

SPOTLIGHT: GEOSCIENTISTS



RHCHR MINING INDUSTRY HUMAN RESOURCES COUNCIL

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Published April 2024

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.

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Overview

Canada's mining industry has entered a promising new era of growth. Since 2020, increased demand for critical minerals and rising metal and mineral prices have fueled substantial capital investments and mineral exploration spending. With global momentum towards decarbonization and green energy initiatives, Canada's key position in the green economy offers a bright future for careers in its mining sector.

Establishing a robust talent pipeline is increasingly important for the sustainable growth of the industry. To this end, The Mining Industry Human Resources Council (MiHR) has identified several essential occupations that face potential labour shortages in the coming years. This publication focuses on one of these crucial occupations: **Geoscientists** (NOC 21102)¹.

Aimed at both job seekers and employers, this report offers information on the position's primary responsibilities, level of remuneration, educational prerequisites and skills profile. Additionally, it delves into the geographical distribution, demographic characteristics, and latest employment and postsecondary education trends for geoscientists.

Job Description

Geoscientists conduct programs of exploration and research to extend knowledge of the structure, composition and processes of the earth, to locate, identify and extract hydrocarbon, mineral and groundwater resources. They also play a crucial role in assessing and mitigating the effects of development and waste disposal projects on the environment².

Mining Needs You

Why are Geologists important?

We need Geologists to support infrastructure planning and ensure that resources are developed in a sustainable manner. Geologists apply their fascination with earth sciences to a wide range of work that is pivotal to mine performance.

What is it Like to Work as a Geologist in Mining?

Geologists are based in an office, laboratory or a core-shack on (or near) the mine site, but will often be required to work and travel in remote locations. At times, they are required to work in challenging physical environments and seasonal environmental conditions. They are occasionally on-call and available to respond to a call on short notice. This career is centred around communication and teamwork. The work is fast paced with daily opportunities to make decisions and to learn.

Why are People Attracted to this Career?

Geologists like the range of working environments, including fieldwork, office work and/or lab work. There are opportunities to learn and apply new techniques and technologies. Geologists are attracted by earth science, traveling, adventure and outdoor activities that keep them physically fit.

Source: Mining Industry Human Resources Council, "We Need Mining, Mining Needs You". https://www.miningneedsyou.ca/job/geologist/

¹ Labour market data is aligned with Employment and Social Development Canada's (ESDC) National Occupational Classification (NOC) framework. Statistics Canada data cited throughout this report will correspond to NOC 21102 (Geoscientists and oceanographers), as it is the closest match. OaSIS data provides additional granularity and excludes oceanographers.

² Statistics Canada, Occupational and Skills Information System (OaSIS).

Duties and Responsibilities

Geoscientists perform some or all of the following duties:

- Conduct theoretical and applied research to extend knowledge of surface and subsurface features of the earth, its history and the operation of physical, chemical and biological systems that control its evolution.
- Plan, direct and participate in geological, geochemical and geophysical field studies, drilling and geological testing programs.
- Plan and conduct seismic, geodetic, electromagnetic, magnetic, gravimetric, radiometric, radar and other remote sensing programs.
- Plan, direct and participate in analyses of geological, geochemical and geophysical survey data, well logs and other test results, maps, notes and cross sections.
- Develop models and applied software for the analysis and interpretation of data.
- Plan and conduct analytical studies of core samples, drill cuttings and rock samples to identify chemical, mineral, hydrocarbon and biological composition and to assess depositional environments and geological age.
- Assess the size, orientation and composition of mineral ore bodies and hydrocarbon deposits.
- Identify deposits of construction materials and determine their characteristics and suitability for use as concrete aggregates, road fill or for other applications.

- Conduct geological and geophysical studies for regional development and advise in areas such as site selection, waste management and restoration of contaminated sites.
- Recommend the acquisition of lands, exploration and mapping programs and mine development.
- Identify and advise on anticipated natural risks such as slope erosion, landslides, soil instability, subsidence, earthquakes and volcanic eruptions.
- May supervise and coordinate well drilling, completion and work-overs and mining activities.

Additional information:

- Mobility between specializations in this group is possible with experience.
- Progression to supervisory or higher level positions is possible with experience in this unit group.
- Advancement to management positions in mining, petroleum and other industries is possible with experience.
- Geologists may specialize in fields such as coal geology, environmental geology, geochronology, hydrogeology, mineral deposits or mining, petroleum geology, stratigraphy, tectonics, volcanology or in other fields.
- Geochemists may specialize in analytical geochemistry, hydrogeochemistry, mineral or petroleum geochemistry or in other fields.
- Geophysicists may specialize in areas, such as petroleum geology, earth physics, geodesy, geoelectromagnetism, seismology or in other fields.

Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada, Occupational and Skills Information System (OaSIS).

Wages and Pay

Geoscientist careers offer a competitive level of compensation. In 2021, the median annual income for *Geoscientists and oceanographers (NOC 21102)* was \$86,000, roughly twice the national average and on par with other physical sciences professions in Canada.

Median Annual Income (Wages, salaries and commissions), Geoscientists and related occupations (2021)

NOC Code	Occupation	Median Annual Income
-	All occupations	\$43,200
21100	Physicists and Astronomers	\$98,000
21101	Chemists	\$64,500
21102	Geoscientists and Oceanographers	\$86,000
21109	Other professional occupations in physical sciences	\$72,000

Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada, Census of Population, 2021

Average offered hourly wage, Geoscientists and related occupations (2021)



Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada Job vacancies, proportion of job vacancies and average offered hourly wage by selected characteristics, quarterly, unadjusted for seasonality, inactive (Table: 14-10-0328-01), 2024

Places of Work

Industries that Employ Geoscientists

Geoscientists work in a variety of industries—as of 2021, roughly 13% worked in the *Mining and quarrying (NAICS 212)* sector. The largest share of geoscientists (41%) was employed in *Professional, scientific and technical services (NAICS 541)*.





Support activities for mining, and oil and gas extraction (NAIC
Professional, scientific and technical services (NAICS 541)
Other Industries

Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada, Census of Population, 2021

Types of Employers

Below is a short list of the types of workplaces that typically employ Geoscientists in Canada:

- Consulting engineering, geology and geophysics firms
- Education institutions
- Governments
- Mining and petroleum companies

Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada, Occupational and Skills Information System (OaSIS).

Work Setting

Geoscientists usually split their time between work in an office setting, in laboratories, and outdoors. Most geoscientists work full time, and some work more than 40 hours per week, travelling frequently to meet with clients and to conduct fieldwork³.

Geoscientists may work as part of a team with other scientists and engineers. For example, they may work closely in natural resource extraction fields with petroleum engineers to find new sources of oil and gas.

In the mining industry, Geoscientists often travel to mining operations and exploration sites located in remote areas.

MAP 1 Producing Mines in Canada



Natural Resources Canada, Principal Mineral Areas, Producing Mines, and Oil and Gas Fields in Canada, 2022

As per NRCan data from 2022, Canada had a total of 135 active mines. Map 1 depicts their geographic spread, denoting the type of operation and where there is a higher density of mines relative to other areas. The figure shows the largest cluster of mining activity is found in Northeast Ontario and Abitibi-Témiscamingue, Québec, where there is a long and established history of mining.

MAP 2 Critical Mineral Projects in Canada



Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Natural Resources Canada, Principal Mineral Areas, Producing Mines, and Oil and Gas Fields in Canada, 2022

The shift to a green economy in Canada will largely depend on critical minerals that will make clean energy technologies possible. With its vast geological landscape, Canada is well-positioned to be a producer of key critical minerals as they are anticipated to increase in demand. Map 2 displays critical mineral projects across Canada in 2021. These projects encompass a variety of critical minerals, including Zinc, Copper, Cobalt, Nickel, among several others.

Labour Force by Province, Geoscientists and MAP 3 oceanographers (NOC 21102) (2021 Census)



Spotlight: Geoscientists, 2024; Statistics Canada, Census of Population, 2021

Map 3 shows how the labour force of Geoscientists is distributed across the country by province of residence. Among provinces, Alberta has the largest number of Geoscientists, followed by Ontario and British Columbia.

³ U.S. Bureau of Labor Statistics, Occupational Outlook Handbook, 2023.

Education, certification and licensing

The following list includes the education, training and/or certifications required to work as a Geoscientist in Canada.

Educational Requirements

- Geoscientists require a university degree in geology, geochemistry, geophysics or a related discipline.
- A master's or doctoral degree in geophysics, physics, mathematics or engineering may be required for employment as a geophysicist.
- Registration with a provincial or territorial association of professional engineers, geologists, geophysicists or geoscientists is usually required for employment and is mandatory to practice in all provinces and territories except Prince Edward Island and the Yukon.
- Geologists and geophysicists are eligible for registration following graduation from an accredited educational program and after several years of supervised work experience and, in some provinces, after passing a professional practice examination.

Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada, Occupational and Skills Information System (OaSIS)

Postsecondary Education Trends

Among undergraduate students, there is significant interest in the geosciences, accounting for 15% of enrolments in the physical sciences as of 2020. Only Chemistry and Physics have a larger share of physical sciences enrolments, with 40% and 28% respectively. Degrees in geosciences benefit from their broader applicability beyond mining.





The cyclical and highly fluctuating nature of employment for Geoscientists contrasts with the comparatively stable decline in enrolment and graduation numbers in the geosciences since 2014. From 2016 to 2020, employment levels, enrolments and graduates all declined by roughly 40%. However, from 2021 to 2023 employment rebounded by 89%, while enrolments and graduates were not projected to respond to this growth.



Employment and Postsecondary Education Trends (Undergraduate), Geoscientists (2012–2023)

Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022



Council, Spotlight: Geoscientists, 2024; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022

With Geosciences Enrolment
Without Geosciences Enrolment

Of the 90 universities shown in Map 4, 32 offered geosciences programs in 2020/2021. Notably, most of the programs are exclusively available in the southern regions of Canada.



Knowledge, Skills, Abilities and Personal Attributes

The Occupational and Skills Information System (OaSIS)⁴ describes the various competencies and characteristics of workers in a given occupation. The following charts provide a set of ratings for the level of knowledge or proficiency attributed to Geoscientists in Canada.

In this context, knowledge refers to the principles and practices most frequently used by Geoscientists for the execution of workplace tasks or activities.



Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada, Occupational and Skills Information System (OaSIS)

4 The OaSIS is a database developed by Employment and Social Development Canada (ESDC) that provides ratings for worker characteristics such as skills and abilities as well as the work environment associated with Canadian occupations.

Skills can be defined as the proficiencies that an individual needs to possess in order to perform effectively in a job, role, function, task, or duty.



Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada, Occupational and Skills Information System (OaSIS) Abilities can refer to inherent and cultivated aptitudes that facilitate the attainment of knowledge and skills required to fulfill job responsibilities effectively.





Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada, Occupational and Skills Information System (OaSIS) Similar to abilities, personal attributes are inherent traits that are cultivated through social contexts and personal experiences. They shape the person and are a valuable asset in determining work performance.



Geoscientists ••• Canadian Average –•– Mining Industry Average

Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada, Labour Force, Occupational and Skills Information System (OaSIS)

Demographic Representation

Understanding the demographic profile of Geoscientists is crucial for workforce planning, promoting diversity and inclusion, tailoring skills development programs, implementing retention strategies and gaining insights into industry trends.

Despite some volatility, women's representation among Geoscientists (27.0%) has been on a clear uptrend over the past two decades. Although the percentage of women is significantly lower than the Canadian average (47.5%), it is also higher than the mining industry average (14%) as of December 2023.

Women's Representation (2001-2023, 12-month Moving Average)



Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada, Labour Force Survey (Custom Data)

According to the Census, the proportion of immigrants in this occupation (29.2%) is on par with the level found across all occupations (28.9%). In the case of Indigenous peoples, their representation among geoscientists is 3.5%, slightly lower than the 4.5% across all occupations in Canada.

Indigenous & Immigrant Representation (2021 Census)



Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada, Census of Population, 2021

The majority of Geoscientists fall within the 25 to 34 age bracket (28%), with a significant portion (26%) nearing or past retirement age. To ensure a robust labour supply pipeline, it is imperative to recruit young workers to replenish the gap created by retiring workers.

Age Distribution (2021 Census)



Source: Mining Industry Human Resources Council, Spotlight: Geoscientists, 2024; Statistics Canada, Census of Population, 2021

