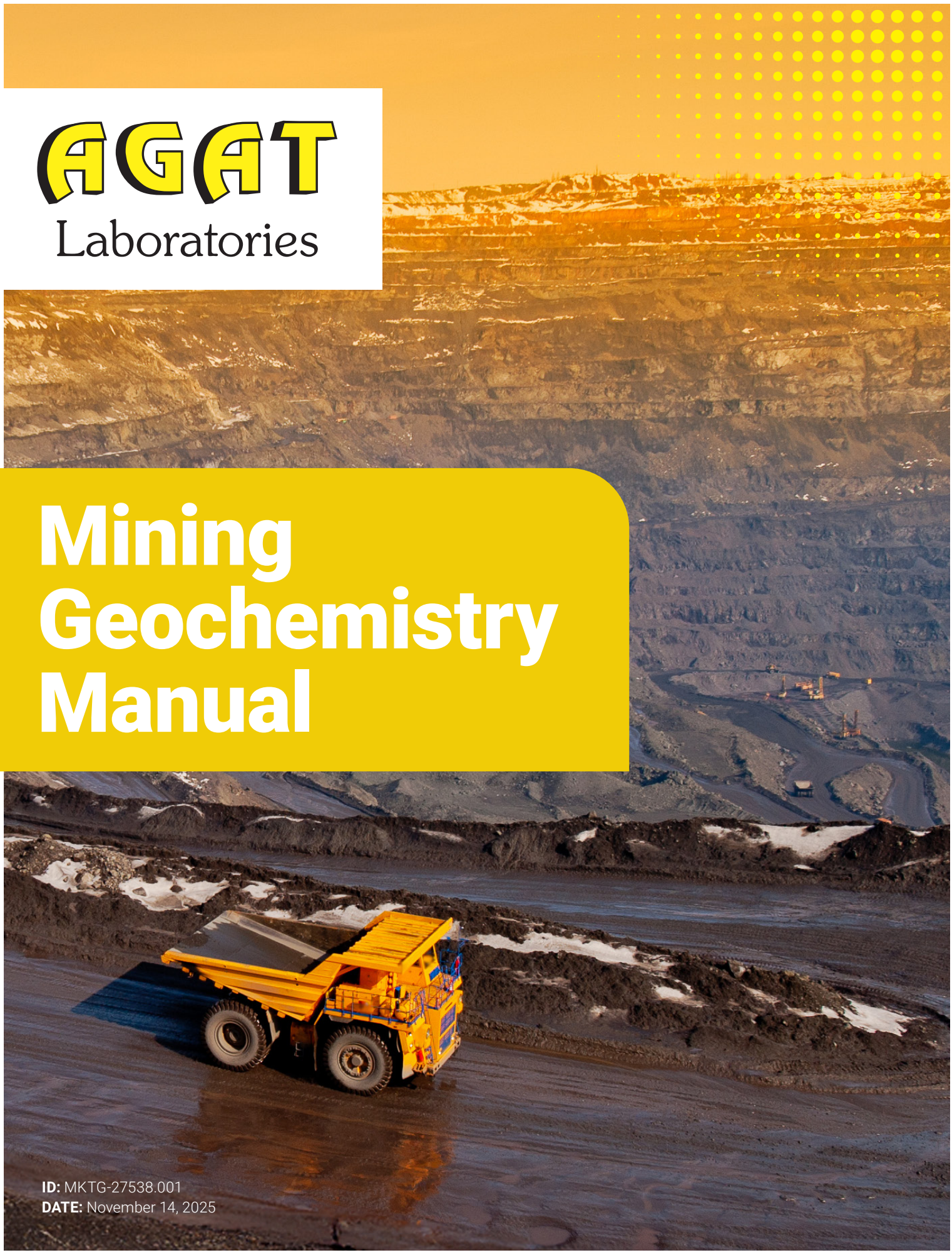
AGAT Laboratories

Mining Geochemistry Manual



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AGAT Laboratories

AGAT Laboratories is a North American leader in analytical services, delivering precise & trustworthy results across the globe. With over four decades of expertise, we've become one of the most geographically diverse and technically advanced laboratory.

Our clients span across diverse sectors, including environmental consulting, energy, mining, food & agriculture, life sciences, and government agencies

We proudly serve industries across Canada, USA and beyond, delivering accurate and defensible results that drive informed decisions and support public health, safety, and environmental stewardship.

AGAT Laboratories specializes in the following scientific areas:

- Advanced Rock Properties
- Agricultural Analysis
- Air Quality Monitoring
- Core & Materials Testing
- Ecotoxicology
- Environmental Chemistry
- Food Testing
- Forensic Investigations
- Geology and Petrology
- Geotechnical Testing
- Lubricants and Fuels Testing
- Mining Geochemistry
- Oil Sands Analysis
- Petroleum Testing
- Reservoir Characterization
- Ultra-trace and Toxicology

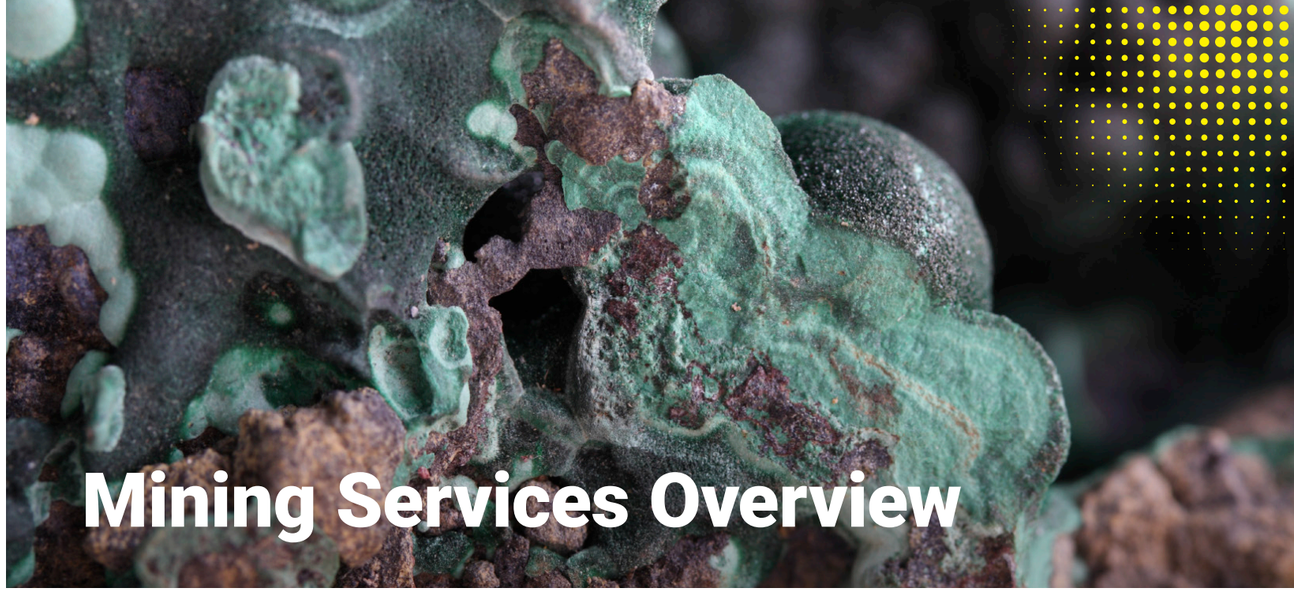
Core Values

- **Integrity –** We do the right thing for the right reason, upholding our ethics no matter the outcome, putting quality above all.
- **Accountability –** We admit when we are wrong and take ownership of our actions.
- **Unity –** We support one another, share a common direction, lift each other up and celebrate our achievements as one.
- **Respect –** We value personal diversity while treating all people with dignity.
- **Innovation –** We push the boundaries of science and technology to provide uniqueness in our processes, culture, and scientific advancements.
- **Passion –** We exude enthusiasm in all that we do, valuing the fun and enjoyable environment that we exist in while embracing every challenge along the way.

Our Purpose

To provide "**Service Beyond Analysis**" to three key pillars:

- **Our People**
- **Our Clients**
- **Our Communities**



Mining Services Overview

AGAT Laboratories' network of laboratory locations provides clients with cost-effective and timely analysis in which the most up-to-date technical standards are met. AGAT Laboratories is proud to set the standard for the laboratory industry, ensuring validity and accuracy of methodologies through our extensive quality assurance and quality control programs. With world- class facilities and instrumentation, our qualified personnel adhere to AGAT Laboratories' mission statement, delivering **"Service Beyond Analysis".**

AGAT Laboratories is a highly specialized Canadian-based company that provides analytical services worldwide. With over 40+ years of experience, coast to coast locations, and over 1,200 employees Canada-wide, AGAT Laboratories is the most geographically and technically diversified laboratory in Canada. It includes multiple scientific divisions across the Mining, Environmental, Energy, Industrial, Transportation, Life Sciences and Agri-Food sectors. Our scientists are highly skilled and specialized in the fields of geology, engineering, chemistry, biochemistry, microbiology and specialty analysis.

AGAT Laboratories Mining Division provides comprehension services to support companies in all stages of their mining and mineral projects, from exploration and mining development, to various environmental monitoring packages. Full service solutions are provided in the following areas:

- **Mining Geochemistry:** Geochemical data acquisition to determine elemental concentrations and mineralization pathways to support mapping, mining, or refinement activities. A wide range of sample preparation and decomposition techniques, followed by state-of-the-art instrumentation and expert analysis, are available to suit program requirements.
- **Mineralogy & Rock Properties:** Geological and petrographic data acquisition to determine mineral composition, assemblage and distribution to support exploration, drilling, excavation and mining activities.
- **Acid Rock Drainage and Environmental Chemistry:** Organic and inorganic chemical analysis of water, groundwater, wastewater, soil, sediment sludge and solid waste to assist in Mining site assessments, monitoring, rehabilitation, and treatment.
- **Core Handling & Imaging:** Expert preparation, storage, and catalogue system for cores, with high resolution digital imaging using AGAT Laboratories Enhanced Core Software.

Experience Excellence

AGAT Laboratories operates under the philosophy of continuous advancement and is constantly strengthening all aspects of our business to provide service excellence to our clients while contributing to innovations of science and technology. We work closely with our clients under the Laboratory Partnership Program to develop new methodology and analytical services and offer cost effective and timely analysis while meeting up-to-date standards.

The following are some benefits our clients gain from partnering with AGAT Laboratories.

Commitment to Quality

AGAT Laboratories recognizes how critical quality control is to the overall success of a project. Our Quality Control department utilizes an integrated Laboratory Information Management System (LIMS) that monitors every step of the laboratory process and our Quality Management System is officially recognized to meet international standards ISO/IEC 17025:2017. Certified reference and standard samples, sample duplicates and blind duplicates are routinely utilized in our laboratory stream to quality check sample preparation, sample quality, instrument precision, and data accuracy.

AGAT Laboratories is accredited or approved for specific analyses by the following agencies:

- The Standards Council of Canada (SCC)
- Association of Professional Engineers and Geoscientists of Alberta (APEGA)
- The Canadian Association for Laboratory Accreditation (CALA)
- Ontario Ministry of the Environment
- Ontario Ministry of Environment Drinking Water Testing License
- Ministère du Développement Durable, de l'Environnement, de la Faune et des Parcs (MDDEFP)
- Nova Scotia Environment
- Alberta and British Columbia Drinking Water (EWQA)

AGAT Laboratories is accredited to the following international standards:

- International Standards Organization ISO/IEC 17025:2017

Accreditation can be found at:
Ask your CSR for further information regarding Accreditation.

Experience

AGAT Laboratories has over 40+ years of laboratory experience and has proven a long-term commitment to investing in Canadian research and technology.

Our laboratories offer a diverse array of services allowing our personnel to draw on the technical expertise and experience of scientists including; Assayers, Geologists, Engineers, Petrophysicists, Environmental Analysts, Microbiologists, Biochemists, Chemists and Agronomists.

Efficiency

AGAT Laboratories is highly efficient at anticipating and responding to our clients' needs. Our Client Service Representative closely monitor each project to ensure it is completed on time and within budget. AGAT Laboratories will complete all mineral analysis and reports upon the receipt of the samples at any one of our facilities. Rush turn-around times are available upon request at an additional cost.

Health, Safety and Environment

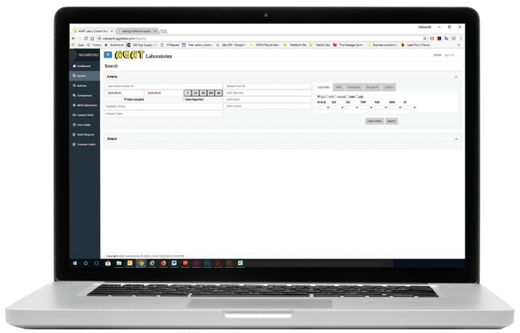
AGAT Laboratories is committed to practicing and promoting professional integrity, safety, and environmental awareness in all aspects of our business and personal activities. Our goal is to enable our clients to make the best business decisions possible. Across all laboratories, the in place environmental management systems monitor air, liquid and solid pollutants and AGAT Laboratories strives to exceed regulatory guidelines where applicable.

Information Technology

AGAT Laboratories has custom software programs for our clients that allow ease of data access and management to improve performance and productivity.

webMINING is our interactive web database designed for mineral exploration. This software package provides clients with real-time access to data with integrated features such as historical data, data trending, guideline comparisons, quality control and customizable export functions.

Ask your Business Development Representative or Client Service Representative for a demonstration.

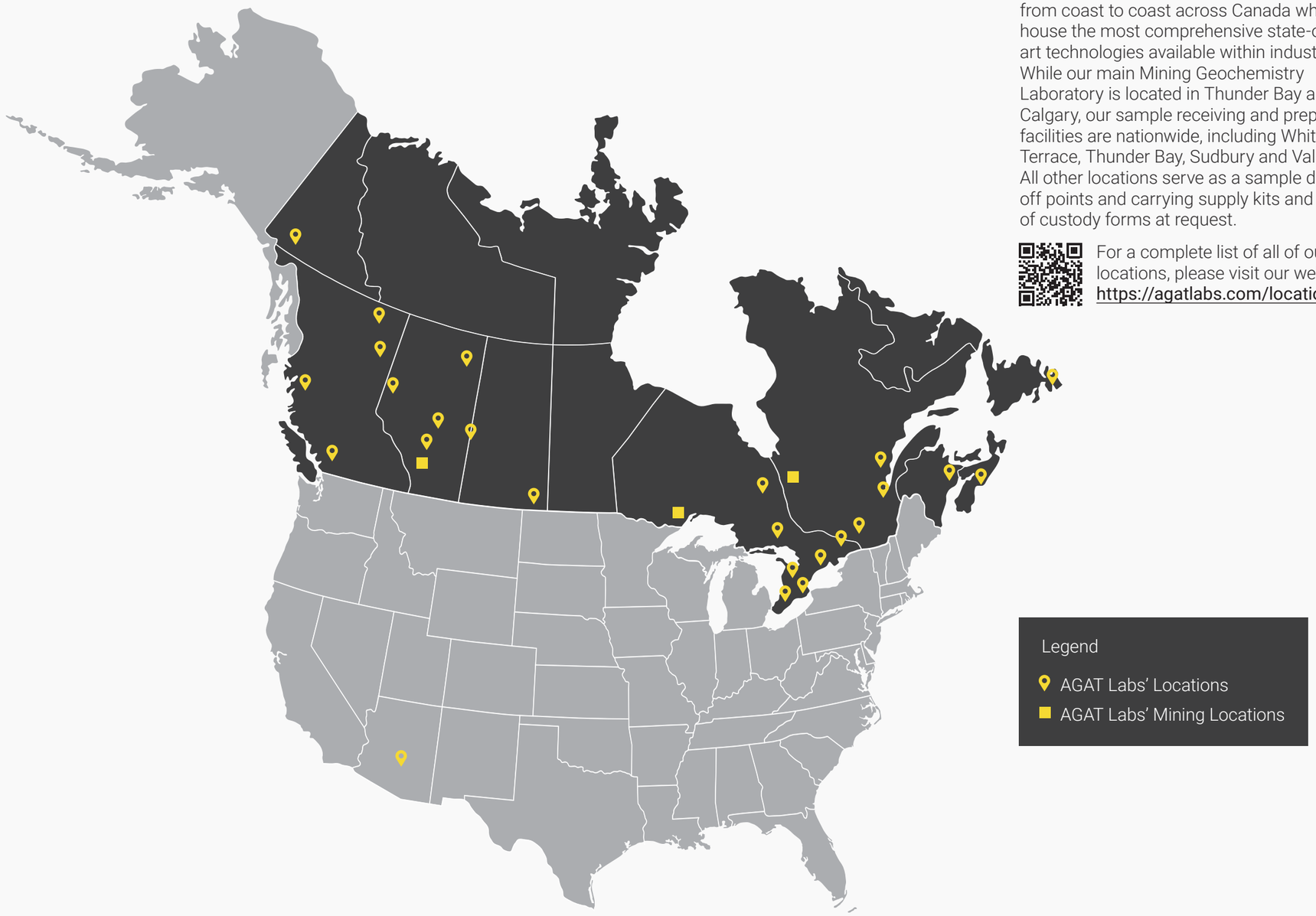


Canada's Mining Exploration Laboratory

Laboratory Locations

AGAT Laboratories has full-service locations from coast to coast across Canada which house the most comprehensive state-of-the-art technologies available within industry. While our main Mining Geochemistry Laboratory is located in Thunder Bay and Calgary, our sample receiving and preparation facilities are nationwide, including Whitehorse, Terrace, Thunder Bay, Sudbury and Val d'Or. All other locations serve as a sample drop off points and carrying supply kits and chain of custody forms at request.

For a complete list of all of our locations, please visit our website at https://agatlabs.com/locations/



Core Processing and Sample Preparation

Core Handling and Processing*

AGAT Laboratories professionally handles core and cuttings material and has automated core cutting saws for high precision preparation and sampling while maintaining optimum safety and productivity. AGAT offers secure storage for archiving core samples which can be retrieved and viewed at a later date. Key geological, structural, mineral and geochemical data can be determined through core description, petrography and mineral/ geochemical analyses.

Core slabbing provides representatives halves for both archive and testing material. Through our Advanced Exploration Services, we also offer high resolution core photography combined with proprietary software for viewing core as a continuous down-hole image and strip-log. These are used for log/core depth-corrections and illustrating key geological data directly on the images.

* Please consult your CSR for information and/or to obtain a Manual for Core Handling and Processing procedures.

Sample Preparation

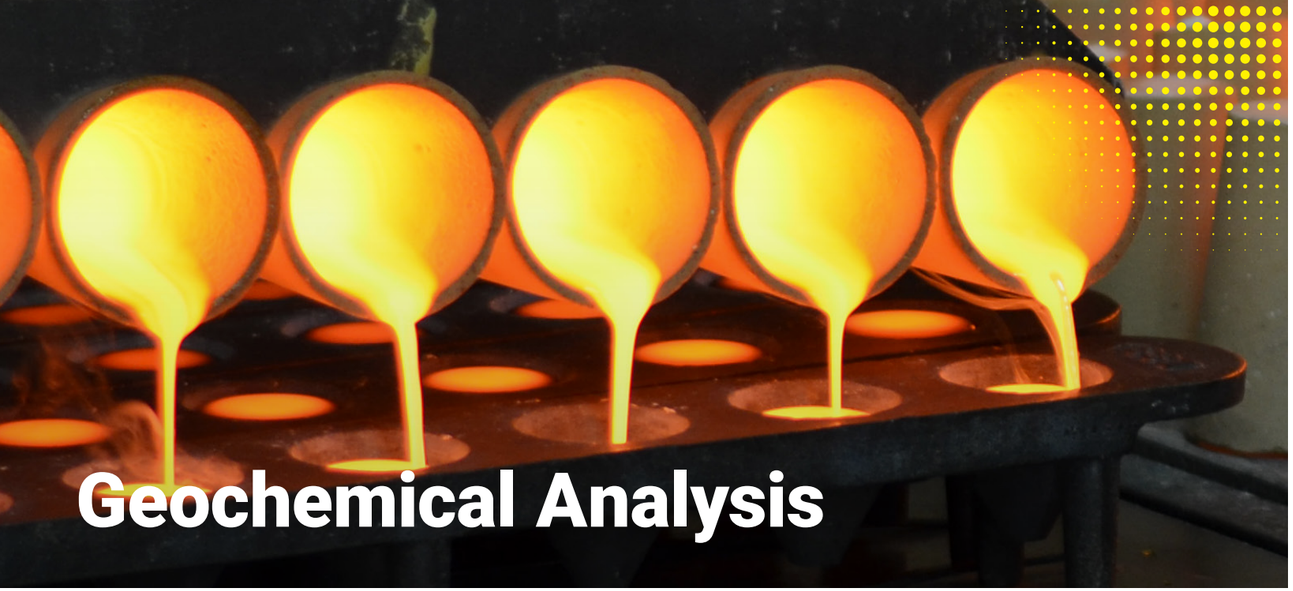
All samples received are carefully assessed and processed through our Sample Preparation Department. The quality of all analyses is contingent on sample selection and preparation. Our quality control in sample preparation ensures homogeneous sub-sample for analysis. We tailor sample preparation for your specific project requirements.

Depending on type and size of sample, common preparation procedures may include drying, crushing, milling or screening of the samples. Please consult with our specialists when choosing the best possible sample preparation for analysis. Sample mass or particle sizing can be assessed along the analytical pathway.

Sample Preparation Packages

Drying & Screening	
Dry, Screen Soils or Stream Sediments - 80 Mesh, < 1 kg	200-012
Dry, Screen Soils or Stream Sediments - 80 Mesh, > 1 kg	200-013
Drying & Crushing	
Dry <5kg, Crush to 75% passing 2mm, split to 250g	200-075
Dry <5kg, Crush to 75% passing 2mm, split to 500g	200-076
Dry <5kg, Crush to 75% passing 2mm, split to 1Kg	200-077

Drying & Crushing	
Dry <5kg, Crush to 80% passing 2mm, split to 250g	200-078
Dry <5kg, Crush to 80% passing 2mm, split to 500g	200-079
Dry <5kg, Crush to 80% passing 2mm, split to 1Kg	200-080
Dry <5kg, Crush to 85% passing 2mm, split to 250g	200-081
Dry <5kg, Crush to 85% passing 2mm, split to 500g	200-082
Dry <5kg, Crush to 85% passing 2mm, split to 1Kg	200-083
Dry <5kg, Crush to 90% passing 2mm, split to 250g	200-084
Dry <5kg, Crush to 90% passing 2mm, split to 500g	200-085
Dry <5kg, Crush to 90% passing 2mm, split to 1Kg	200-086
**standard drying temperature is 60C unless otherwise requested*	
Pulverizing	
Pulverize to 85% passing 75 microns	200-087
Pulverize to 90% passing 75 microns	200-088
Pulverize to 95% passing 75 microns	200-089
Pulverize to 85% passing 105 microns	200-090
Pulverize to 90% passing 105 microns	200-091
Pulverize to 95% passing 105 microns	200-092
Pulverize to 85% passing 75 um - Ceramic Bowl	200-214
Pulverize to 85% passing 75 um - Tungsten Carbide Bowl	200-314
**Standard pulverizing is performed using steel bowls*	
Additional & Speciality Preparation Codes	
Sorting, Labelling Samples Received as Pulps	200-125
Speciality Sample Preparation - Custom Package	200-901
Dry Samples at 105C	200-003
Dry Excessively Wet Samples (as determined by Sample Preparation Department protocols)	200-008
Ashing - Biomass/Vegetation	200-032
Sample Volume Reduction - Riffle Split	200-009
Sample Volume Reduction - Rotary Split	200-051
Compositing (per composite), dry weight	200-033
Oversize Samples - Handling (samples received >5kg or whole/half cores > 50mm in diameter)	200-040
Oversize Samples - Pre Crushing (samples received > 5kg)	200-059
Barren Wash - Crushing Stage	200-018
Barren Wash - Pulverizing Stage	200-052
Sampling Supplies & Services	
Sample Pickup (per km)	200-400
Storage of Pulp Past 90 days	200-020
Storage of Rejects Past 45 days	200-021
Sample Tag / Booklet (50 Tags/Booklet)	200-600
Rice Sack / Bag	200-703
Reject Bag / Bag	200-704
Pulp Bag / Bag	200-705
Freight (Shipping & Handling for sample supplies; returns of Pulps, Rejects or Check Samples)	200-701
Supplied Reference Material	201-701



Geochemical Analysis

AGAT Laboratories offers a variety of geochemical approaches and packages that can be customized to meet client requirements. Sample digestion, decomposition, pressed pellet, or fusion techniques provide the basis for investigating different suites of elements and the techniques should be chosen based on the required detection levels of the elements of interest and consulted with our trained analytical team.

Chemical Preparation of Sample Material

In order to decompose solid rock samples, a number of acid dissolution, fusion or leaching techniques are available. Acid digestion, exposes samples to hot concentrated acids to solubilize target elements. Fusion is a more vigorous method, completely breaking down samples and creating a homogenous molten flux. The following decomposition techniques are important when deciding the right package for the sample matrices/mineralizations and desired elemental coverage:

- Lead Fusion Fire Assay
- Aqua-Regia Digestion
- Four Acid Digestion
- Lithium Borate Fusion
- Sodium Peroxide Fusion

Advanced Technology

AGAT Laboratories operates leading edge instrumentation to detect and determine various levels of elemental concentrations within the samples. Our state-of-the-art instruments are regularly maintained and checked for data accuracy and reproducibility. Depending on the elemental detection requirements of the client or project, instrumentations such as x-ray fluorescence (XRF), inductively-coupled plasma (ICP) mass spectroscopy (MS), emission spectroscopy (OES) or atomic absorption spectroscopy (AAS) are selected for analysis. ICP instrumentation is fully automated to provide timely and cost-effective choices in multi-elemental trace analysis.

Instrumentation & Specialized Equipment

- Inductively Coupled Plasma - Mass Spectroscopy (ICP-MS)
- Inductively Coupled Plasma - Optical Emission Spectroscopy (ICP-OES)
- Flame Atomic Absorption Spectroscopy (AAS)
- X-Ray Fluorescence (XRF)
- LECO Infrared (IR) Combustion Furnace
- Hydride Generation System
- X-Ray Diffractometer (XRD)
- Microbalance
- Muffle Furnace
- Ion Selective Electrodes (ISE)
- pH and EC Meters

Precious Metals Analysis

Many techniques can be used for precious metal analysis. Whether the requirement is for Gravimetric analysis or high-volume baseline fire assay gold exploration work, customers enjoy the advantage of AGAT Laboratories' vast expertise in gold and PGE determinations. Procedures for precious metal analysis include a combination of lead collection fire assay and either ICP-OES, AAS, or gravimetric finish.

Gold Analysis Packages

Description	Range (ppm)	Code
Trace Levels		
Au by Fire Assay (30g), AAS Finish	0.002-10	202-051
Au by Fire Assay (50g), AAS Finish	0.002-10	202-551
Au by Fire Assay (30g), ICP-OES Finish	0.001-10	202-052
Au by Fire Assay (50g), ICP-OES Finish	0.001-10	202-552
Ore Grade (Gravimetric)		
Au by Fire Assay (30g), Gravimetric Finish	0.5+	202-064
Au by Fire Assay (50g), Gravimetric Finish	0.5+	202-564
Au by Fire Assay, Gravimetric Finish - To Extinction (each 50g Fusion)	0.5+	202-164
Metallic Screen		
Screen Met 500g, 1 mesh: +106um to extinction by 30g FA/ICPOES and -106um by 2 FA/ICPOES	NA	202-120
Screen Met 1000g, 1 mesh: +106um to extinction by FA/ICPOES and -106um by 2 FA/ ICPOES	NA	202-121
Screen Met 1000g, 2 meshes: +106um to extinction by 50g FA/GRAV, -106um by 2 FA/ICPOES, -75um by 2 FA/ICPOES	NA	202-123
Screen Met 1000g, 1 mesh: +106um to extinction by 50g FA/AAS and -106um by 2 FA/AAS	NA	202-124
Screen Met 1000g, 1 mesh: +150um to extinction by 50g FA/AAS and -150um by 2 FA/AAS	NA	202-125
Screen Met 1000g, 1 mesh: +150um to extinction by 50g FA/GRAV and -150um by 2 FA/GRAV	NA	202-127
Screen Met 1000g, 1 mesh: +106um to extinction by 50g FA/ GRAV and -106um by 2 FA/ ICP	NA	202-128
Screen Met 500g, 1 mesh: +106um to extinction by 50g FA/ GRAV and -106um by 2 FA/ ICP	NA	202-129
Screen Met 1000g, 1 mesh: +106um to extinction by FA/ICPOES and -106um by 3 FA/ ICPOES	NA	202-130
Screen Met 1000g, 1 mesh: +106um to extinction by FA/AA and -106um by 3 FA/ AA	NA	202-131
Screen Met 1000g, 1 mesh: +106um to extinction by FA/GRAV and -106um by 3 FA/ GRAV	NA	202-132
Au by Metallic Screen by Fire Assay (Entire Pulverization)	NA	202-122
Photon Assay (Subcontract)		
Au by Photon Assay	Available on request	283-600

Gold, Platinum and Palladium Analysis Packages

Description	Analyte	Range (ppm)	Code
Trace Levels			
Au, Pt & Pd by Fire Assay (30g), ICP-OES Finish	Au	0.001-10	202-055
	Pt	0.005-10	
	Pd	0.001-10	
Au, Pt & Pd by Fire Assay (50g), ICP-OES Finish	Au	0.001-10	202-555
	Pt	0.005-10	
	Pd	0.001-10	

Aqua Regia Digest Packages

Aqua Regia Digestion is a powerful, partial leach consisting of a 3:1 hot mixture of hydrochloric and nitric acids. Aqua Regia is an effective digestion for most sulphate, oxide, and carbonate minerals and the rapid oxidizing properties make it an excellent option for the breakdown of sulphide minerals.

The cost-effective packages are initiated with an Aqua Regia digestion, followed by either ICP-OES or ICP/ICP-MS finish.

- 201-073: Metals by Aqua Regia Digest, ICP-OES Finish*
- 201-074: Metals by Aqua Regia Digest, ICP-OES/ ICP-MS Finish*
- 201-173: Metals by Aqua Regia Digest, ICP-OES Finish (25g)
- 201-174: Metals by Aqua Regia Digest, ICP-OES/ ICP-MS Finish (25g)
- 201-061 & 201-062 Metals by Aqua Regia Digest Methods - Overlimit Analysis

Metals by Aqua Regia Digest (0.5g sample weight, results in ppm unless otherwise stated)

Analyte	Reporting Limits		Analyte	Reporting Limits	
	201-073 (ICP-OES)	201-074 (ICP-OES/MS)		201-073 (ICP-OES)	201-074 (ICP-OES/MS)
Ag	0.2 - 200	0.01 - 200	Mn	1 - 50,000	1 - 50,000
Al	0.01 - 25%	0.01 - 25%	Mo	2 - 10,000	2 - 10,000
As	1 - 10,000	1 - 10,000	Na	0.01 - 10%	0.01 - 10%
Au	NA	0.005 - 25	Ni	0.5 - 10,000	0.5 - 10,000
B	5 - 10,000	5 - 10,000	P	10 - 10,000	10 - 10,000
Ba	1 - 10,000	1 - 10,000	Pb	5 - 10,000	5 - 10,000
Be	0.5 - 1000	0.5 - 1000	Rb	NA	0.1 - 10,000
Bi	1 - 10,000	1 - 10,000	Re	NA	0.001 - 0.5
Ca	0.01 - 25%	0.01 - 25%	S	0.01 - 10%	0.01 - 10%
Cd	0.5 - 1000	0.5 - 1000	Sb	10 - 10,000	10 - 10,000
Ce	NA	0.01 - 1000	Sc	0.5 - 10,000	0.5 - 10,000
Co	0.5 - 10,000	0.5 - 10,000	Se	NA	0.2 - 1000
Cr	0.5 - 10,000	0.5 - 10,000	Sn	NA	0.2 - 1000
Cs	NA	0.05 - 10,000	Sr	0.5 - 10,000	0.5 - 10,000
Cu	0.5 - 10,000	0.5 - 10,000	Ta	NA	0.01 - 1000
Fe	0.01 - 50%	0.01 - 50%	Te	NA	0.01 - 1000
Ga	5 - 10,000	5 - 10,000	Th	10 - 10,000	10 - 10,000
Ge	NA	0.05 - 500	Ti	0.01 - 10%	0.01 - 10%
Hf	NA	0.02 - 500	Tl	5 - 10,000	5 - 10,000
Hg	5 - 10,000	5 - 10,000	U	5 - 10,000	5 - 10,000
In	NA	0.005 - 1000	V	0.5 - 10,000	0.5 - 10,000
K	0.01 - 10%	0.01 - 10%	W	5 - 10,000	5 - 10,000
La	1 - 10,000	1 - 10,000	Y	NA	0.05 - 1000
Li	1 - 10,000	1 - 10,000	Zn	0.5 - 10,000	0.5 - 10,000
Mg	0.01 - 25%	0.01 - 25%	Zr	NA	0.5 - 1000

* Au Determination by this method is semi-quantitative due to small sample size

Metals by Aqua Regia Digest Packages (25g sample weight, results in ppm unless otherwise stated)

Analyte	Reporting Limits		Analyte	Reporting Limits	
	201-173 (ICP-OES)	201-174 (ICP-OES/MS)		201-173 (ICP-OES)	201-174 (ICP-OES/MS)
Ag	0.2 - 200	0.01 - 200	Mo	0.5 - 10,000	0.2 - 10,000
Al	0.01 - 25%	0.01 - 25%	Na	0.01 - 10%	0.01 - 10%
As	2 - 10,000	0.1 - 10,000	Nb	0.5 - 10,000	0.1 - 500
Au	NA	0.001 - 25	Ni	0.5 - 10,000	0.5 - 10,000
B	5 - 10,000	5 - 10,000	P	10 - 10,000	10 - 10,000
Ba	1 - 10,000	1 - 10,000	Pb	2 - 10,000	0.1 - 10,000
Be	0.5 - 1000	0.05 - 1000	Rb	NA	0.1 - 10,000
Bi	2 - 10,000	0.01 - 10,000	Re	NA	0.001 - 50
Ca	0.01 - 25%	0.01 - 25%	S	0.01 - 10%	0.01 - 10%
Cd	0.5 - 1000	0.01 - 1000	Sb	2 - 10,000	0.05 - 10,000
Ce	NA	0.01 - 1000	Sc	0.5 - 10,000	0.1 - 10,000
Co	0.5 - 10,000	0.1 - 10,000	Se	NA	0.2 - 1000
Cr	0.5 - 10,000	0.5 - 10,000	Sn	NA	0.2 - 1000
Cs	NA	0.05 - 1000	Sr	0.5 - 10,000	0.2 - 10,000
Cu	0.5 - 10,000	0.5 - 10,000	Ta	0.01 - 1000	0.01 - 1000
Fe	0.01 - 50%	0.01 - 50%	Te	10 - 10,000	0.01 - 1000
Ga	2 - 10,000	0.05 - 10,000	Th	5 - 10,000	0.1 - 10,000
Ge	NA	0.05 - 500	Ti	0.005 - 10%	0.005 - 10%
Hf	NA	0.02 - 500	Tl	5 - 10,000	0.02 - 10,000
Hg	1 - 10,000	0.01 - 10,000	U	10 - 10,000	0.05 - 10,000
In	NA	0.005 - 1000	V	0.2 - 10,000	0.5 - 10,000
K	0.01 - 10%	0.01 - 10%	W	10 - 10,000	0.05 - 10,000
La	0.5 - 10,000	0.1 - 10,000	Y	NA	0.05 - 10,000
Li	0.5 - 10,000	0.1 - 10,000	Zn	1 - 10,000	1 - 10,000
Mg	0.01 - 25%	0.01 - 25%	Zr	NA	0.5 - 1000
Mn	1 - 50,000	1 - 50,000			

4 Acid Digestion Packages

The 4-acid digestion approach is one of the most aggressive acid digestion used in geochemistry and utilizes hydrochloric, nitric, perchloric and hydrofluoric acids. It is commonly referred to as a near-total digestion since it is very effective in dissolving a wide range of mineral species, particularly silicate minerals. The analysis uses either ICP-OES or combined ICP-OES/MS instrumentation and the techniques quantify nearly all elements of geological materials.

Trace Packages

- 201-070: Metals by 4 Acid Digest, ICP-OES Finish
- 201-071: Metals by 4 Acid Digest, ICP-OES/ ICP-MS Finish
- 201-470 & 201-471: Metals by 4 Acid Digest Methods - Overlimits

Metals by Four Acid Digest (0.2g sample weight, results in ppm unless otherwise stated)

Analyte	Reporting Limits		Analyte	Reporting Limits	
	201-070 (ICP-OES)	201-071 (ICP-OES/MS)		201-070 (ICP-OES)	201-071 (ICP-OES/MS)
Ag	0.5 - 100	0.01 - 100	Mo	2 - 10,000	0.05 - 10,000
Al	0.01 - 50%	0.01 - 50%	Na	0.01 - 10%	0.01 - 10%
As	2 - 10,000	0.2 - 10,000	Nb	NA	0.1 - 500
Ba	1 - 10,000	1 - 10,000	Ni	5 - 10,000	0.5 - 10,000
Be	1 - 1000	0.05 - 1000	P	10 - 10,000	10 - 10,000
Bi	1 - 10,000	0.01 - 10,000	Pb	2 - 10,000	0.1 - 10,000
Ca	0.01 - 50%	0.01 - 50%	Rb	NA	0.1 - 10,000
Cd	1 - 1000	0.02 - 1000	Re	NA	0.002 - 50
Ce	NA	0.01 - 1000	S	0.01 - 10%	0.01 - 10%
Co	1 - 10,000	0.05 - 10,000	Sb	10 - 10,000	0.05 - 10,000
Cr	1 - 10,000	1 - 10,000	Sc	1 - 10,000	0.1 - 10,000
Cs	NA	0.01 - 1000	Se	NA	0.5 - 1000
Cu	0.5 - 10,000	0.5 - 10,000	Sn	NA	0.2 - 1000
Fe	0.01 - 50%	0.01 - 50%	Sr	1 - 10,000	0.2 - 10,000
Ga	5 - 10,000	0.05 - 10,000	Ta	NA	0.05 - 1000
Ge	NA	0.05 - 500	Te	NA	0.01 - 1000
Hf	NA	0.1 - 500	Th	10 - 10,000	0.1 - 10,000
In	NA	0.005 - 1000	Ti	0.01 - 10%	0.01 - 10%
K	0.01 - 10%	0.01 - 10%	Tl	5 - 10,000	0.01 - 10,000
La	2 - 10,000	0.5 - 10,000	U	10 - 10,000	0.05 - 10,000
Li	1 - 10,000	0.1 - 10,000	V	0.5 - 10,000	0.5 - 10,000
Mg	0.01 - 50%	0.01 - 50%	W	5 - 10,000	0.1 - 10,000
Mn	1 - 100,000	1 - 100,000	Y	NA	0.1 - 10,000
Li	0.5 - 10,000	0.1 - 10,000	Zn	5 - 10,000	0.5 - 10,000
Mg	0.01 - 25%	0.01 - 25%	Zr	NA	0.5 - 1000
Mn	1 - 50,000	1 - 50,000			

Sodium Peroxide Fusion

Sample fusion with a sodium peroxide flux oxidizes sample material and contains it in the molten flux at elevated temperature (~600C), followed by dissolution in a dilute acid. This technique is effective for analysis of refractory and sulfide-rich minerals, including pyrite, chalcopyrite, cassiterite, chromite and spinels. It is not recommended for carbonate, phosphate, or silicate minerals. AGAT Laboratories offers 4-acid digestion or lithium borate fusion techniques for carbonate, phosphate and silicate minerals.

- 201-079: Metals by Sodium Peroxide Fusion, ICP-OES Finish
- 201-378: Metals by Sodium Peroxide Fusion,ICP OES/ ICP-MS Finish
- 201-380 Metals by Sodium Peroxide Fusion,ICP OES/ ICP-MS Finish, Glassy Carbon Crucible
- 201179 & 201113 Metals by Sodium Peroxide Fusion Methods - Overlimits

Sodium Peroxide Fusion (0.2g sample weight, results in ppm unless otherwise stated)

Analyte	Reporting Limits			Analyte	Reporting Limits		
	201-079 (ICP-OES)	201-378 (ICP-OES/MS)	201-380 Glassy Carbon (ICP-OES/MS)		201-079 (ICP-OES)	201-378 (ICP-OES/MS)	201-380 Glassy Carbon (ICP-OES/MS)
Al	0.01-50%	0.01 - 50%	0.01 - 50%	Nb	NA	5 - 10,000	5 - 10,000
As	30 - 100,000	5 - 100,000	5 - 100,000	Nd	NA	0.05 - 1000	0.05 - 1000
B	NA	20 - 10,000	20 - 10,000	Ni	10 - 100,000	10 - 100,000	10 - 100,000
Ba	10 - 50,000	10 - 50,000	10 - 50,000	P	0.02 - 25%	0.02 - 25%	0.02 - 25%
Be	20 - 50,000	20 - 25,000	20 - 25,000	Pb	30 - 100,000	1 - 10,000	1 - 10,000
Bi	NA	0.1 - 1000	0.1 - 1000	Pr	NA	0.05 - 1000	0.05 - 1000
Ca	0.05 – 50%	0.05 - 50%	0.05 - 50%	Rb	NA	2 - 10,000	2 - 10,000
Cd	NA	5 - 10,000	5 - 10,000	S	0.01 - 50%	0.01 - 50%	0.01 - 50%
Ce	NA	0.1 - 10,000	0.1 - 10,000	Sb	20 - 50,000	1 - 10,000	1 - 10,000
Co	20 - 100,000	1 - 10,000	1 - 10,000	Sc	10 - 50,000	10 - 50,000	10 - 50,000
Cr	0.002 - 10%	0.002 - 10%	0.002 - 10%	Se	NA	5 - 1000	5 - 1000
Cs	NA	0.1 - 10,000	0.1 - 10,000	Si	0.1 - 50%	0.1 - 50%	0.1 - 50%
Cu	10 - 100,000	10 - 100,000	10 - 100,000	Sm	NA	0.1 - 1000	0.1 - 1000
Dy	NA	0.05 - 1000	0.05 - 1000	Sn	50 - 50,000	2 - 10,000	2 - 10,000
Er	NA	0.05 - 1000	0.05 - 1000	Sr	10 - 10,000	10 - 10,000	10 - 10,000
Eu	NA	0.05 - 1000	0.05 - 1000	Ta	NA	0.5 - 10,000	0.5 - 10,000
Fe	0.01 - 50%	0.01 - 50%	0.01 - 50%	Tb	NA	0.05 - 10,000	0.05 - 10,000
Ga	NA	0.5 - 1000	0.5 - 1000	Te	NA	5 - 1000	5 - 1000
Gd	NA	0.05 - 1000	0.05 - 1000	Th	NA	0.1 - 1000	0.1 - 1000
Ge	NA	1 - 1000	1 - 1000	Ti	0.01 - 20%	0.01 - 20%	0.01 - 20%
Hf	NA	NA	1 - 10,000	Tl	NA	0.5 - 1000	0.5 - 1000
Ho	NA	0.05 - 1000	0.05 - 1000	Tm	NA	0.05 - 1000	0.05 - 1000
In	NA	0.2 - 1000	0.2 - 1000	U	NA	0.5 - 1000	0.5 - 1000
K	0.05 - 50%	0.05 - 50%	0.05 - 50%	V	10 - 50,000	10 - 50,000	10 - 50,000
La	10 - 50,000	0.1 - 10,000	0.1 - 10,000	W	50 - 50,000	5 - 10,000	5 - 10,000
Li	10 - 50,000	10 - 50,000	10 - 50,000	Y	10 - 50,000	0.5 - 10,000	0.5 - 10,000
Lu	NA	0.05 - 1000	0.05 - 1000	Yb	NA	0.05 - 1000	0.05 - 1000
Mg	0.01 - 50%	0.01 - 50%	0.01 - 50%	Zn	10 - 50,000	10 - 50,000	10 - 50,000
Mn	10 - 100,000	10 - 100,000	10 - 100,000	Zr	NA	NA	5 - 10,000
Mo	10 - 50,000	5 - 10,000	5 - 10,000				

Borate Fusion Techniques

Sample fusion with lithium borate flux involves heating the sample to ~1000C until it melts with the flux into a homogenous glass. The resulting glass can then be analyzed directly by X-ray fluorescence (XRF), or dissolved in dilute acid for inductively coupled plasma (ICP) analysis. This technique is effective for dissolving many resistant minerals especially silicates, oxides, carbonates, and carbonates. It is not recommended for sulfides and refractory minerals; AGAT Laboratories offers analysis by Sodium Peroxide Fusion for sulfides and refractory minerals.

201-091 Rare Earth Elements by Lithium Borate Fusion, ICP-MS Finish

- 201-076 Major Element Metal Oxides by Lithium Borate Fusion, ICP-OES Finish + LOI
- 201-078 Metals by Lithium Borate Fusion, ICP-MS Finish
- 201-381 Metals by Lithium Borate Fusion, ICP-OES/MS Finish
- 201-063 & 201-064: Metals/Metal Oxides by Lithium Borate Fusion Methods - Overlimits

Lithium Borate Fusion (sample weight 0.2g, results in ppm unless otherwise stated)

Analyte	201-078 (ICP-MS)	201-381 (ICP-OES/MS)	201-076 Oxides (ICP-OES)	201-091 REE (ICP-MS, add on for 201-076)	Analyte	201-078 (ICP-MS)	201-381 (ICP-OES/MS)	201-076 Oxides (ICP-OES)	201-091 REE (ICP-MS, add on for 201-076)
Al (Al2O3)	NA	0.01 - 50%	0.01 - 50%	NA	Nb	0.1 - 10,000	0.1 - 10,000	NA	NA
Ba (BaO)	2 - 10,000	2 - 10,000	0.01 - 10%	NA	Nd	0.1 - 10,000	0.1 - 10,000	NA	0.1 - 10,000
Ca (CaO)	NA	0.01 - 50%	0.01 - 50%	NA	Ni	NA	5 - 10,000	NA	NA
Ce	0.1 - 10,000	0.1 - 10,000	NA	0.1 - 10,000	P (P2O5)	NA	0.01 - 25%	0.01 - 25%	NA
Co	0.5 - 10,000	0.5 - 10,000	NA	NA	Pr	0.1 - 1000	0.1 - 1000	NA	0.1 - 1000
Cr (Cr2O3)	NA	5 - 10,000	0.01 - 30%	NA	Rb	0.2 - 10,000	0.2 - 10,000	NA	NA
Cs	0.1 - 10,000	0.1 - 10,000	NA	NA	Sc	0.5 - 1000	0.5 - 1000	NA	NA
Cu	NA	5 - 10,000	NA	NA	Si (siO2)	NA	0.01 - 50%	0.01 - 50%	NA
Dy	0.05 - 1000	0.05 - 1000	NA	0.05 - 1000	Sm	0.1 - 1000	0.1 - 1000	NA	0.1 - 1000
Er	0.05 - 1000	0.05 - 1000	NA	0.05 - 1000	Sn	1 - 10,000	1 - 10,000	NA	NA
Eu	0.05 - 1000	0.05 - 1000	NA	0.05 - 1000	Sr (SrO)	0.5 - 1000	0.5 - 1000	0.01 - 10%	NA
Fe (Fe2O3)	NA	0.01 - 50%	NA	NA	Ta	0.5 - 10,000	0.5 - 10,000	NA	NA
Ga	0.1 - 1000	0.1 - 1000	NA	NA	Tb	0.1 - 1000	0.1 - 1000	NA	0.1 - 1000
Gd	0.1 - 1000	0.1 - 1000	NA	0.1 - 1000	Th	0.05 - 1000	0.05 - 1000	NA	0.05 - 1000
Ge	1 - 1000	1 - 1000	NA	NA	Ti (TiO2)	NA	0.01 - 30%	0.01 - 30%	NA
Hf	0.1 - 10,000	0.1 - 10,000	NA	NA	Tl	0.05 - 1000	0.05 - 1000	NA	NA
Ho	0.05 - 1000	0.05 - 1000	NA	0.05 - 1000	Tm	0.05 - 1000	0.05 - 1000	NA	0.05 - 1000
In	0.2 - 1000	0.2 - 1000	NA	NA	U	0.05 - 10,000	0.05 - 10,000	NA	0.05 - 10,000
K (K2O)	NA	0.01 - 30%	0.01 - 30%	NA	V	5 - 10,000	5 - 10,000	NA	NA
La	0.1 - 10,000	0.1 - 10,000	NA	0.1 - 10,000	W	0.5 - 10,000	0.5 - 10,000	NA	NA
Lu	0.05 - 1000	0.05 - 1000	NA	0.05 - 1000	Y	0.5 - 10,000	0.5 - 10,000	NA	0.5 - 10,000
Mg (MgO)	NA	0.01 - 30%	0.01 - 30%	NA	Yb	0.05 - 1000	0.05 - 1000	NA	0.05 - 1000
Mn (MnO)	NA	10 - 10,000	0.01 - 10%	NA	Zn	NA	5 - 10,000	NA	NA
Mo	2 - 10,000	2 - 10,000	NA	NA	Zr	0.5 - 10,000	0.5 - 10,000	NA	NA
Na (Na2O)	NA	0.01 - 30%	0.01 - 30%	NA	LOI	NA	NA	0.01 - 100%	NA

XRF Analysis

Samples can be analyzed by X-Ray Fluorescence (XRF) following either Lithium Borate Fusion, or from a pressed pellet method. XRF analysis is particularly useful for samples with high concentration ranges or with minerals that are resistant to acid digestion.

- 11-320 XRF Analysis (WDXRF) - Oxide Content by Lithium Borate Fusion with LOI
- 11-323 XRF Analysis (WDXRF) - Extended Oxide Content by Lithium Borate Fusion with Partial Sulphur and LOI
- 11-325 XRF Analysis (WDXRF) - Extended Oxide Content by Lithium Borate Fusion with Complete Sulphur and LOI
- 11-321 XRF Analysis (WDXRF) - Base Metals and REE by Pressed Pellet
- 11-340 XRF Analysis (WDXRF) - Extended Oxide Content by Lithium Borate Fusion with Complete Sulphur, Base Metals/REE by Pressed Pellet, and LOI

Oxide Content by Lithium Borate Fusion, XRF Finish with LOI (0.2g sample weight, results in %)

Analyte	Reporting Limits		
	11-320	11-323 (Extended, Partial Sulfur)	11-325 (Extended, Complete Sulfur)
Al2O3	0.04 - 90	0.04 - 90	0.04 - 90
BaO	0.01 - 40	0.01 - 40	0.01 - 40
CaO	0.02 - 100	0.02 - 100	0.02 - 100
Cr2O3	0.01 - 10	0.01 - 10	0.01 - 10
CuO	NA	0.01 - 8	0.01 - 8
Fe2O3	0.02 - 80	0.02 - 80	0.02 - 80
HfO2	NA	0.01 - 10	0.01 - 10
K2O	0.05 - 40	0.05 - 40	0.05 - 40
MgO	0.02 - 100	0.02 - 100	0.02 - 100
MnO	0.01 - 80	0.01 - 80	0.01 - 80
Na2O	0.02 - 58	0.02 - 58	0.02 - 58
NiO	NA	0.01 - 10	0.01 - 10
P2O5	0.01 - 40	0.01 - 40	0.01 - 40
PbO	NA	0.01 - 10	0.01 - 10
SO3	NA	0.05 - 59	0.05 - 59
SiO2	0.4 - 100	0.4 - 100	0.4 - 100
SrO	0.01 - 40	0.01 - 40	0.01 - 40
TiO2	0.01 - 40	0.01 - 40	0.01 - 40
V2O5	0.02 - 10	0.02 - 10	0.02 - 10
ZnO	NA	0.01 - 10	0.01 - 10
ZrO2	NA	0.01 - 40	0.01 - 40
LOI	0.02 - 100	0.02 - 100	0.02 - 100

XRF Analysis - Rare Earth Elemens and Base Metals by Pressed Pellet (0.2g sample weight, results in ppm unless otherwise stated)			
Analyte	**11-321 - Lower Reporting Limits**	**Analyte**	**11-321 - Lower Reporting Limits**
As	10	Pb	10
Ba	10	Pr	10
Cd	10	Rb	10
Ce	10	Sb	10
Co	10	Sc	10
Cr	10	Sm	10
Cs	10	Sn	10
Cu	10	Sr	10
Dy	10	Ta	10
Er	10	Tb	10
Eu	10	Th	10
Ga	10	Tm	10
Gd	10	U	10
Ho	10	V	10
La	10	W	10
Lu	10	Y	10
Mo	10	Yb	10
Nb	10	Zn	10
Nd	10	Zr	10
Ni	10		

XRF Analysis - Extended Oxide Content with Complete Sulphur by Lithium Borate Fusion and REE/Base Metals by Pressed Pellet
11-340
Combined analytes from 11-321 & 11-325

Dissolved Metals in Water (Hydrogeochemistry)

- 201-084 Dissolved Metals in Water Samples, ICP-OES Finish
- 201-085 Dissolved Metals in Water Samples, ICP-MS Finish
- 201-086 Rare Earth Elements (REEs) in Water Samples, ICP-MS Finish (Add-on)
- 201-099 Dissolved Metals in Water Samples, ICP-OES/ICP-MS Finish
- 201-082 Overlimits - Water Samples
- 283-080 Additonal Filtration to <0.45um*
- 283-081 Acidify with Nitric Acid*

*Required if water samples arrive not filtered and preserved"

Hydrogeochemistry Table (results in ppb unless otherwise stated)									
Analyte	**Lower Reporting Limits**				**Analyte**	**Lower Reporting Limits**			
	201-084 (ICP- OES)	**201-085 (ICP-MS)**	**201-086 (ICP- MS, REE)**	**201-099 (ICP- OES/MS)**		**201-084 (ICP- OES)**	**201-085 (ICP-MS)**	**201-086 (ICP- MS, REE)**	**201-099 (ICP- OES/MS)**
Ag	NA	0.005	NA	0.005	Na	0.05ppm	10	NA	0.05 ppm
Al	0.02ppm	0.5	NA	0.02 ppm	Nb	NA	0.005	NA	0.005
As	NA	0.05	NA	0.05	Nd	NA	NA	0.005	NA
Au	NA	0.005	NA	0.005	Ni	0.01ppm	0.5	NA	0.01ppm
B	NA	1	NA	1	P	0.02ppm	50	NA	0.02ppm
Ba	0.01ppm	0.1	NA	0.01ppm	Pb	NA	0.01	NA	0.01
Be	NA	0.05	NA	0.05	Pd	NA	0.005	NA	0.005
Bi	NA	0.005	NA	0.005	Pr	NA	NA	0.005 -	NA
Ca	0.02 ppm	20	NA	0.02ppm	Pt	NA	0.005	NA	0.005
Cd	NA	0.002	NA	0.002	Rb	NA	0.01	NA	0.01
Ce	NA	0.005	NA	0.005	Re	NA	0.002	NA	0.002
Co	NA	0.005	NA	0.005	S	0.1ppm	NA	NA	0.1ppm
Cr	0.01ppm	0.2	NA	0.01pm	Sb	NA	0.01	NA	0.01
Cs	NA	0.005	NA	0.005	Sc	NA	0.01	NA	0.01
Cu	0.01ppm	0.05	NA	0.01ppm	Se	NA	0.05	NA	0.05
Dy	NA	NA	0.005	NA	Si	0.05ppm	NA	NA	0.05ppm
Er	NA	NA	0.005	NA	Sm	NA	NA	0.005	NA
Eu	NA	NA	0.005	NA	Sn	NA	0.05	NA	0.05
Fe	0.01ppm	5	NA	0.01ppm	Sr	0.01ppm	0.05	NA	0.01ppm
Ga	NA	0.01	NA	0.01	Ta	NA	0.005	NA	0.005
Gd	NA	NA	0.005	NA	Tb	NA	NA	0.005	NA
Ge	NA	0.01	NA	0.01	Te	NA	0.01	NA	0.01
Hf	NA	0.005	NA	0.005	Th	NA	0.005	NA	0.005
Hg	NA	0.01	NA	0.01	Ti	0.01ppm	0.5	NA	0.01ppm
Ho	NA	NA	0.005	NA	Tl	NA	0.002	NA	0.002
In	NA	0.005	NA	0.005	Tm	NA	NA	0.005	NA
K	0.05ppm	100	NA	0.05ppm	U	NA	0.002	NA	0.002
La	NA	0.005	NA	0.005	V	0.01ppm	1	NA	0.01ppm
Li	0.01ppm	0.5	NA	0.01ppm	W	NA	0.01	NA	0.01
Lu	NA	NA	0.005	NA	Y	NA	0.005	NA	0.005
Mg	0.01ppm	1	NA	0.01ppm	Yb	NA	NA	0.005	NA
Mn	0.01ppm	0.5	NA	0.01ppm	Zn	0.01ppm	0.5	NA	0.01ppm
Mo	NA	0.05	NA	0.05	Zr	NA	0.01	NA	0.01

AAS Hydride Generator Packages

- 201-508: Se by 4 Acid Digestion, AAS-Hydride Generator Finish
- 201-509: As by Sodium Peroxide Fusion, AAS-Hydride Generator Finish

Electro-Chemical Testing of Soils

In soils, electro-chemical testing is used to evaluate the potential for corrosion of buried metallic structures.

Electro Chemical Testing of Soils	
Description	**Code**
Resistivity - Determining Minimum Laboratory Soil Resistivity in Soil (AASHTO T288 / ASTM G187/G57)/Gravel	12-026
Water Soluble Sulphate in Soil by ASTM C1580	284-735
Water Soluble Sulphate in Soil by AASHTO T290	284-736
Water Soluble Chloride Ion Content in Soil	284-759
pH of Soils Used in Corrosion Testing	284-758

Thermal Decomposition Methods

Thermal Decomposition Methods	
Description	**Code**
Moisture or water content analysis, Gravimetric	11-319
Dry Ashing (550°C), Muffle Furnace	201-501
Dry Ashing (650°C), Muffle Furnace	201-512
Loss-on-Ignition (LOI) (475°C), Gravimetric	201-550
Loss-on-Ignition (LOI) (950°C), Gravimetric	201-502
Loss-on-Ignition (LOI) (1000°C), Gravimetric	201-050

Acid Rock Drainage Services

Acid Rock Drainage (ARD) occurs when sulphide minerals from overburden, waste rock, and tailings deposits are exposed to naturally occurring oxidizing conditions. The oxidation of sulphides in the presence of water can generate acidic drainage. This drainage results in the generation of acidity which is also known as acid rock drainage (ARD) and the subsequent release of dissolved metals (metal leaching) into the surrounding environment. As the drainage becomes more acidic, its capacity to leach out elements from the rock, such as heavy metals, increases and can result in the water bearing a number of harmful constituents.

As a result of these interactions, polluted water can drain away from the exposed rock and have a significant impact at operating sites and surrounding areas including bodies of water if the appropriate prevention and management strategies are not adopted. Although this is a natural process, any rock relocation from industrial activities and excavation can trigger this phenomenon by exposing large surface areas of rock to water and oxygen. The additional rock surface exposure increases the reaction rate compared to natural conditions.

Not all industrial operations that expose sulphide bearing rocks result in ARD. In some situations the sulphide minerals may be non-reactive or may even have a buffering capacity to neutralize any acid released from sulphide oxidation, which results in metal leaching without ARD. Determination of the overall ARD potential of a site is based on the likelihood of a sample to exhibit characteristics of generating acid versus characteristics of neutralizing acid. AGAT Laboratories offers full-service analysis capabilities for measuring the ARD potential of a site, as well as potential levels of metal leaching. Our complete range of ARD testing can be performed using both Static and Kinetic phases. Test method include Net Acid Generation (NAG), Acid Base Accounting (ABA), leaching procedures (Shake Flask Extraction (SFE).

ARD Sample Preparation	
Sample Prep [Dry <1kg, crush to 80% passing ¼ inch, split 250 g and pulverize to 85% passing 200 mesh (75 um)]	281-000
Sample Prep [Dry <1kg, crush to 80% passing ¼ inch, split 500 g and pulverize to 85% passing 200 mesh (75 um)]	281-001
Sample Prep [Dry <1kg, crush to 80% passing ¼ inch, split 250g]	281-002
Sample Prep [Dry <1kg, crush to 80% passing ¼ inch, split 500g]	281-003
Screening for <2mm for Rinse-pH from as-received material or crushed sample	281-717
Speciality Sample Preparation - Custom ARD Package	281-901

Static Testing

Static tests are used to quickly determine the likelihood of ARD reactions at a site. The information gathered from these analyses can lead to a more in-depth examination involving Kinetic Testing.

Acid-Base Accounting (ABA) is the analytical cornerstone for static test predictions of ARD potential. ABA methods estimate the amount of acid-bearing material by measuring either total sulfur or sulfide-sulfur. Based on this information, AGAT Laboratories reports Neutralization Potential (NP), Acid Producing Potential and Net Neutralization Potential (NNP), Carbon, Sulphur Speciation (MPA) and Neutralizing Potential Ratio (NPR).

Shake Flask Extractions (SFE) can be used as a rapid means for analyzing leached elements of interest in a sample. Using ICP-OES and ICP-MS instrumentation, data for the quantities of leached elements such as arsenic, selenium and mercury can be quickly obtained.

Acid Base Accounting (ABA) - package options

ABA methods estimate the amount of acid-bearing material by measuring either total sulfur or sulfide-sulfur. Based on this information, AGAT Laboratories reports Neutralization Potential (NP), Maximum Potential Acidity (MPA), and Net Neutralization Potential (NNP).

AGAT Laboratories offers several methods for the determination of NNP, including Modified ABA (Lawrence and Wang 1996- 1997), Modified ABA (Lawrence 1989-1991), Standard Sobek, and Siderite Corrected NP".

ABA Packages	
1996 Modified ABA Package (includes Paste pH, Fizz Test, NNP, NPR, MPA, NP & Total Sulphur and Carbon)	284-702
Modified ABA Package (includes Paste pH, Fizz Test, NNP, NPR, MPA, NP & Total Sulphur and Carbon)	284-704
Standard Sobek ABA Package (includes Paste pH, Fizz Test, NNP, NPR, MPA, NP & Total Sulphur and Carbon)	284-703
Siderite Correction for Standard Sobek Method	284-705

Net Acid Generation (NAG)

The main purpose of the Net Acid Generation or NAG test is to directly assess whether a sample is capable of neutralizing the potential acid produced by sulphide oxidation. This method uses hydrogen peroxide (H_2O_2), a strong oxidizing agent capable of rapidly oxidizing sulphide minerals.

The solid material is titrated with sodium hydroxide (NaOH) after complete oxidation with hydrogen peroxide. The amount of NaOH needed is equivalent to the Net Acid Generation of the material and it is expressed in kg H_2SO_4 per metric tonne. AGAT Laboratories offers single addition NAG by both the EGI and MEND Method.

NAG Packages	
Single Addition Net Acid Generation Test (NAG - EGi method)	284-712
Single Addition Net Acid Generation Test (NAG - MEND method)	284-713
Net Acid Generation (NAG) Extraction*	284-715

* Additional analyses for NAG extracts are available, see table "Additional Analyses for NAG, Shake Flask, and Humidity Cell Extracts"

Shake Flask Extraction (SFE)

The SFE process is meant to mimic what would occur should the rocks present at a particular site be exposed to acidic or leaching solution. Crushed rock sample is mixed with acidic solution in a flask, allowing the extraction of soluble metals, and for testing of the extract for other ARD indicators such as pH, EC and Acidity.

- 284-714 Shakeflask Extraction*
  *Additional analyses for SFE extracts are available, see table "Additional Analyses for NAG, Shake Flask, and Humidity Cell Extracts"

Kinetic Testing

Kinetic Cells, also known as "Humidity Cells", involves a longer process after the initial determination of samples of interest using ABA and/or SFE analysis. Kinetic tests attempt to mimic natural oxidation during weathering conditions using a much larger sample contained in a cell and require a longer time for completion. Each cell provides detailed information on acid production and drainage water quality.

Kinetic Testing - Humidity Cells	
Humidity Cell Testing by MEND method	284-740
Humidity Cell Testing by ASTM Method	284-741
Humidity Cell Setup	284-742
Humidity Cell Weekly Sampling	284-743
**Additional analyses for Humidity Cell extracts are available, see table "Additional Analyses for NAG, Shake Flask, and Humidity Cell Extracts"*	

Additional Analyses for NAG, Shake Flask, and Humidity Cell Extracts*	
pH	284-744
EC	284-745
Oxidation-Reduction Potential (ORP)	284-746
Acidity	284-748
Dissolved Metals by ICP-OES/MS	284-752
Alkalinity	58-527
Anion Scan (Bromide, Chloride, Fluoride, Nitrate, Nitrite, Sulphate)	58-603
Mercury in Water, Low Level	58-824
**These codes can also apply to other liquid samples or extracts submitted by the client*	

Carbon and Sulphur Speciation

AGAT Laboratories operates leading edge LECO infrared combustion furnaces for precise measurements of carbon and sulphur in geological, metallurgical, and environmental samples. Methods involve combusting the sample in a high-temperature furnace, where carbon is oxidized to CO_2 and sulfur to SO_2. These gases are then detected and quantified using infrared (IR) sensors that quantify CO_2 and SO_2 based on absorption. Quantities of carbon and sulphur species can be individually determined using combined ICP-OES instrumentation or sample pre-treatments in addition to LECO analysis.

Carbon Speciation	
Total Carbon (TC) by IR Combustion	284-709
Graphitic Carbon by IR Combustion	284-109
Total Organic Carbon (TOC) by IR Combustion (calculated)	284-710
Total Inorganic Carbon (TIC) by IR Combustion	284-037
Total Inorganic Carbon (TIC) by HCL Leach	284-038
Carbon Speciation (TC, TIC, TOC) by IR Combustion	284-711
Total Inorganic Carbon (TIC) by Coulometer	284-720
Sulphur Speciation	
Total Sulphur (TS) by IR Combustion	284-519
Sulphate Sulphur - HCl Leach (Sulphide Sulphur by difference)	284-706
Sulphide in Soil	284-137
Sulphur Speciation (Sulphate by HCl, Sulphide by HNO_3, Insoluble S by difference)	284-708
Combined Carbon & Sulphur	
Total Carbon and Sulphur by IR Combustion	284-043

Miscellaneous ARD Testing	
Chloride by Ion Selective Electrode (ISE)	284-761
Fluoride by Ion Selective Electrode (ISE)	284-762
Chloride and Fluoride by Ion Selective Electrode (ISE)	284-763
Hg in Pulp/Rock Samples, CVAA Finish	283-047
Collaboration, Planning, and Execution of ARD Specialty Projects*	284-XXX
**Ask your CSR, who will work with AGAT's technical team to plan and build custom project scopes*	

Enhanced Exploration Services

Enhanced Exploration Services

AGAT Laboratories' 40+ years of experience in rock mechanics and geological services allows us to offer our mining exploration clients with a unique advantage for enhanced exploration through our Rock Properties Division. We offer the following geological and core imaging services.

High Resolution Digital Imaging

AGAT Laboratories offers high resolution digital imaging in colour under both ambient and ultra-violet lighting conditions. Photo images are acquired using full-frame digital cameras. Final core images display well name, location, cored interval, core number, recovery, sample numbers, scale and core top and bottom intervals. Photo images are uploaded on our secure FTP site for instant viewing from any location.

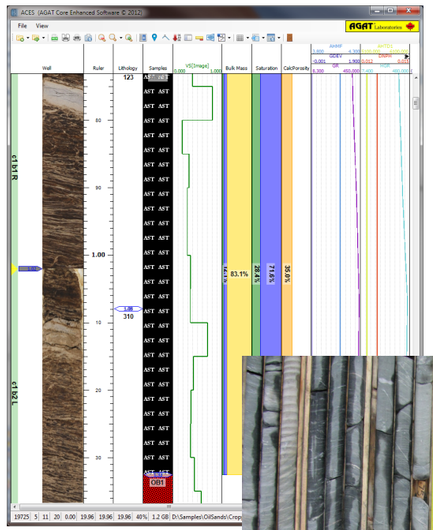
- 04-106: Digital Imaging/meter
- 04-410: CD Media/well
- 02-408: 360 Degree Color Photo/hour

Digital Imaging
Digital Imaging – color 81/2" x 11" – First Prints/print
Digital Imaging - colour 8 1/2" x 11" - additional prints
Digital Imaging – UV 81/2" x 11" – first prints/print
Digital Imaging – UV 81/2" x 11" – additional prints/print
CD Media
Photo images scanned onto CD, per image

ACES: AGAT Laboratories' Enhanced Core Software

AGAT Laboratories has developed a powerful software suite for core description and data management. The ACES software gives geologists the ability to import field data (drill recovery, DDH orientation data, and other tool logs), and takes advantage of AGAT's high quality core photography to allow depth-registration of core photos. Once core images are on-depth, geological features (lithology, structures, mineralization indices, etc.) and rock descriptions can be added, and sample intervals can be selected alongside photos. Ensuing analytical results can be imported and displayed alongside the core and geological data. Annotated core photos, sample location information, geologic strip logs, and raw data can all be exported in various ways to provide concise and clear geological drillhole descriptions which suit your exploration requirements.

Ask your Business Development Representative for a demonstration today.



X-Ray Diffraction (XRD) Analysis

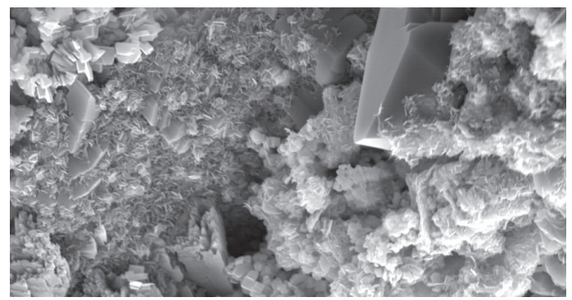
XRD analysis identifies the crystalline mineral phases of rocks, sediments and soils based on characteristic crystal diffraction patterns. Diffractogram data are compared with the current ICDD (International Centre for Diffraction Data) database that provides access to >300,000 international reference patterns. In multi-phase materials, XRD patterns are utilized to quantify mineral phases through Rietveld Refinement methods (bulk fraction). For specific grain fraction analysis, particle size separation and mineral speciation are also performed. For clay minerals, the clay size is isolated and pattern analysis using the Relative Intensity Ratio method provides semi-quantification of clay mineralogy.

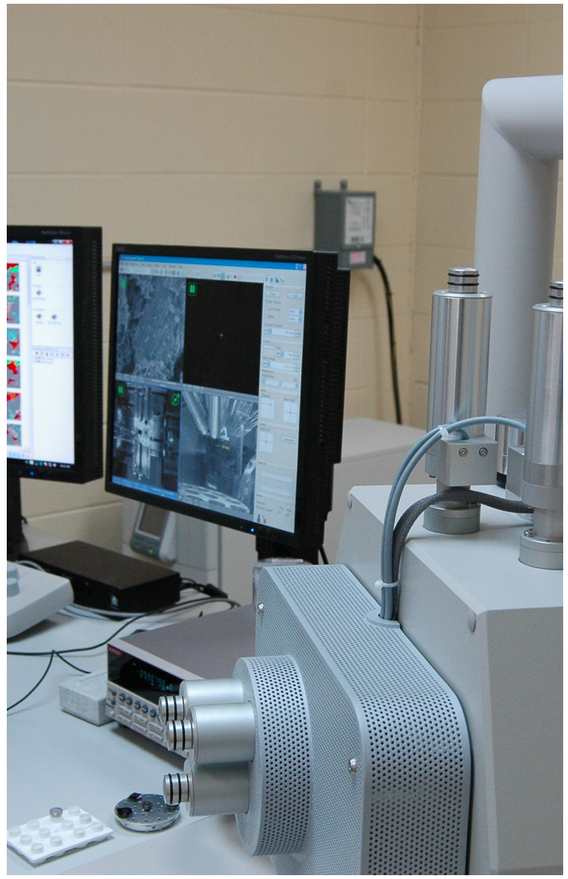
- 11-200: Bulk XRD Analysis/sample
- 11-202: Combined XRD Analysis/sample

Scanning Electron Microscopy (SEM) and Environmental SEM (ESEM)

SEM analysis allows examinations of mineral textures and morphology at a microscopic level (magnifications >1000x). SEM analysis allows the investigation of rocks, minerals, biological specimens, and artificial materials from the sub-micrometer to centimeter scale. Sample preparation can be minimal (no preparation) to polished surfaces in order to achieve the objectives of the investigations. Polished rock/mineral surfaces assist in quantifying mineral composition, size, and zoning as well as mineral deportment and elemental associations. When combined with petrographic light microscopy data, SEM provides key information regarding composition, origin, and alteration of rocks and minerals.

- 11-500: Detailed SEM Examination, Including Interpretation/sample
- 11-502: SEM Examination & Photomicroscopy/ sample

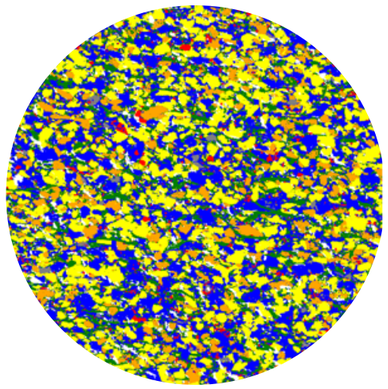




QEMSCAN

Geochemical, mineralogical and microscopic textures can be evaluated utilizing AGAT's FEI Quanta 650 QEMSCAN equipped with dual Bruker SSD EDS detectors. This equipment is advantageous over conventional SEM systems as it has a user-defined raster-scan pattern for backscatter electron and elemental composition area scan modes from which mineral phase assemblage, quantity, distribution and grain texture parameters can be derived immediately. Thin sections and polished pellets of core, chip, channel, or hand samples provide the basis for high-resolution geochemical, mineralogical and textural attributes, providing mineral association and liberation data crucial for beneficiation analysis.

- 11-713: BMA (Bulk Mineral Analysis)
- 11-714: PMA (Particle Mineral Analysis)
- 11-715: Advanced PMA with Mineral Liberation Analysis
- 11-718: Field Scan and Mapping (Field image capture of polished section + frame stitching)



Energy Dispersive X-ray Spectrometry (EDS, or XES)

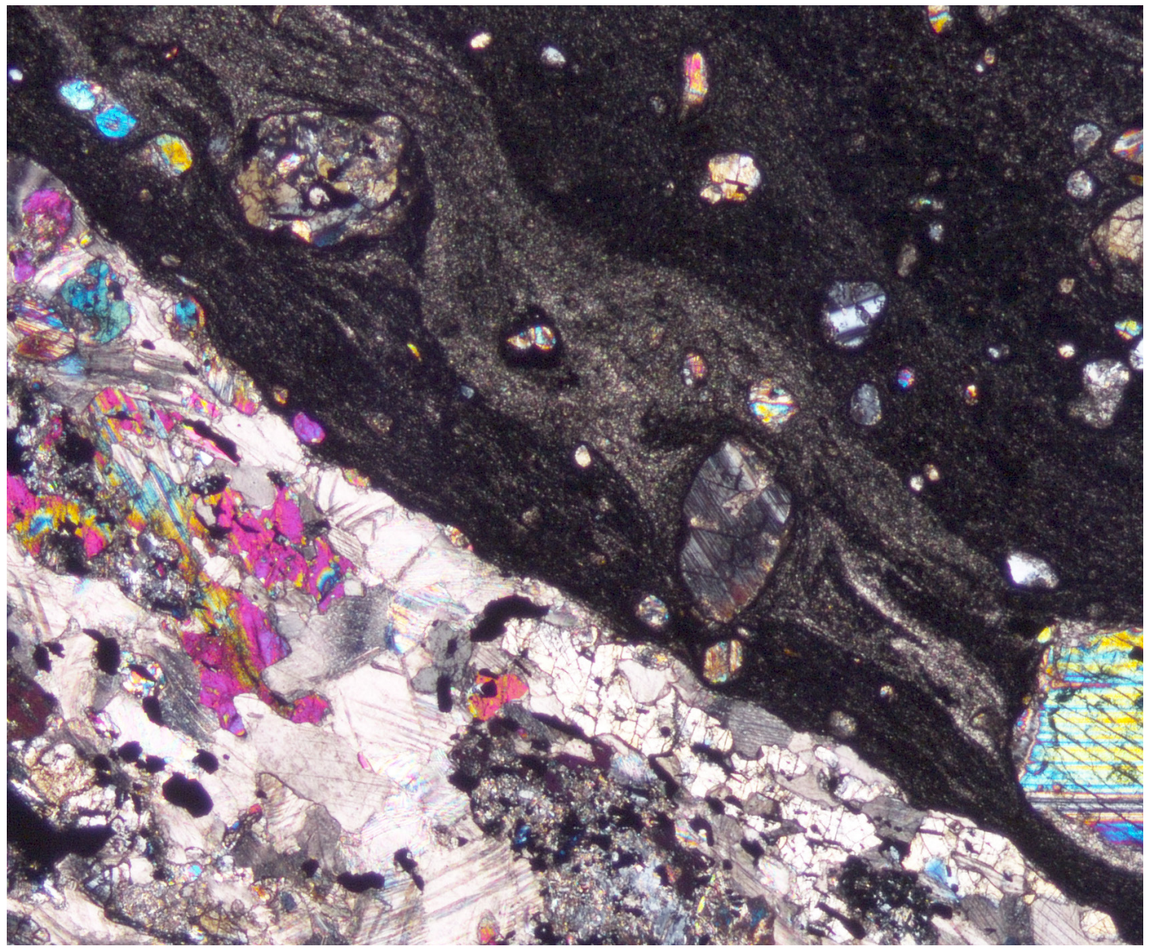
AGAT's SEM units are equipped with EDS systems in order to identify and quantify geochemical compositions of sample constituents and minerals. In samples with high amorphous material present, an EDS can assist in identifying elemental composition of non-crystalline materials, complementing crystalline mineral analysis by XRD.

- 11-504: X-Ray energy spectrometry (XES/sample)

Thin Section Preparation and Petrography

Microscopic petrographic analysis is an accurate, fast and repeatable mean of evaluating rock texture, particle aggregates, mineral assemblages and pore system of rock/soil samples. AGAT operates a comprehensive thin section preparation lab and pride ourselves on the high quality sections we prepare. Sections can be covered or polished, have mineral staining applied, and are viewed under plane-polarized, cross-polarized, reflected, and/or ultra-violet light. AGAT's diverse team of geologists are experienced in a wide range of rock types and resource plays, and build detailed reports incorporating petrography, SEM, XRD, and routine analysis data to provide the best possible interpretation of geologic history, metamorphism and alteration, ore mineralization, and practical implications for extraction and beneficiation.

- 11-100: Thin Section Preparation (Regular Sections)/ sample
- 11-102: Thin Section Preparation (Large Sections)/ sample
- 11-300: Detailed Thin Section Petrography, Including Thin Section Prep, Point Counting & Interpretation/ sample



Notes

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AGAT Laboratories

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and learn more about our wide
range of laboratory services.