

# Building mines of tomorrow

The mining industry in  
British Columbia in 2018



**pwc**

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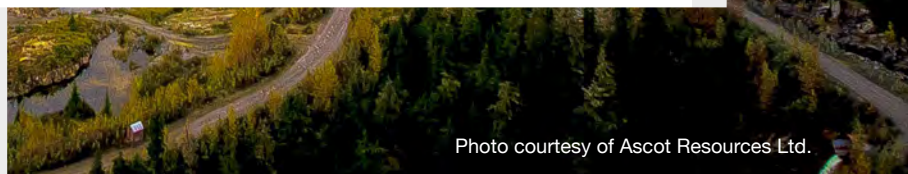
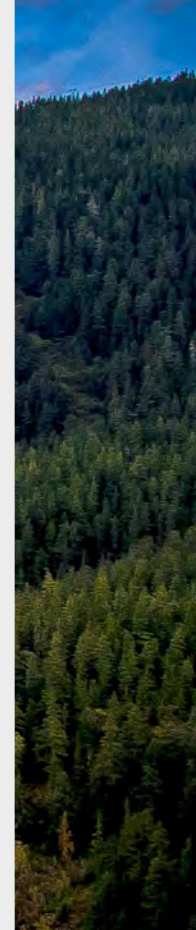
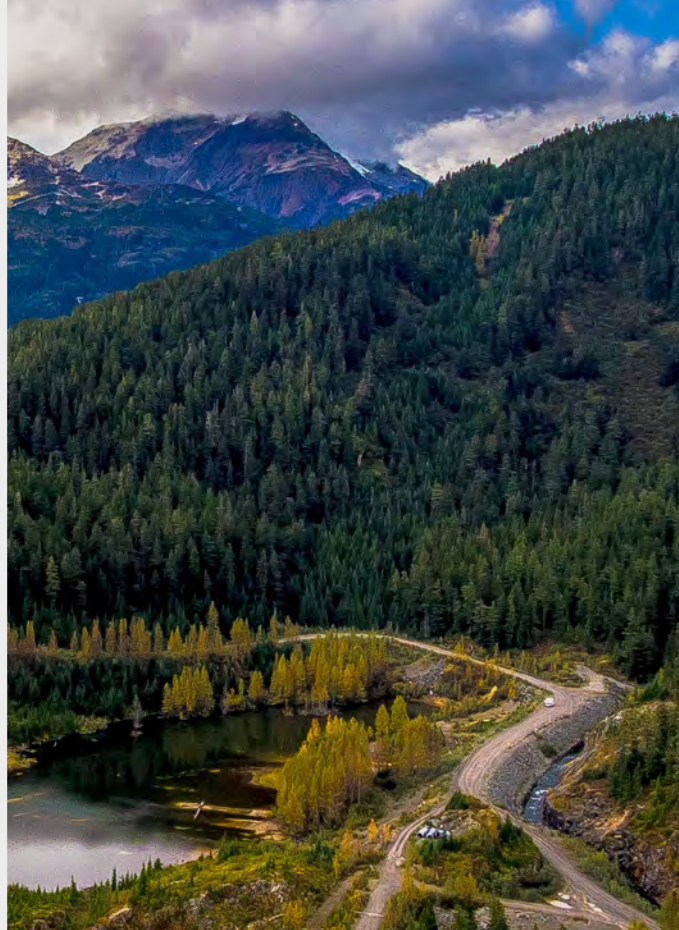


Photo courtesy of Ascot Resources Ltd.

## Preface

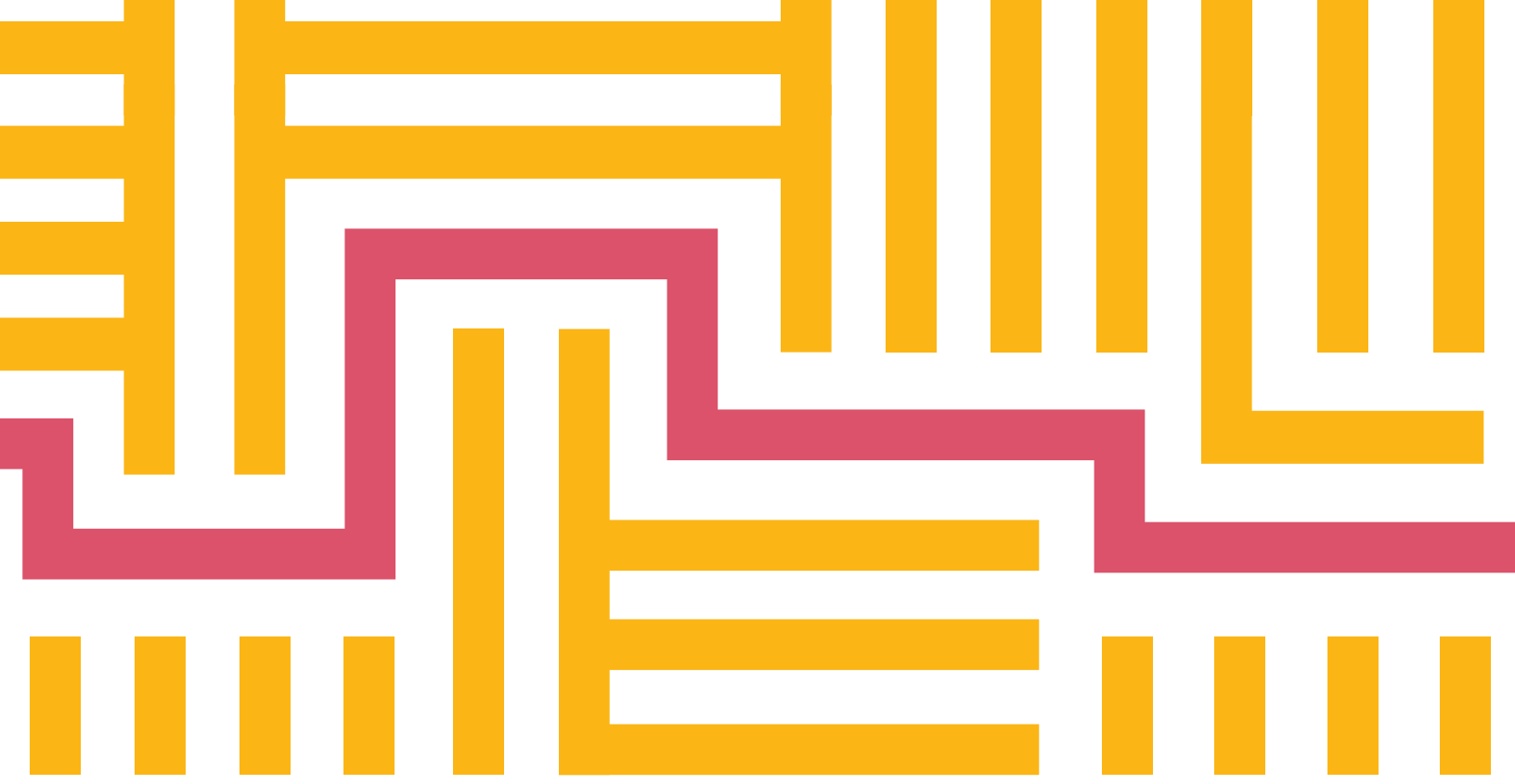
We are pleased to present our 51st annual British Columbia mining report. This edition looks at the financial results for the province's mining industry in 2018.

It has been a busy time for the mining industry across the province. There were a handful of mergers and acquisitions in 2018 and into the first few months of 2019, including Taseko Mines Ltd.'s purchase of Yellowhead Mining Inc. and Newmont Mining Corp.'s acquisition of a 50% interest in the Galore Creek Partnership from Novagold Resources Inc. (to form a partnership with Teck Resources Ltd.). Newmont also recently closed its deal to buy Vancouver-based Goldcorp Inc.

Ascot Resources Ltd. has also been increasing its position in the historic Golden Triangle region

of northeastern British Columbia after buying the Silver Coin property and then IDM Mining Ltd., with its flagship Red Mountain gold project. Imperial Metals Corp. announced an agreement earlier this year to sell a 70% interest in its Red Chris copper and gold asset to Australia's Newcrest Mining Ltd. The companies have formed a joint venture for the operation of the Red Chris asset, with Newcrest acting as operator. The investment follows Imperial's decision to suspend operations at its Mount Polley mine, due to declining copper prices.

While a slow, steady turnaround in the mining industry appears to be underway after an extended period of depressed prices, the optimism is somewhat tempered by ongoing economic and regulatory concerns. As the Mining Association of British Columbia (MABC) discusses



later in this report, regulatory changes, such as the province's carbon tax framework and changes to the BC Environmental Assessment Act, are having an adverse effect on British Columbia's competitiveness and creating significant concerns for the BC mining industry.

Still, there's much to look forward to in the industry. This year's report includes an article on the continuing regeneration of the Golden Triangle area, which has been a significant contributor to the BC mining industry over the years, particularly in terms of gold and silver production. The article features the progress Ascot Resources is making in this area with its projects, as well as its role in boosting economic activity in the southern part of the Golden Triangle.

We also acknowledge the importance of technological advancement and innovation in the mining industry and focus on some of the exciting partnerships being forged by Teck Resources to help improve safety, sustainability and productivity at its operations.

The report also includes our annual overview of economic indicators from BC mining companies, including revenues, capital expenditures, employment and total payments to government. The results are based on an in-depth survey independently prepared by PwC with the co-

operation and assistance of mining companies with operations and activities across the province. This year's survey includes 24 participants: 17 operating mines, six projects in the exploration or development stage and one smelter.

A special thanks to mining companies that took part in this year's survey and to MABC for its assistance and its perspective on mining's vital role in, and contributions to, the BC economy.

We hope you find the information and articles interesting and look forward to presenting the British Columbia mining report again next year.



**Mark Platt**  
Mining partner,  
PwC Canada

# Participants



- X Operating
- Exploration or development
- Highway 37

## Exploration or development stage

Head Office – BC Exploration  
*Teck Resources Ltd.*

Galore Creek  
*Galore Creek Partnership*

KSM  
*Seabridge Gold Inc.*

Premier - Dilworth  
*Ascot Resources Ltd.*

Red Mountain  
*Ascot Resources Ltd.*

Blackwater  
*New Gold Inc.*

## Operating

**Brucejack**  
*Pretium Resources Inc.*

**Copper Mountain**  
*Copper Mountain Mining Corp.*

**Gibraltar**  
*Taseko Mines Ltd.*

**Coal Mountain**  
*Teck Resources Ltd.*

**Elkview**  
*Teck Resources Ltd.*

**Fording River**  
*Teck Resources Ltd.*

**Greenhills**  
*Teck Resources Ltd.*

**Highland Valley Copper**  
*Teck Resources Ltd.*

**Line Creek**  
*Teck Resources Ltd.*

**Trail Metal Smelter Operations**  
*Teck Resources Ltd.*

**Mount Milligan**  
*Centerra Gold Inc.*

**Mount Polley**  
*Imperial Metals Corp.*

**Red Chris**  
*Imperial Metals Corp.*

**New Afton**  
*New Gold Inc.*

**Brule**  
*Conuma Coal Resources Ltd.*

**Willow Creek**  
*Conuma Coal Resources Ltd.*

**Wolverine**  
*Conuma Coal Resources Ltd.*

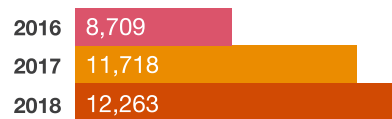
**Silvertip**  
*Coeur Mining Inc.*

# Executive summary

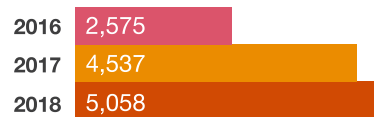
The steady recovery in British Columbia's mining industry continued in 2018 with revenues and operating cash flows generated by survey participants both reaching record highs. The development of new projects and revival of existing ones, alongside the stabilization of commodity prices, provided enough of a boost to offset some setbacks and signalled an upward trend for the sector in British Columbia.

Prices of most metals and minerals produced in the province improved in 2018, although they remain below record or near-record levels set in 2011. On average, copper prices were 6% higher in 2018 relative to 2017, while metallurgical coal prices rose an average of 5% year-over-year. The average price of metals such as zinc, lead and gold remained consistent with 2017, while the price of silver was down 8%.

## Gross mining revenues (\$CAD millions)



## Cash flow from operations (\$CAD millions)



## Statistical summary

(\$CAD millions, except where otherwise noted)

	2018	2017	2016
Gross mining revenues	12,263	11,718	8,709
Net mining revenues <sup>1</sup>	10,698	10,145	7,341
Net income (pre-tax)	3,521	3,545	1,418
Cash flow from operations	5,058	4,537	2,575
Total assets	18,317	16,855	17,537
Pre-tax return on shareholders' investment (%)	27.6	34.7	13.5
Direct employment (number of employees)	11,281	10,221	9,329
Payments to governments <sup>2</sup>	953	884	650
Exploration and development expenditures	95	92	102
Capital expenditures	1,204	1,484	1,370

### Notes

1. Net mining revenues are reported after deduction of smelting and refining charges, freight costs, and marketing.
2. Includes mineral taxes, other levies and payments related to employment but not corporate income taxes.

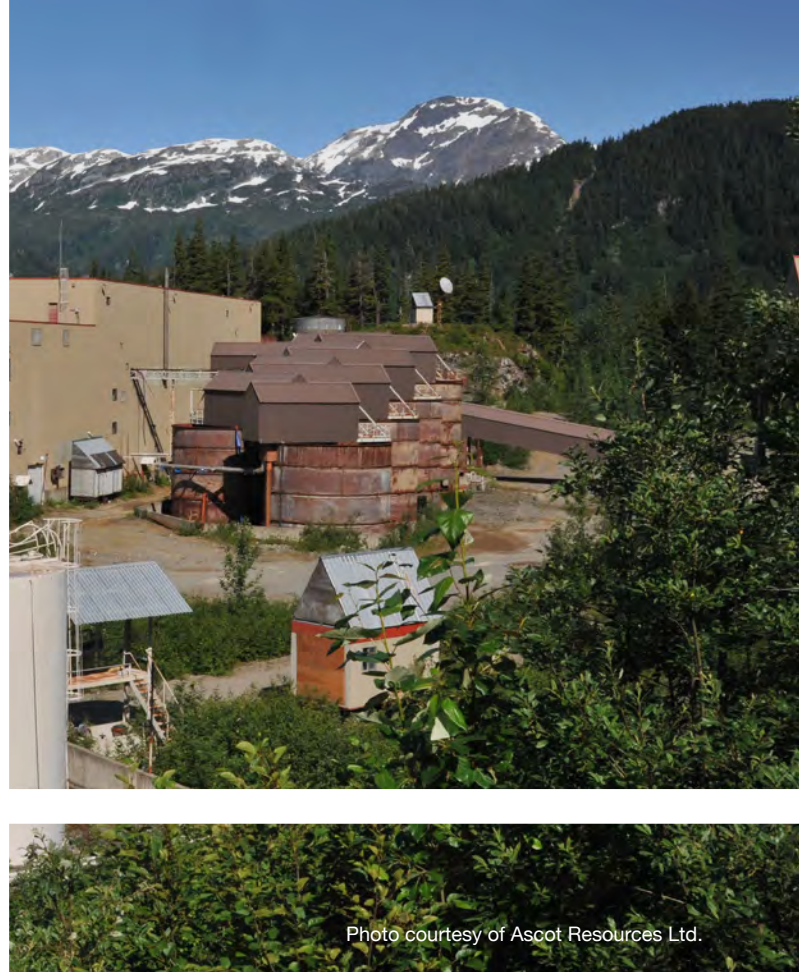


Photo courtesy of Ascot Resources Ltd.

Higher prices led to an increase in revenue and net income at mining companies across the province in 2018. Gross mining revenue from BC operations hit a record high of \$12.3 billion, up from \$11.7 billion in 2017. Net mining revenue—which is after cost deductions for treatment and refining, freight and transportation and sales and marketing—was \$10.7 billion, an increase from \$10.1 billion in 2017. Net income before taxes was consistent with 2017 at \$3.5 billion, while cash flow from operations came in at \$5.1 billion compared to \$4.5 billion a year earlier.

Capital expenditures fell to \$1.2 billion from \$1.5 billion in 2017, as more projects moved into production and construction costs reduced. Exploration and development expenditures increased significantly to \$95 million from \$92 million in 2017.

Underlining the importance of the industry to provincial coffers, total payments to governments increased to \$953 million from \$843 million a year earlier, which reflects the higher revenues generated by mining operations across the province. These payments have doubled in the last five years and, it's important to note, don't

include the income taxes paid by employees of the industry or the corporate income taxes paid by the companies that run these mines. These additional payments would also amount to hundreds of millions of dollars being paid to governments from the BC mining industry.

The industry continues to demonstrate its role as a significant creator of jobs in British Columbia. In 2018, there were 11,281 direct jobs at the companies that participated in this year's survey, which was up more than 10% from a year earlier. As has been the case for decades, many of these positions are well paid and help support families and communities across the province.

These results suggest that confidence and investment are returning to British Columbia's mining industry. As always, there are some success stories and some struggles. The key for the future is for British Columbia to strive to encourage responsible new investment in the province to maintain the pipeline of projects that eventually turn into mines. Investments in exploration projects today will lead to the producing mines in the next decade and beyond.



# The financial picture

**Below is a summary of the financial picture, based on the results of BC mining companies surveyed for 2018:**

**Gross mining revenue** from survey participants totalled \$12.3 billion, compared to \$11.7 billion in 2017 and \$8.7 billion in 2016. The increase was driven by higher prices for key metals and minerals produced in British Columbia, primarily metallurgical coal but also copper. Metallurgical coal operations in the province saw overall revenues increase to \$7 billion in 2018 from \$6.3 billion in 2017. While Teck Resources is by far

the largest producer of metallurgical coal in the province, an important element of the increase is also the continuing growth of Conuma Coal, which brought the Willow Creek mine into production in June 2018. Also, with Pretium Resources' Brucejack gold mine beginning commercial production in July 2017, we saw a full year of revenues from the mine in 2018 for the first time, which added over \$300 million to gross revenues.

**Net mining revenue**, which is made up of gross mining revenue less treatment and refining charges, freight and transport and sales and marketing,

was \$10.7 billion, an increase from \$10.1 billion in 2017, driven primarily by the increase in gross mining revenue. The average realized price of copper increased by 6%, metallurgical coal was 5% higher than in 2017 and zinc and gold were both up 1% over the previous year. Silver and lead decreased by 8% and 3%, respectively, from 2017.

**Net income** before taxes remained consistent at \$3.5 billion for both 2018 and 2017 but was up substantially from \$1.4 billion in 2016. The increase is primarily driven by increased revenues but is also impacted by changes in underlying costs, notably salary increases due to higher employee numbers at surveyed mines.

**Cash flow from operations** came in at \$5.1 billion, compared to \$4.5 billion in 2017 and \$2.6 billion in 2016. The sustained strong cash flow results were substantially driven by strong metallurgical coal revenue performance, with additional positive impacts coming from Brucejack producing for the entire year, the improved performance from Teck's Highland Valley and Trail smelter operations and Conuma's metallurgical coal mining operations, during the year.

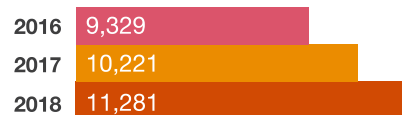
**Capital expenditures** were \$1.2 billion compared to \$1.5 billion in 2017 and \$1.4 billion in 2016. There was a significant decrease in capital spending at Pretium's Brucejack mine in 2018 as the mine went into commercial production mid-year 2017.

**Exploration and development expenditures** were \$95 million, compared to \$92 million in 2017 and \$102 million in 2016. The 2018 expenditures were largely driven by continued development activities at Seabridge Gold's KSM project and New Gold's Afton project.

#### Net income (\$CAD millions)



#### Direct employment (number of mining employees)



**Total payments to government** increased to \$953 million from \$884 million in 2017 and \$650 million in 2016. The increase was driven by employment taxes as the number of individuals working in the surveyed operations increased year over year, as well as a rise in carbon tax and taxes on fuel. The remaining payments for mining-related taxes to provincial and municipal governments were consistent with 2017.

**Return on shareholder investment** was 27.6% before tax, compared to 34.7% in 2017 and 13.5% in 2016. This return is among the highest we have seen in recent years.

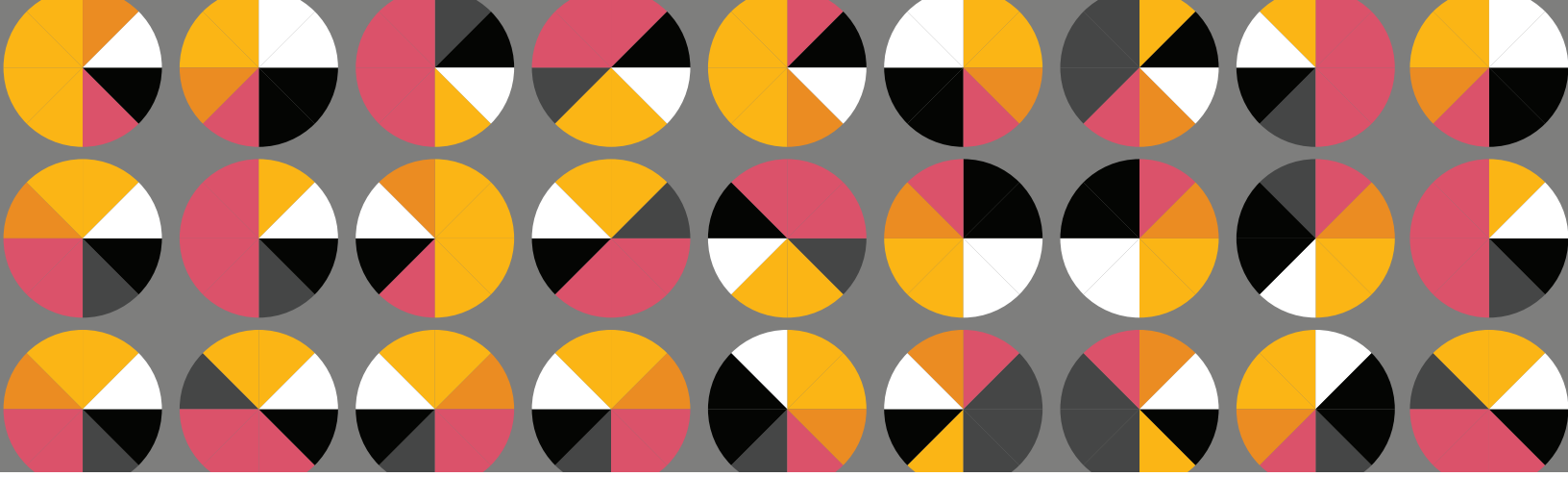
**Labour overview:** The number of people working in direct jobs at survey participants increased to 11,281, compared to 10,221 in 2017 and 9,329 in 2016, partly as a result of the impact of the opening of Conuma Coal's Willow Creek mine during the year and also from increased production at Teck's operations.

#### Earnings summary

(\$CAD millions, except where otherwise noted)

	2018	2017	2016
Gross mining revenues	12,263	11,718	8,70t9
Less: deductions	1,565	1,573	1,368
Net mining revenues	10,698	10,145	7,341
Less: operating costs and other expenses	7,488	6,510	6,011
Other income	(311)	(90)	88
Net income (pre-tax)	3,521	3,545	1,418





## The Golden Triangle

# Investment returns to this historic BC mining region

The Golden Triangle in the northwest corner of British Columbia is one of the world's most prolific and storied mining regions, dating back to the 1860s, before Canada officially became a country. The area has seen its share of boom-and-bust cycles over the past 150 or so years, driven by dramatic price swings for its key producing metals such as gold, silver and copper. In recent decades, the region has been largely depressed due to a drop in metal prices. Its remote location and lack of infrastructure were also seen as a deterrent for investors.

Times have changed. Today, thanks to various infrastructure improvements, relatively stable commodity prices and newly discovered deposits, investment in the Golden Triangle has picked

up once again. The area is now home to some of the world's most promising new mines and mining projects such as Pretium Resources Inc.'s Brucejack Mine and Seabridge Gold Inc.'s KSM Project, among others. Skeena Resources Ltd. is also working to revive the Snip and Eskay Creek mines in the Golden Triangle, which were two of Canada's most successful high-grade precious metal mines in the 1980s and 1990s.

### New player in the Triangle

One of the most active players in the area in recent years has been Ascot Resources Ltd., which is working to revive the Premier gold and silver mine, one of the most profitable underground mines in North America in the first half of the 20th century. The underground mine opened in 1918 and was the largest gold mine in North America until its closure in 1952. By that time, it had produced two million ounces of gold and 45 million ounces of silver. It was operated as an open pit mine in the 1990s before being closed in 2001 due to depressed gold prices. In July 2017, Ascot entered into an agreement with Boliden Ltd. to purchase the property. The deal closed in October 2018, and the mine is now known as the Premier-Dilworth property, after being combined with the Dilworth site already owned by Ascot.

Ascot continues to define high-grade resources for underground mining with the near-term goal of converting the underground resources into reserves. The company has also doubled down

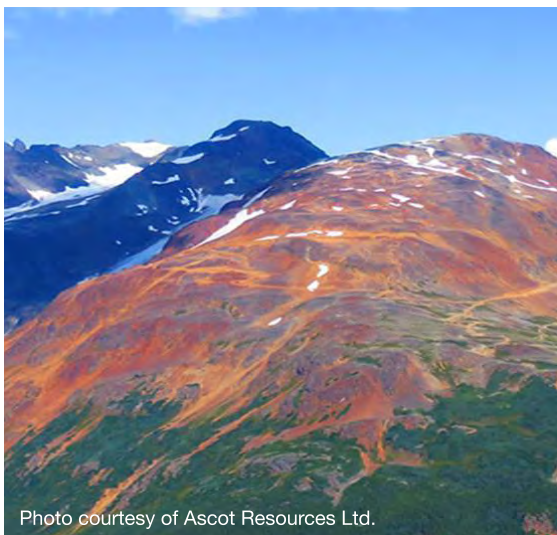


Photo courtesy of Ascot Resources Ltd.

in the region after buying the Silver Coin Property in 2018, which is near its existing infrastructure. In early 2019, Ascot purchased IDM Mining Ltd., adding the high-grade gold and silver Red Mountain project to its portfolio.

Ascot President and CEO Derek White says the acquisitions position the company as a leading consolidator of high-quality assets in the Golden Triangle region. “Our story is about consolidation, to take advantage of infrastructure at Premier and surrounding resources here,” said White, who joined the company in October 2017 after 30 years in the industry.

Prior to Ascot, White was the principal of Traxys Capital Partners LLP, a private equity firm specializing in the mining and minerals sectors. He was also president and CEO of KGHM International Ltd. from 2012 to 2015, and held the positions of executive vice-president, business development, and chief financial officer of Quadra FNX Mining Ltd. from 2004 to 2012.

The Ascot board includes a number of influential names in the industry, including chairman Rick Zimmer, the former president and CEO of Far West Mining Ltd., which was acquired by Capstone in 2011; and former BC Energy and Mines Minister Bill Bennett, who helped to launch British Columbia’s First Nations mine revenue-sharing program.

## Advancing projects

It’s a busy time for the Ascot team. In addition to the key acquisitions of the Red Mountain, Silver Coin and Premier properties, the company has been very active on project advancement, spending more than \$57 million to date. Key milestones include the filing of an updated National Instrument 43-101 resource estimate in June 2018 and the announcement in December 2018 of a significantly increased high-grade resource estimate for its Golden Triangle properties of more than two million indicated and inferred gold resource ounces and more than six million indicated and inferred silver resource ounces.

Among the company’s priorities for 2019 are infill drilling to upgrade resource classifications and exploration drilling to add more high-grade resource ounces to its properties, as well as converting inferred resources to indicated resources and completing engineering studies related to restarting the mill and mine operations.

The attractiveness of the region to the new Ascot team isn’t just what’s in the ground but also the critical infrastructure that has been built in recent years to help open up the Golden Triangle to new investment. Advancements include the 335-kilometre Northwest Transmission Line from Terrace to Bob Quinn Lake; the paving of the Stewart-Cassiar highway north from Smithers; the completion of a three-dam, 277-megawatt hydroelectric facility located 70 kilometres northwest of Stewart; and the opening of ocean port facilities in Stewart.

Ascot notes that its Premier-Dilworth property can be accessed by two gravel roads: the Granduc Highway and the Big Missouri haul road. Key infrastructure assets on site are the mill and assay buildings; the tailings dam facility; the Premier and Big Missouri underground mine complex; the Regional Power hydro dam, penstock and power plant; the BC Hydro power lines from Stewart; and the water treatment plant, along with the associated water treatment ponds. What’s more, due to its proximity to the nearby town of Stewart, about 25 kilometres away, the project doesn’t require a remote campsite for employees.

## Building community

Stewart, which was founded by brothers John and Robert Stewart in the early 1900s, has seen its share of ups and downs from mining over the past several decades. White says Ascot’s plans for the region will bring more people and business to the community. In particular, he expects most workers at the mines to live in and around the community. “We want our people to go home each night to their families in Stewart,” says White.

District of Stewart Mayor Gina McKay also sees “a very bright future” for her community thanks to Ascot’s plans. The population of Stewart today is about 400 people, and McKay says the district is preparing for it to triple to 1,200 or more when both the Premier and Red Mountain mines begin operating in the coming years.

The projects are also bringing new hope to the community. “There’s a renewed energy here,” says McKay, who was born and raised in the area. Her father worked at the former Granduc copper mine, which was active from 1964 to 1984. “You can feel an optimism that we haven’t felt here for many years.”

McKay says the district’s role is to help support the mining industry by making it a welcoming and

supportive place for families to live and work. The district was recently told it would receive a \$1.3-million planning grant from the provincial government to help it build infrastructure to support the industry and a growing population in the area.

“I want to make this a place where families want to move and thrive. That makes a community,” says McKay.

Ascot’s properties also lie within the treaty territory of Nisga’a Nation. The Nisga’a treaty, the first modern treaty in British Columbia, came into effect in May 2000 and gives the Nisga’a control over their land, including the forestry and fishing resources.

“Proponents appreciate having the treaty in place because it provides certainty,” says Collier Azak, CEO of the Nisga’a Lisims Government. “It’s the book we follow to get into the opportunities that are there.”

Azak says his community is in favour of mining, as long as companies comply with the treaty, which includes economic, social and environmental considerations. “We are open for business, but it has to be responsible and sustainable,” he says.

The treaty is also the foundation used to sign benefits agreements with mining companies in the area. For example, the Nisga’a Nation has an agreement with Pretium for its Brucejack project and with Seabridge for its KSM project. The Nisga’a Nation is in discussions with Ascot to come up with an agreement related to its Premier mine. It recently signed a benefits agreement for Red Mountain, based on discussions with IDM before it was acquired by Ascot.

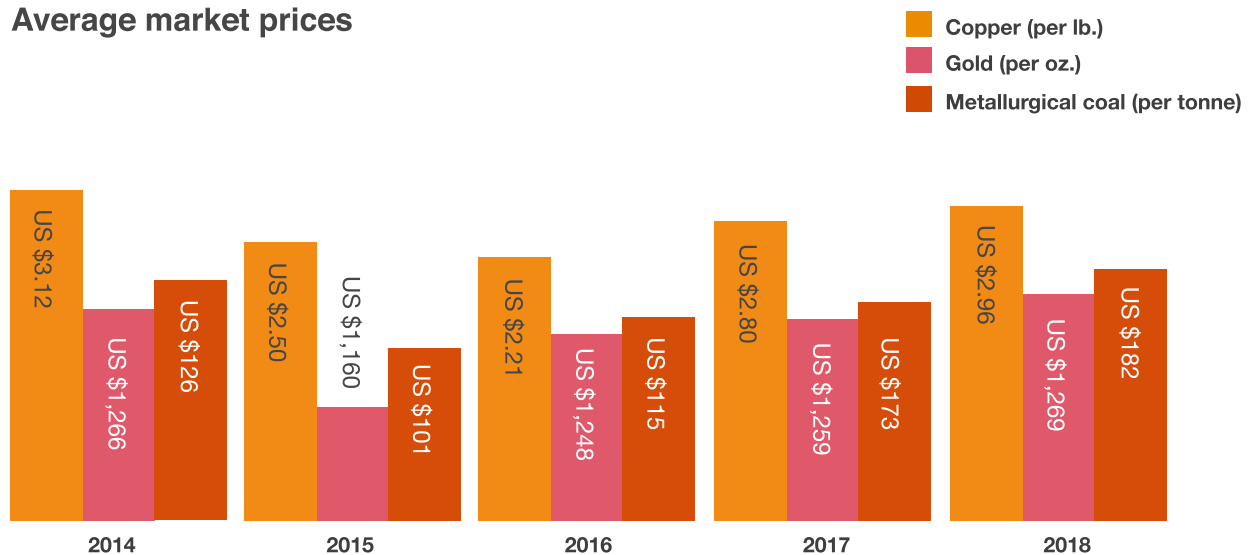
The Nisga’a Nation’s vision is that the new mines in the Golden Triangle will continue to provide jobs and economic stimulus for Nisga’a citizens. “Our people, like anybody else, are looking for sustainable work,” Azak says. In the meantime, the Nisga’a people will continue to provide local knowledge of the area and an eager workforce to bring shared prosperity to the region.

White says Ascot is looking forward to helping build its projects and bring prosperity to the region and to its shareholders. “The Golden Triangle is more than just a prolific mining region but is home to a very supportive mining community,” says White. “We look forward to making it an even more attractive place to live and work for decades to come.”



# Market shipments and market prices

## Average market prices



Source: Bloomberg Finance L.P. and PwC analysis

Net mining revenue was \$10.7 billion, compared to \$10.1 billion in 2017 and \$7.3 billion in 2016. Below is a breakdown by commodity:

**Metallurgical coal** revenue was \$5.8 billion, compared to \$5.2 billion in 2017 and \$3 billion in 2016, with the increase driven by a steady rise in the commodity's price. Overall, shipments for metallurgical coal were 30.1 million tonnes in 2018, up from 28.6 million tonnes in 2017 and 25.4 million tonnes in 2016. Metallurgical coal prices for participants averaged US\$182/tonne in 2018, compared to US\$173/tonne in 2017 and US\$115/tonne in 2016.

**Copper** concentrates revenue totalled \$2 billion, which was on par with 2017 and up from \$1.8

billion in 2016. Shipments of copper concentrate came in at 842,000 tonnes in 2018, compared to 894,000 tonnes in 2017 and 926,000 tonnes in 2016. The price of copper averaged US\$2.96/lb in 2018, compared to US\$2.80/lb in 2017 and US\$2.21/lb in 2016.

**Zinc** revenue was \$1.2 billion, which was on par with 2017 and up from \$877 million in 2016. Shipments were 306,000 tonnes, compared to 309,000 tonnes in 2017 and 312,000 tonnes in 2016. Zinc prices averaged US\$1.32/lb in 2018, compared to US\$1.31/lb in 2017 and US\$0.95/lb in 2016.

**Lead** revenue was \$146 million, compared to \$224 million in 2017 and \$255 million in 2016. Lead

shipments were 59,000 tonnes, down from 86,000 tonnes in 2017 and 97,000 tonnes in 2016. The average price of lead was US\$1.02/lb in 2018, compared to US\$1.05/lb in 2017 and US\$0.85/lb in 2016.

**Gold** revenues rose slightly to \$843 million from \$829 million in 2017 and more significantly from \$651 million in 2016. The price of gold averaged US\$1,269/oz, compared to US\$1,259/oz in 2017 and US\$1,248/oz in 2016. The revenue increase is largely attributable to Brucejack producing gold for the whole year, compared to part of the year in 2017. This increase is offset by decreases in gold produced at Centerra Gold's Mount Milligan mine, as well as other mines in the province that primarily recover gold as a byproduct in copper mining.

**Silver** revenue decreased to \$309 million, compared to \$509 million in 2017 and \$589 million in 2016. The average price of silver was US\$15.70/oz in 2018, compared to US\$17.08/oz in 2017 and US\$17.11/oz in 2016. In British Columbia, silver is generally produced as a byproduct of mining metals such as copper, gold, lead and zinc.





# Pioneering innovation and technology in mining— Teck/LlamaZOO/MineSense

**Teck is deploying several innovative technologies, from sensors to 3D visualization, to make its operations more productive, sustainable and safe.**

The mining industry has a long history of innovation, from pioneering airborne magnetic surveying to today's use of digital technologies to connect operations. Miners are continuously seeking ways to discover resources, improve productivity, increase safety and protect the environment.

Among the industry's leaders in innovation is Vancouver-based Teck Resources Limited ("Teck"), a diversified resource company that deploys a wide range of the latest technologies, such as big data, artificial intelligence (AI) and machine learning, across its operations in Canada, the United States and South America.

For instance, Teck was the first global miner to use shovel-mounted sensors to better separate ore from waste at its Highland Valley Copper Operations in south-central British Columbia. The company is also using big data and machine learning to identify maintenance issues in its haul trucks before they occur; automated equipment like remote dozers, drills and drones; and monitoring blasts using high-tech sensors to better understand where ore and waste moved during a blast to improve efficiency and safety.

Teck is a founding member of Canada's Digital Technology Supercluster—alongside some of the world's biggest names in health care,

telecommunications, natural resources and computing—set up to help drive commercially successful innovation, generate growth and create jobs across the country.

Technology guides the company's responsible resource development and production approach to business, says Victoria Sterritt, Teck's Lead, Technology and Innovation. "Innovation and technology are helping to improve our environmental performance while also making us a safer and more productive company," she says.

Some examples of how Teck is using technology and innovation to increase productivity, safety and sustainability are discussed below.

## **Shovel-mounted sensors to locate valuable ore**

Mining shovels aren't often associated with technology, but Teck has found a way to make its shovels smart. Teck is using BC-based MineSense Technologies Ltd.'s ShovelSense technology to identify valuable ore, one bucket at a time.

The technology uses sensors mounted on the shovel bucket and X-rays to tell the difference between waste rock and valuable ore. When combined with analytics, the sensors provide

real-time information to help Teck determine whether the load is worth sending to the mill for processing or for handling as waste rock.

“It’s a big deal for us because it means you aren’t sending waste to the mill and you’re not sending valuable ore into the waste pile,” says Sterritt. The technology has the potential to generate significant value through productivity improvements, including a reduction in energy use.

The ShovelSense technology can be installed on all mobile equipment typically used either on the surface or underground, such as cable shovels, front-end loaders, excavators and LHDs. The system is designed for use in extreme environmental conditions and can be retrofitted on any existing mobile equipment.

MineSense CEO Jeff More says Teck is the first company to use its technology in a commercial operation. “We view Teck as a very innovative company,” says More, citing that as a reason why MineSense initially approached Teck to pilot the technology.

“You hear a lot about how conservative mining is,” More says. “Teck was willing to be a first adopter and thought it was worth investing the time and resources to make this happen.”

Teck is currently testing the technology at some of its other base metals mine sites in North and South America. In the meantime, MineSense is in discussions with other miners around the world that have shown interest in adopting the ShovelSense system. “Having our technology used at Highland Valley has been a key part of our success to date,” More says.

## Virtual twins help to increase stakeholder engagement

Mining companies invest a lot of time and resources helping investors, analysts and community members better understand their operations, including sending them to remote locations to take a closer look at their operations. Thanks to 3D technology, as well as virtual reality (VR) and augmented reality (AR), miners can now bring the project directly to stakeholders to save time and money and increase engagement.



Photo courtesy of Teck

Teck has partnered with Victoria-based technology company LlamaZOO Interactive to create visualization solutions for mine planning and community outreach. LlamaZOO uses 3D, AR/VR and digital twin technology to create what’s often described as a video game for mine sites. Teck describes it as an immersive VR experience that “not only brings people to the site without having to travel there but also allows them to see aspects of the proposed mine that you couldn’t otherwise see.”

Instead of relying on maps and spreadsheets, the LlamaZOO technology uses data generated by mining companies—such as geology, drill hole information and infrastructure plans—and compiles it into a software platform. Users can travel virtually through each stage of the mine’s life without leaving their home or office.

Users can virtually fly over the site to view land holdings, topography, geological models and existing and planned facilities and infrastructure. What’s more, an underground ore body can be viewed in 3D. VR is helping stakeholders better understand proposed projects and is enhancing both mine production and reclamation planning, according to Teck.

The technology has been used for the Galore Creek project in northwestern BC, within the territory of the Tahltan Nation, which Teck is developing through a joint venture with Newmont Goldcorp. Sterritt says the technology has been a valuable tool that has helped the companies to better understand the significant amount of work completed on the asset and the potential path forward. It has also helped support a renewed understanding of Galore Creek with the Tahltan community.

Sterritt says LlamaZOO used geospatial data to create a visualization of the entire project footprint—including road access, tunnels, development infrastructure and the mine—which is helping Teck, Newmont Goldcorp and, ultimately, the Tahltan to visualize the mine's infrastructure and footprint. The technology will also help Teck in its conversations with regulators and investors.

"It allowed us to advance Teck's and Newmont Goldcorp's understanding of the potential in the Galore Creek project and provides a powerful platform on which to engage with the Tahltan Nation and regulators on how the mine could be developed in a way that people that know the area can truly understand," says Sterritt. Teck is also using the technology for some of its projects in other jurisdictions and to help develop mine expansion plans.

LlamaZOO co-founder and CEO Charles Lavigne says Teck was one of the first companies his organization approached after shifting focus to the mining sector. LlamaZOO started off focusing on 3D anatomy solutions for veterinary students before discovering its technology would be well-suited to the resources sector given its complex geology and remote locations.

"Our technology has been valuable in helping Teck accelerate stakeholder engagement and alignment," says Lavigne, who co-founded the company with Kevin Oke. He says the 3D visualization helps to break down barriers for stakeholders, which allows for deeper analysis and more meaningful conversations about mine projects. "It's about making data more accessible," Lavigne says.

## Teck's technology-driven future

Sensors and 3D visualization are just some of the technologies Teck is using at its mine locations. Drones, which are a common sight at Teck operations, are helping to enhance safety and efficiency through aerial drone surveying.

The company has also used sensors and data since 2011 to monitor the health of haul trucks at its steelmaking coal operations and manage repairs and preventative maintenance. More recently, Teck struck a partnership with Google Cloud and Pythian Group Inc. that uses AI and machine learning to unlock additional insights from the data generated by its mobile fleets. The technology enables Teck to identify problems, such as potential electrical failures, before they happen. Sterritt says the technology helps to limit unplanned maintenance, which reduces costs and helps maintain the equipment so it can be used longer. Teck estimates the savings to be more than \$1 million annually at one site alone.

Teck is also continuously investing in research and development and implementing a number of new technologies and techniques. Sterritt says many of Teck's innovations are based on ideas brought forward by staff, including many on the ground at the company's operations. The company encourages employees to share their thoughts on how it can improve productivity, enhance safety and reduce its environmental footprint.

"It's important for us to stimulate a culture of innovation," says Sterritt. "The more of this we do and talk about it internally and externally, the more we believe we can achieve."

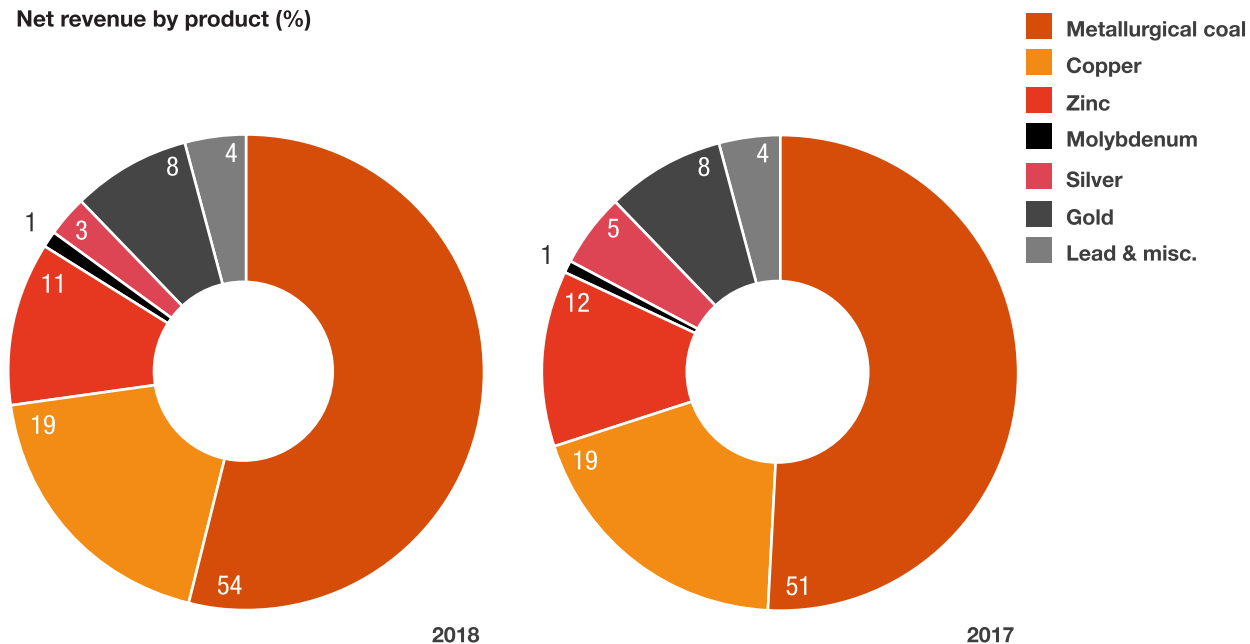




# Commodity performance and outlook

Average prices for British Columbia's key mining commodities were generally positive compared to a year earlier. Copper and metallurgical coal saw the largest year-over-year increases in 2018, increasing 6% and 5%, respectively, compared to 2017. Here's a summary of the performance of the main metals and minerals produced in the province:

## Net revenue by product (%)



Source: Bloomberg Finance L.P. and PwC analysis

Metallurgical coal prices averaged US\$182/tonne in 2018, compared to US\$173/tonne in 2017 and US\$115/tonne in 2016. The spot price was US\$186/tonne as of March 31, 2019, and the consensus forecast for 2019 is US\$178/tonne.

Copper prices increased in 2018 to an average of US\$2.96/lb from US\$2.80/lb in 2017 and US\$2.21/lb in 2016. While higher, the price is still below a record of US\$4.60 per pound reached in 2011. The spot price was US\$2.94/lb as of March 31, 2019, and the consensus forecast for 2019 is US\$2.92/lb.

Gold averaged US\$1,269/oz in 2018, which was a slight increase from US\$1,259/oz in 2017 and US\$1,248/oz in 2016. Gold's record price reached more than US\$1,900/oz in 2011. The spot price for gold was US\$1,292/oz as of March 31, 2019, and the consensus forecast for 2019 is US\$1,298/oz.

The price of silver averaged US\$15.70/oz in 2018, which was down from US\$17.08/oz in 2017 and US\$17.11/oz in 2016. The spot price

was US\$15.12/oz as of March 31, 2019, and the consensus forecast for 2019 is US\$15.99/oz.

The price of zinc averaged US\$1.32/lb in 2018, compared to US\$1.31/lb in 2017 and US\$0.95/lb in 2016. The spot price was US\$1.36/lb as of March 31, 2019, and the consensus forecast for 2019 is US\$1.23/lb.

Metal	Spot price at March 31, 2019	2019 analyst consensus estimate at March 31, 2019
Gold (US\$/oz)	1,292	1,298
Silver (US\$/oz)	15.12	15.99
Zinc (US\$/lb)	1.36	1.23
Metallurgical coal (US\$/tonne)	186	178
Copper (US\$/lb)	2.94	2.92



# Mining Association of British Columbia perspective

## **British Columbia's mining industry was marked by optimism in 2018, but the sector's long-term competitiveness challenges must be addressed**

British Columbia's mining sector began 2018 with optimism and, despite some headwinds, the positive sentiment continues today. The price of many commodities remains relatively stable, allowing companies to press forward with investments to advance exploration, development and production at their sites across the province. Coeur Mining began production last year at their Silvertip mine, while Pretium Resources continued to ramp up production at their Brucejack mine.

Within this environment, 2018 saw a number of mergers and acquisitions, including Ascot Resources' purchase of the Silver Coin property along with their acquisition of IDM Mining in early 2019. More recently, Imperial Metals entered into an agreement to sell a majority interest in their Red Chris mine to Newcrest Mining.

While the mining industry continued to grow in 2018, global trade and economic concerns and apprehension towards Canadian and BC regulatory developments tempered this growth. Changes to the BC Environmental Assessment Act, an increase in the carbon tax, the province's plan to introduce legislation to implement the United Nations Declaration on the Rights of

Indigenous Peoples (UNDRIP), and changes to the governance of qualified professionals in the natural resource sector cast a shadow of uncertainty that weighs on future investment decisions.

As the voice and advocate for mining in BC representing operating steelmaking coal, metal and industrial mineral producers and smelters in the province, MABC works to support a healthy and thriving mining industry for the benefit of all British Columbians. To this end, MABC is working with government, local and Indigenous communities and labour to improve British Columbia's competitiveness and attractiveness as a jurisdiction to build and operate mines.

### **The Mining Jobs Task Force**

In 2018, MABC participated in the Mining Jobs Task Force to identify actions government should take to grow the mining sector and create good jobs for people across the province. To date, the province has committed to move forward with six of the 24 recommendations, including providing \$1 million to boost mining innovation in BC and another \$1 million to help expand the Regional



Photo courtesy of Ascot Resources Ltd.

Mining Alliance, which promotes mining industry partnerships with Indigenous Peoples, as well as providing \$5 million in transitional funding to GeoScience BC.

The government also made permanent two tax incentives—the Mining Flow-Through Share tax credit and the BC Mineral Exploration tax credit—to support mineral exploration.

The recent provincial budget provided the Ministry of Energy, Mines and Petroleum Resources with an additional \$20 million in funding over three years to improve regulatory excellence and increase its capacity for more timely permitting. MABC has long advocated for increased resources for the ministry and was pleased to see this new funding. Adequate resources to allow for the timely processing of permit applications are critical to all of our operating mines and to attracting investment in new mines.

These are important investments in our industry, and the provincial government is to be commended for bringing the task force together. Having said that, the continuing global headwinds and uncertainty created by regulatory changes cannot be ignored. As the task force report stated, BC's mining sector is in transition and, if further action is not taken, there is a real risk the sector and the benefits it delivers will contract.

We must address the competitiveness challenges facing our operations today. Mining companies need clear, consistent and coordinated regulatory and fiscal frameworks to ensure BC remains a world class mining jurisdiction that attracts investment and talent and contributes to our long-term economic prosperity.

## All BC communities are mining communities

British Columbia's competitiveness as a mining jurisdiction is important not only to traditional mining communities, such as Kamloops, Princeton, Prince George and Tumbler Ridge. It is equally, if not more, important to our large urban centres where jobs and economic activity are heavily reliant on mining. Greater Vancouver is BC's largest mining community. The city is home to hundreds of mining companies and their employees, as well as a vast array of suppliers, from equipment manufacturers to engineers and accountants, that provide essential goods and services to the sector.

MABC and the Mining Suppliers Association of BC recently partnered to collect data on the economic benefits of mining to local communities. The data show that approximately 3,000 businesses, located in 125 municipalities and Indigenous communities, benefit from more than \$1.35 billion in spending on materials, goods and services by 13 operating mines in our province. This spending includes \$460 million in goods and services purchased from 1,200 suppliers located in Vancouver and the Lower Mainland alone.

## Mining is a high-tech industry

Of increasing significance is the fact that BC mines are key customers of some of the province's most innovative tech companies. British Columbia's miners have long been innovators, and today's mines are no exception. Leading technology from BC companies—from

artificial intelligence and machine learning to drones—is enabling our mines to use less, conserve more and increase the safety and productivity of our operations. Our industry’s use of new technology provides a customer base for BC’s tech companies and helps foster innovation within both sectors.

The long-term growth and sustainability of our industry is critical to not only our local communities and domestic economy, but also to the global transition towards a lower carbon future. Our mines provide the copper needed for electric cars and the steelmaking coal required to build green infrastructure such as public transit and wind turbines. With BC’s abundant clean energy, our steelmaking coal and copper are among the lowest GHG intensive commodities in the world.

While British Columbia’s mining sector began 2018 with optimism, it’s clear that uncertainty and risk also marked the year. Whether this materializes into real and costly impacts that affect the industry and future investment decisions remains to be seen. From the perspective of the Mining Association of BC and our member companies, it is incumbent on industry, policy makers and stakeholders to proactively improve the competitive footing of BC miners to secure the economic and social benefits the industry has long delivered.



By  
**Michael Goehring**  
President and CEO of  
the Mining Association  
of British Columbia

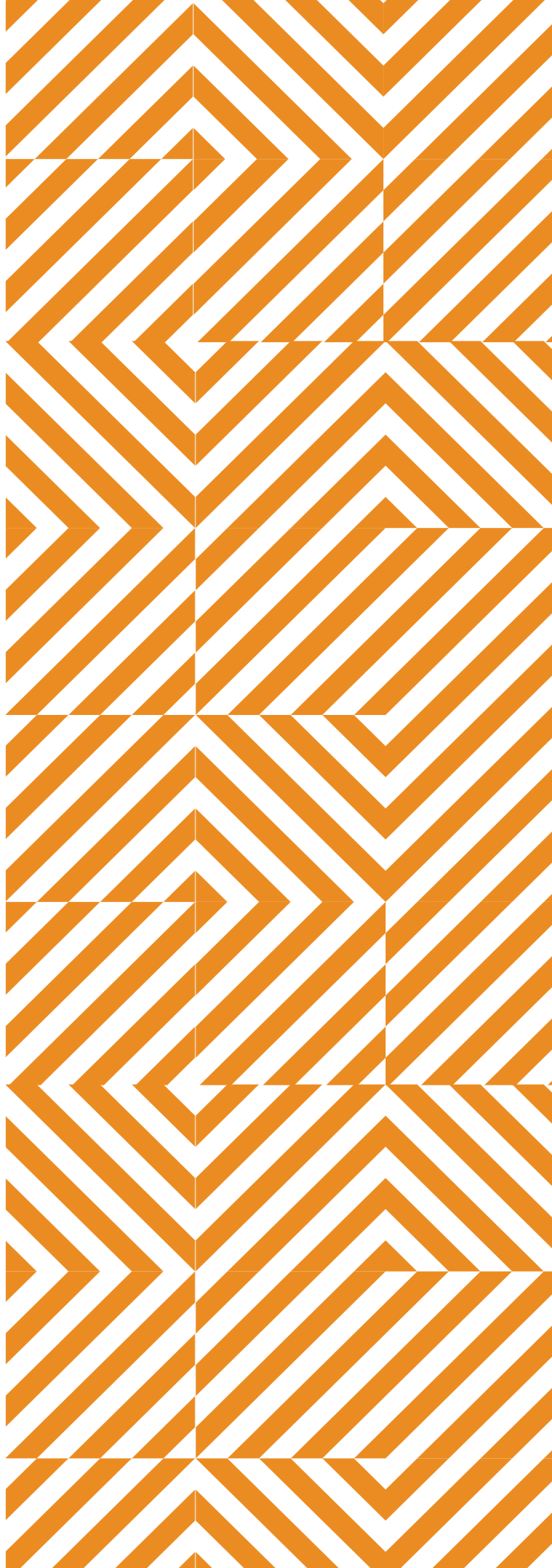




Photo courtesy of Teck

# Conclusion and outlook

Confidence is gradually returning to the BC mining sector after years of depressed commodity prices and reduced mining, exploration and development activity. The renewed optimism is reflected in the recent increase in merger and acquisition activity in the industry in British Columbia, as well as the steady rise in revenues highlighted throughout this report. In particular, metallurgical coal (used in steelmaking) remains the major contributor to the industry in the province, and robust prices for the resource have driven stronger results in the last couple of years. While mining companies and investors remain cautious, there's hope that the bottom of the current mining cycle has been reached and the sector is on a steady upswing.

The province is considered an attractive place to invest and do business in mining, due in part to its rich resources: British Columbia is Canada's largest exporter of metallurgical coal and one of its biggest copper producers. The province also produces significant amounts of gold, silver, lead and zinc. British Columbia is also known for its relatively stable political climate, world-class infrastructure, highly skilled workforce and access to Asian markets through a sophisticated port system.

The BC mining industry is a key producer and supplier of products required as the world transitions to a low-carbon economy. The metals and minerals produced in the region, particularly

copper and zinc, are used in everything from wind turbines to electric vehicles, which are critical as the world works to lower its emissions footprint.

Mining companies are increasingly looking to innovation and technology as part of this drive to remain competitive. In British Columbia and around the world, advances are being made in production and maintenance efficiency, power and fuel consumption, safety and environmental monitoring and protection as the industry looks to move forward responsibly and profitably. Local technology companies, such as MineSense and LlamaZOO, are playing an important part in this step forward and the hope is that more BC technology companies will join in similar partnerships with the mining industry.

Still, the province needs to be seen as a globally competitive mining jurisdiction in order to attract investment and ensure its many stakeholders, including governments, companies and citizens, benefit from its resource wealth. Michael

Goehring, President of the Mining Association of BC, highlights this need: “It is incumbent on industry, policy makers and stakeholders to proactively improve the competitive footing of BC miners to secure the economic and social benefits the industry has long delivered.”

Mining companies, in the meantime, continue to develop their relationships with their key stakeholders, understanding and appreciating that social licence to operate is a critical part of any successful operation. Mining has been a lynchpin of the provincial economy for decades. The many hundreds of millions of tax dollars generated by the industry are vital to the health of the economy, and the tens of thousands of mining and ancillary jobs help support many communities around the province, including the Lower Mainland. There are great opportunities here, and it’s up to the industry, the government and all other stakeholders to make sure BC miners have a level playing field on which to operate and compete as they work to build the mines of tomorrow.

**Five-year financial summary**  
(\$CAD millions, except where otherwise noted)

	2018	2017	2016	2015	2014
Gross mining revenues	12,263	11,718	8,709	7,724	8,238
Net mining revenues 1	10,698	10,145	7,341	6,289	6,760
Net income (pre-tax)	3,521	3,545	1,418	715	288
Cash flow from operations	5,058	4,537	2,575	1,660	1,685
Total assets	18,317	16,855	17,537	17,826	18,200
Pre-tax return on shareholders' investment (%)	28	31.1	13.5	6.3	2.4
Direct employment (number of employees)	11,281	10,221	9,329	9,921	9,954
Payments to governments 2	953	859	650	476	467
Exploration and development expenditures	95	92	102	320	234
Capital expenditures	1,204	1,203	1,370	1,240	1,503

**Notes**

1. Net mining revenues are reported after deduction of smelting and refining charges, freight costs, and marketing.
2. Includes mineral taxes, other levies and payments related to employment but not corporate income taxes.

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