



44<sup>ème</sup>  
<sup>th</sup>

**Conférence et Exposition des  
Analystes des Minéraux Canadiens**

Canadian Mineral Analysts  
Conference and Exhibition

Programme et résumés techniques  
**Program and Abstracts**

Présenté par :  
Hosted by:



**CLAISSE®**

*The First and Finest in Fusion™*

I'll remember...

Je me souviendrai...



**CMA** 2012  
QUEBEC CITY

Canadian Mineral Analysts  
Conference and Exhibit

September 9-13 2012

Loews Hotel Le Concorde

Hosted by



*The First and Finest in Fusion™*





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## Mots de bienvenue / Welcoming Messages



### L'expertise du Québec dans le secteur minier : au cœur de notre essor économique

L'industrie minière joue un rôle important dans l'économie québécoise. Elle génère 34 000 emplois directs et indirects. La valeur des expéditions de produits miniers est passée de 6,2 G\$ en 2008 à 8 G\$ en 2011. Cette industrie vit aujourd'hui un boom qui l'amène à relever d'ambitieux défis.

C'est d'ailleurs dans cette perspective que le Québec a adopté une approche dynamique et à l'avant-garde. La Stratégie minérale lancée en 2009 ainsi que le Plan Nord mis en œuvre en 2011 favorisent l'exploration, la recherche et la connaissance géologique, tout en privilégiant le respect de l'environnement et l'acceptabilité sociale des projets.

La mission de Géologie Québec soutenue par le Fonds des ressources naturelles - volet du patrimoine minier - contribue directement à la promotion du potentiel minéral du Québec.

L'expertise québécoise dans le domaine minier est reconnue à l'échelle internationale. La principale force du Québec repose sur les connaissances et le savoir-faire de sa main-d'œuvre qualifiée, dont vous faites partie. Bon congrès!

### Québec's expertise in the mining sector: at the heart of economic growth

The mining industry plays a key role in Québec's economy. It generates 34,000 direct and indirect jobs. The value of mineral product shipments increased from \$6.2 billion in 2008 to \$8 billion in 2011, and the mining industry is currently experiencing a boom that will require it to meet some ambitious targets.

For this reason, Québec has opted for a dynamic, innovative approach. The Mineral Strategy, launched in 2009, along with the Plan Nord implemented in 2011, promotes exploration, research and geological data acquisition together with respect for the environment and the social acceptability of all projects. As part of its mission, Géologie Québec, supported by the mining heritage component of the Natural Resources Fund, contributes directly to the promotion of mineral potential in Québec.

Québec's expertise in the mining sector has gained international recognition. Québec's main strengths are the knowledge and skills of its highly qualified workforce—a workforce of which you form a part. I wish you all an enjoyable congress!

Yves Ouellet, Deputy Minister  
Ministère des Ressources naturelles et de la Faune



### Message du maire de Québec

La Ville de Québec est honorée d'accueillir le 44<sup>e</sup> congrès annuel des Analystes des minéraux canadiens. Lieu d'avancées scientifiques et technologiques importantes, Québec abrite l'une des plus fortes concentrations de chercheurs et de centres de recherche au Canada. Nous sommes donc très fiers d'accueillir un événement d'une grande importance pour l'industrie minière et du milieu des laboratoires de recherche.

Ayant déjà agi à titre de président de l'Association de l'exploration minière du Québec, je suis très sensible à la mission première de votre congrès visant à maintenir des liens étroits entre tous les laboratoires de l'industrie minière canadienne. Au nom de la population, c'est avec grand plaisir que je vous souhaite la bienvenue.

Je vous invite à profiter de l'occasion pour visiter Québec, reconnue comme l'une des meilleures destinations au Canada, qui saura vous charmer par la richesse de son patrimoine, la qualité de son expertise et de ses installations, par son cachet européen et l'hospitalité de ses habitants.

Bon congrès et bon séjour à Québec!

### Message from the Mayor of Québec City

The City of Québec is honored to welcome the 44th annual Canadian Mineral Analysts Conference. Québec is on the cutting edge of scientific and technological advances and home to one of the biggest concentrations of researchers and research centers in Canada. We are therefore very proud to welcome an event of great importance to the mining industry and research laboratories.

As former president of the Québec Mineral Exploration Association, I am very sensitive to the main purpose of your conference to maintain close ties between all Canadian mining industry laboratories. On behalf of the public, it is with great pleasure that I welcome you.

I invite you to take the opportunity to visit Québec City, recognized as one of Canada's top destinations. It is sure to delight you with its rich heritage, the quality of its expertise and facilities, its European charm, and the warm hospitality of local residents.

Have a good conference and enjoy your stay in Québec City!

Le maire de Québec,

Régis Labeaume



### Message de la présidente de la 44e édition de la Conférence et Exposition Annuelle des Analystes des Minéraux Canadiens

Événement phare de l'industrie minière, la CMA 2012 est présentée dans la ville de Québec et Claisse se voit honorée d'accueillir cette 44e édition de la Conférence et Exposition Annuelle des Analystes des Minéraux Canadiens.

Grâce à notre influence et à notre présence soutenue à l'échelle mondiale, notre organisation a réussi à attirer de nombreux exposants, analystes et experts en provenance des quatre coins du globe et qui partageront avec nous, pour le plus grand bénéfice de tous les participants, leur expérience, leurs stratégies novatrices ainsi que les derniers progrès en chimie analytique. La CMA est sans contredit la conférence incontournable dans le domaine

puisqu'elle rassemble tous les intervenants de l'industrie, des laboratoires aux manufacturiers, en passant par les fournisseurs, les sociétés de services, et plus encore.

En tant qu'organisatrice de la présente édition, je peux vous assurer que Claisse n'a ménagé aucun effort pour offrir à tous les exposants et participants des installations de grande qualité. À cet effet, nous avons choisi l'hôtel Loews Le Concorde, situé sur la Grande-Allée, en plein cœur du quartier commercial et historique de la ville de Québec. Nous sommes convaincus que vous apprécierez autant cette conférence que votre visite à Québec, ville du patrimoine mondial de l'UNESCO depuis 1985.

Avant de clore cette allocution de bienvenue, j'aimerais souligner tout le travail volontaire effectué par les membres du personnel de Claisse. Ils ont été d'un grand soutien et fort généreux de leur temps, comme de leurs efforts. Sans leur aimable collaboration, il nous aurait été impossible d'organiser un événement de cette ampleur.

C'est donc avec grand plaisir que je vous accueille à Québec dans le cadre de la CMA 2012.

### Message from the Conference Chairperson of the 44th Annual Canadian Mineral Analysts Conference and Exhibition

The 2012 CMA is set to be a flagship event held in Quebec City for the mining industry, and Claisse is honored to host this 44th annual edition of the Canadian Mineral Analysts Conference and Exhibition.

Because of our influence and strong presence on the worldwide stage, our organization has succeeded in attracting a great number of exhibitors, analysts and experts from the four corners of the world who will share, for the benefit of all attendees, their experience, innovative strategies and new advances in the field of analytical chemistry. The CMA really is "the" conference to attend since it brings together all the people involved in the industry: laboratories, suppliers, manufacturers, service companies, and so forth.

As the organizer of the current edition, I can assure you that Claisse has devoted its best energy to offer high quality accommodations for all exhibitors and attendees in choosing the Loews Hotel Le Concorde, located on Grande Allée, right in the heart of Quebec City's commercial and historic district. We trust you will be pleased with the conference as well as with your visit in Quebec City, voted by Unesco in 1985, a World Heritage City.

Before closing my welcoming address, I would like to underline all the voluntary work performed by the people from Claisse. They have been so supportive and so giving of their time and efforts. Without their kind collaboration, it would not have been possible to organize such an event.

It will be a great pleasure for me to welcome you in Quebec to attend the 2012 CMA.

**Lucie Simard**

Présidente / Conference Chairperson





## Informations sur les exposants / Information about Exhibitors

The 2012 CMA exhibitors will have the opportunity to display their products and services in the exhibit hall of the Loews Hotel Le Concorde throughout the conference. There are 44 participants registered for the conference coming from various countries.

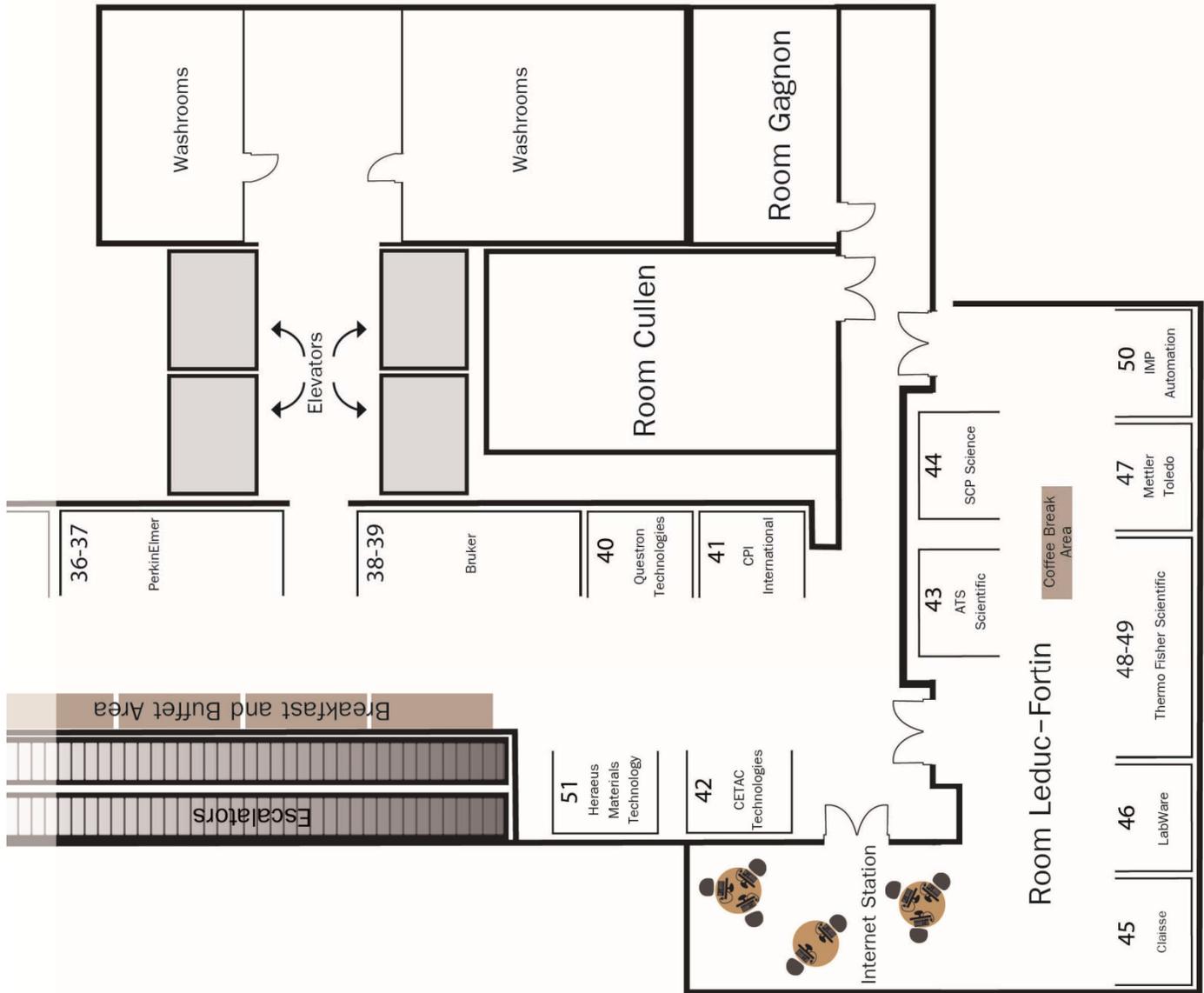
### Exhibit Booth Assignment

Exhibitor	Booth Number	Exhibitor	Booth Number
Activation Laboratories (Actlabs)	18	Innov-X Technologies Canada	33
Agilent Technologies Canada	3-4	Klen International	9
Anachemia Science	1-2	LabWare	46
AssayNet	16	Laval Lab	25
ATS Scientific	43	Leco Instruments	15
Bruker	38-39	Les Systèmes Katanax	23-24
Canadian Association for Laboratory Accreditation (CALA)	10	Métaux Kitco	26
Canalytical	6	Metrohm Canada	35
CETAC Technologies	42	Mettler Toledo	47
Chemco	28	PANalytical	27
Claisse, Corporation Scientifique	45	PerkinElmer Canada	36-37
CPI International	41	Prolite Systems	31
Delta Scientific	12-13	Questron Technologies Corp.	40
Elemental Scientific	32	Rigaku Americas Corporation	20
FLSmidth	8	Romquest Technologies	21
Folio Instruments	17	Scancia	22
Geoscience Laboratories	5	SCP Science	44
Heraeus Materials Technology	51	Standards Council of Canada	30
Herzog Automation Corp.	14	Teledyne Leeman Labs	19
Hoskin Scientifique	11	Thermo Fisher Scientific	48-49
International Centre for Diffraction Data (ICDD)	29	ThyssenKrupp Polysius AG	34
IMP Automation Canada	50	Transition Technologies	7



# Exhibit floor plan







## Exhibit Hours

Exhibit Days	Exhibit Schedule	Coffee Break
Monday, September 10, 2012	6:00 pm - 8:00 pm	10:00 am - 10:30 am - 3:00 pm - 3:30 pm
Tuesday, September 11, 2012	9:00 am - 5:00 pm	10:00 am - 10:30 am - 2:30 pm - 3:00 pm
Wednesday, September 12, 2012	9:00 am - 12:00 pm	10:00 am - 10:30 am

## Exhibitors Description

Company	Description
<b>Activation Laboratories (Actlabs)</b> <a href="http://www.actlabs.com">www.actlabs.com</a> Booth 18	<b>Actlabs</b> has been a global leader in analytical services for over 25 years. We are a primary laboratory for analytical geochemistry and are at the forefront of emerging services like Metal Speciation, Laser Ablation High-Resolution ICP/MS and Mineral Liberation Analyser. We are accredited to ISO 17025 for specific registered tests.
<b>Agilent Technologies Canada</b> <a href="http://www.agilent.com">www.agilent.com</a> Booth 3-4	<b>Agilent</b> manufactures and distributes a complete line of instrumentation serving the clinical, analytical, biotech, environmental, pharmaceutical, forensic science, food and flavor, academia, and all other laboratory markets that have needs for the best in quality, performance, and serviceability in the instruments they purchase.
<b>Anachemia Science</b> <a href="http://www.anachemia.com">www.anachemia.com</a> Booth 1-2	<b>Anachemia Science</b> is a VWR company that has been supplying mining laboratories with quality products for over 60 years. Since our inception as a chemical manufacturer, we have grown to become a full-line international distributor, representing some of the leading manufacturers in the laboratory equipment, products and consumables markets. We can and do supply virtually everything required to start and operate a full lab.
<b>AssayNet</b> <a href="http://www.assaynet.com">www.assaynet.com</a> Booth 16	<b>AssayNet</b> is a LIMS supplier for minesite labs. AssayNet's team has leveraged its experience in Minesite Assay Laboratories to offer a total solution for managing lab data. AssayNet has built its success on a thorough knowledge of the industry, a high degree of professionalism, and strong commitment to its clients.
<b>ATS Scientific</b> <a href="http://www.ats-scientific.com">www.ats-scientific.com</a> Booth 43	Since 1989, <b>ATS Scientific Inc.</b> has been offering the Canadian Mining Community a wide range of laboratory tools for sample preparation, materials processing and measuring instrumentation. Our Canada wide technical staff's 250 + years of combined customer support enables us to provide application driven consultation to our clientele, which routinely involves sample evaluations and instrument demonstrations.



**Bruker**  
[www.bruker-axs.com](http://www.bruker-axs.com)  
Booth 38-39

**Bruker** offers the most advance X-ray solutions for the analysis of minerals. From elemental to phase composition, from major to minors and traces, from benchtop to floor standing and from research to quality control, Bruker provides best-in-class instruments, analytical support, training and service.

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**Canadian Association for Laboratory Accreditation (CALA)**  
[www.cala.ca](http://www.cala.ca)  
Booth 10

The ability to demonstrate the credibility and accuracy of their test results is a key benefit for mineral testing laboratories. Third-party accreditation by CALA is a key differentiator for doing business in Canada's thriving mining sector. CALA provides both accreditation and training services to mineral testing laboratories seeking ISO/IEC 17025 accreditation.

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**Canalytical**  
[www.canalytical.com](http://www.canalytical.com)  
Booth 6

**Canalytical** is an ISO 17025-certified company that represents quality manufacturers such as Teledyne Leeman Labs and Shimadzu Scientific Instruments. The Leeman Labs products are ICP-AES and Mercury analyzers, including the Hydra C combustion Mercury system. The Shimadzu product portfolio includes the AA, Arc/Spark OES, Physical Testing and Balance lines.

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**CETAC Technologies**  
[www.cetac.com](http://www.cetac.com)  
Booth 42

**CETAC Technologies** is a worldwide leader in sample handling and sample introduction technologies for elemental analysis. CETAC provides a comprehensive range of product-based solutions for the analysis of elements in samples. We develop, manufacture and market products and services that provide essential solutions to customers around the globe.

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**Chemco**  
[www.chemco-inc.com](http://www.chemco-inc.com)  
Booth 28

**Chemco Inc.** is a privately owned Quebec Corporation that has been manufacturing and distributing chemicals used in the environmental field for over 20 years. From our factory located in St-Augustin, a suburb of Quebec City, we manufacture inorganic coagulants such as ferric sulphate and alum intended for use in water treatment. We also distribute a wide range of complementary chemicals products. Our skilled technical staff offers our customers consulting services and works with them to optimize their processes for water treatment and soil remediation within the context of mining activities.

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**Claisse, Corporation Scientifique**  
[www.claisse.com](http://www.claisse.com)  
Booth 45

**Pioneer (1976)** in the development of analytical fusion techniques, instrumentation and fine chemistry science, Claisse® is globally recognized for its achievements in the field of inorganic sample preparation by fusion for XRF, AA, ICP and wet chemistry analysis. Our aim is to supply analysts with the ultimate machinery, accessories and new techniques for their work with fusion.

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**CPI International**  
[www.cpiinternational.com](http://www.cpiinternational.com)  
Booth 41

**CPI** was established in 1986 in response to demand from the emerging environmental testing industry for innovative products. Today, the company is a recognized leader for quality, service and innovation in key categories including specialized products for spectroscopy, chromatography, mass spectrometry and microbiology.

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**Delta Scientific**  
[www.delta-sci.com](http://www.delta-sci.com)  
 Booth 12-13

**Delta Scientific** is a Canadian owned and operated company formed in 1985. We offer a wide range of laboratory chemicals, consumables and equipment from a base of over 500 unique vendors. In addition, we supply equipment and supplies for use in AA, ICP-OES, ICP-MS and XRF-XRD.

**Elemental Scientific**  
[www.icpms.com](http://www.icpms.com)  
 Booth 32

**Elemental Scientific (ESI)** is an internationally recognized leader in developing innovative sample introduction systems for metal analysis of geochemical samples by ICP-MS, ICP and FAA. Our product line ranges from consumables to fully automated inline dilution/standardization/QC systems that increase sample throughput and data quality resulting in reduced per sample costs.

**FLSmidth**  
[www.flsmidth.com](http://www.flsmidth.com)  
 Booth 8

**With** more than 13,000 employees and local presence in over 50 countries, FLSmidth is a leading engineering company in the minerals and cement industry. We are focused on developing innovative and reliable equipment. For the last 30 years, we delivered everything from complete automation solutions to single unit manual equipment.

**Folio Instruments**  
[www.folioinstruments.com](http://www.folioinstruments.com)  
 Booth 17

**Folio Instruments** have been Canada's leading supplier of scientific instruments for over 20 years. We have innovative solutions for physical and elemental test applications. We look forward to helping you find the right solution! We don't sell products, we sell performance!

**Geoscience Laboratories**  
[www.mndm.gov.on.ca](http://www.mndm.gov.on.ca)  
 Booth 5

**The Geoscience Laboratories (Geo Labs)** is a full-service geoanalytical facility with a focus on providing analytical and research services in inorganic geochemistry, mineralogy, preparation of reference materials and method development. The Ontario Geological Survey is the Geo Labs' largest client.

**Heraeus Materials Technology**  
[www.heraeus-precious-metals-technology.com](http://www.heraeus-precious-metals-technology.com)  
 Booth 51

**Heraeus** is a global leader in manufacturing and refining of Platinum Labware. Since 1856, Heraeus has specialized in crucibles, dishes and laboratory equipment for use in XRF and other applications. Our Labware Exchange Program allows laboratories to work directly with the manufacturer to maximize the value of used platinum labware towards the purchase of new Heraeus Platinum Labware.

**Herzog Automation Corp.**  
[www.herzogautomation.com](http://www.herzogautomation.com)  
 Booth 14

**Herzog Automation Corp.** is the leading supplier of manual and fully automatic sample preparation systems for spectrographic and x-ray analysis, tube delivery systems for sample transport, and laboratory automation for the mining, steel, aluminum and cement industries.

**Hoskin Scientifique**  
[www.hoskin.ca](http://www.hoskin.ca)  
 Booth 11

**HOSKIN SCIENTIFIC**, with over fifty years of experience dealing with the environmental, material testing (mining) and instrumentation industries, is ready to service your needs, whatever the application. We carry a wide range of products that will provide both analytical and diagnostic analysis. Our knowledgeable sales and service staff is ready to assist you.

**International Centre for  
Diffraction Data (ICDD)**[www.icdd.com](http://www.icdd.com)

Booth 29

ICDD's material identification databases, designed for rapid materials identification, interface with the analysis systems of the world's leading software developers and X-ray equipment manufacturers. The Powder Diffraction File is available in PDF-2 Release 2012 (250,182 entries); PDF-4+ 2012 (328,660 entries); PDF-4/Minerals 2012 (39,410 entries); and PDF-4/Organics 2013 (471,257 entries).

**IMP Automation Canada**[www.impgroup.com](http://www.impgroup.com)

Booth 50

IMP Automation delivers automated process sampling and automated robotic laboratory solutions to the mining and minerals sector in Canada, Australia, the United States, South Africa and Brazil. These include automated sampling, sample preparation and analytical systems for iron ore, gold, nickel, copper, aluminium, steel and zinc. IMP has installed, commissioned and continue to support the three largest fully automated robotic mining laboratories in the world.

**Innov-X Technologies Canada**[www.innovx.ca](http://www.innovx.ca)

Booth 33

Innov-X Canada is focused on the safe, responsible and effective utilization of XRF and XRD analytical equipment. We bring a superior suite of analyzers to markets that provide qualitative and quantitative material characterization for mining and geochemistry applications. Innov-X Canada provides a customized and professional approach to sales, rentals, training and consulting services.

**Klen International**[www.klen.com.au](http://www.klen.com.au)

Booth 9

Established in 1974, KLEN is a global leader providing premium quality fire assay fluxes throughout the geochemical assay laboratory market. We also supply crucibles, cupels and various additional consumables and offer free consolidation services if required.

**LabWare**[www.labware.com](http://www.labware.com)

Booth 46

LabWare, Inc. specializes in the development, implementation and support of enterprise-scale LIMS solutions. We are an exciting and innovative company achieving robust growth in a manageable fashion. LabWare is now the leading supplier of LIMS with sales and support offices around the world.

**Laval Lab**[www.lavallab.com](http://www.lavallab.com)

Booth 25

LAVAL LAB INC is the leading Canadian supplier of laboratory equipment. Sample preparation mills (crushers, grinders, pulverizers), sample division, particle size analysers and zeta potential, sieve shakers, sieves and laboratory balances, XRF-sample preparation (fluxers, platinum labware, borate fluxes and binders for pressed pellets), ultrasonic cleaners, and LIBS spectrometers.

**Leco Instruments**[www.leco.com](http://www.leco.com)

Booth 15

For over 75 years, customers around the world have trusted LECO to provide analytical solutions for a variety of applications and markets, including mined materials and metals, environment and agriculture, energy and fuels, foods and beverages, and life sciences. With a global reputation for rapid, accurate analysis in iron, steel, alloys, refractory metals, and ores, LECO instruments have become the brand leader for these markets. A number of sample preparation and microstructural analysis solutions for the metallography industry, as well as a complete line of consumable products, are also available.



**Les Systèmes Katanax**  
[www.katanax.com](http://www.katanax.com)  
 Booth 23-24

**Katanax** manufactures and sells electric fusion machines (fluxers), used in inorganic sample preparation for XRF, ICP and AA. Equipment is easy to install, use and maintain. Affordable, fully automatic, energy efficient, produces highly accurate and reproducible results. Zirconium and platinum crucibles, molds. We buy back scrap precious metal utensils, vessels.

**Métaux Kitco**  
[www.kitco.com](http://www.kitco.com)  
 Booth 26

Our range of platinum laboratory ware includes crucibles, dishes, boats, thermocouple wires electrodes, among other products. Our products will perform with reliability, even when subject to critical scientific requirements. We offer refining services that can help you reclaim value from used products. Our terms for refining used laboratory ware are among the most competitive in the industry.

**Metrohm Canada**  
[www.metrohmca.com](http://www.metrohmca.com)  
 Booth 35

**Metrohm** is your go-to source for trace metal analysis, offering a complete line of precision titrators and titration automation, ion chromatography and voltammetry systems, and more. Industry-best warranties and local reps who are experts in your applications ensure that you will receive the best instruments and care—always.

**Mettler Toledo**  
<http://ca.mt.com/ca/en/home.html>  
 Booth 47

**METTLER TOLEDO** is a leading global manufacturer of precision instruments and is the world's largest manufacturer and marketer of weighing instruments for use in laboratory, industrial and retail applications. Also, the company is a leading provider of analytical chemical instruments such as the Mettler T70 Automatic Titrator and the Rondo20 Autosampler to provide fully automated unattended titration analysis. Other instruments include refractive index and density meter, pH meters, melting point, thermal analysis and more.

**PANalytical**  
[www.panalytical.com](http://www.panalytical.com)  
 Booth 27

**PANalytical** is the world's leading supplier of analytical instrumentation and software for X-ray diffraction (XRD) and X-ray fluorescence spectrometry (XRF), with more than half a century of experience. PANalytical was founded in 1948 as part of Philips and was formerly known as Philips Analytical

**PerkinElmer Canada**  
[www.perkinelmer.com](http://www.perkinelmer.com)  
 Booth 36-37

As a global technology leader, PerkinElmer designs, manufactures and delivers advanced technology solutions that address the world's most critical health and safety concerns. This includes providing the analytical instrumentation and services that solve problems unique to the needs of today's metallurgical, geological and mining laboratories.

**Prolite Systems**  
[www.prolitepiping.com](http://www.prolitepiping.com)  
 Booth 31

**Prolite Systems Inc.** is a Canadian based international thermoplastic fabricator specializing in dual Laminates. Our custom fabrication facilities for corrosion resistant process equipment allows us to be a leader in engineering, design and fabrication of scrubbers, fume hoods, FRP, dual laminate piping, and tanks. Prolite Systems Inc. has over 30 years of experience in specialty corrosion systems.



**Qestron Technologies Corp.**  
[www.qtechcorp.com](http://www.qtechcorp.com)  
Booth 40

**Qestron Technologies Corp.** is a manufacturer of high quality sample preparation equipment for analytical laboratories. Our product offering covers various techniques like Microwave Digestion, Hot Block Digestion and Microwave Ashing. Vulcan, the ultimate in Automated Block Digestion, comes out of our specialization in the field of All-Plastic automation. Vulcan provides means of Digestion, precise reagent additions, sample cooling, sample transfer and volume levelling in HEPA filter environment.

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**Rigaku Americas Corporation**  
[www.rigaku.com](http://www.rigaku.com)  
Booth 20

**Rigaku** provides the world's most complete line of X-ray diffraction and X-ray fluorescence instruments and components. Systems include the MiniFlex benchtop XRD and Supermini benchtop WDXRF systems, the Ultima IV and SmartLab® multi-purpose diffractometers with SAXS and in-plane capabilities, DMAX Rapid II micro-diffraction systems, SMAX3000 small angle scattering systems, and the ZSX Primus series of high-powered WDXRF spectrometers with mapping capabilities, in either tube-above or tube-below configurations.

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**Romquest Technologies**  
[www.romquest.com](http://www.romquest.com)  
Booth 21

**Romquest Technologies** is the exclusive Canadian distributor for reputable manufacturers of high quality analyzers and consumables from Europe and USA. Our product lines include : Eltra Elemental Analyzers, Eurovector CHNS/O and N-Protein Analyzers, Belec Optical Emission Spectrometers, Elvatech XRF Analyzers, LAC Laboratory furnaces and dryers, Radwag Balances & Scales and Alpha Resources consumables, supplies and certified standards for elemental analyzers/ICP/AA/MS.

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**Scancia**  
[www.scancia.ca](http://www.scancia.ca)  
Booth 22

**Scancia** operates an ultra-clean micro-bead flux production facility. The manufacturer uses only the finest chemicals, provides a wide range of products and offers the purest borate fusion fluxes available on the market. Whether you operate a high-volume industrial laboratory or a research facility, Scancia can assist you by providing you with the best fusion fluxes around.

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**SCP Science**  
[www.scpscience.com](http://www.scpscience.com)  
Booth 44

**SCP** is a privately-owned manufacturer and distributor of analytical instruments, digestion equipment, reagents and certified reference materials for the spectroscopy market. Products include CONOSTAN - oil calibration and verification standards; NOVAWAVE - automated microwave digestion tunnel system; DigiPREP - family of graphite block digestion systems; distillation systems; ICP supplies; XRF supplies; and AA supplies.

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**Standards Council of Canada**  
[www.scc.ca](http://www.scc.ca)  
Booth 30

**The Standards Council of Canada (SCC)** is Canada's national accreditation body. The SCC offers accreditation to Mineral Analysis Testing Laboratories that perform analysis of all media used in mining exploration and processing. Accreditation, according to ISO 17025, in partnership with CAN-P 1579, is the formal recognition of the competence of a mineral analysis testing laboratory to manage and perform this type of activity.

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**Teledyne Leeman Labs**  
[www.LeemanLabs.com](http://www.LeemanLabs.com)  
Booth 19

**Teledyne Leeman Labs** has long been an innovator in atomic spectroscopy introducing many concepts that are now considered industry standards, including the first use of an Echelle spectrometer in an ICP. Key products offered include a range of inductively coupled plasma spectrometers (ICP), DC Arc spectrometers and turnkey, cold vapor, mercury analyzers.

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**Thermo Fisher Scientific**  
[www.thermofisher.com](http://www.thermofisher.com)  
Booth 48-49

**Thermo Fisher Scientific** is the world leader in serving science. The company delivers the industry's broadest selection of analytical instruments, equipment, consumables and laboratory supplies. Thermo Fisher Scientific has over 39,000 employees and serves more than 350,000 customers in environmental, mining and industrial settings, in addition to universities, research institutions and government agencies.

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**ThyssenKrupp Polysius AG**  
[www.polysius.de](http://www.polysius.de)  
Booth 34

**ThyssenKrupp Polysius** is a strong partner for the cement and minerals industry in offering engineering, design, commissioning and service activities for complete production lines, individual products, conversions and upgrades. Our scope covers plant and laboratory automation systems for monitoring, control, regulation and optimization of the process, as well as for assuring constant product quality.

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**Transition Technologies**  
[www.transition.ca](http://www.transition.ca)  
Booth 7

**Transition Technologies** has been serving the Canadian scientific community since 1994 with products, services and applications support. We recently partnered with Bruker to handle combustion instruments (C, H, N, O, S), their complete line of arc/spark spectrometers, and hand-held XRF systems. We also specialize in automation and consumables for ICP optical and mass spectrometry.

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## Programme Social / Social Activities

Several events and social activities have been organized within the framework of the 44th annual CMA Conference. For attendees who wish to partake, the organizing committee provides a casual and relaxed atmosphere as well as a unique opportunity to discover and enjoy magical sites and more of the host region.

### Social Activities

#### Welcoming Mixer | Sunday, September 9

The “Welcoming Mixer” event will be held on Sunday evening, September 9, 2012 at Loews Hotel Le Concorde at the La Galerie Lobby Bar (first floor), from 6:00 pm to 8:00 pm. A selection of wine and tasty hors d’oeuvres will be served. You will have a chance to know one another in a festive and casual setting. Dress code is casual.



#### Sponsored by:



**HERZOG**



**Anachemia Science**

#### Opening Reception | Monday, September 10

The “Opening Reception”, a cocktail with fine wine and cheese, will be held on Monday evening, September 10, 2012, at the Loews Hotel Le Concorde at the Foyer (Exhibit Hall), from 6:00 pm to 8:00 pm. A selection of wines and regional cheeses as well as tasty hors d’oeuvres will be served. You will have a chance to know one another in a festive and casual setting. Dress code is casual.



#### Sponsored by:



#### Banquet Dinner | Tuesday, September 11

The “Banquet Diner” will be held on Tuesday evening, September 11, 2012, at the Québec Parliament’s Le Parlementaire restaurant. The event is scheduled to start at 6:00 pm. A menu featuring local products and a Beaux arts dining room located in the inner courtyard of the National Assembly will delight you. An unaccompanied tour of the Parliament building, including a visit of the Legislative Council Chamber and the National Assembly Chamber, will be optional. The Banquet Dinner promises great surprises, great networking and excellent cuisine. Dress code is formal.



#### Sponsored by:





### Business Lunch | Wednesday, September 12

The “Business Lunch” will be held on Wednesday, September 12, 2012, at Loews Hotel Le Concorde in room Jean-Paul Lemieux, from 12:30 pm to 2:30 pm. A mouth-watering meal will be served at lunch. The idea of this activity is to make a pause and take stock of what the CMA has accomplished during the past year. For the occasion, the Best Paper Award will honour the author(s) of a paper of exceptional merit. Also, a prize recognizing the best in exhibition boot design will be awarded. Dress code is formal

Sponsored by:



**Agilent Technologies**



**PANalytical**

**SGS**

### Claisse Facility Tour | Thursday, September 13

The “Facility Tour” will be held on Thursday, September 13, 2012, from 9:00 am to 4:00 pm. The tour of the facility will provide participants with a glimpse into Claisse’s operations as well as an inside look at some of the company’s research and development efforts. Dress code is casual.

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### Mid-Autumn BBQ Event | Thursday, September 13

The “Mid-Autumn BBQ Event” will be held on Thursday evening, September 13, 2012, at the Manoir Montmorency (Parc de la Chute Montmorency), starting at 6:00 pm. In a decor reminiscent of the grand homes of yesteryear—you’ll find classic architecture, a delightful garden, antique furnishings and works of art—this festive social gathering will allow you to enjoy fine BBQ and grilling recipes. Dress code is casual.

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## Other Activities

### Continental Breakfast

Monday, September 10, from 7:00 am to 8:00 am, in room Cullen.

Sponsored by:



Tuesday, September 11, from 7:00 am to 8:00 am, in the exhibit hall.

Sponsored by:



Wednesday, September 12, from 7:00 am to 8:00 am, in the exhibit hall.

Sponsored by:



Thursday, September 13, from 7:00 am to 8:00 am at the restaurant l'Astral.

Sponsored by:

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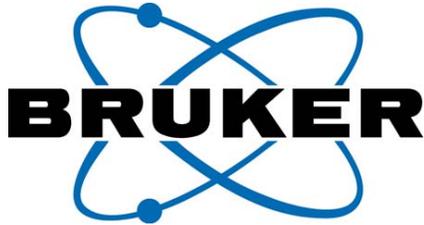


## Buffet Lunch

A complete buffet lunch will be provided as part of your ticket. Choose from a wide array of catered lunch selections, all part of an extensive menu.

Monday, September 10, from 12:00 am to 1:30 pm, at La Galerie Lobby Bar located on the first floor.

Sponsored by



Tuesday, September 11, from 12:00 am to 1:00 pm, at the Foyer (exhibit floor).

Sponsored by:





## Coffee Breaks

During coffee breaks, we will be serving coffee and tea, along with different quality snack options.

Monday, September 10, from 10:00 am to 10:30 am, in room Cullen.

Sponsored by:



Monday, September 10, from 3:00 pm to 3:30 pm, in room Cullen.

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Tuesday, September 11, from 10:00 am to 10:30 am, in the exhibit hall.

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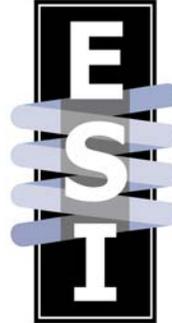




## Coffee Breaks

Tuesday, September 11, from 3:00 pm to 3:30 pm, in the exhibit hall.

Sponsored by



Wednesday, September 12, from 10:00 am to 10:30 am, in the exhibit hall.

Sponsored by



## Starbucks coffee maker and candy (“bonbons”) station

Tuesday, September 11, 2012, all day, in room Leduc Fortin.

# Heraeus



## 2012 CMA Contests

The 2012 CMA Conference holds some surprises. Among other things, plenty of contests are opened to all attendees and exhibitors. One of them is the “Contest to win a new Apple iPad”.

### Contest to win a new Apple iPad

Here are the ways to enter for a chance to be the winner:

#### 1) Submit workshop-related question(s)

Interact online with the experts hosting the workshops via Facebook. The application is now at your disposal. All you have to do is ask your questions—or make your comments—regarding the workshop content, and a prompt reply will be given. *Submitting one or more workshop-related question(s) using Claisse’s Facebook page is ONE of the ways to earn a chance to win the new Apple iPad;*

#### 2) Submit topical questions for panel discussion

Interact with panelists, and contribute to the discussion by sending in your topical question(s) which will then be answered by panelists also using Claisse’s Facebook page. Your question(s) should be dealing with real-life laboratory issues or matters of interest at the analytical technology level (e.g. questions on subjects such as quality control-related issues, sampling, validation of methods, proficiency testing, record keeping, internal audit, traceability, measurement uncertainty, application and implementation of ISO 17025 and NI 43-101 specific clauses, etc.). *Submitting your question(s) for panel discussion using Claisse’s Facebook page is ONE of the ways to earn the chance to win the new Apple iPad;*

#### 3) Vote for your favorite exhibit booth space design (starting on September 11th)

The 44th Annual CMA Conference is an important event for many exhibitors looking to raise their profile. A prize recognizing the “Best in Exhibition Booth Space Design” at this year’s conference will be awarded. The Organizing Committee invites you to vote for the booth you think deserves this title. Conference participants wishing to cast a vote will be able to do so from September 11, via Claisse’s Facebook page, using the “Contest” application. Voting for your favorite exhibit booth space design is ONE of the ways to earn a chance to win the new Apple iPad;

\*By receiving your vote, your favorite exhibitor also earns a chance to win the Grand Prize.

#### 4) Vote for the Best Oral Technical Session (starting on September 11th)

Voted by attendees, the “Best Oral Technical Session Award” will honor the author(s) of a paper of exceptional merit dealing with a subject related to the CMA technical scope. This award will be given to the oral presentation that the attendees vote as the best. Conference participants wishing to cast a vote will be able to do so, from September 11, via Claisse’s Facebook page, using the “Contest” application. *Voting for your favorite paper is ONE of the ways to earn a chance to win the new Apple iPad;*

\*By receiving your vote, your favorite conference speaker also earns a chance to win the Grand Prize.



## Résumé du congrès / Conference Program Overview

The 2012 CMA program features a rich program of oral presentations, workshops, panel discussions, posters, business meetings, lunches, social activities, and of course, prominent industry figures.

### Sunday, September 9, 2012

#### Conference Registration and Check-In

Time	Location	Activities
2:00 pm – 8:00 pm	La Galerie Lobby Bar (located on the first floor)	Registration Desk

#### Social Activities

6:00 pm – 8:00 pm	La Galerie Lobby Bar (located on the first floor)	<b>Welcoming Mixer</b> Happy hour in a well reputed hotel and lovely setting overlooking the Plains of Abraham.
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## Monday, September 10, 2012

### Conference Registration and Check-In

Time	Location	Activities
8:00 am – 6:00 pm	Foyer (Exhibit Hall)	Registration Desk

### Workshop

#### Room Borduas

8:30 am – 12:00 pm	PerkinElmer	How to Get the Most out of Your ICP-OES and ICP-MS
1:30 pm – 5:00 pm	Bruker AXS GmbH	New Advances in XRD/XRF Analysis for the Minerals and Mining Industry

### Poster Session

#### Room Borduas (from 6:00 pm to 8:00 pm)

Craig Taylor	Agilent Technologies	New methodology for determination of gold and precious metals using the Agilent 4100 MP-AES
Vasile Viman, Ph.D.	Technical University of Cluj-Napoca	The Determination of Heavy Metals from Minerals with the Method of Inductively Coupled Plasma Atomic Emission Spectrometry
Yoseif Makonnen	Queen's University	An Argon-Nitrogen-Hydrogen Mixed-gas Plasma as a Robust Ionization Source for Inductively Coupled Plasma Mass Spectrometry (ICP-MS)
Claudiu Margin	Babes-Bolyai University	Study on the radioactivity ash of the Sărmășag lignite, Sălaj county Romania
Alexander Seyfarth	Bruker AXS inc.	Optimum accuracy with custom calibration approaches using HH ED XRF
Melisew Tadele	National Chung-Hsing University	Silver coated magnetic nanoparticles for detection of aqueous benzoic acid
Pamela Wee	Agilent Technologies	Superior reaction control with a triple quadrupole ICP-MS

### Exhibit Hall Information

8:00 am – 4:00 pm	Exhibit Hall	Exhibit Set-up Exhibit Set-up Hours (contact GES for storage, handling and any other services to goods)
6:00 pm – 8:00 pm	Exhibit Hall	Exhibit Hours

### Breaks

7:00 am – 8:00 am	Room Cullen	Continental Breakfast
10:00 am – 10:30 am	Room Cullen	Coffee Break
12:00 pm – 1:30 pm	La Galerie Lobby Bar	Buffet Lunch - available for workshop attendees (only at the first floor)
3:00 pm – 3:30 am	Room Cullen	Coffee Break

### Social Activities

6:00 pm – 8:00 pm	Foyer (Exhibit Hall)	<b>Opening Reception</b> Classic event featuring some of the finest wine and regional cheeses.
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## Tuesday Morning, September 11, 2012

### Oral Presentations - Morning Session

Chairman - John A. Anzelmo | Claisse  
Co-chairman - Ravi Yellepeddi | Thermo Fisher

Time	Speaker	Company	Title
8:00 am	Simard/Anzelmo	Corporation Scientifique Claisse	Opening remarks by Conference Chairman/Technical Program Chairman
8:20 am	Russ Calow, B.Sc., CChem	SGS Minerals Services - <b>Keynote address</b>	Current Trends in mining and laboratories: changes are occurring, will you be ready?
9:00 am	Mathieu Bouchard, M.Sc.	Corporation Scientifique Claisse	Comparison study between the Standard Method ISO 9516-1 for Analysis of Iron Ore and a global methodology using calibration based on certified reference materials
9:20 am	Pierre Pelchat	NRC/Geological Survey of Canada	Overview of pXRF spectrometry at the Geological Survey of Canada
9:40 am	Bart De Baere, Ph.D.	University of British Columbia, Department of Earth, Ocean and Atmospheric Sciences, Vancouver	Measuring mineral dissolution kinetics using an automated flow-through dissolution module
10:30 am	Sharon Ness, Ph.D.	Intertek Genalysis Laboratory Services - <b>Invited speaker</b>	X-ray Analysis of mining and minerals materials in the commercial laboratory - XRF and XRD - their strengths and weaknesses
11:00 am	Eric Arseneault, B.Sc.	Xstrata Zinc Canada- Brunswick Smelter	Challenge around implementing a Lean Methodology in a lab environment
11:20 am	Manny Almeida, Ph.D.	Teledyne Leeman Labs	Analysis of mining samples using a CID detector based Inductively Coupled Plasma Spectrometer
11:40 am	Bussaraporn Patarachao, M.Sc.	National Research Council Canada NRC Energy, Mining, Environmental	Speed and accuracy improvements in TXRF quantification of low-Z metals using borate fusion

### Exhibit Hall Information and Registration

Time	Location	Activities
8:00 am – 12:00 pm	Foyer (Exhibit Hall)	Registration Desk
9:00 am – 12:00 pm	Exhibit Hall	<b>Exhibit Hours</b> Exhibitors display their products and services in the Exhibit Hall of the Loews Le Concorde.

### Breaks

7:00 am – 8:00 am	Exhibit Hall	Continental Breakfast
10:00 am – 10:30 am	Exhibit Hall	Coffee Break
12:00 pm – 1:30 pm	Foyer (Exhibit Hall)	Buffet Lunch

### Miscellaneous

All Day	Room Leduc -Fortin	Go to the Starbucks coffee maker to get the coffee of your choice! Go to the Candy Station to get the “bonbons” of your choice!
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## Tuesday Afternoon, September 11, 2012

### Oral Presentations - Afternoon Session

Chairman - Anthony Chalhoub | PerkinElmer  
Co-chairman - Bruno Vrebos | PANalytical

Time	Speaker	Company	Title
1:00 pm	Timothy Fawcett, Ph.D.	ICDD <b>- Invited speaker</b>	Advanced Mineral Analyses by X-ray Powder Diffraction
1:30 pm	Slobodan Jovanovic, Ph.D.	Canadian Nuclear Safety Commission Laboratory	Uranium species in standard reference materials
1:50 pm	Jane Thomas, M.Sc.	Wyoming Analytical Labs <b>- Invited speaker</b>	Applications of XRF in the coal and minerals analysis laboratory
2:10 pm	Mike Beauchaine	Bruker AXS Inc.	The use of portable Total Reflection X-ray Fluorescence (TXRF) for trace element analysis of mine tailings, water run-off, and heavy metal uptake of biological organisms (Lichens and Daphnia) in the field
3:00 pm	Kai Behrens, Ph.D.	Bruker AXS GmbH <b>- Invited speaker</b>	Grade control of ores - How XRF delivers accuracy and precision in daily routine
3:30 pm	Uwe König, Ph.D.	PANalytical	Application of rapid X-ray diffraction (XRD) and cluster analysis to grade control of ores
3:50 pm	Richard Rousseau, Ph.D.	Les logiciels R. Rousseau	How to apply X-ray Spectrometry to the quantitative analysis of geological materials
4:10 pm	Skage Hem, Ph.D.	FLSmidth, Automated Analysis Technology	Implementation strategies for laboratory automation, exemplified by different types of systems and applications
4:30 pm	Louis Gendreau, M.Sc.	Cleveland Cliffs Mining <b>- Invited speaker</b>	The positive impact of integration to a larger organization on the laboratory operation and management

### Exhibit Hall Information and Registration

Time	Location	Activities
12:00 pm – 5:00 pm	Foyer (Exhibit Hall)	Registration Desk
12:00 pm – 5:00 pm	Exhibit Hall	<b>Exhibit Hours</b> Exhibitors display their products and services in the Exhibit Hall of the Loews Le Concorde.

### Breaks

3:00 pm – 3:30 am	Exhibit Hall	Coffee Break
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### Social Activities

Starting at 6:00 pm	Québec Parliament's Restaurant Le Parlementaire	<b>Banquet Dinner</b> Located in the inner courtyard of the National Assembly building, Restaurant Le Parlementaire will delight you. A tour of the Parliament building will be optional. Dress code is formal. A bus will be available for transport at the front door of the Loews Hotel Le Concorde at 6:00pm; a bus will be available for return to hotel (from the Parliament) at 10:30 pm. ** For those who enjoy walking, the Parliament is within a five minute walking distance (ask the concierge for directions or use Google maps to view the exact location).
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### Miscellaneous

All Day	Room Leduc -Fortin	Go to the Starbucks coffee maker to get the coffee of your choice! Go to the Candy Station to get the "bonbons" of your choice!
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## Wednesday, September 12, 2012

### Oral Presentations - Morning Session

Chairman - Kai Behrens | Bruker AXS GmbH  
Co-chairman - Ed Debicki | Geoscience Laboratories

Time	Speaker	Company	Title
8:10 am	Fergus Keenan, M.Sc.	Thermo Fisher Scientific	Optimizing ICP-MS to address the needs of the mineral analyst.
8:30 am	Farhad Kaveh, Ph.D.	Queen's University, Department of Chemistry, Kingston	Solid sampling ETV-ICP-OES to study the distribution of elements in soil samples so as to ultimately locate undercover ore deposits
8:50 am	Bruno Vrebos, Ph.D.	PANalytical <b>- Invited speaker</b>	Review of Applications of X-ray Florescence spectrometry in mining and geology
9:20 am	Shane Elliott	Agilent Technologies	Ultra-fast ICP-OES determinations of base metals in geochemical or mineral samples using next generation sample introduction technology
9:40 am	Aaron Hineman	PerkinElmer	Advances in RF technology for ICP-OES and its application to high TDS matrices
10:30 am	Ravi Yellepeddi, Ph.D.	Thermo Fisher <b>- Invited speaker</b>	Applications of an integrated XRF and full pattern XRD in minerals
11:00 am	Maureen E. Leaver, BSc.	CANMET – Mining, Natural Resources Canada	Observations on the Data from CCRMP Certified Reference Materials and Proficiency Testing Program – Mineral Analysis Laboratories (PTP-MAL)

### Panel Discussion

Chairman - Kai Behrens | Bruker AXS GmbH  
Co-chairman - Ed Debicki | Geoscience Laboratories

11:20 am	Carol Campbell	Standards Council of Canada	Mineral Analysis Testing Laboratories – A <b>Panel Discussion</b> on technical issues and concerns that challenge laboratories in producing reliable and consistent results
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### Exhibit Hall Information and Registration

Time	Location	Activities
8:00 am – 12:00 pm	Foyer (Exhibit Hall)	Registration Desk
9:00 am – 12:00 pm	Exhibit Hall	<b>Exhibit Hours</b> Exhibitors display their products and services in the Exhibit Hall of the Loews Le Concorde.
2:00 pm – 4:00 pm	Exhibit Hall	Exhibit Tear-Down

### Breaks

7:00 am – 8:00 am	Foyer (Exhibit Hall)	Continental Breakfast
10:00 am – 10:30 am	Exhibit Hall	Coffee Break

### CMA Activities

12:30 pm – 2:30 pm	Room Jean-Paul Lemieux	<b>Business Lunch</b> For the occasion, the Best Paper Award will honor the author(s) of a paper of exceptional merit. Also, a prize recognizing the best in exhibition booth design will be awarded. Dress code is casual.
2:30 pm - 3:30 pm	Room Borduas	<b>CMA Business Meeting</b> Annual CMA meeting for all members.



## Thursday, September 13, 2012

### Claisse Tour

Time	Location	Activities
7:00 am – 8:30 am	Restaurant L'Astral	Continental Breakfast
<b>Claisse Tour Group 1</b> 9:00 am – 12:00 pm Departure time from Loews at 8:30 am	Corporation Scientifique Claisse (place of business)	<b>Claisse Facility Tour</b> Group 1 visits Claisse's laboratories and installations. A bus will be available for transport at the front door of the Loews hotel at 8:30 am.
<b>Claisse Tour Group 2</b> 1:30 pm – 4:30 pm Departure time from Loews at 1:00 pm	Corporation Scientifique Claisse (place of business)	<b>Claisse Facility Tour</b> Group 2 visits Claisse's laboratories and installations. A bus will be available for transport at the front door of the Loews hotel at 1:00 pm.
Departure time from Loews at 5:30 pm	Parc de la Chute-Montmorency	<b>Mid-Autumn BBQ Event</b> This festive social gathering will allow you to enjoy fine BBQ and grilling recipes. Dress code is casual. A bus will be available for transport at the front door of the Loews hotel at 5:30 pm.



## Ateliers / Workshops

The 2012 CMA scientific program also features a group of distinguished experts from PerkinElmer and Bruker AXS who will deliver, on September 10th, a full day of practical conference workshop covering the topics of “New Advances in ICP” and “XRD/XRF Analysis for the Minerals and Mining Industry”.

### PerkinElmer

#### Title:

**How to Get the Most out of Your ICP-OES and ICP-MS.**

#### Time:

Monday, September 10, 2012 from 8:30 am to 12:00 pm in room Borduas.

Coffee break from 10:15 am to 10:30 am

#### Instructors:

- Aaron Hineman, Product Specialist
- Paul Krampitz, Senior Specialist
- Chady Stephan. Product Specialist

#### Details:

##### ICP-OES

- Dealing with high-salt samples and difficult samples
- Tips for running fusion samples at 8 L/min
- Introduction system maintenance and demonstration (Interactive)

##### ICP-MS

- Discussion on interference removal
- Interactive session on cell technologies
- Introduction system maintenance and demonstration with the shell (Interactive)

##### ICP Generic

- Choosing the best introduction system for your application
- Reducing reruns using electronic tools
- Discuss the advances in automation for ICP-OES and ICP-MS in the Minerals and Mining Industry

##### Open Session

- Time to talk about your application





The 2012 CMA scientific program also features a group of distinguished experts from PerkinElmer and Bruker AXS who will deliver, on September 10th, a full day of practical conference workshop covering the topics of “New Advances in ICP” and “XRD/XRF Analysis for the Minerals and Mining Industry”.

## Bruker AXS GmbH

### Title:

**New Advances in XRD/XRF Analysis for the Minerals and Mining Industry**

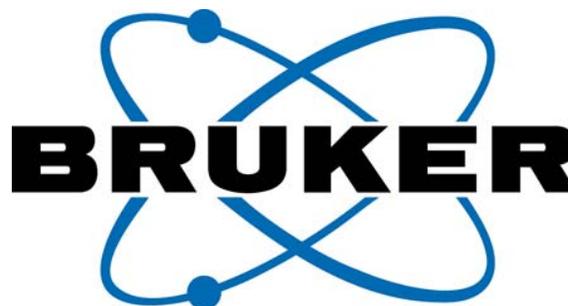
### Time:

Monday, September 10, 2012 from 1:30 pm to 5:00 pm in room Borduas

Coffee break from 3:15 pm to 3:35 pm

### Instructors:

- Arkady Buman, Product Manager XRF -US
- Dan Pecard, SR applications scientist XRF
- Dr. Kai Behrens, Product manager XRF-DE



### Detail:

#### XRD

- What is standardless XRD analysis
- Why XRD can now be used in process control
- Examples of XRD analysis in process control
  - High Grade Fe Ore, Low Grade Fe Ore, Mill scales, Oxidation State, Raw Materials for Al Industry, Aluminum Bath Analysis, Selective Mining,
  - Good Laboratory Practices for XRD analysis in daily practice

#### XRF

- Modern XRF technology for mining labs
  - Sequential or Simultaneous WDXRF?
  - EDXRF or WDXRF?
- Good Laboratory Practices for XRF analysis in daily practice
- Best sample prep methods for Mining
  - Pressed pellets and Fusion
- Examples of XRF analysis in Process Control
  - Grade Control for Fe Ore, Cu and precious metals, Exploration and tailings, Industrial Minerals

#### Working Demonstrations

- Live Demonstration of XRD/TXRF and possibly XRF



## Présentation des Posters / Poster Session

Also slated to take place during the Conference is a poster session featuring knowledgeable presenters discussing topics of interest in the field of analytical technology. The poster session will be held on Monday, September 10, 2012, from 6:00 pm to 8:00 pm, during the Opening Reception (wine and cheese).

### New methodology for determination of gold and precious metals using the Agilent 4100 MP-AES

Authors: Craig Taylor, Shane Elliott.  
Affiliation: Agilent Technologies

Precious metals (Au, Pt, Pd) were measured in fire assay samples using the new MP-AES instrument. The analysis gave good agreement with results from flame AAS, but was found to offer significant improvements over AA. The use of N<sub>2</sub> gas rather than flammable Acetylene and nitrous oxide not only reduces running costs, but also increases safety and allows the instrument to run unattended overnight. Method detection limits on the MP-AES were found to be 4 ug/L for Au, 13 ug/L for Pt and 0.7 ug/L for Pd, offering a significant improvement over AAS. The MP-AES gave excellent agreement with certified materials and was also within 95-105% agreement when compared to AAS determinations.

### The Determination of Heavy Metals from Minerals with the Method of Inductively Coupled Plasma Atomic Emission Spectrometry

Vasile Viman, Mariana Dobra, Gheorghe Vătcă. Technical University of Cluj-Napoca, North University Center of Baia Mare, V. Babeş Street 62A, Romania, vasileviman@yahoo.com, Claudiu Vasile Margin, Environmental Science Faculty, Babeş-Bolyai University Cluj-Napoca

The ores in the researched area are characterized by the existence of Pb, Cu, Zn metals in their composition, as major components, and of Cd, Co, Mn, As metals as minor components. These ores have a poly-metallic characteristic and, from the point of view of chemical combination types in which these metals are found, the sulphides prevail. The ores have a chemical composition very different from that of earth crust, due to them being formed under exceptional conditions or as a result of a succession of events.

For the determination of the major components' concentration, collecting the samples is necessary to ensure representation, objectivity and efficiency.

Quantitatively, the collected samples were 200 g, quantity that has been reduced to 30 g, in such way that the representation of the sample is not affected by reduction. The samples have been subjected to mineralogical - petrography analyzes and to analyzes through physical - chemical methods, mainly to the method of inductively coupled plasma atomic emission spectrometry (ICP-AES).

The samples have been roasted at 1000 oC.

0.29 g of sample were weighed, melted with 1 g LiBO<sub>2</sub> previously roasted at 600 oC in Pt containers. The roasting has been done in order to avoid splashing when roasting with the sample. The melt is dissolved in HCl solution. The obtained solution is brought to 100 ml in a quoted balloon. The final solution contains 3% HCl.

The analytical signal has not been corrected with the computer of the ICP-AES 2000 apparatus, for each type of matrix a witness sample containing 3% HCl and LiBO<sub>2</sub> has been made.



The samples' solutions have been subjected to analyze with the ICP-AES method, the spectral lines emitted by Pb, Cu, Zn elements being established, when they are being introduced into the inductively coupled plasma, which develops a temperature of 10000 K.

The established lines are of 220.35 nm for Pb, 324.75 nm for Cu and 213.36 nm for Zn.

To obtain an optimal analytic signal, the torch has been regulated with a standard solution of yttrium with a content of 1000 ppm, the torch has been centered on horizontal and vertical. The debit of Ar as a carrying gas has been chosen in such way that there's a maximum signal. This has been realized at a cooling Ar debit of 0.5 l/minute, and the carrying Ar debit was 0.6 l/minute.

The experimental determinations have shown concentrations of 1500 - 12300 ppm for Pb, 1582 - 3230 ppm for Cu and 9333 - 9520 ppm for Zn.

Samples of international standards have been analyzed for the verification of the ICP-AES method: andesite: AGV - American and JA-1, JA-2 and JA-3 - Japanese. Comparing the content of Pb, Cu and Zn in standards with the content determined with the ICP-AES method, differences of 1.2% at Pb, 1.7% at Cu and 3.2% at Zn, at the most, have been found.

It can be appreciated that the ICP-AES method for analyzing minerals is sufficiently performing for determining the concentrations of major and minor components, and the results of the determinations are useful for metallurgists, geologists and chemists, but also in pollution studies.

The utilized analyzing method also has the advantage that it can simultaneously determine 50 elements, but, having a photomultiplier, sequential analyzes for different elements of the sample can also be done.

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### An Argon-Nitrogen-Hydrogen Mixed-gas Plasma as a Robust Ionization Source for Inductively Coupled Plasma Mass Spectrometry (ICP-MS)

Yoseif Makonnen

Dr. Diane Beauchemin

Queen's University, Department of Chemistry

A simple, alternative approach to reduce non-spectroscopic interferences (matrix effects) in ICP-MS involves the use of mixed-gas plasmas, where a foreign molecular gas partially or entirely replaces one or more of the four plasma gas flows: outer, auxiliary, sheath or nebulizer. Argon plasmas have been mixed with gases such as helium, nitrogen, hydrogen, air, oxygen, xenon and methane (1; 2; 3).

In this study, an Ar-N<sub>2</sub>-H<sub>2</sub> mixed-gas plasma was optimised in an attempt to find conditions providing robustness with no sacrifice in detection limit. Hydrogen is added as a sheath around the nebulizer flow.

Figure 1 compares the overall performance across the mass range of the optimized Ar-N<sub>2</sub>-H<sub>2</sub> mixed-gas plasma to the Ar plasma under robust conditions. The optimized Ar-N<sub>2</sub>-H<sub>2</sub> mixed-gas plasma is clearly superior to the Ar plasma. The optimized Ar-N<sub>2</sub>-H<sub>2</sub> mixed-gas plasma also significantly decreases the oxide fraction (from 6.5 % to 0.5 %), while it slightly increases that of double charged ions (from 2.7 % to 7.0 %).

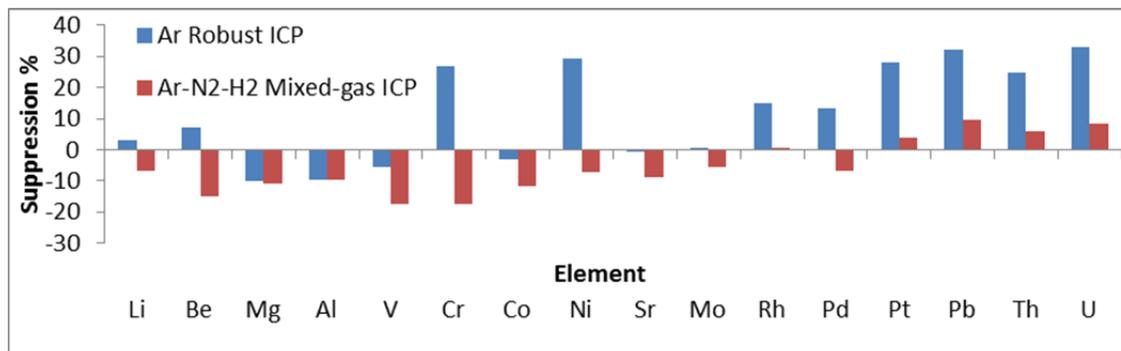
Although there were on average an almost 2-fold improvement in detection limits for 10 elements (Mg, Al, V, Co, Ni, Cu, Zn, Ru, Rh, Au) in 0.1 M Na, detection limits were generally degraded by 5 to 15 fold when using the mixed-gas plasma versus the Ar plasma. On the other hand, a reduction in background intensity resulted (in particular for Ar dimmers and ArO<sup>+</sup>), except for nitrogen-containing ions whose intensity naturally increased.

The optimized Ar-N<sub>2</sub>-H<sub>2</sub> mixed-gas ICP provides improved plasma robustness, with respect to matrix effects,



in comparison to Ar plasmas was demonstrated through the accurate determination of multiple elements in environmental samples (NASS-5, NASS-6, NILAT-N-3, ME-3, PGMS-19 and PD-1) by a simple external calibration, without any internal standardization or matrix matching. It is in fact more robust than a previously optimized Ar-N<sub>2</sub>-N<sub>2</sub> mixed-gas ICP, as it provided more accurate and precise results.

Figure 1.



## References

1. S. M. Burchell. Investigations of Mixed-Gas Plasmas Using a Sheathing Device for ICP-MS. MS Thesis, Queen's University, Kingston (2000). Print.
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## Study on the radioactivity ash of the Sărmășag lignite, Sălaj county Romania

Claudiu MARGIN

<sup>1</sup>Faculty of Environmental Science and Engineering, Babes-Bolyai University, Cluj-Napoca, Romania

The coal deposits still represents the main source of energy production in the world as well as in our country. After the coal is burned, the resulted substances can reach the environment, including soil, water and vegetation. The industrial slag also contains long-lived radionuclids, which can effect the environment for a very long time. This study presents the radioactive content (<sup>238</sup>U, <sup>232</sup>Th and <sup>40</sup>K) of the coal ash mine from Sărmășag area, Sălaj county, Romania.

### Introduction

Physicochemical and biological processes can lead to accumulation of radioactive elements in coal. This is the reason why we wish to identify these elements in ash samples. Surface coal mines contain some radioactive elements from the earth's crust, resulting in increased surface radioactivity. The radioactivity of coal ash content is given mainly by uranium, thorium, potassium and radium (over 80%) (Mauna et Mauna Aren, 2008).

This, accumulation of uranium in coal can vary from place to place depending on the deposits and the geological era of the region. The main radio-nucleus that we encounter in coal and ash are: <sup>238</sup>U, <sup>235</sup>U, <sup>232</sup>Th, <sup>40</sup>K, <sup>226</sup>Ra, <sup>214</sup>Pb, but in addition to these radio-nucleus come across traces of bismuth, polonium, etc can come across. According to the data provided and published by Bradley in 1993, these radio-nuclei are primarily responsible for the emission of radiation.



## Calibration procedure for Optimum accuracy using a Handheld XRF

Alexander Seyfarth

\*\*Bruker Elemental, Kennewick, Washington, USA

Traditional XRF (WD XRF) is a well accepted method for elemental analysis of majors, minors and traces in the geochemist's toolkit. XRF is able to measure a sample directly, without having to atomize and destroy the sample as needed for an ICP analysis. Nevertheless specimen preparation is required, involving the grinding of the sample and potentially (for majors) the fusion of the sample with a glass former to achieve highest accuracy. In this case the non destructive technique is "destructive" although the specimen remains intact as prepared after the analysis and can be used again. How about using powders or fine grained samples directly, or better still can we analyze rock samples directly? The talk starts with the fundamental physics governing XRF and specimen preparation and applies them to the analysis sediments, soils and rocks using hand held XRF. With the concepts in mind it will show the limitations of Point and Shoot instrumentation covering matrices from Limestone to Clays!. By applying lab based XRF calibration concepts to hand held XRF it is possible to achieve comparable results, without sample preparation. Now the hand held XRF can be utilized in the field directly. The approach is illustrated with examples from the field. With the right calibration(s) HH XRF is better than ever, as long as one does not try to overcome the basics physics and is aware of the in homogeneity of the specimen.

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## Silver coated magnetic nanoparticles for detection of aqueous benzoic acid

Melisew Tadele, Jyisy Yang

Department of Chemistry, National Chung-Hsing University, Taichung 402, Taiwan

In this work, silver coated magnetic nanoparticles (Ag@MNPs) are prepared for surface enhanced Raman spectroscopy (SERS) measurements. The magnetic nanoparticles were synthesized from iron (II) and iron (III) solutions by coprecipitation reaction using ammonium hydroxide as precipitating agent. Deposition of silver nanoparticles on the surface of Fe<sub>3</sub>O<sub>4</sub> was done by silver mirror reaction; specified amount of AgNO<sub>3</sub> was mixed with NaOH with subsequent addition of ammonium hydroxide until the Ag<sub>2</sub>O is dissolved. The attraction of AgNPs onto the surface of magnetic nanoparticles (MNPs) was done by soaking MNPs into silver mirror reaction solution under designated conditions. The prepared Ag@MNPs were recovered from the reaction mixture by inserting a cylindrical magnet to attract the particles on the top of magnet. Concentration of AgNO<sub>3</sub>, silver mirror reaction time, amount of magnetic nanoparticles and concentration of iron solutions are the parameters used to optimize the conditions during preparation of the substrate. With a silver mirror reaction time of 6 min, the higher of the concentration of silver nitrate, the better of the SERS signals was obtained. Compared to the SERS signals on AgNPs coated glass substrate, Ag@MNPs prepared in this work further enhance the SERS signals with an order of magnitude as compared to the conventional planar SERS substrate such as Ag@glass. To examine the performance of the prepared Ag@MNPs, the magnet covered with Ag@MNPs was soaked into a pNTP solution for 1 hr to form monolayer of pNTP on the AgNPs that gave reproducible results. This substrate is used for the determination of benzoic acid. Because magnetic fields induce aggregation of Ag@MNPs, the samples in the presence of the magnet exhibit a strong SERS signal compared to the none assembled.

Key words: Benzoic acid; magnetic nanoparticles; silver nanoparticles; surface-enhanced Raman scattering (SERS)



## Superior Reaction Control with a Triple Quadrupole ICP-MS and Enhanced Capabilities in Geochemical Analysis using a Unique ICP-MS/MS Collision/Reaction Cell System

Pamela Wee, Ed McCurdy

ICP-MS is an established technique for rapid, multiple element analysis of diverse materials. Capable of achieving detection limits in the parts per trillion range for most elements, conventional quadrupole ICP-MS is regrettably limited by spectral interferences. With the advent of collision/reaction cells (CRCs), many of these interferences have been reduced, but some problematic interferences remain.

Furthermore, in the quest for even lower detection limits in highly demanding materials, however, conventional reaction-cell ICP-MS had to be improved.

The new Agilent 8800 triple quadrupole ICP-MS offers a unique solution for more effective removal of severe interferences. It is only ICP-MS system with a tandem mass spectrometer configuration. This allows the 8800 to operate in

MS/MS mode where the first quadrupole (Q1) controls the ions that enter the

CRC, providing consistent reaction processes in the cell, and allowing quantification of complex materials with widely varying compositions. Spectral interferences, backgrounds, and detection limits are dramatically reduced and sensitivities are doubled compared to single-quadrupole systems.

Example of MS/MS interference removal performance on the Agilent 8800 will be presented and the following advances analysis modes for methods development and research will be introduced:

1. Product Ion scan – Q1 fixed, Q2 scanned
2. Neutral Gain/Loss Scan - Q1 and Q2 scanned with a fixed mass difference
3. Precursor Ion Scan - Q1 scanned, Q2 fixed



## Programme synthèse / Schedule at a Glance

Sunday, September 9, 2012		
Registration (desk)	La Galerie Lobby Bar	From 2:00 pm to 8:00 pm
Welcoming Mixer	La Galerie Lobby Bar	From 2:00 pm to 4:00 pm
Monday, September 10, 2012		
<b>Continental Breakfast</b>	<b>Room Cullen</b>	<b>From 7:00 am to 8:00 am</b>
Registration desk	Foyer (Exhibit Hall)	From 8:00 am to 6:00 pm
Exhibit set-up	Exhibit Hall	From 8:00 am to 4:00 pm
Workshop – Perkin Elmer – Part 1	Room Borduas	From 8:30 am to 10:15 pm
<b>Coffee Break</b>	<b>Room Cullen</b>	<b>From 10:00 am to 10:30 am</b>
Workshop – Perkin Elmer – Part 2	Room Borduas	From 10:30 am to 12:00 pm
<b>Buffet Lunch</b>	<b>La Galerie Lobby Bar</b>	<b>From 12:00 am to 1:30 pm</b>
Workshop – Bruker – Part 1	Room Borduas	From 1:30 pm to 3:15 pm
<b>Coffee Break</b>	<b>Room Cullen</b>	<b>From 3:00 pm to 3:30 pm</b>
Workshop – Bruker – Part 2	Room Borduas	From 3:35 pm to 5:00 pm
<b>Opening Reception</b>	<b>Exhibit Hall</b>	<b>From 6:00 pm to 8 :00 pm</b>
Exhibit	Exhibit Hall	From 6:00 pm to 8:00 pm
Poster session	Room Borduas	From 6:00 pm to 8:00 pm
Poster session take-down time	Room Borduas	From 8:00 pm to 9:30 pm
Tuesday, September 11, 2012		
<b>Continental Breakfast</b>	<b>Exhibit Hall</b>	<b>From 7:00 am to 8:00 am</b>
Registration (desk)	Foyer (Exhibit Hall)	From 8:00 am to 5:00 pm
Exhibit	Exhibit Hall	From 9:00 am to 5:00 pm
Morning Oral Presentations - Part 1	Room Borduas	From 8:00 am to 10:00 am
<b>Coffee Break</b>	<b>Exhibit Hall</b>	<b>From 10:00 pm to 10:30 pm</b>
Morning Oral Presentations - Part 2	Room Borduas	From 10:00 am to 12:00 pm
<b>Buffet Lunch</b>	<b>Foyer (Exhibit Hall)</b>	<b>From 12:00 pm to 1:30 pm</b>
Afternoon Oral Presentations - Part 1	Room Borduas	From 8:00 am to 10:00 am
<b>Coffee Break</b>	<b>Exhibit Hall</b>	<b>From 10:00 pm to 10:30 pm</b>
Afternoon Oral Presentations - Part 2	Room Borduas	From 10:00 am to 12:00 pm
<b>Banquet Diner</b>	<b>Quebec Parliament's restaurant Le Parlementaire</b>	<b>Departure time from Loews at 6:00 pm</b>
Wednesday, September 12, 2012		
<b>Continental Breakfast</b>	<b>Exhibit Hall</b>	<b>From 7:00 am to 8:00 am</b>
Registration (desk)	Foyer (Exhibit Hall)	From 8:00 am to 12:00 pm
Exhibit	Exhibit Hall	From 9:00 am to 12:00 pm
Morning Oral Presentations - Part 1	Room Borduas	From 8:00 am to 10:00 am
<b>Coffee Break</b>	<b>Exhibit Hall</b>	<b>From 10:00 pm to 10:30 pm</b>
Morning Oral Presentations - Part 2	Room Borduas	From 10:00 am to 12:00 pm
<b>Business Lunch</b>	<b>Room Jean-Paul Lemieux</b>	From 12:30 pm to 2 :00 pm
<b>CMA Business Meeting</b>	<b>Room Borduas</b>	<b>From 2:30 pm to 3:30 pm</b>
Exhibit Tear-Down	Exhibit hall	From 2:00 pm to 4:00 pm
Thursday, September 13, 2012		
<b>Continental Breakfast</b>	<b>Restaurant L'Astral</b>	<b>From 7:00 am to 8:00 am</b>
<b>Claisse Tour group 1</b>	<b>Corporation Scientifique Claisse</b>	<b>From 8:30 am to 12:00 pm</b>
<b>Claisse Tour group 2</b>	<b>Corporation Scientifique Claisse</b>	<b>From 1:00 pm to 4:30 pm</b>
<b>Mid-Autumn BBQ Event</b>	<b>Manoir Montmorency</b>	<b>Departure time from Loews at 5:30 pm</b>

# Merci

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Conference and Exhibit



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- 2- Submit your topical question(s) for panel discussion;
- 3- Vote for the best exhibit booth space design;
- 4- Vote for the Best Oral Technical Session Award.

More information available on **page 20**.





## Présentations Orales / Oral Presentations

The 44th annual CMA Conference promises to be a memorable one. Various distinguished scientists and reputed guest speakers will be discussing their views and allowing attendees to develop in-depth understanding of their topic.

### Tuesday, September 11, 2012 - Morning Session

Chairman - John A. Anzelmo | Claisse  
Co-chairman - Ravi Yellepeddi | Thermo Fisher

8:00 AM

#### Opening remarks by Conference Chairman/Technical Program Chairman

Mrs. Lucie Simard, M. John A Anzelmo  
Corporation Scientifique Claisse®, Québec, QC, Canada

8:20 AM

#### Current Trends in mining and laboratories: changes are occurring, will you be ready?

Russ Calow, B.Sc. CHEM. Vice President Global Geochemistry  
SGS Minerals Services, Lakefield, ON, Canada

#### Keynote Address

The author will examine the effect that China's, India's and Africa's growing and changing requirement for raw materials is having on the Global Mining Industry as well as the structural changes that are occurring due to Chinese national companies using their financial muscle to acquire and develop resources in all mining regions. In addition, the effects of a lingering recession in North America as well as financial upheaval in Europe will be examined for their immediate and mid-term impacts on the Mining Industry.

The author will also examine the effect that regional sociological factors are having on the Mining Analytical Industry and what laboratories need to do to respond to these structural and demographic changes in society in order to build effective operational teams.

Finally the author will examine the current state of analytical technology and highlight the effect of robotics on laboratories as well as highlight the potential effects of novel instrument platforms and the resurgence of XRF.



9:00 AM

## Comparison study between the Standard Method ISO 9516-1 for Analysis of Iron Ore and a global methodology using calibration based on certified reference materials

Mathieu Bouchard M.Sc. Chemist, Charles-Olivier Arsenault and Sébastien Rivard

Corporation Scientifique Claisse®, Québec, QC, Canada

Sharon Ness Ph.D. Senior XRF/XRD Chemist

Intertek Genalysis, Maddington, Western Australia, Australia

Mining companies, which sell their products in millions of tons, could incur millions of dollars of revenue losses as a result of the existence of a slight bias relating to the total iron analysis process. Following the same line of thought, the very survival of any mining company will depend to a large extent on the assays that are run on exploration samples, concentrate, internal standard and/or reference material. This stands true regardless if one is handling high-grade hematite, low-grade hematite or magnetite. The current International Standard Method, which remains widely accepted among peers, is the one entitled "Iron ores -- Determination of Various Elements by X-ray Fluorescence Spectrometry -- Part 1: Comprehensive Procedure" (ISO 9516-1:2003). However, there are a number of unveiled and corroborated limitations to the predominant version of this standard; adaptability is lacking when it comes to coping with recent advances in the fields of sample preparation by fusion and wavelength dispersive X-ray (WDXRF) spectrometry.

Firstly, this paper overviews the results of a survey conducted on our customers about the ISO 9516-1. The goal of this survey was to understand how our customers use this standard and how they cope with its limitations.

Secondly, this paper presents a light version of the ISO 9516-1 standard method for iron ores analysis based on a calibration using pure chemicals for calibration standards preparation. A single fusion method using a Claisse® M4TM fluxer is proven to prepare a very wide range of iron ore types from a worldwide selection.

Thirdly, another aspect is covered: the evaluation of a calibration based on the use of certified reference materials (CRMs) for preparation of the calibration curves. For this evaluation, the fusion methodology and the analytical line parameters from the previous works were used. The material presented in this paper allows laboratory, spectrometry, quality control processes, and so forth, to be simpler and more specific, efficient and user-friendly.

Furthermore, all collected data using the advanced methodologies implemented in combination with a Bruker S4 Explorer WDXRF Spectrometer, will be compared to the analytical requirements of ISO 9516-1. All deviations from the prevailing standard method parameters (calibration, standards, flux, fluxer, etc.) will also be pointed out and discussed.



9:20 AM

## Overview of pXRF spectrometry at the geological survey of Canada

Pierre Pelchat, Chemist  
Natural Resources Canada  
Geological Survey of Canada, Ottawa, ON, Canada

Portable XRF units (pXRF), with their attractive prices and ease of use, have become increasingly popular with field geoscientists for obtaining real-time geochemical data. However, most pXRF users have minimal laboratory experience and view these instruments as a time-saving shortcut for obtaining geochemical data, with little consideration of data quality. The Science Laboratory Network of the Geological Survey of Canada (GSC) has created an in-house center of expertise to optimise the field performance of pXRF geochemical analysis. Its focus is primarily on training, instrument standardisation, SOPs, spectral deconvolution and QA/QC. To date, the most important factor identified for obtaining the best instrument performance is training of users in SOPs for field geochemical analysis. The focus of the training is to improve and standardise data acquisition to the point where results are useable for the researcher's goals.

An example of the analytical variables introduced during training is the level of sample preparation, and its effect on the overall quality of the data. The physical properties of the sample have a strong influence on the quality of the data. A rock sample should be as flat and homogenous as possible, and non-weathered. Best results are obtained for rock powders, but pulverising is not always possible in a field situation. Presentation of the sample to the instrument is also critical. The distance between the sample and the instrument's measurement window influences the final results: a 3 mm gap (e.g., from a rough rock surface) can cause a sensitivity loss of >40%, which adversely affects data interpretation when the user is not aware it. We have also investigated pXRF type standardisation in order to optimise data acquisition for the matrices of interest to the geologist. Overlooking type standardisation and using the factory calibration alone can result in concentrations that are up to 30% low for some elements.

The GSC has a variety of pXRF instruments, each of which has their strengths and weaknesses. Knowledge of these helps in selecting the best instrument for one's objectives; e.g. the use of a field portable vacuum pump gives significantly improved analyses for low mass elements such as Mg and Al.

From our method development, we conclude that data quality is greatly improved by adopting a set of best practise protocols, which include : (1) daily monitoring of a blank sample for possible contamination issues and a monitor sample to check instrument performance versus the day it was purchased, (2) the insertion of replicates to check on precision of the analyses, (3) performing a type standardisation, if applicable, (4) verifying accuracy using appropriate CRMs, (5) checking a certain percentage of the analyses against total analyses (fusion-ICP/XRF) of the same samples from a commercial lab. These steps combined provide a robust QA/QC in a simple to understand SOP for field users of the instruments.

Overall, the GSC's ongoing research into pXRF analysis aims to demystify the black-box nature of these instruments and lower the potential for compromised research derived from erroneous analyses.



Tuesday, September 11, 2012 - Morning Session

9:40AM

**Measuring mineral dissolution kinetics using an automated flow-through dissolution module****Bart De Baere Ph.D.** Marine and Lacustrine Geochemistry / Geochemical Instrumentation Development,  
Roger Francois, Ulrich Mayer

Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver, BC, Canada

We have developed a purpose-built flow-through dissolution sample introduction module. The flow-through module can be programmed to simulate a wide range of chemical leaching conditions in a fully automated manner. Until now, this type of instrumentation has been used to carry out sequential leaching (Haley and Klinkhammer, 2002). The application we are presenting here focuses on the quantification of mineral dissolution rate constants.

The purpose-built flow-through module consists of gradient pumps, connected via solenoid valves to an ICP-MS. Samples are loaded in disposable filters, and are placed between two parallel solenoid valves. As the eluent passes through the filter, the sample gradually dissolves, and the effluent flows either (1) using the online mode, directly into an ICP-MS, generating a fully time-resolved signal or (2) using the offline mode, into a fraction collector for subsequent analysis. In-line pH sensors continuously record eluent and effluent pH.

As a proof of concept study, we focused on the widely studied dissolution kinetics of the mineral calcite. We obtained calcite fragments from Chihuahua, Mexico (Ward's Natural Science). Grains were sonicated in acetone until the supernatant was clear. A single calcite fragment (~4 mg) was then loaded in the flow-through dissolution module, and partly dissolved using DIW and HNO<sub>3</sub> of varying concentration. Using the online mode, the effluent was sent to an Agilent 7700 ICP-MS (Octopole Reaction System in He-mode) and analyzed for Ca.

We also developed a simple geochemical reactive transport model in PHREEQC, using the SOLUTION, RATES, KINETICS, and TRANSPORT keywords. The initial kinetic rate constants used in this forward model were obtained from a previously published study (Chou et al., 1989). Reactive surface area was estimated from the geometric surface area of the fragment. In order to optimize the forward model dissolution rate constants to best reflect the experimental data, PEST software (model-independent parameter estimation) was used to run an inverse model in a weighted least squares sense. Using this set-up, we are able to generate optimized dissolution rate constants and achieve a correlation coefficient between the geochemical model and the observed data of 0.99. Determination of surface area-normalized dissolution rate constants heavily rely on the accurate measurement of the reactive surface area - this aspect of the work is currently ongoing.

The key benefits of this newly developed technique include (1) time efficiency - in this study a typical leaching sequence covering a pH range from 2 to 6 lasted 100 minutes; (2) extensive data coverage (n=2000 in a 100min experiment) which is of particular value to optimize the fit between model and data; and (3) automation - the entire leaching sequence is fully programmed. This approach has the potential to rapidly generate a large database of dissolution rate constants for a wide range of minerals.

References cited:

Chou, L., et al., 1989. *Chemical Geology* 78: 269-282Haley, B.A., Klinkhammer, G.P., 2002. *Chemical Geology* 185: 51-69



Tuesday, September 11, 2012 - Morning Session

10:30AM

### X-Ray Analysis of mining and minerals materials in the commercial laboratory- XRF and XRD- their strengths and weaknesses.

Sharon Ness Ph.D. Senior XRF/XRD Chemist

Intertek Genalysis Laboratory Services, Maddington, Western Australia, Australia

**Invited speaker**

Recent developments have allowed for a significant increase in both the accessibility and cost-effective application of X-ray analytical techniques in commercial laboratories. XRF has benefited from the application of robotic systems to the preparation of fused beads, whilst XRD has had improvements in both hardware and software. The net effect has been the increased throughput of analyses for both techniques and consequently, with XRD, its commercial availability.

An overall discussion on the merits, along with the pitfalls, of both XRF and XRD will be given. This will include their effectiveness for various applications and the benefits of being able to provide a combined XRF/XRD analysis.

11:00AM

### Challenge around implementing a lean Methodology in a lab environment

Éric Arseneault, B.Sc. Laboratory Supervisor

Xstrata Zinc Canada- Brunswick Smelter, Belledune, NB, Canada

For many, Lean is the set of "tools" that assist in the identification and steady elimination of waste (muda). As waste is eliminated quality improves while production time and cost are reduced. There is a second approach to Lean Manufacturing, which is promoted by Toyota, in which the focus is upon improving the "flow" or smoothness of work, thereby steadily eliminating mura ("unevenness") through the system.

Lean has been identified as a continuous improvement system in manufacturing industry. The implementation of those same principles in a service type industry is often non-successful or difficult to sustain. The challenge in moving Lean to services is the lack of widely available reference implementations to allow people to see how directly applying lean manufacturing tools and practices can work and the impact it does have. This makes it more difficult to build the level of belief seen as necessary for strong implementation.

In 2009, Xstrata Zinc - Brunswick smelter had to position itself in the world market. Knowing that the end of the Brunswick mine was near, we had to compete against all the major player for concentrate. It was identified that the image of the Smelter was affected in part by the performance of the laboratory. Quality of the assays was not question but the delay was.

After understanding the process and applying Lean / Six-Sigma tools (Value Stream Mapping, Five S, Kanban, and poka-yoke) and some flow management, using the Plan-Do-Check-Act approach, the cycle time was reduce by more than half from 78 to 36 days. In addition to this reduction in cycle time we almost double the capacity of the lab (number of samples) keeping the same amount of people.

**11:20AM**

### **Analysis of Mining Samples Using A CID Detector Based Inductively Coupled Plasma Spectrometer**

Manny Almeida Ph.D. ICP Product Manager, Maura Rury  
Teledyne Leeman Labs, Hudson, NH, USA

The ICP spectrometer is an important tool in the mining/geological laboratory. The ability of the CID detector based ICP to provide simultaneous measurement of any number of elements/wavelengths gives the analyst the flexibility to handle the large variety of sample types analyzed in these types of labs. In addition, the CID detector, coupled with long focal length spectrometer produces better accuracy on complex matrices.

This paper will present the ICP analysis of selected mining/geological samples: Cu ore and concentrates. The data presented will include line selection and accuracy as well as results obtained under reduced argon flow conditions and sample throughput enhancement techniques.



11:40AM

**Speed and accuracy improvements in TXRF quantification of low-Z metals using borate fusion**

Bussaraporn Patarachao M.Sc. Technical Officer, Daniel Tyo, David M. Kingston and Patrick H.J. Mercier  
National Research Council Canada, NRC Energy, Mining and Environmental Portfolio, Ottawa, ON, Canada

A fast borate fusion sample preparation method was used for TXRF elemental quantification of high silica material. When coupled to TXRF element sensitivity curves (Fig. 1) measured specifically for that sample preparation technique, it is shown here that more accurate quantification of low-Z metals are achieved than those which follow from using element sensitivities provided by the manufacturer. Dissolution of high silica materials by borate fusion provides a completely dissolved and homogeneous solution. Comparatively, this technique takes much less time than traditional methods used for ICP-OES analysis of trace elements (0.1-10 ppm), without involving strong acids (e.g. HF, HNO<sub>3</sub>, HCl, HClO<sub>4</sub>) or microwave digestions. Moreover, borate solutions must be handled carefully in ICP-OES laboratory environments to prevent any clogging that may be caused by their high salt contents. With TXRF, the high salt content is not a problem, but it is necessary to dry the borate solution as a thin film on a flat reflector substrate in order for TXRF measurements to be made. Upon the drying of borate solution, small crystals are formed and are randomly and uniformly distributed under the X-ray irradiated area (Fig. 2). Elements of interest are all captured in these crystals as seen by SEM-EDX analyses. Quantification by TXRF requires knowledge of relative element sensitivities. Therefore, the element sensitivities of 22 elements measured by K- $\alpha$  lines in borate solution and double de-ionized water matrices were developed and compared with those of the manufacturer (Fig.1). The samples fused into solutions were custom standards made from mixtures of pure oxides. Differences in element sensitivities with respect to the manufacturer were observed for elements with lower atomic number (Fig. 3). The resulting element sensitivities determined for borate solutions were used for elemental quantification of samples and compared with elemental analyses derived from the manufacturer's element sensitivities. Improvement in accuracy (Fig. 4) was achieved for metals with low-Z atomic numbers (e.g. K, Ca and Ti) when using element sensitivities developed especially for borate solution matrix. With the methodology development presented here, it has thus become possible to obtain accurate quantification of trace elements in high silica material by TXRF. We expect this development to be particularly useful in obtaining a faster turnaround time on trace element analysis of high silica materials than by traditional ICP-OES

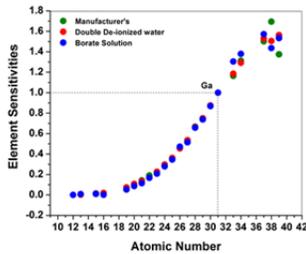


Fig.1: Element sensitivity curves measured by K- $\alpha$  lines for borate solution, double de-ionized water and as received by manufacturer. Symbols in the equation are the following: S is sensitivity, I is net intensity and C is concentration of analyte element (i) and internal standard (j).

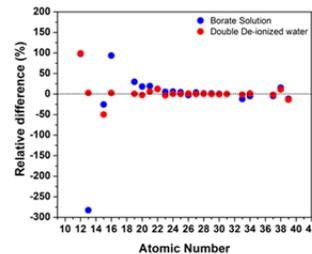


Fig.3: Relative difference between element sensitivities from borate solution and double de-ionized water with respect to those from the manufacturer.

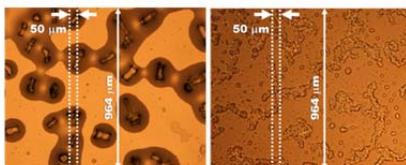


Fig.2: Optical micrographs of air dried borate solution (left) and air dried de-ionized water solution (right). The scales indicate X-ray irradiated area

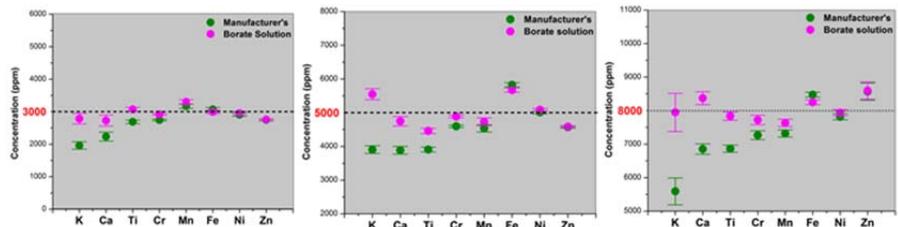


Fig.4: Elemental analyses of high silica custom standards using element sensitivities from borate solution and manufacturer. The dotted lines at 3000, 5000 and 8000 ppm represent the certified concentration in actual samples.



## Tuesday, September 11, 2012 - Afternoon Session

Chairman Anthony Chalhoub | PerkinElmer  
Co-chairman Bruno Vrebos | PANalytical

1:00PM

### Advanced mineral analyses by x-ray powder diffraction

T. G. Fawcett, Ph.D., Executive Director, S. N. Kabekkodu, J. Blanton, C. E. Crowder  
International Centre for Diffraction Data, Newtown Square, PA, USA

#### Invited speaker

Abstract: X-ray Diffraction has been a common characterization tool for the identification of minerals since the 1940's. The initial publication of the Powder Diffraction File in 1941 included a 978 pattern database but it also encompassed a method for the identification of crystalline materials. The Powder Diffraction File in subsequent issues has always incorporated features and database architecture that were integrated with analysis methods. Over the past seventy years the instrumentation, hardware and software, detectors and optics have all significantly advanced resulting in more breadth in diffraction characterization methods as well as improved detection capability. Today powder diffraction is still used for mineral identification but it is also commonly used for quantitative analysis, crystallinity, and crystallite size determinations. Complex mineral mixtures can be analyzed, with improvements in detection capabilities, and we can also study the complex scattering from the crystalline, nanocrystalline and amorphous components in the specimen. Database contents and architecture has been adapted to help with this broader range of analysis methods. All reference materials can be produced as digital patterns, select experimental digital patterns are used to reference non-crystalline materials (i.e..several clays), Crystallite size and molecular orientation can be simulated and analyzed, atomic coordinates and reference intensity ratio's compliment quantitative analysis methods. The 2012 PDF-4+ contain 328,660 entries. The database is organized in relational format with JAVA interfaces, 56 independent searches and 93 different display fields. Searches can be combined and display fields customized so that users can rapidly perform customized multivariant analyses. The database itself has been expanded to contain a wide range of crystallographic, diffraction, physical property, experimental and bibliographic data. This allows the analyst to use all data at their disposal in the analysis not just the d-spacings and intensities.

The mineral content has been collected from global sources including multiple database sources. This results in 39,410 unique entries that have been standardized, classified, and edited. The content contains extensive collections of both natural minerals and synthetics. This content constantly grows as new minerals are discovered and classified around the world. Common mineral types usually have several variants that include both natural and synthetic cation and anion substitutions. The high accuracy and precision in modern analyses enable one to track and often quantitate the influence of various substituents on the crystallography and physical properties of the mineral. In a modern analysis the user is likely to not only identify the mineral class and subclass but also the specific variant and if a natural mineral the specific geologic location. Being a global database there are reference mineral data from all areas of the world. The mineral reference collection alone has data from 1,137 references and 20,686 authors.

Mineral specimen examples will be used to demonstrate the analysis capabilities. We will also discuss how the database content has been interfaced with several commercially available advanced software packages to perform cluster analysis, Rietveld analyses, and other pattern fitting methods. Overall, the combination of designed databases and integrated software packages enables a wide range of total pattern analysis methods giving the user multiple diagnostic analysis tools.



1:30PM

### Uranium species in standard reference materials

Slobodan V. Jovanovic, Ph.D. Analytical Chemist Specialist, Pujing Pan  
Canadian Nuclear Safety Commission Laboratory, Ottawa, ON, Canada

Uranium mining and processing generate waste solids containing various forms of uranium, which inadvertently leads to environmental pollution. In uranium ores, natural uranium is mostly present as minerals. Once the uranium ore is leached, i.e. most uranium content is extracted, the uranium mill tailings may contain a mixture of residual natural uranium minerals, uranium compounds adsorbed on clay minerals and leaching chemicals. During the processing of uranium concentrate, such as in fuel manufacturing, small amounts of uranium fluoride may be released through the stack and deposited in the soil around the processing facility. Uranium tetra-fluoride readily undergoes hydrolysis to uranium oxide and hydrofluoric acid. There are three broad types of uranium containing waste materials, i.e uranium ore, tailings and contaminated soil wastes. To properly assess ecological impact of uranium mining and processing activities, it is important to know how various waste solids will behave in the environment.

The environmental fate of uranium in solids depends to a large extent on its solubility in water and on the mineralogy of uranium bearing phases. In general, uranium (IV) is considerably less soluble in aqueous solutions than uranium (VI). In this study we developed a method to separate and quantify uranium (IV) and (VI) species. First, solid sample was digested in aqueous acid mixture. The digest was then subjected to ion chromatography coupled with inductive coupled plasma mass spectrometer to separate and quantify U(IV) and U(VI), as illustrated in the chromatogram (normalized to U(VI)) of digested standard reference materials (SRMs) in Figure 1.

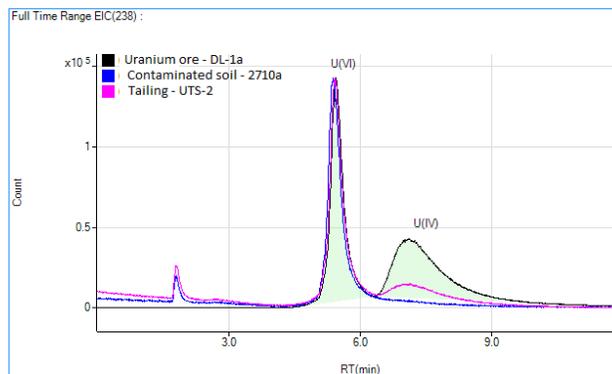


Figure 1. Ion chromatogram of standard reference materials.

We used this method to determine the ratios of U(IV)/U<sub>tot</sub> in nine standard reference materials (SRMs) and one contaminated soil sample. In uranium ore SRMs, the ratio of U(IV)/U<sub>tot</sub> varied from ~1% in DL-1a to 56% in DL-1a. Lower U(IV)/U<sub>tot</sub>, from <1% to 20% was measured in uranium tailings SRMs. The contaminated soil SRM as well as the contaminated soil sample contained negligible concentration of U(IV) (<<1% of total U).

To explain the difference in U(IV) content in studied SRMs, we performed uranium-bearing particle characterisation by scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDS). In those uranium ore SRMs, where higher U(IV)/U<sub>tot</sub> ratios were measured (e.g., DL-1a), we found uranium-bearing particles similar in composition to REE (rear earth element) minerals, where both uranium and thorium may exist in the 4+ state. Conversely, in the contaminated soil SRM where little U(IV) was measured (NIST2710 a) uranium-bearing particles were found to be likely uranyl hydrous oxides.

Our findings of the varying content of U(IV) in different uranium waste solids are discussed and in light of mineralogy of the uranium bearing phases.



Tuesday, September 11, 2012 - Afternoon Session

1:50PM

### Applications of XRF in the Coal and Minerals Analysis Laboratory

Jane V. Thomas, M.Sc. President and Analytical Chemist  
Wyoming Analytical Laboratories, Inc, Laramie, WY, USA

**Invited speaker**

The economic vitality of the mining industry is primarily impacted by two problems: increasing operating costs and decreasing prices for the products, specifically coal and minerals. Coal-burning power plants that once gave away waste coal ash now charge for the fly ash - consequently, the price of concrete has increased. Because of worldwide economic uncertainties, Canada - the fifth largest producer of energy in the world - and her mining industries must ask for improved productivity and efficiency from the extraction/refining and energy industries.

The mining industry will need the support of analytical laboratories to rise to the challenge of this changing global reality. This paper will discuss ways to improve efficiency and reduce turnaround time in the analytical laboratory by the application of x-ray fluorescence spectrometry. This instrumental technique is important in the analysis of coal, minerals, fly ash, and other geochemical materials. Sample preparation techniques will also be discussed.

2:10PM

### The use of portable Total Reflection X-ray Fluorescence (TXRF) for trace element analysis of mine tailings, water run-off, and heavy metal uptake of biological organisms (Lichens and Daphnia) in the field

Mike Beauchaine, Product Manager TXRF, Bruker AXS Inc. Madison, WY, USA

Margarete Mages, UFZ Centre for Environmental Research Leipzig-Halle,

Department of Inland Water Research Magdeburg, Magdeburg, Germany

Stefan Woelfl, Universidad Austral de Chile, Instituto de Zoologia, Valdivia, Chile

Hagen Stosnach, TXRF Application Scientist, Bruker Nano GmbH

Eliza Bontempi, INSTM and Chemistry for Technologies Laboratory, University of Brescia, Brescia, Italy

Field investigations of heavy metals in the environment and from mining sites at trace levels is often difficult due to the lack of instruments sensitive enough and lack of portability. For in the field determination of chemical elements in environmental samples, there are several techniques such as X-ray Fluorescence (XRF), immunoassay, electrochemical sensors, capillary electrophoresis (CE), laser-induced breakdown spectroscopy (LIBS), inductively coupled plasma (ICP) and atomic absorption spectroscopy (AAS). Many of these techniques require costly consumables and have multiple limitations making the use for the in-the-field measurements difficult if not impossible. Although, many applications and locations require onsite analysis due to a large number of required sampling points and the lack of designated laboratories.

In this paper, Total Reflection X-Ray Fluorescence Spectroscopy (S2 Picofox) was used for in-the-field analysis of trace elemental analysis and the understanding of the distribution of heavy metals from mining operations. Three key application areas were examined including mine tailings, sewage and sediments; trace analysis of elements from mining sites downstream in rivers and lakes; and finally the uptake of elements in Daphnia (aquatic) and lichens (air) near industrial sites. Various sample preparation techniques were explored in the field and results were compared to other common laboratory techniques such as AAS and ICP. In each sample the main elements of interest included Cr, Mn, Fe, Ni, Cu, Zn, As, and Pb and a comparison of sites from little to no human influence to sites with heavy industrial influence were investigated.



Tuesday, September 11, 2012 - Afternoon Session

3:00PM

## Grade control of ores - How XRF delivers accuracy and precision in daily routine

Kai Behrens, Ph.D. Product Manager  
Bruker AXS GmbH- Karlsruhe, Germany

**Invited speaker**

Process and grade control of mined materials has become a challenging task in mining operations today: Low grade ores with frequent changes of the mineralogy will be the future source for the metal industry, but making the setup and maintenance of analytical strategies in the mining lab difficult. New environmental regulations are enforcing the control of hazardous elements in the final products. Therefore the early knowledge about contaminations from ores will help producers to avoid e.g. Cd or Pb contaminations in their final metal alloys. These new requirements will enforce a higher degree of analytical flexibility, which cannot be fulfilled with traditional setups in mining laboratories.

XRF is known for the very short time-to-result, the high level of accuracy and precision and the simple sample preparation paired with the high degree of automation. All this is making XRF the best suited analytical method for process and grade control in mining operations. Quick sample preparation on pressed pellets helps to deliver instant results, fused bead preparation requires a higher investment in equipment and setup time but delivers higher accuracy and covers broader material ranges.

Simultaneous wavelength dispersive XRF instruments are delivering accuracy paired with precision in the shortest possible measurement time. Traditionally these instruments are configured with fixed single element channels in Rowland circle geometry for a selection of elements of special interest. This makes them an indispensable tool for process control in metals and mining. The high analytical speed achieves a maximum of sample throughput in mining service labs worldwide. A new instrument design combines the analytical performance of the conventional configuration with fixed wavelength dispersive element channels and a modern simultaneous energy dispersive detector in order to achieve high analytical precision and accuracy. At the same time while the elements of interests are counted the energy dispersive detector records the complete spectrum of the sample. This “snap shot” of the elemental composition enables the monitoring of all elements present in the sample, but doesn’t add additional measurement time.

The new generation of sequential WDXRF spectrometers are offering very flexible and compact beampaths, in combination with new X-ray tubes and advanced X-ray optics these instruments are able to achieve higher analytical speed, but offering the highest degree of analytical flexibility even for future demands in mining.

Application examples for grade control of ores and industrial minerals are shown to demonstrate and to give directions for the use best suitable analytical strategy.

**3:30PM****Application of rapid X-Ray diffraction (XRD) and cluster analysis to grade control of ores**

Uwe König, Ph.D. Product Specialist  
PANalytical B.V, Almelo, Netherlands

The use of high speed detectors let X-ray diffraction (XRD) became an important tool for quality and process control in mining, steel, cement or aluminium industries. As well as the information about the composition of an ore sample it provides useful information in terms of quantification of the crystalline phases and the amorphous content. The investigation of the phases present in an ore body optimises the mining and process operations (flotation, separation, etc.).

Traditionally grade control of ores has relied on elemental analysis of sampled materials such as blast cone drill cuttings. This analysis provides a standard elemental suite that is used in grade control to assign mined material as grade blocks to high grade, low grade or waste destinations.

Assessment of the mineralogical composition of these samples is more subjective however relying on visual inspection of collected samples and interpretation of the elemental data. This paper outlines an additional technique, rapid X-ray diffraction (XRD) analysis, which has been tried to establish the mineralogical composition of a sample to supplement the elemental data.

Several case studies where XRD can be used for grade control of base metals will be demonstrated.

Alternative reliable quantification methods will be presented besides well known methods such as Rietveld or calibration based analysis



3:50PM

## How to apply X-ray spectrometry to the quantitative analysis of geological materials

Richard Rousseau, Consultant XRF/President  
Les logiciels R. Rousseau inc, Cantley, QC, Canada

The quantitative analysis of any geological material is a real challenge. Indeed, it can be composed of almost all the elements of the periodic table, from Hydrogen to Uranium, the concentration of each one can be varying from few ppm to 100%. Therefore, I will present a robust analytical method for obtaining the maximum accuracy from the measured XRF intensities when geological samples are analyzed.

First, the sample preparation must supply specimens that are completely homogeneous and have a perfectly flat and polished surface. Most importantly, the sample preparation must be reproducible. Also, the XRF spectrometer must be as stable as possible.

Then, the first important step of the calculation procedure of sample compositions is the calibration. For rock analysis, it must be matrix independent and valid for the full analytical range, from 0 to 100% of any element to determine (analyte). The calibration procedure must also include an efficient way to correct for instrumental drift in order to maintain the validity of the calibration data for a long period of time.

The second important step is the correction for matrix effects. Currently, the Fundamental Parameters (FP) method is included with the software supplied with each instrument. In this case, be aware that the theoretical relative error introduced by the algorithm alone should be less than 0.1%. Be aware also that the FP method has to be adapted to the analysis of geological samples. The following characteristics should be present:

1. Within a series of analytes, the user should be able to enter easily a mix of elements and oxides to be determined.
2. The FP method should be able to calibrate for large concentration ranges, from few ppm to 100%, of any analyte.
3. The FP method should be able to take into account all the unmeasured components, for example, CO<sub>2</sub>, H<sub>2</sub>O, FeO, SO<sub>3</sub>, LOI, etc.
4. For the analysis of fused discs or pressed pellets, the FP method should be able to take into account the ratio sample/flux or binder.
5. For the analysis of fuse discs prepared with the original sample or the roasted one, the FP method should be able to calculate the sample composition with or without the knowledge of the LOI value.

A summary description of this FP method can be found in the following reference [1].

[1] R.M. Rousseau, The Quest for a Fundamental Algorithm in X-Ray Fluorescence Analysis and Calibration, The Open Spectroscopy Journal, 2009, 3, 31-42.

<http://www.benthamscience.com/open/tospecj/articles/V003/31TOSPECJ.pdf>



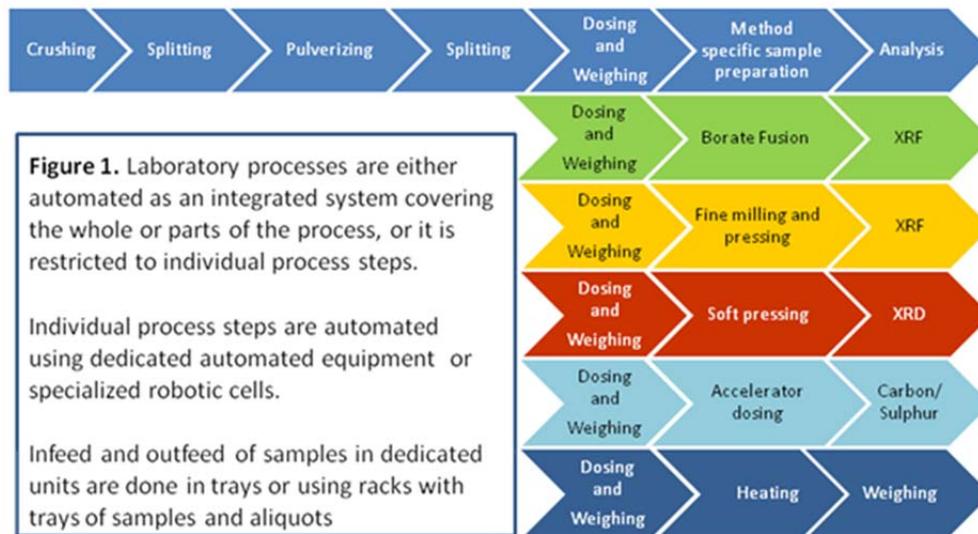
4:10PM

## Implementation Strategies for Laboratory Automation, Exemplified by Different Types of Systems and Applications.

Skage HeM , Ph.D. CEO, FLSmidth, Automated Analysis Technology, Brno, Czech Republic

Jeff KEMMERER FLSmidth Inc (USA)

Automating laboratory processes is a proven way to achieve improvements in throughput while ensuring consistent quality and performance. Automated solutions can be implemented on many different levels, beginning with the automation of one or more pieces of automated equipment, forming an automated island in an otherwise manual sample flow. Such systems can be expanded into a process chain, ending with the complete integrated solution (see Figure 1). The integrated system would automate some or all of the process steps from sample registration to data transfer to LIMS. In the case of the fully integrated system it is important to consider the constraints given by sampling theory relative to the materials that will be processed. The benefits and selection criteria of different automation strategies will be discussed and exemplified with different types of systems.



High performance software solutions are required to accompany high performance laboratory automation solutions, ensuring flexible integration, process control as well as real time monitoring and reporting of performance. Examples of such functionality will be presented.

There is dedicated equipment for many specialized applications. These include crushing and pulverizing, sample dosing and weighing, XRF sample preparation for pressed powder pellets or borate fusion, soft milling and pressing as well as scanning of drill core for quantitative mineralogical applications (XRD or NIR), Carbon-sulphur analysis, LOI and TGA automation. The presentation will provide an overview of the applications and solutions available.



Tuesday, September 11, 2012 - Afternoon Session

4:30PM

**Cliffs Bloom Lake Operation - The positive impact of integration to a larger organization on the laboratory operation and management.- Phase II Commissioning.**

Louis Gendreau M.Sc., Senior Area Manager

Cliffs Bloom Lake Operation

**Invited speaker**

With 164 years history, Cliffs Natural Resources is an iron-ore focused North American based miner. In recent years the Cleveland Company has diversified into new geographies, Asia Brazil and Canada and into new products, metallurgical coal and chromite. In 2011, Cliffs acquired a newly developed Quebec mine operation, the Consolidated Thompson Iron Mine. The aim of the presentation is to provide you with an overview of Cliffs North America Iron Ore (NAIO) mining operation, a description of the Bloom Lake plant, process flow sheet and future grow. The presentation will discuss the integration of an operation into a large corporate organization and his positive impact on the laboratory, development of analytical methods, the relation with laboratory equipment supplier, the creation of an internal technical lab network and in-house interlab. The role and responsibilities of the lab manager will also be reviewed since they are evolving due to the different expectations.



## Wednesday, September 12, 2012 - Morning Session

Chairman - Kai Behrens | Bruker AXS GmbH  
Co-chairman - Ed Debicki | Geoscience Laboratories

8:30AM

### Solid sampling ETV-ICP-OES to study the distribution of elements in soil samples so as to ultimately locate undercover ore deposits

Farhad Kaveh Ph.D. Dr. Diane Beauchemin

Queen's University Queen's University, Department of Chemistry, Kingston, ON, Canada

A simple and fast method using solid sampling electrothermal vaporization inductively coupled plasma optical emission spectrometry (ETV-ICP-OES) was developed to determine the distribution of elements in soil samples from across the Talbot Lake VMS Cu-Zn prospect, in the Flin Flon-Snow Lake, Manitoba, Canada terrain, in order to locate the undercover ore deposit, which is buried under Paleozoic dolomites and Quaternary till. The solid samples were vaporized by the ETV system and finally were transferred to the ICP-OES where, following vaporization and atomization, excitation and ionization of atoms occur. The excited atoms and ions then emitted element-specific radiation that was measured by the SPECTRO ARCOS ICP-OES instrument, which provided simultaneous coverage of wavelengths between 130 and 770 nm allowing the simultaneous detection of numerous elements during the transient signal generated by ETV.

In the development of the method, the mass of sample, flow rate of reactant gas (dichlorodifluoromethane (R12)), the carrier and bypass gas flow rates and the temperature program were optimized. Under optimal conditions and with a four-step ETV temperature program, the distribution of the pathfinder elements (Zn, P, S and I) in soils showed clear anomalies at 400 and 650 m. The results for Zn and P were in very good agreement with results obtained, following aqua regia (AR) digestion, by ICP mass spectrometry (ICP-MS) by Anglo American. Moreover, the distributions of S and I could be precisely determined (these elements were not reported in the Anglo American study). Using 0-4 mg of Anglo S5 standard mixed with with 4.1 mL/min R12 as reactant gas, calibration curves were obtained that, when applied to Talbot soil samples, yielded Zn, S and P concentrations in agreement with AR-ICP-MS results previously obtained by Anglo American (Fig.1). These results clearly show that sample dissolution used in the ICP-MS method is totally unnecessary. Such sample processing is time-consuming, requires reagents and is susceptible to contamination because of the multiple steps involved. In contrast, the ETV temperature program only requires 85 s per sample, which is clearly advantageous over aqua regia extractions. Hence, ETV-ICP-OES completely eliminates the need for extraction or digestion of samples prior to analysis, which significantly simplifies the analysis of geochemical exploration samples. Furthermore, quantitation is not really required, as a comparison of ETV peak areas would be sufficient to pinpoint the projections of undercover ore deposits.

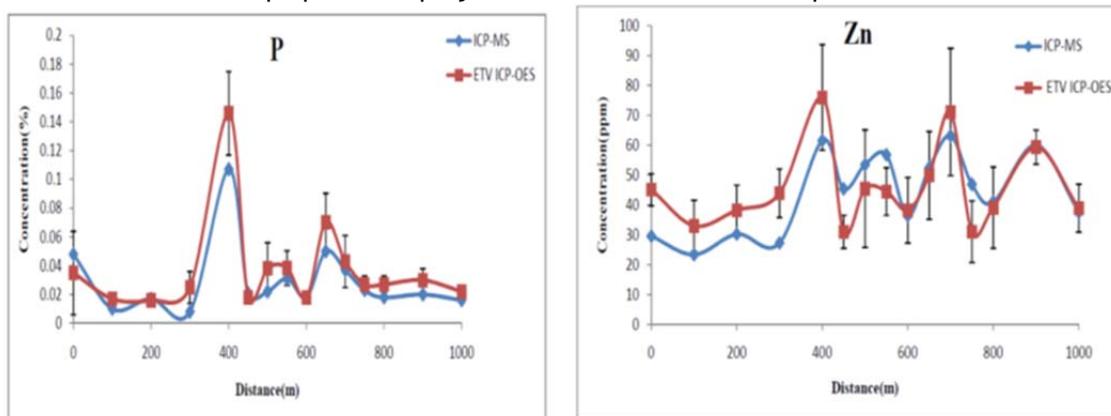


Figure 1: Comparison of the Zn and P distributions in soil samples obtained by ETV-ICP-OES and by aqua regia extraction ICP-MS.



Wednesday, September 12, 2012 - Morning Session

8:50AM

### Review of Applications of X-ray Fluorescence Spectrometry in Mining and Geology

Bruno Vrebos, Ph.D. Senior Scientist  
PANalytical B.V. Almelo, The Netherlands

**Invited speaker**

Wavelength dispersive X-ray fluorescence spectrometry has been applied to quantitative analysis in mining and geology from the very beginning of the development of the technique. Initially, its use was limited to a few selected trace analytes such as e.g. Sr and Rb. Accurate methods to deal with background and line overlap were developed. Matrix correction was done using Compton correction when dealing with trace levels; and the early attempts regarding mathematical matrix corrections methods were undertaken.

The analysis of larger suites of elements - be it at trace level or at higher concentrations - became feasible with automated spectrometers. Around that time methods to deal with interfering absorption edges had been developed, as well as numerical techniques for the correction of matrix effects on minor and major elements.

More recently, a growing interest in analyzing major elements with high precision and high accuracy developed. This is very clear in the iron ore business. Large numbers of (simultaneous) instruments were sold and combined with sample preparation methods in highly automated laboratories. In Australia, an Australian Standards method (AS 2563) to assess the precision of a wavelength dispersive spectrometer was developed by CSIRO et.al. This work has found its way into ISO 9516; and tests against a counting statistical error of about 0.033 % relative. Currently, ISO and Standards Australia are drafting new methods to enable testing of the instrumentation to a level of 0.016 % relative and analyzing iron ore to within 0.084 % (2 standard deviations).

Some of the applications of XRF in geology and mining will be illustrated; and a critical look forward regarding future possibilities will be given.

9:20AM

### Ultra-fast ICP-OES determinations of Base Metals in Geochemical or Mineral Samples using next generation sample introduction technology

Shane Elliott, Product Marketing Manager, John Cauduro, Phil Lowenstern  
Agilent Technologies, Mississauga, ON, Canada

Base metals in ore grade mining samples have been determined by radial ICP-OES using the novel OneNeb nebulizer and productivity enhancing Switching Valve System (SVS 2) accessory. A 4 acid digest was used to prepare the samples and recoveries against certified reference materials were in the range of 90 - 110%. A robust analytical method was used with a reduced plasma flow of 10.5L/min Argon and featured IECs that correct for the various spectral interferences that can occur when analysing a diverse range of mining samples with unpredictable elemental content. The OneNeb was found to be the ideal nebulizer for handling the challenging sample matrix with excellent results being obtained without the need for internal standards. Using the SVS 2 reduced sample to sample time by around 50%, leading to a doubling of sample throughput.



Wednesday, September 12, 2012 - Morning Session

9:40AM

### Advances in RF Technology for ICP-OES and its Application to High TDS Matrices

Aaron Hineman, Ph.D. Product Specialist, Chady Stephan  
PerkinElmer Inc, Woodbridge, ON, Canada

Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) is widely used in geochemical and metallurgical applications for elemental analysis. This presentation describes the analysis of various sample preparations using the recently introduced Optima 8300 ICP-OES by PerkinElmer. The radio frequency (RF) generator is a critical component in any ICP-OES spectrometer. High total dissolved solids (TDS) samples can cause significant long-term load on the RF generator making system stability a concern. The RF power that the generator produces must be exceptionally stable in both the short-term and long-term in order to obtain stable, reproducible emission signals. The RF power supply must provide a high coupling efficiency with the sample to generate maximum emission-signal strength. It must instantaneously compensate for any changes in impedance due to variations in the sample or solvent. The revolutionary RF generator in the Optima 8300 spectrometer features flat induction plates that replace the traditional helical load coil. The Flat Plate plasma induction plate technology delivers a low-flow operating system that does not require coil cooling and is capable of operating at a plasma argon flow as low as 8 L/min. The benefits of the Flat Plate plasma and some of the experiments to date will be presented regarding the determination of metals in these demanding sample types.

10:30AM

### Applications of an integrated XRF and full pattern XRD in minerals

Ravi Yellepeddi, Ph.D. Technical Director  
Thermo Fisher, Mississauga, ON, Canada

**Invited speaker**

There has been a growing demand in the mining and minerals processing industry for a comprehensive analytical solution integrating both chemical and phase analysis. While XRF technique for bulk elemental/oxide analysis is extensively used both in the central laboratory as well as at the process, the use of XRD for key mineral characterization was rather limited to investigative work. XRD technique can provide significantly valuable information in various mineral processing phases (from ore bodies through beneficiation to concentrates and tails and final products for industrial use) in conjunction with the total elemental analysis. Indeed, reliable quantification of specific phases is critical for optimizing process parameters and for increasing the metallurgical accounting. In addition to these laboratory analyzers as reference instruments for accurate chemical and mineral phase analysis, on-stream/on-line analyzers based on PGNA and EDXRF are also used routinely for fast/real-time control of the mineral processing.

Several applications, pertinent to Iron, Copper and heavy minerals, will be presented with a view to highlight the advantages of integrated XRF/XRD analysis in a typical process work-flow. Also, new possibilities with XRF to characterize a mineral sample for its elemental mapping and small inclusions will be presented.



Wednesday, September 12, 2012 - Morning Session

11:00 AM

### Observations on the Data from CCRMP Certified Reference Materials and Proficiency Testing Program - Mineral Analysis Laboratories (PTP-MAL)

Maureen E. Leaver, B.Sc. Coordinator, Canadian Certified Reference Materials Project  
CANMET - Mining, Natural Resources Canada, Ottawa, ON, Canada

The Canadian Certified Reference Materials Project (CCRMP) receives data from laboratories related to the mining industry world wide for the preparation of certified reference materials and Proficiency Testing Program - Mineral Analysis Laboratories (PTP-MAL). The amount of data is statistically large enough that trends in methods, accuracy and precision are evident. These trends and the criteria for the certification of the constituent vales will be discussed. The focus will be on the rare earth materials; the recently released material, WPR-1a, a peridotite with rare earth and platinum group elements, and recent cycles of PTP-MAL.

#### Biographical sketch

- Coordinator of a Canadian government project that has prepared certified reference materials for over 38 years
- 15 years experience of successful registration to ISO 9001 quality management system
- Method Development Chemist for Natural Resources Canada, a Canadian government mining lab
- Member of Advisory Panel to Canadian Association of Laboratory Accreditation

Version date: 2012 08 15



Wednesday, September 12, 2012 - Morning Session

11:20 AM

## Mineral Analysis Testing Laboratories - A Panel Discussion on Technical Issues and Concerns that Challenge Laboratories in Producing Reliable and Consistent Results

Carol Campbell, Client Manager  
Standards Council of Canada, Ottawa, ON, Canada

This Canadian Mineral Analysts Conference technical presentation will be an interactive expert panel discussion soliciting questions from participants and proposing answers and examples of solutions on mineral analyses and laboratory practices. Key experts have been invited to address questions regarding, but not limited to quality assurance, proficiency testing, measurement uncertainty, method validation and sample preparation.

The framework for discussion will center around elements of ISO 17025 General Requirements for the Competence of Testing and Calibration Laboratories, Canadian Procedural Document (CAN-P) 1579 Requirements for the Accreditation of Mineral Analysis Testing Laboratories and, National Instrument (NI) 43-101 for the benefit of both accredited and non-accredited laboratories represented at the Canadian Mineral Analysts Conference. The panelists are a select group of experts, some of whom make up the Standards Council of Canada's Laboratory Accreditation Mineral Analysis Working Group and some Consultants to the worldwide mining industry. Lynda Bloom, (a laboratory and QC expert often acting on behalf of mining companies who also has extensive experience as an officer and director of junior mining companies) will lead the session with a presentation on NI 43-101. The panelists include: Dr. Wesley Johnson (Certified BC Assayer, Consultant with Quality Analysis Consultants, SCC Technical Assessor, and CALA Lead Assessor), Jane Weitzel (SCC and A2LA Technical Assessor and Consultant with Quality Analysis Consultants), Carol Campbell (Client Manager SCC Laboratory Accreditation Program), Jon Forrest (Royal Canadian Mint Laboratory Manager and SCC Technical Assessor) and Valerie Murphy (Quality Manager SGS Mineral Services, SCC Technical Assessor and Technical and Lead Assessor for CALA ). The session will be moderated by André Beaudet, (Director, SCC Laboratory Accreditation Program).

NI 43-101 is a technical reporting scheme used for the public disclosure of information relating to mineral properties in Canada. NI 43-101 is a strict guideline for how public companies can disclose scientific and technical information about mineral projects. Simply, the purpose of NI 43-101 is to ensure that misleading, erroneous or fraudulent information relating to mineral properties is not published and promoted to investors on the stock exchanges overseen by the Canadian Securities Authority. NI 43-101 requires the disclosure of assay QC programs and laboratory methods, whether or not laboratories are accredited.

Since the implementation of NI 43-101 in 2000, many laboratories have implemented or improved quality management systems in response to client needs. The systems have resulted in diminishing the risk of error and increasing confidence in results. Whether a laboratory chooses to undertake ISO accreditation or not, adherence to a structured quality management system and quality assurance program are essential to meet the requirements of clients filing NI 43-101 complaint reports and/or ISO 17025.

Leading up to the 2012 CMA Conference and this panel discussion, participants are invited to submit questions. The Expert Panel format is intended to address real-life issues and matters of interest of the audience aligned with technical demands at the laboratory level



## Comité du CMA 2012 / 2012 CMA Committee

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From left to right: Chantal Audet, John A. Anzelmo, Guylaine Renald, Lucie Simard, Marcel Dessureault, France Morisette, Faycal Bouker and Janice Pître



## Remerciements / Special Thanks

Je voudrais remercier chaleureusement tous ceux qui ont accepté de se déplacer à la ville de Québec, pour participer à la 44<sup>e</sup> Conférence et Exposition Annuelle des Analystes des Minéraux Canadiens.

La qualité d'une conférence se mesure à la qualité de son programme technique. Nous sommes fiers d'affirmer que le programme technique 2012 regroupe uniquement des orateurs de haut calibre et que, de surcroît, il est enrichi par une journée d'ateliers présentée par nul autre que Bruker AXS et Perkin Elmer. Il me faut aussi mentionner la contribution de tous ceux qui ont consacré temps et énergie en vue de prendre part à la séance de présentation par affiches, tout à fait innovatrice cette année. Ces personnes, hautement qualifiées, ont généreusement accepté de partager avec nous leurs connaissances, leur expérience et les dernières nouveautés de l'industrie minière. Il est certain que nous gagnerons à les écouter attentivement et à exprimer notre appréciation du contenu scientifique de leurs présentations. Un grand MERCI à tous nos orateurs, aux animateurs des ateliers techniques, ainsi qu'aux participants à la séance de présentation par affiches.

Que pourrions-nous faire, comment pourrions-nous offrir une conférence de ce calibre sans la compréhension, la collaboration et les généreuses contributions de nos commanditaires? À notre principal commanditaire, Perkin Elmer, ainsi qu'à tous les autres commanditaires de la CMA 2012, un MERCI très sincère de nous avoir donné la possibilité d'offrir à tous les participants, une CMA riche en contenu scientifique tout autant qu'en activités sociales diverses.

Organiser pareille conférence requiert un travail d'équipe, accompli par des personnes qui n'hésitent pas à s'investir pleinement en vue d'un seul objectif : la réussite de l'évènement. Je réitère donc tous mes remerciements aux membres du personnel de Claisse qui, grâce à leurs connaissances et à leurs compétences ont contribué à la réalisation de cet évènement mémorable que constitue la CMA 2012.

En terminant, je m'en voudrais d'oublier de souligner le travail chevronné et le soutien constant de madame Denise Giguère, Gérante des Congrès et Banquets de l'hôtel Loews Le Concorde. Madame Giguère nous a accompagnés sans relâche dans cette aventure mouvementée que fut la gestion d'un évènement dont la popularité et l'ampleur se sont révélées tout à fait inattendues.

Lucie Simard

Présidente de la CMA 2012



I would like to thank all those who have come to Quebec City, to participate to the 44th Annual Canadian Mineral Analysts Conference and Exhibition.

The quality of a conference is measured by the quality of its technical program. We are most certainly proud to say that the 2012 technical program includes only high-calibre speakers; more so, it is enhanced by a full day of workshops that are presented by none other than Bruker AXS and Perkin Elmer. I must also point out the immense contribution of all those who have dedicated their time and energy towards taking part in this year's poster presentations session, as it is quite innovative. These highly qualified individuals have generously accepted to share their knowledge, experiences and latest developments in the mining industry. It is most certain that everyone in attendance will benefit from listening attentively as well as sharing your appreciation for the scientific content of their presentations. THANK YOU to all our speakers, technical workshop hosts, and poster presentations session participants.

What would be of this event and how would it even be possible to present such a high-calibre affair if it were not for the comprehension, collaboration and most generous contributions of our sponsors? I would like to SINCERELY THANK our main sponsor, Perkin Elmer, as well as all the other sponsors of the 2012 CMA, for giving us the possibility of putting together a CMA that is as equally rich in scientific content as it is in social activities for the benefit all of the participants.

Organising such an event requires a team effort, put forth by individuals who do not hesitate to fully dedicate themselves towards one and only goal: achieving a successful event. Again, THANK YOU to all the Claisse personnel, who by the grace of their knowledge and competence have contributed to the realisation of this memorable event which is the 2012 CMA.

Lastly, it is with immense gratitude, that I would like to thank Mrs. Denise Giguère, Congress and Banquet manager of the Loews Le Concorde, for all of her hard work and support. The popularity and scale of this event has come as quite a surprise, and Mrs. Giguère accompanied us tirelessly throughout the entire animated adventure.

Lucie Simard,

Chairperson of the 2012 CMA



## Le Plan Nord / The Plan Nord



Mr. Robert Sauvé, secrétaire général associé au Bureau de transition du Plan Nord, donnera une allocution sur le Plan Nord mardi soir au Restaurant Le Parlementaire.

Le Plan Nord a été dévoilé le 9 mai 2011. D'abord l'expression d'une vision du développement durable du Québec, le Plan Nord constitue désormais un des plus grands chantiers de développement économique, social et environnemental de l'histoire du Québec.

Il propose une démarche planifiée et

cohérente, composée de différentes initiatives élaborées et mises en œuvre en collaboration avec les communautés et les acteurs concernés, en ayant une approche exemplaire en matière de développement durable.

Ces aspects feront l'objet de la présentation de manière à expliquer plus en détail tout le potentiel de développement du Nord ainsi que les enjeux et défis que cela implique.

### FAIRE LE NORD ENSEMBLE Le chantier d'une génération

Le Plan Nord est l'un des plus grands chantiers de développement économique, social et environnemental de notre époque qui se déploiera sur 25 ans. Il entraînera des investissements de plus de 80 milliards de dollars et permettra de créer ou de consolider en moyenne 20 000 emplois par année.



Mr. Robert Sauvé, Associate Secretary General, Plan Nord Transition Office, will give a talk about The Plan Nord on Tuesday night at the Restaurant Le Parlementaire.

The Plan Nord was unveiled on May 9, 2011. It first offered a perspective of sustainable development in

### BUILDING NORTHERN QUÉBEC TOGETHER The Project of a Generation

The Plan Nord is one of the biggest economic, social and environmental projects in our time. The Plan Nord will be carried out over a period of 25 years. It will lead to over \$80 billion in investments during that time and create or consolidate, on average, 20 000 jobs a year.



Québec and is now one of the biggest economic, social and environmental development projects in Québec's history. It proposes a planned, coherent approach comprising initiatives elaborated and implemented in collaboration with the communities and stakeholders concerned. It adopts an exemplary approach to sustainable development.

These facets will be examined in the presentation in order to explain in greater detail the North's full development potential and the attendant issues and challenges.



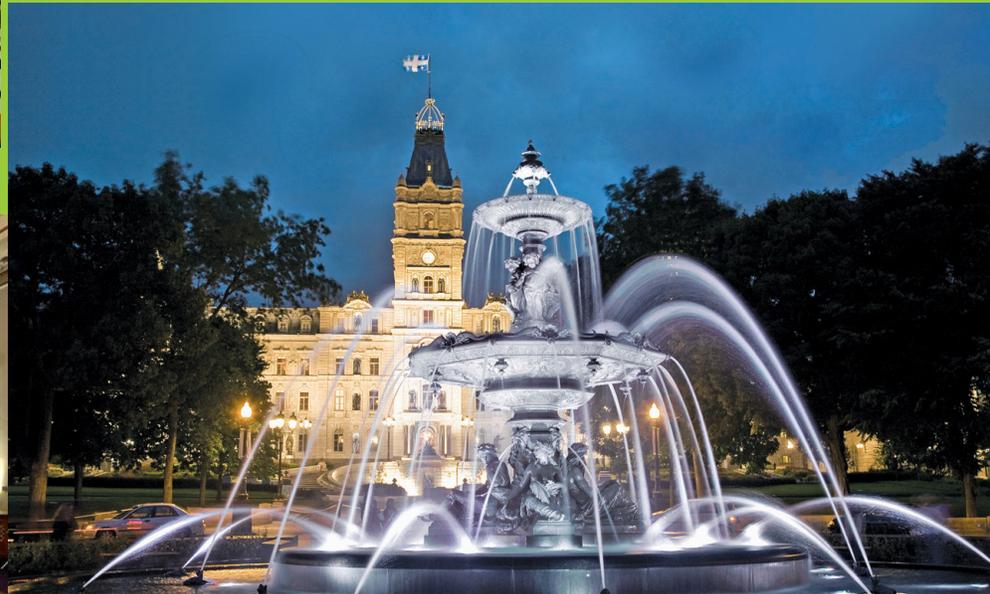
Welcoming Mixer



Opening Reception



Banquet Dinner



Business Lunch



Claisse® Facility Tour



Mid-Autumn BBQ Event



Québec, Canada



Photo: Luc-Antoine Couturier