right solutions.
right partner.

2024

GEOCHEMISTRY

SCHEDULE OF SERVICES & FEES

AUD

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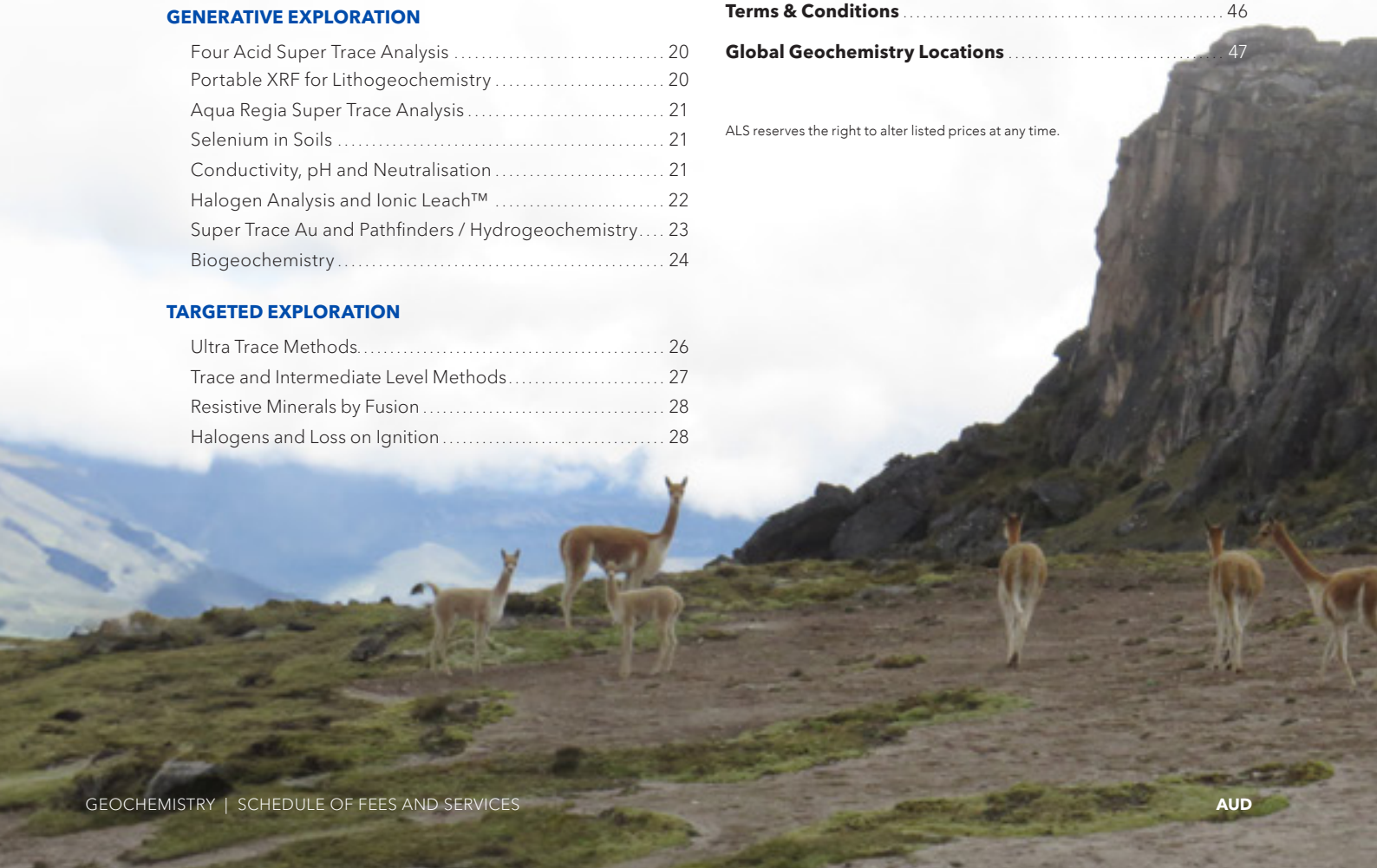
ALS reserves the right to alter listed prices at any time.



Purpose

Science Assurance Sustainability

ALS Geochemistry is the world's most trusted testing service dedicated to high-value geologic data support for the exploration and mining community.

ALS is committed to supplying verifiable, traceable, and defendable data using reliable testing methods and effective data-workflow solutions for our clients.

Safe Resilient Curious Committed Caring Honest

Download on the App Store

ALS GEOCHEMISTRY APP
Track your samples anywhere in real-time

GET IT ON Google Play

On-Site Laboratory Services

safety. assurance. expertise.

Partnering with ALS for an on-site laboratory project ensures that the design, commissioning, and daily laboratory operations will be completed to the safe and high standards that are characteristic of ALS.

Trust ALS to unearth the potential of your mining project with **on-site services** tailored to your needs.

On-site Solutions

- Design, build, or upgrade facilities.
- Containerised or permanent dedicated sample preparation facilities.
- Customised analytical laboratories and methods.

Core Services on-site or in-lab

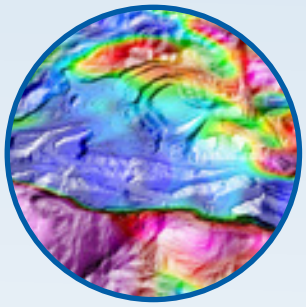
- Core sawing & sampling.
- Core Photography.
- Hyperspectral Mapping & Interpretation.
- CoreViewer™.
- LithoLens™ Digital Platform.

Key deliverables:

- Unrivalled LIMS for global interconnectivity and offsite quality management.
- Webtrieve™ access for real-time tracking & monitoring.
- Automated routine data transfer.
- Process Control Alerts™ to monitor routinely collected and analysed samples.
- Overlimit Alert™ for notifications when results trigger a user-defined overlimit assay.

Discover the Unseen with ALS Consulting & Data Analytics

collect. interpret. discover.



- Find new patterns and targets, and reprocess historic data with **SPOT Geophysics software.**
- **Log core** with **GeoticLog™** and **automate logging** workflows with the **LithoLens™** A.I. platform.
- **Create predictive insights.**
- **Collect** geological, geochemical and geophysical **information** with **Field Services.**
- **Access experts** in field and structural geology, geotechnical engineering, geophysics, geochemistry and data science.

REE POWERING THE FUTURE NOW

Redefine your approach to Rare Earth mineral exploration with ALS's new methods.

Where Analysis Meets Innovation

Rare Earth Elements (REE) are critical to modern high-tech electronics and for fuelling the green energy transition. ALS has added two new methods to aid in REE discovery.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-MS71L™ 0.1g sample	Al	0.05-50%	Eu	0.004-5000	Mo	0.1-10000	Ta	0.005-10000	$66.75
	B	10-10000	Fe	0.05-50%	Na	0.05-10%	Tb	0.001-5000	
	Ba	1-10000	Gd	0.004-5000	Nb	0.02-10000	Th	0.004-10000	
	Be	0.03-1000	Hf	0.008-10000	Nd	0.04-10000	Ti	0.0002-20%	
	Ca	0.01-50%	Ho	0.002-5000	P	0.002-20%	Tm	0.001-5000	
	Ce	0.1-10000	K	0.05-25%	Pb	0.5-10000	U	0.01-10000	
	Co	0.2-10000	La	0.1-10000	Pr	0.01-5000	V	1-10000	
	Cs	0.01-10000	Li	1-10000	Rb	0.05-10000	W	0.2-10000	
	Cu	2-10000	Lu	0.001-5000	Sc	0.04-10000	Y	0.01-10000	
	Dy	0.003-5000	Mg	0.01-50%	Sm	0.006-5000	Yb	0.001-5000	
	Er	0.002-5000	Mn	0.005-50%	Sr	0.4-10000	Zr	0.5-10000	

Super-Trace, Total Extraction REE & Refractory Minerals

ALS's new **super-trace** ME-MS71L™ method employs a unique ammonium bi-fluoride (ABF) decomposition that leverages its high boiling point (239.5° C) to achieve complete recovery of REEs and refractory phases. The ABF chemical digestion coupled with proprietary ICP-MS technology enables detection limits unachievable with traditional flux-based methods.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-MS19™ 30g sample	Al	5-250000	Fe	5-500000	Nb	0.005-500	Ta	0.005-500	$57.55
	B	10-10000	Gd	0.005-1000	Nd	0.05-10000	Tb	0.002-1000	
	Ba	0.5-10000	Hf	0.005-500	Ni	0.1-10000	Th	0.005-10000	
	Be	0.01-1000	Ho	0.002-1000	P	5-10000	Ti	5-100000	
	Ca	20-250000	K	20-100000	Pb	0.05-10000	Tm	0.002-1000	
	Ce	0.005-500	La	0.002-10000	Pr	0.004-1000	U	0.005-10000	
	Co	0.005-10000	Li	0.2-10000	Rb	0.05-10000	V	0.4-10000	
	Cs	0.005-500	Lu	0.002-1000	Sc	0.005-10000	W	0.01-10000	
	Cu	0.04-10000	Mg	1-250000	Si	10-10000	Y	0.005-500	
	Dy	0.005-1000	Mn	0.2-50000	Sm	0.004-1000	Yb	0.004-1000	
	Er	0.004-1000	Mo	0.01-10000	Sn	0.05-500	Zr	0.01-500	
	Eu	0.004-1000	Na	50-100000	Sr	0.03-10000			

REE Exploration in Clays

Our ME-MS19 ammonium sulphate leach is a useful approach for liberating REEs from ionic clays formed by the natural weathering of REE bearing minerals and adsorption onto clay surfaces. This technique reports REEs that have been physically and chemically adsorbed onto clay surfaces to super-trace detection limits.

REFINE YOUR SCALE

Precision meets performance, revealing the most subtle gold signals.

ALS introduces a new groundbreaking method for super-trace level gold analysis. Until now, detection limit vs. total extraction has been a trade-off. Due to impurities in the flux reagents involved with Fire Assay, the lowest detection level available by that technique is 1 ppb. With cyanide or aqua regia leaches it is possible to achieve lower detection limits, however, the trade-off is a partial gold recovery.

The **Au-NANO51** method delivers a **20 parts per trillion detection limit** with the advantage of a cutting-edge hydrofluoric acid based digestion for complete gold extraction. With its 10g aliquot, **this new method delivers sample size, near-total recovery and lowest detection limits.**

CODE	ANALYTE	RANGE (ppb)	DESCRIPTION	PRICE PER SAMPLE
Au-NANO51	Au	0.02-250	Au by Aqua Regia with HF digestion for near-total recovery, and ICP-MS.	$52.90

Core Services & Spectral Mineralogy

Our Core Services encompass core handling and warehouse management, core sawing and sampling, and core photography, all within secure and comfortable logging facilities. 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 MineSite.Operations@alsglobal.com

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

Core Services

ALS offers a full spectrum of no-hassle Core Services that may be bundled in any combination and offered at any of our labs or on-site at your project as needed.

CODE	DESCRIPTION OF SERVICE	PRICE / UNIT
LOG-COREBX	Log in core box for processing.	$2.95 /box
SAW-01 SAW-01FT	Automated high speed core sawing. Cut sheet/details provided by client.	$23.90 /m $7.40 /ft
SAWM-01 SAWM-01FT	Manual sawing for friable core. Cut sheet/details provided by client.	$30.65 /m $9.35 /ft
SAM-COR01	Sampling core based on client instructions. Includes bagging sample for further preparation.	$7.25 /sample
SAM-COR01F	Surcharge for friable core. Sampling core based on client instructions. Includes bagging sample for further preparation.	$9.95 /sample
LOG-COR10	Daily rental of secure core logging facilities with full spectrum lights and other amenities.	$131.65 /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.	$8.15 /box $8.15 /box
STO-COR10	Long-term storage of core boxes in ALS warehouses.	$2.25 /box/month

CoreViewer™

Photo archive, core logging support tool, and data integration platform. Integration with major 3D modelling software.

CODE	DESCRIPTION OF SERVICE	PRICE / UNIT
PRC-PHOCLW	Process Wet Photo of Core	$8.25 /box
PRC-PHOCLD	Process Dry Image of Core	$8.25 /box

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.

CoreViewer™

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 software, including Sequent Leapfrog Geo, Maptek Vulcan and Micromine for deep investigation and verification of exploration, resource and geometallurgical models.

What's in your rocks?

Quantifying common rock-forming minerals in routine mineral exploration has historically been challenging. While infrared spectral mineralogy has supported applied geoscience, its use has been largely qualitative and confined to hydrous mineral phases. Overcoming limitations in quantitative applications, ALS employs machine learning algorithms trained on an extensive library of geological materials. This approach enables accurate predictions of quantitative mineralogy using multi-band infrared spectra and high-quality multielement geochemical data.

CODE	ANALYTES		DESCRIPTION	PRICE PER SAMPLE
FTIR-MIN	Quartz	Ankerite-Dolomite	Quantative determination of mineral abundance using FTIR Spectroscopy and automated interpretation. % Mineral Abundance reported.	$12.90
	Plagioclase	Goethite		
	K Feldspar	Hematite		
	Magnetite	Chlorite		
	Biotite	Epidote		
	Amphibole	White Mica		
	Pyroxene	Pyrite		
	Calcite	FeOx		
	Siderite	Kandite-Kaolinite		
	Spodumene			
FTIR-BAUX	Al_2O_3	C organic	Quantitative determination of bauxite mineral abundance and useful parameters for bauxite processing using FTIR spectroscopy and automated interpretation. % Mineral Abundance reported	$12.90
	Al_2O_3avl	Carbonate		
	SiO_2	Sulphate		
	Rx SiO_2	% Magnetic		
	Fe_2O_3	Boehmite		
	Oxalate	Gibbsite		

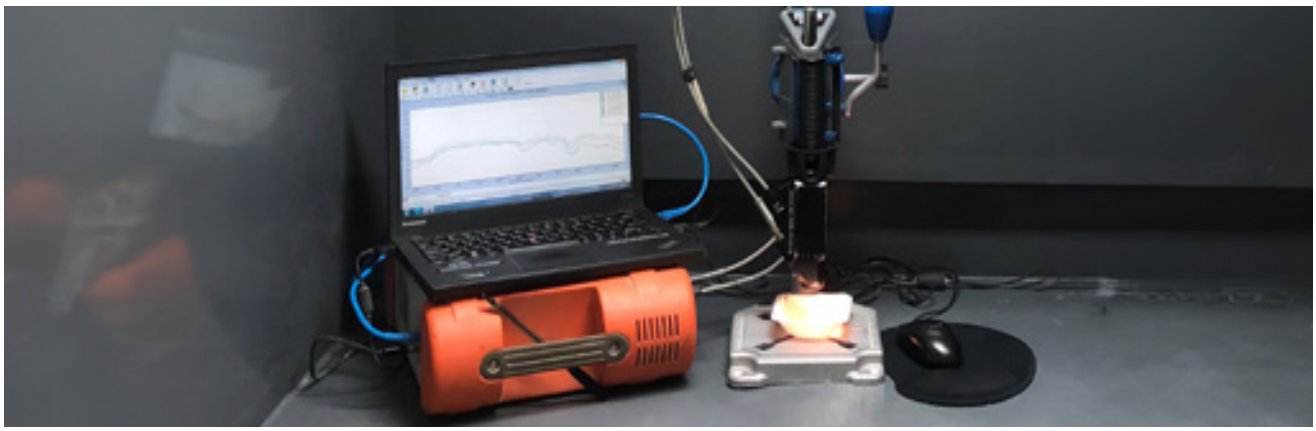
Hyperspectral Imaging & Processing

TerraCore is the only company with commercially available LWIR spectral imaging as well as the standard VNIR & SWIR spectral range to deliver the full spectrum required for rock characterisation.

Results are delivered via CoreViewer™ and IntelliCore®.

CODE	DESCRIPTION OF SERVICE	PRICE / UNIT
Various	Core cleaning, core box preparation, and labour may be provided by ALS or TerraCore	By Quotation
COREIM-10	VNIR-SWIR or SWIR hyperspectral imaging of core boxes and chip trays using TerraCore Core Imaging Systems. Pricing applies to in-lab services.	$10.90 */foot*
COREIM-11		$35.40 */metre*
COREIM-12		$9.80 */chip sample*
COREIM-10L	LWIR and VNIR-SWIR hyperspectral imaging of core boxes and chip trays using TerraCore Core Imaging Systems. Pricing applies to in-lab services	$14.60 */foot*
COREIM-11L		$47.85 */metre*
COREIM-12L		$13.80 */chip sample*

*Minimum charge of $8,775.00
*Chip trays must be black plastic. ALS can transfer samples to black trays for a fee.
Services include high resolution true colour RGB core photographs, mineral assemblage maps and spectral parameters as image displays, numerical mineralogical parameters and products averaged over 10cm intervals across the length of the core.



Spectral Mineralogy

aiSIRIS™ by AusSpec brings a generational leap forward in AI interpretation of TerraSpec® spectral data. Systematic collection of spectral data on dry, coarse crushed rock and drill core can be easily integrated with existing workflows, with routine interpretation enabling delivery of large volumes at fast turnaround times.

CODE	DESCRIPTION OF SERVICE		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 samples minimum*	$11.45
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.	300 samples minimum*	$6.55
TRSPEC-20	Spectral scan using the TerraSpec® 4 HR spectrometer. Crushed reject or RC chips are recommended as the optimal sample type. *For pulverised samples request TRSPEC-21	Raw spectral files in ASD or ASCII format.	$7.90	

The original ASD files as well as the aiSIRIS™ output are reported on every sample for one-to-one comparison.

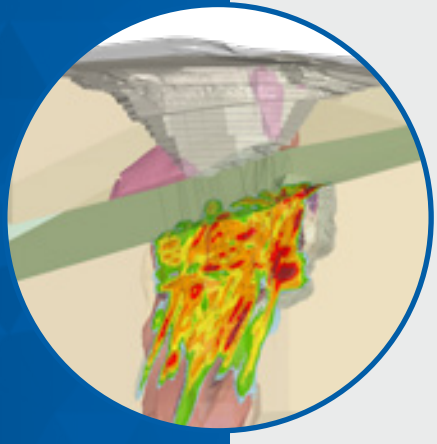
LITHOLENS

Unlock geological insights with LithoLens™: deep learning image analytics combined with A.I. and drilling data for precise predictive geological logging.

What is LithoLens?

Artifical Intelligence platform to:

- Merge datasets
- Automate logging
- Improve ore/waste characterization



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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 customised 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 online from alsglobal.com and on request.

For samples submitted for sample preparation only, with no follow-on analysis, ALS may charge 2x the sample preparation price.

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.

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
BAT-01	Workorder/administration fee applied per processing batch.	Single charge for each batch of samples processed.	**$45.45** */processed batch*
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.	**$0.95**
LOG-22	Samples received without barcode labels attached.		**$1.85**
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.	**$0.95**
LOG-24	Pulps received without barcode labels attached.		**$1.85**
LEV-01	Levy for disposal of all types of laboratory waste.	Required for relevant samples in certain jurisdictions.	**$1.25**
QAR-01	Quarantine charge. AQIS-approved heat treatment and storage.	Required for relevant samples imported into Australia. Additional charges apply for samples over 500g.	**$1.50**
PKP-21	Sample pick-up services	As requested.	**By Quotation**

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 organised environment protected from the elements, and all archive locations are included in the laboratory tracking system.

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
STO-REJ	Monthly archive of coarse rejects. Monthly archive of pulps >250g.	Longer term archiving of coarse rejects and large pulps.	**$1.00** > 45 days
STO-BLK			
STO-PUL	Monthly archive of pulps <250g.	Longer term storage of master pulps.	**$0.60** > 45 days
STO-SCR	Monthly archive of screening reject fractions.	Longer term storage of screening reject fractions.	**$0.60** > 45 days
RET-21	Handling and retrieval of archived samples.	Stored samples.	**By Quotation**
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**

Miscellaneous Procedures

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

CODE	DESCRIPTION	PRICE / UNIT
CMP-21	Compositing of two or more samples. May be done by volume/core length.	**$3.75** /sample
CMP-22	Compositing of two or more samples. May be done by weight.	**$7.15** /sample
WSH-21	Clean crushers with "barren" material after each, or designated samples as an additional cleaning step between mineralised samples.	**$3.60** /sample
WSH-22	Clean pulverisers with "barren" material after each, or designated samples as an additional cleaning step between mineralised samples.	**$5.90** /sample
TRA-21	Transfer sample to drying tray or new sample bag for samples received in containers unsuitable for laboratory storage, or requiring tray drying.	**$2.45** /sample
BAG-01	Bagging large pulps for storage for large pulps/bulk masters.	**$2.45** /sample
HOM-01	Homogenise stored or composited samples by light pulverising.	**$9.40** /sample
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.	**$16.25**/screen size

Specific Gravity & Bulk Density

Specific gravity and bulk density of ores are important parameters that are often under-characterised 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.	**$23.20**
OA-GRA08b	Specific Gravity on pulps using pycnometer.	Reported as a ratio.	**$23.70**
OA-GRA09*	Bulk Density by water displacement.	0.01 – 20g/cm^3	**$23.20**
OA-GRA09a*	Bulk Density after wax coating (wax removal not included).	0.01 – 20g/cm^3	**$37.85**

*For friable or broken core surcharges may apply.

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 clay fraction (-2 to -10 micron) from screened soils. **Minimum 300g of sieved soil required.**	$40.60

Note: Clay samples may require drying and screening (-180 micron or -106 micron) prior to clay separation on the minus fraction. Please discuss suitable options for your program with local client services staff.

Soil & Sediment Preparation Package

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

CODE	DESCRIPTION	PRICE PER SAMPLE
PREP-41	Dry at <60°C/140°F, sieve sample to -180 micron (80 mesh). Retain both fractions. Application: Soil or sediment samples.	$4.25/sample + $3.80/kg

*Other screen sizes available on request.

Portable XRF on Prepared Pulps

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

15g sample required for pXRF analysis.

CODE	ANALYTES & LOWER LIMITS (ppm)	PRICE PER SAMPLE
pXRF-30	**As** 50 **Ca** 0.5% **Cr** 100 **Cu** 50 **Fe** 0.5% **Mn** 100 **Ni** 50 **Pb** 50 **S** 0.1% **Zn** 50	$9.75
pXRF-34	Portable XRF scan of an unmineralised pulverised sample. **Ranges:** **Si** 0.5%-47% **Ti** 0.1%-60% **Zr** 5ppm-5%	$7.35
pXRF-VAL	Customised pXRF method set-up including project and/or matrix specific validation	By Quotation

*pXRF methods available as an add-on to multi-element analysis only.

Portable XRF for Indicative Analysis

Portable XRF is useful for screening large numbers of intermediate to ore grade elements quickly and cost effectively while awaiting standard lab analyses. It can also be used to determine Si and acid-resistive Ti and Zr as a complement to multi-element methods and a proxy for rock characterisation.

For a successful pXRF scan it is important that calibration is matched to specific sample suites on an individual project basis to minimise inaccurate results. 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.

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 mineralised samples that may require special equipment cleaning cycles.

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
CRU-21^	Coarse crushing of rock chip and drill samples.	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 for >70% passing 6mm.	**$3.15** + *$1.00*/kg
PREP-31*^	Crush to 70% less than 2mm, riffle split off 250g, pulverise split to better than 85% passing 75 microns.	Drill core, rock and chip samples.	**$11.90** + *$1.85*/kg
PREP-31Y*^	Crusher/rotary splitter combo - Crush to 70% less than 2mm, rotary split off 250g, pulverise split to better than 85% passing 75 microns.		**$12.00** + *$1.90*/kg
PREP-31B*^	Crush to 70% less than 2mm, riffle split off 1kg, pulverise split to better than 85% passing 75 microns.		**$12.45** + *$1.85*/kg
PREP-31BY*^	Crusher/rotary splitter combo - Crush to 70% less than 2mm, rotary split off 1kg, pulverise split to better than 85% passing 75 microns.		**$12.50** + *$1.85*/kg
PREP-31D*^	Crush to 90% less than 2mm, riffle split off 1kg, pulverise split to better than 85% passing 75 microns.	Drill core and rocks containing high-grade or coarse gold and/or silver.	**$16.45** + *$3.65*/kg
PREP-22*^	Coarse crush sample, pulverise entire sample to better than 85% passing 75 microns.	Drill core, rock and chip samples up to 3kg.	**$13.35** + *$0.80*/kg
PREP-32*^	Crush to >70% less than 2mm, riffle split, pulverise 1.5kg to 85% passing 75 microns.	Drill core, rock and chip samples.	**$18.40** + *$1.90*/kg

* Packages with common split size and particle fineness are listed. Please contact your local client services for alternatives.
^Surcharges are applicable to whole core.

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.

Multiple screen sizes and screening methods are available. Please contact your local client services group for options.

A variety of different pulverising bowls made of diverse media are available on request. All ALS equipment is standardised as low Cr-steel, however, substitution of bowls may be required when specific element contamination is a concern. Bowls available include tungsten carbide, agate and zirconium.

Other options are available for all stages of sample preparation. Please contact ALS with your specific requirements.

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.	**$1.40** *+ $0.95* /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 analysed for volatile elements.	**$1.45** *+ $1.20* /kg
DRY-23	Air-drying of samples.	Selective Leach procedures and others.	**$1.45** *+ $1.20* /kg

Crushing

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
CRU-21*	Coarse crushing of rock chip and drill samples.	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 for >70% passing 6mm	**$3.15** *+ $1.00* /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 pulverised.	**$4.30** *+ $1.60* /kg
CRU-36*	Fine crushing of rock chip and drill samples to 85% passing 2mm.	Option for when a finer crush is desired.	**$1.35** *+ $2.30* /kg
CRU-32*	Fine crushing of rock chip and drill samples to 90% passing 2mm.	Option for when a finer crush is desired.	**$4.30** *+ $2.60* /kg

*Note: Methods with common fineness requirements listed. Additional options available.
*Note 2: Surcharges are applicable for whole core.

Splitting

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
SPL-21*	Split sample using a riffle splitter.	Standard splitting procedure.	**$2.90** *+ $0.70* /kg
SPL-22*	Split sample using a rotary splitter.	Rotary splitting procedure.	**$4.35** *+ $0.75* /kg
SPL-22Y	Split sample using a Boyd crusher/ rotary splitter combination.		**$2.90** *+ $0.75* /kg
SPL-34	Split a received pulp sample for various analysis.	Pulp splitting procedure.	**$1.25**

*Note: For sample splitting and return or archive without analysis add suffix X to the codes above. Additional costs are incurred.

Pulverising

CODE	DESCRIPTION	APPLICATION	PRICE PER SAMPLE
PUL-31*	Pulverise 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.	**$8.30**
PUL-32*	Pulverise a 1,000g split to 85% passing 75 microns.	Large sample size to mitigate nugget effect.	**$9.55**
PUL-32a*	Pulverise a 1,000g split to 90% passing 75 microns.		**$11.35**
PUL-21*	Pulverise entire sample to 85% passing 75 microns.	Appropriate for samples up to 3kg.	**$11.15**
PUL-23*	Pulverise up to 3kg to 85% passing 75 microns. For samples >3kg additional costs are incurred to split the sample prior to pulverising and retaining the remainder.	Appropriate for RC drill chip samples not requiring crushing.	**$11.15**
PUL-24*	Pulverise up to 3kg to 85% passing 75 microns. For samples >3kg an additional cost is incurred to split the sample prior to pulverising. The remainder is discarded.		**$11.15**
PUL-51*	Pulverise up to 100g concentrate sample to 85% passing 75 microns.	Cost includes careful cleaning of the pulverising bowl after grinding.	**$37.30**
PUL-34*	Pulverise 200g to 85% passing 75 microns.	Applicable for high grade material.	**$37.30**

* Surcharges may apply to samples requiring excessively long pulverisation times required for some sample types.

Precious Metals Analysis

The unique chemical properties of gold, silver, and the platinum group elements pose challenges in geochemical analysis. They often occur heterogeneously 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 sulphide 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.

AUD

Gold by Fire Assay

An optimal fire assay flux recipe and rigorous quality control program easily handle problem materials including chromite, base metal sulphides 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	0.001-10	Au by fire assay and ICP-AES. **30g sample**	$24.25
Au-ICP22			**50g sample**	$28.60
Au-AA23		0.005-10	Au by fire assay and AAS. **30g sample**	$23.30
Au-AA24			**50g sample**	$27.70
Ore Grade				
Au-AA25	Au	0.01-100	Au by fire assay and AAS. **30g sample**	$23.80
Au-AA26			**50g sample**	$28.05
Au-GRA21		0.05-10000	Au by fire assay and gravimetric finish. **30g sample**	$35.80
Au-GRA22			**50g sample**	$40.60

* For Au and Ag, request ME-GRA21 (30g) or ME-GRA22 (50g).

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	0.05-100000 (0.01-1000 mg)	**1kg pulp** screened to 100 microns. Other screen sizes available. Duplicate **30g** assay on screen undersize. Assay of entire oversize fraction.	$92.60
Au_SCR24	Au		**1kg pulp** screened to 100 microns. Other screen sizes available. Duplicate **50g** assay on screen undersize. Assay of entire oversize fraction.	$95.55
Au_SCR24B	Au		**1-2kg pulp** screened to 100 microns. Duplicate **50g** assay on screen undersize. Assay of entire oversize fraction.	$131.05
Au_SCR24C	Au		**2-3kg pulp** screened to 100 microns. Duplicate **50g** assay on screen undersize. Assay of entire oversize fraction.	$173.10

* Options available for various sample weights, screen sizes and undersize assays.

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 suite of platinum group elements, nickel sulphide collection fire assay must be used for a quantitative analysis. *Gold is under-reported by this method due to the collection by nickel sulphide.

CODE	ANALYTE	RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE
Trace Level				
PGM-MS23L	Pt Pd Au	0.0001-1 0.0002-1 0.001-1	Super trace Pt, Pd and Au by fire assay and ICP-MS finish. **30g nominal sample weight**	$35.45
PGM-MS23	Pt Pd Au	0.0005-1 0.001-1 0.001-1	Pt, Pd and Au by fire assay and ICP-MS finish. **30g nominal sample weight**	$29.85
PGM-MS24			**50g nominal sample weight**	$34.35
Rh-MS25	Rh	0.001-1	Rh by fire assay, gold collection and ICP-MS. **30g nominal sample weight**	$65.95
PGM-MS25NS	Pt, Pd Au*, Rh Ir Os Ru	0.002-15 0.002-5 0.001-5 0.002-1 0.003-5	Pt, Pd, Ir, Os, Rh, Ru by nickel sulphide collection fire assay and ICP-MS finish. **30g nominal sample weight.** *Au referential value available upon request.	$310.95
PGM-ICP23	Pt Pd Au	0.005-10 0.001-10 0.001-10	Pt, Pd and Au by fire assay and ICP-AES finish. **30g nominal sample weight**	$28.45
PGM-ICP24			**50g nominal sample weight**	$32.80
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**	$30.10

PhotonAssay

A large, 500g sample analysis size makes this technique well-suited for coarse gold mineralisation.

CODE	ANALYTE	RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE
Au-PA01	Au	0.03-350	Au by PhotonAssay Analysis on 500g of crushed sample	$31.50

*Presence of Th, U or Ba cause interference and can result in unreportable data. In the presence of these elements, Fire Assay is a more appropriate choice.
Please contact Client Services for information on whether this technique is appropriate for your project.

Silver

Trace level and low-grade silver samples may be analysed 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-ICP41 (Ag-AA45)	Ag	0.2-100	Ag by aqua regia digestion and ICP-AES or AAS. **0.5g sample**	**$14.60**
Ag-ICP61 (Ag-AA61)		0.5-100	Ag by HF-HNO_3-$HClO_4$ digestion, HCl leach and ICP-AES or AAS. **0.25g sample**	**$20.10**
Ore Grade				
Ag-OG46 (Ag-AA46)	Ag	1-1500	Ag by aqua regia digestion, ICP-AES or AAS finish. **0.5g sample**	**$17.55**
Ag-OG62 (Ag-AA62)		1-1500	Ag by HF-HNO_3-$HClO_4$ digestion with HCl leach, ICP-AES or AAS finish. **0.4g sample**	**$23.20**
Ag-GRA21		5-10000	Ag by fire assay and gravimetric finish. **30g sample**	**$39.50**
Ag-GRA22			**50g sample**	**$47.40**
ME-GRA21	Au Ag	0.05-10000 5-10000	Au and Ag by fire assay and gravimetric finish. **30g sample**	**$44.85**
ME-GRA22			**50g sample**	**$48.80**

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	0.07-999985 0.7-995000	Au and Ag by fire assay and gravimetric finish.	**$143.60** each
Pt-CON01 Pd-CON01 Rh-CON01	Pt, Pd, Rh	0.07-1000000	Pt, Pd and Rh by fire assay and AAS finish.	**$143.60** each
Bullion				
Au-GRA24 Ag-GRA24	Au Ag	0.01-1000 fineness 0.01-1000 fineness	Routine bullion assays by fire assay with gravimetric finish.	**$249.95** each
Au-UMP20 Ag-UMP20	Au Ag	0.07-1000000 0.7-1000000	Umpire assay for bullion samples by fire assay with gravimetric finish.	**$394.30** each
Pt-UMP20 Pd-UMP20 Rh-UMP20	Pt, Pd, Rh	0.07-1000000	Umpire assay for bullion samples by fire assay with gravimetric finish.	**$394.30** each

Gold Cyanidation

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

High concentrations of some sulphides, particularly chalcopyrite, can negatively impact gold extraction. For samples that are expected to contain high copper sulphide concentration please contact ALS for suggestions.

CODE	ANALYTE	RANGE (ppm)	DESCRIPTION	PRICE PER SAMPLE
Au-AA13 Ag-AA13 Cu-AA13	Au Ag Cu	0.03-50 0.03-350 0.1-2000	Au, Ag, Cu by cyanide leach with AAS finish. **30g sample**	**$18.40** + *$9.10*/element
Au-AA14	Au	0.01-200	Au by cyanide leach with AAS finish. 12hr Leach. **Up to 1kg sample**	**$49.45**
Au-AA15a Au-AA15b Au-AA15c Au-AA15d	Au	0.001-125	Au by accelerated cyanide leach using LeachWELL Assay Tabs™ with AAS finish. 4hr Leach. **500g sample request Au-AA15a** **For 1kg request Au-AA15b** **For 2kg request Au-AA15c** **For 3kg request Au-AA15d**	**$37.10** (500g) **$42.30** (1kg) **$44.90** (2kg) **$52.70** (3kg)
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**	**$21.50** each

Note: Cyanide disposal fees apply in some countries. For Super Trace Au with cyanide leach see methods on page 18.

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	0.001-2500mg/L	Au in cyanide liquor by extraction with AAS finish.	**$24.15**
Au-AA44	Au	1-10000	Au on carbon by ashing, aqua regia digestion and AAS. Duplicate analysis.	**$66.10**

Super Trace Near Total recovery for Au

Sample size, total recovery and lowest detection limits, the perfecet balance for Au exploration at ppt levels.

CODE	ANALYTE	RANGE (ppb)	DESCRIPTION	PRICE PER SAMPLE
Au-NANO51	Au	0.02-250	Au by Aqua Regia with HF digestion for near-total recovery, and ICP-MS. **10g sample**	**$52.90**

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**	**$53.20**
Au-CN11*	Au	0.001-50	BLEG – ICP-MS finish. BLEG – extraction AA finish. **Up to 500g sample**	**$40.05**
Au-AA11	Au	0.001-10		

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

Super Trace Au and Multi-Element 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 (ppb)	DESCRIPTION	PRICE PER SAMPLE
Au-CN43™	Au	0.005-1000	Au by cyanide extraction with ICP-MS finish. **25g sample**	**$41.85**
Au-CN44™			**50g sample**	**$46.55**
Au-ST43™	Au	0.1-100	Au by aqua regia extraction with ICP-MS finish. **25g sample**	**$26.25**
Au-ST44™			**50g sample**	**$28.10**

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
AuME-ST43™ **25g sample**	Au	0.0001-1	Cu	0.01-10000	Nb	0.002-500	Ta	0.005-500	**$68.60**
	Ag	0.001-100	Fe	0.001-50%	Ni	0.02-10000	Te	0.001-500	
	Al	0.01-25%	Ga	0.004-10000	P	0.0005-1%	Th	0.0005-10000	
	As	0.01-10000	Ge	0.005-500	Pb	0.005-10000	Ti	0.0001-10%	
	B	2-10000	Hf	0.002-500	Pd	0.001-100	Tl	0.0005-10000	
	Ba	0.05-10000	Hg	0.002-10000	Pt	0.001-100	U	0.0005-2500	
	Be	0.005-1000	In	0.005-500	Rb	0.005-10000	V	0.05-10000	
AuME-ST44™ **50g sample**	Bi	0.0005-10000	K	0.01-10%	Re	0.0002-50	W	0.001-10000	**$73.95**
	Ca	0.01-25%	La	0.002-10000	S	0.002-10%	Y	0.001-5000	
	Cd	0.001-2000	Li	0.1-10000	Sb	0.002-10000	Zn	0.1-10000	
	Ce	0.001-10000	Mg	0.01-25%	Sc	0.005-10000	Zr	0.01-500	
	Co	0.001-10000	Mn	0.1-50000	Se	0.002-1000			
	Cr	0.01-10000	Mo	0.002-10000	Sn	0.01-500			
	Cs	0.001-500	Na	0.001-10%	Sr	0.01-10000			

Low Level Au and Multi-Element in Soils & Sediments

Our trace level methods by aqua regia digestion and ICP-MS finish are excellent for regolith, where gold anomalies indicating mineralisation below surface are well-characterised. Aqua regia dissolves native gold as well as gold bound in sulphide 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	0.001-1	Au by aqua regia extraction with ICP-MS finish. **25g sample**	**$21.45**
Au-TL44			**50g sample**	**$23.90**
Intermediate Grade				
Au-OG43	Au	0.01-100	Au by aqua regia extraction with ICP-MS finish. **25g sample**	**$15.70**
Au-OG44			**50g sample**	**$17.40**

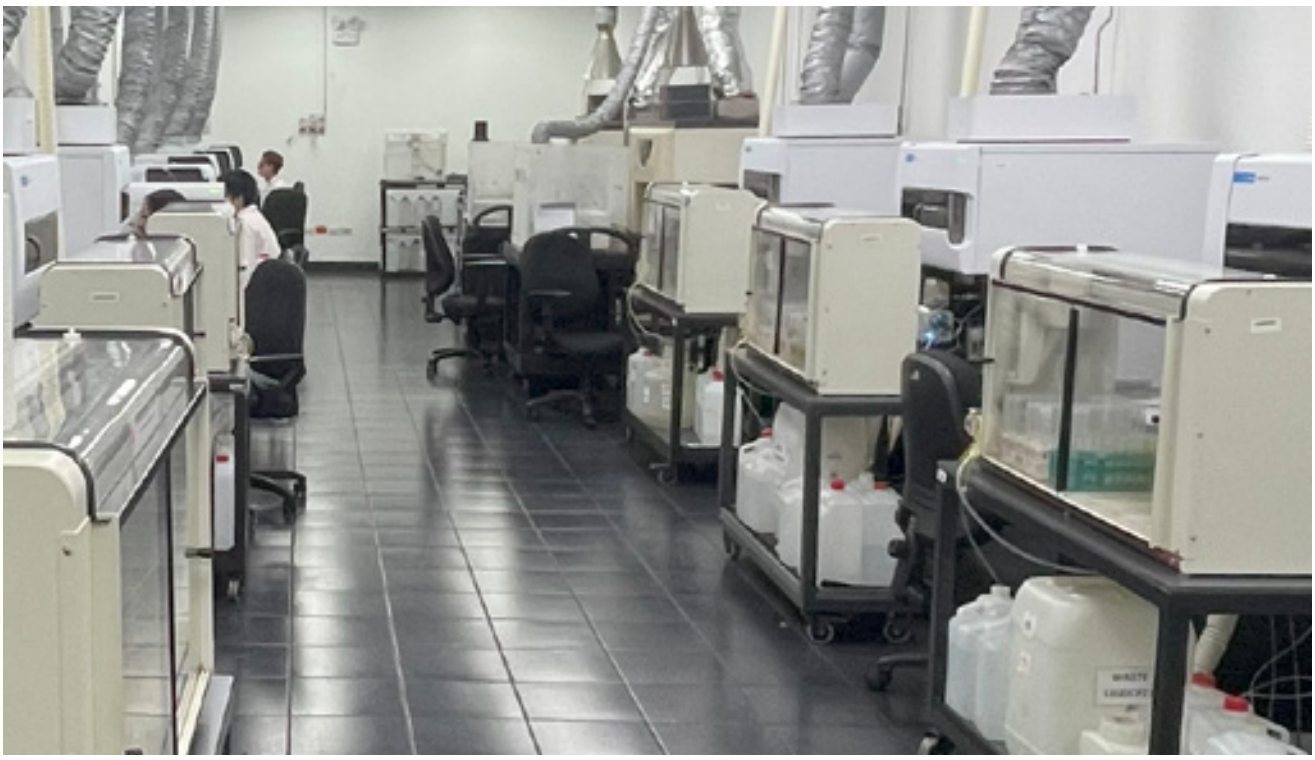
CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
AuME-TL43™ **25g sample**	Au	0.001-1	Cs	0.05-500	Mo	0.05-10000	Sr	0.2-10000	**$48.40**
	Ag	0.01-100	Cu	0.2-10000	Na	0.01-10%	Ta	0.01-500	
	Al	0.01-25%	Fe	0.01-50%	Nb	0.05-500	Te	0.01-500	
	As	0.1-10000	Ga	0.05-10000	Ni	0.2-10000	Th	0.2-10000	
	B	10-10000	Ge	0.05-500	P	10-10000	Ti	0.005-10%	
	Ba	10-10000	Hf	0.02-500	Pb	0.2-10000	Tl	0.02-10000	
	Be	0.05-1000	Hg	0.01-10000	Rb	0.1-10000	U	0.05-10000	
AuME-TL44™ **50g sample**	Bi	0.01-10000	In	0.005-500	Re	0.001-50	V	1-10000	**$52.40**
	Ca	0.01-25%	K	0.01-10%	S	0.01-10%	W	0.05-10000	
	Cd	0.01-2000	La	0.2-10000	Sb	0.05-10000	Y	0.05-10000	
	Ce	0.02-10000	Li	0.1-10000	Sc	0.1-10000	Zn	2-10000	
	Co	0.1-10000	Mg	0.01-25%	Se	0.2-1000	Zr	0.5-500	
	Cr	1-10000	Mn	5-50000	Sn	0.2-500			

Generative Exploration

All of the ICP-MS methods listed in the following section involves some aspect of our innovative methodology for super trace analysis. 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.

AUD



Four Acid Super Trace Analysis

This super trace package is suitable for regional drilling, trenching and hand samples in unmineralised 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	0.02-10000	Na	0.001-10%	Sr	0.02-10000		**$70.05**
	Al	0.01-50%	Fe	0.002-50%	Nb	0.005-500	Ta	0.01-500		
	As	0.02-10000	Ga	0.05-10000	Ni	0.08-10000	Te	0.005-500		
	Ba	1-10000	Ge	0.05-500	P	0.001-1%	Th	0.004-10000		
	Be	0.02-1000	Hf	0.004-500	Pb	0.01-10000	Ti	0.001-10%		
	Bi	0.002-10000	In	0.005-500	Rb	0.02-10000	Tl	0.002-10000		
	Ca	0.01-50%	K	0.01-10%	Re	0.0004-50	U	0.01-10000		
	Cd	0.005-1000	La	0.005-10000	S	0.01-10%	V	0.1-10000		
	Ce	0.01-10000	Li	0.2-10000	Sb	0.02-10000	W	0.008-10000		
	Co	0.005-10000	Mg	0.01-50%	Sc	0.01-10000	Y	0.01-500		
	Cr	0.3-10000	Mn	0.2-100000	Se	0.006-1000	Zn	0.2-10000		
	Cs	0.01-10000	Mo	0.02-10000	Sn	0.02-500	Zr	0.1-500		
MS61L-REE™	Dy	0.005-1000	Gd	0.005-1000	Nd	0.005-1000	Tb	0.002-1000		**$12.15** Add-on only
	Er	0.004-1000	Ho	0.002-1000	Pr	0.004-1000	Tm	0.002-1000		
	Eu	0.004-1000	Lu	0.002-1000	Sm	0.004-1000	Yb	0.004-1000		
MS61L-PbIS™	^{204}Pb	0.01-10000	^{206}Pb	0.01-10000	^{207}Pb	0.01-10000	^{208}Pb	0.01-10000		**$18.20** Add-on only

Portable XRF for Lithogeochemistry

The crucial lithogeochemical 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 an unmineralised pulverised sample. Ranges: Si 0.5%-47% Ti 0.1%-60% Zr 5ppm-5% **15g sample**	**$7.35** Add-on to multi-element analysis only

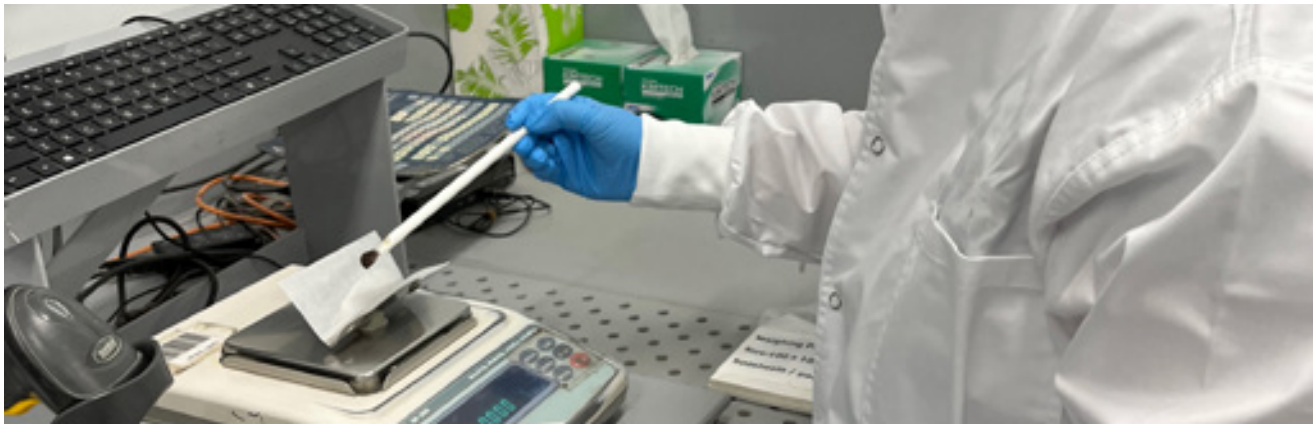
Aqua Regia Super Trace Analysis

Aqua regia digestion with super trace ICP-MS analysis provides extremely low detection limits for the analysis of soils and sediments; 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	Cu	0.01-10000	Nb	0.002-500	Ta	0.005-500	**$57.35**
	Al	0.01-25%	Fe	0.001-50%	Ni	0.04-10000	Te	0.003-500	
	As	0.01-10000	Ga	0.004-10000	P	0.001-1%	Th	0.002-10000	
	Au	0.0002-25	Ge	0.005-500	Pb	0.005-10000	Ti	0.001-10%	
	B	10-10000	Hf	0.002-500	Pd	0.001-25	Tl	0.001-10000	
	Ba	0.5-10000	Hg	0.004-10000	Pt	0.002-25	U	0.005-10000	
	Be	0.01-1000	In	0.005-500	Rb	0.005-10000	V	0.1-10000	
	Bi	0.0005-10000	K	0.01-10%	Re	0.0002-50	W	0.001-10000	
	Ca	0.01-25%	La	0.002-10000	S	0.01-10%	Y	0.003-500	
	Cd	0.001-1000	Li	0.1-10000	Sb	0.005-10000	Zn	0.1-10000	
	Ce	0.003-500	Mg	0.01-25%	Sc	0.005-10000	Zr	0.01-500	
	Co	0.001-10000	Mn	0.1-50000	Se	0.003-1000			
	Cr	0.01-10000	Mo	0.01-10000	Sn	0.01-500			
	Cs	0.005-500	Na	0.001-10%	Sr	0.01-10000			
MS41L-REE™	Dy	0.002-1000	Gd	0.002-1000	Nd	0.002-1000	Tb	0.001-1000	**$12.15** Add-on only
	Er	0.002-1000	Ho	0.001-1000	Pr	0.002-1000	Tm	0.001-1000	
	Eu	0.002-1000	Lu	0.001-1000	Sm	0.002-1000	Yb	0.002-1000	
MS41L-PbIS™	^{204}Pb	0.005-10000	^{206}Pb	0.005-10000	^{207}Pb	0.005-10000	^{208}Pb	0.005-10000	**$18.20** Add-on only

* Gold determinations by this method are semi-quantitative due to the small sample weight used. A weak aqua regia (1:1 ratio HCl:HNO_3) digestion is also available, use code ME-MS41W™.For Au with multi-element using a 25g or 50g charge please use AuME-ST43™ or AuME-ST44™.



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**	**$25.20**

Conductivity, pH and Neutralisation

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

CODE	ANALYTES & RANGES		DESCRIPTION	PRICE PER SAMPLE
OA-GRA04	Acid Insoluble	0.01%-100%	Acid insoluble content. **1g sample.**	**$28.55**
OA-ELE03	pH	0.1-14	pH on 1:10 sample to water ratio. **5g sample**	**$14.60**
OA-ELE04	Conductivity	1-100,000µS/cm	Specific conductivity on 1:10 sample to water ratio. **5g sample**	**$22.95**
OA-ELE05	Soil pH	0.1-14	Soil pH on 1:1 sample to water ratio. **20g sample**	**$22.95**
OA-ELE05AP	Soil pH and soil acid neutralisation	0.1-14	Add on to soil pH. Addition of HCl and pH re-measured.	**$7.70** add-on to soil pH only
OA-ELE06	Soil Conductivity	1-100,000µS/cm	Soil conductivity on 1:1 sample to water ratio. **20g sample**	**$11.75**
OA-ELE07	Paste pH	0.1-14	Paste pH on **10g sample** saturated with water.	**$11.75**
OA-ELE07AP	Paste pH and soil acid neutralisation	0.1-14	Add on to paste pH. Addition of HCl to paste and pH re-measured.	**$7.70** add-on to paste pH only

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 analysed 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.**	**$15.75**
HAL-PREP01	Sample pre-treatment for super trace halogens analysis. Required for soils. **Minimum sample weight required varies, contact your local lab to discuss your project.**	**$21.25**

CODE	ANALYTES & DETECTION LIMITS (ppm)				DESCRIPTION	PRICE PER SAMPLE
ME-HAL01™	F	0.05	Cl	0.1	De-ionised water leach with ICP-MS & ion chromatograph analysis.	**$49.50**
	Br	0.02	I	0.002		

For halogen analysis on vegetation use code ME-HAL01a™ and for water use code ME-HAL01w™.

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 (weight as received, no screening or drying).

CODE	ANALYTES & LOWER LIMITS (ppb)								PRICE PER SAMPLE
ME-MS23™	Ag	0.05	Eu	0.02	Nb	0.02	Tb	0.005	**$70.75**
	As	0.3	Fe	0.01 ppm	Nd	0.02	Te	0.05	
	Au	0.01	Ga	0.01	Ni	1	Th	0.01	
	Ba	10	Gd	0.01	Pb	0.1	Ti	5	
	Be	0.1	Ge	0.03	Pd	0.01	Tl	0.05	
	Bi	0.05	Hf	0.01	Pr	0.008	Tm	0.006	
	Br	0.05 ppm	Hg	0.1	Pt	0.02	U	0.03	
	Ca	0.2 ppm	Ho	0.01	Rb	0.1	V	0.2	
	Cd	0.05	I	0.001 ppm	Re	0.001	W	0.06	
	Ce	0.05	In	0.05	Sb	0.1	Y	0.05	
	Co	0.3	La	0.02	Sc	0.5	Yb	0.008	
	Cr	0.5	Li	0.1	Se	0.04	Zn	10	
	Cs	0.05	Lu	0.005	Sm	0.02	Zr	0.1	
	Cu	1	Mg	0.01 ppm	Sn	0.2			
	Dy	0.01	Mn	0.002 ppm	Sr	0.5			
	Er	0.01	Mo	0.2	Ta	0.005			
MS23-PbIS™	^{204}Pb	0.01	^{206}Pb	0.01	^{207}Pb	0.01	^{208}Pb	0.02	**$17.95** Add-on only

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.

Super Trace Au and Pathfinders

Our new super trace gold and pathfinder package offers industry leading detection limits for exploration of many gold bearing ore systems. Suitable for surface and ground waters.

CODE	ANALYTES & DETECTION LIMITS (µg/L)								PRICE PER SAMPLE
Au-PATH14L™	Au	0.0002-10	Co	0.005-1000	Pt	0.01-100	Tl	0.005-1000	$77.55
	Ag	0.005-100	Pd	0.005-100	Sb	0.02-1000	W	0.02-1000	
	As	0.2-1000							

Hydrogeochemistry

Water that has interacted with rock will take on trace elements which are then transported with the water, producing a larger footprint diagnostic of that rock. Where collection of traditional media such as soils is difficult or impossible such as in swamps, in areas with significant transported cover, and areas where invasive sampling is not possible, hydrogeochemistry provides a direct detection tool on the same scale as stream sediment sampling.

ALS offers multiple reliable and cost-effective water analysis packages to suit your exploration program.

Trace elements and metals analyses require at least 50mL of water. Au requires a minimum of 100mL of water. Anions and physical parameters require a minimum of 150mL of water.

Please contact ALS for information on sampling methodology and preservation if needed. Sampling kits may be purchased at some locations, please enquire.

CODE	DESCRIPTION	PRICE PER SAMPLE
WAT-PREP02	Filter water samples to <0.45um and acidify with nitric acid before analysis. Required when field filtering and acidification has not been performed.	$9.45
WAT-PREP03	Filter water samples to <0.45um before analysis. Required when water has not been filtered before submittal.	$6.30
WAT-PREP04	Acidify water samples with nitric acid before analysis. Required when samples have not been acidified before submittal.	$3.30
WAT-PREP05	Chemical treatment of water samples to desorb Au from containers before analysis.	$4.90

CODE	ANALYTES & DETECTION LIMITS (µg/L)								PRICE PER SAMPLE
ME-MS14L™	Ag	0.005	Cu	0.1	Ni	0.2	Ta	0.01	$97.15
	Al	3	Fe	0.003mg/L	P	0.005mg/L	Te	0.01	
	As	0.05	Ga	0.05	Pb	0.05	Th	0.005	
	Au	0.002	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	$29.30 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	$87.85 Add-on only*
	Cl	0.5mg/L	SO_4	0.5mg/L	TDS	3mg/L	Total Alkalinity	1mg/L	
	F	0.02mg/L							

* Speciated alkalinity (bicarbonate, hydroxide and carbonate ion) and density can also be determined at additional cost. For brines and high TDS water please use ME-MS14™ or ME-ICP15.

Biogeochemistry

Plants selectively absorb trace elements from soil, bedrock and water at depth and incorporate them into their tissue. Analyses of plant tissues can therefore be used as a large-scale geochemical sampling device in areas where the rocks of interest are covered by transported cover and non-prospective lithologies. Careful selection of plant species, tissue type and growth age are important factors to be considered as the geochemical response will vary with these factors.

ALS provides multiple digestion and preparation methods for explorers using this sample media. Preparation methods can include the separation of the tissue of interest from other plant parts, milling and ashing.

Ashing results in the concentration of many elements of interest to explorers and when calculated back to the original pre-ashed weight has the effect of dropping detection limits of many elements by an order of magnitude. 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.	$15.75
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.**	$15.75

CODE	ANALYTES & DETECTION LIMITS (ppm)								PRICE PER SAMPLE
ME-VEG41™ unashed ME-VEG41a™ ashed **1g sample**	Au	0.0002	Cu	0.01	Nb	0.002	Ta	0.001	$50.55
	Ag	0.001	Fe	1	Ni	0.04	Te	0.005	
	Al	0.01%	Ga	0.004	P	0.001%	Th	0.002	
	As	0.01	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	0.002	U	0.005	
	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™ unashed VEG41a-REE™ ashed	Dy	0.002	Gd	0.002	Nd	0.001	Tb	0.001	$12.75 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	
VEG41a-FAC™ Detection limits when back-calculated using the original pre-ash weight of the sample	Au	0.00001	Cu	0.0005	Nb	0.0001	Ta	0.00005	$3.00 Add-on only
	Ag	0.00005	Fe	0.05	Ni	0.002	Te	0.0003	
	Al	0.0005%	Ga	0.0002	P	0.00005%	Th	0.0001	
	As	0.0005	Ge	0.0003	Pb	0.0005	Ti	0.00005%	
	B	0.05	Hf	0.0001	Pd	0.00005	Tl	0.0001	
	Ba	0.005	Hg	0.00005	Pt	0.0001	U	0.0003	
	Be	0.0005	In	0.0003	Rb	0.0005	V	0.003	
	Bi	0.00005	K	0.0005%	Re	0.00005	W	0.0005	
	Ca	0.0005%	La	0.0001	S	0.0005%	Y	0.0002	
	Cd	0.00005	Li	0.005	Sb	0.0005	Zn	0.005	
	Ce	0.0002	Mg	0.00005%	Sc	0.0005	Zr	0.001	
	Co	0.0001	Mn	0.005	Se	0.0003			
	Cr	0.0005	Mo	0.0005	Sn	0.0005			
	Cs	0.0003	Na	0.00005%	Sr	0.001			
VEGFAC-REE™	Dy	0.0001	Gd	0.0001	Nd	0.00005	Tb	0.00005	$11.55 Add-on only
	Er	0.0001	Ho	0.00005	Pr	0.0001	Tm	0.00005	
	Eu	0.0001	Lu	0.00005	Sm	0.0002	Yb	0.0002	

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 sulphide, 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.

AUD

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 sulphide and carbonate minerals.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-MS41™ **0.5g sample**	Ag	0.01-100	Cs	0.05-500	Mo	0.05-10000	Sr	0.2-10000	**$44.95**
	Al	0.01-25%	Cu	0.2-10000	Na	0.01-10%	Ta	0.01-500	
	As	0.1-10000	Fe	0.01-50%	Nb	0.05-500	Te	0.01-500	
	Au	0.02-25	Ga	0.05-10000	Ni	0.2-10000	Th	0.2-10000	
	B	10-10000	Ge	0.05-500	P	10-10000	Ti	0.005-10%	
	Ba	10-10000	Hf	0.02-500	Pb	0.2-10000	Tl	0.02-10000	
	Be	0.05-1000	Hg	0.01-10000	Rb	0.1-10000	U	0.05-10000	
	Bi	0.01-10000	In	0.005-500	Re	0.001-50	V	1-10000	
	Ca	0.01-25%	K	0.01-10%	S	0.01-10%	W	0.05-10000	
	Cd	0.01-1000	La	0.2-10000	Sb	0.05-10000	Y	0.05-500	
	Ce	0.02-500	Li	0.1-10000	Sc	0.1-10000	Zn	2-10000	
	Co	0.1-10000	Mg	0.01-25%	Se	0.2-1000	Zr	0.5-500	
	Cr	1-10000	Mn	5-50000	Sn	0.2-500			

* Gold determinations by this method are semi-quantitative due to the small sample weight used. For Au with multi-element using a 25g or 50g charge please use AuME-TL43™ or AuME-TL44™.

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
ME-MS42™ **0.5g sample**	Ag	0.01-25	Hg	0.005-25	Se	0.2-250	U	0.05-250	**$19.15** + *$1.85*/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			

Request specific elements.

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	0.2-10000	Na	0.01-10%	Sr	0.2-10000	**$55.85**
	Al	0.01-50%	Fe	0.01-50%	Nb	0.1-500	Ta	0.05-500	
	As	0.2-10000	Ga	0.05-10000	Ni	0.2-10000	Te	0.05-500	
	Ba	10-10000	Ge	0.05-500	P	10-10000	Th	0.01-10000	
	Be	0.05-1000	Hf	0.1-500	Pb	0.5-10000	Ti	0.005-10%	
	Bi	0.01-10000	In	0.005-500	Rb	0.1-10000	Tl	0.02-10000	
*ME-MS61m™ **0.75g sample**	Ca	0.01-50%	K	0.01-10%	Re	0.002-50	U	0.1-10000	**$76.80**
	Cd	0.02-1000	La	0.5-10000	S	0.01-10%	V	1-10000	
	Ce	0.01-10000	Li	0.2-10000	Sb	0.05-10000	W	0.1-10000	
	Co	0.1-10000	Mg	0.01-50%	Sc	0.1-10000	Y	0.1-500	
	Cr	1-10000	Mn	5-100000	Se	1-1000	Zn	2-10000	
	Cs	0.05-10000	Mo	0.05-10000	Sn	0.2-500	Zr	0.5-500	
ME-MS61r™	Dy	0.05-1000	Gd	0.05-1000	Nd	0.1-1000	Tb	0.01-1000	**$70.65** Full suite
	Er	0.03-1000	Ho	0.01-1000	Pr	0.03-1000	Tm	0.01-1000	
	Eu	0.03-1000	Lu	0.01-1000	Sm	0.03-1000	Yb	0.03-1000	

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

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
ME-MS62™ **0.25g sample**	Ag	0.01-100	Ga	0.05-500	Se	1-500	Tl	0.02-500	**$24.60** + *$1.85*/ element
	As	0.2-500	Mo	0.05-500	Sn	0.2-500	U	0.1-500	
	Bi	0.01-500	Re	0.002-100	Te	0.05-500	W	0.1-500	
	Cd	0.02-500	Sb	0.05-500	Th	0.01-500			

Request specific elements.

Portable XRF for Lithogeochemistry

The crucial lithogeochemical 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 an unmineralised pulverised sample. Ranges: Si 0.5%-47% Ti 0.1%-60% Zr 5ppm-5% **15g sample**	**$7.35** Add-on to multi-element analysis only.

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	1-10000	Mg	0.01-25%	Sc	1-10000	**$24.80** full package or *$13.75* + *$0.85*/element
	Al	0.01-25%	Cr	1-10000	Mn	5-50000	Sr	1-10000	
	As	2-10000	Cu	1-10000	Mo	1-10000	Th	20-10000	
	B	10-10000	Fe	0.01-50%	Na	0.01-10%	Ti	0.01-10%	
	Ba	10-10000	Ga	10-10000	Ni	1-10000	Tl	10-10000	
*ME-ICP41m **1g sample**	Be	0.5-1000	Hg	1-10000	P	10-10000	U	10-10000	**$36.55**
	Bi	2-10000	K	0.01-10%	Pb	2-10000	V	1-10000	
	Ca	0.01-25%	La	10-10000	S	0.01-10%	W	10-10000	
	Cd	0.5-1000	Li	10-10000	Sb	2-10000	Zn	2-10000	

*To include Hg to a lower detection limit of 0.005ppm by a separate method, please request package 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	1-10000	Mo	1-10000	Th	20-10000	**$30.25** full package or *$19.25* + *$0.85*/element
	Al	0.01-50%	Cu	1-10000	Na	0.01-10%	Ti	0.01-10%	
	As	5-10000	Fe	0.01-50%	Ni	1-10000	Tl	10-10000	
	Ba	10-10000	Ga	10-10000	P	10-10000	U	10-10000	
	Be	0.5-1000	K	0.01-10%	Pb	2-10000	V	1-10000	
*ME-ICP61m **0.75g sample**	Bi	2-10000	La	10-10000	S	0.01-10%	W	10-10000	**$51.20**
	Ca	0.01-50%	Li	10-10000	Sb	5-10000	Zn	2-10000	
	Cd	0.5-1000	Mg	0.01-50%	Sc	1-10000			
	Co	1-10000	Mn	5-100000	Sr	1-10000			

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

Intermediate Level Aqua Regia

These packages can be used as an economical alternative to analysing low grade ore or samples with known mineralisation. 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	5-50000	Mo	5-50000	Th	100-50000	**$36.90** full package or *$19.25* + *$3.80*/element
	Al	0.05-50%	Cu	5-50000	Na	0.05-50%	Ti	0.05-50%	
	As	10-100000	Fe	0.05-50%	Ni	5-50000	Tl	50-50000	
	Ba	50-50000	Ga	50-50000	P	50-50000	U	50-50000	
	Be	5-500	Hg	5-50000	Pb	10-50000	V	5-50000	
	Bi	10-50000	K	0.05-50%	S	0.05-10%	W	50-50000	
	Ca	0.05-50%	La	50-50000	Sb	10-50000	Zn	10-50000	
	Cd	5-2500	Mg	0.05-50%	Sc	5-50000			
	Co	5-50000	Mn	25-50000	Sr	5-50000			

Intermediate Level Four Acid Digestion

These packages can be used as an economical alternative to analysing low grade ore or samples with known mineralisation. 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	10-100000	Na	0.05-30%	Ti	0.05-30%	**$42.60** full package or *$24.90* + *$3.80*/element
	Al	0.05-30%	Cu	10-100000	Ni	10-100000	Tl	50-50000	
	As	50-100000	Fe	0.05-50%	P	50-100000	U	50-50000	
	Ba	50-50000	Ga	50-50000	Pb	20-100000	V	10-100000	
	Be	10-10000	K	0.1-30%	S	0.05-10%	W	50-50000	
	Bi	20-50000	La	50-50000	Sb	50-50000	Zn	20-100000	
	Ca	0.05-50%	Mg	0.05-50%	Sc	10-50000			
	Cd	10-10000	Mn	10-100000	Sr	10-100000			
	Co	10-50000	Mo	10-50000	Th	50-50000			

Mercury

Aqua regia quantitatively dissolves Hg and uses a digestion temperature 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**	$20.95
Hg-ICP42	Hg	1-100000	High grade Hg by aqua regia and ICP-AES. **0.5g sample**	$20.95
Hg-CON01	Hg	1-10000	Hg in ores by acid digestion and ICP-AES. **2g sample**	$137.10

Resistive Minerals 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.

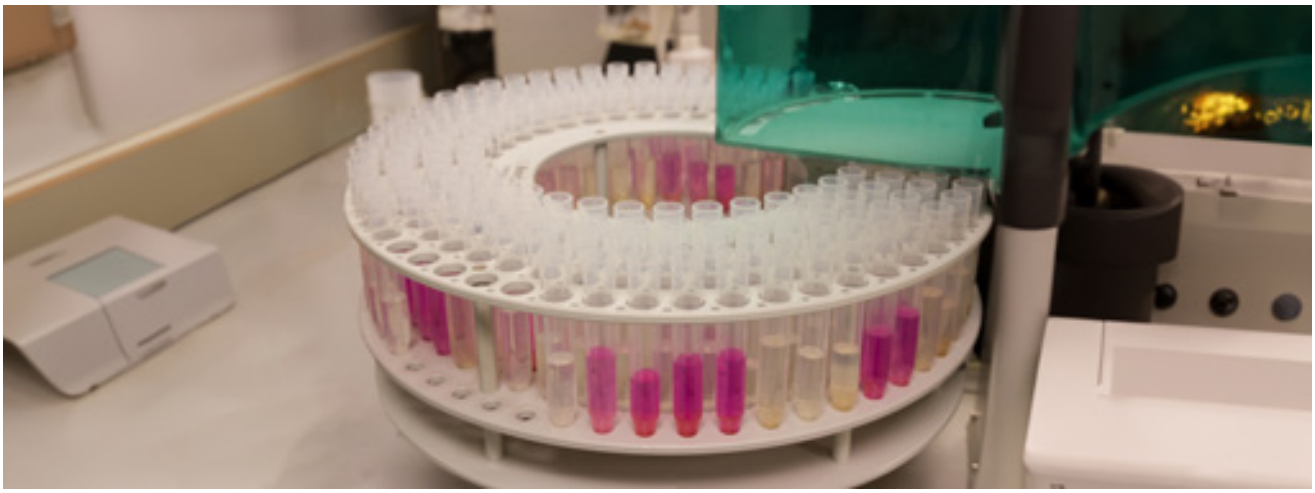
CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-MS85™ **0.1g sample**	Ce	0.1-10000	Rb	0.2-10000	Ta	0.1-2500	W	0.5-10000	**$25.75**
	La	0.1-10000	Sn	0.5-10000	Th	0.05-1000	Y	0.1-10000	+ *$1.90*/element
	Nb	0.05-2500	Sr	0.1-10000	U	0.05-1000	Zr	1-10000	

Notes: For high grade range request ME-MS85h. For the full suite of elements by borate fusion & ICP-MS request ME-MS81 (see page 32).

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
Cl-IC881	Cl	50-20000	KOH fusion and ion chromatography. **0.2g sample**	**$35.35**
Cl-ELE81a	Cl	50-20000	Specific to Cl in phosphates only. KOH fusion and ion selective electrode. **1g sample**	**$47.40**
Cl-XRF20	Cl	0.001-6%	Lithium borate fusion and XRF. **0.7g sample**	**$33.25**
Cl-VOL66	Cl	0.01-65%	Nitric acid digestion and titration. **1g sample**	**$47.40**
F-IC881	F	20-20000	KOH fusion and ion chromatography. **0.2g sample**	**$35.35**
F-ELE81a	F	20-20,000	KOH fusion and ion selective electrode. **0.2g sample**	**$47.40**
F-ELE82	F	0.01-100%	Na_2O_2 fusion, citric acid leach and ion selective electrode. **0.1g sample**	**$52.10**
ME-IC881	Cl F	50-20000 20-20000	KOH fusion and ion chromatography. **0.2g sample**	**$49.50**



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	H_2O (Moisture)	0.01-100	Gravimetric procedure after drying at 105°C. 2 hours (normal samples). 24 hours (hygroscopic samples). **5g sample**	**$22.95**
OA-GRA11				**$23.70** QAQC samples inserted for monitoring
OA-IR06	H_2O + (Water of Crystallisation)	0.01-100	Combustion furnace and infrared spectrometry. **1g sample**	**$28.45**
OA-GRA05xf	LOI @ 500°C	0.01-100	Loss on Ignition at 500°C after sample is pre-dried at 105°C. **1g sample.**	**$26.10**
OA-GRA05	LOI @ 1000°C	0.01-100	Loss on Ignition at 1000°C on an as received basis. **1g sample.**	**$16.15**

Stable Isotopes

Many important parameters of mineralising 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
O-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.	**$231.25** each
H-ISTP01			**$201.50** each
S-ISTP01	Sulphur	Specific to sulphide and sulphate minerals. Determination using TC/EA and IRMS. Sample must be supplied as a single-mineral separate. TAT is 30 days.	**$111.05**
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.	**$80.15**

Pb Isotope Ratios For Exploration

This fast, low-cost analysis of Pb isotope ratios in prepared samples 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	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** For Aqua Regia Digestion request PbIS-RAT41 For Four Acid Digestion request PbIS-RAT61	$53.15
PbIS-RAT61			$57.70

NOTE: Samples must contain >2ppm Pb for analysis to be viable

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.	$562.55
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.	$1,139.40

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 mineralisation.

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
Ar-ISTP01	Ar/Ar	Done on targeted minerals. 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. Price includes sample preparation. Turnaround time approximately 12 months.	$3,018.30
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.	$2,978.50
U-ISTP02	U/Pb	U-Pb dating by LA-ICP-MS of igneous rocks using zircon and monazite. Age of the sample is reported. Analysis includes a standard set of 30 elements, including REE. Price includes preparation of up to 1kg of sample.	$1,587.10 /20 grains*
U-ISTP03		U-Pb dating of detrital grains by LA-ICP-MS. Age probability distribution in the sample is reported. Analysis includes a standard set of 30 elements, including REE. Preparation of 2kg of sample included in price.	$2,659.30 /60 grains*

* larger numbers of grains can be analysed at an increased cost.

Mineral Chemistry

ALS has partnered with CODES Analytical Laboratories, at the University of Tasmania, to provide state of the art mineral analyses for exploration, mining and metallurgical applications.

CODES Analytical Laboratories

CODES

CODE	ANALYTE	DESCRIPTION	PRICE PER SAMPLE
LA-MIN	Laser ablation mineral analyses	Quantitative analyses of in situ minerals. Advantage of small spot size (15-80 micron). Trace and major element compositions are reported.	$64.15/analysis
MIN-MOUNT	Mineral mounts	Preparation of 25 mm round mounts for in-situ mineral analyses in rock samples (no crushing, mineral separation and grain mounting).	$88.15/mount
SEM-IMG	Grain imaging	CL imaging of grains for isotopic dating using SEM. Cost dependent on number of grains or amount of time taken for mineral relationship imaging.	$240.80/30 grains
PREP-THINP	Thin section preparation	Preparation of thin sections for both reflected light microscopy and SEM analysis, and for transmitted light microscopy only.	$174.90 per section/ Reflected light, SEM
PREP-THINS			$88.20 per section/ Transmitted light

Energy Transition & High Tech

The unique properties of minerals and elements associated with the energy transition and high-tech electronics sectors present challenges and opportunities in the field of geochemical analysis. Rare earth elements (REE), transition metals, and lithium often require innovative analytical solutions with choices depending on project needs.

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

Trace Level Lithium Exploration

Lithium hosted in pegmatites 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.

Silica is not reportable by ME-MS89L™ due to the use of HF during digestion and interaction with glassware. Si and elements from ME-ICP81 may be added to ME-MS89L™ for an additional fee.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-MS89L™ **0.2g sample**	Ag	5-12500	Eu	0.03-25000	Nb	0.8-25000	Te	0.5-25000	**$72.60**
	As	4-25000	Fe	0.01-25%	Nd	0.07-25000	Th	0.1-25000	*$9.55*
	B*	8-25000	Ga	0.5-25000	Ni	10-25000	Ti	0.005-25%	
	Ba	2-25000	Gd	0.03-25000	Pb	0.5-25000	Tl	0.02-25000	
	Be	0.4-25000	Ge	0.5-25000	Pr	0.03-25000	Tm	0.01-25000	
	Bi	0.1-25000	Ho	0.01-25000	Rb	0.5-25000	U	0.2-25000	
*B-MS89L	Ca	0.1-25%	In	0.3-25000	Re	0.01-25000	V	1-25000	Add-on only
	Cd	0.8-25000	K	0.05-25%	Sb	0.3-25000	W	0.3-25000	
	Ce	0.2-25000	La	0.08-25000	Se	3-25000	Y	0.2-25000	
	Co	0.5-25000	Li	2-25000	Sm	0.04-25000	Yb	0.02-25000	
	Cs	0.1-25000	Lu	0.05-25000	Sn	3-25000	Zn	10-25000	
	Cu	20-25000	Mg	0.01-30%	Sr	20-25000			
	Dy	0.03-25000	Mn	10-25000	Ta	0.04-25000			
	Er	0.02-25000	Mo	2-25000	Tb	0.01-25000			

*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_2O_3	0.02-100	Cu	0.01-50	MnO	0.01-50	TiO_2	0.02-83	**$52.70**
	As	0.01-10	Fe_2O_3	0.01-100	Ni	0.005-30	Zn	0.01-60	
	CaO	0.07-70	K_2O	0.06-60	Pb	0.01-30			
	Co	0.005-30	Li	0.001-10	S	0.01-60			
	Cr_2O_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**								**$62.00**
ME-ICP82b	Li B	0.001-10 0.02-50	Assay grade lithium and/or boron by Na_2O_2 fusion and ICP-AES. Our highest precision method for Li and B resource determination in known deposits. **0.2g sample**						**$28.85** **+ $5.70/element**

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**	**$14.60**
Li-ICP61	Li	10ppm-1%	Four acid and ICP-AES finish. Multi-element package also available. **0.25g sample**	**$20.10**
Li-OG63	Li	0.005-10%	Ore grade Li by specialised four-acid digestion and ICP-AES finish. Best suited to Li-bearing silicate sediments. **0.4g sample**	**$17.85**
RST-21	Dry roasting pre-treatment		Roasting samples prior to analysis may increase Li recovery due to excess water content promoting insoluble salt formation.	**$11.30**

Lithium Brines

ALS analyses brine samples after settling of suspended particles. 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-MS14™	Li	0.01-10	Includes a suite of 46 elements relevant to brine exploration in addition to Li. **Requires 50mL brine.**						**$78.25**
ME-ICP15 **Requires 100mL brine**	Ag	0.5-100	Cd	0.2-100	Mg	5-100000	S	5-50000	**$68.50**
	Al	5-10000	Co	1-1000	Mn	0.5-1000	Sb	5-1000	
	As	5-1000	Cr	1-1000	Mo	0.5-1000	Sr	2-5000	
	B	5-10000	Cu	0.5-1000	Na	100-150000	Ti	0.5-1000	
	Ba	0.5-1000	Fe	50-50000	Ni	2-1000	V	0.5-1000	
	Be	0.05-100	K	100-150000	P	5-1000	Zn	0.5-1000	
	Ca	10-150000	Li	0.5-20000	Pb	5-1000			
Li-BrPKG	pH, Conductivity, TDS, Alkalinity		Physical parameters and alkalinity of lithium brines. **Requires 100mL brine.**						**$50.35**

Uncommon Metals

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

CODE	ANALYTE RANGE (ppm)		DESCRIPTION	PRICE PER SAMPLE
Be-ICP81	Be	0.01-100%	Na_2O_2 fusion and ICP-AES finish. **0.2g sample**	**$34.55**
B-MS82L	B	5-10000	Na_2O_2 and ICP-MS finish for super trace B. **0.2g sample**	**$35.00**
ME-ICP82b	B Li	0.02-50% 0.001-10%	Na_2O_2 fusion and ICP-AES finish. B and/or Li may be reported. **0.2g sample**	**$28.85** **+ $5.70/element**
Ge-MS66	Ge	1-500	HNO_3-HF digestion with orthophosphoric acid leach and ICP-MS finish. **0.5g sample**	**$51.55**

Super-Trace, Total Extraction REE & Refractory Minerals

A unique ammonium bi-fluoride (ABF) decomposition that leverages its high boiling point (239.5° C) achieves complete recovery of REEs and refractory phases. The ABF chemical digestion coupled with proprietary ICP-MS technology enables detection limits unachievable with traditional flux-based methods.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-MS71L™ **0.1g sample**	Al	0.05-50%	Eu	0.004-5000	Mo	0.1-10000	Ta	0.005-10000	$66.75
	B	10-10000	Fe	0.05-50%	Na	0.05-10%	Tb	0.001-5000	
	Ba	1-10000	Gd	0.004-5000	Nb	0.02-10000	Th	0.004-10000	
	Be	0.03-1000	Hf	0.008-10000	Nd	0.04-10000	Ti	0.0002-20%	
	Ca	0.01-50%	Ho	0.002-5000	P	0.002-20%	Tm	0.001-5000	
	Ce	0.1-10000	K	0.05-25%	Pb	0.5-10000	U	0.01-10000	
	Co	0.2-10000	La	0.1-10000	Pr	0.01-5000	V	1-10000	
	Cs	0.01-10000	Li	1-10000	Rb	0.05-10000	W	0.2-10000	
	Cu	2-10000	Lu	0.001-5000	Sc	0.04-10000	Y	0.01-10000	
	Dy	0.003-5000	Mg	0.01-50%	Sm	0.006-5000	Yb	0.001-5000	
	Er	0.002-5000	Mn	0.005-50%	Sr	0.4-10000	Zr	0.5-10000	

REE Exploration in Clays

This ammonium sulphate leach is a useful approach for liberating REEs from ionic clays formed by the natural weathering of REE bearing minerals and adsorption of REE ions onto clay surfaces.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-MS19™ **30g sample**	Al	5-250000	Fe	5-500000	Nb	0.005-500	Ta	0.005-500	$57.55
	B	10-10000	Gd	0.005-1000	Nd	0.05-10000	Tb	0.002-1000	
	Ba	0.5-10000	Hf	0.005-500	Ni	0.1-10000	Th	0.005-10000	
	Be	0.01-1000	Ho	0.002-1000	P	5-10000	Ti	5-100000	
	Ca	20-250000	K	20-100000	Pb	0.05-10000	Tm	0.002-1000	
	Ce	0.005-500	La	0.002-10000	Pr	0.004-1000	U	0.005-10000	
	Co	0.005-10000	Li	0.2-10000	Rb	0.05-10000	V	0.4-10000	
	Cs	0.005-500	Lu	0.002-1000	Sc	0.005-10000	W	0.01-10000	
	Cu	0.04-10000	Mg	1-250000	Si	10-10000	Y	0.005-500	
	Dy	0.005-1000	Mn	0.2-50000	Sm	0.004-1000	Yb	0.004-1000	
	Er	0.004-1000	Mo	0.01-10000	Sn	0.05-500	Zr	0.01-500	
	Eu	0.004-1000	Na	50-100000	Sr	0.03-10000			

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.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-MS81™ **0.1g sample**	Ba	0.5-10000	Gd	0.05-1000	Rb	0.2-10000	Ti	0.01-10%	$47.50
	Ce	0.1-10000	Hf	0.05-10000	Sc	0.5-500	Tm	0.01-1000	
	Cr	5-10000	Ho	0.01-1000	Sm	0.03-1000	U	0.05-1000	
	Cs	0.01-10000	La	0.1-10000	Sn	0.5-10000	V	5-10000	
	Dy	0.05-1000	Lu	0.01-1000	Sr	0.1-10000	W	0.5-10000	
	Er	0.03-1000	Nb	0.05-2500	Ta	0.1-2500	Y	0.1-10000	
	Eu	0.02-1000	Nd	0.1-10000	Tb	0.01-1000	Yb	0.03-1000	
	Ga	0.1-1000	Pr	0.02-1000	Th	0.05-1000	Zr	1-10000	

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 & Lithogeochemistry section for trace level methods.

CODE	ANALYTES & RANGES (ppm)								PRICE PER SAMPLE
ME-MS81h™ **0.1g sample**	Ce*	3-50000	Ho	0.05-5000	Rb	1-50000	Tm	0.05-5000	$71.80
	Dy*	0.3-5000	La*	3-50000	Sm*	0.2-5000	U	0.3-5000	
	Er	0.2-5000	Lu	0.05-5000	Sn	5-50000	W	5-50000	
	Eu	0.2-5000	Nb	1-50000	Ta	0.5-5000	Y	3-50000	
	Gd*	0.3-5000	Nd*	0.5-50000	Tb*	0.05-5000	Yb	0.2-5000	
	Hf	1-50000	Pr*	0.2-5000	Th	0.3-5000	Zr	10-50000	

*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_2O_3	0.01-10	Sm_2O_3	0.01-10			$47.80
	Dy_2O_3	0.01-10	La_2O_3	0.01-50	Tb_4O_7	0.01-10			
	Er_2O_3	0.01-10	Lu_2O_3	0.01-10	Tm_2O_3	0.01-10			
	Eu_2O_3	0.01-10	Nd_2O_3	0.01-10	Y	0.01-10			
	Gd_2O_3	0.01-10	Pr_6O_{11}	0.01-10	Yb_2O_3	0.01-10			
OA-GRA05x ME-GRA05	Loss on Ignition			Furnace or Thermogravimetric Analyser (TGA) **1g sample**					$8.50 + *$4.05*/temperature

Uranium

ALS is qualified and experienced in handling NORM samples in every area with active uranium exploration and mining, with added lab certification in certain jurisdictions.

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 – 5-10000ppm	$98.20
ME-MS61u™	Full 48 element suite from ME-MS61™, optimised for U with specific CRMs for superior quality control. **0.25g sample**	$75.40
U-XRF10*	Ore grade U assay (0.01%-15%). **2g sample**	$36.00
U-XRF15b	Ore grade U assay (0.01%- 51%). Fusion with oxidising flux. **0.5g sample**	$47.80

*For samples with >4% sulphide choose method U-XRF15b.

Copper Mineral Selective Leaches

These methods may be performed 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**	$20.30
Cu-AA05	Cu	0.001-10	Sulphuric acid leach and AAS finish. **1g sample**	$20.30
Cu-AA07n	Cu	0.001-100	Sulphuric acid/Na sulphite leach and AAS finish. **1g sample**	$20.30
Cu-AA08q	Cu	0.001-100	Sulphuric acid/ferric sulphate leach and AAS finish. **1g sample**	$23.65
Cu-AA17	Cu	0.001-10	Cyanide leach and AAS finish. **2g sample**	$24.60
Cu-PKG06LI	Cu	Various	Sequential leach for oxide, sulphide and residual Cu. Various options available. **1g sample**	$70.00

Total Copper

Aqua regia is an effective solvent for copper oxides and sulphides, but copper occurring with other commodities like molybdenum can be analysed 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 finish. **0.5g sample**	$14.60
Cu-ICP61	Trace Cu	1-10,000 ppm	Four acid digestion and ICP finish. **0.25g sample**	$20.10
Cu-OG46	Cu Assay	0.001-50	Aqua regia digestion and ICP finish. **0.4g sample**	$17.55
Cu-OG62	Cu Assay	0.001-50	Four acid digestion and ICP finish. **0.4g sample**	$23.20
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.	$233.00
Cu-VOL61	Cu Concentrate	0.01-100	HNO_3-HCl-HF-H_2SO_4 acid digestion followed by titration. Cu-CON02 performed in duplicate. **2g sample**	$94.75
Cu-CON02				$137.10

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 (%)								PRICE PER SAMPLE
ME_XRF26s **0.7g sample**	Al_2O_3	0.01-100	Fe_2O_3	0.01-100	Na_2O	0.01-10	TiO_2	0.01-30	**$70.50** LOI included as part of this procedure
	BaO	0.01-66	K_2O	0.01-15	P_2O_5	0.01-46	Total	0.01-110	
	CaO	0.01-60	MgO	0.01-50	SO_3	0.01-34			
	Cr_2O_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 Analyser (TGA)				

Specific Ores & Commodities

Procedures for the evaluation of ores and high grade materials are optimised 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; specialised 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.

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, customisable as required.

CODE	ANALYTES & RANGES (%)						DESCRIPTION	PRICE PER SAMPLE
ME_XRF21u (unnormalised) ME_XRF21n (normalised) **0.7g sample**	Al_2O_3	0.01-100	K_2O	0.001-6.3	Sn	0.001-1.5	Fused disc XRF.	**$60.20** LOI included as part of this procedure
	As	0.001-1.5	MgO	0.01-40	Sr	0.001-1.5		
	Ba	0.001-10	Mn	0.001-25	TiO_2	0.01-30		
	CaO	0.01-40	Na_2O	0.005-8	V	0.001-5		
	Cl	0.001-6	Ni	0.001-8	Zn	0.001-1.5		
	Co	0.001-5	P	0.001-10	Zr	0.001-1		
	Cr_2O_3	0.001-10	Pb	0.001-2	Total	0.01-110		
	Cu	0.001-1.5	S	0.001-5				
	Fe	0.01-74.8	SiO_2	0.01-100				
OA-GRA05x ME-GRA05	Loss on Ignition **1g sample**						Furnace or Thermogravimetric Analyser (TGA)	

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	DESCRIPTION	PRICE PER SAMPLE
DTR_PREP	Multi-stage sieving and pulverising.	**$98.15**
DTR_FeRec	DTR iron recovery.	By Quotation
ME_XRF21h/c/t	XRF analysis on various DTR fractions (head, concentrate, tailing). **0.7g sample each**	**$60.20** each fraction
OA-GRA05xh/xc/xt	Loss on Ignition reported as part of this method.	
Fe-VOL05	Ferrous iron by titration (FeO; 0.01-100%). **1g sample**	**$42.30**
MAG-DTR	Recovery of magnetic fraction by DTR	**$72.70**
MAG-SUS	Magnetic susceptibility.	**$21.70**

*Note: These methods are not suitable for samples with base or precious metals mineralisation.

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 characterisation 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_XRF13u (unnormalised) ME_XRF13n (normalised)	Al_2O_3	0.01-100	MgO	0.01-40	SrO	0.01-1.5	Fused disc XRF. **0.7g sample.**	**$60.25** LOI included as part of this procedure
	BaO	0.01-10	MnO	0.01-31	TiO_2	0.01-30		
	CaO	0.01-40	Na_2O	0.01-5.3	V_2O_5	0.01-8		
	Cr_2O_3	0.01-10	P_2O_5	0.01-23	Zn	0.01-1.6		
	Fe_2O_3	0.01-100	SiO_2	0.05-100	ZrO_2	0.01-1.5		
	K_2O	0.01-6.3	SO_3	0.01-12.5	Total	0.01-110		
OA-GRA05x ME-GRA05	Loss on Ignition **1g sample**						Furnace or Thermogravimetric Analyser (TGA)	
C-IR17	Slow and repeated addition of HCl (50%) to decompose and evolve carbonates as CO_2. Residual carbon is then analysed by induction furnace/IR. 0.02%-100%. **0.1g sample**						TOC by Combustion.	**$42.95**
ME-LICP01	Reactive Silica and Available Alumina, 0.1-100%. Standard digestion temperature 145°C. Alternative temperatures, caustic strength and sample/caustic weight ratio may be requested by the client. **1g sample**						Microwave digestion, chemical separation and ICP-AES analysis.	**$53.35**
ME-LICP02	Reactive Silica and Available Alumina, 0.1-100%. Standard digestion temperature 235°C. Alternative temperatures, caustic strength and sample/caustic weight ratio may be requested by the client. **1g sample**						Microwave digestion, chemical separation and ICP-AES analysis.	**$58.65**
*Si-NIR07	Kaolinitic Silica, 0.4%-100%. **2g sample**						Fourier Transform infrared (FT-NIR).	**$8.70**

*Si-NIR07 requires calibration to be set up with multiple samples from the same deposit that have been analysed by an alternative technique for Kaolinitic Silica to set up a chemometric algorithm.

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_XRF12u* (unnormalised) ME_XRF12n* (normalised) **0.7g sample**	Al_2O_3	0.01-100	K_2O	0.01-6.3	Pb	0.005-1.8	Fused disc XRF.	**$60.25** LOI included as part of this procedure
	CaO	0.01-40	MgO	0.01-50	SiO_2	0.05-100		
	Co	0.001-7	MnO	0.005-30	TiO_2	0.01-30		
	Cr_2O_3	0.005-10	Na_2O	0.01-5.3	Zn	0.001-1.6		
	Cu	0.001-1.6	Ni	0.005-7.86	Total	0.01-110		
	Fe_2O_3	0.01-100	P_2O_5	0.005-23				
OA-GRA05x ME-GRA05	Loss on Ignition **1g sample**						Furnace or Thermogravimetric Analyser (TGA)	

*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_2O_3	0.01-100	MgO	0.01-50	SiO_2	0.01-100	Fused disc XRF.	**$60.25** LOI included as part of this procedure
	CaO	0.01-60	MnO_2	0.01-48	TiO_2	0.01-30		
	Fe_2O_3	0.01-100	Na_2O	0.01-11	Total	0.01-110		
	K_2O	0.01-10	P_2O_5	0.01-50				
OA-GRA05x ME-GRA05	Loss on Ignition **1g sample**						Furnace or Thermogravimetric Analyser (TGA).	

*Fluorine may be added for an additional cost.

Potash

This package is designed for potash exploration to report total chemical composition of samples as well as the proportion of analytes that can be leached with water. ME-XRF26k is a fusion-XRF method that reports total content where ME-ICP03k is a water-leach method that reports soluble elements. OA-GRA04k provides the percentage of residue insoluble in water using a gravimetric method.

CODE	ANALYTES & RANGES (%)						PRICE PER SAMPLE
ME-XRF26K	Al_2O_3	0.01-100	Fe_2O_3	0.01-100	P_2O_5	0.01-46	**$105.90** ME-POTPKG Sold only as a complete package
	BaO	0.01-66	K_2O	0.01-65	SO_3	0.01-71	
	CaO	0.01-60	MgO	0.01-50	SiO_2	0.05-100	
	Cl	0.01-65	MnO	0.01-39	SrO	0.01-1.5	
	Cr_2O_3	0.01-10	Na_2O	0.01-55	TiO_2	0.01-30	
OA-GRA05x	LOI	0.01-100					
ME-ICP03K	Ca	0.01-25	K	0.01-55	Na	0.01-42	
	Fe	0.01-50	Mg	0.01-25	S	0.01-30	
OA-GRA04K	Water Insoluble			0.5-100			

Aqua Regia Overlimit Methods

Aqua regia is a powerful solvent for sulphides, silver and base metals.

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	**$12.80**
	As	0.001-60	Cu	0.001-50	Mo	0.001-10	S	0.01-10	*+$4.75* /element
	Cd	0.001-10	Fe	0.01-100	Ni	0.001-30	Zn	0.001-30	

This method may be triggered as an overrange method automatically on multi-element geochemistry packages.

Four Acid Overlimit Methods

Four acid digestion breaks down most silicates and all but the most resistive minerals.

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	
	As	0.001-30	Cr	0.002-30	Mn	0.01-60	S	0.01-50	**$18.45**
	Bi	0.001-30	Cu	0.001-50	Mo	0.001-10	Zn	0.001-30	*+$4.75* /element
	Cd	0.001-10	Fe	0.01-100	Ni	0.001-30			

This method may be triggered as an overrange method automatically on multi-element geochemistry packages.

Titration Methods

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

CODE	ANALYTES & RANGES (%)		DESCRIPTION	PRICE PER SAMPLE
Cu-VOL61	Cu	0.01-100	Cu by Titration. **0.5g sample**	**$94.75**
Zn-VOL50	Zn	0.01-100	Zn by Titration. **1g sample**	**$45.85**
Pb-VOL70	Pb	0.01-100	Pb by Titration. **1g sample**	**$131.55**
Fe-VOL51	Fe	0.01-100	Total Fe in Concentrates by titration. **1g sample**	**$94.75**
Fe-VOL05	FeO	0.01-100	Ferrous Iron (FeO) by titration. **1g sample**	**$42.30**

Sodium Peroxide Fusion & ICP-AES

Na_2O_2 fusions are used for sulphides, arsenides, chromite, rutile, ilmenite and titanite. This selection is designed for nickel sulphides, but elements are also available individually.

CODE	ANALYTES & RANGES (%)								PRICE PER SAMPLE
ME-ICP81 **0.2g sample**	Al	0.01-50	Cr	0.01-60	Mg	0.01-30	S	0.01-60	**$52.70** full package
	As	0.01-10	Cu	0.002-50	Mn	0.01-50	Si	0.1-50	or *$30.10*
	Ca	0.05-50	Fe	0.05-70	Ni	0.002-30	Ti	0.01-50	+ *$1.50* /element
	Co	0.002-30	K	0.05-50	Pb	0.01-30	Zn	0.002-60	

Intermediate Level Oxidising Digestion

A strong oxidising digestion utilising HNO_3, $KClO_3$ and HBr with aqua regia is applicable to basemetal ores and particularly suitable for massive sulphides.

CODE	ANALYTES & RANGES (%)								PRICE PER SAMPLE
ME-ICPORE	Ag	1-1500ppm	Co	0.001-20	Mn	0.005-50	S	0.05-50	$48.45
	As	0.005-30	Cu	0.001-40	Mo	0.001-10	Sb	0.005-100	
	Bi	0.005-30	Fe	0.01-100	Ni	0.001-30	Tl	0.005-1	
	Ca	0.01-50	Hg	8-10000ppm	P	0.01-20	Zn	0.002-100	
	Cd	0.001-10	Mg	0.01-50	Pb	0.005-30			

Oxidising Fusion & XRF Finish

Samples are analysed by XRF following a lithium borate fusion with the addition of strong oxidising agents to decompose sulphide-rich ores.

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

CODE	ANALYTES & RANGES (%)								PRICE PER SAMPLE
ME-XRF15b* **0.5g sample**	Al_2O_3	0.01-100	Fe	0.01-75	P_2O_5	0.01-25	Th	0.002-5	$45.10 + *$4.75* /element
	As	0.01-10	HfO_2	0.01-10	Pb	0.005-20	TiO_2	0.01-30	
	BaO	0.01-66	K_2O	0.01-6.3	Rb	0.005-5	U	0.001-5	
	Bi	0.01-5	La_2O_3	0.01-50	S	0.01-20	V	0.01-5.6	
	CaO	0.01-40	MgO	0.01-40	Sb	0.005-20	W	0.001-15.9	
	CeO_2	0.01-50	Mn	0.01-30	SiO_2	0.01-100	Zn	0.005-20	
	Co	0.01-7	Mo	0.005-2	Sn	0.005-20	Zr	0.01-20	
	Cr	0.01-10	Nb	0.005-20	Sr	0.01-5			
	Cu	0.005-20	Ni	0.005-20	Ta	0.002-16.4			
OA-GRA05x ME-GRA05	Loss on Ignition**			Furnace or Thermogravimetric Analyser (TGA). **1g sample**					$8.50 + *$4.05* /temperature

*Na is not reportable due to the oxidising flux used in sample preparation.
**LOI is required as part of the ME-XRF15b method.

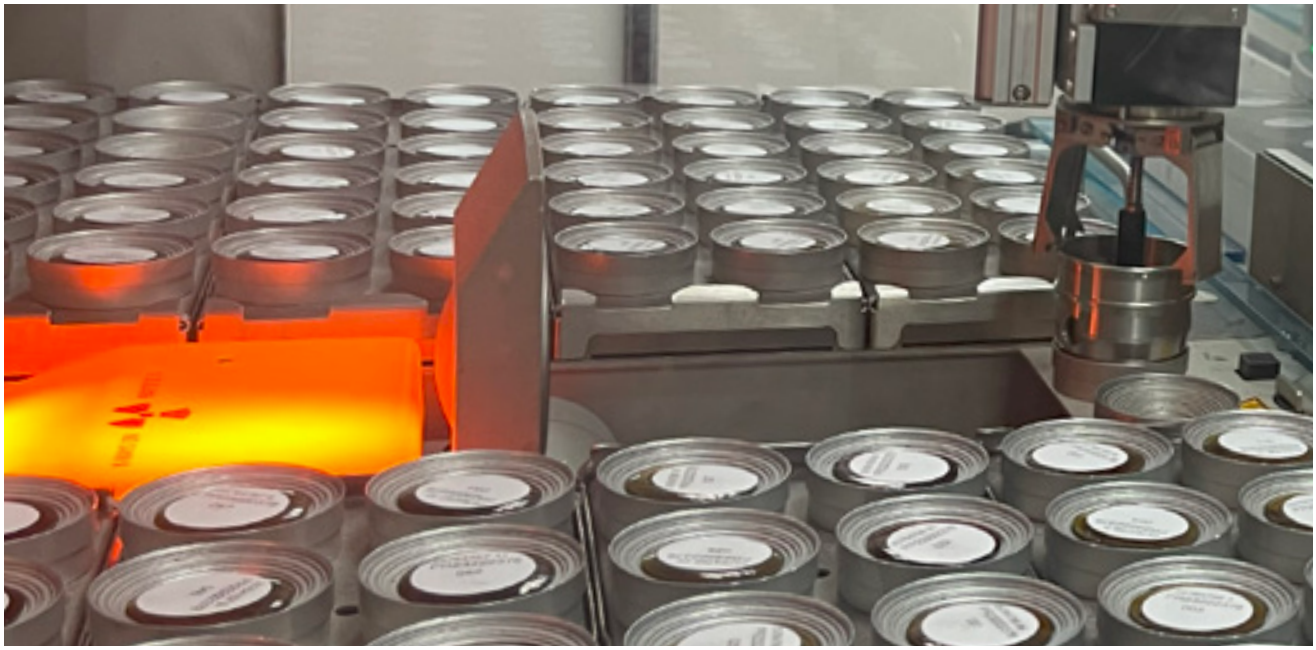
Base Metal Concentrates By XRF

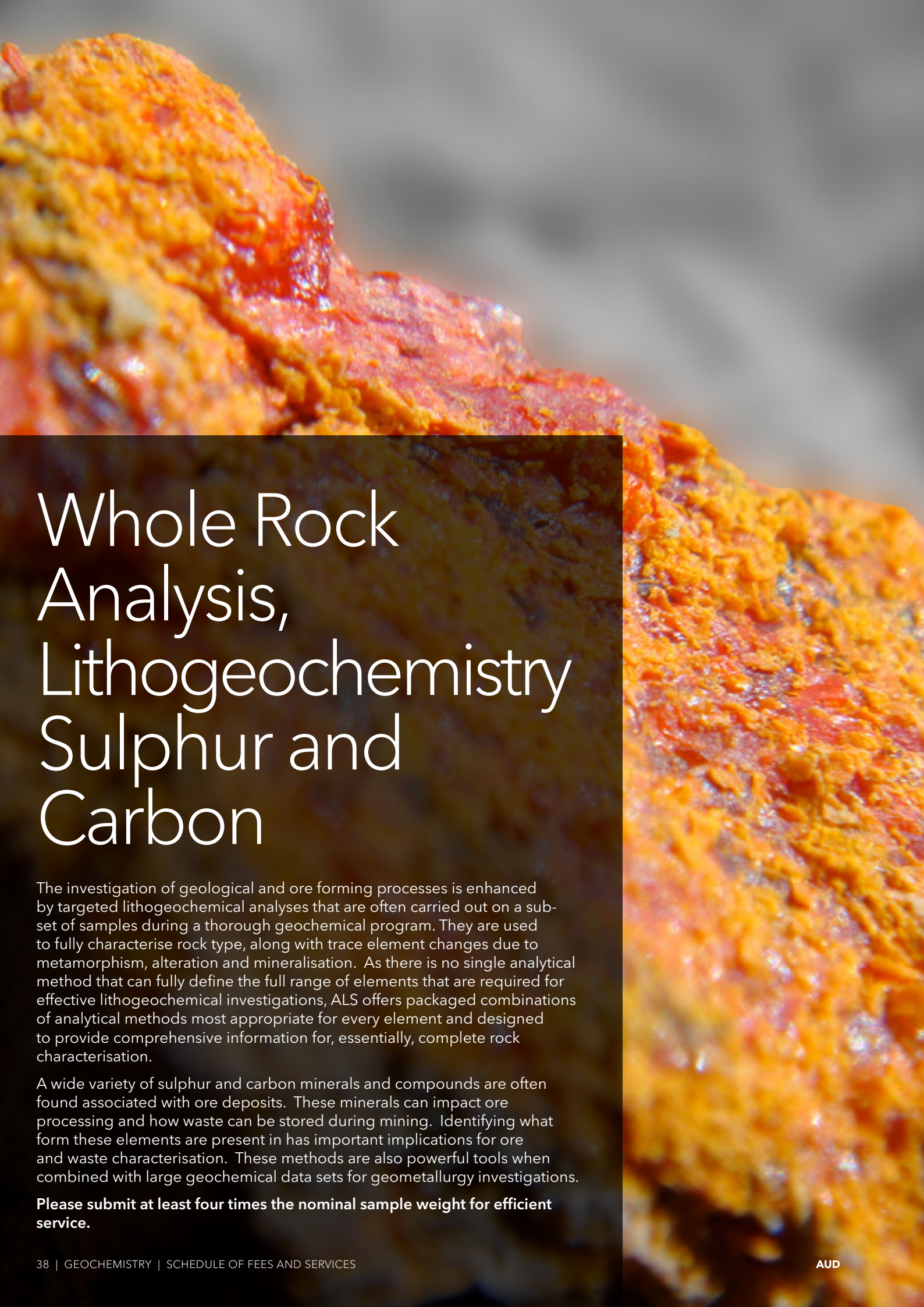
Samples are analysed by XRF following a lithium borate fusion with the addition of strong oxidising agents to decompose sulphide concentrates.

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

CODE	ANALYTES & RANGES (%)						PRICE PER SAMPLE
ME-XRF15c* **0.25g sample**	Al_2O_3	0.01-100	MgO	0.01-40	Sn	0.01-79	$58.65 + *$4.75* /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_2O	0.01-6.3	SiO_2	0.01-100			
OA-GRA05x ME-GRA05	Loss on Ignition**			Furnace or Thermogravimetric Analyser (TGA) **1g sample**			$8.50 + *$4.05* /temperature

*Na is not reportable due to the oxidising flux used in sample preparation.
**LOI is required as part of the ME-XRF15c method.





Whole Rock Analysis, Lithogeochemistry Sulphur and Carbon

The investigation of geological and ore forming processes is enhanced by targeted lithogeochemical analyses that are often carried out on a sub-set of samples during a thorough geochemical program. They are used to fully characterise rock type, along with trace element changes due to metamorphism, alteration and mineralisation. As there is no single analytical method that can fully define the full range of elements that are required for effective lithogeochemical investigations, ALS offers packaged combinations of analytical methods most appropriate for every element and designed to provide comprehensive information for, essentially, complete rock characterisation.

A wide variety of sulphur and carbon minerals and compounds are often found associated with ore deposits. These minerals can impact ore processing and how waste can be stored during mining. Identifying what form these elements are present in has important implications for ore and waste characterisation. These methods are also powerful tools when combined with large geochemical data sets for geometallurgy investigations.

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 mineralisation.

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

CODE	ANALYTES & RANGES (%)								DESCRIPTION	PRICE PER SAMPLE
ME_XRF26* **2g sample**	Al_2O_3	0.01-100	Fe_2O_3	0.01-100	Na_2O	0.01-10	SrO	0.01-1.5	Fused disc XRF, LOI by furnace or TGA	**$53.40**
	BaO	0.01-66	K_2O	0.01-15	P_2O_5	0.01-46	TiO_2	0.01-30		
	CaO	0.01-60	MgO	0.01-50	SO_3	0.01-34	LOI	0.01-100		
	Cr_2O_3	0.01-10	MnO	0.01-39	SiO_2	0.01-100				

*For unmineralised samples with moderate sulphide content, please request ME_XRF06.
For mineralised and/or high sulphide content >4%, please request ME-XRF15c. Performed on dried sample therefore expected to report slightly higher than ME_XRF06.

CODE	ANALYTES & RANGES (%)								DESCRIPTION	PRICE PER SAMPLE
ME_ICP06* **2g sample**	Al_2O_3	0.01-100	Fe_2O_3	0.01-100	Na_2O	0.01-100	TiO_2	0.01-100	Fused bead, acid digestion and ICP-AES. LOI by furnace or TGA	**$53.40**
	BaO	0.01-100	K_2O	0.01-100	P_2O_5	0.01-100	LOI	0.01-100		
	CaO	0.01-100	MgO	0.01-100	SiO_2	0.01-100				
	Cr_2O_3	0.002-100	MnO	0.01-100	SrO	0.01-100				

*For mineralised and/or high sulphide content >4%, please request ME-XRF15c.
Both the ME_XRF26 and ME_ICP06 packages include LOI by furnace or TGA.

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 & RANGES (ppm)								DESCRIPTION	PRICE PER SAMPLE
ME-MS81™ **0.1g sample**	Ba	0.5-10000	Gd	0.05-1000	Rb	0.2-10000	Ti	0.01-10%	Fused bead, acid digestion and ICP-MS	**$47.50**
	Ce	0.1-10000	Hf	0.05-10000	Sc	0.5-500	Tm	0.01-1000		
	Cr	5-10000	Ho	0.01-1000	Sm	0.03-1000	U	0.05-1000		
	Cs	0.01-10000	La	0.1-10000	Sn	0.5-10000	V	5-10000		
	Dy	0.05-1000	Lu	0.01-1000	Sr	0.1-10000	W	0.5-10000		
	Er	0.03-1000	Nb	0.05-2500	Ta	0.1-2500	Y	0.1-10000		
	Eu	0.02-1000	Nd	0.1-10000	Tb	0.01-1000	Yb	0.03-1000		
	Ga	0.1-1000	Pr	0.02-1000	Th	0.05-1000	Zr	1-10000		
ME-MS81d™	Combination of Rare Earth & Trace Elements from method ME-MS81™ plus whole rock package by method ME-ICP06.									**$70.60**
ME-4ACD81 **0.25g sample**	Ag	0.5-100	Co	1-10000	Mo	1-10000	Tl	10-10000	Four acid digestion and ICP-AES	**$13.20** Add on to borate fusion methods only
	As	5-10000	Cu	1-10000	Ni	1-10000	Zn	2-10000		
	Cd	0.5-1000	Li	10-10000	Pb	2-10000				

Complete Characterisation Packages

By combining a number of methods into one cost effective package, a complete sample characterisation is obtained. These packages combine whole rock analysis, trace elements by fusion, aqua regia digestion for the volatile trace elements, carbon and sulphur by combustion analysis, and several detection limit options for the base metals.

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

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

Minimum sample size is 10g.

CODE	ANALYTES & 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%	Sold only as complete packages CCP-PKG01 **$124.65** CCP-PKG03 **$134.85** Includes ME-XRF26 instead of ME-ICP06
	Al_2O_3	0.01-100%	Na_2O	0.01-100%	MnO	0.01-100%	LOI	0.01-100%	
	Fe_2O_3	0.01-100%	K_2O	0.01-100%	P_2O_5	0.01-100%			
	CaO	0.01-100%	Cr_2O_3	0.002-100%	SrO	0.01-100%			
ME-IR08	C	0.01-50%	S	0.01-50%					
ME-MS81™	Ba	0.5-10000	Gd	0.05-1000	Pr	0.02-1000	Tm	0.01-1000	
	Ce	0.1-10000	Ge	0.5-1000	Rb	0.2-10000	U	0.05-1000	
	Cr	5-10000	Hf	0.05-10000	Sm	0.03-1000	V	5-10000	
	Cs	0.01-10000	Ho	0.01-1000	Sn	0.5-10000	W	0.5-10000	
	Dy	0.05-1000	La	0.1-10000	Sr	0.1-10000	Y	0.1-10000	
	Er	0.03-1000	Lu	0.01-1000	Ta	0.1-2500	Yb	0.03-1000	
	Eu	0.02-1000	Nb	0.05-2500	Tb	0.01-1000	Zr	1-10000	
	Ga	0.1-1000	Nd	0.1-10000	Th	0.05-1000			
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	0.02-250			
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 **$150.80** 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 **$169.35** 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 customisable options such as super trace detection limits ME-MS42L™ available for substitution of ME-MS42™

Sulphur Methods

Accurate sulphur 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 sulphur by induction furnace/IR **0.1g sample**	$22.60
S-GRA07	S (Elemental)	0.01-100	Solvent leach with remaining elemental sulphur analysed by gravimetric finish. **3g sample**	$48.90
S-GRA06a	S (Sulphate)	0.01-50	HCl (15%) leach of soluble sulphates, precipitation as barium sulphate and gravimetric finish. Note: little to no dissolution of barite/celestite. **1g sample**	$31.60
S-IR06a	S (Sulphide)	0.01-50	HCl (25%) leach to remove sulphates; induction furnace/IR. Note: little to no dissolution of barite/celestite. **0.1g sample**	$31.10
S-GRA06	S (Sulphate)	0.01-40	$NaCO_3$ leach of sulphates, precipitation as barium sulphate and gravimetric finish. **1g sample**	$57.30
S-IR07	S (Sulphide)	0.01-50	$NaCO_3$ leach of sulphates, induction furnace/IR. **0.1g sample**	$66.25

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 induction furnace/IR. **0.1g sample**	$22.60
C-IR06a	C (Non-Carbonate)	0.01-50	HCl (25%) leach at high temperature for 1 hour to expel carbonates as CO_2, residue analysed for C by induction furnace/IR. **0.1g sample**	$34.35
C-GAS05	CO_2 (Carbonate)	0.2-50	$HClO_4$ digestion and CO_2 coulometer. **0.1g sample**	$32.40
C-IR18	C (Graphite)	0.02-50	HCl (50%) leach of carbonates, roasting to remove organic carbon, induction furnace/IR. **0.1g sample**	$50.65
C-IR17	C (Non-Carbonate)	0.02-100	Slow and repeated addition of HCl (50%) to decompose and evolve carbonates as CO_2. Residual carbon is then analysed by induction furnace/IR. **0.1g sample**	$42.95
C-CAL15	C (Carbonate)	0.02-100	Carbonate carbon calculated by difference. Requires C-IR07, C-IR17.	$0.00

Sulphur 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) S (Total)	0.01-50 0.01-50	Total carbon and sulphur by induction furnace/IR. **0.1g sample**	$37.65
ME-IR06a	C (Organic) S (Sulphide)*	0.01-50 0.01-50	Non-Carbonate carbon and sulphide sulphur by HCl (25%) leach to remove carbonates and sulphates, induction furnace/IR. **0.1g sample**	$43.55

*Sulphide sulphur may be overstated if BaSO4 or SrSO4 are present as they are insoluble with the HCl leach.

Concentrates and ARD

A mine in development or production needs a specialised set of analyses for mine products, and to characterise mine waste behaviour. These include geochemical methods designed for concentrates and high-grade samples; and those used to monitor process metallurgy and umpire assay of bulk concentrates. In the following section methods developed to determine a material's acid mine drainage potential are also outlined. These methods cover a range of requirements which will vary between regions and mineralisation types.

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

Various Elements in Concentrates

All control assays are overseen by experienced certified assayers and analysed 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**	**$137.10** /each
As-CON01	As	0.01-15		Four acid digestion and AAS finish. **1g sample**	**$137.10**
Hg-CON01	Hg	1-10,000ppm		HCl digestion and ICP-AES finish. **1g sample**	**$137.10**
F-CON01	F	20-20,000ppm		KOH fusion and ion selective electrode. **0.2g sample**	**$143.60**

+ 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.

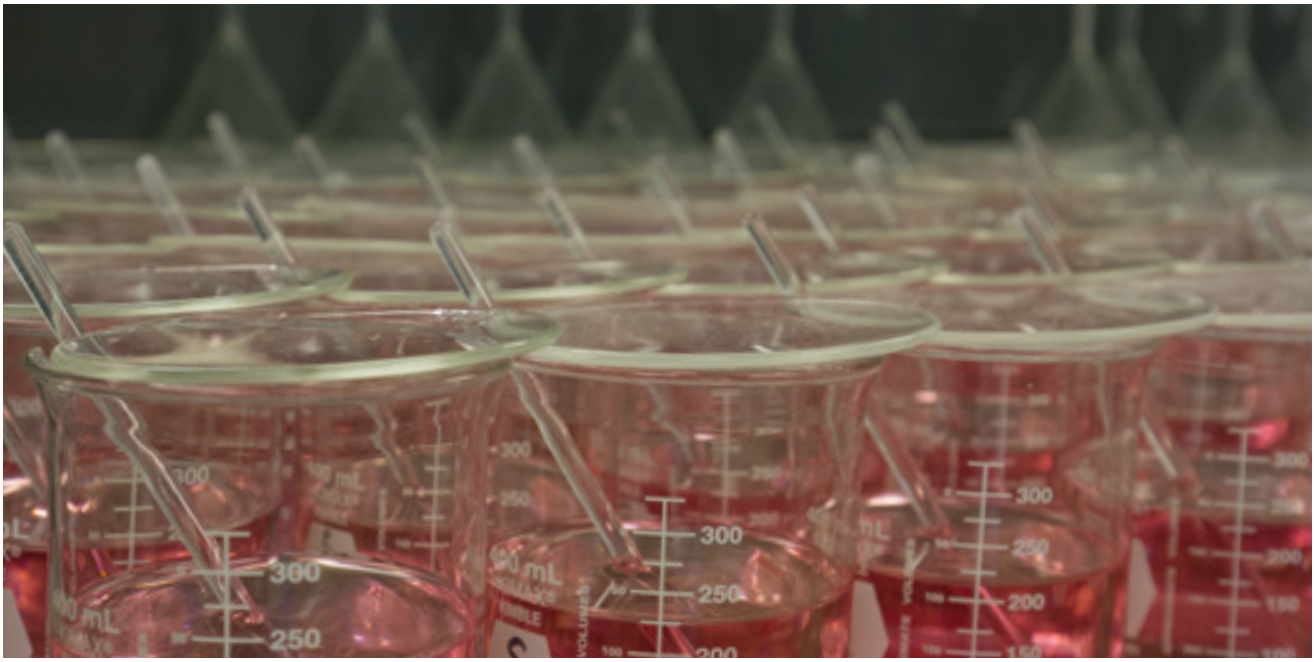
Aqua regia/ICP-MS and oxidising fusion/XRF options are also available.

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	**$360.95**
	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_2O_3, CaO, Fe_2O_3, K_2O, MgO, MnO, Na_2O, SiO_2, SO_3, TiO_2 and LOI	Fusion, XRF **0.7g sample**	**$53.40**
ME_XRF26s	Chromite and Manganese Ore	Al_2O_3, BaO, CaO, Cr_2o_3 Fe_2O_3, K_2O, MgO, MnO, Na_2O, P_2O_5, SO_3, SiO_2, TiO_2 and LOI	Fusion, XRF **0.33g sample**	**$70.50**
ME-ICP86	Limestone, Dolomite, Magnesite, Magnesia	CaO, MgO, Al_2O_3, Fe_2O_3, SiO_2, LOI	Fusion, ICP-AES **0.1g sample**	**$56.40**



Acid-Base Accounting

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

The choice of package will depend on the method of determining the neutralising potential that is required by law in your region, this information can be obtained from your local regulatory agency.

Minimum sample size for all ABA packages is 100g.

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

PARAMETERS	ABA-PKG01 (M/S)	ABA-PKG04 (M/S)	ABA-PKG05 (M/S/B)	ABA-PKG06E*
Net Neutralisation Potential (NNP)	√	√	√	
Maximum Potential Acidity (MPA)	√	√	√	
Neutralisation Potential (NP) & Fizz	√	√	√	
Ratio (NP : MPA)	√	√	√	
Neutralisation Potential (EN 15875 NP)				√
Acid Potential (EN 15875 AP)				√
Maximum Acid Potential (EN 15875 AP Max)				√**
Neutralisation Potential Ratio (EN 15875 NPR)				√
Net Neutralisation Potential (EN 15875 NNP)				√
Paste pH	√	√	√	
Sulphate by ICP				√
HCl-leachable Sulphate		√	√	
Total Sulphate (Carbonate Leach)			√	
Sulphide (calculated)		√	√	√
Sulphide (analysed)	√**	√**	√**	
Total Sulphur	√	√	√	√
Inorganic Carbon (CO_2)		√	√	
Inorganic Carbon (calculated)				√
Organic Carbon				√
Total Carbon				√
Sobek Method	√	√	√	
Modified Sobek (M) Option	√	√	√	
Siderite Correction (S) Option	√	√	√	
MEND Method (B) Option			√	
EN 15875 Method Option				√

* meets EU regulations. ** optional parameter. See client services for pricing.

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
OA-HCTSET	Humidity cell set-up and maintenance fees.	By Quotation
OA-HCT01	Periodic analysis of humidity cell leachate. Many instrument finishes, particle sizes and sample weights are available; please enquire.	

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 oxidise sulphides. NAG is reported in kg H_2SO_4/tonne at pH 4.5 and pH 7.0. **2.5g sample**	$188.00

ALS Mineralogy

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

Quantitative mineralogical data are an essential component in a range of applications such as processing mineralogy, plant surveys, ore characterisation, precious metal and trace mineral characterisation, and geometallurgy analyses.

Access to state-of-the art technology and a highly trained technical team ensures that your requirements are met with high-quality data fit for your purpose.

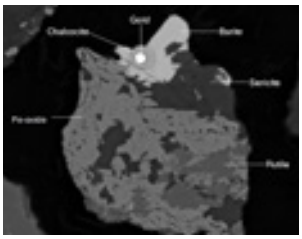
Contact us to determine methods and pricing specific for your project.

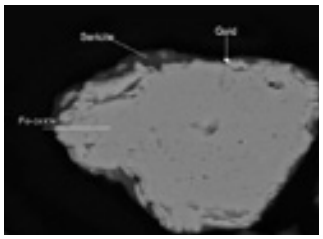
CODE	ANALYSIS	RANGE OF SERVICE
BMA	QEMSCAN Bulk Mineral Analysis	Mineral composition, elemental deportment and assay reconciliation.
BMAL	QEMSCAN Bulk Mineral Analysis with Liberation	Mineral composition, estimate of the liberation, elemental deportment and assay reconciliation.
MIN-CORE	MLA Core Plug Analysis plus Images	Mineral list and abundances by X-Ray point counting, with elemental distributions, and calculated assay; plus high-resolution images of entire surface (both greyscale and processed). Suitable for core plugs or thin sections.
MIN-GXMAP	MLA Bulk Mineral and Textural Analysis with X-Ray Mapping	XBSE analysis with additional X-Ray mapping of similar-appearing gangue or minerals of interest to improve grain segmentation (for texturally complex or finely intergrown samples)
MIN-SPL	MLA Sparse phases - Au, Ag, PGE, U minerals etc. present at ppm to ppt levels or losses of minerals of interest to tails	Data for requested minerals only - does not include bulk mineralogy data - Mineral List and relative abundances, elemental distributions, particle size and grain size distributions, mineral liberation, locking and association data, particle image line ups, - includes high resolution photomicrographs of typical minerals of interest.
MIN-XBSE	MLA Bulk Mineral and Textural Analysis	Mineral List and abundances (to <0.5 Wt%), elemental distributions, particle size and grain size distributions, mineral liberation, locking and association data, grade recovery curves, particle image line ups, assay reconciliation - includes spread sheet reporting - additional reporting options available.
MIN-XMOD	MLA Bulk Mineral Analysis by X-Ray Point Counting	Mineral List and abundances (to ~0.5-1 Wt%), elemental distributions, chemical assay reconciliation - includes basic spreadsheet reporting.
PMA	QEMSCAN Particle Mineral Analysis	Mineral composition, abundance, liberation, locking, association, elemental deportment and assay reconciliation. Typically includes 4-5 size fractions.
TMS	QEMSCAN Trace Mineral Search	Trace mineral characterisation includes liberation, locking, association and size. Cost is dependent on grade and desired number of grains for analysis.
XRDQ	Quantitative XRD	Fully quantitative XRD, including the quantification of the amorphous material present.
XRDSQ	Semi-quantitative XRD	Mineral abundance, normalised over the crystalline content, excluding the quantification of amorphous material.

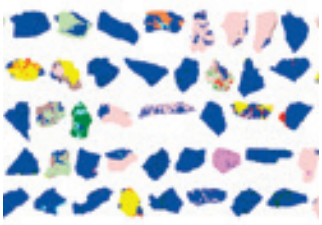
All prices are by quotation. Please contact ALS for more information.

Additional reporting options are also available on request.
Mineralogical data available from our range of technologies include:

- Mineral species, compositions, and abundances
- Elemental deportment
- Mineral grain and particle size distribution
- Grain size and grain texture data
- Mineral liberation including association and locking
- Mineral grade and element grade recovery curves
- Colour-coded particle maps and minerals line-ups
- Annotated high-resolution maps and mineral line-ups
- SEM backscatter images
- SEM particle maps
- Mineral X-Ray and wavelength spectra summary
- XRD analyses of all crystalline materials







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Quality Management Systems

Providing exceptional quality assays to our clients is one of the cornerstones of ALS's business model. We achieve this via a global quality program that has been strategically designed to integrate quality requirements into every process from sample preparation through analysis. It is an integral part of day-to-day activities, involves all levels of ALS staff, and is monitored at top management levels. The global quality program includes inter-laboratory test programs and regularly scheduled internal audits that meets all requirements of ISO/IEC 17025:2017 and ISO 9001:2015.

All ALS Geochemistry hub and many multi-purpose laboratories are accredited to ISO/IEC 17025:2017 for specific analytical procedures.

The physical sample preparation involving accredited test methods as listed on an analytical laboratory's ISO/IEC 17025:2017 Scope of Accreditation may be performed at that location, or at off-site sample preparation laboratories that are monitored regularly for quality control and quality assurance practices. In certain instances an ISO/IEC accreditation body may allow for these off-site sample preparation facilities to be listed on the laboratory's Scope.

* Please contact us for details regarding ISO/IEC 17025:2017 accreditation and scopes of accreditation; or ISO 9001:2015 certification at individual labs.

ISO/IEC 17025:2017 Accredited Methods in North America*

ISO/IEC 17025:2017 Accredited Methods in Romania*

ISO/IEC 17025:2017 Accredited Methods in Turkey*

ISO/IEC 17025:2017 Accredited Methods in Chile*

ISO/IEC 17025:2017 Accredited Methods in Laos*

ISO/IEC 17025:2017 Accredited Methods and ISO 9001:2015 Registration in Peru*

ISO/IEC 17025:2017 Accredited Methods in Ireland

ISO 9001:2015 Registration in Spain*

ISO/IEC 17025:2017 Accredited Methods and ISO 9001:2015 Registration in Australia*

ISO/IEC 17025:2017 Accredited Methods in Zambia*

ISO/IEC 17025:2017 Accredited Methods in South Africa and Ghana*

ISO/IEC 17025:2017 Accredited Methods in Burkina Faso*

ISO/IEC 17025:2017 Accredited Methods and ISO 9001:2015 Registration in China*

ISO/IEC 17025:2017 Accredited Methods in Mongolia*

ISO/IEC 17025:2017 Accredited Methods in Kazakhstan*

ISO/IEC 17025:2017 Accredited Methods in Russia*

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.

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 maximise efficiencies and improve turnaround of the samples. No additional cost will be charged to the client for this service optimisation 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, subject to approved credit, are payment in full, 30 days from the date of invoice (Due Date), unless otherwise agreed in writing prior to the placement of an order or submission of samples.

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) The Client hereby releases and indemnifies and shall continue to release and indemnify ALS, its officers, employees and agents from and against all actions, claims (actual or threatened), proceedings or demands (including any costs and expenses in defending or servicing same) which may be brought against it or them, in respect of any loss (including Consequential Loss), death, injury, illness or damage to persons or property, and whether direct or indirect and in respect of any breach of any industrial or intellectual property rights, howsoever arising out of the use of, reliance on, or benefit of, the Services or any ALS Report, except to the extent that the loss, death, injury, illness or damage to persons or property was directly caused by the negligence, willful acts or omissions of ALS or its employees.

c) 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.

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 is 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.

7. Intellectual Property

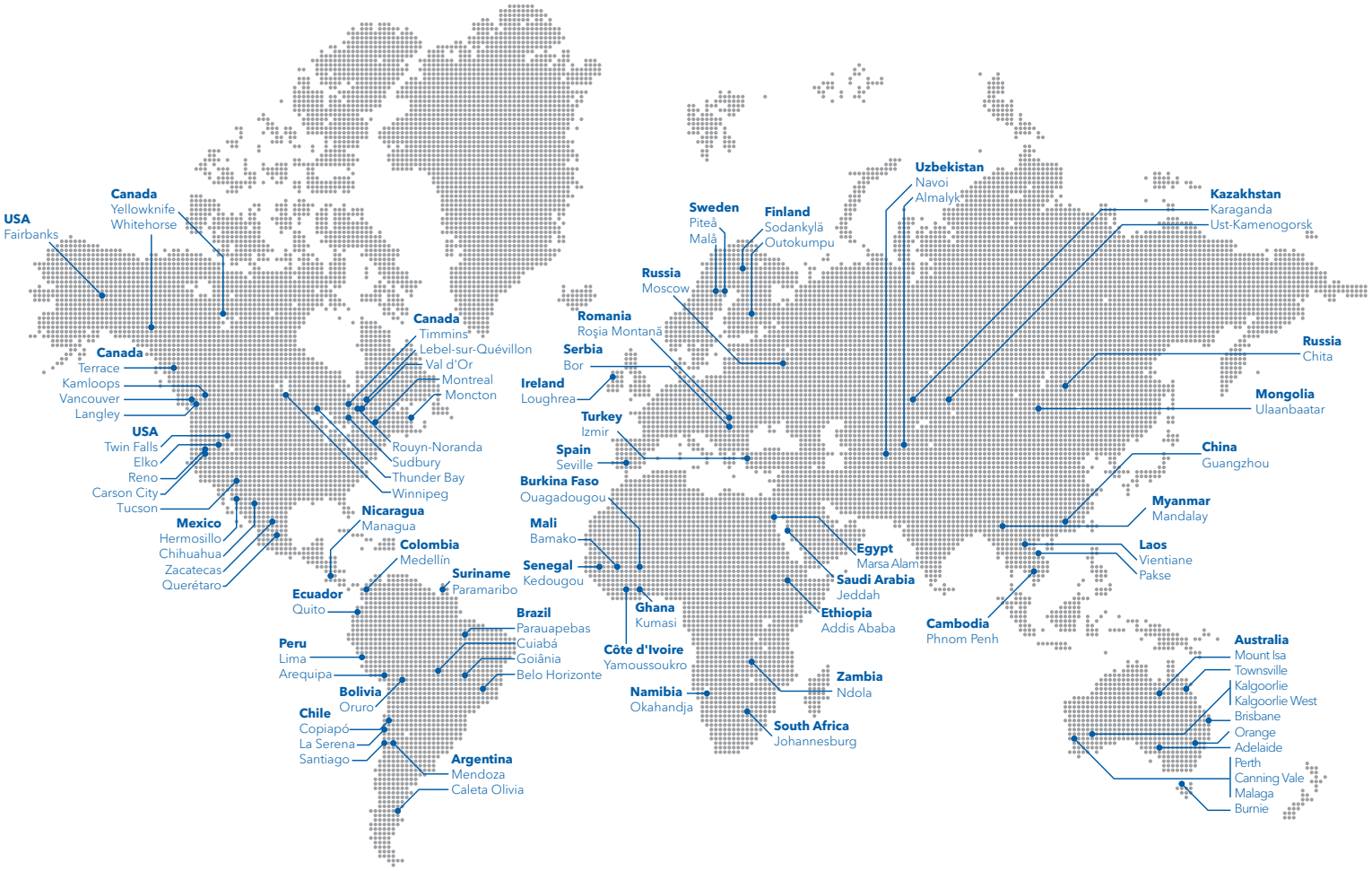
a) All ALS Intellectual Property will remain the property of ALS.

b) ALS grants to the Client a world-wide, non-exclusive, royalty free licence to use ALS Intellectual Property for the purpose agreed to between the Client and ALS to the extent that it is needed for the benefit of the Services.

c) ALS Intellectual Property means all intellectual property and proprietary rights (whether registered or unregistered) owned by ALS prior to performance of the Services, developed by ALS in performance of the Services, or developed by ALS outside of, or after, performance of the Services, and without limitation includes business names, trade or service marks, any right to have information kept confidential, patents, patent applications, drawings, discoveries, inventions, improvements, trade secrets, technical data, formulae, databases, know-how, logos, designs, design rights, copyright and similar industrial or intellectual property rights.

Please refer to the ALS Website for full Terms and Conditions

Global Geochemistry locations



Our integrated network of **over 80 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.

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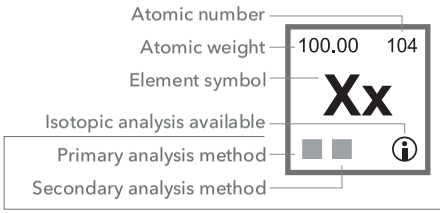
PERIODIC TABLE OF ELEMENTS

Alkali metal
Alkaline earth metal
Transition metal
Lanthanide
Actinide
Post- transition metal
Metalloid
Reactive nonmetal
Noble gas

PREFERRED METHODS OF DECOMPOSITION FOR GEOLOGICAL MATERIALS

More than two digestion methods are available for most elements.



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

1.008 [1.0078, 1.0082] 1 **H** HYDROGEN																	4.0026 2 **He** HELIUM
6.94 [6.938, 6.997] 3 **Li** LITHIUM	9.0122 4 **Be** BERYLLIUM											10.81 [10.806, 10.821] 5 **B** BORON	12.011 [12.009, 12.012] 6 **C** CARBON	14.007 [14.006, 14.008] 7 **N** NITROGEN	15.999 [15.999, 16.000] 8 **O** OXYGEN	18.998 9 **F** FLUORINE	20.180 10 **Ne** NEON
22.990 11 **Na** SODIUM	24.305 [24.304, 24.307] 12 **Mg** MAGNESIUM											26.982 13 **Al** ALUMINIUM	28.085 [28.084, 28.086] 14 **Si** SILICON	30.974 15 **P** PHOSPHORUS	32.06 [32.059, 32.076] 16 **S** SULFUR	35.45 [35.446, 35.457] 17 **Cl** CHLORINE	39.95 [39.792, 39.963] 18 **Ar** ARGON
39.098 19 **K** POTASSIUM	40.078(4) 20 **Ca** CALCIUM	44.956 21 **Sc** SCANDIUM	47.867 22 **Ti** TITANIUM	50.942 23 **V** VANADIUM	51.996 24 **Cr** CHROMIUM	54.938 25 **Mn** MANGANESE	55.845(2) 26 **Fe** IRON	58.933 27 **Co** COBALT	58.693 28 **Ni** NICKEL	63.546(3) 29 **Cu** COPPER	65.38(2) 30 **Zn** ZINC	69.723 31 **Ga** GALLIUM	72.630(8) 32 **Ge** GERMANIUM	74.922 33 **As** ARSENIC	78.971(8) 34 **Se** SELENIUM	79.904 [79.901, 79.907] 35 **Br** BROMINE	83.798(2) 36 **Kr** KRYPTON
85.468 37 **Rb** RUBIDIUM	87.62 38 **Sr** STRONTIUM	88.906 39 **Y** YTTRIUM	91.224(2) 40 **Zr** ZIRCONIUM	92.906 41 **Nb** NIOBIUM	95.95 42 **Mo** MOLYBDENUM	(98) 43 **Tc** TECHNETIUM	101.07(2) 44 **Ru** RUTHENIUM	102.91 45 **Rh** RHODIUM	106.42 46 **Pd** PALLADIUM	107.87 47 **Ag** SILVER	112.41 48 **Cd** CADMIUM	114.82 49 **In** INDIUM	118.71 50 **Sn** TIN	121.76 51 **Sb** ANTIMONY	127.60(3) 52 **Te** TELLURIUM	126.90 53 **I** IODINE	131.29 54 **Xe** XENON
132.91 55 **Cs** CAESIUM	137.33 56 **Ba** BARIUM	57-71 lanthanoids	178.49(2) 72 **Hf** HAFNIUM	180.95 73 **Ta** TANTALUM	183.84 74 **W** TUNGSTEN	186.21 75 **Re** RHENIUM	190.23(3) 76 **Os** OSMIUM	192.22 77 **Ir** IRIDIUM	195.08 78 **Pt** PLATINUM	196.97 79 **Au** GOLD	200.59 80 **Hg** MERCURY	204.38 [204.38, 204.39] 81 **Tl** THALLIUM	207.20 82 **Pb** LEAD	208.98 83 **Bi** BISMUTH	(209) 84 **Po** POLONIUM	(210) 85 **At** ASTATINE	(222) 86 **Rn** RADON
(223) 87 **Fr** FRANCIUM	(226) 88 **Ra** RADIUM	89-103 actinoids	138.91 57 **La** LANTHANUM	140.12 58 **Ce** CERIUM	140.91 59 **Pr** PRASEODYMIUM	144.24 60 **Nd** NEODYMIUM	(145) 61 **Pm** PROMETHIUM	150.36(2) 62 **Sm** SAMARIUM	151.96 63 **Eu** EUROPIUM	157.25(3) 64 **Gd** GADOLINIUM	158.93 65 **Tb** TERBIUM	162.50 66 **Dy** DYSPROSIUM	164.93 67 **Ho** HOLMIUM	167.26 68 **Er** ERBIUM	168.93 69 **Tm** THULIUM	173.05 70 **Yb** YTTERBIUM	174.97 71 **Lu** LUTETIUM
			(227) 89 **Ac** ACTINIUM	232.04 90 **Th** THORIUM	231.04 91 **Pa** PROTACTINIUM	238.03 92 **U** URANIUM	(237) 93 **Np** NEPTUNIUM	(244) 94 **Pu** PLUTONIUM	(243) 95 **Am** AMERICIUM	(247) 96 **Cm** CURIUM	(247) 97 **Bk** BERKELIUM	(251) 98 **Cf** CALIFORNIUM	(252) 99 **Es** EINSTEINIUM	(257) 100 **Fm** FERMIUM	(258) 101 **Md** MENDELEVIUM	(259) 102 **No** NOBELIUM	(262) 103 **Lr** LAWRENCIUM

CONVERSION FACTORS:

ppb	1	100	10,000	-	-
ppm = g/t = µg/g	0.001	0.1	10	10,000	34.2857
oz/ton	0.00003	0.00292	0.29167	-	1
%	-	-	-	1	-

carat	1
mg/g	41.666

ton (avdp.)	1
kg	907.18474

oz (troy)	1
g	31.1035