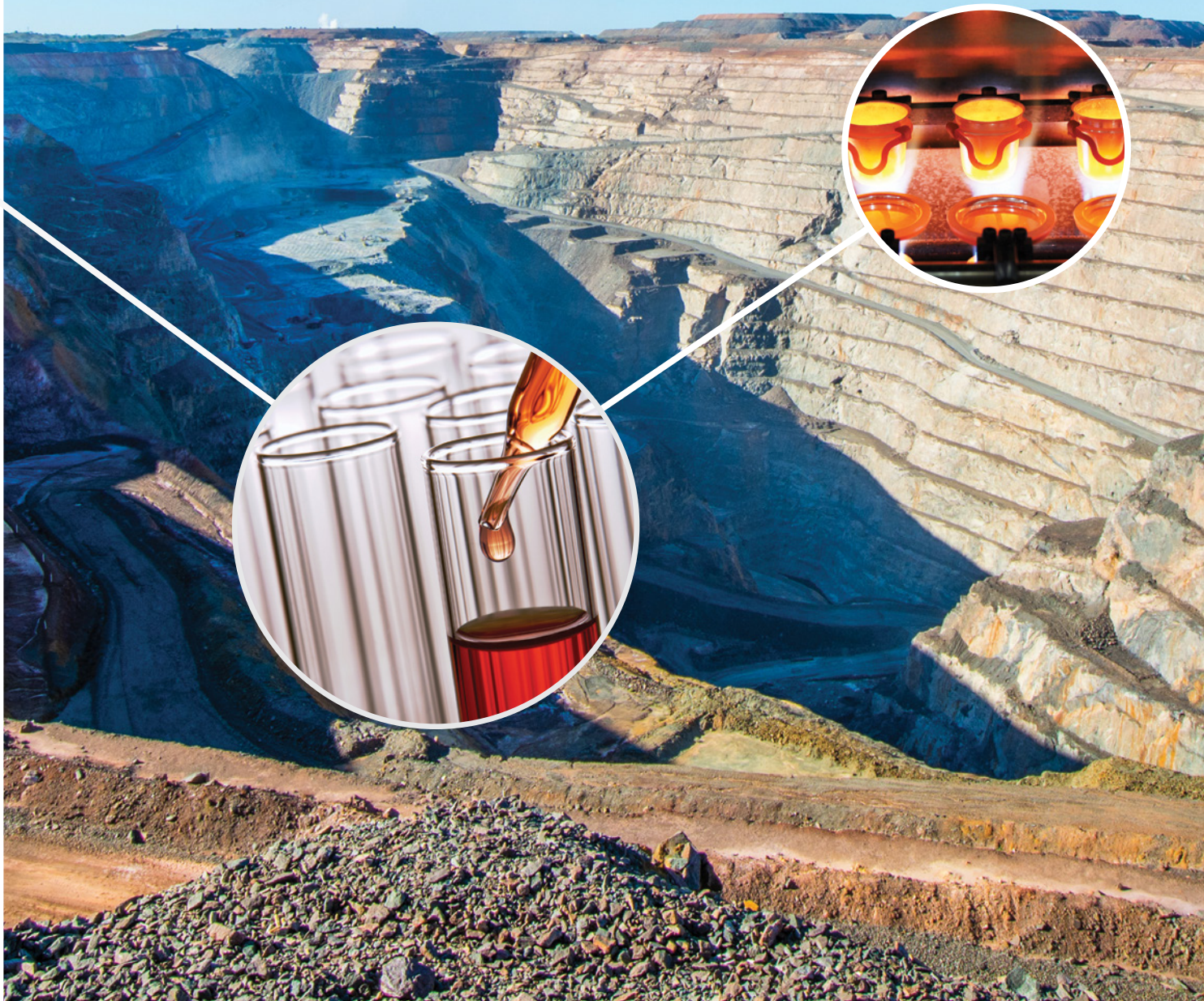
Minerals Services

Intertek

Schedule of Services & Charges 2016 Philippines

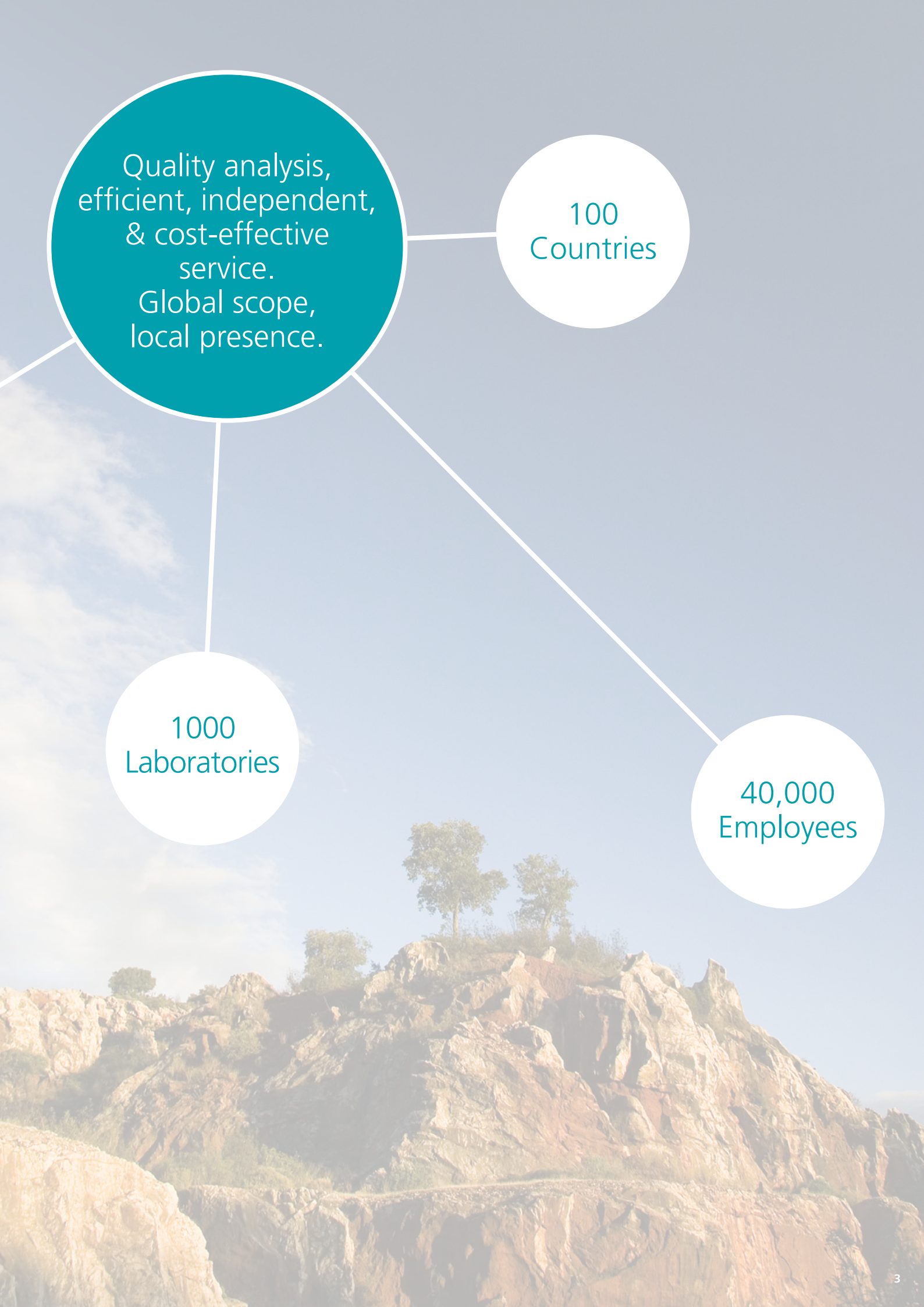


Providing services across the resources supply chain

Intertek is a leading Total Quality Assurance provider to industries worldwide. Our network of more than 1,000 laboratories and offices and over 40,000 people in more than 100 countries, delivers innovative and bespoke Assurance, Testing, Inspection and Certification solutions for our customers' operations and supply chains. Intertek supports companies' success in the global marketplace, by helping customers to meet end users' expectations for safety, sustainability, performance, integrity and desirability in virtually any market worldwide.

Our network of mineral laboratories offer world class geochemical assay and testing services including sample preparation, fire assay and precious metal analysis, exploration geochemistry, environmental testing, mine-site laboratories, coal testing and inspection, consulting minerals inspection, robotics and automated laboratory systems.

Minerals inspection services are available at all major ports & distribution centres.
Visit our website on up to date information on locations, services and fact sheets www.intertek.com/minerals/


Quality analysis, efficient, independent, & cost-effective service. Global scope, local presence.
100 Countries
1000 Laboratories
40,000 Employees

Robotics and Automated Minerals Laboratory Systems

Intertek is the largest global commercial operator of automated and robotic mine site laboratories.

Intertek automated and robotic sample systems are purpose built, ranging from individual cells to fully integrated systems, providing complete end-to-end sampling to analysis solutions.

Using advanced robotic sample handling technology for minerals testing has distinct advantages, including rapid sample throughput, unparalleled consistency, exclusion of human error, a comprehensive audit trail, synchronised process control, reliability and fully programmable comminution parameters. Programmable parameters ensure that ores obtain the requisite treatment consistently.

Robotic systems reduce OH&S exposure to employees, eliminating heavy lifting and isolating personnel from hazardous materials. Thus significantly improving safety.

Advances in Geochemical Analysis

The challenge of identifying geochemical anomalies related to concealed mineral deposits has driven innovation and development in analytical geochemistry.

Streamlined, ultra-clean digestions coupled with the latest ICP-MS collision cell technology offer improved detection limits commensurate with the crustal abundance of almost all elements, with an emphasis on long-term reproducibility.

Innovation through technology

Mine-Site Laboratories

Intertek designs, commissions and operates dedicated mine-site laboratories in remote locations and key mining regions across the globe and supports a range of mineral commodities. Mine-site laboratory services range from sample preparation installations to full service analytical laboratories and automated robotic facilities.

Intertek's minerals laboratories are operated by experienced personnel with support from an extensive global laboratory network. Fast, accurate and independent mineral analyses by Intertek allow mining companies to effectively manage their process control and regulatory reporting requirements.

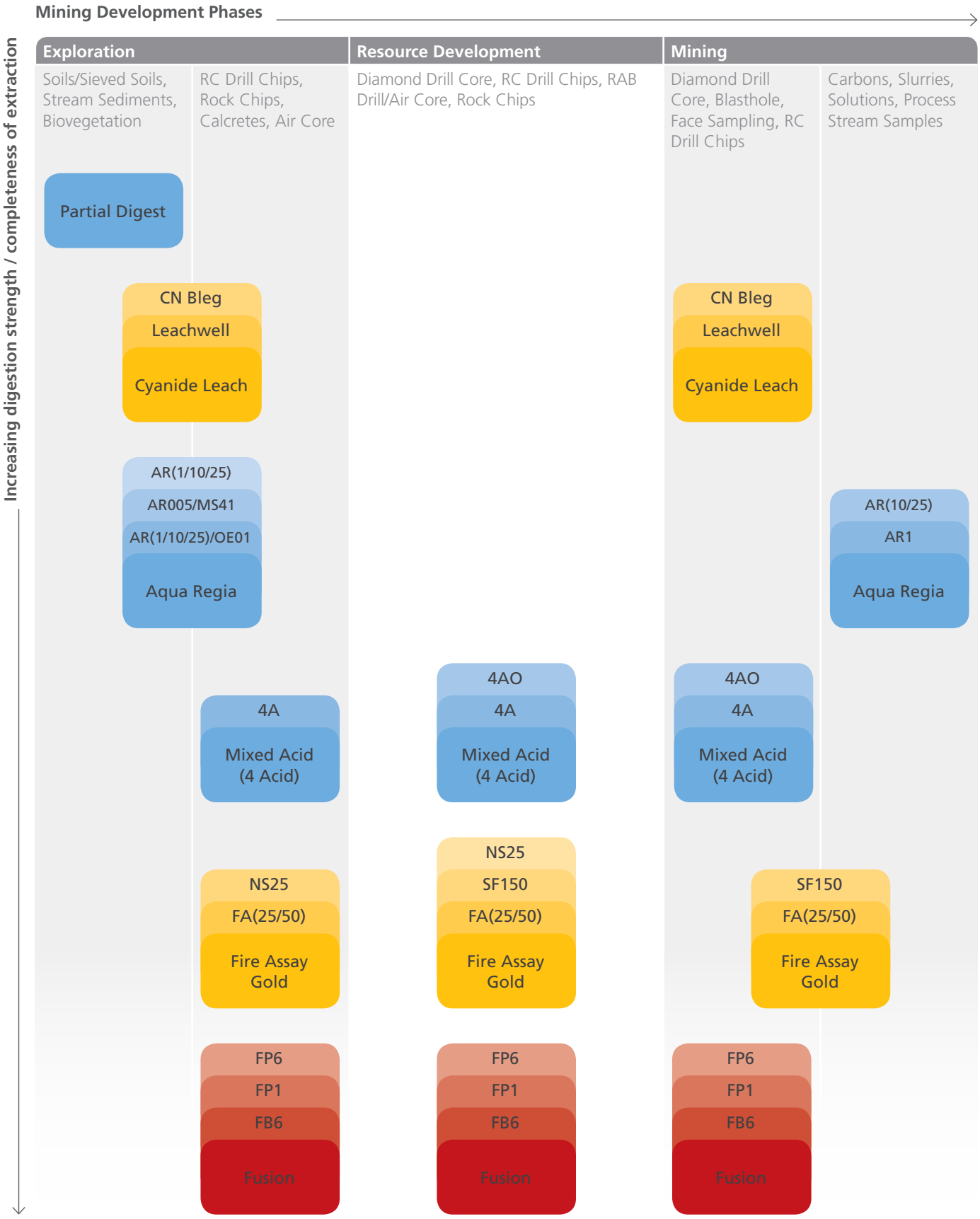
Outsourcing your mine-site laboratory to Intertek ensures your operation will benefit from world-class expertise and services, which enables your company to focus resources and capital on the core business.

Mineralogy

Intertek's leading expertise and state-of-the-art facilities offer a range of mineralogical services. Industry experts in XRF and XRD support local and global operations, producing quality reliable data with the reassurance of years of experience and a proven track record.

- Research quality lithogeochemical packages
- Applied Mineralogy - XRD Specialist on-site
- Low cost XRF & spectral scanning
- TerraSpec Near-Infrared Spectroscopy

Applications



The Philippines schedule outlines the most commonly used analytical procedures. Not all methods are available at all locations. Please contact your local manager to discuss your specific requirements or for any services not listed.

Contents

Sample Preparation

The production of a homogeneous sub-sample, representative of the material submitted to the laboratory is the primary purpose of sample preparation. Correct preparation is critical to obtaining meaningful analytical results. The selection of the actual sample preparation procedures will depend on the type and size of the sample, the mineralogy as well as the client's analytical and budgetary requirements.

Close and ongoing consultation with your Laboratory Manager or Sales Representative will ensure that optimal sample preparation techniques are employed thus maximising the value added in the analytical process.

Sample Submission

Correct submission and receipt of samples is critical in retaining the integrity of the sample chain of custody and facilitating efficient processing of samples. Detailed instructions can be found on Page 36 and submission forms can be downloaded from the Intertek website www.intertek.com/minerals

Sample submission and freight information emailed prior to despatch will expedite the sample receipt process. Upon receipt, samples are issued with a unique barcode ID through the LIMS. Clients are encouraged to submit pre barcoded samples to enable efficient sample receipt and reconciliation.

Sample Storage

All solid samples (assay pulps, bulk pulps and residues) will be stored without charge for 90 days after completion of analysis. After this time all samples will be stored at a daily rate until the client's written advice regarding return, collection or disposal is received.

Description	Code	Price
Storage of bulk, pulp or residue samples	ST101	₱1125/m^3/month
Disposal of samples	ST201	₱8000/t
Expenses related to return	ST30	At cost
Retrieval of selected pulps	ST401	₱15/each
Retrieval of selected coarse/fine residues	RT101	₱40/each

Freight

Freight expenses incurred will be passed on at cost.

Ore Transport Certificates

For the freighting of pulp samples from the remote sample preparation facilities to Manila, the securing of the OTC from the MGB will be charged at cost as long as the original OTC for the delivery of the samples to the laboratory is received.

Sample Preparation Packages

To facilitate easy selection of sample preparation procedures, commonly used techniques have been packaged together.

Partial Pulverise Package

Description	Code	Price
Sort, dry (105°C), crush (95%<10mm), riffle split, pulverise 1.5kg (95%<75µm) up to 2.0kg	SP121	₱243
Additional weight	SP122	₱60/kg
Sort, dry (105°C), crush (95%<2mm), riffle split, pulverise 1.5kg (95%<75µm) up to 2.0kg	SP132	₱265
Additional weight	SP133	₱66/kg

Total Preparation Package

Description	Code	Price
Sort, dry (105°C), crush, pulverise all (95%<75µm) up to 1.5kg	SP111	₱243
Additional weight	SP113	₱79/kg

Soil and Stream Sediment

Description	Code	Price
Sort, dry (105°C), pulverise all (95%<75µm) up to 1.5kg	SP101	₱205
Additional weight	SP103	₱79/kg
Sort, desegregate, dry 105°C & dry Sieve 180µm, reporting fraction weights up to 1.5kg	SP104	₱123
Additional weight	SP105	₱45/Kg

Sample Preparation Procedures

Drying

Sample drying procedures will vary due to the sample type and mass, moisture content and analysis required.

Description	Code	Price
Sort and dry samples received in standard paper packets	SD01	₱33
Sort and dry samples at 105°C	SD02	₱44/kg
Sort and dry samples at 60°C	SD03	₱50/kg
Sort and dry samples at 80°C	SD05	₱50/kg

Crushing

Samples with a volume or dimensions exceeding that which the pulverising vessels can accommodate may require crushing and/or splitting prior to pulverising. Crushing may also be required to achieve an optimum particle size to split to a representative sub sample for further particle size reduction.

Description	Code	Price
Crush to ~10mm	CR01	₱25/kg
Crush to ~2mm	CR02	₱52/kg

Splitting

Splitting of samples may be done to achieve a more cost effective option in reducing the volume of sample for further particle size reduction steps.

Two types of splitters are used; the riffle splitter, sometimes called a Jones Splitter and the Rotary Splitter. It is important to select the correct size splitter for the product being split, correct technique is also important in order that samples are split without introducing bias.

Description	Code	Price
Riffle splitting – up to 6kg discard reject	RF01	₱60
Riffle splitting – up to 6kg retain reject	RF02	₱100
Rotary or arcual splitting	RS01	₱40/kg

Pulverising

Pulverising is carried out on crushed or fine products to achieve a fine homogeneous powder to enable small sub-samples to be taken for analysis that will be representative of the larger coarse sample. For most sample types at least 95% of material will be pulverised to 75µm or better.

All devices used in the crushing and pulverising of samples can impart trace levels of contaminants. Low chrome steel is often the preferred material of choice for pulverising vessels as the chrome and iron contamination is usually negligible compared with the levels commonly encountered in most geological materials.

Description	Code	Price
Coarse pulverise 95%< 850µm	CPU101	₱70/kg
Fine pulverise, 95%<75µm, up to 1.5kg	PU102	₱75
Fine pulverise, 95%<75µm, additional weight	PU104	₱72/kg
Quartz wash (discarded)	QW01	₱40
Quartz wash (retained)	QW02	₱55

Sieving

Sieving may be performed on unprocessed samples to determine the mass distribution of the various size fractions or alternatively, on crushed or pulverised products to ascertain the effectiveness of the preparation processes.

Description	Code	Price
Dry sieve specified mesh size 1 fraction	SV101	₱225/kg
Dry sieve to specified mesh sizes additional fractions	SV101A	₱110/kg
Wet sieve (retain oversize only)	SV102	₱245/kg
Wet sieve (recovering undersize & oversize)	SV102A	₱600/kg
Quality check sizing - 75µm	SV103	₱75/kg
Quality check sizing - 2mm	SV108	₱75/kg

Miscellaneous Procedures

Description	Code	Price
Client specified preparation (technician)	CP01	₱600/hr
Client specified preparation (chemist)	CP02	₱950/hr
Roasting, pulp only up to 200g	PR01	₱240
Reporting weights of samples, wet or dry		₱20/component

Other sample preparation processes (preparation of carbons, magnetic or heavy media separation, compositing and homogenising etc) are also available. Please contact the laboratory to discuss your requirements.

Precious Metals Analysis

A diverse range of precious metal analytical techniques are available for a wide range of applications ranging from grassroots exploration, where sub ppb sensitivities are required, to accurate resource estimation and grade control.
Lead collection fire assay remains the classic method for gold, platinum and palladium, however, aqua regia digestion, accelerated cyanide leach and BLEG (bulk leach extractable gold) are available for specific purposes. The full suite of platinum group elements can be quantified using nickel sulphide collection fire assay.

Lead Collection Fire Assay

Fire assay flux recipes have been carefully formulated to optimise precious metal recovery in diverse mineralogical matrices. Further flux modification and reduction in charge weight can be used to improve recoveries in difficult sample matrices.

Element	Description	Detection Limit	Code	Price
Au	30g fire assay / AAS	0.01ppm	FA30/AA	₱500
Au	50g fire assay / AAS	0.005ppm	FA50/AA	₱560
Au	30g fire assay, new pots / AAS	0.01ppm	FA30N/AA	₱565
Au	50g fire assay, new pots / AAS	0.005ppm	FA50N/AA	₱625
Au, Pt, Pd	50g fire assay / OES	5ppb	FA50/OE	₱965
Au	50g fire assay / Gravimetric	0.2ppm to maximum	FA50/GR	₱500

Concentrates, metallurgical and high grade samples — POA

The full suite of Platinum Group metals (Pt, Pd, Rh, Ru, Ir & Os) on geological materials can be analysed at our specialist facility in Perth by nickel sulphide collection fire assay — POA

Screen Fire Assay

Screen fire assays utilise a large sample mass, typically 1kg, and find application where the precious metal compositional and distributional heterogeneity in a pulp is such that a conventional fire assay would be accompanied by an unacceptable sampling error. The pulp sample is screened and the entire coarse fraction is fired assayed to recover the gold and/or PGEs. Duplicate assays are carried out on the more reproducible undersize fraction. The precious metal content is reported as a mass weighted mean along with the individual fractions' results.

Element	Description	Detection Limit	Code	Price
Au	Screen fire assay 106µm, single undersize analysis / AAS	0.01ppm	SF106/AA1	₱1425
Au	Screen fire assay 75µm, single undersize analysis / AAS	0.01ppm	SF75/AA1	₱1625
Au	Screen fire assay 106µm, duplicate undersize analysis / AAS	0.01ppm	SF106/AA2	₱1985
Au	Screen fire assay 75µm, duplicate undersize analysis / AAS	0.01ppm	SF75/AA2	₱2205

Cyanide Leaches

Cyanide solutions are used to leach gold from large samples providing a useful method for both grassroots exploration and resource work and are usually performed on screened stream sediment samples, providing detection of low level anomalies for regional exploration.

Cyanide Bottle Roll

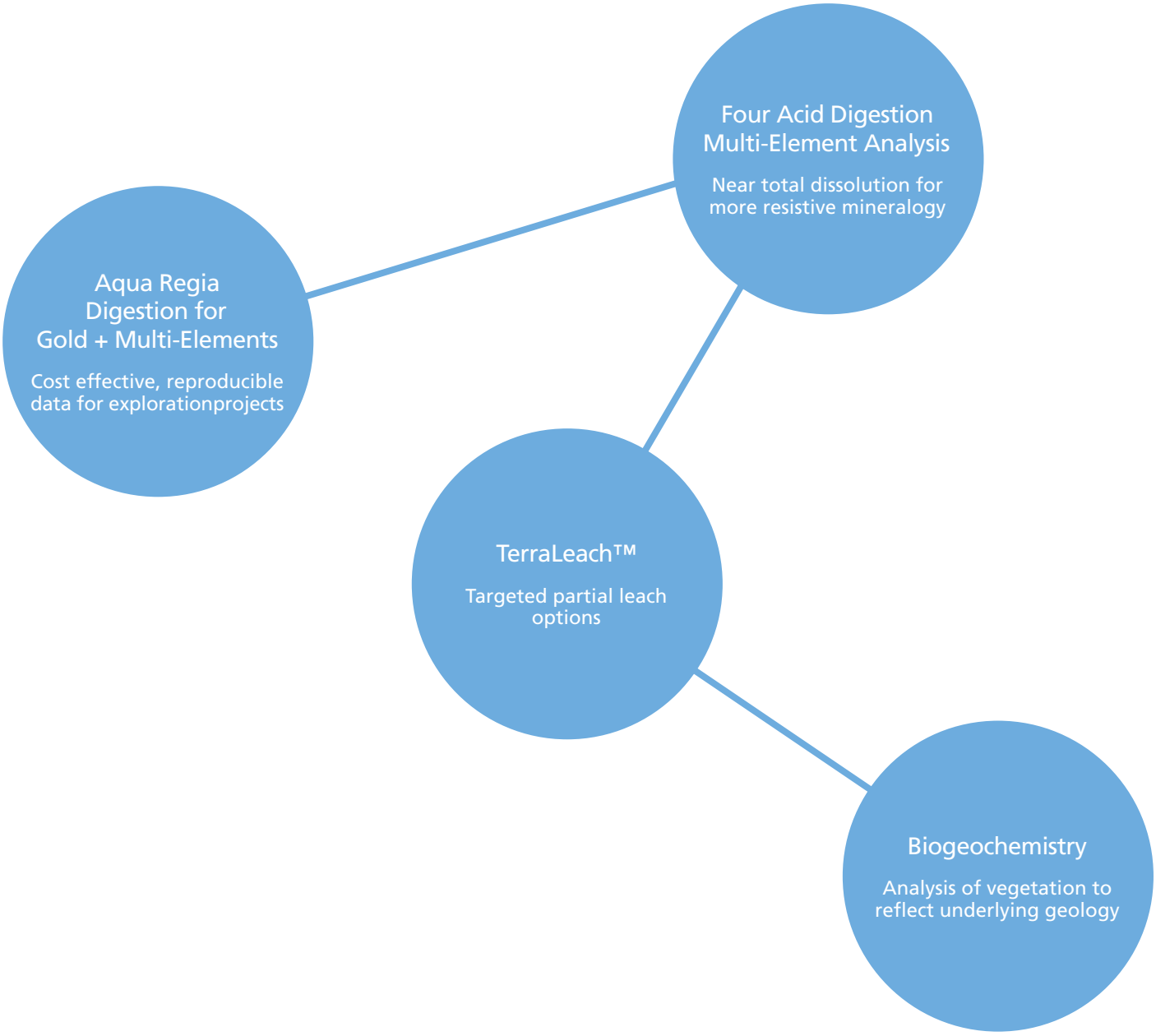
Element	Description	Detection Limit	Code	Price
Au	500g leach / MS	0.001ppm	CN500/MS	₱1150
Au	1.0kg leach / MS	0.001ppm	CN1000/MS	₱1250
Au	2.0kg leach / MS	0.001ppm	CN2000/MS	₱1350
Additional Elements	Ag (0.01), Cu (0.2), Pt (0.002), Pd (0.002), Cd (0.005), Co (0.01), Ni (0.1), Zn (0.5), As (0.05), Mo (0.002), Bi (0.005), Hg (0.02)		per element	₱30
Au	500g leach / AAS	0.01ppm	CN500/SAA	₱718
Au	1.0kg leach / AAS	0.01ppm	CN1000/SAA	₱820
Au	2.0kg leach / AAS	0.01ppm	CN2000/SAA	₱880
Additional Elements	Ag (0.1), Cu (0.2)		per element	₱55

Exploration Geochemistry

The challenge of identifying geochemical anomalies related to concealed mineral deposits has driven innovation and development in analytical geochemistry.

Advances in instrumentation and methodology offer significant improvements in aligning detection limits with elemental crustal abundances and provide exceptional long term data reproducibility.

A number of exploration methods are offered including partial selective leaches, biogeochemical analyses, aqua regia digestions and near-total four acid digestions. The selection of the most appropriate method is critical to achieving the most successful outcome for your exploration project.



Aqua Regia Digestion for Gold + Multi-Elements

The advent of new analytical instrumentation technologies coupled with streamlined, ultra clean aqua-regia digestion methods provide the best platform for fast, cost effective and consistent trace level analysis for your exploration samples.

The aqua regia digestion is a classical empirical digestion technique with successful global application in geochemical exploration. Most oxide, sulphide and carbonate minerals are digested, however, refractory minerals and most silicates may be only partially decomposed. Recovery levels will vary between the elements and sample matrices with indicative recoveries highlighted on the package tables.

Samples containing graphitic or organic material may require roasting prior to digestion.

Aqua Regia Digestion Packages

Aqua regia digestion coupled with ICP-OES and ICP-MS offers a cost effective option for gold and multi-element packages.

Aqua Regia ICP-OES Package

Element	Range ppm			Element	Range ppm			Element	Range ppm		
Ag	0.5	-	100	Fe	100	-	10%	Sc	1	-	500
Al	20	-	10%	K	20	-	5%	Se	20	-	1000
As	5	-	1%	La	2	-	500	Sn	20	-	1000
B	10	-	1%	Li	1	-	500	Sr	1	-	5000
Ba	2	-	2000	Mg	100	-	10%	Te	20	-	1000
Be	1	-	1000	Mn	1	-	1%	Ti	50	-	5%
Bi	2	-	5000	Mo	1	-	5000	V	2	-	1%
Ca	100	-	10%	Na	100	-	5%	W	20	-	2000
Cd	1	-	1000	Ni	1	-	2%	Y	2	-	500
Ce	20	-	1000	P	20	-	2%	Zn	1	-	5000
Co	1	-	5000	Pb	3	-	5000	Zr	2	-	5000
Cr	2	-	1000	S	50	-	5%				
Cu	1	-	1%	Sb	5	-	5000				

Aqua regia digestion 0.5g	AR005/OE101	₱830

Individual Elements by Hydride AAS

Element	Range ppm			Element	Range ppm		
As	1	-	100	Sb	1	-	100

Aqua regia digestion / Hydride AAS per element	AR005/AAH	₱180

Aqua Regia Standard ICP-OES & MS Package

Element	Range ppm			Element	Range ppm			Element	Range ppm		
Au**	1ppb	-	500ppb	Hg*	0.05	-	100	Sb	0.05	-	5000
Ag	0.05	-	250	In	0.05	-	1000	Sc	1	-	500
Al	20	-	10%	K	20	-	5%	Se	1	-	5000
As	1	-	5000	La	0.01	-	500	Sn	0.5	-	200
B*	10	-	1%	Li	0.1	-	1000	Sr	0.2	-	5000
Ba	1	-	2000	Mg	0.01%	-	20%	Ta	0.05	-	200
Be	0.5	-	1000	Mn	1	-	1%	Te	0.05	-	1000
Bi	0.05	-	5000	Mo	0.1	-	5000	Th	0.05	-	500
Ca	0.01%	-	40%	Na	0.01%	-	5%	Ti	5	-	1%
Cd	0.05	-	1000	Nb	0.2	-	200	Tl	0.05	-	1000
Ce	0.01	-	1000	Ni	1	-	1%	U	0.05	-	5000
Co	0.1	-	5000	P	20	-	2%	V	2	-	1000
Cr	1	-	1%	Pb	0.5	-	5000	W	0.1	-	200
Cs	0.02	-	500	Pd**	10ppb	-	500ppb	Y	0.05	-	200
Cu	1	-	1%	Pt**	5ppb	-	500ppb	Zn	1	-	1%
Fe	0.01%	-	50%	Rb	0.05	-	1000	Zr	0.5	-	200
Ga	0.1	-	500	Re	0.05	-	500				
Hf	0.05	-	200	S*	100	-	5%				

Aqua regia digestion 1g / ICP-OES & ICP-MS	AR01/OM10	₱1310
Aqua regia digestion 10g / ICP-OES & ICP-MS	ARU10/OM10	₱1540
Aqua regia digestion 25g / ICP-OES & ICP-MS	ARU25/OM10	₱1640

Note: * B, Hg, S are only available on 1g option, Hg may report low due to losses in sampling and preparation
** Au, Pt, Pd are indicative only on 1g option and must be interpreted with extreme caution

Legend		
Complete recovery for most samples	Near complete recovery for most samples	Not complete recovery

Aqua Regia Comprehensive ICP-OES & MS Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Au**	1ppb - 500ppb	Hg*	0.01 - 100	Sb	0.02 - 5000
Ag	0.05 - 250	Ho	0.01 - 200	Sc	0.1 - 500
Al	20 - 10%	In	0.005 - 1000	Se	1 - 5000
As	1 - 5000	K	20 - 5%	Sm	0.01 - 500
B*	10 - 1%	La	0.01 - 500	Sn	0.05 - 200
Ba	1 - 2000	Li	0.1 - 1000	Sr	0.02 - 5000
Be	0.05 - 1000	Lu	0.005 - 200	Ta	0.01 - 200
Bi	0.01 - 5000	Mg	0.01% - 20%	Tb	0.005 - 200
Ca	0.01% - 40%	Mn	1 - 1%	Te	0.01 - 1000
Cd	0.01 - 1000	Mo	0.1 - 5000	Th	0.01 - 500
Ce	0.01 - 1000	Na	0.01% - 5%	Ti	5 - 1%
Co	0.1 - 5000	Nb	0.02 - 200	Tl	0.01 - 1000
Cr	1 - 1%	Nd	0.01 - 500	Tm	0.01 - 100
Cs	0.01 - 500	Ni	0.5 - 1%	U	0.01 - 5000
Cu	0.5 - 1%	P	20 - 2%	V	2 - 1000
Dy	0.01 - 200	Pb	0.5 - 5000	W	0.05 - 200
Er	0.01 - 200	Pd**	10ppb - 500ppb	Y	0.02 - 200
Eu	0.01 - 200	Pr	0.005 - 500	Yb	0.01 - 200
Fe	0.01% - 50%	Pt**	5ppb - 500ppbb	Zn	1 - 1%
Ga	0.05 - 500	Rb	0.02 - 1000	Zr	0.1 - 200
Gd	0.05 - 200	Re	0.001 - 500		
Hf	0.01 - 200	S*	50 - 5%		

Aqua regia digestion 1g / ICP-OES & ICP-MS	AR01/OM20	₱1950
Aqua regia digestion 10g / ICP-OES & ICP-MS	ARU10/OM20	₱2050
Aqua regia digestion 25g / ICP-OES & ICP-MS	ARU25/OM20	₱2270

Note: * B, Hg, S are only available on 1g option, Hg may report low due to losses in sampling and preparation
** Au, Pt, Pd are indicative only on 1g option and must be interpreted with extreme caution

Elements where the concentration exceeds the upper limit will be re-digested by the appropriate analytical method, which will incur additional charges.

Legend		
Complete recovery for most samples	Near complete recovery for most samples	Not complete recovery

Aqua Regia Digestion Individual Elements

A selection of individual elements is offered to enable suites to be customised to suit your specific needs, or where only a few elements are required.

Aqua Regia ICP-OES Individual Elements

Element	Range ppm			Element	Range ppm			Element	Range ppm		
Ag	0.5	-	250	Cu	1	-	1%	Pb	1	-	5000
Al	20	-	10%	Fe	0.01%	-	50%	S*	50	-	5%
As	5	-	5000	K	20	-	5%	Sb	2	-	5000
B*	10	-	1%	La	20	-	500	Sc	1	-	500
Ba	2	-	2000	Li	1	-	1000	Sr	1	-	5000
Bi	2	-	5000	Mg	0.01%	-	20%	Te	2	-	1000
Ca	0.01%	-	40%	Mn	1	-	1%	Ti	5	-	1%
Cd	0.5	-	1000	Mo	1	-	5000	Tl	5	-	1000
Ce	20	-	1000	Na	0.01%	-	5%	V	2	-	1000
Co	1	-	5000	Ni	1	-	1%	W	2	-	200
Cr	2	-	1%	P	20	-	2%	Zn	1	-	1%

Aqua Regia ICP-MS Individual Elements

Element	Range ppm			Element	Range ppm			Element	Range ppm		
Au	1ppb	-	500ppb	Hf	0.01	-	200	Sc	0.1	-	200
Ag	0.05	-	200	Hg*	0.01	-	100	Se	1	-	5000
Al	10	-	1%	Ho	0.01	-	200	Sm	0.01	-	500
As	1	-	2000	In	0.005	-	1000	Sn	0.05	-	200
Ba	1	-	1000	La	0.01	-	500	Sr	0.02	-	1000
Be	0.05	-	1000	Li	0.1	-	1000	Ta	0.01	-	200
Bi	0.01	-	200	Lu	0.005	-	200	Tb	0.005	-	200
Ca	20	-	1%	Mg	5	-	1%	Te	0.01	-	200
Cd	0.01	-	500	Mn	1	-	5000	Th	0.01	-	500
Ce	0.01	-	500	Mo	0.1	-	500	Ti	5	-	1%
Co	0.1	-	1000	Nb	0.02	-	200	Tl	0.01	-	200
Cr	0.5	-	5000	Ni	0.5	-	5000	Tm	0.01	-	100
Cs	0.01	-	500	Nd	0.01	-	500	U	0.01	-	5000
Cu	0.5	-	5000	Pb	0.5	-	1000	V	1	-	2000
Dy	0.01	-	200	Pd	10ppb	-	500ppb	W	0.05	-	200
Er	0.01	-	200	Pr	0.005	-	500	Y	0.02	-	200
Eu	0.01	-	200	Pt	5ppb	-	500ppb	Yb	0.01	-	200
Fe	10	-	1%	Rb	0.02	-	1000	Zn	1	-	5000
Ga	0.05	-	500	Re	0.001	-	500	Zr	0.1	-	200
Gd	0.05	-	200	Sb	0.02	-	500				

*B, Hg, S are only available on 1g option, Hg may report low due to losses in sampling and preperation.

Aqua Regia AAS Individual Elements

Element	Range ppm			Element	Range ppm			Element	Range ppm		
Ag	0.5	-	250	Cr	5	-	1%	Ni	5	-	2%
As	5	-	1%	Cu	5	-	2%	Pb	5	-	5000
Bi	5	-	5000	Fe	100	-	50%	Sb	5	-	1%
Cd	5	-	1000	Mn	5	-	1%	Zn	5	-	2%
Co	5	-	5000	Mo	5	-	5000				

Description		Code	Price
Aqua regia digestion 1g	/ ICP first element	AR01/OM	₱490
Aqua regia digestion 10g	/ ICP first element	AR10/OM	₱650
Aqua regia digestion 25g	/ ICP first element	AR25/OM	₱740
	/ secondary instrument first element		₱315
	/ per additional ICP element		₱31
Aqua regia digestion 1g	/ AAS first element	AR01/AA	₱310
Aqua regia digestion 10g	/ AAS first element	AR10/AA	₱378
Aqua regia digestion 25g	/ AAS first element	AR25/AA	₱462
	/ per additional AAS element		₱55

Mercury by Cold Vapour AAS

Element	Range ppm
Hg	0.1

Aqua regia digestion / Cold Vapour AAS for Mercury	Individual digest	AR01/CV01	₱360
	Combined digest with elements above	AR01/CV01	₱240

Four Acid Digestion Multi-Element Analysis

Four acid digestion offers a "near total" dissolution of almost all minerals species, targeting silicates not dissolved in less aggressive aqua regia digests. Carefully staged digestion steps minimise losses due to volatilisation of some elements.

Highly resistant refractory minerals such as zircon, cassiterite, columbite-tantalite, ilmenite, xenotime rutile, barite and wolframite will require a fusion digestion to guarantee complete dissolution.

Packages range from basic ICP-OES only suites through to a comprehensive element list utilising both ICP-OES and ICP-MS for ultra-trace levels. Individual elements are available on request.

Four Acid ICP-OES Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	0.5 - 500	K	20 - 10%	Sb	5 - 1%
Al	50 - 15%	La	5 - 5000	Sc	1 - 5000
As	10 - 1%	Li	1 - 5000	Se	20 - 2000
Ba	2 - 5000	Mg	20 - 40%	Sn	20 - 2000
Bi	5 - 1%	Mn	1 - 2%	Sr	1 - 1%
Ca	50 - 40%	Mo	5 - 1%	Te	20 - 2000
Cd	0.5 - 2000	Na	20 - 10%	Ti	5 - 2%
Ce	20 - 1%	Nb	20 - 2000	Tl	10 - 2000
Co	1 - 1%	Ni	1 - 2%	V	1 - 5000
Cr	5 - 2%	P	50 - 5%	W	20 - 2000
Cu	1 - 2%	Pb	5 - 1%	Zn	1 - 2%
Fe	100 - 50%	S	50 - 10%	Zr	2 - 2000

4A/OE01 ₱880

Four Acid Standard ICP-OES & MS Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	0.1 - 500	In	0.05 - 2000	Se	2 - 1%
Al	50 - 15%	K	20 - 10%	Sn	0.1 - 2000
As	2 - 1%	Li	0.1 - 5000	Sr	0.5 - 1%
Ba	1 - 5000	Mg	20 - 40%	Ta	0.05 - 2000
Be	0.5 - 2000	Mn	1 - 2%	Te	0.1 - 2000
Bi	0.05 - 1%	Mo	0.1 - 1%	Th	0.05 - 5000
Ca	50 - 40%	Na	20 - 10%	Ti	5 - 2%
Cd	0.05 - 2000	Nb	0.1 - 2000	Tl	0.02 - 2000
Co	0.1 - 1%	Ni	1 - 2%	U	0.05 - 1%
Cr	5 - 2%	P	50 - 5%	V	1 - 5000
Cs	0.1 - 2000	Pb	1 - 1%	W	0.1 - 2000
Cu	1 - 2%	Rb	0.1 - 2000	Y	0.1 - 2000
Fe	100 - 50%	Re	0.05 - 2000	Zn	1 - 2%
Ga	0.1 - 2000	S	50 - 10%	Zr	0.5 - 2000
Ge	0.1 - 2000	Sb	0.1 - 1%		
Hf	0.1 - 2000	Sc	1 - 5000		

4A/OM10 ₱1600

Rare Earth Elements Add On

Rare earth elements are available as a supplementary package.

Element	Range ppm	Element	Range ppm	Element	Range ppm
La	0.1 - 5000	Eu	0.1 - 2000	Er	0.1 - 2000
Ce	0.1 - 1%	Gd	0.1 - 2000	Tm	0.1 - 2000
Pr	0.05 - 5000	Tb	0.05 - 2000	Yb	0.1 - 2000
Nd	0.1 - 5000	Dy	0.1 - 2000	Lu	0.05 - 2000
Sm	0.1 - 5000	Ho	0.1 - 2000		

4A/MS11 ₱360

Comprehensive ICP-OES & MS Package

Element	Range ppm			Element	Range ppm			Element	Range ppm		
Ag	0.05	-	500	Hf	0.05	-	2000	Sb	0.05	-	1%
Al	50	-	15%	Ho	0.01	-	2000	Sc	0.1	-	5000
As	0.5	-	1%	In	0.005	-	2000	Se	0.5	-	1%
Ba	0.1	-	5000	K	20	-	10%	Sm	0.01	-	5000
Be	0.05	-	2000	La	0.01	-	5000	Sn	0.1	-	2000
Bi	0.01	-	1%	Li	0.1	-	5000	Sr	0.05	-	1%
Ca	50	-	40%	Lu	0.005	-	2000	Ta	0.01	-	2000
Cd	0.02	-	2000	Mg	20	-	40%	Tb	0.005	-	2000
Ce	0.01	-	1%	Mn	1	-	2%	Te	0.05	-	2000
Co	0.1	-	1%	Mo	0.1	-	1%	Th	0.01	-	5000
Cr	1	-	2%	Na	20	-	10%	Ti	5	-	2%
Cs	0.05	-	2000	Nb	0.05	-	2000	Tl	0.02	-	2000
Cu	0.5	-	2%	Nd	0.01	-	5000	Tm	0.01	-	2000
Dy	0.01	-	2000	Ni	0.5	-	2%	U	0.01	-	1%
Er	0.01	-	2000	P	50	-	5%	V	1	-	5000
Eu	0.01	-	2000	Pb	0.5	-	1%	W	0.1	-	2000
Fe	100	-	50%	Pr	0.005	-	5000	Y	0.05	-	2000
Ga	0.05	-	2000	Rb	0.05	-	2000	Yb	0.01	-	2000
Gd	0.01	-	2000	Re	0.002	-	2000	Zn	1	-	2%
Ge	0.05	-	2000	S	50	-	10%	Zr	0.1	-	2000

4A/OM20 ₱2050

Elements where the concentration exceeds the upper limit will be re-digested by the appropriate analytical method, which will incur additional charges.

Legend		
Complete recovery for most samples	Near complete recovery for most samples	Not complete recovery

Four Acid Digestion Individual Elements

A selection of individual elements is offered to enable suites to be customised to suit your specific needs, or where only a few elements are required.

Four Acid ICP-OES Individual Elements

Element	Range ppm			Element	Range ppm			Element	Range ppm		
Ag	0.5	-	500	Fe	100	-	50%	S	50	-	10%
Al	50	-	15%	K	20	-	10%	Sb	5	-	1%
As	10	-	1%	La	20	-	5000	Sc	1	-	5000
Ba	2	-	5000	Li	1	-	5000	Sn	5	-	2000
Bi	5	-	1%	Mg	20	-	40%	Sr	1	-	1%
Ca	50	-	40%	Mn	1	-	2%	Te	5	-	2000
Cd	0.5	-	2000	Mo	2	-	1%	Ti	5	-	2%
Ce	20	-	1%	Na	20	-	10%	Tl	5	-	2000
Co	1	-	1%	Ni	1	-	2%	V	1	-	5000
Cr	5	-	2%	P	50	-	5%	W	5	-	2000
Cu	1	-	2%	Pb	5	-	1%	Zn	1	-	2%

Four Acid ICP-MS Individual Elements

Element	Range ppm			Element	Range ppm			Element	Range ppm		
Ag	0.05	-	500	Ge	0.05	-	2000	Se	0.5	-	1%
Al	10	-	1%	Hf	0.05	-	2000	Sm	0.01	-	5000
As	0.5	-	2000	Ho	0.01	-	2000	Sn	0.1	-	2000
Ba	0.1	-	2000	In	0.005	-	2000	Sr	0.05	-	2000
Be	0.05	-	2000	La	0.01	-	5000	Ta	0.01	-	2000
Bi	0.01	-	500	Li	0.1	-	1000	Tb	0.005	-	2000
Ca	20	-	1%	Lu	0.005	-	2000	Te	0.05	-	2000
Cd	0.02	-	500	Mg	20	-	1%	Th	0.01	-	5000
Ce	0.01	-	5000	Mn	1	-	1%	Ti	5	-	5000
Co	0.1	-	2000	Mo	0.1	-	1000	Tl	0.02	-	500
Cu	0.5	-	5000	Nb	0.05	-	2000	Tm	0.01	-	2000
Cr	0.5	-	5000	Nd	0.01	-	5000	U	0.01	-	1%
Cs	0.05	-	2000	Ni	0.5	-	5000	V	1	-	2000
Dy	0.01	-	2000	Pb	0.5	-	2000	W	0.1	-	500
Er	0.01	-	2000	Pr	0.005	-	5000	Y	0.05	-	2000
Eu	0.01	-	2000	Rb	0.05	-	2000	Yb	0.01	-	2000
Fe	20	-	1%	Re	0.002	-	2000	Zn	1	-	5000
Ga	0.05	-	2000	Sb	0.05	-	500	Zr	0.1	-	2000
Gd	0.01	-	2000	Sc	0.1	-	5000				

Four Acid AAS Individual Elements

Element	Range ppm			Element	Range ppm			Element	Range ppm		
Ag	0.5	-	500	Cr	10	-	2%	Mo	10	-	1%
As	100	-	2%	Cu	10	-	5%	Ni	10	-	5%
Bi	10	-	1%	Fe	100	-	50%	Pb	10	-	1%
Ca	100	-	40%	Mg	10	-	40%	Sb	100	-	1%
Cd	10	-	2000	Mn	10	-	5%	Zn	1	-	5%
Co	10	-	1%								

Description		Code	Price
4 Acid digestion	/ ICP first element	4A/OM	₱625
	/ secondary instrument first element		₱300
	/ per additional ICP element		₱31
4 acid digestion	/ AAS first element	4A/AA	₱530
	/ per additional AAS element		₱55

Four Acid AAS Individual Elements

Element	Range ppm			Element	Range ppm		
As	1	-	100	Sb	1	-	100

4 acid digestion / Hydride AAS per element	4A/AAH	₱180

Individual Elements by Hydride AAS (Additional to first element previous page)

Element	Range ppm			Element	Range ppm			
As	1	-	100	Sb	1	-	100	
4 acid digestion / Hydride AAS per element				4A/AAH				₱180

Trace Elements by Pressed Powder XRF

Pressed powder XRF is a useful technique for the rapid analysis of trace to minor quantities of single elements using quick matrix correction that ensures high daily throughput and fast turnaround. The pulverised sample is mixed with a binder and pressed into a briquette which removes the need for digestion and facilitates the analysis of elements present in refractory minerals. Control of grinding parameters reduces errors due to particle size and mineralogical effects. The pressed powder method is suitable for light matrices. Samples may be diluted with silica to expand the range and reduce matrix effects.

Element	Range ppm			Element	Range ppm		
As	1	-	1%	Mo	1	-	1%

Description		Code	Price
Pressed powder	/ XRF including first element	PP/XRF101	₱300
	/ per additional element		₱80
Over range elements	/dilution including first element	PP/XRF102	₱340
	/ per additional element		₱80

Elements where the concentration exceeds the upper limit will be determined by dilution and re-read or alternatively by an appropriate analytical method. Either option will incur additional costs.

Legend		
Complete recovery for most samples	Near complete recovery for most samples	Not complete recovery

Ores & Commodities

A diverse suite of procedures provide optimum precision and accuracy of the target element typically required in advanced exploration and resource evaluation. Techniques include multi-acid and fusion digests, useful for characterisation of geological samples where total dissolution of the sample is required, coupled with ICP-OES, ICP-MS and XRF instrumentation.

Trade commercial grade sample analysis where results are used for umpire or commercial settlement are available on request, see the Minerals Trade Services section on page 34.

Ores and High Grade Materials

Four Acid Digestion

High grade sulphide ores are readily quantified using a 4 acid digest formulated to retain low-solubility elements such as Pb and Ag in solution at higher concentrations. This is a near total dissolution however elements incorporated in high refractory minerals may not be completely digested.

Four Acid Ore Grade ICP-OES Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	10 - 1%	K	200 - 20%	S	500 - 60%
Al	500 - 50%	Li	20 - 10%	Sb	100 - 10%
As	100 - 20%	Mg	500 - 60%	Sc	10 - 2%
Bi	20 - 5%	Mn	20 - 50%	Sr	20 - 5%
Ca	500 - 50%	Mo	20 - 10%	Te	100 - 5%
Cd	20 - 50%	Na	500 - 20%	Tl	100 - 5%
Co	20 - 20%	Ni	20 - 70%	V	20 - 5%
Cu	20 - 70%	P	500 - 50%	Zn	10 - 70%
Fe	1000 - 70%	Pb	100 - 10%		

Ore grade 4 acid digest / ICP-OES	4AH1/OE101	₱990

Four Acid Ore Grade ICP-OES Individual Elements

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	10 - 1%	K	200 - 20%	S	500 - 60%
Al	500 - 50%	Li	20 - 10%	Sb	100 - 10%
As	100 - 20%	Mg	500 - 60%	Sc	10 - 2%
Bi	20 - 5%	Mn	20 - 50%	Sr	20 - 5%
Ca	500 - 50%	Mo	20 - 10%	Te	100 - 5%
Cd	20 - 50%	Na	500 - 20%	Tl	100 - 5%
Co	20 - 20%	Ni	20 - 70%	V	20 - 5%
Cu	20 - 70%	P	500 - 50%	Zn	10 - 70%
Fe	1000 - 70%	Pb	100 - 10%		

Description		Code	Price
Ore grade 4 acid digest	/ ICP-OES first element	4AH1/OM1	₱700
	/ per additional element		₱31

Four Acid Ore Grade AAS Individual Elements

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	5 - 1%	Co	100 - 40%	Mo	100 - 20%
As	500 - 20%	Cu	100 - 50%	Ni	100 - 50%
Bi	100 - 10%	Fe	200 - 70%	Pb	100 - 20%
Cd	100 - 40%	Mn	100 - 60%	Zn	100 - 60%

Description		Code	Price
Ore grade 4 acid digest	/ AAS first element	4AH1/AA	₱560
	/ per additional element		₱55

Three Acid Ore Grade Digestion

Sulphide and certain oxide base metal ores may also be analysed using a 3 acid digest with nitric, perchloric and hydrochloric acids. The 3AH digest is more effective than aqua regia and will completely dissolve most sulphides, oxides and carbonates. Refractory minerals and most silicates may, however, only be partially digested. The digest should not be considered to be selective. For example, the 3AH/ digest may not give one an accurate indication hosted nickel content of a sample if there is nickel present in both sulphides and silicates. An AAS finish is a cost effective way of analysing a limited suite of elements, whereas ICP-OES allows for the accurate determination of the major ore chemistry as well as lower level characterisation of other elements.

Three Acid Ore Grade ICP-OES Package

Element	Range ppm			Element	Range ppm			Element	Range ppm		
Ag	0.5	-	500	K	100	-	10%	Sb	5	-	1%
Al	100	-	15%	La	5	-	5000	Sc	1	-	5000
As	10	-	5%	Li	1	-	5%	Sn	20	-	2000
Ba	1	-	5000	Mg	20	-	40%	Sr	1	-	5000
Bi	5	-	1%	Mn	2	-	10%	Ta	20	-	2000
Ca	100	-	30%	Mo	5	-	5%	Te	20	-	2000
Cd	1	-	2000	Na	100	-	10%	Ti	5	-	5%
Ce	20	-	5000	Nb	20	-	2000	V	1	-	2000
Co	1	-	5%	Ni	1	-	10%	Y	1	-	2000
Cr	5	-	5%	P	50	-	5%	W	20	-	2000
Cu	1	-	10%	Pb	5	-	2%	Zn	1	-	10%
Fe	100	-	30%	S	50	-	10%	Zr	10	-	2000

Ore grade 3 acid digest / ICP-OES	3AH1/OE101	₱890

Individual Elements by Three Acid Digestion / ICP-OES

Element	Range ppm			Element	Range ppm			Element	Range ppm		
Ag	0.5	-	500	K	100	-	10%	Sb	5	-	1%
Al	100	-	15%	La	5	-	5000	Sc	1	-	5000
As	10	-	5%	Li	1	-	5%	Sn	20	-	2000
Ba	1	-	5000	Mg	20	-	40%	Sr	1	-	5000
Bi	5	-	1%	Mn	2	-	10%	Ta	20	-	2000
Ca	100	-	30%	Mo	5	-	5%	Te	20	-	2000
Cd	1	-	2000	Na	100	-	10%	Ti	5	-	5%
Ce	20	-	5000	Nb	20	-	2000	V	1	-	2000
Co	1	-	5%	Ni	1	-	10%	Y	1	-	2000
Cr	5	-	5%	P	50	-	5%	W	20	-	2000
Cu	1	-	10%	Pb	5	-	2%	Zn	1	-	10%
Fe	100	-	30%	S	50	-	10%	Zr	10	-	2000

Description		Code	Price
Ore grade 3 acid digest	/ ICP-OES first element	3AH1/OM1	₱510
	/ per additional element		₱31

Three Acid Ore Grade AAS Individual Elements

Element	Range ppm			Element	Range ppm			Element	Range ppm		
Ag	0.5	-	0.1%	Co	10	-	10%	Mo	10	-	20%
As	100	-	10%	Cu	10	-	10%	Ni	10	-	20%
Bi	10	-	10%	Fe	10	-	30%	Pb	10	-	20%
Cd	10	-	10%	Mn	10	-	20%	Zn	10	-	20%

Ore grade 3 acid digest / AAS first element	3AH1/AA	₱360
/ per additional element		₱55

Three Acid Ore Grade Hydride AAS Individual Elements

Element	Range ppm			Element	Range ppm		
As	1	-	100	Sb	1	-	100

Ore grade 3 acid digestion / Hydride AAS per element	3AH1/AAH	₱180

Legend		
Complete recovery for most samples	Near complete recovery for most samples	Not complete recovery

Fusion Decomposition

Two principal fusion methods are offered, lithium borate fusions in platinum crucibles and sodium peroxide fusions in either nickel or zirconium crucibles. Fusion methods digest all major rock forming minerals, including many that resist acid digestion. Once dissolved, the fusion product can be analysed by either ICP-OES or ICP-MS. Borate fusions are suitable for quantification of the major oxide components of geological samples and many trace elements. Peroxide fusions are more robust than borate fusions and are used routinely with sulphide ores. Sodium, the crucible element and a small suite of other elements are not available with peroxide fusions.

Specific commodity packages are found from page 25.

Lithium Borate Fusion

Lithium borate fusion offers a high temperature aggressive digest suitable for almost all geological samples. The technique is optimised for accuracy at both high and low element concentrations. Major element analysis can be carried out with either ICP or XRF finishes. The whole rock packages are available on Pg 34 and can be coupled with selected minor and trace elements listed below. Results for Co and, Mo, are semi quantitative only by this fusion method.

Samples containing high sulphides (2%), elevated copper (1%) and other reduced species such as metallics, arsenides, carbides and carbon should be analysed using the sodium peroxide fusion options. Specialised methods on page 30 should be utilised where the REE oxide content exceeds 1%.

Lithium Borate Individual Elements by ICP-OES / ICP-MS

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
Al_2O_3	0.01 - 100%	ICP-OES	Ho	0.1 - 2%	ICP-MS	SiO_2	0.01% - 100%	ICP-OES
Ba	0.5 - 5%	ICP-MS	K_2O	0.01% - 100%	ICP-OES	Sm	0.1 - 10%	ICP-MS
Be	0.5 - 2%	ICP-MS	La	0.2 - 20%	ICP-MS	Sn	1 - 5%	ICP-MS
CaO	0.01% - 100%	ICP-OES	Lu	0.1 - 1%	ICP-MS	Sr	0.2 - 20%	ICP-MS
Ce	0.5 - 30%	ICP-MS	MgO	0.01% - 100%	ICP-OES	Ta	0.1 - 5%	ICP-MS
Co	0.5 - 10%	ICP-MS	MnO	0.01% - 100%	ICP-OES	Tb	0.1 - 2%	ICP-MS
Cr	20 - 5%	ICP-OES	Mo	1 - 1%	ICP-MS	Th	0.1 - 2%	ICP-MS
Cs	0.1 - 1%	ICP-MS	Na_2O	0.01% - 100%	ICP-OES	TiO_2	0.01% - 100%	ICP-OES
Dy	0.1 - 5%	ICP-MS	Nb	0.1 - 5%	ICP-MS	Tm	0.1 - 1%	ICP-MS
Er	0.1 - 5%	ICP-MS	Nd	0.1 - 20%	ICP-MS	U	0.1 - 30%	ICP-MS
Eu	0.1 - 5%	ICP-MS	P_2O_5	0.01% - 100%	ICP-OES	V	10 - 5%	ICP-OES
Fe_2O_3	0.01% - 100%	ICP-OES	Pr	0.1 - 10%	ICP-MS	W	1 - 5%	ICP-MS
Ga	0.5 - 5%	ICP-MS	Rb	0.1 - 5%	ICP-MS	Y	0.5 - 50%	ICP-MS
Gd	0.1 - 5%	ICP-MS	Sb	0.5 - 2%	ICP-MS	Yb	0.1 - 5%	ICP-MS
Hf	0.1 - 5%	ICP-MS	Sc	10 - 5%	ICP-OES	Zr	1 - 50%	ICP-MS

Lithium borate fusion	/ ICP first element	FB6/OM	₱1350
	/ secondary instrument first element		₱415
	/ per additional element		₱45

Sodium Peroxide Fusions

Sodium peroxide fusions offer total dissolution of the sample and can be performed in either nickel or zirconium crucibles to preclude the presence of unwanted contaminant metals thus allowing different element suites to be tailored for various purposes. Sodium peroxide fusions are useful for samples in which the elements of interest are hosted in minerals that may resist acid digestions. These include, amongst others, minerals and ores containing rare earth elements (REE) and the high field strength elements (HFSE), Sn, W, Ti, Ta, Nb and V.

Zirconium Crucible Fusion Individual Elements by ICP-OES & ICP-MS Suitable for Majors, Boron and Base Metals

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
Al	100 - 50%	ICP-OES	In	0.1 - 5%	ICP-MS	Si	0.1% - 50%	ICP-OES
As	20 - 20%	ICP-MS	K	500 - 20%	ICP-OES	Sn	100 - 50%	ICP-MS
B	50 - 10%	ICP-OES	Li	1 - 20%	ICP-MS	Sr	20 - 20%	ICP-MS
Ba	1 - 2%	ICP-MS	Mg	100 - 60%	ICP-OES	Ta	0.1 - 50%	ICP-MS
Be	1 - 2%	ICP-MS	Mn	20 - 75%	ICP-OES	Te	2 - 2%	ICP-MS
Bi	0.1 - 10%	ICP-MS	Mo	1 - 10%	ICP-MS	Th	0.1 - 2%	ICP-MS
Ca	0.1% - 70%	ICP-OES	Nb	2 - 30%	ICP-MS	Ti	100 - 60%	ICP-OES
Cd	10 - 5%	ICP-MS	Ni	20 - 70%	ICP-OES	Tl	0.5 - 2%	ICP-MS
Co	1 - 20%	ICP-MS	Pb	20 - 70%	ICP-MS	U	0.1 - 60%	ICP-MS
Cr	50 - 40%	ICP-OES	Rb	0.5 - 5%	ICP-MS	V	20 - 20%	ICP-OES
Cs	0.1 - 1%	ICP-MS	Re	0.1 - 1%	ICP-MS	W	1 - 50%	ICP-MS
Cu	20 - 70%	ICP-OES	S	500 - 60%	ICP-OES	Y	0.5 - 50%	ICP-MS
Fe	100 - 75%	ICP-OES	Sb	0.5 - 10%	ICP-MS	Zn	20 - 70%	ICP-OES
Ga	1 - 5%	ICP-MS	Sc	10 - 5%	ICP-OES			
Ge	1 - 0.1%	ICP-MS	Se	20 - 2%	ICP-MS			

Sodium peroxide fusion Zr crucible / ICP first element	FP1/OM	₱945
/ secondary instrument first element		₱415
/ per additional element		₱45

Nickel Crucible Fusion ICP-OES & ICP-MS Individual Elements Suitable for Majors and Boron

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
Al	100 - 50%	ICP-OES	Ho	0.1 - 2%	ICP-MS	Se	20 - 2%	ICP-MS
Ag	5 - 2%	ICP-MS	In	0.1 - 5%	ICP-MS	Si	0.1% - 50%	ICP-OES
As	20 - 20%	ICP-MS	K	500 - 20%	ICP-OES	Sm	0.1 - 10%	ICP-MS
B	50 - 10%	ICP-OES	La	0.2 - 20%	ICP-MS	Sn	2 - 50%	ICP-MS
Ba	1 - 2%	ICP-MS	Li	5 - 20%	ICP-MS	Sr	20 - 20%	ICP-MS
Be	1 - 2%	ICP-MS	Lu	0.1 - 1%	ICP-MS	Ta	0.1 - 50%	ICP-MS
Bi	0.1 - 10%	ICP-MS	Mg	100 - 60%	ICP-OES	Tb	0.1 - 2%	ICP-MS
Ca	0.1% - 70%	ICP-OES	Mn	0.2% - 75%	ICP-OES	Te	1 - 2%	ICP-MS
Cd	1 - 5%	ICP-MS	Nb	10 - 30%	ICP-MS	Th	0.1 - 2%	ICP-MS
Ce	0.5 - 30%	ICP-MS	Nd	0.1 - 20%	ICP-MS	Ti	500 - 60%	ICP-OES
Cs	0.1 - 1%	ICP-MS	P	100 - 50%	ICP-OES	Tl	0.5 - 2%	ICP-MS
Dy	0.1 - 5%	ICP-MS	Pb	20 - 70%	ICP-MS	Tm	0.1 - 1%	ICP-MS
Er	0.1 - 5%	ICP-MS	Pr	0.1 - 10%	ICP-MS	U	0.1 - 60%	ICP-MS
Eu	0.1 - 5%	ICP-MS	Rb	0.5 - 5%	ICP-MS	V	50 - 20%	ICP-OES
Fe	100 - 75%	ICP-OES	Re	0.1 - 1%	ICP-MS	W	1 - 50%	ICP-MS
Ga	1 - 5%	ICP-MS	S	500 - 60%	ICP-OES	Y	0.5 - 50%	ICP-MS
Gd	0.1 - 5%	ICP-MS	Sb	0.5 - 10%	ICP-MS	Yb	0.1 - 5%	ICP-MS
Hf	0.1 - 5%	ICP-MS	Sc	10 - 5%	ICP-OES	Zr	5 - 50%	ICP-MS

Sodium peroxide fusion Ni crucible / ICP first element	FP6/OM	₱945
/ secondary instrument first element		₱415
/ per additional element		₱45

Legend		
Complete recovery for most samples	Near complete recovery for most samples	Not complete recovery

Specific Commodities

Iron Ore

X-ray fluorescence spectroscopy (XRF) is the preferred method of analysis for iron ore samples. Accuracy, long term reproducibility and high throughput means XRF is unparalleled in the modern geochemical laboratory for the analysis of the major components of iron ores.

Pulverised samples are fused with a lithium borate flux and cast into disks using semi or fully automated technology. The use of fusion disks eliminates physical effects such as particle size and reduces matrix effects which can compromise the accuracy of XRF analysis. High quality data is produced using either simultaneous or sequential wavelength dispersive instrumentation.

Loss on ignition (LOI) is determined by the use of thermo gravimetric analysis (TGA). Single point LOI is determined at 1000°C and is included in the iron ore packages. Customised multiple point LOI determinations are available on request.

Basic Iron Ore XRF Package

Suitable for exploration and resource modeling this suite is intended to quantify the essential major and minor oxide components of an iron ore sample.

Element	Range %		Element	Range %		Element	Range %	
Fe	0.01	75	MgO	0.01	100	SiO_2	0.01	100
Al_2O_3	0.01	100	MnO	0.01	100	TiO_2	0.01	100
CaO	0.01	100	Na_2O	0.01	100	V_2O_5	0.005	10
Cr_2O_3	0.005	10	P_2O_5	0.001	45	LOI 1000°C	0.01	100
K_2O	0.01	100	SO_3	0.001	40			
Li borate fusion / XRF			FB1/XRF10					₱1320

Iron Ore XRF Extended Suite Package

Suitable for exploration and resource modelling as well as quantification of additional accessory and deleterious elements. These elements are less abundant in most iron ores however, they may affect the quality of the ore if present in significant quantities.

Iron Ore Extended Suite – Standard Detection Limits XRF Package

Element	Range %		Element	Range %		Element	Range %	
Fe	0.01	75	K_2O	0.01	100	Sn	0.005	5
Al_2O_3	0.01	100	MgO	0.01	100	Sr	0.005	5
As	0.005	5	MnO	0.01	100	TiO_2	0.01	100
BaO	0.005	5	Na_2O	0.01	100	V_2O_5	0.005	10
CaO	0.01	100	Ni	0.005	20	Zn	0.005	5
Cl	0.005	5	P_2O_5	0.001	45	Zr	0.005	5
Co	0.005	5	Pb	0.005	5	LOI 1000°C	0.01	100
Cr_2O_3	0.005	10	SO_3	0.001	40			
Cu	0.005	5	SiO_2	0.01	100			
Li borate fusion / XRF			FB1/XRF11					₱1650

Aluminium Ore (Bauxite)

XRF analysis of bauxite is the preferred method to return total values of the component oxides such as alumina and silica. A single point LOI is done at 1000°C. As bauxites are highly hygroscopic, all data is corrected to the dry sample.

Of more fundamental importance are the available alumina and reactive silica components of the bauxite ores. The available alumina is the alumina component that can be extracted using the sodium hydroxide leaching Bayer process. The reactive silica is the silica component that dissolves in the Bayer process and reacts with some of the dissolved alumina and sodium hydroxide, whereby both alumina and sodium are lost to the process. Reactive silica and available alumina are determined in the Perth dedicated bauxite analysis facility.

Bauxite XRF Package

Element	Range %			Element	Range %			Element	Range %		
Al_2O_3	0.01	-	100	MgO	0.01	-	100	TiO_2	0.01	-	100
BaO	0.01	-	100	MnO	0.01	-	100	V_2O_5	0.005	-	100
CaO	0.01	-	100	Na_2O	0.01	-	100	ZrO_2	0.01	-	100
Cr_2O_3	0.005	-	100	P_2O_5	0.002	-	100	LOI 1000°C	0.01	-	100
Fe_2O_3	0.01	-	100	SiO_2	0.01	-	100				
K_2O	0.01	-	100	SO_3	0.002	-	100				
Li borate fusion / XRF					FB1/XRF30						₱1390

Chromite Ore

Chromium ores are usually found associated with ultramafic rocks and may be accurately analysed by fusion XRF with a single point LOI (1000°C). The highly refractory nature of chromite ores requires a specialist approach in the fusion process to ensure that the spinel structure is decomposed and the entire sample is dissolved in the fusion disk. The LOI is usually negative in higher grade ores due to the oxidation of ferrous iron in the spinel structure. The major element analysis can be used to classify the chromite ore.

Chromite Ore XRF Package

Element	Range %			Element	Range %			Element	Range %		
Cr_2O_3	0.005	-	100	MgO	0.01	-	50	SO_3	0.002	-	10
Al_2O_3	0.01	-	100	MnO	0.005	-	10	TiO_2	0.01	-	10
CaO	0.01	-	100	Na_2O	0.01	-	10	V_2O_5	0.002	-	10
Fe_2O_3	0.01	-	100	P_2O_5	0.001	-	10	LOI 1000°C			
K_2O	0.01	-	100	SiO_2	0.01	-	50				
Li borate fusion / XRF					FB1/XRF35						₱1560

Legend		
Complete recovery for most samples	Near complete recovery for most samples	Not complete recovery

Nickel Laterite Ores

The oxidised nature of nickel laterite ore and the low sulphur contents make XRF with a single point LOI an ideal technique for the chemical characterisation of these ores. XRF can accurately quantify the nickel and cobalt contents of the ore, important trace elements such as cobalt and zinc, as well as the major oxide components which are used to classify the laterite ore type. Nickel laterite ores can be hygroscopic with high moisture contents. Moisture is therefore corrected for routinely and all results are reported on a dry basis.

Nickel Laterite Ore XRF Package

Element	Range %	Element	Range %	Element	Range %
Ni	0.005 - 20	Fe_2O_3	0.01 - 100	P_2O_5	0.002 - 100
Co	0.005 - 5	K_2O	0.01 - 100	SiO_2	0.01 - 100
Al_2O_3	0.01 - 100	MgO	0.01 - 100	SO_3	0.002 - 100
CaO	0.01 - 100	MnO	0.01 - 100	TiO_2	0.01 - 100
Cr_2O_3	0.005 - 100	Na_2O	0.01 - 100	LOI 1000°C	0.01 - 100
Li borate fusion / XRF		FB1/XRF40			₱1320

Nickel Laterite Ore XRF Extended Suite Package

Suitable for exploration and resource modelling as well as quantification of additional accessory and deleterious elements. These elements are less abundant in most iron ores however, they may affect the quality of the ore if present in significant quantities.

Nickel Laterite Extended Suite – Standard Detection Limits XRF Package

Element	Range %	Element	Range %	Element	Range %
Ni	0.005 - 20	Cu	0.005 - 5	SO_3	0.001 - 40
Al_2O_3	0.01 - 100	K_2O	0.01 - 100	SiO_2	0.01 - 100
As	0.005 - 5	MgO	0.01 - 100	TiO_2	0.01 - 100
BaO	0.005 - 5	MnO	0.01 - 100	V_2O_5	0.005 - 10
CaO	0.01 - 100	Na_2O	0.01 - 100	Zn	0.005 - 5
Cl	0.005 - 5	Fe_2O_3	0.01 - 100	LOI 1000°C	0.01 - 100
Co	0.005 - 5	P_2O_5	0.001 - 45		
Cr_2O_3	0.005 - 10	Pb	0.005 - 5		
Li borate fusion / XRF		FB1/XRF141			₱1650

Manganese Ore

XRF, with a single point LOI (1000°C), is routinely used in the accurate quantification of the chemical components of manganese ores. A complete oxide suite is analysed which includes Pb and Ba. These two elements can be important components of the ore and the concentrations of these elements are required to do the requisite matrix corrections in the XRF analysis.

Manganese Ore XRF Package

Element	Range %	Element	Range %	Element	Range %
MnO	0.005 - 100	Fe_2O_3	0.01 - 50	SiO_2	0.01 - 80
Al_2O_3	0.01 - 50	K_2O	0.01 - 20	SO_3	0.002 - 10
BaO	0.005 - 5	MgO	0.01 - 20	TiO_2	0.01 - 10
CaO	0.01 - 50	Na_2O	0.01 - 20	V_2O_5	0.002 - 10
Cr_2O_3	0.005 - 20	P_2O_5	0.001 - 10	Zn	0.002 - 5
Cu	0.002 - 5	Pb	0.002 - 5	LOI 1000°C	
Li borate fusion / XRF		FB1/XRF125			₱1390

Limestones & Dolomites

XRF is a very useful technique for the analysis of diverse rock types and is the favored routine method for the full chemical characterisation of assorted industrial mineral feedstocks and products such as attapulgite, kaolinite, pyrophyllite, limestone, dolomite, phosphates, cement, mica and feldspar.

Limestone & Dolomite XRF Package - suitable for samples containing <500ppm uranium.

Element	Range %			Element	Range %			Element	Range %		
Al_2O_3	0.01	-	100	MgO	0.01	-	100	SO_3	0.002	-	100
CaO	0.01	-	100	MnO	0.01	-	100	TiO_2	0.01	-	100
Cr_2O_3	0.01	-	100	Na_2O	0.01	-	100	LOI 1000°C	0.01	-	100
Fe_2O_3	0.01	-	100	P_2O_5	0.002	-	100				
K_2O	0.01	-	100	SiO_2	0.01	-	100				

Li borate fusion / XRF	FB3/XRF60	₱1320

Rare Earth Elements

The refractory nature of many of the minerals which host rare earth elements (REE) make fusion followed by ICP-MS an ideal technique for the accurate characterisation of REE ores along with important major, minor and trace components. The fusion approach ensures the complete digestion of all minerals giving total elemental analyses. All data is checked for consistency using chondrite normalised plots.

REE Mineralisation Na Peroxide Fusion ICP-MS Package

Element	Range %			Element	Range %			Element	Range %		
La	0.2	-	20%	Ho	0.1	-	2%	Ta	0.1	-	50%
Ce	0.5	-	30%	Er	0.1	-	5%	Hf	0.1	-	5%
Pr	0.05	-	10%	Tm	0.05	-	1%	Zr	5	-	50%
Nd	0.1	-	20%	Yb	0.1	-	5%	Sn	2	-	50%
Sm	0.1	-	10%	Lu	0.05	-	1%	W	1	-	50%
Eu	0.1	-	%	Y	0.5	-	50%	Li	1	-	20%
Gd	0.1	-	5%	Th	0.1	-	2%	Be	1	-	2%
Tb	0.05	-	2%	U	0.1	-	60%	Ga	1	-	5%
Dy	0.1	-	5%	Nb	10	-	30%				

REE	Sodium peroxide fusion Ni crucible / ICP-MS	FP6/MS33	₱1870

Legend		
Complete recovery for most samples	Near complete recovery for most samples	Not complete recovery

Copper

A spectrum of analytical techniques are offered that add value to the copper industry supply chain. These include ultra-sensitive exploration methods, ore grade characterization and empirical digestion techniques that target copper in different forms. Acid soluble copper refers to the metal content extractable using dilute sulphuric acid. This includes the most common oxide copper species malachite, azurite and chrysocolla. Other copper minerals may also be partially dissolved. Cyanide soluble copper includes most oxide minerals, common sulphide minerals but not chalcopyrite. These techniques are empirical in that the recovery depends on the conditions of the digest, the degree of comminution and the deportment of the metal in the ore. Total copper is offered by four acid digest. Umpire and commercial exchange assay services are available at Interteks specialist LSI laboratory, see Minerals Trade Services.

Specialised and Classical Methods

Copper Speciation

Analyte	Description	Code	Price
Cu_A	Acid soluble Cu - Dilute H_2SO_4 leach / AAS	CUA/AA	₱400
Cu_CN	Cyanide soluble Cu - Ambient temperature cyanide leach / AAS	CUCN/AA	₱480
Cu_Res	Residual Copper Residual copper after sequential leach	4A/AA	₱530
Cu_A2	Acetic Acid Soluble Cu	CUA2/AA	₱400

The cyanide soluble copper analysis can be performed as a standalone determination or sequential to the acid soluble Cu method.
Copper Speciation Package (Cu_A + Cu_CN + Cu_Res) - CUSEQ ₱1125

Classical Methods

Analyte	Description	Code	Price
Fe	Volumetric analysis of Fe in Iron Ore	FE1/VOL	₱2200
Fe	Volumetric analysis of Fe in Chromite Ores	FE2/VOL	₱2500
FeO	Acid Digestion/ Titration	AD71/VOL	₱2800
Cu	Cu ores & concentrates by short iodide	CU1/VOL	₱2000
Cu	Cu ores & concentrates by long iodide	CU2/VOL	₱3500
Cr	Volumetric analysis of Cr in Chromite Ores	CR1/VOL	₱2500
Si	Gravimetric analysis of Si in general rocks/soils	SI1/GR	₱2100
Si	Gravimetric analysis of Si in Chromite Ores	SI2/GR	₱2100
Si	Gravimetric analysis of Si in Manganese Ores	SI3/GR	₱2100
Si	Gravimetric analysis of Si in Si Sands	SI4/GR	₱2100
S	Gravimetric analysis of S	S1/GR	₱2000
P	Volumetric analysis of total P	P1/VOL	₱2400
Mn	Volumetric analysis of Manganese Ores and concentrates	MN1/VOL	₱2400
Ca	Volumetric analysis of Ca	CA1/VOL	₱2800
CaO	Volumetric analysis of CaO available lime	CAO/VOL	₱1800

Lithium

Lithium is a lithophile element that occurs predominantly in silicate minerals where it is diadochic with potassium, sodium, iron and magnesium. Sources of lithium include brines, certain granite pegmatites in the minerals spodumene, petalite and lepidolite and clays, hectorite, in particular.

Lithium minerals are easily soluble in 4 acid digests and are also amenable to decomposition using fusion digests. Whereas 4 acid digests may be suitable for simple silicate-hosted lithium assays, lithium minerals in pegmatites may be associated with other important economic minerals such as columbite-tantalite, wolframite and cassiterite which require fusion decomposition to quantify accurately.

Intertek has extensive experience with lithium analysis in pegmatites, alkaline rocks and brine solutions as well as almost all common geological materials including vegetation. For analysis of lithium bearing lithologies that contain significant quantities of Sn, Ta, Nb a fusion digest is recommended to accurately quantify these refractory elements.

48 Element Lithium Exploration Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Li	0.1 - 5000	Ge	0.1 - 2000	Sb	0.05 - 1%
Ag	0.05 - 500	Hf	0.05 - 2000	Sc	0.1 - 5000
Al	50 - 15%	In	0.01 - 2000	Se	0.5 - 1%
As	0.5 - 1%	K	20 - 10%	Sn	0.1 - 2000
Ba	0.1 - 5000	La	0.01 - 5000	Sr	0.05 - 1%
Be	0.05 - 2000	Mg	20 - 40%	Ta	0.01 - 2000
Bi	0.01 - 1%	Mn	1 - 5%	Te	0.2 - 2000
Ca	50 - 40%	Mo	0.1 - 1%	Th	0.01 - 5000
Cd	0.02 - 2000	Na	20 - 10%	Ti	5 - 2%
Ce	0.01 - 1%	Nb	0.05 - 2000	Tl	0.02 - 2000
Co	0.1 - 2%	Ni	0.5 - 2%	U	0.01 - 1%
Cr	1 - 2%	P	50 - 5%	V	1 - 2%
Cs	0.05 - 2000	Pb	0.5 - 1%	W	0.1 - 2000
Cu	0.5 - 2%	Rb	0.05 - 2000	Y	0.05 - 2000
Fe	100 - 50%	Re	0.002 - 2000	Zn	1 - 2%
Ga	0.05 - 2000	S	500 - 10%	Zr	0.1 - 2000

Lithium 4 acid digestion/ ICP-MS package	4A-Li/MS48	POA

Zirconium Crucible Fusion ICP-MS Individual Element

Element	Description	Range	Code	Price
Li	Sodium peroxide fusion Zr Crucible	1 - 20%	FP1-Li/MS	POA

Brine Analysis

Description	Code	Price
As, B, Ba, Ca, Co, Cr, Cs, Fe, K, Li, Na, Ni, Mg, Mn, P, Pb, Rb, S, Sc, Se, Sr, Ti, V, Zn	BR-Li01	POA

Detection limits will be dependent on salinity levels. Upper limits may apply for some elements.

Description	Range	Code	Price
Chloride by Colorimetry	5 mg/l	COL03	POA

Brine pH, EC, TDS, SO4, Total Alkalinity Package

Description	Code	Price
pH, EC, TDS, Sulphate (calculated from S), HCO_3, OH, CO_3 by titration	BR-Li02	POA

Legend		
Complete recovery for most samples	Near complete recovery for most samples	Not complete recovery

Individual Methods

Gravimetric Determinations

Element	Description	Detection Limit	Code	Price
LOD	Loss on drying (105°C or client nominated temperature)	0.01%	LOD/GR	₱100
LOD	Loss on drying (105°C or client nominated temperature) to constant weight	0.01%	LOD1/GR	₱225
LOI	Loss on ignition (1000°C or client nominated temperatures)	0.01%	LOI1/GR	₱225
SG	Specific gravity / pulp (Archimedes principle)		SGP/GR01	₱375
SG	Specific gravity / core and rocks uncoated		SG/GR	₱400
SG	Specific gravity / core and rocks wax coated		SGW/GR	₱725

Carbon and Sulphur Analysis

Carbon and sulphur analyses using a variety of spectroscopic or gravimetric methods with the option of pretreatments for targeting specific forms of the analyte element.

Element	Description	Detection Limit	Code	Price
C	Total carbon by CS analyser	0.01% - 50%	CSA01	₱640
S	Total sulphur by CS analyser	0.01% - 50%	CSA02	₱640
C,S	Total carbon & sulfur by CS analyser	0.01% - 50%	CSA03	₱960
S_S2 *	Carbonate leach for estimation of sulfide sulfur	0.05% - 70%	CSA104	₱670
S_SO4*	Carbonate extract for soluble sulfate /gravimetric	0.01% - 50%	S72/GR	₱1890
C non carbonate	Weak acid digestion/ CS analyser	0.01% - 50%	C71/CSA	₱1450

*May not include all Ba, Sr and Pb sulphates

Acid Rock Drainage Package

ARD screening methods are used in categorizing the relative acid forming potential of a sample. The following methods are conducted as per AMIRA 2002 guidelines.

Element	Description	Detection Limit	Code	Price
ANC	Titrimetric measurement of acid consumption	1kgH_2SO_4/t	ARD102	POA
NAG	Titrimetric measurement of acid generation	1kgH_2SO_4/t		
	by oxidation, non-kinetic			
NAG pH	pH of oxidised solution	0.1		
S	S by acid digestion ICP-OES	0.01%		
pH	Paste pH of 1:2 water extract	0.1		
NAPP	Net acid producing potential calculated from	1kgH_2SO_4/t		
	ANC and S			
MPA	Maximum potential acidity calculated from S	1kgH_2SO_4/t		

Follow up testing to obtain more information on acid forming capacities and resolve samples with uncertain classifications such as Sequential NAG, Kinetic NAG and free draining Leach Column Testing would also be available on a project basis.

Analysis of Naturally Occurring Water

Detection limits and prices apply to naturally occurring waters with an electrical conductivity (EC) of less than 1000mS/Cm. More saline or highly mineralised solutions will require dilution and detection limits will be increased. Upper limits may apply to some elements, especially by ICP-MS.

Correct sampling and preservation of samples is critical. Preparation charges may apply. Please contact the laboratory for detailed instructions.

Waters ICP-OES Individual Elements

Element	DL mg	Element	DL mg	Element	DL mg
Ag	0.01	Fe	0.01	S	0.1
Al	0.01	K	0.1	Sc	0.01
As	0.02	Li	0.1	Si	0.05
B	0.01	Mg	0.01	Sr	0.01
Ba	0.01	Mn	0.01	Ti	0.01
Ca	0.01	Mo	0.01	V	0.01
Cd	0.01	Na	0.1	Zn	0.01
Co	0.01	Ni	0.01	Zr	0.01
Cr	0.01	P	0.1		
Cu	0.01	Pb	0.02		

Waters ICP-MS Individual Element

Element	DL µg	Element	DL µg	Element	DL µg
Ag	0.05	Hg	0.1	Se	0.2
As	0.05	Ho	0.01	Sm	0.01
Au	0.01	In	0.01	Sn	0.1
Ba	0.02	La	0.01	Sr	0.01
Be	0.05	Li	0.5	Ta	0.05
Bi	0.01	Lu	0.01	Tb	0.01
Cd	0.02	Mo	0.05	Te	0.1
Ce	0.01	Nb	0.02	Th	0.01
Co	0.05	Nd	0.01	Tl	0.01
Cs	0.01	Pb	0.1	Tm	0.01
Dy	0.01	Pd	0.02	U	0.005
Er	0.01	Pr	0.01	W	0.05
Eu	0.01	Pt	0.02	Y	0.01
Ga	0.01	Rb	0.01	Yb	0.01
Gd	0.01	Re	0.01	Zr	0.05
Ge	0.05	Ru	0.01		
Hf	0.01	Sb	0.05		

/ ICP first element	(WAT/OE, WAT/MS)	₱615
/ first element secondary instrument		₱415
/ per additional element		₱50

Specialised Services

Mineralogy

Applied mineralogy is the study of the mineral phases of materials which contrasts with and complements a traditional chemical analysis. Applied mineralogy identifies the nature of the mineral phase, the grain size and morphology, textures, mineral associations and other parameters. Applied mineralogy has important applications in mineral exploration, mineral processing, mineral waste disposal and treatment, hydrometallurgy, pyrometallurgy and refining. It is also utilised in the oil and gas, coal and environmental industries.

Various ores and commodities can be analysed such as base metal ores, precious metal ores, iron ores, bauxite, chromite, nickel, uranium, rare earths, industrial minerals (including graphite), refractory minerals and clays.

A comprehensive suite of applied mineralogy analyses are available. Please call our Perth laboratory to discuss the options best suited to your requirements with Intertek's XRD specialist.

Bulk Mineralogy

X-Ray Diffraction

Powder X-ray diffraction (XRD) is an analytical technique primarily employed for the identification and quantification of crystalline materials in bulk samples, both natural and synthetic.

The results given are either qualitative (descriptive of the sample make-up) or quantitative. Quantitative results can include the non-crystalline (amorphous) content of the sample

Sample Preparation

XRD Crush and Pulverize Package

Description	Code	Price
Crush -2mm, rotary split 800g, pulverise 800g to < 60µm	XRD13	POA

*Samples are not to be dried

XRD Micronizing Package

Description	Code	Price
Micronizing	XRD14	POA

*Samples are not to be dried

XRD Crush, Pulverize and Micronize Package

Description	Code	Price
Crush -2mm, rotary split 800g, pulverise 800g to <60µm, micronize	XRD15	POA

*Samples are not to be dried

XRD Crush, Pulverize and Micronize Package

Description	Code	Price
Pulverise <800g to < 60µm, micronize	XRD16	POA

X-Ray Diffraction Analysis

A number of qualitative and quantitative options are available. Please contact the laboratory to discuss your specific requirements.

Element	Description	Code	Price
QUALITATIVE	Qualitative analysis for complete mineralogy	XRDQual	POA
QUANTITATIVE	Quantitative analysis for complete mineralogy (crystalline content only)	XRDQuant	POA
QUANTITATIVE	Quantitative analysis for complete mineralogy and amorphous content	XRDQuant01	POA
QUANTITATIVE	Quantitative analysis for complete mineralogy and amorphous content (2 x Scan analysis)	XRDQuant02	POA

Clay Mineralogy

Clays are important constituents of soils, mudstones, shales and some ores that often require specialist attention. A range of analytical tests are available, including:

- Clay separation from bulk materials
- Qualitative or quantitative XRD analysis from the bulk sample
- Clay mineral identification (XRD) (from glycolation and heating regimes)
- High resolution microscopy analysis via SEM-EDS/QEMSCAN
- Swelling Index of clays in water (adapted from the ASTM method)
- Swelling Index of clays in solutions of specific interest
- Cation Exchange Capacity (CEC) analysis

XRD Clay separation

Description	Code	Price
Separation of clay fraction, <2 µm	CLAYF	POA
Separation of clay fraction, <2 µm, in iron-rich samples	CLAYFFe	POA

X-Ray Diffraction Analysis

Element	Description	Code	Price
QUALITATIVE	Qualitative analysis of clays (incl. glycolation and heating)	XRDQual01	POA

ASD Terraspec Scan

The TerraSpec 4 Hi Res spectrometer offers a rapid scan for the identification and characterisation of minerals visible in the NIR range. Minerals and mineral groups include haematite, goethite, garnet, pyroxene, amphibole, epidote, apatite, tourmaline, topaz, clay, mica, chlorite, serpentine, carbonates, hydrous silicates and rare earth minerals. The scan information can be used to identify, characterise and map alteration zones associated with various ore forming processes.

For best results, it is recommended that the characterisation of the mineral analysis be confirmed by XRD analysis on either a continuum or a selected subset of samples.

Description	Code	Price
TerraSpec 4 Hi Res scan	/NIR	POA
TSG Post processing mineralogy report - standard report	/NIR01	POA

Micro Mineralogy

QEMSCAN

Automated mineralogy via QEMSCAN (Quantitative Evaluation of Minerals by Scanning Electron Microscopy) is used to identify mineral phases, in situ, at the micron scale on polished blocks or thin sections.

As well as identifying the minerals present, the processing of the data allows the visualization of the textural and spatial arrangements of the minerals. The processing can thus determine grain sizes and shapes as well as provide information for mineral associations, mineral liberation, elemental deportment and elemental mapping.

The technique is best used in conjunction with the bulk mineralogical data obtained from XRD. Please contact us for options.

Minerals Trade Services

Intertek Minerals Trade Services provide independent inspection, sampling, testing and certification services which assist to protect the quantity and quality of mineral commodities to reduce commercial risk in the trading environment. Inspection and testing services are completed to appropriate international standards and procedures.

Non ferrous commercial exchange assay services are provided by Intertek's industry recognised Laboratory Services International (LSI), based in Rotterdam, Netherlands. LSI is an established umpire laboratory providing analytical services to miners, traders and refiners with a long history of expertise in non-ferrous party and umpire analysis and is an industry leader for accuracy, service quality and independence.

In addition, Intertek provides dedicated onsite laboratory services for grade control, process control and shipment samples for iron ore, gold and base metal operations. Iron ore testing facilities are ISO/IEC 17025 accredited for analysis iron ore as per the ISO-9516 Standard.

The global Intertek Minerals Inspection Team also performs risk management and inspection services in load and discharge ports alike, offering a full scope of WSMD and party assays, in locations from the Americas, Africa to China and the Far East.

Cargo Inspection Services include:

- Marine cargo surveying
- Loading & discharge superintendence
- Independent ship/cargo damage & repair surveys
- Pre shipment inspection
- Government statutory surveys
- Witness & audit
- Marine consultancy
- Stockpile measurement
- Safety and certification services
- Independent draft surveys
- On hire/off hire/draft/bulk surveys
- Ship vetting services
- P & I surveys
- Foreign trade standards
- Metering & tank calibration
- Loss control
- Marine training

Intertek's global independent sampling, inspection and certification services help protect the quantity and quality of commodities and reduce commercial risk. Please contact us to see how Intertek can help your organisation with Minerals Trade Services.

Mine and Port Site Laboratories

Through its dedicated Mine Site Services project team, Intertek is able to provide its clients with a complete solution for any scale of mine or port site laboratory installation, from concept phase to commissioning and contract management. Intertek operates, designs and commissions dedicated mine site laboratories in remote locations to enhance its service to mining operations across multiple mineral commodities.

Intertek's automated and robotic sample systems are purpose built, ranging from individual cells to fully integrated systems providing complete end-to-end sampling to analysis solutions. Intertek Robotic Laboratories (IRL) offers unmatched experience and expertise in the operation of fully automated laboratories in remote locations and is the largest commercial operator of fully automated laboratories.

Outsourcing of a mine-site laboratory offers the benefit of Intertek's world-class expertise and services and enables companies to focus resources and capital on their core business.

Mine-Site Laboratory Services:

- Sample preparation
- Mineral assay services
- Robotics and automated laboratory systems
- Laboratory outsourcing (build, supply, operate options)
- Consulting services e.g. Laboratory design, laboratory audits, round robins
- Ongoing staffing and technical support

Minerals Processing

Supported by Intertek Minerals global laboratory network Intertek offers mineral processing and mineralogical testing services to the mining industry for all major ore types. Sample preparation facilities are licensed radiation premises and equipped to handle hazardous materials.

Intertek Mineral Processing offers tailored programs to the needs of individual projects, from bench scale to small scale pilot plant studies. Services include:

- Ore characterisation
- Flotation
- Magnetic separation
- Batch leaching testwork
- Comminution
- Knelson concentration

Minerals Environmental Testing Services

Intertek environmental laboratories support the minerals industry with water, soil and air testing to governmental, regulatory and industry standards.

Minerals environmental services include:

- Water quality
- Ecotoxicology services
- Biological tissue analysis
- Ambient air quality
- Acid sulphate soils
- Environmental baseline studies
- Waste analysis and characterisation
- Sediment and soil analysis
- Soil nutrient analysis
- Air emissions testing
- Acid rock drainage prediction test
- Field sampling and on-site testing

Exploration and Production Services

From reservoir services and production support, Intertek's analytical and scientific services are focused on extending the longevity of plant and equipment, reducing environmental impacts and optimising operations.

Services include:

- Petroleum geochemistry
- Petrophysics/core analysis
- Environmental chemistry
- Ecotoxicology
- Industrial chemistry

Business Assurance

Management systems auditing helps you find and implement best practices for continual improvement, and adds strategic value to your business.

Intertek's comprehensive auditing and certification services provide the tools you need to evaluate and continually improve your business processes.

As an accredited third party registrar, we provide independent verification to ensure that your management system is effective in achieving your business objectives, while also certifying that it meets internationally recognised standards including ISO 9001, ISO 14001 and OHSAS 18001.

Our internal audit, second party supplier audit, and process analysis services will help you proactively monitor performance while saving valuable time and money.

Our services include:

Management Systems Certification:

- ISO 9001
- ISO 14001
- OHSAS 18001 / AS/NZS 4801

Supply Chain Assessment & Compliance Programs:

- Workplace Conditions Assessment (WCA)
- Supplier Qualification Programs (SQP)
- Global Security Verification (GSV)

Environmental & Sustainability Auditing & Certification:

- QC 080000

Industry Services

Intertek's Industry Services support the mining, oil and gas, power, construction, engineering, chemical and other heavy industries to manage operational risk and maximise returns. Applying leading inspection, testing, verification and monitoring practices, we assist clients to effectively manage product and process development, regulatory compliance, supply chain integrity and plant and asset maintenance. We enhance our customers' returns from production and manufacturing whilst improving safety, reliability and uptime.

Services include:

- Technical Staffing Services (TSS)
- Technical Inspection Services (TIS)
- Intertek Surveying Services (ISS)
- Asset Integrity Management (AIM)
- Non-Destructive Testing (NDT)

General Information

Sample Despatch

To assist with the efficient processing of your samples please email all assay instructions and any freight information prior to or at the time of despatch. Sample submissions received without written instructions cannot be processed until adequate written instructions are received from the client.

All discrepancies between submission sheets and actual samples received will be reported prior to commencement of the processing.

We recommend that all submissions of samples are clearly labelled and packaged in a concise and systematic order and are accompanied by accurate and detailed paperwork. To facilitate safe manual handling we would appreciate that samples be packaged in units not exceeding 25kg each. Sample submissions poorly labelled or packaged may incur additional sorting charges. Please "flag" the bag containing the paperwork.

Sample submission pads and pre-addressed stick-on labels are available upon request free of charge. A sample submission form is available from our web site. We offer an online submission service or the option to print a submission to be either emailed or faxed.

The minimum information required on any sample submission sheet is:

1. Client name
2. List or range of sample numbers
3. Sample preparation required
4. Elements required for analysis
5. Methods of analysis preferred
6. Result destination(s)
7. Electronic data format
8. Invoice destination
9. Sample storage requirements
10. Appropriate warnings if any samples are potentially hazardous
11. Indication of any samples that may cause problems during the preparation or analysis. This includes the presence of normally trace elements at percent levels, visible gold, graphitic shales, etc.

Certain samples may require classification as dangerous goods, for the purpose of transport, processing and storage. Compliance is the client's responsibility, please ensure that the samples have been classified, marked and transported in accordance with the requirements of dangerous goods legislation.

Your co-operation with sample submissions will eliminate unnecessary delays in turnaround.

Service Fees and Surcharges

Prices in this schedule are effective from 1st January 2016.

All prices in this brochure are calculated on the basis of multiple sample batches rather than individual samples; consequently single sample jobs may incur higher costs depending on analytical requirements. and there is a minimum invoice charge of ₱4000.

A waste disposal levy is included in the cost of the analyses that produce lead, alkaline or cyanide based solid or liquid waste that requires specific hazardous waste disposal protocols. Should disposal costs increase prices may be increased accordingly.

A 100% surcharge will be added for any "RUSH" analysis. Please confirm with the laboratory with regards to laboratory workload and results turnaround requirements.

Clients who do not have approved credit lines will be required to pay for the full invoice prior to release of results and maybe asked for a 50% deposit on large sample number submissions prior to work commencing.

Discounts may apply for large batches – please contact Intertek to discuss your needs.

All prices quoted in this schedule are in Philippine Peso, and exclude Philippines Value Added Tax (VAT).

Quality Assurance

Regular participation in international, national and internal proficiency testing programs and client specific proficiency programs complements NATA ISO/IEC 17025 accreditation ensuring international standards are maintained in the laboratories' procedures, methodology, validation, QA/QC and data handling.

Certified Reference Materials and/or in house controls, blanks and replicates are analysed with each batch of samples. These quality control results are reported along with the sample values in the final report. Selected samples are also re-analysed to confirm anomalous results. Prices include the reporting of all QC data except where more than 10% repeats are considered necessary in cases such as poor reproducibility due to particulate precious metals, in which case additional repeats may be charged for.

Where the concentration of an element exceeds the capacity of the original method selected, re-analysis will be carried out using a more appropriate technique at the client's expense, unless otherwise requested.

Ethics and Compliance

Intertek is committed to maintaining the total confidence of its customers and shareholders. One of the Group's primary business objectives is to ensure both compliance with local, national and international laws and the accuracy and validity of reports and certificates that it provides to customers.

The foundations of the policy rest with the Group's employees, each of whom must comply with the company's Code of Ethics and Zero Tolerance policies outlining the high standards expected of them in all business dealings.

Our compliance aims:

- To avoid conflicts of interest and to act openly, responsibly and within the confines of the law and internationally accepted guidelines.
- To implement current 'best practice' policies in all control procedures.
- To maintain a culture in which all employees know what is expected of them.
- To monitor adherence to organisational controls and reporting procedures.
- Compliance is a core component of Intertek's business strategy to ensure high standards of professional conduct and ensure ethical behaviour and integrity of services.

Conversion Tables

Useful Chemical Conversion Factors

Element		Factor	Compound	Element		Factor	Compound	Element		Factor	Compound
Al	x	1.889	Al_2O_3	Fe	x	1.43	Fe_2O_3	Pb	x	1.155	PbS
As	x	1.32	As_2O_3	Fe	x	1.574	FeS	Rb	x	1.094	Rb_2O
B	x	3.22	B_2O_3	K	x	1.205	K_2O	Sb	x	1.197	Sb_2O_3
Ba	x	1.699	$BaSO_4$	La	x	1.173	La_2O_3	Si	x	2.139	SiO_2
Ba	x	1.117	BaO	Li	x	2.153	Li_2O	Sn	x	1.27	SnO_2
Be	x	2.775	BeO	Mg	x	1.658	MgO	Sr	x	1.183	SrO
Ca	x	1.399	CaO	Mg	x	3.648	$MgCO_3$	Ta	x	1.221	Ta_2O_5
Ca	x	2.497	$CaCO_3$	Mn	x	1.291	MnO	Th	x	1.138	ThO_2
Ce	x	1.171	Ce_2O_3	Mn	x	1.582	MnO_2	Ti	x	1.668	TiO_2
Co	x	1.271	CoO	Mo	x	1.5	MoO_3	U	x	1.179	U_3O_8
Cr	x	1.462	Cr_2O_3	Mo	x	1.668	MoS_2	V	x	1.785	V_2O_5
Cs	x	1.06	Cs_2O	Na	x	1.348	Na_2O	W	x	1.261	WO_3
Cu	x	1.252	CuO	Nb	x	1.432	Nb_2O_5	Y	x	1.27	Y_2O_3
Cu	x	1.252	Cu_2S	Ni	x	1.273	NiO	Zn	x	1.245	ZnO
F	x	2.055	CaF_2	P	x	2.291	P_2O_5	Zn	x	1.49	ZnS
Fe	x	1.287	FeO	Pb	x	1.077	PbO	Zr	x	1.351	ZrO_2

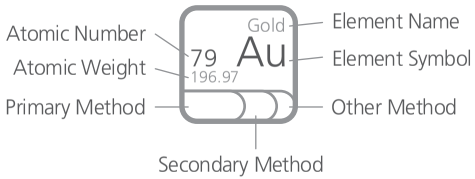
Common Equivalents

ppm	ppb	%	grams / metric tonne
1	1,000	0.0001	1
10	10,000	0.001	10
100	100,000	0.01	100
1,000	1,000,000	0.1	1,000
10,000	10,000,000	1	10,000

Drill Core Specifications

Drill Core	Diameter (mm)	Volume per meter (cm3)		
		Full	Half	Quarter
TT	35.0	960	480	240
BQ	36.4	1040	520	260
NQ	47.6	1780	890	445
HQ	63.5	3170	1585	793
BQ3	33.5	880	440	220
NQ3	45.1	1600	800	400
HQ3	61.1	2930	1465	733
Mass (g) = Volume/meter x SG x length (m)				

Recommended Methods of Analysis
for Low Grade Geological Materials



Hydrogen 1 H 1.0079																	Helium 2 He 4.0026
Lithium 3 Li 6.941	Beryllium 4 Be 9.0122											Boron 5 B 10.811	Carbon 6 C 12.011	Nitrogen 7 N 14.007	Oxygen 8 O 15.999	Fluorine 9 F 18.998	Neon 10 Ne 20.180
Sodium 11 Na 22.990	Magnesium 12 Mg 24.305											Aluminium 13 Al 26.982	Silicon 14 Si 28.086	Phosphorus 15 P 30.974	Sulfur 16 S 32.065	Chlorine 17 Cl 35.453	Argon 18 Ar 39.948
Potassium 19 K 39.098	Calcium 20 Ca 40.078	Scandium 21 Sc 44.956	Titanium 22 Ti 47.867	Vanadium 23 V 50.942	Chromium 24 Cr 51.996	Manganese 25 Mn 54.938	Iron 26 Fe 55.845	Cobalt 27 Co 58.933	Nickel 28 Ni 58.693	Copper 29 Cu 63.546	Zinc 30 Zn 65.38	Gallium 31 Ga 69.723	Germanium 32 Ge 72.64	Arsenic 33 As 74.922	Selenium 34 Se 78.96	Bromine 35 Br 79.904	Krypton 36 Kr 83.798
Rubidium 37 Rb 85.468	Strontium 38 Sr 87.62	Yttrium 39 Y 88.906	Zirconium 40 Zr 91.224	Niobium 41 Nb 92.906	Molybdenum 42 Mo 95.96	Technetium 43 Tc 98	Ruthenium 44 Ru 101.07	Rhodium 45 Rh 102.91	Palladium 46 Pd 106.42	Silver 47 Ag 107.87	Cadmium 48 Cd 112.41	Indium 49 In 114.82	Tin 50 Sn 118.71	Antimony 51 Sb 121.76	Tellurium 52 Te 127.60	Iodine 53 I 126.90	Xenon 54 Xe 131.29
Cesium 55 Cs 132.91	Barium 56 Ba 137.33	Lanthanum 57 La 138.91	Hafnium 72 Hf 178.49	Tantalum 73 Ta 180.95	Tungsten 74 W 183.84	Rhenium 75 Re 186.21	Osmium 76 Os 190.23	Iridium 77 Ir 192.22	Platinum 78 Pt 195.08	Gold 79 Au 196.97	Mercury 80 Hg 200.59	Thallium 81 Tl 204.38	Lead 82 Pb 207.2	Bismuth 83 Bi 208.98	Polonium 84 Po 209	Astatine 85 At 210	Radon 86 Rn 222
Francium 87 Fr 223	Radium 88 Ra 226	Actinium 89 Ac 227	Rutherfordium 104 Rf 261	Dubnium 105 Db 262	Seaborgium 106 Sg 266	Bohrium 107 Bh 264	Hassium 108 Hs 277	Meitnerium 109 Mt 268	Darmstadtium 110 Ds 269	Roentgenium 111 Rg 272	Copernicium 112 Cn 285	Ununtrium 113 Uut 284	Ununquadium 114 Uuq 289	Ununpentium 115 Uup 288	Ununhexium 116 Uuh	Ununseptium 117 Uus	Ununoctium 118 Uuo

Cerium 58 Ce 140.12	Praseodymium 59 Pr 140.91	Neodymium 60 Nd 144.24	Promethium 61 Pm 145	Samarium 62 Sm 150.36	Europium 63 Eu 151.96	Gadolinium 64 Gd 157.25	Terbium 65 Tb 158.93	Dysprosium 66 Dy 162.50	Holmium 67 Ho 164.93	Erbium 68 Er 167.26	Thulium 69 Tm 168.93	Ytterbium 70 Yb 173.05	Lutetium 71 Lu 174.97
Thorium 90 Th 232.04	Protactinium 91 Pa 231.04	Uranium 92 U 238.03	Neptunium 93 Np 237	Plutonium 94 Pu 244	Americium 95 Am 243	Curium 96 Cm 247	Berkelium 97 Bk 247	Californium 98 Cf 251	Einsteinium 99 Es 252	Fermium 100 Fm 257	Mendelevium 101 Md 258	Nobelium 102 No 259	Lawrencium 103 Lr 262

General Information

Intertek Minerals Services Terms and Conditions (2015)

1.0 Unless otherwise specifically agreed in writing Intertek Minerals (hereinafter called "the Company") undertakes services in accordance with these general conditions (hereinafter called "General Conditions") and accordingly all offers or tenders of service are made subject to these General Conditions. All resulting contracts, agreements or other arrangements will in all respects be governed by these General Conditions, except only to the extent that the law of the place where such arrangements or contracts are made or carried out shall preclude any of the General Conditions and in such case such local law shall prevail wherever, but only to the extent that, it is at variance with these General Conditions.

1.1 For the purposes of these conditions the term "Intertek Minerals" comprises all of the Intertek subsidiaries carrying out Minerals testing and inspection activities including but not limited to Intertek, Intertek Minerals, Intertek Genalysis, Intertek Testing Services (Australia) Pty Ltd, Intertek Robotic Laboratories Pty Ltd, (IRL), PT Intertek Utama Services (IUS), ITS (PNG) Ltd, Genalysis Laboratory Services Pty Ltd, Genalysis Laboratory Services SA Pty Ltd, Intertek NTEL, Intertek Minerals Limited, Intertek Testing Services Philippines Inc, Intertek Genalysis Namibia (Pty) Ltd, Intertek International Tanzania Ltd, ITS West Africa, Intertek Commodities Botswana, Intertek Genalysis Zambia Ltd, Intertek Genalysis SI Ltd, Intertek Vigalab SpA, Laboratory Services International.

2.0 The Company is an enterprise engaged in the trade of inspection and testing. As such, it:

2.1 carries out such standard services as are referred to in General Condition 6;

2.2 renders advisory and special services as may be agreed by the Company and as referred to in General Condition 7; and

2.3 issues reports and/or certificates as referred to in General Condition 8

3.0 The Company acts for the persons or bodies from whom the instructions to act have originated (hereinafter called "the Principal"). No other party is entitled to give instructions, particularly on the scope of inspection or delivery of report or certificate, unless so authorized by the Principal and agreed by the Company. The Company will however be deemed irrevocably authorized to deliver at its discretion the report or the certificate to a third party if following instructions by the Principal a promise in this sense had been given to this third party or such a promise implicit follows from circumstances, trade custom, usage or practice.

4.0 The Company will provide services in accordance with:

4.1 the Principal's specific instructions as confirmed by the Company;

4.2 the terms of the Company's Standard Order Form, Sample Submission Form and/or Standard Specification Sheet if used;

4.3 any relevant trade custom, usage or practice; and

4.4 such methods as the Company shall consider appropriate on technical, operational and/or financial grounds.

5.0 5.1 All enquiries and orders for the supply of services must be accompanied by sufficient information specifications and instructions to enable the Company to evaluate and/or perform the services required.

5.2 Documents reflecting engagements contracted between the Principal and third parties, or third parties' documents, such as copies of contracts of sale, letters of credit, bills of lading, etc., are (if received by the Company) considered to be for information only, without extending or restricting the mission or obligations accepted by the Company.

6.0 The Company's standard services may include all or any of the following:

6.1 quantitative and/or qualitative inspection;

6.2 inspection of goods, plant, equipment, packing, tanks, containers and means of transport;

6.3 inspection of loading or discharging;

6.4 sampling;

6.5 laboratory analysis or other testing; and

6.6 surveys and audits.

7.0 Special services where the same exceed the scope of standard services as referred to in General Condition 6 will only be undertaken by the Company by particular arrangement.

Such special services are illustratively not exhaustively:

7.1 qualitative and/or quantitative guarantees;

7.2 supply of technicians and other personnel;

7.3 pre-shipment inspection under government mandated import or customs schemes; and

7.4 advisory services.

8.0 8.1 Subject to the Principal's instructions as accepted by the Company, the Company will issue reports and certificates of inspection which reflect statements of opinion made with due care within the limitation of instructions received but the Company is under no obligation to refer to or report upon any facts or circumstances which are outside the specific instructions received.

8.2 Reports or certificates issued following testing or analysis of samples contain the Company's specific opinion on those samples as received only but do not express any opinion upon the bulk from which the samples were drawn. If an opinion on the bulk is requested special arrangements must be made in advance with the Company for the inspection and sampling of the bulk.

9.0 The Principal will:

9.1 ensure that instructions to the Company and sufficient information are given in due time to enable the required services to be performed effectively;

9.2 procure all necessary access for the Company's representatives to enable the required services to be performed effectively;

9.3 supply, if required, any special equipment and personnel necessary for the performance of the required services;

9.4 ensure that all necessary measures are taken for safety and security of working conditions, sites and installations during the performance of services and will not rely, in this respect, on the Company's advice whether requested or not;

9.5 take all necessary steps to eliminate or remedy any obstruction to or interruptions in the performance of the required services;

9.6 inform the Company in advance of any known hazards or dangers, actual or potential, associated with any order or samples or testing including, for example, presence or risk of radiation, toxic or noxious or explosive elements or materials, environmental pollution or poisons; and

9.7 fully exercise all its rights and discharge all its liabilities under any related contract whether or not a report or certificate has been issued by the Company failing which the Company shall be under no obligation to the Principal.

10.0 The Company shall be entitled at its discretion to delegate the performance of the whole or any part of the services contracted for with the Principal to any agent or subcontractor. Where deemed appropriate by the company, prior consent will be sought from the Principal.

11.0 If the requirements of the Principal necessitate the analysis of samples by the Principal's or by any third party's laboratory the Company will pass on the result of the analysis but without responsibility for its accuracy. Likewise where the Company is only able to witness an analysis by the Principal's or by any third party's laboratory the Company will provide confirmation that the correct sample has been analysed but will not otherwise be responsible for the accuracy of any analysis or results.

12.0 12.1 The Company undertakes to exercise due care and skill in the performance of its services and accepts responsibility only where such skill and care is not exercised.

12.2 All samples submitted to the Company remain the property of the principle. The Company shall not be liable for any claim whatsoever relating to deterioration, contamination, damage or loss of samples. The Principle indemnifies the Company against any claims or legal action resulting from damage, deterioration or loss of samples.

12.3 The liability of the Company in respect of any claims for loss, damage or expense of whatsoever nature and howsoever arising in respect of any breach of contract and/or any failure to exercise due skill and care by the Company shall in no circumstances exceed a total aggregate sum equal to Fifteen (15) times the amount of the fee or commission paid or payable in respect of the specific service or test required under the particular contract with the Company which gives rise to such claims, or US$15,000, whichever is least, provided however that the Company shall have no liability in respect of any claims for indirect or consequential loss including loss of profit and/or loss of future business and/or loss of production and/or cancellation of contracts entered into by the Principal. Where the fee or commission payable relates to a number of services and a claim arises in respect of one of those services the fee or commission may be apportioned for the purposes of this paragraph by reference to the estimated time involved in the performance of each service or the value of the individual services.

12.4 The limit of liability of the Company under the terms of Condition 12.2 may be increased upon request received by the Company in advance of the performance of the service to such figure as may be agreed upon payment of additional fees equal to an appropriate fraction of the increase in such compensation or as may be agreed upon.

13.0 The Principal shall guarantee, hold harmless and indemnify the Company and its officers, employees, agents or subcontractors against all claims made by any third party for loss, damage or expense of whatsoever nature and howsoever arising relating to the performance, purported performance or non-performance of any services to the extent that the aggregate of any such claims relating to any one service exceed the limit mentioned in Condition 12.

14.0 Every officer, employee, agent or subcontractor of the Company shall have the benefit of the limitation of compensation and the indemnity contained in these General Conditions and so far as relates to such limitations any contract entered into by the Company is entered into not only on its own behalf but also as agent and trustee for every such person as aforesaid.

15.0 In the event that any unforeseen problems or expenditure arise in the course of carrying out any of the contracted services the Company shall be entitled to make reasonable additional charges to cover additional time and cost necessarily incurred to complete the service.

16.0 16.1 The Principal will punctually pay not later than Thirty (30) days after the relevant invoice date or upon receipt of invoice where credit is not extended or a credit limit is exceeded or within such other period as may have been agreed in writing by the Company all proper charges rendered by the Company failing which interest will become due at the rate of Eighteen per cent (18%) per annum or one and a half percent (1.5%) from the date of invoice until payment.

16.2 The Principal shall not be entitled to retain or defer payment of any sums due to the Company on account of any dispute, cross claim or set off which it may allege against the Company.

16.3 In the event of any suspension of payment arrangement with creditors, bankruptcy, insolvency, receivership or cessation of business by the Principal the Company shall be entitled to suspend all further performance of its services forthwith and without liability.

17.0 In the event of the Company being prevented by reason of any cause whatsoever outside the Company's control from performing or completing any service for which an order has been given or an agreement made, the Principal will pay to the Company:

17.1 the amount of all abortive expenditure actually made or incurred; and

17.2 a proportion of the agreed fee or commission equal to the proportion (if any) of the service actually carried out and the Company shall be relieved of all responsibility whatsoever for the partial or total non-performance of the required service

18.0 The Company shall be discharged from all liability to the Principal for all claims for loss, damage or expense unless suit is brought within twelve (12) months after the date of the performance by the Company of the service which gives rise to the claim or in the event of any alleged non-performance within three (3) months of the date when such service should have been completed.

19.0 The Company is neither an insurer nor a guarantor and disclaims all liability in such capacity. Principals seeking a guarantee against loss or damage should obtain appropriate insurance.

20.0 No alteration, amendment or waiver of any of these General Conditions shall have any effect unless made in writing and signed by an officer of the Company

21.0 Upon completion of testing the company shall provide a report to the principal on the results of the testing. Where requested by the Principal provisional results may be provided however the Principal agrees that those results shall be subject to confirmation in a final report.

22.0 The company agrees to take reasonable measures to ensure that the results of Inspection or Testing on behalf of the Principal and any other information provided to the company are kept confidential provided that this provision will not apply where the results or other information are in the public domain.

23.0 The Company shall have no responsibility for any action or inaction of any carrier, shipping or delivering any sample to or from the Company premises.

24.0 Samples shall be stored free of charge for a period of sixty (60) days after provision of the invoice. Upon expiration of the free storage period, unless otherwise directed by the Principal storage fees and/or disposal charges shall apply.

25.0 All data will be retained for a seven (7) year period; fees may apply for retrieval of data if longer than three (3) months after the final report date.

Global Locations

Asia Pacific

Philippines

Intertek Testing Services Philippines
Manila Laboratory
Warehouse 7, Philcrest 1 Compound, Cupang, Muntinlupa 1772, Philippines
Tel: +63 2 8423464 | Email: min.apac.phl.lab@intertek.com

Intertek Testing Services Philippines
Surigao Sample Preparation Facility
Rocha Compound, Togbongon Rd, Barangay Rizal, Surigao City, Philippines
Tel: +63 928 507 9224 | Email: min.apac.phl.lab@intertek.com

Intertek Testing Services Philippines
General Santos Sample Preparation Facility
#11 Tiongson St, Lagao, General Santos City, Philippines
Tel: +63 82 552 4513 | Email: min.apac.phl.lab@intertek.com

Australia

Intertek Genalysis
Perth Minerals Head Office and Laboratory
15 Davison Street, Maddington, Western Australia 6109
Tel: +61 8 9251 8100 | Email: min.aus.per@intertek.com
Sample Deliveries: Gate 6, 16 Davison Street, Maddington, Western Australia 6109

Intertek Robotic Laboratories
Tel: +61 8 9251 8100 | Email: min.aus.irl@intertek.com

Kalgoorlie Sample Preparation Facility
12 Keogh Way, Kalgoorlie, Western Australia 6430
Tel: +61 8 9021 6057 | Email: min.aus.kal@intertek.com

Port Hedland Inspection and Sample Preparation
116 Pinnacles Street Wedgefield, Western Australia 6721
Tel: +61 8 9172 4288 | Email: hedland@intertek.com

Adelaide Laboratory
11 Senna Road, Wingfield, South Australia 5013
Tel: +61 8 8162 9714 | Email: min.aus.adl@intertek.com

Townsville Laboratory
9-23 Kelli Street, Bohle, Queensland 4818
Tel: +61 7 4774 3655 | Email: min.aus.tsv@intertek.com

Darwin Laboratory (NTEL)
55 Export Drive, Berrimah, Northern Territory 0828
Tel: +61 8 8947 0510 | Email: ntel@intertek.com

Alice Springs Sample Preparation Facility
41 Ghan Rd, Alice Springs, Northern Territory, 0870
Tel: +61 8 8952 3938 | Email: min.aus.asp@intertek.com

China

Shanghai Head Office & Coal Laboratory
Tel: +86 21 6127 6288 | Email: adam.huang@intertek.com

Tianjin Mineral and Coal Laboratory
Tel: +86 22 2532 7795 | Email: roy.zhang@intertek.com

Urumqi Sample Preparation Facility
Tel: +86 1509916 7729 | Email: hongchang.wang@intertek.com

Qingdao Inspection and Sample Preparation Facility
Tel: +86 13805326726 | Email: stephen.liu@intertek.com

Ningde Inspection and Sample Prepration Facility
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Zhanjiang Inspection and Sample Prepration Facility
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Guangzhou Coal Laboratory
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Lianyungang Office and Inspection
Tel: +86 15062910451 | Email: henry.hu@intertek.com

Rizhao Office and Inspection
Tel: +86 18905326726 | Email: stephen.lui@intertek.com

Indonesia

Jakarta Minerals Head Office and Laboratory
Tel: +62 21 2938 4454 | Email: indo.office@intertek.com

Jakarta Environmental Laboratory
Tel: +62 21 2938 4454 | Email: min.idn.jkt@intertek.com

Samarinda East Kalimantan Coal Laboratory
Tel: +62 541 273111 | Email: min.idn.jkt@intertek.com

Sumbawa (West Nusa Tengarra) Sample Preparation Facility
Tel: +62 371 626475 | Email: min.idn.jkt@intertek.com

Padang (West Sumatra) Sample Preparation Facility
Tel: +62 751 496343 | Email: min.idn.jkt@intertek.com

Manado (North Sulawesi) Sample Preparation Facility
Tel: +62 431 815431 | Email: min.idn.jkt@intertek.com

Kendari (SE Sulawesi) Inspection and Sample Preparation Facility
Tel: +62 811 1587259 | Email: min.idn.jkt@intertek.com

Malaysia

Kuantan Sample Preparation Facility
Tel: +603 33251330 | Email: Muhamad.Othman@intertek.com

Papua New Guinea

LAE Laboratory
Tel: +675 472 8113 | Email: min.png.lae@intertek.com

Solomon Islands

Solomon Islands Sample Preparation Facility
Tel: +677 39234 | Email: min.slb@intertek.com

South Korea

Seoul Inspection and Head Office
Tel: +82 2 860 0271 | Email: raymond.sohn@intertek.com

Thailand

Bangkok Head Office
Tel: +66 (2) 279 5040 | Email: wilai.suphasin@intertek.com

North and South America

Brazil

Nova Lima Minerals Office
Tel: +55 31 3581-8854 | Email: fernanda.moreiran@intertek.com

Canada

Vancouver Coal Laboratory
Tel: +1 604 454 9011 | Email: vancouver.ops@intertek.com

Prince Rupert Coal Laboratory
Tel: +1 604 454 9011 | Email: vancouver.ops@intertek.com

Thunder Bay Coal Inspection and Sample Preparation
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Inspection Services are available at all major ports & distribution centres. website on up to date information on locations, services and fact sheets www.intertek.com/minerals/

Notes

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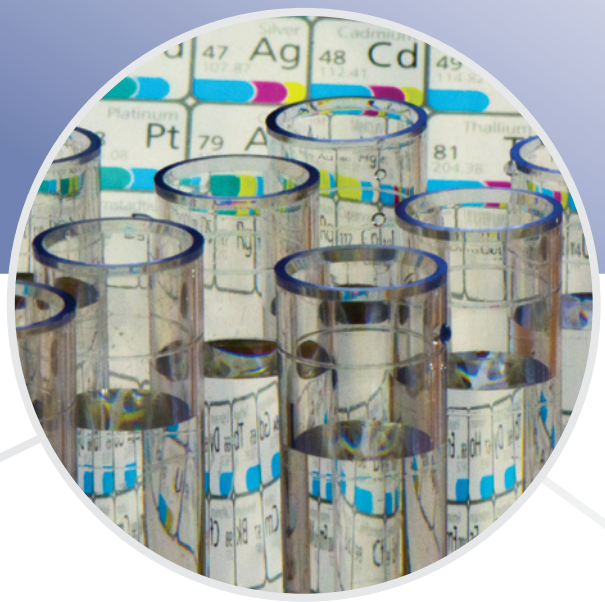

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