



Schedule of Services & Fees

Geochemistry › 2018 › USD



alsglobal.com/geochemistry



Table of Contents

On-Site Services and Mine Site Services	4
Spectral Mineralogy and Core Imaging	6
SAMPLE PREPARATION	
Core Services and ALS CoreViewer™	10
Sample Submission and Storage	11
Sample Preparation Packages	12
Individual Sample Preparation Methods	13
PRECIOUS METALS ANALYSIS	
Gold, Silver and PGEs in Rocks and Drill Core	16
Concentrates, Bullions and Metallurgical Testing	17
Gold in Soils and Stream Sediments	18
GENERATIVE EXPLORATION	
Super Trace Analysis for Soils and Sediments	22
Hydrogeochemistry and Biogeochemistry	24
Super Trace Analysis for Rocks and Drill Core	25
TARGETED EXPLORATION	
Ultra Trace Methods	28
Trace and Intermediate Level Methods	30
Isotopic Analysis and Geochronology	33
WHOLE ROCK ANALYSIS AND LITHOGEOCHEMISTRY	
SPECIFIC ORES AND COMMODITIES	
Copper and Iron Ore	40
Lithium	41
Uranium, Rare Earths and Rare Metals	42
Bauxites, Laterites, and Other Commodities	43
High Grade Methods and Refractory Ores	44
CARBON, SULFUR, ARD AND CONCENTRATES	
Carbon & Sulfur Methods	48
Acid Rock Drainage Testing	49
Concentrates and Metallurgical Samples	50
ALS Mineralogy	51
Quality Statement and Accreditation	52
Terms & Conditions	53
Global Geochemistry Locations	54

Geochemical testing for lithium, rare earths, cobalt, and graphite

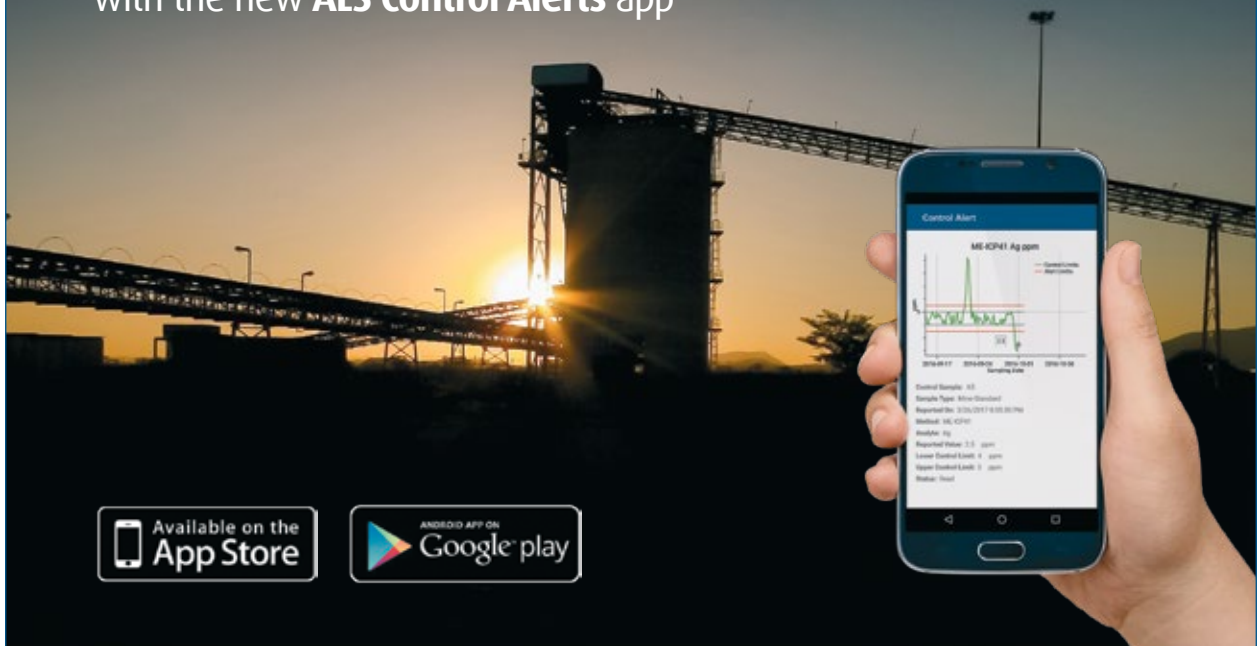


With electric vehicles and solar power generation poised to **transform our world**, commodities critical to batteries and other high tech applications are seeing a **renewed surge of interest from the global market**.

ALS is the premier service provider in critical element analysis, with technical expertise in every region where these commodities are found. Our methods are tailored to different classes of deposit, each with their own unique geological and chemical considerations. Rigorous quality control and expert analytical knowledge applied to lithium, cobalt, graphite, and rare earth elements give you the edge you need in a competitive market. **Talk to us today for more information.**

Keep your process in check

with the new **ALS Control Alerts** app



The new Control Alerts service for ALS Mine Site clients allows plant managers and operators to receive SMS and/or email alerts when a routine analytical control returns out of bounds results.

Quickly address low recovery in the cyclone overflow, react immediately to excess metals in tailings or treated water discharge, and improve your process with ALS Control Alerts 24/7 monitoring.

Key features:

- › Secure access to all grade control, mill processing, and environmental samples analyzed by ALS
- › User-defined graphical and alert limits for any analyte
- › Full audit trail record of all changes to limits
- › Browser-based ALS Webtrieve™ and Android/iOS app options for administering limits
- › Summary statistics and time series graphing for convenience

Ask your preferred ALS contact about setting up Control Alerts for your analytical control points.

We design, install & operate dedicated remote mine site labs

Lease or purchase mine site labs

- › Containerized preparation facilities
- › Customized analytical laboratories

Core services in-lab or on-site

- › Core sawing & sampling
- › Core photography
- › Hyperspectral mapping & interpretation
- › CoreViewer™



**Available at
any location**



aiSIRIS™

Spectral Geology Made Easy

The major hurdle in implementing routine spectral analysis is accurately interpreting large volumes of raw spectral data and integrating it into your workflow. aiSIRIS™ by AusSpec resolves these challenges by rapidly processing raw spectra into database-friendly mineral assemblages and parameters. aiSIRIS is a 3rd generation AI spectral interpretation system. Project geologists can quickly assess relationships between alteration and mineralization about a week after the spectra are acquired, compared to months spent waiting on expert interpretations in the past.

ALS offers TerraSpec® 4 HR scans on dry, coarse crushed rock and drill core. This is an ideal sample fraction for hyperspectral analysis, because it has been thoroughly dried and homogenized by crushing. You receive the original ASD files as well as the aiSIRIS™ output on every geochemical sample for one-to-one comparison.



Access to the aiSIRIS™ App is included for quick spectral plots and assessment against spatial data.

CODE	DESCRIPTION	DELIVERABLES	PRICE PER SAMPLE
HYP-PKG	An economical package combining TerraSpec® 4 HR scanning and aiSIRIS™ expert spectral interpretation. The value of hyperspectral mineralogy in exploration and geometallurgy increases substantially with larger sample volumes. Discounts are available for large submittals covering entire drilling campaigns.	Raw spectral files in ASD or ASCII format, and spreadsheet with mineral assemblages and spectral parameters related to the project geology.	300 sample minimum: \$5.65 1,000-10,000 samples: \$3.75 10,000-25,000 samples: \$3.15 Over 25,000 samples: \$2.80
INTERP-11	Rapid and accurate interpretation of hyperspectral scans by the aiSIRIS™ expert software.	Spreadsheet with mineral assemblages and spectral parameters related to the project geology.	\$3.50 300 sample minimum
TRSPEC-20	Spectral scan using the TerraSpec® 4 HR spectrometer. Crushed reject or RC chips are recommended as the optimal sample type.	Raw spectral files in ASD or ASCII format.	\$3.85



Hyperspectral Core Imaging

TerraCore’s cutting edge combination of hyperspectral imaging hardware, advanced processing software and expert geological oversight provides unparalleled hyperspectral investigation of drill core for exploration, mining and geometallurgy.

The long wave infrared (LWIR) detectors installed on several TerraCore systems allow detailed identification of silicate minerals and improved carbonate speciation, a game-changing development for deposit types with extensive anhydrous alteration.

TerraCore’s services may be delivered in an ALS lab or on-site at mines and advanced exploration projects. TerraCore systems are very portable

and easily slot into your existing core shed infrastructure. Mobilization of a TerraCore unit is by quotation. Volume-based discounts are available for campaigns run in-lab and on-site.

Standard service includes:

- › Projects delivered via CoreViewer™ and IntelliCore®
- › High resolution true color RGB core photographs
- › Minerals, mineral assemblage maps and spectral parameters provided as image displays
- › Database-ready numerical mineralogical parameters and products averaged over 10cm intervals across the length of the drill core

CODE	DESCRIPTION	PRICE
Various	Core cleaning, core box preparation, and labor may be provided by ALS or TerraCore.	By Quotation
COREIM-10 COREIM-11	VNIR-SWIR or SWIR hyperspectral imaging of core boxes and chip trays using TerraCore Core Imaging Systems. Pricing applies to in-lab services.	\$5.50/foot \$18.00/meter \$5.00/chip sample* \$5,000 minimum charge
	LWIR and VNIR-SWIR hyperspectral imaging of core boxes and chip trays using TerraCore Core Imaging Systems. Pricing applies to in-lab services.	\$7.40/foot \$24.00/meter \$7.00/chip sample* \$5,000 minimum charge

*Chip trays must be black plastic. ALS can transfer samples to black trays for a fee.

Skeletonized core boxes have custom pricing. Please enquire.

Sample Preparation

Sample preparation is designed to produce a representative, homogenous sub-sample from the original raw sample. Many variations on the methods and packages in the following pages are available, and sample preparation schemes can be customized to suit any particular project requirement. We have a wide range of expertise available within ALS to help you with any questions you might have.

Samples may be submitted to any of the locations listed on the back pages of this schedule. We can also offer advice on shipping to any of our laboratories by ground, air cargo and air express.

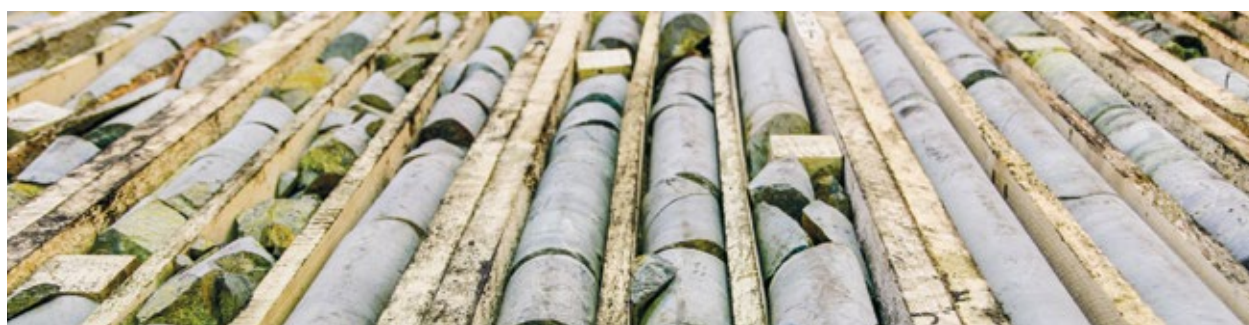
Sample submission forms are available on request.

Core Services

Our Core Services encompass core handling and warehouse management, core sawing and sampling, secure and comfortable logging facilities, and core photography. They may be bundled in any combination at ALS facilities or on-site at your project as needed. These prices reflect in-lab services; for custom on-site quotes, please contact minesitelab@alsglobal.com.

Our highly-trained core sawing technicians use state of the art computerized saws for precision cutting of most rock types. Friable core may be sawn manually to preserve material in the interval.

CODE	DESCRIPTION OF SERVICE	PRICE
LOG-COREBX	Log in core box for processing.	\$2.10/box
SAW-01 SAW-01FT	Automated high speed core sawing. Cut sheet/details provided by client.	\$9.35/m \$2.90/ft
SAWM-01 SAWM-01FT	Manual sawing for friable core. Cut sheet/details provided by client.	\$12.00/m \$3.65/ft
SAM-COR01	Sampling core based on client instructions. Includes bagging sample for further preparation.	\$3.85/sample
SAM-COR01F	Surcharge for friable core. Sampling core based on client instructions. Includes bagging sample for further preparation.	\$5.30/sample
LOG-COR10	Daily rental of secure core logging facilities with full spectrum lights and other amenities.	\$53.05/day
PHO-WET PHO-DRY	High resolution core photography. Delivery via secure file transfer or ALS CoreViewer™ (see below.) Core may be photographed wet or dry based on client preference and requirements.	\$4.10/box
STO-COR10	Long-term storage of core boxes in ALS warehouses.	\$1.15/box



ALS CoreViewer™

CoreViewer™ is a fast and secure core photo archive, core logging support tool, and data integration platform accessible over the web via computers and touch-screen tablets.

Using core photos taken by ALS or provided by you over a secure connection, we create continuous depth-registered downhole core image strips. The box photos and core strips are available to you through CoreViewer™, where you can search for specific intervals and graph any kind of downhole geochemical, mineralogical, or geophysical data for comparison against the images.

Your core photos can be accessed in perpetuity using your secure Webtrieve™ login. For those companies using acquire GIM Suite, CoreViewer™ is available right inside the acquire Neo application, correlated with drill holes and all associated information in the database.

CoreViewer™ also integrates with major 3D modelling programs, including Seequent Leapfrog Geo, Maptek Vulcan and Micromine for deep investigation and verification of exploration, resource and geometallurgical models.

CODE PRC-PHOCLW & PRC-PHOCLD
PRICE \$5.15/box

Sample Submission

Confidence and security in the chain of custody for your samples as they pass through our system are paramount. Your samples are given a barcode and logged into our proprietary global laboratory information management system on receipt. We encourage clients to barcode samples prior to sending them to our laboratories. Our system will accommodate all major barcode formats.

Sample pick-up services

May be arranged from any of our locations. Please contact your nearest ALS office and mention **code PKP-21**.

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
BAT-01	Workorder/administration fee applied per submittal.	Single charge for each batch of samples submitted.	\$28.05 per submittal
LOG-21	Samples received with barcode labels attached to sample bag. Multi-part barcoded sample tags may be purchased from your local lab.	Weigh raw sample and log into global tracking system.	\$0.65
LOG-22	Samples received without barcode labels attached.		\$1.30
LOG-23	Pulps received with barcode labels attached to sample bag.	Weigh pulp and log into global tracking system. At least one out of every 50 samples is selected at random for routine QC tests (LOG-QC). The default specification is 85% passing 75 microns.	\$0.65
LOG-24	Pulps received without barcode labels attached.		\$1.30
LEV-01	Levy for disposal of all types of laboratory waste.	Required for relevant samples in certain jurisdictions.	\$0.65
QAR-01	Quarantine charge. AQIS-approved heat treatment and storage.	Required for relevant samples imported into Australia.	\$0.75 Additional charges apply for samples over 500g.

Sample Storage

Materials submitted for analysis are retained free of charge at our laboratories for a limited time, starting from the day we issue the final Certificate of Analysis. Reasonable monthly charges will apply to samples archived for longer periods in our facilities. ALS sample storage facilities provide a secure and organized environment protected from the elements, and all archive locations are included in the laboratory tracking system.

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
STO-REJ STO-BLK	Monthly archive of coarse rejects. Monthly archive of pulps >250g.	Longer term archiving of coarse rejects and large pulps.	\$0.75 after 45 days
STO-PUL	Monthly archive of pulps <250g.	Longer term storage of master pulps.	\$0.35 after 90 days
STO-SCR	Monthly archive of screening reject fractions.	Longer term storage of screening reject fractions.	\$0.35 after 45 days
RET-21	Handling and retrieval of archived samples.	Stored samples.	\$63.20/hour
DIS-21	Disposal of pulps and coarse fractions.	Pulps and coarse fractions.	By Quotation
RTN-21	Return of samples to client.	Returned samples.	By Quotation

Specific Gravity & Bulk Density

Specific gravity and bulk density of ores are important parameters that are often under-characterized in the determination of grade and tonnage of deposits.

CODE	DESCRIPTION	RANGE	PRICE PER SAMPLE
OA-GRA08	Specific Gravity on solid objects.	Reported as a ratio.	\$12.60
OA-GRA08b	Specific Gravity on pulps using pycnometer.	Reported as a ratio.	\$12.60
OA-GRA09	Bulk Density by water displacement.	0.01 – 20g/cm ³	\$12.60
OA-GRA09a	Bulk Density after wax coating (wax removal not included).	0.01 – 20g/cm ³	\$20.20



Drill Core, Rocks and Chips Preparation Packages

All packages include sample login to the laboratory tracking system and weighing. Excessively wet samples may require additional drying for a surcharge. It is very helpful to advise us of mineralized samples that may require special equipment cleaning cycles.

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
CRU-21*	Preliminary crushing of large drill core and rock samples to 70% passing 6mm.	Large drill core and rock samples.	\$2.85 plus 0.55/kg
PREP-31	Crush to 70% less than 2mm, riffle split off 250g, pulverize split to better than 85% passing 75 microns.	Drill core, rock and chip samples.	\$7.85 plus 0.80/kg
PREP-31Y	Crusher/rotary splitter combo - Crush to 70% less than 2mm, rotary split off 250g, pulverize split to better than 85% passing 75 microns.		\$7.60 plus 0.75/kg
PREP-31B	Crush to 70% less than 2mm, riffle split off 1kg, pulverize split to better than 85% passing 75 microns.		\$8.85 plus 0.80/kg
PREP-31BY	Crusher/rotary splitter combo - Crush to 70% less than 2mm, rotary split off 1kg, pulverize split to better than 85% passing 75 microns.		\$8.85 plus 0.75/kg
PREP-31D	Crush to 90% less than 2mm, riffle split off 1kg, pulverize split to better than 85% passing 75 microns.	Drill core and rocks containing high-grade or coarse gold and/or silver.	\$13.95 plus 1.95/kg
PREP-22	Crush to 70% less than 6mm, pulverize entire sample to better than 85% passing 75 microns.	Drill core, rock and chip samples up to 3kg.	\$10.15

* Standard particle size used varies by region; please contact your local client services for the appropriate method code.

Soil & Sediment Preparation Package

Drying temperature is kept low to avoid the loss of mercury.

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
PREP-41	Dry at <60°C/140°F, sieve sample to -180 micron (80 mesh). Retain both fractions.	Soil or sediment samples.	\$1.50 plus 2.60/kg

Portable XRF on Prepared Pulps

ALS offers portable XRF analysis on pulps immediately after sample preparation at the prep lab closest to your project.

CODE	ANALYTES & LOWER LIMITS (PPM)						PRICE PER SAMPLE
pXRF-30	As	50	Fe	0.5%	S	0.1%	\$4.80
	Ca	0.5%	Mn	100	Zn	50	
	Cr	100	Ni	50			
	Cu	50	Pb	50			

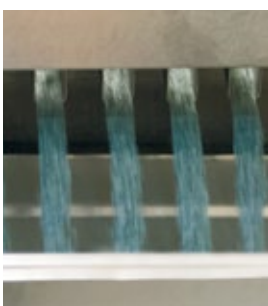
Miscellaneous Procedures

These procedures may be used when specialized preparation or sample compositing is required. An hourly labor charge may apply to time-intensive projects.

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
CMP-21	Compositing of two or more samples. May be done by volume/core length (CMP-21) or by weight (CMP-22).	As requested.	\$2.20
CMP-22			\$4.10
WSH-21	Clean crushers with "barren" material after every sample.	As required. The standard procedure uses compressed air cleaning between samples and barren material between each batch.	\$2.45
WSH-22	Clean pulverizers with "barren" material after every sample.		\$3.20
TRA-21	Transfer sample to drying tray or new sample bag.	As required for samples received in containers unsuitable for laboratory storage, or requiring tray drying.	\$1.30
BAG-01	Bagging large pulps for storage.	For large pulps/bulk masters.	\$1.30
HOM-01	Homogenize stored or composited samples by light pulverizing.	As required.	\$5.60
SCR-51	Screening of samples to any number of standard size fractions, as specified by the client. Weight of undersize fraction reported for each screen size.	Fraction sizing or custom screening as requested.	\$6.35/screen size

Individual Sample Preparation Procedures

The following procedures can be used either separately or combined in a package in order to meet specific needs regarding sample size and composition. Most of these procedures are charged at a rate that is based on sample weight.



Drying

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
DRY-21	Drying of excessively wet samples in drying ovens.	Default drying procedure for most rock chip and drill samples.	\$2.55 plus 0.55/kg
DRY-22	Drying of excessively wet samples in drying ovens that are controlled to a maximum temperature of 60°C.	Most soil and sediment samples that are analyzed for volatile elements.	\$2.70 plus 0.60/kg
DRY-23	Air-drying of samples.	Selective Leach procedures and others.	\$2.70 plus 0.60/kg

Crushing

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
CRU-21	Coarse crushing of rock chip and drill samples to 70% passing 6mm.	Used as a preliminary step before fine crushing of larger sample sizes. No QC is performed for this method. If QC is required, request CRU-21q.	\$2.85 plus 0.55/kg
CRU-31	Fine crushing of rock chip and drill samples to 70% passing 2mm.	Standard preparation procedure for samples where a representative split will be pulverized.	\$2.85 plus 0.50/kg
CRU-36	Fine crushing of rock chip and drill samples to 85% passing 2mm.	Option for when a finer grind is desired.	\$3.20 plus 1.05/kg
CRU-32	Fine crushing of rock chip and drill samples to 90% passing 2mm.	Option for when a finer grind is desired.	\$3.80 plus 1.25/kg


Splitting

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
SPL-21	Split sample using a riffle splitter.	Standard splitting procedure.	\$1.90 plus 0.40/kg
SPL-22	Split sample using a rotary splitter.	Rotary splitting procedure.	\$2.85 plus 0.95/kg
SPL-22Y	Split sample using a Boyd crusher/rotary splitter combination.		\$1.90 plus 0.40/kg
SPL-34	Split a received pulp sample for various uses.	Pulp splitting procedure.	\$0.75

Codes ending with X incur additional charges for send out with no analysis.

Pulverizing

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
PUL-31	Pulverize a split or total sample up to 250g to 85% passing 75 microns.	Default procedure for samples that are finely crushed and split to 250g or less.	\$4.50
PUL-32	Pulverize a 1,000g split to 85% passing 75 microns.	Large sample size to mitigate nugget effect.	\$6.45
PUL-32a	Pulverize a 1,000g split to 90% passing 75 microns.		\$7.80
PUL-21	Pulverize entire sample to 85% passing 75 microns.	Appropriate for samples up to 3kg.	\$10.40
PUL-23	Riffle split sample to maximum of 3kg and pulverize split to 85% passing 75 microns. Retain and bag unpulverized reject.	Appropriate for RC drill chip samples not requiring crushing.	\$7.60 plus 1.00/kg
PUL-24	Riffle split sample to maximum of 3kg and pulverize split to 85% passing 75 microns. Dispose of unpulverized reject.		\$7.60 plus 0.75/kg
PUL-51	Pulverize concentrate sample to 85% passing 75 microns.	Cost includes careful cleaning of the pulverizing bowl after grinding.	\$18.95



Precious Metals Analysis

The unique chemical properties of gold, silver, and the platinum group elements pose challenges in geochemical analysis. They often occur inhomogeneously in geological materials, at scales ranging from micron-sized inclusions in minerals to large nuggets. As a result, large analytical charge weights are required to accurately represent content in the overall sample. Solvent digestions can also lose gold to adsorption on the original sample when certain forms of carbon and sulfide minerals are present, in a process called preg robbing.

ALS has decades of expertise in reliable and reproducible precious metals analysis by fire assay, cyanide leach and aqua regia digestion at parts per billion to percent levels.

Please submit at least three times nominal sample weight for efficient service.

Gold by Fire Assay

An optimal fire assay flux recipe and rigorous quality control program easily handle problem materials including chromite, base metal sulfides and oxides, selenides, and tellurides.

Choice of crushing fineness, splitting technique and pulp size can all affect the analytical outcome of fire assay gold methods. Discuss with your local ALS laboratory for more information.

CODE	ANALYTE	RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE
Trace Level				
Au-ICP21 Au-ICP22	Au	0.001-10	Au by fire assay and ICP-AES. 30g sample 50g sample	\$17.10 \$20.20
Au-AA23 Au-AA24	Au	0.005-10	Au by fire assay and AAS. 30g sample 50g sample	\$16.50 \$19.55
Ore Grade				
Au-AA25 Au-AA26	Au	0.01-100	Au by fire assay and AAS. 30g sample 50g sample	\$17.10 \$20.20
Au-GRA21 Au-GRA22	Au	0.05-10,000	Au by fire assay and gravimetric finish. 30g sample 50g sample	\$21.40 \$25.85

Metallic Screening

When samples contain coarse gold, the metallic screening procedure is recommended for accurate results.

CODE	ANALYTE	RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE
Au-SCR21	Au	0.05-100,000 (0.01-1,000)	1kg pulp screened to 100 microns. Other screen sizes available. Duplicate 30g assay on screen undersize. Assay of entire oversize fraction.	\$56.90
Au-SCR24 (Au-SCR22AA)	Au		1kg pulp screened to 100 microns. Other screen sizes available. Duplicate 50g assay on screen undersize. Assay of entire oversize fraction.	\$63.10
Au-SCR24B	Au		1-2kg pulp screened to 100 microns. Duplicate 50g assay on screen undersize. Assay of entire oversize fraction.	\$85.90
Au-SCR24C	Au		2-3kg pulp screened to 100 microns. Duplicate 50g assay on screen undersize. Assay of entire oversize fraction.	\$106.55

Silver

Trace level and low-grade silver samples may be analyzed by acid digestion for maximum sensitivity and precision. Multi-element packages including Ag are listed in the Targeted Exploration section.

Because silver can suffer from nugget effect, occasional duplicate analysis may help detect sampling error at these low levels. At higher grades, fire assay with larger nominal weights may be preferable.

CODE	ANALYTE	RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE
Trace Level				
Ag-AA45	Ag	0.2-100	Ag by aqua regia digestion and AAS. 0.5g sample	\$6.25
Ag-AA61	Ag	0.5-100	Ag by HF-HNO ₃ -HClO ₄ digestion, HCl leach and AAS. 0.25g sample	\$8.80
Ore Grade				
Ag-OG46 (Ag-AA46)	Ag	1-1,500	Ag by aqua regia digestion, ICP-AES or AAS finish. 0.5g sample	\$11.30
Ag-OG62 (Ag-AA62)	Ag	1-1,500	Ag by HF-HNO ₃ -HClO ₄ digestion with HCl leach, ICP-AES or AAS finish. 0.4g sample	\$13.90
Ag-GRA21 Ag-GRA22	Ag	5-10,000	Ag by fire assay and gravimetric finish. 30g sample 50g sample	\$22.65 \$27.10
ME-GRA21 ME-GRA22	Au Ag	0.05-1,000 5-10,000	Au and Ag by fire assay and gravimetric finish. 30g sample 50g sample	\$27.80 \$32.20

Platinum Group Elements

Platinum, palladium, rhodium and gold may be determined by standard lead oxide collection fire assay and ICP-MS or ICP-AES finish. For the full list of platinum group elements, nickel sulfide collection fire assay must be used for a quantitative analysis.

CODE	ANALYTE	RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE
Trace Level				
PGM-MS23L	Pt	0.0001-1	Super trace Pt, Pd and Au by fire assay and ICP-MS finish. 30g nominal sample weight	\$23.70
	Pd	0.0002-1		
	Au	0.001-1		
PGM-MS23 PGM-MS24	Pt	0.0005-1	Pt, Pd and Au by fire assay and ICP-MS finish. 30g nominal sample weight 50g nominal sample weight	\$20.50
	Pd	0.001-1		\$23.70
	Au	0.001-1		
Rh-MS25	Rh	0.001-1	Rh by fire assay, gold collection and ICP-MS. 30g nominal sample weight	\$23.45
PGM-MS25NS	Au Full PGE Suite	0.005-10 0.002-10	Au, Pt, Pd, Ir, Os, Rh, Ru by nickel sulfide collection fire assay and ICP-MS finish. 30g nominal sample weight.	\$157.90
PGM-ICP23 PGM-ICP24	Pt	0.005-10	Pt, Pd and Au by fire assay and ICP-AES finish. 30g nominal sample weight 50g nominal sample weight	\$20.10
	Pd	0.001-10		\$23.40
	Au	0.001-10		
Ore Grade				
PGM-ICP27	Pt Pd Au	0.01-100 0.01-100 0.01-100	Pt, Pd and Au by fire assay and ICP-AES finish. 30g nominal sample weight	\$21.65

Gold Cyanidation

In mining and exploration applications, cyanide leach tests are used to establish the potential cyanide extraction efficiency for gold and silver.

CODE	ANALYTE	RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE
Au-AA13 Ag-AA13 Cu-AA13	Au Ag Cu	0.03-50 0.03-350 0.1-2,000	Au, Ag, Cu by cyanide leach with AAS finish. 30g sample	\$10.15 plus 5.05/element
Au-AA14	Au	0.01-200	Au by cyanide leach with AAS finish. 12hr Leach. Up to 1kg sample	\$31.55
Au-AA15	Au	0.01-300	Au by accelerated cyanide leach using LeachWELL Assay Tabs™ with AAS finish. 4hr Leach. Up to 3kg sample	\$36.75
Au-AA31 Au-AA31a	Au	0.03-500	Au Preg Rob Leach with Gold Spike. Au Preg Rob Leach without Gold Spike. 10g sample per method	\$11.35 each

Note: Cyanide disposal fees apply in some countries.

Process Samples

Includes gold in cyanide liquors or captured on activated carbon.

Minimum sample weight required varies, contact your local lab.

CODE	ANALYTE	RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE
Au-AA16	Au	0.001-2,500mg/L	Au in cyanide liquor by extraction with AAS finish.	\$22.70
Au-AA44	Au	1-10,000	Au on carbon by ashing, aqua regia digestion and AAS. Duplicate analysis.	\$40.45

Precious Metals in Concentrates and Bullion

High precision analysis and umpire assay of precious metals in concentrates and bullion are performed by the most senior fire assay technicians and checked by certified assayers to ensure accuracy.

Minimum sample weight required varies, contact your local lab.

CODE	ANALYTE	RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE
Concentrates				
Au-CON01 Ag-CON01	Au Ag	0.07-999,985 0.7-995,000	Au and Ag by fire assay and gravimetric finish.	\$87.55 each
Pt-CON01 Pd-CON01 Rh-CON01	Pt, Pd, Rh	0.07-1,000,000	Pt, Pd and Rh by fire assay and AAS finish.	\$91.65 each
Bullion				
Au-GRA24 Ag-GRA24	Au Ag	0.01-1,000 fineness 0.01-1,000 fineness	Routine bullion assays by fire assay with gravimetric finish.	\$133.70 each
Au-UMP20 Ag-UMP20	Au Ag	0.07-1,000,000 0.7-1,000,000	Umpire assay for bullion samples by fire assay with gravimetric finish.	\$210.05 each
Pt-UMP20 Pd-UMP20 Rh-UMP20	Pt, Pd, Rh	0.07-1,000,000	Umpire assay for bullion samples by fire assay with gravimetric finish.	\$196.95 each

Super Trace Gold in Soils & Sediments

ALS offers the lowest detection limits in the industry for gold in soils and sediments by both cyanide and aqua regia digestion, using our innovative super trace analytical methodology.

Full multi-element geochemical suites may be read from the same digest solution as our aqua regia and ICP-MS super trace gold method. This package mirrors our ME-MS41L method, with slight adjustments made to accommodate the larger nominal sample weight necessary for representative gold analysis.

CODE	ANALYTE	RANGE	DESCRIPTION	PRICE PER SAMPLE
Au-CN43 Au-CN44	Au	0.02ppb-1ppm	Au by cyanide extraction with ICP-MS finish. 25g sample 50g sample	\$21.20 \$23.60
Au-ST43 Au-ST44	Au	0.1ppb-0.1ppm	Au by aqua regia extraction with ICP-MS finish. 25g sample 50g sample	\$17.65 \$19.65

CODE	ANALYTES & RANGES (ppm)							PRICE PER SAMPLE	
AuME-ST43 25g sample	Au	0.1ppb-1ppm	Cu	0.01-250	Nb	0.002-250	Ta	0.005-250	\$36.05
	Ag	0.001-100	Fe	0.001%-50%	Ni	0.04-250	Te	0.01-250	
	Al	0.01%-25%	Ga	0.004-250	P	0.001%-1%	Th	0.002-250	
	As	0.01-250	Ge	0.005-250	Pb	0.005-250	Ti	0.001%-10%	
	B	10-10,000	Hf	0.002-250	Pd	0.001-100	Tl	0.002-250	
AuME-ST44 50g sample	Ba	0.5-10,000	Hg	0.004-250	Pt	0.001-100	U	0.005-100	\$38.20
	Be	0.01-250	In	0.005-250	Rb	0.005-250	V	0.1-250	
	Bi	0.001-250	K	0.01%-10%	Re	0.001-50	W	0.001-250	
	Ca	0.01%-25%	La	0.002-250	S	0.01%-10%	Y	0.003-250	
	Cd	0.001-250	Li	0.1-250	Sb	0.005-250	Zn	0.1-250	
	Ce	0.003-250	Mg	0.01%-25%	Sc	0.005-250	Zr	0.01-500	
	Co	0.001-250	Mn	0.1-10,000	Se	0.1-250			
	Cr	0.01-250	Mo	0.01-250	Sn	0.01-250			
	Cs	0.005-250	Na	0.001%-10%	Sr	0.01-10,000			

Bulk Leach Extractable Gold

BLEG is used where cyanide leaching from a stream sediment sample may detect gold anomalies that would otherwise go unnoticed.

Prices for cyanide leaching of samples over 1kg by quotation.

CODE	ANALYTE	RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE
Au-CN12* Au-AA12	Au	0.0001-10	BLEG - ICP-MS finish. BLEG - extraction AA finish. Up to 1kg sample	\$37.90
Au-CN11* Au-AA11	Au	0.001-10	BLEG - ICP-MS finish. BLEG - extraction AA finish. Up to 1kg sample	\$25.35

*Silver and copper may also be reported by these methods for an additional fee.





Low Level Gold in Soils & Sediments

Our trace level methods by aqua regia digestion and ICP-MS finish are excellent for regolith, where gold anomalies indicating mineralization below surface are well-characterized. Aqua regia dissolves native gold as well as gold bound in sulfide minerals; however, depending on the composition of the soil, gold determined by this method may or may not match recovery from fire assay methods.

As with our super trace methods, multi-element packages can be read from the same digestion solution as trace level gold for a complete exploration tool.

CODE	ANALYTE	RANGE(ppm)	DESCRIPTION	PRICE PER SAMPLE
Trace Level				
Au-TL43 Au-TL44	Au	0.001-1	Au by aqua regia extraction with ICP-MS finish. 25g sample 50g sample	\$15.45 \$17.20
Intermediate Grade				
Au-OG43 Au-OG44	Au	0.01-100	Au by aqua regia extraction with ICP-MS finish. 25g sample 50g sample	\$14.75 \$16.50

CODE	ANALYTES & RANGES (ppm)										PRICE PER SAMPLE		
AuME-TL43 25g sample	Au	0.001-1	Co	0.1-500	La	0.2-500	Re	0.001-50	Tl	0.02-500	\$25.45		
	Ag	0.01-100	Cr	1-10,000	Li	0.1-500	S	0.01%-10%	U	0.05-500			
	Al	0.01%-25%	Cs	0.05-500	Mg	0.01%-25%	Sb	0.05-500	V	1-500			
	As	0.1-500	Cu	0.2-500	Mn	5-10,000	Sc	0.1-500	W	0.05-500			
	B	10-10,000	Fe	0.01%-50%	Mo	0.05-500	Se	0.2-500	Y	0.05-500			
	Ba	10-10,000	Ga	0.05-500	Na	0.01%-10%	Sn	0.2-500	Zn	2-500			
	AuME-TL44 50g sample	Be	0.05-500	Ge	0.05-500	Nb	0.05-500	Sr	0.2-500	Zr		0.5-500	\$27.60
		Bi	0.01-500	Hf	0.02-500	Ni	0.2-500	Ta	0.01-500				
		Ca	0.01%-25%	Hg	0.01-500	P	0.001%-1%	Te	0.01-500				
		Cd	0.01-500	In	0.005-500	Pb	0.2-500	Th	0.2-500				
Ce		0.02-500	K	0.01%-10%	Rb	0.1-500	Ti	0.005%-10%					



Generative Exploration

Every method listed in the following four pages involves some aspect of our innovative methodology for super trace analysis on the ICP-MS. Detection limits have been pushed orders of magnitude below average crustal abundance for the majority of elements, enabling excellent precision at geochemical background levels and clearly defined geochemical anomalies. Digestion methods appropriate for any sample medium are available - soils, sediments, regolith, vegetation, water, rocks, and drill core. ALS remains committed to solving long-standing analytical challenges in exploration geochemistry by making use of new instrumentation and fresh ideas from our team of expert analytical chemists and geochemists.

Please submit at least three to four times the nominal sample weight for efficient service.



Aqua Regia for Soils and Sediments

Aqua regia digestion with super trace ICP-MS analysis provides extremely low detection limits useful for regional and deep cover exploration.

The rare earth elements and lead isotope concentrations add new dimensions to super trace data. REEs may be useful pathfinders despite reflecting only the labile component, while Pb isotopic signatures can be used in fingerprinting and hydrothermal fluid history.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE		
ME-MS41L 0.5g sample	Ag	0.001-100	Co	0.001-10,000	La	0.002-10,000	Pt	0.002-25	Th	0.002-10,000	\$29.65
	Al	0.01%-25%	Cr	0.01-10,000	Li	0.1-10,000	Rb	0.005-10,000	Ti	0.001%-10%	
	As	0.01-10,000	Cs	0.005-500	Mg	0.01%-25%	Re	0.001-50	Tl	0.002-10,000	
	Au	0.0002-25	Cu	0.01-10,000	Mn	0.1-50,000	S	0.01%-10%	U	0.005-10,000	
	B	10-10,000	Fe	0.001%-50%	Mo	0.01-10,000	Sb	0.005-10,000	V	0.1-10,000	
	Ba	0.5-10,000	Ga	0.004-10,000	Na	0.001%-10%	Sc	0.005-10,000	W	0.001-10,000	
	Be	0.01-1000	Ge	0.005-500	Nb	0.002-500	Se	0.1-1000	Y	0.003-500	
	Bi	0.001-10,000	Hf	0.002-500	Ni	0.04-10,000	Sn	0.01-500	Zn	0.1-10,000	
	Ca	0.01%-25%	Hg	0.004-10,000	P	0.001%-1%	Sr	0.01-10,000	Zr	0.01-500	
	Cd	0.001-1000	In	0.005-500	Pb	0.005-10,000	Ta	0.005-500			
Ce	0.003-500	K	0.01%-10%	Pd	0.001-25	Te	0.01-500				
MS41L-REE	Dy		0.002	Ho		0.001	Sm		0.002	\$6.10 Add-on only	
	Er		0.002	Lu		0.001	Tb		0.001		
	Eu		0.002	Nd		0.002	Tm		0.001		
	Gd		0.002	Pr		0.002	Yb		0.002		
MS41L-PbIS	²⁰⁴ Pb		0.005	²⁰⁶ Pb		0.005	²⁰⁷ Pb		0.005	\$9.60 Add-on only	
	²⁰⁸ Pb		0.005								

Selenium in Soils

Se at this level holds information for exploration vectoring as well as environmental baselines.

CODE	ANALYTE & RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE	
Se-MS46	Se	0.003-100	Aqua regia digestion and ICP-MS analysis. 25g sample	\$17.65

Clay Separation

The clay fraction in soils acts as a trap for elements migrating to the surface from depth, and may be used to enhance subtle anomalies.

CODE	DESCRIPTION	PRICE PER SAMPLE
SCR-CLAY	Separation of the -10 micron fraction from soils. Minimum 300g of sieved soil required.	\$15.90

Halogen Analysis

Fluorine, chlorine, bromine and iodine hold significant promise in exploration, since many metals are transported through the crust as halide complexes in hydrothermal fluids.

Soil, vegetation or water may be analyzed by this method.

CODE	DESCRIPTION	PRICE PER SAMPLE
VEG-ASH01	Vegetation sample is ashed at 475°C for 24 hours. Pre- and post-ashing weights are reported. Average ash yields are 2-4% for species commonly used in exploration surveys. Minimum sample weight required 100g.	\$6.70
HAL-PREP01	Sample pre-treatment for super trace halogens analysis. Required for soils and un-ashed vegetation. Minimum sample weight required varies, contact your local lab to discuss your project.	\$11.35

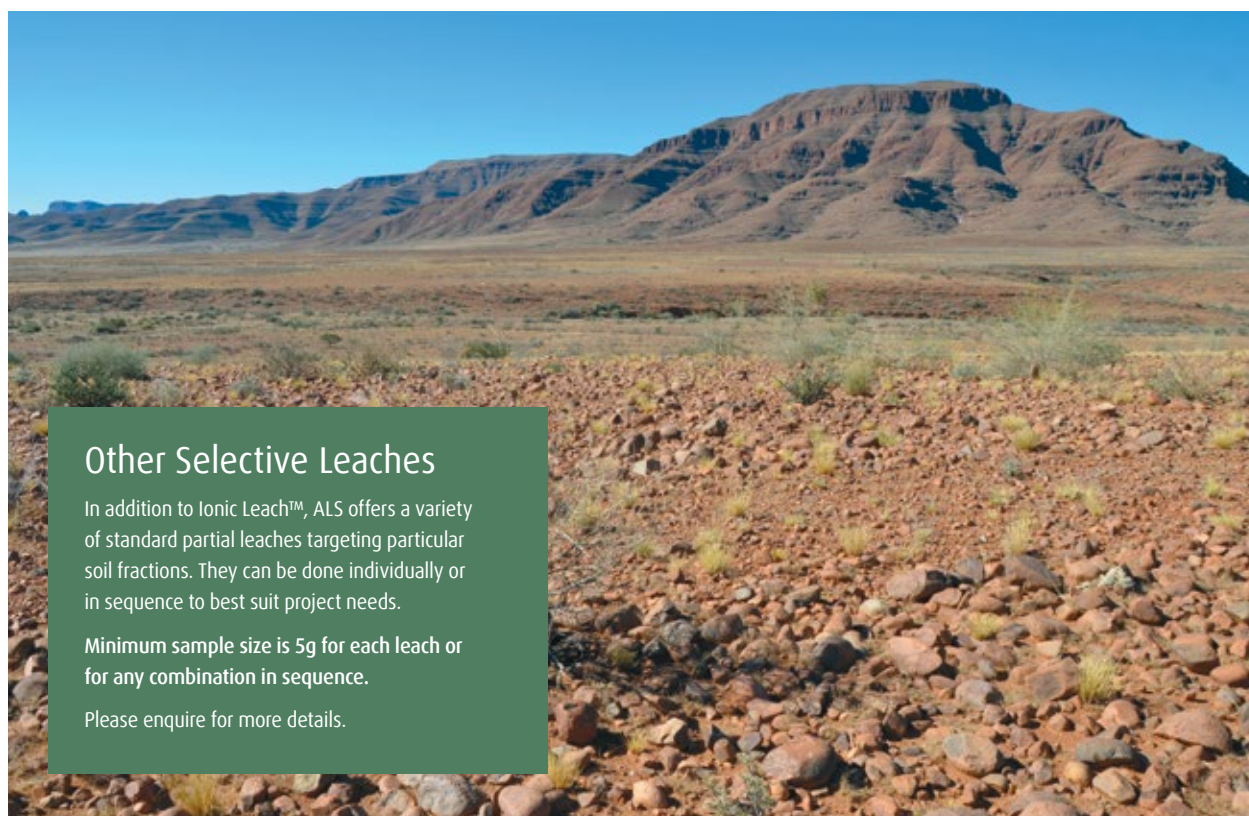
CODE	ANALYTES & RANGES (ppm)	DESCRIPTION	PRICE PER SAMPLE
ME-HAL01	F 0.05 Cl 0.1	De-ionized water leach with ICP-MS & ion chromatograph analysis.	\$33.65
	Br 0.02 I 0.002		

Ionic Leach™

Ionic Leach™ is designed to enhance the most subtle labile geochemical anomalies for a wide range of commodities. It is a static sodium cyanide leach using the chelating agents ammonium chloride, citric acid and EDTA with the leachant buffered at an alkaline pH of 8.5.

Nominal sample weight is 50g (wet weight, no screening). Prepared vegetation samples may be leached at a 5g sample size.

CODE	ANALYTES & DETECTION LIMITS (ppb)	PRICE PER SAMPLE
ME-MS23	Ag 0.1 Eu 0.1 Nb 0.1 Tb 0.1	\$39.95
	As 0.5 Fe 0.1ppm Nd 0.1 Te 0.5	
	Au 0.02 Ga 0.5 Ni 1 Th 0.02	
	Ba 10 Gd 0.1 Pb 0.1 Ti 5	
	Be 0.2 Ge 0.1 Pd 0.05 Tl 0.05	
	Bi 0.3 Hf 0.05 Pr 0.1 Tm 0.1	
	Br 0.05ppm Hg 0.1 Pt 0.1 U 0.05	
	Ca 0.2ppm Ho 0.1 Rb 0.1 W 0.1	
	Cd 0.2 I 0.01ppm Re 0.01 Y 0.1	
	Ce 0.1 In 0.1 Sb 0.5 Yb 0.1	
	Co 0.3 La 0.1 Sc 1 Zn 10	
	Cr 1 Li 0.2 Se 2 Zr 0.1	
	Cs 0.1 Lu 0.1 Sm 0.1	
	Cu 1 Mg 0.01ppm Sn 0.2	
	Dy 0.1 Mn 0.01ppm Sr 1	
	Er 0.1 Mo 0.5 Ta 0.05	
	MS23-PbIS ²⁰⁴ Pb 0.01 ²⁰⁶ Pb 0.01 ²⁰⁷ Pb 0.01 ²⁰⁸ Pb 0.02	



Other Selective Leaches

In addition to Ionic Leach™, ALS offers a variety of standard partial leaches targeting particular soil fractions. They can be done individually or in sequence to best suit project needs.

Minimum sample size is 5g for each leach or for any combination in sequence.

Please enquire for more details.

Hydrogeochemistry

Trace metal analysis in ground and surface waters can reveal mineralization-related anomalies in areas where traditional soil sampling is difficult or impossible, such as swampy terrain, desert, and agricultural disturbance. ALS offers a reliable and cost-effective water analysis package with optional anions by ion chromatography and a full suite of physical parameters.

Trace elements and metals require at least 50mL water. Anions and physical parameters require at least 500mL water. Sampling kits may be purchased in some locations, please enquire.

CODE	DESCRIPTION	PRICE PER SAMPLE
WAT-PREP02	Filter water samples to <0.45um and acidify with nitric acid before analysis.	\$5.20
WAT-PREP03	Filter water samples to <0.45um before analysis.	\$3.45
WAT-PREP04	Acidify water samples with nitric acid before analysis.	\$1.75

CODE	ANALYTES & DETECTION LIMITS (µg/L)								PRICE PER SAMPLE
ME-MS14L	Au	0.002	Cu	0.1	Ni	0.2	Ta	0.01	\$54.75
	Ag	0.005	Fe	0.003mg/L	P	0.005mg/L	Te	0.01	
	Al	3	Ga	0.05	Pb	0.05	Th	0.005	
	As	0.05	Hf	0.005	Pd	0.005	Ti	0.2	
	B	3	Hg	0.05	Pt	0.005	Tl	0.002	
	Ba	0.05	In	0.01	Rb	0.01	U	0.002	
	Be	0.005	K	0.01mg/L	Re	0.002	V	0.05	
	Bi	0.01	La	0.005	S	0.2mg/L	W	0.01	
	Ca	0.02mg/L	Li	0.1	Sb	0.01	Y	0.005	
	Cd	0.005	Mg	0.005mg/L	Sc	0.01	Zn	0.5	
	Ce	0.005	Mn	0.05	Se	0.05	Zr	0.02	
	Co	0.005	Mo	0.05	Si	0.03mg/L			
	Cr	0.5	Na	0.01mg/L	Sn	0.05			
	Cs	0.005	Nb	0.005	Sr	0.05			
MS14L-REE	Dy	0.005	Gd	0.005	Nd	0.005	Tb	0.005	\$16.20 Add-on only
	Er	0.005	Ho	0.005	Pr	0.005	Tm	0.005	
	Eu	0.005	Lu	0.005	Sm	0.005	Yb	0.005	
MS14L-ANPH	Br	0.05mg/L	NO ₃	0.005mg/L	pH	0.1 units	Conductivity	2µS/cm	\$46.65 Add-on only
	Cl	0.5mg/L	SO ₄	0.5mg/L	TDS	3mg/L	Alkalinity	1mg/L	
	F	0.02mg/L							

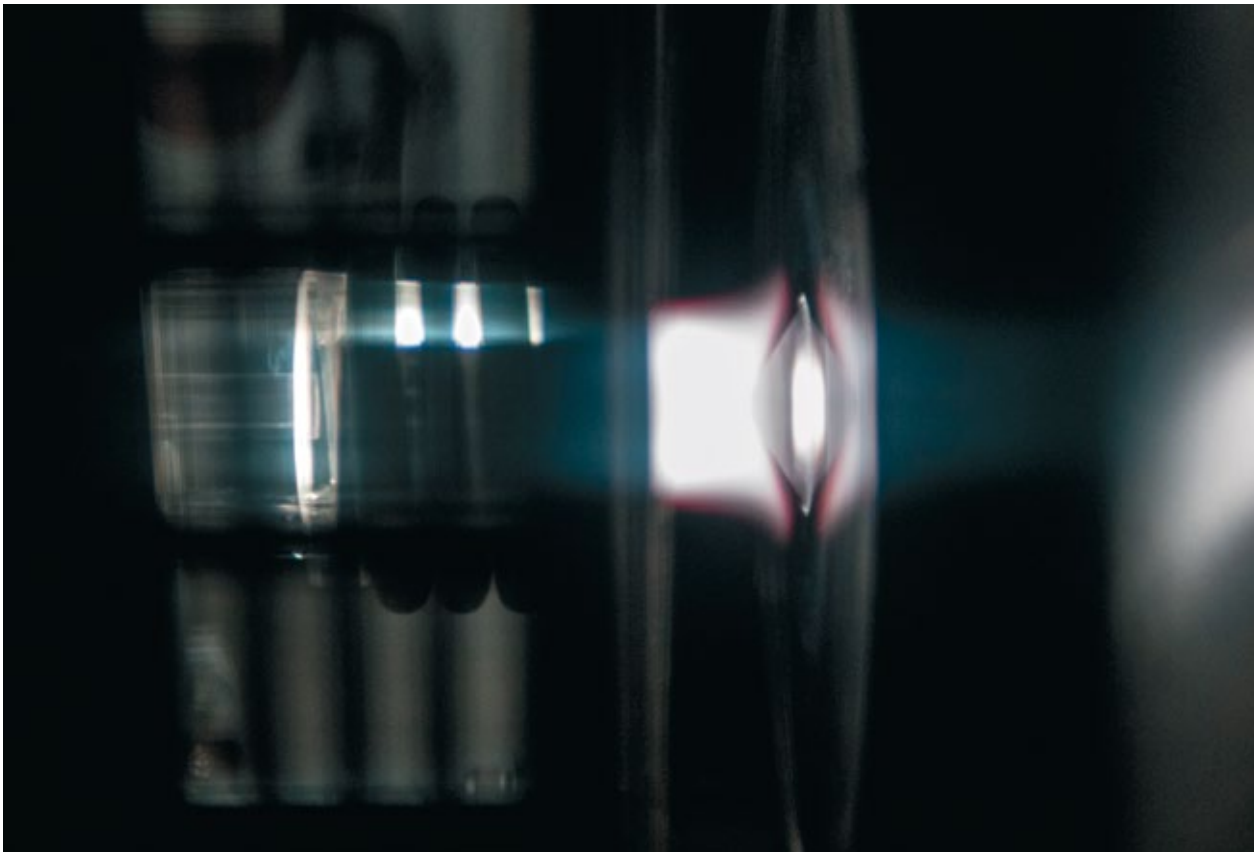
Biogeochemistry

Plants may be viewed as large-scale geochemical sampling devices, with root systems that can selectively absorb elements from a large volume of soil, groundwater, and even bedrock. Careful selection of plant species is important as biological effects control geochemical response.

ALS provides additional vegetation preparation services such as separating the plant parts of interest from waste material. Please contact your local lab to discuss your specific project goals.

CODE	DESCRIPTION	PRICE PER SAMPLE
VEG-MILL01	Milling of dry plant tissue to 100% passing 1mm. Produces a homogenous and representative pulp that can be subsampled for analysis.	\$6.70
VEG-ASH01	Vegetation sample is ashed at 475°C for 24 hours. Pre- and post-ashing weights are reported. Average ash yields are 2-4% for species commonly used in exploration surveys. Minimum recommended sample weight is 100g.	\$6.70

CODE	ANALYTES & DETECTION LIMITS (ppm)								PRICE PER SAMPLE	
ME-VEG41 unashed 1g sample	Ag	0.001	Cu	0.01	Nb	0.002	Ta	0.001	\$18.60	
	Al	0.01%	Fe	1	Ni	0.04	Te	0.02		
	As	0.01	Ga	0.004	P	0.001%	Th	0.002		
	Au	0.0002	Ge	0.005	Pb	0.01	Ti	0.001%		
	B	1	Hf	0.002	Pd	0.001	Tl	0.002		
	Ba	0.1	Hg	0.001	Pt	0.001	U	0.005		
	ME-VEG41a ashed 0.25g sample	Be	0.01	In	0.005	Rb	0.01	V		0.05
		Bi	0.001	K	0.01%	Re	0.001	W		0.01
		Ca	0.01%	La	0.002	S	0.01%	Y		0.003
		Cd	0.001	Li	0.1	Sb	0.01	Zn		0.1
		Ce	0.003	Mg	0.001%	Sc	0.01	Zr		0.02
		Co	0.002	Mn	0.1	Se	0.005			
		Cr	0.01	Mo	0.01	Sn	0.01			
		Cs	0.005	Na	0.001%	Sr	0.02			
VEG41-REE VEG41a-REE		Dy	0.002	Gd	0.002	Nd	0.001	Tb	0.001	\$4.60 Add-on only
		Er	0.002	Ho	0.001	Pr	0.002	Tm	0.001	
	Eu	0.002	Lu	0.001	Sm	0.003	Yb	0.003		



Four Acid Super Trace Analysis

This super trace package is suitable for regional drilling, trenching and hand samples in unmineralized rocks, and can also be used effectively in areas of thick regolith for bedrock mapping. ALS has lowered the detection limits on key pathfinder elements such as As, Sb, Se and Tl to near or below average crustal abundance, revealing anomalous patterns at levels previously unattainable due to technical limitations.

The rare earth elements and lead isotopes are available as add-ons to expand the utility of the method in greenfields exploration.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-MS61L 0.25g sample	Ag	0.002-100	Cu	0.02-10,000	Na	0.001%-10%	Sr	0.02-10,000	\$36.25
	Al	0.01%-25%	Fe	0.002%-50%	Nb	0.005-500	Ta	0.01-500	
	As	0.05-10,000	Ga	0.05-10,000	Ni	0.08-10,000	Te	0.04-500	
	Ba	1-10,000	Ge	0.05-500	P	0.001%-1%	Th	0.004-10,000	
	Be	0.02-1,000	Hf	0.004-500	Pb	0.01-10,000	Ti	0.001%-10%	
	Bi	0.005-10,000	In	0.005-500	Rb	0.02-10,000	Tl	0.004-10,000	
	Ca	0.01%-25%	K	0.01%-10%	Re	0.002-50	U	0.01-2,500	
	Cd	0.005-1,000	La	0.005-10,000	S	0.01%-10%	V	0.1-10,000	
	Ce	0.01-500	Li	0.2-10,000	Sb	0.02-10,000	W	0.008-10,000	
	Co	0.005-10,000	Mg	0.01%-25%	Sc	0.01-10,000	Y	0.01-500	
	Cr	0.3-10,000	Mn	0.2-50,000	Se	0.2-1000	Zn	0.2-10,000	
	Cs	0.01-500	Mo	0.02-10,000	Sn	0.02-500	Zr	0.1-500	
	MS61L-REE	Dy	0.005	Ho	0.002	Sm	0.004		
Er		0.004	Lu	0.002	Tb	0.002			
Eu		0.004	Nd	0.005	Tm	0.002			
Gd		0.005	Pr	0.004	Yb	0.004			
MS61L-PbIS	²⁰⁴ Pb	0.01	²⁰⁶ Pb	0.01	²⁰⁷ Pb	0.01			\$9.60 Add-on only
	²⁰⁸ Pb	0.01							

Portable XRF for Litho geochemistry

The crucial litho geochemical elements - silicon, titanium, and zirconium - may be added to any ALS four acid method for a more complete element suite.

CODE	DESCRIPTION	PRICE PER SAMPLE
pXRF-34	Portable XRF scan of a non-mineralized pulverized sample. Ranges: Si 0.5%-47% Ti 0.1%-60% Zr 5ppm-5% 15g sample	\$3.60 Add-on only



Targeted Exploration

No single method covers all types of geological materials for all geochemically-relevant elements at all concentrations. Sample type, commodity of interest, geochemical pathfinders and expected concentration of target elements should all be considered when selecting appropriate methods for your project.

Broadly, aqua regia readily dissolves many sulfide, oxide and carbonate minerals, as well as retaining mercury, a particularly volatile element. Four acid digestions quantitatively dissolve nearly all minerals, but it may sometimes be necessary to use even stronger techniques such as fusions in order to fully digest barite, rare earth oxides, and tin, tungsten, niobium and tantalum minerals.

The choice between various instrument finishes should be informed by the expected concentrations of the elements of interest in the sample.

**Please submit at least four times
the nominal sample weight for
efficient service.**

Aqua Regia With ICP-MS Finish

Method selection can be key to achieving exploration success. Sample type, target commodity, and pathfinder elements should all be considered when selecting the most appropriate method for your project.

Aqua regia is an excellent exploration tool for various deposit types that involve gold, silver and base metals hosted in sulfide and carbonate minerals.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-MS41 0.5g sample	Ag	0.01-100	Cs	0.05-500	Mo	0.05-10,000	Sr	0.2-10,000	\$23.70
	Al	0.01-25%	Cu	0.2-10,000	Na	0.01%-10%	Ta	0.01-500	
	As	0.1-10,000	Fe	0.01%-50%	Nb	0.05-500	Te	0.01-500	
	Au*	0.2-25	Ga	0.05-10,000	Ni	0.2-10,000	Th	0.2-10,000	
	B	10-10,000	Ge	0.05-500	P	10-10,000	Ti	0.005%-10%	
	Ba	10-10,000	Hf	0.02-500	Pb	0.2-10,000	Tl	0.02-10,000	
	Be	0.05-1,000	Hg	0.01-10,000	Rb	0.1-10,000	U	0.05-10,000	
	Bi	0.01-10,000	In	0.005-500	Re	0.001-50	V	1-10,000	
	Ca	0.01%-25%	K	0.01%-10%	S	0.01%-10%	W	0.05-10,000	
	Cd	0.01-1,000	La	0.2-10,000	Sb	0.05-10,000	Y	0.05-500	
	Ce	0.02-500	Li	0.1-10,000	Sc	0.1-10,000	Zn	2-10,000	
	Co	0.1-10,000	Mg	0.01%-25%	Se	0.2-1,000	Zr	0.5-500	
	Cr	1-10,000	Mn	5-50,000	Sn	0.2-500			

* Gold determinations by this method are semi-quantitative due to the small sample weight used.

Single Elements by Aqua Regia

When analytical results for one or only a few elements with low detection limits are required. More elements are available on request.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
(+)-MS42 0.5g sample	Ag	0.01-25	Hg	0.005-25	Se	0.2-250	U	0.05-250	\$12.60 plus 1.30/element
	As	0.1-250	Re	0.001-250	Te	0.01-250			
	Bi	0.01-250	Sb	0.05-250	Tl	0.02-250			

+ Add element symbol as prefix to method code.





Four Acid Digestion With ICP-MS Finish

Four acid digestion quantitatively dissolves nearly all minerals in the majority of geological materials. However, barite, rare earth oxides, columbite-tantalite, and titanium, tin and tungsten minerals may not be fully digested.

Despite the potentially incomplete digestion of REEs, the leachable portion of these elements may hold important exploration vectoring information and can be chosen as an add-on.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-MS61 0.25g sample	Ag	0.01-100	Cu	0.2-10,000	Na	0.01%-10%	Sr	0.2-10,000	\$28.45
	Al	0.01%-50%	Fe	0.01%-50%	Nb	0.1-500	Ta	0.05-100	
	As	0.2-10,000	Ga	0.05-10,000	Ni	0.2-10,000	Te	0.05-500	
	Ba	10-10,000	Ge	0.05-500	P	10-10,000	Th	0.01-10,000	
	Be	0.05-1,000	Hf	0.1-500	Pb	0.5-10,000	Ti	0.005%-10%	
	Bi	0.01-10,000	In	0.005-500	Rb	0.1-10,000	Tl	0.02-10,000	
ME-MS61m 0.75g sample	Ca	0.01%-50%	K	0.01%-10%	Re	0.002-50	U	0.1-10,000	\$38.55
	Cd	0.02-1,000	La	0.5-10,000	S	0.01%-10%	V	1-10,000	
	Ce	0.01-500	Li	0.2-10,000	Sb	0.05-10,000	W	0.1-10,000	
	Co	0.1-10,000	Mg	0.01%-50%	Sc	0.1-10,000	Y	0.1-500	
	Cr	1-10,000	Mn	5-100,000	Se	1-1,000	Zn	2-10,000	
	Cs	0.05-500	Mo	0.05-10,000	Sn	0.2-500	Zr	0.5-500	
ME-MS61r	Dy	0.05-1,000	Gd	0.05-1,000	Nd	0.1-1,000	Tb	0.01-1,000	\$35.55 Full suite
	Er	0.03-1,000	Ho	0.01-1,000	Pr	0.03-1,000	Tm	0.01-1,000	
	Eu	0.03-1,000	Lu	0.01-1,000	Sm	0.03-1,000	Yb	0.03-1,000	

Note: To include Hg by a separate procedure in the suite of elements above, please request ME-MS61m instead of ME-MS61.

Portable XRF for Lithochemochemistry

The crucial lithochemochemical elements - silicon, titanium and zirconium - may be added to any ALS four acid method for a more complete element suite.

CODE	ANALYTES & RANGES	PRICE PER SAMPLE
pXRF-34	Portable XRF scan of a non-mineralized pulverized sample. Ranges: Si 0.5%-47% Ti 0.1%-60% Zr 5ppm-5% 15g sample	\$3.60 Add-on only

Single Elements by Four Acid

When analytical results for one or only a few elements with low detection limits are required. More elements are available on request.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
(+)MS62 0.25g sample	Ag	0.02-100	Ga	0.05-500	Se	0.5-500	Tl	0.02-500	\$15.20 plus 1.30/ element
	As	0.2-500	Mo	0.05-500	Sn	0.2-500	U	0.1-500	
	Bi	0.01-500	Re	0.002-50	Te	0.05-500	W	0.1-500	
	Cd	0.02-500	Sb	0.05-500	Th	0.01-500			

+ Add element symbol as prefix to method code.

Aqua Regia With ICP-AES Finish

These methods are economical tools for first pass exploration geochemistry. Data reported from an aqua regia digestion should be considered as representing only the leachable portion of the particular analyte.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-ICP41 0.5g sample	Ag	0.2-100	Co	1-10,000	Mn	5-50,000	Sr	1-10,000	\$11.45 complete package or \$5.55 plus 0.75/element
	Al	0.01%-25%	Cr	1-10,000	Mo	1-10,000	Th	20-10,000	
	As	2-10,000	Cu	1-10,000	Na	0.01%-10%	Ti	0.01%-10%	
	B	10-10,000	Fe	0.01%-50%	Ni	1-10,000	Tl	10-10,000	
ME-ICP41m 1g sample	Ba	10-10,000	Ga	10-10,000	P	10-10,000	U	10-10,000	\$17.65
	Be	0.5-1,000	Hg	1-10,000	Pb	2-10,000	V	1-10,000	
	Bi	2-10,000	K	0.01%-10%	S	0.01%-10%	W	10-10,000	
	Ca	0.01%-25%	La	10-10,000	Sb	2-10,000	Zn	2-10,000	
	Cd	0.5-1,000	Mg	0.01%-25%	Sc	1-10,000			

*To include Hg to a lower detection limit of 0.005ppm in this suite of elements, please request method ME-ICP41m

Four Acid Digestion With ICP-AES Finish

Four acid digestions are able to dissolve most minerals, but although the term "near-total" is used, not all elements are quantitatively extracted in some sample matrices.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-ICP61 0.25g sample	Ag	0.5-100	Cr	1-10,000	Na	0.01%-10%	Ti	0.01%-10%	\$15.20 complete package or \$8.10 plus 0.75/element
	Al	0.01%-50%	Cu	1-10,000	Ni	1-10,000	Tl	10-10,000	
	As	5-10,000	Fe	0.01%-50%	P	10-10,000	U	10-10,000	
	Ba	10-10,000	Ga	10-10,000	Pb	2-10,000	V	1-10,000	
ME-ICP61m 0.75g sample	Be	0.5-1,000	K	0.01%-10%	S	0.01%-10%	W	10-10,000	\$25.35
	Bi	2-10,000	La	10-10,000	Sb	5-10,000	Zn	2-10,000	
	Ca	0.01%-50%	Mg	0.01%-50%	Sc	1-10,000			
	Cd	0.5-1,000	Mn	5-100,000	Sr	1-10,000			
	Co	1-10,000	Mo	1-10,000	Th	20-10,000			

*To include Hg in the suite of elements above, please request method ME-ICP61m

Resistive Elements By Fusion

The lithium borate fusion & ICP-MS finish allows analysis of the most resistive elements at trace levels. Additional elements are available on request.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
(+)-MS85 0.1g sample	Ce	0.1-10,000	Rb	0.2-10,000	Ta	0.1-2,500	W	1-10,000	\$16.90 plus 1.30/element
	La	0.1-10,000	Sn	1-10,000	Th	0.05-1,000	Y	0.1-10,000	
	Nb	0.2-2,500	Sr	0.1-10,000	U	0.05-1,000	Zr	2-10,000	

+ Add element symbol as prefix to method code.



Intermediate Level Aqua Regia

These packages can be used as an economical alternative to analyzing low grade ore or samples with known mineralization. Data reported from an aqua regia digestion should be considered as representing only the leachable portion of the particular analyte.

CODE	ANALYTES & RANGES (ppm)							PRICE PER SAMPLE	
ME-ICP41a 0.4g sample	Ag	1-200	Cr	5-50,000	Mo	5-50,000	Th	100-50,000	\$18.95 complete package or \$11.35 plus 2.45/element
	Al	0.05%-50%	Cu	5-50,000	Na	0.05%-50%	Ti	0.05%-50%	
	As	10-100,000	Fe	0.05%-50%	Ni	5-50,000	Tl	50-50,000	
	Ba	50-50,000	Ga	50-50,000	P	50-50,000	U	50-50,000	
	Be	5-500	Hg	5-50,000	Pb	10-50,000	V	5-50,000	
	Bi	10-50,000	K	0.05%-50%	S	0.05%-10%	W	50-50,000	
	Ca	0.05%-50%	La	50-50,000	Sb	10-50,000	Zn	10-50,000	
	Cd	5-2,500	Mg	0.05%-50%	Sc	5-50,000			
	Co	5-50,000	Mn	25-50,000	Sr	5-50,000			

Intermediate Level Four Acid Digestion

These packages can be used as an economical alternative to analyzing low grade ore or samples with known mineralization. Four acid digestions are able to dissolve most minerals, but not all elements are quantitatively extracted in some samples.

CODE	ANALYTES & RANGES (ppm)							PRICE PER SAMPLE	
ME-ICP61a 0.4g sample	Ag	1-200	Cr	10-100,000	Na	0.05%-30%	Ti	0.05%-30%	\$21.50 complete package or \$13.90 plus 2.45/element
	Al	0.05%-30%	Cu	10-100,000	Ni	10-100,000	Tl	50-50,000	
	As	50-100,000	Fe	0.05%-50%	P	50-100,000	U	50-50,000	
	Ba	50-50,000	Ga	50-50,000	Pb	20-100,000	V	10-100,000	
	Be	10-10,000	K	0.1%-30%	S	0.05%-10%	W	50-50,000	
	Bi	20-50,000	La	50-50,000	Sb	50-50,000	Zn	20-100,000	
	Ca	0.05%-50%	Mg	0.05%-50%	Sc	10-50,000			
	Cd	10-10,000	Mn	10-100,000	Sr	10-100,000			
	Co	10-50,000	Mo	10-50,000	Th	50-50,000			

Single Elements by Pressed Pellet XRF

Pressed pellet XRF is suitable for determining elements not easily solubilized by acid digestion, but may be subject to interferences due particle size and mineralogy.

CODE	ANALYTES & RANGES (ppm)							PRICE PER SAMPLE	
(+)-XRF05 10g sample	Ba	10-10,000	Nb	2-4,000	Ta	10-5,000	Y	2-4,000	\$10.15 plus 2.45/element
	Ce	10-4,000	Rb	2-4,000	Th	4-4,000	Zr	2-4,000	
	Cr	5-4,000	Sn	5-5,000	U	4-5,000			
	La	10-4,000	Sr	2-4,000	W	10-5,000			

+ Add element symbol as prefix to method code.



Portable XRF For Indicative Analysis

Portable XRF may be used to screen large volumes of samples for intermediate to ore grade elements when the standard lab test is relatively costly and time-consuming. The pXRF method must be calibrated for a specific sample suite on an individual project basis. Submitting samples not represented in the calibration suite creates a high risk of inaccurate results, including false positives.

ALS offers custom calibration for pXRF on project-specific sample suites, with our rigorous quality standards and XRF expertise ensuring accurate, reliable results. The pXRF instrument can be located in the prep lab nearest your project, or on-site if the project is remote. Contact your local client services team for more information.

Halogens

Elemental analysis of the halide minerals containing chlorine and fluorine generally require fusions that will retain the elements in solution, as well as specific instrumentation for analysis.

CODE	ANALYTES & RANGES (ppm)		DESCRIPTION	PRICE PER SAMPLE
CI-IC881	Cl	50-20,000	KOH fusion and ion chromatography. 0.2g sample	\$21.20
CI-ELE81a	Cl	50-20,000	Specific to Cl in phosphates only. KOH fusion and ion selective electrode. 1g sample	\$18.95
CI-XRF20	Cl	0.001%-6%	Lithium borate fusion and XRF. 0.7g sample	\$18.95
CI-VOL66	Cl	0.01%-80%	Nitric acid digestion and titration. 1g sample	\$31.95
F-ELE81a	F	20-20,000	KOH fusion and ion selective electrode. 0.2g sample	\$18.95
F-ELE82	F	0.01%-20%	Na ₂ O ₂ fusion, citric acid leach and ion selective electrode. 0.1g sample	\$28.05
F-IC881	F	20-20,000	KOH fusion and ion chromatography. 0.2g sample	\$21.20
ME-IC881	Cl F	50-20,000 20-20,000	KOH fusion and ion chromatography. 0.2g sample	\$29.20

Mercury

Aqua regia quantitatively dissolves Hg and uses a temperature of digestion low enough to avoid fuming off this volatile element.

CODE	ANALYTE & RANGES (ppm)	DESCRIPTION	PRICE PER SAMPLE
Hg-MS42	Hg	0.005-100 Trace level Hg by aqua regia and ICP-MS. 0.5g sample	\$10.10
Hg-ICP42	Hg	1-100,000 High grade Hg by aqua regia and ICP-AES. 0.5g sample	\$10.10
Hg-CON01	Hg	1-10,000 Hg in ores by acid digestion and ICP-AES. 2g sample	\$75.80

Loss On Ignition

LOI measures the content of a sample lost as gases when subjected to high temperatures, often including water and CO₂. Many more temperatures and ignition times are available, please enquire.

CODE	ANALYTES & RANGES (%)		DESCRIPTION	PRICE PER SAMPLE
OA-GRA10 OA-GRA11	H ₂ O (Moisture)	0.01-100	Gravimetric procedure after drying at 105°C. 2 hours (normal samples). 24 hours (hygroscopic samples). 5g sample	\$15.20 \$15.95
OA-IR06	H ₂ O + (Water of Crystallization)	0.01-100	Combustion furnace and infrared spectrometry. 1g sample	\$15.20
OA-GRA05xf	LOI @ 500°C	0.01-100	Loss on ignition at 500°C. 1g sample.	\$12.60
OA-GRA05	LOI @ 1000°C	0.01-100	Loss on ignition at 1000°C. 1g sample.	\$8.90

Conductivity, pH and Acid Insolubles

These methods provide crucial information for mineral processing and environmental assessment studies.

CODE	ANALYTES & RANGES		DESCRIPTION	PRICE PER SAMPLE
OA-GRA04	Acid Insoluble	0.01%-100%	Acid insoluble content. 1g sample.	\$15.20
OA-ELE03	pH	0.1-14	pH on 1:10 sample to water ratio. 5g sample	\$10.15
OA-ELE04	Conductivity	1-100,000µS/cm	Specific conductivity on 1:10 sample to water ratio. 5g sample	\$12.60
OA-ELE05	Soil pH	0.1-14	Soil pH on 1:1 sample to water ratio. 20g sample	\$12.60
OA-ELE06	Soil Conductivity	1-100,000µS/cm	Soil conductivity on 1:1 sample to water ratio. 20g sample	\$8.85
OA-ELE07	Paste pH	0.1-14	Paste pH on 10g sample saturated with water.	\$7.60


Pb Isotope Ratios For Exploration

This fast, low-cost analysis of Pb isotope ratios in pulps allows fingerprinting of different lithologies and hydrothermal fluid flow pathways, providing a new vector to ore deposits.

CODE	ANALYTE	DESCRIPTION	PRICE PER SAMPLE
PbIS-RAT41 PbIS-RAT61	Six isotope ratios including ²⁰⁴ Pb, ²⁰⁶ Pb, ²⁰⁷ Pb, and ²⁰⁸ Pb isotopes	Pb isotope ratios by acid digestion and ICP-MS analysis. Total Pb content of the sample is required in advance. May be run on whole rock pulps. 0.5g sample Aqua Regia Digestion Four Acid Digestion	\$37.15 \$33.95

Stable Isotopes

Many important parameters of mineralizing fluids may be determined from stable isotope ratios. The isotopic alteration halo may extend beyond visible mineralogy changes, creating a larger deposit footprint for easier exploration vectoring.

CODE	ANALYTE	DESCRIPTION	PRICE PER SAMPLE
LS-ISTP01	C and O in Carbonate Minerals 	Offered in partnership with the Mineral Deposit Research Unit (MDRU) at the University of British Columbia. Carbon and oxygen isotopic composition is determined specifically on carbonate minerals in whole-rock pulps using laser spectroscopy. 0.5g sample	\$35.00
OH-ISTP01	O and H in Silicate Minerals	Specific to clays and silicate minerals. Determination using a complex gas collection procedure and IRMS. Sample must be supplied as a single-mineral separate. TAT is 30 days.	\$110.00 each
S-ISTP01	Sulfur	Specific to sulfide and sulfate minerals. Determination using TC/EA and IRMS. Sample must be supplied as a single-mineral separate. TAT is 30 days.	\$55.00
CO-ISTP01	Carbon and Oxygen	Specific to minerals containing carbon and/or oxygen. Determination using acid digestion and IRMS. Sample must be supplied as a single-mineral separate. TAT is 30 days.	\$42.00

Radiogenic Isotopes

These methods provide insight into provenance and character of hydrothermal fluids and rock genesis, helping unravel geological history for a more sophisticated understanding of your ore body.

CODE	ANALYTE	DESCRIPTION	PRICE PER SAMPLE
Pb-ISTP01	Pb/Pb	May be done on whole rock pulps or on specific Pb-bearing minerals. Measurement by acid digestion and HR-ICP-MS. Samples may require Hg separation at an additional cost. TAT is 30 days.	\$260.00
Nd-ISTP01	Sm/Nd	Performed on whole rock pulps. Measurement by column separation and HR-ICP-MS. Total Sm and Nd content is required in advance. TAT is 30 days.	\$545.00

Geochronology

These methods may be used to date the ages of specific minerals, hydrothermal alteration events, and emplacement of volcanic-plutonic units. Age constraints on important events can help refine the deposit model and identify alteration that did not contribute to mineralization.

Sample sizes required for most isotopic analysis methods vary depending on mineralogy and purpose; please contact client services for more information.

CODE	ANALYTE	DESCRIPTION	PRICE PER SAMPLE
Re-ISTP01	Re/Os	Specific to molybdenite. Rock or drill core must be received whole as steel jaw crushing will contaminate the sample with Re. Age can only be determined for rocks of >0.5 Ma, and the molybdenite separate must contain >100ppm Re. Price includes mineral separation, solvent extraction, column separation and TIMS analysis. TAT is 70 days.	\$1750.00
ISTP-ZRSEP	n/a	Creation of a zircon mineral separate specifically for U/Pb geochronology. Required sample weight and number of zircon grains recovered depends on original sample content. Extra charges may apply for samples with low zircon content.	\$175.70
U-ISTP01	U/Pb	Specific to U-bearing minerals such as zircon, monazite, and uraninite. Thin sections or mineral separates are analyzed by laser ablation and HR-ICP-MS. Laser ablation averages 40 data points per day; minimum charge is ½ day. TAT is 45 days.	By Quotation
Ar-ISTP01	Ar/Ar	Done on whole rock samples. Rock and drill core should be submitted intact or crushed only, as sample prep is included in the price. Measurement by irradiation and step heating in a mass spectrometer. TAT is approximately 9 months.	\$1250.00

A close-up photograph of a laboratory furnace. Several crucibles containing glowing orange and yellow molten samples are positioned above a blue and white flame. The scene is illuminated with warm, orange light, highlighting the industrial and scientific nature of the equipment.

Whole Rock Analysis & Lithochemistry

Analyses related to lithochemistry, alteration minerals, and trace element mobility are important tools for understanding ore-forming geological environments. Managing and interpreting large datasets generated by lithochemical techniques, while traditionally challenging, have been greatly simplified by powerful software tools now available to geologists and geochemists.

No single analytical method is able to encompass the full range of elements required for effective lithochemical investigation. ALS offers many analytical packages designed to provide comprehensive information for these studies using the most appropriate methods for every element; essentially, complete rock characterization.

Please submit at least four times the nominal sample weight for efficient service.

Whole Rock Analysis

Both x-ray fluorescence (XRF) and ICP-AES instrument finishes can be used effectively for the major rock-forming elements following a fusion. These methods are not suitable for samples with base or precious metals mineralization.

Specific commodities such as iron ore, bauxite, and base metal sulfides should be analyzed with packages designed for those sample types. Please see the Ores & Commodities section for more whole rock analysis options.

CODE	ANALYTES AND RANGES (%)								DESCRIPTION	PRICE PER SAMPLE
ME-XRF26*	Al ₂ O ₃	0.01-100	Fe ₂ O ₃	0.01-100	Na ₂ O	0.01-10	SrO	0.01-1.5	Fused disc XRF, LOI by furnace or TGA	\$31.55
OA-GRA05x	BaO	0.01-66	K ₂ O	0.01-15	P ₂ O ₅	0.01-46	TiO ₂	0.01-30		
ME-GRA05	CaO	0.01-60	MgO	0.01-50	SO ₃	0.01-34	LOI	0.01-100		
2g sample	Cr ₂ O ₃	0.01-10	MnO	0.01-39	SiO ₂	0.01-100				

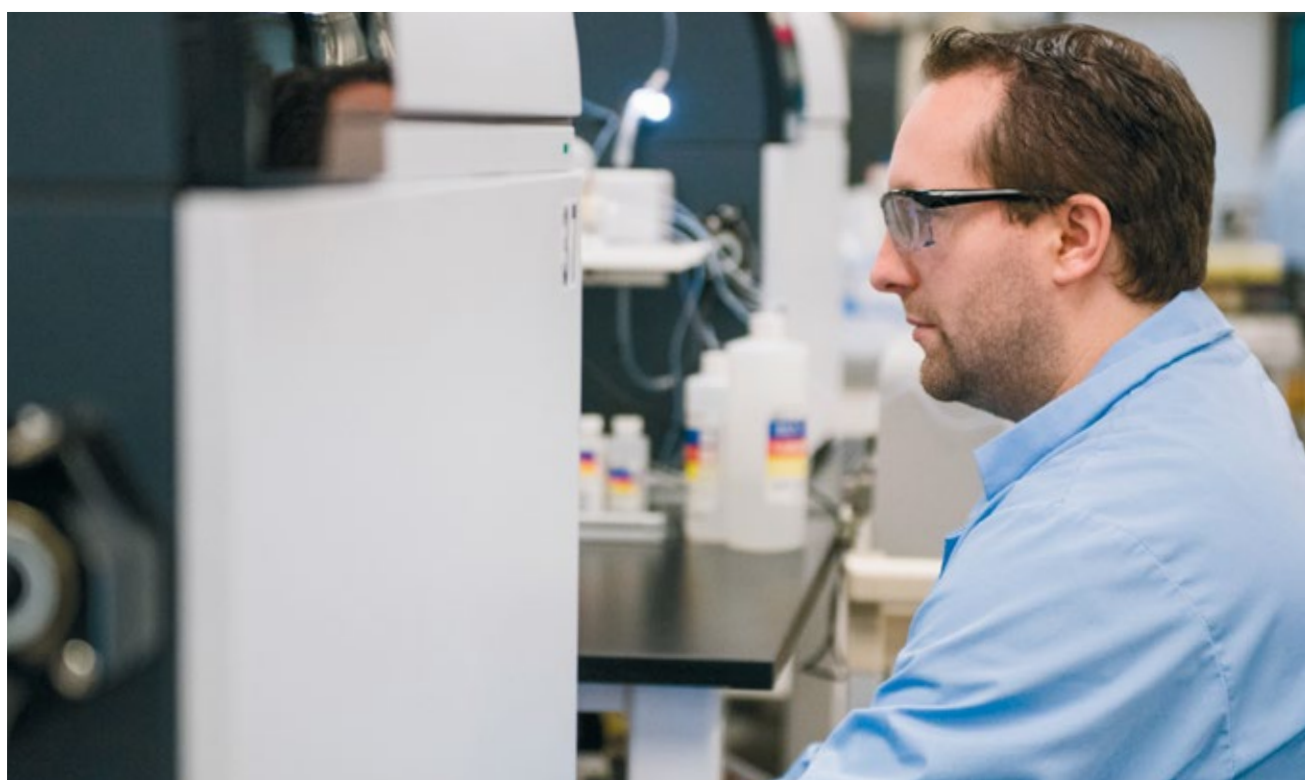
*For non-mineralized samples with moderate sulfide content, please request ME-XRF06.

CODE	ANALYTES AND RANGES (%)								DESCRIPTION	PRICE PER SAMPLE
ME-ICP06 2g sample	Al ₂ O ₃	0.01-100	Fe ₂ O ₃	0.01-100	Na ₂ O	0.01-100	TiO ₂	0.01-100	Fused bead, acid digestion and ICP-AES	\$31.55
	BaO	0.01-100	K ₂ O	0.01-100	P ₂ O ₅	0.01-100	LOI	0.01-100		
	CaO	0.01-100	MgO	0.01-100	SiO ₂	0.01-100				
	Cr ₂ O ₃	0.002-100	MnO	0.01-100	SrO	0.01-100				

Trace Elements by Li Borate Fusion

A lithium borate fusion prior to acid dissolution and ICP-MS analysis provides the most quantitative analytical approach for a broad suite of trace elements. Options for adding the whole rock elements from an ICP-AES analysis on the same fusion, or base metals from a separate four acid digestion, are available.

CODE	ANALYTES AND RANGES (ppm)								DESCRIPTION	PRICE PER SAMPLE
ME-MS81 2g sample	Ba	0.5-10,000	Hf	0.2-10,000	Sn	1-10,000	Y	0.1-10,000	Fused bead, acid digestion and ICP-MS	\$31.65
	Ce	0.1-10,000	Ho	0.01-1,000	Sr	0.1-10,000	Yb	0.03-1,000		
	Cr	10-10,000	La	0.1-10,000	Ta	0.1-2,500	Zr	2-10,000		
	Cs	0.01-10,000	Lu	0.01-1,000	Tb	0.01-1,000				
	Dy	0.05-1,000	Nb	0.2-2,500	Th	0.05-1,000				
	Er	0.03-1,000	Nd	0.1-10,000	Tm	0.01-1,000				
	Eu	0.03-1,000	Pr	0.03-1,000	U	0.05-1,000				
	Ga	0.1-1,000	Rb	0.2-10,000	V	5-10,000				
Gd	0.05-1,000	Sm	0.03-1,000	W	1-10,000					
ME-MS81d	Combination of Rare Earth & Trace Elements from method ME-MS81 plus whole rock package by method ME-ICP06.									\$43.60
ME-4ACD81 0.25g sample	Ag	0.5-100	Co	1-10,000	Mo	1-10,000	Sc	1-10,000	Four acid digestion and ICP-AES	\$7.55 Add-on only
	As	5-10,000	Cu	1-10,000	Ni	1-10,000	Tl	10-10,000		
	Cd	0.5-1,000	Li	10-10,000	Pb	2-10,000	Zn	2-10,000		





Complete Characterization Packages

By combining a number of methods into one cost effective package, a complete sample characterization is obtained.

These packages combine whole rock analysis, trace elements by fusion, aqua regia digestion for the volatile trace elements, carbon and sulfur by combustion analysis, and several detection limit options for the base metals.

Other method combinations are available for complete characterization. Please enquire with your local client services team for more information.

These packages are suitable only for unmineralized samples. To add gold analysis, please see the Precious Metals section.

Minimum sample size is 10g.

CODE	ANALYTES AND RANGES (ppm)								PRICE PER SAMPLE
ME-ICP06	SiO ₂	0.01-100%	MgO	0.01-100%	TiO ₂	0.01-100%	BaO	0.01-100%	
	Al ₂ O ₃	0.01-100%	Na ₂ O	0.01-100%	MnO	0.01-100%	LOI	0.01-100%	
	Fe ₂ O ₃	0.01-100%	K ₂ O	0.01-100%	P ₂ O ₅	0.01-100%			
	CaO	0.01-100%	Cr ₂ O ₃	0.01-100%	SrO	0.01-100%			
ME-IR08	C	0.01-50%	S	0.01-50%					
ME-MS81	Ba	0.5-10,000	Gd	0.05-1,000	Sm	0.03-1,000	W	1-10,000	Sold only as complete packages. CCP-PKG01 \$76.50 CCP-PKG03 \$86.50 Includes ME-XRF26 instead of ME-ICP06
	Ce	0.1-10,000	Hf	0.2-10,000	Sn	1-10,000	Y	0.1-10,000	
	Cr	10-10,000	Ho	0.01-10,000	Sr	0.1-10,000	Yb	0.03-1,000	
	Cs	0.01-10,000	La	0.1-10,000	Ta	0.1-2,500	Zr	2-10,000	
	Dy	0.05-1,000	Lu	0.01-1,000	Tb	0.01-1,000			
	Er	0.03-1,000	Nb	0.2-2,500	Th	0.05-1,000			
	Eu	0.03-1,000	Nd	0.1-10,000	Tm	0.01-1,000			
	Ga	0.1-1,000	Pr	0.03-1,000	U	0.05-1,000			
Ge	5-1,000	Rb	0.2-10,000	V	5-10,000				
ME-MS42*	As	0.1-250	In	0.005-250	Se	0.2-250			
	Bi	0.01-250	Re	0.001-250	Te	0.01-250			
	Hg	0.005-25	Sb	0.05-250	Tl	0.2-250			
ME-4ACD81	Ag	0.5-100	Cu	1-10,000	Ni	1-10,000	Zn	2-10,000	
	Cd	0.5-1,000	Li	10-10,000	Pb	2-10,000			
	Co	1-10,000	Mo	1-10,000	Sc	1-10,000			
ME-MS61	Ag	0.01-100	Cu	0.2-10,000	Ni	0.2-10,000	Zn	2-10,000	CCP-PKG05 \$89.20 Includes ME-MS61 instead of ME-4ACD81
	Cd	0.02-1,000	Li	0.2-10,000	Pb	0.5-10,000			
	Co	0.1-10,000	Mo	0.05-10,000	Sc	0.1-10,000			
ME-MS61L	Ag	0.002-100	Cu	0.02-10,000	Ni	0.08-10,000	Zn	0.2-10,000	CCP-PKG06 \$100.90 Includes ME-MS61L with super trace detection limits.
	Cd	0.005-1,000	Li	0.2-10,000	Pb	0.01-10,000			
	Co	0.005-10,000	Mo	0.02-10,000	Sc	0.01-10,000			

*Other customizable options available for substitution of ME-MS42



Specific Ores & Commodities

Procedures for the evaluation of ores and high grade materials are optimized for accuracy, precision and recovery of the target element. No single digestion or analytical method is suitable for all cases, and ALS provides a wide variety of procedures so the most appropriate method can be selected. Choices include acid digestions with ICP-AES finish; fusion and XRF determination for resistive elements and bulk commodities; specialized solvent digestions for uncommon ores; and classical volumetric methods for very high grade base metals.

**Please submit at least four times
the nominal sample weight for
efficient service.**

Copper Mineral Selective Leaches

These methods may be run alone or in sequence to semi-quantitatively identify potential recovery by various ore processing methods. ALS can also provide custom methods based on metallurgical requirements.

CODE	ANALYTES & RANGES (%)	DESCRIPTION	PRICE PER SAMPLE
Cu-AA04	Cu 0.01-10	Citric acid leach and AAS finish. 0.25g sample	\$12.60
Cu-AA05	Cu 0.001-10	Sulfuric acid leach and AAS finish. 1g sample	\$12.60
Cu-AA07n	Cu 0.001-100	Sulfuric acid/Na sulfite leach and AAS finish. 1g sample	\$12.60
Cu-AA08q	Cu 0.001-100	Sulfuric acid/ferric sulfate leach and AAS finish. 1g sample	\$13.50
Cu-AA17	Cu 0.001-10	Cyanide leach and AAS finish. 2g sample	\$18.35
Cu-PKG	Cu Various	Sequential leach for oxide, sulfide and residual Cu. Various options available. 1g sample	\$37.90

Total Copper

Aqua regia is an effective solvent for copper oxides and sulfides, but copper occurring with other commodities like molybdenum can be analyzed by four acid digestion for consistency across data sets.

CODE	ANALYTES & RANGES (%)	DESCRIPTION	PRICE PER SAMPLE
Cu-ICP41	Trace Cu 1-10,000 ppm	Aqua regia digestion and ICP or AAS finish. 0.5g sample	\$6.30
Cu-ICP61	Trace Cu 1-10,000 ppm	Four acid digestion and ICP or AAS finish. 0.25g sample	\$8.85
Cu-OG46	Cu Assay 0.001-50	Aqua regia digestion and ICP or AAS finish. 0.4g sample	\$11.30
Cu-OG62	Cu Assay 0.001-50	Four acid digestion and ICP or AAS finish. 0.4g sample	\$13.90
Cu-SCR21	Native Cu 0.01-100	Screen 1kg sample to 100 microns, duplicate assay on 0.25g of undersize fraction and assay of entire oversize fraction by four acid digestion and AAS finish.	\$123.05
Cu-VOL61 Cu-CON02	Cu Concentrate 0.01-100	HNO ₃ -HCl-HF-H ₂ SO ₄ acid digestion followed by titration. Cu-CON02 done in duplicate. 2g sample	\$44.25 \$75.80

Iron Ore Analysis

Lithium borate fusion and XRF finish is the industry method of choice for the analysis of oxide iron ores. Single or multi-temperature LOI is available, customizable as required.

CODE	ANALYTES & RANGES (%)	DESCRIPTION	PRICE PER SAMPLE
ME-XRF21n (normalized)	Al ₂ O ₃ 0.01-100	Fused disc XRF.	\$41.80 LOI must be done as part of this procedure.
	As 0.001-1.5		
	Ba 0.001-10		
	CaO 0.01-40		
	Cl 0.001-6		
	Co 0.001-5		
	Cr ₂ O ₃ 0.001-10		
0.7g sample	Cu 0.001-1.5		
	Fe 0.01-75		
	SiO ₂ 0.01-100		
OA-GRA05x ME-GRA05	Loss on Ignition 1g sample	Furnace or Thermogravimetric Analyzer (TGA)	\$5.55 plus 3.35/temperature

Davis Tube Recovery

ALS recommends discussion to determine optimum protocol for your particular ore type. Grind curve confirmation tests, laser sizing, cyclosizing and wet screening are also available.

CODE	ANALYTE	PRICE PER SAMPLE
DTR-PREP	Multi-stage sieving and pulverizing.	By Quotation
DTR-REC	Wash time and mass recovery.	
WT-DTR	Weight of DTR fractions.	
DTR-FeRec	DTR iron recovery.	
ME-XRF21h/c/t	XRF analysis on various DTR fractions. 0.7g sample each	\$41.80 each
Fe-VOL05	Ferrous iron by titration (FeO; 0.01%). 1g sample	\$22.40
MAG-SUS	Magnetic susceptibility.	\$12.55

Trace Level Lithium Exploration

Lithium hosted in pegmatites and jadarite can occur with economic grades of rare earths and other trace metals such as boron and cesium. A sodium peroxide fusion is required for complete recovery in these deposits.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE	
ME-MS89L 0.2g sample	Ag	5-12,500	Er	0.02-25,000	Mo	2-25,000	Ta	0.04-25,000	\$38.00	
	As	4-25,000	Eu	0.03-25,000	Nb	0.8-25,000	Tb	0.01-25,000		
	B*	8-25,000	Fe	0.05%-25%	Nd	0.07-25,000	Te	0.5-25,000		
	Ba	2-25,000	Ga	0.5-25,000	Ni	10-25,000	Th	0.1-25,000		
	Be	0.4-25,000	Gd	0.03-25,000	Pb	0.5-25,000	Ti	0.005%-25%		
	Bi	0.1-25,000	Ge	0.5-25,000	Pr	0.03-25,000	Tl	0.02-25,000		
	*B-MS89L	Ca	0.1%-25%	Ho	0.01-25,000	Rb	0.5-25,000	Tm		0.01-25,000
	Cd	0.8-25,000	In	0.3-25,000	Re	0.01-25,000	U	0.2-25,000		
	Ce	0.2-25,000	K	0.05%-25%	Sb	0.3-25,000	V	1-25,000		
	Co	0.5-25,000	La	0.08-25,000	Se	3-25,000	W	0.3-25,000		
	Cs	0.2-25,000	Li	2-25,000	Sm	0.04-25,000	Y	0.2-25,000		
	Cu	20-25,000	Lu	0.05-25,000	Sn	3-25,000	Yb	0.02-25,000		
	Dy	0.03-25,000	Mn	10-25,000	Sr	20-25,000	Zn	10-25,000		

*B-MS89L - Glassless digestion and analysis to eliminate boron from labware

Intermediate and Ore Grade Lithium

More elements may be added to these methods, and they may be packaged with ICP-MS finishes for associated pegmatite-hosted commodities at trace levels.

CODE	ANALYTES & RANGES (%)								PRICE PER SAMPLE
ME-ICP89 0.2g sample	Al ₂ O ₃	0.02%-100%	Cu	0.01%-50%	MnO	0.01%-50%	TiO ₂	0.02%-83%	\$37.85
	As	0.01%-10%	Fe ₂ O ₃	0.01%-100%	Ni	0.005%-30%	Zn	0.01%-60%	
	CaO	0.01%-70%	K ₂ O	0.01%-60%	Pb	0.01%-30%			
	Co	0.005%-30%	Li	0.001%-10%	S	0.01%-60%			
	Cr ₂ O ₃	0.01%-88%	MgO	0.01%-50%	SiO ₂	0.2%-100%			
MS91-PKG	This package combines ME-ICP89 with ICP-MS determination of Nb, Ta, Sn, W, U and Th for an extended pegmatite exploration suite. 0.2g sample								\$51.20
ME-ICP82b	Li	0.001%-10%	Assay grade lithium and/or boron by Na ₂ O ₂ fusion and ICP-AES. Our highest precision method for Li and B resource determination in known deposits.						\$18.40 one element
	B	0.02%-50%							\$21.45 both elements

Lithium In Sedimentary Deposits

In many cases, aqua regia provides better recovery of Li than four acid digestions due to complex chemical reactions. Roasting samples prior to four acid digestions, particularly hectorite, may mitigate this effect.

CODE	ANALYTES & RANGES	DESCRIPTION	PRICE PER SAMPLE
Li-ICP41	Li 10ppm-1%	Aqua regia and ICP-AES finish. Multi-element package also available. 0.5g sample	\$6.30
Li-ICP61	Li 10ppm-1%	Four acid and ICP-AES finish. Multi-element package also available. 0.25g sample	\$8.85
Li-OG63	Li 0.005%-10%	Ore grade Li by specialized four-acid digestion and ICP-AES finish. Best suited to Li-bearing silicate sediments. 0.4g sample	\$12.45
RST-21	Dry roasting pre-treatment	Roasting samples prior to analysis may increase Li recovery due to excess water content promoting insoluble salt formation.	\$7.60

Lithium Brines

ALS analyzes brine samples as received. If the samples require acidification or filtration in the lab, please indicate this prominently on the sample submittal form.

CODE	ANALYTES & RANGES (mg/L)								PRICE PER SAMPLE
ME-MS14b	Li	0.01-10	Includes a suite of 35 elements relevant to brine exploration in addition to Li. Requires 50mL brine.						\$25.35
ME-ICP15 Requires 100mL brine	Ag	1-100	Cd	0.5-100	Mg	5-10,000	Sb	5-1,000	
	Al	100-10,000	Co	2-1,000	Mn	1-1,000	Sr	2-1,000	
	As	10-1,000	Cr	2-1,000	Mo	1-1,000	Ti	100-1,000	
	B	5-10,000	Cu	1-1,000	Na	100-150,000	V	1-1,000	
	Ba	10-1,000	Fe	100-10,000	Ni	2-1,000	Zn	1-1,000	
	Be	0.1-100	K	500-150,000	P	100-1,000			
	Ca	50-10,000	Li	10-3,000	Pb	5-1,000			
Li-BrPKG	pH, Conductivity, TDS, Alkalinity		Physical parameters and alkalinity of lithium brines. Requires 100mL brine.						\$19.85

Uranium

ALS is qualified and experienced in handling NORM samples in every jurisdiction with active uranium exploration and mining. We're known internationally for leading the industry in lowest detection limits and innovative solutions.

CODE	ANALYTE	PRICE PER SAMPLE
UEXP-PKG01	An exploration package targeted at unconformity-hosted uranium deposits where the ore is in the basin sedimentary rocks. 1g sample Includes full 62 element suite from ME-MS41L. Includes REEs and Pb isotope concentrations. ^{204}Pb , ^{206}Pb , ^{207}Pb , ^{208}Pb - 0.005-250ppm Also includes ultra-trace boron by fusion from B-MS82L. B - 5-10,000ppm	\$53.85
ME-MS61u	Full 48 element suite from ME-MS61, optimized for U with specific CRMs for superior quality control. 0.25g sample	\$42.70
U-XRF10	Ore grade U assay (0.01%-15%). 2g sample	\$18.95

Ore Grade Rare Earth Elements

Many REEs occur in minerals resistant to acid digestion, so fusion is the preferred method of decomposition. ALS offers ICP-MS/ICP-AES and XRF determinations. These methods are most appropriate for known ores; see the Whole Rock Analysis & Litho geochemistry section for trace level methods.

CODE	ANALYTES & RANGES (ppm)	PRICE PER SAMPLE
ME-MS81h 0.1g sample	Ce* 3-50,000 Ho 0.05-5,000 Rb 1-50,000 Tm 0.05-5,000	\$50.15
	Dy* 0.3-5,000 La* 3-50,000 Sm* 0.2-5,000 U 0.3-5,000	
	Er 0.2-5,000 Lu 0.05-5,000 Sn 5-50,000 W 5-50,000	
	Eu 0.2-5,000 Nb 1-5,000 Ta 0.5-5,000 Y 3-50,000	
	Gd* 0.3-5000 Nd* 0.5-50,000 Tb* 0.05-5,000 Yb 0.2-5,000	
	Hf 1-50,000 Pr* 0.2-5,000 Th 0.3-5,000 Zr 10-50,000	

*These elements may be determined up to 30% by ME-OGREE.

CODE	ANALYTES & RANGES (%)	PRICE PER SAMPLE
ME-XRF30 0.7g sample	CeO ₂ 0.01-50 Ho ₂ O ₂ 0.01-10 Sm ₂ O ₃ 0.01-10	\$33.40
	Dy ₂ O ₃ 0.01-10 La ₂ O ₃ 0.01-50 Tb ₄ O ₇ 0.01-10	
	Er ₂ O ₃ 0.01-10 Lu ₂ O ₃ 0.01-10 Tm ₂ O ₃ 0.01-10	
	Eu ₂ O ₃ 0.01-10 Nd ₂ O ₃ 0.01-10 Y 0.01-10	
	Gd ₂ O ₃ 0.01-10 Pr ₆ O ₁₁ 0.01-10 Yb ₂ O ₃ 0.01-10	
OA-GRA05x ME-GRA05	Loss on Ignition	Furnace or Thermogravimetric Analyzer (TGA) 1g sample \$5.55 plus 3.35/temperature

Uncommon Metals

These elements have many high-tech applications in electronics, engineering and pharmaceuticals. They require specialized digestions and instrument methods for precise and accurate measurement.

CODE	ANALYTE	RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE
Be-ICP81	Be	0.01%-100%	Sodium peroxide fusion and ICP-AES finish. 0.2g sample	\$18.40
B-MS82L	B	5-10,000	NaOH fusion and ICP-MS finish for super trace B. 0.5g sample	\$20.60
ME-ICP82b	B Li	0.02%-100% 0.001%-10%	Na ₂ O ₂ fusion and ICP-AES finish. B and/or Li may be reported. 0.2g sample	\$18.40 Add 3.05 for Li
Ge-MS66	Ge	1-500	HNO ₃ -HF digestion with orthophosphoric acid leach and ICP-MS finish. 0.5g sample	\$31.55

Bauxite Analysis

XRF is the industry-standard analytical method for bauxite analysis. Results are reported on a dry weight (110°C) basis by default. Additional characterization methods such as organic carbon, reactive silica and available alumina comply fully with CETEM performance criteria. Multi-screen sizing to determine the optimum screen size for recovery and subsequent wet beneficiation are also available.

CODE	ANALYTES & RANGES (%)							DESCRIPTION	PRICE PER SAMPLE
ME-XRF13n (normalized)	Al ₂ O ₃	0.01-100	MgO	0.01-40	SrO	0.01-1.5		Fused disc XRF. 0.7g sample.	\$41.80 LOI determination must be done as part of procedure.
	BaO	0.01-10	MnO	0.01-31	TiO ₂	0.01-30			
	CaO	0.01-40	Na ₂ O	0.01-5.3	V ₂ O ₅	0.01-8			
ME-XRF13u (unnormalized)	Cr ₂ O ₃	0.01-10	P ₂ O ₅	0.01-23	Zn	0.01-1.6			
	Fe ₂ O ₃	0.01-100	SiO ₂	0.05-100	ZrO ₂	0.01-1.5			
	K ₂ O	0.001-6.3	SO ₃	0.01-12.5	Total	0.01-110			
OA-GRA05x ME-GRA05	Loss on Ignition. 1g sample							Furnace or Thermo-gravimetric Analyzer (TGA).	\$5.55 plus 3.35/temperature
C-IR17	Total Organic Carbon (Non Carbonate Carbon), 0.02%-100%. 0.1g sample							TOC by Combustion.	\$31.55
ME-LICP01 ME-LICP02	Reactive Silica and Available Alumina, 0.1%-100%. Digestion temperature, caustic strength and sample/caustic weight ratio may be specified by client. 1g sample							Microwave digestion, chemical separation and ICP-AES analysis.	\$38.15
Si-NIR07	Kaolinitic Silica, 0.4%-100%. 2g sample							Fourier Transform infrared (FT-NIR).	\$4.70

Nickel Laterite

The elements listed are reported by default, but others are available if they are significant in your deposit. Loss on Ignition (LOI) is an important component of the total analysis.

CODE	ANALYTES & RANGES (%)							DESCRIPTION	PRICE PER SAMPLE	
ME-XRF12n* (normalized)	Al ₂ O ₃	0.01-100	Fe ₂ O ₃	0.01-100	Ni	0.005-7.8	Zn	0.001-1.6	Fused disc XRF.	\$41.80 LOI determination must be done as part of procedure.
	CaO	0.01-40	K ₂ O	0.01-6.3	P ₂ O ₅	0.005-23	Total	0.01-110		
ME-XRF12u* (unnormalized) 0.7g sample	Co	0.001-7	MgO	0.01-50	Pb	0.005-1.8				
	Cr ₂ O ₃	0.005-10	MnO	0.005-30	SiO ₂	0.05-100				
	Cu	0.001-1.6	Na ₂ O	0.01-5.3	TiO ₂	0.01-30				
OA-GRA05x ME-GRA05	Loss on Ignition 1g sample							Furnace or Thermogravimetric Analyzer (TGA).	\$5.55 plus 3.35/temperature	

*Scandium may be added for an additional cost.

Phosphates

The elements listed are reported by default, but others are available if they are significant in your deposit. Loss on Ignition (LOI) is an important component of the total analysis.

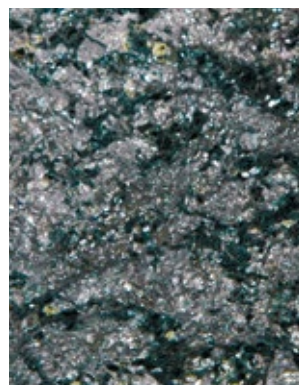
CODE	ANALYTES & RANGES (%)							DESCRIPTION	PRICE PER SAMPLE	
ME-XRF24* 0.7g sample	Al ₂ O ₃	0.01-100	K ₂ O	0.01-10	Na ₂ O	0.01-11	TiO ₂	0.01-30	Fused disc XRF.	\$41.80 LOI determination must be done as part of procedure.
	CaO	0.01-60	MgO	0.01-50	P ₂ O ₅	0.01-50	Total	0.01-110		
	Fe ₂ O ₃	0.01-100	MnO ₂	0.01-48	SiO ₂	0.01-100				
OA-GRA05x ME-GRA05	Loss on Ignition 1g sample							Furnace or Thermogravimetric Analyzer (TGA).	\$5.55 plus 3.35/temperature	

*Fluorine may be added for an additional cost.

Chromite and Manganese Ores

The elements listed are reported by default, but others are available if they are significant in your deposit. Loss on Ignition (LOI) is an important component of the total analysis.

CODE	ANALYTES & RANGES (%)							DESCRIPTION	PRICE PER SAMPLE	
ME-XRF26s 0.7g sample	Al ₂ O ₃	0.01-100	Fe ₂ O ₃	0.01-100	Na ₂ O	0.01-10	TiO ₂	0.01-30	Fused disc XRF.	\$41.80 LOI determination must be done as part of procedure.
	BaO	0.01-66	K ₂ O	0.01-15	P ₂ O ₅	0.01-46	Total	0.01-110		
	CaO	0.01-60	MgO	0.01-50	SO ₃	0.01-34				
	Cr ₂ O ₃	0.01-60	MnO	0.01-80	SiO ₂	0.05-100				
OA-GRA05x ME-GRA05	Loss on Ignition 1g sample							Furnace or Thermogravimetric Analyzer (TGA).	\$5.55 plus 3.35/temperature	



Aqua Regia Overlimit Methods

Aqua regia is a powerful solvent for sulfides, silver and base metals. This method may be triggered automatically on multi-element geochemistry packages.

CODE	ANALYTES & RANGES (%)								PRICE PER SAMPLE
(+) -OG46 0.4g sample	Ag	1-1,500ppm	Co	0.0005-30	Mn	0.01-60	Pb	0.001-20	\$8.85 plus 2.45/element
	As	0.001-60	Cu	0.001-50	Mo	0.001-10	S	0.01-10	
	Cd	0.001-10	Fe	0.01-100	Ni	0.001-30	Zn	0.001-30	

Four Acid Overlimit Methods

Four acid digestion breaks down most silicates and all but the most resistive minerals. This method may be triggered automatically on multi-element geochemistry packages.

CODE	ANALYTES & RANGES (%)								PRICE PER SAMPLE
(+) -OG62 0.4g sample	Ag	1-1,500ppm	Co	0.0005-30	Mg	0.01-50	Pb	0.001-20	\$11.45 plus 2.45/element
	As	0.001-30	Cr	0.002-30	Mn	0.01-60	S	0.01-50	
	Bi	0.001-30	Cu	0.001-50	Mo	0.001-10	Zn	0.001-30	
	Cd	0.001-10	Fe	0.01-100	Ni	0.001-30			

XRF For Resistive Minerals

Some resistive minerals, particularly those containing Sn, W, Nb or Ta, require a fusion for complete recovery. This method is only suitable for samples with <4% sulfides.

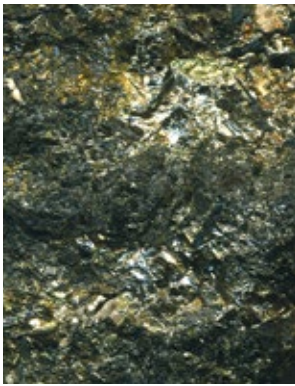
CODE	ANALYTES & RANGES (%)						PRICE PER SAMPLE	
(+) -XRF10 2g sample	Ba		0.009-45	Ta	0.01-50	Zr	0.01-50	\$15.20 plus 3.75/element
	Nb		0.01-10	Th	0.01-15			
	Sb		0.01-50	U	0.01-15			
	Sn		0.01-60	W	0.01-50			

+ Add element symbol as prefix to method code.

Titration Methods

Certain ore deposits naturally have extremely high (>30%) base metal content over short intervals. Specialized digestions and classical chemistry methods are required to analyze these samples.

CODE	ANALYTES & RANGES (%)			DESCRIPTION	PRICE PER SAMPLE
Cu-VOL61	Cu		0.01-100	Cu by Titration. 0.5g sample	\$44.25
Zn-VOL50	Zn		0.01-100	Zn by Titration. 1g sample	\$25.35
Pb-VOL70	Pb		0.01-100	Pb by Titration. 1g sample	\$37.90
Fe-VOL51	Fe		0.01-100	Total Fe in Concentrates. 1g sample	\$45.20
Fe-VOL05	FeO		0.01-100	FeO (Ferrous Iron). 1g sample	\$22.40



Sodium Peroxide Fusion & ICP-AES

Na₂O₂ fusions are used for sulfides, arsenides, chromite, rutile, ilmenite and titanite. This selection is designed for nickel sulfides, but elements are also available individually.

CODE	ANALYTES & RANGES (%)								PRICE PER SAMPLE
ME-ICP81 0.2g sample	Al	0.01-50	Cr	0.01-30	Mg	0.01-30	S	0.01-60	\$39.00 complete package or \$12.60 plus 2.45/element
	As	0.01-10	Cu	0.002-30	Mn	0.01-50	Si	0.1-50	
	Ca	0.05-50	Fe	0.05-70	Ni	0.002-30	Ti	0.01-30	
	Co	0.002-30	K	0.1-30	Pb	0.01-30	Zn	0.002-30	

Oxidizing Fusion & XRF Finish

Samples are analyzed by XRF following a lithium borate fusion with the addition of strong oxidizing agents to decompose sulfide-rich ores.

Other elements are available to report on request. LOI may be optionally added to this method, but it is not used to normalize results.

CODE	ANALYTES & RANGES (%)								PRICE PER SAMPLE
ME-XRF15b 0.5g sample	Al ₂ O ₃	0.01-100	La ₂ O ₃	0.01-50	Sn			0.005-20	\$33.40 plus 3.50/element
	As	0.01-10	MgO	0.01-40	Sr			0.01-5	
	BaO	0.01-66	Mn	0.01-30	Ta			0.002-16.4	
	Bi	0.01-5	Mo	0.005-2	Th			0.002-5	
	CaO	0.01-40	Nb	0.005-20	TiO ₂			0.01-30	
	CeO ₂	0.01-50	Ni	0.005-20	U			0.001-5	
	Co	0.01-7	P ₂ O ₅	0.01-25	V			0.01-5.6	
	Cr	0.01-10	Pb	0.005-20	W			0.001-15.9	
	Cu	0.005-20	S	0.01-20	Zn			0.005-20	
	Fe	0.01-75	Sb	0.005-20	Zr			0.01-20	
OA-GRA05x ME-GRA05	Loss on Ignition		Furnace or Thermogravimetric Analyzer (TGA). 1g sample						\$5.55 plus 3.35/temperature

Base Metal Concentrates By XRF

Samples are analyzed by XRF following a lithium borate fusion with the addition of strong oxidizing agents to decompose sulfide concentrates.

Other elements are available to report on request. LOI may be optionally added to this method, but it is not used to normalize results.

CODE	ANALYTES & RANGES (%)								PRICE PER SAMPLE
ME-XRF15c 0.25g sample	Al ₂ O ₃	0.01-100	MgO	0.01-40	Sn			0.01-79	\$43.05 plus 3.50/element
	As	0.01-10	Mn	0.01-30	Ta			0.01-41	
	Ba	0.01-50	Mo	0.01-60	TiO ₂			0.01-50	
	Bi	0.01-5	Nb	0.01-35	V			0.01-5.6	
	CaO	0.01-40	Ni	0.01-50	WO ₃			0.01-100	
	Co	0.01-7	P	0.01-10	Zn			0.01-50	
	Cr	0.01-10	Pb	0.01-32	Zr			0.01-20	
	Cu	0.01-50	S	0.01-40	Total			0.01-110	
	Fe	0.01-75	Sb	0.01-80					
	K ₂ O	0.01-6.3	SiO ₂	0.01-100					
OA-GRA05x ME-GRA05	Loss on Ignition		Furnace or Thermogravimetric Analyzer (TGA). 1g sample						\$5.55 plus 3.35/temperature



Carbon, Sulfur, ARD & Concentrates

The following pages describe methods useful in resource estimation, process metallurgy, and characterization and umpire services for bulk concentrates. The wide variety of sulfur and carbon minerals and compounds present in many deposits can complicate the determination of acid drainage potential or oxygenation requirements for ore processing. Likewise, target element deportment may not be revealed by geochemical analysis and assays only; process mineralogy is often required to fully characterize the location of key economic and penalty elements, with implications for mineral processing design and environmental remediation.

Please submit at least four times the nominal sample weight for efficient service.

Sulfur Methods

Accurate sulfur speciation can be crucial to early identification of recovery and environmental issues on many projects. Variations on the most common speciation methods can be implemented to suit your project's specific mineralogy; please contact client services in your region for more information.

CODE	ANALYTES & RANGES (%)	DESCRIPTION	PRICE PER SAMPLE
S-IR08	S (Total) 0.01%-50%	Total sulfur by Leco furnace. 0.1g sample	\$15.20
S-GRA07	S (Elemental) 0.01%-100%	Solvent leach, gravimetric finish. 3g sample	\$34.10
S-GRA06a	S (Sulfate) 0.01%-50%	HCl (15%) leach of sulfates, gravimetric finish. Note: little to no dissolution of barite/celestite. 1g sample	\$27.80
S-IR06a	S (Sulfide) 0.01%-50%	HCl (25%) leach of sulfates, Leco furnace. Note: little to no dissolution of barite/celestite. 0.1g sample	\$20.20
S-GRA06	S (Sulfate) 0.01%-40%	NaCO ₃ leach of sulfates, gravimetric finish. 1g sample	\$31.55
S-IR07	S (Sulfide) 0.01%-50%	NaCO ₃ leach of sulfates, Leco furnace. 0.1g sample	\$31.55

Sulfur and Carbon Packages

These elements are often determined together, so ALS provides several economic packages for convenience.

CODE	ANALYTES & RANGES (%)	DESCRIPTION	PRICE PER SAMPLE
ME-IR08	C (Total) and S (Total) 0.01%-50% 0.01%-50%	Total carbon and sulfur by Leco furnace. 0.1g sample	\$21.15
ME-IR06a	C (Organic) and S (Sulfide)* 0.01%-50% 0.01%-50%	Organic carbon and sulfide sulfur by HCl (25%) leach of carbonates and sulfates, Leco furnace. 0.1g sample	\$28.25

*Sulfide sulfur may be overstated if BaSO₄ or SrSO₄ are present.

Carbon Methods

Carbon has important metallurgical and environmental implications for many types of mineral deposits. Carbonates may consume acid, impacting leach process design and mine waste remediation, while preg robbing by organic carbon can interfere with the cyanidation of gold and silver ores.

CODE	ANALYTES & RANGES (%)	DESCRIPTION	PRICE PER SAMPLE
C-IR07	C (Total) 0.01%-50%	Total carbon by Leco furnace. 0.1g sample	\$15.20
C-IR06a	C (Organic) 0.01%-50%	HCl (25%) leach of carbonates, Leco furnace. Other acid strengths available. 0.1g sample	\$20.20
C-GAS05	CO ₂ (Carbonate) 0.2%-50%	HClO ₄ digestion and CO ₂ coulometer. 0.1g sample	\$21.40
C-IR18	C (Graphite) 0.02%-50%	HCl (50%) leach of carbonates, roasting to remove organic carbon, Leco furnace. 0.1g sample	\$37.00
C-IR17	C (Non-Carbonate) 0.02%-100%	Dilute acid digestion followed by combustion furnace. 0.1g sample	\$31.55
C-CAL15	C (Carbonate) 0.02%-100%	Carbonate carbon by difference.	Requires C-IR07, C-IR17





Acid-Base Accounting

Acid-base accounting (ABA), also called static testing, calculates a net neutralization potential (NNP) representing the ability of a body of rock to produce acid rock drainage or to consume free acid and neutralize it.

The packages listed here are those most commonly used. Ask our client services team for other options.

Minimum sample size for all ABA packages is 100g.

CODE	DESCRIPTION	PRICE PER SAMPLE
ABA-PKG01	Our most basic package. Includes the Sobek NP method and total sulfur.	\$82.10
ABA-PKG05	A full-featured ABA package including the Sobek NP method, total sulfur, HCl-leachable sulfate sulfur, total sulfate sulfur by carbonate leach, sulfide sulfur by difference, and inorganic carbon.	\$158.45
ABA-PKG05B	This package follows the MEND 1991 method for NP. Includes total sulfur, HCl-leachable sulfate sulfur, total sulfate sulfur by carbonate leach, sulfide sulfur by difference, and inorganic carbon.	\$218.45
ABA-PKG06E	Follows the European standard for ABA. Includes the EN 15875 NP method, total sulfur, total sulfate sulfur by carbonate leach, sulfide sulfur by difference, total carbon, organic carbon, and inorganic carbon by difference.	\$166.55

Sulfide is determined by calculation in these packages. If you would prefer sulfide determined by analysis, add A to the package code (additional cost.)

Net Acid Generation

NAG provides a quantitative estimation of the acid that can be generated by mine waste.

CODE	DESCRIPTION	PRICE PER SAMPLE
OA-VOL11	Net Acid Generation. Hydrogen peroxide is used to rapidly oxidize sulfides. NAG is reported in kg H ₂ SO ₄ /tonne at pH 4.5 and pH 7.0. 2.5g sample	\$126.30

Humidity Cells & Metal Leaching

Tests to quantify metal leaching from mine waste under meteoric conditions can range from simple shake flask analysis to long term column leaches. Many analytical options are possible on the leaches; prices will vary based on analytical package requested.

CODE	DESCRIPTION	PRICE PER SAMPLE
ME-SFE14L	Sample is shaken in a flask with de-ionized water and leachate is analyzed for various metals by ICP-AES/ICP-MS. 100g coarse crushed sample	By Quotation
OA-SFE14L	Determination of pH and Conductivity by way of 3:1 Water to Solids leach. 100g of sample is shaken and leached for 24 hours with de-ionized water.	
OA-HCTSET	Humidity cell set-up and maintenance fees.	
OA-HCT01	Periodic analysis of humidity cell leachate. Many instrument finishes, particle sizes and sample weights are available; please enquire.	

Various Elements in Concentrates

All control assays are overseen by experienced certified assayers and analyzed in duplicate at a minimum to assure quality. Umpire assays are also available – please enquire.

Precious metals in concentrates and bullion are found in the Precious Metals section.

CODE	ANALYTES & RANGES (%)	DESCRIPTION	PRICE PER SAMPLE
(+)-CON02	Zn Cu Pb Mo Co Ni 0.01%-100%	Appropriate digestion and titration or gravimetric finish. 4g sample	\$75.80/element
As-CON01	As 0.01%-15%	Four acid digestion and AAS finish. 1g sample	\$75.80
Hg-CON01	Hg 1-10,000ppm	HCl digestion and ICP-AES finish. 1g sample	\$75.80
F-CON01	F 20-20,000ppm	KOH fusion and ion selective electrode. 0.2g sample	\$91.65

+ Add element symbol as prefix to method code. More elements are available. Please enquire.

High-Grade Multi-Element Analysis

This is a four acid multi-element procedure specifically designed for major, minor and trace elements in high-grade samples and concentrates. Extra care is taken with senior staff reviewing the results in detail.

Aqua regia/ICP-MS and oxidizing fusion/XRF options are also available.

CODE	ANALYTES & RANGES (ppm)	PRICE PER SAMPLE
ME-MS61c 0.4g sample	Ag 0.1-1,000 Fe 0.02%-100% Ni 2-100,000 Th 2-5,000	\$252.65
	Al 0.02%-100% Ga 0.5-5,000 P 100-100,000 Ti 0.01%-100%	
	As 2-100,000 Ge 0.5-5,000 Pb 5-100,000 Tl 0.2-5,000	
	Ba 50-100,000 Hf 1-5,000 Rb 1-5,000 U 1-10,000	
	Be 0.5-10,000 In 0.05-2,500 Re 0.02-500 V 5-100,000	
	Bi 0.1-100,000 K 0.02%-100% S 0.05%-10% W 1-100,000	
	Ca 0.05%-100% La 5-5,000 Sb 0.5-10,000 Y 1-5,000	
	Cd 0.2-5,000 Li 2-5,000 Sc 1-10,000 Zn 20-100,000	
	Ce 0.1-5,000 Mg 0.02%-100% Se 10-10,000 Zr 5-5,000	
	Co 1-100,000 Mn 10-100,000 Sn 2-5,000	
	Cr 10-100,000 Mo 0.5-100,000 Sr 2-100,000	
	Cs 0.5-5,000 Na 0.02%-100% Ta 0.5-1,000	
	Cu 2-100,000 Nb 1-5,000 Te 0.5-5,000	

Industrial Minerals

Industrial minerals commonly have highly refractory components requiring aggressive digestions. These methods are designed to completely dissolve the analytical sub-sample, leaving no inhomogenous residual material behind.

CODE	ORE/PRODUCT	ANALYTES	DESCRIPTION	PRICE PER SAMPLE
ME-XRF26	Cementitious Materials	Al ₂ O ₃ , CaO, Fe ₂ O ₃ , K ₂ O, LOI, MgO, Mn ₂ O ₃ , Na ₂ O, SiO ₂ , SO ₂ , TiO ₂	Fusion, XRF 0.7g sample	\$31.55
ME-ICP86	Limestone, Dolomite, Magnesite, Magnesia	CaO, MgO, Al ₂ O ₃ , Fe ₂ O ₃ , SiO ₂ , LOI	Fusion, ICP-AES 0.1g sample	\$44.55
ME-XRF31r	Rutile Product	Al ₂ O ₃ , CaO, Cr ₂ O ₃ , Fe ₂ O ₃ , LOI, MnO, Nb ₂ O ₅ , P ₂ O ₅ , SiO ₂ , TiO ₂ , V ₂ O ₅ , ZrO ₂ (Other elements available on request)	Fusion, XRF. 0.7g sample	\$39.00 plus 22.30/element
ME-XRF31z	Zircon Product	Al ₂ O ₃ , CaO, Fe ₂ O ₃ , HfO ₂ , LOI, MgO, P ₂ O ₅ , SiO ₂ , TiO ₂ , ZrO ₂ (Other elements available on request)	Fusion, XRF. 0.7g sample	\$39.00 plus 22.30/element
ME-XRF31i	Ilmenite Product	Al ₂ O ₃ , CaO, Cr ₂ O ₃ , Fe, LOI, MgO, MnO, Nb ₂ O ₅ , P ₂ O ₅ , SiO ₂ , TiO ₂ , V ₂ O ₅ , ZrO ₂ (Other elements available on request)	Fusion, XRF. 0.7g sample	\$39.00 plus 22.30/element
ME-XRF31h	Intermediate Plant Flows	Al ₂ O ₃ , CaO, Cr ₂ O ₃ , Fe ₂ O ₃ , LOI, MgO, MnO, Nb ₂ O ₅ , P ₂ O ₅ , SiO ₂ , TiO ₂ , V ₂ O ₅ , ZrO ₂ (Other elements available on request)	Fusion, XRF. 0.7g sample	\$39.00 plus 22.30/element

ALS Mineralogy

ALS Mineralogy has a market leading position in the range and capabilities of our automated mineralogy equipment, which includes the **Mineral Liberation Analyzer (MLA)**, **QEMSCAN®**, **X-ray Diffraction**, **ParticleSCAN** and **HyLogger™**.

These technologies can be utilized to add value to a wide range of commodities including precious and base metals, rare earth elements, mineral sands, coal, iron ore, graphite and phosphate deposits. The technology is also applicable to the management of smelters and undertaking of environmental assessments.

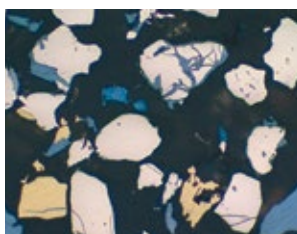
Access to state-of-the-art technology and a highly trained technical team ensures your requirements are understood and you are provided with relevant, representative and high-quality quantitative data.

Contact us to determine methods and pricing specific to your project.



CODE	ANALYSIS	RANGE OF SERVICE	PRICE
BMA	Bulk Mineral Analysis	Mineral composition, elemental department and chemical reconciliation.	\$180.00
BMAL	Bulk Mineral Analysis with Liberation	Mineral composition, estimate of liberation, elemental department and chemical reconciliation.	By Quotation
PMA	Particle Mineral Analysis (PMA)	Mineral composition, abundance, liberation, fragmentation, elemental department and chemical reconciliation. Typical PMA includes 4-5 size fractions.	By Quotation
TMS	Trace Mineral Search (TMS)	Trace mineral characterization includes liberation, fragmentation and size. Cost depends on grade and number of target grains for analysis.	By Quotation
XRDSQ	Semi-Quantitative XRD	Mineral composition estimate on powdered samples; Rietveld analysis available.	\$173.00
XRDMP	Mineral / Phase XRD	Specific mineral phase identification.	By Quotation

Prices do not include assays, sample preparation and administration fees where applicable. High precision quantitative XRD available upon request.



Mineralogical data available from our range of technologies includes:

- Mineral species, composition and abundance
- Elemental department
- Mineral grain and particle size distributions
- Mineral liberation (including association and locking)
- Mineral surface exposure
- Mineral X-ray spectra summary
- Mineral phase identification
- High resolution photomicrographs
- Mineral textural information
- Process mineralogy / plant survey
- Trace mineral characterization
- QEMSCAN backscatter images
- QEMSCAN bitmap particle & core generated images
- Geometallurgical analysis

Americas

Kamloops

2957 Bowers Place,
Kamloops BC V1S 1W5
T +1 250 828 6157
F +1 250 828 6159
metallurgy.kamloops@alsglobal.com

Australia

Perth

6 MacAdam Place, Balcatta
Western Australia 6021
T +61 8 9344 2416
F +61 8 9345 4688
metallurgy@alsglobal.com

Brisbane

32 Shand St, Stafford
Queensland 4053
T +61 7 3367 7900
F +61 7 3243 7218
metallurgy@alsglobal.com

South Africa

Johannesburg

53 Angus Cres
Longmeadow Business Estate
Edenvale, 1610
T +27 11 608 0555
ALSJB_ClientServices@alsglobal.com

Quality Management Systems

ALS believes that one of the foremost requirements of our business is providing exceptional quality assays to our clients. We achieve this through strategically designed processes and a global quality management system that meets all requirements of International Standards ISO/IEC 17025:2017 and ISO 9001:2015. All ALS geochemical hub laboratories are accredited to ISO/IEC 17025:2017 for specific analytical procedures.

The ALS quality program includes quality control steps through sample preparation and analysis, inter-laboratory test programs, and regular internal audits. It is an integral part of day-to-day activities, involves all levels of ALS staff and is monitored at top management levels.



ISO 17025:2017 Accredited Methods & ISO 9001:2008 Registration in Australia



ISO 17025:2017 Accredited Methods in North America



ISO 17025:2017 Accredited Methods & ISO 9001:2015 Registration in Peru



ISO 17025:2017 Accredited Methods in Ireland



ISO 17025:2017 Accredited Methods in South Africa



ISO 17025:2017 Accredited Methods in Romania



ISO 17025:2017 Accredited Methods in Turkey



ISO 17025:2017 Accredited Methods in Mongolia



ISO 17025:2017 Accredited Methods in Kazakhstan



ISO 17025:2017 Accredited Methods in Russia.



ISO 17025:2017 Accredited Methods & ISO 9001:2015 Registration in Kyrgyz Republic



ISO 17025:2017 Accredited Methods & ISO 9001:2015 Registration in China



ISO 9001:2015 Registration in Spain



ISO 9001:2015 Registration in Chile & Argentina



ISO 9001:2015 Registration in Laos

Please contact us for details regarding the scope of ISO registration at individual laboratories.

Open Lab™ Initiative

The Open Lab™ Initiative is about enabling complete confidence in the accuracy of data produced by ALS through transparency in the laboratory process.

Through the Open Lab™ Initiative, we provide access to all of your results in perpetuity and the ability to track sample status in real time through Webtrieve™, our on-line interface to laboratory data. Webtrieve™ also displays complete chain of custody audit trails, important QC data, and standard reference material control charts relevant to your samples. Please ask your local laboratory to have a Webtrieve™ account set up for you.



Spectral Mineralogy



AUSSPEC

TerraSpec Scanning and aiSIRIS™ Expert Interpretation

TERRACORE
GEOSPECTRAL IMAGING

TerraCore Hyperspectral Core Imaging

For more information, visit
alsglobal.com/geochemistry

Selected Terms & Conditions

1. Terms and Conditions

Complete Terms and conditions of service are included with each service quotation provided to clients. The following lists some of the key terms and conditions that will be applicable to every quotation for work.

2. Provision of Services

- a) The Client acknowledges that it is the Client's sole responsibility to make its own assessment of the suitability for any purpose of the Services, detection limits and confidence intervals inherent in ALS's standard testing methodology, the ALS Report and its contents.
- b) If the Client requires the Services to be performed by specific test method, or requires detection limits and/or confidence intervals different to those inherent in ALS's standard testing methodology, then the Client must instruct ALS of such a variation prior to ALS performing the Services.
- c) ALS may transfer samples within its laboratory network to maximize efficiencies and improve turnaround of the samples. No additional cost will be charged to the client for this service optimization measure.

3. Fees and Payment

- a) ALS reserves the right to review prices at any time if significant changes to ALS's costs are incurred that are beyond ALS's control. Such changes may include, but are not limited to, changes in legislative requirements, Client variations to sample numbers, analytes requested, turnaround required, or reporting requirements.
- b) Payment terms are payment in full, 30 days from the date of invoice (Due Date), unless negotiated otherwise prior to the placement of an order or submission of samples. Any such variance from the standard payment terms must be agreed upon by ALS and stipulated separately in writing in the Agreement.
- c) All prices quoted by ALS are exclusive of GST (or other value added tax if relevant) unless stated otherwise.

- d) All fees due and payable after the Due Date (Outstanding Amount) will be subject to the payment of interest at a rate of 1.5% per month of the Outstanding Amount from the Due Date up to and including the date of payment, unless ALS and the Client otherwise agree in writing.
- e) The Client will indemnify ALS for any fees incurred by ALS to recover the Outstanding Amount, including any solicitor fees, or collection agency fees.

4. Limitation of Liability

- a) To the full extent permitted by law, ALS excludes all warranties, terms, conditions or undertakings (Terms), whether expressed or implied, in relation to the Services, the ALS Report, or its contents. Where any legislation implies any Terms in this Agreement that cannot be modified or excluded then, such Terms shall deem to be included. However, to the full extent permitted by law, ALS's liability to the Client for any breach of any Terms that cannot be excluded by law is limited at ALS's option to the re-performance of the Services or the refund of the fee for the Services.
- b) Notwithstanding any other provision in this Agreement, the cumulative liability of ALS under this Agreement to the Client and any third party is limited for any claim for loss or damage whatsoever, whether arising in tort or contract or any other cause of action, to the value of the Services provided by ALS to the Client.
- c) Without limiting the generality of clauses 4.a) and 4.b), it is agreed that, to the full extent permitted by any applicable laws having jurisdiction, ALS will not be liable to the Client or any other person for any special, indirect or Consequential Loss arising from the Client's use of, reliance on, or benefit of, the Services or any ALS Report.
- d) The Client acknowledges that during the performance of the Services, any samples supplied by, or on behalf of, the Client or parts thereof may be altered, lost, damaged or destroyed. ALS will not be liable whatsoever to the Client or any third party for any samples so altered, lost, damaged or destroyed.

5. Termination

- a) ALS may suspend or terminate its obligations under this Agreement if (a) monies payable to ALS by the client are outstanding 60 days or more (unless otherwise agreed) after the date of invoice, (b) other substantial breach by the Client of their obligations under the Agreement, which breach is not remedied within 30 days of written notice from ALS requiring the breach to be remedied, (c) by giving the Client 60 days written notice of ALS's intention to terminate.
- b) The Client may terminate its obligations under this Agreement in the event of a substantial breach by ALS of its obligations under the Agreement, which breach has not been remedied within 30 days of written notice from the Client to ALS requiring the breach to be remedied.
- c) If ALS, acting reasonably, suspects that the Client is insolvent or is having difficulties paying its debts as and when they become due, or the Client is insolvent, ALS may give written notice to the Client of ALS's intention to immediately suspend or terminate its obligations under this Agreement.
- d) In the event of termination, ALS is entitled to be paid for all work performed before the date of termination and for any unavoidable commitments entered into by ALS before the date of termination.

6. Confidential Information

- a) Neither ALS nor the Client will disclose Confidential Information of the other party to any third party without the prior written consent of the other party, unless required by law or the rules of a relevant stock exchange.
- b) ALS and the Client will only use Confidential Information of the other party for the purpose of the supply of the Services.

Please refer to the ALS Website for full Terms and Conditions

Global Locations

ARGENTINA

Mendoza

Tel: +54 261 431 9880
alsargentina@alsglobal.com

AUSTRALIA

Adelaide

Tel: +61 8 8359 0890
Email: alsminerals.adelaide@alsglobal.com

Brisbane

Tel: +61 7 3243 7222
Email: alsminerals.brisbane@alsglobal.com

Burnie

Tel: +61 3 6431 6333
Email: alsminerals.burnie@alsglobal.com

Kalgoorlie

Tel: +61 8 9021 1457
Email: alsminerals.kalgoorlie@alsglobal.com

Mount Isa

Tel: +61 7 4740 1700
Email: alsminerals.mtisa@alsglobal.com

Orange

Tel: +61 2 6393 1100
Email: alsminerals.orange@alsglobal.com

Perth

Tel: +61 8 9347 3222
Email: alsminerals.perth@alsglobal.com

Townsville

Tel: +61 7 4796 0600
Email: alsminerals.townsville@alsglobal.com

BOLIVIA

Oruro

Tel: +591 2 527 8235
Email: alsbolivia@alsglobal.com

BRAZIL

Belo Horizonte

Tel: +55 31 3045 8400
Email: alsbrasil@alsglobal.com

Goiânia

Tel: +55 62 3088 4800
Email: alsbrasil@alsglobal.com

BURKINA FASO

Ouagadougou

Tel: +226 5035 6077
Email: alsbm.ouagadougou@alsglobal.com

CAMBODIA

Phnom Penh

Tel: +855 23 729 236
Email: alsminerals.phnompenh@alsglobal.com

CANADA

ClientServicesECAN@alsglobal.com
ClientServicesWCAN@alsglobal.com

Kamloops

Tel: +1 250 573 5700
Email: alsmin.kamloops@alsglobal.com

Lebel-sur-Quévillon

Tel: +1 819 753 7293
Email: alsmin.valdor@alsglobal.com

Rouyn-Noranda

Tel: +1 819 797 2810
Email: alsrouyn-noranda@alsglobal.com

Sudbury

Tel: +1 705 560 7225
Email: alsmin.sudbury@alsglobal.com

Terrace

Tel: +1 250 635 3309
Email: alsmin.terrace@alsglobal.com

Thunder Bay

Tel: +1 807 475 3329
Email: alsmin.thunderbay@alsglobal.com

Timmins

Tel: +1 705 360 1987
Email: alsmin.timmins@alsglobal.com

Val d'Or

Tel: +1 819 825 0178
Email: alsmin.valdor@alsglobal.com

Vancouver

Tel: +1 604 984 0221
Email: alsmin.vancouver@alsglobal.com

Whitehorse

Tel: +1 867 633 4746
Email: alsmin.whitehorse@alsglobal.com

Yellowknife

Tel: +1 867 873 5159
Email: alsmin.yellowknife@alsglobal.com

CHILE

Antofagasta

Tel: +56 55 289 2113
Email: alschile@alsglobal.com

Copiapó

+56 52 254 3570
Email: alschile@alsglobal.com

La Serena

Tel: +56 51 267 2783
Email: alschile@alsglobal.com

Santiago

Tel: +56 2 2654 6100
Email: alschile@alsglobal.com

CHINA

Guangzhou

Tel: +86 20 3687 5966
Email: alsgz@alsglobal.com

COLOMBIA

Medellin

Tel: +57 4 306 9122
Email: alscolombia@alsglobal.com

DR CONGO

Lubumbashi

Tel: +24 3 818 886677
Email: alsmin.lubumbashi@alsglobal.com

ECUADOR

Quito

Tel: +59 32 247 6475
Email: als.ecuador@alsglobal.com.ec

ETHIOPIA

Addis Ababa

Tel: +251 9454 36 909
Email: alsmin.addisababa@alsglobal.com

FINLAND

Outokumpu

Tel: +358 050 415 2812
Email: alsot.lab@alsglobal.com

Sodankylä

Tel: +358 050 320 4300
Email: alsmin.sodankyla@alsglobal.com

GHANA

Kumasi

Tel: +233 54 444 4440
Email: alsmin.kumasi@alsglobal.com

IRELAND

Loughrea

Tel: +353 91 841 741
Email: alsmin.loughrea@alsglobal.com

IVORY COAST

Yamoussoukro

Tel: +225 071 74445
Email: alsmin.bamako@alsglobal.com

KAZAKHSTAN

Ust-Kamenogorsk

+7 7232 527 096
+7 7779 701 666
alsmin.kazlab@alsglobal.com

LAOS**Pakse**

Tel: + 856 31 900 472
Email: alsminerals.vientiane@alsglobal.com

Vientiane

Tel: +856 21 31 3438
Email: alsminerals.vientiane@alsglobal.com

LIBERIA**Monrovia**

Tel: +233 244 314509
Email: alsmonrovia@alsglobal.com

MALI**Bamako**

Tel: +223 223 6949
Email: alsmbamako@alsglobal.com

MAURITANIA**Nouakchott**

Tel: +222 45290034
Email: alsmonouakchott@alsglobal.com

MEXICO

ClientServicesMEX@alsglobal.com

Chihuahua

Tel: +52 614 417 9728
Email: alsinchihuahua@alsglobal.com

Guadalajara

Tel: +52 33 3619 7438
Email: alsinguadalajara@alsglobal.com

Hermosillo

Tel: +52 662 218 4403
Email: alsinhermosillo@alsglobal.com

Zacatecas

Tel: +52 492 768 1474
Email: alsinzacatecas@alsglobal.com

MONGOLIA**Ulaanbaatar**

Tel: +976 11 343882
Email: alsmongolia@alsglobal.com

MYANMAR**Mandalay**

Tel: +95 2515 2036
Email: alsminerals.mandalay@alsglobal.com

NAMIBIA**Swakopmund**

Tel: +264 644 06498
Email: alsmswakopmund@alsglobal.com

PERU**Arequipa**

Tel: +51 54 46 3649
Email: alsperu@alsglobal.com

Lima

Tel: +51 1 574 5700
Email: alsperu@alsglobal.com

ROMANIA**Rosia Montana**

Tel: +40 258 780 395
Email: alsrm.lab@alsglobal.com

RUSSIA**Chita**

Tel: +7 3022 368038
Email: chita.office@alsglobal.com

Moscow

Tel: +7 495 419 0474
Email: alsmsmoscow@alsglobal.com

SAUDI ARABIA**Jeddah**

Tel: +966 12 6361199
Email: alsjd.lab@alsarabia.com

SERBIA**Bor**

Tel: +381 648243340
Email: alsmbor@alsglobal.com

SOUTH AFRICA

ClientServicesAfrica@alsglobal.com

Johannesburg

Tel: +27 11 608 0555
Email: alsinjohannesburg@alsglobal.com

SPAIN**Seville**

Tel: +34 9555 13 035
Email: alssev.lab@alsglobal.com

SWEDEN**Malå**

Tel: +46 70 565 4728
Email: alsmslab@alsglobal.com

Piteå

Tel: +46 911 65 800
Email: alsppi.lab@alsglobal.com

TANZANIA**Mwanza**

Tel: +255 754 302 047
Email: alsmmwanza@alsglobal.com

TURKEY**Izmir**

Tel: +90 232 281 71 10
Email: alsiz.lab@alsglobal.com

USA

ClientServicesUSA@alsglobal.com

Elko

Tel: +1 775 738 2054
Email: alsmelko@alsglobal.com

Fairbanks

Tel: +1 907 452 2188
Email: alsmfairbanks@alsglobal.com

Reno

Tel: +1 775 356 5395
Email: alsmleno@alsglobal.com

Tucson

Tel: +1 520 747 3218
Email: alsmtucson@alsglobal.com

ZAMBIA**Ndola**

Tel: +26 0 979 376284
Email: alsmlandola@alsglobal.com

Global Locations

70 commercial laboratories • 17 on-site laboratories



Our integrated network of **70 laboratories** around the world ensures consistent quality and dependable client service wherever we might meet you.



Our services are available through any one of the many general service laboratories listed on these pages. We also provide custom services for on-site laboratory and sample preparation facilities, as well as mobile laboratories and sample preparation installations.

Visit our website for complete location details at alsglobal.com/locations

Preferred methods of decomposition for geological materials

Atomic Weight	Element Symbol	Atomic Number	Primary Analysis Method	Secondary Analysis Method	Isotopic Analysis Available
1.01	H	1			
6.94	Li	3			
9.01	Be	4			
22.99	Na	11			
24.31	Mg	12			
39.10	K	19			
40.08	Ca	20			
44.96	Sc	21			
47.87	Ti	22			
50.94	V	23			
52.00	Cr	24			
54.94	Mn	25			
55.85	Fe	26			
58.93	Co	27			
58.69	Ni	28			
63.55	Cu	29			
65.38	Zn	30			
68.72	Ga	31			
72.63	Ge	32			
74.92	As	33			
76.97	Se	34			
78.97	Br	35			
83.80	Kr	36			
85.47	Rb	37			
87.62	Sr	38			
88.91	Y	39			
91.22	Zr	40			
92.91	Nb	41			
95.95	Mo	42			
98.91	Tc	43			
101.07	Ru	44			
102.91	Rh	45			
106.42	Pd	46			
107.87	Ag	47			
112.41	Cd	48			
114.82	In	49			
118.71	Sn	50			
121.76	Sb	51			
126.90	Te	52			
131.29	Xe	54			
132.91	Cs	55			
137.33	Ba	56			
138.91	La	57			
178.49	Hf	72			
178.49	Ta	73			
183.84	W	74			
186.21	Re	75			
192.22	Ir	77			
195.08	Pt	78			
196.97	Au	79			
200.59	Hg	80			
204.38	Tl	81			
207.20	Pb	82			
208.98	Bi	83			
209	Po	84			
210	At	85			
223	Fr	87			
226	Ra	88			
227	Ac	89			
232.04	Th	90			
231.04	Pa	91			
238.03	U	92			
237	Np	93			
244	Pu	94			
247	Am	95			
247	Cm	96			
247	Bk	97			
251	Cf	98			
257	Fm	100			
258	Md	101			
259	No	102			
269	Lr	103			
287	Lu	71			
287	Yb	70			
287	Tm	69			
287	Er	68			
287	Dy	66			
287	Ho	67			
287	Sm	62			
287	Eu	63			
287	Gd	64			
287	Tb	65			
287	Dy	66			
287	Ho	67			
287	Er	68			
287	Tm	69			
287	Yb	70			
287	Lu	71			
287	La	57			
287	Ce	58			
287	Pr	59			
287	Nd	60			
287	Pm	61			
287	Sm	62			
287	Eu	63			
287	Gd	64			
287	Tb	65			
287	Dy	66			
287	Ho	67			
287	Er	68			
287	Tm	69			
287	Yb	70			
287	Lu	71			
287	Sc	21			
287	Ti	22			
287	V	23			
287	Cr	24			
287	Mn	25			
287	Fe	26			
287	Co	27			
287	Ni	28			
287	Cu	29			
287	Zn	30			
287	Ga	31			
287	Ge	32			
287	As	33			
287	Se	34			
287	Br	35			
287	Kr	36			
287	Rb	37			
287	Sr	38			
287	Y	39			
287	Zr	40			
287	Nb	41			
287	Mo	42			
287	Tc	43			
287	Ru	44			
287	Rh	45			
287	Pd	46			
287	Ag	47			
287	Cd	48			
287	In	49			
287	Sn	50			
287	Sb	51			
287	Te	52			
287	Xe	54			
287	Cs	55			
287	Ba	56			
287	La	57			
287	Ce	58			
287	Pr	59			
287	Nd	60			
287	Pm	61			
287	Sm	62			
287	Eu	63			
287	Gd	64			
287	Tb	65			
287	Dy	66			
287	Ho	67			
287	Er	68			
287	Tm	69			
287	Yb	70			
287	Lu	71			
287	Sc	21			
287	Ti	22			
287	V	23			
287	Cr	24			
287	Mn	25			
287	Fe	26			
287	Co	27			
287	Ni	28			
287	Cu	29			
287	Zn	30			
287	Ga	31			
287	Ge	32			
287	As	33			
287	Se	34			
287	Br	35			
287	Kr	36			
287	Rb	37			
287	Sr	38			
287	Y	39			
287	Zr	40			
287	Nb	41			
287	Mo	42			
287	Tc	43			
287	Ru	44			
287	Rh	45			
287	Pd	46			
287	Ag	47			
287	Cd	48			
287	In	49			
287	Sn	50			
287	Sb	51			
287	Te	52			
287	Xe	54			
287	Cs	55			
287	Ba	56			
287	La	57			
287	Ce	58			
287	Pr	59			
287	Nd	60			
287	Pm	61			
287	Sm	62			
287	Eu	63			
287	Gd	64			
287	Tb	65			
287	Dy	66			
287	Ho	67			
287	Er	68			
287	Tm	69			
287	Yb	70			
287	Lu	71			
287	Sc	21			
287	Ti	22			
287	V	23			
287	Cr	24			
287	Mn	25			
287	Fe	26			
287	Co	27			
287	Ni	28			
287	Cu	29			
287	Zn	30			
287	Ga	31			
287	Ge	32			
287	As	33			
287	Se	34			
287	Br	35			
287	Kr	36			
287	Rb	37			
287	Sr	38			
287	Y	39			
287	Zr	40			
287	Nb	41			
287	Mo	42			
287	Tc	43			
287	Ru	44			
287	Rh	45			
287	Pd	46			
287	Ag	47			
287	Cd	48			
287	In	49			
287	Sn	50			
287	Sb	51			
287	Te	52			
287	Xe	54			
287	Cs	55			
287	Ba	56			
287	La	57			
287	Ce	58			
287	Pr	59			
287	Nd	60			
287	Pm	61			
287	Sm	62			
287	Eu	63			
287	Gd	64			
287	Tb	65			
287	Dy	66			
287	Ho	67			
287	Er	68			
287	Tm	69			
287	Yb	70			
287	Lu	71			

- Lithium borate fusion
- Sodium peroxide fusion
- Fire assay (lead or nickel sulfide collection methods)
- Aqua regia
- Four acid
- Other (combustion, speciality)

More than two digestion methods are available for most elements.

Conversion Factors

1 ppb = 0.001 ppm = 0.00003 oz/ton
 100 ppb = 0.1 ppm = 0.00292 oz/ton
 10,000 ppb = 10 ppm = 0.29167 oz/ton

1 ppm = 1 µg/g = 1 g/ton
 10,000 ppm = 1%
 1 oz/ton = 34.2857 ppm

1 carat = 41.666 mg/g
 1 ton (avdp.) = 907.18474 kg
 1 oz (troy) = 31.1035 g