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FEATURES

DEPARTMENTS

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Coming in January
Canadian Mining Journal looks at the relationship between the mining sector and First Nations, as well as mining in B.C., Yukon and N.W.T.

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Alisha Hiyate

Canada shines in risk-off climate

In a still-tepid M&A market in mining, any trends that develop stand out all the more clearly. One such trend jumped out at us this year: the popularity of established mining districts across North America.

Many of these deals involve Canadian mining companies with significant overseas exposure buying projects in Canada to lower their risk profile. That's not to say they're working in highly unstable countries. But these companies have had some unpleasant surprises that have made doing business harder or put their assets in jeopardy.

Alamos Gold, which has several development projects in Turkey, has encountered permitting delays there, including the overturning of its EIA permit for its Kirazli project by an administrative court in 2014. The EIA has since been reinstated by a higher-level court, and further permits have been granted.

But the miner, which already had two operating mines in Mexico, has recently turned to Canada for new acquisitions. Alamos bought Richmont Mines this year for its Island Gold mine in Ontario, and in 2015, it picked up AuRico Gold for its Young-Davidson mine in Ontario.

Centerra Gold has really taken a shine to Canada as a dispute with the government of Kyrgystan regarding its Kumtor gold mine dragged on. While the two parties recently came to a settlement agreement after 18 months of negotiations, it cost Centerra Gold a one-time payment of US$57 million to two newly established, government-administered funds, and accelerated reclamation payments of US$6 million a year. The government had wanted US$300 million in environmental fees.

In 2017, Centerra purchased AuRico Gold spinoff AuRico Metals for its Kemess copper-gold project, in B.C.; last year, it acquired Thompson Creek Metals for its Mount Milligan gold-copper mine in B.C.; and in 2015, it signed a deal to earn up to 50% of Premier Gold's Greenstone gold project in Ontario.

Finally, Eldorado Gold recently launched legal action against the government of Greece and threatened to pull out of the country, where it has several advanced projects as well as one operating mine. (The company also has two operating mines in Turkey.) Eldorado put its Skouries project on care and maintenance in November, saying that development has faced "unjustifiable delays."

This summer, Eldorado acquired Integra Gold for its Lamaque gold project in Quebec. Interestingly, the project is its first and only project in North America.

Some of the other recent acquisitions that have taken place recently are in the U.S. (Nevada, Idaho) and Mexico (Sonora state).

In North America, we're seeing a little bit of political instability of our own, namely uncertainty around the current North American Free Trade Agreement (NAFTA) talks.

While those negotiations, which were initiated by U.S. president Donald Trump's administration, could mean higher costs for miners and a hit to the economies of all three signatory countries if NAFTA is dissolved, they won't undo the conditions that make North America a safe and profitable place to invest. **CMJ**


Capturing the risks and opportunities of climate change

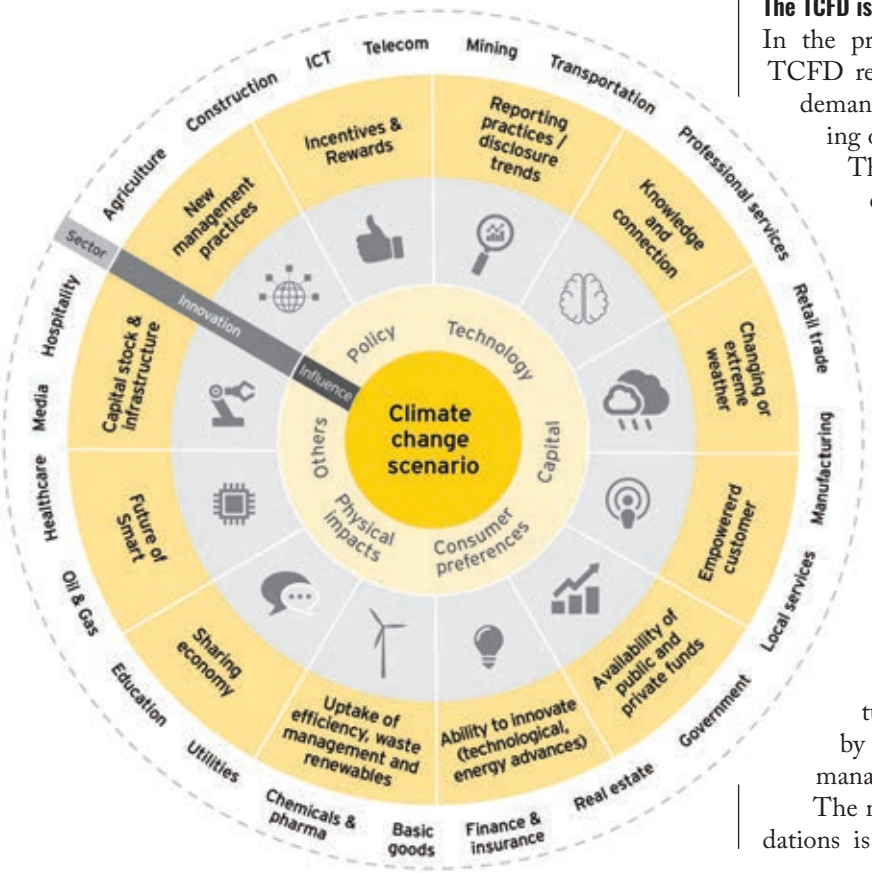
By Diane Larsen and Susan McGeachie

Recognition of climate change risks has propelled global warming to the top of many corporate agendas and forced companies to face many connected climate-related risks and opportunities. These include policy shifts, technological advancement and a high probability of extreme weather.

This past June, the Task Force on Climate-related Financial Disclosures (TCFD), chaired by Michael Bloomberg, submitted its final recommendations for voluntary climate-related financial disclosures to Mark Carney, chair of the Financial Stability Board. The objective of the TCFD recommendations is to help companies around the world understand the information investors need to better measure and respond to climate change risks.

Leading up these recommendations, in December 2015, the 21st annual Conference of the Parties (COP 21) reached an unprecedented international consensus to limit global temperature rise to well below 2°C over this century.

Managing climate risks means ensuring the resilience of your operations. This requires an assessment of the impact of climate change-related policies and laws, technology, consumer preferences, changing weather and business innovation.



Addressing the impact

Research suggests that opportunities arising from the energy transition will outweigh climate-related risks. The lower-carbon transition can be linked to other global trends which could indicate one future economic scenario over another (Figure 1). As we become more comfortable with managing the risks associated with this transition, and more accepting of their inevitability, we can start to answer the question: How do you seize the upside of climate-related disruption?

The TCFD is balancing investors

In the process of developing their recommendations, the TCFD realized that they required equal parts information demand from investors and information supply from mining operators for this type of disclosure to be successful. This balanced ledger resulted in the first guidance on climate change disclosure to apply to both issuers and investors.

Other sustainability reporting frameworks, including CDP (formerly the Carbon Disclosure Project), GRI (Global Reporting Initiative) and PRI (Principles for Responsible Investment), have agreed to align their own disclosure guidance with the recommendations.

The TCFD recommendations are structured around four core themes: governance, risk management, strategy, and metrics and targets. It states that all organizations should describe their governance around climate-related risks and opportunities, including the structure for board oversight and management's role in addressing climate-related risks and opportunities. Companies should also disclose the process by which climate-related risks are identified, assessed, managed and integrated into overall risk management.

The most challenging aspect in the TCFD's recommendations is in the area of performing scenario analyses for

governments to achieve a 2°C or lower world or, inversely, realize a 4°C world, or higher. Such scenario analyses are relatively new concepts, and involve varying assumptions that may or may not be useful to the users of this information.

The most contentious aspect of the recommendations is the reporting of carbon released per unit of product produced. Many issuers and investors don't agree that this is a useful metric to inform investment decision making.

The TCFD climate-related financial disclosures recommendation report is one new disclosure standard among many. Climate risks are not mutually exclusive, thereby making it difficult to isolate a specific issue on climate change. Mining companies' audit committees should form a view as to where (and if) climate-related risks are discussed in corporate reports.

Next steps

In general, mining companies are still at the early stages of responding to climate-related risks. Some lack the in-house expertise to develop an informed view about climate change scenarios, and many still find it difficult to incorporate climate risks into investment strategies while meeting near term performance metrics.

Companies can begin their journey with a robust assessment of their exposure to climate change. This assessment should include consideration of upside opportunities such as an increased demand for minerals to support a global clean energy transition.

On the risk side, specific weather data around the world is much more reliable and accessible, including weather projections to 2100 based on different carbon scenarios. Your assessment should also take into account rapid technological advancements, policy trends, capital flows and shifting social licence to operate.

A key objective of the work performed by the TCFD was for executives and boards to increase the current financial planning period from one to five years. Early support for these recommendations from the finance community and securities regulators indicate that companies will be under increasing pressure to address climate risks. It's up to companies to see the challenge of transitioning to a lower-carbon economy as an opportunity. **CMJ**

DIANE LARSEN is a partner, Assurance Services, with EY's Global Professional Practice and **Susan McGeachie** is a market leader with EY's Climate Change and Sustainability Services.

Reflecting on Treaties Recognition Week

By Isadore Day

Now that the Canada 150 celebrations have concluded, all Canadians must bring a renewed focus on a nation-to-nation relationship with First Nations based upon our Treaty relationship to share the lands as equals.

To mark the second annual Treaties Recognition Week in Ontario this past November, David Zimmer, Minister of Indigenous Relations, and I released the following joint statement:

"There are more than 40 treaties, land purchases and other agreements across Ontario. Treaties are the reason Ontario, as we know it today, exists. Yet many Ontarians have not had a chance to learn about how treaties continue to shape the places we call home.

As leaders, we have worked together on numerous initiatives to improve relationships between Ontario and First Nations. We have also worked to increase public awareness of treaties between First Nations and the Crown not only as historical documents, but also for their continuing relevance today. That's why it is so important that the Ministry of Indigenous Relations and Reconciliation's first piece of Legislation was the Treaties Recognition Week Act.

This year, that week runs from Nov. 5-11, and we are proud to be working together during this second annual Treaties Recognition Week to continue to bring awareness to the important role that treaties play in the past, present and future of Ontario.

First Nation Peoples made agreements with one another long before settler governments arrived on Turtle Island – now more widely known as North America. When settlers arrived, those same First Nations helped them survive and eventually signed treaties with the Crown. Historically, treaties were signed to create mutual benefits for both Indigenous and non-Indigenous peoples. Sadly, Crown governments haven't always lived up to treaty promises.

Elevating Indigenous voices and perspectives is an important part of Treaties Recognition Week. That's why teachers across the province are inviting Indigenous speakers into their classrooms to share a view of history young people may not have heard before. Understanding Indigenous perspectives on treaties is critical to reconciliation, and that includes understanding the areas where disagreement still exists both on how treaties were agreed to in the first place and how they are implemented today.

Although many treaties were signed over a century ago, treaty commitments are just as valid today as they were then. This week, we will continue to work together to build a dialogue about Ontario's treaty relationship with Indigenous peoples. A fundamental understanding of treaties is essential to addressing the challenges faced by Indigenous people – challenges that can only be solved by listening to each other and working together."

One week later, at the 25th Annual meeting of the Canadian Aboriginal Minerals Association (CAMA) in Toronto, I made these comments:

"CAMA was founded back in 1992 to assist communities in their dealings with mining companies that were entering their lands. In many cases, these companies had little contact with the Indigenous communities. It has taken a good 25 years for both government and industry to understand that First Nations have rights and jurisdiction over the lands and waters.

Over the years, CAMA has become an organization that assists communities on natural resource economic development. It has taken 25 years for government and industry to realize that every First Nation community must benefit economically in the long term – from partnerships to procurement.

Let us never forget that Canada is celebrating 150 years as a country because our Peoples shared the lands and resources. Our ancestors signed treaties as equal partners. The treaty partnership was meant to ensure that future generations would prosper along with all Canadians.

In 2017, a token 10% Indigenous labour force on a resource project is not enough. Ten per cent First Nation ownership of a project is not enough. Our Peoples must have meaningful involvement in order to overcome poverty and despair. We must begin now to rebuild at the community level. We must offer hope so our children no longer contemplate suicide.

Our children must be able to see a bright future where they are the masters of their own destiny. Our children must be empowered to become contributors and protectors of their families, their languages, and their cultures. Our children must be able to prepare for a future where they are the leaders of happy, healthy communities. ***Most importantly, a future where they control their own economies and their own destinies.***" **CMJ**

ISADORE DAY Wiindawtegowinini, is Assembly of First Nations Ontario Regional Chief.

MAC adopts the Voluntary Principles on Security and Human Rights

By Michael Torrance

On March 2, the Mining Association of Canada (MAC) voted to adopt the Voluntary Principles on Security and Human Rights (the VPs). While several MAC members were already formally implementing the VPs, the adoption by MAC means that the human rights standard now applies to all MAC members. This brings MAC in line with the government of Canada's own endorsement of the VPs in 2009.

The VPs were established in 2000 as a collaboration between the United Kingdom and United States governments, extractive companies (primarily in the oil and gas sector) and non-governmental organizations (NGO). They were created to help extractive sector companies protect their assets and people, while respecting human rights. The VPs include commitments by signatories to conduct risk assessments and manage relations with public and private security to protect human rights.

The VPs require company signatories to rely on credible information acquired from various stakeholders (including local governments and civil societies) to assess the human rights risks present in their operating environments relating to security issues. This includes identifying political, social and economic risks and any related potential for violence. It also requires consideration of the human rights records of local governments and the application of the rule of law as well as any other sources of conflicts that could have bearing on the extractive project.

If companies are relying on publicly provided security offered by local government, the VPs require companies to regularly consult with the government and local community about the human rights related impact of their security arrangements.

Where private security is used, the VP require companies to ensure that the security deployed is competent, appropriate and proportional to the threat and that any use of force is properly reported (both to the company and the appropriate governmental authorities). If misconduct has occurred, it should be subject to discipline as appropriate. Companies should also be conducting due diligence on security providers and not engage anyone who has engaged in past human rights abuses.

Companies should also develop and implement company policies on the use of force and limit their role to preventative defensive services only. The policies and processes should comply with applicable international standards. While the VPs pre-date the UN Guiding Principles on Business and Human Rights, consideration of how this important standard affects policy and practice on security and human rights would be prudent and consistent with the VPs (including consideration of remedy where adverse human rights impacts have occurred). This apparent relationship was alluded to by MAC's president and CEO Pierre Gratton when he remarked publicly at the time of the announcement that the adoption of the VPs "…underscores MAC members' commitments to respect human rights and to operate responsibly with respect to security practices."

MAC's adoption of the VP means that all MAC member companies that rely upon private or public security forces are committing through their association with MAC to implement a security and human rights approach that is consistent with the VPs. This necessitates conducting and evaluating risk assessments on the extractives projects and facilities they control. MAC members will also report on their implementation of the VPs in MAC's *Towards Sustainable Mining* annual progress reports.

The adoption is made significant from a legal perspective in light of litigation in Canada where adherence to the VPs by adopting companies has been used to ground tort claims against parent companies in Canada for human rights damages relating to subsidiary companies operating outside of Canada. This potential legal risk will make implementation a legally significant question for MAC members that should not be taken lightly.

Ultimately, however, adoption of the VPs by MAC is designed to mitigate rather than create risks for its memberships and follows a broader trend towards adoption of human rights standards in the extractive sector. This is underscored by the Canadian government's endorsement of the VPs in the Corporate Social Responsibility (CSR) Strategy for the Extractive Sector originally released in 2009 and updated in 2015. The CSR Strategy expressly endorses the VPs as one of six leading standards that Canadian extractive companies are expected to apply to their international operations. In this sense, the move by MAC to endorse the VPs is responsive to the prevailing view on minimum standards on security and human rights in the industry. **CMJ**

MICHAEL TORRANCE is a partner at Norton Rose Fulbright, Toronto.

• Haul Trucks | ASI, Liebherr collaborate on autonomy

Liebherr's T284 mining truck. CREDIT: LIEBHERR

Autonomous Solutions, Inc. (ASI) and Liebherr Mining Equipment have announced that Liebherr's new autonomous ready haul trucks will be compatible with ASI's autonomous command and control platform. Liebherr's vision of an autonomous haul truck includes an open interface that enables the truck to integrate with ASI's Mobius platform. Liebherr's autonomous vehicles can be controlled under an OEM agnostic command system for autonomous vehicles, providing maximum flexibility for their customers.

"By adopting the Mobius platform, Liebherr is poised to differentiate its autonomous vehicles by addressing the market need for interoperability and openness," explains ASI's Drew Larsen, director of business development for mining. "I believe the market will welcome Liebherr's decision."

Liebherr has integrated with the Mobius protocols for its vehicle control interface, rather than establishing a proprietary command and control platform on its own. This move to an open platform will provide much needed flexibility to their customers when integrating different autonomous vehicle types throughout a mine site.

• Equipment | Market recovery continues

A recovery in the mining equipment market worldwide is under way, according to Parker Bay Company, a market research firm specializing in mining and mining equipment.

Data measuring shipments of large surface mining equipment, showed an 11% increase in the third quarter, adding to a recovery that began one year ago. The market has now seen its fifth consecutive quarter of growth.

The company says that the deliveries continue a trend that started in the third quarter of 2016, and along with other factors, indicate a sustained and growing recovery of mining and equipment markets worldwide.

While the market has almost doubled since a cyclical low reached in the second quarter of last year, it remains more than 60% below the market peak in the first quarter of 2012.

"The overriding attribute of this overview of Q3 shipments is one of optimism," said the company in a release. "The mineral and equipment market conditions that have evolved over the past 12-18 months and led miners to increase their purchases of new machines are still in place and expected to continue for the next year, and likely longer. Current demand remains sufficiently below the levels obtained at the 2012 peak such that further growth appears very likely, and fully warranted by mineral supply/demand conditions in nearly all product, geographic, and mineral sectors."

The report revealed that the biggest increase in sales came in the category of excavators and loaders.

• Environment | Mining sector unites for supercluster application

The Canadian mining sector has submitted a full application for a clean resources Supercluster as part of the federal Innovation Superclusters Initiative. Prepared by CEMI, CIMRE, CMIC, COREM, IMII and MSTA, the application seeks to establish the CLEER (clean, low-energy, effective, engaged and remediated) supercluster.

The CLEER Supercluster has the potential to transform the mining sector's productivity, performance, and global competitiveness by harnessing innovation across the ecosystem to tackle global challenges of water, energy, and environmental footprint, with bold targets of 50% reductions in each area by 2027. CLEER will execute its strategy through tapping into regional clusters of expertise within British Columbia, Alberta, Saskatchewan, Ontario, and Quebec. Through collaborative activities, CLEER will engage the Canadian mining services and supply sector, anchor companies, R&D innovation support organizations, post-secondary institutions, and partners from other sectors across Canada, including clean tech.

If successful in the final application process, the CLEER Supercluster will provide widespread economic benefits across Canada, with the potential of creating more than 38,000 new direct high paying jobs and training opportunities within the cluster (and more than 100,000 jobs including indirect sectors). It is anticipated that the Supercluster's GDP contribution would exceed $26 billion after five years.

View of the tailings dam breach at Imperial Metals' Mount Polley mine, in B.C.
CREDIT: CARIBOO REGIONAL DISTRICT

• Tailings | MAC, UNEP release reports

On Nov. 7 the Mining Association of Canada released its third edition of its *Guide to the Management of Tailings Facilities*. The release coincides with the Tailings and Mine Waste Conference in Banff, Alta.

Canadian tailings management guidance is recognized as globally leading. Following the inquiry into the tailings release at the Mount Polley mine in British Columbia, that province said all mines must adhere to MAC guidelines or their equivalent. After the tailings failure at the Samarco mine in Brazil, the guidelines were examined and found to be the most comprehensive of any national framework.

The third edition of the Tailings Guide is another step in the continual improvement process for tailings management, moving towards the goal of minimizing harm: zero catastrophic failures of tailings facilities, and no significant adverse effects on the environment and human health. It contains new technical components, including those critical to the physical and chemical stability of tailings facilities. It also strengthens key management components throughout the tailings facility's life cycle, such as change management, critical controls for risk management, and performance evaluation.

UNEP Report

In October, the United Nations Environment Programme (UNEP) released a report on mine tailings called: *Mine Tailings Storage: Safety is no accident*.

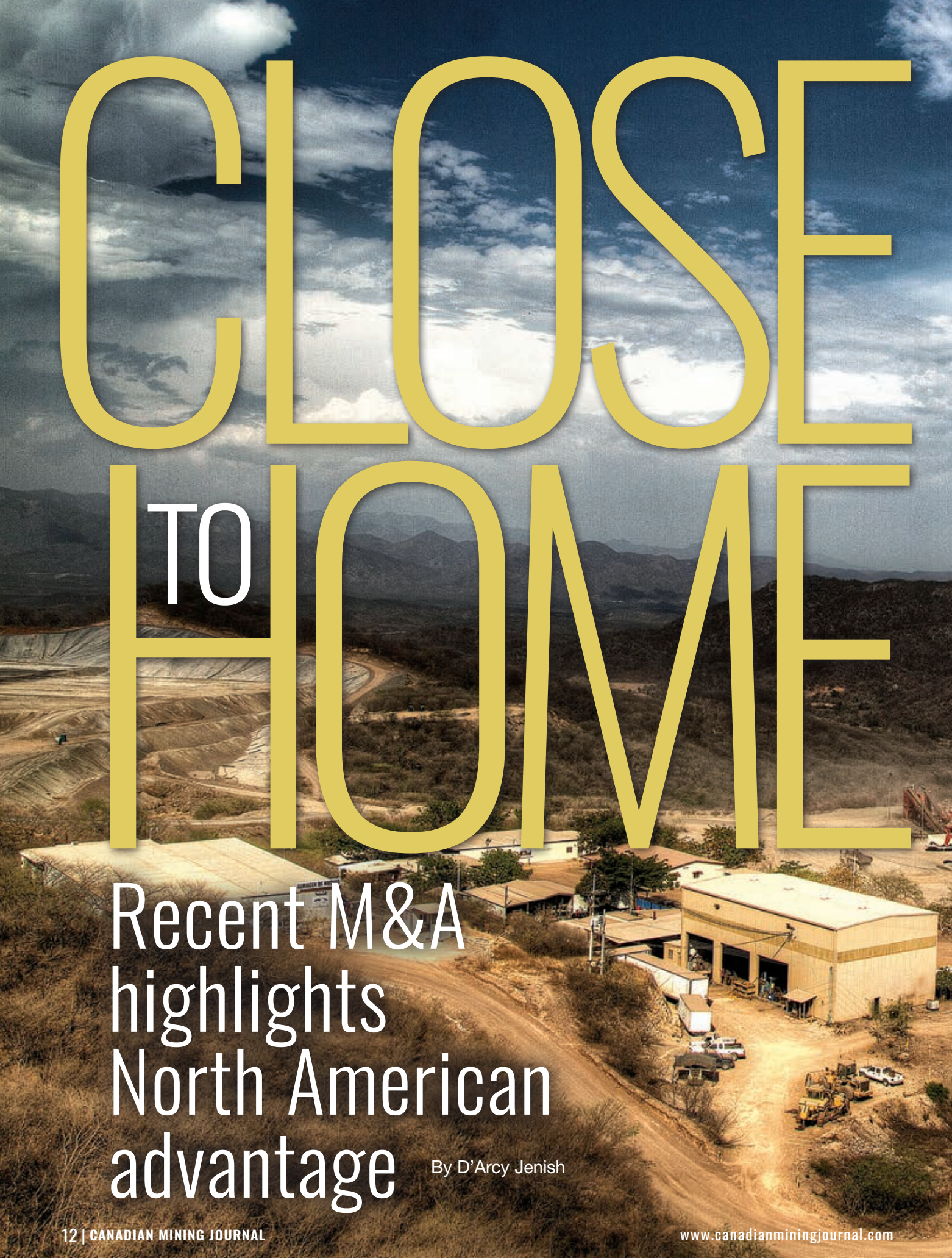
The report makes a number of recommendations, principally that regulators, industries and communities should put safety first, and adopt a zero-fail objective with safety attributes being evaluated separately from economic considerations. It also says that cost should not be the determining factor in tailings decisions.

In addition, the report recommends the establishment of a UN Environment stakeholder forum to strengthen tailings dam regulation internationally.

The report details 40 known mining waste failures in the past decade, including eight in 2014. Since 2008, mining waster failures have killed 341 people.

An analysis of tailings dam failures over the past three decades indicates that even as the number of failures has decreased overall, the number of serious failures has actually increased.

Other recommendations include establishing a global database of tailings facilities and research, funding research into tailings failures and the management of tailings facilities, the expansion of regulations to include independent monitoring and enforcement for non-compliance, and the funding of a global insurance pool. **CMJ**



CLOSE TO HOME

Recent M&A highlights North American advantage

By D'Arcy Jenish

Canada's gold miners – those that are financially healthy, at any rate — are on the move these days. They're out shopping for properties, mostly in Canada, the U.S. and Mexico, but their motives are as mixed as the assets acquired. Some have taken advantage of distress sales of underpriced projects. Some are out to keep the production pipeline full, while others are seeking the safety of first-world jurisdictions and still others are acquiring size in order to make themselves more attractive to investors.

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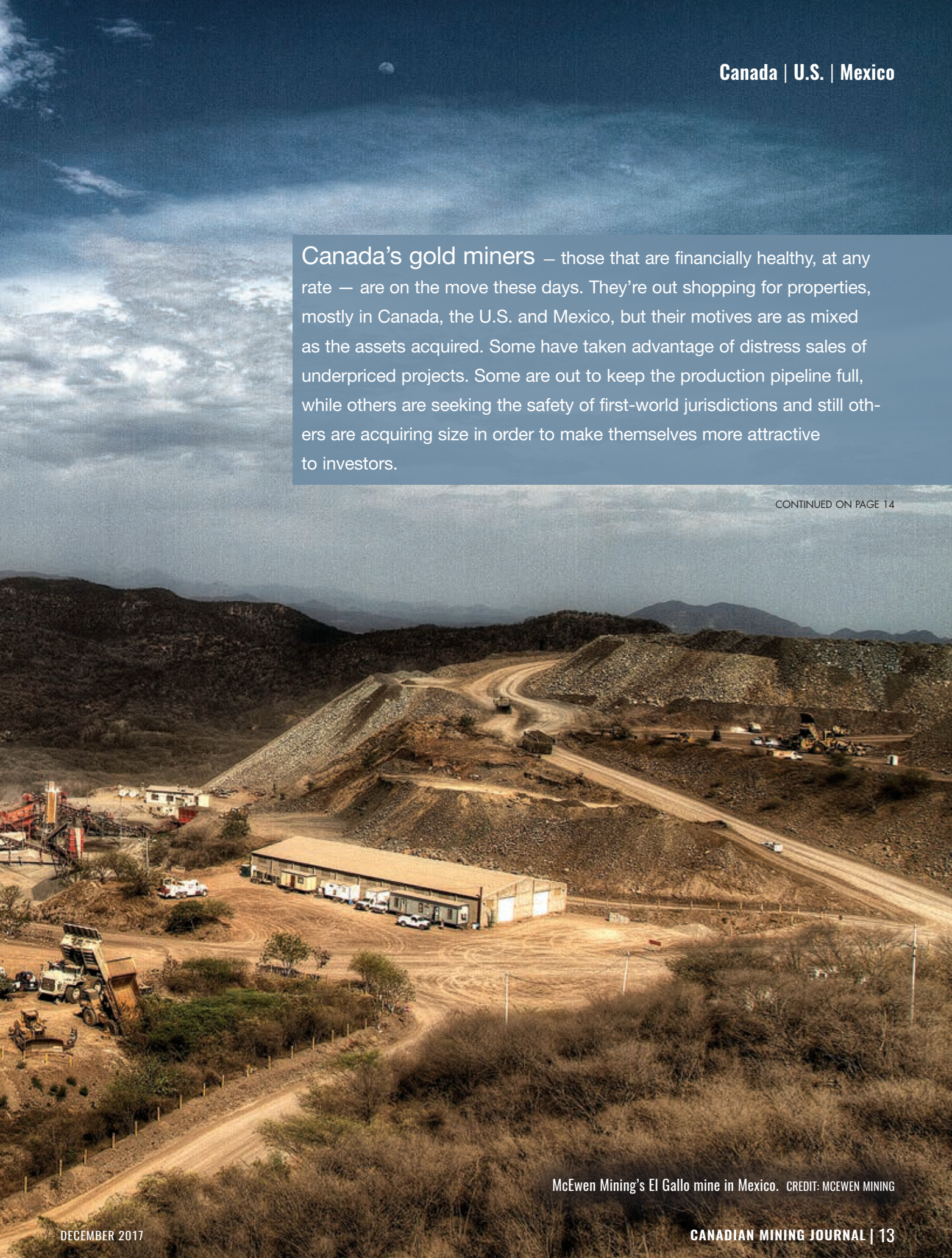

McEwen Mining's El Gallo mine in Mexico. CREDIT: MCEWEN MINING

Alamos Gold's Island gold mine in Ontario. CREDIT: ALAMOS GOLD

In October, Toronto-based McEwen Mining acquired the Black Fox mine, 65 km east of Timmins, Ont., from Primero Gold. Primero paid $300 million for the property in 2014, assumed $140 million in liabilities, spent $120 million on capital expenditures and exploration and then sold to McEwen for $35 million.

"We paid very little for it," says company founder and president Rob McEwen. "It diversifies and increases our production base and expands our exploration potential in one of the world's great gold districts."

The property was mined intermittently starting in the 1960s, but has been producing non-stop since May 2009 when previous owners began extracting ore from an open pit. That operation has since been shut down, but underground mining has been ongoing since October 2011 and was projected to yield 11,000 oz. of gold in the fourth quarter of this year.

The company will spend $15 million in the next 12 to 18 months on exploration and development. The mine is part of the Black Fox complex, which spans 17.5 sq. km, and McEwen says he and his team have identified several promising targets to explore. They also intend to develop new mine headings underground in order to increase the production and efficiency of the operation and to process more ore in their mill, which is currently running below capacity.

McEwen currently has a 49% interest in the San José mine in the Argentinian province of Santa Cruz and owns outright the El Gallo mine in Mexico's Sinaloa State in the northwestern part of the country. But both of these operations have short operating horizons based on current reserves – five years for San José, which is a high-grade underground operation, and two and a half years for El Gallo, which is an open pit.

> **"(Black Fox) diversifies and increases our production base and expands our exploration potential in one of the world's great gold districts.**
>
> – ROB MCEWEN, PRESIDENT OF MCEWEN MINING

McEwen is reasonably confident that exploration will yield new reserves at San José, but the company faces a couple of challenges at El Gallo. "Next year, we'll be close to the end of our oxide ores in Mexico," he says. "We've outlined a growing base of sulphide ores. Now we're looking for a way to treat them economically."

The other issue is Mexico's rampant crime and the company has experienced that first hand. "Two years ago we had a robbery at the mine," McEwen says. "They took $8 million worth of precipitate, which was covered by insurance, and there've been a number of other robberies down there."

Meantime, the company recently received its final permits to

begin construction of its open pit Gold Bar mine in Nevada. There is already equipment on site and McEwen hopes to have the mine in full production by late 2018. Gold Bar currently has a measured and indicated resource of 611,000 oz. in 22 million tons grading 0.95 g/t and 111,000 inferred oz. in 4.6 million tons grading 0.82 g/t gold.

Alamos scales up

Toronto-based Alamos Gold has three producing mines – Young-Davidson near Kirkland Lake, Ont. and Mulatos and El Chanate in the Mexican state of Sonora. It also has six development properties: three in Turkey, one in the U.S., another in Mexico and a third at Lynn Lake, Man. In mid-September, the company announced the acquisition of Richmont Mines and its underground Island Gold project in Dubreauville, Ont., 83 km northeast of Wawa.

The company pursued the Richmont deal for several reasons.

"I spent most of my career outside Canada," says Alamos president and CEO John McCluskey. "There have been a number of very high-profile blowups in Eritrea, Indonesia, the Philippines and certain countries in Africa. My instinct has been to see the value of Canadian assets and to look for good quality, long-life, low-cost underground mines."

The Island Gold project nicely fit those criteria. It has been in production for 10 years and was viewed as a low-grade, relatively shallow deposit until a new executive team, led by Renaud Adams, took control in August 2012. Renaud's group launched an aggressive exploration program. By the end of 2016, Richmont had completed nearly 42,000 metres of drilling and discovered deposits hosting as much as a million ounces of gold between 400 and 1,000 metres below surface and open at depth.

"The orebody was getting better the deeper they went," McCluskey says, noting it expanded from 4.5 metres in width to 6.5 metres while the grade improved from 4.8 g/t gold to over 9 g/t.

"They started to attract our attention two and a half years ago."

McCluskey's strategy has been to increase high-quality production and he's been doing it year over year. The company's output has grown from 140,000 oz. in 2014 to 380,000 oz. in 2015 and will exceed 400,000 oz. this year. Island Gold will add 100,000 oz. in 2018 and Alamos expects to hit 600,000 oz. in 2019 when one of its Turkish projects comes on stream.

"We're one of the fastest growing gold companies in the world," he says. "We're making money, we're debt free and we're financing growth out of cash flow."

Nevertheless, the company's stock has taken a pounding due to the power of huge investments funds that now dominate the markets. The stock was trading at just over $13 in August 2016, but had been knocked back to about $8 by March of this year after one of these funds dumped 25 million shares of Alamos. And even after the Richmont deal was announced, it hadn't recovered.

"The funds don't give a damn about technicalities, mine type or political risk," McCluskey says. "They're completely agnostic about the management team and the business. They're just driven by numbers. We need scale. We need to consolidate and

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The Triangle deposit at Eldorado Gold's Lamaque project, in Quebec. CREDIT: ELDORADO GOLD

achieve sufficient size. Our merger with Richmont makes perfect sense in the context of the stock markets."

Eldorado looks for quality first

Like Alamos, Eldorado Gold of Vancouver has three operating mines and annual production of just under 500,000 oz. The company has two gold mines in Turkey and a smaller silver-lead-zinc mine in Greece. In July 2017, Eldorado paid US$360 million to acquire the Vancouver-based junior Integra Gold and its Lamaque gold project near Val d'Or, Que.—the objective being to develop a high-grade underground mine capable of producing upwards of 125,000 oz. annually.

"We're agnostic when it comes to jurisdiction," says Jason Cho, vice-president, corporate development. "An asset needs to stand on its own technical merits and Lamaque ticked a lot of the boxes for us."

The property is located in Abitibi region, which has historically been one of the most productive mining camps in the world. It is adjacent to the town of Val d'Or, well served by infrastructure, and the company can draw on a highly skilled local labour force. Lamaque currently hosts indicated resources of 1.5 million oz. gold in 5.1 million tonnes grading 9.13 g/t (at a 5 g/t cutoff grade).

Eldorado plans to explore and develop the Triangle deposit within the Lamaque property. The latter includes the Sigma-Lamaque complex, which was previously mined by two majors, Placer Dome and Teck Corp., but Triangle is a new discovery where modern exploration and mining methods are being used.

The company is currently applying for a mining permit and will be applying for another to restart the tailings and mill on the property. Eldorado plans to issue a prefeasibility study in the first quarter of 2018. It is currently in the midst of an aggressive technical study that will include around 73,000 metres of drilling within the Triangle deposit not included in the March 2017 resource and another 17,00 metres elsewhere on the Lamaque property.

"We haven't come out with a specific date or time period for production," says Cho. "The expectation is that we would be shooting for production by late 2019 or early 2020."

Underground equipment at Lamaque. CREDIT: ELDORADO GOLD

Integra takes off the blinders

After selling Integra Gold, three former executives of the company launched a new venture called Integra Resources and in early September, they announced their first major deal — the acquisition of the DeLamar gold and silver project in southern Idaho from a subsidiary of Kinross Gold.

The property has been mined intermittently since the late 1800s, yielding 1.6 million oz. of gold and 100 million oz. of silver. But for almost two decades now, it has sat dormant. The last producing mine was a low-grade, near surface operation that was shut down due to low precious metal prices.

Integra CEO George Salamis and his team decided DeLamar was worth a second look despite its history as a producing property. For one thing, historical records from the end of the 19th and start of the 20th centuries showed high-grade veins yielding as much as 15 grams per ton below the shallow deposit.

Two views of Integra Resources' DeLamar project in Idaho. CREDIT: INTEGRA RESOURCES.

"When a mining company works an orebody over a long period of time, they put the blinders on," he says. "They've tested everything within the parameters of what they've been doing and they decide there's nothing there."

Salamis intends to prove them wrong by going deeper. His company plans to be "aggressive with the drill bit," just as they were at Lamaque. They've budgeted for 20,000 metres of drilling in the next 12 to 18 months. They will incorporate the results of their exploration program, along with the wealth of historical data and will publish a preliminary economic assessment based on the results.

As for their long-term plan, Salamis says it all depends on what they find, but he is confident there is a rich resource awaiting discovery at depth. **CMJ**

The Heart Corporation

nexa

PREMIER SHIFTS INTO HIGH GEAR

Ontario-focused explorer transforms into North America-focused gold producer

By Alisha Hiyate

In its early years, Thunder Bay, Ont.-based Premier Gold was strictly an exploration company, acquiring and exploring land in established mining camps in Canada.

The strategy was based on one day being acquired by a major. But that didn't happen for the company, which was spun out in 2006 of Wolfden Resources (a company that was acquired in 2007 for $363 million).

So instead, Premier's management decided to go the opposite way.

"We've been able to make some great acquisitions and have gone from 15, 16 months ago from having no mines to having two operations producing gold," says Ewan Downie, Premier's president and CEO.

Premier really started to shift its strategy when Ebe Sherkus, who had been an influential executive at Agnico Eagle Mines, joined the company as chairman in mid-2012.

"Ebe had participated very successfully in the growth of Agnico from being an explorer to a small producer to what today is one of the more respected producers, so part of the reason I wanted Ebe to join our company was because of his track record."

In deciding to pursue a path as a gold producer, the company's timing couldn't have been better. With the majors looking to trim debt by selling off non-core assets, Premier has jumped on opportunities to acquire high-quality gold production in the U.S. and Mexico over the last two years.

Now in addition to five exploration projects in different stages, Premier has two producing gold mines.

In 2016, its first year as a producer, the company produced 112,000 oz. gold, and it expects production to reach 130-140,000 oz. in 2017 at cash costs of US$580-610 per oz. (all in sustaining cash costs of US$660-690 per oz.).

In May 2015, Premier bought Goldcorp's 40% stake in South Arturo, a development project on the Carlin trend in Nevada in return for US$24 million and the transfer of a 5% stake in the Rahill-Bonanza project, a joint venture between the two companies in Red Lake, Ont. South Arturo, a JV with operator Barrick Gold, was permitted – Premier just had to put its share

Premier Gold's Mercedes mine in Sonora state, Mexico. CREDIT: PREMIER GOLD

of the development costs, which totalled US$99 million to the end of 2016, to reap the rewards.

South Arturo poured its first ounce in August 2016. Premier's share of production in 2017 is expected to be 50,000 to 55,000 oz. gold. Ore at the mine is processed at Barrick's Goldstrike mill, only 6 km away, keeping costs low. Open pit production at South Arturo could last for up to 8 or 9 years, and permitting is under way there for the El Nino underground development.

And in October 2016, Premier acquired the Mercedes mine in Sonora, Mexico, for US$140 million from Yamana Gold. The 2,000 t/d underground mine is expected to produce 85,000 to 90,000 oz. gold at cash costs of US$680 to US$710 per oz. (AISC of US$810 to US$840 per oz.)

"We were fortunate in the Mercedes acquisition that we acquired a completely de-risked and well operating mine," Downie says.

Downie considers the acquisition the actual marker of Premier becoming a producer, rather than South Arturo. "South Arturo is run by Barrick's Goldstrike mining team, so our input into the day to day mining is almost none and acquiring Mercedes, our input is every day."

The mine, which began production in 2011, has proven and probable reserves of 404,000 oz. gold and 3.3 million oz. silver in 2.9 million tonnes grading 4.32 g/t gold and 35.7 g/t silver. Premier has planned up to 50,000 metres of drilling to add to reserves and resources.

Risk averse

While Premier has been mostly focused in Ontario until recently, it did branch out with an exploration project in Baja California, Mexico, in 2008.

"Our desire would be to be mostly Canadian and U.S.-focused, but we've had a great experience so far in Mexico, so we view Mexico as quite favourable," Downie says.

Recent troubles that so many companies have had overseas or

CONTINUED ON PAGE 22

Premier's management and board at South Arturo in Nevada. CREDIT: PREMIER GOLD

even in different areas of Mexico just serve as reminders of why Premier has been so careful about the jurisdictions it operates in.

"We stick to known mining camps with a long history of past production that we view as being favourable towards mining. Even moreso, I'd say Canada and the U.S. – politically, both countries are very, very stable and if Trudeau is out and someone else is in, I wouldn't expect the whole stance of the country towards mining to change with the government."

North America-focused

Premier boasts a healthy $29-million exploration budget for 2017 – an amount that would be considered high for even a mid-size producer. That includes drilling at Mercedes to find more ore, the Hasaga project in Red Lake, and the Goldbanks project in Nevada, where the company is earning a 50% stake from Kinross Gold.

But Premier's next most advanced project after the next two developments planned at South Arturo (a permitted Phase 1 open pit and El Nino), is the Cove McCoy project in Nevada.

"We do have the permit to go underground there and we're completing a PEA and getting prepared to start advanced underground exploration towards completing a full feasibility study," Downie says.

The company's Greenstone development project in northern Ontario (which includes the Hard Rock deposit near Geraldton), a 50/50 joint venture with Centerra Gold, is currently in permitting. The EA and EIS were submitted just this summer. The project, which could produce 288,000 oz. gold per year for 14.5 years (a total of 4.2 million oz. gold), is by far Premier's largest. A November 2016 feasibility pegged the cost of development at $1.3 billion.

Still growing

As busy as the Premier team is with its growing portfolio of projects, they are always on the lookout for more.

"One thing I tell our team is no matter how good our projects are, let's not lose sight of there might be something better – and if we find something that's better, we should own it," Downie says.

Now classified as a Tier 3 producer, the company is focused on growing production to become a mid-tier (production of 350,000 oz. to 600,000 oz.).

"We would like to graduate into being a mid-tier, but very focused on cost," he adds.

Downie, who is one of Premier's top 10 shareholders, is aiming for the company to one day pay a dividend to its shareholders – an objective that seems quite possible if Premier can stay disciplined as it grows.

"I think the real indicator of how you're doing as a mining business is whether your cash balance is going up quarter to quarter – and is it going up because you issued shares or did some financing or is it going up because you're making money," Downie says. "In our peer group, I think we're far and above the greatest true cash flow generator." **CMJ**

A Cat autonomous truck at work at a Fortescue Metal Group iron ore mine in Australia. CREDIT: CATERPILLAR

CAT BRINGS PARTNERSHIPS TO THE FORE

By Alisha Hiyate

Every year, Caterpillar hosts a group of mining journalists at its Tinaja Hills Demonstration and Learning Center in Tucson, Ariz., to hear about its latest advancements in mining technology and to see first-hand how they work.

Ecuador has suffered the consequences. As the smallest member of OPEC, and one of the poorer countries in South America, Ecuador could see its economy contract further without attracting foreign capital, according to the International Monetary Fund.

This year, however, one of the biggest takeaways from the two-day program in September was not Caterpillar's new products, but the company's strategy. Over the past few years, that strategy has shifted from a focus on product offerings to one of partnerships and the "ecosystem" of solution providers that Caterpillar can offer its customers.

"A collaborative approach yields so much value for the customer as opposed to a transactional approach just selling Cat-branded technology," said Craig Watkins, mining technology sales support, one of more than 10 Cat representatives to present during the program.

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One obvious advantage is that Cat can access the expertise of its technology partners in specialized areas and combine that knowledge with its own expertise to bring new technologies to market.

"Partners enhance speed and agility to get things to customers," said Bill Dears, mining technology commercial manager.

In fact, the world's largest construction and mining equipment manufacturer even brought in some of its partners – Torc Robotics, Trimble, and Alight to name a few – to demonstrate the depth and advantages of its ecosystem approach.

Torc has expertise in autonomous vehicle technology and Cat has adopted some of Torc's technology in mining applications. The companies are also working together on a retrofit program that will allow Cat technology to control Komatsu 930E mining trucks. (Command for Hauling, Cat's autonomous hauling application within its MineStar system, will be available for use with the 930E trucks in the first quarter of 2019.)

Michael Fleming, CEO of Torc said that while self-driving trucks are already a mature technology, further advances and disruptions will happen in the space and a partnership model is needed as no one company has all the skill sets needed to adapt.

Cat's Watkins added that the partnership model allows Cat to focus on core capabilities so it doesn't get bogged down in details that Torc or other partners are better able to address.

Network services provider FTP Solution is helping Cat address the communications piece at mine sites, preventing hiccups in communication that can have a big financial impact. Building redundancies into communication systems has been one way to manage that, but Watkins said FTP is now evolving toward identifying breakdowns before they happen.

Trimble, which is a leader in industrial GPS and in hardware development, is working with Cat on making data more consistent at mine sites, where mismatched data often exists in various formats, originating from multiple sources.

Financial forecasting company, meanwhile, Alight can help mining companies gain better insight into their businesses to make better decisions.

Tough market

One could argue Cat had no choice but to change its strategy to deliver more to customers: the mining business hasn't been booming in recent years.

"In 2014, when the decision was made at Cat to execute this strategy, it was a dark time in mining," acknowledged Sean McGinnis, mining technology product manager.

For example, after a peak in the sale of large mining trucks (150-400 ton capacity) in 2012, there was a dramatic drop in demand. In 2016, the company's truck sales were down 95% from the peak numbers achieved in 2012.

The company has adjusted in the last three years by focusing on mine production systems rather than machines and on delivering autonomous solutions to its customers that are brand agnostic to accommodate mixed fleets.

Since big purchases are unlikely for a while as mining companies continue to watch their spending, the retrofit market is still the biggest for autonomy. So interoperability – giving customers the ability to use Cat Command with equipment made by other OEMs – will be key.

First up is the Komatsu 930E truck, but Cat is also working to get Command for Drilling to work with P&H drills (Komatsu).

> **"In 2014, when the decision was made at Cat to execute this strategy, it was a dark time in mining.**
>
> –SEAN MCGINNIS,
> MINING TECHNOLOGY PRODUCT MANAGER

Autonomous mining

Cat reports a surge in interest in autonomous systems since MineExpo in late 2016, with an increasing recognition among customers of the safety and productivity that autonomous systems offer.

"This year, we thought we'd do a couple of demos, but we've done 13," said Bill Dears.

Cat only started offering autonomous vehicles less than five years ago. The industry is still in the early stages of automation with autonomous trucks only accounting for a couple hundred of the 8-9,000 mining trucks operating around the world.

About 90 of the company's 793F autonomous trucks are in operation at

Jag Samaraweera leads a demonstration of Cat's autonomous haul technology.
CREDIT: ALISHA HIYATE

three different mine sites, said Jag Samaraweera, sales support consultant, mining technology at a live demonstration in Tucson. Before the end of the year, that number will reach 100.

"They've moved about 550 million tonnes autonomously in five years' time and they've done that, most proudly, safely," Samaraweera said.

The trucks have operated alongside manned trucks without a single lost-time accident.

"Being able to run manned and autonomous trucks together in the same site is a key differentiator that we've got with MineStar," Samaraweera said at the demo, as the visitors watched autonomous trucks in operation: waiting their turns to get into position to be loaded, and detecting and avoiding other vehicles or hazards in their paths.

Caterpillar's MineStar technology platform, which consists of a suite of applications including fleet management, safety, equipment health monitoring and other applications, can be used to optimize an entire mine site, whether it's manned or unmanned.

At the MineStar Command Centre next to the demonstration area, visitors got a glimpse at how autonomous vehicles work so seamlessly. It starts with a "Builder" at the mine site office, who builds a virtual mine plan that the trucks follow. The builder can customize truck operations according to conditions and act as a trouble shooter – for example, accounting for weather conditions or telling the trucks to avoid a developing pothole in its path. The trucks can also "see" what around them and avoid obstacles with the help of LiDAR (light detecting and ranging) technology and Cat Detect.

In addition, when manned vehicles are working side by side with autonomous vehicles, the operator of the manned vehicle can take control of the autonomous vehicle – telling it when it can enter an area and when to leave and go to the next point.

Cascading benefits

While only the 793F truck is fully autonomous now, soon all large Cat mining trucks will be available with autonomous operation.

Semi-autonomous operation of drills and LHDs has been available from Caterpillar for some time, and an autonomous solution for drills will be available in first quarter 2018. Semi-autonomous operation of dozers is in trials at four mine sites now.

Autonomy itself, however, is not really the goal – consistency is.

Eliminating variability has cascading benefits: For example, in drilling and blasting, when all holes are drilled to the exact same level, you will end up with a level surface to drive on right away, McGinnis noted.

Overall, there's about a 34% productivity and value improvement possible in drilling and blasting through automation, he said, including savings in capex, the cost of explosives, faster cycles and reduced maintenance, and increased and consistent crusher throughout.

In loading and hauling, the productivity improvement is even greater, up to 40%, through improved throughput, shortened dump times, and increased payload capacity.

Cat is also working on extending the benefits of automation to smaller mines, with the launch of NextGen MineStar in 2018. The platform will allow smaller mines to leverage digital information and intelligence. **CMJ**

MEASURING PUBLIC SUPPORT FOR mining in

Photos: Kalistratova, SL_Photography, xeni4ka – iStockimages

Over the past decade, Ecuador has not been the most hospitable country for Canadian mining companies. High taxes, well over the average for other Andean countries, and the sudden introduction of a "windfall profits" tax at the end of 2007, eventually forced Kinross Gold to shut down operations in 2013 after having spent five years advancing Fruta del Norte – what it called "one of the most exciting gold discoveries of the past 15 years."

Ecuador has suffered the consequences. As the smallest member of OPEC, and one of the poorer countries in South America, Ecuador could see its economy contract further without attracting foreign capital, according to the International Monetary Fund.

To reverse its economic fortunes, Ecuador has rebranded itself a mining-friendly

Ecuador

by Patrick Luciani

jurisdiction. Ecuador's mining minister, Javier Cordova, wants to attract US$5 billion in mining investments over the next few years, hoping to improve the living conditions of 15 million Ecuadorians.

The Economist Intelligence Unit has now forecast that foreign direct investment will rise quickly as long as the government continues to promote investment in its mining sector.

To encourage an infusion of capital and growth, Ecuador is once again open for business with new mining laws that reduce tax and royalty burdens for foreign miners. Though it was once shunned by Canadian miners, companies such as Lumina Gold are taking a second look. Lumina now has the second-largest package in Ecuador with excellent potential for gold and copper.

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Lundin Gold's Fruta del Norte project in Ecuador.

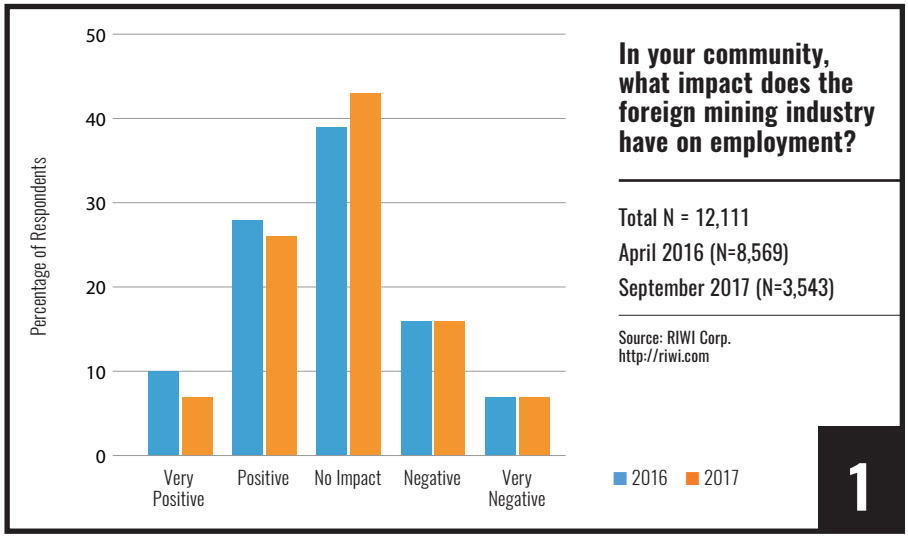
CREDIT: LUNDIN GOLD

"Mining is no longer a four-letter word in Ecuador," said Lukas Lundin, CEO of Lundin Gold at the Prospectors and Developers Association of Canada (PDAC) conference in Toronto in March 2016. Lundin, whose company is the current owner of Fruta del Norte, was referring to government policy.

But will the people follow?

Although the government of Ecuador appears to be fully committed to attracting foreign investment in an effort to catch up and compete with its neighbours in the region, one question remains: will the population support the government's plan to open the country to more foreign mining projects?

When Ecuador's mining minister appeared at PDAC in 2017, he wasn't the only Ecuadorian there. Representatives from the Mining Injustice Solidarity Network delivered a statement opposing the government's plans to expand mining operations in Ecuador. The statement was endorsed by over 20 Ecuadorian organizations claiming that mining brings various human rights violations and environmental destruction to the country.



Sentiment towards foreign mining investment

Companies looking to invest in Ecuador – or anywhere – need to have a better understanding of where the general public stands on foreign investments when it comes to mining. RIWI Corp., a Canadian Big Data company that specializes in public sentiment surveys and message tests in every region of the world, has conducted two independent public opinion surveys on evolving mining attitudes in Ecuador, comparing the data in 2016 and 2017.

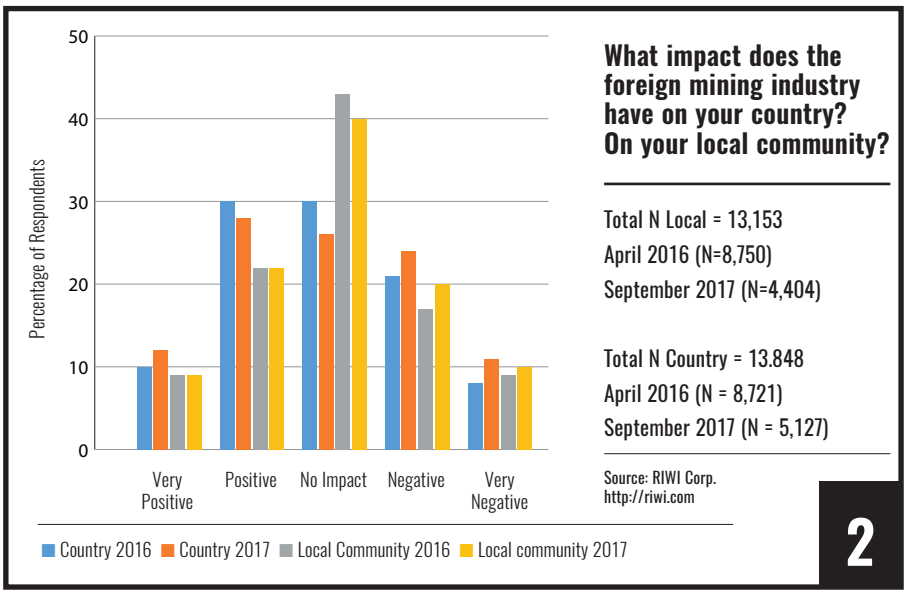
RIWI's data projects on Ecuadorian sentiment were conducted on the heels of the government's aggressive policy and rhetoric encouraging more mining investment. The first study was completed in the spring of 2016, followed by another in the summer of 2017 verifying its results. RIWI has previously applied its software to conduct attitude and sentiment analytics on the extractives industry in different regions of the world for the World Bank.

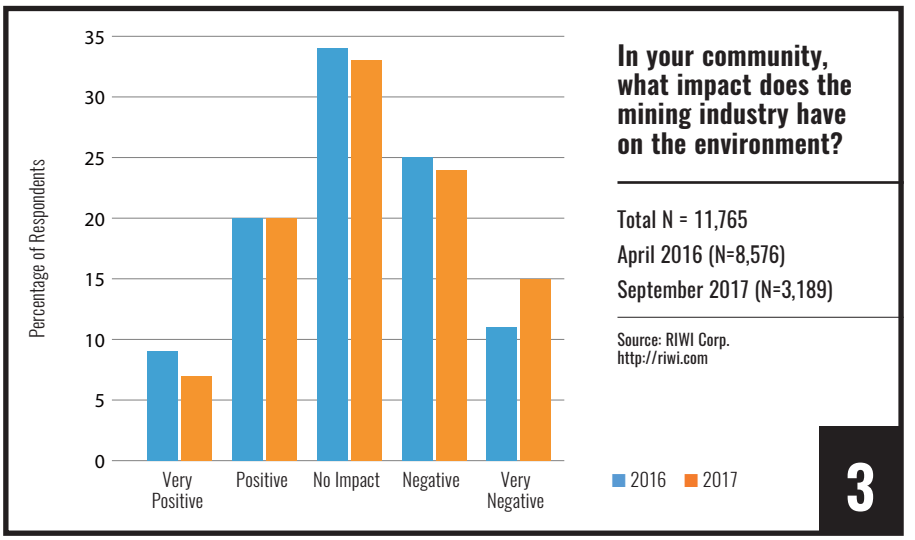
RIWI surveyed over 12,000 random Ecuadorians in 2016 and 2017 combined, who had access to the internet on any Web-enabled device, including low-cost mobile access in poorer areas. Along with gathering information on the impact mining has on local jobs, the local economy and the environment, these surveys also present data regarding educational levels, marital status, the number of residents in each home, or whether respondents lived in big or small towns or urban or rural areas.

For both 2016 and 2017, Ecuadorians saw foreign investment in mining as a net positive regarding its effect on local communities and employment. As far as the impact on the environment, the results were evenly split between those who felt strongly one way or the other.

Chart 1 shows that 33% of respondents considered the impact on jobs was either very positive or positive compared to 23% who felt the impact was negative or very negative. Forty per cent answered that mining had no impact on employment. These numbers shouldn't come as a surprise given the high levels of unemployment in the country. Among those who completed the RIWI survey, 17% were looking for work in 2017. This high level of unemployment among those interviewed might help explain the relatively high levels of overall support for more foreign investment.

Chart 2 shows that Ecuadorians were generally optimistic about the benefits





of foreign investments in mining. Asked about the impact of such investment on the country as a whole, 40% of respondents answered that the impact would be either very positive or positive compared to 35% who believed the impact would be negative or very negative. When it comes to their local community, 30% of respondents believed the benefits of foreign mining investment outweigh the costs while 27% believed that more investment in mining would have a negative impact on their communities.

If there is one area where respondents showed more pessimism about foreign investment, it was regarding the environment. In **Chart 3** we see that 27% thought the impact on the environment would be very positive or positive while 39% felt the opposite. Seen in a different light, 34% saw no environmental impact from increased foreign mining putting those who were positive or neutral about the impacts on the environment in the majority.

Summary

Local opposition to Ecuadorian mining indeed exists, but this opposition does not appear to be shared by the general population. The government of Ecuador is pursuing an economic policy that is more or less in keeping with the will of the majority of its citizens.

The move to open Ecuador's resource development is good news for Canadian mining companies. However, taking risks in developing countries today involves more than assessing new tax levels, royalties, and regulatory rules. Companies have to do their homework on a range of social and political issues that require buy-in from all sectors of the population, particularly Indigenous peoples and environmental groups.

Modern mining is as much about understanding public attitudes to resource development as extraction itself. That's why it's crucial to gather and monitor attitudes to mining locally and nationally. As more people have greater access to the internet, it is becoming easier for miners to measure shifting public perceptions on social and political issues through companies such as RIWI. By seeking out this type of information, miners can gain a better understanding of the true level of support they might expect to see, and even gain insight into how to build a case for their project to increase that support. **CMJ**

Patrick Luciani is Senior Fellow at the Global Cities Institute at the University of Toronto. He has engaged RIWI to do research on public attitudes in Mexico towards a sugar tax.

■ *RIWI has a U.S. patent for its Random Domain Intercept technology to gather random data on public attitudes around the world.*

SEVEN trends driving drone adoption

Since mining and aggregates companies first started to adopt drone technology several years ago, it has saved them time and money while increasing safety.

As a result, miners have embraced the technology and are finding more ways to use the.

"Three years ago, you could count the number of drones in mines, construction, and quarries on your hands and feet," said Mike Winn, a cofounder of DroneDeploy.

"Now, there are thousands of them and in the not too distant future there will be not just one drone per job site, but actually multiple, and you'll see them flying frequently across these sites."

Drones are now firmly entrenched in applications such as volumetrics, mapping, and equipment inspection, *CMJ* heard at InterDrone.

So now that drones are being embraced by the mining sector, what are some of the future trends in the industry?

Drones are going in-house

Many companies started out intending to sell drone flying services or actual drones to customers, but the dominant companies in the space offer more. They have software that makes stockpile reconciliation, contour mapping, blasting, mine planning and day-to-day operations cheaper and easier to manage.

Mining companies have stepped up to buy and fly their own drones, realizing it's the most practical and cost-effective way to make use of the technology.

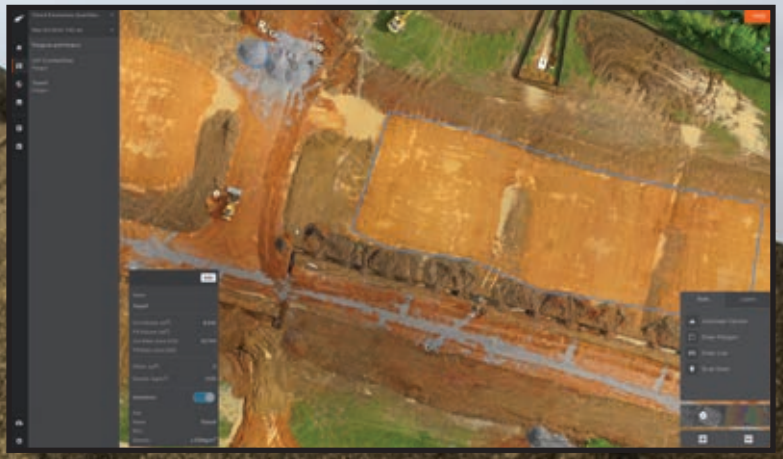
"It's hard to see this industry scale if people are not buying their own drones," said Lewis Graham, president and chief technical officer of GeoCue Group.

"The way we see it moving forward is more and more mining companies are going to internalize the actual flying. We have customers today that are flying their own drones that two years ago said they would never think about doing this – so we have seen that shift and it's all about scale," Graham said. "They themselves really can't see how to do it in an affordable way without internalizing at least a part of it."

Besides, companies have made the drones and the software that processes droned data, easy to use.

"Drones are a lot simpler than you might think to operate," says Winn of DroneDeploy. "Images are uploaded to our cloud

In September, *CMJ* headed to the annual InterDrone conference in Las Vegas, speaking with several companies in the drone service and software business, and moderating a panel on the use of drones in mining. Here's what we found.



Kespry's drone; Inset: Kespry's software makes volumes of material easy to measure and track. CREDIT: KESPRY

and we process them into 3-D models. The whole process is designed to be very easy."

With the most popular drone in the industry – the Phantom 4Pro only around US$1,500, there's no barrier for smaller companies/operations to make use of the technology.

However, most companies still rely on service providers to ensure they're making the most of the technology.

"Most of our clients self-perform," said Adam Rice, business development director at Kespry. "They engage Kespry a lot in what they're looking to do to help solve the problem and build some sort of protocol for collecting data that meets their needs."

Drone data can unlock productivity

In an industry that's been focused on productivity, drone data offers new ways to unlock those advances, says Francis Vierboom, co-CEO of Propeller Aero.

He notes that while information technology has turned ecommerce, finance, consumer electronics and other industries upside down, there are a lot of things on large work sites in the mining, construction and heavy civil engineering fields that look the same as they did 20 years ago.

"The pace of change hasn't been the same and I think it's been hard for those industries to benefit from all of the information technology that has been available," he says. "There's a lot of spreadsheets out there at construction sites."

Although there have been productivity improvements, Vierboom says drone data opens up another level of innovation and productivity gains.

"A big part of it is just the fact that there's a new kind of information that is actually going to empower people to do a lot more themselves with this information. And because it's so visual, it's easier for work site teams to comprehend and collaborate on.

"We are finding that as people adopt Propeller as a visualization platform for their drone data, they're discovering a really wide range of different impacts they can have on a number of workflows that they do. So because you have this shared, every-

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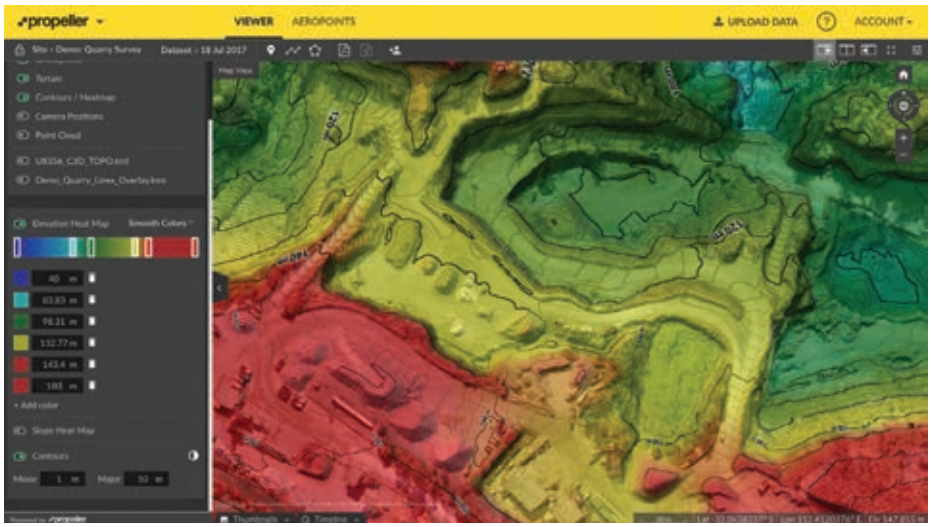

A quarry elevation heat map with contour lines. CREDIT: PROPELLER AERO

one on the same page, repository of info, it ends up being just kind of a normal background part of meetings."

Automation

Drones are starting to be used to collect data input for automated machine control – for example, to provide a good topographic map to feed data into equipment like autonomous haul trucks. Graham sees this trend as a main driver in the future for the drone business.

"Companies like Rio Tinto are already doing it and it will come down to smaller businesses," he says. "But to do that, you have to fly every day – it can't happen every week, you have to map every single day, you need a new topography to run equipment."

New uses continue to evolve

GeoCue's Graham says mining clients are always asking about new ways to use drones.

"When we first started selling technology to the mining industry, we focused on volumetrics because that was the thing they needed to do," he said. "But once they realize the value of being able to put a sensor anywhere they need to put a sensor – which is really the only purpose a drone serves – they're really inventing new ways of using them on a weekly basis."

Graham adds this trends will spur the development of new sensors that can be flown on drones.

While sensors are currently limited, with optical, infrared and basic laser scanners being the main types, Graham sees the development of new sensors that can be flown on drones in the future (for example, vibration or magnetometer).

Adam Rice of Kespry agreed, adding: "We're at the tip of the iceberg and the thing that's going to diversify application is sensor integration – being able to put different sensors and automate some of the answers that you can get back," he said. "There's going to be a true marriage of the physical and digital states in an industry that hasn't really changed a lot."

Rice says another evolving area is integration of drone data with other third-party systems that mining companies may use. Bringing the raw data into software you can use to manipulate 3-D data like Vulcan or Surpac will lead to new applications of the data.

Integrating the data into ERP (enterprise resource planning) systems such as SAP could also lead to new insights, such as in sales forecasting based on inventory.

Accuracy will continue to improve

The question of accuracy in aerial mapping is a complex one. A survey can be relatively accurate (the position of one point to another in a map or model) without having a high degree of absolute accuracy (how closely a point on a map or model corresponds with its actual physical coordinates).

Using ground control points – markers on the ground that are placed strategically around the mapping area – will increase absolute accuracy, although this level of accuracy isn't necessary for all applications (such as volumetrics).

"Accuracy needs to be product driven," Winn said. "In different scenarios, you need different things. Just orthomosaic (individual images that are stitched together to form a composite) can be very useful – not necessarily to make all your comparisons against, but actually give you a very good sense of what's going on and give you a useful volumetric record."

A lot of drone software presents data in a powerful, attractive and easy to grasp visual form. But that doesn't mean it's accurate.

It can be instructive for companies to experiment with drone technology to understand the value they can get from it and potential pitfalls, says Winn.

"You can actually start quite small – it costs $1,000 to buy a drone on Amazon – and its's really good to pair that bottom up approach with working top down."

Doing so will help companies answer questions such as: "What is the process for me to scale this across my organization? What do I need to be able to share data? What does my CEO need?"

Advances in drone hardware

There are limitations to UAVs in terms of flying time, flying conditions, and the cameras and sensors they can fly.

"People always want a drone that flies longer," said Kespry's Rice. "They always want a drone that flies in 45 mile an hour winds and torrential downpours – so there are going to be some operational improvements that the industry's going to be able to provide."

Big Data

Lastly, drone data will be another Big Data input that will have future implications for businesses.

"Looking into the future, there are really important reasons to start building up this data set," Vierboom said. "It is like an actual record of your site every day, and having a record of your site that reaches back for years is going to open up big efficiency opportunities. It's one of those things that companies need to start building today to be able to have that advantage in the future." **CMJ**

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Dealing with the avarice of the state

By Sander Grieve

Almost as soon as life returned to the mining commodities sector and capital started to come back into the space, resource nationalism has re-emerged as a major threat to miners.

The same jurisdictions that have enjoyed years of capital investment by miners – Western Australia, Greece, Tanzania, Indonesia, South Africa, Zambia and elsewhere – have recently looked to miners to try to solve their fiscal problems.

Despite mining companies being a major employer, often responsible for the entirety of the economy in certain regions, governments see mining companies as easy prey. What better target than a company that won't show up at the ballot box, is typically barred from donating to the political process, and won't march in any street protest. When finances tighten and governments look to cover their profligacy, increasing taxes and royalties in conjunction with political attacks on mining companies appears to be an all too elegant solution. Companies need to be wary and engage in defensive tactics quickly.

The latest analysis

EY's recent study, Top Ten Business Risks Facing Mining and Metals 2017-18, identifies resource nationalism as back this year at number five. While the challenge isn't new to mining companies, some of the approaches being taken are. EY writes, "[m]any governments and tax authorities have a new view of resource nationalism and will seek to increase the level of tax raised from the sector through controversy and disputes, with a shifting of focus to the way businesses are structured rather than what was attempted in the earlier part of this decade, through creating new mining taxes or increasing royalty rates."

So while countries are getting more creative in how they approach their cash problems, their solution remains the same. Rely on mining companies for an easy revenue grab. This easy answer does not, however, reflect the realities of mining. Successful projects require long-term and carefully executed exploration and development, which often stretches past the term of one elected government. This timeline and the prospectivity of the ground may lead some investors to ignore political uncertainty, but investors do take notice. The Fraser Institute's latest survey of mining companies, which ranks countries based on their policies toward miners, lists South Africa, Greece and Indonesia – all countries with a penchant for resource nationalism – as 84th, 91st and 99th, respectively, out of 104 countries.

Why us?

Like it or not, mining companies are easy targets for governments in developing nations. Mining projects are incredibly capital intensive and governments know they are there for the long term. Governments can also pull the lever of infrastructure, including the cost of power, which can be used to shift costs to industry.

Increased taxes, royalties, putting in import-export restrictions or redefining a country's mining laws may go so far as to constitute expropriation creep. Any of these changes may fall short of expropriation, but when taken to extremes can have severe and significant impacts on the mining companies that do business in that jurisdiction. Ultimately, they can lead the companies to abandon future investment in the face of regulatory hostility.

How to deal with the new, old challenge

Companies are not without tools to respond to rising risks. They should be thinking about how to do all of this.

- Engage and ask their employees to engage. Initiatives to publish tax and other contributions provide a basis to demonstrate contributions made to the host communities. To the extent permitted by law, engage with the community to clearly and regularly communicate the investment in the community and the benefits of their presence. Encourage employees to speak up for the industry that is changing lives for the better through stable and lucrative employment.

- Use their home government (and the home government of their investors) to pressure the host governments to respect the international rules, and the conditions put in place to encourage the investment in the first place.

- Consider the rules carefully. Structure activities, where possible, to fall within investment protection agreements. Encourage your home government to pursue or expand such agreements with the host government.

- Communicate the pricing of risk in the marketplace to the home government and try to get them to join in investment promotion activities by joining roadshows and making commitments to encourage further investment. **CMJ**

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