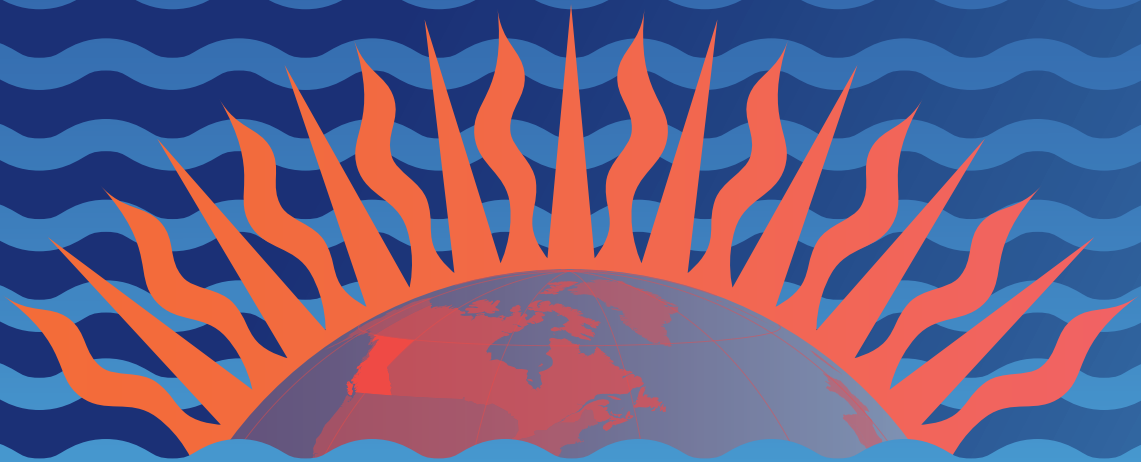


# GLOBAL BUSINESS REPORTS

INDUSTRY EXPLORATIONS



## BRITISH COLUMBIA AND VANCOUVER AS A GLOBAL MINING HUB 2019



Institutional Support and Regulations - Finance Trends  
Innovation and Industry 4.0 - Exploration - Services and Support



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# Dear Reader,

- GBR is delighted to release this edition of our Industry Explorations series covering the mecca of mining that is British Columbia, Yukon and Vancouver. GBR has been covering British Columbia's mining industry ever since our first visit to the province in 2004 and has witnessed the effects of the super cycle and the subsequent downturn here more than perhaps anywhere else in the world. From the multiplying plethora of juniors benefitting from copious flows of capital that we described then, to an industry in consolidation dependent on alternative methods of raising money from a more limited pool of funds that we witness today.

Vancouver's miners are in the painful process of reinventing themselves and their methods in order to conform to the requirements of a new era in mining financing. GBR has spoken to the current generation of juniors seeking to raise capital, as well as to the royalty and streaming companies that are increasingly replacing the conventional equity and debt financing for mining projects, to study the opportunities that the new conditions afford.

Furthermore, British Columbia currently lags behind other Canadian jurisdictions such as Ontario and Québec in terms of its ability to attract new exploration activity and investments. This report explores the efforts being made to remedy this, including the formation of the B.C. Regional Mining Alliance, which aims to stimulate reconciliation and collaboration between stakeholders, including the first nations, thus enabling the development of new mining districts, notably to Golden Triangle in northern British Columbia.

Vancouver can, however, still lay claim to being the capital of world mining, with over 800 mining companies and juniors headquartered in the city, more than Toronto and Perth (home to the second and third most) combined. The newly formed Newmont Goldcorp confirmed this status by its decision to move its North American regional operations office from Nevada to Vancouver. Companies from Vancouver can be found operating from Finland to Mozambique, bringing world-class processes and technologies with them.

Meanwhile, Yukon has become a hotbed of exploration activity, and will welcome three new mines that are expected to enter production over the next six years: Victoria Gold Corp's Eagle mine, Goldcorp's Coffee project, and Western Copper and Gold's Casino project.

In this report, juniors, explorers, financiers, producers and regulators based in British Columbia provide their opinions on the current state of the market and on the opportunities and hindrances that it presents, accompanied by GBR's own analysis together with maps and charts.

We would like to thank all our interviewees who have taken the time to provide their insights into the market. To all our readers, we always welcome your feedback or insights; please feel free to contact us at [apascoletti@gbreports.com](mailto:apascoletti@gbreports.com).



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BRITISH COLUMBIA AND VANCOUVER  
AS A GLOBAL MINING HUB 2019  
*Industry Explorations*  
Global Business Reports

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0 75 150 Kilometers  
0 75 150 Miles

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# Introduction to British Columbia

“We are a very strong regulatory jurisdiction, and we expect that the revitalized provincial environmental assessment legislation will further improve the predictability of the process, reduce overall time to move through that process and ensure that local communities are engaged earlier and meaningfully. The challenges are always the commodity price signals and how we can enable continuity to an industry that provides jobs, capacity building and wealth at regional levels. AME is working through the Mining Jobs.”

- Edie Thome,  
President and CEO,  
Association for Mineral Exploration

# Introduction to British Columbia

## Cohesion between government, Indigenous groups and the industry takes center stage

On March 5<sup>th</sup>, 2019, the Canadian Prime Minister Justin Trudeau addressed the Prospectors & Developers Association of Canada (PDAC), underlining the federal government's support for its mineral industry, illustrated by the five-year extension of the Mineral Exploration Tax Credit (METC). The Prime Minister, in conversation with PDAC president Glenn Mullan, also stressed the importance of collaboration between Indigenous communities and mining companies in an effort to build a bridge between the economic disconnect that exists between northern and southern Canada. "The way to get projects built is to do it in partnership with local communities," stated Trudeau.

Indigenous peoples have inhabited the area that constitutes British Columbia for over 10,000 years. Today, they account for roughly 200,000 of the province's population; there are 198 First Nations, Inuit and Métis with over 30 languages and nearly 60 dialects, all of which form the fabric of British Columbia. With a history of abuse towards Indigenous people, which included removing children from their families and forcing them to attend residential schools, British Columbia is now entering an era of reconciliation and building a community in which Indigenous people and the industry can flourish. "It is vital that every mining company not forget the importance of engaging with First Nations. Most of the time, it is the dialogue that is the most crucial part of the process," says Bob Faris, president and CEO of Shamrock Resources.

Modern day treaties were negotiated in British Columbia following King George III's Royal Proclamation of 1763, where it was acknowledged that Indigenous land in North America was to remain in possession of each Nation until 'ceased' or 'purchased' by the Crown. The proclamation now falls under section 25 of the Constitution Act of 1982. Nations with a treaty gain jurisdictional power and can create rules and regulations that affect the mining permitting process. However, First Nations remain eager to defend their ancestral rights: "In these negotiations, the First Nations group is made to give up many of the rights and title over their homelands. The Tahltan land is vast and rich in minerals and other natural resources, and thus, we are not willing to give up or negotiate our rights, titles and territory," said Chad Day, president of the Tahltan Nation.

Only a select few of B.C.'s Indigenous groups have established treaties with the government. Day is trying to modify the online staking program that the government administers for companies wanting to enter their land. "Through this system, people from all over the world are allowed to stake claims in our territory. We receive notifications of the permits and can then provide feedback or concerns," Day continued.

Their goal is to develop a land-use plan with the government whereby some areas are open for business and others are not. The determining factors would include assessing whether mining negatively impacts species, water and the environment and preserving culturally significant areas.

The focus of industry players on reconciliation and collaboration has led to the creation of the B.C. Regional Mining Alliance (BCRMA), a partnership between the provincial government, the Tahltan Central Government, the Nisga'a Lisims Government, the Association for Mineral Exploration, Dolly Varden Silver, Skeena Resources and GT Gold. The target is to develop a culture of support amongst all actors from permitting to mine closure.

The BCRMA represents industry players in the Golden Triangle, a region in northwest British Columbia that has a 150-year mining history. Rich in gold, silver, zinc, copper, lead and molybdenum, the area covers nearly 25% of the province. With strong road connectivity, three new run-of-river hydroelectric facilities and the completion of the Northwest Transmission line, which provides miners access to the power grid rather than relying on diesel, the industry in the Golden Triangle is strongly positioned for development. "Projects that were generally diesel powered now have a chance to plug into US\$0.04-kWh electricity. The far north will get serious amounts of snow, but the flip side is that we have a very supportive government and local communities understand mining. The Tahltan and the Nisga'a, who are south of us, are dream partners in terms



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## BRITISH COLUMBIA: DEMOGRAPHIC DATA

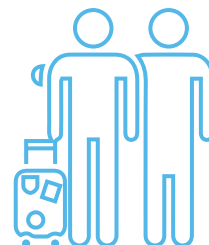
Source: Statistics Canada



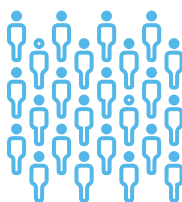
Population (2019)

**5,020,302**

Largest city (2019)

**Vancouver**  
metropolitan population  
of 2.48 million

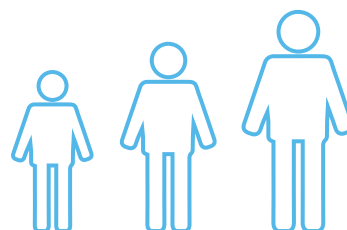
Non-Canadian Citizens (2016)

**421,940 (9.3%)**

Population density (2019)

**5.3 people per sq km**

Life Expectancy (2016)

**84.86 (female) 80.61 (male)**

Average Age (2016)

**42.3**

Home Ownership Rate

**68% (1,279,020)**

Labor Force

**2,670,800**Citizens Employed by the  
Mining Industry (2018)**16,600**

of their understanding of mining,” said Walter Coles, president and CEO of Skeena Resources.

Skeena Resources, which has strong relationships with First Nations communities, aims to partner with international investors looking to operate in the Golden Triangle. “The potential for mineral deposits in the area is spectacular, and it is easier for global companies to partner with somebody local than to develop a First Nations relationship and a geological and regulatory expertise entirely on their own,” added Coles.

At the AME Roundup’s 2018 Reconciliation Breakfast, Chief Dr. Robert Joseph, co-founder of Reconciliation Canada and hereditary chief of the Gwawaenuk First Nation, stated: “It has always, always

been about relationships: whether they’re good, or developing, or they’re broken.”

Chad Day expanded on this theme: “It is very important for the mining industry and government to adapt to modern times and act in partnership with First Nations within the territories they want to operate in. We are starting to become more assertive, and our capacity and revenues are growing significantly. It is paramount for companies to recognize and fully respect the unique jurisdictions, rights and titles of First Nations people in British Columbia.”

The intent is certainly to ensure that companies not only enter and take from the land, but also share and give back to communities that have a deep knowledge of the land. British Columbia is working on

its image in order to convey that the province is open for business and able to support mining companies wanting to move into production. It hopes to increase transparency and public confidence, while advancing reconciliation with Indigenous groups. “Perception plays a key role in attracting investment, so building on the successes of the BCRMA will help address any concerns directly,” said Edie Thome, president and CEO of AME.

Lengthy permitting processes have certainly dissuaded some from entering British Columbia, but these efforts ensure that both communities and miners benefit from the territory’s local knowledge and skilled workforce. Sustainability must undergird the industry. “We must also remember that this province is the largest employer of Indigenous peoples, and they play a paramount role in developing the mining industry in British Columbia,” said Bryan Cox, president and CEO of the Mining Association of B.C.

Starting to operate on a global platform, the Tahltan Nation has established relationships with communities outside of Canada

that face similar challenges. Day recently met with the Ngäbe Indigenous people of Panama and Costa Rica, who hold tens of thousands of acres of land in the region. Day believes that exporting knowledge on how to mitigate mining’s negative environmental impact and strengthen relationships between industry and communities is paramount to the Nation. “In Latin America, for example, the central government often has the power to overrule the opinion of Indigenous groups, and there are many issues between local and central governments with regards to how much of the money received by the latter is reinvested into the communities,” said Brian Abraham, global mining expert for Dentons.

One of British Columbia’s strengths is the required consent and collaboration from First Nation’s groups, but this can also deter activity. Many projects can have numerous Nations in their holding, which means that they must communicate with each to reach a unanimous decision to move forward. “There is often no true alignment of objectives amongst them, and the strength and claim of each group must thus be consid-

ered. The B.C. government has an incentive where a percentage of the revenue (resource revenue sharing) from a successful mining project is shared with Indigenous groups in terms of tax revenue, but First Nations will often also request community benefit agreements or employment and training initiatives to be implemented,” added Abraham. A prime example is the C\$7.9 billion Enbridge Northern Gateway Pipelines project, which aimed to build parallel pipelines from Bruderheim, Alberta to Kitimat, British Columbia, carrying gas condensate and diluted bitumen for export to Asia via seaborne tanker. “33 indigenous groups were required to sign an approval: 29 did and four did not, so the project did not move forward. Companies need to make everyone happy here despite the global polarity of opinion,” said Peter Espig, president and CEO of Nicola Mining.

True cohesion between government, indigenous groups and the mining sector is still in the works, but British Columbia is committed to building a collaborative environment that will enable all parties to benefit from the province’s mineral wealth. ■

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## Bryan Cox

President and CEO  
MINING ASSOCIATION OF  
BRITISH COLUMBIA

“

The ability to demand a premium for green commodities is currently a very interesting topic of conversation, and although this is not yet a reality, there is no better jurisdiction positioned for this opportunity than ours.

”

### What is the relevance of the mining sector in Vancouver for the growth of the B.C. economy, as well as the development of the mining industry worldwide?

Our recent ‘One Province, One Economy’ study focused on highlighting the diverse value chain in the sector contributing to the B.C. economy. We believe in an integrated and connected economy, not only between rural and urban communities, but also as a world industry operating on the global stage. We wanted to establish what operating mines spend their money on and where their supplier communities are located, as it is often not only a mine’s immediate location that benefits from its operations. The results indicated that in 2017, operating mines were spending at least C\$1.5 billion and had over 3,000 suppliers across the province. Most of the expenditure was in the Lower Mainland, with C\$142 million in Vancouver, C\$129 million in Burnaby and C\$76 million in Surrey.

British Columbia is a very favorable mining destination, and we will continue growing the sector responsibly to support the incredible foundational economy, which promotes prosperity in the entire province.

### What is the strategy to continue growing the mining sector in Vancouver?

The mining sector growth in British Columbia has historically been fueled by the adoption of innovation and technology. An example of this is Victoria-based Llamazoo, which was building video games until 2016 when they realized their technologies were transferrable to other industries. Partnered with Teck Resources, they created a virtual world to ‘walk through a virtual mine site’ using virtual reality goggles. This technology provides an opportunity to engage with communities by viewing what is being proposed in real time and suggest changes.

### How does British Columbia intend to continue spearheading the transition into a greener industry future?

We have had carbon taxes in British Columbia for more than 10 years and were the first jurisdiction to implement that type of structure. We are currently collaborating with the government to create a mechanism that protects our trade-exposed

industries while ensuring we produce the cleanest and greenest products. We are the largest producer of copper and steel-making coal, the second largest producer of silver, the only producer of molybdenum and the third largest producer of gold in Canada. All these commodities are necessary in the transition to a lower carbon economy, whether for solar panels, wind turbines or clean energy vehicles. Policy-makers must remember that B.C. mining companies compete in the global marketplace, and we sell our commodities at prices set by global markets. The ability to demand a premium for green commodities is currently a very interesting topic of conversation, and although this is not yet a reality, there is no better jurisdiction positioned for this opportunity than ours. With 97% hydroelectricity, we have the cleanest grid in North America, and our mines are connected to it.

### There is the concern that too much of British Columbia’s talent and skills are exported to other provinces and countries. What is being done to retain strong talent?

Losing talent is definitely a concern, and we try to retain our skilled workforce by ensuring that we have strong and responsible projects put into operation. The province has excellent geology, technical knowledge and infrastructure, but we must get projects approved. It can take up to 15 years to ready a project for the EA process in British Columbia, which in turn can take one to five years and many millions of dollars. Once a certificate is received, the permitting process continues for the entire life of mine. From an investment perspective, consistency, clarity and coordination throughout the permitting process are vital. We are working very closely with the government and other stakeholders to try to ensure that our regulatory process is geared towards improving the transparency in the process. We must also remember that this province is the largest employer of Indigenous peoples, and they play a paramount role in developing the mining industry in British Columbia. This is an excellent jurisdiction to invest in; we have all the fundamentals in place to continue to lead the world as a mining jurisdiction, and we want to encourage people to come to our province and invest their capital. ■



## Edie Thome

President & CEO  
**ASSOCIATION FOR  
MINERAL EXPLORATION**

“

Given the vast amount of expertise in the Vancouver and B.C. area and the steady climb of both gold and copper prices over the year, we hope to see an increase in exploration dollars.

”

**Could you describe the ways in which the AME has pushed to establish collaboration within the province since we last met?**

In the last year, AME has been involved in three very collaborative processes with the province of British Columbia that will support our members. Consistent goals of these initiatives are to increase public confidence, implement the principles of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), advance reconciliation with Indigenous groups and to improve predictability for industry. First, AME is proud to partner with the provincial Ministry of Mines, Energy and Petroleum Resources, the Nisga'a Nation, the Tahltan Central Government and several mineral exploration and mining companies in the newly formed B.C. Regional Mining Alliance (BCRMA) where we aim to collectively promote British Columbia as the best mineral exploration and mining jurisdiction to invest in. Secondly, AME was a participant in the Environmental Assessment Advisory Committee to Minister George Heyman as the Ministry of Environment and Climate Change Strategy undertook a process to revitalize the Environmental Assessment process in British Columbia. Finally, we have been working collaboratively through the Mining Jobs Task Force, established by Minister Michelle Mungall in February of 2018.

**How have exploration investment trends changed in the last couple years, and what can we expect to see moving forward?**

In 2017, we saw the first increase in exploration spending in the province since 2012. The 20% increase of C\$41 million contributed to the total C\$246 million spent across the province. About C\$37 million of that increase was in gold exploration, which is an interesting statistic considering the strength of our copper resources in the province. Raising capital is still a challenge for companies, and contributing to this are the various options for venture capital investment. Given the vast amount of expertise in the Vancouver and B.C. area and the steady climb of both gold and copper prices over the year, we hope to see an increase in exploration dollars.

**In which ways is British Columbia incentivizing companies and global investors to position itself as the leading Canadian**

**province for the mining sector?**

First of all, we should all be proud of our Canadian mineral exploration and mining industry. As a country, we have incredible expertise, practices, regulations and legislation. Our goal is to ensure continuity and growth in the percentage of investment dollars that British Columbia attracts. As such, we have completed a thorough analysis of the other Canadian provinces to compare the incentives they offer the industry, and what it would take to legitimately say that our province is the leading investment jurisdiction in Canada. Perception plays a key role in attracting investment, so building on the successes of the BCRMA will help address any concerns directly. Secondly, tax incentives can also play a key role in attracting investment. At the moment, both a flow-through scheme, which benefits the investor, as well as an exploration tax credit rebate for companies, are under consideration.

**What challenges do companies face when navigating CSR and environmental requirements in British Columbia?**

We are a very strong regulatory jurisdiction, and we expect that the revitalized provincial environmental assessment legislation will further improve the predictability of the process, reduce overall time to move through that process and ensure that local communities are engaged earlier and meaningfully. The challenges are always the commodity price signals and how we can enable continuity to an industry that provides jobs, capacity building and wealth at regional levels. AME is working through the Mining Jobs Task Force to try to reduce some of the impacts of a volatile market on projects, which hopefully will result in good projects being built faster.

**How does the AME Roundup play a role in strengthening the B.C. mining network?**

The AME has been organizing Roundup for 35 years and, in 2018, we brought together over 6,500 people from 39 countries. I am proud of the long history of technical excellence shared at the conference along with the focused indigenous programming in The Gathering Place, now in its seventh year. This year we will also be holding our second annual Reconciliation Breakfast, as well as an increased program in The Innovation Hub, which is also in its second year at the conference. ■



## Chad Norman Day

President  
**TAHLTAN CENTRAL  
GOVERNMENT**

“

We want to showcase that there are opportunities where Indigenous groups, the province and the industry can work in collaboration to have successful mining projects.

”

### Can you outline the structure of the Tahltan Nation and how relevant the mining industry is within it?

The Tahltan Nation has existed since time immemorial and refers to our land-base and 4,000 members, approximately 800 of whom live in one of our three communities: Iskut, Dease Lake and Telegraph Creek. The rest of our members are dispersed throughout British Columbia, the Yukon and other areas in Canada and the United States. Mining dominates the economy in Tahltan territory and is extremely relevant to our communities. Indeed, three of the 16 active mines in British Columbia – Silvertip, Red Chris and Brucejack – are located within Tahltan territory, employing over 200 Tahltans each year. Our Impact Benefit Agreements and Communication Agreements, with companies operating in our territory, brings further benefits, including revenue sharing, scholarships, contracts and training opportunities.

### There are only three nations of over 200 that have a government treaty in British Columbia. Why have you rejected a treaty and how do you define borders?

The modern day treaty process would include negotiations with the Crown, where we would be granted new jurisdictional powers under Canadian law. In these negotiations, the First Nation group is made to give up many of their rights and title over their homelands. Tahltan land is vast and rich in minerals and other natural resources, and thus we are not willing to give up or negotiate our rights, titles and territory. Nations that have treaties would have specific abilities to create their own laws and regulations surrounding permitting under Canadian law. The mining companies would then have to specifically talk to each Nation, as each will have their own jurisdiction and permitting process.

### How can mining companies negotiate permits with the Tahltan Nation today?

Currently, British Columbia uses an online staking system that the Tahltan Nation does not support. Through this system, people from all over the world are allowed to stake claims in our territory. We receive notifications of the permits and can then provide feedback or concerns. Unfortunately, we do not have a veto or a structured land-use plan to stop this process. In addition, there

is currently more access to stake in Tahltan territory than we would like. We are working internally to manage our own land base by creating a land-use plan, and we are also collaborating with the government to ensure that a better process is implemented. We are developing this plan to help us identify areas where we would be open for development and those where we are absolutely opposed to any development: for example, close to our communities and/or areas of high cultural significance.

### When determining if you are open for a new development in a specific area, what elements do you take into consideration?

We will take cultural values into consideration, such as fish and wildlife, archeology and the proximity to the community and key ecological resources. Cumulative impacts are also taken into consideration, and we may be open to having one mine in a certain area, but not more, as the impact would be too serious on the area. Water resource management is another important area taken into consideration.

### What milestones have you achieved in the past two years?

TahltanWorks has now been divided into two distinct departments: the Employment and Contracts and the Education and Training departments. This ensures more resources and internal capacity for the proper training of our people to increase employment. At 2019's AME Roundup, we are going to bring the largest Tahltan delegation ever, including Tahltan youth so that they can realize the employment opportunities in the market. In addition, we will be meeting with approximately 20 of the exploration companies that are working in our territory.

### Do you have a final message for our international readership?

We are starting to become more assertive, and our capacity and revenues are growing significantly. It is paramount for companies to recognize and fully respect the unique jurisdictions, rights and titles of First Nations people in British Columbia. We want to showcase that there are opportunities where Indigenous groups, the province and the industry can work in collaboration to have successful mining projects. ■



## Gregory Dipple

Director  
BRIMM

“

BRIMM is focused on assembling interdisciplinary research teams from across campus to work on large scale lifecycle problems for the mining industry.

”

### What is the current mandate and focus of the Bradshaw Research Initiative for Minerals and Mining (BRIMM)?

BRIMM at the University of British Columbia (UBC) is modelled after the vision and generosity of Peter Bradshaw, who provided the seed funding to launch BRIMM. BRIMM is focused on assembling interdisciplinary research teams from across campus to work on large scale lifecycle problems for the mining industry. UBC has had a strong relationship with the mining industry for over 100 years. There are a number of influential and successful units on campus that work with the mining sector, but most of those relationships have traditionally been siloed. The mandate for BRIMM is to connect these silos by getting those groups to collaborate on some of the larger problems that the industry faces. BRIMM is focused on applied research that can provide solutions for industry in the near term.

### Can you provide an overview of the groups under the BRIMM umbrella?

There are four big groups on campus involved in multimillion-dollar research with the mining industry. The Mineral Deposit Research Unit has expertise that is largely, but not exclusively, focused on exploration. The Norman B. Keevil Institute of Mining Engineering covers a fairly broad spectrum, working in areas such as extraction, processing and social responsibility. The Department of Materials Engineering's Hydrometallurgy Group, driven by Dr. David Dreisinger, is recognized as one of the global leaders in hydrometallurgy. Finally, the Geological Engineering Program is very strong in both hydrogeology and geotechnical engineering.

### How is BRIMM working to bring different silos together?

We have launched two initiatives, or themes, to date, both of which contain researchers from across the campus. The first theme, Geometallurgy, aims to extract additional value from the information collected during exploration and integrate knowledge across the full mining process. The goal is to make sure that the entire mining circuit is designed to appreciate the diversity of the materials. The second theme, the Mining Microbiome, brings together faculty that use genomics in mineral

exploration, processing and environmental impact and ecological restoration. Again, these groups have historically worked in isolation of one another, but we see great value in integrating the databases and outcomes across the full mining lifecycle.

### Can you walk us through how CO<sub>2</sub> sequestration works and the benefits thereof?

We have worked on CO<sub>2</sub> sequestration in mine tailings for nearly 15 years in collaboration with mining companies from Australia, Canada and Southern Africa. We focus on ore types that are hosted in magnesium silicate rich rocks, ultramafic rocks that are inherently reactive to carbon dioxide in air and in flue gas. During this reaction, which happens spontaneously in mine tailings at slow rates, the carbon is combined with magnesium in the tailings to form carbonate minerals that are stable, thus safely storing carbon in solid mineral form for millennia. Essentially we are making a rock akin to limestone. More than 90% of carbon on earth is in rocks, so you are just putting carbon back into rocks instead of having it in the air or in the ocean. The research has focused on understanding what limits the reaction rates and then designing processes that overcome those restrictions so that carbon can be sequestered at a scale similar to that of mine greenhouse gas emissions, providing operational offsets. There are also co-benefits, such as cementation and stabilization of tailings, immobilization of toxic metals and dust reduction.

### What are BRIMM'S principal objectives for the next 18 months and outlook for the future?

In a year and a half, BRIMM should have launched a half a dozen multidisciplinary research partnerships with industry in geometallurgy, genomics and beyond. As those projects grow, we will use our seed funding to expand the scope and size of our activities. With regards to the CO<sub>2</sub> sequestration project, BRIMM is moving into field pilots at active mines in 2019, and I would expect that within two years we should have at least three pilots operating, which could get scaled up and incorporated into mining operations, thus offsetting the greenhouse gas emissions from operations. ■

# Gavin C. Dirom & Bruce Madu

GD: President, CEO & Director  
BM: Vice President Minerals & Mining  
**GEOSCIENCE BC**



GD



BM

“

The aim of the project was to catalyze exploration for potential undiscovered mineral deposits by encouraging informed decisions, responsible development and investment within the area.

”

## Can you introduce Geoscience BC and explain its mission?

GD: Geoscience BC is an independent non-profit society created in 2005 with a C\$25 million grant from the provincial government to augment the B.C. Geological Survey. The organization is closely aligned with industry, government, communities and First Nations for the purpose of identifying relevant science and research opportunities that will make a difference in terms of attracting investment or informing decisions around natural resource development. We focus on foundational science to drive interest and support the exploration and mining sector, as well as the oil and gas industry in British Columbia.

## What was the aim of Geoscience BC's Search Phase III project?

BM: Geoscience BC completes a significant amount of regional scale surveying to stimulate exploration in the province. The Search Phase III is one of these regional scale surveys. Approximately 9,600 square km were flown in a highly prospective part of northern British Columbia where there are former and current operating copper and gold mines. The aim of the project was to catalyze exploration for potential undiscovered mineral deposits by encouraging informed decisions, responsible development and investment within the area.

GD: The data was released in January 2018, and it immediately attracted interest. This was followed by exploration programs in the area. A junior mining company, Serengeti Resources, knew we would be in the area, and after seeing the results, decided to stake more claims and invest further into their projects. This is just one example of the investment and interest public geoscience brings to an area.

## Can you explain the science behind shooting gold grains with lasers to find out where they came from?

BM: In the same way that fingerprinting can catch criminals, the concept can be applied to identify where gold grains came from. A gold grain not only has gold in it, but also a variety of elements that are alloyed with the gold such as mercury, silver and palladium, which provide a unique 'fingerprint.' By measuring all the other alloyed elements within the grain and comparing it to established standards, one can

make an informed estimate as to the type of metal deposit from which it came. If the gold grain is high in silver, for example, it may have come from the particular type of deposit for which you are searching.

The researchers we support analyze gold grains with a laser attached to an inductively coupled mass spectrometer (ICP-MS). This ICP-MS is an industry standard analytical tool used for detecting metals in samples, and the laser makes it unique. Under a microscope, a gold grain will be shot with the laser, and the vaporized material is then vacuumed up and sent through the ICP-MS to measure the elements within the grain. This approach is an innovative and high-tech version of sleuthing and should make an explorer more efficient in finding good targets.

## How can this technology benefit prospectors and exploration companies?

BM: The ability to analyze gold grains and confidently understand where they come from should make it a much faster process to define what is being targeted when prospecting an area. In British Columbia, a particular composition of gold is associated with large copper deposits. If you are finding gold that is indicative of a copper deposit, this technology may help you find the associated copper deposit.

To date, our researchers have been establishing standard gold grain compositions for known deposits. In 2019 we are launching a program in central British Columbia, where we will go in 'blind' as we do not know where deposits are. We will collect samples of gold grains in the natural environment and analyze them, and the publicly available results should help explorers establish targets in the area.

## What was the vision laid out in Geoscience BC's 2018-2022 strategic plan?

GD: Geoscience BC heard from more than 400 people from industry, communities, government and First Nations to inform the development of our strategic plan, entitled Forging Opportunities Through Earth Science Partnerships. Our vision is to be a leading provider of fact-based and relevant earth science research in British Columbia. The strategic plan is organized into six focus areas, including minerals, energy, water, governance, public data management and communications. ■





# Mining Finance

“The amount of capital available to the mining sector has declined by up to 80% over the last couple of years, and institutional capital is minimal. There has also been a drag of money out of the actively managed funds into ETFs and Index funds, which do not do private placements. There is hardly any money for exploration. The only money available is coming from majors. A lot of risk capital went into cannabis and crypto-currencies, as well as the tech sector. It is very difficult for mining companies to raise capital, and this is arguably the strongest place for mining expertise in the world.”

- Walter Coles,  
President and CEO,  
Skeena Resources

# Mining Finance

## Exploration spending increases, but small-cap juniors continue to feel the pinch

Since the end of the super-cycle in 2012, conventional equity and debt financing for mining projects has become incrementally harder to find, and even as optimism returns to the market, competition from the cannabis industry has taken even more capital from the natural resource space in Canada. While the global mining industry appears to be in the tentative stages of a new upcycle, the fruits of this renewed enthusiasm have yet to trickle down to the small-cap juniors, many of which reside in Vancouver. The question to ask then is if rather than when the money will start flowing back to the smaller players in the exploration space? “The world has truly changed with respect to the way capital markets function,” stated Nolan Watson, president, CEO and director of Sandstorm Gold Royalties, continuing: “The advent of passively managed capital has become such a strong force, as the fees are extremely low, and these passive ETFs are making investments based on only two criteria: the size and the liquidity of the company.”

George Pyper, director of Endeavour Financial, has also noticed the changing dynamics of the mining finance space: “Historically, mining projects would be financed by banks, but this has changed over the last seven to 10 years. The number of banks active in the space has reduced, as well as the amount of capital that the banks that are still operating in the space are able to deploy.” Endeavour Financial, with offices in Vancouver and London, has changed its service

es to adapt to this new context. Specialist groups, often backed by U.S. institutional funds with a specific mandate to invest in the natural resources space, are increasingly replacing retail investors: “What used to be alternative financing options, such as specialist funds, are now mainstream,” added Pyper.

### The rise of royalty & streaming financing

The royalty and streaming model, contrary to the traditional equity and debt model of financing mining projects, continues to go from strength to strength. With commodity prices deflated, the value of upfront and periodic payments for a return of current or future mineral production has become increasingly attractive. “From a macro perspective, mining companies typically use royalty and streaming when equity becomes more expensive and when their share prices are down, which is why many royalty and streaming companies have been very busy in recent years,” explained Brett Heath, president, CEO and director of Metalla Royalty & Streaming.

Streaming has brought a significant change in the mining landscape, originally for producing companies, but also now increasingly for development projects that require financing. “As the capital markets have been constrained, streams have been pursued all the way down the value chain,” added George Pyper.

Vancouver is home to a number of royalty and streaming firms that have seen significant growth in recent years, the largest of which is Wheaton Precious Metals (WPM), a pioneer in the metals streaming space. Focusing on assets that fall into the lower part of the cost curve, WPM’s portfolio includes Vale’s Salobo mine, the largest copper deposit ever discovered in Brazil, and Glencore’s Antamina polymetallic mine in Peru. Randy Smallwood, WPM’s president and CEO, elaborated on the benefits of the financial model: “By taking a non-core value and reinvesting it into core franchise, a company can continue to grow, and that is exactly what streaming delivers,” he said.

Sandstorm Gold Royalties has hit record production each year for the last eight years and looks set to continue on an upward trajectory with a portfolio of streams due to come online, including Yamana’s Cerro Morro mine in Argentina, the Hod Maden project in north-eastern Turkey and Lundin Gold’s Fruta del Norte gold project in Ecuador. “The company has over 185 streams of royalties, ranking us third in the world in terms of portfolio, which gives us the diversification factor. We are the only streaming and royalty company in the world trading under its net asset value,” concluded Nolan Watson.

Another Vancouver-based royalty and streaming company to have experienced rapid growth since its launch in 2016 is Maverix Metals, which currently has 79 royalties and streams in 15 countries. Dan O’Flaherty, Maverix Metals’ president and CEO, illustrated the remarkable rise of a company that only employs seven people: “Maverix’ share price has increased from C\$0.54 cents to over C\$2.25, and it has a market cap of around C\$500 million.”

Metalla Royalty & Streaming Ltd. also opened in 2016, when Brett Heath, Metalla’s president, CEO and director, observed an opportunity to capitalize on a part of the market that the rest of the sector was not focusing on: the so-called secondary market, or third party owners of existing royalties. “We realized that there was no product or platform that gave third party royalty

holders the type of valuations or liquidity afforded to majors,” explained Heath, continuing: “Metalla identified a number of potential deals that the bigger companies were not focusing on, which helped us close deals in a much faster manner. In 2018 the average material transactions for royalty and streaming companies were around 1.5, whereas Metalla completed five.”

#### **Conclusion: M&A activity should not be restricted to the majors**

2018 saw the highest M&A spending since 2012, a sign of market revival. The market trend of mergers between equals, highlighted by the two mega-deals between Barrick and Randgold, followed by the Newmont-Goldcorp agreement, is an indication that

the industry is prioritizing core-assets. This will present new opportunities for mid-tiers and well-financed juniors looking to acquire the non-core assets discarded by the majors. The lack of investment in both exploration and mine development during a six-year downturn will also force mining companies to acquire and develop new projects, but the swathes of junior companies must adapt to the current climate, where promising drill results alone do not guarantee financing. In this context, mergers between juniors are also advisable, such as the creation of Québec Precious Metals, which was formed from three junior companies. “Companies need to self-rationalize and merge to grow in size and liquidity to attract financing,” observed Nolan Watson.

The substantial growth of royalty and streaming financing during the downturn

demonstrates that the right projects can generate profit regardless of market conditions. However, mining is a cyclical business, and the nature of the industry will therefore always present opportunities for investors at the start of a new upturn. As the market for acquisitions heats up, junior companies must advance their projects to a stage that makes them attractive, and this requires financing.

When asked what advice he would give to exploration companies looking for financing, Mike Vint, vice president of Endeavour Financial, underlined the importance that smaller companies have a long-term goal and keep their options open: “At a junior stage, and when equity markets are not there, they have to be open to alternatives. Do not jump into bed with the first person that comes along,” he concluded. ■

### **Mining markets at a glance - YTD April 30, 2019**

Source: Toronto Stock Exchange

|                                    | <b>TSX Venture (TSXV)</b> | <b>TSX</b>      | <b>TSXV and TSX</b> |
|------------------------------------|---------------------------|-----------------|---------------------|
| <b>Number of Issuers</b>           | 955                       | 214             | 1,169               |
| <b>QMV (C\$)</b>                   | 17,954,674,107            | 294,270,040,191 | 312,224,714,298     |
| <b>New Listings</b>                | 4                         | 1               | 5                   |
| <b>Equity Capital Raised (C\$)</b> | 567,543,832               | 283,631,652     | 851,175,484         |
| <b>Number of Financings</b>        | 308                       | 45              | 353                 |
| <b>Volume Traded</b>               | 6,752,008,069             | 7,588,283,272   | 14,340,291,341      |
| <b>Value Traded (C\$)</b>          | 1,571,732,726             | 61,034,956,275  | 62,606,689,001      |
| <b># of Trades</b>                 | 906,689                   | 13,429,303      | 14,335,992          |



## Randy Smallwood

President & CEO

WHEATON PRECIOUS METALS

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From an investment perspective, I believe that the streaming model really is the best way to invest into the precious metals industry, offering the lowest risk and highest return.

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### Why do you think the royalty and streaming model has been so successful in the last decade?

Streaming has developed as a strong and trustworthy source of capital for the mining industry. The mining industry perpetually needs capital, and it needs to consistently reinvest into itself mainly because resources do not last forever. The streaming industry is a source of this capital, and we compare favorably against equity and other traditional forms of finance. Streaming always improves a project's economics and always improves the return on invested capital. By taking a non-core value and reinvesting it into core franchise, a company can continue to grow, which is exactly what streaming delivers.

### What were the reasons for rebranding from Silver Wheaton to Wheaton Precious Metals in 2017?

In 2013 we decided to move into the gold space by making two investments and have since expanded by moving into cobalt. We realized that the name Silver Wheaton did not cover all that we offered, and changing our name to Wheaton Precious Metals represented our evolution from a pure silver streaming company to a diversified precious metals streaming company.

### Which of Wheaton's streams and royalties have been standout performers in recent years?

Vale's Salobo mine is our flagship property; it is the largest copper deposit ever discovered in Brazil with incredible potential. It is a deposit with high operating and profit margins, with Wheaton's consolidated production figures expected to average 180,000 oz/y over the first 30 years. Glencore's Antamina polymetallic mine in Peru is also an incredible asset with a very long life and low cost. Goldcorp's Peñasquito mine has had a few tough years but has started to turn the corner, and we are seeing some good grades. The Stillwater mine, Wheaton's acquisition last year, is the only U.S.-based mine for platinum group metals (PGMs) and the largest primary producer of PGMs outside of South Africa and Russia.

### Considering Wheaton Precious Metals does not operate any mines, why does the company have a strong CSR focus?

I have operated gold mines in Canada and recognize how important a social license is when doing so – when you work in a community you need to make sure you deliver a sustainable and positive effect to the community long after the mine has closed. One of the first initiatives I kick started was Wheaton's CSR program. We approach the site managers at the mines, look at the programs they have in place and then provide the ability to double the capacity of these programs. I believe that if you are benefiting from the minerals being extracted, you need to make sure you are giving back to those communities.

### At what stage of the mining cycle do you believe the industry currently sits?

There seems to be three phases to every mining cycle: the development phase where prices go up and people invest and buy assets; the harvest phase where commodity prices are high and there is a lot of equity available; and the balance sheet preparation phase where those who invested in peak cycle are sourcing capital to bring debt levels down. We could say the balance sheet preparation phase was from 2013-2018, and now in 2019 we are seeing commodity prices increase and more market optimism for growth.

### Do you have a final message for the readers of *Global Business Reports*?

From an investor's perspective, Wheaton Precious Metals has taken a lot of the risk out of a traditional mining investment, yet still delivers all the rewards. We have growth, yield and leverage, and we deliver so much more at an attractive valuation. From an investment perspective, I believe that the streaming model really is the best way to invest into the precious metals industry, offering the lowest risk and highest return.

To operators and potential partners, you must never forget that the ultimate goal is to deliver the maximum return on the invested capital, and I do not know of another financing mechanism that delivers as positive of an impact on the investment front. Streaming allows us to take away the production risk and be an equity partner, yet we contribute more than joint ventures. ■



# Nolan Watson

President, CEO & Director  
**SANDSTORM GOLD ROYALTIES**

“

Investors typically base our value solely on our cash flowing assets, but what gives us a competitive edge in the market is that we have built a significant portfolio of projects that are not yet in production and are actively being developed or explored.

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## How significantly has Sandstorm Gold Royalties grown since its establishment in 2008?

In 2018, Sandstorm Gold Royalties announced record gold production of 57,600 oz. Sandstorm is a growth company: we have hit record production each year for the last eight years, and we aim to continue this trend in 2019. Based solely on the assets Sandstorm already has in its portfolio, we expect 2020 to be another year of record production as well. We will continue to buy assets, and we hope to continue to set records as we grow.

## Does Sandstorm's model as a royalty company differ from those of its competitors?

Sandstorm's focus is to continue to build a company that not only has a significant diversified portfolio of cash flowing royalties and streams, but also a diversified portfolio of development and exploration stage assets.

Investors typically base our value solely on our cash flowing assets, but what gives us a competitive edge in the market is that we have built a significant portfolio of projects that are not yet in production and are actively being developed or explored. We have a great technical team that can pick the right assets to add value for our investors. Approximately 90% of the capital that we allocate is for assets coming into production in the foreseeable future.

## Which of Sandstorm's streams and royalties will significantly impact the company's cashflow?

One of Sandstorm's streams that will come online shortly is the Yamana's Cerro Morro mine in Argentina. This will be the largest stream that we have had come online to-date, and at today's commodity prices, we will obtain approximately US\$12 million in cash flow annually from this stream.

We are also very excited about our royalties on the Hod Maden project in northeastern Turkey, as this asset will contribute significantly to Sandstorm's growth over the next four years. We expect the Hod Maden project to expand and grow significantly in the years to come.

In addition, we have royalties on a number of world-class assets. We recently bought a royalty on Lundin Gold's Fruta del Norte gold project in Ecuador. Sandstorm's focus is to buy royalties on projects where we think that the mine life can be dramatically extended, which is one of the main ways in which we add value for our investors.

## How do you view the fundamentals of the gold developing in the next 12 months?

I am one of the few CEOs in the industry with a track record of saying what I actually think of the gold price, instead of saying what I think I am paid to say. For the last three years, my opinion about the gold price was that it is first going to decrease before we see a significant increase. Over the last four months, we have seen the fundamentals of the gold market change very positively and I have an optimistic and bullish outlook for the market moving forward.

## What advice would you give to companies that are looking for funding in the current climate?

The world has truly changed with respect to the way capital markets function. Traditionally, the vast majority of capital in the world was held by active institutional investors, including many specialty funds, which you then had to convince to invest in your company. Today, the advent of passively managed capital has become such a strong force, as the fees are extremely low, and these passive ETFs are making investments based on only two criteria: the size and the liquidity of the company. Companies thus need to self-rationalize and merge to grow in size and liquidity to attract financing.

## Do you have a final message for the readers of Global Business Reports?

My message to investors will be to keep four key aspects in mind: growth in production, exploration upsides, diversification and value. Sandstorm has more growth built into its portfolio than any other stream royalty company globally, as well as more exploration upside dollar for dollar. The company has over 185 streams of royalties, ranking us third in the world in terms of portfolio, which gives us the diversification factor. ■

# George Pyper & Mike Vint

GP: Director

MV: Vice President

**ENDEAVOUR FINANCIAL**



GP



MV

“

Streaming has brought significant change to the mining landscape, originally for producing companies, but also now increasingly for development projects that require financing.

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**Can you provide an overview of Endeavour Financial and its corporate structure?**

GP: Endeavour Financial was established in Vancouver over 30 years ago to offer financial services specifically to the mining industry. The company later opened an office in London in the early 2000's, and today our footprint and services span across geographies such as the Americas, Europe, Africa and Asia. We are an advisory group, and the ethos of the company is to assist mining companies in realizing their projects through project development, M&A, financial advisory, strategic advisory and structured finance.

MV: Endeavour Financial also has technical mine analysis capabilities. Any kind of lender due-diligence that is required for financing, we tend to do upfront, so that companies are aware of what the lenders will look at and how they will look at it within the cashflow model and the lending capacity of the project.

**To what extent has the streaming model impact the world of mining finance?**

GP: Streaming was an Endeavour Financial incubated innovation. Silver Wheaton was an Endeavour Financial shell company, and we advised on the original transaction where Silver Wheaton acquired streams from the Mexican assets of Wheaton River. Streaming has brought significant change to the mining landscape, originally for producing companies, but also now increasingly for development projects that require financing. As the capital markets have been constrained, streams have been pursued all the way down the value chain.

**Can you highlight some case studies where Endeavor Financial has attained financing for interesting projects in foreign jurisdictions?**

GP: Endeavour Financial recently advised Lundin Gold on the financing of the US\$750 million Fruta Del Norte gold project in Ecuador. Ecuador is a very exciting and upcoming mining jurisdiction, and we were fortunate to be part of this project. Another case study relating to an area where there has not been a significant number of projects developed was in Guyana. We advised Guyana Goldfields on the financing of the Aurora gold project, which is the first ever greenfield gold project in Guyana. We have also been involved in the Bisha project in Eritrea where we offered services to Nevsun Resources and the Eritrean state mining company. Endeavour Financial is now advising another company in Eritrea, Danakali, on its Colluli Potash Project, which will be a total game changer for the country.

**2018 saw the highest M&A spending since 2012. Is this an early sign of market revival?**

MV: Mergers of equals seems to be a current trend in the market. I believe that as long as the equity markets continue to underperform, M&A will continue to be the trend. This trend is also a result of the industry doing away with non-core assets that are being discarded or incorporated into new entities. There is potential to create new mid-tier companies that can again attract investment into the industry.

**What are Endeavour Financial's objectives moving forward?**

GP: Endeavour Financial's vision is to continue to consolidate its position as the go-to advisors for developing companies. We place an emphasis on being as innovative as possible, and we are always on the lookout for new sources of finance and new ideas that could help our clients realize value for their projects in a more efficient way. The strategy is also to continue to bring diversification across the products that we offer as we move forward.

MV: We are very cost competitive in the field in which we operate. With an experienced team, we can offer in-depth advice to help companies get their projects ready for financing, from both a technical and financial point of view. We know the market, and we get deals done. Endeavour Financial is ultimately a service provider, and we aim to be the provider of choice within the mining industry. ■



## Brett Heath

President, CEO & Director  
**METALLA ROYALTY & STREAMING LTD.**

### How does Metalla differ from a traditional royalty and streaming company?

I started Metalla in September 2016 after recognizing an opportunity to capitalize on a part of the market that the rest of the sector was not focusing on – what we call the secondary market or third party owners of existing royalties. Specifically in the precious metal side of the business, there are royalties on basically every single property. We realized that there was no product or platform that gave third party royalty holders the type of valuations or liquidity afforded to majors. Metalla identified a number of potential deals that the bigger companies were not focusing on, which helped us close deals in a much faster manner.

### How significant is Metalla's financial flexibility to complete transactions?

The nature of the business is to provide a platform for industry royalty holders, and as a consequence of that the existing holders of the royalties in the secondary market often want to have a material stake in Metalla in exchange for assets. This allows Metalla to scale into assets that are larger than what we would generally be able to transact on. Since the establishment of Metalla in 2016 we have been most productive over the C\$5-15 million range. The bigger royalty companies are not interested in deals of this scale, which gives us a niche to work in, and an advantage to attain a higher return on deals with less competition.

### What are the challenges faced by royalty and streaming companies as the mining industry enters the upturn?

From a macro perspective, mining companies typically use royalty and streaming when equity becomes more expensive and their share prices are down, which is why many royalty and streaming companies have been busy in recent years. When capital eventually flows back into mining, equity could become a more attractive option and the royalty and streaming business could slow down. The biggest problem for royalty companies during a commodity bull market is always growth. ■



## Dan O'Flaherty

President and CEO  
**MAVERIX METALS**

### Can you explain the factors that led to the establishment of Maverix Metals Inc. (Maverix) from Pan American Silver's royalty assets?

Maverix's Chairman previously spent 12 years as the CEO of Pan American Silver. He decided to step down from that role at the end of 2015, and in the process of doing so, realized that the company had a collection of royalties that were grossly undervalued by the market as they were buried under Pan American Silver's large operating mines. The decision was made to spin out Pan American's portfolio of 13 royalties and streams, two of which were paying, into a separate vehicle to generate greater value.

### How has Maverix been able to achieve growth despite adverse market conditions?

The streaming and royalty sector is very scalable. Maverix has been able to diversify its portfolio quickly through a number of key transactions. After the spin out of the Pan American Silver portfolio in 2016, we connected with South African gold producer Gold Fields, which had a similarly undervalued portfolio of 11 royalties, five of which were paying. In terms of critical mass, it made sense to combine the portfolios instead of doing another spin out, and Maverix acquired Gold Fields' portfolio for equity at the end of 2016, which essentially doubled our portfolio out of the gate.

### Maverix's portfolio includes a number of advanced projects. To what extent will production value increase over the next few years?

Maverix has assets across the development scale, from production to late stage development, to early stage exploration and everything in between. In 2016, the company's attributable gold equivalent ounces (GEO) was under 2,000 oz. In 2017 our GEO's were at 11,000 oz and in 2018 we exceeded 20,000 oz. We have a number of royalties on assets that are currently ramping up production, and with this natural growth we expect to see production of between 22,500 to 24,500 oz in 2019. We will continue to make deals to add new assets to our portfolio, and we expect to see significant growth in the coming years. ■





# Vancouver: The Global Mining Hub

“The attractiveness of the province relates to the extremely talented pool of people it has to offer. Vancouver will continue to be a global mining center as it is currently the exploration capital of the world, hosting approximately 800 junior companies.”

- Brian Abraham,  
Global Mining Expert,  
Dentons

# Vancouver: The World's Mining Hub

The British Columbia mining industry looks outwards to export its expertise

Days after the all-share merger between Barrick and Randgold became effective in January 2019, Newmont Mining Corporation entered into a definitive agreement with Goldcorp in a stock-for-stock transaction valued at US\$10 billion to create Newmont Goldcorp, as Newmont announced it will move its North American regional operations office from Nevada to Vancouver. While few mining companies can match Goldcorp's financial clout, the Vancouver-based major has one thing in common with hundreds of players across the value chain headquartered in B.C.: none of its operating mines or development projects are based in British Columbia.

Vancouver can lay claim to being the capital of world mining, with over 800 mining companies and juniors headquartered in the city, more than Toronto and Perth (home to the second and third most) combined. However, B.C. lags behind Québec and Ontario in terms of its ability to attract exploration activity and investment, according to a Fraser Institute report from July 2018, citing factors including onerous regulatory and permitting processes. 2017 saw the first increase in exploration spending in B.C. since 2012, an indication that enthusiasm is returning to the province's domestic industry. Nonetheless, the real driver of Vancouver's mining econo-

my has become its global reach: "Vancouver is truly a mining hub as well as a leading service center for the mining industry. Canada's leadership at extracting natural resources, and Vancouver's unlimited expertise in the sector, leads many to headquarter in Vancouver and then export knowledge around the globe," observed Bryan Cox, president and CEO of the Mining Association of B.C. (MABC).

This sentiment was echoed by Ken Embree, managing principal and president of Knight Piésold, the engineering and environmental consultancy that helps clients understand the regulatory regimes in which their projects are situated: "Many of our Canadian clients have mining properties in other areas of the world... We encourage them to apply the same innovative developments, technologies and best practices to all their operations, including their projects located outside of Canada."

Global law firm Dentons has also noticed the evolving operational footprint of its clients: "Until a couple of years ago, Dentons was primarily focused on the mining industry in Canada and B.C., but the company's focus has now expanded to include Asia, Australia, Latin America, Africa, the Caribbean and Mexico," commented Brian Abraham, the Canada co-chair and a global lead for Dentons' mining group.

## Vancouver-based mid-tiers diversify their international asset portfolios

A number of Canadian mid-tier producers have experienced impressive growth in recent years, capitalizing on the availability of undervalued assets in a 'buyer's market.' Precious-metals producers like SSR Mining have been adding value to their asset portfolios by diversifying across the Americas, and have completed four acquisitions in the past four years: the Marigold mine and Valmy property in Nevada, the Seabee gold operation in Saskatchewan, and the Puna operations JV in Argentina. "SSR is proactively on the lookout for more properties," affirmed Paul Benson, president and CEO.

Vancouver-based Silvercorp Metals, with its six operating mines at the Ying mine district in Henan and the GC mine in Guangdong, China, has managed to thrive despite a deflated commodity market, generating positive free cash flow of around US\$40-45 million per annum, according to chairman and CEO, Rui Feng. Citing the significant improve-



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f t in

ments made in the grades of silver, lead and zinc resources at its operating mines, Feng credited the 2016 implementation of Silvercorp's innovative productivity management tool, "Enterprise Blog", which has increased head grades and minimized dilution through improved efficiencies.

Silvercorp recently diversified its asset portfolio by investing US\$23 million for a 30% stake in New Pacific Metals Corp., and Feng sees great potential in New Pacific Metals' Silver Sand project in Bolivia: "We believe that the project has the potential to become a formidable mine. The first batch of drilling results were released on January 22, 2019, with a remarkable 94 out of 98 holes having returned attractive grades, the highlights of which included 135 m of 240 g/mt silver."

In January 2019, New Pacific entered into a mining production contract (MPC) with La Corporación Minera de Bolivia (COMIBOL), the national mining corporation of Bolivia. The MPC grants New Pacific the rights to carry out exploration, mining, and production activities in the areas adjoining the Silver Sand project, and the agreement is the first of its kind to be put into law with a foreign entity. Gordon Neal, New Pacific's president and CEO, believes the recently signed agreement will be used as a template for companies wanting to enter the mining industry in Bolivia. "Since New Pacific signed the MPC, I have had calls and meetings with at least four other foreign companies looking at Bolivia with investment interest. I expect the number of foreign companies operating in Bolivia to double before the end of 2019," stated Neal.

Another silver producer to have entered South America is Endeavour Silver, which has added the Aida, Paloma and Cerro Marquez expansion projects in northern Chile to its portfolio. "We have a great portfolio of 'home run' exploration projects, and our goal is to make a world-class discovery. We want to become a larger, better and more sustainable company. Chile offers us a strategy to attain this. It is a high-risk and high-reward situation," said Brad Cooke, CEO of Endeavour Silver, which produced approximately 10 million oz silver and equivalents in 2018 from its four underground high-grade silver-gold mines operating in Mexico.

Chile is the main focus of Amerigo Resources, which produces copper concentrates at its 100% owned MVC operation by processing fresh and historic tailings from Codelco's El Teniente mine. Rob Henderson, Amerigo's president and CEO, believes the country's infrastructure is equivalent to Canada's: "There are people with strong technical skills and the government is supportive of mining, as it makes up 25% of their GDP. Environmental regulations are based on a high standard and are clear, and the rules of business are stable and transparent," noted Henderson, adding: "Additionally, the geological potential is enormous, under-explored, and its position in the Andes indicates there is much to find."

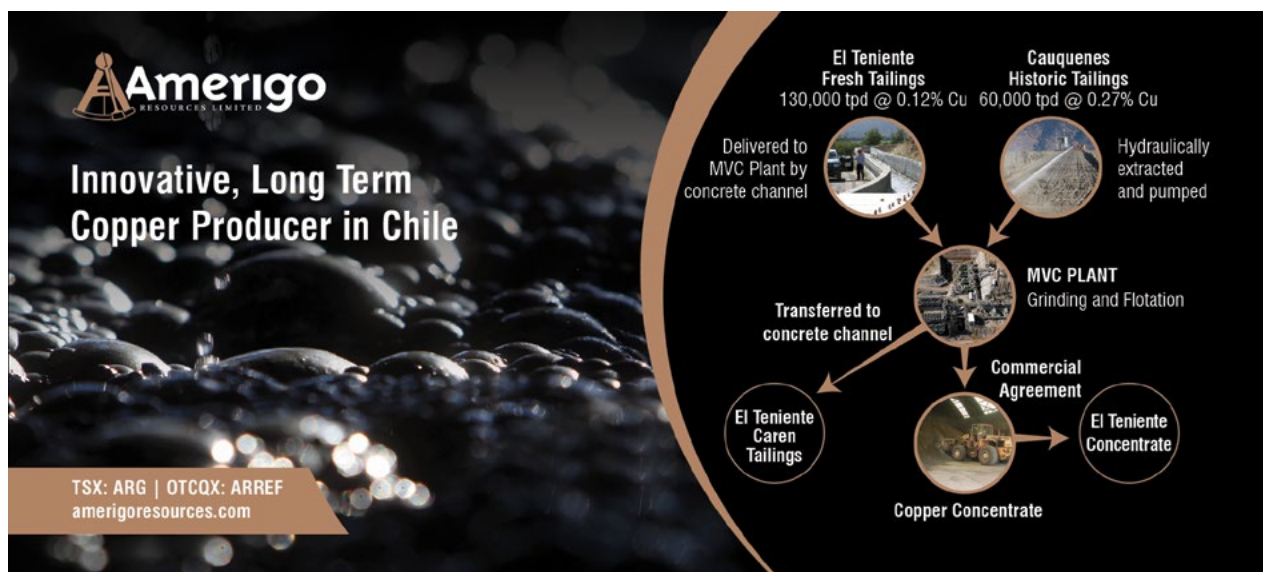
#### Precious metals in the United States: new players head south of the Canadian border

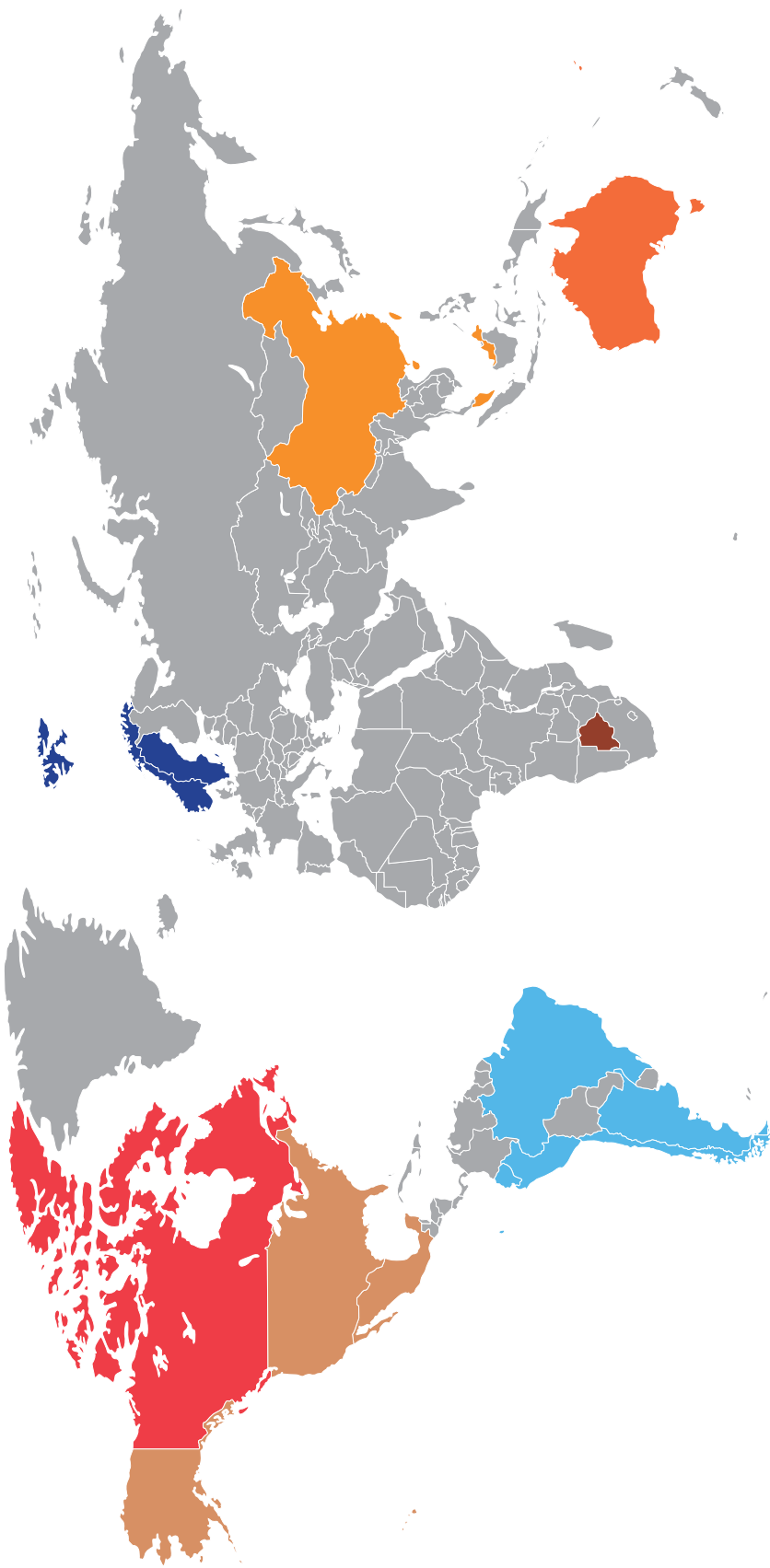
While the influx of Canadian mining companies into Central and South America has

gathered pace, others prefer to look closer to home. Nevada, a two-hour flight from Vancouver, is synonymous with gold and currently ranked the number three global mining jurisdiction by the Fraser Institute. Fiore Gold was founded in 2016 with a focus on exploration stage projects in Latin America, but soon realized the traditional exploration model of having to return to the market to source equity funding for exploration was not conducive to success during the down-cycle. A merger with the private company GRP in September 2017 led to Fiore Gold restarting the Carlin-style, open-pit Pan mine in Nevada. "The generalists in the mining sector were no longer involved and many of the mining specific funds had either shrunk or disappeared completely," said Tim Warman, Fiore Gold's CEO and director. "This resulted in us having to investigate more advanced, producing assets that could generate cash flow that in turn could fund exploration," he explained.

Another gold-focused company based in Vancouver to have entered Nevada in 2017 is Contact Gold, focusing on its flagship Pony Creek asset, a 13,771-hectare land package situated on the prolific Carlin trend. The group behind Contact Gold is hoping to repeat the success they had with Frontier Gold, which was acquired by Newmont in 2011 in a deal valued at US\$2.3 billion. Since going public in June 2017, Contact Gold has conducted comprehensive strategies including soil sampling and mapping at Pony Creek, enabling the company to generate six new targets that are supported by data sets. "Contact Gold now has tangible proof that

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| COMPANY          | TICKER                   | COUNTRY                          | PROJECTS                                 | MINERAL            | STAGE       |
|------------------|--------------------------|----------------------------------|--|--------------------|-------------|
| SSR Mining       | NASDAQ: SSRM / TSX: SSRM | Nevada, USA                      | Marigold Mine                            | Au                 | Production  |
|                  |                          | Northern Saskatchewan, Canada    | Seabee Gold Operation                    | Au                 | Production  |
|                  |                          | Jujuy, Argentina                 | Chinchilla Project & Pirquitas Operation | Ag, Pb, Zn         | Production  |
|                  |                          | Ancash, Peru                     | San Luis                                 | Ag, Au             | Development |
|                  |                          | Durango, Mexico                  | Pitarilla                                | Ag, Pb, Zn         | Development |
|                  |                          | Saskatchewan, Canada             | Amisk                                    | Ag, Ag             | Exploration |
|                  |                          | Northeastern Nevada, USA         | Maverick Springs                         | Au, Ag             | Exploration |
|                  |                          | Northwest territories, Canada    | Sunrise Lake                             | Pb, Zn, Cu, Ag, Au | Exploration |
|                  |                          | Durango, Mexico                  | Guanacevi                                | Ag, Au             | Production  |
|                  |                          | Guanajuato, Mexico               | El Cubo                                  | Ag, Au             | Production  |
|                  |                          | Guanajuato, Mexico               | Bolanitos                                | Ag, Au             | Production  |
|                  |                          | Zacatecas, Mexico                | El Compas                                | Ag, Au             | Production  |
|                  |                          | Jalisco, Mexico                  | Terronera                                | Ag, Au             | Development |
|                  |                          | Chihuahua, Mexico                | Parral                                   | Ag                 | Exploration |
| Endeavour Silver | TSE: EDR / NYSE: EXX     | Guanajuato, Mexico               | Lourdes                                  | Ag, Au             | Exploration |
|                  |                          | Chihuahua, Mexico                | Guadalupe y Calvo                        | Au, Ag             | Exploration |
|                  |                          | Andes, Chile                     | Cerro Marquez                            | Cu                 | Exploration |
|                  |                          | Northern Chile                   | Aida                                     | Ag, Zn             | Exploration |
|                  |                          | NW Maricunga and El Indio, Chile | Paloma                                   | Au                 | Exploration |

|                                  |   |  |  |                    |                          |
|----------------------------------|---|--|--|--------------------|--------------------------|
| Silvercorp                       | NYSE: SVM / TSX: SVM                                | <ul style="list-style-type: none"> <li>Henan, China</li> <li>Henan, China</li> <li>Henan, China</li> <li>Henan, China</li> <li>Guangdong, China</li> <li>Hunan, China</li> </ul>               | SGX Mine                                       | Ag, Pb, Zn         | Production               |
|                                  |   | <ul style="list-style-type: none"> <li>Henan, China</li> </ul>   | HPG Mine                                       | Ag, Au, Pb         | Production               |
|                                  |   | <ul style="list-style-type: none"> <li>Henan, China</li> </ul>   | TLP Mine                                       | Ag, Pb             | Production               |
|                                  |   | <ul style="list-style-type: none"> <li>Henan, China</li> </ul>   | LM Mine  | Ag, Pb             | Production               |
|                                  |   | <ul style="list-style-type: none"> <li>Guangdong, China</li> </ul>   | GC Mine  | Ag, Pb, Zn         | Production On Hold       |
|                                  |   | <ul style="list-style-type: none"> <li>Hunan, China</li> </ul>   | BYP Mine                                       | Au, Pb, Zn         | Production               |
| Lucara Diamond                   | TSX: LUC  | <ul style="list-style-type: none"> <li>Central District, Botswana</li> </ul>   | Karowe Mine                                    | Diamonds           | Production               |
| Amerigo                          | TSX: ARG / OTCQX: ARREF                             | <ul style="list-style-type: none"> <li>Central Chile</li> </ul>  | MVC Operation                                  | Cu, Mo             | Production               |
| Lundin Gold                      | TSX: LUG / NASDAQ STOCKHOLM: LUG                    | <ul style="list-style-type: none"> <li>Southeast Ecuador</li> </ul>  | Fruta del Norte Project                        | Au, Ag             | Production               |
| New Pacific Metals               | TSX-V: NUAG / OTCQX: NUPMF                          | <ul style="list-style-type: none"> <li>Potosí, Bolivia</li> <li>Yukon, Canada</li> <li>Qinghai, China</li> </ul>   | Silver Sand                                    | Ag                 | Development              |
|                                  |   | <ul style="list-style-type: none"> <li>Yukon, Canada</li> </ul>  | Tadish Lake Gold Project                       | Au                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Qinghai, China</li> </ul>   | RZY  | Ag, Pb, Zn         | Exploration              |
| Norra Metals                     | TSX-V: NORA / FRANKFURT: 1KO                        | <ul style="list-style-type: none"> <li>BC, Canada</li> <li>BC, Canada</li> <li>North Central Norway</li> <li>Norway</li> <li>Norway</li> <li>Västerbotten County, Sweden</li> </ul>            | Pyramid  | Cu, Au             | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>BC, Canada</li> </ul>   | Kinskuch Lake                                  | Cu, Au             | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>North Central Norway</li> </ul>   | Bleikvassli                                    | Pb, Zn, Ag         | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Norway</li> </ul>   | Meraker  | Cu, Zn, Au         | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Norway</li> </ul>   | Sagvoll  | Ni, Cu, Co         | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Västerbotten County, Sweden</li> </ul>  | Bastuträsk                                     | Zn, Cu, Pb, Au, Ag | Exploration              |
| Lumina Gold Corp                 | TSX-V: LUM  | <ul style="list-style-type: none"> <li>Oro, Ecuador</li> </ul>   | Cangrejos Project                              | Au, Cu             | Exploration              |
| Luminex Resources                | TSX-V: LR   | <ul style="list-style-type: none"> <li>Oro, Ecuador</li> <li>Zamora Chichipe, Ecuador</li> <li>Western Cordillera, Ecuador</li> <li>Ecuador</li> <li>Morona Santiago, Ecuador</li> </ul>       | Condor Project                                 | Au, Ag, Cu         | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Western Cordillera, Ecuador</li> </ul>  | Pegasus Earn-in                                | Au, Cu, Mo, Ag     | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Ecuador</li> </ul>  | Orquideas/Cascas Earn-in                       | Cu, Mo, Au         | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Morona Santiago, Ecuador</li> </ul>   | Tarqui Earn-in                                 | Cu, Au             | Exploration              |
| Lion One Metals                  | TSX-V: LIO / OTCQX: LOMLF                           | <ul style="list-style-type: none"> <li>Viti Levu, Fiji</li> </ul>  | Tuvatu Gold Project                            | Au                 | Development              |
| Monument Mining Limited          | TSX-V: MMY / FSE: D7Q1                              | <ul style="list-style-type: none"> <li>Pahang State, Malaysia</li> <li>Western Australia</li> </ul>  | Selinsing Gold Portfolio                       | Au                 | Prod., Dev., Expl.       |
|                                  |   | <ul style="list-style-type: none"> <li>Western Australia</li> </ul>  | Murchison Gold Portfolio                       | Au                 | Development, Exploration |
|                                  |   | <ul style="list-style-type: none"> <li>Pahang State, Malaysia</li> </ul>   | Mengapur Copper-Iron Project                   | Cu, Au, Ag         | Development, Exploration |
| Fiore Gold                       | OTCMKTS: FIOGF / TSX-V: F                           | <ul style="list-style-type: none"> <li>Nevada, USA</li> </ul>  | Pan Mine                                       | Au                 | Production               |
|                                  |   | <ul style="list-style-type: none"> <li>Nevada, USA</li> </ul>  | Gold Rock                                      | Au                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Washington State, USA</li> </ul>  | Golden Eagle                                   | Au                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Antofagasta, Chile</li> </ul>   | Cerro Tostado                                  | Ag                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Salares Norte, Chile</li> </ul>   | Rio Loa  | Au, Ag             | Exploration              |
| Contact Gold                     | TSXV: C   | <ul style="list-style-type: none"> <li>Nevada, USA</li> <li>Nevada, USA</li> <li>Nevada, USA</li> </ul>  | Pony Creek                                     | Au                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Nevada, USA</li> </ul>  | South Carlin Projects                          | Au                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Nevada, USA</li> </ul>  | Nevada Regional Projects                       | Au                 | Exploration              |
| Arizona Silver Exploration       | OTCMKTS: AZASF                                      | <ul style="list-style-type: none"> <li>Arizona, USA</li> </ul>   | Ramsey Silver Project                          | Ag, Pb, Zn         | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Arizona, USA</li> </ul>   | Sycamore Canyon Property                       | Au, Ag             | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Arizona, USA</li> </ul>   | Philadelphia Property                          | Au, Ag             | Exploration              |
| Portofino Resources              | TSX-V: POR / FSE: POT                               | <ul style="list-style-type: none"> <li>Catamarca, Argentina</li> <li>Catamarca, Argentina</li> <li>Catamarca, Argentina</li> <li>Catamarca, Argentina</li> <li>Catamarca, Argentina</li> </ul> | Del Condor                                     | Li                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Catamarca, Argentina</li> </ul>   | Pucara   | Li                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Catamarca, Argentina</li> </ul>   | Project II                                     | Li                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Catamarca, Argentina</li> </ul>   | Yergo  | Li                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Catamarca, Argentina</li> </ul>   | Hombre Muerto West                             | Li                 | Exploration              |
| Centurion Minerals Ltd           | TSX-V: CTN  | <ul style="list-style-type: none"> <li>Argentina</li> </ul>  | Ana Sofia Agri-Gypsum Project                  | Gypsum             | Production               |
| Falcon Gold Corp                 | TSX-V: FG   | <ul style="list-style-type: none"> <li>Ontario, Canada</li> <li>Ontario, Canada</li> </ul>   | Central Canada Cobalt & Gold Project           | Cu, Co, Zn, Au     | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Ontario, Canada</li> </ul>  | Burton Property                                | Au                 | Exploration              |
| Altamira Gold                    | TSXV: ALTA / FSE: T6UP / US: EQTRF                  | <ul style="list-style-type: none"> <li>Brazil</li> <li>Brazil</li> <li>Brazil</li> </ul>   | Cajueiro                                       | Au                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Brazil</li> </ul>   | Crepori  | Au                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Brazil</li> </ul>   | Aplacas  | Au                 | Exploration              |
| Borealis Metals                  | TSX-V: BMX  | <ul style="list-style-type: none"> <li>Sweden</li> <li>Sweden</li> <li>Sweden</li> </ul>   | Gumsberg VMS Project                           | Zn, Pb, Cu, Ag     | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Sweden</li> </ul>   | Adak VMS Project                               | Cu, Au, Ag         | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Norway</li> </ul>   | BURJORD IOCG PROJECT                           | Cu, Au             | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Norway</li> </ul>   | Tynset VMS project (Heros District)            | Au, Ag             | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Norway</li> </ul>   | Modum Cobalt Project                           | Co, Cu, Au         | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Sweden</li> </ul>   | Guldgruvan Project                             | Co, Cu, Ni         | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Sweden</li> </ul>   | Midvattnet and Njugsträskliden Nickel Projects | Ni                 | Exploration              |
| Southern Silver Exploration Corp | TSX-V: SSV / FSE: SEG1 / SSEV: SSVCL / OTCQB: SSVFF | <ul style="list-style-type: none"> <li>Durango, Mexico</li> <li>New Mexico, USA</li> </ul>   | Cerro Las Minitas                              | Ag, Zn, Pb         | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>New Mexico, USA</li> </ul>  | Oro Polymetallic Project                       | Ag, Zn, Pb, Cu     | Exploration              |
| Valterra Resources Corporation   | TSX-V: VQA / OTC: VRSCF                             | <ul style="list-style-type: none"> <li>BC, Canada</li> <li>Nevada, USA</li> <li>Chihuahua, Mexico</li> </ul>   | Swift Katie Property                           | Cu, Au, Ag         | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Nevada, USA</li> </ul>  | Weepah Property                                | Au                 | Exploration              |
|                                  |   | <ul style="list-style-type: none"> <li>Chihuahua, Mexico</li> </ul>  | Los Reyes                                      | Cu, Au             | Exploration              |
| Bravada Gold Corporation         | TSX-V: BVA / BRTN:STU / OTCQB: BGAVF                | <ul style="list-style-type: none"> <li>US</li> </ul>   | Carlin-type and Low-Sulfidation-type Projects  | Au                 | Exploration              |



## Rui Feng

Chairman and CEO  
**SILVERCORP METALS INC.**

“

Silvercorp Metals' approach is different from its competitors: our strategy has been to acquire projects and develop mine operations quickly, to generate profit before the project's potential is fully drilled.

”

### ■ **How has Silvercorp Metals managed to maintain high levels of profit despite difficult market conditions?**

The key behind Silvercorp Metals' success is our excellent internal management. Our team consists of technical personnel, engineers and geologists who have extensive experience within the mineral resources industry. Silvercorp Metals' approach is different from its competitors: our strategy has been to acquire projects and develop mine operations quickly, to generate profit before the project's potential is fully drilled. Cash flow from our operations is used to fund further exploration, resource expansion and production ramp-up. As of January 2019, the company has over US\$125 million in the treasury, and we plan to grow the business further through consolidation, exploration, mine development and acquisition.

### **What were the contributing factors behind the improvement of metal grades at Silvercorp Metals' four operating mines in the Ying mining district?**

Over the last few years, Silvercorp Metals has experienced a significant improvement in the grades of silver, lead and zinc resources at our operating mines. The improvement in grades can be partially attributed to the innovative productivity management tool Enterprise Blog, which we implemented in Q2 2016 with the goal of increasing head grades and minimizing dilution through improved efficiencies.

### **Can you elaborate on the benefits of the Enterprise Blog management system?**

The Enterprise Blog is a digital cloud system that enables the distribution and flow of information. Everyone in the company, regardless of position, is required to load onsite inspections onto the system, which are then listed in a structured data format, containing information and supporting photos. The management team can then access information directly on the blog in real time. The Enterprise Blog system allows for information collection, distribution, retrieval and monitoring to become transparent and immediate. Assessment of information and knowledge can now flow freely, which allows for more accurate and faster decisions to be made.

### **How significant is the production capacity from Silvercorp Metals' two centralized mills?**

Silvercorp Metals owns and operates two

floatation mills with a total combined capacity of 3,200 mt/d producing silver-lead and zinc concentrates that are sold to six smelter customers located within a 200 km radius. During the milling process, the minerals are separated by a series of flotation circuits, producing a lead concentrate (carrying the silver), which averages 69% lead and a zinc concentrate that averages 52% zinc. The concentrates are of premium quality, containing very little deleterious elements. Metal recoveries to-date have averaged over 95% for lead, 94% for silver and 72% for zinc, exceeding the expectations from the design specifications.

### **Which policies highlight the company's commitment to the environment, as well as safety in production?**

Silvercorp Metals recognizes that its success is driven by the welfare of its labor force and the environment that supports its growth. We have voluntarily built a water pipeline to mitigate risk of environmental damage from flooding, and we operate a zero-discharge mill. We have always given priority to environmental protection and safety in production, and this was recognized as we were awarded The National Green Mine Pilot Enterprise by the Ministry of Land and Resources in China.

### **Silvercorp Metals recently invested US\$23 million for a 30% stake in New Pacific Metals Corp. What potential do you see in its Silver Sand project in Bolivia?**

We believe that the Silver Sand project has the potential to become a world-class deposit. The drilling results were released on January 22, 2019 and February 20, 2019, with a remarkable 190 out of 195 holes having returned attractive grades, including a highlight of 99.91 g/t of 244 g/mt silver. Drilling activities will continue in 2019 to build a resource estimate. Pan American Silver, which has operated the San Vicente silver mine in Bolivia since 1999, is also a shareholder of New Pacific.

### **What are Silvercorp Metals' strategy and objectives moving forward?**

Silvercorp Metals' strategy is to continue to grow the company, increase existing resources organically through drilling and acquire high grade projects with defined resources that can quickly be brought into profitable operation with reasonable capital expenditures. We also intend on bringing the BYP mine back into production, with an expectation of 30,000 oz/y gold. ■



## Rob Henderson

CEO and President  
**AMERIGO RESOURCES**

“

As the world industrializes further and more people have the need for electricity, the demand for copper will continue to increase. What is tricky is the supply; mines, by nature, have finite lives.

”

### Could you provide an update of the Minera Valle Central (MVC) operation?

Amerigo produces copper concentrates at its 100% owned Minera Valle Central (MVC) operation in Chile by processing fresh and historic tailings from Codelco's El Teniente mine. It has now been four years since our feasibility study and, at that time, the copper price was above US\$3 a pound. The intention was to spend US\$140 million, increase production from 40 million pounds to 85 million pounds and drop cash costs to \$1.45/lb. We managed to achieve this through debt financing split into two phases to minimize risk. We completed the first phase two years ago and, in terms of the second phase, we have finished construction and are in the completion test stage. We expect to hit commercial production Q4 2018.

### How did you manage to navigate the downturn in the market?

The price of copper was high at the start of the project, and investment banks were willing to support, but when copper prices went down, we were only left with the support of Spanish BBVA and the Canadian EDC. We decided to complete the project in two parts: first, to introduce infrastructure and take Cauquenes into our existing plant. We finished that first leg on time and below budget. However, we knew we were not getting the full recovery in the plant at that time. Phase two of the project would be putting more flotation cells in for better recovery efficiency. When the copper price went up to US\$2.80, we had the support of the banks in the form of US\$35 million and the plant was built, taking our recovery up from 33% to 45%. The input costs have been largely the same, and we have now enjoyed five profitable quarters. In full stride, production should be at 85 million pounds. It is a very exciting time for us as the story is still unfolding.

### Do you have any plans to process tailings from other mines in the future?

Codelco has recognized we have a successful model at El Teniente, which can be applied to other projects. We are currently completing preliminary metallurgical work and copper recovery research into other tailings deposits. It is a win-win situation, as Codelco will receive a royalty from any copper we produce. Additionally, we have seen an increase in demand of molybdenum. It is used in steel manufacturing to strengthen steel to make pipelines. We produce about 2 million lb/y of molybdenum. If there is residual value in old tailings, miners tend to want to process their own tailings at the end of the life of mine. This is typically a long time in the future. Our proposal to the miners is that we can build and operate a tailings recovery plant for them quickly and efficiently, provide a revenue stream for them and potentially reduce legal liabilities from the old tailings.

### Are you using any interesting technology to do your work?

We use traditional grinding and flotation technology that is both efficient and benign to the environment. However, we recently implemented an innovative flotation cell process from Woodgrove that has two separate tanks. One has a high-intensity agitation system, contacting particles to the bubbles, and the other tank has no agitation, which allows everything to rise to the surface for bubble extraction.

### How do you see the demand for copper to evolve as we transition towards cleaner technology and electrification?

When we observe copper consumption over the last fifty years, it has gone up steadily, with few jumps up or down. As the world industrializes further and more people have the need for electricity, the demand for copper will continue to increase. What is tricky is the supply; mines, by nature, have finite lives. A strong mine has the life of 20 years and an ordinary mine usually has about 10 years. It takes time and money to find a mine, and then another 10 years to build. Mining companies have cut exploration and development budgets, so supply of copper is predicted to decrease, and we can see a supply gap on the horizon. More investment is needed, which should happen as the copper price rises. Amerigo would like to develop a second or third property with the success of MVC. We want to reward shareholders through dividends and grow the company via other tailings deposits. ■



# Eira Thomas

President and CEO  
**LUCARA DIAMOND**

“

No two diamonds are alike, and they sell at thousands of different price points. As a producer, our goal is to try and sell this heterogeneous product regularly, for repeatable revenues.

”

■

## How has Lucara's production developed in the last two years?

Over the last couple of years, Lucara has been reinvesting heavily into the company. We are in the process of completing a major waste stripping campaign, with the aim of opening up the South Lobe orebody for the next six to eight years of open pit mining. The bulk of the campaign was completed in 2018, and, although we have additional waste being moved in 2019, we are through the bottleneck. By the end of 2019, we expect our strip ratio to come back down in the order of around 2.84 to 1. The strip ratio will eventually settle below 2.5 to 1, which will positively impact costs.

## What is the current status of Lucara Diamond's Karowe mine with regard to plans for underground development?

Based on a positive preliminary economic analysis completed in 2017, Lucara initiated a full-scale feasibility study in 2018 to evaluate the potential for expanding the Karowe mine underground. We are encouraged by the results of this work to date and remain optimistic that the underground project will prove economically attractive. Provided that the study is positive, we will start investing in the underground mining project in 2020 with the aim of starting production from underground by 2026, when the open pit ceases production.

## What would the benefits be for utilizing sub-level caving or block for Karowe?

The benefit of going with a block cave is that we mine from the bottom up, and thus we are able to access the higher value ore earlier in the mine plan. The potential disadvantages of block cave are that the initial capital costs are higher, and the mining method is less flexible. Assisted block caving, at least to start, is being considered to help mitigate this risk. The advantage of using sub-level caving or sub-level retreat, which is a top-down approach, is that the upfront capital required could be lower. The company is in the process of running both scenarios, but the final approach selected will be driven by economics and managing risk.

## How do diamond miners sell their products?

Diamonds are a tricky commodity to sell, as they are a completely heterogeneous product. No two diamonds are alike, and they sell at thousands of different price points. As a producer, our goal is to try and sell this heterogeneous product regularly, for repeatable revenues. In response to this challenge, we have resorted to accumulating our diamonds over an entire quarter, and with enough inventory on hand, we can then create basic assortments or baskets of diamonds based on broad criteria including size, color and quality. These categorized assortments are then sold to customers who are not able to pick and choose; rather, they are required to bid on the entire assortment or basket.

## Can you elaborate on Lucara's acquisition of Clara Diamond Solutions (Clara)?

Lucara acquired Clara in 2018, and we believe we are well positioned to disrupt and transform the traditional rough diamond sales process, unlocking significant value for both producers and manufacturers. The aim of Clara is to stop selling our diamonds using the traditional basket approach and instead start selling diamonds individually, based on a customer's actual wants and needs. We are transforming the diamond sales process from a traditional push-style system to a pull-style system. This could not have been achieved a decade ago, but today we have the technologies available to match individual rough diamonds from producers to their optimal polished orders generated by the manufacturers. The current sales paradigm is antiquated, inefficient and inflexible, and Clara's aim is to be a disruptor in the marketplace and unlock significant value throughout the value chain.

Clara also provides the assurance of diamond provenance using blockchain technology, which comes at a time when there is an increasing demand for transparency in the diamond marketplace. ■



# Paul Benson

President and CEO  
SSR MINING

■

## Could you describe the reason behind the company's name change from Silver Standard Resources to SSR Mining and elaborate on your renewed focus?

The company has been in existence for 70 years, and our initial name came from a silver mine in British Columbia called the Silver Standard mine. During the late 1990s and early 2000s, the business model was to act as a silver land bank, which included acquiring exploration properties with silver deposits. The model was tremendously successful, especially for U.S. retail investors. In 2006, the decision was made to develop one of the properties, transforming us into a producer in 2009. In 2014, we bought the Marigold mine, which changed our company revenue into 50% silver and 50% gold. In 2016, the acquisition of the Seabee gold mine in Saskatchewan increased our revenue split to 80% gold, 20% silver. We then decided to change our name to better reflect the type of company we are.

## Can you describe SSR Mining's three operating assets and the outlook for them moving forward?

The Marigold mine in the United States is our flagship property, producing 210,000 oz/y gold on average. Our Seabee gold mine in Canada will produce around 100,000 oz in 2019, but the cost of production is lower, and thus this project delivers higher margins. The Puna operation in Argentina has been in our company for the longest period of time but is the smallest in terms of our share of production.

## What is the outlook for SSR Mining's development projects?

SSR Mining's two main development projects are Pitarrilla in Mexico and San Luis in Peru. Pitarrilla is one of the largest underdeveloped silver projects in the world. SSR Mining conducted a feasibility study in 2012 with a configuration that made sense in what was then a high silver price regime. We postponed the project when the silver price dropped, and today we are revisiting the project to see if there is a configuration focused on the higher-grade portion of the orebody that is economically viable at spot prices. At San Luis, which is a small high-grade gold and silver deposit, we are focused on building community support for the project. ■



# Brad Cooke

CEO  
ENDEAVOUR SILVER

■

## Can you tell us a bit about your current operations in Mexico?

We currently have four underground high-grade silver/gold mines operating in Mexico. Production in 2018 should come in just under 10 million oz silver and equivalents. Our oldest mine is Guanacevi in Durango state, while El Compas is our newest mine in Zacatecas state. It will be our smallest but highest grade mine, and it can be scaled up should we define more resources. We are currently commissioning the mine for commercial production by year-end 2018. El Compas should also have a good first full year of production in 2019.

## What is your strategy for ramping up production going forward?

Over the next three years, we plan to build new mines to grow our production by up to 50% and shrink our costs on an all-in basis below US\$10 per oz silver net of the gold credit.

## Do you have any expansion plans in other regions?

Exploration in Chile is part of our long-term strategy. Previously we focused on buying small high-grade mines in historic mining districts in Mexico, then renovating and expanding them. Terranero represents a new direction for us, as it is our first greenfields discovery that we will build from scratch.

## What are some of the milestones you would like to achieve going forward?

We have a number of forthcoming catalysts across our portfolio of assets in the near-term that will drive shareholder value. El Compas should be in commercial production by year-end 2018; Guanacevi is developing two new ore bodies to boost production and reduce costs; we are targeting construction at Terronera in 2019 with production in late 2020; and Parral should deliver a robust PEA next year to support the case for production possible in 2022. In terms of Chile, we would like to see a significant new discovery come out of our exploration drilling in 2019. ■



## Gordon Neal

President and CEO  
**NEW PACIFIC METALS CORP.**

“

When you have the kind of metrics on a mineralized area such as New Pacific does at Silver Sand, as well as shareholders that include Silvercorp Metals and Pan American Silver, it makes sense to take the project through to production.

”

### ■ What were the circumstances that led to New Pacific Metals Corp. (New Pacific) acquiring Empresa Minera Alcira (Alcira)?

New Pacific acquired Alcira, the owner of the Silver Sand project, in 2017. The largest shareholder in Alcira (99%) was facing challenges with its tin operation and looking for capital, and so decided to put its Alcira properties up for sale. We caught wind of the opportunity and discovered that there were three drill holes and approximately 845 channel samples, which looked too good to be true. New Pacific's VP of exploration, Alex Zhang, went to Bolivia to verify the potential of the project. He was followed by Rui Feng, CEO of New Pacific. Confirmation drilling was subsequently performed, after which we sent channel samples and drill core back for assay, which all checked out.

### How much exploration work has New Pacific performed at the Silver Sand project so far?

We conducted a 55,000 m exploration program between October 2017 and December 2018, drilling 195 holes, 190 of which showed impressive width with some areas of high-grade mineralization. Bolivia is still an underexplored country, and we see the potential to make significant discoveries. The Silver Sands property has advantages as the mineralization is close to surface and there are wide intercepts. The plan for 2019 is to drill another 50,000 m on both our 100% owned property and on the surrounding Comibol land.

### Can you elaborate on the Mining Production Contract (MPC) granted to New Pacific by La Corporación Minera de Bolivia (COMIBOL)?

In January 2019, New Pacific entered into a MPC with COMIBOL, the national mining corporation of Bolivia, which holds the mineral rights to the most highly prospective properties in the country. This agreement expanded our land position from 5 sq km to 57 sq km. The MPC grants New Pacific the rights to carry out exploration, mining and production activities in the areas adjoining the Silver Sand project. This MPC agreement is the first of its kind to be put into law with a foreign entity and is being used as a template for companies wanting to enter the mining industry in Bolivia. Since New Pacific signed the MPC, I have had calls and meetings with at least four other foreign companies looking at Bolivia with investment interest.

### What are the terms of the MPC?

The MPC covers an area of up to approximately 57 sq km, involving two separate areas. The first area consists of 29 special temporary authorizations (ATEs) located directly west of Silver Sand, and the second area may include an additional 201 mining grids to the north, east and south of Silver Sand. The contract has a validity of 45 years, which consists of three terms of 15 years each. The first phase of the MPC will include five years of exploration and, if applicable, environmental studies, engineering studies, pre-feasibility and feasibility studies as well as development and pilot production. The second and third phases of the MPC will cover full commercial production, environmental studies and mine closure. New Pacific has committed to a minimum investment of C\$6 million during the first five years of the MPC for mineral exploration and related activities. If commercial production commences, COMIBOL will receive a 4% gross sales value of all minerals produced from the COMIBOL areas covered under the MPC.

### Is the plan to move the Silver Sand project into production?

When you have the kind of metrics on a mineralized area such as New Pacific does at Silver Sand, as well as shareholders that include Silvercorp Metals and Pan American Silver, it makes sense to take the project through to production. We hope to be able to attain an exploitation license within nine months, and due to the near-surface mineralization that we are seeing, the project can be advanced fairly quickly. New Pacific has significant working capital, and its shareholders have the capabilities and desire to put projects into production. Having said that, any public company is obligated to present reasonable offers to purchase the company to its shareholders, and I cannot predict if that will happen in the future. ■

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its targeting mechanism is effective, and we are positive that further drilling on the other targets will support this,” stated Matthew Lennox-King, president, CEO and director of Contact Gold.

Further south, Arizona Silver Exploration (AZS) has focused its attention on a high-grade gold-silver vein target in Mohave County, north western Arizona. In January 2019 AZS entered into a lease with option to purchase on 11 unpatented lode mining claims that cover the majority of the old workings and potential strike extension of the former operating Arabian-Philadelphia Mine in the Oatman Mining District, which has produced over 2 million ounces of gold. Mike Stark, chairman and director of AZS, is optimistic about the outlook for precious metals: “Here we are at the end of a long bear metals market, and hopefully we have turned the corner and are now heading into a long-awaited bull market. With the recent rise in both gold and silver prices, people will be looking for safe havens and history proven investments.”

### Mining in Mexico and Central America

Further south, on the other side of the proposed wall that a certain high-profile US politician has been threatening to construct, the election of a populist of a different leaning, Andrés Manuel López Obrador (also known as AMLO), and the agreement to replace NAFTA with the United States–Mexico–Canada Agreement (USMCA), have been dominating the headlines in a jurisdiction that has strong links to the Vancouver mining community.

Despite the perceived instability of its recent general election, “Mexico possesses a broad range of mineral prospectivity, and many interesting projects. It is an excellent platform with many opportunities for a junior company headed towards becoming a mid-tier producer” said Arturo Prestamo, CEO of Santa Cruz, which currently has four underground high-grade silver-gold mines operating in the country.

Another Vancouver-based company active in Mexico, Telson, has recently entered an agreement with Glencore Technology to test the mineralization at Campo Morado using the Albion Process to improve precious metal recoveries. With six plants worldwide using “a combination of ultra-fine grinding and oxidative leaching at atmospheric pres-

sure,” Telson hopes that “by 2020, we will be recovering most gold and silver at Campo Morado using this new Albion Process Technology,” said Ralph Shearing, Telson’s CEO and president.

Morgan Poliquin has the task of running three companies active in Mexico – Almaden Resources, Azucar Resources & Almadex Resources. Almaden’s Ixtaca project had progressed to a stage where it was ready for development, so the decision was made to spin out 20 other projects in Almaden’s portfolio into Almadex Resources. Shortly after this, the significant El Cobre discovery was spun out into Azucar Resources as Newcrest came on board. Poliquin elaborated on the findings of the feasibility report filed for the Ixtaca project in January 2019: “Results indicate an after-tax IRR of 42% and payback period of 1.9 years. The deposit will produce over 200,000 gold equivalent ounces per year for the first six years of production at a grade of 2g/mt.”

Manex Resource Group is another Vancouver-based company with multiple interests, consisting of three companies with projects in Mexico (Southern Silver Exploration -

SSV), Nevada (Bravada Gold Corp) and BC (Valterra Resource Corp). Security issues in Mexico, particularly in states such as Guerrero, Chihuahua and Veracruz, as well as mounting social pressure from NGOs, have complicated mining development in the country. However, Lawrence Page, Manex Resource Group’s president, was quick to highlight the stability of the Mexican state of Durango where SSV’s Cerro Las Minitas project is located, observing that the company has not encountered any problems in over a decade of operation in the region. “We are very cognizant of the fact that we are operating in someone else’s backyard and we have put in the effort to build relationships at the government level, as well as with the community,” he explained.

Moving further down the coast, Nicaragua is a Central American nation set between the Pacific Ocean and the Caribbean Sea, known for its dramatic terrain of lakes, volcanoes and beaches. However, drama of a less pleasant kind plagued the country in 2018 and 2019, as protests against the social security reforms decreed by President Daniel Ortega resulted in 325 people being killed as of



**New Pacific Metals** TSX-V: NPMF OTCQX: NUPMF

**A New Frontier for Silver Exploration**

- Advancing the Silver Sand project in Bolivia with strategic partners Silvercorp Metals and Pan American Silver
- First foreign company to sign a mining production contract (MPC) with Corporación Minera de Bolivia (COMIBOL)

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February 6th, 2019. Still, many companies feel that unlocking Latin America's immense mineral wealth is worth navigating potential instability. Gregory Smith, CEO and president of Calibre Mining, explained how President Ortega, the son of a miner, is very supportive of the sector: "Mining is currently the third largest export after coffee and beef, and foreign investment is encouraged," said Smith, adding: "Nicaragua is a young democracy but full of promise as it supports mining and exploration."

### Ecuador aims to double its mining economy by 2021

The Ecuadorian government has the target of attracting US\$4 billion in mining investment into the country by 2021, backed by a wave of exploration and development projects and improvements to the country's fiscal regime, including the removal of the windfall tax in August 2018. However, growing concerns from NGOs and rural and indigenous communities on the proposed uptick in natural resource extraction prompted Fitch Solutions Macro Research to rank Ecuador as a riskier environment than Mexico, Colombia and Chile.

The need to balance mining-friendly improvements to Ecuador's regulatory framework with respect for local heritage will be key to the development of the country's mining industry, as touched upon by Ron Hochstein, president and CEO of Lundin Gold: "The exploration potential in Ecuador is significant and the government realizes that improvements still need to be made while protecting the environment and indigenous cultures."

Construction at Fruta del Norte began mid-2017 and its first gold pour is expected in Q4 2019. Hochstein sees potential for Lundin's flag-

ship asset in southwestern Ecuador to expand significantly: "Fruta del Norte's reserves of 5 million oz at an average grade of 8.74 g/mt only represent 67% of our indicated resource," he elaborated.

The opening up of the cadastral system in 2016 created a staking rush for new concessions, and at the time the Ecuadorian institutions were not prepared to handle all the related permitting and processing, according to Marshall Kovall, president, CEO and director of Lumina Gold and Luminex Resources. However, Kovall has noticed improvements in the years since: "There is a significant amount of collaboration between industry, government and communities, and the country is very supportive of advancing its burgeoning mining industry."

### After the storms: unlocking mineral potential in Argentina

As the IMF increased Argentina's bailout package to US\$57 billion in September 2018, storm clouds of the literal variety were forming, with torrential rains and flooding ravaging the country from October until the beginning of 2019. Despite the turbulence, Argentina's mineral sector has continued to attract investment, with Canadian mid-tiers SSR Mining and McEwen Mining advancing their Puna and Los Azules projects, and a host of juniors taking advantage of the economic context to purchase cut-price assets.

One such junior is Vancouver-based Portofino Resources, which has the right to acquire a 100% interest in the Hombre Muerto West lithium-brine project located in the Salar del Hombre Muerto in the Catamarca province, the region that has produced the most lithium in Argentina. "Although volatility in the lithium space affected valuations and made it difficult to raise money, projects have become cheaper to acquire," reflected David Tafel, Portofino's president and CEO, continuing: "Considering this context, Portofino is in the process of looking at other potential projects within the Catamarca province to expand its portfolio in this current buyers' market."

David Tafel is also the CEO of Centurion Minerals, a producer of gypsum, a fertilizer used commonly in the South American agro-industry. Centurion has built a pilot crushing and processing facility at its Ana Sofia agricultural gypsum project in Santiago del Estero, Argentina, with a current capacity of approximately 40,000 tonnes per annum. Interestingly, the torrential rains in rural Argentina may have presented an opportunity for Centurion: "As well as being a fertilizer, gypsum can be used to revitalize land which has been spoiled, for instance from flooding," explained Tafel.

The short drilling seasons in Canada have prompted some juniors to add assets in warmer climates, allowing for year-round exploration. Falcon Gold entered into an option agreement with Esperanza Resources in 2017 for its La Rioja project in Argentina to give the Vancouver-based junior a two-pronged focus: exploration on its Central Canada gold mine property in north-western Ontario in the summer, and exploration on La Rioja during the Canadian winter. Stephen Wilkinson, Falcon Gold's CEO and director, elaborated on his company's diversity-focused business model: "We are trying to eliminate some of the liability of exploration work by having a number of commodities covered, but anchored by gold."

### Brazil looks to attract foreign investment as Vale cleans up after the Brumadinho tragedy

President Jair Bolsonaro was elected with a mandate to attract foreign investment and reduce the red tape that has hindered mineral produc-



**NORRA METALS**

**EXPLORING  
IN THE NORTH**

Two countries, four properties, one deal in  
North Europe

**Sweden:** Bastutrask  
**Norway:** Bleikvassli/Sagvoll/Meraker

Two high quality properties in BC's  
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# Mike Devji & George Cavey

MD: Executive Director and CEO

GC: VP Exploration

**NORRA METALS CORP.**  
(FORMERLY OK2 MINERALS)



MD



GC

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The Bastuträsk project can be considered a grade A prospect. Our main goal is to establish a resource estimate as efficiently and quickly as possible. The infrastructure in terms of access and power is phenomenal.

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**In 2018, Norra Metals acquired a past producing mine and advanced stage exploration assets in Norway and Sweden. What were the reasons behind these acquisitions?**

MD: Norra Metals has a number of excellent properties in British Columbia that have been advanced to drilling stages. However, the challenge in British Columbia is that we have very short seasons, and shareholders become restless and investor interest wanes as exploration companies have to wait out the winter season. In addition, many stocks have decreased significantly in value in the Golden Triangle, and this combination of factors led Norra Metals to reevaluate the focus and direction of the company. The decision was made to look for assets in other jurisdictions that would allow for operating projects 12 months of the year. We identified a number of projects within Scandinavia that we liked and went to do field examinations in August 2018, when we identified four properties that were of particular interest.

**What attracted you to the Bastuträsk project in Sweden?**

GC: The Bastuträsk asset was favorable as it is located in the central Skelleftea belt, which is the main massive sulfide-producing belt in Sweden. The project consists of 60 km of six operating mines, plus the Ronnskar copper smelter. It is an advanced stage project that had previously been explored by Boliden, with over 70 known drill holes completed to date.

MD: The Bastuträsk project can be considered a grade A prospect. Our main goal is to establish a resource estimate as efficiently and quickly as possible. The infrastructure in terms of access and power is phenomenal.

**Can you provide an overview of Norra Metals' Norwegian assets?**

MD: Norra Metals' Norwegian assets, Bleikvassli, Sagvoll and Meraker, are very intriguing. Norway is quite unknown in the mining industry; however, the mining history in the country is extensive, dating back to the 1600s. The corporate tax rate in Norway is 27%, and there are no royalties, which makes the location more favorable. Infrastructure and power costs are also low, and the permitting process is simple. The Norwegian government owns all the mineral rights in the country.

**With four assets in two countries, is Norra Metals focusing on any asset in particular?**

GC: Norra Metals' current focus is the Bastuträsk project in Sweden, as we will be able to start drilling activities on the property quite soon. We are currently raising approximately C\$700,000, which is budgeted to work all four properties. C\$500,000 will be spent on the Bastuträsk project during drilling.

MD: Our second project of focus is Bleikvassli in Norway. Bleikvassli was the last operating sulphide metal mine producing lead, zinc and silver mineralization in Norway from 1914 to 1997. When they finished mining, there were three years of resources left, which we are not claiming as current resources. At this stage we are yet to identify where the historical mining took place and where the resources are located.

**Can you elaborate on the advantages of Sweden and Norway as mining jurisdictions?**

MD: The key advantage of Sweden and Norway is that historic operators have not explored the properties extensively, so the potential upside is excellent. Cost of operations is low, the infrastructure is developed, and we can access our projects all year round. One of the most significant advantages to working in Scandinavian or Nordic countries is the recognition that natural resources play a key role in their economic growth. A significant amount of people in Europe relate to projects in their continent. There are also listing opportunities on some of the Scandinavian exchanges, which Norra Metals is exploring.

**What are Norra Metals' objectives moving forward?**

MD: In 2019, Norra Metals will have a focus on its Norwegian and Scandinavian projects and spend approximately C\$1 million on the four projects. We also recently released a 3D model of our Kinskuch project, favorably located in the Golden Triangle in British Columbia. This video highlights the historical drilling but more importantly the excellent work recently completed by various exploration, government and academic teams. We have six exciting projects that all offer new discovery upside as well as exposure to high-value historical work, including advanced drilling and mine operations. ■



## Marshall Koval

CEO, President & Director  
**LUMINA GOLD CORP AND  
LUMINEX RESOURCES**

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Over the last few years, Ecuador has seen changes in government in support of the mining sector, which improved the potential fiscal liability of mining projects.

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### What were the circumstances surrounding the spinout of Luminex Resources from Lumina Gold Corp?

In 2014, we gained control of Odin Mining & Exploration and subsequently changed the name to Lumina Gold in 2016. We had a long history in Ecuador, and our primary asset at the time was the Cangrejos gold-copper project. In 2017, the Ecuadorian government opened the cadastral system, and we were able to acquire new concessions through an auction system that required a work commitment. We acquired several assets and also did a merger with Ecuador Gold and Copper. In 2018, we decided to create Luminex because we wanted to have a pure gold focus in Lumina Gold. All of our properties were transferred to Luminex, except for the Cangrejos project.

### Can you provide an overview of Luminex Resources' portfolio of projects and JV with First Quantum Minerals?

Luminex is a precious and base metals exploration and development company focused on earlier stage gold and copper projects in Ecuador. The company has a JV with First Quantum Minerals at our Orquideas porphyry copper project where we have done significant geophysics and are in the process of obtaining all the final permits. Luminex is also really excited about the discovery we made at Tarqui, which is an exploration project over which we have 100% ownership. Luminex also acquired the Condor project from Ecuador Gold, which is a fairly large land package and holds three distinctive types of mineralization.

### How significant is the infrastructure surrounding the Cangrejos project, and what scale of mine did the results of the PEA indicate?

The Cangrejos project is located in the El Oro province of Ecuador, 30 km from the Pan American Highway and 40 km from the deep water commercial port of Puerto Bolivar. There is a field camp and core facility located on the property, which receives power from the national grid and has easy road access. The project has gold-copper mineralization that is associated with a sequence of intercalated porphyritic dioritic intrusions and hydrothermal breccias.

In 2018, Lumina completed a PEA on the Cangrejos project. The engineering work, resource drilling and estimation concluded that we have a project with a 16-year mine life, with an inferred mineral resource of 8.5 million oz gold and 1 billion pounds of copper. Initially the project would start out at 40,000 mt per day for the first five years, and in year six it would expand to 80,000 mt per day. Although the Cangrejos is primarily a gold project, it is on the scale of a porphyry copper deposit.

### How do you view Ecuador as a mining jurisdiction?

Over the last few years, Ecuador has seen changes in government in support of the mining sector, which improved the potential fiscal liability of mining projects. The cadastral system was also opened, and a significant amount of new concessions were granted throughout the country. On the down side, the institutions were not prepared to handle all the permitting and processing related to all these new concessions being granted. However, the capacity of the institutions is improving. There is a significant amount of collaboration between industry, government and communities, and the country is very supportive of advancing its burgeoning mining industry.

### What are the details of the earn-in agreement signed between Luminex and Anglo American for the Pegasus property?

The Pegasus project is Luminex' largest land package, consisting of approximately 67,000 hectares. Anglo American is the operator on the property, and their strategy for 2019 is to continue geophysical work to advance the project. Anglo American has the right to earn a 60% ownership interest in a joint venture company indirectly holding the properties if it invests an aggregate amount of US\$50 million and makes US\$7.3 million of cash payments over a seven year period. They have the option to increase ownership to 70% if they fund the project to a mining decision. ■



## Michael Bennett

President and CEO  
**ALTAMIRA GOLD**

“

When we first came to the area, people had only been looking for gold. However, copper was present too; Anglo American arrived in 2016 and started doing work east of our Santa Helena property where they discovered copper porphyry.

”

### **Altamira Gold started its life as a private Brazilian company in 2013. What attracted you to Brazil?**

Altamira's focus is on the Jurueña Belt and Alta Floresta Belt in the north of the state of Mato Grosso and south of Para. We saw that the geology was poorly understood, as the primary source itself had never been explored. In 2013 we intended to begin a project, however the government paperwork was difficult to finalize, and we needed funding. Over the course of 2016 and 2017, we reverted to exploration. We currently hold a land package of approximately 260,000 hectares, with eight projects in the center of Alta Floresta, one to the far east of Alta Floresta and one in Para State.

### **Could you provide updates from Cajueiro and describe the geological potential?**

Initially, we believed that the mineralization was controlled by north-SW structures, which have a lower grade, but we began a trenching program on the central part of our Baldo zone and found important east-west continuous trending zones for many kilometers. We have only drilled four holes at 50 m each so far, but there is potential to go down to 70 m and that a higher grade is present. On the seven identified east-west structures in Baldo, we will have several hundred ounces of shallow mineralization. Small-scale production is a solid financial option and strong opportunity for us. The plan is to do more exploration and reveal the full extent of the growing resource.

### **Historically, what kind of exploration has been done in the region where you are located?**

When we first came to the area, people had only been looking for gold. However, copper was present too; Anglo American arrived in 2016 and started doing work east of our Santa Helena property where they discovered copper porphyry and have been drilling ever since. They have claimed 2.5 million hectares in the belt surrounding us. Two weeks later, Nexa Resources arrived and staked 500,000 hectares. Next, Codelco claimed 900,000 hectares on the belt. There are four other majors now scouting the area. We are the only junior with +260,000 hectares in the area, which puts us in a favorable position. We are lucky that Anglo American found copper porphyry in the area, and it looks like the belt is being recognized as an important place for copper, other base metals and gold. Cajueiro is on a 35 km east-west stride extension, and it seems to bear resemblance to the Angostura gold deposit in Colombia, where 2.7 million oz of gold were found.

### **What is the general sentiment for the mining sector in Brazil following Jair Bolsonaro's election as President?**

When it comes to politics in South America, the major problem is bureaucracy. The roadblocks come in the form of the various permits for work. The mining departments in Brazil are poorly staffed and have been overlooked for many years. It seems that the new government is looking for people with experience in different sectors and who really understand the business. The market needs things to move faster: time is money, and investors need to see results for their shareholders sooner. We feel positive about the situation, because some proactive steps by government have been taken. It is my hope that investor sentiment will also change in 2019.

### **Where would you like Altamira Gold to be in the next 12-18 months?**

We would like to see production begin in Cajueiro, a consolidation of our Apiacas project, and establish a joint venture with one of the majors. Our message for the large players interested in copper and gold: we are in a new district that is much larger than half a million ounces. We are the only junior in the central part of the Alta Floresta Belt. Our Cajueiro property has everything we need in terms of infrastructure and paperwork to carry us to the next stage. We have done metallurgical testing on the ore: on both oxides and sulphides. With that, we can get 92-96% of gold recovery. We have also reinterpreted our airborne geophysics and found out that there is the likelihood of deeper-seated porphyry targets. ■



## Stephen Mann

Managing Director  
**LION ONE METALS**

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The islands of Fiji are largely unexplored but are located in a very prospective section of the South Pacific “Ring of Fire,” one of the most mineralized gold provinces in the world.

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### What have been the main milestones achieved by Lion One Metals in the past two years?

Lion One has focused on the development of its 100% owned Tuvatu gold project in Fiji over the past two years. The company has continued to finesse its mine plan, mine design and mine schedule to ensure it is appropriately optimized. This has included a change from a planned 600 mt/d of ore mine production and processing to 1,000 mt/d. The company has also moved towards a more mechanized operation.

Lion One is building its own state-of-the-art geochemical and metallurgical laboratory in Fiji. As there are no such commercial laboratories in Fiji, previously all samples have been dispatched to either Australia or Canada for analysis. The company purchased all the drilling assets in Fiji belonging to Geodrill, as the company was exiting the country. This will be an important and strategic acquisition moving forward because there are limited drilling companies in Fiji.

### What is the development timeline for the Tuvatu Gold project?

Commencement of diamond drilling began in Q1 2019. Completion and commissioning of the geochemical and metallurgical laboratory will follow in Q2 2019, followed by the start of underground development and completion of site civil works in Q3. The construction of the process plant and surface infrastructure is due to finish in Q1 2021, with the first gold pour expected shortly after in Q2 2021.

### What are the main challenges and benefits of mining in Fiji?

The islands of Fiji are largely unexplored but are located in a very prospective section of the South Pacific “Ring of Fire,” one of the most mineralized gold provinces in the world. Lion One has secured the entire Navilawa Caldera, a 4.5 million year old volcanic center containing dozens of very significant gold geochemical targets, many of which have visible gold on the surface.

Because of the mining history in Fiji, there is an existing, experienced workforce, and the community supports development through mining. The government is stable and strongly encourages mining and development. Because of the country’s location in the middle of Pacific Ocean (over 2,000 km from New Zealand and almost 3,000km from Australia), specialized mining, processing equipment and consumables need to be imported into the country, which can take time and incur additional costs.

### To what extent will the purchase of Geodrill’s drilling assets help advance exploration?

There are very few drilling rigs of any sort available in Fiji. Lion One used Geodrill, a Fiji registered company, to carry out diamond drilling for the past 30,000 m of drilling we completed since late 2012. This includes exploration, resource definition and geotechnical diamond drilling. Geodrill were intending to pull out of Fiji and planned to sell its equipment into Australia. To ensure Lion One had access to quality drill rigs and drill crew so that it could undertake its exploration, resource definition and geotechnical surface and underground drilling when it required, and at reasonable meter rates, the company acquired all the assets of Geodrill, including a surface and underground drill rig, vehicles, support trucks, all necessary survey equipment, spare parts and an experienced drilling crew. This will allow exploration to be undertaken when it suits the company and at a reduced cost.

### What are Lion One Metals’ principal strategy and objectives for 2019 and 2020?

Lion One’s main strategy is to complete the development of the Tuvatu gold project’s surface infrastructure and mine development and to realize a cash flow from its initial operation. This will enable the company to further explore and develop the Navilawa Caldera into a major, internationally recognized gold camp. 2019/2020 will see the continuation of exploration and resources definition diamond drilling, the completion of its world-class geochemical and metallurgical assay laboratory, the completion of the site civil works for the surface infrastructure and mine development and the substantial completion of the construction of the process plant, tailings dam and workshop. The commencement of underground mining, both from the existing exploration decline and a new development decline will be well underway by mid 2020, whilst a considerable stockpile of high-grade gold ore is envisioned prior to the commencement of processing. ■



## Ron Hochstein

President and CEO  
**LUNDIN GOLD**

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The exploration potential in Ecuador is significant, and the government realizes that improvements still need to be made, while maintaining a strong stance on protection of the environment and indigenous cultures.

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### **What was the impact of Kinross' decision to abandon Fruta del Norte in Ecuador, and how is Lundin Gold successfully moving the project towards production?**

Fruta del Norte was first discovered in 2006 by Aurelian. Kinross then acquired it in 2008 and did a lot of work on it, but ultimately decided to walk away in 2013. Kinross's decision to abandon Fruta del Norte had a large impact on the country: externally, it affected how the outside world perceived Ecuador, and internally, the decision was taken to heart. Previously, the Ecuadorian government thought that mining could operate with the same rules and fiscal regime as the oil and gas industry. However, this was not the case, and when this became apparent, Wood Mackenzie came on board to help Ecuador make the fiscal regime for mining more competitive.

In mid-2014, we negotiated the deal with Kinross, but prior to signing we flew to Ecuador to talk to the government. It was after these discussions that we felt comfortable to move forward, because the government demonstrated commitment to developing the mining industry. We signed the deal with Kinross in October 2014. Most of Lundin Gold's senior management team, other than the finance and legal departments, are in Ecuador, which shows our commitment to the project.

### **How unique is Fruta del Norte in terms of geology and grade?**

There are other high-grade deposits around the world, but typically they are vein-type deposits where the grade is erratic and you need many open faces. Furthermore, there are always issues with dilution and mining recovery. Fruta del Norte is unique in that it is not the traditional vein-type deposit, but gold is found in high-grade zones. It is a compact deposit: our reserves are 600 m in length, 300 m from top to bottom, and 100 to 150 m wide; but it is large in that just over 5 million oz are contained in that compact area.

### **What drove the decision to update the project estimate ('UPE') while already in the midst of construction?**

Our board pushed for that review. Many projects find issues along the way, even if there are good project controls in place. It is sometimes beneficial to step back and do a full bottom-up review of the capex, opex and schedule. We found areas where we could save costs and, as a result, we have a much higher level of confidence in the project. By reviewing our mining plan and mining method, we reduced the all-in sustaining cost to US\$583 per oz, down from US\$609.

### **Ecuador is still experiencing a learning curve in terms of permitting and consultation. How is that evolving?**

It is true that Ecuador needs to improve its framework to be more attractive for mining investment. More importantly, it needs to improve permitting for exploration. Currently, one needs a full EIA for drilling, which does not make much sense. The government continues to listen and improve the regulatory regime and the cadaster system to grant concessions. The exploration potential in Ecuador is significant, and the government realizes that improvements still need to be made, while maintaining a strong stance on protection of the environment and indigenous cultures.

### **Looking forward, what is the potential to increase the mine-life of Fruta del Norte beyond the current 15 years, and how could Lundin Gold find more assets in Ecuador or elsewhere?**

Fruta del Norte's reserves of 5 million oz at an average grade of 8.74 g/mt only represent 67% of our indicated resource. We believe that once we get underground, we will be able to expand our reserves. Our inferred resource is to the south of the ore body, and we will reach that area as we develop the mine. We have identified a potential 16 km trend with similar geology and prospects, and in addition, we have signed an exploration option agreement with Newcrest on concessions to the south and north of the Fruta del Norte prospective land package.

At Lundin, we are excellent at finding assets that do not fit into other companies' portfolios and making the best of them. Our focus right now is to put Fruta del Norte into production, and once we achieve this, we will start looking at potential growth opportunities. ■

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tion in Brazil. A mere 24 hours after Bolsonaro had officially taken office as Brazil's 38th president, South America's largest country was rocked by the news that a tailings dam at Vale's Brumadinho mine in Minas Gerais had collapsed. By February, the death toll from the disaster had risen to 134 and a further 199 reported as still missing, and Brazil's biggest mining company had lost a quarter of its market value – approximately US\$19 billion. Disasters such as Brumadinho, the Samarco dam failure in 2015 and Mount Polley in 2014 reverberate beyond borders and negatively impact the image of the global mining industry as a whole.

As the dust settles and fallout from the tragic event in Minas Gerais begins, the Brazilian mining sector must balance image reparation with investment in an industry of enormous potential. For Michael Bennett, president and CEO of Altamira Gold, the government is being proactive in reducing bureaucracy, one of the major roadblocks to South American mining development: "It seems that the new government is looking for people with experience in different sectors and who really understand the business," he said.

Altamira's focus is on the Jurueña Belt and Alta Floresta Belt in the state of Mato Grosso, south of Pará. The Vancouver-based junior currently holds a land package of approximately 260,000 hectares, and Bennett sees multi-million oz resource potential in a region occupied by Anglo American, Nexa Resources and Codelco.

Another player in Brazil's new gold rush is Cabral Gold, advancing the district scale Cuiú Cuiú project in the Tapajós Region in the state of Pará, northern Brazil. This region was the site of a major gold rush by artisanal miners from the late 1970s until the late 1990s which, ac-

cording to the Brazilian Department of Mineral Production (DNPM) had a total historical production of between 20 and 30 million ounces of gold.

### Due South: The Canadian service sector in Latin America

In the first three months of 2019, energy and mining companies based in Canada invested a net C\$15.5 billion outside of the country, in stark contrast to the C\$123 million investment coming into Canada's energy and mining sector from abroad, according to a report by Statistics Canada. The significance and direction of this flow of investment has not gone unnoticed by mining service companies based in British Columbia, who are increasingly marketing their products to jurisdictions that may share similar topographical characteristics to Canada, but do not have the luxury of a mature service ecosystem.

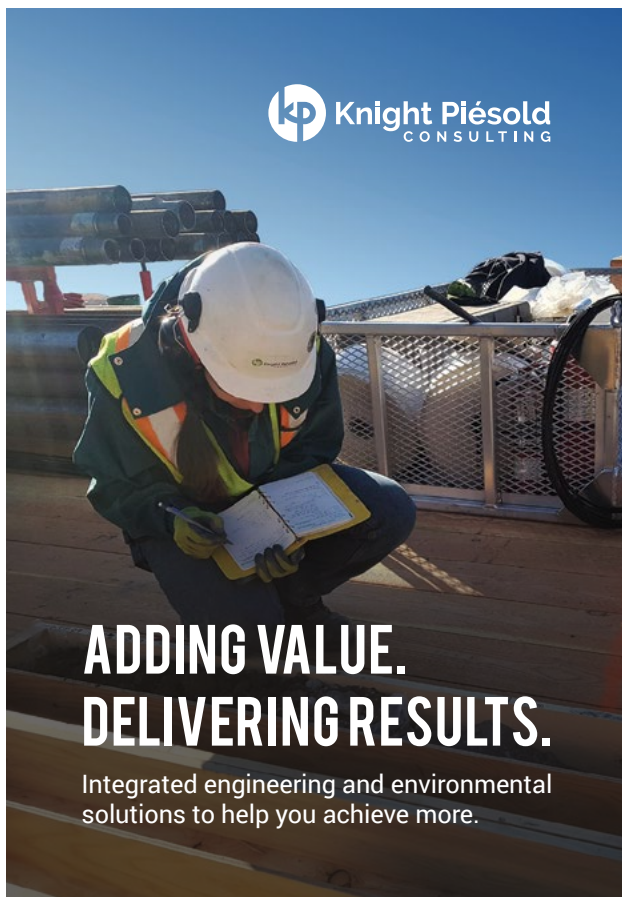
The Canadian service sector has been supplying remote locations in Canada's north for generations, and this expertise is being applied to similarly hard-to-reach areas throughout the Americas. "The cost of failure is high in remote locations, and we want to guard against this by being certain a system is designed for maximum operational up time," said Scott Plummer, president and CEO of RMS-Ross Corporation.

Working with small and mid-tier companies, RMS-Ross ships its heavy-duty mining equipment around the globe, designing and manufacturing recovery systems tailored to individual projects in over 60 countries. Its recent elemental analysis work performed at a gold mine in Bolivia led to the discovery of seven new saleable grade products. Vancouver-based companies have long been exporting technologies to overcome challenges unique to South America. Global UAV Technologies can now service the high-elevation, surveying obstacles faced by companies operating in the Andes: "These environments are too risky to fly with a manned helicopter, and surveying is physically impossible by foot. Drones are thus the only solution, and we are able to fly surveys at an altitude of approximately 15,000 feet," said Michael Burns, Global UAV's CEO.

### Vancouver's African footprint

Vancouver's geographical position makes it a natural base for companies operating throughout the Americas, particularly those with projects situated along the west coast of the two continents. While London and Perth have been the traditional location for mining players focused on the high risk/reward opportunities available in Africa, there are also a number of Vancouver-based companies active in a continent that presents some of the highest-grade projects available today. As keynote speaker at the 2019 CRU World Copper Conference in Santiago, Chile, Robert Friedland, founder and executive chairman of Ivanhoe Mines, spoke of the vast untapped mineral potential of the Democratic Republic of Congo, declaring: "Chile has two new competitors in the world of copper – Mongolia and the DRC."

While copper may be "a clear investor favorite", as affirmed by Andrew Thake in the run-up to Mines and Money New York in 2019, the world's most precious mineral resource, the diamond, has long been a source of interest in Africa. The largest diamond producing country globally is Botswana, home to Lucara Diamond's Karowe mine, where the world's second largest gem-quality diamond, Lesedi La



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Rona, was found in November 2015. Lucara acquired Clara Diamond Solutions (Clara) in 2018, with the aim of disrupting and transforming the traditional rough diamond sales process, according to Eira Thomas, Lucara's president and CEO. "The current sales paradigm is antiquated, inefficient and inflexible," stated Thomas, "the aim of Clara is to stop selling diamonds using the traditional basket approach and instead start selling diamonds individually based on a customer's actual wants and needs," she explained.

Despite the success experienced by companies such as Ivanhoe Mines and Lucara Diamond, the investment community has not been convinced en masse, as some even struggle to differentiate between the countries that make up the continent. "Out of every 100 investors, 20 look at Africa, as 'one country' instead of as a continent. They seldom realize that there are 54 countries there, which are all very different," mentioned Douglas MacQuarrie, president and CEO of Asante, which is currently focused on raising US\$20 million to further development at the Kubi mine in Ghana. With an NI-43-101 resource of 350,000 proven, indicated and

inferred gold ounces, MacQuarrie spoke of perception challenges that foreign investors sometimes carry: "Ghana has been producing gold from large 'western' mines for more than 100 years and is Africa's second-biggest gold producer... Our story sells better in London and Europe than it does in Canada because of the historical ties they have to the continent."

#### **Nordic exploration: the emergence of Scandinavian mining**

Scandinavia has a rich mining history, with historical production from mines such as Falun in Sweden, which supplied Europe with copper for a millennium from the 10th century to 1992. Today, Sweden is the largest iron-ore producer in Europe and, with its Nordic neighbor Norway, is attracting the attention of a junior community looking to take advantage of a region yet to receive as much wide-spread attention as many jurisdictions in the Americas.

In 2018, Norra Metals (formerly OK2 Minerals) acquired a past producing mine and

advanced stage exploration assets in Norway and Sweden, after re-evaluating the focus and direction of the company and deciding to look for assets in jurisdictions that would allow for operating projects 12 months of the year, according to Mike Devji, executive director and CEO. This year, Norra Metals intends to work towards establishing a resource estimate at its Bastuträsk project in the central Skelleftea belt, the main massive sulfide producing belt in Sweden. In addition to this, exploration work will begin on its Bleikvassli, Sagvoll and Meraker assets in Norway. "The advantage of Sweden and Norway is that the properties have not been intensively explored by historic operators so the potential upside is excellent," stated Devji.

Patricio Varas, CEO of Boreal Metals, another Vancouver-based junior active in Scandinavia, expanded on the economic benefits of mining in Sweden: "The cost of power in Sweden is probably the cheapest in Europe, which means one can mine lower grades without the excess costs. There are also a lot of smelters in Scandinavia, so ore does not have to be shipped very far." ■



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## Scott Plummer

President & CEO  
RMS-ROSS CORPORATION

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We used the downturn to expand, redesign and improve our product line, making it more robust, efficient and easy to operate. Making all the changes during the downturn was extremely beneficial for business.

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**RMS-Ross has a strong presence in North America. Which other regional targets will you be focusing on for continued growth?**

RMS-Ross continues to strengthen its presence within Canada and the United States, but it is our goal to expand further into Central and South America and Africa. We presently have sold our mining equipment and systems in over 60 countries around the world.

**Can you outline the range of your service offering and highlight a recent success story?**

We mainly work with the small and mid-tier mining companies, as we are a heavy-duty mining equipment and mining recovery system designer and manufacturer. We work closely with smaller companies to ensure they find the right solutions for their projects. One of our proudest accomplishments was a recent shipment we completed to a project in Bolivia. The company's project had started as a gold mine, but once we had a complete elemental analysis performed on the heavy mineral black sand concentrate, we discovered that there were seven additional valuable target products that were potentially separable and profitable. By analyzing the results and conducting a range of advanced separations, it was determined that these products could each be separated to saleable grade products, using just advanced magnetics in tiered gauss levels, eddy current and electrostatics. The company would not have to do any chemical extraction, and their resources could be worth many times that of the gold that was being recovered, as each of the products was a high percentage, saleable grade.

RMS is also now incorporating advanced sensor-based ore sorting technology into some of our plant designs so that we can remove barren or uneconomic rock prior to secondary and tertiary crushing and separation, significantly decreasing overall mine energy consumption and dramatically increasing throughput while also greatly increasing grade of the ore that is fully processed.

**What are your flagship products?**

We are widely known for our advanced, robust modular Circular Jig Plants, which can effectively be adapted to a wide range of heavy mineral concentration, from a wide range of metals and minerals, to gems such as diamonds. We are also known for our

heavy duty DEROCKER, which allows the alluvial processing and scrubbing and recovery of values from ground full of rocks and boulder as large as 1.3 m diameter several mt in weight. We also do advanced sluice systems, however, we integrate other associated leading mining technology companies' products into the circuit design, depending on the unique specifics of the ore and heavy mineral content/concentrates – whether it is hardrock or placer etc. – in order to be certain that we are designing and building the most efficient and robust recovery system to meet the exact needs of our customer's ore and target value recovery.

**What was RMS Ross' strategy for navigating the mining downturn in order to continue growing?**

We used the downturn to expand, redesign and improve our product line, making it more robust, efficient and easy to operate. Making all the changes during the downturn was extremely beneficial for business. We improved our customers' experience and made shipping and manufacturing easier and more affordable. We presently have 13 projects where we have completed circuit layouts and designs, and three more are right now in the stages of final funding.

Another challenge that we faced was that a company in Russia and one in China copied our innovative product. The quality was very low, and the attempted copies had very short operational life in comparison, but certainly it was an unpleasant experience.

**What are some of the milestones that you would like to achieve in the next year or two?**

We would like to continue expanding our knowledge for conquering unique orebodies and on mastering multistage leading edge advanced separation. Geologists and field experts are very skilled at what they do; however, sourcing the right information to be able to determine and achieve the type of multistage scale separation like we did on the aforementioned Bolivia project is currently lacking in the industry. We will continue to strengthen our relationship with specialty separation laboratories where we can achieve detailed analysis and the range of precise separation work needed to be done. RMS-Ross is currently working with universities and studying new emerging equipment in order to continue improving our service offering. ■

# Ken Embree & Greg Smyth

KE: Managing Principal and President (effective 2019)

GS: Project Manager / Associate  
**KNIGHT PIÉ SOLD**



KE



GS

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Many of our Canadian clients have mining properties in other areas of the world. We help companies understand the regulatory regimes in which their projects are situated so that they can advance their projects in the most efficient manner.

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## What are Knight Piésold's top priorities for the upcoming year?

KE: In 2019, Knight Piésold will continue to focus on the company's technical excellence and client service. We intend to remain at the forefront of advancing trends in tailings and management of all things related to water. We are also pursuing opportunities in instrumentation and automation that will allow us to enhance this important aspect of our business. We will participate in industry best practice forums, which set standards that are adopted worldwide, and we will focus on the development of our team so that we can continue to provide excellent services to our clients. Knight Piésold has a strong focus on the mining and energy industries, and we are identifying more opportunities to further integrate these two sectors.

## Can you elaborate on Knight Piésold's service offering for the mining sector?

GS: Knight Piésold's service portfolio includes geotechnical and hydrogeological site investigations to support mine design; environmental and social baseline studies, impact assessments and permitting; tailings and waste management; dam breach inundation studies; water management with regards to both surface and ground water; rock mechanics, both underground and open pit; and pipelines and pump stations. The power segment of our business provides services relating to energy supply, transmission and distribution. Every mine needs power, and we support our mining clients in this regard.

## What is the importance of Canada as a market for Knight Piésold?

KE: Knight Piésold has operations worldwide, and we have nine regional centers in Canada, Australia, Argentina, Chile, Ghana, Peru, South Africa, United Kingdom and the United States. Globally, our practice in Canada is one of the largest, and we work with all of our regional centers. For our Canadian operations, approximately 50% of our project portfolio is in Canada, 25% is in the United States and 25% is in the rest of the world. Within Canada, approximately 65% of our work is within the province of British Columbia.

## From your perspective, what are the key challenges that the industry will face in the next five years?

KE: Knight Piésold believes that the main challenge within the industry is, and will continue to be, attracting and retaining skills and talent. We will invest in training for the new generation entering the industry. We have always had the most success through organic growth by finding the right young people that fit our culture and helping them develop their careers. We aim to create an enjoyable and rewarding working environment and give our employees responsibility over their tasks, with the right level of guidance and supervision from our experts. We also have internship programs and offer technical mentoring on every level in the company.

## How does Knight Piésold bridge the gap between North American and Asian markets?

GS: Many of our Canadian clients have mining properties in other areas of the world. We help companies understand the regulatory regimes in which their projects are situated so that they can advance their projects in the most efficient manner. We encourage them to apply the same innovative developments, technologies and best practices to all their operations, including their projects located outside of Canada. This is a way in which Canada can transfer knowledge and expertise to other parts of the world.

## Do you have a final message for our international readership?

KE: Knight Piésold is recognized for technical excellence and dependability. We are nearing our 100-year anniversary and have operated in Canada for 44 years. Our B.C. based clients will continue to play a very important role in our operations, and we will continue to partner and integrate with them. We are proud of our track record in sustainable development, both in power and mining projects, and aim to continue to grow and enhance our capabilities moving forward. ■



## Wayne Barnett

Principal Consultant (Structural Geology)  
**SRK CONSULTING**

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More recently, the strongest growth in our Vancouver office has been in the water management and mining engineering teams, and we have also rebuilt resource estimation specialization.

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### ■ Can you provide an overview of the footprint SRK has in British Columbia and Canada, and elaborate on the areas of expertise at the Vancouver office?

SRK's focus is on the full mining pipeline, from exploration to reclamation. We are involved across the province of British Columbia and the broader region of Canada. Within SRK Vancouver alone, we can cover all aspects of the pipeline, but we work closely with other offices across North America and globally from where we can call upon high-value individuals and teams with specific expertise and experience. SRK Vancouver's footprint over western Canada and Alaska is particularly strong, with significant cold climate practical and technical experience.

We have strong expertise in geo-environmental studies, tailings, waste and ground-water management, mining design and geo-technical and geological studies, including structural geology and resource geology.

### How extensive is SRK's global reach when it comes to serving the mining industry?

Many of our employees work regularly around the world, providing support in exploration and mining operations to every mining-active continent. This is a benefit of employing people with varied previous international expertise and background. SRK's consulting clients are looking for specific skills, and there is acceptance that SRK specialists from other countries may undertake work respectfully within the region of practice of another office, but whenever possible we involve the local office.

### Have there been any services driving growth for SRK in recent years?

More recently, the strongest growth in our Vancouver office has been in the water management and mining engineering teams, and we have also rebuilt resource estimation specialization. Another highlight has been the growth of our diamond specialist group, which is probably now the strongest diamond focused consulting group in the industry.

### Have you noticed an uptick in the adoption of innovative technologies in the mining sector?

SRK is known for its innovative solutions and use of new technologies, and we are

seeing a broad spectrum of clients showing an increasing interest in the implementation of new technologies as long as they add value. I think the downturn sparked the drive for more innovation, and because the new upcycle has been slow and incremental, we have had the opportunity to develop innovative solutions and allow them to mature organically.

### Can you give some examples of the innovative solutions that SRK uses?

Some of the most exciting innovations are on the geo-environmental side. SRK is currently working on a project where waste rock backfill is being used within an open pit and manipulated to enhance natural processes to remove selenium and nitrate from mine waters. We are also working with a client on technology to preserve permafrost in foundations of infrastructure. I am also excited about our development of augmented reality tools to enhance geological data collection significantly, rather than simply visualizing it.

### How does SRK deal with the challenge of attracting and retaining talent?

SRK recognizes employees who strive for excellence by challenging the normal through independent thinking. We look for individuals who seek to build their own consultancy within SRK. I believe that creating an environment of like-minded people with independent thinking attracts other valuable human resources. SRK is also owned by its employees, and this means that there is self-investment within the company, so the motivation comes more naturally.

### Where would you like to see SRK, particularly the Vancouver office, in the next 12 months?

We will continue the rewarding process of finding the most effective practical solutions for our clients. We are getting involved in British Columbia's Government Professional Reliance Review. Although SRK has always had a flat, empowering reporting structure, there has been a strong recent drive to better empower our younger staff throughout SRK North America to contribute to the organizational structure and strategic management. This process will continue, so that SRK's future will grow from the current younger engineers and scientists. ■



## Andy Haynes

Vice President Mining North America  
**GOLDER ASSOCIATES**



## Brian Abraham

Global Mining Expert  
**DENTONS**

### How has Golder's restructuring in 2016 impacted the mining side of the business?

The restructuring has allowed us to enhance collaboration between offices and pool together the right people to meet client needs, whereas prior to 2016 individual offices generally managed client relationships and projects. We now provide clients with a mix of local employees combined with the best skilled employees across Golder's global network.

### Can you provide an example of how Golder's various fields of mining expertise have collaborated to help a client in British Columbia?

Golder designed a depressurization program for Highland Valley Copper, installed the wells and operated them for a few years before handing the operations over to Teck. This is a great example of being able to integrate the entire solution: our hydrogeologists and rock mechanics map out what needs to be done, and our construction team drilling and installing the wells, monitoring them and constantly feeding back to the designers in order to achieve the required performance to depressurize the slopes and hence maintain slope stability.

### How does Golder's integrated approach to engineering and environmental services differ from the traditional consultancy model?

There have been many examples where two separate teams, one from the consultancy and the other from the client, have conducted environmental permitting and design in parallel. This process often led to several discrepancies in the end result due to lack of communication and differing assumptions made along the way. Golder's approach entails bringing the two teams together to work cohesively, as was the case in the work we performed for Dominion Diamonds, resulting in an increase in efficiency and a more favorable timeline in gaining regulatory approval. ■

### How important is Canada, and specifically British Columbia, to Dentons' global operation?

Until a couple of years ago, Dentons was primarily focused on the mining industry in Canada and British Columbia, but the company's focus has now expanded to include Asia, Australia, Latin America, Africa, the Caribbean and Mexico. With a presence in more than 60 countries and 150 cities, Dentons has experienced significant growth, especially within Latin America.

### What are the greatest challenges faced by companies seeking to be permitted in British Columbia, and how does the jurisdiction compare to others on a global scale?

In British Columbia, project proponents are obligated to consult with all Indigenous groups that might be impacted in the area. There is often no true alignment of objectives amongst them, and the strength and claim of each group must thus be considered. The B.C. government has an incentive whereby a percentage of the revenue (resource revenue sharing) from a successful mining project is shared with Indigenous groups in terms of tax revenue, but First Nations will often also request community benefit agreements or employment and training initiatives to be implemented.

### What makes British Columbia such an attractive mining destination for international investors?

The attractiveness of the province relates to the extremely talented pool of people it has to offer. Vancouver will continue to be a global mining center as it is currently the exploration capital of the world, hosting approximately 800 junior companies. The geology in the province is second to none, and it is relatively easy to raise money here. However, the challenges faced when it comes to permitting projects might cause companies and investors to look to other countries for their exploration and mining activities. Knowledge is easy to export, and expertise skills must be developed in foreign countries with Canadian knowledge and financing capacity so that they can start developing their own mines in cooperation with us. ■





# Exploration in BC, Yukon, and Canada's North

“The frustration lies in that the goal posts keep moving further away from what proponents need to attain in order to get a project permitted. 10 years ago it would not have taken as long as it has taken us now. I do not think that by increasing permitting times we are necessarily attaining safer designs, and this must be discussed. When I look at British Columbia and other jurisdictions in Canada, they are not too different from the Yukon. Do I wish it was shorter? Absolutely.”

- Paul West-Sells,  
President and CEO,  
Western Copper and Gold

# Exploration in British Columbia, Yukon and Canada's North

**Rhetoric must become action if British Columbia is to remain competitive**

At the Association of Mineral Exploration's (AME) Roundup 2019 conference, Premier John Horgan emphasized the B.C. government's commitment to its mining industry. Horgan vowed to make the Mining Flow-Through Share Tax Credit and the B.C. Mining Exploration Tax Credit permanent, and he also outlined plans to invest C\$2 million into developing a road map for innovation and expanding the B.C. Regional Mining Alliance (BCRMA).



**Advancing projects in British Columbia's Golden Triangle and the Yukon**



1st drill hole of 2018 discovered multiple high-grade zones including 62.4 g/t gold over 6.0m within 38.7 g/t gold over 10.0m at the Forrest Kerr Project in BC's Golden Triangle

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Incentivizing exploration should certainly be a priority for the regulatory bodies in British Columbia, as Canada's share of global exploration spending for non-ferrous minerals has dropped from over 20% in 2008, to 15% in 2018. The province lags behind Ontario (28% of Canadian allocations) and Québec (24%) in the domestic rankings, according to S&P Global Market Intelligence. As majors allocated an all-time low of 0.4% of their revenue to grassroots exploration in 2017, a lack of new projects coming online points to a bullish outlook for metal prices in the medium to long term.

An expected incremental growth in the demand for copper from Asian and African infrastructure construction and the impending vehicle electrification revolution should be good news for British Columbia as Canada's largest producer of the base metal. Considering the timeline for taking a copper project from early-stage exploration through to development and production, the importance of fostering an attractive climate for exploration investment should not be underestimated. Speaking at AME Roundup 2019, Chris Welton, Rio Tinto's exploration director for the Americas region, gave an indication of the extent of these timespans: "On average, a greenfield program will take 15 years to deliver a discovery, and that discovery can take another 10 to 15 years to permit and develop."

Despite rich mineral wealth, a mature service sector and a deep-rooted mining tradition that dates back to the signing of the Oregon Treaty in 1846, a number of Vancouver-based juniors are turning their attentions away from home. "The challenge in British Columbia is that we have very short seasons, and shareholders become restless and investor interest wanes as exploration companies have to wait out the winter. In addition, many stocks have decreased significantly in value in the Golden Triangle," explained Mike Devji, executive director and CEO of Norra Metals, which rebranded from OK2 Minerals in 2019 to signify its change in focus from British Columbia to Scandinavia.

Despite a challenging context for the Canadian junior community, with small-cap players in particular suffering from the fast money being made by cannabis and cryptocurrency speculation, 2017 witnessed British Columbia's first increase in exploration spending since 2012, reaching C\$246 million in comparison to C\$205

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## Jim Pettit

President and CEO  
**ABEN RESOURCES**

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We had a good year, raised a lot of capital and now have about C\$6.5 million in the bank, which means I do not need to focus on raising money. This is not a common position for a lot of juniors in the market.

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### How has Aben Resources' consolidation of the Forrest Kerr area progressed over the last two years?

We have been successful in bringing together three separate properties that are now what is known as the area of Forrest Kerr. Aben Resources received access to all the data from the three different companies that had worked on these properties and then performed a data compilation and put it all into one project. We used that data to come up with a series of prioritized targets, and the first drilling campaign commenced in 2017. This large exploration program was to reconfirm what the data had showed us, and we drilled nine holes on what will be the first of 21 targets. We had success with holes four, five and six in 2017 and discovered a zone in the north part of the boundary zone where we hit very good results – 22 g/mt gold over 6 m. The first hole of 2018 blew the market away: we ended up with four separate distinct high-grade zones from our first hole alone. We hit 10 m of 38 g/mt and within that we had a section of 6 m of 62 g/mt, which was spectacular.

### How did the Forrest Ker exploration results in 2018 impact Aben Resources' financing?

On the back of our 2018 exploration results we raised C\$6 million in one week on a trip to Toronto. We bumped the program up to 10,000 m, and being well financed has allowed Aben Resources to drill 45 holes in two years, 36 of which were drilled in 2018 at the North Bound zone. We had a good year, raised a lot of capital and now have about C\$6.5 million in the bank, which means I do not need to focus on raising money. This is not a common position for a lot of juniors in the market.

### Aben Resources released results showing high-grade gold at its Justin project in the Lost Ace zone in the Yukon Territory. Can you elaborate on these findings?

In 2017, while trenching and sampling we took a bulk sample and did a gold-in-soil analysis and discovered 1,135 gold grains in that representative sample, 90% of which were pristine. We sent a team of geologists up there who found the Lost Ace zone, which is similar and on strike to Golden Predator's 3 Aces project. The high-grade gold here appears to be a second, older mineralizing event that could enhance the previously discovered intrusion related gold system at the POW Zone.

Work completed in 2018 included the collection of 19 channel and 28 chip samples from five trenches, 16 rock samples, seven till samples and 240 soil samples with coverage totaling six line-km. The 2018 field program focused primarily on the Lost Ace zone, a gold bearing zone discovered in 2017. Lost Ace is located 2 km west of Aben's POW zone where past drill results indicate potential for bulk-tonnage gold mineralization. 2018 results from the Lost Ace quartz stockwork vein zone included 88.2 g/mt gold over 1.0 m, at an average of 20.8 g/mt gold over 4.4 m.

### Considering the exploration results from the Justin project, will Aben Resources pursue a two-pronged approach focusing on its assets in both British Columbia and the Yukon?

Aben Resources is now in a position to move forward with exploration work on both properties. Some investors suggest a focus on one asset is more prudent, but when the properties show such potential, and considering that we are well funded, we firmly believe Aben's assets in both provinces can create value for shareholders.

### What are Aben Resources' main priorities for 2019?

Forest Kerr is Aben's flagship asset and produced excellent results in 2018, so we will be advancing exploration work there. The North Boundary zone is in an area that is 4 km long and 2 km wide, and there is a lot more work to do on the initial targets we identified. The Forrest Kerr property is about 50 km long and has huge potential. We are considering two drills in operation as we have a lot of drilling to complete. Additionally, we will continue to explore the Justin project in the Yukon.

There is a lot to watch for: Aben Resources is not afraid of advancing projects on two fronts, and we have the financing. ■



## Walter Coles

President and CEO  
**SKEENA RESOURCES**

“

The moment when everyone wants to invest is the worst time; bear markets are when we work hardest to build a foundation for success during the next up-cycle.

”

■

### Could you provide an update of Skeena Resource's operations?

The major change was the optioning of the Eskay Creek project in the Golden Triangle from Barrick. We subsequently completed a 43-101 on that project, which exceeded our expectations, coming in at about 1.87 million oz of indicated and inferred gold. The open pit grades hovered around 4.6 g/mt, and the underground is 10 g/mt. We are advancing that project doing metallurgy, and the goal is to try to complete either a PEA or a pre-feasibility study next spring. Skeena Resources also recently secured a deal with Peruvian Hochschild Mining, who are now taking a percentage ownership in the company and optioning the Snip mine.

### Will Skeena Resources carry on exploring for more opportunities within the Golden Triangle?

We have built a strong team here and are firm believers that consolidating projects within the Golden Triangle will allow us to build district-scale capability and expertise. M&A is always a part of our strategy, since our primary objective is to generate shareholder value. However, our primary objective in the Golden Triangle is to position Skeena Resources as experts in the region, able to partner with international companies and investors. The potential for mineral deposits in the area is spectacular, and it is easier for global companies to partner with somebody local than to develop a First Nations relationship and a geological, regulatory expertise entirely on their own.

### How has Skeena Resources financed its operations in the past, and what kind of impact have junior companies experienced due to recent market trends?

Skeena has been able to move forward through the recent investment from Hochschild and last spring's financing led by Sprott. The amount of capital available to the mining sector has declined by up to 80% over the last couple of years, and institutional capital is minimal. There has also been a drag of money out of the actively managed funds into ETFs and Index funds, which do not do private placements. There is hardly any money for exploration. The only money available is coming from majors. A lot of risk capital went into cannabis and crypto-currencies, as well as the tech sector. It is very difficult for mining companies to raise capital, and this is arguably the strongest place for mining expertise in the world.

### What makes Skeena Resources an attractive investment opportunity?

With the best all-round capability to deliver, we devote much time and effort to operating at the highest environmental standards and building long-term relationships with indigenous groups, governments and regulators. Road connectivity in the Golden Triangle has always been strong, but we now have the NW Transmission line, as well as three new run-of-river hydroelectric facilities at about a billion dollar cost, which plug into the power line neighboring our projects. Projects that were generally diesel powered now have a chance to plug into US\$0.04 kWh electricity.

### Where would you like to position Skeena Resources in the next couple of years?

We would like to be nearing production or in production in two years. Large companies are not replacing reserves as quickly as they are depleting them; therefore there are many opportunities for strong partnerships on the horizon. Contrary to market trends, Skeena Resources has taken advantage of the downturn to look at strategic opportunities at very attractive prices. The moment when everyone wants to invest is the worst time; bear markets are when we work hardest to build a foundation for success during the next up-cycle. ■



## Martin Turenne

President and CEO  
**FPX NICKEL**

“

The demand that comes from electric vehicle batteries is a new driver for the demand of nickel, currently contributing around 3-4% of total nickel demand, but the consensus is that this will grow to about 10- 15% over the next few years.

”

■

### What have been the major developments at FPX Nickel since 2017?

In April 2017, we rebranded from First Point Minerals to FPX Nickel, a logical move considering the company's focus on nickel since 2008 and the potential we see in the metal. Since 2017 we have focused on optimization of FPX's flagship project, which is the Decar nickel district in central British Columbia. Our former joint venture partner Cliffs Natural Resources did a Preliminary Economic Assessment (PEA) in 2013 on the project. We took ownership of the project in late 2015, and subsequently in 2017 we kicked off a more intensive program optimizing various development parameters. This has ranged from resource expansion to metallurgical optimization. We hope to bring an updated PEA to the market in due course.

### Can you expand on the Baptiste deposit and your expectations for this project?

Canada is known for other large nickel districts. The mineral deposit that we have discovered in the Decar district places us in the same category as those in terms of the amount of contained nickel tonnage in 43-101 resources.

Decar itself covers about 245 square km of land, and within this land package is the Baptiste deposit. Baptiste is one of the largest underdeveloped nickel deposits in the world; it contains over 6 billion pounds of nickel in 43-101 resources. There are also other targets within the broader Decar district, adjacent to Baptiste, which we believe have the potential to host deposits that could compete with Baptiste for scale and/or grade.

### Is your plan to move the projects into production or do you plan on selling the project?

Our plan in moving the project forward is to demonstrate technical and economic feasibility to the high standards of major mining companies. We have the skills in house to develop the project, but ultimately, given the scale of the project, we see it sitting in the hands of a major company.

### How do you view the fundamentals of nickel?

The underpinning of the nickel market has traditionally been stainless steel, which currently counts for about 70% of nickel demand. The demand that comes from electric vehicle batteries is a new driver for the demand of nickel, currently contributing around 3-4% of total nickel demand, but the consensus view is that this will grow to about 10-15% of total nickel demand over the next few years. Since 2016, the nickel market has been in structural shortage, meaning that demand has consistently exceeded supply. The world requires new nickel mines to fill this gap.

### Can you elaborate on the work FPX has been doing with the University of British Columbia (UBC) on its CO2 sequestration project?

We have been at the forefront of helping to fund research work at UBC on the issue of carbon sequestration using mining tailings. Our deposit at Baptiste is rich in a mineral called brucite. When brucite is exposed to CO<sub>2</sub>, either from flu-gas or atmospherically, it acts as a carbon sink and catches carbon and stabilizes the tailings material. FPX and De Beers have funded work with UBC and other universities to delve into this. We believe that there is potential to demonstrate that mines with the right mineralogical characteristics could have a neutral carbon footprint. In the context of global concerns over climate change, this would be a revolutionary step for the mining industry.

### Do you have a final message for the readers of *Global Business Reports*?

The nickel market is in a sustained period of structural deficit, and the industry needs to build new mines. FPX Nickel's Baptiste project has the potential to be one of the top nickel mines in the world in terms of annual nickel output over at least a 25-year mine life. The PEA suggests that we will be able to produce nickel at an operating cost of approximately US\$6,000/mt, which would place our operation in the bottom third of the cost curve for the nickel business. ■



## Robert McLeod

President and CEO  
IDM MINING

### ■ Could you describe the development and exploration that has taken place at the Red Mountain project since we last met Q1 2017?

Red Mountain is one of the few near-shovel-ready, high-grade and high-margin potential gold producers in the industry. Since we last met, IDM Mining has focused on getting to a shovel-ready stage and securing all of our permits while continuing to explore. Our intent is to update our feasibility study, which was published just one year ago, because we have significantly expanded our measured and indicated resources since then. We are currently undertaking a drilling program and aim to have a fully permitted, highly feasible, affordable, bulk-mineable and underground operation in the Golden Triangle. We received our Environmental Assessment Certificate in October 2018, the largest milestone in the permitting process in British Columbia.

### ■ Your resource estimate for 2018 increased by 20% compared to 2017 in measured and indicated gold ounces. What can we expect for 2019?

It is our goal to continue expanding the resource. These results are directly related to a geological breakthrough we had in the fall of 2017, which allowed us to gain a greater understanding of the Red Mountain project. We noticed that after the gold mineralization had formed, tectonic plate movements had caused it to fold into a series of waves. What we initially thought were parallel zones were in fact the same horizon. The deposit is now wide open for expansion, and we are now currently drilling to prove the model.

### ■ Glacial retreat in British Columbia has opened up new targets for exploration. How much has this impacted IDM Mining's operations?

In the past couple of years we have seen a thin area of glacial ice retreat about a square km near our resource. Glacial retreat has led to many new discoveries in British Columbia, such as the Mitchell deposit at Seabridge's KSM property and Pretvim's Brucejack mine. ■



## Peter Espig

President and CEO  
NICOLA MINING

### ■ Nicola Mining's M-68 permit had just been amended. Could you contextualize this change?

The amendment to our M-68 permit positioned Nicola Mining as the 'defacto' milling facility for small projects throughout the province. Given that it is harder to receive a milling and discharge permit than a mining and bulk sampling permit, we were in a strong position. Nicola Mining now has the right to accept and process mill feed from anywhere in British Columbia, subject to notifying the Ministry of Mining 10 days prior.

### ■ With new exploration results expected Q4 2018, could you describe Nicola Mining's current key exploration targets?

Our exploration is focused on four parts: greenfield operations, the Craigmont West zone, the Halo area and waste piles.

### ■ Could you explain your decision to move HQ to the Lower Nicola region, and what role the environment plays in Nicola Mining's decision-making process?

We moved Nicola Mining's HQ two years ago to the Lower Nicola region because

management, team and community need to be close. In terms of the environment, there is not a mining jurisdiction in the world where people are as environmentally conscientious as they are in British Columbia. The perfect example is the Northern Gateway Pipeline, where 33 Indigenous groups were required to sign an approval: 29 did and four did not, so the project did not move forward. Companies need to make everyone happy here despite the global polarity of opinion.

### ■ What would you like investors to know about Nicola Mining's objectives for the next couple of years?

In two years, we want to prove that Craigmont will, at some point, become a successful copper mine. Additionally, it is important for the company to become self-sufficient through milling activities and other alternative sources. The goal is to fund operations fully and approach the capital markets as a place to tell the story and not to raise additional capital. If we can execute on self-sufficiency and cash accumulation, we open the opportunity to become a consolidator of small gold projects in British Columbia. ■



SM



LR

## Scott Martin & Lara Reggin

SM: Regional Manager and  
Vice President Mining

LR: Manager, Mining

**TETRA TECH CANADA,  
VANCOUVER**

**How substantial are Tetra Tech's Canadian operations and what is the significance of mining to its portfolio?**

LR: Tetra Tech's Vancouver office employs around 200 people and covers a range of industries including natural resources. In mining, we work throughout the full life cycle of the mine, including exploration and interpreting data, NI 43-101 reporting, geotechnical projects and upgrades to name a few. We have a large presence in the North with a specialization in arctic permafrost engineering and geotechnical work at the diamond mines.

**For which services to the mining industry have you experienced growing demand?**

SM: In the last year or two, it is mostly early-stage work, more on the studies side of things. This includes due diligence work, preliminary economic assessments and cost estimators.

**What would you say to mining companies as to why they should consider Tetra Tech?**

SM: Mining companies should work with Tetra Tech because we are one of the few companies that understand the full mining cycle from front to back, from the earlier stages of drilling the deposit to the last days of closing it. There are companies that excel in different parts of the life cycle, but given the diverse range of technical people that we have in this company, we truly can understand the implications of all decisions we make both short and long term. It is also beneficial to work with us given our size and geographic coverage. We can have face-to-face consults yet have enough people to offer a diverse range of skills and services.

**What is Tetra Tech's vision for the next two to three years?**

SM: Tetra Tech's vision is to match the mining sectors' vision and see stable, measured growth with the new upturn. We are cautiously optimistic about the state of the industry and confident we can mirror the ambitions of a broad range of mining clients. ■



## Dominique Lascelles

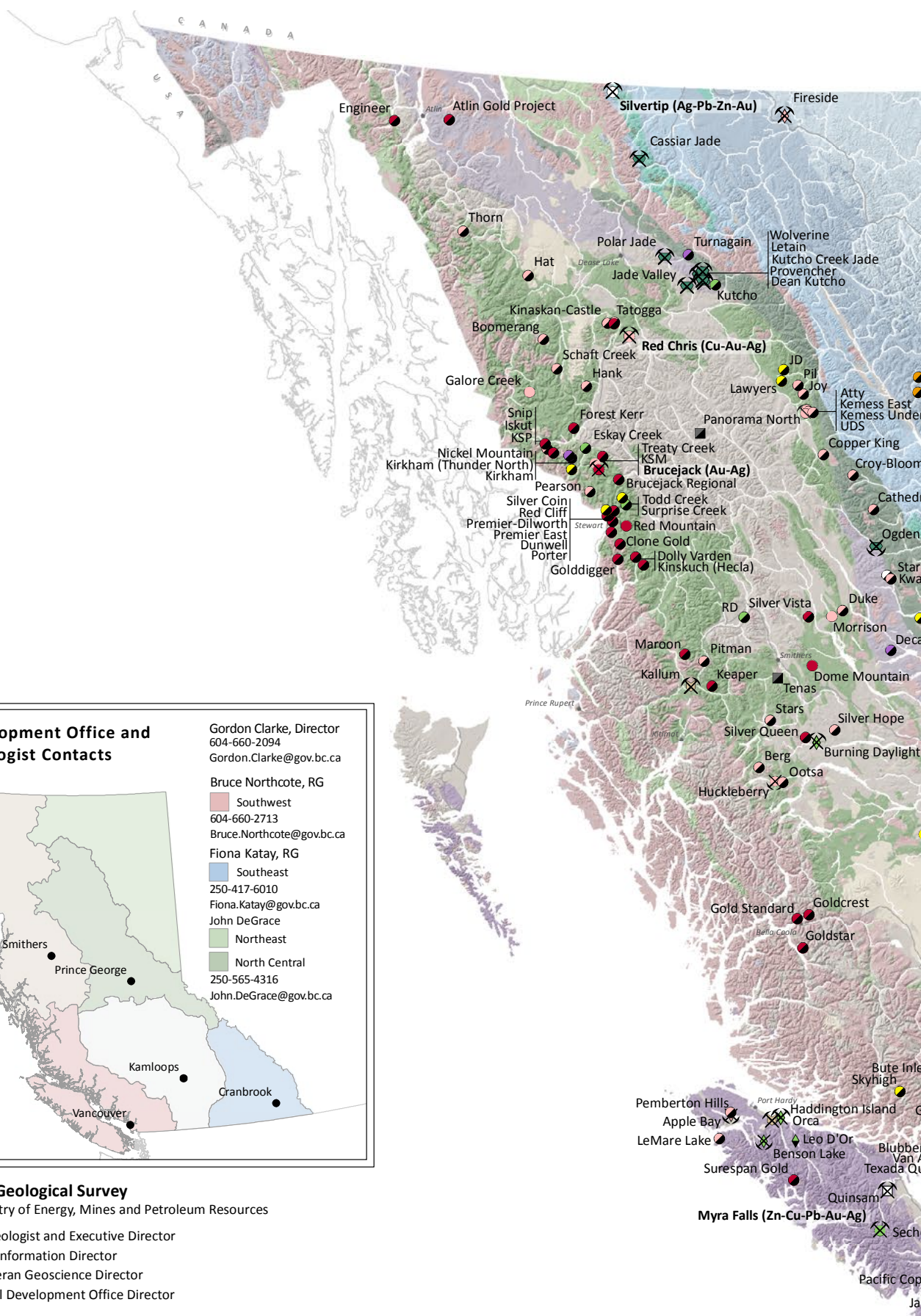
Metallurgy Lead  
**SGS**

**Could you provide a few highlights from SGS's mining and metallurgy division and your main focus for 2019?**

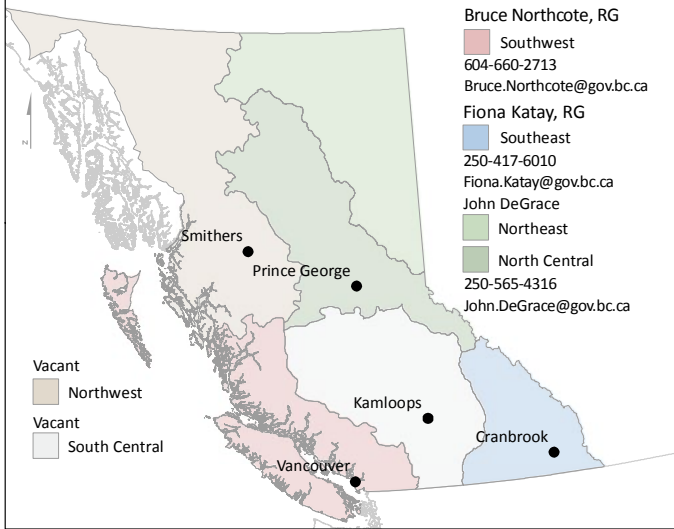
SGS has become an industry sector leader through innovation and technology services applied in real-time measurement systems and on-line analysis. In Vancouver, we have focused on gold heap leaching or flotation, due to the metal's heightened demand. With a renewed interest in green technologies, we have also strengthened our base metals service offering. We complete a large quantity of SAG Mill Comminution (SMC) test work to characterize ore samples for project optimization and production forecasts. Another key focus area has been ore sorting, for which we have a partnership with U.S.-based STEINERT. Many of our clients are looking at increasing their mine life or reducing capex by getting rid of material through ore sorting. SGS completes all the upfront preparation and analysis, and then we complete downstream test work. We forecast these demands to continue in 2019.

**Could you outline your service offering for the mining industry and highlight the services in most demand?**

SGS Vancouver can offer geology, exploration and geochemical services – our laboratory in the province is large and comprehensive. In terms of metallurgy, we can complete any process to extract the concentrate – from gravity separation, flotation, cyanidation, pressure-oxidation and heap leaching, to solvent extraction supported by our mineralogy facilities. Our trades division will complete inspection of shipments at port. Here in Vancouver we work mostly in the sulphur and potash for trade. We also supply mine plant services for process optimization and advanced systems. At the end of the process, we complete solid-liquid separation and filtration testing, and have a small water treatment division. We also have an acid rock drainage department for waste rock and tailings analysis. Ore sorting and heap leaching make up the highest demand we experience in the province. ■



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## British Columbia Geological Survey

British Columbia Ministry of Energy, Mines and Petroleum Resources

Adrian Hickin, Chief Geologist and Executive Director

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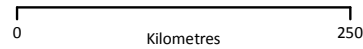
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# Mines, mine development, selected proposed mines, and selected exploration projects in British Columbia, 2018

Gordon Clarke, Bruce Northcote, Fiona Katay, and John DeGrace

Cartography by Holly Arnold












## Property status (overlay on sector and predominant deposit group)

-  Operating mine\*
-  Care and Maintenance \*\*
-  Mine development
-  Proposed mine
-  Exploration project






\* Operated in, or for a portion of 2018  
\*\* Operated within the last 3 years

## Sector and predominant deposit group (possible commodities listed beside)



### Metal

-  Porphyry - Cu, Mo, Au, Ag
-  Vein, breccia, and stockwork - Au, Ag, Cu, Pb, Zn, Co, Te
-  Sediment-hosted - Cu, Co, Pb, Zn, Au, Ag, V
-  Epithermal - Au, Ag, Cu, Sn, Pb, Zn
-  Marine volcanic association - Cu, Pb, Zn, Au, Ag
-  Skarn - W, Cu, Fe, Au, Ag, Pb, Zn, Mo, Co
-  Ultramafic/Mafic - Cu, Ni, PGE, Co, Au, Ag
-  Manto - Ag, Pb, Zn
-  Carbonatites - Nb, REE

### Industrial

-  Industrial rocks - Andesite, basalt, dimension stone, limestone, marble, pumice, shale, silica
-  Sediment-hosted - Bentonite, magnesite, barite, kaolin, talc
-  Chemical sediment - Gypsum, diatomite, phosphate
-  Continental sediments and volcanics - Zeolite, silica
-  Metamorphic-hosted - Graphite

### Coal

-  Metallurgical
-  Thermal

### Aggregate

-  Aggregate

### Gems and semi-precious stones




-  Jade

### Miscellaneous









-  Clay
-  Tailings

## Geology





### Post accretionary assemblages

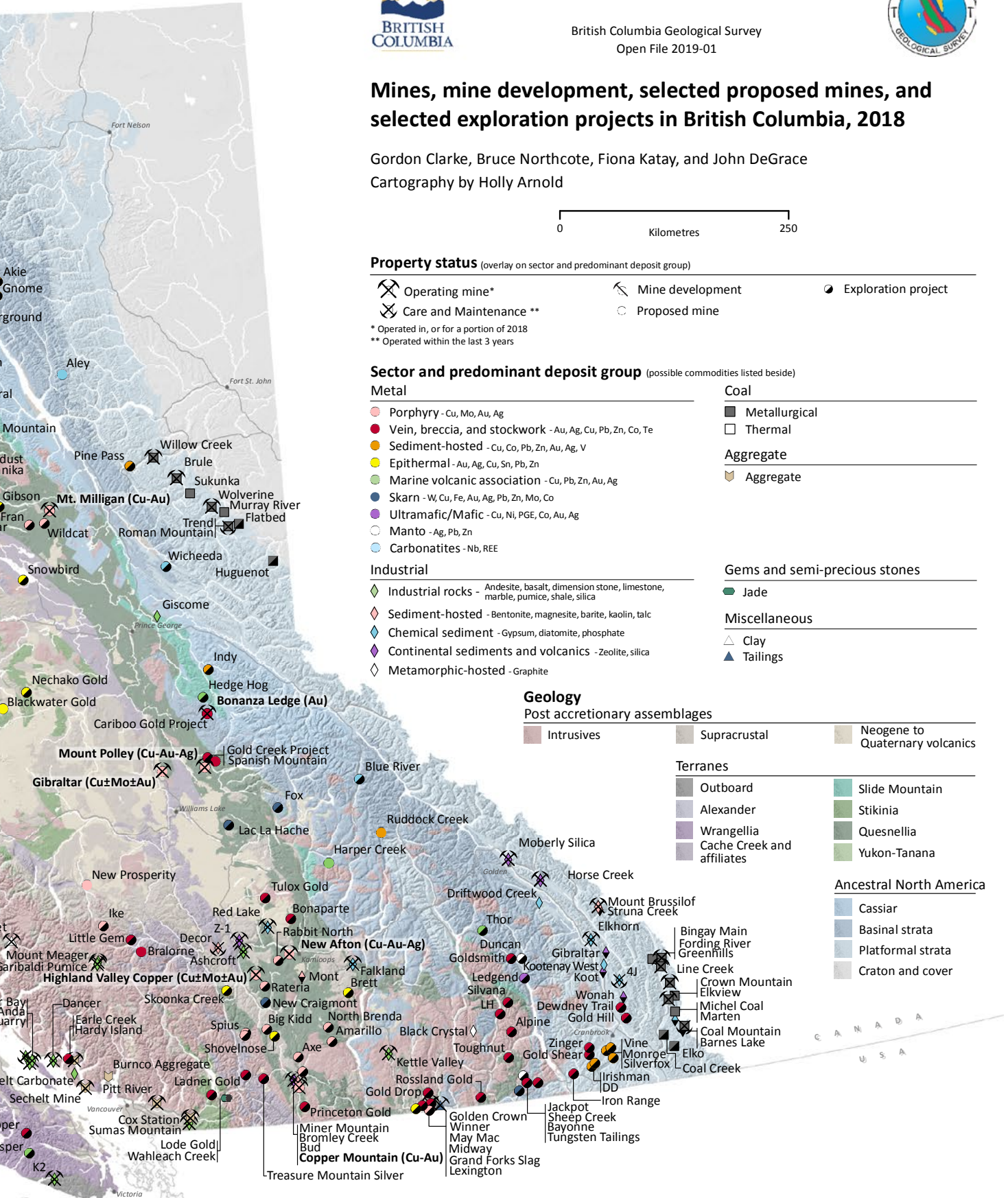
-  Intrusives
-  Supracrustal
-  Neogene to Quaternary volcanics

### Terranes

-  Outboard
-  Alexander
-  Wrangellia
-  Cache Creek and affiliates
-  Slide Mountain
-  Stikinia
-  Quesnellia
-  Yukon-Tanana

### Ancestral North America

-  Cassiar
-  Basinal strata
-  Platform strata
-  Craton and cover



&lt;&lt;50

million in 2016. About C\$37 million of that increase was in gold exploration, an interesting statistic considering the province's strength in copper resources. One of the gold-focused juniors to have continued extensive exploration is Aben Resources, which drilled 45 holes between 2017 and 2018 at its flagship Forrest Kerr property. Jim Pettit, president and CEO, elaborated on Aben's exploration results: "The first hole of 2018 blew the market away: we ended up with four separate distinct high-grade zones from our first hole alone. We hit 10 m of 38 g/mt and, within that, we had a section of 6 m of 62 g/mt, which was spectacular."

### Boom times on the horizon for Yukon mining

In November 2018, the Conference Board of Canada released a territorial outlook economic forecast that points to Yukon as having the fastest growing economy in Canada in the next few years, anchored by three new mines moving into production: Western Copper and Gold's Casino project in 2025, Goldcorp's Coffee project




in 2021 and Victoria Gold's Eagle mine, which expects its first gold pour in September 2019.

The Eagle mine will be the largest gold mine in Yukon history and, to tackle the impending HR challenge, Victoria Gold has developed a program to retain talent in collaboration with the government's apprenticeship programs: "There are many Yukoners who have left to work in other provinces because they could not find a job locally. We are starting a campaign to attract and recruit Yukoners across Canada, which will give them an opportunity to come back home to work," revealed John McConnell, Victoria Gold's director, president and CEO.

Western Copper and Gold's Casino project is currently in the permitting phase, but when in operation will initially produce over 100,000 mt/y of copper and 400,000 oz/y of gold, with an internal rate of return (IRR) of over 20%, and a net present value (NPV) of close to C\$2 billion at today's commodity prices, according to Paul West-Sells, Western's president and CEO. "The Casino project's revenue distribution will be approximately 50% from copper, 40% from gold and 10% from molybdenum. Finding such a large amount of gold in a single deposit, approximately 18 million oz including the reserve and inferred resource, is quite rare," he added. Shawn Ryan received PDAC's Prospector of the Year award in 2010 and appeared on the cover of the New York Times Magazine in May 2011, dubbed "the king of a new Yukon gold rush" after his prospecting led to the discovery of Goldcorp's Coffee project. Now serving as White Gold's CTO, Ryan is bullish about the district-scale potential of White Gold's 439,000 hectare land package: "[In 2018] our proprietary exploration strategy produced four brand new gold discoveries – Vertigo with 23.44 g/mt gold over 24.38 m, Ryan's Showing with 20.64 g/mt gold over 6.09 m, GS West with 2.97 g/mt gold over 10.0 m and Betty with 1.08 g/mt gold over 50.29 m."

White Gold's CEO, David D'Onofrio, went on to outline how the company's flagship Golden Saddle deposit had expanded in the last two years: "In 2017, we added approximately 300,000 oz to the existing 1 million oz, and in 2018 another 200,000 oz were added to the resource," he said.





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Cathy Wood, co-founder of RyanWood Exploration, whose deep soil sampling techniques led to both the White Golden Saddle discovery and the Coffee gold project in the Yukon White Gold District, co-founded GroundTruth Exploration in 2010. Today, GroundTruth offers a “drone to drill” service that includes soil sampling, drone surveying, IP and resistivity surveying, probing and drilling. The Yukon-based company’s expertise lies in identifying targets, bringing them up to a level that a junior mining company can work with or that might interest a major. “At the core of our values is a firm belief that we have the capability to transform how exploration technology evolves to be more successful at finding deposits while at the same time reducing the impact necessary,” stated Wood.

Copper tumbled into a bear market in the second half of 2018, as the U.S.-China trade dispute, a strong U.S. dollar, and increased supply from Chile and Peru saw the price of the base metal fall from US\$3.30/lb in June to US\$2.60 in December. However, the medium to long-term outlook for copper is more promising, with BHP Billiton estimating that the build-out of the electric car market will add 5% to global copper demand, requiring US\$25 billion in new copper supply investment. Doug Ramsey, president and CEO of Copper North Mining, has focused on transforming Copper North’s flagship Carmacks project in the Yukon to make it economically attractive regardless of the commodity cycle: “We have reengineered our metallurgical process, specifically bringing the precious metals within the Carmacks resource into the economic model,” he explained, continuing: “This decreases the cash cost of copper production from C\$1.67/lb as a copper-only heap leach project to C\$1.08/lb as a copper-gold-silver project after precious metal credits.”


Another Vancouver-based junior active in the Yukon is Alexco Resources. The company is currently focusing on the expansion of its Bermingham silver deposit at Keno Hill, which has increased reserves significantly to over 40 million oz of silver, according to Clynton Nauman, Alexco’s chairman and CEO. Alexco aims to begin production towards the end of 2019, market conditions considered, and Nauman praised the mining-friendly environment

in the Yukon. The company has benefitted from the final and self-government agreements held by 11 of the 14 First Nations in the territory: “This context gives insurance that there is jurisdictional safety and that companies can move their projects from exploration to production,” he said.

This sentiment was echoed by Brandon Macdonald, CEO and director of Fireweed Zinc, one of the new players to enter the Yukon junior community: “A key benefit of working in Yukon is that the mining community has the attention of senior members of the government and the Council of Yukon First Nations,” stated Macdonald.


Fireweed Zinc was created in 2016 following the signing of an agreement with Hudbay Minerals to acquire the Tom and Jason projects. Since Fireweed’s IPO in mid-2017, the company raised an additional C\$12.5 million and grew the project size from 55 square km to 540 square km through deals with Newmont and Teck.

Scott Sheldon, director and CEO of Go Cobalt Mining, cited the Yukon Mineral Exploration Program (YMEP) as a key factor in the company’s success in the territory. “Part of the incentive is based on



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**TSX-V: COL**



## John McConnell

Director, President and CEO  
**VICTORIA GOLD CORP**

“

Considering we are operating in Canada's North, we are very well connected. The Eagle Gold project is about 50 km from a paved highway, and we have built an all-weather road to the site, which means we have year-round road access.

”

### ■ Could you describe the latest milestones achieved by Victoria Gold Corp?

Victoria Gold Corp conducted a C\$12.5 million exploration program in 2017 to look at all identified targets on the Dublin Gulch property. In 2018, we have followed up on three of those targets with a smaller exploration program. In terms of work on the Eagle Gold project, we completed a C\$30 million program last fall, on earthworks, expanding the camp, upgrading roads and all pre-construction work to minimize any construction risks. At the moment, we are about 50% through construction and aim to complete the build by mid-2019. The mine will produce approximately 200,000 oz/y of gold starting in 2020, operating year-round at an all-in sustaining cost (AISC), including financing, of less than C\$750/oz. The Eagle Gold mine will be the largest gold mine in Yukon's history, and the company is set to be cash-flowing C\$100 million per year.

### What is the capital cost for the Eagle Gold mine and how are you financing the project moving forward?

The capital cost is C\$440 million. Back in 2017, we spent most of the C\$40 million that we had in treasury by Q4. However, in April 2018 we signed a construction financing package for just over C\$500 million in aggregate with Orion Mine Finance, Osisko Gold Royalties and Caterpillar Financial Services. This means that we are funded through development and into commercial production. The reason we raised more money was to have additional working capital, finance the sustaining capital and pay for the costs of financing, including legal fees. We received C\$87.2 million of the financing package in September 2018 from funding partners.

### How well positioned is the project in terms of infrastructure?

Considering we are operating in Canada's North, we are very well connected. The Eagle Gold project is about 50 km from a paved highway, and we have built an all-weather road to the site, which means we have year-round road access. We are currently building a power line from site that will tie into Yukon Energy's power grid, accessing hydroelectric power at a reasonable cost. The community of Mayo is about 85 km to the south and holds a full-service airport with five flights a week from Whitehorse.

### Which are the greatest challenges and ad-

### vantages of operating in the Yukon?

Mother Nature always affects projects, and we have always assumed lower productivity during the cold weather. The flip side is that we have daylight 24/7 during the summer months, so productivity rises considerably. In terms of financing, the Yukon has the same federal program for flow-through financing, however certain provinces have an add-on to this, which British Columbia, Ontario and Québec have. The Yukon has a very small tax base with only 37,000 people in the whole territory, which does not provide the territorial government the same opportunities as more densely populated provinces. However, the Yukon does have the advantage of the lowest corporate tax rates in Canada.

### Have you been able to source all your skilled labor needs within the Yukon?

Although we have had to turn to other provinces, we have far exceeded our expectations of hiring from within the Yukon, including from local First Nations communities. Trades people with large-scale industrial experience are particularly challenging to find across the country, and the Yukon has apprenticeship programs supported by government. There are many Yukoners who have left to work in other provinces because they could not find a job locally. We are starting a campaign to attract and recruit Yukoners across Canada and give them an opportunity to come back home to work.

### Could you describe the 'Every Student Every Day' program and in what way Victoria Gold is involved in mining education within the Yukon?

'Every Student Every Day' is a charity we run to raise awareness and funds to support increasing student attendance in schools throughout the Yukon. Guided by the volunteer, not-for-profit Victoria Gold Yukon Student Encouragement Society, which was created in Q4 2012, we have raised over C\$300,000 to aid over 70 projects across the Yukon, from Whitehorse to Mayo and Watson Lake to Old Crow. This initiative was created because most students, on average, miss a full year of school between grades one through six, and two years between grades eight to twelve due to absences. It is our target to change this and encourage improved school attendance in order to keep the minds of tomorrow in the classroom and help them succeed. ■



## Paul West-Sells

President & CEO

**WESTERN COPPER AND GOLD**

“

Copper mines have simply not been built since the price of copper peaked in 2011, and there is a need to bring more online. Based on data by Wood Mackenzie, we are going to need about 5 million more mt of copper over the next decade.

”

**Western Copper and Gold's flagship is the Casino project in the Yukon. Could you describe the project's progress in terms of permitting and development?**

Western Copper and Gold listed in 2006 and subsequently acquired Lumina resources, where we took possession of the Casino project. We have over a decade of development experience on Casino, having taken it from exploration to a feasibility study and permitting. The latter has taken about three years now. In the last 18 months, we worked hard alongside First Nations representatives, the territorial government and the regulators to find the best strategy to deal with tailings and mine waste. It took a long time, with many daylong meetings with the group, but we have finally reached a consensus in order to move forward. Making sure we are using the best technology and have the safest facilities is paramount to ensuring the successful development and permitting of the project.

**We have consistently heard that permitting projects across the country can be a lengthy process. How does the Yukon compare to other provinces in this area?**

The permitting process in the Yukon is very similar to the rest of Canada. The frustration lies in that the goal posts keep moving further away from what proponents need to attain in order to get a project permitted. 10 years ago it would not have taken as long as it has taken us now. I do not think that by increasing permitting times we are necessarily attaining safer designs, and this must be discussed. When I look at British Columbia and other jurisdictions in Canada, they are not too different from the Yukon. Do I wish it was shorter? Absolutely.

**Could you describe the Casino project's geology and future potential?**

This is a very large copper/gold project producing initially over 100,000 mt/y copper and 400,000 oz/y gold, with an internal rate of return (IRR) of over 20%, and a net present value (NPV) of close to C\$2 billion at today's commodity prices. When in operation, the Casino project's revenue distribution will be approximate-

ly 50% from copper, 40% from gold and 10% from molybdenum. Finding such a large amount of gold in a single deposit, approximately 18 million oz including the reserve and inferred resource, is quite rare. The project has 4.5 billion mt of copper in reserve, with a 22 year mine life. The inferred resource brings the life of mine up to 55 years, and there is more that is yet unidentified.

In terms of going forward, we will continue to de-risk and are looking to bring in a partner that can take the project to the next level.

**Casino is positioned North West of Whitehorse. Could you describe the project's connectivity in terms of roads and power?**

The Yukon has a strong network of paved highway. Our project is located about 200 km from this network, and we therefore need to build a road. About a year ago there was a Yukon infrastructure announcement made by Canadian Prime Minister Justin Trudeau consisting of three roads. One of them is the road to the project. If we take the 200 km and divide it roughly in half, the first segment will be 100% funded by the government, servicing both our project and other mining areas. The second half will be funded 30% by the government and the rest by Western Copper and Gold.

**You mentioned at the Denver Gold Forum that junior-owned copper projects globally are very few. How does this impact the commodity's outlook?**

Copper mines have simply not been built since the price of copper peaked in 2011, and there is a need to bring more online. Based on data by Wood Mackenzie, we are going to need about 5 million more mt of copper over the next decade, and this study does not take into account the increased demand due to electrification. The market for majors looking to take a project into production is very, very small. There are about 13 junior-owned advanced copper projects listed on the TSX and TSX-V globally, with a few more in the Australian market. There is a real dearth of copper projects out there, placing Casino in a strong position. ■

# Shawn Ryan & David D'Onofrio

SR: CTO

DD: CEO

WHITE GOLD CORP.



SR



DD

“

Combining our more than 1 million acres of claims with our regional exploration methodology, we are primed for the continued generation of new discoveries to build our existing resource base.

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## What have been the recent major developments with White Gold?

SR: 2018 was a very successful year for White Gold, bringing us multiple high-grade discoveries, expanding our land position and adding a new deposit to our portfolio. Our proprietary exploration strategy produced four brand new gold discoveries – Vertigo with 23.44 g/mt gold over 24.38 m, Ryan’s Showing with 20.64 g/mt gold over 6.09 m, GS West with 2.97 g/mt gold over 10.0 m and Betty with 1.08 g/mt gold over 50.29 m. We also continue to have a strong exploration pipeline of regional targets across our significant land package. Combining our more than 1 million acres of claims with our regional exploration methodology, we are primed for the continued generation of new discoveries to build our existing resource base.

DD: Our flagship Golden Saddle deposit has had some significant updates since 2017 as well. Originally discovered by Underworld Resources and acquired by Kinross in 2010 for C\$140 million, Kinross proceeded to give the Golden Saddle deposit to White Gold, while still retaining equity in the project. This put the project back into the hands of the people who discovered it and had been working on it for over 15 years, including our VP of Exploration, Jodie Gibson, who oversaw the original drilling as part of Underworld. In 2017, we added approximately 300,000 oz to the existing 1 million oz, and in 2018 another 200,000 oz were added to the resource.

## In January 2019 a new discovery was announced at White Gold’s Betty property. Can you elaborate on its significance?

SR: Out of all the early stage exploration projects that White Gold has, the Betty property was a favorite for many. The Betty property is contiguous to the Coffee project owned by Goldcorp and is located along the eastern extension of the Coffee Creek fault. In 2018, White Gold started drilling activities on the property, which led to the discovery of near surface gold mineralization. One of the intercept highlights is 50.29 m of gold mineralization at 1.08 g/mt, which is just a great example of what we have there.

## What were the reasons behind White Gold’s acquisition of the QV Gold project from Comstock Metals in early 2019?

DD: We knew this acquisition was a great fit for us as the QV property has undergone extremely limited exploration work to date, and its targets share many similarities with our current assets, including our Golden Saddle deposit and Vertigo discovery. The QV Gold project covers approximately 16,000 hectares in the White Gold District, which brings our total holdings in the region to over 439,000 hectares, or over 1 million acres.

SR: The QV Gold project is also contiguous to our White property which hosts our flagship Golden Saddle and Arc deposits, and is located 20 km southwest of the Vertigo discovery on our JP Ross property, and 44 km northwest of Goldcorp’s Coffee project, so the property is very strategically located. The project is just another strategic and attractive complement to White Gold’s large portfolio of high-quality assets in the district.

## What is White Gold’s vision and strategy moving forward?

DD: White Gold is currently in the process of finalizing its budget and focus for 2019. At this stage our efforts will continue to be earlier stage regional exploration, advanced exploration at our White property and phase two exploration at the Vertigo deposit.

## Do you have a final message for the readers of *Global Business Reports*?

DD: White Gold owns a huge part of a relatively unexplored district, which we believe holds significant potential. We have identified ounces in the ground, produced multiple high-grade discoveries and have a world-class team that has been highly successful in the district. We are also operating in a very friendly mining jurisdiction, which only adds to the attractiveness of our projects.

SR: The mining infrastructure already set up in the region is very beneficial for White Gold and the company’s vision to move forward. This is a long-term district scale project of enormous potential – a unique opportunity at an early stage that is set to continue to grow significantly. 2018 was a very successful year, and we are very excited to continue to build upon this success. ■



## Doug Ramsey

President & CEO  
**COPPER NORTH MINING**

“

By producing cathode copper rather than a concentrate, our greenhouse gas footprint is a good deal lower than it would be for a comparable sulfide project that is producing a concentrate that needs to be shipped to smelters.

”

### Can you provide an overview of Copper North Mining's main developments since 2017?

Over the last 18 months, Copper North Mining's focus has turned to the transformation of the flagship Carmacks copper-silver project. It is currently at the development stage and is potentially a near-term production project. We have reengineered our metallurgical process, specifically bringing in the precious metals within the Carmacks resource into the economic model. A number of advantages have come from that, which we saw from our 2016 PEA – namely a 12% increase in the capital cost for the project will see an increase in the net revenue by 30%.

### How has the addition of precious metals to the Carmacks property made it a more competitive project economically?

Because we have precious metals, which are still a byproduct, this decreases the cash cost of copper production from C\$1.67/lb as a copper-only heap leach project to C\$1.08/lb as a copper-gold-silver project after precious metal credits. This pushes the project down into the lower decile of the cost curve for projects that are coming on-line in the next five years. At C\$1.08, even when factoring in engineering and closure, it is only a C\$1.16/lb. Even with today's prices in a bear market, Carmacks could function profitably, which is very attractive. The process engineering part of the picture is still at the PEA level, and the rest of the project is at feasibility engineering level. The next step is to move the process engineering to the feasibility level as well.

### What environmental initiatives has Copper North Mining introduced at Carmacks?

There is a strong environmental sustainability focus for the project – it is something that none of us can ignore any longer. By being able to produce cathode copper rather than a concentrate, our greenhouse gas footprint is a good deal lower than it would be for a comparable sulfide project that is producing a concentrate that needs to be shipped to smelters. We leach with sulfuric acid but produce on site, which reduces cost by about 65% compared to shipping it in from elsewhere. This provides waste heat from the process used to heat copper

leach tanks rather than to use electricity or burn fossil fuels, and also reduces the amount of time it takes to leach copper from 16 to four hours.

### What kind of mine do you envision for Carmacks and is there potential for the resource to grow?

It will initially be open pit, with the shallow oxide resources in the top 300 m. It is close to surface so that even in the pre-stripping period we will be stockpiling ore. Copper North Mining's exploration since the 2016 PEA has expanded the resource by about 35%, from a potential seven-year mine life to nine and a half years. The exploration process also identified a sulfide resource that sits below the oxide and is at least the same size as the oxide resource – 16 million mt. To define the full extent of the sulfide deposit, drilling must be performed to delineate it.

### How do you view the current market dynamics of copper and its fundamentals moving forward?

In June 2018 copper prices exceeded US\$3.20/lb. Then, with the imposition of tariffs by the United States on China, the copper price dove to the US\$2.60 to US\$2.75 range and has stayed there. My sense is that we will not see a material change in the copper price in the short term, until China announces that its rate of growth has not dropped as much as they feared it would or until the removal of the tariffs. A trade agreement between the United States and China would likely cause a response in the copper price.

### Do you have a final message for the readers of *Global Business Reports*?

Copper North Mining is significantly undervalued at the moment, and this presents an attractive investment opportunity. Yukon is a very stable and predictable jurisdiction with a settled land claims situation and First Nations support. We are a green energy metal producer with an environmental sustainability focus, which is of increasing importance to the global market. Copper North Mining intends to position itself at the forefront of the green energy movement, and this environmental connection adds great value to the project for both end users and shareholders. ■



## Clynton Nauman

Chairman and CEO  
**ALEXCO RESOURCES**

### What are the production estimates for the Keno Hill mines and is there existing infrastructure in the region?

There are four mines in the district of which we hope to have at least two operating simultaneously, with a production estimate of approximately 400 mt/d. In 2018, the company did a significant amount of underground work in anticipation of taking its deposits into production, and we completed approximately 1,000 m of underground development at both the Flame and Moth and Birmingham deposits. All of the underground infrastructure that is currently in place is within easy striking distance from the ore deposits themselves.

### Alexco aims to establish production towards the end of 2019, market conditions considered. Can you elaborate on these conditions?

The price of silver is not Alexco's only driver, as there are two other important factors to consider. One of these factors is the exchange rate. Ironically, a weaker domestic currency is a benefit for a commodity producer that sells in US dollars. Another consideration will be the actual global demand for whatever metal that is being produced. There is currently a significant demand due to lack of supply from lead mines. Smelters around the world are anxious to get their hands on precious metal-rich lead concentrates. Alexco will be producing a lead concentrate that has approximately 16,000 g/mt silver, which will be unique in the global marketplace.

### Can you provide insight into the Alexco Environmental Group (AEG)?

Separately from Alexco's mining company, we established a firm focused on environmental consulting and remediation. The group is involved in environmental management, baseline environmental studies and regulatory work. Today, the group consists of 90 professionals with seven offices spread across Canada and the United States. Revenue from this business has grown from C\$1 million per year to approximately C\$20 million per year today. AEG was the firm responsible for the cleanup of the Animas River in Colorado after the EPA incident in 2015, and we are still operating the plant today. ■



## Brandon Macdonald

CEO & Director  
**FIREWEED ZINC**

### What are the grades and potential size of the current resource at the company's Tom and Jason projects?

The research published in early 2018 showed 11.2 million mt at 9.6% zinc equivalent plus an inferred resource of 39.5 million mt at 10% zinc equivalent, consisting of 60% zinc, 30% lead and 10% silver. Our drilling has found high-grade resources on average, largely due to its design. Low-grade tonnes will be drilled off the project, and we will focus on adding tonnes that are economically meaningful.

### How do you view the Yukon as a mining jurisdiction?

A key benefit of working in Yukon is that the mining community has the attention of senior members of the government and the Council of Yukon First Nations. Furthermore, all the juniors within the mining industry work together in unity. This focus and effort makes a significant difference in relations with the government, First Nations and the broader community. Yukon has incredible geological potential that has been inadequately explored, which presents a great opportunity.

### What is driving the demand for zinc and how do you see this dynamic evolving?

The bulk of zinc is used for galvanization of steel, which is used in infrastructure and for automobiles. The persistent trade tensions between the United States and China negatively impacted the price of zinc, however the fact remains that zinc demand is growing whereas supply has stayed consistent. In the short term, 2019 might produce a second peak in zinc prices. In the medium to long term, zinc will remain a bull case like many base metals because there has been an inadequate investment in discovery.

Any broad infrastructural refresh will create a strong demand for zinc, and zinc has fertilizer use in China and other countries where there is insufficient zinc in the food. Disruptive technologies such as zinc-air batteries for energy storage may also create a substantial increase in demand. ■



CW



IF

## Cathy Wood & Isaac Fage

CW: Owner

IF: Operations Manager

**GROUNDTRUTH  
EXPLORATION**


## Matt Turner

President, CEO &amp; Director

**ROCKHAVEN RESOURCES**

### Can you elaborate on the range of services GroundTruth offers?

CW: GroundTruth's service focus has been to identify targets, bring them up to a level that a junior mining company can work with or bring the target up to a level that would interest majors. We offer a 'drone to drill' service that includes soil sampling, drone surveying, IP and resistivity surveying, probing and drilling. GroundTruth's innovative approach is cost effective and has a low impact footprint with high impact results.

### How does GroundTruth utilize UAV drones in its integrated data approach?

IF: Our aerial drone surveys provide high-resolution project scale imagery and digital models at a resolution and cost that was previously unobtainable. The drone technology allows for effective and efficient exploration planning and data analysis.

### What steps does GroundTruth take to minimize its environmental footprint?

CW: At the core of our values is a firm belief that we have the capability to transform how exploration technology evolves to be more successful at finding deposits while at the same time reducing the impact necessary. We provide frozen meals at the sites to minimize waste, for example, and use rubber track machinery that moves over the ground with less impact.

### What are GroundTruth Exploration's principal objectives for the next 18 months?

CW: GroundTruth is expanding its presence into the United States, particularly north of the Yukon into Alaska. With regard to expansion, we want to ensure that we do not lose sight of what we actually are and that the focus will always remain on quality. The method that we use increases the probability for success, and we are excited for the journey moving forward.

IF: GroundTruth consists of a team of agile and adaptable people, and we are open to the opportunities that come our way. We are the right team for the job, with emphasis on integrity and commitment to success. ■

### Can you outline Rockhaven's major milestones over the past few years?

In 2009 Rockhaven acquired the Klaza property in the Dawson Range Gold Belt in the Yukon. Today, we have 434 drill holes and are approaching 100,000 m drilled. The most recent update is from June 2018, with an impressive resource estimate of about 4.5 million mt grading 4.8 g/mt gold and 98 g/mt silver for 686,000 oz of gold and 14 million oz of silver in the indicated category. There is also 5.7 million mt in the inferred category grading 2.8 g/mt gold and 76 g/mt silver for 507,000 oz of gold and 13.9 million oz silver.

### What are the next steps that will be taken to advance development at Klaza?

Klaza hosts the best of both worlds for an advanced exploration project. There is still lot of exploration potential, and there are many untested or only weakly-tested zones on the property that have similar soil geochemical and geophysical signatures as the resource areas. On the other hand, we feel that we are past the minimum threshold, and a case could be made that we should advance into the pre-feasibility or feasibility stage. In a challenging market to raise money, the project could go either way, and I believe that the path will be determined by what happens next in terms of where and when our next strategic round of capital comes from.

### How is Rockhaven's relationship with the First Nations in the region where you operate?

Rockhaven has an exploration benefits agreement (EBA) with the Little Salmon Carmacks First Nation. The project is situated within their traditional territory. We have always had a really positive relationship with them because we began engaging before exploring the project in 2010. Rockhaven has focused on hiring local, and from year to year the average has been around 50%. We also contribute through sponsorship programs to sports and community events. ■

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hiring locally, working with people from the Yukon and creating a dialogue with the First Nation. In fact, we were the first company to sign a First Nations agreement on the Class 1 exploration license,” explained Sheldon.

### District-scale opportunities in the Northwest Territories and Nunavut

Canada’s three federal territories sit to the north of its 10 provinces and are much less inhabited than their southerly neighbors, each with populations below 50,000. Due to their remote location, they also have underexplored mineral potential, with short exploration seasons and expensive logistics limiting historical resource development. However, favorable geology and the availability of substantial land claims are increasingly attracting the attention of a mining community in need of district-scale discoveries.



Northwest Territories (NWT) is home to TerraX Minerals’ flagship Yellowknife City Gold project, a 783 square km property located on the Yellowknife Greenstone Belt, covering 67 km of strike length on the southern and northern extensions of the shear system, which hosted the prolific high-grade Con and Giant gold mines. Working in collaboration with the Geological Survey of the NWT and the Giant Mine Remediation project, TerraX managed to recover 16,000 m of historical drill core. After sorting through and recovering the material, TerraX identified that the core came from holes that were drilled on three of its four targets that had been identified for expanding the deposit. “To find 16,000 m of core in a market where capital raising is difficult is an extraordinary advantage,” stated David Suda, TerraX Minerals’ president and CEO. “This enables us to advance our project at very low cost,” he added. Regarding the financial viability of a project in the NWT, Suda pointed to the proximity of TerraX Minerals’ project, within 10 km of the city of Yellowknife, being close to infrastructure such as all-season road access, air transportation, service providers, hydroelectric power and a skilled workforce. “TerraX Minerals is in position to potentially find Canada’s next Giant mine,” he announced.

To the west of NWT sits Nunavut, the current focus of Blue Star Gold, which rebranded from WPC Resources in January 2019. The name Blue Star is taken from the official flag of Nunavut, representing the company’s dedication and focus on Canada’s North. Through its subsidiary, Inukshuk Exploration, Blue Star owns the 8,015 hectare Hood River gold property located contiguous to the Ulu mining lease. Blue Star also has an option for the right to acquire the entire Ulu property, subject to the approval of the Kitikmeot Inuit Association (KIA).

Stephen Wilkinson, Blue Star’s president, CEO and director, elaborated on the resource potential he sees for the project: “The Ulu deposit has a resource of 600,000 oz measured and indicated, and 250,000 oz inferred at a grade of 7.8 g/mt, down to a depth of 400 m,” he said, concluding: “Our aim is to increase this resource to a minimum of 2 million oz within the Ulu property and Hood River.” ■





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## David Suda

President & CEO  
**TERRAX MINERALS**

“

As a junior company, the strength of the asset must be matched by the strength of your shareholders, and TerraX Minerals has the support of high quality, strong-handed and long-term investors that have a long history in the mining industry.

”

### **The Yellowknife City Gold project is TerraX Minerals' flagship asset. What potential do you see in the project moving forward?**

The Yellowknife City Gold project holds huge potential and would be a meaningful project for any mid-tier or major company. The 783 square km property lies on the Yellowknife Greenstone Belt and covers 67 km of strike length on the southern and northern extensions of the shear system, which hosted the prolific high-grade Con and Giant gold mines. The ground is highly prospective, and there has been significant work sampling and drilling ground outcrop over the last five years. Numerous gold showings and high-grade drill results indicate the project's potential as a world-class gold district. Being within 10 km of the city of Yellowknife, the project is close to vital infrastructure such as all-season road access, air transportation, service providers, hydroelectric power and a skilled workforce.

### **TerraX Minerals managed to recover 16,000 m of historical drill core in collaboration with the Geological Survey of the NWT and The Giant Mine Remediation project. What is the significance of this finding?**

As part of their cleanup work at Giant, they were going to remove the core facility at the mine site, and we were asked to help move some of this core to store it for historical purposes. There was also an indication that some of this core was from ground that we had acquired over time. After painstaking work to sort through and recover the material, we were able to identify that 16,000 m of the core actually came from holes that were drilled on three of our four targets that we identified for expanding the deposit on our properties. To find 16,000 m of core in a market where capital raising is difficult is an extraordinary advantage. It will allow TerraX Minerals to give the market results that are technically significant to our understanding of the gold structures at a time when the market did not expect any news from us. This enables us to advance our project at very low cost.

### **How has TerraX Minerals been able to maintain a robust market cap in challenging conditions for the junior mining community?**

TerraX Minerals announced its targeting in early 2019, which is something that the market was looking for. As a junior company, the strength of the asset must be matched by the strength of your shareholders, and TerraX Minerals has the support of high quality, strong-handed and long-term investors that have a long history in the mining industry.

We are confident that the quality of our asset speaks for itself and that the work the team has done to-date validates this. The team is firing on all cylinders and has the ability to generate market awareness, raise funds and of course to execute the new plan on the ground.

### **What are TerraX Minerals' key objectives for the next 18 months?**

By 2020, TerraX Minerals would like to come to market with a surprising discovery of a cohesive major gold deposit. Our goal for the Yellowknife City Gold asset is to bring an estimate to market that will put us at the front of the pack. People should look to TerraX Minerals as we are at a point in the market where the share price is grossly undervalued, and we have recently repositioned ourselves to bring value to shareholders with clear targets, historical core and a focused plan. We believe that the company will be a standout performer in the market in the very near future.

### **Do you have a final message for the readers of *Global Business Reports*?**

With the Yellowknife City Gold project, TerraX Minerals is in position to find Canada's next Giant mine. Not only do we have four high priority targets where we plan to drill, we also have a huge piece of ground that provides blue-sky targets. It is a perfect package, and after extensive targeting work, we have a clear path for the foreseeable future. This puts us in a very interesting spot as the M&A space is heating up. ■





# The Future of Mining

“We work in knowledge-intensive industries where there are shortages of professionals. At the same time, we are inundated with data. The only solution to thrive in this environment is to manage knowledge assets and commit knowledge to computers to augment how humans carry out their tasks.”

- Clinton Smyth,  
CEO,  
Minerva Intelligence

# The Future of Mining

## Innovative solutions transforming a traditional industry

Low commodity prices, a lack of new mining operations and a dearth of market capital has forced producers to focus on improving productivity by increasing mine life on existing assets, while compelling juniors to dilute their share structures just to stay afloat. Neither of these solutions is sustainable, and significant improvements in performance require the industry to put down its pickaxes and think outside the box.

British Columbia's tech sector generates around C\$15 billion in GDP, the equivalent of 7% of its economy and, while mining currently represents a fraction of this, one of the province's oldest industries is also ripe for the development and implementation of

new technologies that can leverage the global reach of its companies to export to jurisdictions worldwide.

One of the companies leading the charge in the march towards modern mining is Minerva Intelligence, which provides artificial intelligence (AI) software and services to reduce costs and improve success rates in mineral exploration. At PDAC 2019, Minerva launched MinSem – short for Mineral Semantics – a software-as-a-service (SaaS) application that helps companies interoperate their knowledge assets across their mineral exploration, metallurgical and environmental protection activities.

Emphasizing the importance of combining machine intelligence with human intelligence, Clinton Smyth, Minerva's CEO, stated: "We work in a knowledge-intensive industry where there are shortages of professionals. At the same time, we are inundated with data. The only solution to thriving in this environment is to manage knowledge assets and commit knowledge to computers to augment how humans carry out their tasks."

Another company that has implemented AI into their product offering is Motion Metrics, headquartered in the heart of the University of British Columbia (UBC), with their most recent release being BeltMetrics, which uses stereo-imaging and deep learning algorithms to analyze rock fragmentation on mining conveyor belts. "Now mines can continuously measure rock size distribution in real-time along the entire mine-to-mill comminution circuit," explained Shahram Tafazoli, president and CEO.

The implementation and adoption of digital solutions into operating mines was the topic of discussion at an industry-led panel hosted by Maestro Digital Mine on Monday, March 4th, at PDAC 2019. If "data is the gold of the future," as stated by Ethan Hull, CEO of TECHrep Global and formerly at Barrick Gold, then how do we fully attain its value? Being able to interpret the vast amounts of data available will not only require embracing technology but the human resources with the requisite skillset: "In the near future everyone in every department will need some kind of data scientist," added Michel Samovojski, technology coordinator at Goldcorp.

LlamaZOO, one of the finalists in Goldcorp's #DisruptMining 2018 competition, made the transition from the videogame industry to producing a software platform for representing a mine plan from exploration to reclamation using virtual reality (VR). Charles Lavigne, LlamaZOO's co-founder and CEO, noted how mining companies struggle to obtain and share information from numerous non-interoperable software packages across different organi-

**MINERVA INTELLIGENCE**

**AI within REASON**  
Knowledge engineering for the mining industry

The diagram illustrates the REASON framework, a cycle of four steps: DESCRIBE, REASON, EXPLAIN, and ADVISE. Each step is represented by a white pill-shaped button with a circular arrow icon and the word 'Semantics' written vertically on the left and right sides. The background is dark blue with a network of white lines and nodes.

Minerva develops and applies innovative AI solutions for exploration, mining and other earth science-focused industries. By integrating AI technology with human knowledge Minerva is able to engineer products that explain their results and significantly enhance the productivity of technical experts.  
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zational silos. He elaborated on how LlamaZOO's technology can help: "MineLife is disrupting the mine planning process by centralizing data into an interactive and visual VR experience and making that data accessible on-demand and remotely, from anywhere in the world."

### **Future metals players diversify and create cash flow from processing technology**

While players in the battery metals space have attracted substantial investment in recent years, the capex of constructing a new lithium mine, for instance, is so significant that a number of companies have instead decided to focus on the optimization of processing technology. Through R&D, some of these companies have had such success that they have made the transition from conventional mining to providers of technology that is being exported across the globe and generating cash flow.

MGX Minerals has a portfolio of mineral assets across North America, but since its establishment in 2012, has transitioned into a diversified clean energy and mining technology company. Using low capital expenditure costs and robust filtration systems, MGX aims to help the industry transition to a greener energy future through cleaner extraction processes and technology and invest in commodities that power batteries.

MGX is looking to partner with majors in Latin America through its rapid lithium extraction technology, which won the 2018 S&P Global Platts Metals Leadership Base and Specialty Metals award. "The government of Chile has announced that it will no longer allow for the solar evaporation of lithium. With a current 300 million gallons of water evaporation in the country, the government wants to see rapid extraction," said Jared Lazerson, president, CEO and director of the company. "We see these new policies as a potential niche for MGX Minerals," he continued.

MGX also intends to apply its lithium extraction technology to the shale market in the eastern United States. 76>>



**MGX**  
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MGX Minerals is leading the transition from fossil fuels to renewables through investments in battery commodities, extraction processes and clean technologies.

Petrolithium Extraction ● Wastewater Handling Solutions ● Zinc Air Battery

**CSE: XMG    OTC: MGXMF    FSE: 1MG    [www.mgxminerals.com](http://www.mgxminerals.com)**



## Clinton Smyth

CEO  
MINERVA INTELLIGENCE

### Can you elaborate on the vision behind Minerva Intelligence?

We wanted to represent geological knowledge within computers and use that knowledge to efficiently interpret very large data sets that were already within computers. In 2017, Minerva Intelligence acquired the AI software and intellectual property of Geo-reference Online. Today, Minerva pursues its vision by deploying AI applications for economic geology and geohazards mitigation.

### How does Minerva's software differ from a regular machine learning platform?

Our AI software is very different from machine learning software. It takes as inputs the products of human learning and then uses that knowledge to draw conclusions from large or complex data collections, some of which may include the output from machine learning, such as features recognized in a satellite image. It is essen-

tially a reasoning platform. Because we use reason to derive our conclusions and products, we are able to explain how we derived them. This is a critical advantage we have over machine learning systems that cannot explain how they reached their conclusions. From day one we realized that this approach was not only applicable to minerals exploration, but also to problem solving in areas such as metallurgy, environmental protection, landslide hazards, flooding and even medicine.

### How does Minerva's MinSem AI semantics platform help companies manage their knowledge assets?

MinSem – short for “Mineral Semantics” – is a software-as-a-service (SaaS) application that helps companies optimize their knowledge assets by enhancing their interoperability across mineral exploration, metallurgical and environmental protection activities – activities that share a lot of knowledge and terminology. This enhancement is achieved through semantic tools that facilitate the creation, cross-indexing and recovery of knowledge assets using standard terminology. MinSem tools provide a framework within which exploration and mining companies can implement a semantics-based knowledge management policy. Such policies make it easier for companies to integrate their activities into AI systems, including those provided by Minerva.

### Can you expand on the work Minerva has been doing to identify new mineral targets in the Yukon?

The Yukon Geological Survey publishes high-quality public domain data that includes thousands of samples, each analyzed for 53 elements, geological maps, mineral occurrence data, structural maps and terrain maps. This is a very large volume of data that is too much for an individual or a team of geologists to interpret efficiently. As a demonstration of Minerva's technology, we imported these multiple layers of data into our software and from them produced 55 target maps for 55 different

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Minerva Intelligence is at the forefront of representing human knowledge on computers, and then using that knowledge to solve problems efficiently.

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mineral deposit types in the Yukon. These interactive target maps are available on an open-access website for explorers to use. Users are able to ask the system to explain how targets were identified and prioritized and to request advice on how to further explore each target.

### What are Minerva's key objectives moving forward?

Minerva wishes to grow its value in two ways: firstly by expansion of our minerals industry consulting revenue arising from client use of our growing list of AI and AI-related software; and secondly by deploying our AI platform in diverse SaaS products, initially related to geohazards. SaaS applications are highly scalable and can be designed for governments – municipal, provincial or federal – corporations or members of the public. In practice, our consulting business has built, and continues to expand, the foundation upon which we build our SaaS applications.

### Do you have a final message for the readers of *Engineering & Mining Journal* and *Global Business Reports*?

We work in knowledge-intensive industries where there are shortages of professionals. At the same time, we are inundated with data. The only solution to thrive in this environment is to manage knowledge assets and commit knowledge to computers to augment how humans carry out their tasks. Minerva Intelligence is at the forefront of representing human knowledge on computers, and then using that knowledge to solve problems efficiently.

The investment community needs to have a careful look at the different kinds of AI. Minerva Intelligence's technologies, rather than being traditional machine learning platforms, are cognitive advisor systems. My advice would be that industries and investors should not put all their eggs in the basket of machine learning, but also pay attention to how human knowledge expressed on a machine can be used to improve their bottom line. ■



## Shahram Tafazoli

President and CEO  
**MOTION METRICS**

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If you provide real value to your clients, then mines cannot afford to not buy your products. Our company grew throughout the downturn because our solutions helped mines compete under those challenging economic conditions.

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### Can you provide an update on some highlights of Motion Metrics since we last met in early 2017?

There has been much to celebrate since we last met – the final numbers confirmed that Motion Metrics has exceeded 30% revenue growth for the third consecutive year! We have a record number of service and support agreements, and we recently opened a new office in Perth, Western Australia to accommodate client demand in this burgeoning region.

A focus on machine learning has accelerated our recent growth. Previously, I emphasized our intentions to bring AI to all our camera-based solutions. I’m happy to report that we have accomplished just that, and the result is a more flexible range of equipment monitoring solutions with improved accuracy. We have built our reputation on missing tooth detection, but today we are leaders in applied AI and machine vision solutions.

We also launched a new product, BeltMetrics™, this year that uses stereo imaging and deep learning algorithms to analyze rock fragmentation on mining conveyor belts. The release of BeltMetrics™ marks an important development in our fragmentation analysis product line – now, mines can continuously measure rock size distribution in real time along the entire mine-to-mill comminution circuit.

### How does Vancouver compete with regards to technology and innovation?

Our city is home to more than 800 miners and juniors and represents the world’s largest cluster of mining exploration companies. Vancouver also has a strong technology culture that has earned the city its reputation as the Silicon Valley of the North. Located on the University of British Columbia campus, we have access to some of Canada’s brightest computer science and mining minds. We have never felt limited by our location and are proud to be a British Columbian success story.

### Geographically, what is Motion Metrics’ strongest regional target?

In recent years, we have become a truly international company. Building on our early successes in North and South America, Motion Metrics now has customers across six continents and is currently looking to Australia for our next phase of growth.

### Can you describe how your strategy allowed the company to expand during the mining downturn?

If you provide real value to your clients, then mines cannot afford to not buy your products. Our company grew throughout the downturn because our solutions helped mines compete under those challenging economic conditions. Mines are especially interested in improving their margins when times are tough, and our solutions provide those improvements. For example, mines recoup the cost of our missing tooth detection system by avoiding a single crusher obstruction. Similarly, mines can offset the costs of our fragmentation analysis solutions by using our data to optimize their blast parameters and increase throughput.

### Last time we spoke, Motion Metrics had the notion to replace human employees with AI. Especially in terms of safety and security but also in terms of human jobs, has Motion Metrics encountered any objections?

No. Our solutions support human intelligence rather than replacing it. Our products occupy a middle ground between simple task automation and fully-fledged autonomy – we use AI to augment human abilities and simplify daily decision-making processes. Our solutions do not steal jobs – they make existing ones better.

Mine safety is one area where workers can really benefit from AI. Consider, for example, a crusher obstruction caused by a missing tooth. Clearing a crusher obstruction is extremely dangerous and unpredictable due to the tremendous amount of stored kinetic energy – each year, mine workers are killed during the removal process. Our missing tooth detection system uses AI to mitigate the risk of a crusher obstruction and thereby prevent these horrific accidents.

AI can also make jobs more interesting and less mundane. For example, our AI-based fragmentation analysis solution provides mine personnel with a wealth of data that used to be too time and labor intensive to gather. This system can provide accurate size distribution information in near real-time, and hours that would previously have been spent performing sieve analysis can be reallocated to data analytics. With AI, mine personnel can focus on optimizing blast parameters and maximizing throughput based on their fragmentation data, rather than sieving rocks. ■



## Michael Burns

CEO  
GLOBAL UAV TECHNOLOGIES

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Global UAV is positioning itself as a premier drone manufacturer and one of the largest drone service providers globally. We aim to replicate our services in as many industry verticals as possible, such as public safety, construction and agriculture.

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**Global UAV Technologies (Global UAV) acts as an umbrella company for several divisions. Could you describe the company's structure and focus?**

Global UAV provides technology solutions to the industry and develops in-house drone technologies. Approximately 80% of our revenue stems from the mining and exploration industry. We entered the mining sector as a consolidator able to accompany clients throughout their whole journey. We purchased innovative startup companies in the services, manufacturing and regulatory compliance sectors to build a vertically integrated drone solutions company. Today we have a manufacturing and engineering division that builds high-end commercial grade helicopter drones used for surveying and mapping. We also have a services division that is comprised of two companies – Pioneer Aerial Surveys and High Eye Aerial Imaging. The latter is predominantly focused on land surveying work, including high-resolution LiDAR surveys and change-detection on tailings impoundments.

**You developed the UAV-MAG™ through Pioneer Aerial. Could you describe this subsidiary's focus and what differentiates this product in the market?**

Pioneer Aerial is probably the leading drone service provider in the mining industry worldwide in terms of exploration and geophysics. In 2014, we developed a way to fly geophysics surveys using drones, which has since been very widely adopted amongst juniors and majors in the mining industry, including Rio Tinto, De Beers, Dundee and Anglo American. Our clients have all been very pleased with the results in terms of how the UAV-MAG™ technology increases safety in fieldwork, reduces costs and generates better data.

The Procyon 800E helicopter drone, built by NOVAerial Robotics, our engineering and manufacturing division, is targeted at the commercial level, and the product cost is approximately US\$65,000. The drone is built to lift very expensive high-end payloads of up to 3.5 Kg, such as a LiDAR sensor, which is worth approximately US\$300,000. We designed a purpose built product from the ground up, reducing the mechanical complexity to mitigate the risk of component failure. The drone is more efficient, reliable, safe and has longer flight times of up to 50 min with greater high-wind and low-temperature stability. We currently

have 12 production prototype Procyon 800E products in operation around the world and are in the process of transitioning to full-scale commercial production. We will be selling and leasing the product to customers in the near future.

**Are there any regional targets where the company would like to expand?**

Our presence and operations are widespread, with projects in Serbia, Bulgaria, Nigeria, Argentina, Brazil, the United States and Canada. There has been significant interest for our surveys in areas that do not have access to geological survey providers. For instance, South America is experiencing a huge challenge in terms of surveying, as the elevations are very high. These environments are too risky to fly with a manned helicopter, and surveying is physically impossible to do by foot. Drones are thus the only solution and we are able to fly surveys at approximately 15,000 feet of elevation. We are not only disrupting the existing survey methods, but we are also opening up an entirely new market that has never had a solution before to collect high resolution geophysical data in challenging areas year round.

**Can you elaborate on Global UAV's regulatory compliance services?**

Global UAV's regulatory services range from assisting smaller clients with obtaining flying licenses, to helping larger corporations establish internal drone programs. We assist with licensing, permitting, training, insurance and setting all approvals in place with Transport Canada to operate commercially. This division also is critical for Global UAV's ability to obtain beyond visual line of sight flight (BVLOS) permission in Canada and abroad for our survey operations.

**What is Global UAV's strategy to continue growing in the future?**

Global UAV is positioning itself as a premier drone manufacturer and one of the largest drone service providers globally. We aim to replicate our services in as many industry verticals as possible, such as public safety, construction and agriculture. We also provide services with regards to data processing, and our initial survey designs can ensure high quality data collection. Innovation is critical, and Global UAV can provide industries with unique solutions across the value chain. ■



## Charles Lavigne

CEO & Co-Founder  
LLAMAZOO

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The video game industry develops very large digital simulation environments, and our aim was to take this expertise of real time simulation and big data systems and apply them to real world scenarios.

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### How did you make the transition from video games to mining?

The transition to the mining industry was a serendipitous journey, but very fortuitous. After working in the video game industry for more than a decade, my co-founder and I decided to establish LlamaZOO. The video game industry develops very large digital simulation environments, and our aim was to take this expertise of real time simulation and big data systems and apply them to real world scenarios. Living in British Columbia gave us the opportunity to look into our own backyard and establish what the major industries in the province were. Since then, we have been very focused on the mining industry, which represents approximately 70% of LlamaZOO's portfolio, as well as other natural resource sectors such as forestry and oil and gas.

### Can you elaborate on the benefits of LlamaZOO's MineLife technology?

We have found that mining companies struggle to obtain and share information from numerous non-interoperable software packages across different organizational silos. MineLife allows us to fuse different datasets, from exploration to mine planning. Any data typically has subject matter experts that need to interpret and manipulate the data, which creates a barrier for other stakeholders to access this data. For non-technical stakeholders such as policymakers, local communities and First Nations, accessing and using such data is often impossible. When we fuse all this data together, including satellite imaging and GIS, LlamaZOO can create a digital replica of the site and the surrounding area. MineLife is innovating and disrupting the mine planning process by centralizing data into an interactive and visual VR experience and making it accessible on-demand and remotely from anywhere in the world.

### LlamaZOO partnered with Teck to create MineLife. How did this relationship develop?

In the case of Teck, for the Galore Creek site we created a 30,000 square km digital replica of the region. This replica includes data from all of their exploration, all the highways, all the nearby mines and anything that you would want to see within the region for the life of mine. This allowed the stakeholders evaluating the project to get a sense of the scope and scale of the existing investment that Teck had already put into the project. This technology saved Teck, and their partner Newmont, a significant amount of money, and it also considerably accelerated the project timeline.

### Can you explain the concept of digital twinning and how this can help mining operations?

NASA founded the digital twin concept approximately 30 years ago, and it transforms complex data into pure jet fuel that accelerates decision-making. The idea is that you can digitally replicate any physical asset, process or system with the replica sharing the physical characteristics of its real-world counterparts. Digital twins also replicate status and behavior by incorporating real-time data from sensors.

Mining companies can utilize digital twins to analyze and monitor their data to prevent issues before they occur, avoid downtime and even simulate future circumstances and events. By using a digital twin, the company can significantly cut down on the costs.

### What are LlamaZOO's growth strategy and principal objectives moving forward?

LlamaZOO currently has a 25-person team, and we have a number of jobs listed that we are hoping to fill. Victoria, British Columbia, remains our headquarters, but we are also growing teams in Vancouver and Calgary. Over the next 18 months, our aim is to double in size. LlamaZOO aims to have a larger global presence, and we are looking to expand our footprint not only across Canada, but also South Africa and Australia. LlamaZOO is changing the way the world sees data, and this sets us apart in the market. We act as a centralized integrator, which means that we want to partner and find the right channels to grow across industries in multiple jurisdictions. ■



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Another company with mining assets but a focus on exporting its technology to foreign jurisdictions is Surrey-based VanadiumCorp, joint owners of VanadiumCorp-Electrochem processing technology (VEPT), a chemical process that addresses the recovery of vanadium, iron, titanium and silica feedstocks. In December 2018, Ultra Power Systems signed an exclusive patent option agreement with VanadiumCorp to purchase a full license of VEPT to utilize in Australia. "Ultra's main focus is on using the technology to expedite construction of the world's first dedicated vanadium processing facility," Adriaan Bakker, president and CEO of VanadiumCorp, explained.

On February 26th 2019, VanadiumCorp announced that national entry phases had been filed in South Africa, India and the United States for VEPT, and Bakker is bullish about its potential moving forward: "We are confident VEPT will revolutionize the cost and sustainable nature of energy storage as well as vanadium, titanium and iron production worldwide."

The importance of vanadium, lithium and cobalt to the battery industry is widely known, but there are other more niche metals fundamental in battery production, such as tantalum, which is used for capacitors. Chris Grove, president of Commerce Re-

sources, whose Blue River project in British Columbia contains an estimated 24 million pounds of tantalum, commented on the market dynamics of the blue-grey, lustrous transition metal: "Economic deposits of tantalum and niobium are very rare. There has not been a new western producer of these mines in the last 30 years, and the amount of tantalum coming out of Africa is decreasing as the demand for tantalum increases."

### The rise of 'urban mining'

Conventional mining relies on the development of a finite resource that will, by definition, eventually stop producing. 'Urban mining' of electronic waste (E-waste), on the other hand, tackles a growing problem by recycling metals from an ever-increasing feedstock of used electrical goods. Rather than having to construct high-capex mines to extract metals, urban miners can have feedstock delivered to them from all over the world.

EnviroLeach was founded in 2016 after developing an alternative chemistry to cyanide for gold processing. Today, the company also has an E-waste division, working in partnership with some of the largest recyclers, electronic manufacturers and

smelters in the world, according to EnviroLeach's CEO and director, Duane Nelson. "There are 380 mt of gold going into electronics annually and less than 20% of that is being recycled. A lot of money is going into landfills. There is C\$62 billion worth of precious metals that can be recovered," observed Nelson, adding: "The average grade of gold mines around the world is less than 5 g/mt. We see E-Waste with an excess of 100 g/mt."

The recycling of lithium-ion batteries (LIBs) has become a key focus for American Manganese, which shifted attention away from its portfolio of mining assets in North America after the price of manganese dropped to a level that would take 11 years to pay back its Artillery Peak project in Arizona. American Manganese partnered with Kemetco Research to work on a solution to produce electrolytic manganese metal from samples at Artillery Peak using a sulfurous acid method of extraction. Recognizing that the chemistries used in this process could extract the cathode material out of the manganese, a five-part pilot plant program was established, due to be completed by Q2 2019. "American Manganese is able to get a 100% recovery of metals from LIBs, such as cobalt, lithium, nickel, manganese and aluminum – all strategic future metals," ex-

plained Larry Reaugh, president, CEO and director of American Manganese. “If we put 1,000 mt of batteries through American Manganese’s treatment process, it is worth C\$360 million in recovered cathode materials.”

#### **Collaboration between research organizations and industry for a carbon neutral footprint**

For meaningful innovation to truly mature, an investment of time as well as money must be committed to R&D that is not restricted by commercial demands. From the biopharma superclusters in Massachusetts and the San Francisco Bay Area, to the Fraunhofer institutes and research establishments in Germany, some of the most transformational advances in innovation originate from universities working in collaboration with industry partners.

The Bradshaw Research Initiative for Minerals and Mining (BRIMM) at UBC is dedicated to solving large-scale lifecycle problems for the mining industry, bringing together the traditionally siloed academic and mining groups to collaborate on issues that need an interdisciplinary focus. “BRIMM is directly focused on solving the industry’s problems in the near-term, not just 10 or 20 years from now,” explained Greg Dipple, BRIMM’s director.

Peter Bradshaw, current chairman of FPX Nickel and a recent inductee of the Canadian Mining Hall of Fame, provided the seed funding to launch BRIMM, but collaboration with industry players across the value chain is helping to advance BRIMM’s R&D to a commercial stage. BRIMM has been working on a CO<sub>2</sub> sequestration project for almost 15 years with mining companies across Australia, Canada and Southern Africa. De Beers, the world’s largest diamond producer, and FPX, a Vancouver-based junior, have been at the forefront of funding research work at UBC on the issue of carbon sequestration using mining tailings. FPX’s flagship Baptiste deposit in the Decar nickel district in central British Columbia is rich in a mineral called brucite. When brucite is exposed to CO<sub>2</sub>, either from flu-gas or atmospherically, it acts as a carbon sink and catches carbon and stabilizes the tailings material. Martin Turenne, president & CEO of FPX, sees transforma-

tional potential in BRIMM’s CO<sub>2</sub> sequestration project: “We believe that there is the potential here to demonstrate that mines with the right mineralogical characteristics could have a neutral carbon footprint. In the context of global concerns over climate change, this would be a revolutionary step for the mining industry.”

#### **Conclusion:**

#### **A diverse Vancouver mining community prepares for the impending upturn**

For some companies, the downturn has been a blessing in disguise, forcing the hand of a traditional industry to develop new solutions that, in turn, can be exported to a global audience. “The downturn sparked the drive for more innovation, and because the new upcycle has been slow and incremental, we have had the opportunity to develop innovative solutions and allow them to mature organically,” observed Wayne Barnett, principal consultant (structural geology) at SRK’s Vancouver office.

For the swathes of small-cap juniors residing in Vancouver, lessons must be learned from the barren years, and an adaptation to the current mining context, where promising drill results alone will not guarantee financial gain, is critical. Mike Vint, vice president of Endeavour Financial, emphasized the need for smaller companies to have a long-term goal and keep their options open with respect to financing: “At a junior stage, and when equity markets are not there, they have to be open to alternatives. Do not jump into bed with the first person that comes along.”

The mid-tiers and majors operating on a global scale must take note of the potential pitfalls of unsustainable growth in an environment ripe for M&A activity. When acquiring a company, you also acquire its liabilities and, in a worst-case scenario, tragedies, such as the Brumadinho tailings dam collapse, which can leave scars far deeper than the balance sheet. “I have operated gold mines in Canada and recognize how important a social license is when doing so. When you work in a community you need to make sure you deliver a sustainable and positive effect to the community long after the mine has closed,” concluded Randy Smallwood, president and CEO of Wheaton Precious Metals. ■

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## Jared Lazerson

President and CEO  
MGX MINERALS

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MGX Minerals was established in 2012 and has transitioned into a diversified, clean energy and mining technology company. We develop lithium, magnesium and silicon projects using innovative processes to supply the new energy economy.

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### Could you provide a brief company background and highlight some milestones from 2018?

MGX Minerals was established in 2012 and has transitioned into a diversified, clean energy and mining technology company. We develop lithium, magnesium and silicon projects using innovative processes to supply the new energy economy. MGX Minerals acts as an umbrella company for MGX Renewables, which was initially bought as ZincNyx, Petrolithium Corporation of America and engineering company, PurLucid, of which we own 60%, as well as the patent on lithium extraction. They are experts in water, and we are the experts on lithium. For Petrolithium, we won the Platts-Metals leadership awards for base and specialty metals for lithium extraction from oil in 2017. We also have been nominated for two SMP Energy awards.

### Could you describe the potential of your flagship asset, the Driftwood Creek magnesium oxide deposit?

MGX aims to become the second producer of magnesium oxide in North America through the development of Driftwood Creek, which hosts a high-grade magnesite deposit. We have completed the PEA on the project, which showed a 19-year mine life, with all-in sustaining costs of C\$351/mt MgO, an average annual MgO production of 169,700 mt, a 3.5 year payback and C\$529.8 million pre-tax NPV. It could potentially be mined as an open pit and has excellent connectivity to infrastructure. We pride ourselves on being environmentally friendly, as magnesium oxide is used as fertilizer, waste water treatment, animal feed and even as a human supplement. The first drill program was run four years ago and now it is about to enter a PFS, which we expect to complete by Q1 2019.

### Which of your technologies is driving growth at the moment?

One of the biggest value drivers in the company is wastewater treatment, related to lithium extraction. We now have some of the most advanced technology in the world to treat heavy wastewater economically. It was developed at the University of Alberta, and we just deployed our first system to treat SAG-D wastewater with EBD therein, which is highly toxic. A huge achievement is that we have just obtained approval from the regulator to allow for in-line. This is a major breakthrough for us as a company and for technology in general. It has meant the acceptance of our equipment in oil sands operations, and our plant is valued at C\$5 billion. The system we use is a high-temperature and high-pressure system that will remove other related filtration equipment, allowing water not to be cooled down. The results are savings in terms of greenhouse gases, energy, finances and reduction of high-cost toxic disposal. This is a significant breakthrough for oil sands and represents a paradigm shift for water treatment and reuse.

### What are MGX Mineral's objectives within Latin America?

We began to look at a pure lithium project in South America without petrolithium technology, which resulted in strong economics. In South America we get up to 1500 ppm lithium easily. MGX Minerals is currently looking to partner with majors that want to expand their operations. The government of Chile has also announced that it will no longer allow for the solar evaporation of lithium. At the moment, there are 300 million gallons of water evaporation in the country, and the government wants to see rapid extraction. Since we already have a large operation in Chile in the Cobre territory, we see these new policies as a potential niche for MGX Minerals. The major advantage of our systems is that the capex costs are very low. We use filters, no evaporators, no major chemicals and few reagents.

### Do you have a final message for our international readership?

Clean technology is the way of the future. MGX Minerals has some of the most advanced mineral extraction, water technology and mass storage in the world. We partner with the largest players in the industry and are working on the most important projects in Canada. Our removable skin layer (RSL) technology relies on advanced membranes and filtration, and is cutting edge. The company will continue to lead the transition from fossil fuels to renewables through extraction, investment in battery commodities and clean technology. ■



## Adriaan Bakker

President and CEO  
**VANADIUMCORP**

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There are not many technologies that can handle the storage of multi-gigawatt power, which is critical for the deployment of renewable energy. The size and scale of what is being built right now is staggering.

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### Can you introduce VanadiumCorp-Electrochem Processing Technology (VEPT) and explain how it works?

It represents the most efficient and sustainable method to produce vanadium. Technically speaking, it is a patent pending chemical process jointly developed with Electrochem Technologies & Materials Inc. that addresses the recovery of vanadium, iron, titanium and silica feedstocks. The process is capable of digesting vanadiferous feedstocks into concentrated sulfuric acid, resulting in all metals recovered in solution. The exothermic sulfation reaction operates quasi-autogenously while producing a sulfation cake, hence minimizing the energy consumption and carbon footprint drastically compared to smelting and roasting methods used by vanadium, iron and steel producers.

### What is VanadiumCorp's business model and mandate for VEPT?

Our objective is to create cash flow through licensing and production by allowing efficient production of vanadium from many sources. In early 2017, we built the first prototype and announced the filing of our U.S. provisional patent for VEPT. We then started testing a variety of different feedstocks and initiated trial production of multiple feedstocks. We began to receive interest in potential licensing, and the company developed a new business model and mandate to develop cashflow through option agreements leading to licensing out VEPT globally. This means that other companies will take on the technical, financial and commercial responsibility. Thus there is less of an onus on VanadiumCorp to dilute its share structure to raise capital. This also changed our plans for our 100% owned resources and developments in Canada. We plan to secure production rights by allowing third parties cover mining costs in exchange for all the feedstock we require to build a VEPT plant in Canada.

### Can you elaborate on the exclusive patent option agreement VanadiumCorp signed with Australian company Ultra Power Systems (Ultra) in December 2018?

Ultra has an option to exclusively purchase a full license of VEPT to utilize in Australia. Ultra's main focus is to use the technology to expedite construction of the world's first dedicated vanadium processing facility. Their core objective is to integrate low-cost battery grade vanadium electrolyte directly

into vanadium redox batteries from virtually any source for a fraction of the time and capital requirements of current vanadium extraction processes. Ultra's key interest is that VEPT dramatically reduces emissions associated with vanadium extraction in addition to offsetting the operating cost of the vanadium substantially through the production of valuable by-products.

### Vanadium represents approximately 80% of vanadium redox flow batteries (VRFBs). What is the energy storage potential of these batteries?

There are not many technologies that can handle the storage of multi-gigawatt power, which is critical for the deployment of renewable energy. The size and scale of what is being built in countries such as China, India and the Middle East right now is staggering. This requires the unique ability to store and manage megawatt to gigawatt power that vanadium batteries can handle easily. Vanadium batteries have been commercialized in the market for approximately 30 years and are ready to take on unlimited scale deployment in many applications. Furthermore, the energy density will likely improve to the point that vanadium could replace gasoline in electric cars, as VRBs are essentially two tanks filled with liquid vanadium.

### What is the current status of VanadiumCorp's Lac Dore VTM project in Québec?

VanadiumCorp intends to implement a drill program aligned with recommendations from Micon International Limited's NI 43-101 report on the Lac Dore VTM project, with an estimated total of 16,000 m of NQ drilling expected. The plan is to expand and reach a level of value until it makes sense for a partnership or joint venture to move the project ahead.

### What is VanadiumCorp's final message to readers?

We are entering the most exciting chapter in the history of the company. VanadiumCorp's key focus is vanadium and vanadium for energy storage, and with VEPT we have a disruptive technology that vastly supersedes any technology before it. We are confident that VEPT will revolutionize the cost and sustainable nature of energy storage as well as vanadium, titanium and iron production worldwide. ■



## Duane Nelson

CEO and Director  
**ENVIROLEACH**

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Today, obtaining permits for the use of cyanide is very difficult, and some jurisdictions have outlawed the use cyanide entirely. Many believe that the use of cyanide is going to disappear within 10 years.

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### What were the circumstances surrounding the creation of EnviroLeach?

EnviroLeach was founded in 2016 after developing an alternative chemistry to cyanide for gold processing. Today, EnviroLeach essentially has two divisions: gold production and electronic waste (E-Waste). There are very few compounds that can dissolve gold into liquid. Cyanide and its alternatives break the gold down into a new gold complex or compound. It is then extracted through activated carbon, electrowinning, ion exchange or precipitation. 80% of the gold that is produced today uses vat or heap leach processing. The EnviroLeach process is designed for vat leaching, and the recoveries of our product are superior to that of cyanide and other alternatives. It is the world's only safe, stable, sustainable, eco-friendly and economic alternative to cyanide and strong acids for the extraction of gold.

### Can you outline the environmental benefits of EnviroLeach's chemical process?

EnviroLeach's solution, which is based on water-based chemistry containing a number of ingredients that are safe for humans, is prepared electrochemically. This helps to maintain the ability to reuse the formula over and over. Cyanide products are usually not recyclable, however, our solution does not create a water effluent stream and requires no tailings detoxification process like cyanide. No fluid leaves the plant and goes into the stream. It has an environmental footprint of zero.

### What are the economic benefits of EnviroLeach's process?

There is no need for a cyanide destruct circuit and no concern regarding the pH levels of the cyanide reaching below a certain level and producing hydrogen cyanide gas. Cost of chemistry is comparable to cyanide considering the solution is completely recyclable. A vast amount of time is spent on permitting when there is construction of a new mine. Today, obtaining permits for the use of cyanide is very difficult, and some jurisdictions have outlawed the use cyanide entirely. Many believe that the use of cyanide is going to disappear within 10 years.

### What type of mining companies has EnviroLeach worked with?

We currently deal with four of the top 10 mining producers in the world and another important mining company here in British Columbia. Those form the core group that EnviroLeach works with for collaboration, research and pilot plant development.

### Can you elaborate on Cyanide and how the EnviroLeach formula positively affects mining?

Cyanide has been the predominant method because it has been the most economical solution for the last 100 years. Many jurisdictions have banned the use of it based on environmental concerns and safety issues. With the environment increasingly a top priority, the industry needs alternatives. Many other chemical processes have been developed that have been tried and have failed. The EnviroLeach solution allows access to gold reserves that were not previously accessible.

### How much gold can be produced from urban mining?

The average grade of gold mines around the world is less than 5 g/mt. We see E-Waste with an excess of 100 g/mt. The beauty is that we do not have to go underground for it; it is delivered to us in containers that come from all around the globe. There are 380 mt of gold going into electronics annually, and less than 20% of that is being recycled. A lot of money is going into landfills. A value of C\$62 billion in precious metals can be recovered, and the carbon footprint of 1 oz of gold recycled from E-Waste is less than the equivalent gold produced by conventional mining.

### Moving forward, what is EnviroLeach's strategy for growth?

Mining is one of the least innovative sectors and therefore has a lot of room for development and growth. EnviroLeach is focused on the larger gold producers as they have the means and credibility to move our technology forward. In addition to tapping into previously untouchable resources, our process reduces the environmental regulations burden. Social responsibility is a huge part of mining and we are proud to be a part of lowering the negative impact on the environment. ■



## Paul Cowley

President, CEO & Director  
**FIRST VANADIUM CORP.**

### Why did First Vanadium Corp decide to rebrand from Cornerstone Metals in September 2018?

Rebranding from Cornerstone Metals to First Vanadium Corp was a strategic decision to portray a more accurate image to the industry of what the company focus is. We have a significant vanadium project, and rebranding was an opportunity for us to get a clearer message to the market. Having Vanadium in our title also significantly helps in the world of social media.

### First Vanadium Corp recently announced its thickest high-grade intercept to date at the Carlin Vanadium project in Nevada. What potential do you see in the project?

The deposit is very attractive as it is a high grade and near surface shallow dipping deposit, making it ideal for an inexpensive open-pit method. The Carlin Vanadium project has an amazing location with great infrastructure and is in an established mining jurisdiction just six miles from the town of Carlin, Nevada. The project is located within the Carlin gold trend, which has the advantage of infrastructure that has already been developed by major mining companies operating in the area.

### What are First Vanadium Corp's main objectives for the next 18 months?

First Vanadium hopes to have a very positive mineral resource delivered, followed by a positive pre-feasibility study before the end of 2019. The pre-feasibility will give us direction on how to move forward with the feasibility process, which we aim to complete by 2020. We have a great team with the skillsets to take the mine into production, which is our end goal. We would only sell the asset if we received an offer we could not refuse. First Vanadium has a very tight share structure, and we do not expect a great deal of dilution to take place moving forward. ■

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# 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.

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## THANK YOU

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Also, special thanks to:

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[www.tmx.com](http://www.tmx.com)

“There seems to be three phases to every mining cycle: the development phase where prices go up and people invest and buy assets; the harvest phase where commodity prices are high and there is a lot of equity available; and the balance sheet preparation phase where those who invested in peak cycle are sourcing capital to bring debt levels down. We could say the balance sheet preparation phase was from 2013-2018, and now in 2019 we are seeing commodity prices increase and more market optimism for growth.”

**- Randy Smallwood, president & CEO,  
Wheaton Precious Metals**

“The world has truly changed with respect to the way capital markets function. Traditionally, the vast majority of capital in the world was held by active institutional investors, including many specialty funds that you then had to convince to invest in your company. Today, the advent of passively managed capital has become such a strong force as the fees are extremely low, and these passive ETFs are making investments based on only two criteria: the size and the liquidity of the company. Companies thus need to self-rationalize and merge to grow in size and liquidity to attract financing.”

**- Nolan Watson, president, CEO and director,  
Sandstorm Gold Royalties**

“Permitting for basic exploration in British Columbia is a huge challenge for the industry, and the government takes significantly long times to issue permits. There are different factors that influence the permitting process such as the environmental aspects, communities, First Nations and local governments. To improve the permitting process, governments must put in place specific timelines and be more transparent to allow investors to have more security when spending funds on a project.”

**- Brian Abraham, global mining expert,  
Dentons**



"It is paramount for companies to recognize and fully respect the unique jurisdictions, rights and titles of First Nations people in British Columbia. The Tahltan Nation, Nisga'a Nation, provincial government and selected exploration companies have formed a group called the B.C. Regional Mining Alliance to talk about the opportunities in British Columbia and help combat some of the negative stereotypes."

**- Chad Day, president,  
Tahltan Central Government**



"It's not technology that the mining industry is averse to, but risk. Mining companies often outsource innovation and technological development to OEMs and third-party corporations to mitigate cost and risk, but they are more than willing to implement new technologies that are easy to use and provide a clear return on investment. If you provide real value to your clients, then mines cannot afford to not buy your products."

**- Shahram Tafazoli, president and CEO,  
Motion Metrics**

"We work in knowledge-intensive industries where there are shortages of professionals. At the same time, we are inundated with data. The only solution to thriving in this environment is to manage knowledge assets and commit knowledge to computers to augment how humans carry out their tasks."

**- Clinton Smyth, CEO,  
Minerva Intelligence**

"I would hope that within five years we have mines that have substantial carbon offsets within their operations, providing the potential for mines to be net negative, which would contribute to the long-term goal of generating an environmental benefit from mining."

**- Gregory Dipple, director,  
BRIMM**



## COMPANY/ INSTITUTION

## WEBSITE

**Associations, Research Institutes and First Nations**

|   |  |
|---|--|
| Association for Mineral Exploration (AME)                     | <a href="http://www.amebc.ca">www.amebc.ca</a>   |
| B.C. Regional Mining Alliance (BCRMA)                         | <a href="http://www.amebc.ca/bc-regional-mining-alliance">www.amebc.ca/bc-regional-mining-alliance</a> |
| "Bradshaw Research Initiative for Minerals and Mining (BRIMM) | <a href="http://www.brimm.ubc.ca">www.brimm.ubc.ca</a>   |
| Council of Yukon First Nations                                | <a href="http://www.cyfn.ca">www.cyfn.ca</a>   |
| Geoscience BC   | <a href="http://www.geosciencebc.com">www.geosciencebc.com</a>   |
| Kitikmeot   | <a href="http://www.kccnunavut.com">www.kccnunavut.com</a>   |
| Little Salmon Carmacks  | <a href="http://www.lscfn.ca">www.lscfn.ca</a>   |
| Mining Association of B.C. (MABC)                             | <a href="http://www.mining.bc.ca">www.mining.bc.ca</a>   |
| Ngäbe   | n/a  |
| Nisga'a Lisims  | <a href="http://www.nisgaanation.ca">www.nisgaanation.ca</a>   |
| Nunavut   | n/a  |
| Prospectors & Developers Association (PDAC)                   | <a href="http://www.pdac.ca">www.pdac.ca</a>   |
| Tahltan Nation  | <a href="http://www.tahltan.org">www.tahltan.org</a>   |

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| Sandstorm Gold Royalties    | <a href="http://www.sandstormgold.com">www.sandstormgold.com</a>                 |
| Wheaton Precious Metals     | <a href="http://www.wheatonpm.com">www.wheatonpm.com</a>                         |

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## COMPANY/ INSTITUTION

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