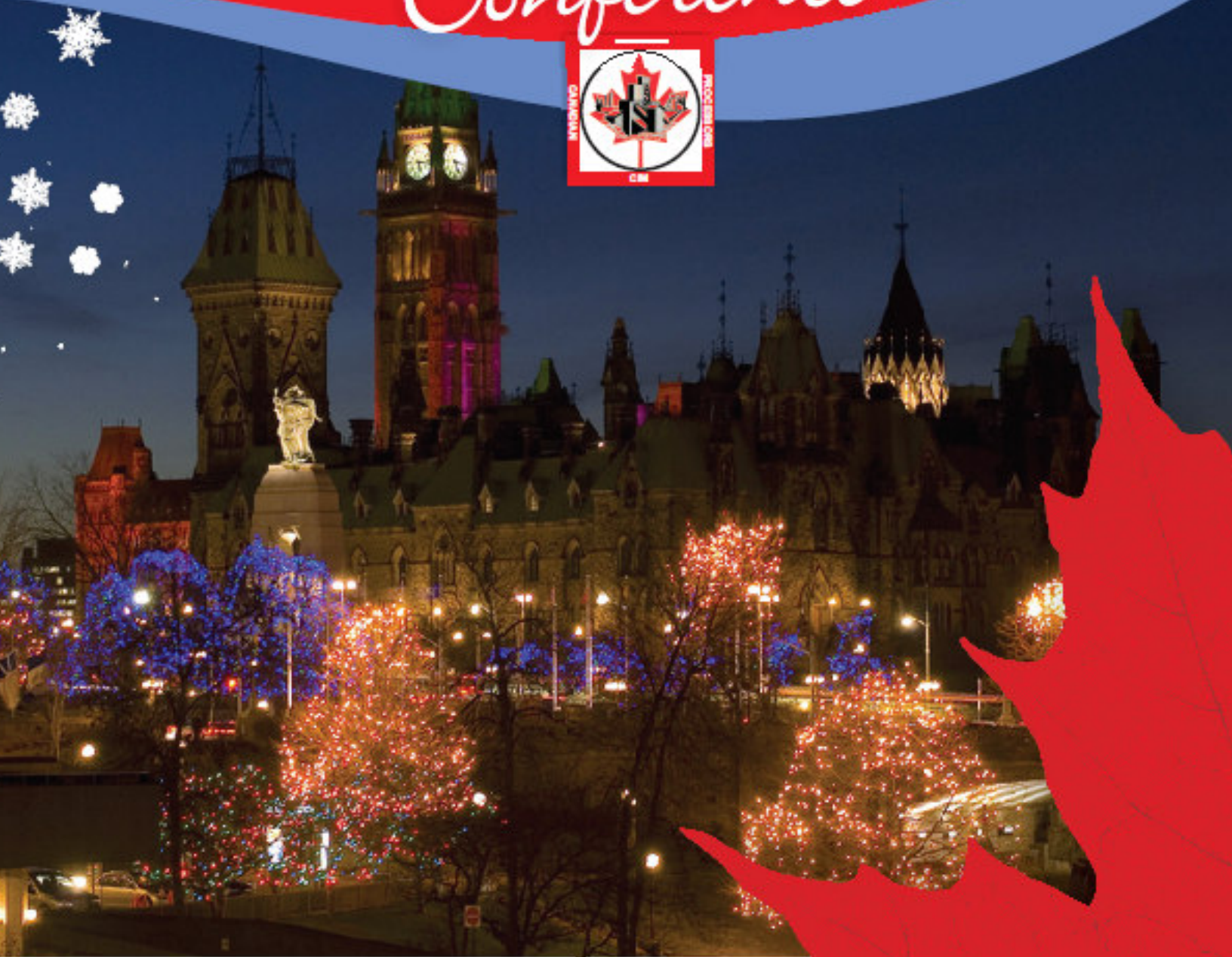


CANADIAN MINERAL PROCESSORS

2012 *Conference*



www.cmpsoc.ca

January 17-19, 2012
The Westin Hotel
Ottawa, Canada

PLENARY SESSION

TUESDAY 8:30

Significant Canadian Developments in Mineral Processing Technology 1961-2011
J.E. Nessel

TUESDAY, 9:20

Update of Chilean Mining Projects and Technological Trends
J. Rosas, C. Schuffeneger and C. Cornejo

(BREAK)

SESSION I – OPERATIONS

C. Spence, P. Staples

TUESDAY 10:15

Z1600 Jameson Cell Test Rig - from Rental to Revenue
A. Taylor, J. Doucet, M. Blanchette, R. Barrette, V. Lawson

TUESDAY 10:40

Concentrate Grade and Regrind Size Improvement on the East Pit Hypogene Ore at Kemess Mine
M. Brissette and E. Roman

TUESDAY 11:05

Applying a Customer-Based Approach at Vale's Clarabelle Mill
R. Barrette, A. Taylor, J. Doucet, J. Shelegey, H. Sullivan, V. Lawson

TUESDAY 11:30

Diagnosis of the Operation of a Hydraulic Classifier for Iron Ore Concentrate
M. Desnoyers, C. Gosselin, G. Chevalier, C. Bazin, G. M. Payenzo

SESSION II – RARE EARTHS, INDUSTRIAL AND ENERGY MINERALS

B. Hilscher, S. Wilson

TUESDAY 13:30

Rare Earth and Thorium Recovery in Canada
J.R. Goode

TUESDAY 13:55

A Review of Rare Earth Mineral Processing Technology
J. Zhang and C. Edwards

TUESDAY 14:20

A Preliminary Comparison of Coal Classification and Processing Between Canada and China
T. Lu, G. Laman

(BREAK)

TUESDAY 15:15

Secondary Recovery of Bitumen using Jameson Downcomers
O. Neiman, B. Hilscher, R. Sij

TUESDAY 15:40

An Overview of Potash Flotation
M. Oliazadeh, M. Aghamirian, T. Grammatikopoulos, D. Imeson

TUESDAY 16:05

An Overview of Spodumene Beneficiation
M. Aghamirian, C. Mohns, T. Grammatikopoulos, D. Imeson, G. Pearse

SESSION III – FLOTATION

C. Hardie, P. Wells

WEDNESDAY 8:30

Canatuan Cu/Zn Flotation Metallurgy - Dealing with Zinc Pre-Activation
C.V. Umipig, E.E. Israel, G.G. Hutalle, S.R. Williams

WEDNESDAY 8:55

Constrained Multivariable Control of a Pilot Flotation Column at the Laronde Concentrator
D.E. Calisoya, A. Riquelme, A. Desbiens, É. Poulin, R. del Villar

WEDNESDAY 9:20

A Benchmarking Tool for Assessing Flotation Cell Performance
J.E. Nessel, W. Zhang, J.A. Finch

(BREAK)

WEDNESDAY 10:15

An Overview of Optimizing Strategies for Flotation Banks
M. Maldonado, R. Araya, J.A. Finch

WEDNESDAY 10:40

Nanoparticle Flotation Collectors for Pentlandite
S. Yang, R. Pelton, M. Xu, Z. Dai

WEDNESDAY 11:05

Innovations in Reagent Technology: New Collectors and Modifiers for Difficult to Treat Ores
T. Bhambhani, D.R. Nagaraj

WEDNESDAY 11:30

Development of Processing Alternatives for Frankfield East Deposit using Selective Arsenopyrite-Pyrite Flotation
G. Wilcox, D. Koningen, R. Jackman

SESSION IV – GOLD AND HYDROMETALLURGY

P. Blatter, J. MacDonald

WEDNESDAY 13:30

An Overview of the Lithium Carbonate Process Flow Sheet for Concentrates Derived from Hard Rock Lithium Sources
S. Mackie, M. Aghamirian, C. Forstner, T. Grammatikopoulos, G. Pearse

WEDNESDAY 13:55

Error Associated with the Sampling of Gold Ores
C. Bazin, R. Mermillod-Blondin

WEDNESDAY 14:20

Gold Passivation: Some Fundamental Issues to Highlight
A. Azizi, C. Olsen, C. Gagnon, A. Bouajila, M. Ourriban, P. Blatter, F. Larachi

(BREAK)

WEDNESDAY 15:15

Goldex, The GRG Jewel
F. Robichaud, G. Belzil, M. Fullam

WEDNESDAY 15:40

Cu-DETA Catalyzed Non-Ammoniacal Thio-sulfate Leaching from a Sulfidic Gold Ore
C. Xia

WEDNESDAY 16:05

The Limitations of Activated Carbon in CIL Circuits Handling Preg Robbing Solids
G. Van Weert, Y. Choi

SESSION V – ADVANCED TECHNOLOGIES

R. Fostokjian, A. Vien

THURSDAY 8:30

Membrane Technology Applications in Mineral Processing
R. Cameron, C. Edwards

THURSDAY 8:55

Development and Testing of a More Effective Froth Handling Pump
R. J. Visintainer, W. L. Whitlock

THURSDAY 9:20

Comparison of Flotation Grade Dynamics Enabled by Real-Time Measurement
K. Keet and F. E. du Plessis

(BREAK)

THURSDAY 10:15

Implementing Best Practices of Metal Accounting at the Strathcona Mill
L. Lachance, D. Leroux, S. Gariépy

THURSDAY 10:40

In-Plant Hydrogeochemical Mapping: A Tool to Localise Potential Deleterious Reactions due to Water Quality in a Process
S. Somot, É. Proulx, J.-S. Marois, A. Bouajila, C. Gagnon, M. Ourriban, M. Drouin, P. Blatter

THURSDAY 11:05

Triboelectric Belt Separator for Beneficiation of Fine Minerals
S. A. Gasiorowski, J. D. Bittner, F. J. Hrach

THURSDAY 11:30

Characterising Ore Micro-texture using X-Ray Micro-Tomography
C.L. Evans, E.M. Wightman, X. Yuan

SESSION VI – COMMINUTION

R. Barrette, D. Barratt

THURSDAY 13:30

Tendencies and Considerations for Energy Efficiency in SAG Mill Circuit Design from Recent Projects in Chile
C. Schuffeneger

THURSDAY 13:55

Using MillMapper to Reduce Milling Costs and Improve Performance
P. Clarke, T. Gabardi

THURSDAY 14:20

Inspection Techniques - Non-Destructive Evaluation - Mill Gear Inspection Using Eddy Current Array (ECA) Combined with Alternating Current Field Measurement (ACFM) Techniques
T. Shumka

(BREAK)

THURSDAY 15:15

Predicting the Effect of Grinding Media Size Distribution on the Performance of a Ball Mill using Discrete Element Method (DEM) and Population Balance Techniques
S. Makni, A. Faucher, A. Bouajila, F. Robichaud

THURSDAY 15:40

Improvements in HPGR and Grinding Mill Technology
S. J. Hall, E. J. Hofmann, C. Carpinisan

CMP 2012 – CONFERENCE OVERVIEW

CHAIRMAN'S WELCOME

On behalf of the CMP Executive and CANMET, I want to welcome all delegates to crisp and beautiful Ottawa for the **44th Annual Meeting of the Canadian Mineral Processors**. Last year, you were nearly 500 to attend this highly regarded mineral processing plant operators' conference. Again this year, the meeting is providing you with outstanding opportunities for networking, knowledge sharing and personal development

With thirty-seven papers, the technical program will be the heart and soul of the conference. Three full days of technical presentations will be delivered by fellow mill operators and mineral processing professionals. In addition to Canadians describing Canadian milling practices, you will hear Canadian and international speakers talk about mineral processing challenges they meet elsewhere. Following a keynote session on Canadian mineral processing innovations by world renowned Dr. Jan Nettet, the program will present papers on innovative operating practices, plant optimization projects, as well as potential solutions, economic and/or environmental, to challenging comminution, flotation, gold and other mineral processing circuits. All presentations are supported by technical papers that are assembled in the Conference Proceedings which are available to all delegates at the registration desk.

This year, the three-day (Tuesday to Thursday) technical program is preceded by a short course program covering three themes (Flotation Fundamentals, Metal Accounting and Statistical Benchmark Surveying). Because it is a two-day event, the first short course starts on the Sunday while the two others are one-day short courses and are delivered on the Monday. This is the very first time that the CMP short course program covers more than one topic. The high level of interest that delegates expressed through registration clearly indicates that a multi-topic short course program meets the needs of our community.

Attendance to the CMP Annual Conference also includes invitations to a number of social and professional networking events. On the Monday evening, the Student Mixer is providing an opportunity to meet students from almost every Canadian colleges and universities where education in mineral processing is offered. On the Tuesday evening, delegates can either socialize between themselves at the Chairman's Reception (where a new friendly competition between guitar playing delegates, called '**CMP's Got Talent**' will be held) and/or participate in the friendly annual hockey game between delegates from Eastern and Western Canada. Finally, on the Wednesday evening, all delegates are invited to the CMP Annual Banquet where are recognized the exceptional contributions of our peers to the advancement of our Society and of our mineral processor profession.

You will also notice that a large group of mineral processing students from Canadian schools are attending the CMP meeting under the invitation of the CMP Student Program (funded by generous sponsors of our industry). Along with them are the winners are the André Laplante Memorial Scholarship and of the Student Essay Competition. Please do not hesitate to meet them and discuss career perspectives into our fascinating industry.



Finally, I would like to highlight that the Annual Business Meeting is a great opportunity for all delegates to hear the CMP Executive report on the activities they conducted throughout the year and to make suggestions to further improve the CMP society. The meeting will take place on Tuesday, January 17th at 12:30 during the luncheon.

I wish you all a most enjoyable, memorable and productive CMP Conference.

Donald Leroux
CMP 2012, Chairman

CMP 2012 – CONFERENCE OVERVIEW

Sunday, January 15th

8:00 - 17:00 Short Course, Governor General
Ballroom, 4th Floor

Monday, January 16th

8:00 - 17:00 Short Courses, Governor General
Ballroom, 4th Floor
10:00 - 17:00 Board of Directors Meeting
Rideau Suite, 22nd Floor
12:00 - 13:00 Short Course Luncheon
Daly's, 3rd Floor
19:00 - 22:00 Early Conference Registration
4th Floor Westin Hotel
20:00 - 23:00 Student Mixer
Quebec Room, 4th Floor

Tuesday, January 17th

7:00 - 8:15 Authors' Breakfast
Nunavut Room, 4th Floor
7:00 - 15:15 Registration
4th Floor Westin Hotel
8:30 - 16:30 Technical Program
Confederation Ballroom
12:00 - 13:30 Beer and Sandwich Luncheon
Governor General's Ballroom
12:30 - 12:45 Annual Business Meeting
Governor General's Ballroom
19:00 - 21:00 Hockey Cup Challenge
Carleton University
21:00 - 24:00 Chairman's Reception
Governor General's Ballroom

Wednesday, January 18th

7:00 - 8:15 Authors' Breakfast
Nunavut Room, 4th Floor
7:30 - 15:15 Registration
4th Floor Westin Hotel
8:30 - 16:30 Technical Program
Confederation Ballroom
18:00 - 19:30 Executive Reception
Rideau Suite, 22nd Floor
18:30 - 19:30 Reception
4th Floor, Westin Hotel
19:30 - 22:00 Annual Banquet
Confederation Ballroom
22:00 - 1:00 Post Banquet Reception
Rideau Suite, 22nd Floor

Thursday, January 19th

7:00 - 8:15 Authors' Breakfast
Nunavut Room, 4th Floor
8:00 - 15:30 Registration
4th Floor Westin Hotel
8:30 - 16:05 Technical Program
Confederation Ballroom
16:30 - 20:00 Board of Directors Meeting
Rideau Suite, 22nd Floor

SHORT COURSES

Flotation Fundamentals and Applications

Jan. 15th & 16th – Governor General III, 4th Floor
Registration – 8:00 to 9:00, Course – 9:00 to 5:00

Lead Instructor: Dr. Janusz S. Laskowski, Professor
Emeritus, University of British Columbia

Objectives:

- Review of flotation fundamentals and flotation technology

State of the Art Metallurgical Accounting

Jan. 16th – Governor General I, 4th Floor
Registration – 8:00 to 9:00, Course – 9:00 to 5:00

Lead Instructor: Frederic Flament, Algosys

Objectives:

- Learn the best practices of metallurgical accounting.

Statistical Benchmark Surveying

Jan. 16th – Governor General II, 4th Floor
Registration – 8:00 to 9:00, Course – 9:00 to 5:00

Lead Instructor: Norman Lotter, Xstrata Process
Support

Objectives:

- Provide a structure for the production of a representative set of concentrator flowsheet samples taken for quantitative mineralogical measurement.

Looking for a place to
gather with friends,
colleagues and peers?

CMP Landmarks Lounge



3rd Floor, Daly's, Westin Hotel

Hours

Mon. Jan 16th – 16:30 to 24:00
Tues. Jan 17th – 16:30 to 21:00
Wed. Jan. 18th – 16:30 to 18:30

TUESDAY, JANUARY 17th
Morning Session

PLENARY PRESENTATIONS

8:30

Significant Canadian Developments in Mineral Processing Technology 1961-2011

J.E. Nesset

I had been requested earlier this year by MetSoc, our sister society of CIM, to contribute a chapter on technical developments in Canadian mineral processing over the past 50 years to their 50th Anniversary volume. Accepting the challenge of assembling such a chapter seemed at first a reasonably straightforward task, until one realises that the list of contributions by Canadians to mineral processing over this period has been more than just significant. It turns out to have been an extraordinarily fertile time for innovation and impact for Canadian-based technology. The list is necessarily a subjective one, however I had no trouble identifying twenty technology developments that are clearly outstanding, and there are undoubtedly others. As much as possible, I approached the individuals themselves who played key roles in each technology and asked that they tell the "story". Without exception, all who were invited accepted eagerly and delivered more than I had hoped for.

The technologies have been grouped into those that are truly Canadian innovations, such as the Knelson gravity concentrator and the McGill gas dispersion sensors in flotation, and technologies where Canadians and Canada played a very significant role in their success and implementation, such as AG/SAG grinding and ion-beam surface analysis. Also included are what may be termed technology transfer initiatives and institutions that have risen to a world class level, such as SGS Lakefield and the Canadian Mineral Processors Society of CIM. The challenge is now for the coming generation to continue this record of innovation and contribution to the industry, and that includes the (mostly) Canadian mining and metallurgical companies who have taken the longer term view and supported many of these initiatives, through their critical early years, with both financing and project sites for these ideas. Let us hope that the current trend of mining company globalization will not dampen their enthusiasm to participate. This plenary presentation will highlight many of these technologies, the individuals behind them, and their significance to the mineral processing industry.

9:20

Update of Chilean Mining Projects and Technological Trends

J. Rosas, C. Schuffeneger and C. Cornejo

At the end of 2010 the AMSA Esperanza Concentrator started commissioning. Located in the Atacama Desert this project is the first of several large size concentrators developed recently to operate in Northern Chile.

In addition to the new operations to be implemented in the short term, many existing installations are planning expansions. The use of large size equipment is one of the common characteristics of the new concentrators, but also

new technologies are being considered and innovation is present in most cases. Sea water or desalinated water will be required to process large tonnages of sulphide copper ores as well as gold bearing ores, since process water supply from the Andes will no longer be available. The high cost of sea water or desalinated water supply and the high cost of energy are not a limitation as the current metal market scenario allows obtaining an attractive NPV even from installations designed to process relatively low grade ores.

A review of the current concentrators being developed in Chile is presented, including a description of the main design issues related to technology and innovation. An analysis of the Chilean mining industry is also presented, detailing mine and plant capacities as well as expected final products.

OPERATIONS

10:15

Z1600 Jameson Cell Test Rig – From Rental To Revenue

A. Taylor, J. Doucet, M. Blanchette, R. Barrette, V. Lawson

A Z1600 Jameson Cell Test Rig was rented for test work at Vale's Clarabelle Mill operation. This paper discusses the evolution of renting the unit for test purposes to owning the unit and operating it as a revenue generating process component.

The paper focuses on three aspects of the Z1600 project; the initial rental and installation, the test work performed in the cleaning circuit, and the business factors which led to the unit being permanently incorporated into the copper circuit.

10:40

Concentrate Grade and Regrind Size Improvement on the East Pit Hypogene Ore at Kemess Mine

M. Brisette and E. Roman

For its end of life, Kemess Mine processed its difficult-to-treat hypogene ore from the east pit, which is a lower grade copper and higher pyrite content gold ore. Metallurgical testwork showed that improvement was possible with finer grinding. In July 2010, small grinding media were introduced into the regrind mill resulting to a nearly 50% decrease of the power draw with a finer grind, an increase of 1.1% in the final copper grade, an increase of 1.2% in copper and 2.9% in gold recoveries at the cleaners. The overall recoveries of copper and gold increased by 0.6% and 1.3% respectively.

11:05

Applying a Customer-Based Approach at Vale's Clarabelle Mill

R. Barrette, A. Taylor, J. Doucet, J. Shelegey, H. Sullivan, V. Lawson

Historically, performance at Vale's Clarabelle Mill was measured by Mill throughput and Mill recovery. After the economic collapse in 2008, a series of reviews were performed to drive improvements in business efficiency. These identified that product quality (e.g., concentrate grade, variability in concentrate grade) had a profound impact on downstream processes and suggested that

CMP 2012 – ABSTRACTS

improved control of these parameters would generate the greatest value for the customer (the Copper Cliff Smelter) and the company (Vale). Consequently, a movement was initiated to transform the Mill operating philosophy to consider customer needs as paramount. Systems and strategies used to drive the transformation are described.

In 2011, an unexpected furnace failure resulted in decreased capacity at the Copper Cliff Smelter. In response, a two-stage change in production strategy was developed at Clarabelle. The first stage was to modify the ore blend feeding Clarabelle so that the concentrate grade could be significantly increased with minimal impact on recovery. The second stage was a circuit modification to ensure the elevated concentrate grade could be sustained. Execution of the first stage was complete five days after the failure and the second stage was complete within 10 weeks. Steps involved in each stage are outlined and the overall benefits are presented.

11:30

Diagnosis of the Operation of a Hydraulic Classifier for Iron Ore Concentrate

M. Desnoyers, C. Gosselin, and G. Chevalier, C. Bazin, and G. M. Payenzo

ArcelorMittal Mines Canada operates hydraulic classifiers to reduce the silica content of an iron oxide concentrate from 4.5% to less than 1.2% SiO₂. Sampling campaigns were conducted to develop a preliminary model for the hydraulic classifier. Results show that iron oxide and quartz are respectively concentrated in the coarse and fine size fractions of the classifier feed. The mineral partition curves in the classifier and the size distribution of the minerals in the feed are used to simulate the classifier operation in order to identify the source of variability observed in the daily plant production data. Results indicate that most of the variation is probably caused by unsteady operating conditions of the classifiers.

TUESDAY, JANUARY 17th
Afternoon Session

RARE EARTHS, INDUSTRIAL AND ENERGY MINERALS

13:30

Rare Earth and Thorium Recovery in Canada

J.R. Goode

The year 2011 witnessed a major surge in rare earth prices as China, supplier of +95% of the world's rare earths, reduced export quotas and increased export taxes and duties. In response, companies around the world are scrambling for alternative sources. In Canada too, there is a race to be the "first" rare earth producer.

Something that is not generally realized is that Canada has a long history of rare earth production and was a major supplier from the early 1960's to 1990. At one stage, Canada was said to be supplying more than one third of the world's yttrium and probably supplied even more than that.

Five decades ago, thorium was a key element in many non-nuclear applications and Canada became a major

supplier of thorium from the late 1950's to 1968, first as a by-product of uranium and then as a co-product of rare earths.

This paper reviews the development of Canada's original rare earth and thorium production facilities, which were located in the Elliot Lake uranium camp in Northern Ontario. The uses of these elements, geology, mineralogy, markets of the time, and processing are all discussed. Some of the lessons learned from these pioneering operations might be useful in today's race to develop the next generation of rare earth production plants.

13:55

A Review of Rare Earth Mineral Processing Technology

J. Zhang and C. Edwards

The versatility and specificity of rare earth elements (REEs) have led to their use in an ever increasing variety of applications in new technologies. Consequently, demand for REEs has increased significantly. However, to separate REEs safely and effectively is a complex and expensive process. While China has consistently invested in R&D of REE processing technologies, there have been only sporadic activities in REE mineral processing in North America in the past 20 years. This paper presents a review of REE mineral processing technology, providing an update on current capabilities in REE mineral processing.

This paper reviews REE extraction from the major commercially valuable REE-bearing minerals such as bastnaesite, monazite, and xenotime, and also from the ion-absorption type of REE deposits. Currently, there are four major REE mining areas in China, one in the United States, and one in Australia. A review of the REE extraction processes in these major REE mining areas closes out the paper.

14:20

A Preliminary Comparison of Coal Classification and Processing Between Canada and China

T. Lu and G. Laman

This document compares the systems of coal classification described under ASTM standards used in Canada to GB standards used in China. A preliminary connection of metallurgical coal classes was set up between the two classifications. In GB classification system, there are nine metallurgical coal groups, namely PS, SM, JM, FM, 1/2 ZN, RN, 1/3 JM, and QM used in coal blending for coke production. PS coal is almost equivalent to the Low Volatile Bituminous coal; SM, JM, and FM coal groups fall into Low to Medium Volatile Bituminous range; 1/2 ZN, RN, 1/3 JM, and QM are equivalent to bituminous coal with medium to high volatile matters; QF contains higher volatile bituminous coal compared with High Volatile Bituminous coal. The caking properties commonly used in respective country are also compared in this document. These properties include free swelling index (FSI) and maximum fluidity used in Canada, as well as caking index (G_{R.I.}), and the maximum plastic layer thickness (Y) mainly employed in China. It has been observed that the log of the maximum fluidity has a stronger correlation with the caking index than the Y values. Metallurgical coal processing strategy and typical coking coal product qualities are briefly discussed in the last section of this

CMP 2012 – ABSTRACTS

paper. Currently there is a trend to use heavy medium cyclone in both countries. In Canada the conventional two-product cyclone technology is the preferred practice; whereas in China the three-product heavy medium cyclone arrangement is widely used.

15:15

Secondary Recovery of Bitumen using Jameson Downcomers

O. Neiman, B. Hilscher, R. Siy

A full-scale prototype of "Jameson Downcomer" technology has been installed and tested on a Tailings Oil Recovery (TOR) vessel in Syncrude's Mildred Lake extraction plant. Jameson Downcomers are a type of mineral flotation equipment used in the coal industry that Syncrude has extended to the recovery of secondary bitumen in the oil sand extraction process. The TOR vessels are currently being operated as single-gravity separation vessels, in series with the Primary Separation Vessels (PSV's). We have developed a model to differentiate between "floating" and "non-floating" bitumen in the PSV's, and then applied it to verify that the current TOR performance only captures the "floating" bitumen by simple separation. The existence of "non-floating" bitumen provides an opportunity for recovery enhancement by means of the Jameson Downcomers. To achieve bitumen recovery enhancement, middlings slurry is withdrawn from the TOR vessel, and passed through a number of parallel Jameson downcomers, within which the slurry is accelerated to a high-velocity free jet, and impinged upon the slurry surface inside the downcomer, in the presence of air. The aerated slurry is returned to the middlings zone inside the TOR, resulting in an incremental recovery improvement of bitumen in the TOR. The operation of the downcomers is thought to produce suitably small air bubbles for the flotation of bitumen, either by fluid shearing during the slurry jet impingement, and/or by micro-bubble nucleation. This full-scale prototype design has met or exceeded the recovery expectations of the original Research piloting, recovering at least 40% of the non-floating bitumen. In Syncrude Extraction, this provides high business value by a separation efficiency gain achieved with modest expenditure. As well, the system has demonstrated excellent operability and maintainability.

15:40

An Overview of Potash Flotation

M. Oliazadeh, M. Aghamirian, T. Grammatikopoulos, D. Imeson

More than 70% of potash is produced worldwide by froth flotation. Flotation of potash was developed in the early 1930s. Amines are widely used for flotation of sylvite (KCl) from halite (NaCl) and insoluble materials such as clays. Amine collector is also absorbed by clays. Therefore, clays are usually separated by scrubbing and de-sliming prior to flotation. Alternatively, slimes can be floated ahead of potash flotation. Flotation recoveries of sylvite are commonly in the range of 85%, while losses can occur in slimes, flotation tailings and make-up of process brine. Ores containing free coarse-grained sylvite are generally screened, whereas both fine and coarse fractions are conditioned and floated separately.

The unique features of potash flotation include solubility of sylvite in water, the size of particles floated and fast

kinetics. Particles up to 2.3 mm can be floated and about 50% of flotation feed can be removed in the rougher stage in few minutes. The main challenges in potash flotation are the recovery of potash from slimes, flotation efficiency in the presence of carnallite and recovery of coarse potash grains. A review of potash flotation shows that there is still room for improvement in both coarse and fine potash flotation.

The present paper reviews the most significant flotation parameters including reagent type and dosage, flotation circuits, flotation equipment size and new developments in potash flotation. The latter include new reagents, flotation technologies (Hydrofloat, Jameson and column cells) larger flotation cells and slimes flotation.

16:05

An Overview of Spodumene Beneficiation

M. Aghamirian, C. Mohns, T. Grammatikopoulos, D. Imeson, G. Pearse

Spodumene mineral is a source of lithium for lithium ion batteries. Thus, the production of a spodumene concentrate with an approximate grade of 6% Li₂O is targeted. Traditionally, spodumene is concentrated by froth flotation using fatty acid as the collector. Amine collector can also be used to float mica ahead of spodumene as required or feldspar from the spodumene tailings. Slimes have a negative effect on spodumene flotation and they are commonly separated by scrubbing and de-sliming prior to spodumene flotation. The main losses in spodumene flotation typically occur in cyclone overflow, scrubbing slimes, spodumene flotation tailings and mica concentrate.

In recent years, dense media separation (DMS) is the main concentrating process in Australian spodumene operations. In these operations, DMS is efficient at generating coarse grain concentrates and rejecting large portions of silicate gangue, thereby directly reducing the milling cost. The ore should be crushed to 3/8" or coarser while further crushing is possibly necessary on the middling particles to scalp further spodumene. The DMS feed should be classified to remove fines (typically -0.5 mm particles). The final middlings and undersize fractions could then be processed by flotation. The main requirement in DMS operations is to have good spodumene liberation at relatively large grain size.

This paper reviews the most significant DMS and flotation parameters in spodumene beneficiation. The treatments of different minerals in the spodumene ore are also addressed.

WEDNESDAY, JANUARY 18th
Morning Session

FLOTATION

8:30

Canatuan Cu/Zn Flotation Metallurgy - Dealing with Zinc Pre-Activation

C.V. Umipig, E.E. Israel, G.G. Hutalle, S.R. Williams

TVI Resource Development (Phils) Inc. Canatuan mine is a polymetallic ore deposit located in the Province of

CMP 2012 – ABSTRACTS

Zamboanga del Norte on the island of Mindanao in the Philippines. The deposit consisted of an oxidized capping of gossan overlying a Besshi type volcanogenic massive sulphide lens which is near surface and flat lying. Construction and development of a sulphide processing plant began in early 2007 and commissioned in November 2008. During the initial stages of sulphide operation, high copper (Cu)-low zinc (Zn) ore was fed to the plant. Marketable copper concentrate at 91-95% recovery was produced utilizing a high-pH bulk sulphide rougher flotation and 2 cleaning stages. Because of increased levels of Zn of the ore body, a Cu/Zn separation circuit was initiated in early 2010 following an intensive laboratory test work program. This Cu/Zn separation circuit was necessitated because of the copper ion pre-activation of the sphalerite that lead to the zinc being readily recovered to the copper rougher concentrate. In-situ activation of zinc (in the pit and stockpiles) was caused by the leaching of secondary copper minerals in the ore (particularly from the dominant copper species, chalcocite and covellite). This problem required the development of metallurgically complex and intensive reagent regime to effectively depress the activated sphalerite. As well, the immediate reactivation of zinc after it has been depressed, at the onset of Cu/Zn separation flotation, added additional metallurgical complexity to the process. Subsequent to the Cu/Zn separation circuit, an unconventional, yet proven effective, simultaneous cyanide detoxification-zinc flotation circuit was set-up to recover the zinc. Laboratory test work results realized Cu-Zn recovery differential from a Cu/Zn separation circuit of over 40-45%. This performance has been achieved in the plant, at 72% Cu overall recovery. With the gradual improvements on-going with zinc circuit capacity and effective zinc separation being achieved, zinc recovery has currently reached 40%.

8:55

Constrained Multivariable Control of a Pilot Flotation Column at the Laronde Concentrator

D.E. Calisaya, A. Riquelme, A. Desbiens, É. Poulin, R. del Villar

A 15 cm diameter by 732 cm height, fully automated pilot column was installed in the Agnico-Eagle's Laronde concentrator (Québec), for evaluating the performance of newly developed sensors and advanced process control algorithms. For eventual comparison purposes, the pilot column is continuously fed with the same slurry feeding the copper-circuit third cleaner column. It is equipped with electrical conductivity-based sensors for estimating the three variables used in the multi-variable control algorithm under evaluation: froth depth, fraction of wash water underneath the interface and gas hold-up. Froth depth is regulated using a PI controller while a predictive controller is formulated as the minimization of the tracking errors of gas hold-up and bias rate, keeping several operating constraints between their practical upper and lower limits. In particular, an unreachable high set point of gas hold-up can be selected in order to maximize the bubble surface area available for particle collection, while maintaining bias rate above a minimum value required for froth cleaning. The proposed strategy may indirectly help optimizing flotation column operation by using these secondary variables, without the implementation of a real-time optimization layer

9:20

A Benchmarking Tool for Assessing Flotation Cell Performance

J.E. Nettet, W. Zhang, J. A. Finch

Bubbles are unquestionably the heart of the flotation process. Their size and combined surface area are largely what drive the recovery process. This suggests that plant engineers should be aware of where their plants are operating with respect to what is achievable for these key parameters. The paper presents a model of how the key operating variables of frother type and concentration, gas rate, altitude (above sea level) and viscosity affect the Sauter mean bubble size (D_{32}) and bubble surface area flux (S_b). The results are compared to a set of plant measurements that demonstrate the benchmarking capability of the approach. A case study is used to link hydrodynamic change to improved metallurgical performance.

10:15

An Overview of Optimizing Strategies for Flotation Banks

M. Maldonado, R. Araya, J.A. Finch

A flotation bank consists of a serial arrangement of cells. How to optimally operate a bank remains a challenge. This article reviews three strategies for optimizing bank performance: air profiling, mass-pull (froth velocity) profiling and Peak Air Recovery (PAR) profiling. These are all ways of manipulating the recovery profile down a bank, which may be the property being exploited. Mathematical analysis has shown that a flat cell-by-cell recovery profile maximizes the separation of two floatable minerals for a given target bank recovery when the relative floatability is constant down the bank. Available bank survey data is analyzed in respect to recovery profiling. Possible variations on recovery profile to minimize entrainment are discussed.

10:40

Nanoparticle Flotation Collectors for Pentlandite

S. Yang, R. Pelton, M. Xu, Z. Dai

Hydrophobic polystyrene nanoparticle suspensions were evaluated as potential flotation collectors for pentlandite. Experiments involving both clean model mineral suspensions and complex ultramafic nickel ores confirmed that conventional water-soluble molecular flotation collectors such as xanthate could be partially or completely replaced by hydrophobic nanoparticle flotation collectors. The ability of nanoparticles to induce flotation was demonstrated by floating hydrophilic, negatively charged glass beads with cationic polystyrene nanoparticle collectors. Electrostatic attraction promoted the spontaneous deposition of the nanoparticles on the glass surfaces raising the effective contact angle sufficiently high to promote the adhesion of beads to air bubbles. As little as 10% coverage of the bead surfaces with our most effective nanoparticles could promote high flotation efficiencies, whereas conventional small molecular flotation collector requires ~ 20% or higher coverage for a good recovery. Surface functionalized nanoparticles enhanced the ability for nanoparticle collectors to selectively deposit onto surfaces of the desired mineral particles in the presence of gangue. For example, poly(styrene-co-vinylimidazole) nanoparticles were designed to selectively deposit onto nickel mineral (pentlandite) in

CMP 2012 – ABSTRACTS

the presence of Mg/Si slime. Flotation tests of ultramafic nickel ores at Vale with these nanoparticle collectors have shown improvements in both pentlandite recovery and selectivity. On-going work includes attempts to identify specific applications where nanoparticle flotation collectors might be cost effective.

11:05

Innovations in Reagent Technology: New Collectors and Modifiers for Difficult to Treat Ores

T. Bhambhani and D.R. Nagaraj

Ultramafic Ni ores present significant challenges in processing in that both recoveries and grades are not satisfactory, due to the presence of Mg silicates in large amounts. Significant quantities of xanthates and CMCs are generally used for their recovery by flotation. Additionally, given that some of these ores are processed under acidic conditions, CS₂ generation due to xanthate decomposition presents some safety hazards. Technology to replace xanthate has been developed for which the safety and health issues are absent. Collector S-10294 shows significant improvements in Ni and overall S recovery at a dosing rate of one half that of xanthate. New polymeric modifiers have also been developed that help reduce the Mg content of the concentrates at very low dosages. The reagents are custom designed for use in normal or hypersaline water, and acid or alkaline conditions.

11:30

Development of Processing Alternatives for Frankfield East Deposit using Selective Arsenopyrite-Pyrite Flotation

G. Wilcox, D. Koningen, R. Jackman

Gowest Gold Ltd. is in the process of developing the Frankfield East gold deposit located along the largely undeveloped Pipestone fault northeast of Timmins, Ontario. In addition to resource development and environmental permitting work the company has had an ongoing program of metallurgical and engineering studies aimed at evaluating options for processing the Frankfield East ore.

Mineralization at the Frankfield project contains arsenopyrite and pyrite as the major sulphide minerals. Bulk flotation of all sulphides results in extremely high gold recovery. However, the gold is almost entirely associated with the arsenopyrite fraction of the ore and is refractory in nature requiring preoxidation treatment. Selective flotation was investigated to recover a gold-arsenopyrite concentrate thereby reducing the mass which would be subjected to further gold processing. As part of this work, a pyrite concentrate low in arsenic content was also recovered that would be suitable as a source of sulphur for a smelter (or other pyrometallurgical facility). Production of separate arsenopyrite and pyrite concentrates is frequently examined but rarely adopted due to the distribution of gold between the two products or the inability to achieve adequate separation. Several flowsheet options were investigated in the study. The best results were achieved following a sequential flotation flowsheet. The flowsheet configuration was key to meeting the targets for the two products. In this paper, the various options investigated are reviewed and the results of the final flowsheet are presented.

The overall plan by Gowest was to evaluate all process options to bring the Frankfield East deposit into production. The ability to effectively separate the arsenopyrite and pyrite components in the ore provides Gowest with added opportunities to pursue both short and long term production scenarios

WEDNESDAY, JANUARY 18th

Afternoon Session

GOLD AND HYDROMETALLURGY

13:30

An Overview of the Lithium Carbonate Process Flow Sheet for Concentrates Derived from Hard Rock Lithium Sources

S. Mackie, M. Aghamirian, C. Forstner, T. Grammatikopoulos, G. Pearse

SGS Minerals Services (Lakefield, Ontario site) has conducted a number of developmental and pilot programs that examined methods for the beneficiation, extraction and recovery of lithium from a variety of spodumene containing hard rock sources. An overview of the beneficiation programs is presented separately by Aghamirian, Mohns, Grammatikopoulos, Imeson & Pearse (2011). The focus of this discussion will be the hydrometallurgical steps involved in producing a high grade lithium carbonate (Li₂CO₃) sample from the spodumene concentrate. SGS has applied the standard Li₂CO₃ hydrometallurgical flow sheet to a number of spodumene concentrates and has determined that all of these samples respond in a similar manner to the process and produce a final product having a Li₂CO₃ grade of >99.5%. The standard process is sufficiently robust to accommodate the observed variability in the concentrates that have been tested. Advantage of one spodumene deposit over another will thus be gained through process optimization and innovation. Optimization at the beneficiation stage and at the hydrometallurgical stage must be considered. Some aspects of the process optimization of the hydrometallurgical flow sheet will be presented.

13:55

Error Associated with the Sampling of Gold Ores

Claude Bazin, Raphaël Mermillod-Blondin

Sampling is an important step for ore body evaluation and daily plant material balances. The Gy's equation is regularly used to assess the size of the samples to be collected and to estimate the reproducibility of the collected samples. The equation works well for iron and base metal ores but seems to produce pessimistic estimates of the gold content reproducibility for gold ores. A model is proposed to simulate the division of samples using a standard splitter and discrepancies are observed between the Gy's equation predictions and simulated samples reproducibility for crushed gold ore. Results of the simulation show that sampling a pile of ore crushed to -2 mm should lead to more reproducible gold content than it is observed in practice and predicted by the Gy's equation.

CMP 2012 – ABSTRACTS

14:20

Gold Passivation: Some Fundamental Issues to Highlight

A. Azizi, C. Olsen, C. Gagnon, A. Bouajila, M. Ourriban, P. Blatter, F. Larachi

Due to the high reactivity of sulfide minerals in alkaline cyanide solutions, some parasitic reactions inflict a heavy gold surface passivation and excess cyanide consumption resulting in a dramatic decrease of the gold leaching rate. Atmospheric pre-oxidation was shown to be an effective tool to enhance gold extraction by preventing a passive film from forming on the surface of gold grains. This work aims to highlight efforts undertaken to determine: (1) how gold cyanidation is limited by passivation; (2) what are the reactions and mechanisms involved during gold cyanidation; and (3) how a better understanding of fundamental issues can be used to design a proper pre-oxidation strategy.

15:15

Goldex, The GRG Jewel

F. Robichaud, G. Belzil, M. Fullam

The Goldex mining and milling complex is operated by Agnico-Eagle Mines Ltd. and is located in the Abitibi greenstone belt of Northwest Quebec, Canada. The mill operates presently at a throughput of 8,250 tpd with gold grade varying between 1.8 and 2.2 g/t. The ore is very high in gravity recoverable gold (GRG) at about 92% and as such a significant emphasis was placed on the gravity circuit. Commercial production started in 2008. Average gold recovery is 93.5% with about 68% of gold recovery coming from the gravity circuit.

Over the course of the first several years of production, several gravity audits were carried out. In 2009, a complete gravity audit was completed, including ore, classification, Knelson Concentrators, and the gold room. In 2011, an audit was undertaken of the flotation circuit to determine the efficiency by which GRG is floated. Large samples of flotation feed and tails were collected and process for GRG content. This allowed a link between gravity and overall recovery to be made. This paper presents results of the audits and the development of a model linking gravity and overall gold recovery, and outlines improvements made to increase gravity performance and reduce operating costs.

15:40

Cu-DETA Catalyzed Non-Ammoniacal Thiosulfate Leaching from a Sulfidic Gold Ore

C. Xia

A highly sulfidic gold ore was tested using various leaching processes. The cyanidation process leached 81.6% gold in 24 hours. Ammoniacal thiosulfate with 1 mol/L ammonia extracted 82.4% gold in 24 hours with 34 kg/t ammonium thiosulfate consumed. The baseline non-ammoniacal thiosulfate leaching test using Cu-DETA catalyst had a low leaching rate. Only 65.7% gold was extracted in 4 days with 15 kg/t sodium thiosulfate consumed. To accelerate this process, four enhanced methods were tested. Method 1 and 2 increased the gold extraction to above 81.0% in 96 hours. The gold extraction in the sodium thiosulfate leaching test increased to 77.4% in 48 hours with the Method 3. The combination of the Method 2 and 3 further increased the gold extraction to 84.6% in 48 hours.

Higher gold leaching rate was realized through applying the Method 4. The gold extraction reached 90.8% at 24 hours and 89.0% at 48 hours. The combination of the Method 4 and 2 allowed gold to be dissolved even faster. However, the leach slows down after 6 hours and the final gold extraction was 85.7%. These methods and their combinations are capable of accelerating the non-ammoniacal thiosulfate leaching process significantly.

16:05

The Limitations of Activated Carbon in CIL Circuits Handling Preg Robbing Solids

G. Van Weert and Y. Choi

In regular CIL circuits, activated carbon is used for two purposes: avoiding solid/liquid separation after cyanide leaching, and minimizing gold losses in the tails. The carbon distribution and gold profiles in the successive CIL stages are operating variables, not objectives. When the CIL feed contains a preg robbing constituent however, such as native carbon, there will be competition for gold cyanide and this conflicts with minimizing of losses of gold to CIL tails. This paper examines some of the limitations of activated carbon in CIL circuits handling preg robbing Carlin Trend ores.

THURSDAY, JANUARY 19th
Morning Session

ADVANCED TECHNOLOGIES

8:30

Membrane Technology Applications in Mineral Processing Plants

R. Cameron and C. Edwards

Stringent environmental performance criteria and regulations, and the desire to minimize water use have made membrane-based treatment and separation processes an attractive option. This has led to many advances in all aspects of the technology. Membrane separation processes have found application in sea water desalination, brackish water treatment, decontamination of ground water, and wastewater treatment. Development of membranes with better resistance to harsh feed conditions has created new opportunities for the broader application of membrane separation technologies to mineral processing streams. There are examples in mineral processing operations, including treatment of acidic drainage, pre-concentration of pregnant leaching solution in heap leaching operations, separation of acids and metals from waste streams and intermediate process streams, as well as gold and cyanide recovery from a heap leaching operation. This paper provides a brief overview of membrane technology principles, followed by a discussion of current membrane technology applications relevant to the mining and mineral processing industry. The paper further explores the potential for the application of membrane separation as an integrated component in mineral processing operations.

CMP 2012 – ABSTRACTS

8:55

Development and Testing of a More Effective Froth Handling Pump

R. J. Visintainer and W. L. Whitlock

Difficulties with the sizing and operation of centrifugal froth pumps are common and the underlying fluid dynamics are complex. Design and selection often relies on previous experience, offering unreliable guidance for novel applications or unexpected problems. The current paper describes a program of extensive laboratory testing on froth handling centrifugal pumps, covering a range of flows, heads, speeds, viscosity, air content and froth stability. Variations in impeller vane design and the effectiveness of an airlock venting apparatus were also examined. The program resulted in a better understanding of centrifugal froth pump dynamics and insight for the troubleshooting of field applications.

9:20

Comparison of Flotation Grade Dynamics Enabled by Real-Time Measurement

K. Keet and F. E. du Plessis

The distinction between data suitable for process control and data subject to aliasing only becomes quantifiable with the availability of rapid real-time measurements. Expecting the dynamics of flotation to vary for different ore types, process flows and equipment types; a study was conducted to compare the dynamics of different flotation processes. The results shed light on the critical sampling intervals required for process control which in turn allows process stabilization and optimization. The technology used for the in-line measurements is based on diffuse reflective spectroscopy and has been introduced into the mineral processing industry over the past ten years. It has been widely implemented in the sulphide flotation industry in South Africa for the real-time measurement of grade.

10:15

Implementing Best Practices of Metal Accounting at the Strathcona Mill

L. Lachance, D. Leroux, S. Gariépy

The importance of coherent material balance results has long been recognized by mining and metallurgical companies. Although this is still true nowadays, various stakeholders are increasingly concerned about the origin and the accuracy of the reported numbers. The last decade has shown that most metallurgical accounting concerns can be addressed by making two important changes to plant performance monitoring practices. First, introducing data redundancy into the metal balance procedure allows the estimation of measurement errors. Second, the migration from spreadsheet-based to relational database based systems brings transparency, data integrity, traceability and auditability into metallurgical accounting. Relational databases also facilitate the production of reports that metallurgical accountants must issue routinely. Recognizing the caveats of the spreadsheet-based metal accounting method they had been applying for years, Strathcona decided to switch to a commercial relational database system in 2008. For the most part, the migration was seamless. Some challenges were raised but they could all be overcome and outweighed by benefits gained from day-to-day utilization of the system.

10:40

In-Plant Hydrogeochemical Mapping: A Tool to Localise Potential Deleterious Reactions due to Water Quality in a Process

S. Somot, É. Proulx, J-S Marois, A. Bouajila, C. Gagnon, M. Ourriban, M. Drouin, P. Blatter

The mining industry has to face increasing restrictions concerning the use of fresh water in Québec and throughout the world. Increasing recirculated water usage could lead to a better control of the quality and the quantity of water supplied to the mineral processing units. Furthermore, it could reduce the volume of waste water to be managed and treated before its release to the environment. However, process water may have a negative impact on mineral processing operations, thereby limiting the incentive for sustainable development initiatives. As a first step into selecting and testing remediation strategies, one of which being blending local waters, a mapping of process water quality (inorganic and organic fractions) allowed to locate zones in an industrial case study where fresh water is introduced into the circuit and to detect dissolution and precipitation zones. A complementary hydro-geochemical modeling study on water blends was also performed showing encouraging results towards the objectives of the project.

11:05

Triboelectric Belt Separator for Beneficiation of Fine Minerals

S.A. Gasiorowski, J.D. Bittner, F. J. Hrach

Separation Technologies, LLC (ST) has developed a processing system based on triboelectric charging and electrostatic separation that provides the mineral processing industry a means to beneficiate fine materials with an entirely dry technology. The environmentally friendly process can eliminate wet processing and required drying of the final material. The process requires little if any pre-treatment of the material other than grinding and operates at high capacity - up to 40 tonnes per hour by a compact machine. Energy consumption is low, approximately 1 kWh/tonne of material processed. Since the only potential emission of the process is dust, permitting is typically relatively easy. In contrast to the other available electrostatic separation processes that are typically limited to particles greater than 75 µm in size, the ST belt separator is ideally suited for separation of very fine (<1 µm) to moderately coarse (500 µm) materials with very high throughputs. The triboelectric particle charging is effective for a wide range of materials and only requires particle-particle contact. The small gap, high electric field, counter-current flow, vigorous particle-particle agitation and self-cleaning action of the belt on the electrodes are the critical features of the ST separator. The high efficiency multi-stage separation through charging / recharging and internal recycle results in far superior separations and is effective on fine materials that cannot be separated at all by the conventional electrostatic techniques. Since 1995, this triboelectric process has been extensively used for the beneficiation of coal fly ash with eighteen separators in place and over 100 machine-years of operation at locations in North America and Europe. The technology has been also successfully applied to the beneficiation of a variety of minerals including calcium carbonates, talc, and potash.

CMP 2012 – ABSTRACTS

11:30

Characterising Ore Micro-texture using X-Ray Micro-Tomography

C.L. Evans, E.M. Wightman, X. Yuan

The processing behaviours of ores such as their liberation characteristics in comminution and their response in separation processes are affected by their mineralogical characteristics. Key ore characteristics which are relevant to processing, such as mineral proportions, mineral grain size, grain shape and mineral associations are routinely measured at the micro-scale in polished section using optical microscopes and SEM-based automated mineralogy systems. The application of X-ray micro-tomography to mineral processing provides the means to quantify these important micro-textural characteristics in three dimensions, removing the stereological issues encountered when measuring volumetric information in two-dimensional polished sections. In this paper we present several examples of ore textures to illustrate where X-ray micro-tomography can be applied successfully to obtain quantitative measures of ore characteristics which are useful in a variety of process modelling applications.

THURSDAY, JANUARY 19th
Afternoon Session

COMMINUTION

13:30

Tendencies and Considerations for Energy Efficiency in SAG Mill Circuit Design from Recent Projects in Chile

C. Schuffeneger

The design of SAG milling circuits for mining projects requires the incorporation of the energy consumption considerations and the evaluation between different flexibility-adding options to absorb the time-dependent variation in the ore lithology. In order to expand the focus of the engineering design, a higher level of deepness and quality in the baseline information must be achieved to elucidate all of the constraints on throughput, energy consumption and product quality generating a design optimization consistent with an integrated vision of the process. This paper presents a review of a collection of typical examples of the copper and gold mining project in the Chilean Andes, in which both process and energy efficiency criteria are considered when the focus is to deliver an integral solution that incorporate those areas in the design. The intensive use of energy in the SAG milling, the process continuity and the quality of the product are a function of the proper design and selection of grinding equipment and plant layout, aligned with the mining plan and associated with projected future expansions and production increases.

13:55

Using MillMapper to Reduce Milling Costs and Improve Performance

P. Clarke and T. Gabardi

MillMapper™ is a new 3D laser scanning technology that has only recently been introduced into the North American mining industry. It enables mill operators to gain a much more complete understanding of the condition of their mill internals and to more accurately predict how liners will perform in the future. This paper describes the technology and techniques used to obtain data on internal mill conditions, how this data is processed into meaningful information which enables better prediction of liner life and gives examples of the reports provided by the software. Examples are given, using client sites data, on how this information is being used to reduce the costs and improve the revenue from SAG and ball mills.

14:20

Inspection Techniques - Non-Destructive Evaluation – Mill Gear Inspection Using Eddy Current Array (ECA) Combined with Alternating Current Field Measurement (ACFM) Techniques

T. Shumka

All mineral processing facilities that use girth gear driven mills need to inspect the gear teeth on a routine basis, whether it be every six months to every three years. The inspection frequency depends on gear tooth condition, and the objective is to ensure the operational integrity of the gear teeth. Conventional methods such as magnetic particle testing, visual inspection or dye penetrant examinations rely heavily on operator interpretation. At best, these techniques can determine whether a defect exists, but are unable to provide information on defect severity. This paper describes the use of combining combined eddy current array (ECA) and alternating current field measurement (ACFM) to provide a complete survey of all surface breaking indications on the whole gear tooth depth. This method accurately determines the size, length and depth of any cracks found on the surface.

15:15

Predicting the Effect of Grinding Media Size Distribution on the Performance of a Ball Mill using Discrete Element Method (DEM) and Population Balance Techniques

S. Makni, A. Faucher, A. Bouajila, F. Robichaud

Optimizing the ball charge in a grinding mill may be needed to maximise throughput or alternatively, to achieve proper product size in more challenging situations. Efforts to optimise the ball charge however are essentially empirical and suffer from the lack of appropriate, accessible and reliable tools. To address these limitations, a new model-based technology was developed that relies on 3D Discrete Element Method and population balance techniques: it takes on the form of a simulator that aims to significantly decrease the time required to optimise the size distribution and the grinding media load within a ball mill. This paper summarizes the research work related to the development of this simulator. The calibration of the different constituting sub-models will be highlighted. The successful use of the simulator to predict the effect of ball make-up on the grinding product size distribution in one plant is also reported.

CMP 2012 – ABSTRACTS

15:40

Improvements in HPGR and Grinding Mill Technology

S. J. Hall, E. J. Hofmann, C. Carpinisan

Since presenting a technical paper regarding their unique capabilities in Forged Steel Mill Gearing at the SAG-2006 Conference, Australian heavy engineering company Hofmann Engineering has pioneered a number of new manufacturing processes and design concepts for components of large comminution equipment. These include:

1. Novel design improvements for HPGR Rolls with forged steel tyres and a unique patented tungsten carbide insert designed to improve wear life, enhance autogenous layer build-up, and to reduce breakage & chipping under load.
2. Development of forged fabricated Mill Heads using rolled & welded high-tensile steel plate as alternatives to cast conical mill heads.
3. Insitu Girth Gear measurements for profile and wear via portable 6-axis CMM.
4. Gear and Pinion designs to AGMA-6114 for SAG mills of 38'-40' diameter to 24MW and for Ball Mills of 26' diameter to 18MW.

The paper presents case studies from the Australian heavy manufacturing facilities of Hofmann Engineering, combined with news of their new gear manufacturing and gearbox overhaul facility in Canada.



AUTHORS

Authors, session chairs must register as conference delegates. A speaker's breakfast will be provided starting at 7:00 am on the day of their presentation in the in the Nunavut Room. Authors, please contact John Chaulk for presentation information.

CMP PUBLICATIONS

Past proceedings, compilation proceedings on CD, and other mineral processing related books are available for purchase at the registration desk.

CMP 2012 SPONSORED STUDENTS

School	Students
Dalhousie University	Timothy Sarker Kyle MacPherson
Laval University	Pier-Olivier Devin Marc-André Tanguay
McGill University	Bakani Moesi Edgar Oliva
Queens University	Jenna Bennett Trevor Weir
Laurentian University	Patrick Campeau Yongmei Jiao
University of Alberta	Sara Fitzel Tawnya Thornton
University of British Columbia	Cameron Bruin Craig Archibald
CEGEP de L'Abitibi-Temiscamingue	Karl Côté Lafrenière Marie-Eve Riopel
CEGEP de L'Amiante	Lyne Tardif Andréanne Banville
Haileybury School of Mines, Northern College	Names not available at the time of printing.
University College of the North	
University of Toronto	Qiuyi Li Nicolas Scarcelli-Casciola
British Columbia Institute of Technology	Greig Hull Josh Larsen
Cambrian College	Kevin Ashmore Philip Wall
Lakehead University	Jenna Hedderson Shayne Roberts
Memorial University	Samantha Nash Corrine Smith
Student Essay Winner	Xiang Zhou
Andre Laplante Scholarship Winner	Gary Yang

CMP 2012 – EXECUTIVE, REGIONAL and COMMITTEE REPRESENTATIVES

CMP EXECUTIVE

Chair	Donald Leroux, Algosys, dleroux@algosys.com
Past Chair	Dominic Fragomeni, Xstrata Process Support, dfragomeni@xstrataprocesssupport.ca
1 st Vice-Chair	Erin Legault, SGS Mineral Services, erin.legault@sgs.com
2 nd Vice-Chair	Pierre Julien, Lincoln Strategic, pierre.julien@lincolnstrategic.com
Secretary	Janice Zinck, NRCan/CANMET-MMSL, jzinck@nrcan.gc.ca
Treasurer	Ray MacDonald, macdon@storm.ca

REGIONAL REPRESENTATIVES

Maritime	VACANT – please contact CMP if interested in serving as the representative
NFLD/Labrador	Matthew Lindsay, Iron Ore Company, matthew.lindsay@ironore.ca
N.W. Quebec	Paul Blatter, Agnico-Eagle, paul.blatter@agnico-eagle.com , http://cmpnoq.ca/
Montreal	Colin Hardie, BBA, Colin.Hardie@bba.ca ; cmpomq@gmail.com
N.E. Ontario	Richard Fostokjian, BASF, richard.fostokjian@basf.com
Toronto	Pierre Julien, Lincoln Strategic, pierre.julien@lincolnstrategic.com
N.W. Ontario	Daniel Hamilton, Lac des Iles Mine, dhamilton@nap.com
Central Ontario	Katherine Hopkins, Hatch, khopkins@hatch.ca
Manitoba	Cassandra Spence, HudBay Minerals Inc., cspence@hbms.ca
Saskatchewan	Lorne Schwartz, Hatch, schwartzlorne@hotmail.com
Alberta NWT/Nunavut	Brent Hilscher, Syncrude, hilscher.brent@syncrude.com
British Columbia/ Yukon	Tad Crowie, Endako Mines, tcrowie@tcrk.com

REPRESENTATION ON CIM and CMP COMMITTEES

CIM Council Representative	Janice Zinck
MetSoc	Janice Zinck
Publications/Technical Journal	Tad Crowie
Education	Lucky Amaratunga, amaratunga@eastlink.ca
SAG	Rob Henderson
International Relations	Peter Lahucik, Pete.Lahucik@sgs.com
IMPC 2016	Jan Nessel, nessetech@bell.net
Regional Coordinator	Stuart McTavish, sf.mctavish@sympatico.ca

CMP 2012 – HOCKEY, COMPANIONS, AWARDS, CMP'S GOT TALENT

LOCAL ORGANIZING COMMITTEE

Janice Zinck, Planner
Ray MacDonald, Treasurer
Wesley Griffith, Registrar
John Chaulk, Audio-Visual
Dave Hardy, Students
Louise Madaire, Companions
Gilles Tremblay, Hospitality
Al Kuiper, Photography

ATTENTION ALL CMP HOCKEY PLAYERS AND SPECTATORS!!!!

The 12th Annual East / West CMP Hockey Cup Challenge will be held at the 2012 Canadian Mineral Processors Conference.



THE TEAMS: EAST vs. WEST
The border is Manitoba-Ontario. East gets Finland, West gets the rest of the world.

THE RULES: No hitting, no slapshots, Full equipment must be worn. The game is open to any paid, registered conference delegate.

THE GAME: Tuesday, January 17th, 2012, 19:00 at Carleton University

TO SIGN UP:

Contact: Mark Griffiths, Mark.Griffiths@wardrop.com

Don't miss this exciting event. Open to all levels of hockey skills and spectator enjoyment levels. Check at the registration desk for bus departure times.

WHO WILL TAKE THE COVETED KILBORN CUP?

COMPANION'S PROGRAM

The companion's program this year will offer a coffee and tea social, a visit to the Museum of Civilization with lunch, and a wine and food tasting event. The cost of the program is \$50 and does not include a ticket to the Wednesday Reception and Awards Dinner.

Itinerary

Tuesday, January 17th

10:00 - Meet & Greet - Nunavut Room
14:00 - Wine tasting with Martin Rémillard Sommelier
ACSP, Rideau Suite 22nd floor

Wednesday, January 18th

11:30 - Travel to Museum of Civilization
11:50 - Lunch at Voyageurs Cafeteria
13:00 - Tour of Museum

Thursday, January 19th

Gather for coffee

CMP AWARDS 2013 NOMINATION INVITATION

The Executive of the Canadian Mineral Processors Society invites nominations from the membership for the CMP Awards 2013 under the following five categories.

CMP Award	Recognizing ...
Mineral Processor of the Year	Outstanding results recently achieved by an active CMP member while tackling significant mineral processing challenges.
Lifetime Achievement	Outstanding results/influence achieved by a retired CMP member throughout his/her career in mineral processing.
Bill Moore Special Achievement	Outstanding results achieved by an active CMP member throughout the early part of his/her career in mineral processing.
A.R. MacPherson Commintion	Outstanding results recently achieved by an active CMP member while tackling commintion challenges in mineral processing plants.
Ray MacDonald Volunteer	Exceptional volunteer contribution to the Canadian Mineral Processors Society

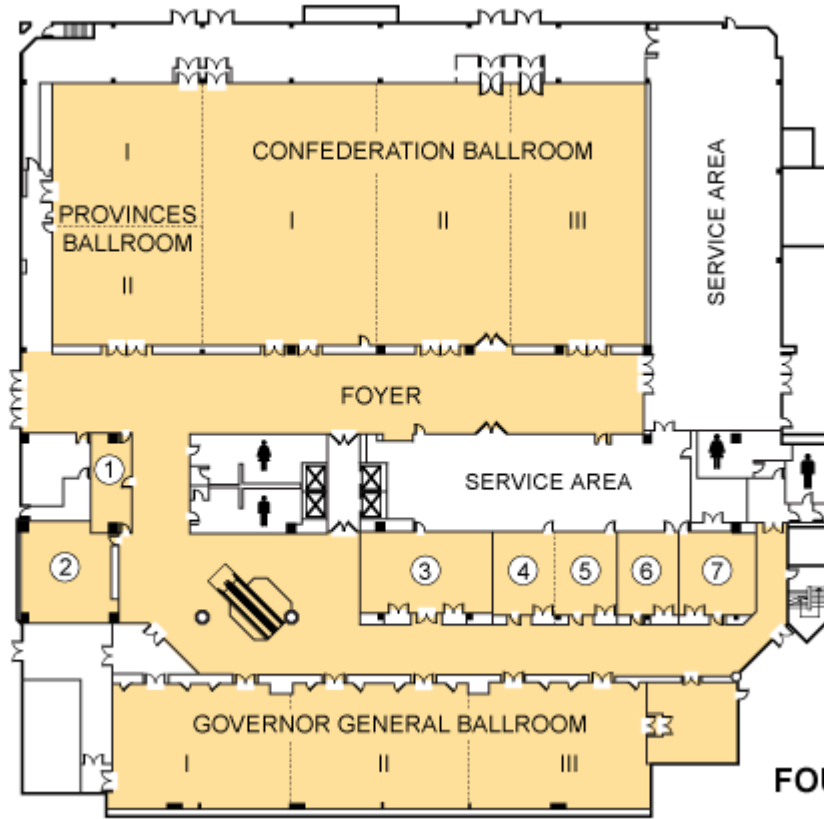
Awards are in the form of an engraved medallion and a framed certificate and will be presented during the Awards Banquet to be held at the 2013 Annual CMP Meeting in Ottawa. Nominations open on **January 20, 2012** and nomination applications must be prepared and sent electronically to *Donald Leroux, CMP Past Chairman* (dleroux@tpt.com) by **November 15, 2012**. Guidelines for nominations, award categories, selection criteria, and information on past awards are available at www.cmpsoc.ca. We look forward to hearing from you.

CMP'S GOT TALENT!

WANTED: Acoustic Guitar Players

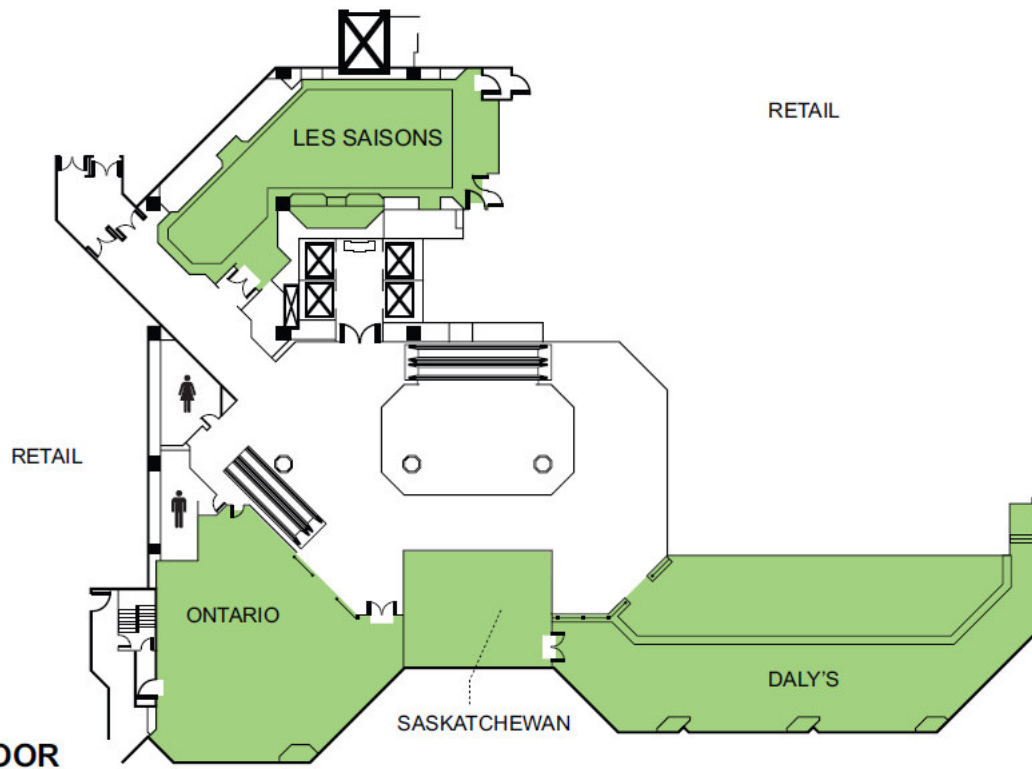
Guitar playing CMP delegates of all skill levels are invited to bring their guitar to Ottawa for the CMP Got Talent – Acoustic Guitar event. This friendly talent competition will take place at the Chairman's Reception on January 17th, 2012 at the Westin Hotel. Two microphones (voice and guitar) will be available. Each participant will have the opportunity to play as many as three songs. The guitar player who will most successfully make the audience sing along will be declared the winner. Registration is absolutely free but open exclusively to CMP delegates. For registering, please send an email to CMP Chairman, Don Leroux at dleroux@alqosys.com indicating the title of three songs you'd like to play (song selection will be granted on a 'first in, first served' basis). We know that many CMP delegates Got Talent and we look forward to hearing from them.

FLOOR PLAN



- 1. PRINCE EDWARD ISLAND
- 2. NUNAVUT
- 3. QUEBEC
- 4. NOVA SCOTIA
- 5. NEWFOUNDLAND
- 6. NEW BRUNSWICK
- 7. ALBERTA

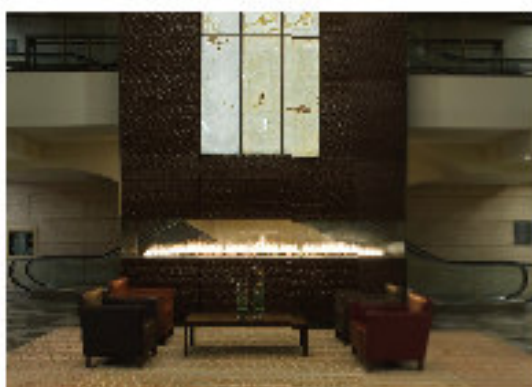
FOURTH FLOOR



THIRD FLOOR

CMP gratefully acknowledges the contributions and financial support of the following companies for this year's conference and student program.





Photos: Courtesy of The Westin, Ottawa Tourism, and the City of Ottawa