

# EXTRACTION

2018

August 26–29, 2018 | Westin Ottawa | Ottawa, Ontario, Canada

## FINAL PROGRAM

[www.ExtractionMeeting.org](http://www.ExtractionMeeting.org)



Organized by the Metallurgy and Materials Society (MetSoc) of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM); the Society for Mining, Metallurgy & Exploration (SME); and The Minerals, Metals & Materials Society (TMS).

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Extraction 2018 Proceedings

Enjoy your complimentary copy of the Extraction 2018 proceedings!



## Welcome to Extraction 2018!

While Extraction 2018 may seem like another new conference, it was actually borne out of a membership initiative within three societies to reduce the number of extractive meetings in 2018. Extraction 2018 is the industry's first collaborative global metallurgy conference focused exclusively on extractive metallurgy, where issues around geography, resources, environment, and human capital are all in play and making for an ever-changing landscape.

The conference has come to fruition out of the hard work of the staff of the three sponsoring societies. The Metallurgy & Materials Society (MetSoc) of CIM (Canadian Institute of Mining, Metallurgy & Petroleum) organized the logistics for this conference, while at the same time holding its first-ever annual meeting outside of Canada at Materials Science & Technology 2018 (MS&T18) in Columbus, Ohio. The Society for Mining, Metallurgy & Exploration Inc. (SME) mobilized its team to manage the trade show and sponsorship, while The Minerals, Metals & Materials Society (TMS) was instrumental in supplying the backbone of the conference for abstract management, author interaction, and marketing. Regular contact between the societies has been beneficial for everyone and will have lasting positive impacts long after Extraction 2018 is over.

Several volunteers from each society were also critical to the organization of the symposia, generously donating considerable personal time to help develop, review, and organize the conference. This includes short courses, tours, and posters, as well as the technical symposia. Extraction 2018 is the home for several important recurring symposia that examine new developments in foundational extractive metallurgy topics and techniques. It also offers new programming designed to share the latest research and insights on emerging technologies and issues that are shaping the global extractive metallurgy industry. The symposia include: the 7th International Symposium on Advances in Sulfide Smelting; the Peter Hayes Symposium on Pyrometallurgical Processing; Hydrometallurgy 2018; the Gordon Ritcey Symposium: Advances in Hydrometallurgical Solution Purification Separations; Processing of Critical Metals; and Sulfide Flotation.

The response to this endeavor has been very encouraging—a reflection of the fact that there are numerous high quality symposia being brought to the conference. It was difficult to balance the number of abstract submissions with the desire to have a manageable conference; we hope the right balance has been achieved.

It will be a lot to take in, but we hope that everyone will get as much as they can from the conference. When the dust has settled, we will take stock of how things went, and if the stars realign in the future, we might try to do this again. But for now, welcome to Extraction 2018—you are among friends!

Sincerely,

The Extraction 2018 Conference Co-Chairs:



Pictured from left to right:

**Boyd Davis**,  
Kingston Process Metallurgy Inc.  
**Michael Moats**,  
Missouri University of Science and Technology  
**Shijie Wang**,  
Rio Tinto Kennecott Utah Copper Corporation

All times are listed in Eastern Daylight Time (EDT) UTC/GMT-4 hours

| Saturday, August 25      |  | Location                | Participation      |
|--------------------------|--|-------------------------|--------------------|
| 7:30 a.m. to 5:00 p.m.   | Professional Development Registration Opens  | Les Saisons             | Course registrants |
| 8:30 a.m. to 5:00 p.m.   | Professional Development Course<br>Exploring Advanced Thermodynamic Process Simulation Tools: From SimuSage to Coupled CFD + Thermochemistry Based Models with COMSOL+M4Dlib+ChemApp | Les Saisons             | Course registrants |
| Sunday, August 26        |  | Location                | Participation      |
| 7:30 a.m. to 7:00 p.m.   | Registration   | Nunavut                 | All                |
| 8:30 a.m. to 3:30 p.m.   | Exhibitor Setup  | Confederation II to III | Exhibitors         |
| 8:00 a.m. to Noon        | Professional Development Courses<br>Reducing GHG Footprint of Pyrometallurgical Processes  | Alberta                 | Course registrants |
| 8:30 a.m. to 3:50 p.m.   | Exploring Advanced Thermodynamic Process Simulation Tools: From SimuSage to Coupled CFD + Thermochemistry Based Models with COMSOL+M4Dlib+ChemApp                                    | Les Saisons             | Course registrants |
| 8:30 a.m. to 3:50 p.m.   | Metallurgical Accounting: Principles and Main Applications   | Ontario                 | Course registrants |
| 8:30 a.m. to 3:50 p.m.   | Solvent Extraction in Hydrometallurgy: Principles, Flowsheet Design, and Selected Applications   | Governor General II     | Course registrants |
| 1:00 p.m. to 4:00 p.m.   | Technical Session: Extractive Metallurgy Markets & Economics, <i>Sponsored by Kingston Process Metallurgy Inc.</i>   | Governor General I      | All                |
| 4:00 p.m. to 5:30 p.m.   | Opening Plenary, <i>Sponsored by Kingston Process Metallurgy Inc.</i>  | Confederation I         | All                |
| 5:30 p.m. to 7:00 p.m.   | Opening Reception in the Exhibit Hall  | Confederation II to III | All                |
| 5:30 p.m. to 7:00 p.m.   | Society Booths Open  | Confederation II to III | All                |
| Monday, August 27        |  | Location                | Participation      |
| 7:00 a.m. to 8:15 a.m.   | Morning Coffee and Muffin Service  | Grand Foyer             | All                |
| 7:00 a.m. to 5:50 p.m.   | Registration   | Nunavut                 | All                |
| 8:00 a.m. to 12:10 p.m.  | Technical Sessions   | See Technical Program   | All                |
| 10:00 a.m. to 1:00 p.m.  | Exhibit Hall and Society Booths Open   | Confederation II to III | All                |
| 10:00 a.m. to 10:45 a.m. | Coffee Break   | Confederation II to III | All                |
| 10:00 a.m. to 10:45 a.m. | Poster Viewing   | Grand Foyer             | All                |
| 12:10 p.m. to 2:00 p.m.  | Lunch on Own   |                         | All                |
| 2:00 p.m. to 5:50 p.m.   | Technical Sessions   | See Technical Program   | All                |
| 3:00 p.m. to 7:00 p.m.   | Exhibit Hall and Society Booths Open   | Confederation II to III | All                |
| 3:40 p.m. to 4:10 p.m.   | Coffee Break   | Confederation II to III | All                |
| 3:40 p.m. to 4:10 p.m.   | Poster Viewing   | Grand Foyer             | All                |

|                             |   |   |                   |
|-----------------------------|---|---|-------------------|
| 5:30 p.m. to 7:00 p.m.      | Networking Reception in Exhibit Hall,<br><i>Sponsored by FLSmidth</i>   | Confederation II to III                 | All               |
| 7:00 p.m. to 10:00 p.m.     | Pyro Pub Night, <i>Sponsored by the University of Queensland, Canadian Engineering Associates, and Advisian WorleyParsons</i> | Heart & Crown                           | Ticketed event    |
| 7:00 p.m.                   | Free evening  |   | All               |
| <b>Tuesday, August 28</b>   |   |   |                   |
| 7:00 a.m. to 8:15 a.m.      | Morning Coffee and Muffin Service   | Grand Foyer                             | All               |
| 7:00 a.m. to 5:50 p.m.      | Registration  | Nunavut                                 | All               |
| 8:00 a.m. to 12:10 p.m.     | Technical Sessions  | See Technical Program                   | All               |
| 10:00 a.m. to 4:10 p.m.     | Exhibit Hall and Society Booths Open  | Confederation II to III                 | All               |
| 10:00 a.m. to 10:45 a.m.    | Coffee Break  | Confederation II to III                 | All               |
| 10:00 a.m. to 10:45 a.m.    | Poster Viewing  | Grand Foyer                             | All               |
| 12:10 p.m. to 2:00 p.m.     | Lunch on Own  |   | All               |
| 2:00 p.m. to 5:50 p.m.      | Technical Sessions  | See Technical Program                   | All               |
| 3:40 p.m. to 4:10 p.m.      | Coffee Break  | Grand Foyer/<br>Confederation II to III | All               |
| 3:40 p.m. to 4:10 p.m.      | Poster Viewing  | Grand Foyer                             | All               |
| 4:10 p.m. to 7:00 p.m.      | Exhibitor Move-Out  | Confederation II to III                 | Exhibitors        |
| 6:00 p.m. to 6:30 p.m.      | Conference Banquet Shuttle Bus  | Hotel Lobby                             | Banquet attendees |
| 6:30 p.m. to 9:30 p.m.      | Conference Banquet  | Canadian Museum of History              | Ticketed event    |
| <b>Wednesday, August 29</b> |   |   |                   |
| 7:00 a.m. to 8:15 a.m.      | Morning Coffee and Muffin Service   | Grand Foyer                             | All               |
| 7:00 a.m. to 5:50 p.m.      | Registration  | Nunavut                                 | All               |
| 8:00 a.m. to 12:10 p.m.     | Technical Sessions  | See Technical Program                   | All               |
| 10:00 a.m. to 10:45 a.m.    | Coffee Break and Poster Viewing   | Grand Foyer                             | All               |
| 12:10 p.m. to 2:00 p.m.     | Lunch on Own  |   | All               |
| 12:15 p.m. to 2:00 p.m.     | Gordon Ritcey Luncheon, <i>Sponsored by M3</i>  | Confederation II                        | Ticketed event    |
| 12:15 p.m. to 2:00 p.m.     | Video Tour: Glencore Sudbury INO Smelter & XPS Expert Process Solutions   | Confederation III                       | Ticketed event    |
| 2:00 p.m. to 5:50 p.m.      | Technical Sessions  | See Technical Program                   | All               |
| 3:40 p.m. to 4:10 p.m.      | Coffee Break and Poster Viewing   | Grand Foyer                             | All               |
| 5:50 p.m.                   | Conference Conclusion   |   | All               |
| <b>Thursday, August 30</b>  |   |   |                   |
|                             | Industry Tours  | Offsite                                 | Tour registrants  |
| 8:00 a.m. to 8:30 p.m.      | CanmetENERGY & KPM Laboratory Tours and Thousand Islands Cruise   | Offsite                                 | Tour registrants  |
| 8:00 a.m. to 4:30 p.m.      | Glencore - CCR Refinery Tour  | Offsite                                 | Tour registrants  |

## COMPLIMENTARY MEMBERSHIP FOR EXTRACTION 2018 PARTICIPANTS!

### JOIN THE TMS COMMUNITY FREE FOR ONE YEAR!

As an attendee of Extraction 2018, you are eligible for a complimentary, one-year electronic membership in The Minerals, Metals & Materials Society (TMS).\*

### HOW DO YOU JOIN?

Visit the TMS membership booth at Extraction 2018 to learn how to activate your complimentary membership or visit the following website for instructions:

[www.tms.org/CompMembership](http://www.tms.org/CompMembership)

### WHAT CAN YOU DO WITH YOUR NEW MEMBERSHIP?

- **Read:** Access more than 20 journals published by TMS and Springer for free and explore online publication libraries available only to members
- **Network:** Join one of our seven technical committees related to extraction and processing or connect with colleagues through the TMS Membership Directory
- **Save:** Receive discounted registration on meetings that gather your colleagues from around the world, like the TMS 2019 Annual Meeting & Exhibition
- And Much More!

Start your free membership today and discover the value of being part of the TMS community!

*\* Please note: This offer is only valid for new members. Individuals who are current or former TMS members do not qualify.*

In Our **Members' Words**



## Registration

Delegates of Extraction 2018 enjoy the following benefits:

*(Exception: not applicable for short course only registrants)*

- Access to the technical presentations
- Access to the trade show and poster sessions
- Free copy of the electronic proceedings of the meeting
- Hors d'oeuvres and one free drink ticket during the Sunday Opening Reception in the Exhibit Hall
- Refreshments at coffee breaks on Monday, Tuesday, and Wednesday
- Morning coffee and pastries on Monday, Tuesday, and Wednesday
- One free drink ticket at the Monday Networking Reception in the Exhibit Hall, sponsored by FLSmidth

## Registration Hours

Badge pick-up for the Exploring Advanced Thermodynamic short course will be available at the hospitality desk on **Saturday, August 25**, in the Les Saisons room (3rd floor) of the Westin Ottawa from 7:30 a.m. to noon.

For the rest of the conference, the registration desk will be open in the Nunavut room (4th floor) of the Westin Ottawa at the following times:

|                             |                        |
|-----------------------------|------------------------|
| <b>Sunday, August 26</b>    | 7:30 a.m. to 7:00 p.m. |
| <b>Monday, August 27</b>    | 7:00 a.m. to 5:50 p.m. |
| <b>Tuesday, August 28</b>   | 7:00 a.m. to 5:50 p.m. |
| <b>Wednesday, August 29</b> | 7:00 a.m. to 5:50 p.m. |

## Visit MetSoc of CIM, SME, and TMS

Each of Extraction 2018's three organizing societies, MetSoc, SME, and TMS, will have membership booths located at the Exhibit Hall in Confederation II to III ballrooms. Learn more about each organization—stop by and visit while you're at Extraction 2018! Society booths will be open during the following hours:

|                           |   |
|---------------------------|---|
| <b>Sunday, August 26</b>  | 5:30 p.m. to 7:00 p.m.                            |
| <b>Monday, August 27</b>  | 10:00 a.m. to 7:00 p.m.<br>3:00 p.m. to 7:00 p.m. |
| <b>Tuesday, August 28</b> | 10:00 a.m. to 4:10 p.m.                           |

## Technical Sessions

All oral presentations will be held at the Westin Ottawa. See the Technical Program on pages 23–91 for room locations. All poster presentations will be held in the Grand Foyer of the Westin.

## Poster Author Directory

To encourage networking outside of the designated poster viewing times, please refer to the online poster author director on the Technical Program page of the Extraction 2018 website ([www.ExtractionMeeting.org](http://www.ExtractionMeeting.org)). Here you will find contact information for the poster authors and can set up one-on-one discussions.

## Exhibit Hall Hours

The Extraction 2018 Exhibit Hall will be located in the Confederation II to III ballrooms at the following times:

|                           |  |
|---------------------------|--|
| <b>Sunday, August 26</b>  | 5:30 p.m. to 7:00 p.m.                                   |
| <b>Monday, August 27</b>  | 10:00 a.m. to 1:00 p.m.<br>and<br>3:00 p.m. to 7:00 p.m. |
| <b>Tuesday, August 28</b> | 10:00 a.m. to 4:10 p.m.                                  |

## Wi-Fi Access

Wi-Fi access is available for conference attendees at the Westin Ottawa, including inside meeting rooms. Select "Westin Meeting Room" as your Wi-Fi network and use the password **extract2018** to connect.

## Nursing Mother's Room

A private room has been set aside for our delegates who need a private space for nursing. For access to the Nursing Mother's Room, please visit event staff at the registration desk (located in the Nunavut room). The room is equipped with a comfortable chair, table, and mini-fridge.

## Business Center

The Business Center at the Westin Ottawa hotel will provide delegates the opportunity to stay connected, with a secure, reliable computer system and copy machine. The Business Center features high-speed internet, computers, printer, fax machine, and copier. Charges may apply.

## Cu IN VANCOUVER IN 2019

## CALL FOR ABSTRACTS

### COM 2019 HOSTING COPPER 2019 AUGUST 18-21, VANCOUVER, CANADA

MetSoc, the 58<sup>th</sup> annual Conference of Metallurgists (COM 2019) and CIM are honoured to host Copper 2019, marking a milestone in the International Copper Conference Series with the 10th Edition. The success and outcome of the Copper Conference is the work of the eight leading International Professional Societies (GDMB, IIMCh, MetSoc of CIM, MMIJ, NFSOC, SAIMM, SME, TMS) who tirelessly persevere in bringing forth symposia of the highest quality to the delegates.

#### Conference Chairs:

##### COM 2019 Chair:

Dr. Edouard Asselin, University of British Columbia

##### Cu2019 Chair:

Dr. Joël Kapusta, BBA Inc.

#### Co-organized by:



#### Topics will include:

- Cu: Plenary sessions
- Cu: Downstream Fabrication and Applications
- Cu: Economics, Markets, and Historical Perspectives
- Cu: Electrowinning and Electrorefining
- Cu: Health and Safety in Operations
- Cu: Hydrometallurgy
- Cu: Mineral Processing
- Cu: Process Control, Optimization, and Instrumentation
- Cu: Pyrometallurgy (The Phillip Mackey Symposium)
- Cu: Sustainability and Waste Management
- COM 2019 UBC-McGill-UofA Symposium

Share your knowledge  
**SUBMIT AN ABSTRACT**  
[com.metsoc.org](http://com.metsoc.org)

#### Key dates

|                              |              |
|------------------------------|--------------|
| Call for Abstract Open       | Aug 29, 2018 |
| Call for Abstracts Deadline  | Nov 30, 2018 |
| Author Registration Deadline | May 15, 2019 |

## Opening Reception in the Exhibit Hall

**Date:** Sunday, August 26

**Time:** 5:30 p.m. to 7:00 p.m.

**Location:** Confederation II to III, Westin Ottawa

All delegates are invited to attend, network, and enjoy a complimentary drink and hors d'oeuvres.

## Networking Reception in the Exhibit Hall

**Date:** Monday, August 27

**Time:** 5:30 p.m. to 7:00 p.m.

**Location:** Confederation II to III, Westin Ottawa

Join your fellow delegates after a full day of learning to network, exchange, and have fun in the Exhibit Hall. Don't miss this opportunity to meet our exhibitors!

Thank you to the sponsor of this event, FLSmidth.



## Pyro Pub Night in Honor of Peter Hayes *Sold Out*

**Date:** Monday, August 27

**Time:** 7:00 p.m. to 10:00 p.m.

**Location:** Heart & Crown Pub, 67 Clarence St., Ottawa, ON K1N 5P5

The Heart & Crown Pub is within walking distance of the Westin Ottawa. Ask at the concierge desk for directions or use Google.

Join your colleagues at our local pub night in honor of Peter Hayes. The evening will include a buffet and two drink tickets per person. Located in Ottawa's historic ByWard Market, the Heart & Crown consists of five pubs under one roof with six patios. Ottawa's Irish Village welcomes you!

Thank you to the co-sponsors of this event, The University of Queensland, the Canadian Engineering Associates, and Advisian WorleyParsons



THE UNIVERSITY  
OF QUEENSLAND  
AUSTRALIA



Advisian  
WorleyParsons Group

## Conference Banquet & Reception

**Date:** Tuesday, August 28

**Reception Time:** 6:30 p.m. to 7:15 p.m.

**Dinner & Awards Time:** 7:15 p.m. to 9:30 p.m.

**Location:** Canadian Museum of History, 100 Laurier Street, Gatineau, Québec K1A 0M8

*Please remember to wear your badge for security identification and bring your ticket.*

Join us at the Canadian Museum of History for the Extraction 2018 Conference Banquet & Reception. The venue is located directly across the Ottawa River from Parliament Hill in Ottawa. The evening will feature presentation of awards from MetSoc, SME, TMS, and AIME to members of the extractive metallurgy community. For more information on each of the evening's award recipients, visit the Awards section of [www.ExtractionMeeting.org](http://www.ExtractionMeeting.org). A three course meal with wine and transportation\* is included with purchased tickets.

Please note that registration was required for this event through the conference registration form. Onsite ticket sales are based on availability. For more information, check with conference staff at the registration desk in the Nunavut room. Have a ticket but can no longer attend? Why not donate your ticket to a student? Visit us at the desk to donate.

### \*Banquet Bus Shuttle Information

A shuttle bus will depart from the Westin Ottawa hotel lobby from 6:00 p.m. to 6:30 p.m. The returning shuttle bus will depart from the museum at 9:45 p.m.

## Gordon Ritcey Luncheon

**Date:** Wednesday, August 29

**Time:** 12:15 p.m. to 2:00 p.m.

**Location:** Confederation II, Westin Ottawa

This annual luncheon is the Hydrometallurgy Section's premier social event of the year. This year, we will be celebrating hydrometallurgy through a tribute to the life work of Gordon Ritcey in whose honor we have named our annual Hydrometallurgy Section symposium. The featured speaker at this luncheon will be George Demopoulos of McGill University, who will speak to the many contributions made by Ritcey over his career, as well as share some of the lighter moments from the past. The

event will also honor the Hydrometallurgy award recipients for 2018.

Please note that registration was required for this event through the conference registration form. Onsite ticket sales are based on availability. Please check with conference staff at the registration desk in the Nunavut room for more information.

Thank you to the sponsor of this event, M3.



## INDUSTRY TOURS

If you registered for one of the three industry tours in advance, please take note of the following important information.

*Onsite ticket sales are based on availability. If you did not register for a tour and are still interested in participating in one of the following offerings, please check with conference staff at the registration desk, in the Nunavut room for more information.*

### Video Tour: Glencore Sudbury INO Smelter & XPS Expert Process Solutions

**Date:** Wednesday, August 29

**Time:** 12:15 p.m. to 2:00 p.m.

**Location:** Confederation III, Westin Ottawa

View this unique video presentation of Glencore's Sudbury Integrated Nickel Operations (INO) Smelter and XPS Expert Process Solutions facilities. In-person representatives with process samples will guide you through the tour and answer your questions over lunch. The video tour has been timed so that you will be able to view each process up close and in action! Lunch will be provided and is included in the cost of the video tour.

### CanmetENERGY & KPM Laboratory Tours and Thousand Islands Cruise *Sold Out*

**Date:** Thursday, August 30

**Time:** 8:00 a.m. to 8:30 p.m.

This full-day tour includes a visit to CanmetENERGY-Ottawa, followed by lunch in the historic city of Kingston, a visit to Kingston Process Metallurgy, and a sightseeing cruise of the Thousand Islands. A charter bus will pick attendees up at the Westin Ottawa at 8:00 a.m. and will return around 8:30 p.m. Transportation and lunch are included in the tour price. Dinner is not included, but attendees will have the opportunity to purchase food and beverages.

### Glencore – CCR Refinery Tour *Sold Out*

**Date:** Thursday, August 30

**Time:** 8:00 a.m. to 4:30 p.m.

This full-day tour will include the copper refinery and impurities areas of the CCR Refinery, based in Montreal East. A charter bus will pick attendees up at the Westin Ottawa at 8:00 a.m. and will return around 4:30 p.m. Lunch is included with this tour registration fee.

## Badges

All attendees must wear registration badges at all times during the conference to ensure admission to events included in the paid fee, such as technical sessions, exhibitions, and receptions. Thank you to our lanyard sponsor, GeoTemps/GeoPros.

## Refunds

The deadline for all refunds was August 1, 2018. No refunds will be issued at the congress. Fees and tickets are nonrefundable.

## Cell Phone Use

In consideration of attendees and presenters, we kindly request that you minimize disturbances by setting all cell phones and other devices to “silent” while in meeting rooms.

## Photography and Recording

Attendees may be photographed by the conference staff while at Extraction 2018. Further, those photos may be used for promotional purposes.

Any unauthorized recording of sessions (audio, video, still photography, etc.) is strictly prohibited during the conference sessions.

## Time Zones

Please note that all times for this conference and related events will take place in the local time zone, Eastern Daylight Time (EDT) UTC/GMT -4 hours.

## Language

The conference and all presentations, program materials, and signage will be in English.

## Dress Code

Traditional business attire is appropriate for all conference activities, including technical sessions, the conference banquet, and other social events.

## Attendees with Disabilities

Any delegates requiring special assistance or equipment should contact conference staff at the registration desk located in the Nunavut room at the Westin Ottawa.

## EMERGENCY PROCEDURES

Although the probability of an emergency situation occurring at Extraction 2018 is low, being prepared to react effectively in case of an incident is the most critical step in ensuring the health and safety of yourself and those around you. Please take a few moments to review the maps of the Westin Ottawa printed in this program (on page 99). When you enter the building, familiarize yourself with the exits and the stairs leading to those exits. When you arrive at your session or event location, look for the emergency exits that are closest to you.

The Westin Ottawa has a minimum of three emergency response team (ERT) members on the

property at all times. All ERT members are trained in first aid and CPR. Extensive emergency supplies, including oxygen, are maintained onsite.

In the event of an emergency, guests can dial the emergency speed dial on their room phones or dial 7-7-7-7 from any hotel phone. The ERT will be immediately dispatched.

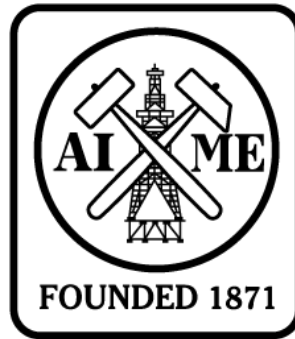
Should an alarm sound, please wait for instructions from the hotel front office via the P/A system. If an evacuation is required, hotel staff will be assigned at various locations to assist you to the exits and security.

## ABOUT THE VENUE

### Westin Ottawa

Located in the heart of downtown Ottawa, the Westin is connected to the Rideau Centre, one of Canada's leading shopping destinations. The visitor-friendly layout of downtown Ottawa makes it easy for attendees to explore the city. The Westin Ottawa features several in-house dining options featuring locally inspired Ottawa cuisine, including Daly's Restaurant, Daly's Express, and the Shore Club. A variety of restaurants are also located within walking distance of the hotel. See the Westin website for more details on dining and local attractions: [www.thewestinottawa.com](http://www.thewestinottawa.com)

**GOLD SPONSORS:**



**SILVER SPONSORS:**



**BRONZE SPONSORS:**





**August 26–29, 2018 | Westin Ottawa | Ottawa, Ontario, Canada**

# **EXHIBITOR DIRECTORY**

**[www.ExtractionMeeting.org](http://www.ExtractionMeeting.org)**



Join the Society for Mining, Metallurgy & Exploration (SME) to stay current on the latest technical advancements and expand your professional network.

#### STAY CURRENT

- Search the largest global consortium of mining and minerals articles and research at OneMine.org
- Receive timely insights with complimentary subscriptions to *Mining Engineering* and *Tunneling & Underground Construction* magazines

#### ADVANCE YOUR CAREER

- Share your expertise by presenting at a conference or developing a paper
- Make connections that could lead to your next job opportunity

#### SAVE MORE

- Use your member discount to receive up to 25% off technical resources and educational offerings in the SME Store
- Reduced registration rates at our industry-leading conferences

Join online at [www.SMENET.org](http://www.SMENET.org)



## Upcoming Leading Conferences in **Mining, Minerals** and **Metallurgy**



**THRIVE2018**  
Innovations Advancing Mining

Sept. 27, 2018  
Pittsburgh, PA



**ARIZONA**  
CONFERENCE • 2018  
DECEMBER 2 - 3 • TUCSON, ARIZONA



**SME Annual Conference & Expo**

**SMART MINING**

Resources for a Connected World  
FEBRUARY 24 - 27, 2019 • DENVER, COLORADO



Learn more at: [www.SMENET.org](http://www.SMENET.org)

Current as of August 15, 2018.

Visit the Exhibition page of [www.ExtractionMeeting.org](http://www.ExtractionMeeting.org) for the most current list.

|  |                |                               |                |
|--|----------------|-------------------------------|----------------|
| 6th Wave Innovations Corp                  | Booth 100      | Limpact International Limited | Booth 412      |
| Activation Laboratories Ltd. (Actlabs)     | Booth 305      | M4Dynamics                    | Booth 103      |
| Air Liquide                                | Booth 413      | Metso Minerals                | Booth 313      |
| Andronaco Industries                       | Booth 102      | MetSoc                        | Booth 407      |
| APETECK Inc.                               | Booth 307      | OLI Systems, Inc.             | Booth 308      |
| Ashland                                    | Booth 204      | Pex-Industrial                | Booth 113      |
| AuTec Innovative Extractive Solutions Ltd. | Booth 404      | Praxair                       | Booth 105      |
| Canadian Engineering Associates Ltd.       | Booth 209      | PROMETIA                      | Booth 205      |
| CANAMIX Mixing & Pumping Solutions         | Booth 302      | Pultrusion technique          | Booth 210, 212 |
| China Nerin Engineering Co., Ltd.          | Booth 402      | Purolite Corporation          | Booth 202      |
| Derrick Corporation                        | Booth 403      | Quinn Process Equipment Co.   | Booth 405      |
| Dundee Sustainable Technologies Inc.       | Booth 310      | RHI Magnesita                 | Booth 207      |
| Flottweg Separation Technology, Inc.       | Booth 208      | SGS Canada Inc.               | Booth 203      |
| GEA Systems North America LLC              | Booth 304      | Sipi Metals Corp.             | Booth 104      |
| Genesys International Ltd                  | Booth 213      | SME                           | Booth 409      |
| Hatch                                      | Booth 110, 112 | SysCAD                        | Booth 306      |
| Heath & Sherwood                           | Booth 211      | TMS                           | Booth 411      |
| ION  | Booth 311      | Turtle Tough                  | Booth 206      |
| Kingston Process Metallurgy Inc.           | Booth 303      | Univar                        | Booth 312      |
| Kopper Chemical Corp., LTD                 | Booth 401      | XPS Expert Process Solutions  | Booth 309      |

|       |     |     |     |     |     |       |     |
|-------|-----|-----|-----|-----|-----|-------|-----|
| F & B |     |     |     |     |     | F & B |     |
| 112   | 113 | 212 | 213 | 312 | 313 | 412   | 413 |
| 110   | 111 | 210 | 211 | 310 | 311 | 410   | 411 |
| 108   | 109 | 208 | 209 | 308 | 309 | 408   | 409 |
| 106   | 107 | 206 | 207 | 306 | 307 | 406   | 407 |
| 104   | 105 | 204 | 205 | 304 | 305 | 404   | 405 |
| 102   | 103 | 202 | 203 | 302 | 303 | 402   | 403 |
| 100   |     |     |     |     |     |       | 401 |

## **6th Wave Innovations Corp.**

### **Booth 100**

IXOS® nanotech beads are molecularly imprinted and specifically designed to recover dicyanoaurate from alkaline cyanide processing of gold-bearing ore. IXOS® beads do not foul with other metals like carbon and ion exchange resins. IXOS® can significantly enhance gold recovery and mitigate solution losses as proven in lab and field tests. The elution process is simple and inexpensive when compared to activated carbon with no reactivation step. The resin is supplied ready-to-use, with a range of particle sizes available to accommodate heap leach and resin-in-leach/pulp circuits.

## **Activation Laboratories Ltd. (Actlabs)**

### **Booth 305**

Activation Laboratories Ltd. (Actlabs) are leaders in Quality, Innovation and Service. We have been recognized as one of the highest quality labs serving the mineral exploration industry for over 30 years. Adapting the latest technologies to help solve our customer's challenges, we provide complete Assay and Geochemical Services, Radiochemistry, Mineralogy, Metallurgy, On-site Laboratories, Environmental analysis and more.

## **Air Liquide**

### **Booth 413**

The world leader in gases, technologies and services for Industry and Health, Air Liquide is present in 80 countries with approximately 67,000 employees and serves more than 3 million customers and patients. Oxygen, nitrogen and hydrogen are essential small molecules for life, matter and energy. They embody Air Liquide's scientific territory and have been at the core of the company's activities since its creation in 1902. Extractive Metallurgy being no exception, Air Liquide is showcasing valuable gas-based solutions geared towards higher recovery yields, productivity and cost efficiencies.

## **Andronaco Industries**

### **Booth 102**

A global leader and manufacturer of corrosion resistant piping components for the safe and reliable transfer of the hazardous chemicals used in the hydro-metallurgical processing of ores. Products include pipe spools, fittings, valves, basket strainers, expansion joints, flexible hoses, gaskets and other piping accessories. Piping components manufactured from vinyl ester and epoxy composites, fluoropolymer lined and corrosion resistant exotic metals. ISO 9001-2015 certified company with CRN documentation. Piping design and layout services available.

## **APETECK Inc.**

### **Booth 307**

Being a professional supplier of anode and cathode for electrowinning industry, APETECK has their sophisticated fabrication facility in China so as to provide customers all over the world quality anode and cathode at competitive price for over 10 years. You are cordially welcomed to our booth for the latest products and equipment information.

## **Ashland**

### **Booth 204**

Ashland Derakane™ resins are used in hydrometallurgical equipment used to extract and refine copper, nickel, cobalt, and rare earth metals exposed to extremely corrosive chemical environments. Derakane™ resins have been providing critical reliability in corrosion-resistant FRP applications from chemical processing, water treatment and pollution control, to power generation for over 50 years. Ashland is a premier global specialty chemicals company serving customers in a wide range of industrial and consumer markets, including automotive, building & construction, infrastructure, marine, corrosion and adhesives.

## **AuTec Innovative Extractive Solutions Ltd.**

### **Booth 404**

AuTec is a metallurgical testing, process development and piloting facility. We focus on helping our clients in the mining industry overcome their unique extractive metallurgy challenges to unlock the greatest possible value from their mineral assets. We have a broad range of analytical and testing capabilities to support the development and evaluation of process flow sheets, with exceptional expertise in the recovery of gold from refractory and preg-robbing ores.

## **Canadian Engineering Associates Ltd.**

### **Booth 209**

Canadian Engineering Associates Ltd. is a group of dedicated experienced engineers focused on quality delivery of services to the metallurgical industry in a safe and environmentally compliant manner. With the final operation always in mind, our group delivers only the necessities to achieve an effective outcome in a lean concise manner. Servicing clients on every inhabited continent, we are specialists in smelting, electrorefining, furnace and equipment design, bulk materials handling, gas handling, all aspects of assessment, design, engineering and operation of smelters and refineries.

**CANAMIX Mixing & Pumping Solutions****Booth 302**

CANAMIX designs and manufactures processing equipment for all industries. Superior Quality. Up to date technology. Competitive Pricing. Process Guarantee. That's the CANAMIX Promise!

**China Nerin Engineering Co., Ltd.****Booth 402**

China Nerin Engineering Co., Ltd., a large comprehensive engineering company based in Nanchang, China, is reformed from the predecessor Nanchang Engineering and Research Institute of Nonferrous Metals. Nerin, founded in 1957, has a staff of over 1400 employees. Nerin has taken and completed over 4000 projects home and abroad so far, has good knowledge and understanding of the market, equipment manufacturers and suppliers, and rich experience and expertise in project engineering, especially in copper smelting, metallurgical gas treatment and acid making.

**Derrick Corporation****Booth 403**

Derrick® has manufactured an array of innovative wet and dry, fine screening technology for the Mining & Industrial marketplace for over 66 years. Derrick offers its clients leading-edge solutions to maximize separation efficiency. Using this patented equipment and innovative screen surface technology, offers unmatched performance – increased product recovery and reduced power consumption. Derrick's equipment symbolizes rugged reliability, and remains committed to providing the latest technological enhancements that evolve alongside industry best practices and market developments.

**Dundee Sustainable Technologies Inc.****Booth 310**

Dundee Sustainable Technologies Inc. (DST) offers proprietary metallurgical processes for the treatment of material from the mining industry. DST's processes are applied for the extraction of precious and base metals and for the removal and stabilisation of contaminants, such as arsenic, antimony and mercury from ores, concentrates and tailings. DST provides environmentally friendly, viable and efficient processes, capable of handling complex and refractory ores which cannot be processed with conventional approaches due to metallurgical issues or environmental considerations.

**Flottweg Separation Technology Inc.****Booth 208**

Flottweg Separation Technology Inc. is a worldwide ISO 9001 supplier of liquid solid separation equipment for mining applications. Flottweg 2 and 3 phase decanter centrifuges and separator centrifuges are used in a variety of liquid-solid process applications including drilling mud recovery, solvent extraction crud separation, solids dewatering, gravel washing, oil water solids separation, solids sorting, and wastewater treatment. Skid mounted and containerized systems are also available.

**GEA Systems North America LLC****Booth 304**

GEA is one of the largest suppliers of process technology for the food industry and a wide range of other industries. The international technology group focuses on process technology and components for sophisticated production processes in various end-user markets.

**Genesys International Ltd.****Booth 213**

Genesys International Limited is an industry leader in the development and manufacture of specialty membrane chemicals for RO/NF and UF systems. Genesys™ antiscalants have been developed to allow maximum system recovery rates and the Genesol™ cleaners are proven to reduce CIP frequency and operating costs. Our reputation is built around a team of specialist membrane industry experts and a network of over sixty distributors, delivering our products and services world-wide to miners such as Barrick, Buenaventura, OCP, Potash Corp, Newmont, Mantos Copper and Lundin Mining.

**Hatch****Booth 110, 112**

Our organization is passionately committed to the pursuit of a better world through positive change. We embrace your visions as our own and partner with you to develop better ideas that are smarter, more efficient, and innovative. Our global network of 9,000 professionals work on the world's toughest challenges. Our corporate roots extend back more than a hundred years, and our experience spans over 150 countries around the world in the metals, energy, infrastructure, digital, and investments market sectors.

## **Heath & Sherwood**

### **Booth 211**

Tuyere Line Management equipment used around Copper & Nickel Converters. Automatic Sampling Systems. On-Stream Analyzers and Particle Size Monitors. Founded in 1927 with equipment operating in 65 countries. Gaspé Tuyere Punchers, Tuyere Pyrometers, Tuyere's, Tuyere Silencers, Refractory Drilling Machines. Sampling of all Mineral Commodities and in Mineral Processing Operations.

## **ION**

### **Booth 311**

Automation positively transforms the lives of people and business. ION is reinventing the way business is done through innovations in automation technology. Our software improves decision-making, increases efficiency, simplifies complex processes, and empowers people. ION commodities solutions automate the management of your supply and value chains. Wherever you are, and whatever industry you're in, ION puts you in control of your trading and procurement, enterprise risk, logistics, and scheduling. We also help you manage your storage and inventory, processing, settlement, and accounting.

## **Kingston Process Metallurgy Inc.**

### **Booth 303**

Kingston Process Metallurgy (KPM) is a contract process development firm for metallurgical and chemical companies. KPM practices "integrated" process development, where the laboratory work is directed by the economics and technical risk of the process. Work is staged so that the necessary derisking of the project is done at the right time. Clients are typically large producers, but KPM also works with junior companies and startups. The lab work is supported by analytical and a machine shop as well as employees experienced in techno-economics.

## **Kopper Chemical Corp., Ltd.**

### **Booth 401**

KopperChem is a national high-tech enterprise and located in Chongqing (Changshou) Chemical Industry Park, which integrates R&D, manufacturing, marketing and systems engineering services into one enterprise. KopperChem is one of the world's largest manufacturers of solvent extraction reagents, and provides the most complete series of extractants and engineering services, including Mextral series solvent extraction reagents and diluents, which are widely used in the hydrometallurgy of copper, zinc, cobalt, nickel, precious metals, rare earth metals, etc., as well as wastewater treatment, secondary resources recovery, etc.

## **Limpact International Limited**

### **Booth 412**

Limpact has been an active manufacturer/exporter of custom products for the non-ferrous electrolytic metals refining industry for over 40 years. We are a privately owned company operating from the city of Cobourg, Canada. Our unique process of impact bonding dissimilar metals allows us to manufacture energy-saving products with increased service life for metals refining. You will find Limpact products in most of the leading zinc refineries around the world, as they have been for the past 45 years.

## **M4Dynamics**

### **Booth 103**

M4Dynamics™ is a Toronto based consulting and software development company specializing in Multiphysics and Solution Thermodynamics Simulations Analysis and development of custom built applications or physics models. We also offer training in COMSOL® and GTT-Technologies products FactSage™, ChemApp™, SimuSage™, ChemSheet™, CSFAP, KilnSimu software, FactSage™ (FACT, SGTE, FS, FT, etc.) and GTT oxide databases.

## **Metso Minerals**

### **Booth 313**

Metso is a world-leading industrial company offering equipment and services for the sustainable processing and flow of natural resources in the mining, aggregates, recycling and process industries. With our unique knowledge and innovative solutions, we help our customers improve their operational efficiency, reduce risks and increase profitability. Metso employs over 12,000 people in more than 50 countries.

## **MetSoc of CIM**

### **Booth 407**

The Metallurgy & Materials Society (MetSoc) of CIM (Canadian Institute of Mining, Metallurgy & Petroleum) serves society and the needs of professionals in the global metallurgy & materials community. We are of service for those involved in the research, development, and application of science and technology for environmentally responsible extraction, fabrication, utilization, and recycling of metals and materials. MetSoc is headquartered in Montreal, Quebec, Canada. For more information, visit [www.metsoc.org](http://www.metsoc.org).

**OLI Systems Inc.****Booth 308**

Global technology leader in electrolytes, providing simulation software for mining and metals refining. OLI software is used to optimize water use in ore concentrating, COG cleaning, coke / slag quenching, steel descaling, boil feed, ingot cooling and dust control. Better process designs can help control costs in PAH emissions control, cooling water cycle-up, corrosion and scaling, water use optimization, sludge processing and ammonia and light oil recovery. Anticipate, diagnose and fix costly operations and minimize time, cost and risk in lab, pilot and field tests.

**Praxair****Booth 105**

Praxair has served extractive metallurgy since the inception of tonnage gases to enhance productivity, yield, product quality, and environmental performance. Praxair's gases are used throughout the periodic table from aluminum, cement, copper, gold, silver, steel to zinc processing, rare earths extraction, from mine to smelter to refinery. Praxair's deep quest for reliable supply, value added gas applications and our unparalleled commitment to safety and sustainability support our drive to make our planet more productive. Praxair—your ultimate partner for Extraction and Processing.

**PROMETIA****Booth 205**

PROMETIA is an international association promoting innovation in mineral processing and extractive metallurgy for mining and recycling of raw materials. PROMETIA aims to strengthen European technical skills and industrial know-how in raw materials processing and support industrial and economic development promoting an easier access for industrial partners to the most relevant and competent European R&D teams as well as to services & facilities for up-scaling metallurgical and mineral processes; and promoting the most innovative cutting-edge scientific results from European research teams towards industrial partners.

**Pultrusion technique****Booth 210, 212**

Pultrusion parts, polymer concrete parts, epoxy parts, thermoset resins, RRIM, Compression moulding, handly-up, others process for mining, petroleum, and distribution of electricity.

**Purolite Corporation****Booth 202**

Purolite is a leading developer, manufacturer and supplier of ion exchange, adsorbent and specialty

resins. Headquartered in Pennsylvania, USA, we have ISO 9001 certified manufacturing facilities in the USA, China, and Romania and operate five global R&D centers. Established in industries such as hydrometallurgy, mining, metals plating, ultra-pure water among others. With the largest, most knowledgeable technical sales force and over 40 sales offices in more than 30 countries, Purolite can help solve your metallurgical process challenges.

**Quinn Process Equipment Co.****Booth 405**

Quinn Process Equipment Co. (QPEC) specializes in the design and manufacture of a wide range of mineral process equipment for pilot and small commercial size plants. QPEC has provided equipment for a broad range of plants throughout the world. QPEC's specialty is conventional design solvent extraction mixer-settlers for flows from 100 ml up to 7 cubic meters per minute. QPEC has a full range of small to medium size flotation cells from 0.3 cubic feet up to 180 cubic feet per cell. Special materials are available for most corrosive/abrasive applications.

**RHI Magnesita****Booth 207**

RHI Magnesita is the result of the combination of RHI and Magnesita to form the global leading supplier of high-grade refractory products, systems and services which are indispensable for industrial high-temperature processes exceeding 1,200°C in a wide range of industries, including steel, cement, non-ferrous metals, and glass, among others. With a vertically integrated value chain, from raw materials to refractory products and full performance-based solutions, RHI Magnesita serves more than 10,000 customers in nearly all countries around the world and has more than 14,000 employees.

**SGS Canada Inc.****Booth 203**

SGS is the global leader in inspection, verification, certification and testing services. Our flowsheet development, pilot plant testing and chemical analysis have earned the respect of the global minerals industry and we are the world's leading provider of bankable metallurgical services. We offer an extensive range of services that covers exploration, plant design and engineering, production, industrial applications and decommissioning and closure. As your strategic partner, we provide testing, technology, and trade services to help deliver more growth, improve your speed to market and reduce risk.

## **Sipi Metals Corp.** **Booth 104**

Sipi Metals is a leading refiner of precious metal-bearing materials and is a manufacturer of copper alloys and addition agents that meet or exceed the highest industry standards. Our precious metals division serves the mining, electronics manufacturing, and e-scrap industries. Our copper alloys division is a trusted partner with the most discriminating non-ferrous foundries and alloys manufacturers. We deliver peace of mind. We're certified to ISO 9001 and ISO 14001 standards, have an exemplary environmental record, and have been independently owned since 1905.

## **SME** **Booth 409**

The Society for Mining, Metallurgy & Exploration Inc. (SME) is a professional society (nonprofit 501(c)3 corporation) whose more than 13,000 members represent all professionals serving the mining, minerals, and underground construction industry in more than 85 countries. SME members include engineers, geologists, metallurgists, educators, students, and researchers. SME advances the worldwide mining, minerals, and underground construction community through information exchange and professional development. SME's staff of 51 are located in Englewood, Colorado, USA. For more information, visit [www.smenet.org](http://www.smenet.org).

## **SysCAD** **Booth 306**

SysCAD is a powerful and versatile plant simulator, and can be used to simulate the simplest processing circuit through to a complex full plant operation. When used to its full potential, it can serve in every aspect of the plant life cycle from feasibility studies, to design, commission, operations and maintenance to expansion and more.

## **TMS** **Booth 411**

The Minerals, Metals & Materials Society (TMS) is a professional society that connects minerals, metals, and materials scientists and engineers who work in industry, academia, and government positions around the world. TMS creates networking, publication, and professional development opportunities by convening international conferences, publishing books and journals, administering awards, conducting short courses and training, and bringing together the professional community to address issues of common concern. TMS currently supports nearly 13,000 professional and student members on six continents. For more information, visit [www.tms.org](http://www.tms.org).

## **Turtle Tough** **Booth 206**

Turtle Tough designs and develops sensors for liquid analysis for the world's toughest applications. We are a world leader in the development of electrochemical sensors for hydrometallurgy applications. We have dedicated years to perfecting measurement solutions in the refining and extraction of gold, copper, nickel, uranium and zinc. We have also engineered time tested solutions for titanium dioxide production, ammonium nitrate, solvent extraction, and industrial waste water. Turtle Tough sensors provide superior reliability, lower maintenance, less drift, better accuracy and the lowest cost of ownership.

## **Univar** **Booth 312**

Supplier of Chemicals and Waste Management Services (Chemcare)

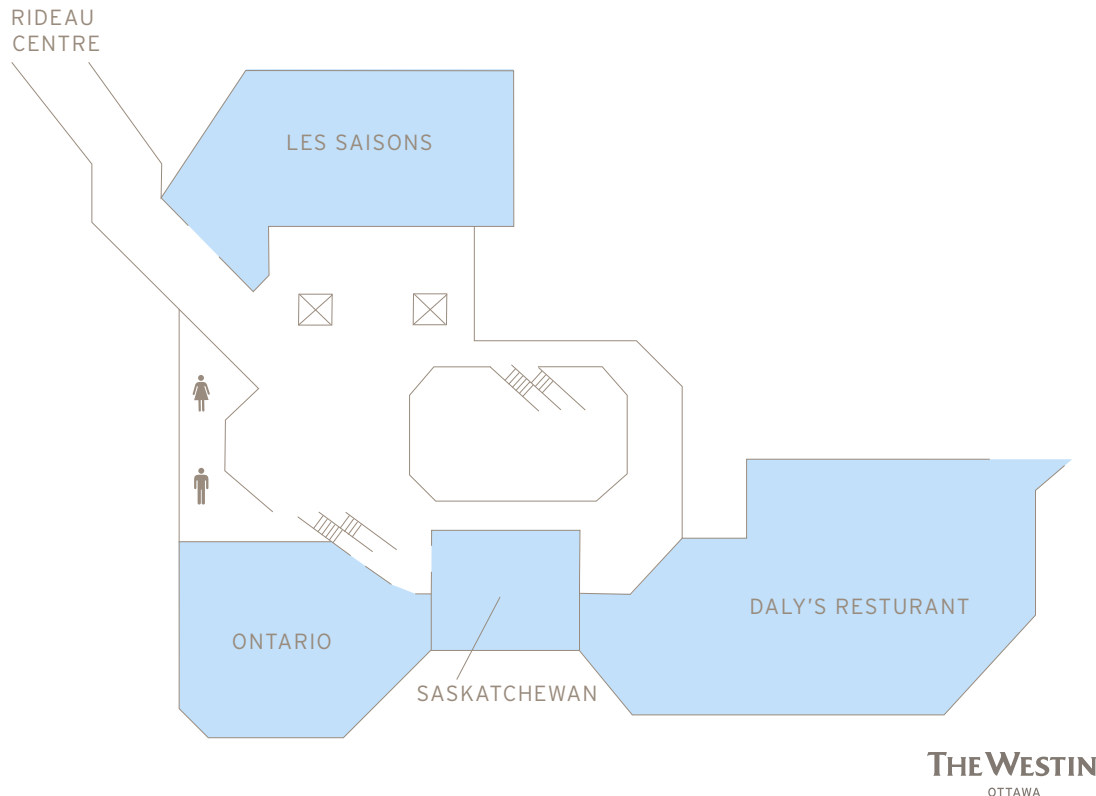
## **XPS Expert Process Solutions** **Booth 309**

XPS is a metallurgical engineering, technology and test services business offering industry leading expertise in orebody characterisation, flowsheet development, operational support, techno-economic analysis and asset integrity management for most commodities including gold, nickel, copper, cobalt, zinc, PGEs, rare earth, lithium and industrial minerals. XPS offers solutions from five integrated groups, Process Mineralogy, Extractive Metallurgy, Process Control, Materials Technology and Plant Support and Commissioning.

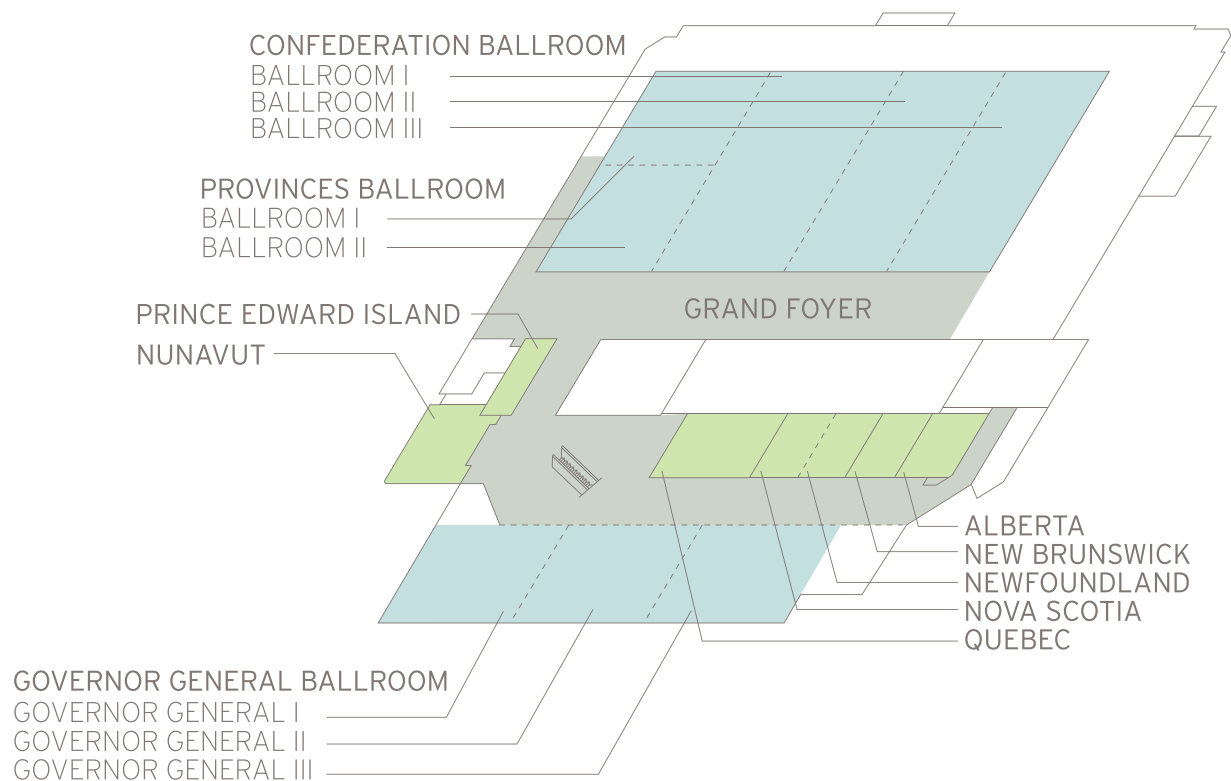
## Upcoming Events from MetSoc, SME, and TMS

| Event   | Dates                        | Location                            |
|---|------------------------------|-------------------------------------|
| SME 2018 THRIVE Conference<br><a href="http://www.smeTHRIVE.com">www.smeTHRIVE.com</a>  | September 27, 2018           | Pittsburgh, Pennsylvania, USA       |
| Materials Science & Technology 2018 Technical Meeting and Exhibition (MS&T18), Including COM 2018 – 57th Annual Conference of Metallurgists<br><a href="http://www.matscitech.org">www.matscitech.org</a>                       | October 14–18, 2018          | Columbus, Ohio, USA                 |
| SME 2018 Arizona Conference   | December 2–3, 2018           | Tucson, Arizona, USA                |
| SME 2019 Annual Conference & Expo, held in conjunction with the Colorado Mining Association's 121st National Western Mining Conference<br><a href="http://www.smeannualconference.com/">http://www.smeannualconference.com/</a> | February 24–27, 2019         | Denver, Colorado, USA               |
| TMS 2019 Annual Meeting & Exhibition (TMS2019, Including REWAS 2019)<br><a href="http://www.tms.org/TMS2019">www.tms.org/TMS2019</a>  | March 10–14, 2019            | San Antonio, Texas, USA             |
| SME 2019 Minnesota Conference   | April 15–16, 2019            | Duluth, Minnesota, USA              |
| CMSC 2019 – Canadian Materials Science Conference<br><a href="http://www.cmsscConf.org">www.cmsscConf.org</a>   | June 19–22, 2019             | Vancouver, British Columbia, Canada |
| 5th World Congress on Integrated Computational Materials Engineering (ICME 2019)<br><a href="http://www.tms.org/ICME2019">www.tms.org/ICME2019</a>  | July 21–25, 2019             | Indianapolis, Indiana, USA          |
| COM 2019 – 58th Annual Conference of Metallurgists<br>Hosting Copper 2019<br><a href="http://com.metsoc.org">com.metsoc.org</a>   | August 18–21, 2019           | Vancouver, British Columbia, Canada |
| 11th International Conference on Porous Metals and Metallic Foams (MetFoam 2019)<br><a href="http://www.tms.org/MetFoam2019">www.tms.org/MetFoam2019</a>  | August 20–23, 2019           | Dearborn, Michigan, USA             |
| Materials Science & Technology 2019 Technical Meeting and Exhibition (MS&T19)   | September 29–October 3, 2019 | Portland, Oregon, USA               |
| TMS 2020 Annual Meeting & Exhibition (TMS2020)<br><a href="http://www.tms.org/TMS2020">www.tms.org/TMS2020</a>  | February 23–27, 2020         | San Diego, California, USA          |
| SME 2020 Annual Conference & Expo   | February 24–27, 2020         | Phoenix, Arizona, USA               |
| Uranium 2020<br><a href="http://www.metsoc.org">www.metsoc.org</a>  | May 10–13, 2020              | Saskatoon, Saskatchewan, Canada     |
| ICTP 2020: The 13th International Conference on the Technology of Plasticity  | July 26–31, 2020             | Columbus, Ohio, USA                 |
| COM 2020 – 59th Conference of Metallurgists<br><a href="http://www.metsoc.org">www.metsoc.org</a>   | August 24–27, 2020           | Toronto, Ontario, Canada            |
| 14th International Symposium on Superalloys (Superalloys 2020)<br><a href="http://www.tms.org/Superalloys2020">www.tms.org/Superalloys2020</a>  | September 13–17, 2020        | Seven Springs, Pennsylvania, USA    |

## THIRD FLOOR



## FOURTH FLOOR





**AMERICAN  
ELEMENTS**

THE ADVANCED MATERIALS MANUFACTURER®

|                                   |                                  |                                   |                                     |                                 |                                  |                                    |                                 |                                  |                                    |                                   |                                   |                                  |                                 |                                 |                                   |                                  |                                 |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 1<br>H<br>1.00794<br>Hydrogen     |                                  |                                   |                                     |                                 |                                  |                                    |                                 |                                  |                                    |                                   |                                   |                                  |                                 |                                 |                                   |                                  | 2<br>He<br>4.002602<br>Helium   |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3<br>Li<br>6.941<br>Lithium       | 4<br>Be<br>9.012182<br>Beryllium |                                   |                                     |                                 |                                  |                                    |                                 |                                  |                                    |                                   |                                   |                                  |                                 |                                 |                                   |                                  |                                 |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 11<br>Na<br>22.98976928<br>Sodium | 12<br>Mg<br>24.304<br>Magnesium  |                                   |                                     |                                 |                                  |                                    |                                 |                                  |                                    |                                   |                                   |                                  |                                 |                                 |                                   |                                  |                                 |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 19<br>K<br>39.0983<br>Potassium   | 20<br>Ca<br>40.078<br>Calcium    | 21<br>Sc<br>44.955912<br>Scandium | 22<br>Ti<br>47.887<br>Titanium      | 23<br>V<br>50.9415<br>Vanadium  | 24<br>Cr<br>51.9961<br>Chromium  | 25<br>Mn<br>54.938045<br>Manganese | 26<br>Fe<br>55.845<br>Iron      | 27<br>Co<br>58.933195<br>Cobalt  | 28<br>Ni<br>58.6934<br>Nickel      | 29<br>Cu<br>63.546<br>Copper      | 30<br>Zn<br>65.38<br>Zinc         | 31<br>Ga<br>69.723<br>Gallium    | 32<br>Ge<br>72.64<br>Germanium  | 33<br>As<br>74.9216<br>Arsenic  | 34<br>Se<br>78.96<br>Selenium     | 35<br>Br<br>79.904<br>Bromine    | 36<br>Kr<br>83.798<br>Krypton   |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 37<br>Rb<br>85.4678<br>Rubidium   | 38<br>Sr<br>87.62<br>Strontium   | 39<br>Y<br>88.90585<br>Yttrium    | 40<br>Zr<br>91.224<br>Zirconium     | 41<br>Nb<br>92.90638<br>Niobium | 42<br>Mo<br>95.96<br>Molybdenum  | 43<br>Tc<br>(98)<br>Technetium     | 44<br>Ru<br>101.07<br>Ruthenium | 45<br>Rh<br>102.9055<br>Rhodium  | 46<br>Pd<br>106.42<br>Palladium    | 47<br>Ag<br>107.8682<br>Silver    | 48<br>Cd<br>112.411<br>Cadmium    | 49<br>In<br>114.818<br>Indium    | 50<br>Sn<br>118.71<br>Tin       | 51<br>Sb<br>121.757<br>Antimony | 52<br>Te<br>127.6<br>Tellurium    | 53<br>I<br>126.90447<br>Iodine   | 54<br>Xe<br>131.29<br>Xenon     |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 55<br>Cs<br>132.9054<br>Cesium    | 56<br>Ba<br>137.327<br>Barium    | 57<br>La<br>138.9047<br>Lanthanum | 72<br>Hf<br>178.48<br>Hafnium       | 73<br>Ta<br>180.948<br>Tantalum | 74<br>W<br>183.84<br>Tungsten    | 75<br>Re<br>186.207<br>Rhenium     | 76<br>Os<br>190.23<br>Osmium    | 77<br>Ir<br>192.225<br>Iridium   | 78<br>Pt<br>195.084<br>Platinum    | 79<br>Au<br>196.96657<br>Gold     | 80<br>Hg<br>200.59<br>Mercury     | 81<br>Tl<br>204.3833<br>Thallium | 82<br>Pb<br>207.2<br>Lead       | 83<br>Bi<br>208.9804<br>Bismuth | 84<br>Po<br>(209)<br>Polonium     | 85<br>At<br>(210)<br>Astatine    | 86<br>Rn<br>(222)<br>Radon      |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 87<br>Fr<br>(223)<br>Francium     | 88<br>Ra<br>(226)<br>Radium      | 89<br>Ac<br>(227)<br>Actinium     | 104<br>Rf<br>(261)<br>Rutherfordium | 105<br>Db<br>(262)<br>Dubnium   | 106<br>Sg<br>(266)<br>Seaborgium | 107<br>Bh<br>(264)<br>Bohrium      | 108<br>Hs<br>(277)<br>Hassium   | 109<br>Mt<br>(268)<br>Meitnerium | 110<br>Ds<br>(285)<br>Darmstadtium | 111<br>Rg<br>(289)<br>Roentgenium | 112<br>Cn<br>(285)<br>Copernicium | 113<br>Nh<br>(284)<br>Nihonium   | 114<br>Fl<br>(289)<br>Flerovium | 115<br>Mc<br>(288)<br>Moscovium | 116<br>Lv<br>(293)<br>Livermorium | 117<br>Ts<br>(294)<br>Tennessine | 118<br>Og<br>(294)<br>Oganesson |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| epitaxial crystal growth          |                                  |                                   |                                     |                                 |                                  |                                    |                                 |                                  |                                    |                                   |                                   |                                  |                                 |                                 |                                   |                                  |                                 | macromolecules |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | silver nanoparticles |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| uFOD                              |                                  |                                   |                                     |                                 |                                  |                                    |                                 |                                  |                                    |                                   |                                   |                                  |                                 |                                 |                                   |                                  |                                 | GD             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| um dots                           |                                  |                                   |                                     |                                 |                                  |                                    |                                 |                                  |                                    |                                   |                                   |                                  |                                 |                                 |                                   |                                  |                                 | mischm         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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