Actlabs
Quality Analysis...
Innovative Technologies

2015 Euro Schedule of Services




Revised: Mar. 6/15

SCC Accredited LAB
LAB Accrédité CCN
TM

NELAP ACCREDITED
TNI
LABORATORY
E87979

28 Years of Innovation
Since 1987

kiwa
ISO 9001 QUALITY
QUALITY MANAGEMENT

TRC
ISO 9001:2008
TRC 00817

www.actlabs.com

President's Message

Quality, Innovation, and Service are the three words which best describe Activation Laboratories Ltd. (Actlabs). Since our inception in 1987, we have strived to identify and develop new and innovative technologies that we could implement with the help of our customers. Our customers in over 90 countries have always been one of our most important assets providing valuable feedback on ways that we can improve and better serve the industry.

With 27 laboratories in 13 countries around the world, we are committed to bringing the most modern technologies and a higher level of competencies to the analytical laboratory for the mineral industry. Our facilities are unrivalled by any commercial lab in the services that we offer and our very highly-skilled workforce.

Despite the low performance of the mineral industry in 2014 there were signs of recovery in certain geographical areas. As a result we opened two new facilities in 2014. We built a new lab in Copiapo, Chile, which became operational in October. As well, our sample preparation facility in Oulu, Finland became operational and has already proven to be quite successful.

We completed our move into our new 200,000 sq. foot global headquarters in the spring of 2014. The new facility consolidates all operations from our five buildings in Ancaster and has been designed with "lean 6 sigma" processes eliminating much of the waste. This is now one the most automated mineral labs in the mineral industry and is the largest geochemical lab in Eastern Canada. This will provide our customers with faster turnaround times and even higher quality standards.

The year 2014 continued to be very trying for the mineral industry with falling metal prices, particularly for gold and iron. We believe that the signs are now here that a recovery is just beginning. Hopefully 2015 will turn out to be a substantial improvement on 2014.

Eric Hoffman, PhD, P.Geo.
President and CEO
Activation Laboratories Ltd. (Actlabs)

New Global Headquarters, Ancaster, Ontario

Sample Packaging & Shipping Instructions

For convenience and to improve turnaround time, a sample submittal sheet can be filled out on-line and e-mailed. Make sure to include date of shipment, carrier or shipment method and the waybill number so that we can track delayed shipments. Please ensure all samples are identified clearly with sample numbers. This can be accomplished with waterproof ink on the sample bags or with sample tags in the sample bags. Turnaround time will be improved by packaging samples in order, neatly in shipping containers and providing an accurate sample list, with a hard copy with the shipment and an electronic copy sent by e-mail. If using pop top vials or glass bottles, ensure that they are taped shut and protected from breakage. Sealed plastic bags are best for shipping pulps. If using Bus Parcel Express, the bus station of destination is Hamilton, Ontario (for Ancaster, Ontario shipments). For most efficient delivery, we recommend the use of couriers, or transport companies for heavier shipments.

Samples should be shipped to: (for main Ancaster, Canada lab)

Activation Laboratories Ltd.
41 Bittern Street
Ancaster, Ontario
Canada L9G 4V5
Tel: 1-888-ACTLABS (1-888-228-5227)
or 1 (905) 648-9611
Fax: 1 (905) 648-9613
E-mail: samplereception@actlabs.com

Waybill Instructions:
Mineral Samples for Analysis, No Commercial Value
Value for Customs: €5.00

Canadian Customs Tariff (Harmonized Code) 2617.90.00.90
Customs Broker: Thompson Ahern & Co Ltd.

Instructions for report and invoice distribution should be included with each shipment, or can be sent to our e-mail address ***samplereception@actlabs.com***. Complimentary shipping labels are available upon request. Heavy duty plastic sample bags, cloth sample bags, soil envelopes and sample books are available at cost. Filling out a Request for Analysis form will provide all of the information required. ***Please visit www.actlabs.com for a Request for Analysis form.*** Sample submissions poorly labelled or packaged, or having incomplete or no submission sheets may not be processed until adequate written instructions are received from the client and may incur additional sorting charges. ***All soils and/or vegetation samples from outside Canada being sent to Canada for analysis should be sent to our main lab at 41 Bittern St.***

Quality Assurance/Quality Control (QA/QC)

Activation Laboratories Ltd. has achieved the ultimate accreditation to international standards, with either ISO 17025 for specific registered tests or certification to ISO 9001:2008. Our Ancaster, Ontario lab is also accredited to NELAP in the USA. ISO 17025 evaluates the quality system and specific analytical methodologies through proficiency testing and routine audits of the laboratory. In addition, we have achieved accreditation to CAN-P-1579, specific to mineral analysis laboratories. We are one of the few commercial laboratories which have achieved this distinction. Activation Laboratories Ltd. can also advise on methods you can use to ensure security of samples during transport to the laboratory. We have a rigorous chain of custody protocol in place to ensure security of your samples once we receive them. Analytical uncertainty is available on request. In 2007, Activation Laboratories Ltd. became accredited to NELAP in the USA.

Turnaround Time

Please enquire regarding turnaround time. Normal turnaround depends on the analytical package, sample volume as well as time of year. Excessively wet samples may slow turnaround time, as will undocumented and unorganized shipments. RUSH Analysis: If you require analyses by a certain date, please ensure that this is clearly noted on the Request for Analysis form. We will make every effort to meet your requirements, however, rush conditions will require payment of a surcharge (i.e., 3 days – 200%, 1 week – 100%, 2 weeks – 50%).

Return of Data

In an effort to reduce our impact on the environment, all reports and invoices are transmitted electronically in a PDF format and/or as an excel file at the e-mail address that you specified in your Request for Analysis form, sent together with your samples. If required, hard copies of reports and/or invoices are available upon request.

Weblims

We have implemented an online **Laboratory Information Management System (LIMS)**. Clients can track samples from sample reception and logging through to preparation, analysis and reporting. Please contact customerservice@actlabs.com to establish a WEBLIMS account for your project.

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Sample Preparation Packages

To obtain meaningful analytical results, it is imperative that sample collection and preparation be done properly. Actlabs can advise on sampling protocol for your field program if requested. Once the samples arrive in the laboratory, Actlabs will ensure that they are prepared properly. As a routine practice with rock and core, the entire sample is crushed to a nominal minus 10 mesh (1.7 mm), mechanically split to obtain a representative sample and then pulverized to at least 95% minus 150 mesh (105 microns). All of our steel mills are now mild steel and do not introduce Cr or Ni contamination. Quality of crushing and pulverization is routinely checked as part of our quality assurance program. Samples submitted in an unorganized fashion will be subject to a sorting surcharge and may substantially slow turnaround time. Providing an accurate detailed sample list by e-mail will also aid in improving turnaround time and for Quality Control purposes.

Rock, Core and Drill Cuttings

Code RX1	Crush (< 7 kg) up to 90% passing 10 mesh, riffle split (250 g) and pulverize (mild steel) to 95% passing 105µ included cleaner sand	€8.00
Code RX1+500	500 grams pulverized	add €1.00
Code RX1+800	800 grams pulverized	add €1.75
Code RX1+1.3	1.3 kg pulverized	add €2.50
Code RX1-SD	Crush (< 7 kg) up to 90% passing 10 mesh, rotary split (250 g) and pulverized (mild steel) to 95% passing 105µ	€7.50
Code RX3	Oversize charge per kilogram for crushing	€1.00
Code RX4	Pulverization only (mild steel) (coarse pulp or crushed rock) (< 800 g)	€5.25
Code RX5	Pulverize ceramic (100 g)	€13.00
Code RX6	Hand pulverize small samples (agate mortar & pestle) (<10g)	€13.00
Code RX7	Crush and split (< 5 kg)	€4.00
Code RX8	Sample prep only surcharge, no analyses	€3.25
Code RX9	Compositing (per composite) dry weight	€2.00
Code RX10	Weight (kg) as received	€1.75
Code RX11	Checking quality of pulps or rejects prepared by other labs and issuing report	€7.00
Code RX12	Ball Mill preparation	on request
Code RX13	Rod Mill preparation	on request
Code RX14	Core cutting	on request
Code RX15	Special Preparation/Hour	€48.00
Code RX16	Specific Gravity on Core	€12.00
Code RX16-W	Specific Gravity (WAX) on friable samples	€16.00
Code RX17	Specific Gravity on the pulp	€12.00
Code RX17-GP	Specific Gravity on the pulp by gas pycnometer	€16.00

Note: Larger sample sizes than listed above can be pulverized at additional cost.

Our Sample Preparation pricing is all-inclusive including: sorting, drying, labeling, new reject bags, using cleaner sand between each sample and crushing samples up to 7 kg (for RX1 and RX1-SD).


Riffle Splitting

Soils, Stream and Lake Bottom Sediments, and Heavy Minerals

Code S1	Drying (60ºC) and sieving (-80 mesh) save all portions	€3.00
Code S1 DIS	Drying (60ºC) and sieving (-80 mesh), discard oversize	€2.50
Code S1-230	Drying (60ºC) and sieving (-230 mesh), save oversize	€4.00
Code S1-230 DIS	Drying (60ºC) and sieving (-230 mesh), discard oversize	€3.75
Code S2	Lake bottom sediment preparation crush & sieve (-80 mesh)	€6.25
Code S3	Alternate size fractions and bracket sieving, add	€2.00
Code S4	Selective Extractions or SGH/OSG drying (40ºC) and sieving (-80 mesh)	€3.50
Code S5	Wet or damp samples submitted in plastic bags, add	€1.50
Code S6	Separating -2 micron material	€20.00
Code S7mi	Methylene iodide heavy mineral separation specific gravity can be customized (100 grams)	€52.00
Code S7w	Sodiumpolytungstate heavy mineral separation specific gravity can be customized (100 grams)	€52.00
Code S8	Sieve analysis (4 sieve sizes) coarser than 270 mesh	€28.00
Code S9	Particle size analysis (laser)	€72.00


Sample Pulverizers

Sample Preparation

Sample Preparation Packages

Biogeochemical Samples

Code B1	Drying and blending humus	€4.00
Code B2	Drying and macerating vegetation	€5.00
Code B3	Dry ashing	€7.00
Code B4	Washing vegetation	€3.50
Code B5	Samples submitted in plastic bags, add	€1.50

Special Digestion Procedures

Code MDI	Microwave digestion - closed vessel	€32.50

Sample Submission, Storage and Return

When submitting samples, please indicate on the Request for Analysis form if you require sample storage, disposal or if you require samples to be returned after analysis. For returns, please include all necessary shipping information e.g., courier, account number, etc. Return of samples is done at cost + 10%. The reject portion of samples prepared by Actlabs will be retained for a period of not more than 60 days from the date of final report. Pulps and rejects stored at the customers request will be subject to a storage charge (see sample submittal sheet for charges) billed quarterly. Irradiated material will be discarded after 30 days unless prior arrangements are made. Return of radioactive material requires a Nuclear Safety Commission licence. Cost per shipment of radioactive materials is €200.00 plus shipping costs. Disposal of soil, sediment or vegetation samples, which have entered Canada under a CFIA permit, will incur a disposal cost for larger sample volumes.

All soil, sediment and vegetation coming from outside Canada require incineration prior to disposal under CFIA regulations. All pulps and rejects will be returned to the client at cost + 10%. Disposal costs are additional. Pulps and rejects will incur a storage fee after the free period listed.

RTRN	Return of all reject portions and/or pulps	At cost + 10%
INCIN	Incineration of soil, sediment and vegetation samples from outside Canada (for samples up to 0.5 kg; samples over 0.5 kg will have higher incineration costs)	€0.30
H&R	Handling and retrieval of stored pulps and core	€46.25/hour to end of rock core and drill cuttings sample storage & disposal
DISP	Disposal of pulps and reject to landfill site	€0.20
STORE 1	Monthly storage of reject after 60 days	€0.25
STORE 2	Monthly storage of pulps after 90 days	€0.10
STORE 3	Monthly storage of sieve rejects after 3 months	€0.15

Gold and Silver Analyses

Gold and Silver Analyses - Geochem

Code	Method	Sample Weight (g)	Metric Range	Price
1A1	Au Fire Assay - INAA	30	1 - 20,000 ppb	€14.50
1A2 *	Au Fire Assay - AA	30	5 - 5,000 ppb	€12.00
1A2-50 *	Au Fire Assay - AA	50	5 - 5,000 ppb	€13.75
1A2-ICP	Au Fire Assay - ICP-OES	30	5 - 30,000 ppb	€13.00
1A6	Au BLEG - ICP-MS	1,000	0.1 - 10,000 ppb	€32.00
1A8	Au Aqua Regia - ICP-MS	30	0.2 - 2,000 ppb	€13.00
1E-Ag	Ag Aqua Regia - ICP-OES	0.5	0.2 - 50 ppm	€5.00

Gold and Silver Analyses - Assay

Code	Method	Sample Weight (g)	Metric Range	Price
1A3-30	Au Fire Assay - Gravimetric	30	0.03 - 10,000 g/mT	€16.00
1A3-50	Au Fire Assay - Gravimetric	50	0.03 - 10,000 g/mT	€17.00
1A3-Ag	Au, Ag Fire Assay - Gravimetric	30	0.03 - 10,000 g/mT (Au) 3 - 1,000 g/mT (Ag)	€18.50
1A4 **	Au Fire Assay - Metallic Screen	500	0.03 g/mT	€56.00
1A4-1000 **	Au Fire Assay - Metallic Screen	1,000	0.03 g/mT	€64.00
8-Ag	Ag Fire Assay - Gravimetric	30	3 - 1,000 g/mT	€13.00

When submitting samples for Au and Ag analysis, or Au, Pt Pd and Rh analysis, please try to ensure you send two-times the listed weight.

Gold, Platinum, Palladium and Rhodium

Code	Method	Sample Weight (g)	Range (ppb)				Price
			Au	Pt	Pd	Rh	
1C-Exploration	Fire Assay - ICP-MS	30	2 - 30,000	1 - 30,000	1 - 30,000		€16.00
1C-EXP 2	Fire Assay - ICP-MS	30	1 - 30,000	0.5 - 30,000	0.5 - 30,000		€17.75
1C-research	Fire Assay - ICP-MS	30	1 - 30,000	0.1 - 30,000	0.1 - 30,000		€25.75
1C-Rhodium	Fire Assay - ICP-MS	30	-	-	-	5 - 10,000	€24.00
1C-OES	Fire Assay - ICP-OES	30	2 - 30,000	5 - 30,000	5 - 30,000		€13.75
8 Au Pt Pd	Fire Assay - ICP-OES	30	0.001 - 1000 g/mT	0.001 - 1000 g/mT	0.001 - 1000 g/mT		€36.00

Platinum Group Elements

Code	Method	Sample Weight (g)	Range (ppb)								Price
			Os	Ir	Ru	Rh	Pt	Pd	Au	Re	
1B1	NiS Fire Assay - INAA	50	2	0.1	5	0.2	5 †	2	0.5	5	1-2 samples €256.00 3+ samples €128.00
1B2	NiS Fire Assay - ICP-MS	50	-	1	1	1	1	1	1	1	1-2 samples €256.00 3+ samples €128.00

Organic Sample Surcharge - €1.00/sample for Fire Assay packages

Notes:

Use of 50 gram sample for fire assay may not provide optimum recovery.

* Detection limit can be extended to 10,000 ppb if required. Please specify when required.

** A representative 500 gram or 1000 gram (or customized) sample split is sieved at 100 mesh (150 micron), with assays performed on the entire +100 mesh fraction and two splits of the -100 mesh fraction. It is important not to overpulverize the sample too finely, as tests have shown gold will plate out on the mill and be lost. When assays have been completed on the coarse and fine portions of the bulk sample, a final assay is calculated based on the weight of each fraction.

† Detection limits for Pt are increased with high Au/Pt ratios and limits for other elements will be affected by abnormally high Au, Sb and Cu content.

Samples with high Au can be reanalyzed by Code 1C exploration or research. Zn concentrates are not amenable to the nickel sulphide fire assay. Au results by Code 1B1 or 1B2 can be low by nickel sulphide fire assay. For accurate Au values, please request Code 1C-exploration.

Aqua Regia Partial Extractions

This leach uses a combination of concentrated hydrochloric and nitric acids to leach suphides, some oxides and some silicates. Mineral phases which are hardly (if at all) attacked include barite, zircon, monazite, sphene, chromite, gahnite, garnet, ilmenite, rutile and cassiterite. The balance of silicates and oxides are only slightly to moderately attacked, depending on the degree of alteration. Generally, but not always, most base metals and gold are usually dissolved.

Note: **Results from aqua regia or total digestions may be lab dependent or lab operator dependent. Actlabs has automated this aspect of digestion using a microprocessor designed hotbox to accurately reproduce digestion conditions every time.**

Hg add-on by cold vapour FIMS	
Code 1G (5 ppb)	add €7.25

Assays

Package	Code 8 - AR ICP-OES	Code 8 - AR ICP-MS
Ag	0.0003 - 1 %	-
As	-	0.0004 - 10 %
Bi	-	0.0001 %
Cd	0.003 %	-
Co	0.003 %	0.0001 %
Cs	-	0.0001 %
Cu	0.001 - 10 %	0.0001 - 10 %
Fe	0.003 - 30 %	-
Ga	-	0.0001 %
Ge	-	0.0001 %
Hg	0.001 %	-
In	-	0.0001 %
Li	-	0.0001 %
Mn	0.003 - 20 %	-
Mo	-	0.0001 %
Nb	-	0.0001 %
Ni	0.003 %	0.0001 %
Pb	0.003 - 4 %	0.0001 - 4 %
Re	-	0.0001 %
Se	-	0.0001 %
Sn	-	0.0003 %
Ta	-	0.0001 %
Te	-	0.0001 %
Th	-	0.0001 %
Tl	-	0.0001 %
U	-	0.0001 %
W	-	0.0001 %
Zn	0.001 - 20 %	0.0001 - 2 %
One Element	**€9.25**	**€12.00**
Each Additional Element	**€1.75**	**€1.75**
All Elements	**€13.25**	**€16.00**

	ICP-OES		ICP-MS		ICP-OES + ICP-MS
Package	**1E**	**1E3**	**1DX/AQ200**	**Ultratrace 1**	**Ultratrace 2**
Ag	0.2 - 100 ppm	0.2 - 100 ppm	0.1 - 100 ppm	0.002 - 100 ppm	0.002 - 100 ppm
Al *	-	0.01 - 10 %	0.01 - 10 %	0.01 - 10 %	0.01 - 10 %
As	-	2 - 10,000 ppm	0.5 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm
Au *	-	-	0.5 - 1,000 ppb	0.5 - 10,000 ppb	0.5 - 10,000 ppb
B *	-	10 - 10,000 ppm	20 - 2,000 ppm	1 - 5,000 ppm	1 - 5,000 ppm
Ba *	-	10 - 10,000 ppm	1 - 10,000 ppm	0.5 - 6,000 ppm	0.5 - 6,000 ppm
Be *	-	0.5 - 1,000 ppm	-	0.1 - 1,000 ppm	0.1 - 1,000 ppm
Bi	-	2 - 10,000 ppm	0.1 - 2,000 ppm	0.02 - 2,000 ppm	0.02 - 2,000 ppm
Ca *	-	0.01 - 50 %	0.01 - 50 %	0.01 - 50 %	0.01 - 50 %
Cd *	0.5 - 2,000 ppm	0.5 - 2,000 ppm	0.1 - 2,000 ppm	0.01 - 2,000 ppm	0.01 - 1,000 ppm
Ce *	-	-	-	0.01 - 10,000 ppm	0.01 - 10,000 ppm
Co	-	1 - 10,000 ppm	0.1 - 5,000 ppm	0.1 - 5,000 ppm	0.1 - 5,000 ppm
Cr *	-	1 - 10,000 ppm	1 - 10,000 ppm	0.5 - 10,000 ppm	1 - 10,000 ppm
Cs *	-	-	-	0.02 - 500 ppm	0.02 - 500 ppm
Cu	1 - 10,000 ppm	1 - 10,000 ppm	0.1 - 10,000 ppm	0.01 - 10,000 ppm	0.01 - 10,000 ppm
Dy	-	-	-	0.1 - 1,000 ppm	0.1 - 1,000 ppm
Er *	-	-	-	0.1 - 1,000 ppm	0.1 ppm
Eu *	-	-	-	0.1 - 100 ppm	0.1 ppm
Fe *	-	0.01 - 50 %	0.01 - 50 %	0.01 - 50 %	0.01 - 50 %
Ga *	-	10 - 10,000 ppm	1 - 1,000 ppm	0.02 - 500 ppm	0.02 - 500 ppm
Gd *	-	-	-	0.1 - 1,000 ppm	0.1 - 1,000 ppm
Ge *	-	-	-	0.1 - 500 ppm	0.1 - 500 ppm
Hf *	-	-	-	0.1 - 500 ppm	0.1 - 500 ppm
Hg	1 - 10,000 ppm	1 - 10,000 ppm	0.01 - 50 ppm	10 - 10,000 ppb	10 - 10,000 ppb
Ho *	-	-	-	0.1 - 1,000 ppm	0.1 - 1,000 ppm
In *	-	-	-	0.02 - 500 ppm	0.02 - 500 ppm
K *	-	0.01 - 10 %	0.01 - 5 %	0.01 - 5 %	0.01 - 5 %
La *	-	10 - 10,000 ppm	1 - 10,000 ppm	0.5 - 10,000 ppm	0.5 - 1,000 ppm
Li *	-	-	-	0.1 - 10,000 ppm	0.1 - 10,000 ppm
Lu *	-	-	-	0.1 - 100 ppm	0.1 - 100 ppm
Mg *	-	0.01 - 25 %	0.01 - 10 %	0.01 - 10 %	0.01 - 10 %
Mn *	2 - 100,000 ppm	5 - 100,000 ppm	1 - 10,000 ppm	1 - 10,000 ppm	1 - 10,000 ppm
Mo *	2 - 10,000 ppm	1 - 10,000 ppm	0.1 - 10,000 ppm	0.01 - 10,000 ppm	0.01 - 10,000 ppm
Na *	-	0.001 - 10 %	0.001 - 5 %	0.001 - 5 %	0.001 - 5 %
Nb *	-	-	-	0.1 - 500 ppm	0.1 - 500 ppm
Nd *	-	-	-	0.02 -5,000 ppm	0.02 - 5,000 ppm
Ni *	1 - 10,000 ppm	1 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm
P *	-	0.001 - 10 %	0.001 - 10 %	0.001 - 10 %	0.001 - 10 %
Pb	2 - 5,000 ppm	2 - 5,000 ppm	0.1 - 5,000 ppm	0.01 - 5,000 ppm	0.01 - 5,000 ppm
Pr *	-	-	-	0.1 -1,000 ppm	0.1 - 1,000 ppm
Rb *	-	-	-	0.1 - 500 ppm	0.1 - 500 ppm
Re	-	-	-	0.001 - 100 ppm	0.001 - 100 ppm
S +	0.001 - 20 %	0.01 - 20 %	1 - 20 %	1 - 20 %	0.001 - 20 %
Sb *	-	2 - 10,000 ppm	0.1 - 500 ppm	0.02 - 500 ppm	0.02 - 500 ppm
Sc *	-	1 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm
Se	-	-	0.5 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm
Sm *	-	-	-	0.1 - 100 ppm	0.1 - 100 ppm
Sn *	-	-	-	0.05 - 200 ppm	0.05 - 200 ppm
Sr *	-	1 - 10,000 ppm	1 - 5,000 ppm	0.5 - 5,000 ppm	0.5 - 5,000 ppm
Ta *	-	-	-	0.05 - 50 ppm	0.05 - 50 ppm
Tb *	-	-	-	0.1 - 100 ppm	0.1 - 100 ppm
Te	-	1 - 500 ppm	0.2 - 500 ppm	0.02 - 500 ppm	0.02 - 500 ppm
Th *	-	20 - 10,000 ppm	0.1 - 200 ppm	0.1 - 200 ppm	0.1 - 200 ppm
Ti *	-	0.01 - 20 %	0.001 - 20 %	0.001 - 20 %	0.01 - 20 %
Tl *	-	2 - 10,000 ppm	0.1 - 500 ppm	0.02 - 500 ppm	0.02 - 500 ppm
Tm *	-	-	-	0.1 - 1,000 ppm	0.1 - 1,000 ppm
U	-	10 - 10,000 ppm	-	0.1 - 10,000 ppm	0.1 - 10,000 ppm
V *	-	1 - 10,000 ppm	2 - 1,000 ppm	1 - 1,000 ppm	1 - 1,000 ppm
W *	-	10 - 200 ppm	0.1 - 200 ppm	0.1 - 200 ppm	0.1 - 200 ppm
Y *	-	1 - 1,000 ppm	-	0.01 - 500 ppm	0.01 - 500 ppm
Yb *	-	-	-	0.1 - 200 ppm	0.1 - 200 ppm
Zn	1 - 10,000 ppm	2 - 10,000 ppm	1 - 5,000 ppm	0.1 - 5,000 ppm	0.1 - 5,000 ppm
Zr *	-	1 - 10,000 ppm	-	0.1- 5,000 ppm	0.1 - 5,000 ppm
Price:	**€8.75**	**€10.00**	**€12.75**	**€17.00**	**€18.50**

* Partial extraction only
\+ only sulphide sulphur is extracted

"Near Total" Digestions

This acid attack is the most vigorous digestion used in geochemistry. It will employ hydrocholoric, nitric, perchloric and hydrofluoric acids. Even with this digestion, certain minerals (barite, gahnite, chromite, cassiterite, etc.) may not go into solution. Other minerals including zircon, sphene and magnetite may not be totally dissolved. Most other silicates will be dissolved, however some elements will be erratically volatilized, including Si, As, Sb, Cr, U and Au.

Near-Total digestion **cannot** be used to get accurate determinations of REE, Ta, Nb, As, Sb, Sn, Hg, Cr, Au and Si.

Note: **Results from aqua regia or total digestions may be lab dependent or lab operator dependent. Actlabs has automated this aspect of digestion using a microprocessor designed hotbox to accurately reproduce digestion conditions every time.**

Hg add-on by cold vapour FIMS	
Code 1G (5 ppb)	add €7.25

Assays

Package	Code 8 - 4 Acid ICP-OES	Code 8 - 4 Acid ICP-MS
Ag	0.0003 - 1 %	0.0001 - 1 %
As	-	0.0001 %
Ba	-	0.0001 %
Be	-	0.0001 %
Bi	-	0.0001 %
Cd	0.003 %	0.0001 %
Co	0.003 %	0.0001 %
Cu	0.001 %	0.0001 %
Fe	0.003 %	-
Li	0.01 %	-
Mn	0.003 %	0.0001 %
Mo	0.003 %	0.0001 %
Ni	0.003 %	0.0001 %
Pb	0.003 - 10 %	0.0001 - 10 %
Sb	-	0.0001 %
Se	-	0.0001 %
Sn	-	0.0001 %
Sr	-	0.0001 %
Tl	-	0.0001 %
U	-	0.0001 %
Zn	0.001 - 40 %	0.0001 - 40 %
One Element	**€10.50**	**€12.00**
Each Additional Element	**€1.75**	**€1.75**
All Elements	**€14.50**	**€16.00**

	ICP-OES	ICP-MS		ICP-OES + ICP-MS	
Package	**1F2**	**1EX/MA200**	**Ultratrace 4**	**Ultratrace 6**	**ME-MS61**
Ag	0.3 - 100 ppm	0.1 - 100 ppm	0.05 - 100 ppm	0.05 - 100 ppm	0.01 - 100 ppm
Al *	0.01 - 50 %	0.01 - 20 %	0.01 - 10 %	0.01 - 10 %	0.01 - 50 %
As *	3 - 5,000 ppm	1 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm	0.2 - 10,000 ppm
Au	-	100 - 2,000 ppb	-	-	-
B	-	-	1 - 6,000 ppm	-	-
Ba *	7 - 1,000 ppm	1 - 10,000 ppm	1 - 5,000 ppm	1 - 5,000 ppm	10 - 10,000 ppm
Be	1 - 10,000 ppm	1 - 1,000 ppm	0.1 - 1,000 ppm	0.1 - 1,000 ppm	0.05 - 1,000 ppm
Bi	2 - 10,000 ppm	0.1 - 4,000 ppm	0.02 - 2,000 ppm	0.02 - 2,000 ppm	0.01 - 10,000 ppm
Br	-	-	-	-	-
Ca	0.01 - 70 %	0.01 - 40 %	0.01 - 50 %	0.01 - 50 %	0.01 - 50 %
Cd	0.3 - 2,000 ppm	0.1 - 4,000 ppm	0.1 - 1,000 ppm	0.1 - 1,000 ppm	0.02 - 1,000 ppm
Ce *	-	1 - 2,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm	0.01 - 500 ppm
Co	1 - 10,000 ppm	0.2 - 4,000 ppm	0.1 - 500 ppm	0.1 - 500 ppm	0.1 - 10,000 ppm
Cr *	1 - 10,000 ppm	1 - 10,000 ppm	0.5 - 5,000 ppm	0.5 - 5,000 ppm	1 - 10,000 ppm
Cs	1 - 10,000 ppm	0.1 - 10,000 ppm	0.05 - 100 ppm	0.05 - 100 ppm	0.05 - 500 ppm
Cu	1 - 10,000 ppm	0.1 - 10,000 ppm	0.2 - 10,000 ppm	0.2 - 10,000 ppm	0.2 - 10,000 ppm
Dy *	-	-	0.1 - 5000 ppm	0.1 - 5,000 ppm	-
Er *	-	-	0.1 - 1,000 ppm	0.1 - 1,000 ppm	-
Eu *	-	-	0.05 - 100 ppm	0.05 - 100 ppm	-
Fe *	0.01 - 50 %	0.01 - 60 %	0.01 - 50 %	0.01 - 50 %	0.01 - 50 %
Ga	1 - 10,000 ppm	-	0.1 - 500 ppm	0.1 - 500 ppm	0.05 - 10,000 ppm
Gd *	-	-	0.1 - 5,000 ppm	0.1 - 5,000 ppm	-
Ge	-	-	0.1 - 500 ppm	0.1 - 500 ppm	0.05 - 500 ppm
Hf *	-	0.1 - 1,000 ppm	0.1 - 500 ppm	0.1 - 500 ppm	0.1 - 500 ppm
Hg	1 - 1,000 ppm	-	10 - 10,000 ppb	10 - 10,000 ppb	-
Ho *	-	-	0.1 - 1,000 ppm	0.1 - 1,000 ppm	-
In	-	-	0.1 - 100 ppm	0.1 - 100 ppm	0.005 - 500 ppm
K	0.01 - 10 %	0.01 - 10 %	0.01 - 5 %	0.01 - 5 %	0.01 - 10 %
La *	-	0.1 - 2,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm	0.5 - 10,000 ppm
Li	1 - 10,000 ppm	0.1 - 2,000 ppm	0.5 - 400 ppm	0.5 - 400 ppm	0.2 - 10,000 ppm
Lu *	-	-	0.1 - 100 ppm	0.1 - 100 ppm	-
Mg	0.01 - 50 %	0.01 - 30 %	0.01 - 50 %	0.01 - 50 %	0.01 - 50 %
Mn	1 - 100,000 ppm	1 - 10,000 ppm	1 - 10,000 ppm	1 - 10,000 ppm	5 - 100,000 ppm
Mo	1 - 10,000 ppm	0.1 - 4,000 ppm	0.05 - 10,000 ppm	0.1 - 10,000 ppm	0.05 - 10,000 ppm
Na	0.01 - 10 %	0.001 - 10 %	0.01 - 3 %	0.01 - 3 %	0.01 - 10 %
Nb *	-	0.1 - 2,000 ppm	0.1 - 500 ppm	0.1 - 500 ppm	0.1 - 500 ppm
Nd *	-	-	0.1 - 10,000 ppm	0.1 - 10,000 ppm	-
Ni	1 - 10,000 ppm	0.1 - 10,000 ppm	0.5 - 5,000 ppm	0.5 - 5,000 ppm	0.2 - 10,000 ppm
P	0.001 - 10 %	0.001 - 5 %	-	0.001 - 10 %	10 - 10,000 ppm
Pb	3 - 5,000 ppm	0.1 - 5,000 ppm	0.5 - 5,000 ppm	0.5 - 5,000 ppm	0.5 - 10,000 ppm
Pr *	-	-	0.1 - 5,000 ppm	0.1 - 1,000 ppm	-
Rb	-	0.1 - 2,000 ppm	0.2 - 500 ppm	0.2 - 5,000 ppm	0.1 - 10,000 pm
Re	-	-	0.001 - 100 ppm	0.001 - 100 ppm	0.002 - 50 ppm
S +	0.01 - 20 %	1 - 10 %	-	0.01 - 20 %	0.01 - 10 %
Sb	5 - 10,000 ppm	0.1 - 4,000 ppm	0.1 - 500 ppm	0.1 - 500 ppm	0.05 - 10,000 ppm
Sc	4 - 10,000 ppm	1 - 200 ppm	-	1 - 5,000 ppm	0.1 - 10,000 ppm
Se	-	-	0.1 - 1,000 ppm	0.1 - 1,000 ppm	1 - 1,000 ppm
Sm *	-	-	0.1 - 100 ppm	0.1 - 100 ppm	-
Sn *	-	0.1 - 2,000 ppm	1 - 200 ppm	1- 200 ppm	0.2 - 500 ppm
Sr	1 - 10,000 ppm	1 - 10,000 ppm	0.2 - 10,000 ppm	0.2 - 1,000 ppm	0.2 - 10,000 ppm
Ta *	-	0.1 - 2,000 ppm	0.1 - 1,000 ppm	0.1 - 1,000 ppm	0.05 - 100 ppm
Tb *	-	-	0.1 - 100 ppm	0.1 - 100 ppm	-
Te	2 -10,000 ppm	-	0.1 - 500 ppm	0.1 - 500 ppm	0.05 - 500 ppm
Th *	-	0.1 - 4,000 ppm	0.1 - 500 ppm	0.1 - 500 ppm	0.2 - 10,000 pm
Ti	0.01 - 10 %	0.001 - 10 %	-	0.0005 - 10 %	0.005 - 10 %
Tl	5 - 10,000 ppm	0.05 - 10,000 ppm	0.05 - 500 ppm	0.05 - 500 ppm	0.02 - 10,000 ppm
Tm *	-	-	0.1 -1,000 ppm	0.1 - 1,000 ppm	-
U	10 - 10,000 ppm	0.1 - 4,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm
V	2 - 10,000 ppm	4 - 10,000 ppm	1 - 10,000 ppm	1 - 1,000 ppm	1 - 10,000 ppm
W *	5 - 10,000 ppm	0.1 - 200 ppm	0.1 - 200 ppm	0.1 - 200 ppm	0.1 - 10,000 ppm
Y *	1 - 1,000 ppm	0.1 - 2,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 500 ppm
Yb *	-	-	0.1 - 5,000 ppm	0.1 - 5,000 ppm	-
Zn	1 - 10,000 ppm	1 - 10,000 ppm	0.2 - 10,000 ppm	0.2 - 10,000 ppm	2 - 10,000 ppm
Zr *	5 - 10,000 ppm	0.1 - 2,000 ppm	1 - 5,000 ppm	1 - 5,000 ppm	0.5 - 500 ppm
Price:	**€14.50**	**€15.00**	**€18.50**	**€25.75**	**€21.75**

* Partial extraction only
\+ only sulphide sulphur is extracted

Trace Element Geochemistry & Digestion Specific Assays

Peroxide Fusion Packages

Peroxide Fusions: Sodium peroxide fusion will result in a total metal recovery. It is effective for the decomposition of sulphides and refractory minerals. For nickel sulphide deposits this is the preferred method. This method is not suitable if sodium is required.

Note: **Results from aqua regia or total digestions may be lab dependent or lab operator dependent. Actlabs has automated this aspect of digestion using a microprocessor designed hotbox to accurately reproduce digestion conditions every time.**

Assays

Package	ICP-OES	ICP-MS
	8-Peroxide ICP-OES	8-Peroxide ICP-MS
Al	0.01 - 50 %	-
As	0.01 - 10 %	0.001 - 10 %
Be	0.001 - 1 %	-
Bi	-	0.001 - 1 %
Ca	0.01 - 50 %	-
Co	0.002 - 10 %	0.001 - 10 %
Cr	0.01 - 60 %	-
Cs	-	0.001 - 1 %
Cu	0.005 - 40 %	0.001 - 40 %
Fe	0.05 -100 %	-
Ga	-	0.001 - 1 %
Ge	-	0.001 - 1 %
In	-	0.001 - 1 %
K	0.1 -100 %	-
Li	0.01 - 10 %	0.001 - 10 %
Mg	0.01 - 30 %	-
Mn	0.01 - 100 %	-
Mo	-	0.001 - 10 %
Nb	-	0.001 - 10 %
Ni	0.005 - 40 %	0.001 - 40 %
P	0.005 - 20 %	-
Pb	0.01 - 30 %	0.001 - 30 %
Re	-	0.001 - 0.5 %
S	0.01 - 60 %	-
Se	-	0.001 - 1 %
Si	0.01 - 100 %	-
Sn	-	0.001 - 40 %
Ta	-	0.001 - 10 %
Te	-	0.001 - 1 %
Th	-	0.001 - 10 %
Ti	0.01 - 30 %	-
Tl	-	0.001 - 30 %
U	-	0.001 - 10 %
W	0.005 - 20 %	0.001 - 10 %
Zn	0.01 - 40 %	0.001 - 40 %
One Element	**€13.00**	**€15.25**
Each Additional Element	**€2.50**	**€2.50**
All Elements	**€20.00**	**€24.00**

Note: For concentrates, titration may be applicable. Please inquire.

Package	ICP-OES+ICP-MS
	Ultratrace 7
Al *	0.01 - 25 %
As	5 - 100,000 ppm
B	10 - 10,000 ppm
Ba *	3 - 10,000 ppm
Be	3 - 10,000 ppm
Bi	2 - 10,000 ppm
Ca	0.01 - 50 %
Cd	2 - 10,000 ppm
Ce *	0.8 - 5,000 ppm
Co	0.2 - 5,000 ppm
Cr *	30 - 10,000 ppm
Cs	0.1 - 10,000 ppm
Cu	2 - 10,000 ppm
Dy *	0.3 - 5,000 ppm
Er *	0.1 - 5,000 ppm
Eu *	0.1 - 1,000 ppm
Fe *	0.05 - 75 %
Ga	0.2 - 10,000 ppm
Gd *	0.1 - 5,000 ppm
Ge	0.7 - 5,000 ppm
Hf *	10 - 5,000 ppm
Ho	0.2 - 1,000 ppm
In	0.2 - 1,000 ppm
K	0.1 - 25 %
La *	0.4 - 10,000 ppm
Li	3 - 10,000 ppm
Mg	0.01 - 30 %
Mn	3 - 10,000 ppm
Mo	1 - 10,000 ppm
Nb *	2.4 - 10,000 ppm
Nd *	0.4 - 5,000 ppm
Ni	10 - 10,000 ppm
P	0.005 - 20 %
Pb	0.8 - 5,000 ppm
Pr *	0.1 - 1,000 ppm
Rb	0.4 - 10,000 ppm
S +	0.01 - 20 %
Sb	2 - 10,000 ppm
Se	0.8 - 10,000 ppm
Si	0.01 - 60 %
Sm *	0.1 - 1,000 ppm
Sn *	0.5 - 10,000 ppm
Sr	3 - 10,000 ppm
Ta *	0.2 - 10,000 ppm
Tb *	0.1 - 1,000 ppm
Te	6 - 10,000 ppm
Th *	0.1 - 1,000 ppm
Ti	0.01 - 50 %
Tl	0.1 - 1,000 ppm
Tm *	0.1 - 1,000 ppm
U	0.1 - 10,000 ppm
V	5 - 10,000 ppm
W	0.7 - 10,000 ppm
Y *	0.1 - 1,000 ppm
Yb *	0.1 - 1,000 ppm
Zn	25 - 10,000 ppm
Price:	**€32.00**

Hg add-on by cold vapour FIMS	
Code 1G (5 ppb)	add €7.25

* Partial extraction only
\+ only sulphide sulphur is extracted

Multi-Method Packages

	INAA+ICP-OES	INAA, ICP-OES, ICP-MS	INAA+ICP-MS
Package	**1H**	**Ultratrace 3**	**Ultratrace 5**
Ag	0.3 - 10,000 ppm	0.05 - 10,000 ppm	0.05 - 100,000 ppm
Al *	0.01 -50 %	0.01 - 50 %	-
As	0.5 - 100,000 ppm	0.5 - 100,000 ppm	0.5 - 100,000 ppm
Au	2 - 30,000 ppb	2 - 30,000 ppb	2 - 30,000 ppb
Ba *	50 - 500,000 ppm	1 - 100,000ppm	1 - 100,000 ppm
Be	1 - 10,000 ppm	0.1 - 1,000 ppm	0.1 - 1,000 ppm
Bi	2 -10,000 ppm	0.02 - 10,000 ppm	0.02 - 2,000 ppm
Br	0.5 -5,000 ppm	0.5 - 5,000 ppm	0.5 - 5,000 ppm
Ca	0.01 - 70 %	0.01 - 70 %	0.01 - 50 %
Cd	0.3 - 2,000 ppm	0.1 - 2,000 ppm	0.1 - 1,000 ppm
Ce *	3 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm
Co	1 - 5,000 ppm	1 - 5,000 ppm	0.1 - 5,000 ppm
Cr *	2 - 100,000 ppm	1 - 10,000 ppm	1 - 100,000 ppm
Cs	1 - 10,000 ppm	0.05 - 5,000 ppm	0.05 - 5,000 ppm
Cu	1 - 10,000 ppm	0.2 - 10,000 ppm	0.2 - 10,000 ppm
Dy *	-	0.1 - 5000 ppm	0.1 - 5000 ppm
Er *	-	0.1 - 1,000 ppm	0.1 - 1,000 ppm
Eu *	0.2 - 10,000 ppm	0.05 - 1,000 ppm	0.05 - 100 ppm
Fe *	0.01 - 70 %	0.01 - 70 %	0.01 - 50 %
Ga	-	0.1 - 500 ppm	0.1 - 500 ppm
Gd *	-	0.1 - 500 ppm	0.1 - 5,000 ppm
Ge	-	0.1 - 500 ppm	0.1 - 500 ppm
Hf *	1 -5,000 ppm	0.1 - 5,000 ppm	1 - 5,000 ppm
Hg	1 - 10,000 ppm	10 - 10,000 ppb	10 - 10,000 ppb
Ho	-	0.1 - 1,000 ppm	0.1 - 1,000 ppm
In	-	0.1 - 100 ppm	0.1 - 100 ppm
Ir	5 - 10,000 ppb	5 - 10,000 ppb	-
K	0.01 - 10 %	0.01 - 10 %	0.01 - 5 %
La *	0.5 - 10,000 ppm	0.5 - 10,000 ppm	0.1 - 10,000 ppm
Li	1 - 10,000 ppm	0.5 - 10,000 ppm	0.5 - 400 ppm
Lu *	0.05 - 10,000 ppm	0.1 - 100 ppm	0.1 - 100 ppm
Mg	0.01 - 50 %	0.01 - 50 %	0.01 - 10 %
Mn	1 - 100,000 ppm	1 - 100,000 ppm	1 - 10,000 ppm
Mo	1 - 10,000 ppm	0.2 - 10,000 ppm	0.05 - 10,000 ppm
Na	0.01 - 50 %	0.01 - 20 %	0.01 - 20 %
Nb *	-	0.1 - 500 ppm	0.1 - 500 ppm
Nd *	5 - 10,000 ppm	0.01 - 10,000 ppm	0.1 - 10,000 ppm
Ni	1 - 100,000 ppm	0.5 - 100,000 ppm	0.5 - 100,000 ppm
P	0.001 - 10 %	0.001 - 10 %	-
Pb	3 - 5,000 ppm	0.5 - 5,000 ppm	0.5 - 5,000 ppm
Pr *	-	0.1 - 1,000 ppm	0.1 - 1,000 ppm
Rb	15 -10,000 ppm	0.2 - 5,000 ppm	0.2 - 5,000 ppm
Re	-	0.001 - 100 ppm	0.001 - 100 ppm
S +	0.01 - 20 %	0.01 - 20 %	-
Sb	0.1 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm
Sc	0.1 - 1,000 ppm	0.1 - 1,000 ppm	0.1 - 1,000 ppm
Se	3 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm
Sm *	0.1 - 10,000 ppm	0.1 - 100 ppm	0.1 - 100 ppm
Sn *	0.01 - 20 %	1 - 200 ppm	1- 200 ppm
Sr	1 - 10,000 ppm	0.2 - 1,000 ppm	0.2 - 1,000 ppm
Ta *	0.5 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm
Tb *	0.5 - 10,000 ppm	0.1 - 5,000 ppm	0.1 - 100 ppm
Te	-	0.02 - 500 ppm	0.1 - 500 ppm
Th *	0.2 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm
Ti	0.01 - 10 %	0.01 - 10 %	-
Tl	-	0.05 - 500 ppm	0.05 - 500 ppm
Tm *	-	0.1 - 1,000 ppm	0.1 - 1,000 ppm
U	0.5 - 10,000 ppm	0.1 - 10,000 ppm	0.1 - 10,000 ppm
V	2 - 10,000 ppm	2 - 10,000 ppm	1 - 1,000 ppm
W	1 - 10,000 ppm	1 - 10,000 ppm	1 - 10,000 ppm
Y *	1 - 1,000 ppm	0.01 - 10,000 ppm	0.1 - 10,000 ppm
Yb *	0.2 - 10,000 ppm	0.1 - 5,000 ppm	0.1 - 5,000 ppm
Zn	1 - 100,000 ppm	0.5 - 100,000 ppm	0.5 - 100,000 ppm
Zr *	-	1 - 5,000 ppm	1 - 5,000 ppm
Price:	**€24.00**	**€36.00**	**€27.25**

* Partial extraction only
\+ only sulphide sulphur is extracted
Bold elements are reported by INAA (total elements)

Geochemical Exploration for Epithermal Deposits

	INAA+ICP-OES	INAA, ICP-OES, ICP-MS
Package	**Code 1EPI**	**Code 1EPI/MS**
Ag	**0.2 - 10,000 ppm**	**0.2 - 10,000 ppm**
As	**2 - 10,000 ppm**	**2 - 10,000 ppm**
Au	**5 - 30,000 ppb**	**5 - 30,000 ppb**
Ba	**50 - 100,000 ppm**	**100 - 100,000 ppm**
Bi	-	0.1 - 1,000 ppm
Ca *	-	0.01 - 50 %
Cd	0.5 - 5,000 ppm	0.5 - 5,000 ppm
Cs	-	**2 - 10,000 ppm**
Cu	1 - 10,000 ppm	1 - 10,000 ppm
Fe	**0.02 - 75%**	**0.02 - 75 %**
Ga *	-	1 - 10,000 ppm
Ge	-	0.1 - 1,000 ppm
Hg *	1 - 10,000 ppm	0.01 - 1,000 ppm
K *	-	0.01 - 20 %
Mn	2 - 20,000 ppm	2 - 20,000 ppm
Mo	2 - 10,000 ppm	2 - 10,000 ppm
Na	-	0.01 - 50 %
Ni *	1 - 10,000 ppm	1 - 10,000 ppm
Pb	2 - 5,000 ppm	2 - 5,000 ppm
S +	0.001 - 20 %	0.001 - 20 %
Sb	**0.2 - 10,000 ppm**	**0.2 - 10,000 ppm**
Se	-	0.1 - 1,000 ppm
Te	-	0.1 - 1,000 ppm
Tl *	-	0.1 - 1,000 ppm
W	**4 - 10,000 ppm**	**4 - 10,000 ppm**
Zn *	1 - 10,000 ppm	1 - 10,000 ppm
Price:	**€19.25**	**€26.50**

Hg add-on by cold vapour FIMS	
Code 1G (5 ppb)	add €7.25

ICP-OES and ICP-MS analyses by 4-acid (hydrochloric, nitric, perchloric and hydrofluoric) digestion are "near total" digestions. INAA analysis yields total metals.

Note: **Results from aqua regia or total digestions may be lab dependent or lab operator dependent. Actlabs has automated this aspect of digestion using a micro-processor designed hotbox to accurately reproduce digestion conditions every time.**

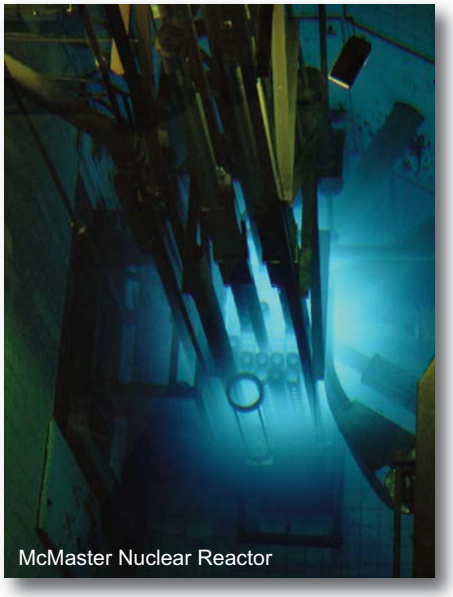
INAA Packages

INAA	
1D Enhanced	
Ag	5 - 100,000 ppm
As	0.5 - 10,000 ppm
Au	2 - 30,000 ppb
Ba	50 - 10,000 ppm
Br	0.5 - 1,000 ppm
Ca	1 - 50 %
Ce	3 - 10,000 ppm
Co	1 - 5,000 ppm
Cr	5 - 100,000 ppm
Cs	1 - 10,000 ppm
Eu	0.2 - 2,000 ppm
Fe	0.01 - 75 %
Hf	1 - 500 ppm
Hg	1 - 1,000 ppm
Ir	5 - 10,000 ppb
La	0.5 - 10,000 ppm
Lu	0.05 - 1,000 ppm
Mo	1 - 10,000 ppm
Na	0.01 - 10 %
Nd	5 - 10,000 ppm
Ni	20 - 10,000 ppm
Rb	15 - 10,000 ppm
Sb	0.1 - 10,000 ppm
Sc	0.1 - 200 ppm
Se	3 - 10,000 ppm
Sm	0.1 - 10,000 ppm
Sn	0.02 - 10 %
Sr	0.05 - 40 %
Ta	0.5 - 10,000 ppm
Tb	0.5 - 1,000 ppm
Th	0.2 - 10,000 ppm
U	0.5 - 10,000 ppm
W	1 - 10,000 ppm
Yb	0.2 - 1,000 ppm
Zn	50 - 100,000 ppm
Price:	**€17.00**

5B - Other Elements	
As	1 - 10,000 ppm
Au	2 - 30,000 ppb
Ba	100 - 100,000 ppm
Br	0.5 - 1,000 ppm
Ce	3 - 10,000 ppm
Co	0.5 - 10,000 ppm
Cr	1 - 100,000 ppm
Cs	0.5 - 10,000 ppm
Eu	0.2 - 2,000 ppm
Fe	0.01 - 75 %
Hf	0.5 - 500 ppm
La	0.1 - 10,000 ppm
Lu	0.05 - 1,000 ppm
Mo	2 - 10,000 ppm
Na	100 - 100,000 ppm
Nd	5 - 10,000 ppm
Rb	20 - 10,000 ppm
Sb	0.1 - 10,000 ppm
Sc	0.1 - 200 ppm
Se	2 - 10,000 ppm
Sm	0.01 - 10,000 ppm
Ta	0.5 - 10,000 ppm
Th	0.2 - 10,000 ppm
U	0.1 - 10,000 ppm
W	2 - 10,000 ppm
Yb	0.2 - 1,000 ppm
One Element	**€14.50**
Each Additional Element	**€1.75**

5S - Short Lived Isotopes	
Al	1 - 100,000 ppm
Br	5 - 10,000 ppm
Cl	100 -100,000 ppm
Cu	5 - 2,500 ppm
Dy	0.5 - 5,000 ppm
Ga	5 - 10,000 ppm
I	0.5 - 5,000 ppm
In	0.1 - 5,000 ppm
Mg	0.05 - 50 %
Mn	0.1 - 10,000 ppm
Na	50 - 200,000 ppm
Re	1 - 5,000 ppm
Ti	50 - 100,000 ppm
V	0.1 - 10,000 ppm
One Element	**€32.00**
Each Additional Element	**€5.75**

INAA: Instrumental Neutron Activation Analysis - Samples are encapsulated and irradiated in a nuclear reactor. After a suitable decay, samples are measured for the emitted gamma ray fingerprint. INAA is very good for Au, Co, As, Sb, W, Ta, U, Th, Cs, In, Re, Cl and lower levels of LREE.


McMaster Nuclear Reactor

Hg add-on by cold vapour FIMS	
Code 1G (5 ppb)	add €7.25

Pressed Pellet XRF

XRF	
4C1	
Ba	* 5 - 10,000 ppm
Co	** 5 - 1,000 ppm
Cr	** 5 - 10,000 ppm
Cu	** 5 - 2,500 ppm
Ga	* 5 - 10,000 ppm
Nb	* 1 - 10,000 ppm
Ni	** 4 - 4,000 ppm
Pb	** 5 - 1,000 ppm
Rb	* 2 - 10,000 ppm
Sn	5 - 10,000 ppm
Sr	* 2 - 10,000 ppm
V	** 5 - 10,000 ppm
Y	* 2 - 10,000 ppm
Zn	** 5 - 1,000 ppm
Zr	* 5 - 10,000 ppm
One Element	**€9.00**
Each Additional Element	**€3.00**
*** lot**	**€17.00**
**** lot**	**€17.00**


XRF

Bullion

Element	Range	Method	Price
Au	0.1 - 99.99 %	Au-fire assay – Gravimetric finish	€96.00

Concentrates

Code Conc

Analysis of mine concentrates is a critical step for purchase and sale of commodities as well as optimizing recoveries. Control Assays require the highest degree of accuracy and precision.

Element	Range	Method	Price
Ag	0.1 - 99.99 %	Ag- fire assay – Gravimetric finish	€96.00
Cu	0.5 - 100%	Cu by Titration	€104.00
Zn	0.5 - 100%	Zn by Titration	€104.00
Pb	0.5 - 100%	Pb by Titration	€104.00
Fe	10 - 100%	Total Fe in Concentrate By Titration	€104.00
U	10 - 100%	U by Titration	€88.00

Prices are for normal turn-around time of 2 - 3 weeks. Expedited turnaround time as low as 1 day can can be achieved at an additional cost.

Assay Products for Miscellaneous Metals

Code 8 - Assay Products

Assays provide quantitative determinations of elements in non-processed geological materials. Assays are usually required only when the client knows or suspects higher levels of metals in samples. Geochemical methods generally provide lower detection limits than assays. For lower levels, geochemical methods should be used. All assays are traceable to international reference standards. Prices listed in our fee schedule are for normal geologic materials and are not for metallurgical products. Metallurgical products such as heads and concentrates are handled separately to prevent contamination in the laboratory. These materials are charged at three times the prices listed in our fee schedule.

Element	Price
Alumina - Al_2O_3	€16.00
Antimony - Sb	€16.00
Arsenic - As	€16.00
Barium (Instrumental) - Ba	€16.00
Barium (Gravimetric) - Ba	€22.50
Beryllium - Be	€16.00
Bismuth - Bi	€16.00
Boron - B	€16.00
Bromine - Br	€16.00
Cadmium - Cd	€16.00
Calcium (oxide) - CaO	€16.00
Cerium - Ce	€16.00
Chlorine - Cl	€20.00
Chromium - Cr	€16.00
Cobalt - Co	€10.50
Copper (total) - Cu	€10.50
Copper (CN soluble)	€9.00
Copper (Acid soluble)	€9.00
Copper (Ferric sulfate soluble)	€9.00
Copper (Sequential Oxide Analysis)	€27.25
Fluorine - F	€16.00
Gold - Au	See Code 1A3, p. 7
Gold-Silver (Au-Ag)	See Code 1A3-Ag, p. 7
Gallium - Ga	€16.00
Germanium - Ge	€16.00
Insolubles	€16.00
Iron (oxide) - Fe_2O_3	€13.75
Lanthanum - La	€13.75
Lead (total) - Pb	€9.00
Lead (oxide) - PbO	€18.50
Lithium - Li	€12.00
Loss on ignition - LOI	€8.00
Mercury - Hg	€14.50
Manganese (oxide) - MnO	€14.50

Element	Price
Magnesium (oxide) - MgO	€14.50
Moisture - H_2O	€8.00
Molybdenum (total) - Mo	€9.00
Molybdenum (oxide)	€18.50
Molybdenum (sulfide)	€18.50
Nickel - Ni	€9.00
Nickel - Ni Sulphide	€18.50
Niobium - Nb	€14.50
Phosphorous (oxide) - P_2O_5	€14.50
Platinum-Palladium-Gold (Pt-Pd-Au)	€36.00
Potassium (oxide) - K_2O	€14.50
Rhenium - Re (Mo concentrates)	€32.00
Rhodium - Rh	See Code 1C-Rh, p. 7
Selenium - Se	€16.00
Silicon (oxide) - SiO_2	€14.50
Silver - Ag	€13.00
Sodium (oxide) - Na_2O	€14.50
Specific Gravity - S.G.	€12.00
Specific Gravity (wax encapsulation)	€16.00
Strontium - Sr	€14.50
Sulfur (Infrared)	€13.75
Sulfur (Gravimetric) - S	€22.50
Sulfate - SO_4	€18.50
Tantalum - Ta	€14.50
Tellurium - Te	€14.50
Thallium - Tl	€14.50
Thorium - Th	€14.50
Tin - Sn	€14.50
Titanium (oxide) - TiO_2	€14.50
Tungsten (oxide) - WO_3	€14.50
Uranium (oxide) - U_3O_8	€18.50
Vanadium (oxide) - V_2O_5	€14.50
Zinc (total) - Zn	€9.00

Lithogeochemistry and Whole Rock Analysis

Lithogeochemistry Packages

When submitting pulp material it must be 95% -200 mesh (-74 µm) or additional pulverization charges will apply.

The most aggressive fusion technique employs a lithium metaborate/tetraborate fusion. Fusion is performed by a robot at Actlabs, which provides a fast fusion of the highest quality in the industry. The resulting molten bead is rapidly digested in a weak nitric acid solution. The fusion ensures that the entire sample is dissolved. It is only with this attack that major oxides including SiO_2, refractory minerals (i.e. zircon, sphene, monazite, chromite, gahnite, etc.), REE and other high field strength elements are put into solution. High sulphide-bearing rocks may require different treatment but can still be adequately analyzed. Analysis is by ICP-OES and ICP-MS. Quality of data is exceptional and can be used for the most exacting applications. Values on replicates and standards are provided at no cost, as are REE chondrite plots. Eu determinations are semiquantitative in samples having extremely high Ba concentrations (> 5 %).

Mineralized Samples: Although intended primarily for unmineralized samples, mineralized samples can be analyzed. However, data may be semiquantitative for chalcophile elements (Ag, As, Bi, Co, Cu, Mo, Ni, Pb, Sb, Sn, W and Zn). For quantitative chalcophile data see **Quant** add-ons below.

Code 4B ICP-OES Whole Rock Package: Whole rock data which meets or exceeds quality of data by fusion XRF. 3 g required.

Code 4C, the old standard in whole rock analysis. 3 g required.

Code 4B2 Trace Element ICP-MS package: The trace element package by ICP-MS, Codes 4B2-STD or 4B2-RESEARCH, on the fusion solution provides research quality data whether using standard or research detection limits. 0.5 g required.

Research designation: indicates lower detection limits.

Code 4Litho and Code 4Lithoresearch: The 4B and 4B2 packages are combined. 5 g required.

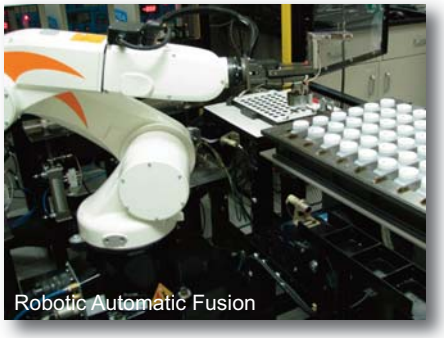
Quant designation: For quantitative values of chalcophile elements a surcharge will apply. A minimum sample weight of 5 g is required.

(+) Code 4B1: Optional elements by multiacid digestion. Please Add 0.5 g.

(++) Code 4B-INAA: Optional elements are available by INAA. Please add 0.5 to 30 g depending on sample size you prefer to analyze for Au with this option.

All elements are in ppm except where noted. Prices per sample.

Add-ons:		
4B1	€8.00	surcharge
4B-INAA	€14.00	surcharge
QUANT	€15.00	surcharge



Robotic Automatic Fusion

	WRA-ICP 4B	Trace element 4B2-std	WRA+ICP 4Litho	Trace element 4B2 -research	WRA+Trace 4 Lithoresearch
Al_2O_3	0.01%		0.01%		0.01%
CaO	0.01%		0.01%		0.01%
Cr_2O_3	0.01%		0.01%		0.01%
Fe_2O_3	0.01%		0.01%		0.01%
K_2O	0.01%		0.01%		0.01%
MgO	0.01%		0.01%		0.01%
MnO	0.001%		0.001%		0.001%
Na_2O	0.01%		0.01%		0.01%
P_2O_5	0.01%		0.01%		0.01%
SiO_2	0.01%		0.01%		0.01%
TiO_2	0.001%		0.001%		0.001%
LOI	0.01%		0.01%		0.01%
Ag	(0.5+)	0.5	0.5	0.5	0.5
As	(0.5++)	5 (0.5++)	5 (0.5++)	5 (0.5++)	5 (0.5++)
Au	(2 ppb++)	(2 ppb++)	(2 ppb++)	(2 ppb++)	(2 ppb++)
Ba	2	3	3	3	3
Be	1		1		1
Bi	(10+)	0.4	0.4	0.1	0.1
Br	(0.5++)	(0.5++)	(0.5++)	(0.5++)	(0.5++)
Cd	(0.5+)	(0.5+)	(0.5+)	(0.5+)	(0.5+)
Co	(1++)	1	1	1	1
Cr	(5++)	20 (5++)	20 (5++)	20 (5++)	20 (5++)
Cs	(1++)	0.5	0.5	0.1	0.1
Cu	(1+)	10 (1+)	10 (1+)	10 (1+)	10 (1+)
Fe		(0.01%++)		(0.01%++)	
Ga		1	1	1	1
Ge		1	1	0.5	0.5
Hf	(1++)	0.2	0.2	0.1	0.1
In		0.2	0.2	0.1	0.1
Ir	(5 ppb++)	(5 ppb++)	(5 ppb++)	(5 ppb++)	(5 ppb++)
Mo	(5++)	2	2	2	2
Na		(0.01%++)		(0.01%++)	
Nb		1	1	0.2	0.2
Ni	(1+)	20 (1+)	20 (1+)	20 (1+)	20 (1+)
Pb	(5+)	5	5	5	5
Rb	(20++)	2	2	1	1
S	(100+)	(100+)	(100+)	(100+)	(100+)
Sb	(0.2++)	0.5 (0.2++)	0.5 (0.2++)	0.2	0.2
Sc	1	(0.1++)	1 (0.1++)	(0.1++)	1 (0.1++)
Se	(3++)	(3++)	(3++)	(3++)	(3++)
Sn		1	1	1	1
Sr	1	2	2	2	2
Ta	(0.5++)	0.1	0.1	0.01	0.01
Th	(0.2++)	0.1	0.1	0.05	0.05
Tl		0.1	0.1	0.05	0.05
U	(0.5++)	0.1	0.1	0.01	0.01
V	5	5	5	5	5
W	(1++)	1	1	0.5	0.5
Y	1	1	2	0.5	0.5
Zn	(1+)	30 (1+)	30 (1+)	30 (1+)	30 (1+)
Zr	2	5	4	1	1
La	(0.5++)	0.1	0.1	0.05	0.05
Ce	(3++)	0.1	0.1	0.05	0.05
Pr		0.05	0.05	0.01	0.01
Nd	(5++)	0.1	0.1	0.05	0.05
Sm	(0.1++)	0.1	0.1	0.01	0.01
Eu	(0.2++)	0.05	0.05	0.005	0.005
Gd		0.1	0.1	0.01	0.01
Tb	(0.5++)	0.1	0.1	0.01	0.01
Dy		0.1	0.1	0.01	0.01
Ho		0.1	0.1	0.01	0.01
Er		0.1	0.1	0.01	0.01
Tm		0.05	0.05	0.005	0.005
Yb	(0.2++)	0.1	0.1	0.01	0.01
Lu	(0.05++)	0.01	0.04	0.002	0.002
1 - 10 samples	**€30.50**	**€44.00**	**€62.50**	**€72.00**	**€88.00**
11 + samples	**€25.75**	**€40.00**	**€52.00**	**€60.00**	**€72.00**

	INAA 4A-research	WRA-XRF 4C	Total IDENT 4E-expl.	Total IDENT 4E-research
Al_2O_3		0.01%	0.01%	0.01%
CaO		0.01%	0.01%	0.01%
Cr_2O_3		0.01%		
Co_3O_4		0.005%		
CuO		0.005%		
Fe_2O_3		0.01%	0.01%	0.01%
K_2O		0.01%	0.01%	0.01%
MgO		0.01%	0.01%	0.01%
MnO		0.001%	0.01%	0.01%
Na_2O		0.01%	0.01%	0.01%
NiO		0.003%		
P_2O_5		0.01%	0.01%	0.01%
SiO_2		0.01%	0.01%	0.01%
TiO_2		0.01%	0.005%	0.005%
V_2O_5		0.003%		
LOI		0.01%	0.01%	0.01%
Ag	2		0.5	0.5
As	1		2	1
Au	2 ppb		5 ppb	1 ppb
Ba	20		3	1
Be			1	1
Bi			2	2 (0.1 ‡‡)
Br	0.5		1	0.5
Ca	0.2%			
Cd			0.5	0.5
Co	0.1		1	0.1
Cr	0.5		1	0.5
Cs	0.2		0.5	0.2 (0.1 ‡‡)
Cu			1	1
Fe	0.005%			
Ga			(5 ‡)	(5 ‡) (1 ‡‡)
Ge				(0.5 ‡‡)
Hf	0.2		0.5	0.2 (0.1 ‡‡)
In				(0.1 ‡‡)
Ir	2 ppb		2	2
Mo	2		5	2
Na	0.001%			
Nb			(1 ‡)	(2 ‡) (0.2 ‡‡)
Ni	50		1	1
Pb			(5 ‡)	(5 ‡)
Rb	10		20 (2 ‡)	10 (2 ‡) (1 ‡‡)
S			0.001%	0.001%
Sb	0.1		0.2	0.1
Sc	0.01		0.1	0.01
Se	0.5		3	0.5
Sn			(5 ‡)	(5 ‡) (1 ‡‡)
Sr	100		2	2
Ta	0.3		1	0.3 (0.01 ‡‡)
Th	0.1		0.5	0.1 (0.05 ‡‡)
Tl				(0.05 ‡‡)
U	0.1		0.5	0.1 (0.01 ‡‡)
V			5	5
W	1		3	1
Y			1	1
Zn	10		2	2
Zr			4	4 (1 ‡‡)
La	0.05		0.5	0.05
Ce	1		3	1 (0.05 ‡‡)
Pr	(0.01 †)			(0.01 ‡‡)
Nd	1		5	1 (0.05 ‡‡)
Sm	0.01		0.1	0.01
Eu	0.05		0.1	0.05 (0.005 ‡‡)
Gd	(0.01 †)			(0.01 ‡‡)
Tb	0.1		0.5	0.1 (0.01 ‡‡)
Dy	(0.01 †)			(0.01 ‡‡)
Ho	(0.01 †)			(0.01 ‡‡)
Er	(0.01 †)			(0.01 ‡‡)
Tm	(0.01 †)			(0.005 ‡‡)
Yb	0.05		0.1	0.05 (0.01 ‡‡)
Lu	0.01		0.05	0.01 (0.002 ‡‡)
1 - 10 samples	**€55.25**	**€32.00**	**€44.00**	**€96.00**
11 + samples	**€52.00**	**€27.25**	**€40.00**	**€80.00**

When submitting pulp material it must be 95% -200 mesh (-74 µm) or additional pulverization charges will apply.

Research designation: indicates lower detection limits.

Code 4A-research: Grades are determined by INAA. A minimum sample weight of 2 g is recommended. REE chondrite plots are provided at no charge. **Code 4A RES-MS**: elements indicated by † are analyzed by fusion ICP-MS.

Code 4C: The tried and true fusion XRF whole rock package. Samples containing high barite or high sulphide (greater than 1%) should be analyzed with Code 4B. A minimum sample weight of 3 g is required. We reserve the right to change analytical method to Code 4B if required by the sample composition.

Code 4E: This package uses ICP and INAA technologies to completely characterize geological samples. This package is not suitable for analyzing concentrates or mill products. A minimum sample weight of 5 g is required.

Code 4E Options

- ‡ **Code 4E-XRF** elements Ga, Pb, Sn, Nb and Rb are examined by Pressed Pellet XRF. This package can be added to Code 4E exploration or Code 4E research (please add 6 g of sample).
- **Code 4E-XRF Fusion** major oxides are examined by Fusion XRF.
- ‡‡ **Code 4E ICP-MS** add-on option: can only be added to Code 4E research grade.

Code 4F: Other analyses associated with WRA (can be added to any Code 4 package). Add 1 gram for each option chosen (see below).

All elements are in ppm except where noted. Prices per sample.

Add-ons:		
Code 4E-XRF	€17.00	surcharge
Code 4E-XRF Fusion	€17.00	surcharge
Code 4E ICP-MS	€27.75	surcharge

Carbon & Sulphur Packages

4F - C-Total (0.01%) by IR	€13.75
4F - C-Organic (0.5%) by IR	€22.50
4F - C-Graphitic (0.05%) by IR	€20.00
4F - C,S (0.01%) by IR	€16.00
4F - S (0.01%) by IR	€13.75
4F - Sulphide	€18.50
4F - SO_4 (0.3%) by IR	€18.50
4F - CO_2 (0.01%) by IR or Coulometry	€13.75

Code 5G - Carbon & Sulphur/Metallurgical Balance Package

Price: €68.00/sample

Element	Detection Limit
C-Total	0.01%
C-Graphitic	0.05%
C-Organic	0.5%
CO_2	0.01%
S	0.01%
SO_4	0.3%

Miscellaneous Analyses

4F - Cl (0.01%) by INAA	€20.00
4F - B (2 ppm) by PGNAA	€17.00
4F - B (0.5 ppm) by PGNAA	€25.00
4F - F (0.01%) by ISE	€11.25
4F - N (Total)	€32.00
4F - Hg by Cold Vapour FIMS	€7.25
4F - FeO (0.1%) by Titration	€13.75
4F - H_2O +/- (0.01%) IR or Gravimetric	€18.50

Hydrogeochemistry Packages

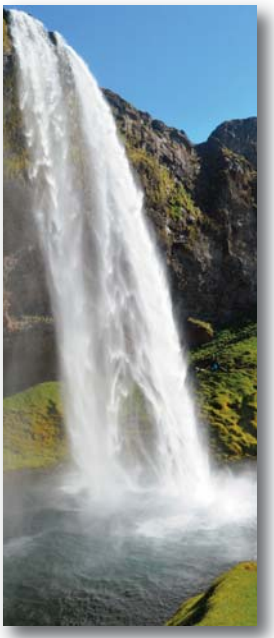
All detection limits are in µg/L except where noted.

Sample Preservations Instructions on page 18.

	ICP-MS	ICP-OES	PGE HR-ICP-MS	HR-ICP-MS	Au HR-ICP-MS
Ag	0.2	5		0.002	
Al	2	0.1 mg/L		0.5	
As	0.03	30		0.02	
Au					0.1 ng/L
B	3 **			0.1	
Ba	0.1	20		0.01	
Be	0.1	2		0.001	
Bi	0.3	20		0.001	
Ca	700	0.1 mg/L		5	
Cd	0.01	2		0.001	
Ce	0.001	30		0.001	
Co	0.005	2		0.001	
Cr	0.5	20		0.01	
Cs	0.001			0.001	
Cu	0.2	2		0.05	
Dy	0.001			0.0005	
Er	0.001			0.00005	
Eu	0.001			0.00005	
Fe	10	0.01 mg/L		1	
Ga	0.01			0.001	
Gd	0.001			0.00005	
Ge	0.01			0.001	
Hf	0.001			0.00005	
Hg	0.2 (0.006+)			0.05	
Ho	0.001			0.00001	
In	0.001			0.0001	
Ir			1 ng/L		
K	30	0.1 mg/L		1	
La	0.001			0.001	
Li	1	0.05 mg/L		0.05	
Lu	0.001			0.00005	
Mg	2	0.1 mg/L		0.2	
Mn	0.1	0.01 mg/L		0.05	
Mo	0.1	5		0.005	
Na	5	0.1 mg/L		5	

	ICP-MS	ICP-OES	PGE HR-ICP-MS	HR-ICP-MS
Nb	0.005			0.0001
Nd	0.001			0.0001
Ni	0.3	5		0.05
P		0.02 mg/L		
Pb	0.01	10		0.005
Pr	0.001			0.00005
Pd			1 ng/L	
Pt			0.5 ng/L	
Rb	0.005			0.005
Re				0.0001
Rh			0.5 ng/L	
Ru			3	
S		1 mg/L		
Sb	0.01	10		0.001
Sc	1			0.01
Se	0.2	20		5
Si	200	0.1 mg/L		
Sm	0.001			0.0005
Sn	0.1	10		0.01
Sr	0.04	10		0.01
Ta	0.001			0.0005
Tb	0.001			0.00002
Te	0.1	10		0.001
Th	0.001			0.00002
Ti	0.1	10		0.01
Tl	0.001	10		0.0001
Tm	0.001			0.0001
U	0.001	0.05 mg/L		0.0001
V	0.1	10		0.001
W	0.02	10		0.001
Y	0.003	10		0.0005
Yb	0.001			0.00005
Zn	0.5	5		0.5
Zr	0.01			0.001

** Optional element
+ Hg - cold vapour - FIMS



Code 6 is applicable only to natural waters with low total dissolved solid content (<0.05%). Any individual cations greater than the dynamic range of the ICP-MS will be reported as (>) unless the ICP-OES overrange option is chosen. Samples submitted under all Code 6 packages (with exception of Code 6 Dissolved and Code 6 Total Recoverable mentioned below) will be analyzed on the supernatant portion of waters as received, acidified to pH <2 without filtration or digestion. The Code 6 Dissolved package includes filtration with 0.45µ filters while the Code 6 Total Recoverable Natural Waters package include water digestion according to EPA protocols. Samples will be analyzed on the supernatant portion of waters as received, acidified to pH <2 without filtration. Analysis of waste waters and other solutions are available, but at varying costs. Please inquire. Samples submitted as natural waters, but with elevated total dissolved solids (TDS >0.05%) will be charged as 6MB. For hydro samples being analyzed by ICP-MS or by Ion Chromatography, please include field TDS/conductivity measurements, if available.

Actlabs' unique High Resolution ICP-MS water package provides unrivaled sensitivities for hydrogeochemical surveys on natural waters with low TDS.

From Eppinger et al., 2013:
'Anomalous concentrations of Ag, In, Sb, Th, U, W fall in the exceedingly low ng/l concentrations ranges discernible only with the HR-ICPMS method'. Only HR-ICP-MS could see the deeply-buried Pebble Porphyry Copper Deposit.

Water
'Lower determination limits for cations analyzed by HR-ICP-MS, a relatively new technique available commercially since around 2005, are commonly two and perhaps three orders of magnitude below those by standard ICP-MS. As a consequence, the resulting dataset is robust and has few highly censored elements (i.e., those with "less than" values), an unusual feature for water analyses. The lower determination limits for elements analyzed by HR-ICP-MS allow observation of element patterns at exceedingly low concentrations ranges.'

Code 6 - Hydrogeochemistry

Code 6 - Natural Waters with low TDS (<0.05%) **1-50 samples as received**	€36.00
Code 6 - Natural Waters with low TDS (<0.05%) **51+ samples as received**	€31.50
Code 6 - Total Recoverable Natural Waters with low TDS (<0.05%) **1-50 samples**	€51.25
Code 6 - Total Recoverable Natural Waters with low TDS (<0.05%) **51+ samples**	€47.25
Code 6 - Dissolved Natural Waters with low TDS (<0.05%) **1-50 samples**	€51.25
Code 6 - Dissolved Natural Waters with low TDS (<0.05%) **51+ samples**	€47.25
† Code 6 MB - Marine Water, Brines or other aqueous solutions with TDS > 0.05%	€61.75
Code 6 ICP-OES Overrange - Overrange elements in **Code 6 MB** reanalyzed by ICP-OES if required	add €15.25
Code 6 ICP-OES - Hydrogeochemistry ICP-OES for 36 elements	€20.00
Code 6 Hg - Hg(+) option on separate sample by FIMS	add €19.25
Code 6 Boron - Boron add-on by ICP-MS	add €5.75
Code 6 EXPER - Where % RSDs are required (1-4 elements only)	€50.50
Code 6 ENVIR - Where Chain-of Custody for legal defense is required	€64.00
Code 6 Ion Exchange - Separating base metals from brines (price includes analysis and separation)	€78.50
Code 6 INAA - Gold analysis by INAA on activated charcoal	€35.25
Code 6 Au HR-ICP-MS - Au by High Resolution ICP-MS	€50.50
Code 6 HR-ICP-MS - Water analysis by High Resolution ICP-MS	€50.50
Code 6 PGE HR-ICP-MS - PGE by High Resolution ICP-MS	€92.000
Code 6 Acidify - With ultrapure nitric to pH <2	€2.50

† Detection limits for samples with high dissolved solids such as marine waters or brines, may be elevated by a factor of 10-1000.

Ion Chromatography

Code 6B - Ion Chromatography

Analyte	Detection Limit (mg/L)
Fluoride (F)	0.01
Chloride (Cl)	0.03
Bromide (Br)	0.03
Nitrite (NO_2)	0.01
Nitrate (NO_3)	0.01
Phosphate (PO_4)	0.02
Sulphate (SO_4)	0.03

First analyte	€20.00
Each additional	€13.75
All analytes	€50.50

Radionuclides

Code 6C - Radionuclides

Gross Alpha, Gross Beta
Ra^{226}
Pb^{210}
Po^{210}
Th^{230} and Th^{232}
Th^{228}

Price: €160.00/sample for each nuclide.

Miscellaneous Analyses

Code 6C

pH	€5.75
Total Suspended Solids (TSS)	€18.50
Total Dissolved Solids (TDS)	€17.00
Conductivity	€5.75
Salinity	€17.00
Acidity	€17.00
Turbidity	€9.00
Oil and Grease (Total)	€45.75
Oil and Grease (Mineral)	€32.00
Oil and Grease (Vegetable)	€32.00
Reactive Silica	€18.50
Total Phosphorous	€13.75
NH_3 + NH_4	€27.25
Colour	€13.75
Hardness (must also do Code 6 ICP-OES)	€9.00
Perchlorate (EPA 331.0)	€185.00

Cyanide (Total CN)	€27.25
Cyanide (Free CN)	€27.25
Cyanide (Weak Acid Dissociable - WAD CN)	€27.25
Total organic carbon (TOC)	€27.25
Biological oxygen demand (BOD)	€27.25
Chemical oxygen demand (COD)	€27.25
Dissolved oxygen (DO)	€22.50
Total kjeldahl nitrogen (TKN)	€27.25
Total petroleum hydrocarbon (TPH-Heavy) - C28-C44 for Heavy Oil	€73.75
Total petroleum hydrocarbon (TPH-GRO/DRO) - C6-C10/C10-C28 for Gasoline/Diesel Range	€92.00
Alkalinity ($CaCO_3$) [includes carbonate (CO_3) & bicarbonate (HCO_3)]	€17.00
BTEX (Benzene Toluene Ethylbenzene Xylene)	€36.00
Microbiology (E.coli, Total Coliforms, Fecal Coliforms, Heterotrophic Plate Count)	€32.00

Metal Speciation in Water

Our research activities over the last few years have allowed us to link the capillary electrophoresis and HPLC techniques to conventional ICP-MS or High Resolution ICP-MS. Using as little as 5 µg/L of solution, we can conveniently speciate a number of metals for their inorganic or organic metal species. This allows determination of a number of metal species sequentially. Actlabs can consult on the best ways to preserve samples for speciation analysis. **Note - Minimum of 10 samples.**

Pore Water Extraction (from sediment core)	€92.00
As speciation (As^{3+}, As^{5+}, MMA, DMA, Arsenobetaine)	€161.75
Sn speciation (Tripropylpentyl; Tributylpentyl; Dibutyldipentyl; Monobutyl,tripentyl; Monophenyl,tripentyl; Diphenyl,tripentyl; Triphenyl,tripentyl)	On request
Fe Speciation (Fe^{3+}, Fe^{2+})	€87.25
Se Speciation (Se^{6+}, Se^{4+}, Se-Methionine, Se-Cystine)	€161.75
Cr Speciation (Cr^{3+}, Cr^{6+})	€87.25

Sample Preservation Instructions

Helpful Hints

The conventional method of preservation of water for analysis is 0.2% (2 mL/L) of concentrated ultra pure nitric acid. This may be inadequate in alkaline environments. The acid should be added only after the sample has been collected, and not as precharged acid in bottles which may leach metals from the bottle. When filling the bottle, it should be rinsed with the sample water twice before retaining the sample. It should then be acidified. A test of pH using pH paper will indicate if the pH after acidification is adequate (pH 2). Depending on the sample composition, preservation with nitric may invalidate Ag, As, Br and I analyses. We require 30 mL of water for analysis. Samples for Hg should be preserved with several drops of 0.5% BrCl as the GSC study indicates the conventional preservation method of $K_2Cr_2O_7$ in 0.1% HNO_3 may be inadequate to keep Hg in solution. We require 30 mL of water for Hg in a glass bottle. Do not freeze water as it will cause precipitation of some elements. Samples should be shipped to the lab as soon as possible for analysis. Gold unfortunately is not stable and will be adsorbed onto the sides of the bottle within a short period of time (hours). Samples for ion chromatography should not be preserved at all. Code 6 HR-ICP/MS method removes these metals from the plastic bottle and puts it back into solution for analysis directly by HR-ICP-MS. Please inquire for a list of preservation and bottle types for the different types of analysis.

Parameter	Minimum Volume (mL)	Sample (g)	Container Type		Preservation [+]	Maximum [++] Holding Time
			Liquid	Soil / Sediment		
Alkalinity	100		* Polyethylene		Refrigerate	ASAP 14 day max.
Ammonia	100	25	Glass of PET	Glass	4°C, H_2SO_4, < pH 2	10 days
Anions	50		* Polyethylene	Glass or PET	Refrigerate	28 days
BOD	500		* Polyethylene or Glass		Refrigerate	ASAP (2 days)
BTEX / LH	40 mL x 2	50	^ Glass (amber) No headspace	^ Glass (amber) No headspace	4°C, H_2SO_4, < pH 2, No headspace	14 days
Carbon, total organic (TOC)	50	100	* Polyethylene or ^ Glass (amber) No headspace	Glass	4°C, H_2SO_4 or HCl < pH 2	28 days
Chlorine, total residual	50		* Polyethylene		Analyze immediately	---
Chromium VI	100		* Polyethylene		4°C	24 hours
C.O.D.	50	50	* Polyethylene	Glass	4°C, H_2SO_4 , < pH 2	28 days
Total Coliform, E. Coli, Fecal Coliform, Heterotrophic Plate Count	125		* Polyethylene (Sterile)		Na_2SO_4 Precharged	ASAP
Colour	50		* Polyethylene		4°C	48 hours
Conductivity	50	100	* Polyethylene	Glass	4°C	28 days
Cyanide	50	100	* Polyethylene	Glass	NaOH > pH 12	14 days
Dissolved Metals	30		* Polyethylene		Filter (0.45 microns) ** HNO_3 pH < 2	28 days
Dioxins & Furans	1,000		^ Glass (amber)		4°C	7 days
DOC	50	100	Glass	Glass	4°C, H_2SO_4, < pH 2	14 days
Geosmin & Methyl Isoborneal	40 mL x 2	50	^ Glass (amber)		4°C	7 days, analyzed within 40 days of extraction
Hardness	50		* Polyethylene		4°C, HNO_3 < pH 2	28 days
Hydrogen Sulphide	100		Glass or * Polyethylene		0.5 mL Zn Acetate followed by $NaCO_3$ to pH 10	7 days
Total Metals (ICP-MS / ICP-OES)	100	50	* Polyethylene	Ziploc or Soil Envelope	** HNO_3 to pH < 2	30 days
Mercury	100	25	Glass (amber)	** Ziploc or Soil Envelope	several drops of 0.5% BrCl	28 days
Nitrite & Nitrate	50	100	Glass or PET	Glass	4°C	48 hours
Nitrogen (organic, kjeldahl)	20	100	* Polyethylene	Glass	4°C, H_2SO_4, < pH 2	28 days
Total Organic Halogens (TOX)	1,000		^ Glass (amber)		4°C, H_2SO_4, < pH 2	7 days
Oil and Grease	1,000	250	^ Glass (amber)	Glass	4°C, H_2SO_4, < pH 2	28 days
Organic Volatiles	40 mL x 2		Glass (fill to overflowing)		4°C, H_2SO_4, < pH 2	7 days, store at 4°C
PAH	1,000	50	^ Glass (amber)	^ Glass (amber) No headspace	4°C, store in dark	7 days
PCB	1,000		^ Glass (amber)		4°C	30 days
Pesticides / Herbicides	1,000		^ Glass (amber)		4°C	7 days
pH	50	100	* Polyethylene	Plastic bag	None	ASAP (within 72 hours of receipt)
Phenolics (by GC)	1,000		^ Glass (amber)		4°C	7 days
Phenols	50		^ Glass (amber)		4°C, H_2SO_4, < pH 2	10 days
Propylene & Ethylene Glycol, Ethanol	40 mL x 2	50	^ Glass (amber)		4°C	7 days, analyzed within 40 days of extraction
Reactive Silica	40		* Polyethylene		4°C, H_2SO_4, < pH 2	28 days
Residue (solids)	100		* Polyethylene		4°C	7 days
Resin and Fatty Acids	1,000		^ Glass (amber)		4°C, H_2SO_4, < pH 2	7 days
Semi-volatiles	1,000		^ Glass (amber)		4°C	7 days
Sulfide	250		* Polyethylene		2N Zn acetate	7 days
Surfactants	500		* Polyethylene		4°C	48 hours
TEH or TPH	1,000		^ Glass (amber)	^ Glass (amber) No headspace	4°C, H_2SO_4, < pH 2	7 days
Total Solids	500		* Polyethylene		4°C	7 days
Total Dissolved Solids	500		* Polyethylene		4°C	7 days
Total Suspended Solids	500		* Polyethylene		4°C	7 days
Turbidity	50		* Polyethylene		4°C	48 hours
Volatile Scan (EPA 624)	40 mL x 2		^ Glass (amber)			7 days

Notes:

* We recommend Nalgene brand screw-cap containers
** For Hg on soil or sediment, we recomment drying below 40°C
^ Teflon-lined cap
[+] If no temperatures are listed, then room temperatures apply
[++] Holding times for soils are indefinite

Additional information on sample containers is available by contacting Actlabs.

	Humus INAA Code 2A	Vegetation INAA Code 2B	Ash Package INAA Code 2C	Base Metal Vegetation Aqua Regia-ICP Code 2C1	Ash Package Digestion ICP-MS Code 2D	Ash Package ICP-MS Au+Pt+Pd Code 2E	Vegetation Unashed ICP-MS Code 2G	Vegetation Unashed HR-ICP-MS Code 2F	Vegetation Unashed Code 2F-PGE
Ag	2	0.3 ppb	2	0.2	0.2	0.2	**10**	1	
Al					2	2	**1000**		
As	1	0.01	0.5		1	3	**10**	5	
Au	1 ppb	0.1 ppb	5 ppb			5 ppb	**0.2**	0.1	
B			*(2)		5	5	**1000**	200	
Ba	100	5	50		3	3	**10**	1 ppm	
Be					0.005	0.08	**50**	0.1	
Bi					0.05	0.05	**0.5**	1	
Br	1	0.01	1						
Ca	0.5%	0.01%	0.2%		0.1%	0.1%	**10,000**	2 ppm	
Cd					0.01	0.01	**10**	0.1	
Ce	1	0.1	3		0.01	0.01	**1**	0.5	
Co	1	0.1	1		0.01	0.01	**2**	0.5	
Cr	1	0.3	1		1	10	**20**	10	
Cs	0.5	0.05	0.5		0.001	0.001	**2**	0.1	
Cu				1	0.2	0.2	**10**	20	
Dy					0.001	0.001	**0.5**	0.05	
Er					0.001	0.001	**1**	0.05	
Eu	0.2	0.05	0.01		0.001	0.001	**1**	0.1	
Fe	0.05%	0.005%	0.05%		0.01%	0.01%	**1 ppm**	0.5 ppm	
Ga					0.1	0.1	**4**	0.5	
Gd					0.01	0.01	**4**	1	
Ge					0.1	0.1	**1**	10	
Hf	0.5	0.05	0.5		0.01	0.01	**3**	2	
Hg	0.5	0.05	1				**10**	5	
Ho					0.001	0.001	**0.4**	0.01	
In					1 ppb	1 ppb	**0.2**	0.1	
Ir	5 ppb	0.1 ppb	2 ppb						0.2 ppb
K		0.01%	0.05%		0.01%	0.01%	**10**	10 ppm	
La	0.1	0.01	0.1		0.002	0.002	**3**	0.2	
Li					0.5	0.5	**10**	5	
Lu	0.1	0.001	0.05		0.001	0.001	**0.4**	0.2	
Mg					0.01%	0.01%	**1000**	0.5 ppm	
Mn				1	0.1	0.1	**100**	10	
Mo	0.5	0.05	2	1	0.1	0.1	**10**	1	
Na	100	1	10		0.01%	0.01%	**1000**	10 ppm	
Nb					0.005	0.005	**2**	0.5	
Nd	3	0.3	5		0.002	0.002	**5**	0.2	
Ni	10	2	50	1	5	5	**10**	0.1 ppm	
P							**3000**		
Pb				1	0.1	0.1	**5**	10	
Pd						3 ppb	**0.1**	2	0.1 ppb
Pr					0.002	0.002	**2**	0.5	
Pt						2 ppb	**0.2**	2	0.2 ppb
Rb	20	1	5		0.01	0.01	**20**	10	
Re					0.1 ppb	0.1 ppb	**0.2**	0.1	
Rh									0.1 ppb
Ru						10 ppb			0.2 ppb
Sb	0.1	0.005	0.1		0.02	0.02	**5**	0.2	
Sc	0.1	0.01	0.1		0.5	0.5		1	
Se	2	0.1	2		1	10	**10**	0.2 ppm	
Si					0.2%	0.2%			
Sm	0.1	0.001	0.1		0.001	0.001	**2**	0.1	
Sn						1	**30**	40	
Sr	100	10	300		0.1	0.1	**50**	20	
Ta	0.5	0.05	0.5		0.001	0.001	**1**	0.1	
Tb	0.2	0.1	0.5		0.001	0.001	**2**	0.02	
Te					0.01	0.01	**5**	1	
Th	0.5	0.1	0.1		0.001	0.001	**1**	5	
Ti					1	1	**200**	20	
Tl					0.001	0.001	**0.5**	0.5	
Tm					0.001	0.001	**0.1**	0.05	
U	0.1	0.01	0.1		0.001	0.001	**0.5**	1	
V					1	10	**20**	10	
W	1	0.05	1		0.5	0.5	**5**	5	
Y					0.001	0.001	**4**	0.2	
Yb	0.1	0.005	0.05		0.001	0.001	**3**	0.4	
Zn	20	2	50	1	1	1	**100**	0.2 ppm	
Zr					0.5	0.5	**20**	5	
Price	**€15.25**	**€17.75**	**€17.00**	**€9.00**	**€21.75**	**€27.25**	**€28.00**	**€51.25**	**€96.00**

Codes 2A, 2B, 2C, 2C1, 2D, 2E: all elements are in ppm, except where noted. Codes 2F, 2F-PGE, 2G: all elements are in ppb, except where noted.

Code 2A - Humus
Code 2B - Vegetation
INAA provides a very cost effective, rapid means of analyzing humus or vegetation to very low detection limits for gold and many other elements useful for geochemical exploration. The organic material is dried below 60°C, macerated and a 15 g aliquot is compressed into a briquette and analyzed using Code 2A or Code 2B depending on whether the material is purely organic (Code 2B) or contains mineral matter (Code 2A). These briquettes are irradiated and their gamma ray spectra are measured and quantified. The advantages of this technique are simplicity (less chance of human error and contamination, ashing is costly and the results in loss of gold) and INAA is the technique with ultimate sensitivity for gold and other trace elements. Prices listed in Codes 2A and 2B are for standard 15 g briquettes. Selected elements may be available at lower costs.

Code 2C - Vegetation Ash INAA
Boron add-on option.
Code 2C1 - Vegetation Ash-ICP-OES
Prices for Code 2C1 for single element is **€4.75** with each additional element costing **€2.00**.
Code 2D - Vegetation Ash-ICP-MS
Some geologists prefer ashing samples at low temperature (480°C) and determining metals on the ash. This may be advantageous, particularly if base metals are also required for your gold project or for base metal exploration. Note when samples are ashed, there may be volatile loss of certain elements (Au, As, Br, Hg, Cd, etc). Results are reported on an as received basis. Code 2D uses a proprietary acid digestion on the ash followed by ICP-MS and extends the list of elements which are available. Not all elements may be total. This package can be quite useful for diamond exploration.

Code 2E
This package is similar to Code 2D but requires a different digestion of the plant ash to obtain Au, Pt and Pd to low levels. This method has been shown to be very effective for PGE exploration.

Code 2F
Dry vegetation samples are dissolved in acid and analyzed by High Resolution ICP-MS.

Code 2F-PGE
Actlabs has developed a new package capable of detecting the PGE in vegetation at the sub-ppb level by microwave digestion, ion exchange and High Resolution ICP-MS. This method eliminates interferences.

Code 2G
Dry vegetation samples are dissolved in acid and analyzed by ICP-MS.
***** RECOMMENDED*****

Actlabs only ashes vegetation in dedicated vegetation ashing furnaces to avoid contamination.

Aggregate Testing

All prices are by request.

Micro-Deval Abrasion	ASTM D7428 ASTM D6928	Standard Test Method for Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus Standard Test Method for Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
Soundness	ASTM C88	Standard Test Method for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
Freeze-Thaw	SCA A23.2-24A	Test for Resistance of Unconfined Coarse Aggregate to Freezing and Thawing
Density, Relative Density, Absorption	ASTM C127 ASTM C128	Standard Test Method for Density, Relative Density, and Absorption of Coarse Aggregate Standard Test Method for Density, Relative Density, and Absorption of Fine Aggregate
Particle Size and Shape	ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
Petrographic	ASTM C295	Standard Guide for Petrographic Examination of Aggregates for Concrete

Bauxite

Code 8 - Bauxite - Li borate fusion/XRF **Price: €28.00**

Al_2O_3	0.01 - 100 %	Fe_2O_3	0.01 - 100 %	Na_2O	0.01 - 100 %	V_2O_5	0.005 - 100 %
BaO	0.01 - 100 %	K_2O	0.01 - 100 %	P_2O_5	0.002 - 100 %	ZrO_2	0.01 - 100 %
CaO	0.01 - 100 %	MgO	0.01 - 100 %	SiO_2	0.01 - 100 %	LOI 1000°C	0.01 - 100 %
Cr_2O_3	0.005 - 100 %	MnO	0.01 - 100 %	TiO_2	0.01 - 100 %		

Option:
Code 4F - SulphateSO_4 (0.3% by Infrared)

Price: €18.50

Coal

Code 8 - Coal Package

Parameter	ASTM Method	Price
Sample Preparation (up to 5 kg)	D2013	€21.75
Dry Screen Analysis (1 kg) (first fraction)	D4749	€55.25
Specific Gravity (Relative Density)	D167	€38.0
Total Moisture (TM)	D3302	€19.00
Proximate Analysis (Ash, Inherent Moisture, Volatile Matter)	D3172	€53.00
Free Swelling Index	D720	€24.00
Calorific Value (CV)	D5865	€53.00
Total Sulphur	D4239	€35.25
Forms of Sulphur (including sulphates, pyritic sulphur and organic S)	D2492	€103.75
Mercury	D3684	€111.75
Equilibrium Moisture	D1412	€62.50
Ash Fusion Temperature (Reducing, Oxidizing, Combined)	D1857	€188.00
Ultimate Analysis:	D3176	
Carbon		€262.00
Hydrogen + Carbon		€130.50
Carbon + Nitrogen		€130.50
Nitrogen	D5373	€85.00
Bulk Density		€41.75
F in coal		€57.75
Cl in coal		€57.75
Loss on Ignition 750°C	ASTM D7348	€22.50
Hardgrove Grindability	ASTM D409/D409 M-09	€94.00

Major and trace elements on ash: Elements and Detection Limits (ppm, except where noted) **Price: €140.00**

SiO_2	0.01%	Au	2 ppb	Eu	0.05	Ni	1	Th	0.1
Al_2O_3	0.01%	Ba	3	Ga	1	Pb	5	Tl	0.1
Fe_2O_3	0.01%	Be	1	Gd	0.1	Pr	0.05	Tm	0.05
MgO	0.01%	Bi	0.4	Ge	1	Rb	2	U	0.1
MnO	0.001%	Br	0.5	Hf	0.2	S	0.001%	V	5
CaO	0.01%	Cd	0.5	Ho	0.1	Sb	0.2	W	1
TiO_2	0.001%	Ce	0.1	In	0.2	Sc	0.1	Y	2
Na_2O_5	0.01%	Co	1	Ir	5 ppb	Se	3	Yb	0.1
K_2O	0.01%	Cr	5	La	0.1	Sm	0.1	Zn	1
P_2O_5	0.01%	Cs	0.5	Lu	0.04	Sn	1		
LOI	0.01%	Cu	1	Mo	2	Sr	2		
Ag	0.5	Dy	0.1	Nb	1	Ta	0.1		
As	0.5	Er	0.1	Nd	0.1	Tb	0.1		

Coltan

Code 8 - Coltan XRF

Samples not requiring rare earths can be analyzed by fusion with lithium metaborate/tetraborate in platinum crucibles with the molten glass cast into a glass disc in platinum crucibles. These glass discs are analyzed by XRF. Generally low Ta_2O_5 detection limits can't be achieved with this package and the INAA technique is recommended for tantalum.

Elements	Detection Limit (%)
Ta_2O_5	0.003
Nb_2O_5	0.003
U_3O_8	0.005
ThO_2	0.005
ZrO_2	0.003
Fe_2O_3(T)	0.01
P_2O_5	0.01
SnO_2	0.003
Y_2O_3	0.003
WO_3	0.003

Price: €28.00, Volume discounts are available.
Coltan Concentrates > 10% Nb_2O_5 + Ta_2O_5: €160.00

INAA Option:

Elements	Detection Limit (ppm)
Ta	0.5
Th	0.2
U	0.5
La	0.5
Ce	3
Nd	5
Sm	0.1
Eu	0.2
Yb	0.2
Lu	0.05

Price: First element €15.25
Each additional €1.00

Major Oxide Option:

Elements	Detection Limit
Al_2O_3	0.01%
CaO	0.01%
Cr_2O_3	0.01%
Co_3O_4	0.005%
CuO	0.005%
K_2O	0.01%
MgO	0.01%
MnO	0.001%
Na_2O	0.01%
NiO	0.003%
SiO_2	0.01%
TiO_2	0.01%
V_2O_5	0.005%
LOI	0.01%

Price: €17.00

Chromite/PGE

Code 8 - Chromite/PGE Assay XRF Package

Chromite assays are usually combined with major oxide analysis as other elements are required for the metallurgical use of the chromite. Cr/Fe ratios are very important in assigning value to chromite as well as other deleterious elements.

Elements	Detection Limits	Elements	Detection Limits
Al_2O_3	0.01%	MnO	0.01%
CaO	0.01%	Na_2O	0.01%
Cr_2O_3	0.01%	NiO	0.01%
Co_3O_4	0.01%	P_2O_5	0.01%
CuO	0.01%	SiO_2	0.01%
Fe_2O_3	0.01%	TiO_2	0.01%
K_2O	0.01%	V_2O_5	0.01%
MgO	0.01%	LOI	0.01%

Price: €28.00 Volume discounts are available.

PGE (ICP-OES) Option:

Au	2 - 30,000 ppb
Pt	5 - 30,000 ppb
Pd	5 - 30,000 ppb

PGE Option: €13.75 Volume discounts are available.

Graphite

Code 8 - Graphite

C - Graphitic (Infrared)	0.05%	€20.00
C - Total	0.01%	€13.75
CO_2	0.01%	€13.75
% Ash Yield		€20.00
Liberation and Grain Size (by MLA)		On request

MLA image of graphite flakes

Industrial Minerals

Code 8 - Clay, Limestone, Dolomite, Gypsum **Price: €28.00**

Suitable for samples containing < 500 ppm uranium.

Al_2O_3	0.01 - 100 %	Fe_2O_3	0.01 - 100 %	MnO	0.01 - 100 %	SiO_2	0.01 - 100 %
CaO	0.01 - 100 %	K_2O	0.01 - 100 %	Na_2O	0.01 - 100 %	TiO_2	0.01 - 100 %
Cr_2O_3	0.01 - 100 %	MgO	0.01 - 100 %	P_2O_5	0.002 - 100 %	LOI 1000°C	0.01 - 100 %

Options:
Code 4F - Sulphate (SO_4 - 0.3% by Infrared) **€18.50**

Code 4F - Carbonate (CO_2 - 0.01% by IR or Coulometry) **€13.75**

Code 8 - Phosphate **Price: €28.00**

Phosphate majors XRF package.

Al_2O_3	0.01 - 100 %	Fe_2O_3	0.01 - 100 %	MnO	0.01 - 100 %	SiO_2	0.01 - 100 %
CaO	0.01 - 100 %	K_2O	0.01 - 100 %	Na_2O	0.01 - 100 %	TiO_2	0.01 - 100 %
Cr_2O_3	0.01 - 100 %	MgO	0.01 - 100 %	P_2O_5	0.002 - 100 %	LOI 1000°C	0.01 - 100 %

Code 8 - Potash **Price: €60.00**

Includes moisture, insoluble residue left from the water soluble component and the ICP-MS, ICP-OES soluble multielement suite.

Element	Detection Limit	Element	Detection Limit	Element	Detection Limit	Element	Detection Limit
Al_2O_3	0.01%	Cd	1 ppm	La	1 ppm	Sr	1 ppm
CaO	0.01%	Ce	1 ppm	Li	1 ppm	Ta	1 ppm
Fe_2O_3	0.01%	Co	1 ppm	Mo	1 ppm	Tb	1 ppm
K_2O	0.01%	Cr	1 ppm	Nb	1 ppm	Th	1 ppm
MgO	0.01%	Cu	1 ppm	Nd	1 ppm	U	2 ppm
MnO	0.01%	Dy	0.2 ppm	Ni	1 ppm	V	1 ppm
Na_2O	0.01%	Er	0.2 ppm	Pb	1 ppm	W	1 ppm
P_2O_5	0.01%	Eu	0.2 ppm	Pr	1 ppm	Y	1 ppm
TiO_2	0.01%	Ga	1 ppm	S	10 ppm	Yb	0.1 ppm
Ag	0.2 ppm	Gd	1 ppm	Sc	1 ppm	Zr	1 ppm
Ba	1 ppm	Hf	1 ppm	Sm	1 ppm	Zn	1 ppm
Be	0.2 ppm	Ho	1 ppm	Sn	1 ppm		

Iron Ore

Code 8 - Iron Ore (XRF)

Oxides and Detection Limits (%)					
SiO_2	0.01	MnO	0.001	K_2O	0.01
TiO_2	0.01	MgO	0.01	P_2O_5	0.01
Al_2O_3	0.01	CaO	0.01	Cr_2O_3	0.01
Fe_2O_3	0.01	Na_2O	0.01	LOI	0.01
V_2O_5	0.003				

Price: €28.00 Volume discounts are available

Davis tube magnetic separation **Price: €60.00**
Sulphur **Price: €12.00**
TGA Analysis **Price: €28.00**
Satmagan Test **Price: €16.00**

Options: **Metallic Fe by titration** **€80.00**
Total Fe by titration **€80.00**
FeO by titration **€13.75**

Davis Tube Recovery - Recoveries of ferromagnetic products are evaluated by Grind Size and Magnetic Field Strength (Gauss). To determine the chemical composition, the magnetic and non-magnetic recoveries can be analyzed by XRF and Lithium Metaborate Fusion. Contact Actlabs to discuss your requirements as procedures are very ore specific.

Lithium Ore

Code 8 - Lithium Ore

Li assays by Peroxide Fusion ICP-OES (detection limit 0.001%)	**Price: €13.00**
Li assays by 4-Acid Digestion ICP-OES (detection limit 0.001%)	**Price: €10.50**
Li assays on brines by ICP-OES (detection limit 0.05 mg/L)	**Price: €13.00**

Add-ons:
Any of the above packages can be converted to multielement analysis. Common elements requested are K, Mg, B, Na and Ca. **Price: €14.50**
F assay by ISE. **Price: €12.00**

Notes:
For geochemical packages, see Code 1F2 for 4-Acid Digestion ICP or Code Ultratrace 7 for Peroxide Fusion ICP-OES+ICP-MS. Multielement brine package is Code 6MB. Volume discounts are available.

Manganese Ore

Code 8 - Manganese Ore - Li borate fusion/XRF **Price: €28.00**

Mn	0.01 - 80%	Cr_2O_3	0.005 - 100 %	MgO	0.01 - 100 %	TiO_2	0.01 - 100 %
Al_2O_3	0.01 - 100 %	Cu	0.005 - 5 %	Na_2O	0.01 - 100 %	V_2O_5	0.005 - 100 %
BaO	0.01 - 100 %	Fe_2O_3	0.01 - 100 %	P_2O_5	0.002 - 100 %	LOI 1000°C	0.01 - 100 %
CaO	0.01 - 100 %	K_2O	0.01 - 100 %	SiO_2	0.01 - 100 %		

Nickel Laterite

Code 8 - Ni Laterite **Price: €28.00**

Al_2O_3	0.01 %	CuO	0.005 %	MnO	0.001 %	SiO_2	0.01 %
CaO	0.01 %	Fe_2O_3	0.01 %	Na_2O	0.01 %	TiO_2	0.01 %
Cr_2O_3	0.01 %	K_2O	0.01 %	NiO	0.003 %	V_2O_5	0.003 %
Co_3O_4	0.005%	MgO	0.01 %	P_2O_5	0.01 %	LOI 1000°C	0.01 %

Oil Shale

Code 8 - Oil Shale

These analytical methods are used in exploration programs to determine the anticipated shale oil yield and to better delineate core characteristics.

Analytical Method	Description	Price/sample
Sample Preparation	Wash, grind, homogenize 40 mesh	€8.00
	Grinding for Fischer Assay	€20.00
Rock-Eval 2 Pyrolysis	S1 - hydrocarbons evolved at 300°C (mg/g) S2 - hydrocarbons evolved between 300 and 600°C (mg/g) heating at 25°C/min S3 - organic carbon dioxide evolved at 300°C and up to 390°C (mg/g) Production Index, Hydrogen Index, Oxygen Index and TMAX **(MUST ANALYZE TOC TO OBTAIN HI AND OI)**	€105.00
	Total Organic Carbon (LECO)	€40.00
Rock-Eval 6 Pyrolysis	Programmed pyrolysis + TOC + CO_2	€210.50
Fischer Assay-ASTM D3904	Free water - moisture (wt%) by oven drying Retort water (wt% and L/tonne) Oil yield (wt% and L/tonne) Gas yield (wt% and L/tonne) Spent shale (wt%) Gas average molecular weight Oil relative density	€160.00
GC Scan	GC scan of shale gas to include as a minimum: H_2, N_2, CO, CO_2, C1, C2, C3, C4, C5+	€252.00
Elemental Analysis	Total carbon, sulphur	€18.50
	Total organic carbon	€40.00
	Total oxygen	€67.25
	Pyritic sulfur	€48.00
	Sulfate sulfur	€32.00
	Mercury	€111.75
	Fluoride	€48.00
	Mineral Identification	€152.00
Ultimate Analysis	Quantitative elemental determination	€262.00
	Includes: Carbon	€75.00
	Carbon + Hydrogen	€130.50
	Nirtogen	€85.00
	Total Sulphur	€28.00
Proximate Analysis	Ash, moisture and volatile matter (used to determine the distribution of products obtained when the coal sample is heated under specified conditions)	€53.00
Free Swelling Index	A measurement of the swelling properties of coal when heated without physical constraints	€20.00
Calorific Value	Quantity of heat produced by combustion	€48.00
Ash Fusion Temperatures	Includes: Reducing	€106.00
	Oxidizing	€106.00
	Combined	€188.50
Whole Rock Analysis	A whole rock analysis is performed to provide chemical analysis of inorganic components of the rock	€36.00
Trace Metal Analysis	Near total digestion is performed and a full trace metal scan by ICP shall be conducted to include at least the following elements: Cu, Pb, Zn, Fe, W, Mo, Sn, In, Bi, Cd, Sb, F, Nb, Ta, Th, Cs, Y, As, Ag, U and V.	€28.00

Rare Earth Elements

Code 8 - REE Assay - Rare Earth Element-Niobium-Zirconium-Yttrium-Tantalum-Uranium-Thorium-Beryllium-Phosphate-Tin Assay ICP-OES and ICP-MS Package

Rare earths and rare elements are among the most difficult to analyze properly. It is essential that the sample be ground to 95%-200 mesh to ensure complete fusion of resistate minerals. The analysis requires a lithium metaborate/tetraborate fusion with subsequent analysis by ICP-OES and ICP-MS. Mass balance is required as an additional quality control technique and elemental totals of the oxides should be between 98 to 101%. In certain circumstances the presence of small amounts of phosphate will have very severe consequences to Nb_2O_5 assays by this method with results being very low for Nb_2O_5. Reanalysis is required for Nb_2O_5 by fusion XRF. In many cases these types of deposits may contain high amounts of fluorite. This should be noted on the Request for Analysis form or F assays should be requested. This will speed up processing as mass balance won't be achieved otherwise and a delay in returning results will ensue as samples get repeated. IN NO CIRCUMSTANCES SHOULD AN ACID DIGESTION OF ANY TYPE BE USED TO EVALUATE THE ELEMENTS BELOW AS THEY WILL ONLY BE PARTIAL ANALYSIS. All elements are quantified and no exceeding upper limit signs are reported.

Fusion ICP-OES & ICP-MS, Elements and Detection Limits (ppm, except where noted)

Al_2O_3	0.01%	Be	1	Rb	2	La	0.1
CaO	0.01%	Bi	0.4	Sb	0.5	Ce	0.1
Fe_2O_3	0.01%	Co	1	Sc	1	Pr	0.05
K_2O	0.01%	Cr	20	Sn	1	Nd	0.1
MgO	0.01%	Cs	0.5	Sr	2	Sm	0.1
MnO	0.001%	Cu	10	Ta	0.1	Eu	0.05
Na_2O	0.01%	Ga	1	Th	0.1	Gd	0.1
P_2O_5	0.01%	Ge	1	Tl	0.1	Tb	0.1
SiO_2	0.01%	Hf	0.2	U	0.1	Dy	0.1
TiO_2	0.001%	In	0.2	V	5	Ho	0.1
LOI	0.01%	Mo	2	W	1	Er	0.1
Ag	0.5	Nb	1	Y	2	Tm	0.05
As	5	Ni	20	Zn	30	Yb	0.1
Ba	3	Pb	5	Zr	4	Lu	0.04

Price: €56.00

Volume discounts are available.

If samples contain >0.3% P_2O_5 then Nb_2O_5 and ZrO_2 is recommended to be replaced by fusion XRF as ICP-MS results may be very low.

Code 8 - XRF Nb_2O_5, ZrO_2 & Ta_2O_5 Option	**€17.00**
Code 8 - F Option	**€12.00**

Uranium

Code 8 - Uranium

Total uranium can be determined by delayed neutron counting using an automated system at a nuclear reactor. The principle advantage of this is to provide very rapid and accurate assays for high volumes of samples at a very low cost. The upper limit of this technique is 1% U. Results can be reported as U or U_3O_8. From 1 to 10% U_3O_8 fusion XRF will provide the best quality assay results and above 10% U_3O_8 titration is recommended for accuracy.

Acid digestion using both aqua regia and "4 acid near total" digestion with ICP-MS is also possible but uranium in resistate phases (zircon, monazite, etc) may not be included in the assays. "Near Total" digestions may not be total for uranium depending on mineralogy. Hydroflouric acid is used in the digestion and some uranium may be volatilized due to combination with the HF.

Code 5D - U_3O_8 Assay DNC (0.1 ppm - 1% U_3O_8)	Price: €13.00
Code 8 - U_3O_8 Aqua Regia by ICP-MS	Price: €13.75
Code 8 - U_3O_8 Assay by XRF (0.005%- 10% U_3O_8)	Price: €18.50
Code 8 - U_3O_8 "Near Total" by ICP-MS	Price: €15.25
Code 8 - U_3O_8 Titration (>10% U_3O_8)	Price: €29.00
Geochem V, U by XRF Pressed Pellet	Price: €9.75
Code 5D-Peroxide Boron (2 ppm)	Price: €11.25

Code ICPMS1 - Sandstone and Basement Exploration Package Price: €49.75

Three separate analyses will be performed in this package:

- ICP-MS analysis on the partial digestion
- ICP-OES analysis for major and minor elements on the total digestion
- ICP-MS analysis for trace elements on the total digestion

Partial Digestion:

Element	Detection Limit	Element	Detection Limit	Element	Detection Limit
As	0.01 ppm	Hf	0.01 ppm	Se	0.1 ppm
Ag	0.01 ppm	Hg	0.01 ppm	Sm	0.01 ppm
Sb	0.01 ppm	Ho	0.01 ppm	Sn	0.01 ppm
Be	0.01 ppm	Mo	0.01 ppm	Ta	0.01 ppm
Bi	0.01 ppm	Nb	0.01 ppm	Tb	0.01 ppm
Cd	0.01 ppm	Nd	0.01 ppm	Te	0.01 ppm
Co	0.01 ppm	Ni	0.01 ppm	Th	0.01 ppm
Cs	0.01 ppm	Pb	0.02 ppm	U	** 0.01 ppm
Cu	0.01 ppm	Pb 204	0.01 ppm	V	0.1 ppm
Dy	0.01 ppm	Pb 206	0.02 ppm	W	0.1 ppm
Er	0.01 ppm	Pb 207	0.02 ppm	Y	0.01 ppm
Eu	0.01 ppm	Pb 208	0.02 ppm	Yb	0.01 ppm
Ga	0.01 ppm	Pr	0.01 ppm	Zn	0.1 ppm
Gd	0.01 ppm	Rb	0.01 ppm	Zr	0.01 ppm
Ge	0.01 ppm	Sc	0.1 ppm		

Total Digestion:

Element	Detection Limit	Element	Detection Limit	Element	Detection Limit	Element	Detection Limit
Ag	0.02 ppm	Eu	0.02 ppm	Nd	0.1 ppm	Ta	0.1 ppm
Al_2O_3	*0.01 %	Fe_2O_3	*0.01 %	Ni	0.1 ppm	Tb	0.02 ppm
Ba	*1 ppm	Gd	0.1 ppm	P_2O_5	*0.002 %	Th	0.02 ppm
Be	0.1 ppm	Ga	0.1 ppm	Pb	0.02 ppm	TiO_2	*0.001 %
Bi	0.1 ppm	Hf	0.1 ppm	Pb 204	0.01 ppm	W	0.1 ppm
CaO	*0.01 %	Ho	0.02 ppm	Pb 206	0.02 ppm	U	** 0.02 ppm
Cd	0.1 ppm	K_2O	*0.002 %	Pb 207	0.02 ppm	V	0.1 ppm
Ce	*0.1 ppm	La	*1 ppm	Pb 208	0.02 ppm	Yb	0.02 ppm
Cs	0.1 ppm	Li	*1 ppm	Pr	0.1 ppm	Y	0.1 ppm
Cr	*1 ppm	MgO	*0.001 %	Rb	0.1 ppm	Zn	1 ppm
Co	0.02 ppm	MnO	*0.001 %	Sc	0.1 ppm	Zr	1 ppm
Cu	0.1 ppm	Mo	0.02 ppm	Sm	0.1 ppm		
Dy	0.02 ppm	Na_2O	*0.01 %	Sn	0.02 ppm		
Er	0.02 ppm	Nb	0.1 ppm	Sr	*1 ppm		

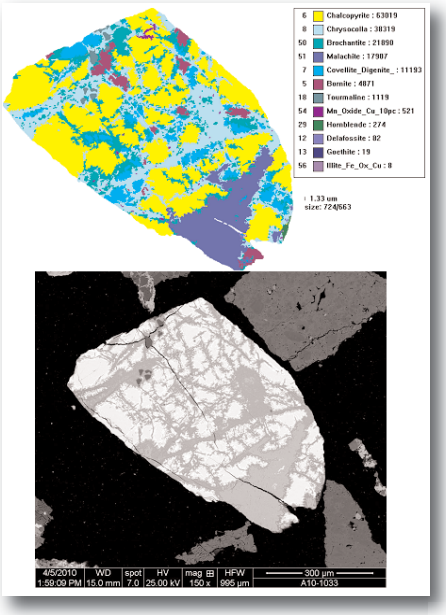
* Analysis carried out by ICP-OES. All other elements analyzed by ICP-MS.
**Depending on mineralogy some U may be volatilized as total digestion uses HF and some U may form UF6 which is volatile.

Equilibium Studies

The most abundant naturally occurring radioactive elements are potassium (K), uranium (U) and thorium (Th). K, eU and eTh are determined by gamma spectrometry from daughter products of the uranium and thorium series. The method assumes that the decay series are in radioactive equilibrium. The samples are sealed and stored for a minimum of 28 days before analysis. When total U, Th and K are determined, it is possible to determine if the samples are in equilibrium with their natural environment or if components have been leached out. The equilibrium studies are critical when using gamma bore hole logging techniques to avoid overestimating or underestimating resources.

Pricing upon request.

MLA & QEMSCAN Services



Applied Mineralogy is a discipline of mineralogy by which the unknowns and problems encountered during different mining steps can be approached and solved. Applied Mineralogy can be used to characterise the ore body, identify and quantify target minerals and their associations, and reveal the liberation, locking and grain size of the favoured phases; The data provided by Applied Mineralogy is essential for ore characterization, optimising recovery and mineral processing plans.

Geometallurgy is an integrated methodology and multi-disciplinary field which aims to add value to a mineral deposit or resource while looking ahead at risk- reduction, improved decision-making and cost-effective down-stream activities (e.g. development, pre-feasibility, feasibility and production). The objective of successful Geometallurgy is quality ore-characterization and establishing links and relationships between geology, mineralogy and processing characteristics.

For quantitative mineralogical analyses, Actlabs is equipped with FEI Quanta 650F MLA and QEMSCAN 650F instruments; they are state-of the-art Scanning Electron Microscopes (SEM) with superior resolution and performance over typical SEM systems. The Field Emission Gun source makes for significantly higher resolution analysis relative to regular MLA and QEMSCAN technology. Actlabs' Quanta 650F MLA and QEMSCAN 650F provide rapid, automated, non-destructive quantitative micro analysis used for integrated mineralogical and petrographical analyses.

Actlabs offers mineralogical analysis of assay rejects, drill core, RC drilling chips, plant samples and most other forms of man-made and natural materials. MLA can be applied to precious metals (Au, Pt, Pd, Ag), base metals (Cu, Ni, Co, Pb, Mo, Zn), ferrous and non-ferrous raw materials (Fe, Sn, Mn, W, Ta, Nb, U and REE), mineral sands, and graphite bearing rock.

Deliverable services for Geometallurgy and Applied Mineralogy

Quantified Modal Mineralogy Analysis
A rapid and efficient solution for identifying and quantifying the minerals present with detection limit of 0.1%. The measurement can be done on both thin section and polished section.

Particle and Grain Data Analysis
This type of analysis provides information on texture variations, size distribution of the target minerals, as well as locking and liberation characteristics for the ore minerals. Theoretical grade/recovery curve and association of the ore mineral with the gangue is also provided by this analysis.

Specific Phase Search (Including specific packages for Gold and Silver minerals)
This type of analysis is suitable to find PGM, low-grade levels of ore minerals, and other low-grade minerals like gold and silver. Trace and pathfinder phases can also be characterized. Once trace phases have been identified, data such as grain size distribution, classified images and particle counts can be provided. Actlabs has extensive experience in mineralogical analyses of precious metals as well as the ore minerals. Using our FEG (Field Emission Guns) equipped QEMSCAN/MLA we are able to find and characterise fine micron-sized or sub micron sized (>0.3 µm) Gold or Silver particles locked in the pyrites, quartz and other gangue minerals. We can perform total precious metal deportment useing FEG.

SE/BSE Imaging & Spectrum
Field Emission Gun technology enables us to take high-quality Backscattered Electron (for textural) and Secondary Electron (for topographic) images. In addition, both our MLA and QEMSCAN are equipped with two BRUKER SSD EDS detectors. The combination of detectors with the high intensity bright FEG source provides rapid and therefore low cost analysis for the customer.

Electron Probe Micro-analyzer
Whenever the major and minor elements of a mineral shall be identified and quantified with a high precision, EPMA in-situ analyses will be the solution. Actlabs has a procedure for oxides, silicates, sulphides and sulphates as well as alloys. EPMA analysis can be done in conjunction with MLA and QEMSCAN measurements as a complementary method.

Petrographic Analysis
For detailed description the rock, its mineralogy and textural relationships, as well as identification of the Coal components, Actlabs employs transmitted/reflected petrographic microscopy (Olympus BX52) on polished thin sections and polished sections.

For more details and quotation inquiries, please contact *geometallurgy@actlabs.com*.

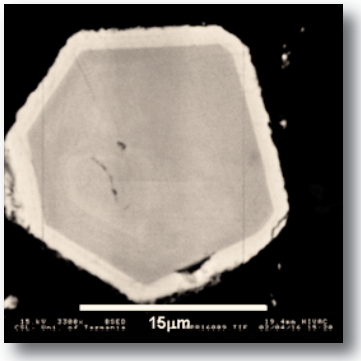
LA-ICP-MS

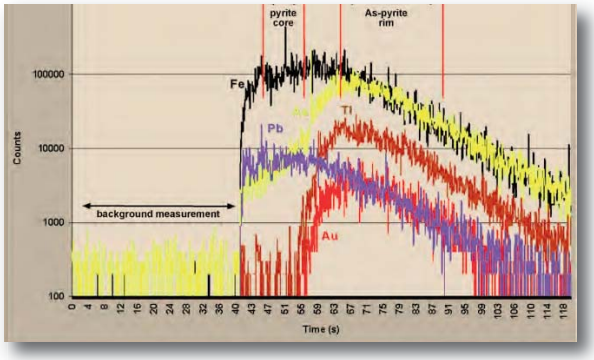
Actlabs offers services using our New Wave Research 213 nanometer laser which is linked to our Thermo Finnigan-High Resolution ICP-MS. Using our Super Cell, this provides the ultimate in sensitivity. The laser beam can analyze spots from 5 microns to 100 microns. Usually polished sections or polished thin sections can be analyzed. Scans across sections can be run on a programmed grid pattern as well. A number of elements can be scanned at the same time.

Some applications include: U/Th dating in Ziron from rim to core, Lead isotopic ratios in minerals, Analysis of trace elements in carbonate-rich matrices such as mussel shells, otholites, etc., Evaluation of impurities in metal samples, Rare earth elements scan in minerals, Selective extraction analysis of soils, Forensic analysis of plastics, ceramics, paint and glass, Analysis of metal contents in tree rings.

All pricing is by request. Please contact geometallurgy@actlabs.com.

Backscattered electron image of an euhedral pyrite grain with As-rich pyrite (light grey) rimming as As-poor core.





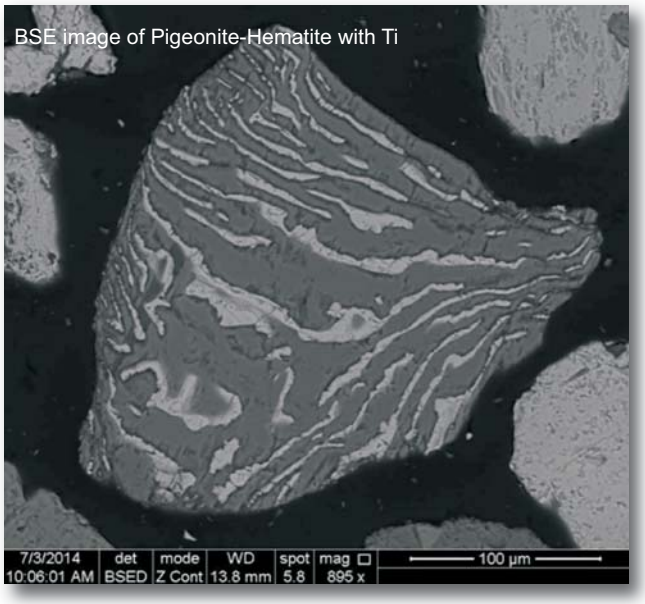
Analytical counts spectrum from a LA-ICP-MS spot analysis of a pyrite crystal similar to that seen in the backscattered electron image of pyrite.

From: Newsletter of the Centre for Ore Deposit Research, an ARC Special Research Centre at the University of Tasmania, Codes Newsletter 15 - December 2003.

Electron Microprobe Analysis

Playing a major role in mineralogy since it's development, the electron microprobe is used to determine the compositions of minerals in polished sections without destroying the mineral grains. It is a microbeam instrument, like the SEM, but wavelength spectrometers (WDS) are used to detect the X-ray counts from the sample surface instead of the EDS. Unlike the EDS, which detects and counts the X-rays signals for all elements at the same time, the WDS counts X-rays signals for only one element at a time. The WDS can count many more X-rays for the specific element in the same length of time and hence is more accurate than EDS, and has a lower detection limit. The relative error for microprobe is +/- 1% with detection limit of around 100 ppm.

All pricing is by request. Please contact geometallurgy@actlabs.com.



X-Ray Diffraction

Most minerals are crystalline and therefore scatter X-rays in a regular, characteristic way dependant on their crystal structure. Each mineral produces a unique diffraction pattern and can be identified from that pattern like a fingerprint. Identification of minerals is made by comparing their diffraction patterns with a library of over 17,000 mineral patterns stored in the International Centre for Diffraction Data (ICDD). Detection limits depend on the sample. For geological material, it is estimated that the minerals present in less than 2% of the sample might not be detected. The samples for X-ray diffraction analysis are ground or milled to a fine powder and then hand pressed into the sample holder. Approximately 1cm^3 of the material is sufficient for rock mineral analysis but smaller amounts can also be accommodated by using a low background holder.

Code 9	Price
Mineral Identification (semi-quantitative) - minerals are identified and their amounts determined using the Rietveld method	€80.00
Mineral Identification (quantitative) - minerals are identified and their amounts determined using the Rietveld method Corundum is added to the sample as an internal standard in order to determine the amount of X-ray amorphous material	€124.00
Mineral Identification (qualitative) - minerals are identified, however their amounts are not determined	€60.00
Clay Speciation	€160.00
Alpha Quartz	€80.00
Mineral Identification (Rietveld) + Clay Speciation	€240.00

* Quantity discounts may be applicable.

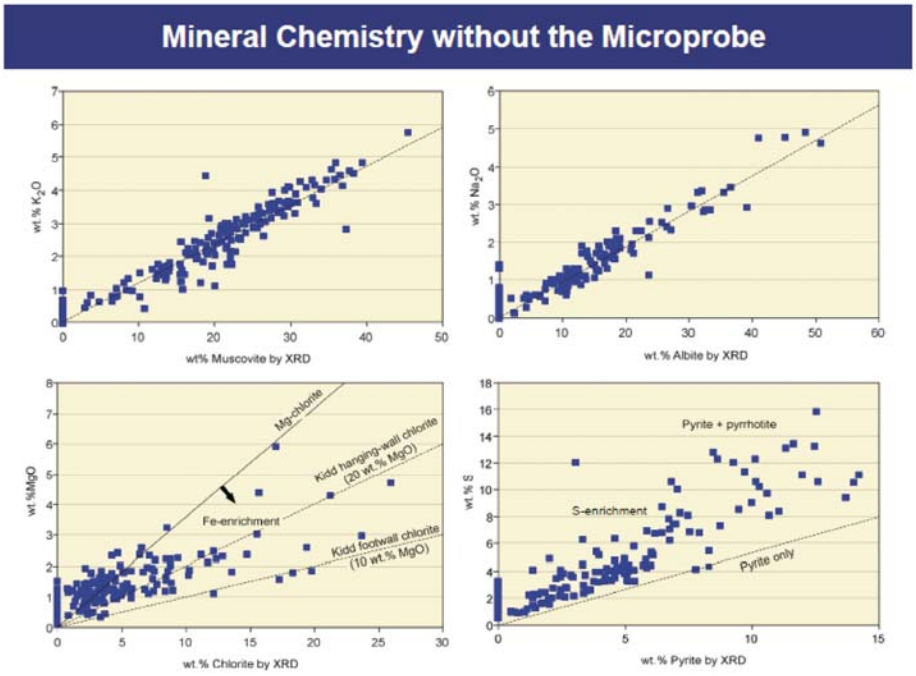
XRD Cluster Analysis

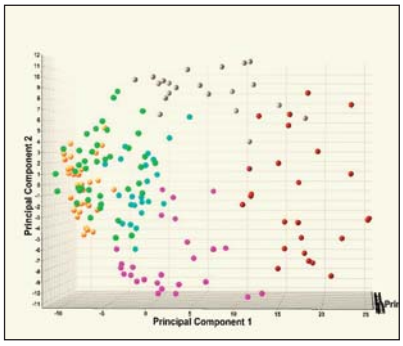
At Actlabs, we use the X'Pert HighScore Plus software to perform cluster analysis on X-ray diffraction (XRD) patterns. This is a statistical tool that groups XRD patterns into clusters based on the similarity of their peak and profile information, and it can be used to rapidly group large data sets into smaller clusters with more similar mineralogy. This has potential applications for mining and exploration, wherein clustering would highlight existing changes in mineralogy within a deposit. Clustering would also be useful for determining mineralogical variability within metallurgical processing samples that could inform methodology.

Some Useful Applications:

- Create a multidimensional compositional ore deposit maps or alteration maps
- Ore grade control

An example of applying XRD can be seen in the following diagrams by Dr. Mark Hannington (2013) of the University of Ottawa.





3-D Principle Component Plot

Pricing available upon request.

Metallurgical Services

Actlabs offers a full characterization of the ore and evaluation and testing of ore processing and extraction methods.

We use geometallurgy techniques to characterize the ore and forecast the behavior of the ore and gangue minerals during processing and optimize the recovery.

We offer bench-scale metallurgical testing which is customized and designed in consultation with each client and project.

Services offered cover a wide range of precious metals, base metals and industrial minerals.

The Metallurgical services offered include:

Sample Preparation	Custom preparation of small to bulk samples including compositing, blending and preparation of representative test sub-samples Customized crush and grind size
Comminution	Crushing (Jaw & Roll) Grinding (Steel Ball & Rod, Ceramic Media) Bond Work Index Size Classification (Screening and Cyclosizing)
Gravity Concentration	Centrifugal Concentration (Knelson) Shaking Table (Wilfley) Heavy Liquid Separation
Flotation	Batch Flotation Kinetic Testing Locked Cycle Testing
Magnetic Separation	Davis Tube Recovery
Hydrometallurgy	Bottle roll and tank leaching Cyanide, acid and alkaline leach CIL & CIP Activated Carbon Testing (Adsorption & Quality) Sequential Diagnostic Leaching

Additional Services may become available on site and additional services including pilot plant tests are available through a partner service provider, please enquire.

All pricing is by request.

Contact details:

Metallurgy@actlabs.com

807-622-6707 ext 422

Knelson Concentrator

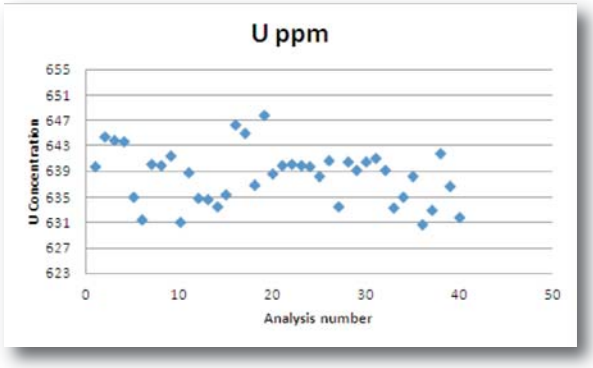

Graphite flotation


Cyanide Titration


Iron Ore Tabling


Bond Grindability Mill

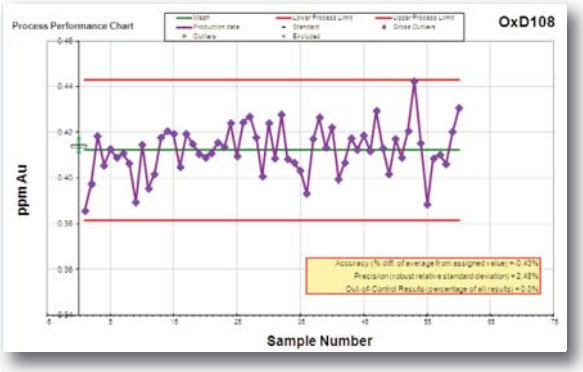
Standard Reference Materials (SRM) of known elemental composition play an important role in the quality assurance (QA) of grass roots exploration programs and development projects. SRMs are developed to meet measurement needs and as control samples. They provide a known, well characterized entity to compare and evaluate laboratory analysis results. Unfortunately not all laboratory results are the same despite the fact they may be generated by the same analytical method such as fire assay with an atomic absorption finish. There are variations to the technique that each lab uses as well as a variety of calibration procedures which may lead to vastly different results on your samples. Some of these differences include amount of litharge in the flux, the flux to sample ratio, reuse of the same crucibles, age and state of repair of instrumentation, diligence of analysts in calibration, age of standards, sample preparation, etc. Using hidden SRMs with values only known to you on your standards provides an excellent means to judge accuracy and precision of the labs you are using. This is critical for the QP to avoid future embarrassment and undermine confidence in results in the investor's mind on the reliability of results.



Homogeneity Testing

SRM Preparation

In order to provide the exploration market with SRMs, Actlabs has developed a set of rigorous sample preparation procedures. We can use natural soils, rock, ores or sediments collected by the client from their project area so their matrix is matched (best case scenario on your samples). Samples from 1 and up to 125 kg can be prepared as an SRM. The whole sample is dried at 60 degrees, then is crushed, pulverized and screened with 100% #240 mesh (-63 microns) stainless-steel sieve. The resulting pulp goes through a blending step using a Stainless Steel industrial V-Blender. The blend is achieved by the constant dividing and inter-meshing particle movement by the two connected cylinders. Inside the blender is a high-speed agitator bar to thoroughly mix the sample. Each cylindrical leg has an access cover for easy material loading and cleaning.

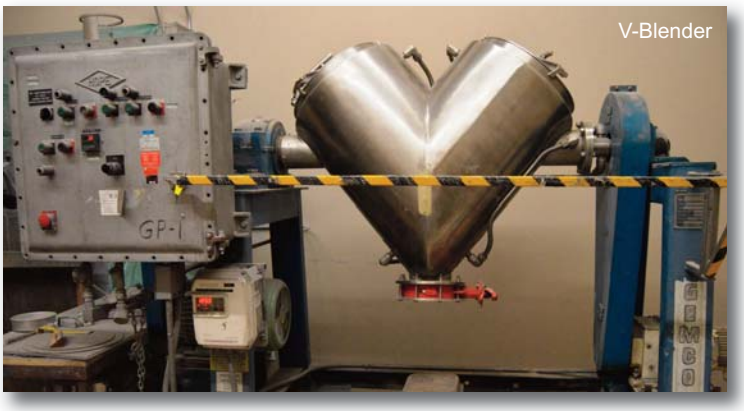


Au Control Charting

A homogeneity test will show that all elements in the mixture were distributed evenly within the material. After results of the homogeneity testing are determined, the mixed material is packed in plastic bottles or in sealed foil pouches under nitrogen (to prevent oxidation of sulphides).

Any suggested elements or group of elements can be certified (this also applies to major, minor and trace elements). Actlabs can certify concentration of elements by using any digestion you will use for your projects or for total metals. As we have perhaps the most diverse lab with virtually all instrumentation including fire assay (nickel sulphide and lead), atomic absorption, gravimetric, ICP-OES, ICP-MS, HR-ICP-MS, XRF, INAA, CNHS analyzers and many more, we can develop values or can go round robin to other labs to certify values.

For more information please contact us at *crm@actlabs.com*.



V-Blender

Spatiotemporal Geochemical Hydrocarbons (SGH)

This "organic" based geochemistry has been researched and refined since 1996 to locate blind mineral targets. It has been found to have a high level of performance and success. Most clients that use SGH for the first time send in orientation surveys over known mineralization to test this organic based geochemistry. SGH has been found to be effective as over 90% of these clients have returned to have larger exploration surveys analyzed using SGH. SGH is a dual purpose geochemistry as it identifies and locates targets at depth as a vertical projection. SGH has some unique and powerful traits such as:

- SGH is deep penetrating detecting mineral and petroleum targets at over 1,000 metres in depth. Relatively shallow targets of 10 metres can be delineated equally as well.
- SGH detects 162 specific and unique hydrocarbons that are heavier, in the C5 to C17 carbon series range. It does not measure gaseous hydrocarbons in the C1 to C4 carbon range as the name implies. These hydrocarbons are from the decomposition of bacteria that have used the target mineralization as a food source. This signature provides a highly confident forensic identification of the mineralization at depth.
- SGH can be conducted on a wide range of sample types, not just soils. Successful surveys have used soil from a variety of horizons, as well as sand, humus, peat, till, submerged lake-bottom sediments and even snow. This flexibility is vital in areas that are challenging to sample, especially in northern latitudes, and ensures that none of the intended samples in a planned survey are missed.
- SGH interpretation templates have been defined and currently include SGH signatures for Copper, Gold, Nickel, Zinc, and Uranium targets; VMS, SEDEX, Polymetallic, Tungsten, IOCG and PGE based deposits, Kimberlites, as well as for Coal seams, oil and gas plays. These general templates have also been applicable to a wide variety of lithologies; e.g. sediment-hosted, massive-sulphide, epithermal, vein hosted, disseminated, porphyry, Carlin, and polymetallic settings for gold and other types of deposits.
- SGH is discriminating. This geochemistry has been said to be a "REDOX cell locator" but has also been proven to be able to discriminate between ore-bearing and barren conductors; and between mineralized targets and barren granitic or graphitic magnetic anomalies.
- SGH has been directly linked to geophysical results such as from airborne magnetic surveys, and induced potential surveys (IP, CSAMT).
- SGH is blind to the inorganic content of samples and thus does not reflect mobilized anomalies or any nugget effects.
- SGH has been thoroughly researched in CAMIRO (Canadian Mining Industry Research Organization) projects as well as projects conducted by Geoscience-BC; the Ontario Geological Survey (OGS); AMIRA; CSIRO; University based projects; and individual company sponsored projects. These studies have demonstrated that SGH is capable of providing clear, easily identifiable, target related anomalies even in surveys where other geochemical methods have been unsuccessful.
- SGH results are delivered in an Excel spreadsheet accompanied by an SGH Interpretation Report (> 40 pages). The report includes a comparative rating of your results against studies over similar target types.
- SGH has been used successfully to discover new previously un-drilled mineral deposits.

Sample Type and Survey Design: It is highly recommended that at least a minimum of 50 sample "locations" is used in a survey to obtain enough samples into background areas on both sides of small targets (wet gas plays, Kimberlite pipes, Uranium Breccia pipes, veins, etc.). More samples are recommended for large targets. SGH can also be used in regional surveys. Enough samples over both the target and background areas are recommended in order to fully study the dispersion patterns or geochromatography of the SGH Pathfinder Classes of compounds. Consult our website or call the lab for assistance in survey design.

SGH has been shown to be very robust to the use of different sample types even "within" the same survey or transect. This capability has been vital to the successful use of SGH in areas of difficult terrain. This enables the interpretation of a regular grid or set of transects as samples do not have to be missed due to the different sample types encountered. Samples should be "fist" sized (50-100 grams), can be drip dried in the field, and do not need special preservation for shipping.

Pricing for SGH: **€38.50 per sample**. A minimum of 50 samples locations per target is required unless a custom quotation has been obtained. For large surveys volume discounts may apply, please enquire. Relative or UTM sample coordinates must accompany the samples when submitted to allow development of the SGH interpretation report.

Sample preparation charges are additional (Code S4). This pricing includes the delivery of an SGH interpretation report for one commodity type (e.g. Cu, Ni, Au, U, Kimberlite, etc.), for more complex targets (e.g. VMS, SEDEX, Polymetallic, IOCG, IOCGU, Cu-Au Porphyry, etc), an extra price of €400.00 is applied to cover the time for the additional interpretation required. Further additional requested interpretations (using the same SGH data) are available at a price of €960.00 each. The basic SGH Interpretation Report of approximately 50 pages is optimized for conveying the most important information. A more in-depth supplemental report is available at a price of €960.00. A GIS package is available that includes a set of geo-referenced image files for each SGH map shown in the final report as well as an Excel spreadsheet of the SGH data used in producing the maps. Price for the GIS package is €240.00.

Please contact Mr. Dale Sutherland (dalesutherland@actlabs.com or 1.888-228-5227 x. 114) for more information and for a custom quotation.

Organo-Sulphur Geochemistry (OSG)

ORGANO-SULPHUR GEOCHEMISTRY (OSG) *****NEWLY AVAILABLE*****
OSG has been developed, researched and refined since 2008. This new geochemistry analyzes for 105 sulphur-based compounds that are from the decomposition of bacteria feeding on sulphur-based mineralization. To date it has proven to be an excellent drill targeting tool providing dart board like vectoring. This geochemistry can be use to supplement SGH and provide more precise drill target locations.

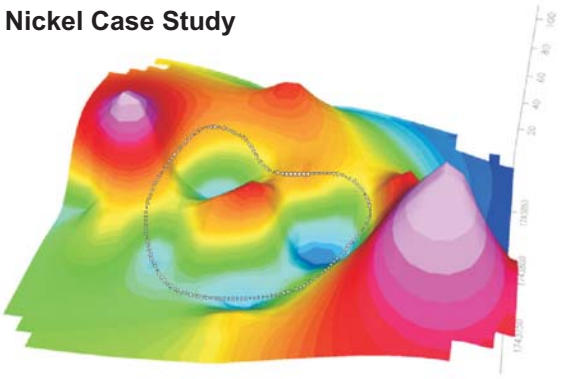
Pricing for OSG: **€38.50 per sample**. A minimum of 50 samples locations per target is required unless a custom quotation has been obtained. For large surveys volume discounts may apply, please enquire. Relative or UTM sample coordinates must accompany the samples when submitted to allow development of the OSG interpretation report.

Sample preparation charges are additional (Code S4). This pricing includes the delivery of an OSG interpretation report for one commodity type (e.g. Cu, Ni, Au, Ag, or VMS). A GIS package is available that includes a set of geo-referenced image files for each OSG map shown in the final report as well as an Excel spreadsheet of the OSG data used in producing the maps. Price for the GIS package is €240.00.

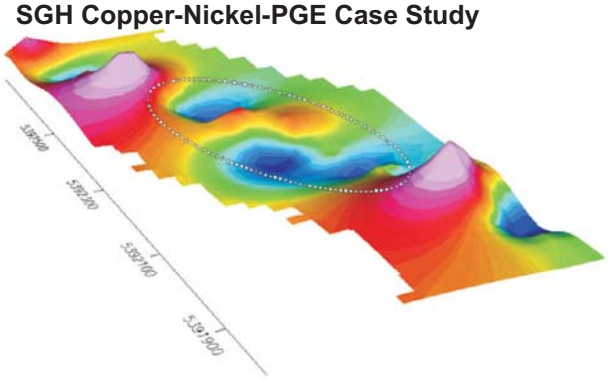
Please contact Mr. Dale Sutherland (dalesutherland@actlabs.com or 1.888-228-5227 x. 114) for more information and for a custom quotation.

SGH and OSG Case Studies

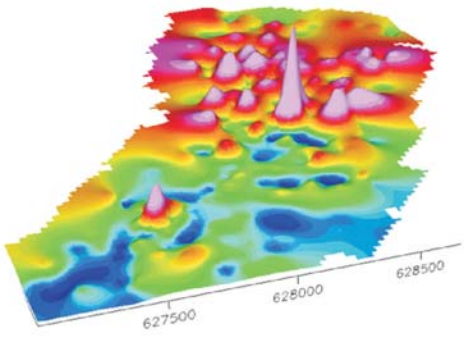
SGH Nickel Case Study



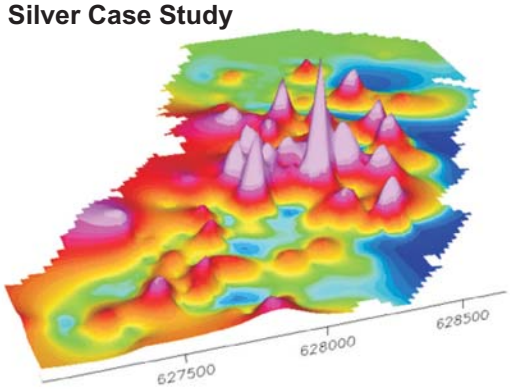
SGH Copper-Nickel-PGE Case Study



OSG Gold Case Study



OSG Silver Case Study



Enzyme Leach, Bioleach, MIG and Selective Extractions

Selective Extractions (SE) are a cost-effective method of finding blind mineralization through deep cover such as exotic over burden, lake beds, barren bedrock, or younger volcanic rocks. Very subtle trace element signatures have been added to soil above mineralization by elements migrating to the surface through a variety of mechanisms. Some traps for these signatures include Mn oxides, clay, carbonates, and organic material. Varieties of Selective Extractions target different trap types to release the signal of mineralization. A weaker leach is required to isolate the signal of blind mineralization from that of the over burden. Conventional partial leaches, like aqua regia extraction-ICP, extract metals from sulphides, oxides and silicates. This provides a partial composition of the overburden which will contaminate the signal of the buried mineralization. Pattern recognition is the key to proper interpretation of SE data, since anomaly patterns can be different from conventional geochemical data. Selective extractions have been shown to work effectively in both acidic and alkaline environments, and have been used successfully in desert, tropical, glacial and permafrost terrains.

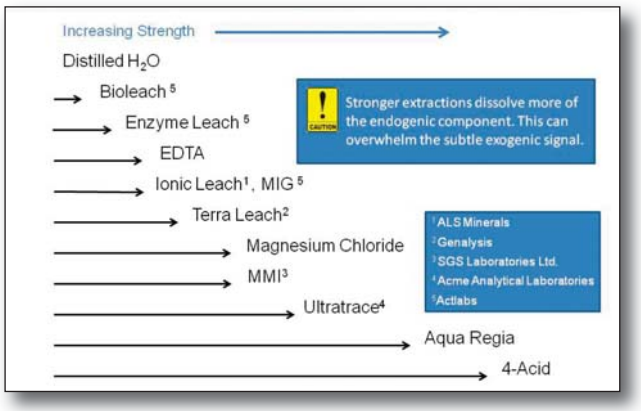
Enzyme Selective Extraction (ESE) is one of the most discriminating of the selective analytical extractions in use today. This selective extraction targets amorphous mixed oxide coatings. By selectively removing the amorphous manganese dioxide from these coatings, the mixed oxide coatings collapse, releasing trapped trace elements. At this time, the greatest depth of penetration of ESE for a mineral deposit is greater than 800 metres.

Bioleach uses technology proprietary to Actlabs. Through years of research by Actlabs supported by CAMIRO (Canadian Mineral Research Organization) with our SGH technology, Actlabs has proven that microbiological processes are exceptionally important for the mobilization of metals from a mineral deposit to the surface. Redox cells develop above mineralization which bacteria then feed upon. Bioleach digests remnant proteins that these bacteria have left behind when they die. These proteins contain elements related to concealed mineral deposits. The proteins migrate upwards and become adsorbed on soil particles and can then be digested by Bioleach.

MIG (Mobile Ion Geochemistry) isolates the chemically active metal ions which were loosely adsorbed to soil particles. This is a weak leach that uses a solution of organic and inorganic compounds to extract target elements.

Preparation and Analysis
The recommended sample material is upper B-horizon soil sampled at a continuous depth. After materials are collected, they are air dried or dried in special rooms kept below 40°C. Samples then undergo the chosen SE under rigidly controlled conditions. The resultant solutions are analyzed by ICP-MS.

Add-ons:	
Final pH of leach solution	€6.50
Conductivity of leach solution	€6.50
pH and conductivity	€10.00
Prewash, if required, on high salt samples	€2.50



	7ESE Enzyme SE	7EnhESE Enhanced Enzyme	7SaltESE High Salt	7 Bioleach	7 MIG Mobile Ion Geochem.
Ag	0.2	0.1	0.2	0.2	0.2
Al	0.5ppm	0.5 ppm	0.5 ppm	0.5 ppm	0.5 ppm
As	1	0.1	5	0.5	0.5
Au	0.05	0.005	0.1	0.05	0.05
Ba	1	0.5	1	1	1
Be	2	0.1	20	0.07	0.07
Bi	0.8	0.5	1	0.1	0.1
Br	5	1	30	5	5
Ca	5 ppm	5 ppm	0.5 ppm	5 ppm	0.5 ppm
Cd	0.2	0.1	0.2	0.05	0.05
Ce	0.1	0.01	1	0.02	0.02
Cl	* 2000	* 1000	* 3000		
Co	1	0.2	1	0.1	0.1
Cr	20	3	50	* 2	* 2
Cs	0.1	0.01	1	0.01	0.01
Cu	3	1	5	0.5	0.5
Dy	0.1	0.01	1	0.01	0.01
Er	0.1	0.01	1	0.01	0.01
Eu	0.1	0.01	1	0.01	0.01
Fe	1 ppm	1 ppm	1 ppm	1 ppm	1 ppm
Ga	1	0.3	1	0.1	0.1
Gd	0.1	0.01	1	0.03	0.03
Ge	0.5	0.05	1	0.05	0.05
Hf	0.1	0.01	1	0.04	0.04
Hg	* 1	* 0.1	* 1	* 0.05	* 0.05
Ho	0.1	0.01	1	0.01	0.01
I	2	1	10	1	1
In	0.1	0.01	0.2	0.1	0.1
K	5 ppm	5 ppm	5 ppm	5 ppm	5 ppm
La	0.1	0.01	1	0.01	0.01
Li	* 2	* 0.5	* 10	* 0.2	* 0.2
Lu	0.1	0.01	1	0.01	0.01
Mg	2 ppm	2 ppm	2 ppm	2 ppm	2 ppm
Mn	1	0.4	10	0.1	0.1
Mo	1	0.1	1	2	2
Na	5 ppm	5 ppm			
Nb	1	0.1	1	0.2	0.2
Nd	0.1	0.01	1	0.03	0.03
Ni	3	1	5	0.2	0.2
Os	1	0.5	1	1	1
Pb	1	0.1	1	0.1	0.1
Pr	0.1	0.01	1	0.01	0.01
Pt	1	0.5	1	0.5	0.5
Pd	1	0.5	1	0.5	0.5
Rb	1	0.1	1	0.1	0.1
Re	0.01	0.005	0.1	0.01	0.01
Ru	1	0.5	1	0.05	0.05
Sb	0.1	0.01	1	0.2	0.2
Sc	*100	*10	*1000	*0.5	*0.5
Se	5	1	30	1	1
Sm	0.1	0.01	1	0.03	0.03
Sn	0.8	0.2	1		
Sr	1	0.1	1	0.1	0.1
Ta	0.1	0.02	1	0.01	0.01
Tb	0.1	0.01	1	0.01	0.01
Te	1	0.5	1	1	1
Th	0.1	0.01	1	0.02	0.02
Ti	* 100	* 10	* 1000		
Tl	0.1	0.005	1	0.2	0.2
Tm	0.1	0.01	1	0.01	0.01
U	0.1	0.01	1	0.01	0.01
V	1	0.1	5	1	1
W	1	0.1	1	0.01	0.01
Y	0.5	0.05	1	0.02	0.02
Yb	0.1	0.01	1	0.02	0.02
Zn	10	5	10	2	2
Zr	1	0.1	1	0.5	0.5
Price:	**€24.75**	**€32.00**	**€32.00**	**€23.25**	**€23.25**

All elements are in ppb except where noted.

* Semi-Quantitative

	Sodium Pyro-phosphate Leach	Sodium Pyro-phosphate HR-Leach	Sodium Acetate Leach	Hydro-xylamine Leach	De-ionized water Leach
Ag	500	8	5	10	0.1
Al	10 ppm		5 ppm	10 ppm	0.5 ppm
As	300	160	30	40	0.1
Au	5	28	5	5	0.005
B		970			
Ba	300	16	1000	50	0.5
Be	50	4	10	20	0.1
Bi	40	1	10	100	0.5
Br	300	2009	500	2000	1
Ca	500 ppm	20	200 ppm	700 ppm	5 ppm
Cd	20	1	10	5	0.1
Ce	40	8	3	2	0.01
Cl					* 1000
Co	50	4	5	5	0.2
Cr	* 500	* 24	* 100	* 5000	3
Cs	2	4	2	5	0.01
Cu	600	40	100	40	1
Dy	5	0.1	2	1	0.01
Er	1	0.1	1	1	0.01
Eu	5	0.1	1	0.5	0.01
Fe	50 ppm	400	5 ppm	10 ppm	1 ppm
Ga	20	4	10	5	0.3
Gd	5	0.1	1	1	0.01
Ge	300	4	5	10	0.05
Hf	5	0.4	2	5	0.01
Hg	* 200	* 160	* 20	* 20	* 0.1
Ho	1	0.04	0.5	0.5	0.01
I	1000	80	100	200	1
In	2	0.4	1	0.5	0.01
K	50 ppm	4000	20 ppm	50 ppm	5 ppm
La	20	8	2	2	0.01
Li	* 1000	* 120	* 100	* 50	* 0.5
Lu	1	0.04	0.5	0.5	0.01
Mg	10 ppm	800	5 ppm	10 ppm	2 ppm
Mn	300	400	100	40	0.4
Mo	40	16	20	20	0.1
Na				50 ppm	5 ppm
Nb	20	0.4	1	0.5	0.1
Nd	20	0.4	2	2	0.01
Ni	1000	200	30	80	1
Os	100		100	100	0.5
Pb	1000	12	40	20	0.1
Pr	5	0.1	0.5	0.5	0.01
Pt	100		100	100	0.5
Pd	100		100	100	0.5
Rb	20	20	20	10	0.1
Re	1	0.4	0.5	0.5	0.005
Ru	100		100	100	0.5
Sb	20	4	5	5	0.01
Sc	* 300	* 40	* 200	* 200	*10
Se	700	600	600	200	1
Sm	10	1	2	2	0.01
Sn		24	10	100	0.2
Sr	100	40	100	100	0.1
Ta	3	2	1	0.5	0.02
Tb	1	0.1	1	0.5	0.01
Te	200	4	50	10	0.5
Th	100	0.1	1	0.5	0.01
Ti		* 40	* 400	* 500	* 10
Tl	100	0.4	0.5	1	0.005
Tm	1	0.4	1	0.5	0.01
U	200	0.4	1	0.5	0.01
V	200	2	20	500	0.1
W	30	4	10	5	0.1
Y	10	1	1	0.5	0.05
Yb	2	0.2	3	0.5	0.01
Zn	1000	1600	2000	500	5
Zr	100	4	80	400	0.1
Price:	**€32.00**	**€40.00**	**€32.00**	**€32.00**	**€32.00**

Sequential Leaches

Sequential leaches can target specific soil or rock phases and allow a better interpretation of the geochemical processes involved. A sample will undergo sequential leaching process starting with the weakest leach to the strongest leach with subsequent analysis of each of the leachates by ICP-MS.

Some of the potential leaches which can be combined sequentially include from the weakest to the strongest:

Code 7 - Deionized Water	This water soluble leach attacks any water soluble component or most labile bound components. The leach is not buffered and can be affected by buffering the sample mineralogy.
Code 7 - Enzyme SE	Selectively goes after amorphous Mn oxides
Code 7 - Bioleach	A leach proprietary to Actlabs that has been designed to extract dead bacterial remnants
Code 7 - Sodium Acetate Leach pH 5	For exchangeable cations adsorbed by clay and elements co-precipitated with carbonates
Code 7 - Sodium Pyrophosphate Leach	0.1M leach for elements adsorbed by organic material (humic and fulvic components)
Code 7 - MIG Leach	For mobile metal components
Code 7 - Hydroxylamine Leach cold	For amorphous Fe oxides and crystalline Mn oxides
Code 7 - Hydroxylamine Leach hot	For amorphous and crystalline Fe oxides and crystalline Mn oxides.
Code 7 - Aqua Regia	Will leach sulphide species and clay minerals
Code 7 - Four Acid	Will dissolve silicate remnant material

Price: €32.00/leach/sample

Note: There is a €160.00 set-up charge per leach chosen if there are under 10 samples.

Add-ons:	
Final pH of leach solution	€6.55
Conductivity of leach solution	€6.50
pH and conductivity	€10.00

All elements are in ppb except where noted.

* Semi-Quantitative

Heavy Mineral Concentrates

	HMC Thermal Code 3A	HMC Base Metals Code 3C
Ag	5 ppm	0.2 ppm
As	2 ppm	
Au	5 ppb	
Ba	200 ppm	
Br	5 ppm	
Ca	1%	
Cd		0.5 ppm
Ce	3 ppm	
Co	5 ppm	
Cr	10 ppm	
Cs	2 ppm	
Cu		1 ppm
Eu	0.2 ppm	
Fe	0.02%	
Hf	1 ppm	
Hg	5 ppm	
Ir	50 ppb	
La	1 ppm	
Lu	0.05 ppm	
Mn		2 ppm

	HMC Thermal Code 3A	HMC Base Metals Code 3C
Mo	20 ppm	2 ppm
Na	0.05%	
Nd	10 ppm	
Ni	200 ppm	1 ppm
Pb		2 ppm
Rb	50 ppm	
S		100 ppm
Sb	0.2 ppm	
Sc	0.1 ppm	
Se	20 ppm	
Sm	0.1 ppm	
Sr	0.2%	
Ta	1 ppm	
Tb	2 ppm	
Th	0.5 ppm	
U	0.5 ppm	
W	4 ppm	
Yb	0.2 ppm	
Zn	200 ppm	1 ppm

Code 3A - Heavy Mineral Concentrates (Thermal Irradiation)

Heavy mineral concentrates prepared from reverse circulation drilling samples or from panned concentrates are expensive to collect. The nugget effect may require that the entire sample be analyzed to ensure that the few particles of gold which may be present can be measured. With INAA the whole concentrate can be analyzed without grinding the samples. The sample is therefore preserved for other chemical or mineralogical work. Actlabs only irradiates with thermal neutrons so as to avoid low gold values due to self shielding effects from irradiation with epithermal neutrons. The price varies depending on the volume of concentrate to be analyzed. **There are 3 vial sizes available: small (2 g) €15.25, medium (20 g) €17.00 or large (60 g) €21.00**. Actual weight may vary depending on mineralogy.

Code 3C - HMC Base Metals by Aqua Regia ICP

When the analyses by INAA are completed, the sample is available to determine additional elements by other analytical techniques. Code 3C is a frequently requested Aqua Regia extraction ICP-OES package (0.5 g required). **First element price for Code 3C is €5.00 with each additional element costing €1.75. All elements €9.00**. Code 3C may require the sample to be pulverized finer, if coarser than 80 mesh, (+175 micron) at an additional cost.

Radionuclides - Solids

For Liquids, see page 19

Code 14 - Radionuclides Analysis on Solid Samples

Nuclide	Method	Detection Limit	Price
Ra^{226}	Alpha Spectrometry	0.01 Bq/g	€144.00
Gross α, Gross β	L/B Alpha, Beta Counting	α = 0.05 Bq/g; β = 0.15 Bq/g	€96.00
Pb^{210}	L/B Alpha, Beta Counting	0.2 Bq/g	€160.00
Po^{210}	Alpha Spectrometry	0.01 Bq/g	€140.00
Th^{230} and Th^{232}	Alpha Spectrometry	0.01 Bq/g	€160.00
Th^{228}	Beta Counting	0.04 Bq/g	€160.00

Code 15 - Gamma Scan (all or part nuclides)

Method: Gamma Spectrometry

Nuclide	Detection Limit
Pb^{210}	0.1 Bq/g
Ra^{226}	0.1 Bq/g
Pb^{212}	0.05 Bq/g
Pb^{214}	0.1 Bq/g
Tl^{208}	0.03 Bq/g
Bi^{212}	0.05 Bq/g
Bi^{214}	0.1 Bq/g
Ac^{228}	0.1 Bq/g
K^{40}	1.0 Bq/g
Price	**€80.00**

Code 16 - Equivalent uranium (eU)

Gamma Spectrometry

Nuclide	Detection Limit
K^{40}	1.0 Bq/g
U^{238}	0.1 Bq/g
Th^{232}	0.1 Bq/g
Price	**€160.00**

Isotopic Analysis

When submitting samples, please supply details on rock or mineral type and alteration.

Code 10 A - Parameter	Amt. Required	Precision	Price
Pb - Isotopic analysis by HR-ICP-MS (Pb >15ppm) (1-10 samples)	~ 1 g	0.4 - 0.5%	€168.00
Pb - Isotopic analysis by HR-ICP-MS (Pb >15ppm) (>10 samples)	~ 1 g	0.4 - 0.5%	€124.00
Pb - Isotopic analysis by TIMS	~ 1 g	0.1 - 0.2%	€376.00
Nd - Isotopic Analysis by TIMS	~ 1 g		€376.00
Sr - Isotopic Analysis by TIMS	~ 1 g		€376.00
Sm-Nd - Isotopic Analysis by TIMS	~ 1 g		€544.00
Rb-Sr - Isotopic Analysis by TIMS	~ 1 g		€544.00
Hg - Isotopic Analysis by multicollector ICP-MS	~ 1 g		On request
$\delta^{13}C$ – Graphite or Organic Material	1 mg C	0.2 ‰	€152.00
$\delta^{13}C$ and $\delta^{18}O$ – Carbonates	1 mg C	0.2 ‰	€124.00
$\delta^{13}C$ and $\delta^{18}O$ – Siderite, Magnesite, Dolomite	1 mg C	0.2 ‰	€152.00
Nitrogen Isotopes - Organic Material			€124.00
Deuterium Isotopic Analysis – Water	20 ml	3.0 ‰	€148.00
Deuterium Isotopic Analysis – Minerals	1 mg	0.2 ‰	€340.00
$\delta^{18}O$ – Water	20 mL	0.2 ‰	€128.00
$\delta^{18}O$ – Silicates	15 mg	0.3 ‰	€300.00
$\delta^{18}O$ – Sulphates	25 mg	0.3 ‰	€144.00
$\delta^{18}O$ – Organics	10 mg N	0.2 ‰	€160.00
$\delta^{34}S$ – Sulphate	10 mg	0.2 ‰	€92.00
$\delta^{34}S$ – Sulphate in water			€148.00
$\delta^{34}S$ – Sulphide	5 mg	0.2 ‰	€92.00
$\delta^{34}S$ – Sulphide-bearing material which contains carbonate	100 mg	0.2 ‰	€128.00
$\delta^{34}S$ – Silicate rocks which contain sulphur			€128.00
^{3}H – Direct	20 mL	8.0 TU	€128.00
^{3}H – Enriched	1L	0.8 TU	€344.00
^{3}H – Accelerator Mass Spectrometry (AMS)	1L		€560.00
C-14 - Accelerator Mass Spectrometry (AMS)	1 g C		€480.00

Geochronology

CODE 10B - Ages of geological formations or secondary events (i.e. alteration or metamorphism) can be determined through using K-Ar, (Ar-Ar), U-Pb, Rb-Sr or the Sm-Nd dating methods. These analytical procedures include several steps:

(i) dating method selection
(ii) sample collection
(iii) sample preparation, mineral separation and treatment
(iv) irradiation of the samples in a nuclear reactor for the Ar-Ar technique
(v) high precision determination of the concentration of the mother and daughter isotopes by TIMS (thermal ionization mass spectrometry)
(vi) apparent age calculation and interpretation of the results

The dating strategy depends on the type of formation (magmatic, metamorphic or sedimentary), the sample composition and the age of the formation. The concentration of the mother and the daughter isotopes, as well as the apparent age can be determined with high precision. In many cases, however, the determined age may not be the real age of the geological event. The apparent age may be affected by the post-depositional or post-formation history of the rocks. Natural contamination of chemical sediments with detrital material can also affect the results of dating of diagenesis.

There are some techniques and calculations which can "look through" the post formation event. These include isochron dating (K-Ar, U-Pb, Rb-Sr and Sm-Nd) or the step heating Ar-Ar technique of the K-Ar method. In the Ar-Ar technique, the K and Ar are measured on the same sample aliquot. First the sample is irradiated in a nuclear reactor, where fast neutrons convert some of the ^{39}K to ^{39}Ar. After irradiation, the Ar is released fractionally by incremental heating. The result is a series of apparent ages from which useful information about the geologic history and the age of the sample can be inferred. Specific techniques for dating clay fractions have also been developed.

Our geochronological services provide dating methods for all types of geological samples through use of modern analytical facilities. We can advise on selecting the method of dating, sampling and interpretation of the data so that meaningful geological results are obtained.

For the dating of a monomineralic sample only tens of milligrams of sample are required. For rocks, a few hundred milligrams are typically used for analysis. Size of the rock sample required will vary considerably for mineral separation depending on which minerals must be separated and the amount and type of the accessory minerals present.

Advice concerning dating strategies and interpretation of data is provided, as required. Discounts may be applicable for large dating programs. For more information, please contact: Dr. Yakov Kapusta (kapusta @actlabs.com) or at (905) 648-9611.

10 B - Services Offered	Description All prices by request
K-Ar dating	Rock fractions, clay fractions and separated minerals (e.g., biotite, hornblende, sericite, K-feldspar, illite, glauconite, etc.)
K-Ar dating in duplicate	Two independent measurements on one sample
^{40}Ar-^{39}Ar step heating dating	Rock fractions, clay fractions or separated minerals (e.g., biotite, hornblende, sericite, K-feldspar, illite, glauconite, etc.)
U-Pb dating by TIMS	Single grain analysis (e.g., zircon, monazite, titanite, apatite)
U-Pb isochron dating by SHRIMP	Single grain analysis
Rb-Sr dating by TIMS	Isochron dating whole rock and minerals
Sm-Nd dating by TIMS	Isochron dating whole rock and minerals
Re-Os dating	Re-Os dating
Petrographic description	Includes thin section preparation
Mineral Separation	Specific mineral phases are separated to provide best data for age dating

Enviromining & Acid Base Accounting

Static Testing

Code 11 – Acid-Base Accounting

Acid Base Accounting (ABA) is used to make static measurements of Acid Rock Drainage potential. Measurements of total sulphur or sulphide sulphur are used to estimate the amount of acid bearing material. Using this information the Neutralization Potential (NP), Acid Producing Potential (APP) and Net Neutralization Potential (NPP) are reported.

The Sobek package is the original method described by Sobek for the US EPA. The Modified Sobek package is that by Lawrence and Wang. The Siderite correction package applies a method to limit the overestimation of NNP in the Sobek method caused by the presence of siderite.

Code 11 – Maximum Potential Acidity (MPA)

The amount of acid that could be generated by the sulphur contained within a sample. This is done assuming that all sulphur occurs as reactive pyrite.

Actlabs offers the following ABA packages:

Parameter	11-Acid/Base Package	11-Acid/Base Enhanced Package	11-Acid/Base Supreme Package
AP	X	X	X
NP + Fizz	X	X	X
Net NP	X	X	X
MPA	X	X	X
NP: MPA Ratio	X	X	X
Paste pH	X	X	X
Sulphur (total)	X	X	X
Acid Soluble Sulphate		X	X
Sulphide		X	X
Sulphide (total)			X
CO_2			X
Sobek Package	**€60.00**	**€80.00**	**€112.00**
Modified Sobek Package	**€100.00**	**€120.00**	**€152.00**
Siderite Correction Package	**€100.00**	**€120.00**	**€152.00**

Code 11 – Net Acid Generation (NAG)

A direct oxidation method used to estimate the acid forming potential of a sample. The sample is reacted with hydrogen peroxide to oxidize any sulphide minerals present. The sample must be acid generating and not acid neutralizing. This causes acid generation and acid neutralization to occur simultaneously, with the end result being a direct measurement of the net amount of acid a sample can generate. If the reacted sample has a pH of 4.5 or less it is likely to be acid generating. Titration of the mixture is used to determine the amount of acidity generated. False positive results may occur if a high organic content is present. This false positive can be identified by combination with a NAPP test. In order to analyze for metals in the leachate a full second leach must be performed. Therefore the procedure will be charged twice.

Price per sample: €88000
Price per sample with NAG and NAPP: €176.00

Code 11 – Acid Neutralizing Capacity (ANC)

Acid buffering inherent to the sample caused by a reaction of produced acid with other minerals contained within the sample. The ANC is determined using the Modified Sobek Method. A known amount of hydrochloric acid is added to a sample and allowed to react. The sample is then back-titrated with sodium hydroxide to determine the amount of unreacted HCl. The amount of acid consumed by the reaction with the sample is calculated and expressed as kg H_2SO_4/t.

Price per sample: €112.00

Code 11 – Net Acid Production Potential (NAPP)

Amount of acid potentially produced by a sample after allowing for inherent neutralizing capacity (ANC). The NAPP is calculated using the formula: NAPP = Maximum Potential Acidity – ANC.

Refer to ANC and ABA for pricing.

Kinetic Testing

Code 11 – Kinetic Net Acid Generation

This test provides an indication of the reactivity of sulphides contained within a sample. It is used to provide a qualitative assessment of the likely lag time before the onset of acid conditions in the field. The test is performed like the NAG test, however the pH and temperature are monitored. The reaction kinetics are then extrapolated to the field situation.

Price per sample: €96.00

Code 11 – Sequential Net Acid Generation

Samples with high sulphide content may need to be reacted with hydrogen peroxide more than once in order to ensure complete oxidation of all sulphides has occurred. A sample is reacted several times and at the end of each stage the sample is filtered to separate the solids and NAG liquor. The NAG liquor is then assayed for pH and acidity, following the method for a standard NAG test. The solids are then recovered for repeat oxidation. The total NAG capacity of the sample is determined by adding the individual acid capacities from each stage.

Please enquire for price.

Code 11 – Acid Buffering Characterization Curves (ABCC)

ABCC is determined by acidifying a sample with dilute acid to approximately pH of 3 in a 16 to 24 hour time period. This method typically accounts for more readily available carbonates, such as calcite and dolomite, as this is a less aggressive treatment than the ANC method. When carbonates are present in sufficient quantity they will typically buffer a waste rock at near neutral pH. This is required to maintain low metal solubilities.

Please enquire for price.

Code 11 – Free Draining Kinetic Column Leach Procedure

These columns are used in addition to environmental geochemical investigations on mine rock and waste materials to determine drainage chemistry. The columns simulate field weathering conditions in order to provide data for sulphide reactivity, oxidation kinetics, metal solubility and leaching behavior of test materials. The procedure simulates a weekly wet-dry cycle and a monthly leaching cycle.

Please enquire for price.

Code 11 – Shake Flask Extraction (SFE)

Used to obtain leached elements of interest, such as As, Se and Hg, from a sample. Leached elements are analyzed using ICP-MS and measurements of pH and conductivity are reported.

Price per sample: €48.00

Code 12 - Leachate Quality

Parameters	Leachate Extraction Procedure	Leachate Analysis
SWEP	X	X
TCLP	X	X
EPA (includeds metals and Hg)	X	X
MWEP (leach only for metals)	X	X
Price	**€56.00**	**€56.00**

Leachate Extraction Procedure - for organics
Please enquire

Code 13 - Humidity Cell (ASTM D5744 – 96)

This method accelerates the natural weathering rate of a sample causing diagnostic weathering products. The weekly parameters measured are pH, Eh, conductivity, sulphate-ion concentration, acidity and alkalinity. Selected metals are measured on a less regular basis (weeks 0, 1, 2, 4, 8, 12, 16 and 20). Weekly cycles are used with three days of dry air, followed by three days of water saturated air. Day 7 uses a leach with water. It is recommended that a test duration of 20 weeks be used.

Test	
Humidy Cell set-up	
Weekly Humidty Cell test	
Metal Measurements (Cu, Zn) (cost per analysis)	

Price on Request.

Code 13 - Vegetation Growth Potential

Gradation (% clay, silt, sand, gravel)	€56.00	N – NH_3	€13.75
Paste pH	€5.75	N – NH_4	€13.75
Conductivity	€11.25	N – NH_4 + NH_3	€20.00
Sodium Adsorption (SAR)	€68.00	Total Nitrogen (LECO)	€13.75
Organic Carbon	€22.50	Total Carbon (LECO)	€13.75
Meteoric Water Mobility Test	on request	S (Leach ICP)	€24.00
Colour	€8.00	K (Ammonium Acetate Leach)	€8.00
Nitrate (KCl extractable)	€32.00	P (Sodium Bicarbonate Leach)	€8.00

Mobile Sample Prep & On-Site Services

Custom Mobile Sample Laboratories

For those projects that have logistical barriers or it's more economical to process samples on-site, Actlabs Mobile Sample Laboratories is your solution. Actlabs can provide and deliver a complete turnkey package to operate an on-site preparation or complete laboratory anywhere in the world. The construction and operation of remote sample testing facilities requires very robust choice of equipment to ensure reliability and to minimize downtime. These labs, with state-of-the art equipment and supplies, can be configured and supplied very quickly as Actlabs maintains a stock of new equipment for custom mobile labs.

Some equipment which may be employed in mobile sample labs include:

- Jaw crushers
- Pulverizers
- Splitters (Riffle or Rotary)
- Dust collectors
- Drying ovens
- Core saws

Actlabs Custom Mobile Sample Laboratories are fully configured for rapid installation in 20 or 40 foot containers and can be shipped anywhere in the world using standard container handling equipment. In addition to installation, Actlabs offers training and staffing solutions for mobile sample laboratories. Labs are designed to be efficient with proper choice of equipment for robustness.

In order to recommend the best solution for your project, we require the following information:

- Type of Analysis Required
- Size and Type of Sample
- Number of samples to be processed per day (maximum and minimum)
- How long the program will operate

Our experienced Mobile Laboratory Team can provide Standard or a customized solution based on your project requirements and is 'Fit for Purpose'. Contact our Client Service Team to discuss your project needs and how Actlabs Custom Mobile Laboratories is the right fit for you; mobilelabs@actlabs.com.

Mine Site Laboratory Sevices

Mine site laboratories allow you to receive a range of Actlabs services on site at your mining facility.

Our mine site laboratory services are fit for propose and designed to suit the requirements of your project.

At Actlabs we:

- Design and build new mine site labs for sample preparation and/or analytical services
- Optimize existing mine site labs
- Expand mobile sample preparation facilities into full service labs.
- Operate and maintain mine site labs
- Perform Laboratory audits
- Offer training and consulting

Quality Statement

"Quality is meeting our customers' requirements at all times and striving to exceed whenever possible."

Quality Assurance and Quality Control (QA/QC) is an integral aspect of our analyses and is a key component to Actlabs' vision, strategy and mission. Actlabs' Quality System monitors all steps and phases of our operations. Our Quality System outlines comprehensive details concerning our facilities, personnel qualifications and processes used. Additionally, we are routinely audited by four regulatory agencies that focus on continual improvement. As a result, we continue to raise the bar with respect to quality of our services in order to exceed both their expectations and that of our customers.

Actlabs' Quality System is accredited to international quality standards through the International Organization for Standardization/ International Electrotechnical Commission (ISO/IEC) 17025 (ISO/IEC 17025 includes ISO 9001 and ISO 9002 specifications) with CAN-P-1578 (Forensics), CAN-P-1579 (Mineral Analysis) and CAN-P-1585 (Environmental) for specific registered tests by the SCC. The accreditation program includes ongoing audits which verify the QA system and all applicable registered test methods. We are also accredited by the National Environmental Laboratory Accreditation Conference (NELAC) program and Health Canada.

Terms and Conditions

Fees and Payment

a) All prices in this pricelist are in Euros and are applicable for samples received in Canada from clients within the European Union.

b) These prices apply to most geological materials for routine analyses. A surcharge may apply for abnormal matrices or non routine analytical requirements. The client will be advised of any such conditions prior to performing the analytical work.

c) A minimum charge of €100.00 will be effective on all orders. A fee of €75.00 will be charged if a Chain of Custody form is required.

d) Payment should accompany the order unless credit has been established. Terms are net 30 days.

e) Prices and packages are subject to change without notice.

f) Customers are responsible for paying bank charges and should not be deducted from the total amount of the invoice.

g) Please select OUR under Details of Charges when paying by direct bank deposit (EFT).

h) Clients can pay invoices by cheque, bank draft, Visa, Mastercard, AMEX or direct bank deposit (EFT). To pay by credit card, a signature is required - either in the original paperwork or sent by fax or e-mail. We also require the security code found on the card. If paying by Western Union please add a surcharge of 10% to your payment.

i) Any customs or shipping charges incurred while shipping samples to Actlabs is the responsibility of the customer, unless specified otherwise.

For wire transfer, please pay to:
Royal Bank of Canada
180 Wellington St. West
3 Floor, Foreign Exchange
Toronto, Ontario CANADA
SWIFT: ROYCCAT2
Transit/account number: 092118700916
Favour: Activation Laboratories Ltd.

Liability

a) Any analysis, testing, inspection or investigation in connection with any work performed by Activation Laboratories Ltd. shall be conducted in accordance with recognized professional analytical standards. Neither Activation Laboratories Ltd., nor its subcontractors, consultants, agents, officers or employees shall be held responsible for any loss or damage resulting directly or indirectly from any default, negligence, error or omission. While every effort will be taken to store the unused portion of your samples, Activation Laboratories Ltd. cannot bear any responsibility for loss or damage, regardless of the cause.

b) The liability, if any, of Activation Laboratories Ltd. shall be limited to the cost of performing the analyses.

c) Governing law shall be in the Province of Ontario, Canada.

Services

a) We reserve the right to subcontract work to affiliated laboratories.

b) It is the responsibility of the client to determine the suitability of any services provided by Activation Laboratories Ltd.

Confidentiality

a) All data derived on client's samples is confidential only to the client and cannot be disclosed to other parties unless approved in writing by the client. In the event of demands by regulatory bodies data may be released to them if subpoenaed.

Quality Statement and Locations

Actlabs Locations

Canada

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09 BP 120 Ouagadoug ou 09
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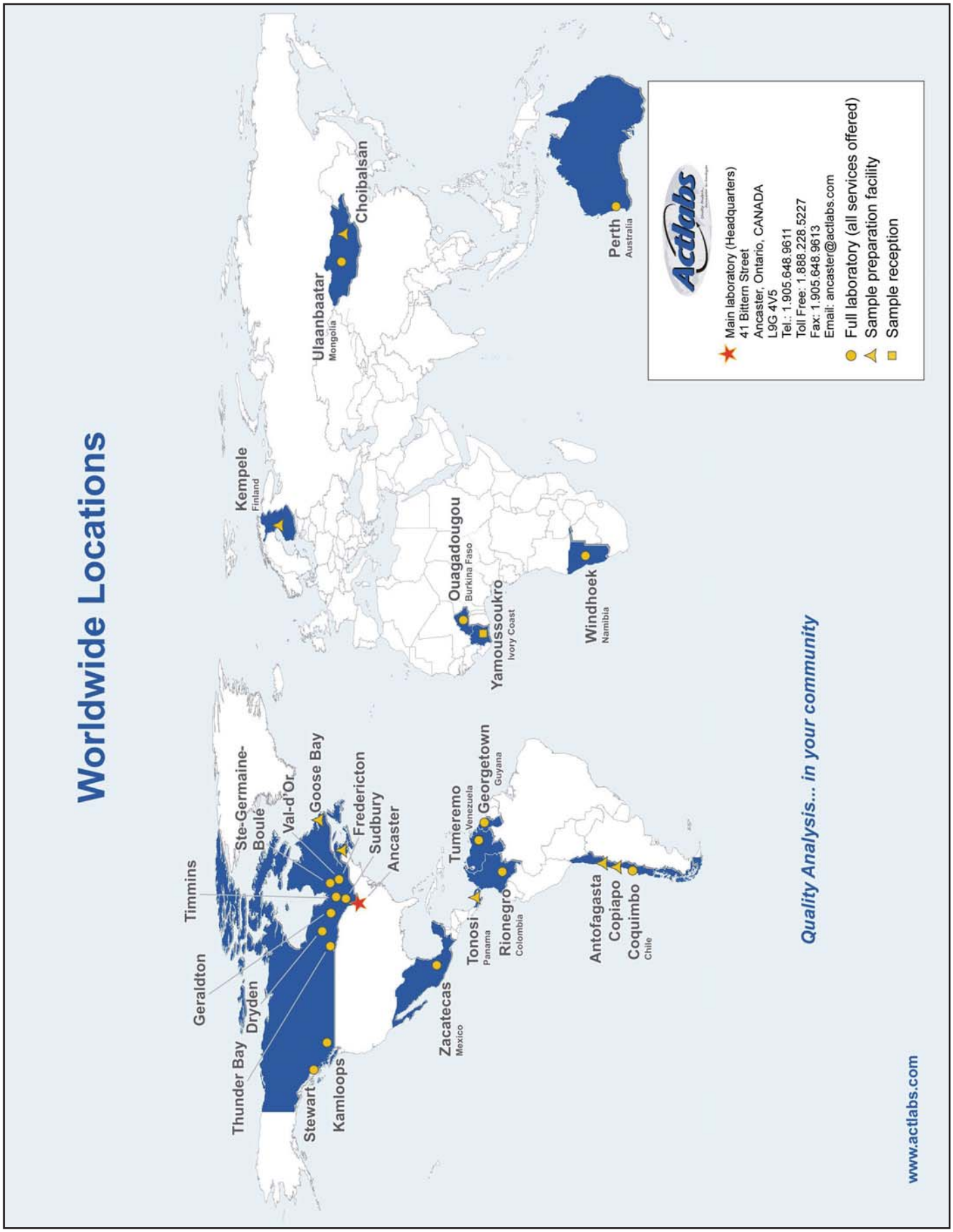
Techniques and Methods available at each *Actlabs* facility

	Canadian Locations												Latin America Locations								Other Locations						
	Ancaster	Thunder Bay	Timmins	Geraldton	Dryden	Sudbury	Ste-Germaine-Boulé	Val-d'Or	Fredericton	Happy Valley-Goose Bay	Stewart	Kamloops	Zacatecas, Mexico	Tonosi, Panama	Medellin, Colombia	Tumeremo, Venezuela	Georgetown, Guyana	Antofagasta, Chile	Copiapo, Chile	Coquimbo, Chile	Kempele, Finland	Ouagadougou, Burkina Faso	Windhoek, Namibia	Ulaan-Bataar, Mongolia	Choibalsan, Mongolia	Yamoussoukro, Côte d'Ivoire	Perth, Australia
Sample Preparation	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
Techniques																											
INAA	●																										
AAS	●	●	●	●	●	●	●	●			●	●	●		●	●	●			●		●	●	●			
ICP/OES	●	●	●			●	●				●	●	●		●					●			●	●			
ICP/MS	●	●										●								●							
HR-ICP/MS	●																										
LC/MS/MS	●																										
GC/MS	●																										
Capillary Electrophoresis	●																										
Autoanalyzers	●																										
XRF	●	●										●			●								●				
Fire Assay	●	●	●	●	●	●	●	●			●	●	●		●	●	●			●		●	●	●			
Ion Chromatography	●																										
XRD	●																										
Coulometry	●																										
Leachwell/Cyanide	●												●							●		●	●	●			
Titration	●																			●				●			
Carbon/Sulphur Analyser	●											●								●			●	●			
Gravimetric	●	●	●	●	●	●	●	●			●	●	●		●	●	●			●		●	●	●			
FEG SEM-MLA	●																										
FEG QEMSCAN SEM	●																										
DNA Instrumentation	●																										
Laser Ablation	●																										
Age Dating Isotopic	●																										
Davis Tube	●	●										●								●			●	●			
Methods																											
High-level REE	●	●																									
Enzyme Selective Extractions	●																										
Soil Gas Hydrocarbons	●																										
Biogeochemistry	●	●										●															
Coal Analysis	●											●											●	●			
BLEG	●														●	●	●			●		●	●	●			
Aqua Regia	●	●	●			●	●				●	●	●		●					●			●	●			
4-acid Digestion	●	●	●			●	●				●	●								●			●	●			
Robotic Meta/Teta Borate Fusion	●	●																									
Peroxide Fusion	●	●				●						●								●			●				
Delayed Neutron Counting	●																										
Pyrolysis	●																										
TerraSol™ Leach	●																										
BioLeach™	●																										
Ion-Selective Electrodes	●																			●				●			
Isotopic Analysis	●																										
Hydrogeochemistry	●	●										●															
Metallurgy		●																									
Trace Element Geochemistry	●	●	●			●	●				●	●	●		●					●			●	●			
CVAAS	●																							●			
Hydride-AAS																								●			
Environmental	●						●								●					●				●			
Standard Reference Materials	●	●																		●							
Geochronology	●																										
Litho-geochemistry	●	●																									
Ore Grade Analysis	●	●	●		●	●	●	●			●	●	●		●	●	●			●		●	●	●			
ISO 17025	●	●	●			●	●					●												●			●
ISO 9001:2008					●						●		●		●		●	●		●	●	●					
NELAP	●																										
Health Canada	●																										


Worldwide Locations
Timmins
Geraldton
Ste-Germaine-Boulé
Val-d'Or
Goose Bay
Fredericton
Sudbury
Ancaster
Thunder Bay
Dryden
Stewart
Kamloops
Zacatecas
Mexico
Tumeremo
Venezuela
Georgetown
Guyana
Tonosi
Panama
Rionegro
Colombia
Antofagasta
Copiapo
Coquimbo
Chile
Kempele
Finland
Ouagadougou
Burkina Faso
Yamoussoukro
Ivory Coast
Windhoek
Namibia
Ulaanbaatar
Mongolia
Choibalsan
Perth
Australia
Actlabs
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L9G 4V5
Tel.: 1.905.648.9611
Toll Free: 1.888.228.5227
Fax: 1.905.648.9613
Email: ancaster@actlabs.com
Full laboratory (all services offered)
Sample preparation facility
Sample reception
Quality Analysis... in your community
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Useful Information

Geochemistry vs. Assays

Geochemistry analysis provides +/- 20% at detection limit. This type of analysis is for trace level of metals below 1% for base metals.

Assays analysis are for ore reserve calculations and provide higher levels of metals and accuracy for 2-3% at greater than 100x the detection limit. Major elements will provide 1-2% at greater than 100x the detection limit.

Chemical Conversions

Element	Compound	Factor
Al	Al_2O_3	1.889
Ba	$BaSO_4$	1.699
Ca	CaO	1.399
CaO	$CaCO_3$	1.785
CaO	$CaSO_4$	3.397
Ca	CaF_2	1.948
CaO	CaF_2	1.392
Cr	Cr_2O_3	1.462
Fe	FeO	1.286
FeO	Fe_2O_3	1.111
Fe	Fe_2O_3	1.43
K	K_2O	1.205
Mg	MgO	1.658
Mn	MnO	1.291
Mo	MoS_2	1.668
Na	Na_2O	1.348
P	P_2O_5	2.291
S	SO_4	2.996
Sr	$SrSO_4$	2.096
Th	ThO_2	1.138
Ti	TiO_2	1.668
U	U_3O_8	1.179
W	WO_3	1.261
V	V_2O_5	1.785
Zr	ZrO_2	1.35

Common Tyler Sieve Sizes

Mesh	Aperature (µm)
10	1,680
20	841
35	420
60	250
80	177
100	149
150	105
170	88
200	74
250	63
270	53
325	44
400	37

Common Drill Core Sizes

Size	Core Diameter (mm)	Core Volume Per Meter Length (m^3x10^{-3})
AQ	27.0	0.57
TT	35.0	0.96
BQ	36.4	1.04
NQ	47.6	1.78
HQ	63.5	3.17
BQ3	33.5	0.88
NQ3	45.1	1.6
HQ3	61.1	2.93

Core weight per metre (kg) =
core volume per metre x specific gravity

Gold Conversion Factors

1 ppb	0.001 g/tonne
1 ppm	1 g/tonne
1 oz/ton	34.286 grams/tonne
1 gram/tonne	0.0292 oz/ton
1 gram/m^3	0.0421oz/yd^3

Grain Size (Diameter)

Gravel	2 to 4 mm
Sand	63 µm - 2 mm
Silt	4-63 µm
Clay	<4 µm

Pulverization Contaminants Added

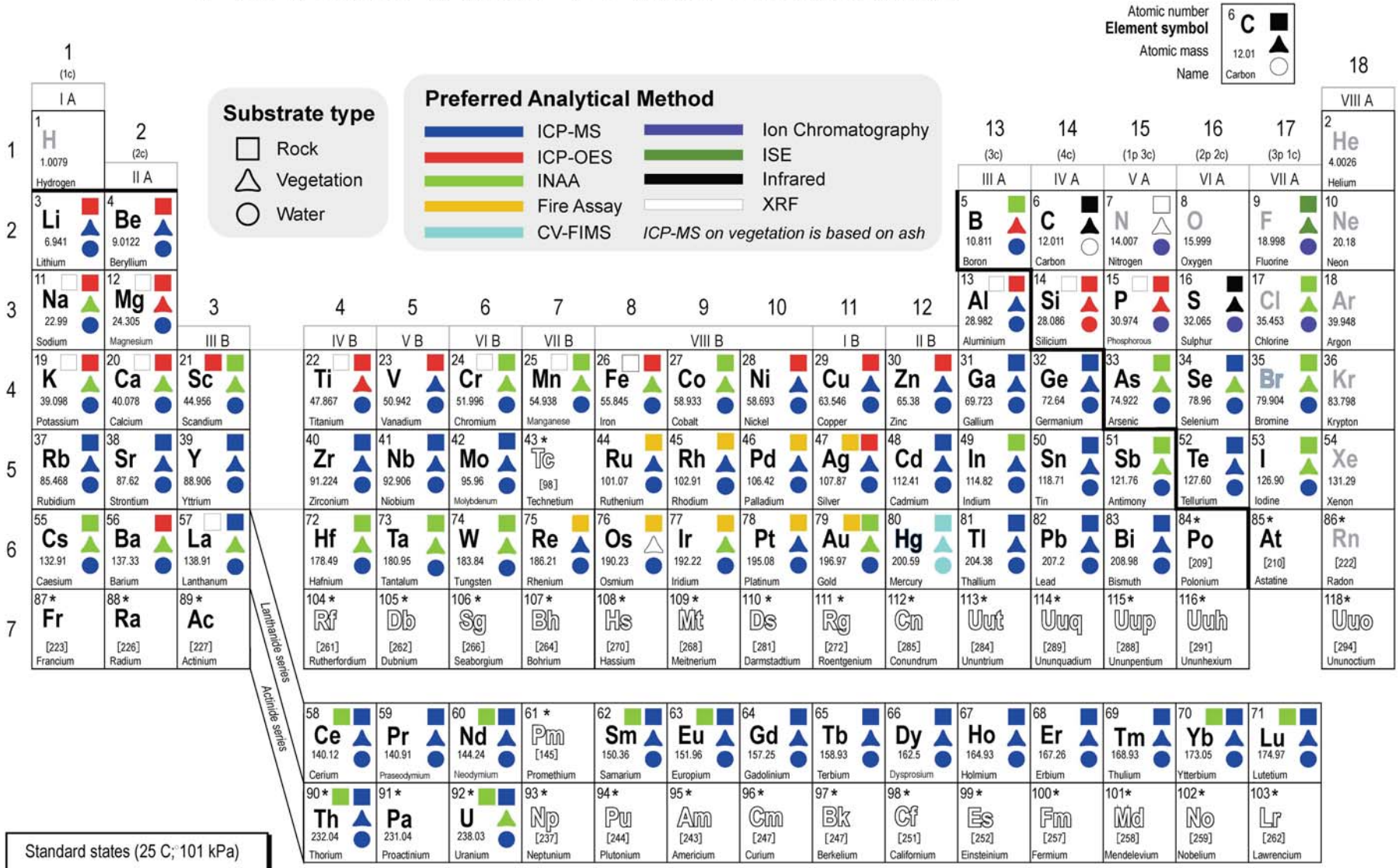
(amount added depends on hardness of material and particle size required)

Mill Type	Contaminant Added
Mild Steel (best choice)	Fe (up to 0.2%)
Hardened Steel	Fe (up to 0.2%), Cr (up to 200 ppm), trace Ni, Si, Mn and C
Ceramic	Al (up to 0.2%), Ba, trace REE
Tungsten Carbide	W (up to 0.1%), Co, C, Ta, Nb and Ti
Agate	Si (up to 0.3%), Al, Na, Fe, K, Ca, Mg, Pb

Ore Content

1% Cu	2.89% $CuFeS_2$ (chalcopyrite)
1% Mo	1.67% MoS_2 (molybdenite)
1% Pb	1.15% PbS (galena)
1% U	1.18% U_3O_8 (pitchblende)
1% W	1.26% WO_3 (scheelite)
1% Zn	1.49% ZnS (sphalerite)
1% Fe	2.15% FeS_2 (pyrite)
1% Fe	1.57% FeS (pyrrhotite)
1% Fe	1.38% Fe_3O_4 (magnetite)
0.1% U_3O_8	2 lbs/ton U_3O_8

Periodic table of the elements



Standard states (25 C; 101 kPa)

Ne - gas
Fe - solid
Br - liquid
Pm - synthetic

The asterisk (*) identifies a radioactive element (unstable)

The updated atomic masses (2007) are from the IUPAC website: http//www.iupac.org/

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