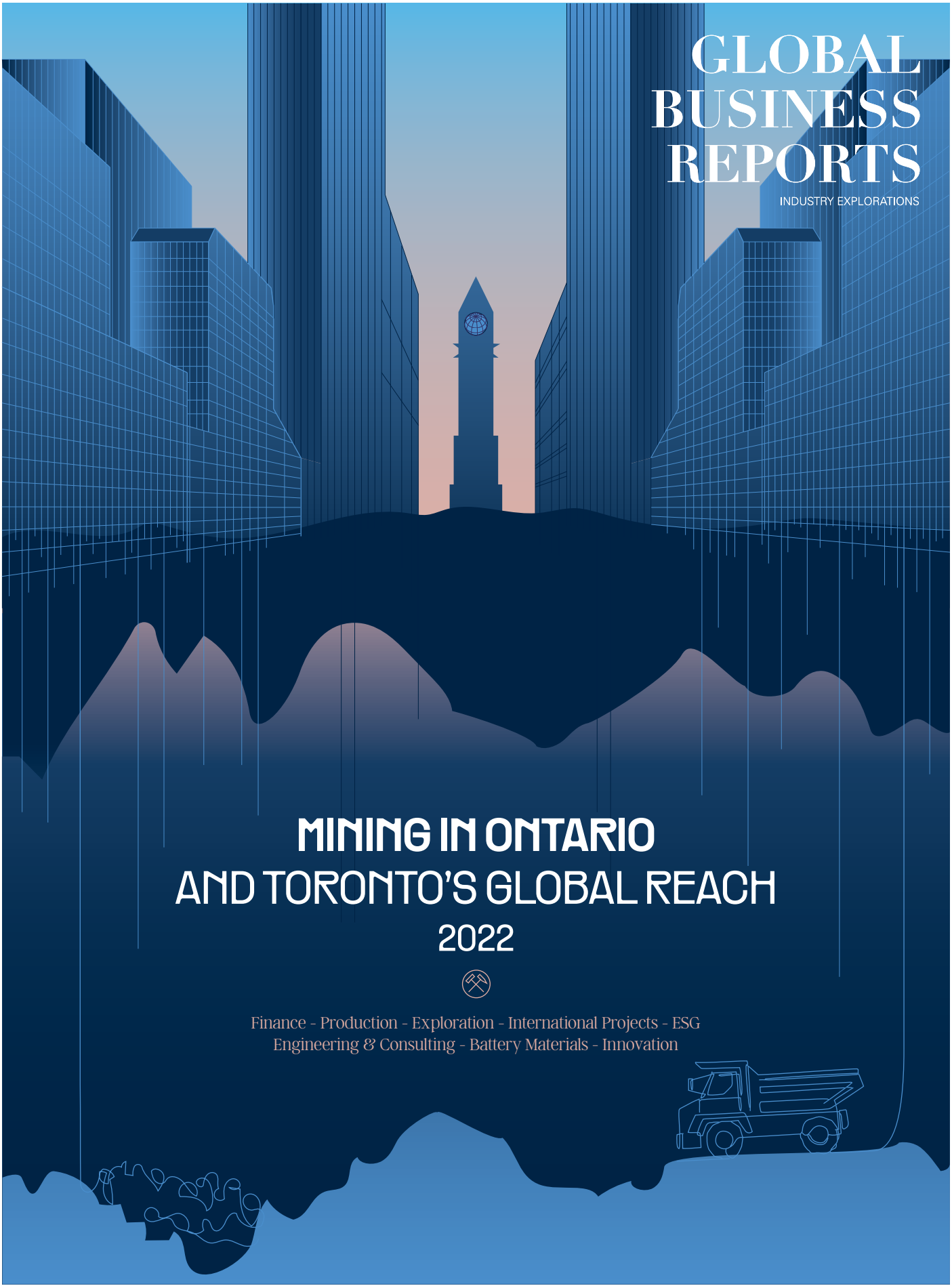

GLOBAL BUSINESS REPORTS

INDUSTRY EXPLORATIONS

MINING IN ONTARIO AND TORONTO'S GLOBAL REACH 2022

Finance - Production - Exploration - International Projects - ESG
Engineering & Consulting - Battery Materials - Innovation

Dear Mining Community,

Global Business Reports is proud to release our 2022 in-depth analysis of the Ontario mining sector and the impact it has across the world. Conducting interviews with over one hundred CEOs from majors, producers and juniors to lawyers, engineers and government, we aim to provide an overarching vision of the whole value chain involved in Ontario's metal and mineral extraction industry.

In a world still battling the effects of the pandemic, miners are cooperating more closely than ever with international, cross-industry consortiums and organizations, collaborating intensely on finding impactful solutions. Financial institutions are navigating uncertain territories, continuously seeking innovative strategies to access larger pools of capital for the sector. Juniors are juggling investor news flow with various types of supply chain delays, including assays spending lengthy times at labs. Drilling and services remain in high demand, with many explorers requiring government extensions to retain their stakes.

The whole world is undergoing a transformative period, trying to strategize the plan to stop the impact of global warming. Now, more than ever, demands on the mining sector will exponentially increase. How effective the industry becomes at adopting innovation, developing new technologies and showcasing the importance of mining to the greater public will play a crucial role in the struggle against global warming.

It is a time to lend a hand, share knowledge, and work together. We would like to thank all of our interviewees for providing their valuable insights and taking the time to make this report, the 2022 Ontario Mining and Toronto's Global Reach report, as accurate as it can possibly be. We encourage our readers to provide feedback and reach out, should they wish to be interviewed for future reports.

We hope the following pages are both informative and inspiring, as we hear directly from the industry leaders currently shaping the future of the mining industry.

Alfonso Tejerina
General Manager
GBR

Margarita Todorova
Senior Project Director
GBR

Elisa Iannacone
Project Director
GBR

ONTARIO MINING AND TORONTO'S GLOBAL REACH 2022
Industry Explorations
Global Business Reports

This research has been conducted by Margarita Todorova, Elisa Iannacone and Ben Cherrington.
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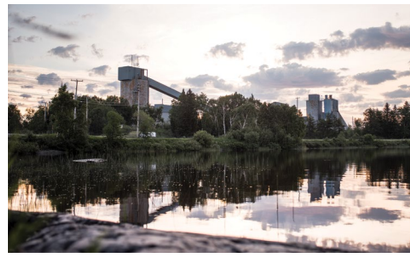
Introduction to Mining in Ontario 6-17

A strong commodity market, continuous innovation and a new focus on energy metals bolster Ontario's mining sector.



Mining Production and Development 18-31

GBR tracks developments at Ontario's mines as they strive to benefit from rising prices.

Toronto's Global Reach 44-57

Ontario continues to influence global mining through finance, technology and innovation.

Services, Technology and Innovation 100-121

GBR looks at how Ontario is contributing towards the digital, automated and fossil free mines of the future.

INTRODUCTION TO ONTARIO

"We are working with the government to unlock geoscience funding to build out the country's data set, which will in turn attract FDI, and want to drive the concept that Canada can be a supplier of choice for minerals and metals that contribute to the green agenda."

- Alex Christopher,
38th President,
Prospectors & Developers Association of Canada (PDAC)

Introduction to Mining in Ontario

EVOLVING MINING PRACTICES

During this volatile time, the agility of the Ontario mining sector has allowed it to retain a strong position through high levels of managerial discipline and caution. Rising commodity prices have allowed for greater production cashflows and balance sheets have become stronger. Majors have amassed capital reserves and have liquidity to continue exploring, developing and producing. However, the junior sector has continued to face challenges with a highly scrutinous investor base and supply-chain delays.

In the past 20 months, the industry has remained remarkably active, with many exciting transactions taking place. Perhaps the most notable is the merger of Agnico Eagle and Kirkland Lake Gold. On February 8th, 2022, the merger was completed, and the company now has approximately US$2.3 billion of available liquidity, with a mineral reserve base of 48 million ounces of gold (oz Au). With a large exploration and development pipeline, Agnico Eagle Mines is primed for continued and sustainable growth, as is the Ontario mining sector as a whole.

The Ring of Fire has come back into the spotlight with a thrilling bidding war for Noront Resources between industry giant BHP Billiton and Wyloo Metals, now owned by one of Australia's largest private companies, Tattarang. It was only after several months of discussions that the winner from down-under was announced, with BHP withdrawing from the race.

The victory of Australian billionaire, Andrew "Twiggy" Forrest, over the world's largest mining company, BHP, may have been seen as a surprise in some quarters. However, Wyloo's previous foothold in the shares of Noront, combined with its determination to expand its portfolio of nickel properties, caused BHP to walk away from the deal.

Equinox and Orion Mine Finance Group's Greenstone mine has started construction and will be one of the largest in Canada, costing about US$1.23 billion. It is expected to produce more than 5 million oz Au, with 400,000 oz/y for the first five years, and have a 14-year mine life. Construction at Argonaut's Magino is on-going and IAMGOLD's Cotê project construction is on-schedule, with commercial production expected H2 2023.

The sector is positioning itself to address increasing demand from rising urbanization and population growth, along with the crucial contribution of materials needed for the low carbon economy transition.

– Louise Pearce, Global Mining Director, ERM

M&A has been on the rise throughout 2021, with companies looking to consolidate whole mining regions. Single-asset companies that have struggled to replenish reserves through the last mining cycle given low commodity prices and capital strains are now keen to partner with stronger players. Lessons from previous M&A deals and retaining shareholder interest, given many distractions such as cryptocurrencies and new technologies, will be more important than ever to avoid high premiums and debt, which stifled the industry in years past. The Agnico/Kirkland and Wyloo/Noront deals could be the first in a wave of M&A activity necessary to consolidate projects.

Toronto's financial markets have witnessed mining take a prominent place in the TSX30 – a ranking of the top 30 performers on the Toronto Stock Exchange over a three-year period based on dividend-adjusted share price appreciation. TSXV to TSX graduation rates have also risen in 2021, and mining finance firms including PearTree Securities, Triple Flag Precious Metals, Haywood Securities, Stifel GMP, IBK Capital and Roth Canada have had their hands full with transactions, continuously finding innovative ways for Canadian mining companies to access larger pools of capital.

The rapid printing of money throughout the pandemic and increased demand have led to challenges regarding inflationary costs. The hardest hit companies in the sector have been those in the midst of building new projects, with companies witnessing steep cost increases to their operations also due to the Canadian dollar gaining strength. "You see projects that have been inflated by up to 40%," said Renauld Adams, president and CEO, New Gold.

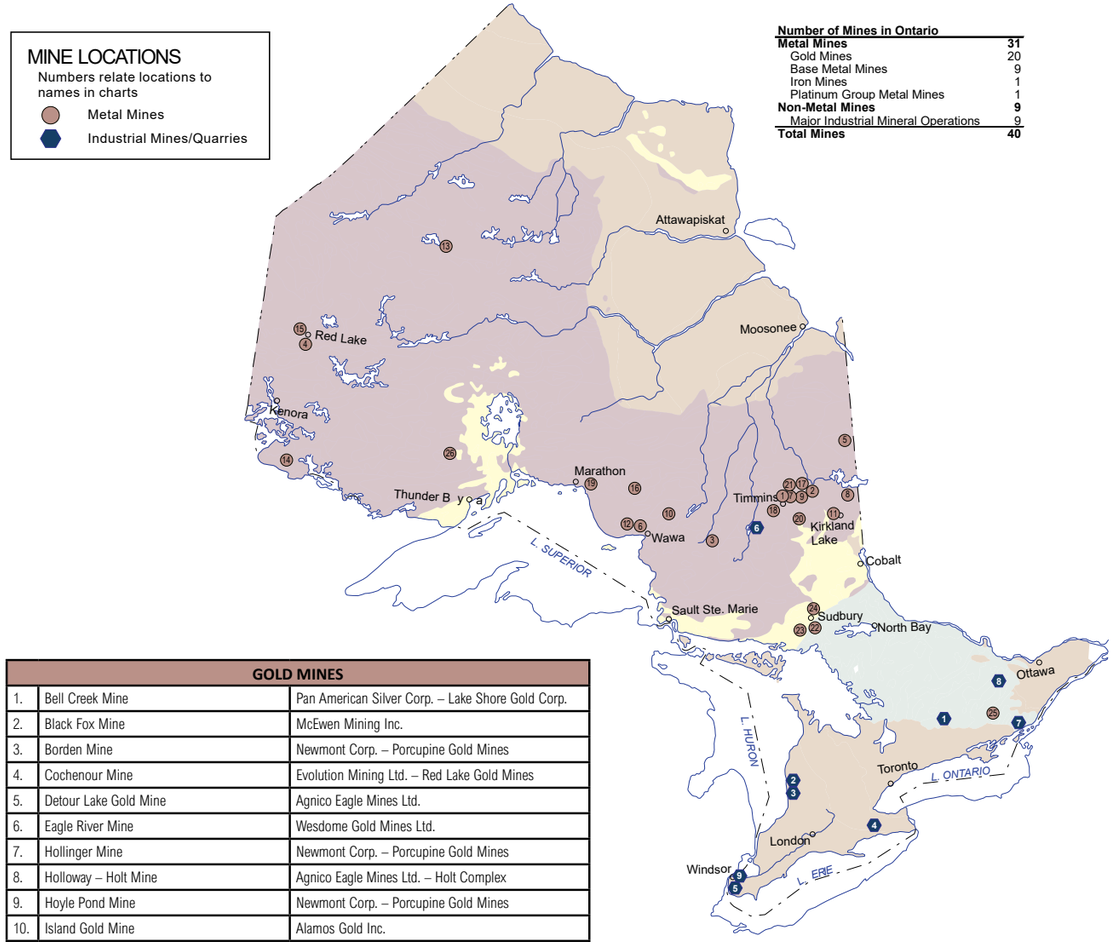
With mining sitting at the core of the planet's future, low-carbon targets have rippled across the value chain. PwC's 2021 CEO Survey saw 76% of global mining and metals executives raise concerns regarding the environment, up 5% from 2020. The importance of investing in ESG and sustainability has given rise to new and innovative ESG platforms looking to support the sector through simplifying information and streamlining international requirements. There has never been a more important time to highlight the positive impact of the mining industry on all businesses across the globe. "Funds are much more rigorous on their ESG measurements and demands, and it is a trend that will only continue," said Alex Pernin, CEO, Star Royalties.

Over the past 18 months, we have witnessed the return of the generalist investor to the sector. Companies that are better able to disclose ESG practices, standards and compliance to investors are getting more interest.

– Dean McPherson, Head of Global Mining, Toronto Stock Exchange & TSX Venture Exchange

A critical acceleration on the importance of Industry 4.0 processes fuelled by Covid has been observed in the past few years. Digital and technological transformation is a key priority for mining CEOs to become more efficient, with a strong interest in collaborating across industry sectors to find innovative solutions. As a swift response to the pandemic, new communications processes and protective gear entered the market, with mining companies taking a leading role in supporting rural communities through Covid. The Ontario mining sector continues paving the way globally for protocols, community relations, safety and efficiency. ■

Mining Operations Map 2022



Number of Mines in Ontario	
Metal Mines	**31**
Gold Mines	20
Base Metal Mines	9
Iron Mines	1
Platinum Group Metal Mines	1
Non-Metal Mines	**9**
Major Industrial Mineral Operations	9
Total Mines	**40**

GOLD MINES		
1.	Bell Creek Mine	Pan American Silver Corp. – Lake Shore Gold Corp.
2.	Black Fox Mine	McEwen Mining Inc.
3.	Borden Mine	Newmont Corp. – Porcupine Gold Mines
4.	Cochenour Mine	Evolution Mining Ltd. – Red Lake Gold Mines
5.	Detour Lake Gold Mine	Agnico Eagle Mines Ltd.
6.	Eagle River Mine	Wesdome Gold Mines Ltd.
7.	Hollinger Mine	Newmont Corp. – Porcupine Gold Mines
8.	Holloway – Holt Mine	Agnico Eagle Mines Ltd. – Holt Complex
9.	Hoyle Pond Mine	Newmont Corp. – Porcupine Gold Mines
10.	Island Gold Mine	Alamos Gold Inc.
11.	Macassa Mine	Agnico Eagle Mines Ltd.
12.	Mishi Gold Mine	Wesdome Gold Mines Ltd.
13.	Musselwhite Mine	Newmont Corp.
14.	Rainy River Mine	New Gold Inc.
15.	Red Lake Mine	Evolution Mining Ltd. – Red Lake Gold Mines
16.	Sugar Zone Mine	Harte Gold Corp.
17.	Taylor Mine	Agnico Eagle Mines Ltd. – Holt Complex
18.	Timmins West Mine	Pan American Silver Corp. – Lake Shore Gold Corp.
19.	Williams Mine	Barrick Gold Corp.
20.	Young – Davidson Mine	Alamos Gold Inc.
BASE METAL MINES		
21.	Kidd Creek Mine	Glencore PLC – Glencore Canada Corp.
22.	Sudbury Operations: McCreedy West Mine	KGHM International Ltd.
23.	Sudbury Operations Coleman Mine, Copper Cliff North Mine, Creighton Mine, Garson Mine, Totten Mine	Vale S.A. – Vale Canada Limited
24.	Sudbury Operations: Fraser Mine, Nickel Rim South Mine	Glencore PLC – Sudbury Integrated Nickel Operations

IRON MINES		
25.	Tomclid Iron Mine	Ferromin Inc.
PLATINUM GROUP METAL MINES		
26.	Lac des Iles Mine	Impala Platinum Holdings Ltd. – Impala Canada Ltd.
MAJOR INDUSTRIAL MINERAL OPERATIONS		
1.	Blue Mountain Operations (nepheline syenite)	Covia Holdings Corp.
2.	Goderich Brine Field (salt)	Compass Minerals Canada Corp.
3.	Goderich Mine (salt)	Compass Minerals Canada Corp.
4.	Hagersville Mine (gypsum)	CGC Inc.
5.	Ojibway Mine (salt)	K+S Windsor Salt Ltd.
6.	Penhorwood Mine (talc)	Imerys Talc
7.	St. Lawrence Mine (wollastonite)	Canadian Wollastonite
8.	Tatlock Quarry (calcium carbonate)	OMYA Canada Inc.
9.	Windsor Brine Field (salt)	K+S Windsor Salt Ltd.

Source: Ontario Mining and Exploration Directory and Resource Guide 2021

Greg Rickford

Minister of Northern Development, Mines, Natural Resources and Forestry
Minister of Indigenous Affairs,
GOVERNMENT OF ONTARIO

> There is a new centre of gravity emerging for mining in northwestern Ontario, particularly for gold opportunities.

Which commodities and projects are you most excited about in Ontario?
Ontario is rich in gold, nickel, copper, zinc, platinum group metals (PGMs), silver, cobalt, uranium and other industrial metals. Our government moved quickly to get many projects across critical milestones, including critical minerals projects and infrastructure. We are also promoting processing in Ontario to add significant value to our growing critical minerals supply chain. We are actively looking at the feasibility of lithium processing in Thunder Bay and our government is investing C$5 million in the first cobalt facility in North America.
I am excited about numerous areas continuing to see significant gold exploration and activity, such as Timmins, Kirkland Lake, Wawa, Red Lake and the Kenora mining district. There is a new centre of gravity emerging for mining in northwestern Ontario, particularly for gold opportunities. In Uchi Lake, Rainy River and Wawa, there is also an evolving area for mining rare earth elements and other minerals. We are also optimistic about the copper, nickel and platinum deposits in the Lake Superior region, the Greenstone Belt, and the Ring of Fire.

What initiatives is the government pushing to unlock the Ring of Fire's exploration potential?
We are focused on supporting and implementing policies that benefit isolated and remote First Nation communities in the region. We are supporting legacy infrastructure, including First Nations led all-season road projects, to create a 'Corridor to Prosperity.' These projects will unlock unprecedented access to health and social services, broadband connectivity, and clean alternatives to diesel-generated electricity for Northern First Nation communities. These projects, if approved, would support the development of the Northern Road Link that will connect these projects to the area known as the Ring of Fire.
The private sector is recognizing that this opportunity could finally become a reality.

How are you addressing the gap in skilled labor and what kinds of collaborations are emerging with Indigenous communities in this area?
One of the most attractive features of mining is that it is the largest employer of Indigenous peoples in Canada and Ontario. Ontario is now offering expanded resource revenue sharing agreements with Indigenous communities proximal to mining, forestry or aggregate developments. Our government has also made significant investments in training programs for Indigenous people. This includes C$3.6 million through the Ministry of Labor, Training and Skills Development to help 150 Indigenous people receive training to start careers at the Greenstone mine. We have also supported initiatives for employment opportunities on major energy infrastructure projects, such as the Wataynikaneyap power transmission project. This will serve the interests in the Greenstone Belt and translate to a transferable skill set for Indigenous workers. Trained workers will have other exciting opportunities as more critical energy infrastructure and mining projects start construction.

Can you comment on the ongoing technological advancements in the sector?
Ontario has always been globally competitive in mineral exploration and development spending. Sudbury, North Bay and Timmins, which I would nickname the 'Ontario Triad', are all top destinations for the mining services supply sector. These mineral sector hubs are inventing and testing world-leading technologies that help keep workers safe and reduce capital costs for the mines of the future.
I also announced our intention to develop a Critical Minerals Strategy that will support cutting edge technologies and ensure we capture the growing global market for strategic minerals.
Ontario is recognized as having one of the top ten ranked geological databases in the world, according to the 2020 Fraser Institute Mining survey. We remain committed to incentivizing innovation through opportunities such as the Ontario Junior Exploration Program. This program committed C$5 million dollars over two years to help junior exploration companies find the mines of the future. We also built out the Aboriginal Participation Fund and revitalized the Northern Ontario Heritage Fund to ensure mining supply and service companies have government support. Innovation and technology are the heart and soul of what our government is investing in. For too long, certain mining deposits were not seen as market friendly. Now, we are seeing far greater interest in these deposits due to the high level of sophistication of the technology available. ■

Chris Hodgson

President,
ONTARIO MINING ASSOCIATION (OMA)

> The rise of the green economy and digitization rests on the mining industry's success, and we need to ensure the cycle is complete by producing essential minerals and metals in an environmentally friendly manner.

What have been OMA's key highlights and milestones over the last year?
OMA is excited to be celebrating our 100th anniversary this May (the 2020 celebration was delayed due to the pandemic). We also have our first female chair, which is another milestone worthy of celebration. Safety remains paramount to the industry, and Ontario is one of the safest jurisdictions in the world for mining. We achieved a 96% improvement in lost time injury frequency over 30 years. When Covid-19 struck, we applied our expertise to ensure safety across all operations.

How have you seen ESG progress in Ontario's mining industry?
ESG is a framework that helps us balance benefits to people and the planet, while delivering profits and helping the economy. The rise of the green economy and digitization rests on the mining industry's success, and we need to ensure the cycle is complete by producing essential minerals and metals in an environmentally friendly manner. In Ontario, our electrical grid is essentially carbon-free, giving us a considerable advantage on GHG emissions. The whole supply chain must be green to achieve green inputs in operations and our association has been focused on delivering on Target Zero+ goals: that is, mining with zero harm to workers, zero carbon and zero waste, while improving productivity. Using electric vehicles underground is an example of a practice that is good for the environment, and also makes our operations more profitable, since other equipment would require more frequent repairs due to a high number of moving parts. There are 40 operational mines in Ontario and they are implementing new technologies where it is feasible and economically viable.

How has the OMA adapted to Covid-19?
Due to the public health hazards in meeting face-to-face, we now hold our meetings and workshops remotely using online platforms. Our current working mode allows us to pull together hundreds of participants quickly, and makes it easier for them to attend. In general, the pandemic was a time to re-think many standard approaches.

When major safety incidents happen, how would you describe the ripple effect on the industry and what support do you provide?
Every one of these incidents is a learning tool. One of these very rare events, which made the news recently, was a mine shaft becoming compromised at Vale's Totten mine, necessitating the rescue of 39 miners who were stuck underground. Fortunately, all the miners were brought up to the surface quickly and no one was injured. There will be lessons learned from this experience, as well as reports and investigations, that will inform future preventative practices. Every operating mine relies on their local team, which is assisted by the provincial team. Even though mines in Ontario go deeper than 1,200 m in many cases, there is always a safe frame, ventilation and communication – including WIFI, which the miners at Totten used to watch videos, relieving tension as they waited for the rescue teams to arrive. There are also alternative exits. The infrastructure is solid and stable, and the safety protocols that rely on safe rooms and rescue teams ensure that no harm is done to workers.

What is being done to mitigate the risk of skilled labour shortage?
The OMA created the "This Is Mining" campaign to educate millennials on the importance of mining and to make them excited about joining the mining workforce. We encourage your readers to listen to This Is Mining: The Podcast, winner of Outstanding Branded Series at the 2021 Canadian Podcast Awards, to get a flavour of the campaign. We plan to continue our outreach activities to help young people recognize the exciting career and lifestyle opportunities that mining offers. The average weekly wage in Ontario mining is 70% higher than the average industrial wage in the province, so that is one thing that should help us attract skilled labour. But we need to do more collectively to reach into the school system and promote careers in mining to women, since they are underrepresented in the industry, and to youth overall. ■

Alex Christopher

38th President,
PROSPECTORS & DEVELOPERS ASSOCIATION OF CANADA (PDAC)

What were the reasons behind moving the PDAC 2022 event to June?
Capacity limits for indoor gatherings and large events are currently in place by the Government of Ontario, with no guarantee as to the timing of their removal. We could not confidently continue planning for an in-person event in March with so much uncertainty.
The PDAC 2022 Convention will now take place in-person at the Metro Toronto Convention Centre from June 13-15 and online from June 28-29. By rescheduling from March to June, we are offering the best chance of success for all of our stakeholders.

What are the biggest challenges the mining industry is facing?
Currently, PDAC's focus is to ensure that the mineral sector remains viable through the pandemic. We are advocating for an extension of mineral exploration tax credits and doubling exploration tax credits for critical minerals to encourage grassroots exploration and increase the viability of mining that will drive us into a greener future. We are also working with the government to unlock geoscience funding to build out the country's data set, which will attract FDI. We want to drive the concept that Canada can be a supplier of choice for minerals and metals that contribute to the green agenda.

What advice would you give juniors?
Delivering a consistent news flow has always been a primary challenge for junior exploration companies. With potential for backlogs in support services like drilling and assaying, maintaining a consistent news flow is even more challenging. With high commodity prices and investor appetite returning there is a lot of available money for exploration and delays in news flow can impact how a company finances future activities. Fortunately, we have many opportunities to speed up data transfer and communicate results, but pre-planning and being transparent with the market is critical at this point. ■

Pierre Julien

President,
CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM (CIM)

What are the main themes CIM sees impacting Canada's mining industry in 2021 and 2022?
There are a number of high profile issues such as decarbonization, water consumption, diversity, inclusion and digitization that are impacting the industry. There has been a huge uptick in mining projects and activity across a number of different commodities. This has resulted in a surging demand for people, not only at the mine operations level, but also at project development and execution levels. During the last super cycle, the demand for talent was filled by a number of retired professionals coming back to plug the gap. However, many of these individuals are now too old. Furthermore, we have seen a continuous decrease in university enrolments and graduates in mineral extraction and mineral resource programs.

How can the mining industry attract a more diverse workforce?
The sector is still perceived in a negative light, as an old, dirty, low-tech industry. In reality, the mining industry builds, deploys and operates some of the most advanced and sophisticated technologies and machines on the planet; but this message is not reaching society. The lack of diversity relates to the negative perception of the industry. We have to relay a positive message to society from an early stage, even at school level. Industry organizations and government need to collaboratively do something grander to explain the importance and opportunities modern mining presents. I believe that we should ramp up mining education opportunities in communities that already have exposure to the industry, which can play an important part in attracting talent in the areas that need it most. Although ESG has gained more significance in recent years, especially from an investment perspective, gradual technological advancements have allowed the industry to reduce pollutants by 98% since the 1970s. ■

Navigating Uncertainty

A SEMBLANCE OF NORMALITY ALONGSIDE THE PANDEMIC

Though it might all fade into one challenging blur, it has been two years since the Covid-19 pandemic started, with over 32,000 casualties in Canada - 10,700 of which were in Ontario. Disruptions to all industry verticals impacted the globe, with many thinking that after the first pandemic wave subsided in 2021, we would all be able to start building back businesses. Unfortunately, Omicron came to throw a spanner in the works, and just like other sectors, miners have suffered numerous inflationary, operational and supply chain disruptions.

The New Year has begun with the news that PDAC 2022 is officially postponed from March to June, and will continue to be a hybrid event moving forward. Events going virtual and companies making a switch to remote work is not something that will go away any time soon. The Ontario government went back to imposing restrictions, with schools, restaurants and gyms back in the cross-hairs, but mining remains an essential service. The general sentiment is that people and companies just want everything to be over and are trying their best to carry on despite the added challenges.

Source: PDAC/OMA

Vaccine uptake has been prevalent across Canada, with fourth doses starting to be offered to vulnerable people. In Ontario, 78.54% of the province has been fully vaccinated, with 83.9% having received their first dose as of January 26th, 2022. All provinces continue to face lab delays and various companies were harder hit with the second wave than the first. "Initially, we did not see much Covid in Québec, however, now Covid has gotten into the province in a big way, and Omicron has affected some of our company. A lot of our team were very eager to get vaccinated though, which was a good sign for us," said Jose Vizquerra, president and CEO of O3 Mining.

In March, the first signs of spring were accompanied by better news on the Covid front, as Premier Doug Ford began to lift restrictions in Ontario. Although the province has learned to adapt to the pandemic, the challenge of dealing with rising inflationary pressures means that businesses will welcome a semblance of normality returning.

Although there appears to be light at the end of the tunnel from a Covid perspective, companies headquartered in Toronto with international operations have had to stay nimble, and many CEOs have stated they have not been able to visit their projects as often as they would have liked over the past two years. Even travelling across Canada or intra-provincially has been more challenging than before, limiting access and causing delays.

Through this slightly surreal time, technology has been a major driver for investment, with new technologies being pushed faster and further than ever before to optimize operations. Now, more than ever, ensuring there is adequate monitoring and response to cyber-threats is pivotal for mining companies to mitigate risk, detect safety breaches quickly and prevent damages. EY Canada's mining and metals leader, Theo Yameogo, warns that cybersecurity needs to be monitored 24/7. "Ongoing integration between IT and OT networks, reliance on third parties with less secure networks and limited workforces are all creating new entry points for cybercrime."

Despite all of the challenges, the Ontario mining sector has not only been able continue to function, but has played a key role in supplying PPE to remote areas and donating equipment to communities and hospitals. Covid will linger, but there is hope that the widespread vaccination program will diminish the impact of the virus and may believe that soon things will start to streamline again. In the meantime, isolation programs and testing continue to be an indispensable part of every company's operations.

The mining sector, resilient and familiar with the cycles of fortune, is perhaps better equipped than most to navigate this uncertain landscape. With access to some of the best technologies, resources, communities and innovation for mining in the world, Ontario mining companies will continue to respond to the challenges, leveraging on their world-leading expertise and experienced mining community. The mining sector in Ontario retains a resolute, fighting-attitude, ready for what is, and what may come. ■

> *New discoveries are becoming increasingly rare as the low hanging fruit is gone, and global gold resources amongst major mining companies have dropped precipitously over the past decade. IAMGOLD has been adding resources over this period of time with new discoveries. This industry trend is going to continue, given that exploration is not a faucet you can turn on and off and get immediate results. It requires an investment over time and talent.*
>
> ***– Daniella Dimitrov, President, CFO and Interim CEO, IAMGOLD***

Denis Frawley

Partner,
ORMSTON LIST FRAWLEV LLP

> The greening of the economy is going to reach deeply through supply chains, and that will open opportunities for projects with lower environmental impacts and stronger community support.

How has the mining industry recovered from the pandemic and what impact will the renegotiated NAFTA have on the sector?

My sense is that the mining and mineral exploration sectors have recovered, but will face important challenges and changes in the coming years. After the initial shock of the pandemic subsided, the commodities market recovered strongly and rapidly. In this new cycle, industrial metals and minerals – those used in the production of goods and equipment – seem to be leading (although precious metals remain important). With inflation becoming an important risk, perhaps precious metals will take the lead again. Nonetheless, a more broad-based increase in the price of all commodities is positive for mineral exploration and mining, even if challenges remain due to labor shortages, cost increases, climate change, etc.

The increasing electrification of the transportation system, particularly through the electric vehicles revolution, has boosted the prospects for most of the minerals used in new types of vehicles and changes to the power grid. The renegotiated NAFTA (or USMCA) appears to have fostered a healthy exploration environment in Canada for a number of industrial minerals. The changes in country of origin rules, coupled with the move of the auto sector towards electric vehicles, seem to be pushing EV companies to source a greater percentage of their components from North America. Also, the disruption of the global supply chain and the increasingly high cost of shipping during the pandemic may lead businesses to source their inputs in ways that reduce shipping costs and risks. Overall, these factors are converging to foster healthy conditions for exploration in North America.

How challenging is it to move from the TSX Venture Exchange to the TSX, and what support do you provide?

It is not terribly challenging from a regulatory perspective. As compared to the TSX, there are more granular rules to be complied with on the TSX-V. For example, most property acquisitions will trigger TSX Venture Exchange filing or approval requirements, which would not always be the case on the TSX. On the TSX, the rules are more conceptual and the thresholds triggering TSX interactions or filings are higher. Conversely, internal control and corporate governance requirements are more exacting for TSX listed companies, and reporting deadlines are tighter. This can mean that a graduating company needs a bigger board and more staff. For a TSX-V company, moving to the TSX can feel as though external operational constraints are reduced, but that internal governance and reporting structures are thickened.

We can certainly assist with preparing for that transition, from considering whether the conditions for graduating are met, to educating a client on the difference in compliance requirements, to building out appropriate internal controls and governance structures.

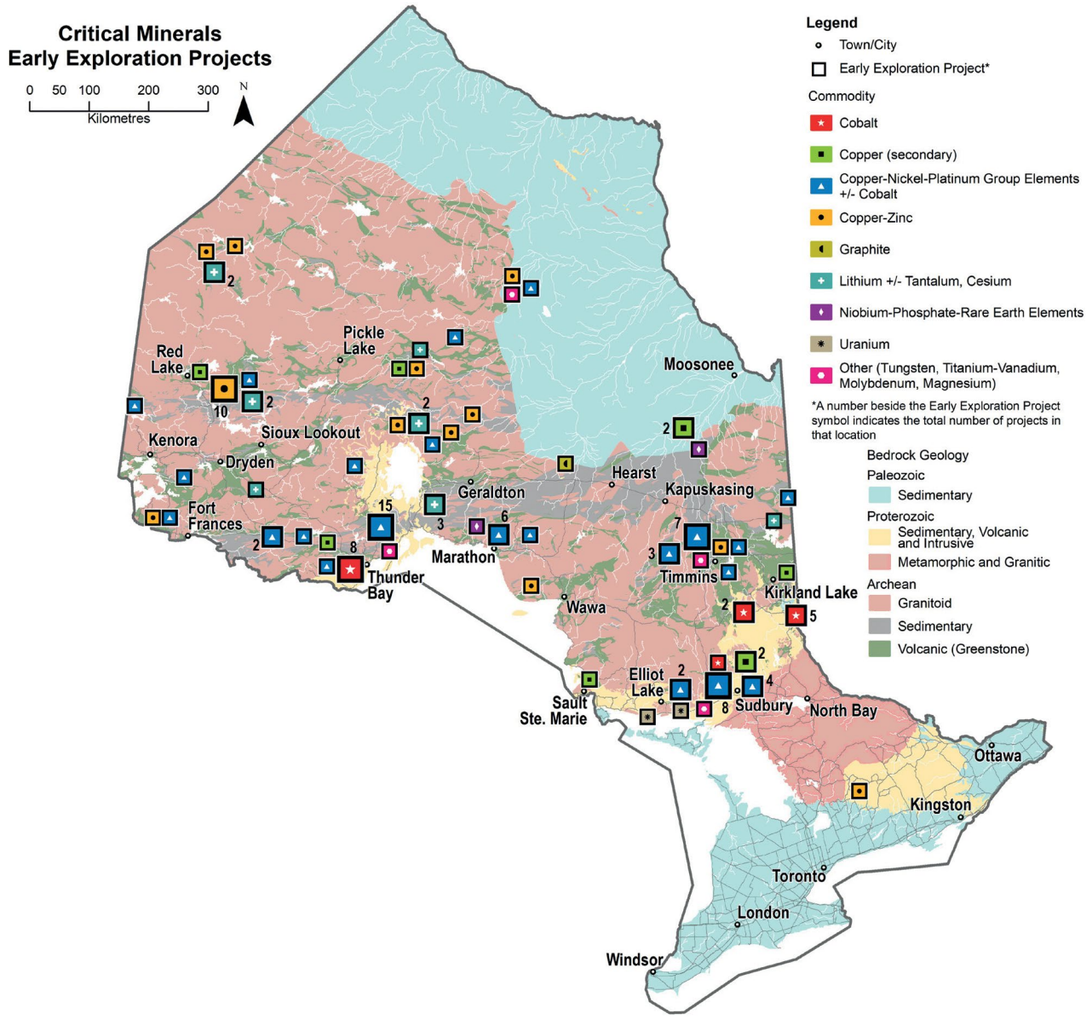
Have we reached a point of saturation of regulation as we move towards the fourth industrial revolution?

In recent years, securities regulators have shown a real desire to streamline rules and reduce regulatory burden, especially for juniors, which is a positive development. It is critical to regularly review regulations and their structures to ensure that the rules are right-sized while addressing risks. However, I think the biggest regulatory risk faced by juniors does not stem from securities laws. It takes too long to move a project from exploration to production; that process requires streamlining. We have to find more efficient and timely processes that still protect the environment and address the needs of affected communities and stakeholders. Not every project will satisfy all the criteria for moving to production, but efficiently identifying those that do and positioning them to advance is crucial.

Do you have any final messages to share with our readers in the mining sector?

For projects in Canada, it is fundamental that our First Nations are engaged as partners. Historically, this has not happened. Models have emerged that allow First Nations to share in the opportunity and wealth created by resource projects through ownership stakes, by leveraging projects to improve infrastructure and economic capacity, etc. That must continue, and hopefully more models will emerge. The greening of the economy is going to reach deeply through supply chains, and that will open opportunities for projects with lower environmental impacts and stronger community support. ■

Critical mineral early exploration projects currently underway in Ontario (as of March 2022)



Source: Ontario's Critical Minerals Strategy: 2022-2027

MINING PRODUCTION & DEVELOPMENT

"When you build a mine you do not really own it, you are renting a national asset – the natural resource endowment of a country. If you cannot create value out of it, then you shouldn't develop it, because that's theft. If you can create value, that value should be part of a pie that is shared with local communities and the people of the host country. As a public company, your responsibility to the silent S (in ESG) is enormous."

- Mark Bristow,
President and CEO,
Barrick Gold

Image courtesy of Wesdome Gold Mines

Production and Development in Ontario

AN OVERVIEW OF THE SECTOR

Canada produces about 60 minerals and metals in roughly 200 mines and 6,500 sand and gravel pits and stone quarries, accounting for nearly C$44 billion in mineral production. Ontario houses 40 of these mine sites in operation, and is the largest Canadian producer of gold, PGMs, nickel and the second largest copper producer. Québec had the largest mineral production value with C$11.6 billion in 2020, followed closely by Ontario at C$10.7 billion. Along with British Columbia, the trio of provinces made up 68% of the country's total mineral production.

The Canadian mining sector managed to stay nimble throughout the pandemic and rising commodity prices have helped the industry to thrive. Rising gold prices brought renewed enthusiasm to producers, with the precious metal peaking at US$2,076/oz in August 2020. Although gold has suffered compared to other commodities in 2021, a yearly average price around US$1,800/oz means the industry is generating record free cash flow.

Wesdome Gold Mines ranked 10th on the TSX30 Top Performance list for 2021, and is the only mining company to feature in all three editions of the annual list of the best performers on the exchange. Year to date production at the Eagle River complex in Ontario reached 76,773 oz by Q3 2021, and the company's production profile is set to grow after the successful restart of its Kiena mine in Québec. On October 14th, 2021, the company announced that the first 5,511 oz Au had been mined at Kiena, with the project set to ramp up in 2022. "Wesdome Gold Mines is on a growth path to becoming an all-Canadian mid-tier producer. The potential for resource and reserve expansion at Kiena is tremendous," said Duncan Middlemiss, president and CEO, Wesdome Gold Mines.

After over thirty years in continuous operation, Barrick's Hemlo has produced over 21 million oz Au. Located 350 km east of Thunder Bay, the project was severely impacted due to Covid-19 and the decision was made to close the pit. However, Barrick continues to drill to increase reserves and resources. "As we saw in Australia after the turn of the century, new waves of exploration can transform regions, but Canada has been lacking this. Canadian schools produce terrific engineers and geologists, but many of them leave, and Canada's domestic mining industry is left to be run by promoters. However, I have no doubt that Canada has the potential to still deliver significant discoveries," said Mark Bristow, president and CEO, Barrick Gold.

Newmont's Musselwhite also faced pandemic challenges, and the mine was put into care and maintenance until the health and safety of workers and communities could be guaranteed. Electric technology is being implemented at the company's Borden mine, with the aim to replicate the technology elsewhere. Newmont's Porcupine gold mines complex continues to be developed. Tom Palmer, president and CEO of Newmont said: "Hollinger is nearing the end of its mine life, but we are just starting to bring on another nearby open pit and have committed to installing infrastructure to de-water the site and then do a layback which will extend the life of Porcupine well beyond this decade."

> *Borden is a mine of the future where we are looking to use electric technology, not only for that mine, but to prove the technology up and replicate it elsewhere.*
>
> ***Tom Palmer, President and CEO, Newmont***

Alamos Gold achieved its best hole drilled at Island Gold in June 2021. Combined with the development of the Lynn Lake project, Alamos is aiming to ramp up its Canadian production base to around 600,000 oz/y Au by 2025— making Alamos one of the largest gold producers in the country. "It would mean that 80% of our production would be coming out of Canada, as opposed to internationally," said John McCluskey, president and CEO of Alamos Gold.

The company's Young-Davidson project, located 60 km west of Kirkland Lake, is one of Canada's largest underground mines and is projected to have strong free cash flow growth moving forward.

New Gold's gold-silver Rainy River mine in Ontario is transitioning from open-pit to underground and is focused on optimization, cash-flow and profit. "We have invested a lot of time and resources in the last few years with a focus on waste stripping to optimize the mine plan and provide better access to the ore. Between 2022 and 2026, we expect better access to open-pit ore until depletion," said Renaud Adams, president and CEO, New Gold Inc.

With rising demands in environmental and social performance, relentless global demand, yet decreasing resource quality, the Ontario mining sector is ramping up the development for transition metals. Indispensable for the shift towards electrification and renewables, copper has been the showstopper, with prices moving from an average of US$2.81/lb in 2020, to an average of US$4.24/lb in 2021. Ontario produced 123,630 mt of copper in 2020, but the vast majority of copper produced by Canadian companies is mined abroad. Canada's First Quantum attained the highest global increase in copper production, with a reported 10.4% growth. A similar outlook for transition metals such as lithium, cobalt, graphite and nickel is expected given rising demand.

Ontario has attracted the attention of foreign majors and mid-tiers looking to expand in North America. Melbourne-based BHP, the world's largest mining company by market capitalization, moved its nickel and copper HQ to Toronto in 2021. Another Australian mining producer, Evolution Mining, acquired Newmont Goldcorp's Red Lake gold complex in November 2019. Since then, the company has focused on consolidating the district with the C$342 million acquisition of Battle North in Q2 2021. Evolution Mining has added milling capacity for Red Lake and is planning to mill around 2 million mt to produce about 350,000 oz/y Au, revealed Jake Klein, executive chairman of Evolution Mining.

Vale's Creighton mine continues breaking records, not only by retaining first place as the deepest nickel mine in Canada, but also by having hosted the deepest underground concert at 7,200 feet below surface for International Music Day.

Looking to replenish nickel reserves in Sudbury, majors continue investing in Ontario. Vale's copper production reached 69,200 mt in Q3 21, which is 5.7% lower compared to Q2 21, predominantly due to challenges with about 2,450 miners going on strike in Sudbury last summer for several weeks. Vale continues to focus on the area, working with Glencore to develop the Nickel Rim South project to access ore at Vale's Victor mine. The Nickel Rim South mine is the largest operation in Sudbury, with nickel and copper as its main metals.

Following month-long discussions, Wyloo Metals came out the winning bidder against BHP in December 2021, for Noront at C$616.9 million. Wyloo will provide a C$29.4 million loan to cover the C$17.8 million termination fee Noront owes to BHP. The value of having enough resources to supply the increasing demand for battery metals and having a source of nickel in North America is being prioritized.

Ontario's only diamond project, the high-value-per-carat Victor mine, officially closed in 2019, taking the province off the precious stone map, further solidifying the Northwest Territories as the leading diamond production province in Canada. Coal production has continued to trend down in all provinces, with about half of the country's production being exported, predominantly to Asia.

The Canadian government aims to eliminate energy generated by coal by 2030, but will continue to allow for it to be used in metallurgical processes. Following a G7 agreement in May 2021, Ottawa has halted the mining of thermal coal by new projects because of the environmental impact. Ontario was recognized as the first major jurisdiction to enforce a coal phase-out strategy. ■

Tom Palmer

President and CEO,
NEWMONT

> Looking at the locations in which we operate, gold mining by reputable companies plays a huge role in creating wealth and improving the lives of local communities.

Can you provide an overview of Newmont's portfolio of mines in Ontario?
Newmont has a significant presence in Ontario, which includes the Musselwhite mine, the Porcupine gold mines complex, and the Borden mine. Our Musselwhite mine is a fly-in fly-out operation that has already produced over 4 million oz Au since it was commissioned, and produces in the region of 200,000 oz/y. It has had considerable investment in recent times, including a new conveying system and a crushing material handling system that allows us to move ore more efficiently at depth. As the pandemic was unfolding in 2020 we proactively put the mine into care and maintenance and did not bring it back into operation until we could ensure the health and safety of our workers and local communities.
Porcupine is located in and around the city of Timmins and is made up of a number of operations and processing plants, including the Hoyle Pond underground mine and Hollinger open pit mine. Hollinger is nearing the end of its mine life, but we are just starting to bring on another nearby open pit.
Our Borden mine, which opened in 2019, feeds ore to the processing facilities in Timmins at the Porcupine complex. Borden is a mine of the future where we are looking to use electric technology, not only for that mine, but to prove the technology up and replicate it elsewhere, much like we are doing with autonomous haulage at Boddington in Australia.

Can you elaborate on Newmont's decarbonization initiatives?
In 2020, Newmont led the gold industry to set targets for 2030 for the reduction of scope 1, 2 and 3 greenhouse gas emissions. We are committed to reducing our scope 1 and 2 emissions by more than 30%, and our scope 3 emissions by 30% by 2030, with the ultimate goal of being net zero by 2050. Newmont will have those targets signed off by the Science-Based Target Initiative (SBTI), and we are committing US$500 million over the next five years to support these targets.
In the decarbonization effort we are working on three main areas. First of all, continuous improvement; we have a program called Full Potential which has been in place for over eight years and delivered more than US$4 billion of value across our operations. It is predicated upon all 12 of Newmont's managed operations having a set of improvement projects, which include carbon reduction initiatives in their business plans. The second big area is renewable energy, where we can use wind and solar to replace other forms of electricity generation around our business. This will be the key step change for Newmont as the decade progresses. The third area is how to introduce and support new technologies such as bringing in hydrogen or battery electric to replace diesel.

Can you outline Newmont's vision for ESG?
We have been on an ESG journey for over 30 years and have learned a lot of hard lessons from different experiences around the world.
Newmont started reporting transparently 17 years ago, publishing a sustainability report with set targets that measured performance. We were also a founding member of ICMM, which has a strong focus on sustainability. From a governance standpoint, Newmont has had an executive accounting for sustainability for over 15 years, and a safety and sustainability committee to continuously improve our standards for over 15 years.
The key to ESG progress is not standing on your laurels and challenging the company to stretch itself to go further by making bold commitments. Newmont's purpose as a company is to create value and improve lives through responsible, sustainable mining. Looking at the locations in which we operate, gold mining by reputable companies plays a huge role in creating wealth and improving the lives of local communities. As the world's largest gold mining company, we look to set a standard that others can follow, and this is why the ESG piece is so important.
When it comes to decarbonization, as gold operations are developed, you will see more copper-gold mines coming online, such as Yanacocha or our projects in British Columbia. Newmont will always remain a gold miner, but copper and gold produced together will go hand in hand as a very important metal for decarbonization, along with a very important metal in terms of a store of wealth that improves lives. ■

Mark Bristow

President and CEO,
BARRICK GOLD

> Our pipeline, whether it's the work we are doing in the Veladero Pascua–Lama region, advancing Donlin Gold in Alaska, or the various frontiers that we have opened such as Egypt, Japan and Guyana, means the company's future is in good shape.

What did Barrick's Q3 2021 results show you about progress made since the Randgold merger?
After the Barrick/Randgold merger, Nevada Gold Mines (NGM) was established, we took Acacia private, and sold Sabodala to Teranga (before the Endeavour merger). From the initial discussions with John Thornton in 2015 we had a strategic plan based upon flattening the structure and focusing on the Randgold model whereby the operations own the orebodies, have a responsibility to unlock their value, and importantly, are able to respond quickly to changes.
Barrick's Q3 results show that we have been able to deliver on our strategy of focusing on the best assets, fixing the balance sheet and ensuring our social license to operate, even though the environment changed around us. If we have a challenging next seven years, like we had from 1992 to 1999, Barrick will still do well because we are fundamentally profitable. We run our business on US$1,200/oz Au and have a significant amount of net cash. This makes us independent of the market, and means the responsibility of creating value sits with management.
Another key aspect highlighted in Q3 was Barrick's focus on exploration. We replaced more than 70% of the gold we have mined in the last two years, and in 2021 we will replace all the gold we mined. Our pipeline, whether it's the work we are doing in the Veladero Pascua-Lama region, advancing Donlin Gold in Alaska, or the various frontiers that we have opened such as Egypt, Japan and Guyana, means the company's future is in good shape.

You have been outspoken about Barrick's intention to increase its portfolio in Canada. What type of asset are you looking for?
We look to consolidate significant land packages that we can put geological models to, and then commit to investing in exploration. I have no doubt that Canada has the potential to still deliver significant discoveries.
The criticism I have of the current breed of fund managers is that they keeping forcing the gold industry into short-term trading. They do not work with the industry to consolidate good assets under quality management. You have too many managers managing too few assets. Assets are rarely high quality when they get discovered or announced, and are forced into deals at inappropriate times, after the heart of the deposit has been mined out. As a result, mines get taken out at the top of the market because of necessity, at a higher price than they're worth. We were keen on a number of assets, but saw them become too expensive so their value eroded. Considering this context, we decided that if we cannot find mines to buy that fit our criteria, let's build mines ourselves.

What is the status of the transition to underground mining at Hemlo?
Hemlo has very high grades and is a mine that made money in spite of what people did with it. It was one of our assets that needed the most fixing, and one that was impacted the most be Covid. We decided to close the pit and bring in Australian contractors to retrain the workforce, but lockdowns in Canada and Australia have delayed this process. However, we have not stopped drilling to increase reserves and resources.

On the topic of ESG, what benefits have you seen when empowering local workforces?
I grew up in South Africa under apartheid, and know that you cannot put a value on the liberation of people. People speak about the "E" component until they are blue in the face, but I call the S in ESG "the silent S" because no one talks about it. When you build a mine you do not really own it, you are renting a national asset – the natural resource endowment of a country. If you cannot create value out of it, then you shouldn't develop it, because that's theft. If you can create value, that value should be part of a pie that is shared with local communities and the people of the host country. As a public company, your responsibility to the silent S is enormous. The mining industry used to arrive, put up a fence, employ foreign contractors, pay tax and one day disappear – no wonder the sector has a bad reputation. ■

Duncan Middlemiss

President and CEO,
WESDOME GOLD MINES

> Wesdome Gold Mines is on a growth path to becoming an all-Canadian mid-tier producer.

What were the factors that contributed to Wesdome Gold Mines featuring in all three editions of the annual TSX30 list, and why did you decide to start trading on the OTCQB?

A number of factors contributed to this success, one of which is the excellent jurisdictions we operate in: Ontario and Québec. Another contributing factor is our operational optimization period that allowed us to double production from our producing asset, Eagle River, and show a lot of upside through the exploration efforts there. Our work at the Kiena complex has also been a driver. Following the discovery of the high grade A Zone in 2016 in the Kiena mine, we worked on a PEA and a PFS in support of the restart which we are now embarking on. We should be in commercial production there by Q2 2022. The Kiena mine's production is forecasted at 100,000 oz/y Au, according to the PFS, compared to 50,000 oz/y Au five years ago.

We have a lot of US investors who wanted easier access to the market and to our shares, so trading on the OTCQB was our way to facilitate that. The company is predominantly self-funded with our last share issuance being in 2016. There is not dilution and our shareholders appreciate that.

How do you intend to further optimize Wesdome's Eagle River mine?

Production at Eagle River has increased steadily since 2016, through high-grade exploration results. There is a shear zone in the surrounding 20 km of the property, which is what we have been mining within the diorite. The Falcon 7 was discovered in 2019, highlighting the prospectivity of the volcanic rocks both to the east and west to host additional gold mineralization beyond the currently existing footprint of the Eagle River mine. Mining of the Falcon zone began towards the end of Q3 2021. This will help us advance production because it is in a diverse geographical area not associated with the bottom of the ramp. With enhanced infrastructure, such as ventilation and mobile equipment, and our great exploration results, we aim to match mine production to mill production. If we can mine to the mill, it will push up Eagle River's production to 125,000 oz/y Au.

What is your trajectory for commercial production at the Kiena Complex?

The first 5,500 oz were mined in October 2021, which is a big milestone. We are likely to declare commercial production in Q2 2022. Having this second operating asset is crucial to our de-risking strategy and is what we need to become a mid-tier producer. The grades and discovery potential at Kiena are phenomenal. Wesdome Gold Mines is on a growth path to becoming an all-Canadian mid-tier producer. We recently discovered the Footwall Zone, which was not in the PFS. The potential for resource and reserve expansion there is tremendous.

Can you elaborate on Wawa, Ontario, and the area's geological potential?

All the big discoveries in northwestern Québec and northeastern Ontario were made in the early 1990s. However, the biggest discovery and commercial success was that of Hemlo, discovered in 1980. What we find in Wawa is a billion-year-old greenstone belt, so we are witnessing a lot of activity in the area such as Alamos Gold's Island Gold mine in Dubreuilville, the Hemlo operation continuing for Barrick, ongoing exploration by Red Pine, as well as Argonaut Gold's Magino project. Our mine is about 40 km outside of Wawa.

To what extent have you experienced inflationary cost increases at Eagle River and Kiena?

There are always financial and macro-economic factors at play, such as monetary policy and bond yield changes. The devaluation of the dollar is also impacting inflationary pressures so gold has to evaluate to mimic the money supply. There is room for the gold price to increase overall, but its correlation to inflation has been relatively low. We first witnessed the cost increases with steel for ground support and mechanical parts, as well as hydrocarbons, which affect explosives. Currently, we are witnessing weight pressure. Inflation currently stands at 4.5 to 5% in Canada and we are working on increasing wages to ensure that employees are keeping up with it. ■

John McCluskey

President and CEO,
ALAMOS GOLD

> Since 2015, Alamos has spent close to C$2 billion on acquisitions in Canada, and on these projects we have spent between C$300 and C$400 million in capital to improve them, while creating thousands of jobs.

Could you provide an overview of Alamos Gold's international presence?
Alamos Gold is a diversified intermediate gold producer with a clear strategy and a very strong outlook. We have the Young-Davidson and Island Gold mines in Ontario, as well the Lynn Lake gold project in Manitoba. In Mexico, we own and operate the Mulatos mine in Sonora, and have the Esperanza gold project in Morelos at a permitting stage. We also hold the Kirazlı, Ağı Dağı and Çamyurt gold development projects in Turkey, as well as an option to acquire a 100% interest in the Quartz Mountain gold project in Oregon, USA.
Alamos Gold achieved the best hole drilled at Island Gold in June 2021. How is this project moving forward?
We are in a very intensive capital program, investing heavily to expand our Island Gold mine. From the time we purchased Island Gold until now, resources have tripled in size and the grades have gone up. The latest hole that we drilled not only was of an extraordinarily high grade at 71 g/t Au uncut, but it was also over a 21-meter true width. The average width of the vein that we mine is roughly 4 meters, so, this was five times the normal width. That is an extraordinary hole, and we have several others in proximity to it that have confirmed that we are drilling in an area where there is very high grade. We took the asset from a 7-year mine life to over 15 years with further upside to that, given the ongoing exploration success.

How will the Young-Davidson mine support the company's goals moving forward?
Young-Davidson is one of the country's largest underground mines and a long-life operation where we are also getting great exploration results to support mine life extension. Though it is still early days, we are getting a clear idea of where the mine is going — which is very strong with higher production, lower operating costs and a strong free cash flow growth going forward. The project is located in the Abitibi Greenstone Belt, about 60 km west of Kirkland Lake, and will serve as our foundation for growth for many years to come. In mining, exploration truly is our R&D. If you are not investing in R&D, you will be left behind because mines are finite businesses.

What is the outlook for your Mexican operations?
We have a fairly substantial expansion project of US$140 million underway at Mulatos where we are building the low-cost La Yaqui Grande project. We would like to be doing much more but there is a certain level of uncertainty that the current government has introduced into project development and our ability to predict how business will perform in Mexico moving forward.
Twenty years ago, there was a very strong push to attract foreign investment into the country. Mexico was not considered a favourable jurisdiction for mining capital, but we anticipated that the market would eventually change and it did. Alamos prospered very well in Mexico. If the country takes an adverse view to foreign capital to help develop its industry, it will be to the detriment of many of the people who need it most. So we see opportunities in Mexico, but until we get a clearer idea of where the Mexican government wants to go with this industry, we will implement a much slower development timeline.

What is Alamos Gold's production target for the next few years?
Since 2015, Alamos has spent close to C$2 billion on acquisitions in Canada, and on these projects we have spent between C$300 and C$400 million in capital to improve them, while creating thousands of jobs. Between the expansion at Island Gold and the development of our Lynn Lake project, which would add roughly another 170,000 oz/y Au to production, we ultimately to aim get our Canadian production base up to around 600,000 oz/y Au, and achieve that by 2025. This would make us one of the larger gold producers within Canada. It would also mean that 80% of our production would be coming out of Canada, as opposed to internationally. I believe maintaining a low risk profile on our production base would give investors a lot of confidence. ■

Jake Klein

Executive Chairman,
EVOLUTION MINING

What are the most recent updates of the Red Lake project?
The Red Lake operation, which we acquired in April 2020 for US$375 million, is located in northwestern Ontario. In May 2021, we closed the C$342 million Battle North acquisition, which consolidates our ground position and also provides us with the additional milling capacity to fulfill our strategy for Red Lake. We aim to restore the asset to a premier Canadian gold mine producing approximately 350,000 oz/y of low-cost gold. Historically, Red Lake has had access to bonanza grade ore from the famous "high grade zone" which was 30 to 50 g/t to produce up to 700,000 oz/y Au in some years. The future we are planning for Red Lake is a medium grade mine of around 7 g/t.

What are some of the highlights of the Mungari project?
We recently completed an acquisition at Mungari that has many similarities to the synergies of consolidating Red Lake with Battle North. We own a productive, efficient and modern mill but faced a lower grade future due to mine depletion. However, on the other side of the tenement boundary there are high-grade mines owned by Northern Star with no nearby mill. Therefore, we saw an opportunity for a transaction that made commercial and industrial sense for both parties.

What is your ESG strategy?
We have made the commitment to reduce our carbon footprint by 30% by 2030 and to have net zero emissions by 2050. We expect to reduce our footprint by accessing renewable power, since 70% of our emissions are through energy consumption. The remaining 30% of our emissions are largely due to diesel, for which the solution is to move to electric-powered or other low carbon mobile equipment and vehicles that can be charged with renewable power. ■

Renaud Adams

President and CEO,
NEW GOLD

Can you give us an update regarding the Rainy River mine?
In 2019, we took the time to reassess the operation's unique characteristics. The evaluation process produced a new NI 43-101 that was released in early 2020, which we have been executing. Currently, Rainy River is entering the next phase, which focuses on optimization, free cash flow and profitability. The mine is to transition from open pit to underground, and in 2022, we will start mining from the Intrepid underground ore zone. When the open-pit is depleted in 2026, the mine will transition to a full underground operation.

What is your strategy to decrease all-sustaining costs by over US$600/oz and increase gold production by over 35% over the next few years at Rainy River?
We have invested a lot of time and resources in the last few years with a focus on waste stripping to optimize the mine plan and provide better access to the ore. In addition, incorporating some underground mining set to commence in late-2022 will lead to an improved grade profile compared to an open-pit only mining scenario. Simultaneously, the need for stripping of the pit will no longer be needed, allowing capital to be allocated elsewhere. As we deplete the pit, we will also transition equipment. This will lower all-in sustaining costs, especially between 2024 and 2026. Looking beyond the current mine life, exploration remains key.

What do you foresee for the gold mining sector in Ontario?
The merger of Kirkland Lake and Agnico Eagle is a great step in creating a Canadian focused mining company. The industry must be open-minded to attract the technical skills needed and must undergo a process of consolidation to continue to perform. As we look to the future, the advancements with First Nations and equal opportunities are crucial to the success to both the industry and our company. ■

A new wave of Ontario gold mines

PRECIOUS METALS DEVELOPMENT PROJECTS

Côté Gold project. Image courtesy of IAMGOLD.

Ontario is set to increase its gold output in the years to come on the back of three major projects, each of which promises to be a game-changer for the operating companies. The most significant project in Ontario's development pipeline is IAMGOLD's Côté Gold located between Sudbury and Timmins, which commenced construction in 2020 and is expected to move into production in 2023. The mine will produce nearly 500,000 oz/y for the first five or six years at an AISC of US$600/oz, with the average production guideline across the full 18-year LOM closer to 300,000 oz/y.

Argonaut Gold has built its production profile through mines in Mexico and Nevada, however, the company's Magino development project is the real jewel in Argonaut's crown, which is currently under construction and due to move into production in 2023. Located close to Alamos Gold's Island Gold mine, both projects share a deep vein system with mineralization becoming richer at depth, offering Argonaut a tantalizing opportunity to increase resources through exploration and mine development following the Alamos Gold model which has proved so successful. "A year ago, there were less than 50 people in Magino, yet today there are over 500 people on site," revealed Dan Symons, Argonaut's vice president - corporate development and investor relations, adding: "In Magino, we released some of the best drill holes ever drilled on a property earlier this year."

Set about 275 km northeast of Thunder Bay, a new mine is being developed by Equinox Gold and Orion Mine Finance Group in a 60/40 partnership. The Greenstone mine has a capex forecast at US$1.23 billion. On October 27th, 2021, Equinox announced groundbreaking for full-scale construction at the project, which is expected to produce more than 5 million oz Au, with 400,000 oz/y for the first five years, and a mine life of 14 years. "Construction is underway now and Greenstone will be the third or fourth largest mine in Canada when it is operating," said Christian Milau, CEO, Equinox.

Commercial production at Greenstone is due to start in 2024. The project area includes the former Hardrock, MacLeod-Cockshutt and Mosher underground mines, which were active from the 1930s until the 1970s, and produced over 2 million oz Au. Greg Rickford, Ontario's Minister of Northern Development, Mines, Natural Resources, Forestry and Indigenous Affairs, stated: "Greenstone mine will be an economic driver for Northwestern Ontario and the latest in a series of recent success stories in Ontario's mining sector— successes that our government is proud to support. This project will bring well paying jobs and prosperity to northern and Indigenous communities."

Companies focused on gold production have varying strategies for their financials, with most trying to be conservative. "We have fully hedged our total expected fuel exposure for the Côté construction period and have been buying certain commodities in bulk ahead of time; placing our orders on things like steel and copper cable to mitigate our exposure to additional inflation down the road," said Daniella Dimitrov, President, CFO and Interim CEO, IAMGOLD.

With central banks buying gold bullion and inflation playing an important part in a savers strategy given the global turmoil, gold is sought after for stability. "An ounce of gold can buy you a good suit a thousand years ago and today, which is a continuity that no currency could ever claim," said Kevin Bullock, president and CEO, Anaconda Mining.

The need to replace gold reserves drove M&A in 2021. Certainly, the precious metal underperformed following 2020's record highs, but this was not surprising given the rise in interest rates and the introduction of Covid-19 vaccines, which paved the way for potential business normalcy and an economic upturn. The return of riskier attitudes within the market was felt, with crypto, cannabis and new technologies being strong drivers. Nonetheless, the pandemic outlook is still uncertain and gold will continue to provide a security base for investors. Ontario is positioning itself to continue playing a key role in gold production for the longer term. ■

New generations are not as excited about gold as it cannot make 200% returns in a month like bitcoin. However, gold holds its value in the long-term. If gold increases too rapidly, it creates fear factors and inflationary trends, so I prefer a gradual increase.

– Christian Milau, CEO, Equinox Gold

Majors are looking for projects that can produce between 2 million to 4 million ounces of gold, and if your project is fitting to that profile, there will be some buying interest. Our aim is to build the mine, place a mill on site, go into production, and then look at any buying interest from majors to give as much value to shareholders as possible."

– David Russell, President and CEO, Galleon Gold Corp

Dan Symons

Vice President, Corporate Development & Investor Relations,
ARGONAUT GOLD

> Our success over the next two years will be fueled by our exploration sizzle and development story from our projects.

Why is it a good time for investors to invest in Argonaut Gold?
Argonaut Gold presents a unique one-stop-shop intermediate producer investment opportunity type. This is because we offer everything from cash flow from existing operations, the excitement in high-grade exploration discoveries to the development story, as we bring a project online with Magino. In Magino, we released some of the best drill holes ever drilled earlier this year, and in September we released additional information from drilling at La Colorado which indicated grades between 40 - 90 g/t over a 4 - 5 metres width and in some cases up to 20 metres wide, which are spectacular results. In 2021, we set a target of generating C$100 million in cash flow from our existing operations, which we surpassed after the first nine months of the year. A year ago, there were less than 50 people in Magino, yet today there are over 500 people on site. So with the exploration sizzle at Magino and La Colorada, the growth through the development of Magino and the cash flow from the existing operations, it really makes Argonaut Gold a one-stop-shop for investors looking to play various aspects on the mining cycle.

What is the timeline for the development of Magino, and once in production, how will the mine change the production profile of Argonaut Gold?
We expect to be pouring gold at Magino during the first half of 2023. Magino is expected to add 150,000 oz/y once fully ramped up. Now, we will lose about 40,000 oz/y as our El Castillo mine, which has been operating since 2007, ramps down. We also believe there is an opportunity to expand early in the mine life using Magino cash flows, which could double Magino's profile to 300,000 oz/y.

Can you elaborate on your ESG strategy and initiatives?
The key to a successful ESG strategy is to remain engaged with investors, local communities and the government. Argonaut Gold managed to strike a perfect balance in this regard and reduce its operational carbon footprint across the company. We are proud to have been recognized by the government for the 10th year in Mexico as an environmentally socially responsible company. In leaching operations, we are minimizing our use of plastic in drip lines and chemicals. We are also reducing our water consumption by placing the lines closer to the ground, which also reduces energy consumption. In Magino we are using more energy efficient equipment. We invest in social programs in Mexico for smaller surrounding communities to elevate their living standards. We also offer a scholarship program to incentivize all age groups to pursue a formal education.

How would you describe the current operational environment from a political standpoint in Mexico?
It has been a bit challenging in the mining industry, the fourth biggest industry in the country, with the current administration. Any type of permitting or action where we are looking to get concessions has predominantly been paused over the last two years. Much of this could be simply due to the Covid environment and it is picking up slowly now. There are also areas in Mexico that present some security challenges. Fortunately for us, we operate in areas where we have managed those security risks well.

What are your plans and focus for the upcoming year?
For us it is centred on transformation: changing operations from short mine life, high cost to longer mine life and lower costs. This strategy will allow us to reduce the company's risk profile. Our success over the next two years will be fueled by our exploration sizzle and development story from our projects. We believe if we execute on this business plan, we will successfully transition the company from a higher-cost, junior gold producer to a lower-cost, intermediate gold producer that is operating assets with long mine lives.

Can you provide updates regarding the Florida Canyon project?
Our goal was to enhance operational performance and efficiency. In our first year, production increased by around 25% and cash costs decreased by 16%. ■

Daniella Dimitrov

President, CFO and Interim CEO,
IAMGOLD

How is the Côté Gold project construction evolving?
We are very excited about Côté. It is a tier one, multi-generational asset located approximately halfway between Timmins and Sudbury and sits 6 km off the highway, giving us excellent access to skilled labor, hydropower and transportation routes. Côté is a 70%-30% joint venture between IAMGOLD and Sumitomo Metal Mining, and currently has an 18 year mine life on a reserve base of over 7 million oz Au on 100% basis. The project is expected to produce close to 500,000 oz/y for the first five years, with life of mine average of 367,000 oz/y at all-in sustaining costs of US$802/oz. We started construction in September 2020 and overall project completion was just over 43% at the end of Q4 2021. It is very exciting to see the rate of change and progress at the project.
Côté is a mine for the future as it will be the first fully autonomous haulage open pit project in Ontario, offering better efficiencies and reduced environmental impacts over the life of the mine. This project will be transformational for IAMGOLD as well as for our communities as the project is expected to generate over C$5 billion in wages for Northern Ontario. We remain on-schedule for commercial production in H2 2023.

How is the Gosselin deposit progressing?
Gosselin was an IAMGOLD discovery and sits right beside the Côté Gold deposit. In addition to what we already have at Côté itselfGosselin offers an additional 3.4 million oz of indicated and other 1.7 million oz of inferred resources. We have a lot more work to bring Gosselin into a conceptual mine plan. Côté and Gosselin are located in a large land package of over 540 square kilometers. This is a massive gold bearing system and we are confident in potential for additional discoveries in the region. ■

Christian Milau

CEO,
EQUINOX GOLD

Can you tell us about the Greenstone project?
We acquired Greenstone in 2021 through our acquisition of Premier Gold. More than 4 million oz Au had been produced in the region between 1940 and 1970 from a number of underground mines, but Premier was the first to look at developing an open-pit mine. They had done a lot of exploration and engineering work and published a study that showed a 5.5-million-oz deposit with the potential of producing 400,000 oz/y for 14 years. That certainly caught our interest. Greenstone is located in Ontario, which is one of the world's best mining jurisdictions. There's lots of skilled labor and the project is right on the Trans-Canada Highway. Greenstone will be the third or fourth largest mine in Canada when it is operating.

How has inflation impacted your plans for the project?
We adjusted our original capital estimate for Greenstone from US$1 billion to US$1.2 billion to account for these changes. We also included a contingency of 14% to account for external pressures. Fortunately, we witnessed heightened inflation before we started construction so we were able to anticipate and factor those costs into our construction budget.

How would you rate the jurisdictions you operate in terms of ease of doing business?
We started operating in Brazil five years ago when the government was undergoing transition and our experience has been very positive. Regulations have been streamlined. Eastern California has a long history of mining and we are the primary employer in the region, so local communities are generally excited about the prospect of more jobs. As the Biden administration increases taxes our margins in California will decrease a bit, but it's still a great jurisdiction for mining.
We knew when we acquired the Mexico mines that it was a challenging jurisdiction and that is one of the reasons we chose to acquire the Greenstone project in Ontario. ■

MINING FINANCE & INVESTMENT

"In the last bull market, M&A was a predominant theme, but many mistakes were made which came to the forefront as prices came down and capital costs escalated significantly. However, as we transition towards a greener future, M&A will become more of a necessity to develop projects."

Adam Schatzker,
Managing Director - Mining Research,
Research Capital Corporation

Image by eskystudio

Mining Finance and Investment

THE MONEY THAT ORCHESTRATES GLOBAL MINING

Many consider that we are currently experiencing the largest economic transition of our times. Largely triggered by the Covid pandemic, international governments have been printing money at historically unconventional speeds. "The debasement of currencies is unprecedented. Everyone should expect their wallets to buy much less over the next few years," said Rob McEwen, chairman and chief owner of McEwen Mining.

According to Nasdaq's financial advisor, Ron Surz: "As of March 2021, COVID costs totaled US$5.2 trillion. World War II cost US$4.7 trillion (in today's dollars). All-in money printing totaled US$13 trillion: US$5.2 trillion for COVID, plus US$4.5 trillion for quantitative easing, and US$3 trillion for infrastructure."

The current climate for investment in all metals, from base metals for infrastructure, such as copper and iron, through to battery metals like lithium, cobalt and nickel, and even a resurgence in the precious metals space in 2022, mean that the mining finance world has become a hive of activity.

The relevance of the mining sector seems to only recently be understood by the general population. With an urgent need for clean energy and electrification, the ability to mitigate global warming relies on the mining industry's capacity to provide the materials required for the transition. The TSX has seen a rebound within the mining space with the return of generalist investors. With 14 mining companies on 2021's TSX30 ranking, a renewed interest in the sector seems to be taking place. There are currently record levels of mining companies looking to graduate from the TSX to the TSX-V, with the time spent on the latter declining. Companies graduating from the TSXV to TSX made up 56% of new TSX mining listings up until August 2021, a 13% increase from 2020.

More than ever before, investors are looking at ESG reporting as a pivotal element in their decision-making process. "We are continuing to make it easier for global investors to participate in our market, with complete transparency and confidence they are accessing the best companies in the global mining sector," said Dean McPherson, head of business development – global mining, Toronto Stock Exchange and TSX Venture Exchange.

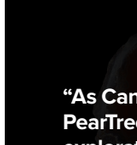
Shifting to the big board is often seen as a major accomplishment, adding to a companies' reputation and making it eligible for index inclusion, which has a tendency to add to demand. "However it is not a panacea or guarantee of liquidity or premium valuations," said Braden Fletcher, president and head of investment banking at Roth Canada, who explained that company fundamentals remain the most important focus for investors: "Selecting a listing venue should be about accessing the deepest pool of capital possible – which is why we see so many Canadian listed companies pursuing a dual list in the US," he added.

Triple Flag Precious Metals joined the TSX in May 2021, raising over US$250 million in its IPO. Having realized that traditional financing opportunities are often limited for the mining sector, Triple Flag has focused on supplementing traditional financing methods: "We believed that there was real opportunity for additional stream and royalty financing to service the funding needs of mining companies," said Shaun Usmar, founder and CEO of Triple Flag Precious Metals Corp.

Streaming agreements emerged around 2004 and involve an up-front payment to an operator in exchange for having a percentage of fixed-price metal purchasing rights in the future. This benefits operators by retaining equity, and investors by securing access. "Streaming is becoming widely accepted as it is extremely patient to the mine building process and can be complementary to other forms of financing," added Usmar.

When it comes to the relative dearth of mining M&A activity over the last couple of years, despite high metals prices, Adam Schatzker, managing director, mining research at Research Capital, reflected: "In the last bull market, M&A was a predominant theme, but many mistakes were made which came to the forefront as prices came down and capital costs escalated significantly.

> *Star Royalties is trying to provide a new form of competitively-priced financing, mainly focused on the smaller end of the sector that has been capital-starved for many years. As equity valuations are currently depressed, there is no shortage of smart capital deployment opportunities, with many developers and producers looking at royalties and streaming opportunities as they do not want to dilute at these levels.*
>
> **– Alex Pernin, CEO, Star Royalties**



TSX30 2021™ MINING

$30.3B
Total Market Capitalization

429%
Average 3-year Market Cap Growth

322%
Average Share Price Performance

RANK	COMPANY NAME	TICKER	3-YEAR (%)
1	Aura Minerals Inc.	ORA	1125%
3	Trisura Group Ltd.	TSU	523%
5	Capstone Mining Corp.	CS	433%
6	Champion Iron Limited	CIA	365%
8	Orla Mining Ltd.	OLA	313%
9	SilverCrest Metals Inc.	SIL	286%
10	Wesdome Gold Mines Ltd.	WDO	283%
11	Marathon Gold Corporation	MOZ	258%
12	Aya Gold & Silver Inc.	AYA	253%
13	Victoria Gold Corp.	VGCX	251%
15	Ivanhoe Mines Ltd.	IVN	231%
21	Copper Mountain Mining Corp.	CMMC	194%
22	NioCorp Developments Ltd.	NB	188%
29	Ero Copper Corp.	ERO	165%
30	Lithium Americas Corp.	LAC	162%

Key trends to watch in the mining sector for 2022: Insights from Toronto Stock Exchange

Expert Opinion Article by **Dean Mcpherson**,
Head of Global Mining, **TORONTO STOCK EXCHANGE & TSX VENTURE EXCHANGE**

There are any number of trends that jump to mind. This year I have picked out four: The COVID-19 recovery; the looming prospect of inflation; climate change; and the buoyant market for new listings.

The long recovery from COVID-19

There are few industries that have escaped the direct impact and lingering aftershocks of COVID-19. The mining industry is no exception; from the doom and gloom of mine closures as the pandemic unfolded, to the robust response from miners globally and the rapid recovery in metals prices. The effects of the pandemic will remain for years to come, and in many instances, those effects will be positive.

Take the issue of the health and safety of employees and local communities. This was made a priority very early on in the crisis. Supporting livelihoods and helping to build long-term community resilience to any future crises were two issues brought to the fore as miners, governments and communities collaborated in recovery efforts.

The theme of resilience will take centre stage in another area whose frailties were exposed by the COVID-19 pandemic – that of global supply chains. Mining companies are well acquainted with the challenges associated with supply chains serving often remote mine sites. But those challenges were hugely exacerbated. Operations that were previously optimised for cost and based on just-in-time supply chains simply lacked the resilience to cope with the disruption caused by the pandemic. This will remain a key area of focus for miners in coming years.

Inflation looming large

In mid-November, gold reached a five-month high on the back of US Labor Department data which showed consumer prices surge with October seeing a 6.2% jump from last year, the most since December 1990. Inflation – should it persist – will once again be a boon for the gold sector. Aside from its use in jewellery and electronics, gold's key value is its inflationary protection.

An emerging asset class is increasingly talked of as an alternative inflationary hedge: Cryptocurrencies. However, it is not obvious that cryptocurrencies should lead to the phasing out of gold. Given the volatility seen in cryptocurrencies and global efforts to effectively regulate that asset class, there are plenty of headwinds that may well see gold remain the inflationary hedge of choice well into the future.

Climate change and the increasing demand for critical minerals

As climate change continues to drive the agenda, the focus has further sharpened on the mining of green and critical metals that are seen as a crucial part of meeting global warming targets. The decarbonisation of the transportation sector, amongst others, is a crucial pillar of carbon reduction, contributing as it does around 20% of global emissions.

According to the International Energy Agency (IEA), in 2020 alone, the global stock of electric cars increased by over 40% to 10 million units.

Wood Mackenzie estimates that even a 2° C global warming pathway will require EVs to account for fully three quarters of all car sales by the end of the next decade. That level of EV supply would place huge demand on the supply of battery metals and indeed other metals that will be needed to produce so many vehicles.

Continued strong demand for new listings

The start of this year saw something of a capital markets renaissance as an increasing number of companies were met with strong investor appetite for their initial public offerings and follow-on equity placements. At TSX, we saw an increase in the number of new listings, number of companies raising capital and the amount of capital raised; helped in no small part by the strong rebound in commodity prices following initial pandemic related declines. And, encouragingly, we saw significant demand and interest in the junior market as well. In fact, on multiple occasions this year, volume on the TSXV exceeded or matched volume on TSX.

In 2022, we will undoubtedly find it hard to escape the long shadow of COVID-19 and its growing number of variants. It seems inevitable that the pandemic and risks such as inflation will continue to give rise to volatility in all markets and across all asset classes. I would expect resiliency to remain top of the agenda for the coming year, particularly amongst the mining community. I am also encouraged by the increasing importance being placed on climate change and the consequent focus on green technologies including electric vehicles. More capital will flow to explorers and producers of input materials required to satisfy rapidly growing demand and, with TSX being the market of choice for many green and critical mineral miners, it is hugely exciting to be at the nexus of this global shift. ■

Mining Finance and Investment

"The market is retail-investor focused and favours companies that release great drill hole results but not necessarily those drilling the correct orebody. There are many great drill holes in deposits that are not economically viable. To access capital, companies must understand their geology, metallurgy and value proposition, and communicate it to investors. We help companies put together their investment proposal for a mine, and help them access capital. Dundee Corp. also invests in these companies themselves – so we are not in it for the fee, but for the investment."

- Jonathan Goodman, President and CEO, Dundee Corporation

"SIFMA's 2020 year end review or their 2021 fact-book say that US capital markets are roughly US$44 trillion, whereas Canada's are US$2.5 trillion. Roth Capital is the leading underwriter of companies under a billion dollars US market capitalization, they have spent almost 35 years cultivating unique Buy-Side relationships and developing a team that focuses on these growth equity names. Today, the firm has over 150 professionals across the US, including roughly 25 research analysts covering over 300 companies, an institutional sales force in Newport Beach and New York, and sector specific investment banking depth across all sectors. Last year, Roth Capital did over US$15 billion in financing activity across 148 transactions, with 2021 already beating those numbers. When we work with Canadian companies, we leverage this platform to help provide access to new prospective investors."

- Braden Fletcher, President and Head of Investment Banking, Roth Canada, ULC

"The main issue for the sector is the high cost of capital. When compared to companies like Tesla, the major miners have a cost of capital that is much, much too high. Part of the reason for this is the sector's legacy of volatility and inconsistent capital allocation decisions. Nonetheless, the sector's cost of capital needs to decrease significantly. The market is generally undervaluing mining assets. Individual mining companies must increase in size to utilize economies of scale and produce low-cost metals efficiently. There has to be a reallocation of capital to the extractive end of the supply chain."

- Egizio Bianchini, Vice Chairman, Head of Metals & Mining Investment Banking, Stifel GMP

"It is difficult to find a time when all the metals were performing well. Such is the case now, so it is an exciting time for the mining industry and it is not a surprise some are calling it another super-cycle. The number of financings in 2021 may even exceed the peak year in the super-cycle in 2012. We are now strategically redirecting a significant portion of our efforts to Future Metals. The proposed " New Green Deal" legislation in the US will require a tremendous amount of metals, and we are seeing that traditional base metals such as nickel and copper are now transformational metals."

- Keith Spence, CEO & Partner, Global Mining Capital Corp.

However, as we transition towards a greener future, M&A will become more of a necessity to develop projects."

Focused on large returns with smaller sized companies, Research Capital Corp. takes interest in projects in low-risk jurisdictions with a strong ESG focus. Adam Schatzker elaborated on the firm's relationship with Canada Nickel: "The geology of their project and Ontario's very low carbon footprint for its electricity generation makes it theoretically possible for Canada Nickel to produce nickel with basically no environmental footprint," he said.

TSX-V and OTCQX listed precious metals royalty and streaming company Star Royalties has an 85% gold-focused portfolio. Star generated the first carbon-negative gold royalty platform with Green Star Royalties, which will position the company to be carbon negative by 2023. "It will promote our first-mover advantage and better position us for improved equity and debt cost of capital to fund our precious metals deals," said Alex Pernin, CEO of Star Royalties.

Earlier this year, Star Royalties announced a new royalty acquired on carbon offset credits with Elizabeth Metis Settlement (EMS Forest Project) in Alberta. "The project is a pure-green, ESG-focused investment where we are literary investing in allowing a forest to grow to generate carbon credits. The business model is massively scalable and there is no shortage of opportunities," said Pernin.

In the past twenty years, Roth Capital's sustainability team has completed nearly US$30 billion in transactions. "This has not been a recent opportunistic shift, this is a team of long-believers in solar, water and electric vehicles," said Roth Canada's Fletcher.

A palpable interest in developing provincial competences to not only produce but process transition metals within North America, without having to rely on China, is present across the value chain. Though far behind the Asian powerhouse, small seeds are being planted in order to develop this industry vertical in future - such as the green-lit Electra Battery Materials Park hosting nickel sulphate and cobalt production plants with a lithium-ion recycling facility that can serve North American and global clients. In parallel, Chinese companies continue expanding their investment footprint across the globe, and Ontario is no exception.

With a US$19 billion market cap, Chinese mining financier Sinomine Rare Metals Resources has taken a US$3 million equity stake in TSX-V listed Power Metals Corp, exploring in northeastern Ontario. An off-take agreement has also been negotiated for all the cesium, tantalum and lithium produced on the Case Lake project.

A stronger focus on engaging with indigenous communities is also part of the ESG shift. "Models have emerged that allow First Nations to share in the opportunity and wealth created by resource projects through ownership stakes and by leveraging projects to improve infrastructure and economic capacity" said Denis Frawley, partner at Toronto-based law firm, Ormston List Frawley LLP.

A C$40 million investment from the federal government to create the Mining Innovation Commercialization Accelerator (MICA) in July 2021 is also a reflection of the importance placed on innovation and collaboration across sectors. The pan-Canadian initiative has become a platform where stakeholders from diverse backgrounds are collaborating to speed up and commercialize mining processes to optimize productivity. With sustainability set as a key driver for the network, the mining sector is bound to uncover new ground in the months and years to come, at a speed hardly ever witnessed in the past. ■

Toronto financial district on a cold winter day. Image by InkDropCreative.

Canada, the US and Australia are looking closely at identifying critical minerals in their countries to attempt to decrease their reliance on China, and invest in promoting exploration.

– Keith Spence, CEO & Partner, Global Mining Capital Corp.

Shaun Usmar

Founder and CEO,
TRIPLE FLAG PRECIOUS METALS CORP.

> **Streaming is becoming widely accepted as it is a patient and forgiving form of financing for mine developers and complements traditional financing when structured well.**

How has Triple Flag evolved over the past few years?
Triple Flag has delivered tremendous growth. In 2020, we had five projects come online that are ramping up, and we expect to have annual growth in gold equivalent ounces ("GEOs") of 30% in 2021, building on a sector-leading 24% CAGR from 2017 to 2020. When we last met, Triple Flag had completed a small Mongolian deal with Steppe Gold on the ATO mine, which hit commercial production in 2020. Since then, the company completed a transaction with RBPlat in South Africa, where we streamed gold on their PGM mines, added the best and largest precious metal stream we have seen in five years, which was the US$550 million gold and silver stream on the Northparkes copper mine in Australia, and did the largest mining IPO on the TSX since 2012 in May 2021.

How has the stigma that private money cannot compete with large publicly-listed royalty companies evolved?
We've proven the opposite. We believed that there was real opportunity for additional stream and royalty financing to service the funding needs of mining companies, particularly where larger cheques and technical and commercial know-how represent significant barriers to entry. Our demonstrated growth has proven our beliefs to be true, and we see that continuing. The bulk of our efforts are focused on idea generation - putting proposals in front of mining companies and educating them on the benefits it can provide - versus just participating in auctions. We aim to supplement or replace conventional financing while offering miners solutions that meet their specific needs. Streaming is becoming widely accepted as it is a patient and forgiving form of financing for mine developers and complements traditional financing when structured well.

How central is ESG to Triple Flag's investments?
ESG is an increasing focal point for investors in the sector. Triple Flag has considered our role as a capital provider from first principles - how to live our values and make a positive impact in this ecosystem. It starts by recognizing that we are a financier and not an operator. Our point of greatest impact is at the time of investment when we choose who we partner with. We avoid deals where we are concerned about ESG practices and orientations. We like to invest alongside our partners to enhance their privilege to operate with their host communities and governments, and have funded scholarship programs with various partners, including Royal Bafokeng Platinum and Northparkes. We are also working with our partners towards reducing carbon emissions, and report the scope 1, 2 and 3 carbon emissions associated with our portfolio that account not only for the emissions from our corporate activities, but also attributable emissions from our investment into mining companies. We then acquire accredited offsets to ensure the ongoing carbon neutrality of our business.

Can you elaborate on how you see M&A activity unfolding in the new mining cycle?
The evidence at the moment is that management teams are perhaps demonstrating too much fidelity to the lessons learnt from the last cycle. We are seeing more discipline in capital allocation, companies are returning capital via share buybacks, growing dividends are being paid, and balance sheets are in good shape. On the other hand, this focus has resulted in a relative scarcity of capital being made available to sustain the industry longer term via exploration, reserve replacement, and new project delivery. The sector is also too fragmented, with individual companies lacking the scale to be relevant in the minds of many investors and OEMs, which I think creates the conditions for more thoughtful M&A. This is especially relevant with regards to the energy transition, where I believe EV and battery OEMs are underestimating the full extent of the vertical supply chain they will need to satisfy potential consumer demand for EVs. In a relatively fragmented sector, consolidation would help satisfy the near-term demand while investment into exploration and development of new mines catches up. Stream and royalty financing can help fund M&A activity in a symbiotic manner. I'm excited about the promise of this next cycle. ■

Lisa Davis

CEO,
PEARTREE SECURITIES

> **Once people realize the amount they can get in tax savings, they tend to increase their donations, which also results in more exploration capital for the resource sector.**

How has PearTree navigated the last couple years and how has investment in flow-through capital been affected?
PearTree started operations almost 15 years ago and has raised over US$2 billion for resource exploration and development. We have become the single largest source of flow-through capital in Canada. Like most businesses, everyone was paralyzed for a month or two at the time of the first COVID-19 shutdown, but by the end of May 2020 there were more opportunities for financing. This was partly due to the price of gold going up very quickly, resulting in a lot of the exploration in Canada. PearTree has become busier than ever, having hired six new people to meet demand.

How does the process work for issuers and how do investors benefit from acquiring flow-through shares?
From the perspective of an issuer of flow-through shares, they are simply issuing those shares to our clients, the same way they would in any other flow-through offering. Behind the scenes, we then arrange for those clients to donate the shares to their charities, and then the charities sell those shares on to an institution or strategic investor that would otherwise not have been able to participate in the flow-through offering, such as non-Canadian or institutional investors. When somebody is buying shares for donation purposes, they are not looking for a return in the conventional sense, but as philanthropists, they are looking to give a certain amount to a charitable cause. From the perspective of a Canadian resident flow-through share subscriber, they can reduce the after-tax cost of a cash donation to charity from about C$0.50 cents on the dollar to something in the range of C$0.10 cents after tax. Donors access two Canadian tax incentives with one cheque; they are getting both a donation tax credit and the tax benefits of a flow-through share subscription. The subscribers are not making an investment return, but they are able to give more for less. Once people realize the amount they can get in tax savings, they tend to increase their donations which also results in more exploration capital for the resource sector.

You have mentioned before that 70% of capital raised for exploration in Canadian markets involves flow-through shares. Do you foresee any changes in future trends?
Ten years ago, most of the buyers which have come to be known as "traditional flow-through funds"—were funds set up as limited partnerships which raised money to buy flow-through shares through the distribution of limited partnership units to a largely retail investor base. Over the past eight or ten years, the economics of structuring transactions through the PearTree platform has improved deal economics for the issuer and global investors who are buying newly issued shares through this process. The result is a new investor paradigm. That said, a big part of our business is driven off of strategic buy side investors acquiring 10% to 20% in exploration issuers, both public and private. As far as future trends, we are seeing our platform adopted in ever bigger financings well above the typical flow-through financings we have historically seen. Four transactions this year were all over C$50 million with one – OSK – at C$70 million. I think we are likely to continue to see the trend accelerating value creation in the junior market.

What goals would you like to achieve with PearTree in the next few years?
The future of PearTree can be summed up in two words: growth and innovation. We have built a strong base of relationships with mineral exploration companies, donors, charities, and institutional and strategic buyers that will allow us to continue to grow even if the size of the overall market contracts. For the first time in recent years, there has been a lot of M&A activity providing new applications for our platform. For example, this year we structured and financed an offering with subscription receipts as well as off of a shelf prospectus. We also continue to look at other solutions that are creative financing tools for the mining sector that can allow us to meet the philanthropic objectives of our donor clients without necessarily relying solely on flow-through shares. ■

Michael White

President and CEO,
IBK CAPITAL

> We are most excited about the carbon offset market and its ability to help preserve our biosphere.

How has the transition towards renewables and technology altered IBK's investments since 2018?
The big push for ESG takes the lead over the last five years as pressure and influence from stakeholders continues to mount. It gave rise to changes like immutability and transparency in supply chains with blockchain. It has us headed towards net-zero carbon emissions for all production activities. For example, Carbon Streaming Corporation offers investors exposure to carbon credits through a portfolio of streams associated with jungles and rainforests in southeast Asia and central Africa. The company trades publicly in Canada and has a US$250 million market cap. Another entrant into the Carbon offset market is Aurcrest Gold and its 100% owned subsidiary, Big Tree Carbon Corp. Aurcrest and Big Tree have First Nations leadership and ownership and are planning to create carbon credits through the preservation of Canada's boreal forests. These companies plan to generate revenue from the sale of carbon credits produced through the preservation of forests worldwide. The revenue for this activity globally could exceed hundreds of billions of dollars per year and represent the largest transfer of wealth in history from those that pollute to those that ensure the preserve our planet's biosphere.

How can juniors balance trying to please stakeholders and having a steady news flow as assay turnaround times have increased?
Delays cost time and money but it is challenging to improve the situation. Proper understanding of assay results is critical in guiding next steps of exploration. Without results, companies are searching in the dark. The companies that choose to skip steps are destined to waste valuable shareholders' money and see their share prices fall. Those that choose to wait before taking next step arguably are doing the right thing but may suffer similar consequences from lack of news and impatient shareholders.
Some companies are developing creative ways to move exploration campaigns forward at a reasonable pace without sacrificing quality work. We are seeing the use of multiple labs in multiple jurisdictions, XRF guns to help guide exploration with a positive correlation between the assays and other indicator minerals and mineral ratios.

Can you elaborate more on how you see M&A activity unfolding in this new cycle?
We should expect increasing M&A activity. New money into exploration will result in new discoveries. These new discoveries will be bought. The larger mining companies use new discoveries to replace depleting reserves. To add fuel to the fire, large, world-class type discoveries are harder to find. World-class mining companies now have to focus on incremental growth in and around existing mine camps. In Ontario alone, we are witnessing high levels of exploration activities in Red Lake, Timmins, Wawa and other greenstone areas, led by juniors, seniors and mid-tiers. The results they produce will undoubtedly drive M&A activity through the consolidation of those areas by the incumbents or new entrants looking to "buy the district". The same trend is unfolding in other mining jurisdictions around the world. The time is now. Demand for many metals is on the rise, especially in the EV space where metal demand is forecasted to double or triple over the next five years.

What are some of the most exciting projects IBK Capital is involved in?
We are most excited about the carbon offset market and its ability to help preserve our biosphere. A great example of this is our work with AurCrest and Big Tree Carbon. We are also excited about the increasing exploration activity in Ontario. One of our portfolio companies with great potential is New Age Metals, which has the largest palladium deposit in Ontario with four million ounces located just outside Sudbury. The company is heavily owned by Eric Sprott (24%) which is understandable given it is a prime acquisition opportunity. Large mining companies like geographical diversification, each location being centered around a world class deposit or cluster of deposits with infrastructure. This is not only good for New Age but others in the Sudbury area with similar style deposits like SPC Nickel. It is drilling very shallow high-grade nickel-palladium deposits not too far from New Age Metals. ■

Michael Mackasey

Vice Chairman,
RED CLOUD SECURITIES

> We know our clients backwards, and are constantly in front of investors making sure the markets know what is going on within these companies.

With over 40 years of experience in capital markets, what drew you to Red Cloud Securities and what is your background?
Bruce Tatters and I worked together from 1996 to 2000. I worked at the National Bank and ran their equity capital markets, sales and trading and their institutional training research areas. Eventually, I worked at Macquarie, and Bruce and I worked on a deal together. When their institutional desk shut down, Bruce needed someone who knew their way around the markets over at Red Cloud Securities, so I joined. I originally returned on a part-time basis since I was theoretically retired, but it has since then become a full-time job. In the past year, we have been able to ramp up the infrastructure side of Red Cloud Securities so that we can serve our clients more efficiently.

Which kinds of innovative strategies does Red Cloud Securities use for mining companies to help them to access greater pools of capital?
We focus on emerging markets, the junior mining space, and we know the landscape inside out. We are able to streamline and structure issues so that they become the most attractive possible. Mostly though, we just know our clients backwards and are constantly in front of investors, making sure the markets know what is going on within these companies, keeping them informed. We can provide advice in terms of their financial structure, make sure to keep them out of trouble, and ensure they truly understand their reality. We get behind our clients not only for the capital raising part, but across the chain, including settlements, investment banking and advisory. On that basis, we probably know our clients best, which is why we have had such growth and success in the two years since becoming an IIROC dealer.

What advice would you give to investors that wish to work with Red Cloud Securities and how do you think markets will evolve in the coming years?
We have a very rigorous process to decide whether we are going to take on a client or not. We predominantly take a look at the resource potential and management team. Reputation matters, and if we are not convinced that the team will be able to deliver on what it started developing, we do not work with them. Red Cloud Securities's clients are as important as our issuers' source of capital.
I do not think we are in a large inflationary period. We will see rates increase, but it is too early to tell whether this is really going to be an inflationary period like it was in the 70s. One of the big opportunities on the mining side is batteries. I still think we are going to see gold over US$2,000 by the end of 2022 —inflation or not. Gold is a hard asset with a long history. We will also see more nuclear plants, which is good for uranium markets. The whole market is pretty nervous at this point but I am bullish about the future; you do not get growth without raw materials. ■

TORONTO'S GLOBAL REACH

"The high concentration of TSX-listed mining companies makes Toronto one of the mining capitals of the world. This landscape provides companies with access to industry funds, networks and communications with mining-focused institutions that are not available elsewhere easily."

Dominic Duffy,
President and CEO,
Mandalay Resources

Image courtesy of Metso Outotec

Toronto's Global Reach

COMPANIES HEADQUARTERED IN THE CITY WITH OPERATIONS ABROAD

Over 1,340 Canadian mining and exploration companies held Canadian Mining Assets (CMAs) abroad, valued at over C$273 billion in 2020. This was a 3.7% rise comparatively to 2019. The Canadian mining footprint expanded to 97 countries in 2020, and foreign assets accounted for nearly 66% of total CMAs value. When it comes to Ontario, with nearly half of global public mining companies listed on the TSX and TSX-V, miners and investors from around the world recognize the province as the global mining hub for finance. About 37% of the global equity capital raised for the mining sector was raised within the TSX universe over the last five years. With investors recognizing the key role that mining will play in the global landscape in the next few decades, looking for companies governed by high ESG standards is paramount, and Ontario has a long list on the menu. Foreign Investment Promotion and Protection Agreements (FIPAs) as well as Free Trade Agreements (FTAs) open channels for unrivalled opportunities within the mining market for the international investor community.

PearTree Securities has become the largest source of flow-through capital in the country, with over US$2 billion raised for exploration and development. The flow-through model relies on philanthropists buying shares to donate to a charity of choice. The non-profits then sell on those shares to Canadian or international investors or institutions. "Since buyers are purchasing the shares stripped of their Canadian tax value, there is an opportunity for a larger universe of global investors to acquire equity at discounted prices," said Lisa Davis, PearTree's CEO.

"What makes Ikkari unique is that it is a cohesive deposit comprised of broad intervals of strong and consistent gold mineralization which can be drilled off relatively quickly to an inferred category. Ikkari remains open at depth and along strike and up to a further 90,000 m of drilling will be conducted by the end of 2022."

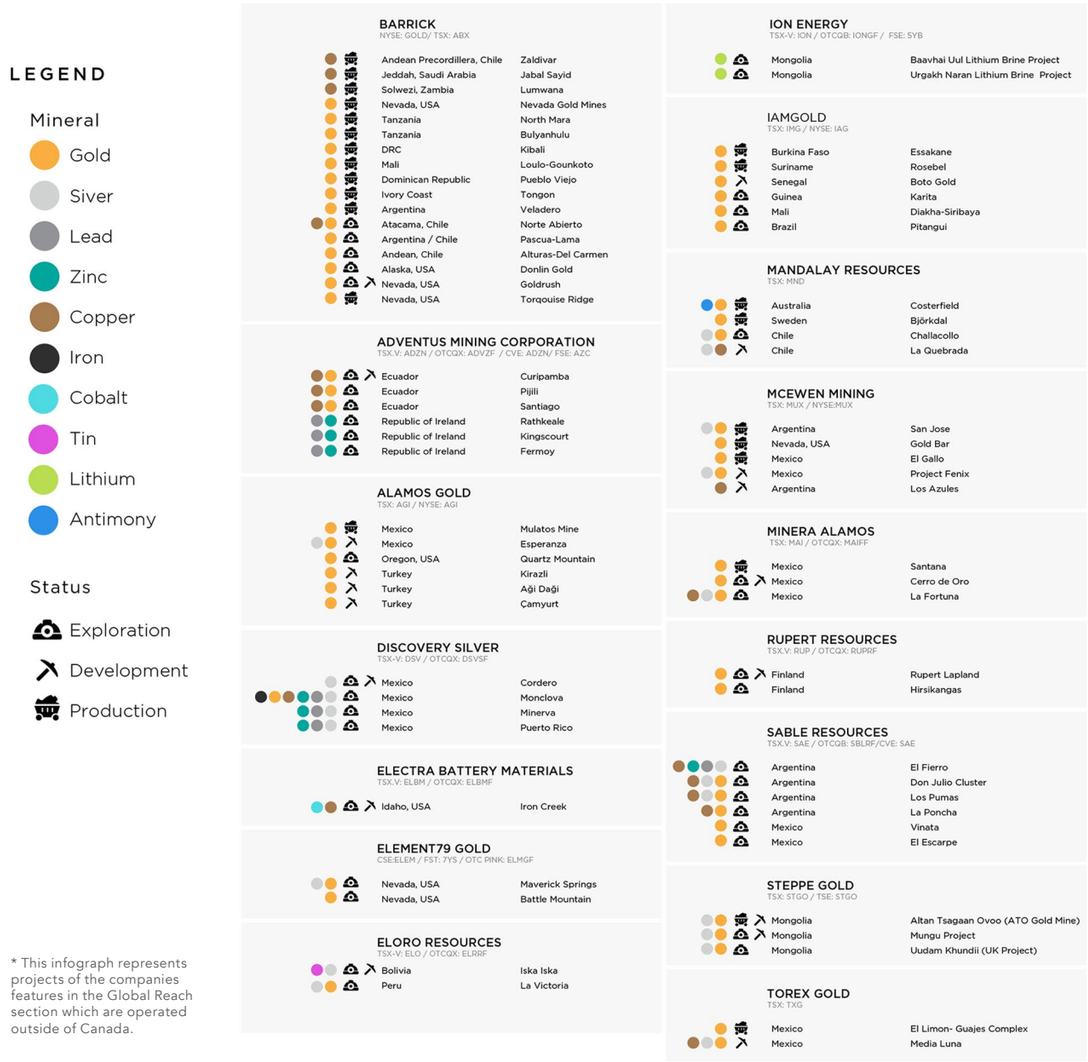
– James Withall, CEO, Rupert Resources

For Canadian residents, cash-donation tax costs can be reduced from an average of C$0.50 cents on the dollar to about C$0.10 cents after tax. "They are getting both a donation tax credit and the tax benefits of a flow-through share subscription," added Davis.

Making use of the flow-through model, Red Pine Exploration entered an agreement with Haywood Securities for a private placement financing to secure the consolidation of its Wawa gold project. "Shares in the offering qualified as standard flow-through and charity flow-through shares. […] The premium on charity flow-through is quite significant at approximately 35%," said Quentin Yarie, president and CEO of the company.

To calculate tax credits, one must take into account the 100% federal flow-through deduction, plus a 15% tax credit, in addition to a 5% Ontario Focused Flow-Through Share Tax Credit (OFFTS) for eligible individuals. According to the Ontario government: "The amount of the OFFTS tax credit in a tax year will reduce the balance in an individual's cumulative federal Canadian Exploration Expense pool in the year following the tax credit claim."

Toronto's Global Reach Projects



* This infograph represents projects of the companies features in the Global Reach section which are operated outside of Canada.

With over US$15 billion in financing activity in 2020, US-based Roth Capital Partners is a leading underwriter focused on companies with a market cap of under US$1 billion. "Roth has taken an interest in working with Canadian mining companies since mining makes up roughly 15% of the aggregate Canadian public markets and because of the relevance of the sector in the transition economy. Its goal is to help companies access new pools of capital .US capital markets are somewhere between 20 and 35 times the size of Canadian capital markets," said Braden Fletcher, president and head of investment banking of Roth Canada.

With a leadership in best practices within the sector, miners from around the world often look to Canada for pathways in innovation, technology, sustainability and community relations. Many service providers, such as AMC Consultants, which is originally Australian, view Canada as a key market. AMC started with an office in B.C. in 2007 and then Toronto in 2011. "Ontario specifically is of great significance to the company, as it has a rich mineral endowment making it an attractive location for investment by Canadian as well as international mining companies," said Francis McCann, general manager, Toronto, AMC Consultants.

Companies, such as Anaconda Mining, have chosen to base their headquar-

Jody Kuzenko

President and CEO,
TOREX GOLD RESOURCES

> From the beginning, we understood how important a desired workplace culture is to safely achieve our goals, particularly in a jurisdiction as socially complex as Guerrero, Mexico.

Torex Gold has a diverse team. What role does culture play in your strategy?
From the beginning, we understood how important a desired workplace culture is to safely achieve our goals, particularly in a jurisdiction as socially complex as Guerrero, Mexico. We were deliberate and systematic about creating a workplace where people want to willingly do their best. It started with a framework that we call Systems Leadership, which is a collection of interconnected models that, when applied correctly, create the leadership behaviours, systems and symbols that create an environment where people want to come to work. The result speaks for itself; we recently reached a milestone of 10 million hours lost time injury-free, which is rare amongst our peers, and we are well on track to hit the high end of our production guidance this year.

What is Torex's plan for the upcoming year for El Limón Guajes and Media Luna?
For our El Limón Guajes mine (ELG) our plans are centred around optimising and extending the operation. From a production and cash flow perspective, we will manage the ELG underground, open pits and stockpiles to deliver consistent production and cash flow during the transition period between ELG and Media Luna in 2024. We also hope to extend the life of the ELG underground mine through ongoing exploration. Meanwhile, over the next year, Media Luna is to be de-risked and advanced. We expect to deliver the feasibility study in Q1 of 2022, and complete the 2021 infill drill program, which totals 83,000 metres. Since Media Luna is seven kilometres away from our existing infrastructure, we must execute the early works program early to ensure we can access the deposit. Finally, we need to continue to advance our permitting plan.

Can you elaborate on your future acquisition plans?
We want to diversify through value derived from M&A, to grow beyond a single asset to become a million to a million and a half-ounce producer. At this point, we are in evaluation mode and are looking at possible acquisition targets. In the near term, our priority is organic growth through Media Luna. Another key aspect of our strategy is prudent capital allocation to continue to strengthen our already strong balance sheet. In Q1 of 2021, we became debt-free and, at the end of Q2, we had US$345 million in available liquidity. Our balance sheet will allow for the development of Media Luna and enable a new slate of opportunities through value creative M&A.

What is the outlook for Torex's diversification into copper?
Around 30% of the value of Media Luna sits in copper. When it is in full production, we expect to produce 50 million pounds of copper annually, which will require changes to our flow sheet since on the north side of the river we have to add a copper flotation circuit to produce marketable copper concentrate. The upgraded circuit will also allow us to process ore from Media Luna and ELG. Product diversification is healthy, especially given fluctuations in demand and the prices of metals.

How has the AMLO administration's approach to the mining industry impacted you?
We have some common interests with the Federal government in Mexico. The President has been clear that he is supportive of environmentally responsible mining, which we support. We also support his goals to eradicate poverty. His moratorium on granting mining concessions has not impacted us since we already had everything we needed. Regarding permitting delays in Mexico, we experienced a two-month delay in securing the permit to allow us to do early works on the south side for Media Luna. Other more permanent delays were experienced by other companies, which does not bode well for permit efficiency. Nonetheless, permit applications differ depending on the quality of the project and permit, as well as environmental impacts, community endorsements and the relationship with the regulators, and we believe we are in good stead on all of those fronts. There are some supply mix, pricing and availability concerns associated with the current administration's proposed energy reform, which we are currently analyzing. ■

Doug Ramshaw

President,
MINERA ALAMOS

> Minera Alamos is now at the far peak of the curve, which is a great differentiator as very few explorers and developers get to be producers.

Can you highlight recent developments at Minera Alamos' Santana mine?
Santana is a core asset for Minera Alamos and is one of three mines the company plans to build over the next few years. We are in an industry where so many companies focus on the front peak of the Lassonde curve, and there are very few that make their journey across the wilderness that is the orphaned period of the curve, where you are permitting and constructing. We have proudly made this journey, which has not taken particularly long given the short permitting and construction timelines in Mexico. Minera Alamos is now at the far peak of the curve, which is a great differentiator as very few explorers and developers get to be producers. Although six months behind schedule due to delays caused by the pandemic, we are quite proud that we were still able to build a gold mine for US$10 million during the midst of it all.
We are continuing with the ramp up of open pit heap leach operations at Santana as we head toward a commercial production decision, which will be a function of net cash generation and mining rates being at an appropriate and sustainable level. If achieved, we will be set up nicely for 2022, with the hope of starting construction on Cerro de Oro in the latter part of the 2022 or early 2023. We have an aggressive development path and are aiming for this project to come online in 2023, and our third mine, La Fortuna, to come online in late 2024 or 2025.

Mining operations in Mexico have occasionally been targets for cartel activity. Has Minera Alamos faced any issues in this regard?
We have not experienced any operational issues relating to cartel activities, but the key is understanding how to operate in Mexico. Minera Alamos has operated in the country for approximately 14 years, and we also benefit from the fact that our team is Mexican. During the pandemic, with the ports of entry into the US closed off, more petty crimes emerged such as truck and fuel theft. The challenges in the areas where we operate are less about the cartels and more about communities that are really struggling. Minera Alamos has the mission to not only be a good corporate citizen, but also to create opportunities for communities as we develop the country's resources.

The AMLO government has spoken of taking greater control of electricity provision, which could lead to cost increases. How sensitive are Minera Alamos' projects to these factors?
Our La Fortuna project is the largest power hog as it is a milling operation, whereas power demand for a heap leach mine such as Santana is much less as the process is not energy intensive. However, La Fortuna is currently not tied to the power grid, and we will only look to connect to the grid some years from now. For us, inflationary cost pressures in Mexico are to some extent mitigated by local currency weakness, roughly 70% of our operating costs are in Mexican pesos.
With regard to permitting restrictions, a moratorium was placed on new exploration claims. The reason for this is that there is a backlog of approximately 20,000 claims that they have to work through before accepting any new claims. We have received EIA permits for two of our three projects from the AMLO government and look forward to working with the government agencies as we enter permitting activities on our third project. The biggest change we have seen under the AMLO government has been the rise of union strength.

What are the expected mine lives for Santana and Cerro de Oro?
We will start something up which is in the 30,000 to 50,000 oz/y range, and then look to scale both mine life and the production profile accordingly. Santana will start out at a six to seven-year mine life, but we have geological visibility on how we can grow the resource, leading to the growth of mine life and the production profile. Any project the company looks at, has to meet two key criteria – can we build it, and if built, can we expand the operation in due course. On the resource defined to-date at Cerro de Oro, mine life is approximately seven years, but there are also strong indicators for expansion. ■

Ruben Padilla

President and CEO,
SABLE RESOURCES

> Latin America is an area where we would gladly acquire more projects, particularly in San Juan as well as in northern Mexico, considering our experience there.

Can you provide an update on your operations in Argentina and Mexico?
We have large prospective land packages along the Central Mexico Silver Mineral Belt and on the extensions of the Maricunga and El Indio belts in San Juan, Argentina. Three projects in Argentina are seeing drilling this season, while we continue target generation work at the rest of our properties in Argentina and Mexico.
Sable is planning to drill around 25,000 m in three different projects during the South American field season. Field work reinitiated in September 2021 with trenching and mapping work at the Los Pumas Project, a new project found by Sable's exploration team within the regional properties, located 21 km south of Don Julio. Last May, Sable completed a first drilling campaign at its flagship El Fierro project, which included 25 drill holes and 3,278 m. El Fierro project is located in one of the best known old high-grade vein mining districts in San Juan and has not been explored in modern times. High-grade intercepts reported in our first drill phase are a good first step in an area where mapping has defined a footprint of 8.6 by 6.5 km with approximately 14.5 km of veins.
Sable has started drilling activities at two of its other projects in the promining province of San Juan – the Don Julio and La Poncha projects, which both have multiple Au-Cu porphyry targets defined. Final drill locations were completed in the months of November and December 2021, and drilling commenced in early 2022.

How far can your balance sheet currently take your operations?
At the end of the last quarter, Sable had C$28 million in cash and investments. We are fully financing the work at both El Fierro and La Poncha and our joint venture partner South32, one of the largest base metal companies in the world, is financing the Don Julio and Los Pumas projects. After we have completed exploration and drilling over the next 12 months, we should still have over C$14 million to continue more advanced exploration work.

How does your relationship with local communities compare from Mexico to Argentina?
In both countries we interact with local communities, municipalities, environmental authorities and land owners, which could be private parties or community associations in the case of Mexico. We comply with all legal requirements and maintain good communication with the environmental and mining authorities. We conduct community baseline studies to gain a good understanding of the local communities, create communication channels, and identify areas of mutual collaboration. So far, we have not had any problems in Mexico or in San Juan as both of these areas have a long history of mining and good acceptance of mineral exploration work and we ensure we maintain good relationships and comply with all legal requirements.

Since you are listed on the TSX-V and the OTCQB, how do both compare?
As a Canadian based company, we have higher volume in Canada. The OTCQB gives us access to the US retail market providing for additional liquidity for shareholders. In 2022 we will spend more time marketing in the US to increase our exposure to US investors but note that most institutional shareholders, like one of our major shareholders Franklin Templeton, use Canadian brokers so we don't see impact on OTCQB trading from institutions.

What types of projects are you looking for to acquire?
We look at projects with a geological potential to lead to a discovery that will capture the attention of large and mid-tier companies. The size, grade and jurisdiction of new discoveries are the real generators of value for shareholders. We like to put our efforts in projects with a potential of over 2 million ounces of gold or 120 million ounces of silver since the same effort is required to explore large or small deposits, so the geological potential makes or breaks a project. In terms of jurisdictions, Latin America is an area where we would gladly acquire more projects, particularly in San Juan as well as in northern Mexico, considering our experience there. Peru is also a country of interest. We are well funded with multiple high-quality targets and we hope that one of our various drilling campaigns will lead to a discovery of a deposit that fits with our minimum size and quality criteria. ■

James Withall

CEO,
RUPERT RESOURCES

> We started to demonstrate the prospectivity of our land package and in particular the new 4 million oz Ikkari discovery, which has been the main driver for the valuation of the company over the last 18 months.

What drew you to joining Canadian-based Rupert Resources?
I decided to re-enter the industry and joined Rupert Resources as CEO in 2017 to build a business in a Tier 1 jurisdiction. Canada is such a well-known destination for raising funds for the resources sector and an established base to have our public listing and headquarters, regardless of where your assets are around the world.

Can you elaborate on Rupert Resources' balance sheet and the company's financing strategy moving forward?
Our Finnish assets got transferred into Rupert Resources in 2016, and we had a very strong core group of shareholders that funded the company through the early, high risk, conceptual stages of the business when it is hard to attract external investors. From there, we started to demonstrate the success of our exploration approach and attracted the interest of Agnico Eagle to come onboard as strategic investor in February 2020. Not long after, we started to demonstrate the prospectivity of our land package and in particular the new 4 million oz Ikkari discovery, which has been the main driver for the valuation of the company over the last 18 months. With people starting to understand the discovery, we have been able to raise C$48 million to continue exploration with 60% of our budget allocated to Ikkari and 40% of our budget allocated to our regional program and on making further discoveries of scale. We are well funded until the middle of 2023.

Can you speak to Rupert Resources' partnership with Trillium Gold Mines at the company's Red Lake asset?
As we focused our attention on our Ikkari discovery we were looking for partners for our Canadian assets. In August 2020, Rupert Resources entered into an arm's length, definitive agreement to joint venture the company's Gold Centre property in Red Lake with Trillium Gold Mines. Trillium will have an 80% participating interest in the joint venture and Rupert Resources will have a 20% carried participating Interest. In order to maintain its 80% Participating interest, Trillium will be required to spend C$2 million per annum in each of the first five years and C$500 000 in each subsequent year. After the completion of a positive feasibility study and a decision to proceed to production, expenditures representing Rupert's 20% participating interest will be treated as a loan by Trillium to Rupert Resources.

Can you elaborate on Rupert Resources Lapland project and highlight some recent developments?
The Rupert Lapland project in the Central Lapland Greenstone Belt (CLGB) in Northern Finland includes our multi-million ounce Ikkari discovery and permitted Pahtavaara mine and mill within a total land package of 595 km2. The CLGB can be compared to the Abitibi in Canada, or greenstone belts in West Africa and Western Australia, as it has significant similarities. The CLGB has two gold mines of significance - Agnico Eagle's Kittilä mine, the largest gold mine in Europe, and our permitted Pahtavaara mine. There is also significant base metals potential in the region with Boliden's Kevitsa mine and Anglo American's world class Sakatti project located in close proximity and Rupert's systematic exploration program is designed to find deposits of scale across the commodities spectrum.
In September 2021, we announced a maiden inferred mineral resource estimate for Ikkari of 49 million tonnes at 2.5 g/t Au for 3.95 million ounces. This estimate was based on over 36,000 m of drilling to the end of June. What makes Ikkari unique is that it is a cohesive deposit comprised of broad intervals of strong and consistent gold mineralization which can be drilled off relatively quickly to an inferred category. Ikkari remains open at depth and along strike and up to a further 90,000 m of drilling will be conducted by the end of 2022. We believe the demonstrated size, grade, cohesive mineralization and growth potential, combined with non-refractory metallurgy and proximity to infrastructure, positions Ikkari as one of the most high-quality advanced exploration-stage assets of recent years. We are surrounded by hydro facilities and a large proportion of our power supply is from renewable sources. The site also has excellent 4G connectivity. We are well funded for further exploration and will deliver a PEA in mid-2022 to give the market some color on the potential the discovery holds. ■

Tom Larsen & Bill Pearson

TL

BP

TL: CEO
BP: Executive Vice President of Exploration
ELORO RESOURCES

> **The Bolivian mining industry is still in a place where they need outside expertise and that is where we are fortunate to be accepted in the country.**

Can you provide some highlights from Eloro Resources' operations over the past few years?
TL: Prior to our involvement at Iska Iska, our focus was La Victoria, a gold bearing low sulphidation epithermal system in North Central Peru. Notwithstanding the mineral potential of this system, it has been an arduous permitting process. We continue to work towards an official land rental agreement with the Pallasca community.

When did you close the Iska Iska deal?
TL: Eloro has until January 6th of 2024 to acquire a 99% interest in the project.

BP: We commenced our first drill program underground in September 2020 and have completed approximately 40,000 m to date. In November 2020, we discovered the presence of breccia pipes on site. These tend to occur in clusters and are typical of larger systems. Noting this, we followed that with a key drill result in late January of 257.5 m @ 126.8 oz Ag eq/t. To date, we have drilled 65 holes, and all have been mineralized. Our exploration success has allowed us to raise over C$30 million in equity the first quarter of 2021, which has funded our drill program to date. The company has no debt outstanding. Year round drilling with great infrastructure has helped with cost control. Our current focus is to bring out an inaugural 43-101 mineral resource report, but with continuously finding more mineralization, we will probably have it by Q2 2022.

Eloro is listed on various stock exchanges. How does each of the company's listings compare to the TSX-V?
TL: Our main trading volumes are on the TSX-V and will likely continue to be that way in the near future. Our OTCQX gives Eloro more exposure to the US market, but has low trading volumes. Eloro has a solid European investor following, but also with relatively small volumes on our Frankfurt listing. One of the key milestones for 2022 is a maiden resource report and meeting the listing requirements of the TSX.

Can you elaborate on the Iska Iska project's connectivity in terms of water and road access?
BP: One of the great aspects of the Iska Iska project is the location. Its proximity to Tupiza, a major mining town located 48 km north, provides an exceptional exploration base, but also is distanced enough to not infringe on the community. Roads are well maintained and water for drilling has not been an issue with the Tupiza river being close by. High voltage power is just 25 km away. One of the next steps is an engineering review of the project and we have already had an initial site review.

Can you speak to Bolivia as a mining destination?
TL: From our time in country, we have had no issues and continue to be extremely pleased with the reception we have received by the local community and the larger government bodies. Since Luis Arce came into office as president in 2020, we have not seen radical changes in any type of official mining code, but rather key incentives to encourage industrial and mining growth, such as the elimination of VAT when importing equipment. One advantage we possess is that we are dealing with a private owner, and we are working with two top Bolivian law firms who have been through many regimes. The Bolivian mining industry is still in a place where they need outside expertise and that is where we are fortunate to be accepted in the country. ■

ters in Ontario, while operating across Canada. The TSX-listed emerging gold producer in Newfoundland and Nova Scotia is focused on growing and developing the Goldboro project. "The Environmental Assessment Registration Document will be submitted to the government around Q2 of 2022, which starts the final permitting process and is expected to last 18 months. The project should be shovel ready by the end of 2023," said Kevin Bullock, president and CEO.

TSX-listed Mandalay Resources has the world's second highest-grade gold mine, Chesterfield, in Victoria, Australia, with all-in sustaining costs of about US$1,000/oz. Mandalay is currently not interested in a dual listing with the ASX due to the cost and added layers of challenges when reporting. "Toronto provides companies with access to industry funds, networks and communications with mining-focused institutions that are not available elsewhere easily," said Dominic Duffy, president and CEO of Mandalay Resources.

"The TSX uses NI 43-101 for mineral resource and ore reserves reporting while the ASX uses the JORC code. The TSX also requires quarterly financial results, while the ASX requires quarterly reports without a lot of financial detail," said Jake Klein, executive chairman of Evolution Mining.

TSX-listed Steppe Gold operates the ATO gold mine in Mongolia, and the company has created a joint venture with the provincial government to unlock the Uudam Khundii (UK) project – the first time the Mongolian government has invested in a gold company with its new sovereign funds. Eventually, Steppe wishes to enter a dual listing with the Mongolian Stock Exchange (MSE). "Since our first gold pour, all of our gold has been sold domestically through the central banks. This allows us to have a rapid sale cycle while increasing the government's reserves," said Aneel Waraich, Steppe Gold's executive vice president.

Although some Ontario mining companies have faced challenges of perception when getting involved with Chinese investors, such as Power Metals Corp. partnering with Beijing-based Sinomine Resource Group, it has not been a deterrent. "We had a little bit of pushback, […] and people thought that they were taking over our minerals, but it is not the truth," said Johnathan More, chairman, Power Metals Corp. "Canada, the US and Australia are looking closely at identifying the Critical Minerals in their countries to attempt to decrease their reliance on China," said Keith Spence, CEO and partner, Global Mining Capital Corp.

Mining companies from around the globe look to Ontario as a source of know-how, stability, technological leadership and finance. As the race to secure critical minerals continues, Ontario's ESG standards will give the province a competitive edge when compared to many Asian counterparts. Although still in its infancy stages, the province's experience and professionalism is bound to make the battery metals sector prosper.

The continued support by the federal and provincial governments makes Ontario a very attractive investment destination and mining base. Incentives, such as the Mineral Exploration Tax Credit (METC), which helps companies raise capital by giving tax credits to investors, the Scientific Research and Experimental Development (SR&ED) Program, which grants income-tax credits and refunds for certain R&D Canadian expenditure, and the Accelerated Capital Cost Allowances (ACCA), which can make way for a depreciation allowance of the total asset cost, draw international attention. It is a location where capital pools can be accessed and innovation is developed."

In the same way that the MICA network was created across Canada to develop and optimize processes in mining, Ontario is actively collaborating with international Universities, research labs, innovation hubs and multi-disciplinary professionals to leverage on combined expertise for a mining future. The province's far-reaching, global network allows it to stay on the cutting edge of new technologies and innovation on the world stage. ■

Eyes on Latin America

POTENTIAL AND POLITICS

Silver and gold have been on the spotlight for centuries in Latin America, with over half of global silver production taking place in the continent in 2019. Mexico, Chile and Bolivia feature in the world's top 10 players by silver reserves, while Peru retains the largest reserves in the world. However, the star player today is copper with Chile alone accounting for over 28% of global output in 2020. Covid impacted all countries, but only diminished Chile's annual copper output by 2% in 2020.

The second largest iron ore producer in the world in 2020 was Brazil, nearing half a billion metric tons of production. The mining giant was also in the top five producers of bauxite. According to government statistics, 22% of the country's total exports in Q1 2020 were mining products, down 11.5% compared to Q1 2019.

In Ecuador, mining is the responsibility of the national government as there is no provincial input or permitting regulation. The national government is extremely focused on bringing in tax dollars and FDI into the country. Companies build their own social license to operate, and most developments have the support of local communities surrounding projects.

– Christian Kargl-Simard, President and CEO, Adventus Mining Corp.

As the world shifts towards renewables, Latin America's stronghold on lithium reserves is as yet unmatched by any other region, with Chile and Argentina taking the lithium production lead.

With a history steeped in socio-economic disparity and abuse, the rise of populism across the continent has re-emerged, as it once did during the Great Depression. Improving conditions for the ever-growing working class is in the spotlight, with many politicians using the banner of hope as a means to get into power, with very few tangible results for their electorates.

Mexico has long been a key mining destination for Ontario companies, such as Torex Gold and Minera Alamos, which managed to permit, build and move its Santana mine into production in 2021, despite Covid and weather-induced challenges. The country offers a historically strong mining culture with affordable labor and access to an experienced mining professional pool. Mexico ranks highly in terms of operational and capital costs, however, President Andrés Manuel López Obrador's (AMLO) moratorium on new exploration claims along with permitting delays have made the mining community slightly tentative about the country's future. Reduced staffing due to Covid at Semarnat, the environment ministry, has also added to strenuous permitting delays.

Adding to the web of challenges, a slump in heroin prices has meant that cartels, which generally stay drug-focused, have diversified into other verticals, including extortion within the mining sector. The Mexican government's criticism of the industry's environmental impact is also rippling across public perception, and chipping away at the positive ESG progress on the mining sector's side. Certainly a need for more deeply informed leaders within the government is rising for mining industry and policy-makers to re-align goals. Despite the setbacks, AMLO has not raised the 7.5% special mining tax in Mexico as of January 2022, and existing concessions have been respected. The rise in prices of Mexico's key metals, such as gold, silver and copper, has placed the country high on investor's radars, who are trying to gage how policies will evolve.

Doug Ramshaw, president at Minera Alamos, spoke of the advantages of operating in Mexico, including a 1-year permitting process and operating costs that allowed the company to build its Santana mine for US$10 million. Regarding the challenges that Mexico presents, Ramshaw explained that the country has a 20,000-claim backlog. "The biggest change we have seen under the AMLO government has been the rise of union strengths," he said.

"Mining is too important to the Mexican economy for the government to do any harm to it," added Taj Singh, president and CEO of Discovery Silver, noting that the current administration has changed implemented drastic changes.

Despite the current political challenges in Mexico, Torex Gold believes some of AMLO's policies align with its goals of environmentally responsible mining and ending poverty. However, the Mexican president has also put in a bill for constitutional reform that would hand the State greater control of electricity supply, which many expect will cause energy prices to increase if it goes through. "There are some supply mix, pricing and availability concerns associated with the current administration's proposed energy reform, which we are currently analyzing," said Jody Kuzenko, president and CEO of Torex Gold.

Torex wishes to become a million-ounce producer, and the company became debt-free Q1 2021 and had US$345 million in available liquidity. Its core focus is currently delivering a feasibility study for Media Luna in Q1 2022, advancing permitting, and completing the 83,000-meter infill drill program this year. The gold, copper and silver project aims to generate an expected average annual gold equivalent production of approximately 350,000 oz/y over 10 years once it reaches production. Optimizing and extending El Limón Guajes (ELG) is also a target to reach consistent cash flow and production to transition from ELG to Media Luna in 2024.

Sable Resources' projects in Latin America are advancing with a healthy balance sheet of over C$28 million in cash and investments as of Q3 2021. "We are financing the work at both El Fierro and La Poncha and our JV partner South32 is financing Don Julio. On the other hand, Los Pumas, 21 km south of Don Julio, is a grassroots discovery," said Ruben Padilla, president and CEO, Sable Resources.

McEwen Mining, owner of the Fox Complex in Ontario, also has operations in Mexico and Argentina. A historically gold-focused company, McEwen has recently decided to create McEwen Copper to move the Los Azules project in Argentina from Preliminary Economic Assessment (PEA) to Pre-feasibility Study (PFS) within the next two and a half years. The aim is to take the new company public within the next year. "The left leaning political rhetoric in Chile and Peru has recently improved Argentina's profile as a destination for foreign investment in mining projects," said Rob McEwen, chairman and chief owner, McEwen Mining. Los Azules' PEA was generated with a US$3/lb copper price, producing 415 million lbs of copper concentrate at a US$1.14/lb cost for the initial 13 years, with a lower, but still profitable rate for the 23 years following. "Los Azules is equivalent to a gold deposit of greater than 70 million ounces and with a gold equivalent production of just under 1 million oz and a cost equivalent of US$500/oz," added McEwen. ■

"We have an aggressive development path and are aiming for our Cerro de Oro project to come online in 2023, and our third mine, La Fortuna, to come online in late 2024 or 2025."

– Doug Ramshaw, President, Minera Alamos

Rob McEwen

Chairman and Chief Owner,
MCEWEN MINING

Could you provide some highlights from your operations in Timmins, Nevada and Mexico, as well as the creation of McEwen Copper to develop Los Azules and Elder Creek?
Production costs are falling and generating operating profits in our gold operations. We have a US$23 million exploration program principally focused on extending mine life and increasing production. While our treasury is strong enough to drive our current operations, we did not feel comfortable issuing additional capital at current prices to fund the advancement of Los Azules, since we do not believe the project's true value was being reflected in our share price. We created McEwen Copper to raise the necessary funds to move Los Azules forward from a PEA stage to a PFS stage. The plan is to take McEwen Copper public within 10 months. The other copper property in the portfolio is an early stage copper/gold exploration target in Nevada, named Elder Creek.

What are the project challenges and opportunities of operating in Argentina?
From a geopolitical standpoint, the left leaning political rhetoric in Chile and Peru has recently improved Argentina's profile as a destination for foreign investment in mining projects.

What is your opinion on investing in gold vs. copper?
In light of the enormity of the global monetary stimulation by governments worldwide in response to Covid, one definitely should have some exposure to gold. The debasement of currencies is unprecedented. Everyone should expect their wallets to continue to buy much less over the next few years. Copper demand is growing due to the world's quest for cleaner air, renewable energy technologies, and the continuing urbanization of Southeast Asia. The capital cost of new mines is high and permitting new mines is taking longer. A shortfall in supply is likely, resulting in a higher copper price. ■

Taj Singh

President and CEO,
DISCOVERY SILVER CORP.

Could you provide some highlights from your recent PEA and updated resource estimate for Cordero?
The Cordero PEA outlines excellent project economics at the base case of US$22/oz silver, including an after-tax NPV5% of US$1.2 billion, an IRR of 38% and a payback of 2.0 years. These financials are backed by a 16-year mine life with average annual production of 26 million oz AgEq, which would make Cordero one of the largest primary silver operations in the world. The average life-of-mine all-in sustaining cash costs come in at US$12.35/oz, which rank among the lowest in the industry. The capital efficiency of the project is also industry-leading, with a base case NPV to capex ratio of 3.2x.
Our current cash balance of over C$75 million should allow us to progress Cordero to a feasibility level / construction decision within two years and have approximately the same cash balance as we have now.

What is your vision for filling a pipeline of early-stage growth projects for Discovery Silver?
Cordero is located on a 35,000 hectare land package. The resource / PEA area represents less than 1,000 hectares of this package. Between the geological, geochemical and geophysical layers of information, we have already outlined +15 very interesting early-stage targets on the property that have seen limited exploration work. We believe there is high potential for a brand-new discovery on the property in 2022.

What are the challenges of operating in Mexico in the current climate?
The current administration in Mexico has not really done anything drastic to change things, but they have created a lot of headline noise, which is challenging. Mining is too important to the Mexican economy for the government to do any harm to it. ■

Dominic Duffy

President and CEO,
MANDALAY RESOURCES

Could you outline the vision you have for Costerfield, Björkdal and Cerro Bayo in the next few years?
Our main cash flow generator is Costerfield due to its significant margins, with all-in sustaining costs around the USD$1,000/oz range. It is the second highest grade gold mine in Australia, and has the exploration discovery potential of extremely high gold grades to further extend its current life of mine. The grades of our veins are higher than Fosterville's, but they are narrower so we are looking for dilation.
Björkdal will fuel our growth over the coming years. We are also ramping up exploration for the first time in 2022 by drilling in other areas of the property to look for a new deposit. We are aiming to improve our production profile to over 60,000 oz/y Au over the next three years. Currently, Björkdal's production sits around 50,000 oz/y Au. We have quite a large processing facility of 1.3 million mt/y. We are also in the process of conducting an optical sorting study and the preliminary results look promising. This project is estimated to boost our low-grade material of 0.6 g/t to around 1.0 g/t before passing through the plant. Lastly, Cerro Bayo, our Chilean asset, was acquired by ASX-listed Equus Mining in Q4 2021.

How has Mandalay navigated the challenges posed by the pandemic?
We saw differing country reactions in mitigating the pandemic risks. In Sweden, the country remained quite open with the necessary safety protocols in place so that operations were minimally interrupted. On the other hand, in Victoria, Australia, there have been consistent snap-lockdowns. At both sites we altered the working environment by restricting on site personnel to only essential workers and visitors and implemented flexible work arrangements to maintain social distancing. ■

Aneel Waraich

Executive Vice President,
STEPPE GOLD

How has Steppe Gold's relationship with the Mongolian government evolved?
To unlock the Uudam Khundii (UK) project, we formed a joint venture with the provincial government and since then, the government made its first-ever investment in a gold company through their newly established sovereign funds. Having a supportive government providing funding to gold companies like ourselves is a huge benefit to operating in Mongolia. The government's Gold-II program, which we were the first to sign in 2017, was implemented to help gold companies to expand production as the government wanted to increase production from primary sources. Since our first gold pour, all of our gold has been sold domestically through the central banks.

What are your plans for the ATO project?
We are taking a phased approach to the ATO asset, so we built the heap leach with a strong inventory and we confirmed that we can produce profitably. This gives us a starter mine that can be in production for the next three to four years. We have the ability to generate our own cash flow to develop the sulphide resource. While building phase one, we doubled the sulphide resource, allowing us to expand to a larger base. Within weeks, we will announce a FS confirming the capex figures for phase two and the additional mine life. Our target is 10 years mine life with between 100,000 - 150,000 oz/y of gold equivalent production.
The second mine should be online within 18 - 24 months, which is below ATO. The oxides are shallow from surface to around 40 metres, after which are the sulphides down to 300 metres. Mungu is located in the northeast of ATO which will be included in the future as an add on. ■

JUNIOR EXPLORATION

"Cashflow is the Queen that actually runs the kingdom. If you can cover your SG&A (Selling, General and Administrative Expenses) with the cash flow generated by one asset, you have significantly more latitude to feed your team while not burning treasury funds, which in my opinion, should be used for exploration or bringing mines to production."

James Tworek,
CEO,
Element79 Gold

Image courtesy of Conquest Resources

Junior Exploration

EAGER EXPLORERS DELAYED BY HURDLES

Exploration in winter. Image courtesy of ALX Resources.

Exciting transactions have taken place in the sector, such as Noront Resources reaching an agreement with Wyloo Metals and Kinross' purchase of Great Bear Resources. Majors from all over the world are looking closely at the Ontario junior sector to secure future reserves and consolidate land packages. As commodity prices improve and critical metals enter the spotlight with more force than ever before, a drilling frenzy seems to be taking over the province.

The Covid pandemic exacerbated the challenges historically faced by the junior sector. The Russia/Ukraine crisis then added to already rampant global inflation, resulting in higher oil and food prices to transport crews to site, power equipment and feed camps. Many projects experienced delays and limited access to services, parts and equipment. The need for speedier permitting to build new mines remains a challenge, but demand for new projects is on the rise and the relevance of the sector has never been stronger. "We are witnessing high levels of exploration activities in Red Lake, Timmins, Wawa and other greenstone areas, led by juniors, seniors and mid-tiers," said Michael White, president and CEO of IBK Capital.

When it comes to services, such as drilling or laboratory results, explorers have faced costly delays and a shortage of skilled labor. Assay delays causes junior mining companies to mount extreme balancing acts in order to sustain on-going news flow for investors. In some instances, companies sent assays to three different laboratories hoping for speedier turnarounds. Periods of twelve or more weeks were not unheard of. "The problem really begins to hit home on projects where there is no visible mineralization, which means geologists need the assays from previous holes to guide the next set of holes," said Adam Schatzker, managing director for mining research at Research Capital Corp.

Investors' interest in drill results to better comprehend mineral content can place undue pressure on explorers who are trying to preserve stakeholder value and capital investment. Without timely results, drill programs can be rushed, at times reducing the quality of the work, and in turn negatively impacting companies' financials and market valuation. "Laboratories are overwhelmed and were unprepared for the large volume of work this year. We have been affected by that in North America, and it has impacted the timing of our resource update," said Gary O'Connor, CEO and chief geologist of Moneta Gold.

With companies such as Electra Battery Materials, formerly First Cobalt, aiming to increase the capacity of its hydrometallurgical cobalt refinery, and Canada Nickel Company expanding with the acquisition of 13 new properties near the Crawford nickel sulphide project, transition metals are primed to solidify as Ontario's core assets. The province remains the largest nickel producer in the country.

Access to capital and permitting are two historical challenges the junior sector has faced, however, juniors have experienced larger flow-through financings in the past year. PearTree Securities's CEO, Lisa Davis, said: "Four transactions this year were all over C$50 million, with one – OSK – at C$70 million. I think we are likely to continue to see the trend accelerating value creation in the junior market."

Despite the added interest, Denis Frawley, partner at Ormston List Frawley LLP, spoke of the urgent need to streamline the process to take a project from exploration to production: "We have to find more efficient and timely processes that still protect the environment and address the needs of affected communities and stakeholders."

With a strong mining history, First Nations communities continue to solidify relationships for the exploration and development of new mining projects in the province. However, the S in ESG remains a delicate subject that must not be overlooked, as exemplified by the Asubpeeschoseewagong (Grassy Narrows) First Nation community taking the Ontario government to court for issuing nine mineral exploration permits which they said they were not consulted for. This comes after ten tonnes of untreated mercury polluted the river water for hundreds of kilometres, including the Grassy Narrows region, in the 60s and 70s. Although many positive steps are being taken, history remains a legacy to heal in Canada and Ontario in order to generate positive and lasting relationships between First Nations communities, the exploration community and eventually, producers. ■

Assay turnaround times have gone up unbelievably, which has created a serious dilemma for management teams, because junior mining/exploration companies live and die on news flow. Where it used to take four to six weeks to receive assays, now it can be 12 weeks or even longer.

– Adam Schatzker, Managing Director – Mining Research, Research Capital Corp.

Chris Taylor

President and CEO,
GREAT BEAR RESOURCES

> We announced Kinross' purchase of Great Bear Resources for C$1.8 billion in late 2021.

What have been some of the major highlights over the last 18 months, including the sale of GBR?
We announced Kinross' purchase of Great Bear Resources for C$1.8 billion in late 2021, which is certainly the most important milestone for GBR. Prior to this, we completed a drilling program on our LP target of which 4 km is complete, concluding phase one and paving the way for an initial mineral resource disclosure in 2022.
The Dixie project remains GBR's core asset, where we completed 340,000 m of drilling and Kinross has already slated a 200,000-m drill plan on the LP Fault Zone for this year. We set the wheels in motion to publish the initial resource estimate, resource follow-ups, PEA, and permitting landmarks over the next couple of years. The project has made massive progress, considering that it was discovered only two years ago.

What has been your experience with the permitting process?
In jurisdictions such as Ontario, it is crucial to establish good relationships with First Nation partners and have a clear dialogue. We are operating on traditional territories and are glad to have support for the project. We hope to enter into a mine benefits agreement with our First Nations partners over the long term. After establishing a meaningful and ongoing dialogue with local communities, the environmental survey baseline work is started. Generally, the government is easy to work with and the process is laid out which we follow in accordance with their instructions.

How did your funding strategy and share price contribute to solidifying the Kinross deal?
In early 2021, we raised enough capital to support our exploration activities for two years with around US$65 million, of which US$45 million was to be allocated to the drilling program in 2022. We also expected to produce a resource update and PEA the same year. This not only gave our shareholders the confidence that we would not go fundraising at diluted pricing, but it also solidified our strong balance sheet. Our strategy meant that we always raised money at a higher share price than the previous time, which is why we have had the lowest share count of any company with our market cap, as we have 58 million shares issued and a market cap of over US$ 1 billion.
The market expected a low-cost long-term operating project with a high rate of production and the information we released is in favor of this conclusion. As we drilled deeper into the LP fault, we noticed that the target is larger than anticipated with higher gold recovery. Therefore, those factors coupled with a rapidly moving M&A market resulted in our current share price and eventually, acquisition.

What is your outlook on gold?
Inflationary pressures are mounting so in the long-term it is only natural for metal prices to increase. Due to inflation, our drill costs increased by 15% compared to one to two years ago. Our project is high grade with easy access so it is insulated against the fluctuations of the gold price. Cryptocurrencies also impacted investment in gold particularly from young investors. However, as cryptocurrencies become heavily regulated the large returns on them will decrease and gold will attract more attention as an excellent hedge to inflation.

How are you adopting industry 4.0 processes and innovating to optimize your operations at this stage?
One of the most sophisticated software we rely on is for three-dimensional modeling. We also employ an oriented drill core. Both help us understand and interpret the orientation of gold and other geological units in the deposit. Even though these tools are costly, they save millions of dollars in the long run because drill holes are not repeated as all the information is collected. Geological information is collected daily, and multi-element geochemistry is completed on the rock coupled with the samples' assessment for gold assays. We usually know that we are going to hit a gold zone before it is drilled so we drill with high levels of accuracy. This quality data and its real-time processing, therefore, saves us time and increases our efficiency. ■

Jose Vizquerra

President and CEO,
O3 MINING INC.

> We are on track to become a gold producer and will continue working towards that goal.

O3 Mining recently reported the latest drill results from the 2021 program at Marban. What are the project's next steps?
O3 Mining's Marban project is located in Val-D'Or Québec, 12 kilometres from the Canadian Malartic mine, the largest operating gold mine in Canada. The Marban project already has resources in both measured and indicated categories which we intend to increase with the completion of our infill drilling program in 2021, and will be included in an updated resource by the end of Q1 2022. We are now moving from the previously completed PEA to the PFS, which we intend to finish this year to have more certainty as we continue to move towards production and to add greater fundamental value for our shareholders. We are on track to become a gold producer and will continue working towards that goal. We aim to have the Marban project in production by the end of 2026.

What is your long-term vision regarding potential depth expansion at Marban, and what is the relevance of having Canadian Malartic's mill nearby?
Having projects on the prolific Cadillac-Larder Lake Fault zone (CLLFZ), at the boundary between the Abitibi Subprovince and the Pontiac Subprovince, means we are operating on a deep-seated structure. The fault hosts over six mines, with four in operation, including Goldex and Wesdome. These projects extend up to two kilometres and beyond at depth.
The open-pit operation at Canadian Malartic will run out of ore by 2028. Its Odyssey project, expected to produce approximately 545,400 oz, will start production in 2029 through 2039. The plant capacity was designed to support the open pit mine processing around 55,000 mt/d; with some days hitting up to 60,000 mt/d. As the mine transitions to underground, the mill will be processing significantly less ore. Given it is a single circuit plant that uses the same amount of power despite the amount of ore, we believe the opportunity to collaborate is open in the future.

How will your relationship with Moneta evolve following the sale of the Garrison project?
Having a consolidated project facilitates drilling to expand the resource. For us, Garrison was not a sale, but rather the relocation of the asset into Moneta Gold. Many years ago, we bought Garrison knowing the property hosted 2.5 million oz. We also knew that the extension of the project was something worth monitoring resulting in the conversation with Moneta Gold for a strategic partnership combining the Garrison property and the Golden Highway property to create the Tower Gold project. I believe that Moneta Gold will be the next mine to be built in Ontario in the next five years. They hold potential for not only open-pit, but also underground mining scenarios.

How are the expansion drilling plans for Alpha evolving?
Alpha is a unique part of our land package in Val-d'Or, covering 20 km of the Cadillac Break, and located about three km south of Eldorado's Lamaque mine. Our drilling at the Alpha project has been focused on the northern side of the project, where we have continued to produce very good drilling results from the Akasaba sector, Omega sector and the Bulldog-Kappa sector. This year, 33,000 m of drilling will focus on the expansion of the Kappa and Bulldog deposits, following up on significant Sigma type veins at the Omega sector to prove the existence of an auriferous system, and resource expansion of the Akasaba deposit.

How has the pandemic impacted your operations?
Being in the Abitibi-Témiscamingue region of Québec, we initially did not see many cases of Covid surrounding our projects and luckily, had zero cases with either our employees or our contractors. Through the implementation of added safety measures, we were able to continue with our activities, including the execution of our large-scale drill program. The primary effects we experienced were delays in getting assay results from the lab. The Omicron wave of the pandemic has been unavoidable and has directly impacted O3 Mining. To keep our employees and community safe we have implemented additional health and safety procedures to mitigate Covid transmission. ■

Chris Frostad

President and CEO,
PUREPOINT URANIUM GROUP

> Now that more funding is available to the uranium sector we can expand our work across our ten 100% owned projects where early discoveries have already been made.

How are uranium prices impacting Purepoint's core targets?
For the first time in a number of years, uranium prices have started to move in earnest towards levels that will allow for new uranium production, bringing significant capital into the sector. In recent years, Purepoint has focused on our Hook Lake Joint Venture while preserving our portfolio of 100% owned projects. Located within the Patterson Uranium District, the Hook Lake project is jointly owned by Cameco Corporation (39.5%), Orano Canada (39.5%), and ourselves (21%) who have been the operator since 2007. The project lies adjacent to Fission Uranium's Triple R and NexGen's Arrow discoveries, which have come in so far at over 350 million pounds of U3O8. Now that more funding is available to the uranium sector we can expand our work across our ten 100% owned projects where early discoveries have already been made.
As we now aggressively advance our entire portfolio, Purepoint will be raising capital on an ongoing basis as we see markets improving. The company has raised C$7 million over the past 12 month. Advancing exploration projects to discovery is expensive, but we feel that our significant land package and mature prospects will allow for continued support from our investors.

What role can uranium play in the green energy revolution?
Ten years ago, anything related to nuclear safety was seen as a global danger. Today, however, carbon has become the dominant danger, with nuclear power and uranium fuel being heralded as major components of a green strategy. The use of solar and wind energy will continue to grow and fill gaps, but nuclear and uranium will play a large role in terms of replacing carbon fuels and serving an ever-growing need for energy around the planet. With a significant amount of smaller modular reactors (SMRs) now coming into proper commercial production, it will add a new level of demand that did not exist ten years ago. Electricity demand globally will continue to rise at a strong pace, and I believe that nuclear will maintain its share of this power source.

Where is the demand for uranium coming from?
A fairly significant portion of Canada's electricity is provided by nuclear power, in Ontario more so than other provinces. Globally, 25% of the reactor fleet is located in the US, with the challenge being that they do not have an adequate source of domestic uranium and thus import from Canada, Australia or Kazakhstan.

Can you elaborate on Purepoint's team and the challenges faced with regards to skilled labor shortages across the mining sector?
Purepoint has a highly qualified leadership team with decades of experience in uranium exploration. We have a small internal team which is focused on the technical aspects but are able to cover a lot of ground by outsourcing much of the field activities. With the recent availability of funds, it has gotten very busy in the field resulting in challenges in securing services right across the board in areas such as drills, drilling crews, helicopters and geologists. Fortunately, Purepoint has longstanding relationships with many service providers and we have been able to navigate shortage challenges fairly easily. There have been delays in permitting as we are dealing with communities in a more structured manner, but again we were fortunate to come into 2021 with permits already in hand, as is the case for 2022, which will allow us to hit the ground running and keep moving forward.

What are Purepoint's targets at the Hook Lake deposit moving forward?
We have moved some of our focus at Hook Lake to the Carter Corridor, which is a corridor that only exists within our claim block. This was one of the first areas we drilled and we hit uranium on our first, and only, drill program, but this predated any of the recent discoveries in the area. We now have a much deeper understanding of the geological setting and how uranium deposits were most likely formed in the region. We will continue exploring this shallow area which has the indicators and size more than capable to host a tier 1 deposit. ■

Warren Stanyer

CEO and Chairman,
ALX RESOURCES CORP.

What role is Rio Tinto playing in ALX Resources' Falcon nickel project?
In 2020, ALX Resources signed an option agreement with Rio Tinto for the Firebird nickel project in northern Saskatchewan. We have completed one drilling program, which was successful in locating the style of mineralization that we are looking for – magmatic sulphides.

What is your vision for the Electra project?
In December 2020, ALX signed a definitive agreement for an option to purchase a 100% interest in the Electra nickel project in Ontario. We recently completed a leading-edge airborne survey, which has pinpointed conductors that were not detected by historical surveys. We will be focusing our exploration attention to build out what we believe will be a quite sizable project.

How will you continue developing Cannon Copper and Vixen projects?
In January 2021, ALX announced an exploration review on our Cannon copper project in Ontario. We did an airborne survey with and are currently evaluating the data. It has been over a year since we acquired the Vixen gold project in Ontario, where we completed some prospecting activities. ■

David Russell

President and CEO,
GALLEON GOLD CORP.

Can you give an overview of recent developments at the West Cache gold project?
Galleon Gold acquired the West Cache project in 2020, and since that time we completed 46,000 m of drilling, commenced baseline and metallurgical studies and initiated permitting activities. Our drilling was very successful at infilling and expanding known mineralization, as well as discovering the high-grade Zone #9 ore shoot.
The PEA considers an underground mine utilizing toll processing with annual gold production of 85,000 oz/y Au over an 11-year mine life. The economics are robust with pretax NPV (5%) and IRR of C$378 million and 33.7% respectively. We have significantly increased the resource and now have an Indicated Mineral Resource of 472,000 oz Au and an Inferred Mineral Resource of 1,088,000 oz Au.

Can you elaborate on the location of the project and how it is relevant?
The project is located on the Porcupine – Destor Deformation Zone, only 13 km west of the town of Timmins. Provincial Highway 101 bisects the property. ■

Quentin Varie

President and CEO,
RED PINE EXPLORATION

How has the Wawa gold Project progressed?
We raised C$20 million in March 2021, of which C$14.2 million went towards the consolidation of 100% interest in the Wawa gold project. Pursuant to the consolidation transaction, Red Pine Exploration entered into an agreement with Haywood Securities as lead agent and sole bookrunner in connection with a private placement financing to be completed on a "best efforts" agency basis. Shares in the offering qualified as standard flow-through and charity flow-through shares. We conducted approximately 15,000 m of drilling in 2021, with even more planned for 2022. Our results thus far have been positive.

What kinds of projects does Red Pine Exploration look for?
Although we are currently solely focused on drilling the Wawa gold project, we remain opportunistic. Aligned with the company's strategy to consolidate the Wawa gold project land package, we purchased 100% interest in additional mining claims located in the McMurray Township in April 2021. I do not see us moving away from the Wawa area or anything that is not continuous to our current project. ■

Exploring across Canada

ONTARIO AS AN INTER-PROVINCIAL BASE

Many companies exploring across the country have chosen Ontario as their headquarters given the access to resources, capital markets, innovation and industry collaborations. Here we highlight some of the exciting developments taking place inter-provincially.

Québec

With C$393 million in mining revenue in 2020, Québec continues to shine and evolve in the mining spotlight. The province has a diversified portfolio including metals and minerals for the green transition economy, such as lithium, graphite, vanadium and niobium. Québec has attracted major investment into the sector, such as The Pallinghhurst Group's billion dollars put into Nemaska Lithium and Nouveau Monde Graphite, and accounts for 43% of the country's iron ore shipments and slightly under 25% of nickel shipments. However, nothing shines brighter than gold in this province - the core pillar of its mining economy.
Sitting in the company of Wesdome and Canadian Malartic, O3 Mining has reported several encouraging drill results from its Alpha and Marban projects, with the latest assay highlights as of late January 2022 including 12.4 g/t Au at the Kappa zone over an intercept of 1.9 m from a depth of 53 m. The company holds a portfolio of assets across over 137,000 hectares and intends to continue its winter drilling program with 73,000 metres planned for 2022. O3 aims to have a PFS completed by the end of the year and Marban in production by Q4 2026.
O3 mining is also exploring the Omega area for quartz and tourmaline veins. "The importance of talking about these styles of mineralization is that you really see the endowment of the area. The more styles of mineralization, the more it means that the gold was able to be deposited in different areas— independently of the type of rock formations," said Jose Vizquerra, president and CEO of O3 Mining.
Capitalizing on Canadian Malartic's low-grade open pit running out of ore by 2027, O3 mining is planting the seeds for the possibility of making use of Malartic's single-circuit plant. While Canadian Malartic is currently passing up to 60,000 mt/d, this will diminish in future and a collaboration could emerge.

Saskatchewan

Accounting for 30% of global potash production, Saskatchewan reached record high potash sales of C$5.5 billion in 2020. Minister Bronwyn Eyre believes 2022 will be a year of continued growth for the province's farming and mining industries. A hope that the seven-year slump in prices could be nearing the end provides encouragement to the sector.
With projects in northern Saskatchewan, ALX Resources signed an option agreement with Rio Tinto in 2020 for the Firebird nickel project, formerly known as the Falcon nickel project. ALX has completed one drill program that successfully located its target of magmatic sulphides.
Regina-based technology development company Prairie Lithium Corporation has also brought exciting news to the province by proving strong results in the extraction of lithium from oilfield brines. As the transition to cleaner energy sources evolves, the importance of nuclear power will also increase. "Ten years ago, anything related to nuclear was seen as a global danger. Today, however, carbon has become the dominant danger, with nuclear power and uranium fuel being heralded as major components of a green strategy," said Chris Frostad, president and CEO of Saskatchewan-based Purepoint Uranium Group.
Uranium miners have required resilience for longer than most given the 2007 peak in prices, followed by a steady decline—but this has started to change. The role that nuclear is expected to play, coupled with a steep rise in energy prices making it more competitive, has shifted the landscape. China has increased its commitment to nuclear, and innovative technologies such as SMRs are on the rise. Recent violent protests in Kazakhstan —the largest uranium producer in the world representing about 40% of global output— have also triggered uncertainty around the country's supply.
Partnered with Cameco and Orano, two of the largest uranium producers world-wide, Purepoint Uranium is aggressively developing the Hook Lake JV, alongside a range of wholly owned projects in the Athabasca Basin. With the largest high-grade uranium mines in the world, such as McArthur River and Cigar Lake, and uranium rising by over 30% last year, Saskatchewan is ready to reap some rewards.

British Columbia

Vancouver remains a vital mining destination, with over 800 mining and junior companies headquartered in the city, employing over 30,000 people across B.C. Metallurgical coal represented 34% of the province's mining net revenue in 2020, with copper following at 28% and gold at 18%.
Minister of Energy, Mines and Low Carbon Innovation, Bruce Ralston, has expressed the goal to grow the province's mining sector riding the current commodity prices wave. With some of the lowest GGH emission-intensive mines and smelters world-wide, and as leaders in environmental, safety and community relations, B.C. is positioning itself to spearhead within the realm of ESG in years to come. The BC Mining Innovation Hub will continue to foster a culture of support and collaboration, while the CleanBC Facilities electrification Fund and Clear BC program for Industry are helping mines electrify their projects.
British Columbia is the homeland of nearly 200 First Nations, Inuit and Metis communities, with a long history of partnerships with the mining sector. This is the first Canadian province to share mineral tax revenue with Indigenous communities, and mining remains one of their significant employers.
Ontario-based New Gold has signed a cooperative agreement with the SSN Community around the copper-gold New Afton mine based west of Kamloops. This is one of the only block-caving projects in North America and has a mine life beyond 2030. The company has over 10 years of experience in block caving in the area, and an asset that generated over US$800 million in free cash flow since 2012. "If commodity prices remain strong over the coming years, then mining in Canada will truly channel its growth and play a leading role on the global stage," said Renaud Adams, president and CEO, New Gold. ■

Gold Juniors replacing depleting resources

SOLIDIFYING FUTURE RESERVES

As commodity prices rise and enthusiasm ripples across the sector, M&A activity is expected to increase. New discoveries need to be developed and producers will be looking to replace depleting reserves. "World-class mining companies now have to focus on incremental growth in and around existing mine camps," said Michael White, president and CEO of IBK Capital.

White predicts a rise in M&A activity through the consolidation of each area as companies look to 'buy the district'. With a gold and iron ore history dating back to 1897, the Sault Ste. Marie region in the municipality of Wawa, Ontario, became a steel empire. Today Wawa no longer relies on iron ore, but rather focuses on gold, diamonds and other minerals. Built around those initial gold mines, Red Pine Exploration has now obtained a 100% interest in the Wawa gold project, located in the Michipicoten greenstone belt. Red Pine spent C$14.2 million out of a C$20 million raise in March 2021 to consolidate its 100% interest in the operation. "We attained new shareholders along with the financing raise and the additional interest transaction was quite accretive for our shareholder base," said Quentin Yarie, president and CEO of Red Pine Exploration.

Red Pine Exploration intends to expand its current 700,000-oz inferred and indicated resource, to what Yarie believes could become 2 million oz of inferred and indicated resources. With a 15,000-meter drill program completed in 2021, and more to follow in 2022, the company is still looking to acquire and explore further in the area. Red Pine has purchased a 100% interest in additional mining claims in the McMurray Township. "I believe we are watching the development of a gold camp not dissimilar to the Timmins gold camp," said Yarie.

Element79 has an LOI with Plutus Gold to ultimately acquire the Snowbird property, and is focused on M&A activity to grow and generate value for shareholders. Element79 chose to finance Plutus Gold's Q4 2021 drill program with a C$1.1 million loan facility, which allows for Plutus to complete the remaining obligations they have to Gitennes Exploration under an option agreement. "Our acquisition focus is on easy to develop properties and formerly producing mines in de-risked and politically friendly mining jurisdictions, which we can turn back on and develop within a relatively small capex budget and short timeframe to be able to bring cash-flow into the company," said James Tworek, CEO.

In addition to the development of Springpole, we began consolidating ownership in the Birch–Uchi Greenstone belt, increasing our land package from about 40,000 Ha to 70,000 Ha in 2021 through acquisitions and option agreements. The region has been historically fragmented and underexplored despite some very interesting geological trends.

– Dan Wilton, CEO, First Mining Gold

Located about 110 km to the northeast of Red Lake, First Mining's Springpole asset is one of the largest undeveloped gold projects in Canada. A PFS was completed Q1 2021 showing a production output of more than 300,000 oz/y at the lowest quartile all-in sustaining costs. Optimizing the treatment plant for tailings and waste rock has been a focus, while producing first drafts for an EA to be submitted Q1 2023. Dan Wilton, First Mining's CEO, revealed he is open to partnerships and has not yet decided whether to develop the asset alone.

In December 2020, First Mining also consolidated the land package around the Cameron project, a 1 million oz resource located 80 km from Kenora city. "We have signed an exploration agreement with the AWZ 37 community and this has been a great partnership thus far," said Wilton.

Recently re-branded Moneta Gold, previously Moneta Porcupine Mines, added a new underground discovery with open pit resources at Westaway in Q4 2021 and recently acquired the Garrison project. "This increased our mineral resources to 8.4 million oz, of which 4.4 million oz are indicated, 4 million are inferred, and 2.8 million oz are underground, while 5.6 million are open pit," said Gary O'Connor, CEO and chief geologist of Moneta Gold.

Moneta's share price has performed well following a 2021 resource update and signing a deal with O3 Mining, an Osisko Group company.

With gold prices on the rise and a positive outlook for the precious metal, Goldshore Resources decided to take over the Moss Lake gold project, which sits in Kashabowie within 1 km of Highway 11, and 130 km west of Thunder Bay. "We believe that gold is going to trade between US$1,800 and US$2,200 for the foreseeable future, and the project works in this gold trading range. There has been a PEA completed, which, when sensitized to today's numbers relates to more than a US$1 billion NPV on the historical resource we acquired, " said Brett Richards, CEO at Goldshore Resources.

In order to acquire the asset, Goldshore Resources sourced C$25 million in Sudbury seed financing, with C$15 million as hard dollars and C$10 million as flow-through receipts into Sierra Madre. "We were doing a reverse takeover on Goldshore into Sierra Madre and changed the name to Goldshore Resources. Everything was submitted to the TXS for approval, and we were admitted for trading on June 4, 2021," added Richards.

Goldshore Resources aims to ramp up to four rigs by Q4 2021, and hold about C$11 million in the bank to push its operations forward for the next nine months. It was admitted into the TSXV and is currently on the OTC pink and also hopes to be approved for the OTCQB and the Frankfurt Stock Exchange.

With a C$139 million market cap as of Q4 2021, 03 Mining remains focused on the conversion and expansion of resources and making new discoveries. Following the trend of consolidation, Kinross announced the acquisition of Great Bear Resources for C$1.8 billion in December 2020, after being actively involved in the project since 2018. Much excitement revolves around the flagship Dixie project, which has the potential to become a top-tier deposit with a long-life mine complex to boost Kinross' future production.

Dixie also remains a highly prospective area with vast exploration potential, including the LP Fault, Hinge and Limb Primary Zones. Great Bear completed over 340,000 m of drilling at the time of sale and Kinross has announced a 200,000 m drill plan for 2022 on the LP Fault Zone. The project has the possibility of long-term tax benefits due to Kinross' tax pools in the country and power supplies stem from Ontario's low-carbon energy grid. The Dixie property is located 25 km southeast of Red Lake, in the highly prolific mining district of Northern Ontario, proportionally reducing Kinross' need to expose to higher risk jurisdictions to increase their portfolio of operations and secure future resources.

As Q2 2022 started on the back of an escalating Russia/Ukraine crisis, sparking fears of stagflation, gold's role as a safe-haven asset saw prices rise towards the all-time-highs. For Ontario's PM juniors, the window to finance drill campaigns appears to be open. ■

Gary O'Connor

CEO and Chief Geologist,
MONETA GOLD

> We are right in the middle of the new investments taking place and we have the largest set of undeveloped projects there.

Can you elaborate on the Moneta Gold's name change and the progress made in your flagship project, Tower Gold?
Changing our name from Moneta Porcupine Mines to Moneta Gold was our way of adapting to the new era of search engines and social media. It was time for a rebrand to focus our strategy primarily on gold, especially following the acquisition of the adjacent Garrison project. In December 2020, we updated our resources and added a new underground discovery with significant open pit resources at Westaway. The acquisition of the adjacent open pit resources at Garrison was completed in February. This increased our resources to 8.4 million ounces, of which 4.4 million ounces are indicated, 4 million are inferred, and 2.8 million ounces are underground, while 5.6 million are open pit. One more round of drilling was planned to test southwest near-surface resources, Westaway and others. A 70,000 m resource expansion program will be completed in 2021. We expect to have a resource update by early 2022, following processing and an assaying geology model.
A PEA will follow the updated resource for the new combined Tower Gold project, including all of the Golden Highway and Garrison zones. We will also embark on a PFS, to be completed by early 2023. We are well underway with our environmental baseline study and have already initiated our community engagement programs. The DFS will likely begin in 2024.

What is the secret behind the performance of your share price relative to your peers?
The first trigger that the market took note of was our resource update last year. Our share price then increased further following our deal with O3 Mining. They are our largest shareholder, with a 26% shareholding, and were brought in as a partner with the acquisition of the Garrison project. They are looking forward to playing a part in a major gold development story so our visions are aligned. People liked the idea of the consolidation of a much larger project.
Our share price appreciated as the market resonated with our vision and plan to develop a major gold project in Canada. It is also a reflection of the marketing strategy we put in place.

How do you strike a balance between delays in assay results and keeping a steady news flow?
Laboratories are overwhelmed and were unprepared for the large volume of work this year. We have been affected by that in North America, and it will impact our resource update. Another reason laboratories are delaying the results is due to Covid-19 and social distancing measures, limiting the number of staff available. We did not feel tremendous pressure from investors regarding these delays. Nonetheless, our shareholders want to see a steady news flow, which we take into account. We are considering alternatives and doing what we can to get results back as soon as possible. Moneta relies on a primary laboratory and a secondary one. One must be careful not to send samples to too many laboratories as you need to maintain similar procedures and QA/QC.

Given the rising interest in metals such as copper and nickel, why does gold remain an attractive investment opportunity?
Gold remains a great store of wealth and hedge against inflation. The volatility of currencies, particularly the dollar, only puts gold more in the spotlight. In many countries, the main store of wealth is to buy gold, and in some, everything from rentals to financial agreements are backed by gold equivalents. It also has other uses in the electronics industry, for example. Demand for gold is set to increase.

What potential do you see for Timmins?
Timmins is Canada's largest most prolific gold mining camp. It offers excellent infrastructure and resources, and is a prime camp for new development. Since infrastructure is already existent, our operations have a lower carbon footprint relative to other jurisdictions, since we do not need to build new roads or structures. Recent M&A activity has attracted the world's largest gold producers, such as Newmont who acquired Goldcorp. Kirkland Lake, who is a major player in the region, merged with Agnico Eagle. We are right in the middle of the new investments taking place and we have the largest set of undeveloped projects there. ■

Brett Richards

CEO,
GOLDSHORE RESOURCES

> Goldshore Resources will conduct exploration activities to develop the project to a stage where a major will buy the project to build a mine.

Can you highlight some milestones Goldshore Resources has achieved over the past 18 months?
With a belief that the gold trajectory was going to remain positive, we were looking for gold projects that were economic at approximately US$1,600 to US$1,800 gold price. We got wind of the Moss Lake project and concluded a transaction on January 26, 2021. We did pre-transaction funding to support the transaction, and were also able to obtain C$25 million Sudbury seed financing of which C$15 million was hard dollars and C$10 million was flow-through receipts into Sierra Madre. We were doing a reverse takeover on Goldshore into Sierra Madre and changed the name to Goldshore Resources. Everything was submitted to the TXS for approval, and we were admitted for trading on June 4, 2021. The company is currently trading on the TXSV under GSHR, on the OTC pink for the next few weeks under GSHRF where we are hoping to be approved for the OTCQB, and the Frankfurt Stock Exchange.

How much funding does Goldshore Resources have to take the Moss Lake project forward?
The Moss Lake project is an under drilled project in Ontario with significant upside resource potential. In July 2021, the company commenced with a 100,000 m drill program and additional exploration activities to further develop it. The company currently has approximately C$11 million in the bank, which will take us forward for about 10 months at concurrent levels. We are currently running two rigs and are planning to ramp up to four rigs by November 2021. We need a really cold winter to get on top of the lake, and if it is not the case, we will drill other targets. Goldshore Resources will conduct exploration activities to develop the project to a stage where a major will buy the project to build a mine. We thus decided to run geophysical airborne VTEM/mag surveys over the entire land package, conducted by Geotech in March/April 2021, and hired Technolmaging alongside Geotech to do the interpretation.

How well connected is the Moss Lake project in terms of infrastructure and community relations?
The base of our operations is already established at Kashabowie, just 1 km off Highway 11. The project has access to grid power, telecommunications, water and other utilities that will facilitate all-year operations. Thunder Bay is only 130 km away from our site. We have completed construction of an on-site core shack and office, enabling core processing at a rate of 400 m per day. It is important to listen to host communities and really understand what they want. Goldshore Resources has a dedicated community engagement team to foster longstanding supportive relationships and we have open and ongoing communication with the communities, including the Lac des Mille Lacs, Fort William, and Metis First Nations, in our efforts to de-risk the project. We also support the local communities through focusing on prioritizing local businesses and their affiliates, and our logistics team is fully comprised of indigenous community members.

What is your opinion about electrification and the speed of adoption within the mining industry?
The mining industry has been fundamental for more than 100 years and a significant amount of technological advancements have been made to improve efficiencies. The use of oil for power is not sustainable and there is currently a great move towards renewable power generation and electrification in mines. Some mines are still fundamentally stuck on old values and do not want to rock the boat, and in some cases the capital costs of moving to renewables is a little prohibitive. Companies that place emphasis on sustainability are now already thinking how they can implement technologies that are more environmentally friendly, and which contribute to a carbon neutral future. Mining houses need to start taking action and look at alternative power sources to reach a zero carbon footprint goal. ■

Robert Vallis

President and CEO,
SIGNATURE RESOURCES

> We are now in a position to rapidly deliver steady news-flow and shareholder value directly proportional to the number of meters we are able to fund and drill.

Can you highlight some key milestones achieved at the Lingman Lake Gold deposit over the past year?
Our 100%-owned high-grade gold project presents a strong growth opportunity with 234,000 historical ounces grading at approximately 7 g/t as a start point, in the back yard of the Red Lake mining district. We have developed our exploration camp and all the logistics around it to be as low cost as possible, while operating 24/7. We own our two drills supported with our own drill crews and consumables as the industry is currently challenged with an approximate four to six-month delay on attaining consumables. We experienced some challenges in the summer with wildfires in the region shutting down operations but managed to reclaim the lost time quickly to restart drilling in September 2021. We raised over US$5.5 million in 2021, which has gone towards significant regional and local geophysical data collection for optimal drill targeting, positioning our drill camp to operate 24/7 with two rigs, and starting a 10,000 m drill campaign. We are now in a position to rapidly deliver steady news-flow and shareholder value directly proportional to the number of meters we are able to fund and drill.

Can you elaborate on Signature's current balance sheet and the company's financing strategy?
Signature will be looking to add fuel to our tanks before the end of 2021 to maintain the drilling momentum into 2022. We have several warrants due early December 2021, which we expect to provide further buoyancy in our share price. Our financial strategy going into 2022 continues to be to financially maintain drilling and regional exploration efforts at our installed capacity as consistently as possible to maximize in-situ gold ounce growth, advancement towards additional discoveries, and its overall value delivery to shareholders.

Can you elaborate on the connectivity and ease of access to the Lingman Lake project?
The Lingman Lake project is located approximately 40 km East of Sachigo Lake First Nations in Ontario and 55 km from Red Sucker Lake First Nations in Manitoba. Power infrastructure development into Northwestern Ontario communities continues over the next two years according to current published planning. Mining projects and communities lying within these areas are poised to benefit greatly from this infrastructure development. I believe that this development acts as a unifier between mining projects and nearby communities and paints a picture of an exciting, viable future for the communities and mineral industry in this jurisdiction.

What is your outlook for the fundamentals of gold for the next few years?
Global spending is increasing despite a severely constrained global supply chain that is driving inflation up while other parallel risk factors have also gone up proportionally, including new variants of Covid and China-US relations. Many other risk elements are steadily coming into play too such as increasing extreme weather events. Our project experienced this first-hand this past summer with the regional wildfires and drought. All these risks ripple through and into all industries, including mineral exploration. Global risk keeps ratcheting up and I think that at some point soon the gold price will start moving again in an upward trend in tangent with this rising risk fundamentals.

If you had to place your confidence in gold equities vs. gold bullion, which will you choose and why?
I believe the fundamentals supporting higher gold price underpins the view on the value of gold equities. If we take this view and agree that there is an optimistic path forward for the gold price, then gold equity values depend directly on the performance of said equities to deliver value to the market rapidly and in the most meaningful, sustainable way. If you identify a gold company which is positioned for value growth success and can deliver results consistently, then you have a strong case for a gold equity investment. I believe there is a strong investment case for junior gold exploration equities that can move up the mountain of growing value generation and prompt delivery and Signature Resources checks all these boxes. ■

James Tworek

CEO,
ELEMENT 79 GOLD

> I firmly asset that cash flow is the queen that actually runs the kingdom. If you can cover your selling, general and administrative expenses with the cash flow generated by one asset, you have significantly more latitude to feed your team while not burning treasury funds, which, in my opinion, should be used for exploration or bringing mines to production.

Can you elaborate on the letter of intent Element79 has with Plutus Gold to ultimately acquire the Snowbird property?
We recently finished our work plan at our Dale property in Ontario, and our focus is now set on our M&A strategy to acquire easy to develop properties that we can add value to. The Snowbird property has seen a significant amount of historical work done. Our goal is now to conduct the analytical work to prove what the historical and recent drills yield. We have established that it will take approximately 10,000 to 20,000 m of additional drilling to prove up the resource, and as of December 15, we have completed a 3,000 m drilling program. The work is actually done by Plutus Gold with which we have an LOI in place. Element79 has opted to finance Plutus Gold's fall drill program via a drawable loan facility up to C$1.1 million in order to facilitate the fulfilment of Plutus Gold's final obligations remaining under the Option Agreement between Plutus Gold and Gitennes Exploration. We have already started the process of obtaining new mining permits for the next five years.

Is Element79 actively looking for more acquisitions?
The acquisition of Plutus Gold and the Snowbird property is part of our extensive M&A strategy and is only the first of several potential opportunities. We are very interested in expanding into the US and are looking at potential acquisition properties in Nevada. Our acquisition focus is on easy to develop properties and formerly producing mines in de-risked and politically friendly mining jurisdictions, which we can turn back on and develop within a relatively small capex budget and short timeframe to be able to bring cashflow into the company.

Can you elaborate on the Dale property and the advantages of operating in Timmins?
The acquisition of the Dale property was paired with the gentleman that had done the most exploratory work on it over the past decade. He helped our Thunder Bay team with the work-plan, including sampling, trenching, prospecting, and following up on the drone based magnetic resonance which we completed earlier in 2021. Timmins is a great district to have a gold play in, and the Dale property was a solid starter kit for Element79 to get up and running with.

Element79 has a C$5 million equity capital facility agreement with Crescita Capital. What will this capital be used for?
With regards to the Dale property, Element79 did a small raise just prior to the IPO and had enough cash in hand for both the startup costs and the required work load for 2021/22. Our agreement with Crescita Capital is an equity draw down facility where we have to advise them 10 market days in advance for funding. We intend to use this financing for the acquisition of the Snowbird property and for what we are doing to close on the potential portfolio of properties in Nevada. By closing these intended acquisition deals, we will have melted through approximately C$3,5 million of the equity facility. Crescita Capital is onboard with our strategy and are open to the possibility of extending the equity facility dependent on Element79 reaching its milestones. We are also on the cusp of launching a fall 2021 financing campaign where we intend to raise C$2 million hard capital and C$1 million in flow through. The flow through funds will go towards further development of the Dale and Snowbird properties, and the hard capital into SG&A and the Nevada acquisition.

How do you see the gold landscape evolving as we move towards a green revolution?
Moving forward, I believe that globally, we will be seeing increased uses of gold, in terms of volume, as industrial demand goes up, as well as specialization uses such as electrification and space travel. There is going to be an increasing case for the need for precious metals, and Element79 is here to prove these metal resources up and get mines into production to meet this demand. ■

Stefan Spears

Chairman and CEO,
INVENTUS MINING CORP.

> Our focus remains on precious metals, but in some of our drilling, cobalt, copper and nickel contribute a significant portion of the metal value.

Could you give us an overview of Pardo and Sudbury 2.0?
Pardo is the largest and most advanced paleoplacer gold project in North America. Major deposits of this type have become mines in South Africa, Ghana, Brazil and Australia. Pardo is basically a flat-lying gold deposit at or near the surface, which presents the opportunity for very low cost mining. The question becomes where to process it since we do not have a mill. We are fairly close to Sudbury, but those mines are typically producing nickel-copper. It would make sense for us to have a cooperative arrangement with a nearby operation. We are currently conducting test trial mining at Pardo, which will be processed in Timmins, and we hope to develop a maiden resource estimate in 2022 and continue mining and producing cash flow at a small scale, if possible.
Our second project is called Sudbury 2.0 because our work has really identified hitherto unknown exploration opportunities right to the east of the Sudbury mining district. Our projects are situated above one of the largest positive magnetic and conductive geophysical anomalies in the world, called the Temagami Magnetic Anomaly. We have multiple polymetallic showings ranging from super high-grade palladium-platinum-gold-copper with samples grades up to 31% copper equivalent, and another area with a 44 m mineralized intersection of gold-cobalt-nickel in drilling. This winter, we are conducting a 5,000 m drilling program following up on very promising results from the Spring of 2021.

How do you hope to make a discovery at Sudbury 2.0?
Our primary method of exploration is detailed fieldwork and prospecting followed by drilling. There is a lot we do not know about the East Range of Sudbury, but our geologic models predict it has potential for ore deposits. Earlier in 2021 we acquired some land that had advanced prospects, meaning they have been drilled historically with good results for gold and copper. We did some drilling in early 2021, which again returned good results. Over the summer, we conducted a detailed 3D induced polarization (or IP) survey to help target the next phase of drilling. The survey showed a very nice large anomaly ready for drilling, which started in January 2022.

Will Inventus Mining shift its focus towards base and battery metals?
Our focus remains on precious metals, but in some of our drilling cobalt, copper and nickel contribute a significant portion of the metal value. We also recently acquired a property specifically because of a cobalt occurrence, where one of our samples returned 1.2% cobalt, which is equivalent to 12 g/t Au or more. We are going to conduct more cobalt-focused exploration given the strong demand. This property is early stage, but what we see on surface is analogous to the Cobalt Hill property that we drilled in 2021. We are also exploring for palladium and platinum.

How are you currently funding your operations and when will you need another raise?
When I became CEO in 2016, Rob McEwen and Eric Sprott were already large holders of Inventus. Since that time, Rob has increased his stake to over 20%, and Eric is still there with 10%. We have also added a third mining magnate with 7% and a handful of high-net-worth individuals as shareholders. Management and advisors hold about 5% and have been consistently buying in the market. The unique nature of our projects with large risk/reward, coupled with our efficiency at using their capital attracts this type of investor. We have not done a financing since the beginning of 2020 and expect to do another raise at the appropriate time in H2 2022.

What is your outlook for the mining sector?

My thesis has always been that it will be challenging for mining and metals whenever the broad market is performing extremely well. The generalist capital ignores the resource space when you have the NASDAQ and S&P at all-time highs, allowing for very little risk with a diversified approach. If central banks continue to print money and pump it into the system, we could see even higher highs, however, history shows that it will invert eventually, at which point investors will pile into undervalued assets, and that is when the mining industry really shines. ■

Transition Metals on the Rise

INCREASED DEMAND FOR COPPER, NICKEL AND PALLADIUM

With the transition to green energy and electrification, copper and nickel are in the spotlight. Conquest Resources' key exploration target is high-grade massive sulphide copper. Tom Obradovich, president and CEO of the company, came across the Copperfields mine, which resembled a Sudbury-style deposit, and has focused on the unusual mineralization found in the Temagami magnetic anomaly ever since. "I have been accumulating land in the area for approximately 20 years under my private company and the last piece I needed was owned by Conquest Resources, so it was agreed with John Kearney, the director of Conquest, to merge both companies," said Obradovich.

> *The rate of new mines to replace depleted production is lagging metal demand. Ignorance and a lack of understanding of the mining process and environmental standards we ad– here to in the industry are also challenges facing are industry.*
>
> ***– Tom Obradovich, President and CEO, Conquest Resources***

The company now controls over 350 sq. km in the area. There is evidence to sustain that the Temagami magnetic anomaly could indeed be related to Sudbury's Igneous complex, where the world's second largest nickel camp was formed. Sudbury aged rocks were found following a 2.2 km drill hole at 19,189 meters deep into the anomaly. "Inventus, a company we are associated with, recently made some significant discoveries in the Rathburn area and found nickel, cobalt and gold deposits in and around the area east of us and west of Sudbury," added Obradovich.
With Kirkland Lake Gold investing US$1.3 million for exploration, Conquest Resources has raised over US$5 million through an IPO to continue operations.
Magna Mining raised C$7 million concurrent with its reverse takeover public transaction to develop the Shakespeare deposit and surrounding land package. The past producing Ni-Cu-

PGM project is in one of the most recognized nickel mining districts in the world, about 70 km south west of Sudbury. Around C$2 million have been allocated for a 9,000-meter drill program predominantly around the project's gap zone. In September 2021, Magna announced success at the PGM nickel-copper deposit, which is 5 km from the Shakespeare deposit. Magna has launched a C$3 million charity flow-through with PearTree Securities to fully fund its 2022 exploration targets. "One of the options we are looking at is the restart of the toll milling operation used a decade ago when the project went into production, which would be a very low-cost, fairly near-term potential cash flow generator. We hope to have some resolution on that sometime in Q1 of 2022," said Jason Jessup, Magna Mining's CEO.

Before the rise of base metals in 2021, palladium had been the star of 2019 and 2020, experiencing an astounding price move from US$966/oz in February 2018 to US$2,800/oz in February 2020. While the price has hovered around a very healthy US$2,000/oz mark for most of 2021, palladium's shine has been dimmed to some extent when viewed in comparison to copper.

Palladium is used as a catalytic reactor within the motoring industry and the metal is now being used in fuel cells to power vehicles. Both palladium and platinum are coveted as a part of gasoline engine auto catalysts that lower carbon emissions. With the former metal being in a current supply deficit, and rising demand to meet carbon emission standards in Europe, China and India, palladium is bound to rise again. Certainly the rise of electric vehicles will impact catalytic convertor demand, but palladium is projected to play a role in the shift away from hydrocarbons. Renewable-sourced hydrogen used to produce electricity via fuel cells is now in the spotlight and will require PGMs for catalysts.

"Clean Air Metals has shifted its focus towards platinum because it is only with platinum that water is the waste by-product in fuel cells," said Abraham Drost, CEO of Clean Air Metals.

With other metals, the residue is hydrogen peroxide. Clean Air Metals' 43-101 mineral resource statement stated a 1.8 million oz palladium equivalent resource at its Thunder Bay North project.

Generation Mining completed a FS in Q1 2021 for its Marathon palladium-copper project in northwestern Ontario, with attractive results for both metals. "Results demonstrated a 30% Internal Rate of Return (IRR), a C$1.07 billion NPV and a 2.3-year payback at a US$1,725 palladium and US$3.20 copper price," said Kerry Knoll, executive chairman of Generation Mining.

The Marathon mine requires an initial capex of C$665 million to be built, and with palladium and copper trading well above the metrics used in the company's feasibility study, there should be appetite for financing the project. The Marathon airport is located within the project's property and the Trans-Canada Highway traverses it. A C$1 billion investment by the Ontario government to build a northern power line in the province also means that the power line goes right over the Marathon project. "This allows us to make use of the grid, which only has a 4% carbon footprint," added Knoll.

New Age Metals' flagship River Valley palladium property, sitting about 100 km northeast of the Sudbury metallurgical complex, is now a multi-million oz primary palladium resource. With a PEA completed in 2019, it aims to have a FS completed within five years to move into production. "Tesla has already bought into a mine in Nevada, something you normally do not see — where automakers come down and actually get into the development and mining of lithium," said Harry Barr, New Age Metals' chairman and CEO, who views Canada as a key destination for lithium projects, given the proximity to manufacturers.

The Timmins mining region saw exploration programs rise in the fall of 2021, as a huge drive to develop a new generation of mines. Canada Nickel Company has continued proving up the Crawford nickel sulphide project - just north of the region. Its PEA projects a mine-life of 25 years. It is clear that new technologies and innovation are making waves in previously-explored land to reach new discoveries.

Northern Ontario hosts an abundance of critical metals needed for the transition economy. Government, associations and companies are working in tandem to transform the province into a significant player in the EV market by generating mineral supplies nearer to assembly plants. The US has also expressed an interest in bringing supply chains closer to home, and the Canada-US Joint Action Plan on Critical Minerals Collaboration has emerged to solidify both nation's manufacturing supply chains moving forward. ■

Tom Obradovich

President and CEO,
CONQUEST RESOURCES

Our plan is to find one of the biggest Canadian deposits ever.

What drew you to Conquest Resources and the Belfast Teck-Mag project?

I was a prospector in Kirkland Lake and a small mine discovered on Temagami Island caught my attention. It was known as the Copperfield's mine and was hosted unusual mineralization and resembled a Noranda-style deposit, but it was more like a Sudbury-style deposit. The historic mine sits above the Temagami Magnetic Anomaly, which is one of the largest positive magnetic anomalies on the Earth. I have been accumulating land in the area for approximately 20 years under my private company and the last piece I needed was owned by Conquest Resources, so it was agreed with John Kearney, Chairman of Conquest, to merge both companies. We had ambitions for a large regional exploration project, which we undertook, and Conquest now controls over 350 sq.km. of land in this highly prospective area. We always thought that the former-producing Golden Rose mine on our property was perhaps related to a VMS deposit. It was thought that the area had the potential to host magmatic nickel-copper deposits similar to what they had on Temagami island, VMS deposits and IOCG deposits similar to the Olympic Dam deposit in Australia. Our plan is to find one of the biggest Canadian deposits ever.

What is the relationship of the project to the Sudbury Igneous Complex?

In 2014, my private company set out to study the relationship, if any, between the Sudbury Igneous Complex and the Temagami Magnetic Anomaly. Therefore, a 2.2 km hole was drilled and, after examining it for four years and a PhD study, Sudbury aged rocks were discovered at 1,989 meters deep into this anomaly. This led us to believe that the Temagami Magnetic Anomaly could be related to the Sudbury Igneous Complex. In fact, from a magnetic spatial point of view the two anomalies are a mirror image of each other.

Can you elaborate on the financing strategy to execute all your plans?

When the company went public over a year ago, approximately US$4 million was raised between flow through shares and hard dollar financing. We also had an institutional investor who was fascinated with the project and was interested in high-risk, high-reward projects. Kirkland Lake Gold invested US$1.3 million for exploration. In total, we had just over US$5 million, which we are spending carefully on preliminary exploration. Our phase one drilling is about a US$3 million program and we are coming to a point where we have 24 of the 34 targets drilled. We also have a nickel-copper-PGE target with a large anomaly that we had drilled in parallel to the conductor. In addition to that, we plan to drill two IOCG targets during Q2 of 2022.

Which are the greatest challenges faced by the industry as we enter the era of electrification?

The rate of new mines to replace depleted production is lagging metal demand. Ignorance and a lack of understanding of the mining process and environmental standards we adhere to in the industry are also challenges facing are industry. Companies like Patagonia and Arcteryx refuse to sell their products to extraction companies, even though the equipment they use to make their clothes are certainly not made of granola, they rely on metals at every stage of manufacturing. Their communication equipment, shipping systems, and warehouses also rely on mined products. This anti-mining corporate attitude is not very well thought out. Mining sites around the world take up less surface area than Walmart parking lots.

Is the green revolution truly as clean as we want it to be?

There are 5.8 million BTU's or 1,700 Kwhrs in one barrel of oil. It takes a lot of solar panels to produce that kind of energy. Producing the metals required for EVs will also lead to increased greenhouse gases. It is unrealistic to assume that we will somehow eradicate fossil fuels. What can be done, however, is to manage the exhaust of fossil fuels using better technologies to recover carbon from the exhaust fumes. It is only if the world disintegrates that mining will cease to be relevant. The world cannot operate without mining as it is crucial in everyday life - electronics, talc, clay, gravel, oil, even breast implants are made of mined silicon. ■

Kerry Knoll

Executive Chairman,
GENERATION MINING

> We will be producing some of the cleanest palladium worldwide.

Can you highlight some of the latest developments at Generation Mining's Marathon project?
Generation Mining is actively developing our 100%-owned Marathon palladium-copper project in northwestern Ontario. We completed a feasibility study in March 2021, which demonstrated a 30% IRR, a C$1.07 billion NPV and a 2.3-year payback at a US$1,725 palladium and US$3.20 copper price. The study showed that it would produce approximately 245,000 oz/y of palladium equivalent, and putting this into a gold equivalent, it would be about 300,000 oz/y. The Marathon project is significant and would rank in the top 10 precious metal mines in Canada. The capex to build the mine was listed at C$665 million, which is quite reasonable for a mine this size. Generation recently signed a C$240 million streaming deal with Wheaton Precious Metals to help fund the construction, and is actively seeking project debt.

Can you elaborate on the permitting process?
We still have four main jobs to complete moving forward, the first one with the longest timeline being seeking approval of our environmental assessment (EA). We are doing permitting alongside the EA review so that we are ready to go with the permits as soon as possible after EA approval. There are a lot of different permitting routes mining companies in Canada can be in, and the one Generation Mining is in is called a joint review panel, which was jointly appointed by the Province of Ontario and the Federal Government. This panel has a defined amount of time to review the project as they look at the submissions we have given them and come back with questions. When we get to the point where there are no more questions, community hearings with all the interested parties will follow. The panel will make a recommendation to the various ministers of the environment, federally and provincially, who will then make their decision within 90 days, and if positive, the company will be in the position to attain permits. We expect this entire process to take us into the middle of 2022.

How is Generation Mining developing community relations and how are these evolving?
Generation Mining has signed a letter of intent with a large First Nation group close to our site, the Biigtigong Nishnaabeg, and are in the process of concluding a full community benefit agreement with them. We are also in discussion with the Pays Platt First Nation, where we are reasonably close to getting to the letter of intent stage. We are also working with other peripheral First Nation groups who are interested in the environmental impacts of the project. We have close relationships with the surrounding communities and the Mayor of Thunder Bay has announced that the Council is backing our project. The town of Marathon is also very supportive towards both mining in general and our project.

Can you elaborate on the ease of access to the Marathon project?
The project has fabulous access with the Trans-Canada Highway coming through the property, and the town of Marathon very close by. The Marathon Airport is actually on our property and there is a CPR (Canadian Pacific Railway) main line coming through the town. The government of Ontario has also spent approximately C$1 billion building the East West Tie power line across Northern Ontario, connecting the South with Thunder Bay to have a truly single grid across the province. This powerline goes right over the Marathon property, allowing us to make use of the grid which only has a 4% carbon footprint. We will thus be producing some of the cleanest palladium worldwide.

Can you elaborate on Generation Mining's financing situation to push forward the project?
At the end of August 2021, Generation Mining had approximately C$12 million in the bank and we are fully funded for the permitting process. We do however need to raise another C$50 million to get to construction, including the detailed engineering of the project and ordering equipment which has long lead times such as the mining fleet. We are taking a non-diluting financing approach and looking for bridge financing, such as streaming, royalties, or debt-equity to get us to construction. ■

Abraham Drost

CEO,
CLEAN AIR METALS

> Clean Air Metals realizes that the basket of metals we have at our Thunder Bay North project are on point for the direction that the world needs to go.

Can you explain the usage and advantage of platinum versus palladium?
Palladium has seen its most efficient use as a principal metal for catalytic conversion of harmful exhaust gases in gas burning internal combustion engines (ICE) and gasoline-hybrid electric vehicles. Platinum is the metal of choice in diesel burning internal combustion engines, however with the trend moving sharply away from diesel fuel use, platinum has somewhat fallen out of favor. The climate change imperative has set a strong push towards continued de-carbonization and clean energy transportation solutions. In this context, we believe platinum is a potential metal of choice in the medium to long term. Platinum is not only a precious metal with demand from the jewelry and catalytic conversion markets, but is also the element of choice for anode and cathode construction in the increasingly mainstream hydrogen fuel cell market. Platinum may be seen as the metal of the future in terms of its green energy applications and also in primary electrolysis of water to form green hydrogen and oxygen. Hydrogen is a completely carbon free and abundant source of energy.
It is only with platinum as anode and cathode that as hydrogen and oxygen are combined in a fuel cell, electrons are freely released to a battery and water (H_2O) is the waste byproduct. We note that non-PGE metals typically produce undesirable hydrogen peroxide (H_2O_2) as a waste byproduct. As the lowest-cost PGE metal presently, we believe that platinum has a strong growth trajectory in the burgeoning hydrogen transportation market. Platinum, palladium, and rhodium markets are potentially supply constrained. Palladium, because of increasingly more stringent emission standards has been profoundly short, so prices have risen to over US$2,000 per ounce. Platinum while in balance in the present markets, may come increasingly into short supply given its importance in the clean energy sector.

How will Clean Air Metals be taking part in the green revolution, and can you highlight some developments at the company's projects?
Clean Air Metals recently published a base case Preliminary Economic Assessment (PEA) on the Current and Escape deposits of the Thunder Bay North Project near Thunder Bay, Ontario returning a post-tax NPV5 of C$293m and 25.2% IRR. A total mill feed of 12Mt at 7.3g/t PtEq at a cash cost of C$86.61/t milled is projected to produce payable metals of 629 k oz Platinum, 618 k oz Palladium, 111 M pounds Copper, 57 M pounds Nickel, 38 k oz Gold, 850 k oz Silver (2,886koz PtEq) over a 10-year LOM. Exceptional grades provide a 59% operating margin in the first 5-years of production, offering a rapid 2.6-year payback on initial capital costs of C$367m, which includes a >20% contingency allowance. Clean Air Metals understands that the basket of metals at the Thunder Bay North project is uniquely positioned to support the clean energy direction that the world needs to go.

How do you see the reduction of emissions versus the need for fossil fuels to keep the green revolution going panning out, and does one offset the other?
It is all about balance. There is room to grow on the green energy side and targets set around emission reductions are achievable in a balanced and orderly manner. The energy transition cannot happen overnight as we observe that the entire world is still very dependent on hydrocarbons for basic energy and heating requirements. The energy crisis in Europe over this winter underscores this reality. For example, Norway still relies heavily on its hydrocarbon economy, but is taking a leading role in developing green energy initiatives as they realize that long term, the clean energy transition must and will take place. The world has become increasingly more urban and we have large cities and populations to service. The problem is that we cannot all go back to living on the farm and growing vegetables, being almost self-sustainable. With urbanization comes the need for waste, water and sanitation services and lifestyle options that require reliable electricity on demand. Although people are willing to sacrifice to some extent for the planet, lifestyle demands will not change dramatically as power consumption shifts to more sustainable, renewable, clean energy solutions.

Can you elaborate on Clean Air Metals' community relations and engagements?
During COVID, we have been in consultations via virtual platforms and continue to actively engage with local First Nations, municipalities, and other stakeholders. This exercise is being carried out with integrity and respect to establish positive and constructive participatory relationships. Clean Air Metals is committed to continual and meaningful engagement with First Nations and Metis communities as well as other stakeholders to develop our project in a sustainable way. The Board of Directors and management at Clean Air Metals are focused on building and maintaining a positive health and safety culture and maintaining the highest standards of operational integrity. ■

Vance White

President and CEO,
NOBLE MINERAL EXPLORATION INC.

> **Noble Mineral Exploration has maintained the project generator model, securing numerous partnerships while continuing to feed the pipeline with projects.**

What is the outlook for Project 81 following the sale of a large portion of the property?
About 30,000 hectares of Project 81 have either been sold or are in the process of being sold to Canada Nickel. This is related specifically to all of the nickel targets that exist on the project area. The remaining balance of the land includes volcanic massive sulphide (VMS) and gold targets. Moving forward, we are going to be focusing on a number of additional projects that we brought in to replace those that were in the Project 81 area. We now have a significant shareholding in Canada Nickel, of which 3.5mm shares will be dividended out to the Noble shareholders, thereby providing them with a direct interest in what Canada Nickel is doing and more particularly their Crawford nickel deposit.

Which properties will you be focusing on throughout 2022?
Over the next six months, apart from the drilling that is currently underway at the Dargavel-Aubin Township Gold Trend near Cochrane, we are going to be putting a drill on our Nagagami carbonatite niobium/rare earth project near Hearst, Ontario. This will likely begin sometime in March. In February, I expect that we will mobilize a drill into the Buckingham graphite property that we acquired just east of Ottawa. There was an NI 43-101 report completed on this property in 2017 showing that the grades are very good and that the recoveries are in the order of 94% to 96%. We have made some initial approaches to the property owners to the south of us, Gratomic, who are focusing on their graphite projects in Namibia and in Brazil.
Our Mann Township properties are being optioned by Canada Nickel, but this is a deal that needs final approval with the Venture Exchange, and subsequently our shareholders. We have called a shareholders meeting for March 14th, 2022, on this matter.

How have Omicron-related challenges compared to initial pandemic delays?
It is a challenge to get programs underway and in Ontario; we have gone back into a quasi-lockdown in 2022. Mining and exploration are still considered an essential service, but the difficulty is that the service providers are short staffed and we have to maintain social distancing. Assay labs are taking up to 16 weeks to turnaround results, which makes it very difficult to balance the program in the field and news flow. Drilling crews are limited and in high demand.

How has the Ontario government supported your operations?
From a financial standpoint, we applied for and received a C$200,000 grant, which is being applied to our Dargavel-Aubin program. I suspect we will be able to apply for subsequent grants with the Ontario Junior Exploration Program as well. Currently, we have about C$2 million in cash and about C$22 million in security positions. Of that, about 3.5 million shares of Canada Nickel will be dividended directly to our Noble shareholders. After approval and closing of the current deals being put to shareholders we will retain about 3 million shares of Canada Nickel, and I fully expect that that those shares are going to see a significant increase in value. We have also noticed that all of the digital filings with claim registrations, coordinated by the Ontario government, are working very well.

Do you have a final message for international investors?
Noble Mineral Exploration has maintained the project generator model, securing numerous partnerships while continuing to feed the pipeline with projects. We are always looking for partners with exploration expertise, funding, small cash and share position, and then a joint venture at the tail end. This is similar to what we did with Spruce Ridge Resources, where we increased our holdings of Spruce common shares up to 18 million. Our focus has remained that of being a project generator, but to also acquire and explore underexplored areas in order to take the early risk out of a project and to bring a partner in at a later date, where we really could find elephant sized deposits. We can complete an airborne program, take that data and to go into an early drill program. If we come back with some interesting results, then we can start to look for partners.■

Jason Jessup

CEO,
MAGNA MINING

You went public on the TSX-V in May 2021. How far will this take your operations?
The Shakespeare deposit is located near the Sudbury basin. Our current deposit has 14,4 million tonnes of open pit indicated resource and an additional 1.7 million tonnes of open pit inferred resource, plus underground resources.
We raised C$7 million concurrent with our RTO public transaction and we have allocated a budget of approximately C$2 million to our 9,000 m drill program. The majority were allocated to drill in and around the gap zone of the Shakespeare deposit, as well as testing some targets and extensions of the resource. The remainder of that program was allocated to some of our regional targets, which we believe have great potential for discovery. We were successful in the PGM nickel-copper discovery, announced in September 2021. We launched a C$3 million charity flow through, and that will completely fund our exploration in 2022. ■

Grant Mourre

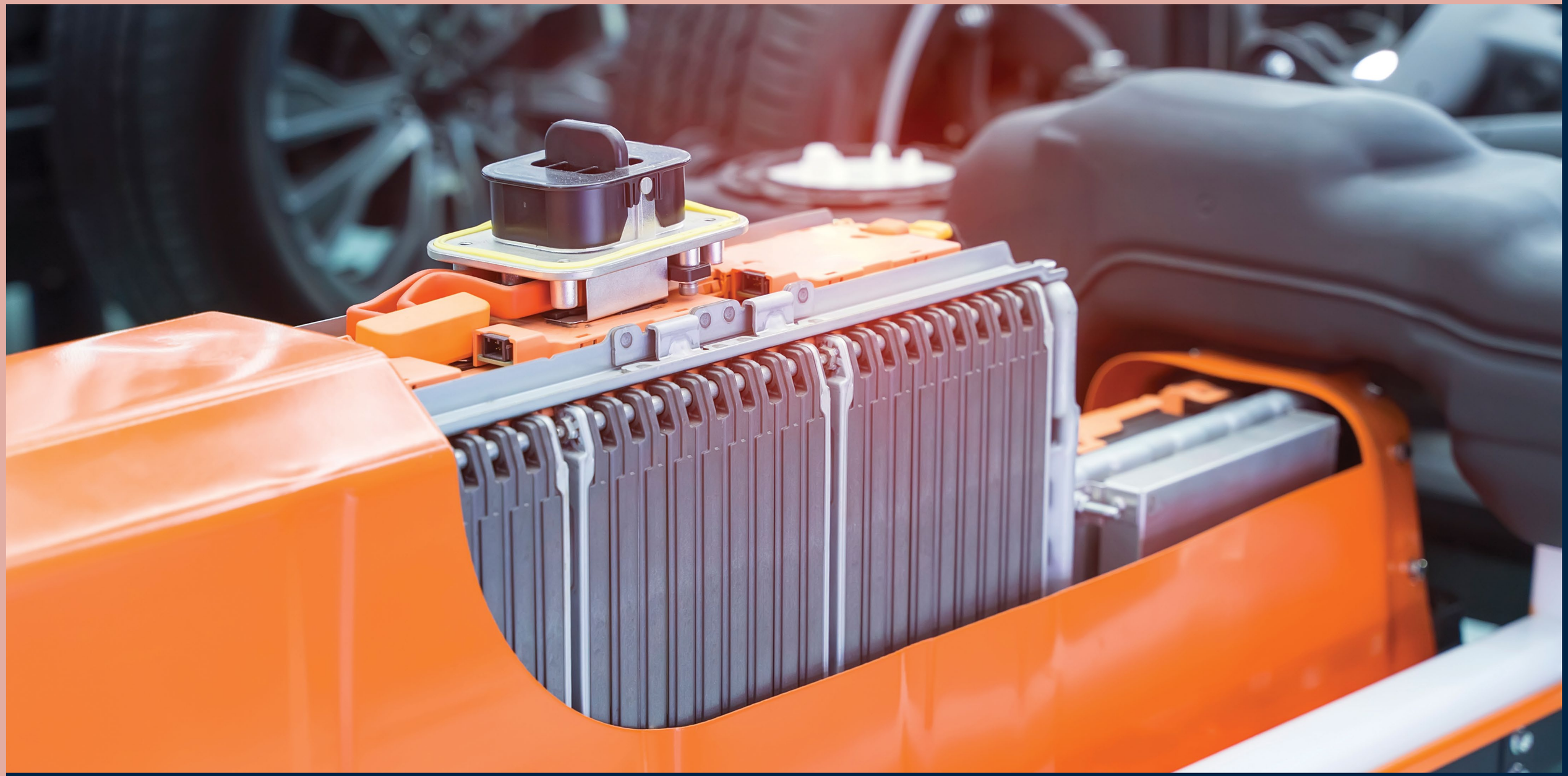
CEO,
SPC NICKEL CORP.

Could you provide some highlights since you started trading on March 8th, 2021?
We took the leap into getting listed in March of 2021. We felt it was the right time to take the company public given the interest in nickel with batteries and EVs. We are actively exploring within one of the few established nickel camps in North America, Sudbury.
Our AER-Kidd project is book-ended by two world class assets — Vale's Totten mine and KGHM's Victoria project, which are both large high-grade nickel/copper/platinum/palladium deposits. Drilling is targeting the property for a "Totten-sized" deposit at depths greater than 1,000 m, while also testing the property for small zones of mineralization above 1,000 m. We also hold a 100% interest in the more advanced Lockerby East project where there is currently a near surface 10 million tonne resource, grading approximately 0.6% NiEq. The project has over 100 million pounds of nickel in the ground plus 70 million pounds of copper. Our third project, Janes, is a palladium/platinum/copper/nickel opportunity just west of Sudbury. ■

Michael Gunning

President and CEO,
VR RESOURCES

What impact could your work at Hecla-Kilmer and Ranoke have in terms of project size?
Hecla-Kilmer and Ranoke are located on a major crystal shear zone in northern Ontario that has been active for almost 1.9 billion years. It hosts a number of large, high temperature, Proterozoic alkaline and carbonatite intrusive complexes. Their unique mineralogy and chemistry underscores the potential for a large-scale hydrothermal breccia system with IOCG affinity. VR is exploring the Kapuskasing shear zone using new exploration technologies and applying modern carbonatite and IOCG mineral deposit modeling. The hydrothermal footprint at Hecla-Kilmer exceeds a kilometer in size, and occurs within a polyphase complex some six kilometres across.
Even at this earliest-stage of drilling at Hecla-Kilmer, the potential for niobium and rare earth elements is clear. Hecla-Kilmer is the type of target with the scale needed to address the concerns of government bodies across North America with regard to the shortage of domestic supply of critical metals and rare earth elements. ■



ESG AND TRANSITION METALS: THE BATTERY MATERIAL SUPPLY CHAIN

"No company is perfect. However, the willingness to submit to an external, impartial assessment and being transparent by publicly disclosing the underlying scores and data, warts and all, demonstrates a mature, secure leadership team that has a genuine commitment to ESG. That is what investors are looking for."

- Jamie Strauss,
CEO,
Digbee

The Move to Combat Climate Change Gathers Pace

A TRANSITION BORN OF NECESSITY

The transition towards electrification and the 'green-revolution' is one born out of necessity. The impact of climate change has rippled across the world, with U.N. Secretary-General António Guterres speaking of a "code red for humanity" following a report generated by scientists at the Intergovernmental Panel on Climate Change (IPCC). Only the most optimistic out of five proposed future scenarios presents a world that meets the Paris Agreement's goal of keeping global warming capped at around 1.5 degrees Celsius. Each of the five scenarios in the report detail varying degrees of irreversible human impact on Earth. An urgent lowering of carbon emissions is required and electrification and the green energy revolution have been presented as the means to achieve this. Energy research and consultancy firm Wood Mackenzie forecasts that to limit global warming to 2 degrees Celsius by 2030, the following mining developments will be necessary: 20 new lithium mines the size of Greenbushes in Australia (the largest in the world); 10 new cobalt mines the size of Mutanda in DRC; 22 new nickel operations the size of Ambatovy in Madagascar.

For development on this scale to become even remotely feasible, greater acceptance of mining is paramount. In turn, mining companies are placing an emphasis on net zero emissions targets. "We have made the commitment to reduce our carbon footprint by 30% by 2030 and to have net zero emissions by 2050. […] Buying carbon credits to achieve this goal is our least preferred option. Instead, we expect to reduce our footprint by accessing renewable power, since 70% of our emissions are through energy consumption," said Jake Klein, executive chairman of Evolution Mining.

Many remain skeptical of the ambitious zero emissions target. "Becoming a fully electric-powered society will likely not occur by 2050," said Egizio Bianchini, head of metals and mining investment banking at Stifel GMP. "The world cannot overcome its addiction to hydrocarbons unless dramatic action is taken," he added.

A reliance on renewable energy does not mean that our carbon footprint can be reduced to zero. "There is more energy in a barrel of oil than in ten solar panel fields, and to manufacture solar panels, more carbon is created in the atmosphere than for the making of one barrel of oil. Producing the metals required for EVs will also lead to increased greenhouse gases. It is unrealistic and naive to assume that we will somehow eradicate fossil fuels," stated Tom Obradovich, president and CEO of Conquest Resources. "What can be done, however, is to manage the exhaust of fossil fuels using better technologies to recover carbon from the exhaust fumes", he added.

Further challenges are revealed when reliance on uncontrollable natural phenomena, such as wind, forces renewable energy companies to have fossil fuel power plants as backups waiting to be utilized. With the technology, innovation and resources we have today, the blueprint for a net zero carbon world by 2050 is not yet clear. Nonetheless, a change is necessary and demand will only increase. "A key driver for the market is the global green energy revolution which promotes electric and battery-powered vehicles. There is a solid demand for copper, nickel, battery metals and we see a healthy pipeline of projects," said Paul Healy, president of the Americas at Redpath Mining.

Though emissions are eliminated throughout use, vehicles must be charged, often relying on fossil fuel-based power sources to do so. "When people talk about net zero and zero carbon emissions, I do not think anybody really knows what that means since a footprint of some sort will always exist. One can only really mitigate," said Trent Mell, president and CEO of Electra Battery Materials (previously First Cobalt).

Solar and wind power are often presented as key solutions to shifting the pendulum, given that fossil fuels still control most of the world's energy mix, however, neither is yet capable of powering large-scale operations. The largest solar farm in the world, the Bhadla Solar Park in India, can only produce power for about four and a half million homes. However, wind power now makes up 4.7% of power generation in the US and 3.3% in China, and technology is rapidly evolving. "Instead of a fossil fuel backup, the possibility for a battery backup is there, and many companies have already started to incorporate battery backups for their renewable energy sources, where the batteries can also be charged on renewables," said Emily Thorn Corthay, founder and CEO, Thorn Associates.

To properly measure the impact that electrification and green energy has on the world, an umbrella vision approach must be taken. "The starting point here is reducing carbon emissions, but we need to mature our approach being cognizant of the inputs into the solutions. The lifecycle of these products needs to be a part of the equation, such as the concept of the circular economy. We cannot have an automotive company making electric vehicles, yet sourcing nickel, which has a high GHG footprint to produce the metal. You cannot make a solution that has a dirty process. We will need to move along the maturity curve to truly reach a net benefit for the world," said Ryan McEachern, managing director of MSTA Canada.

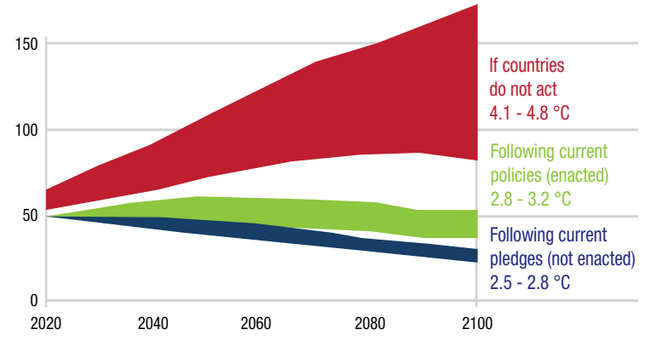
Abraham Drost, CEO of Clean Air Metals, spoke of Norway paving the way in the long-term green energy realm while still relying heavily on hydrocarbons. "We cannot all go back to living on the farm and growing vegetables…. Although people are willing to sacrifice to some extent for the planet, lifestyle demands will not change as they become more green energy intensive," he added.

In Ontario, mining companies can often connect to the provincial power grid accessing low cost electric power through hydro. "In Ontario, our electrical grid is essentially carbon-free, giving us a considerable advantage on GHG emissions. The whole supply chain must be green to achieve green inputs in operations and our association has been focused on delivering on Target Zero+ goals: that is, mining with zero harm to workers, zero carbon, and zero waste, while improving productivity," said Chris Hodgson, president of the Ontario Mining Association (OMA).

Roth Canada's Braden Fletcher believes the International Energy Agency's (IEA) 19% growth in energy demand by 2040 forecast cannot be solely based on renewables. "Nuclear is going to be a necessity. Global stockpiles are in decline, and that should be positive for uranium," he said. ■

How Much Worse will the Problem Get?

Emissions* and expected warming by 2100



*Emissions are in Gigatonnes of CO_2 equivalent

Source: Climate Action Tracker

Laurie M. Clark

Founder and CEO,
ONYEN CORPORATION

> ESG is ethically and financially necessary for companies in the current environment, so we wanted to help them navigate the complexities of reporting.

What led you to establish Onyen, and what are the company's milestones?
My experience with complex systems in the finance industry led me to tackle the challenge of ESG analysis and reporting, and inspired me to establish Onyen. ESG is ethically and financially necessary for companies in the current environment, so we wanted to help them navigate the complexities of reporting. Rather than having the company align with ESG frameworks worldwide, we take a system profile of the company and extract the standards that align with the company – it is an opposite but more precise approach.
The Americas are our primary market, but we are receiving attention from the UK, Europe and Australia. In the future, we will enter the Asian markets. Our service is subscription-based but we also offer a concierge service. The Onyen team consists of multilingual capital markets, technology, mining and oil and gas experts; and our ESG analysts under the concierge service – which consist of geoscientists, CFAs, engineers, environmental and land surveyors and lawyers - support the customer throughout their onboarding experience.

How does the Onyen system collate all the international standards and rating agencies?
The Onyen system is automated to provide mass data sets and output to all the rating agencies and standard frameworks. We upload metrics and standards in an automated fashion. Onyen prompts the customer to enter the relevant ESG information, analyzes it, and highlights potential issues. ESG reports are updated and published on our customer's websites

What pitfalls do mining companies fall into when navigating ESG?
All mining companies, regardless of their size, release big statements of ESG targets without providing the data and evidence to support them, also known as 'green washing'. These statements are not quantified. ESG risks can be long-term and minor improvements towards measurable targets will illustrate the company's sustainability journey. Onyen records performance against targets and helps management track progress on Onyen's 'Executive Dashboard'.
Companies may work hard in securing a license to operate and invest in community development programs, however, this is not often captured and disclosed in a manner that highlights how important it is to the company's success. Relevant documents, descriptions and pictures support disclosures on a scorecard accessible to all stakeholders. Onyen helps mining companies navigate their ESG journey and associated challenges.

What key goals or transitions do you want to attain moving forward?
Our vision is to first manage the ESG goals of mining and oil and gas companies globally in a cost-effective manner, and then tackle other global industry sectors. The system was built in six months. We launched in March 2021 and have exceeded every target that we set. The demand is overwhelming because companies have realized the importance of ESG disclosure to their financial wellbeing, and appreciate the Onyen systems' ease of use and powerful features that drive investment dollars to their company. The challenge for us now is to meet this demand while keeping a high quality of support. Our rigorous recruitment standards ensure we get the most skilled members on our team.
Our goal is to continue to simplify and automate sustainability reporting by leveraging our technology. It is extremely rare for a company to launch a product that perfectly fits the needs of its times but Onyen is that company.

What success story can you share with us about how Onyen supported a client?
As companies are realizing that they must respond to the disclosures, demand for our services has skyrocketed. One of our guiding principles is to help companies access alternative sources of capital, so when the ESG report is published, the outcome should be a financial reward. In two instances, it increased financial commitment from investors. One case in particular I would like to highlight is Troilus Gold, who utilized our system and finalized their first robust ESG report. Their European investors requested specific ESG disclosures and because they were on the Onyen system they were able to provide the investors with the information requested, and exceeding their fundraising objective. An ESG report helps companies measure their improvement, communicate on their corporate citizenship, and importantly, it is a function of access to alternative sources of capital. ■

Mining with the First Nations

LAYING THE GROUNDWORK FOR SOLID FOUNDATIONS

Geological Technician from Webequie First Nation sets up survey equipment. Image courtesy of Noront Resources.

"The industry needs to do a better job of showing what it does well. There is a communication and trust deficit between communities and the perception of what mining companies are doing," said Ryan McEachern, managing director of MSTA Canada.
The social contract is no longer about ticking a box in order to move a project forward, but rather an opportunity to re-build trust, exemplify the positive impact that mining companies can have on communities, and integrate a fractured society.
Working in tandem with First Nation communities, The Corridor to Prosperity is an initiative that aims to connect Ontario's Far North to infrastructure, power and roads. This would allow northern communities to become a part of the economic prosperity that can be unlocked mining. Ontario has committed C$1 billion to support the year-round road network.
The Corridor to Prosperity aims to create a sustainable pathway that connects the Far North and benefits the original inhabitants and mines alike. Establishing agreements with Indigenous communities in proximity to mine sites and creating opportunities for these communities to become involved with the industry have often been led by the mining companies. However, in this instance the process has been streamlined by having First Nations communities as proponents for the cause.
"Given that First Nations communities have the traditional territory and land use, a better model emerged in which the First Nations themselves would lead the road development and permitting," said Alan Coutts, president and CEO, Noront Resources.
Environmental assessments for the Corridor are scheduled to take at least until Q4 2023, at which point the road can begin to be built. Coutt's best estimate is to have a fully permitted road in 2026.
Speaking to the Wabun Tribal Council, it would seem that, though a palpable amount of progress has been made, there is still much that needs to change. "We have met some captains of the industry that have been fantastic, but there are still those out there who believe they have a free entry system and that First Nations should just remain silent while they collect their government checks. Let's go forward, not backwards," said Jason Batise, executive director of the Council.
Ontario is home to 133 First Nations communities, representing 23% of all Indigenous peoples in the country. The province has more remote communities than any other region in Canada, with 30 First Nations only accessible by air or ice road for large parts of the year. Sudbury, Thunder Bay, Sault Ste Marie, Timmins, Ottawa and Toronto have large Indigenous populations living off-reserve. Indigenous people make up 3% of the Canadian total population and account for 6% of the country's mining labor force.
"Ontario is now offering expanded resource revenue sharing agreements with Indigenous communities proximal to either mining, forestry or aggregate developments," said Greg Rickford, Ontario's Minister of Northern Development, Mines, Natural Resources, Forestry and Indigenous Affairs.
The Ministry's Aboriginal Participation Fund (APF) supporting consultation, education and relationship-building has been built-out, while the Ministry of Labor, Training and Skills Development has invested C$3.5 million to help 150 Indigenous people receive training to join the Greenstone mine.
"We have also supported initiatives for employment opportunities on major energy infrastructure projects, such as the Wataynikaneyap Power Transmission project. This project will serve the interests of the Greenstone Belt and translate to a transferable skill set for Indigenous workers," added Minister Rickford.
Mining companies are increasingly realizing that incorporating Indigenous communities not only into their field operations, but also into their boards, fosters long-term collaborations and de-risks projects for the future. ■

Leading the Charge

We are seeing a lot of regulations trying to make sure that batteries and EVs have minimal impacts, and sourcing your materials from one supplier or another can really make a difference.

– Robert Pell, Founder and CEO, Minviro

OVERCOMING CHALLENGES FOR AN EV LANDSCAPE

The International Council on Clean Transportation (ICCT) has made a research study on BEV emissions over time in Europe, the US, China and India, and concluded that 'the life-cycle emissions over the lifetime of BEVs registered today are lower than comparable gasoline cars'. When used with 100% renewable energy sources, an 81% GHG emission reduction is observed comparatively to gasoline. The study took various types of power into account — diesel, gasoline, biofuels, hydrogen, natural gas and electricity— and concluded that out of internal combustion engine vehicles (ICEVs), encompassing hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), and fuel cell electric vehicles (FCEVs), only BEVs and FCEVs have the capacity for deep decarbonization when it comes to passenger vehicles. A 15 to 18 year life cycle was considered, however, the report did not take into account emissions stemming from mining in order to produce the materials to manufacture the vehicles.

The IEA released a 2021 report stating that electric cars will require six times the amount of mineral input compared to a fuel-based car, and an off-shore wind power plant would require thirteen times the mineral resources than a gas-fired power plant of the same size. Though coal production currently accounts for more than 10 times the revenue of energy transition minerals, these numbers are projected to reverse by 2040.

Demand for lithium by this time is meant to increase by 42 times relative to 2020, graphite by 25, cobalt by 21, nickel by 19 and rare earths by seven times. "The metal mining industry is increasing its capacity just over 1% every year, but we will require seven times greater growth in years to come," said Doug Morrison, president and CEO at the Centre of Excellence in Mining Innovation (CEMI).

China currently holds a clear leadership on transition mineral processing. "Roughly half of the world's lithium is produced in Australia with the remainder produced in China and South America. Much of the world's feedstock is then shipped to China to undergo conversion into chemicals. It is then transported to other markets, such as Japan and South Korea, to produce the active materials that go into batteries made for a variety of end uses," said Trevor Walker, president and CEO of Frontier Lithium.

Electra Battery Materials' target is to become the only one-stop-shop in North America to bridge the gap in the value chain. The company currently produces 25,000 mt/y of battery-grade cobalt sulphate. "If we do this, we will start to attract the precursor cathode manufacturers in Finland and China. In 2022, we will be commissioning and making our way into production," revealed Trent Mell.

As ESG came into the spotlight, water management followed so companies are more proactive in that respect. Even if we do not see major action being taken yet across all mining companies, the fact it is now a topic of conversation is cause for celebration. We foresee a lot more action being taken regarding water treatment in the coming years.

– Eric Lannegrace, Managing Director & Founder, minera Environmental Solutions

Reporting ESG

Part of the journey towards an impactful ESG process will be to properly delineate the parameters required for reporting that take full life cycles into account. "There is no harmonization and clearly ample room for subjectivity in judgment, particularly where the standards are still trying to come together," said Shaun Usmar, founder and CEO of Triple Flag Precious Metals Corp.

"All mining companies, regardless of their size, release big statements of ESG targets without providing the data and evidence to support them, also known as 'green washing'. These statements are not quantified," said Laurie M. Clark, founder and CEO of Onyen Corporation. "Reporting should not be an expensive output. It should be quantitative, qualitative, substantiated, and easily dissected. The data sets should communicate the company's pitfalls and guide it towards improvements," she added.

Companies such as Onyen Corporation, Digbee and Minviro are focused on improving the industry's ESG reporting standards to showcase the positive impact the sector has in communities, development and connectivity. "The willingness to submit to an external, impartial assessment and being transparent by publicly disclosing the underlying scores and data, warts and all, demonstrates a mature, secure leadership team that has a genuine commitment to ESG," said Jamie Strauss, CEO of Digbee.

The mining sector still battles with perception. "Companies like Patagonia and Terrex refuse to sell their products to extraction companies, even though the equipment they use to make their clothes are certainly not made of bamboo and plastic, and rely on metals at every stage of manufacturing. This anti-mining corporate attitude is ill placed and false. Mining takes up less space than Walmart parking lots around the world," said Tom Obradovich, president and CEO of Conquest Resources.

Having a unified ESG reporting strategy is pivotal for the sector. "Being aligned with global standards is much more relevant than worrying whether one should adopt one or another standard," added Digbee's Jamie Strauss. "If we achieve our goals during the next few years, this industry will not be at the bottom of the S&P 500, and that has a direct impact on valuation," he added.

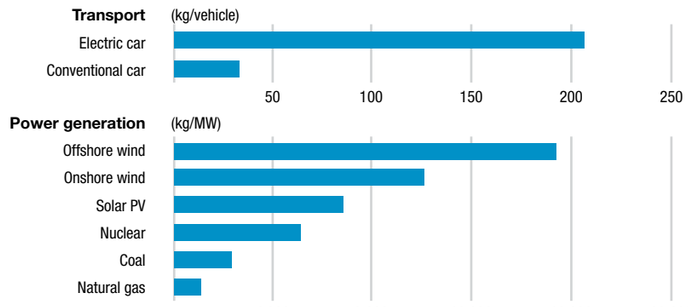
Minviro helps companies mitigate environmental impact by applying the life cycle assessment (LCA) approach. Minviro supported First Cobalt in this way, comparing peers with cobalt refineries in China to quantify impact. It is cur-

We are actively looking at the feasibility of lithium processing in Thunder Bay and our government is investing C$5 million in the first cobalt facility in North America.

– Greg Rickford, Minister of Northern Development, Mines, Natural Resources and Forestry Minister of Indigenous Affairs, Government of Ontario

The Shift to a More Mineral-intensive Energy System

Minerals used in selected energy technologies

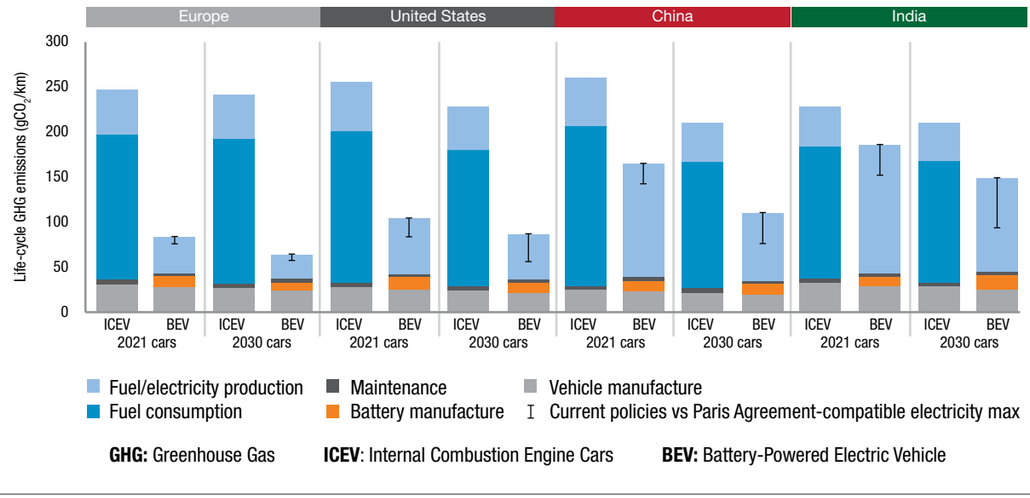


Source: International Energy Agency (IEA)

rently helping Australian Pilbara lower its CO2 density per kg. Minviro also aims to release its MineBIT tool in 2022: "This will allow clients to design their supply chain based on their LCA. This is very important because we are seeing a lot of regulations trying to make sure that batteries and EVs have minimal impacts, and sourcing your materials from one supplier or another can really make a difference," said Robert Pell, founder and CEO, Minviro.

How efficiently companies report their ESG is still often dictated by internal business protocols and criteria. As the sector gains insights and support to understand international standards, such as the GHG protocol, and translates them into actionable steps, ESG reporting standards will continuously improve. "To benchmark best practices and fast track the whole process of ESG reporting and disclosure, we launched ESG 101, an information portal for issuers, and entered into an agreement with IHS Markit to create an ESG Reporting Repository, a portal focused on providing centralized and streamlined data to investors," said Dean McPherson, head of business development global mining at Toronto Stock Exchange and TSX Venture Exchange. ■

Life-cycle GHG Emissions of ICEVs vs BEVs



Source: International Council on Clean Transporation White Papers (ICCT)

Trent Mell

President and CEO,
ELECTRA BATTERY MATERIALS

We have all the ingredients to become a one-stop-shop for cathode material and battery recycling, the only one of its kind in North America.

Why did you decide to change names from First Cobalt to Electra Battery Materials Corporation?

We want to capitalize on our Battery Materials Park strategy for Canada and North America. Our refinery is one of a kind on the continent and we are now fully financed to expand and commission our refinery to produce battery-grade cobalt. This first phase will be commissioned in Q4 2022, and at full operation will produce 25,000 tonnes of cobalt sulphate per year. We are already advancing work on Phase 2, which will entail recycling lithium-ion batteries. After batteries are disassembled, the cathode and anode material are crushed into a fine material known as black mass, which must be further beneficiated through smelting or refining. The way of the future is to refine it in a hydrometallurgical facility such as ours, owing to superior ESG metrics and better metal recoveries. We have a first mover advantage given that our facility is permitted and largely built. The third phase of our growth is to produce nickel sulphate, another raw material for lithium-ion cathodes that is currently not produced in North America. This step is likely 3-4 years away and would entail building an adjacent plant producing four times more nickel than cobalt, given the widespread adoption of nickel-rich cathodes for long-range vehicles. If we can do all of this, we have all the ingredients to become a one-stop-shop for cathode material and battery recycling, the only one of its kind in North America. This same business plan was implemented in China and Finland, and it attracted the next step of the battery manufacturing chain – precursor production – to co-locate and capture operational and logistical efficiencies. As we look toward an ambitious future, we are laser-focused on executing Phase 1 in 2022 and making our way to production and first cash flow.

What are you hoping to achieve with the Electra Battery Materials Corporation plant?

Our hydrometallurgical facility has a 10-year operating history with a replacement value of approximately US$100 million. More importantly, we have permits already in place which gives us a multi-year advantage over a greenfield project. An independent life-cycle assessment demonstrated that our greenhouse gas levels (GHGs) will be 51% lower than peer operations in China, in part because we are on a clean, hydroelectric grid.

Over the last six months we have quietly grown our footprint from 120 acres to over 600 acres to ensure that we have sufficient real estate for an industrial complex. We already have the water pipeline, roads, and power in place, and we are situated north of Toronto in the mining corridor between Sudbury and Timmins which is rich with skilled talent, contractors and suppliers. All these ingredients have given us a head start and anybody trying to replicate us is going to be five years behind.

How will demand for cobalt change in upcoming years and how will it be impacted by LFPs?

Cobalt demand will be driven by lithium batteries, particularly by electric vehicles (EV) demand growth, but also mobile electronics, motorcycles, bicycles, power tools, maritime and aviation applications, stationary storage and a whole range of industrial and consumer applications in which lithium-ion batteries have previously been absent. Today, lithium-ion batteries represent more than 50% of global cobalt demand. Laptops, cell phones, power tools and other portable electronics was the largest segment until 2020, and now EVs make up the greatest share.

As cathode chemistries have evolved, we have seen a decrease in the amount of cobalt required per kwh of battery. This has sometimes been mischaracterized as signaling the removal of cobalt entirely from the battery, but the investment decisions of the battery makers reveal that risk to the integrity of the battery are too high. Moreover, larger vehicles, longer ranges and higher EV penetration rates translate into a projected CAGR for cobalt in the battery segment of 19% through 2030. Lithium-iron-phosphate (LFP) batteries are made without nickel or cobalt, but this chemistry has been confined to entry level, short-range vehicles. While the reliability of LFP has improved, it is not likely to be widely adopted in the West, where consumers value longer range options relative to Chinese buyers. Nickel and cobalt bearing cathodes are thus projected to make up 80% of the EV market by 2030. ■

Trevor Walker

President and CEO,
FRONTIER LITHIUM

> Our PAK lithium project is unique because it presents us with the ability to have both extraction and downstream lithium refining all within a relatively confined geographic area within the Great Lakes Region and near the end-users of the product.

Can you provide us with details regarding Frontier's PAK lithium project in Ontario?
Early in my tenure with the predecessor of what is now Frontier Lithium, I began thinking about the potential of rare metals. A discovery made by the Ontario Government in 1999 in northwestern Ontario caught my attention as it had the potential to host rare metals, and what I would learn later was high grade, high quantity lithium bearing spodumene. A short time later the decision was made to focus our efforts on one asset, the PAK lithium project, which is located about 150 km north of Red Lake. Since 2010, we have made four discoveries, two of which (the PAK and Spark deposits) have strong potential to become open pit mines to supply the feedstock required to produce lithium chemicals. Work is required on the other two discoveries to determine their potential as mines.
Recognizing that the move towards electrification and batteries would be more of an evolution than a revolution, we took a cautious approach by de-risking the asset and growing the deposit to the size required to support downstream production of lithium chemicals. The PEA, released five months ago, assessed the business case for a fully integrated operation with two open pits and a mill. The mill would take a 2% lithium resource and turn it into 6% lithium concentrate where it would then be transported to a chemical production facility within the Great Lakes region to produce lithium chemicals. This is the model that we feel maximizes the value of the project and the one we are pursuing. To support the pre-feasibility study, we continue to advance the work required, including the ongoing delineation drilling on the Spark deposit, which remains open in all directions.

How and why is the project's positioning within the Electric Avenue district beneficial?
Electric Avenue is the most extensive, contiguous corridor of lithium-bearing pegmatites in Ontario. It is essentially an area that has historically yielded discoveries of the mineral spodumene with low impurities. Our PAK lithium project is unique because it presents us with the ability to have both extraction and downstream lithium refining all within a relatively confined geographic area within the Great Lakes Region and near the end-users of the product. It has the potential to limit overall production costs and greenhouse gas emissions.

How is demand for lithium unfolding?
Roughly, half of the world's lithium is produced in Australia with the remainder produced in China and South America. Much is then shipped to China to undergo conversion into chemicals. It is then transported to other markets, such as Japan and South Korea, to produce the active materials that go into batteries made for a variety of end uses.
The growth in EV manufacturing globally has been the catalyst for much of the lithium demand we are seeing. Announcements and investments from EV manufacturers, coupled with increasing societal awareness of the importance of cutting global carbon emissions, are continuing to drive demand for lithium. With the market for lithium expected to grow over the next five years and our proximal location to large automobile OEM hubs in southern Ontario and Michigan, Frontier Lithium is well-positioned to supply Canadian, North American and, potentially, European markets with high quality lithium depending on the need.

Can you tell us more about your lithium chemicals test work and how it has evolved?
Frontier Lithium is performing an internal scoping study to assess how best to manufacture high quality lithium chemicals from its feedstock. Of importance to us is the ability to produce a high quality, consistent lithium chemical sustainably, which means we can do so economically and in a manner that minimizes environmental impacts. With funding assistance from the Government of Ontario, we are currently assessing two processing options, one is a sulphate process route and the other uses an alkaline process route. When this work is completed, we will look at the pros and cons of each process and determine the next steps. Consistent with our pre-feasibility study, we plan to make a lithium chemicals processing decision by the end of the year or early in 2022. ■

Mark Selby

Chairman and CEO,
CANADA NICKEL

How can Canada Nickel's tailings at the Crawford nickel sulphide project sequester CO2?
Canada Nickel announced initial lab scale testing results demonstrating the carbon sequestration potential of tailings from the Crawford nickel-sulphide project. Crawford tailings have the potential to capture 17.5 kg CO2 per tonne of tailings - more than three times the amount required to offset Crawford's projected carbon footprint of 4.6 kg / tonne of tailings during proposed operations. Any amounts in excess of projected 4.6 kg CO2 per tonne could be sold for carbon credits.
Serpentine rock naturally absorbs CO2 when exposed to air through a naturally occurring process of spontaneous mineral carbonation. The deposition of waste rock and tailings during the proposed Crawford mining process will expose the serpentine rock to air, which provides the potential for this material to absorb CO2 through natural mineral carbonation.

What do you aim to achieve with larger scale pilot tests?
We are now quite confident that we can get beyond NetZero to a point where Crawford could have carbon credits available for sale. With 856 million tonnes of tailings generated in the PEA, each kg of CO2 per tonne of tailings beyond what's required for NetZero would generate nearly 9 million tonnes of carbon credits over the life of mine.

What role can carbon capture play in the transition economy?
Canada Nickel's ongoing discussions with investors and downstream users reinforce growing concerns around stainless steel and battery material production standards and supply chain sustainability, transparency and reliability, as they prepare for significant demand growth over the next decade. Our performance in these areas is supported by our commitment to staying within the 1.5 degree global warming target. Canada Nickel is currently undertaking the engineering and feasibility study of the Crawford nickel sulphide project toward becoming the world's first NetZero nickel mining operation. ■

Dirk Harbecke

Chairman and CEO,
ROCK TECH LITHIUM

How is the Georgia Lake project evolving?
We are working on two main areas — bringing our Georgia Lake project into production by following the necessary steps, such as permitting and working on downstream facilities to convert raw materials from the mine into battery grade lithium chemicals. Over 2021, a lot of progress was made on both fronts as we announced our first studies for a conversion facility in Thunder Bay and recently published the first engineering study for a large hydroxide converter in Germany, which will be the first European conversion facility.

Can you elaborate on the capacities the converter?
The shortages in the medium to long term in the battery supply chain are not due to the lack of mining, but rather the lack of knowledge around converting the mine's lithium product into lithium carbonate or lithium hydroxide, which are used in cathode production for batteries. We are hoping to introduce this knowledge to Europe. Canada is keen to strengthen the supply chain for batteries, but Europe began this process years earlier. Subsidy programs are yet to be introduced in Canada but I am optimistic that the market will develop rapidly in North America.

How do you foresee lithium market dynamics evolving in the next decade?
Demand will outperform supply and supply shortages are expected for the next four to five years. Analysts foresee lithium hydroxide prices to increase over the next six months due to the shortage. It is difficult to forecast the state of the market in the medium run. However, our analysis confirms an ongoing shortage even by 2030. Nonetheless, as lithium prices increase then more projects are likely to start, but the market is not struggling with the availability of lithium but the availability of the skill and knowledge of its extraction and conversion. ■

The Battery Material Supply Chain

SHIFTING POWER DYNAMICS

Battery size, charging times, and power capacity remain key hurdles to overcome in order for companies to fully embrace electrification; working in tandem with other renewable sources. The three main types of lithium-ion batteries today are lithium ferrophosphate (LFP), lithium nickel cobalt aluminum oxide (NCA), and lithium nickel manganese cobalt oxide (NMC), which is what Tesla has used historically. "NMC batteries are most popular because they have the highest gravimetric and volumetric energy density. So you can pack a bigger punch for less weight and less volume," said Michael Insulan, vice president – commercial, at Electra Battery Materials (formerly First Cobalt), one of the main players in Ontario's metal metals supply chain.

Our macro view is that we will see continued and significant lithium demand from the Chinese market in the near–term, which will increase substantially in the mid– to long–term as the EV movement gathers pace.

– Ali Haji, CEO, ION Energy

Lithium

Lithium prices sky-rocketed in 2021, and 2022 has continued in the same vein. A mid-March assessment by Benchmark Mineral Intelligence, a battery supply chain researcher and price reporting agency, showed battery grade lithium carbonate averaging $76,700 a tonne, up 95% since the start of the year alone, after quadrupling in price in 2021.

Most global lithium production emerges from Australia, with the rest being dominated by South America and China. The majority is then shipped to China to be processed and transformed into chemicals. Frontier Lithium currently hold the largest land position in Electric Avenue and aims to become a manufacturer of battery-grade lithium hydroxide for EV supply chains in North America, and possibly Europe. With support from the Ontario government, Frontier Lithium is evaluating whether to use a sulphate or alkaline process. "Of importance to us is the ability to produce a high quality, consistent lithium chemical sustainably, which means we can do so economically and in a manner that minimizes environmental impacts," said Trevor Walker, President and CEO of Frontier Lithium.

Toronto-based ION Energy has been exploring at its flagship Baavhai Uul lithium project in Mongolia, located close to the Chinese border. Ali Haji, ION's CEO, spoke of the dynamics of global lithium demand today, with China accounting for 75% of the world's battery giga-factories. Meanwhile, Chinese automotive manufacturers are selling more EVs per capita than anywhere else in the world. "Our macro view is that we will see continued and significant lithium demand from the Chinese market in the near-term, which will increase substantially in the mid- to long-term as the EV movement gathers pace."

Nickel and Cobalt

Demand for transition metals will exponentially rise. Although lower cathode percentages are required per battery kWh given evolving chemistries, larger vehicles, longer ranges and higher EV penetration rates translate into a projected CAGR for cobalt in the battery segment of 19% through 2030. "LFPs have no cobalt and have gained popularity in Asia, but they are not likely to be widely adopted in the West, where consumers value longer range options relative to Chinese buyers. Nickel and cobalt bearing cathodes are thus projected to make up 80% of the EV market by 2030", said Trent Mell, president and CEO of Electra Battery Materials.

Battery chemistry is the key determinant regarding battery density. As formulas progress, nickel is starting to play a more prominent role in the manufacturing of batteries, with as much as 80% of mass cathodes being made up by the metal. "About 70% of the world's nickel production goes into stainless steel. With the forecasted growth for EVs by the end of 2030, the amount of nickel needed to meet demand hovers around 50 to 60% over current production," said Grant Mourre, CEO, SPC Nickel Corp.

Tesla is now expected to be the first to use LG's NCMA battery cells, which contain a 90% nickel composition. In order to use nickel for EV battery purposes, the metal needs to be Class one nickel, with a 99.98% purity level. Under 40% of nickel production stems from sulphide deposits, like the ones in Sudbury, which are the key source of Class one nickel. Class two nickel has too many impurities for EV batteries and tends to be used for stainless steel. "If the industry pushes for more high-pressure, acid-leaching, as we see in Indonesia, with the current energy mix in that country, that could have a bigger CO2 footprint. However, there are regions in Canada or Europe where you can use clean hydro energy for these processes," said Robert Pell, founder and CEO of Minviro.

Indonesia produces the largest volume of nickel globally. Mostly due to Chinese investment, the country is on track to launch several new high-pressure, acid-leach nickel projects with a combined capacity of nearly 450,000 mt/y of nickel. Macquarie predicts that Indonesian nickel production will rise from 28% to about 60% of global production by 2028. Investors and industry leaders will hold the burden of choice - to determine how much value they place on carbon footprint. "In the end, it will be the market that dictates how important is the carbon footprint of the different products," added Pell.

With car manufacturers getting involved in mining, and billionaires like Jeff Bezos and Bill Gates investing in mining exploration for critical electric vehicle metals and minerals, the direction the world is taking is clear. The number of investors and companies who decide to enter the mining sphere has a long way to go, and we can certainly expect to see an investor awakening, with interesting surprises moving forward. ■

Some institutions are playing a bit of smoke and mirrors — there are currently hedge funds shorting big emitters, like big oil companies, and classifying that as a carbon credit to claim that their fund is carbon neutral! We should be reducing the amount of energy we are using and becoming more efficient with the resources that we have.

– Zimi Meka, Co–founder & CEO, Ausenco

Ali Haji

CEO,
ION ENERGY

ION Energy is looking to bring on a resource in Asia which will allow Asian manufacturers to obtain the necessary lithium for battery manufacturing within their own continent, as opposed to importing from Australia or Latam.

What have been the main milestones achieved by ION Energy since listing publicly on the TSX-V?
Since then, our major achievements included listing publicly on the Frankfurt Stock Exchange, as well as adding some of the leading names in the lithium space to our team. We started exploration shortly after going public, conducting a micro-seismic and geophysics program on our Baavhai Uul flagship project in October 2020, obtaining results that allowed us to dictate where drilling would start. In November 2020, the government of Mongolia instituted its first lockdown since the pandemic began which delayed field work. However, we used this hiatus to look at acquisitions in-country for additional licenses and to ensure that we were upgraded to the OTCQB.
In February 2021, we were looking to raise C$3 million in a bought deal financing co-led by PI Financial and Stifel GMP. In less than eight hours, we had demand for C$10 million, but decided to take C$5 million with a C$750,000 over-allotment option to bring in C$5.75 million at C$0.50 per unit with a C$0.70 warrant. The demand was exhilarating, but we had to play the balancing act to ensure that we maintained shareholder value without dilution. Once the deal closed in March, our team was able to fulfill our shareholder commitment to pursue an aggressive growth strategy.

Can you outline ION Energy's exploration work?
Drilling at Baavhai Uul commenced in May, with the primary objective of determining exactly where the aquifers were below surface. The collection of core samples and sediments have been completed and submitted to SGS Laboratories for assaying results. Importantly, the drilling proved the hypothesis that brines do in fact exist at Baavhai Uul. The next exploration steps are to use additional hydrogeological and auger sampling to pull up brines from specific depths to arrive at an average grade and reach an early resource indication.
We also acquired the Urgakh Naran license. The project covers approximately 20,000 hectares, situated in the arid and infrastructure-rich region of the South Gobi Desert. Urgakh Naran is highly prospective for lithium brine, and a fast-tracked drilling and geophysics exploration program commenced in September 2021.

How does ION Energy's position next to the Chinese border benefit the company?
China today has 75% of the world's giga-factories, which means they are producing the vast majority of batteries that are used worldwide. Meanwhile, Chinese automotive manufacturers are selling more EVs per capita than anywhere else in the world. Our macro view is that we will see continued and significant lithium demand from the Chinese market in the near term, which will increase substantially in the mid to long term as the EV movement gathers pace. ION Energy is looking to bring on a resource in Asia which will allow Asian manufacturers to obtain the necessary lithium for battery manufacturing within their own continent, as opposed to importing from Australia or Latam.

Can you elaborate on how you intend to advance the project in 2022?
We expect sampling at both Baavhai Uul and Urgakh Naran to be completed by Q1 2022 to reach an early indication that will give a clear understanding of what the resource might be. We will also engage with strategic partners, allowing them to potentially have a toe-hold in the organization where we will leverage their strengths to better understand the profile of our assets.

Looking ahead, how could a producing lithium brine operation become a reality in Mongolia?
For lithium brine production to become a reality in Mongolia, government support is paramount. Mongolia today is a net importer of just about everything, and what better way to get the country on the map than collaborating with academia to develop batteries in-country that can be exported and add to the GDP? We are working with each of these stakeholders to ensure that the end product of the ION Energy story is an advantage to the Mongolian economy and its shift from fossil fuels to a cleaner energy transition. ■

ESG and the Battery Material Supply Chain

"Ford Motor Company recently announced that they want 40% of their production by 2030 to be electric. As of yet, there is no real standalone mine in Canada. As all the major manufacturers are here, this will be the place to be developing new lithium deposits. I think the price of lithium will help juniors like us find partners or raise our own money to get out there and do the work. North America is a long way behind what it could be in terms of exploration, development, and eventually production. However, Tesla has already bought into a mine in Nevada, something you normally do not see — where automakers come down and actually get into the development and mining of lithium. They usually want the final product. I think we will see more car manufacturers get involved in the mining and production of lithium."

- Harry Barr, Chairman and CEO, New Age Metals

"Cesium is one of those metals that hardly anyone knows about, but it is really found in everything. It is used as a lubricant on all the offshore drilling, and drilling companies look for it regularly. In fact, it is so rare that they rent the cesium for the lubricant and have to give it back when they are done. It is also used in detection systems, a lot of high-tech missile defense systems, GPS locators, special optical glass, and it is such a rare metal, that if you find it, you are noticed. When we found this exceptionally high-grade cesium area on our property, with over 14% cesium in our drill core, companies were contacting us immediately. There is currently no production of cesium anywhere in the world."

- Johnathan More, Chairman, Power Metals Corp.

"Spodumene is lithium silicate, and in its pure form, it contains around 8% lithium oxide. It is the main mineral we look for in hardrock lithium deposits and it can be easily converted to lithium hydroxide or lithium carbonate. Spodumene can be visually identified before we even drill and in our area lithium oxide typically averages 1-1.5% in the dykes that make up our deposit."

- J.C. St-Amour, President, Imagine Lithium Inc. (formerly Infinite Ore Corp.)

"Both wind and solar have challenges because of the availability of power, but once battery systems are implemented with renewables, the need for fossil fuels will diminish. Battery cost, effectiveness and reliability will make renewable energy sources a viable alternative. In principle, a complete renewables power system could be executed but there is always the risk of relying on a variable source of energy."

- Robert Black, Director Business Development, PCL Construction

Alan Coutts

President and CEO,
NORONT RESOURCES

How is the Corridor to Prosperity progressing?
In Ontario the consultation, environmental assessments and permitting processes are quite extensive. When dealing with linear corridors like the Corridor to Prosperity there is a lot of work that has to get done. Part of it is the environmental science, but there is also the consultation with the communities. Having First Nations as the proponents has been great and that will certainly streamline the process. But we expect that the environmental assessments will take at least until the end of 2023 to be completed, at which time road construction can begin. This is probably going to be a three-year construction process on top of another two and a half years of environmental assessments. So, we are looking at the end of 2026 before there is a permitted road in place.

What are the greatest challenges when dealing with First Nations communities?
All of the indigenous communities are different, as is their history, experience and expectations. Many want to see resource development, but some have priorities that are more focused on the community itself. It is hard to look at resource development plans when there isn't enough housing or clean water in the community. So, it is about understanding who you are working with and how you can help them achieve what is important to them. Canadians are uniting around the desire to meaningfully improve the lives of First Nations communities. I see the Ring of Fire as a real opportunity. The Corridor to Prosperity is not just about mining, it is about bringing much needed infrastructure to improve the lives of local First Nations in the region. The concept of economic reconciliation is real. ■

Louise Pearce

Global Mining Director,
ERM

How will the circular economy bring value to mining?
It is not a new concept for the mining sector, consumers or other industries, as we have all been reusing and recycling products and materials for centuries. For example, ~75% of all aluminium mined from bauxite production is still in circulation; and ~85% of steel is recovered from demolition.

What is your view on electrification and the green transition economy?
We see five essentia l steps that are key to this journey: understanding your footprint, knowing your end goal, using less energy to result in less carbon, choosing low carbon power sources and removing remaining carbon. For this to work, the primary focus of net zero needs to be on GHG reductions. Offsets and carbon credits cannot be justified as a sole solution, however, offsets will have a role to play in areas where significant carbon reductions cannot be achieved due to the hard to abate nature of certain industries where technology is not yet at a scale to provide alternatives (e.g. steel).

To what extent are renewables and carbon sequestration a feasible solution?
It is clear that carbon sequestration will play a role, but it is further down the hierarchy compared to alternative fuels, particularly the use of hydrogen. As leading miners shift thinking from being landowners to land stewards in an interconnected society for a longer term, this is generating tremendous opportunity for sequestration and nature-based solutions. With renewables, some are confident that technology can solve the issue, yet others think more nuclear power will be needed. However, more than half of the world continues to rely on coal. The shift away from coal power requires an understanding of the complex and interconnected economy that forms the ecosystem of coal producing regions and the need for collaboration with governments and all industry towards a just transition. ■

Robert Pell

Founder and CEO,
MINVIRO

Jamie Strauss

CEO,
DIGBEE

James Oliver

Managing Director,
BLUVEIN

Could you speak about your MineLCA, MineMetric and MineBIT solutions?
MineLCA helps companies reduce their environmental impact by applying the life cycle assessment approach. You can collect data in terms of material and energy, and the tool does some background calculations on a number of environmental impacts, one of them being CO2 emissions.
MineMetric is about benchmarking performance, and the user profile of this tool is slightly different to MineLCA. It is more suitable for downstream purchasers of material who want to identify their supply chain risk. MineBIT is focused on the batteries, which are a key component to the low-carbon transition. We have done a lot of work uncovering the impact of different supply chains in these technology materials, and we have packaged that data together with our knowledge of battery processes and battery chemistries. The tool, that we plan to launch in 2022, will allow clients to design their supply chain based on their LCA. We are seeing a lot of regulations trying to make sure that batteries have minimal impacts, and sourcing your materials from one supplier or another can really make a difference. ■

How does the Digbee ESG platform work?
Mining companies sign up for free onto digbee.com, they specify what stage their projects are at, and then get free access to the appropriate ESG framework, which is completed via our online platform. Once completed, they seek internal board approval via our platform, and only then do they submit to us. It is at this point we invoice them.
Two independent ESG experts then assess the company's submission. The resulting output is a Digbee ESG Report that delivers real value back to the company with a balanced narrative of opportunities and threats along with objective scores. Following a debrief to the company and an opportunity for engagement, Digbee will publish the scores onto digbee.com, allowing any stakeholder to access and track a company's ESG journey for free.
The willingness to submit to an external, impartial assessment and being transparent by publicly disclosing the underlying scores and data, warts and all, demonstrates a mature, secure leadership team that has a genuine commitment to ESG. ■

What is your strategy to electrify machines with the heaviest duties for surface and underground mining?
BluVein is a 50%-50% joint venture partnership between EVIAS (Stockholm) and Olitek (Australia). Our BluVein1 product is targeting circa 60 ton payloads, and has an added urgency given the diesel particulate emissions and known health impacts in underground mining. BluVein1 is also well suited to smaller open pit mines and quarries. BluVein is also developing BluVeinXL, which enables the safe, flexible and viable electrification of very heavy haul trucks with circa 220 ton payloads. With a standard IP rated rail, we adapt the power in feed to suit a variety of vehicle power requirements. This allows for a mining company to install a single power rail to service a mixed fleet of mining vehicles and all high voltage conductors are fully enclosed.
The BluVein Hammer connects the heavy vehicle to the BluVein Rail. Power is delivered directly to the vehicles' drive motors whilst simultaneously top-up charging the onboard batteries. The BluVein Rail only needs to be installed in heavy duty zones such as inclines and ramps. ■

SERVICES, TECHNOLOGY AND INNOVATION

"The greatest overall project for the industry has to be the development and implementation of autonomous systems which are designed to operate without people and be energy efficient. Making that change to the cost of production allows us to reduce the cut-off grades in mining operations, which means that some mineralization that is currently not viable to mine will become feasible."

- Doug Morrison,
President and CEO,
Centre for Excellence in Mining Innovation (CEMI)

Image courtesy of Sandvik

Engineering, Construction & Consultancies

ADAPTING TO SUPPLY CHAIN DISRUPTIONS

The global supply chain was deeply affected by the Covid pandemic. Images of excavators and dredgers trying to liberate the Ever Given container ship in the Suez Canal, March 2021, sum up the kind of challenges that service providers have had to deal with in the past 19 months. As mining projects were delayed and uncertainty became the currency of the day, demand for equipment also decreased, while maintenance was top of mind. "To be successful in business, you need to be flexible and able to adapt, and I believe that some challenges that arose from the pandemic have made companies adapt for the better," reflected Marla Tremblay, executive director of MineConnect.

Delays in sourcing parts and receiving deliveries and replacements held up projects. "Today, it is still a challenge getting parts in a reasonable time frame. Where possible, we will substitute parts, but that is not always practical. It is inefficient to start assembly without having all the parts, but to meet deadlines, we sometimes have no choice," said Christina Visser, CEO of Ionic Technology Group.

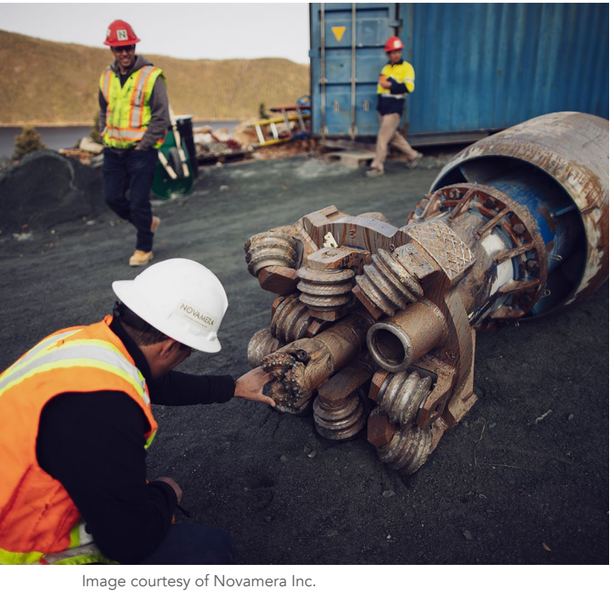


Image courtesy of Novamera Inc.

Adaptation and quick innovation have been key for the service sector to meet clients' needs, with several companies now experiencing more demand than ever before. Epiroc Canada received record orders in 2021, with a heightened interest in components and mid-life services.

One way of dealing with supply constraints is recycling. Epiroc recently opened Reman Centre in Sudbury, where there is a parts exchange program, and a recycling strategy to recycle everything possible from each core. "We are at less than 2% waste now and are still working on reducing that," said Andre Bertrand, business line manager – parts and services, Epiroc Canada.

The Reman Program guarantees the availability of specific components for clients' projects at all times— a major selling point, given current delays. Epiroc is increasingly involved with the ramping up of Batteries as a Service (BaaS) "Taking ownership of the batteries, having the full warranty and lifecycle ownership, BaaS allows us to now sell power instead of product," added Bertrand.

Kal tire has focused on retreading mining tires in Canda to reach up to three life-cycles, at a lower cost for clients. The company's Maple Program supports companies in reaching their environmental targets. "Our third-party verified carbon calculator provides clients with quantified data related to the fuel and carbon emissions saved in the retreading and repair process," said Dave Allan, vice president of Canada, Kal Tire's Mining Tire Group.

In line with the concept of the circularity, Halyard Inc made the decision to purchase EcoVac Solutions, which allows for the reprocessing, cleaning, separating and recycling of excavated materials. Having a facility near the city allows construction companies to source material and deposit their waste in a centralized location. "Previously, the materials were being disposed of in unregulated ways. […]EcoVac offers a facility in close proximity to Toronto which significantly reduces costs and the carbon footprint of construction companies," said Justin Taylor, president.

When it comes to mineral resource estimations, companies like SRK and AMC have continuously focused on de-risking projects. The industry has relied on 70-year old tools for modelling, but with decreasing profit margins, there has been a rise in stochastic resource models. This is predominantly by majors. "Technical teams can estimate the tonnage and grade using drill hole data, integrated with the geology and statistics," said Oy Leuangthong, corporate consultant (geostatistics) at SRK Consulting.

SRK recently created a machine-learning approach that uses qualitative and quantitative date for mineral resource classification. "This should make data integration easier and faster to repeat, given there are often multiple updates of a mineral resource model, and also allow it to be an auditable process," Leuangthong added.

AMC described its Hill of Value services as follows: "These are developed to model anything that can be described, overlay all the results, and provide our clients with a comprehensive and complete evaluation. This allows our clients to make informed decisions to de-risk projects and create value for their stakeholders," said Francis McCann, general manager, Toronto, AMC Consultants.

This process leads into their Predictive GeoMetallurgy service, which generates a dynamic 3D block model. This allows clients to understand the ore body to improve their design and recovery while minimizing costs and volatility. AMC's Smart Data database completes the largest independently validated collection of hard-rock mine performance data sets in the world.

Developing new services through innovation remains a key focus within the industry, with international member-driven organizations collaborating to reach new solutions. Carl Weatherell, executive director and CEO at the Canada Mining Innovation Council (CMIC) believes that no problem is impossible when approached through collaboration. "We asked the question a few years ago —can we develop technology to reduce energy in a process by 50%? Within three years, we had a demo prototype up and running, demonstrating a 42% reduction. We are not commercialized yet, but that is the next step. We have another tech variant where we are looking at a 72% energy reduction," he said.

The CMIC is running 10 consortiums in parallel to tackle different challenges within the industry. BluVein, a joint venture between Australian-based Olitek and EVIAS, is one of them. "BluVein is the mining version of the 'European electric highway," said James Oliver, managing director. "With a focus on dynamic charging, we are changing the paradigm by enabling lower cost, high productivity electrification of even the heaviest duty applications in mining," he added.

Companies such as Vale, Glencore and AngloGold Ashanti make up the eight-member partnership to develop the technology. By focusing on dynamic charging, BluVein aims to enable lower cost, high-productivity electrification of even the heaviest applications within the mining sector. All partners are investing in the BlueVein1 product for commercial release.

With more companies committing to zero waste and net-zero emissions targets, a new competitive streak is emerging in the sector. Those who do not disclose their operations' GHG emissions will start on a slippery slope that could mean being left behind as the sector moves towards greater transparency. "Our focus is on transformation to attain zero waste in the mining industry, which is basically about changing the paradigm of the business — of what is achievable," added Weatherell. ■

> *Most people will only consider change when it offers financial gain. Green initiatives have a net positive impact on the long-term survival of businesses and sustainability, so it makes sense to install processes that guarantee long-term success.*
>
> **– Justin Taylor, President, Halyard Inc.**

Eric Smith

Managing Director,
CEMENTATION AMERICAS

> We need to maintain a measured approach on the new technologies we incorporate given the cost, but will continue to transform our culture and how we perform work.

What are your goals for Cementation Americas in the next two years?
The goal is to become the preferred provider for mining services. As a contractor the resource we supply to our clients is the skills and expertise of our employees. Our people are our number one priority so we ensure they have the necessary resources and are challenged and invest in innovation to differentiate Cementation's role in the market. A key focus is safety so we work on developing safe operations, particularly in underground mining, which is traditionally labor-intensive and has yet to incorporate many technologies that are common in other industries. We are working on automation which not only has a safety benefit, but also allows us to have a diverse workforce as it increases our options.

How are you navigating the challenges posed by the skill shortages in the labor market?
As we draw from the existing labor pool we are investing in training new employees who have no mining background. We try to rely on equipment and methods that are intuitive and do not require years of experience to operate. For example, some of the drill jumbos we use are automated and only require the click of a button to drill out a blast pattern. If an individual uses an Xbox or Playstation, then they are well on the path to being able to operate much of the equipment we use.

Can you tell us more about the Hatch-CIM Mining & Minerals Project Development Safety award that Cementation and Compass Minerals won?
Compass Minerals and Cementation were awarded for an exceptional safety program at the Goderich shafts relining project in Ontario. The project's successful completion was facilitated due to the excellent relationship we had with the client who was supportive and did not compromise on safety. Our people dedicated a lot of time planning, so as to ensure safety during the operation. The trust between our workforce and management was a key factor in our success. There is an open constant communication channel between management and employees as they report hazardous situations and near misses to minimize operational risks.

What are some of the milestones at the Alamos Gold's Young-Davidson operation?
One key accomplishment at Young-Davidson was our innovative solution to sink their shaft. We developed a method that required no one to be inside the shaft for excavation by using a raise bore to excavate the shaft and then install the hoisting plant over the top. There was a raise bore machine pulling up a reamer used for excavation and we relied on directional drilling technology to ensure a straight shaft. We are replicating this model also in projects in the US.

Can you comment on your rate of adoption of mining industry 4.0 technologies and its benefits?
Technology is a means to perform operations safely and efficiently, so we ensure we incorporate automation where it is feasible and accessible. Innovations in cutting the rock and remotely operating vehicles underground are some examples of our adoption. Concerning virtual reality (VR), our engineering and design group is designing 3D models that can be viewed in VR space. This is an example of rapid prototyping where you can see and experience a shaft sinking plant, for example, and identify and eliminate safety issues and interferences before it is built.
Virtually operated machinery is another focus of ours at the moment. For example, we are assessing the use of virtually operated robots that can undertake hazardous tasks. However, we have to have a measured approach on what new technologies we attempt to incorporate because as a mining contractor we must be cost-conscious. Nonetheless, we are investing in transforming our culture and how we perform work. We are fortunate that our culture aligns with that of our progressive clients, which motivates us more to adopt new technologies.

Do you have a final message to our readers on your outlook for the sector?
As the world evolves and technologies are identified that help minimize our impact on the planet, the mining sector is at the helm with providing minerals which make this possible. Cementation will remain dedicated to supporting clients in mine design, construction and early project development and is a partner mining companies can trust to deliver, even during a pandemic. ■

Zimi Meka & Jared Dietrich

ZM: Co-founder & CEO,
JD: VP of Technical Services – North America,
AUSENCO

ZM

JD

How is Ausenco celebrating its 30th year, and the relevance of the Canadian mining sector for your operations?
ZM: We are preparing a book called 30 moments in 30 years. One of these significant moments was a series of acquisitions in 2008, which allowed us to gain a presence in Canada. It also allowed us to work with clients who were taking their businesses into South America or West Africa. Today we have many opportunities in Ontario, we are working with Treasury Metals, First Mining and are approaching nearly a year of working on Argonaut Gold's Magino project.
JD: Musselwhite is another great project that came to us in 2019 as a result of our strong relationship with Goldcorp around the Newmont acquisition. They needed a strong construction management team to help with the replacement of their main underground conveyor, which essentially halted production. Within a couple months we were on site, and then Covid hit, so we helped them develop Covid safety protocols. We actually finished the project within the year (2020), which in turn supported a return to full production.
How close are we to being able to attain net-zero without carbon credits?
ZM: ESG is not just about carbon footprint or net zero. Net zero through carbon credits means you have paid a financial institution or received a government tax credit that gives you the right to say you have offset your carbon emissions. But that carbon is still going up in the atmosphere. We are working on technologies to try and upgrade the ore that we are processing, using ore sorted and implementing coarse particle flotation, so we apply less energy, which is the highest energy intensive component. We also dry stack our tailings, extract the majority of the water, and recycle it. ■

Paul Healy

President Americas,
REDPATH MINING

How significant is Ontario to your operations?
Eastern Canada continues to be a significant contributor to our overall volume. Our client base in the region includes Kirkland Lake Gold, Alamos Gold, Glencore, Vale, Newmont and others. Historically, as our clients moved around the world, we followed, allowing us to expand our international footprint to Indonesia, Mongolia and South America. We grew and have established our offices in all the major markets worldwide with over 6,000 employees. Nonetheless, Canada remains our base, especially for the technical aspect of our operations for which we rely on local Canadian skills.

Can you tell us about Redpath Mining's record-breaking hole at Kirkland Lake Gold's Macassa mine?
As mining progressed to deeper levels, heat from host rock posed problems for workers and equipment alike, which made additional ventilation necessary. Kirkland Lake Gold engineers devised a ventilation circuit consisting of a 1,010 m raise and a 660 m raise, which would bring fresh air from surface to the underground workings. Redpath Raiseboring was up to the task, and in 2021, completed the record-breaking continuous leg to the 1,670 m level. The feat was accomplished with a Redbore 70 underground, and a Redbore 90EX on surface.

Can you elaborate on Redpath's approach to innovation and technology?
We have dynamic operational teams and involved technical teams on the ground that communicate on opportunities for innovation, such as adapting products by OEMs or developing technology in-house to address certain challenges faced by clients. A big driver of innovation for us is safety and working on reducing operational risk. Overall, our technology tends to follow a pattern of starting off with a problem that evolves into a Redpath solution. A recent focus of ours has been working on products that provide real-time information so that decision-makers can lead operations with accuracy and make well-informed rapid choices. ■

Theo Vameogo

EV Americas Mining and Metals Leader &
EV Canada Mining and Metals Leader,
ERNEST & YOUNG

> The EV annual review of risks and opportunities finds environment and social, decarbonization and license to operate are the top risks facing miners over the next 12 months.

How significant is mining to EY's business in Canada?
Last year, EY launched the Americas Mining and Metals Centre of Excellence, a growth engine that will allow us to respond to the energy transition requirement facing the industry. Millions of dollars are invested in the centre to offer companies across North and South America access to cutting-edge services and innovation-led solutions. We are working closely with key industry players such as NORCAT, Exyn Technologies, Sympact and Enviro Integration Strategies to bring this to clients. An example of our work in Canada is our collaboration with Exyn, where we are working on a solution that will allow us to monitor tailings using robotic drones alongside automation. The team from EY automates the calculations and dashboarding for the mining companies and the drone captures the data using IoT devices and geotechnical sensors then send it through the Cloud. This allows monitoring of tailings at any given time.

What challenges is the industry facing in the technological and digital realms and how can EY support?
While digital transformation will remain in boardroom discussions, the priority item on all agendas is ESG. The EY annual review of risks and opportunities finds environment and social, decarbonization and license to operate are the top risks facing miners over the next 12 months. But navigating these pillars is increasingly challenging given the breadth of issues the sector faces, coupled with the myriad of reporting standards they need to adhere to. Greater investments in digital and innovation will be needed to help companies diversify and differentiate.
Digitizing can also support more efficient monitoring of operations to deliver transparent reporting to meet the increasing demands of stakeholders and the capital markets.
As companies make greater and more rapid investments in technology to drive optimal efficiency, they cannot ignore a major growing risk: cybersecurity. Ongoing integration between IT and OT networks, reliance on third parties with less secure networks and limited workforces are all creating new entry points for cybercrime. We are working with clients to assess the business risks, critical assets and risk event scenarios to not only respond, but mitigate cyber threats.

How can the mining industry achieve Net Zero and is it attainable without carbon credits?
Net Zero goes back to an equation on input and output. Carbon credits or offsets seem to be one of the easiest ways. Regardless, we'll expect to see most of our clients change the way they do business on their journey to achieve net-zero emissions. For example, some are reducing diesel and HFO usage, and others are investing in solar farms. Another trend is the electrification of equipment to help cut back on diesel usage. Overall, the industry is mixing both; using offsets and changing their approach to mining to make it more sustainable. At EY, we're proud to have achieved carbon negative in 2021 and look forward to progressing on our target to become net zero by 2025.

Are there enough resources in the world to achieve the global target of reducing emissions by 45% by 2030 or are new technologies needed?
For the mining industry, the role is two-fold. Companies must address their carbon footprint and reduce emissions, while providing the minerals and materials needed to help companies in adjacent industries do the same. But balancing the two is becoming increasingly complex. And with recent calls from the UN Climate Change Conference of the Parties (COP26) demanding all businesses to take action, the pressure is mounting for Canadian mining and metals companies to accelerate their decarbonization efforts. Goodwill is not enough to force change. It's going to take collective action, progressive regulation and new technologies to help reach ambitious carbon reduction goals.

Do you have a final message to share with our readers?
Whether stone, bronze, iron, silica (computer processors) or beyond, every industrial revolution has been reliant on the mining industry to achieve meaningful progress. Today's landscape is no different. We must build a sustainable, equitable sector that can help deliver the critical minerals needed to accelerate energy transitions and achieve decarbonization efforts. ■

Kurt Boyko

Director,
NORDMIN GROUP OF COMPANIES

James Lill

Manager, East Canada,
MINING PLUS

Oy Leuangthong

Corporate Consultant
(Geostatistics),
SRK CONSULTING

What is your footprint in Ontario as Nordmin reaches 20 years of operations?
Nordmin's head office is in Thunder Bay. We also have an office in Sudbury and in Salt Lake City for our US operations. We are focused on showcasing our team's skills by executing major greenfield operations in Ontario. Over the years we have worked on many new builds across Canada and internationally, primarily on an EPCM basis where we work on individual components of the whole such as mine design, hoisting plan design, or process plant improvements. We have yet to execute a project that encompasses all of the elements from start to end, and this is one of Nordmin's major goals.

Can you highlight some key mining projects Nordmin has been involved in?
One of our most significant projects to date has been assisting Ivanhoe Mines with the development of Oyu Tolgoi. Nordmin has also worked extensively with Rio Tinto at the Kennecott Bingham Canyon mine, the deepest open pit mine in the world. Within Ontario, we have completed front-end engineering studies for groups such as Frontier Lithium and Clean Air Metals. ■

Can you speak of Mining Plus' relationship to Byrnecut Group?
Mining Plus is part of Byrnecut Group and is a global mining consultant group with North American offices in Vancouver, Toronto and Denver. We cover everything from corporate support, due diligence, M&A, conceptual studies, strategic studies, NI43-101 / S-K1300 technical studies and site based secondments. We support Byrnecut with technical planning and they complete the project execution. We collaborate often, such as on the Red Lake project where they are developing a new portal with a new suite of the Sandvik equipment including a bolting jumbo and 60 t haul truck. 2021 has seen our secondment business grow significantly, which reflects the high staff turnover many mine sites have been experiencing particularly across the Abitibi region. Today clients are very open to allowing strategic mine planners to work off-site and only be onsite for one week a month. This is quite a big step-change; with everything now being cloud based, you do not really need key strategic planners on-site. ■

Could you run us through some common stumbling blocks in simulation?
Simulation begins with geological interpretation, the domaining. Different types of simulation allow you to vary the domains since the geologic boundaries are unknown away from drill-holes. One type of simulation focuses on variability in geology. Grade values are simulated by randomly drawing from a local distribution of uncertainty, informed by a mean grade that is close to an estimated grade but also considers the uncertainty in this estimate. This technique could result in hundreds of possible models, which could then be used to assess worst, expected and best-case scenarios. The power lies in recognizing the overlap in those models from a planning perspective, since the overlapping region is an area of greater confidence. This modeling approach has been in existence since the 1990s, but until recently, downstream tools to deal with these scenarios in mine planning have been limited. Conditional simulation quantifies uncertainty, which could be used to mitigate risk, with potential for economic savings if there is higher confidence in the deposit and project footprint. ■

Technological Advancements & Innovation

THE NUTS, BOLTS AND TECHNOLOGY DRIVING MINING OPERATIONS

Innovation for mining' is a term used by the Centre of Excellence in Mining Innovation (CEMI) to reference the urgent need for inter-sector collaboration to find solutions to meet the mining sector's global demands and lower production costs to make projects viable. "All the plans in other sectors of the economy come to nothing if the mining industry cannot provide the volume of raw materials they require to innovate," stated Doug Morrison, CEMI's president and CEO. Adopting renewable energy and electric vehicles needs to be made possible, not only for majors, but for the whole value chain. Financial challenges remain an obstacle to be navigated, especially by smaller companies that do not have the capex to invest in these technologies. "More expensive copper and nickel makes electric cars more expensive, which is not going to drive the transition to an electric economy," Morrison added.

The Canadian government has invested C$40 million into CEMI to fund the Mining Innovation Commercialization Accelerator (MICA). The multi-disciplinary network will be developing clean tech, robotics and automation, which will help extend mine life, shorten the time needed to bring projects into production, and increase safety and efficiency. Following a successful initial program with Vale, NORCAT launched an open innovation platform to share challenges faced by the sector to a larger global technology network. "We work so they can develop and test their proof of concept in our underground operating mine, to expedite the process and facilitate a potential transaction," said Don Duval, CEO of NORCAT.

A culture of strategic change management implementation is imperative and we must build technology solutions to achieve business and operational goals. The industry in planning not only for broad-scale BEVs, but for the next generation into hydrogen.

– Ben Sharpe, Senior Industry Consultant: Mining, Metals, Cement & Aggregate, Rockwell Automation

The sector is rapidly understanding the value of an opportunity to trial-run efforts in an operational mine to then reach clients with fully tested and de-risked opportunities. As relatively new players on the turf, SK Godelius recently opened its office at NORCAT's Underground Centre. "We are proud to say that we have been awarded a project related to automation and robotics by Vale in the Sudbury area, and NORCAT is coordinating the relationship between us and Vale," said Fernando Bracco, CEO and founder of SK Godelius.

"Battery electric vehicle (BEV) equipment providers are using the NORCAT Underground Centre to develop, test and / or demonstrate how their emerging technologies are poised to transform the global mining industry," added Duval.

If a mine's operations are not efficient with traditional technology, advanced or new technology are not necessarily the answer to improved production – digitalization and automation are not a magic bullet to resolve productivity issues – it is important to identify and resolve the root issues prior to defining and undertaking the digital transformation journey.

– Francis McCann, General Manager – Toronto, AMC Consultants

The speed at which innovation and new technologies are emerging also poses a challenge for the mining industry, given that by the time a new product or service becomes de-risked — to a certain extent, technology has already evolved and new possibilities reach the market. "Do you wait, or do you draw a line in the sand and learn, knowing that you could update at a later stage?" reflected Ryan McEachern, managing director of MSTA Canada. "Back in 2015, we identified an adoption issue. First to be second still rules the day."

Global, multi-disciplinary collaboration is required for the mining sector to implement Industry 4.0 processes to meet demand pressures necessary for the transition economy. "The world-wide pandemic restricted mobility and, as a result, accelerated the trend towards automation and digitization," said Christina Visser, CEO, Ionic Technology Group.

International knowledge will need to be shared and developed by global players - whether they belong to the mining sector directly or not - to ensure that global metal and mineral demands can be met. "This allows for better decisions to be taken that are better for the environment and for the bottom line," explained Pierre Julien, president of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM).

Generating lower GHG emissions when it comes to explosives remains a challenge faced by mining companies. EPC has a factory that recycles all chemicals utilized in explosives manufacturing and wishes to supply greener explosives to the industry. "We ensure that the manufacturing process is one where carbon emissions are minimal. Explosives represent less than 1% of the total mine's carbon footprint, so manufacturing them sustainably is how we can help the mine reduce its footprint further," said Olivier Vandenabelle, president and CEO, EPC Canada.

Fragmentation is a key challenge faced by the sector when trying to hit green energy targets. Global mining tech company, IMDEX, is currently developing precision solutions to enhance blast design, and remove the compressed gas and dust generated during drilling. "Poor fragmentation is one of the main reasons for the sector's high energy consumption," said Paul House, CEO of Australian-based technology company IMDEX.

When it comes to safety, the Ontario mining sector is very mature, yet continues to innovate. Gus Minor, chief innovation officer of Sofvie, chose to transition from a tech background into the mining sector to address safety protocols using data collected from the front lines. With a personal history of family loss due to mining accidents, Minor said: "Complacency creates a lot of the hazards when we become very used to the environments that we work in. The mining workplace can be a very safe one, but when we start to let things slide when they should be picked up or put away, next thing you know, there is a trip and a fall."

Sofvie's software creates baselines and analysis trends to share information, from workers to the CEO, and foster positive reinforcement for achieving daily goals. "Shifting away from blame culture is a game changer in the industry. We focus on making the workers successful," added Minor.

Implementing new safety protocols during the Covid pandemic led companies to rapidly develop technologies that are likely to stay for the longer term, such as touch-less in-

terfaces. Synaptic Technologies have generated a system that can scan IDs and ask screening questions without physical contact. “Thermal cameras can also be integrated with the technology to check temperatures, eliminating the need for several devices,” said Christina Visser, CEO, Ionic Technology Group.

The need to increase digital processes has been made amply clear in the past couple of years. Americas president for Redpath Mining, Paul Healey, said Redpath is focused on providing real-time information to leaders in order to make swift and accurate decisions. "This has only been accelerated by Covid, as operations moved remotely which amplified this requirement.”

Focused on data processing, highly integrated workflows and analytics to support clients' operations, Centric Mining Systems was acquired by Datamine early in 2021. The company aims to empower decision-makers to make choices for the mines of the future. Chris Novak, Centric’s CEO, gave the example of Perseus Mining: “In a short period of time we proved to Perseus that you could have a better run business using data-driven decision-making processes. With that success under our belt, we moved to the next two sites, increased the amount of information being collected and integrated the head office in Perth into that information management framework.”

One of the largest stumbling blocks to Industry 4.0 and digital adoption has been connectivity underground. Maestro Digital Mine saw a 56% increase of Industrial Internet of Things (IIoT) devices and software products in 2020, with further growth in 2021. Maestro believes in “disruption by elimination” and “developing mine hardened multi-variable measurement and devices that eliminate complex PLCs, cabinets, engineering services and wiring,” according to Michael Gribbons, Maestro Digital Mine’s president, CEO and co-founder.

Another challenge for the sector is the presence of proper illumination in underground environments. Founded in 2019, x-Glo North America partnered with FiComm Technologies, focused on IoT mining safety systems, to de-

Michael Gribbons

President, CEO & Co-Founder,
MAESTRO DIGITAL MINE

> Most of our new business is from the top 20 global mining companies, due to the success of other projects at their sister sites.

Which markets and jurisdictions hold the strongest potential for growth for Maestro Digital Mine?

Maestro continues to grow its market share in North America due to local presence as well as the ability to serve and support our clients in similar time zones. We were also very fortunate to participate and support a C$35 million CAD project managed by the Ultra Deep Mining Network in Canada to solve some of the challenges of mining in ultra-deep mines. With ventilation-on-demand (VoD) having its origins in Sudbury-Canada, we have been able to use the IP and lessons learned to advance our newest solutions and products. The United States is very similar. With proven products and solutions, it has been far quicker to enter this market, resulting in a new office in Nevada to support the hard-rock mining companies. Most of our new business is from the top 20 global mining companies, due to the success of other projects at their sister sites. Having a strong reputation for living up to our core purpose and values has helped scale our business. Two other markets that have seen a huge uptick are Africa and Australia. Maestro Digital Mine is also putting huge effort into Latin America, realizing that this market needs time for us to adjust to both cultural and language differences.

Maestro Digital Mine wanted to increase sales 40% by 2022. Has the company reached this target?

All our Industrial Internet of Things (IIoT) devices and software products increased by 56% over 2020. Last year was our best year ever, and 2021 has improved even more. We are seeing great growth in the IIoT, network communications, and software spaces. One of our major value propositions entails what we call “disruption by elimination” by developing mine hardened multi-variable measurement and devices that eliminate complex PLCs, cabinets, engineering services and wiring. Maestro Digital Mine’s product that continues to be most in demand is our environmental monitoring station, which include our Vigilante AQS and Zephyr AQS platforms.

Is Maestro looking to grow into the LTE space and how rapid is the sector’s rate of adoption?

At this moment, it appears that LTE is over-promising and under-delivering in the underground mining sector. At times, mining companies want a magic bullet to their problems instead of looking at a holistic solution that might involve several solutions that are unique but immediately functional. From a technical standpoint, we are willing and able to develop for this environment noting that LTE will not eliminate wired Ethernet solutions that exist in all conventional networks. We see LTE as a good solution for mobile communication applications if the LTE industry can properly scale and reduce costs. The mining client will need a greater depth of expensive outside support or more trained on-site communication specialists that can handle the extra complexity of LTE, while still servicing traditional Wi-Fi and wired networks. Simply put, it is not for the faint of heart. Our Plexus PowerNet last mile communication network has proven this point having a 60% growth over last year. It is simple, can be rolled out by any electrician or development miner and reduces the requirement of expensive and additional power distribution to all the wireless access points.

How does Maestro Digital Mine’s ventilation IIoT and last mile network solutions support clients?

Maestro Digital Mine manufactures and retains the IP of all devices and digital networks and specifically serves the underground mining sector. We work with clients towards energy savings by directing ventilation air to the areas that require it and reducing it to the areas without miners or operating equipment. This can reduce ventilation demand by 20-50%, contributing to greenhouse gas reduction to support global warming and energy initiatives. Our ventilation IIoT solutions have been successfully integrated into Howden's Ventsim CONTROL Ventilation Optimization software which can remotely monitor, control, and automate in real-time the total underground mine ventilation from the surface. Combined with Maestro's Vigilante AQS and Zephyr AQS air quality monitoring stations and using MaestroFlex automated regulators, Ventsim CONTROL can be easily configured to manage the ventilation by reducing the complexity and integration time of any project. ■

Marla Tremblay

Executive Director,
MINECONNECT

What is your vision for MineConnect?
Ensuring that we are supporting the mining supply and services sector throughout all of Northern Ontario. The region has significant capacity, technology and innovation, and working together as a broader cluster makes us stronger. We are constantly creating new tools for our members to take advantage of the benefits we offer. We are also working to attract new business to the North through showcasing our membership to other jurisdictions and prospective leads.

MineConnect is currently opening an office in Navada. What are your goals with this new project?
MineConnect USA is a pilot project whereby Northern Ontario MSS companies are invited to apply to be part of a small cluster of companies that will be represented in Nevada through a staffed office that we are currently establishing. The objective is to meet existing needs in the market while providing expansion opportunities to businesses within the cluster. If this pilot project is successful we may look at launching similar initiatives in other jurisdictions.

How quickly have you seen the mining industry and regulation evolve from a sustainability point of view?
Mining trends are around battery electric vehicles, reduction in carbon emissions, reducing the dependence on diesel, automating systems, digitization, and trying to keep things safe and clean. In terms of regulations, it always takes some time to get it right. Many times, policies are created in geographic locations by people who have never been to the places where the effects are felt – it sounds great on paper, but does not necessarily apply in the real world. That said, we are fortunate in Ontario to have knowledgeable people who care about the industry and are open to discussion. ■

Ryan McEachern

Managing Director,
MINING SUPPLIERS TRADE ASSOCIATION CANADA (MSTA CANADA)

Could you provide some recent highlights for MSTA as it celebrates its 40th anniversary?
It is an exciting time as we sit with just over 240 corporate members and continue to advocate on behalf of the MSS sector with the government and abroad. Our mandate remains clear — to connect our members to opportunities that grow their businesses. We have embraced and adopted digital platforms, triggered by the pandemic. Our video series, MSTA CANADA The DIG, is a great platform to communicate, inform and connect our members.

How has the "Made in Canada" brand evolved and what is the meaning it carries?
Canada has a long vibrant history in modernizing mining, and the mining supply and services sector continues to adapt. As the industry migrates to digitalization and decarbonization, the supply and services sector in Canada continues innovating and providing products for the mining industry's needs.

How is the mining sector struggling with Industry 4.0 after it never fully adopted Industry 3.0?
Back in 2015, we identified an adoption issue. Exactly what you said in your question is what the issue is, and first to be second still rules the day. Mining is a highly variable and unstable work environment. As soon as you blast, the rock mother earth gives you is a surprise, and variability builds upon itself from there. The solutions and willingness are there but how to implement is the issue. Trying to de-risk solutions is crucial. As technology and innovations move so fast, the industry is trying to keep up. Do you wait, or do you draw a line in the sand and learn, knowing that you could update at a later stage? There is this need for a universal translator. We have so much data and different things communicating now. The data is not yet being fully utilized. ■

Don Duval

CEO,
NORCAT

Could you describe the recently opened NORCAT Underground Centre?
Our facility brings together the skilled labor, training, and development aspect of NORCAT, as well as our role to serve as the global one-stop shop for the future of mining technology and innovation – creating a vibrant collaborative ecosystem unlike any other in the world. At MINExpo, we announced NORCAT will be hosting Mining Transformed in September 26-29, 2022; the world's first technology exhibition in an underground operating mine.

How has the NORCAT Open Innovation Platform evolved since we last spoke?
The NORCAT Open Innovation Platform is an online marketplace to convey the challenges of our partner mining companies to a broader technology community. Our initial pilot program with Vale was successful. We have also launched our curated market intelligence services and our buy / sell days, whereby we invite emerging technology ventures to install and demonstrate their technology in the NORCAT Underground Centre to an audience of prospective mining company buyers. Our value proposition across all our offerings is rooted in our underground operating mine – a unique asset that enables us to offer a referenceable site for product development and proof-of-concept demonstrations of emerging technology poised to transform the global mining industry.

Can you tell us more about your VR mine rescue training?
NORCAT aspires to be the global leader in skilled labor training and development in major industries, including mining, forestry and construction. This goal is rooted in our investments in Studio NORCAT, where we build proprietary technologies that can be integrated with more traditional experiential learning to create dynamic and meaningful blended learning programs. The mine rescue VR training simulates the procedures and protocols of an actual mine rescue event. We won Facebook's Oculus "VR for Good" initiative as part of a global competition to demonstrate how VR tools and techniques can be used to transform safety in the workplace. ■

Doug Morrison

President and CEO,
CENTRE FOR EXCELLENCE IN MINING INNOVATION (CEMI)

What must the sector bear in mind when transitioning to Industry 4.0?
Unlike manufacturing, which went through industry 3.0 some years ago with the mechanization of equipment systems, then automation and robotics, the mining sector has not completed industry 3.0. The industry has been very slow and almost no mines have the kind of sophisticated supply chain management systems other industries have. This generates opportunities for disruptors from other industrial sectors to make those changes. Tesla are becoming directly involved in mining because they do not see the industry shifting fast enough to meet their needs.

Why is innovation for mining paramount to the world today?
The metal mining industry is increasing its capacity just over 1% every year, but will require seven times greater growth in years to come. The industry of today cannot achieve that level of growth. It is very convenient for investors right now to be reaping the rewards of higher metal prices, but this is short-term profitability. We are beginning to see the number of tailings dam failures increasing, and the financial implications of those failures becoming extremely large. As climate change progresses, we will see more damage to infrastructure through extreme weather events and that will affect global supply chains. All the plans in other sectors of the economy come to nothing if the mining industry cannot provide the volume of raw materials they require to innovate. More expensive copper and nickel makes electric cars more expensive, which is not going to drive the transition to an electric economy. At CEMI we have started to use the phrase: "innovation for mining", which is the integration of sectors to help improve mining. We believe it is the most important thing that we can do in the world today. ■

Chris Novak

CEO,
CENTRIC MINING SYSTEMS

> We see Centric's work with Perseus Mining as a real success, and therefore, an excellent opportunity for a case study as to how a small and mid-size producer saw value in data-driven decision support and executed with us.

What are the details regarding the acquisition of Centric Mining Systems by Datamine, and what does it mean for Centric from an operational standpoint?
There were converging interests in our vision to deliver solutions to the mining industry focused on knowledge management and innovation. Datamine has been in acquisition mode over the last few years, looking for partners that fit their strategic vision to join their team. They saw Centric Mining Systems as a real growth opportunity. Being part of the Datamine group will also provide long-term benefits for Centric, our staff and customers. We have the opportunity to strengthen and grow our business by leveraging resources, including an office network across 20 countries and profound software and mining expertise. Datamine and Centric also shared a vision for a series of highly integrated solutions that would deliver an enterprise-scale, full-service mine information management framework. There is much focus on increasing our market share in traditional markets. However, with Datamine, there is now a focus on South America, Africa and even the Far East and Russia.

Could you provide an overview of Centric's case study with Perseus Mining?
Perseus is a company we started speaking to a few years ago when they started off as a junior. I thought they had a very progressive outlook in terms of wanting to operate based on data, not just on instinct, while being highly integrated to head office. The leadership team understood that as the company continued to grow, it would require sustainable, scalable processes to be a high functioning, streamlined business that could react quickly and make effective decisions. That aligned with Centric's mission, so we began to deploy across their mines, replacing a lot of inefficient and inaccurate processes around data collection and decision making. In a short period of time, we proved to Perseus that you could have a better-run business using data-driven decision-making processes. With success at the first site under our belt, we moved to the following two sites, increased the amount of information collected, and integrated the head office in Perth into that information management framework. We see it as a real success, and therefore, an excellent opportunity for a case study as to how a small and mid-size producer saw value in data-driven decision support and executed with us.

How can technology providers convince mining management teams and operators of the benefits of new solutions?
The mining industry is interesting. When we go through low metal prices, or just moderate metal prices, the reaction is almost always that there is no money for innovation. When prices go up and demand goes up, then the attitude is that there is no time to innovate. So, I think the answer links back to having case studies. Mining is traditionally an information management space, not a space for thought leadership. They are skeptical, so they need proof, as we did with Perseus to demonstrate success. The more of these wins we can present to the industry, the more we will, slowly but surely, see adoption rates increasing.

Are there any main themes revolving around the industry as we wrap 2021, and what you would like to achieve in 2022?
The predominant theme we are seeing is getting value from data. In the same way ESG has made a key appearance, there is a real trend towards analytics, something we have been talking about for a couple of years now. As we look forward, we have a long road and a bright future with the adoption of cloud applications, and we continue to upgrade and enhance the Centric Mine Information Management Platform. Our goal is essentially to do a case study on every one of our customers, to publish their success so that people can see the benefits of this strategy. And, of course, we will be leveraging our Datamine partnership. We have a fantastic relationship with all the Datamine partners, with a range of operating companies and products within the Datamine organization. ■

Peter Corcoran

Vice President,
SANDVIK MINING AND ROCK SOLUTIONS, CANADA

Which are some of Sandvik's new innovations within the battery and automation realms?
We introduced some of our latest technology at MINExpo 2021, headlined by the Sandvik TH550B battery electric truck, which can carry 50 tons. We currently have 24 BEV trucks and loaders, and seven battery drills operating in production in Canada, many of them in Ontario. We are focused on developing refined and industrialized products. AutoMine Surface Drilling is an example of a system for autonomous and teleremote operations for a wide range of Sandvik iSeries surface drill rigs. We also are undergoing rigorous testing on the CAS 9 (Collision Avoidance System), which is going into operation outside of Canada, and allows for concurrent manual and autonomous operations, safely.

Is there a success story you would like to highlight regarding Sandvik's client support?
We supported Agnico Eagle on their LaRonde Zone 5 mine (LZ5) through automation. We set up multiple trucks running on a ramp with traffic management using Sandvik's AutoMine platform. We are also supporting the Pretivm Resources Brucejack mine with their fleet of Sandvik Z50 BEVs.

Which are the greatest challenges Sandvik's clients are currently facing and how are you supporting them?
Change management is certainly the biggest challenge, and Sandvik stays actively involved to ensure a smooth transition. We are seeing increased demand for our jumbos, set up to do face drilling and bolting at the same time. Mine operators are looking for strategies to optimize their costs and mine economically at any metal price. This is where automation and investing into the future with BEVs can reduce costs significantly, such as the area of ventilation. Automation might not be the full mine to begin with; people can start with a smaller automation project, like a single loader, to learn, and then take incremental steps towards greater automation. ■

Charlie Ekberg, Shawn Samuels, Andre Bertrand

(CE) General Manager Rocvolt
(SS) Business Line Manager Rocvolt
(AB) Business Line Manager Parts & Services,
EPIROC CANADA

CE

SS

AB

What is Epiroc's business strategy for Ontario?
CE: We currently have many automation efforts for underground mining, such as remote working and rapid mine development solutions. Our vision for the future is "Dare to Think New". We have made several acquisitions in Canada over the past year, including FVT Research, a specialist in mining vehicle battery conversions; Meglab, a mining electrification solutions provider; MineRP, a leading productivity provider; and the remaining shares in Mobilaris MCE which provides situational awareness software.

What trends have you witnessed in the mining sector when it comes to digitization and electrification?
SS: Battery conversions are also becoming a large part of our portfolio, and we offer solutions which can convert some diesel operated equipment to battery electric equipment. In over 90% of the batteries we have deployed, the client has taken the Batteries-as-a-Service (BaaS) option. In these cases, Epiroc owns the battery carrying the capital expense, with the client only having an operating expense and paying a monthly fee for using the KW hours. We put depleted batteries into a second life in mobile equipment or energy storage, and eventually recycle them to build the next batteries.

How does The Reman Program service the continent and how is it revolutionizing the market?
AB: Beyond the traditional service exchange — I sell you a component and you give me back the core - we also generated a recycling program to extract all the recyclable materials from every core. We are at less than 2% waste now and are still working on reducing that. The program also brings guaranteed availability. In a world where there are constant delays and challenges, our forecasting tool and registration to the program, secures long-term components for clients.■

velop a customizable Visual Alert Control System (VACS) so clients can integrate low-voltage, long lifespan and highly resistant x-Glo LED strip lights for traffic control. They are currently integrated in over 500 mines in 74 countries. "Visual alerts are crucial when operating an underground mine and communicating emergencies," said Don Bertrand, general sales manager at x-Glo North America.

Automation and robotics appear to be necessary frontiers to meet the demands of the future, with many companies competing for achieving higher levels of automation in their processes. "Level 4 Autonomy is one of our key differentiators," said Nader Elm, CEO and co-founder of Exyn Technologies, regarding his company's Exyn Aero drone technologies. "What that means is that truly all the intelligence is on-board the vehicle itself. In addition to enabling breakthrough capabilities it reduces the load of actually operating the robots," he added.

However, some remain skeptical of automation and robotics being all-encompassing solutions. "AMC's experience and data collected has shown that many operations that 'go digital' and / or 'automated' do not see the improvements in production that are often cited as the justification for the capital injection required to introduce such systems," observed Francis McCann, general manager – Toronto, AMC Consultants.

Peter Corcoran, vice president at Sandvik Mining and Rock Solutions, Canada, believes more advanced technologies provide a cleaner mining landscape. "It might not be the full mine to begin with; people can start with a smaller automation project, like a single loader, to learn and then take incremental steps towards greater automation," he said. "The whole sector will become more attractive because mining will have a clean and technically advanced profile."

Our Tire Operations Management System (TOMS) allows for real-time data capture which drives meaningful fleet inspection reports. With predictive maintenance tools taking all aspects, even seasons, into account, the system also helps clients forecast inventory. We are working on implementing technologies to automate the system further in terms of data capturing.

– Dave Allan, Vice President of Canada, Kal Tire's Mining Tire Group

Majors have been embracing automation for several years, with the world's first automated mine built in 2018 in Australia — the Syama Underground Mine. Ontario has deep knowledge and is leading the way when it comes to new processes. Companies have embraced technological advancements for drilling and transportation of raw materials, and continuously explore for new solutions. "North America is now fully embracing mine automation, especially majors such as Barrick, Newmont, Rio Tinto and BHP," said James Lill, manager, East Canada, Mining Plus.

Robotics and automation companies can expect competition to grow at exponential rates, with preference given to those who have been in the sector for a long time. Drone and surveying processes are becoming more user-friendly and speed for data collection and processing is paramount. Having developed the SafeScanner technology to be mounted directly under drones to collect and transform data, SafeSight Exploration is trying to cut turn-around times. "Actionable information emerges minutes after the pilot ends the flight, rather than taking it to surface and processing it for hours or days," said president Mike Campigotto.

Trying to combat the reluctance that some companies have to new technologies, Northern Survey Supply (NSS) has partnered with Exyn Technologies on a GPS-denied, autonomous, aerial, robot system. "A personal milestone will be to continue educating people on our technology, promote its adoption, and have more people embedded in technology overall," said Bruno Lalonde, president of NSS.

Beyond automation, SK Godelius has seen unstructured robotics, generally pertaining to processes that cannot be programmed in advance, gain enormous traction. SK Godelius is currently bridging human and artificial intelligence and delivering solutions that are both autonomous and tele-operated. "Our company's specialty is to create, develop, manufacture, integrate, implant, and operate engineering solutions related to automation, tele-operation, robotization and the connectivity of large machines, vehicles, robots and processes in open-pit and underground mining," explained founder and CEO, Fernando Bracco.

A key challenge faced when operating in the robotics field is that of interoperability, but SK Godelius views this as a necessary step for the industry. Through its NORCAT partnership, it is designing an automated and robotic solution for the loading of Vale's sulphuric acid trains. "The solution involves, amongst other things, the automated opening of hatches and valves of the wagons of transportation trains through artificial vision, robotics and teleoperation technologies," added Bracco.

The rapid adoption of technology boils down to having leaders with a long-term vision, and enough support to make swift and accurate decisions. Technology and innovation companies are continuously developing strategies to de-risk their products as quickly as possible to make them more appealing for a sector that is juggling safety, skilled labor shortages and a need to rapidly increase and optimize operations. This new roadmap involving sustainable change will necessitate evolving business models, questioning productivity levels and cross-sector collaboration. Digitization can only do so much on its own, but it is the cultures of trust, collaboration and focus that will allow teams to meet the demands faced in the future. Luckily, Ontario has all the ingredients to succeed as we enter a new digital mining era. ■

We need to ensure that greenhouse gas data, which is mostly energy data, is up to the same level of rigor and verification as financial data."

– Emily Thorn, Founder and CEO, Thorn Associates

Michael Zahra

Former President and CEO,
DRONE DELIVERY CANADA

> The time-critical delivery nature of some of the cargo in the mining industry makes our solution extremely relevant.

What is Drone Delivery Canada's strategy to consolidate its presence in Canada and grow beyond it?
Drone Delivery is a Canadian company established in 2014. Our initial focus is Canada. We have supported international regulators with feedback as they write their regulations. Entering other markets in the US, Europe, Australia, South America and Asia is something we are actively looking at and we have some relationships in place. At the moment, we are not operating in any mines but the new Condor, the larger helicopter size gasoline-powered drone with a 200-km range and payload of 180kg, lends itself more to mining and we are excited to introduce it to the market.

How are your drone solutions applicable to the mining industry today?
Most mines are in remote areas, perfect for drone logistics. Our target markets also include oil and gas, healthcare, and pharmaceuticals. The time-critical delivery nature of some of the cargo in the mining industry makes our solution extremely relevant. Condor will be introduced to the market in 2022, which can be used to transport samples, repair parts etc. The mining industry is not always an early adopter, but with drone delivery we expect that to change given the numerous obvious benefits to the industry. The use of our drones' limits person-to-person contact, which is a fairly new demand that came with the pandemic. Mining camps may prefer to isolate and limit the number of external individuals visiting the camp as a precaution to avoid the virus spreading, but they need to maintain their supply chain so drones are a perfect unmanned solution.

Can you elaborate more on how you cater your software and hardware to each customer's needs?
The system is fairly customizable and is sold as a turnkey, managed service. We own the hardware but we supply the solution so the customer has the benefit of the infrastructure we set up, such as the drones, depots, the software system called FLYTE, thus providing a full logistics solution. This all falls under our award-winning, patented intellectual property. The mine staff load and unload the cargo and we manage everything behind the scenes from our Operations Control Centre. The drone flies unmanned and automatically, while the customer just schedules the deliveries and manages the cargo. The system is pre-programmed with the customer's routes. Drone depots can be set up where the drone takes off and lands in a secure environment or we can drop cargo where there's no infrastructure.

Where does Canada stand on aerial delivery regulations and how is it evolving?
Canada's airspace regulations outline the rules and we have a compliant operator status from Transport Canada, allowing us to fly projects within those rules. There are no specific lanes mapped for drones. Our solution allows us to detect other aircraft, drones and the weather to ensure safety. We have the ability to operate in complex airspace. For example, in Alberta we operate a project on airport property. The system runs unmanned automatically as it is pre-programmed based on a customer's network of routes. However, we have human operators 24/7 monitoring our drones and local conditions like security, other aircraft, and weather. If there were an emergency or some anomaly in the local airspace at a particular project we are able to act to safely deconflict the situation.

Could you speak about battery life and how this impacts your operations?
Our new Canary has new battery technology that reduces the battery weight significantly. We've used the weight savings to add an aircraft parachute and other features. We expect a flight range of 20 km to 30 km, to be confirmed when we finish testing, and a cargo capacity of 4.3 kg. Mining companies can reduce costs, increase logistics efficiency, reduce their carbon footprint, as well as enhance safety, for example, to inspect blasting, sending drones as opposed to a manned vehicle. Our large gasoline-powered Condor drone is more cost effective and environmentally friendly than a traditional helicopter. Even though our drones are focused on delivery, they can also incorporate cameras or sensors for data collection. ■

Ed Santamaria

President and CEO,
NORMET GROUP

What is the relevance of Canada's mining sector for Normet?
Canada is one of the world leaders in terms of safety, productivity, and how we operate underground. With the electrification trend, Canada was also one of the early adopters. The country's leading position is very much aligned with Normet's goal and ambitions to be leaders in technology, to be innovative, and to bring new safer and sustainable solutions to the industry.

Which key innovations developed by Normet will play a significant role in underground mining?
Normet offers some of the best electrification solutions such as our SmartDrive platform, a battery electric vehicle (BEV) compromising of the latest Li-ion battery technology with a fast charging capability. High-torque electric motors provide instant torque and efficient operation without any local emissions, and the fully reversible 4WD ensures safe and sure movement in difficult underground conditions. The SmartDrive system has a built-in energy recuperation technology which maximizes the storing of regenerative braking energy during downhill driving and deacceleration.

How are you becoming greener within your concrete spraying process?
On the back end, if we can optimize the concrete mix, we can reduce the amount of raw cement that is used, which has a tremendous benefit in terms of decarbonization. In our spraying process we focus on having the right concrete mix and have implemented technologies which optimizes the positioning and scanning of the spraying equipment so that the spray area is optimized and wastage is reduced. We have also started to automate the spraying process.

What is Normet's strategy to attract and retain talent?
We are big believers in having as many local people as we can. Today, getting work visas for expatriates can be a challenge, but fortunately our local teams can leverage from expert knowledge through virtual platforms and technologies. ■

Giuseppe Campanelli

President of North and Central America,
METSO OUTOTEC

What is Metso Outotec's vision for the Americas?
We have been operating in Canada for over 100 years. We have a large presence in Eastern and Central Canada and are hoping to expand our presence more to the Western parts.
Metso Outotec develops partnerships with our customers and assists them with their planning and preparation to ensure that they are not falling short. We support them with Life Cycle Services contracts, supply and consignment agreements, and work with them in understanding their short and long term needs to ensure their pipeline is full and they are not risking their operations. Our recently inaugurated state-of-the-art warehousing facility was one of our efforts to help our logistics supply chain to ensure that our warehousing is more reliable.

Can you elaborate on Metso Outotec's eScrap solutions?
eScrap is one of the fastest growing waste streams worldwide and it is becoming increasingly complex how we manage this waste. There is a great need for safe and environmentally friendly recycling. Metso Outotec's eScrap solutions unlock the value of Waste Electrical and Electronic Equipment (WEEE) using our proven smelting, refining, hydrometallurgy and gas-cleaning technologies. By turning waste into valuable metals, our solutions help to take advantage of the exciting new opportunities being created now for the circular economy of the future. Emission reduction, decreased water consumption and recycling form a big part of the company's agenda in all our R&D activities moving forward.
Metso Outotec itself has the target of reducing our carbon emissions by 50% by 2024, and to reach net zero by 2030. In terms of our logistics and supply chain, our objective is to reduce emissions by 20% by 2025. We aim to help our customers achieve zero emissions through the optimization solutions we offer them. ■

Gus Minor

Chief Innovation Officer,
SOFVIE

> Complacency creates a lot of the hazards when we become used to the environments that we work in.

Sofvie transitioned from technology into the mining sector. What key goals do you have with Sofvie?
Sofvie came together as a brand with the word 'Sofia', the Greek goddess of wisdom and knowledge and 'vie' meaning 'life' in French. It is a software that flows information through to help save lives. That always holds near and dear to me, and it always reminds us what our core mission is— to enable people in the field to make the best decisions to make sure they go home at the end of the day with their families. I lost my grandfather to the mining industry with cancer back when there were no masks and PPE. And in 1985, my uncle was crushed due to an old sorting method in mine storage. Safety today is much more at the forefront, but at the same time, many things are still in filing cabinets. With Sofvie, we are trying to have everything in real time and available digitally to shorten the distance of time between analyzing things and preventing reoccurrences.

Which current mining hazards do you feel have not been properly addressed yet?
Complacency creates a lot of the hazards when we become used to the environments that we work in. The mining workplace can be a very safe one, but when we start to let things slide, next thing you know, there is a trip and a fall. Sofvie creates more sustainable safety systems by having a digital record of everything. As soon as we start creating that accountability, workplaces and equipment are cleaner. It creates a major lasting effect on the amount of hazards that get flagged in a day, because things are being addressed proactively the way they should.

What sets Sofvie apart as a solution for the mining sector?
We have built our system from the ground up, from the workforce that is doing the work every day, to give them the wins that they need to have every single day. So it is less of a big brother kind of environment because it makes people actually want to contribute the data to keep the work moving forward. Shifting away from blame culture is a game changer in the industry; we focus on making the workers successful. We are creating new custom and tailored data technologies that will be introduced in 2022 with wearable sensors to move away from blanket assumptions and allow each worker to operate according to their own body. This is applicable in terms of need for rest or best work environments for each person, for example, and it allows them to have that conversation with supervisors.

Your current revenue model is subscription based. Will this evolve in future?
We are very much in startup mode with just a little over 1,000 users in our system. Now we are starting to grow exponentially every month, and gain more coverage in Canada, the US, South Africa and Mexico, among others. We are also transcending industries, because hazard recognition and risk management is a universal language. So we have seen farms, chemical manufacturing and even a daycare network in the US reach out.

How can Sofvie's positive reinforcement and inclusive technology shift the sector moving forward?
Sofvie is a very inclusive technology where the biggest gains become how people are relaying information from shift to shift, where people are positively acknowledging each other for work well done, whether they are working together or from a different shift. The system ties it together that way. In this way you can have everybody, from the worker all the way to the CEO, able to see a copy of the pre-operational checks, the lineups, all the positive recognition that is happening in the field. And certainly, positive recognition from a supervisor to a worker is great, but it is almost expected if you are in the right leader. But when you see workers acknowledging workers, workers acknowledging supervisors or above, you really get to see what the heartbeat of the organization looks like, and what the culture is in the field. It becomes about having each other's backs. ■

Denis Larocque

President and CEO,
MAJOR DRILLING

How significant is Canada and particularly Ontario to Major Drilling's revenue?
Canada is our biggest operation and represents around 35% of revenue, with Ontario at the helm. To consolidate our presence in Timmins, we acquired Norex. Major Drilling is known for specialized drilling. A big part of the fleet in Canada are deep hole rigs with more capacity than the average rig in the industry that can dig at depth. We drilled the deepest hole ever drilled in Canada at Osisko Mining's Windfall project in Québec in January 2020. Another area of focus is more hands-free underground equipment, to which we will dedicate some of our capex budget.

As base metal needs increase, how are you planning for drilling demands?
We expect base metal companies to increase their budgets in 2022, which could be somewhat problematic for the industry because there is a shortage of rig supply with only gold companies increasing their production to date. It will likely get worse when base metal companies follow suit. At the beginning of 2022, companies will be drilling to explore until they hit a target, which is when they will ramp up their definition drilling. This is why we forecasted 2023 as the time when we will see extensive definition drilling programs.
Sourcing talent has been our main challenge recently, due to a lack of exploration from 2013 to 2019. A lot of talent exited the industry. The last 18 months increased to almost full utilization in some markets such as Canada, the US and Australia. Our capex budget rose by 66%, we ordered new drill rigs to increase capacity, and increased our efforts in training and recruitment to keep up with demand. ■

Dustin Angelo

President, CEO and Co-Founder,
NOVAMERA

How can Novamera's SMD solution impact the future of mining?
The low hanging fruit in mining is getting depleted and it is much harder to find quality deposits, especially at surface. Many mining companies are starting to go deeper, but with a lot more costs and risks involved. There are still a significant number of deposits that are near surface and part of the mineral resource portfolio of a company, but which cannot be mined with conventional methods. Novamera is effectively enabling companies to unlock these mineral resources through our cost-effective, more precise and minimally invasive method of mining. We are unlocking value in opportunities at or near surface, within 300 metres, which were ignored before as they did not fit with conventional mining methods. We are encouraging companies to think differently about small scale mining and are helping them to maximize the value of their projects. We are not only selling a mining method, but clients also have the ability to use our imaging tool in an exploration capacity.

How will Novamera's processes impact the Anaconda site and optimize the project?
Anaconda has been mining about 15,000 to 20,000 oz/y Au for about a decade at the Point Rousse project. The Romeo and Juliet deposit is a small scale deposit that cannot be mined using conventional methods. By using SMD, Anaconda can add low cost production, leverage the existing infrastructure and generate significant profits. In addition, SMD can help Anaconda extend the life of the Point Rousse project.

What is Novamera's financial plan moving forward?
Novamera is fully funded until late spring 2023. These funds include Atlantic Canada Opportunities Agency funding, and a Sustainable Development Technology Canada grant. We will again start a capital raise in the latter part of 2022. ■

Concluding Thoughts

During our research, we speak to business leaders across the value chain to gain a qualitative understanding of the state of the mining industry based on their experiences. Through what amounts to several hundreds of conversations, we compile a database of valuable knowledge on a range of important topics. In these pages, please find a brief selection of quotations that we feel best summarize some of the challenges the mining community should expect to encounter going forward, the opportunities to find success, and also thoughts we found to be motivational. Thank you to all of the individuals that took the time to share their insights with us, and we look forward to continuing to learn from you in the years to come.

"There is a huge amount of cognitive dissonance between society in general and what the mining industry does. Unfortunately, the many efforts by various industry associations trying to improve the general public's view of mining have not been able to move the dial and the sector is still perceived in a negative light. In reality, the mining industry builds, deploys and operates some of the most advanced and sophisticated technologies and machines on the planet, but this message is not reaching society and we need to come up with a different plan of attack to engage a wider audience. Ironically, this negative view is actually decelerating decarbonization efforts."

Pierre Julien, President, Canadian Institute of Mining, Metallurgy and Petroleum (CIM)

"People speak about the 'E' component until they are blue in the face, but I call the S in ESG 'the silent S' because no one talks about it. When you build a mine you do not really own it, you are renting a national asset – the natural resource endowment of a country. If you cannot create value out of it, then you shouldn't develop it, because that's theft. If you can create value, that value should be part of a pie that is shared with local communities and the people of the host country."

Mark Bristow, President and CEO, Barrick Gold

"Product stewardship connects mining to other industries as it means that whoever designs, produces, or sells a product has to take responsibility for minimizing the product's environmental impact through all stages of its life cycle. For the mining industry, it means mining and processing responsibly, and embracing the circular economy."

Louise Pearce, Global Mining Director, ERM

"The greatest overall project for the industry has to be the development and implementation of autonomous systems which are designed to operate without people and are energy efficient. Making that change to the cost of production allows us to reduce the cut-off grades in mining operations, which means that some mineralization that is currently not viable to mine will become feasible. We have to dramatically increase the amount of metals that we produce, as well as reduce the cost of those metals to shift to a low carbon economy."

Doug Morrison, President and CEO, Centre for Excellence in Mining Innovation (CEMI)

"Cashflow is the Queen that actually runs the kingdom. If you can cover your SG&A (Selling, General and Administrative Expenses) with the cash flow generated by one asset, you have significantly more latitude to feed your team while not burning treasury funds, which in my opinion, should be used for exploration or bringing mines to production."

James Tworek, CEO, Element79 Gold

"The return of generalist investors and perhaps an evolved mindset within investors in general has brought a change to how they look at companies and what they demand of companies in terms of disclosures. ESG has certainly taken a front seat. Companies that are better able to disclose ESG practices, standards and compliance to investors are getting more interest."

Dean McPherson, Head of Global Mining, Toronto Stock Exchange & TSX Venture Exchange

"Investors are eager to see frequent press releases, and if companies do not put them out when expected, share prices may weaken. However, people need to keep in mind that exploration is a science that has well defined processes that should be followed to optimize results. My advice to both investors and exploration companies is to be patient, thorough, and let the science be done correctly."

Adam Schatzker, Managing Director – Mining Research, Research Capital Corp.

COMPANY	WEBSITE	COMPANY	WEBSITE
Adventus Mining Corporation	www.adventusmining.com	Global Mining Capital Corp.	www.globalmining.ca
Alamos Gold	www.alamosgold.com	Goldshore Resources	www.goldshoreresources.com
ALX Resources	www.alxresources.com	Great Bear Resources	www.greatbearresources.ca
AMC Consultants	www.amcconsultants.com	Halyard Inc.	www.halyard.ca
Anaconda Mining	www.anacondamining.com	IAMGOLD	www.iamgold.com
Argonaut Gold	www.argonautgold.com	IBK Capital	www.ibkcapital.com
Aurum Exploration Services Canada	www.aurumexploration.com	Imagine Lithium (previously Infinite Ore Corp)	www.imaginelithium.com
Ausenco	www.ausenco.com	IMDEX	www.imdexlimited.com
Bluvein	www.bluvein.com	Inventus Mining	www.inventusmining.com
Barrick	www.barrick.com	ION Energy	www.ionenergy.ca
Canada Nickel Company	www.canadanickel.com	Ionic Technology Group	www.ionicmechatronics.com
Canadian Institute of Mining, Metallurgy and Petroleum (CIM)	www.cim.org	Kal Tire (Canada)	www.kaltire.com
Canada Mining Innovation Council (CMIC)	www.rethinkmining.org	Klohn Crippen Berger	www.klohn.com
Cementation Americas	www.cementation.com	Maestro Digital Mine	www.maestrodigitalmine.com
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Centric Mining Systems	www.centricminingsystems.com	Major Drilling	www.majordrilling.com
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Conquest Resources	www.conquestresources.com	McEwen Mining	www.mcewenmining.com
Digbee	www.digbee.com	Metso Outotec	www.mogroup.com
Discovery Silver	www.discoverysilver.com	MineConnect	www.mineconnect.com
Drone Delivery Canada	www.dronedeliverycanada.com	Minera Alamos	www.mineraalamos.com
Dundee Corporation	www.dundeecorporation.com	minera Environmental Solutions	www.minerasolutions.com
Electra Battery Materials	www.electrabmc.com	Mining Plus Canada	www.mining-plus.com
Element79 Gold	www.element79.gold	Mining Suppliers Trade Association Canada (MSTA CANADA)	www.mstacanada.ca
Eloro Resources	www.elororesources.com	Ministry of Northern Development and Mines	www.mndm.gov.on.ca
EPC Canada	www.epc-groupe.ca	Minviro	www.minviro.com
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Equinox Gold	www.equinoxgold.com	New Age Metals	www.newagemetals.com
ERM	www.erm.com	New Gold	www.newgold.com
Evolution Mining	www.evolutionmining.com.au	Newmont	www.newmont.com
Exyn Technologies	www.exyn.com	Noble Mineral Exploration	www.noblemineralexploration.com
EY Canada	www.ey.com	NORCAT	www.norcat.org
First Mining Gold	www.firstmininggold.com	Nordmin Engineering	www.nordmin.com
Frontier Lithium	www.frontierlithium.com	Normet	www.normet.com
Galleon Gold	www.galleongold.com	Noront Resources	www.norontresources.com
Generation Mining	www.genmining.com	Novamera	www.novamerainc.com

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NSS Canada (Northern Survey Supply)	www.nsscanada.com
O3 Mining	www.o3mining.com
Ontario Mining Association (OMA)	www.oma.on.ca
Onyen Corporation	www.onyen.com
Ormston List Frawley LLP	www.olflaw.com
PCL Construction	www.pcl.com
PearTree Securities	www.peartreecanada.com
Power Metals Corp	www.powermetalscorp.com
Prospectors & Developers Association of Canada (PDAC)	www.pdac.ca
Purepoint Uranium Group Inc	www.purepoint.ca
Red Cloud Securities	www.redcloudfs.com
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Research Capital Corporation	www.researchcapital.com
Rock Tech Lithium	www.rocktechlithium.com
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Roth Canada	www.rothcanada.ca
Rupert Resources	www.rupertresources.com
Sable Resources	www.sableresources.com
SafeSight Exploration Inc	www.safesightxp.com
Sandvik	www.home.sandvik
Signature Resources	www.signatureresources.ca
SK Godelius	www.godelius.com
Sofvie	www.sofvie.com
SPC Nickel Corp	spcnickel.com
SRK Consulting	www.srk.com
Star Royalties	www.starroyalties.com
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Torex Gold Resources	torexgold.com
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