

British Columbia Mineral and Coal Exploration Survey

2016



Ministry of
Energy and Mines



Foreword

The British Columbia Mineral and Coal Exploration Survey is a joint initiative between the Government of British Columbia's Ministry of Energy and Mines (MEM), the Association for Mineral Exploration (AME) and EY that has been conducted to provide a view of the state of the mineral and coal exploration sector in British Columbia (BC, the Province). The survey examines a wide range of economic, sociopolitical, and organizational issues that impact companies in 2016 and prospectors exploring in the Province, and has been designed to provide previously unavailable insight into the mineral and coal exploration industry in BC.

Data and analysis presented in this report are for the period 1 January through 31 December 2016 and are based on data collected directly from 30 prospectors and 177 companies operating in BC. The mining companies that responded to the survey collectively represent 259 projects across the Province.

Note that for the 2016 calendar year, and for the first time, this survey replaces the annual MEM mineral exploration expenditures survey, and for ease of completion it is designed to be similar to (though broader than) the Natural Resources of Canada's (NRCAN) *Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures*.

Thank you to our participants

A special thank you to the survey participants who spent their time and shared their information to support us in this new endeavor of shedding light on the exploration sector in BC.

About the collaborators

MEM

MEM is the provincial government agency responsible for overseeing mineral and coal exploration activity in BC. Ministry staff helped in the design of the survey and collected additional information about exploration expenditures from companies and prospectors that did not complete the online survey. Expenditure data was solicited directly from the companies and prospectors or estimated by the MEM regional geologists and British Columbia Geological Survey (BCGS) staff under the direction of the BC Mineral Development Office.



AME

AME is the lead association for the mineral exploration and development industry based in BC. Established in 1912, AME represents, advocates, protects and promotes the interests of thousands of members who are engaged in mineral exploration and development in BC and throughout the world. AME encourages a safe, economically strong and environmentally responsible industry by providing clear initiatives, policies, events and tools to support its membership. AME's participation has facilitated the collection of previously unavailable insight into the industry.



EY

With a volatile outlook for the sector, the global mining and metals industry is focused on how to maintain a strong and flexible balance sheet while preparing for future growth. The sector is also faced with the increased challenges of improving productivity, access to capital, dealing with increased transparency, maintaining license to operate and maintaining a license to operate.

EY's Global Mining & Metals Network is where people and ideas come together to help mining and metals companies meet the issues of today and anticipate those of tomorrow by developing solutions to meet these challenges. It brings together a worldwide team of professionals to help the industry succeed – a team with deep technical experience in productivity improvement, capital management, innovation and digital, tax and transactions to the mining and metals sector. Ultimately it enables us to help the industry compete more effectively.





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Northwest

Northeast

North
Central

Smithers

Prince George

South
Central

Kamloops

Southwest

Vancouver

Victoria

Disclaimer

- EY has relied upon unaudited financial information provided by mineral and coal exploration companies and prospectors in BC, third party research, and information provided by other data sources and relevant associations and bodies. EY has not audited, reviewed or otherwise attempted to verify the accuracy or completeness of such information.
- Financial information referred to in this report was prepared based on figures provided by entities, estimates and assumptions. As such, readers are cautioned that variations between estimations and actuals could be material.
- Unless otherwise stated all monetary amounts contained herein are expressed in current (2016) Canadian dollars.
- MEM staff assisted in the collection of survey data and information. Specifically, where a response was not received directly from a company through the online survey, key points of data were either solicited directly from the companies and prospectors themselves or estimated by the MEM regional geologists and British Columbia Geological Survey (BCGS) staff under the direction of the BC Mineral Development Office and through use of professional opinion and experience.
- Where exploration projects were known to exist but were deemed to have expected expenditure of less than \$10,000 in the 2016 calendar year, individual project data was not specifically sought.

We are pleased to present the findings of our 2016 British Columbia Mineral and Coal Exploration Survey. Data and analysis presented in the survey is based on information collected from 30 prospectors and 177 mineral and coal exploration companies operating in British Columbia (BC). Collectively, these companies represent 259 exploration projects across the Province.

2016 was another challenging year for the exploration industry in BC, as low commodity prices and market uncertainty continued to make it difficult for exploration companies, which rely heavily on investment, to fund exploration activity.

Analysis of survey data identified a number of key themes and observations:

- ▶ \$205 million was invested by exploration companies and \$1.8 million from prospectors. This represents a \$70 million (25%) decline over the prior year and is the lowest level since 2009.¹
- ▶ Exploration expenditure in the Province has declined for four consecutive years and is \$475 million (70%) lower than peak spend of \$681 million in 2012.
- ▶ The sector is at the end of a 10- to 15-year mine development cycle in the Province. A number of projects that were approved and funded prior to the 2012 mining downturn that have supported exploration expenditure over the past five years have evolved (or been postponed). Exploration focus has now shifted to less capital-intensive grassroots and early-stage exploration.
- ▶ Notwithstanding the current downturn, the industry remained an important source of jobs and was and continues to be an economic contributor to communities throughout the Province.
- ▶ Exploration companies continue to demonstrate their commitment to local communities and First Nations engagement through targeted activities, investment, employment and procurement.
- ▶ Of the Prospectors surveyed, they collectively incurred just under \$2 million in exploration expenditures in 2016. Broadly speaking, this expenditure was spread equally across the province's regions.
- ▶ Looking forward, the outlook for the exploration sector in BC will largely be influenced by the level of investment in grassroots and early-stage exploration that, in turn, will be determined by commodity prices and the ability of exploration companies to raise capital.

Table 1: Exploration in BC summary statistics, 2016

		BC	Northwest	Northeast	North Central	Southwest	South Central	Southeast
Regional centre			Smithers	Prince George	Prince George	Vancouver	Kamloops	Cranbrook
Projects	#	259	79	10	47	26	35	62
Expenditure	\$m	\$205	\$84	\$9	\$29	\$2	\$44	\$37
Change from 2015	%	25%	-28%	-71%	-27%	-46%	45%	-26%
Share of 2016	%	100%	41%	4%	14%	1%	21%	18%
Total drilling	metres	290,702	115,230	2,866	34,474	3,809	102,982	31,341
Coal-only drilling	metres	26,125	-	2,866	1,850	-	-	21,409

¹ Prior year's data were gathered from other sources including MEM and Natural Resources Canada.

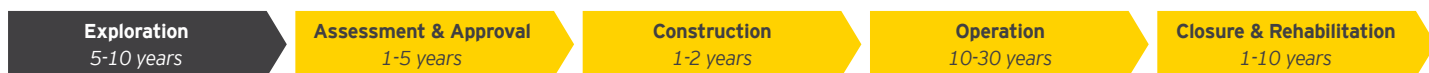
Exploration in British Columbia in 2016



Exploration is a key driver of BC's economy

Exploration, the process of finding commercially viable minerals and coals to mine, is the first stage in the mining lifecycle (Figure 1) and is a significant contributor to the Province's economy. Between 2011 and 2015, more than \$2.2 billion was spent on exploration in BC, with activity taking place in every region of the province.² Exploration is an important source of jobs and economic growth for remote and rural areas and, in many cases, is the major driver of regional and local economic activity in the Province.

Figure 1: Mining Life Cycle



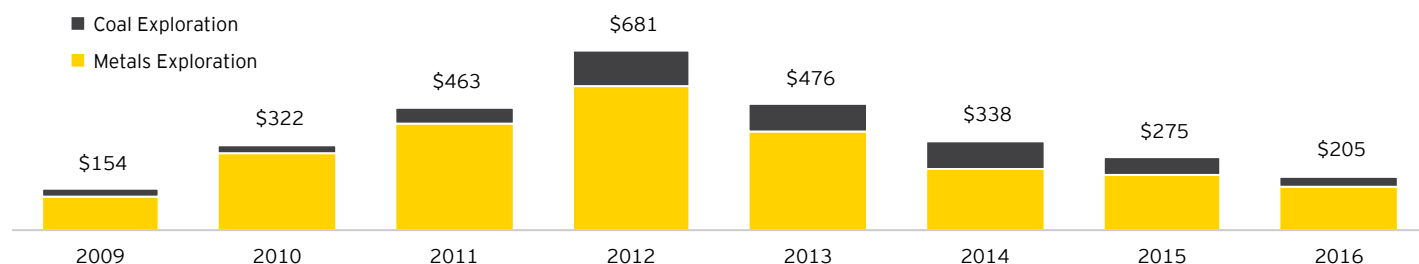
Exploration expenditure in B.C. continued its downward decline in 2016

Our survey of mineral and coal exploration expenditure in BC identified an annual decline in 2016 of 25% to \$205 million, down from \$275 million in 2015³. This is the fourth consecutive annual decline and is 70% less than peak spend of \$681 million in 2012 (Figure 2).

This continued downward trend coincides with a period of declining prices across a broad range of mineral commodities, a persisting bear market outlook, an unfavorable capital market for financing mineral and coal exploration, and, as a result of these circumstances, the adoption of measures by companies to trim costs and focus efforts on core assets.⁴

In our survey, lack of access to funding and poor market conditions were cited most often by exploration companies as reasons they did not undertake exploration activity in 2016.⁵

Figure 2: Annual exploration expenditure in BC, \$m (2009-16)⁶



² MEM research.

³ Survey data aligned with NRCan's latest estimates for exploration expenditure. In NRCan's semiannual report, *Exploration and Deposit Appraisal Expenditures, by Province and Territory*, NRCan states an initial estimate of \$206 million in British Columbia.

⁴ Natural Resources Canada Canadian Mineral Exploration Information Bulletin, March 2016.

⁵ Thirteen exploration companies surveyed did not undertake any exploration activity in the Province in 2016.

⁶ MEM research.

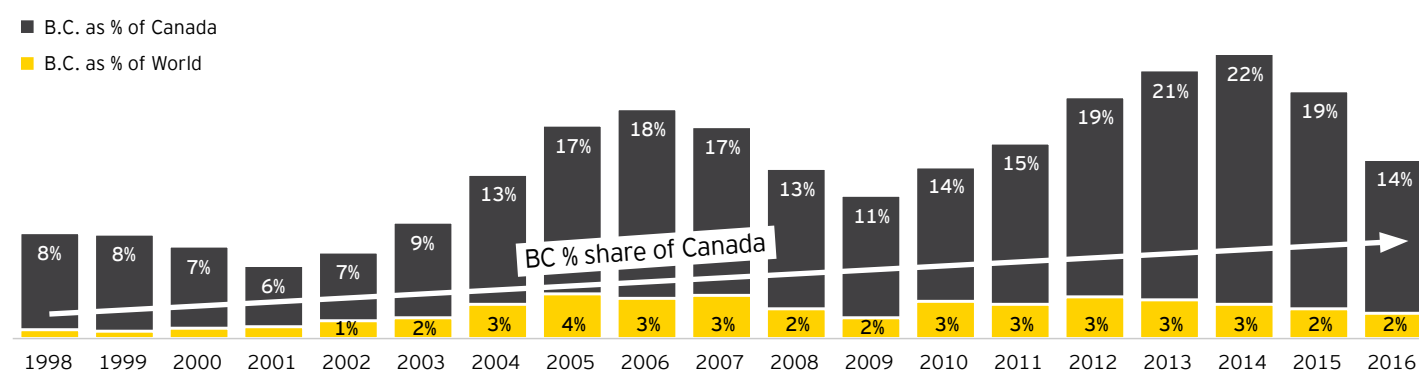
Nationally, BC's share of exploration spend is down year on year, but remains above its historical average

National Resource Canada (NRCan) projects another decrease in exploration expenditure in 2016 across Canada's primary mining jurisdictions, including Saskatchewan, Ontario, Quebec, and Newfoundland and Labrador, and in each of the three territories.⁷ Although the downward trend has been felt across each of these mining jurisdictions, BC has experienced a relatively sharper decline in the past three years. The Province's share of national exploration expenditure has dropped to 14% from a peak of 22% in 2014.

There are a number of contributing factors to this. Expenditure in advanced-stage exploration in BC has dropped sharply since 2014 as a number of large-scale mine development projects have evolved or been deferred. At the same time, NRCan data has identified as a contributing factor the changing commodity mix where exploration for diamonds throughout Northern Canada, and uranium (particularly in Saskatchewan) continued to be at historically high levels throughout the economic downturn. Now however, this is changing.

Notwithstanding the recent decline in relative performance, BC's share of national exploration expenditure has demonstrated a long-term upward trend.⁸ Furthermore, on a global basis BC continued to hold a 2% share of global exploration spend in 2016.⁹ The resilience of the exploration industry in BC over time reflects the Province's favorable geology, good infrastructure, and a stable and attractive policy environment.

Figure 3: BC expenditure as proportion of both total Canadian and global exploration spend



⁷ NRC Canadian Mineral Exploration Information Bulletin, March 2016.

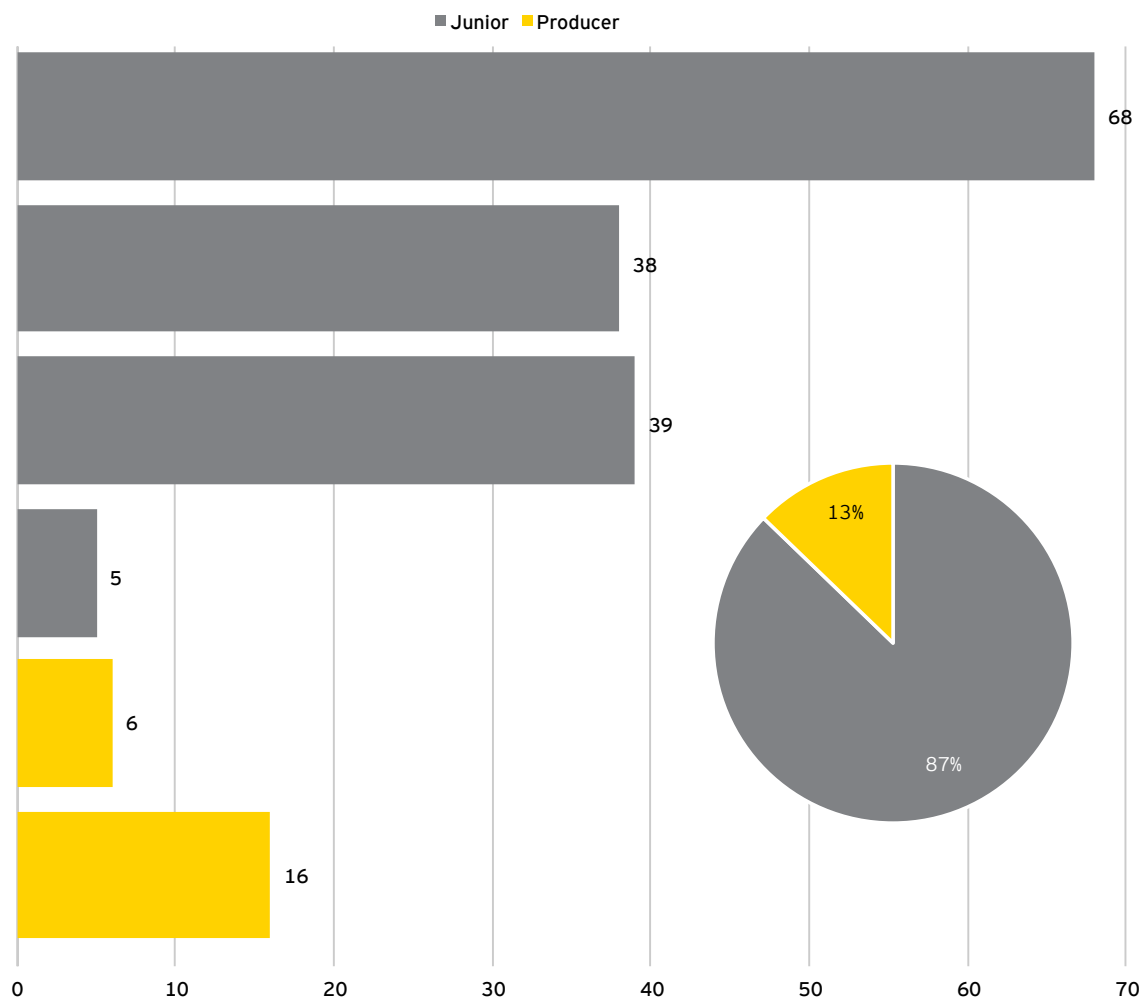
⁸ 3% compound annual growth rate (CAGR) in national share between 1998 and 2016.

⁹ Estimated using data extracted from SNL Metals & Mining (formerly Metals Economics Group) World Exploration Trends (various years).

Small, public juniors continued to lead exploration activities in 2016

Tracked exploration activity was undertaken by 177 companies covering 259 exploration projects in 2016. Of those companies, 87% were junior exploration companies, which speaks to the role that junior companies play in the mine lifecycle to explore, find and develop the Province's future mines. Juniors exploring in BC in 2016 were primarily publicly listed (70%) and small, with a capitalization of less than \$10 million (71%).

Figure 4: Distribution of exploration companies operating in BC¹⁰



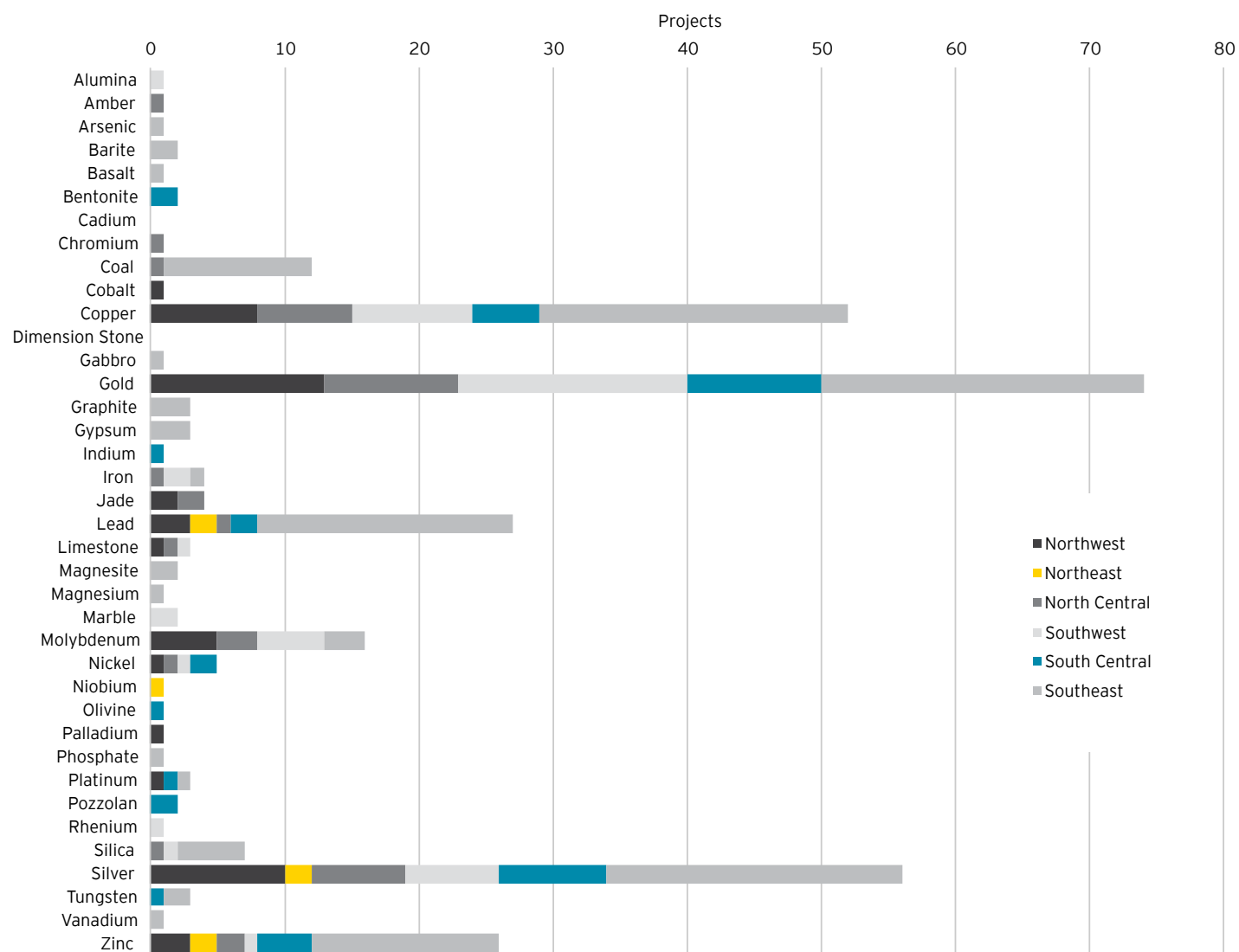
¹⁰ **Private, small producer:** Private small coal or mineral producing company (<\$500m capitalization plus earning revenue from a mineral resource); **Public, large producer:** Publicly traded large coal or mineral producing company (>\$500m market capitalization plus earning revenue from a mineral resource); **Private, small junior:** Private small junior exploration company (<\$10m capitalization); **Public, small junior:** Publicly traded small junior exploration company (<\$10m market capitalization); **Private, large junior:** Private large junior exploration company (>\$10m capitalization); **Public, large junior:** Publicly traded large junior exploration company (>\$10m market capitalization).

Metallic minerals drive exploration activity

Commodities currently extracted in BC include metallurgical coal, copper, molybdenum, gold and silver, as well as more than 30 industrial minerals including gypsum and limestone. Survey responses identified 38 commodities of interest for an exploration project in 2016.

The top commodities explored in 2016 were gold, silver, copper, lead, zinc, molybdenum and coal. Gold was identified as an exploration target for more than 55% of companies surveyed which indicated their commodity focus, with silver and copper a target for 41% of respondents.

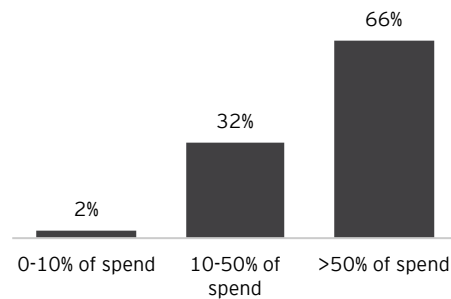
Figure 5: Commodities related to BC exploration, by region



Exploration companies continued to be an important part of regional and local economic activity

A significant percentage of exploration spend remains in the local community. When asked what percentage of project budget is spent locally, of those who responded to this question, 66% indicated that 50% of the budget or more was spent locally (Figure 6), with nearly 30% indicating 90% or more was spent in the local community.

Figure 6: % of project expenditure spent in local community, 2016 ▶



Survey data reinforce the commitment of exploration companies to First Nations

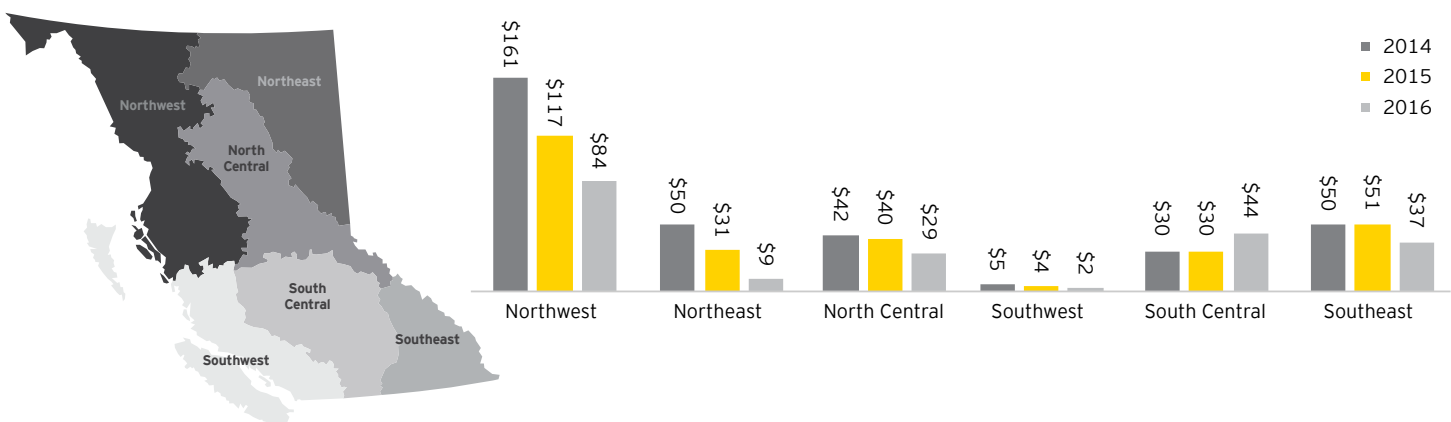
Of the companies that responded to First Nations engagement questions, 14 indicated they engaged First Nations-owned suppliers to assist in a combined 42 exploration projects, amounting to an engagement rate of 33% and First Nations supplier spend of just over \$17 million. This equates to 34% of the total expenditure incurred on these 42 projects.

With regard to employment, data indicated that 25% of exploration project full-time employees are First Nations individuals.

The impact of the current mining downturn on exploration expenditure was felt Province-wide in 2016

Investment in exploration in 2016 decreased by \$70 million from the previous year. With the exception of the South Central region of the Province, expenditure declined in each of the Province's mining regions (Figure 7). A potential explanation for South Central's deviation from the trend exhibited by the other mining regions may be the increased advanced exploration in areas located near already operational mines in the South Central region.

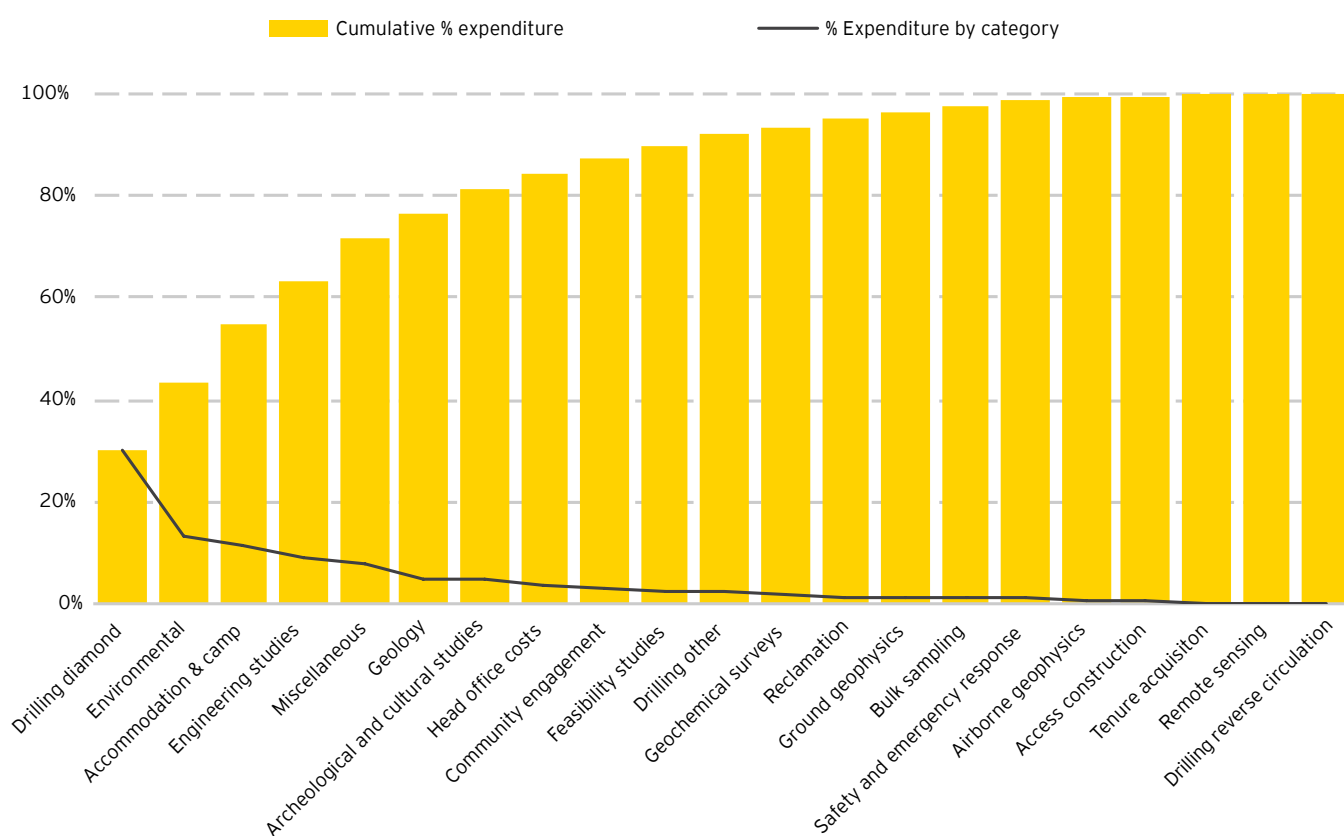
Figure 7: Annual exploration expenditure in BC, by region, \$m (2014-16)



The Northwest region of BC saw the highest mining exploration expenditure, with a total of \$84 million (41%), followed by South Central with a total of \$44 million (21%). Southwest saw the least exploration investment, only attracting 1% of the province's total spend, with just under \$2 million being spent on exploration in the region in 2016.

For those respondents who provided total expenditures by expenditure type, the top seven expenditure items accounted for 80% of total exploration expenditure (Figure 8). Not surprisingly, diamond drilling was the most significant expense, accounting for 30% of all expenditure.

Figure 8: % of Exploration expenditure allocation %, 2016

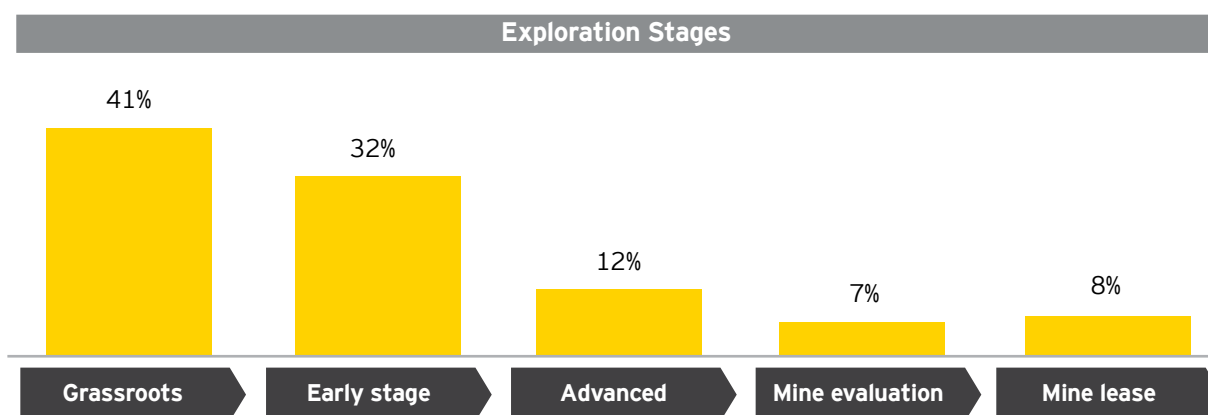


Labor costs attributable to exploration projects were provided by approximately 20% of respondents. Of those who provided wage data, the total wage cost related to exploration expenditure in 2016 amounted to \$6.2 million, which is equivalent to 14% of exploration expenditure incurred by these respondents.

Continued downturn or the start of a new mining cycle?

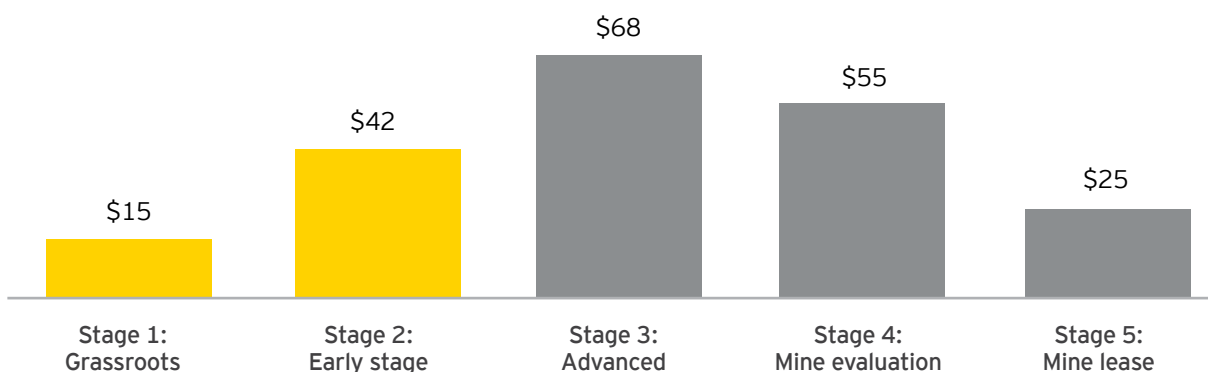
A large majority of survey respondents indicated that their exploration projects were largely focused on grassroots or early-stage exploration (Figure 9). Grassroots is the search for an exploration target, whereas early-stage exploration is the initial work conducted on a target, usually based on a deposit model.¹¹

Figure 9: Distribution of exploration activity by stage



In terms of exploration expenditure, however, the majority of expenditure in 2016 was incurred in the more activity-rich, cost-intensive later-stage exploration projects (Figure 10), with almost \$150 million invested in stage 3-5 exploration. In contrast, \$57 million was invested in grassroots and early-stage exploration.

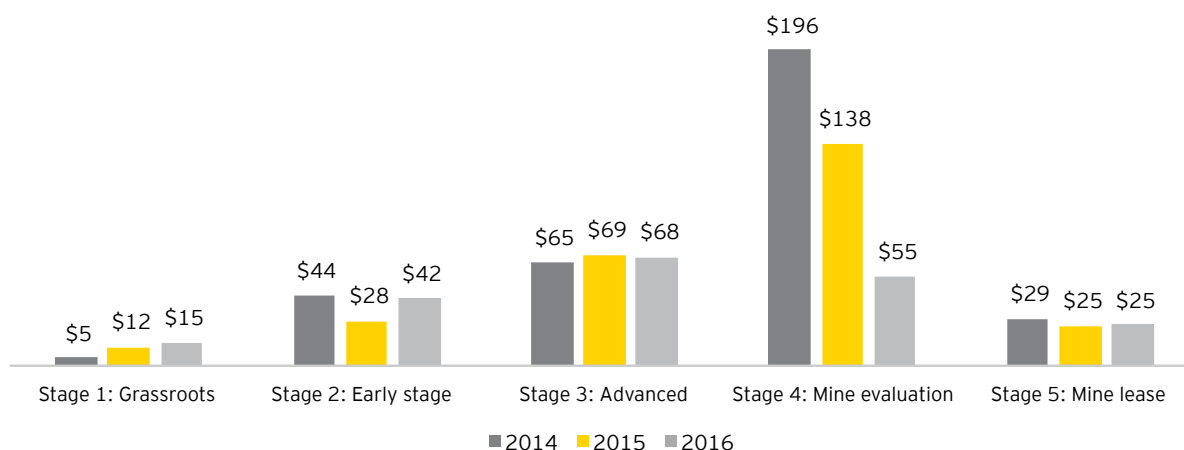
Figure 10: Expenditure by exploration stage, \$m (2016)



¹¹ Appendix I provides a detailed description of each exploration phase.

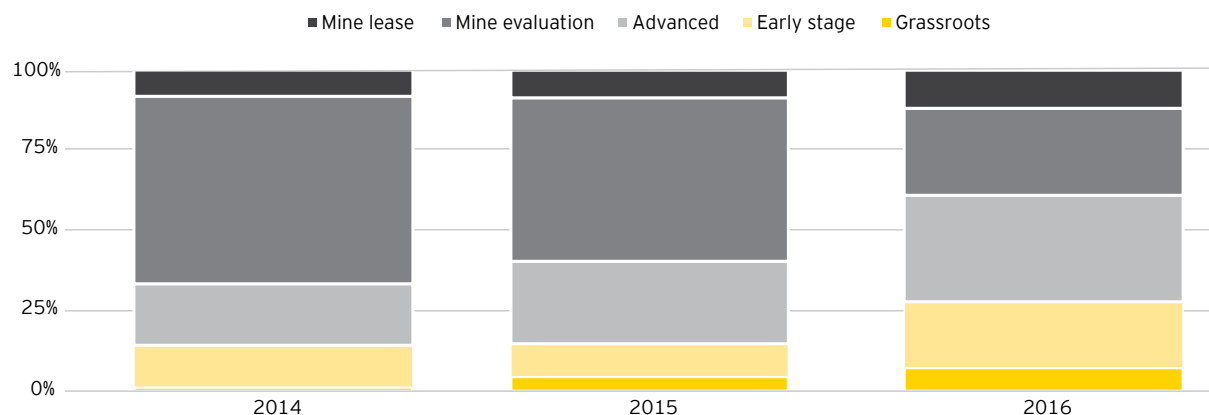
Expenditure in advanced-stage exploration, however, has dropped sharply since 2014. Investment in mine evaluation (stage 4) in 2016 was \$140 million (71%) lower than two years ago. In contrast, investment in grassroots and early-stage exploration has steadily increased over this same period (Figure 11).

Figure 11: Expenditure by exploration stage, \$m (2014-16)



The result is a mix of exploration expenditure that is increasingly focused on the initial stages of exploration (Figure 12).

Figure 12: % Share of exploration expenditure by stage (2014-16)



This trend suggests that exploration in BC may be nearing or experiencing a mining exploration lifecycle “reset.” Over the past five years, the Province has benefitted from large-scale mine development projects that were approved and fully funded prior to the 2012 mining downturn.

Examples include:

- ▶ Advanced development work at KSM, Brucejack, Ajax, Woodjam, Kemess Underground, Schaft Creek, Blackwater-Davidson and Highland Valley expansion
- ▶ Commencement of Copper Mountain, New Afton, Mount Milligan and Red Chris metal mines
- ▶ Expansion of a range of coal mines

As these development projects have evolved and other advanced projects have been postponed, the attention has once again turned to grassroots and early-stage exploration and, accordingly, the junior exploration company sector.

Whether investment in these initial stages of exploration continues will largely be influenced by commodity prices and the ability of exploration companies, primarily juniors, to now raise new capital in soft markets.



Prospectors expended \$1.75 million across the Province in 2016

Survey information was collected from 30 prospectors, most of whom operated in a specific region in 2016 (8 prospectors, or 27%, operated in more than one region in 2016).

Collectively, these prospectors incurred approximately \$1.75m in exploration expenditures in 2016. Broadly speaking, expenditure was spread equally across the province's regions (Figure 14).

Figure 13: Regions frequented by prospectors

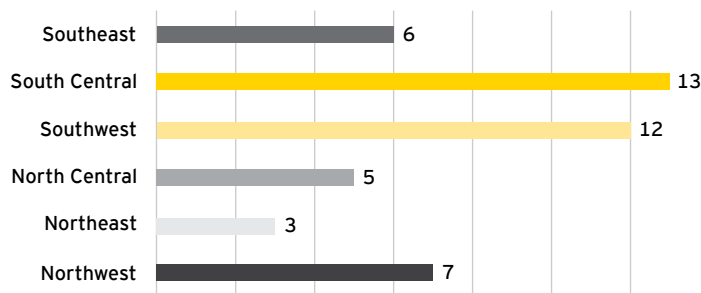
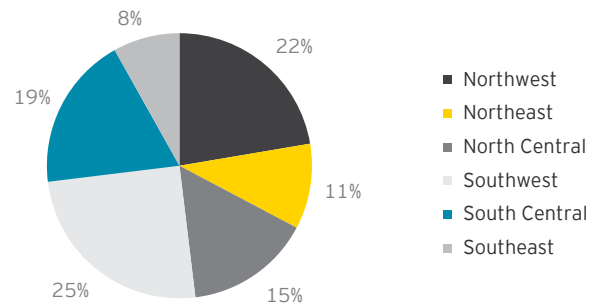
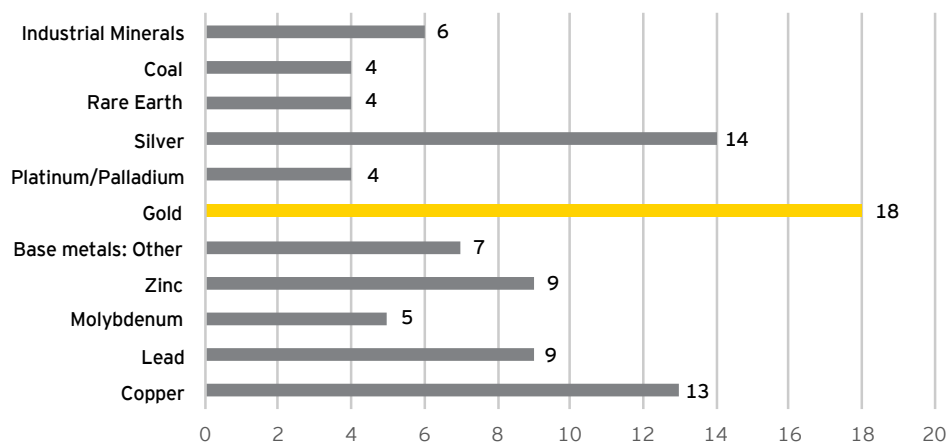


Figure 14: Breakdown of prospector spend by region



Gold was the most significant commodity of interest for prospectors, with a third of prospectors identifying gold as the most-searched mineral and nearly two-thirds rating it in their top four searched commodities. Silver and copper were also identified by multiple prospectors as being significant commodities.

Figure 15: Most-prospected commodities



Appendix I: Exploration stages



EXPLORATION STAGES (includes mine lease exploration)

Stage	GRASSROOTS EXPLORATION	EARLY-STAGE EXPLORATION	ADVANCED EXPLORATION	MINE EVALUATION
Evaluation activities	Grassroots is the search for an exploration target. Normally it spans pre-tenure activities, such as literature research and airborne surveys, or on-ground work which will usually be on mineral tenure, such as prospecting, silt and rock sampling and, in some instances, drilling for geological information. Grassroots work is commonly confidential and secretive and therefore may not be fully captured. Grassroots typically does not need a Notice of Work (NOW).	Early-stage exploration is the initial work conducted on a target, usually based on a deposit model. It comprises a focus on geological mapping, soil geochemical and geophysical surveys, generally on a grid, trenching and drilling. A property may remain in "early stage" for more than one campaign of drilling if new areas are tested	Advanced-stage exploration concerns the delineation of a mineral resource. The main activity is regularly spaced drilling. Other activities may be undertaken but are subordinate to resource definition drilling, baseline environmental and access surveys, bulk sampling, bench-scale metallurgical study and exploration of satellite or secondary targets.	Mine evaluation is concerned with the environmental, social, engineering and financial evaluation of a proposed mine. It includes application for an environmental assessment certificate and/or a Section 10 permit. It includes technical assessment of the project, identification of potential impacts and design of mitigation measures. It requires studies that examine aspects like wildlife, surface water, groundwater and geotechnical issues.
Objectives	Identify areas of interest and potential targets.	Testing areas of interest and targets initially identified. Often includes some grassroots activities. Begin First Nations engagement.	Focused on resource delineation, can include some grassroots and early-stage activities.	Focus on acquisition of an environmental assessment development certificate, seeking First Nations and community support plus getting government approvals. Most company expenditures are unrelated to exploring to find more mineral resources, and often they are more offsite than onsite activities.
Resource status	No resource.	No resource.	Defining a resource	Resource defined or largely defined. Convert resource (or part) to ore reserve.

MINE LEASE EXPLORATION

Mine lease exploration is work done on the mining lease away from the existing ore deposit.



Should you require any information regarding this report and its contents, please contact the relevant organization through the following representatives:

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