OUTLOOK 2023

CANADIAN MINERAL EXPLORATION HR

MINING INDUSTRY HUMAN RESOURCES COUNCIL

PROSPECTORS & DEVELOPERS ASSOCIATION OF CANADA

MINING INDUSTRY
HUMAN RESOURCES COUNCIL

For more information, contact:

Mining Industry Human Resources Council
50 Frank Nighbor Place, Unit 105
Kanata, Ontario K2V 1B9
(613) 270-9696
research@mihr.ca

Or visit the website at:

www.mihr.ca

Published December 2023

Canada

This project is funded in part by the Government of Canada.

The opinions and interpretations in this publication are those of the author and do not necessarily reflect those of the Government of Canada.

mihr.ca

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Canada's mining industry has experienced rapid growth following the global pandemic, driven primarily by higher metals and minerals prices. The mineral exploration sector in particular has expanded substantially. In 2022, exploration-related spending was 86% higher than just two years prior.

In addition, low-carbon environmental policies, including efforts to diversify the global energy infrastructure, promise to significantly increase demand for mining and mineral exploration in the coming decades.

Canada's mining industry is well-positioned to play a key role in the production of critical minerals needed to transition to a clean economy, and the mineral exploration sector will be crucial to its success.

Unlike other mining subsectors, mineral exploration is not covered by Statistics Canada's industry definitions and therefore lacks dedicated labour market information. To address this information gap, the **Mining Industry Human Resources Council (MiHR)** and the **Prospectors & Developers Association of Canada (PDAC)** have partnered to produce this report on the state of human resources in Canada's mineral exploration sector. The purpose of this research is to help stakeholders identify and mitigate the labour market challenges facing the exploration sector.

About MiHR

MiHR is Canada's knowledge centre for mining labour market information. An independent, non-profit organization, MiHR leads collaboration among mining and exploration companies, organized labour, contractors, educational institutions, industry associations and Indigenous groups to identify opportunities and address the human resource and labour market challenges facing the Canadian minerals and metals sector.

MiHR serves as a central repository for mining labour market research and analysis. A deep understanding of current trends, data-driven projections of future needs, and a clear picture of potential sources of labour form the foundation for proactive and collaborative human resource strategies.

About PDAC

PDAC is the leading voice of the mineral exploration and development community, an industry that employs more than 664,000 individuals, and contributed $132 billion to Canada's GDP in 2021. Currently representing over 7,000 members around the world, PDAC's work centers on supporting a competitive, responsible, and sustainable mineral sector.

PDAC
PROSPECTORS & DEVELOPERS ASSOCIATION OF CANADA

OBJECTIVES

The primary objectives of this research initiative are to:

- Enhance the labour market information available to mineral exploration stakeholders.
- Use primary data collection to complement and validate public data sources.
- Assess a variety of labour supply and demand factors in mineral exploration.
- Identify short- and long-term workforce challenges and opportunities facing various groups in the mineral exploration sector.
- Inform the development of a mineral exploration industry strategy and action plan to address key human resource issues.

KEY FINDINGS

This report consists of two parts: (1) an overview of the latest relevant statistics describing the exploration sector, and (2) a survey of stakeholders regarding their perspectives on mineral exploration careers. The findings provide a basis for developing and refining existing programs to increase participation and retention in the mineral exploration labour force.

The study reveals several overarching themes related to mineral exploration:

- Labour demand trends are often disconnected from post-secondary education trends in many key occupations for mineral exploration, e.g., geoscientists. Dwindling or stagnating enrolment trends can create difficult labour market conditions and skills shortages. This is especially concerning as mining and mineral exploration are poised to expand in the coming decades.
- The age distribution of many important occupations skews younger. This could be seen as indicative of a healthy labour pipeline. On the other hand, it could also be related to the attrition of the labour pool as workers age and seek better work-life balance.
- Generally, there is a higher representation of women and immigrants in exploration-related occupations than in the broader mining industry.
- Among career seekers in mineral exploration, a majority (62%) do not have any exposure to the sector until post-secondary studies or after graduating. This limits the reach of recruiters and educators within the industry, underscoring the need for a K-12 outreach strategy.
- Workers and consultants have a much more positive outlook for the industry over the next five years than they did in 2019.

ACKNOWLEDGEMENTS

MiHR partnered with PDAC to develop this research initiative, including the design of the survey questionnaire and its promotion through various channels. MiHR and PDAC are grateful to all the individuals and organizations in the Canadian mineral exploration sector who contributed their valuable time, resources, knowledge and insights to this study and report.

We are particularly indebted to PDAC's Human Resource Development Committee for their hard work, guidance and insights:

- **Karen Rees**, Committee Chair
- **Peggy Bell**, Resource Becoming
- **Laura Clinton**, Mining Matters
- **Conrad Dix**, Agnico Eagle Mines Limited
- **Mary Louise Hill**, Lakehead University
- **Felix Lee**, P.Geo.
- **Jessie Liu-Ernsting**, G Mining Ventures Corp.
- **Krishana Michaud**, PDAC (partner)
- **Ryan Montpellier**, MiHR
- **Christine Petch**, CPETCH Consulting
- **Alexandra Squires**, New Found Gold Corp.
- **Kendra Zammit**, Skeena Resources

CHAPTER ONE:

OVERVIEW OF THE EXPLORATION SECTOR

DEFINITION

Mineral exploration is the initial phase of the mining cycle, a process focused on gathering information to assess the mineral potential of a particular area. The goal is to identify a target area with a high likelihood of mineral endowment. There are five main stages of mineral exploration:

1. **Planning and mineral assessment:** This involves the identification and analysis of potential target areas, using publicly available information from local, provincial and federal governments, as well as information made public by companies that have worked in the area. This work is conducted by geologists and prospectors, among others.

2. **Staking a claim:** Once a target area has been identified, it must be staked if it is on Crown land, or else the exploration rights to the area must be purchased from the current claim holder. This work is conducted by geologists, prospectors, among others.

3. **Reconnaissance:** This involves prospecting, mapping, sampling, aerial photography, and geophysical and geochemical surveying to help identify geological targets indicative of a mineral deposit. This work is performed by geologists, geochemists, prospectors, geophysicists, among others.

4. **Advanced exploration:** Once geological targets have been identified, further work (drilling, trenching, sampling, assaying, etc.) is required to determine the economic viability of the targeted deposit. This work is carried out by geologists, drillers, geotechnical assistants, among others.

5. **Economic evaluation:** After the size and quality of the ore deposit has been determined (estimation of mineral resources), a feasibility study is conducted to determine whether the deposit is economically viable given the costs of operation, construction, rehabilitation, transport and other costs. This work is done by resource geologists, geological engineers, among others.

In short, mineral exploration is the search for materials in the earth's crust that occur in concentrations and quantities high enough to be profitably extracted and processed. This encompasses a wide range of activities, including reconnaissance (e.g., aerial photography, airborne geophysical surveys), prospecting and ground surveys, drilling and trenching, project engineering and feasibility studies.

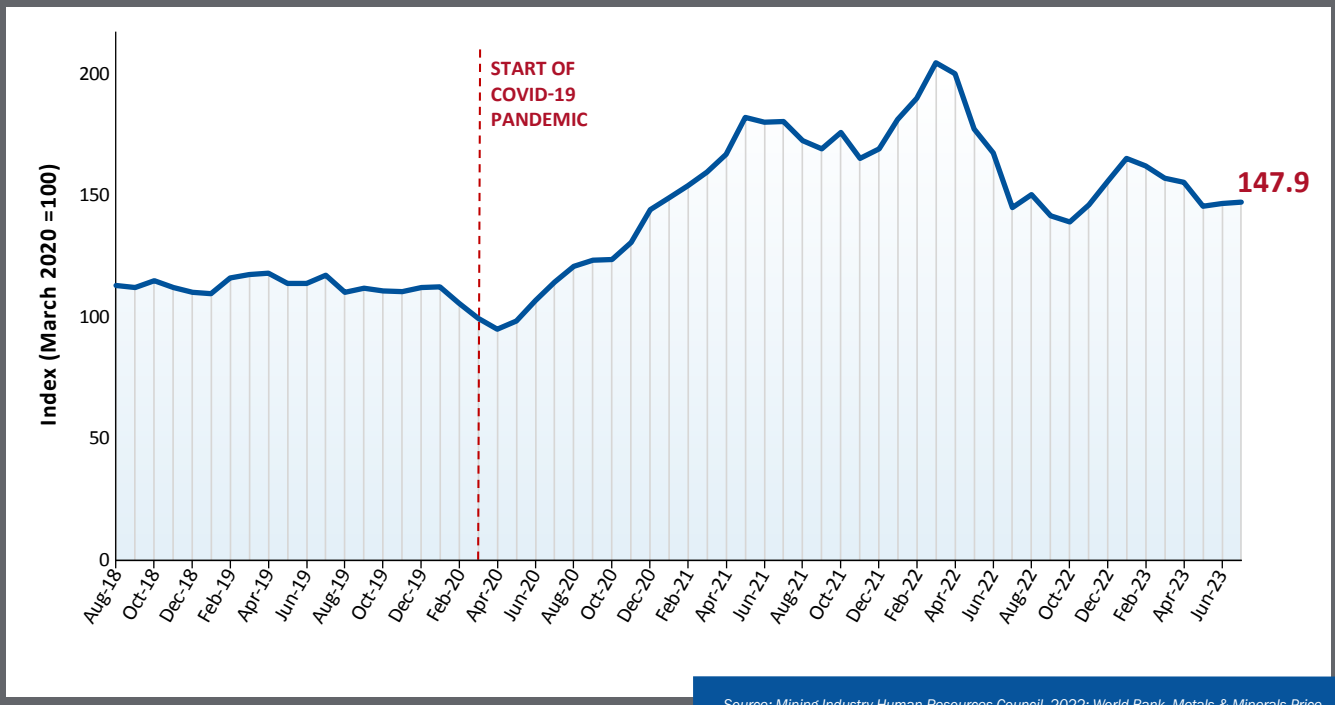
Throughout the five stages of mineral exploration, two vital ongoing activities play a significant role in shaping responsible and sustainable practices within the industry:

- **Engagement and Consultation:** Mineral exploration companies maintain regular consultations with Indigenous communities and local stakeholders. This process ensures that all parties are well-informed about exploration activities, potential impacts, and measures taken to mitigate any adverse effects. Collaborative dialogue helps in gaining social license and building partnerships that are crucial for the success of exploration projects.
- **Environmental Planning and Management:** Environmental planning is at the core of responsible mineral exploration. From the planning stage onwards, environmental considerations are integrated into the decision-making process. Comprehensive environmental impact assessments (EIAs) are conducted to identify potential risks and assess the overall impact on local ecosystems, water resources, air quality, and biodiversity. Environmental planning is integral to projects involving the reclamation or restoration of exploration sites, and it plays a key role in advanced exploration to establish a baseline understanding of the environment.

MINERAL EXPLORATION'S RECENT EXPANSION

The global economy has undergone significant restructuring since 2020 due to several factors, including the COVID-19 pandemic, the Russia-Ukraine conflict, major supply chain disruptions and persistent inflation. These events have coincided with a substantial rise in the prices of metals and minerals, fueling an expansion in mining and mineral exploration. At their peak in early 2022, prices had more than doubled from March 2020 levels and, despite a correction, they remained 48% higher as of July 2023 (Figure 1).

***FIGURE 1:** WORLD BANK METALS AND MINERALS PRICE INDEX (2018 - 2023)*



Source: Mining Industry Human Resources Council, 2022; World Bank, Metals & Minerals Price Index (accessed via Ycharts), Metals & Minerals Price Index.

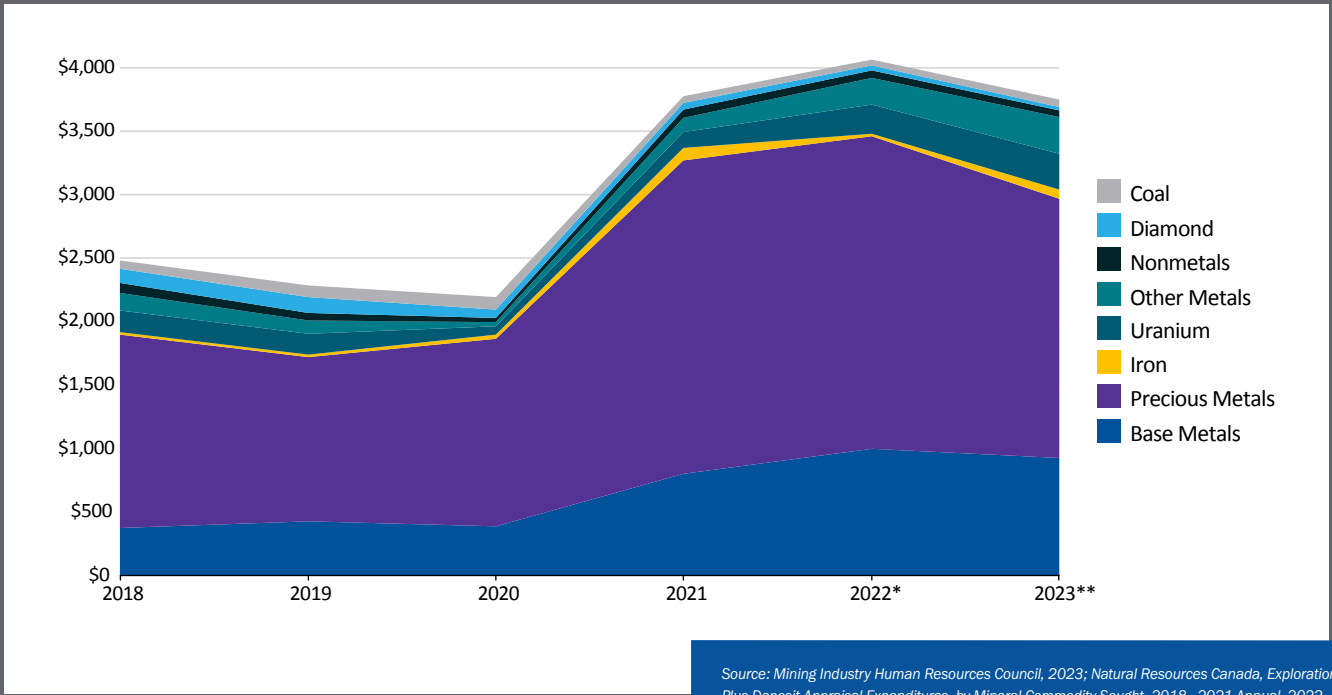
Higher commodity prices and a renewed interest in critical minerals have contributed to a pronounced rise in exploration spending, as companies are better able to secure the necessary financing for new exploration projects. In 2022, exploration and deposit appraisal expenditures exceeded the amount spent in 2020 by $610 million, an 86% increase (Figure 2).

The upsurge in exploration spending has been partially offset by a tight labour market, higher fuel costs and the pervasive effects of inflation[1]. Additionally, given sluggish capital markets and a higher interest rate environment, spending in 2023 is expected to decline slightly but remain elevated by historical standards.

While gold and other precious metals continue to attract the most interest, certain minerals are projected to have significantly higher exploration spending in 2023 compared to three years earlier, particularly base metals (+140%), iron (+148%), uranium (+321%) and other metals (+776%) such as cobalt, lithium and rare earth elements.

1 *Canadian Mineral Exploration Information Bulletin*, Natural Resources Canada, June 2023.

***FIGURE 2:* EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES ($ MILLIONS), BY COMMODITY**

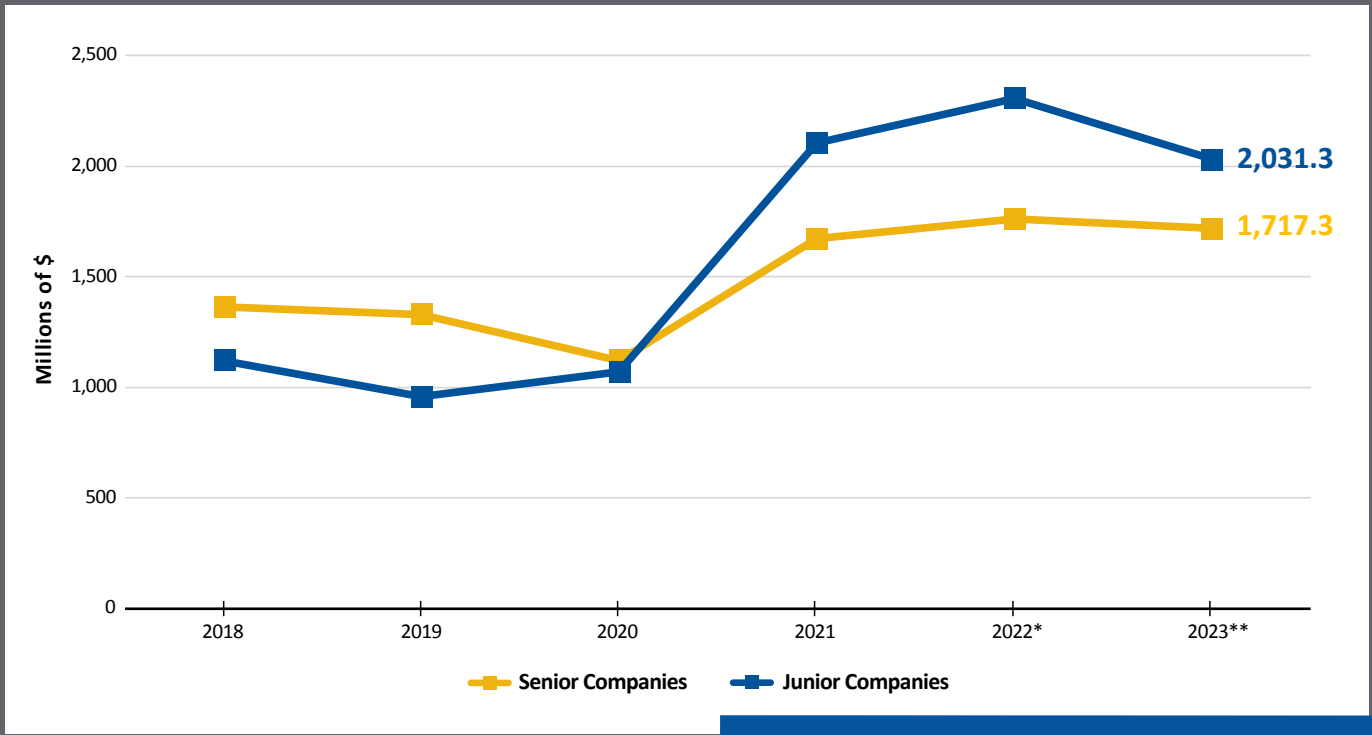


Source: Mining Industry Human Resources Council, 2023; Natural Resources Canada, Exploration Plus Deposit Appraisal Expenditures, by Mineral Commodity Sought, 2018 - 2021 Annual, 2022 Preliminary Estimates and 2023 Spending Intentions, 2023.

**Preliminary Estimates*
***Spending Intentions*

Since 2020, spending by junior exploration companies has far outpaced that of senior companies (Figure 3). While senior companies tend to invest exploration dollars near existing mine sites, junior companies generally search for new deposits in less developed regions. Junior companies are comparatively less established and are heavily reliant on external financing; their expansion in recent years is indicative of greater market interest in mining and mineral exploration.

FIGURE 3: EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES ($ MILLIONS), BY COMPANY CLASSIFICATION

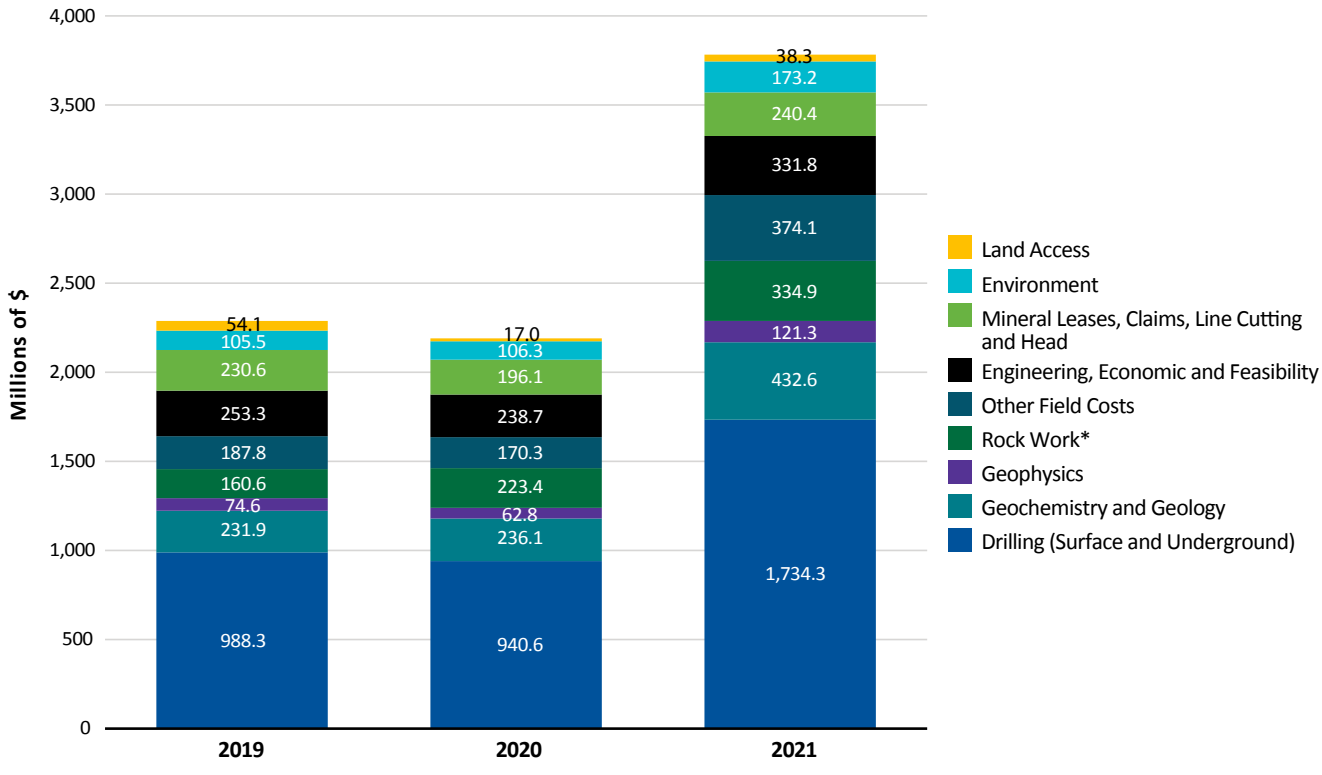


Source: Mining Industry Human Resources Council, 2023; Natural Resources Canada, Exploration Plus Deposit Appraisal Expenditures, by Junior and Senior Companies, by Province and Territory, 2018 - 2021 Annual, 2022 Preliminary Estimates and 2023 Spending Intentions, 2023.

**Preliminary Estimates*
***Spending Intentions*

The largest spike in exploration spending occurred from 2020 to 2021, with average costs rising by 72% (Figure 4). Every expense category within exploration and deposit appraisal activities experienced significant increases. Notably, drilling, which accounts for the largest component of spending at approximately 45% of the total, saw an increase of $794 million (84% higher).

FIGURE 4: EXPLORATION AND DEPOSIT APPRAISAL ACTIVITY ($ MILLIONS)

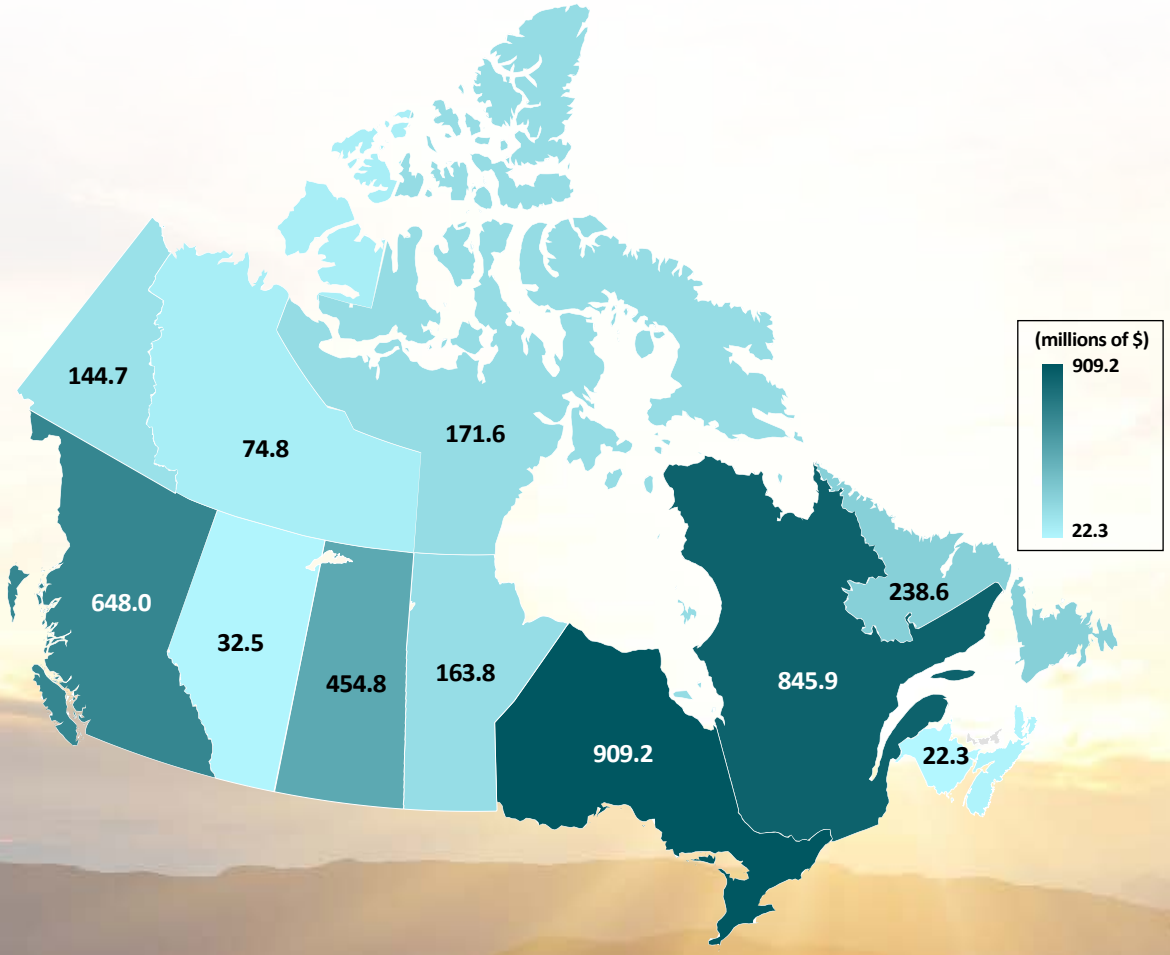


Source: Mining Industry Human Resources Council, 2023; Natural Resources Canada, Exploration Plus Deposit Appraisal Activity, by Province and Territory, 2019 - 2021, 2023.

**Includes stripping, trenching, shaft work, drifts, cross-cuts, raises, declines, rock sampling, and dewatering costs.*

Mineral exploration takes place across Canada, especially in remote and sparsely populated regions. However, nearly half of mineral exploration spending is concentrated in Ontario and Quebec (Figure 5).

***FIGURE 5:* 2023 EXPLORATION AND DEPOSIT APPRAISAL SPENDING INTENTIONS, BY PROVINCE**



Source: Mining Industry Human Resources Council, 2023; Natural Resources Canada, Exploration Plus Deposit Appraisal Expenditures, by Junior and Senior Companies, by Province and Territory, 2018 - 2021 Annual, 2022 Preliminary Estimates and 2023 Spending Intentions, 2023.

FUTURE DRIVERS OF GROWTH FOR MINERAL EXPLORATION

In addition to the recent surge in mineral exploration activity, there are long-term trends that suggest the industry's growth trajectory will continue for years to come.

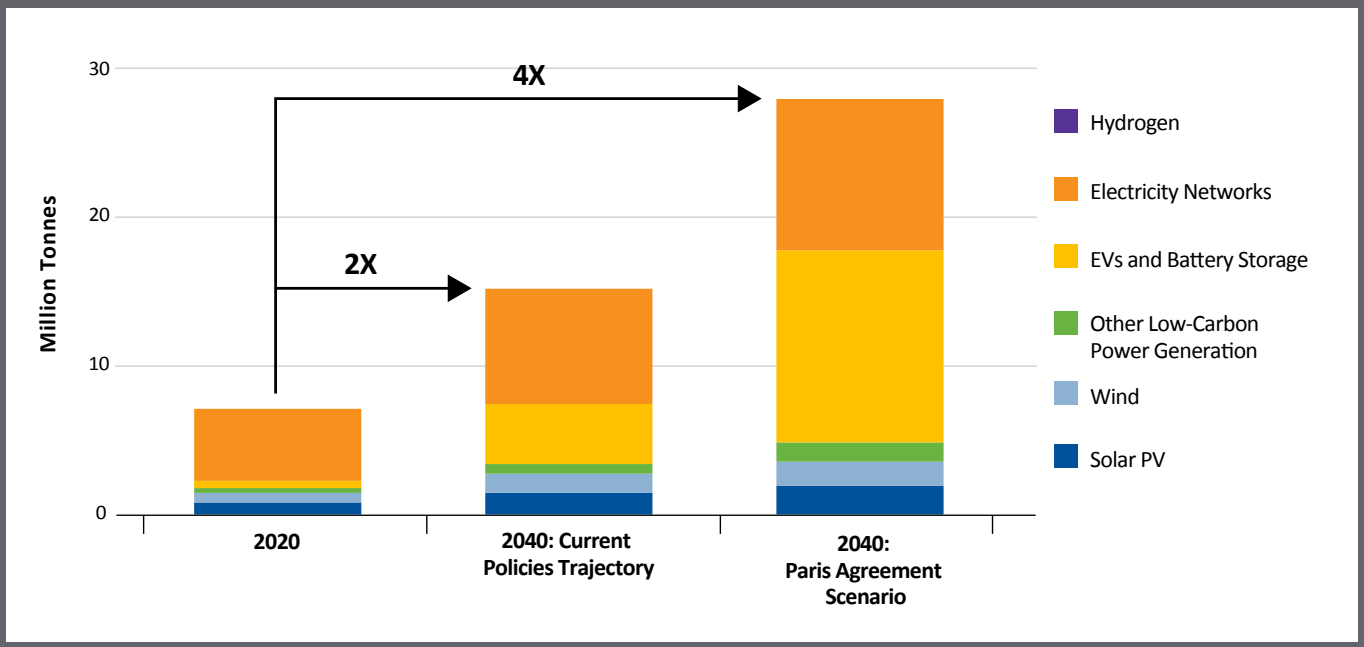
In particular, the shift to a greener, low-carbon global economy is expected to dramatically increase demand for critical minerals in the coming decades. At the same time, the continued rise of middle-class populations in emerging markets will add to the existing demand for minerals[2].

The International Energy Agency (IEA) estimates that global mineral requirements will double by 2040 under current policies (Figure 6), and they would need to quadruple for the world to meet the carbon reduction targets outlined in the 2015 Paris Agreement[3]. Figure 7 illustrates the wide range of minerals needed to diversify the energy supply as the global community moves toward cleaner, more sustainable energy solutions.

2 Fengler, W., Kharas, H., & Caballero, J. *Asia's tipping point in the consumer class*. Brookings, 2022. https://www.brookings.edu/blog/future-development/2022/06/02/asias-tipping-point-in-the-consumer-class/

3 The 2015 Paris Agreement, adopted by 193 countries and the European Union, is an international treaty aimed at combating climate change and limiting global warming to well below 2 degrees Celsius above pre-industrial levels. It sets out various goals and provisions to achieve this objective, including targets for reducing greenhouse gas emissions, promoting sustainable development, and mobilizing financial resources for climate action.

***FIGURE 6:** DEMAND SCENARIOS FOR CRITICAL MINERALS (INTERNATIONAL ENERGY AGENCY STUDY)*



Source: International Energy Agency (IEA), The Role of Critical Minerals in Clean Energy Transitions, World Energy Outlook Special Report (2022).

FIGURE 7: MINERALS USED IN LOW-CARBON TECHNOLOGIES (2020)

	Hydro	Nuclear	Gas	Wind	Geo-thermal	SP	CSP	Energy Storage
Aluminum		●	●	●		●		●
Chromium	●	●	●	●	●			●
Cobalt			●					●
Copper	●	●	●	●	●	●	●	●
Graphite								●
Indium		●				●		
Iron				●				●
Lead	●	●		●		●		●
Lithium								●
Manganese	●		●	●	●			●
Molybdenum	●	●	●	●	●	●		
Neodymium				●				
Nickel	●	●	●	●	●	●		●
Silver		●				●	●	
Titanium	●	●	●		●			
Vanadium		●						●
Zinc	●	●		●		●		●

Note: SP = Solar photovoltaic; CSP = Concentrated solar power. This is not an exhaustive list of all clean energy technologies or the range of materials needed for each technology.

Source: World Bank, Climate-smart Mining: Minerals for Climate Action Report, 2020; Mining Industry Human Resources Council, 2023.

Across the globe, governments and the private sector have embraced the goal of reducing carbon emissions and transforming economies to be more environmentally sustainable. Nations have entered multilateral agreements to promote mutual accountability and to address the detrimental effects of human activities on the environment. This requires mining and mineral exploration to play a key role in facilitating low-carbon technologies and infrastructure. To this end, the Canadian government has launched several initiatives:

- The Mineral Exploration Tax Credit (METC): A 15% credit designed to help exploration companies raise equity funds in addition to the regular tax deduction associated with FTS investments. In 2018, the government extended the METC until March 31, 2024[4].
- The Canadian Minerals and Metals Plan (CMMP): Launched in 2018 to enhance the competitiveness and sustainability of Canada's mining sector and position it as a global leader in sustainable and responsible mining practices.
- The Canadian Critical Minerals Strategy[5]: A plan to increase the supply of responsibly sourced critical minerals and support the development of domestic and global value chains for the green and digital economy. This strategy is backed by $4 billion in the 2022 federal budget, which includes:
  - A new 30% Critical Mineral Exploration Tax Credit to support specified exploration expenditures incurred in Canada – applicable to specific critical minerals including nickel, lithium, cobalt, graphite, copper, rare earth elements, vanadium, and uranium, among others.
  - Up to $1.5 billion for infrastructure development for critical mineral supply chains, with a focus on priority deposits.
  - $79.2 million for public geoscience and exploration to better identify and assess mineral deposits.

4 *Tax incentives for mining and exploration*, Natural Resources Canada. <https://natural-resources.canada.ca/our-natural-resources/minerals-mining/mining-policy-taxation-and-industry/taxation/mining-taxation-canada/mining-specific-tax-provisions/8892>

5 *The Canadian Critical Minerals Strategy*, Natural Resources Canada, 2022. <https://www.canada.ca/en/campaign/critical-minerals-in-canada/canadian-critical-minerals-strategy.html>

ESSENTIAL OCCUPATIONS FOR MINERAL EXPLORATION

Labour market activity in mineral exploration is tricky to measure since Statistics Canada's industry definitions[6] do not fit mineral exploration activities neatly. No dedicated industry code exists for mineral exploration–rather, it is distributed among many NAICS such as *Mining and quarrying* (NAICS 212) and *Support Services for Mining* (NAICS 213), and less relevant ones like *Architectural, Engineering and Related Services* (NAICS 5413). Because of this it is almost impossible to accurately gauge mineral exploration employment or wage statistics.

Instead, this report focuses on the labour market conditions of a selection of occupations that are critical to the sector. Table 1 outlines a list of occupations considered important for mineral exploration activity to thrive and expand in Canada, which is the focus of this section.

TABLE 1: MINERAL EXPLORATION OCCUPATIONS IN FOCUS

OCCUPATION	RELATED NOC CODE	RELATED JOB TITLES	ROLE IN THE EXPLORATION SECTOR
Geologists	*21102 - Geoscientists and oceanographers*	• Environmental geologist • Development geologist • Exploration geologist • Geochemist • Geologist • Geophysicist	• Analyze data to pinpoint mineral exploration areas, employing surveys, geophysics, and geochemistry. • Collaborate to assess economic viability and ensure responsible extraction.
Geological Technicians	*22101 - Geological and mineral technologists and technicians*	• Prospector[7] • Assayer • Geological engineering technician • Geophysical technologist • Metallurgical technologist	• Support mineral exploration through field surveys, sample collection, and analysis. • Collaborate with geologists in lab work, data collection, and equipment operation, ensuring precise data. • Aid in mapping and visualization of geological data.
Geological Engineers	*21331 - Geological engineers*	• Geological engineer • Geophysical engineer • Geotechnical engineer • Hydrogeological engineer	• Oversee exploration, merging geology and engineering to pinpoint mineral deposits. • Evaluate economic feasibility, ore quality, and safety measures, collaborating with geologists for efficient extraction.
Metallurgical Engineers	*21322 - Metallurgical and materials engineers*	• Materials engineer • Metallurgical engineer • Extractive engineer	• Analyze mineral deposits through tests on ore samples. • Evaluate extraction methods, design recovery processes, and minimize environmental impact. • Crucial for critical mineral exploration projects requiring specialized processes for ore beneficiation, to advance projects from exploration to advanced stages.

6 See the *North American Industry Classification System (NAICS) Canada 2017 Version 3.0* <https://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=1181553>

7 Prospectors are not assigned a separate NOC code and are instead categorized under geological technicians for analytical purposes.

OCCUPATION	RELATED NOC CODE	RELATED JOB TITLES	ROLE IN THE EXPLORATION SECTOR
Geomatics Professionals	*22214 - Technical occupations in geomatics and meteorology*	• Cartographer • Aerial survey technician • Geographic information systems (GIS) technician • Map draftsman/woman • Mapping technician • Photogrammetric technician	• Employ advanced techniques to define areas, assess terrain, gather data for modeling, identify hazards, and ensure environmental compliance in mineral exploration.
Drillers	*73402 - Drillers and blasters - surface mining, quarrying and construction*	• Core drill operator • Diamond drill operator • Foundation drill operator • Seismic prospecting driller • Blaster	• Extract geological samples and minerals using specialized equipment, creating boreholes for vital data collection in mineral exploration.

Source: Mining Industry Human Resources Council, 2023

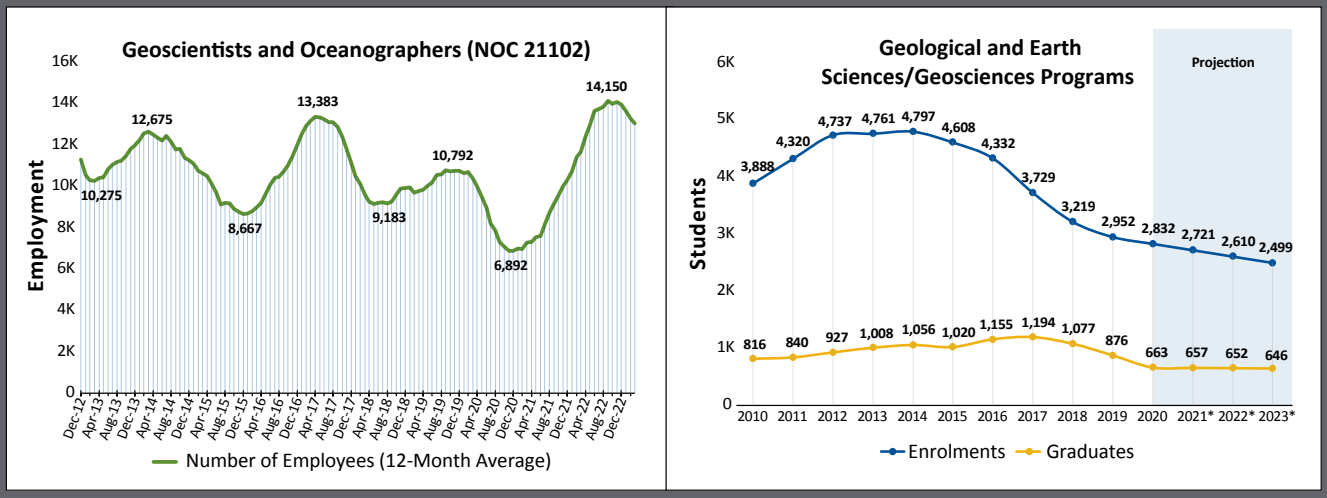
Geologists

Geologists collect and analyze geological data to identify potential target areas for mineral exploration. This involves conducting field surveys and employing geophysical and geochemical techniques to estimate deposit size, quality and environmental impact. Collaborating with other experts, they play a crucial role in assessing a deposit's economic viability and ensuring responsible resource extraction.

Employment in this occupation is characterized by cyclicality, depending on macroeconomic conditions and commodity prices. Since 2020, employment among geoscientists has roughly doubled (Figure 8). However, post-secondary enrolment trends are largely unresponsive to the labour needs of the industry and have declined steadily over the past decade. From 2014 to 2020, the number of geosciences undergraduate enrolments decreased from approximately 4,800 to only 2,800, a 42% decline. The dwindling number of students entering this profession is likely to lead to tight labour markets and labour shortages during periods of expansion.

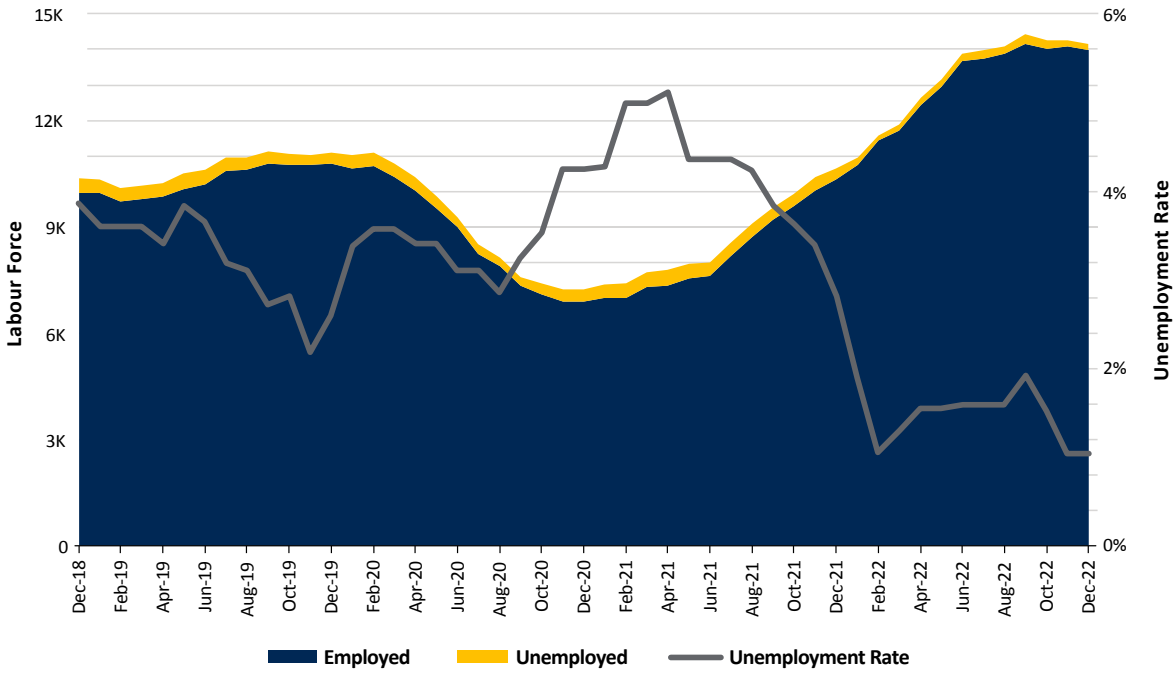
During this most recent growth cycle, the unemployment rate for geoscientists has declined steadily and remained low, pointing to acute labour market tightness, just as employment has been ramping up (Figure 9).

FIGURE 8: EMPLOYMENT AND PSE TRENDS (UNDERGRADUATE AND BELOW), GEOSCIENTISTS



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Post-secondary Information System (Table 37-10-0182-01); Statistics Canada, Labour Force Survey (Custom Data).

FIGURE 9: EMPLOYMENT AND UNEMPLOYMENT TRENDS (12-MONTH AVERAGES), GEOSCIENTISTS



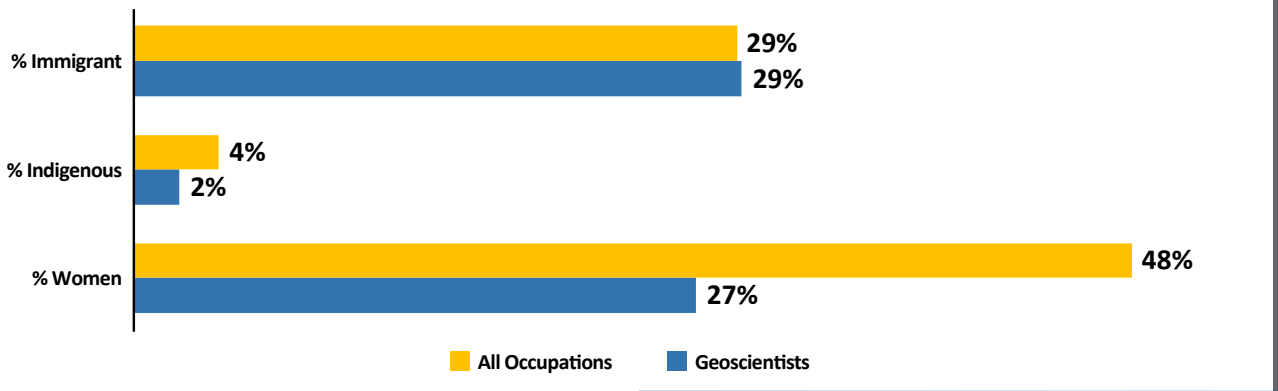
Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Labour Force Survey (Custom Data).

Approximately one third of geoscientists are immigrants[8], which is in line with the average immigrant representation across all occupations (Figure 10). Indigenous workers are underrepresented, at 2%, compared to the overall labour force average of 4%. While women make up half of the overall Canadian labour force, they constitute only 27% of geoscientists.

The age distribution of geoscientists tends to be relatively younger, with a higher proportion (55%) between the ages of 25 and 44. There is a marked drop-off in the number of geoscientists for older cohorts, which could point to difficulties retaining workers as they age, potentially due to lifestyle barriers characteristic of this occupation.

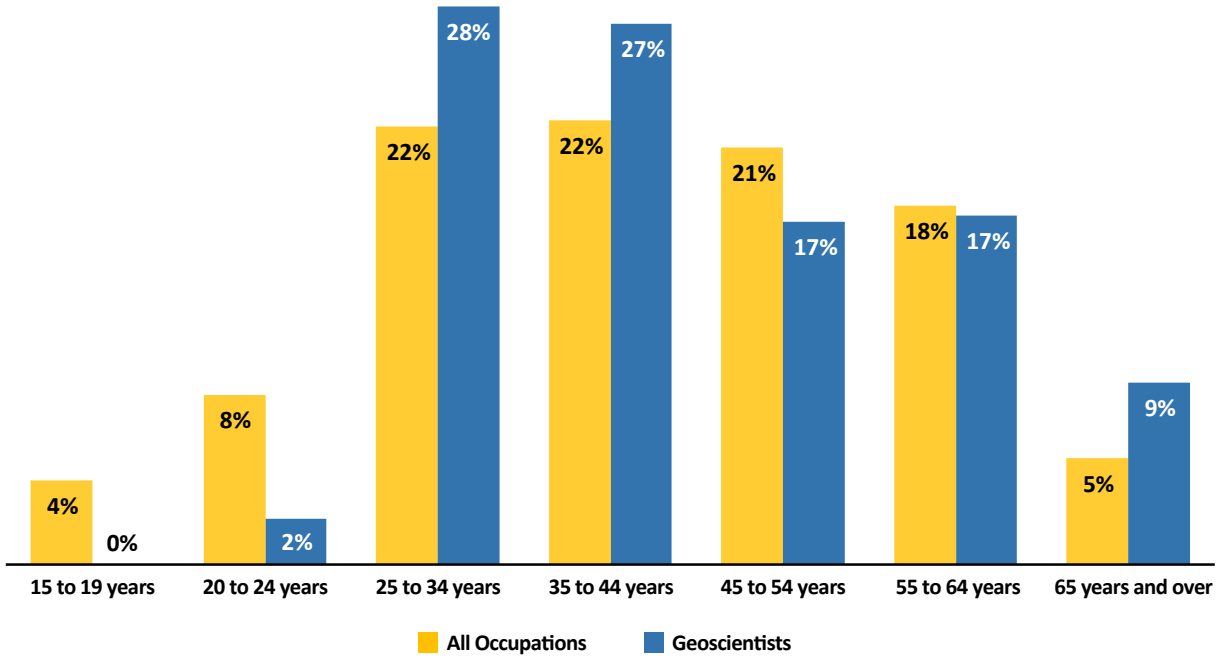
8 Includes all workers not born in Canada, regardless of citizenship or permanent residency status.

FIGURE 10: LABOUR FORCE REPRESENTATION OF IMMIGRANTS, INDIGENOUS PEOPLES AND WOMEN AMONG GEOSCIENTISTS



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

***FIGURE 11:** LABOUR FORCE AGE DISTRIBUTION, GEOSCIENTISTS*



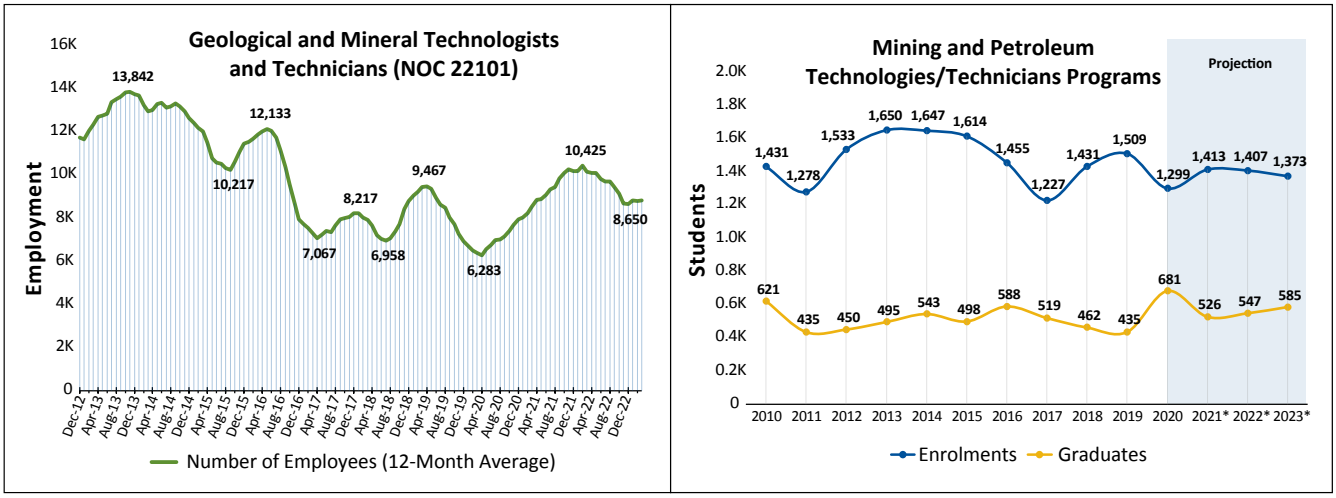
Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

Geological technicians

Geological technicians provide essential support in mineral exploration by assisting in field surveys, and by collecting and analyzing soil, rock and core samples. They collaborate with geologists in sample collection, laboratory analysis and equipment operation, ensuring accurate data gathering. They also assist in the mapping and visualization of geological information.

As with geologists, employment for geological technicians is highly cyclical. Their employment levels have risen by about 38% since 2020, although they remain lower than a decade ago, during the previous commodity supercycle (Figure 12). Post-secondary education trends have remained stagnant, neither rising nor falling significantly throughout this period.

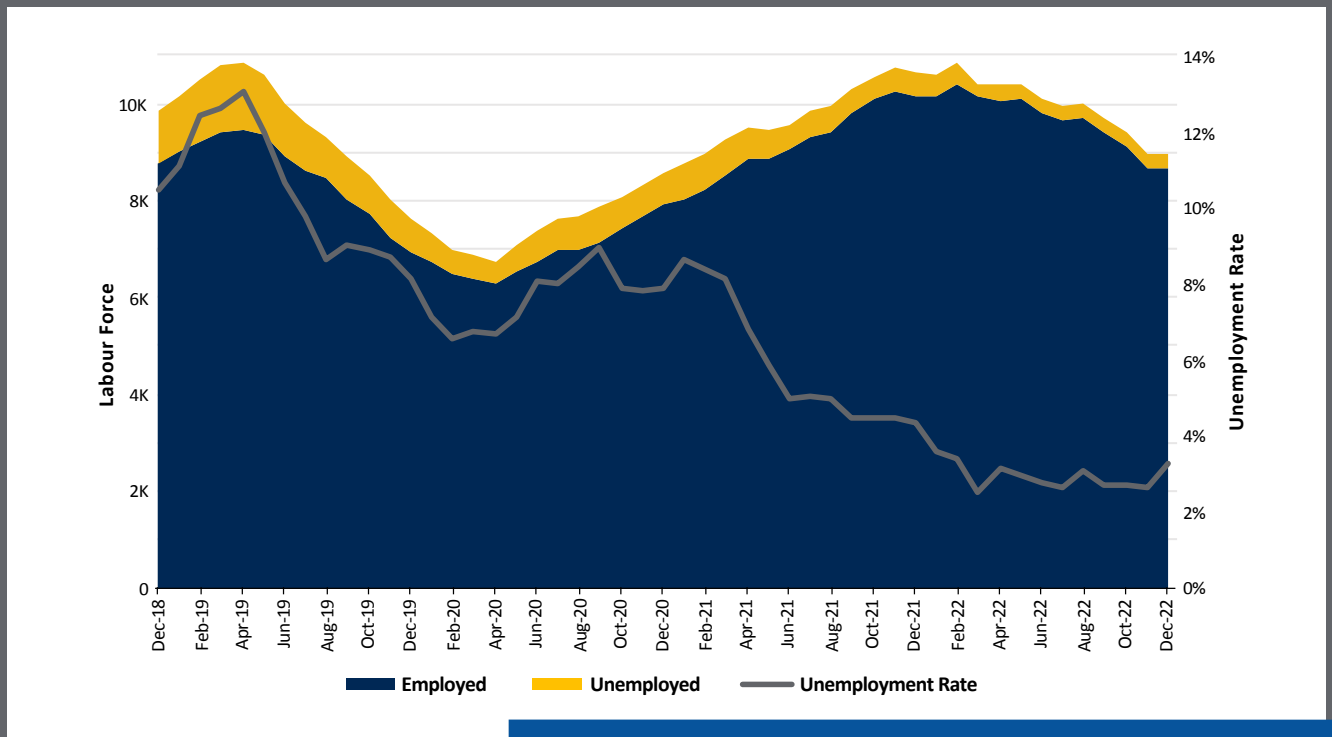
FIGURE 12: EMPLOYMENT AND PSE TRENDS (UNDERGRADUATE AND BELOW), MINING TECHNICIANS



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Post-secondary Information System (Table 37-10-0182-01); Statistics Canada, Labour Force Survey (Custom Data).

Geological technicians have experienced a steady and significant decline in their unemployment rate, signalling increasing labour market tightness and pointing to difficulties in finding new recruits for the labour pool. This is in contrast with the previous employment peak prior to the pandemic, which had similarly high levels of employment, but a much larger pool of job seekers.

FIGURE 13: EMPLOYMENT AND UNEMPLOYMENT TRENDS (12-MONTH AVERAGES), GEOLOGICAL AND MINERAL TECHNOLOGISTS AND TECHNICIANS

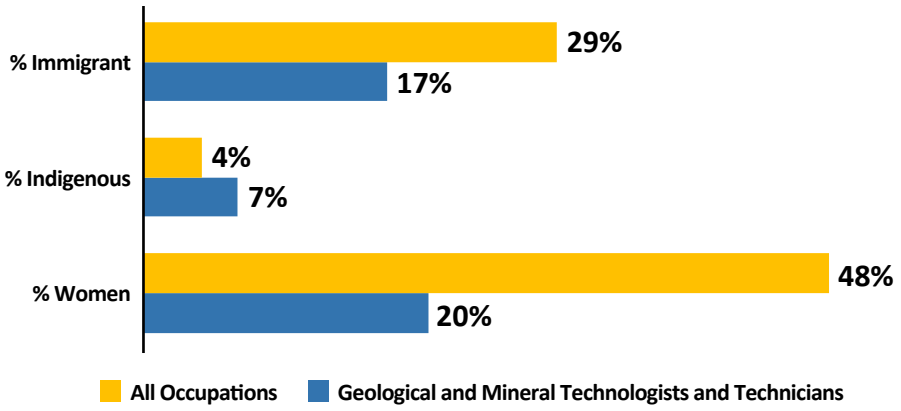


Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Labour Force Survey (Custom Data).

Geological technicians have lower than average levels of representation among immigrants and women, with 17% and 20%, respectively. Conversely, Indigenous workers in this occupation make up a higher share of the labour force (7%) than the Canadian average (4%).

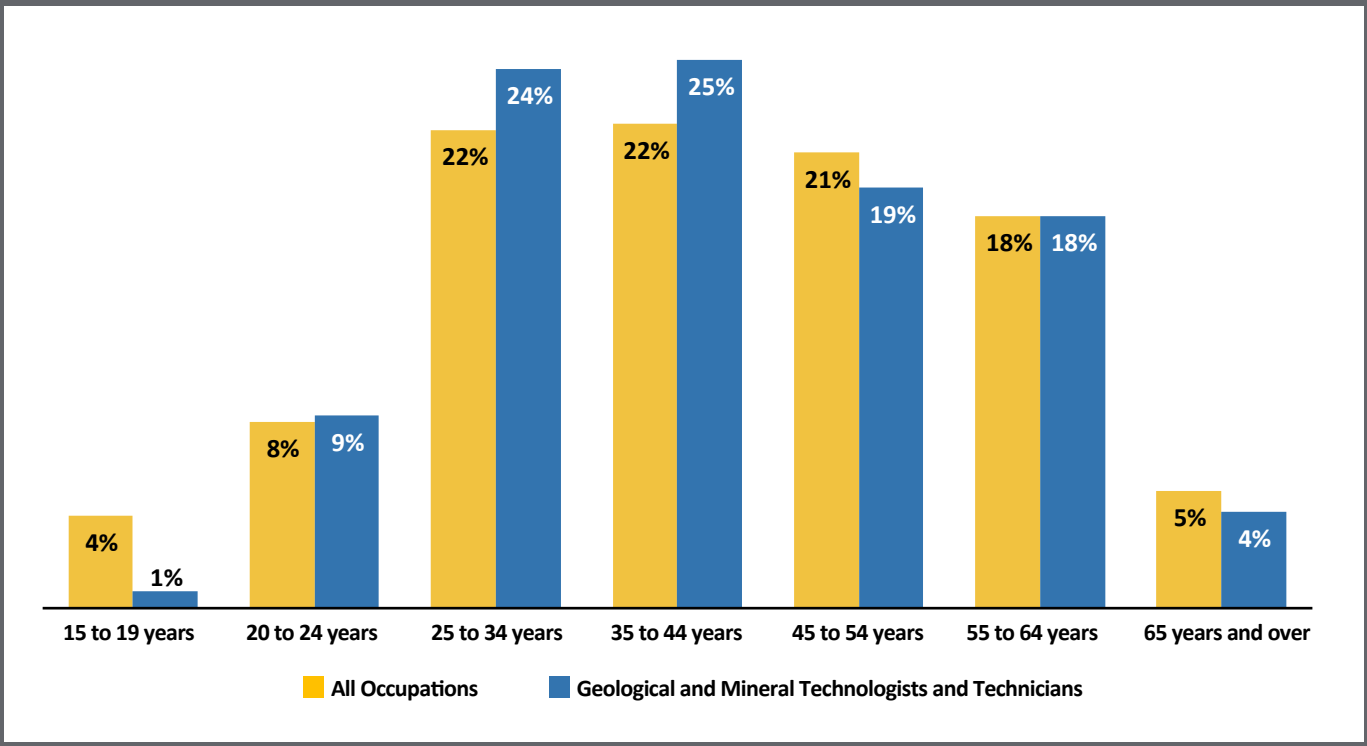
The age demographics for this occupation follow roughly the same distribution as the average labour force, with a slightly higher than average concentration around ages 25 to 44 (about 49% of the workforce).

***FIGURE 14:* LABOUR FORCE REPRESENTATION OF IMMIGRANTS, INDIGENOUS PEOPLES AND WOMEN AMONG GEOLOGICAL AND MINERAL TECHNOLOGISTS AND TECHNICIANS**



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

***FIGURE 15:* LABOUR FORCE AGE DISTRIBUTION, GEOLOGICAL AND MINERAL TECHNOLOGISTS AND TECHNICIANS**



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

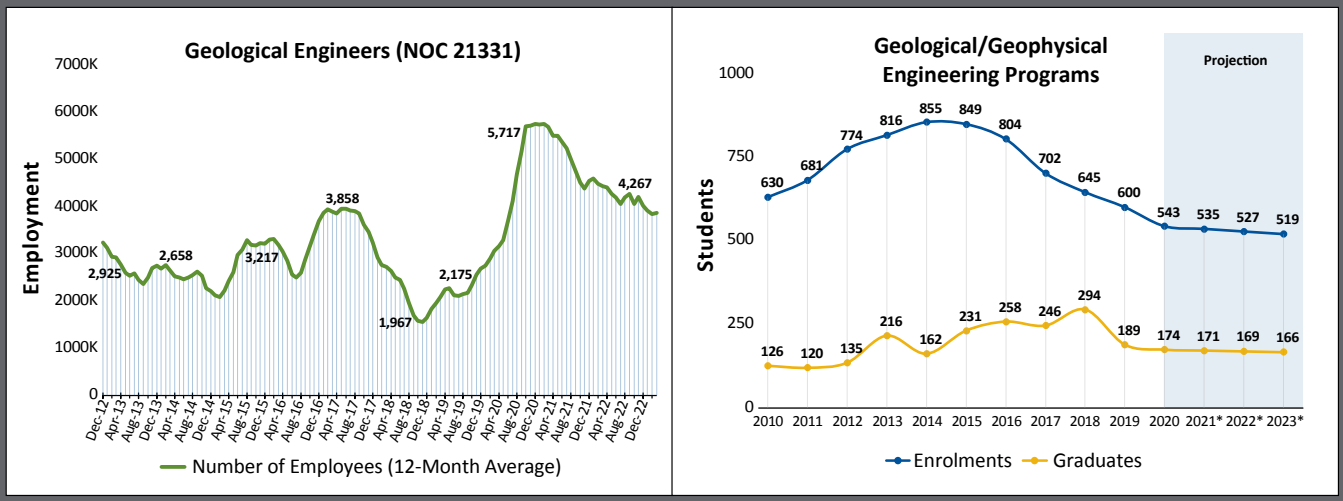
Geological engineers

Geological engineers design and oversee mineral exploration programs, integrating geological data analysis with engineering principles to identify mineral deposits. They assess the economic viability of potential sites, considering factors like ore quality, extraction methods and environmental impact. Lastly, they develop strategies for safe and efficient extraction, collaborating with geologists and technicians.

Geological engineers have experienced a large expansion in the last four years (Figure 16). Their employment previously declined, reaching its low point in late 2018. Throughout 2020, there was explosive growth in the demand for geological engineers, roughly tripling and peaking in early 2020. Since then, employment has cooled off but remains higher than the previous decade. Post-secondary education trends appear to be completely disconnected from the labour market, having peaked in 2014 and stagnated since then. As of 2020, enrolments had declined by about 40% from their highest levels.

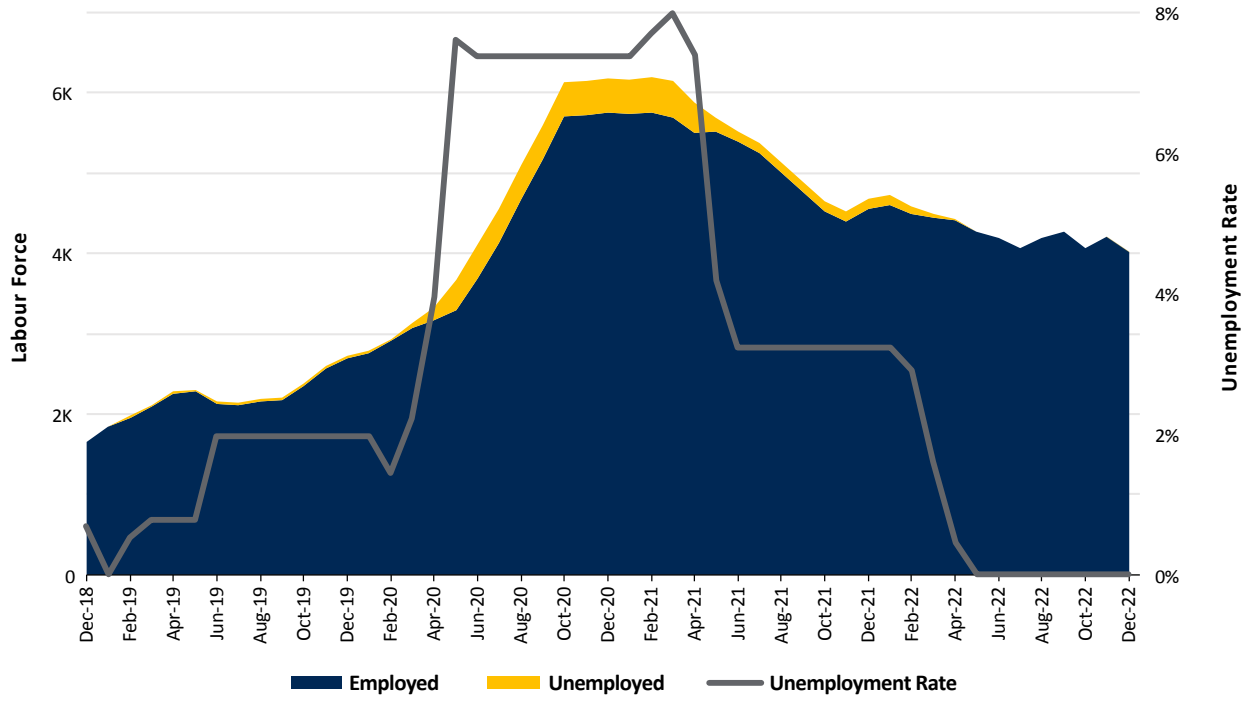
During the pandemic, unemployment rates reached 8% but have since dropped precipitously (Figure 17). The consistently low unemployment rate among geological engineers suggests a low level of attachment to this occupation, meaning that workers are more likely to seek employment in other engineering professions. Despite a reduction of about 2,000 employees, by the end of 2022 the pool of unemployed job seekers in this occupation appeared to have dried up completely.

***FIGURE 16:** EMPLOYMENT AND PSE TRENDS (UNDERGRADUATE AND BELOW), GEOLOGICAL ENGINEERS (2012 - 2022)*



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Post-secondary Information System (Table 37-10-0182-01); Statistics Canada, Labour Force Survey (Custom Data).

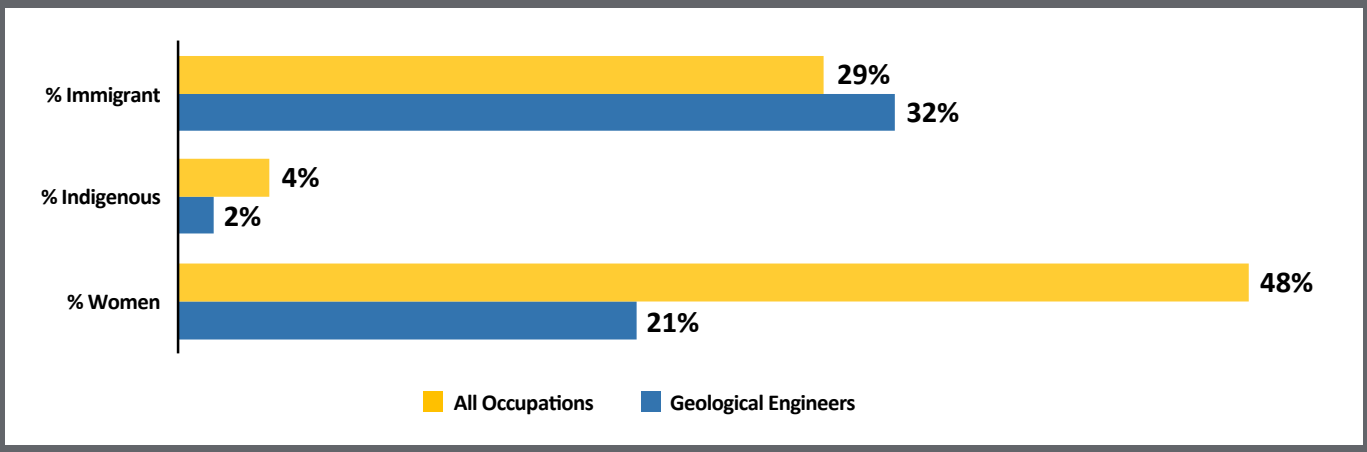
FIGURE 17: ***EMPLOYMENT AND UNEMPLOYMENT TRENDS (12-MONTH AVERAGES), GEOLOGICAL ENGINEERS (2018 - 2022)***



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Labour Force Survey (Custom Data).

According to the 2021 Census, 29% of geological engineers are immigrants, which is on par with the national average. On the other hand, the percentage of women (21%) and percentage of Indigenous workers (2%) are much lower than the average for all occupations in Canada.

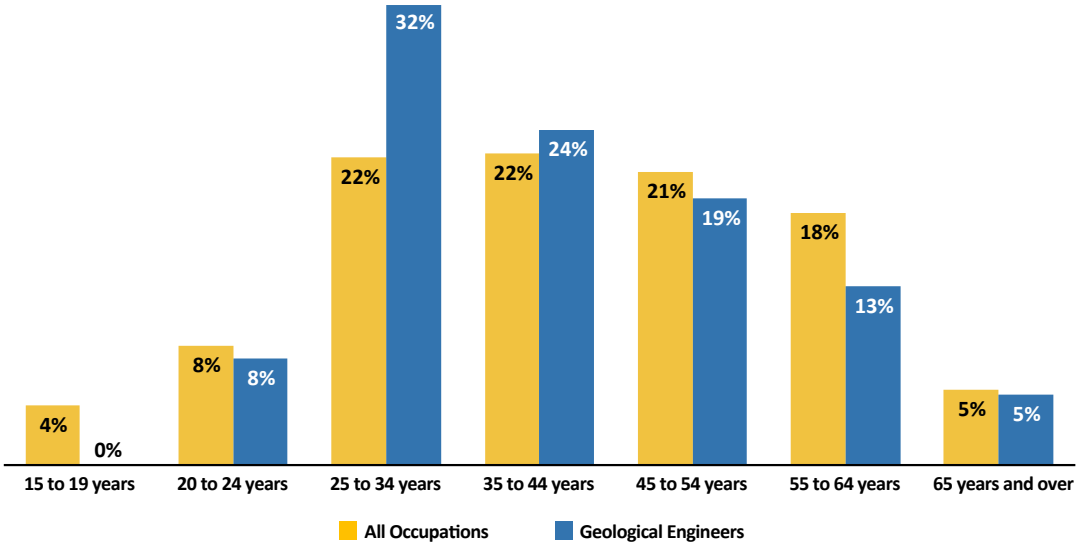
FIGURE 18: ***LABOUR FORCE REPRESENTATION OF IMMIGRANTS, INDIGENOUS PEOPLES AND WOMEN AMONG GEOLOGICAL ENGINEERS (2021 CENSUS)***



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

The age distribution for geological engineers skews young. Forty percent of workers in this occupation are under the age of 35, while relatively few people in this occupation are 55 years and older. The age demographics for geological engineers appear favourable compared to other occupations in the industry.

***FIGURE 19:** LABOUR FORCE AGE DISTRIBUTION (2021 CENSUS), GEOLOGICAL ENGINEERS*

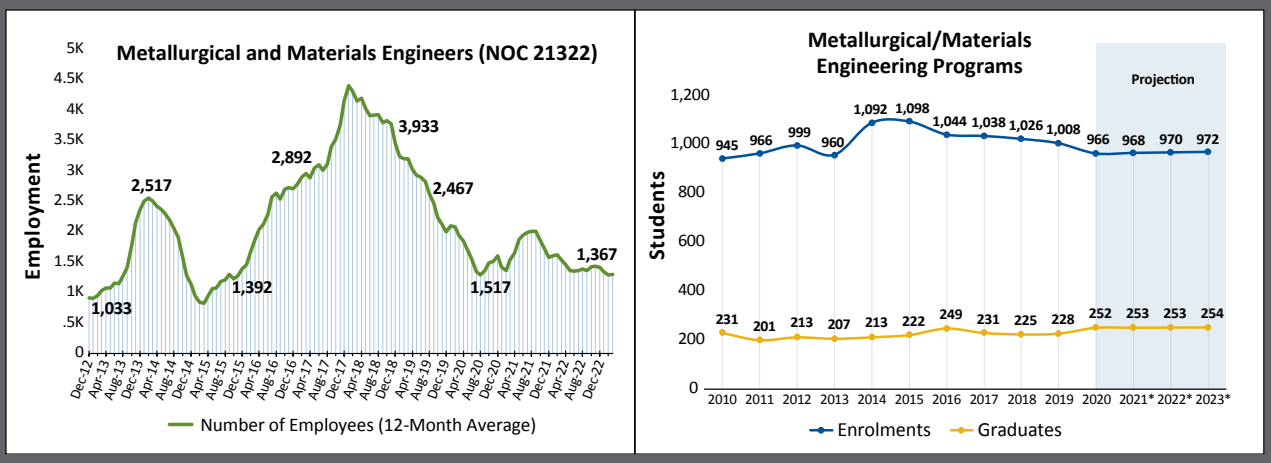


Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

Metallurgical engineers

Metallurgical engineers work to measure the composition and properties of mineral deposits. These engineers conduct metallurgical tests to analyze ore samples, evaluate extraction techniques and design mineral recovery processes to determine the optimal methods for extracting valuable minerals while minimizing environmental impact. They are important to critical mineral exploration projects, as they often require special processes to beneficiate the ore, which can be a barrier to taking a project from exploration to advanced exploration.

***FIGURE 20:** EMPLOYMENT AND PSE TRENDS (UNDERGRADUATE AND BELOW), METALLURGICAL AND MATERIALS ENGINEERS*

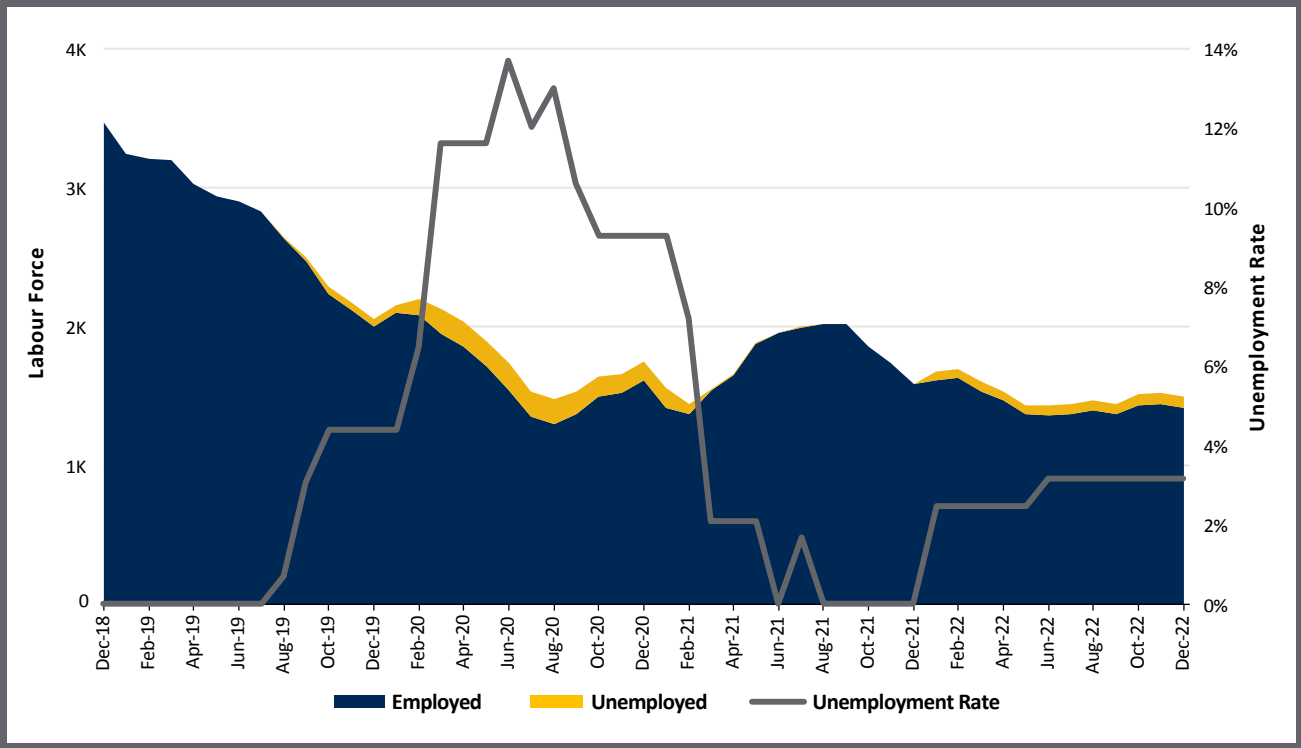


Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Post-secondary Information System (Table 37-10-0182-01); Statistics Canada, Labour Force Survey (Custom Data).

Employment for metallurgical engineers reached its height in late 2017, and has declined dramatically since then, by about 66%. Demand for this occupation has not recovered in the post-pandemic period and remains near the lowest levels seen over the last decade. Post-secondary education trends for metallurgical engineers have been almost completely flat throughout this period, with the same number of enrolments in 2020 as a decade before.

Following the pandemic, the unemployment rate has been consistently low, even as employment has also declined (Figure 21). As with geological engineers, this could be indicative of a low level of attachment to this occupation, a sign that metallurgical engineers might seek employment in other engineering professions.

***FIGURE 21:** EMPLOYMENT AND UNEMPLOYMENT TRENDS (12-MONTH AVERAGES), METALLURGICAL AND MATERIALS ENGINEERS*

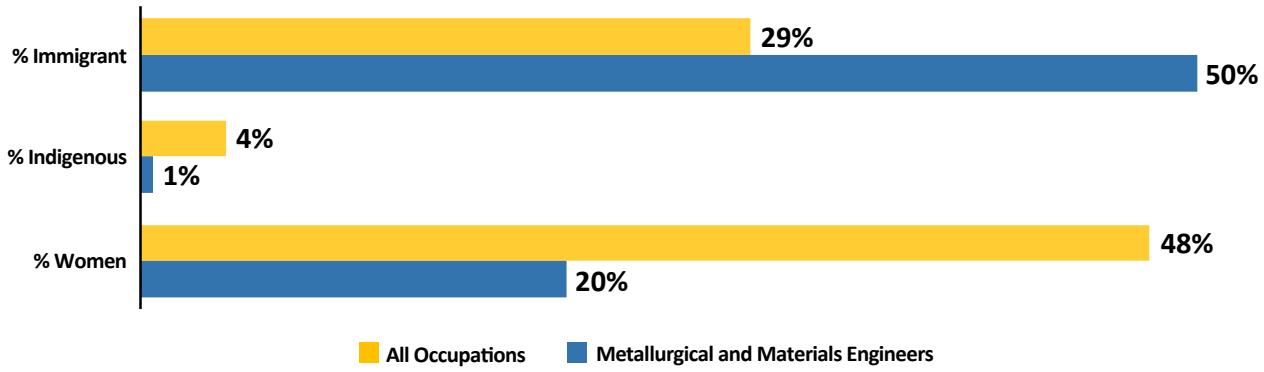


Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Labour Force Survey (Custom Data).

Immigrants are very well represented among metallurgical engineers, comprising half of the labour force in this occupation. Indigenous workers and women are underrepresented, comprising only 1% and 20% of the labour force, respectively.

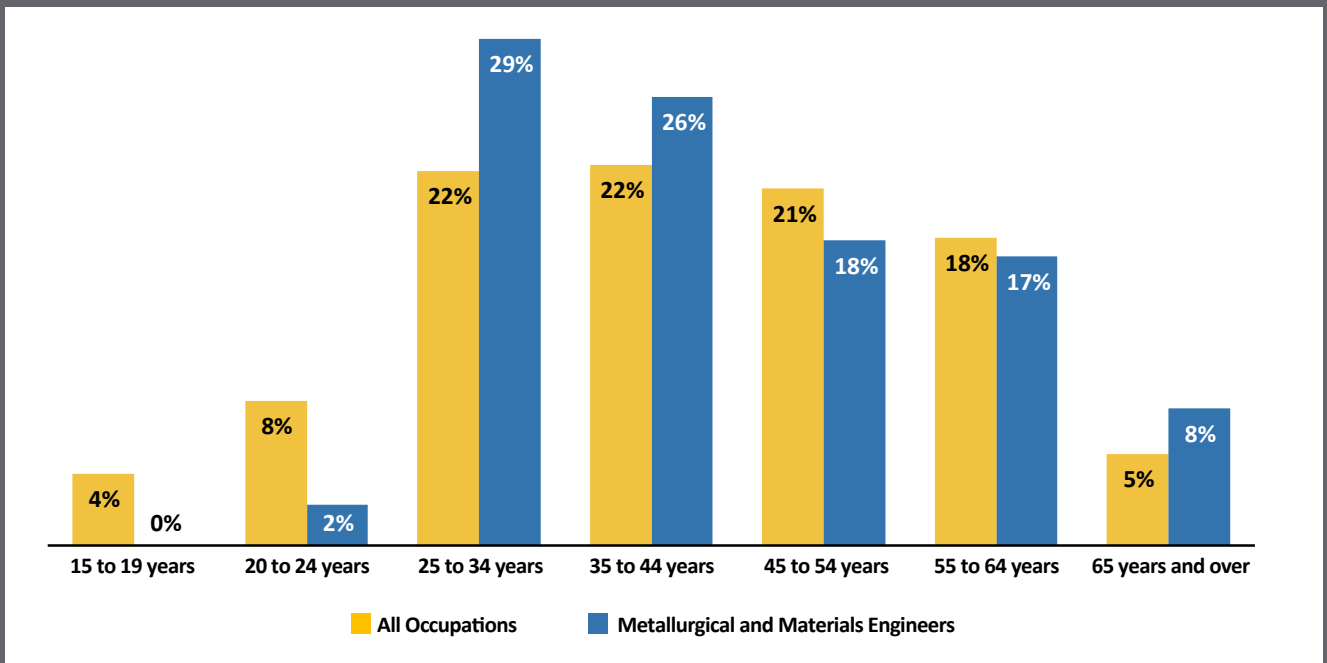
Metallurgical engineers are another mineral exploration occupation that has a relatively high concentration of workers between the ages of 25 and 44 (with 55%).

***FIGURE 22:** LABOUR FORCE REPRESENTATION OF IMMIGRANTS, INDIGENOUS PEOPLES AND WOMEN AMONG METALLURGICAL AND MATERIALS ENGINEERS (2021 CENSUS)*



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

***FIGURE 23:** LABOUR FORCE AGE DISTRIBUTION, METALLURGICAL AND MATERIALS ENGINEERS*



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

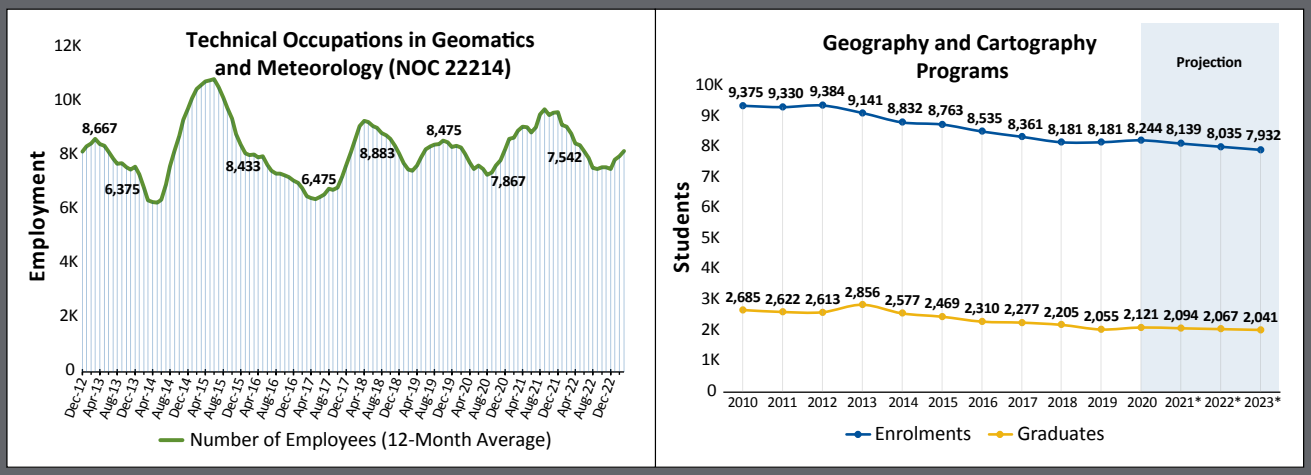
Geomatics professionals

Geomatics professionals use advanced surveying and mapping techniques to precisely define exploration areas and assess terrain conditions. They gather critical data for comprehensive ecological modeling, identify potential hazards and ensure compliance with environmental regulations.

Demand for geomatics professionals also appears to follow some cyclicality, although not as pronounced as some other occupations in the sector. This is most likely because geomatics professionals are likely to work in a variety of industries. In 2020 and 2021, demand rose by about 25%, although it fell to 2019 levels in 2022. Post-secondary enrolments for this occupation have followed a relatively flat, slightly declining trend.

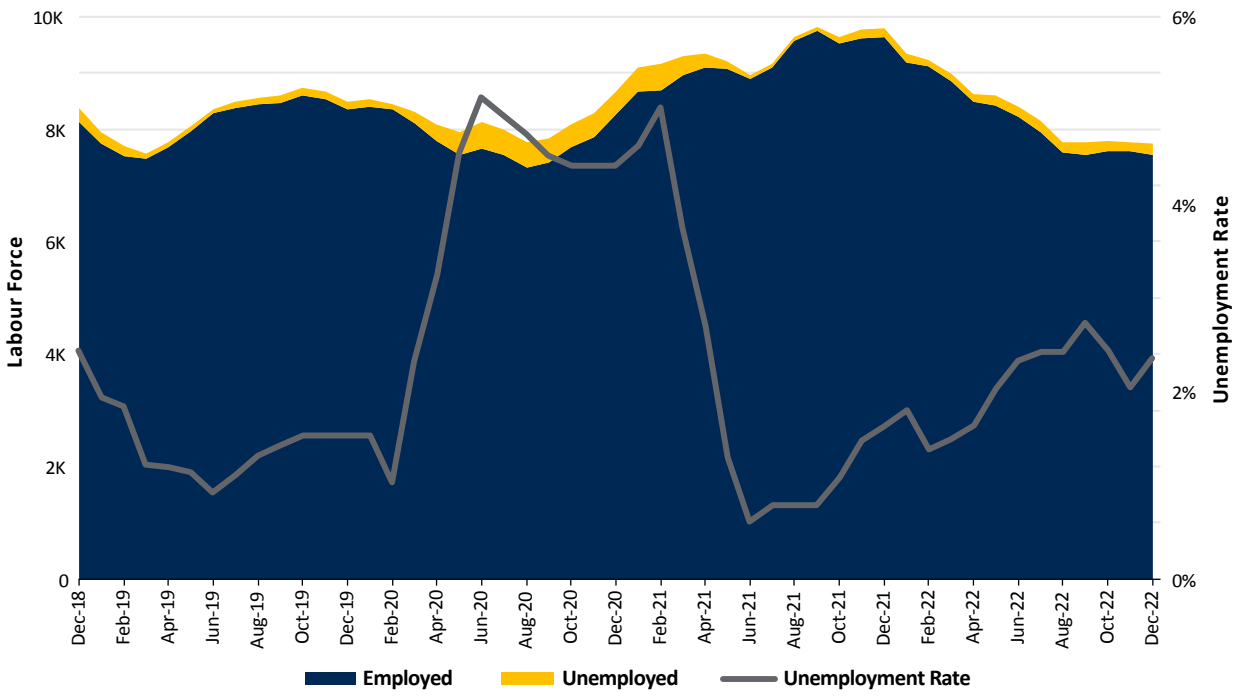
The unemployment rate for this occupation is relatively stable, typically fluctuating between 1% and 2% over the last five years.

FIGURE 24: EMPLOYMENT AND PSE TRENDS (UNDERGRADUATE AND BELOW), TECHNICAL OCCUPATIONS IN GEOMATICS AND METEOROLOGY



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Post-secondary Information System (Table 37-10-0182-01); Statistics Canada, Labour Force Survey (Custom Data).

FIGURE 25: EMPLOYMENT AND UNEMPLOYMENT TRENDS (12-MONTH AVERAGES), TECHNICAL OCCUPATIONS IN GEOMATICS AND METEOROLOGY

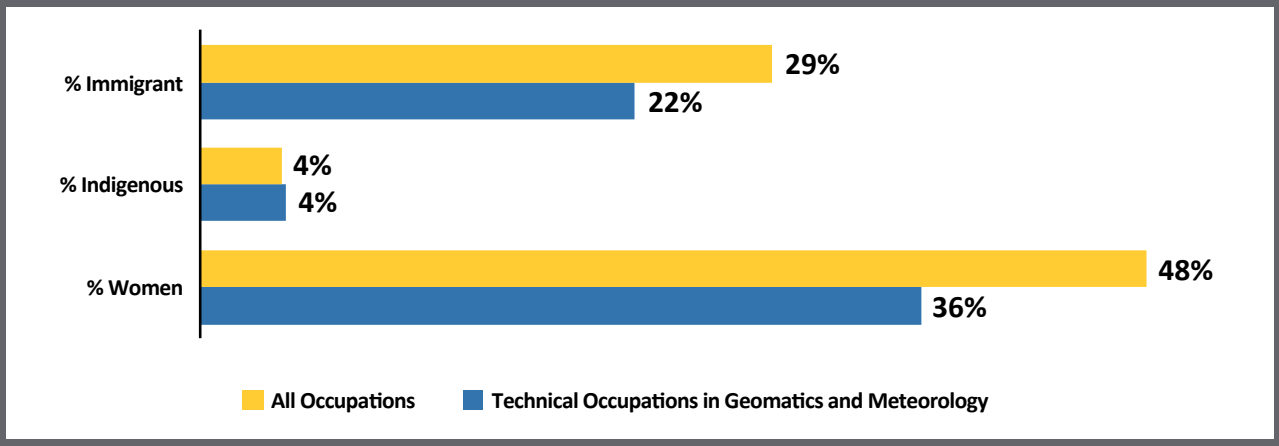


Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Labour Force Survey (Custom Data).

Indigenous representation of geomatics professionals is on par with that of the overall Canadian labour force, at 4%. Immigrants are slightly underrepresented (at 22%, 7% lower than the Canadian average), while women have only a 36% share of the labour force.

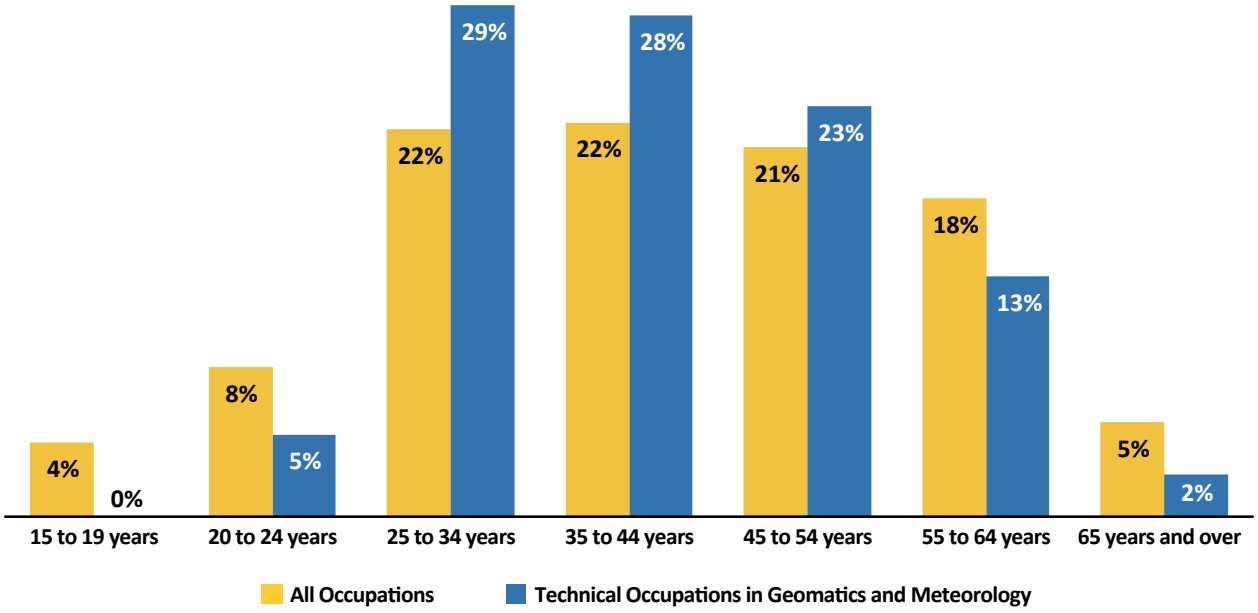
This is another occupation with a large majority of workers between the ages of 25 and 44 (with 57%), possibly related to the need for specialized software skills in this profession.

FIGURE 26: LABOUR FORCE REPRESENTATION OF IMMIGRANTS, INDIGENOUS PEOPLES AND WOMEN AMONG TECHNICAL OCCUPATIONS IN GEOMATICS AND METEOROLOGY



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

FIGURE 27: LABOUR FORCE AGE DISTRIBUTION, TECHNICAL OCCUPATIONS IN GEOMATICS AND METEOROLOGY



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

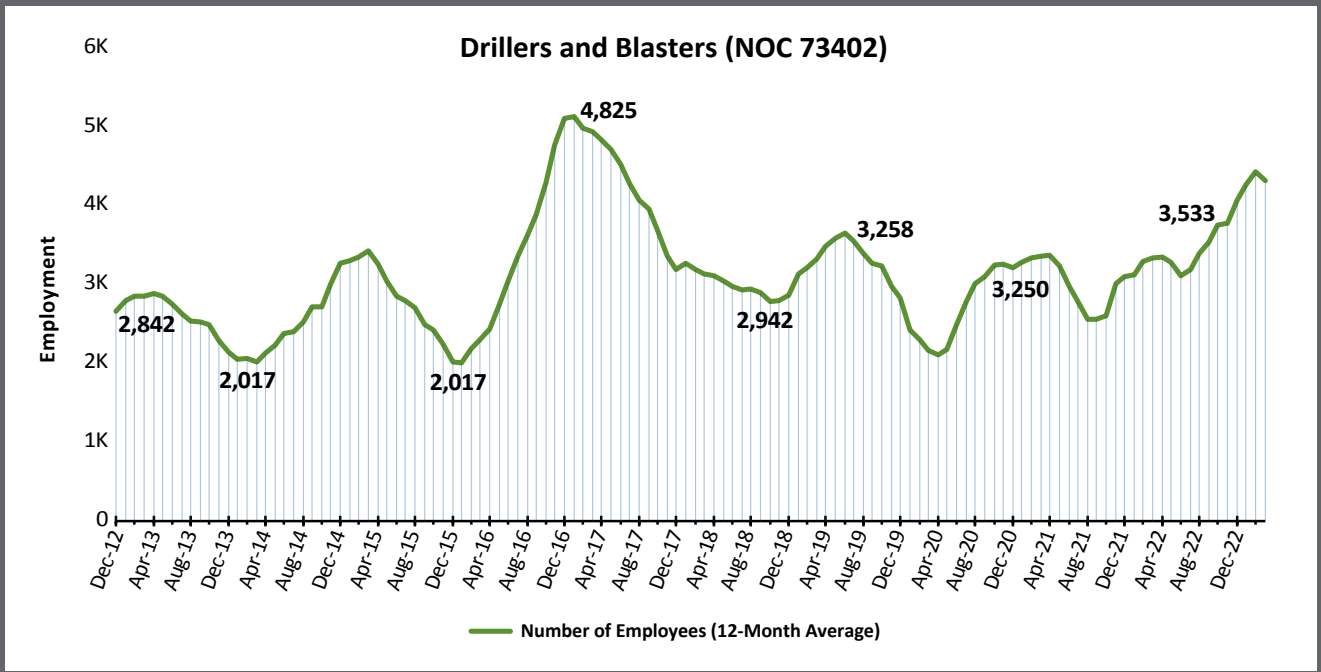
Drillers

The role of drillers in mineral exploration is to extract geological samples from the earth's surface. Drillers operate specialized equipment to create boreholes for sample collection, contributing essential data for geological analysis and resource evaluation.

It is worth noting that, according to the 2021 Census, a large segment of this occupation (61%) has only a high school education or below. In addition, PSIS post-secondary data for fields of study related to drillers lacks the necessary specificity. For these reasons, post-secondary data has been excluded from the analysis.

Demand for drillers has experienced significant fluctuations over the past decade, with the labour force reaching as high as 4,800 and as low as 2,000 workers. Since 2020 lows, employment in this occupation has roughly doubled, approaching historic highs.

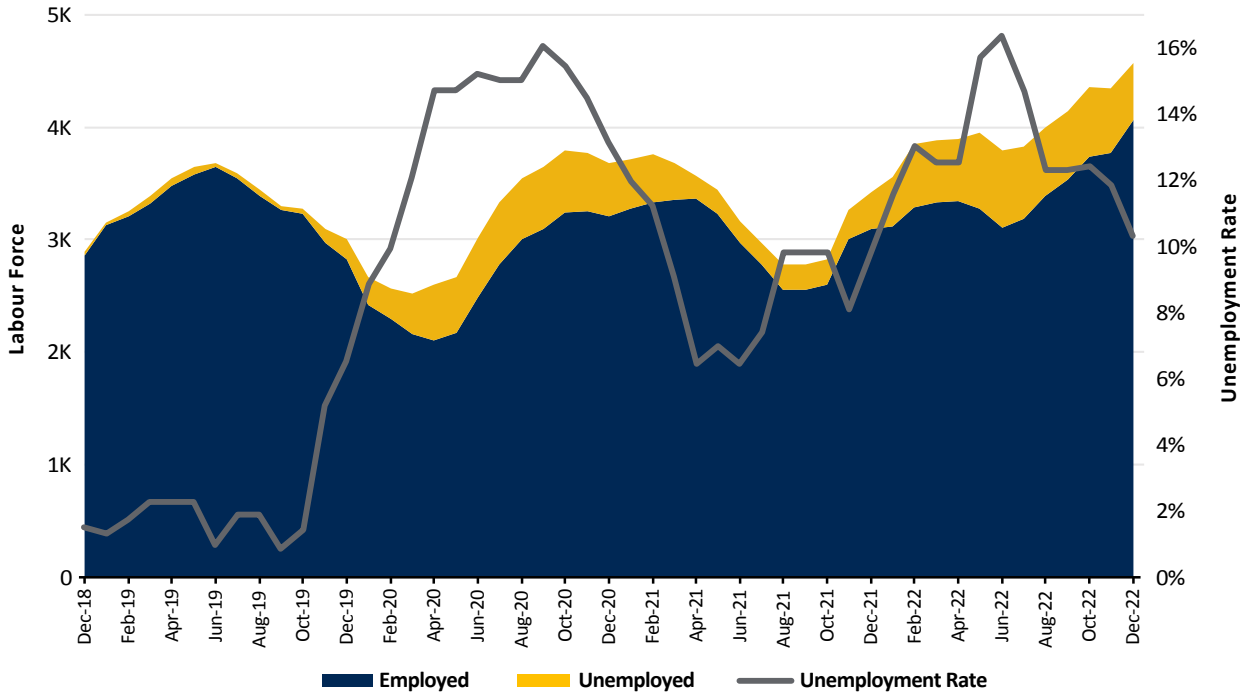
FIGURE 28: EMPLOYMENT, DRILLERS AND BLASTERS



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, ; Statistics Canada, Labour Force Survey (Custom Data).

Despite the significant growth seen in recent years, unemployment levels for drillers remain elevated, surpassing 10% throughout 2022. This is contrary to the other occupations analyzed and points to a relatively slack labour market.

FIGURE 29: EMPLOYMENT AND UNEMPLOYMENT TRENDS (12-MONTH AVERAGES), DRILLERS AND BLASTERS

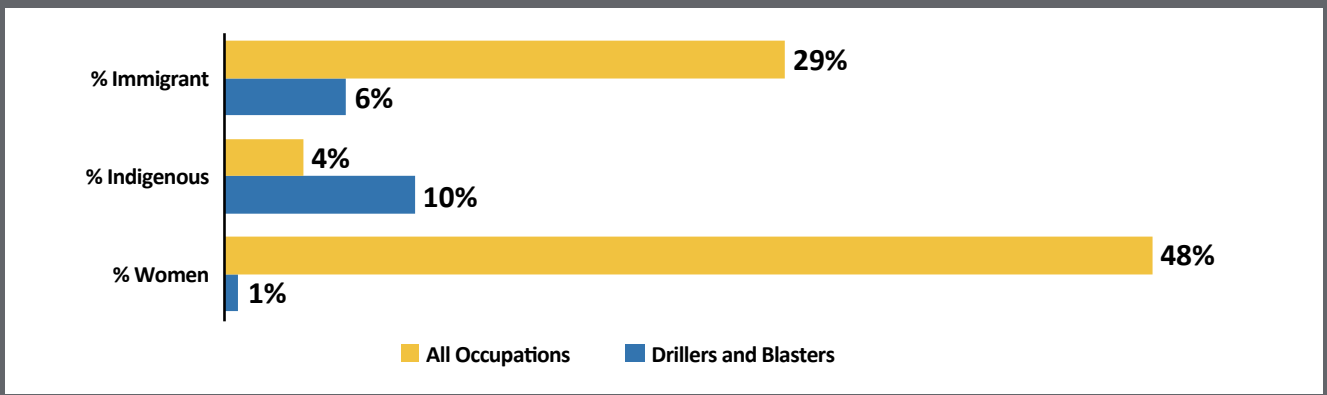


Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Labour Force Survey (Custom Data).

Indigenous workers are well represented, making up 10% of the labour force in this occupation. Conversely, representation of women and immigrants is greatly lacking for drillers, with only 6% and 1% of the labour force, respectively.

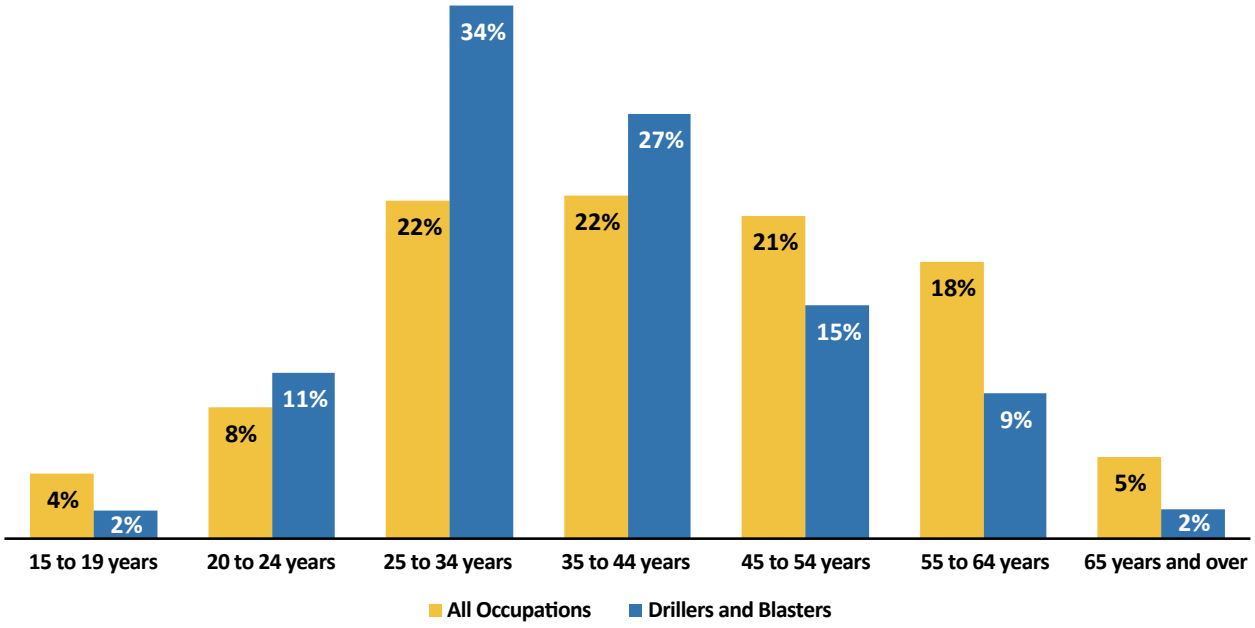
This is another occupation with younger age demographics. Roughly three fourths (74%) of all drillers are below the age of 45.

FIGURE 30: LABOUR FORCE REPRESENTATION OF IMMIGRANTS, INDIGENOUS PEOPLES AND WOMEN AMONG DRILLERS AND BLASTERS



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

***FIGURE 31:* LABOUR FORCE AGE DISTRIBUTION, DRILLERS AND BLASTERS**



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

Overarching Themes for Mineral Exploration Occupations

The six occupations in the field of mineral exploration analyzed above exhibit some recognizable patterns:

- Employment trends in these roles tend to fluctuate significantly due to the volatility and cyclicality of labour demand.
- Following the impact of the COVID-19 pandemic, labor market conditions have tightened, leading to lower unemployment rates.
- The representation of women across these occupations remains limited, highlighting an opportunity to broaden the labour pool.
- On a positive note, there is a substantial presence of immigrants within these roles.
- Indigenous representation varies across occupations, with some enjoying robust participation and others still in need of progress.
- These roles primarily attract individuals between the ages of 25 and 44, as the age distribution leans towards these younger cohorts.

Other Important Occupational Categories

Aside from the six occupations previously examined, stakeholders have cited the critical importance of certain occupational groupings. The occupational categories below are less specific to the sector but nonetheless highly important to mineral exploration activities (Table 2).

TABLE 2: OTHER IMPORTANT OCCUPATIONAL CATEGORIES

OCCUPATION	RELATED NOC CODE(S)	ROLE IN THE EXPLORATION SECTOR
Sustainability and Environmental Conservation Occupations	• 22113 – Conservation and fishery officers *(Conservation officer)* • 41400 – Natural and applied science policy researchers, consultants and program officers *(Environmental impact analyst, sustainability consultants)*	These workers ensure environmentally conscious practices. They assess risks, design mitigation strategies, and ensure compliance with regulations. Collaborating with other professionals, they develop sustainable exploration plans, balancing resource extraction with environmental preservation.
Community and Stakeholder Practitioners	• 41403 – Social policy researchers, consultants and program officers *(Community social development officer)* • 42201 – Social and community service workers *(Community and social services worker, Community liaison worker)*	These workers engage with and build relationships between local communities and other stakeholders. They facilitate communication, address concerns, and ensure that exploration activities align with community interests and expectations.
Logistics and support for remote locations	• 31301 – Registered nurses and registered psychiatric nurses • 42202 – Early childhood educators and assistants • 63200 – Cooks • 65312 – Janitors, caretakers and heavy-duty cleaners • 73301 – Bus drivers, subway operators and other transit operators	This encompasses a wide range of occupations that support mineral exploration activities in isolated areas, managing transportation, supplies and infrastructure: • Bus drivers and other transit operators ensure safe travel to and from exploration sites. • Cooks provide essential catering services, looking after the nourishment of exploration teams. • Early childhood educators and assistants support families engaged in exploration, offering quality childcare services. • Registered nurses and registered psychiatric nurses deliver vital medical care and well-being support. • Janitors, caretakers, and heavy-duty cleaners maintain hygiene and functionality of facilities in remote settings, fostering a conducive work environment for all involved.

Source: Mining Industry Human Resources Council, 2023.

CHAPTER TWO:

MINERAL EXPLORATION SURVEY RESULTS

In 2023, MiHR and PDAC launched a comprehensive survey of stakeholders in the Canadian mineral exploration sector, including workers, consultants, employers, students and educators. This section of the report describes the survey methodology and results.

SURVEY METHODOLOGY

Two comprehensive surveys were designed to gather input from various stakeholders associated with the Canadian mineral exploration landscape. These stakeholders include students, workers, consultants, contractors, prospectors, educators and employers.

The first survey, intended only for students, was distributed at the 2023 PDAC Convention held from March 5-8, 2023, in Toronto, Ontario. The second survey catered to all other stakeholders (primarily workers, consultants, educators and employers) and was made available via PDAC newsletters and social media. Sample respondents had the option to access the surveys in both English and French.

Both surveys were collectively answered by a total of 149 respondents, of which 110 valid submissions were retained after preprocessing. Only completed survey responses have been used for the purposes of this report, after discarding incomplete data.

SAMPLE OVERVIEW

Note that the majority of responses are from individuals actively involved in the exploration sector (e.g., geosciences students attending the PDAC conference) and who were geographically closer to the conference (i.e., Ontario). Thus, the survey results will reflect their tendencies, perceptions or biases.

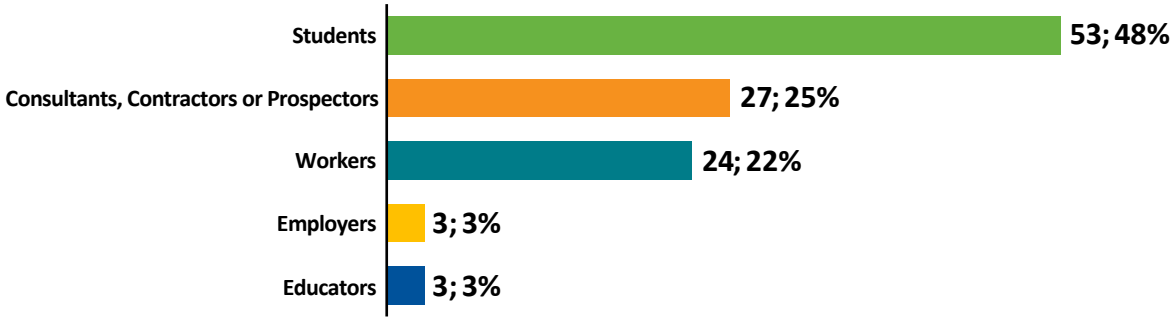
Of the 110 valid entries, almost half (48%) of the respondents in the sample self-identified as students, either currently enrolled or having graduated within the last two years (Figure 32). This was followed by consultants, contractors or prospectors (25% of the sample) and workers (22%). Employers and educators had the smallest share of the sample, with 3% each.

RESPONDENT DEFINITIONS

The survey targeted five distinct groups within the mineral exploration sector, as outlined below:

1. **Employers:** Individuals involved in hiring exploration personnel within their organizations.
2. **Consultants/Contractors/Prospectors:** Typically self-employed and working in the mineral exploration sector either independently or on a contract basis with exploration companies.
3. **Workers:** Current or former employees as well as those seeking employment in the mineral exploration sector.
4. **Educators:** Individuals responsible for providing post-secondary education and training in mineral exploration.
5. **Students:** Post-secondary students enrolled in a program or course focused on mineral exploration, as well as those who have graduated within the past two years.

FIGURE 32: SAMPLE COMPOSITION BY RESPONDENT TYPE

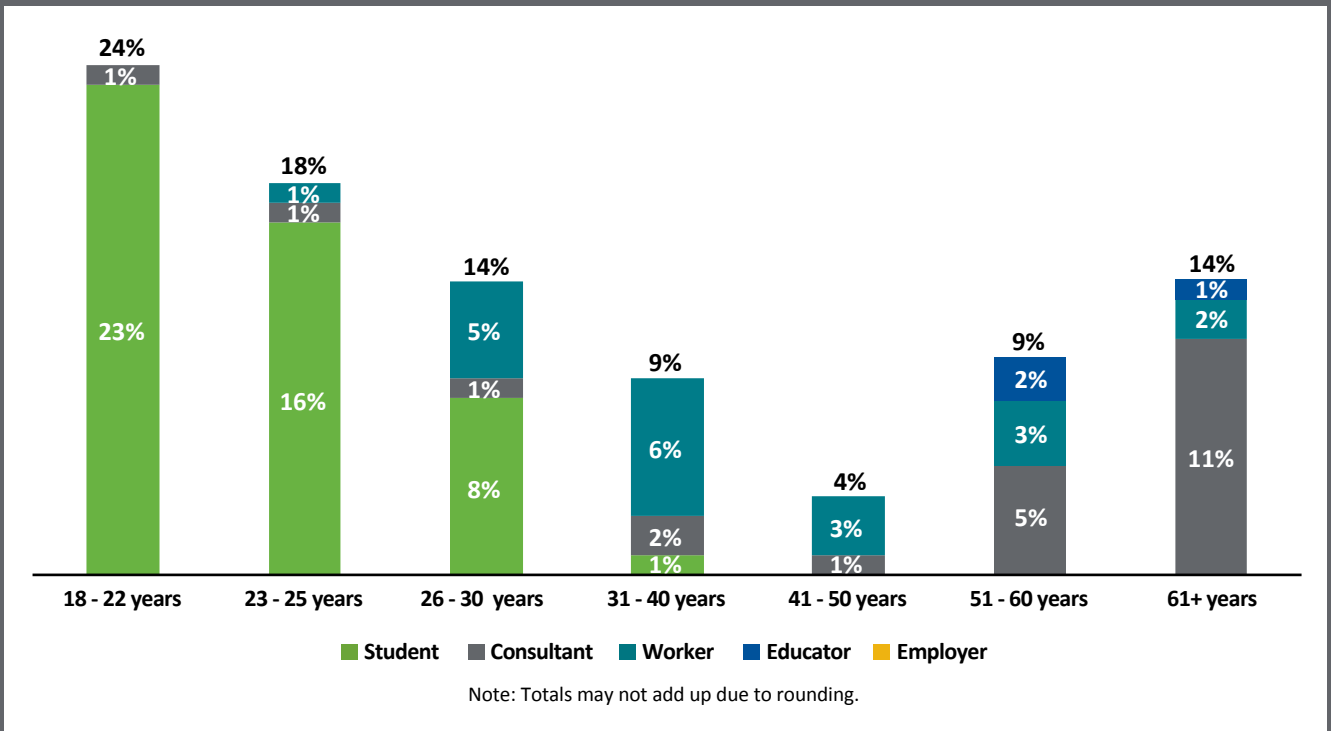


Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023.

Age

The age distribution of respondents shows a notable imbalance towards the two ends of the spectrum. In particular, the '18-22 years' and '61+ years' age groups account for large proportions of the sample (24% and 14%, respectively) (Figure 33). The comparatively lower middle-age representation is partly due to students constituting about 50% of the sample.

FIGURE 33: SAMPLE COMPOSITION BY AGE



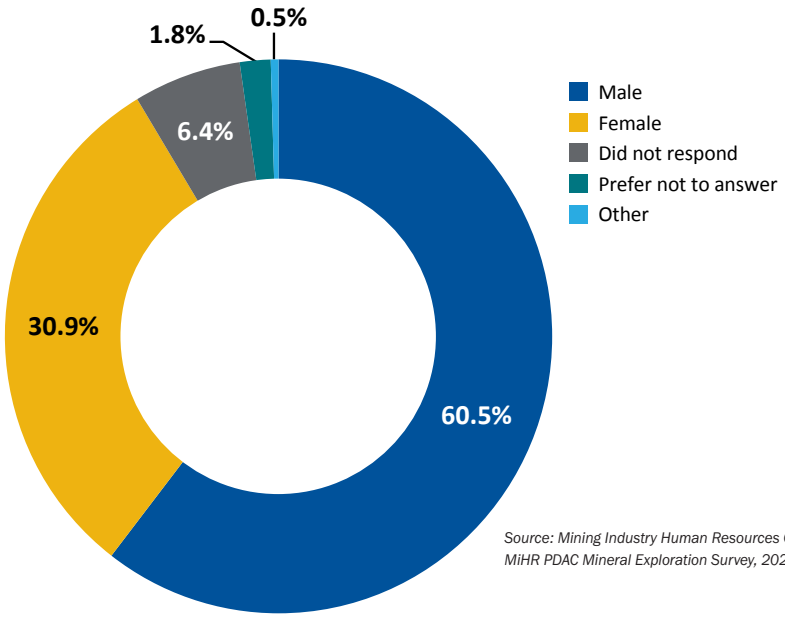
Note: Totals may not add up due to rounding.

Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023.

Diversity

Sample respondents were asked to indicate their gender identity, as summarized in Figures 34 and 35. Notably, this sample has a higher female presence (31%) than the mining industry (NAICS 212), where female representation stands at 16% of the labour force according to 2021 Census figures. Although the survey sample outperforms the mining sector from a diversity perspective, these percentages are well below female representation in the overall Canadian labour force (48%).

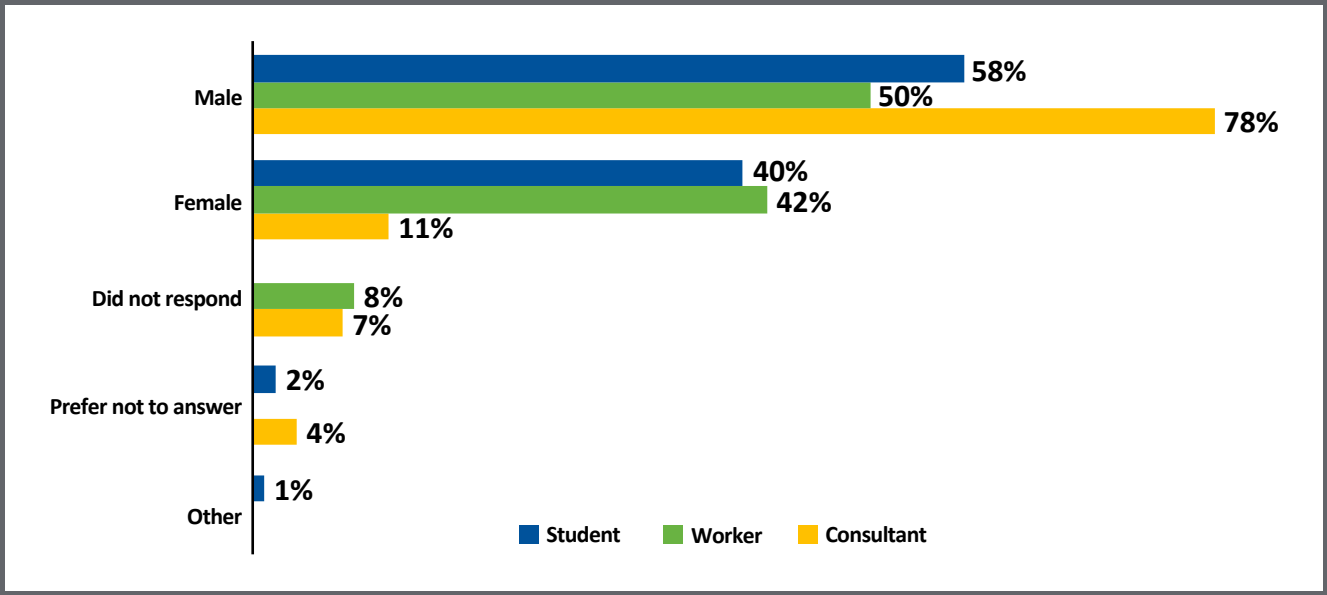
FIGURE 34: SAMPLE COMPOSITION BY GENDER



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023.

Figure 35 shows the gender distribution among the different types of respondents in the sample. Workers have the highest female representation (42%) among the categories, while consultants appear to be the least gender diverse (11%).

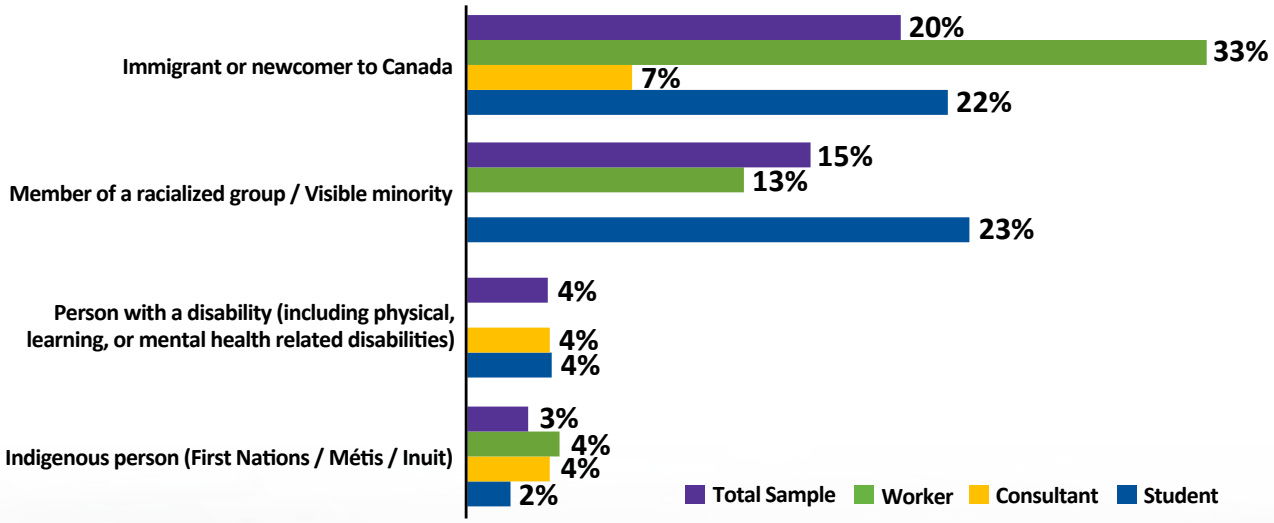
FIGURE 35: SAMPLE COMPOSITION BY GENDER: BREAKDOWN BY RESPONDENT TYPE



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023.

Respondents were also asked to indicate whether certain demographic characteristics applied to them (Figure 36). This was done to analyze trends through the lens of inclusivity, an essential first step in creating more equitable workplaces. Immigrant representation is 20%, much higher than the mining workforce (8%) but lower than the national average (29%). Indigenous representation in the sample is 3%, which is comparable to the Canadian labour force (4%). While the mining industry has a relatively high level of Indigenous participation (roughly 11%), this is not reflected in the sample.

FIGURE 36: SAMPLE REPRESENTATION OF EQUITY DESERVING GROUPS



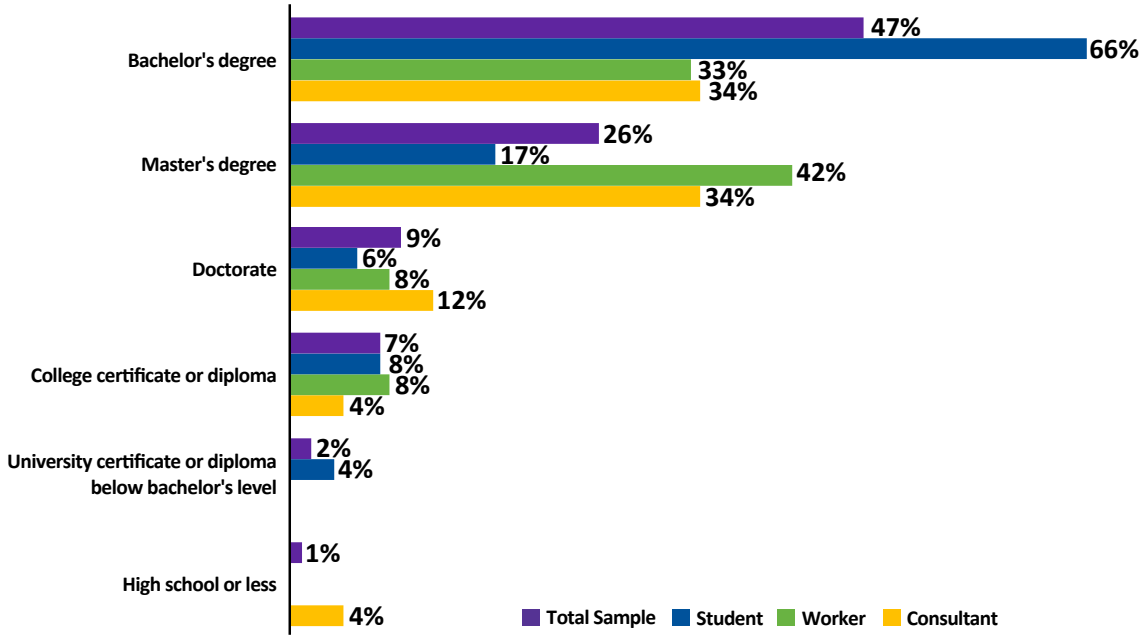
Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023.

Education

Eighty-two percent of respondents reported having at least a bachelor's degree or higher, including master's and doctoral degrees (Figure 37). This statistic is more than four times the share for the mining industry (17%) and more than twice the share for the Canadian labour force (33%). It is worth noting that a significant percentage of workers in the sample have master's degrees (42%) and doctorates (8%).

The relatively higher level of education among respondents is presumably a result of sample bias. This is because the PDAC conference, where the questionnaire was distributed, is more likely to attract professionals with post-secondary degrees.

FIGURE 37: SAMPLE COMPOSITION BY EDUCATION

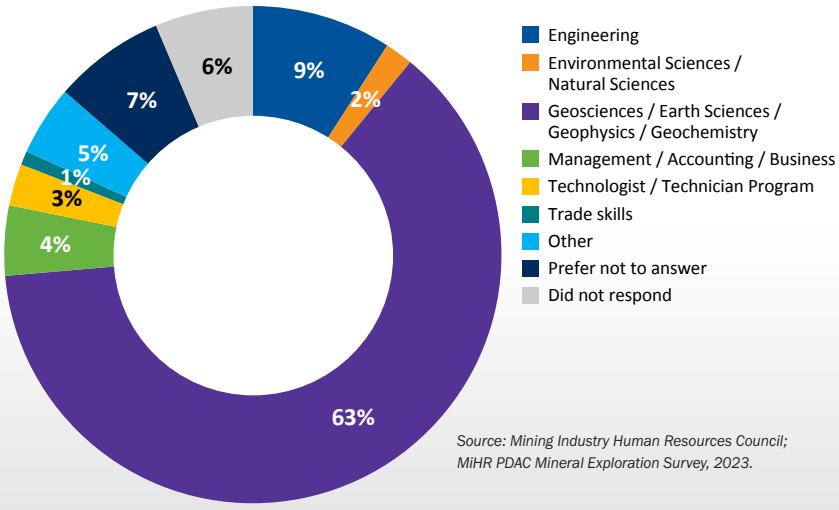


Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023.

Primary Field of Study

Approximately 63% of respondents indicated that their primary field of study was in geosciences, earth sciences, geochemistry or geophysics (Figure 38). This finding suggests that a large proportion of individuals attending or associated with PDAC have their roots in geology. The field of geosciences offers broad applications and career prospects in industries other than mining and mineral exploration, which may contribute to its popularity among students.

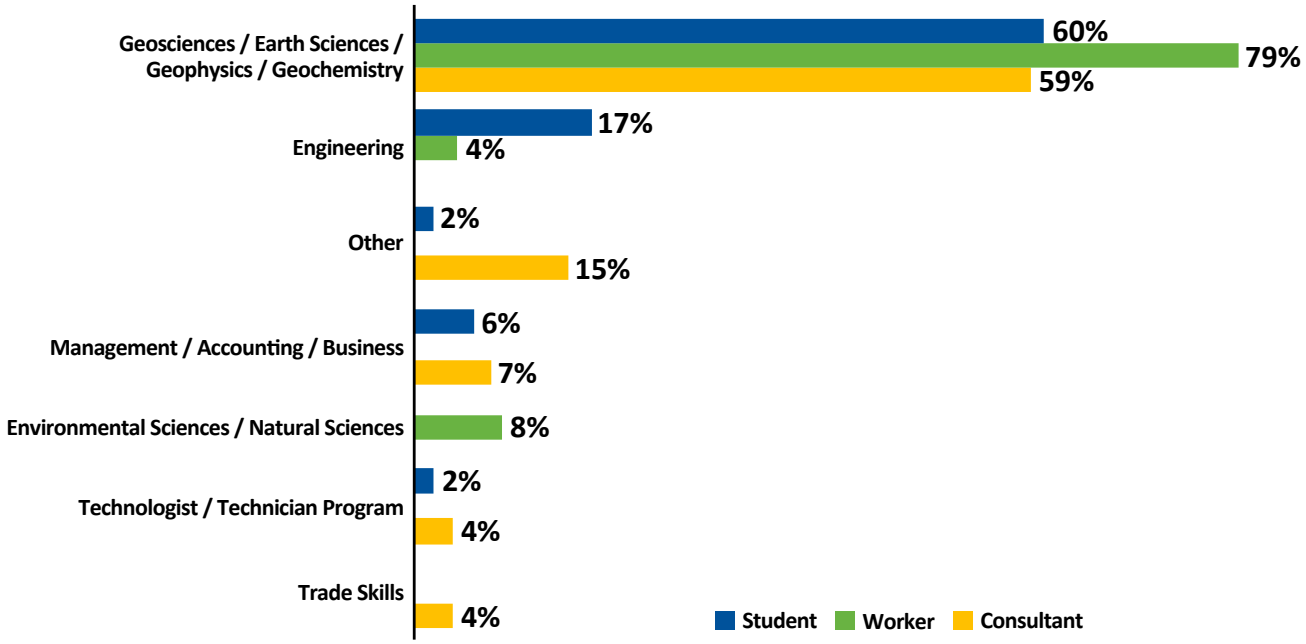
FIGURE 38: SAMPLE COMPOSITION BY PRIMARY FIELD OF STUDY



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023.

Figure 39 shows that the majority of respondents in all categories chose geosciences (including earth science, geophysics and geochemistry) as their primary field of study. Approximately 60% of students were enrolled in these programs, with engineering the next most favoured alternative (17%).

***FIGURE 39:** SAMPLE COMPOSITION BY PRIMARY FIELD OF STUDY: BREAKDOWN BY RESPONDENT TYPE*



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023.

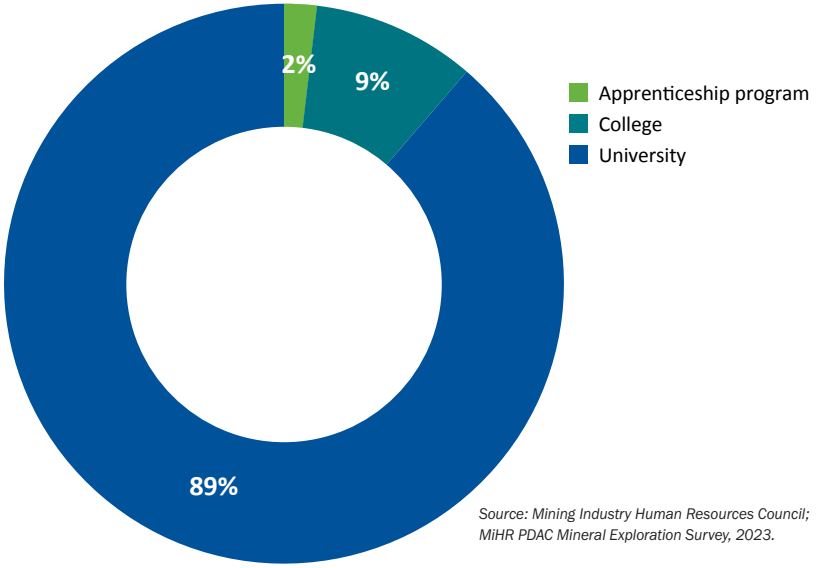
STUDENTS

Background

The student survey received 59 responses, of which 53 were deemed "valid" (Figure 32). University students comprised the majority of the sample at 89%, followed by college students at 9% (Figure 40). This directly corresponds to the educational level of those surveyed as previously shown in Figure 37.

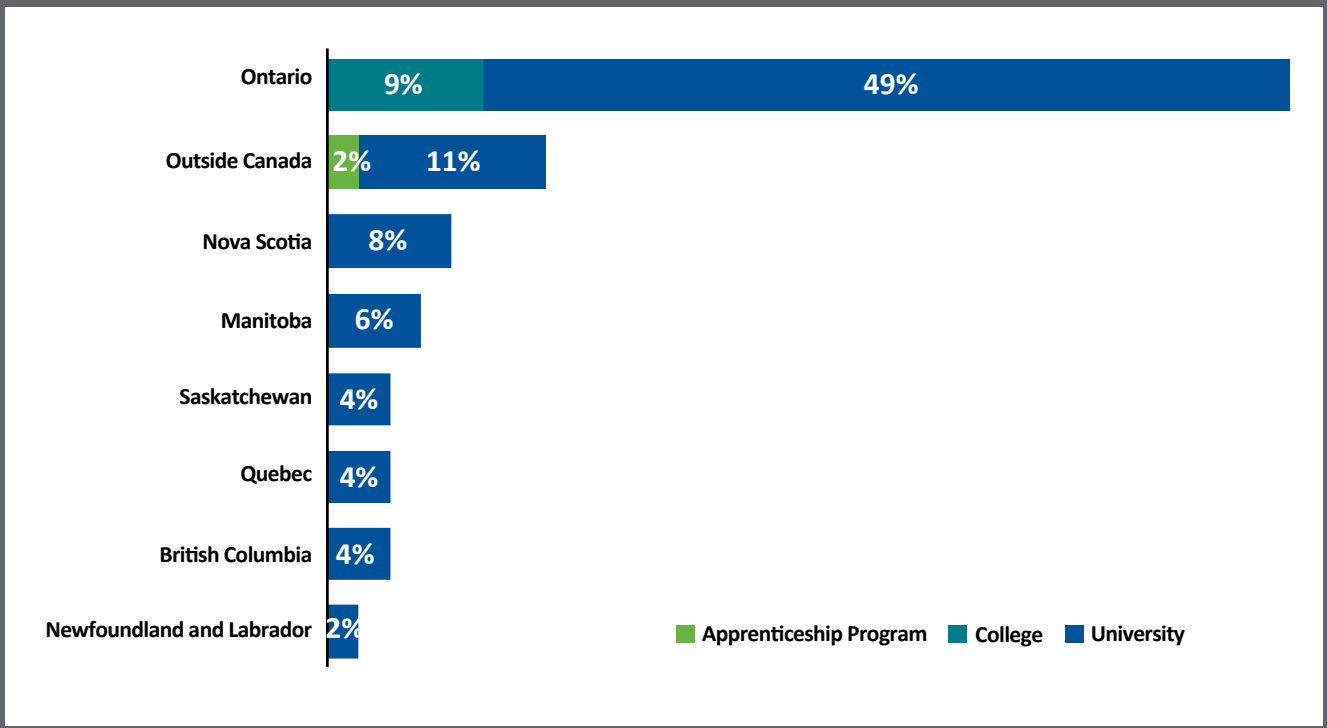
Approximately 58% of the students' educational institutions are in Ontario, also a potential source of survey bias (Figure 41).

FIGURE 40: 'WHICH OF THE FOLLOWING ARE YOU CURRENTLY ATTENDING OR HAVE PREVIOUSLY ATTENDED?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023.

FIGURE 41: 'IN WHICH PROVINCE OR TERRITORY ARE YOU CURRENTLY ATTENDING OR HAVE PREVIOUSLY ATTENDED SCHOOL?'



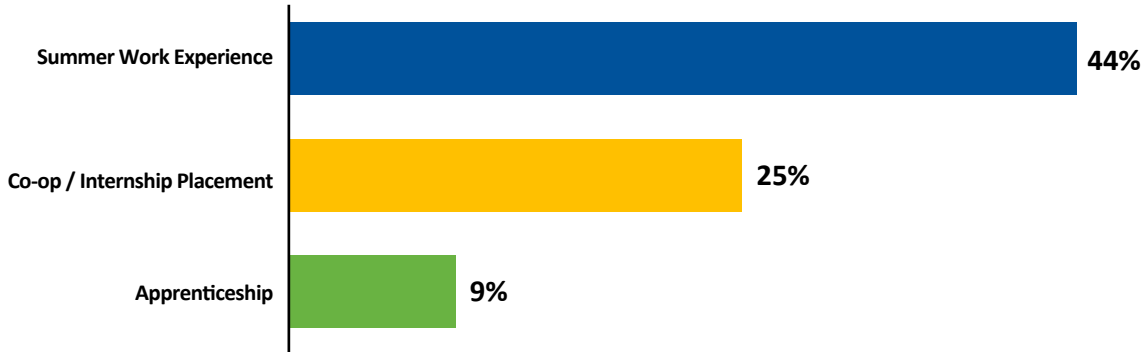
Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023.

Experiences

Students find work-integrated learning (WIL) to be of great value in gaining practical work experience that will help them enter the labour market after graduation. Survey results indicate that 44% of students had summer work experience as part of their program, followed by co-ops and internship placements (25%) (Figure 42). Apprenticeships were the least common (9%) among respondents.

In interviews, post-secondary administrators pointed to the industry's well-known cyclical nature as a factor leading to the inconsistent availability of co-op spots.

FIGURE 42: 'HAVE YOU COMPLETED OR DO YOU PLAN TO ENGAGE IN ANY OF THE FOLLOWING ACTIVITIES AS PART OF YOUR PROGRAM?'

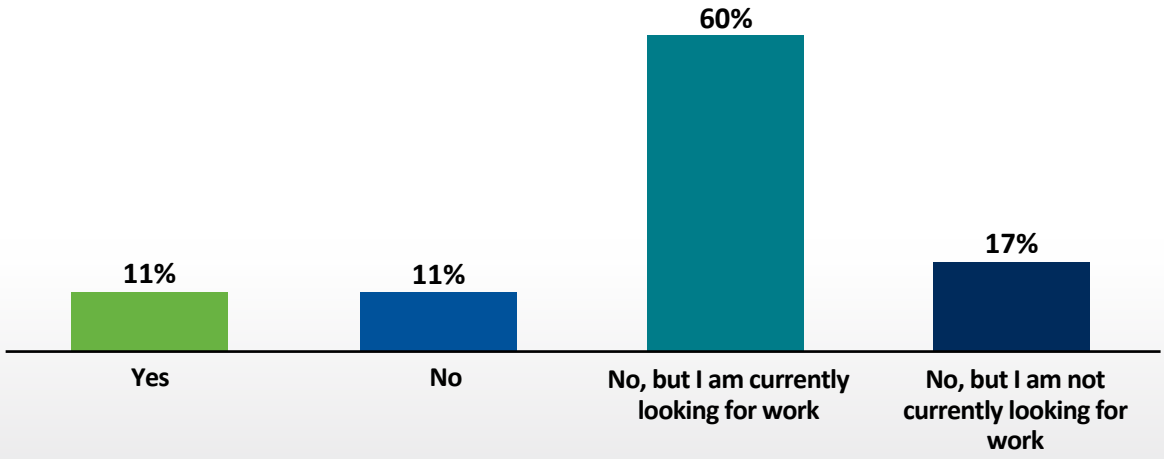


Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

When asked if they had employment arranged after graduation, only 11% of the students responded in the affirmative (Figure 43). Of those who did not, a large majority (60% of respondents) said that they were currently looking for work. The survey was distributed at the PDAC convention, where students often come to network and look for potential career opportunities. Their attendance suggests a high level of interest in mining and mineral exploration careers.

Approximately 17% stated that that they do not have employment arrangements and were also not looking for work. This may indicate a potential willingness to pursue higher education following graduation.

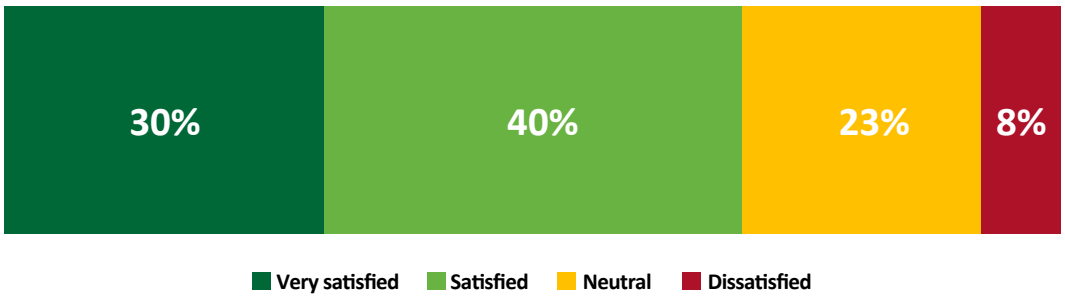
FIGURE 43: 'DO YOU/DID YOU HAVE EMPLOYMENT ARRANGED AFTER YOU GRADUATE FROM THIS PROGRAM?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Approximately 70% of the sample indicated that they were either satisfied or very satisfied with their program and how it had prepared them for a future in mineral exploration (Figure 44). It is difficult to draw any strong conclusions from this because of sample survivorship bias—students who chose to attend PDAC were interested in the mining sector in the first place and will show higher levels of satisfaction than those who chose not to attend. Nonetheless, this result tells us that student responses are reflective of people who generally have positive attitudes toward mineral exploration.

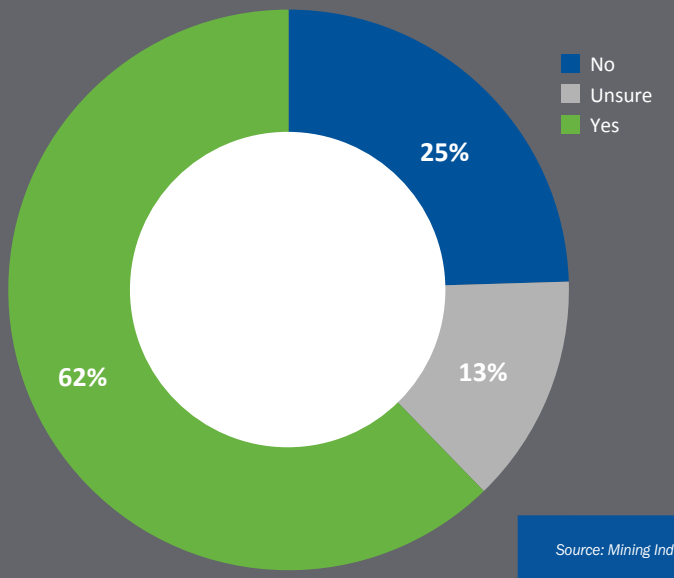
FIGURE 44: 'WHAT IS YOUR LEVEL OF SATISFACTION WITH YOUR PROGRAM OF STUDY, IN TERMS OF HOW IT HAS PREPARED YOU FOR A FUTURE CAREER IN MINING OR MINERAL EXPLORATION?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Most respondents (62%) indicated that they had received field safety training as part of their program, which is a positive step toward establishing good health and safety practices (Figure 45). Although 25% of students reported that they had not received this training, this number may include respondents in their first years of study who will eventually receive field safety training as they progress through their program.

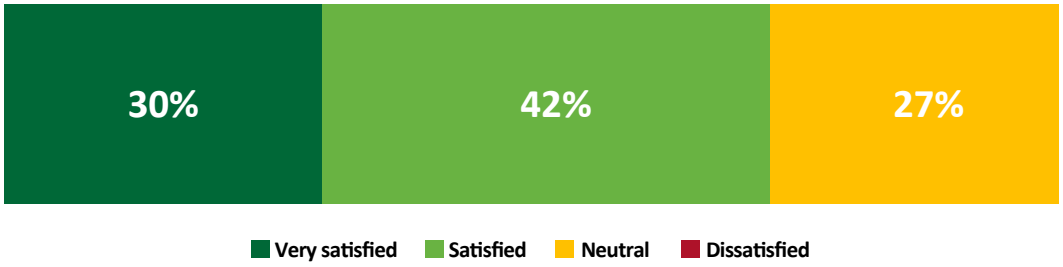
FIGURE 45: 'WITHIN YOUR PROGRAM OF STUDY, HAVE YOU BEEN/WERE YOU TRAINED IN FIELD SAFETY?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Of those who received field safety training, the vast majority found it adequate – 72% said they were satisfied or very satisfied with the quality of the training (Figure 46).

FIGURE 46: 'IF YES, HOW SATISFIED ARE/WERE YOU WITH THE FIELD SAFETY TRAINING YOU RECEIVED?'

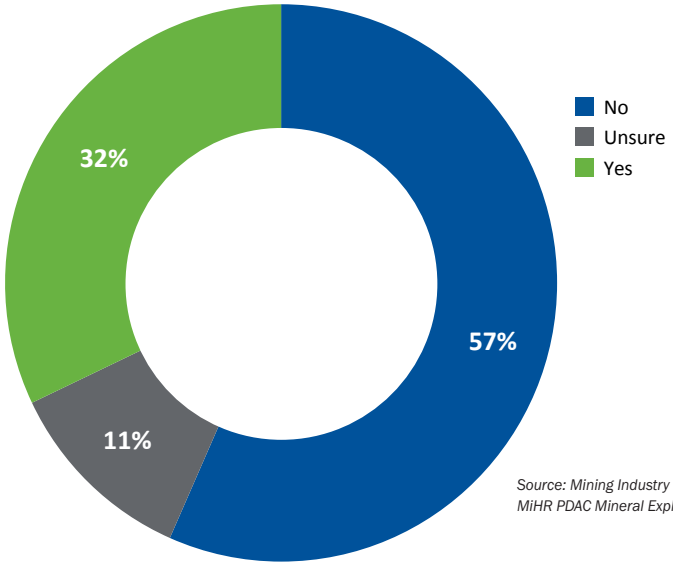


Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Respondents were also asked if they had received training on preventing and responding to harassment in the mining workplace, including in the field. Only about 32% said they had, while 57% said they had not (Figure 47).

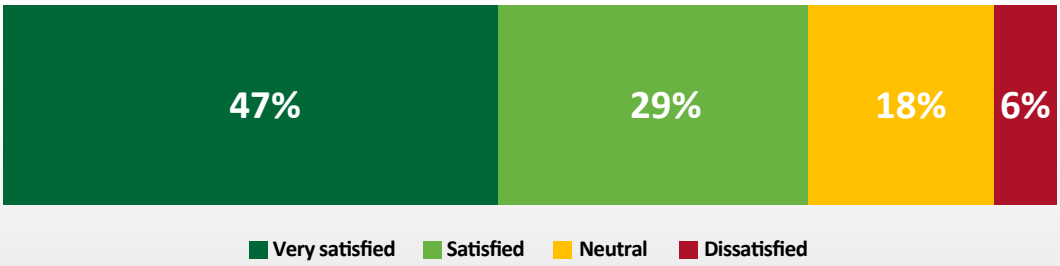
Among respondents who received the training, approximately 76% were either very satisfied or extremely satisfied with the training (Figure 48).

FIGURE 47: 'WITHIN YOUR PROGRAM OF STUDY, HAVE YOU BEEN/WERE YOU TRAINED IN HARASSMENT PREVENTION AND RESPONSE IN THE MINING WORKPLACE, INCLUDING IN THE FIELD?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

FIGURE 48: 'IF YES, HOW SATISFIED ARE YOU WITH THE HARASSMENT TRAINING YOU RECEIVED?'

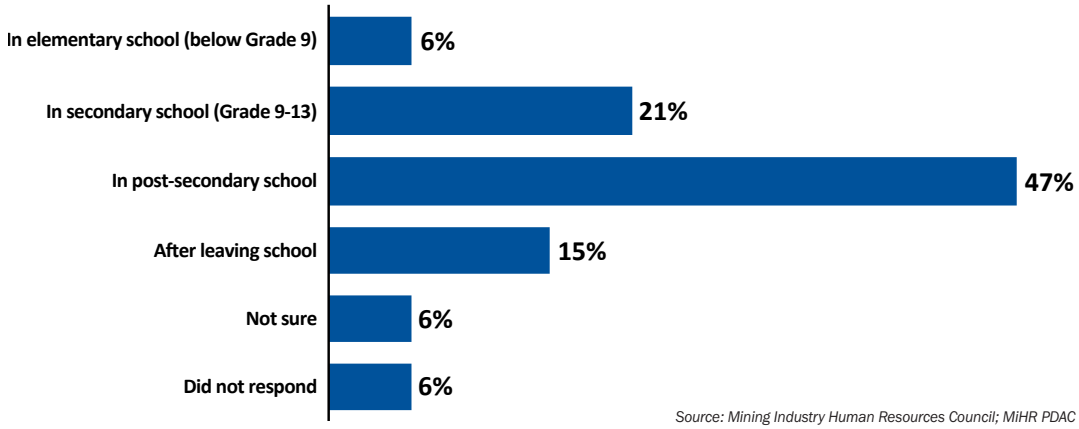


Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

When asked when they were first introduced to careers in mining or mineral exploration, about 41% said they were exposed to the industry as a potential career path in post-secondary school (Figure 49). In addition, about 15% of the sample first learned about mining and mineral exploration careers after leaving school. Promoting awareness of the mining sector at the early stages of education, ideally before entering the post-secondary education system, is essential to strengthening the labour pool and talent pipeline.

"I didn't know about mining until my third year of university […] I was exposed to mining through my previous degree in geology." – Geosciences Student

FIGURE 49: 'WHEN DID YOU FIRST LEARN ABOUT CAREERS IN MINING OR MINERAL EXPLORATION?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Twenty-eight percent of student respondents became aware of careers in mining or mineral exploration through family, friends and word of mouth (Figure 50). This underscores the importance of networks and the need to promote a positive image of mining not only to students, but also to their teachers, parents and others. These findings are corroborated by MiHR's qualitative research, as presented in the recently released report "*From Classroom to Mine Site: A Review of Canada's Post-Secondary Education Pipeline for the Mining Sector*".

FIGURE 50: 'HOW DID YOU FIRST LEARN ABOUT CAREERS IN MINING OR MINERAL EXPLORATION?'

"My family works in mining, so I was exposed to [mining] at a young age. The familiarity attracted me [to pursue an education in mining]."
– Undergraduate Student

Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

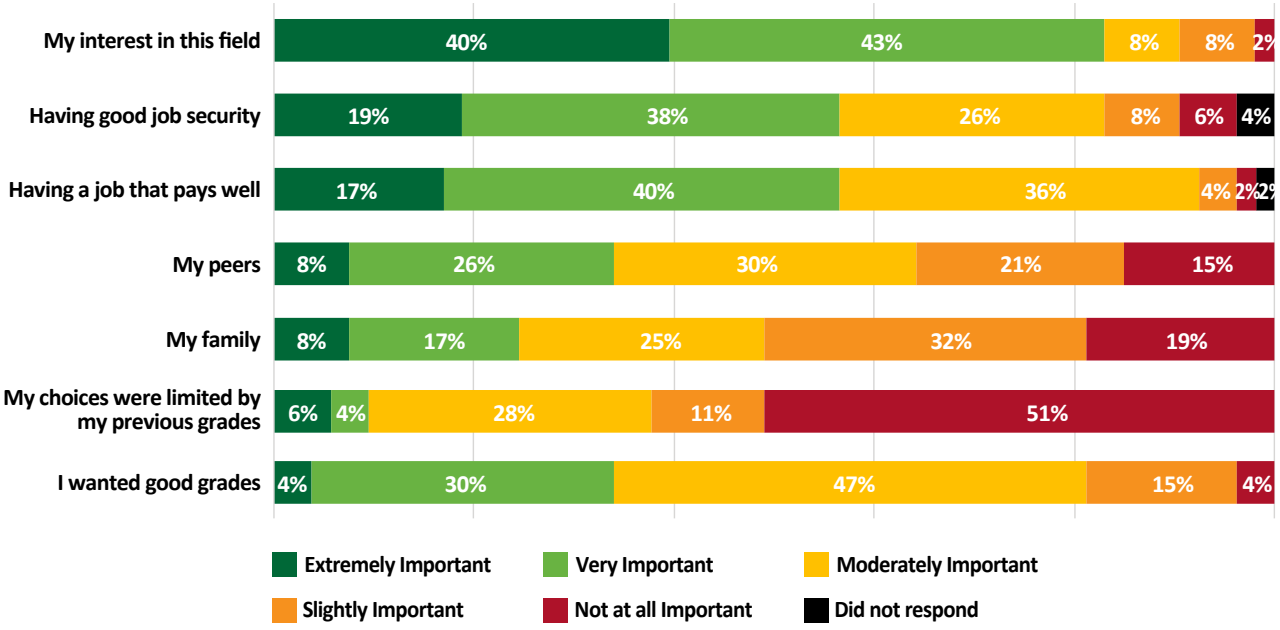
Motivations

Interest in the Field

When asked to rank the most important factors in choosing their field of study, students indicated that their personal interest in the field was by far the most important factor, with 83% rating it as very or extremely important (Figure 51). This highlights the strong intrinsic drive students have to pursue their genuine passion and interest in their field, which they prioritize over external factors such as family expectations or grades. This also underscores the importance of building awareness of mining and mineral exploration at an early age, insofar as this is a prerequisite for building interest and passion in the subject.

Job security and compensation were also cited as important factors, though to a lesser extent.

***FIGURE 51:* 'WHEN CHOOSING YOUR PROGRAM OF STUDY, HOW IMPORTANT WERE THE FOLLOWING FACTORS?'**



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

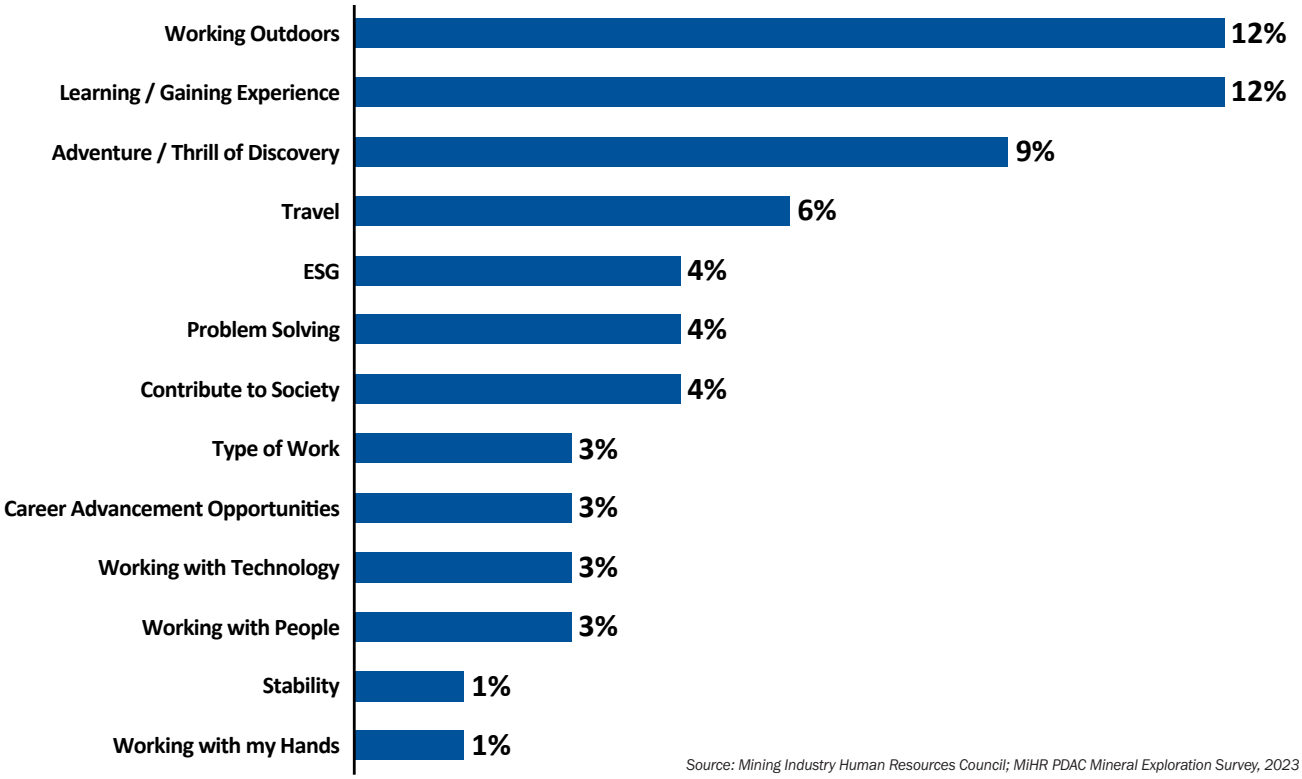
Students were also asked in an open-ended format to list the most positive and negative aspects of a potential career in mining or mineral exploration (Figures 52 and 53).

On the positive side, the results show that respondents most often mentioned unique aspects of mineral exploration, including working outdoors, the sense of adventure and the opportunity to travel. Learning and gaining experience were also cited as highly attractive to students.

The most frequently cited negative aspects were the environmental impact and negative public perceptions associated with mining. Despite the recent decline in support for the environmental, social and governance (ESG) label in the investment community, younger generations remain committed to environmental and social issues, so prioritizing these values remains critical to effectively engaging with this demographic. Respondents also highlighted the challenges associated with remote living, job insecurity and the cyclical nature of employment.

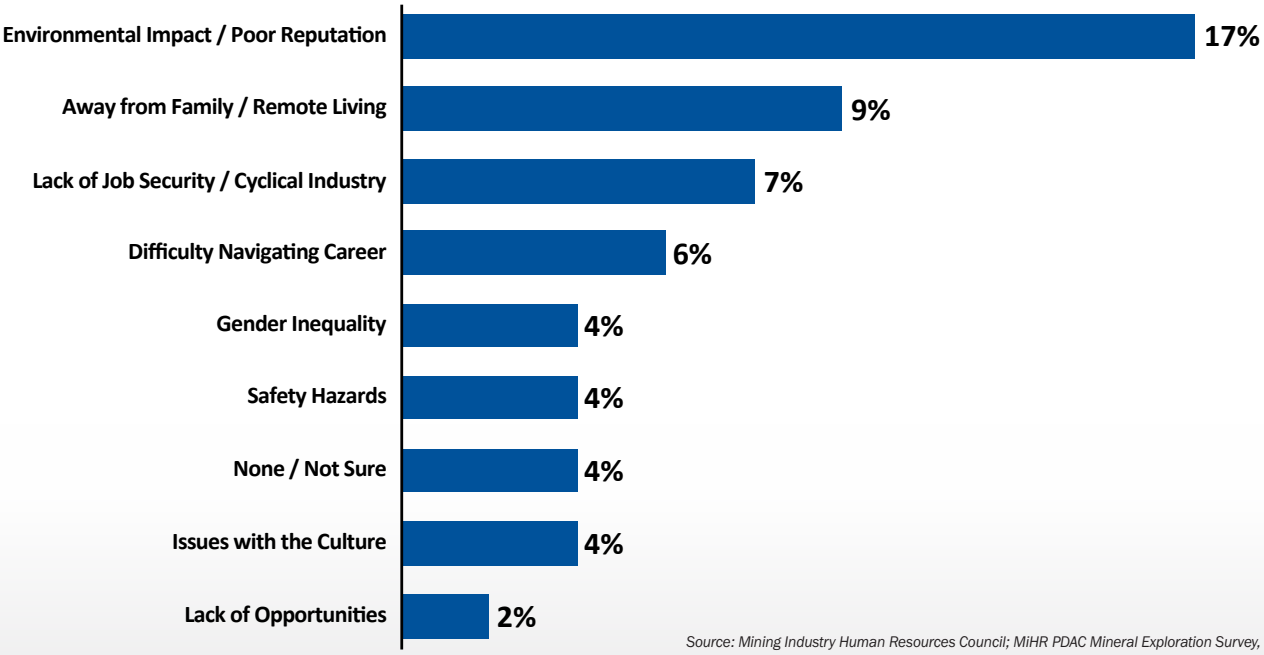
These insights into student motivations can be valuable for recruiters and stakeholders interacting with students and can be an aid in talent attraction and retention.

FIGURE 52: 'IN YOUR OPINION, WHAT IS THE MOST POSITIVE ASPECT ABOUT A CAREER IN MINING OR MINERAL EXPLORATION?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

FIGURE 53: 'IN YOUR OPINION, WHAT IS THE MOST NEGATIVE ASPECT ABOUT A CAREER IN MINERAL EXPLORATION?'

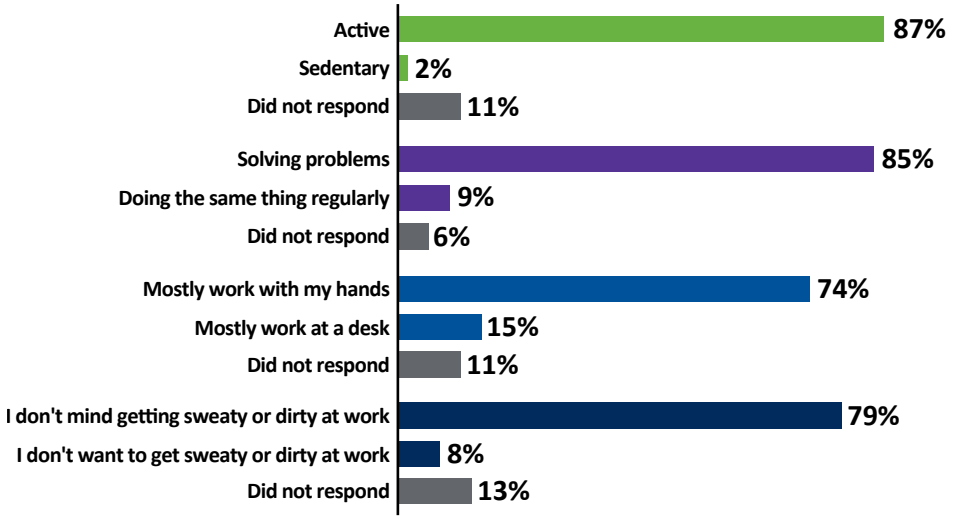


Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Preferred Career Path

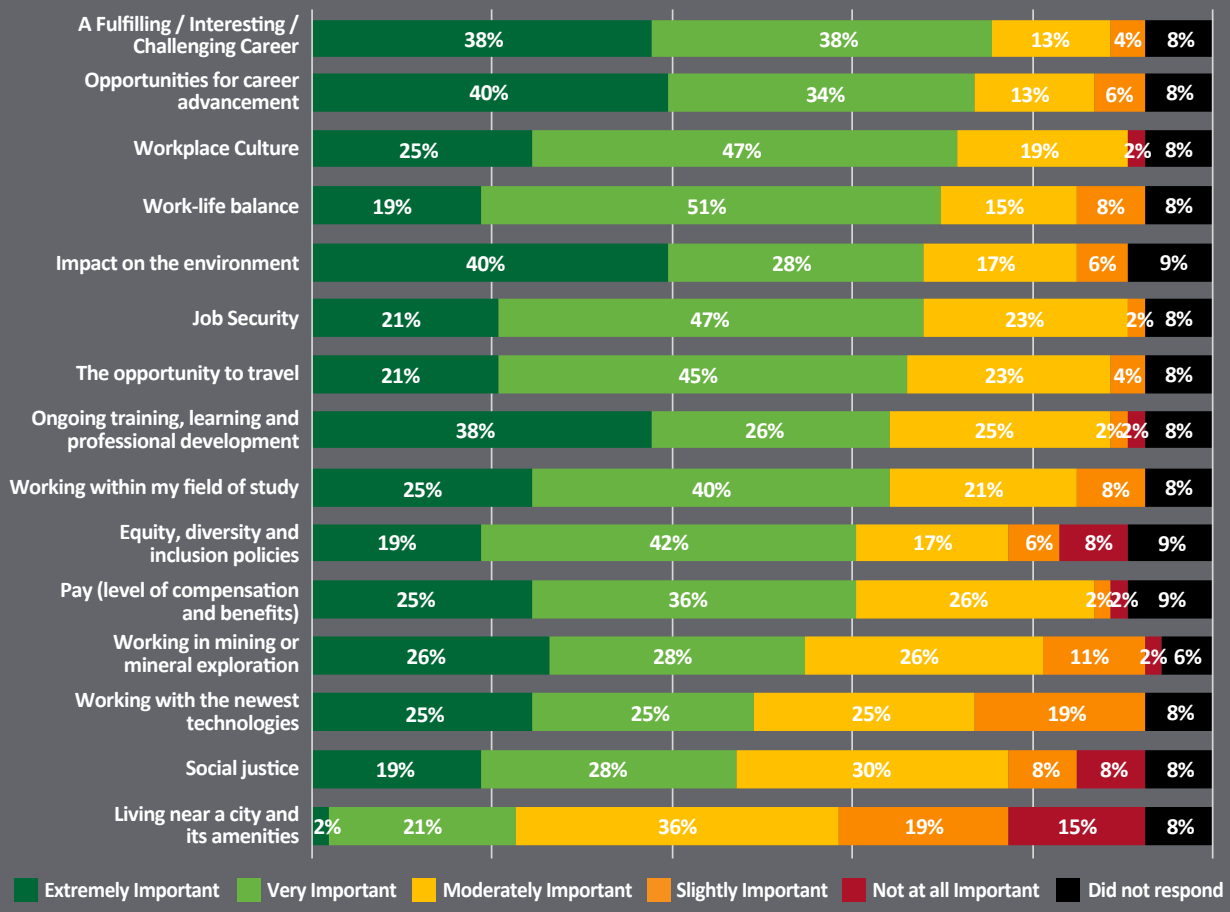
Students were given a set of four questions, each containing two statements, and were asked to align them with their desired career. Figure 54 reveals that mineral exploration students, mainly geosciences students, value being active (87%) and working outdoors and with their hands (74%) as opposed to working at a desk.

FIGURE 54: 'WHICH OF THE FOLLOWING BEST DESCRIBES YOUR PREFERRED CAREER?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

FIGURE 55: 'HOW IMPORTANT ARE THE FOLLOWING WHEN CONSIDERING YOUR FUTURE CAREER?'



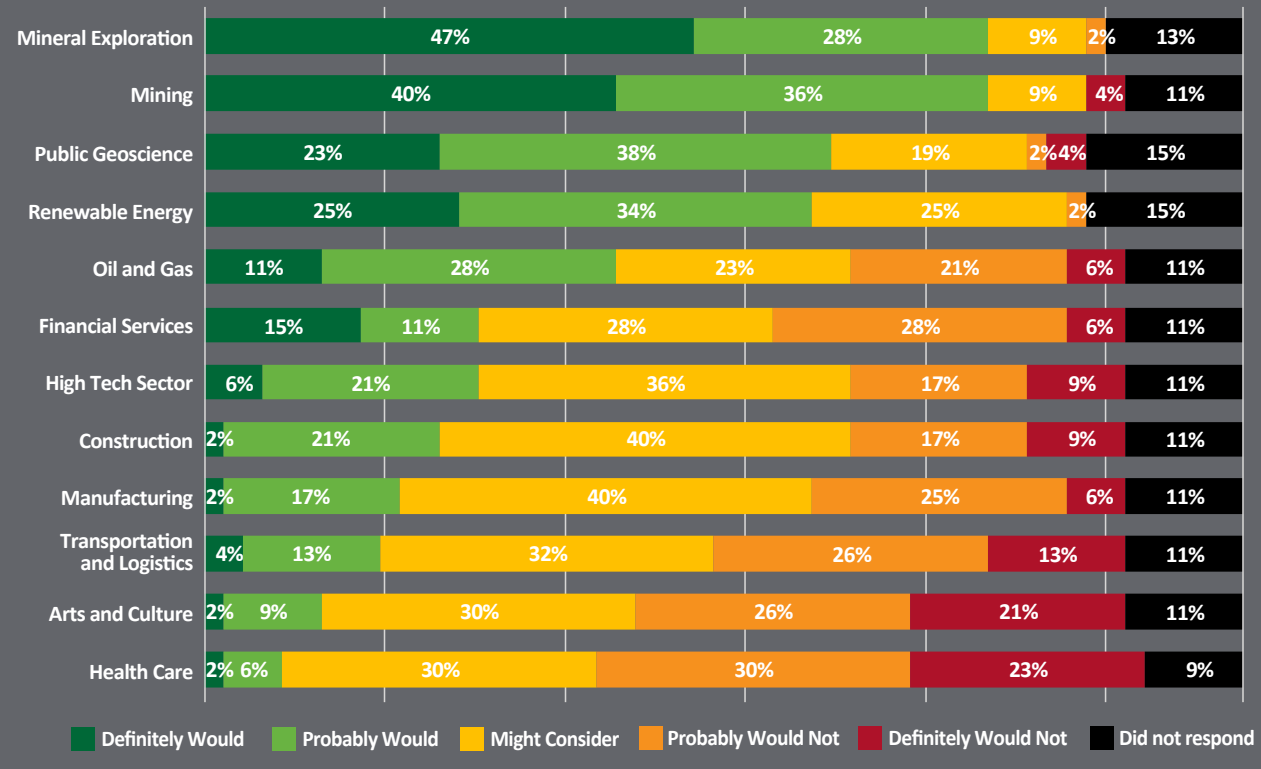
Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

When asked about the importance of various factors when considering a future career, 76% of respondents consider a fulfilling and engaging career to be “extremely” or “very” important (Figure 55). Equally important, at 74%, is the prospect of career advancement and avoiding a dead-end job. Workplace culture (72%), work-life balance (70%) and environmental impact (68%) round out the top five.

Notably, living near a city is the least important factor for these students. It is worth mentioning that this could be misleading due to the young age of the respondents, as their preferences could change drastically as they get older.

When asked which industries they would consider working in, besides mining and mineral exploration, students expressed interest in public geosciences and renewable energy, indicating a strong affinity for their field of study and a genuine desire to make a positive impact for the environment.

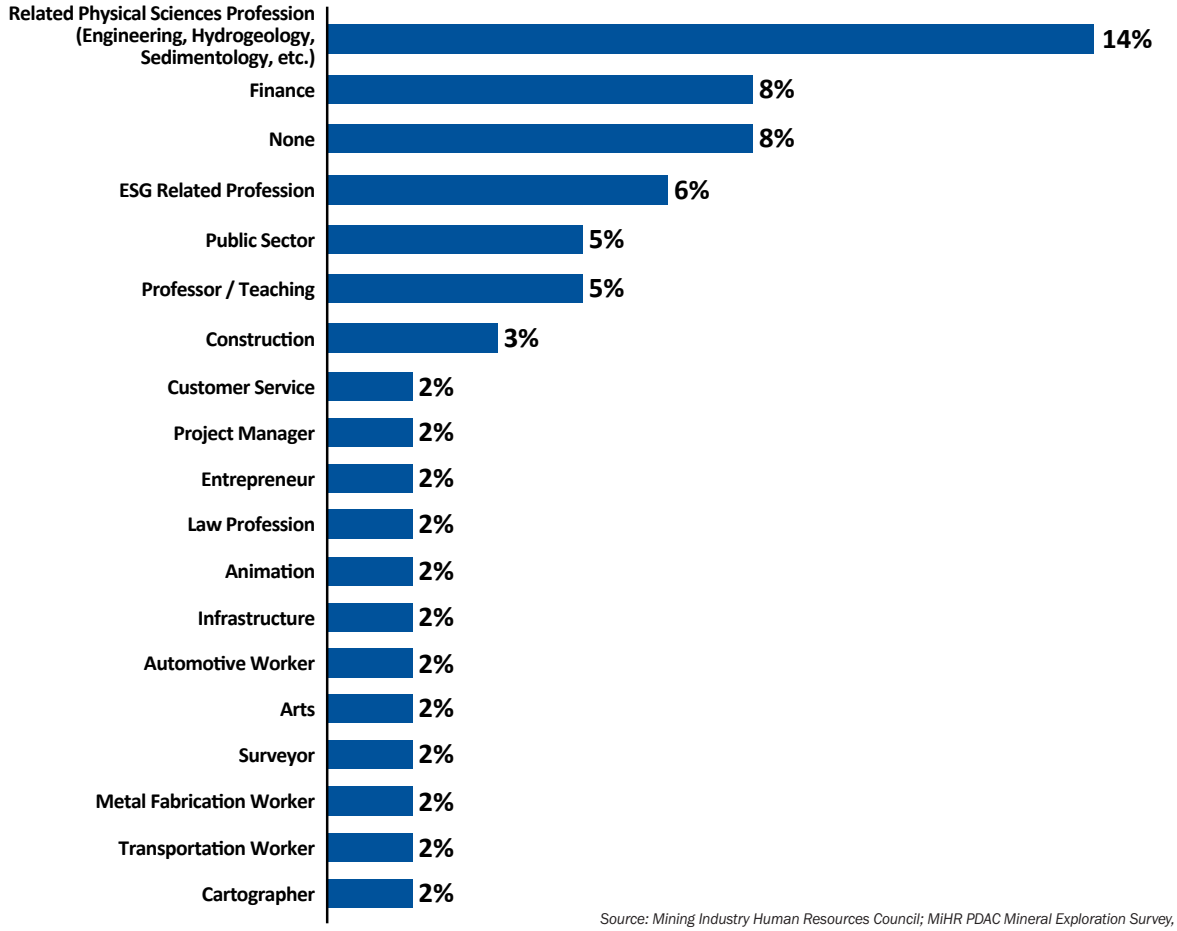
FIGURE 56: ‘WHICH OF THE FOLLOWING INDUSTRIES WOULD YOU CONSIDER WORKING IN?’



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

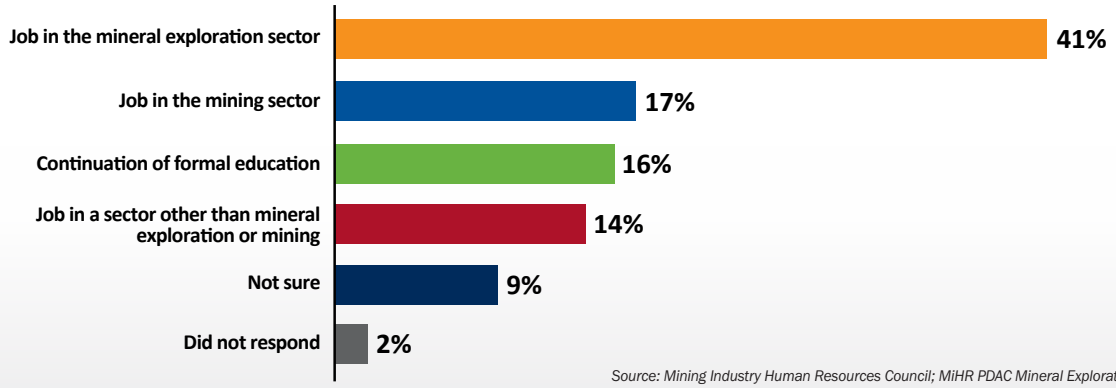
Students were asked in an open-ended format to list what other careers or occupations they might consider. The top choice was "related physical sciences professions", which may reflect geosciences students' attachment to the sciences and strong identity as scientists. Interestingly, two other frequently mentioned fields were finance and ESG-related professions.

FIGURE 57: 'BESIDES MINING OR MINERAL EXPLORATION, WHAT OTHER CAREERS OR OCCUPATIONS DO YOU SEE YOURSELF WORKING IN?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

FIGURE 58: 'WHAT ARE YOUR CAREER PLANS AFTER YOU GRADUATE, OR WHAT HAS BEEN YOUR CAREER PATH SINCE GRADUATING FROM THIS PROGRAM?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Finally, students were asked about their career plans after graduation. 58% of respondents indicated that they plan to work in mining or mineral exploration, while 16% plan to continue their post-secondary studies. A small minority said they did not plan to work in either sector (14%). This suggests that respondents and PDAC participants overall, have a strong attachment to the mining and mineral exploration sector. In other words, their views are indicative of people who have been successfully recruited into the industry.

For stakeholders seeking to expand the pool of students interested in mineral exploration, the findings indicate that it is important to promote the unique aspects of mineral exploration careers at an early age (K-12), including working with hands, problem solving and working outdoors. Helping students develop a personal connection or identity with mining and mineral exploration careers is also very important in strengthening the pool of specialized professionals.

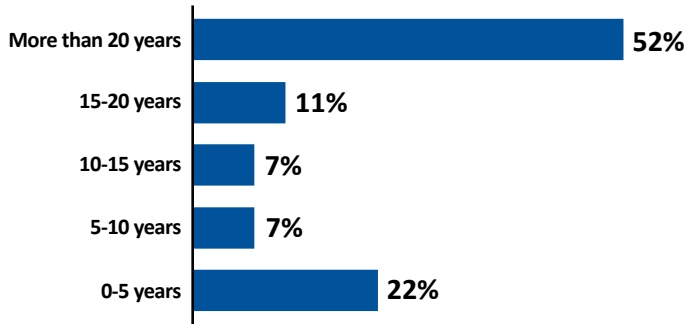
CONSULTANTS AND WORKERS

Background

Consultants

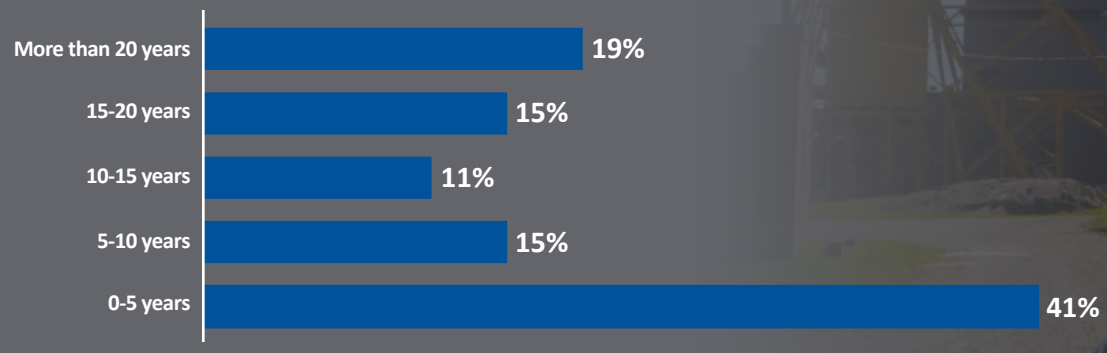
The sample of consultants who responded to the survey consists of 27 valid responses. Most respondents have had long careers in the mineral exploration industry, with more than half (52%) having more than 20 years of experience (Figure 59). A significant percentage of respondents have also been self-employed or worked for their own company for a very long time; 45% of consultants have been self-employed for more than 10 years, and a further 7% have been working under similar conditions for five to 10 years (Figure 60).

FIGURE 59: 'HOW MANY YEARS HAVE YOU BEEN WORKING IN THE MINERAL EXPLORATION SECTOR?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

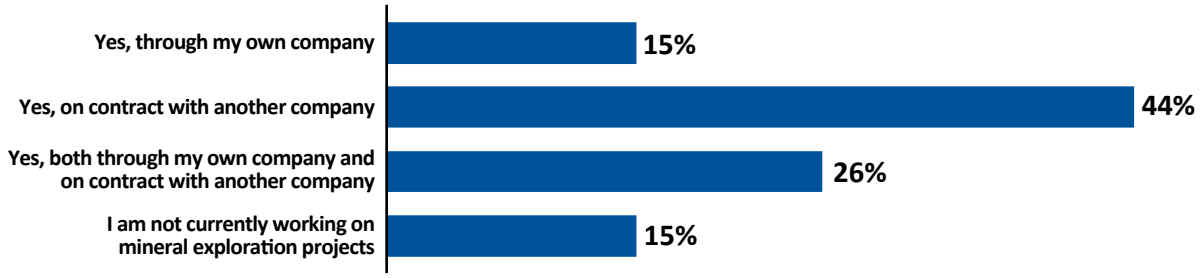
FIGURE 60: 'HOW MANY YEARS HAVE YOU BEEN SELF-EMPLOYED OR WORKING FOR YOUR OWN COMPANY?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

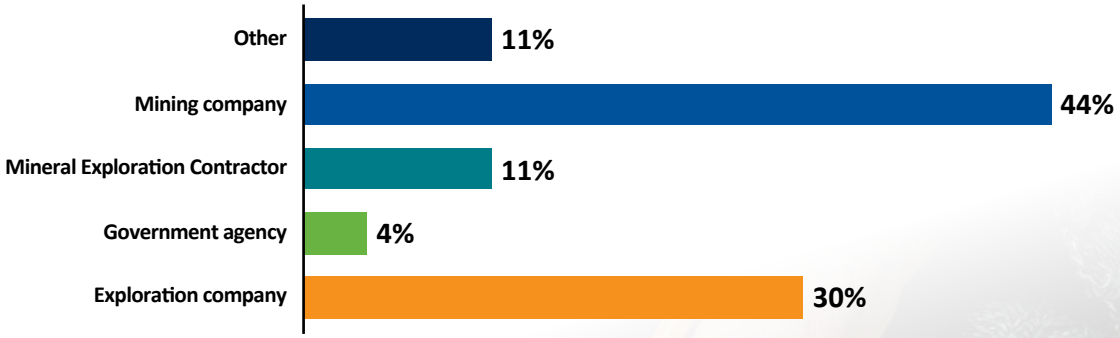
The majority of consultants in the sample (70%) are currently working on a contract basis, either exclusively for another company or for another company as well as their own (Figure 61). The most common type of client for contractors in the sample are mining companies (44%), followed by exploration companies (30%) (Figure 62). Lastly, when asked to describe their position in a mineral exploration operation, the most cited role was geoscientist (48%), with prospector a distant second (11%) (Figure 63).

FIGURE 61: 'ARE YOU CURRENTLY WORKING ON MINERAL EXPLORATION PROJECTS THROUGH YOUR OWN COMPANY OR ON CONTRACT WITH ANOTHER COMPANY?'



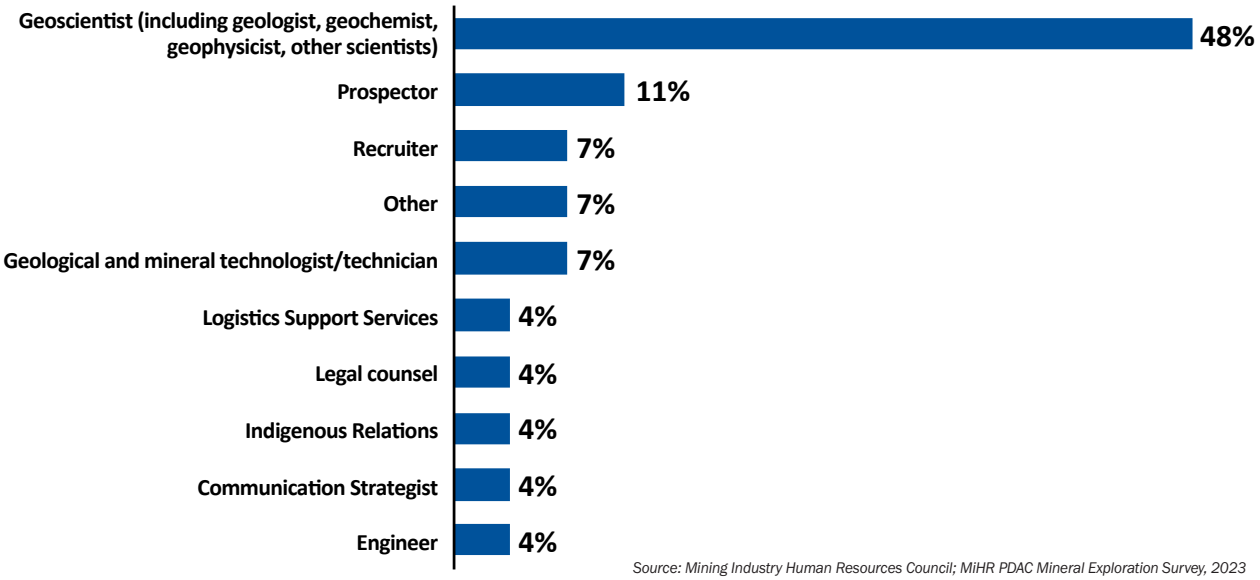
Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

FIGURE 62: 'WHAT TYPE OF CLIENT DO YOU MOST COMMONLY WORK FOR WHEN CONSULTING/PROSPECTING?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

FIGURE 63: 'WHICH OF THE FOLLOWING BEST DESCRIBES YOUR POSITION IN YOUR CURRENT/MOST RECENT MINERAL EXPLORATION JOB?'

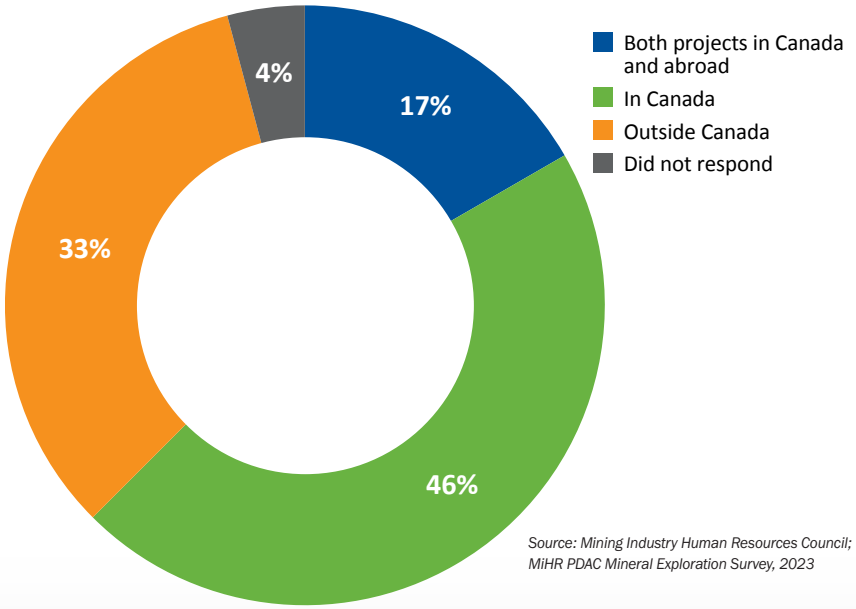


Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Workers

The sample of workers who responded to the survey consists of 24 valid responses. Almost half of the respondents (46%) work exclusively in Canada (Figure 64). Interestingly, 50% work exclusively abroad or work abroad as well as in Canada. This number may be somewhat inflated by the fact that 18% of the consultants surveyed have a permanent residence outside of Canada.

FIGURE 64: 'DO/DID YOU WORK IN MINERAL EXPLORATION IN CANADA OR ABROAD?'

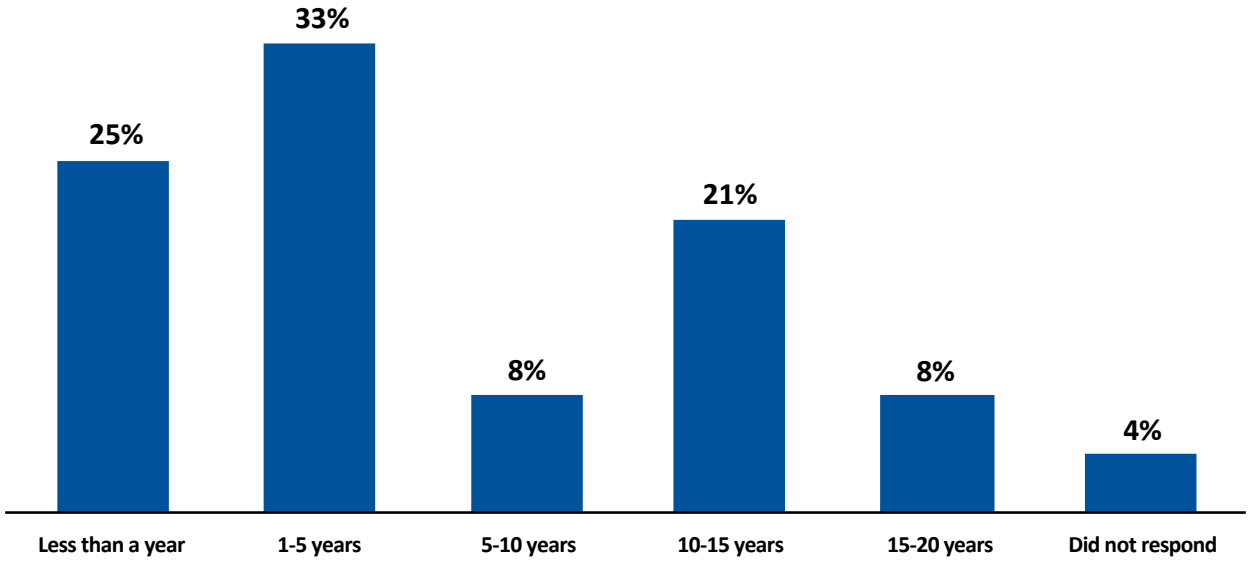


Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

When asked about their tenure with their most recent mineral exploration employer, the numbers are fairly evenly distributed (Figure 65). 25% have been employed for less than a year, 33% for one to five years and 29% for 10 years and above.

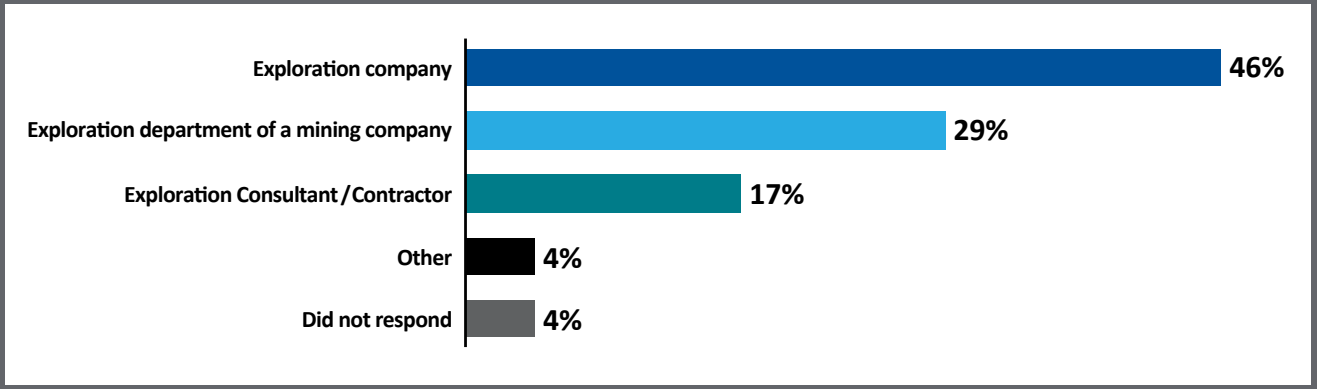
In contrast to consultants, the most frequently cited employer for workers is exploration companies, at 46% (Figure 66).

FIGURE 65: 'HOW LONG HAVE/DID YOU WORK(ED) FOR YOUR CURRENT/MOST RECENT EMPLOYER IN MINERAL EXPLORATION?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

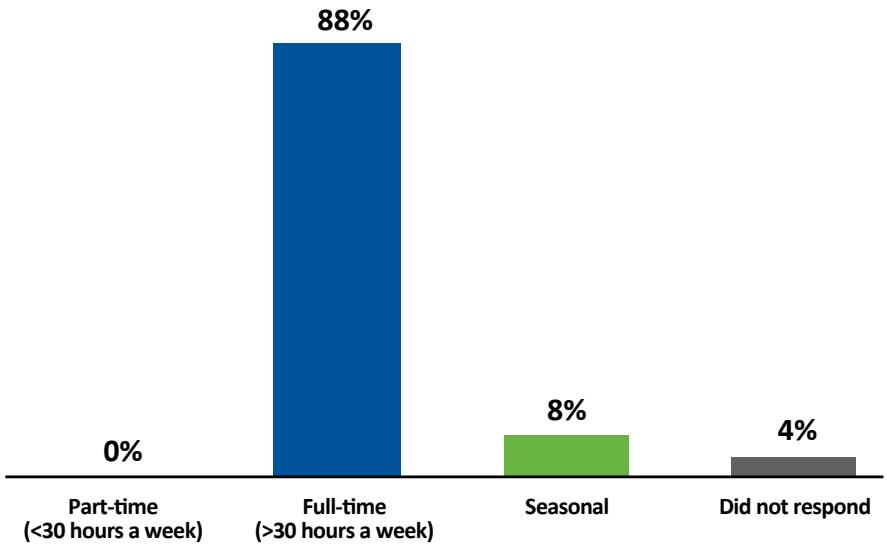
FIGURE 66: 'WHAT TYPE OF EMPLOYER ARE/WERE YOU CURRENTLY/MOST RECENTLY WORKING FOR?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

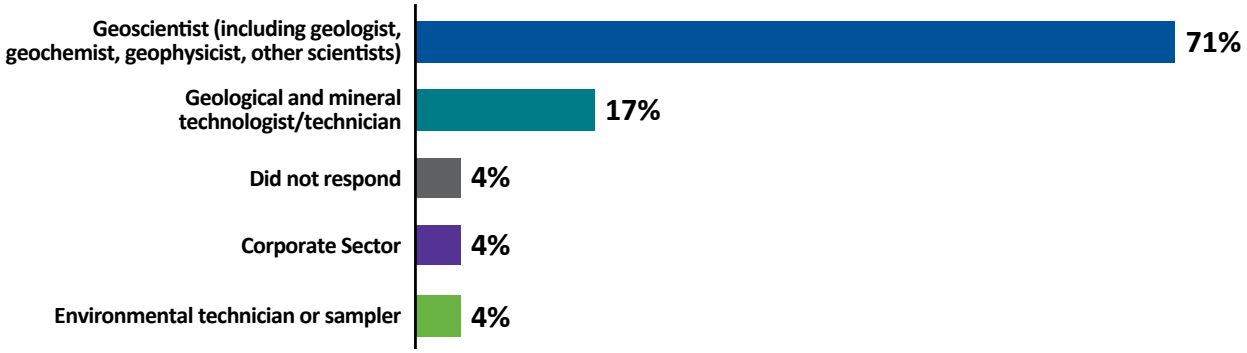
A majority of workers in the sample of respondents (88%) worked a full-time position, while only 8% worked seasonally (Figure 67). Finally, the geoscientist role is overwhelmingly well-represented among workers (with 71%), followed by geological technicians (with 17%) (Figure 68).

FIGURE 67: 'ARE/WERE YOU FULL-TIME, PART-TIME, OR SEASONAL?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

FIGURE 68: 'WHICH OF THE FOLLOWING BEST DESCRIBES YOUR POSITION IN YOUR CURRENT/MOST RECENT MINERAL EXPLORATION JOB?'



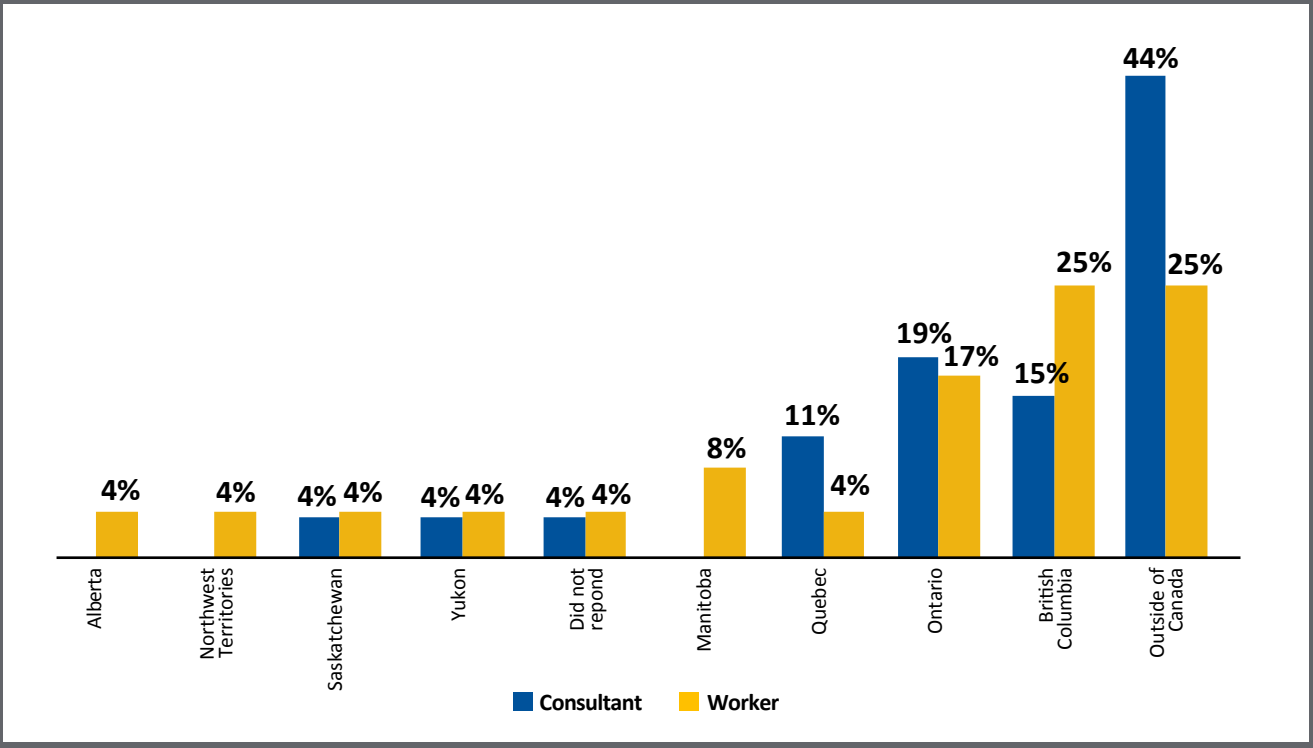
Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Experiences

Consultants and workers were asked about their primary work location. Among respondents working in Canada, the geographic distribution was fairly even across all provinces, except for two notable exceptions (Figure 69). Specifically, 19% of consultants and 17% of workers allocated most of their time to Ontario, while 15% of consultants and 25% of workers focused their efforts on British Columbia.

Interestingly, the largest share of respondents indicated that they spend most of their working time outside of Canada, with 44% of consultants and 25% of workers. This is reflective of the sample, since 33% of consultants and 21% of workers reported having a permanent residence outside of the country.

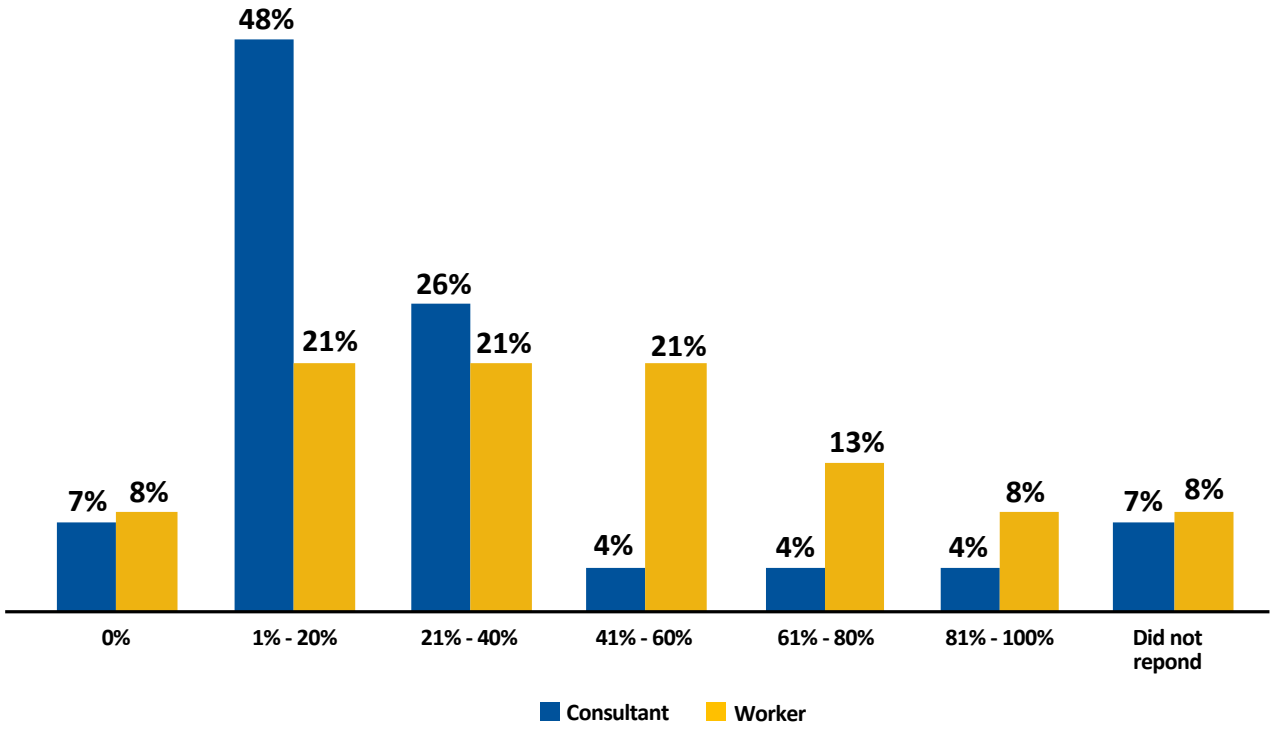
***FIGURE 69:** 'IN YOUR CURRENT OR MOST RECENT JOB, WHERE DO/DID YOU SPEND MOST OF YOUR WORKING TIME?'*



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Among consultants, 81% spend 40% or less of their time in the field (Figure 70). This contrasts with the 2019 mineral exploration survey, which showed that 57% of consultants spend 40% or less of their time on the field, and the 2017 survey, which showed that contractors and consultants spend most of their time on the field. This trend suggests a shift towards a more digitally enabled mineral exploration workforce, as approximately two thirds (65%) of respondents are geoscientists, which has historically been a predominantly field-based occupation.

FIGURE 70: 'IN YOUR CURRENT OR MOST RECENT JOB, WHAT PERCENTAGE OF YOUR TIME DID YOU SPEND IN THE FIELD?'

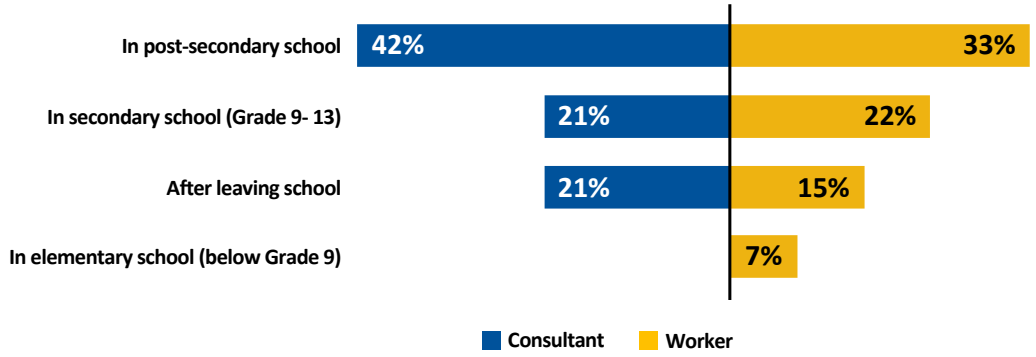


Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Figure 71 shows the level of education at which workers and consultants first learned about careers in mining and mineral exploration. Sixty-three percent of workers and 48% of consultants became aware of careers in the sector either in post-secondary school or after leaving school.

This is consistent with students' survey responses and supports MiHR's qualitative research, which indicates that there is a significant opportunity to increase awareness of the mining industry in K-12 education.

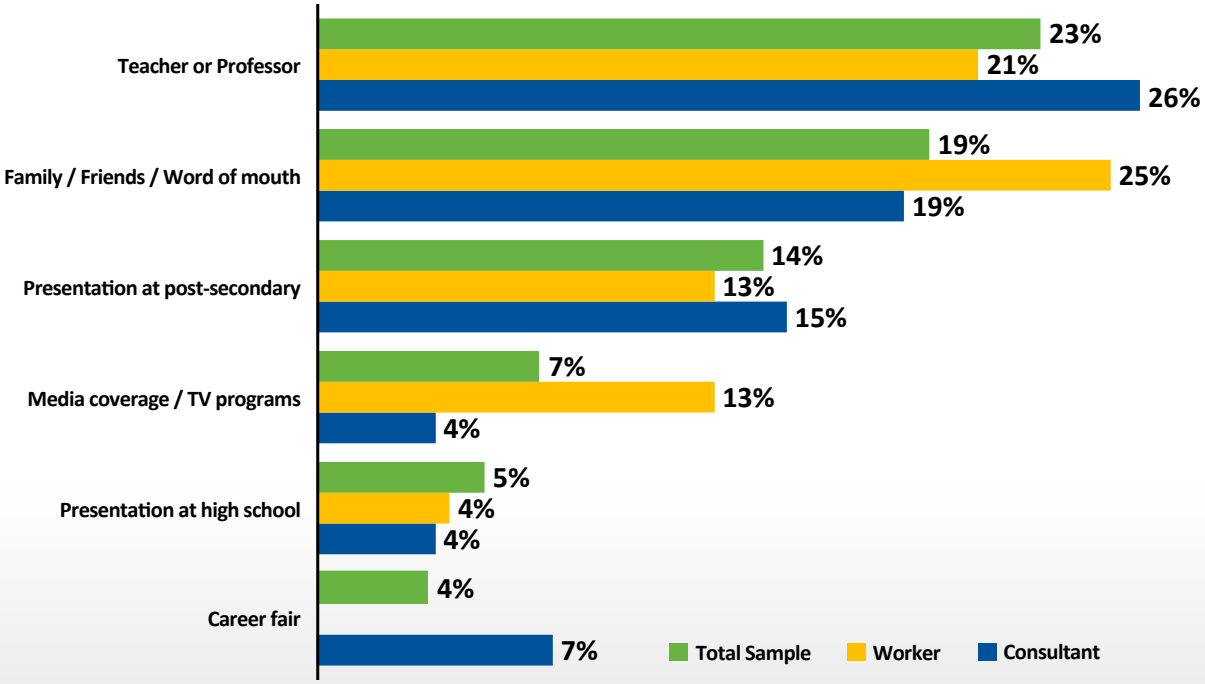
FIGURE 71: 'WHEN DID YOU FIRST LEARN ABOUT CAREERS IN MINING OR MINERAL EXPLORATION?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Similar to the student results, the majority of workers (46%) and consultants (45%) first learned about mining in school or through word of mouth (Figure 72). A negligible percentage learned about mining at career fairs. This highlights the importance of spreading awareness through networks of people, reaching not only individual students but also those around them.

FIGURE 72: 'HOW DID YOU FIRST LEARN ABOUT CAREERS IN MINING OR MINERAL EXPLORATION?'

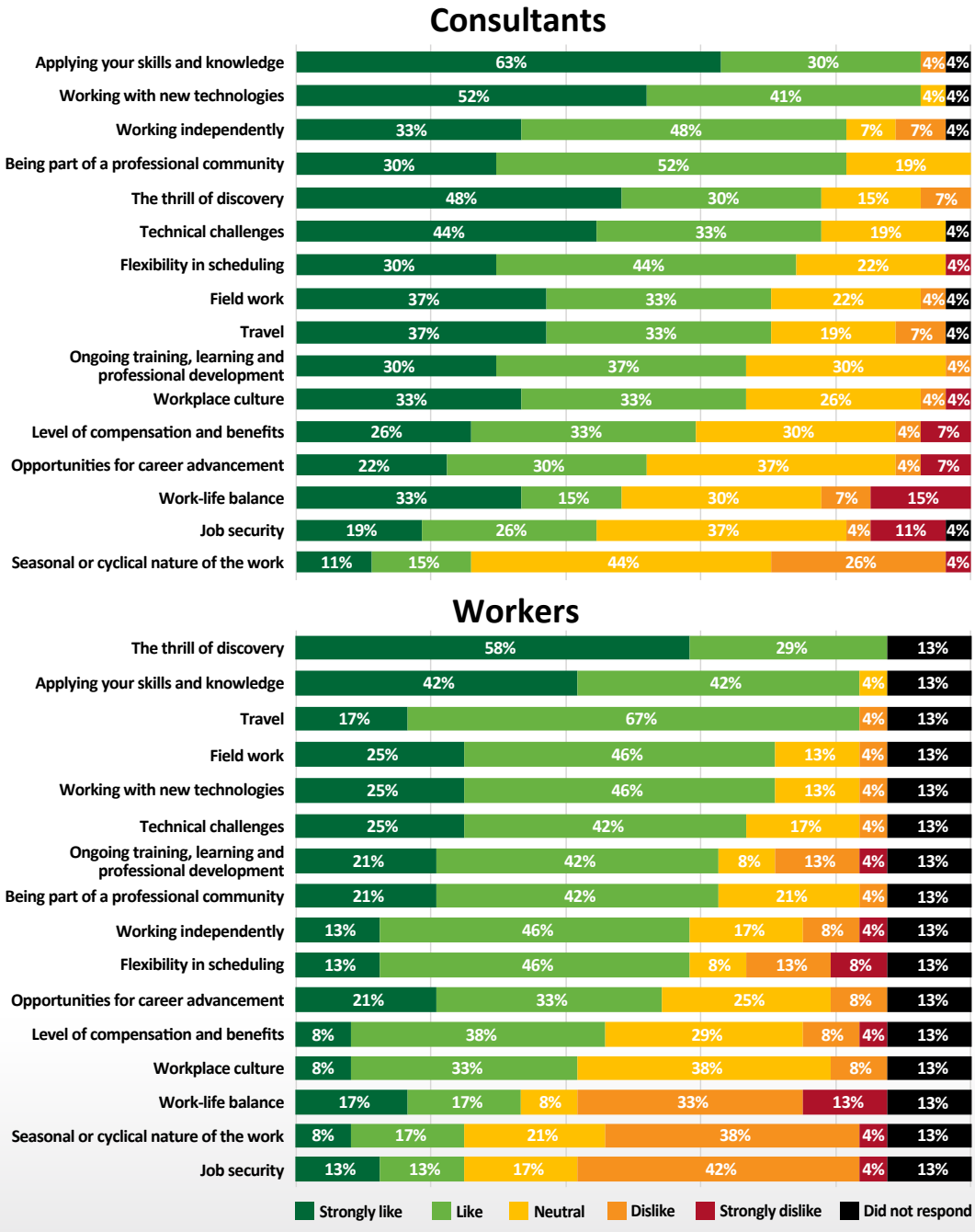


Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Motivations

When asked to rate different aspects of working in mineral exploration, consultants and workers responded similarly (Figure 73). Both mentioned applying their skills and knowledge, working with technology and the thrill of discovery in their top 5. Conversely, both expressed significant dissatisfaction with the industry's work-life balance, cyclicality and job security. This is noteworthy because students have emphasized the importance of work-life balance. Negative perceptions around these issues could have a negative impact on reputation and retention.

FIGURE 73: 'PLEASE RATE EACH OF THE FOLLOWING ASPECTS OF WORKING IN MINERAL EXPLORATION.'



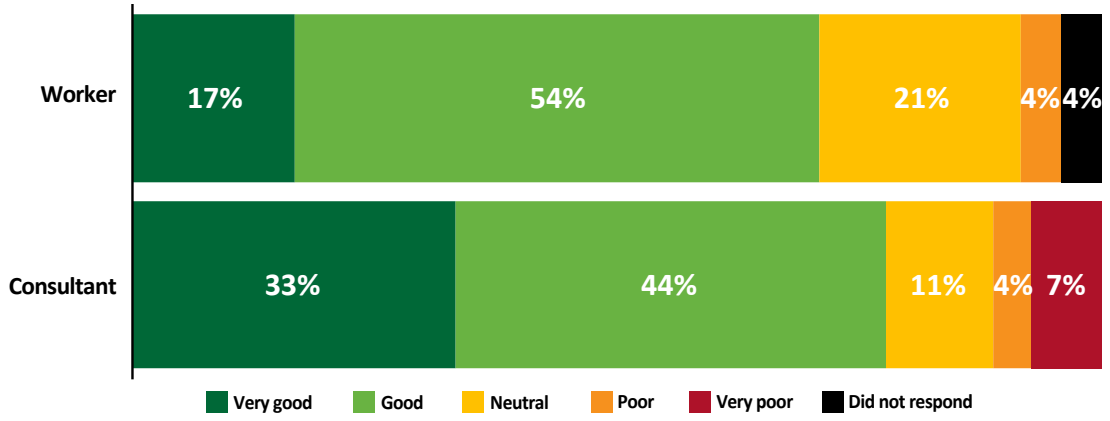
Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Outlook

In the 2019 version of this survey, about 45% of workers and 30% of consultants had a good or very good outlook for the next five years. In 2023, the outlook appears to have improved significantly: 71% of workers and 77% of consultants said the five-year outlook was good or very good (Figure 74).

On the other hand, a poor or very poor outlook dropped from 21% of employees and 33% of consultants to 4% and 11%, respectively.

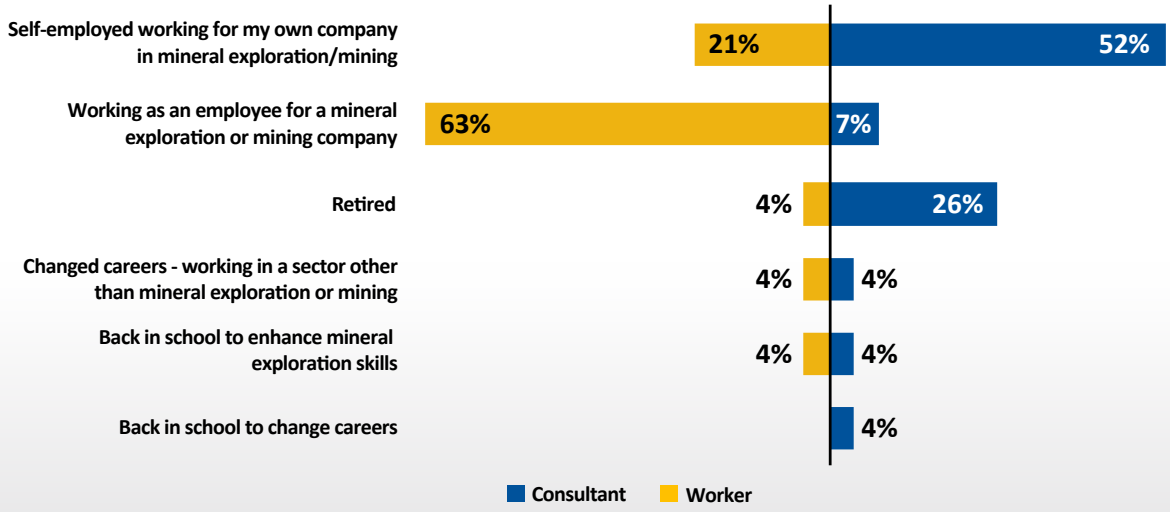
FIGURE 74: 'OVER THE NEXT FIVE YEARS, WHAT DO YOU THINK THE CAREER OUTLOOK FOR ANYONE WORKING IN THE CANADIAN MINERAL EXPLORATION SECTOR WILL BE?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Workers and consultants were asked to indicate where they saw themselves in five years' time (Figure 75). The majority of employees (61%) saw themselves continuing to work as an employee for a mining or mineral exploration company, while a smaller share (21%) saw themselves working independently for their own mineral exploration company. Approximately half of consultants (52%) saw themselves continuing along the same path, and a small fraction (7%) saw themselves employed by a mining or mineral exploration company. A large segment of consultants (26%) saw themselves retiring, which is to be expected given the age demographics of this group.

FIGURE 75: 'FIVE YEARS FROM NOW, WHAT DO YOU SEE YOURSELF DOING?'



Source: Mining Industry Human Resources Council; MiHR PDAC Mineral Exploration Survey, 2023

Recommendations from Workers and Consultants

Respondents to the exploration survey were asked "How can industry associations (e.g., PDAC, MiHR, CIM, KEGS, etc.) better support post-secondary programming in mineral exploration?"

Their open-ended responses are summarized below. PSE programming in mineral exploration can be supported by:

a) Promoting careers in mineral exploration

- Showcase how jobs in mineral exploration can be exciting and interesting.
- Highlight the cutting-edge technologies used in mining and mineral exploration.
- Communicate the benefits that come with jobs in the sector, including opportunities for travel and excellent compensation.
- Provide students with a more holistic image of the industry, such as the financial side and other less known aspects of the sector.
- Provide education on career options and expectations.
- Work to repair the negative reputation surrounding mining and mineral exploration.
- Publicize the positive future of mineral exploration and the need for new discoveries of mineral deposits.

b) Creating opportunities to engage with students

- Develop websites, interesting videos and other interactive tools that are focused on engaging youth to learn about careers in the sector.
- Provide opportunities for professionals and students to interact.
- Sponsor employees to visit schools to spread knowledge about mineral exploration.
- Foster a closer connection between industry and educational partners.
- Boost exposure through job fairs, conferences and recruitment expos to attract younger audiences.
- Sponsor classroom projects and field trips to inject mining into high school curricula.

c) Broadening outreach strategies

- Open recruitment to different post-secondary institutions, not only ones with mining programs.
- Shift focus from "mining schools" to recruiting from other disciplines.
- Support cross discipline integration like across geosciences (geochemistry, geology, geophysics) to better understand how they interact with each other.
- Expand the curriculum to underdeveloped areas of mining education (e.g., legal, accounting, tax, etc.)
- Provide additional coop partnerships for students in engineering, sciences, geo-sciences, environment, social sciences, business, law, and communication to address the many facets of work that mining companies undertake.
- Begin outreach strategy before the post-secondary stage, as that is too late.
- Focus on STEM programs at the K-12 level to generate interest in the geosciences, so that students are primed and aware of mineral exploration occupations on their first day of post-secondary education.[9]
- Engage mining companies to provide real datasets for students to learn to deal with real-life problems.

d) Providing more support tools and resources to students

- Offer career advisory services at tertiary institutions or key organizations.
- Provide summer work programs in the minerals and mining industry.
- Develop career tools such as job boards and global message boards for internships.
- Set up survey booths to gauge interest among students and connect them to networking opportunities with employers.
- Organize additional networking events.
- Extend financial supports to students and professionals to remove financial barriers and allow more exposure to the sector (e.g., employment, bursaries, loans, fellowships, grants and discounted student memberships).
- Offer professional development and career transition courses.
- Help universities develop programs and classes related to mineral exploration.
- Support development of post-grad certifications in mining to ease entry into post-graduate work.
- Develop supports for new graduates to prevent student burnout and lower the incidence of student attrition.

9 This is necessary, as registration requirements for a P.Geo designation require starting in 1st year at University with respect to core STEM courses—waiting until 2nd or 3rd year (or later) is too late in many cases.