ALBERTA WOMEN IN THE FIELD:
GEOSCIENTISTS IN THE RESOURCE INDUSTRY, GOVERNMENT
RESEARCH, AND ACADEMIA, 1914-1999

by

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A thesis submitted in conformity with the requirements
for the Degree of Doctor of Education,
Department of Theory and Policy Studies in Education,
The Ontario Institute for Studies in Education of the
University of Toronto

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ABSTRACT

This dissertation takes a threefold approach in examining the changing nature of the entry experiences, career opportunities, and professional identities of Alberta women geoscientists working in the resource industry, government research, and academia between 1914 and 1999. First, it explores the literature related to women in science, women’s entry to universities and graduate schools, women in academia and the professions, and women and the resource frontier. Second, it engages in the recovery and analysis of the careers of three early women geoscientists. Third, it undertakes an empirical study based on interviews of thirty-four contemporary women geoscientists in Alberta.

The review of the literature on women in science shows British women were in the vanguard of education for women in the geosciences, the cross-fertilization of scientific knowledge across international boundaries, and the impact of the transition from the amateur naturalist tradition to institutionalized and academic settings, which resulted in loss of visibility for the early contributions of women in science.

The diversity of the careers of Grace Anne Stewart, Helen Belyea, and Mary Turner illustrates the three different possibilities in terms of career path for women geoscientists: university teaching, research and field work in government service, and
work in private industry and the oil patch. Stewart and Belyea fit the category of high achievers who concentrated on their careers, while Turner had a shortlived career in geology, married, and later resumed her teaching career.

The interview-based study shows that while career opportunities for women in the booming Alberta resource industry are very positive, social attitudes are the slowest part of the job equation to change. While women are gaining senior technical and management positions, lingering social stereotypes and outdated exclusionary practices continue to exist, and women continue to have to work to overcome them. Despite these challenges, a majority of women geoscientists interviewed in the study are experiencing or have experienced fulfilling and financially rewarding careers.
ACKNOWLEDGEMENTS

A research project of this nature can only be accomplished with the assistance of many people. I would like to acknowledge all those individuals who supported my endeavours over the last three years. My first vote of thanks goes to my thesis supervisor, Elizabeth Smyth, who helped me come up with the dissertation topic, and then guided me through all the various stages of the thesis journey from the formation of the committee to the ethical review process, the research, the writing, and the many stages of revision. Her encouragement, good humour, and excellent computer skills helped us stay connected at a distance and kept me on track for the most part. Without her enthusiasm for the project and her facility in communicating through the electronic medium, I would not have been able to accomplish this goal.

To the other two members of the thesis committee I owe a similar debt of gratitude. Both Sandra Acker and Alison Prentice have been a constant source of inspiration through their writings, as has Elizabeth Smyth, and all three have been of immeasurable help in bringing this project to fruition. To Sandra I owe a special vote of thanks for inviting me to attend her thesis group and her graduate seminar in the Department of Sociology and Equity Studies in Education, where I met students at all stages of the dissertation process and heard about interesting research experiences and projects. Thanks also to Sandra for her initial help with the ethical review process and the development of the ethical review protocol and letter of consent. To Alison and Elizabeth, my thanks to you for going online with your Women in Higher Education course. Many of my key research interests originated in that stimulating distance seminar. The thesis committee’s many constructive suggestions and critical comments on the draft versions of the thesis have improved the finished product considerably. Many thanks to Alison, Sandra, and Elizabeth for providing feedback at critical times when I needed it, almost invariably right before they were leaving on trips to India, France, Australia, and England and needed time for their own preparations. I am very appreciative of their support and friendship.

I would also like to express my thanks to other members of the OISE/UT faculty, in particular to David Levine for helping me to prepare for the comprehensive exams and insisting that I do an annotated bibliography, and to both David Levine and Hesh Troper for their stimulating seminars. In addition to the support and encouragement of the History of Education faculty, I am grateful to two members of the Adult Education, Community Development and Counselling Psychology faculty who welcomed me into their graduate seminars on my first tentative return to graduate school after many years away from U of T, and who subsequently supported my application for doctoral studies: James Draper and Alan Thomas. In particular, I would like to thank James Draper for going out of his way to help revise several drafts of my application letter, and both James and Alan for their letters in support of my application. I might have missed all of these wonderful educational experiences if they had not encouraged me to persist with my application.
In addition to my very fine thesis committee and the other faculty members at OISE/UT, I owe a tremendous debt of gratitude to the thirty-four participants in my interview-based study. The Alberta women geoscientists that I met were warm hearted, interesting, and unfailingly generous with their time and support. I feel privileged to have been briefly a part of their lives and hope that I have done justice to their stories that connect the earth, rocks, plants, animals, and people on the planet. Thanks are also in order to Marianne Gosztonyi Ainley for breaking the trail with her insightful research on women in science in Canada and for providing me with valuable research suggestions over a lunch we shared at the Canadian History of Education Association meeting in Vancouver.

I also owe a vote of thanks to my employer, Keyano College, and to my colleagues at the college who provided professional development leave and funding for my year of residence in Toronto. In addition, I would like to thank the reference librarians and staff at the Keyano College library, Bill Glaister, Carol Hintz, and Susan Brayford, all of whom were extremely helpful with interlibrary loans and searches on various and sundry topics. Reference librarians and archivists at several different academic institutions and archives were in fact helpful with this project: the OISE/UT and Robarts Libraries in Toronto; the University of Alberta Library and Archives; the University of Calgary Library; the Glenbow Museum and Archives; Dalhousie University Archives; and the Ohio State University Archives.

In particular, I would like to express my thanks to Bertha L. Ihnat, Assistant Archivist and the friendly voice on the other end of the phone at Ohio State Archives. Bertha mailed me several packages of information on Grace Anne Stewart and searched through files to find Stewart’s employment and salary records. I am very grateful for her assistance. Thanks also to Dr. Don Stott, executor of Helen Belyea’s estate, who spoke with me over the phone, and to Dr. Charles Armour, archivist at Dalhousie University, for verifying information about Helen Belyea’s dates of graduation.

Finally, to the family and friends who supported me throughout this endeavour, I am deeply appreciative. Thanks to my sisters, Fran Chesney and Ann Whitley, who carried much of the burden of family responsibilities in Ontario for me, and to my brother Bob Nelles for continued encouragement. Special thanks to my brother, Viv Nelles, who regaled me with interesting stories over several delightful lunches during my stay in Toronto and introduced me to William Cronon’s “Kennecott Journey” and Nature’s Metropolis, thus influencing the entire direction of this thesis. He also helped me to understand that a good thesis needs only to show change over time. Love and thanks also to my husband Neil, who provided encouragement, moral support, unflagging good humour in the face of chaos on the home front, and financial support at critical times when my own funds were sadly depleted. Neil encouraged me to take time out from work and family responsibilities to pursue my own interests and has been supportive of my efforts from day one. In fact, he has retrieved so many feminist and women’s studies books from the U of A Library that he has become very well informed if not reformed.
Thanks to my daughter Susan who was literally left home alone with the trusty beagle Napoleon, the birds, and Dad on the weekends during the year of my residence in Toronto. Her unfailing good sense kept her out of trouble, I think, and what I don't know probably won't hurt me! Thanks also to my daughter Sarah for her support and for the great mother/daughter road trip from Fort McMurray, Alberta, to Rock Hill, South Carolina. Our trip took time from my research one summer, but was an unforgettable adventure as Sarah took up her first job in journalism in the United States, and we travelled south with the sky lit up by Fourth of July fireworks. To the fledgling young engineer in the family, my son Sanford, I also express my thanks for his good humour, support, and the occasional retrieval of doctoral dissertations from the University of Calgary Library. My fondest hope is that he too will graduate this year so we can celebrate together. When Sanford first mentioned that he was going to take a women's studies course as an engineering student, I knew that the world was indeed changing!

The dissertation journey has been extremely worthwhile even if somewhat longer than originally intended. My final words of appreciation are reserved for my parents, Dorothy and Henry Nelles, for encouraging all five children to attend university and for instilling in all of us a love of history. This is for them and for Neil.
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\(^1\) Geocological term referring to a "crustal block or fragment that preserves a distinct geologic history that is
different from the surrounding areas and that is usually bounded by faults." Webster's Revised Unabridged
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CHAPTER ONE

PARKAS, PACKSACKS, AND ROCK HAMMERS

Introduction

Life on the Shield represents the things that are quintessentially Canadian—things like checked shirts, high-cut boots, toques, parkas, packsacks, snowshoes and bush aircraft. The human images associated with it are the stuff of Canadian mythology: the Indian trapper, the voyageur, the lumberjack, the prospector, the bush pilot.¹

Although loaded with stereotypes, like most stereotypes, these images present some of the reality of the life of men—and women too—on the Canadian Shield. This dissertation explores one of the female images within this context. It tackles questions about the entry of women to the geoscience professions. The dissertation examines the changing nature of the entry experiences, career opportunities, and professional identities of Alberta women geologists, geophysicists, and geological/geotechnical engineers working in three key areas of employment between 1914 and 1999: the resource industry, government research, and academia. The starting date of the dissertation’s coverage is the year in which the first Canadian woman entered a university geology program, and the concluding date is the year in which the personal interviews for the study were completed. In the dissertation I examine the experiences of women geoscientists working in the three key areas of employment through a review of the historical evidence, an exploration of the careers of three early Canadian women in geosciences, and an empirical study that involved interviews with thirty-four women geoscientists in the province of Alberta.
As the initial quotation suggests, the geosciences are physically demanding professions. In the early days of geology before the use of airplanes, helicopters, and remote sensing, exploration and mapping often involved long periods in the field and arduous physical exercise such as hiking and canoeing into remote areas. Field work in geology required participants with both the physical strength to chisel samples with a rock hammer and the physical stamina to carry the samples over the frequently rough terrain. Gaining the opportunity to participate in field work (both land and ocean going exploration) and to work in underground mines proved to be difficult for women, and initially may have prevented all but the most determined women from entering the geoscience professions.

It is useful at this point in the discussion to briefly review the nature of the work that geoscientists perform. Geologists look directly at the rocks and drill holes to analyze the drill core and rocks. Geophysicists apply physics to the study of the earth. They put tools down drill holes to measure electrical, physical, or magnetic effects, and they interpret what these responses mean in terms of geology. Geological and geotechnical engineers are both engineers and geologists or geotechnical specialists. They apply geological/geotechnical information to engineering design.

Engaging in a regional and Alberta-based study on the topic of women geoscientists proves to be a fruitful area of research for a number of reasons. Alberta is a resource-rich province in which there have been opportunities for geoscientists in industry in the extraction of resources such as coal, conventional oil and gas, heavy oil and oilsands, as well as in government service, research work, and university teaching. The geoscience professions are highly mobile ones in which professionals gravitate to
areas of high employment, and the high level of activity in the Alberta resource sector has attracted geoscientists from around the world.

The 1996 census results from Statistics Canada show 7,615 geologists, geochemists, and geophysicists and 1,625 geological engineers in Canada. Of those numbers, 3,370 geologists, geochemists and geophysicists and 450 geological engineers (41 percent in total) are located in Alberta. Of the women in these occupational categories, the 1996 census shows 1,115 geologists, geochemists and geophysicists and 185 geological engineers in Canada as compared with 430 geologists, geochemists and geophysicists and 75 geological engineers (39 percent in total) in Alberta.²

To put the statistical data in perspective, one needs to move back in time to 1975, the year in which the Geological Association of Canada (GAC) published its Report on the Status of Women Geoscientists in Canada. In “Women Geoscientists—Why Not?” Norah Allman, the chairperson of the GAC task force, reported the following information:

At April 30, 1975, our register contained the names of 537 women studying or graduated and/or working at one time employed in the geological sciences in Canada. In general any information on these women referred to their status in 1974. According to Statistics Canada, in 1961, 54 females were employed in geology or geological sciences, compared to 2,716 males; in 1971, 140 females compared to 4,550 males.³

If one compares the data from 1971 and from 1996, there is considerable contrast in the number of geoscience professionals in Canada. In 1971 there were 140 women and 4,550 men employed in the geological sciences in Canada. In 1996 the statistics show 9,240 geoscience professionals employed in Canada, including geological engineers. Of that number, 3,820 or 41 percent were working in Alberta. Of the 1300 women reported working in all branches of the geosciences in Canada in 1996, 505 or 39 percent were
employed in Alberta. The statistics clearly show that over a third of the women geoscientists in Canada are located in Alberta. The province is therefore a very good location for a study of women geoscientists. Table 1 and Figure 1 report the Census Canada data in additional detail.

**Rationale for the Study**

The dissertation developed from the author's life experiences as the marital partner of a geologist and as a long-term resident of a northern resource community located in the province of Alberta. The resource-rich community in which I live supplies approximately 20 to 30 percent of the oil that Canada consumes. It is a high-tech and affluent community because of the wealth that resource extraction provides. But along with the benefits and potential problems created by relative affluence, the community faces environmental issues of local and national significance and intercultural conflicts over traditional land use and ownership versus resource development. My geographical location in the hinterlands of the country and in a resource-rich community has influenced this study in several significant ways.

First, it has encouraged me to take a regional history approach and to focus the study in my own province. Second, it has encouraged me to make sure that geoscientists working in the north are well represented in the study and that the study is not focused only on activity occurring in and around large urban centres. All too often, even regional studies in Canadian history are guilty of ignoring or downplaying activity that takes place in the north. Third, the environmental and intercultural issues faced by my community have prompted me to look to the new field of environmental history for a possible framework for my research. Physical location and personal life experiences therefore
Table 1: Census Data on Geoscientists in Canada

<table>
<thead>
<tr>
<th></th>
<th>1996 - Canada</th>
<th>1996 - Alberta</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Census Male</td>
<td>Census Female</td>
</tr>
<tr>
<td>Geologists, geochemists, and geophysicists (1)</td>
<td>6495</td>
<td>1115</td>
</tr>
<tr>
<td>Geological Engineers (2)</td>
<td>1440</td>
<td>185</td>
</tr>
<tr>
<td>Total Numbers (1+2)</td>
<td>7935</td>
<td>1300</td>
</tr>
</tbody>
</table>

Calculations for Total Alberta Data as a Percentage of Total Canada

<table>
<thead>
<tr>
<th></th>
<th>1996 - Canada</th>
<th>1996 - Alberta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>7935 (100%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3305 (42%)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>1300 (100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>505 (39%)</td>
</tr>
<tr>
<td>Total</td>
<td>9235 (100%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9240</td>
<td>3810 (41%)</td>
</tr>
</tbody>
</table>

Notes:
1. All 1996 Census data are from Statistics Canada, Nation Series CD-ROM, 93F0020-XCB96004, Labour Force 15 Years and Over by Detailed Occupation and Sex, File 7_t7.ivt.
2. The 1996 Census data were collected either from 100% of the population or on a sample basis with the data weighted up to provide estimates for the entire population. The statistics for the Labour Force 15 years and over fall into the latter category, i.e., they were collected on a 20% sample basis, and weighted up to compensate for sampling.
3. The total numbers reported by Statistics Canada may be slightly higher than the calculated totals for Male and Female categories. In their "Notes on Other Non-Sampling Errors" for this Table, Statistics Canada reported that information may be missing for some questions or individuals. Thus, the occupation may be noted, but the sex may be missing or impossible to read on written questionnaires.
Figure 1: Geoscientists in Canada and Alberta 1996

Notes:
1. All 1996 Census data are from Statistics Canada, Nation Series CD-ROM, 93F0020-XCB96004, Labour Force 15 Years and Over by Detailed Occupation and Sex, File 7.t7.ivt.

2. The 1996 Census data were collected either from 100% of the population or on a sample basis with the data weighted up to provide estimates for the entire population. The statistics for the Labour Force 15 years and over fall into the latter category, i.e., they were collected on a 20% sample basis, and weighted up to compensate for sampling.

3. The total numbers reported by Statistics Canada may be slightly higher than the calculated totals for Male and Female categories. In their "Notes on Other Non-Sampling Errors" for this Table, Statistics Canada reported that information may be missing for some questions or individuals. Thus, the occupation may be noted, but the sex may be missing or impossible to read on written questionnaires.
have influenced my choice of topic, my approach to the topic through a regional study, and the environmental history approach that I take in questioning the impact of geoscientists’ work on the environment and on the people, plants, and animals in that environment.

Just as physical location has been an influential factor in determining the choice of topic and the regional and environmental history approach, a number of other factors have prompted me to focus my attention on women geoscientists. First, as a feminist and historian with a strong interest in women’s history and issues, the topic is personally engaging and relevant. Defining a feminist approach is far from an easy task, particularly in a postmodern environment in which there are multiple and shifting perspectives and many forms of feminism. However, the definition offered by Ruth Pierson and Alison Prentice in “Feminism and the Writing and Teaching of History” is highly appropriate:

Feminism, in our view, is both a movement and an ideology. Insofar as some of its followers have engaged in extended philosophical analysis it has also given rise to theory. Intrinsic to feminism is women’s sense of grievance, arising out of an awareness that ‘women suffer from systemic social injustice because of their sex.’ This awareness of injustice depends, in turn, on a belief in and commitment to the idea of equality. In a world in which there existed no concept of equality, we would argue, there could be no feminism. As an ideology, feminism is premised on the belief that women suffer from oppressive inequalities in a number of areas and puts forward the ideal of a world in which the sexes would be equal. As a movement, it strives to make the achievement of justice, perceived as the attainment of women’s equality with men, a political and economic reality. While we recognize that inequality is not necessarily synonymous with oppression, we believe that systematic inequalities lead to abuses of power and therefore to oppression. Feminists, by definition, are particularly concerned with systematic inequalities based on sex.5

Pierson and Prentice point out that one of the tasks of feminist historians is to “examine the structures of women’s inequality.”6 They suggest, however, that the task of examining the positive aspects of women’s experiences is equally important to examining
the negative examples of "systematic subordination of women." The authors stress that one of the key ways in which women have been oppressed is their invisibility in official histories and the silencing of their contributions to society: "In fact, one of the basic oppressions that women suffer is the silencing of their whole experience, both negative and positive. A basic injustice that feminists wish to redress, therefore, is inequalities in terms of visibility. What feminists demand is the right to know and understand the experience of women and to have it analyzed, taken into account, recorded and valued, equally with the experience of men."

Examining the history of women in geosciences is one way of making this small but important group of Canadian women in science more visible, and of helping them have their contributions recorded, valued, and taken into account. Focusing on regional history, in this case on the province of Alberta, also provides an opportunity to examine the experiences of a group of women who are underrepresented in three ways—as women, as scientists, and as individuals residing in the west on the periphery of national consciousness.

Another important rationale for the study is that the history of women in science and technology in Canada and the role of women in the economic history of Canada have not received adequate attention from historians or economists. It is important as women that we have a sense of our own history and that we acknowledge the contributions of women in the past—not only the exceptional achievers, but also the ordinary individuals and practitioners in scientific and other fields. Pierson and Prentice emphasize the necessity of reclaiming our own histories:

The feminist perspective is also responsible for our growing understanding of the fact that women, like men, need their history. The sense of self depends on
having a sense of one’s past. To the extent that modern women have been denied, in the historical canon, all but the faintest glimpses of their own history, they are like victims of amnesia. The fact is that the experiences of men and women in the past has not been exactly the same. Women cannot be subsumed under the general category of ‘Everyman.’ The nature and implications of the differences between the histories of the sexes must be discovered and examined if as women we are to repossess our past.\(^9\)

Marjorie Theobald adds to the point that just as men and women’s experiences have not been the same, the experiences of all women are not identical. She states that the category “woman” is therefore open to contest: “Feminist historians also want to argue that gender itself, in both its masculine and feminine forms, is historically contingent and intimately connected to the dynamic of power between men and women. This perception of gender as historically contingent has been further refined into the notion that the category ‘woman’ (and therefore the category ‘man’) is not fixed and is always open to contestation.”\(^10\) Thus, the “past” that is recovered and analyzed by women’s historians is multiple and diverse rather than singular, and always “open to contestation.”\(^11\)

It is also important to familiarize students with the contributions made by past generations of women in science in order to encourage young women to pursue careers in science and technology. Whether one likes it or not, science and technology seem to be driving the global economy. If more Canadian women are not attracted to these areas of study, women will be shut out of positions of power and decision-making authority on issues that will affect not only the products we purchase as consumers, but also our health and the environment in which we live. As a result, there is a need to improve career education for students and to increase public awareness of and education, not only on geoscience topics, but also in all other areas of science and technology.
The final rationale for the study may seem trivial in comparison to the other points, but it is relevant nonetheless. I must confess a strong curiosity about and admiration for the pathbreakers in various professional fields. This curiosity spurred my interest in field-oriented women who chose to break gender boundaries in their pursuit of professional careers. I am interested in the triggering events that encouraged women’s entry to geology, which had been a male-dominated field in Canada since the establishment of the Geological Survey in 1842.

**Research Methodology**

Once women gained access to fields such as the geosciences, it is important to examine their accomplishments, the context in which the accomplishments occurred, and their experiences. In light of the current gaps in the history of women in science in Canada, there is a study to be done that answers certain questions and explores certain concepts. This study will take a threefold form: first, an exploration of the literature on related topics; second, historical recovery of the lives and context of early women geoscientists; and third, an empirical study based on interviews of thirty-four contemporary women geoscientists in Alberta.

The exploration of the literature on related topics forms a major part of the study for a number of reasons. The first reason is that the dissertation topic is interdisciplinary in its scope; therefore, there is a vast amount of information that is relevant. The second reason is that the Canadian field of women in science is so recent in its development that there has been no overall synthesis of the research that has been done to date. Relevant topics include the history of women in science, the history of women’s entrance to universities and graduate schools, the history of women in academia and the professions,
and the relationship of the resource frontier and the new field of environmental history to women in geosciences. My examination of the literature is selective. I have chosen to refer primarily to those sources that shed light on the experiences of women in geosciences. However, although it is beyond the scope of the current study, the Canadian women in science field is very much in need of further research and scholarship that would provide a comprehensive overview of the subject.

An exploration of the careers and accomplishments of three early Canadian women geoscientists forms the second major focus of the dissertation. This exploration bridges the gap between the historical literature and the empirical study. It provides an important point of comparison for the experiences of contemporary women geoscientists outlined in the study. It also helps to compensate for the fact that the study was focused on women geoscientists at the beginning or middle of their careers. Only a few of the study participants were in their sixties or seventies and of a slightly earlier generation. The exploration of the careers of the three early women geoscientists therefore helps to balance the representation of the different generations. Two of the early women geoscientists fit the category of superachievers, and the third experienced a short-lived career in geology before marrying and returning to teaching as a career.

The empirical study in Part II of the dissertation forms the third focus of attention. This study involved a small sample (6.7%) of the 505 women geoscientists working in Alberta. However, the thirty-four participants were a representative sample of the larger group, with some of them working in industry, some of them working in government departments or research institutes, and some of them teaching at universities. The oral history approach gave me the opportunity to explore the lived experiences of a
contemporary group of Canadian women in science. It also satisfied one of the basic feminist principles of inclusivity in that it allowed me to examine the experiences of not only the superachievers, but also the ordinary practitioners in scientific fields, as well as the individuals who chose to move to other professional fields.

Although the study focused on the experiences of women geoscientists who are current or recent residents of Alberta,¹² the participants attended a cross-section of all the major Canadian university geoscience departments as well as universities in Britain, United States, Europe, New Zealand, and South America. A snowball sampling technique in which initial contacts referred the researcher to other possible participants was employed. Nineteen semi-structured interview questions were developed and approved by the OISE/UT ethical review committee.¹³ A semi-structured approach allowed the participants ample opportunity to address topics that I may have neglected to include, but also ensured that all participants were given an opportunity to respond to the same basic set of questions. Further details on the structure and methodology employed in the study will be provided in Chapter Six of the dissertation, “Oral Histories in the Oil Patch: Researching the Lives of Contemporary Alberta Women Geoscientists.”

Research Questions

The dissertation asks a number of questions in examining women’s experiences in the geosciences. What were the triggering factors that encouraged women’s entry to the geoscience fields? How did women’s entry experiences to universities and careers vary? How easy was it for women to gain entry to field schools in university and field experiences in the workplace? After they gained their academic training, what kinds of opportunities were available to women in the geosciences? Under what circumstances
did women's career opportunities in the geoscience fields improve or decline? In what way did the public professional image or identity of women geoscientists change over time? How did the personal professional images of women geoscientists change over time as a result of increasing professional competence and expertise? Change over time in women's professional opportunities and experiences forms a central theme in this thesis, as well as the question of whether the change was positive or negative.

In "History and Difference," Joan W. Scott emphasizes that the focus in women's history on gaining entry or passing through barriers has distracted researchers from important issues such as "How are those who cross the thresholds received? If they belong to a group different from the one already 'inside,' what are the terms of their incorporation? How do the new arrivals understand their relationship to the place they have entered? What are the terms of identity they establish?" These questions are all of interest with respect to women's incorporation into the geoscience professions, which traditionally have been very male-dominated fields. Scott states that the "knowledge said to be vested in a profession...implies its structure, organization, and membership." Issues of race, class, gender, and ethnicity have a bearing on entry, but so do the "social practices" and the way in which members of a profession "interpret the meaning of their work." Scott emphasizes that "We understand the full meaning of occupational identities only when we see who is included in them, how differences among practitioners are dealt with, which differences matter, how they are understood, and how they change over time." The issues Scott raises both inform the interview questions in the empirical study and focus the analysis of the historical evidence.
Part II of the dissertation examines the following factors in terms of their relevance to the oral histories of participants: potential influences on women’s career choices such as the role of families, parents’ careers, and early socialization, including elementary and high school experiences; the impact of private girls’ schools and all-female social activities and clubs; the influence of teachers with geoscience backgrounds and of outdoor education courses that incorporated geoscience topics; the role of first-year university professors in attracting women to geoscience fields; and finally, the significance of women students’ interest in the natural environment and their participation in challenging outdoor physical activities.

Other questions are raised by the review of the historical literature on women in science. Marianne Gosztonyi Ainley, who has pioneered the study of Canadian women in geosciences, states that the early graduates in geology experienced both “lateral…and hierarchical segregation.” Ainley suggests that the early women geoscientists in Canada were “channeled into certain areas of science,” and they were often “kept in undervalued, underpaid positions.” Ainley concludes that “in geology, with its old associations of masculinity and rugged outdoor activity, career advancement and recognition have remained different for men and women.” In a 1994 article in Geoscience Canada, Ainley states that “women remain glorified technicians and assistants; they rarely work in the field or do high-level interpretive work with computers.” In addition to the previously mentioned research questions, this dissertation will critically examine Ainley’s findings to determine their applicability to both the early women and the contemporary participants in geoscience fields. In the dissertation I examine both the historical pattern of women’s participation in geosciences.
as well as the changes that have occurred in employment opportunities for women in
geosciences in recent years. The changing nature of the career opportunities and
experiences for women in geosciences is therefore a key issue addressed by the
dissertation.

**Overview of the Thesis**

This thesis develops in ten chapters. Following this initial chapter in which the
rationale, methodology, and research questions are outlined, three chapters outline the
literature on which this thesis is based. Chapter Two surveys the literature on the history
of women and science in Europe, Britain, Russia, the United States, and Canada. The
chapter emphasizes the strong evidence for the exchange of scientific knowledge and
expertise across borders. In addition, it points out a number of key themes that inform
and frame the study and that require further research. These themes include the
movement in science from the amateur naturalist tradition to institutionalized and
academic settings, the influence of all-female schools and colleges, the impact of the
development of separate women’s professions and separatist strategies, and the impact of
the world wars and the end of the Second World War on professional opportunities and
training for women.

Chapter Three examines the historiographical context for women’s entry into
sciences in order to become geologists. It focuses on the entry of women to
undergraduate and graduate programs in various countries and the problems in gaining
entry to field work once women achieved the requisite academic credentials. It also
looks at the whole issue of professionalism and its meaning for women in academia and
scientific fields. Finally, it examines the feminist critique of science and its relevance to
contemporary geoscientists' experiences. A number of key themes are explored in this chapter: the significance of formative school experiences and the gendered nature of women’s educational experiences; the debate over separate women’s professions and specialized areas within scientific fields for women; a discussion of the separate spheres concept and debate over its continuing relevance or lack thereof; the impact of the world wars on professional training for Canadian women; and finally, a discussion of the relatively privileged backgrounds of early Canadian women students.

Chapter Four looks at the historical literature on the resource frontier and the work of the New West and environmental historians in the United States for possible approaches to the dissertation topic. In the chapter I reconnoiter the terrain of Western economic history and New West and environmental histories. Although I find that women are for the most part missing from the economic histories of resource frontiers, I discover in the New West and environmental histories an approach that is highly congruent with my own research. The New West and environmental historians put women, ethnic and aboriginal minorities, and the natural environment into a central position in their regional histories, and that is exactly what this study proposes to do.

Chapter Five examines three women’s careers in geology. Two of the women featured in the chapter were prominent as pathbreakers in the geoscience fields, and the third woman was chosen to illustrate a short-lived but very interesting career in the geosciences as a contrast to the careers of the two superachievers. Since the empirical study in Part II included only a small number of women in their sixties and seventies, Chapter Five attempts to balance the focus on contemporary geoscientists with the exploration of three careers representing women of an earlier era.
Part II of the dissertation is a study examining contemporary women geoscientists’ experiences. Chapter Six provides an introduction to the structure and methodology of the study. Chapter Seven examines the “stepping stones” or entry experiences to university education and geoscience careers. Chapter Eight looks at the juggling act required by many geoscience professionals in order to manage families and demanding careers. Chapter Nine examines the changes in participants’ personal and public professional images as well as the attitudes of women geoscientists to resource development and environmental issues. The Conclusion summarizes the results of the study in the context of the literature review and research questions and suggests the need for further research on women in science in Canada.

Conclusion

This dissertation takes a threefold approach in examining the changing nature of the entry experiences, career opportunities, and professional identities of Alberta women geoscientists working in the resource industry, government research, and academia between 1914 and 1999. First, it explores the historical literature related to women in science, women’s entry to universities and graduate schools, women in academia and the professions, and women and the resource frontier. Second, it engages in the recovery and analysis of the careers of three early women geoscientists. Third, it undertakes an empirical study based on interviews of thirty-four contemporary women geoscientists in Alberta.

All dissertations are grounded in both scholarly and personal interests. I have three personal aims for writing this thesis. I hope the dissertation arouses readers’ interest in the topic and encourages them to contribute to further research on women in
science. I anticipate that the dissertation contributes to making women’s experiences in science more visible and to helping women reclaim their own history and develop a sense of pride in past and contemporary women in professional fields. Finally, it is my hope that the dissertation will inspire and challenge young women to make their own contributions in scientific and non-traditional areas of employment for women.

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2 Statistics Canada, Nation Series (93F0020XC96004), Labour Force 15 Years and Over by Detailed Occupation (713) (Based on the 1991 Standard Occupational Classification) and Sex (3), for Canada, Provinces, Territories and Census Metropolitan Areas, 1991 and 1996 Censuses (20% Sample Data). (Note that the totals for male and female geoscientists in Canada and in Alberta are slightly higher than the simple addition of the male and female categories for a number of reasons. First, the data is only a 20% sample, and numbers are rounded. Second, the confidentiality issue means that a number of individuals have chosen not to indicate their gender; therefore, they only show up in the totals columns. The five to ten individuals not showing under either the male and female categories will have a marginal effect on the graphs showing male and female participation in the workforce, but this situation is unavoidable.)
4 Statistics Canada, Nation Series (93F0020XC96004), Labour Force 15 Years and Over by Detailed Occupation (713) (Based on the 1991 Standard Occupational Classification) and Sex (3), for Canada, Provinces, Territories and Census Metropolitan Areas, 1991 and 1996 Censuses (20% Sample Data).
5 Ruth Pierson and Alison Prentice, “Feminism and the Writing and Teaching of History,” Atlantis 7, 2 (Spring 1982), 37-38. The authors add the following footnotes: “We do not use the term ideology pejoratively nor in the narrow sense of a system of values and beliefs imposed by a ruling class. Still, Mattingly’s view that ‘ideology’ can be used synonymously with ‘theory’ seems to us to deny the sense of logical construction implied in theorizing. We concur, however, with his statement that the word ‘ideology’ need not ‘possess its popular American connotation of narrow deference to a particular manifesto or rigid apologia impeding practical action.’ Paul H. Mattingly, The Classless Profession: American Schoolmen of the Nineteenth Century (New York: New York University Press, 1975), p. 187. Mattingly refers to Karl Mannheim’s Ideology and Utopia (New York, 1936). If we followed Mannheim’s distinction between ideology as a complex of ideas serving to maintain an existing order and utopia as a complex of ideas calling for transformation of an existing order, we would find ourselves among those of utopian bent. But partly because that term ‘utopia’ implies a value judgement unrealizable from the viewpoint of the upholder of the status quo, we choose to employ the term ideology more generally to include sets of ideas and values which call into question and seek to change a prevailing social system as well as those which work to preserve an existing order. In accepting this view of ideology, we take issue with many aspects of Lewis Feuer’s definition, especially the notion that all ideologies are closed systems that are inimical to scholarly inquiry. Lewis S. Feuer, Ideology and Ideologists (Oxford: Basil Blackwell, 1975). Janet R. Richards, The Sceptical Feminist: A Philosophical Enquiry (London: Routledge & Kegan Paul, 1980), p. 1. See Abigail J. Stewart’s and David G. Winter’s ‘The Nature and Causes of Female Suppression’ where they state that ‘Central to the field of women’s studies is the concept of female suppression—which means the interlocking complex of lower status and limited opportunities for women, as compared with men, in the spheres of law, education, the economy, and social power.’ Signs: Journal of Women in Culture and Society, 2, 3 (Spring 1977), p. 531. Awareness of this point derives from conversations with the anthropologist Jean Briggs in which she has argued persuasively that in Inuit society one thinks in terms not of equality between the sexes but rather of complementarity and interdependence.”
Ibid, 38.
Ibid, 38.
Ibid, 38.
Ibid, 41.
11 Ibid., 5.
12 One participant in the study has recently moved to British Columbia. Another participant in the study does all of her geology work in Alberta, but lives across the border in British Columbia. She also was a resident of Alberta at the commencement of the study.
15 Ibid., 94.
16 Ibid., 94.
17 Ibid., 94.
18 Marianne Gosztonyi Ainley, "Women's Work in Geology: A Historical Perspective on Gender Division in Canadian Science," Geoscience Canada 21, 3 (September 1994), 140.
19 Ibid., 140.
20 Ibid., 141.
21 Ibid., 141.
CHAPTER TWO
SURVEYING THE TERRANE¹: WOMEN IN SCIENCE

This chapter examines the key contributions from the literature on the history of women and science in Europe, Britain, Russia, the United States, and Canada. It focuses in particular on women in the geological or earth sciences and comments on the way in which the current study on Alberta women geoscientists adds to or challenges the arguments presented. In the chapter, I argue that the experiences of Canadian women scientists must be examined in the broad North American context since so many of the early scientists received their graduate education in the United States and since there was so much exchange of scientific knowledge and expertise across borders. In addition, I argue that there is much work that remains to be done in documenting the history of Canadian women in science—in fact, the work has just begun. A cursory exploration of the historical research that has been done on American women in science shows that research on Canadian women in science is lagging behind American scholarship even in terms of compensatory history, which is the earliest stage of interpretation in women’s history.

The approach in this chapter in many ways responds to a call by historian Marianne Gosztonyi Ainley for further research on the history of Canadian women in science and for better record keeping and documentation of the careers of women scientists currently working in Canada. Ainley has produced much of the historical work to date on Canadian women in science in works such as Despite the Odds: Essays on Canadian Women and Science,² “Women’s Work in Geology: A Historical Perspective on Gender Division in Canadian Science,”³ and “Women Scientists in Canada: The Need
for Documentation. She is therefore more aware than many Canadian historians of the problems of finding primary sources on this topic, particularly for the first generation of women scientists:

Since there is no comprehensive history of Canadian science and since the few histories of the scientific disciplines and institutions understate or ignore the role of women, research has to be conducted from primary sources. The lives and careers of women scientists must be abstracted piecemeal from office files, university and government records, personal correspondence, and the recollections of scientists, family, friends, and peers. Unfortunately, there are problems with these sources. Memories may be faulty, people may be reluctant to talk about long gone colleagues or family members, and important papers may have been ‘cleaned out.’ Documentation is badly needed to help provide a clear picture of the socio-economic and cultural factors responsible for the current status of Canadian women scientists, and their historical role in scientific education and research.  

Ainley asks why it is that so little is known about the contributions of Canadian women in science. She concludes that women have been “under-represented in positions of power within an increasingly complex scientific community.” In addition, even those women who have made substantial contributions to the various scientific disciplines have received only minimal recognition in scientific bibliographies and textbooks. Ainley asserts that women’s double under-representation “...is the result of complicated historical processes, which first obstructed women’s higher education and career advancement, and then, because of rampant stereotyping, obscured and minimized their actual participation in science.” This under-representation is by no means confined only to women scientists in Canadian geology and science textbooks. In “Florence Bascom and the Exclusion of Women from Earth Science Curriculum Material,” Lois Arnold documents a similar exclusion of women scientists from American geology and science textbooks.
As a result of this under-representation in the scientific literature, the history of women in scientific fields such as geology is just starting to be pieced together, and much of the available data comes from memorials and tributes published in scientific journals on the deaths of prominent scientists. These tributes are hardly the stuff of historians' dreams in terms of source materials, but for the reasons Ainley mentioned, they often represent the only entry point to women's scientific careers that historians have available. It is therefore difficult to be critical of early historians of women in science for lack of interpretive depth because the sources often are not available to accomplish much more than a superficial examination of women's careers, and even to accomplish the latter requires painstaking effort.

**Early European, British, and Russian Women in Science**

Although this section of the dissertation concentrates on women in science in Europe, Britain, and Russia, some of the research referred to includes American women in science. There is therefore a slight overlap between this topic and the next section on American women in science. For a number of reasons it seemed appropriate to give the research on American women in science separate coverage. First, the literature available on this topic is quite extensive. Second, the cross-border influences between Canada and the United States, particularly in respect to the early women in geosciences, make it an important area of exploration for this dissertation topic. Third, it serves as a point of comparison to the section on Canadian women in science. Turning now to the European women in science, one finds that the work of Londa Schiebinger provides an excellent starting point for the analysis.
Schiebinger has written a very useful review essay, "The History and Philosophy of Women in Science," as well as a book that documents the early contributions of European women in science, The Mind Has No Sex? Women in the Origins of Modern Science. In her review essay, Schiebinger identifies what she terms four "conceptual approaches" to research in the area of gender and science. The first approach is primarily compensatory in that it seeks to recover the contributions of women scientists that have been ignored in mainstream scientific literature. The second approach builds on the first by extending the analysis to include not only the entry and participation of women in scientific fields, but also their current situation in terms of scientific knowledge production. The third approach looks at the way in which women have been "defined (and misdefined)" by the sciences, in particular by the "biological and medical sciences." The final approach investigates the masculine nature of science and the distortions in the scientific norms and methods that result from this masculine bias.

Schiebinger also contrasts the three very different points of view that appear in the literature on gender and science. The first viewpoint asserts that women simply cannot produce great science—that there is something in their physical, psychological, or intellectual makeup that prohibits this achievement. This position strikes one as being highly indefensible in light of the outstanding scientific accomplishments of scientists such as Barbara McClintock, Marie Sklodowska Curie, Gerty Radnitz Cori, Irene Joliot-Curie, Maria Goeppert Mayer, Rita Levi-Montalcini, Dorothy Crowfoot Hodgkin, Gertrude B. Elion, and Rosalyn Sussman Yalow, all of whom have received Nobel Prizes.
The second viewpoint argues that lack of women in scientific positions is a simple matter of access to both education and employment and recommends the full integration of women into scientific fields. The question one asks here is why has this full integration not happened. Historian Joan W. Scott would argue that access or entry to scientific or professional fields is only the start—that "entry alone does not solve the problems of discrimination, that organizations are hierarchically differentiated systems, and that physical access is not the end of the story." The third viewpoint Schiebinger identifies argues that it is not enough for women to become scientists if science continues on its present course—that women must in fact work to make science more responsible and to use their entry into scientific professions as an opportunity to critique and change science from within.

Schiebinger has done an excellent job of identifying the four conceptual approaches and the three differing viewpoints offered within these approaches. Many of the articles referred to in this chapter could be categorized within the first conceptual approach of compensatory history. One could argue, however, that recovery or compensatory history also involves analysis, as many of these articles do, and that the distinctions among the approaches identified by Schiebinger are blurred rather than sharply delineated. In addition, one could argue that the history of women in science remains necessarily a matter of recovery since there is so much to be done, particularly in the field of Canadian women in science. Since the research on Canadian women in science also commenced at a much later date than the research on American women in science, the processes of recovery and analysis are often carried out simultaneously in this country.
Schiebinger's book, *The Mind Has No Sex? Women in the Origins of Modern Science*, also makes an important contribution to the history of women in science in Europe. It explores a number of key issues such as why there are so few women scientists today, why there are so few that we know about from the past, and what the nature is of what Schiebinger calls the "long-standing quarrel between science and what Western culture has defined as 'femininity.'" The author asserts that it is necessary to re-examine the history of women in science in order to understand the way in which gender differences operate in science today. Schiebinger first looks at the development of the institutions of science, focusing on how gender divisions were negotiated in universities and scientific academies of the seventeenth century. She shows how modern science originated in the academies, courtly circles, Parisian salons, and artisan workshops in which a number of women managed to make a place for themselves, as well as in medieval universities that remained closed to all but a few exceptional women scholars. Schiebinger argues that, in earlier times, it was not at all obvious that women would eventually be excluded from the "new institutions of science."

The author also offers a number of biographical sketches of early women scientists and natural philosophers such as Emilie du Chatelet, physicist; Maria Winkelman, astronomer; Margaret Cavendish, natural philosopher; Dorothy Erxelben, Germany's first medical doctor; Caroline Herschel, astronomical assistant; and many others. By examining the lives of women prior to the twentieth century, Schiebinger is able to show how women were excluded from the new scientific institutions and were increasingly restricted to the private sphere of the home where they often became "invisible assistants" to the male members of their families. She also explores how the
"scientific readings of female nature were used to argue for or against the participation of women in science," and she examines the "cultural meanings" of femininity and masculinity. Finally, she explores how the theory of sexual complementarity was used to justify the exclusion of women and what came to be defined as "feminine" from the scientific world. In many ways, Schiebinger's work and the work of Thomas Laqueur in *Making Sex: Body and Gender from Greeks to Freud* intersect. Together the authors show how the development of modern science and the scientific construction or reconstruction of the notions of sex and gender led to a serious constriction of women's roles within both the scientific community and society at large. Schiebinger concludes her book by examining "the self-reinforcing character of the gender system in science."

Pnina Abir-Am and Dorinda Outram's *Uneasy Careers and Intimate Lives: Women in Science, 1789-1979* is a collection of essays on women in science that examines the careers of a number of nineteenth- and twentieth-century European and American women scientists such as astronomer, Maria Mitchell; mathematician, Sofia Kovaleskaia; research scientist, Marie Curie; astronomer, Cecilia Payne-Gaposchkin; and mathematical biologist, Dorothy Wrinch. The essays explore the impact of family life on women's scientific careers and challenge the notion that the scientific community was primarily male even as late as the nineteenth century. In their introduction, Abir-Am and Outram also call into question the idea that "the development of modern science can be understood only in terms of progressive 'professionalization.'" The term "professionalization" implies paid positions for full-time pursuit of scientific work within institutional structures rather than at the vagaries of patronage, as well as formal
certification of professional competence through recognized educational institutions or licensing bodies.

Although Abir-am and Outram note the strong movement in the direction of professionalization and institutionalization of scientific endeavours, they state that most of the scientists discussed in the essays fail to conform in one way or another to these norms of professionalization. A number of exceptional women scientists struggled against the grain of professionalization and managed to continue operating within the family context or as independent researchers. The essays draw attention to the way in which science was transformed from a domestic and often amateur context to an institutional one and the detrimental impact of this change on many women scientists.

In “Women in Early Geology,” Eleanor S. Elder uncovers the previously invisible contributions of three groups of women: those who “assisted” husbands in their geological careers; those who were amateur naturalists and fossil collectors; and those women who formed the more recent group of professionally trained geoscientists. Although Elder concentrates on American women in science in this article, she also outlines the contributions of a number of European and British women scientists. Martine de Bertereau, Baroness de Beausoleil (1602-1640) assisted her husband who was a mining engineer, and in the process gained equal expertise, writing most of his reports. This husband-wife team was broken up when they were accused of sorcery and thrown into jail by Cardinal Richelieu.26

Mary Ann Anning (1799-1847) was a Lyme Regis fossil collector, trained by her father, and well known in paleontological circles for her identification and description of specimens and for contributions to important museum collections. The British Museum
in fact granted her a pension in recognition of her outstanding work. Elizabeth Philpot (1780-1857) and her sisters Mary and Margaret also were residents of Lyme Regis in Dorset and, according to Elder, were equally avid fossil collectors who were well known in professional circles for their fine “cabinet” of specimens. Swiss geologist Louis Agassiz made extensive use of specimens supplied by Elizabeth Philpot in his five-volume *Recherche sur les poissons fossiles* (1833-44), and he named a species after her, *Eugnathus philpotia*. William Buckland, another leading geologist of the era, also referred to Elizabeth in his publications.

Elder makes an important point regarding the distinction between “closet” and “field” naturalists in terms of who wrote the publications and who collected the fossils:

Although it may be argued that neither the Philpots nor Mary Ann Anning made original contributions to science, it should be remembered that the structure of scientific community was completely different in the nineteenth century. Not only were they female (for whom publication of any kind was socially unacceptable, as evidenced by the great numbers of women writers and illustrators who published anonymously), but as naturalists, they came closer to the ‘field’ variety. Barber (1980) points out that there was a sharp distinction between the ‘closet’ naturalists and the ‘field’ naturalists; the former almost exclusively did the writing and reporting while the latter did the collecting.

The Philpots and Mary Ann Anning therefore had less prestige as collectors and field naturalists than they would have received as closet naturalists or writers.

Mary R.S. Creese and Thomas M. Creese also comment on the prominence of British women in nineteenth-century geology in “British women who contributed to research in the geological sciences in the nineteenth century.” By counting the number of geological papers by women listed in the Royal Society’s *Catalogue of Scientific Papers* from 1800 to 1900, the authors found that 118 out of 181 (65 percent) were by British women, 23 were by Russian women and one was by a Polish woman (13 percent), and 16
(9 percent) were by North American women. The authors attribute the prominence of British women in the geological field to a number of factors: the widespread interest in geology in Britain in the early decades of the century; the establishment of numerous provincial scientific societies that accepted women in the second half of the century; the establishment of formal instruction in the earth sciences in leading girls' secondary schools from the 1860s onwards in contrast to the leading boys' schools, which still emphasized a classical curriculum; and women's entry to university-level training in geology from the 1870s.

The Creeses group the British women in geology into two distinct but slightly overlapping categories of amateur naturalists and university-trained geologists:

The first comprises the small but fairly continuous progression of self- or privately-taught 'amateurs', for the most part observers, collectors and classifiers, who, along with their far more numerous male counterparts in the naturalist tradition, were active from the early decades of the century. Those in the second category, the women with formal university training in geology, appeared in increasing numbers from the 1880s onwards, following the establishment of the women's colleges at Cambridge, the improvement of one or two already in existence in London, and the admission of women to some of the other universities.

The authors also emphasize that a significant number of nineteenth-century British women scientists received their training at Cambridge University. They attribute the influence of Cambridge to a number of factors. The opening of Girton College in 1869 and Newnham College in 1871 at Cambridge predated the opening of courses for women at Oxford University and the University of London by about a decade. In addition, connections between the Cambridge colleges and the leading girls' schools were established when graduates from the colleges began to take up teaching positions at these girls' schools and send a steady stream of their top students to study at Cambridge.
authors also attribute the Cambridge Natural Sciences Tripos curriculum for encouraging both academic excellence and original research. In particular, the authors suggest that the geology curriculum "was especially successful, combining specialized work with a broad, integrated scientific training." 

The Creeses estimate that two-thirds of the professionally trained women geologists in this period were graduates of Cambridge (eight were students of Cambridge, three were students at University College London, and one was a student at Oxford). Two geology professors at Cambridge, Thomas McKenny Hughes and John Edward Marr, were highly influential in training the majority of the professionally educated British women geologists in the nineteenth century. Both Professors Hughes and Marr were "widely recognized for their original work and inspiring teaching, and at a time when women students were still not routinely admitted to lectures and laboratories they welcomed them into theirs." 

Although the Creeses devote considerable attention to outlining the contributions of women in the amateur geology category, they suggest that the contributions of the post-1880 university-trained geologists soon eclipsed the work of the earlier group of amateurs, even though there was some overlap in the categories. In particular, four of the group of twelve geologists with university-training made outstanding contributions to the field: Marie Ogilvie Gordon, Catherine Alice Raisin, Gertrude Lilian Elles, and Ethel Wood.

Ogilvie Gordon (1864-1939) received her London D.Sc. in 1893, the first in geology awarded to a British woman, and her Ph.D. in geology from the University of Munich in 1900. After the publication of numerous papers in the Quarterly Journal of the
Geological Society as well as two monographs on fossil corals, in 1927 Ogilvie Gordon published a two-volume monograph on the stratigraphy, tectonics, and paleontology of the South Tyrol. Another monograph, a geological guide to the western Dolomites, was published the following year. In total, Ogilvie Gordon published over thirty papers as well as translating von Zittel's *History of Geology and Palaeontology*. She was recognized by the University of Innsbruck, the Geological Survey of Austria, and by the London Geological Society, which awarded her the Lyell Medal.39

Catherine Alice Raisin (1855-1945) was the first woman to take geology classes at University College. She received her B.Sc. in geology and zoology in 1884 and her London D.Sc. in geology in 1898, the second such degree awarded to a woman. Raisin assumed the position of head of the geology department at Bedford College for Women in 1890, and she continued to hold this position for thirty years until she retired. She was in fact the first British woman to become the head of a geology department. Raisin published twenty-four papers in the period from 1887 to 1905 and was awarded the Lyell Fund in 1893.40 She was the first woman to receive this award from the Geological Society as well as one of the first women geologists to be accepted to the Geological Society when women began to be admitted in 1919. She was a member of the Geologists' Association for sixty-seven years, since it had never barred entry to women. Raisin was also a social activist who worked diligently for women's causes.41

Gertrude Lilian Elles (1872-1960) was one of the early Newnham College graduates in geology, also studying under Professors Hughes and Marr. She received her Dublin D.Sc. in 1907, but had to wait until 1948 for Cambridge University to retroactively grant her the doctorate she had earned forty-two years earlier.42 Elles was
another one of the first women admitted by the Geological Society, and she was made a Fellow in 1919. She was awarded the Lyell Fund in 1900, the Murchison Medal in 1919, and she was President of Section C of the British Association for the Advancement of Science. Despite all these accolades, Elles remained at Cambridge without an official academic position until she received a lectureship in 1926 under the Revised Statutes of the university. She became the first woman Reader at Cambridge close to her retirement. At Newnham she served as Lecturer, Fellow, Vice-Principal, and Honorary Fellow.43

Ethel Wood (1871-1945) was also a student of Hughes and Marr at Newnham College, and her first publication was a study of the Lake District co-authored with Elles and published in the Geological Magazine in 1895. In 1904 Wood was awarded the Wollaston Fund by the Geological Society. She became an Associate of Newnham College in 1905, and received a D.Sc. from Birmingham University in 1906. Although Wood gave up her teaching position on her marriage to G. A. Shakespear, a lecturer in physics, she continued her research collaboration with Gertrude Elles. She became a Fellow of the Geological Society in 1919, and she received the Murchison Medal after the publication of the final part of the Elles and Wood monograph. Like many of the other early women geologists, Wood had a high sense of civic responsibility and undertook considerable volunteer work during World War I. She was recognized for her voluntary efforts with the MBE in 1918 and the DBE in 1920.44

The Creeses also emphasize the important work of Russian women geologists, whose graduation from Russian institutions paralleled the appearance of the professionally trained British women geologists in the post-1880 period. The authors attribute the emergence of the professionally trained Russian women to the establishment
in the 1870s of the Higher Courses for Women in St. Petersburg, Moscow, Kiev, and other major centres. The authors note that three Russian women geologists were prominent contributors to the *Royal Society Catalogue*: Mariia Tsvetaeva, Evgeniia Solomko-Sotiriadis, and Mariia Pavlova.

Mariia Tsvetaeva (born 1854) studied under S.N. Nikitin at the Lubianskie Higher Courses for Women and continued her field studies under Nikitin along the Volga in later years. Although much of her work was incorporated into Nikitin’s publications, in 1888 and 1898, two monographs were published under her own name in the *Bulletins of the St. Petersburg Geological Committee*. She was not only one of the few women geologists to attend the International Geological Congress held in St. Petersburg in 1897, but she was also a member of the Organizing Committee for the event.46

Evgeniia Solomko-Sotiriadis (1862-98) studied at the Higher Course for Women in St. Petersburg and then with von Zittel in Munich, as did many of the British women geologists. She received her Ph.D. from the University of Zurich in 1887 and published two monographs on stromatoporoids and Jurassic and Cretaceous corals.47 Her career was impressive despite her short life.

Mariia Pavlova (1854-1938) was the author of over half of the pre-1901 publications by Russian women geologists. The Creeses conclude that Pavlova was the most distinguished of the group of Russian women geologists since she was known in international circles for her important work on fossil ungulates and evolutionary theory:

Following studies at the Sorbonne in the early 1880s, she worked at Moscow University’s geological museum (of which she was later director), and from 1910 until 1917 taught at the Lubianskie Higher Course for Women. After the October Revolution she became a professor of palaeontology at Moscow University, and in 1925 was elected a corresponding member of the Soviet Academy of Sciences.48
The historians who have researched the topic of European, British, and Russian women in science have uncovered a rich collection of the experiences of their subjects and their contributions to various fields. Some of these women in science had strong American ties, and many of the historians wrote about American as well as European, Russian, and British women in science. The connections between the fields of historical research and the cross-border influences on scientific disciplines in Europe, Britain, Russia, and the United States lead naturally to the next topic of discussion, American women in science.

**American Women In Science**

In the article "In from the Periphery: American Women in Science, 1830 to 1880," Sally Kohlstedt examines the early participation of American women in the sciences in terms of three loosely defined and overlapping categories: "independents, disseminators, and group coordinators." In the early decades of the nineteenth century, Kohlstedt states that women worked as independent investigators, rarely asking for or receiving public recognition for their efforts. Many of them were amateur naturalists from upper middle class families, who collected plant specimens in collaboration with male family members or for the purposes of correspondence with professional botanists. The next generation of women scientists, working at mid-century, acted as disseminators of science through the production of textbooks and scientific illustrations. Kohlstedt notes that these women "remained within their prescribed sphere, working primarily as educators and populizers."

The third generation of women scientists chose to pursue their interests either by working in local and amateur scientific clubs or by working in the emerging scientific
professions in post-Civil War America. Kohlstedt states that "An increase in relative numbers of women in science and a growing spirit of camaraderie created a positive environment for those who finally found full-time employment and were accepted as professionals in the 1880s." The work of historians such as Patricia Palmieri also has shown how social and demographic factors had a significant bearing on the opportunities for this generation of women scientists. The high attrition of the war years meant there were fewer prospects in terms of husbands for the post-Civil War generation of women. Spinsterhood and professional careers therefore became more respectable as the need for self-support became more pressing. The categories Kohlstedt has developed are very helpful in examining American women's contributions in the geological sciences, and Marianne Ainley's work in "Last in the Field? Canadian Women Natural Scientists, 1815-1965" also shows that they could prove useful in the Canadian context.

Eleanor Elder also identifies Erminnie Adel Platt Smith (1836-1886) as an early contributor to geology in the United States. Smith was a graduate of Troy Female Seminary and had the advantage of taking the advanced science courses offered there. After her marriage to a wealthy lumber dealer, Smith continued to pursue her interest in geology as an amateur. When she accompanied her boys to school in Germany, she was able to study crystallography at Strausbourg and mineralogy at the School of Mines at Freiberg. Elder notes that on her return to Jersey City, Smith's home "took on the appearance of a mineralogical museum where she delivered lectures on geological and cultural subjects." Although Smith did not hold a professional position, she presented papers to scientific associations such as the American Association for the Advancement of Science, and she was well known for her later work in anthropology. Her career
shows the fluid movement of scientists from one area of science to another, as the
disciplinary boundaries were not well defined in this period.

Elder also mentions the work of a number of professionally trained geologists
such as Florence Bascom, Ida Ogilvie, Mignon Talbot, Carlotta Maury, and Elizabeth
Florette Fisher. These women were also prominent as early contributors to the geological
sciences, and their work was recognized in Cattell's first edition of American Men of
Science.\(^{56}\) Florence Bascom (1862-1945) founded the Bryn Mawr Department of
Geology and was responsible for training many of the first generation of American
women geologists. Her famous students included Ida Ogilvie, Julia Gardner, Eleanora
Bliss Knopf, and Anna Jonas Stone.\(^ {57}\)

Mignon Talbot (1869-1950) was an Ohio State graduate who went on to receive
her doctorate from Yale and to have an outstanding career in the geology department at
Mount Holyoke.\(^ {58}\) Carlotta Maury (1874-1938), educated at Radcliffe College, the
University of Paris, and Cornell, was one of the few women in this period to earn her
living in the oil industry. She taught for a number of years at Columbia University and
worked for the Louisiana Geological Survey, but she also worked as a consultant for
many years for the Royal Dutch Shell Petroleum Division, as well as for the Geological
and Mineralogical Survey of Brazil.\(^ {59}\) Elizabeth Florette Fisher (1873-1941) was a
graduate of Massachusetts Institute of Technology who became a professor of geology at
Wellesley College. One of her students, Winnifred Goldring, became the first woman
president of the Paleontological Society.\(^ {60}\) The most important point that Elder's
examination of the careers of these early geologists reveals is the strong influence of
women's colleges and their science programs on the early generation of professionally-trained American women scientists.

Lois Arnold's 1975 article, "Florence Bascom and the Exclusion of Women from Earth Science Curriculum Materials," documents the sexism in earth science textbooks in three specific areas: "the comparative absence of women and girls from illustrations and the reinforcement of sex-role stereotypes in them, the use of language that excludes women, and the omission of women from portrayals of the history and present activities of the earth sciences." Critiques such as Arnold's have resulted in marked improvement in science textbooks in recent years. Arnold devotes considerable attention in her article to documenting the remarkable career of Florence Bascom, who was the first woman to gain a Ph.D. at Johns Hopkins and the first American woman to receive a doctorate in geology. As Elder's article mentioned, Bascom taught for two years at Ohio State University and then spent the rest of her career building the geology department at Bryn Mawr, working in the summer for the United States Geological Survey. In 1894, Bascom was the first woman to be elected a Fellow of the Geological Society of America. Arnold also comments on Bascom's tremendous influence on the following generation of scholars:

Her example, and the excellence of the department that developed under her leadership, attracted students from all over the country, and foreign countries as well. Of these, many became eminent geologists in their own right. In addition to Ida Ogilvie, who founded the geology department at Barnard College, there were Anna Jonas (Stose), chief geologist with the U.S.G.S. [United States Geological Survey], and Eleanora Bliss (Knopf), who taught at Yale. Julia Gardner, a leading paleontologist with the U.S.G.S., and Dorothy Wyckoff, who followed in Bascom's footsteps at Bryn Mawr, were also her students. As an indication of the way in which she steadily opened up the profession of geology for other women, by 1937 there were 11 female Fellows of the Geological Society of America, of whom 8 were graduates of Bryn Mawr.
In “A Life of Firsts: Florence Bascom,” Jill S. Schneiderman adds the following names to the list of famous students taught by Florence Bascom: Katharine Fowler-Billings, Louise Kingsley, crystallographer Mary Porter, petroleum geologist Maria Stadnichenko, Scripps College's Isabel Fothergill Smith, and Anna Heitonen. Schneiderman also refers to a letter Bascom wrote to Professor Herman Fairchild in 1931 explaining her approach to teaching: "I have always claimed that there was no merit in being the only one of a kind....I have considerable pride in the fact that some of the best work done in geology today by women, ranking with that done by men, has been done by my students....these are all notable young women who will be a credit to the science of geology."

Michele L. Aldrich's “Women in Paleontology in the United States 1840-1960” covers much of the same territory as the previous two articles in her description of the more recent generation of professionally trained scientists. However, Aldrich also does an excellent job of recovering the contributions of an earlier generation of scientific illustrators. Aldrich credits the “accomplishments” curriculum at the early girls' schools and academies such as Troy Female Seminary and Mount Holyoke for training women in sketching. It was their ability to sketch and colour maps that gave women such as Orra White Hitchcock (wife of Edward Hitchcock of the Massachusetts State Survey), Sarah Hall (wife of New York district geologist James Hall), and others such as Mrs. Brooks, Miss or Mrs. H. Martin, and Cecilia Beaux (who later became a well-known portrait artist), the opportunity to supplement or earn their income as scientific illustrators. In “Women in Geology,” Aldrich states that it was artistic work that initially gained women a tentative entry to the geological sciences:
Women, then, first appeared in American geology in the role of scientific artists. Their function reflected women's schooling at the time and seemed consistent with femininity, which made it easier to get a toehold in the science and accustomed men to women's involvement in geology. Most importantly, women contributed significantly to the science itself by conveying evidence about specimens and landscape through proficient and attractive drawings.  

Aldrich also notes that American women were active from the 1850s on in collecting specimens for the state geological surveys. Miss Errington collected for the California Survey and had a fossil named after her, Mrs. Oakley collected for the Mississippi State Survey, and Mary P. Haines collected for the Indiana State Survey. Other women wrote books on geology topics such as Hester Lynch Piozzi's account of an Italian earthquake, Mary Austin Holley's book on Texas, Lydia Maria Child's account of a visit to Mammoth Cave in Kentucky, and Susan Fenimore Cooper's observations of the natural landscape of New York. These observer accounts were followed by the publication of poetry on geological topics and then by textbooks on geology written by well-known women's educators such as Emma Hart Willard and her sister Almira Hart Lincoln (Phelps). Together these women form the cohort that Kohlstedt has categorized as scientific disseminators. Aldrich concludes the following:  

Though the number of women who published in geology was small, they popularized the discipline through textbooks, articles in magazines, and even poetry. Individually, their contributions to the field of geology may seem minor, especially to a modern scientist used to large-scale research projects. As Sally Gregory Kohlstedt remarked about women in nineteenth-century American science generally, these women were at the periphery of the science, not its center. Nonetheless, their collective presence was a significant precedent for the more intense, professional involvement of women in geology in the 1890s and into the twentieth century.  

Aldrich points out that these "geologic artists, collectors, and writers were not professional geologists who did research and published it under their own name for wages." Although they did not fit the category of professional geologists, many of the
illustrators, fossil collectors, and writers were paid for their work, and they may have considered themselves to be somewhere between amateur and professional status. In *Women Scientists in America: Struggles and Strategies to 1940*, Margaret Rossiter also points out that Almira Hart Lincoln (Phelps) followed her sister Emma Willard’s example with textbook writing because she was a widow and needed to earn a living. By attending the lectures of Amos Eaton, a science professor at Rensselaer School, Lincoln was able to gain enough knowledge to write a very successful series of textbooks, starting with her first book, *Familiar Lectures on Botany*, which went through seventeen or more editions.74 Rossiter states that “This and her other textbooks on chemistry and natural philosophy eventually made her a wealthy woman.”75 She also taught at Troy Female Seminary and at the Patapsco Female Institute in Maryland.76 Willard herself undoubtedly helped sustain Troy Female Seminary through the proceeds of her publishing. Although these women may not have considered themselves professional scientists, they were able to earn a living from their work.

The discussion of amateur versus professional status is also relevant with respect to British women fossil collectors such as Mary Ann Anning and the Philpot sisters. Although they fit Kohlstedt’s category of independent investigators and amateur naturalists, their collecting activity may have allowed them to achieve a degree of economic independence. Anning supported herself and her family through the sale of fossils, and the Philpot sisters also may have relied to a certain extent on income from the sale of fossils, despite the fact that their home was provided by a brother.77 One of the key questions raised by the articles under discussion is whether women’s scientific activity fits into the category of professional if it is done outside of an academic setting.
and without the credentials provided by an academic or scientific institution. A corollary of this question asks where payment for services fits into the equation of professionalism. These are difficult questions to answer but important ones to raise. The discussion will return to the topics of professionalism and its definition in the next chapter under the heading of “Literature on Women in Academia and the Professions.”

Aldrich’s article on women and geology also raises the issue of field work for professionally trained geologists. Gaining entry to field work was the initial problem for women, but how to dress, how to act, and how to gain treatment as equals were also troubling issues. Although this topic will be discussed in detail in Chapter Three, Aldrich’s description of the problems is informative:

Doing field work was something of a vexing issue early in the era of women’s entry into professional geology. The problems ranged from the trivial (what to wear) to the serious (safety). Winnifred Goldring was urged by Ray Bassler of the U.S. National Museum not to imitate Marjorie O’Connell’s example of arming herself with a revolver and heading into the field. The disapproval was not voiced by men only, however. Mignon Talbot of Mount Holyoke College, who included field trips in training her students, nonetheless believed that laboratories, offices, or museums were more proper spheres for women than most field locales. Many women geologists simply ignored this taboo and went into the field to do research, despite bad health, the inconvenience of dress, and the head-shaking of colleagues.

The issues of breaking gender boundaries and defying taboos about participation in field work recur repeatedly in the literature on women in the geological sciences. Cynthia Irwin-William’s article, “Women in the Field: The Role of Women in Archaeology before 1960,” also shows that women archaeologists faced similar problems in gaining entry to field parties.

Before the analysis moves to the Canadian women in science field, it is necessary to outline the important contributions made by Margaret Rossiter on American women in
science. Rossiter’s two books, Women Scientists in America: Struggles and Strategies to 1940 and Women Scientists in America Before Affirmative Action, 1940-1972, and her numerous articles are the key references on this topic. In her first book, Rossiter examines the emergence of women in science in terms of three main periods: before 1880, 1880 to 1910, and after 1910.\(^{80}\) In the earliest period, education for women was justified on the grounds that it would improve women’s performance as wives and mothers. This period in the United States has been referred to as one of “Republican Motherhood,” in which women devoted their spare time to religious activities, good works, and local reading and scientific clubs.\(^ {81}\)

In the second period, women confronted the increasing professionalization of the sciences and sought entry to employment in museums, research institutes, and observatories, as well as entry to professional organizations. The reaction of the professional organizations to “impending feminization” was very interesting: some of them raised the standards of entry in order to exclude women; others developed a two-tiered or multi-tiered membership to keep women in subordinate positions.\(^ {82}\)

Rossiter points out that after 1910, the innovative and fluid movement of women into new professions ended, and women began to be more rigidly confined to a narrow range of activities in the sciences. She also highlights two types of strategies employed by women scientists in order to overcome professional barriers: the first was an “idealistic, liberal-to-radical, and often confrontational strategy”\(^ {83}\) in which women demanded full equality and the rejection of stereotypical female roles; the second was “a more conservative and ‘realistic’ tactic”\(^ {84}\) in which women reluctantly accepted the inequality and constraints of sexual stereotypes and sought to work within these
constraints to build areas of expertise for women. The development of fields such as social work exemplified this second strategy. Rossiter argues that success in terms of numbers of women entering scientific fields was gained at the expense of "accepting a pattern of segregated employment and underrecognition."\textsuperscript{85}

In \textit{Women Scientists in America Before Affirmative Action, 1940-1972}, Rossiter depicts the 1942 to 1972 period as a disappointing one for American women in science, particularly in light of the extensive government campaigns in the war years to encourage women to seek advanced degrees in scientific and technical fields.\textsuperscript{86} In the period of affluence and growth in the United States after World War II, Rossiter notes that more doors closed than opened for women in science. She states that this period of affluence unleashed forces "that hastened the women's exit and subsequent marginalization and underutilization, which could then be cited to justify denying further training for their successors."\textsuperscript{87} Rossiter outlines how the traditional employers of women such as women's colleges, teachers' colleges, and home economics departments started closing doors to women faculty members and how they were largely excluded from teaching positions in the new coeducational colleges and universities. The anti-nepotism policies of universities affected married women adversely, but Rossiter shows that even single women had difficulty in gaining faculty positions.\textsuperscript{88}

In an effort to become prestigious institutions, many schools became state universities, hired new Ph.D.s, and began to encourage extensive research activities. Part of the sign of "progress" was to discard the "old girls" who had been hired in an era that had been more welcoming to women faculty members.\textsuperscript{89} Rossiter calls this process the "masculinization of formerly female-dominated areas."\textsuperscript{90} She also suggests that this
“chill” went beyond employment to influence awarding of prizes and election to professional organizations.91 Leaders of some women’s organizations spoke out about this discrimination, but Rossiter argues that on the whole, organizations such as the American Association of University Women (AAUW) and the National Federation of Business and Professional Women’s Clubs were “less outspoken” and more cautious than they might have been.92 It was not until the 1960s when women such as Betty Friedan and sociologist Alice Rossi started to publish books and articles and the civil rights movement provided a model for action that a women’s movement started to take shape.93

Rossiter documents the numerous status of women reports produced in the late 1960s and early 1970s and the federal hearings on sexual discrimination in the workplace and on campuses, all of which led to equal pay and affirmative action legislation by 1972. The author concludes that record numbers of women scientists existed during the 1950s and 1960s, but they were marginalized and underutilized:

Trained to advanced levels, they were, to use some military terms of the period, ‘camouflaged’ as housewives, mothers, and ‘other’ and ‘stockpiled’ in cities and college towns across America (where many still remain), ready but uncalled for the big emergency that never came.94

Rossiter’s work adds significantly to the history of American women in science particularly because her work focuses on the contributions of the ordinary women scientists, not just the exceptional achievers. It is an interesting question as to whether women scientists in the post-war period in Canada experienced the same shutting down of opportunities and closing down of doors to faculty positions and professional associations. Alison Prentice’s work on women faculty in the physics department at the University of Toronto seems to confirm that this may have been the case in at least one
department. The results of the current study suggest that the exact opposite may have occurred in Alberta after the oil discoveries at Leduc in 1947.

An article by Rossiter, “Sexual Segregation in the Sciences: Some Data and a Model,” helps explain why this may be the case. Rossiter has adapted U.S. Geological Survey Director Henry W. Menard’s theory about the effect of the “growth rate” of particular branches of science on the career track of scientists in those fields. She extends this model to examine the “employment opportunities for women and minority groups and the attitudes of other scientists to them.” Rossiter’s hypothesis was that employment opportunities for women and minorities would expand during periods of shortages of trained professionals such as when fields are rapidly expanding:

...in a rapidly growing field, with a shortage of highly qualified people, women would be tolerated and even sought out, especially since they would be typically paid lower salaries than men. But in a crowded field where the growth rate had slowed, as in some fields in the 1930s, women, especially married women, would be the first people laid off, or would not be hired.

Rossiter thought she would find a correlation between the “growth rates in various sciences in a given period and the percentage of women entering each field.” In fact, what she found was that women were more likely to be found at “the two extremes of the growth curve”—at the top end where fields were rapidly expanding and at the bottom end where fields were stagnating or shrinking in terms of demand. Rossiter concludes:

Thus women were not only likely to enter and be welcomed into rapidly growing fields but they were, at the same time, more willing than men to endure the hardships of a stagnant or shrinking field. They were relatively less attracted to fields undergoing average growth, where normal competitive and discriminatory practices prevailed.

The Menard-Rossiter model may be applicable to the geoscience fields in Alberta, particularly after the petroleum boom in the late 1940s when there were shortages of
trained professionals in the geological sciences. However, the sample size of the current study is too small to offer definitive proof.

In *Unequal Colleagues: The Entrance of Women to the Professions, 1890-1940*, Penina Glazer and Miriam Slater also contribute to the scholarship on women in the professions by identifying the four strategies of superperformance, separatism, innovation, and subordination.\(^{103}\) Using a biographical approach, Glazer and Slater examine the careers of nine outstanding American women who were pioneers in the professions of college and university teaching, medicine, research science, and psychiatric social work. Their study examines the careers of Mary E. Woolley, academic administrator; Nellie Nielson and Bertha Putnam, historians; Dorothy Reed Medenhall and Anne Walter Fearn, physicians; Florence R. Sabin and Alice Hamilton, research scientists; and Mary C. Jarrett and Bertha C. Reynolds, social workers. The authors find that the women adopted the strategies of superperformance in all of the fields, separatism in the women's colleges, innovation in research science and public health, and subordination in the field of social work.\(^ {104}\) However, Glazer and Slater note that their subjects often had to employ more than one strategy over the course of their careers, and that individual strategies were not narrowly confined to any one field.

The authors also comment on the tactic of superperformance and its implications for the nine high achievers in their study:

Superperformance was an obvious approach: women sought professional status through extraordinary efforts and performance. They overcame barriers by dint of hard work, outstanding ability, and their willingness to sacrifice traditional relationships for their careers. Very few of the women who reached the highest places married; many were willing to forgo the conventional boundaries of private life. Since they had no children and tended to be geographically removed from their families of origin, relations with colleagues served as their principal social and familial outlet.\(^ {105}\)
Glazer and Slater also suggest that the personal sacrifices made by women who chose careers in the separate women’s schools and colleges may have worked for their generation of scholars, but could not be sustained in the next generation:

What the separatists failed to address was the durability of marriage and motherhood as compelling traditions that were reinforced by all major structures in society. Although the majority of women students always saw college as an interlude before marriage, during the first three decades of the twentieth century substantial numbers of young women were socialized to accept the virtues of professionalism and scholarship over marriage. But the need of the colleges to operate in the larger world undermined their long-term capacity to resist these pressures.106

Glazer and Slater note that superperformance was also applicable to women who chose to marry. In combining marriage and motherhood with academic careers, many women went to extraordinary lengths to ensure that they did not neglect their roles as homemakers and mothers. In the process many of them had to subordinate career ambitions to domestic considerations.

The authors emphasize the fact that separatist education for women not only provided scientific training for students, but was also a key employer of women graduates and a key source of funding for postgraduate training:

For some fields, such as physics and math, the women’s colleges represented virtually the only possible employer of female professionals. Several of the colleges’ important leaders, Mary Woolley and M. Carey Thomas among others, were more fully aware of the need to foster opportunities for the ongoing professional development of their faculties. The most ambitious among the women presidents ferreted out every possibility. They cajoled, bargained, and pleaded to obtain adequate financial resources to fund postgraduate work, sabbaticals, and professional meetings and to build a general endowment that would secure the future of their institutions.107

To add to this point, Margaret Rossiter shows in Women Scientists in America: Struggles and Strategies to 1940 that in women’s colleges such as Bryn Mawr, where
strong science departments developed, faculty planned for their succession by mentoring talented women students and encouraging them to pursue Ph.D.s at prestigious universities so they could later hire them back. In fact, Rossiter notes that faculty members who were not able to find students willing to succeed them expressed considerable regret. Faculty members such as Ida Ogilvie at Barnard were known to have used their own private wealth to support students in further graduate studies.

Glazer and Slater conclude that although the strategies of superperformance, separatism, innovation, and subordination proved effective for individual women achievers, they did not provide for succession by the next generation of women scholars because exceptional women were not sufficiently numerous or in sufficiently powerful positions to be able to assist the next generation of students. The questions the authors raise about the impact of separatist and superperformance strategies are of particular relevance to the study of women in geosciences, a field in which many of the early achievers also chose to remain single, to seek professional advancement through exceptional achievement in their fields, and to focus on the public rather than the private sphere of their lives. American scholars have uncovered similar themes to their European colleagues. Yet other themes emerge which are more closely tied to the Canadian rather than the European experience.

Canadian Women in Natural Sciences and Geology

Marianne Gosztonyi Ainley has made an important contribution to the history of Canadian women in science through her numerous publications on the topic. Ainley suggests that there are gender dimensions to the values that different sciences place on field work, museum work, and laboratory work. Ainley’s research, as well as that of
Morris Zaslow in *Readings the Rocks: The Story of the Geological Survey of Canada, 1842-1972* shows that the few women employed by the Geological Survey in the 1880s and 1890s were usually employed in the office or the library. By World War I, women had begun to work as photographers and as museum assistants, cleaning and sorting specimens for the Geological Survey. Ainley asserts that early Canadian women geologists such as Alice Wilson and Madeleine Fritz experienced "lateral segregation" (being channelled into certain areas of science), and/or "hierarchical segregation" (being kept in undervalued, underpaid positions). In "Last in the Field? Canadian Women Natural Scientists, 1815-1965," Ainley shows that the early scientific activity of Canadian women followed the same pattern as women in the United States. Although the author does not use Sally Kohlstedt's categories of amateur naturalists and independent investigators, scientific disseminators and illustrators, and group coordinators, the activities she describes fit these categories. Instead of using these terms, Ainley refers to a pre-professional and a professional period of women's scientific activity.

In the pre-professional period, amateur naturalists such as Lady Dalhousie and her friends Harriet Sheppard and Mary Ann Perceval collected plant specimens and founded the Quebec Literary and Historical Society in 1824. These women sent botanical specimens to Kew Gardens in England and to American botanists William Darlington and L. D. Schweinitz. Anne Grubble Haviland also was a Prince Edward Island collector who sent specimens to Kew Gardens. Lucy Lawson, wife of a Queen's University professor, was a founding member of the Botanical Society of Canada in 1860. Catherine Parr Traill of Upper Canada was perhaps the best known of these
early amateur naturalists since she published the results of her work in *The Backwoods in Canada* in 1836, *Canadian Wildflowers* in 1868 and *Studies in Plant Life in Canada* in 1885. Sister Sainte-Amélie at the Convent of Saint Croix, Montreal, was also another important plant collector.

In "Land of Promise, Promised Land: The Culture of Victorian Science in Canada," Suzanne Zeller comments on the amateur naturalist tradition in Britain and the impact it had on North American naturalists and writers such as Catherine Parr Traill. Zeller suggests that Traill and other North American naturalists were influenced by British naturalist Gilbert White's book, *The Natural History of Selborne*, written in 1788:

> A longstanding amateur naturalist tradition among educated classes in British society stimulated aesthetic as well as intellectual tastes for nature and natural objects. Natural history made it fashionable to go on nature walks, to observe plants and animals in their seasonal cycles, and to collect and classify natural specimens. Notebook, sketchpad, collecting box and butterfly net (the latter sometimes discreetly disguised as book and umbrella) became accoutrements of the genteel naturalist. Members of the aristocratic and professional middle classes habitually recorded sightings of flora and fauna, weather conditions, planting and gardening routines, and other eclectic information. An enormously successful example of the amateur naturalist outlook is preserved in Gilbert White, *The Natural History of Selborne* (1788), a charming collection of letters describing the natural environs of an English clergyman's parish, and one of the most frequently re-published books in the English language.

In *Sisters in the Wilderness*, her biography of Susanna Moodie and Catharine Parr Traill, Charlotte Gray also remarks on the influence of Gilbert White's book on Traill's writing. As a result of reading White's book as a child, Traill used it as a model for her Canadian botany manual. Gray provides the following details about White's focus of attention: "White, a country parson who lived in Hampshire, kept a careful record of the seasonal changes in his beloved birthplace. His work reflects a poetic affection for wildlife and nature, and a love of the picturesque in landscape."
The first edition of *Canadian Wild Flowers*, which Traill produced with her niece Agnes Fitzgibbon, was published in 1868 and received excellent reviews. Traill had more difficulty, however, in finding a publisher for her longer manuscript on the topic. There were several reasons for her difficulty. The first reason may have been that her writing style was beginning to seem a little old-fashioned, but the second important reason was that the study of natural history was moving out of the field and into laboratories where work began to be focused on the study of evolutionary change. Gray comments on the way in which academic and institutionalized learning began to crowd out the amateur naturalists:

Catharine’s writing style—the attractive mix of scientific nomenclature and literary elegance that she had learned from Gilbert White—was increasingly out-of-date. Interest faded in books that reflected sheer love of nature’s bounty and admiration of God’s handiwork. There was no room for gifted amateurs amongst the academically qualified male scientists in professional associations. In 1897, when D.P. Penhallow, professor of botany at McGill University, published a review of Canadian botany from 1800 to 1895, there was not a single woman mentioned in his list of over one hundred people who had contributed to the subject.

Despite the absence of their names in official publications, there were many other women engaged in amateur naturalist activities in Canada. Well-known botanists and collectors in the Canadian West included Marion Moodie, Edith Farr, Mary Shaefer, and Julia Henshaw in Alberta and British Columbia and Martha Black in the Yukon. Charlotte Flett King, the native wife of a Hudson’s Bay Company fur trader, was also active as an amateur zoologist and frequently sent samples from her collection of animal skins to American naturalists. Western writers on natural science topics included Moira O’Neill, a rancher from southern Alberta, Margaret and Esther Wemyss, homesteaders in Manitoba and Saskatchewan, and Elsie Cassels from Red Deer, Alberta.
Marianne Ainley has done an excellent job of identifying the early scientific work by Canadian women. Although Ainley does not use Sally Kohlstedt’s categories, they could perhaps be usefully applied to the early Canadian women as well as to the Americans. The work of identifying the Canadian women engaged in disseminating scientific ideas through their writings has only just begun on this side of the border, and there may be Canadian women other than Traill, Moodie, and Fitzgibbon who published books and article on natural history and fit this category. Certainly Ainley’s work suggests that several Western women regularly published articles on natural history in magazines and newspapers. Much like Almira Hart Lincoln (Phelps) and Emma Willard in the United States, Traill, Moodie, and Fitzgibbon were motivated to write not only for the pleasure of artistic expression, but also out of the economic necessity of having to earn or supplement their livings. Many of the Western women writers may also fit these circumstances.

Moving now from the amateur naturalist category of women in science to the academically trained, one again finds that Marianne Ainley has done the initial work of recovering and analyzing the participants’ contributions. In “Women’s Work in Geology: A Historical Perspective on Gender Division in Canadian Science,” Ainley provides short but interesting profiles of Alice Wilson (first a museum assistant and then a paleontologist with the Geological Survey of Canada), Madeleine Fritz (a professor at the University of Toronto and paleontologist with the Royal Ontario Museum), Helen Belyea (a senior scientist based out of the Calgary office of the Geological Survey of Canada), as well as Grace Anne Stewart (the first woman to graduate in geology in Canada). Both Belyea’s and Stewart’s careers will be outlined in detail in Chapter Five.
Ainley contends that women have been increasingly relegated to laboratory work in geology, while men monopolized the field work and the computer analysis that has now become so essential to the profession. She suggests that "in geology, with its old associations of masculinity and rugged outdoor activity, career advancement and recognition have remained different for men and women."¹²⁷ Ainley sees both hierarchical and lateral segregation in the field of geology, stating that "Women remain glorified technicians and assistants; they rarely work in the field, or do high-level interpretive work with computers."¹²⁸ She concludes that although opportunities have expanded for women geologists since the 1950s, "lingering stereotypes and the internal hierarchies of scientific practice can and do perpetuate previous gender divisions in science."¹²⁹

Barbara Sherriff and Shelly Reuter also offer short biographical sketches of five Canadian women geoscientists in "Notable Canadian Women in the History of Geology": Kathleen Lincoln Rice; Alice Wilson; Madeleine Fritz; Helen Reynolds Belyea¹³⁰; and Gabrielle Donnay. Of the women who earned Ph.D.s, all of them except Madeleine Fritz went to the United States for graduate studies. Kate Rice (1883-1963) is one of the few women prospectors documented in Canadian geology. She is credited not only as "the first female prospector in Manitoba, but also the only female dog musher in northern Canada."¹³¹ Rice lived and travelled alone in the north for much of her 45-year career and discovered nickel at Rice Island, an ore deposit at Schist Lake, and a feldspar deposit at Walrus Island. It is interesting that Rice graduated with the gold medal in mathematics from the University of Toronto, and with this training went on to pursue a career as a prospector in northern Manitoba.¹³²
Alice Wilson (1881-1963) is well known as the first Canadian woman to establish a career in geology in Canada. Wilson was a graduate of the University of Toronto with an honours degree in modern languages and history. She was first employed by the Mineralogical Division of the Royal Ontario Museum and then by the Geological Survey of Canada as a museum assistant responsible for dusting, sorting, and labelling fossils. Eventually she was able to obtain leave from the Geological Survey to complete a Ph.D. in invertebrate paleontology at the University of Chicago. Her life work included studies of the Ottawa-St. Lawrence Valley area and the shoreline of Lake Winnipeg, Manitoba.\(^{133}\)

Madeleine Alberta Fritz (1896-1990) was inspired by Alice Wilson to pursue a Ph.D. in geology at the University of Toronto after she worked on a field project with Wilson on Lake Winnipeg. Fritz worked on fossils at the Royal Ontario Museum, eventually becoming curator, and taught as a professor of geology and paleontology at the University of Toronto.\(^{134}\)

Gabrielle Donnay (1920-1987) graduated from the University of California with honours in chemistry, and pursued a Ph.D. at the Massachusetts Institute of Technology, investigating the structure of tourmaline. She spent twenty years with the Geophysical Laboratory, Carnegie Institute of Washington, and then became a faculty member at McGill University. Gabrielle and her husband Jose Donnay became internationally known for their work on crystallography.\(^{135}\) One of the participants in my study also mentioned that she took courses from Gabrielle Donnay at McGill University.

These individuals represent some of the early success stories for women in the geoscience fields in Canada. However, as Marianne Ainley suggests, only a “handful” of
Canadian women scientists were in this category. Despite obtaining advanced degrees, a second group of women scientists experienced somewhat marginal careers as teachers, research assistants, or helpmates to husbands in what Ainley calls the “two-person single career.” A third group worked as “volunteer investigators (or independent scholars),” and a fourth group gave up scientific careers to become homemakers, although they often continued to contribute as volunteers in museums and science centres. Margaret Rossiter’s work on American women in science has shown that the superachievers represent only the tip of the iceberg in terms of women’s work in the sciences, and the same is probably true in the Canadian women in science field.

Although these points conclude the presentation of information on the early Canadian women in geosciences, a more in-depth discussion of the careers of three early Canadian women in geosciences will follow in Chapter Five of the dissertation. Two of the women, Grace Anne Stewart and Helen Belyea, fit Rossiter’s and Ainley’s descriptions of superachievers, and the third, Mary Turner (Pandachuk), fits Ainley’s fourth category of women scientists who gave up careers to become homemakers, but continued to contribute through teaching or voluntary activities.

**Conclusion**

This chapter shows both the fluid movement of scientific knowledge and expertise across the European, British, Russian, American, and Canadian borders and the need for further research and documentation on Canadian women in science. To date, the Canadian women and science field has been primarily preoccupied with documenting and analyzing the history of early women achievers. Although this is very important work, all too little is known about the ordinary practitioners in fields such as the geosciences. It
my hope that the results of the current study will begin to fill some of the gaps in this area, and that looking at the topic from a regional perspective will add fresh new insights and depth to the analysis.

The literature examined in this chapter raises a number of interesting issues that are deserving of further study. Some of these themes are taken up in greater detail in the next two chapters, and others are taken up in the empirical study that constitutes Part II of the dissertation. Still others will have to be the subjects of future scholars' dissertations. A number of key themes resonate throughout the literature on women in science. The first important theme is the impact of the change from the amateur naturalist tradition to institutionalized and academic settings that required academic credentials. In the process of institutionalization and professionalization, many of the contributions of women in the amateur naturalist tradition seem to have been downplayed, underrepresented, or ignored altogether in the academic literature. The lack of recognition accorded to the early achievers is one of the key reasons for the strong emphasis in women's history on recovering the contributions of this early generation of women.

As Marianne Ainley suggests in her work, however, the scanty resources and research materials available on both the early achievers and the ordinary practitioners in scientific fields unfortunately make it difficult to do much more than a cursory examination of their careers. Critical personal records, correspondence, and research notes are not always available, and researchers must rely on the recollections of friends and associates, death notices, and fragments of newspaper articles. Pierson and Prentice also comment on the difficulties of sources in women's history:

New approaches to the problem of sources have to be discovered: official statistics and their categories have to be challenged, different questions have to be
put to old sources and new sources have to be found....A commitment to getting at the actual experience of women underlies the collection and publication of such primary sources as the letters and diaries of ordinary women, scrapbooks and photograph albums, recipe books and reminiscences recorded in writing or on tape.139

It is fortunate that scholars such as Marianne Ainley and Alison Prentice started the recovery of information on the early Canadian women in science when they did, or the information available would be even more fragmentary than it currently is.

A second theme that emerges in the literature, particularly on American women in science, is the influence of all-female schools, academies, seminaries, and colleges in providing courses in science and in training an early generation of women scientists. Penina Glazer and Miriam Slater also point out that another important function of these women’s schools and colleges was as a source of employment for women graduates as teachers, research scientists, and academics and as a source of funding for postgraduate training and professional development.140

The influence of these educational institutions spanned several generations of women’s activity in science, from the first period of amateur collecting and independent researching to the second period of dissemination of scientific ideas through textbook writing and illustrating, and right up to the third and most recent period of academic and professional training for women in science. It also spanned international borders, since many of the first generation of Canadian scholars sought advanced training and fellowships at American women’s institutions. The importance of separate education for women in the United States in stimulating the movement toward scientific training cannot be overemphasized. The issue of educational separatism or all-female schooling in Canada and in other countries and its impact on scientific training for women is certainly
a question that is worthy of further study. It is also a question raised by data in the empirical study in Part II of the dissertation.

A third theme that emerges in the literature on women in science is the impact of the development of separate women’s professions. Margaret Rossiter has suggested that the development of women’s fields such as social work led to a “segregated pattern of employment and underrecognition” for women. Other scholars such as Glazer and Slater tend to view the development of new women’s fields such as research science and public health as innovative. Glazer and Slater also examine the separatist strategy employed by women faculty and administrators in American women’s colleges and institutions and note that many of the early high achievers in academic institutions chose to remain single and childless. This phenomenon is also a social trend that crosses international borders and may be equally applicable to many of the early Canadian women who were high achievers in science and other fields. The debate on separate women’s professions is a highly contentious one that has engaged historians in many different countries and cultural contexts, and the discussion of this topic will be one of the focuses of attention in Chapter Three.

A fourth theme that emerges in this chapter is the impact of the world wars on opportunities and scientific training for women. Once again it is Margaret Rossiter who provides the framework for this discussion in her extremely influential books on American women in science. Rossiter describes the shutting down of opportunities and the closing of doors to academic and research positions for American women after the Second World War. Does this same phenomenon occur in the Canadian context? In the next chapter the discussion will turn to the entry of women to universities and
graduate schools in Britain, United States, Russia, and Canada. In examining the entry of Canadian women to fields such as physics and medicine, historians such as Alison Prentice and W.P.J. Millar and R.D. Gidney shed light on the positive influence of the world wars in opening professional opportunities and training for women. Prentice’s work on women in physics also considers the question of whether doors started to close for Canadian women in science at the end of World War II. Discussion of these issues then will be resumed in the chapter to follow.

All four of these themes—the movement from the amateur naturalist tradition to institutionalized and academic settings, the influence of all-female schools and colleges, the impact of the development of separate women’s professions and separatist strategies, and the impact of the world wars and the end of the Second World War on professional opportunities and training for women—raise questions that require further research by historians, by scholars in other fields, and by interdisciplinary teams of researchers. They are the themes that both inform and frame the remaining literature review chapters in Part I as well as the empirical study in Part II of the dissertation.

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1 Geological term referring to a “crustal block or fragment that preserves a distinctive geologic history that is different from the surrounding areas and that is usually bounded by faults.” The term suggests depth as well as surface area. Thus, I imply that my analysis has depth as well as breadth. Webster’s Revised Unabridged Dictionary; [cited 7 June 1999]; available from http://www.lib.uwaterloo.ca/dictionaries.html; Internet.
3 Marianne Gosztonyi Ainley, “Women’s Work in Geology: A Historical Perspective on Gender Division in Canadian Science,” Geoscience Canada 21, 3 (September 1994): 140-44.
Ibid., 7.

Ainley, introduction to Despite the Odds, 18.

Ibid., 18.


Schiebinger, The Mind Has No Sex, 9.


Schiebinger, The Mind Has No Sex, 2.

Ibid., 7.

Ibid., 8.

Ibid., 8-9.


Schiebinger, The Mind Has No Sex, 9.


Ibid., 287-8.

Ibid., 288.

Ibid., 289.

Ibid., 289.


Ibid., 42.

Ibid., 42.

Ibid., 42.

Ibid., 42.

Ibid., 37.

Ibid., 33.

Ibid., 43.

Ibid., 33.

Ibid., 35.

Ibid., 36. Note that the Lyell Fund is a prize or award.

Ibid., 36.

See Chapter Three under "Entry of Women to British Universities" for an explanation of Elles's delay in receiving her doctorate from Cambridge University.

Creese and Creese, "British women who contributed to research in the geological sciences," 38.

Ibid., 38-39.

Ibid., 43.

Ibid., 44.
doi: https://doi.org/10.1080/00104165.1997.10665492


Margaret Rossiter considers Bascom to be the second woman to receive a doctorate in the geological sciences since Mary E. Holmes of Rockford, Illinois, received a Ph.D. in paleontology from the University of Michigan in 1888. Cited in Margaret W. Rossiter, "Geology in Nineteenth-Century Women's Education in the United States," *Journal of Geological Education* 29, 5 (1981), 231.

Note that Jill Schneideman spells Katharine Fowler-Billings with an e, as in Katherine. All other references, including Fowler-Billings' own books, spell Katharine with an a.


Rossiter, introduction to *Women Scientists in America: Struggles and Strategies to 1940* (Baltimore: Johns Hopkins University Press, 1982), xvii.
83 Ibid., xvii.
84 Ibid., xvii.
85 Ibid., xvii.
87 Ibid., xv.
88 Ibid., xv.
89 Ibid., xvi.
90 Ibid., xvi.
91 Ibid., xvii.
92 Ibid., xviii.
93 Ibid., xviii.
94 Ibid., xviii.
96 For a detailed discussion of the impact of the Leduc oil finds on the local and provincial economies, see Chapter Four, “The Resource Frontier and Women Geoscientists in Alberta.”
98 Ibid., 146.
99 Ibid., 147.
100 Ibid., 147.
101 Ibid., 149.
102 Ibid., 147.
104 Ibid., 15-21.
105 Ibid., 211-12.
106 Ibid., 221-22.
107 Ibid., 220-21.
109 In “Women in Early Geology,” Eleanor Elder states that Ogilvie contributed anonymously to support students at Bryn Mawr, Columbia, and Barnard, and eventually left the bulk of her estate to the Bryn Mawr Geology Department (290).
111 Ainley, “Women’s Work in Geology,” 141.
113 Ainley, “Women’s Work in Geology,” 140.
114 Ibid., 140.
116 Ibid., 28.
117 Ibid., 28.
118 Ibid., 28.
119 Ibid., 29.
122 Ibid., 301.
123 Ibid., 301.

Ibid., 29.

Ibid., 29.

Ainley, "Women's Work in Geology," 141.

Ibid., 141.

Ibid., 142.

See Chapter Five for a detailed examination of Helen Belyea's career with the Geological Survey of Canada.


Ibid., 123.

Ibid., 123.

Ibid., 123.

Ibid., 125.

Ainley, introduction to *Despite the Odds*, 20.

Ibid., 20.

Ibid., 21.

Ibid., 42.

Glazer and Slater, *Unequal Colleagues*, 220.

Rossiter, introduction to *Women Scientists in America: Struggles and Strategies to 1940*, xviii.


See W.P.J. Millar and R.D. Gidney, "'Medettes': Thriving or Just Surviving? Women Students in the Faculty of Medicine, University of Toronto, 1910-1951," in *Challenging Professions*, eds. Smyth et al., 215-233.
CHAPTER THREE

BECOMING A GEOLOGIST: FROM “MALE HEADS ON FEMALE SHOULDERS” TO “SEX ON THE ROCKS”

Some of the geoscientists discussed in the previous chapter had academic careers, others had professional careers in government service or industry, and all of them other than the “amateur” category of scientists attended institutions of higher education. Since the contemporary subjects of this thesis are part of the continuum of educated women stretching back to the nineteenth century, it is important to examine the literature on women in higher education and the professions in order to understand their experiences more fully. The entry to universities and graduate programs was a critical component of gaining the credentials that women required for careers in academia, government service, and industry. Margaret Rossiter has called the process of women’s “quiet infiltration” into universities and graduate programs “a kind of educational ‘guerilla warfare’ or slow war of attrition.”1 The women who took part in this “quiet infiltration” of universities and doctoral programs were the pathbreakers who led the way for others.

This chapter poses the following questions in an effort to correlate the entry of women to higher education and the professions to the entry of women to the geoscience fields. What is the historiographical context for women’s entry into sciences in order to become geologists? What is the history of women’s experience in the area of postgraduate studies in the struggle to become geoscientists/academics? How does the profession of geology address women’s entry to the field? Finally, how does the current feminist scholarship in science further inform this experience? It is important to remember that access to universities and graduate programs was only the first hurdle that
women in the geoscience fields encountered. Access to field work proved to be an equally difficult problem for the early generation of women geoscientists.

"Male Heads on Female Shoulders?"

Alison Mackinnon raises a number of key questions about the experiences of women in higher education in "Male Heads on Female Shoulders? New Questions for the History of Women's Higher Education."2 Many of these questions are applicable to women in the geoscience fields. Mackinnon asks whether women who experience higher education internalize the "dominant male thinking about women's place" in society, whether women's experiences of higher education vary depending on whether they attend coeducational or separate women's institutions, and whether there is a link between higher education for women and declining rates of marriage and fertility.4

A corollary of Mackinnon's first question is whether women who work in what have been traditionally considered male-dominated fields internalize the social attitudes and behaviour set of their male colleagues. Do women in these fields have to adapt to the norms of their male colleagues in order to fit in, to be part of a crew, or to survive in the field? Or do women choose fields such as geoscience because they already feel comfortable working with men, enjoy strenuous physical activities, and like a rough and ready outdoor environment? These provocative questions serve as an excellent framework for the discussion of women's experiences in higher education and the professions that follow in this chapter, even though it is not possible to provide definitive answers to all of them.

In "Perspectives on the History of Women’s Education in the United States,"5 Jill Ker Conway questions whether coeducation was a liberating experience for women and
whether access to professional education necessarily placed women on an equal playing field with men. In her opinion, providing access to educational opportunities does not necessarily result in social change unless women’s “consciousness of themselves as independent intellects” is raised in the process. Conway asserts that feminist consciousness raising occurred in separate women’s institutions, but was not necessarily fostered in coeducational institutions. In addition, Conway argues that the development of separate service-oriented professions for women perpetuated the separate spheres ideology and gender norms that held women back from assuming an equal status in “traditionally male spheres of competence”:

The development of the women’s professions should thus be interpreted as a conservative trend by which the potential for change inherent in changed educational experience was still-born and women’s intellectual energies were channeled into perpetuating women’s service role in society rather than into independent and self-justifying intellectual endeavour. It was also a trend by which the direction and support of most kinds of intellectual enquiry remained unquestionably male-controlled. Thus, the development of women’s professions has not significantly altered their status in intellectual life nor has it fostered women’s intellectual creativity.

In “Postmodern Patchwork: Some Recent Trends in the Writing of Women’s History in Canada,” Gail Cuthbert Brandt argues that although “separate spheres” was originally a useful concept, feminist historians have recently become increasingly critical of its limitations. Brandt argues that one of the major initiatives of more recent women’s historians has been “to develop paradigms that avoid the dichotomies that characterized much of the earlier analysis of women’s situation.” Joy Parr is one of the historians who has been working with this end in mind. In “Nature and Hierarchy: Reflections on Writing the History of Women and Children” and in The Gender of Breadwinners: Women, Men and Change in Two Industrial Towns 1880-1950, Parr questions the
notion of public and private spheres and the equation of men with public and women with private spheres. She asserts that historians have failed to adequately consider the political nature of the private or domestic sphere and the many ways in which the private sphere shapes or influences the public world of work and politics.\(^{13}\) Parr’s comparison of the Paris knitting mills and the Hanover furniture making industries is an excellent example of historical work that questions the links between the two spheres. In the process the author subtly alters the reader’s understanding of the gender constructs of the period and troubles the notions of the male breadwinner and the family wage.

Brandt, Conway, and Parr all agree that the separate spheres concept has outlived its usefulness. Conway also concludes that the women’s professions were an extension of the domestic sphere for women and did not offer adequate opportunity for intellectual creativity. In contrast to Conway’s opinion on this issue, Penina Glazer and Miriam Slater view the development of fields such as public health and research science as innovative in *Unequal Colleagues: The Entrance of Women in the Professions*.\(^{14}\) Historians of women in science such as Marianne Ainley would probably argue that it was not only in the service professions that women were relegated to serving a secondary and subservient role. Ainley suggests that the internal hierarchies within scientific fields meant that even women strong enough to challenge entry to traditionally male-dominated fields ended up initially being relegated to the peripheries or sidelines.\(^{15}\)

Although historians differ on their opinions of the development of service-oriented professions for women, one could make a valid case that there were both positive and negative aspects to their development. The service-oriented professions may be seen as positive in their innovative response to the lack of career opportunities for
women in male-dominated areas of employment and in the comfortable haven they provided in terms of the numerical dominance of women in these fields. They may be viewed as negative insofar as they were usually rewarded with lower levels of respect and lower levels of pay than male areas of employment. In addition, they may have held back the movement of women to the higher paying fields traditionally dominated by men.

The debate over coeducation versus separate education for women is also just as controversial and relevant an issue today as it was when Jill Ker Conway first wrote about it over twenty years ago. Private girls’ schools have never gone out of style, and in provinces such as Alberta, all girls’ junior high and high schools have begun to make a comeback because of the academic benefits of separate education. However, one could again make a valid argument that there are both advantages and disadvantages to separate education and that neither alternative has a monopoly on consciousness raising.

Women’s Entrance to British Universities

Many of the struggles for women to achieve professional status were waged on university campuses on the national and international stages. British women formed the vanguard of early university entrants. As the research of Mary and Thomas Creese shows, in the nineteenth century British women geoscientists surpassed those in other countries both in their numbers and in their production of scientific papers. Understanding the conditions of their entry to universities is important because many British women in the early years of university admission did all of the course work, passed all of the exams, but still did not receive university degrees. The lack of degrees may have been detrimental to their professional advancement and may have been the reason that so many of the early geoscientists pursued doctoral degrees in Europe or elsewhere abroad after taking initial
course work at Cambridge and Oxford. In addition, the precedents established in Britain regarding university education for women without the granting of degrees and restricted entry for women to graduate programs undoubtedly influenced the pattern of women's education in the United States and other countries.

Rita McWilliams-Tullberg examines the admission of women to British universities in "Women and Degrees at Cambridge University, 1862-1897." McWilliams-Tullberg outlines the founding of Girton College by Emily Davies in 1869 and Newnham Hall by Anne Jemima Clough and Henry Sidgwick in 1871. Both women struggled hard to gain admission for women to Cambridge examinations. Although Davies and Clough eventually achieved their objectives and women were allowed to take the exams, for years women were refused admission to lectures and university libraries and were tutored separately in women only classes. In addition, women received certificates rather than degrees since Cambridge degrees granted the recipients automatic voting privileges in matters of university government, and administrators declined to give women that prerogative.

Despite the numerous campaigns to gain equal admission status with men, women at Cambridge did not receive degrees and full university membership until 1948, whereas Oxford admitted women to degrees and full university membership in 1920. McWilliams-Tullberg also notes that London University granted full degrees to women in 1878, as did the Scottish universities, the Royal Irish, Wales, Durham, and the other new colleges and provincial universities by 1895. This situation put Cambridge women students at somewhat of a disadvantage as they could not put degrees behind their names.
even though they had earned them. In 1948 the degrees were granted retroactively, but by that time the damage to careers had already been done.

As far as careers open to graduates of all these universities, McWilliams-Tullberg states that teaching was about the only option for women. Her opinion of this option echoes that of Jill Ker Conway:

We come then to the interesting hypothesis that better education for the middle-class woman was not simply the sine qua non of her eventual escape from the home and into employment but a relief work, a whole industry created for women. As such, the new educational opportunities were not the self-evident vehicle of emancipation they are sometimes thought to have been. Although women were allowed to rule in their own schoolrooms, they were confined there and little encouragement, legal or otherwise, was given to an educated woman who looked for an intellectually satisfying job outside teaching....This is not to say that the improvements in women’s education in any way hindered emancipation, but the resulting emergence of a ‘women’s’ industry, complete with discriminatory wages and for the most part controlled by men, should not pass unnoticed.20

The research by Mary and Thomas Creese also shows that even the early British geoscientists who managed to attain university-teaching positions “faced handicaps—marginal places in educational institutions and only partial acceptance in the scientific community.”21

Women’s Entrance to Graduate Degrees in the United States

Entrance to undergraduate and graduate programs proved just as difficult for women in United States as it did for women in Britain. In “Doctorates for American Women, 1868-1907,” Margaret W. Rossiter describes the struggle for women to achieve graduate degrees in the United States as a war that was waged simultaneously on several fronts:

When all the attempts by women to gain higher degrees at universities in the U.S. and Germany over three decades (1870-1900) are viewed together, they can be seen as a process of quiet infiltration, a kind of educational ‘guerrilla warfare’ or slow ‘war of attrition’ against universities. Under this almost military strategy,
individual women sought to test the repressive system on as many fronts (departments and universities) as possible. They probed for weak points, using what friends they had to help them evade the rules informally. When enough ‘exceptional’ women had been admitted in this way and had surpassed their fellow students without the imagined disruption, they pushed for a change in policy, which could now be seen as harmless, ‘only fair,’ long overdue, and quietly enacted. Thus, over the decades, a series of women eventually accomplished their objective but at great human cost.22

In the period from 1868 to 1890, women were generally granted entrance to graduate schools only as “special students” and were not eligible for degrees.23 Students like Ellen Swallow Richards and Christine Ladd-Franklin, both former students of astronomer Maria Mitchell at Vassar College, had to contend with “special status” and no degrees when they attended institutions such as the Massachusetts Institute of Technology and Johns Hopkins University.24 Rossiter suggests that only “modest universities” such as Boston, Syracuse, and Wooster were granting graduate degrees to women in this early period.25 Smith College, University of Michigan, and Cornell also apparently granted a few graduate degrees to women.

It was not until the period from 1890 to 1892 that women received official entrance to six major graduate schools: Yale, Pennsylvania, Columbia, Brown, Stanford, and University of Chicago.26 Even though these institutions finally admitted women to graduate schools, they did not necessarily capitulate regarding women’s entrance to their undergraduate schools. Rossiter points out that the decision regarding coeducation for undergraduates varied from institution to institution:

Two universities (Yale and Pennsylvania) linked their admission of women to graduate work with a continued refusal to allow them into the undergraduate college; two others (Columbia and Brown) tied their decision to admit them to the graduate school to a more cautious-formation of a coordinate college for women undergraduates; and two new institutions out west (Stanford and the University of Chicago) were the most liberal of all and announced in 1891-2 that they were for full coeducation at both the graduate and undergraduate levels.27
Finally, in the period from 1893 to 1907, many of the institutions that had been hold-outs to graduate degrees for women such as Harvard and Johns Hopkins reluctantly granted women's entrance to doctoral programs.\(^{28}\) Harvard University solved the problem of granting graduate degrees to women in 1902 by establishing Radcliffe Graduate School as a degree granting institution for women.\(^{29}\) Johns Hopkins admitted women officially in 1907, but a number of women had previously taken courses as "special students." President Ira Remsen of Johns Hopkins tempered the acceptance of women to graduate programs with the proviso that "Women were to be admitted to all classes provided that there was 'no objection on the part of the instructor concerned.'"\(^{30}\)

Well-known American geologist Florence Bascom was in fact the first woman to receive a Ph.D. from Johns Hopkins University in 1893.\(^{31}\) Mary and Thomas Creese compare Florence Bascom's experiences in the United States to the experiences of Russian geologist Evgeniia Solomko-Sotiriadis in Germany: "Bascom was accepted at Johns Hopkins (as a special student) only after she had made a convincing case to the university's committee that she could not get the instruction she wanted in petrography anywhere else in the country. She worked to some extent in isolation, listening to lectures from behind a screen, such as Solomko had done in Munich in the 1880s. Her Ph.D. was the first in any field that Johns Hopkins gave to a woman."\(^{32}\) Rossiter points out that Bascom received her doctoral degree as a "special student" well before the university policy officially permitted graduate degrees to be bestowed on women:

Admitted in 1891 as a 'special student,' Bascom performed so well and proved so helpful to her professor, who used her fieldwork in his reports to the Maryland Geological Survey, that in 1892 he recommended her admission to candidacy. Apparently her case was greatly aided not only by her having all the 'ability, energy and enthusiasm that could be expected of any man,' as her professor put it,
but also by the support of another older professor, who had been a college classmate of her father. (John Bascom, then professor of political science at Williams College and the former president of the University of Wisconsin, may also have known Gilman personally.) Besides citing these strong personal assets, Bascom's supporters could also inform trustees that she would probably be hired in a year or two by Bryn Mawr College, whose dean M. Carey Thomas was at the time involved in a major-fund-raising campaign for the new Johns Hopkins Medical School. Thus if the Hopkins trustees were ever to make an exception to their prohibition on degrees for women, Bascom was as good and as safe a candidate as they were likely to get.33

Although Johns Hopkins finally relented and admitted women to graduate degrees in 1907, former distinguished students such as Christine Ladd-Franklin still had a long wait to receive the degrees they had earned. Rossiter states that it was not until 1926 that Ladd-Franklin was retroactively granted her doctorate: "Finally, in 1926 at its fiftieth anniversary celebration, Johns Hopkins University awarded a long overdue doctorate to one of its most talented graduates, Christine Ladd-Franklin, who, now a sprightly 79-year old, made it a point to attend the ceremonies and collect her degree forty-four years late."34 As a result of improved access to graduate programs, the number of doctorates awarded to American women increased significantly in the 1890s, changing from 25 in the pre-1890 period to 204 in the period from 1890 to 1900.35

Mary and Thomas Creese also suggest the importance of von Zittel at the University of Munich who was sympathetic to the plight of women students and accommodated them in his lecture halls to the best of his ability long before they were officially allowed to audit courses. British students Ethel Skeat and Maria Ogilvie as well as the Russian student Evgeniia Solomko studied under von Zittel:

Permission for individual women to audit courses at the University of Munich was first granted formally by the authorities only in 1896; James Albisetti has noted that the first woman to take classes there was the English geology student Ethel Skeat...who also worked under von Zittel....It would seem likely, therefore, that Ogilvie went to Munich in 1891 as a private student of von Zittel and
Hertwig. Even earlier (probably in 1886) the Russian student Evgeniia Solomko...had been sympathetically received by von Zittel. He arranged for her to listen to his lectures through an open door in a room next to the auditorium where the German male students sat. Solomko took the complete course of lectures and also had full access to the Palaeontological Museum with its coral collection, her special interest.36

Canadian women were also able to take advantage of graduate programs in the United States and Europe once women had achieved admission. Both Alice Wilson and Grace Anne Stewart are examples of Canadian geoscientists who gained doctoral degrees at the University of Chicago. Rossiter states that more than half of the doctorates granted to American women between 1877 and 1900 were from four universities: Yale, Chicago, Cornell, and New York University. The University of Chicago was in second place with twenty-nine doctoral degrees granted to women, and was only slightly behind Yale, which granted thirty-six doctoral degrees to women in this period.37

Higher Education for Russian Women

Christine Johanson's Women’s Struggle for Higher Education in Russia, 1855-190038 offers an opportunity to contrast women’s higher education in Britain and North America with that of women in Russia. Similar arguments were used to oppose women’s higher education in Russia as in the West, such as fear about the immorality and social and political radicalism of women students. In addition, similar types of fragmented responses to women’s demands were initiated in Russia. These responses included the development of separate courses for women, the opening of separate educational institutions, and the provision of university-level instruction without degrees, just as occurred initially at Oxford and Cambridge in England and at universities in the United States.
Johanson documents the remarkable flowering of advanced studies for women in this period in Russia. In particular, the emphasis of these courses was on scholarship rather than career preparation. Since many of the male faculty members who taught the courses were renowned scholars in their fields, the academic standards were exceptionally high. Russia was a leader both in Europe and abroad in its promotion of courses for women. Chemistry and medical research attracted the highest numbers of advanced Russian women students, but geology courses were close behind in the number of women students they attracted.

One reason for the prevalence of Russian women in medicine was that for many years it was the only academic area in which professional designation could be achieved. It was not until the liberalization under Nicholas II (1894-1917) that women became able to assume teaching positions in secondary schools and institutes of higher learning or to write state examinations and receive the same degrees as men, including law degrees. The inability to gain degrees and professional designations in Russia was the reason that many of the early Russian women geoscientists went to Europe to complete doctoral degrees.

Since women were able to gain degrees in medicine in Russia, many women chose this option. By 1882, the number of Russian women trained as physicians was 200 as compared to 26 in England, 7 in France, and 0 in Germany and the Austro-Hungarian Empire. By 1884, the number of Russian women physicians had increased to 385, and it would reach 698 by 1888. As a point of comparison, France had only 95 women physicians by 1900 and England only 258. In Canada, the first woman doctor did not graduate until 1883. Despite the number of Russian women physicians, however,
Johanson points out that women were not paid the same salaries as male physicians and often had to work as paramedics and midwives even though they were fully trained physicians.

Thomas and Mary Creese also emphasize the prominence of Russian women in the geosciences and the fact that this prominence continued long into the Soviet era:

Among early Russian and British women geologists, the majority were palaeontologists or biostratigraphers. Of the five Russian women whose nineteenth-century work is listed in the Royal Society Catalogue, the three most productive were palaeontologists. The prominence of women in this area persisted for many decades, at least in the former Soviet Union, the country which by the mid-twentieth century, trained and employed most women geologists. A survey of about 2500 Soviet palaeontologists made in 1968 brought out the fact that more than half (about 1500) were women. Furthermore, the most difficult and complex fossil groups were those most often studied by women; of 480 workers specializing in foraminifers (small, primitive protozoans), 400 were women, while of 180 people studying brachipods (where the labour required is considerably less monotonous and demanding) 100 were men and 80 were women.43

Christine Johanson concludes that had the tsarist regime more effectively utilized its women graduates, and had it extended medical and educational benefits to the emancipated peasantry, the society would not have been so ripe for revolution. In the end, Johanson says that lack of vision “exacerbated the social tensions and polarities of Imperial Russia and, by the twentieth century, alienated virtually all elements of society from the autocratic regime.”44 The reforms under Nicholas II therefore came too late to change the revolutionary course of events.

**Women’s Entrance to Canadian Universities**

Although a rich body of literature exists documenting the entrance of women to Canadian universities,45 this analysis will concentrate primarily on the post WWI period since the first woman entered a geoscience program in Canada in 1914. Grace Anne
Stewart, the first woman to graduate in geology in Canada, began her studies at the University of Alberta in 1914. A number of articles deal with Canadian universities after the First World War and show the development of new courses such as physiotherapy, the entry of women to faculties such as physics and medicine, the establishment of women's Red Cross units on campus in response to wartime needs, and the general movement toward professionalism for women.

Ruby Heap's "Training for a New 'Women's Profession': The Beginnings of Physiotherapy at the University of Toronto, 1917-1940," indicates that world war was a stimulus toward professional training for women. Heap's article documents the "subordinate status" of physiotherapists to physicians, the low pay or volunteer work of many physiotherapists in their early careers, and the emphasis the profession placed on service and "humanitarian values." Her research also shows that physiotherapy led the way for the development of other new professional programs for women at the University of Toronto such as social work, library science, and public health nursing. Heap quotes A. B. McKillop on this trend: "What occurred in Ontario, as elsewhere, in the interwar years, was the gradual public acceptance of the idea of social utility and of the professional ideal as determining and essential forces in society."

Heap notes that the term "professionalism," which traditionally has been associated primarily with male-dominated occupations, is also applicable to women's careers such as nursing, teaching, and social work:

Professionalism has usually been associated with male-dominated occupations. Historical and sociological scholarship, for a long time neglectful of women in the professions, reinforced this practice by giving the impression that the 'culture of professionalism' only shaped men and that women seeking the status of 'professional' represented an anomaly. Historians have begun to dispel these assumptions by showing that the male model of professionalism described above
could appeal to middle- and upper-class educated women aspiring to a career, including the leaders of the so-called ‘semi-professions’ of nursing, teaching, and social work.49

In “Three Women in Physics,”50 Alison Prentice also discusses the impact of the world wars on careers for women in physics. Prentice examines the careers of Elizabeth Laird, Elizabeth Allin, and Allie Vibert Douglas, all of whom achieved their first degrees at the University of Toronto and McGill University between 1896 and 1926. The author shows that women were involved in the field of physics in Canada almost from the outset of its development. In fact, women comprised a substantial proportion of the Ph.D. graduates in physics at the University of Toronto in the early twentieth century. Prentice notes that opportunities for women students and faculty seemed to be opening at the University of Toronto in the interwar years.51 However, after the 1930s, despite the fact that the physics department was expanding, the number of women faculty declined dramatically.52 Prentice concludes the following:

...women were seen as worthy students and assistants in physics when research was just beginning in Canada and departments were small....As physics grew and became more competitive with the advent of ‘big science,’ however, young men were increasingly attracted to the field, and women were either less welcome or simply massively outnumbered.53

The career of Elizabeth Rebecca Laird, the earliest of the three women to graduate in physics in 1896, has a number of close parallels to that of Grace Anne Stewart, first Canadian woman to graduate in geology. Prentice comments that “…Laird appears to have been the first woman physicist of her era to make a lifetime career as a research-oriented academic.”54 Stewart was also the first Canadian woman to achieve a lifetime career as an academic in the geosciences. Although Laird achieved the top marks in her University of Toronto physics class, she was denied the Exhibition Scholarship for
graduate study abroad; instead the prestigious prize was awarded to a male student. Like Grace Anne Stewart, Laird eventually chose to pursue graduate studies in the United States. Laird studied at Bryn Mawr and later received a fellowship to study in Berlin; Stewart did her doctoral studies at the University of Chicago.

Both women seemed to have difficulties in gaining academic positions in Canada. Laird spent her entire teaching career in the United States in the physics department at Mount Holyoke College until her retirement in the late 1930s. She then returned to London, Ontario, to assume a position as an unpaid researcher in the physics laboratories at the University of Western Ontario. Stewart spent her entire teaching career at Ohio State University and returned to Canada as a consultant in the oil patch only after her retirement. As the careers of Laird and Stewart suggest, it may have been easier for the first generation of women graduates in science to achieve full-time academic careers in the United States than it was in Canada. Access to graduate scholarships also seemed to be easier for women students in the United States than it was in Canada at this time.

In "The Early History of Women in University Physics: A Toronto Case Study," Alison Prentice also makes the point that it is erroneous to assume that the sciences were non-traditional areas of study for women. From the outset of the development of fields such as physics in Canada, Prentice emphasizes that women have been active as scholars, research assistants, and faculty members:

That women have studied all of the sciences and have been involved in scientific work in all disciplines is increasingly demonstrated by a growing literature. In Australia, as Marjorie Theobald has shown, science was part of the 'women's studies' curriculum of women's schools and academies throughout the colonial period. A collection of essays dealing chiefly with modern Europe reveals women at work in the sciences, from the eighteenth century when much science was conducted in domestic or semi-domestic settings, to more recent times. A recent collection, edited by Marianne Gosztonyi Ainley, carries the story to
Canada. While none of these studies suggests that it was easy for women to be scientists, the overall message of the involvement is clear. Women have always been interested in science and studied it whenever and wherever they could manage to do so; and some women, in every period since the eighteenth century, have reached the highest levels of excellence in all areas of scientific endeavour. That science—even physics—is a ‘non-traditional’ area for women is largely false.57

W.P.J. Millar and R.D. Gidney look at the world wars as an impetus to professional training for women in “‘Medettes’: Thriving or Just Surviving? Women Students in the Faculty of Medicine, University of Toronto, 1910-1951.” Millar and Gidney point out that in 1910, there was only one female medical student at the University of Toronto out of 114 students. By 1914 the number of women students in first-year medicine had increased to 10, and by 1918 the number had exceeded 30. This high level of enrollment was not reached again until the Second World War when more than 25 women entered medical school in each year from 1943 to 1945.58 Millar and Gidney comment on the “extraordinary” opportunities presented to women by wartime circumstances: “Wartime offered opportunities to both single and married women for novel and sometimes extraordinary work, not only in the armed forces but also in residency and specialist training positions that might not have been available to them under normal circumstances.”59

The authors also make another important point about the relatively privileged backgrounds of the women medical students in the period from 1910 until after the Second World War:

From the outset it is clear that we are dealing with a relatively privileged group—privileged in terms of family background and social standing, religious affiliation, and previous schooling. For most of the period, the female students’ fathers were more likely to work as professionals or in business, supervisory positions, or the burgeoning white-collar sector than were the fathers of male students. Thus from 1910 until after the Second World War, we generally find that the proportion of women from professional and business families was above 70 percent—sometimes
well above—while in contrast, the percentage of men from similar social backgrounds remained at much more modest proportions.60

The one aspect of wartime participation that did not appear to alter the status of Canadian women university students was work as volunteers for the Canadian Red Cross. Nancy Kiefer and Ruth Roach Pierson's "The War Effort and Women Students at the University of Toronto, 1939-1945"61 outlines the efforts made by campus women and faculty wives to show their commitment to the war effort. These efforts included knitting socks, organizing clothing drives, and participating in first aid training. Eventually, a Canadian Red Cross Corps was formed on campus despite the reluctance of university officials to have women wearing uniforms on campus. As a result of the controversy over women's uniforms, great care was taken in the selection of the apparel to ensure that it was not unnecessarily masculine in appearance.62 This concern about apparel is one that is shared by women in geoscience fields. Issues of safety, practicality, comfort, and durability were all important, but physical appearance was also an issue. Kiefer and Pierson conclude that university women's contribution to the war effort served to reinforce "their inferior status and popular conceptions of femininity".63

...the war service of female university students did not result in the breakdown of sexual stereotypes or of the sexual division of labour. On the contrary, the emphasis of women's service programs on the value of unpaid voluntary labour and service in the home tended to reinforce notions of female self-subordination that facilitate women's exploitation in both the public and private spheres.64

Although participation in voluntary work during the war did not seem to increase the status or add to the professionalism of women students, Nicole Neatby's "Preparing for the Working World: Women at Queen's during the 1920s"65 suggests that there was an impetus towards professionalism for Queen's University women students during the interwar years. Neatby finds the Queen's University women graduates of the 1920s were
preparing themselves not just for paid employment, but for higher status employment as high school teachers or administrators in the educational system.\textsuperscript{66} She notes that the Dean of Women at Queen's was influential in counselling women students about opportunities for both traditional and non-traditional avenues of employment, and that the fact that women were seriously considering professional careers “suggests that traditional attitudes toward paid employment and higher education for women were being eroded in the 1920s.”\textsuperscript{67}

The author also points out that the social origins of Queen's University women students were slightly different from those of the male students. Three-quarters of women students at Queen's had parents with professional and business backgrounds, whereas male students were much less likely to come from backgrounds of influence and privilege.\textsuperscript{68} Neatby’s observations on the relatively privileged social origins of Queen’s women students offer a parallel to the findings of Millar and Gidney on women medical students at the University of Toronto. The relatively privileged family backgrounds of both groups of students are consistent with the pattern of family backgrounds revealed in the interviews with my group of women geoscientists, which will be discussed in Part II of the dissertation. The points about Queen’s University graduates are also relevant to my study of women geoscientists since Queen’s University has always had a strong geology and engineering faculty, and several of the geoscientists who participated in my study were Queen’s graduates. Since two of the key requirements of professional training for women involved access to and funding for graduate study, these are the next topics of discussion.
Access to Funding for Post-Graduate Training

Gaining access to and funding for post-graduate training were problems that both Canadian women and men students faced. In "Financial Support for Post-graduate Students and the Development of Scientific Research in Canada," Yves Gingras points out that although there was a limited amount of research being done at Canadian universities early in the twentieth century, the research function did not become firmly established at these institutions until such time as there was adequate financial aid available to students interested in pursuing post-graduate work. Doctoral programs established at the University of Toronto in 1897 and McGill University in 1906 therefore did not attract significant numbers of students until after the First World War, and the increase in numbers of students at that time was directly related to the financial aid offered by the National Research Council (NRC). 69

Gingras also outlines the financial aid available to students before 1916 that allowed students to access graduate training in Europe and the United States, and in fact stimulated the development of doctoral programs and financial aid programs in Canada. Awards such as the Gilchrist Scholarship, established in 1868 to promote study at the University of London and the University of Edinburgh, or the 1851 Exhibition Scholarships established to promote research in the sciences, meant that students returned to Canada with a research-oriented outlook. Graduate students' research orientation in turn helped to transform the outlook of professors in Canadian institutions from primarily a teaching focus to a research focus. 70 Canadian institutions also responded to competition from American institutions such as Johns Hopkins, Cornell, Harvard, and
Chicago, which offered research-based doctoral programs as well as a generous system of financial scholarships and bursaries to talented students regardless of nationality.⁷¹

It is not surprising then that so many of the early Canadian women geoscientists obtained post-graduate training at these or other American institutions. Both Grace Anne Stewart and Alice Wilson went to the University of Chicago and Helen Belyea to Northwestern University for doctoral studies. Stewart received a scholarship from the University of Chicago. One of the participants in my study was also a recipient of an international scholarship that allowed her to study geology in Canada.

Gingras concludes that the scholarships and awards established by the National Research Council in 1917 played a critical role in promoting the development of scientific research at Canadian universities. He also notes that the research capability of the universities was a “necessary precondition for the creation of a national scientific community, which needs well-defined institutional structures to reproduce itself.”⁷² Peter Ross’s “The Establishment of the Ph.D. at Toronto: A Case of American Influence,” also emphasizes that competition from universities such as Johns Hopkins in the United States was a major factor in the establishment of doctoral programs in Canada.⁷³ After the establishment of the NRC grants, articles in the geological journals began to criticize the hierarchy that had developed in Canadian research sciences and the fact that physics and chemistry students gained most of the fellowships. Extensive lobbying efforts eventually resulted in a more equitable distribution of the grants.⁷⁴

In both Canada and the United States, women’s organizations began to offer fellowships that helped students pay for post-graduate training. For example, the Canadian Federation of University Women offered Alice Wilson a fellowship to do
graduate work at the University of Chicago.75 In the United States, the Association of Collegiate Alumnae frequently sponsored women's graduate studies abroad.76 These fellowships and others like them provided critical funding for women students seeking post-graduate training.

**Literature on Women in Academia and the Professions**

A number of influential books examine the contemporary academic and professional environment for women in Canada, the United States, and abroad. Nadya Aisenberg and Mona Harrington's *Women of Academe: Outsiders in the Sacred Grove* studies two groups of American academic women, one tenure-track and the other non-tenure track. Recurring patterns for both groups of women include professional marginalization, exclusion from positions of authority, and the shared experience of outsider status.77 In *Breaking Anonymity: The Chilly Climate for Women Faculty*, the Chilly Collective documents the patterns of stereotyping, harassment, exclusion, and devaluation that many Canadian women academics continue to experience.78 In the Introduction to *Storming the Tower: Women in the Academic World*, Suzanne Stiver Lie and Virginia O’Leary compare the experiences of women academics in nine different countries and conclude that in all of the countries, women lagged significantly behind their male counterparts in achieving positions of power in the academy.79

Mary Kinnear's *In Subordination: Women and the Professions, 1870-1970* takes up the strategies of separatism, superperformance, subordination, and innovation that Penina Glazer and Miriam Slater developed in relation to American academics and professionals. Kinnear examines the participation of Manitoba women in university teaching, medicine, law, nursing, and high school and elementary teaching.80 She
concludes that the Manitoba pattern does not entirely conform to the American one in that subordination was the primary fact of life for the first generations of Manitoba women in the professions.81 If Kinnear sees any evidence of innovation, it is in the way in which Manitoba women struggled to juggle the multiple demands of home and family responsibilities with professional careers.

The most recent addition to the literature on Canadian women in the professions is Challenging Professions: Historical and Contemporary Perspectives on Women's Professional Work, edited by Elizabeth Smyth, Sandra Acker, Paula Bourne, and Alison Prentice. The objective of the collection of essays is to "...expand our knowledge not only of how the professions have challenged women but of how women’s engagement with the professions has both challenged and changed them."82 Smyth, Acker, Bourne, and Prentice suggest that even three decades after the publication of Mary Quayle Innis’s The Clear Spirit, it is still challenging to find a suitable definition of the term “profession.” The authors refer to the standard sociological definition of “professionals”:

Professionals, the new sociologists of professionalism opined, had special bodies of knowledge, acquired through extensive study, which defined them as highly educated experts; they accepted fees for particular work rather than hourly or weekly wages; many had been ‘called’ to their profession and believed that their work constituted service to clients whom they had agreed to serve, rather than customers whom they had not chosen; all had ethical concerns about the conduct of their occupations. Professionals had organizations to define pertinent bodies of knowledge and appropriately ethical practices. Through these organizations they attempted to control recruitment to their professional group.83

The authors emphasize that “...the professions and what is commonly referred to as ‘professionalization’ in any given occupation are historically and culturally contingent.”84 In addition, they suggest that professional organizations are more concerned with gatekeeping than recruitment to the professions, particularly once the
education of professionals is transferred to universities and women begin to demand entry.\textsuperscript{85} This theme echoes the point made by Anne Witz in *Professions and Patriarchy*, who states that "professional projects are best conceptualized as processes of occupational closure".\textsuperscript{86}

To abandon a generic notion of profession, and work within a more historically specific notion of professional project does not, however, preclude making general statements about what constitute professional projects. Professional projects are strategies of occupational closure which seek to establish a monopoly over the provisions of skills and competencies in a market for services.\textsuperscript{87} As we have seen, Larson (1979) emphasises that the core of the professional projects is the structural linkage it seeks to secure between education and occupation. Thus credentialists tactics, the use of educational certificates and accreditation to monitor and restrict access to occupational positions, are one of the major tactical means of professional closure.

Witz points out that these exclusionary strategies are also concerned with "mechanisms of intra-occupational control."\textsuperscript{88} Within professional groups, jockeying for positions of dominance is the norm, and constant review of professional regulations regarding inclusion and exclusion is required. Witz concludes that female professional projects are "positioned not only within class relations, but also within gender relations of dominance and subordination, or the gender relations of patriarchy."\textsuperscript{89} The author suggests that any analysis of women's professional projects must consider the following issues:

How were women to mobilise the means of credentialism when the modern university was an exclusive male preserve that admitted only men, was governed by men and used its powers to exclude women? How were women to lobby the state when it was a patriarchal capitalist state to which women had no access, save by proxy male power? What were the implications for female professional projects of the very fact that they had to rely on the support and intervention of organised groups of men in order to advance their own cause?\textsuperscript{90}

Definitions of semi-professions prove to be just as problematic as definitions of professions. In the *Semi-Professions and Their Organization*, Amitai Etzioni defines the
key characteristics of what he termed the "semi-professions." According to Etzioni, semi-professionals' training is not as extensive as professionals' training; their status is lower; their knowledge is less specialized; "their right to privileged communication less established... and they have less autonomy from supervision or societal control than 'the' professions."  

In "The Theoretical Limits of Professionalization" in Etzioni's book, William J. Goode defines the "four great person professions" as "law, medicine, the ministry, and university teaching." He also suggests that some aspiring semi-professions have made it to full professions, others will make it, and others will fail. In Goode’s opinion, the two key characteristics that determine entry to full professionalization are "levels of knowledge" and "dedication to service."  

In response to Etzioni and Goode, Anne Witz argues the following: “It is paradoxical that the functionalist paradigm of profession within which the semi-professions thesis is located has been largely displaced, but the semi-professions thesis lingers on....The ‘semi-profession’ thesis is based on an androcentric model of profession, which takes what are in fact the successful professional projects of man at a particular point in history to be the paradigm of profession.” Smyth, Acker, Bourne, and Prentice approach the classic definition of professions with a similar degree of skepticism to Witz’s:

We came to our network discussions and our research with considerable scepticism regarding the professions: their claims to exclusive expertise, the power of one profession over another, the relegation of some groups to categories such as the ‘semi-professions,’ even the use of terms such as ‘non-professional’ or ‘unprofessional.’ In our scepticism we echoed recent sociological analyses that have seen professionalism as something between a mystique and a conspiracy, rather than as a series of admirable traits.
The debate over what constitutes a profession, what constitutes a semi-profession, and whether the terms should be used at all is highly relevant to engineering and geoscience fields. Engineering and geological technology programs are undergoing considerable expansion both in terms of enrollment numbers and in terms of subject areas being taught, particularly in resource-rich provinces such as Alberta. Graduates of these technology programs are knocking at the doors of professional associations such as APEGGA (Association of Professional Engineers, Geologists, and Geophysicists of Alberta). As a result, the associations are increasingly being called upon to define and enlarge their scope of membership. Sue Evison, P.Eng., the current president of APEGGA and the first woman president in the 80-year history of the association, comments on the changing dimensions of professionalism in a recent issue of The Pegg, the association’s newsletter: "As the boundaries between technical areas and professions push against each other and cause pressure (and sometimes friction), we must decide whether to maintain these boundaries or dissolve them. We have to ask ourselves whether we are ready to accept expansion of the scope of our practice and/or encourage new alliances with other professions."96

**Generational Patterns of Women’s Careers**

Although the discussion of professions and semi-professions has only touched the surface of the complexity of issues surrounding professionalism, the analysis now turns to the generational patterns of women’s careers. Anita M. Harris examines these patterns in *Broken Patterns: Professional Women and the Quest for a New Feminine Identity*. Her conclusions echo the earlier work of Patricia Palmieri on higher education for women in the United States from 1820 to 1920. Palmieri found that a strong cohort of women in
higher education and the professions in one generation caused a backlash in the next generation.\textsuperscript{97} She suggests that the eventual passing of the old guard of women high achievers and the public backlash against them led to a new emphasis on combining careers with marriage in the next era. In this process, the previous generation of women graduates began to be labelled as somewhat “deviant” for their failure to marry and reproduce. It is important to note that this labelling of women academics as deviant, grotesque, and unfeminine\textsuperscript{98} has had a very lengthy history that originated long before the modern feminist movement.

Harris describes “emotional push-pulls”\textsuperscript{99} between mothers and their daughters, as daughters rejected parts of their mothers’ legacy while accepting other aspects of it. Harris concludes that there are “ebbs and flows”\textsuperscript{100} to the generational patterns: “I turned to history to try to understand our mothers’ experience and soon learned that we were by no means the first generation of women to enter men’s careers. At least twice in the past, feminist movements—accompanied by movements of women into the professions—had risen and fallen, most recently in the 1920s.”\textsuperscript{101} Harris’s point is that life is neither linear nor cyclic, but rather spiral in its generational ebbs and flows. Much like Mary Catherine Bateson in Composing a Life,\textsuperscript{102} Harris sees this spiral as a creative process involving separation and connection and ultimately leading to growth.\textsuperscript{103}

Through this spiral process, which operates on many levels, we move toward the new, yet return psychically to reincorporate into our lives values and aspects of the past we care about in order to move forward once again. The principle of separation and reconnection, Broken Patterns concludes, can and should be used to explore the differences and similarities not just between men and women, but among women themselves. In this way, we can, should, and will find new ways of being, and being equal, in the future.\textsuperscript{104}
Research by Alison Mackinnon in Love and Freedom: Professional Women and the Reshaping of Personal Life relates the history of women in the professions to demographic change, in particular, to the fertility decline at the turn of the century among highly educated women in Western societies. Mackinnon argues that in order to understand such demographic shifts, researchers must engage in cross-disciplinary work that breaks boundaries and takes a feminist approach.105 Mackinnon emphasizes that the approach must be “one which acknowledges that relations between men and women are unstable and contested, that power is wielded and resisted, that decisions about sexuality and reproduction change in relation to wider social change, that changes in women’s lives will inevitably make an impact on reproduction.”106

Mackinnon also asserts that we must rethink our categorizations of women’s options as only that of marriage or spinsterhood and recognize the diversity of household arrangements negotiated by “women-identified women.”107 The author suggests that there was less conflict between love and freedom of professional autonomy for women-identified women than there was for women in heterosexual relationships. “In the domain of heterosexual relations the combination was to be a long time in the making. Why, we ask, are we still struggling with expressed oppositions of love and freedom, career or family, ‘working mother’ or homemaker?”108 Mackinnon has hope that the current generation of women in the professions “can leave behind them the painful dilemmas faced by their mothers and grandmothers”.109

...some vocal young women are challenging anew the boundaries between work and home, profession and private life. Refusing to choose between love and freedom, they lay claim to all aspects of their subjectivity....But can they escape, as many confidently expect to do, the pitfalls of romantic love, the tug of children’s tears, the intransigence of our institutions?110
This conflict between love and freedom of professional autonomy is highly relevant to the geoscientists in my study, many of whom are struggling to manage families and careers. The personal stories of both the innovation and compromise with which they juggle the demands of young families and careers will be discussed in Part II of the dissertation.

**The Hazards of Field Work: Dangers of “Sex on the Rocks”**

Although the conflict between love and freedom of autonomy has been a problem for all professional women, access to field work has been an additional and equally difficult problem experienced by women in the geoscience profession. Morris Zaslow vividly describes the physical dangers and hardships that early geologists encountered in their field work in *Reading the Rocks: The Story of the Geological Survey in Canada 1842-1972*:

The physical exertions of the officers cannot be minimized. There were the difficulties of travelling along rivers and lakes of the Precambrian or Cordillera in canoes manned largely by Métis and Indian crews, steering through dangerous white water, and making long, back-breaking portages between navigable stretches. In the mountains there were the supply packtrains and the scrambles over or around fallen timbers and through thick brush, clambering up steep mountainsides to collect samples and to sketch or photograph long perspectives. Work in the extensive forests and marshlands of the Middle North presented further difficulties for travelling and finding rock outcrops. Common to these operations were the discomforts of biting insects, accidents on the water, falls from heights, axe-cuts, or occasional encounters with dangerous moose or bears.

Despite the physical hardships and hazards of the profession, women sought entry only to be confronted by discriminatory attitudes. As recently as 1973, in an address to the Geological Association of Canada, the retiring president E.R. Warde Neale stated that “It’s incredible in this era of liberal attitudes that there are still so many primitive sexual hangups in our profession....A major hang-up was field work and the concern that
scheming female field geologists would lure innocent sons and husbands to sex on the rocks during our long, cold summers in remote areas.” To some extent, Neale’s implicating of wives and mothers in the lingering discrimination against women’s participation in geological field work may have been an attempt to avoid close scrutiny of predominant male attitudes in the profession. Whatever the case, his comments certainly provoked controversy, as was his stated intention, and a committee was set up to study the status of women geoscientists in Canada.

The report by the Status of Women Geoscientists Committee made eight key recommendations, three of which related to field work and access to underground mines. The Status of Women Geoscientists Committee recommended:

(5) Field work be accepted as an essential part of any geologist’s training and work activity.
(6) Mining companies be encouraged to permit women underground particularly in mixed parties of professionals, semi-professionals, or students.
(7) Provinces and territories be encouraged to investigate their mining legislation to ensure that sections relating to the employment of women in mines are not out-of-date.

The Committee’s research showed that mining legislation governing women’s right to work in mines varied from province to province in the early 1970s. By 1976, prohibitive legislation had been eliminated in New Brunswick, Prince Edward Island, Manitoba, British Columbia, the Yukon and the Northwest Territories. In Alberta and Saskatchewan, legislation still existed prohibiting women from working in mines, but the Individual Rights Protection Act and the Fair Employment Practices Act took precedence over the Mining Acts. Ontario and Nova Scotia still had prohibitive legislation against women in mines, and Quebec legislation permitted only women who were geologists and engineers to work underground. The Committee called for legislative reform that
would make practices consistent in all provinces and territories. It also pointed out that the inability of women to gain field work seriously impeded their career advancement and often affected their acceptance to graduate programs. The Committee noted that husband-wife geology teams often solved the field work problems, except in the case where companies' policies did not allow relatives to work in the same department.¹¹⁵

The Noah Principle: "Two by Two, Like Elephants in a Zoo"

Whether the geoscientists were a husband-and-wife team or not, "two by two" seemed to be the norm at least for women participants on ocean-going research vessels. The Proceedings of the First Northeastern Women's Geoscientists Conference held in 1976, in Canton, New York, offer a few examples of American women's experiences with field work. Susan Dana Halsey, an instructor of geology at St. Lawrence University, reports that faculty advisors were initially reluctant to allow her to rough it in the field. Halsey states they "had not dealt with women who could function without the expected creature comforts, and they weren't sure they wanted to."¹¹⁶ Gaining permission to go on ocean-going field trips was equally difficult:

The other problem dealt with the procedures for the ocean-going research vessel which I dubbed, the Noah Principle. This meant that odd numbers of females were not allowed to go to sea. Of course, no women were preferred, but if one woman wanted to go, she had to find another woman to fill the empty bunk in the stateroom. Two by two, like elephants in a zoo although male students were never held to this rule. We never got assigned to staterooms in the hold either (there are some advantages to the gender); instead our assignments were always on deck level.¹¹⁷

Halsey also comments that supervisors were often reluctant to send her out on drilling parties because of the heavy and dirty work involved until she was able to prove that she "could do the work and didn't mind getting dirty."¹¹⁸ Halsey's advice to other
Laurie Brown Isaacson, then an Assistant Professor of Geology at the University of Massachusetts, talks about her need for an older woman as a role model. She states that "It is difficult to be told what you can or cannot do professionally solely on the fact that you are a female. When I began graduate school this was quite evident: field camps that did not admit women, special research projects for men only, restrictions on when and with whom I could go on the research vessels were a few of the evident problems." Isaacson also talks about the problems of developing and maintaining personal relationships and of the fact that trying to maintain two careers in the geosciences more than just doubles the problems. Alluding to Judy Syfers' article, she adds that it would be nice to have a "wife" to take care of her clothes, house, and personal needs.

Impact of the "Stag Effect"

In "Piecewise Discontinuous Function: Experiences in Engineering," Marybeth Lima discusses the importance of mentors. In particular, Lima emphasizes the positive impact that mentors can have on recipients' career development by "providing introduction and access to outside contacts in the scientific community." Lima states that "because mentoring is predominantly a male phenomenon, women are often isolated from informal collegial connections, and such isolation, whether by choice or by exclusion, renders them at a professional disadvantage." Lima summarizes the overall impact of what is termed the "stag effect":

The term stag effect has been coined by Bernard (1976b) to describe the structural segregation of women professionals. It represents the outcome of a system of exclusionary conventions, procedures, attitudes, customs, and other social traditions, that essentially guard the male turf from the encroachment of women.
As a consequence, female professionals may not be given adequate support in their professional development, may receive less recognition for their accomplishments, or may be actively shunned by their male colleagues all together.\textsuperscript{125}

Although the terminology "stag effect" may be relatively new, the discriminatory practices have been in place for a long time. The Geological Society of America memorial to geologist Alice Mary Dowse Weeks describes the "subterfuge" in which she had to engage in order to gain entry to underground mines:

At a time when few women worked in the field, Alice did extensive field work and visited many mines. Although she was generally well received, there were occasions when the superstitions against women caused her to use subterfuge to gain access to the mines. She willingly disguised herself as a man and waited until few miners were around, then quietly entered the mine to collect samples. The miners were never aware that women had been underground.\textsuperscript{126}

In "Woman with a Passion for Understanding the Earth," Jane Werniuk describes Canadian geologist Alice Wilson’s experiences with field work. Werniuk states that Wilson "wanted to go out and map the rocks and collect the specimens herself. At that time it was unthinkable that she would be sent to a remote camp. That restriction did not deter her. She chose as her study area the fairly accessible Ottawa-St. Lawrence Lowland, and in 1913 became the first woman sent to the field by the Survey."\textsuperscript{127} In "Alice Wilson, 1881-1964," Anne Montagnes adds a few more details on Alice Wilson’s struggles to do field work. Wilson was assigned a bicycle rather than the car that all the male geologists received as their standard due at the Geological Survey. The powers that be at the Geological Survey did not approve of women driving vehicles. Not to be deterred, Wilson apparently went out and bought her own Model T Ford, strapped the bicycle to the side, and set off to the field.\textsuperscript{128}
Montagnes also discusses Wilson’s field attire, which consisted of knee-length boots and a Cossack suit she had made by a Russian tailor. After years of wearing this outfit in the field, Wilson found that the severity of her clothing frightened school children on her frequent field trips with them, so she “discarded the rather formidable Cossack suit and knee boots for slacks and brogues.” Even field work close to home required adaptation and infinite patience with a bureaucracy that was predisposed to favour male practitioners over female. On the rare occasions when Wilson ventured farther from home, such as the field work she did with Madeleine Fritz around Lake Winnipeg, it helped that she had a brother well positioned in the Department of Mines to lend support and assistance when required.

There were many prejudices and taboos that early women geoscientists had to contend with in order to succeed in their chosen fields. Gaining field experience was just one of the hurdles that had to be confronted. The Geological Association of Canada committee that investigated the status of women geoscientists in Canada concluded its report in 1975 with the following point:

Field work is an essential part of any geologist’s training and work activity. The myth of the married male geologist’s wife not wanting her husband in the field with a female geologist should be laid to rest. Professional conduct infers that a male-female relationship in the field be a professional one, as it is in the office. Depriving female geologists of work opportunities in order to avoid vague or feared potential behavioural problems is not justified.

Feminist Critique of Science

Having established the fact that field work plays a key role in the professional induction of geoscientists, one now turns to the final topic to be examined in this chapter: the feminist critique of science that has developed in recent years. A number of authors have made important contributions in this area. For example, in a collection of essays
titled *Feminist Approaches to Science*, Ruth Bleier explores the nature of modern science and attempts to envision a science that is "different, better, feminist, and emancipating." In *Reflections on Gender and Science*, Evelyn Fox Keller asserts that both gender and science are social constructs—"that masculine and feminine are categories defined by a culture, not by biological necessity" and that "science is a set of practices and a body of knowledge delineated by a community, not simply by the exigencies of logical proof and experimental verification." 

Keller's nine essays in this book all illustrate her point that "the making of women and men has affected the making of science." In her essay on Barbara McClintock and in her book, *A Feeling for the Organism*, Keller presents an alternative vision of a science that combines both relatedness and separation. McClintock is her key example of a scientist who is able to accomplish this feat through her "feeling for the organism," which Keller sees as eliminating the boundaries between subject and object and emanating from a profound respect for the natural world rather than a desire to dominate it.

In "Feminist Scholarship in the Sciences: Where Are We Now and When Can We Expect a Theoretical Breakthrough?" Sue Rosser provides a very useful overview of feminist writing on women and science, which she categorizes under the six headings of "teaching and curriculum transformation in science," "history of women in science," "current status of women in science," "feminist critique of science," "feminine science," and "feminist theory of science." Under the latter category, authors such as Evelyn Fox Keller ask whether gender can influence the methods and theories of science. Rosser points out that feminists in some disciplines in the humanities and social sciences have been able to transform the theoretical frameworks of their disciplines, and that authors
such as Ruth Bleir and Elizabeth Fee offer suggestions as to how a feminist science would differ from traditional science. Rosser concludes that the field needs more feminist scientists to "explore science and its relationships to women and feminism in order to change traditional science to feminist science."¹³⁸

Much of the recent literature on women in science focuses on issues of attracting women to and retaining them in specialized areas in science, engineering, and technology. In "Women in Science: Issues and Actions," Rose Sheinin argues that there are two main factors that contribute to the unsatisfactory status of women in science, engineering, and technology (SET): the field continues to be primarily populated by men under hierarchical structures that have not provided a "hospitable or supportive environment" for women; and the upbringing and socialization of women in our society does not encourage them to seek careers in SET. Sheinin argues that the issues of productivity gap and tenure impasse, career selection and development, and reaction to career setbacks all must be examined in relation to the "hierarchical exclusion of women from almost all policy-making and implementing structures within our societal institutions, including SET."¹³⁹ Undoubtedly there have been significant improvements in women's participation since Sheinin's article was published in 1984, but many of her points are still valid, particularly in terms of the upbringing and socialization of young women.

**Difficult Balancing Act for Women in Science**

In "Cutting Loose," Susan S. Allen discusses the dilemma of values experienced by women in science fields:

Those of us indoctrinated into fields of science are taught to closely mimic the behavior of others, to be unemotional in our interactions with colleagues, and to
express ourselves verbally in a traditional language established by men. Yet as women, society teaches us that creativity, emotional warmth, and intuition are valuable traits. These characteristics are the opposite of those viewed as desirable by men in science and medicine. Being a woman scientist becomes a delicate balancing act in which one must exude a male-defined ‘professional’ aura in order to be recognized as a competent scientist, while often suppressing those qualities with which one defines one’s self as a woman. This struggle comprises what I believe to be the extra effort women must exert on a daily basis simply to be accepted as scientists.\textsuperscript{140}

Allen is not alone in recognizing this dilemma. In “Just Where Is ‘Our Place’?” Angela Pattatucci emphasizes the “difficult balancing act for women”\textsuperscript{141} in combining work and family roles. She points out “the stress associated in switching from the role required at the office—tough, no-nonsense, autonomous, and neutered—to the personal sphere, which includes being tender, compliant, dependent, and sensual.”\textsuperscript{142} Pattatucci concludes that it is difficult to maintain the duality of these two roles over an extended period of time and that the assumption is that most women will choose family over careers. She emphasizes that the decision to marry or have children can have a devastating impact on scientific careers:

Marriage and family are seen as a career-\textit{enhancing} move for men while at once a career-\textit{ending} one for women....On announcing a pregnancy or plans to wed, a woman is instantly branded as undedicated and nonproductive. Her record of accomplishments and the fact that she may be a highly respected scientist are completely negated by this single choice in her life. It is as if she has committed an act of treason and her punishment is lifetime banishment from the scientific community.\textsuperscript{143}

Pattatucci also states that women who prove able to manage both families and careers may be subjected to other “innuendos”: “The presumption that women should not be able to manage career and family over time is so strong that women able to do so are subject to a host of innuendos regarding their gender and sexuality—insinuations that also
typically extend to their spouse." The author concludes that it should not come as a surprise that many professional women choose not to marry and not to have children.

In "Coming to Terms with Science: A Woman's Story of Disillusionment," Beth Martin discusses the entrenched social dichotomies that she sees as characteristic of scientific disciplines: "...commonly accepted binary opposites include active versus passive, thought versus feeling, and knowledge versus intuition. In each case, the first term is associated with masculine characteristics, the second with feminine." In Martin's opinion, exceptional women in science are stigmatized just as unfairly as women scientists who choose to marry, only the labels are slightly different:

Famous women in science such as my personal heroine, the Nobel laureate Barbara McClintock, are usually described as being abnormal in some way. They have mystical qualities; they are loners; they do not raise a family or have husbands. They are often disliked by their professional peers, misunderstood, and ignored. They are viewed as lacking in femininity, and it is precisely because of this lack that they are able to be good scientists. Famous male scientists are sometimes depicted as eccentric, but they are still considered 'normal' men.

In Creative Couples in Science, editors Helena M. Pycior, Nancy G. Slack, Pnina G. Abir-Am and individual contributors examine the difficulties experienced by collaborative scientific couples. Many of the problems experienced by the scientific couples are consistent with the issues raised by Allen and Pattatucci. However, several of the authors emphasize the creative possibilities offered by intimate relationships and the fact that the close companionship of equal or near-equal partners leads in some cases to highly successful scientific partnerships. Marianne Ainley's account of the careers of the Berkleys in marine biology and the Hoggs in astronomy illustrates that the "winding tracks" of professional women's lives occasionally lead to late-blooming but highly productive professional careers equal to or surpassing that of their spouses. Ainley
suggests that these two scientific couples had exceptional collaborative partnerships for a number of reasons: "they were compatible, had complementary scientific interests, supported each other, and the husbands encouraged their wives' research." \(^\text{148}\)

However, Ainley concludes that married women scientists often assisted their husbands as unpaid research assistants and garnered little recognition in the scientific community for their efforts: "Collaboration with her husband could provide intellectual challenge for a woman and lead to private satisfaction, though hardly ever to professional recognition....Only rarely did married couples develop complete partnerships that allowed equal or better recognition for the female member of the team." \(^\text{149}\) In the case of Helen Hogg's career, it was only after the premature death of her husband that she had success in moving up the academic ladder in astronomy at the University of Toronto. However, she had received recognition for the publication of numerous academic papers previously and had lectured at the university for years, which left her well placed for promotion.

**Positive Aspects of Winding Career Paths**

In *Composing A Life*, Mary Catherine Bateson comments on the complexity of women's lives and the winding career paths they often experience. Rather than lamenting the lack of permanency in her own life and the lives of the four other women that she recounts, Bateson sees this lack of permanency as a factor that contributes significantly to their individual creativity and success:

Once you begin to see these lives of multiple commitments and multiple beginnings as an emerging pattern rather than an aberration, it takes no more than a second look to discover the models for that reinvention on every side, to look for the followers of visions that are not fixed but evolve from day to day. Each such model, like each individual work of art, is a comment about the world outside the frame. Just as change stimulates us to look for more abstract
constancies, so the individual effort to compose a life, framed by birth and death and carefully pieced together from disparate elements, becomes a statement on the unity of living.\textsuperscript{150}

Bateson’s book reinforces the point that Inga Elgqvist-Saltzman makes about women’s “‘winding tracks’ through education”\textsuperscript{151} in “Straight Roads and Winding Tracks: Swedish educational policy from a gender equality perspective.” Elgqvist-Saltzman suggests that researchers use “reversed life-line curves”\textsuperscript{152} to examine professional careers. She turns the traditional life-line approach to mapping professional careers upside down by inverting the life-lines and colouring women’s reproductive activity as “Green Hills” and highly productive periods in their life-cycle.\textsuperscript{153} In this case, the reproductive and nurturing work of women shows up as a positive attribute for women and the absence of such as a deficiency in men’s careers.

Elgqvist-Saltzman asks provocative questions about the relevance of life skills cultivated by women:

What kind of qualities are cultivated in unpaid work, e.g. taking care of children, of old and sick people who depend on you? How do periods of reproductive work add to the development of competence in a life-perspective? How is competence, developed in reproductive work, taken advantage of in productive work? What kind of competence is needed in the future in post-industrial societies?...How are women’s knowledge, experiences and values used to enrich the development of society?\textsuperscript{154}

While the author does not answer all of these questions, she suggests that more equitable sharing of parenting responsibilities and adequate recognition within work places for such activities would be important starting points.

In “Reflecting on reversals: an Australian view,” Joan Eveline comments on the importance of Elgqvist-Saltzman’s research: “Rather than it being taken for granted that women’s life patterns are somehow deficient when measured against men’s, the Green
Hills show a wealth of activity which is lacking in the lives of men." Eveline sees the inverted life-line perspective to be important for a number of reasons. First, it takes a feminist perspective and validates the importance of women's work; second, it shows that scholarship in the social sciences that does not analyze "women's lived experiences" is lacking; and finally, it disrupts "the male benchmark by which social science is usually conducted." Eveline concludes: "Thus, the reversed life-line displaces the male norm as the unremarked basis of the dominant discourse, while it simultaneously affirms the value of the feminist perspective."

In *Women in Science: Meeting Career Challenges*, Angela Pattatucci emphasizes the need for revamping of institutional policies relating to recruitment and retention as well as the time frame for tenure. She suggests not only that credit for mentoring responsibilities should be the norm but also that provisions for child care and parental leave should not end up penalizing the recipients in terms of chances for receiving tenure.

**Conclusion**

The discussion now returns to the questions raised by Alison Mackinnon at the beginning of the chapter. The verdicts are far from unanimous on a number of the questions Mackinnon raises. Jill Ker Conway and a number of other historians such as Rita McWilliams-Tullberg question the development of separate women's professions as a negative rather than positive force in women's emancipation. Conway also questions the mixed results of coeducation, and Conway, Parr and Brandt point out the limitations of the "separate spheres" concept. To a certain extent, Alison Mackinnon answers her own questions about male heads on female shoulders when she concludes the following:
If indeed they learned to ‘think’ like men, women frequently used their reasoning and verbal skills to argue for an increase of women’s autonomy, as do many highly educated women today....While there is evidence that women internalised dominant discourses, they also used a range of diverse strategies and resistances which shaped the major transformation of the period.159

The themes of separatism in women’s education, professions, and spheres that are touched on in this analysis deserve further study. The term separatism itself is multifaceted in the various meanings it connotes—from separate education versus coeducation, to the development of separate women’s professions and separatist strategies, and finally to the discussion of the separation of public and private spheres. I agree with Conway, Parr, and Brandt that the separate spheres concept has been overemphasized in the literature and has outlived its usefulness. However, I would also argue that there is a moderate position that one could take regarding separate education and separate women’s professions, one that analyzes both the positive and negative aspects of their development. Ruth Pierson and Alison Prentice argue in “Feminism and the Writing of History” that all too often “rigid categories and dichotomies” have proved to be divisive forces in women’s history:

We recognize that all too often women’s choices have been circumscribed by rigid categories and dichotomies, positing unreconcilable conflict between two solutions, two interpretations, or even between two supposedly opposite types of feminism that force women into one camp or another....We want to argue that women can be both different and equal, separatist and assimilationist; that women have a right in certain situations and moments in their lives to their own organizations and the creation of sisterly solidarity at the same time that we have the right to integration with men in the public domain of power.160

These themes of separation are relevant to my study of women geoscientists in a number of important ways. First, the gendered nature of education informed the interviews concerning formative schooling experience in the participants’ lives. As well, analysis of the data provided through the interviews raised further questions concerning
the role of all-female learning environments as factors that contributed to success in non-traditional settings. Second, the research on separate women’s professions both intersects with and runs parallel to the study of women in the geosciences. As Marianne Ainley has suggested, rather than being streamed into separate women’s professions, Canadian women in geosciences were initially relegated to specialized areas of employment such as work as laboratory and museum assistants and in office-bound research rather than field-based investigations. As the participants’ recollections will testify, these gender-oriented distinctions caused bitterness that is still apparent even decades after they occurred.

Third, the theme of separate spheres so resonant throughout the writings of women scientists reechoes in the lived experiences of contemporary women geoscientists. Combining public presence with domestic commitment, and field-based research with the gendered expectations of woman, wife, worker, and mother, creates tensions and role conflicts. There is a reciprocal relationship between each of these themes and the interviews insofar as the literature informed the thesis and the interviews extended the observations.

The fourth important theme that emerges in the literature on entrance of women to Canadian universities is the positive impact of the world wars on professional training for women. Alison Prentice, W.P.J. Millar, and R.D. Gidney refer to the increasing numbers of women who gained access to professional training in fields such as physics and medicine in both the war and the interwar years. Millar and Gidney also suggest that the group of women medical students came from relatively privileged backgrounds. Ruby Heap links the First World War to the development of new specialty fields for women such as physiotherapy at the University of Toronto, which led the way for the
development of degree programs in social work and public health nursing. Nicole Neatby’s research also suggests that the impetus toward professionalism for women was not confined to the University of Toronto, but was also evident in Queen’s University women graduates.

Finally, the emergence of a feminist critique of science provides an opportunity to engage in a different discourse concerning the possibilities that science provides to women. Scholars such as Evelyn Fox Keller state that the “remaking of science” requires the “simultaneous remaking of our conceptions of men, women and science”\textsuperscript{161}:

The projects of ‘remaking’ cannot be separated from one another, because the development of individual men, women, and scientists depends so critically on the interlocking ideals of masculinity, femininity, and science that derive so much of their coherence, endurance, and force from the simultaneous acceptance of all three....In the conclusion to my book \emph{Reflections on Gender and Science}, I suggested that the emancipation of science from its ‘masculinist’ heritage requires ‘not a juxtaposition or complementarity of male and female perspectives, nor...the substitution of one form of parochiality for another. Rather, it [requires] a transformation of the very categories of male and female, and correspondingly, of mind and nature.’\textsuperscript{162}

These same issues that provoke Keller to call for a reconceptualization of science have led other scholars, particularly those in the complex discipline known as history, to view the past through different lenses. One of the most relevant lenses for this study of women in geoscience deals with the object of their work (resource extraction) and gave rise to the topic of chapter four, the new field of environmental history.

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\textsuperscript{1} Margaret W. Rossiter, “Doctorates for American Women, 1868-1907,” \textit{History of Education Quarterly} (Summer 1982), 161. Note that this article becomes chapter two in Rossiter, \textit{Women Scientists in America, Struggles and Strategies to 1940} (Baltimore, Johns Hopkins University Press, 1982).


\textsuperscript{3} Ibid., 37.

\textsuperscript{4} Ibid., 37.
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6 Ibid., 1.
7 Ibid., 9.
8 Ibid., 9.
10 Ibid., 445.
18 Ibid., 143.
19 Ibid., 135.
20 McWilliams-Tullberg, “Women and Degrees at Cambridge University, 1862-1897,” 144.
21 Creese and Creese, “British women who contributed to research in the geological sciences,” 41.
23 Ibid., 159.
24 Ibid., 160.
25 Ibid., 162.
26 Ibid., 164.
27 Ibid., 164.
28 Ibid., 166.
29 Ibid., 173.
30 Ibid., 174.
32 Creese and Creese, “British women who contributed to research in the geological sciences,” 46, (see footnote #84).
34 Ibid., 174-175.
35 Ibid., 165.
36 Creese and Creese, “British women who contributed to research in the geological sciences,” 33-34, (see footnote #35).
38 Christine Johanson, Women’s Struggle for Higher Education in Russia, 1855-1900 (Kingston: McGill-Queen’s University Press, 1987).
39 Ibid., 74.
40 Creese and Creese, “British women who contributed to research in the geological sciences,” 43.
41 Johanson, Women’s Struggle for Higher Education in Russia, 90.
42 Augusta Stowe was the first Canadian woman physician to graduate according to Carlotta Hacker, The Indomitable Lady Doctors (Toronto: Clarke, Irwin, 1974), 29.
43 Creese and Creese, “British women who contributed to research in the geological sciences,” 44-45, (see footnote #77).
44 Johanson, Women’s Struggle for Higher Education in Russia, 1855-1900, 103.
45 For a discussion of the entrance of women to Queen’s University, McGill University, and the University of Toronto see Jo LaPierre, “The Academic Life of Canadian Coeds, 1880-1900,” Historical Studies in Education/Revue d’histoire de l’éducation 2, 2 (Fall 1990): 225-245. LaPierre points out that in the early years of university entrance, women did not go out of their way to make themselves highly conspicuous on university campuses because they knew that their welcome was uncertain. Also see Sara Z. Burke, “New Women and Old Romans: Coeducation at the University of Toronto, 1884-95,” Canadian Historical Review 80, 2 (June 1999): 219-241. Burke argues that women students at the University of Toronto were more vocal and more visible on campus than LaPierre would have us believe; however, her evidence is based on one isolated protest in which a small number of women students were involved. See also Lykke de la Cour and Rose Sheinen, “Women at Queen’s University, 1895-1905: A ‘Little Sphere’ All Their Own,” Ontario History LXXVIII, 4 (December 1986): 331-349. For a discussion of Queen’s University women in the 1920s, see Nicole Neatby, “Preparing for the Working World: Women at Queen’s during the 1920s,” Historical Studies in Education/Revue d’histoire de l’éducation 1, 1 (Spring 1989): 53-72. For an examination of the experiences of women students at the University of British Columbia, see Lee Stewart, ‘It’s Up to You’: Women At UBC In The Early Years (Vancouver: University of British Columbia Press, 1990).
47 Ibid., 150.
51 Ibid., 126.
52 Ibid., 131.
53 Ibid., 131-32.
54 Ibid., 125.
55 Ibid., 125.
56 For a more detailed description of the career of Grace Anne Stewart, first woman to graduate in geology in Canada, see Chapter Five, “Three Women’s Careers in Geology.”
58 W.P.J. Millar and R.D. Gidney, “‘Medettes’: Thriving or Just Surviving? Women Students in the Faculty of Medicine, University of Toronto, 1910-1951,” in Challenging Professions, eds. Smyth et al., 215.
59 Ibid., 225.
60 Ibid., 218. The authors also add the following in a footnote: “This tendency held for women university students generally. See Axelrod, Making a Middle Class, 29; Judith Fingard, ‘College, Career, and Community: Dalhousie Coeds, 1881-1921,’ in Youth, University, and Canadian Society, eds. Paul Axelrod and John G. Reid (Kingston: McGill-Queen’s University Press, 1989), 27-35; Nicole Neatby, ‘Preparing for the Working World: Women at Queen’s during the 1920s,’ in Gender and Education in Ontario: An Historical Reader, eds. Ruby Heap and Alison Prentice (Toronto: Canadian Scholars’ Press, 1991), 336.”
62 Ibid., 169-70.
63 Ibid., 178.
64 Ibid., 161.
66 Ibid., 68.
67 Ibid., 68.
68 Ibid., 56.
69 Yves Gingras, “Financial Support for Post-graduate Students and the Development of Scientific Research in Canada,” in Youth, University and Canadian Society, eds. Axelrod and Reid, 301-2.
70 Ibid., 302-5.
71 Ibid., 303.
72 Ibid., p. 316.
77 Nadya Aisenberg and Mona Harrington, introduction to Women of Academe: Outsiders in the Sacred Grove (Amherst: University of Massachusetts, 1988), xii.
81 Ibid., 165.
82 Smyth et al., eds., introduction to *Challenging Professions*, 17.
83 Ibid., 5.
84 Ibid., 4.
85 Ibid., 5.
87 Ibid., 64.
88 Ibid., 193.
89 Ibid., 67-68.
90 Ibid., 67.
93 Ibid., 267.
95 Smyth et al., introduction to *Challenging Professions*, 6-7.
100 Ibid., 18.
101 Ibid., 22.
103 Harris, *Broken Patterns: Professional Women and the Quest for a New Feminine Identity*, 22.
104 Ibid., 22.
106 Ibid., xi.
107 Ibid., xii.
108 Ibid., xii.
110 Ibid., 243.
114 Ibid., 23.
115 Ibid., 26.
117 Ibid., 15.
118 Ibid., 15.
119 Ibid., 15.
120 Ibid., 19.
124 Ibid., 87.
129 Ibid., 275.
130 Ibid., 269.
132 In the interests of brevity, the discussion of this topic is selective rather than comprehensive in its coverage. Omitted in the discussion, for instance, is the debate over the three major positions that have emerged in feminist writing on gender and science: feminist empiricism, feminist standpoint theories, and feminist postmodernism. For a discussion of these themes, see Sandra Harding, The Science Question in Feminism (Ithaca and London: Cornell University Press, 1986). For another lively debate on this issue, see Susan Hekman, “Truth and Method: Feminist Standpoint Theory Revisited,” Signs: Journal of Women in Culture and Society 22, 2 (Winter 1997): 340-365. Responses from Nancy C.M. Harstock, Patricia Hill Collins, Sandra Harding, Dorothy E. Smith, and a reply from Susan Hekman follow the article.
135 Ibid., 4.
136 Ibid., 162-5.
137 Sue Rosser, “Feminist Scholarship in the Sciences: Where Are We Now and When Can We Expect a Theoretical Breakthrough?” in Feminism & Science, ed. Nancy Tuana (Bloomington and Indianapolis: Indiana University Press, 1989), 4-9.
138 Ibid., 3.
142 Ibid., 103.
143 Ibid., 99-102.
144 Ibid., 103.
146 Ibid., 55.

Bateson, Composing A Life, 17-18.


Ibid., 52.


Ibid., 52.

Joan Eveline, "Reflecting on reversals: an Australian view," in Gender and Education in Life Perspective, eds. Bjerenc and Elgqvist-Saltzman, 162.

Ibid., 162.

Ibid., 162.


Ruth Pierson and Alison Prentice, "Feminism and the Writing and Teaching of History," Atlantis 7, 2 (Spring 1982), 39.


Ibid., 89.
CHAPTER FOUR

THE RESOURCE FRONTIER AND WOMEN GEOSCIENTISTS IN ALBERTA

This chapter poses the question of to what extent does the literature of the resource frontier inform an analysis of women geoscientists in Alberta. To answer the question, I engage in what Frederick Jackson Turner has called a “reconnaissance” of the literature on the economic history of the province of Alberta and the frontier thesis. This reconnaissance considers a number of questions as possible approaches to the current study. Was the Western resource frontier more egalitarian in its approach to women’s participation in the professions? Did the fact that women achieved the vote first in the West translate into the development of more egalitarian attitudes in other areas of public life? Does Frederick Jackson Turner’s frontier thesis fit the Canadian patterns of settlement and resource development? How have new American interpretations of the frontier thesis affected its applicability to the province of Alberta? Finally, how are the Alberta environment, the resources, the inhabitants, and the plant and animal life in that environment connected to the work that geoscientists do?

This reconnaissance did not lead to answers to all of these questions, but it assisted me in the development of the following two arguments. The first is that women are for the most part absent in the economic history of Alberta as it is currently written, and that this omission needs to be rectified. The second is that the work of the New West and environmental historians in the United States offers the most promising approach for the current study. These historians are leading the way in terms of putting women, cultural minorities, aboriginal peoples, the borderlands, and the environment into a central position in the new regional histories. The work of environmental historians such
as William Cronon reveals that J.M.S. Careless’s concept of “metropolitauïsm” is undergoing a resurrection in the United States. Cronon uses the concept in Nature’s Metropolis: Chicago and the Great West and in a number of articles in which he restates Turner’s frontier thesis in metropolitan terms.

Cronon’s article titled “Kennecott Journey: The Paths Out of Town” is an interesting description of a journey he took to an abandoned copper mine located at the foot of Kennecott Glacier in a remote area of Alaska that is now inside the Wrangell-St. Elias Park. The author points out that the history of Kennecott’s development and subsequent abandonment provides “a classic study in the environmental history of western North America”:

In exploring Kennecott’s changing environment, we ask questions that have a significance beyond this place, for they point to new ways of thinking about the West as a region, new ways of approaching environmental history in other times and other places. In posing them, we seek to integrate three broad elements: the ecology of people as organisms sharing the universe with many other organisms, the political economy of people as social beings reshaping nature and one another to produce their collective life, and the cultural values of people as storytelling creatures struggling to find the meaning of their place in the world. Our goal in peering through these three lenses is to see how environmental change relates to other changes in human societies. The special task of environmental historians is to tell the stories that carry us back and forth across the boundary between people and nature to reveal just how culturally constructed that boundary is—and how dependent on natural systems it remains.

Cronon’s journey to Kennecott reminds one that there are hundreds if not thousands of locations just like it in the North American West. One such location is Bitumount, a remote location in northern Alberta that was once the site of the pilot oilsands extraction plant of Robert Fitzsimmons and later became the Government of Alberta Plant. After driving for hours on rough and remote bush roads, one encounters a rather derelict Alberta Culture historic site nestled on the banks of the Athabasca River.
Empty and decaying bunkhouses, deserted single family dwellings, laboratories with equipment left ready to resume work, and the abandoned extraction plant all demonstrate the impermanence of the work of human beings. Nature is starting to reclaim the site, much as it is reclaiming the site at Kennecott, but human labour leaves permanent reminders in the way of scars on the landscape.

Cronon’s essay is pivotal in informing this dissertation: the key point is that the work that geoscientists perform has to be considered in its broad environmental context. Even in mapping and exploration, geoscientists alter the environment as they pass through it. They engage in interchange with the inhabitants, utilize the fish, wildlife, and plant life, and frequently alter their own outlook as a result of experiences. These factors all have to be taken into consideration in the current study. Cronon asserts that “Mapping out the geography of gender, class, race, ethnicity remains one of the most important but least studied aspects of environmental history.”7 The author asks the following questions: “How do the many categories into which people divide themselves define the ways they experience and affect the landscape? Who has power over whom in this place, and how does the land reflect that power?”8 These are very important questions to ask about physical locations, but they also need to be asked in reference to professional occupations and the roles that people adopt within those occupations.

**Literature on Resource Exploration and Development**

Even a brief glance at the literature on resource exploration and development leads to a very disappointing conclusion—women are largely missing from the pages of these histories. Morris Zaslow’s *Reading the Rocks: The Story of the Geological Survey of Canada, 1842-1972*9 is an obvious first place to look on the topic of the geological
sciences. Unfortunately, Zaslow’s history is written in the great men in history tradition. It is a richly detailed account of the mapping and exploration of the territory that came to be Canada. As a result of the strenuous nature of the field work demanded in the early days of the geology profession, it may have seemed natural that most of the practitioners were men. It also obviously seemed natural to Zaslow to focus the book within the interpretive framework of the great men in geology performing heroic work.

There were, however, a number of women working in geology. Zaslow acknowledges them briefly. A photograph of Alice Wilson is included, and she is mentioned all of nine times. Wilson was first a museum assistant with the Geological Survey and then went on to complete a Ph.D. in invertebrate paleontology at the University of Chicago before returning to spend the rest of her career with the Survey. Helen Belyea, a field geologist and sub-surface stratigrapher who spent almost her entire career in the Calgary office of the Geological Survey of Canada, is referred to once. Mrs. D.M. Sutherland receives accolades for her work in maintaining the library and map collection, and Miss Gertrude E. Derry is included in a photograph and acknowledged as the chief geologist’s secretary.  

Zaslow also provides a very useful list of all the employees of the Geological Survey at the end of the book. If one looks closely, one finds that there were a surprising number of women employed in varying capacities over the years, including a number of paleontologists who worked for short periods of time and went on to other institutions. Women also show up as photographers, librarians, and secretaries. Despite its limitations, Zaslow’s book is full of very useful information on the work done by the Survey. The author very effectively illustrates the importance of the Geological Survey
to the development of the mining industry in Canada. In addition, Zaslow notes the remarkable longevity of the Geological Survey of Canada, which stands in contrast to similar but shortlived institutions established by many other countries.

Another important book in terms of assessing the impact of petroleum development on the province of Alberta is Eric J. Hanson’s *Dynamic Decade*. Hanson, a professor of economics at the University of Alberta, analyzes the dynamic decade between 1947 and 1957. The author outlines the sequence of events in the petroleum development, the importance of the events, and their impact on the regional economy, the population, and the income of the province and its inhabitants. Hanson describes the province’s economy at the beginning of the decade as more or less static, highly dependent on agricultural exports, and the province’s population as “stationary.”12 By the end of 1956, Alberta was producing four-fifths of Canada’s output of crude oil and more than nine-tenths of its production of natural gas.

Hanson notes that of the four billion dollars invested in the petroleum industry in Canada during the decade, two and a half billion were invested in Alberta. The extensive investment created new regional industries, new occupations, increases in population income, and a new entrepreneurial elite. Hanson states that “Between 1946 and 1956, the population rose by two-fifths, personal income more than doubled, the net value of production tripled and bank clearings quadrupled.”13 The author emphasizes that the structure of the province’s economy also changed dramatically, with the contribution of mining (mainly petroleum) rising from 10 to 26 percent, construction increasing from 14 to 26 percent, manufacturing remaining stable at 18 percent, and agriculture declining in importance from 54 to 27 percent.14
The petroleum industry also was responsible for the development of many new towns such as Devon, Redwater, and Swan Hills, as it was for the rapid expansion of previously existing centres such as Edmonton, Calgary, Lethbridge, Medicine Hat, Camrose, Lloydminster, and Red Deer. New employment opportunities also became available for professionals such as geologists and engineers who were required in large numbers for petroleum development. Hanson concludes the following:

Just as the development of the agricultural potential of Alberta’s land led to rapid settlement and new employment and income opportunities half a century ago, so the petroleum potential has induced a great rise in population and income at mid-century. In both cases a high rate of economic progress was made possible by substantial inflows of capital and labour.

David H. Breen’s *Alberta’s Petroleum Industry and the Conservation Board* is another important source of information on the conservation legislation put in place as a result of the rapid period of oil development after the discoveries at Turner Valley and Leduc. Breen states that “the history of oil and gas conservation in Alberta divides naturally into relatively distinct periods that are shaped by market, technical, and political factors.” The first period of oil development was the pioneer phase that lasted until 1938. Breen states that this period was characterized by “‘rule of capture’ doctrine,” which in effect meant that everything was wide open. If one owned the mineral rights to a property, one could capture whatever quantity of resources one could manage to get out of the ground. Since oil was valuable in this period and natural gas was not, there was a very high level of waste in the natural gas flaring that took place. Breen also notes that development in this pioneer period was dependent on “local capital resources and marked by an unstable economic setting.”
The second period of development was a transition period between the pioneer phase and the post-Leduc era. It commenced in 1938 with the formation of the Petroleum and Natural Gas Conservation Board, which was a regulatory body established to develop conservation policies in relation to the Turner Valley oilfield outside of Calgary. Breen regards it as fortunate that the Conservation Board put its regulations into place when the oil industry was relatively small in scale and centred on one oilfield, the Turner Valley:

Along with and directly related to the imposition of active regulation in the public interest came important advances in reservoir engineering that began to reshape ideas about what was acceptable production practice. Business organization in the Alberta petroleum sector was also in transition, and during this period it moved much further away from dependence on local capital and entrepreneurship.

The third period of development commenced with the Leduc discovery in 1947. Breen notes that within the short span of a year, the petroleum industry in Alberta had shifted from a modest regional operation to one of “continental significance.” The big multinational and American companies flocked to the province, and with them came oil executives, technical experts, oilfield managers, drillers, and other highly skilled specialists. Breen summarizes what these changes meant for the province:

The dimension and pace of change in the industry and its impact on the province are easily conveyed with just a few statistical reference points. In 1938, only about 60 wells were being drilled each year, compared with nearly 400 in 1948 and almost 1,700 by 1959. More than 60 percent of Alberta’s current (1992) conventional crude oil reserves and more than 40 percent of natural gas reserves were discovered before 1960, mainly in the 1948-49 period. In 1938-39, the energy resource industry contributed $1.3 million towards the total provincial budget expenditure of $11.4 million. By 1948-49, these figures had grown to $14.6 and $46.5 million respectively, and by 1959-60 revenue from the energy sector’s direct contribution to the provincial treasury equalled more than 50 percent of the provincial budget total, $143.3 of $228.2 million.

From the perspective of the current study on geoscientists, the most important point Breen makes is that the Conservation Board built up a highly competent
professional staff, most of them educated at the University of Alberta. Breen also notes that the Conservation Board provided a "unique public sector training environment for dozens of young Canadian engineers who later moved to careers in the industry." Unfortunately, he does not comment on the male/female ratio of engineers in the early years of the Conservation Board. However, the transcript of the interview with Mary Turner in the Petroleum Industry Oral History Project, which will be discussed in the next chapter, suggests that women employees were not numerous either before or during WWII. Breen concludes that the Petroleum and Natural Gas Conservation Board played one of the most important roles in the province's post-war economic development. In addition, by its example, it influenced the conservation practices in other oil- and gas-producing provinces, particularly British Columbia and Saskatchewan. "As the first, and by far the largest, producer of oil and gas, regulations and procedures set by Alberta established the standard and became the reference model for other Canadian jurisdictions."

James G. MacGregor also comments on the impact of the oil industry on the province in A History of Alberta. MacGregor emphasizes the growth in population, per capita income, and urban centres as well as the province's diversification into manufacturing processes by the 1970s:

In regard to population, while Canada grew from 12,292,000 to 21,377,000 (1971), Alberta grew from 803,000 to 1,600,000, an increase of one hundred percent as compared to Canada's growth of seventy-four percent. But far more significant was the increase in its per capita income, which in 1939 had been $340 and by 1969 was $2,915. Not only had Alberta's population doubled during the quarter century since Leduc No. 1 but on the average every one of this doubled population had about eight times as much money to spend as his counterpart at the beginning of the period....By 1970 Alberta, the one-time forlorn farming province, found its prosperity firmly supported on four substantial bases: mining (including oil), construction, manufacturing, and agriculture.
MacGregor also notes the increase in urban population in Alberta by 1971: the city of Edmonton grew from a population of 113,000 to 449,000, Calgary’s population increased from 100,000 to 387,000, and Lethbridge’s population changed from 16,500 to 39,500. Smaller centres such as Wetaskiwin, Red Deer, Lloydminster, Camrose, and Grande Prairie also experienced increases in population. Although MacGregor provides an excellent overview of the province’s history and the economic growth of the province through resource development and diversification into manufacturing, he makes only occasional references to the role of women such as the arrival of the Grey Nuns in the missions and the arrival of the first white woman in the province.

In *The Canadian Prairies: A History*, Gerald Friesen also points out that Alberta was “Canada’s Cinderella in the post-1940 decades.” Friesen ties the increasing prosperity of the province to the shift in wealth creation from agricultural production to mining and petroleum. From 1935 to 1971, the significance of agricultural production declined from 50 percent of Alberta’s wealth creation to 15 percent, and mining and petroleum increased from 10 percent to 40 percent. Friesen concludes that “The discovery of oil at Leduc in 1947 was as significant an event in regional history as the original influx of homesteaders before the First World War, and the implications of the windfall were still being worked out in the 1970s and the 1980s.”

A number of other books refer to resource development in Alberta. Peter Foster’s *The Blue-Eyed Sheiks: The Canadian Oil Establishment* deals with the period of rising oil prices after the OPEC crisis in 1973-74 and Peter Lougheed’s battles with the federal government to determine who would profit from price increases. Foster documents the rise of a home grown entrepreneurial elite in Alberta personified by individuals such as
Jack Gallagher of Dome Petroleum and Bob Blair of Alberta Gas Trunkline. These entrepreneurs and others like them gained enough financial clout to be able to compete with the multinationals for major oil and pipeline projects. Unfortunately, the only reference to women in Foster’s book is in regard to their restricted entry to the Calgary Petroleum Club and to wives and children who were part of the horse riding and country club set. As recently as 1979, women still had to enter the Petroleum Club through the back door and were admitted only after 3:30 p.m., after the lunch hour rush and the serious drinking and deal making were over. Foster notes that these restrictions were beginning to be a problem as a result of the increasing numbers of women geologists and women oil executives.

John Richards and Larry Pratt take a slightly more academic look at the rising power of the Prairie West in *Prairie Capitalism: Power and Influence in the New West*. Richards and Pratt contrast staple-led economic development in Alberta and Saskatchewan and the transition in both provinces in the post-war period from a wheat economy to the new resources of oil, natural gas, and potash. In many ways, the book is a study of the contrasts between right and left wing prairie populism and its impact on resource development, as demonstrated by the Social Credit government in Alberta and the Cooperative Commonwealth Federation in Saskatchewan. Richards and Pratt “trace the impact of the new staples on the economic base, class structure, and political institutions of prairie society.” A corollary of this theme is the “gradual, if uneven, emergence” of the provincial governments as key players in directing and regulating resource development. Women are for the most part absent in the analysis in Richards and Pratt’s book as well.
The authors conclude that staple-based resource development does not necessarily lead to permanent dependency. In fact, the pattern of resource development in Saskatchewan and Alberta shows a gradual movement away from "dependent regional capitalism." Richards and Pratt suggest that whenever prairie governments tried to artificially implant secondary industries, they were usually failures: "...they have succeeded by and large in the 1970s where they have exploited favourable market conditions in their resource industries and have concentrated their bargaining power in order to maximize the provincial share of rents and closely linked industries."

The authors also emphasize that political leadership and the growing power and expertise of regional entrepreneurs and the provincial governments have been critical to the success of staple-led economic growth:

Within the traditions and norms of North American capitalism, the choice of a staple-led strategy of development may well be the most rational course–always provided (and it is admittedly no small proviso) local entrepreneurial initiative and skills are available to exploit changing markets and to maximize potential benefits that inhere in such development. If the hard choices of prairie development necessarily occur within the limits of a staple-dependent region, then the strength of regional entrepreneurship and the distribution of political power have been the decisive factors in determining how–and for whose benefit–the staples are developed.

Aubrey Kerr looks at resource development from the local historian’s perspective in the four books he has authored. *Leduc* and *Redwater* show the human dimension to resource development, and provide a fair number of references to the strong contributions of women in marriage partnerships. Kerr provides biographical sketches of oil personalities and local families at the conclusion of both of these books. One sketch in particular documents geophysical assistant Norma Cooley McNeil’s struggle to maintain employment in the oil patch in the early years after the Leduc discovery when
discrimination against women was well entrenched. Kerr includes the sketch on McNeil because it "epitomizes the emergence of female employment in an otherwise male-dominated oil patch."46 The tapes and transcripts from the Petroleum Industry Oral History Project that Kerr helped to initiate at the Glenbow Archives in Calgary are also a useful resource and provided valuable information on the career of geologist Mary Turner.

Barry Glenn Ferguson documents the early years of oilsands development in Athabasca Oil Sands: Northern Resource Exploration, 1875-1951. Ferguson outlines the early exploration of Geological Survey parties under the leadership of John Macoun and Robert Bell and the work of Mines Branch geologist Sidney Ells.47 He also explores the work of the Alberta Research Council under Dr. Karl Clark and the founding of Abasand Oils by Max Ball and International Bitumen Company by Robert Fitzsimmons at Bitumount, the latter of which became the Government of Alberta Plant.48 Although the history of oilsands development is highly relevant to the current study in terms of the exploitation of provincial resources, very few women figure in these early histories.

Local historian Darlene Comfort provides slightly more detail on women in the north engaged in entrepreneurial and other activities. These activities included storekeeping, fur trading, provision of rooming house and laundry services, as well as the work of women religious who provided medical, religious, and educational services to oilsands communities such as Fort McMurray.49 However, there are few if any references to women working in a technical capacity in the early history of oilsands development. Fortunately, there are a number of taped interviews at the Provincial Archives, one with the wife of engineer Elmer Adkins, who worked at Fitzsimmons' plant at Bitumount.50
However, it was not until the more recent period of oilsands development and the establishment of Great Canadian Oil Sands (G.C.O.S. now known as Suncor) and Syncrude Canada Ltd. that women began to be hired in professional roles as geologists, geophysicists, and engineers.

J. Joseph Fitzgerald’s *Black Gold With Grit: The Alberta Oil Sands* also deals with early exploration and oilsands development, but it continues the history to include the development of G.C.O.S. and Syncrude. Even though the author deals with a more recent period of development, women do not play a part in his narrative. One begins to wonder where the women are in Alberta history, and why it is that the narratives so systematically skip over the economic contributions of women to pioneer communities. Authors such as Jennifer S.H. Brown, Jacqueline Peterson, and Sylvia Van Kirk have done an excellent job of analyzing the role of aboriginal and Métis women in the fur trade; however, with the exception of the recent collection edited by Catherine Cavanaugh and Randi Warne, historians have tended to neglect the more recent contributions of women to the provincial economy.

**Women’s Contribution to Resource Development**

Veronica Strong-Boag, however, has examined the double work load of prairie farm women in “Pulling in Double Harness or Hauling a Double Load,” and Patricia Roome has analyzed the political activity of “Amelia Turner and Calgary Labour Women, 1919-1935.” Both Roome and Strong-Boag make important points about feminism in the West in the post-enfranchisement period. Roome states that Amelia Turner and Calgary labour women were a significant political force, but “the continued focus on male elites keeps hidden from analysis the structural barriers and contradictions
that women faced, and precludes an understanding of the solutions they developed." Patricia Roome asks historians to look beyond this narrow focus on politics and "male elites," and Veronica Strong-Boag raises the issue of the "three dichotomies: political/apolitical, public/private, and male/female." Strong-Boag emphasizes that "we must reexamine our understanding of what is political, where it occurs and who is involved. Private life can be very political indeed, involving important struggles over power and authority which engage both men and women." Strong-Boag’s discussion of the public/private, male/female, and political/apolitical polarities adds to the discussion of separate spheres introduced in the previous chapter and provides an excellent lead-in to the work of sociologists such as Meg Luxton.

Sociologists fortunately have been active in documenting the contribution of women to resource communities. Meg Luxton’s More Than A Labour of Love: Three Generations of Women’s Work in the Home is a classic study of the domestic labour of three generations of women in Flin Flon, a northern Manitoba resource community. Luxton emphasizes the sharp divide between work and home or the public/private spheres in these women’s lives and the invisible and often unacknowledged nature of their “labour of love.” Luxton states that “It appears that there are two distinct and unrelated spheres: the public world of work, based on economic relations, and the private world of the family household, based on love relations.” The author emphasizes that this division of spheres fails to acknowledge the many ways in which domestic labour is critical to activities in the workplace, from the reproduction of workers themselves to their physical sustenance and psychological well being. Luxton argues that working-class
households are "sustained by two distinct but connected labour processes: wage labour and domestic labour."58

Luxton's choice of location for her study is particularly interesting since she is able to follow the way in which the community changes from a raw pioneer outpost with no amenities to a modern resource community with all the amenities that modernity implies. This transition occurs over a relatively short fifty-year period in Flin Flon, so that the three generations of women in her study reflect this change over time. Luxton concludes that the isolation in which women work in the home often makes it difficult for them "to see beyond their own personal situation, to recognize that their domestic labour is more than a labour of love and to acknowledge the oppressive qualities of their work."59 She asserts that if women want to change the conditions of domestic labour, they are forced to enter the "terrain of politics."60 Even though the percentage of working mothers has skyrocketed in Canada in the last twenty years, the double work-day that Luxton refers to in relation to the small group of working women in her study probably has not changed all that much for most Canadian working women. More work needs to be done by sociologists on modern resource communities to add to the information provided by classic studies such as Luxton's.

*Minetown, Milltown, Railtown: Life in Canadian Communities of Single Industry* by Rex A. Lucas is another study that is relevant to the topic of resource development. Lucas outlines the development of single industry communities from the construction stage and bunkhouse life typical of this early stage of development to the recruitment of citizens and the development of social, civic, and economic infrastructures such as social clubs, health services, schools, and recreational facilities.61 Lucas also examines the
motivations and psychological outlook of temporary construction workers, the impact of citizens' feelings of impermanence on the communities, and the problems of attracting and keeping professionals such as doctors, lawyers, and teachers to these communities. His definition of a single industry community is that it must be under 30,000 in population and a one-company town in which less than a quarter of the community is engaged in providing subsidiary services.\(^{62}\)

Lucas's definition does not take into account modern mega-projects such as oilsands plants that result in the construction of large communities in which there might be two or more companies engaged in the exploitation of a single resource. In addition, the range of auxiliary services required in modern resource communities has expanded significantly in the recent era of contracting out non-essential services. In short, this study should be updated to reflect the changing nature of resource communities. However, since Lucas does not identify the communities in his study as other than minetown, milltown, and railtown, the present-day researcher has no way of going back to look at the changes that have occurred in these communities in order to update his findings. Despite the problems posed by his restrictive definition of single industry communities, the author's conclusions are valid even in relation to the larger communities spawned by oilsands mega-projects:

...Canadian communities of single industry are twentieth-century products of an age of industry and technology. They are communities of today, relevant, with few past memories. They are new communities, and their very existence depends upon advanced technology, a complex division of labour, and a sophisticated system of exchange. With few exceptions they have a short past, because they were born of technology; the oldest of the communities are the products of the coal and rail ages; the newest have been created to supply industrial metals [and oil]. Their inhabitants have no lingering myths of days gone by; they know that their community, jobs, and lives depend upon twentieth-century science and technology....They know that their future depends upon impersonal forces outside
their community such as head office decisions, government policies, and international trading agreements.63

Thomas W. Dunk's *It's a Working Man's Town: Male Working-Class Culture in Northwestern Ontario* is a study of a modern resource community. The author examines the attitudes and working-class culture of white male workers in the pulp and paper community of Thunder Bay.54 In particular, Dunk examines workers' leisure activities and their attitudes toward gender, ethnicity, and regionalism. His primary focus is to explore how these workers "understand their own position in contemporary capitalist society, and...the limitations of this perception."65 Dunk's work is relevant to the current study of women geoscientists in that it depicts an all too familiar male working-class culture with well-entrenched racist and sexist attitudes. This culture is one that women who work in resource communities still have to contend with.

In a doctoral dissertation dealing with women in management rather than male workers, *The Frontier ‘Cowboy’ Myth and Entrepreneurialism in the Culture of the Alberta Oil Industry. Professional Women's Coping Strategies: An Interpretive Study of Women's Experience*, Gloria E. Miller also finds that a masculine culture pervades the oil and gas industry. She concludes that "the most durable barriers to women in the workplace are largely symbolic and embedded in the gendered cultures of organizations."66 Miller outlines what she calls the "hegemonic masculinity of the oil industry" in terms of the "myth of the frontier and the cowboy hero."67 She argues that the culture of the oil industry is revealed through the following "four mechanisms or processes":

...the myth of the frontier and the cowboy hero create a consciousness, a belief in a particular type of approach to work and to life; that belief system is expressed as entrepreneurialism, and combined with the technical, rational culture of engineers,
reinforces the division of work by gender; daily interactions are characterized by a reliance on informal, shared masculine interests and paternalistic behavior toward women, effectively excluding them from circles of power; finally, women's strategies for adapting to the culture serve to reinforce the masculine value system resulting in short term success and long term failure.68

Miller emphasizes that for women to succeed in the oil and gas industry, they must assume the characteristic norms of high competitiveness, entrepreneurialism, and a male ethos that combines the raw frontier energy of the cowboy hero with the functional rationality and reliability of the engineer. In “Sturdy Oaks,” a recent article in Oilweek, Gordon Jaremko comments on Miller’s thesis:

What does it take for women to break into big roles in oil and gas? The answer does not come easily. Miller, like journalists who venture into this territory, discovered there is ‘an extreme concern’ with honoring a code that is a central part of the oil mentality. It puts a premium on the strong, silent type. Talk—or even worse, display feelings—and ‘you get portrayed as a whiner. These are women who have successfully adapted to the culture. They were better at playing that male game than most men. To say it’s unfair goes against everything they’ve lived. You’re a sturdy oak. Never do you whine.’69

Miller also raises the issue of old boys’ networks and family connections that her study found still exert a pervasive influence in the oil and gas industry. Miller’s research shows that management literature identifies cliques of top male executives and old boys’ networks as one of the top three forms of discrimination against executive women. On the basis of her interviews with twenty women executives in the oil and gas industry, Miller concludes that although the “formal exclusionary policies” in the industry are changing rapidly, the “discriminatory policies based in norms rather than policies are much more difficult to change.”70 Miller describes the informal networks in the following terms:

In this study, I heard many comments about informal networks and gender-based camaraderie which pervades the organizations and the industry as a whole. I heard about people being ‘members’, essentially, of the petroleum industry on the
basis of family connections; of 'old boys networks' at the top; of work groups where the male members get together informally outside of work for various activities; of the long-standing exclusion of women by particular 'clubs' which attract industry members; of annual sporting activities organized and financially supported by the industry which have been exclusively male for many years.\textsuperscript{71}

Miller's study reveals that many women executives are choosing to leave organizations rather than try to change them from within: "...instead of staying in organizations and attempting to create change there, women are leaving to work in environments where they are free to express their own belief systems."\textsuperscript{72} The author points out that the characteristics that lead them to success in these organizations--self-reliance, high ability, and independence--also lead them to accept responsibility themselves when their careers stagnate at a certain point. Miller asserts that they often fail to consider the organizational structures and "the gendered nature of the assumptions underlying social relations which maintain and reproduce exclusion."\textsuperscript{73} Miller concludes her interview with Gordon Jaremko by asserting that things are changing for women in the oil and gas industry, but there still needs to be improved access to top management positions: "Clearly it's changing. It's not changing yet at the top levels. But all the women (in the study) talked about changes they saw. There was much more conscious effort being put into accepting women. There is still a long way to go."\textsuperscript{74}

Just as Miller's work attempts to redress the relative neglect of women in management, work by historians such as Eliane Leslau Silverman, Catherine A. Cavanaugh, and Randi R. Warne attempts to redress the glaring omission of women from Alberta history. However, there is much work that remains to be done. Silverman's \textit{The Last Best West: Women on the Alberta Frontier, 1880-1930} documents the lives and work of the generation of women who were pioneer homesteaders. Through her
interviews with 150 pioneer women, Silverman is able to fill an important void in historical knowledge of topics that range from migration, child birth, and contraception to household work, working out, religion, community, and ethnicity.\(^{(75)}\) Although her topic does not entirely intersect with the current study, her observations are relevant. Silverman concludes, much as historian Joy Parr does in relation to Paris textile workers,\(^{(76)}\) that the public/private life dichotomy obscures the multi-dimensional aspects of these pioneer women’s lives:

They perceived their lives within the private realm, rarely fitting even their paid labour into a public context. Indeed, it is precisely the integration of the private world of women with men’s public spaces that must take place among scholars before women can have their place in our common world.\(^{(77)}\)

Cavanaugh and Warne’s collection of essays, *Standing on New Ground: Women in Alberta*,\(^{(78)}\) offers insights on a number of topics from Women’s Institutes and the activities of Methodist and United Church Women’s Missionary Societies to women legislators and campus activities at the University of Alberta. In “From Friedan to Feminism: Gender and Change at the University of Alberta, 1960-1970,” Elaine H. Chalus shows that changes in campus attitudes during the period from 1960 to 1970 reflected the impact of the women’s movement and the trend towards professional occupations for women.\(^{(79)}\) Chalus shows the evolution of student attitudes as reflected in the University of Alberta student newspaper, *The Gateway*, and the records of the women’s Wauneita Society. The latter society slowly lost touch with the changing attitudes of women in the student body and ended its activities in the early 1970s.\(^{(80)}\)

In “Remembering Together: Reclaiming Alberta Women’s Past,” Patricia Roome makes a similar plea to Silverman’s: “In remembering together, our voices speak out against the myths and stereotypes of women embedded in western Canadian history and
challenge the dichotomies which have circumscribed women’s experience.” Roome states that when women do appear in western histories, “They are confined by the script to minor roles as refined ladies, helpmates, or ‘bad women’; while native women play the part of princesses or squaws.” Roome’s comments echo those made by many of the New West historians in relation to the stereotypical roles women are relegated to play in American histories of the West. Her article does an excellent job of outlining the rich literature that has been written by and about ethnic minorities and aboriginal women in Alberta.

An article by William Cronon, Howard R. Lamar, Katherine G. Morrissey, and Jay Gitlin titled “Women and the West: Rethinking the Western History Survey Course,” reinforces the point that the relative absence of women from the history of the West is far from just a Canadian problem. These authors suggest a number of alternative ways in which the Western survey course in American history could be restructured to be more inclusive. They also pinpoint the problems with the way in which such courses have been structured in the past:

The standard economic ‘resource frontiers’ around which many of us organize our courses—the mining frontier, the cattle frontier, the farming frontier, the transportation frontier, and so on—implicitly revolve around masculine work roles. With the partial exception of agriculture, in which the role of farm families (and hence women) is sometimes recognized, such frontier inhabitants as ‘the miner,’ ‘the cowboy,’ ‘the railroadman,’ and even the ‘farmer’ are almost always silently assumed to be masculine. Inevitably, these industrial frontier classifications treat male economic roles more or less in isolation from the community around them, so that by definition male work becomes primary and female work secondary.

The authors emphasize the fact that the invisible work of women contributes in many ways to all these various resource frontiers—the work of wives and mothers who raise children and provide services to families, as well as the work of scores of others
such as schoolteachers, women religious, cooks, boardinghouse keepers, laundry workers, prostitutes, and storekeepers. The authors conclude that "In short, removing gold or silver from the ground and bringing it to market required the labour of all these people, for in fact mining was an activity not of individuals but of communities—communities in which women's work was as important as men's." Cronon, Lamar, Morrisey, and Gitlin's comments about the mining frontier are equally applicable to other resource frontiers. Their comments also show why it is important to document the participation of women in the professional occupations related to these resource frontiers once this activity starts to occur. Even in professional areas such as the geosciences, women's work has tended to remain invisible and to be subsumed under a masculine work identity.

In "The Gentle Tamers Revisited: New Approaches to the History of American Women in the West," Joan M. Jensen and Darlis A. Miller reinforce Patricia Roome's point about the very limited range of women's images that have been portrayed in histories of the American West. The authors state that these images fall into four categories: "gentle tamers, sunbonneted helmpmates, hell-raisers, and bad women." Under the category of "gentle tamers," the authors include women as civilizing influences, proponents of the arts and literature, suffrage activists, and above all, ladies who upheld strict standards of hygiene and behaviour. The other three images speak for themselves, and all but the hell-raiser type are equally applicable to women in the Canadian West. The "bad women" of red light districts and gambling saloons are familiar images in both the Canadian and American West, but the Canadian frontier does not seem to produce "hell-raisers" like Calamity Jane, unless of course the suffragists are
included in this category. Perhaps the presence of the Canadian Mounties kept Calamity Janes well suppressed on the Canadian frontier.

The important point that Jensen and Miller make is that these images need to be critically examined and challenged. They need to be tested against the realities of women's lives, and new images need to be developed that will more accurately portray not just Euro-American women but Native American women, Hispanic women, Afro-American women, and Asian women. The same holds true for the images of men in the American West, which also have tended to be uni-dimensional in depicting only the white Euro-American male. The full diversity of religious affiliations also needs to be explored in relation to both men and women's experiences in the West, as does that of political and labour activism.

Jensen and Miller also suggest that oral history and interdisciplinary approaches with fields such as sociology and anthropology open the possibility of documenting the lives and work of people who have previously been omitted from the histories. They conclude that a multicultural approach offers a chance to reconsider the stereotypical images of women in the West and perhaps retain some of the images, recast others, and create new images that are more inclusive and accurate:

A multicultural approach need not eliminate class or politics from western women's history. Rather, it can insure that the problems of political power and the political dimensions of social history are not ignored. Women of the West were divided not only by culture but also by the conflicts among cultures. The point where women crossed boundaries to share common interests as women can be as carefully noted and analyzed as the points at which they remained separate. With a broader comparative perspective, many of the previous assumptions and generalizations about western history may be questioned. Some generalizations will prove adequate and survive; others will undoubtedly have to be abandoned. But out of the testing will come a more representative history of both men and women in the West.
In “Women and Men in Western History: A Stereoptical Vision,” Susan Armitage presents a similar position to Jensen and Miller’s. Armitage emphasizes that the field of Western history needs to move away from its focus on individuals and place more emphasis on groups, families, and kinship links in relation to both migration patterns and development. In particular, she stresses that the family and not just the male partner in the family needs to be considered as an economic unit. Even in male-dominated work groups, Armitage sees the benefit of looking at women’s perspectives and at possibly associated women’s work activities. Armitage asks us to consider “sex role ideology as an indicator of frontier adaptation,” and like Jensen and Miller, she emphasizes “the value of a multicultural approach”:

Multicultural research allows us to expand our focus and develop a wider framework that will be appropriate to all the different racial and ethnic groups that inhabit the West. We ought to work toward the development of inclusive, rather than exclusive paradigms....One theme that crosses racial and time barriers is that of family and group adaptation to both the physical environment and to the presence of other groups.

The necessity of achieving a more inclusive and more representative history of the Canadian West is equally important. Armitage’s emphasis on family and group interaction with other groups and cultures and with the environment poses an equal challenge to Canadian historians.

**The Influence of the Frontier Thesis**

Moving now to the significance of the frontier thesis to Alberta history, the analysis will focus on the key articles and books that have been influential in shaping an approach to the current study. The statement of Frederick Jackson Turner’s frontier thesis that is most frequently referred to by historians is as follows: “The existence of an area of free land, its continuous recession, and the advance of settlement westward,
explain American development." How Turner thought this slowly receding frontier was able to explain the development of egalitarian and democratic impulses unique to the American experience is a complex issue. The important point is that he did, and that his ideas have provoked admiration, controversy, and contradictory viewpoints in the hundred or so years since he first presented his thesis at the American Historical Association meeting at the Chicago World’s Fair in 1893.

Although Canadian historians have been influenced by the idea of the frontier as the seedbed of democracy, they have never been quite as enraptured by Turner’s thesis as American historians have been. J.M.S. Careless explains the reasons for the reluctant fit of the frontier thesis to Canadian circumstances in “Frontierism, Metropolitanism, and Canadian History.” Careless notes the strong influence in Canada of “conservative-minded eastern urban centres” which were “far-removed from any impulses of forest democracy.” In addition, he emphasizes the strong influence of British ideas and institutions and the dominant pull of British metropolitan centres over the Canadian hinterland. Finally, in the tradition of Harold Innis and Donald Creighton, Careless emphasizes the importance of a strong communications/transportation system, which was accomplished in Canada through a combination of public/private initiatives. Careless states that “Canada has pioneered not so much in democracy as in the large-scale combination of public and private interests to overcome the problems raised by a difficult environment...”

For Careless, the fact that the Canadian Pacific Railway was built well in advance of settlement and served as a incentive for settlement is proof of metropolitan rather than
frontier interests at work.\textsuperscript{96} For Careless then, metropolitanism more accurately depicts the Canadian experience than Turner’s idea of forest-born democracy:

Briefly this implies the emergence of a city of outstanding size to dominate not only the surrounding countryside but other cities and their countrysides, the whole area being organized by the metropolis, through control of communications, trade, and finance, into one economic and social unit that is focussed on the metropolitan ‘centre of dominance’ and through it trades with the world. Political activity too may also become centred on the metropolis.\textsuperscript{97}

Careless also notes that culture and knowledge are disseminated from metropolitan centres and that frontier religious and political movements often benefit from the intellectual leadership that rises out of those same centres.\textsuperscript{98} From Careless’s perspective, the frontier is far from “independent and self-reliant” but is in “the largest sense a dependent.”\textsuperscript{99} Careless sees frontier protest movements as a natural outgrowth of this original dependency, since the hinterland comes to resent the influence exerted by powerful metropolitan centres and eventually tries to seize control and reap the benefits of its local economy. The author concludes with the cautionary advice that since he has rejected “frontier determinism,” it would hardly seem appropriate to replace it with “metropolitan determinism.”\textsuperscript{100} In Careless’s words, “No good historian would try to make it fit too exactly...”\textsuperscript{101} The concept of “metropolitanism” is now on its second or third regeneration in the 1990s, and is currently influencing the work of whole new group of American environmental historians. It is to the environmental and New West historians that the analysis now turns.

Patricia Limerick’s “What On Earth Is the New Western History?” is a good place to start. In this article, Limerick summarizes the distinctive approaches of the New West historians. Limerick states that the group loosely referred to as New West historians sees “process” involved in the development of western regions, but that they do not define it
in terms of the "frontier process." For Limerick and many other historians, Turner's frontier process was "nationalistic, and often racist," as well as being premised on the assumption of history as progress. Limerick suggests that New West historians try to "break free of the old model of 'progress' and 'improvement,' and face up to the possibility that some roads of western development led directly to failure and injury." They use terms such as "invasion, conquest, colonization, exploitation, development, expansion of the world market" to describe the process that shaped western regions. They also emphasize cross-cultural interaction and the impact of this interaction on the "natural environment."

Limerick states that the process of shaping regional identities "involves the convergence of diverse people—women as well as men, Indians, Europeans, Latin Americans, Asians, Afro-Americans—in the region, and their encounters with each other and with the natural environment." Finally, Limerick states that New West historians "surrender the conventional, never-very-convincing claim of an omniscient, neutral objectivity." Limerick states that it is appropriate historians write from regional perspectives and show that they "care about their subjects," as long as they are careful "to acknowledge and understand different points of view." The approach of the New West historians offers considerable potential for the Western Canadian and Alberta history fields in its focus on cross-cultural interaction and the interaction of diverse cultural groups with the natural environment.

Limerick's work leads directly to a discussion of William Cronon's insightful essays on the Western frontier and the frontier thesis. In "Becoming West: Toward a New Meaning for Western History," William Cronon, George Miles, and Jay Gitlin argue
that "a comparative study of parallel regional changes—'frontier processes'—has much to offer." They see Turner's idea of "regions undergoing parallel historical change" as the most useful aspect of his frontier hypothesis. However, they reject Turner's idea that the process was necessarily progressive or that it followed the same predetermined pattern in all regions that mirrored the "stages of civilization" or "some inevitable march of progress." Cronon, Miles, and Gitlin see the movement from frontier to region as "a shift from relative newness to relative oldness or from flux to fixity."

The authors put forward six frontier-to-region processes as "non-Turnerian foundations for a new frontier and regional history." The first is "species shifting" or the movement of organisms and microorganisms into New World environments. Species shifting describes the transplantation of animals, plants, and people into new environments, but also the devastating influx of diseases. The second process the authors describe is "market making" or the exchange of goods and services, which involves both friendly exchange and conflict. The third process describes "land taking," which is far from a peaceful undertaking. The authors assert that "Violence was central to the frontier experience. Sometimes it was perpetrated by individuals, and sometimes by the military power of the state. Always it drew dark lines on a landscape whose newly created borders were defended with bullets, blades, and blood."

The final three processes that Cronon, Miles, and Gitlin suggest might be used to characterize the development of regional identities are "boundary setting," "state-forming," and "self-shaping." These six processes are equally applicable to the history of the Canadian West if one substitutes province building for state-building or moves into the whole issue of Native land claims.
Cronon, Miles, and Gitlin also shift the focus of frontier history to a new emphasis on metropolitan influences. They suggest in fact that one way of looking at frontier communities is “as peripheries whose dependence on imperial metropoles helped define local society. Perennially short of labor and capital, frontier economies were usually extractive, transferring non-industrial resources to more populous areas nearer the centre of empire.” For Canadians well versed in the historical traditions of J.M.S. Careless, Donald Creighton, and Harold Innis, the New West historians echo the very familiar theme of metropolitanism.

In another essay by William Cronon titled “Revisiting the Vanishing Frontier: The Legacy of Frederick Jackson Turner,” the author stakes his position as to what he finds useful in Turner’s approach:

For myself, the most useful elements of Turner’s frontier are its focus on the history of how human beings have interacted with the American landscape; its ability to relate local and regional history to the wider history of the nation; its interdisciplinary focus; and, not least, its commitment to putting ordinary people at the center of the story.

In fact, it is these same attributes that are so compelling in Cronon’s work because of his focus on the work of ordinary people and their interaction with the environment. Cronon offers one additional insight in this essay when he correlates Turner’s vanishing frontier to the abundance and scarcity of resources. The author states that “If the frontier represented only one kind of plenty, then it ought to be possible to rewrite western history—which in one rather Turnerian sense is actually the environmental history of North America—in terms of a transition not from free to occupied land, but from abundance to scarcity.” Cronon emphasizes that definitions of abundance and scarcity
are fluid rather than fixed, and that groups within the same environment often have conflicting viewpoints on the relative abundance or scarcity of resources.\textsuperscript{122}

Cronon's argument is relevant to the discussion of abundance and scarcity raised by Julian Simon in \textit{The Ultimate Resource 2}. Simon argues that fears about overpopulation and the scarcity and ultimate depletion of natural resources are misplaced.\textsuperscript{123} He has infinite faith in the capacity of human beings to overcome temporary scarcities and environmental problems through the development of innovative alternatives and solutions.\textsuperscript{124} One might say that Frederick Jackson Turner's essay on the vanishing frontier was the first in a long series of American books documenting the increasing scarcity of resources. Simon's response is that human beings are the ultimate resource in that we have the capacity to respond to both environmental challenges and temporary scarcities of resources through innovative adaptation.

\textbf{Conclusion}

Reconnoitering the terrain of Western economic, environmental, and New West histories has been extremely productive. Although it is disappointing to find that women are for the most part missing from the economic history of Alberta as it is currently written, it is the intent of the current study to contribute in some measure to redressing this omission and to reaffirming the importance of regional studies. This reconnaissance of the field also has revealed an example to follow in the approach of the American New West and environmental historians. Their emphasis on putting women, ethnic and aboriginal minorities, and the natural environment into a central position in their regional histories offers considerable food for thought in terms of new approach for the study of the province of Alberta and the Canadian West.
The approach of the New West historians has influenced the design and theoretical framework of this study of women geoscientists in Alberta in a number of significant ways. First, women are the central focus rather than a peripheral focus of the study. Second, the study relates regional and local history to the broad national scene and takes an interdisciplinary approach, using both historical and sociological method. Third, participants in the study were chosen to reflect the multiculturalism of the province and the ethnic diversity of geoscientists in the province. Although the participants are still predominantly white and Anglo-Saxon in origin, they do include geoscientists from a number of national, linguistic, and ethnic backgrounds. Fourth, I follow the environmental historians' approach in recognizing the influence of metropolitan rather than frontier forces on resource development in Alberta. Finally, I take an environmental history approach in emphasizing the interaction of human beings with the environment and the impact of that interaction over time.

William Cronon defines the task of environmental historians as one of telling "the stories that carry us back and forth across the boundary between people and nature to reveal just how culturally constructed that boundary is—and how dependent on natural systems it remains."125 Through this study of women geoscientists in Alberta, I tell a number of important stories of how geoscientists have interacted with the environment, how their work has made an impact on the provincial and regional economies, and how women's participation in this traditionally male-oriented field has exerted change from within the profession.


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41 Ibid., 327.
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45 Aubrey Kerr, Redwater (Calgary, Alberta: S.A. Kerr, 1994).
46 Kerr, Leduc, 235.
48 Ibid., 199-211.
50 Archivists recorded these interviews in order to document the early period of oilsands development, and the tapes offer a first-hand view of life at remote locations such as Fort McMurray and Bitumount.
55 Ibid., 402-403.
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66 Gloria E. Miller, The Frontier ‘Cowboy’ Myth and Entrepreneurialism in the Culture of the Alberta Oil Industry: Professional Women’s Coping Strategies: An Interpretive Study of Women’s Experience (Ph.D. diss.: University of Calgary, 1998), iii.
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120 William Cronon, "Revisiting the Vanishing Frontier: The Legacy of Frederick Jackson Turner," The Western Historical Quarterly 18 (April 1987), 171.
121 Ibid., 172.
122 Ibid., 172.
124 Ibid., 16.
CHAPTER FIVE
THREE WOMEN'S CAREERS IN GEOLOGY

Just as the historical literature reveals context for the study, the biographies of three early Canadian women in geology serve as a bridge into the oral histories. This chapter explores the careers of Dr. Grace Anne Stewart, a University of Alberta graduate who had an outstanding academic career at Ohio State University; Dr. Helen Belyea, a graduate of Dalhousie and Northwestern Universities who had an outstanding career in the Calgary office of the Geological Survey of Canada; and Mary Turner, a graduate of the University of Alberta and University of Toronto who had a shortlived but interesting wartime career in geology with the Petroleum and Natural Gas Conservation Board and Rio Bravo Oil. The similarities and differences among the careers of the three women illustrate the impact of life choices on career path and the various career options for women geologists in academia, government service, and industry. The careers of the first two women, Stewart and Belyea, were examined because of their prominence in the geological field and because of the fact that they were both pathbreakers in establishing women's careers in the sciences. Turner's shortlived career serves as an excellent contrast to the careers of Stewart and Belyea in that she chose to abandon her work in the oil industry in order to marry and raise a family.

Sources for the pioneers or pathbreakers in women's careers, particularly in the science fields, prove to be problematic at best. Finding the interview with Mary Turner at the Glenbow Museum and Archives was the result of hard searching and a little serendipity on my part.¹ The transcripts from the Petroleum Industry Oral History Project included very few women, and most of the women interviewed served as

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secretarial or support staff to oil industry magnates. Turner was the only woman geologist included in the Petroleum Industry Oral History Project. The fact that the oral history interviews exist at all at the Glenbow Archives is probably related to the tenacity and determination of local historian Aubrey Kerr, who initially conceived of the idea and convinced the Glenbow Archives of the project's merit.

In contrast to the rich information revealed in the Petroleum Industry Oral History interview with Mary Turner, details about the careers of Grace Anne Stewart and Helen Belyea have had to be painstakingly pieced together from various sources: from the obituaries and memorial tributes on their deaths, from the occasional newspaper articles written about them during their careers, from their record of publications, from the University of Alberta Department of Geology papers and the Ohio State University biographical and employment files for Stewart, and from the recollections of Dr. Don Stott, estate executor and friend of Belyea. These sources were far from ideal, and in the case of the newspaper articles frequently did not include the names of authors, the names of the newspapers in which the articles were located, or the dates of publication.

In retrospect, it is easy to point out that archivists should have been much more careful in documenting the newspaper articles when they were collected. However, given the inadequate staffing and funding of most university archives during the period of collection, it is perhaps more appropriate to be grateful that the clippings were retained at all. In the case of the correspondence between Grace Anne Stewart and Dr. J.A. Allan at the University of Alberta, the documents in the Department of Geology files were not identified by author. As a result, it was necessary to examine numerous file boxes of correspondence spanning about a twenty-year period in order to find nine letters of
relevance. Since there was no way of determining in advance whether the files contained anything of value, it was much like uncovering buried treasure to discover these letters.

It was fortunate that Dr. Allan was a prolific letter writer, kept in close contact with his former students, and saved both the carbon copies of his own letters and the originals of his students' letters. Interestingly enough, one finds that the correspondence with students either was not continued to the same extent after Allan's tenure ended as chairman of the Department of Geology at the University of Alberta, or the letters were not saved under the direction of the succeeding administrations. Certainly the lively correspondence between Stewart and Allan goes a long way toward filling in the gaps in one's knowledge about Stewart's career. In addition, the correspondence adds the depth of her own insights on her career, which would not otherwise be available.

Although these difficulties in obtaining sources are common to all researchers, they are particularly serious problems for women's historians, as many of the pathbreakers in women's careers did not have a generation of scholars ahead of them to remind them to retain their correspondence or to write their memoirs. In addition, many of the pathbreakers in women's careers were single and had no offspring to carefully sort through their papers after their deaths and send appropriate correspondence and files to archives. In Belyea's case, she apparently discarded her office files rather ruthlessly at the beginning of her final struggle with Alzheimer's disease, and she may not have been well enough to make the important decisions about what was to be kept and what was to be discarded. For all of these reasons, the challenges of piecing together the careers of the pathbreakers in women's professions prove to be quite daunting and make it even more gratifying when one is able to accomplish the task.
Grace Anne Stewart’s Academic Career: A Milestone for Canadian Women

In “Last in the Field? Canadian Women Natural Scientists, 1815-1965,” Marianne Ainley points out that in 1918 Grace Anne Stewart was the first Canadian woman to graduate in geology. She received both her Bachelor’s and Master’s degrees at the University of Alberta. Stewart left Canada to do her Ph.D. at the University of Chicago, and eventually gained employment at Ohio State University. Although she studied in the United States, Stewart worked during the summers for both the Research Council of Alberta (1919-1920) and the Geological Survey of Canada (1921-1922). Ainley states that “At that time, there were no career opportunities for a woman geologist at Canadian universities, and Stewart knew that ‘prejudice against women was strong in the Canadian Survey.’”

In his “Memorial to Grace Anne Stewart, 1893-1970” Edmund M. Spieker confirms that Stewart experienced a hostile working environment at the Geological Survey of Canada:

During the summers of 1919 and 1920 she worked for the Research Council of Alberta, and she spent those of 1921 and 1922 with the Geological Survey of Canada, working at the National Museum. In those days prejudice against women as geologists was strong in the Canadian Survey, and it took a brave young lady to withstand the unpleasantness provided by her male superiors and counterparts. I don’t recall ever discussing this specifically with Grace Anne, but I feel sure she was attracted by the haven of the United States, and especially the Department of Geology at Ohio State, whose head, Dr. John A. Bownocker, took pride in his favorable disposition toward women. And yet, later on (about 1928) she spent another summer with the Geological Survey of Canada, and at that time, I have been assured by her former colleagues, courage was still of the essence.

Spieker was a friend and colleague of Stewart’s who also wrote the History of the Department of Geology at The Ohio State University. The two academics initially began their friendship as a result of their mutual connection with Alberta. Spieker made the
following comment about their long association: "Her years in Edmonton, correlated with my own work in northwestern Alberta and northeastern British Columbia in 1919 and 1920, brought us together the moment I arrived at Ohio State, just one year after her own initiation there, and served as one of the many bonds between us that never dissolved; we spent many fascinating hours comparing notes on all aspects of western Canada."7

The 1918 graduation edition of The Gateway at the University of Alberta gives a little information about Grace Anne Stewart's early life.8 She attended Normal School in 1912 after graduating from high school in Minnedosa, Manitoba, and then she headed west to take up teaching. In 1914 she registered as a student at the University of Alberta. The Gateway gives the following capsule version of her activities: "Here she took an enthusiastic part in the scholastic and other activities, working in the Y.W.C.A., Dramatic Society and Ladies Athletics. Grace was also a member of the Alberta College Literary Society, where she lived during her Freshman and Sophomore years. Hockey is her hobby and as captain of the girls team of 1918 she engineered one of the most successful years in that sport in the history of the University."9 Stewart's prowess in sports activities is consistent with my finding that a majority of the geoscientists participating in my oral histories study excelled in sports or outdoor physical activities.

The 1920 graduation edition of The Gateway also points out Stewart's small stature:

'And still we gazed, and still the wonder grew
That one small head could carry all she knew—'
about Paleontology—Grace's specialty.
Since her graduation in 1917, she has been assisting in Geology and working towards her Master's degree. Strangers would never suspect it. They naturally assume she is an Alberta College aspirant for matriculation. It all comes of her being a 'vest pocket edition.' But don't forget it 'Good things are done up in small parcels.'10
In a 1940 newspaper article reporting Stewart’s recollections of her early career, Stewart attributed receiving her initial graduate assistantship at the University of Alberta to the wartime shortage of men in the department: "Most of the young men were away fighting and it was probably because of the shortage of men that I was given a chance to become a graduate assistant in the geology department." There is also a statement that Stewart owed her geological career to the war and to her love of the outdoors and the Rocky Mountains: "If it were not for the World war [sic], Dr. Grace Stewart probably would not, today, be the only woman teaching geology at Ohio State university [sic]. She was attending the University of Alberta, in Canada, when the world was at war in 1917.…Her love of the out of doors plus the fact that she was educated in the shadow of the Rocky mountains [sic] are responsible for Dr. Stewart’s choice of career."

After receiving her M.A. in 1920, Stewart won a fellowship to attend the University of Chicago to study paleontology under Stewart Weller. Edmund M. Spieker wrote in his “Memorial to Grace Anne Stewart” that although Stewart’s father followed the family tradition of farming, several of his brothers offered examples of intellectual careers. Three of her uncles gained medical degrees at the University of Chicago, another uncle was a lawyer, and a fifth uncle was a building contractor. Spieker writes that “Despite the fact, then, that Grace Anne grew up on a farm, she had abundant example before her in the careers of her uncles to draw her toward an intellectual career.”

After her graduation with the Ph.D. degree cum laude from University of Chicago in 1922, Stewart worked at Ohio State University for the remainder of her career, other than a brief stint during World War II working on geographical studies for the Office of
Strategic Services (a forerunner of the Central Intelligence Agency),\textsuperscript{15} and a brief period in the oil patch in Calgary after her retirement from Ohio State. Edmund Spieker notes in his "Memorial to Grace Anne Stewart" that she retired from Ohio State University in 1954 at age sixty-one, nine years earlier than normal, reportedly stating that she was "discouraged."\textsuperscript{16} Perhaps Stewart was experiencing some of the backlash against women faculty members hired in an earlier era that Rossiter describes in her second book. The determined and complete manner in which Stewart severed her ties with Ohio State on her retirement suggests how anxious she was to leave it behind. Spieker describes her retirement as follows:

About the time she turned sixty she began to show weariness in her work, and, for reasons that to my knowledge never came out into the open, discouraged. In 1954 she decided to retire, long before the normal time for such withdrawal (not required at Ohio State until age [age] 70) and when she retired she did it just as finally and effectively as she had done other things—she pulled up roots completely, shook the dust of rocks and fossils off her feet, and moved to the genial climate of Tucson, Arizona (she hated cold weather), where she spent happily most of the last sixteen years of her life.\textsuperscript{17}

Correspondence between Grace Anne Stewart and Dr. J.A. Allan at the University of Alberta in fact confirms that Grace was dissatisfied with her position at Ohio State University long before she took early retirement in 1954 after thirty-one years of teaching. Dr. Allan was chairman of the department of geology at the University of Alberta and was both a friend and mentor to Stewart. A series of nine letters between the two individuals was found as a result of my painstaking search through the boxes of Department of Geology Papers in the University of Alberta Archives. The correspondence dated from April 2, 1924, to November 27, 1941, and included a letter of reference for Stewart written by Dr. Allan to the Bureau of Economic Geology.
Fortunately, Dr. Allan was very organized and kept both Stewart’s letters and carbon copies of his replies. Four of the nine letters were written in 1924, shortly after Stewart had received her doctorate from the University of Chicago and had accepted the academic position at Ohio State. Since Stewart was the first geology graduate of the University of Alberta to receive a Ph.D., Dr. Allan and his colleagues in the department were very proud of her. They also appreciated the fact that she kept in touch with them and sent them copies of her articles and samples of rocks and fossils from Ohio.

In her “Faculty Member’s Annual Report” for the period from 1943 to 1944, Stewart wrote that two of the “greatest handicaps and obstacles” to effectiveness were “lack of adequate office space and a telephone” and “poor mental attitude because of slowness in professional advancement.” When asked, “What new or changed opportunities for development do you desire the University to provide you in the immediate future,” Stewart once again requested a telephone, larger office space, “a clearer definition of my place in the Department of Geology, and an understanding of the opportunities which I might expect after twenty-one years of service here.” Stewart continued to lament the “insufficient class room space, inadequate office space, and inadequate space and equipment for research” in her “Faculty Member’s Annual Reports” throughout her tenure at Ohio State.

On October 4, 1941, she wrote to Dr. J. A. Allan explaining her dissatisfaction with the current state of affairs at Ohio State:

For several years I have been wanting to make a change in my work. In the first place because the climate has never agreed with me here, and in the second place I can never expect to get much further considering the sort of person we have for the head of the Department here. He is conservative to the nth degree. Women are alright professionally provided they don’t want too much, whether it is in geology or anything else. This year he brought in a new man at full professorial
rank at a much higher salary than most of us in the department are getting. Two of us, the other a man, feel that our toes especially have been stepped on. Dr. Stockdale, who had been connected somewhat longer than I went this year to take a very fine position as chairman of the Geology and Geography Department at the University of Tennessee. His departure was really what precipitated the crisis.

So I feel if I don’t bestir myself with real energy it will soon be too late to make a change, and it will mean a life sentence here. I made my great mistake some years ago when I didn’t take the Mount Holyoke position.23

Stewart went on to mention a number of employment alternatives to Dr. Allan, including the suggestion that the Parks Services of the Canadian National Parks would benefit from an educational service such as that offered by the Ranger Naturalists in California, which provided tours and illustrated lectures for tourists. Stewart thought she would enjoy providing this type of educational service to the public and wondered whether the tour bus lines such as Greyhound might be interested in the idea if the Park Services were not. She emphasized her desire for a change: “I’ve been thinking it would be a pleasant change to get away from the teaching side of the profession. Not that I haven’t enjoyed the teaching for the most part, and feel in all due modesty that I have been as successful as the average teacher. But I really need something to give me an entirely new perspective....At any rate, I’ve definitely decided that this is going to be my last year here.”25

In Dr. Allan’s reply to Stewart on October 31, 1941, he expressed regret that things were not going smoothly in the geology department at Ohio State, but urged her to exercise caution about leaving a secure position before she had a firm offer from another academic institution. He also encouraged her to pursue employment possibilities with the Canadian Park Services, but said that he did not hold out much hope of her ideas receiving a positive reception:
Referring to your personal problems, I was indeed sorry to hear that things have not been going on within your department as you and others would have liked. In this respect, Ohio seems to be no different from most of the other Universities. We all know how hard it is to carry on when the machinery is not working as smoothly as we would like. I know you will not act rashly and my advice would be not to decide to make a change until you are absolutely sure of the new position and certain within yourself that you would like the change. It is wise to make enquiries ahead of time and not to wait until local conditions are too unpleasant to remain longer.

As to your suggestion of an educational service bureau within our National Parks, the idea is an admirable one, but if you knew the National Parks organization in this country as well as I do, you would not be very hopeful. The need for such a service is much in evidence, but the difficulty would be to get an organization for this purpose within the Parks. I have more than once talked over this idea with many, the minister in charge, the deputies, directors, superintendents, etc. They will agree that such a service is important, however, nothing happens.26

Dr. Allan also encouraged Stewart to approach the two rail lines or Brewster Bus Lines27 with the possibility of providing an educational service for tourists. She replied to Dr. Allan’s letter on November 27, 1941, and assured him that she would exercise caution:

No, I do not intend to act rashly. That isn’t my nature. But I have thought over this thing for a long time, and feel that I must make a change for my own peace of mind. There is so much more to living than a salary cheque. When I came to this institution I didn’t realize that it was to be almost a life sentence. It would be alright if we had a different type of person for the head of the department. But since we haven’t, and he is likely to be here for several years yet, there isn’t likely to be much change in policy.

In the meantime, I would be glad to consider anything even if it means a sacrifice in salary. I’ve been wondering about the war effort in Canada, and have written to Canada to inquire about it. I have yet to take out my final citizenship papers over here, so am still a Canadian citizen. Do you think there might be any chance of the oil companies in Alberta doing anything with micro-paleontology?28

Stewart also referred obliquely to the possibility of teaching courses in micropaleontology at the University of Alberta in a number of letters to Dr. Allan, but no offer of employment was ever forthcoming from her alma mater. Dr. Allan replied to one
such query about employment on October 31, 1941, suggesting that the geology department would have to receive an endowment from a wealthy donor in order for a faculty position to become open for her:

Thanks very much for your opinions on the course in micropaleontology. I am much interested in this course and feel that we should be offering a general course in the subject, especially in this University in a province where so much Petroleum Geology is being worked on. There is no chance, however, of giving any work this year because Dr. Warren’s time is fully taken up as he is in charge of the University’s military work. If Ralph, or some other wealthy graduate, were to leave a quarter of a million to this department we might be able to offer you some inducement to look after a department of micropaleontology, but no such luck at the present time.

Stewart’s teaching position at Ohio State did in fact turn out to be a lifetime commitment. Other than a brief leave of absence during World War II when she worked as a geographer with the Office of Strategic Services in Washington from October 1944 to October 1945, Stewart continued teaching at Ohio State until her retirement. The wartime service with the Office of Strategic Services may have reinvigorated Stewart, since she stayed at Ohio State University another thirteen years after she had first written to Dr. Allan suggesting that she could not continue teaching another year under the current administration.

An Edmonton Journal article, “Fossil Namesake; Rare Compliment,” gives a few details about Stewart’s work during the war and indicates that she had fossils named after her:

During the war years, Dr. Stewart was on leave of absence working with the OSS—Office of Strategic Services—in Washington, D.C. The map information department, which she joined as a member of the European Desk, kept filed thousands of details on the topographies of countries all over the world. Roads, bridges, railroads and industries were all recorded. As well, information on rock structure was of importance in military manoeuvres. It was the map information department which sent out information which told the army where to build its bridges and landing fields, and which beaches would make good landing areas.
Dr. Stewart remembered one occasion on which the army had made unexpectedly quick gains and then had to stop—to await information from the map information department.\textsuperscript{31}

Returning to the correspondence between Stewart and Dr. Allan, one finds that in 1936, Dr. Allan wrote a letter in support of her application for summer work with the Geological Survey of Canada. Stewart found she was available for summer employment when the Geological Survey of Ohio was unable to run field parties for a number of summers as a result of lack of funding. She had worked as an assistant geologist with the Geological Survey of Ohio for seven summers from 1923 to 1930.\textsuperscript{32} Dr. Allan wrote to Stewart on March 18, 1936, commenting on the Canadian Survey's reluctance to hire women: "I realize full well the attitude that is usually taken towards geologists of the fairer sex but I have pointed out that you are quite able to undertake any geological task that may be given to you."\textsuperscript{33}

Allan's letter of support addressed to F.C.C. Lynch, Director of the Bureau of Economic Geology in which the Geological Survey was then located, included the following remarks:

I know it is unusual for a woman geologist to apply for geological survey work but it is a pleasure for me to recommend Dr. Grace Stewart in so far as geological ability is concerned. If there is an opportunity of obtaining office work or paleontological work during the summer and the name of Dr. Stewart was considered favorably I am sure that she would render efficient service.\textsuperscript{34}

Dr. Allan's subtle assumption in this letter is that the Geological Survey would only consider hiring a woman geologist for office work or paleontological work. Field work seemed to be a relatively difficult attainment for women geologists in Canada to achieve in the 1930s; Stewart had worked in the National Museum in her previous summers of employment with the Geological Survey of Canada. The limited information
available at Ohio State University Archives does not confirm whether Stewart fared any better in terms of doing field work in the summers that she worked for the Geological Survey of Ohio. However, Edmund M. Spieker’s “Memorial to Grace Anne Stewart” suggests that she was able to attain her fair share of field work in the United States. Spieker writes that “It should not be overlooked, either, that she worked just as hard and effectively in the field as in the office, laboratory, museum, and classroom, assuming boldly a role then generally accepted as an exclusively male prerogative.”

Spieker’s “Memorial to Grace Anne Stewart” also states that she gained summer employment with the Canadian Survey in 1928 or thereabouts, but her Biographical Files at Ohio State University Archives fail to confirm this information. In fact, they indicate that she worked for the Geological Survey of Ohio in the summer of 1928. In addition, the Biographical Files do not show any record of employment with the Geological Survey of Canada as a result of Dr. Allan’s letter of support in 1936. Spieker may have been mistaken. Stewart may have worked for the Canadian Geological Survey in 1938 rather than 1928, or it may be that she did not work for the Canadian Survey at all after her first two summers there in 1921 and 1922.

The 1944 “Basic Who’s Who” at Ohio State University Archives records an extensive list of Stewart’s publications from 1924 to 1941 (sixteen in total), including an Illustrated Catalogue of Type Invertebrate Fossils of North America, co-authored with Madeleine A. Fritz of the University of Toronto. It lists Stewart’s honors as “Cum laude with Ph.D. degree, Member Sigma Xi, Fellow Ohio Academy of Science, Fellow Paleontological Society, Fellow Geological Society of America, [and] in Who’s Who - Women of America.”
In her comments on this “Who’s Who” evaluation form, which was part of her yearly performance appraisal, Stewart indicates that she had served one year as “Chairman” [sic] of the Faculty Women’s Group and that a great deal of her time in the department was dedicated to work in the Geological Museum. The research of both Marianne Ainley and Margaret Rossiter has shown that many of the early women academics in the sciences devoted a considerable amount of their time to the establishment and maintenance of department museums, and Stewart’s career is consistent with this pattern.

One positive result of Stewart’s correspondence with Dr. J.A. Allan at the University of Alberta was that Ohio State University and the University of Alberta engaged in a reciprocal and long-term exchange of rock samples and fossils that proved beneficial to the geological museums at both institutions. A document titled “The Donations to Department of Geology, 1924-25,” located in the University of Alberta Archives, notes the following contribution from Ohio State: “Fossils: large suite from University of Ohio, through the kindness of Dr. Grace Anne Stewart, who was the first graduate in geology from the University of Alberta to obtain her Ph.D., and the first Canadian women [sic] to take a Ph.D. in geology.”

After Stewart’s retirement and move to Arizona, she was offered employment in the oil patch in Calgary. Spieker notes that “Her special task here was to correlate the fossils found in oil well cores from different areas, to provide a more complete picture of the whole field. This did not last long, however, for she could not stand the Alberta winter, and was soon back in Tucson.” An Edmonton newspaper article stated that she was employed with the Canadian Stratigraphic [sic] Services in Calgary after her
retirement from Ohio State. The article noted that she retired permanently to Tucson after leaving the position in Calgary and that "she recently finished writing the Devonian geology section for an encyclopedia of science that was to be published in 1960."42

On her death in Tucson, Arizona, on October 15, 1970, The Board of Trustees of Ohio State University issued a statement expressing condolences to Stewart's family. The statement documents aspects of Stewart's life: her birth in Minnedosa, Manitoba, in 1893, the daughter of John Stewart and Elizabeth Crerar Stewart; her academic training at the University of Alberta and University of Chicago; and her progression through the academic ranks at Ohio State as she was appointed as an instructor in 1923, an Assistant Professor in 1928, an Associate Professor in 1937, a Professor in 1946, and finally a Professor Emeritus on her early retirement in 1954. The Board of Trustees summed up her long list of accomplishments in the following way:

As a teacher, she was methodical, thorough, patient, and helpful, as many alumni can testify. Her research work dealt mainly with microfossils of the Paleozoic of North America, especially Foraminifera, ostracodes, and conodonts. Her main books are Fauna of the Silica Shale of Lucas County, published by the Ohio Geological Survey (1927) and Middle Devonian Corals of Ohio, a special paper of the Geological Society of America (1938). In addition, she published numerous shorter papers in the Journal of Paleontology, the Ohio Journal of Science, and the American Midland Naturalist. She will be remembered as a member of that band of pioneer women who refused to be deterred from qualifying as geologists because it seemed to be a masculine preserve. She attained a leading position in the profession by quiet but persistent effort, the production of professional work, and willingness to do a man's work in the field when it was required.43

Stewart also served as the Vice-President of the Geology section of the Ohio Academy of Science in 1936, President or Chairman44 of the Faculty Women's Group in 1937, and Acting Chairman of the geology department in the summer of 1946.45 The fact that Stewart found employment at Ohio State is indicative of the institution's long history
of encouraging women geology students. Margaret Rossiter points out that Ohio State ranked right behind Bryn Mawr in terms of the number of Bachelor's degrees it had awarded to women geologists subsequently listed in *American Men of Science.*

Rossiter also comments on the influence of Edward Orton at Ohio State:

Ohio State's relative receptivity to women geology students probably goes back once again to Edward Orton's willingness to hire Florence Bascom in 1893 and to take students like Mignon Talbot on field trips. In fact, the more one reads about women geologists of the 1890s, the more important Edward Orton, by then in his sixties, appears.

Edward Orton was not alone in his positive attitude toward women students. There were many other male faculty members such as Alexander Winchell at Syracuse University and G.H. Williams at Johns Hopkins who were instrumental in helping the first few women achieve Ph.D.s in the geological sciences. Edmund Spieker also noted in his "Memorial to Grace Anne Stewart" that Dr. John A. Bownocker, the head of the geology department at Ohio State, supported hiring women. However, Spieker also noted in his *History of the Department of Geology at The Ohio State University* that Bownocker's favorable disposition to women did not seem to extend to the matter of salaries. Spieker noted the salary of the one woman on faculty just before Stewart's arrival at Ohio State:

It may interest the reader of this account to know that at the time here reported (1920-21) the salaries of the staff were as follows: Dr. Bownocker, $3,750; Dr. Carman, $3,500; Dr. Peattie, $2,750; Mr. Webb, $2000; Miss Morningstar, $1,800. (Dr. Bownocker was a strong supporter of women in the scheme of things — until it came to the question of salary.)

Payroll cards for Grace Anne Stewart from Ohio State University Archives indicated that she started as an Instructor in 1923 at a salary of $2000. Her salary increased to $2800 when she became an Assistant Professor in 1928/29. Stewart became
an Associate Professor in 1937, but her salary stayed the same until it was increased to $2820 in 1939/40. For some reason, probably because of the salary cuts during the Depression, Stewart’s salary in fact decreased marginally in the period from 1933 to 1934. After she became Associate Professor, she received a small yearly increment in salary. When she became a full Professor in 1946/47, her salary increased to $4200 and then to $4500 in 1947/48. Her top salary as a full Professor was $6525 in her final year of teaching.50

Comparisons with the salary levels of J. Ernest Carman and Edmund M. Spieker at the various professorial levels show that Stewart was paid less than the other two faculty members in comparable positions.51 Spieker was hired at Ohio State as an Assistant Professor a year after Stewart was hired. He became an Associate Professor almost ten years before Stewart at a salary that was approximately $1500 more than she would receive at the Associate Professor level in 1937/38. Since Stewart progressed much more slowly up the academic ladder than her male colleagues, she was stuck at lower salary levels for a much longer period of time than the men in the department. Stewart seemed aware of salary inequities in the department and wrote to Dr. John Allan in 1941 complaining of her unfair treatment by the head of the department.52

It is difficult to know whether Stewart would have made the same career choice had she had the opportunity to do it all over again. The 1940 newspaper article suggests that she may have had moments of regret from time to time about the inequities she experienced as a woman in geology, but that she would probably make the same choice again. Stewart is quoted in the article as follows:

“There aren’t many openings for ‘lady geologists’ in coeducational institutions,” she said. “Of course, such openings today are more numerous than they were 20
years ago. Some of the girls’ colleges in the east have women geologists on their staffs.”

Would she if she had it to do over again, become a geologist? Dr. Stewart isn’t sure. “I suppose I would,” she laughed, then added, “but you can never tell. Though it’s hard to admit it, there are some things, such as certain phases of field work, which a woman can’t do and a man can.”

Despite Stewart’s slight reservations about her career choice and about a woman’s ability to do everything that a man could do in the field, she evidently had no serious regrets about her career. It was in fact remarkable for a prairie farm girl from Canada to become a full professor at a major American university in this era, particularly in a non-traditional field for women. Perhaps the years of subtle discrimination she experienced as a woman geologist had worn her spirits down a little by the end of her career, but she was indomitable in her determination to continue contributing to the geology field. Even on her retirement to Tucson, she was still writing the geological entries to an encyclopedia of science.

**Helen Belyea’s Career in the Calgary Office of the Geological Survey of Canada**

Helen Belyea is another Canadian woman who had an outstanding career in the geological sciences. According to Barbara L. Sherrif and Shelly Reuter, Helen Reynolds Belyea graduated from the University of New Brunswick with a B.A. in languages and geology, received her M.A. in geology from Dalhousie University, and her Ph.D. from Northwestern University. She was hired in 1945 by the Geological Survey of Canada as a field geologist and sub-surface stratigrapher, and she subsequently devoted much of her life work to the Devonian of the Western Plains, working out of the newly established Calgary office. In the memorial to Helen Belyea published in the 1987 *Transactions of the Royal Society of Canada*, Digby J. McLaren offers additional information about Belyea’s background. She was born in St. John, New Brunswick, on February 11, 1913,
and her parents were descendants of United Empire Loyalists. McLaren says that Belyea received her early schooling in Saint John, New Brunswick, but received both her B.A. and M.A. in geology from Dalhousie University. Dr. Charles Armour, Chief Archivist at Dalhousie University, has confirmed that Belyea received both her B.A. in 1934 and her M.A. in 1936 from Dalhousie University.  

McLaren notes that Belyea’s thesis at Northwestern University was on “The Geology of Musquach Area, New Brunswick.” He writes that “She began World War II as a high school teacher and ended as a lieutenant in the navy’s WRCNS. In 1945 she joined the Geological Survey of Canada as a sub-surface stratigrapher.” According to McLaren it was the discovery of oil at Leduc in 1947 that prompted the Geological Survey to open an office in Calgary in 1950, and Helen Belyea and R.T.D. Wickenden were appointed as the first geologists at the Calgary office. Belyea continued to be associated with the Geological Survey for forty-one years. Digby J. McLaren describes Belyea’s ground-breaking research and exploration in the following way:

Although described as a sub-surface geologist, Dr. Belyea developed, in fact, into a field geologist of considerable ability and looked at rocks wherever she could find them, from the tops of mountains to the bottoms of oil wells. As a result of Leduc, she began work on the rocks on which the discovery was made—the Devonian System. She spent her life explaining and synthesizing knowledge of these important and difficult rocks over the vast region of the western sedimentary basin from the Montana border to the Mackenzie River country, and from the Canadian Shield to the Rocky Mountain Trench. In the early 1950s her concepts were few. Little was known about limestones, and less about the detailed structure of reefs and their disposition and relations with adjoining sedimentary basins. Through the 1950s and 1960s concepts changed and interpretation was built on evidence from increased drilling activity as well as increased field work. It was in this environment that Helen undertook the unending task of trying to put sense into the Devonian of the Western Plains.

In 1952 Belyea published her first paper, “Notes on the Devonian System of the North Central Plains of Alberta.” Her second paper, “Cross-sections through the
Devonian System of the Alberta Plains," was published in 1955. McLaren explained that this paper "outlined the southern margin of the reef complexes and began what was almost a lifetime wrestle with the problems of relationships in the upper part of the succession, above the Woodbend reefs and biostromes....In all this she rapidly won the support and approval of her colleagues in industry, and indeed, they were well served."59

Late in the 1950s Belyea worked in the Northwest Territories on the stratigraphy of the area west of Hay River and south of the Mackenzie River. McLaren credits Belyea with developing "a synthesis and terminology for the Devonian rocks of the region, which still stand."60 Early in the 1960s Belyea once again achieved recognition for her input to the "Geological History of Western Canada," also called "The Atlas." In 1967 Belyea played a significant role in the First International Devonian Symposium held in Calgary, the same year in which the Institute of Sedimentary and Petroleum Geology (ISPG) opened and the Geological Survey moved to its new building.

Dr. Don Stott, a colleague of Belyea's at the Geological Survey and the executor of her estate, confirms that she was in contact with geoscientists from all over the world as a result of the Devonian Symposium. He also recalls that she maintained an active correspondence with many of these researchers throughout her career. Although Belyea retained her office and the title of Research Scientist Emeritus when she retired from the ISPG in 1975, she went through the papers in her office in the months before her final illness left her debilitated. Unfortunately, she ruthlessly discarded correspondence and research notes that would have been relevant to researchers. Dr. Stott and a colleague cleared the rest of her files from her office on her death in 1986 and found very little left that was of consequence.61 To my knowledge, there is no record of correspondence with
professors such as the letters written by Grace Anne Stewart to Dr. J.A. Allan that help shed light on Belyea’s career.

Belyea’s publication in 1971 of “Middle Devonian Tectonic History of the Tathlina Uplift, Southern District of Mackenzie and Northern Alberta” was considered to be one of her most important contributions, and it led to considerable exploration work in the years that followed. Digby McLaren sums up the contributions of Belyea in his tribute to her in the Transactions of the Royal Society of Canada:

Helen Belyea began to work in Alberta when the petroleum industry was a man’s world. But this small determined woman, with a daunting intellect, who never suffered fools gladly, was quickly accepted as a valued colleague, as well as being admired and loved as a warm, humorous, and generous friend. Helen was a ‘woman of parts’; her circle of friends was far wider than the geological profession. She was an athlete who enjoyed mountaineering, walking, skiing, swimming, and was an able equestrian and lover of pack-horse journeys. She travelled widely as a geologist and as an interested traveller and lectured in France, which she loved, and other countries of Europe. She was interested in the arts and music, a member of the Calgary Philharmonic Orchestra League and an Associate Director of the Calgary Zoological Society.

...During her lifetime Helen Belyea received many honours that acknowledged her contributions to Canada and to Canadian geology. She was elected a Fellow of the Royal Society of Canada in 1964 and was made an Honorary Member of the Canadian Society of Petroleum Geologists. In 1956 she was awarded the Barlow Memorial Medal by the Canadian Institute of Mining and Metallurgy. She received honorary degrees from Windsor and Dalhousie universities and in 1976 was named an Officer of the Order of Canada.

Belyea’s career with the Geological Survey was definitely a noteworthy one. It is unfortunate that she did not keep a diary, retain her field notes, or publish an autobiography. It would be very interesting to hear her own reflections on what it was like to be a woman working in geology and producing ground-breaking research in an era when it was still largely a male-dominated field.
Mary Turner’s Wartime Career in Geology

Mary Turner’s wartime career with the Petroleum and Natural Gas Conservation Board and Rio Bravo Oil offers a number of contrasts to Stewart’s academic career and Belyea’s career in government service. Mary Turner was born in 1914 in Medicine Hat, Alberta. She moved to Edmonton when she was six years old and spent the rest of her childhood in Edmonton, attending the University of Alberta in the 1930s. Interviewed in 1984 for the Glenbow’s Petroleum Industry Oral History Project, Turner explained why she chose to attend university during the depression years: “There weren’t many opportunities and most of my friends were going to university and so it seemed the thing to do...to go to university because what else were you going to do.” When asked whether it was common for women to go to university at that time, she replied: “Oh yes. There were lots of us and these friends of mine, two went into medicine...doctors, one of them still practising. Yes, there were lots of us.”

Turner chose to study geology for a number of reasons. A cousin of her mother whom she described as “quite scholarly in her own way” longingly expressed a wish that she could go to university with her so that they could study geology together. This reference was the first time Turner had even heard of geology. As a result of the conversation, she took a geology course with Dr. Warren in her first year: “I was hooked or something and this was how I got on with it....I enjoyed my classes and I worked with him. I really liked Dr. Warren very much and felt quite comfortable with the idea of going on and working with him but, of course, I took mineralogy from Dr. Rutherford. I don’t know if I had anything from Dr. Allan at that time.”
When asked about activity in the oil industry when she was at university, Turner replied: “There wasn’t too much oil activity in the oil industry in those days. Just Turner Valley. Leduc hadn’t been discovered or any of these other fields. I think most of the fellows figured they were going into hard rock mining that took geology when I was there.”

When asked by the interviewer whether she thought studying geology would offer a chance for adventure and working outdoors, Turner replied: “That’s what I thought. I thought it would be great to be out climbing mountains and picking up pieces of rock and whatnot but it didn’t work out that way. It wasn’t convenient to have a female geologist in the field and so I didn’t do much field work.”

Turner graduated with her B.Sc. in 1936 and found that there were not many employment opportunities for her: “I was a female geologist and ‘we do not employ female geologists.’ That’s what I got told so that’s when I decided I had to do something.”

After working in the geology laboratory at University of Alberta for a year and taking additional courses in psychology and philosophy, Turner decided to pursue graduate studies at the University of Toronto. She spent two years working with Dr. Madeleine Fritz at the Royal Ontario Museum: “I did quite a bit of micro-paleontology. …that’s what I wrote my thesis on, ostracods…from the oil wells of southwestern Ontario….So I spent a lot of time looking through a microscope there in Toronto….I guess at that time most of the emphasis in geology was on studying fossils and looking at the way the earth had been formed.”

When she received her M.Sc. in 1939, Turner again found employment opportunities for women geologists were not very encouraging, even with the Geological Survey. As a result of poor employment prospects, she decided to return to Alberta to
pursue teaching certification, despite the strong objections of Dr. Madeleine Fritz, who was very annoyed with her when she decided against pursuing Ph.D. studies. Fritz may have been trying to encourage her protégées to pursue doctoral studies so that there would be a strong cohort of women trained to replace her on her retirement, just as Margaret Rossiter has suggested that American women professors tried to do in the United States. For single women professors, in particular, successful students formed just as important a part of their intellectual legacy as their academic publications. Turner did not seem to have a burning desire to spend the additional years at university required to achieve a Ph.D., even though she understood that the doctoral degree could open employment opportunities: “I couldn’t go on being a student forever. Madeleine Fritz wanted me to go on and get my Ph.D. very badly and she was very annoyed at me....I suppose maybe you had to have a Ph.D. for a woman to get a job in those days. If you had a Ph.D. they might look at you and consider it.”

Turner taught in Banff for two years at a small private school called The Mountain School that was run by an elderly English couple, the Greenhams. Unfortunately, Turner does not mention in her interview the grade levels or the subjects that she taught. There were only about twenty students attending the school, and some of them boarded at the two cottages located on the school premises. A number of the students came from the coast of British Columbia, and there were also two English students who were sent to Canada because of the war. Turner finally had an opportunity to work in geology when Dr. Allan at the University of Alberta recommended her for a job with the Conservation Board. She attributed her entry to the profession to the wartime shortage of geologists: “I taught for two years and then, I always say it was
because the war came along and took the fellows away, so they let me work, ...they let me into the conservation board [sic].” She described her work as mainly logging the samples that came in from the wells:

...we had all these enamelled saucers and we washed the sample and then we put the saucers on a hot-plate to dry and then we put them in bottles and labelled them. We were slaves. We did that ourselves. Of course, we had to log the samples and check them with a microscope. We had big long sheets...and we had a different colour for sandstone and there was a strip like this where you put different colours in for the limestone, shale, sandstone, and then you had a little description here with the different depths. That was mainly what we did there."

When asked if she received much experience in the field when she was at the Conservation Board, Turner recalled that one of her colleagues, Red Goodall, had been horrified to discover she had no field experience:

...so he took me out on one of his inspection trips out to the Turner Valley and got me standing on a derrick floor. I was really amazed at the thing that they call a kelly and saw [how] all these parts of a drilling rig worked. Another time we went down into southern Alberta, Oyen and down around there and saw some of the wells out on the plains but apart from that, I just kept my nose to the microscope."

Turner also remembered being involved in the early meetings of a professional organization in Calgary, which her interviewer noted was probably the Alberta Society of Petroleum Geologists. The meetings usually included a lecture or slide show and the occasional dinner. When asked if she met many other women employed in a professional capacity at that time, Turner recalled that Standard Oil brought up two women geologists to Calgary from the United States and that she knew one other Canadian geologist named Diane Loranger. She had a few amusing stories about the field trips that she and Diane Loranger experienced. Loranger described a field trip with a number of Imperial Oil geologists in the following terms: “‘Oh gee, Mary,...It nearly killed me but you’re the only person I can admit it to.’” Turner added, “I guess that was sort of a stigma against
bringing women into the field. They were worried that...they’d have to provide special comforts for you or something.”

Loranger refused to admit that she had to push herself physically in order to keep up with the male geologists because she did not want them to have to make any special concessions on her account.

After working for the Conservation Board, Turner was hired by Rio Bravo Oil Company of Calgary as a sub-surface geologist. She described her work in the following way: “I was just running my samples, making my logs, making my sub-surface maps. I wasn’t involved in the actual decision about when or where to drill a well.”

In this job she had a number of interesting field experiences with Norville Nichols. Nichols was “a great, big tall fellow...I just about had to trot to keep up with him, but I didn’t find it all that strenuous or anything.”

Turner found that the most difficult part of her field trip to Montana was the potential hazard from rattlesnakes: “The worst thing about that trip was that there were rattlesnakes around and thank goodness, he was just as scared of them as I was. He didn’t pretend to be any braver than I was when there was a snake concerned.”

Sleeping arrangements on field parties were problematic as costs had to be kept to a minimum and buying extra tents or paying for an extra hotel room was sometimes out of the question. Turner described the various accommodations she shared with Norville Nichols while on field excursions:

Well, when Nick and I were out together, we slept in the same tent. I knew his wife and kids. Jeepers, we’d set our own sleeping bags. I wasn’t interested in him anyway. So, there was no problem that way. It all depends on the individual, I guess. If you were out looking for a man, why ‘look out man, aye?’ But I wasn’t and so we had no problem that way, at all. We went up to Banff and it seems to me we measured some sections along the limestone bed and we stayed in the hotel there but when we were down in Montana...we stayed in a ranch for a while...I think we took our meals there but there wasn’t any room in the house so we had our tents pitched, just an ordinary little tent...no problems at all.
When asked about social activity in the oil industry at that time, Turner said that women rarely went to bars in those days. Since she was excluded from socializing in bars, she did not make a lot of close friends with the drilling and oil industry crowd: "I knew all these people but didn't really make friends amongst them very much. I was in love with the Alpine Club and I used to go to all their meetings and hikes and I was really very active there. Wanted to climb mountains. That's all I really wanted to do. So I didn't really mix around very much with the oil well people. I just met them in connection with my work." When the interviewer asked her if she noticed "any kind of a stigma against being a woman in the industry at that time," Turner gave the following reply:

No, I didn't except for the field work...that angle of it. I never felt any...maybe I was too dumb to notice it or care but...I grew up with two brothers and I always like[d] men and nothing to do with sex or anything like that...I just liked men. I enjoyed working with them and was quite at ease with them. I don't think I bothered them anymore [sic] than they bothered me. I was just one of the guys more or less.

When Turner's husband-to-be returned after serving six years overseas in the war, he proposed and asked Turner to move to the Elmworth area where he was planning to take over the operation of the family farm. When the interviewer asked her about attitudes in the oil industry toward married women geologists, Turner was a little uncertain in her response. She felt that her marital status probably would not have been an impediment to retaining employment in the industry: "I don't know if they would have cared if I'd get [sic] married and continued to live in Calgary. I don't think there would have been any problem." However, her change in location was a determining factor, and she left her career in geology behind when she married. It is somewhat ironic that in recent years the Elmworth area has been the location of major gas field discoveries.
These gas fields probably would have provided geological work for Turner if they had been discovered a few decades earlier and if there had been a strong market for gas at that time.

Turner recalled thinking she had struck it rich when she first went to work in the oil patch: “I thought I was really rich. School teachers didn’t get much in the way of pay in those days. I really thought I was in clover when I got the job at the Conservation Board as far as money went.” She remembered her two years of teaching experience in Banff very fondly, nevertheless, calling it one of “the nicest experiences of her life.” Turner eventually returned to teaching later in her married life; she also raised three sons and a daughter and had eight grandchildren at the time of the interview. She commented on her reasons for returning to teaching:

Actually, I really enjoyed teaching. I don’t know why but I went back to it afterward [sic] I was married...they were so short of teachers and whatnot. I don’t know if I enjoyed my work in the Conservation Board or not. It was just a job. You know, when your [sic] not involved in making decisions about where you’re going to drill or what you’re going to drill...it didn’t concern me. ...As I say, there were other things I’d done that I enjoyed more. It was a job and I guess I enjoyed it but it wasn’t very exciting because I wasn’t really involved especially at the Board. I never did see a sample of a well that Rio Bravo drilled so it was...just getting information...just building up information. We weren’t doing anything. Nothing had been done with it up to that point.”

Turner concluded her preliminary letter to the interviewer with the following remark: “The Petroleum & Natural Gas Conservation Board, as we used to call it, the oil company fellows and that whole world, of which I was once a part for four years, seem very remote now.” Despite graduate training in the sciences, Mary Turner worked for a very short number of years as a professional in the oil industry, but she undoubtedly used her science training in her teaching career and in her volunteer work during her married life. Giving up her fledgling career in geology was one of the sacrifices she made for
marriage and family life, and she did not appear regretful at all in her later life for the
choices she had made.

The routine nature of her day-to-day geology work and her relative lack of input
in the decision-making process made her slightly ambivalent about her enjoyment of
work as a geologist. However, if she had not relocated to her husband's family farm at
Elmworth, she might have struggled a little harder to combine marriage with a geological
career. Since she had her teaching certification, she had a fallback career that made it
easier for her to accept a proposal of marriage that took her out of the Calgary area and
away from employment prospects in the oil industry.

Common Themes and Differences

The lives and careers of these three women share a number of similarities and
differences. All three women received graduate training in the geological sciences.
Belyea and Stewart did their Ph.D.s at American universities, and Turner did her
Master's degree at the University of Toronto. Although encouraged by Dr. Madeleine
Fritz to pursue doctoral studies, Turner expressed no strong desire for a career in
academia. In addition, she may not have wanted to make the personal sacrifices that
many of the early women in geology had made in terms of remaining single and focusing
solely on their careers. Stewart and Belyea both followed this pattern, remaining single
throughout their careers, whereas Turner chose to marry at the end of WWII and to
sacrifice her geological career in order to raise a family. Fortunately, she had a fallback
career as a teacher that helped sustain her interests and provide additional support for her
family.
Stewart chose to remain in academia for the majority of her career, other than a brief leave of absence to work as a geographer during WWII and a brief foray as a consultant in the oil patch in Calgary after her retirement from Ohio State University. Stewart attributed the fact that she initially gained a graduate assistantship in the geology department at the University of Alberta to the wartime shortage of male students in the department. Belyea was a career civil servant, joining the Geological Survey right after WWII and remaining associated with it until her retirement in 1975. Her position with the Geological Survey also may have been gained because of the shortage of qualified men after WWII. Turner also credited her entry to the geological profession to the shortage of geologists as a result of WWII. Her geological career was shortlived compared to both Stewart's and Belyea's, but she continued to contribute professionally in her teaching career.

All three women were physically fit and engaged in strenuous outdoor activities such as mountaineering, hockey, skiing, and horseback riding. This pattern of activity is consistent with the findings of my study on women geoscientists. Both Stewart and Belyea were well liked by their colleagues and were noted for their sociability and entertaining skills, although McLaren noted that Belyea "never suffered fools gladly." There are no records that elaborate on Turner's social skills. Stewart and Belyea travelled extensively during their careers for both professional work and personal pleasure. It is slightly surprising that of the three women, it is Turner's field experiences that historians know the most about.

Neither Stewart nor Belyea seemed aware of or concerned about the fact that they were breaking new ground for women in terms of careers. Perhaps they were too busy
experiencing their careers and churning out the steady stream of publications demanded
by both academia and government service to worry about writing diaries or memoirs.
However, the absence of such material on their careers should provide ample warning to
the current generation of geoscientists to safeguard their correspondence and field notes
until they have the free time to produce memoirs or autobiographies. It is only because
of the Glenbow’s Petroleum Industry Oral History Project that we know as much as we
do about Turner’s shortlived but interesting career in government service with the
Conservation Board and in industry with Rio Bravo Oil Company.

The diversity of the three women’s careers illustrates the three different
possibilities in terms of career path for women geoscientists: university teaching, research
and field work in government service, and work in private industry and the oil patch.
Turner’s geological career was a combination of government service and work in private
industry. In addition, her roles after marriage as first a stay-at-home mother and then as a
school teacher reflect two of the four categories of women scientists developed by
Marianne Gosztonyi Ainley. In Ainley’s descriptive categorization, the first category
refers to the women scientists who were superstars or high achievers; the second category
refers to the marginal achievers who worked as teachers, research assistants, or assisted
with husband’s careers; the third category refers to the independent scholars; and the
fourth category refers to the women who abandoned careers to become homemakers and
science volunteers.90

Mary Turner fits the second and fourth of Ainley’s categories in that she
abandoned her geological career to become a wife and mother and later returned to her
earlier career as a school teacher. As a woman scientist who had a somewhat marginal or
shortlived career, Turner is probably much more representative of the majority of early
women scientists than the superstars such as Helen Belyea and Grace Anne Stewart.
Although the career paths of these three women are different, they illustrate the various
avenues of employment for women geoscientists in academia, government service, and
private industry. In addition, their careers fit into the history of women in science, the
history of women in higher education, and the history of women in geology, as outlined
in the earlier chapters of the thesis. As a result of all these factors, the careers of Grace
Anne Stewart, Helen Belyea, and Mary Turner serve as an excellent introduction to the
oral histories study of contemporary geoscientists that is the focus of Part II of the
dissertation.

1 Mary Turner’s married name was Pandachuk. The Glenbow Museum and Archives (GMA) has filed
some information on Turner under her married name and other information under her maiden name. It
would be easy to miss finding Turner’s transcript from the Petroleum Industry Oral History Project
because it is filed under the name of Pandachuk. Since all of her geological work was done under the name
of Turner, I have chosen to use this name throughout the analysis.
2 Marianne Gosztonyi Ainley uses the name Grace Anna Stewart in her articles and books, but Stewart is
referred to as Grace Anne in all the American references and in the Geology Papers in the University of
Alberta Archives (UAA). Edmund M. Spieker writes in his “Memorial to Grace Anne Stewart, 1893-1970”
in the Geological Association of America Memorials that her friends never referred to her as anything other
than Grace Anne (page 1).
3 Marianne Gosztonyi Ainley, “Last in the Field? Canadian Women Natural Scientists, 1815-1965,” in
Despite the Odds: Essays on Canadian Women and Science, ed. Marianne Gosztonyi Ainley (Montreal:
4 Ibid., 31.
5 Ibid., 32.
6 Edmund M. Spieker, “Memorial to Grace Anne Stewart 1893-1970,” Geological Association of America
Memorials (1973) 2, 110-111.
7 Ibid., 111.
8 Ohio State University Archives (OSUA) Biographical File, “Grace Anne Stewart.” A brief note in the
1920 graduation edition of The Gateway, the student newspaper at the University of Alberta, reports that
Stewart graduated with her B.A. in 1917. However, all the newspaper reports on her death and her OSUA
Biographical Files indicate 1918 as the date of her first degree.
9 UAA, The Gateway, University of Alberta, Graduation Number 1918, 12.
11 For a discussion of the impact of the American draft of male graduate students for the Vietnam War, see
Chapter Seven under “Influence of Social, Political, or Scientific Events.” This war was comparable to
WWI and WWII in that it opened spaces in graduate schools and graduate assistantships for women.
Numerous American women professors of geology have attributed the draft for the Vietnam War as a significant factor in their entry to the geoscience fields.

10 OSUA Biographical Files (Grace Anne Stewart), "Woman Geologist at O.S.U. Isn't Sure She'd Choose That Career a Second Time," dated 2-23-40 [1940]. There is no newspaper name, author, or location indicated, but one would assume that the clipping is from a newspaper located in Columbus, Ohio.

11 Ibid.


15 Ibid., 112.

16 OSUA, The Ohio State University Evaluation Program. Faculty Member's Annual Report, "Grace Anne Stewart," 1943-44, 1.

17 Ibid., 1.

18 Ibid., 1.

19 OSUA, The Ohio State University Evaluation Program. Faculty Member's Annual Report, "Grace Anne Stewart," April, 1947, 1.

20 Bertha L. Illnat, Archives Assistant for Manuscripts at Ohio State University Archives, was kind enough to look up the name of the chair of the department of geology in 1941: Dr. J. Ernest Carman.

21 See Carole B. Schmurak and Bonnie S. Handler, ""Castle of Science": Mount Holyoke College and the Preparation of Women in Chemistry, 1837-1941," History of Education Quarterly 32, 3 (Fall 1992): 315-342. This article discusses the impact of the science education at Mount Holyoke Seminary and later Mount Holyoke College in preparing women for non-traditional careers.

22 Ibid., 1943-44, 1.

23 Ibid., 2-3.

24 UAA, Department of Geology Papers, Dr. Grace Anne Stewart to Dr. J. A. Allan, 4 October 1941, Accession No. 7762.

25 Ibid., 2-3.

26 UAA, Department of Geology Papers, Allan to Stewart, 31 October 1941.

27 Brewster Bus Lines is a well-known Alberta company that is still in business.

28 UAA, Department of Geology Papers, Stewart to Allan, 27 November 1941.

29 Ralph is mentioned frequently in the correspondence between Stewart and Allan. Ralph was a graduate student at the University of Alberta at the time that Stewart did her Master's degree there, and apparently the two were very competitive. Dr. Allan took delight in reminding both of them that Stewart had a higher mark than Ralph did on several final examinations. Ralph received his doctorate at the U of A shortly after Stewart received her Ph.D. at the University of Chicago, and he apparently went on to become a faculty member at U of A. Although his full name is never mentioned in the correspondence, the Assistant Archivist at the University of Alberta confirms that Ralph's last name was Rutherford. Presumably he came from a wealthy family, and Dr. Allan hoped that he would donate a chair to the department.

30 UAA, Department of Geology Papers, Allan to Stewart, 31 October 1941.


32 OSUA Biographical Files, "Grace Anne Stewart."

33 UAA, Department of Geology Papers, Allan to Stewart, 18 March 1936.

34 UAA, Department of Geology Papers, Dr. J.A. Allan to Mr. F.C.C. Lynch, Director, Bureau of Economic Geology, Department of Mines, Ottawa, letter, 18 March 1936, Accession No. 7762.


36 OSUA Biographical Files, "Grace Anne Stewart."


38 Ibid., 2.

39 See Marianne Gosztonyi Ailey, "Women's Work in Geology: A Historical Perspective on Gender Division in Canadian Science," Geoscience Canada 21,3 (September 1994): 140-144. Also see Rossiter, Women Scientists in America.

40 UAA, "Donations to the Department of Geology, 1924-25," Accession No. 7762.


42 UAA, "Fossil Namesake: Rare Compliment," Edmonton Journal (n.d.).
43 OSUA, Novice G. Fawcett, President of The Ohio State University to Mr. Robert S. Tuller, Attorney at Law, Tucson, Arizona, letter, 4 December 1970.
44 OSUA, The Ohio State University Evaluation Program. Faculty Member’s Annual Reports, “Grace Anne Stewart.” Stewart listed the position as both President and Chairman on different evaluation forms.
45 OSUA Biographical Files, “Grace Anne Stewart.”
47 Ibid., 231.
48 Ibid., 231.
50 OSUA, Payroll Pedigree Cards for Grace Anne Stewart, RG 6/c-13/16.
51 OSUA, Payroll Pedigree Cards for J. Ernest Carman and Edmund M. Spieker, RG 6/c-13/16.
52 UAA, Department of Geology Papers, Stewart to Allan, 4 October 1941.
53 OSUA Biographical Files on Grace Anne Stewart, “Woman Geologist at O.S.U. Isn’t Sure She’d Choose That Career a Second Time,” (dated 2-23-40).
55 Dr. Charles Armour, e-mail message to author, 30 August 1999.
57 Ibid., 199.
58 Ibid., 199.
59 Ibid., 199.
60 Ibid., 200.
61 Dr. Don Stott, telephone conversation with author, Victoria, B.C., 12 July 1999.
63 GMA, Petroleum Industry Oral History Project Transcript, Susan Birley’s Interview with Mary Turner (Pandachuk), 23 November 1984, Manuscript No. M6807.2.
64 Ibid., 2.
65 Ibid., 3.
66 Ibid., 3.
67 Ibid., 3.
68 Ibid., 5.
69 Ibid., 6.
70 Ibid., 6-7.
71 Ibid., 9.
72 Ibid., 9.
73 Ibid., 9.
74 Ibid., 12.
75 Ibid., 16.
76 Ibid., 16.
77 Ibid., 22.
78 Ibid., 15.
79 Ibid., 15.
80 Ibid., 17.
81 Ibid., 20.
82 Ibid., 23.
83 Ibid., 24.
84 Ibid., 23.
85 Ibid., 24.
86 Ibid., 25.
87 Ibid., 25.
89 Ibid., 200.
90 Ainley, introduction to Despite the Odds, 21.
CHAPTER SIX
ORAL HISTORIES IN THE OIL PATCH: RESEARCHING THE LIVES OF CONTEMPORARY ALBERTA WOMEN GEOSCIENTISTS

The exploration of the three early women's careers in geosciences serves as an excellent bridge to the current chapter of the dissertation, which outlines details of my interview-based study of thirty-four contemporary women geoscientists in Alberta. The study unfolds in four chapters. Chapter Seven explores the stepping stones or triggering factors that prompted women's entry to geoscience careers as well as participants' entry experiences to university and the workplace. Chapter Eight examines the juggling act performed by many women geoscientists as they struggle to integrate families and careers. Chapter Nine examines the changing personal and public professional images of women geoscientists as well as their attitudes to environmental issues. Chapter Ten connects the conclusions from the study to the literature review and the research questions outlined at the beginning of the dissertation and calls for further research on Canadian women in science.

Methodology and Use of the Oral History Approach

The need to document the experience of contemporary women working in the oil patch led me to use oral history as a methodology. From an extensive review of the literature, I developed a semi-structured protocol and a letter of informed consent that were reviewed by the OISE/UT Ethical Review Committee. I chose to use a semi-structured interviewing approach because it seemed to offer the most attractive option in terms of eliciting information about specific questions that I had and offering participants the opportunity to comment freely on topics that they wished to address. Shulamit
Reinharz has suggested why semi-structured or unstructured interviewing appeals to
feminist researchers in *Feminist Methods in Social Research*:

It differs from ethnography in not including long periods of researcher
participation in the life of the interviewee and differs from survey research or
structured interviewing by including free interaction between the researcher and
interviewee. Survey research typically excludes, and interview research typically
includes, opportunities for clarity and discussion.\(^2\)

In the interests of clarity and open discussion, then, the interviews were semi-
structured in format. In addition, I employed a snowball sampling technique in which
initial participants identified other potential candidates for interviewing. The sampling
technique will be described in more detail later in the chapter. Participants were
contacted in advance by letter about the research project and had a chance to thoroughly
consider their participation and review the interview schedule. All participants signed
consent forms agreeing to participate in the study and acknowledging the researcher’s
commitment to keep their identities confidential and to maintain the research data in a
secure location. The interviews were audiotaped with the permission of participants, and
field notes were taken. The tapes were analyzed with the protocol serving as an
organizer. Interview notes were coded. Answers to key questions were then transcribed
and further analyzed.

The interviewing extended over a three-year period, and I conducted all of the
interviews myself, either in person or in two instances through e-mail correspondence. I
took very detailed notes during the interviews and carefully recorded dates, times, and
places. The interviews were very pleasurable experiences for me, and I felt that I was
making many new friendships throughout the research process. Participants’ interest in
the project seemed genuine. I have received numerous e-mails and follow-up calls since the interviews to inquire how I am progressing with the thesis.

Although the interviews were pleasant and intellectually stimulating experiences, they were also quite intensive both in terms of the content that participants divulged and the length of time that the interviews took. Interviews ranged in length from one to two hours, and I was often quite exhausted at the end of them, particularly if I had travelled any distance to meet the participants. Trying to interview participants over a meal, or interviewing two people together as I did in one instance, only added to the challenges of keeping track of the conversations and the speakers’ voices.

In addition, because of the travelling distance and cost involved in interviewing participants in locations away from home, occasionally I scheduled several interviews in one day. I found that the maximum number of interviews that I could handle effectively in one day was three. This number may vary for different researchers depending on their personal stamina and the length of the interviews. Often I felt that the last few questions in the interview schedule did not get answered as completely as they might have been simply because they were positioned at the end of a lengthy interview. As a result, I would position complex questions more carefully in future interview-based studies that I undertake.

Ethical Considerations in Relation to the Study

In the Introduction to Challenging Professions: Historical and Contemporary Perspectives on Women’s Professional Work, Elizabeth Smyth, Sandra Acker, Paula Bourne, and Alison Prentice comment on the challenges that confront researchers when
they are connected in some way through their own or their partner's work to topics they are researching or people they are interviewing:

Increasingly, and in line with much feminist writing, we recognize that our own personal and occupational concerns are integral to our scholarly work....Although we might elaborate further on the personal ties that bind the authors to their work, it is sufficient perhaps to pose the questions that arise when we consider such ties. As insiders, or scholars near to insiders, do we see more of the flaws than others would? Or, on the contrary, are we less inclined to be critical? Do our contemporary subjects trust us more because we understand their world? Or do they hesitate to tell us secrets that might be passed onto others in the work community? Do we gain greater understanding because we know what people in the field are talking about? Or do we lose information because informants assume that, because we know things already, there is no need to elaborate? Do some of us project our own feelings and experiences, as professional women and men, onto the subjects of our essays? It is not always clear how our various positions affect our understandings. 3

I share similar concerns to these authors regarding my connection to the topic of women geoscientists. My partner is a geologist, and it is through his work that I am connected to the topic. Since he is very active in the geoscience community and has worked for close to twenty-five years in the province of Alberta, his connections in industry, government, and professional associations have opened doors to me that otherwise might not have opened. His network of friends, colleagues, and associates welcomed my interest in their field and were generous in referring me to contacts throughout the province who were willing to participate in the research project. It has been very advantageous to be well connected to the geoscience field in terms of accessibility to potential participants. However, the question of whether some information remains off limits or whether sometimes secrets are revealed because of insider status is an ethical issue worth considering. On the whole, I found that participants were candid and open in answering my questions whether I was meeting them for the first time or had met them many times previously.
The other connection I have in relation to my topic is that I am a mother working in postsecondary education who has grappled with many of the problems experienced by participants who have partners and families. Shulamit Reinharz has suggested that we choose topics to help us learn about ourselves and to figure out how we might have coped more effectively with challenges that have confronted us. To some extent, I am curious about the innovative alternatives regarding childcare and work schedules that participants are developing and that may be available to my daughters if they choose to have families. I am selfish enough career-wise to hope that these arrangements will not involve more than occasional help from mother. These, then, are some of the reasons that prompted me to devote an entire chapter to the topic of juggling rocks, careers, and families.

Kathleen Weiler’s comments on her connections to her research topic in “Reflections on Writing a History of Women Teachers” summarize the issues effectively:

In writing this history, in a sense I explored my own past, since I was born and raised in a small town in California, the daughter and niece of women teachers in country schools. The idea that history is a narrative construct shaped by the interests of the historian has been widely discussed in recent years, but it is feminist historians who have emphasized the importance of the stance of the historian, not only in terms of intellectual and political beliefs, but in terms of personal history as well.

In keeping with feminist practice, I have identified my stance and my personal history in relation to the topic. In addition, I have raised the question of ethical issues that confront the researcher when one has insider knowledge or status. I realize that raising these issues does not resolve them, but it is at least a start in the right direction. From these theoretical questions, the discussion moves to methodological details in addressing the specific issues such as developing pseudonyms, sample size, age range of participants, and other characteristics of the sample group.
Use of Pseudonyms

As a result of the guarantee of confidentiality given to participants, I was obliged to develop pseudonyms for their names and to omit the location of the interviews in the documentation. The decision to eliminate the locations of the interviews in order to protect the identities of the participants was made with considerable regret. Suffice to say that their locations were widely scattered throughout the province of Alberta. Participants lived in the province’s major urban centres as well as four towns scattered throughout the oil patch.

In coming up with pseudonyms for participants in the study, I was no less perplexed than the prospective parent when faced with the daunting task of naming children. It helps to use a systematic approach in developing pseudonyms, but it is also helpful to have a little fun with the names and to choose names that suit the individuals’ interests. I therefore decided to use the tables of rock and mineral names in a standard geology textbook as the source of participants’ surnames. First names were assigned in alphabetical order starting with A with the first participant and moving to Z and then starting in alphabetical order again. The participants’ first names were chosen randomly under the appropriate letter of the alphabet in a book of 400 names.

There was no attempt to match the participants’ ethnicity with the names chosen. Some of the names are unusual only because of the combination of rock and mineral surnames and the letters of the alphabet governing the first names. Table 2 shows the pseudonyms, dates of the interviews, and participants’ highest degrees, designated by graduate or undergraduate degrees. Participants’ pseudonyms are listed in order according to the dates that interviews took place, moving from first to last. After
deliberating over what information to include and what to exclude, I somewhat reluctantly decided that naming the locations of the interviews, the specific years of participants’ graduations, their areas of employment, and the achievement of doctorates would make it too easy to identify study participants. Much as I regret the loss of detail in omitting this information, it is necessary in order to safeguard participants’ anonymity.

**Age Range of Participants and Size of Sample Group**

In addition to trying to ensure the participants’ geographic locations were widely dispersed throughout the province, I also attempted to ensure that different age cohorts were represented in the study. Figure 2 shows that a majority of participants were in the mid-career age range. The oldest participant in the study graduated from university in 1949 and was seventy-five at the time of the interview. The youngest participant graduated from university in 1995 and was twenty-five at the time of the interview. There was some representation in the study from every age range of geoscientists available for consultation: three participants were in their 20s; nine were in their 30s; eleven were in their 40s; five were in their 50s; five were in their 60s; and one participant was in her 70s.

University graduates of an earlier era were not always easy to track down, but the alumnae grapevine and the personal contacts of participants helped open doors and made the process of snowball sampling fairly effortless. In fact, it was amazing how few refusals to participate that I received in over three years of interviewing. I did not have a set number of participants in mind at the outset of the research, but decided to stop
Table 2: Pseudonyms, Date of Interviews, and Degrees of Study Participants

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Date Of Interview</th>
<th>Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Alice Granite</td>
<td>September 27, 1997</td>
<td>Graduate Degree</td>
</tr>
<tr>
<td>2. Barbara Marble</td>
<td>October 1, 1997</td>
<td>Undergraduate Degree</td>
</tr>
<tr>
<td>3. Cindy Granulite</td>
<td>October 12, 1998</td>
<td>Undergraduate Degree</td>
</tr>
<tr>
<td>4. Debbie Quartzite</td>
<td>January 9, 1998</td>
<td>Undergraduate Degree</td>
</tr>
<tr>
<td>5. Evelyn Diabase</td>
<td>March 4, 1998</td>
<td>Undergraduate Degree</td>
</tr>
<tr>
<td>6. Fiona Shale</td>
<td>March 7, 1998</td>
<td>Undergraduate Degree</td>
</tr>
<tr>
<td>7. Geraldine Syenite</td>
<td>March 22, 1998</td>
<td>Undergraduate Degree</td>
</tr>
<tr>
<td>8. Hannah Basalt</td>
<td>April 3, 1998</td>
<td>Undergraduate Degree</td>
</tr>
<tr>
<td>9. Isobel Rhyolite</td>
<td>April 5, 1998</td>
<td>Undergraduate Degree</td>
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<td>17. Querida Felsite</td>
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<td>34. Harriet Serpentinite</td>
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interviewing when the data seemed adequate to the task at hand. Twenty interviews did not seem to provide an adequate source of information, and fifty interviews seemed excessive in terms of the time it would take to accomplish them. Thirty-four interviews offered adequate data and could be accomplished over a reasonable length of time. As is evident from the Table 2, most of my interviews were accomplished during the summer months when I was not actively teaching. Now that the age range of participants and the size of the sample have been outlined, the next topic to be addressed is other characteristics of the sample group.

Other Characteristics of Sample Group

In an attempt to satisfy readers' curiosity about study participants, I will outline the few other details that I can safely provide without breaking their anonymity. Thirteen of the thirty-four participants or approximately 38 percent have graduate degrees at either the master’s or doctoral level. Eleven of the thirteen did some or all of their graduate studies in Alberta. Fourteen participants or approximately 41 percent did their undergraduate degrees in Alberta at the University of Alberta or the University of Calgary. Other participants attended a representative sample of Canadian academic institutions for their undergraduate degrees as well as universities in the United States, England, Europe, and several other countries. The Canadian universities attended by participants included the University of Toronto, University of Saskatchewan, University of British Columbia, University of Western Ontario, University of Windsor, University of Manitoba, University of Waterloo, Queen’s University, McGill University, University of Montreal, and St. Francis Xavier University.
In the interests of maintaining the anonymity of participants, I have chosen not to identify the academic institutions outside of Canada that participants attended. However, it is interesting to note that unlike Canadian women geoscientists of an earlier generation such as Grace Anne Stewart, Alice Wilson, and Helen Belyea, all the Canadian-born participants in this study who gained graduate degrees attended Canadian institutions. As one can see, although the study is Alberta-based, participants came to Alberta from all parts of the country and abroad and attended a wide range of universities. Nine of the thirty-four participants or approximately 26 percent are originally from countries other than Canada.

Marital status of participants is another factor of interest to many readers. Four participants are single and have never been married. Eight of the participants or approximately 23 percent are either separated, divorced, or have divorced and remarried. Of the participants who have been married, fifteen or 44 percent identified that they were at one time married or still are married to geoscientists or engineers. Other participants were married to scientists, technologists, teachers, or other professionals/semi-professionals. It also may be of interest to note that none of the participants had partners working in health-related professions despite the fact that many of their parents had professions related to these areas. Participants seem to have met their partners at university or in places of employment. None of the participants identified themselves as being involved in same-sex relationships. Two of the four participants who are single are fairly recent graduates who have not decided about marriage.

Single status is not necessarily indicative of childless status since several participants who are separated or divorced have children from previous marriages.
Although I did not specifically ask participants the number of their children, all of the married participants identified that they had children of their own or stepchildren. Individual participant's children ranged in number from one to four, and two children were about the norm. Ages of children ranged from adults to preschoolers. Since not all participants told me how many children they had, I am unable to give an accurate total count. However, if each participant had two children, the count would be over sixty. This number would probably be a good estimate. Although some participants have only one child, others have three or four.

The above demographic data gives a numeric portrayal of the participants in the study. The rest of the chapter explores the details of eight women geoscientists' lives. These women's stories have been selected primarily because they reveal themes that will be developed more fully in the following chapters. These themes include factors that attracted them to geology, difficulties with field work and field schools, and establishment of careers in specialized or innovative fields. I have tried to make sure that the oral histories included at least one graduate from each of the decades from the 1950s to the 1990s, as well as participants who received their undergraduate education both in Canada and abroad. The oral histories also have been edited quite extensively to remove identifying information and details that will appear under various themes in later chapters. The histories offer readers another opportunity to get to know one or more participants for each decade with careers representative of women in the geoscience fields in industry, academia, and government service. The oral histories serve as an effective bridge between the introduction and the study that follows.
Figure 2: Age Distribution of Participants in Oral History Interviews
Wartime Service Offers Entry to University for Rachel Pitchstone

Rachel Pitchstone graduated in geology in the 1940s. Initially she found it difficult to get a job in her field. She first had to prove herself doing secretarial work before she was later hired to do mapping and lease acquisition for the same small oil company that initially hired her as a secretary. Even though she stayed at home until her children went to school on a full-time basis, Pitchstone kept a foothold in geology by reading seismic logs at home, which she found to be financially lucrative. Although Pitchstone did not elaborate on the details, at some point her marriage ended, and her new independence gave her both the freedom and the additional financial incentive to resume a full-time career. She subsequently worked for ten years in research and then relocated to do geological work for a large oil company for another five years.7

As with many of the earlier graduates interviewed, Pitchstone was very active in sports throughout university, and she remains fit and active as a senior citizen. She attributed her opportunity to go to university to her service in the air force during WWII and commented that she jumped at the chance to receive funding to attend university. She was exposed to the mountains as a child through occasional family picnics in Banff. She was also stationed on the West Coast during the war years where she was employed in tracking enemy aircraft, and she enjoyed the mountain vistas there. Pitchstone stated that she became more self-confident and assertive as a result of her professional accomplishments. She took great pride in her profession and indicated that she made her highest income in the last few years of her employment as a senior geologist in the oil patch. She probably would not have retired as early as she did had it not been for a cyclical downturn in the oil industry and subsequent layoffs of senior staff members.8
Banff's Mountain Vistas Attract Una Obsidian

Una Obsidian remembered her university years in the 1950s with pleasure. She enjoyed the university experience both socially and intellectually, had excellent peer support, and made many good friends. Although she had started out in nursing, she did not care for it, and her parents encouraged her to pursue her interest in a non-traditional career for women. A summer experience working in Banff also spurred her interest in geology. She enjoyed the mountains and read a Geological Survey of Canada booklet about Banff and the surrounding area.9

When she returned to university in the fall, she transferred into geology courses and received her highest mark in the fossil part of the courses. She also had a friend who took geology at the University of Manitoba who visited her and sent her mineral and sulphur samples. Initially she had to combat opposition from the Dean of Arts when she transferred into geology. He told her she would be very sorry later on for choosing this career. Obsidian recalled that the faculty members in the geology department were neither encouraging nor discouraging: “They took the attitude that if you were qualified, you were accepted.”10 Once in the program, she found faculty members very supportive.

Obsidian said that the Leduc oil finds were very much in the forefront of Edmontonians’ minds in this era, and graduates in geology usually had their choice of two or three jobs. Women as well as men had the advantage of choosing among several offers of employment, although Obsidian commented that women were usually paid lower salaries than the men. Obsidian recalled having one job offer at parity to men’s salaries, but she did not take it because of its location. Her work in geology was quite varied, from reading logs to taking samples and producing maps. However, she did not
get the chance to do wellsite geology, which she would have enjoyed. Access to field work was still limited for women in this period.\textsuperscript{11}

Obsidian was fortunate in being able to participate on field trips in university because there was another woman student she could bunk with, but the women students were put next door to the professors as an additional security measure. Obsidian recalled going to the Sullivan mine on one field trip. She was allowed to go underground in the morning, but was refused entrance in the afternoon because of the complaints from miners. In mining circles, there was a taboo about bad luck following women who went underground. Obsidian also recalled being pointed out by passers-by when her long hair and pony tail were visible when she was chipping at a road cut with her rock hammer.\textsuperscript{12}

\textbf{Burgess Shale Interests Vera Breccia}

Vera Breccia is another geology graduate of the 1950s. As a child she walked the river valleys in her locale and collected rocks with her father. She also read about the dinosaurs and was fascinated with fossils. She was intrigued with stories about the Burgess Shale in Yoho National Park and other fossil discoveries in the Peace River country. In addition, it helped spur her interest that she had a cousin in geology. Breccia and her classmates regularly worked together in small study groups. Since the geology classes were smaller than engineering classes, the students all came to know each other well.\textsuperscript{13}

Breccia worked for a small oil company doing regional geology when she graduated. After her marriage to a geologist, she found it difficult to work for a rival oil company because the companies were all worried about industry secrets. Her husband also encouraged her to stay at home once they had children. Breccia commented that the
graduating classes in this era had excellent opportunities, and classmates networked on a regular basis through monthly meetings over lunch. These meetings continue to this day, and Breccia has always attended with her husband and has tried to keep up to date on activities in the oil industry.\textsuperscript{14}

Breccia kept up her professional interests by going into the field with her husband and by accompanying him on conferences and on his frequent trips for both personal and professional activities. She has been active on various voluntary associations and boards in her community, and has taken a keen interest in the activities of local museums. In addition, she and her husband believe in sharing their good fortune, love of education, and their varied academic interests with others. As a result, they have donated several scholarships to universities in the province.\textsuperscript{15}

\textbf{Laurel Coquina's Troubles with Field Trips}

Laurel Coquina is a geology graduate who gained her graduate and undergraduate degrees in the 1960s. When she was not invited to do graduate work on receiving her Bachelor's degree despite the fact that she had one of the highest marks in her class, she gained a job working in research. Her work involved examining minerals in the lab, but it was not long before Coquina was frustrated by her lack of opportunity to do field work. She also found that she needed a graduate degree to get anywhere in research, and this realization prompted her return to graduate school shortly after entering the workplace.\textsuperscript{16}

Coquina commented that she was "not quite one of the boys"\textsuperscript{17} during her university years. She had difficulty getting on field trips because she was the only woman in her class. She in fact had to recruit a couple of girlfriends in order to participate in one undergraduate field excursion. Even as a graduate student, she was
prohibited from taking a field trip that she desperately wanted to attend, despite the fact that her father had been able to arrange accommodation for her as well as a flight through an acquaintance who ran an air service. Years later, she still resented the injustice of such discriminatory treatment.\textsuperscript{18}

\textbf{Brenda Phyllite and the Noah Principle on Ocean-Going Field Schools}

Brenda Phyllite is a 1970s geology graduate who has had several experiences on ocean-going research vessels that corroborated the Noah Principle mentioned by other women geoscientists. Phyllite had to bunk above deck with other women participants on her ocean-going field trips, and she recalled being treated in a slightly paternalistic or protective manner. She was pregnant on several of the cruises in which she participated, and on one trip she was held back from going ashore when the waters were particularly rough. Fortunately, Phyllite took such paternalistic expressions of concern for her safety in good stride and did not let them prevent her from enjoying the field experiences.\textsuperscript{19}

Phyllite also related an amusing incident about arriving at a university to take up a graduate fellowship only to discover that the faculty members had expected her to be a man. Although slightly taken aback by their momentary shock, Phyllite stated that she did not experience any discrimination from faculty. Fellow graduate students were another matter, however, particularly in the first semester of graduate school when she tried hard to fit in and found that her male classmates seemed to feel threatened by the presence of a woman. She turned out to be the first woman to receive a Ph.D. in geology from this university. Eventually Phyllite was able to overcome the attitudinal obstacles that contributed to her initial exclusion, and later she would marry a classmate.\textsuperscript{20}
Farrah Anthracite Uses Language and Research Skills

Farrah Anthracite is a 1960s graduate in geology who has used her strong research and language skills in public service, private industry, and work as an independent consultant. She studied both languages and geology in her country of origin, and felt fortunate she was able to utilize training in both of these areas to gain employment when she came to Canada. She recalled when she was a child that her mother used to earn extra income as a translator, and she finds it slightly ironic that she also has made excellent use of her language skills.21

Anthracite said that she and her husband had to start over when they came to Canada, and necessity prompted both of them to work hard and take advantage of all their opportunities for employment. She also commented that her confidence has grown with every year that has passed. The combination of being good at what she is doing, having the children all grown up, and having a mature and satisfying relationship with her husband all contribute to this growing sense of confidence.22

A Specialized Career in Geoscience Attracts Wen Pumice

Moving to more recent graduates, the discussion turns to Wen Pumice, a 1980s graduate whose career has taken her across the country almost from coast to coast. Although Pumice’s parents encouraged her to strive high, she received no encouragement to go into engineering despite the fact that her father was an engineer. Her choice of a specialized geoscience field was directly related to a first-year university talk she heard about high incomes in her particular branch of geosciences. Pumice could recall no problems with peer acceptance at university, and she said that she experienced no
discrimination from professors. However, she also had no female professors and no mentors at university.\textsuperscript{23}

Her class consisted of only eight students, and women formed 25 percent of the class. Pumice stated that she graduated at a time when it was difficult to get a job and to establish a base of experience. Her nine years with a major oil company were therefore a critical formative period in terms of establishing her professional competence. She says that she also had to take the initiative to move on when the time was right in order to advance her career. Finding the energy and internal initiative to risk new opportunities has been very important in terms of Pumice’s upward career advancement. She has had broad experience with a number of different companies. She also credits a little luck and the active support of her husband for her career success.\textsuperscript{24}

Pumice is also very active on professional organizations related to her field. She indicated that her career opportunities have improved because the markets have done well, but also because she has had the initiative to create her own opportunities. Her years of experience add to the weight that her co-workers place on her opinions in the workplace. She has learned to be assertive and to state clearly and firmly what her opinions are so that her voice is heard in meetings. She also pointed out that the representation of women in the boardrooms of big corporations has improved dramatically in recent years.\textsuperscript{25}

The turning point for her in realizing this fact was a recent meeting in which there was only one man in attendance and all the rest of the participants were professional women. Pumice commented that this juxtaposition left her momentarily off balance since she has become so accustomed over the years to the style of communication that
men employ. In fact, she is finding it difficult to adapt her style to the mixed balance of participants at meetings that she increasingly is finding is the norm in business. Pumice says that she is risk-tolerant, forward looking, and continually searching for new challenges to keep her occupied. She has “a need to be doing things that impact the bottom line” in her organization. Rather than being obsessed with making it to the top, she concentrates on meeting her own personal goals. The rest should happen by itself in her opinion.

Beaches, River Systems, and Earthquakes Attract Sarah Hornfels

Sarah Hornfels is a 1990s graduate in geosciences who first became interested in how the earth was formed when she was exposed to beaches, river systems, and witnessed the devastating impact of earthquakes in the country in which she was born. Hornfels pointed out that she always enjoyed the company of boys when she was growing up and was considered somewhat of a tomboy. Since she did not have any brothers and lost her father at any early age, Hornfels says that she liked being in a male environment and craved male authority figures because of their absence in her life. The geosciences were a perfect field for her interests, and one of her male professors at university became a close friend and academic mentor, and continues to be a source of career advice.

Access to field work has not been a problem for Hornfels. In fact, she has had very interesting field experiences in remote and rugged locations. She says that her novelty as a woman doing field work in such rugged locations worked to her advantage, since drillers helped her lift boxes of core weighing 50 to 60 pounds, and would go out of their way to do favours for her such as warming her cup of soup with a blowtorch. Her
self-confidence, outgoing nature, and no nonsense attitude probably had a lot to do with her ability to get along in such field camps. The fact that she is very comfortable working in a male environment also has helped her gain acceptance in the field. Compared to the period right after she graduated, when the economy went into a downturn and positions started to close down in geoscience fields, Hornfels says that the current economic upturn is an excellent time in which to be a geoscientist. She says, "the demand for resources is high, there are many different levels of geological work available, the future outlook is very positive for resources, and it's one of the best times to be in the field."28

Conclusion

These brief excerpts from the oral histories of participants highlight the changes that have taken place over several decades in the experiences of professional women geoscientists and hopefully whet readers' appetites for the study that follows. Shulamit Reinharz has suggested a number of reasons that researchers take an oral history or biographical approach:

Just as in the past, contemporary feminist researchers are interested in oral histories and biographical work for several reasons: to develop feminist theory, express affinity and admiration for other women, contribute to social justice, facilitate understanding among social classes, and explore the meaning of events in the eyes of women.39

In a number of ways I agree with the principles of feminist perspective and methodology that Reinharz articulates, and have attempted in my own work to "express affinity and admiration for other women,"30 "explore the meaning of events in the eyes of women,"31 and "contribute to social justice"32 by making the previously invisible contributions of women in geosciences become visible. The first point in Reinharz's
approach is in considering feminism a perspective rather than a method. The second is in considering a multiplicity of research methods one of the hallmarks of feminist research, including oral histories, ethnographies, biographies, survey techniques, and other creative methodologies that get at the lived experience of women. The third is in her emphasis on studying the contributions of women that have been previously ignored:

Making the invisible visible, bringing the margin to the centre, rendering the trivial important, putting the spotlight on women as competent actors, understanding women as subjects in their own right rather than objects for men—all continue to be elements of feminist research.³³

The fourth point that Reinhartz makes is that feminist research often benefits from cross-disciplinary or transdisciplinary approaches. The fifth is that feminist research is “connected to social change and social policy issues.”³⁴ The sixth is that feminist research “acknowledges the paradox that women are alike in some ways and dissimilar in others.”³⁵ It in fact celebrates the diversity of women’s experiences. Reinhartz’s seventh point is that feminist researchers often start from their own experiences: “Feminist researchers frequently start with an issue that bothers them personally and then use everything they can get hold of to study it. In feminist research, then, the ‘problem’ is frequently a blend of intellectual question and a personal trouble.”³⁶

The eighth point that Reinhartz makes is that there is often a connection that develops between the researcher and the researched: “In general, feminist observational or interview-based studies include a strong connection between the ‘researcher’ and the ‘subject’ that develops during the course of the study and lasts beyond it, sometimes only in memory, sometimes in actuality.”³⁷ The final point that Reinhartz makes relates to the connection between the researcher and the reader: “A characteristic of feminist research
seems to be a desire on the part of the researcher to address the reader directly and to forge a connection through her between the reader and the people studied."

In this chapter that serves as the introduction to my interview-based study, I have outlined how I have followed many of these basic principles of feminist perspective in researching the topic of Alberta women in geosciences. First, I have explained my connection to the topic; second, I have addressed ethical concerns relating to the topic; third, I have shown that the connection between the researcher and the participants is more than just one of interviewer and subjects and may in fact result in ongoing relationships; fourth, I have attempted to make the invisible become visible through the study of women in geosciences; fifth, I have taken an interdisciplinary approach in using both historical and sociological methodology; and finally, I have tried to engage the reader directly. The next topic of exploration is the stepping stones to women’s careers in geosciences.

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1 See Appendix 1 and II for the Research Protocol and Letter of Informed Consent.
7 Rachel Pitchstone, [pseud.], interview by author, 17 August 1998.
8 Ibid.
10 Ibid.
11 Ibid.
12 Ibid.
13 Vera Breccia, [pseud.], interview by author, 19 August 1998.
14 Ibid.
15 Ibid.
17 Ibid.
18 Ibid.
19 Brenda Phyllite, [pseud.], interview by author, 6 July 1999.
20 Ibid.
21 Farrah Anthracite, [pseud.], interview by author, 8 July 1999.
22 Ibid.
24 Ibid.
25 Ibid.
26 Ibid.
27 Sarah Hornfels, [pseud.], interview by author, 17 August 1998.
28 Ibid.
30 Ibid., 134.
31 Ibid., 134.
32 Ibid., 134.
33 Ibid., 248.
34 Ibid., 251.
35 Ibid., 252.
36 Ibid., 259-60.
37 Ibid., 263.
38 Ibid., 267.
CHAPTER SEVEN

"STEPPING STONES" TO CAREERS IN GEOSCIENCES

In her autobiography, Stepping-Stones: The Reminiscences of a Woman Geologist in the Twentieth Century, Katharine Fowler-Billings vividly describes childhood experiences on the eastern seaboard of the United States that sparked her lifelong interest in geology:

My early summers were spent at the seashore, swimming in the cold waters of the Atlantic, digging in the sand in the mornings and going to Rocky Beach afternoons. I liked to climb the large glacial erratics and learned to keep my balance on the shore rocks. I watched the tides come and go and collected seashells and interesting pebbles. Later, my father brought me books to identify my finds. My schoolteachers encouraged my summertime pursuits and in the fall I took great pride in exhibiting my troves of seaweed, flowers, and rocks.¹

Fowler-Billings went on to become a well-known geologist. She was one of the first women geologists to work in Africa, exploring and prospecting in Sierre Leone by herself when she was prohibited from accompanying her first husband on his geological field work on the Gold Coast.² She later taught at Wellesley College, travelled extensively in Russia and Japan, and produced geological maps of the Laramie Mountains of Wyoming and of New Hampshire. The geological mapping of New Hampshire was accomplished with the assistance of her second husband, Marland Billings, who was a well-known Harvard geology professor.

Fowler-Billings's reminiscences about her childhood experiences at the seashore are a fitting introduction to this chapter, which explores the stepping stones to careers in the geosciences. Many of the participants in this study as well as other geoscientists share outdoor experiences similar to those described by Fowler-Billings. Almer Eamer is a University of Calgary geology graduate whose career story has been published in The
newsletter. She emphasizes the influence of family outdoor adventures on her subsequent choice of career. In her case, fishing trips beginning at the crack of dawn on weekends proved to be the impetus to her career in geology. She comments that "It was during these many trips, which are still a part of my life and my children’s now, that I found endless hours of joy, entertainment and mystery in looking at the rocks, boulders and ‘gems’ all around us. ...It wasn’t long before I would be filling my pockets and bags with an assortment of rocks and ‘gems’ to bring home, sometimes instead of a fish." Alma Eamer’s rock collecting experiences, which are so similar to Katharine Fowler-Billings’ seashore rock collecting experiences, set the scene for the chapter to follow.

The chapter starts with an exploration of family influences and early socialization on participants’ career choices and then moves to the influence of high school courses, teachers, and guidance counsellors. It addresses the following questions identified in the Chapter One of the dissertation: What were the triggering factors that encouraged women’s entry to geoscience fields? How did women’s entry experiences to universities and careers vary? What were the terms of women’s incorporation into the geoscience professions? How easy was it for women to gain entrance to field schools in university and field experiences in the workplace? How did women gain access to postgraduate funding and acceptance to graduate schools? After gaining their academic training, what kinds of opportunities were available to women in the geosciences? Under what circumstances did women’s career opportunities in the geoscience fields improve? Although the study does not answer all of these questions definitively, it does shed light on participants’ experiences in many of these areas. The chapter is therefore an examination of the changes that occurred over time in women’s professional
opportunities and experiences in geosciences. It also examines the ways in which the findings of the oral histories study coincide with or contradict those outlined in the review of the historical literature. In particular, it reviews Marianne Gosztonyi Ainley’s findings on women in geosciences to determine their applicability to the experiences of the contemporary women geoscientists in my study.

Factors Encouraging Entry to Geoscience Careers

Factors encouraging the entry to careers in the geosciences were varied, but for a majority of the thirty-four participants in this study, family influences and early socialization played a major role. Sixty-two percent of the participants (21 of 34) had fathers, grandfathers, uncles, brothers, and in four instances, mothers, who were geologists or chemical, mechanical, civil, mining, or agricultural engineers. The parental role models also included a prospector, a geology professor, a mining recorder, medical doctors and nurses, teachers, an air traffic controller, a high-ranking government official, a pharmacist, a chemist, a forester, and many parents engaged in other professions who had amateur interests in geology or astronomy. Sixty-eight percent (23 of 34) of the study participants engaged in rock collecting as a childhood hobby or were constantly exposed to rocks or fresh rock cuts through living in a mining environment, living near the ocean, or spending time at cottages in the Canadian Shield. In two families, rock collections dated back several generations and still continue to be expanded.

Exposure to outdoor activities and travel also played a major role in the impetus to careers in the geosciences. A similar pattern of family travel, outdoor activities, camping, and exposure to natural wonders has shown up in most of the participants’ backgrounds regardless of the socioeconomic status of the families. Jessica Gneiss’s
parents enjoyed the outdoors so much that they camped every summer with their children. During the course of Jessica's childhood, the family travelled from coast to coast in Canada. Brenda Phyllite's parents took the family fishing in the Midwest for two weeks every summer. Phyllite also had trips with her parents to the Rocky Mountains and Yellowstone Park. Barbara Marble was another participant who camped and enjoyed outdoor recreational activities with her family. She lived on a lake near a northern Ontario mining community, and was close to many geological features. She also had access to the large collection of rocks in her father's office and to all the "rock hounds" who frequently visited his office and home. Memorable holidays with her family included trips to California and Yellowstone Park.

Ophelia Diorite also camped and travelled extensively with her family, and these experiences included extended periods living abroad. Yannakis Schist spent summers at the ocean and loved digging trenches and looking at the layers. Dorothy Pridotite fished and camped for two weeks every summer, often travelling to the Kootenays in British Columbia through the Rockies. Other summers her family spent holidays in northeastern Alberta, travelling by horseback or horse and buggy. Pridotite was highly influenced by her father's love of collecting rocks and arrowheads. Geraldine Syenite travelled to see Niagara Falls and the rock museum there. She also went down the nickel mine at Sudbury and enjoyed summers spent at family cottages. These examples are only a few of the many such influences on participants' histories.

Forty-one percent (14 of 34) of the participants in the study in fact indicated that they had visited the Grand Canyon, the Canadian Rockies, Glacier National Park, or Yellowstone Park as children. Since seven of the participants lived in locations outside
of North America as children, the percentage of Canadians and Americans to visit these locations is fairly high, despite the fact that they were in locations scattered across the North American continent. One participant had a vivid recollection of her father giving a mini-lecture at Yellowstone Park on the geological forces responsible for Old Faithful’s spectacular display. The strong influence of travel and outdoor activities on the participants is readily apparent.

Participants growing up in more distant locations such as Australasia and Europe were exposed to mountains, streams, beaches, and occasionally volcanoes and earthquakes that aroused their interest in geology. Amber Slate often took a one-hour trip to the beach with her parents and brothers and sisters.11 Farrah Anthracite went on frequent rock collecting excursions with her parents and grandparents in the mountainous European country in which she lived.12 Nora Sandstone’s European grandmother loved fresh spring water, and on their frequent excursions together to collect water, she and her grandmother also collected shells, rocks, and snails that Sandstone later would take to her school teacher for explanation.13

Even the participants who did not have extensive travel experiences could boast of constant exposure to the outdoors through vacations at parents’ or grandparents’ cottages in the Canadian Shield or elsewhere, through hikes to mountain streams, or through living in family homes near rivers or lakes.14 Laurel Coquina spent her summers with her father in the Northwest Territories. She recalled pulling wagon-loads full of rocks around as part of her play as a youngster.15 Isobel Rhyolite had the following recollections of her childhood holidays:

My childhood holidays were all about the outdoors. We canoed, camped, travelled just to see natural attractions. I grew up on a hobby farm for many years
with a creek through the property where I collected fossils. I recognized them later at university and wished I had kept some as they were Devonian. My recreational pursuits were all outdoor-oriented—skiing, canoeing, hiking, cycling. I loved the Red Deer River from the foothills to Drumheller and have canoed and rafted it many times prior to my career selection. The geology is perfectly exposed. Of my most cherished high school memories are my Phys Ed Outdoor class. We climbed mountains, camped in make-shift lean-tos, camped in the snow, skied, and canoed. If my parents only knew the perils we encountered...\[16\]

Many of the other participants also indicated that they enjoyed challenging recreational pursuits such as skiing, hiking, golfing, canoeing, horseback riding, hockey, football, or rock climbing.\[17\] Zoya Mylonite, for instance, was a national junior sports champion as well as an avid skier.\[18\] Farrah Anthracite described herself as "not the typical feminine type" either in appearance or in her choice of activities. She enjoyed strenuous mountain hikes, prided herself on her physical fitness, and loved outdoor adventure.\[19\] She came by this love of the outdoors naturally since her father, a lawyer, also enjoyed nature and strenuous physical activity. Dorothy Pridotite also played football and hockey as a youngster.\[20\] A majority of the participants were physically fit and indicated that they enjoyed strenuous sports and outdoor recreational activities. These recreational activities helped prepare the geoscientists for the occasionally strenuous field work in their future careers.

Influence of Parents and Grandparents

Both stay-at-home mothers and working mothers were positive influences on their daughters, but the participants who had working mothers frequently indicated that their mothers' work was influential in their decisions to pursue careers. Kerry Gabbro indicated that her mother was unusual among her peer group in that she insisted on maintaining her teaching career after marriage.\[21\] Her grandmother also had been a teacher. In several instances, stay-at-home mothers of participants had experienced early
careers as nurses, secretaries, engineers, a geologist, or a radio officer in the Signal Corps of the Air Force during World War II. One mother who was a geologist later had a second career as a school librarian. Another mother who was an engineer had a later career as a junior high school math and science teacher. In another instance, marital breakdown and the absence of a career on her mother’s part made Fiona Shale determined to have a financially lucrative career as a geologist. Wen Pumice also indicated that the monetary motivation was an impetus to her career in geophysics. She heard about the high incomes of geophysicists in her first year of university, and her desire for financial independence helped determine her future career path.

Both stay-at-home mothers and working mothers of participants were highly supportive of higher education, but initially some of them expressed reluctance to have their daughters enter what traditionally had been considered male-dominated professions. All of them eventually came around to a supportive position once their daughters had entered the field of study. Fathers were equally mixed in their attitudes about daughters’ choices of profession. Some of the professional fathers who were doctors or engineers still had traditional attitudes about women’s roles, while others pushed their daughters in the direction of non-traditional careers for women. Even though Wen Pumice’s father was an engineer, her parents did not encourage her to become one. Her father did not take her to his workplace and did not tell her much about his career. In Ophelia Diorite’s case, it was her grandfather who provided encouragement for her to enter geology. He was an amateur geologist and a strong advocate of women’s rights. Diorite recalled spending countless childhood hours exploring Alberta river valleys with him.
Several of the participants’ fathers were particularly supportive of open career opportunities for women. Mary Siltstone had a father, mother, both grandfathers, and numerous uncles all in the engineering field. As the oldest child in the family, she was often invited to accompany her father when he was travelling to inspect remote construction sites. From an early age she was allowed to drive on the remote roads to these sites. The enjoyment she experienced on these occasions reinforced the idea that engineering was fun. She now has a graduate degree in geotechnical engineering and is engaged in major construction projects throughout the province and the country.

Laurel Coquina spent every summer working alongside of her prospector father. Coquina grew up with the notion that she could do anything or become anything she wanted to be. What she wanted to do, of course, was to discover an ore deposit that would become a producing mine. As the oldest child, she was taken to visit her father’s prospecting and stockbroker friends on a regular basis. She learned a great deal from them about both prospecting and investing. Placement or position in at least these two families seems to be a significant factor in terms of the amount of parental attention received.

Isobel Rhyolite grew up with an engineer father who was a single parent as her only role model. She knew that higher education was a given from an early age, and she received considerable encouragement to excel in math and science. In contrast, Querida Felsite had a father who was a mining engineer, and she spent her childhood moving from one location to another across the United States and Canada. Her father had to look after the family after the death of his wife, and he advised his daughter to study home economics as her aunts had done. Despite his encouragement in this direction, Felsite
was very unhappy in home economics. She had spent her entire life in a mining environment, and she was not cut out to be a home economist. She subsequently changed universities, transferred into geology, and paid for her own education.\(^{32}\)

A number of participants remarked on the influence of their grandmothers and grandfathers. Several stated that they had grandmothers who were among the first graduates of universities in the Maritimes, United States, Britain, and Australia.\(^{33}\) Zoya Mylonite's grandmother was a medical doctor. Kerry Gabbro cited the positive examples of her mother and grandmother who collected botanical specimens for museums and took her on frequent field excursions and of her grandfathers who also were well educated:\(^{34}\)

The family travelled a great deal in the holidays, and I became very fascinated in the variety of nature. My mother had grown up in the country and was very knowledgeable about flowers, trees, birds, animals, etc. We were always collecting and cataloguing specimens for the museum. I had a very influential 'Nature' teacher in elementary school who encouraged my natural interests/experiments. As stated before, my father and grandfather were civil engineers and very interested in geology, archaeology, and architecture. These were also the fields I was interested in. The other grandfather was a clergyman and classical scholar. He influenced my choice of Latin at school, which has greatly influenced my interest in paleontology and biology and also challenged my debating skills regarding evolution. My mother and grandmother were both teachers who worked even when they had young children. This was a role model to me in the pursuance of my career.\(^{35}\)

The influence of parents who were medical doctors and nurses on daughters' subsequent careers in science is also revealed by this study. Yannakis Schist's father and grandfather were both medical doctors, and her mother and her grandmother were both nurses.\(^{36}\) She also had a great grandfather who went to the Klondike and an uncle on her mother's side who was a geophysicist. Zoya Mylonite had a grandmother and father who were both medical doctors, a sister who became a psychiatrist, and an uncle who
was an engineer. Her teacher mother excelled in science and sports. She raised her children as a single parent.37

Other grandparents provided the summer cottages at which fledgling geologists started their first rock collections.38 Patricia Archos spent summers at her grandparents’ cottage where she spent countless hours collecting shells, rocks, and pine cones. Later she excelled at outdoor sports as a teenager, particularly enjoying whitewater canoeing.39 Erika Travertine also spent six weeks with her extended family at the lake every summer, and enjoyed going into the bush with her father, who was a forester. Travertine’s maternal grandfather was a well-known explorer, and his example seemed to influence her love of adventure. She expressed frustration at the fact that her mother was a graduate nurse who had never worked in the nursing field. Right after graduation, her mother had married and followed her husband into the bush.

Travertine suggested that her mother’s lack of career ambition might have been a negative reaction to having a mother who was completely preoccupied with her career. Her grandmother had a Master’s degree and had worked as a Curator of a Museum of Natural History in the United States. The grandmother was described as “not a housekeeper.”340 The example of Travertine’s mother and grandmother reflects the generational ebb and flow of women into and out of careers that Anita Harris describes in her research.341 Travertine, the granddaughter, has remained single and has achieved a senior management position. Family friends of parents or friends of siblings who had engineering or geology backgrounds often exerted influence on the career paths of other participants.
The only exception to the pattern of love of outdoors was a geotechnical engineer who fell into a career in geosciences through a computer error in her first-year engineering registration. Hannah Basalt had shown an aptitude for mechanical engineering from a young age, had spent all of her time indoors taking things apart and putting them back together, and had enjoyed countless hours taking part in hands-on science experiments at one of her city’s museums. Despite the error in registration, Basalt found she liked geosciences and decided to stay in them when she found she was not strong in the math required in other engineering courses. Her role models included a woman medical doctor whose children she babysat as a teenager and a girlfriend’s sister who went into engineering. Basalt wanted to hear the hush of surprise that came over the commencement audience members as they heard that the young woman had chosen to pursue a career in engineering!

Influence of High School Courses and Guidance Counsellors

The influence of high school courses and high school guidance counsellors is a contentious issue. Very few participants in this study mentioned high school courses that interested them in geology other than outdoor physical education courses, science courses at private schools, or courses taught by teachers who happened to be geology graduates. Those participants who could cite positive high school influences had exceptional experiences. Two of the participants went to all-girls’ schools. Both schools had a strong academic orientation and encouraged students to excel in math and science. Kerry Gabbro had the following comments about her early education:

My early socialization was unusual because I attended a boarding school (girls only) from the age of ten. This school had very high academic standards and required a minimum of 90 percent in a national exam taken at age 9/10/11 (the 11+ exam), and high marks in a further ‘Common Entrance Exam’ and a
successful interview to join the school. Consequently my socialization at the school did not represent society. All the teachers were women.... My high school education was channeled towards science by the school. Performance and aptitude at national exams taken at age 15/16 directed the choice of specialization of subjects for the last two years at school. Specialization is required for university entrance in the United Kingdom. The Chemistry/ Biology/ Geography combination I took qualified me for entry into the geosciences.43

Laurel Coquina pointed out that all of her teachers were women with advanced university degrees, including the science teachers. She felt these teachers were excellent role models and that the rigorous training she received in high school left her well prepared for her university study of geology.44

Three other participants also mentioned specific high school courses that sparked their interest in geology. Thomasina Perlite was fortunate in having a geologist as a high school science teacher. He had graduated in a year with poor employment opportunities and had taken up teaching as a career. His addition of a geology component to the grade nine science course was this student’s first exposure to geology, and it sparked a lifelong interest.45 The second student, Evelyn Diabase, had the advantage of an experimental outdoor science course that included rock climbing, canoeing, and exposure to traditional native outdoor activities and crafts such as snowshoeing, arrowhead making, and tanning hides. The outdoor geology component of this course again sparked a lifelong career interest.46 Isobel Rhyolite also mentioned that mountain climbing, skiing, camping, and canoeing in her outdoor physical education course were highlights of her high school memories.47

The participants’ stories about high school guidance counsellors were similar, even for those individuals who were recent graduates. In many cases, students entered geology or engineering courses against the advice of counsellors. Some students said that
the counsellors had books of women's careers and books of men's careers and that they were discouraged from looking at the career listings for engineering or geology. Other students said that women's gym classes were scheduled at a time that conflicted with the senior math and science courses that were required for entry to engineering or science programs. The not so subtle message was that women would not be interested in these courses anyway. Harriet Serpentinite commented that high school guidance counsellors “didn’t provide any guidance.”

Several participants mentioned having to fight to get enrolled in the courses that would gain them entry to university-level engineering and science courses. One student was told that women could not be geologists or discover a mine. Since she had known from about the age of four that this was exactly what she wanted to do, she never visited the counselling office again. Her father also actively encouraged her to ignore the counsellor’s advice, and he went out of his way to introduce her to mining professionals and academics who could smooth her entry into the geoscience profession. Although the separate red books for women's career choices and blue books for men's career choices had disappeared by the time most of the more recent graduates attended high school, the bias against non-traditional careers for women had not necessarily disappeared. In most cases, participants in the study found out the career information they needed to know by themselves or with the active support of parents. They refused to be discouraged by guidance offices or by university registrars who were sometimes skeptical about employment possibilities for women in geology.
Influence of Social, Political, Economic, or Scientific Events

Participants were asked about the influence of social, economic, political, or scientific events on their career choice because the literature on American women geoscientists showed the influence of such events. The American space program attracted people to careers in the sciences and geosciences and led to toughened standards in U.S. science programs. In addition, the draft of male graduate students for the Vietnam war opened opportunities for women graduate students and left vacancies in positions for graduate assistants. Susan Dana Halsey, an American professor of geology, commented in “Footprints in the Sands of a Beach Daughter” that “My application to graduate school coincided with the decision to draft graduate students out of school for the Vietnam war. Since women weren’t draftable, it became expedient to admit them in order to cover anticipated assistantship vacancies.”

Laurie Brown Isaacson, also an American professor of geology, wrote in “Journey into Geophysics” that “My jump from college to graduate school was accomplished relatively easily even with only one course in Geology. This was because it was 1968, the Vietnam draft was at its height, and quite literally, there was room for newcomers like myself.” Maria Luisa Crawford, another American professor of geology, similarly wrote of the influence of natural science events in “Choosing A Career for the Fun of It.” Crawford wrote: “I suppose my interest in geology started as I grew up in Guatemala in the shadow of volcanoes and with the recurrent effects of earthquakes. But more than that, it was the picnics presided over by my archaeologist grandfather, A.V. Kidder, which showed me the fascination of seeking our [out] secrets hidden in fields and underground.”
A majority of the participants in my study found it difficult to cite specific examples of such factors; however, several participants were able to pinpoint influences of this nature. Two of the geoscientists viewed touring moon rocks when they were children. Debbie Quarzite was taken to view the moon rocks when they toured the Maritimes. Ophelia Diorite saw them in the geology department at the University of Alberta. Several of the early graduates interviewed also mentioned the influence of the Leduc oil discovery. Querida Felsite remembered an excited professor rushing into the classroom to announce the oil discovery and to tell them that there would be lots of employment for all of the geology students in the oil industry. Vera Breccia recalled seeing the Leduc flares in the distance from Edmonton and being taken for a close-up view by an uncle who worked in the Leduc oilfield.

Many participants recalled the unprecedented economic boom that the Leduc oil discovery created in Alberta, and they directly attributed the enrolment increases in geology to the positive prospects for employment in the province. Other participants commented on the influence of scientific events and theories on their career choices. For example, Brenda Phyllite was intrigued by her first-year geology professor's theories on plate tectonics. The professor was an oceanographer who had the courage to present new theories on plate tectonics even though half the faculty in his department did not accept his viewpoint. The controversial new theories spurred Phyllite's interest in the field. The evidence is far from conclusive in terms of the small number of participants who could recall the influence of scientific factors in their career choices. However, major discoveries such as the Leduc oil find, events such as touring moon rocks associated with
the space program, and changes in scientific theories had an impact on some participants' career paths.

When participants were asked whether they were aware of the influence of economic factors on geoscience careers, most of them indicated that they were blissfully unaware of the cyclical nature of the resource industry until they graduated from university. Many of them had entered science programs because they desired economic independence, but unless they had parents, friends or siblings in the mining or resource industry, they were unaware of the dramatic upturns and downturns in this area of the economy. A majority of the participants in the study stated that the economic cycle at the time of their graduation directly influenced their career options. Some participants had four interviews and four offers of employment; others could not even get an interview on graduation despite extensive summer field experience. A number of participants went on to do Master's degrees in geology when full-time employment did not materialize.

One participant worked in the service industry for a year and a half before gaining work in geology, and she had to move to a different province to get a job. Another participant worked in financial services for two years before she also had to relocate to another province to take a position in geosciences. A third participant who graduated in the mid-eighties could not gain employment at all and decided to go back to university to use her science courses to gain a graduate degree in Food Sciences. She expressed a love of the outdoors and regretted that she was unable to parlay several summers of geology field experience into a full-time career, but she is now very successful in her second career choice.
The relationship of the economic cycle to geoscience careers is highly relevant to this study. This study's findings on Alberta women geoscientists seems to corroborate Margaret Rossiter's theory on sexual segregation in the sciences at least in terms of the ease of access for women to careers in the geosciences during the boom cycles of the resource economy. One of the European-born participants in this study also mentioned that shortages of geoscientists in her country were an important factor in her decision to enter the geoscience profession. The field was welcoming newcomers, including women, at the time she made her career decision.

University Experiences

Parental support of participants' university education varied from moral support and encouragement, to provision of a home base and car privileges, to full financial support in the case of a few fortunate individuals. A majority of participants said that they paid their own way or received minimal financial assistance from parents. Isobel Rhyolite commented that "Support was demonstrated by empowering me to be responsible for my own choices. I was given a lot of respect and very little money." Querida Felsite switched into geology from another program and had to take time off from her studies to work in an office in order to be able to afford to finish her education. Laurel Coquina was fortunate to come from a fairly affluent family. As a result, she was able to keep her scholarship winnings for her own use, and her parents paid the full cost of her university studies. Many students were recipients of scholarships and fellowships for graduate work.

Most parents encouraged their daughters to pursue new goals and challenges. In several instances, parents were extremely supportive when their daughters changed their
minds about initial courses they had entered such as nursing, secretarial studies, or architecture and switched to geology. One father expressed relief when his daughter decided that a nursing career was not for her. On the other hand, the father of the home economics student who switched into geology was far from supportive. There does not seem to be a consistent pattern of parental support, nor does such support seem essential for student success. Yannakis Schist in fact stated that she pursued education at the doctoral level to spite a professional father who had not expected his daughter to last at university. She took great delight in the fact that she became a very successful academic in a field in which her father thought she could not succeed.

Entry experiences at university varied from participant to participant and from university to university. Strong academic support and mentoring from professors seemed to vary inversely with the size of the department and to depend on the country in which the participant studied. Graduates of British, European and South American universities commented that professors were treated more formally and kept themselves at more of a distance from students than they found was the norm when they moved to North American universities. Graduate students in all universities had more access to support and mentoring from professors. Even in Canada, graduates of large engineering programs stated that few professors established mentoring relationships with undergraduates, but this was not necessarily true for professors located in small geology or geophysics departments. First year geology professors were in many cases responsible for attracting students to careers in the geosciences.

When asked about mentors, many participants commented that they did not require mentors, that male professors served adequately as mentors, or that the few
women graduate students and professors available served as mentors for them. Very few of the participants could recall any women professors in their undergraduate programs. One participant who did have a woman professor said that she was harder on the women students than the male professors and did not go out of her way to make other women welcome since she enjoyed being the only woman in the field.70 Another participant who had an undergraduate class with a renowned female scientist at McGill University found that this professor was more interested in graduate students.71 Graduates of European universities said that women students and professors were far more numerous in the geosciences in Europe than in North America.72 Part of the reason for this phenomenon may have been that European women had access to university programs at a much earlier date than Canadian women, since European universities were established at a much earlier date.

While many of the study participants said that it would have been helpful to have women mentors, most of them had exhibited a streak of independence and determination long before they had reached university campuses and were used to managing without a lot of mentoring support. Some participants stated that there were very few women in their high school classes who took senior level math and science courses. It therefore did not come as a surprise to them that there were very few women in their engineering or geology classes when they reached university. Those participants who had the good fortune to be enrolled in small geology or engineering departments often reported an excellent academic climate and very good support from male classmates and professors. In contrast, students in large engineering classes expressed some feelings of isolation
from classmates, and one commented that she did not have access to old exams and the old boys' network.73

Most of the participants in this study said that they were welcome to participate in engineering and geology society activities. Some participants took part in these activities, several acted on the executives, and others commented that they had neither the time nor the inclination to participate. Some of the women engineering students also declined to take part in socializing in bars and "strip joints." Hannah Basalt simply could not afford to socialize and felt she missed out on information from the informal network.74 Isobel Rhyolite indicated that she felt accepted in the academic environment, but occasionally felt isolated socially: "I did not feel left out intellectually. Socially, I felt respected in the university setting, but the boys often took off to strip clubs outside of school hours, and I chose never to participate in those kinds of social activities. At these times I wondered who my real friends were."75 Similar mixed feelings about participation or lack of participation in social activities enjoyed by peers have been expressed by Peggy Tripp-Knowles in "The Feminine Face of Forestry in Canada." Social barriers to networking in fields such as forestry and engineering are a very real problem for women students. Tripp-Knowles describes her dilemma in the following terms:

One social event involved playing a hockey game followed by drinking at a local strip bar. I recall this incident with mixed feelings. I recollect a sense of comfort at being accepted by my peers, along with the discomfort of sports and drinking as a recreational activity.76

A number of students in smaller university departments reported that a camaraderie developed among classmates and that peer support was excellent, with male colleagues sticking up for female classmates whenever there were isolated problems with professors. Several of the University of Alberta graduates from the late 1940s and the
1950s remarked that they enjoyed the attention they received from male classmates and had no shortage of opportunities for socializing. Many of them married their classmates. In fact, 57 percent (17 of 30) of the married participants in this study chose mining engineers, geotechnical engineers, geologists, geophysicists, or geochemists as their spouses. Four of the participants in this study are single, and several are now divorced.

Several participants reported minor incidents with older professors who exhibited condescending attitudes toward women students. However, these students were not shy about setting professors straight when their remarks were out of line. One professor returned a top examination mark to one of the participants and said “Pretty good for a girl,” only to receive a chorus of boos from the audience for his slighting remarks. Harriet Serpentinite took an engineering geology elective in her fourth year and received the top mark in the class on the first midterm. The professor condescendingly asked the men in the class, “How do you guys like being beat by a girl?” Several participants said that professors with old-fashioned attitudes about women’s roles either retired or changed their attitudes quickly when their remarks received a chorus of complaints.

Participants who graduated twenty or thirty years ago had occasional problems in gaining approval to participate on overnight field trips, particularly if they were the only woman in their year. Years later, resentment still lingers about such discriminatory treatment. Laurel Coquina was denied permission to participate on a field trip in the 1960s and also recalled being the only graduate in her year not invited to do graduate work even though she had one of the highest marks in her graduating class. Despite her resentment over these two incidents, she had positive comments about the mentoring
roles that several of her professors continued to play throughout her professional career, and she was able to enrol in graduate school several years later.\textsuperscript{79}

Farrah Anthracite’s experiences in the 1960s were slightly different from Coquina’s. She felt it was a little easier for women geology students in her European country because 10 percent of both the students and the professors were women. There were always classmates to share a room or tent with on field trips. Consequently, women were not treated any differently than male students and had equal access to trips. In fact, she recalled shocking her entire family when she went on an excursion to an underground mine and travelled 1600 meters down the shaft with all the other students.\textsuperscript{80}

Graduate students were nearly unanimous in their opinion that male professors could perform the role of mentoring as well as women professors. Many participants have maintained contact with their graduate professors. In some cases they continue to work on a consulting basis with professors on major projects during the summer months. Participants of the study reported that peer support and academic climate at the graduate level of studies were generally excellent. Needless to say, their experiences varied from professor to professor and program to program. Participants pointed out that there were certain professors who went out of their way to support students’ applications for graduate fellowships, summer field experience, and full-time employment. In addition, a number of participants stated that they changed universities if they did not receive the support they required or did not find professors with specialization in the fields in which they were interested.
Access to Field Work

Just as entry experiences for participants varied from university to university and from program to program, so did entry experiences to careers. Many of the women who graduated between the late 1940s and the 1970s indicated that they had difficulty gaining field experience. Oil companies were happy to hire them to read drilling logs and to perform routine geological work in the office, but they were reluctant to have them spend time out on drilling rigs. Several participants stated that they occasionally inspected drilling sites with supervisors, but they did not have the opportunity to work in the field for extended periods of time.81

Una Osidian, for example, stated that in her early geology career she read logs and did cross-sections on a regional and local basis, but she did not get to work on wellsite geology. She said that she would have liked the chance to do field work, but her employers were reluctant to have women working in the field. Obsidian was a 1950s graduate in geology.82 Querida Felsite, who gained her B.Sc. and M.Sc. around 1960, also stated that women were not allowed to work on oil rigs during her period of employment.83 Rachel Pitchstone, a late 1940s graduate in geology, worked early in her career reviewing drilling logs and carrying out regional stratigraphy. She also stated that women were not encouraged to participate in field work in the early years of her career.84 Vera Breccia, an early 1950s graduate in geology, worked primarily on regional geology for a small company after she graduated. The company did not let women do field work, so she did not get a chance to do wellsite geology. However, she was able to gain a limited amount of field exposure working with petroleum engineers, although she was required to stay in bunkhouses overnight rather than sleep in camp.
Dorothy Pridotite stated that she never had the opportunity to experience field work early in her career, and she was a late 1960s graduate. When she started working, the policy of the board governing her department was that only junior engineers would be sent into the field. Since she was not an engineer, she was not eligible to participate. That policy was changed about ten years ago, but by that time Pridotite was already well advanced into the hierarchy of the organization and was beyond the point where field work would have been useful for her career advancement.85

The transcripts of the interview with Mary Turner, which are housed at the Glenbow Archives, also confirm the bias in the 1940s against women performing field work. These study results therefore corroborate the findings of Marianne Ainley who concluded that the early women geologists such as Alice Wilson and Madeleine Fritz experienced "lateral segregation (being channeled into certain areas of science) and hierarchical segmentation (being kept in undervalued, underpaid positions)."86 The early women graduates of geology in Alberta who participated in this study seemed to be relegated to office work and research and had few opportunities to do field work unless they were accompanied into the field by supervisors. Only those early graduates who had lengthy careers were able to take advantage of changed attitudes toward field participation by women that seem to have occurred in the mid- to-late 1970s.

**Increased Awareness and Changing Opportunities**

The issue of access to field work was addressed in the *Report on the Status of Women Geoscientists in Canada* published by the Geological Association of Canada in 1975. Whether the positive changes in terms of access to field work can be attributed to this committee’s report or not is debatable, but opportunities for women in the
geosciences began to change for the better about this time. It is difficult to pinpoint the specific demarcation point when access to field work started to improve or the specific reasons other than broad societal changes in attitudes towards women's roles. In many cases it was individual field party chiefs and supervisors who made the difference in women's acceptance in the field rather than company-wide edicts that mandated the change. The following examples of early field experiences will corroborate the positive changes that occurred in terms of access for women.

Erika Travertine, a 1970s graduate, stated that her first geology job was in a company located in eastern Canada. She replaced a woman as office geologist, so she was not the first woman hired by the company. However, she mainly provided research support and wrote monthly reports. She worked for this company for three years, and two of those years were spent battling to get into the field and to gain equal opportunity with the other geologists. The company eventually allowed her to do "safe" field jobs in locations close enough to civilization that she could stay in hotel accommodation. Travertine stated that her best field experience was with a large oil company on a summer field party in which the party chief was a woman. Three women worked on an equal footing in this field party and had their own trailers for accommodation. Later in the 1970s, Travertine worked overseas, where she felt excluded both culturally and professionally since she was out of her home environment and found that geologists were not ranked as high in the hierarchy of professionals as they were in North America. She worked as a research geologist, but served primarily a support function as a "glorified library research assistant." Travertine was not sorry to leave this experience behind when she returned to Canada and slowly began to work her way into managerial ranks.
Fiona Shale, a 1980s geology graduate, stated that she only had one negative experience as a student in applying for a field job. She was interviewing for a mineral exploration company and already had two or three summers of field experience. The interview was going well, and she had a good feeling about the outcome when the interviewer told her that she had excellent credentials. However, he then proceeded to tell her that the company would not hire women for field parties because a female student had become pregnant on the previous year's field party. Shale was very bitter that this incident should be held against her, and wondered why the company personnel had bothered to interview her when they had no intention of hiring her.

Debbie Quartzite, also a 1980s geology graduate, spent the early part of her career working in eastern Canada. Quartzite emphasized that she has never been held back from doing field work. In fact, she said that women in geology were quite a novelty at the outset of her career, and one company she worked for hired several young single women at one time. The boss was particularly supportive of women's careers, and since the popular television show *Charlie's Angels* was being broadcast at that time, the young women became known as Murphy's [pseudonym] Angels, after their boss's name. Quartzite stated the range of opportunities in the coal mining industry may have been narrower than those opportunities later available to her in the oil industry, but it was difficult to generalize about the differences between hard rock as opposed to soft rock mining.

Geraldine Syenite, a 1990s graduate, recounted only one discouraging experience in interviewing for a field position. Syenite made the mistake of dressing up too much for an interview with one mining company. As a result of her appearance, she was asked
if she could carry twenty pounds of samples. At this point the interviewer told her he was not prepared to hire a woman. She later learned that the interviewer hired a male classmate who was 6' 3" and sturdily built to do the field job. Not to be deterred by this discouraging experience, Syenite landed a job on a field party on the West Coast working with two other women exploration geologists. The company hired local workers to carry the rock samples and much of the equipment, and the field party was a very positive experience.

Other field work in the north proved to be a good experience in which all members of the field party shared the cooking responsibilities rather than leaving it all to her because she was a woman. Syenite later worked as a production geologist at an open pit mine where she was in charge of grade control and ore mapping. In this position she was the only professional woman working for the company other than the accountant, and the experience was not quite the same as having the companionship of women co-workers. The only women on staff other than the accountant were working in service-oriented positions such as cleaning or cooking, and Syenite did not have many interests in common with them.90

Ophelia Diorite, who received her B.Sc. and M.Sc. in the 1980s, stated that initially she spent a few summers working in labs before she became more assertive and pushed for field experience. She subsequently was a member of both all-women and mixed field crews in western and northern Canada. She described the field camps as good experiences as long as you were young, healthy, and self-reliant. In addition, the settings and geological exposures were very interesting as a result of the remote locations the helicopters were able to transport the crews to. She experienced no harassment in the
field in these locations. However, one summer experience as the party chief of a field crew in eastern Canada was not so pleasant. She was only one of two party members from out of the province, and as party chief and a woman, she felt that she lacked the respect of her male co-workers. Although the pay and work experience were excellent and there was never any doubt in her mind that she could do the job, she concluded that the cultural setting was an inappropriate one for her to test her wings as a field party chief.

Evelyn Diabase, a late 1980s geology graduate, had very good experiences early in her career in terms of field work. She was fortunate to be hired to work on a field crew on the West Coast in which over half of the staff were women. She described the crew as consisting of five women geologists, two women draftspeople, two women administrative assistants, a woman geostatistician, two male senior geologists, and two junior male geologists. The project manager was male, and he liked working with women. The crew stayed in cabins by a lake, and on clear days they worked in the field, and on rainy days they did office work plotting data and mapping. Diabase stated that the crew members were fortunate in having assistants to scrape moss from the rocks and carry samples. All the hard preparatory work was done for them so that they could concentrate on geological mapping. These early field experiences gave her the confidence to handle responsibilities in the field later when she was outnumbered by men in her work locations.

Harriet Serpentinite, a 1990s graduate with a doctoral degree, indicated that when she graduated with her undergraduate degree, jobs were prevalent, and all the students had offers of permanent positions. In fact, second-year students were offered jobs as wellsgeologists. One of her professors encouraged her to apply for a fellowship for
graduate work, and when she was offered it, she jumped at the chance. She stated that she had just enough field experience with industry to know that she might be stuck with meaningless routine work if she did not pursue a graduate degree. She was fortunate to have worked on a field party on her first summer in geology with a well-known woman geologist, an experience she found very enjoyable and beneficial professionally.

In other summers she worked on field crews in the western provinces. On one of these field parties she was one of only two women in a fifty-person camp. Although she described herself as fairly naïve, she said that she never had any serious problems with co-workers, even though she did have some "oddball and funny experiences." In her opinion, a woman's physical size makes a difference. She stated that petite women geologists often have a more difficult time in terms of harassment and may feel more physically vulnerable in their interactions with co-workers. Serpentinite indicated that she made a point never to let situations get out of hand or go too far and as a consequence thoroughly enjoyed her field experiences. These are just a few of many examples of participants' experiences with field work. They serve to illustrate that access to field work slowly improved for graduates from the mid-1970s on.

Entry Experiences in the Workplace

While career opportunities for women in the booming Alberta resource industry are very positive, entry experiences remain a sobering reminder that social attitudes are slow to change. Isobel Rhyolite, who entered the workplace about fifteen years ago, expressed shock at the mining industry's failure to evolve. Colleagues still had pictures of scantily clad women on their walls and women colleagues had responded with equally inappropriate pictures of men. Rhyolite commented as follows:
...I was actually shocked to discover that sexual stereotyping did exist in the workplace, and I was wrong that it was a thing of the past. I was completely naïve to the fact that the mining industry had still not evolved. I felt sick communicating with my new co-workers when they had ‘girly’ pictures on their office walls. It took all my courage to complain to my supervisor, and he handled the situation with compassion and discretion. I really appreciated that response to my new reality.93

Fortunately, the sympathetic supervisor insisted that all the offensive pictures be removed, and shortly after the incident, harassment policies were implemented at the company to solve similar problems in future.94 Geraldine Syenite, a recent graduate, related uncomfortable incidents such as receiving an obscene letter on the first day she arrived at a drilling job in a remote northern location. Again, managers handled the incident effectively, but it was frightening to her nonetheless.95 Gloria Amphibolite related a similar incident in which she was on a remote drilling job and had to share a trailer with the drilling foreman, who had a drinking problem. He apparently hated all geologists and was dismissed at the end of the job because of his hostile attitude. However, the three days she had to contend with this individual were unpleasant. She was unable to leave because her vehicle would not make it down the muddy road, and at that time there were no cellphones to call for assistance.96 Other participants in the study also said that older professionals sometimes initially resented what they considered to be the intrusion of women into the geoscience fields. These attitudes again were largely overcome by demonstrations of professional competence.

Many of the participants in the study said that as women they always have to prove themselves as competent when they are supervising drilling crews or geophysical crews or doing field work in remote locations or under rugged conditions. The good news is that discriminatory attitudes rarely persist once they have demonstrated their expertise.
However, it can be tedious to constantly have to prove oneself, particularly if one works in a consulting capacity and moves from location to location, or if one’s position demands the supervision of crews primarily composed of men. Participants also commented that as professionals they are very conscious of the fact that they can spoil it for others if they fail to pull their own weight in field situations. These factors are additional pressures that women in supervisory positions face that men in similar positions rarely experience.

Jessica Gneiss stated that although things are getting better all the time, the geoscience field is still a male-dominated environment in which women have to have “a thick skin” in order to survive. She commented that “the feminine part of you is put aside; you don’t take it to work.”97 Evelyn Diabase added that she goes out of her way to remain professional in her dealings with colleagues. She avoids personal squabbles, internal politics, and problems of too much socializing with male colleagues by eating her lunch at her desk.98 Mary Siltstone, a senior geotechnical engineer, summed it up this way: “You walk into every field situation knowing that you have to prove yourself—that’s a given. Men are accepted until proven otherwise….who you are and what you know count—experience shortens the acceptance time. Experience also teaches you how to laugh at or brush off things that are not important.”99 In her opinion, attitudes are only an initial barrier that can be overcome.

Whether the geoscientists are in the remote Athabasca oilsands or in boardrooms of the Calgary oil patch, social attitudes, whether they are only initial barriers or not, are the slowest part of the job equation to change. They linger far behind the willingness of companies to promote women to senior positions. Gloria Miller’s doctoral thesis, The
Frontier 'Cowboy' Myth and Entrepreneurialism in the Culture of the Alberta Oil Industry, comes to a similar conclusion. Miller states that it is "the gendered nature of the assumptions underlying social relationships which maintain and reproduce exclusion." One geoscientist in this study says that even the big oil companies prove reluctant when it comes to promoting women to president and CEO positions. She claims that many of the current generation of geoscientists have not yet reached a point in their careers that they recognize that there is still a barrier preventing access to the top positions of CEO and President. In her opinion, only a critical mass of women reaching the doorstep will likely change this reluctance on companies' parts.

Amber Slate remarked that although opportunities for senior positions in government are improving for women, advancement to some extent is still dependent on the "old boys' club and buddy system." Slate said that "who you know has always been important." In addition, those women who have mentors in prominent positions have a better chance of progressing up the ranks. The ability to read the political and environmental climate accurately and seize opportunities also is very important in terms of promotions. Slate commented that some people are not comfortable with self-promotion and would rather plateau at a reasonable career level and let others worry about struggling to get to the top. Dorothy Pridotite commented that if you had asked her about the glass ceiling for women ten or fifteen years ago, she would have had an entirely different response. At the time, she did not think that there were any barriers to the top positions in government. Now that she has come very close to the top, she realizes that there may be hidden barriers that ultimately block access to top positions and cause careers to plateau.
While some participants expressed reservations about women’s chances of reaching the very top positions in industry and government, a majority of the participants agreed that career opportunities for women are improving. Participants noted that the increased demand for geoscientists, the increased flexibility on the part of employers to approve flex- or part-time schedules or job sharing, and the increasing numbers of women in the field all contributed to this improvement. Despite the increased demand for geoscientists, there are still individuals who experience stagnating careers.

The interviews showed that a few key factors generally were evident in the case of individuals with advancing careers. They share a willingness to diversify and learn new skills. Many of them are risk takers. They very seldom stay too long in one position, and they try to make a career move if their advancement is blocked by someone in a position ahead of them. They are strong supporters of professional development, take courses on a regular basis to upgrade their qualifications, and participate actively in professional organizations such as the Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA), the Canadian Geotechnical Society (CGS), the Canadian Society of Petroleum Geologists (CSPG), the American Association of Petroleum Geologists (AAPG), the Canadian Institute of Mining, Metallurgy and Petroleum (CIM), and the Geological Association of Canada (GAC). Some of the participants have been the first women presidents of a number of these organizations or have served as elected members of council or chaired various committees.

These are proactive, goal-oriented women, with a philosophy articulated by one of their peers in the July/August 1998 issue of Alberta Venture: “I have a real bias for action. If you don’t shoot, you won’t score. I don’t think about it too much, which is one
Attitudes such as these also spill out of the corporate boardrooms to translate into community voluntarism and activism. Many of the participants in the study indicated that they dedicate countless hours to community activities and school career days. Many of them are also raising young families or are active as grandparents with the next generation of children. The myriad ways in which they struggle to manage family and professional responsibilities will be the subject of the next chapter.

**Opportunities for Career Advancement**

Although the findings from the interviews undertaken for this study confirm Marianne Ainley’s analysis in respect to access to field work for early graduates, they differ from her position on a number of other issues. In an article published in *Geoscience Canada* in 1994, Ainley stated that “in geology, with its old associations of masculinity and rugged outdoor activity, career advancement and recognition have remained different for men and women.”

Ainley concluded that “Women remain glorified technicians and assistants; they rarely work in the field, or do high-level interpretive work with computers.” Although Ainley’s contentions are certainly valid for an earlier generation of geoscientists, the findings from this study suggest that they may no longer be valid for the generation of geoscientists who entered the workforce after the mid-1970s.

Participants in this study were among the first women to do high wall mapping at a large open-pit mine. Many of the participants perform field work in rugged conditions and in temperatures as low as -40°C or -50°C. Other women engineers and geoscientists are doing mine development, drill monitoring, slope monitoring, tailings stability
analysis, ore grade control and mapping, computer modelling and software development, and short- and long-range planning to name just some of their responsibilities. Women geologists have reached the director, manager, and senior geologist level, and numerous others are working in entry and middle levels of government service. Senior female geophysicists occupy spacious offices in the heart of the Calgary oil patch and often have several computers on their desks to do the high-level computer analysis that their work requires.

Senior women geotechnical engineers and consultants from Alberta are called in to help with major projects in our own province and in other provinces. Women also have reached the Vice-President level in the Calgary oil patch and have been in position for President and Chief Executive Officer positions. The discouraged or impatient ones leave large oil companies to start their own companies and to become presidents in this way, but others are struggling to make it to the top in large corporations. There are also several women geology and geophysics professors in the province occupied in training an entire new generation of geoscientists.

While there are still many hurdles to be overcome for women to reach the top of their fields, enough women are now within grasping distance of top positions that they should be able to make it easier for the next generation to build on their successes. The other point that should be made is that not all women long to hold top management positions. Many of the geoscientists interviewed stated that they preferred technical and field work to management responsibilities. Whatever route they choose in terms of career success, they form a critical mass of practitioners who can serve as mentors and role models for others. Many of them take this mentoring responsibility very seriously
and as a result take an active role in school visits and activities such as Project Minerva, a lecture and mentoring program designed to interest young girls of junior high school age in careers in science. One of the participants in the study indicated that she was happy to talk to all interested high school and university students about her field of specialty, but saw no need to single out young women for special attention. She felt that the very fact that she is a woman performing at the top of her field sends a positive message to young women.107

Conclusion

For now, it is enough to conclude that the geoscience fields have offered many women in Alberta fulfilling and financially rewarding careers that go far beyond the role of "glorified technicians and assistants."108 The results of this study reinforce the importance of early socialization and family activities in the participants’ choice of careers. The role of high school courses and teachers was not quite as high on the list of motivating factors as family. However, those participants who had teachers with strong science or geology backgrounds, who attended schools with high academic standards, or who had the advantage of courses combining science and outdoor activities such as rock climbing, canoeing, and orienteering indicated the importance of these factors in their choice of careers.

High school guidance counsellors and some university registrars often proved more of a hurdle to overcome than a source of encouragement for the students wishing to choose non-traditional careers for women. Many participants indicated the importance of first-year geology professors in interesting them in careers in geosciences. Harriet Serpentinite, for example, recalled her first-year geology professor as being very
charismatic. His charisma helped attract her to the field. In light of the importance of first-year instruction in career choice, it would seem advantageous for academic institutions to ensure that first-year students are exposed to the brightest and the best instructors in their specific fields.

Mentoring is another important issue examined in this study. However, it is difficult to come to firm conclusions on this subject, since the opinions were fairly varied. While most participants felt having a mentor would have been desirable, a number of them stated that they did not have a mentor. Those that did have mentoring relationships indicated that male professors could fulfill this role just as readily as female professors and that women graduate students filled in the gaps when women professors were unavailable or relationships with male professors did not materialize. Since most of the participants in the study attended university at a time when there were very few women professors available, it is not surprising that some of the participants developed long-standing mentoring and collaborative relationships with male professors.

The study also reveals that although women’s access to field work and high-tech positions increased dramatically over the last two and a half decades, social attitudes in the workplace are a little more difficult to change. A number of participants commented on the additional stress that always having to prove themselves in field situations adds to an already challenging job. Workplace attitudes may in fact be a more challenging problem to solve than the difficulties of entry to the academic environment. Many participants indicated that they had developed coping mechanisms or that they did not have any problems with male co-workers at all. Participants seemed almost unanimous
in stating that demonstrating professional competence was the most effective way for women to gain respect in their fields.

The necessity of pulling one's own load was another common theme, since participants were aware that failure to do so might reflect negatively on women in the field in the future. This theme echoes the advice of American geologist Susan Dana Halsey who told students interested in coastal research that "you had to be able to 'carry your own end of the canoe.'" The advice is applicable to more than just holding up one's end of a canoe. Ophelia Diorite commented that "anyone who is persistent and good enough opens doors for others." The corollary is that those individuals who fail to carry their end of the load hinder the chances of the women who follow in their career tracks.

Many of these themes connect the oral histories of the participants to the literature reviewed at the beginning of the dissertation. In terms of separate versus coeducation, an overwhelming majority of the participants in the study experienced coeducation. Only two women indicated that they attended private or separate women's schools, but both of them emphasized the positive impact of all-female schools and of having well qualified women teachers who encouraged them to excel, particularly in the sciences. Private women's schools and colleges did not seem to be quite as influential a factor for women students on this side of the border as they were in the United States, perhaps because they were not as widely available.

Participants who wished to pursue advanced degrees seemed to have few difficulties in gaining access to graduate schools. Only one person mentioned that she was not invited to attend graduate school immediately after her undergraduate degree.
However, the delay was only temporary; the participant gained a Master's degree several years later. All of the Canadian participants who achieved graduate degrees did so in Canada, unlike early geoscientists such as Grace Anne Stewart, Helen Belyea, and Alice Wilson, who attended graduate school in the United States. In fact, a number of participants from other countries also did their graduate work in Canada. It is important to note that graduate studies in Canada were coeducational, since there were no separate women's universities offering advanced degrees in this country.

Another theme that reemerges in this chapter is the importance of the amateur naturalist tradition, which was identified in the historical literature by Suzanne Zeller and Thomas and Mary Creese. A majority of the study participants engaged in rock collecting as a childhood hobby. Many parents and grandparents were active role models in this regard. One participant in particular mentioned the influence of her mother and grandmother who collected botanical specimens for museums. Another participant collected rocks and arrowheads with her father. Others fished, camped, and canoed with their parents and grandparents.

A third theme that connects the historical literature with the participants' oral histories is the history of women's entrance to universities. Several participants had grandmothers who were among the early university entrants in their countries. Role models provided by parents and grandparents with professional occupations seem to be a factor that influenced participants' choice of career path. A high number of participants had parents who were engineers, geologists, medical doctors, nurses, and teachers. The theme of generational differences in women's attraction to careers also surfaces in the oral history of at least one participant.
The fourth theme that connects the oral histories with the historical literature is the relative affluence of the majority of participants in the study. This characteristic of participants is consistent with the findings of W.P.J. Millar and R.D. Gidney on women medical students at the University of Toronto between 1910 and 1951. It is true that many of the participants helped to pay for their own education, and that a small number of participants identified themselves as coming from working class families. However, the pattern of family travel and vacations and the professional occupations of their parents would lead one to believe that two-thirds or more of the participants came from comfortable, middle-class if not affluent families.

A final theme that emerges in this chapter is the strong influence of outdoor adventure courses, recreational activities, and camping trips on participants’ career paths. Two papers presented at the 79th Annual Canadian Historical Association Conference shed light on the impact of camping trips and strenuous outdoor activities on young women. In “‘Strap a Compass and Knife and an Axe to Your Belt:’ The Role of Camp Counselor Training in the Socialization of Women at the Margaret Eaton School (1925-1941),” Anna H. Lathrop comments on the character building aspects of camping:

The camping movement provided an opportunity for girls and young women to break out of the constraints of home and school, pick up an axe and paddle, and wear clothing that was more relaxed and suitable to the outdoor environment. These physical experiences were celebrated in camping songs which described campers as ‘sturdy’ ‘strong’ and ‘hale’—typically masculine descriptors. Physicality, in fact, was ‘caught,’ not ‘taught,’ in the wilderness environment. Similar to the way in which the bicycle had changed the material and physical world of women at the end of the nineteenth century, the canoe had begun to offer these possibilities to girls and women in the twentieth.

Lathrop’s comments are congruent with the personal narratives of many of the participants in my study. Whether the participants’ camping experiences occurred within
their families, in all-female groups such as Girl Guides or Canadian Girls in Training, in private camps, or in coeducational high school classes does not always come through clearly in the interviews. When participants discussed voluntarism in the community, a few indicated that they had participated in and had been positively influenced by all-female groups when they were children and young adults. Several participants also indicated that they continue to contribute to these groups as leaders or as guest speakers. The discussion of community voluntarism will be continued in Chapter Nine.

In the second of the papers, "‘Nothing But a Rag Between You and the Sky’: Northway Lodge Girls’ Camp and Wilderness Experience,” Susan L. Forbes also addresses the impact of wilderness and camping experiences for women on prevailing attitudes toward gender roles and women’s physicality:

The very fact that young girls lived the pioneer life in the wilderness cast doubt on the Victorian notion of female frailty. Long hikes in the bush, fishing, fighting forest fires and constructing camp building[s] also challenged existing attitudes and beliefs about the weaker sex. Nothing challenged prevailing attitudes about gender appropriate attitudes as much as canoe tripping. At times, these trips reflected traditional masculine and feminine roles as guides handled the heavy work, plotted the canoe routes and guided the trips. But this was their job. At other times, the girls and women took charge of all aspects of their own trips. They charted and guided the trip, steered their own canoes and carried the heavy equipment.¹¹⁶

Susan Dana Halsey’s comment that as a geologist you had to be able to “carry your own end of the canoe” is therefore a fitting way to conclude the chapter. Participation in strenuous outdoor activities, camping, and canoeing may have contributed to participants’ willingness to challenge entry to geosciences and what had traditionally been considered male-dominated fields. My study group of women geoscientists not only mastered carrying their end of the canoe, but many of them also learned to juggle families and careers, which is the next topic of discussion.
2 Fowler-Billings wrote her first book about her experiences in prospecting for gold in Africa. It was titled *The Gold Missus* and was published by W. W. Norton in 1938; the author's name at that time was Katharine Fowler-Lunn.
3 *The Pegg* is the newsletter of the Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA).
5 Jessica Gneiss [pseud.], interview by author, 10 April 1998.
6 Barbara Marble [pseud.], interview by author, 1 August 1997.
7 Ophelia Diorite [pseud.], interview by author, 10 August 1998.
8 Yannakis Schist [pseud.], interview by author, 19 August 1998.
9 Dorothy Pridotite [pseud.], interview by author, 7 July 1999.
10 Geraldine Syenite [pseud.], interview by author, 22 March 1998.
11 Amber Slate [pseud.], interview by author, 6 July 1999.
12 Farrah Anthracite [pseud.], interview by author, 8 July 1999.
13 Nora Sandstone [pseud.], interview by author, 5 August 1998.
14 Alice Granite [pseud.], interview by author, 27 September 1997; Marble, interview; Fiona Shale [pseud.], interview by author, 7 March 1998; Syenite, interview; Isobel Rhyolite [pseud.], interview by author, 5 April 1998; Laurel Coquina [pseud.], interview by author, 22 July 1998; Diorite, interview; Patricia Archos [pseud.], interview by author, 10 August 1998; Thomasina Perlite [pseud.], interview by author, 18 August 1998; Wen Pumice [pseud.], interview by author, 20 August 1998; Schist, interview.
15 Coquina, interview.
16 Rhyolite, interview.
17 Evelyn Diabase [pseud.], interview by author, 4 March 1998; Shale, interview; Syenite, interview; Rhyolite, interview; Gneiss, interview; Coquina, interview; Diorite, interview; Archos, interview; Querida Felsite [pseud.], interview by author, 17 August 1998; Sarah Hornfels [pseud.], interview by author, 17 August 1998; Perlite, interview; Una Obsidian [pseud.], interview by author, 18 August 1998; Vera Breccia [pseud.], interview by author, 19 August 1998; Pumice, interview; Xavier Graywacke [pseud.], interview by author, 20 August 1998; Debbie Quartzite [pseud.], interview by author, 9 January 1999.
18 Quartzite, interview.
19 Anthracite, interview.
20 Pridotite, interview.
21 Kerry Gabbro [pseud.], interview by author, 14 April 1998.
22 Shale, interview.
23 Pumice, interview.
24 Hannah Basalt [pseud.], interview by author, 3 April 1998; Pumice, interview.
25 Schist, interview; Felsite, interview.
26 Obsidian, interview.
27 Pumice, interview.
28 Diorite, interview.
30 Coquina, interview.
31 Rhyolite, interview.
32 Felsite, interview.
33 One participant's grandmother was the first woman to do a Master's degree at a Maritime University. She married a minister and went as a missionary to the Far East; a second participant's grandmother was one of the first women to graduate in medicine in her country of origin; and a third participant's grandmother was an early university graduate in her country of origin.
34 Gabbro, interview.
35 Ibid.
36 Schist, interview.
38 Archos, interview.
39 Ibid.
40 Erika Travertine [pseud.], interview by author, 7 July 1999.
41 Anita M. Harris, Broken Patterns: Professional Women and the Quest for a New Feminine Identity (Detroit: Wayne State University Press), 18.
42 Basalt, interview.
43 Gabbro, interview.
44 Coquina, interview.
45 Perlite, interview.
46 Diabase, interview.
47 Rhyolite, interview.
48 Hannah Basalt was told by counsellors that women do not go into business administration or sciences (1980s university graduate).
49 Harriet Serpentinite, [pseud.], interview by author, 9 July 1999.
50 Coquina, interview.
51 Fiona Shale remarked on the blue binder of men’s careers and the red binder of women’s careers in the high school guidance counsellor’s office in her school. Nowhere in the red book could she find references to engineers, geologists, or careers in the pure sciences, so she looked in the blue binder.
52 Obsidian, interview.
57 Quartzite, interview.
58 Diorite, interview.
59 Felsite, interview.
60 Breccia, interview.
61 Brenda Phyllite [pseud.], interview by author, 6 July 1999.
63 Anthracite, interview.
64 Rhyolite, interview.
65 Felsite, interview.
66 Coquina, interview.
67 Examples include Brenda Phyllite, Yannakis Schist, Amber Slate, Mary Siltstone, and Harriet Serpentinite. Numerous other participants may not have mentioned receiving awards and scholarships.
68 Obsidian, interview.
69 Schist, interview.
70 Diabase, interview.
71 Travertine, interview.
72 Sandstone, interview; Anthracite, interview.
73 Diabase, interview.
74 Basalt, interview.
75 Rhyolite, interview.
77 Rhyolite, interview.
78 Serpentinite, interview.
Coquina, interview.

Anthracite, interview.

Felsite, interview; Rachel Pitchstone [pseud.], interview by author, 17 August 1998.

Obsidian, interview.

Felsite, interview.

Pitchstone, interview.

Pridotite, interview.

Marianne Gosztonyi Ainley, "Women’s Work in Geology: A Historical Perspective on Gender Division in Canadian Science" Geoscience Canada 21, 3 (September 1994), 140.

Travertine, interview.

Ibid.

Shale, interview.

Syenite, interview.

Diabase, interview.

Serpentinite, interview.

Rhyolite, interview.

Ibid.

Syenite, interview.


Gneiss, interview.

Diabase, interview.

Siltstone, interview.


Coquina.

Slate, interview.

Pridotite, interview.


Ibid., 141.

Ibid., 141.

Siltstone, interview.

Ainley, “Women’s Work in Geology,” 141.

Serpentinite, interview.


Diorite, interview.


See W.P.J. Millar and R.D. Gidney, “‘Medettes’: Thriving or Just Surviving? Women Students in the Faculty of Medicine, University of Toronto, 1910-1951,” in Challenging Professions, eds. Smyth et al., 215-233. Also see Chapter Three in this dissertation, "Becoming a Geologist: From ‘Male Heads on Female Shoulders’ to ‘Sex on the Rocks.’”


CHAPTER EIGHT
JUGGLING ROCKS, CAREERS, AND FAMILIES

One of the most engaging and personally relevant issues examined in this study is the manner in which professional women are managing to navigate the frequently perilous divide between personal and professional lives. How in fact does one manage to have a life outside of a profession when its demands may require long hours and often extended periods of time away from one’s home base? How does one negotiate time out for child bearing or the responsibilities of extended families? If professional leave or flexible- or part-time schedules are not available or not desired, how does one handle childcare responsibilities and the demands of children’s and spouses’ activities? If one is single, how does one manage the responsibilities of maintaining one’s home, caring for household pets and extended families, and maintaining friendships and professional associations when one’s position may entail frequent travel or time away from home? Although many of the participants in my study indicated the support of females, their articulated orientations are overwhelmingly heterosexual.

This chapter explores the innovative ways in which women in the geoscience professions are struggling to meet the multiple demands of careers, families, professional activities, and personal lives. It examines the options available for professional women in handling childcare responsibilities and the flexible work arrangements that many women have been able to negotiate. It reveals that professional women in the geosciences are making decisions on an individual and situation-by-situation basis. Participants in all three career areas of industry, government service, and academia have been able to negotiate flexible and partial schedules in recent years. However, not all
participants are willing to forgo career advancement in order to take advantage of such options. In addition, a slightly earlier generation of geoscientists did not have the advantage of flexible employment options.

Many variables affect participants' decisions on whether to opt for flexible or partial schedules: the policies of the companies for which they work, the availability of in-house daycare facilities, the availability of flex- or part-time schedules or telecommuting opportunities, the support of spouses and extended families, and personal preferences regarding the amount of time individuals wish to spend with children and the amount of time-out they are prepared to take from careers.

These are issues faced by all professional women who choose to have partners and families, as well as by single women who have responsibilities for elderly parents, siblings, or children. However, the field work frequently required in geoscience professions often adds to the difficulty of juggling families, careers, professional activities, and personal lives. The impact of support or lack of support from partners regarding career maintenance and continuing professional competence is an important issue. Lack of such support may be a factor in marital breakdown, just as frequent absenteeism from families as a result of career demands may be a factor in the failure of marriages. The significance of all of these issues on the careers of women geoscientists is the focus of the analysis in this chapter. The first topic of discussion is the impact of children on careers.

**The Impact of Children on Careers**

A few examples of participants' experiences suggest the varied impact that having children has on women's careers. These examples concentrate on participants’
experiences in industry and government service. The experiences of women in academia will be discussed under "Problems of Dual Careers and Demands of Academic Life." The impact of children on the careers of an earlier generation of geoscientists will also be discussed under "Experiences of an Earlier Generation of Geoscientists."

When asked about the impact of family responsibilities on career and professional advancement, Isobel Rhyolite commented that she has chosen to temporarily suspend her professional advancement in order to accommodate the needs of her young family:

My opportunities have improved, but I chose to decline. What I mean by this is I had to pull back the reins on my level of commitment to my career because I became committed to a new family. My top priority is to my...children. My career fits in second right now, and I do the best I can within those constraints. I have lower expectations in my career. When the constraints are removed in the future, I expect to make the most of my opportunities. Top geoscientists in the field dedicate a lot of time--a commodity I cannot. It is not a problem; I will pick up when the time is right.¹

Hannah Basalt indicated that she experienced difficulty in integrating career and family responsibilities. She described herself as a "workaholic"² who voluntarily quit working the year after her first child was born. She increasingly had felt that she was not doing a good job either at home or at work. In addition, her male supervisor at the time was not particularly supportive of professional women. Now that her family is complete, she is reentering the job market very gently and trying to maintain a balance between work and family responsibilities. She finds the flexibility of hours and the part-time nature of her current position in management highly desirable. When necessary, she is able to work from home using up-to-date technology--her computer, fax machine, and cellphone.³

Another participant described the struggle early in her career to manage work responsibilities, the care of a young infant, and maintaining a marriage in an extended
family in which her mother-in-law did not support continuing careers for women. Nora Sandstone commented that even as recently as fifteen to twenty years ago, the larger oil companies were not very flexible about meeting employees’ needs in terms of childcare emergencies. She recalled how difficult it was being sent to work on a wellsite located in an adjacent province and having to leave her young child who was ill at the time. The stress of leaving home under these circumstances did not make for a pleasant work experience, particularly since having to do so only added to the criticism she received from her extended family.4

Fiona Shale married in her thirties, and although early in her career she never anticipated having children, she now has a family. To date, Shale and her engineer husband have managed to share childcare responsibilities quite effectively, and neither partner has taken a partial schedule. They have alternate sitters who come into their home, and they have been very happy with their childcare arrangements. They also bank overtime or use vacation time to handle childhood emergencies and illnesses. In retrospect, both partners agree that the decision to have a family was the right one, but at the time they were uncertain about the impact that it might have on their dual careers.5

Amber Slate has one child who is now grown up. She gained a graduate degree in the late 60s, spent several years teaching overseas with her husband, and then gained a position in government service in which she has made steady career advances. Slate stayed at home until her child entered kindergarten. She commented that professional women have two jobs, one at home and one at work, and no matter how hard partners try to help, the workload is never even.6 These are only a few examples of participants’ comments on the impact of childcare responsibilities on their careers. Supportive
partners, help from extended family members, and paid caregivers make it possible for many participants to maintain employment.

**Supportive Partners and Help from Extended Families**

A number of participants indicated that they could not continue to work without the support they receive from partners, extended families, and paid caregivers. For example, Evelyn Diabase manages her young family with the active support of both her husband and her mother-in-law. Her mother-in-law acts as a nanny for the children while Diabase is working and usually has the dinner prepared by the time she arrives home from work. Her husband is a shiftworker who frequently has days off, and he takes over the childcare responsibilities and meal preparation on these days in order to give his mother time to enjoy her own activities. Even with such a tremendous support system, Diabase found that spending time at home after the birth of her children was very important, particularly since she had her children in rapid succession. Since she works in a contract position, she was able to negotiate the time that she needed.\(^7\)

Gloria Amphibolite has a senior position in industry and has found that larger companies are more tolerant of employees who have family responsibilities. In her current position she can do her job without having to feel guilty that she cannot stay at work until ten o’clock at night. Amphibolite stressed the importance of support from one’s partner. Even with a supportive relationship, professional women sometimes find that marriages do not always work out because of the strains of trying to juggle two careers or of other incompatibilities. Amphibolite is currently managing as a single parent, and on the day of the interview was trying to juggle making a birthday cake, spending time at a core lab, and supervising a birthday party with the assistance of the
child’s father. One would think that this constant juggling act would take its toll on her energy. Fortunately, Amphibolite seems blessed with a high stamina and has enough energy to spare to be very active on the executives of various professional organizations. She also has the financial advantage of being able to hire a part-time nanny when she requires help with childcare and household responsibilities.8

Another interesting twist in the support that partners can provide is their network of associates and scientific colleagues. Harriet Serpentinite indicated that although her partner is not very focused in terms of household detail, he has been invaluable in providing her with a support network of colleagues, friends, and scientific associates that she has come to rely on for socializing and intellectual stimulation. Many of her important contacts continue to be made through her husband’s network of associates. In terms of a support network and collegiality among members of her own department, Serpentinite suggested that her colleagues are all so busy that they rarely have time to socialize.9

Wen Pumice works in a specialized geoscience field and stated that her husband has difficulty explaining to his co-workers what she does for a living and why he helps so much at home. He works in a technical position in the field rather than in a professional capacity, and most of his friends and co-workers have spouses who handle all or a majority of the household responsibilities. Pumice feels she has developed a very supportive relationship with her husband and has been successful in negotiating the allocation of household responsibilities. The fact that she is the higher income earner may have helped with these negotiations. Pumice also has tried to make life as “seamless”10 as possible for her children despite the long hours she spends in the
workplace. A critical component of her support network is the nanny hired to help look after her children.

Mary Siltstone described her time at graduate school “as a period to slow down in between the birth of children and to spend time at home with her children.” She has a very high stamina to be able to handle young children and graduate studies at the same time. Her high energy level has continued throughout her career, and she now works in a consulting capacity in the geotechnical field. She indicated that she has a very supportive and open-minded husband who encourages her to accept challenging work despite the inconvenience that her time away from home occasionally causes her family. Her children are also highly supportive of her work, and she keeps in close contact with them by telephone whenever she has to be away from home. One recent consulting job required her to be away from home for a twenty-month period by the time the work was finished. Throughout the duration of the project, she travelled by air back and forth to her home base every second or third weekend. Since her husband is also a consultant and occasionally has to be away from home himself, he understands her need to go where the work is technically challenging. Unfortunately, not all participants were blessed with supportive partners, had the good fortune of help from extended family members, or could afford to hire caregivers. Some participants’ partners were in fact unsupportive and inflexible in their attitudes.

**Impact of Lack of Supportive Partners**

In one case, the decision about career location even before the arrival of children had a later impact on the marriage. Xavier Graywacke was discouraged at the outset of her marriage when she had to turn down a good job offer from a company located in one
province in order to follow her geoscientist husband to a remote location in another province. Unfortunately, the employer in this community was not very receptive to hiring the spouses of employees. Graywacke subsequently felt isolated and resented the fact that she was unable to gain even part-time employment. Her husband also discouraged her from trying to reestablish her career after the birth of children. Graywacke commented that her self-esteem was very low as she reentered the job market after her marriage ended. In addition, her employment prospects were limited because of her childcare commitments and inability to spend extended periods of time in the field. She eventually moved to a major city and shifted her career slightly to accommodate the needs of her young family. Through a combination of consulting work in geology and eventually full-time work in a related field, she has coped in the job market and managed to raise her family. Graywacke indicated that she now has a very positive self-image and much more confidence, but that it took a long time to rebuild.13

After working several years in geology, Carol Argillite began experimenting with an alternate career just before her first marriage ended. A temporary assignment with her employer left her in an advantageous position to pursue similar employment with another company located in a major city. Even with experience in the specific field, she had to start at the bottom in a semi-clerical position and take a considerable cut in pay. She said that the effort has paid off, however, since she has rapidly progressed up the hierarchy in her organization. She now has her sights set on moving up to the top ranks of management and broadening her exposure to different areas of the organization.14

Kerry Gabbro also commented that her career opportunities and self-image took a turn for the better after her first marriage ended. Although her husband did not support
her decision to continue working after their children were born, she managed to maintain a foothold in a career by taking maternity leave, adopting a flexitime schedule, and later by doing part-time work. Gabbro stated that "By choice, I took time off from work after the birth of my children...I was able to work flexitime doing four days/week instead of five, adjusting office hours, etc., and found my employers very cooperative in this respect." 15

After Gabbro's marriage ended, she found it necessary to resume her career in earnest, but she still found that she had to accommodate her work to the demands of her young family. When asked about the availability of work, Gabbro stated that "Generally, my opportunities for career and professional advancement have been good. I have never experienced problems obtaining work. At present my place of residence limits my work to part-time contracts and working from home....Currently, I am hourly-paid and have the freedom to work the hours I choose provided certain core hours are worked, deadlines met, etc....My goals for advancement are on hold until my children are older." 16

While at graduate school, Laurel Coquina married a researcher and subsequently began her family. As well as looking after the children, she tried to eke out a living working part-time and publishing articles. She described her first husband as being completely preoccupied with his research and no help at all with the children. If she wanted to do research in the lab or go on a field trip, it was up to Coquina to organize her activities and arrange for all the childcare. Once her children were in school, Coquina started working full-time for a consulting firm. Her experiences in consulting work and her record of publications were what made her marketable when her marriage finally ended. It took all the courage she had to move to another city where things were
booming in the oil industry. Through sheer persistence and a lot of hustle, she landed a full-time job in the oil patch and has never looked back professionally since then. Her willingness to "seize the moment by going where the action is" helped her reconstruct her life.

Participants' comments suggest that partners' support or lack of support for ongoing professional activity had an impact on both careers and marriages. Although there were undoubtedly multiple factors involved in the failure of marriages, lack of career support and lack of help with childcare were mentioned repeatedly by participants who experienced divorce or separation. As well as the benefits of having supportive partners, participants emphasized that it was helpful to have flexible employers who were willing to experiment with innovative work arrangements.

**Flexible Employers and Innovative Work Arrangements**

Flexible employers and innovative working arrangements such as telecommuting, job sharing, or part-time or flexible hours have enabled a number of participants with children to maintain employment. Isobel Rhyolite has chosen to take an innovative approach to managing her career rather than completely abandoning it. She is telecommuting from her home and maintaining her professional employment in this manner. Telecommuters do all of the work that they normally would do in an office environment in their own homes by utilizing computers, modems, e-mail, and fax machines to transmit their work electronically and to communicate with co-workers and supervisors. Telecommuting has required a number of compromises on Rhyolite's part, as she can no longer do the geological field work that she loves. For the moment, however, telecommuting seems to offer the best of both worlds to her. The work is
challenging and requires her to stay on top of the latest technological advances in her field. It also allows her to stay at home to supervise the activities of her children while still maintaining her professional activities.\(^{18}\)

The only problem with working from home is that the work is never left behind at the end of the day. Rhyolite is not alone in experiencing this problem. Many other professionals, particularly academics, find that the boundary between work and home is very loose, with work responsibilities often gravitating into personal time. When asked about the conflicting demands of work and home, Rhyolite had the following comments:

I wish to be the best employee that [her company] ever hired, and I wish to be the best mother possible to my children. These are not mutually compatible, so each day is a juggling act. I feel I compromise both. I often over-commit to both. I strive to invent the best solution. I have worked three days/week, four days/week, and I took six months off to be home full time. At the moment I work from home. I hold a professional job, five days a week while working from home and telecommuting. I invented this job. It is mutually beneficial for myself and my employer. It is the closest to perfect yet. It is still a juggle. I still long to be 100 percent dedicated to both. I don’t believe my husband geoscientist is faced with these same choices.\(^{19}\)

The issue of receiving adequate pay in an innovative career position such as this one is another problem that professional women encounter. Career advancement also may be affected detrimentally because the telecommuting employee is less visible in the organization. Rhyolite commented that discussions were ongoing regarding the value of her work in relation to the work of other employees: “I invented the position, but the work that I do was once done by others who they were willing to pay more. I took the stuff that could be done from one location. My co-workers travel. They seem to be telling me that you get to work from home; therefore, we’ll be paying you less. Getting to work from home is part of your payment. Equal work for equal pay—not really. Negotiations continue.”\(^{20}\)
Telecommuting is only one example of innovative solutions to childcare responsibilities. Other participants in this study have chosen to opt for flex- or part-time positions, job-sharing, use of company daycare facilities, live-in nannies, support of mothers or mothers-in-law for childcare, high-level participation of spouses, and extended leave from employment. Ophelia Diorite has chosen to participate in an innovative job sharing position that is the first in the department in which she works. She described herself as feeling somewhat dislocated for one day a week as she tries to pick up where her co-worker left off. She also said she finds it slightly more difficult to establish close working relationships with co-workers when she is only present in the workplace part of the week. However, the job sharing arrangement offers her the flexibility to be at home with her young family for part of the week as well as the opportunity to maintain her professional competence.21

Field geology is what Diorite really enjoys doing, but she describes it as “the wrong profession for raising a family.”22 Since she has a graduate degree and experience as a sessional lecturer, she has considered full-time employment in the educational sector. Whether that will mean teaching in the high school system or in university will depend on her circumstances. For now, she enjoys both her work and her time at home with her children, and she satisfies her love of teaching by making numerous career presentations at schools as a volunteer.23

Evelyn Diabase finds the flexibility offered by contract employment critical to maintaining her professional activities. She is paid for the hours she works and has vacation time, but if she needs time off to look after sick children, she can take the time without pay. If she worked for one of the larger companies in her community, she stated
that she would have more benefits, but also more difficulty in handling childhood emergencies. Diabase pointed out that many larger companies are tracking employees' controllable absences from work. Even though employees are not necessarily penalized for valid absences, Diabase does not want to have to deal with the stress of such stringent attendance requirements until her family is older. At the time of the interview, she was in the process of proposing a four-day working week to her employer. She thought a slightly reduced schedule would help her to cope more effectively with the demands of young children.24

Although in-house daycare centres are another childcare option, it is surprising how few companies offer such facilities. Only one of thirty-four participants indicated such facilities were available to her. Gloria Amphibolite indicated that she could not have managed without such in-house daycare. She took six months' leave after the birth of her children and then returned to work. Because the daycare is in-house, she was able to spend her morning and afternoon coffee breaks and her lunch hour with her children. Her employer also offers in-house fitness facilities that help her maintain her fitness level. It seems to be beneficial to be located in a large urban centre if one desires to have the advantage of in-house daycare facilities.25

After the end of her first marriage, Carol Argillite took up a new career outside of geosciences that does not require field work and offers her much more flexibility in terms of meeting the needs of her young children. Because of her high energy level and the good support that she now has at home, Argillite seems able to balance and integrate work and family life. However, she stated that she has learned to moderate her demands at work and has not opted to request job sharing or leave for childcare responsibilities. In
her opinion, such a request would automatically invoke a glass ceiling on her career aspirations. She intimated that it would not be possible to aim for the top positions without a full-time commitment to work. At the same time, she finds that her current employer is very supportive of her need to take occasional time-out for children's school activities or to make presentations at school career days.26

Another participant indicated that she has good opportunities for career advancement and good support from both her partner and her employer in terms of raising her young family. Barbara Marble is currently working on a partial schedule while her young children are preschoolers. She was in fact the first woman in her area of employment to request a partial schedule. She finds it ideal to be able to spend time with her children, but also to maintain her career interests by working three days a week.27

In another workplace, Patricia Archos has chosen to opt for a partial schedule similar to the one that Barbara Marble occupies. She works four days a week from 8 to 3 p.m., and she spends Fridays helping at the school that her children attend. During the summer months when the children are out of school, she often works from home. She relies on family members to courier work materials back and forth. The flexibility that this position offers has made it possible for her to continue working in her field.28 Archos stayed at home to look after her young children for a number of years, but has no regrets for the time-out she has taken from work or for having to put her career aspirations on temporary hold. The transition of going back to work after staying at home with children was slightly traumatic for her, but she managed to pull herself through it. She sometimes wonders about reorienting her career to education because of the immense satisfaction she receives from her volunteer work with young people.29
These are only a few examples of the innovative working arrangements and flexible schedules that participants stated helped them to maintain families and careers. It is evident from participants' comments that there are both advantages and disadvantages to these flexible arrangements. The advantages are clearly on the side of having more time to devote to childcare, household responsibilities, and marriages, and less stress in terms of fatigue and overload. The downsides to the flexible arrangements are specific to the alternatives chosen by participants. Telecommuting has disadvantages in the participant's lack of visibility in the workplace and in the fact that the work is always there. One cannot leave it behind at the end of the day as easily as one can in the workplace. Career advancement and salary levels also may be affected detrimentally. Employee visibility may be improved by having the participant spend at least one day a week in the regular workplace, but this option would affect childcare arrangements and might not make a significant difference in terms of career advancement.

Job sharing offers similar advantages to telecommuting, but has its own share of disadvantages. There is always a day of adjustment in picking up where the other employee left off, and working relationships may be more difficult to establish because of the flexible work schedule and periods of absence from the workplace. Partial schedules are another option chosen by a number of participants. The advantages again are clear in terms of having more time for families and reduced stress. However, the downsides are that career advancement is usually put on hold and incomes are lowered. Reduced incomes are factors to consider for participants who take part in both job sharing and partial schedules.
Contract employees also indicated that they have increased flexibility in terms of maternity leave and time off for childcare emergencies, but they often have to sacrifice benefits such as employee thrift plans, performance bonuses, and long-term pension accumulation. Contributing to registered retirement funds individually can offset some of these disadvantages, but the sacrifice of benefits as well as seniority in the workplace are definitely factors that adversely affect contract workers. Single women, both with and without children, face many of the same choices and challenges as those of married women geoscientists, as well as a few additional ones.

**Single Women With and Without Children**

After Nora Sandstone’s marriage ended, she experienced the additional stress of child rearing as a single parent and managing financially on a single income. For many years she earned her livelihood working in a consulting capacity for small companies. She found this environment to be exciting and rewarding, but also very demanding. She met many new people and worked on an interesting variety of projects. However, the pace of work was very intensive, and she often had to work around the clock to meet tight deadlines. Fifty- and sixty-hour weeks were hard on her family life, but she managed to deal with these stresses until the cyclical downturns in the resource sector forced her to reconsider working as a consultant. As a single wage earner, Sandstone found the financial instability of working on only a part-time basis during the downturns too stressful.

Fortunately, Sandstone’s continuing educational activities left her well positioned to enter a more secure and permanent professional position when the opportunity presented itself. She expressed no desire to slow down even though she is reaching an
age at which many of her colleagues are longing for or already taking early retirement. Sandstone suggested that it is not easy for single women to gain the financial security required for retirement. If their careers start later as a result of graduate work, family circumstances, immigration, or if they work in a consulting capacity for years without the benefits of pension accumulation, they may find that they need additional years of employment to add to the financial security of their retirement years. Even without these economic factors, Sandstone strikes one as a professional not likely to want to enter into retirement too early, even if she had the requisite financial security.31

A few participants have chosen to remain single or have not yet decided whether to marry. Geraldine Syenite followed her boyfriend to a mining community and has been able to gain contract work in her field.32 Alice Granite is very career-oriented and ambitious. She is worried about the impact of marrying and having children on her career path. Her goal is to advance into more senior management positions, but she also expresses some dissatisfaction with not having a personal life and personal relationships. Her shift in priorities has prompted her to work on planning exploration rather than spending three months in the bush actually doing the exploration herself. As a result, she is doing more office work now than she did earlier in her career.33 Jessica Gneiss is also single and describes herself as not a “social party-type person.”34 She enjoys going camping and kayaking on her vacations and likes to enter pristine areas where she can imagine what the explorers experienced when they saw new territories for the first time. She enjoys the solitude of the outdoors, and her family includes a number of well-loved cats.35
Laurel Coquina commented that being a single parent may have been a complicating factor in her career advancement, but she has never regretted having children. She worked very hard to reestablish her career after her first marriage ended, often working nights and on weekends. Her level of professional activities limited her children’s range of activities, but she tried to ensure that they were involved in community-based extracurricular activities. She described herself as having a great deal of stamina in an era that was a little tough on single parents. Coquina emphasized that there were no daycares available and paid maternity leave was unheard of in industry when she had her children.36

These examples are only a sample of participants’ experiences with single status. A number of issues are raised by participants’ comments. Working women who are single parents experience triple workloads in terms of child rearing, financial responsibilities, and normal workload in the workplace. Contract workers experience the additional difficulties of uncertain work because of economic downturns and the problem of accumulating sufficient funds for retirement. Single women without children often face the dilemma of whether to relocate in order to follow partners’ careers or to engage in long distance relationships. Single women without romantic entanglements worry about their lack of personal time and the sacrifice of personal relationships in order to focus on career advancement. Thus, the challenges of single women with and without children are no less daunting than those of married women geoscientists. Women geoscientists engaged in academic pursuits such as research and teaching face a different set of stressors from those experienced by women in industry and government service.
Participants’ experiences suggest that academic life is one of the more demanding career areas that geoscientists pursue.

Problems of Dual Careers and Demands of Academic Life

A number of participants have married geoscientists and have had to contend with two careers in geosciences. This problem is particularly acute when both partners are academics or research scientists because of the difficulties in finding two academic openings in one location. Brenda Phyllite found it discouraging to have to constantly struggle to reestablish her career every time her husband accepted a job offer in a new location and moved throughout North America. Phyllite suggested that it would frequently take a year to a year and a half to reestablish her career, and by time she became settled in a new position, her husband would usually be getting ready to leave again. She suggested that she was annoyed and more than a little frustrated by this pattern. The net result was that over a ten-year period she experienced a varied career path of part-time employment as a sessional lecturer. The part-time and contract positions usually paid her less than half of a full-time salary. However, the flexibility of part-time positions allowed her to spend more time with her children and to achieve a balance between family and career.37

Publishing articles at the expected rate of a full-time academic was also a contentious issue. Phyllite indicated that she had a steady record of publications, but never published at the rate expected in the years when she was raising young children. Competition in the dual-career marital partnership was also an issue whenever both partners competed for scholarly recognition. Now that both marital partners have well-established careers, competition is a non-issue or at least has diminished significantly.
Nonetheless, Phyllite’s competitive outlook must have made it hard for her to put her own career aspirations in a secondary position in the early years of her marriage.38

Other participants also indicated that they experienced difficulty in managing heavy student workloads, major research projects involving outside funding and deadlines, and family responsibilities. Harriet Serpentinite lamented the fact that many of her colleagues were able to devote sixty to eighty hours a week to their work and research when she felt hard pressed to manage forty hours.39 She opted for a reduced teaching schedule in the year after the birth of her youngest child, but still experienced anxiety about falling behind on her research schedule and publications. However, Serpentinite stressed that funding agencies seem to be taking the situations of young women academics into account and that extensions are granted for research deadlines. In addition, her department head is very supportive, and in general “everyone is more sensitized to the special situation that women have.”40 She also pointed out that professional development activities are very important for academics in terms of networking and keeping current in their subject areas. Unfortunately, the difficulties in arranging childcare and the time involved in writing the papers to present at these academic conferences have meant that she does not attend as many of these functions as would be desirable.41

Even when she does have uninterrupted time available for research and writing, Serpentinite said that her head is so full of the trivia involved in the daily operation of her household that it is difficult to concentrate. Someone has to sort out when the cleaning staff will arrive, what will be served for dinner, who will chauffeur children to soccer games, who will take the youngest child to doctor’s appointments, and so on.
Serpentinite suggested that although her partner is very supportive in other ways, he seems oblivious to or able to ignore the daily trivia involved in running the household. Energy that she has to spend on such mundane details saps her strength for the work that counts in academia and leaves her feeling frustrated and envious of colleagues who have much more time to devote to their work.42

Yannakis Schist is another academic who commented on the serious shortage of time that she finds is a constant pressure in her daily work. Although Schist did not elaborate on the demands of her family, she acknowledged that she found the demands of academia very heavy, particularly since workloads have effectively doubled since the provincial cutbacks in education in Alberta. She noted that class sizes are large, student advisement is very time consuming, and she has a large number of graduate students. She said she spends much more of her time in advising and mentoring students than her male colleagues simply because she has a reputation for being good at it. As a consequence of this heavy load of student advisement, she feels that she took longer to reach full professor than she might have if she had not taken on so much responsibility in this area.43

These comments reinforce the conclusions reached by Sandra Acker in “Caring as Work for Women Educators.”44 Acker states that women academics pay a high cost in terms of heavy workload because of their high level of “caring” and student advisement. Acker questions the lack of rewards for “caring” behaviour in both elementary-school and university-level teaching: “Why was it that all that ‘good citizen’ effort and student support was not usually recognized in university tenure, promotion, and merit reviews,
yet was a layer of extra work apparently reserved for women academics? Why did so many women feel stressed and suffer health problems?\textsuperscript{45}

One reason that teachers and academics experience health problems is their heavy workloads. Schist indicated that she never has time for vacations. All of her spare time is spent working on papers for conferences and publication, and her vacation time is spent on field trips and on consulting activities that keep her in touch with industry. Her opportunities for professional consulting have improved, mainly because she is doing work that is relevant to industry. If she were located in a different province, she suggested that she would likely be engaged in more academic research. As it is, she has a good track record with industry because of the practical applications of her research, and all of her recent graduate students have landed jobs.\textsuperscript{46} Despite these positive aspects of her work, she is always short of sleep and worries about burnout, as she says most of her colleagues do. A leave of absence other than a sabbatical would certainly be attractive from Schist’s point of view since a sabbatical is not really a holiday for academics. As one can see from their comments, academics carry very high stress loads in trying to juggle multiple responsibilities. From the topics of heavy workloads in academic life and the problems of dual careers, the discussion now moves to the experiences of an earlier generation of geoscientists.

**Experiences of an Earlier Generation of Geoscientists**

Although many of the geoscientists discussed to this point in the analysis have had to struggle to maintain employment in their respective fields after marriage, most of them have managed to do so. However, participants in this study who were in their late 60s and 70s had a slightly different story to tell about employment prospects after
marriage. Una Obsidian was a geology graduate in the 1950s. Obsidian indicated that there were five or six women out of a class of sixty in this period. After graduation, she worked in the Alberta oil patch. Following her marriage and the birth of her first child, Obsidian returned to work in geology for a short time doing subsurface geological mapping for small companies. She emphasized that she would have stayed in geology all of her working career had it not been for the upward career moves of her husband. She found it difficult to maintain employment in geology because of his constant relocations. As a result, Obsidian has changed careers many times and has worked in both the public and private sectors.47

Querida Felsite received her undergraduate and graduate degrees in the late 1950s and early 1960s. Her strong research skills helped her land a job as a researcher after she received her graduate degree. Felsite noted that her area of graduate work in paleontology was so specialized that it did not lend itself to work in industry. Her career in research ended shortly after she married a research scientist employed by the same institution. She continued to work until a month or so before the birth of her first child.48 Later Felsite found it difficult to gain employment in industry because many companies had switched their head offices to Calgary in this period. In addition, rival oil companies did not want to risk having confidential information leaked to employees' partners. She also said it would have been awkward for her to return to the institution in which her husband was employed and was rapidly progressing up the ranks. Felsite therefore devoted herself to raising her young family and doing extensive volunteer work in which her rigorous training in research continued to be advantageous.49
In a number of instances, then, participants who graduated in the 1940s, 1950s, and 1960s, many of whom had highly successful husbands, dropped out of the paid workforce or moved to other careers. The reasons for abandoning or changing careers were varied. For some participants, time-out for child rearing made reentry to the workforce difficult. In other instances, husbands did not encourage their wives to return to careers, or the demands of the husbands' careers made it difficult to have working partners. The professional rivalry in the oil patch also made it difficult for marital partners to work for different companies. In Vera Breccia's case, she seemed to be a partner in her husband's career, frequently accompanying him to the field, attending professional conferences as a delegate, participating in regular networking lunches, and helping him make investment decisions. Several other participants of this generation returned to full-time work only when their children had entered school or when their marriages dissolved and financial necessity prompted them to resume careers.

Factors Contributing to Successful Integration of Families and Careers

What does one conclude from the patchwork of women's lives that this study has examined? How effectively are women geoscientists managing to integrate personal and professional lives? What are the factors that contribute to their success or failure to integrate the two? As the analysis clearly shows, the solutions to success in this struggle for balance between work and home life are as varied as the participants themselves. There is no magic three-step plan that will help one overcome all the obstacles to experiencing successful careers and families, but there are a few key factors that contribute to one's chances for success. Supportive marital partners are a key factor both in terms of commitment to childcare and household responsibilities and commitment to
their partners' continuing professional careers. Participants in this study who were lacking either one or both of these kinds of commitments from marital partners frequently chose to leave their partners rather than leave careers. Or it may be that marital difficulties and the necessity of earning a living were key incentives in women's return to careers after divorce.

Flexibility on the part of employers and the support of partners, caregivers, nannies, mothers and mothers-in-law, and in-house daycare facilities also contributed substantially to making life easier for working mothers. Are any of these solutions ideal? Unfortunately, there are no easy options or ideal solutions that enable one to be able to continue careers after children. Many participants chose to take time away from work after the birth of children. The time varied from individual to individual and in length from several months to several years. Some women found reintegration to the workforce smooth and easy; others expressed some difficulty in returning to work. The length of time away from work may be a significant factor in the difficulties experienced on reentry.

The vagaries of the economic cycle also play a role in determining whether the jobs are available when the time to return to work is right personally. At the present moment, the resource sector in Alberta is booming, and employers are scrambling to recruit the professionals they need to mount all the expansion plans under development. Participants stated that as a consequence of this economic activity and demand for professionals, companies' flexibility and willingness to offer employees alternative schedules, job sharing, and partial schedules are probably better than they have ever been. However, the economy in this province is tied directly to the price of oil, and a
precipitous decline in price that lasted for any length of time could radically alter the environment.

The current shortage of professionals makes it easier for women to negotiate with their employers in order to gain work schedules that are suitable for their family situations. The only downsides to such arrangements are that they tend to hinder professional advancement while the individuals are on a partial schedule, and they reduce income and pension accumulation. Several ambitious and upwardly mobile participants in this study indicated that they would not request a partial schedule because they felt it would slow their career advancement. Others were willing to temporarily put advancement on hold and live with lower incomes in order to enjoy a more relaxed schedule with their children. Participants also indicated that with the current level of activity in Alberta, there is no difficulty in returning to a full schedule when they desire.

The most stressed participants interviewed in this study were the academics, whether they had children or not. Professors' heavy teaching loads and their requirement to research and publish translate into long working days, little vacation time, and inevitable conflicts between the demands of work and home. In terms of separate spheres and the divide between public and private lives, young women geoscientists are still questioning whether they have to sacrifice personal relationships and families in order to advance into upper management positions. Alison Mackinnon's hope that young professional women can escape 'the painful dilemmas faced by their mothers and grandmothers' such as the 'expressed oppositions of love and freedom, career and family, 'working mother' or homemaker' may not yet be realized.
Whether the participants in this study were in academia, government service, or industry, they were nearly all committed to participating in professional associations and community activities. In fact, their commitments to these activities are quite extraordinary considering the multiple demands on their time. In addition, a majority of the study participants are also engaged in ongoing educational and professional activities. A high percentage of the participants already have graduate degrees. These factors all contribute to their career advancement and success. The old adage that if one wants to get something done, one should ask a busy person proves to be true in this case. The participants are all busy and high-energy individuals who believe that contributing to the communities in which they live is a part of their professional responsibility. A number of the participants have received awards, honorary degrees, and recognition for their distinguished community service. Their numbers include executive members of national and provincial organizations and members of premier’s task forces. One might question in fact whether women without high energy levels and activist orientations would have made it through the barriers to entry to geoscience professions.

Change over time in terms of improved opportunities for field work and a wide range of professional activities is clearly evident from the interviews with participants in this study. Early graduates in the geosciences had more difficulty in gaining access to field trips in university, in obtaining field work in their permanent positions, and in maintaining careers after marriage. Numerous graduates from the 1940s to the 1960s stated that their marital partners did not encourage them to continue careers after marriage and that oil companies were worried about industry secrets being divulged to competitors by partners who were also geoscientists. Other graduates from this period
indicated that they resumed their careers primarily out of financial necessity when their marriages ended.

Recent graduates tended to report few if any difficulties in gaining field work, increased support and flexibility on the part of both employers and marital partners, and increasing diversity in the range of employment opportunities available. The frequent absences required from home bases necessitated by the field work in the geoscience professions are complicating factors that many other professional women do not experience. The demands of field work and the frequent separations from family as a result of field work are the key factors that led a number of mid-career participants in this study who had young children to consider other career options. Field work and young families are not an easy combination to handle, and a number of participants with young children also indicated that they have had to moderate career ambitions for a time in order to meet the needs of their young families.

In conclusion, a high level of professional commitment, high energy levels, increasingly flexible employers, active participation in professional associations, strong commitment to ongoing educational and professional activities, highly supportive partners, and good support networks and mentors are the main factors that contribute to the success of the married participants in this study and to their ability to integrate families and careers. The topic of mentors in the workplace will be explored in detail in the next chapter. All of the these factors are equally applicable to the single participants in this study with the exception of the supportive partners, and some of the single women also have significant others, extensive circles of friends, or household pets that require time commitments as well. The changes in the geoscience professions are positive and
encouraging to women despite the fact that there is always room for improvement, particularly in terms of opportunities for advancement to the top positions in industry.

1 Isobel Rhyolite, [pseud.], interview by author, 5 April 1998.
2 Hannah Basalt, [pseud.], interview by author, 3 April 1998.
3 Ibid.
4 Nora Sandstone, [pseud.], interview by author, 5 August 1998.
5 Fiona Shale, [pseud.], interview by author, 7 March 1998.
6 Amber Slate, [pseud.], interview by author, 6 July 1999.
7 Evelyn Diabase, [pseud.], interview by author, 4 March 1998.
8 Gloria Amphibolite, [pseud.], interview by author, 9 July 1999.
10 Wen Pumice, [pseud.], interview by author, 20 August 1998.
12 Ibid.
14 Carol Argillite, [pseud.], interview by author, 6 July 1999.
15 Kerry Gabro, [pseud.], interview by author, 14 April 1998.
16 Ibid.
18 Rhyolite, interview.
19 Ibid.
20 Ibid.
21 Ophelia Diorite, [pseud.], interview by author, 10 August 1998.
22 Ibid.
23 Ibid.
24 Diabase, interview.
25 Amphibolite, interview.
26 Argillite, interview.
27 Barbara Marble, [pseud.], interview by author, 1 October 1997.
28 Patricia Archos, [pseud.], interview by author, 10 August 1998.
29 Ibid.
30 Sandstone, interview.
31 Ibid.
32 Geraldine Syenite, [pseud.], interview by author, 22 March 1998.
34 Jessica Gneiss, [pseud.], interview by author, 10 April 1998.
35 Ibid.
36 Coquina, interview.
37 Brenda Phyllite, [pseud.], interview by author, 6 July 1999.
38 Ibid.
39 Serpentinite, interview.
40 Ibid.
41 Ibid.
42 Ibid.
43 Yannakis Schist, [pseud.], interview by author, 19 August 1998.
46 Schist, interview.
48 Querida Felsite, [pseud.], interview by author, 17 August 1998.
49 Ibid.
50 Vera Breccia, [pseud.], interview by author, 19 August 1998.
52 Ibid., xii.
CHAPTER NINE

GEOSCIENTISTS AND THE ENVIRONMENT: IMAGE AND ETHICS

The final issues to be examined in this study return the analysis full circle to questions raised in the opening chapters. How have the personal and public professional images of participants changed as a result of their careers? To what extent do the participants perceive that their personal professional images have changed over their careers? How do these changes intersect with life patterns of marriage and motherhood? To what extent have the public professional images of women geoscientists changed over time? What are the attitudes of women geoscientists toward resource development and environmental issues? Are women geoscientists’ attitudes in fact any different from the attitudes of male geoscientists? Is there any evidence of a feminist critique of resource development from within the geoscience community? These questions on personal and public professional images and environmental issues were positioned as the final questions in the interviews for a number of reasons. It was essential as the researcher that I developed trust and rapport with the participants before tackling the complex issues of personal and public professional images and the ethics of development. The question on environmental issues also gave me the opportunity to review the relevance of the environmental history approach discussed in the introductory chapters of the thesis. Finally, a discussion of these topics was necessary in order to reach meaningful conclusions to the study and to suggest possible avenues for future research.

Many members of the public are aware of the work of geoscientists from their involvement in the positive and negative press surrounding environmental issues. An oil company may be drilling on a property, and adjacent landowners may become worried
about contamination of groundwater supplies, or annoyed that they have not received adequate warning of the fact that drilling is taking place. Adjacent landowners may combine forces to prevent a seismic line from being cut in their back forties. Geoscientists' work is most visible to the general public when it involves environmental issues that have the potential to affect the lives of people or the communities in which they reside. There is a very good reason for placing the issues of professional image and environmental issues side by side in the analysis since the public image of geoscientists is very closely connected to the impact of their work on the environment. Before the discussion turns to the professional or public image of geoscientists, however, it is informative to look at the way in which the personal images of participants have changed as a result of their professional activities.

Participants' Personal Professional Images

A number of participants suggested that time away from the workforce, unsupportive partners or employers, and failed marriages contributed to their weak personal professional images. Since this topic has been explored in detail in Chapter Eight under "Impact of Lack of Supportive Partners," a few examples should illustrate the point. Participants indicated that a number of factors contributed to their perceptions of themselves as practising professionals and that their feelings varied over time. Xavier Graywacke\(^1\) and Kerry Gabbro\(^2\) both indicated that lack of support from partners regarding continuing employment contributed to their weak personal professional images when they reentered the workforce after their marriages ended. Hannah Basalt indicated that a supervisor who was not supportive of working women contributed to her decision to temporarily abandon her career after having children.\(^3\) Nora Sandstone also found that
lack of career support from her husband and his extended family caused her stress and contributed to the failure of her marriage.  

Having children also contributed to major shifts in attitude for other participants. For example, when asked about the relationship between her personal image and her professional activities, Isobel Rhyolite indicated that her attitudes had undergone a major readjustment since she had become a mother:

I used to think, 'I am a geologist.' I was brought up with questions like 'what are you going to be when you grow up?' I was going to be 'something.' If you are not 'something,' then what are you? A lot of my self worth came from validating myself with career credentials. I was my career. Now I prefer to say, 'I work in geology or in the mining industry or software industry,' but rarely 'I am a geologist.' I am a lot of things, not just a person who works in the geoscience field. I don't think it is healthy to define yourself by what you do to earn a living. I think a lot of mothers in this society suffer from low self-esteem because they can't put a label that implies high wages or high intellect on the most important job of all, raising the next generation. I don't like career labels anymore.  

Carol Argillite says that her high level of success and rapid promotion with her current employer have given her increased confidence and faith in her own expertise and ability to handle anything on a professional basis. Jessica Gneiss has had to become more assertive in the workplace because of negative experiences she has had in terms of harassment. Now she is "very hard-nosed and tough-skinned in her approach to co-workers." She states that she "does not put up with any nonsense and stops potential problems before they get started." Her new confidence and maturity have influenced her career positively and she "likes the way she is now."  

Dorothy Pridotite has been a pathbreaker throughout her career, opening doors for women with each additional career advance she made. She has been the first woman to fill many of the positions she has occupied both in work and in professional associations. Pridotite emphasized that a big part in her success has been making her own
opportunities. She likes to be involved in decisions and likes challenges. The demands of her career also have had a dramatic impact on her confidence level and her personality. She commented that she used to be quite introverted—"single, silent, and solitary"—were the words she used to describe herself early in her career. Her career advancement to more senior positions has changed her personality since she has had to grow with each increasing level of responsibility. This growth required learning new skills and communication techniques in order to handle the management activities she undertook. She emphasized that "Insecurity is normal. Everyone can do more than they think they can."

Brenda Phyllite looks back on her winding career tracks and concludes that they helped her reach her current level of confidence and professional competence. She describes herself as more confident now than ten or even two years ago. Although she is still doing a fair amount of travelling in her work, she can combine the research she enjoys with the supervision of graduate students' research. She plays an active role in mentoring young colleagues primarily because she remembers all too well the impact that the lack of such a mentor can have on careers. Since she never had a woman professor in geology herself and had no women role models as a young graduate student, she knows how important it is to be visible in her community.

Laurel Coquina emphasized that she has always been self-confident and has never felt inferior to men in her field. She stated that she would not have experienced the successes she has had without this self-confidence. The only isolation she said that she ever experienced "came from systemic societal forces." She also suggested that the women's movement and the sexual revolution of the 1960s opened doors for a slightly
older generation of women as well as the young. Social conventions were thrown out the window, and job horizons expanded for women. Coquina called these events a "sea change for women in terms of acceptance of the fact that we can do whatever we want."14

Coquina’s community voluntarism and activity in professional associations have garnered her numerous awards and personal recognition. Her list of professional associations is lengthy. On many of these organizations she has served in an executive capacity or as an elected member of council. Despite the time that she devotes to these professional associations, Coquina always has time for community voluntarism, and she is very active in making school presentations to young people and encouraging them to pursue careers in science. Any frustration she may have experienced in getting close to but not right to the top position in industry has been offset by her other accomplishments. She still contends, however, that there are barriers that prevent all but a handful of women from reaching the top in large corporations.15

Like many of the other participants in this study, Querida Felsite has an activist orientation. She has served on various organizations related to her children’s activities and her own professional interests. In addition, she has participated on government environmental boards, has been active in various environmental organizations, and has researched briefs on issues such as the impact of resource extraction industries on river systems. Her self-confidence and self-image as a professional have developed through her community activism and volunteer work. She emphasized that her strong research skills have been an asset in every endeavour she has undertaken.16 Although she did not maintain her career for very long after her marriage, she used her scientific training in many of her volunteer activities.
Feelings of Isolation and Exclusion

Wen Pumice described herself as more analytical than people-oriented and stated that the only feelings of isolation she has ever experienced have been with her own extended family or at social gatherings. She said that she is not skilled at the small talk required for socializing and that members of her own and her husband's family have difficulty in understanding what she does for a living. Pumice suggested that “they don’t speak the same language.” She meant this comment in a figurative sense since most of her family members do not have the technical vocabulary or training required to be able to understand her work. These barriers have made her feel somewhat isolated in social settings.

Amber Slate suggested that having a career based in one location helps build one's respect and prestige, but she still remains outnumbered as a woman in her department and finds that vertical advancement is dependent on “the old boys' system or buddy system.” Slate said that her voice is heard at meetings, but is not always listened to despite the fact that she is treated well by colleagues. She also has been committed to ongoing professional activities and voluntary activities in her community, which have contributed to her self-confidence and strong self-image.

Kerry Gabbro commented on the feelings of isolation and exclusion she experienced in her first job:

The only feelings of exclusion/isolation I felt were at my very first job. I was the first professional woman ever to be employed by the firm of consulting engineers I joined....Consequently, I felt 'on trial' and went out of my way to prove myself. The company was very uncertain of my ability to do the work and tried to compensate. Some of the work entailed mapping remote locations, using heavy equipment, dealing with residents, etc. This was usually done by a single geologist, but I was not allowed in the field unaccompanied. I persuaded the company that I could do the work alone and proved I could without incident.
Much of this was due to the very old-fashioned views at the time. On my first day of employment, I was told outright that I must not date any other employees! The feelings of isolation/exclusion faded with time, and after my marriage I was more accepted.\footnote{20}

As one can see from participants’ comments, a majority indicated that their personal professional images and self-confidence increased significantly as a result of their professional employment and their participation in volunteer work and professional associations. A small number of participants who experienced marriages in which partners did not encourage ongoing professional activity indicated that they had difficulties with personal professional images on reentry to the workforce after their marriages ended. Several participants experienced feelings of isolation or exclusion early in their careers. One participant also experienced difficulty in communicating with non-specialists outside of her field. It may be that academic socialization in highly specialized scientific fields does not lend itself to the cultivation of soft skills such as communications. Another important point that one participant’s comments revealed was the impact of the sexual revolution of the 1960s in opening career opportunities for both young women as well as a slightly older generation of women. The importance of mentors and the impact that lack of mentors have had on some participants’ careers are the next topic of discussion. To some extent the two topics of personal/public professional images and mentors overlap, since participants tended to discuss them in relationship to each other.

**Mentors in the Workplace**

When asked about the factors contributing to her rapid rise in her organization, Argillite suggested that hard work, ambition, an excellent mentor, and her willingness to pursue ongoing education and certification all played a role in her success. She
particularly commented on the importance of her mentor, a woman in a senior management position in her organization. Ongoing advice from the mentor has helped her master organizational politics and evaluate her potential career moves. Argillite emphasized that her own science background also has been a strong asset. It trained her to be “numbers-oriented, logical, and always to have a plan of attack.” She stated that her ability to manage numbers has been a considerable asset in developing and managing department budgets. In addition, her extensive work experience in project development, exploration, and plant-site geology helped her establish credibility with line employees in her current business.

Another participant’s recollection of not having a mentor provides a good contrast to Argillite’s experience. Brenda Phyllite’s first permanent position came at a time when she was very busy with the responsibilities of young children. Phyllite commented that she was discouraged from taking maternity leave, lacked the helpful advice of a mentor, and had difficulty balancing the demands of a young family with the long hours of work required as an academic. Only after she had handed in her resignation because of the overwhelming demands of family and work responsibilities did her colleagues come forward to offer encouragement and assistance.

By that time, the assistance was too late to be meaningful. Phyllite said that had she had the time to network or socialize with colleagues, she may not have felt as isolated. As it was, she was so pressured by the demands of her young family that coffee breaks and leisurely lunches with colleagues were out of the question. To compound matters, when she discussed the possibility of leave with administration, she was told she would be assigned all the heavy undergraduate classes and be relieved of the small
graduate seminars that she enjoyed. In effect, she still would be working full time for half-time pay. She decided not to bother with maternity leave because of these factors, but work overload may have contributed to her decision to resign. Ironically, the male professor who was hired to replace her was assigned a mentor.25

Erika Travertine entered the ranks of upper management through hard work, ambition, and by gaining graduate qualifications in business on a part-time basis. She attributed her organizational savvy to having a good mentor early in her career and the fact that he was able to show her the ropes by example. When her mentor gained a graduate degree in business, she realized she could do it too and followed suit. She suggested that she is much more confident and assertive now than she was at the beginning of her career when she was easily intimidated. Trial and error helped her learn the political ropes, and she has become attuned to organizational politics in order to survive in an era of cutbacks. She also has been involved on an experimental committee that provided mentoring to women in order to help them gain management experience. The mentoring was done in a group environment rather than on an individual basis. In addition, Travertine has been active in professional organizations.26

Mary Siltstone emphasized that all her mentors have been male since she never had any women professors. Even in the workplace there has never been a woman working in a position senior to her own to offer her any mentoring assistance. Fortunately, she has never felt the need for a female mentor. At a recent conference she attended, Siltstone noticed that she was only one of two women in attendance out of 250 delegates. She noted that there are some advantages to being numerically outnumbered. She stands out in the crowd, and finds it easy to be well known in her professional field.
As a result, she has been very active in professional associations and has taken on a number of executive positions.\(^{27}\)

These are only a few examples of participants' experiences with and without mentors. As one can readily observe, although participants' opinions about the importance of mentors during university were mixed, most of them commented on the positive role that mentors played in helping them navigate organizational politics, guide their career advances, and cope with the heavy responsibilities of the workplace. A few participants also indicated that it did not matter whether mentors were male or female since most of their academic mentors had been male professors.

**The Changing Image of Women Geoscientists**

Women geoscientists interviewed in the study had varied opinions on the degree to which their public professional image has changed. The relative ages of participants and the length of time that had elapsed since they had graduated from university or retired from actively working in industry, government service, teaching or research may have had some bearing on attitudes on this question. Even among participants within the same age cohorts, however, opinions were far from unanimous on the professional image of geoscientists. The diversity of opinions on the issue may reflect the fact that the professional image of geoscientists may be viewed from varied perspectives.

The first perspective is the changing professional image of women geoscientists as viewed from within the profession by the practitioners themselves and as illustrated in the professional literature in the geoscience fields and in industry advertisements and publications. The second perspective is the public image of women geoscientists or the perspective from outside the profession as demonstrated by the attitudes of the general
public and by portrayals of geoscientists in the popular press. Both of these perspectives offer valid insights on the changing professional image of women geoscientists.

Many of the more recent graduates who participated in this study indicated that there have been positive changes in the professional image of geoscientists. Evelyn Diabase stated that women in science have been promoted in the last decade and that for the most part women are now perceived positively both within and outside of the profession. Hannah Basalt, a participant in mid-career, stated that the image of women engineers and geoscientists has softened somewhat in recent years, and that the stereotypical view of women having to be tough, assertive, and one of the boys to survive in these fields has moderated. Basalt stated that even as recently as the mid-1980s, women had to be academically exceptional in terms of their abilities and performance in order to be accepted. She noted that the increasing numbers of women in geoscience and engineering fields have meant that participants have a wider range of academic abilities and that women are increasingly being judged by the same standards as men. However, Basalt also suggested that although there is now a more balanced attitude toward women in geoscience and engineering professions, full equality has yet to be achieved.

Some participants agreed with Basalt, and others were more positive in their assessment of full equality for women geoscientists. Xavier Graywacke suggested that there have been many changes for the better and that women are now accepted without barriers. Graywacke attributed the changes in acceptance to a combination of factors: the increasing number of women professionals in the field, changing societal attitudes, and the fact that early members of the field paved the way for others. Nora Sandstone had similar comments to Graywacke's. She stated that the working environment is definitely
more positive for women now because of the increased numbers of women, changed attitudes, and expansion of employment opportunities for women. Sandstone qualified these remarks by suggesting that these factors may vary from company to company and from department to department, but that generally the changes have been in a positive direction.\(^\text{32}\)

Although Querida Felsite is a representative of an older generation of women geoscientists, her comments echoed those of Graywacke and Sandstone. Felsite stated that women are accepted as the norm now and that the "world's available, not just for unique women."\(^\text{33}\) She also emphasized that in her day "you had to be better than a man to be equal, and they knew that!"\(^\text{34}\) Felsite meant that women of her generation had to be better academically and in the field, and most of their male colleagues knew that only high achieving women were able to gain employment. She added that now it is no longer necessary for women to be exceptional achievers in their fields of study in order to succeed. In Felsite's opinion the playing field has evened out considerably for men and women in the geosciences.

Geraldine Syenite, the most recent graduate in the study, also stated that the popular misconception that only tough and somewhat more masculine women enter geoscience fields has moderated considerably, and many women geoscientists do not come close to fitting this stereotyped image. Syenite described herself as "slight in build and not tough"\(^\text{35}\) in terms of physical strength. In "The Feminine Face of Forestry in Canada," Peggy Tripp-Knowles discusses the fact that the forestry profession also had a very masculine bias in its orientation until recent years: "Forestry as a profession has been a male bastion for most of its almost century-long existence in Canada. This bias
has been the result in part of the history of forest work, which required stamina, strength, and relocation away from urban centres. Remnants of this reputation are still evident in forestry education, with such professional rituals as ‘lumberjack’ competitions.\textsuperscript{36}

There are many parallels between the forestry and the geoscience professions in terms of the emphasis on physical stamina and field work. Winifred, one of the participants in Tripp-Knowles’ study, commented that her qualifications were better than most of her male colleagues: "...my unique combination of academic and practical experience made me significantly better qualified than most of my male peers."\textsuperscript{37} Querida Felsite in my study made a similar comment with respect to the women geoscientists of her era.\textsuperscript{38} Tripp-Knowles also commented on the gender barriers or challenges that Marie, one of the participants in her study, experienced in forestry: "In considering the topic of gender barriers in forestry, Marie preferred the term ‘challenges.’ According to her, the perception of events as barriers is a matter of interpretation that was never a component of her mindset. Rather, she attributes career success and collegial respect to a positive outlook on life, in contrast to a negative attitude or blaming male students and professors."\textsuperscript{39}

Winifred described her pursuit of a Ph.D. in forestry as her strategy in dealing with employment obstacles: "My objective was to make myself so well and uniquely qualified that prospective employers couldn’t afford to pass me up, despite my gender."\textsuperscript{40} Winnifred summarized her philosophical approach to career obstacles as follows: "‘Seize all opportunities! Persevere in the tough times! When obstacles arise, blaze new trails around them.’"\textsuperscript{41} Although Winifred is a forester rather than a geoscientist, the philosophy she articulates is similar to that of participants such as Laurel Coquina and...
many others in my study. Similar barriers or challenges in the two fields have resulted in the development of similar responses to challenges. One additional challenge confronting geoscientists is the perception of status differences between engineers and geologists.

**Status Differences Between Engineers and Geologists**

Carol Argillite remarked that there has “always been an aura of eliteness to the group of geologists and engineers” even though she suggested that there is sometimes mutual rivalry between the two groups. Numerous participants indicated there is a sense of hierarchy among professionals, with engineers definitely considering themselves to be the first-class citizens. Argillite’s experience when actually working with engineers on projects was that all parties “worked as equals to mutually resolve problems.” However, Argillite was not the only participant to speak candidly about the somewhat unequal status of geoscientists and engineers. Geraldine Syenite stated that there is tension between engineers and geologists primarily because they take differing perspectives on issues. She noted that “geologists are interested in the big picture and that engineers have different priorities.” Syenite has studied both engineering and geology; therefore, she is well positioned to comment on the issue. She observed that there was a slight rift evident between the two groups of students on her university campus despite the fact that engineers and geoscientists took part in many joint social and academic activities.

Fiona Shale emphasized that the value placed on engineering versus geological input has nothing to do with gender and everything to do with holding a geoscience rather than an engineering degree. In Alberta, geologists and geophysicists are registered in the Association of Professional Engineers, Geologists, and Geophysicists of Alberta.
(APEGGA), the association that also registers all the professional engineers in the province. The Professional Engineers of Ontario (PEO) has not chosen to go the same route as APEGGA in registering geologists and geophysicists in one association with engineers. Shale commented that geologists "have struggled for a long time to be part of a team of resource professionals and that they still feel like being second-class citizens in terms of being placed within the engineering association."\(^{46}\)

At times, Shale has felt that her input as a geologist has not been as valued on work teams as an engineer's input. These attitudinal barriers have given her an extra incentive to prove herself to the team. She has felt sufficiently challenged by the differential status among professionals to become active in professional organizations in order to exert change from within. Shale emphasized that it is not only in Alberta that geologists face the challenge of acceptance from engineers. Despite the differences in registration procedures for geologists and engineers in different provinces, Shale suggested that attitudinal barriers between the two fields are general across the country, and geologists struggle constantly with the dilemma of second-class status.\(^{47}\)

Jessica Gneiss reinforced Shale's opinions on the competition between geologists and engineers. She commented that engineers have an attitude about "being better than anyone else," and that geologists occupy "low status on the totem pole" of resource professionals. In Gneiss's opinion, status differentials also are based on the universities with which engineers are associated. She felt that the same distinctions are made in relation to geoscience professionals on the basis of their university affiliation. Gneiss stated that graduates of smaller universities with geoscience or engineering degrees that do not entirely conform in their course requirements to the registration requirements of
professional associations such as APEGGA often find it necessary to take additional courses and to write examinations in order to become registered.\textsuperscript{48}

The comments from participants suggesting a status difference between geologists and engineers should not come as a surprise in light of the research on the professions and semi-professions presented earlier in the analysis.\textsuperscript{49} In the Introduction to \textit{Challenging Professions: Historical and Contemporary Perspectives on Women's Professional Work}, Elizabeth Smyth, Sandra Acker, Paula Bourne, and Alison Prentice discuss the primary role of professional organizations as one of gatekeeping rather than recruitment.\textsuperscript{50} This emphasis explains the necessity for professional associations such as APEGGA to require prospective members to pass examinations in areas in which their credentials fall short of meeting a standard set of course requirements in their specific fields. In \textit{Professions and Patriarchy}, Anne Witz also points out that intra-occupational competition and jockeying for positions of dominance are the norms in what she calls "professional projects...strategies of occupational closure which seek to establish a monopoly over the provisions of skills and competencies in a market for services."\textsuperscript{51}

In the case of APEGGA, the intra-occupational competition may be exacerbated because all the geoscience professionals other than geochemists are registered in one association with the engineers in the province. The PEO currently does not include geologists in its membership unless the geologists also happen to be engineers. The role of professional associations goes beyond gatekeeping, however, and includes promoting the professional image of both its male and female members. Companies also play a role in the positive portrayal of professional women in the varied roles that they play in their organizations, and these topics are the next focus of attention.
Role of Companies and Professional Associations in Changing Images

Brenda Phyllite stated that she has observed changes in the image of women geoscientists as a result of positive news articles and features on women geoscientists on television, advertisements featuring professional women published by APEGGA and other professional associations, and the promotion of women in key roles in advertisements and publications by large companies such as Syncrude and Suncor. Phyllite suggested that the representation of women in top executive positions in industry is changing, but not fast enough to reflect the changing numbers of women in scientific and business fields. Erika Travertine reiterated Phyllite’s opinion that there is much more visibility for women in geology, geophysics, and engineering in the professional literature and in such publications as The PEGG newsletter. In addition, she suggested that one-third to one-half of the students in undergraduate classes in these fields are women. The image of women geoscientists portrayed in the professional literature ranges from neutral to positive in Travertine’s opinion.

Kerry Gabbro added the following insights about both the changes in the professional identity of women geoscientists in the course of her career and the changes in her own self-image as a geoscience professional:

Our image has changed considerably since I started working in 1974. This is directly due to the increased number of women geoscientists in all types of industries. There are increasing numbers of women in managerial positions. Employers are aiding the balance of home and career responsibilities more and more. More conferences are geared towards women...My self-image as a woman geoscientist has improved considerably from a person who has to prove herself to be considered as an equal to being confident that I am an equal and treated respectfully as one.

Yannakis Schist stated that universities still educate more females than are employed in industry and that the fall-out or attrition rates for women are of concern to
universities, particularly in fields such as geophysics where women represent only about 5 percent of members. Company initiatives in endowing faculty positions for women in fields such as engineering have started to address the imbalance in male/female faculty ratios. However, Schist's comments suggest that more work needs to be done to attract young women to specialized fields in science and to prepare them academically to achieve success in these fields. Although the efforts of companies and professional associations in positively portraying professional women are important, the day-to-day changes in attitude and behaviour that occur in the workplace are a more accurate barometer of change. Changing attitudes are therefore the next topic of discussion.

**Changes in Attitudes Within the Profession**

Barbara Marble, one of the groundbreakers in terms of opening new opportunities for women in field work, stated that initially there was a period of adjustment in gaining acceptance to perform work such as high wall mapping. She noted that attitudes toward women performing field work have changed considerably in the course of her career. Women have "gained respect because of their work and their reliability." Farrah Anthracite suggested that there is a tendency "to make women more visible because they fought hard to gain that visibility." Anthracite pointed out that the quality of the work itself and not the gender of the professional is the decisive factor in gaining acceptance. She stated that everything "depends on the initiative of the individual."

Mary Siltstone commented that she is "still a woman in a man's world" in her field. Although she finds that there are "some archaic attitudes in the workplace, they are only an initial issue that can be overcome once you start working with people and show what you know." Amber Slate commented that the increase in the number of women
working in geosciences in itself has helped women to gain respect in these fields. However, she noted that this respect does not always translate into promotions for women. In Slate’s opinion, the fact that the geosciences are no longer exclusively a man’s field is starting to be reflected in journals, interviews, and news articles.61

While many of the participants talked about the significance of increased numbers of women geoscientists, none of them offered specific numbers in support of their assertions.62 The concentration of women geoscientists in Alberta may in fact give practitioners in the geoscience fields a sense of strength in numbers that women geoscientists in other provinces may not experience, depending on the province in which they are located.

Recent graduates who participated in this study were more definite about the changes in the professional image of women geoscientists they had observed. For example, Sarah Hornfels indicated that more recent graduates are less tolerant of the old boys’ club and unwilling to put up with derogatory terms relating to women professionals. In addition, Hornfels stated that the current generation of young men is more sensitive to gender issues and less likely to have negative stereotypes about women.63 Other participants such as Laurel Coquina agreed that there has been a “sea change for women in terms of acceptance.”64

Very few participants commented on the public image of women geoscientists. Harriet Serpentinite suggested that the knowledge level about geoscientists in general is not high outside of Calgary. Since Calgary is the location of the head offices of many major corporations, its citizens are more knowledgeable about the resource industry and the professionals in that industry since both have a strong impact on the local economy.65
Laurel Coquina commented that although “the image of women geoscientists has improved 200 to 300 percent in industry...geologists have no public image as a profession.”

To some extent, the participants' varying opinions regarding the professional image of women geoscientists may reflect the varied perspectives from which the question may be viewed, or it may reflect the fact that the image is slowly evolving. Some participants focused their comments on changes that have occurred within the profession itself—on how the attitudes and behaviour of geoscience professionals have changed. Other participants focused their attention on the perceived difference in status between geologists and engineers. A third group of participants focused attention on the changing image of women geoscientists as portrayed in the professional literature and the industry advertisements. A final group of participants focused attention on the public image of the geoscience profession or their perception of the lack of a public image.

**Future Directions for Change**

Although the varied responses make it difficult to come to firm conclusions on the way in which the professional image of women geoscientists has changed, participants' comments suggest that there has been change over time. Changes within the professional literature and advertising by professional associations and industry seem to be perceived as positive by most participants. In addition, participants' comments on changing attitudes within the profession were for the most part positive. However, a few participants pointed out that there are still some archaic attitudes in the workplace that women geoscientists have to contend with, that the old boys' network is still active in some organizations, and that access to the top management positions is still not as good
as it should be for women whether they are in industry, government service, or academia. The fact that women hold senior positions in all three of these areas is in itself a positive indication of improvements in career opportunities for women. However, there still may be a time lag before women are sufficiently numerous or in sufficiently powerful positions to meet Penina Glazer and Miriam Slater’s criteria of being able to assist the next generation of women in reaching their career goals.\textsuperscript{67}

Status differences between geologists and engineers were a concern for some participants who also questioned geoscientists’ participation in APEGGA. Participants’ opinions on the public image of the geoscience profession were difficult to evaluate. The few participants who commented indicated that they did not think the general public’s knowledge about geoscience topics or geoscience professionals was very high, particularly outside of Calgary. This perception of a lack of public knowledge about geoscience topics probably needs to be addressed by the professional organizations and associations in the various geoscience fields. Many of these issues are in fact being addressed by APEGGA through the establishment of a special geoscience task force. However, the general public’s knowledge of and understanding of geoscience issues and geoscience professionals will only improve over time if these issues are tackled broadly on a number of fronts. Professional organizations, the popular press, industry through its in-house publications and its public advertisements, and geoscience professionals themselves all need to make a concerted effort to expand their initiatives in public education.

All too often it is only the dramatic events that attract the public’s attention. Events such as the Bre-X mining scandal offer short-lived opportunities for public
education on geoscience topics. However, more attention needs to be devoted on a regular and ongoing basis to improving public knowledge about the role of geoscience professionals in general and the role of women geoscientists in particular—both their increasing numbers and their more prominent profile within industry, government service, academia and professional associations. How this objective is to be accomplished will have to be determined by geoscience professionals themselves and by their professional organizations and associations.

The final point to be made relates to the role of professional associations as both the gatekeepers to professional accreditation and the caretakers of the professional image of members. Both companies and professional associations have improved their efforts to promote professional women through advertisements, enhanced career opportunities, and appointments of women to executive positions. But are these efforts sufficient to increase the visibility of women in professional fields and to increase their opportunities for promotion to the top management positions? The verdict is still undecided on these questions. In addition, the isolation and sense of exclusion experienced by a few participants in the study lead one to believe that the stag effect is still operating in some organizations. Marybeth Lima has identified the stag effect as "a system of exclusionary conventions, procedures, attitudes, customs, and other social traditions, that essentially guard the male turf from the encroachment of women." Until discriminatory behaviour such as the stag effect is completely eliminated in the workplace, professional women in fields like geosciences, where they are still in a numerical minority, will remain at a disadvantage in competing for top management positions.
Geoscientists and the Ethics of Development

The final group of questions in the interviews explored the relationship of geoscientists’ work to the environment with a focus on the ethics of development. To what extent is there an ingrained conflict between resource development and the professional responsibility of geoscientists to preserve and protect the environment, or can a mutual compatibility exist? How does one rationalize the development of hydro-electric projects and dams that directly alter river systems and the environment around them, and yet at the same time provide power in a cost-effective and responsible manner since they reduce the need to burn fossil fuels? How does one balance the development of oilsands mega-projects that provide employment to thousands of people and supply fossil fuels that fill 20 to 30 percent of Canada’s consumption needs, when at the same time one understands the full impact of their development on the environment?

Some of the participants in this study work in government research organizations and regulatory bodies trying to maintain a delicate balance between sustainable development and protection of the environment. These participants seem to face less conflict in their daily working lives. Other participants are involved in exploration and the actual development phase of projects, and their work has a direct impact on the environment. The third group of participants includes university academics and researchers. Although the popular perception of university professors and researchers is that they are slightly removed or distanced from the day-to-day environmental and ethical issues facing industry, they are not entirely removed from the ethical fray. Many of them perform consulting work for industry during vacations or sabbaticals, or have research projects and/or teaching chairs funded by industry.
The ethics of development is an issue that causes major angst for many geoscience professionals, even for those who are pro-development in their orientation. Although the attitudes of interviewees were quite diverse on the question of resource development, I found some evidence of change over time in terms of the degree of environmental awareness taught in university classrooms and practised in industry and government sectors, and in the environmental courses and specializations now offered by universities. The attitudes of participants toward resource development and environmental issues will be the focus of the remainder of the chapter.

**Work-Related Environmental Activity**

Participants working for research institutions, government departments, or regulatory bodies had the easiest time in stating their positions on environmental issues since many of them are actively engaged in developing or supporting legislation offering protection to the environment. Dorothy Pridotite stated there is no question she has concerns and conflicts over environmental issues. She has been involved in numerous environmental committees and on special committees that evaluate locations that merit environmental protection under provincial legislation. Pridotite commented that “Although sustainable development is a belief that companies espouse, the bottom line is dollars....Legislation is crafted carefully to enable things that generate dollars.” She also noted that it is not always possible to say what you believe on these committees when you are there as a representative of either government or industry.

Amber Slate expressed confidence that her work contributes directly to the protection of and clarification of knowledge about the environment. She does not in any way see her work as conflicting with the environment, but as protecting it. She noted,
however, that environmental regulations result in increased costs to industry. Farrah Anthracite believes that her work has a positive impact on the environment in that she safeguards both the public’s interests as well as the interests of private companies. If she provides up-to-date and timely information, she can prevent companies from spending money needlessly and wasting time and resources in a unproductive manner.  

Participants with Pro-Development Orientations  

A few participants indicated that they had never experienced conflict over the impact of their work on the environment; others were more open in admitting that at times in their careers they have had concerns about the environmental impact of their work. Sarah Hornfels indicated she had no problem in rationalizing the work that she does with its impact on the environment. Hornfels stated she has “no sympathy for tree huggers.” She emphasized that if people exercised caution as consumers, recycled, and took the effort to avoid littering, these actions in themselves would make it a safer environment in which to live. In her words, “the earth is in a cycle just like human beings.” Like Hornfels, Alice Granite indicated that she has not experienced conflict either in relation to the impact of her work on the environment or in respect to environmental regulations.

Erika Travertine remarked that one “could not be an environmentalist and do this kind of work.” Travertine described herself as pro-development in her orientation. She noted that people who like a comfortable life do not always realize that resources provide this comfort level. As a geoscientist, she expressed a strong appreciation of the environment for both aesthetic and pragmatic reasons. She does her best to minimize the environmental impact of resource development by actively participating on
environmental committees.76 These examples are just a sample of participants' pro-development orientations. Only a handful of participants expressed pro-development attitudes. By far the majority of participants in the study indicated that they had mixed attitudes about development of resources and environmental protection. Similarly, a majority indicated that at times they had experienced conflict between their professional work and their personal ethics.

**Mixed Attitudes and Conflicting Roles**

Ophelia Diorite indicated that she had occasionally experienced conflicts in her work in industry, but not enough to put her off from being a geoscientist. She cited the strong demand for resources, the fact that environmental controls are strict, and that geoscientists are increasingly being hired to work on the environmental protection side of issues for companies. She also stated that drilling methods have improved and now have a lower impact on the environment.77 Laurel Coquina takes the same kind of pragmatic approach to development as Diorite. Coquina pointed out that resources are "where you find them, not always where you want them to be."78 She expressed confidence that the socially unacceptable legacies of the past can be cleaned up and that operating mines have the ability to reduce the environmental impact of their operations through the use of new technology. She is supportive of environmental regulations that require companies to define the starting point of their operations and to return the environment to that point at the end of their operations.79

Gloria Amphibolite looks at the issue of environmental impact from an industry standpoint. In her opinion, large companies are working on being good corporate citizens, and competition within industry is good for innovation and development.
Amphibolite stated that oil and gas companies are now diligent about cleaning up wellsites; there are fines for exceedances in the area of gas emissions; and that a number of joint-ventures on the part of oil and gas companies currently are working on environmentally sensitive issues. Wen Pumice noted that her work has a direct impact on the environment in the activities that she has company employees perform. In Pumice's words, "seismic lines impact people's lives." The best she can do is to try to minimize the impact by "working in a manner that is the least invasive of the environment."

Mary Siltstone commented that the environmental impact of her work is a big question. Although she is very conscious of the environment and the need for its protection, she suggested that being "too green" might not be helpful. Siltstone stated that the "real challenge is to strike a balance to use resources in a way that is not hurting the environment and to sustain the people in the world." Since Siltstone has worked on hydro-electric projects, she says she is well aware of "a whole new habitat created by such projects." Siltstone cautioned that the public must weigh the alternatives such as coal or nuclear energy plants very carefully. These issues both challenge and trouble her, but not enough to make her abandon the work she clearly enjoys and excels at.

Siltstone also commented that the pendulum theory on environmental regulations is highly applicable in that an imbalance in one era in terms of being too careless in protecting the environment is usually counterbalanced by a swing too far in the other direction in terms of restrictive regulation. In her opinion, finding a balanced position in the middle is both difficult and highly desirable. Yannakis Schist reinforced other participants' comments about the improvement in regulations protecting the environment
and the fact that oil companies are now more environmentally conscious. As a scientist, Schist says she "goes 400 percent overboard in terms of environmental safety."87 In her opinion, it is important that environmental safeguards are maintained.

On a related issue, Schist commented that from a geoscientist's perspective, the phenomenon of global warming is not necessarily related to greenhouse gas emissions. Harriet Serpentinite made similar remarks on the issue of greenhouse gas emissions. She stated that the relationship of global warming to greenhouse gases is a political issue in which the scientific dissenters have not received adequate attention. There have been major fluctuations in global climate throughout geological time that occurred long before the impact of human activity. Some scientists are of the opinion that it may be presumptuous to assume that human activity alone is responsible for the current trend toward global warming.88

In terms of role and value conflicts, Serpentinite pointed out that the applied research she is currently doing leaves her slightly removed from the ethical fray of environmental issues. However, she stated that when she worked in industry she experienced conflict all the time. Serpentinite commented that spills due to drilling operations and contamination of groundwater supplies have a direct impact on humans.89

Carol Argillite also stated that she experienced some conflict as an employee when she worked in industry, but that she also understood the delicate balancing act in which industry must engage. She felt fortunate to work for a company that placed a high emphasis on environmental protection and reclamation efforts. She saw such efforts as representative of the "fundamental beliefs of the organization."90 At the same time,
Argillite pointed out that there is always room for additional government regulation in the area of environmental protection.\textsuperscript{91}

Patricia Archos stated it was hard to resolve the conflicts between the work that she does and its impact on the environment. She pointed out that almost anything one does as an engineer has a direct impact on something else. She emphasized that in her opinion there are major ethical issues involved in the construction of engineering structures or industrial plants that are located adjacent to or on river systems. At the same time, Archos noted that there have been positive developments in the courses in environmental science designed to respond to such challenges. As a result of these courses, there is more professional expertise available to develop alternatives that will have less impact on the environment. Archos pointed out that many students are now enrolled in these new university courses and programs in environmental science. Consequently, Archos believes that recent graduates of geoscience programs have a more balanced attitude toward environmental issues than graduates of an earlier era did.\textsuperscript{92}

Zoya Mylonite pointed out that technology is available to protect the environment, but is not always used, especially in developing countries. She emphasized that a balanced approach toward resource development is necessary if consumers wish to maintain their comfortable lifestyles. In Mylonite’s opinion, “the environmentalists tend to be far more flamboyant, so they get front coverage.”\textsuperscript{93} In addition, Mylonite added that the geoscience community is not always as vocal in expressing its positions as it could be.

Mylonite also noted that participating on committees for professional associations can be difficult in terms of potential conflicts in roles. Sometimes it is necessary to
identify when one is expressing personal opinions and when one is expressing the official positions of professional associations. Representing two or more positions at one time can be difficult. One could be representing an industry position, a professional association’s position, or one’s own personal opinion, and the three may not always be compatible. Knowing when and where to draw the lines is a complex issue that many individuals who are active on professional associations and on industry and government committees and task forces have to contend with. Many participants balance their paid employment with volunteer work that contributes to environmental awareness.

**Volunteerism with Youth and School Groups**

Isobel Rhyolite stated that she demonstrates her commitment to public education on environmental issues through her volunteer work with young people. Rhyolite commented on the connection that childhood experiences in youth groups had to her career interest in geology:

I have recently realized one of the significant factors in the evolution of my interests from girl to geoscientist was [name of youth group]....Only now am I realizing what an impact it had on my perceptions as a child. I am a [youth group] leader now and...I remembered how much I loved it as a girl and now as an adult I see how valuable the program is and how it instills the values of service, society and the environment. We did the environmental appreciation badge last week and I was just in heaven teaching these eager young girls to open their eyes to nature’s subtleties.

Rhyolite emphasized the personal satisfaction she receives from her volunteer work with young people, her increased awareness of the interrelationship between social and scientific issues, and the professional leadership skills she has gained through this activity:

It seems to me that women in the sciences, perhaps women who are raising children, may later become more aware of the integration of social issues and the science they are passionate about. It becomes important to raise the awareness of
the children of the next generation and show them how intricate the web of nature and human consequence is. It gives me a chance to help many other girls learn about science, art, the outdoors and many other things within a nurturing environment. You can bet we'll be either doing or inventing a 'rock' badge. I am finding that [this youth group] is the perfect opportunity for me to contribute to the global community and at the same time gain personal and professional leadership skills.  

Several other participants mentioned their involvement with youth groups for young women and the pivotal role such groups played in their lives as young adults. Alice Granite and Brenda Phyllite mentioned that they regularly make presentations to youth groups on geoscience topics. Phyllite devotes a considerable amount of time to public education as a result of what she sees as the public's misunderstanding of the geoscience professions and their role. She concentrates her efforts on the younger generation by participating as a judge in science fairs and by making presentations to school and other youth groups. Her own work is research-oriented and is directly beneficial to the protection of the environment.

Ophelia Diorite, Gloria Amphibolite, and Laurel Coquina also have made numerous presentations to school groups on geoscience topics. In addition, Dorothy Pridotite has assisted her partner in assembling rock kits for demonstration purposes for students. It is apparent that involvement in such community activities offers participants the opportunity to balance the work they do in industry, government service, or academia with public education initiatives on geoscience and environmental issues.

**Generational Differences in Education on Environmental Issues**

Graduates of an earlier era such as Vera Breccia, Rachel Pitchstone, Querida Felsite, and Una Obsidian pointed out that there was no talk about the environment during their university education. Breccia commented that the environment was "not
even considered.”\textsuperscript{98} She noted that “companies were careless about drilling wells, building roads, and cleanup in my day, but rules and regulations are more stringent now, which is good.”\textsuperscript{99} In Breccia’s opinion, there are times when “the environment should come first and times when the development of resources is necessary until we find something better to replace them.”\textsuperscript{100}

Rachel Pitchstone commented that she did not think about the impact of the oil industry on the environment in the early years of her career. She noted that now there is more environmental consciousness, and there are more government regulations.\textsuperscript{101} Querida Felsite stated that it is necessary to achieve a balance between development and environmental protection. She is in favour of toughening government regulations and safeguards for environmental protection.\textsuperscript{102}

Una Obsidian also commented that people were not as aware of environmental impact when she was at university. She remarked that when Leduc No. 3 well burned out of control in the late 1940s, the public never thought of pollution. It was just a phenomenon that riveted the public’s attention.\textsuperscript{103} Although Breccia, Pitchstone, Felsite, and Obsidian represent an earlier era of university graduates, more recent graduates like Thomasina Perlite stated that the environment was one of the last things she thought about when she graduated from university in the 1980s. She noted that there was not much public protest over coal mining, gas lines, or pulp mills then. Now she describes herself as very environmentally conscious in terms of recycling in her home and ensuring that she leaves her campsites in pristine condition when she is on vacation.\textsuperscript{104} Perlite related her change in attitudes to general societal change in attitudes toward environmental awareness.
Participants' attitudes on resource development and environmental issues were varied and reflected the full range of possibilities from strong proponents of development to strong proponents of improved environmental regulations and increased restrictions on resource development. A majority of participants favoured a balanced approach to resource development that would offer the maximum benefit to the public with minimal impact on the environment. Participants also expressed a fair degree of optimism regarding the ability of technological innovations to reduce the environmental impact of resource development.

A key point that participants' comments revealed was the changing attitudes on environmental issues. These changes were evident in a number of ways: first, in the increased public consciousness of environmental issues; second, in the improvements in university training and the expansion in the range of environmental courses and programs offered; third, in the increased environmental awareness of geoscience professionals themselves; fourth, in the more responsible attitudes of industry to environmental and safety issues; fifth, in the more stringent development and enforcement of regulatory legislation protecting the environment; and finally, in the enhanced visibility and expanded role of the professional associations related to the geoscience fields. All of these indicators suggest that protection of the environment has now become a much more prominent focus of attention for members of the public, for industry and government, and for geoscience professionals. The increasing number of students currently being attracted to courses in environmental science also means that there will be more expertise available to deal with the socially unacceptable legacies of the past.105
Turning now to one of the most complex issues raised in the opening of this chapter, one must ask if the attitudes expressed by women geoscientists are any different from those of male practitioners in the field. Since there has not been a comparable study done on male geoscientists, this question cannot be answered directly. In Chapter Three of the dissertation, Alison Mackinnon was quoted as questioning whether women who experience higher education internalize the “dominant male thinking about women’s place” in society and whether they perform as “male heads on female shoulders.” I added a corollary question as to whether women who work in what have been traditionally considered male-dominated fields internalize the social attitudes and behaviour set of their male colleagues. One might further ask if they internalize their male colleagues’ attitudes toward environmental issues, or if there are any signs of the development of a feminist critique of resource development from within the geoscience professions. These are very tough questions to ask, and they are even more difficult to answer.

Peggy Tripp-Knowles has tackled a similar set of issues in relation to women in forestry. Gwen, one of the participants in Tripp-Knowles’ study, raises issues that are relevant to my study on women geoscientists:

My sense of forestry is that it is controlled by corporate influences...the same way I see most other things in the world, especially resource-based economies...that it's controlled by corporate interests and that there's a very similar set of circumstances that go with that and that is...lip-service to development...lip-service to reforestation...increasing government policies [that are] increasingly giving corporate interests a freer hand in taking forests for their own use... and not providing any particular regulatory power...Individual people are losing control...particularly women...[So] I have a hard time thinking about women and forestry impacting in a particular way. The women who have entered industry have been co-opted...The size and nature of industry is too large for women to have an impact...That is one thing I have learned from my feminist organizing around social change and economic justice...is that you can’t enter
into that without your own agenda...The issue is...who becomes just token representatives?...It doesn’t matter if they are strong women or not...they go to a meeting and their agenda is completely overlooked...they’re not listened to...they can’t make any valuable contribution [all ellipses are in the original source].

The questions of whether women are co-opted in industry and whether their voices are heard on committees when they express dissenting opinions are equally applicable to women in the geoscience professions. In addition, the power of large corporations and the distance of head offices from the people most affected by resource development mean that dissenting voices often do not get heard. The mammoth scope of the new mega-projects staggers the imagination and leaves one questioning whether regulatory agencies alone can operate as effective watchdogs on environmental issues. Are there dissenting voices developing from within the geoscience fields? Are women geoscientists speaking out on environmental issues?

It is evident from the comments of participants in this study that there are dissenting opinions being voiced and that there are environmental activists among this group of women geoscientists, but the voices are not too loud or too vocal as yet. Participants in all three areas of employment—government service, industry, and academia—expressed concerns about environmental issues. Age of participants also did not seem to make a difference in environmental consciousness. The only key difference that related directly to the age of participants was the environmental awareness taught in university courses and the extent of regulatory controls on resource development. Geoscientists of an earlier generation indicated that they were not taught about environmental issues at university and that regulatory controls were not as well developed or as well enforced when they began their careers.
As Peggy-Tripp Knowles suggests in relation to forestry, "the critical voice is yet a whisper," but the fact that it exists at all is potentially a step in the right direction. For the most part, the participants in this study are action-oriented women. Although most participants are self-reflective in relation to personal professional issues, they are not all critically reflective about the environmental impact of their professional actions. The academic socialization in science and engineering programs and the predominantly male faculty also influence graduates to adopt male mentors and the male professional model. In addition to their academic socialization, many of the study participants earn their livelihoods in industry and may have been reluctant to be openly critical of the resource development that provides them with employment income as well as the opportunity for meaningful careers. A number of participants pointed out that most Canadians enjoy a comfortable lifestyle because of the development of resources that are used to produce consumer goods and operate mechanical equipment.

Few participants in science and engineering programs have been exposed to feminist or women's studies at university, which makes it unlikely that they would offer well-developed feminist critiques of resource development. This situation may change as the number of women faculty members with perspectives that include ecofeminism increases at universities and a broader range of environmental courses become part of university curricula. The themes of ecofeminism link very effectively with the environmental history approach that has informed and guided the development of this dissertation. Mary Mellor defines ecofeminism in the following terms in *Feminism & Ecology*:

Ecofeminism is a movement that sees a connection between the exploitation and degradation of the natural world and the subordination and oppression of women.
It emerged in the mid-1970s alongside second-wave feminism and the green movement. Ecofeminism brings together elements of the feminist and green movements, while at the same time offering a challenge to both. It takes from the green movement a concern about the impact of human activities on the non-human world and from feminism the view of humanity as gendered in ways that subordinate, exploit and oppress women.\textsuperscript{109}

As movements such as ecofeminism enter the mainstream in university curricula, changes in the outlook of some women students are bound to occur.

**Conclusion**

This chapter shows a strong connection between participants' personal professional images and the utilization of their professional skills. It also shows that a majority of participants perceive the changes in the public professional image of women geoscientists as positive. However, a small number of participants still see considerable room for improvement in attitudes and behaviour toward women from within the profession and in opportunities for promotion of women to senior executive positions. A majority of participants in the study also advocate a balanced approach to environmental issues. While a balanced approach has its merits, I see a pressing need for the development of a feminist critique of resource development practices from within the geoscience professions. Such a critique would help ensure that environmental issues are given adequate attention and that the safety of the environment and the public is ensured.

This study provides a strong indication that there has been change over time in terms of women geoscientists' awareness of environmental issues, and that for the most part, the change has been positive. However, there is still a long way to go in terms of the development of a vocal feminist critique of resource development from within the geoscience professions. Peggy-Tripp Knowles' conclusion with respect to forestry is equally applicable to the geoscience fields: "I would earmark this component of women's
influence on forestry [and geosciences] as worth watching as a harbinger of a greater contribution in the future.\textsuperscript{110}

\textsuperscript{1} Xavier Graywacke, [pseud.], interview by author, 20 August 1998.
\textsuperscript{2} Kerry Gabbro, [pseud.], interview by author, 14 April 1998.
\textsuperscript{3} Hannah Basalt, [pseud.], interview by author, 3 April 1998.
\textsuperscript{4} Nora Sandstone, [pseud.], interview by author, 5 August 1998.
\textsuperscript{5} Isobel Rhyolite, [pseud.], interview by author, 5 April 1998.
\textsuperscript{6} Carol Argillite, [pseud.], interview by author, 6 July 1999.
\textsuperscript{7} Jessica Gneiss, [pseud.], interview by author, 10 April 1998.
\textsuperscript{8} Ibid.
\textsuperscript{9} Ibid.
\textsuperscript{10} Dorothy Pridotite, [pseud.], interview by author, 7 July 1999.
\textsuperscript{11} Ibid.
\textsuperscript{12} Brenda Phyllite, [pseud.], interview by author, 6 July 1999.
\textsuperscript{13} Laurel Coquina, [pseud.], interview by author, 22 July 1998.
\textsuperscript{14} Ibid.
\textsuperscript{15} Ibid.
\textsuperscript{16} Querida Felsite, [pseud.], interview by author, 17 August 1998.
\textsuperscript{17} Ibid.
\textsuperscript{18} Amber Slate, [pseud.], interview by author, 6 July 1999.
\textsuperscript{19} Ibid.
\textsuperscript{20} Gabbro, interview.
\textsuperscript{21} Argillite, interview.
\textsuperscript{22} Ibid.
\textsuperscript{23} Phyllite, interview.
\textsuperscript{24} Ibid.
\textsuperscript{25} Ibid.
\textsuperscript{26} Erika Travertine, [pseud.], interview by author, 7 July 1999.
\textsuperscript{27} Mary Siltstone, [pseud.], interview by author, 30 July 1998.
\textsuperscript{28} The term “recent graduates” is used in reference to participants who graduated from university in the last fifteen years.
\textsuperscript{29} Evelyn Diabase, [pseud.], interview by author, 4 March 1998.
\textsuperscript{30} Basalt, interview.
\textsuperscript{31} Graywacke, interview.
\textsuperscript{32} Sandstone, interview.
\textsuperscript{33} Felsite, interview.
\textsuperscript{34} Ibid.
\textsuperscript{35} Geraldine Syenite, [pseud.], interview by author, 22 March 1998.
\textsuperscript{37} Ibid., 199.
\textsuperscript{38} Felsite, interview.
\textsuperscript{39} Ibid., 200.
\textsuperscript{40} Ibid., 199.
\textsuperscript{41} Ibid., 199.
\textsuperscript{42} Argillite, interview.
43 Ibid.
44 Syenite, interview.
45 Ibid.
46 Fiona Shale [pseud.], interview by author, 7 March 1998.
47 Ibid.
48 Gneiss, interview.
49 See Chapter Three under the heading of "Literature on Women in Academia and the Professions."
50 Smyth et al., eds., Challenging Professions, 5.
51 Anne Witz, Professions and Patriarchy (London and New York: Routledge, 1992), 64.
52 Phyllite, interview.
53 -Travertine, interview.
54 Gabbro, interview.
55 Yannakis Schist [pseud.], interview by author, 19 August 1998.
56 Barbara Marble, [pseud.], interview by author, 1 October 1997.
57 Farrah Anthracite, [pseud.], interview by author, 8 July 1999.
58 Ibid.
59 Siltstone, interview.
60 Ibid.
61 Slate, interview.
62 See Census Canada data outlined in Chapter Five. The statistics show that over a third of the women geoscientists in Canada are located in Alberta.
63 Sarah Hornfels [pseud.], interview by author, 17 August 1998.
64 Coquina, interview.
65 Harriet Serpentinite, [pseud.], interview by author, 9 July 1999.
66 Ibid.
69 Pridotite, interview.
70 Slate, interview.
71 Anthracite, interview.
72 Hornfels, interview.
73 Ibid.
74 Alice Granite, [pseud.], interview by author, 27 September 1997.
75 -Travertine, interview.
76 Ibid.
77 Ophelia Diorite, [pseud.], interview by author, 10 August 1998.
78 Coquina, interview.
79 Ibid.
80 Gloria Amphibolite, [pseud.], interview by author, 9 July 1999.
81 Wen Pumice, [pseud.], interview by author, 20 August 1998.
82 Ibid.
83 Siltstone, interview.
84 Ibid.
85 Ibid.
86 Ibid.
87 Schist, interview.
89 Serpentinite, interview.
90 Argillite, interview.
91 Ibid.
92 Patricia Archos [pseud.], interview by author, 10 August 1998.
93 Zoya Mylonite, [pseud.], interview by author, 20 August 1998.
94 Rhyolite, interview.
95 Granite, interview; Phyllite, interview.
96 Phyllite, interview.
97 Diorite, interview; Amphibolite, interview; Coquina, interview.
98 Vera Breccia,[pseud.], interview by author, 19 August 1998.
99 Ibid.
100 Ibid.
101 Rachel Pitchstone, [pseud.], interview by author, 17 August 1998.
102 Ibid.
103 Una Obsidian, [pseud.], interview by author, 18 August 1998.
104 Thomasina Perlite, [pseud.]. interview by author, 18 August 1998.
105 Coquina, interview.
108 Ibid., 210.
CHAPTER TEN

The fascination of any search after truth lies not in the attainment, which at best is found to be very relative but in the pursuit, where all the powers of the mind and character are brought into play and are absorbed in the task. One feels oneself in contact with something that is infinite and one finds a joy that is beyond expression in ‘sounding the abyss of science’ and the secrets of the infinite mind.¹

Truth and Objectivity in Historical Writing

In the opening quotation, geologist Florence Bascom addresses the question of truth in academic pursuits. This topic is very apropos to a discussion of the oral history and interview-based methodology employed in this study. The truth or validity of the experiences reported in oral histories and the definition of truth itself have been the subjects of debate for feminists and other researchers in recent years. Shulamit Reinharz comments on the relevance of interview-based studies as follows:

Feminist researchers who have done interview studies have modified social science concepts and created important new ways of seeing the world. By listening to women speak, understanding women’s membership in particular social systems, and establishing the distribution of phenomena accessible through sensitive interviewing, feminist interview researchers have uncovered previously neglected or misunderstood worlds of experience.²

The positive results of interview-based studies that Reinharz identifies are clearly evident. Reinharz also addresses the issue of trust and “believing the interviewee”³ in her chapter titled “Feminist Interview Research,” but she adroitly avoids the questions of objectivity and truth. Kathleen Weiler, on the other hand, tackles the questions head-on in “Reflections on Writing a History of Women Teacher,”⁴ when she discusses what she calls “the constructed quality of memory and experience”⁵:

It is the sensitivity to the constructed quality of memory and experience that has led feminist theorists in a number of disciplines to suggest the use of the term ‘subjectivity.’ Subjectivity has been employed to try to capture this quality of the
social construction of the self: it implies the struggle and contest over identity; the ways in which selves are unstable, shifting, constructed through both dominant conceptions and resistance to those conceptions; and suggests the incomplete and sometimes contradictory quality of our lives both in the present and as we construct our pasts through memory.6

If one’s memories are indeed historical constructs, where does this realization leave the historian in terms of analysis of facts and objective truth? The Personal Narratives Group addresses the issues of accuracy and relevance of historical memory in *Interpreting Women’s Lives: Feminist Theory and Personal Narratives*:

When talking about their lives, people lie sometimes, forget a lot, exaggerate, become confused, and get things wrong. Yet they are revealing truths. These truths don’t reveal the past ‘as it actually was,’ aspiring to a standard of objectivity. They give us instead the truths of our experiences. They aren’t the result of empirical research or the logic of mathematical deductions. Unlike the reassuring Truth of the scientific ideal, the truths of personal narratives are neither open to proof nor self-evident. We come to understand them only through interpretation, paying careful attention to the constructs that shape their creation and to the world views that inform them. Sometimes the truths we see in personal narratives jar us from our complacent security as interpreters ‘outside’ the story and make us aware that our own place in the world plays a part in our interpretation and shapes the meanings we derive from them.7

Historians are therefore dealing with multiple truths rather than objective truth in writing historical narratives, and they also play a role in shaping the meanings and interpretations that are drawn from the narratives. The Personal Narratives Group suggests that if one considers these plural truths in the light of objectivity and the criteria of validity, which are the standard measurements in many academic disciplines, they often fail to measure up:

Considered in these terms, the truths in personal narratives cannot stand the test to which they are subjected, i.e., the tests of verifiability, reliability, facticity, or representativeness. Using such a limited definition of Truth admits only one standard at a time for the perception and interpretation of a small segment of complex reality. While such a conception may be ‘safe’ in its claim to meet any claim to its scientific validity, it inevitably excludes certain experiences that require understanding. As appealing as it may be to some to carry out this
Cartesian division of the world into discrete and knowable parts, the cost is high. It is devastating for those whose experience, history, and perceptions—whose truths—are obliterated.\textsuperscript{8}

It is necessary, therefore, to expand the definition of Truth to multiple truths in order to validate the use of oral history and personal narratives methodology. Otherwise the historian has no way of exploring the experiences of the vast majority of women and men who leave no records and who have had their histories ignored in the past. Kathleen Weiler receives the last word on this subject:

A feminist history that begins with a concern with the constructed quality of evidence moves uneasily between historical narrative and self-conscious analysis of texts. There is the seductive attraction of narrative, to write the past as a coherent story or plot, framed by implicit or explicit judgments and perceived as moral lessons. On the other hand, there is the analysis of representations, a critical suspicion of the evidence of written texts or the oral accounts produced through questioning, and a concern with the contemporary biases of the historian/critic/narrator....As is true of any historian, I can only analyze and understand the evidence of lives through discursive categories while recognizing and acknowledging my complicity in the narratives I call forth and the narrative I construct. In my history, I hope to present both a story and a meditation on what it means to be a teacher and a woman and to try to capture what, in Steedman’s words ‘might have been.’\textsuperscript{9}

Like Weiler, I acknowledge my own “complicity in the narratives I call forth and the narrative I construct”\textsuperscript{10} and only hope that I have captured some of the truths of what it means to be both women and geoscientists in the province of Alberta and “what...‘might have been.’”\textsuperscript{11}

**Reviewing the Historical Literature**

A number of key themes emerge in the review of the historical literature in the early chapters of the dissertation. Mary and Thomas Creese show that British women were in the vanguard of early education for women in the geosciences, with Russian women close behind in their numbers and their academic publications, and American
women led by Florence Bascom trailing somewhat behind women in the other two countries both in their numbers and in their record of academic publications.¹²

The cross-fertilization of ideas and scientific knowledge and the transparent borders for graduate scholarship were a second theme that emerges in the historical literature. Canadian women were not even minor players on the international scene when studies for women in geosciences started to flower abroad. Canada’s colonial and dependent status, the fledgling status of its academic institutions, as well as its universities’ lack of a research focus¹³ were all factors in the delayed entry of Canadian women to formal training in the sciences in this country. These factors were also influential in the decisions made by several of the early Canadian women in geology to do their graduate studies abroad.

Canadian women such as Alice Wilson, Grace Anne Stewart, and Helen Belyea are examples of early Canadian graduates who found it necessary or advantageous to pursue doctoral studies in geosciences in the United States. By the time Madeleine Fritz (1896-1990), who was a young protégée of Alice Wilson, entered graduate studies at the University of Toronto, the university had developed its graduate programs and expanded its focus on scientific research in order to compete with American universities. As a result, Fritz did not find it necessary to leave Canada for doctoral studies abroad, as her predecessors had.

A third theme that emerges in the literature is the change from the amateur naturalist tradition to institutionalized and academic settings and its impact in terms of loss of visibility for women’s contributions. Charlotte Gray’s research on Catharine Parr Traill very effectively shows the transition from the amateur naturalist tradition to
professional activity in the sciences and its impact in the silencing of the contributions of the earlier amateur naturalists.\footnote{14}

Although there was a slight time lag between American and Canadian women’s entry to professional work in geosciences, historians such as Marianne Gosztonyi Ainley have documented the existence of a pre-professional period of women’s scientific activity in this country.\footnote{15} Sally Kohlstedt also has outlined three early categories of women’s scientific activities in the United States: work as amateur naturalists, work as scientific disseminators, and work in amateur scientific clubs and the emerging scientific professions.\footnote{16} These categories of scientific activity may be equally applicable to the early Canadian women in science such as Catharine Parr Traill and other naturalists and scientists. However, since the time frame of scientific activity in Canada lagged behind that of American activity, the three categories of scientific activity were compressed into a shorter span of time and may have overlapped more than was the case in the United States. The compressed time frame of Canadian women’s activity may explain why Marianne Gosztonyi Ainley has not chosen to use this categorization in reference to the Canadian women and has chosen instead to refer to a pre-professional and a professional period of activity.

In addition to examining the pre-professional activity of Canadian women in science, Ainley also has documented the history of the early achievers in the geoscience professions in Canada. She suggests that scientific superachievers were fairly small in number in Canada, and that only a “handful” of Canadian women scientists fit this category. A second group of women scientists experienced marginal careers as teachers, research assistants, or helpmates to husbands in what Ainley calls the “two-person single
career." A third group worked as "volunteer investigators (or independent scholars)," and a fourth group gave up scientific careers to become homemakers, although they continued to contribute as volunteers in museums and science centres. The exploration of careers of three early Canadian women in geosciences in Chapter Five of the dissertation shows that a number of Ainley's categories are applicable to the careers of Grace Anne Stewart, Helen Belyea, and Mary Turner.

In documenting the history of women in science in the United States, Margaret Rossiter describes the period of "Republican Motherhood" before 1880 in which education for women and participation in local scientific clubs were justified on the grounds that they would improve women's performance as wives and mothers; the 1880 to 1910 period, when women began to seek entry to employment in museums, research institutes and observatories and to join professional organizations; and the period after 1910, when women began to be confined to a narrow range of activity in the sciences, and success in numbers was gained at the expense of segregated employment and lower status in terms of recognition. Rossiter also depicts the period from 1942 to 1972 as a disappointing one for American women. Despite encouragement to achieve graduate degrees in sciences and technical fields during the war years, women began to be shut out of positions on the faculties of the new coeducational colleges and universities.

Since there has not yet been a comprehensive history of women's scientific activity in Canada comparable to Rossiter's work on activity in the United States, one is faced with looking at the details piecemeal through scholars' work on specific topics. However, the research of Alison Prentice on women in physics, W.P.J. Millar and R.D. Gidney on women medical students, and Ruby Heap on women in physiotherapy
suggests the positive impact of the world wars on professional training for women. More work needs to be done to verify whether the doors started closing on women’s professional opportunities in Canada after the Second World War, as Rossiter indicates happened in the United States. Did events such as the Leduc oil find in Alberta contribute to the opening of professional opportunities for women? Only further research will verify or refute this claim.

In fact, a number of themes require further research in the areas of women’s education and professions. The multi-faceted meanings of separatism deserve further examination. In particular, the theme of separate education versus coeducation and the differences between the Canadian and American experiences with all-female schooling deserve further study. Is all-female education a factor in women’s adoption of non-traditional career interests or in their pursuit of academic excellence and professional careers? Did the first generation of women in the professions come from relatively affluent backgrounds? My study shows some evidence of the relatively privileged backgrounds of participants, but to determine whether this a generalized trend for all the first generation of professional women will require further research. Another theme that requires further research is the development of separate women’s professions and separatist strategies. In this area, again, it would be helpful if rigid dichotomies could be avoided and both the positive and negative aspects of separate women’s professions could be examined.
Making the Connections

Making the connections between the themes that emerge in the interview-based study and themes that emerge in the review of literature relevant to the topic is another important task to be accomplished before conclusions can be drawn. The thirty-four participants in the interview-based study represent a variety of age and experience. They are representative of the Alberta-based continuum of age and experience of women practising geoscience in Canada. The study shows that early socialization and family activities played an influential role in participants’ career choices. High school teachers with strong science backgrounds and first-year university professors also influenced participants’ career paths. Access to field schools and field work increased dramatically for women in geosciences from the mid-1970s to the present. Improved career opportunities for women and increased flexibility on the part of employers have made it easier for the current generation of geoscientists to integrate family and careers. The booming Alberta economy and current shortages of professionals in scientific and engineering fields may be important factors in employers’ willingness to negotiate flexible employment options, but changing societal attitudes and management practices are also significant forces. These themes connect with the review of historical, sociological, and management literature in a number of ways.

The first connection between the findings of the study and the review of literature is to the separate spheres or public/private dichotomy that has been challenged by numerous women’s historians such as Joy Parr, Gail Cuthbert Brandt, and Jill Ker Conway. Participants’ comments in the study show that lack of encouragement or lack of opportunity to maintain professional employment potentially leads to weak personal
professional images and marital difficulties or divorce, particularly if marital partners are not supportive. All the participants in the study other than the retired women were focused on using their professional training and integrating professional and personal lives. Indeed, many of the retired participants also were actively using their professional training in volunteer activities. It is time, therefore, for the separate spheres theme that has so dominated the historical literature on women to be put to rest. As Marjorie Theobald so aptly comments, "Feminist historians have... challenged the taken-for
granted orthodoxy that the public and private spheres are substantive, discrete categories of human existence, the former constituting the natural domain of men and the latter constituting the natural domain of women."  

The second connection to the literature relates to the feelings of isolation and exclusion experienced by a number of participants in the study. The themes of isolation and exclusionary practices connect with the research of both Marybeth Lima and J.
Bernard on the "stag effect" and with Gloria E. Miller's findings on women executives in the oil and gas industry. Marybeth Lima shows that men’s exclusionary practices in the workplace serve to isolate and alienate women and disadvantage them in terms of the attainment of senior management positions. Miller also states that in the oil and gas industry "daily interactions are characterized by a reliance on informal, shared masculine interests and paternalistic behaviour towards women." Miller’s research on management literature also identifies old boys’ networks as one of the key forms of discrimination against executive women. 

Although these themes did not surface quite as strongly in my study as they did in Miller’s dissertation, they did emerge in the interviews, particularly in relation to events
that took place early in participants’ careers. A number of participants commented on missing out on informal networks outside of work hours, being excluded from male camaraderie because of topics of discussion, and having to break through barriers in order to gain entry to male sporting events. Several of the participants in my study have been pathbreakers in gaining election to top executive positions in professional organizations and in challenging discriminatory practices such as sports tournaments that in the past were exclusively male events.

A third connection to the literature relates to the theme of volunteerism with school and youth groups. Many of the participants in the study indicated that they had been influenced in their choice of careers through participation in youth groups, school activities, and family outings that exposed them to camping and outdoor experiences. The interviews with participants also revealed that many of them remain active with youth groups and school groups either as leaders, guest speakers, or science fair judges. Their volunteerism is related both to the professional ethic espoused by geoscientists and engineers and to participants’ desires to inculcate their love of the outdoors and the natural world in a new generation of students. The strong component of service to community in the professional ethic of geoscientists and engineers also connects to the discussion of professionalism in Part I of the thesis.

The mandate of many youth groups in exposing young people to camping and outdoor activity also connects to the historical research on women’s wilderness camping experiences by Susan L. Forbes and Anna H. Lathrop. Their research suggests that camping, canoeing, and wilderness activity contributed to women's challenging attitudes about gender-appropriate activities and "widened the purview of professional
employment opportunities for female graduates of the school [Margaret Eaton School].”

My study results also indicate that camping and outdoor experiences were factors in widening participants' career horizons to traditionally male-dominated fields such as geosciences. In an *Edmonton Journal* article on the topic of technology and the environment, biologist and environmentalist David Suzuki is quoted as recommending, “Get your kids out camping. We need to get out into nature to see it has a different time frame than ours.” Since many of the geoscientists who participated in this study did in fact gain their initial interest in geology through camping experiences with families, school, and youth groups, Suzuki's advice is highly appropriate.

The final connection to the literature is through the themes of metropolitanism and environmental history. Since much of the work that geoscientists do in a resource-rich province such as Alberta involves resource extraction and development, metropolitan influences are as important if not more important than frontier influences. The head offices of major corporations are located in large urban centres, and resource extraction on the scale that is occurring currently in Alberta involves large corporations, heavy capital investment, and head offices that are sometimes distant from the people affected by development. These factors make the approach of the New West environmental historians highly appropriate to the study of women geoscientists in the province. Environmental historians suggest that one way of looking at frontier communities is "as peripheries whose dependence on imperial metropoles helped define local society." They suggest that the activities of such communities are focused on the extraction of resources that are transferred to "more populous areas near the centre of empire." Although the days of empire are ended and the concept of frontier is now disputed, many
centres of resource extraction such as Fort McMurray and other northern resource communities fit the category of primarily extractive economies.

Environmental historians such as William Cronon also "seek to integrate three broad elements...in new ways of thinking about the West as a region, new ways of approaching environmental history in other times and other places." The first element of the environmental history approach is "the ecology of people as organisms sharing the universe with other organisms." Participants' comments in this study show their varying degrees of awareness about the impact of their work on the environment and the plants, animals, and people in that environment. The development of a more vocal critique of resource development from within the geoscience professions and increased exposure of geoscience students to environmental and ecofeminist studies were earmarked as possibilities for the future.

The second element of the environmental history approach is "the political economy of people as social beings reshaping nature and one another to produce their collective life." Participants' comments also reveal that they are challenged and sometimes troubled by the impact of their work in reshaping rivers, reconstructing the physical terrain, and altering the habitat of fish, wildlife, and people, but not enough to make them give up the work they find professionally challenging and rewarding. Again, the increasing numbers of students being attracted to environmental science programs may result in higher levels of environmental awareness and innovative solutions to cleaning up the unattractive environmental legacies of the past and preventing such occurrences in the present.
The third element of the environmental history approach is "the cultural values of people as storytelling creatures struggling to find the meaning of their place in the world."40 To some extent, participants’ high level of interest in this study and willingness to be interviewed related to their desire not only to tell their own stories, but also to hear other people’s stories, and to have someone try to make meaning out of all their combined histories. Since the focus of geoscientists’ work is the earth, their oral histories do indeed “carry us back and forth across the boundary between people and nature to reveal just how culturally constructed that boundary is—and just how dependent on natural systems it remains.”41

Just as the boundaries between people and nature are cultural constructs, so too are participants’ memories historical constructs revealing multiple truths. Kathleen Weiler quotes Ruth Roach Pierson on contextualizing women’s narratives: “Ruth Pierson cautions: ‘As collectors and recorders of the stories of others, therefore, we cannot accept a woman’s recollections uncritically, that is, unmediated by cultural/historical context. Instead, we need to contextualize women’s narratives, for to be understood they have to be thoughtfully situated in time and place.”42 Telling participants’ stories and placing them into meaningful contexts have been for me one of the most personally rewarding aspects of writing this dissertation.

Are Women Geoscientists Just Glorified Technicians and Assistants?

One of the objectives I identified at the outset of the dissertation was to place the contemporary experience of women in geoscience alongside of the findings of historical patterns identified by Marianne Gosztonyi Ainley. The results of my regional study confirm Ainley’s findings on the early women in geology, but reveal that the patterns are
shifting for contemporary women geoscientists. The review of the historical literature and the exploration of three women’s careers in geology show that the early graduates in geology experienced both “lateral…and hierarchical segregation.” As Ainley suggests, the early women geoscientists in Canada were “channeled into certain areas of science,” and they were often “kept in undervalued, underpaid positions.”

My interview-based study also shows that there are lingering stereotypes that still exist and that women geoscientists have to contend with on a regular basis in field situations. However, my study indicates that Ainley’s conclusion “in geology, with its old associations of masculinity and rugged outdoor activity, career advancement and recognition have remained different for men and women” is no longer the reality for all women in the field. The experiences of the thirty-four participants in my study challenge her 1994 assertion that “women remain glorified technicians and assistants; they rarely work in the field or do high-level interpretive work with computers.” While this point may have been true at one time, my study indicates that many positive changes have occurred in employment opportunities for women in geosciences, particularly in the last fifteen years.

While the study shows that career opportunities for women in the booming Alberta resource industry are very positive, entry experiences in the workplace remain a sobering reminder that social attitudes are slow to change. Having to constantly prove oneself in the field is an additional pressure that women in geosciences face that men in similar positions rarely experience. Although most participants in the study stated that attitudes are only an initial barrier that can be overcome through the demonstration of
professional competence, the necessity of having to do so can be a trying part of geoscientists' early employment experiences.

Whether geoscientists are in the remote Athabasca oilsands or in the boardrooms of the Calgary oilpatch, social attitudes seem to be the slowest part of the job equation to change. While women are gaining senior technical and management positions, lingering social stereotypes and outdated exclusionary practices continue to exist, and women continue to have to work to overcome them. Despite these challenges, a majority of women geoscientists interviewed in the study are experiencing or have experienced fulfilling and financially rewarding careers that go far beyond the role of "glorified technicians and assistants."\(^{47}\)

In considering possible reasons for the differences between Marianne Ainley's findings and my own, I have questioned whether the regional basis of my study has led to more positive findings as a result of the booming resource sector in Alberta. Future studies of a regional nature may help to identify employment patterns for women in geosciences and their success in moving into senior ranks in government, academia, and industry as well as the variations from province to province. I would encourage geoscientists themselves to contribute to the studies of their own professional activities, as many of them already have been doing through their publications in professional journals.

The ongoing challenge for Alberta women geoscientists is to move through the ranks from senior to the top management and CEO positions in industry and to increase the numbers of women on faculty at universities and in senior government positions. Gaining sufficient numbers of women in these areas is a necessary step in breaking the
lingering patterns of male cliques and exclusionary practices and in being able to offer assistance to the next generation. Much progress has been made in this regard and will continue to be made if the commitment and energy of the thirty-four participants in my study are any indication of the future. There are women currently occupying senior positions in government, academia, and industry in the province of Alberta, and they are much more than "glorified technicians and assistants." The next critical step is to increase their numbers.

Directions for Future Research

There is much work that remains to be done in documenting both the work of early Canadian women in science and the work of contemporary Canadian women in science. In conversations with participants in my study, I discussed the difficulties researchers experience in locating sources on the early Canadian women in scientific fields. I also encouraged participants to safeguard their research papers, field notes, and correspondence until they themselves or other researchers have time to write about their experiences. Many participants seemed genuinely intrigued that anyone might be interested in reading about their personal experiences. Canadians scientists in general have not been as prolific writers about their own experiences as American scientists have, nor have biographers and historians jumped in too enthusiastically to fill the void.

The development of new fields of history and the adoption of social science methods made biographies seem somewhat passé for a time, but the pendulum swings in historical writing. Recent historical biographies of individuals in professions other than political life such as Charlotte Gray's *Sisters in the Wilderness: The Lives of Susanna Moodie and Catharine Parr Traill*, Marianne Ainley's *Restless Energy: a biography of*
William Rowan, 1891-1957, and Michael Bliss’s William Osler: A Life in Medicine are excellent examples of this form of historical writing. The writing of such illuminating critical biographies, especially those of women, should be encouraged. As Shulamit Reinharz has commented, “we should not be complacent with oral histories. Women deserve full-fledged biographies and should be encouraged to write their own autobiographies.”

As well as generating critical biographies and encouraging the writing of autobiographies, I would encourage historians to experiment with methodologies such as oral histories, ethnographies, surveys, and other creative ways at getting at the lived experiences of contemporary Canadians. Shulamit Reinharz states that “Biography and oral history have the potential of bringing women ‘into’ history and making the female experience part of the written record. This form of research thereby revises history, in the sense of forcing us to modify previously published accounts of events that did not take women’s experiences seriously.”

Conclusion

The historiography of Canadian women in science and other professional occupations is in its early stages. Although considerable progress has been made by historians and sociologists in recent years in documenting the experiences of women in the professions, there is much that remains to be done. W.P.J. Millar and R.D. Gidney have looked at the records of women medical students; Alison Prentice has researched women in physics and teaching; Ruby Heap has written about women in physiotherapy and household science; Peggy Tripp-Knowles has examined women in forestry; Elizabeth Smyth has explored the topic of women religious; Linda Muzzin, Patricia
Sinnott, and Claudia Lai have looked at women in pharmacy; Sandra Acker has studied women elementary teachers and university professors; Meryn Stuart has examined nurses’ training; Cyndy Allen and Margaret Conrad have explored the world of chartered accountants in Nova Scotia, and there are many others contributing to the scholarship in these areas. However, time is of the essence, particularly in relation to sources for the early contributors in professional areas. Many valuable papers and records of women’s activity have already been lost, and they will continue to be lost unless proactive measures are taken. As historians, sociologists, and researchers, we need to do a better job of informing professional women about the value of their personal correspondence and private research papers and encouraging them to write about their own experiences.

In addition to scholars engaged in research on specific areas of women’s professional activity, the field of women’s studies needs scholars interested in working on a comprehensive history of Canadian women in science, such as the work that Margaret W. Rossiter has accomplished on women in United States. The field also needs scholars to contribute regional studies such as the one I have undertaken in this dissertation. As well as researching women in the professions, historians and sociologists could broaden their horizons to examine all the occupational areas that have provided employment for women, including traditional and non-traditional areas.

In my community, for instance, many women operate heavy equipment in the oilsands industry and drive mammoth-sized vehicles such as 240 tonne heavy haulers. These women are breaking new ground in non-traditional career areas and are earning salaries that are equivalent to those of engineers. Their stories deserve to be recorded.
Expanding the range of activities we study and dispensing with the artificial distinctions between professions, semi-professions, and occupations and the artificial divisions between academic disciplines would go a long way toward making the histories we write more inclusive and more relevant to the lives of ordinary people. These are tall orders for the small community of scholars currently working on topics related to women’s work and the professions in Canada. In order to accomplish these objectives, the field needs to attract a new generation of scholars who are interested in learning about and critically examining the multiple truths of women’s professional and other occupational experiences.

To the extent that this study of Alberta women in geosciences serves the threefold purposes of exploring women’s professional lives, interesting readers in contributing to the history of women in science, and encouraging young women to enter the fields of science and technology, it will have been a useful exercise. The Personal Narratives group comments that “Traditionally, knowledge, truth, and reality have been constructed as if men’s experiences were normative, as if being human meant being male. *Interpreting Women’s Lives* is a part of a larger human effort to undermine this partial construction and to create a more inclusive, more fully human conception of social reality.” If my work on women geoscientists in Alberta contributes to creating a “more inclusive, more fully human conception of social reality,” it would be an additional bonus to the accomplishment of the above-stated objectives and would contribute in Florence Bascom’s words to “a joy beyond expression.”

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3 Ibid., 28.
5 Ibid., 641.
6 Ibid., 641.
8 Ibid., 262.
10 Ibid., 653.
17 Ainley, introduction to Despite the Odds, 20.
18 Ibid., 21.
19 See Margaret W. Rossiter, Women Scientists in America: Struggles and Strategies to 1940 (Baltimore: Johns Hopkins University Press, 1995).
29 Miller, *The Frontier ‘Cowboy’ Myth and Entrepreneurialism in the Culture of the Alberta Oil Industry*, iii.
30 Ibid., 138.
33 Ibid., 28.
36 Ibid., 10.
38 Ibid., 32-33.
39 Ibid., 32-33.
40 Ibid., 32-33.
41 Ibid., 32-33.
43 Marianne Gosztonyi Ainley, “Women’s Work in Geology: A Historical Perspective on Gender Division in Canadian Science,” *Geoscience Canada* 21, 3 (September 1994), 140.
44 Ibid., 140.
45 Ibid., 141.
46 Ibid., 141.
47 Ibid., 141.
48 Ibid., 141.
53 See Millar and Gidney, “‘Medettes’: Thriving or Just Surviving? Women Students in the Faculty of Medicine, 1910-1951,” in *Challenging Professions*, eds. Smyth et al.: 215-233.
63 Ibid., 3.
64 Smith, The Stone Lady, 33.
APPENDIX I

RESEARCH PROTOCOL

BACKGROUND INFORMATION
S1. Name and Age
S2. Professional Designation(s)
S3. University Affiliation(s) and Date of Last Degree
S4. Place(s) of Employment
S5. Professional Affiliations

ENTRY EXPERIENCES
S6. What factors encouraged you to enter the geosciences?
S7. To what extent did your upbringing or early socialization have an impact on your choice of career path?
S8. To what extent were the professions of your parents influential in your choice of career?
S9. To what degree was your family supportive of your career goals? If so, how was this support demonstrated?
S10. How have political, social, economic, or scientific events played a factor in your decision to pursue a career in the geosciences?
S11. How would you describe your university experiences in terms of professional socialization, academic climate, and mentoring?
S12. To what extent have you experienced social or intellectual isolation or feelings of exclusion from your professional group in either your university education or in your career?

CAREER OPPORTUNITIES
S13. How would you describe your opportunities for career and professional advancement?
S14. How have your opportunities for career and professional advancement improved or declined over the course of your career? What circumstances do you think contributed to these changes?

S15. How have your personal life (i.e. marital status and/or family responsibilities) and career development intersected?

S16. To what extent (if any) have you experienced lateral segregation (being channeled into certain areas in the geosciences) in your career?

S17. To what extent (if any) have you experienced hierarchical segregation (being kept in undervalued, underpaid positions) in your career?

**PROFESSIONAL IDENTITY OF WOMEN GEOScientISTS**

S18. To what extent do you think the professional image of women geoscientists has changed over the course of your career? To what extent are environmental issues a factor in changing images?

S19. How has your own identity or self-image as a woman geoscientist changed over the course of your career?
APPENDIX II

LETTER OF INFORMED CONSENT

117 Signal Bay
Fort McMurray AB T9H 3R6
Edmonton Phone: 488-0337

{Date}

{Participant’s Name}
{Street Address}
{City, Province Postal Code}

Dear {Participant’s Name}:

I am requesting your participation in a study of women geoscientists in Alberta working in the resource industry, government research, and academia. I am a student at the Ontario Institute for Studies in Education of the University of Toronto, and I am currently working on my doctoral thesis in the Department of Theory and Policy Studies in Education. Your participation in this study would assist me in compiling the data to complete my research.

My thesis is titled “Alberta Women in the Field: Geologists, Geophysicists, and Geological Engineers in the Resource Industry, Government Research, and Academia, 1914-1998.” In the thesis, I propose to examine the changing nature of the entry experiences, career opportunities, and professional identities of women geoscientists working in the three areas of the resource industry, government research, and academia in the time period of 1914 to 1998. I am interested in three specific research questions: What factors encourage women to enter the geoscience fields, and how do their entry experiences vary? Under what circumstances do women’s career opportunities in the geosciences improve or decline? In what way does the professional image or identity of women geoscientists change over time, and how does their self-image correspond to the professional image of the geoscientist presented in the literature of the professional organizations and the newspapers of the period?

In a semi-structured interview of 60 to 90 minutes, I would like to ask you some questions about your entry experiences, career opportunities, and professional identity as stated in the previously mentioned questions. I will send participants a preliminary list of interview questions prior to our meeting. With your permission, the interview will be tape-recorded, and I will take notes. The tapes will be transcribed as required. You may choose to withdraw from the research project at any time, either before, during the interview, or after it has been completed. In addition, you may request that the tape-recorder be turned off so that you can speak “off the record,” or you can refuse to answer particular questions. Care will be taken to ensure that participants will not be identifiable in any written or oral reports resulting from this research. Names and places of employment will be replaced by pseudonyms or codes, and cross-cutting themes rather than individual narratives will be employed to ensure that participants are not identifiable. There will
be no attempt on the researcher’s part to evaluate your work, your career, or your views. Raw data, tape-recordings, and transcripts will be kept in confidential locked files by the researcher, and as the researcher, only I will have access to this data.

I am very grateful for your assistance with this research project, and I would be happy to answer any questions you may have regarding the project or the interview process. You may contact me through one of the following options: by phone at home at 1-403-743-0253; at work at Keyano College at 1-403-791-8946; by e-mail at work at Cynthia.O'Donnell@keyanoc.ab.ca or at home at nodonnel@telusplanet.net. Please indicate your consent to participate in the research by signing the tear-off sheet and returning it to me at the interview.

Sincerely,

Cynthia O’Donnell
Doctoral Student
Department of History of Education
Ontario Institute for Studies in Education/ University of Toronto

I have read the letter describing the research being conducted by Cynthia O’Donnell on women geoscientists in Alberta, understand the procedures and safeguards outlined, and agree to participate.

Date: __________________________

Name: __________________________

Signature: ________________________
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