

# Canada's Mining Industry and Recent Social, Economic and Business Trends

Jeremy Mouat

## Introduction

A half century is a long time; it is hardly surprising that some profound changes have occurred over the past fifty years. These changes - economic, social and political - have had a significant impact on the work of the metallurgist and more generally on the mining industry. Phrases that are now commonplace, such as “environmental impact assessment”, “corporate social responsibility”, “stakeholder consultation” or “global warming”, were unknown in 1961. The meaning of these phrases, as well as their frequent use today, suggest the ways in which our world has become more complicated. The purpose of this chapter is to detail that complexity, as well as its relevance to the changes in metallurgy and materials in Canada. It begins with a caveat: these are the reflections of a historian, not a metallurgist. The intention is to describe the broader context, the backdrop against which the specific changes described by other authors took place.

The phrase, “The efficient production of metals”, captures a common goal of the mining and metallurgical industry. More lies behind that innocent-sounding phrase, however, than the careful application of science and technology. The production of which metals, in what quantity and with what profit, reflects not only the quality and extent of a specific ore body, but also uncertain demand and fluctuating prices. The past half-century has underscored that reality. In the forty years since the government of the United States abandoned the gold standard, for example, the market price of gold has become a measure of many things, particularly global insecurity but also fashion and even the proximity of the wedding season in India (Wood and Wachman, 2010). The cost of energy has also fluctuated widely. Its volatility since the early 1970s, as well as the double digit inflation that followed the first oil shock, are key features in the trajectory of the global economy.

Whatever the influence of these external factors, the mineral resource itself cannot be ignored. The news is not good. Canada's ore reserves are dwindling: government data on Canadian reserves of selected major metals for 1977-2008 demonstrate the continuing depletion of all the identified minerals with the exception of gold<sup>1</sup>. Declining

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<sup>1</sup> See Table 3.6 in the Canadian Intergovernmental Working Group on the Mineral Industry's *Overview of Trends in Canadian Mineral Exploration, 2009*. In 2008, copper reserves were 44% of what they had been in 1977; nickel, 47%; lead, 7%; zinc, 19%, and silver, 18%. The one exception, gold, had nearly doubled, from 493 tonnes in 1977 to 947 tonnes in 2008, although it's worth

ore reserves as well as an overall trend to leaner ore deposits suggest the challenges confronting the mining industry over the period. While the prospect of scarcity is a cause for concern, this is not a new development. More than a century ago a leading geologist acknowledged the increasing reliance on low-grade ores, which even then was a feature of North American mining, and drew attention to one positive outcome. Speaking at a mining congress held in Denver in 1906, Waldemar Lindgren pointed out that, “The interests of good mining are not always served by the finding of rich ore. True progress in the art [of metallurgy] is more apt to be recorded at the low-grade mines” (Lindgren, 1906).

Increasingly, companies have turned to economies of scale to deal with the challenge of leaner ores but that solution can create additional problems: recoveries can be affected and treating higher volumes inevitably produces greater waste. Given today's increasingly stringent environmental standards, massive production of tailings further complicates the work of mining.

Fifty years ago, metallurgists worked with richer ore, ore that was more abundant than it is today, and in a cultural milieu that was much less critical of industrial activity (especially when it was carried out far from centres of population). Controversy was not absent, however. One highly contentious issue was the seemingly inexorable growth in American ownership of Canadian resources. A rancorous parliamentary debate in 1956 over the construction of a natural gas pipeline across the country, which raised the possibility of American control, as well as a 1957 Royal Commission on the Canadian economy that catalogued the growing dominance of the United States focused attention on the issue.<sup>2</sup> By 1961 a growing mood of anti-Americanism was palpable across the country and beyond. When Harvard University Press published Hugh Aitken's *American Capital and Canadian Resources* that year, for example, the book's dust jacket noted that, “many Canadian industries are virtually controlled by the

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noting that even gold had declined after reaching a highpoint of around 1,600 tonnes through the late 1980s.

<sup>2</sup> As one historian has pointed out, before [the 1957 Royal Commission on Canada's Economic Prospects] ..., Canadian economists did not consider foreign investment a proper topic for debate. For them it went without saying that governments should not limit the free flow of capital across national borders. The Gordon Report was seminal, triggering considerable political and academic discussion of the subject. The report gave Gordon's concerns over foreign investment an air of legitimacy, (Stephen Azzi, *Walter Gordon and the Rise of Canadian Nationalism*, Montreal: McGill-Queen's University Press, 1999, p. 57).

United States. This fact ... has led to considerable resentment in Canada" (Aitken, 1961). This mood also influenced the politics of the era: the relationship between Prime Minister Diefenbaker and President Kennedy was arguably the worst between any Canadian prime minister and American president<sup>3</sup>.

SIDEBAR: *A Dinner Invitation:*

"The President telephoned to say he had just been reading about our deteriorating relations with Canada, which was something he had not been aware of; that we have done so much to keep good relations. The Secretary said he had not been aware of this either; that we have had many meetings with the Canadians and they all went off well. The President said he has not had Diefenbaker down here and, while he is merely a Prime Minister, the President thought he could give him a little more of the red carpet treatment since he is the Prime Minister of such a close neighbor. The President said if we could get him down, the President would be glad to give him a dinner, but would try to avoid Diefenbaker returning the dinner. The President said if he had him for some conversations and a dinner that that would be all he would need to do. The Secretary agreed and said he thought Diefenbaker would be very pleased if this could be worked out..." (LaFantasie, 1960).

Warmer relations between the two governments followed the election of Pearson and the Liberals to power in Ottawa in 1963, although a good number of Canadians remained skeptical of the adequacy of American foreign and domestic policies. In light of the war then raging in Vietnam and the riots that swept American cities, such an attitude was not hard to understand.<sup>4</sup> The nationalism that would inform Liberal policies through the 1970s, including such initiatives as the Foreign Investment Review Agency (1973) and the creation of Petro-Canada (1975), had its origins in this public mood.

For its part, the American government devoted considerable attention to the ownership and availability of base and precious metals. As far back as 1917, for example, the US Bureau of Mines commissioned a series of reports on *Political and Commercial Control of the Mineral Resources of the World*, an interest that continued through to the 1960s. The Cold War underscored the importance of strategic mineral supplies; resource security was the focus

<sup>3</sup> For a description of just how bad that relationship became, see Knowlton Nash, *Kennedy and Diefenbaker: Fear and Loathing Across the Undefended Border*, Toronto: McClelland and Stewart, 1990. For a useful corrective to those who blame Diefenbaker for this state of affairs, see Kevin J. Gloin, Canada-U.S. Relations in the Diefenbaker Era: Another Look, in Donald C. Story and R. Bruce Shepard, eds., *The Diefenbaker Legacy: Canadian Politics, Law and Society since 1957*, Regina: Canada Plains Research Centre, 1998, pp. 1-14.

<sup>4</sup> For a representative contemporary range of Canadian views, see Al Purdy, ed., *The New Romans: Candid Canadian opinions of the U.S.*, New York: St. Martin's Press, 1968.

of such studies as the Paley report, commissioned by the American president and published in 1952 as *Resources for Freedom*. The tensions of the Cold War and the concerns around resource security that informed the Paley report contributed to the growth and development of Canadian mineral resources through the 1950s and into the 1960s. From the perspective of the mining industry, such direct foreign investment was critical:

"...the proper development of the mining industry ... requires capital. Like it or not, the internal sources of money [in Canada] are just not sufficient. Some foreign investment is absolutely necessary. In our reaction to the extent of American investment in our country, we tend to lose sight of the fact that this foreign capital is essential to us."<sup>5</sup>

The contrast between the nationalist public mood and a resource sector largely buoyed by American demand and foreign capital was striking.

Despite the anxieties of some Canadians, the mining industry grew throughout the 1960s and 1970s. This growth was not unique to Canada: as Nickolas Themelis pointed out in 1993, the period can be characterized as the Golden Age of Metallurgy (Themelis, 1993). Echoing the phrase a little over a decade later, Michael King referred to a golden age of extractive metallurgy, which he felt extended from the end of the Second World War until the late 1970s. He also pointed to the sustained prosperity that enabled individual companies within the nonferrous metals industry to finance their own technology development (King, 2007). Most of the large Canadian companies during this period could boast significant metallurgical advances that they themselves had pioneered, a number of which are described in other chapters of this book.

Prosperity also facilitated a far greater geographical reach for the industry and the period saw a series of mines opened in the Yukon and Northwest Territories. For example, Pine Point in the Northwest Territories went into production in 1964 and Cyprus Anvil's Faro mine in the Yukon began shipping in 1970. Further north again, Nanisivik became the first mine in the Canadian Arctic when it opened in 1976, followed several years later by the Polaris mine and Echo Bay's Lupin Mine. All of these mines have since closed. Much later in 1997, Falconbridge successfully started the Raglan nickel mine located at Katinniq, Quebec, north of the 62<sup>nd</sup> parallel. This mine remains in operation and reportedly has quite a long remaining life (more than 20 years).

<sup>5</sup> Roy M. Longo, ed., *Historical Highlights of Canadian Mining, Including Canadian Personalities*, Toronto: Pitt Publishing Co., 1973, p. 164. In a study examining the establishment and financing of the six largest miners (INCO, Cominco, Noranda, Hudson Bay Mining and Smelting, Falconbridge and Sherritt-Gordon), Alexander Dow has questioned the accuracy of this assertion; see his Finance and Foreign Control in Canadian Base Metal Mining, 1918-55, *Economic History Review*, 2<sup>nd</sup> Series, Vol. 37, No. 1 (February 1984): 54-67.

## The Death of Mining?

The good times, however, did not last. The energy crisis of the 1970s drove up costs and commodity prices were either flat or dropping. Partly to cope with the rising costs, Canadian miners became far more interested in ore deposits further afield. Again, this was a trend that was hardly confined to Canada. In 1984, for example, *Business Week* ran a cover story on “*The Death of Mining*” (Anon, 1984). Although much of the story examined American copper companies, the piece noted that the problems it described were endemic throughout the North American metals mining industry. Partly, these reflected declining ore values but the article identified another factor as well:

*“The pangs of mining are the latest example of what may be an industrial megatrend: the inexorable shift of the production and processing of all basic materials from the industrial countries to the Third World. Like steelmaking, metals’ mining is vulnerable to some fundamental forces. It is an industrial activity in which, these days, the developing nations have an almost unbeatable pair of economic advantages: cheap labour plus very-low-cost reserves.”*<sup>6</sup>

If a number of Canadian companies increased their offshore holdings, on occasion, new discoveries within Canada still made headlines. Perhaps the most unlikely, given its location, was the gold find in Ontario literally beside the Trans Canada Highway, which would become the Hemlo mine. Another rich gold strike came in northwest British Columbia, at Eskay Creek. Not only gold was found: the announcement that kimberlite pipes had been discovered near Lac de Gras in the Northwest Territories heralded a staking rush in the early 1990s. Shortly afterwards, a new nickel discovery in Labrador led to what was then one of the biggest mining deals in Canadian history, when Inco bought the property from Vancouver-based Diamond Fields for more than four billion dollars. Diamond Fields meteoric rise attracted a good deal of attention and helped to propel other speculative mining stocks on the Vancouver Stock Exchange into the stratosphere. A year later the spectacular crash of Bre-X brought the excitement to a quick and inglorious end.<sup>7</sup>

If occasionally the juniors could still play important roles as prospecting/exploration companies, only rarely, if at all, could they make the transition to established producers. The ownership structure of the Canadian mining industry has changed in some fundamental ways,

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<sup>6</sup> See also the two perceptive pieces by historian Michael Malone: The close of the copper century, *Montana: The Magazine of Western History*, Vol. 35 (Spring 1985): 69-72, and The Collapse of Western Metal Mining: An Historical Epitaph, *Pacific Historical Review*, Vol. 55, No. 3 (August 1986): 455-64.

<sup>7</sup> The best account of the Bre-X crash is Jennifer Wells, *Fever: The Dark Mystery of the Bre-X Gold Rush*, Toronto: Viking, 1998; on the link between Diamond Fields and the speculative bubble after the Voisey’s Bay deal, see Jacquie McNish, *The Big Score: Robert Friedland, Inco, and the Voisey’s Bay Hustle*, Toronto: Doubleday Canada, 1998, pp. 315-21.

unimaginable in 1961. It is now dominated by very large companies indeed. Booming commodity prices have meant that even companies once giants in the field could fall victim to take-overs. Cominco was one of the first to disappear, gradually being absorbed by Teck to become first “Teck Cominco”, and more recently (2009) simply, “Teck Resources”. Two other industry leaders, Noranda and Falconbridge, merged in 2003, although in effect this was a Noranda takeover. Some years later, the Swiss firm Xstrata expanded its minority holding in Falconbridge to take control of the company. Inco also sought to acquire its long-time Sudbury rival but failed to do so. It then became a target for others, as both Teck Cominco and the Brazilian firm CVRD (subsequently re-named Vale) sought control of the nickel giant. In the summer of 2006, just as Xstrata acquired Falconbridge, Vale purchased Inco. Earlier in the same year, Toronto-based Barrick Gold Corporation had bought Vancouver-based Placer Dome to become the largest gold producer in the world. All of these transactions were multi-billion dollar deals.

The diamond properties staked in Canada’s north were also acquired by very large offshore mining companies. The first diamond mine to go into production, the Ekati mine, is chiefly owned by BHP Billiton, while the Diavik mine is partly owned by the Rio Tinto Group. The third producer, Snap Lake Diamond Mine, is owned by DeBeers. Many businesses in Yellowknife, as well as First Nations peoples in the region, have felt the economic benefits of this new industry but the absence of any majority Canadian ownership suggests the extent to which the mining industry has changed.

## The Environmental Impact

Much else has changed in addition to the structure of ownership. The saga of the Windy Craggy project, which Geddes Resources proposed in the late 1980s, is a good example of the growing environmental sensitivities that need to be accommodated in any new mining project. The property’s location to some extent determined its destiny, to become a park rather than a mine, although that fact was frequently lost sight of in the controversy which raged over the property. After several years of heated debate, the BC Premier declared in June 1993 that the area would become a wilderness park, a pronouncement which pleased a large and increasingly powerful environmental lobby while provoking displeasure from industry figures.<sup>8</sup>

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<sup>8</sup> J. C. Day and Joseph Affum, Windy Craggy, Institutions and Stakeholders, *Resources Policy*, Vol. 21, No. 1 (March 1995), p. 21-26; Windy Craggy phantom haunts CIM gathering, *Northern Miner*, Vol. 80, No. 34 (Oct. 24-30, 1994), p. 1-2. Six years after the BC government’s decision, the President of the Mining Association of Canada listed the problems confronting Canadian mining companies, which in his view included governments making arbitrary decisions, the most notorious example being the Windy Craggy deposit (Peeling, 1998).

Although the BC government made the decision to disallow the project, Geddes faced considerable opposition and on many fronts. The federal government had earlier rejected its application for a slurry pipeline and would likely have continued to oppose the project; an impressive coalition of environmental groups (with an estimated North American membership of over ten million people) were also against it; and the US Congress signalled its willingness to invoke the Boundary Waters Treaty between Canada and the US to block the project from proceeding. The decision to declare the area a wilderness park was thus far more than one provincial government opting to align itself with the environmental movement: it reflected the growing misgivings of large numbers of the North American community, from local First Nations all the way to the White House.

Such broad support for environmental protection had emerged quite recently. For example, Rachel Carson's *Silent Spring*, the book that encouraged a very large North American audience to ponder environmental degradation, was published only in 1962. Then the issue seemed to be on everyone's lips. In 1966, the Canadian Council of Resource Ministers (the relevant federal and provincial cabinet ministers) convened a conference in Montréal on "Pollution and Our Environment", planning for which had begun two years earlier (Canadian Council of Resource Ministers, 1967).

At the end of the decade, the first Earth Day was celebrated (in April 1970), the same year that Greenpeace was launched in Vancouver. The publication of two other books added further weight to the growing unease that economic growth was rapidly becoming unsustainable. The *Limits to Growth* was prepared for the Club of Rome in 1972, followed by E. F. Schumacher's *Small Is Beautiful: Economics As If People Mattered* in 1973. The oil shock of the same year appeared to confirm that the status quo had become unstable and that energy supply could no longer be taken for granted as a reliable driver of economic growth.

The mining industry was not immune from these ideas. It was not long before the environmental concerns that had become ubiquitous during the 1970s were heard at gatherings of mining and metallurgical engineers. When Columbia University's Herbert Kellogg gave the Sir Julius Wernher Memorial lecture in 1977 (Kellogg, 1977), for example, he drew attention to:

*"...the urgent need for conservation of natural resources [which] obliges the metal production industry to adopt process designs that use less energy, require less capital investment and protect the environment and the health of workers."*

The following year, he returned to the same theme in his Distinguished Lecture in Materials and Society, which he titled "Toward Materials-Conservation Ethic" (Kellogg, 1978), and he pointed out to his audience that,

*"Clearly, we are in environmental trouble today. We face real, identifiable risks to life and well being, both*

*inside and outside our factories, in the air of our cities and in the water we drink. The problems may not yet be at a crisis stage, but they are serious enough to justify the sometimes costly efforts for environmental protection. Within recent years we have seen enactment of state and federal laws to control environmental pollution. I see this trend as inevitable, necessary, long-term, and involving an increasing number of industrial and individual actions subject to control. Gone are the simpler days of 1900 when the earth, the air and the water served as convenient sewers, with danger only to a minor fraction of the population..."*

He included a figure that showed the relationship between increasingly low grade ores and the energy required to recover their metal. His point was that the growing reliance on lower grade ores came at a cost in labour, capital, energy requirement and environment damage, and that sooner or later these costs could well become prohibitive.

Kellogg's was hardly the only cautionary voice within the industry, of course. Others would continue to reiterate such themes, notably Nickolas Themelis, inventor of the Noranda Process and later one of Kellogg's successors as Stanley-Thompson Chair of Chemical Metallurgy at Columbia University. In 1993, the same year that the BC government closed the door on the Windy Craggy project, Themelis contributed to an earlier fiftieth anniversary, that of the Finnish Association of Mining and Metallurgical Engineers. In a talk with an open-ended title, "*The Golden Age of Extractive Metallurgy: 1950 to ?*", he described the remarkable jump in the production and consumption of copper since the Second World War, as well as the various innovations that had made this increase possible (Themelis, 1993). He then struck a note of caution, citing Kellogg's work and concluding that,

*"...mineral resources, despite the large sums spent and the great advances in exploration technology, on a constant ore grade basis, are constantly dwindling. As a result, the average grade of mined ore has decreased by a factor of two or more since 1950. In consequence, the amount of energy and other costs required to produce a unit of metal have increased, despite the great strides in technology..."*

*"...Because of this unavoidable trend, the mining and processing of the future ores will be less profitable than today. Yet, the present day mineral industry, with few notable exceptions, apparently can hardly scrape together the funds needed to support industrial and academic research. As a result, most centres of excellence on extractive metallurgy have been shut down or changed their names and goals to loftier subjects, such as "advanced materials" or the like."*

Ironically, four years later Themelis himself would oversee the transformation of Columbia's School of Mines, the first such school established in the United States, to the Department of Earth and Environmental Engineering.

## New Initiatives

By the early 1990s the structural, social and environmental challenges confronting the Canadian mining industry were hard to ignore. The Mining Association of Canada opted to take the initiative and approached the federal, provincial and territorial mines ministers with a suggestion for a multi-stakeholder process (Natural Resources Canada, 2011). Formally dubbed the Whitehorse Mining Initiative [WMI], the process came to include not only industry and government leaders, but also First Nations, environmental groups, and unions. As an article, Fitzpatrick et al. (2011) on the process pointed out,

*“This effort [the Whitehorse Mining Initiative] was a radical departure for an industry better known for its individualistic, competitive and isolationist nature. In the early 1990s, the industry was not faring well. It was facing competitive challenges abroad and an unsympathetic reception at home. While once the Canadian public interest was considered synonymous with resource development, the end of the twentieth century saw a voting urban population and their elected officials more concerned with environmental issues than the fate of the mineral industry. The industry found itself sharing the public arena with many other participants, and a number of them were not sympathetic to the competitive concerns of mineral prospectors, developers, or producers. The industry continued to produce significant revenues for the country as well as jobs and spin-off economic activities, but its overall reputation became linked to serious environmental degradation and social problems. The industry hoped that the WMI would foster a broader and more sympathetic understanding of its activities and role in Canada as well as a more hospitable regulatory environment.”*

The President of the Mining Association later explained to an international audience that the Whitehorse Mining Initiative was part of an effort by the industry to restore investor confidence, to counter negative public perceptions, and to foster better relations with First Nations and other groups. As part of this broader strategic goal, the Mining Association (Peeling, 1998), also launched a publicity exercise, “Keep Mining in Canada”, which continues today under the slogan, “Mining Works for Canada”.

As with other developments throughout the past half century, the Canadian situation was not unique: similar difficulties confronted the world mining industry. At the 1999 World Economic Forum in Davos, nine mining CEOs, including those of Noranda and Placer Dome, decided to pursue what they termed the Global Mining Initiative.<sup>9</sup> Like

<sup>9</sup> For an excellent history of the Global Mining Initiative, see Luke Danielson, *Architecture for Change: An Account of the Mining, Minerals and Sustainable Development Project. History*, Berlin: Public Policy Institute, 2006, available online at [http://www.sdsg.org/wp-content/uploads/2010/02/Architecture-for-Change-MMSD\\_Full\\_Report1.pdf](http://www.sdsg.org/wp-content/uploads/2010/02/Architecture-for-Change-MMSD_Full_Report1.pdf)

the earlier project undertaken by the Mining Association of Canada, the Global Mining Initiative proceeded from the premise that the external environment was hostile to mining and that this called for a creative and diverse response from industry. A two year research project was launched, led by a co-founder of the Friends of the Earth, entitled, “Mining, Minerals and Sustainable Development”. This in turn formed a conference held in Toronto in May 2002, “Resourcing the Future”. Finally the Initiative created a coordinating body of corporate mining leaders, the International Council on Mining and Metals, whose work is ongoing. In part, this new body was a response to the increasingly globalized business world, as more and more countries welcomed new investment and liberalized their economies.

In Canada, the Mining Association of Canada launched another initiative in 2004, “Towards Sustainable Mining”. Explicitly embracing the definition of sustainable development devised by the 1987 Brundtland report, *Our Common Future*, the new initiative attracted considerable attention, receiving the Globe Industry Association Award for Environmental Performance in 2005. In accepting the award, the Mining Association’s president acknowledged that the industry had lost public trust (Mining Association of Canada, 2005):

*“We knew we had to improve our performance and put in place an initiative like TSM to regain that social license to operate while we continued to contribute to this country’s economic prosperity.”*

As it happened, members of parliament were scrutinizing the practises of Canadian mining companies at precisely the same time, in the spring of 2005.

Specifically, the House of Commons’ Subcommittee on Human Rights and International Development (a subcommittee of the Standing Committee on Foreign Affairs and International Trade) examined the actions of a Canadian mining company operating in the Philippines, although it also looked at the more general issue of Canadian mining companies active in developing countries. The Standing Committee on Foreign Affairs and International Trade passed on the subcommittee’s report to the government of Canada with a request for “a comprehensive government response to this Report”. The government ultimately decided that the most appropriate way to handle the issue was to convene a series of meetings, the National Roundtables on Corporate Social Responsibility and the Canadian Extractive Industry in Developing Countries, which met in the second half of 2006. In March 2007 the advisory group that had been struck to track this process presented its report on the roundtables to the federal government.

Nearly two years later, and before the government had responded to the advisory group’s report, a private member’s bill was introduced in the House of Commons. Although it was defeated, the bill articulated many of the recommendations of the 2007 advisory group’s report. The official response from the federal government came in

March 2009, entitled, *“Building the Canadian Advantage: A Corporate Social Responsibility (CSR) Strategy for the Canadian International Extractive Sector”*. Criticised by some for its refusal to adopt mandatory compliance, the government nonetheless established an Extractive Sector CSR Counsellor whose mandate is “to review CSR practices of Canadian companies operating outside of Canada, and to advise stakeholders on the implementation of ... the OECD Guidelines for Multinational Enterprises, ... the International Finance Corporation’s Performance Standards, the Voluntary Principles on Security and Human Rights and the Global Reporting Initiative”.<sup>10</sup> In addition, a Centre for Excellence in CSR is being developed by CIM as a web-based resource.

The need to act, and be seen to act, as socially responsible businesses was not only an overseas venture, as the Whitehorse Mining Initiative had acknowledged. In the past two decades, mining companies operating in Canada have made much greater effort to negotiate respectful agreements with First Nations and to ensure that mines provide significant and realistic employment opportunities for local people. (A recent Mining Association of Canada document reported that there are currently over fifty impact benefit agreements in place).

On the environmental front, the initiatives continue. In 2009, for example, cabinet ministers from the federal, territorial and provincial governments agreed to adopt a Pan-Canadian Green Mining Initiative and to this end created the Green Mining Initiative Task Group. At the time of writing the work of this group appears to be confined to creating a document that identifies, “government-funded green mining research and innovation programs and activities ... that are related to the four broad GMI themes: Footprint Reduction, Innovation in Waste Management, Mine closure and rehabilitation and Ecosystem Risk Management”, National Resources Canada (2010). Aligning the practices of mining and metallurgy so that they reflect a real commitment to corporate social responsibility will in all likelihood continue to change the face of the industry.

## Conclusion

The past half century has seen the development of impressive new metallurgical processes, notable examples include flash smelting, reactor and bath smelting, solvent extraction/electrowinning, as well as numerous other proprietary processes, although perhaps the changes that the industry itself has undergone are the more significant. Most of the dominant corporate players in 1961 no longer exist. This process is not without its drawbacks, as an American government study pointed out in the Committee on Technologies for the Mining Industry (2002):

<sup>10</sup> For the official website from which this quotation is drawn, see [http://www.international.gc.ca/csr\\_counsellor-conseiller\\_rse/About\\_us-A\\_propos\\_du\\_bureau.aspx](http://www.international.gc.ca/csr_counsellor-conseiller_rse/About_us-A_propos_du_bureau.aspx)

*“Through mergers and acquisitions, the number of [mining] companies has decreased, and foreign ownership has increased. The search for economies of scale has also intensified. Mines now employ fewer people per unit of output, and operators are eager to adopt new technologies to increase their efficiency; which benefits customers and reduces the cost of products. Because metal mines have no control over commodity prices, their prevailing philosophy to survive is that they must cut costs. As a result, most domestic metal mining companies have largely done away with in-house research and development, and many are reluctant to invest in technology development for which there is no immediate need.”*

Commentators have identified the same process at work in Canada (Yudelman, 2006).

The industry consensus that informs such creative strategies as the Whitehorse Mining Initiative would have been unimaginable fifty years ago, as incomprehensible in its way as those phrases listed in the introduction to this chapter (“environmental impact assessment”, and so on). In addition, Canada now plays a far more significant role as a provider of mining finance: the Toronto and Vancouver exchanges supply much of the capital for mining exploration and development around the globe. Indeed, today’s far greater ease of movement of capital, commodities and entrepreneurs is striking, making it difficult to ascribe national labels to particular companies or mining activity. (Is a company owned by a majority of British investors operating in Canada, Canadian? Is a company owned by American capital but based in Canada and operating in Africa, Canadian?)

The complexities of the mining world will not diminish in the next half century; if anything, the world will become an even more challenging place for resource companies to function successfully. It is a fact that our ability to provide our children and grandchildren with productive and creative lives will rest in part on our ability to continue to produce the metals and materials that remain basic building blocks of so many of the commodities in daily use. This will be no easy task, but the record of the past fifty years, described in other chapters of this book, should encourage cautious optimism.

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