

Mining, Minerals and Sustainable Development North America

Industry in Transition

A Profile of the North American Mining Sector

Alistair MacDonald
Talmac Consulting

iisd International Institute for
Sustainable Development
Institut International du
Développement Durable

 **MMSD**
NORTH AMERICA

Mining, Minerals and Sustainable Development North America

Industry in Transition

A Profile of the North American Mining Sector

Alistair MacDonald
Talmac Consulting

The International Institute for Sustainable Development contributes to sustainable development by advancing policy recommendations on international trade and investment, economic instruments, climate change, measurement and indicators, and natural resource management. By using Internet communications, we report on international negotiations and broker knowledge gained through collaborative projects with global partners, resulting in more rigorous research, capacity building in developing countries and better dialogue between North and South.

IISD's vision is better living for all—sustainably; its mission is to champion innovation, enabling societies to live sustainably. IISD receives operating grant support from the Government of Canada, provided through the Canadian International Development Agency (CIDA) and Environment Canada, and from the Province of Manitoba. The institute receives project funding from the Government of Canada, the Province of Manitoba, other national governments, United Nations agencies, foundations and the private sector. IISD is registered as a charitable organization in Canada and has 501(c)(3) status in the United States.

Copyright © 2002 International Institute for Sustainable Development and Alistair MacDonald (Talmac Consulting)

Published by the International Institute for Sustainable Development

All rights reserved

Copies are available for purchase from IISD.

National Library of Canada Cataloguing in Publication Data

MacDonald, Alistair, 1972-

Industry in transition

Includes bibliographical references.

ISBN 1-895536-52-9

1. Mineral industry--North America. I. International Institute for Sustainable Development. II. Title.

TN22.M32 2002 338.2'097 C2002-910318-5

International Institute for Sustainable Development

161 Portage Avenue East, 6th Floor

Winnipeg, Manitoba

Canada R3B 0Y4

Tel: +1 (204) 958-7700

Fax: +1 (204) 985-7710

E-mail: info@iisd.ca

Internet: <http://www.iisd.org>

Industry in Transition was designed by Donald Berg.

Printed by Unigraphics Manitoba Ltd. (<http://www.unigraphics.mb.ca/>), Winnipeg, Manitoba.

Cover photography: Left and centre photos by Tamra Rezanoff. Right side photo courtesy of IAMGOLD Corporation.

Acknowledgements

Resources

The following companies have contributed to MMSD–North America through their sponsorship of MMSD Global. Those with North American interests are bolded and italicized; those who are members of the Mining Task force of the World Business Council of Sustainable Development are marked with an asterisk. MMSD Global has also received support from governments, international agencies and universities.

*Anglo American plc**

Alcan Inc.

Alcoa Inc.

Anglovaal Mining Ltd.

Barrick Gold Corporation

*BHP Billiton**

*Codelco**

De Beers Group

EDM/Somincor

Freeport-McMoRan Copper and Gold Inc.

Gold Fields Ltd.

Lonmin plc

MIM Holdings Ltd.

Mitsubishi Materials/Mitsubishi Corporation

Mitsui Mining & Smelting Co. Ltd.

*Newmont Mining Corporation**

Nippon Mining & Metals Co. Ltd.

*Noranda Inc**

Normandy Mining Limited

Norsk Hydro ASA

Pasminco Ltd.

*Phelps Dodge Corporation**

*Placer Dome Inc.**

*Rio Tinto Group**

Sibirsky Aluminium Group

Sumitomo Metal Mining Co. Ltd.

Teck Cominco Metals Ltd.

WMC Limited*

In addition to the above, the following have provided support specifically earmarked for MMSD–North America:

Greater than US\$25,000

Natural Resources Canada (Ottawa)

Knight Piésold Ltd. (Vancouver)

US\$10,000

AMEC Simons Mining and Metals (Vancouver)

Bechtel Corporation (San Francisco)

Coudert Frères (Montreal)

ESG International (Waterloo)

Gallagher & Kennedy (Phoenix)

Geomega (Boulder)

Golder Associates (Toronto)

McCarthy Tetreault (Toronto)

Newmont Mining Corporation (Denver)

North American Palladium Ltd. (Toronto)

SENES Consultants Ltd. (Toronto)

URS Corporation (Phoenix)

US\$2,000 – \$10,000

Beak Consultants Inc. (Toronto)

CAMECO Mining Corporation (Regina)

KPMG (Vancouver)

Acknowledgements

I started studying the “risky business” that is the global mining industry about four years ago. In that time, I have met with countless people devoted to the promotion of mining, and many individuals who have harnessed all their energies to controlling the effects of mining on this and future generations. While there is often little “middle ground” to claim in these complex debates, I am heartened by the mere fact that groups on both sides of the debate over mining (if only it were so simple as to have just two sides!) have almost always been willing to discuss these matters with me in sensible dialogue. I would like to thank all of the individuals and groups I spoke with while working on the project. My sincere hope is that the openness with which I have been received (as an outsider to the mining industry and organized civil society groups) will eventually be the norm for all stakeholders in the mining “game.”

Special thanks have to go out to several groups and individuals. To Tony Andrews at PDAC, Mike Marchand in Calgary, and the folks at Natural Resources Canada in Ottawa, all of whom sponsored roundtable meetings. To Tony Hodge, Dirk van Zyl, Ian Thomson and other members of MMSD–North America, for choosing me to present this picture of the North American mining sector. To the folks who slogged through various drafts of this work: Peter Dietrich (and for putting me up when in Toronto), John McDonough and Leigh Freeman. To the corporate sponsors of the overall MMSD initiative and MMSD–North America: kudos for funding research that might in years past have been considered too provocative by the industry. In an information economy, openness, transparency and legitimacy are the hallmarks of the forward thinking.

As always, thank you to MzT for putting up with me through long nights and early mornings.

Alistair MacDonald
Talmac Consulting
March 2002

Preface

In 1999, nine Chief Executive Officers of some of the world's largest mining companies came together in Davos, Switzerland. Driven by a concern that a disconnect had emerged between mining/minerals-related practices and the values of today's society, they voiced a concern that their "social licence to operate" was in jeopardy.

Working through the World Business Council on Sustainable Development (WBCSD), they subsequently commissioned the International Institute of Environment and Development (IIED, London) to undertake a global review of practices related to mining and minerals. The resulting project, "Mining, Minerals and Sustainable Development (MMSD)," has been driven by the following four goals:

1. to assess global mining and minerals use in terms of the transition to sustainable development—its track record in the past and its current contribution to and detracting from economic prosperity, human well-being, ecosystem health and accountable decision-making;
2. to identify if and how the services provided by the minerals system can be delivered in accordance with sustainable development in the future;
3. to propose key elements of an action plan for improvement in the minerals system; and
4. to build a platform of analysis and engagement for ongoing cooperation and networking between all communities of interest.

As part of its delivery mechanism, MMSD Global created a suite of regional activities with partners operating in Southern Africa, South America, Australia and North America. In North America, the International Institute for Sustainable Development (Winnipeg) has served as the regional partner working in concert with the Mining Life-Cycle Centre, Mackay School of Mines, University of Nevada, Reno.

For its part, the participants of MMSD–North America opted to pursue five tasks in discharging their mandate:

Task 1: Story/Profile

Objective 1A: to develop a profile of the North American mining industry (U.S. and Canada) from the perspective of the nature of the companies that comprise the industry.

Objective 1B: to articulate the contribution and implications of mining (to people and their communities, to ecosystems, to economies) through the eyes of various communities of interest and as it has changed over time.

Task 2: Test/Guideline for Sustainability

Objective 2A: to develop a set of *practical* principles, criteria and/or indicators that could be used to guide or test the exploration for, design, operation and performance monitoring of individual, existing or proposed, operations in terms of their compatibility with concepts of sustainability.

Objective 2B: to suggest approaches or strategies for effectively implementing such a test/guideline.

Task 3: Agenda for Change

Objective 3: to collaboratively develop an "Agenda for Change" comprising specific actions and timelines for the North American mining industry and related communities of interest to meet in moving towards sustainable development.

Task 4: Scenarios

Objective 4A: to develop of a set of scenarios that bracket the likely futures to be faced by the North American mining and minerals industry and the related communities of interest.

Objective 4B: to use the scenario-building exercise as a means to identify and discuss:

- risks and opportunities;
- issues, challenges and areas of consensus and disagreement on their resolution; and
- potential prescriptions (aimed potentially at any or all of the communities of interest) for adjusting mining- and minerals-related policy, practices, behaviour and infrastructure.

Task 5: Final Report

Objective 5: to synthesize and communicate the results of MMSD–North America.

Contents

1. Executive Summary	1
1.1 Research Methods	1
1.2 Comparison of the U.S. and Canadian Mining Sectors	2
1.3 Corporate Culture(s) and Sustainability in Mining	3
1.4 Key Issues Identified by the North American Mining Sector	4
1.5 Future Directions for Research and Action	5
2. Introduction	7
2.1 Background – MMSD	8
2.2 Purposes of the Project	8
2.3 Limitations of the Report: A Comment on Methods and Commodity Types	9
2.4 Structure of the Report	10
3. Methodology	13
3.1 Analytical Methods	13
3.1.1 Database Structures and Replicability	13
3.1.2 Utilization of External Data Sources	14
3.1.3 Roundtable/Interview Respondents and Question Types	14
3.1.4 Content Analysis of Annual Reports	15
3.2 Conceptual Framework	15
3.2.1 What is a Mineral Production System?	16
3.2.2 Other Definitional Issues	21
4. The Canadian Mineral Production System	23
4.1 Introduction to the Canadian Mining Industry	23
4.1.1 History of Mining in North America	23
4.1.2 Changing Role of Mining in the Canadian Economy	23
4.1.3 Non-Focus Sectors (Industrial Minerals, etc.)	24
4.2 The Structure of the Canadian Metals Mining Sector	27
4.2.1 Home Places	27
4.2.2 Firm Size	33
4.2.3 The Production System Defined – The Population Pyramid	35
4.2.4 Organizational Focus	40
4.2.5 Inter-firm Relationships	47
4.2.6 Investment Patterns	54
4.3 Changing Nature of Risk in a Globalizing Industry	59
4.4 The Role of Governments and Other Stakeholders – Industry Perceptions	63
4.5 Summary of Major Issues Exposed	68

5. The U.S. Mineral Production System	71
5.1 Introduction to the U.S. Mining Industry	71
5.1.1 Special Limits Placed on This Analysis	71
5.1.2 History and Role in the National Economy	71
5.1.3 Focus on the Industrial Minerals	72
5.2 The Structure of the U.S. Metals Mining Sector	73
5.2.1 Mapping Home Places	73
5.2.2 Firm Size	75
5.2.3 The System Defined – The U.S. Population Pyramid	76
5.2.4 Organizational Focus and Inter-firm Relations	77
5.2.5 Investment Patterns	78
5.3 Major Issues Identified by the U.S. Mining Sector	82
5.3.1 Public Perception, Public Policy and Mining	82
5.3.2 Key Issues for Discussion	84
6. Comparing the Canadian and U.S. Mining Sectors	87
6.1 Summary of the Canadian Mining Sector	87
6.2 Summary of the U.S. Mining Sector	90
6.3 Comparison of the Canadian and U.S. Mining Sectors	91
6.3.1 Quantitative Comparisons	91
6.3.2 Qualitative Comparisons	93
6.4 Is There a “North American Mining Sector?”	95
6.4.1 Global Portals; National Image; Local Communities	96
6.4.2 Global Mining Consolidation: Patterns and Impacts	97
7. Dealing with “Sustainability”: Promise and Peril for the North American Mining Sector	101
7.1 Introduction to Sustainability Issues in Mining	101
7.2 Mining and Sustainability – A Maturation Process	102
7.2.1 The Large Firm Sector and Sustainability	102
7.2.2 Small and Medium-Sized Firms and Sustainability	105
7.2.3 Sustainability and the Mineral Production System	107
7.3 Remaining Sustainability Issues for Mining	109

8. Conclusions	115
8.1 Issues and Trends Identified in the “North American Mining Sector”	115
8.2 Spotlight on MMSD’s “Big Eight” Topics and the North American Mining Sector	119
8.3 Current Areas of Concern for Different Firms in the Mineral Production System	122
8.4 Big Issues for the Corporate Mining Sector Coming into the New Millennium	126
8.5 Concluding Remarks	126
Appendices	
Appendix 1: Glossary of Acronyms	129
Appendix 2: Largest Canadian Metals Mining Companies, 1996–2000	131
Appendix 3: USMS Database–Structures and Findings	132
Appendix 3a: Key Statistics from the USMS Sample Database	133
Appendix 3b: Explaining the Database Structure	136
Appendix 4: Global Mining Sector – Firm Size and Organizational Focus	138
Bibliography of Sources	139

I. Executive Summary

Mining, Minerals and Sustainable Development North America (MMSD–NA) has conducted research into North American mining to determine the nature of its corporate structures and how they relate to the global industry and to sustainability. This report is the result of a three-month analysis of this North American Mining Sector (NAMS). The NAMS is defined here as all publicly traded mining firms with their head offices located in the United States or Canada.

I.1 Research Methods

The research methodology was fivefold:

1. Data, methods and concepts from a previous exhaustive, qualitative and quantitative study on the movement of Vancouver-based mining sector (VBMS) firms to Latin America (MacDonald: 2000a) were used as a conceptual guide and, where applicable, to highlight key NAMS issues;
2. Quantitative data was collected from as many secondary sources that analyze portions of the NAMS as possible;
3. In-depth corporate interviews (36 in total, including 17 from the previous study) and three roundtables with NAMS firms were conducted in Vancouver, Toronto, Ottawa and Calgary, and by telephone with key mining industry contacts in the United States. The topics ranged from issues of corporate culture to the changing nature of the industry, encompassing the breadth of the major issues that industry members were concerned about. Participant feedback thus forms much of the substance of this report;
4. Annual reports from over 300 mining firms were examined to establish and supplement the author's understanding of the industry and its members, and to provide key anecdotal, structural and financial data; and
5. Because of the limited corporate analysis available of the USMS, a statistical database of U.S. mining sector (USMS) firms was created, similar to one created for Canadian firms in the previous study.

The resulting blend of qualitative and quantitative data allows this study to offer a holistic picture of North American mining while zeroing in on specific target issues with detailed analysis. All of the findings have been filtered through a two-part conceptual framework emphasizing that:

1. The NAMS (or sub-sectors therein) can be described as an integrated *production system*, rather than as a loose collection of parts only weakly related by the fact they are involved in the same industry. The concept of mining as a production system implies that all member firms, from large to small, accept that they are linked inexorably to each other not simply by their place in the production chain, but also in the perceptions of external parties. Thus,
2. Determining the promise and peril for the industry from the rising need to address “sustainability” *demands* that all types of mining-related corporate actors be examined, and the linkages between them identified and where need be, solidified. The study shows that when viewed as a production system, the Canadian and American industries have fundamental disconnects among different stakeholders on issues that, until rectified, will hold back progress toward sustainability.

1.2 Comparison of the U.S. and Canadian Mining Sectors

The United States is the world's leading mining country, when measured by production value. Despite this, the number of mining companies based in the United States is relatively small compared to that of Canada. Much of the difference in competitive strength can be attributed to these factors:

- **Economic:** Access to vibrant venture capital pools is unquestionably the number one factor in Canada's corporate dominion. As the world's dominant country for exchanges focused on raising mining finance, Canada is home to more publicly-listed mining companies than the rest of the world combined.
- **Political:** Mining plays a much more important role in the Canadian economy than it does in the U.S. Mining is almost a forgotten industry in the U.S., overshadowed by the profile, size and success of other sectors. As a result, mining's environmental impact more than overwhelms its economic value in the perception of the American public. Politically, mining is viewed by many as a "pariah industry" in the U.S.
- **Historical and Geographic:** Canada has a long mining tradition and a multitude of different mineral types distributed across the country. This rich geological tradition has attracted capital and expertise from other countries that have subsequently taken root in Canada. In addition, Canada, more so than the U.S., has retained strong resource-based economic roots over time.
- **Corporate Culture:** All of the above elements and others have led to the development of a strong corporate culture of mining in Canada, an advantage that builds its own momentum.¹ While there are obviously differences in the characteristics and strategies of individual mining firms, there are also essential similarities in the way they are geared to react to each other and the "outside world" that need to be better understood. Canadian mining has developed a reputation, a skilled workforce, an experience base, internal communications methods and mechanisms for self-rejuvenation that have made it a continued world power in the industry. Many of these skills are argued to be related to the unique support mechanisms and information pathways of the Canadian "home place."

Thus, the domestically-controlled corporate sector of the Canadian mining industry is a much larger and more internationally competitive mineral production system than that of the U.S. Indeed, as of 2000, more than one half of the work (in particular at the exploration stage of development) done in the U.S. is by Canadian-based firms. It is tempting then to describe the United States mining sector (USMS) and the Canadian mining sector (CMS) as weak sister and big brother, respectively. This would be a mistake, however, as defining mining sectors solely by nationality is an illusory exercise in today's world. The mining industry is becoming increasingly global. There is very little to differentiate a Canadian firm from an American firm through their corporate agenda, size and activities. Indeed, there is often some debate over whether defining a mining company by its "home place" (its head office or country of origin) has merit in one of the world's most dispersed of industries. In addition, the very attributes that have previously made Canada attractive to mining companies are now being adopted by other countries around the globe, and are also being challenged by changing attitudes among the Canadian public and polity, and indeed among mining companies themselves, many of whom are questioning the future role of Canada as a home place for mining.

The public does not seem to differentiate very much between U.S. and Canadian firms nor, in fact, between firms large and small regardless of nationality. This is problematic, because there are different corporate cultures and fiscal drivers that motivate the *action* and *reaction* spaces² of junior and senior firms. More important in the future than com-

paring the nationality of firms will be understanding the needs and niches filled by different sizes of firms in the global mining industry.

1.3 Corporate Culture(s) and Sustainability in Mining

The corporate cultures of different sized and variously focused mining companies are highly differentiated, leading to gaps in their ability to react to changing political, social and economic climates. For example, while there are some firms that have the resources and the mindset to focus on “best practices” and public consultation in their projects, there are many more for whom such terms are foreign or create negative images solely associated with higher costs. Broken down by company size, the most important disconnections between prevailing corporate cultures and the ability to act sustainably are:

- Junior exploration companies often lack the managerial capacity, experience and financial ability to engage local communities in a dialogue about the nature of their work at the initial exploration stages of development. This can lead to misunderstandings and long-term grievances from what otherwise could be minute, easy-to-handle issues. Developing strategies to communicate with locals effectively often receives short shrift because a distinct corporate culture—emphasizing the maintenance of a relatively low profile amongst locals as part of an overall “flying under the radar screen” attitude to initial exploration projects—is engrained in the mindset of most juniors. Indeed, the ability to get into and out of successive areas quickly and with least resistance has been considered essential in the past to success among juniors;
- Mid-sized mining companies (“expansionary” juniors and intermediates) are often involved in the most highly publicized negative situations, environmentally and socially. This is often because they are in a transitional stage between junior explorationism and senior extraction, where the learning curve is very steep, as is the punishment for mistakes. The lack of financial flexibility and mining experience within the firm are also major hurdles to success and the ability to respond to changing risk environments; and
- Senior mining companies are the ones that seem to have embraced the principles of sustainability with the most gusto, yet they are burdened with several major issues: dealing with the loss of reputation capital (often) attributable to the actions of smaller firms; finding the line between offering benefits to communities and becoming a “quasi-governmental entity”; and increasing corporate pressures to grow and consolidate. Lost in the shuffle is the need for senior firms to instill the values of sustainability throughout the corporate entity, rather than have sustainability policies espoused mainly by upper managers.

Corporate culture generally is broken down into junior, intermediate and senior firm cultures, but there are more subtle divisions in size, activity types and corporate mindset that can further distinguish between firms exposed in this report.

In order to overcome difficulties in dealing with sustainability issues, the global mining industry as a whole has to create an integrated understanding of what needs to be done at each level of the mineral project life cycle to contribute to sustainability. The inability to do so up until this point can be attributed to a lack of study of *fundamental connections* and *fundamental disconnects* among many of the stakeholders involved. Key among these is greater linkage between junior and senior company interests at the policy formulation level and more research devoted to understanding mining as a production system, with a firm-centric analytical focus rather than the current focus on production levels and holistic social and environmental concerns about mining. Local sites and situations have to be the priorities of firms and other stakeholders in mining debates.

1.4 Key Issues Identified by the North American Mining Sector

This is a scoping document for the NAMS only and, as such, cannot claim to cure the industry's ills. To do so would be premature, and the reliance on a single set of voices contributing to the “future of mining” debate—the corporate sector—is not acceptable. Finding common ground *within and outside* of the industry is going to be the essential ingredient in the transition to a more open and responsive corporate culture. What can be offered, however, is a series of “spotlights” on issue areas that need to be addressed in further Mining, Minerals and Sustainable Development/Global Mining Initiative (MMSD/GMI) research, discussion and analysis.³ These spotlights are meant to illuminate areas where conflicts can be triggered by any of a series of “*fundamental disconnects*” among different actors over issues relating to the minerals industry. They come up repeatedly in discussions with industry contacts, and need to be among the first areas examined by further study. They include:

- the relationship among—and competing needs of—junior, mid-sized and senior firms in the mineral production system. For example, the professional mindset that guides the corporate culture of the firm may be on entirely different timelines and wavelengths for a senior producer and a junior explorer. The senior firm often seeks input from locals and searches for mechanisms to create a positive social environment around the mine. In this fashion, many seniors have seen sustainable development as a value-adding—or at least, a risk-reducing—mechanism. Juniors usually have short-term horizons, and many just want to “fly under the radar” until their initial explorations are complete. Despite these differences, the firms are intimately related through the “project pipeline”;
- the juxtaposition of the need to enhance the overall reputation of the industry and the need to maintain the healthy variation in the corporate cultures of different-sized firms. The junior sector and its regulation, especially, needs to find middle ground between the stifling of entrepreneurialism (the current “paralysis by over-regulation”) and increasingly negative public opinion created by the sensationalized cases of “poor practices”;
- the public perception of mining (generally benign or positive in Canada and overwhelmingly negative in the U.S.) and the image projected in the popular media (generally negative/sensationalized regardless of constituency) need to be addressed proactively by the industry.⁴ There is a disconnection between the mass of information available about the role of the mining industry in economy, polity and society, and the perceptions about the industry. The industry’s message just doesn’t appear to be getting through, or is often presented in simplistic forms that do not appeal to today’s more attuned populace;
- the perception of the role of the mining company, in the eyes of the firm and the eyes of the local communities with which they interact. There are mindset differences between the needs of companies to focus on the “site,” and the demands of local communities that explorers and miners attend to the “situation” around the site;
- the definitions of sustainability among mining companies and interest groups. The NAMS has a vision of sustainable development that needs to be articulated. The member firms believe that the “three-legged stool” (environmental, economic and social) of sustainable development has been built with two strong legs and a withered one. The weaker leg has been economic viability, which the industry feels has been sacrificed unfairly and unfeasibly. Sustainability for mining needs to recognize and incorporate the fundamental driver of the publicly-traded mining company—the generation of profits and value added for shareholders;

- one of the most serious and far-reaching aspects of these fundamental disconnects, and indeed the root cause in many cases, is that mining is almost always a market-system industry. This is disconnected from the planning-system needs of sustainable development and local consultation and participation;
- the paradox of Canada's role as a globally dominant mining country and a potential victim of its own success. This argument examines the declining importance of domestic "home places," with them being replaced by what one industry insider calls "international portals"; and
- a disconnection between the capacity of firms to "go international"—an increase in their action spaces—and their capacity to adapt their corporate culture to maintain long-term positive interaction with these new international interests ("stay international"), or their reaction space. Changing risks often prove just as hard to handle abroad as they are in the "home place," perhaps more so because of unfamiliarity with the cultural, political and legal structures in these foreign countries.

1.5 Future Direction for Research and Action

This study, while focusing on the North American mining sector, isolates several major issues facing the increasingly inter-connected global mining industry. From this brief examination, several areas of future research needs at this global level have surfaced, including:

- the need to create a self-sustaining research organization that focuses not solely on industry-wide quantification of production and exploration trends, but examines individual firms and the relationship between them and other stakeholders. The real trick here is that the research "engine" cannot be perceived to be a tool for the industry to propagate its own positive vision of its activities; this needs to be a credible, independently run organization. Credibility with the public is the key here;
- highlighting the mining industry's need to focus on isolating "best practices" and the value created by acting in a sustainable fashion in order to light the path toward sustainable mining. This involves devoting more attention to "sustainability" not only as a cost and a requirement to change public perception and policy, but as an essential value-adding mechanism of the successful modern mining corporation;
- examining the mining industry as a "mineral production system" rather than arbitrarily divorcing the activities of individual firms. For example, the exploration "industry" needs to be re-conceptualized as a research and development arm for the overall mining industry and therefore treated as an integral part of it;
- more examination of the risks that face mining firms and how these risks—and how they are perceived—limit the action spaces of firms. The creation of norms of practice and corporate policy for all aspects of project development through the mineral production chain—to which the industry should aspire—demands recognition of the changing risk environments that limit the actions and reactions of individual firms at any given time within the system; and
- examination of the movement toward globalization in mining, and what effects this has on the ability of the industry to adapt "across the board" to speed bumps on the road to sustainability.

Endnotes

- 1 Corporate culture is a term often used to refer to information flows, social and political values, and other aspects of the way *an individual* corporation works and presents its face to the outside world. In this instance, we are looking at the mining industry as having a discernible corporate culture at a holistic, industry-wide level, as well as breaking down differences in corporate cultures based on firm size, organizational focus, “home places,” etc. A more in-depth definition of mining corporate culture is presented in Chapter 2.
- 2 A company’s *action space* is the investment boundaries it places on itself due to the knowledge, financial capacity and corporate agenda of the firm. Similarly, a company’s *reaction space* is its ability to react to (often rapidly) changing variables in its business environment, constrained of course by the same set of conditions as the action space.
- 3 And beyond the MMSD/GMI lifetime of course. With their limited time mandates, these initiatives will in 2002 be passing on the torch to other initiatives and/or organizations to forward the debate. It is to these actors that this report speaks to in the long run.
- 4 The mining industry has often been criticized for its reactive public engagement strategies, accused of “closing ranks” when there are public concerns over environmental or social issues at the minesite or industry wide level. In addition, most of the public relations work done at the industry level has been “preaching to the converted”—distributing information to people already actively supportive of the industry—rather than reaching out to new audiences.

2. Introduction

"Their lamp-lit world down there is as necessary to the daylight world above as the root is to the flower... More than anyone else, perhaps, the miner can stand as the type of the manual worker, not only because his work is so exaggeratedly awful, but also because it is so vitally necessary and yet so remote from our experience, so invisible, as it were, that we are capable of forgetting it as we forget the blood in our veins." - George Orwell in *The Road to Wigan Pier* (1958)

"A mine is a hole in the ground with a liar on top." - attributed to Mark Twain, successful novelist and failed prospector in 1860s Nevada (Twain: 1872)

The words of Orwell and Twain are not chosen here to offer a trite commentary on the state of mining. Rather, they were chosen because they represent the highly—if not hopelessly—convoluted nature of the debate over mining's (and miners') role in society and in sustainable development. Although couched in the language of "sustainability" in recent times, there has long been a debate over the costs and benefits of mining. In recent years, the *costs* are typically measured not so much in human sweat and hardship, as was the case in Orwell's exaggeratedly awful work in the British coal mines of the 1930s. Rather, they are now measured more by the unsightly and often environmentally damaging mine life cycle that starts with exploration and continues long after the closure of the minesite (if ever). Increasingly, the costs are also measured in social dislocation, economic alteration and environmental disengagement of local communities from their natural surroundings, particularly in less developed regions.

The *benefits* are Orwell's "blood in our veins"—the minerals and metals that provide for the standards of living the modern world either has or longs after. That minerals and metals are absolutely necessary for the sustenance of human life is not in question. Rather, what is questioned are the methods used to find, extract and refine these materials.

And yet, behind these questions and demands the general public knows little about the corporate sectors that drive the industry. While the bitter critique levelled by Mark Twain some 130-odd years ago could still pass for much of public opinion, most could not explain much beyond a visceral dislike for environmental degradation. There is just not enough credible information made available to the public. And what information is available is generally wrapped up in competing innuendoes, generally reactive in nature, and certainly lacking in the transparency and legitimacy that the public demands and expects in an information age. Mining is often an easy target for criticism because of the visibility of its costs versus the seeming invisibility of its benefits; a necessary evil that is a remnant of "smokestack society" to be tolerated "over *there* but not-in-my-backyard (NIMBY)."

This report is an attempt to start building a bridge across this credibility gap. It provides neither defence nor damnation of mining; rather it is an examination of the industry that seeks to break down the structures inside its corporate sector in more detail than has previously been attempted. Why? To reach dual audiences, both of which can benefit from a more detached perspective. In part, to shed a little light on this world "invisible" to the general public; in part, to put some popular perceptions of the industry to the analytical test. And in large part, to cause industry members to take a look at themselves and their role in seeing mining become more sustainable.

This report starts with the credo that mining is neither good nor ill—it simply is. Without it, the modern world could not function; how future mining practices and policy are managed is up to our ability to better understand the structures that make up the industry. The corporate sector of the mining industry has much to tell us, and much to learn. This corporate monologue is hoped to contribute to future substantial dialogue among *all* stakeholders.

Based on current mineral consumption, each North American will require over a lifetime about 800 pounds of lead and zinc, 1,500 pounds of copper, 3,600 pounds of aluminum, 14 tons of clays and salt, 16 tons of iron and over 600 tons of stone, sand, gravel and cement (Natural Resources Canada: 1995).⁵

"Double Standard: What happens when Canadian mining companies go abroad?" - Headline in *The Peak*, Simon Fraser University's student newspaper (March 20, 2000), with an accompanying picture of the horrible working conditions at an open pit gold mine in Brazil. Unfortunately, the picture is of a non-Canadian garimpeiro (or peasant miner) operation

"We often talk about working on getting information to the public. What we need to differentiate more is the key role of perceptions, not just information." - Exploration Manager of a junior firm

2.1 Background – MMSD

Mining, Minerals and Sustainable Development (MMSD) is an independently managed, mining industry-funded, two-year research project attempting to develop a framework of issues and options for the global mining industry to come to terms with “sustainability.” MMSD is part of the Global Mining Initiative (GMI), the self-described “change agent for a transition to sustainable development in the mining industry” (Global Mining Initiative: 2001). Part of the MMSD global mandate is for each of the four regional groups (North America, South America, Africa and Australia) to create region-specific industry profiles to enhance understanding of current structures and future needs across the world. This report is the only such effort to focus mainly on the corporate structures that are pervasive in the increasingly borderless mining industry. So part of our mandate has also become to examine how North American mining fits into the global industry.

2.2 Purposes of the Project

MMSD is an independent research body reporting to the Global Mining Initiative - (Global Mining Initiative: 2001)

At a meeting of the MMSD–NA Canadian sub-group in Winnipeg in December 2000, one of the priority tasks assigned was to develop a profile of the mining industry in Canada. In addition, MMSD North America later decided that the U.S. mining sector (USMS) needed to be examined and compared to the Canadian sector. While this cannot be done at an exhaustive level in this study, inroads to comparative analysis have been made by creating a database of U.S. firms and through interaction with key contacts in the industry. This report is, in part, the fulfillment of Task 1 of MMSD–NA, defined as follows (paraphrasing from MMSD–North America: 2000):

Task 1. Current/Historic Profile

Purpose: To develop a current and historic profile of the North American minerals/metals industry from the perspective of sustainability. The profile will include a description of:

1. the junior to senior community of players that comprise the industry and form an integrated production system;
2. the role of North American companies off-shore and the role of non-North American companies working in North American constituencies; and
3. the commodities that are generated and the significance that each plays in the global supply.

In the past, the simplistic structural dichotomy of mining firms being either junior or senior has seemed to suffice for the industry itself and for the public. The author’s recent MA thesis on the Canadian mining industry (MacDonald: 2000a) unearthed a more complex set of organizational types, fiscal capacities and corporate interactions. That preliminary study showed much still needs to be learned about the reality (rather than the reputation) of the Canadian mineral production system. This report takes this analysis beyond the Vancouver-based mining sector (VBMS) which was the focus of previous work, and compares it with other portions of what we have called here the North American Mining Sector (NAMS).⁶

In the end, this particular research project contributes three things to the MMSD/GMI initiatives:

1. A working document for the MMSD initiative that gives a broad outline of the “North American mining sector,” with a focus on the corporate structures and inter-firm relations that make up the “mineral production system.” It will serve as a foundation piece as well as a discussion paper posing questions for future projects to consider.

2. More dialogue in general on the changing nature of the North American mining sector, and increased recognition of the workings of the MMSD initiative as it represents a move toward “sustainable mining.” This has come about as a result of the roundtable/interviews done across Canada by this researcher, the analysis presented herein, and feedback from readers to the author and MMSD representatives afterwards.
3. A report that addresses the critical gap between information and perception in the mining industry. What this means is that while the statistical data that are so often used to define the industry are examined here, they are considered to be no more important than perceptions about the state of the industry from within and from the outside. Factual data is no more valuable than perception here, because people and not statistics govern mining, like all industries. Therefore, it is to the voices of the people that run the companies rather than the industry’s raw production numbers to which this report closest bends its ear.

“The recent series in the Seattle paper (the Seattle Post-Intelligencer: McClure and Schneider: 2001) is the most concentrated, focused, anti-mining series of articles. It went on for weeks. They had article after article about Summitville, the Pegasus project, all the horrible things mining has done in the states. It serves to reinforce stereotypes about mining... I cringed when I read it.” - Canadian mining journalist

2.3 Limitations of the Report: A Comment on Methods and Commodity Types

The North American mining sector is not a homogenous group of companies. In addition, the commodity targets of the member firms vary widely. The following Table 1 is a list of minerals types widely considered to encompass the “mining industry”:

Table 1: Metals and Mineral Products (Source: Hodge 2001)

Category	Metal/mineral
1. Metals	aluminum (bauxite), antimony, barium, beryllium, bismuth, cadmium, calcium metals, chromium, cobalt, copper, germanium, gold, indium, iron and steel, iron ore, lead, lithium, magnesium and magnesium compounds, manganese, mercury, mineral pigments, molybdenum, nickel, niobium, platinum group metals, rare earth metals, selenium, silicon, silver, strontium, tantalum, tin, titanium metals, tungsten, vanadium, zinc, zirconium, (plus others)
2. Non-metals	Abrasives, arsenic, asbestos, barite and witherite, boron, bromine, calcium, chlorine and chlorine compounds, diamonds, feldspar, fluorspar, glass and glassware products, graphite, gypsum, iodine, mica, nitrogen, pearls, peat, perlite, phosphate and phosphate compounds, potash and potassium compounds, salt and sodium compounds, silica and silica compounds, sulphur and sulphur compounds, talc, soapstone and pyrophyllite, titanium oxides, vermiculite, (plus others)
3. Structural Materials	Cement, clay and clay products, dolomite, granite, lime, limestone flux and other limestone, marble, travertine and other calcareous stones, olivine, sand and gravel, sandstone, slate, (plus others)
4. Energy	Coal and coke, oil and tar sands, uranium and thorium (note that uranium and thorium are metals)

This report focuses attention on the metals sector in part because it has a production system distinct from other mineral products. It is also the subject of most public concerns over environment and social transformation, rightly or wrongly.⁷ Metals are also separated from the other categories because of the different cost breakdowns and risks associated with steps on the production chain. In particular, this “hard rock” industry, where production is so costly, has little semblance to the liquid petroleum and gases industries, where production costs are relatively inexpensive.⁸

While exploration for metals needs to be cheap to compensate for high production costs, it is by no means easy. Indeed, one of the defining elements of metals mining is the division of labour between exploration companies supported by the risk capital markets, and production companies who are supported by institutional investors as well as their own debt financing. This differentiates them from non-metals and structural materials, where the same firms most often do exploration and production. This is because deposits of “industrials” are often much easier to delineate in situ, occur in larger, more consolidated amounts over much wider geographic spread, and are cheaper to extract and refine (if this is necessary at all). Aggregates and other structural minerals are well distributed in massive quantities across the world, and often there are different materials that can be utilized depending on local availability (United States Geological Survey: 1999). Thus, and because of the extremely high transport costs of bulk materials compared to metals, structural mineral operations are based more on proximity to markets than the metals sector. This easy exploration, bulk production, lack of need for refining and localization, all make for a less “risky business” in industrial minerals. And, as we shall see, risk in its many and varied forms is what truly defines the metals sector.

The metals sector is defined by risk. More so than with any other mineral sector, and perhaps any other industry in the world, the metals sector is a “risky business.”

Nonetheless, the other mineral types will not be completely neglected, as they represent important economic and environmental concerns. Where applicable, industrial minerals and coal are compared to metals to show their relative value to the North American mining economies. In addition, there is some space devoted to “niche” firms, including the rapidly growing diamond mining sector, which Natural Resources Canada (NRCAN) data indicate was the number one commodity explored for in Canada for the first time in 2000–01 (Natural Resources Canada: 2001). Diamonds, although they are not a metallic element, fit into the analysis here because they are being explored for in large part by the same firms and the same geologists as the metals, and are extracted in a similar fashion to most metals mining operations (the “drill, blast and muck” model).

Another area of limitation in this report is the exclusion of two *actors* that have played key roles in the industry in the past: private companies and independent prospectors. It is virtually impossible to get reliable data about the role of these groups, because they are not subject to the same reporting requirements as the publicly traded firms. In addition, as the industry and its regulations have modernized, become more risky and expensive to maintain, and rely more heavily on venture capital infusions, these traditional parties have become less important to the overall sector than they have been in the past. Where applicable, some mention is given to their current and historical role in the industry.

“These new regulations [National Policy 43-101] on Qualified Persons; they have eliminated the prospector from the equation. Just wiped them out.”
- President of a junior firm

2.4 Structure of the Report

This report is structured to meet two goals—one analytical and the other conceptual:

1. To devise a new methodology for a deeper examination of the mining industry. This is accomplished in two ways:
 - a. By simplifying and coalescing the massive, yet widely dispersed, quantitative data available on the North American mining sector.⁹ Included is a broad sampling of mining’s vital statistics, with special emphasis on how these statistics relate to the future of the industry.
 - b. By using qualitative analysis and direct dialogue with industry members to better understand what makes the NAMS tick, where problems are faced and what the future may hold according to the industry members themselves. Every effort is made here to allow their words and actions to speak for themselves.
2. The second, overarching goal of this project is to understand the capacities and incapacities of the corporate portion of the NAMS to function sustainably. With that in mind, many sections include “Spotlights” that analyze the implications of

different aspects of mining on the overall sustainability question. It is argued herein that the ability to function according to the dictates of sustainability depends on two things—the mindset of the individuals involved (*corporate culture*), and the ability of those actors to both see the necessity of, and have the capacity to, adapt to change (a corporation or industry’s *action* and *reaction spaces*). An industry’s (or corporation’s) action (and reaction) spaces and corporate culture are guided by three elements: its internal structure, the external environment in which it functions and, perhaps most importantly, decision-makers’ perceptions of those environments and their place in it.

With these goals in mind, the report is divided into the following chapters:

- Chapter 3 illustrates the methods used to create this report, admits their limitations and critiques other data sets and reporting organizations. In addition, the key notion of mining as a *production system* is outlined as the conceptual framework used to describe the NAMS.
- Chapter 4 breaks down the Canadian mining sector into its constituent parts. First, the locations, structures and functions of individual firms are exposed for their contributions to the overall production system; then an effort is made to look beyond the numbers at the relationships in the sector and at some key issues confronting it. The majority of this report’s key themes are introduced through analysis of the Canadian industry.
- Chapter 5 does much the same for the United States mining sector, but to a more limited degree. This is due to the size of the sector and to this project’s initial Canadian focus and short timelines. More detailed research into aspects of the USMS is called for in the conclusions.
- Chapter 6 summarizes and then compares the structures of the Canadian and U.S. mining sectors, and attempts to determine whether such a thing as a “North American mining sector” even exists in a globalizing industry, examining the juxtaposition of “home place” with increasing international mobility, and the future implications of current industry consolidation patterns.
- Chapter 7 examines mining’s corporate culture and its role in the ability of—and attempts by—the industry to conform to “sustainability.” Essential patterns, problems and issues are highlighted.
- Chapter 8 identifies past patterns and ones that will occur in the mining industries of Canada and the United States if current trends continue. Several “fundamental disconnects” among actors over “sustainability” issues are identified; areas that need further study and discussion are presented; and potential action areas are offered for review.

Endnotes

- 5 In this report, the sidebars are used to highlight key facts or anecdotes to support the arguments being developed. Many of the sidebars are interview responses.
- 6 Of course, Mexico, Central America and the Caribbean all are considered part of North America in most instances. However, all of these countries have such different economic, political, and socio-cultural attributes from the U.S. and Canada that including them in the analysis would be misleading. These nations (with the debatable exception of Mexico) are also generally target (or *host*) countries for mining companies, rather than having well established domestically-controlled mining industries. Hopefully, these nations will receive more examination through the MMSD South America initiative.
- 7 McClure and Schneider's (2001) series of "anti-mining" articles in the *Seattle Post-Intelligencer* (wherein much of the U.S. west is envisioned as a toxic dumping playground for uncaring mining interests) represent perhaps an extreme example of the treatment of mining issues by the popular press.
- 8 Even this "clear cut" comparison shows that defining the "mining industry" is a difficult task, however. For example, the oil sands of northern Alberta turn this equation on its head, involving massive earth moving operations with highly capital-intensive equipment and infrastructure, more typical of "hard rock" mining.
- 9 The fact that there is no comprehensive guide on the North American mining sector, both in quantitative and qualitative terms, should be of major concern to any efforts to bring about substantive change in the industry. How can we know what the problems are, or make any real progress toward the goals of sustainability, without a central point (i.e., a policy centre) for the understanding of and dissemination of information on said industry?

3. Methodology

This chapter breaks down the methodology using the two main goals of the report as a guide. First, the mixture of qualitative and quantitative analysis that is attempting to “dig deeper” into how the mining industry actually works at the corporate level is rationalized. Second, the conceptual framework of the study is defined in more detail, focusing on mining as a production system, and the consequent roles of corporate culture, home places and risk in defining the modern North American mining sector.

3.1 Analytical Methods

The mining industry has never been much for navel gazing (for example, the Canadian industry, along with the federal government, allowed the only academic policy institute for mining in Canada, Queens University’s Centre for Resource Studies, to wither away and die in the 1990s). While there are a multitude of quantitative analyses of production and exploration statistics collected by governments, industry organizations and research groups, there is little qualitative analysis of the industry, especially in regards to delineating the roles of different firm types. The traditional dichotomy of junior and senior firms (or large firm and small firm) is often the only differentiation attempted. In addition, much of the quantitative analysis is based on industry-wide analysis, negating the capacity to examine even simple things like the role of firm size on organizational foci. These limitations are ones this study attempts to address.

3.1.1 Database Structures and Replicability

Because this project was designed as a broad overview to be conducted in a short time period, there has not been room for extensive database analysis.¹⁰ Previous database research on Canadian firms (MacDonald: 2000a) was utilized to identify topic areas to examine further in content analysis research and in interview/roundtable settings. A gap analysis was also done to see what mining sectors needed to be examined in more depth. That gap analysis determined that the USMS had the least information available on individual firm structures. Accordingly, a population database has been created for this sector. The population of 223 USMS firms is examined for several variables, while the structures and activities of 100 of those firms, randomly selected, are examined in detail utilizing over 20 discrete variables per firm (see Appendix 3 for more on the USMS database structure).

A secondary database used is from the aforementioned previous work by this author (MacDonald: 2000a), which examined the population of Vancouver-based mining companies with interests in Latin America from 1987 to 1998. This database attempted to create a comprehensive picture of individual firm characteristics and investment patterns, digging deeper than the traditional statistical analysis of countrywide exploration and production trends. This database is similar in structure to that created for the USMS sample group.

■ **SPOTLIGHT: Longitudinal Databases and the Mining Industry.** The longitudinal database, which studies individual firms or entire populations over time, is a form of research useful not only as a baseline, but as a repetitive mechanism. Once the groundwork is laid, repeating the exercise across time and space is simple and, according to industry sources, a worthwhile and underutilized endeavour in understanding heretofore “primitively” understood mining industry strategies and structures at the individual firm level. Such research thus acts to illuminate the past problems, current concerns and future directions of the industry. This form of research needs to be continued by whatever long-term mechanisms are created coming out of the MMSD/GMI process. It is a cost-effective way of providing industry analysis and information transparently, legitimately and accessible to a wider audience. It also could provide a tool to help overcome the inability of the industry to plan long-term, a theme that resounds throughout this analysis.

“Why don’t you just get the Metals Economics Group data and use that?” - Federal government official, on where to find a solid database of Canadian mining companies. Unfortunately, a copy of the MEG’s annual report costs CDN\$10,000!

“Little attention (in mining) is paid to gathering meaningful physical and operating data in useful and reliable databases. Consequently, the quality of information used in making both strategic and operating decisions is primitive... Effective planning systems do not exist in many mining companies, and a reactive approach to problems and change continues to be the dominant basis for action.” - Richardson (1992)

It should be noted that the source material for the databases is not without flaws. The Financial Post's *Canadian Mines Handbooks* and *American Mines Handbooks* (Southam Mining Group: 2001a and b) do not clearly delineate the nationality of mining firms. This is perhaps understandable in an industry that often belies national boundaries, but that does complicate the research. Here, a Canadian mining firm is defined as a publicly traded entity with its head office in Canada; not majority controlled by a foreign entity; and holds rights to at least one property focused on mineral investment, exploration or production. A similar definition covers USMS firms.

3.1.2 Utilization of External Data Sources

One driver behind this report was that existing data sources on the NAMS are sectorally defined and limited in their focus. The following details existing sources of data on the mining industry in North America, with notes on their limitations. Despite these limitations, each source of information provided valuable statistical data used in this report:

- Natural Resources Canada (NRCan) provides some of the most comprehensive data on the production levels of all minerals and metals in Canada. In addition, they carry out an annual survey on exploration expenditures by Canadian companies and in Canadian constituencies. Unfortunately, the data collected is superficial in that it focuses on end product results and a simple notion of firm size (large firm vs. small firm), with a subsequent inability to highlight firm-based functions and strategies.¹¹
- The National Mining Association (NMA), Northwest Mining Association (NWMA) and the U.S. Geological Survey (USGS) are the three biggest providers of information on the USMS. Their information is almost solely limited to production statistics. The lack of exploration sector analysis in the U.S. has left a research gap that necessitated this study to assemble a corporate population database for the USMS.
- The main source of data on the role of mining in the Canadian economy comes from the national industry organizations, in particular the Mining Association of Canada, which provides data on production statistics, including Canada's global rankings. Again, exploration statistics are not generally under their purview, because their mandate is to lobby on the behalf of mineral *producers*.
- The Prospectors and Developers Association of Canada is the national organization to promote the interests of the junior sector. One of the things it does is identify the population of junior firms in Canada. The PDAC data is very illuminating, yet incomplete. Its database is simplistic in some key areas (i.e., the examination of individual rather than just agglomerations of firms) that this study will attempt to strengthen.
- Other data sources include industry analysts (e.g., Canaccord Capital) or independent research groups like the aforementioned MEG. The Metals Economics Group, based in Halifax, has some of the most in-depth analysis of the large firm sector available. They show little interest, however, in the junior sector, or at the very least that vast majority of the sector that does not spend at least CDN\$4 million annually on exploration. Further, their material is priced out of reach of lay persons (not to mention researchers!).

The Mining Association of Canada represents 32 production-oriented mining companies; the Prospectors and Developers Association of Canada ostensibly represents the interests of the remainder (estimated to be between 1,200 and 2,000 total corporate entities).

"MEG is no longer involved with our survey. They have no interest in the small firm sector."
- Executive with an industry organization

3.1.3 Roundtable/Interview Respondents and Question Types

This project went beyond quantitative data collection to directly engage mining industry executives, as well as key contacts from outside the corporate sector. There were three types of interviews, excerpts of which are found throughout this report:

- 17 interviews with Vancouver-based mining firm executives during late 1999 and early 2000.
- 19 interviews with corporate executives, consultants and key contacts between June and August of 2001.¹²
- Three roundtable meetings, with over 55 total representatives from: Calgary's Mineral Exploration Group, members of Natural Resources Canada's Minerals and Metals Sector in Ottawa, and members of Toronto's junior mining community in a PDAC-sponsored event.

These interviews and meetings focused on several aspects of corporate culture and current and future mining issues, including (but not limited to):

- the nature of the different mining communities; perception of community; role of mining in North America;
- the relationships between firms of different sizes and type, at local, national and international levels;
- current issues of importance to the mining industry and perceptions for the future;
- the nature of risks faced by the mining industry;
- getting the corporate perspective on the concepts of "sustainable development" and how mining is attempting to come to grips with this concept; and
- the globalization of the mining industry and impacts on the individual firm and the structure of the industry.

3.1.4 Content Analysis of Annual Reports

During the course of this study, annual reports from 1999 and 2000 for 308 publicly traded mining companies from Canada (245), the U.S. (45) and other countries (18) were collected. This supplemented an earlier collection of annual reports from 1996 to 1998 for over 150 Canadian mining companies. The annual reporting of mining firms, alongside other reporting documents like prospectuses, Environmental, Health and Safety (E, H and S) reports, and sustainable development reports, provide valuable insight into the size, strategies, organizational foci, strengths and weaknesses of individual firms; and a broad assessment of changing market and other risk environments external to the firm. While annual reports must be treated with a grain of salt (they represent the public face that the firm uses to attempt to promote its value to current and potential shareholders, after all), they are a valuable resource in studying the changing priorities of an industry. This is especially true for an industry like mining that has been experiencing a crisis over the past half decade (what with low metals prices, lowering public opinion of mining as an economic activity, higher pressures from civil society for the industry to "open its books" and "act sustainably," and an extremely weak financial climate to raise money for projects—all issues that will be exposed in this study).

Ala-Harkonen (1993) argues that the use of annual reports in researching mining firms is important because they provide a valuable "cultural context" to sectoral studies.

All together, these different analytical methods allow this study a depth and breadth of research that has been sorely lacking in previous mining research. Regardless, however, of the merits of the analytical tools, is the fact that without a solid conceptual foundation—a new way of envisioning how the mining industry works—this report would add little value. It is to this conceptual framework we turn our attention now.

3.2 Conceptual Framework

Not only does this study utilize a multitude of analytical methods, the mining industry and its member firms are also *conceived* of in new ways. This section defines some of the

conceptual elements that drive this new way of seeing the industry, focusing on what makes up a mineral production system, the production chain of mineral project development, and on defining and highlighting the divisions of labour among different firm types within the industry. Highlighted are the hypothetical key roles of “production systems,” “home place” and “risk” in understanding the corporate culture as well as the action/reaction spaces of the corporate mining community.

3.2.1 What is a Mineral Production System?

“Look down at the street there. All those people driving around in cars made primarily of metals. And yet, if you ask them, most will say they don’t care about mining, don’t need it, it’s dirty.”

– Exploration
Vice-President of a
junior company

When conceiving of a production system, the analogy of a car is a useful one.¹³ An automobile is basically a production system in miniature. It utilizes the systemic relations of a multitude of parts and processes to produce end products—forward movement and controllable high-speed transportation. None of these parts can provide the product, or even a portion thereof, without a working production system. At the industry level, a production system has been defined by Hayter (1997) as “networks of firms that are linked to one another through flows of goods and services in order to manufacture a particular product.”

For the purposes of the mining industry, some modifications are necessary. Mining as an industry has special limitations because by nature its “final end use product” is most often a commodity rather than a manufactured item. Commodities (e.g., grain, lumber, metals) are much more subject to price fluctuations than consumer durables or value-added manufactured goods, having prices controlled almost entirely by external supply and demand considerations, with virtually no room for value-adding through product differentiation. They are also site specific. Firms cooperate in moving “projects” rather than “products” up the production chain, tied to one location from which minerals *may* be extracted. It is this “may be”—the notion of risk—that is another defining element to be discussed later. Additionally burdensome are the long time sequences prior to seeing any return from a mining project, and the massive development costs that need to be financed prior to any income being generated.

These special limitations make the industry extremely vulnerable to factors beyond their immediate control, highly specialized in their economic activities, and extremely cautious when planning a development project. All of these attributes, while valuable survival tools for miners, count against flexibility and adaptation to change, according to many industry insiders:

“The market is driven by growth, rightly or wrongly. It should be driven by improvement, better profit margins and efficiencies, but that is not feasible in mining. Look at it here, and tell this to the world if you can. Mining is hamstrung in many ways, but one of the most fundamental is that the finite nature of the resource defines the industry. We would love to build our reputation on quality and corporate efficiency, building profits and assets internally. We would excel as a corporation in that environment. However, with a finite commodified resource as our main industrial output, we need to focus on adding to resources and cutting costs per unit, and there is no way around it!” – Vice-President, Development, senior firm.

Analysis of a mineral production system thus needs to consider the economic and political environment in which the firms work, given that stakeholders outside the corporate sector also play vital roles in production decisions and project outcomes. In mining, the production system is thus **the sum total of the relationships in all steps in the mineral production chain from the initial exploration decision to the selling of the metals on the open market. This includes all aspects of a mineral life cycle from initial demand creation by society to the post-mining phases of development which post-date the sale of metals to consumers.**

The global corporate metals mining industry needs to be seen as a production system, something with which the industry has never come to terms. It has previously been envisioned as a hyper-competitive system, with junior and senior firms stratified in such a

Table 2: Generalized Model of the Mineral Development and Mining Process

Phase	Mineral Resource Assessment	Mineral Exploration					Mineral Deposit Appraisal				Mine Complex Development	Mine Production	Environmental Restoration
Stage	MRA	Grassroots Exploration					DA-1	DA-2	DA-3	DA-4	MCD	MP	EP
		EX-1	EX-2	EX-3	EX-4	EX-5							
	Various surveys, research and synthesis	Exploration planning	Regional reconnaissance and surveys	Prospecting and ground surveys of anomalies	Verification of anomalies and showings	Discovery and delimitations of a mineral deposit	Mineral Deposit definition.	Project engineering	Project economics	Feasibility study, productions decision	Mine development, construction of processing plant and infrastructure	Production, marketing and renewal of reserves	Mine complex closure and decommissioning, site restoration
Objectives	Supply information and tools required to develop the mineral potential economic benefit, in the perspective of sustainable development	Select target commodities. Establish exploration objectives and strategies. Select target areas and sites. Acquire claims or permits if appropriate.	Seek anomalies of interest over wide areas by various survey methods. Select the more promising targets. Acquire claims or permits.	Confirm the presence, exact location and characteristics of anomalies. Acquire additional claims, leases and properties.	Investigate the cause of anomalies. Find mineral showings. Acquire additional claims, leases and properties.	Discover, delimit and interpret grade quality and tonnage of a new mineral deposit. Determine if it constitutes a mineral resource of “potential economic interest” to justify more intensive and detailed work.	Define the limits, controls and internal distribution of grades, mineral processing characteristics of the deposit. Acquire all data required for project engineering and cost estimation	Determine, in an iterative fashion, in design, plans, schedules, capital cost and operating cost estimates for all aspects of the project. Establish technical feasibility and costs thoroughly and realistically	Obtain all the information required and determine, based on corporate objectives, parameters for the economic, financial and social-political evaluation of the project.	Diligently validate and integrate project data interpretations, estimations, plans and evaluations to MCD and production objectives. Decide on whether to undertake the mining project. Obtain permits and financing.	Complete mine development and construction on schedule and within budgets and specifications. Ensure efficient and timely mine complex start-up according to schedule, specifications and cash flow forecasts.	Achieve commercial production on schedule and meet cash flow forecasts and quantity and quality specifications. Achieve mine profitability and company survival in the perspective of sustainable development.	Restore minesite, outside plant and infrastructure to environmentally acceptable condition. Ensure the future quality of the environment.
Evaluation Methods	Geoscientific, mineral and economic surveys, research, compilations and synthesis by governments, research institutes universities and industry.	Metal and mineral market research. Review of geological and ore deposit information and of the legal, fiscal and socio-political context in various areas	Remote sensing, aerial photography and airborne geophysics. Prospecting, geology and geochemistry. Appraisal, rating and selection of anomalies.	Ground, geological, geochemical and geophysical prospecting and surveys. Compilation of results, appraisal of results, recommendations for further work, and selection of new targets.	Geological mapping and other surveys. Trenching, drilling and sampling. Appraisal of results, recommendations for further work, and selection of new targets.	Stripping, trenching, mapping, sampling, drilling	Detailed mapping, sampling and drilling on surface or from underground. Systematic mineralogy and mineral processing tests. Detailed environmental and site surveys. Pre-feasibility studies.	Pilot tests, engineering design and planning. Capital and operating costs for mining, mineral processing infrastructure, environmental protection and restoration. Technical risk analysis. Pre-feasibility studies.	Market, prices, product development and financial studies. Environmental, economic, financial, and socio-political risk analysis. Pre-feasibility studies	Exhaustive due diligence review of all data interpretations, plans and estimates. Evaluation of profitability, given the geological, technical, financial and qualitative risks, and up-side factors.	Project management methods in a quality assurance perspective. Training program for personnel and detailed start-up plan to meet the requirements of this demanding period.	Production management methods to ensure continuous quality and efficiency improvements. Exploration, deposit appraisal and development of new zones or deposits on mine-site and off-mine-site.	Mine closure and decommissioning. Environmental restoration and monitoring.
Results	Maps, databases, tools and models	Exploration projects	Regional anomalies	Local anomalies	Mineral showings	Mineral deposit	Deposit appraisal project			Mining project	Mining complex	Mineral production	Restored site
Mineral Inventory	Undiscovered mineral potential					Inferred resource	Delimited Mineral Resource			Mineral Reserve			Full compliance
	Speculative		Hypothetical				Indicated	Indicated and Measured		Proven and Probable			
Estimation Error (targeted margin of error of tonnage/grade estimates at the 90% confidence level)						± 100%	± 50%	Indicated: + 50 to 30% Measured: + 20 to 10% (often several sample grid dimensions are used in each category)		Proven (feasibility: ± 10%, mining: ± 5%)			
Investments	Moderate	Low, but increasing multiple investments.					Larger and increasing multiple investments			Very large industrial investment.			
Risk Level	Low	Very high, but decreasing risk of failure and financial loss.					High, but decreasing risk of failure			Moderate to low industrial risk			

(Adapted from Cranstone, Lemieux and Vallee: 1994, in Lemieux: 2001).

"You are talking apples and oranges here. Putting juniors and seniors together in one industry may be a fatal flaw."
- Senior company representative, on examining mining as a integrated production system

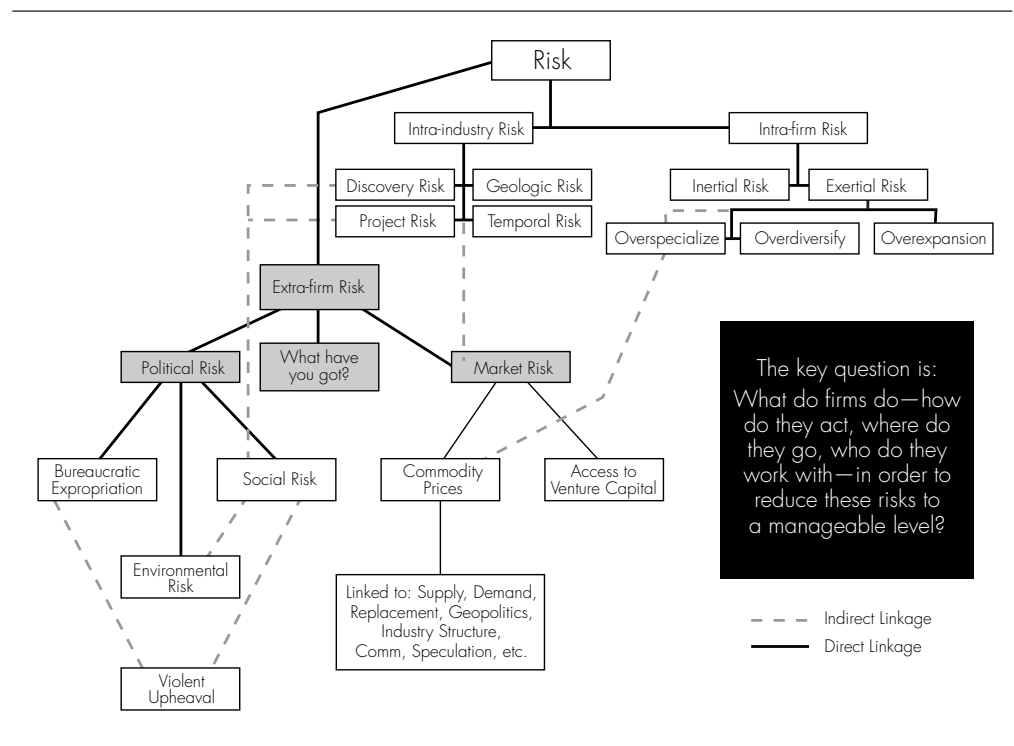
way to make it seem that they are co-existent but not co-dependent (often they are treated as different industries). To recall the automotive analogy, this is like saying that the clutch and gearbox in a car exist in proximity, but that their actions are only coincident rather than mutually self-supportive and necessary. It will also be shown that considering different corporate actors in the mining industry as being in "different industries" creates arbitrary and artificial boundaries. These boundaries actually limit the capacity of the industry as a whole to come to grips with sustainability and thereby also limit the ability to institute constructive change at the industry level.

The definition of a mineral production system used here relies heavily on another concept—the *mineral production chain*. This is essentially the mineral production system without actors or risk. Perhaps the best breakdown of this production chain is a generalized model of the mineral development and mining process created by Natural Resources Canada (Cranstone, Lemieux and Vallee: 1994, in Lemieux: 2001), shown in Table 2.

There are two major problems with looking solely at mining projects as a production chain.¹⁴ One is that the relationships *between* actors are often not made clear. The development of projects from stage to stage in the NRCan model in Table 2, for example, appears seamless. Yet, project development often includes a transfer of ownership or effective control between parties at different stages. This often occurs several times during the life of a mining development. Because of this and other influences, the mineral production system is a much more risky business than implied in this model.

And further to risk, Cranstone, Lemieux and Vallee's model does not adequately explain the complexity of risks facing the mining industry at each stage in the mineral life cycle. To their way of thinking, risk is a singular element that varies in importance from very high to low, and where each level on the production chain has an easily calculable degree of risk. This is a very limited examination of what is really a multi-faceted set of phenomena that changes rapidly over time and space (as will be shown in the analysis of changing investment patterns of the CMS in Section 4.2.6). MacDonald (2000a) looked closer at mining risks and delineated risks of three types, as seen in Figure 1.

Figure 1: Risks Associated with the Mineral Industries



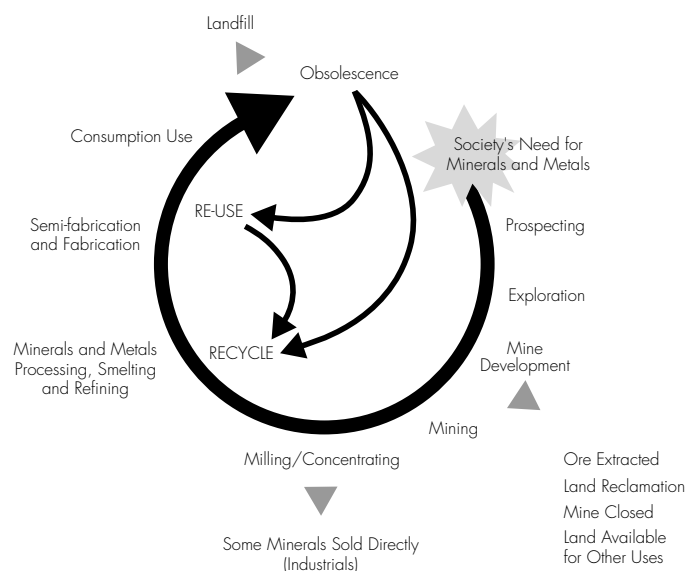
Intra-firm risks are those directly attributable to the management of the firm itself, such as the decision to expand into new regions or new steps up the production chain. Intra-firm risk shows that none of the three major risk types actually operate in isolation, however; commodity price fluctuations, among other risk factors, can make the most careful planner look foolish.

Intra-industry risks are those specific to the nature of the industry, such as the high levels of discovery risk facing mining firms, or the long lead times before production starts (often 8–10 years), during which all manner of other risks may become paramount in a given project.

Extra-firm risks are the ones that get the most press and the most blame from industry insiders for problems in the industry. Things like commodity prices, social risk and political risk can make or break projects without prejudice toward the money or time invested.

The essential thing to remember about these risks is that they interact with each other, and they also change over time and space. Mining is *the* risky business, and any efforts to change the way the industry works must be aware of the risks inherent in the mineral production system as well. These risks fundamentally limit the ability of the industry to react to changing social, political, economic and environmental values.

Figure 2: Lifecycle of Minerals and Metals (Source: Natural Resources Canada: 1995)



Important also in the mineral production system is the inclusion not only of the corporate actors who move projects through the production chain, and the risks that inhibit those movements, but also external actors who have a say in the process. The current parlance for these actors is *stakeholders*, and their importance in the mineral production system has never been greater than it is today. An examination of the NRCan model of the minerals and metals life cycle (Figure 2) shows a couple of important facets of the mineral production system that are controlled by external factors attributable to these stakeholders: public demand for minerals, and (somewhat juxtaposed) public demand for sustainable development (i.e., making land available for other uses and the importance now given to the re-use and recycling of metals). Twenty years ago, we would not have spoken of these so-called “soft” issues as being part of the life cycle of minerals and metals, yet today they are at the forefront.

“You can look at 1,000 properties to find 100 worth spending a day on. Of those 100, you can do the next round of work to whittle it down to 10 that are worth a serious drilling job (maybe \$250-500,000), and of those 10 maybe one of them will turn into a mine.” - President of an exploration junior on discovery risk

“A few years ago an advertisement for Bankers Trust caught my attention. It warned: ‘Risk You have to look at it even when you don’t want to.’” - Vertzberger (1998)

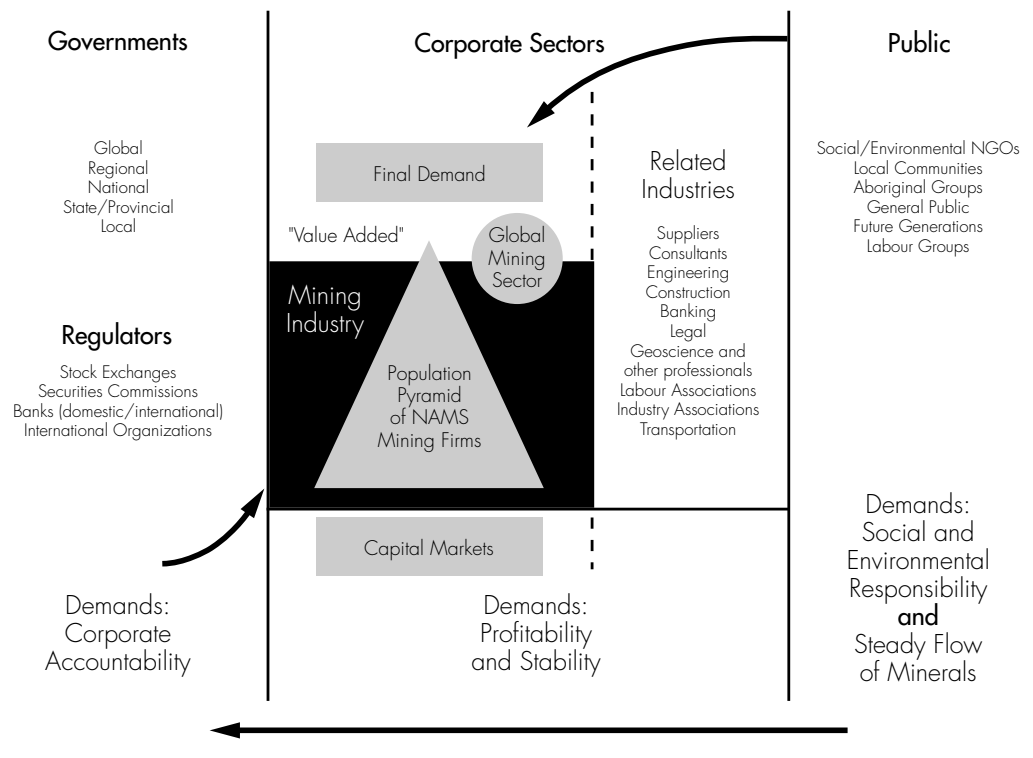
*“The old ways of doing business in the background, unregulated, are over. Like it or not, we are in the public’s eye **all the time**” - Public relations expert on mining (emphasis added)*

The industry also finds itself on the horns of a dilemma created by society's dual demands for:

- 1) continued large quantities of inexpensive raw materials, and
- 2) substantive change in the social and environmental externalities created by the companies that extract these raw materials. These changes cost time and money to incorporate, but the associated costs are expected to be internalized by the corporations, not the consumers!

Figure 3 represents a simplified prototypical mineral production system, showing the three main sectors involved: the corporate sector; the governmental and quasi-governmental bodies that regulate the activities of the mineral production system; and the public that demands minerals *and* sustainability-based industry governance. Note that only a small, highly constrained portion of the overall picture is made up of the "mining industry" itself, and that very few extremely large firms can break out of the "commodity trap" into value-added manufacturing. Also of note is that while only a couple of relationships among the public, governments and the corporate sector are highlighted here, a true diagram of the mineral production system would be much more complex. It is this labyrinth of relationships, changing risks and often conflicting demands over the breadth of the production chain to which the mining industry finds itself adapting. The concept of mining as a production system makes navigating these difficult times a little bit simpler because it shows the relationships among stakeholders, and how the burden of risk and shoulder of blame is shared throughout. Mining firms of all sizes are affected by industry-wide practices and reputation capital, for example.

Figure 3: Stakeholders in a Prototypical Mineral Production System



3.2.2 Other Definitional Issues

The “mining industry” is defined here as the population of member firms whose industrial occupation focuses on the exploration for, identification of, and/or extraction of solid minerals/metals from beneath the earth’s surface across a vast number of mineral commodities (see Table 1 in Chapter 2). This includes all aspects of the mine life cycle from exploration to reclamation. This study disagrees with attempts to artificially segregate the exploration and production sides of the industry. It will be shown that not only are the separations illusory, they are a long-term danger to the creation of sustainable mining.

The holistic notion of a “mining industry” is subdivided here through analysis of “mining sectors.” A mining sector can be defined as any divisible portion of the mining industry, whether the differentiating variable is location of head offices, commodity focus, or organizational focus, among others. The analysis of distinct sectors within mining will point out both the obvious differences between and the unavoidable linkages within, the overall mining industry. In this study, the CMS and USMS were defined as being separate sectors based on the hypothesis that the location of the “home place” of a mining sector will be important in its overall composition and the corporate culture attributes of member firms. Whether this is a realistic assumption in a rapidly globalizing industry will be determined herein. In addition, the vast majority of this analysis focuses on the metals sector because it has different risks, stakeholder relations and corporate structures from other mining sectors.

■ **SPOTLIGHT: “Home Places.”** The notion of home place is an industrial geography concept that argues that the head office location of the original organization has implications on the way that entity is subsequently run (its corporate culture), and thus its competitiveness at home and abroad (its action space). For example, it can be argued that locating one’s head office in Canada provides access not only to capital, but also to a positive “critical mass” of inter-firm relations, communication links and suppliers. In this study, home places are analyzed both at the national and “community” level for the corporate mining sector. In the mining industry, there has been a recent rapid movement toward globalization in the corporate sector, especially in the early and mid-1990s. This movement is argued to have implications for place-based mining sectors that are strong internationally as well as those that are not, the so-called “host countries.” For example, the U.S. is now more of a “host” country than a “home place” in the global mining industry. What implication does that have on its future competitiveness? These implications are not couched in traditional terms of first world dominance/third world subservience, or the strategic minerals propaganda of a Cold War era. Rather, it is argued that home place is a tenuous and perhaps self-defeating concept in the globalizing mining industry. For example, MacDonald (2000b) argues that Canada, ironically, having been the most successful country in exporting its production system overseas, now faces the potential of long-term domestic corporate decline, in part associated with the effects of its overseas dominance! (See Chapter 4 for more on this paradox.)

“Corporate culture” is loosely defined here as the mindset of the individual firm and its peer group in the industry. For example, junior firms have a different corporate mindset from senior or intermediate-sized firms, and Canadian firms have a different mindset from Australian firms. The corporate culture of a firm (or sector at a “big picture” level) can be argued to expand or reduce a firm’s “action space.” There are home places in select global cities now where action spaces are widening to a global scale. Freeman (2001b) calls these “global portals,” and their role in the industry continues to grow. Yet, a key question remains: can the corporate culture of mining, so skilled at *thinking globally*, find

“In parallel with the growth of the mining industry and driving it was the growth of a distinct exploration industry. This industry has a structure and life of its own.” - Harper and Andrews (2001)

“The very strengths that have led Vancouver to house the biggest concentration of exploration geologists in the world have paradoxically contributed to a growing marginalization of the profession in B.C.” - MacDonald (2000b)

the mindset and skill set to *act locally* in a responsive and responsible manner? This study will help to address this new spin on an old question.

A final definition looks at the flip side of a firm's corporate action space—its ability to react and adapt to changing risk environments over time. Herein, this adaptability is called “reaction space.” It will be shown that the capacity to move into new environments does not guarantee success in those environments, and that one of the major problems facing mining from a pragmatic as well as reputation perspective is that the industry's action space expanded much quicker than its reaction space in the internationalization movement of the 1990s. The ability of the industry to adapt to these changing risks over time and space is a significant part of this analysis.

Endnotes

- 10 This consideration is given credence when one considers that even by the strict definitions utilized here, the North American mining sector consists of close to 1,900 member firms (more than 1,650 Canadian firms, and 223 American firms). The statistics are derived from the Southam Mining Group (2001a and b).
- 11 This is in part due to necessity. NRCan data has to protect the confidentiality of its source firms.
- 12 Overall there were 30 interviews with mining company representatives; four of whom were senior company executives; four were intermediate company executives; and 22 were junior company executives.
- 13 Perhaps ironically, mining insiders often use the example of a car to highlight the hypocrisy they feel the industry is treated with in the public's eye! Ad campaigns and industry brochures ask people where they would be without their modern conveniences like automobiles, and then to consider the fact that the mining industry—so much reviled—provided the vast bulk of material inputs to make that machine. Much of the effort put forth in marketing campaigns by the industry focuses on this reality that metals are absolutely essential to the modern world and the living standards of (particularly Western) consumers. The merit of this argument has not borne much fruit in the public relations tree thus far, however.
- 14 It is beyond the scope of this document to break down in further detail the mine development process that is so integral to the mineral production system. For those interested in further examining this process, a recommended introduction is Placer Dome Inc.'s *Mine Development Process* guidebook (Placer Dome: 1998).

4. The Canadian Mineral Production System

4.1 Introduction to the Canadian Mining Industry

There is an avalanche of raw numbers generated on the production, consumption, export and import of minerals and metals in Canada every year. However, without context, these numbers are just noise. What is important is the competitive role mining plays inside Canada (how it adds value to the Canadian economy in comparison with other industries) and how competitive it is on a global scale.

Mining contributes more than five per cent of global GDP - Lemieux (2000)

4.1.1 History of Mining in North America

Mining in North America in general was extremely limited as a dedicated economic activity before the mid-19th century. The subsequent rise in North American metal mining was characterized by several stages of growth, similar to previous European patterns (Burt and Waite: 1988). Most mines started out quite small, following a land rush to access high grade, easily accessible ores, and only later did entrepreneurs step in to mine deeper ore bodies in a more comprehensive fashion. The spread of mining was spurred by the California gold rush of 1849, at which point the western U.S. almost overnight went from a “harsh wasteland to a land of milk and honey” in the popular perception (Smith: 1987). As with most gold mining booms, the California rush was followed closely by a bust, but those “49ers” who chose to remain were some of the initial Caucasian settlers of the American west. The Cariboo Gold Rush served a similar purpose for British Columbia, and caused a redoubling of efforts by the British and then Canadian governments to gain control of this cross-continental possession. Mining, therefore, can be seen as an historic, economic and geographic nation-building force in the United States and Canada.

“In some ways it is unfortunate, but if I go back to my university economics courses, as a country becomes wealthier, it begins to look inwards more to protecting its resources. In this case, we have become quite environmentally unfriendly to mining, so we are pushed out of the country to some degree by those environmental sources.” - Vice-President of exploration for a Canadian junior

While mining initially retained an image as a strong resource base around which North Americans could build and maintain industrial societies, history would not always bear this out. Over time, it became increasingly obvious that an emphasis on primary resource extraction would not in itself lead to an endless boom economy (see especially Frickel and Freudenberg: 1996, for their historical perspective on the linkages between mining and persistent rural poverty in the United States). In recent years, mining is often criticized as being an industrial stage through which the economies of the developed nations should have already passed.

As of 1991, there were over 100 mining-dependent communities in Canada, with over 700,000 inhabitants combined. - (Hodge: 2001)

4.1.2 Changing Role of Mining in the Canadian Economy

Mining has played an important role in the Canadian economy in many ways, from providing the fuel for the growth of a manufacturing base in central Canada, to providing some of the impetus for national expansion through the gold rushes of the 19th century. However, mining would not always be considered a force for national consolidation or economic development. As time went by, the economic dominance of so-called “central Canada” came to be decried as imperialistic by the margins. The Canadian scholar Harold Innis (whose 1936 tome *Settlement and the Mining Frontier* is the definitive historical treatment of Canadian mining) coined the term “staples trap” to reflect the situation by which resource-rich regions in the national “periphery” were affected. The periphery is seen as being forced into a cycle of dependency by the control over industry, capital and government in the core.

Aside from concerns that mineral wealth being extracted from remote Canadian regions were being unfairly siphoned to Central Canada, there was also a lively debate on the impact of international mining capital entering Canada. Was this another example of neo-colonialism in the Canadian frontier? Not so, says Alexander Dow, whose 1987 study of foreign investment in Canadian base metal mining in the early 1900s showed that it was actually internally generated capital inputs that drove sectoral growth (Dow: 1987). This sectoral trait was instrumental in creating the financial markets open to venture capital investment; one reason why Canada has one of the most vibrant mining sec-

According to Mining Association of Canada data (2000), metals mines alone generate almost as much revenue in Canada as the entire forest sector.

*"There are at least 2,200 firms of all sizes based in Canada that advertise specialized mining goods and services."
- Lemieux (2000)*

1999 MABC survey findings indicated that 98 per cent of British Columbians did not disagree with mining in the province as long as it was socially and environmentally responsible.

*"Why not let nature take its course and let mining die in North America?"
- President of a Calgary-based junior*

*"I don't think we will ever be back and interested (in Canada). It's just too unstable. Access to land and security of tenure have just soured us so much."
- Exploration Manager of a senior Canadian firm*

tors in the world (although the degree to which internal capital inputs have sustained the industry over time has declined with the globalization of capital markets).

Following Dow's study, the evidence for the "success story" model of Canadian mining and Canadian development seems to hold through history. Mining has been perceived by the bulk of the populace as reaping net benefits to regional and national economies in Canada. Mining has been a vital industry, ranking in the top five world producers for 18 different minerals. Canada ranks sixth in the world in mineral production value (Lemieux: 2000). The mining industry in 1998 created 3.7 per cent of GDP and 14.2 per cent of exports (Mining Association of Canada: 1999). The Canadian mining centres of Vancouver and Toronto have also over time gained an international reputation for world class financial, engineering, geological, management and mining expertise; the Vancouver sector being well established as having the largest exploration geology community in the world (Mining Quarterly: 1999).

The Canadian mining sector also has a major impact "beyond the headframe." Canadian suppliers of mining goods and services command a good deal of the estimated CDN\$250 billion annual market to maintain the world's mining, development and exploration sites. Canada ranks third or fourth—behind the U.S. and U.K., and comparably with Germany and Australia—in the provision of mining goods and services globally (Lemieux: 2000).

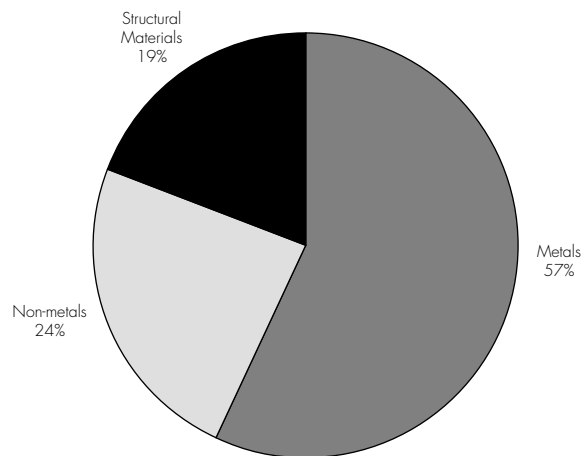
While the industry and its service providers have a strong international reputation and is highly important in many ways to the domestic economy, the image of mining in Canada, as in much of the developed world, has eroded over time. Many academics, politicians and interest groups have argued that these industries have shifted from a positive benefit to a negative one over time. While mining has kick-started regional development in the past, it is now seen as a "sunset" or "smokestack" industry—one with low value added, a shrinking (if highly paid) work-force, and an activity with very negative environmental externalities (e.g., Power's [1996] pronouncement of mining as an "economy of the rear view mirror"). As the developed world "goes green," the mining industry has also found it difficult to keep up with the dictates of sustainable development (McAllister, Scoble and Viega: 1999). With the lowering of the economic importance of the primary industries and a negative environmental image, mining has been a ready target for governments eager to gain support of highly-visible interest groups. (Notably, Canada—as a country with a long established focus on raw material extraction—has a populace that has been more hesitant to decry mining than more industrialized countries like the United States and those in Europe.)

Many in the industry are frustrated by shifting public image and public policy against their activities, shifts that the industry members feel have been fueled by a rising network strongly connected interest groups. But more recently there has been a more troubling trend, especially among the junior company circuit—resignation. Many in the industry feel that North America has turned its back on mining, and in return many companies are turning their backs on North America. In recent years, Canadian companies have led the movement into international waters, particularly in developing countries with high geological potential, but limited expertise and capital, which have been provided by the "project pipeline" based out of Canada. As such, the Canadian mining sector (CMS) makes for a useful sectoral study of the future of mining in an increasingly global era. What effects will this shifting of investment patterns have on "home" and the "host" places? Will these shifts last; and why? What changes in risk and reward environments are going to change the "push" and "pull" patterns of competing investment climates?

4.1.3 Non-Focus Sectors (Industrial Minerals, etc.)

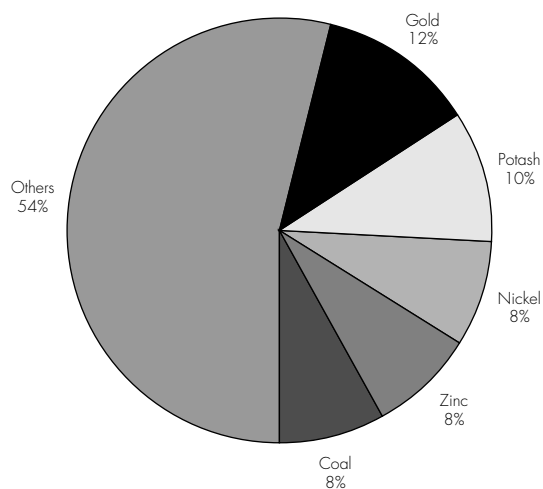
The non-metals sector (excluding diamonds) of the Canadian mineral production system is economically very important and growing versus metals, though not to the same degree as in the United States. Figure 4 shows the breakdown in value of the different non-fuel mining sectors inside Canada:¹⁵

Figure 4: Value of Non-fuel Mineral Products in Canada, by Type: 1999
(Source: NRCan 2000)



According to the Mining Association of Canada (2000), in 1995, 63 per cent of Canadian mining value was from the metals sector. By 1999, that had fallen to 57 per cent.

Figure 5: Top Five Mineral Products Produced in Canada, by Value: 1999
(NRCan 2000)

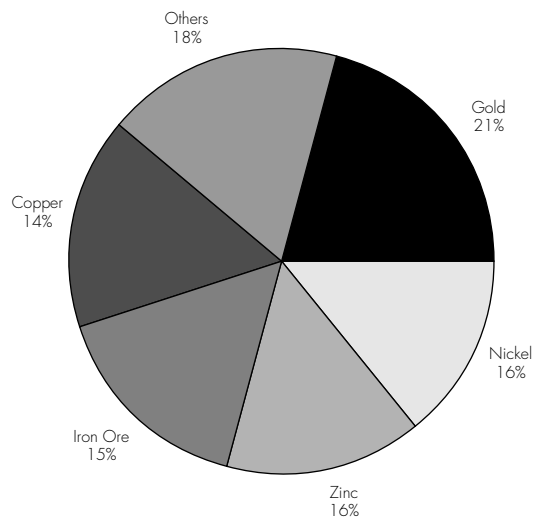


Different sectoral structures pervade the metals and non-metals sectors of the CMS. The non-metals sector includes firms involved in coal, industrial minerals, structural materials and oil sands mining. Canada is among world leaders in gypsum, salt, asbestos and particularly potash (number one in the world; number two in Canadian mineral value [Figure 5]) production. In addition, Canada produces more uranium than any other country (uranium and potash are almost exclusively produced in Saskatchewan). The companies that are involved in the extraction of potash and uranium are very different from mainstream metals producers. Characteristics include:

- a very limited number of firms looking for the resource, because the prospects are generally already well delineated geographically, and don't have the "market buzz" associated with metals exploration; and
- a couple of massive domestic producers, often with foreign partners who are attempting to ensure security of supply for their downstream industries (Saskatchewan Potash is involved in the production of fertilizers from their potash, Cameco is involved in energy production from mined uranium).

These commodities are thus not examined in depth here. Other sectors not examined here are the vertically-integrated and energy sectors. As Canada does not have as strong an industrial base as the U.S., there is a smaller sector of these diversified mineral producers, but several firms, like Alcan Aluminum, Luscar Coal, several iron ore companies, and the tar sands giants Suncor and Syncrude, play key roles in the Canadian economy.

Figure 6: Metals Value by Commodity, Canada 1999 (NRCan: 2000 data)



Structural materials are not a very accurately monitored economic sector, because there are so many informal (often small) producers out there. In addition, structural materials are often mined by governmental maintenance providers. Exploration and extraction processes are cheap and technologically simple, and deposits are widespread and abundant in size, so there is little of the risk involved with metals exploration and development.

It is worth noting that the number of mineral commodities produced in Canada that are important contributors to the national economy is wider than that of the U.S. In Canada, the top five mineral commodities account for less than 50 per cent of all mineral value (Figure 5); in the U.S. that number is 80 per cent, led by non-metals in the form of industrial minerals and coal. (See Chapter 5 for U.S. numbers). Canada also has five different metals each contributing between 14 and 21 per cent of total metals values (Figure 6). For Canada, then, the metals mining sector is important to the national economy, and diverse in its structures. It is this sector that to which we now devote our attention.

4.2 The Structure of the Canadian Metals Mining Sector

The CMS (and the USMS after it) will be analyzed by looking at five key and often intertwining elements:

1. location of head offices (the so-called “home place” of the mining firm);
2. firm size;
3. organizational focus;
4. inter-firm relations; and
5. geographic investment patterns.

4.2.1 Home Places

So neglected has the role of “home place” been in previous studies of the mining industry, not a single study was located that broke down firm structures and actions using the locations of their head offices as a variable. In mining, home place studies have only looked at the nationality of firms as being important. Ask a Toronto or Vancouver-based miner if they think they are identical in character! However, before looking at the specific locales that drive the corporate CMS, introduction to Canada as a “home place” at a larger scale is in order.

Canada as a Home Place

Australia has perhaps the more developed domestic mining sector and the London-based “Mining Houses” have the globally dominant firms, but no other country in the world attracts firms and investment capital (and a reputation for “mine-finding”) like Canada does. What Canada offers is mining experience in difficult and distant areas, a fully integrated mining business community (meaning all aspects of mining, from initial finance to mine reclamation and everything in between), and the most venture capital driven stock exchanges in the world in the TSE and CDNX. With these elements in place, a great number of mining firms based in Canada have made the international step.

The Canadian mining industry has continually attempted to get word out to the general public about the role of mining in Canada and the dominance of Canadian miners around the world (Werniuk: 1997; Mining Association of Canada: 1999). Reasons given by mining firms for locating in Canada include the availability of risk capital on the Canadian venture exchanges, the mining focus of the two major Canadian exchanges (the TSE and the CDNX) and the visibility of these firms to potential investors as a result of the large number of mining analysts looking into the activities of Canadian firms. These venture capital foci, while important, are somewhat superficial, however, in that they neglect the role played by other factors in *creating* Canada’s mining climate. Other keys factors as to why Canada has dominated overseas include:

- Canada’s long mining history, and the associated fact that there is an international reputation for developing projects at great distance from existing infrastructure; and
- the development of an industrial milieu based on mineral extraction, that has branched out forwards and backwards on the mineral production chain. This means that Canadians haven’t simply extracted minerals; they have developed a mineral production system that has incorporated domestic labour, capital and technology at each step of the production chain.

Ironically, it has been Canada’s domestically grown competitive advantages in mining, alongside increasingly onerous domestic requirements for mining firms and the opening of developing countries to foreign investment (so-called “push-pull” factors), that have in the past decade not just allowed, but perhaps forced, Canadian mining firms to move

Canada is the world’s centre for mine financing. In 1998, Canadian financial institutions raised \$3.2 billion... for the global mineral industry. Canada represents 61.3 per cent of total global equity raised for exploration and mining. - Mining Association of Canada (1999)

Canada has become number one in mining, in our way of looking at the world. We saw (Canada) as the best place to be in terms of knowledge of the mining sector.” - Swedish mining giant Trelleborg/Boliden on why they moved to Toronto (Elias and Turner: 1997)¹⁶

“According to one 1996 industry report, mining firms listed on Canadian exchanges hold 2,750 mineral properties in 99 countries.” - (Elias and Turner: 1997)

“Exploration is risk. They go hand in hand. The VSE (now part of the CDNX) has given us something very special, access to risk financing. There is no other exchange like it in the world. Now that is not entirely true—Australians have good access to risk financing, the U.S. does not. The SEC (Security and Exchanges Commission in the U.S.) doesn’t appreciate the junior market like we do in Canada.” - Exploration Manager of a management group

"I think the Australians to some degree can do it as well, but if a European is looking at investing in a speculative mining venture, he is going to look at Canadian firms, and for Americans you could get venture capital easier in Canada. The CDN and the TSE are the key."
- President of a junior firm

"The frontier typically was the Canadian north and the Australian desert, but now it is the interior of Kazakhstan, or the Andes. There is a cultural willingness to go off to far away places in search of minerals"
- Vice-President, Exploration, of an intermediate firm

"There are a couple of U.S. mining houses down there [Latin America], there's a couple of British outfits, there's at least one Australian outfit; but I mean Australia can work the South Pacific a lot more effectively than we can and they have a lot more territory (in Australia) than we have to work on."
- President of a Canadian exploration junior, on reasons why Canada has become dominant in Latin America

more aggressively into international districts. In this way, Canada may be destined to follow the U.K. (which started doing so as far back as the 1890s!) as a major mining nation forced to "take their dirty business elsewhere" (Svela: 1991).

The point is also made time and again by respondents that Canadians have an innate capacity to enter into new environments more easily than people from other countries. This is attributed to anti-Americanism (what one firm called the "gringo" complex), the mining history in far flung reaches of Canada itself that created a heritage based on a "frontier mentality," and the long-term dominance of large Canadian firms in the international field.

Another reason for the timing of a rise in Canadian foreign direct investment (FDI) in mining was ironically borne of failure. The expansion of the junior firm sector in the mid-to-late 1980s came in the midst of a severe restructuring of the Canadian mining industry in the 1980s (Mackenzie and Doggett: 1993). Many large firms were downsizing, and much of the geological expertise floating around unemployed ended up joining—indeed, creating—the burgeoning junior sector. Many of these explorationists had experiences and contacts around the world with seniors, and a strong knowledge base of what it takes to compete and interact internationally:

"Many times major companies laid off senior people, and so there were senior people with worldwide experience who could form the technical team for junior companies to go out there and find something. So there really isn't anywhere much in the world where the rocks don't look pretty much familiar (to Canadians); it is more of the culture that you have to adjust to, but we have extensive experience with different cultural types, so that helps a lot in these places." - President of an exploration junior

There is also a degree of territoriality to the distribution of international mining ventures by companies from the major mining nations. Canadians feel that their areas of expertise are in North America, Latin America and, to a lesser degree, in Africa. The dominant new region for Canadian investment over the past decade—in part due to proximity—has been Latin America. Aside from the geographical location being a factor, industry members feel there was a unique opportunity presented by Latin America's "opening arms" during the 1990s (a changing socio-political environment, often called "Neo-liberalism," that saw the reduction of trade barriers, opening to international investors and reduced government controls over the economy, across a broad swath of the developing world). This opening exposed in Latin America a mining environment ideally suited to the skill base of Canadians, that being a blend of financial, technological and geological expertise:

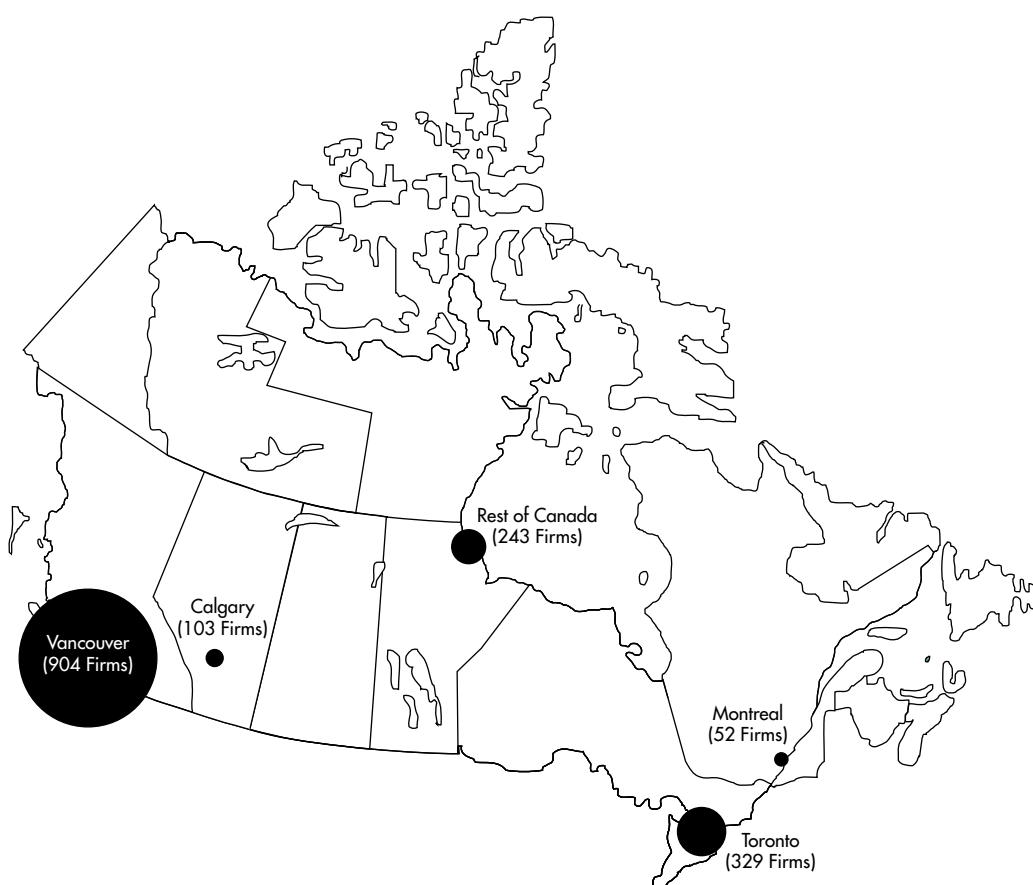
"Most of what I have seen in South America, with the exception of Chile... (is) a lot of modest production out of fairly small operations highgrading, but a real lack of capital in those operations... The other thing is that most of these places don't worry about exploration... and again there are opportunities for people like us that are more used to reading the rocks, making blind discoveries." - President, production junior

The rise of Canada as a global mining power, then, comes from a timely mixture of internal and external industry and economic changes, alongside an inter-industrial capacity built over time in the "home country" of the Canadian mining firm. Is identifying these country-level characteristics enough, though? To say that there is a single corporate mining sector in Canada would be an injustice to the characteristics derived by regional minesite and/or head office locations. Much of the variability has to do with the mining histories of the various parts of Canada. To say that companies that mine coal in Alberta's Rocky Mountains are the same as the uranium miners of northern Saskatchewan or the gold miners of northern Ontario would be fallacious. The same can be said of companies with head offices in Vancouver vs. Toronto. Their "spheres of influence" in global markets are also different. The Vancouver based mining sector (VBMS) is well known for its ability to invest in Latin America and the Pacific Rim; Quebec-based firms have cultural inroads that make investing in Francophone countries (especially in west Africa) much easier; and the Toronto-based mining circuit, while it has a

wide distribution of interests, seems to have better access to Africa and central Asia than its Vancouver counterparts. This suggests that there are not only national, but also localized “home places,” most often associated with the head offices of mining firms.

The four biggest Canadian mining cities are Vancouver (most firms); Toronto (first in terms of financial importance and senior firm head offices, and considered to be Canada’s mining capital by most observers); Calgary; and Montreal. Map 1 shows the distribution of junior mining head offices in the “Big Four” cities for the year 2000. (Junior head office numbers come from Prospectors and Developers Association of Canada: 2001 analysis.) In contrast to the distribution of junior companies, senior companies are more prominently located in Toronto. Twenty-four of the 39 Canadian mining firms with assets over CDN\$100 million are based in Toronto. Clearly, Vancouver and Toronto play different roles in the Canadian mineral production system, and thus merit our attention here.

Map 1: 2000 Head Office Locations of Canadian Junior Mining Companies



Comparing Canada’s Two Major Mining Cities: Vancouver and Toronto

Vancouver is a global centre for preliminary exploration, high-risk capital raising, geosciences expertise and the premium “pipeline” of communication with South American and Asian mining prospects. Toronto is well known as a global centre for mine development finance and venture capital access for actual mineral production. It is home to the majority of large Canadian firms, and there several major global “mining houses” with offices there.

"Mining works for urban communities. Toronto is considered the mining capital of the world and is home not only to Toronto Stock Exchange (TSE) but also to more than 400 mining and exploration company offices; at least 30 mining company head offices, including Inco, Noranda, Falconbridge and Barrick Gold; and over 260 mining suppliers, consultant firms and service providers"
- MAC (2000)

"Vancouver is the world's mining exploration centre with more than 850 mining and exploration company offices including Cominco, Placer Dome, and Teck Corporation. In addition, more than 400 mining suppliers, consultants, etc., are located in the Greater Vancouver area with an additional 290 mining suppliers located in the rest of British Columbia."
- MAC (2000)

PDAC research tells us that in 2000, 55 per cent of Canadian junior mining companies had head offices in Vancouver. Toronto is second, with about 20 per cent (PDAC 2001).

From the mid-1960s to its amalgamation with the Alberta Stock Exchange in 1999, the VSE raised CDN\$20 billion for mining exploration and helped discover over 125 mines
- Brock (1998)

The Vancouver-based mining sector has often in the past been criticized for being too "loose" in terms of stock regulation enforcement, leading to a "wild west" perception of its capital markets. This is a good example of how the erosion of reputation capital is hard to recoup, because this perception of the market remains, even though the CDNX itself—and the B.C. Securities Commission (BCSC) governing its activities—have incorporated some of the most demanding guidelines of any mining market. The *Northern Miner* (1998) noted this irony of low reputation capital and high enforcement measures:

"It is somehow ironic that Vancouver, long perceived and unfairly reviled as the 'scam capital of the world,' has emerged with some of the best guidelines for junior companies. This is because officials have seen every trick in the book."

Table 3: Differentiating Toronto vs. Vancouver-based Mining Communities¹⁷

Variable	Toronto	Vancouver
Number of firms (2000)	approximately 360	approximately 900
Number of firms with more than CDN\$100 million in assets	<ul style="list-style-type: none"> • 22 (including Canada's top seven mining firms, by asset value). • as percentage of total firms—6–7 per cent. 	<ul style="list-style-type: none"> • 14 (including three of Canada's top 10 mining firms). • as percentage of total firms—1–2 per cent.
Percentage of Canadian firms in Latin America (1998)	20 per cent (100 firms—28 per cent of total Toronto mining firm population).	62 per cent (243 firms—27 per cent of total Vancouver mining firm population).
Primary geographic project locations	Canadian focus, particularly in the mining districts of Ontario and Quebec; world-wide in 1990s, especially in Africa and Central Asia.	Previously British Columbia and western U.S.; first to move to Latin American districts and Southeast Asia.
Market reputation	Known as a world centre for large (senior) firms, with a reputable market (TSE and banks) for raising <i>mine development</i> finance.	Known as a world centre for raising venture (a.k.a. risk) capital for <i>initial exploration projects</i> by juniors.
Primary industry function	Focal point for financial and administrative control over large mining firms.	Focal point for grassroots exploration and discovery in highly prospective, relatively underexplored, high risk areas.
Mining as percentage of Stock Exchange volume (1998)	23 per cent (of total exchange trading volume).	53 per cent (of total exchange trading volume).

In addition to domestic firms, both cities house exploration/development offices of many of the world's major "mining houses" and senior firms. In this area, Vancouver seems to be just as important as Toronto. Consider this statement by the exploration manager of a global giant:

"Vancouver is used because it is by a wide margin the worldwide exploration capital, I think. That is why the big three (RTZ; BHP Billiton; Anglo America) are all located here after some fashion. Used to be Toronto or Reno, but now they are subservient."

*"Of course, Toronto is the mining capital of Canada, not Vancouver. That is where all the senior companies are and the big money is." -
President of a
production junior*

■ **SPOTLIGHT: What is a Mining House?** The "mining houses" of London, England, are the head offices of the global mining giants, consisting of Rio Tinto Zinc (RTZ), Billiton (now BHP Billiton), De Beers Anglo America (these last two are actually South African-based firms with their administrative heads and market listings in London). Their exploration and development offices in Vancouver and/or Toronto are to the mining industry what the trading post was to the fur trade—an acknowledged location where goods (in this case exploration projects) can be exchanged for other necessities of life (in this case, most often, cash or shares in the larger company, as well as a retained percentage interest in the site). As one giant firm representative in Vancouver put it, these offices represent an interface between the junior and senior markets. Virtually all of the global mining giants have Canadian offices, and indeed many have offices in both Vancouver and Toronto. Often, these offices serve as hemispheric bases as well as Canadian ones. Firms like Kennecott (a RTZ subsidiary), De Beers, and BHP Billiton have offices in Vancouver, which perform the necessary function of providing a funding pipeline to promising projects. As the exploration manager at the Vancouver branch office of one of these global giants put it: "This office represents the key interface between the junior and senior markets." The location of mining houses around the world is further evidence of the footloose nature of the industry, and calls into question the very notion of "regional" or "national" mining sectors. At the same time, this notion of a "project pipeline" highlights another key issue for sustainability in mining—security of reserves supply for the senior circuit. We will come back to this in Chapter 6.

*"The people in Vancouver are notorious; they will buy the stock on Monday, and hope they can sell on Thursday before they have to pay for it. On the other hand, an investor in Toronto will hold on for years. When we formed (an intermediate) we couldn't get out of Vancouver fast enough to get listed in Toronto." -
President of a
production junior*

Other "Home Places"

Calgary is seen as the prototypical oil "boomtown." It has benefited greatly from the oil patch in the past. It has also become a second tier junior mining city in Canada over the years, due to two factors: one of the highest populations of geologists per capita of any city in the world; and because it continues to be a centre for venture capital access for resource projects. Mining still takes a back seat to oil and gas here, however, a situation that has not been aided by the weak mining markets of the past five years. Thus, Calgary represents a useful case study for understanding the junior mining sector's impressions of the current state and future prospects of the CMS.

Currently, the fiscal climate the Calgary metals mining sector finds itself in can be described as a survival/dormancy mode of activity. The junior firms that make up the bulk of the population are finding it hard to raise any money on the venture capital exchanges. Many firms, showing the chameleon-like qualities of junior investment companies, have moved either into high-tech (1999–2000) or oil and gas (2001). The majority of industry insiders believe that the shift is "just another cycle,"¹⁸ although as this generation of geologists gets older, the question arises as to where the next generation of "minefinders" will come from.

Generally, there is a pervasive sense of pessimism in the Calgary junior mining community that arguably goes deeper than the recent negative market climate. Admittedly, they recognize that the all-purpose failure of the venture capital markets for mining in the past five years is a major source of sectoral discomfort. However, they are confused and bitter about three additional things in particular:

*"There are more geologists per capita in Calgary than in any other place in the world. But 95 per cent of these people are in the oil patch because of the depressed metals markets." -
President of an
investment junior*

*"You can't go near the diamond fields now without a Native group coming up to you and asking where your IBA (impacts and benefits agreement) is, and where is your negotiator. The junior sector can't afford it, but the seniors have pushed up local expectations."
- Geologist for an exploration junior*

1. a public that has NIMBY tendencies and yet demands massive amounts of minerals and metals. "You can't have it both ways," is the common refrain from explorers, who feel hamstrung by mounting environmental, permitting and other regulatory delays imposed by what one junior explorer called "an overheated bureaucracy driven by a low public opinion of mining." One can see the evolution of an "us vs. them" stance here, between mining companies on the one hand and both civil society and governmental regulators on the other. This sort of hardening of attitudes toward these groups can only lead to more friction in the future;
2. a senior sector that has effectively abandoned the junior sector both through inaction (inability to support promising prospects held by juniors through capital infusions), or too much action ("ramping up" costs of doing business by engaging locals in costly [time and money] consultations from the very start of projects—something the juniors don't perceive as affordable—for example, in the burgeoning diamond fields of northern Canada); and
3. venture capital markets and securities commissions that have turned their backs on their previous bread and butter, the junior mining sector, through new reporting and listing requirements. Some say this stifles entrepreneurialism, which is one of the defining elements of the value of the junior exploration sector.

These three concerns are mentioned time and time again by members of the junior sector and come up again later in this analysis. If the perceptual gap between actors both inside and outside the industry widens, the ability of industry members to mend fences and work together with the "other" can only decline.

Montreal: The Quebec mining sector is focused on two areas: mining in the Canadian Shield; and, increasingly, expanding their investment horizons into francophone countries, particularly in west Africa. This predisposition isolates another key characteristic of "home places"; their international allegiances. Increasingly, it is the capacity to adapt to and integrate oneself into the culture of the project location that makes or breaks the project. Thus, French-speaking firms have advantages in countries like Suriname and Cote d'Ivoire.

Is "Home Place" Important?

In previous work by this author (MacDonald: 2000a and b), an argument was developed that the "home place" at the national and local level has importance for the future stability of a mining sector, as declining exploration investment in "domestic" climates has long term effects on the competitiveness of the "home place." This is due to a gradual erosion of the skilled mining professions domestically, and subsequently, loss of the "critical mass" of technology, funding and infrastructure that drive the mining sector in these regions. Mining "home places," often explained away as merely imagined centres, in fact create significant economies of scale and industrial agglomerations within the corporate mining sector and amongst supplier firms (following Lemieux: 2000). The decline in this "critical mass" that drives innovation, entrepreneurialism and cooperation in the mining industry, has become an increasing concern in the CMS, highlighted by a human resource problem often known as the "greybeard phenomenon."

■ **SPOTLIGHT: The "Greybearding" of the CMS – Mining and HR in the 21st Century.** There is an argument to be made that Canada has never really been a "mining country," an argument aided by the fact that a high percentage of explorationists came to Canada as expatriates (usually from England or Australia, but also of late from Latin America). Perhaps Canada has set up a facade of being a mining country that has succeeded through self-replicating human resource development, when in fact, Canada was simply another target for explorationists that happened to offer a quality of life, and potential for earnings, that encouraged their setting down roots here. This

*"Fifteen to 20 years ago there started to be virtually nobody coming into Canadian geology, and now the average age is probably in the late 40s, early 50s. The sustainability of mining itself in Canada is going to be in question without an adequate workforce replacing a retiring generation of 'minefinders.' Huge issue from my perspective."
- Mining consultant*

argument begs the question: Where is that next generation of minefinders to come from? And does it matter if they are not Canadian? One mining insider looked at this issue with an historical perspective: “If you look at history, 100 years ago, what was equivalent to a junior (today) was being run out of London and Europe, all the geologists were there. They migrated to North America when Europe became ‘civilized’ and the sector died. The same thing is going to happen here, but now we will migrate to Chile, Peru, South America. That will be within the next 25 years, and the Canadian sector will wither and die.” When discussed in interviews, there was a highly mixed reaction to this “greybeard” treatise. Many people in the industry are concerned about the state of human resources, some consider the availability of openings to be a positive development that will attract new talent via a vacuum effect (this is the general position of some in the governmental sector) and still others consider the notion of a “home place” and a “national” mining sector to be anachronisms in a global era. As one Peruvian expatriate working out of Canada put it: “It works both ways. You send geologists to us. Now I come here to you. Nationality doesn’t matter anymore.” Indeed, the very notion of a “home place” is being brought into question, although there are still implications to be examined further in Section 6.4.

4.2.2 Firm Size

Traditional measures of firm size in metals mining have relied on the junior/senior firm dichotomy. For example, Metals Economics Group considers any firm with assets below US\$200 million to be juniors. This definition is overly simplistic and arguably inadequate. MacDonald (2000a) created new definitions based not solely on a simple financial cut-off, but rather by looking at the places in the production system of firms of different sizes, and the effect firm size has on the ability to adapt to changing risks. That work is extended here using the example of the largest firms in the CMS.

The Metals Economics Group (2000) defines junior companies as those capitalized at less than US\$200 million in the year 2000.

Appendix 2 shows the 39 Canadian metals mining companies that had total assets valued over CDN\$100 million in 1996, and their relative strengths four years later. An examination of trends among firms of different sizes within this subpopulation highlights several things:

- there is a clear division between intermediate-sized producers and seniors in the CMS. This division is reflected by the gap in total assets between those companies that have several large scale mines, and those that have only a few. Only the top eight Canadian mining companies (circa 2001) could be considered senior companies, with perhaps Rio Algom (before its amalgamation with Billiton) and Cameco, a uranium producer, as entries on the cusp of the senior realm. This suggests that somewhere around CDN\$2 billion in total assets 18 is a decent cut-off point for the senior sector;
- unlike the senior sector, there is no clear division between established intermediate-sized firms and those firms that are either moving into or down out of the intermediate sector (called expansionary juniors here). Any boundary chosen must be arbitrary to a point, but there are clear differences in the Canadian mining sector between intermediates with assets between CDN\$369–700 million and expansionary juniors with assets below that number;
- these differences are manifest when you consider the changes between 1996 and 2000 among the expansionary junior sector. There is a clear indication that the expansionary juniors—from Eldorado Gold down to Glamis Gold (whose head office is now located in the U.S.)—have as a group suffered the most during the mining downturn of 1997–2000. Among this group of 19 companies that had total assets between \$107 and 369 million in 1996, only three (Aur, Glamis and Breakwater) have seen their assets grow more than 10 per cent in the four-year interim; and

In this study, a “large firm” is one with total assets valued over CDN\$100 million. This includes seniors, intermediates and the different expansionary juniors.

- a significant number of firms have been involved in mergers and acquisition activities since 1996. This occurs across firm size boundaries with equal abandon. If one includes firms that have controlling interests from outside, of the 39 largest miners in 1996, only 23 still exist as independent entities at the time of this writing.

All three of the so-called “large firm” sector sub-types are really transitional modes. The senior sector is consolidating and globalizing at a rapid pace; the intermediate sector is struggling continually to grow its reserves in order to build more mines and move into the senior sector (or face takeover); and the expansionary junior sector is actually a misnomer, because firms are both expanding and contracting, some rapidly growing toward multiple production portfolios, some rapidly downward, failing as producers.

The following examines all of the firm sizes theorized to make up the mining population pyramid in more detail:

Giant Firms/Seniors

While Canadian and U.S. firms are competitive globally, many in the sector lament the fact that their competitiveness is hampered by not having a domestic “giant firm” among the many mining seniors. When measured by market capitalization, only two (Phelps Dodge and Barrick) of the world’s 10 largest mining companies, are from North America (Bogden: 2001). The truly massive “giant firms” are all based in London, Australia or South Africa. The most important players on the world scene are the large, multi-commodity and more vertically-integrated firms of Broken Hill Proprietary (BHP), Billiton PLC (now united with BHP), Anglo-American/De Beers and Rio Tinto Zinc (RTZ).

In addition, mining as a whole suffers from a fiscal reality that the industry is but a blip on the global economic map. Peter Munk of Toronto’s Barrick Ltd. is famous for pointing out that Microsoft has a larger market capitalization than the entire global mining industry. For even the largest mining companies, there is not the leverage with national governments or the financial community that large firms in many other industries have. Nonetheless, Canada does have a relatively vibrant senior firm population, with 10 firms from the metals sector with current assets of over CDN\$2 billion.

Mid-Sized Firms: Intermediates and Expansionary Juniors

The Canadian mining sector has close to 30 companies in the CDN\$100 million to CDN\$2 billion market capitalization range. About 10 are unquestionably intermediate-sized firms, with more than one medium-to-large-scale operation up and running. Below these are close to 20 firms with assets of CDN\$100–370 million, herein called expansionary juniors, although as mentioned this label is actually a bit of a misnomer. These companies are really of two distinct types, moving in opposite directions from each another. First of all, there are previous seniors or long-term producers who have failed to adapt to changing market conditions, have been unable to ensure security of resource supply, and are quickly becoming footnotes in history. These might better be called (dis)expansionary juniors, and the number of these firms in any given time period is a good indication of the state of commodity prices. Many firms fail during downturns in the metals markets like we have seen since 1997.

Passing these failing companies on the way up are those expanding exploration juniors or investment companies that have managed to find a solid mineable deposit, and through fiscal competency and good management, have placed that prospect into production without diluting their control of the prospect. They can then use this start-up mine to finance their further expansion. These are the true expansionary juniors.

Junior Firms

There is some debate over how to define junior mining companies. The reason that they are difficult to capture is that most don’t have any revenues coming in, because they are

In this study, seniors are any firms with assets over CDN\$2 billion.

In this study, giant firms are defined as those mining companies whose total assets exceed US\$10 billion.

*“At about US\$180 billion, the aggregate market capitalizations of the global non-ferrous mining industry is now less than that of the individual market cap’s of many large U.S. MNCs such as General Electric and Microsoft.”
- Bogden (2001)*

In this study, intermediates are firms with assets between CDN\$370 million and CDN\$2 billion.

In this study, expansionary juniors are any firms with assets between CDN\$100 million and CDN\$370 million.

not producers. Analysis of their relative strengths then comes down to their market capitalization, total assets, or their exploration expenditures. Total assets are used here.¹⁹

Here is a generalized picture of the inner workings of a junior company. Most junior firms are run by up to three experienced geologists or financiers, who (often) forsake a guaranteed salary in exchange for equity positions in the firm. Because money is often tight, most of both the administrative and technical work is done internally by the firm members, although their technical capacities differ according to the organizational focus of the firm. In Canada, rapid growth occurred in the junior sector during the major downsizing among major firms in the mid-1980s, flooding the domestic junior market with seasoned, highly skilled exploration, development and production experts.

As the vast majority of junior mining companies have no revenues from production, their value to shareholders is measured in their capacity to increase price of stock. Part of the negative image many investors have of the junior mining sector is driven by the “risky” nature of these investments. With high risk comes high reward, though. A well-known fact in the industry is that the most “value-added” in any mining venture (in percentage terms) occurs at the point of initial discovery, when stock prices for juniors escalate rapidly (Miranda Minerals Inc.: 1997). With no regular source of income, juniors depend entirely on new financings on a regular basis or the ability to hibernate for several years during down cycles in the market. The only other option is outright failure. The junior sector is thus subject to more ups and downs, and in more rapid succession, than any other facet of the mining industry.

Junior/Juniors: The Unknown Quantity

It has been postulated that there exists below that portion of the junior mining sector considered “legitimate,” yet another layer of very small “mining companies,” mainly focused on accessing venture capital on the Canadian exchanges and manipulating stock prices. These we have dubbed the junior/junior companies, and their strengths and weaknesses both play key roles in the Canadian mining sector, as seen in the analysis of the Canadian population pyramid below.

In this study, juniors are any firms with assets between CDN\$2 million and CDN\$100 million.

*Junior companies on the VSE (according to Brock: 1998):
1954: 171
1990:2000
1998: 800.*

■ SPOTLIGHT: “Apples and Oranges”—Are Juniors and Seniors in the Same Industry?

One industry insider considered grouping juniors and seniors in one industry a potentially “fatal flaw.” It can be argued alternatively that not grouping them as part of an integrated production system certainly *will* prove fatal. Junior and senior miners are not apples and oranges. In reality, they are seeds and trees. Juniors provide the seeds for growth, and the resources provided by the senior trees are vitally necessary for regeneration in the junior sector. This inter-relationship is fundamental, yet misunderstood or ignored on an industry-wide basis, and its importance shall be proved out in the next four sections.

In this study, junior/juniors are any firms with assets below CDN\$2 million.

4.2.3 The Production System Defined – The Population Pyramid

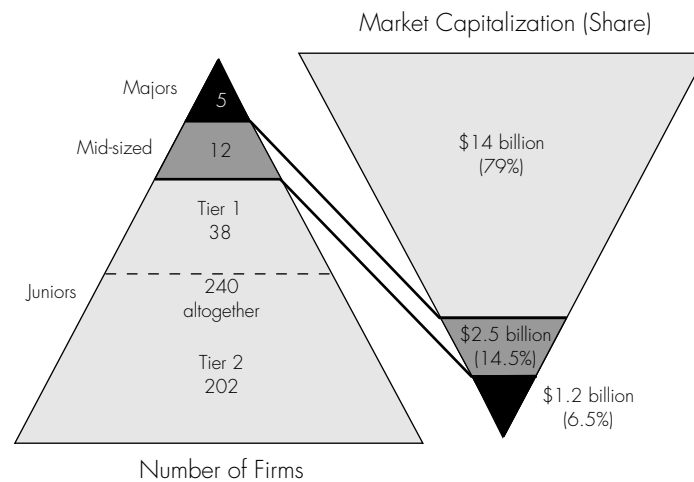
The firm size:firm population ratio in the mining industry is best identified as a population pyramid (Figure 7). The largest firms are also the fewest in number, and this inverse relationship follows on down to the smallest firms. Canaccord Capital (2000) data show this firm size/firm population relationship quite well for the North American *gold* exploration community (Figure 8).²⁰ The average market capitalization of a gold major (called seniors here) is close to \$3 billion, while for mid-sized firms it is just over \$200 million, and juniors about \$5 million.

The gold exploration sector thus shows quite well the inverse relationship between the number of firms and the control over the available capital for the sector. The main reason for this relationship is there is only a limited amount of capital available around the

world for mining, and the bulk of it is necessarily going to be tied up in those firms that are proven producers. A secondary reason is that the structure of the population pyramid serves a purpose of its own, as the risks inherent in mineral exploration need to be spread among a great number of different firms, supported from below by venture capital market structures. It is in the interests of the senior circuit that there be strong intermediate and junior sectors, and vice versa. The notion of cooperation as well as competition is one that we will examine further.

Canaccord Capital (2000) data show this firm size/firm population relationship quite well for the North American *gold* exploration community (Figure 8).²⁰ The average market capitalization of a gold major is close to \$3 billion, while for mid-sized firms it is just over \$200 million, and juniors about \$5 million. The gold exploration sector thus shows quite well the inverse relationship between the number of firms and the control over the available capital for the sector.

Figure 7: Firm Size Distribution in the North American Gold Sector
(adapted from Canaccord: 2000)

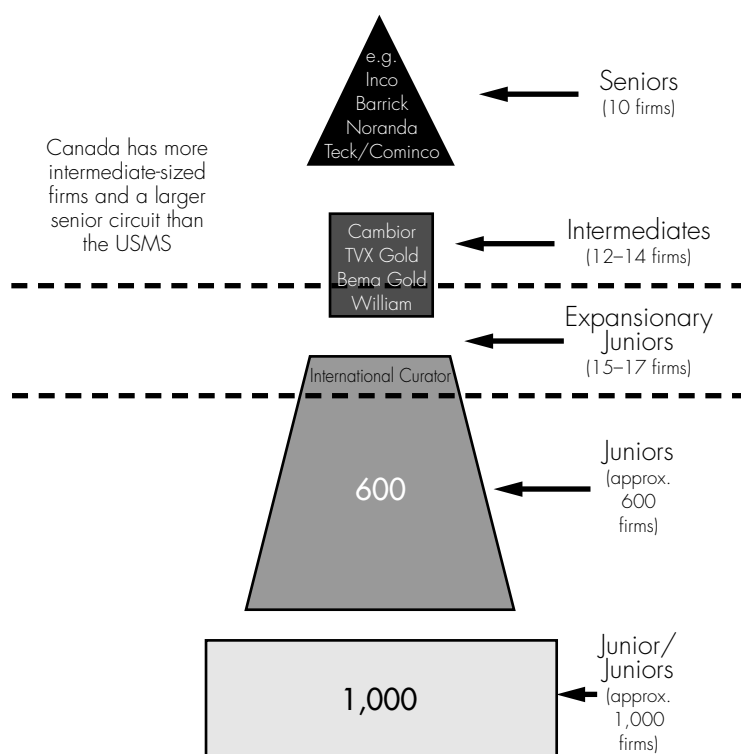


Going beyond the gold-focused sector, there are now about 1,650 discernible mining companies in Canada consisting of the 39 “large firms” identified in Appendix 2 which have assets over CDN\$100 million and over 1,600 “small firms” identified by PDAC (2001) researchers. Figure 8 shows how these numbers break down. Canada has the largest number of “large firms” and of “small firms” in the world. Indeed, mining firms with head offices located in Canada represent well over half of all global publicly traded mining companies. According to Lemieux (2000), three quarters of all global mining companies are listed on Canadian exchanges. In comparison, the United States is home to fewer than 250 publicly traded mining companies; the U.K. only 45; and Australia between 100 and 250 (Lemieux: 2000).

Figure 9 creates a typology of the CMS production system, broken down into a generalized population pyramid. The arrows indicate the potential directions firms can take (either growth or decline) at each stage of the production system. Each group of firms (differentiated in general by size) has a set of core competencies and limitations. Their limitations can be generalized as a series of gaps, barriers to movement through the production chain. The junior/junior firms (those whose assets are less than CDN\$2 million),

are that stereotypical “shell” firm for which Vancouver is renowned. These companies are defined by their access to venture capital, but their ability to grow into viable exploration juniors is often limited by a fundamental lack of expertise in geology (a knowledge gap). This does not mean that this firm does not employ geologists, but rather that their geologists tend to be contract workers, not directly involved in the core firm. This type of firm is the most numerically prominent in the CMS. The international scene is also more difficult for these firms to enter, as weak financial situation and a lack of technical expertise handicap their mobility. Their numbers and effectiveness are thus somewhat diluted outside the “home place.”

Figure 8: Size Distribution of Firms in the Canadian Mineral Production System



MacDonald (2000a)

If and when junior/junior firms can generate enough venture capital, they can hire more expertise and perhaps pass through this knowledge gap to become “legitimate” juniors.²¹ Junior firms have assets anywhere between CDN\$2 and \$100 million, reflecting the diversities that make summarizing their characteristics difficult. They can be differentiated through recognition of their ability as “skilled space invaders”—they are Crowson’s (1992) “footsoldiers” of international mining. These firms were at the forefront of the Canadian move into international waters. They are usually led by geologists and have a specific strategic niche that they are attempting to fill. Singularly, their movements internationally have been focused and limited (except in the all encompassing rush of an “area play”); as a population, their movements have broken down the barriers to entry throughout the globe.

Although some juniors can actually get to the mineral production stage, their numbers are extremely limited by a “production capacity gap.” Junior firms that are breaching \$100 million in assets are often bridging this gap and have thus been labelled “expan-

"At one time, small mines could be put into production that produced some cash flow... much more difficult and expensive now. Small mines are not economic."
- Junior company president

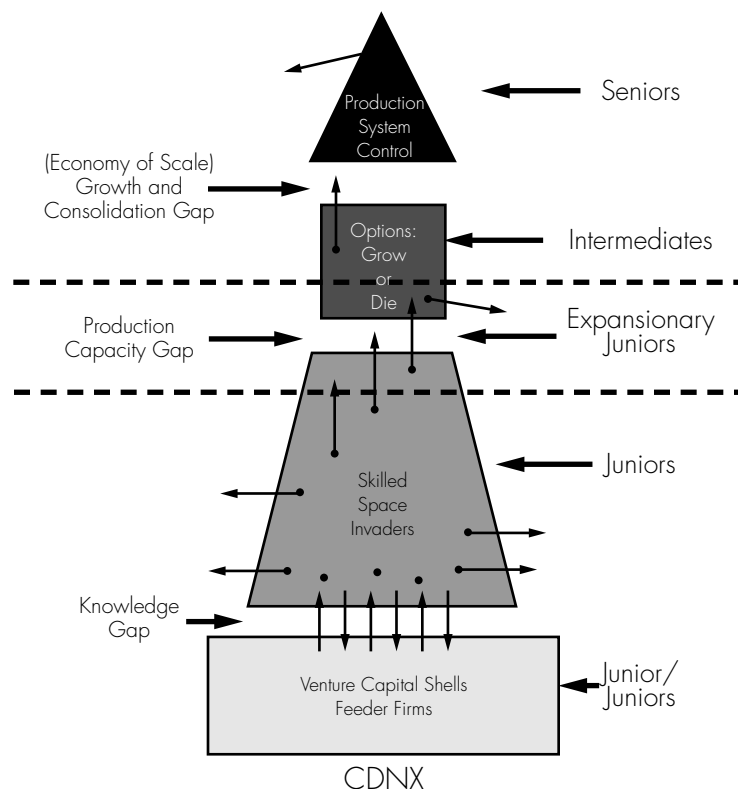
"It really comes down to the fact that (with) a junior our size, you could probably put into production a gold project with a capital cost of \$50-100 million. But our project has a capital cost well over \$400 million, so no bank will lend a company our size the money, so we would need a major company partner to go into production."
- President, exploration junior

"Certainly, the big are getting bigger. The intermediate sizes are getting bigger in the sense that they have to consolidate and amalgamate in order to stay alive... The strong survive and the weak fall by the wayside and we have gone through a whole lot of that."
- President, junior firm

sionary juniors" here. This reflects not simply that they want to expand, but that within the structures of the production system, they have to either expand or they will be usurped by larger firms. Usually, these "expansionary juniors" start by having one or two highly prospective sites they are attempting to self-develop to the production stage. Expansionary juniors do not often last long in the system, however. They must proceed up the production ladder or face immediate outside takeover (friendly or unfriendly). Often, these sites will be vended to larger firms and the expansionary junior will cease to exist, having accomplished its mandate of "adding shareholder value," free to begin the process again. In reality, this process of developing projects and then selling them off to start anew more resembles the game of "Snakes and Ladders" than an organized business cycle. Firms actually vend virtually their entire asset base (in the guise of their single major project) in one fell swoop, often liquidating the corporation at the same time. Nonetheless, this nature of the mine development cycle is widely understood and accepted, for reasons we look at closer in Section 4.2.5.

Sometimes, these expansionary juniors will manage to start up their own operations, thereby defeating the "production capacity gap." McClintock (1989) considers this movement as an inevitable one for firms to develop up the production chain. What he does not reflect is the rarity of this actually happening. By way of example, only about two to three per cent of all firms in the CMS (39 out of 1,650) have assets greater than CDN\$100 million, considered here the dividing line between small and large firms. The inability to develop a mine comes down to a mix of organizational incapacity and simple economics.

Figure 9: Size Distribution of Firms in the Canadian Mineral Production System



Intermediate firms are also limited in their capacities. If they struggle, they cannot simply turn back to the market for support. This is due to the fact that they have to invest a mass of debt financing in the creation of a viable minesite. Intermediates have two options: either grow or die. In truth, this “death” can come in a few different ways: firms can simply fail, they can merge with other intermediates or be subsumed through acquisition by larger firms. In today’s mining industry, the latter is becoming more and more commonplace (Gleason: 1998).

Firms that do go the merger route reflect the difficulty of getting past the final gap—an “economy of scale gap”—that necessitates surviving firms to either grow internally or consolidate (merge with another firm). The difficulty in moving into the senior firm arena is also illustrated by the fact there is no real value defining the line between intermediates and seniors. How then can seniors be defined? Perhaps the old joke is true—if you have to ask, then you don’t fit the category. Senior firms are few in number and expansive in power. Vancouver, for example, only has three “true” seniors: Placer Dome Ltd., Teck Corporation, and Cominco Ltd—and Teck and Cominco are now merged! Each firm is worth more than \$2 billion, has a diversity of mining operations around the world and is globally competitive in a significant market niche. Placer Dome’s niche is its commodity focus on gold. Cominco’s niche is its base metal emphasis accompanied by a significant vertical integration up the production chain. Teck’s niche is its mine development capacity and strong ties with—and support of—exploration firms.

What does this analysis of the architecture of the Canadian mineral production system tell us about the larger mining industry? Certainly, that the junior/senior dichotomy is too limited in detail to capture the complexity of the inter-relationships within the industry. Secondly, there is merit in the notion that stagnancy on the mineral production chain is not feasible; like sharks, mining firms must continue to move or die. Indeed, this explains some of the growth and subsequent consolidation and stagnation in international exploration through the past decade. Overall, metals mining is an industry associated initially with rapid place-based growth to capture a portion of market interest and to develop significant production assets, followed by movement internationally to capture more market share over time, with a subsequent consolidation movement at the corporate level as firms find their activities overextended and vulnerable over time, leading eventually a reduction in the number of firms, as relatively small and/or weak firms are bought up or die off. The cycle begins afresh when new markets open or a vacuum is created in the “project pipeline” (a phenomenon on which the industry is rapidly closing in).

The Canadian mineral production system also denies simplistic efforts to define it as having either a planning system or market system structure. Planning systems emphasize long range planning, organizing corporate or systemic goals around distant time horizons, often over decades, with a multitude of built in defences against changing risk environments. Market systems are driven purely by the whims of the market, and decisions are made rapidly, subsequent to—and in consideration of—changes in the prices of produced goods. While intuitively, we know that mining firms are highly subject to market fluctuations, the production system within which individual firms operate has built in “shock absorbers” to deal with market shifts, a hallmark more of an organized plan than disorganized chaos.

Consider for example, the size distribution of mining firms. Although the size distribution of firms is a typical pyramidal structure, with the amount of control one can impose correlating to the size of the firm, do not look at the system as a population pyramid. Rather, try to envision it as like a propulsion unit, fueled from below by venture capital and the entrepreneurial fervor of the junior sector, and guided from above by the planning system strategies of the largest firms. Neither type of company can survive without the other. This is because they are not only different in size, but in their purpose in the production system. It is to this “division of labour” in the production system and the patterns of interaction related to it that we now turn our attention.

Lifeworlds:

Junior/Juniors = their stock price;

Juniors = their project;

Expansionary Juniors = their mine;

Intermediates = their reserves;

Seniors = their industry.

“It is like an ecosystem and there is a current gap in the corporate sizes.

There are benefits to having a spectrum of firm sizes. The intermediates provide an alternative to the senior mindset and thus can help prop up the junior sector as well.” - President of a private junior

4.2.4 Organizational Focus

There have been many attempts in the past to identify characteristics of firms that can be used to delineate their organizational function in the mining industry. For example, Canaccord Capital (2000) breaks down the gold exploration sector into two groups: a) exploration divisions of major companies, and b) juniors/mid-sized companies, of which there are three types:

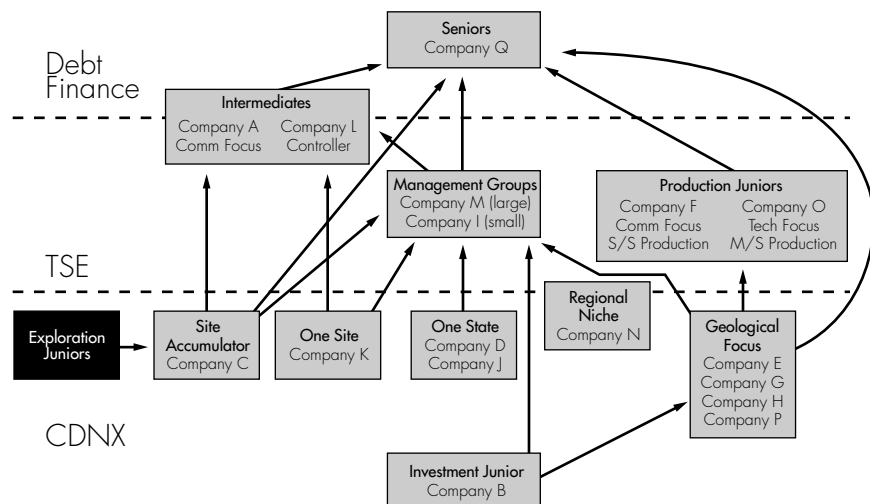
Type 1: “Single Purpose” juniors whose entire corporate existence hinges on developing deposits to sell to majors (the examples they use are Pangea Goldfields and Argentina Gold). These firms comprise some 81 per cent of the total firm population;

Type 2: “Transition” firms (expansionary juniors or intermediates), who attempt to develop deposits to become producers (TVX Gold, Bema Gold). Nine per cent of all firms in the gold sector are considered to be in transition; and

Type 3: “Professional” companies (called “Management Groups” here), that manage a portfolio of companies for sale or joint venturing (Hunter Dickenson, Lundin Group). Significantly, about 10 per cent of the firm population in the gold sector is considered professional or under the umbrella of a professional company. These companies are becoming more important over time.

The Canaccord analysis is an excellent breakdown of the end goals specific to gold exploration companies, but what it lacks is a total metals sector outlook and a deeper assessment of the multitude of strategies firms pursue to reach these goals. With this in mind, this author (MacDonald: 2000a) developed a more distinctly stratified conceptualization of the corporate types in a mineral production system, based on firms interviewed in a study of the Vancouver-based mining sector. Figure 10 shows not only a more descriptive approach to defining the role of firm types in a production system, but also the financing sources used and the relations between firms in the production system. For our purposes, this organization chart of firms will be broken down into production, management, development (not shown in Figure 10), exploration and investment foci. Each type of firm plays a key role in the overall mineral production system, and each faces individual hurdles to future growth and ability to adapt to change. (Note: the key role played by the changing capital funding sources available for each firm type, shown in the left hand column of Figure 10, have been highlighted already during the discussion of firm size, as a major factor in the overall strength of firms.)

Figure 10: Company Types in the Latin American Production System²²



Production Focus

Mineral production currently is almost entirely in the purview of the intermediate and senior firm sub-sectors. This was not always the case. In the very recent past, it was often the goal of junior explorationists to make a go themselves at becoming producing companies. Some of the largest and most successful firms in mining started out as exploration juniors, firms like Barrick and Teck Corporation.

By definition, all senior firms are production-focused, yet they exhibit great diversity in organizational strategy. They maintain their productive operations and growth patterns through creation of market niches to secure supply of ores and lower costs. Appendix 4 examines how firm size and organizational focus interrelate, and shows four different organizational strategies for senior firms, each associated with certain risk and reward tradeoffs:

1. *Commodity focus (COFO)*, where firms attempt to corner a significant market share of an individual commodity to create economies of scale (Placer Dome and Barrick are the major Canadian gold players), but expose themselves significantly to commodity price fluctuations;
2. *Vertical integration*, into refining, and/or value-added manufacturing. Firms like Cominco attempt to reduce their risk to commodity flux and increase profits through this process, but run the risk of overexpansion and losing their core competence in mining;
3. *Strategic (controllers)*, like Billiton or Teck, known for their interactions with junior companies to reduce exploration costs and ensure a solid project pipeline (security of supply). These firms are vulnerable to phenomena which reduce the effectiveness of the junior sector; and
4. *Acquisitional firms*—where Barrick would now more properly fit—who reduce discovery and project development risks by spending cash in acquiring proven deposits, or even other firms. Often, however, the price paid for advanced projects can actually exceed the value added to the purchasing company.

In addition, some junior companies have always found ways to run actual mining operations. In the late 1980s and early 1990s, the growth of heap-leaching for gold was driven by small firms appreciative of the low cost and short timelines for production start-up. The past couple of years have seen a major decline in this capacity of junior and intermediates to start up small to medium-sized mines. A mixture of low commodity prices, low venture capital availability, and low confidence from the primary lending institutions have seen to that. Whether this decline in smaller-scale mining is a positive or negative occurrence depends on your viewpoint.

■ **SPOTLIGHT: Future Scale of Operations – Is Small Really Beautiful?** Many analysts argue that the future of mining may be in small operations that don't require great investments of capital to get up and running. These mines would be smaller and shorter lived projects, but would they have a lesser cumulative impact than other operations of a larger scale? There is certainly a lot of negative public image problems for heap/leach mining, wherein ores with grades as low as 0.01 ounces of gold per ton of ore have been exploited using cheap cyanidic impregnation methods. An argument can be made that a reduction in the number of smaller mines would have a positive effect in the industry's move to sustainability, with fewer marginal economic sites coming on stream under companies with short planning horizons and limited treasuries and therefore, little capacity to "batten down the hatches" and ride out a commodity price fall. Fewer smaller mines could also mean greater localization of the industry into fewer (albeit extremely large) mines, thus reducing the distributed spread of environ-

Appendix 4 is a graphical representation examining how firm size and organizational focus interrelate in the global metals mining sector.

"It only cost us about 400 grand in Mexico, and we got 500 grand out of the test heap. And another thing is that it took us only 90 days from when the bulldozer started on the property to when we got our first revenue cheque, so not only is it cheap but very fast. So it is a little man's business as well as a big man's business." - President of a production junior

*"Realizing that there are a finite number of two million ounce gold deposits in the world, a "small is beautiful" objective could emerge for future miners."
- Brock (1998)*

mental hazards; the consistent creation of better managed sites, controlled by experienced mining teams; a reduction in the number of mine sites governments and civil society needs to regulate and monitor, meaning that monitoring could be more site specific and comprehensive; and could add to the industry's public reputation by subtracting those smaller operations more prone to catastrophic economic or structural failures. The last thing the industry needs is to have more abandoned mines! At the same time, large scale mining is not without its negative aspects also. Alongside the large vs. small debate are questions about methods like reworking old tailings and converting existing underground mines to open pits, both of which are potentially innovative ways of limiting the distribution of mining effects to new sites. Done safely, this new form of "recycling" could prove beneficial. Debates over the scale and nature of operations at future mine-sites, and who should be doing the work, should remain at the top of the agenda.

Exploration Focus

As Figure 10 shows, there are any number of strategies available for exploration-focused firms. Exploration juniors are the companies that actually develop the largest number of viable mining projects to the pre-feasibility level of the production chain. They also discover the majority of "bonanza" or "elephant" finds in opening regions. Examples from the 1990s include DiaMet's Ekati find in the Northwest Territories; International Musto's (Bajo de la Alumbrera), and Argentina Gold's (Veladero) finds in Argentina; and Sutton Resources' Bulyanhulu find in Tanzania. Tellingly, each of these major finds was taken to production by a larger firm after a buy out or takeover (although DiaMet stayed on as a joint venture partner in Ekati).

Thomson (2001) argues that exploration firms are fundamentally spenders of wealth because they spend money on exploration without producing any true end "product." It can alternatively be argued that they "create wealth" for the mineral production system by being its geographic research and development arm. Exploration is research and development for the mineral production system, wherein dedicated "minefinders" utilize all of their many skills to produce "economic places out of unvariegated geographic space." Of all the risks faced by miners, the geological (or discovery) risk of only one out of 1,000 potential sites ever becoming a mine is the most extreme. Indeed, many consider the exploration arm of the mining industry to be "organized gambling." This does not mean that it is a haphazard exploit, however. On the contrary, the depth and breadth of technology and intellect it takes to locate and delineate a mineral deposit is impressive, no matter how it is measured. With that expertise and commitment come some limitations in vision that have potentially detrimental effects on "soft" issues like sustainability. Such is the double-edged sword of the minefinder.

■ **SPOTLIGHT: What Makes a "Minefinder?"** At a recent dinner between academics and mining industry insiders, the academic crowd was stunned to hear that the most effective weapons successful "minefinders" have are often not high technology, sophisticated communication linkages, and modern data collection and analytical techniques. While these variables have made exploration easier and more thorough over time, they were told the best true weapons of the "minefinder" are: imagination, dogged perseverance, single-mindedness and intuition. Similarly, their audience was surprised to find that—in the opinion of the geologically trained audience—only one per cent of geologists likely find 50 per cent of major mines. True minefinders are rare and important. However, the same single-minded, headstrong attitudes many take to their projects can be misread by locals as arrogance, callousness or evasiveness. And one of the major risks facing mining, especially in "non-traditional" regions of the world, is "social risk" in dealing with local communities. Overcoming these risks demands explorers broaden their view to include the local situation as well as the immediate site.

Investment Focus (a.k.a. Speculators)

Investment juniors rarely find the deposits that create producing mines. They serve a function somewhat off kilter from the rest of the production system in that an investment in them is usually a stock play, where value comes from the speculative movement of the stock rather than through the goal of acquisition by a larger firm or eventual production by the firm itself. Nonetheless, these firms do serve a role in the production system by funnelling as much venture capital as possible into the mainstream exploration sector, thus helping drive bull markets to their maximum capital-raising ability. Firms with an investment focus are usually the smallest of mining firms, the so-called junior/juniors. Their head office activities are usually run not by seasoned geologists, but rather by a group of people interested in mining, backed up by seasoned venture capitalist speculators. This group—although it employs geologists in the field—has the least chance of actually making an economic find, and its activities have often put the industry into disrepute through various scams, but properly regulated, these speculators do have a role to play in the industry. The speculative groups have the skills necessary to cycle risk capital into the mining market, thus providing the lifeblood of the junior sector—exploration capital.

■ SPOTLIGHT: The Role of Reputation Capital vs. the Role of Venture Capital.

More so than an investment in a producing senior company, investment in a junior company is a risky proposition. Nonetheless, while events like the scams (Bre-X among others) that have rocked the Canadian venture capital community do happen, the reputation that these rare events have created is out of proportion with their actual occurrence. Indeed, attempts recently to build reputation capital in the junior sector through increased regulation may end up having the opposite effect of forcing more small firms into precarious fiscal situations, at which point “best practices” quite naturally will take a seat far behind simply surviving. Instead, the investing public needs to be better educated about the risky nature of a mining investment (although most investors already understand the high risk/high reward scenario. Indeed, Freeman [2001] argues that investors in the mining industry are often just as knowledgeable about the nature of the industry as mining executives!). Venture capital availability in relatively open stock markets is perhaps more important for the vitality and flexibility of the sector (and thus its capacity to change its mindset to fit new ideals of practice), rather than imposing regulations in order to regain reputation capital, a debatable strategy currently imposed on the junior sector from without. This balancing of reputation vs. “real” capital remains a tricky equation for the industry and the capital markets that support it.²³

Development Focus

Firms with a developmental focus typically have one or two projects only, and are attempting to forward those projects to at least the feasibility stage, perhaps to the point where they can start an extractive operation on the site. When an initial resource is defined by a company, that is the point at which the stock price appreciates faster than at any other point in time for any mining company, junior or senior. This causes most juniors to seek buyers for their project, so that they can take advantage of both stock appreciation and a buyout payment. Firms that seek to move a project to the feasibility, permitting and construction stages are much rarer, although during positive mining market climates like in the mid-1990s, their numbers soared, as treasuries bolstered by the market made every explorer a potential miner.

Developmental firms face a much different risk environment than exploration firms, because as projects get more involved and more money is invested, the project becomes

According to PDAC (2001) data, “as many as 20 per cent of junior companies change their names, addresses, telephone or facsimile numbers every year.

“I would bet that half of all Vancouver-based mining firms do not regularly employ a geologist.” - President of an investment junior

“The lottery style nature of investing in the junior stock market was **clearly understood**.” - Harper and Andrews (2001) highlighting the traditional role of investment juniors (emphasis added)

“We are currently involved in a court case with an NGO. These days you can’t have a good mine without first having a good court case. They showed up once we had invested over \$10 million in our site; not a peep before that.” - President of a development junior

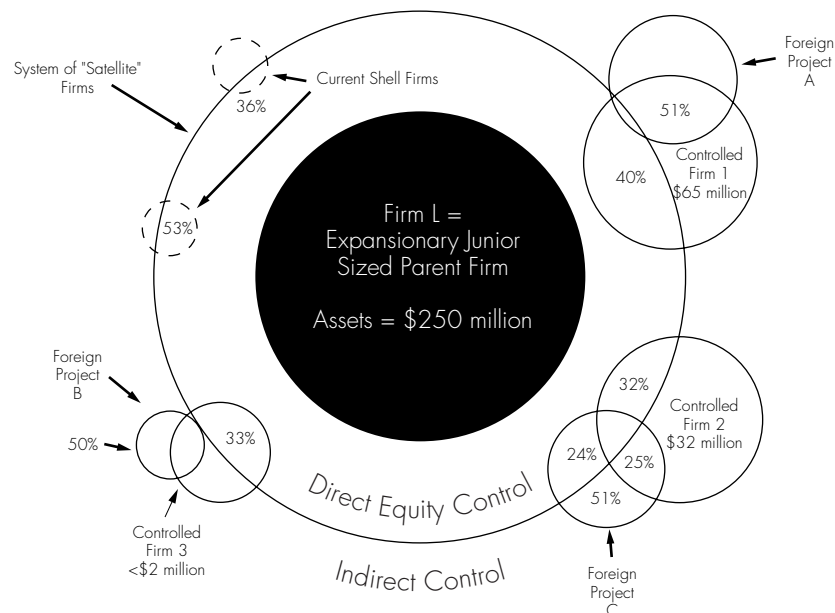
the “lifeworld” of the firm. Significant amounts of time and capital are invested in mining development projects, thus risks compile on each another, especially as more and more stakeholders get involved with these higher profile, more intrusive and capital-intensive activities. This is often the time when firms start to get involved in proactive relationships with locals, when in fact this is argued by many to be a strategy that should start from day one (more light will be shed on engagement strategies with locals in Chapter 7).

Management Groups

The Lundin Group, Hunter Dickinson Ltd and several smaller “management groups” attempt to create value by providing a centralized management structure for several mining companies. For example, the Lundin Group (a business entity with its management in Switzerland and corporate offices and market listings in Vancouver [mining] and Sweden [oil and gas]) has for decades run a bevy of junior mining companies (currently it runs 12 mining and oil/gas exploration firms). Management groups are distinctive from individual companies because they are conglomerations of junior firms where administrative functions are pooled in a central core, and individual firms are utilized on a project-by-project basis. The advantages of this method are found in both the skilled management and capital-raising capacities of the management group and the ability to focus on an individual project rather than dilute the energies of the firm to a multitude of projects.

The management groups, unlike most junior exploration companies, rely on long-term shareholder loyalty created through consistent identification of developable properties that are being held by marginal or struggling firms, overtaking those properties and developing them to the feasibility stage whereupon they are vended (usually along with the corporate identity involved) to intermediate or senior firms. These management groups are not bottom feeders, *per se*, but rather serve a fundamental service in the “production pipeline” of identifying projects that would otherwise stagnate from lack of capital investment, and propel them forward.

Figure 11: Parent Firm as Investor/Controller



"The survivors [of the current mining market downturn] will be run by the lean and mean groups. There are lessons to learn from the likes of the Lundin Group."
- Brock (1998)

Another type of management group is presented by the example in Figure 11. Firm L in Figure 11 is a mid-sized producer that fits into a small group of large firms that MacDonald (2000a) sub-categorized “Investor/Controller” firms. These firms are often among the largest of miners, comprised of expansion-driven intermediate firms and the established seniors. This type of firm is different from traditional management groups in a couple of ways:

- a) their original focus and strategic vision is that the subsidiary companies will fuel growth of the parent firm; whereas traditional management groups like Hunter Dickinson Ltd. have no core firm, only corporate satellites orbiting around a purely administrative core office; and
- b) their emphasis is also on production by their own corporate entities rather than development and vending of properties. Their project pool is there for internal growth purposes. The only reason the projects are not all swallowed right away by the core firm is because there are organizational and market constraints working against this consolidation.

Why not incorporate all the satellite firms’ assets into one large firm? It is the structure of the venture capital market and the production system that dictates against this scenario. Firm L finds that it cannot independently pursue activities all over the world at this stage in its development because it is still heavily reliant on attracting investor capital (it hasn’t reached the economies of scale where it can totally “go it alone” by raising debt finance yet). In order to attract investors, a producing firm must show a focused strategic vision. The exploration manager of another management group firm put it this way when reflecting on the way they manage their member firms:

“We have one property per company, in that way the company and its shareholders can focus on one property or one commodity, or a package of commodities. The advantage is that you may have, for example, diamond shareholders who are not interested in gold or copper. If each company focuses on a specific deposit type, it has its own following. You love classical music or you like rock; you combine the two and you lose both—it is the same concept.”

The parent firm has core competencies in medium-to-large scale production, but in order to expand without losing focus, has created a system of satellite firms for specific project management. In each project, Firm L holds a direct equity percentage, and shares the rest of the project between the satellite firm (in which L holds another percentage interest) and an outside partner. In this way, the day-to-day control over projects is handled by the smaller firms, but the parent group has the option to develop that project into a mine if it proves beneficial over time. Firm L reduces its exposure to the over-extension that large firms fear, but maintains control over final extraction through this method. In an industry that demands specialization and an ever-growing exploration base to fuel growth, this “arms-length” but controlling strategy seems appropriate. Nonetheless, Firm L is in a vulnerable position in an industry that demands large firms “grow or die”; a firm on the border of the market system/planning system dichotomy, as expressed by their Vice-President of Corporate Development:

We are not at the point yet where our one mine’s cash flow pays for our overhead. Now, there are two choices there, because the market demands growth, and people by their nature demand growth. We can cut our company back so the only thing that happens is the mining, or you can live on the cash flow which, at this gold price, would be impossible. We would all have to work without being paid. So you have to be able to raise money through the equity markets to grow. When the mine reaches a stage where it can pay for our overhead, then we’ll have to change how we are doing business. But, right now, we need financing to continue to grow, and to... keep the lights on.

In recent years, the failure of commodity prices has led firms like L, which invested a lot of time into planning to seed their own “project pipeline,” to cut loose all but their core activities. The inherent vulnerability of mining to its commodified products rears its ugly head again.

Niche Firms – The Wild Cards

A niche firm is defined here as a mining company that moves into a very specific production, exploration type or commodity niche in order to carve out a distinct market differentiation from the mining “pack.” Examples include firms like Diagem attempting vertical integration in the diamond sector, several junior companies looking into the gemstone markets, and a rising number of firms that are examining things more exotic than typical “commodities of the month”—like titanium sands, micrometallics or new technological applications.

While it is typical for niche firms to attempt to specialize in a commodity that has previously been neglected, there are other means by which firms can create value through developing a market niche, including:

- geographic specialization (currently, Southeast Asia is a hot area);
- technological innovation (new methods of extraction and exploration, especially in reworking old sites);
- the usage of unique geological models to narrow down the search targets (e.g., “Hot Springs” geology); and
- focusing on their interactions with locals in such a way as to create value through risk reduction—the so-called “partner of choice” difference (see Section 4.2.5).

Of course the development of successful niches by market leaders is almost always followed by a mass of laggards attempting to join in the new market attraction. In mineral exploration, niches can quickly become “commodities of the month” (like the move toward Platinum Group Metals [PGMs] recently) or geographically centralized “area plays.” These bursts of activity are generally led by explorers, fueled by avid risk capitalists and speculative investment firms, and then burn out rapidly from poor fiscal and project management and overstated potential. Much of the reputation capital lost by the mining industry has come from “area plays” like Busang in Indonesia and Kilometer 88 in Venezuela. Every so often, a major find is behind or comes out of these area plays. The Voisey’s Bay nickel and Lac de Gras diamond finds are Canadian examples that may yet bear further fruits of discovery.

One area that is often criticized by industry members is this temptation to join the “commodity of the month” club, where firms are willing to abandon existing exploration efforts to move toward commodities that have attracted a lot of attention in the markets. In recent years, the PGMs and the diamond sector have grown exponentially, and much of the exploration is being done by firms that have no experience in these commodities. Mind you, many of the firms that decry the “commodity of the month” club, also join it when forced to! This is a good example of the problems of being a market system industry—there are very few firms that can adopt long-term planning horizons that they can adhere to regardless of market changes. This is a problem well worth coming back to and is expressed in part by the diversification versus specialization debate.

The Diversification vs. Specialization Debate

Diversification: Movement of mining companies into additional commodity foci, new stages of development in their operations, larger numbers of activities, or into non-mining activities. It often includes the opposite also: movement of non-mining firms into mining activities (as occurred in the early 1980s with oil and gas firms). Diversification usually occurs when there is plenty of capital available for expansion (bull markets) and

In reality, all truly successful miners are or become “niche” firms.

“We have to look at it. We have no choice; our shareholders demand that we follow the market, even though we have no experience in diamonds.”

- Exploration manager of a junior firm, on the pressures they felt to move into this “commodity of the month” exploration market

“The energy majors were all over the place in the late ‘70s, early ‘80s. They had big budgets and they thought ‘it’s a natural resource, we can mine it.’ But they weren’t terribly successful at finding things.”
- President of an investment junior

is rationalized as a corporate hedge against any single commodity price or project failure. Diversification tends to fail when it is undertaken solely to take advantage of prevailing market conditions, such as the move of oil and gas firms into mining during the heady days in the late 1970s and early 1980s, when gold was well over US\$500/oz. Due to the cyclical nature of commodity prices, the downside risk often proves too much for the uninitiated to bear, not to mention the effect on project costs that a lack of mining experience can have. These are the failures that befell the oil and gas sector's efforts to make inroads into hard rock mining 20 years ago.

Specialization: Limitation of the activities of a firm to the perceived "core competencies" of the firm. In mining, this often means limiting one's commodity focus, and this activity also has risks. One need look no further than the wholesale devastation of the gold exploration sector in the late 1990s.

"The focus we have is what gives us our unique strength, increases our market multiples, and reduces the number of competitors" - Executive with an intermediate silver producer

■ **SPOTLIGHT: The Gold Exploration Sector.** Gold mining is a special case in the CMS and, indeed, the entire global mining industry. It is the commodity that attracts the most attention from the investing public, the most celebrity from the general public, and the most exploration investment from the corporate community. Gold exploration has dominated exploration spending in Canada and around the world for the past 25 years, (although in Canada it was replaced by the "new kids on the block" in the diamonds sector in 2000). What is the power of gold, and what implications does this power have on sustainability in mining? Even though gold prices have faltered in recent years, it remains the primary commodity on the global exploration marketplace, because of gold's unique relationship with investors. It has higher market multiples, shorter timelines to mine development, and a great deal of panache besides. Gold and other precious metals are also attractive because of the relative simplicity of their extraction and refining, compared to the base metals, iron or bauxite/alumina, leading to higher profit margins. Gold also requires lower initial investments before recouping of funds. Despite the fluctuations in its value, the metal still is highly valuable in relatively small quantities and is widely spread around the world. These are the reasons that the gold sector has been less subject to the extreme consolidation evident in many other mining sectors. Harquail (2001) points out that it takes three times as many producers of gold to control a 40 per cent market share than that of any other major metal (although 2000–2002 may see these numbers falling with increased sectoral consolidation). With this relative openness comes a sustainability cost, though. For example, because it is possible to become a gold producer more easily than a copper producer, gold mine developments are often pursued by firms that do not have the capacity to plan for long-term development, have little if any previous "mining" experience and are too small to have the fiscal capacity to institute "best practices" technology, communication or management skills in their sites. In the Canadian mid-sized firm sector there have been several examples of problems in mine startups and vulnerability to early and abrupt closure among these expanding juniors/intermediate miners. Very few firms are currently even attempting small-to-medium-sized mine construction, but further examination of the reasons behind gold mine failures (environmental, social and economic) is merited in preparation for the next bull market, when the queue to become a mid-sized producer will start afresh.

"Given that the stock market likes gold, it is relatively easy to finance gold claims... there is only so much money in the mining business, and base metals take the back seat. Virtually all of the gambling money (and this is strictly a gambling business, really) has been in gold." - President of a production junior

4.2.5 Inter-firm Relationships

The Canadian mineral production system is not simply an exploitative relationship whereby giant firms control the junior firms. Rather, there is evidence of a mixture of cooperation, competition and control (borrowing from Patchell: 1996), defined by different firms' attempts to reduce exposure to risks. We now turn to these elements by analyzing inter-firm relations.

Historically the industry has been characterized by the dominance of the senior companies, traditional exploration territory and a herd mentality approach to commodities in vogue. With the removal of political and economic barriers to activity in many countries that characterized the 1990s, the industry has undergone a dramatic change. The choice of geologic terrain and countries multiplied, the junior sector became a major element in the industry and the senior companies started to rethink their role and approach to the exploration business.

- Harper, Andrews and Fenoulhet (1999)

"Depending on the economics of the times, if you have a prospect you can either raise capital on the public market or go to a major."

- President of a private junior company

"Small companies... have more relaxed attitudes towards risk than large companies. With little capital at stake, they often go to countries or areas and look for mineral products, which larger companies may regard as too risky. In that regard, they blaze a trail for others to follow... smaller companies, properly regulated, can act as the scavengers of the mining industry."

- Crowson (1996)

The Traditional Junior–Senior Dichotomy

Perhaps because of the perceptions of illegitimacy of the junior mining firm, prior studies of mining's organizational structures have been generally limited to large firms. Rugman and McIlveen (1985) and Ala-Harkonen (1993) look only at Canada's largest mining firms. Ala-Harkonen's (1993) study of large global mining firms, while critical of views of the industry as "old-fashioned, of being incapable of corporate change and renewal," still limits his analysis to a trio of definitions of firms being minerals-driven, technology-driven or business-opportunity driven. In doing so, his large firm focus overlooks the myriad of subtle differences firms use to create their own market niches. Work that has been done on juniors has focused on the intra-firm characteristics that make smaller firms more successful in exploration over time (Neugebauer: 1976), but not on the role that juniors play in a larger production system dynamic.

To understand the relationships between the junior and senior mining sectors, and perhaps refine these distinctions, it is first necessary to understand the priorities of different firm types. We have attempted to do this in this chapter's analysis of organizational types. It is also essential to have an understanding of the risks that help define firms' roles in the production system. Clearly, it is beyond the mandate of this publication to exhaustively examine the entire plethora of risks facing the mining industry. Just one example is used here to show the risk/reward tradeoffs incumbent to inter-firm relations. The first risk encountered occurs prior to even making the plunge into a new location. *Inertial risk* refers to the fear of the unknown, when you get to the base of it. Firms would prefer to stick to the places and processes they understand best, and most often this is North American exploration, in the case of CMS firms. Overcoming problems of initial "entry barriers" (Hayter and Edgington: 1997) associated with distance, language, legislative and cultural differences (among others) with other countries make Foreign Direct Investment (FDI) a counter-intuitive choice for the individual firm, and in particular large firms.

Stop there, you say! Large firms are more hesitant to internationalize? Speaking of counterintuitive, this seems to cut against the grain of what we learn in studying FDI, where most studies emphasize the growth in massive firms expanding outwards from their home countries to become multinational corporations. Despite this, evidence from the mineral industries argues convincingly that junior firms are better adapted to going international. McClintock (1989) follows Neugebauer (1976) in expounding at length on the higher capacity of small firms to enter into unfamiliar environments, in large part because of their relative flexibility. Small firms are seen by some as not only better, but actually essential to overcome inertial risk.

This requires a re-examination of the relationship between small and large firms, which has been theorized elsewhere as a one-sided, exploitative one (Hayter *et al*: 1999). The dual segmentation model of firms holds that there are market-system and planning-system firms. Planning-system firms are the large multinationals, whose bulk allows them to control the entire production system; while market-system firms have to emphasize finding a niche in which to sell their products (often to these larger "controlling" firms). In mining, this perception appears to hold upon initial review. After all, the senior firm takes over control of the productive process after the initial "grunt work" has been done by the small, junior firms. Even the language of the names *senior* and *junior* are monikers which bring to mind control and subservience.

The truth is a little different. While junior firms do lose *control* over their sites after initial exploration, they usually retain a minority *interest* in the sites which plays out all the way to the production stage. In exchange for losing overall control in a project, they gain some or all of the following:

- stock and/or cash payment from the senior firm;

- retained percentage ownership of a site, without having to expend their own money on further exploration. The reality is that most junior firms would find the increased financings and changing organizational skills needed for advanced exploration, mine feasibility, mine construction and mining extraction difficult, if not impossible, to handle; and
- heightened value of the stock of the firm. As mentioned previously, the highest percentage of value-added to any mining stock is known to come at the point of initial prospect discovery (Miranda Minerals Inc.: 1997).

If it is “natural” for larger firms to dominate smaller ones, there have to be some elements in mining that make it in the best interests of large firms to support smaller firms and make the necessary trade-offs. Otherwise, the larger firms would simply internalize all of the operations that make up the mineral production chain. What do junior firms have that seniors do not?

McClintock (1989) argues that successful firms emphasize strong exploration, even when they have become producers. While mining professionals need to take over the extractive operations, he argues, the exploration arm has to have relative autonomy from the core firm. When the exploration arm is placed into a large bureaucratic (“planned”) organization, it loses the fundamental requirements of speed, flexibility and technical emphasis. Juniors, McClintock realized, are the independent version of the exploration arm of a senior, the “worker ants” of the industry, and their chaotic movements would be stifled under central choreography. He thus called for offshoot of firms devoted to exploration “adaptive to external environments in which companies must compete.”

McClintock’s argument that exploration and production need to be isolated due to their polarized organizational needs has been taken to the next level by many mining firms in the 1990s.²⁴ With downsizing in the largest firms and the need to focus on their production prerogative, large firms have in many cases lost capacity and incentive to effectively undertake their own grassroots exploration. Filling this gap are junior firms eager to create their own market niches, even in subservient roles to larger firms in subcontracting relations.

Junior firms are seen in the industry as having specific skills which come into play in breaking new ground at the grassroots level internationally, as expressed by the President of a Canadian junior:

“Well, we don’t operate with any administration manual and we’re much less structured. You can make decisions very quickly, there are only four people in the office, so if a decision comes up to increase the budget... we’re not waiting for a budget management committee to think it over for two weeks; there would be a couple of phone calls and we’ve made the decision yes or no. So we’ve got much bigger flexibility, much less bureaucracy.”

Key in the relationship between juniors and seniors then is the recognition that not all these firms are “mining firms.” Just as Goodyear is not a car manufacturer, the exploration junior is not a miner, and most never will be. They are *suppliers*, a reality that is all too often learned a bit too late, as by the President of this formerly producing junior:

Exploration geologists just don’t think like mine managers, and that is the mistake that we made... in the past, we tended to meddle with the production management side of it, which just shouldn’t be done. We found out the hard way.

Without cooperative structures in the division of labour between juniors and seniors up the production chain, mining exploration in general, and exploration internationally in particular, would be beyond difficult; it would be next to impossible. Many of the firms involved in the interview process stated that they felt that the Canadian mining industry was especially adept at developing the inter-relations necessary among junior and senior firms to create a cooperative nexus of firms which can cover vast amounts of space.

A 1978 study by Freyman (in Snow and Mackenzie: 1989) found that while juniors spent only 28 per cent of exploration expenditures, their activities were responsible for 62 per cent of all economic deposit discoveries.

I think we are so focused now; we are getting a lot more for our exploration dollar now with our focus. We are not doing large regional grassroots type things like we used to do... I think that we try to be more focused, more skinny and more global in outlook, rather than regional and local with large initial exploration. - Exploration Manager, senior firm

“The junior company has significantly less overhead and every dollar in the ground goes a lot further than a dollar that’s supporting a major corporation. There’s no doubt about it and that has been demonstrated by firms being partly, but not fully acquired by large companies.” - President, exploration junior

“In reality, an intermediate is a company that is changing industries, from being a service provider to a production-oriented corporation.”
 - Industry consultant

“Why is it necessary to get bigger? Because of the access to capital equation! It is the old Catch-22, we don't have enough funds to get funds.”
 - Operations Manager of an intermediate firm

Table 4 gives a breakdown of the organizational structures of—and relationships between—juniors and seniors in the CMS. Each firm type has something to offer, a realization that most previous studies have neglected to assess as an element of industrial location in mining. Without an understanding of the mixture of competition, cooperation and control inherent to the industry structure, it would be impossible to reliably assess the motivations of firms.

■ **SPOTLIGHT: Where Do the Intermediates Come In?** The intermediate sector is in the unique and problematic situation of being in the transitional stage between total reliance on the venture capital markets for cash flow, and having an operating asset to consistently generate funds. When markets are positive, intermediates can go to the risk capital sector to generate funds and can also leverage their assets with the banking establishment. When markets are weak, intermediates often have to dilute their project ownership with a senior partner (e.g., Aur Resources had to sell Teck Corporation 25 per cent of its Louvicourt deposit in order to finance the mine construction). If the intermediate manages to protect its ownership and start up a mine, that asset is still more vulnerable to market fluctuations than those of its senior competitors. Consider the following quote from an industry consultant that sums up the changing role of the intermediate sector: “The middle tier is disappearing either because they can’t adapt to changing economic circumstances (because they have only one mine, in one commodity, in one region, and some are much more exposed to market or political fluctuations), or because they are consolidating, whether through mergers with other like-sized firms or being swallowed by a major. The mid-sized firms are a very important part of any industry because they are needed as corporate feed stock, to graduate up the ladder to the large cap sector. I believe a measure of the health of the industry is the number of intermediates, because it means that market fundamentals are strong... the question that has to be asked is ‘does the elimination of the vitality of the intermediate sector add value to the sector, or does it reduce industrial efficiency?’, because the large and the small are all that seem to be left now.”

Table 4: Differences Between Junior and Senior Mining Companies

Variable	Junior Companies	Senior Companies
Control	Land/Exploration sites	Finances/Minesites
Position in Production System	Controlled: sells out	Control: buys in
Financiers	Venture capital market	Internal (equity) or financial institutions (debt)
Investment Portfolio	Aggressive (risk seekers)	Defensive (risk averse)
Strengths	<ul style="list-style-type: none"> • Entrepreneurialism • Geological skills • Organizational flexibility • Venture capital access 	<ul style="list-style-type: none"> • Strong financial independence • Extraction capability/ experience • Reputation/bargaining leverage • Existing infrastructure

Variable	Junior Companies	Senior Companies
Risks Associated with Operations	<ul style="list-style-type: none"> • Discovery risk • Loss of corporate control to seniors • Shareholder perceptions = market risk • Market/political risks of initial production chain stages 	<ul style="list-style-type: none"> • Market/political risks of long-term investment • Lower rate of return in joint ventures with juniors • Overextension/loss of core values if bureaucracy too big • Commodity price fluctuations
Production Prerogative	Find	Mine
Corporate Goals (success means...)	Increase shareholder value/ Stock price growth/Vendable mineral project/Find JV partners or grow internally	Long-term growth/Market share/Diversification and consolidation
Attributes selling to investors	Speed, agility and entrepreneurialism (flexible specialization—post-Fordism)	Size, strength and stability (Fordist production system)
Sell to Each Other	Spatial dispersion to reduce risks of: a) discovery b) organizational over-reach	Provide anchorage and financial incentives for exploration/reduce fiscal risk for small firms
Production Unit	Economic places	Commodities/material wealth
Sell to Investors	Space (maneuverability; ease of entry)	Time (experience; stability)
Spatial Goal	Dispersal to highest number of potential sites	Site accumulation at development stage and control of production system
Long-term Spatial Directive	Find market niche to exploit (maximize single site potentials)	De-glomeration of activities (reduces risks of one place and one focal extraction type)

Re-mapping Inter-firm Relationships

There are three fundamental changes occurring in inter-firm relations in the CMS. One, seniors and juniors are looking at new ways to interact. Second, more and more firms are choosing local (host state) partners in their international activities. And third, more and more large firms are consolidating or at least joint venturing mine development projects. All of these changes are reflective of changing risk/reward environments in an increasingly global industry, and show an industry rapidly becoming “flexibly specialized.”

1) Changing Relationships Among Juniors, Intermediates and Seniors

The decline of the intermediate sector and the growing gap between the small number of producers and large number of explorers have implications for the relationships between firms in the Canadian mineral production system. In the past, there was a “dig/drill and tender” model existent in the Canadian mineral production system, wherein there was an implied capacity for juniors to feed their initial, market-funded projects forward to the highest bidder among the large firm community. This model was successful for a couple of decades, but the weakness

in the venture capital markets for juniors to raise finances has been such in the past several years that new models have had to be developed. One is the taking of direct equity investment in smaller firms, creating a group of “satellite firms” for an intermediate, mining group, or senior firm as expressed in the analysis here of Firm L. The second option is what Thomson (2001) calls the “Billiton model,” wherein a senior firm enters into specific subcontracting relationships with select junior firms, which effectively become their independent exploration tentacles across the globe. Billiton and Teck have utilized this strategy in the past to great benefit, and BHP Billiton continues to create unique strategic alliances with such junior companies as Vancouver’s Corriente Resources.

“Way back when, mining was driven by juniors and geologist—technical people. Today’s mining industry is driven by accountants and lawyers.”
- Industry consultant

As far back as two decades ago, Snow and Mackenzie (1981) argued that the “‘hunting band’-size group of seven to 10 geologists with an annual budget of \$3 million to \$6 million is the most efficient and effective exploration group.” In the near future, as project pipelines continue to shrink, many large mining companies may feel it is in their best interests to either prop up and support junior companies, or create “arms length” exploration groups within the parent company, but with looser administrative reins than other operating units. Grassroots exploration of some sort must be revamped to ensure long-term security of supply for the producing firms but with looser administrative reins than other operating units. And the junior circuit has shown time and time again that it is more skilled than the bureaucratized seniors at “minefinding.” While these new systems may be more effective for exploration, a cautionary note is worth extending. These units need to be better prepared for encountering local communities than they have been in the past. The increasing use of locals rather than expatriates for exploration work is a positive move (in most cases) in the direction of greater local acumen and positive relationship building.

2) Extra-national Firm Partnerships

In recent years, there has been a marked increase in cooperative agreements between firms from different countries. This has been of two types:

1. Increasing usage of “host country” geologists instead of “home place”-based expatriates; and
2. Cultivating more interdependent relations, especially between large firms from different countries and between foreign-based mining houses and Canadian exploration firms.

The second phenomenon has more to do with consolidation and economies of scale in operations, while the former has more to do with adaptation to changing risk environments in host countries. It can even be argued that interacting with “host” country firms may be becoming the “*pattern* of choice” in global mining.

“Primarily it lowers costs because of local experience. And second, these firms have political connections. It is very important to have a partner down there like that... if they want to talk to the Minister of Mines, they will be given an audience, and that way, we can speed things up more.”
- Vice-President, Exploration Junior, on why they use “host state” partners

Previous work by this author (MacDonald: 2000a) found that VBMS firms in Latin America preferred local “host state” firms over other joint venture partners. In the past, Canadian firms often entered these relations with locals because restrictive legislation demanded a local equity interest. With the opening of developing countries to FDI, local equity restrictions have been eliminated in most countries, and the reasons for involving locals have changed. Survey respondents overwhelmingly found that local “host state” firms are becoming the “partner of choice” for Canadian firms primarily because Canadians want to bridge the social and cultural gaps that have proven problematic for many exploration projects in developing countries. In addition, there is a growing skilled workforce in places like Latin America geared toward the mining industry.

Junior firms were found to be more than twice as likely to associate with locals than they were to associate with other Canadian juniors or Canadian seniors. This

indicates that juniors are attempting to come to terms with the social and political risks associated with “first contact” with communities affected by mining exploration. Having a local partner is often meant to foster better social ties with existing communities for these firms, as well as providing a cheaper alternative to starting everything afresh:

“They came with an office, and they are very good technically. They know the laws, they know the land and geology, and it gives us that exploration arm rather than creating one over about 18 months. They know the country and how to operate. It makes it that much easier.” - Exploration Manager, development group

Alternatively, the VBMS study found that large firms emphasize the sharing of risks and costs as reasons for their joint venturing, rather than the creation of better local ties. This indicates that economic risk is a greater priority for these firms, something that has led to rampant consolidation and joint venturing over the past three or four years among the large firm sector.

3) Consolidation and Joint Venturing in the Senior Circuit

Recent years have seen a great deal of consolidation in the global mining sector via mergers and acquisitions. This has been especially prevalent among the large firms sector. The main reasons behind these shifts are examined in more detail in Section 6.4. Increasing also have been cooperative arrangements (joint venturing) by senior firms in larger and more complex mining projects. Peru’s Antamina base metals mine, for example, had a capital cost of US\$2.3 billion, necessitating the involvement of a consortium of firms in its financing and construction. The reality of growing size and the need for economies of scale in the metals mining sector means that larger and larger projects are coming on stream, and mines like Antamina are simply too much financing to bear alone even for powerful, solvent senior firms.

“You might see big—no, huge—major mining companies and junior explorers out there doing the groundwork.” - Industry consultant

“Joint venturing not only allows sponsors to raise additional cash and spread risk, it secures additional operating or marketing expertise and can improve the terms of the debt financing.” - Bogden (2001)

■ **SPOTLIGHT: Implications of Changing Relations Between Firms.** There was never any question that there are fundamental differences between the roles of juniors and seniors in the CMS. What has not been exposed before are the inter-relationships between firms at different levels in the production system. This is “common knowledge” among miners, and yet the industry does little to develop recognition of the symbiotic relationship between juniors and seniors, often falling back to the argument that juniors and seniors are entirely different industries. The most problematic thing about this myopia is that substantive change demands that juniors, seniors and intermediates all get on the same page. In a world where the general public doesn’t delineate between firms large and small; where the vast majority of projects are initiated by small firms and passed on to larger firms at a later date; where the industry is becoming increasingly interconnected, often to the point of formal consolidation; and where the lines between “home” and “host” are becoming increasingly blurred; recognizing mining as a production system is a priority for industrial survival. This author would go as far as arguing that the mining is becoming “flexibly specialized.” We have seen that mining firms use a wide variety of methods to reduce risks and create niches for themselves within the constraints of the industry. This accommodation to ceaseless change is in direct contrast to the industry’s “dinosaur” image in the public’s eye. With flexibility comes responsibility. Because the mineral production system relies on networks of firms, and contracting out of many services, changing the mindset of the individual firm toward new issues like sustainability is not enough. The mindset of the entire industry must be attuned to these concerns, or the effort as a whole will be a failure. That is the challenge, and the best time to confront and solidify change is actually during a downturn in the market, because corporate planning priorities often go

“We have to deal with our own problems. The junior sector has to deal with it’s own. They have the PDAC, we have the MAC. Each looks after their own industry’s concerns. That is how it works” - Exploration Manager, senior firm

out the window when venture capital pours back into the sector. The time is now, the pressure is on.

4.2.6 Investment Patterns

Two themes have governed CMS investment patterns in the 1990s:

1. a *relative* shift in exploration intensity, starting in the early part of the decade, from traditional domestic areas to international ones with the opening of developing countries to foreign investment, and tightening regulations in traditional areas (so-called “Push/Pull” factors); and
2. a decline in the base of capital available for mineral exploration in the wake of triple market crises (Bre-X, declining gold prices, and alternative risk capital investment areas on the rise [e.g., the “dot.com” revolution].) This has led to a major downturn in the *total* amount of investment since 1997.

How have these dual themes of rising internationalization and market downturn affected the geographical investment patterns of Canadian mining firms? It is argued here that the answers to this question get to the root of the role of venture capital for the minerals industry, and the changing nature of risk facing metals miners in a globalizing industry.

Domestic Investment Patterns

Exploration spending in Canada plummeted between 1996 and 1999 by any measure, declining some 44 per cent from a high of CDN\$895 million. Several areas were hit extremely hard, especially British Columbia, where grassroots exploration levels have reached historic lows. Despite these numbers and the doom and gloom pervasive in the CMS's corporate sector, Canada remains the sixth largest mining economy in the world. It also remains the second largest country for exploration investment in the world, behind Australia, although the rise of exploration in developing countries over the past decade has seen a relative shrinking of Canada's preeminence. Interestingly, the past year has seen a reprise in the importance of Canada as an exploration target, back up to 14.9 per cent of total global spending (MEG: 2001). Clearly, exploration spending is a cyclical phenomenon at both the national and intra-national levels.

Being a global centre for mining finance has in the past meant that individuals who wanted to explore in Canada had an easy time starting up a company located there for that very purpose. As a result, there was an influx of expatriates, especially from the U.K., to Canada in the 1950s and 1960s. Thus, for a long period of time the vast majority of spending in Canada has been by these “Canadian” corporations. Natural Resources Canada data show that a consistent 70 per cent of exploration spending in Canada is by Canadian firms. Nonetheless, in recent years there has been a movement of foreign multinationals, especially among the senior circuit, into Canada to explore. The particular impetus for this movement has been the diamond plays in the Northwest Territories and Nunavut, where deposits of gem diamonds which rival any global source have been identified. The London mining houses have led this charge, with RTZ, BHP Billiton and De Beers all making their presence felt as London and Australia have become alternative sources of venture capital on the global scale.

Currently, approximately 15 per cent of total mine ownership in Canada is by foreign companies. Some of the more recent large mines opened have been developed by foreign firms, especially in this burgeoning diamond sector. Foreigners seem more likely to invest in Canada in project development, relying on the already strong internal exploration sector to handle grassroots exploration. Often, investment is done by large integrated mining (or vertically-integrated manufacturing) firms attempting to ensure security of supply for downstream industries they are involved in (e.g., diamond cutting and merchan-

“In the beginning of the 1990s, we started to go offshore more and more, to the point where by 1997 80 per cent of our business was offshore”
- Representative of a mining geotechnical consulting firm

According to MEG statistics, the global junior sector has lost 70 per cent of its value between 1996 & 2000
- Chender and Lowrey (2001)

dising for De Beers, coal and copper for Japanese firms like Sumitomo, which are involved in the production of steel and other manufacturing sectors).

Most of the decline in overall exploration levels in Canada (and worldwide) over the second half of the 1990s can be chalked up to commodity price and venture capital market crises. These far outweigh the changing risks associated with investing in Canada which firms often argue pushed them out of the country.

The Current Venture Capital and Commodity Crises and Their Effects

The past five years have been some of the most difficult on record for the global mining industry, and the Canadian mining sector has not been left unscathed. The metals sector became a virtual pariah among the investing public—fueled by the Bre-X crisis, a rising portfolio of technology stocks competing for risk capital, and the rapid decline in the price of gold after 1996, among other phenomena. The effects were startling. At the start of 1996, the TSE mining sector index tracked very close in relative value to the TSE 300 index. By early 2000, it had plummeted fivefold in relative value (Harquail 2001). As a result (and indeed as a symptom of this malaise), mining was placed on the perceptual back burner of the Canadian stock market investor. Whereas mining has traditionally held between 15–20 per cent of the TSE 300, that number fell to under five per cent by mid-2000.

Thus, in the past five years, the CMS has been in what industry members less than cheerfully call “survival mode.” Utilizing Canaccord Capital (2000) data on the gold exploration sector as an example, of the population of firms in 1992, only 31 per cent survived into 1999, and just over 10 per cent are stable companies with no financial problems. Of 100 randomly chosen firms, 81 had been forced into share consolidations and 76 had endured at least one name change between 1992 and 1999. Similarly, MacDonald (2000a) found that virtually all Vancouver-based mining firms had suffered reductions in their share prices and cash positions since 1997, with the junior sector especially devastated. Of course, Canada is not alone: in Australia 172 of 250 (68.8 per cent) of mining companies in business in mid-1998 had ceased to operate by early 2000 (Lemieux: 2000). Only London’s upstart AIM trading board has managed to grow as a mining market.

J.S. Brock (1998) identified seven bull/bear cycles in the VSE since 1960, and stated that “this bear is the worst seen in the past 35 active years of the VSE and its listed junior companies.” That was almost three years ago now, and there has been little improvement since! He argued that bull cycles on mining exchanges are typically created by one of three things: discovery, commodity price rises or economic market rise. Bears are created by commodity price failure, recessions or scams. In the current case, however, the mining companies have to deal with an additional, even more damaging foe—lack of interest—because mining has been replaced (until recently) by high technology stocks as a risk capital venue.

MacDonald (2000a) took up the question of “What affect does a mining market downturn have on overall investment levels across different firm sizes?” During the market downturn of the late 1990s, it was found that seniors took advantage by picking up more assets through site acquisitions while reducing their grassroots exploration programs. In addition, seniors increased their global reach even during this downturn. On the other hand, juniors entered “survival mode”; reducing their property portfolio, on-site expenditures and emphasis on precious metals. Junior miners typically have to raise about CDN\$300,000 in financing per year just to get by, a number that has held up for several decades, according to Brock’s (1998) time-adjusted analysis. Of late, very few can raise that much money, effectively putting them into hibernation:

“The nature of equity financing by juniors is such that when a market window of opportunity opens up, they finance to the maximum extent to provide a working cap-

Gold prices in 2000 are off over 30 per cent from early 1996. Gold prices are at a 25-year low in real terms.

Natural Resources Canada data (2000) show that there was an almost 50 per cent decline in grassroots exploration and project development appraisals in Canada between 1997 and 1999, with all areas of the country experiencing decline.

"Canadian companies have interests in 150 mines, smelters or refineries in over 40 foreign countries... With over 3000 foreign mineral properties... in more than 100 countries, Canadian companies are very active abroad. In 1999, they planned to undertake almost 30 per cent of all the larger-company programs around the world."
- Natural Resources Canada (2000)

Most industry members speak with confidence that they will be out of the woods when more venture capital becomes available. This shows the "short-sighted" nature of this market-driven industry, when in fact the biggest hurdles may well be dealing with new stakeholder demands for "sustainable" mining.

MacDonald (2000a) chronicled a **six-fold increase** in the number of VBMS firms with interests in Latin America between 1987 and 1998.

ital reserve to carry forward as long as possible. The equity has to finance administration and day-to-day corporate requirements of the company as well as the exploration and development expenditures... In general when markets are poor for financing one will see a higher proportion on monies raised going to corporate maintenance and less to exploration." - PDAC (2001).

MacDonald (2000a) also took up the question of "What affect does a mining market down-turn have on *geographic* investment patterns, rather than just overall investment levels?" In other words, in periods of absolute decline, which areas are relatively preferred, and why? In order to understand this better we need to look at the changing comparative risks and rewards of investing at "home" vs. "abroad."

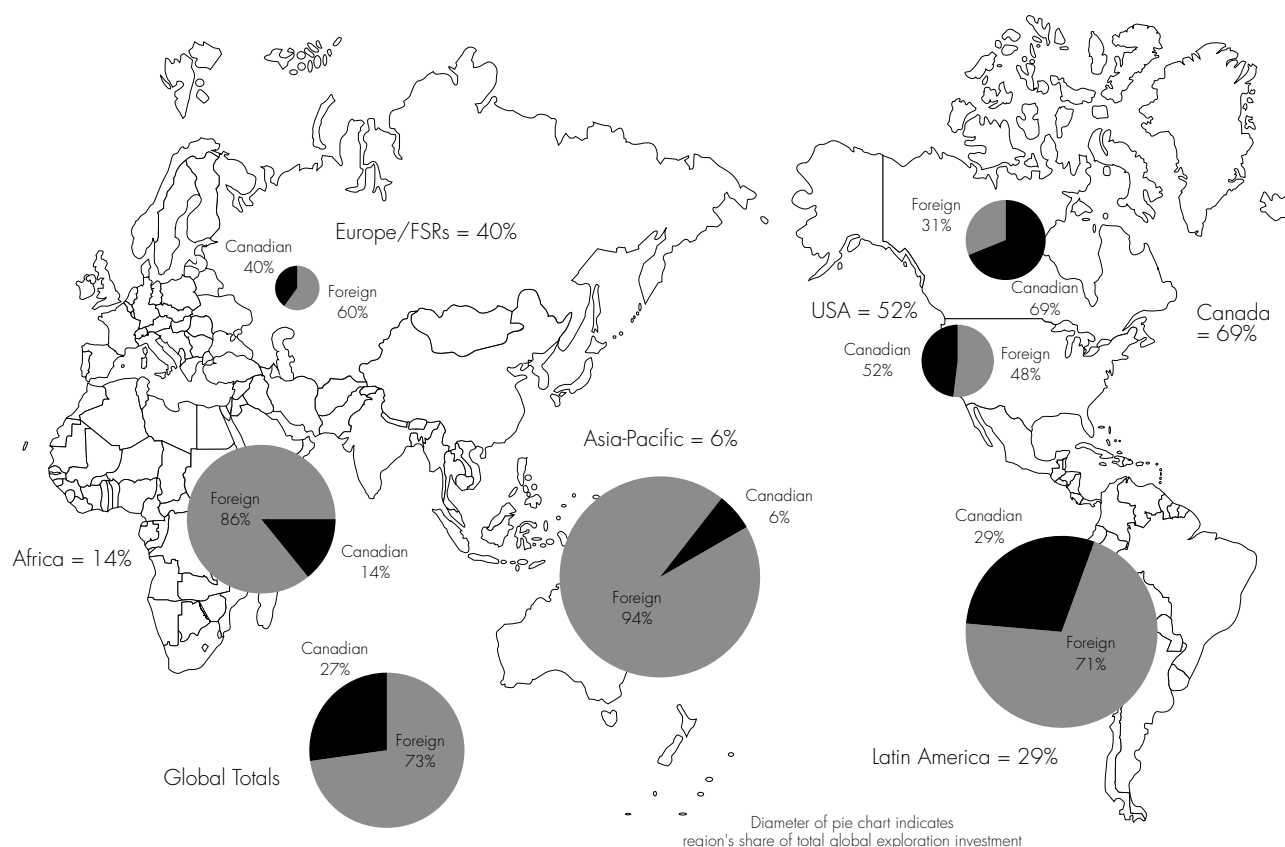
■ **SPOTLIGHT: Commodity Prices and Sustainability.** The complexity of supply and demand curves in the global minerals industry make planning for the future difficult. As Freeman (2001a) puts it: "Commodity prices vary with real changes in the global supply as well as with speculation, misinformation and over-reaction." In a perfect world, all mining companies would be adaptive to negative market environments such as those experienced by the metals sector in the past five years (in particular gold). However, because they trade in commodities and because only the aluminum giants are truly vertically-integrated, most mining firms are highly subject to market fluctuations. Chender and Lowrey (2001) argue that for senior firms, long-term survival strategy demands either that they grow and/or lower costs. Both strategies have impacts on the sustainability practices of the sector. Growth in and of itself is no threat to sustainable development. Indeed, it can be argued that the larger companies have been more responsive to social and environmental concerns than other firms. In addition, the mergers and acquisitions activity required to grow, swallow up some intermediate producers and eliminate others from the market. This may be positive, as intermediates and expansionary juniors often have the most vulnerable operations for aforementioned reasons. Lowering costs is more problematic and is of course the most chosen tactic during commodity price fluctuations. Lowering costs often means that cost-effective but so-called "disreputable" methods like heap leaching may be the only way to economically extract ores. In addition, the "soft" costs of dealing proactively with locals are frequently among the first cut, and this can be a monumental error on the part of the firm.

International Investment Patterns

Canadian firms have been the world's best at entering into the global minerals market-place. Some 27 per cent of all corporate mining investment worldwide is generated and conducted by Canadian firms. In the early 1990s, firms started moving en masse into developing countries because of "push" and "pull" factors. At the heart of changing investment patterns is the fact that the "traditional" investment regions (consistent of the U.S., Canada and Australia) are no longer considered the safe bet they were even 15 or 20 years ago. When examining the effects of commodity price decline and a weak venture capital market in the past five years, one is struck by the fact that more investment decline has occurred at "home" than "abroad" (until very recently). This is a clear indication of two things:

- that the fundamental balance of risk has changed between investing domestically and internationally over the past decade; and
- that the movement into international districts was not purely a short-term global "area play," but represented the tip of a larger—and fated to be longer lasting—globalization iceberg. The very definition of what makes a home and host must now be reconsidered, and the effects of "home place" investment decline on the domestic "project pipeline" assessed.

Map 2: Regional Shares of Global Exploration Spending, 1999
(adapted from Natural Resources Canada: 2000)



Map 2 clearly shows that there is a wide distribution in the global mineral exploration market. Canadian firms have been very effective in inserting themselves internationally, particularly in the important U.S. and Latin American markets. One of the major reasons for this is that the venture capital raising system in Canada has historically been geared to these risky investments. Currently, there are concerns for the future of this system, as expressed by industry members talking about the role of the domestic venture capital markets on their vitality.

■ SPOTLIGHT: What is the Role of the Domestic Venture Capital Markets?

Canadian dominance in venture capital raising remains, but it is eroding. Part of this has to do with internal changes, as the last few years have brought major changes in the way the venture capital markets in Canada have related to the mining sector. As late as 1996, there was a sense of unlimited venture capital-raising potential on the TSE and VSE for mining ventures. These exchanges have traditionally been world leaders in mining: In January 2000, mining companies accounted for roughly 20 per cent of the total market capitalization of companies listed in the Canadian stock exchanges: 16 per cent of the CDNX, five per cent on the TSE, versus less than one per cent of the LSE. Since 1997, several things have changed, including (and in turn prompted by): the Bre-X crisis and the concomitant fall of gold prices, rising alternative mining exchanges in Australia and London, and rising competition from other risk sectors like "dot.com." The securities regulators in Canada chose to focus on rebuilding the markets' reputation capital, attempting to increase investor confidence

"It is the OSC that kills you. The whole attitude of the OSC is that they want to stop us." - Private company President

through more stringent listing and disclosure requirements. The junior sector, especially, has had trouble adapting to some of the new rules. One junior company president said that “juniors are run on a shoestring, with most of the funds allocated to field exploration. When regulations add high costs to these companies, they are much less effective. The regulators have no knowledge of the cost factors.” Regulators disagree; they argue that the future strength of the junior sector relies on it becoming more transparent and building reputation capital through legitimacy. One securities regulator argued that “one of the biggest problems in mining is that we keep shooting ourselves in the foot with this stuff. If someone hits a good drill hole, that is met with more skepticism than excitement—is this too good to be true? If the industry wants to point fingers at its inability to raise funds, it should be pointing right back at themselves. This is a made-in-the-industry problem.” The biggest concern for explorationists is that the Canadian risk exchanges are no longer functioning to meet their industry’s requirements - to promote the fast paced, high risk/high reward, highly speculative, mining exploration market. The markets were set up to absorb the high levels of risk associated with mineral exploration, and now they appear somewhat dysfunctional. Light may yet exist at the end of the tunnel, as committees of regulators and industry members meet regularly to try and find points of compromise that would allow the securities markets to be reputable and efficient in the future.

While the bulk of the credit (or blame) for reduced internal investment in Canada has to go to market factors, the rise of international investment is also partly to blame. This becomes an important consideration when looking at the relationship between exploration investment and future production levels.

The Link Between Mineral Exploration and Mine Financing – The “Project Pipeline”

Exploration expenditures are a minuscule investment when considered against capital spending on mining projects. For example, in 2000 there was approximately US\$2.4 billion in exploration spending versus \$85 billion spent on capital projects. Latin America has over 30 per cent of this capital spending at present, the largest regional share (Harquail: 2001; Government of Canada: 2000). There is a strong relationship between exploration levels in a region and the future capital spending on projects in that region. For example, Latin America had a rapid growth spurt in exploration expenditures in the early to mid-1990s, and it is now benefiting from increased capital spending, some five years down the road. When one considers that mine financing investments can be anywhere between eight and 40 times that of exploration expenditures, it is perhaps understandable that much of the interest of senior companies would be in focusing on these development and construction stages. To do so with no recognition of the state of the “project pipeline,” however, would be to their long-term detriment. Grassroots exploration is an essential element of the mineral production system because it is the “headwaters” of the project pipeline. Exploration is an important lead in to economic growth.

As such, while the junior sector has been the most effected thus far by the declining venture capital stocks to fuel exploration, the large firm sector cannot thus cannot be far behind. The exploration sector is often envisioned as the “roots of the mining tree,” and without strong roots, the sector will wither:

“We’re saying basically is that the roots of the mining tree are dying. And it will not produce fruit in the future, if you starve the roots of nutrients. A good analogy to make. Now there’s still some apples on the tree that can be financed and put into production, but if the roots starve there will be no future harvest.”

Canada has already felt the effects of a soft decade of mineral exploration, as seen in the MAC statistics that show the deficit of mines opening versus those closing in Canada in

Total Canadian mine
financing (CDN\$ billion):
1996–\$8.7 1999–\$1.8

In Canada in 1999, 10
mines opened and 23
mines closed (11 closures
and 12 suspensions).
(MAC: 2000)

1999. Considering that the Canadian mine financing outlook in 1999 had declined more than 80 per cent, and the fact that project lead time in mining is so long, these numbers will not change until some time after any re-growth in exploration levels in Canada.

Fortunately, this appears to be exactly what is happening at present. According to the MEG (2001), Canada's percentage of global spending on exploration grew faster in 2000 than any other area, increasing to 14.9 per cent of the global total. The forecast for 2001 was for spending to be even more sharply swung towards Canada with the percentage among Canadian junior firms rising to 45 per cent, eclipsing Latin America at 28 per cent (PDAC: 2001). This raises important questions about the changing nature of risk in the global mining industry, and which risks firms are willing to submit to versus those which are too onerous to face through a "bear" market. Are Canadian firms "coming home"; and if so, why? The answers get at the heart of changing risks faced by miners.

4.3 Changing Nature Of Risk in a Globalizing Industry

Mining is *the* risky business. There is no comparable industry when it comes to the percentage chance of failure that any given exercise is faced with. And the intriguing paradox here is that while those in the industry have, by definition through their very continued existence proven themselves capable of adapting to known risks like geological risk and market fluctuations, they have not proven as adept at managing/planning/foreseeing **changes** in their risk environments. In addition, the industry has not managed to explain to the public that their industry faces the heights of risks that it does. Thus, it has neither a sympathetic audience nor a coordinated plan of action in the face of changing risks coming into the new millennium. This is one of the major reasons that this whole exercise (GMI/MMSD) has been developed, so we need to turn now to an analysis of these risks.

Examined closer here are two of the main risk types mining firms can face: one is at the corporate/industry level, and these risks are usually dealt with at the head office/home place level. Examples include changing regulatory environments, market flux and the amount of investment capital available and gross political shifts away from mining as a "legitimate" industry. The rising tide of NGOs in the developed countries opposed to mining is an example of the latter.

A second group of risk are encountered on a project-by-project basis in the field. Misunderstandings, the invasive nature of the mine development process, uncertainty over the role of the firm vs. that of the governments, competing political agendas and the high profile of the mining sector (especially in developing countries) can all lead to major problems in getting mine developments completed, whether or not there is governmental (or sometimes even local) support for a mine. A strong current example of these complex phenomena working together is the Tambo Grande project in Peru, where Vancouver-based junior Manhattan Minerals finds itself embroiled in a multi-sided dispute over a mining development. Social unrest is proving to be a potential deal breaker in many large mining projects. Both the role of NGO's in these disputes and research into the patterns of practice that can create irreparable harm to the project should be examined deeper by industry groups like MMSD. Increasingly, also, exposure of Canadian mining firms to developing markets has revealed complex governance issues of many forms, including legislative inconsistencies, and the corrosive effects of corruption and graft.

■ **SPOTLIGHT: Corruption and Legal Title Concerns in the Developing World – Is the "Bloom Off the Rose?"** Many Canadian companies cite corruption as one of their major concerns in dealing abroad. Especially in the African and Latin American countries, but also to some degree in Asia and the FSR's, bribery ("manana" or "mor-dida" to the Spanish-speaking countries) is part of how business gets done. Junior companies are more vulnerable to bribery because they have only one or two projects work-

"So there are high risks in Russia, but I still (and I am sure Joe Blow in Victoria is not going to like this) am sure that Russia is less risky than B.C." - Vice-President, Exploration for an expansionary junior

"Latin America was really hot for explorers 10 years ago. Now things have cooled off, so many firms have streamed out as conditions have changed. Costs are higher; the rules have changed. There are new expectations from communities, governments and public at large." - Industry consultant

"Once a hand goes in your pocket, there is nothing harder in the world to get out." - Vice-President, Project Development, Canadian senior

ing anywhere in the world, and will often hang onto those projects with all their collected might when in “survival mode.” Smaller firms in the CMS have felt pressured to cave in to corruption because of the amount of time and corporate effort placed in their one or two select projects. One president of an investment junior stated: “In the case of Venezuela, our operators were having problems getting permits and had to pay off officials to get them; the national guard would set up roadblocks and you had to bribe them to get through. It was just not a very pleasant place to do business, but we did it.” Countries like those in West Africa, Venezuela, Indonesia and Ecuador are often pointed out as problem spots for corruption. Senior companies, at least those in the NAMS, say they are much less willing to get involved in bribery. As one Canadian senior executive pointed out: “it is a slippery slope, and once you start sliding there is no stopping right to the bottom and it seems like everyone is on for the ride.” The costs can be high in both time and money invested in failed deals and opportunity costs, however. A Canadian senior recently found itself forced to pull out of a major project opportunity in Africa, largely due to corruption. Regardless of the actions of Canadian firms, of course, the significant question remains: how can corruption be eliminated if some global miner is willing to pay the requisite price to grasp at the “gold ring”?

“Three years ago, everyone was bitching about land tenure, bureaucratic inertia, permits in Canada. Now, no one talks about that stuff anymore. That is maybe the scariest thing—the sense of hopelessness.”
- President of a junior company

There have been two main recent trends which have presented new elements of risk to the mining industry at both the corporate and project level. One is the rise of civil society and demands by local communities and interest groups alike for miners to be responsive to *their* needs, and the other is the aforementioned mineral market crisis, which has shaken out many of the traditional risk investors.

Table 5 highlights the changing nature of several types of risk between 1987 and 2001, as expressed by CMS firms. The most important risk types (in italics) have changed over time. While in the late 1980s, it was virtually impossible to invest overseas due to stringent “anti-FDI” laws across much of the developing world, now commodity prices and the lack of a strong venture capital base take precedence. In addition, political risks differ across space as well as time. We have already seen that political risks in the developed countries (low public image, high levels of bureaucracy) differ from those in developing ones (graft, corruption, cultural distance between firms and locals, political instability).

Table 5: Changing Nature of Risk 1987–2001

	Political Risk	Market Risk	Discovery Risk	Intra-firm Risk
1987	<i>National bureaucracy and global political economy</i>	Cyclical commodity price changes	Lack of knowledge of areas/Poor geological records	Inertial risk (inability to invest in FDI)
2001	Local contingency and global NGO nets	<i>War on commodities and rise of investment alternatives</i>	Declining risk/reward ratio and market saturation	Exertial risk (over-expand and over-diversify)

“Mining has become a volatile, easily manipulable area of conflict in these countries.”
- Latin American mining consultant

What effects have these changing risks had on the CMS over the past five years? Several different studies and an avalanche of secondary evidence shows that the CMS is in the longest and steepest market downturn it has ever endured. MacDonald (2000a) used survey results to show that in the VBMS, changing risk factors had not only reduced investment levels, but changed worldwide investment patterns. Large firms have increased assets and mineral reserves, even while their cash reserves and stock prices declined. Small

firms have lost across the board. Nonetheless, they did not appear to abandon selectively their “offshore” investments, especially those in Latin America for VBMS firms. Indeed, by 1998 only 51 per cent of VBMS in Latin American firms had any Canadian properties (down from 81 per cent in 1993!). This indicates that the VBMS, at least, has become an inherently “global” portal for investment capital.

Large firms’ corporate size provides a lot more insurance against market downturns, and they can feasibly come through the other side of market crisis more specialized and focused. At the same time, small firms are primarily engaged in “survivor mode,” so there is a fundamental shift in the power relations of the industry:

“Five years ago there was so much money available for the juniors that they could out-flank and move much quicker than the majors could. Right now the shoe is on the other foot, as juniors have to hold any funds they do access very tightly in their treasury, and the majors still have cash flow, so they have the opportunity to take advantage of depressed prices for projects that would otherwise have been brought about by juniors.” - President, exploration junior.

In this sense, changing market risk has played out very much like a zero-sum game in the industry thus far. That may be one reason that the senior circuit has been reluctant to “prop up” the junior sector. This cannot continue indefinitely. Very shortly, the weakening of the “project pipeline” will show that long-term market decline affects seniors and juniors equally, an issue we come back to in Section 6.4.

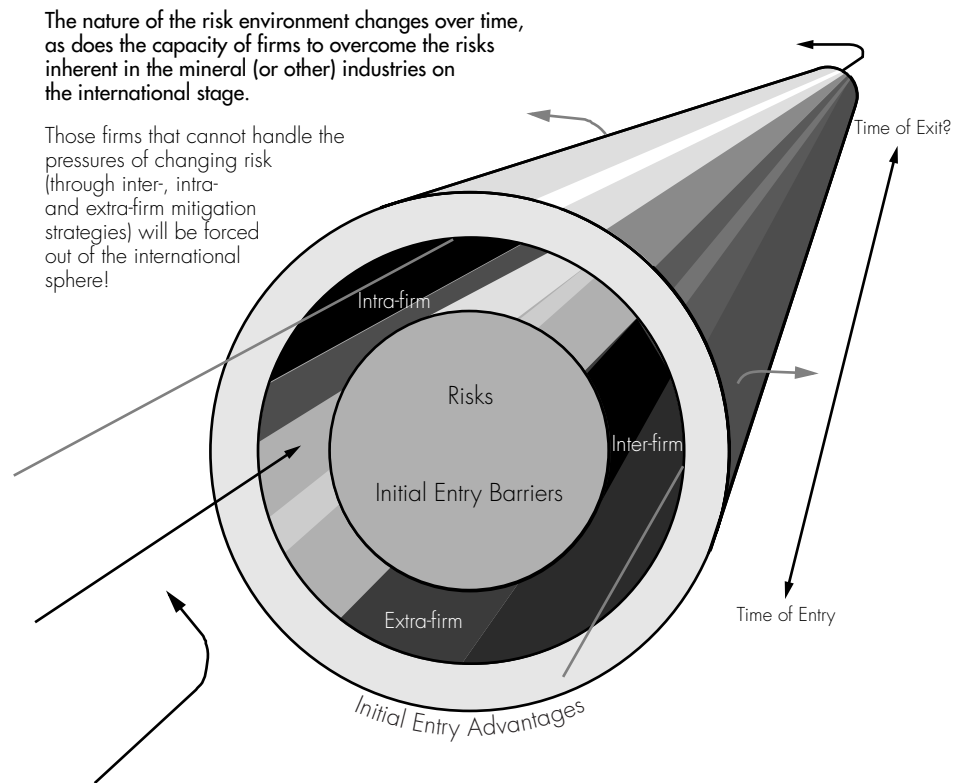
How do the findings of the VBMS case study compare to the overall CMS? Research by Canaccord Capital (2000), PDAC (2001) and NRCan (2000) all show extreme declines in exploration levels both in Canada and abroad between 1997 and 2000, raising questions over the very viability of the Canadian junior exploration sector. For example, Cannacord Capital (2000) looked at a cross-section of North American gold exploration firms, and found that of those firms focused on gold in 1992, only 24 per cent were still focused on gold eight years later, less than the number that had moved into other industries! Seventeen per cent had failed out-right and de-listed from public trading. Canaccord also estimated that of the population of gold exploration firms on Canadian exchanges in 1992, only 30 per cent remained by 2000, and less than 40 per cent of those remaining were without severe financial problems. Clearly, the trends exposed in the VBMS case study transcend home place borders.

The recent shift back to Canada indicates that the risks associated with entering new markets may “come home to roost” over time. While the global mining sector remains weak, comparatively strong exploration markets may be returning to the more politically (and importantly now, socially) stable countries of Canada and Australia. Even here, though, the industry will find itself pinned against the wall by calls for it to adapt to the goals of sustainability. Sustainability may mean different things across the world, but there is no place left to hide from this new challenge for the mining industry.

What does this study of the risks faced in the mining industry indicate for the future? Several points are essential:

1. Mining firms need access to risk capital generated by stock markets. This is the only viable source for the amounts of capital needed to properly generate the sizable “project pipeline” which is the feed stock of the production-oriented companies in the mineral production system. The future health of the venture capital markets for mining is a fundamental industry priority, regardless of firm size. Without the unique mixture of risk and reward offered by the venture capital markets, the system of independent exploration companies combing the earth in this “risky business” would not be possible.

Figure 12: Risk is a Tunnel; a Continuum



"Most companies have not been too keen to use our political risk analysis. We have criticized this, because not only does it analyze risk, it allows firms to **recognize opportunities**"
- Industry consultant (emphasis added)

Risk defines mining. It does not have to defeat it.

2. The globalizing of mining does not come without risks itself, and many Canadian firms in the past half decade have found out that "the grass is not always greener...." The action spaces of Canadian firms have proven to be much wider than their reaction spaces—the ability to adapt to new environs.
3. Mining companies are notorious for being market-driven, rather than planning-system, firms. The reasons for this are obvious in a non-vertically oriented commodified production system, but nonetheless, effective planning systems are available which can add long-term value to firms through the analysis and reduction of exposure to external risks. Planning not only at the firm, but at the industry, level is essential if mining is to overcome some of the risks which affect not one but all firms. Sustainable development is one of these changing demands. Risks are inherent in mining, but those firms that can plan for and manage them best will realize "value added."
4. Risk is not a "one-off" event, nor is it a linear process wherein all risks are overcome and thus eliminated. Cranstone *et al's* (1994) model's encapsulation of the mineral project life cycle is a typical example of an overly simplistic risk analysis (See Table 2). In any risky business like mining, risk has to be envisioned as a pipeline (or tunnel—see Figure 12) to be passed through, rather than as singular event horizon. Perhaps the best way to explain risk is as the cholesterol of the mining circulatory system. Risks are seen in Figure 12 as potential blockages of the fluid movement of mining firms through space and time, much as cholesterol can clog our arteries. Fortunately for the mining industry, risks can be treated and their impacts reduced, although this takes time, effort and understanding on the behalf of the firm. More analysis by individual firms and the industry as a whole of risks faced over time and space will allow for the creation of viable market niches and overall risk reduction strategies.

While mining companies and the industry as a whole are accustomed to facing a high degree of risk in their operations, the sister element of risk—uncertainty—can be even more disconcerting. One of the areas of uncertainty that the industry is currently trying to come to terms with is how it can relate better to the new breed of “stakeholders” who have shown that their perceptions of the industry can have immediate ramifications on the ability to do work around the world.

4.4 The Role of Governments and Other Stakeholders – Industry Perceptions

While mining is not an industry that spends a great deal of time in critical self-analysis, there is no shortage of critical analysis of *external* actors by industry members. While there is an impressive amount of diversity in the way stakeholders—including different levels of government, financial entities and regulators, NGOs, local communities, and industry organizations—are perceived, certain “broad brush” perceptions of the CMS can be discerned with respect to:

The Canadian federal government: The mandate of the federal government in Canada is split between supporting a vibrant mining sector with the taxes, job creation and international trade that come with it, and protecting the environment of the country. Generally, the Canadian federal government has strong support for mining, especially in the offices of Natural Resources Canada (NRCan). There is an especially strong working relationship between the Minerals and Metals Sector of NRCan, the MAC, and the senior firms of the CMS. In addition, when pressured by industry lobby groups, the federal government has often created economic stimulus packages to bolster mining. Recent attempts to invigorate exploration spending through a re-established “super flow through” shares tax deduction are an example.

On the other hand, the relationship between other federal government agencies and the mining industry are not as positive, especially where the plethora of environmental regulations are concerned, and also with the Department of Indian and Northern Affairs (DIAND). Most companies are not concerned about the content of environmental regulations, but rather the “regulatory quagmire,” the convoluted process associated with environmental permitting and negotiations with First Nations. This has been a particular concern in the Northwest Territories and Nunavut, where governmental and Native priorities and position at the bargaining tables are often not on the same page. The overall industry perception of the federal government is that except for NRCan, Ottawa does not often prioritize the value of the mining industry to Canada.

■ **SPOTLIGHT: Firm Size and Relations with Governments in General.** Different sized companies tend to have differing perceptions of stakeholders, largely according to their organizational prerogatives. Junior companies are much more concerned about bureaucratization of regulatory structures, because these things can slow down their progress when speed is an important factor in their activities. In addition, the sheer number and lack of transparency of regulations are often mentioned as key factors. Senior and intermediate mining companies are more often concerned that governments want corporations to take on quasi-governmental status in local communities and become responsible for the welfare of entire populace. In remote, economically backwards regions where the vast majority of gainful employment is or will be reliant on the minesite, corporations feel this burden (and vast swaths of sparsely populated Canada fit into this geographic and socio-economic profile). As such, large companies are concerned that their enterprises not become political pawns in a power game. Mining enterprises, especially in less developed regions, are massive targets because they are so important, and do provide so much of the necessary revenue for local, regional and national development. And the bigger you are, the bigger a target you become.

Canadian provincial governments: In Canada, control over natural resources resides overwhelmingly with the provincial governments, so this is the main type of government interaction with the mining industry. The attractiveness of provinces to mining companies varies wildly in Canada, and not solely because of natural endowments. Provinces like Quebec and Ontario are considered to have generally attractive investment climates, while B.C. is a virtual “no man’s land” and has been since the Windy Craggy incident of the early 1990s. This begs the question—what makes for an attractive investment climate? MacDonald (2000a) addressed this question in a survey of 57 Vancouver-based mining firms, where the following 13 factors were ranked for their importance in fostering a positive mining climate:

Table 6: Factors in the Creation of a Positive Mining Climate

Fundamental Factors	Supplemental Factors	Ornamental Factors
1. Right to mine legislation	Levels of political risk	Personal experience in area
2. Access to land provisions	Transparency of environment regulations	Exchange rate policy
3. Ease/speed of permitting process	Non-onerous mining taxation policy	Labour costs
4. Proven geological deposits	Level of geological information available	Geographic proximity to your “home place”
	Adequate existing infrastructure	

In Canada, three out of the four fundamental factors in the creation of a positive mining climate are controlled by provincial governments. Right to mine legislation involves a system of assurances that minerals found in an area will be accessible for extraction by the mining sector.

■ **SPOTLIGHT: Windy Craggy, Access to Land and Governmental Relations.** The Windy Craggy incident in northwestern British Columbia has been one of the sore points for Canadian mining firms, and is considered emblematic of land tenure and access issues in North America at present. An American company, Geddes Resources Ltd., had spent over US\$30 million in developing the multi-mineralized project, but was blocked from further development when the provincial government re-zoned the area as part of the new Tatsenshini Wilderness Area in 1993. Environmental groups lauded the decision, while the entire mining industry considered it an absolute betrayal of trust. Why? Consider for a moment the requirements of a junior exploration company. They take on (with the wide shouldered support of the venture capital markets) all the risk of finding a viable mineral deposit. This is a daunting task, along the lines of 1,000:1 ratio of potential sites to actual minesites. So, in exchange for having what they consider a miniscule initial “ecological footprint,” junior exploration companies demand access to land and tenure assurances in order to minimize the risk of developing a viable prospect. When both access to land and tenure assurance are compromised in one case, this means that these issues are compromised (at least in the industry’s perception) throughout that political boundary. The lasting negative impact of the Windy Craggy incident on B.C. exploration investment indicates that land tenure and access are perhaps the most important issues between developed country governments and junior companies.

“I was surprised at the depth of betrayal of trust felt by the industry toward the government over the Windy Craggy incident.”
- Sustainable Development expert

Access to land is the crisis issue in British Columbia, where the “Protected Areas Strategies” and other land withdrawals have been criticized by the mining industry for the past decade. The ease and speed of permitting (or lack thereof) can also have a negative effect on the ability of (especially juniors) to get any work done in the field. These priorities are in question in large parts of Canada, in part because of the impacts of outstanding native land claims. Overall, then, while certain jurisdictions are considered safe by explorationists (Quebec being the highest rated—Fraser Institute: 2000), much of Canadian provincial policy toward mining has been considered blatantly confrontational by the CMS over the past decade, to the point where many industry members consider some bureaucracies to be “captured agencies”:

“Where bureaucracy comes into play is where you go into the U.S. and Canada—you have a fifth column operating within the bureaucracy that don’t want to see mining development, and they will do their utmost to slow down or stop development. This is the biggest fear for the mining industry throughout the world, but it doesn’t happen in places like Peru or Chile.”

Canadian securities regulators and stock exchanges: In recent years, there has been a tightening of the rules of securities and stock market regulations in the mining sector, mainly as a result of the negative public image created through a series of high profile “scams” culminated by the multi-billion dollar Bre-X debacle. Measures like National Policy 43-101 have subsequently been imposed in an attempt to assure shareholder protection through better disclosure practices.

The senior sector has generally welcomed these tighter rules, but the junior sector considers them extremely onerous, perhaps even the major burden facing the sector, alongside the weak commodity prices of recent years. There is a constant stream of criticism of the tightening of regulations, effectively narrowing down to two items: 1) that the regulations are wrongheaded, reactionary and will not eliminate the frauds they are meant to; and 2) that the burdening of the junior sector is like getting blood from a stone, and that they in fact make cost cutting on more important items like environmental and social concerns more likely!²⁵

NGOs: Again, there are some major differences in the perception of large vs. small companies to the non-governmental organization community. Senior companies very often attempt to facilitate interaction with select NGOs that are not entirely “anti-mining.” Indeed, some of the major companies have had outspoken critics of the industry speak to their management teams, in order to better understand the ideals of this stakeholder group. However, while at the company level, there are growing efforts to engage the NGO sector, many if not most individuals within the corporations still consider the relationship to be one of “us vs. them.”

That “us vs. them” dichotomy is not only echoed, but amplified, by the relationship between juniors and the NGO community. While many juniors would agree that not all NGOs are overtly “anti-mining,” the sheer mass of the NGO sector limits industry members’ capacity to differentiate between “good” and “bad” NGOs. From the perspective of an exploration company, the very few “good” NGOs are those that don’t pay much mind to what juniors do, or if they do get involved, it is only to smooth over relations with local communities. All other NGOs are to be avoided at all cost, just in case they turn out to be “troublemakers.” In addition, the lack of accountability among the NGO sector, which is perceived by the industry as being entirely unregulated, makes directly confronting NGO “propaganda” a no-win situation from the perspective of both the junior and senior sector. As a result, absolute avoidance is the usual strategy for junior-NGO relations. As one junior company President stated: *“Any information in the hands of NGOs can be damaging to us... we fight tooth and nail not to give them any information.”* Thus, the strategy of the junior sector is to fly under the collective radar screen of NGOs until such time as they are confronted by them. Again, this is an example of a reactive rather than a proactive engagement strategy.

“In B.C., when you want to drill, the government requires you send out letters to Native groups to see if they object. But the process takes 60 days, and we only have a two and a half month window in high altitudes. It doesn’t make sense.” - President, investment junior

“The costs of compliance run between 25–36 per cent of total costs for a junior issuer now. That means between \$60–70,000 per annum for small, struggling companies, just to keep regulators happy!” - President of several junior companies

“The OSC has just cast to the wolves the juniors that didn’t go to the CDNX, and there are 1,000 companies on the CDNX that don’t fit the tougher listing specifications now.” - President of a junior

“Some NGOs are very helpful, others are out to create havoc and disinformation. And that is one of the biggest hurdles the industry has—determining who we can work with.” - Corporate Development Vice-President of a senior firm

“How do we fix the industry? First of all, get rid of all the NGO’s” - President of a development junior

"It was a management team decision, based solely on our understanding of how good projects get made. The important thing was that I was a company person doing this work. That inside presence is important. To be inside the community and to learn as much about them, most firms will not do that."
- IBA Negotiator, development junior

Lemieux (2000) chronicles some 60 business associations and 40 professional associations related to mining in Canada.

"We are preaching to the converted here. The MAC sends out fliers on the role of mining in the economy, but most of them go to people who work in the industry! What is our target audience?"
- Industry journalist

Local communities: While a reactive engagement strategy with NGOs may or may not have negative effects on a mining project, the utilization of similar strategies with the communities around the minesite is much more likely to create a negative outcome. Many mining firms have started to act proactively with locals as well as NGOs, but whether or not this happens has a lot to do with the level of prior experience of the firm and its principals. Proactive community engagement then is still done in only a scatter-shot fashion by select firms who have been through it before. More also needs to be done here at the industry level through standard setting, workshops on cultural acclimatization, and university level courses for young geologists on the social impacts of mining and how to engage with people of other cultures.

Industry organizations: A recent GMI-funded publication looked at the role of industry organizations in more detail than we are afforded here (The Allen Consulting Group: 2001). It found that there tends to be a great deal of overlap in the mandates of different industry organizations, creation of vested interests within the organization based on self-preservation as much as assisting the industry and called for the senior sector to create a new global industry organization whose mandate it is to lead the move toward sustainability in the industry (this has become the newly formed ICMM—International Council on Minerals and Metals).

From discussions with members of industry organizations in Canada, it has been ascertained that one of the main problems that needs to be addressed is the separation of juniors and seniors through having different organizations. While the MAC and subsidiary units like MABC do effectively lobby for the senior sector; and similar groups like the PDAC and BCYCM do solid service for the junior sector, there are precious few integrated actions between the two groups. By separating the producing and exploration sectors, the industry has maintained an artificial boundary between the needs and requirements of the two sectors, effectively rendering them two different industries. This path of action is fraught with peril as has already been established herein.

The popular media: The popular media are treated with skepticism and outright derision by many in the mining sector, due to the fact that most stories that come out about the industry project negative images. The industry itself can be equally criticized for sticking its collective head in the sand when confronted by critical press. As one industry journalist put it:

"NGOs of all stripes have regular editorial meetings with major newspapers, and they get their message across because they are motivated and they have an ideology to push. What is mining's ideology? The industry doesn't have one; the industry organizations don't have one. I have never seen mining executives say 'I am going to the newspaper to set things straight.' We don't band together to prove when an NGO is mis-reporting the truth, because the industry doesn't feel it has enough credibility with the public—but how can they build that credibility without a fight?"

The general public: Mining industry insiders consider the public to be somewhat hypocritical in its views of the industry. While mining has run out of favour in recent years in many areas of developed countries, the mining industry in countries like Canada and the U.S. still provides jobs, taxes and vital resources that everybody uses every day. The NIMBY phenomenon is a persistent trend among the developed countries, and most in the mining sector have come to grudgingly accept that the U.S., especially, has followed the UK in setting as a public policy goal the eventual elimination of metals mining, and is willing to invest elsewhere. Canada has not yet followed suit because of its long resource tradition and weaker industrial base, but certainly stakeholder concerns over mining are more vocal than in the past and are on the rise.

■ **SPOTLIGHT: Public Education and the Mining Industry.** Mining industry organizations have made highly expensive efforts to show the public that “mining matters.” The question is—has it worked? Yes and no. Programs put on by the MABC and PDAC have been particularly effective at introducing young people at the grade school level to mining issues. Problematically, fewer inroads have been made at the post-secondary level, when young people are determining how they are going to look at and confront the world around them. In addition, even industry insiders have concluded that the majority of Canadians, although they think mining is a reasonable economic activity if done sustainably, really don’t know of its importance to the economy and certainly would not fight to maintain its role in Canada. This apathy is perhaps as dangerous to the industry as those people opposed to mining outright. There are cost-effective ways for more, better, and more relevant information to be disseminated to mining’s “target audiences” that need to be considered by groups like MMSD and the ICMM.

The financial and brokerage communities: Put quite simply, *size matters* in both the banking and brokerage communities. The junior sector, once a hot prospect amongst risk capital brokerage houses, has fallen out of favour in the wake of Bre-X and the rise of the technology stock sector. Only in the past half year have some doors reopened from a cautious brokerage community. Juniors, of course, don’t even register on the radar screens of major banks or mutual funds.

The intermediate sector has a love-hate relationship with banks. When commodity prices are good, there are several banks that will lend to intermediates for mine financing; that dissolves pretty rapidly when the markets turn south. The fiscal crisis of the late 1990s has hit the intermediate sector the hardest of any miners, in light of the fact that they were burdened with debt loads often in the hundreds of millions, and their operating revenue was falling below the levels necessary just to pay the interest on outstanding loans.

The senior sector is considered a relatively safe bet by the limited number of international banks that still finance the mining community. But the minimal size of the sector makes it merely a blip on the financial radar screen *except* in Canada!

■ **SPOTLIGHT: The Role of Consulting Firms.** As mining has become more specialized an industry in recent years, many firms have chosen to outsource the majority of their activities to consulting firms. This includes numerous non-traditional aspects of the mineral development cycle, like environmental and social impact assessments, analysis of social and political risks, and any number of aspects which relate to long-term stability and sustainability of mining projects. This indicates that firms, especially the larger firms in the system, are becoming more attuned to the needs of sustainability, and are seeing these needs less as costs and more as R&D for the future of mining. It is much more difficult for junior companies to jump on the sustainable development “bandwagon,” because they have a different mindset (often geared to their belief that their “ecological footprint” is miniscule) and because with their limited resources (financial and human resources), extended and intensive interaction with local people and government bodies is perceived to be avoided at all costs! The amount of business being generated for these consulting firms (not to mention other supplier firms) is enormous, but is rarely counted when assessing the value added of the mineral industries. Do they not have a stake in seeing a more sustainable mining industry created? If so, they should be offered a seat at the stakeholder table alongside the other members of the mineral production system alongside all the other stakeholders we have looked at here.

“A year ago they wouldn’t even talk to us. It is still not overwhelming interest, but at least they don’t say—go away.” -
President, investment junior, on the local brokerage community

“There are only about 20 banks that will talk to us in mining, whereas there used to be 2-3 times that.” -
Operations Vice-President for an intermediate producer

“We are becoming an industry of consultants!” -
Mining industry consultant

4.5 Summary of Major Issues Exposed

This in-depth analysis of the CMS has focused on explicating the corporate structures underlying the mineral production system. In doing so, it has also isolated several key issue areas for the future of Canadian mining, and in reality, global mining:

- the shifting importance of home places in a globalizing industry;
- the changing nature of risk at home and abroad and the implications of changing investment patterns on the future of these “home places”;
- the adaptability of firms of different size and organizational focus to these changing risk factors, and indeed the adaptability of the industry (a market-driven one) to the needs of sustainability (requiring long-term planning horizons);
- the inter-relations of firms of different size and organizational focus in a production system, and how these relationships change over time; and
- the relationships between “miners” and stakeholders outside of the corporate sector of mining, and perceptual problems keeping these different parties from more proactive engagement.

In the next decade, the Canadian mining sector may face questions of legitimacy similar to those that have been asked in the U.S. for the past one. We will come back to some of these issues in Chapters 6, 7 and 8 of this paper. First, for a closer examination of some of the issues that may develop in the Canadian minerals sector, this paper now turns to a comparative analysis of their neighbours to the south.

Endnotes

- 15 Note that unless otherwise noted, Canadian production, exploration and other monetary values are in Canadian funds, while U.S. operations are recorded in U.S. funds. At the time of this writing (March 2002), US\$1 = CDN\$1.60.
- 16 Just how “Canadian” these firms are has been brought into question when firms like Trelleborg/Boliden “moved” to Canada! For the purposes of this study, Boliden would not have been considered Canadian because its charter is Swedish. Additionally important is the fact that the firm has only recently packed up its Toronto offices, and moved back to Sweden! The footloose, globetrotting nature of the industry’s corporate sector raises several issues relating to corporate governance and national allegiances, studied further in Chapter 6.
- 17 Data from Table 3 comes from Prospectors and Developers Association of Canada (2001), database analysis from the Mining Handbooks (Southam Group: 2001a and b), and MacDonald (2000a).
- 18 At the time of this writing (March 2002), the venture capital markets for mining have been bolstered from a more than five-year-long trough. Regardless of the drivers of this recent perception of a rising market (generally held to be driven by a “market buzz,” a sense that the venture capital markets for mining are “off bottom,” as much as by any positive economic indicators), this changing market perception raises issues related to the role cyclicalities plays in the corporate priorities of mining firms. If the mining economic cycle turns from negative to positive, will the priorities of firms shift from trying to understand why the industry has struggled in recent years (questions inexorably linked to public perception of mining and the quandary of “sustainability”), to focusing only on how they can take advantage of a positive financing environment? It remains to be seen.
- 19 One industry insider went a long way to clearing up some of this debate by citing research that stated market capitalization and exploration expenditures tend to be closely related in the junior mining sector. This indicates that the majority of money that is raised really does go into the ground for most junior firms. However, of late, the increasing regulatory requirements are estimated by mining company executives to have eaten up 25–36 per cent of the money raised by juniors listed in Canada. Exploration expenditures have been artificially lowered as a result, so total assets are again the chosen measuring stick here, as with the large firm sector.
- 20 It is worth noting that the Canaccord (2000) analysis lists U.S.-based firms traded on Canadian exchanges, making it one of the few truly North American mining analyses.
- 21 Another way juniors can be created is when geologists are caught in downsizing cycles. Then, firms are created by the pool of unemployed expertise, and enter the market already having passed the knowledge gap.
- 22 Due to space constraints, some descriptors in Figure 10 are shortened. Comm focus (commodity focus) means a firm is focused on exploration for—or production of—a single metal type. Tech focus (technology focus) indicates that a firm’s activities are driven by a certain pet technology or type of analysis. S/S production and M/S production stand for small scale and medium scale, respectively.
- 23 It is worth noting that when the Canadian venture capital markets became more rigid and cumbersome to mining companies in the mid-to-late 1990s, the London Stock Exchange was perfectly happy to fill the capital financing void, through the auspices of its new Alternative Investment Market. The Canadian securities apparatuses argument for building long-term reputation capital through increased regulation doesn’t make a lot of sense in light of the fact other less regulated markets are willing to fill the financing vacuum.
- 24 And indeed into the new millennium. In August of 2001, Placer Dome announced that it was halving its exploration budgets from CDN\$100 million to CDN\$50 million, and focusing on minesite exploration/expansion and acquisition instead of grassroots exploration.
- 25 An MMSD paper on “Access to Information” (Thomson et al: 2001) in the global mining industry addresses these concerns alongside other stakeholder concerns over information disclosure patterns around the world.

5. The U.S. Mineral Production System

5.1 Introduction to the U.S. Mining Industry

5.1.1 Special Limits Placed on This Analysis

This analysis of the USMS must be considered a preliminary overview. The author acknowledges that his experience with the U.S. sector is limited, and almost entirely reliant on the preliminary database analysis for the past year, rather than longitudinal analysis and in-depth industry response as has been utilized with the Canadian sector. This analysis is presented here as an initial examination, open to debate among parties more versed in the workings of the U.S. mining sector.

Even more so than the Canadian mining sector, the USMS has not had a dedicated research organization looking at the structures and functions of member firms. Almost all research is focused on production and consumption trends, rather than looking at *who* is actually doing the work. This makes previous analyses of the mineral production system limited at best. In order to provide a solid initial overview of the USMS, this analysis utilizes a statistical database of USMS firms alongside key communications with contacts in the U.S.

The database structure looked first to identify the population of publicly traded, American controlled and U.S. head office firms with mining interests, as reported in the *American Mines Handbook*, a *Financial Post* publication (Southam Mining Group, 2001b). A total of 223 firms were identified. From there, some preliminary data were assessed on the entire population, after which a random sampling of 100 firms was utilized for further in-depth analysis. All uncited percentage data used in this analysis come from database statistics. Appendix 3 also consists of key statistics from the database (3a) and an explanation of its structure (3b).

5.1.2 History and Role in the National Economy

Mining in the United States is governed by three systems of mining law:

1. the Mining Law of 1872, under which tenure over a discovery on public lands involved only staking a claim and undertaking a minimal amount of annual assessment work and the transference of ownership of public land to individuals or companies for \$5/acre;
2. a series of leasing acts starting in the WWI era; wherein coal and industrial mineral extraction necessitated a payment of royalties to the government for the usage of public lands; and
3. a series of laws governing the relationship between private landholders and mining companies, providing for fair compensation.

The Mining Law of 1872 is still in place in the metals sector, despite many efforts to eliminate it over the years (most recently by the Clinton administration—McClure and Schneider: 2001). However, and in part because of the problems involved in the original law, the federal and state governments in the U.S. have attempted to utilize administrative law (creeping legislation, if you will) to control access to land and tenure on public lands in the United States. Regulations have replaced the fundamental legislation, creating an “intricate web of federal, state and local laws and restrictions dealing with mining... complicated by inconsistencies in policy goals, uneven enforcement and overlapping jurisdictions of the enforcement agencies” recognized as far back as 30 years ago (Dempsey: 1973, in Cameron: 1981).

This “intricate web” is one of the major reasons the USMS has been shrinking in importance and is a consequence of losing legitimacy in the public’s opinion and among policy-

The U.S. has the largest mining sector in the world by volume but, less than .5 per cent of U.S. GDP comes from direct mineral extraction. Of that, only 1/5th the value is from the metals sector. (National Mining Association: 2000a)

“You ask the average American person, are you in favour on mining in the U.S., they would probably say ‘no, take your dirty business elsewhere.’ And the politicians pick up on this, so they are making life increasingly difficult for mining companies to get permits... I wish I could make a living in my own country but I can’t. I have to go to Latin America.” - President of an American junior producer

“In surveys done in the U.S. over the past year, the mining industry was ranked just ahead of the tobacco industry as the sector that enjoyed the least public confidence.” - Presentation by Jim Rader, Business for Social Responsibility

In 1980, 98,000 Americans worked in the metals sector. Today, only 44,000 do, and numbers will continue to shrink. Meanwhile, non-metals minerals employment has been maintained at previous levels.
- NMA (2000a)

"Aggregates accounted for more than two-thirds of volume of non-fuel minerals produced in the United States."
- USGS (1999)

According to the USGS (1999), industrial mineral production has increased over 40 fold between 1900 and 1996.

The construction materials and industrial minerals sector of the U.S. economy, now constitutes by far the largest proportion of total materials flow in the U.S.—over 80 per cent of the total.
- (USGS: 1998)

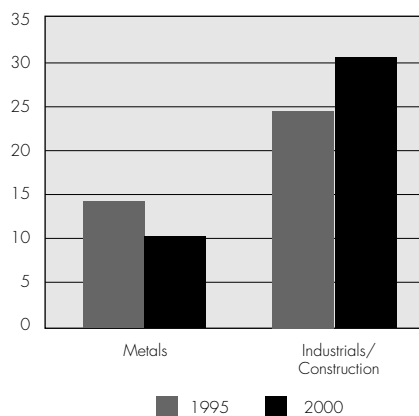
makers. Another is the nation's preeminent position in the global economy. The very fact that the United States has the most developed economy of any nation in the world may be the harbinger of bad tidings for its mining industry. There is an argument to be made that as a middle class develops in a country, its populace (more learned and well off in physical terms) comes to appreciate amenities and aesthetics over raw industrial power. In the U.S., with this shift has come the prolonged criticism of the mining sector. This is a reason often mentioned by mining firms when talking about why they have been investing more in developing countries.

Mining, regardless of issues over antiquated laws or public perception, remains a strong economic sector in the U.S. In terms of total value created, the U.S. mining industry is the largest in the world. The U.S. has a US\$40 billion mining industry, and metals make up about US\$9 billion of that total. The U.S. is also the world's number one country in the provision of mining goods and services worldwide, dominating this US\$250 billion market (Lemieux: 2000). The U.S. is the world's second leading producer of coal, copper, gold and silver. Despite its relative anonymity, domestic mining and the movement of U.S. firms overseas are both large revenue earners for the domestic economy, but unless the industry's reputation is bolstered by proactive measures, its future vitality is certainly in question.

5.1.3 Focus on the Industrial Minerals

The United States demands more industrial minerals than any other nation on earth. Industrial minerals consist of fertilizers and other industrial chemicals, and the structural materials used for the construction industries (aggregates, sand, etc.). The distribution of these industrial minerals, especially for the aggregate industries, is widespread throughout the U.S., so localized production is the norm. While the unit values are very low for these products, the sheer scale of production means that industrial minerals provide some 48 per cent of total U.S. mineral production value and those numbers are growing fast, as seen in figures 13 and 14.

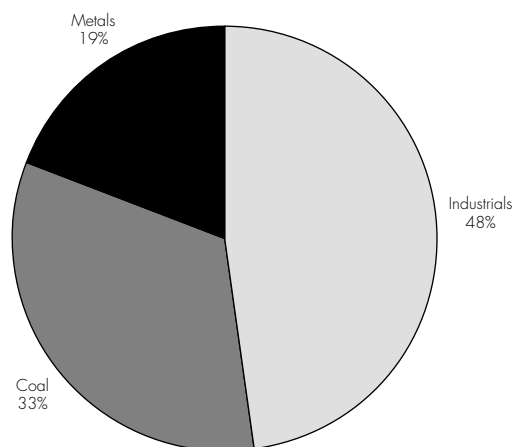
Figure 13: Non-fuel Minerals Production Value (US\$ billions): 1995 vs. 2000



Source: National Mining Association (2000)

Data indicate that while the U.S. mining industry is extremely valuable, it is also neither highly focused on metals, nor highly diverse in the types of metals produced. The U.S. mining sector is less diverse than that of Canada, although it is larger by almost 70 per cent in total value. Of the top 10 minerals produced in the U.S. by value, only copper (#5), gold (#6), and iron ore (#7) are metals. Gold (32 per cent), copper (30 per cent) and iron ore (18 per cent) account for about 80 per cent of total U.S. metals production. Coal alone is much more important than the entire U.S. metals sector.

Figure 14: United States Mineral Production Value, By Sector (1998)



Industrials and coal also represent much of the visible aspect of mining on the U.S. (and Canadian, to a lesser degree) landscape, a fact decried by several metals miners. “*They do the most damage; we get the most blame,*” argued one senior metals company representative, noting that the vast majority of visible workings in both the U.S. and Canada are in fact industrial minerals operations. Of course, the general public and regulatory decision-makers do not differentiate in this fashion. All told, only 323 of the over 11,000 current U.S. mining establishments are metallic.

“Mining has touched less than 1/4 of one per cent of all the land in the U.S.” - (NMA 2000)

5.2 The Structure of the U.S. Metals Mining Sector

5.2.1 Mapping Home Places

Map 3 shows the general distribution of head office locations for all identifiable publicly-traded U.S. mining firms. There are arguably three of what Freeman (2001b) calls major “portals,” located in Denver, Colorado (13 firms and many more in the surrounding area); the Spokane-Coeur d’Alene corridor on the Washington-Idaho border (some 40 firms); and Reno, Nevada (eight firms). Each of the three main head office agglomerations serves a “portal” function similar to the Vancouver (junior sector)/Toronto (mining finance) division of labour in Canada:

- Denver is the most internationally-focused, the only true “global portal” for U.S. mining.
- The Spokane-Coeur d’Alene corridor is the home place for juniors in the Northwest states, and the most common home for U.S. firms launching exploration efforts into the Canadian west. Most of the firms are junior/juniors, with an investment rather than an exploration focus, and utilize the smaller “over the counter” stock exchanges like the SpOTC in Spokane. Thirty-two per cent of all USMS firms are located in Idaho or Washington.
- Reno is the administrative head of the vital and vibrant precious metals industry based in Nevada.

5.2.2 Firm Size

The U.S. metals mining sector is in reality two very different animals. The bulk of the USMS is fundamentally inward-oriented, its member firms almost all emphasizing the examination and exploitation of domestic U.S. mineral deposits. This is diametrically opposed to the inner workings of the CMS, which is the world's most capable outward-oriented mining sector. Contrastingly, there is in the U.S. a small but vibrant circle of majors, intermediates and expansionary juniors as globally competitive as their neighbour to the north.

The large firm sector is without question the most important one in the USMS. Newmont is the largest gold producer in the Western Hemisphere, while Phelps Dodge is the second largest copper producer in the world. The size of the sector is quite small, however, and of late highly vulnerable to merger and acquisition activities (as are Canadian firms).

Much of the mining done by U.S.-based corporations is actually done by firms that have their focal points in other, related industries. Table 7 shows the top 20 U.S.-based public firms with direct mining interests (meaning they or their wholly owned subsidiaries operate at least one "hard rock" mining establishment). Of the top 20 "mining" companies, only nine would be typically called miners; only five of the 20 (and none of the top four) would be called metals miners.

Table 7: Top 20 U.S.-based Public Firms with Direct Interests in Mining Activities (by Total Asset Valuation US\$-2000)

Rank	Firm	Assets (2000)	Primary Industry	Hard Rock Mineral Focus
1	Exxon	50 billion	Oil and Gas	Coal
2	Chevron	41 billion	Oil and Gas	Coal
3	Alcoa	31 billion	Aluminum	Alumina
4	Anadarko	16 billion	Oil and Gas	Coal
5	Phelps Dodge	7.8 billion	Metals	Copper
6	Peabody	5.8 billion	Energy	Coal
7	Teco	5.7 billion	Energy	Coal
8	Bethlehem	5.5 billion	Steel	Iron Ore
9	IMC Global	4.3 billion	Fertilizers	Potash/Phosphate
10	Freeport-McMoran	4.0 billion	Metals	Copper/Gold
11	Newmont	3.5 billion	Metals	Gold
12	Montana Power	3.0 billion	Diversified	Coal
13	Pittston	2.5 billion	Diversified	Coal
14	Arch Coal	2.3 billion	Energy	Coal
15	MDU	1.6 billion	Diversified	Coal
16	Homestake	1.5 billion	Metals	Gold
17	FMC	1.5 billion	Diversified	Industrials
18	Washington Group	1.1 billion	Diversified	Coal
19	Cleveland-Cliffs	728 million	Ferrous Metals	Iron Ore
20	Oglebay Norton	700 million	Industrial Minerals	Industrials

Of the 36 “large firms” in the USMS, only 11 are primarily metals firms.

Another assessment of the strength of the USMS comes from analyzing just the metals miners. It is here that the limited nature of the production system in the U.S. is exposed. Table 8 shows the top 11 “purely metals” miners based in the U.S. (companies that focus mainly on metals mining, not including ferrous metals):

Table 8: Largest “Purely Metals” Companies Based in the U.S. (2000 Total Assets)

U.S. Rank	World Rank*	NA-Rank*	Firm Name	Assets (2000)	Major Metals	Firm Size	Revenue (2000)	2000 Net Income
1	10	2	Phelps Dodge	7.8 billion	Copper	Senior	4.5 billion	29 million
2	n/a	n/a	Freeport-McMoran	4.0 billion	Copper/Gold	Senior	1.87 billion	77 million
3	17	6	Newmont	3.5 billion	Gold	Senior	1.56 billion	(19 million)
4	24	12	Homestake	1.6 billion	Gold	Senior	748 million	5 million
5	22	10	Stillwater	679 million	PGMs	Intermediate	225 million	6.1 million
6	n/a	n/a	Battle Mountain	569 million	Gold	Intermediate	228 million	(119 million)
7	n/a	n/a	RTI	386 million	PGMs	Intermediate	249 million	7 million
8	n/a	n/a	Coeur d’Alene	354 million	Gold/Silver	Intermediate	86 million	(28 million)
9	n/a	n/a	Hecla	195 million	Silver/Gold	Expansionary Junior	76 million	(84 million)
10	n/a	n/a	Meridian Gold	171 million	Gold	Expansionary Junior	128 million	40 million
11	n/a	n/a	Glamis Gold	163 million	Gold	Expansionary Junior	57 million	(21 million)

* North American and World ranks are from Harquail (2001), and are based on market capitalization of global metals firms. Freeport McMoran was not included in his analysis.

Of special note is that this is the entire population of U.S. mining firms with assets over US\$100 million, and it is still shrinking. Even with corrections made for currency exchange, only three more firms in the U.S. metals sector are valued at CDN\$100 million. Compare those 14 U.S. firms to the 39 Canadian firms with assets over CDN\$100 million. The sector has shrunk in the past year as Battle Mountain has merged into Newmont, and Homestake has been taken over by the Canadian firm Barrick, an indication again of the rampant consolidation in the global large firm sector.

The junior circuit of the USMS is entirely juxtaposed with this large firm sector. Where the large firm sector is outward-oriented, the small firm sector is inward-oriented. The vast majority of junior firms publicly traded in the U.S. have one or two assets, highly constrained investment patterns (action spaces located in one site, one state or at the widest, the western U.S.), and are investment-focused rather than exploration-focused in their activities. Examination of the population pyramid shows these disparities in greater relief.

5.2.3 The System Defined – The U.S. Population Pyramid

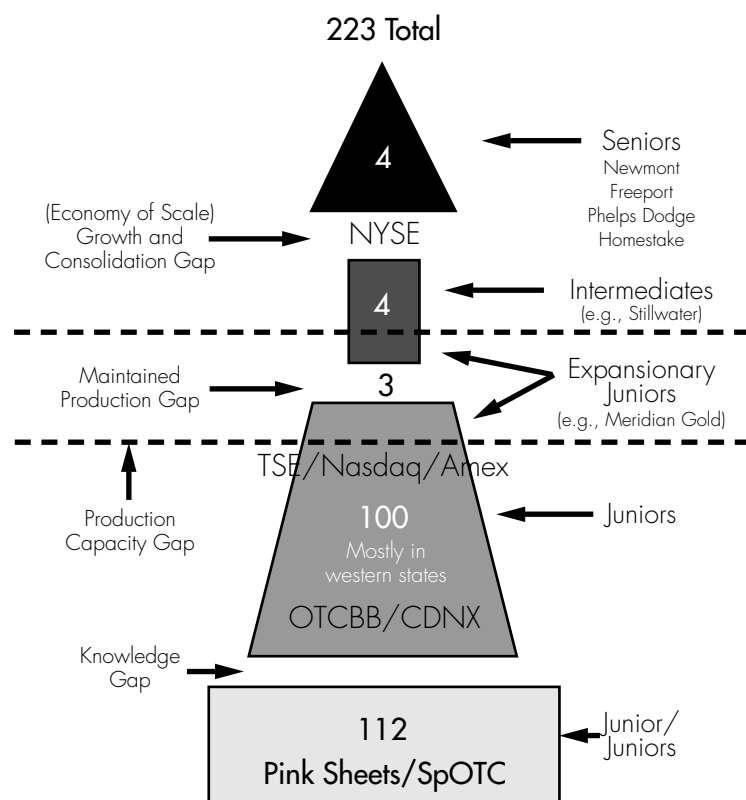
Of the 223 U.S. mining firms identified by the database, there are only 36 “large firms.” Only 11 of those qualify as “metals miners,” whose population pyramid is examined here in Figure 15.

Only four metals miners qualify as seniors (Newmont, Freeport McMoran, Phelps Dodge and Homestake in declining order of total assets); four qualify as intermediates (RTI, Stillwater, Battle Mountain [now a Newmont subsidiary] and Coeur d’Alene); and three

qualify as expansionary juniors (Hecla, Meridian Gold and Glamis Gold). By any measure, there are only about a third as many large firms in the U.S. compared to Canada.

Additionally, there is a much weaker “small firm” sector evident in the USMS. Of the 212 small firms (about one-eighth the amount based in Canada), only about 100 qualify as juniors (assets over US\$2 million), while the remaining 112 are junior/juniors.

FIGURE 15: Size Distribution of Firms in the U.S. Metals Production system



The junior/juniors are inevitably traded “over-the-counter” on exchanges like the SpOTC or Pink Sheets. The “reputable” junior firms start out with risk capital from one of these boards or the CDNX, but eventually seek listings on Amex, Nasdaq, the TSE, and only the largest firms reach the holy grail of the NYSE.

Overall, the USMS exhibits a much skinnier, top-heavy population pyramid, with the exploration sector therefore more vulnerable to external control, and the entire sector less self sustaining than that of the CMS.

5.2.4 Organizational Focus and Inter-firm Relations

The companies in the USMS tend to fall under three main organizational foci:

1. **Investment Juniors**, who focus on a specific geographic area, most often close to their head office. Investment Juniors don’t tend to develop their prospects with any strategic vision, lacking the technology, funding and/or business acumen to develop past the initial exploration stages. Forty-six per cent of all U.S.-based “mining” companies, and 55 per cent of juniors, fit under this umbrella.

2. **Exploration Juniors**, who have a dedicated focus on delineation and development of one to several exploration prospects. Only 22 per cent of U.S.-based mining companies are exploration-focused juniors. Interestingly, only about a quarter of U.S. *juniors* are exploration focused, a much smaller number than we would find in Canada. There are very few firms in the U.S. that focus on dedicated exploration as their defining *modus operandi*. The lack of such a domestic exploration sector is one of the main reasons that much of the exploration and development in the U.S. metals sector is foreign controlled.
3. **Development- and Production-focused Juniors, Mid-sized firms and Seniors.** Almost 32 per cent of all U.S.-based mining companies fit under this umbrella. This includes more vertically-integrated companies than found in Canada. Some 25 per cent of large firms in the USMS are involved in these vertically-integrated sectors.

■ **SPOTLIGHT: The Vertically-Integrated Mining Sector: The Aluminum, Coal, and Steel Firms.** The U.S. consistently exhibits a ten-fold increase in value between domestic non-fuel raw mineral production and processed materials of mineral origin. For example, in 2000, estimates were for US\$40 billion in non-fuel minerals sales, but US\$429 billion in “value added” manufacturing of minerals products (NMA: 2000a). This hints at two things: one, that the U.S. is a highly developed manufacturing economy wherein the minerals sector plays but a small part; and two, that there is a great deal of import reliance by companies “adding value” to raw minerals materials. Mining, because of reasons listed elsewhere, is an industry not particularly suited to vertical integration. However, there are sectors within mining where vertical (downstream in the production system) and horizontal (into other industries) integration do occur. Aluminum companies and iron ore companies are often heavily involved in “adding value” to their own mined products (in the case of aluminum in the U.S. and Canada, all the raw materials are imported); while the major coal companies in the U.S. are often but part of larger, diversified energy companies. While ferrous metals, aluminum and fuel minerals are not the focus of this paper, their role in determining the legitimacy of any move toward sustainability are huge, and the inclusion of firms in these sectors in the dialogue toward changing mining practices is essential.

The biggest problem then, is not that there are no larger firms present in the U.S. to develop properties forwarded by juniors. Rather, there is a relatively small domestic firm exploration sector, in part due to foreign corporate dominance (particularly by Canadian firms) and in part due to the shrinking mining investment climate in the U.S. as a whole.

The firms in the USMS also exhibit a couple of distinctive patterns in their inter-firm relationships. For one thing, the majority of joint ventures are with Canadian, rather than domestically-based, firms, because more than half of all exploration work in the U.S. is being done by these Canadian firms. Secondly, the large firm sector is being caught up in the consolidation movement of the industry. Newmont’s acquisition of Battle Mountain Gold (and more recently their acquisitions of Franco-Nevada (Canada) and Normandy (Australia)), the acquisition of Asarco by Grupo Mexico and the recent Barrick (Canada)-Homestake merger are but a few examples of a trend that knows no national boundaries.

5.2.5 Investment Patterns

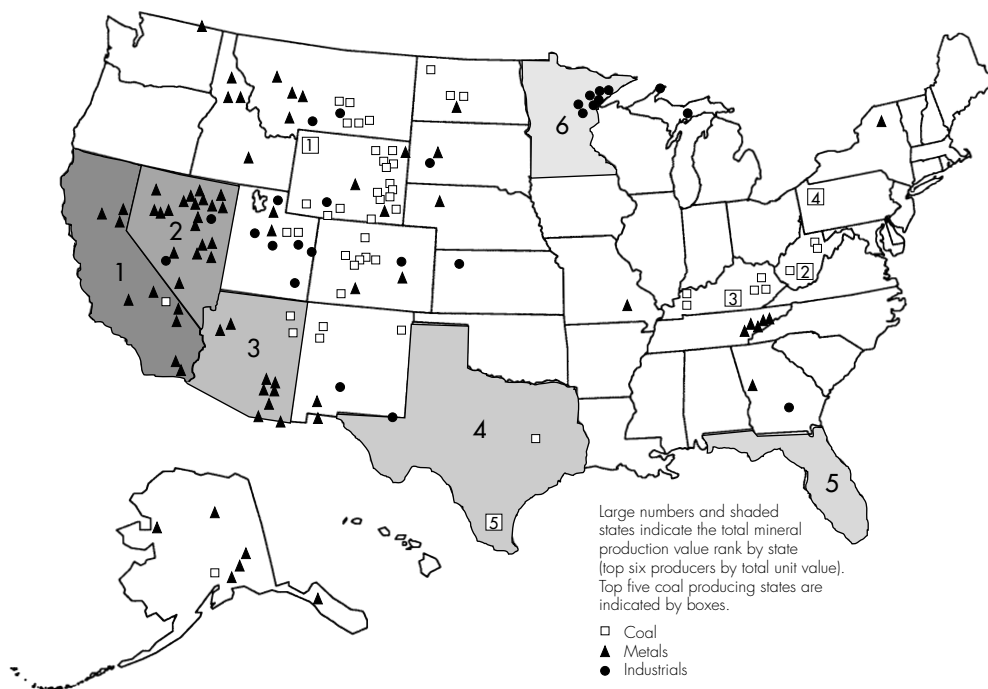
Internal Investment Patterns

As shown in the examination of organizational focus, there is quite a large proportion of development or producing firms in the USMS. About 29 per cent claim to have at least

one active minesite. Data from MacDonald (2000a) suggest that in Canada, by contrast, less than 10 per cent of firms are involved in production. Therefore, it may be useful to examine the distribution of mining operations, to better understand the USMS.

Map 4 indicates the general distribution of *active minesites* in the U.S. The top six states are ranked by total mineral value. There is an abundance of metals and open pit coal mines in the western states, while activity in the east is limited almost exclusively to coal (especially underground in the Appalachian region) and industrial minerals (with significant deposits of phosphates in Florida being the most valuable example).

Map 4: Distribution of U.S. Minesites: circa 2000



The U.S. is the third most popular country for mineral exploration behind Australia and Canada.

There are 323 metals mines in the U.S. There are well over 10,000 industrial minerals mines by comparison.

Source: Southam Mining Group (2001b)

While western states generally dominate mining, there are some significant outliers. Florida is the number one producer of phosphates in the U.S.; Tennessee is the number one producer of lead and zinc; Minnesota in ferrous metals (iron ore). California has the largest mining economy by value in the U.S., much of that industrial minerals to fuel its huge population infrastructure needs. Nevada has the nation's largest metals sector (mainly due to its rich gold deposits); Arizona leads in copper. Wyoming is the nation's leader in coal mining.²⁷

■ SPOTLIGHT: Operations Type, Economies of Scale and Public Image in Mining.

Perhaps one of the main reasons that mining has become something of a pariah industry in the U.S., is that the damage done by mining has become more **visible** over time. The effects of coal mining in the Appalachians have long been a symbol of resource dependence and environmental degradation, and most of those operations were **underground and effectively out of sight**. Today's open pit coal mining industry often more closely resemble dredging operations and are highly visible. The metals sector is similar. Open pit mining and the usage of more caustic separation chemicals are symp-

There has been significant damage to groundwater and streams in Colorado, southern Arizona/northern Mexico, western Montana, and parts of northern California, all attributable to mining practices. (McClure and Schneider: 2001)

Bingham Canyon, British
giant RTZ's copper-
molybdenum mine in Utah,
is the world's largest
man-made excavation.

tomatic of cost reductions necessary to process the lower grade ores being mined, as easy-to-access rich ores have been depleted over time. While there are fewer mines in the U.S. than 20 years ago by about a 3:1 ratio, and often in the metals sector there is a reworking of old deposit areas, the sector as a whole is perhaps even more visible than ever. This is due to the fact that abandoned mines “never die or fade away,” current mines offer less employment because they are more technology intensive (thus reducing the number of “converts” to the importance of mining), and there is widespread utilization of chemicals like cyanide to leach metals out of heaps of ore. In general, the creation of economies of scale and cost cutting measures utilizing new technology have done little to make mining more acceptable to the general public. Shifting mining operation types have been driven by weaker commodity prices over time, lower returns to investment, and the necessity to increasing the size of operations to create larger economies of scale. There always seem to be tradeoffs involved as well: the intermediate sector has declined in recent years, meaning “medium-sized” mines that would have opened five years ago, are not viable today. This may be a benefit of “addition by subtraction,” as these medium-scale operations are often the most problematic in planning and execution. At the same time, several of these mid-sized mining companies have gone bankrupt in the U.S., leaving virtually all of the clean-up costs to the taxpayer (the Summitville mine in Colorado is the most talked about example).

Mining in the United States is currently typified by the following:

- massive growth in the importance of economies of scale and gross tonnage, rather than a focus on “highgrading” like was seen in the underground mining traditions started in the 1840s with lead/zinc mining in the midwest;
- generally, domestic control of operations. 76 per cent of U.S. mines reporting to the *American Mines Handbook* were controlled by U.S.-based corporations in 2000. In contrast, Canadian firms (though having half of the exploration market cornered) controlled only 11 per cent of U.S. minesites;
- a shift from underground to open pit mining across many different commodity groupings over the past 20 years. Gone are the days of underground mines with just a headframe sticking up to alert passersby of the existence of a mine. The proportion of underground to surface mines has shifted from 1.73:1 to 1:1.58 since 1980, according to NMA data. This makes mining a more visible blight on the landscape;
- a rapid growth over the past decade and a half in the importance of heap leach operations, primarily in the precious metals sector; and
- the increasing scale (and concomitantly, costs) of operations and mine development has seen a move towards more joint ventures and syndicate-controlled operations, especially among the ferrous metals and coal communities. Recent evidence from some massive Latin American operations (e.g., Antamina) indicates that this trend may be the future also for the global non-ferrous metals sector.

What about exploration patterns? Most domestic juniors (about 55 per cent) are investment-rather than exploration-focused, so they average one or two sites each, rather than the three to five or more most often associated with Canadian juniors. Seventy-five per cent of USMS firms have their investment focus on U.S. districts, with 45 per cent limiting their interests to a one state or even one site focus. Overall, 82 per cent of USMS firms have domestic interests, but that fact misses the key point that many of the truly “competitive” firms are focusing the majority of their new investments abroad. This includes virtually all of the “large firm” sector, as will be shown in an examination of international investment patterns.

The gold grades at Pegasus
Gold's Montana operations
averaged only 0.01 ounces
of gold per ton of ore.

International Investment Patterns

Much of the USMS has only had limited success investing internationally. Several reasons for this exist:

- there is often an “ugly American” perception in international markets, which predisposes locals to be suspicious of American mining firms. This is often referred to as the “gringo” phenomenon, and is mentioned by many Canadian miners as one reason they are favoured over U.S. firms in Latin America;
- lack of exploration experience in foreign climes. Success breeds success, while failure breeds failure. Because of stiff competition by Canadian and Australian “minefinders” on the international scene, most U.S. mining firms have chosen to stay home;
- the USMS has perhaps been spoiled in the past by the richness of its domestic mineral deposits, which are among the best in the world. This has led to an inward-orientation over time; and
- overall weakness of the sector. In particular, the absence of a core mining exchange in the U.S. has limited the amount of exploration capital available to domestic firms, thereby limiting the growth of a strong, mobile exploration sector. Thus, the fact that only eight per cent of USMS firms have Canadian exploration interests is not overly surprising.

Nonetheless, the large and mid-sized firm sector in the USMS has moved its focus to external markets of late. Thirty-six per cent of USMS firms have some aspect of international investment in their property portfolio. Just about half of these focus on Latin America (particularly Mexico), followed distantly by Canada and Australia. Consider the following assessment by Freeman (2001b):

“Phelps Dodge does no exploration in the U.S. Their future is with their South American assets acquired as part of the Cyprus acquisition. Freeport’s asset is in Indonesia. Newmont’s future is Yanacocha in Peru. Outside the immediate environs of the Carlin district in Nevada they have no exploration in the U.S. Homestake’s asset future is Valadero in Argentina. Meridian’s only performing asset is in Chile. They will not explore in the U.S. Glamis is now a Central American mining company. They will not explore in the U.S.”

Thus, while the bulk of the USMS does not invest outside of the “home place,” the most vital portions have recognized that the future of mining in the U.S. looks bleak, and have used their earlier success, generated from the mining rich regions of the U.S. west, to finance their expansion internationally. Again, the USMS exposes itself as two animals: one forward looking, and the other irrevocably stuck in the past.

International Firm Investment in the United States

The U.S. has been among the top three countries for mineral investment for the better part of the 20th century, along with Canada and Australia. In the past few decades, however, the U.S. has lost ground as an exploration target both to its developed country rivals and to the developing world. The U.S. now attracts about 10 per cent of global exploration capital in any given year, and ranks third behind Australia and Canada in this regard.

More disconcerting, perhaps, for advocates of a strong domestic industry, is who is doing the exploring in the U.S. In 1999, for the first time, Canadian companies actually spent more money in the U.S. than domestic firms (by a clear margin of US\$70 million, according to Natural Resources Canada (2000)). Does this have implications for the long-term competitiveness of the domestic mining sector?

While an estimated 76 per cent of currently operating large scale metal minesites in the U.S. are domestically controlled, the reduction of the domestically-fueled exploration sector

The 100 USMS firms in the random sample used in this study had interests in a total of 21 foreign countries in the year 2000.

NMA data tells us that U.S. mining firms have interests in 45 foreign countries.

“American companies have budgeted decreasing amounts for exploration in the United States every year since the early 1990s. While they accounted for almost 60 per cent of the exploration programs there in 1992, they accounted for only 29 per cent in 1999.” - Natural Resources Canada (2000)

"Analyzing the U.S. sector seems the most opportune time to speak to the effects public opinion has on mining in developed countries. We have already discussed the aging population of minefinders and the lack of appeal on mining to young people."
- U.S. Mining Academic

"In 1905, development of its mineral resources was considered essential to the economic welfare of the United States. In 1980, the development of mineral resources seems to be viewed by the general public primarily as a source of profits to large mining companies, as a source of disturbance of the environment, and as an activity in conflict with more attractive pursuits. The mining industry is not now widely perceived as an essential element in the national economic structure."
- Cameron (1981)

According to the National Mining Association (2000a), the average wages of miners are 65 per cent higher than those of the total private sector.

"During the 1960s and 1970s, the mining industry was identified as one of the worst, if not the worst, of all industries in its impact on the environment. [because] the effects of past mining in certain areas, such as the coal mining regions, are both conspicuous and consequential"
- Cameron (1981)

indicates a shrinking project pipeline for domestic firms. While it is true that Canadian and other foreign explorationists *can* vend their properties to Americans, their more natural ties are to intermediates and seniors from their own jurisdictions. In addition, there are more foreign large firms seeking to invest in the U.S. than there are American large firms. This is due both to the small relative size of the USMS's large firm sector, and the fact that many U.S. domiciled firms, tired of creeping regulations and low public opinion in the U.S., have read the writing on the wall and turned their expansionary eyes toward Latin America and beyond, happy to use the rewards from decades of mining in the U.S. to build a global future.

5.3 Major Issues Identified by the U.S. Mining Sector

5.3.1 Public Perception, Public Policy and Mining

The U.S. metals sector has consistently shrunk over the years in almost every measure, including:

- declining numbers of mines, both underground and open pit. The trend in the U.S. has been toward larger, open pit mines, with an eight-fold decrease in the number of underground mines since 1981 (NMA: 2000a). There are also fewer open pits, with a significant three-fold decrease over the same time period;
- declining import of metals mining in the national economy, absolutely and compared to other minerals; and
- declining as a nation in attracting foreign explorationists, alongside declining internal exploration by Americans.

There is a fundamental paradox at the heart of the USMS behind these recent declines. On the one hand, the USMS consists of only one-eighth as many firms as the CMS. On the other, the U.S. mining industry actually produces more minerals by dollar value than the Canadian industry and improve communication with and education of the public. What explains this apparent discontinuity is the key role played by Canadian firms in maintaining the U.S. "project pipeline," because the USMS's corporate sector has remained small relative to global competitors as a result of several interlinked factors:

- the existence of this strong, dedicated Canadian exploration sector which provides services in the U.S.;
- U.S. venture capital markets are not geared for the high-risk ventures of explorationism;
- very poor public image of mining, and concomitant poor investor image of the value of mining investments;
- increasingly stringent public policy in reference to mining, with only a few western states being seen as having positive geology and bureaucracy (Nevada is the one most often pointed to as having a strong investment climate); and
- the U.S. mining sector does not have the critical mass of aligned institutions that the CMS has to fuel it.

Mining as a whole is on the decline as exploration lags and mines are harder to permit. "An industry in crisis" is the only way to characterize the USMS. The National Mining Association and the federal government teamed up in 1998 to create a "Vision for the Future" of the mining industry (NMA: 2000b). Among the issues identified by the USMS during that process are several to do with technological improvements, but more importantly perhaps, the need to create positive partnerships with government and improve communication and education with the public. These more "soft" issues are being given greater credence by the industry, as they have driven several negative outcomes for the industry over recent years, as chronicled by the NMA/government task force (note the similarities of these concerns to those voiced in Canada):

- the “greybearding” of the USMS’s human resources and the inability to attract a replacement workforce;
- problematic relationships with governments over permitting time delays, and a need for more consistently applied regulations in mining;
- problematic relationships with the general public, who rate mining very low in attractiveness as an occupation, and often consider it an “illegitimate” economic activity; and
- the inability of the industry to overcome its vulnerability to the commodity markets, because there is little value-added created by the extractive portion of the sector and continually low profitability in the sector.

One of the major reasons that the USMS has fallen behind the global leaders of Australia and Canada (in both internal investment levels and external investment levels by domestic firms) is that the political climate for mining has been the poorest of the three major mining nations.²⁸ Political changes are often traced back to the Wilderness Act of 1964 (Cameron: 1981), which was the first of many systematic withdrawals of public lands from the purview of mineral explorers. Land withdrawal continues to be the number one issue for USMS firms domestically. It is linked to a changing public image of the role of mining in the national economy, the inadequacies of the antiquated Mining Law of 1872, and the extreme visibility of the sector’s past and present, widely believed to be of great impact on the natural environment.

Mining activities provide some of the highest economic return per unit of land disturbed: Over \$100,000 per hectare, versus \$5,700 for forestry, and \$1,400 for agriculture.

■ **SPOTLIGHT: Rhetoric vs. Reality – Why Does Mining Always Lose the Public Relations Game?** While mining cannot be said to have no deleterious effects on the natural environment, its impact, in the opinion of the industry and many scientific observers, is generally overstated in the popular press and by interest groups. Consider the transfer of public lands to mining interests that has caused such a negative backlash in the U.S. in recent years. While “patenting” (or privatizing) public lands for about \$5/acre does seem ludicrous, the amount of land privatized by miners is miniscule compared to industries like agriculture and even commercial railroads. In addition, there are wildly varying estimates about the damage created by, and even the numbers of, abandoned mines in the U.S. west (some estimates state that there are as many as 500,000 out there). The generally held public belief that mining is an extensive land use is patently false. What it irrevocably is, is an intensive land usage that creates a higher value per hectare than any other resource industry, over a smaller space in the U.S. than any other major resource industry. Why then can’t the industry shake its image? Several factors have conspired against it, some of which are actually in the industry’s control. Chief among these are two things: 1) the industry has not shaken off the “us vs. them” stance in much of its public and private statements, and its credibility has been undermined by this counterproductive and generally reactive attitude. Groups like the NWMA in the U.S. have taken a combative public stance versus the external interests they feel are aligned against them. This is problematic and indeed often self-defeating. Calling for an extermination of the “cancer of environmentalism” (Pfau: 2001) is highly inflammatory at the same time that it is just “preaching to the church choir”; and 2) the industry has been reluctant to open its books to outside analysis and has not funded credible researchers to look at many key issues, which means that transparency and credibility are undermined. What is there left to hide in a global information economy?

Acres of public to private land transfers in the U.S.: Railroads = 94 million, Agriculture = 288 million, Mining = 3 million. (NMA 2000a)

Thus, examination of the USMS exposes a series of seeming contradictions. It has the largest mining industry by value of any nation in the world, yet is one of the countries

least reliant on mining as an economic activity. It has one of the largest resource asset bases by value in the world, yet is highly import dependent for many metals. Its massive mining industry is supported by a relatively vulnerable domestic corporate mining sector. What do these seeming contradictions mean for the future of mining in the U.S. if current trends continue? Only time and much more dedicated research on the USMS will be able to tell, but some key issues for examination are worth exposing.

5.3.2 Key Issues for Discussion

Because this study has been an exploratory one, drawing conclusions about the USMS seems premature. Perhaps more value can be derived from highlighting some key issues for discussion that need to be addressed in the movement of the USMS toward the future, and toward the ideals of sustainability:

- Establishing responsibility for environmental problems associated with mining. Without a doubt, the environmental aspects of mining are major concerns facing the USMS. This includes examination of who will pay for the clean-up of abandoned mines, what the implications are of having minesites put on the U.S. “Superfund” list, liability concerns for producers vis-à-vis reworking old mines, the use of heap leaching technologies and creation of a transparent and consistent reclamation bonding procedure across different jurisdictions. The question of responsibility is one that is often difficult, given that many U.S. mining companies are actually Canadian firms that have opened subsidiary companies in the U.S.
- A revamping of the fundamental metals mining legislation in the U.S.—the Mining Law of 1872. Even many in the industry argue that the Mining Law is hopelessly outdated, and the negative public image created by its detractors actually outweighs the remaining low prices of “patenting” public lands according to dictates of a 125-year-old law! As far back as 1974, the U.S. federal government’s general accounting department reported that miners don’t pay fair prices for minerals on public lands, and that the law fails to protect the land. Attempts to change the law have stalled at the congressional level, however, with no short-term break to the impasse in sight. Other formulas for a more equitable distribution of mining benefits need to be examined, including questions of leasing mineral rights rather than buying land, creating a fair taxation system, and whether to impose royalties.
- Increasing external reliance for a number of minerals brings back questions of whether metals mining will become a strategic enterprise in the U.S. again. The weakly developed corporate mining sector, at least when compared to Canada and Australia, brings up issues of security of supply that have not been asked since the end of the Cold War more than a decade ago.
- Human resources, akin to Canada. There are very few mining students working through post-secondary institutions. What are the effects for tomorrow?
- One of the major problems facing mining in the United States is that while its size is large globally, its import is relatively miniscule domestically. By any measure of value, the metals sector falls well below one per cent of GDP, and its place in the economic scheme of things only seems to be falling further over time.

When summarizing issues facing the USMS, it is interesting to look at a statement by Eugene Cameron:

“This period... should probably not be taken as a normal one. It has been a time of definition of environmental problems, of considerable trial and error in the framing of environmental regulations, of extremism, of constant change in the ground rules of

According to the NMA (2000a), more than three dozen federal environmental laws govern the USMS’s domestic activities.

“Let’s face it. The Mining Law is a big part of our problem. Yet we are still trying to maintain it”
- Industry consultant

We can place three to four times as many students as we graduate... but it is just not glamorous to be a miner these days. The public just doesn’t care.”
- American Mining Academic

According to the NMA (2000), metals production represents a miniscule 0.10 per cent of U.S. GDP.

mineral exploration and development, and of conflict between and among state and federal regulatory boards, commissions, and agencies. The mining industry has been caught in what to some extent has been an experimental process, part of a transition from an era of little in the way of environmental regulations to one of close control. The difficulties of the period have been exacerbated by much angry rhetoric and by the treatment of issues too often on an emotional rather than an analytical basis. It is to be hoped that this chaotic period is coming to an end and that a better balance between the national need for adequate mineral supplies and the national need to minimize environmental damage can be achieved.”

A strongly articulated argument for the issues that have plagued U.S. mining. The irony is that this statement covered the decade of the 1970s (Cameron: 1981)! The debates that rage in U.S. mining are now about 30 years old with little end in sight. If the actual outcome to present of his hopeful prediction is any indication, similar problems may still plague the USMS 20 years from now.

Endnotes

- 26 At the statutory rather than securities regulation level, Delaware and Idaho are considered to have the most mining-friendly **regulatory** environments in the United States. Delaware is the chartered home of 16 per cent of USMS firms mainly because it has the easiest corporate takeover legislation in the country; Idaho is home to 22 per cent of firms because it represents a state with a positive infrastructure for mining and head office locations for mining companies.
- 27 The top five coals states are identified in Map 4 by black boxes. Production values data come from the National Mining Association (2000a).
- 28 Australia, Canada and the U.S. are isolated as the three major mining nations because they all have a vital internal and external investment sector. The U.K.’s “mining houses” are globally dominant in size, but the U.K.’s internal mining sector has shrunk from being a world leader in the 1800s, and South Africa has little global presence outside southern Africa.

6. Comparing the Canadian and U.S. Mining Sectors

6.1 Summary of the Canadian Mining Sector

The Canadian mining sector (CMS) is dominated by publicly traded companies, usually traded on the CDNX or TSE. It has, in sheer numbers, dominated the movement of mining companies into overseas markets, especially in the exploration sector. Particular foreign “spheres of influence” have been carved out by Canadian firms in the U.S., Latin America and (to a lesser degree) Asia and Africa.

Canada is also the world’s second most popular target country for mineral exploration (after Australia) and has been among the top three targets for over 25 years. In the 1990s, its proportional share of the global investment dollar dropped as many developing countries (especially in Latin America) became more attractive exploration targets. It is Canadian firms themselves, to a large degree, that have driven into these new markets. Currently, changing risks associated with investing overseas have tempered this outward-looking trend.

Canada, and therefore the CMS, has been globally dominant in several mining related functions: mining finance infrastructure (at the capital market level and the corporate banking level), exploration finance (through the venture capital markets), exploration, development and mining services provision (alongside Europeans and Australians), and the production and sales of mining equipment, R&D, and consulting services (behind only the U.S. and U.K.). This capacity was developed around domestic operations, but in the past 15 years has expanded internationally faster than any other major mining country. Canada’s dominance is now in question for the future, with rising foreign competition from the U.K. and Australia, alongside internal capacity building in developing countries that have a “stake” in the mining game.

The major advantages the CMS has in going overseas can be broken down to elements of corporate culture, the size distribution of firms in the system and the availability of venture capital, all at one time unique to the Canadian mineral production system. All of these advantages are now facing either erosion or significant challenge coming into the new millennium.

Corporate culture: Canadian miners have developed reputations as premiere “minefinders,” and are especially well known for their willingness and ability to explore in harsh and/or unfamiliar environments. Australia appears to have the only comparable mining culture. In recent years, there has been a radical shift in the way Canadian mining companies do business. Gone are the heady days where every annual report promulgated the primary goal of “maximizing shareholder value.” Now, firms are “positioning” themselves for “future growth potential.” There is a common industry term utilized: “survivor mode.” The race across the globe to access newly opening, highly prospective mining areas, has slowed during the downturn in metals prices, and with this fiscal incapacity has come limited organizational flexibility in the face of new challenges for firms to become sustainable. Canadian firms have had a difficult time adapting to these changing needs, because a whole new corporate mindset is often required.

Size distribution of firms: Canada has maintained a strong intermediate sector up until recent times, wherein small exploration firms, through careful management, long-term strategy, and skilled minefinding, could take advantage of the mass of available venture capital to start up viable mining operations. Of late, this strong intermediate sector has faltered badly, taking the brunt of the blow from a downturn in mining markets along with the junior sector. The vital role of juniors supported by venture capital in providing a stable “project pipeline” has also been eroded in the current fiscal climate. This is of course linked to the third supposed advantage of Canadian firms—

The availability of venture capital: The decline in venture capital availability has shifted the global balance of power in mining. One result has been the movement of the London

based LSE back into the exploration financing fray in a large way, with the establishment of its Alternative Investment Market (AIM) as a major exploration exchange in 2000. This and the growth of the Australian finance raising sector is a sign of the erosion of Canada as dominant global mining financier.

Breakdown By “Home Place”

The “home place” of firms based in Canada is very much dependent on one of two factors: place of the firm in the production system and thus the type of necessary funding, or location of deposits. The location of head offices is much more important than previously recognized, when the location of a capital market for finance raising was argued to be the sole reason for location. This study (and MacDonald: 2000a) has shown that there is a significant sense of “community” to the home place, agglomerations of service industries, and most recently, many “home places” have become what Freeman (2001b) calls “global portals,” effectively pipelines of information to select global mining regions. Canada as a whole, and the four major mining cities in it, represent “global portals.”

Toronto and Vancouver represent preeminent global mining cities in their distinct categories: Toronto as a global centre for mining finance and senior deal-making; and Vancouver as a global centre for exploration finance and international investment. As global mining cities, only Perth, Australia, and London, England, are comparable.

Home places in Canada appear to be less defined by the proximity of the resources than home places in the U.S. They can be argued to be defined more by “business opportunity” than “resource proximity.” In fact, the example of Quebec-based firms selectively investing in francophone countries shows that cultural proximity may be of more importance than distance for these new “global portals.”

Breakdowns By Firm Size, Organization Type and Geographic Investment Patterns

This study has built on previous research by the author in sub-categorizing firms based on size, place in the production system, investment patterns and commodity focus, among other factors. These new categorizations have profound implications on the study of the mining industry, because all of the activities of individual firms are envisioned as being part of a larger “production system.” In a production system, all parts of the system (including individual firms, outside stakeholders and the patterns of inter-relations between actors over time and space) play a part in the efficient operating of the system, a recognition the industry has struggled to come to terms with.

Junior firms (those with assets below CDN\$100 million in this study) play a key role in the mineral production system, especially in the metals sector, where exploration is a high risk venture. Their role has too often been neglected in previous research. Junior firms are far too diverse to be considered a single category of companies. They are broken down both by firm size (the distinct category of junior/junior covers those firms with assets below CDN\$2 million) and organizational focus (junior firms can be investment, exploration, development, production, or management group firms).

Junior companies are the base of the mineral production system, providing the key role of reducing the high levels of “discovery risk” associated with metals exploration. Their unique access to high risk venture capital in Canada is one of the major reasons Canada has maintained its status on the global mining stage. In addition, junior firms are often the point of “first contact” with local communities, government representatives and interest groups, and thus their actions and perceptions of same are keys to the overall assessment of mining as an industry, not just on a project-by-project basis.

Expansionary juniors (those with assets roughly between CDN\$100 and CDN\$350 million) are just that, firms in a transition stage that are experiencing a fundamental shift in their corporate culture as they attempt to bridge the gap between exploration focus and

production capacity. This gap is often too wide and many of these firms fail or are swallowed by larger firms during this process. Intermediate firms (those with assets between CDN\$350 million and CDN\$2 billion in this study) are among the most vulnerable firms in the NAMS. They must grow into efficient producers or die off through outright failure or corporate takeover. While the junior sector represents the point of “first contact” with local communities, much of the current erosion of reputation capital associated with the mining industry has come from high-profile crises (environmental asocial) involving these “mid-sized” companies. In part, this is due to their ability to prioritize sustainability issues during the financing and revenue crises associated with the downturn in the global mining markets over the past half decade. When in “survival mode,” the mining industry often turns away from “soft” issues management.

Senior firms (those with assets of more than CDN\$2 billion in this study) dominate metals production. These firms are usually global in focus, and they face increasing pressure to grow through mergers and acquisitions rather than internally. This is no homogenous group either, as pressure to specialize in a commodity niche is rampant among the senior sector, except for the very few firms (none Canadian) that have developed the sheer mass of global conglomerates (RTZ, BHP Billiton, Anglo/De Beers).

Increasingly after the late 1980s, internationalization of mining companies large and small has been occurring. A mixture of push (changing regulatory structures and public image toward mining) and pull (opening of highly prospective developing countries to foreign investment) factors have led this charge. Interestingly, in many ways, the more flexible junior sector has driven CMS movements into these newly opening countries, again providing a risk-reduction mechanism for the larger firm sector. The recent downturn in the mining economy has resulted in reduced investment levels across the board, with international investment and domestic investment affected similarly. This indicates that the movement toward globalization is a long-term condition, rather than a market blip. However, as mentioned before, 2000–2001 has seen a growth in the Canadian domestic exploration market, perhaps indicating “push” and “pull” factors are not a one way street.

Major Issues Identified By the Canadian Mining Sector

Major issues facing the corporate sector of the CMS coming into the new millennium include the following:

- All of the major competitive advantages the CMS has had in the past (strong venture capital markets for mining, strong professional community geared toward mining and high levels of domestic investment) are facing possible erosion, in the face of devastatingly poor commodity prices and financing environments over the past five years, and changing investment patterns in a globalizing industry.
- Junior-senior interactions and misunderstandings. Juniors feel seniors are ramping up the costs of initial exploration through heightening indigenous groups’ expectations, are not supporting them enough through capital infusions and “grubstaking,” and lack an understanding/appreciation of the skills of juniors. Seniors consider the junior set dangerous from a public relations standpoint; they are a force to be divorced from in the public image. There is also a current lack of a healthy intermediate sector and the flexibility these firms provide for the overall production system. On the whole then, there is very little currently being done to recognize and bolster the inter-relations between firms of different types in the Canadian mineral production system.
- Declining capital stocks. Here, not only is financial capital being eroded, but so is reputation capital and intellectual capital through the “greybearding” process. How to rejuvenate those capital stocks and human resources to remain competi-

tive at home and abroad will be a key issue confronting the future of Canadian mining (MacDonald: 2000b).

- Challenges from popular social and environmental groups; and balancing those challenges against both the firm's financial imperative and the wants of local communities. Coming to terms with new demands from regulatory and public sectors for more sustainable mining practices will be the essence of the sustainability debate in mining. Part of this challenge is confronting the public image of the industry, and part of it is internally changing the corporate cultures of firms and individuals *in* mining toward sustainable ideals.
- Changing listing requirements and more rigid venture capital market regulations in Canada, and the potential effects this will have on the vital junior sector. Alongside this is the loss of financing prestige on the venture capital markets with the rise of alternative investment types and alternative global markets.
- Behind all of these changing risks is the fundamental reality that the primary drivers facing the industry have not changed. Investors still demand appreciation in the company's value, and the commodified nature of the industry's output highlights the difficulty of implementing the necessary long-term planning system in a market-driven industry! In addition, there are structural changes going on in the industry on an almost daily basis that affect the capacity of the industry to adapt. This includes growing consolidation and internal downsizing among seniors, the accompanying decline of the intermediate sector, and constant pressures on the junior sector to "survive" and to develop a sufficient "project pipeline" to fuel the senior sector.

6.2 Summary of the U.S. Mining Sector

The United States Mining Sector (USMS) is much smaller than its Canadian counterpart, at a proportion of about 8:1, if assessed by the number of firms in the system. Nonetheless, the U.S. has the largest mining industry by value of any developed nation. Those public companies that do exist usually focus on attracting capital through the Canadian exchanges or on the less mining-focused U.S. markets (Nasdaq, Amex the over-the-counter exchanges).

There are no powerhouse mining "home places" in the USMS comparable to Vancouver or Toronto in the CMS. Other than the general small size of the mining corporate sector, one of the main reasons for this is that many ostensibly "U.S." firms list on the Canadian exchanges, and generate most of their funding in Canada or in Europe. Thus, the location of head offices near major exchanges is not as important as it is in Canada. Nonetheless, there are some discernible patterns in the location of head offices of U.S. firms. Many of the junior investment companies are based near an American junior exchange like in the Spokane-Coeur d'Alene corridor. Western states are much more likely to house exploration companies (often in close proximity to their projects), and the midwest and northeast are the more likely homes for more vertically-integrated companies with mining links in their overall corporate supply chain. Reno represents the administrative home of the Nevada mining industry, while Denver is perhaps the closest thing the U.S. has to a "global portal," with many of its companies looking overseas.

The USMS (metals sector) is really two distinct animals. One is a surprisingly weak domestic exploration sector, and the other is a small group of globally competitive companies that have (usually) taken advantage of strong domestic growth to fuel external expansion.

Some 46 per cent of the 223 publicly traded companies based in the U.S. are investment juniors, with one or two exploration sites, usually in the mineral-rich western states. Their weakness shows that there is no truly effective U.S. domestic exploration sector, in part due to the more stringent regulations on U.S. stock exchanges, and in part due to a lower pub-

lic opinion of the role of mining in the national economy. This weakness is highlighted by the fact that more exploration in the U.S. is done by Canadian firms than by Americans.

Despite the minimal size and general weakness of the corporate sector, there are some globally competitive senior and intermediate-sized firms in the USMS. Firms like Newmont, Freeport McMoran, Phelps Dodge and vertically-integrated companies like Alcoa, Peabody Coal and IMC Global, are all senior mining companies with far-flung operations. The success of the vertically-integrated companies is generally domestic-driven and dependent on the growth of domestic markets; the growth of the metals firms has been overwhelmingly international in recent years, perhaps a reading of “writing on the wall” for the future of mining in the U.S.

Only a few western states have strong metals mining industries. U.S. mining companies are well known for their abilities in a couple of key industry areas: development of porphyry copper deposits, and heap leach gold deposits.

The USMS is something of a paradox then, in part due to the success of Canadian firms exploring in the U.S. The U.S. is one of the most important exploration targets in the world, and one of the dominant producers of a multitude of minerals. Yet it is an industry that has a negative public profile, where exploration is highly controlled by foreigners (if that matters), and whose activities are regarded as a rather tiny, dirty blip on the economic map. These are all concerns that will continue to be raised in the future and result in an overarching question: do Americans want mining in their backyard?

Major Issues Identified By the United States Mining Sector

1. Lack of public support for mining in the U.S.
2. Continual calls for reassessment of the Mining Law of 1872, long considered a competitive advantage as a policy instrument but perhaps now more of a public image millstone around the industry’s neck.
3. Rising legislative and regulatory concerns governing things like land access, permitting and environmental liabilities in the mining sector.
4. Security of supply, and the re-emergence of metals as strategic commodities. This is pointed out as being a potential reason for the re-growth of a domestically led USMS, rather than a foreign dominated one as exists today. The USMS is currently caught in a scenario where, even though it is the largest mineral producing country in the world, the size of its domestic economy is so large that it still relies on massive mineral imports to sustain its manufacturing core. Trends in global geopolitics will determine whether “security of domestic mineral supply” will be a key future issue.

6.3 Comparison of the Canadian and U.S. Mining Sectors

6.3.1 Quantitative Comparisons

Table 10: Top 10 Metals Miners, Canada vs. U.S. (2000 US\$)

Ranking in Country	Canadian Mining Firms (Assets: 2000 US\$)	United States Mining Firms (Assets: 2000 US\$)
1	Noranda (7.8 billion)	Phelps Dodge (7.8 billion)
2	Inco (6.5 billion)	Freeport-McMoran (4.0 billion)
3	Teck Corp (5.4 billion)	Newmont (3.5 billion)
4	Falconbridge (3.2 billion)	Homestake (1.6 billion)

Ranking in Country	Canadian Mining Firms (Assets: 2000 US\$)	United States Mining Firms (Assets: 2000 US\$)
5	Barrick (3 billion)	Stillwater (679 million)
6	Placer Dome (2 billion)	Battle Mountain (569 million)
7	Cominco (2 billion)	RTI (386 million)
8	Cameco (1.9 billion)	Coeur d'Alene (354 million)
9	Franco-Nevada (900 million)	Hecla (195 million)
10	TVX Gold (740 million)	Meridian Gold (171 million)

Table 11: Comparing the Canadian and U.S. Mining Sectors²⁹

Variable of Interest	Canadian Mining Sector	United States Mining Sector
% of GDP (2000) derived from mining sector (not oil and gas)	Non-fuel total = 3.7%	metals = 0.10% non-fuel total = 0.40%
Total revenues from mining industry (2000 US\$) World Bank	#6 in world with \$24 billion	#1 in world with \$40 billion
Total revenues from metals mining (2000 US\$)	\$13 billion	\$9 billion
% of land base devoted to mining	<0.1%	0.25%
% of mineral raw materials exported	very high	low to miniscule
% of population (direct/indirect) employed in mining	180,000 (.6% of pop'n) 26,000 in metals sector	357,000 (.12% of pop'n) 45,000 in metals sector
Number of publicly traded mining firms (by head office)	1,650+ (eight times as many as the U.S.)	225
% of mining establishments run by domestic firms (50%+ control)	>90%	76%
% of exploration in country done by domestic firms	69%	29%
% of exploration in country done by U.S./Canadian firms	<8% of exploration done by U.S. firms	52% of exploration done by Canadian firms
Number of global countries where domestic firms have interests	over 100	45
Number of domestic metals mining firms with assets over \$100 M	approximately 34	11
Major importer of	alumina/few others due to smaller industrial base	alumina/copper/iron ore/silver/variety of others
Direct impact on economy of minerals and metals products sector	>US\$60 billion	US\$451 billion

Table 10 compares the largest metals mining firms from the U.S. and Canada, while Table 11 compares several variables of interest between the U.S. and Canadian mining sectors, as of late 2000.

Table 10 shows the top 10 metals mining companies in the CMS and USMS, with total assets converted to current U.S. dollars for the Canadian firms. While the top four seniors are comparable, the U.S. senior sector ends there while the Canadian senior sector remains intact through at least the top eight firms. Of course, in an industry so rife with cross-border merger activity, it is not surprising that our otherwise flawless graph of U.S. from Canadian mining firms, has hidden within it two subsequent international corporate mergers (both Newmont/Franco Nevada; and Barrick/Homestake, have since merged). Indeed, if one includes the acquisition U.S.-based Battle Mountain Gold in the equation, Newmont's position in the North American Mining Sector has grown to an over US\$5 billion portfolio in the past year. This is truly an industry in transition.

The two key differences between the United States and Canada in mining actually have little to do with the metals sector. Number one, U.S. coal production far outweighs Canadian coal production. Secondly, the U.S. utilizes more industrial minerals than any other nation, due to its massive infrastructural needs. In total metals production, the two countries are similar in the value created, with Canada slightly ahead.

Several issue areas can be extracted from these statistical comparisons:

- while the import of mining on the overall economy is obviously much greater in Canada than in the United States, the U.S. is overall a larger producer of minerals on the global stage. While both countries are world class miners, the U.S. is the world's largest overall producer of mineral wealth, while Canada is sixth. Both countries clearly have a major stake in the global mining game, whether or not their publics realize it;
- while the U.S. uses most of its mineral wealth internally, Canada is an overwhelming exporter of minerals and metals. Therefore, metals production for international trade is a strategic enterprise in Canada, while having a steady supply of metals for industrial consumption is more of a strategic priority in the U.S. Questions remain over whether minerals and metals will become truly "strategic" again if internal supply falters in the U.S.; and
- Canada has more and larger firms and subsequently greater global reach than the U.S. This raises the question: what are the strategic implications for Americans of Canadian firms doing most of the mineral extraction in their borders in coming years? Some might welcome this, in that it can create an "ugly Canadian" rather than an "ugly American" perception for a change of pace in the international community!

6.3.2 Qualitative Comparisons

Pure statistics can tell us only so much about the similarities and differences between mining in the U.S. and Canada. In addition, there are perceptual considerations. U.S. and Canadian firms have similar concerns about the roles of governments, industry associations, the general public and NGOs of many shades; and their effects on the industry's vitality and even viability. One of the major problems for the CMS and USMS is the combative tenor of their relations with governments, other regulators, and public interest groups. However, while in the U.S. the very legitimacy of mining as an industry is under attack from several fronts, in Canada it is more a concern about the role of governments and interest groups in generating added costs and risks to an already "risky business." A good example of this comes when talking about different socio-economic concerns faced by mining firms in Canada and the U.S. While in Canada, firms often talk about negotiating with aboriginal groups or isolated communities for Impact and

"Some states are difficult to operate in because of watchdog environmental groups who carry political clout and tend toward the extreme—especially Idaho and Montana." - Investment relations professional

Benefits Agreements (IBAs), in the U.S. firms speak instead of an overarching resolve by many U.S. states to totally eliminate mining from their constituencies.

Both the U.S. and Canada are federations of states/provinces, with two levels of government having roles to play in mining regulations and legislation. There are some unique differences however, especially in the perceived role of the federal governments vis-à-vis the mining sector. In Canada, the Minerals and Metals Sector of NRCan is generally perceived as being a benign or positive element in the Canadian mining industry. The real concerns are at the provincial level, which controls access to land and mining development regulations. In the U.S., concern more often has been the opposite, with things like federal “creeping legislation” playing a major hindrance to mining development, especially during the Clinton administration.

■ **SPOTLIGHT: Environmental Image and Historical Liabilities – Mining’s Legacy.**

Both of these issues remain major concerns in Canada and the U.S. For example, Noranda found their efforts to redevelop a cobalt property in Idaho, one that had been run by the U.S. government in WWII, stalled and doomed to failure because the clean-up costs from the previous operation were just too much (they ended up—with other partners—paying US\$65 million without ever mining a pound of cobalt). In areas with long mining histories, like the entire western Cordillera, the clean-up costs from bygone eras become an increasing concern and can become virtual deal breakers. The public image of mining is also growing equally problematic, and can be relayed in an old Canadian joke relayed by a senior mining company representative: “*During WWII, the German Luftwaffe actually were to make a daring bombing run on Canadian shores. They came in under heavy cloud, and when the clouds broke they were over Sudbury, and that is what saved us. The Germans realized the place had already been bombed, and turned for home.*” This is the lingering image of the effects of mining on the landscape; yet, Sudbury today looks nothing like that. These two examples are just a few of many indicators that in modern mining, neither perception and reality, nor culpability and responsibility, necessarily coincide. These are the **legacy** of mining’s history, and they cannot be hidden from.

In the fall of 2001, Cominco Ltd’s Trail lead/zinc smelter came under intense media and legal scrutiny in the wake of an incident where maintenance workers were exposed to toxic levels of thallium.

“What we face in B.C. and Canada is an extreme level of combined issues experiences in other mining regions; [that] puts us in a unique position to—and responsibility to—educate and explore new directions for the industry.”
- Exploration Manager of a senior firm

Other than the fact that Canada has a much more integrated mineral production system to push projects up the mineral production chain from exploration to production, a factor initially driven by the presence of strong risk capital market structures, and eventually fuelled by agglomerations of capital, skill and service providers in Canada’s major mining cities, there would be little to differentiate the mining sectors of the U.S. and Canada. With the number of challenges facing the industry’s corporate sector in coming years, the pessimist would be forgiven for saying that Canada “only has more to lose.” Here are some of the challenges both the CMS and USMS will face in coming years:

1. the market regulations in Canada are rapidly becoming as stringent as those imposed in the U.S., vis-à-vis listing and reporting requirements. Capital access may become more constrained in both countries;
2. the public’s attitude toward mining, and that of regulators and politicians, is becoming increasingly ambiguous. Canada may be following the lead of the U.S. and U.K. in this regard; and
3. both countries are facing consolidation in the large firm sector with relatively weak hands against the “global giants” from the UK, Australia and South Africa.

But don’t just take my word for it! Ringwald and Kent (2001) held discussions with several senior executives from large North American mining companies in preparation for their groundbreaking conference on sustainability issues for the Canadian Institute of

Mining, Metallurgy and Petroleum Products (CIMM). Their findings echo those reported herein, including major issues facing the NAMS:

- mining's crisis state in North America, due to a volatile and self-perpetuating mixture of a negative public perception of mining (e.g., industrial dinosaur, sunset industry), shrinking enrollment in the mining professions, rising protest and inability or inaction by the industry to "fight back" against these protests. Mining is an "easy target";
- positive elements are identifiable, however, because the NAMS is still a world class industry, which because—rather than despite the fact—it faced the "first wave" of sustainability and changing public policy perspectives, has become experienced in handling the "worst case scenario"; and
- North America is seen by the industry as the worst jurisdiction in which to work in the world. This is a bit of an overstatement, because the exploration and development record, both in levels and success ratio, points to North America as remaining attractive up to the present time. But certainly, in rhetorical terms, this notion is mentioned time and again. Fundamentally, the risk of mining in North America has changed on the global scale. Currently the biggest hurdles to getting work done in North America are permitting processes, political intrusions, heightened bureaucracy and lack of transparency of regulation.

Into this vacuum, Latin America has presented itself as a beacon of investment interest. The attractiveness of Latin America means that the essential task of training new "minefinders" is not occurring at "home." Whether this is important or not depends on your individual viewpoint; some in the industry, usually those who migrated to Canada and the U.S. themselves, see this as a continuation of a pattern from about 30 years ago. Others, usually "North American grown" geologists, are concerned that North America will lose its intellectual capital base, and with it a leadership position in global mining circles.

All is not rosy, either, in the movement toward globalization. Increasingly, firms are finding that the bureaucratic inertia and public image problems they thought were left behind in North America are following them to places like Latin America, or are being replaced by new types of social risk. Nonetheless, Canadian and U.S. firms are creating new competitive advantages by being major "global portals" to places like Latin America, developing the skills, information networks and reputation capital necessary to get work done in these newly opening countries.

In reality, the future of mining in the U.S. and Canada are linked, because it is becoming increasingly apparent that mining industries cannot be isolated by nationality in what is becoming an increasingly global sector. As Freeman (2001b) puts it: "*The issue of globalization, including free-trade and World Bank-type privatization issues, fuels change. Globalization diminishes the importance of national issues. It allows investors to move freely to those businesses with the best corporate components.*" This begs two questions: Is there a "North American mining sector?" And if not, what does a "stateless" mining industry mean for the future of national mining sectors?

6.4 Is There a "North American Mining Sector?"

As mining becomes a truly global industry, competition between "home places" would appear on the surface to be ramping up. In recent years, Australia has approached rivalling Canada as a vital centre for both mining finance and expertise. The London junior market, AIM, has seen recent rapid growth, and many industry respondents consider its formula and profile for venture capital raising in the vital European market to be a significant draw away from the Canadian markets.³⁰ Another significant advantage of London is the presence of the big "mining houses," which give London a global prestige, investor confidence, and a ready downstream market for explorer's projects. This burgeoning London sector is

In a sense, we have turned our backs on North America and are trying to become the 'partners of choice' in a new global region. And I mean that not at the firm level only, but the Canadian sector as a whole. We did it here [Canada]; we can do it there [overseas]." - Vice-President, Exploration, Canadian junior company

"Several companies have delisted here and taken their production to London. Their market is better geared for juniors than the CDNX now." - President, exploration junior

already well established in Europe, Africa and South America. Will North America be next (e.g., De Beers' acquisition of Winspear's diamond play in Canada's north)?

At the same time, and perhaps in contrast, the mining industry may be one of the first sectors to fully bloom into a "borderless" economy. Look at a firm like Laminco, which has a Canadian charter, a U.S. head office and in 2000, merged with a Norwegian firm. A Mexican senior, Grupo Mexico purchased a U.S. senior, Asarco. BHP of Australia and Billiton of England have merged. There are border-crossing consolidation deals among the aluminum giants. 2001 found a Canadian senior (Barrick) create the world's second largest gold producer through the purchase of Homestake, an American firm; with U.S. giant Newmont hot on their "merger mania" heels. There are two patterns being exposed here: one is that national identities are becoming blurred in mining, and the second is a continual move toward industrial consolidation. Both are identified in turn here and their implications examined:

6.4.1 Global Portals; National Image; Local Communities

In previous work (MacDonald: 2000a and b), the author has introduced the idea that "home places" for mining firms served more than a ceremonial or historical function, and that the location of head offices in agglomerations created competitive advantages, especially for Canadian firms in a rapidly globalizing industry. This argument is borne out when you consider that different home places have identifiable global "spheres of influence." Similar to the global oil sector, only about six or seven global cities carve up the vast majority of the "mining pie." Current spheres of influence globally are:

- Canada (Vancouver) – Latin America, Southeast Asia, U.S. and Canadian west
- Canada (Toronto) – Canada east and central, Africa, Central Asia
- Canada (Quebec) – Francophone countries in Africa, Latin America
- U.S.A (Denver) – Latin America
- London, England – Africa, Eastern Europe, South and Central Asia
- Australia – Australia, Pacific, Southeast Asia, some Africa
- Chile/Brazil – South America
- Johannesburg – Southern Africa

Freeman (2001b) argues persuasively that cities with these "spheres of influence are global portals" and that Canada (specifically the major centres of Toronto and Vancouver) has had the most important global portals in recent years. This is mainly as an outgrowth of a financial pattern related to the openness of Canada's venture capital markets to raising mining finance and, paradoxically, the small size of the domestic economy:

"There is a critical mass of mining companies on the TSE. Most of the investor money is in pension and mutual funds base-loaded with index buying from the TSE 300. The Canadian economy is sufficiently small enough that the market cap of intermediate and senior mining companies constitutes target investments for these index investors. This then attracts other companies with global assets to Canadian markets, and the Canadian markets then evolve to attract further companies. By providing the stock exchanges of choice for global investments, Canada attracts the investors, the corporate assets, and the talent to manage them. These companies are not Canadian. They are absolutely global."

This fundamental reality brings up many issues, not least of which is: when a firm is "stateless," who then becomes responsible for its actions in foreign climes? It is worth noting that national reputation is a major concern for not only mining companies, but other

"The Chileans and Brazilians are starting to run around South America a lot now... But that is good. We need competition on the global scale."
- President of an exploration junior

"There are only five cities in the world that the oil patch is worked out of, so in that sense Calgary is a global city."
- President of a private company

"The money can be European, the experts Canadian, the project South American and the principals can live in the U.S. for the tax."
- Mining industry consultant

"Down there, you mention you are Canadian and that is the first topic of conversation—mining. 'Are you a miner?' The image of Canadian mining is increasingly the image of Canada [in Latin America]."
- Canadian academic, specializing in Nicaraguan research

stakeholders. For example, the Canadian federal government is very concerned with the image created by “Canadian” mining companies investing abroad. This is one of the major reasons behind the Minerals Policy Research Initiative and the federal government becoming the first to define a “Sustainable Development Policy” for minerals and metals (Government of Canada: 1996). Herein lies a major concern. Will mining companies hide behind a national flag of convenience, similar to that used in the shipping industries, to evade real responsibility? Already, we see in countries as far flung as the United States, Indonesia and Nicaragua an image created that it is “Canadian” mining companies behind many (if not most) of the major mining incidents. This negative public image needs to be combated at the same time that the reasons why projects *do* fail or face a public backlash are confronted. Perception and reality play equal roles on the global stage.

Members of the “North American mining sector” are also going to have to come to grips with the changing scales at which it operates. The industry has done well in advancing its interests overseas, becoming increasingly international in the 1990s. Where it may yet falter is at an entirely different scale—the **local**. Miners are educated in working on *sites*; they are often not fully aware of the surrounding socio-economic-political-cultural *situations*. It is this juxtaposition of the local and the global that mining firms will have to balance if they are to succeed and prosper in a “sustainable development” economy.

While Canadian and U.S. firms are not the largest (see Section 6.4.2 below), they are certainly (in the Canadian case, at least) the most numerous. And the sheer size and subsequent capacity to be the first large group of expatriate companies to go global begets a degree of responsibility on these firms. Canadian international mining firms are under the watchful eyes of the world, and must be at the forefront of the move to sustainable mining. Opportunity begets responsibility!

In this paradoxical world of stateless corporations, powerful local/global portals of finance and communication, and continual association of national identity with mining firms, the local, national and global have never been so closely tied. Indeed, the mining industry may yet serve as an initial sectoral study of “global-local” disorder.

6.4.2 Global Mining Consolidation: Patterns and Impacts

Alongside the confusion over where mining companies are *from* is a growing sense of concern over where the industry is *heading*. One of the major concerns has to do with the consolidation of the production side of the industry in the hands of fewer and fewer producers. Harquail (2001) highlighted this by graphing the 24 largest metals mining companies in the world, and their head office locations, as seen in Figure 16. North American mining companies are grey (Grupo Mexico, not considered in this analysis, is white), while companies from the rest of the world (in actuality only the U.K., South Africa or Australia) are depicted in black.

Obviously, mining companies from North America are not amongst the largest of the large. This has created a sense of vulnerability on the part of the North American mining sector, leading to a growing number of what might be considered “defensive” mergers in recent times. A defensive merger is one headed into not necessarily because the two firms have complementary attributes that will lead to a high level of synergy and growth, but rather in order to reduce the chances of one’s self being taken over by a larger firm, or to preclude larger firms from taking over other competitors and accessing their resources. Most industry insiders spoken to by this researcher question whether this consolidation period can hold on much longer, and the very logic of growing bigger, often at the expense of getting “better.” Table 12 indicates some of the merger and acquisition activity that has occurred in the last couple of years, and how it has changed the mining map.

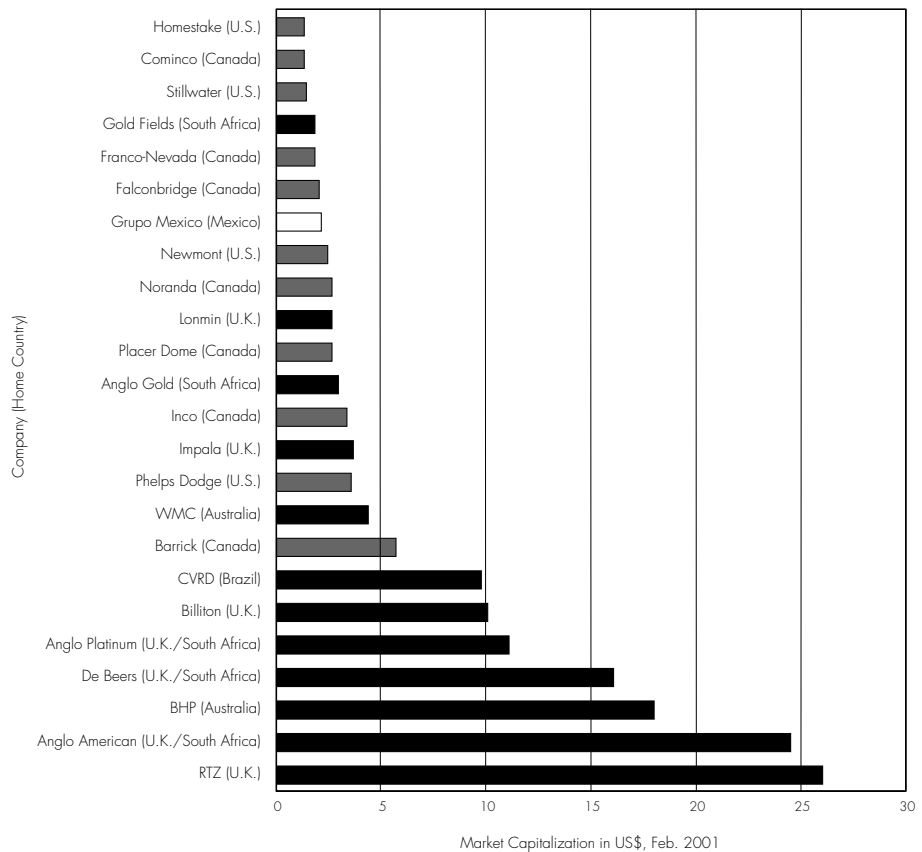
“For MMSD, I think it is important that we document the global nature of the mining industry... recognize that mining is a global not a national business.” - Freeman (2001b)

“You can be just about anywhere in the world and have access to this exchange... they are trying to create a cross-country ‘virtual exchange.’” - President of private company referring to CDNX

“Right now we are still the best, but that won’t be for long... maybe Chile will be #1 for geologists and speculative capital.” - Vice-President—Exploration, expanding junior

“North American mining companies are increasingly becoming the small fish surrounded by sharks.” - Harquail (2001)

**Figure 16: North American Mining Companies in Global Perspective
(from Harquail: 2001)**



"Mergers are often driven by fear of being taken over by someone else, driven by senior management and for questionable reasons."
- Mining industry consultant

"The major concern is that consolidation is all about fiscal rationalization in an industry where the profit margins are just that, marginal, so there is always some downsizing in human resources when a merger occurs. Fewer and fewer ideas being bandied about in small groups, no incentives for having initiative. And thus, fewer and fewer deposits being found."
- President of a junior company

While this consolidation movement has obvious implications for competitiveness in the senior ranks, the junior sector (which seems to follow every move of the senior set with a mixture of heady anticipation and absolute dread) is quick to point out that there are problems created for the junior circuit by this pattern. Juniors have traditionally depended on seniors like Billiton and Teck to support their activities, and concerns are that these "Investor/Controlling" firms will not be focusing as much on the junior sector now that they are extremely large (although BHP Billiton's continued strategic alliance with firms like Corriente somewhat belies these concerns).

At the same time, however, this consolidation brings the hint of greater long-term opportunity for junior firms, because of a fundamental imbalance between the size of the new "mega miners" (Harper and Andrews: 2001) and their ability to find their own new reserves. Consider this nugget of reality expressed by Chender and Lowrey (2001): "*An AngloGold/Gold Fields combination that is the subject of current market speculation would need to find more in appropriately sized deposits than the entire industry typically discovers in a year, just to replace reserves!*"

Because seniors must replenish their reserves as quickly as they are exhausted, maintaining a healthy project pipeline is essential. This should make a upswing in exploration, in all probability fuelled by juniors, a must situation very soon. Seniors more and more are moving away from grassroots and the junior sectors will have to pick up the slack.

Table 12: Consolidation in the Global Mining Industry, 1996–2000

Predators	Vanquished (no longer exist)	Controlled (more than 50%)	Vulnerable to Takeover Bids
RTZ (North, Ashton, Kennecott)	Cyprus Amax (Phelps Dodge)	Falconbridge (Noranda controls majority)	
Billiton – BHP (Rio Algom/focus on junior sector)	Rio Algom (Billiton)	Cominco (Teck owns majority – they are effectively merged)	Almost any intermediate firms
Anglo-American/ De Beers (Minorco)	Labrador Iron Ore (RTZ)	Glamis Gold	Overextended senior firms
Phelps Dodge (Cyprus Amax)	Asarco (Grupo Mexico)	Hudson's Bay M&S (Anglo-American)	
Noranda (Falconbridge)	Battle Mountain (Newmont)		
Barrick (Pangea, Sutton, Homestake)	Homestake (Barrick)		
The Aluminum Giants (Alcoa, Alcan Reynolds, Pechiney)	Rayrock (Glamis)		
Newmont (Battle Mountain) Franco-Nevada (Normandy)	Westmin (Boliden)		
	Euro-Nevada (Franco-Nevada) (Newmont)		

At present, this contraction of the “project pipeline” means there are already premiums being paid by senior firms for solid prospects generated by junior firms, in some cases in excess of \$200 per ounce of gold reserves defined. Is this sort of hyperinflationary auctioning of properties economical for the senior sector? In a sector where seniors often no longer have the capacity (or interest) for grassroots exploration, incredible reward scenarios can be envisioned for the junior sector. Just by way of example, Barrick paid US\$790 million to acquire Pierina in Peru from Arequipa Resources. This represented a 2,000 per cent reward to initial Arequipa investors, from the initial share prices a couple of years previous.

Currently, there has been increased dilution of the junior financing environment because of weak markets *and* a lowering of the capacity of senior companies to do their own grassroots exploration. This has created a bit of a Catch-22 situation, in which the project pipeline is shrinking from above and below, an untenable project supply situation that will have to change in very short notice. This author feels that the changes will be driven by a mixture of market forces, where project scarcity will fuel a rise, and increasingly, more strategic partnerships between juniors and seniors following the celebrated “Billiton model.” At the very least, the coming scarcity of advanced projects to fuel the majors demands closer relationships between firms large and small, and not just at the project level.

“Few acquisitions are profitable at today's prices... we expect to see the pendulum swing back towards exploration in the coming years.” - Chender and Lowrey (2001)

“It takes a major 10-20 years to find and start a mine, that is why today they just want to buy them.” - Calgary-based entrepreneur

Yet another issue arises if, as Bogden (2001) argues, the mining business cycle is akin to a clock. In that case, we can expect the consolidation movement to play itself out as large companies become too top heavy and eventually create dis-economies, rather than economies, of scale. He argues that this consolidation movement naturally occurs during a market trough, when increasing firm size is only possible through direct takeover of other producing firms, because the developing project pipeline is the first area of the mineral production system to become constrained by a market downturn. As we come out of the trough, there is the natural tendency for more juniors to develop and pick up the exploration slack, which may lead to rationalization in some of the newly combined firms, and a renewing of the cycle afresh.

Where this becomes disconcerting is if we look at the tendency for industry members to view the current mining industry crisis simply as a market cycle. Why? Because the tendency during the inevitable upswings in markets is to forget all of the lessons of previous years. Consider the following quote from a junior firm: *"If the junior companies can raise money they are going to spend it. They don't think too far into the future. I'm not saying that's right or wrong; it's just the nature of the business."* What will happen to the goals of "responsible mineral development" in the presence of a bull market?

"How long before we have one economy, Mexican, American, Canadian, when are those borders going to come down?"
- Exploration
Vice-President for
a junior firm

Finally, the entire notion of "home place" being essential for the creation and maintenance of a strong corporate culture is brought into question by the increasingly international investment patterns of "NAMS" firms. What we are seeing now is that several places are becoming portals for international movement, rather than for the bolstering of the domestic industry. Industry actors are of two minds on this issue. Many argue that continual outward movement is a natural extension of a process begun by Anglo and European mining groups over a century ago; others see the decline of import of the "home place" as leading to a human resources failure and therefore declining competitiveness in the U.S. and Canada.

The transition from "home places" to "global portals" also portends changes in the regulation (internal and external), responsibilities, and structure of the corporate sector of mining. Appendix 4 attempts to map out the corporate portion of what is becoming a "global mining sector." However, this is only the corporate sector, and the idea of a mineral production system argues that all stakeholders and risk variables be taken into consideration. And for the global mining sector, a vast number of the issues that will determine its vitality over the coming century fit under the umbrella of "sustainability." It is analysis of the way the industry has and is confronting "sustainable development" that we turn to in the final analytical section.

Endnotes

- 29 Unless otherwise noted, Canadian data comes from the Mining Association of Canada (2001); U.S. information comes from the National Mining Association (2000). Because of different time lags in their publication, both cover year 2000 statistics.
- 30 One of the major elements of the AIM's rise is that it has an innovative listing and reporting structure, which many consider simpler than other venture capital markets. In AIM, a nominated advisor firm and brokerage house takes much of the burden off regulators, and therefore startup firms with no trading history, relatively small market capitalization and tightly held shares (typical of mining startups) are allowed on the AIM board, and are provided a solid mentorship program. This formula merits further attention from the North American exchanges.

7. Dealing with “Sustainability”: Promise and Peril for the North American Mining Sector

Junior and senior mining executives are quick to point out that while they are seen in a negative environmental light, most people are not out there boycotting minerals and metals. The mining industry is well versed in this prototypical defense of the invasive nature of its activities. When it is confronted with its environmental or social record, it replies en masse with an analogy: “*Try driving to work without minerals and metals*” (the less charitable and more confrontational saying refers to an iteration of “*Let them freeze in the dark.*”). Coming to terms with sustainability means changing from this reactive attitude toward other stakeholders in the mining game, but corporate culture(s) and industry structure make this transition a difficult one.

No matter how it is defined, sustainable development is proving to be a difficult concept for the mining industry to comprehend (McAllister, *et al.*: 1999). The definition that has been found most valuable is that which embraces the “Triple Bottom Line” of economic growth, socio-cultural acceptance and ecological protection (Hodge: 2001, also known as the three legs of the sustainable stool). The economic “leg of the stool” is the one most miners feel has been neglected in the past, a perception that has hardened many industry members’ attitudes toward any dialogue referring to sustainability. What is sustainable from an ecological or social perspective may not be economically sustainable for a mining corporation.

Thus, the perception of what sustainability is, and what sustainable development will demand of the mining industry, continues to be a subject of confusion and frustration in the NAMS. Buzzwords like civil society, social capital and stakeholder engagement have become the language of the day, and the corporate culture of “heads down and dig” is being challenged. Looked at here are the perceptions of different actors towards: first of all, what sustainability is; secondly, how (or whether) the NAMS has adapted to these new dictates of modern business practice; and finally, remaining issues to be confronted.

7.1 Introduction to Sustainability Issues in Mining

Sustainable development has altered significantly from its origins around the Club of Rome’s dire warnings of imminent commodity shortages in the 1970s. When sustainable development was first framed as a concept, it referred in large part to the struggle to sustain access to material resources in the future. Concerns were mostly about looming shortages, having more to do with the conservation of materials movements of the inter-war period than environmentalism as it exists today. That has changed because the mining industry has defeated the shortage crisis by relying on the cyclical nature of exploration to boost reserves and resources via economic supply and demand patterns. The threat of total depletion of the “wasting asset” of minerals remains far off in the horizon, at minimum hundreds of years away.³¹

While conservation concerns have been eliminated in the near term, concerns over the effects of mining on its surrounding ecosystems have come to the forefront in recent years. Concepts like global warming, acid rain, acid mine drainage (AMD), ecosystem disruption and protection of endangered species, among others, all have implications for the mining industry. While conservation of minerals previously was conceived as an *economic* priority for nations, now environmental values envision economics as but one leg of the “sustainability stool.”

From detailed study of information provided by industry organizations and mining firms, a clear picture emerges of what “sustainability” is from the perspective of the North American mining sector. Attributes include:

- above all else, the technological aspects which can lead to environmental sustainability have been prioritized;
- also of importance for most firms is the health and safety of its workers and local inhabitants; and

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” - (The Brundtland Commission: 1987)

“Constructively done, mining projects can contribute to a “Triple Bottom Line” of economic wealth generation, ecological well-being and social well being, which together make up a form of sustainability.” - Mining consultant

“Natural resources epitomize the challenge of sustainable development. Few sectors have more direct impact on the natural environment, yet few are more important to the economic and social health of every region of Canada.” - Natural Resources Canada (2001)

“Last year at Mining Millennium 2000 we started every morning off with issues forums. Access to capital and survival strategies—everyone came to that meeting, but when Friday came along and we talked about the environment there was basically nobody there.” - Mining industry journalist

Q: What is the NGO presence where you are working?

A: There are none. And that is the way we like it. - Exploration Manager for a junior mining company

"I would challenge the assessment that sustainability is a true priority of any mining firm. The test is still 'ounces in the ground.'"
- President of a junior firm

- lagging somewhat in third is the role of respect, involvement and giving voice to local people in reference to their socio-cultural values and expectations from mining projects. This is the weakest leg of the sustainability stool the industry has built thus far. It is especially weak (indeed mostly non-existent) at the exploration stage of the mineral production system.

In recent years, the senior metals mining community has gone to what it considers great lengths to come to terms with sustainability (thus, of course, the GMI and MMSD). Starting in the mid 1990s, several firms came out with "sustainable development" initiatives and policy applications, committed to putting the post-mining phase of the mineral cycle alongside the rest of the mine life cycle in importance, and instituted a series of requirements on their employees and management to follow these new dictates. Entire "sustainability" departments sprang up in some large mining companies (e.g., Placer Dome). The buzzwords became "responsible mine development," "full life cycle management," "the way we work," and "toward sustainable development." What caused this shift toward the "three-legged stool" of sustainable development?

- continual bombardment from external sources attacking the industry's record environmentally and (initially to a much lesser degree) socially, made these issues come to the forefront;
- it became increasingly difficult to finance mining operations without a commitment beyond economic viability. Multilateral lending agencies were the first to implement "SD" type requirements, but the commercial banks also began to recognize environmental and social factors could affect the health of projects;
- risk factors were changing on a site-by-site basis, particularly social issues areas in developing countries, and environmental areas in traditional markets; and
- there was also a recognition that future good results could be dependent on how you get those results today. This refers to a re-evaluation of "reputation capital" at the project, firm and industry levels.

Despite the moves that have been made, significant gaps remain in the corporate sector of mining's efforts to become "sustainable." The movement of mining toward sustainability has to be envisioned as a maturation process!

7.2 Mining and Sustainability – A Maturation Process

In their sustainability policy outline, Placer Dome (2000) management speak of their (and indirectly, the entire mining industry's) understanding of sustainability as a maturation process. This is a valid assessment, because the nature of how mining sees sustainability has changed significantly over the short lifetime of the concept, and firms large and small appear to have different views on sustainability and their role in it.

7.2.1 The Large Firm Sector and Sustainability

A survey of public documents builds the skeleton frame of what "sustainability" has meant and now means to the large firm sector of Canadian mining. Nine Canadian intermediates and seniors (and several from other countries) include in their investor packages separate documents outlining their social and environmental standards.³² This documentation ranges in publication date from 1996 to 2001, and from it we can generate a broad overview of what "sustainability" means to the modern miner and how this has changed over time. "Sustainability" back in the mid-1990s meant:

- first and foremost, a balance between economic necessity (and this means society's needs for minerals and metals as much as the corporate bottom line) and the protection of the environment;

"While the minerals we extract are essential to the daily needs of an advancing world, we cannot ignore the wider implications of our activities."
- Cominco Ltd. (1997)

- many firms were much more comfortable dealing with environmental problems than social issues. For example, many firms generated only “environmental” policies, rather than “sustainability” policies;
- firms built on long established initiatives for clean and safe work practices. The large scale global mining industry has actually been a world leader in these initiatives, rising from a historical legacy of high risk work environments, strong labour movements to promote health and safety, and a culture of promoting technological innovation in health and safety, alongside production innovation. The “third leg” of the sustainability stool (after economic viability and environmental responsibility) was seen as the protection of human health and welfare, and a great many producing firms found themselves starting E, H and S departments to put into words these long standing traditions;
- an opportunity for some mining companies to separate themselves from “the pack” through implementing “SD” as part of their corporate culture. Placer Dome was especially active in this regard. “Sustainability” was seen as capacity building to become the “partner of choice” in major mining projects;
- technology above all things. Sustainability was an R&D exercise, wherein negative externalities were internalized and/or eliminated through old fashioned technical expertise. Despite the historic reputation of being an “industrial dinosaur,” when presented with technologically-oriented problems the industry has proven time and again to be innovate and responsive. This is where the industry has truly shone, in rehabilitating environments and reducing negative ecological externalities from all aspects of the mine life cycle;
- implementation of “best practices” regardless of the location of activities. This meant that firms would utilize the same environmental standards used in their North American activities anywhere they went overseas; and
- greater emphasis and public commitment to change by companies that were “visible polluters,” meaning those that are involved in downstream activities such as smelting, refining, or remanufacturing of metals (particularly in the base metals).

Concepts of “sustainability” have altered somewhat in the past couple years as part of the large firm sector’s response to increasing public, regulatory and interest group pressures. Measures now include:

- eliminating the corporate tendency to avoid past issues; the “that was the standard at the time” argument. Many companies have come to terms with their past practices in a more meaningful way, and have implemented proactive rather than reactive measures for incident reporting. These procedures have gone a long way to repairing the transparency and legitimacy rift the industry has been suffering from. In addition, prevention is now espoused as becoming the industry norm rather than a focus on clean-up and reaction times;
- stronger commitment to working with (rather than just in) the community. This has been perhaps the number one shift in the few short years since sustainable development became a buzz phrase in mining. Communities have become partners, hosts and stakeholders rather than subjects or “sites,” to the point now where companies like Placer Dome (2000) place them second on their commitment list, promising to “*provide for the effective involvement of communities in decisions which affect them, to treat them as equals, respect their cultures, customs and values, and take into account their needs, concerns and aspirations in making our decisions*”. Compare this to the statement by Cominco (1997) in the pull quote on the side of this page;

“We wouldn’t be good corporate citizens of this world if we didn’t use Canadian standards.” - Operations Manager of an intermediate firm

“It is no longer good enough to simply comply with the law. Formerly ‘acceptable’ levels of pollution are increasingly less acceptable, legal or not.” - David Kerr, Chairman and CEO, Noranda (1997)

“We have a lot of smelters around the world, and that is the first main place that these concerns came up. They are the most obvious targets for criticism.” - Project Development Manager for a senior firm

“The mining industry has a legacy of environmental damage to be repaired. However, it is not widely understood that the industry has undergone a historic shift: new methods and technologies have significantly improved environmental conditions at most mining operations in recent years.” - Rio Algom Limited (1997)

“Where applicable, local communities are consulted and their needs and concerns reflected in our strategies.” - Cominco Ltd. (1997)

"If Canada is to maintain its position as a world leader in mining, a wide-spread commitment is needed to develop a new approach to mining. The mining industry has traditionally looked to technology and economies of scale to improve its competitiveness. In the new global environment, however, this approach may not prove effective."
- (McAllister et al: 1999)

- stronger commitment to working with (rather than just in) the community. This has been perhaps the number one shift in the few short years since sustainable development became a buzz phrase. Communities have become partners, hosts and stakeholders rather than subjects or "sites," to the point now where companies like Placer Dome (2000) places them second on their commitment list, promising to "*provide for the effective involvement of communities in decisions which affect them, to treat them as equals, respect their cultures, customs and values, and take into account their needs, concerns and aspirations in making our decisions*";
- there is a sense (though no concrete evidence yet) that reputation capital for being a "sustainable" corporation will have future benefits on a company's bottom line.³³ The industry as a whole should focus on quantifying the benefits as well as the costs of becoming sustainable;
- product stewardship is also becoming more important, or as one company puts it, the goal for large companies now is "to be best from mine to market" (Pasminco: 2001);
- there has also been a significant, if subtle, movement toward extending the economic growth and development aspect of mining back into the local community, with both shareholders and stakeholders increasingly calling for "value added"; and
- finally, there has been a re-jigging of the "technology as saviour" mindset. As McAllister et al (1999) state:

"Mining has traditionally looked to technology and economies of scale to improve its competitiveness... [but] the information age fosters global awareness of the social, economic and environmental impacts of mining—challenges not readily resolved by technology alone."

This last shift is perhaps the key one. A new era of risks unfamiliar to the traditional industry mindset has been unleashed. The industry *must* adapt. As far back as the turn of the last decade, mining industry analysts were calling for the industry to turn its back on the "hard-nosed" management focus of yesteryear's "drill-blast-muck" mentality, and become systems-driven firms with long planning horizons (Richardson: 1992). This has not been the general outcome, despite efforts by many firms. The focus in this information/knowledge economy era has to be on a mixture of elements in creating sustainability, including a re-conceptualization of the social aspects of mining development, to be more inclusive than simple protection of health and welfare. In addition, reaching for the goal of fully integrating "sustainability" into the culture of the corporation is essential. This involves not seeing sustainability as a hurdle, but rather as a necessary paradigm shift in the way companies do business, part of the overall business plan, and another aspect of the company that can undergo innovation and create long-term "value added."

For example, Noranda has incorporated the "Six Sigma" approach to productivity enhancement throughout its employee structure. Six Sigma programs attempt to teach employees how to innovate in their day-to-day activities, thus seeking out cost reductions through improved efficiencies. By making the training process a continual one, and focusing on creating a positive environment for change, rather than one that frowns on change, economic efficiencies have been gained. Also, employees have been given the initiative to find cost savings through environmental, health and safety measures. Could not similar techniques be applied to dealing with other aspects of sustainability like community involvement and capacity building?

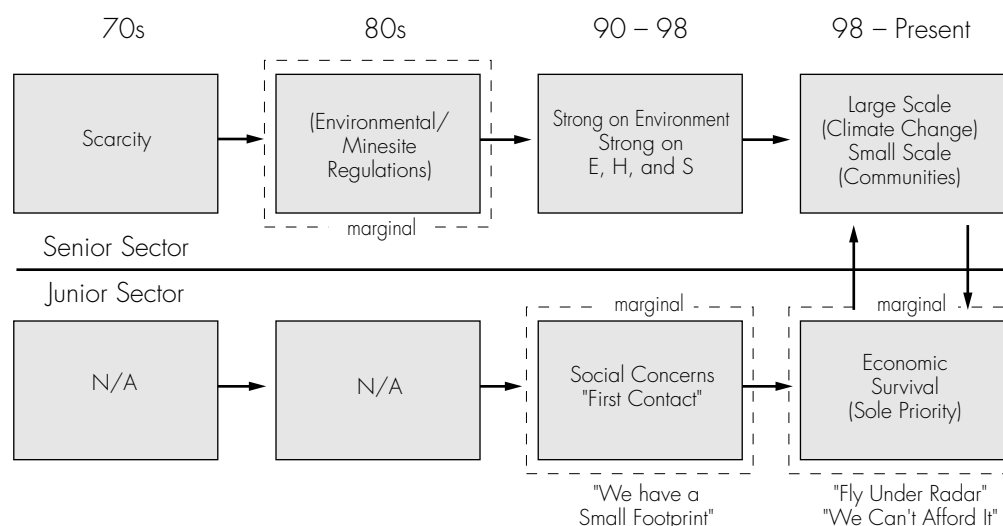
The senior sector seems to have taken to heart the ideals of sustainability, at least at the management levels. The main reason behind this has been shifting corporate ideals, changing external demands by interest groups and governments, recognition of the long-term costs of not properly including stakeholders in the planning processes, the proximity of producers to forms of consumer demand not seen in the exploration sector (where the only consumers are

the producer firms), changing financial regulations (especially among major mining banks) and the high visibility of the senior sector to the outside world. Often, firm representatives mention something like “good corporate citizenship” as if these mining firms woke up one day and decided to make a better world. A more realistic assessment would be that it was a mixture of technological progress, public/governmental demand, and intra-corporate change, all working in concert, that has slowly shifted firms toward sustainable ideals.

7.2.2 Small and Medium-Sized Firms and Sustainability

Of course, attitudes toward sustainability espoused by the management team of large firms represent only the pinnacle of power and planning capacity in the industry. What about the small firms’ views toward sustainability? Changing perspectives on sustainability by different sized firms are highlighted in Figure 17 (note that those eras with dotted boxes around them are ones where the concepts of sustainability were largely treated as objectives of only marginal importance).

FIGURE 17: Changing Perspectives on Sustainability in the North American Minerals Industry, 1970s–present



"Establishing a corporate identity and culture... may be relatively simple in the Vancouver headquarters, but is much more complicated in a remote part of southern Venezuela... corporate culture is subordinate and the public perception of the company ultimately hinges on a select few individuals." - Day et al (1999)

It is often stated in development studies that “there is a certain point of poverty beyond which thinking about sustainability is a luxury people can’t afford.” Clearly, with economic survival the sole priority for large numbers of firms in metals mining at present, there remain significant issues in coming to grips with sustainability. Of course, this is especially true among the “poorest/weakest” of the sector: the juniors and mid-sized companies. Why does this inability to come to terms with “SD” issues occur? While it may sound crass to the uninitiated, the junior sector claims that it cannot accede fully to the same sustainability requirements as producing firms do, in large part because of a lack of funding, but also because of other requirements of their corporate culture. A lot of it comes down to the corporate culture, economic drivers and the business prerogatives of mining companies large and small. Table 13 examines the corporate culture aspects of junior and senior mining companies with a view toward their capacity to adapt to sustainability requirements.

Because juniors are most often the point of “first contact” with local communities, their greatest challenges lie there. As one industry consultant put it:

“Our challenge in the future will be to manage the less tangible impacts, the social and cultural impacts... the actual impressions being made on remote communities are being done by exploration geologists with junior companies... therefore, those junior companies need to be included in the larger planning process.”

Table 13: Corporation Culture and Sustainability – Comparing Juniors and Seniors

Corporate Culture Attribute	Junior Mining Companies	Senior Mining Companies
Individual site timeline	Short-term (one week to three to five years)	Long-term (20–100 years)
Production prerogative	Sites	Mines
Percentage of sites where success in business cycle anticipated	Less than one per cent	At least one third (33 per cent)
Perception of community	Something that exists outside of the exploration site	Long-term labour force; long-term neighbours
Seeks from community	Anonymity	Quietude; peaceful interaction
Gives to the community	New heightened expectations; new fears and hopes for future	Jobs; facilities for community development; radical change
Responsibility for the community lies with...	The local, regional and national authorities/rule of law	Mixture of community, govt. and mining company
Amount of environmental change associated with activities	Very miniscule (new roads sometimes, small camps, drilling)	Localized but very visible (open pits, large infrastructure, tailings dams, etc.)
Biggest hurdles to interactions with communities	Corporate culture that seeks invisibility; lack of funds and training for proper local interaction	Often, dealing with “outside influences” and increasingly, dealing with remnants of junior company interactions with locals

Effectively, what the past decade has seen is that corporations in the mining sector have expanded their action spaces exponentially with rapid changes in the perception of risk environments of developing nations for mineral exploration. Lagging far behind these expanding action spaces, however, have been the corporate capacities to engage new cultures in the type of proactive relationship necessary. When actions spaces outrace the ability to adapt to new environments (their *reaction space*), new risks will inevitably occur. The challenge now is to change corporate cultures accordingly.

How to accomplish these necessary shifts in corporate culture? Freeman (2001a) argues that junior mining companies need to be more professionally managed as business entities in order to compete in today’s economy, citing the key role of innovation in its many and varied forms. Most important is Freeman’s redefinition of a mining entrepreneur as “(a manager of) the business of providing natural resources to serve the community and society.” This runs against the popular perception that mining entrepreneurs are slippery

“In recent years... geologists only concerned themselves with science; nowadays, however, a geologist’s skills must again take into account everything that gets impacted by the presence of the mining industry.”
– Freeman (2001a)

speculators out to make a buck off a completely unknowledgeable public. It also forces the mining entrepreneur in firm's large and small to take their responsibilities outside that to the shareholder seriously. Freeman is one of the first authors to note that innovation can be utilized to overcome changing "needs of the community" which has also been extended here to include the new need for mining companies to generate a social license to operate (Thomson and Joyce: 1997) both at "home" and "host" sites.

Freeman also attempts to identify some of the many challenges facing mining "entrepreneurs," especially as geotechnicians—trained to interpret the natural environment—now also try to interpret the social environment. The lack of cultural sensitivity training and the building of a socially adaptive mindset may not have hampered the industry exploring in the developed countries in the 1960s–80s, but the move to globalization means those same exploration geologists are now doing grassroots work from Argentina to Zambia.

The entire Freeman position is that only through incorporating both the technical skills of geologists and the social skills necessary to understand society's needs and the machinations of venture capital markets, can a mining business both find assets and realize their full value. This involves an entirely new mindset that focuses on "adding value" through the development of new corporate competencies outside the physical sciences.

Mentioned earlier was the inability of most junior companies to jump the "production capacity" gap and become full fledged mining companies. In a way, this may be seen as a good thing in environmental terms. Many of the stories of environmental damage and prematurely abandoned minesites come from the expansionary junior sectors. For example, mines developed by Dayton, Triton, Greenstone, Bema Gold, Royal Oak and others all suffered from problematic planning and construction, in large part because the firms themselves were relative novices at this stage of development. While not all of these "fledgling miners" suffer from environmental problems, there is a much larger chance that a site with less than perfect planning, and cost overruns or financing problems, will cut corners in the construction stage that can prove costly in the long run.

This corner cutting can also be seen in some of the attitudes toward sustainability among the small and mid-sized firms. Several firms have simply adopted the definitions of sustainability developed by other organizations such as the MAC. While these definitions are well thought out and studiously developed by the industry organizations, working on answering the question: "What is sustainability for our firm" should really be a committed planning exercise rather than a cookie cutter one for individual firms.

7.2.3 Sustainability and the Mineral Production System

Thomson (2001) speaks at length about these sustainability challenges unique to the exploration phase, clearly indicating that juniors and seniors are actually both in the same lifeboat. Thomson argues that the junior sector needs to have greater interaction with the seniors and vice versa, because the fundamental reality of mining as a production system means that projects must be continually improved upon ("adding value" if you will) before they can be passed from owner to owner up the production chain. This is rarely considered, even though the most problematic relations with locals often occur after projects change hands. Thomson's arguments for more interaction between juniors and seniors breaks down to three elements:

1. there is a fundamental disconnect between junior and seniors, both in their corporate mindset and their perception of the role of the "other" in the production system. For example, juniors will create different expectations and tensions in their interactions with locals than seniors will;
2. the relationship between firms large and small is the most essential part of the "project pipeline," a key factor in the strength of the CMS over the past 15 years or more, and this relationship is synergistic because of rather than despite their

"Small mines are if anything probably better... if you do things at a large scale, if you are doing something wrong, you are going to make a big environmental mess." - President of a Heap Leaching production junior

"We have a written (sustainability) policy which basically embraces the Mining Association of Canada policy." - Vice-President of an intermediate producer

"The industry has been reluctant to point fingers in the past, but we are becoming much less reticent these days, because we have found by bitter experience that one bad apple can spoil the barrel." - Vice-President, Corporate Development, senior firm

many differences. The vast majority of advanced projects have passed through at least two sets of corporate hands; and

3. despite their absolute co-mingling on the “project pipeline” there exists a great deal of problems that can be created, especially for the larger firms, based on the way projects are handled at early stages. The large firm sector is actually more vulnerable because of the exponential growth in the amount of capital invested in projects by the time they reach the feasibility and construction stages. And while juniors and seniors may consider themselves different, local people most often will not differentiate between mining companies in the same fashion. Thus, the senior sector has in its own interest efforts to include the junior sector in their move toward sustainability. These are some fundamentals connecting juniors, intermediates and seniors in the mineral production system.

In the end, perhaps the most important aspect of increasing the transparency and capacity of “mining” companies to adapt to sustainability will be this recognition both internal and external to the industry that different types of mining firms have different *needs* as well as *responsibilities*. The mining corporation’s bottom line remains the creation of shareholder value: this is not a negotiating point. Mining companies large, small and niche create shareholder value in different ways that require their corporate cultures be different from each other. Junior explorers need to be able to get in and out of an area quickly without becoming entrenched in bureaucracy. At the same time, they need to recognize that their very presence may create an expectation in a less developed region, and adapt to that possibility. Senior companies need social quietude; in order to prosper they must have local support for their activities. At the same time, they must realize that because juniors “graduate” most new mining properties to seniors, some of the onus is on the seniors to assist in bettering the junior sectors understanding of how to deal with local people. The negative downstream effects otherwise will be the senior firms’ to deal with in later years! Large, integrated mining companies have to work on both big ticket issues like climate change and little ticket issues like social impact assessment, not one or the other and not in isolation from the junior sector.

“Who are we to regulate the junior sector? They have their own set of problems, and any attempts by us to solve them would be paternalistic.”
- Senior industry representative

Currently, senior firms still take a conflicting stance vis-à-vis their role in promoting sustainable practices within the intermediate and small-firm sectors. While many seniors recognize and decry the sustainability problems in these sectors, and call for examination of these issues, it has only been very recently that they have opened the door to greater dialogue with these smaller firms (the potential mechanism currently being promoted for more junior-senior cooperation on sustainable development is the International Council for Minerals and Metals).

Also a point of concern is the conundrum that the senior/junior relationship brings into full light. Juniors are better than seniors at moving in and out of projects quickly and quietly, eliminating with minimal cost over 99 per cent of all potential sites, thus reducing discovery risk to manageable levels. Yet, the seniors don’t seem to recognize that these capacities are part of what makes juniors susceptible to external conflict! Can we expect both the efficiencies of juniors to remain and their inefficiencies to just disappear? What makes the juniors important is also what makes them vulnerable to sustainability concerns.

In summary, the capacity of the NAMS to come to grips with “sustainability” can be described as follows:

- senior companies are among world leaders in sustainable development, due in part to exposure early to stiffening environmental standards at home, and in part due to being among the “first in” to a lot of new international mining areas, where social and cultural issues have had to be administered;
- the U.S. mining sector has not adapted as well as Canada’s, in part because of the nature of the deposits they are exposed to, the traditionally weak (but ever stiff-

ening) domestic regulatory structures (including problematic and contradictory mine bonding rules across different states), and the fact they have had little overseas exposure that has forced them to adapt. Increasingly, however, they are moving overseas and will have to adapt quickly to new demands on their practices;

- the Canadian intermediate (and expansionary junior) sub-sector is the one most subject to sustainability concerns at present; and
- the Canadian junior sub-sector faces an entirely different set of sustainability concerns, ones that very few firms have adequately come to terms with yet. Many small firms complain that the bureaucracies built around the mining industry's regulation are just too confusing and that agencies often work at cross-purposes within the industry.

7.3 Remaining Sustainability Issues for Mining

The industry still has yet to come to terms with several aspects of sustainability, including the following:

- the relatively limited technical and financial capacity of intermediate sized firms; their vulnerability to market fluctuations and the resulting mine failures which cause social, environmental, economic and reputational damage to the area and the industry;
- intermediate sized firms' inability to overcome market fluctuations and the resulting mine failures which cause social, environmental, economic and reputational damage to the area and the industry;
- seeing sustainability as an industry responsibility, rather than as a project-by-project individual corporate responsibility;
- treading the "treacherous middle path" between community involvement and becoming a quasi-governmental welfare state. The creation of expectations for local communities is a major concern. Coming to terms with government over the role of the corporate entity in developing countries is a must: is it an economic enterprise, or a social service provider? What role should the corporation play in the distribution of mineral rents?;
- determining the balance of global vs. local "sustainability" requirements. Practices that are considered acceptable and sustainable in South Africa or Bolivia may not be acceptable in British Columbia or California. Does that make the practices illegal or immoral? Miners don't believe it does. The argument is forwarded by North American mining companies that they improve all standards when they acquire overseas interests, but that perhaps "baby steps" in changing practices are all that are socially, politically, and economically feasible dependent on the type of site. There is another Catch-22 here! As national and international regulators struggle to adapt to changing investment patterns and changing roles of mining in their economies, there are often actors left in the background, struggling to find voices. The question remains: in a global mining industry, what role is there for the local community?;
- competing with local (host-state companies) who may not have to perform to the same environmental standards in their projects (especially the existing ones) is part of the challenge. The Canadian sector at least, appears willing to act in the most sustainable fashion, but still feels it gets tarred with the same brush as other less conscientious firms;
- aboriginal groups are a special concern where they do exist, in part because ILO 169 enshrines their rights to take part in any management of their traditional land base.³⁴

"It is often when firms attempt to go beyond their core competencies that errors occur. I think this is because they are unfamiliar with the activities, they have cost overruns, and they look for places to cut corners. This happened a whole lot with intermediates in the heydays of Latin America in the 1990s, and the whole industry paid for it later." -

Vice-President, Corporate Development, senior firm

"The problem is we are not running a charity. Our shareholders demand return on their dollars, and so if the costs of cleaning up an old mine exceed the return on investing in that area, we won't do it just for the fun of it." -

Vice-President, Development, Canadian senior

"You can't borrow money from the World Bank unless you have all the environmental I's and T's crossed nowadays." -

Vice-President, development junior

It is cheaper to install a sprinkler system than to rebuild after a major fire. So why treat social issues as an afterthought? Treat them like insurance!

Work by CSC Project Management Ltd. has shown that of all risk factors, social and political risk can have the most deleterious effects on various NPV measures: "We were able to qualify that social risk can mean as much as 15-20 per cent of a project's value... Firms have to recognize that their ability to deal with these soft issues can make a real difference to their bottom line."

"There are always some environmental groups that think mining is bad everywhere, and they turn around and use the products of mining every day."
- Vice-President,
intermediate producer

While their nations have not ratified ILO 169, in both the United States and Canada aboriginal groups and development organizations have negotiated directly with mining companies on sharing the proceeds of mineral development through Impact and Benefits Agreements (IBAs). This is becoming an informal industry norm;

- providing a solid economic argument for imposing "best practices." Right now, best practices are loosely governed by international financing protocols and practical example, but the industry itself needs to take the lead here; and
- diffusing "sustainability" ideals down the corporate ladder to all employees.

Two areas where the mining industry absolutely has to change its mindset are in the way it perceives the costs versus the benefits of utilizing best practices in their projects, and in their characterization of NGOs.

The consideration of sustainability practices as a necessary evil, a cost to the company enforced rather than chosen, is entirely the wrong way to look at sustainability because it is a hollow and jaded outlook that does not allow for the creation of market strength and a culture of sustainability innovation.

■ **SPOTLIGHT: Proving the "Value Added" of Sustainability vs. Imposing "Self Regulation."** There has been a great deal of discussion among the corporate elite in mining of late regarding the best ways to create and maintain a sustainable industry. Should the industry focus of applying the "carrots" of proving how "best practices" create competitive advantage for responsible firms, thus creating implicit norms of practices naturally: or should the "sticks" of self regulation be imposed by an industry body on member firms, theoretically to the point of censuring bad actors. After following this debate for some time, this author has come out on the side of emphasizing best practices and the creation of norms from practice rather than enforced regulations. The industry appears to have little stomach for, and questions over the legality of, explicit codes of conduct governing corporate practices. One of the major problems with focusing on "best practices" however, is that there is little substantive proof available yet that it works! While there have been many authors talking of issues like ethics (Cragg *et al.*: 1995), building social licenses to operate (Thomson and Joyce: 1997), building community relations and reputation capital (Crowson: 1997), and the notion of ecological efficiency equaling economic efficiency (Warhurst and Bridge: 1996), strong case study analysis and quantitative proof of the "value adding" of these efforts have been few and far between. The promised importance of ethical capital investors is still to materialize, and efforts by companies like Placer Dome to become "partners of choice" based on sustainability standards have had an uneven response. While part of this can be related to the downturn in the market in recent years, this is often an overrated factor. More culpable is the inability of the industry to prove to its members, in terms they understand, that sustainable development is not a "soft" issue, nor a net cost to the industry, but rather research and development for tomorrow's successful mining firm. The industry needs to fund independent research to quantify the effects of good, average and bad practices, in order to prove that investing a little in social and environmental equity early in a project pays off late. Only by doing so in economic terms, can "best practices" become the norm rather than a far off goal. In the end, in order to create sustainable mining in the long term, the industry leaders have to embrace the motto of "lighting a path, rather than forcing a march" toward sustainability.

One of the major problems with the mining industry's efforts to come to terms with sustainability is that it has often adopted one of two positions: offended denial or outright

avoidance of issues. The industry members often come off as being extremely defensive, adopting an “us vs. them” attitude when talking about environmental or social issues, in large part because they are frustrated that they have little effective voice against well funded, cohesively organized and “plugged in” NGOs. A second strategy is avoidance. For example, most junior companies show no interest in “stirring up the leaves” as it were, for example, proactively engaging NGOs in negotiations or issues analysis. After all, mining has been an easy target for NGOs, due to its high visibility, the economic and physical scale of mining operations (especially in backwards regions where there is little economic activity), and the invasive nature of the miner’s task.

Currently, there are several “hot button” issues that define debates over “sustainability” in the opinions of miners. All of these areas merit further examination by groups like the MMSD/GMI:

- mine closure effects on local inhabitants—the “manufactured ghost town” reality of the mining life cycle;
- the needs and goals of aboriginals and local communities on the whole, and the inherent tradeoffs between these goals and the needs of other interested parties. Public participation is going to be a key element of sustainable mining;
- the role of the junior sector in promoting “sustainable practices” through project-by-project performance. The PDAC has gone as far as looking into developing an “ISO-like” standard for exploration practices, so that a credible independent body can give industry claims more credence;
- the aforementioned debate over weeding out “poor practices” through self regulation or by example;
- the vast gulf between modern practices utilized by North American miners, and those utilized in many developing countries by less technologically advanced miners; and
- the fact that sustainability issues are not even in the investor’s viewscape in most instances. Investors still demand return on their investments, and by and large they don’t care what practices are used to get there. This makes it difficult for firms to adapt to demands from outside while still having the same “bottom line” prerogatives.

In order to appease both public demands and corporate necessities, mining firms have to look at sustainability in a new way that emphasizes it as a cost reduction, rather than cost addition, exercise. We already know that mining is a “risky business.” Is it not logical then that any steps taken to proactively reduce risk will in the end recoup value for those firms willing to invest in these steps? For example, here are but two ways to reduce risk on a project-by-project basis. Utilizing both is preferable, but either used by themselves can be effective, non-cost prohibitive means to reduce risk:

1. in-depth country, regional and local analysis *before* entering into a project. This involves identifying more than just geologically prospective regions and includes economic, social, cultural and political analysis; and
2. proactive engagement of local communities, preferably from day one of the project life cycle. As one exploration manager of a global senior put it: “*It is the cost of doing business. If you can’t bear the cost, don’t do the business.*”

Both measures require efforts not only by individual firms, but also by the industry as a whole to develop facilitation mechanisms to build corporate capacities and provide information to member firms. This may be the best type of “self-regulation” of all.

Keys to sustainability in mining are incremental steps like setting industry-wide standards or codes of conduct, reducing exposure to corruption, linking projects from start to fin-

“How many mining companies have Vice-Presidents of Environment? Certainly more than five years ago. How many have Vice-Presidents of Public Participation? I would guess none.” - Moore (1997)

“An industry-based initiative is a good idea, but the make up of the committees need to be much wider with all stakeholders getting seats at the table.” - Industry consultant

“Targeting investors is becoming a much more popular and effective tool that has been used by church, environment and labour activists against irresponsible mining practices.” - Young (1998)

“Sustainability seldom arises in communications I have with investors. Their concern is with exploration results, share prices and the like. Client companies actually seem more concerned about public perception than is borne out by the public!” - Investor relations professional

ish with the goals of local communities as well as corporations and governments, and teaching firms how to plan ahead for projects and how to deal with different cultures and changing societal demands. In order to facilitate these steps, the industry has to be willing to invest—emphasizing research on “best practices” strategies for project management and proving their value to firms’ bottom lines, reaching out more to the public with transparently collected, outside monitored, data derived from a “neutral” information environment, and reaching out and creating strategic alliances with those NGOs whose mandates have room for the “third leg of the sustainability stool,” corporate growth and profitability.

“Planning in the mining sector, especially among junior miners but also in seniors, seems to be about a 20-minute exercise.”
- Mining consultant

Of all challenges, one of the largest and most intractable will be the nature of the metals mining industry itself. The commodified nature of the output of the sector limits the ability of member firms to effectively plan in any long-term, cohesive fashion. For example, Freeman (2001a) suggests that as commodity-driven and publicly traded firms, mining companies are subject to dual market whims based often more on perception, speculation and hedging at the market or industry level, rather than based on the value of the individual firm. Not only does a firm have to find mines, but they have to find them at the right time! This implies that the modern mining industry often involves more “market management” than “mining management.” Long-term planning, the type needed for effective incorporation of sustainability in the corporate culture, is thus counter-intuitive to the mining “mind.”

The mining industry has thus not been able to incorporate the ideals of sustainability throughout the corporate hierarchy thus far. This is not for lack of effort by many, however. There are signs that the industry is making efforts to infuse all levels of the corporate bloodstream with sustainability. The Canadian Institute of Mining and Metallurgy (CIMM) is making a bona fide effort to come to terms with these “soft” issues, in part by dedicating virtually their entire annual conference to these concerns in April of 2002. This is but one example of real, substantive change eclipsing the notion of SD as a “public relations exercise.” There are many others. The key here is a more subtle change, mentioned by one industry consultant as already being on the rise:

“Some things are difficult to change, and one of the biggest is an industry’s mindset. But there are clear signs not only that mining needs to change, but that the decision-makers’ may be ready to change.”

One thing is for certain: if the industry’s decision-makers are not ready to make the necessary changes, mining may be a sunset industry throughout North America.

■ **SPOTLIGHT: Mining in the U.S. and Canada—Sunset Industries?** T.M. Power calls them “economies of the rear view mirror.” In the U.S., mining rates just above tobacco in public appreciation. The industry in the developed nations is an easy target for criticism because of the visibility of its historical and current environmental effects. Does all this add up to mining being a doomed industrial force in the developed nations? The jury is out on this issue, but certainly the industry has put a great deal of effort into trying to gauge this issue. Brock (1998) makes a strong case for what he calls a “huge shift in the way we know mining and the way we conduct it, after one more working generation,” as recycling and replacement materials push mining onto the relative scrap heap of industrial history. Some industry insiders don’t envision this reduction in demand in the foreseeable future, but rather a changing position for U.S. and Canadian involvement in the sector: “We are going to be the sellers of technology and the Latins can operate their own shows,” stated the president of a exploration management group. How it all plays out depends highly on the willingness of industry, governments, the public and interest groups to reach compromise on the role of mining in the developed world.

Endnotes

- 31 One potentially negative aspect of the technological revolutions in geology that allowed for better exploration in the last quarter century, is that they reinforced the concept for mining companies that technology can solve all ills, and the best way to solve a site specific problem is to “throw money at it.”
- 32 Canadian firms, at least from the public relations standpoint, appear to be light years ahead of their American counterparts in this reporting regard. Although this author received annual reports from eight out of the 10 largest American metals mining companies, not a single one included separate E, H & S documentation or statements of business practices.
- 33 Although, to this point in time, existing shareholders have not focused on sustainability issues, nor have “ethical funds” borne much fruit for investors in mining or in general. As long as the *economics* of acting sustainably remain shaky and unproven, the industry will be slow to react.
- 34 Pasminco Limited, an Australian company, reflected this increasing importance of aboriginal groups in its 1999 publication “Working with Aboriginal Communities,” the first document of its type to devote all its energies to espousing corporate policies distinctly to the aboriginal groups it gets involved with (although companies like Pasminco have had indigenous policies since the mid-1990s).

8. Conclusions

It is companies that mine, not industry organizations, governmental departments, market regulators, or super-national bodies. This study has covered a lot of ground in examining the changing nature of this *corporate sector* of mining coming into the new millennium. As usual, more questions than answers surface in any such work. This concluding section looks first at some issues and trends identified in the NAMS, their implications for the ability of the industry to come to terms with “sustainability” and points out some areas for discussion and further research.

8.1 Issues and Trends Identified in the North American Mining Sector

Several trends from the past decade have been isolated in this sectoral study. Geographically, the mid-1990s saw global expansion into mining firms as never before, with Canadian firms at the forefront. Despite this growth, however, there has been a retrenching very recently among traditional exploration districts, a sign that the risk/reward scenario of “going international” may not be as positive as envisioned during the heady days of the “land rush” of the mid-1990s.

Alongside global expansion, this decade saw both the decline of importance of the traditional targets and one of the severest downturns in venture capital availability of the 20th century for mining. As mentioned, the former seems to be easing; the latter has shown some signs of ending, but commodity prices and changing images of mining as a risk capital investment are still providing uncertainty in the sector. Additional uncertainty is provided for the NAMS by the rise of new investment alternatives in London and Australia. Canada’s dominion over the raising and funnelling of global capital to mining firms, in particular, is being challenged like never before.

Through this uncertainty, the senior sector has managed to maintain its strengths, although there has been a great deal of consolidation among these large firms. On the other hand, junior firms have been in “survival mode” for the past four or five years, and their continued ill health needs to be addressed industry wide, because of their key role in the mineral production system. The mid-sized firm sector has been equally damaged, and its wide action space at the beginning of the decade, accompanied by very narrow *reaction space* at the end of the decade, has effectively made this sub-sector very vulnerable to project failure. This has contributed to the declining reputation of the industry, often reported by the popular press or by powerful NGO groups.

The USMS is seen here as exemplary of all the problems that could be facing the CMS in the future, unless proactive steps are taken immediately to engage with stakeholders over the role of mining in Canada. The USMS exhibits a relatively weak domestic exploration sector, in large part due to weak capital markets for high risk exploration projects, and a very poor public image for mining in the U.S. Both factors could potentially become part of the fabric of the CMS as well in the future.

All in all, there is an air of uncertainty hanging over the NAMS. The global mining industry is in a phase where it is undergoing a series of transitions—birthing pains really, as there has never been a truly global mining industry in the past. The transition has many facets: from one that emphasizes “home places,” to one where the administrative/head office location function is served by a few “global portals” through which capital is funneled to global spheres of influence; from a purely technological mindset to one that values information and perception as key ingredients to both firm and project success; from one where exploration and production are internalized by one firm, to a system where subcontracting and consulting firms will use their distinctive skills on different levels of the production chain; from one where competition for reserves and cost reductions are the key, to one that *recognizes the need* to add value to projects by looking at issues heretofore considered “soft.”

"A crisis, Gramsci once observed, arose when an old order was dying and a new order had yet to be born."
- Cooke and Morgan (1993)

By all appearances, this is a crisis period in the global minerals and metals industry. That does not imply that all is negative however. A new order is being developed out of the ashes of the old "business case" for mining, no longer acceptable in the eyes of many stakeholders. Here are 10 trends and issues that are becoming apparent in this transitional period:

1. *The role of the "home place" is one that industrial geographers have long considered important in the corporate culture and competitiveness of an industry/corporation.* This study has shown that while the "home place" (in the form of the head offices and nationality of the firm) has historically been very important in the creation of competitive advantages for mining firms (especially in the CMS), the increasingly global industry and cross-national pollination of mining firms and projects has eroded the role of the "home place" to the point now where mining companies can be considered in many regards entirely footloose. This freedom from national constraints will have a reckoning of sorts, and indeed already has. Mining in new climates brings promise and peril in equal amounts. Promise in the ability to transfer knowledge and technology into areas that may not have been as "picked over" as grounds in the traditional northern exploration targets. Peril in the unfamiliarity with new cultures, polity, social arrangements—often, the new make-or-break risk factors in mineral exploration. The implications of globalization for the industry, its governance, and the capacity of local communities and interest groups to have their voice heard by all parties, are at the essence of defining sustainability for mining.
2. *Increasing market regulations will do one of two things to the mining industry based in North America.* They will increase the industry's reputation capital among investors and bolster the amount of venture capital available for exploration (particularly) and development; or they will inhibit new listings and concomitantly the ability for the entrepreneurial spirit that drives junior firms to flourish, leading to a long-term decline in the number of new discoveries until the cycle either rejuvenates itself or is replaced by institutionalizing junior/senior relationships in more "subcontracting" style relations. The senior sector is unaffected by new market regulations and separates its image from that of the junior sector; when security of supply is threatened and their reserves deplete, they may not feel the same way about the role of juniors.
3. *Mining is indeed the "risky business."* We have looked in this study at some of the risks involved in engaging in mineral exploration, development and extraction. The surface has only been touched in this regard. We have broken down some of the many and varied risks that mining firms face, but more importantly posed the question that for the industry itself is most important: How can the industry reduce these risks? Is it always on the shoulders of the individual firm? If it is, most will surely fail. More industry-wide efforts to understand and counteract the effects of risks must be encouraged.
4. *The firms involved in the NAMS are often bitter about the limited definition of "sustainable development," as it represents a significant hurdle for an industry that deals with a finite resource.* Most often, these companies want to act in the most environmentally clean, socially responsible manner—not because of some innate sense of socio-environmental justice, but because it makes smart business sense to do so. What is most disconcerting to mining firms is the perception that mining is a non-essential activity that is going to be phased out over time. Mining companies want to see the concept of sustainable development add a section for a sustainable mining industry where individual companies can do all the right things and still make money, add value to their shareholders investment. Is the "sustainability barometer" of mining firms the same as that of other interests?

5. *There is a changing firm size structure in the NAMS, particularly in the more vibrant Canadian portion.* There is a slimming down of the base of the population pyramid, if you will. There are fewer small firms being supported by the venture capital markets (and virtually none being propped up by the seniors). At the same time, there is a movement toward more consolidation of the senior sector, and a virtual disappearance of the intermediate sector as a viable force in the industry. This is often written off to the cyclical nature of the industry, but one should be careful in doing so. One of the biggest hurdles to proactive action in the mining industry is that the cyclical nature of commodity prices acts as a crutch, preventing substantive changes from being made. Perhaps the junior sector will ramp up again as demand for ore reserves reaches critical levels. The key question here is what effects the replacement of a bear market with a bull market will have on the industry's movement toward sustainability. The junior and intermediate-sized firms, in particular, tend to have short memories. Have any lessons really been learned over the past five years?
6. *Sustainable development is a term bandied about mostly by mining executives (usually among the senior firms), and not often at all in either the professional or the general labour ranks.* What really needs to be created is a corporate culture that incorporates sustainable practices at the site level and throughout all levels of the corporate hierarchy, rather than simply focusing on it in high level corporate agenda. This work needs to be done at the ground level, with the mining company representatives who make "first contact" with local communities and other interested parties.
7. *There is a great deal of distrust in certain constituencies among the corporate sectors of mining, government actors and external stakeholders.* Building trust and engaging all manner of stakeholders is certainly going to be a key factor in capacity building if the NAMS is to emerge as a sustainable mining sector. Up to this point, the industry has maintained a bunker mentality, shell-shocked by continuing attacks (in its perception) by NGOs and different levels of government. Additionally, the industry often feels that the general public has abandoned mining, even as it depends more and more on the products of the industry. These factors have led to the creation of an "us vs. them" mentality in the industry that needs to be eliminated if the goals of transparency, stakeholder engagement, and legitimacy are to be created in the long-term.
8. *The mining industry is one where myths pervade not only in public perception, but also in the industry itself.* This is an industry that juxtaposes incredibly advanced technological and professional sophistication with an anachronistic position of how to get its perspective across to the general public. It also neglects critical self-analysis and strong examination of the realities of the outside world like an ostrich with its head in the sand. The future demands mining and sustainability; so it is up to the industry to develop the proactive capacity to understand and adapt to change, in order to balance both the need for profitability and sustainability in mining.
9. *NAMS firms are very specialized, very skilled, but also overly vulnerable to market fluctuations.* Market system firms dominate the mineral production system, and market system firms are always more vulnerable to changes in market structures or commodity prices. The mining industry will never be able to become a true "planning system" activity because of the commodified nature of its products, but by planning ahead to reduce risks, member firms can insulate themselves better against the multitude of risks in their working environments.

10. *There is a looming human resources crisis that the industry has not adapted itself well to.* The mining industry is often envisioned as a bucket and shovel industry, but at the heart of the NAMS can be seen the core importance of people. Despite surface appearances, the industry has been highly flexible and innovative at turns. And its growth has been driven by skilled professionals. That human resources strength (especially evident in the Canadian sector) is facing a crisis in coming years. Many industry insiders cite this “greybearding” phenomenon as the major future crisis for the industry. Indeed, if looked at in a hyper-critical fashion, one can argue that the very notion of a “Canadian mining sector” has been illusory, in that much of its growth and professionalization over the past 50 years has been driven by “expatriates” from other countries, who saw Canada in past years much as a “Canadian” explorationist now sees countries like Peru and China, as a future stomping ground, lands of opportunity. The implications of the reduction of human resource capacity in countries like Canada and the U.S. need to be closer examined.

Overall, there are a disconcerting number of “fundamental disconnects” mentioned throughout this paper that need to be addressed at an industry wide level. These fundamental disconnects include:

- a vast gulf between what the industry does and what it is perceived to be doing by the public, the academy, the press, interests groups and different levels of government. This gulf between practice and perception is often fueled by the highlighting of the “worst cases” in the public’s eye;
- misunderstandings between junior and senior firms. This could easily be addressed if those charged with analyzing the industry were to look beyond the “production prerogative” and focus more on mining as a production system. Allowing for these misunderstandings to flourish is supplied by the inability of junior and senior industry associations to generate positive long-term cooperation amongst themselves and their member firms. These gulfs are highlighted by the fact that the majority of the junior mining circuit does not understand the goals and means of the GMI/MMSD;
- there is a fundamental disconnect in the U.S. between the presence of a strong mining industry that is nonetheless simply a blip on the national economic scale and considered a pariah industry by many. The USMS provides much of the material wealth that fuels the world’s number one economy; yet it is in danger of becoming a country where minerals become a strategic vulnerability because of a weakening domestic mining sector;
- there is a further fundamental disconnect between the needs of a project at the exploration stage, and the needs at the production stage. The core competencies of juniors and seniors are juxtaposed and feed well off one another, but there is always the possibility that juniors will attempt to move up the production system chain into the intermediate and senior ranks. This is always difficult, and often problematic in sustainability terms. Should explorers become miners?;
- there is a fundamental disconnect between the corporate culture of exploration firms and the cultures of local communities. This is shown in particular relief in developing countries. Of major concern for explorationists is unimpeded access to land. Of major concern to local people is often control over resources. When people see large tracts of land given over to mining companies, they often believe that a mining operation will soon exist there and change their lives, for better or worse. Of course, 99.9 per cent of projects do not become mines, but the expectations created still exist, and can be part of misunderstandings between firms and locals. This is just another example of the fundamental disconnect between the needs of

miners and the perceptions of local communities. In mining, perception is just as important as reality in project success; and

- there is a fundamental disconnect that mining firms tend to feel is the most unfair of all in its bias against their continued existence—that of the strengthening of the social and environmental legs of the sustainability stool at the expense of the economic one. Mining firms feel competing demands from shareholders (who want profits and dividends) and the public and regulators (who want clean ecosystems and local empowerment). The industry has yet to find a formula that properly appeases both parties.

Of course, this is but a partial list of the disconnects exposed herein. In order for mining to be true to the goals of sustainability, the industry has to look closer at itself and the outside world, be willing to engage stakeholders more openly, and commit human resources and funding to developing plans for the future. The Mining, Minerals and Sustainable Development initiative represents but the first step in this process. Let's look now at how the findings of this report fit into the framework of MMSD's goals.

8.2 Spotlight on MMSD's "Big Eight" Topics and the North American Mining Sector

One of the goals of MMSD is to focus on eight broad topics in its analysis of the mining industry.³⁵ In summation, it may be useful to see how the current investigation can help identify solutions (or at least light a path to issue areas) for the queries that make up the MMSD mandate.

1. *Can the sector move towards a more viable structure that will contribute effectively to sustainable development?*

The production system that is the North American Mining Sector merited close attention here. It was found that while the CMS was among the globally dominant mining sectors, there are problems inherent in the population pyramid that makes up the sector. Each step up the size chain delineates a change in business function and place on the mineral production chain. The most damage to the environment and social relations with stakeholders occurs when companies attempt to move from one business mode in which they excel, up a level to a different business function. This is seen when investment juniors go overseas, when junior companies become small scale producers, or when producing juniors attempt to make the move into the mid-size ranks by opening a medium-to-large scale mining operation.

While it is not viable to "lock in" companies in their position in the mineral production system, closer examination of the problems inherent in changing one's business focus from the comfort zone to "terra incognita" may isolate ways to mitigate these "growing pains." The only way to identify these problems is by looking at mining as a production system, analyzing both the goods and services flows and the actors on the stage.

The key terms in the creation of a more viable structure for the NAMS are "*planning*" and "*innovation*." An industry consultant spoke to both issues with these comments:

"The industry and its individual members have to take a longer viewpoint of who they are, what they are and what role they play in the future. And they have to spend more efforts on engaging stakeholders, the public at large and governments about the long-term role of mining in industrial society."

“Mining has to find ways to foster more innovation in its business practices at large. I am not suggesting that they become vertically integrated per se, but they have to look at efficiencies and inefficiencies in the way they do business, and breed a corporate culture of innovation to create value, rather than relying on the old “ounces in the ground, land in the portfolio” model. Upgrade business practices to become more consistent with what is going on around other resource industries and other industrialists.”

Indeed, mining has to change its mindset about what is research and development. Currently, R&D is solely focused on technical applications. In Canada alone, the MAC estimated that the industry spent some \$340 million on technologically-based R&D in 1999. Should not some of that money be going into examining social and political issues around mining? The corporate culture of mining has to embrace these “soft” issues.

2. *How can the minerals sector support the development of national economies, especially in the poorest countries?*

What is the role of government vs. the role of the company in creating sustainable futures for mining-related communities in developing countries? This is a difficult equation that needs to be addressed by the MMSD and other key stakeholders. When mining companies take on or are expected to take on quasi-governmental roles in an area, this is a recipe for disaster. Social appeasement can become a ticking time bomb if governments are not willing to take on some of the responsibility for the governance of an area.

North America, as analyzed here, consists of two of the richest countries in the world, yet the activities of the mining firms who are based on its shores have implications for development in the poorest countries in the world. Canadians in particular have excelled in bypassing spatial inertia and entering international waters. As such, NAMS firms are in direct contact with mining in the “South.” Areas of concern include questions raised by the sector on its role in development—as contributors or detractors, paternal influences or surrogate governments. The relationship between mining corporations, local communities and national governments need to be examined in greater detail in order to avoid confrontations in the future.

3. *How can the sector best contribute to sustained improvements in livelihoods and well-being at the community level?*

This is actually a more important question than the role of mining in the development of national economies, in this author’s opinion. Too often, locals are the last persons consulted about mining projects. In the future, demands will be imposed on the mining firm to engage locals proactively, while at the same time they will not be allowed to impose their will on communities like has occurred on occasion in the past. Communities have to feel that they have power over their own future; if this is denied to them, they will halt mining projects in their tracks.

4. *How can the minerals industries become leaders in environmental management?*

Discussed earlier was the widening of the mining industry’s concept of “innovation.” It is only through seeing sustainability not as a cost or a default regulatory burden on the firm, but rather as an R&D opportunity to add value to the corporation, that the minerals industries, driven by member firms rather than by top-down regulatory structures, will become proactive rather than reactive environmental managers. This requires a paradigm shift not just in the management levels of major firms, but also within the junior and mid-sized ranks of firms, and down to the operations level with individual employees. Corporate culture must

be altered from traditional perspectives of “ounces or grade” to a triple bottom line made up equally of economic viability, ecological efficacy and social acceptance. It can be argued that NAMS firms have a head start on becoming world leaders in “sustainable mining,” having seen changing environmental and social demands at home and abroad. The minerals industries can become leaders in environmental management (and social engagement, for that matter) only by treating these as “business cases” to be developed as competitive advantages for the individual firm. Investments rather than costs.

5. *What are the ground rules for land: its management, access, control and use?*

NAMS firms are very eager to understand how this equation works out in their traditional mining areas of the U.S. and Canada. They have been less concerned thus far about land access in developing countries, but this too will change. Land access is consistently rated as one of the most important aspects in creating a positive investment climate for mining, reflecting both its import as a feed stock for the mineral production system, and the crippling role of uncertainty of tenure on mineral exploration investment. A better understanding of the exploration cycle needs to be communicated to the public for the industry to get across its belief that mining, while it represents an extremely invasive and intensive process at the extractive stage, is neither extensive in its land usage, nor invasive at the vast majority of sites in the mineral production chain (meaning the sites that are examined, not found to have economic ore values, and abandoned with minimal impact). Also, the industry is confused by often competing and contradictory land use policies in its traditional exploration climates; this issue needs to be made more transparent.

6. *How can we ensure that future markets and consumption patterns are compatible with a sustainable world?*

Consumption patterns for minerals and metals do not appear to be easing, with population growth and rising standards of living in many highly populated parts of the world. How then can the mining industry be regulated to be as responsible as possible in a world of high demand? Certainly, this will involve governments around the world imposing solid laws for the responsible extraction of minerals, but in the absence of responsible lawmaking, the corporate mining sector has to commit to imposing “best practices” technology and management not just where it is required, but *everywhere*. Thus, it is incumbent on research groups like MMSD and academics to prove the “business case” for why it is in the best interests of miners to use “best practices” everywhere they work.

7. *How can we ensure meaningful access to information for all stakeholders?*

The NAMS member firms are highly concerned about the masses of regulations to which they are beholden, but just as ominous looms the key distinction between perception and information. The mining industry feels that it is at a disadvantage vis-à-vis the distribution of “information” to the general public, because groups opposed to mining are not subject to similar regulations on their public announcements. This has contributed to the sense of futility in dealing with many NGOs, and the consequent choice by many firms to attempt to “fly under the radar screens” of opponents of the industry, adding to the insularity of the sector. In order to ensure meaningful access to information for all stakeholders, the industry and its member firms have to get past the “us vs. them” mentality that has driven the industry away from engaging many stakeholder groups. Again, it has to be shown that solid communications links between stakeholders in the mining game reduce risks of misunderstandings, protest and potential project failure. Thomson *et al* (2001) examines these issues more closely.

8. *What should be the administrative relationships, role, responsibilities and performance standards of the key actors in a more sustainable future?*

This is a big picture question that plays into the re-conceptualization of mining as a production system. Throughout this analysis, mining firms have been broken down in more sophisticated ways than in past research. This is not an academic exercise. The goal is to generate understanding both within and outside the industry of the core competencies and weaknesses of different firm types. Only by understanding both firms' responsibilities and needs, can realistic performance standards be generated. Further to this notion, a short review of the areas of concern for different types of firms in the NAMS is in order.

8.3 Current Areas of Concern for Different Firms in the Mineral Production System

What the Junior Sector is Concerned About:

1. *The relationship between the juniors and the seniors.*

This is a natural extension of a market-led concern, which disappears when the venture capital markets are strong. It hasn't been considered a major issue in the past because of its cyclical nature, but the truth is that unless the senior sector better funds the exploration process (unlikely) or funds a third-party as an "intra-industry watchdog" and creates some form of punitive measures to discipline "bad actors," the junior sector will create havoc by not being able to implement sustainable practices in their operations. Poorly funded juniors perceive a need to focus on the bottom line of drill holes per dollar, and that leaves no room for "soft" issues like sustainable development. Their reputation is the reputation of the industry. The industry watchdog option does not appear realistic at the current time.

2. *The tightening of regulations in both the venture capital markets and in project-based permitting and reporting.*

The junior sector feels doubly stressed by the lack of senior support and the corresponding tightening of regulatory requirements placed on them by both legislative and financial agencies. The junior exploration sector is built on a tradition of independence and entrepreneurialism, just as much as it is by the fuel of venture capital. Tighter reporting requirements and excessive permitting lead times means more time spent on administration and less time in the field. Not enough capital and not enough time mean a slowdown in exploration activity and "minefinding." In addition, the relations between junior companies and some regulators have become adversarial also, which is not a positive relationship to be in for either side.

3. *The inability to compete with new avenues for venture capital investment.*

The mixture of Bre-X, the price of major commodities in decline (particularly gold), the rise of technology stocks on the junior capital markets, and the perception of mining as a dirty, speculative business, all mix together to reduce the pool of venture capital available to small cap "miners." In some ways this is a good thing: some of the less mining-oriented "investment" firms are out of the system—separating the wheat from the chaff. In others it is a bad thing: juniors are now pressured to do more work with less capital, inevitably leading to a preoccupation with cutting corners whenever possible. Increasingly also, other locations with junior mining communities are becoming global players, especially through the Australian and London markets. The pool of venture capital for junior mining has not only shrunk, it has been stretched in a wider geographic net, leaving less for the Canadian-based markets.

4. *Survival—pure and simple.*

The mixture of all of the above limits the capacity of the junior sector to come to terms with sustainable development issues, because for the vast majority, short-term survival is their only priority currently. Any movement toward cross-industry acquisition of the skill set of sustainability will require either a better market environment, or some set of incentives that proves to the junior set that acting sustainably will add to their bottom line. This will either come from the market, or from the senior sector getting more involved with the juniors, and lighting a path toward a sustainable future.

What the Junior Sector Should be Worried About:

1. *The “greybearding” phenomenon.*

This aging of the intellectual capital of the exploration sector is a major concern for the senior sector as well. Mining is no longer an attractive profession for young people in the developed nations. While the effects have not been felt as yet, in part because of the willingness of developing nations to fill the skilled labour gap with their own budding geological traditions, does this phenomenon have implications for the future of mining in North America? At the very least, it brings into question the relationship between home places, industrial competitiveness, and the roles of market locations vs. the role of intellectual capital in the location of head offices of mining firms.

2. *Creating market niches, rather than playing “follow the leader.”*

The junior sector traditionally has had two types of actors: “minefinders” and other skilled geologists with a nose for minerals or a model they are passionate about and willing to follow around the world in search of new deposits; and speculators, “investment” companies that follow the leaders into area plays and “commodities of the month” in efforts to create stock price valuation. The industry has to focus on developing more of the former, and less of the latter; while at the same time not neglecting the key role of running a junior company like any other business venture.

What the Mid-Size Firm Sector is Worried About:

1. *Financing (and re-financing) their development projects.*

Keeping debt manageable is the number one priority for the mid-sized firms in the NAMS at present. In the current financing environment, there are much fewer sources of capital investment for mine development projects. As a result of this constricted environment, many expansionary junior and intermediate firms have struggled to survive, and many have failed outright. This has implications not only for the corporate entity, but also for the social and environmental problems left behind at these projects.

2. *Consolidation in the industry.*

The other major concern of mid-sized firms at present feeds of their fiscal problems. Mid-sized firms are in a precarious position in the mining population pyramid, wherein they must continually grow or face takeover by larger firms. In recent years, there has been a rash of these consolidations, which has in turn reduced the number of mid-sized producers out there.

What the Mid-Sized Firm Sector Should be Worried About:

1. *Finding its market niche within the overall production system and becoming responsible miners.*

The intermediate sector of the mining industry is perhaps both its most vulnerable, and the one that should be the cause for most concern by the industry as a whole. While the junior sector has struggled in the past five years, the rise and fall of junior companies can usually go by with little recognition from the outside world. The rise and fall of a producing intermediate-sized (or expansionary junior) firm often is accompanied by environmental and social legacies, the ones that the industry has come to pay the price for in the public eye. The failure of Colmac, the Omai spill in Guyana, the New World mine, Summittville, accidents in Eastern Europe, closures by Dayton and Greenstone, among others, have been “highlight reel” issues for the mining industry, and most if not all have been as a result of firms whose inexperience or lack of capital have led them to make mistakes. The question for those who would become mid-sized producers is this: is there a place for these firms as producers in a “sustainable” mining industry? If there is going to be, intermediates are going to have to do a lot more planning than we have seen from their projects in the past. Perhaps the even more important question is: *Who will make sure the necessary changes in practice and policy actually happen, and how?*

What the Senior Sector is Worried About:

1. *The public image of mining in the developed countries.*

This obviously affects firms both large and small, but seniors are more concerned about being seen as corporate “good neighbours.” *Reputation capital* seems to be more important to the large firms, which is perhaps understandable when one considers the length of time their extraction projects are in place and the amount of capital tied up in each operation. Junior firms, by contrast, are the commandos (ugly word, mind you) of the mining scene, and their success is as much tied up in eliminating non-prospects quickly and quietly, as it is in actually defining mines. The senior sector is concerned not only then with the public perception of their actions, but also the ramifications of poor practices of other types of firms (juniors and mid-sized) on the public’s perception of mining in general.

2. *Liability, liability, liability!*

One of the problems that most dogs mining and sustainability is the question of picking up an older project and attempting to work it. In many ways, this is the definition of “recycling”—going back through a project that didn’t extract the maximum utility out of the resource previously. Companies are perfectly happy (they say) to invest the necessary funds to put the current part of the project to and above environmental standards. However, they are often expected to clean up not only their own mess, but the messes of all who came before. And any damage to the surrounding environments becomes a historical liability issue. Very often, in this circumstance, firms will have to “pass” on redeveloping these historical producers. Instead, a new project is developed that effectively doubles the damage to the environment in the long term. Would it not be better to work over old projects first before starting new “holes in the ground?”

3. *Creating a defensible universal standard of “sustainable practice” for mining firms.*

The mining industry is a very competitive one, with low profit margins (comparatively speaking) and a high degree of competition for mining development, finance, shareholders and projects. If only some of the firms are doing things “sustainably,” they can take a severe short-term hit in their competitiveness. And

short-term is often the only time horizon that a market driven industry can sustain! Thus, the senior sector has been working doggedly to try and find mechanisms whereby all individual firms can either be forced (through self-regulation) or convinced (through research proving that acting sustainably adds value to the firm) to act in a fashion that is similar to that of other firms. Any sort of universal standard-setting is proving elusive, however, in light of the fact that corporate cultures and politico-economic cultures differ across space.

4. *Consolidation pressures in the industry.*

Companies, even in the largest bracket of the industry, the seniors, feel a lot of pressure to add to their reserves through acquisition or mergers. Often times, these moves are about getting bigger at the expense of getting better!

What the Senior Sector Should be Worried About:

1. *Taking sustainability seriously; not just as an exercise in public relations.*

One of the things that is disconcerting to many researchers is the “lily-white” homogeneity of the written statements put out by mining companies concerning sustainable development. Too much homogeneity indicates a cut and paste attitude on the part of the industry that will not wash with the general public or interest groups, and reflects a lack of planning, foresight and limited commitment to the ideals of sustainability. In addition, senior firms have to attempt to diffuse the ideals of sustainability throughout their corporate ranks, rather than keeping those ideals stored in the head offices.

2. *Creating project-based standards of “sustainability.”*

Actually creating universal standards for sustainable development would be one of the worst things the industry could attempt to do. This is because sustainability has to be determined in the local context, more so than the global. It has to be done on a site-by-site basis, with local people involved in aspects of the decision-making; not imposed from without. And all three legs of the sustainability stool have to be as strong as the others in each project!

3. *Finding opportunities hidden among the panicked hordes.*

The mining company has always been a species of pack animal; it is a relatively open industry internally, with close personal ties in the professional ranks and among senior executives of “opposing” firms. The industry will always follow the leader if someone creates value from a type of innovation. And creating shareholder value by becoming the “partner of choice” in mining projects is going to be the next big theme in mining. Each individual firm should be making the attempt to be that industry leader; and these combined efforts will make it easier for laggards to follow the leader in instituting best practices and sustainable ideals into their corporate culture. Again, not because they have to, but because it makes business sense to do so. This sort of reassessment of the role of sustainable practices in mining will allow for the following important initiatives to begin from within:

- those firms that do manage to focus a great deal of energy on acting sustainably will eventually (unless there is a wholesale shift away from sustainability) create “reputation capital” based on their efforts. Whether this will occur before they go out of business, or after the market cares no more, remains in question; and
- an opportunity for the mining community to reassess the risks of doing different types of business will present itself. This study has couched much of its analysis in a veil of risk; seeing where firms can add value by reducing their risk load. Individual firms would do well to consider the same strategy!

8.4 Big Issues for the Corporate Mining Sector Coming into the New Millennium

The following questions would appear to be among the most vital for members of the North American Mining Sector to answer (or at least pose), coming into this era of transition in both their corporate cultures and their relations with the outside world.

1. Two elements of corporate culture need to be markedly reconsidered. First of all, how do firms incorporate sustainable practices into the everyday activities of the firm? How do the senior executives who have driven the sustainability bus get the individual managers and the professionals who are most often in contact with locals and the environment to “buy in” to these concerns.³⁶
2. A second question relating to changes in corporate cultures, asks how can the relationships between junior and senior firms be solidified in such a way to create a stronger, more vital and risk resistant production system? This involves recognition of the synergistic relations of the two types of firms in a healthy “project pipeline.” How can the two sectors interact together better to ensure future security of supply in a consolidating global industry?
3. Creating competitive advantage; should it be through example or through centralized control measures? Do “best practices” create competitive advantages in the long term, or is self-regulation the way to go? Performance-driven vs. compliance regulation management systems are both to be considered.
4. Public image, both north and south; what is the role of information vs. perception and how do you measure the value of public image bolstering for the industry? And is the industry norm of “preaching to the converted” the best way to get this message across?
5. Social issues associated with globalization; how do you become culturally attenuated at the corporate and project scales?
6. Planning for sustainability in a market-driven industry. Earlier in this study, the corporate sector of mining was envisioned as a population pyramid. Likewise, sustainable development can be seen as a pyramid of its own, as developed by government regulators, interest groups, and public demands. Of major concern for the corporate sector of mining is that while the base of the pyramid (environmental and social values) is strong, economic vitality is almost an afterthought, the very tip of the pyramid. Thus, it is a very precarious balance for the industry to undertake, between fulfilling their economic prerogative with very little (profit) margin for error. What other stakeholders need to appreciate is that a strong, vital corporate sector of mining has much more “reaction space” to adhere to sustainable ideals than a weak, survival-oriented corporate sector. It is a question of balance that all stakeholders have to appreciate.

8.5 Concluding Remarks

A critical mass is being generated around sustainability issues in the NAMS. Not only individual firms, but also new industry organizations and initiatives (ICMM, GMI); existing industry organizations (MAC’s “Towards Sustainable Development,” PDAC’s efforts to develop standards for exploration projects); governmental departments (e.g., the Minerals and Metals Sector of NRCAN’s sustainability policy guidelines); professional groups (CIMM’s upcoming 2002 annual meeting in Vancouver is almost entirely devoted to sustainability issues); and extra-national organizations (the upcoming 2002 summit of the World Business Council on Sustainable Development in Johannesburg is a prime example), have devoted themselves to defining mining as a sustainable economic activity.

“The real voyage of discovery lies not in seeking new landscapes but in having new eyes.”
- Atapa Minerals Inc.
(1998)

What is the role of the GMI/MMSD in all this activity? Considering the reaction received by this researcher during an extensive research period, the senior and junior sectors have entirely different feelings toward this international effort and others like it. For the senior sector, GMI represents the strongest effort by the industry to find its voice, and most large firms have bought into its ideals: *“I think GMI is crucial. The biggest thing I see as a barrier to mineral development around the world is the interaction between mining companies and communities, particularly communities in which we operate.”*

Junior firms, on the other hand, feel left out of the process. Many did not even know what either entity (GMI or MMSD) was, or their mandates. Several warned the interviewer that they didn’t think he would be able to raise money for this MMSD thing! And the general thought was that the GMI at best represents a senior-led public relations exercise. Even members of the federal government are concerned about the role and goals of the GMI. As one professional at NRCan put it: *“We are concerned about the direction and role of the MMSD in particular, and the GMI in general. Is it just a public relations exercise? If so, it is doomed to failure.”*

Where all the industry organizations and groups like MMSD can be beneficial is in providing transparent, legitimized and unbiased research on mining issues. The mining industry has struggled to have its collective voice heard in recent years, especially in regards to some myths associated with mining. Such enduring myths are not created solely by powerful interest groups “subverting” the truth, as many in the industry believe (or would have us believe) but just as importantly, a mixture of historical fact and inability of the industry to credibly research and express to its external stakeholders how it has changed its ways. Enduring myths include:

- that mining is a high profit industry, when in fact mining suffers from declining rates of return, and declining terms of trade vis-à-vis the manufactured sectors, and has done so for the better part of a century;
- that mining exists almost entirely of digging giant holes in the ground, when in fact there is a dedicated, high value-adding production system behind every production site;
- that mining is an extensive land usage industry, when in fact it is highly intensive, affecting far less than one per cent of any country’s land base;
- that we don’t need mining any more, regardless of the fact that mineral demands have never been as high; and
- that the junior mining sector is an entirely speculative, illegitimate occupation, bent on exploiting hapless investors. Contrastingly, Freeman (2001a) suggests that the experienced investors who drive the risk capital sector “use” and “manipulate” mining firms more so than the opposite.

The fact that these myths still remain is an indication that efforts by the industry to tell “its side of the story” have generally failed. Thus, the time for “preaching to the converted” is over. The modern mining industry needs to extend an olive branch of information and dialogue in order to reduce the perceptual problems that it has had over the past few decades. MMSD/GMI has been a stepping stone in that process, but the process is far from over.

Overcoming myth in the minerals industry in North America will require more than good public relations firms and their magic wand. It will require the corporate sector of the NAMS to look very carefully at reassessing their industry, its role in the global economy, their definitions of success and the development of an entirely new “business case” for sustainable mining, examining the corporate landscape with “new eyes.”

The worst thing the industry could do is attempt to ride out the current negative market cycle and then go on with business as usual afterwards. In the past, the mining industry

has treated the concepts of sustainability as a bruise, something of an unsightly blemish that will go away if treated. In reality, a “bruise” can be a sign of much deeper, systemic problems, a warning sign as it were, of the need for substantial rather than cosmetic changes to the way the industry does business in order to survive in a rapidly changing global economy.

Endnotes

- 35 See the following web sites for more information on the MMSD project: <www.globalmining.com>; <www.iied.org/mmsd>; <www.iisd.org/mmsd>.
- 36 For example, there has been some uproar among the CIMM’s professional membership that the 2002 annual meetings in Vancouver are to be devoted entirely to sustainability issues. Typically, these meetings focus on deposit types, new commodities of interest, and extraction technologies. The change to focus on “soft” issues was not initially taken to well by some members.

Appendix I: Glossary of Acronyms

AIM: Alternative Investment Market on the London Stock Exchange, geared toward start-up companies

AMD: Acid Mine Drainage, caused by the exposure of sulphide-laden rock to water, often during the mining process

Amex: American Stock Exchange

AMH: American Mines Handbook

ASE: Alberta Stock Exchange

BCSC: British Columbia Securities Commission

BCYCM: British Columbia/Yukon Chamber of Mines

BHP: Broken Hill Proprietary, an Australian-based “Giant Firm”

CDNX: Canadian Venture Exchange

CIMM: Canadian Institute of Mining, Metallurgy and Petroleum Products, a professional organization

CMS: Canadian Mining Sector

DIAND: Department of Indian and Northern Affairs, a department of the Canadian federal government charged with the administration of Canada’s north

E, H and S: Environment, Health and Safety (Many larger mining companies have a division devoted to these issues)

FDI: Foreign Direct Investment

GMI: Global Mining Initiative

HDI: Hunter Dickenson, a Vancouver-based junior exploration management group

IBAs: Impact and Benefits Agreements between mining companies and aboriginal groups/local communities (often seen in Canada’s north in recent years)

ICMM: International Council for Minerals and Metals (formerly ICME: International Council for Metals and the Environment)

LSE: London Stock Exchange

MABC: Mining Association of British Columbia

MAC: Mining Association of Canada

MEG: Metals Economics Group, an industry think tank based out of Halifax

MMS: Minerals and Metals Sector of Natural Resources Canada

MMSD: Mining, Minerals and Sustainable Development

MMSD–NA: Mining, Minerals and Sustainable Development North America, a regional subgroup reporting to the MMSD initiative

NAMS: North American Mining Sector

NGO: Non-governmental Organization

NIMBY: Not-in-my-backyard (refers to perception that an economic activity vital to modern society, is not acceptable near where “we” live)

NMA: National Mining Association, the national metals mining industry organization in the United States (geared toward the larger, producing firms)

NRCan: Natural Resources Canada

NWMA: Northwest Mining Association, the leading industry association based in the United States

NYSE: New York Stock Exchange

OTCBB: National Association of Securities Dealers Over-the-Counter Bulletin Board, an American stock market

OSC: Ontario Securities Commission

PDAC: Prospectors and Developers Association of Canada

PGMs: Platinum-Group Metals (e.g., platinum, palladium)

R&D: Research and Development

RTZ: Rio Tinto Zinc, a London-based “Giant Firm”

SD: Sustainable Development

SEC: the Securities and Exchange Commission of the United States

SpOTC: Spokane Over-the-Counter Exchange

TSE: Toronto Stock Exchange

USGS: United States Geological Survey, the federal government department charged with the mapping and support of the U.S. mining industry, among other aspects of geology in its varied mandate

USMS: United States Mining Sector

VBMS: Vancouver-based Mining Sector

VSE: the former Vancouver Stock Exchange, merged in 1999 with the ASE into the CDNX

Appendix 2: Largest Canadian Metals Mining Companies, 1996–2000

HO	Firm	1996 Rank	1996 Assets	1996 Focus	1996 Firm Size	2000 Rank	2000 Assets	2000 Profit/Loss	2000 Firm Size	96-00 Notes	%Change	Current Status
Toronto	Noranda	1	\$15 b	Diverse Resources	Senior	1	\$11.7 b	293 m	Senior	N/A	-22%	Out of natural resources/ controls Falconbridge
Toronto	Inco	2	7.6 b	Nickel/Refining	Senior	2	9.7 b	400 m	Senior	N/A	28%	Weaker/gambling on Voisey's Bay
Toronto	Barrick	3	4.5 b	Gold	Senior	5	4.5 b	(766 m)	Senior	N/A	0%	Stronger/buying Homestake
Toronto	Falconbridge	4	3.5 b	Ni/Copper/Refining	Senior	4	4.8 b	368 m	Senior	N/A	37%	Controlled by Noranda/Stable
Vancouver	Placer Dome	5	3 b	Gold	Senior	7	3 b	(89 m)	Senior	N/A	0%	In stasis/Las Cristinas failed to materialize
Vancouver	Cominco	6	2.8 b	Lead/Zinc/Refining	Senior	8	3 b	170 m	Senior	N/A	7%	Weaker/Teck taking over
Vancouver	Teck	7	2.5 b	Base Metals Focus	Senior	3	5.1 b	85 m	Senior	N/A	104%	Stronger/Taking controlling position in Cominco
Saskatoon	Potash Sask	8	2.5 b	Potash/Fertilizers	Senior	6	4.1 b	198 m	Senior	N/A	64%	Still Strong
Toronto	Rio Algom	9	2 b	Base Metals Focus	Senior	N/A*	N/A	N/A	N/A	N/A	N/A	Taken over by Billiton
Saskatoon	Cameco	10	1.7 b	Uranium	Senior	9	2.8 b	(78 m)	Senior	N/A	37%	Still Strong
Edmonton	Sherritt	11	1.3 b	Metals	Intermediate	11	1.3 b	0 m	Intermediate	N/A	0%	Weaker
Toronto	Inmet	12	1.2 b	Copper/Gold	Intermediate	19	317 m	10 m	Exp. Junior	N/A	-74%	Weaker
Montreal	Cambior	13	802 m	Gold	Intermediate	14	522 m	(358 m)	Intermediate	99 data	-35%	Weaker/Omai spill affects
Toronto	TVX Gold	14	661 m	Gold	Intermediate	12	740 m	(48 m)	Intermediate	99 data	12%	Weaker/Overleveraged
Vancouver	Westmin	15	609 m	Metals	Intermediate	N/A	N/A	N/A	N/A	N/A	N/A	Acquired by Boliden 1998
Toronto	Kinross	16	533 m	Gold	Intermediate	13	700 m	(126 m)	Intermediate	N/A	31%	Weaker
Toronto	FrancoNevada	17	492 m	Gold	Intermediate	10	1.4 b	98 m	Em. Senior	99 data	285%	Stronger/used niche strategy
Toronto	Euro-Nevada	18	440 m	Gold	Intermediate	N/A	N/A	N/A	N/A	N/A	N/A	Amalgamated with Franco-Nevada 1999
Toronto	Agnico-Eagle	19	412 m	Precious/Base	Intermediate	16	365 m	(5 m)	Intermediate	N/A	-13%	Weaker
Vancouver	Prime Res's	20	381 m	Metals	Intermediate	N/A	N/A	N/A	N/A	N/A	N/A	Acquired by Homestake 98
Vancouver	Eldorado	21	369 m	Gold	Exp. Junior	N/A	121 m	1 m	Exp. Junior	N/A	-67%	Much Weaker
Vancouver	Miramar	22	341 m	Gold	Exp. Junior	N/A	203 m	(20 m)	Exp. Junior	99 data	-40%	Much Weaker
Toronto	Aur	23	337 m	Copper	Exp. Junior	15	465 m	(15 m)	Intermediate	N/A	38%	Stasis
Toronto	Goldcorp	24	314 m	Gold	Exp. Junior	N/A	170 m	(19 m)	Exp. Junior	N/A	-46%	Stasis/stock price strength!
Toronto	William	25	292 m	Metals	Exp. Junior	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vancouver	Bema	26	229 m	Gold	Exp. Junior	N/A	204 m	(4 m)	Ex. Junior	N/A	-11%	Weaker/expanded too quickly
Vancouver	Viceroy	27	203 m	Gold	Exp. Junior	N/A	120 m	(45 m)	Exp. Junior	N/A	-40%	Weaker
Toronto	Rayrock Yellowknife	28	185 m	Metals	Exp. Junior	N/A	N/A	N/A	N/A	N/A	N/A	Acquired by Glamis 1999
Vancouver	Rea	29	185 m	Metals	Exp. Junior	N/A	N/A	N/A	N/A	N/A	N/A	Bankrupt 1997
Toronto	Campbell	30	165 m	Metals	Exp. Junior	N/A	29 m	(63 m)	Junior	N/A	-82%	Failing/trying to merge with two other juniors
Toronto	Denison	31	164 m	Base Metals Focus	Exp. Junior	N/A	166 m	9 m	Exp. Junior	N/A	1%	N/A
Toronto	IAMGOLD	32	160 m	Gold	Exp. Junior	N/A	176 m	11 m	Exp. Junior	N/A	10%	Book is out
Toronto	Caledonia	33	155 m	Gold	Exp. Junior	N/A	33 m	(7 m)	Junior	99 data	-89%	Basically dead
Toronto	Greenstone	34	153 m	Gold	Exp. Junior	N/A	N/A	N/A	N/A	N/A	N/A	Out of business in 2000
Toronto	Novicourt	35	132 m	Metals	Exp. Junior	N/A	N/A	N/A	N/A	N/A	N/A	Effective Noranda subsidiary
Toronto	Breakwater	36	129 m	Base Metals Focus	Exp. Junior	17	348 m	(14 m)	Intermediate	N/A	269%	Strength through zinc focus
Vancouver	Northn Orion	37	124 m	Metals	Exp. Junior	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vancouver	Goldn Knight	38	115 m	Metals	Exp. Junior	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vancouver	Glamis	39	107 m	Gold	Exp. Junior	N/A	163 m	(21 m)	Exp. Junior	99 data	52%	Moved to U.S./acquisitional firm

NOTES

- Several companies have moved up into the >\$100 million range between 1996 and 2000. For example, Diamet of Kelowna moved up due to the success of the Ekati mine in the NWT. The negative market environment has dampened the vertical movement of most companies over the 1996–2000 period, however.
- In addition, some companies that would fit in the list in 1996 have fallen out (Caledonia) or no longer exist (Greenstone). Finally, a firm like Glamis would actually be considered American in 2000, with the move of their head office to Reno, while Exho Bay (2000 assets: 339 million) has since moved its corporate offices from the U.S. to Edmonton.
- Head Offices: 22 Toronto firms, 13 Vancouver firms, four others.
- All dollars are Canadian, meaning that firms 36 through 39 would probably not have made the U.S. list (US\$100 million = CDN\$125 million [approx] in 1996).
- It appears that the mid-tier companies (down the line from Sherritt and Inmet down to the smallest Expansionary Juniors), have suffered the most in the interim.
- Alcan, Luscar, Dofasco, and other potential "mining" firms are not included herein because they are not "mainstream" metals miners. Cameco and Saskatchewan Potash are because the character of their core businesses are close to that of metals mining.
- There seems to be three distinct tiers of "large firms": a senior sector (the top 10 firms between \$1.7 billion and \$15 billion in assets); an established intermediate sector (between \$370 million and \$1.7 billion in assets); and an expansionary junior/struggling intermediate sector between \$100 million and \$370 million.
- The senior sector has increased its asset portfolio between 1996 and 2000. The established intermediate sector has had mixed results, with some expansion (Kinross; Franco Nevada) and some downsizing (Inmet; Cambior). The expansionary junior sector has struggled mightily in the interim, with three of 19 firms showing any significant growth, and several firms failing outright.
- Sources: Canadian Mines Handbooks (1997/8 and 2001/2).
- * Some 2000 data are marked N/A, indicating one of two things: that firm is no longer in business as of 2000, or data are incomplete.
- All Canadian "metals" mining companies with Assets over CDN\$100 million in 1996 are included in this analysis.

Appendix 3 (a and b): USMS Database – Structures and Findings

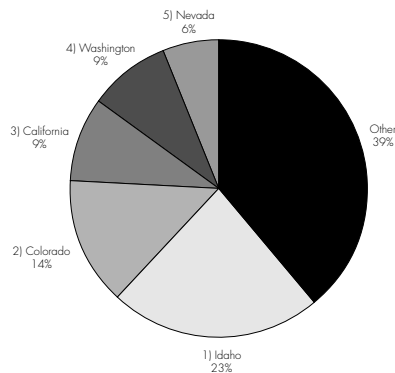
These appendices go through the structure and select findings of the USMS database created for this project. Research found a 223 firm population of publicly traded mining companies based in the United States. This population and the subsequent 100 firm random sample from this population was identified using the 2001 *American Mines Handbook* (Southam Mining Group: 2001b). An Excel spreadsheet structure was used to collect and collate data. There are 22 variables that could theoretically be derived from each individual firm. Of course, the actual amount of data depend on the detail of the reporting that firm offered to the *American Mines Handbook*. Where there were not enough data, the category was marked N/A in the Excel datasheet. Appendix 3b looks at the variables used in, and limitations of, the database structure.

Appendix 3a contains 16 graphs of data collected from the 100 firm random sample, with information on the USMS's structures from locus of control, firm sizes, organizational foci and minesite information, among others. This information is meant to supplement data assessed in the body of this paper.

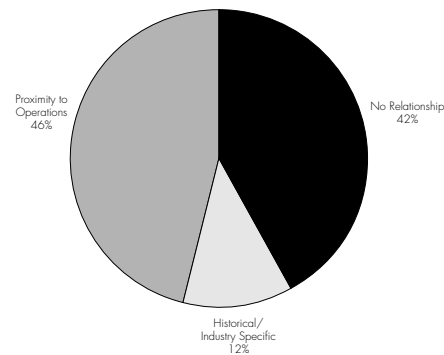
Appendix 3b explains the database structure in more detail, showing how data were collated and explaining the importance of different variables. The author is at pains to explain these structures because of a belief that this type of data collection is exemplary of the sort of work the industry needs to focus on in coming to terms with the "information economy." This database structure is a simple way to collect data on any given mining sector, and could easily be replicated quickly and cost efficiently (indeed, it has, as this database is an altered version of an earlier one created by MacDonald [2000a]).

Appendix 3a: Key Statistics From the USMS Sample Database

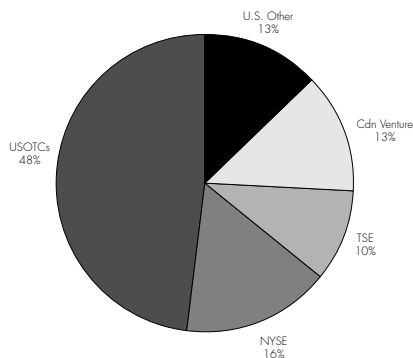
Distribution of Head Offices of Publicly Traded USMS Firms, 2000 Population Statistics



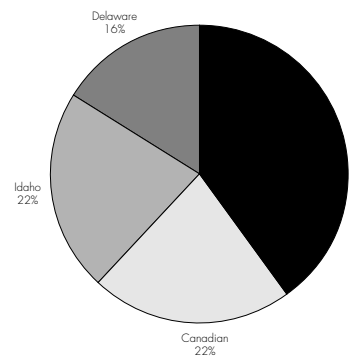
Head Office Relation to Operations: USMS Sample



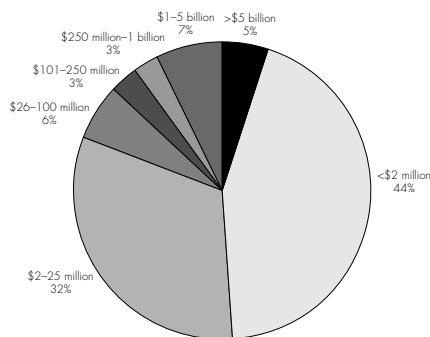
Stock Exchanges of USMS Publicly Traded Firms



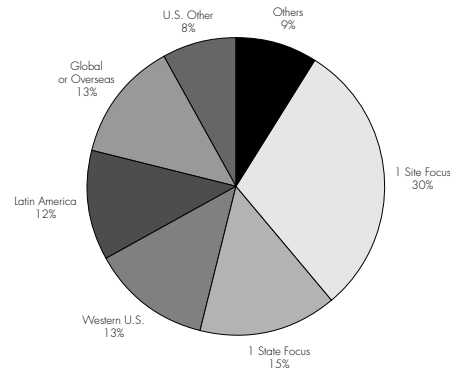
Location of Charters of USMS Firms



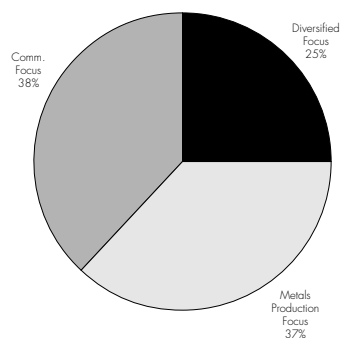
Firm Size by Assets, USMS Firm Sample



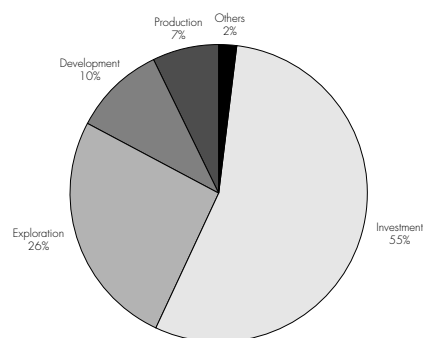
Spatial Focus of USMS Sample Firms



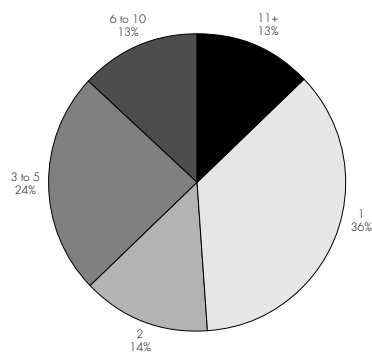
**Large Firm Organizational Focus:
USMS Sample (16 Firms)**



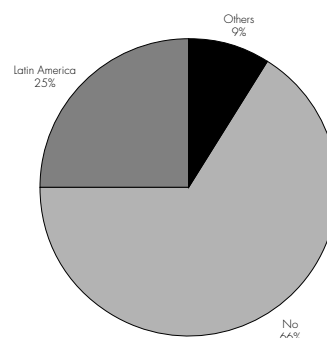
**Junior Firm Organizational Focus: USMS
Sample (84 Firms)**



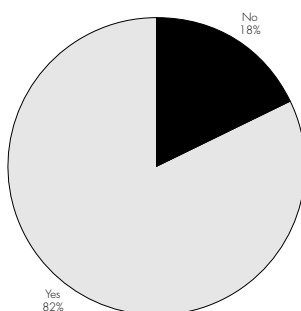
**Number of Sites:
USMS Sample Firms**



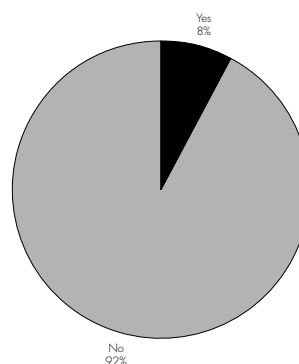
**Operations in Other Countries? USMS Firm
Sample (Canada not included)**



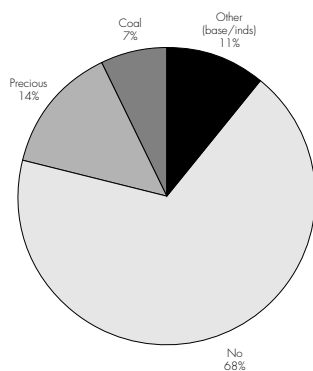
**Percentage of USMS Sample Firms
with U.S. Mining Interests**



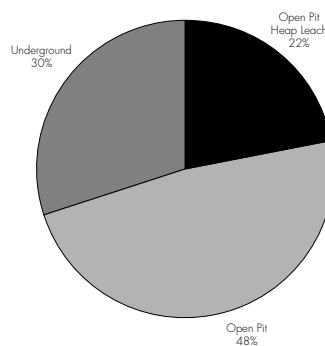
**Percentage of USMS Firms with Activities
in Canada, 2000**



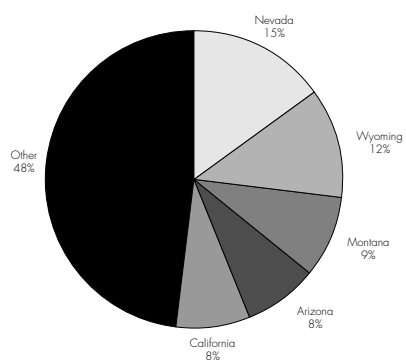
**Do You Have Producing Mines?
USMS Sample Firms**



Minesite Operations Type, U.S. 2000



**Location of Operating Minesites by State,
U.S. 2000**



**Controlling Interests in U.S. Operating
Mines, by Country**

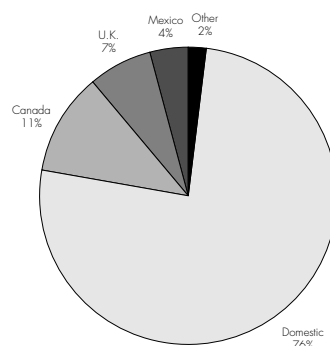
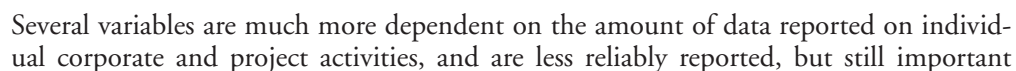


Figure a3.1: Constructing the Database



when mentioned. Variables like **site control**, **ownership of the firm**, **linkages** (e.g., joint venturing) and **with whom** those linkages are and **agreement type**, all examine the relationships between firms at the project and corporate level—the so-called “inter-firm relations.”

A final set of variables is almost entirely qualitative, and is based on the assessment of the rest of the data. **Spatial focus** assesses the geographic investment patterns of the firm, **firm type** assesses their place in the production system, and **market position** assesses the firm’s relative strengths vis-à-vis market competitors.³⁸

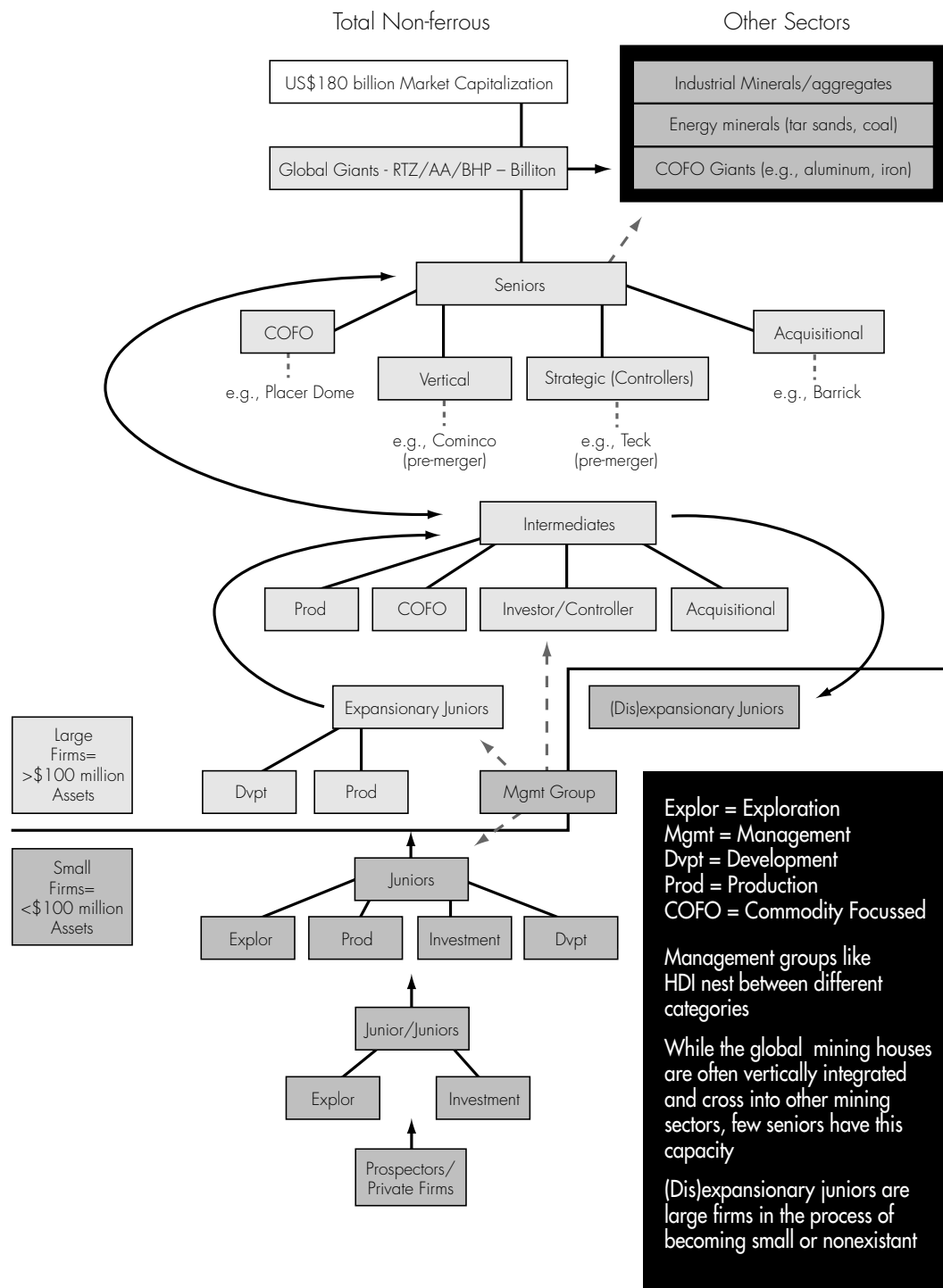
For those interested in further breakdown of the database analysis, please contact the author. Suffice it to say here that this sort of data collection is sorely lacking in the mining industry, because—as shown in MacDonald (2000a)—database analysis over time can illuminate patterns in industry otherwise unexposed. This is but one example of cost effective research that can create value in the long term on an industry wide basis.

Endnotes

37 Note that this example was used because it is rather clear cut in nature. Most firm entries in the handbooks are neither this cut and dried, nor, in many cases, contain this much information.

38 For those counting, the bolded variables amount to about 20. In addition, each firm could have further pertinent information listed in the categories **notes** and **other**.

Appendix 4: Global Mining Sector – Firm Size and Organizational Focus



Bibliography of Sources

- Ala-Harkonen, (1993). "Corporate growth and diversification paths within the minerals industry." *CRS Perspectives*, May/June 1993, 2-17.
- The Allen Consulting Group (2001). *Options for a Global Industry Association Structure for the Mining, Minerals and Metals Sector*. Report to the Global Mining Initiative. Melbourne, Australia: The Allen Consulting Group.
- Atapa Minerals Ltd. (1998). *1997 Annual Report*. Toronto: Atapa Minerals Ltd.
- Bogden, G.J. (2001). *Mining Finance in Difficult Times: What Can be Done?* Paper, Prospectors and Developers Association of Canada Conference, March 11-14, 2001.
- Brock, J.S. (1998). *Goldilocks and the Seven Bears*. Vancouver: J.S. Brock Ltd.
- Brundtland (1987). *Our Common Future*. World Commission on Environment and Development. Oxford: Oxford University Press.
- Burt, R. and P. Waite (1988). *Bibliography of the History of British Metal Mining*. Exeter. England: University of Exeter.
- Cameron, E.N. (1981). "Changes in the political and social framework of United States mineral resource development, 1905-1980." *Economic Geology*, 75th Anniversary Volume, 955-964.
- Canaccord Capital (2000). *Research Update: the North American Gold Exploration Sector*. Vancouver: Canaccord Capital.
- Chender, M. and J. Lowrey (2001). *The Outlook for Primary Gold Production*. Conference Paper, 24th Annual FT World Gold Conference, Rome, Italy.
- Cominco Ltd. (1997). *Responsible Mine Development*. Vancouver: Cominco Ltd.
- Cooke, P. and K. Morgan (1993). "The Network Paradigm: New Departures in Corporate and Regional Development." *Environment & Planning D: Society & Space*, 11, 543-564.
- Cragg, W., D. Pearson and J. Cooney (1995). "Ethics, surface mining and the environment." *Resources Policy*, 21(4), 229-235.
- Cranstone, D.A., A. Lemieux and M. Vallee (1994). Generalized Model of the Mineral Development and Mining Process. In Lemieux, A., *Canadian Suppliers of Mining Goods and Services*. Ottawa: Minerals and Metals Sector, Natural Resources Canada.
- Crowson, P. (1992). "Geographical shifts in the competitive strength of mineral production since 1960, and their causes." *Resources Policy*, 18(4), 252-266.
- Crowson, (1996). "Mining during the next 25 years: issues and challenges." *Natural Resources Forum*, 21(4), 231-238.
- Day, A., A. Perez, and M. Bapna (1999). *Placer Dome's Las Cristinas Project, Venezuela*. Caracas: Trilateral Development Alliance.
- Dow, A. (1987). "Finance and foreign control in Canadian base metal mining, 1918-1955." *Economic History Review*, 31, 54-67.
- Elias, J. and J. Turner (1997). "Mining: Canada leads in mining finance." *International Financial Law Review*, 16(9), 63-64.
- Fraser Institute (2000). *Fraser Institute Annual Survey of Mining Companies: 2000/2001*. Vancouver: The Fraser Institute.

- Freeman, L. (2001a). *Entrepreneurship in the Mining Industry: the Integration of Innovation and Business*. Draft paper. Leigh Freeman, Management Consultant, Downing Teal, Denver. Colorado.
- Freeman, L. (2001b). *Personal Communication*. Management Consultant: Downing Teal, Denver, Colorado.
- Frickel, S. and W.R. Freudenburg (1996). "Mining the past: historical context and the changing implications of natural resource extraction" *Social Problems*, 43(4), 444-466.
- Gleason (1998). "Mergers and acquisitions: the gold giant." *Finance Week*, 76(21), M15-M18.
- Global Mining Initiative (2001). *The Global Mining Initiative: Questions and Answers*. www.globalmining.com
- Government of Canada (1996). *The Minerals and Metals Policy of the Government of Canada: Partnerships for Sustainable Development*. Ottawa: Ministry of Supply and Services.
- Government of Canada (2001). *Overview of Trends in Canadian Mineral Exploration*. Ottawa: Economic and Financial Analysis Branch, Minerals and Metals Sector, Natural Resources Canada.
- Harper, G. and T. Andrews (2001). "Boosting the Discovery of New Mineral Deposits by Attracting Investments." The Canadian Expenses Conference Paper; Expo SIBRAM 2001.
- Harper, Andrews and Fenoulhet (1999). "Exploration—adapting to a changing world." Toronto: Prospectors and Developers Association of Canada.
- Harquail, D. (2001). "North America in Review." PDAC Presentation, March 2001. [http://www.pdac.ca/pub/papers/2001/Harquail\(M-2\)](http://www.pdac.ca/pub/papers/2001/Harquail(M-2)).
- Hayter, R. (1997). *The Dynamics of Industrial Location: the Factory, the Firm, and the Production System*. Chichester: John Wiley & Sons.
- Hayter, R. and D. Edgington (1997). "Cutting against the grain: a case study of MacMillan Bloedel's Japan strategy." *Economic Geography*, 73(2).
- Hayter, R., J. Patchell and K. Rees (1999). "Business segmentation and location revisited: innovation and the Terra incognita of large firms." *Regional Studies*, 33(5), 425-442.
- Hodge, R.A. (2001). *Mining: a Study in Sustainability and Change in the Knowledge Economy*. Paper Presentation, Conference on Building Canadian Capacity—Sustainable Production and the Knowledge Economy. Ottawa: Carleton University, April 4-5, 2001.
- Lemieux, A. (2000). *Canadian Suppliers of Mining Goods and Services*. Ottawa: Minister of Supply and Services.
- MacDonald, A. (2000a). *Risky Business: the Movement of Vancouver-based Mining Firms to Latin America*. M.A. Thesis, Dept of Geography, Simon Fraser University.
- MacDonald, A. (2000b). "Promise and Peril: Globalization and BC's Geological Community." *Innovation*, May 2000, 18-22.
- Mackenzie, B.W. and M.D. Doggett (1993). "There's nothing average about Canadian mineral deposits." *CRS Perspectives*, July/August 1993, 22-36.
- McAllister, M.L., M. Scoble and M. Viega (1999). "Sustainability and the Canadian Mining Industry at Home and Abroad." *CIM Bulletin—Canadian Institute of Mining, Metallurgy and Petroleum*. 92 (1022), 85-92.

- McClintock, J.A. (1989). *Power and Structural Transformation During Mining Company Growth*. Simon Fraser University: MBA Thesis.
- McClure, R. and A. Schneider (2001). "The General Mining Act of 1872 has left a legacy of riches and ruin." *Seattle Post-Intelligencer*, June 11, 2001. <http://seattlepi.nwsource.com/specials/mining/>
- Metals Economics Group (1997). *Corporate Exploration Strategies: A Worldwide Analysis*. Halifax: Metals Economics Group.
- Metals Economics Group (2000). *Strategic Report*. March/April 2000. Halifax: Metals Economics Group.
- Metals Economics Group (2001). *Exploration Spending Nearing Bottom of Cycle*. <http://www.metalseconomics.com/catalog/pages/press.htm>
- Mining Association of Canada (1999). *1998 Facts and Figures*. Ottawa: the Mining Association of Canada.
- Mining Association of Canada (2000). *1999 Facts and Figures*. Ottawa: the Mining Association of Canada.
- Mining Association of Canada (2001). *2000 Facts and Figures*. Ottawa: the Mining Association of Canada.
- Mining Quarterly (1999). "Vancouver—a World Centre for Mining?" *Mining Quarterly*, 6(1), page 3.
- Miranda Minerals Inc. (1997). *Corporate Profile*. Vancouver: Miranda Minerals Inc.
- MMSD North America (2000). *Meeting Notes*. Meeting of Canadian Subgroup of MMSD, Winnipeg, Manitoba, December, 2000. Chair: Tony Hodge.
- Moore, P. (1997). "Hard Choices for Environmentalists and the Mining Industry." Presentation, Prospectors and Developers Association of Canada. http://www.bc-mining-house.com/opinions/opin_pm.htm
- National Mining Association (2000a). *Fast Facts*. <http://www.nma.org/fastfacts.html>
- National Mining Association (2000b). *Mining: Industry of the Future*. <http://www.nma.org>.
- Natural Resources Canada (1995). *Sustainable Development and Minerals and Metals: an Issues Paper*. Ottawa: Natural Resources Canada.
- Natural Resources Canada (2000). *Canadian Minerals Yearbook, 2000*. Ottawa: Minister of Supply and Services.
- Natural Resources Canada (2001). *Sustainable Development*. <http://www.nrcan.gc.ca/dmo/susdev>.
- Neugebauer, H.E.O. (1976). *Organizational Characteristics of Effective Mining Exploration Companies*. Simon Fraser University: MBA Thesis
- Noranda, Inc (1997). *Summary Environment, Health and Safety Report*. Toronto: Noranda, Inc.
- The Northern Miner (1998). *Editorial—Rebuilding investor confidence no easy task*. Volume 84 (16), June 15-21, 1998.
- Pasminco Limited (1999). *Working with Indigenous Communities—Pasminco's Approach—1999-2002*. Melbourne: Pasminco Limited.
- Pasminco Limited (2001). *Environment Report: 2000*. Melbourne: Pasminco Limited.

- Patchell, JR. (1996). "Kaleidoscope economies: the process of cooperation, competition and control." *Annals of the Association of American Geographers*, 86, 481-506.
- Pfau, M. (2001). "Chickens, eggs and the BANANA syndrome." *Northwest Mining Association Bulletin*, June 2001. [Http://www.nwma.org](http://www.nwma.org).
- Placer Dome Inc. (1998). *The Mine Development Process*. Vancouver: Placer Dome Inc.
- Placer Dome Inc. (2000). *Ensuring our Future: 1999 Sustainability Report*. Vancouver: Placer Dome Inc.
- Power, T.M. (1996). *Lost Landscapes and Failed Economies: The Search for a Value of Place*. Washington: Island Press.
- Prospectors and Developers Association of Canada (2001). *Canadian Junior Mining Sector Exploration Trends, 1999-2000* (Draft Copy). Toronto: PDAC.
- Richardson, P.R. (1992). "Mining—the systems revolution." *Canadian Mining Journal*, 119(4), 6-10.
- Ringwald, J. and A. Kent (2001). "Leadership in the mining industry—developing the agenda for CIM 2002 in Vancouver." Discussion Paper, Canadian Institute of Mining, Metallurgy and Petroleum Products.
- Rio Algom Limited (1997). *Responsible Mining for the 21st Century*. Toronto: Rio Algom Limited.
- Rugman, A.M. and J. McIlveen (1985). *Megafirms: Strategies for Canada's Multinationals*. Toronto: Methuen.
- Smith, D.A. (1987). *Mining America: the Industry and the Environment, 1800-1980*. Lawrence, Kansas: University Press of Kansas.
- Snow, G.G. and B.W. Mackenzie (1981). "The environment of exploration: economic, organizational and social constraints." *Economic Geology*, 75th Anniversary Volume, 871-896.
- Southam Mining Group (2001a). *Canadian Mines Handbook: 2000-2001*. Don Mills, Ontario: Financial Post Publications.
- Southam Mining Group (2001b). *American Mines Handbook: 2000*. Don Mills, Ontario: Financial Post Publications.
- Svela, O. (1991). "Mining to a Latin beat." *The Northern Miner Magazine*, June 1991, 27-35.
- Thomson, I. (2001). "Sustainability Challenges for Junior Mining Companies." Paper Presentation, COPP Transition Task Force, International Council for Metals and the Environment. Vancouver, BC: July 19, 2001
- Thomson, I and S.A. Joyce. (1997). "Mineral exploration and the challenge of community relations." *PDAC (Prospectors and Developers Association of Canada) Communiqué*. Toronto: PDAC.
- Thomson, I., F. Loayza, G. Baker and S. Fulop (2001). *Access to Information: a Key to Building Trust in the Minerals Sector*. Forthcoming MMSD paper. Vancouver: Ian Thomson Consulting.
- Thomson, I., F. Loayza, G. Gibson & S. Fulop (2001). *Access to Information: a Key to Building Trust in the Minerals Sector*. MMSD background paper, International Institute for Environment and Development; London.
- Twain, M. (1872). *Roughing It*. Hartford, Conn.: American Publishing.

- United States Geological Survey (1998). *Materials Flow & Sustainability*. USGS Fact Sheet FS-068-98.
- United States Geological Survey (1999). Natural Aggregates—Foundation of America's Future. *USGS Fact Sheet* 144-97, U.S. Department of the Interior.
- United States Geological Survey (2000). *Mining and Quarrying Trends*. <http://minerals.usgs.gov/fact-sheets>.
- United States Geological Survey (2001). *Mineral Commodities Summaries: 2001*. <http://minerals/usgs.gov/fact-sheets>.
- Vertzberger, Y.Y.I. (1998). *Risk Taking and Decision-making*. Stanford, California: Stanford University Press.
- Warhurst, A. and G. Bridge (1996). "Improving environmental performance through innovation: recent trends in the mining industry." *Minerals Engineering*, 9(9), 907-921.
- Werniuk, J. (1997). "View from the top: how Canadians score in the world of mining." *Canadian Mining Journal*, Dec. 1997, 118(6), 11-16.
- WMC Limited (2001). *Toward Sustainable Development: Community-Environment Report 2000*. Melbourne: WMC Limited.
- Young, A. (1998). "Environmental Mining Council of British Columbia: Protecting the Future Through Action Today." http://www.miningwatch.org/emcbc/publications/VSE_hazardous_waste.html.

Publications Order/Information Request Form

Publications and Reports from Mining, Minerals and Sustainable Development North America

All publications will be available in May 2002.

All prices are in Canadian funds.

Publications Available Now

- _____ MacDonald, A. *Industry in Transition: A Profile of the North American Mining Sector* (\$20 including taxes; add \$5 for shipping and handling).
- _____ MMSD Work Group 4. *Learning from the Future: Alternative Scenarios for the North American Mining and Minerals Industry* (\$15 including taxes; add \$5 for shipping and handling).

Publications Available in May 2002

(please check the items about which you would like to get more information)

- Book** _____ MMSD–North America Final Report: *Towards Change*. (Price TBA)
- Brochure** _____ MMSD Work Group 2. *Seven Questions to Sustainability*. (Free!)
- Technical Paper (Report Format)** _____ MMSD Work Group 2. *Seven Questions to Sustainability*. (Price TBA)
- CD Rom** _____ Synthesis of all MMSD–North America output. (Price TBA)

Name _____ Title _____

Company/Organization _____

Address _____ City/Town _____

Province/State _____ Postal Code/Zip Code _____

Phone Number _____ Fax Number _____

E-mail Address _____ Web Site _____

Total current purchase \$ _____

☐ Cheque enclosed (payable to the International Institute for Sustainable Development)

Please charge the amount above to my ☐ Visa ☐ Mastercard

Credit Card Number _____

Expiry Date _____ Name on the Card _____

Send your completed form to:

The International Institute for Sustainable Development
161 Portage Avenue East, 6th floor
Winnipeg, Manitoba R3B 0Y4
Attention: MMSD Publications
Phone: 204-958-7700
Fax: 204-958-7710
E-mail: info@iisd.ca

For office use:

The mining industry is changing. And so is the planet. As the industry grows and globalizes, there is increasing pressure for mining to embrace the principles of sustainable development. In *Industry in Transition*, Alistair MacDonald delivers a thorough profile of the North American industry, outlining the challenges and opportunities on the path to sustainability. The changing nature of risk in the mineral industries is highlighted, and it is argued that the industry needs to be treated as an integrated *production system* in order to make the necessary transition an effective one.

International Institute for Sustainable Development
161 Portage Avenue East, 6th Floor
Winnipeg, Manitoba
Canada R3B 0Y4
Tel: +1 (204) 958-7700
Fax: +1 (204) 985-7710
E-mail: info@iisd.ca
Web site: <http://www.iisd.org>