ppm	10000 ppm	
	<b>Be</b>	1 ppm	1000 ppm	
	<b>Bi</b>	0.1 ppm	4000 ppm	
	<b>Ca</b>	0.01 %	40 %	
	<b>Cd</b>	0.1 ppm	4000 ppm	
	<b>Ce</b>	1 ppm	40 %	
	<b>Co</b>	0.2 ppm	4000 ppm	
	<b>Cr</b>	1 ppm	10000 ppm	
	<b>Cu</b>	0.1 ppm	10000 ppm	
	<b>Fe</b>	0.01 %	60 %	
	<b>Hf</b>	0.1 ppm	1000 ppm	
	<b>In</b>	0.05 ppm	1000 ppm	
	<b>K</b>	0.01 %	10 %	
	<b>La</b>	0.1 ppm	2000 ppm	
	<b>Li</b>	0.1 ppm	2000 ppm	
	<b>Mg</b>	0.01 %	30 %	
	<b>Mn</b>	1 ppm	10000 ppm	
	<b>Mo</b>	0.1 ppm	4000 ppm	
	<b>Na</b>	0.001 %	10 %	
	<b>Nb</b>	0.1 ppm	2000 ppm	
	<b>Ni</b>	0.1 ppm	10000 ppm	
	<b>P</b>	0.001 %	5 %	
	<b>Pb</b>	0.1 ppm	10000 ppm	
	<b>Rb</b>	0.1 ppm	2000 ppm	
	<b>Re</b>	0.005 ppm	100 ppm	
	<b>S</b>	0.1 %	10 %	
	<b>Sb</b>	0.1 ppm	4000 ppm	
	<b>Sc</b>	1 ppm	200 ppm	
	<b>Se</b>	1 ppm	1000 ppm	
	<b>Sn</b>	0.1 ppm	2000 ppm	
	<b>Sr</b>	1 ppm	10000 ppm	
	<b>Ta</b>	0.1 ppm	2000 ppm	
	<b>Te</b>	0.5 ppm	1000 ppm	
	<b>Th</b>	0.1 ppm	4000 ppm	
	<b>Ti</b>	0.001 %	10 %	
	<b>Tl</b>	0.5 ppm	10000 ppm	
	<b>U</b>	0.1 ppm	4000 ppm	
	<b>V</b>	4 ppm	10000 ppm	
	<b>W</b>	0.1 ppm	200 ppm	
	<b>Y</b>	0.1 ppm	2000 ppm	
	<b>Zn</b>	1 ppm	10000 ppm	
	<b>Zr</b>	0.1 ppm	2000 ppm	
<b>AQ200-Hg</b>	<b>Aqua Regia ICP-MS, add-on</b>			<b>\$16.65</b>
	<b>Hg</b>	0.01 ppm	50 ppm	

Digestion is partial for some Cr and Ba minerals and oxides of Al, Fe, Hf, Mn, Sn, Ta, Zr and REEs. Volatilization during fuming may result in loss of As, S, Se and Sb.



# EXPLORATION GEOCHEMISTRY

## ULTRA-TRACE BY ICP-ES/MS

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
MA250		Ultra-trace ICP-ES/MS, 59 elements, 0.25 g					\$53.80
	Ag	20 ppb	200000 ppb	Nb	0.04 ppm	2000 ppm	
	Al	0.01 %	20 %	Nd	0.1 ppm	2000 ppm	
	As	0.2 ppm	10000 ppm	Ni	0.1 ppm	10000 ppm	
	Ba	1 ppm	10000 ppm	P	0.001 %	5 %	
	Be	1 ppm	1000 ppm	Pb	0.02 ppm	10000 ppm	
	Bi	0.04 ppm	4000 ppm	Pr	0.1 ppm	2000 ppm	
	Ca	0.01 %	40 %	Rb	0.1 ppm	2000 ppm	
	Cd	0.02 ppm	4000 ppm	Re	0.002 ppm	100 ppm	
	Ce	0.02 ppm	2000 ppm	S	0.04 %	10 %	
	Co	0.2 ppm	4000 ppm	Sb	0.02 ppm	4000 ppm	
	Cr	1 ppm	10000 ppm	Sc	0.1 ppm	200 ppm	
	Cs	0.1 ppm	2000 ppm	Se	0.3 ppm	1000 ppm	
	Cu	0.1 ppm	10000 ppm	Sm	0.1 ppm	2000 ppm	
	Dy	0.1 ppm	2000 ppm	Sn	0.1 ppm	2000 ppm	
	Er	0.1 ppm	2000 ppm	Sr	1 ppm	10000 ppm	
	Eu	0.1 ppm	2000 ppm	Ta	0.1 ppm	2000 ppm	
	Fe	0.01 %	60 %	Tb	0.1 ppm	2000 ppm	
	Ga	0.02 ppm	100 ppm	Te	0.05 ppm	1000 ppm	
	Gd	0.1 ppm	2000 ppm	Th	0.1 ppm	4000 ppm	
	Hf	0.02 ppm	1000 ppm	Ti	0.001 %	10 %	
	Ho	0.1 ppm	2000 ppm	Tl	0.05 ppm	10000 ppm	
	In	0.01 ppm	1000 ppm	Tm	0.1 ppm	2000 ppm	
	K	0.01 %	10 %	U	0.1 ppm	4000 ppm	
	La	0.1 ppm	2000 ppm	V	2 ppm	10000 ppm	
	Li	0.1 ppm	2000 ppm	W	0.1 ppm	200 ppm	
	Lu	0.1 ppm	2000 ppm	Y	0.1 ppm	2000 ppm	
	Mg	0.01 %	30 %	Yb	0.1 ppm	2000 ppm	
	Mn	1 ppm	10000 ppm	Zn	0.2 ppm	10000 ppm	
	Mo	0.05 ppm	4000 ppm	Zr	0.2 ppm	2000 ppm	
	Na	0.001 %	10 %				
AQ200-Hg		Aqua Regia ICP-MS, Add-on					\$16.65
	Hg	0.01 ppm	50 ppm				

Digestion is partial for some Cr and Ba minerals and oxides of Al, Fe, Hf, Mn, Sn, Ta, Zr and REEs. Volatilization during fuming may result in loss of As, S, Se and Sb.



## EXPLORATION GEOCHEMISTRY

### LOW GRADE ORE ANALYSIS

The following multi-element assays provide an expanded range of analysis by combining the geochemical analysis MA200 and AQ200 with the upper limit precision of the assay packages MA370 and AQ370. AQ270 and MA270 combine both ICP-ES and ICP-MS analysis to extend the upper limits and provide a broader spectrum of elements. Intended use of this package is for exploration not resource calculations.

### AQUA REGIA ICP-ES/MS

Same digestion as AQ370 but uses both ICPES and ICP-MS to expand the detection limits and increase the number of elements analyzed.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>AQ270</b>	<b>Aqua Regia ICP-ES/MS, 34 elements</b>			<b>\$39.55</b>
	<b>Ag</b>	0.5 ppm	1000 ppm	
	<b>Al</b>	0.01 %	40 %	
	<b>As</b>	5 ppm	10000 ppm	
	<b>Ba</b>	5 ppm	5000 ppm	
	<b>Bi</b>	0.5 ppm	10000 ppm	
	<b>Ca</b>	0.01 %	40 %	
	<b>Cd</b>	0.5 ppm	10000 ppm	
	<b>Co</b>	0.5 ppm	10000 ppm	
	<b>Cr</b>	0.5 ppm	50000 ppm	
	<b>Cu</b>	0.5 ppm	100000 ppm	
	<b>Fe</b>	0.01 %	40 %	
	<b>Ga</b>	5 ppm	5000 ppm	
	<b>Hg</b>	0.05 ppm	10000 ppm	
	<b>K</b>	0.01 %	40 %	
	<b>La</b>	0.5 ppm	50000 ppm	
	<b>Mg</b>	0.01 %	40 %	
	<b>Mn</b>	5 ppm	200000 ppm	
	<b>Mo</b>	0.5 ppm	50000 ppm	
	<b>Na</b>	0.01 %	25 %	
	<b>Ni</b>	0.5 ppm	100000 ppm	
	<b>P</b>	0.001 %	25 %	
	<b>Pb</b>	0.5 ppm	40000 ppm	
	<b>S</b>	0.05 %	30 %	
	<b>Sb</b>	0.5 ppm	50000 ppm	
	<b>Sc</b>	0.5 ppm	500 ppm	
	<b>Se</b>	2 ppm	500 ppm	
	<b>Sr</b>	5 ppm	10000 ppm	
	<b>Th</b>	0.5 ppm	10000 ppm	
	<b>Ti</b>	0.001 %	10 %	
	<b>Tl</b>	0.5 ppm	5000 ppm	
	<b>U</b>	0.5 ppm	10000 ppm	
	<b>V</b>	10 ppm	50000 ppm	
	<b>W</b>	0.5 ppm	10000 ppm	
	<b>Zn</b>	5 ppm	200000 ppm	

Requires at least 2 g per sample.

### MULTI-ACID ICP-ES/MS

Same digestion as MA370 but includes ICP-ES and ICP-MS analysis.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>MA270</b>	<b>Multi-acid ICP-ES/MS, 41 elements</b>			<b>\$55.75</b>
	<b>Ag</b>	0.5 ppm	1500 ppm	
	<b>Al</b>	0.01 %	40 %	
	<b>As</b>	5 ppm	100000 ppm	
	<b>Ba</b>	5 ppm	50000 ppm	
	<b>Be</b>	5 ppm	5000 ppm	
	<b>Bi</b>	0.5 ppm	20000 ppm	
	<b>Ca</b>	0.01 %	50 %	
	<b>Cd</b>	0.5 ppm	20000 ppm	
	<b>Ce</b>	5 ppm	10000 ppm	
	<b>Co</b>	1 ppm	20000 ppm	
	<b>Cr</b>	1 ppm	50000 ppm	
	<b>Cu</b>	0.5 ppm	100000 ppm	
	<b>Fe</b>	0.01 %	60 %	
	<b>Hf</b>	0.5 ppm	5000 ppm	
	<b>K</b>	0.01 %	40 %	
	<b>La</b>	0.5 ppm	10000 ppm	
	<b>Li</b>	0.5 ppm	10000 ppm	
	<b>Mg</b>	0.01 %	40 %	
	<b>Mn</b>	5 ppm	200000 ppm	
	<b>Mo</b>	0.5 ppm	50000 ppm	
	<b>Na</b>	0.01 %	25 %	
	<b>Nb</b>	0.5 ppm	10000 ppm	
	<b>Ni</b>	0.5 ppm	100000 ppm	
	<b>P</b>	0.01 %	25 %	
	<b>Pb</b>	0.5 ppm	100000 ppm	
	<b>Rb</b>	0.5 ppm	10000 ppm	
	<b>S</b>	0.05 %	30 %	
	<b>Sb</b>	0.5 ppm	10000 ppm	
	<b>Sc</b>	1 ppm	1000 ppm	
	<b>Se</b>	5 ppm	5000 ppm	
	<b>Sn</b>	0.5 ppm	10000 ppm	
	<b>Sr</b>	5 ppm	10000 ppm	
	<b>Ta</b>	0.5 ppm	2000 ppm	
	<b>Th</b>	0.5 ppm	20000 ppm	
	<b>Ti</b>	0.001 %	10 %	
	<b>U</b>	0.5 ppm	20000 ppm	
	<b>V</b>	10 ppm	50000 ppm	
	<b>W</b>	0.5 ppm	10000 ppm	
	<b>Y</b>	0.5 ppm	50000 ppm	
	<b>Zn</b>	5 ppm	400000 ppm	
	<b>Zr</b>	0.5 ppm	10000 ppm	

Digestion is partial for some Cr and Ba minerals and oxides of Al, Fe, Hf, Mn, Sn, Ta, Zr and REEs. Volatilization during fuming may result in loss of As, S, Se and Sb.

VEGETATION ANALYSIS

We offer two types of vegetation preparations depending on the elements of interest and application of the results. The first is an aqua regia digestion on the raw material. This method is best where volatile elements such as As, Se, and Hg are of interest. The second type of preparation involves the ashing of plant material followed by aqua regia digestion. Ashing is effectively a preconcentration step that allows for the detection of low level precious metals that would otherwise be below instrument detection.

PREPARATION

For dry plant material free of any soil. Importation permits may apply; contact the laboratory prior to shipment.

CODE	DESCRIPTION	USD
DISPL	Dispose of pulps	\$0.25
SVRJT	Saving all or part of reject fraction	\$1.40
VA475	Ashing 50 g dry vegetation at 475°C	\$14.65
VGMAS	Dry and macerate vegetation, per 100 g	\$14.65
VGWSH	Wash plant samples with demineralized water, dry at 60°C, per 100 g	\$4.25
WGHT	Weigh samples	\$0.95





## EXPLORATION GEOCHEMISTRY

### PLANT MATERIAL ANALYSIS

Analysis of vegetation samples using a 1 g or 5 g split digested in HNO<sub>3</sub> then aqua regia and analyzed by ICP-MS for ultra low detection limits. Washing with demineralized water is recommended if samples are coated with inorganic material. (See VGWSH above).

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>VG101</b>	<b>Dry Vegetation ICP-MS, 37 elements, 1 g</b>						\$ 41.50
<b>VG105</b>	<b>Dry Vegetation ICP-MS, 37 elements, 5 g</b>						\$ 47.00
	<b>Ag</b>	2 ppb	100000 ppb	<b>Mo</b>	0.01 ppm	2000 ppm	
	<b>Al</b>	0.01 %	10 %	<b>Na</b>	0.01 %	5 %	
	<b>As</b>	0.1 ppm	10000 ppm	<b>Ni</b>	0.1 ppm	10000 ppm	
	<b>Au</b>	0.2 ppb	100000 ppb	<b>P</b>	0.001 %	5 %	
	<b>B</b>	1 ppm	2000 ppm	<b>Pb</b>	0.01 ppm	10000 ppm	
	<b>Ba</b>	0.1 ppm	10000 ppm	<b>S</b>	0.05 %	10 %	
	<b>Bi</b>	0.02 ppm	2000 ppm	<b>Sb</b>	0.02 ppm	2000 ppm	
	<b>Ca</b>	0.01 %	40 %	<b>Sc</b>	0.1 ppm	100 ppm	
	<b>Cd</b>	0.01 ppm	2000 ppm	<b>Se</b>	0.1 ppm	100 ppm	
	<b>Co</b>	0.01 ppm	2000 ppm	<b>Sr</b>	0.5 ppm	2000 ppm	
	<b>Cr</b>	0.1 ppm	10000 ppm	<b>Te</b>	0.02 ppm	10000 ppm	
	<b>Cu</b>	0.01 ppm	10000 ppm	<b>Th</b>	0.1 ppm	2000 ppm	
	<b>Fe</b>	0.001 %	40 %	<b>Ti</b>	10 ppm	50000 ppm	
	<b>Ga</b>	0.1 ppm	1000 ppm	<b>Tl</b>	0.02 ppm	1000 ppm	
	<b>Hg</b>	1 ppb	50000ppb	<b>U</b>	0.01 ppm	2000 ppm	
	<b>K</b>	0.01 %	10 %	<b>V</b>	2 ppm	10000 ppm	
	<b>La</b>	0.01 ppm	10000 ppm	<b>W</b>	0.1 ppm	100 ppm	
	<b>Mg</b>	0.001 %	30 %	<b>Zn</b>	0.1 ppm	10000 ppm	
	<b>Mn</b>	1 ppm	10000 ppm				
<b>+ REE</b>	Rare Earth, add-on						\$9.15
<b>+ PGM</b>	Pt Pd, add-on						\$3.05
<b>+ ISO</b>	Lead Isotope, add-on						\$18.90
<b>VG104</b>	Ash Ultra-trace ICP-MS, 36 elements, 0.5 g (same elements & detection limits as AQ250 excluding Hg, p .29)						\$41.50
<b>VG104-EXT</b>	Ash Extended suite, 52 elements, 0.5 g						\$46.25



## EXPLORATION GEOCHEMISTRY

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>VG101-EXT</b>	Dry Extended suite, 53 elements, 1 g			\$46.25
<b>VG105-EXT</b>	Dry Extended suite, 53 elements, 5 g			\$51.75
	<b>Be</b>	0.1 ppm	1000 ppm	
	<b>Ce</b>	0.1 ppm	2000 ppm	
	<b>Cs</b>	0.02 ppm	2000 ppm	
	<b>Ge</b>	0.01 ppm	100 ppm	
	<b>Hf</b>	0.001 ppm	1000 ppm	
	<b>In</b>	0.02 ppm	1000 ppm	
	<b>Li</b>	0.01 ppm	2000 ppm	
	<b>Nb</b>	0.01 ppm	2000 ppm	
	<b>Pd</b>	2 ppb	100000 ppb	
	<b>Pt</b>	1 ppb	100000 ppb	
	<b>Rb</b>	0.1 ppm	2000 ppm	
	<b>Re</b>	1 ppb	10000 ppm	
	<b>Sn</b>	0.02 ppm	100 ppm	
	<b>Ta</b>	0.001 ppm	2000 ppm	
	<b>Y</b>	0.001 ppm	2000 ppm	
	<b>Zr</b>	0.01 ppm	2000 ppm	
<b>+ ISO</b>	Lead Isotope, Add on			\$18.90

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>+ REE</b>	Rare Earth elements			\$9.15
	<b>Dy</b>	0.02 ppm	2000 ppm	
	<b>Er</b>	0.02 ppm	2000 ppm	
	<b>Eu</b>	0.02 ppm	2000 ppm	
	<b>Gd</b>	0.02 ppm	2000 ppm	
	<b>Ho</b>	0.02 ppm	2000 ppm	
	<b>Lu</b>	0.02 ppm	2000 ppm	
	<b>Nd</b>	0.02 ppm	2000 ppm	
	<b>Pr</b>	0.02 ppm	2000 ppm	
	<b>Sm</b>	0.02 ppm	2000 ppm	
	<b>Tb</b>	0.02 ppm	2000 ppm	
	<b>Tm</b>	0.02 ppm	2000 ppm	
	<b>Yb</b>	0.02 ppm	2000 ppm	

## EXPLORATION GEOCHEMISTRY

### GENERATIVE EXPLORATION PACKAGE

This package has been designed to provide a suite of elements common in rocks associated with hydrothermal systems. It represents excellent value for applications where only ore forming elements are of interest.

CODE	ELEMENT	USD
<b>GENX10</b>	Suite of elements common in rocks associated with hydrothermal systems	\$35.05
	<b>Au</b> 0.005 - 10 ppm <b>Ag</b> 0.3 - 100 ppm <b>As</b> 2 - 10,000 ppm <b>Bi</b> 3 - 2,000 ppm <b>Cu</b> 1 - 10,000 ppm <b>Pb</b> 3 - 10,000 ppm <b>Hg</b> 0.01 - 100 ppm <b>Mo</b> 1 - 2,000 ppm <b>Sb</b> 3 - 2,000 ppm <b>Zn</b> 1 - 10,000 ppm	<p>Au determined by FA430 (30 g Fire Assay/AAS finish) Hg determined by Cold Vapour/AA</p> <p>All other elements determined by AQ300 Digest with ICP analysis</p>

### COMPLETE EXPLORATION ACID DIGESTION PACKAGE

This package provides additional elements by aqua regia digestion normally volatilized in the multi-acid digestion.

CODE	DESCRIPTION	USD
<b>GEO05</b>	MA250 + AQ250 (7 elements: As, Au, Hg, Sb, Se, Te, Tl)	\$57.55
<b>+ Au</b>	Fire Assay (FA430: 30 g Fire Assay/AAS finish), add-on	\$19.75

### OTHER CHARGES

CODE	DESCRIPTION	USD
<b>EN004</b>	Environmental fee charge	\$1.20

### ANALYSIS OF NATURAL WATERS

Surface and groundwater surveys are an effective means for exploration of remote and blind ore deposits.

Analysis of water geochemical parameters, including, trace metals, pH, electrical conductivity, alkalinity, cations and anions, provides the necessary parameters for complete characterization of water samples. Complete water characterization allows for the determination of not only the type of water (i.e., CaSO<sub>4</sub> or NaCl), but how the type of water relates to ore deposit pathfinder elements. Contact us for details on analytical options.



**CONTACT US FOR A QUOTE**





BUREAU  
VERITAS

# LITHOGEOCHEMISTRY

**LITHOGEOCHEMICAL METHODS EMPLOY FUSION TECHNIQUES TO COMPLETELY DIGEST MOST REFRACTORY MATRICES. THESE METHODS ACCOUNT FOR STRUCTURAL WATER AND ARE THE ONLY MULTI-ELEMENT METHODS THAT PROVIDE QUANTITATIVE DETERMINATIONS FOR SILICA.**

The determinations from these methods are the most suitable for constructing rock classification diagrams, molar element ratios and alteration indices. Determination by ICP-ES, ICP-MS, XRF, and laser ablation options are available to suit almost all elements, concentration ranges, and professional preferences.

LITHOGEOCHEMISTRY

WHOLE ROCK MAJOR AND MINOR ELEMENTS BY ICP-ES

Lithium borate fusion, a highly aggressive dissolution, is effective for most refractory and resistive mineral phases. When coupled with ICP-ES/MS or XRF analysis, the methods provide excellent determination of the total element content.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
LF300	Standard suite of major oxides			\$43.30
	SiO <sub>2</sub>	0.01 %	100 %	
	Al <sub>2</sub> O <sub>3</sub>	0.01 %	100 %	
	Cr <sub>2</sub> O <sub>3</sub>	0.002 %	10 %	
	CaO	0.01 %	100 %	
	Fe <sub>2</sub> O <sub>3</sub>	0.04 %	100 %	
	K <sub>2</sub> O	0.01 %	100 %	
	MgO	0.01 %	100 %	
	MnO	0.01 %	30 %	
	Na <sub>2</sub> O	0.01 %	100 %	
	P <sub>2</sub> O <sub>5</sub>	0.01 %	100 %	
	TiO <sub>2</sub>	0.01 %	10 %	
	Ba	5 ppm	50,000 ppm	
	Nb	5 ppm	1,000 ppm	
	Ni	20 ppm	10,000 ppm	
	Sc	1 ppm	10,000 ppm	
	Sr	2 ppm	50,000 ppm	
	Y	3 ppm	50,000 ppm	
	Zr	5 ppm	50,000 ppm	
	LOI	0.1 %	100 %	
	Sum	0.01 %	100 %	
LF300-X	Any 1 element			\$27.95
LF300-EXT	Extended package			\$48.05
	Ce	30 ppm	50,000 ppm	
	Co	20 ppm	10,000 ppm	
	Cu	5 ppm	10,000 ppm	
	Zn	5 ppm	10,000 ppm	

WHOLE ROCK MAJOR AND MINOR ELEMENTS WITH C & S

CODE		USD
LF302	Major oxides ICP-ES, 20 elements Package including LF300 + TC000 (C & S)	\$59.05
LF302-EXT	Major oxides ICP-ES, 24 elements Package including LF300-EXT + TC000 (C & S)	\$63.80

TOTAL WHOLE ROCK CHARACTERIZATION

These packages combine LF300 and LF100 into a single fusion (LF200) and other specifically selected methods to provide results of virtually all elements present in a geological sample.

CODE		USD
LF200	Package including (LF100 + LF302)	\$86.95
LF200A	Same as LF200 without TC000 (C&S)	\$73.60
LF202	Package including (LF100-EXT + LF302)	\$97.40
LF600*	Package including (LF100-EXT + XF700 + TC000)	\$113.25

Requires at least 5 g per sample.  
\*Requires at least 20 g per sample.

TRACE ELEMENTS BY ICP-MS

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
LF100	Refractory and Rare Earth elements only			\$43.25
	Ba	1 ppm	50,000 ppm	
	Be	1 ppm	10,000 ppm	
	Ce	0.1 ppm	50,000 ppm	
	Co	0.2 ppm	10,000 ppm	
	Cs*	0.1 ppm	1,000 ppm	
	Dy	0.05 ppm	10,000 ppm	
	Er	0.03 ppm	10,000 ppm	
	Eu	0.02 ppm	10,000 ppm	
	Ga	0.5 ppm	10,000 ppm	
	Gd	0.05 ppm	10,000 ppm	
	Hf	0.1 ppm	10,000 ppm	
	Ho	0.02 ppm	10,000 ppm	
	La	0.1 ppm	50,000 ppm	
	Lu	0.01 ppm	10,000 ppm	
	Nb*	0.1 ppm	1,000 ppm	
	Nd	0.3 ppm	10,000 ppm	
	Pr	0.02 ppm	10,000 ppm	
	Rb*	0.1 ppm	1,000 ppm	
	Sm	0.05 ppm	10,000 ppm	
	Sn	1 ppm	10,000 ppm	
	Sr	0.5 ppm	50,000 ppm	
	Ta*	0.1 ppm	1,000 ppm	
	Tb	0.01 ppm	10,000 ppm	
	Th	0.2 ppm	10,000 ppm	
	Tm	0.01 ppm	10,000 ppm	
	U	0.1 ppm	10,000 ppm	
	V	8 ppm	10,000 ppm	
	W	0.5 ppm	10,000 ppm	
	Y	0.1 ppm	50,000 ppm	
	Yb	0.05 ppm	10,000 ppm	
	Zr	0.1 ppm	50,000 ppm	
LF100-X	Lithium borate fusion ICP-MS, any 1 element			\$27.95
LF100-EXT	Trace elements ICP-MS, 45 elements Package including (LF100 + AQ200)			\$55.50
	Ag	0.1 ppm	100 ppm	
	As	1 ppm	10,000 ppm	
	Au	0.5 ppb	100,000 ppb	
	Bi	0.1 ppm	2,000 ppm	
	Cd	0.1 ppm	2,000 ppm	
	Cu	0.1 ppm	10,000 ppm	
	Hg	0.01 ppm	50 ppm	
	Mo	0.1 ppm	2,000 ppm	
	Ni	0.1 ppm	10,000 ppm	
	Pb	0.1 ppm	10,000 ppm	
	Sb	0.1 ppm	2000 ppm	
	Se	0.5 ppm	100 ppm	
	Tl	0.1 ppm	1,000 ppm	
	Zn	1 ppm	10,000 ppm	

\*For higher upper limits on Ta, Nb, Cs, Rb — Request REEPKG Results for Co, Cu, Ni, Pb and Zn may not be quantitative by this method.

# LITHOGEOCHEMISTRY

## CARBON & SULPHUR ANALYSIS

CODE	DESCRIPTION	DETECTION LIMIT	UPPER LIMIT	USD
TC000	IR Combustion – C	0.02 %	100 %	\$26.35
	IR Combustion – S	0.02 %	20 %	
	Surcharge samples > 20% (S)	20 %	50 %	+ \$9.65
TC000-C	IR Combustion – Total C	0.02 %	100 %	\$22.45
TC005-GRA	Graphite C	0.02 %	20 %	\$47.60
TC906	Inorganic Carbon by Coulometry Method	0.01 %	100 %	\$26.20
TC006	Inorganic Carbon (Leco analysis of CO <sub>2</sub> evolution using perchloric acid)	0.08 %	100 %	\$26.35
TC005-ORG	Organic C Calculation requiring TC000-C, TC005-GRA and TC006	0.02 %	100 %	\$47.80
TC000-S	IR Combustion – Total S	0.02 %	20 %	\$22.45
	Surcharge samples > 20% (S)	20 %	50 %	+ \$9.65
TC008-SO4	Sulphate – IR Combustion after ignition	0.05 %	100 %	\$32.95
TC008-S-	Sulphide – Calculation requiring TC000-S and TC008-SO4	0.05 %	100 %	\$34.60
TC508	Sulphate – gravimetric	0.05 %	100 %	\$39.50
TC901	Elemental S	0.01 %	14 %	\$43.45

Requires at least 5 g per sample.





LITHOGEOCHEMISTRY

XRF

X-ray fluorescence analysis on fused discs is an excellent method for the determination of whole rock major elements, as well as some minor elements. It is the preferred method for iron ore, bauxite, Ni-laterites, and phosphate ores. Bureau Veritas also offers a specific XRF method for the determination of major elements, plus sub-percent to high-grade Cu, Pb, and Zn ore concentrations.

WHOLE ROCK MAJOR OXIDES

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
XF700	Standard Package, 15 elements			\$43.30
	SiO <sub>2</sub>	0.01 %	100 %	
	Al <sub>2</sub> O <sub>3</sub>	0.01 %	100 %	
	Fe <sub>2</sub> O <sub>3</sub>	0.01 %	100 %	
	CaO	0.01 %	100 %	
	MgO	0.01 %	100 %	
	Na <sub>2</sub> O	0.01 %	15 %	
	K <sub>2</sub> O	0.01 %	15 %	
	MnO	0.01 %	50 %	
	TiO <sub>2</sub>	0.01 %	20 %	
	P <sub>2</sub> O <sub>5</sub>	0.01 %	40 %	
	Cr <sub>2</sub> O <sub>3</sub>	0.01 %	10 %	
	Ba	0.01 %	58.8 %	
	LOI	0.1 %	100 %	
	SO <sub>3</sub>	0.002 %	10 %	
	Sr	0.002 %	1.5 %	
XF702	Standard Package including TC000 (C & S)			\$57.75

Requires at least 12 g per sample.

BAUXITE

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
XF701	Bauxite Package, 17 elements			\$54.65
	SiO <sub>2</sub>	0.01 %	100 %	
	Al <sub>2</sub> O <sub>3</sub>	0.01 %	100 %	
	Fe <sub>2</sub> O <sub>3</sub>	0.01 %	100 %	
	CaO	0.01 %	50 %	
	MgO	0.01 %	40 %	
	Na <sub>2</sub> O	0.01 %	8.5 %	
	K <sub>2</sub> O	0.01 %	15 %	
	MnO	0.01 %	50 %	
	TiO <sub>2</sub>	0.01 %	10 %	
	P <sub>2</sub> O <sub>5</sub>	0.001 %	40 %	
	Cr <sub>2</sub> O <sub>3</sub>	0.004 %	10 %	
	BaO	0.01 %	10 %	
	ZnO	0.002 %	1 %	
	ZrO <sub>2</sub>	0.01 %	1.5 %	
	V <sub>2</sub> O <sub>5</sub>	0.002 %	10 %	
	SO <sub>3</sub>	0.01 %	3.5 %	
	LOI	0.1 %	100 %	



# LITHOGEOCHEMISTRY

## IRON ORE ANALYSIS

Fused discs for XRF analysis provide robust and precise data for all iron ore matrices. Loss On Ignition (LOI) is determined separately at 1000°C. Sample is mixed with lithium tetraborate/metaborate flux followed by fusion and casting into glass discs. Fused discs are entirely homogeneous and eliminate matrix and grain size variability thus presenting an ideal sample to an extremely stable analytical platform. The data produced is of the highest assay quality and is verified with a full spectrum of iron ore specific certified reference materials.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>XF732</b>	<b>Standard suite of major oxides</b>			<b>\$48.40</b>
	SiO <sub>2</sub>	0.01 %	100 %	
	Al <sub>2</sub> O <sub>3</sub>	0.01 %	100 %	
	Fe	0.01 %	75 %	
	CaO	0.01 %	50 %	
	MgO	0.01 %	50 %	
	K <sub>2</sub> O	0.01 %	15 %	
	MnO	0.01 %	50 %	
	TiO <sub>2</sub>	0.01 %	20 %	
	P	0.001 %	10 %	
	Cr	0.001 %	10 %	
	LOI	0.1 %	100 %	
<b>XF732-EXT</b>	<b>Iron Ore Extended suite, 23 elements</b>			<b>\$53.15</b>
	V	0.002 %	5 %	
	Ba	0.005 %	10 %	
	Ni	0.001 %	8 %	
	Co	0.001 %	5 %	
	Cu	0.002 %	5 %	
	Pb	0.005 %	8 %	
	Zn	0.001 %	1.5 %	
	As	0.002 %	1.5 %	
	Sr	0.001 %	3 %	
	Zr	0.001 %	1 %	
	S	0.001 %	5 %	
	Na <sub>2</sub> O	0.01 %	8 %	

\*Requires at least 12 g per sample.

## PHOSPHATE ROCK

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>XF740</b>	<b>Phosphate Rock Package, 11 elements (includes LOI)</b>			<b>\$54.65</b>
	SiO <sub>2</sub>	0.01 %	100 %	
	Al <sub>2</sub> O <sub>3</sub>	0.01 %	100 %	
	Fe <sub>2</sub> O <sub>3</sub>	0.01%	100 %	
	CaO	0.01%	80 %	
	MgO	0.01%	80 %	
	Na <sub>2</sub> O	0.01%	15 %	
	K <sub>2</sub> O	0.01%	15 %	
	MnO	0.01%	50 %	
	TiO <sub>2</sub>	0.01%	40 %	
	P <sub>2</sub> O <sub>5</sub>	0.01%	40 %	
	LOI	0.1%	100 %	

## XRF FOR BASE METAL BEARING SAMPLES

In addition to commonly reported major elements such as oxides, this XRF method also reports Cu, Pb, and Zn concentrations. The benefit of base metal determination by Li-borate fusion/XRF are the dynamic concentration ranges achievable, plus the absence of potential recovery issues that may exist with acid digestions where sulphur contents are high.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
<b>LF725</b>	<b>Base Metals bearing Package 15 elements (includes LOI)</b>			<b>\$50.45</b>
	SiO <sub>2</sub>	0.02 %	100 %	
	Al <sub>2</sub> O <sub>3</sub>	0.02 %	100 %	
	Fe <sub>2</sub> O <sub>3</sub>	0.02 %	100 %	
	CaO	0.02 %	100 %	
	MgO	0.02 %	100 %	
	K <sub>2</sub> O	0.01 %	15 %	
	MnO	0.01 %	50 %	
	TiO <sub>2</sub>	0.01 %	50 %	
	P <sub>2</sub> O <sub>5</sub>	0.01 %	40 %	
	Cr <sub>2</sub> O <sub>3</sub>	0.01 %	10 %	
	Ba	0.01 %	58.8 %	
	Cu*	0.01 %	8 %	
	Pb*	0.01 %	25 %	
	Zn*	0.01 %	40 %	
	LOI	0.1 %	100 %	

\*Over limit analysis up to 30% Cu; 75% Pb; 60% Zn.

LITHOGEOCHEMISTRY

NICKEL LATERITE ANALYSIS

Exploration and evaluation of nickel laterite requires total determination and mass balance accounting of the major rock-forming elements and the commodity elements Ni, Cu and Co. BVM delivers these requirements by XRF or laser ablation.

LATERITE STANDARD SUITE BY XRF

This package uses a predetermined amount of sample dried at 105°C to remove moisture to ensure that the hygroscopic nature of the material does not add error to the analysis. A test portion of that dried material is then fused in a platinum gold crucible with a lithium tetraborate flux and cast into a disc. Fused discs are analyzed by XRF. Another test portion of dried sample is roasted at 1000°C to determine the loss on ignition. Another test portion of dried sample is roasted at 1000°C to determine the loss on ignition.

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
XF720	Laterite Standard suite by XRF, 15 elements			\$54.65
	SiO <sub>2</sub>	0.01 %	100 %	
	Al <sub>2</sub> O <sub>3</sub>	0.01 %	100 %	
	Fe <sub>2</sub> O <sub>3</sub>	0.01 %	100 %	
	CaO	0.01 %	50 %	
	MgO	0.01 %	50 %	
	K <sub>2</sub> O	0.005 %	15 %	
	MnO	0.002 %	50 %	
	TiO <sub>2</sub>	0.01 %	10 %	
	P <sub>2</sub> O <sub>5</sub>	0.001 %	15 %	
	Cr <sub>2</sub> O <sub>3</sub>	0.005 %	6.8 %	
	Ni	0.002 %	7.5 %	
	Co	0.001 %	3.5 %	
	Cu	0.002 %	8 %	
	Zn	0.001 %	1.5 %	
	LOI	0.1 %	100 %	
XF722	Laterite Package including TC000 (C & S)			\$65.20

Laterite analytical methods incorporate special handling procedures to minimize moisture accumulation due to the hygroscopic nature of the material. Please contact us if you are interested in using other analytical methods not listed here for laterites.

XRF SPECIFIC ELEMENTS BY FUSION

CODE	ELEMENT	DETECTION LIMIT	UPPER LIMIT	USD
XF750-X	High Grade Tin and Tungsten			\$26.30
	First element			
	SnO <sub>2</sub>	0.01%	35 %	
	WO <sub>3</sub>	0.01%	50 %	
	Second element			\$5.25
LF700-X	High Grade Cesium			\$24.95
	Cs	0.01%	30 %	
	Additional element			By quote



# LITHOGEOCHEMISTRY

## LASER ABLATION PACKAGES

This package utilizes state-of-the-art laser ablation and ICP-MS instrumentation to analyze the fused glass disk from a Li-borate fusion digestion. It can be coupled with wavelength dispersive XRF to provide a complete total whole rock analysis.

### FUSED BEAD LASER ABLATION ICP-MS

CODE	ELEMENT	DETECTION LIMIT	USD
LA001	Basic package, 36 elements		By quote
	Ag	0.01 ppm	
	As*	0.2 ppm	
	Ba	0.5 ppm	
	Be	0.2 ppm	
	Bi	0.2 ppm	
	Cd*	0.1 ppm	
	Ce	0.02 ppm	
	Co	0.1 ppm	
	Cr	1 ppm	
	Cs	0.01 ppm	
	Cu	2 ppm	
	Ga	0.1 ppm	
	Ge	0.05 ppm	
	Hf	0.01 ppm	
	In	0.05 ppm	
	La	0.01 ppm	
	Mn	1 ppm	
	Mo	0.2 ppm	
	Nb	0.01 ppm	
	Ni	2 ppm	
	Pb	1 ppm	
	Sb	0.1 ppm	
	Sc	0.1 ppm	
	Sn	0.2 ppm	
	Sr	0.1 ppm	
	Ta	0.01 ppm	
	Tb	0.01 ppm	
	Te	0.2 ppm	
	Th	0.01 ppm	
	Ti	1 ppm	
	U	0.01 ppm	
	V	0.1 ppm	
	W	0.5 ppm	
	Y	0.02 ppm	
	Zn	5 ppm	
	Zr	0.5 ppm	

Method is performed at BVM's Perth, Australia facility. Shipping and Australian Customs charges may apply. Ask us about documentation and costs. \$300 minimum charge for service. \*Partially volatilized.

- + Lower detection limits are comparable to traditional acid digestion methods.
- + XRF and LA-ICP-MS capabilities can be combined to extend the dynamic range, which removes the need for overlimit analyses (i.e., Sn from 0.2 ppm to percent level).
- + Simplification of the analytical process (only 1 digestion needed for major and trace whole rock characterization).
- + Safety and environmental advantages - there are no acids used in digestion.

CODE	ELEMENT	DETECTION LIMIT	USD
LA001-EXT	Extended package including LA001, 49 elements		By quote
	Rb	0.05 ppm	
	Re	0.01 ppm	
	Se*	5 ppm	
	Tl	0.2 ppm	
	Dy	0.01 ppm	
	Er	0.01 ppm	
	Eu	0.01 ppm	
	Gd	0.01 ppm	
	Ho	0.01 ppm	
	Lu	0.01 ppm	
	Nd	0.01 ppm	
	Pr	0.01 ppm	
	Sm	0.01 ppm	
	Tm	0.01 ppm	
	Yb	0.01 ppm	

\*Partially volatilized.

CODE	ELEMENT	DETECTION LIMIT	USD
+ XRF	Major Oxides Package, Add-on		By quote
	Al <sub>2</sub> O <sub>3</sub>	100 ppm	
	CaO	100 ppm	
	Cl	10 ppm	
	Fe <sub>2</sub> O <sub>3</sub>	100 ppm	
	K <sub>2</sub> O	100 ppm	
	MgO	100 ppm	
	MnO	10 ppm	
	Na <sub>2</sub> O**	100 ppm	
	P <sub>2</sub> O <sub>5</sub>	10 ppm	
	SO <sub>3</sub>	10 ppm	
	SiO <sub>2</sub>	100 ppm	
	TiO <sub>2</sub>	10 ppm	
	LOI	0.01 %	
	Sum	0.01 %	

\*\*May not be available for some sample types.



BUREAU  
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# METALS & MINERALS TRADE

**BY PROVIDING OUR BROAD RANGE OF INDEPENDENT INSPECTION AND TESTING SERVICES THROUGHOUT THE ENTIRE SUPPLY CHAIN, WE AIM TO MINIMIZE COMMERCIAL RISK BY QUICKLY DETERMINING THE PHYSICAL PROPERTIES OF YOUR SHIPMENTS.**

For over 150 years Bureau Veritas has been one of the leading global providers of independent Inspection & Testing services to the metals trade sector.

Metal & Minerals supply chains are global and highly dynamic – the industry requires service partners able to operate through a consistent global platform. Bureau Veritas' minerals trade team provides timely and accurate estimates of Quantity and Quality which allow our clients to manage their risks and agree the financial value of their transactions. Third parties, such as trade finance partners, also rely on our work - so Integrity and our Brand Reputation is fundamental to our long-term success in this sector.

## METALS & MINERALS TRADE

### PRODUCTS SERVED

#### KEY PRODUCTS

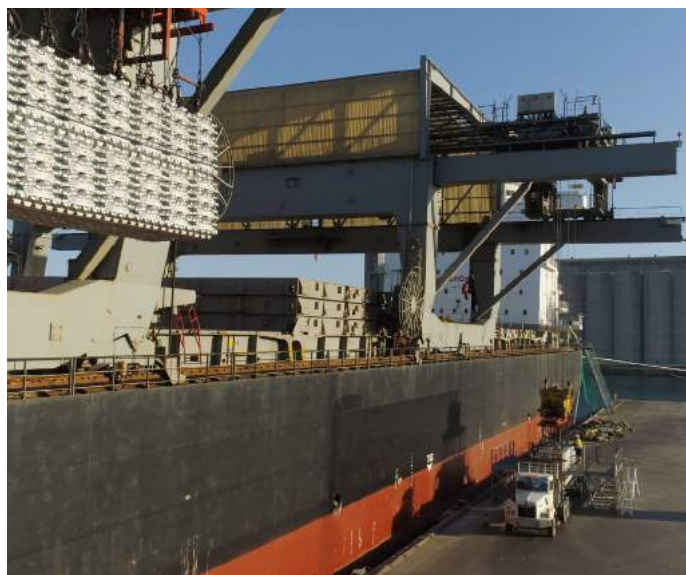
- | Non-Ferrous Metals: Copper, Zinc, Lead, Nickel concentrate & intermediates
- | Precious Metals: Gold, Silver & Platinum Group Metals (PGM)
- | Recycled Materials: Catalysts, Electronic Scrap, Battery metals
- | Steel Raw Material: Iron Ores & Iron ore pellets, HBI, Ferroalloys
- | Steel Scrap
- | Chrome Ores, Manganese Ores, Bauxite
- | Industrial Minerals

#### INSPECTION SERVICES

Accurate commercial settlement relies on Representative Sampling – working throughout the world's main logistic hubs, mining and refining locations, Bureau Veritas' expertise is on hand to help our client reduce risk and facilitate the smooth flow of physical commodities through the provision of independent and accurate weight and quality data.

#### KEY CAPABILITIES

- | Load and Discharge Supervision and Inspection
- | Weight Determination
- | Warehouse, Vault & Storage Facility Auditing Services
- | Sampling & Assaying Consultancy Services



#### LABORATORY SERVICES

Bureau Veritas' network of dedicated Trade Laboratories covers the main trading regions and time zones. Our clients rely on our experience and expertise across a wide range of traded metal products to deliver accurate and precise measurement of economic and penalty elements.

#### KEY CAPABILITIES

- | High Precision Assaying
- | Arbitration "Umpire" Testing
- | Transportable Moisture Limit (TML) & UN Tests
- | Coke Reactivity
- | Laboratory Auditing and Training Services







# ACID ROCK DRAINAGE

**LABORATORY ACID ROCK DRAINAGE (ARD) PREDICTION TESTS ARE USED TO DETERMINE THE MOST APPROPRIATE DISPOSAL OPTIONS FOR WASTE ROCK AND TAILINGS IN ORDER TO MINIMIZE ENVIRONMENTAL IMPACT.**

Bureau Veritas offers the full range of ARD testing services for prediction studies and routinely conducts geochemical analysis, static testing and kinetic test programs. To better approximate site conditions, larger scale tests under specific environmental conditions can be conducted. To simulate underwater disposal of waste materials, custom subaqueous disposal (SAD) tests can be conducted to predict pore water quality, seepage quality to groundwater, and surface water quality.

## **ACID ROCK DRAINAGE**

Bureau Veritas has participated in the development of acid generation potential testing as well as sulphur speciation to support ARD prediction testing for many years. This testing is used to determine appropriate disposal options and storage for waste rock and tailings to minimize environmental impact.

Bureau Veritas offers the full range of ARD testing services for prediction studies and routinely conducts geochemical analysis, static testing and kinetic test programs. All test methods are offered including MEND, EPA, ASTM, and NAG methods. Custom tests include a variety of sequential leach tests. Our extensive laboratory facilities enable customized experimental design and testing over a wide range of simulated environmental conditions.

## ACID ROCK DRAINAGE

### SAMPLE PREPARATION

Bureau Veritas has a well-equipped sample preparation lab to provide sample drying, crushing, splitting and pulverizing when needed. Customized sample preparation is also offered.

### GEOCHEMICAL CHARACTERIZATION

Bureau Veritas offers a complete suite of geochemical analyses for characterization of overburden, waste rock and tailing materials by a variety of techniques.

### STATIC TESTING

#### ACID BASE ACCOUNTING (ABA)

Bureau Veritas offers all acid base accounting (ABA) procedures including standard Sobek, modified Sobek, Net Acid Generation (NAG), and siderite corrected NP. Analyses commonly include paste pH, fizz rating, total sulfur, sulfate sulfur, sulfide sulfur and neutralization potential (NP). We also calculate and provide maximum potential acidity (MPA), carbonate NP (NNP), net NP and NP ratio (NPR).

#### STATIC WATER LEACHING PROCEDURES

Short-term water extraction (18 to 24h) procedures are routinely conducted to determine the presence of readily leachable contaminants. Methods we offer include the MEND SFE, SPLP, TCLP and Meteoric Water Mobility Procedure (MWMP). Extract analysis commonly includes pH, EC and dissolved metals by ICP-ES or ICP-MS. Other possible analytes include ORP, alkalinity, acidity, sulfate, TDS, Cl, F, Br, nitrate-N, nitrite-N, ammonia-N, TKN, total P, ortho-phosphate, CN species and other anions.

### KINETIC TESTING

#### HUMIDITY CELL TESTS — MEND AND ASTM D5744 METHODS

These tests are used to evaluate the long-term weathering characteristics of mine waste materials disposed under subaerial conditions. Tests are run in strict adherence to standard procedures. Possible analyses of leachates include: pH, EC, ORP, electrical conductivity, TDS, hardness, sulfate, anions (nitrate, nitrite, chloride, fluoride, phosphate, ortho-phosphate, TKN, ammonia), alkalinity, acidity, Hg by CVAf, and dissolved metal scans by ICP-ES or ICP-MS.

#### LEACH COLUMNS (LYSIMETERS)

While similar to humidity cell testing in some ways, these tests simulate site waste disposal conditions (such as

saturated, non-saturated or partially saturated) more closely. Water is typically added in a trickle leach fashion, but periodic flushings are possible to better simulate field conditions. Analyses that can be conducted on leachate water are the same as those for humidity cell tests.

### SUBAQUEOUS DISPOSAL COLUMNS

These tests simulate underwater disposal of tails or wasterock and the impacts of such disposal on the water system. Clear cast acrylic type column material is used. These tests often incorporate a series of ports, which enable sampling of surface water and pore water within the waste material. These tests can be operated under anoxic conditions using nitrogen or argon to displace oxygen. A custom in-line sampling port can be installed for in-situ analysis of selected parameters such as pH, Eh, ORP and dissolved oxygen. Analyses conducted on the water samples are the same as those for leach column tests, with the addition of dissolved oxygen analysis.

### OTHER NON-STANDARD TESTS

Bureau Veritas has the ability to construct and operate customized test systems for the purpose of ARD and/or metal leaching prediction. This allows for investigation of scaled-up tests or custom environmental conditions to simulate field conditions. Larger scale versions of the humidity cell and static water leach tests, as well as barrel tests, are offered. These provide a larger volume of leach water, which may be required for atypical water analyses such as radionuclides investigation, confirmation of novel controls, or prevention measures. Also, customized sequential leach tests are offered.





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# OIL CONDITION MONITORING

**MINING EQUIPMENT OPERATES IN DEMANDING ENVIRONMENTAL CONDITIONS AND IS CONTINUALLY EXPOSED TO THE CONTAMINATION OF SITE DUST AND DIRT, EXTENSIVE HOURS OF OPERATION, AND EXTREME RANGES IN TEMPERATURE.**

Bureau Veritas offers an effective oil analysis program that will help to identify component failures before they occur. Our testing packages help to safeguard your critical assets, such as engines, geared systems, hydraulic systems, and cooling systems. Left undetected, wear and contamination issues can result in catastrophic failure. Monitoring machine fluids with oil analysis, coolant analysis, and fuel analysis will ensure peak performance and extend equipment life and reliability.



# OIL CONDITION MONITORING

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## ENGINES

The biggest concerns in maintaining engine health are wear and contamination. An engine oil's four worst enemies are dirt, soot, fuel dilution and glycol, or engine coolant. Bureau Veritas' testing for engines includes spectrochemical analysis (21-elements), viscosity at 100°C, fuel soot, and water (%).

## GEARED SYSTEMS

Implementing a routine oil analysis program to monitor transmission wear and contamination can prove to be an extremely viable means for preventing gearbox failure, reducing downtime and controlling maintenance costs. We offer application testing for transmissions, differentials, final drive, and gearboxes, that include spectrochemical analysis (21-elements), viscosity at 40°C, water (%), and particle quantifier (PQ Index).

## HYDRAULIC SYSTEMS

Hydraulic fluid cleanliness is critical to optimal hydraulic system performance and should be monitored regularly with oil analysis to maintain system health and reliability at a minimal cost. Our hydraulic systems testing includes, spectrochemical analysis (21-elements), viscosity at 40°C, water (%), and ISO particle count.

## COOLING SYSTEMS

Coolant testing and analysis monitors changes in coolant properties due to chemical reactions occurring within the cooling system before they escalate to engine or coolant system failure. Bureau Veritas offers cooling systems testing that includes, corrosion metals & inhibitor (14-element ICP profile), appearance, color, foam, oil, fuel, magnetic precipitate, non-magnetic precipitate, odor, pH, glycol %, freeze point, nitrites, specific conductance, total hardness, and carboxylic acid.



# QUALITY ASSURANCE QUALITY CONTROL

At Bureau Veritas Minerals (BVM) our core product is analytical data. Over many years, we have invested heavily in proprietary software and staff development to ensure that you get the highest quality data. BVM has implemented a comprehensive quality management system meeting the requirements of ISO/IEC 17025 to ensure the necessary processes and oversight are in place to achieve this goal.



### QUALITY ASSURANCE

Through the process of external auditing by recognized organizations, our facilities maintain ISO 17025 accreditation. This accreditation provides independent verification that the management system has been implemented and meets the requirements of the standard. All analytical hubs have received ISO/IEC 17025 accreditation for specific laboratory procedures and sample preparation facilities are monitored to ensure compliance with quality control and quality assurance requirements for off site preparation.



### AUDIT PROGRAM

All BVM facilities are also internally audited against the above ISO standard by knowledgeable and trained personnel on a scheduled basis.



### PROFICIENCY TESTING PROGRAMS

BVM laboratories routinely participate in national and international inter-laboratory comparison studies in order to independently assess individual laboratory performance for the test method(s) analyzed.



### QUALITY CONTROL

Through comprehensive training, BVM ensures that laboratory staff are competent to perform the analysis requested. All labs use validated methods to achieve accurate reproducible results with equipment that is maintained and calibrated to achieve the highest levels of performance. At all steps of sample handling, the laboratory maintains traceability of samples through the use of barcode tracking and maintains detailed audit trails of the people and equipment used to perform analysis.



### In Sample Preparation

As one of the most critical steps in the sample analysis process, BVM continually monitors the efficiency of crushing and pulverizing to ensure that a representative portion of each sample submitted is prepared. Sample duplicates are created and analyzed for all rock and drill core samples submitted.



### In Analysis

In addition to routine calibration solutions the laboratory inserts reference materials, replicates and blanks into randomly assigned positions within each analytical rack generated by our proprietary LIMS. These QC materials provide a final verification of the entire analytical process.



### In Data Review and Evaluation

This is the final layer that is made up of sophisticated proprietary software and professional personnel reviewing the data.

GLOBAL FOOTPRINT MAP



- Geoanalytical Services
- Environmental Services
- Environmental Services

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CONVERSION CHARTS & VALUATIONS

OXIDES CONVERSION FACTORS

ELEMENT	CONVERSION FACTOR	OXIDE
Al	1.889	Al <sub>2</sub> O <sub>3</sub>
Ba	1.669 1.116	BaSO <sub>4</sub> BaO
Be	2.775	BeO
C	3.666	CO <sub>2</sub>
Ca	1.399 2.497	CaO CaCO <sub>3</sub>
Cr	1.461	Cr <sub>2</sub> O <sub>3</sub>
F	2.055	CaF <sub>2</sub>
Fe	1.286 1.430	FeO Fe <sub>2</sub> O <sub>3</sub>
K	1.205	K <sub>2</sub> O
Mg	1.658 3.468	MgO MgCO <sub>3</sub>
Mn	1.291	MnO <sub>2</sub>
Na	1.348	Na <sub>2</sub> O
Nb	1.431	Nb <sub>2</sub> O <sub>5</sub>
Ni	1.273	NiO
P	2.291	P <sub>2</sub> O <sub>5</sub>
Pb	1.077	PbO
Rb	1.094	Rb <sub>2</sub> O
S	2.497 2.996	SO <sub>3</sub> SO <sub>4</sub>
Si	2.139	SiO <sub>2</sub>
Sn	1.270	SnO <sub>2</sub>
Sr	1.185	SrO
Ta	1.221	Ta <sub>2</sub> O <sub>5</sub>
Th	1.138	ThO <sub>2</sub>
Ti	1.668	TiO <sub>2</sub>
U	1.179	U <sub>3</sub> O <sub>8</sub>
V	1.785	V <sub>2</sub> O <sub>5</sub>
W	1.261	WO <sub>3</sub>
Y	1.270	Y <sub>2</sub> O <sub>3</sub>
Zn	1.244	ZnO
Zr	1.351	ZrO <sub>2</sub>

1 Metric Tonne (MT) = 1000 kilograms = 2204.6 pounds  
1 Short Ton (ST) = 907.2 kilograms = 2000 pounds  
1 Long Ton (LT) = 1016 kilograms = 2240 pounds

MESH TO MICRON CONVERSION CHART

OPENING	US STANDARD	TYLER
2.00 mm	10	9
1.70 mm	12	10
1.40 mm	14	12
1.18 mm	16	14
1.00 mm	18	16
850 µm	20	20
710 µm	25	24
600 µm	30	28
500 µm	35	32
425 µm	40	35
355 µm	45	42
300 µm	50	48
250 µm	60	60
212 µm	70	65
180 µm	80	80
150 µm	100	100
125 µm	120	115
106 µm	140	150
90 µm	170	170
75 µm	200	200
63 µm	230	250
53 µm	270	270
45 µm	325	325
38 µm	400	400

ASSAY VALUATIONS

VALUE	PARTS PER MILLION (ppm)	METRIC TONNE	SHORT TON	LONG TON
1 Gram / MT	1	0.03215	0.02917	0.03266
1 Troy oz / MT	31.104	1	0.9072	1.106
1 Troy oz / ST	34.286	1.1023	1	1.120
1 Troy oz / LT	30.612	0.9842	0.8929	1

CONVERSION FOR WEIGHTS	TROY OZ.	AVOIRDUPOIS OZ.	GRAMS
1 Troy oz.	1	1.0971	31.104
1 Avoirdupois oz.	0.91146	1	28.35
1 Gram	0.03215	0.03527	1



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