Effects of Field Experience on Recruitment and Retention of Geoscientists in Canadian Mineral Exploration

Prepared by
The Mining Industry Human Resources Council
(MiHR)

For
Prospectors & Developers Association of Canada
(PDAC)

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MiHR

The Mining Industry Human Resources Council (MiHR) is the council for the Canadian minerals and metals industry. A recognized leader in the development and implementation of national human resources solutions, MiHR contributes to the strength, competitiveness, and sustainability of the Canadian mining sector. The products and services supporting our endeavours are based on sound research into the skills and labour market issues that matter most to the Canadian mining industry.

PDAC

The Prospectors & Developers Association of Canada (PDAC) is a national association representing the mineral exploration and development industry. The PDAC has more than 10,000 individual and corporate members, and encourages the highest standards of technical, environmental, safety and social practices in Canada and around the world. Areas covered by the association's wide range of advocacy work include Aboriginal affairs, access to capital, corporate social responsibility (CSR), finance and taxation, geosciences, human resources, education, business insurance, land access, and securities regulations.

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- Association of Professional Engineers and Geoscientists British Columbia (APEGBC)
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Introduction and Background

Introduction

The Canadian mineral exploration industry is facing challenging times. An aging workforce, coupled with the cyclical nature of the industry, has made the retention and recruitment of workers a challenge. In addition, the exploration sector presents a unique work environment, particularly with regards to geoscientists; there is a reliance on a worker's ability to engage in field work throughout their career path. The thrill and adventure that is associated with remote work can over time prove to be very challenging for workers with regards to flexibility and work-life balance. Ensuring that new graduates have the knowledge, skills and experience within field environments to succeed in their professional roles is an important area of focus for the industry. In addition, ensuring that the field environment is conducive to the retention of geoscientists will ensure that the industry as a whole remains competitive in the increasingly tight race for highly skilled labour.

The objective of this research study was to investigate the impacts of post-secondary field experience on the flow, recruitment and retention of talent from education in geosciences to the mineral exploration industry. This research followed on recommendations from the 2011 study, *Unearthing Possibilities: Human Resources Challenges and Opportunities in the Canadian Mineral Exploration Sector* conducted in partnership between MiHR and PDAC.

From the *Unearthing Possibilities* study, employers articulated that the most challenging positions to fill within the exploration sector were geoscience positions, and for all positions that require field work a lack of field experience persists as the number one challenge in filling those vacancies.

Background

Highlighting the Issues – *Unearthing Possibilities*

In 2011, MiHR and PDAC conducted an extensive labour sector study of the Canadian mineral exploration industry. The purpose of this research was to provide reliable, relevant and timely labour market information to support strategic workforce planning, and to stimulate a proactive and collaborative approach to the human resources challenges facing the sector. The result of this research was the report; *Unearthing Possibilities: Human Resources Challenges and Opportunities in the Canadian Mineral Exploration Sector*.

Unearthing Possibilities provided significant information on the demographic profile of the exploration industry, and the education and work backgrounds of the current labour force. This report illustrated some significant national and regional gaps in the attraction and retention of workers within the industry.

Exploration Labour Supply and Demand Challenges

The Canadian labour market will face significant challenges over the next 20 years and the mineral exploration sector is no exception. The number of people employed in the exploration sector has more than doubled over the past decade and this is tightly linked to the growth in economic activity. As the need for workers expands, the exploration workforce is also aging, with its share of workers aged over 55 years set to double over the next 10 years. Compounding the challenges of an aging workforce, the exploration sector underperforms the Canadian labour market in the employment of women, Aboriginal peoples, immigrants and youth.

In addition, exploration is an industry with a heavy reliance on knowledge workers, and the reliance on these workers necessitates a forward-thinking workforce strategy. Developing knowledge workers requires significant amounts of time dedicated to education. This highlights the need to have these workers in the education pipeline long before the workforce need is presented.

Ensuring access to a talent pool that has the skills and knowledge to perform is only half of the battle, *Unearthing Possibilities* also highlighted that there are significant challenges with regards to mid-career attrition in exploration. Specifically, there is a gap of middle-aged workers in exploration compared to other sectors. With a workforce that is highly educated, with the bulk of the exploration workforce made up of experienced geoscientists and technicians, this demographic scenario illustrates a substantial capacity gap within the industry.

The Impact of Field Experience

The exploration sector places a high value on the role of experiential learning. Due to the nature of work in the sector, there is a heavy reliance on a workers ability to navigate field work. This requires both graduates with field experience, and workers who are willing and able to conduct field work throughout their career.

Despite the need for field experience and the heavy reliance on recent graduates to work predominately within the field environment, previous research found graduates of post-secondary exploration programs often completed their education with limited exposure to work within the field. Employers also indicated a concern about the field knowledge and experience of recent graduates. There have been some attempts to rectify this both nationally and regionally, in some cases students have been placed in co-op placements to provide them with field experience and to build initial work relationships that will lead to full-time employment. (MiHR, 2011a, p. 41).

Unlike other industries, field experience is not just a work reality for junior employees. The exploration of resources requires field work from experienced professionals, and many employers have found it increasingly difficult to recruit senior and experienced workers for field work later in their career. Perpetuating this challenge is the need for skilled geoscientists for junior companies who simply do not have the resources to offer the stability and benefits of larger organizations. Secondly, junior geologists are missing the mentorship in the field as more senior geologists are being pulled from this all important role of knowledge transfer (MiHR, 2011a, p. 44).

Geoscience Education and Labour Market Overview

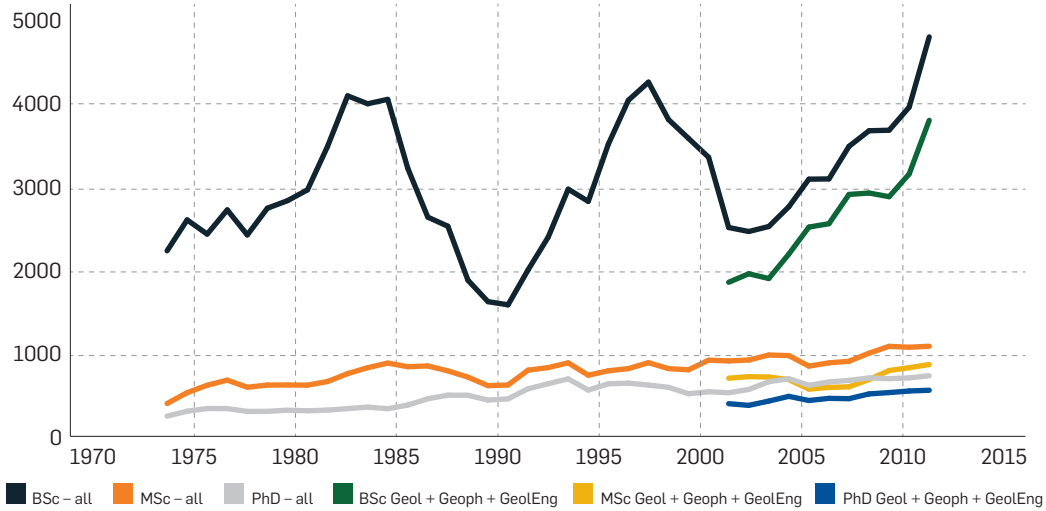
Geoscience Education and Labour Market Overview

Geoscience Education Enrollment and Demographics

In Canada, there are currently 37 universities [1] providing geoscience education programs. These programs range from undergraduate course work to postgraduate level: 32 offer full BSc programs, 31 offer MSc programs, and 25 offer PhD programs (Raeside & Kosters, 2012, p. 2). In 2012 it was estimated that 5,000 students were currently registered in geoscience programming at universities across Canada. Of these students, 75 percent were registered in BSc programs (Raeside & Kosters, 2012, p. 2).

Figure 1 illustrates the trend for enrollment in geoscience from 1974-2011 by the Council of Chairs of the Canadian Earth Science Departments. This graph highlights the cyclical shifts that have characterized Bachelors level programming while graduate level enrollment has remained relatively stable over time. Of note, the decline in mineral exploration experienced in the 1990s following tax law amendments and the Bre-X scandal are possible explanations to the drop in enrollment seen to the early 2000s (Raeside & Kosters, 2012, p. 7).

Figure 1 CCCESD[2] report 2011 – Number of BSc (>year 1), MSc and PhD program registrants[3]



1 http://cccesd.acadiau.ca/links.html
2 Council of Chairs of Canadian Earth Science Departments
3 http://cccesd.acadiau.ca/2011survey1.gif

Education Demographics

Since the mid-1990s the number of women in geoscience programs has been tracked by the CCESD, and the number of participants has stayed fairly constant at around 40-45 percent. The fraction of women in graduate programming has shown a steady increase from 25-45 percent during the same period, and 15-35 percent for PhD programs, and 10-20 percent for faculty members.

Career Development in the Geosciences

Career development is largely shaped by the experience students have within their educational environment. A 2010 study describes students' interest and ambition in the geosciences and analyzed differences and similarities between Native Americans and immigrants in geoscience programs in the USA. The key differences were in the career path trajectory which indicated a preference for industry based careers from Native American students, and a preference for research or academic careers from immigrant student populations (Houlton, 2010).

This research analyzed the trajectory of career path, interest and attraction based on critical incidents identified in Levine et al. (2007) study of the geoscience retention factors (Levine & Gonzalez, 2007). The critical incident factors that lead to a career in geoscience included course selection, geoscience awareness, effective instruction, familial factors, career development activities, outdoor experiences, and mentors (Levine et al., 2007 as referenced in Houton, 2010 p.5). The reasons behind the differences in career trajectory are multi-faceted; however this study illustrates the need for a more detailed understanding of the career development process from the point of education into professional development.

Careers paths are becoming more challenging to define. Historically, careers developed along linear and regimented paths in a mostly predictable manner. Deregulation, deconstruction of union environments, and increased reliance on technology has led to career paths that are harder to predict, mobile, and are shaped by diverse organizational structures (Brown, van Leeuwen, & Mitch, 2004, p. 3 as cited in Hughes 2012). These changes have created further complexities when attempting to categorize or predict career paths, particularly when quantifying advancement. In the mining and exploration industry there have not been extensive studies on the career development paths within the industry (Hughes, 2012, p. 29). Similarly, there is a lack of information on the career paths of Canadian earth science graduates, and "despite enrolment growth we do not really know where earth science graduates go" (Raeside & Kosters, 2012).

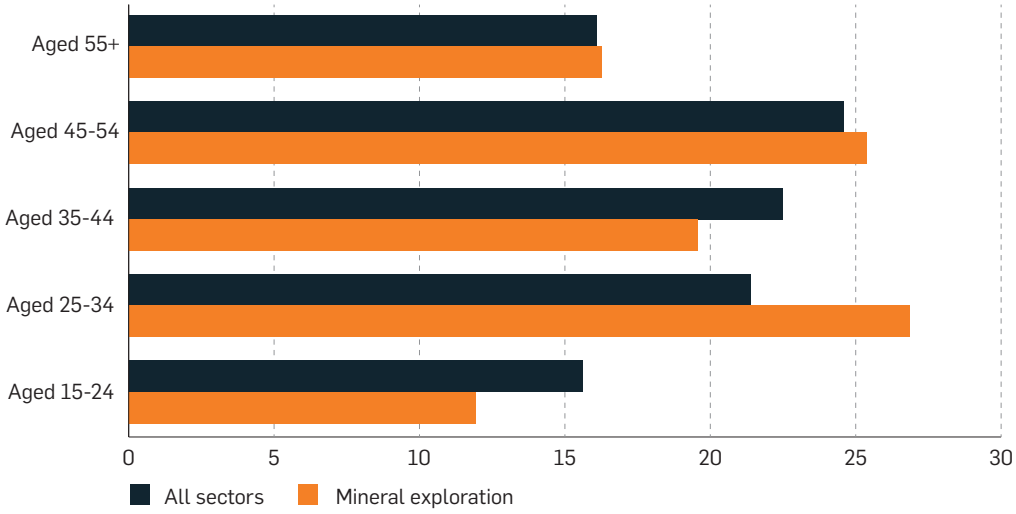
Workforce Demographics and Forecasted Labour Demands

The mineral exploration workforce is experiencing unprecedented growth, and this growth is largely correlated with the increases in commodity prices. In 2009, the mineral exploration employment workforce was estimated to include 25,109 people (MiHR, 2011a, p. 19).

Age

Similar to many industries in Canada, exploration is experiencing shifting demographics as a result of an aging workforce.

Figure 2 Age Profile of Exploration Workforce (share of labour force, percent)



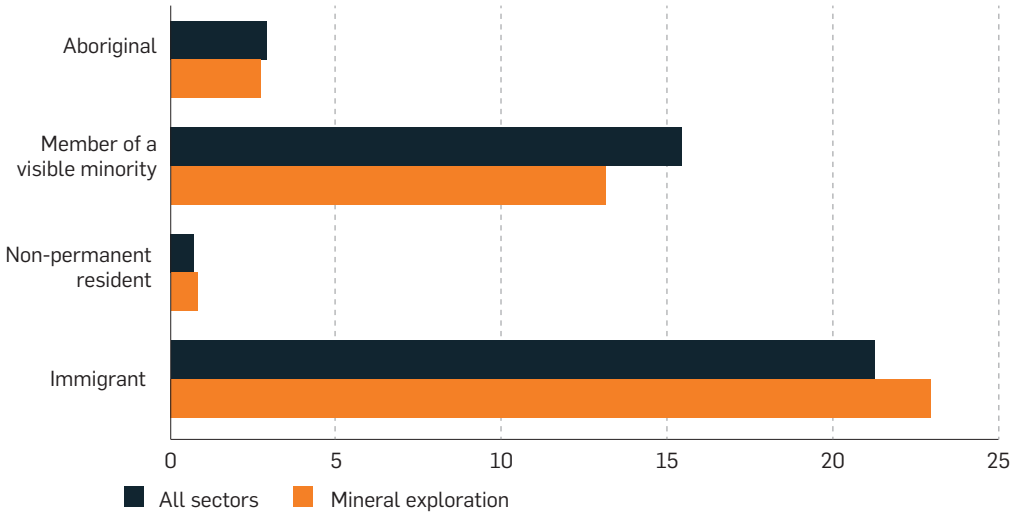
Source: *Unearthing Possibilities*, MiHR 2011

Despite a large and growing population of workers under the age of 35, the sector's older demographic, particularly the workforce over the age of 55, has increased. With reference to careers that require a Bachelor's degree or higher in the geosciences, over 22 percent of geologists in the industry are over the age of 55. Of particular concern is the lack of workers in the middle career age ranges, 35-44, indicating challenges with mid-career attrition (MiHR, 2011a, p. 24). This lack of workers in mid-career roles presents challenges with regards to knowledge transition from senior workers to younger workers, as traditional career development steps may be accelerated for younger workers. This highlights the importance of ensuring that new graduates have the field experience and classroom knowledge to succeed through this acceleration.

Diversity

The challenges of an aging workforce are compounded within the mineral exploration industry because of a lack of diversity within the workforce. This is especially true for women, as geoscience graduates are increasingly equally represented by both male and female graduates. However, women only account for about 20 percent of the workforce in exploration, as compared to 47 percent of the entire labour force. Similarly, visible minorities and Aboriginal people are underrepresented within mineral exploration with a participation rate of 13 percent (as compared to 15 percent of the national labour force) and 2.7 percent (as compared to 2.9 percent of the national labour force).

Figure 3 Minority Groups in Exploration (share of labour force, percent)



Source: *Unearthing Possibilities*, MiHR 2011

Knowledge Workers

Knowledge workers are an important and valuable segment of the mineral exploration workforce and the focus of this research study. For the purpose of this study, knowledge workers are defined as workers who have obtained a Bachelor's degree or higher. Knowledge workers within the geosciences often hold critical roles; senior technical positions; leadership and management positions; lead research and development; provide education to the future workforce; and ensure the industry's long-term competitiveness (MiHR, 2011b). Knowledge workers are a highly mobile segment of the workforce and are presented with a wide range of career opportunities. Attrition of knowledge workers can be both costly to organizations as these workers are often significant sources of organizational knowledge, and they can be challenging to replace. With the aging demographics of geoscience professionals, and an increase in demand for knowledge workers throughout all sectors, it will be more difficult to recruit and retain geoscience graduates into the future.

Forecasted Labour Demands

MiHR produces forecasts of hiring requirements annually for the mining and exploration sector. Assuming a baseline scenario, the sector will require 145,870 new workers by 2023.[4] Despite a decrease in employment of nearly 2,000 workers in exploration, the cumulative hiring requirement remains considerable due to an aging workforce, pending retirements and other workforce separations including long term leaves and movement to other sectors. These factors have resulted in a cumulative hiring requirement of 21,690 exploration workers by 2023.

4 Canadian Mining Industry Employment and Hiring Forecasts 2013, MiHR, 2013

Figure 4 **Cumulative Hiring Requirements Forecasts by Industry Sector, Baseline Scenario 2013 to 2023**

	Employment in 2013	Net Change in Employment	Replacement Requirements		Cumulative Hiring Requirements
			Retirement	Non-Retirement	
Exploration	51,395	-1,935	13,075	10,550	21,690
Mining and Quarrying (except oil and gas)	70,690	10,425	20,965	16,860	48,255
Mineral Processing	72,080	17,136	22,555	18,120	57,810
Support Activities for Mining	40,650	-1,040	10,595	8,545	18,100

Source: Mining Industry Human Resources Council, 2013

The Challenges

Unearthing Possibilities highlighted some key HR issues surrounding career awareness and attraction, recruitment and retention. This research study builds on the findings developed in the *Unearthing Possibilities* report, and seeks to provide a deeper understanding on the following items, particularly as they relate to graduates of geoscience university programs.

HR Challenges facing the Exploration Sector[5]

Career Awareness and Attraction
- Underrepresentation of women, Aboriginal peoples, immigrants, and youth
- The coordination of industry and educational institutions

Recruitment
- The thinning labour pool of geoscientists
- Candidates lacking critical field experience

Retention
- Seasonal nature of work in a wildly cyclical industry, along with the short lifespan of companies, maps and projects, leading to a high seasonal turnover of workers
- The fact that remote locations and field work are deterrents for some under-represented groups (e.g. women, immigrants) and for professionals in mid and later stages of their careers
- Mid-career attrition – preponderance of professionals leaving the sector in mid-career

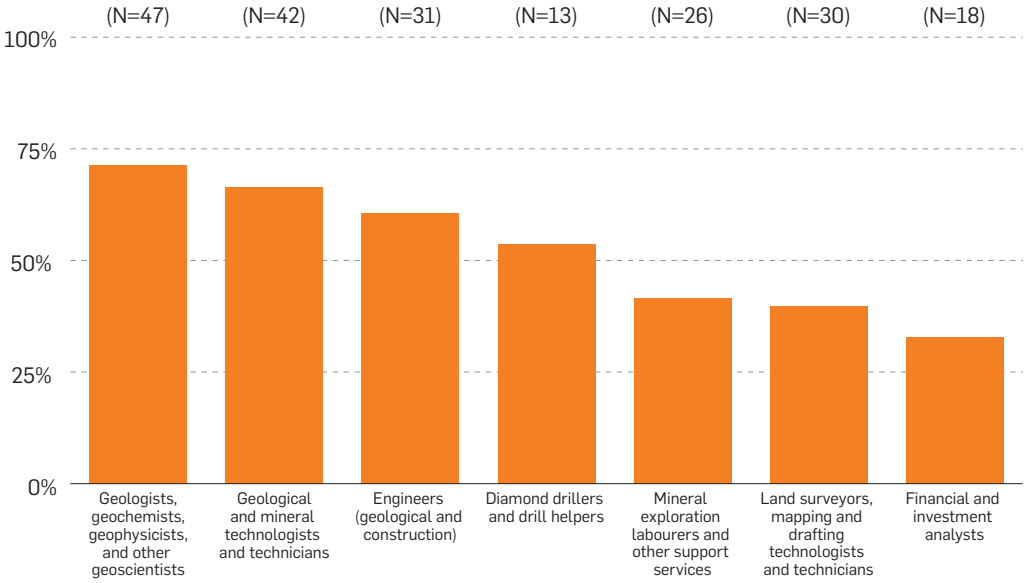
5 Summarized from *Unearthing Possibilities* report available at http://www.pdac.ca/pdac/misc/pdf/110929-mihr-full-report.pdf

Research Objectives and Methodology

Research Objectives and Methodology

The objective of this research study was to investigate the impacts of field experience on the flow, recruitment and retention of talent from education in geosciences to the mineral exploration industry. From the *Unearthing Possibilities* study, employers articulated that the most challenging positions to fill within the exploration sector are geoscience positions, and for all positions that require field work a lack of field experience persists as the number one challenge in filling those vacancies.

Figure 5 Recruiting Challenges by Occupation



Source: *Unearthing Possibilities*, MiHR 2011

Research Questions

This research sought to answer the following research questions;

- What is the impact of field school experience on career decision process?
- What are the typical career progressions for geoscience grads?
- What are the key influencing points during career progression (recruitment/retention)?
- How does the field work component of geoscience careers affect women and other underrepresented groups?

Research Scope

The targeted research sample for this project was individuals who had completed a minimum of a Bachelor's degree in the geosciences within the last 10 years. These specifications were indicated in the survey communication provided to the universities and associations who assisted in the dissemination of the research survey.

Methodology

This study included both secondary and primary research. Secondary research activities included an analysis and review of relevant labour market data and career development literature. Primary research activities consisted of the development and management of a career pathway and field experience survey of Canadian geoscience alumni.

This survey provided respondents the opportunity to provide information on their career to date. Determining the career development pathways of geoscience graduates and the interaction of field experience on their career development was investigated. To determine the career pathways of the geoscience graduates, each respondent to the survey was taken through a series of questions outlined in Appendix A. The respondents were taken through the same series of questions, which provided information on defined career variables for each career position[6] they had held. The end result was a standardized career description for each of the respondents. This survey was based on the career pathway model utilized in Hughes' 2012 study.

Primary Research – Survey

The survey was distributed by geoscience alumni departments at Canadian universities, and professional geoscience designation associations. An online survey was developed in English and distributed through email of the associations and departments contact lists.

The following organizations assisted in the dissemination of the survey link;

- University of British Columbia
- Association of Professional Engineers and Geoscientists British Columbia (APEGBC)
- Association of Mineral Exploration British Columbia (AMEBC)
- Association of Professional Engineers and Geoscientists Alberta (APEGA)
- Association of Professional Engineers and Geoscientists Saskatchewan (APEGS)
- Association of Professional Geoscientists Ontario (APGO)
- Memorial University of Newfoundland
- Laurentian University

In support of these activities both MiHR and PDAC promoted the survey through social media platforms including Twitter, Facebook, and LinkedIn.

6 Career Positions was defined as any career-related work experience lasting at least six months.

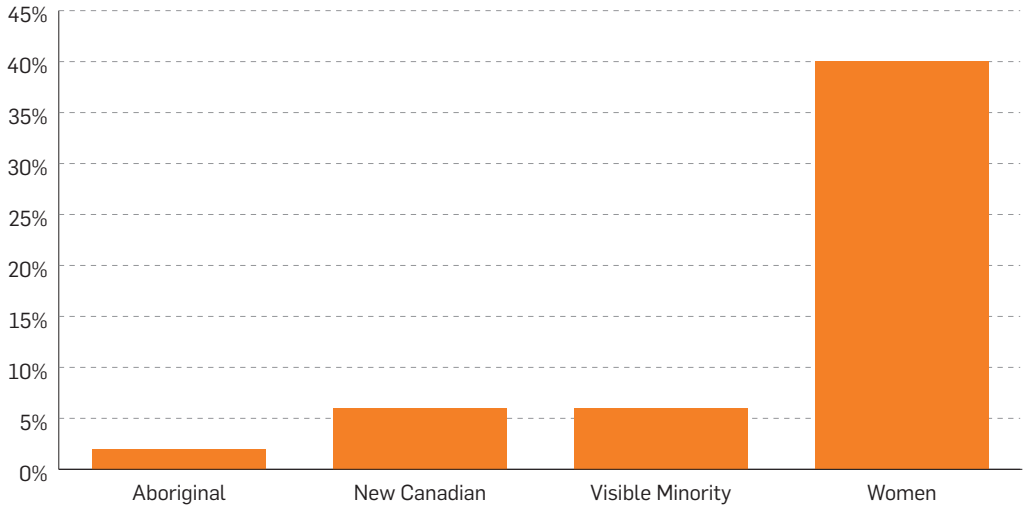
Research Results and Analysis

Research Results and Analysis

Diverse Demographics of Respondents

The survey was available through an online platform that was open to respondents from November 2012 to January of 2013. In total, 291 responses were received. Of the respondents who provided information on their gender (231), 60 percent of the respondents were male and 40 percent female. As shown in Figure 6, just over 5 percent of respondents indicated they were immigrants or visible minorities, and less than 5 percent of the respondents self-identified as Aboriginal.

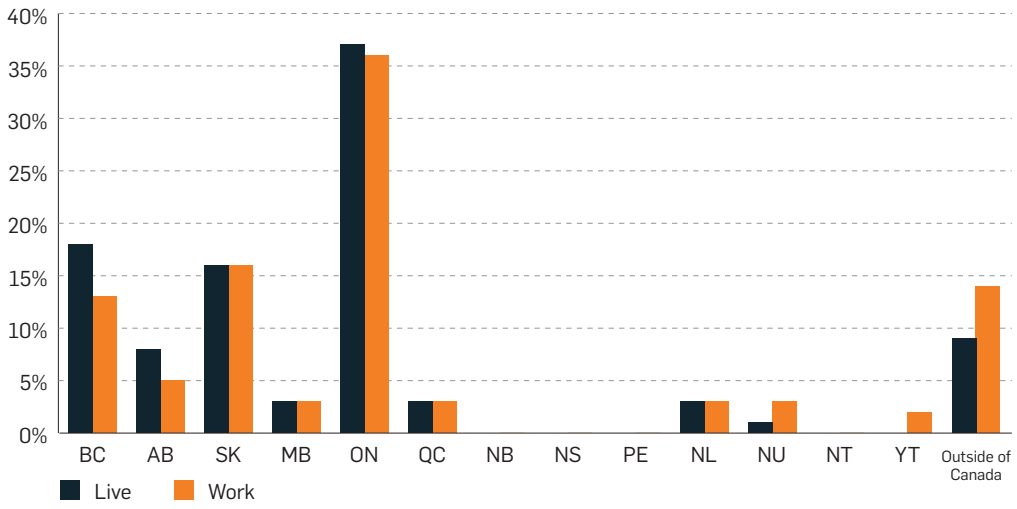
Figure 6 Respondent Demographics



Source: Geoscience Alumni Survey, MiHR 2013

Figure 7 outlines the work and live locations of the respondents. As indicated, the highest percentage of respondents worked and lived in Ontario, British Columbia, Saskatchewan, and in various locations outside of Canada. Not surprisingly, based on the constraints of the survey (graduates within the last 10 years) the majority of respondents were between the ages of 25-34.

Figure 7 Live and Work Locations of Respondents

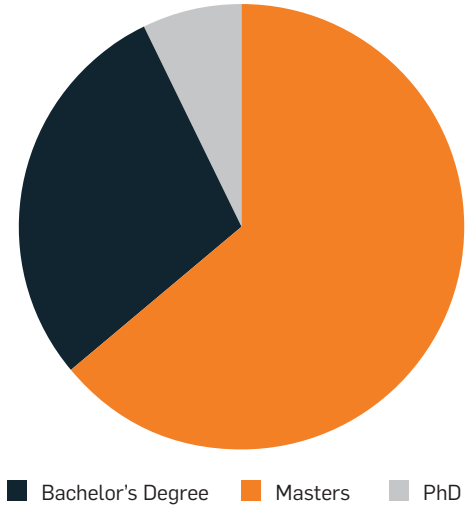


Source: Geoscience Alumni Survey, MiHR 2013

Education Profile of Respondents

Of the respondents who indicated their highest educational attainment, 60 percent of the respondents had completed a Bachelor's degree, while 30 percent had completed a Masters. Less than 10 percent had completed a PhD as indicated by Figure 8. The most common area of study was earth sciences or geology, which was the field of study for 68 percent of the respondents, followed by geophysics 10 percent, and geological engineering 7 percent. The respondents had completed their post-secondary education across the country, but the largest numbers of respondents (39 percent) were graduates of Ontario universities.

Figure 8 Post-Secondary Education Profile of Respondents



Source: Geoscience Alumni Survey, MiHR 2013

Awareness of Careers in the Geosciences

Respondents indicated that their awareness of careers in geoscience occurred at a variety of different points during their education. Most of the respondents indicated initial career awareness about careers in the geoscience occurring in post-secondary school, and less than 10 percent of the graduates indicating any awareness of careers in geoscience during elementary school.

When asked how geoscience graduates first learned about careers in exploration, the response was predominately from a professor or teacher, or family and friends. Less than 3 percent of the graduates had first learned of careers in exploration through an industry presentation during their high school education.

Career Pathways of Respondents

The survey respondents were given the opportunity to provide information on up to eight career positions. The number of career positions varied for each respondent based on: the respondents' age; the amount of career mobility exhibited and whether they opted out of the sector for a period of time.

Current Employment

Just over half of the respondents (58 percent) indicated they were currently working in the mineral exploration sector. Sixty-nine per cent of the respondents had worked in exploration for at least one career position.

Career Path Analysis

The following career model was utilized to determine the career pathways of the respondents from the completion of their geoscience degree to date. For each career position, respondents were asked to provide information on specific career variables including;

> **Type of Organization** (*Junior Exploration Company, Junior Mining, Major Mining, Government, Industry Association, Educational Institution, Support Services Firm for Mineral Exploration*)
> **Work Environment** (*Field Work, Corporate Office, Mine Operations, Personal Office Space/Worked From Home*)
> **Position Level** (*Clerical and Support, Labour, Skilled Trades and Technical, Professional Administration – Legal, HR, Finance etc., Professional – Technical and/or Scientific, Middle and Line Management/Supervisor, Executive Director/Senior Management, President, CEO*)

As indicated in Figure 9, geoscience alumni's first career positions were predominately in the field working for a junior exploration company in a professional technical or scientific role (junior geologist, project geologist, etc.). Reasons for leaving their first career position varied, although close to a third of the respondents were currently still working in their first career position.

Figure 9 Career Path of Geoscience Alumni

Source: Geoscience Alumni Survey, MiHR 2013

Figure 9 highlights the most common career pathway as indicated by the survey respondents. As specified the most common career experience included predominately field work in the first two career positions, followed by a corporate position. Respondents tended to work within a professional technical and/or scientific role for their first three career positions, with little indication of movement into management or senior leadership roles within these career positions.

Comparison of Male and Female Geoscience Career Pathways

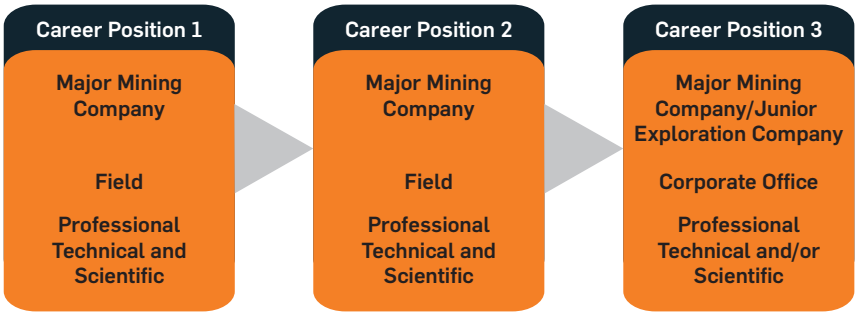
Figure 10 and Figure 11 show the breakdown of the career pathways for female and male geoscientist respondents, respectively.

Figure 10 Geoscience Career Path – Female Respondents

Source: Geoscience Alumni Survey, MiHR 2013

As illustrated in Figure 10, female geoscientists tended to work for junior exploration companies, and predominately worked in the field for their first two positions. In the third position respondents most commonly indicated that their work took place in the field, and a corporate office.

Figure 11 Geoscience Career Path – Male Respondents



As indicated in Figure 11, male respondents tended to work for major mining firms and moved from field work into corporate work as they entered their third career position. Similarly to the female respondents, male geoscience grads tended to remain within professional scientific and/or technical roles through their first three career positions. If we compare both male and female respondents career paths, we can see that both groups of respondents indicated that when they completed their geoscience education, their first three career positions were characterized as professional scientific and/or technical roles, indicating that geoscience graduates early career development involves the application of their educational attainment. There was not a prevalence of graduates moving into management or leadership roles in their first three career positions, indicating career pathways that at least in the early stages tend towards technical specialization instead of leadership.

In their first career position, male respondents indicated a tendency to work for mining organizations whereas female respondents indicated a tendency to work for junior exploration companies.

Previous research has indicated high rates of mid-career attrition for women in the geosciences. This study has found that the career path tendencies for women and men geologists differ with regards to the size of organizations. Women geoscientists tended to work for smaller organizations, while men tended to work for larger mining organizations. With smaller workforces, junior companies may rely heavier on staff to conduct field work resulting in less flexibility than is possible in larger organizations.

Where have all the Geoscientists Gone?

Forty-two per cent of the total respondents indicated that they were not currently working in exploration. Of the respondents who indicated they were not currently working in exploration, 23 percent were currently working in the mining sector and 32 percent were working in a sector other than the mining and exploration; 7 percent were currently pursuing further education in the exploration and mining sector; and 13 percent were looking for work within the exploration sector. Of note, 7 percent of respondents indicated they were currently working or pursuing employment in the oil sands.[7]

The reasons for career movement from leaving each career position were asked of the respondents after they indicated a career position ended. Of the respondents who were no longer working in their first career position, the most common reason for employment in their first career position to come to an end was the receiving of an internal opportunity within their organization. Secondly, some respondents left their first employment to pursue further education, or to take on an external job opportunity outside of their current employer.

Mid-Career Attrition

In recent years, there have been increasing amounts of research on the mid-career attrition of highly qualified women. In the science, engineering and technology fields the retention of women is more of a pressing issue as it has been found that over 50 percent of women in these fields leave their field of work (Hewlett, Luce, & Servon, 2008). Working in the field and in remote locations was seen as a deterrent for women in the geosciences to stay within the industry (MiHR, 2011a). This mid-career exodus is in contrast to what we are seeing in the education system; women are making great strides in the geoscience classroom in Canada, but they still only represent 20 percent of the exploration sectors employees. (MiHR, 2011a).

With reference to this research, 46 percent of women respondents were currently not working in the exploration sector. Women respondents left the exploration sector for a variety of reasons as illustrated in Figure 12.

7 Note the remaining respondents indicated 'other' employment status and/or temporary personal leaves of absence.

Figure 12 **Reasons for ending employment – Women**

Why did your employment come to an end?	It didn't this is my current role	Resignation	Termination	Completion of dontract	Received an internal opportunity	Received an external opportunity	Went back to school	Site closure
Career Position 1 (n=60)	19	7	1	7	10	8	8	0
Career Position 2 (n=38)	14	7	2	5	1	3	6	0
Career Position 3 (n=17)	10	2	0	1	1	2	0	1

Source: Geoscience Alumni Survey, MiHR 2013

The time frame which is represented by this career-path model is a crucial point within career development. Previous research has indicated that women were more likely to leave their current position for external opportunities during their first three career positions (Hughes, 2012). Similarly in this study, the female respondents indicated that as their career paths developed they were more likely to leave their current employer for external opportunities, resignations, and further education – indicating challenges with regard to retaining workers within their initial hiring organization.

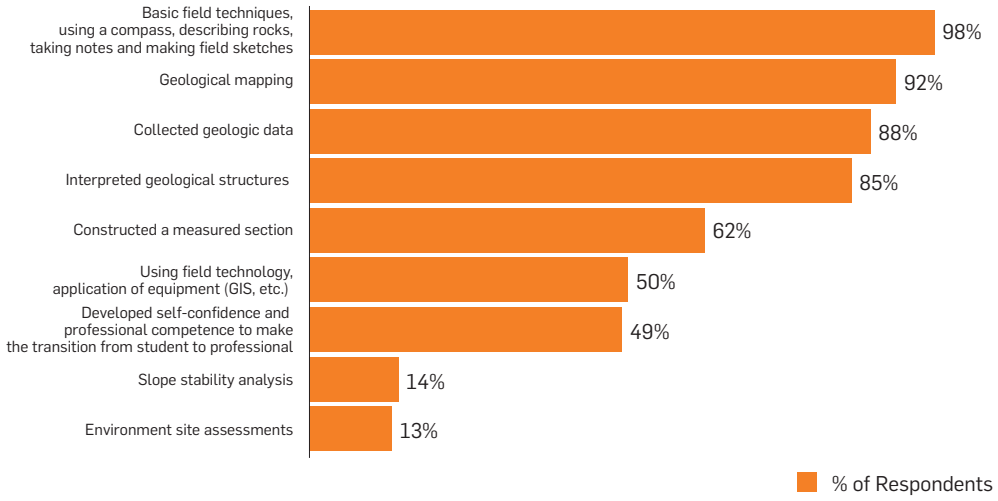
Influence of Field Experience on Career Paths

Influence of Field Experience on Career Paths

When asked if they had completed a field school as part of their post-secondary geoscience education, 94 percent of respondents indicated that they had. In addition, the survey respondents were asked to identify from a list of learning outcomes the skills and experience they obtained through their field school experience. Figure 13 illustrates the skills and experience obtained as indicated by the respondents. Basic field techniques and geological mapping were skills and experience that were gained by all respondents, while environmental site assessment and slope stability analysis were skill sets gained through field school for less than 15 percent of the respondents. Only half of the respondents who completed a field school indicated they had exposure to field technology through application of equipment (GIS, etc.). Less than half of the respondents indicated that field school provided them with the self-confidence and professional competence to transition from student to professional.

As indicated in the *Unearthing Possibilities* study, geoscience graduates are increasingly being stretched with regards to competence in communication, community liaison, and environmental regulations and expectations, although less than 13 percent indicated they received training on environmental assessment during their field school.

Figure 13 Learning Outcomes from Field School



Source: Geoscience Alumni Survey, MiHR 2013

The respondents were provided with an option to indicate other skills and experience obtained and two respondents indicated that they also learned three-dimensional visualization through their field school experience.

Respondents were also asked to indicate the impact of field experience on their ability and interest in entering a career in the geosciences.

Figure 14 Field School as a Career Influencer [8]

Statement	Strongly Agree	Agree	Some-what Agree	Neither Agree or Disagree	Some-what Disagree	Disagree	Strongly Disagree
My field school experience was a significant factor in my decision to pursue a career in the geosciences.	23%	22%	15%	23%	5%	9%	3%
My field school experience was a significant factor in my ability to secure employment in the geosciences.	12%	20%	23%	23%	7%	12%	3%
My field school experience deterred me from a career in the geosciences.	1%	1%	3%	9%	8%	26%	52%

Source: Geoscience Alumni Survey, MiHR 2013

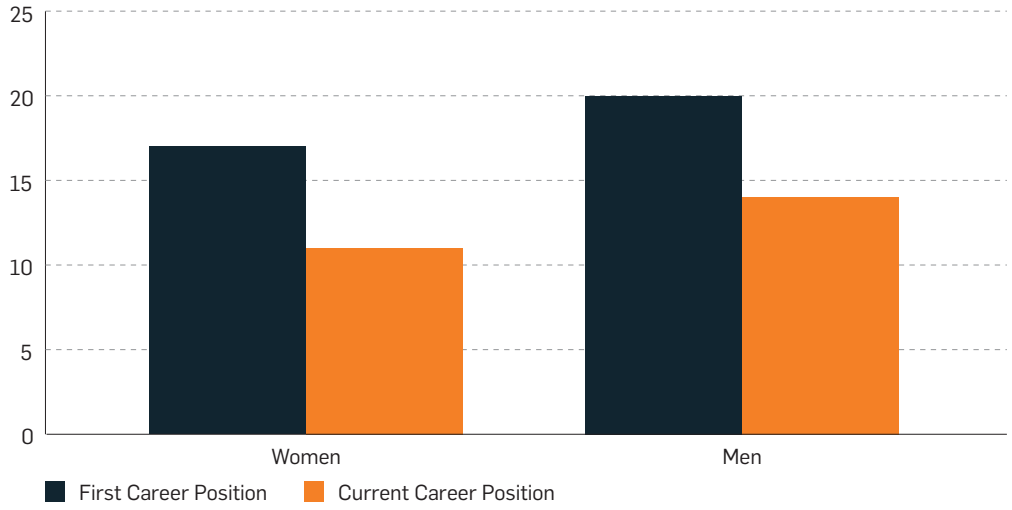
As shown in Figure 14, a strong majority of the respondents indicated that their field experience was a significant factor in their decision to pursue a career in the geosciences, signifying the importance of current field schools for attracting graduates to careers in the sector. In conjunction with this finding, only 5 percent of respondents found that their field school experience deterred them from pursuing a career in the geosciences.

Respondents also indicated that their field school experience was a significant factor in their ability to secure employment in the geosciences, which supports previous findings on the importance of field experience from an employer's perspective.

Time in the field over career path

As indicated in Figure 15, time in the field was shown to diminish over the course of the career progressions for the respondents.

Figure 15 Weeks in the Field, First Career Position and Current Career Position



Source: Geoscience Alumni Survey, MiHR 2013

8 Percentages have been rounded to whole numbers

When asked how many weeks in the field geoscience alumni spent in their first position, the cumulative average was 19 weeks. Conversely in their current or most recent position, the respondents indicated 13 weeks in the field.

For the female respondents the average number of weeks in the field in their first career position was 17, and in their current or most recent position the average number of weeks was 11. For male respondents the average number of weeks in the field was 20 weeks in their first career position and 14 weeks in their current or most recent employment.

Career Trajectory's and Field School

With 94 percent of the respondents having completed a field school component during their geoscience education, the sample of graduates who did not complete a field school was limited. However, a comparison of the career trajectories of these two distinct graduate groups infers some key differences in the career experiences of individuals with or without field school experience.

Of the graduates who did not complete a field school (N=15), four of them were not currently working in exploration and six of the graduates had never had a career position in exploration. The most common education field for these respondents was a Bachelor's degree in geophysics.

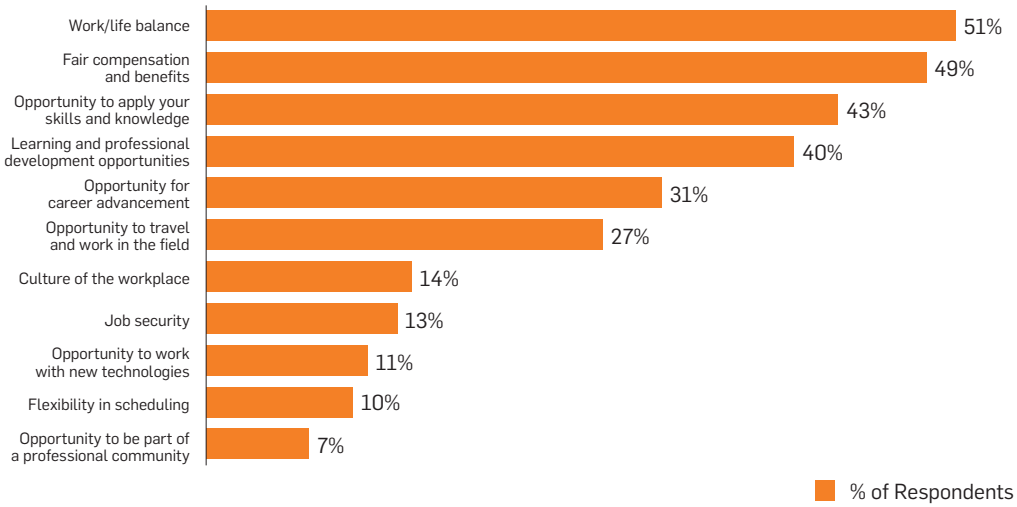
By comparison, the respondents who had completed field school predominately completed a Bachelor's degree in earth science, and the large majority had been employed in at least one exploration career position.

Retention

What do geoscience graduates value in their career? As voiced by respondents, geoscience graduates want to work for employers with "High Safety, Health and Environment Standards." They want "opportunities to practice interesting science" and they value the "adventure and interesting science" a career in the geosciences provides.

From a list of career attributes, the respondents were asked to identify the top three items that they value most in a job. As illustrated in Figure 14, work-life balance was identified as the most valued career attribute of geoscience alumni, followed closely by fair compensation and benefits, and the opportunity to apply skills and knowledge.

Figure 16 Career Attributes valued by Geoscience Alumni



Source: Geoscience Alumni Survey, MiHR 2013

By comparison, female respondents ranked the most important attributes as work-life balance, learning and professional development opportunities, followed by opportunities to apply skills and knowledge.

Field Experience – Women

Female survey respondents were asked a series of qualitative questions to determine their perspective on gendered barriers to employment that were imposed by field work in geoscience careers.

The following challenges were articulated by the female respondents;

- The existence of pay discrepancies
- Lack of flexible work practices
- Limited opportunity for advancement or promotion for women
- Prevalence of problematic workplace culture, discrimination, masculine networks
- Health and field work challenges, and the need for work-life balance

Exploration employers can utilize technology to increase the flexibility offered within their workforce. As one respondent suggests:

> *"Better benefits and a way to evolve your career if/when you want to have a family. An example would be to take an exploration geologist and give them an opportunity to work with GIS and databases so they can work from home more but still benefit the company."*

This acknowledges that the challenges indicated by women are not static and that the barriers to retention often evolve over the course of one's career. As articulated by one respondent,

> *"Under a certain age it's easy enough to be a woman in exploration. But once a woman decides to have a family it can become quite a different situation. There is an 'old school' mentality that having children makes one less capable and dependable from an employer's point of view. Hiring women is easy enough; retaining women over 35 [is] not always. It's important to have a good maternity leave policy and also for management to be understanding to how a changing family [situation] requires a dynamic work environment. I was provided with options when I became pregnant and it went a very long way towards my decision to stay with my current employer."*

Respondents to the survey highlighted a number of retention challenges that were a direct result of problematic "camp work culture." A startling number of women indicated the prevalence of gender based discrimination, including personal accounts of harassment, bullying, difficulty in building working relationships with contractors, and limited opportunities in the field as a result of gender. Evidence of gender discrimination and problematic workplace culture is increasing; recent national studies have identified workplace culture within the mining and exploration industry as a significant barrier for women's advancement and retention (Hughes, 2012; Women in Mining Canada, 2010). This highlights the need for industry to take concrete action to ensure inclusive workplaces in all facets of business, from corporate environments to field camps.

HR Challenges and Opportunities Findings

HR Challenges and Opportunities Findings

Ensuring employee engagement is challenging for any organization. In the exploration industry, the remote nature of the work, the prevalence of small sized employers with limited human resources support, makes the job even more difficult. It is therefore paramount that collaboratively the industry develops strategies and actions to ensure geoscience graduates are supported in their career development and remain engaged with the industry.

The following table articulates the key career roadblocks in ensuring geoscience engagement throughout the employee lifecycle, and some of the potential areas of strategic focus to address these challenges.

Figure 17 **Geoscience Employment Cycle – Career Barriers and Strategies**

Source: Geoscience Alumni Survey, MiHR 2013

As indicated by the respondents, career awareness of the geosciences is generally occurring during post-secondary school, and there exists further opportunity for increasing career outreach activities through industry presentations during secondary and elementary school to increase the attraction and demystify the sector.

Field experience is a significant factor in the preparation of geoscience graduates for employment within the exploration sector. The unique nature of the field work environment and the reliance on geoscience graduates to not only work in the field at the beginning of their career, but to engage with field work throughout their career progression makes it an important aspect of career expectations and engagement. Graduates of geoscience programs need to be prepared for the realities of field work, and at the same time organizations need to review the current field work environments to ensure that they are inclusive and do not deter worker engagement.

Industry and Educational Partnerships

The results of this research have indicated that the majority of post-secondary geoscience students are completing field school during their education. With reference to the *Unearthing Possibilities* study, there exists a gap between the experience gained in field school and the needs employers have for workers with field experience. Field school is not a substitute for field work but the gap in experience can be bridged by further intensification of the field school experience, to ensure the learning outcomes are more in line with employer requirements.

One of the greatest sources of information with regards to the effectiveness of recruitment and retention strategies are geoscience alumni groups. Despite the importance of alumni in this research area, there is often a lack of resources applied to systematic follow-up with alumni (Raeside & Kosters, 2012).

PDAC's Student-Industry Mineral Exploration Workshop (S-IMEW)
In 2013, twenty-six senior geosciences students from across Canada converged on the Greater Sudbury area for PDAC's annual Student-Industry Mineral Exploration Workshop (S-IMEW). The two-week, all expenses-paid gathering will give the students, hand-picked from post-secondary institutions across the country, an opportunity to experience the many facets of the mineral exploration industry. In addition, students will meet and receive instruction from industry experts, expanding their networks and developing career opportunities.

Ultimately, this gap illustrates a need for further collaboration between industry and education to ensure that students leave their post-secondary education with field school experience that is transferable and applicable in today's field work environments. The model for industry and education collaboration can be varied and include traditional field school, co-op experience, scholarships and bursaries,[9] research investment and other partnerships.

With the pending skills shortage and the reliance of younger professionals to take on increasing responsibility within the field environment, increasing the intensity or breadth of field programs may be necessary to ensure that the graduates have the appropriates skills and experience needed to hit the ground running. In addition, as the mineral exploration industry is largely comprised of small and medium sized employers (MiHR, 2011a, p. 23), the model for industry and education partnerships may need to be revised to support participation by smaller organizations.

9 PDAC compiled list of bursaries and scholarships: http://www.pdac.ca/pdf-viewer?doc=/docs/default-source/students-docs/student-scholarships.pdf

Recommendations and Next Steps

Recommendations and Next Steps

In summary, the exploration industry should consider the following recommendation areas for action in the development of strategies for attraction and retention of geoscience graduates;

Enhance Current Field Training Programs. Field training programs can be enhanced through the inclusion of environmental assessment, cultural sensitivity, and communication training elements. In addition, students need further exposure to the realities of field work to ease the transition from student to professional. Students need access to current and future workplace technologies and the development of this programming should be continuously evaluated and further developed with the support of industry to remove any programming gaps. In addition, as the exploration industry begins to rely more heavily on more junior workers to take on roles of responsibility, the role of field schools to ensure graduates are ready for this work will likely increase. Additionally, further evaluation of the role of field schools as a training format to support professional development or assistance for transitioning workers may be explored. For example, as a worker may be returning to work after years of absence the field school model may play a role in providing skills training and/or upgrading to a returning geoscientist.

Strengthen Industry and Education Collaboration. In previous research, perceptions exist among employers that graduates are lacking familiarity and field knowledge to sufficiently perform in their occupation. In contrast, respondents to this survey indicated a strong reverence for the education and skills obtained through their field school, thus indicating a disconnect between the needs of the industry and the experience of students. To address this, existing partnerships between industry and education need to be strengthened, and new partnerships should be explored. Through these partnerships continuous evaluation of field schools will ensure that field school learning outcomes are relevant to the current geoscience working environment. Due to the increasing scarcity of skilled geoscientists, the demand for more junior workers to assume greater responsibility will continue. This highlights the importance for greater industry and education collaboration in the delivery of field school to ensure that recent graduates have robust skills and knowledge set to apply to field work upon graduation.

Address Problematic Field Work Culture. A significant number of female respondents articulated discrimination and harassment as a substantial problem within field camps. There needs to be both industry and organizational efforts in reducing sources of discrimination, and ensuring that field camps are not a place where discrimination and harassment are tolerated simply because of their distance from corporate environments.

- **Address Mid-career Attrition.** Remote work, lack of flexibility, and coping with employment that is highly sensitive to market volatility has resulted in high levels of mid and early career attrition in the geosciences. The cost to industry of losing this talent stream is simply too high, and mitigation strategies should be set in place to ensure that attrition is reduced and opportunities to return to the industry are available to those who have left. During a geoscientist's career path, it is likely that they will be presented with a time during their career that field work presents a significant barrier. This may be a result of increased family responsibilities, personal health issues, or other circumstances. When this happens, industry can work collaboratively to ensure that those that take a break from their career or field work are given the opportunity to remain engaged with and ultimately return to the industry. To reduce midcareer attrition, further evaluation of more inclusive and flexible working practices in both corporate and field work environments is needed.

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Appendix A

Effects of Field Experience on Recruitment and Retention of Geoscientists in Canadian Mineral Exploration

The Prospectors & Developers Association of Canada (PDAC) has partnered with the Mining Industry Human Resources Council (MiHR) to undertake a study on the impacts of field experience on the flow, recruitment and retention of talent from education in geosciences to the mineral exploration industry. This research builds on the recommendations from the 2011 national sector study *Unearthing Possibilities* which was conducted in partnership between MiHR and PDAC.

The purpose of this study is to better understand geoscience graduates career choices, what influences graduates career decisions, and to stimulate a proactive approach to addressing the retention challenges facing the exploration sector. As part of the research process we are seeking information from alumni of geoscience university programs from across Canada.

This project has been reviewed and approved according to MiHR's Research Ethics protocol. If you wish for more information on this or other research at MiHR please contact the research team at **research@mihr.ca** or 613-270-9696.

This survey will take approximately 20 minutes to complete.

This survey is intended for geoscience graduates who have completed their education within the last 10 years (Graduation 2002).

Educational Profile

1. What is the highest level of education you have completed in the **geosciences**?
   - ❑ Trade Certificate or Diploma
   - ❑ College Certificate or Diploma
   - ❑ University Certificate or Diploma below Bachelors Level
   - ❑ Bachelor's Degree
   - ❑ Master's Degree
   - ❑ Doctorate Degree
   - ❑ I did not complete post-secondary education in the geosciences.
   - ❑ Prefer not to answer

2. What was your major or field of study?
   - ❑ Geological engineering
   - ❑ Earth Sciences
   - ❑ Geology
   - ❑ Geophysics
   - ❑ Geochemistry
   - ❑ Natural Sciences
   - ❑ Other _____

3. Where did you complete this degree/diploma?
   - ❑ British Columbia
   - ❑ Alberta
   - ❑ Saskatchewan
   - ❑ Manitoba
   - ❑ Ontario
   - ❑ Quebec
   - ❑ New Brunswick
   - ❑ Nova Scotia
   - ❑ Prince Edward Island

4. Did you complete a field school as part of your education?
   - ❑ Yes
   - ❑ No

5. What skills and knowledge were obtained through your field school experience? Select all that apply.
   - ❑ Basic field techniques, using a compass, describing rocks, taking notes and
   - ❑ making field sketches
   - ❑ Slope stability analysis
   - ❑ Environmental site assessments
   - ❑ Collected geologic data
   - ❑ Constructed a measured section
   - ❑ Interpreted geological structures
   - ❑ Geological mapping
   - ❑ Using field technology, application of equipment (GIS, etc.)
   - ❑ Developed self-confidence and professional competence to make the transition
   - ❑ from student to professional
   - ❑ Other _____

6. Please indicate your level of agreeance with the following statements (Strongly Agree, Agree, Somewhat Agree, Neither Agree or Disagree, Somewhat Disagree, Disagree, Strongly Disagree)
   - ❑ My field school experience was a significant factor in my decision to pursue a career in the geosciences.
   - ❑ My field school experience was a significant factor in my ability to secure employment in the geoscience.
   - ❑ My field school experience deterred me from a career in the geosciences.

7. When did you first learn about careers in exploration?
   - ❑ In elementary school (Kindergarten – Grade 7)
   - ❑ In secondary school (Grade 8-13)
   - ❑ In post-secondary school (college or university)
   - ❑ After graduation

8. How did you first learn about careers in exploration?
   - ❑ Media coverage
   - ❑ TV programs
   - ❑ Teacher or professor
   - ❑ Presentation at high school
   - ❑ Presentation at university
   - ❑ Conversation at career fair
   - ❑ Conversation at mining-specific career fair
   - ❑ Family/friends/word of mouth
   - ❑ Other (please specify): _____

9. Are you currently working in mineral exploration?
   - ❑ Yes
   - ❑ No

10. Please indicate which statement best describes your current work situation.
    - ❑ I am currently working in the mining sector
    - ❑ I am currently working in a sector other than exploration and mining
    - ❑ I am looking for work in the exploration sector
    - ❑ I am looking for work in sectors other than exploration and mining
    - ❑ I am not working and not actively looking for work
    - ❑ I am pursuing further education in the exploration and mining sector

11. Please indicate which sector you are currently working in.
    - ❑ Manufacturing
    - ❑ Forestry
    - ❑ Oil and Gas
    - ❑ Retail
    - ❑ Public Service
    - ❑ Finance/Legal
    - ❑ Business or Professional Consulting
    - ❑ Health
    - ❑ Transportation
    - ❑ IT/Communications
    - ❑ Other _____

12. Why did you choose a career in this sector?

13. Would you consider future opportunities in exploration? Why or why not?

Career Profile

The following section will ask you a series of questions to better understand your career path after you completed your **first** geoscience diploma or degree. Selecting from the drop-down menu please describe your first career position.

Career position is defined as employment in a career oriented job that lasts at least six months.

After you finish the questions that describe your first career position you will be asked if this is your most recent career position. If it is, you will move on to the next section of the survey, and if it is not, you will go through the same questions for each subsequent career position (with a maximum of eight positions). This will build a chronological resume of your work after you completed your first geoscience diploma or degree.

14. In your **first** career position what was your job title?

15. In your **first** career position, what industry did you work in?
    - ❑ Mining
    - ❑ Exploration
    - ❑ Other _____

16. In your **first** career position, what type of organization did you work for?
    - ❑ Junior Exploration Company
    - ❑ Junior Mining (company with less than 1000 employees)
    - ❑ Junior Exploration Company
    - ❑ Junior Mining (Company with less than 1000 employees)
    - ❑ Major Mining (Company with more than 1000 employees)
    - ❑ Government
    - ❑ Industry Association
    - ❑ Educational Institution
    - ❑ Support services firm for mineral exploration
    - ❑ Other _____

17. In your **first** career position, where did you work? (Select all that apply).
    - ❑ In the field
    - ❑ In a corporate office
    - ❑ Mine operations
    - ❑ Personal office space/worked from home

18. In your **first** career position, what type of job did you have? (choose what you consider to be the most appropriate category).
    - ❑ Clerical and Support
    - ❑ Labour
    - ❑ Skilled Trades and Technical (ex. GIS Technician)
    - ❑ Professional Administration – Legal, HR, Finance, etc.
    - ❑ Professional – Technical and Scientific
    - ❑ Middle and Line Management/Supervisor
    - ❑ Executive Director/Senior Management
    - ❑ President, CEO

19. Why did your employment in your **first** career position come to an end?
    - ❑ It didn't. This is my current career position.
    - ❑ Resignation
    - ❑ Termination
    - ❑ Completion of Contract
    - ❑ Received an internal opportunity
    - ❑ Received an external opportunity
    - ❑ Retirement
    - ❑ Went back to school
    - ❑ Site closure
    - ❑ Other _____

20. You have finished answering the questions that described your **first** career position. Is this your most recent or current career position?
    - ❑ Yes
    - ❑ No

    (If yes, move on to question 21. If no, start from question 14-20).

Career Influencing Factors

21. From the following list select the three things you value most in a job. (Multiple selection with max of three)
    - ❑ Fair compensation and benefits
    - ❑ Opportunity to work with new technologies
    - ❑ Opportunity to apply your skills and knowledge
    - ❑ Work-life balance
    - ❑ Opportunity for career advancement
    - ❑ Learning and professional development opportunities
    - ❑ Culture of the workplace
    - ❑ Job security
    - ❑ Flexibility in scheduling
    - ❑ Opportunity to travel and work in the field
    - ❑ Opportunity to be a part of a professional community
    - ❑ Other? _____

22. Some career paths include a large amount of time in the field. In your **first career position** after completion of your geoscience degree please indicate the number of weeks you spent in the field each year.
_____ weeks

23. In your most **recent or current career position**, indicate the number of weeks you spend in the field each year.
_____ weeks

Demographic Profile

24. What is your age range? (Multiple Choice)
- ❑ 18-24
- ❑ 25-34
- ❑ 35-44
- ❑ 45-54
- ❑ 55-64
- ❑ 65 and over

25. Where do you currently live? (Multiple Choice – one selection)
- ❑ British Columbia
- ❑ Alberta
- ❑ Saskatchewan
- ❑ Manitoba
- ❑ Ontario
- ❑ Quebec
- ❑ New Brunswick
- ❑ Nova Scotia
- ❑ Prince Edward Island
- ❑ Newfoundland
- ❑ Nunavut
- ❑ Northwest Territories
- ❑ Yukon Territory
- ❑ Other _____

26. In your current or most recent job, where do you spend most of your working time? (Multiple Choice – one selection)
- ❑ British Columbia
- ❑ Alberta
- ❑ Saskatchewan
- ❑ Manitoba
- ❑ Ontario
- ❑ Quebec
- ❑ New Brunswick
- ❑ Nova Scotia
- ❑ Prince Edward Island
- ❑ Newfoundland
- ❑ Nunavut
- ❑ Northwest Territories
- ❑ Yukon Territory
- ❑ Other _____

27. What is your gender?
    - ❑ Male
    - ❑ Female

    (If female go to question 28-30)

28. In your opinion, what can mineral exploration companies do to retain women in the industry?

29. From your experience, what challenges do women face when working in the field?

30. What challenges do women face with regards to career advancement in the mineral exploration industry?

31. Please indicate any of the following statements that apply to you?
    (Type of Question: Multiple Selection)
    - ❑ I am Aboriginal
    - ❑ I am an immigrant
    - ❑ I am a visible minority
    - ❑ I have a disability(ies)

    (If Aboriginal go to question 32).

32. In your opinion, what can mineral exploration companies do to retain Aboriginal people in the industry?

33. What challenges do Aboriginal people face with regards to career advancement in the mineral exploration industry?

34. What challenges do Aboriginal people face when working in the field?

Thank you for taking the time to participate in this research! The final report will be available on **www.mihr.ca** and **www.pdac.ca** in the spring of 2013. If you are interested in receiving an advanced copy of this research report, please provide your email address.

END OF SURVEY

Prepared by
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For
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MiHR RHM
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CONSEIL DES RESSOURCES HUMAINES DE L'INDUSTRIE MINIÈRE

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