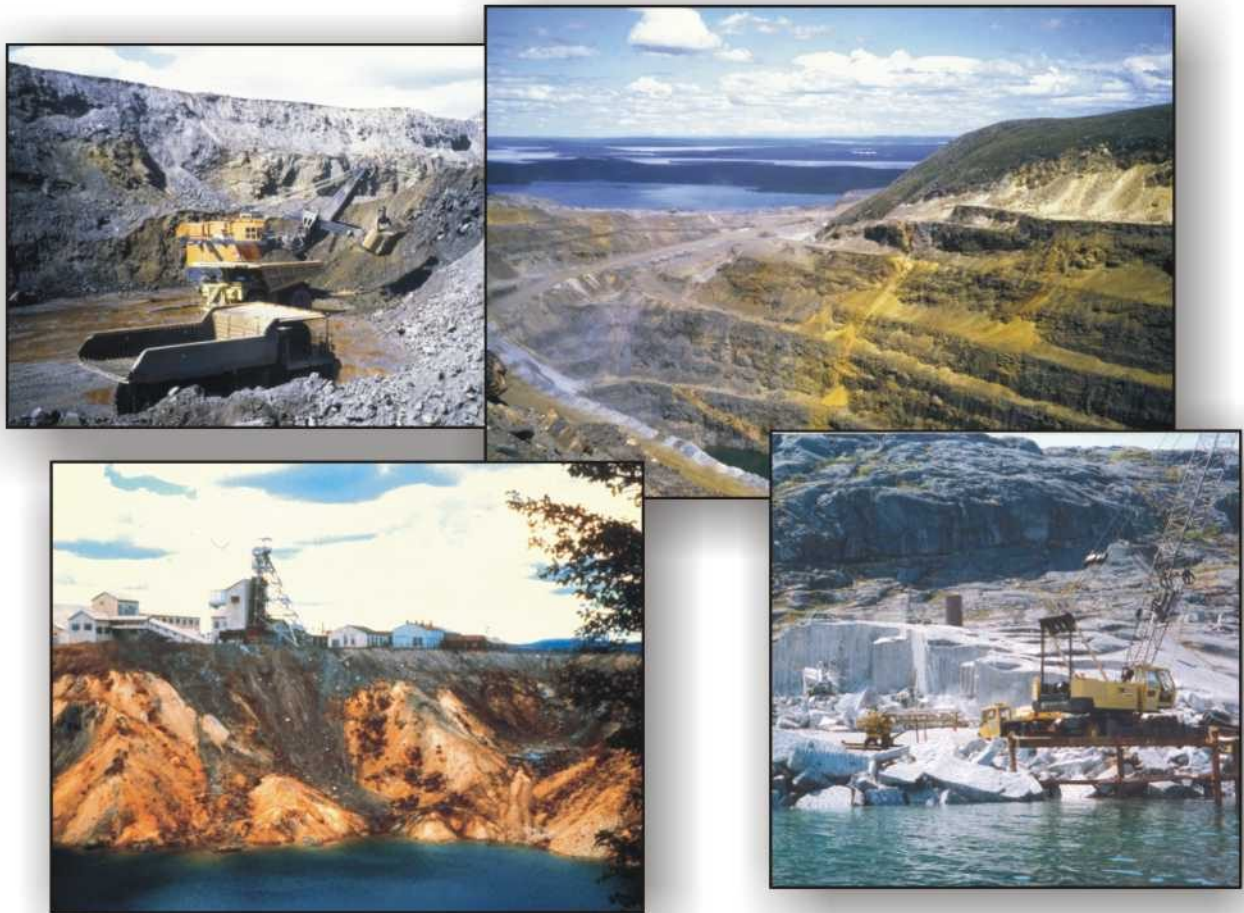




GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR
Department of Natural Resources
Geological Survey

THE MINERAL INDUSTRY IN NEWFOUNDLAND AND LABRADOR: ITS DEVELOPMENT AND ECONOMIC CONTRIBUTIONS



R.J. Wardle

Open File NFLD/2889

St. John's, Newfoundland
October, 2004

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REMARKS

This document presents a brief overview of the economic development and current status of the Newfoundland and Labrador minerals industry, including its exploration sector. It is a non-technical document with an emphasis on the review of statistical data, many of which have not been previously compiled in an easily accessible format. The first part reviews the history of mining and mineral policy in the province; followed by a presentation on the modern mining scene. This is followed by an examination of the historical trends in the gross value of mineral production, mineral taxation, and employment in the province. Finally, the last section examines the provincial historical trends in the mineral exploration sector.

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SUMMARY

This document presents a brief overview of the economic development and present-day status of the Newfoundland and Labrador minerals industry, including its exploration sector. It is a mostly non-technical document that has an emphasis on the review of statistical data, much of which have not been previously compiled in an easily accessible format. Details of mining history are discussed, where appropriate, but the document does not attempt to provide a comprehensive account of the mining industry in Newfoundland and Labrador.

Mining is the process of extracting minerals from the earth. The industry has long been a vital component in the development of nations and has made significant historical contributions to the development of Newfoundland and, in particular, Labrador. This Province has a long history of mining that on a small scale extends back to pre-historic times but which, in a modern sense, commenced with the discovery and extraction of copper in the 1860s. This ushered in the first mining boom in what has proved to be a cyclical history of boom and recession. The period 1860-1900 was dominated by a surge in copper production in Notre Dame Bay and also by the discovery of the Wabana iron deposits of Bell Island. This was then followed by a prolonged period of quiescence lasting until the late 1940s, punctuated only by the widely spaced discoveries of the Aguathuna (limestone), Buchans (base metals) and St. Lawrence (fluorite) deposits. Buchans was the stellar discovery of the period and experienced rapid growth even through the Great Depression and Second World War. The end of the Second World War in 1945 was followed by the greatest mining boom in the Province's history. This saw a series of discoveries and mine openings that lasted until ca. 1970, with perhaps the greatest achievement being the development of the western Labrador iron mines at Schefferville¹ (Knob Lake), Labrador City and Wabush. Significant discoveries also occurred in Newfoundland resulting in important mines such as Baie Verte (asbestos) and Rambler (base metals).

In contrast, the following period of 1970 to 1990 marked a decline in mining activity that saw the closure of many operations that represented the heart of the Province's mining industry. Two of the more important closures were Buchans and Schefferville. The period 1990 to present has seen a gradual recovery in activity, notably a renaissance in the dimension-stone industry and most importantly, the discovery of the Voisey's Bay nickel-copper-cobalt deposit. This latter major discovery is presently scheduled to enter production in 2005 and promises to revitalize the provincial mining industry.

Government policy with respect to the mining industry has evolved considerably. Policy in the pre-confederation era was driven principally by the need to open up the interior of Newfoundland and provide economic development. Therefore, mining was seen very much as a frontier activity that would create jobs and provide infrastructure, and where direct financial benefits through taxation and royalties was a secondary consideration. Regulation of the industry began in the 1860s, and provided for the staking of claims as well as the awarding of mineral rights through fee simple grants. In the early half of the 20th century, particularly in the period that followed the installation of the Commission of Government in 1934 (during which Newfoundland reverted to British colonial administration), a growing tendency emerged to award mineral rights by special agreement – the so-called concession system. This system was based upon the award of large tracts of land to selected companies or individuals for extended periods of time; the rationale being that this was the most effective manner in which to attract the exploration and development capital required to mount large-scale, prolonged exploration surveys in remote regions. Following confederation with Canada in 1949, Newfoundland regained control of its mineral resources and began a systematic effort to promote its mineral potential to take advantage of the surging post-war demand

¹The operation was originally referred to as Knob Lake but later became based on the town of Schefferville on the Québec side of the Québec/Labrador border and became more commonly known under that name. Schefferville is therefore used in this report but with the understanding that for the most part it only refers to production from the Labrador part of the operation. Production was approximately equal from both sides of the border.

for such resources. This post-war period was characterized by almost exclusive use of the concession system. Many significant discoveries were made under this system and all, including the landmark iron ore developments in western Labrador, came into production under the terms of special agreements that also determined the level of government royalties. Royalties, however, continued to be a secondary consideration after jobs and development. By the 1970s, the merits of the concession system were being questioned on the basis of the meager royalties that it generated and the perception that the Province was becoming under-explored in comparison with other areas of Canada. A series of reforms in the mid-1970s drastically overhauled the mineral tenure system and replaced the concession system with one based upon the competitive claim staking that had become the norm elsewhere in Canada. Measures were also brought in to encourage concession holders to surrender land so that it could be explored under the new regime. Concomitant changes were also made to the mining tax legislation to provide for increased royalties, however, these only applied to operations that came on stream after 1978. This revised legislative framework has survived more or less intact to the present day. Modifications in ca. 1995, prompted in large part by the Voisey's Bay discovery of 1994, focused on ensuring that a greater degree of primary processing takes place in the Province, and on dealing with the mineral-resource aspects of aboriginal land claims. A growing focus on resource management issues and the need to provide for adequate closure and rehabilitation measures have also driven increased regulation of the mining industry, notably through the Mining Act of 1999.

In 2003, the mining sector in Newfoundland and Labrador consisted of 12 operations, three of which are metal mines, seven are industrial-mineral operations and three are dimension-stone operations. The major metallic mining operations are the iron ore mines of the Iron Ore Company of Canada and Wabush Mines in western Labrador. The only other metallic mining operation is the small Hammer Down gold mine operated by Richmond Mines Inc. in northeastern Newfoundland. The industrial-mineral operations are dominated by limestone, dolomite and dimension stone, and lesser amounts of peat, silica and gypsum. The largest industrial-mineral operation is that of Atlantic Minerals Ltd. at Lower Cove, which produces high-purity limestone and dolomite for export. Construction materials such as sand, gravel and aggregate stone are also a significant part of the industry but are dispersed as a number of small quarrying operations across the Province and service a mostly domestic market. The dimension-stone industry has seen considerable growth over the last decade and produces slate and 'granite' (including a variety of different rock types).

Also, there are some significant undeveloped deposits that may see production in the near to medium term. The most significant of these, is the Voisey's Bay nickel-copper-cobalt deposit of Labrador which is scheduled to enter production in 2005. The Duck Pond base-metal deposit of central Newfoundland is also being considered for production. Other undeveloped resources include the Strange Lake yttrium-zirconium deposit of northern Labrador, and a number of small gold, base-metal and industrial-mineral deposits in Newfoundland. Most of these will require either higher commodity prices or additions to their mineral resource bases to become economic.

Mining brings benefits to the Province through shareholder profits, taxes, wages, and the spin-off gains that accrue from local employment and purchasing. Measures of the contribution of the industry that are examined here include the Gross Value of Mineral Production – a measure of the sales revenue that is received for each mineral commodity produced in the Province; taxation returns, and wage and employment levels. Some recent (ca. 2003) key statistics for the industry are:

- Mining in 2001 accounted for 8% of the Gross Domestic Product of the provincial goods-producing sector and 3% of the overall Gross Domestic Product of the Province.
- Mining in the Province employs about 2500 persons at an average wage of \$66 000, based upon 1999 wage data.
- The Province currently produces almost 6% of the total gross value of mineral shipments in Canada and ranks 6th in terms of other provinces and territories.

- *The Province is the leading producer of iron ore in Canada, accounting for 63% of Canadian iron ore production, and 2% of world production.*
- *When the Voisey's Bay nickel deposit enters production ca. 2005, the Province will probably be the second largest supplier of nickel in Canada, yielding 30 to 34% of total Canadian production.*

The Gross Value of Mineral Production is examined from the start of records in 1867 to the present. Between 1867 and 1945 the industry was characterized by highly cyclical activity that was disrupted by the economic upheavals associated with two world wars and the intervening Great Depression. Pronounced growth in the gross value of production followed the Second World War and lasted almost unabated until 1979, at which point it began a steep cyclical decline that has lasted to the present day. Mineral production up until the 1960s was fairly diversified but has since become progressively dominated by iron ore with this product presently accounting for 91% of mineral production. Of the remainder, 3% consists of gold production and 6% of non-metals, chiefly the construction materials (sand, gravel, and aggregate stone), dimension stone and dolomite. In recent years, the main growth in the non-metals area has been in crushed rock aggregate, dolomite and dimension-stone production.

The extent of the change in the gross value of production is reflected in the fact that the historical peak production value achieved in 1979 was \$2700 million, in constant year-2000 Canadian dollars, compared to a current value of around \$800 million. In constant-dollar terms, present-day production is only at early 1960s levels. The reason for this pronounced decline is thought to be a combination of mine closures (e.g., Buchans and Schefferville), coupled with a steep decline in the constant-dollar price of iron ore and most metals. These price declines were driven by global trends, chiefly the emergence of new sources of cheaper minerals, technological changes that drove down the cost of production, and oversupply. The Province's iron-ore industry suffered in particular from the impact of cheap new production from offshore competitors (notably Brazil) in its principal market areas of the United States and Europe.

The gross value of the Province's historical mineral production has been further examined in terms of the contributions of individual mining operations. The overall value of production from each operation has been calculated in year-2000 US dollars using historical commodity prices. Pertinent facts that emerge from this analysis are:

- *89% of the value of the Province's historical mineral production has been provided by four operations: Labrador City, Schefferville, Wabush and Buchans.*
- *One operation (Labrador City) has contributed 46% of the total value of production.*
- *Iron-ore operations (Wabana, Schefferville, Labrador City and Wabush) have accounted for 75% of the total value of mineral production.*
- *The historical total gross value of mineral production from 1867 to present is estimated at around US\$54,000 million year-2000 dollars.*

This underscores the message from elsewhere in the world that it is the few, very large deposits that contribute the bulk of the value of mineral production; a global rule of thumb (e.g., Singer, 1995) being that the top 10% of deposits are estimated to contain between 50 and 80% of the total reserves for the most commonly used metal ores. After the four large provincial operations noted above, the next highest contributor was Wabana, which provided 3% of the total.

A further analysis considers the hypothetical impact of the Voisey's Bay project when it comes on stream in 2005. Based on present day price forecasts and mining of the 32-million-tonne ovoid deposit, this will increase the 2002 gross value of mineral production by ca. 85%, and thus restore

it to a ca. 1984 level. The overall value in-situ² of the Voisey's Bay deposit at this level appears comparable to that of the Buchans, Wabush and Schefferville operations but is easily exceeded by the gross production value to date of the Iron Ore Company of Canada's Labrador City operation.

Similar analysis indicates that the Province's major mining projects also compare favourably in terms of their gross value of production with the predicted gross in-situ value of the Hibernia and Terra Nova offshore-oil projects; in fact the value produced to date by the Labrador City iron ore operation exceeds the predicted value of the in-situ recoverable reserves of each oil project.

An analysis of taxation revenues examines Mining Tax and Royalty payments as well other taxes that are applied to the mining sector. Mining Tax and Royalties consist of tax paid under the Mining and Mineral Rights Tax Act, and royalties paid under a number of long-standing private acts, particularly in the iron-ore industry. Revenue to the Province from these sources has increased from an average value of about \$10 million in the 1949-76 period, to an average level of about \$25 million in the 1985-2002 period. When looked at as a percentage of the gross value of mineral production (GVMP), this translates to an increase from an average value of 1% of GVMP in the former period to 2.5% of GVMP in the latter - an overall increase of about 150%. This increase was primarily due to the impact of the Mining and Mineral Rights Tax Act of 1975 on the private royalties paid by the iron-ore industry, and to a lesser extent to new mining operations, such as Daniel's Harbour, that came on stream under the Act.

Other taxation revenue (corporate, fuel, retail sales, municipal and sundry taxes), for which data are only available for the 1990-98 period, exceeded Mining Tax and Royalties revenue by a factor of four and averaged 8.7% of the gross value of mineral production. Total taxation revenue amounted to 11% of the gross value of mineral production during the 1990-98 period.

Employment in the mining industry appears to have been roughly correlated with the gross value of mineral production, rising from 3500 in 1949 to a peak of around 7000 ca. 1970 (perhaps rising even higher at the time of peak mineral production in the late 1970s to mid 1980s – a period for which data are unavailable), followed by a steady decline to a present level of about 2500. Current employment levels are the lowest in the province's mining history. Metallic mining (mostly iron ore) has accounted for 81% of employment in the provincial mining industry over the past decade.

In contrast to the decline in employment, average wages have shown a consistent increase since 1949, even when adjusted to constant dollar values. The 1999 average annual wage of around \$66 000 (the most recent data available) was reputedly one of the highest in the provincial resource sector. Since the late 1980s, average wages have continued to increase strongly in the face of declining employment, probably as the result of increased technical specialization and higher skill requirements in the industry.

The final section of this document examines the exploration sector, which is the vital forerunner to mining development and is an essential component of a healthy and sustainable industry. The measures of exploration activity examined are exploration expenditures, claim staking activity and amount of diamond drilling carried out. Records for these activities extend back to 1945, however, expenditure figures may not be fully representative of overall provincial activity for the pre-1981 period. Prior to 1981, much land was held under the concession system and exploration activity tended to be under-reported. Exploration expenditures have been strongly cyclical, showing peaks in the late 1950s-60s, late 1980s and mid 1990s corresponding to periods of high metal prices and new discoveries, and intervening lows that generally correlate with downturns or recessions. The boom of the late 1950s-early 1960s was sparked by demand for steel and the result of exploration for iron ore in western Labrador. This peaked at expenditure levels of \$100 million

²In-situ value as used here refers to the theoretical value of a reserve that is still completely or largely in place in the ground. Obviously, this value is based on long-term price assumptions and differs from a realized production value.

(year-2000 dollars). The mid-1980s peak was driven by gold exploration (aided by a program of federal flow-through share incentives) and focused predominantly on the Island of Newfoundland. The Hope Brook gold mine resulted from this phase, as did some smaller discoveries that have since become mines (e.g., Nugget Pond and Hammer Down). The mid-1990s phase was prompted originally by diamond exploration but switched rapidly to nickel following the serendipitous discovery of the Voisey's Bay deposit in northern Labrador. The exploration surge following this discovery resulted in another expenditure peak of \$100 million dollars (year-2000 Canadian dollars) in 1996. This was followed by the most recent cycle, which has been a downturn that apparently bottomed in 1999-2000. Expenditures are now increasing and the current level of \$42 million is above the historical average of \$35 million (in year-2000 dollars). This mimics national exploration trends, although it should be noted that much of the expenditure has been directed toward the Voisey's Bay project in Labrador.

Claim staking and diamond drilling activity have generally followed the expenditure patterns. The Voisey's Bay discovery resulted in record claim staking activity, and in drilling activity that equaled that of the mid-1980s boom. Claim staking and diamond drilling now appear to be increasing following a cyclical low in 1999-2001.

At a national level, the Province has accounted for an average of 6% of total Canadian exploration expenditures over the 1989-2001 period and has ranked 6th highest amongst the provinces and territories. In terms of the ratio of exploration expenditure to value of production, the Province ranks 4th highest in Canada. Therefore by national standards at least, the Province seems to be doing comparatively well at attracting exploration dollars in proportion to the size of its mining industry. It is also to be expected that the development of the Voisey's Bay project will result in a further rise in provincial exploration expenditures, as may the renewed gold exploration in insular Newfoundland.

The purpose of exploration is to sustain the industry through the discovery of new orebodies. A brief examination of the state of the Province's reserves and resources indicates that for the vital iron-ore operations, these are sufficient for the foreseeable future – provided that present technological and economic requirements do not change. Significant new resources have been discovered for nickel, cobalt and copper, the Voisey's Bay deposit having more than replaced the copper produced from the Province to date. On the downside, however, resources for zinc, lead, gold and silver are in significant decline and exploration has failed to replace those consumed through mining. Industrial-mineral and construction-material resources for operations currently in production are adequate for the foreseeable future. Increased production in this sector will probably depend more on market improvements than additional discoveries.

In conclusion, the mining industry of Newfoundland and Labrador has changed significantly over the years, moving from a well-diversified state prior to 1960, to one presently overwhelmingly dominated by iron ore. An analysis of the gross-production value of the industry indicates that 90% has come from four mines; Buchans (base metals) and Schefferville, Wabush and Labrador City (iron ore). The existence of this "big four" reinforces the message derived from elsewhere in the world that it is the few, very large mineral deposits that make by far the greatest contribution to provincial and national economies. This is not to decry the value of other smaller operations but their benefits are orders of magnitudes lower and have likely been more significant at the regional rather than provincial level. The industry grew to its heyday in the late 1970s but then entered a prolonged decline that has lasted in a cyclical fashion to the present day. This decline has been driven by global economic forces that have affected the Canadian mining industry as a whole and have been beyond the Province's ability to control. The decline will be offset to a considerable degree by the Voisey's Bay mine, which when it enters production in 2005, has the capacity to increase the present gross value of production by 85%. A further bright note is that the average industry wage continues to increase despite falling employment levels, indicating a trend to a smaller but more highly paid workforce. Exploration activity appears to be emerging from the latest cyclical downturn at a strong level.

INTRODUCTION

The mineral industry has had a profound effect on the economic development of Newfoundland and Labrador. In addition to its substantial contributions to the provincial treasury, the industry has been the principal agent of growth in several regions of the Province. For example, late 19th century copper mining in the Notre Dame Bay area spearheaded the drive to construct the trans-Newfoundland railroad and thus connect the scattered settlements of the former colony for the first time. Subsequent 20th century developments led to the growth of Baie Verte, Wabana, Springdale and Buchans as towns that depended heavily, if not exclusively, on mining. Perhaps the greatest impact of mining, though, was in the mid 20th century drive to open up and develop Labrador. The result of this was the establishment of the Wabush–Labrador City area as one of the Province’s main industrial centres. When the Voisey’s Bay project enters production in 2005, it will revitalize the Province’s mineral production and have a significant impact on economic development.

This document presents a brief overview of the economic development and present-day status of the Newfoundland and Labrador minerals industry, including its exploration sector. It is a relatively non-technical review that is intended to provide a factual analysis of the historical development of the industry and its mineral production. The emphasis throughout is on review of statistical data, many of which have not been previously compiled into an easily accessible format. Details of mining history are discussed where appropriate and a comprehensive account of the mining industry in Newfoundland and Labrador has been more than adequately accomplished in other publications (e.g., Martin, 1983). The findings for the most part are self evident. Analysis is provided where appropriate but it is not the purpose of this document to comment or make recommendations on industry or government policy. The raw statistical data are presented in Appendix 4 in both tabular and spreadsheet (MS Excel 2000; *see* CD-ROM enclosed) format.

This paper first examines the history of mining and mineral policy in the Province followed by a review of the modern day mining scene. It then examines the economic benefits that the province derives from mining, namely through the gross value of production, the revenues that accrue to various levels of government through taxes and royalties, and employment. Finally, it examines the exploration sector, which is vital to the sustainable development of mining in the Province.

Mines and Mineral Deposits – The Importance of Size

Mining is the process of extracting and processing minerals from a mineral deposit. A mineral deposit is a mineral

concentration that is generally defined by its size (commonly expressed in millions of tonnes) and grade (the degree to which the deposit is enriched in the desired mineral or element). When a mineral deposit is proven to have sufficient tonnage and grade that it can be mined at a profit, it is then referred to as an orebody or ore reserve.

An important point is that mineral deposits are not created equally – they exist in all combinations of grade and size. As a result, of the many mineral deposits that have been found in Newfoundland and Labrador, only a few have proven rich or large enough to be mined. It is also one of the under-appreciated aspects of mineral deposits that their value is very much concentrated in the larger deposits of the so-called giant or world-class type. These are usually defined as the top 10% of deposits on a global basis in terms of the amount of metal that they contain, and are estimated to contain between 50 and 80% of the most commonly used metal ores. Thus, a relatively small number of deposits have an entirely disproportionate influence on metal supply and profitability. These large deposits have sustained production for many decades, even exceeding a century in some cases. The wealth that they have generated has built substantial communities and in many cases has provided the impetus for the growth of entire regions and states. Australia for example owes much of its early growth to giant base-metal and gold discoveries; South Africa grew on the basis of world-class diamond and gold discoveries, and Ontario benefitted enormously from the nickel deposits of the Sudbury area. World-class deposits are also known as company-builders in the sense that their discovery has formed the basis for the growth of many of the world’s leading mining companies (e.g., Rio Tinto, BHP-Billiton, Inco). Understandably, therefore, giant or world-class deposits are intensely sought after by the world’s mining community.

Newfoundland and Labrador has been fortunate to possess at least one mineral operation that is clearly world-class, namely the Labrador City–Wabush iron-ore mining complex (also including its cross-border extension in the Fermont area of Québec and the now-closed Schefferville operations). This area of Labrador–Québec is the premier source of iron in Canada and ranks as a global asset. Also, the Province has had another very valuable, arguably world-class, group of deposits at Buchans in central Newfoundland. These produced base metals and closed in the mid 1980s. As will be demonstrated elsewhere, these four deposits (or deposit areas to be correct because each site includes multiple deposits), namely Labrador City, Wabush, Schefferville and Buchans collectively account for about 90% of the historical value of mineral production from the Province, reinforcing, in a local fashion, the message that it is the very large deposits that really matter. Another world-class deposit at Voisey’s Bay was discovered in the mid 1990s and is scheduled for production in 2005.

A SHORT HISTORY OF MINING IN NEWFOUNDLAND AND LABRADOR

Early Days

The record of pre-confederation (pre-1949) mining in Newfoundland has been compiled by Martin (1983) and Snelgrove (1938) and most of the following is summarized from that account, supplemented for post-confederation years by information from Snelgrove and Baird (1953), Gibbons and Mercer (1982) and unpublished records of the *Department of Mines and Energy. The locations of historically significant mining operations are illustrated in Figure 1.

The first record of mining in the Province was in Pre-historic times, commencing about 4000 years ago, when the Maritime Archaic Indians mined chert from northern Labrador, and the Dorset Eskimos quarried soapstone from deposits near Baie Verte on the Island of Newfoundland. Both cultures developed extensive coastal trading networks that, at least in part, depended upon these minerals. There is also evidence that the Vikings, who settled in northeastern Newfoundland ca. 1000 A.D., mined bog iron ore near their settlement at L'Anse aux Meadows. The potential mineral resources of Newfoundland were noted by early European settlers in the 16th and 17th centuries; however, it was not until the mid 19th century that the first attempts at mining for commercial purposes were made. A number of ventures commenced between 1855 and 1860 around the Avalon Peninsula and Notre Dame Bay areas, the most notable being the La Manche lead mine, which managed some intermittent production until final closure in 1873. The first commercially successful venture was the Tilt Cove copper mine in Notre Dame Bay, which commenced production in 1864. This ushered in the Newfoundland copper boom, which peaked in the 1880s and finally expired in 1913. This period saw the development of several successful mines in the Notre Dame Bay area, notably Little Bay, Betts Cove and Pilley's Island and a host of smaller short-lived operations. During this time, Newfoundland was for a while the sixth largest producer of copper in the world. Most of the copper was shipped to smelters in Swansea, Wales, however, several of the mines established local smelting operations with varying degrees of success – and pollution. The wane of the copper boom was determined partly by poor management – many mines were subject to high-grading during market lows – but also by competition from new and cheaper sources of copper from large open-pit resources in Spain, the southwest USA and South America. A plunge in copper prices following World War I provided the coup de grace to the Newfoundland industry. An interesting sidebar to the copper boom was the development of the Sops Arm (Browning) and Goldenville mines (1900-06) in the Baie Verte area. Although short-lived,

these mines were Newfoundland's first experience with gold mining, something that would not attract attention again until the 1980s.

Just as the copper boom was waning, a new mining industry sprang to life with the discovery of iron ore on Bell Island. Although this resource had been noted in the early 19th century, it was not until 1892 that the full potential was realized. The discovery led to the development of the Wabana mining operations by the Scotia Company in 1894, joined later by the Dominion Company. These companies merged in 1921 as the British Empire Steel Corporation (BESCO), which in 1930 came under the control of the Dominion Steel and Coal Company (DOSCO). Throughout their lives, these mines shipped primarily to the Cape Breton steel plants but also periodically to European markets, notably Germany where re-armament was underway, in the years leading up to World War II. Their life began to decline following the war when huge new resources were discovered in Labrador, but also when steel-making plants began to demand ore with lower phosphorous contents, and when higher grades of iron ore were becoming internationally available. As a result, production declined and the operation finally closed in 1966. In addition to iron ore, the Cape Breton steel plants also required a plentiful supply of limestone for use as a flux. The limestone was initially supplied from Cape Breton but in 1913 the Dominion Company commenced development of the Aguathuna quarry on the west coast of Newfoundland. This finally closed in 1967 due to the discovery of more proximal limestone resources in Cape Breton.

Although dominated by copper and iron, the early days of mining also included a number of ventures in what are today termed industrial and construction minerals. The quarrying of roofing slate near Trinity, ca. 1860, started an industry that was to last until 1910. Also, brick manufacturing commenced in the Trinity area in 1866, starting a small industry that was to supply the domestic market intermittently until 1999. Limestone quarries were also developed at Cobbs Arm, Notre Dame Bay, as early as 1882 and provided a long-term source of supply of lime for agricultural and industrial uses that lasted until 1966.

The construction of the Newfoundland railway in 1897, prompted in large part by the need to connect the Avalon Peninsula with the mining developments of Notre Dame Bay, finally opened the interior of the Island to resource exploration. Initial interest focused on the timber potential, however, this soon spread to minerals. Coal was discovered in western Newfoundland and was worked sporadically but with little success until 1929. Railway construction also required the opening of a number of stone quarries across the

* Now Department of Natural Resources.

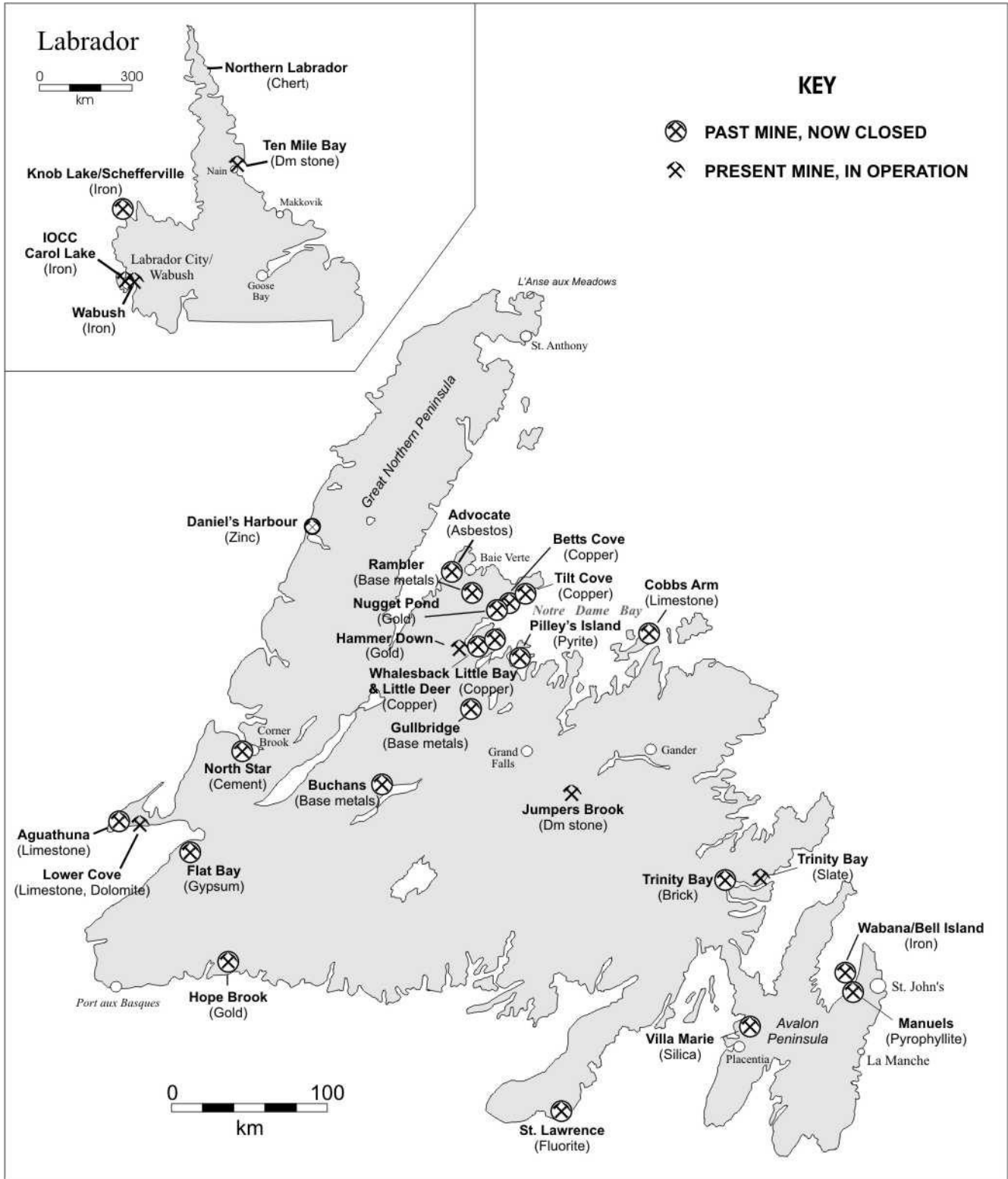


Figure 1. Past and present mining operations of Newfoundland and Labrador.

Island and these also temporarily became a source of building stone across Newfoundland. However, the most significant result of the opening of the interior was the discovery in 1905 of copper, lead and zinc mineralization at what was to become the Buchans mine site. The complexity of the Buchans ore prevented its development until the late 1920s, when additional ore was discovered and when the American Smelting and Refining Company (ASARCO) developed a new processing technique for the complex ores. As a result, mining was able to commence in 1928 and lasted without interruption until the ore bodies were exhausted and the mines closed in 1984.

Modern Mining

The late 19th century was a period of great technological change in the industry. Prior to 1860, mining was a difficult and dangerous activity that relied on hand drilling, black powder explosives, candles or safety lamps for illumination, and either men or horses for haulage. Ore processing consisted of hand picking the highest grade pieces prior to smelting; a tedious and labour-intensive process that prevented mining of anything but high-grade ore. The period 1860 to 1900 saw the development of compressed air tools for drilling, the invention of dynamite, the introduction of electrification for use in both haulage and illumination, and the development of mechanical crushing and milling methods. Collectively these transformed mining into an industry capable of developing large, lower grade deposits that in previous decades would have been uneconomic. Commensurate advances were also made in exploration technology. The introduction of diamond drilling in the late 1800s and the development of early geophysical techniques in the 1920s meant that it was now possible to prospect for commercial deposits without the laborious necessity of sinking shafts.

The Buchans mines were able to benefit from many of these advances and proved to be some of the most profitable in the Province's history. The discovery of new ore bodies ca. 1925 also resulted from one of the first uses of electrical geophysical prospecting, heralding the introduction of a technique that still dominates exploration technology for base metals.

The onset of the Great Depression in the early 1930s proved a traumatic time for Newfoundland, resulting in a request to the British Government that it resume administration of the former colony. The resulting Commission of Government was established in 1934 and lasted until Confederation with Canada in 1949. Mining, together with all other industries was hard hit during this period. Wabana, Aguathuna and Buchans were the only mines able to survive the Depression, Wabana being the most hard hit and reduced almost to bankruptcy. However, in the midst of the crisis, in

1933, a new mining operation came into being at St. Lawrence on the south coast of Newfoundland. This was based upon the production of fluorite and led to the creation of two mining operations by the St. Lawrence Corporation and the American Newfoundland Fluorspar Corporation. The latter was later sold to the Aluminum Company of Canada (ALCAN), which eventually acquired the assets of both mining operations and used the fluorspar mostly as a flux in aluminum smelting. Increasing competition from cheaper Mexican ore eventually led to closure in 1978. Despite a brief and unsuccessful attempt to resume mining in the mid 1980s, the deposits have remained inactive.

The end of the Second World War saw an enormous increase in the demand for metals and minerals and resulted in a new boom in exploration and mine development. At the forefront of this effort was the expansion of exploration into Labrador. Hitherto, this was a remote and largely unknown region, however, the advances in aviation technology resulting from World War II now offered a cost-effective means of opening up this huge area. Initial interest had started in 1936 when the Newfoundland Government granted a concession to the Labrador Mining and Exploration (LME) company to begin its investigation of the iron deposits that had been reported by early explorers in western Labrador. Labrador Mining and Exploration was acquired in 1942 by Hollinger Consolidated Gold Mines Ltd., with minority participation by the M.A. Hanna Company of Cleveland, a prominent US iron mining company. It, together with its sister company in Québec, the Hollinger North Shore Exploration company, proceeded to explore the concession area and rapidly identified major iron ore resources in the Knob Lake (now Schefferville) area. Development proceeded rapidly following the end of the war and saw the construction, starting in 1950, of a 588 km-long railway from Sept-Île on the Gulf of St. Lawrence, to Schefferville on the Québec-Labrador border. Mining commenced in 1954 under the control of the Iron Ore Company of Canada (IOCC), a private company owned by a number of US and Canadian steel companies, including the M.A. Hanna corporation, and operating on LME leases. By 1958, four mines were in production and numerous other potential deposits identified. Production continued until the early 1980s but then declined, when the growing use of electric open-hearth furnaces for steelmaking forced the market away from the direct-shipping ores of the Knob Lake deposits toward higher quality ores suitable for concentration and pelletizing. As a result, the operation was closed in 1983. At around the same time that the Knob Lake area was being developed, LME also began investigating discoveries of iron ore in southwest Labrador. These led to the development of the Carol Lake mining project by IOCC and the construction of the town of Labrador City in 1961, followed by production in 1962. Simultaneously, the Canadian Javelin Company, operating on a concession granted to the

Newfoundland and Labrador Company Ltd. (NALCO), developed the Wabush iron mining project on deposits to the southwest of those found by IOCC. This led to construction of the townsite of Wabush and to production in 1965. The Wabush operation was financed by several US and Canadian steel companies and following several changes in ownership is today owned by the Cleveland-Cliffs Company of the USA and Stelco Incorporated and Dofasco Incorporated of Canada. Both the Wabush and IOCC (Labrador City) operations have remained in production, more or less without interruption, to the present day.

The Island part of the Province also saw renewed activity in the post-Second World War period. An increase in the price of copper led to re-activation of the Tilt Cove and Little Bay mines between 1957 and 1969, this time using modern bulk-mining techniques to extract previously uneconomic, low-grade ore, and also to the development of the short-lived Whalesback, Gullbridge and Little Deer mines (1965-1974). These were all located in the area of northeastern Newfoundland that had supported the 19th century copper boom (Figure 1). However, the most important discovery of this time was that of the Rambler copper-lead-zinc deposits near Baie Verte. These were brought into production by Consolidated Rambler Mines Ltd. in 1964 and lasted until 1982. The 1960s also saw the discovery of the Daniel's Harbour zinc deposit on the west coast of Newfoundland, a deposit that entered production in 1975 under the control of Newfoundland Zinc Mines Ltd., and that closed following exhaustion in 1990.

The post-Second World War boom of the 1950s and 1960s also saw an expansion in the development of industrial minerals in the Province. This commenced with developments based upon the limestone-hosted resources of western Newfoundland. The Flat Bay gypsum mine (1951-1994) was opened, initially under Government control (the Atlantic Gypsum Company), but later under the ownership of Flintkote Canada to supply material for wallboard construction. The operation was later sold to Domtar Inc. in 1987 and although officially closed in the same year, resumed production from 1988 to 1994. A similar government-sponsored venture in 1952 created the North Star cement company based upon shale and limestone quarries in the Corner Brook area. This operation was later privatized and did not close until 2000 when changes in market demand rendered it uneconomic. In 1963, the Baie Verte asbestos mine was established in northeastern Newfoundland. Owned initially by Advocate Mines and then Baie Verte Mines Ltd., this remained in production until the early 1980s, when it began to experience difficulties in the face of declining market demand, and finally closed in 1987 after several further changes of ownership. In 1957, Newfoundland Minerals (a division of Armstrong world Industries) developed the pyro-

phyllite mine at Manuels on the Avalon Peninsula and shipped the product to the United States for use in production of ceramic tiles. The mine closed in 1996 following a decision by a new owner to switch to talc as the base for its tile making. Finally, in 1968 the Villa Marie silica mine operated by the Dunville Mining Company opened to supply raw silica to the ERCO phosphorous plant at Long Harbour, south-east Newfoundland. The operation was phased out in 1988 following closure of the phosphorous plant.

In contrast, the following decades of the 1970s and early 1980s were marked by the progressive closure of many prominent operations that unfortunately were not replaced with sufficient new discoveries. Exploration did, however, continue. The energy crisis of the early 1970s sparked a renewed international interest in uranium as a fuel mineral and it was exploration for this commodity that dominated the period. Limited success was achieved in Labrador where two small but potentially economic deposits were identified in the Makkovik area, however, the collapse of prices following the Three Mile Island accident in the US and the recession of the early 1980s forestalled their development.

The 1980s were introduced by a surge in the price of gold, sparked in part at least by the inflationary excesses of the previous decade. This gold renaissance produced a spate of exploration that although driven initially by high gold prices, was also given considerable impetus by federal exploration tax credits related to flow-through shares, and by the increasing amount of land coming open for claim staking (*see* section, The Development of Provincial Mineral Policy). Newfoundland, which until that time had few recorded gold occurrences, benefitted considerably from this period of exploration. The first success was the discovery of the Hope Brook deposit on the south coast of the Island by BP Minerals. This deposit entered production in 1987 but closed in 1991 due to production problems and lower gold prices. The operation was resumed by Royal Oak Mines Ltd. in 1992 and lasted until its exhaustion in 1997. The gold exploration boom of the 1980s also resulted in the discovery of numerous small gold deposits in northeastern Newfoundland. Although insufficiently large to be of interest at the time, two of these deposits at Nugget Pond and Hammer Down later became mines. The same period of exploration also saw the discovery of the Duck Pond base-metal deposit, a potential future mine.

Industrial minerals had declined in importance since the 1960s but a new interest began to appear in 1990 with the development of a limestone aggregate operation at Lower Cove in western Newfoundland. This operation was later taken over by Atlantic Minerals Ltd., which changed the focus of production to high-purity limestone and dolomite, chiefly for use in the iron and steel industry, and has maintained production to this date.

The 1990s was a decade of globalization following the collapse of the Soviet Union and the spread of democratic government into many parts of the third world. The result was a huge diversification of investment by the major international mining companies into areas previously deemed to have too high a political risk. South America was the primary beneficiary of this change, whereas Canada began to experience a net decline in the level of major company exploration. It was thus left to the junior exploration sector to assume the leadership in many areas of the country, including Newfoundland. The decline was partially offset by the 1991 discovery of diamonds in the Northwest Territories; the first commercial discovery of this mineral in Canada. This landmark discovery fueled a surge of exploration activity that rolled across the country, eventually reaching Newfoundland and Labrador where a small company called Archean Resources managed to attract sufficient funding to mount a diamond exploration program in Labrador. The result was the serendipitous discovery of the Voisey's Bay nickel-copper-cobalt discovery in 1994, which in turn generated its own exploration boom. This boom, which peaked in 1996, resulted in a huge staking rush in Labrador and a peak exploration expenditure level of \$93 million. The deposit was later acquired by Inco Ltd. but development was delayed by protracted discussions with the Province over issues related to primary processing. Following an agreement between these parties in 2002, the deposit is now scheduled for production in 2005.

Elsewhere in the Province, a previous gold discovery at Nugget Pond in northeastern Newfoundland was brought into production by Richmond Mines in 1997. This small mine proved remarkably successful in the face of the steep decline in gold prices that took place in the 1990s and following exhaustion in 2001 was replaced by a new mine at the nearby Hammer Down deposit.

A side-benefit of the Voisey's Bay boom was the development of a Newfoundland-based junior-exploration company sector that has since been remarkably successful in generating exploration projects. After the Voisey's Bay boom subsided, junior exploration companies focused their attention on central Newfoundland, where the breakup of one of the last surviving concession areas (*see* section, The Development of Provincial Mineral Policy) enabled the junior sector to acquire mineral licenses in the region that had given rise to the Buchans mines. At the time of writing it is likely that one of these deposits in this area – the Duck Pond deposit – will come into production in the near future. This was originally discovered by Noranda in 1987, was acquired by Thundermin Resources Incorporated and then sold to Aur Resources Inc. who, as of late 2003, are considering a development decision. Junior exploration has since broadened to

include most areas of the Province and has resulted in the discovery of new mineralization.

Overshadowed during the 1990s by the Voisey's Bay discovery and the ensuing controversy over its development, was a renaissance in the Province's dimension-stone industry. This commenced in 1992, when Newfoundland Slate Incorporated resurrected the slate industry in the Trinity Bay area (previously exploited in the late 19th century) with production of roofing slate for shipment to Europe and the northeastern US. The operation subsequently closed but production has been resumed by the Hurley Slateworks Company. In 1993, the Ten Mile Bay anorthosite quarry near Nain, northern Labrador, was developed by Torngat Ujanganniavingit Corporation (a subsidiary of the Labrador Inuit Development Corporation). This high-value product has been largely exported to Italy for finishing and re-export. These operations were joined in 1996 by the International Granite Company, which began producing black granite for use in the monument industry from its Jumpers Brook quarry in central Newfoundland. Several other small quarries have been opened across the Island and efforts are underway to expand the industry.

Summary – A Cyclical History

Figures 2, 3 and 4 summarize the mining history of the Province. Figure 2 depicts the historical development of mine development, each bar corresponding to the life of an individual mining operation. Figures 3 and 4 look at the same data but in terms of the number of mine openings and closings per decade, and the number of mines in operation per decade respectively. Appendix 4A summarizes the operational history of Provincial mining operations. From Figures 2, 3 and 4, it is evident that mine development was highly cyclical, consisting of booms and intervening lows. Figure 4 also correlates these cycles with the major socio-economic upheavals of the period 1860-2002, namely the two world wars, the depression and the post-World War II boom. The first boom cycle in the period 1860 to 1900 was marked by a spate of early mines focused mostly on copper in the Notre Dame Bay area ("copper boom", Figure 4), but also included the Wabana iron-ore discovery. The number of mines that opened and closed in this period (Figures 2 and 3) may appear understated to those familiar with the mining history of Notre Dame Bay; however, this is due to the fact that many of the smaller "mines" were in reality test exploration projects, since actual mining was the only practical method at the time of exploring a deposit, and did not result in significant commercial production. The period 1900-1910 saw an increased number of mine closings and marked the end of the Newfoundland copper boom.

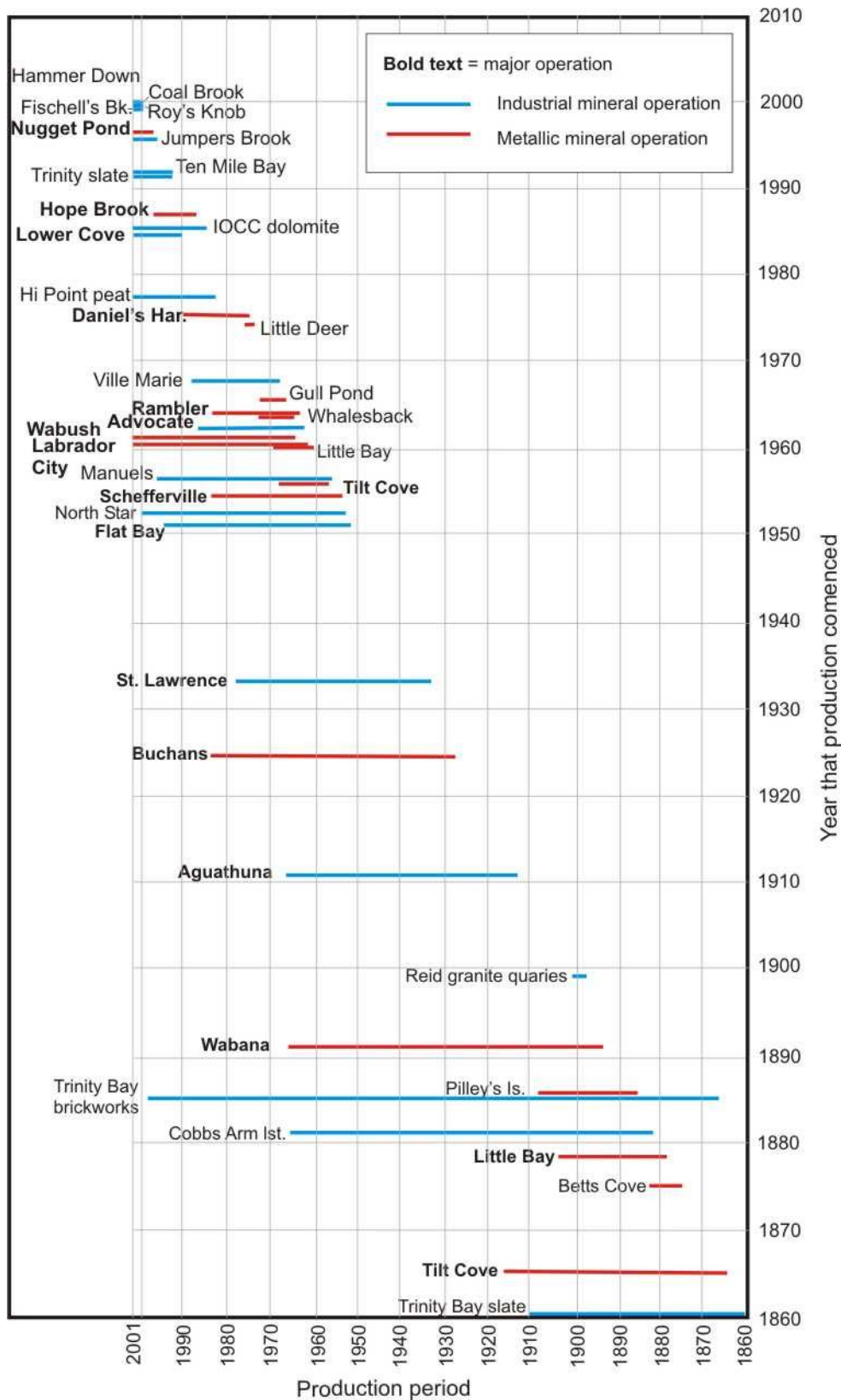


Figure 2. Historical development of mining in Newfoundland and Labrador, 1860 to 2001 (Source Appendix 4A).

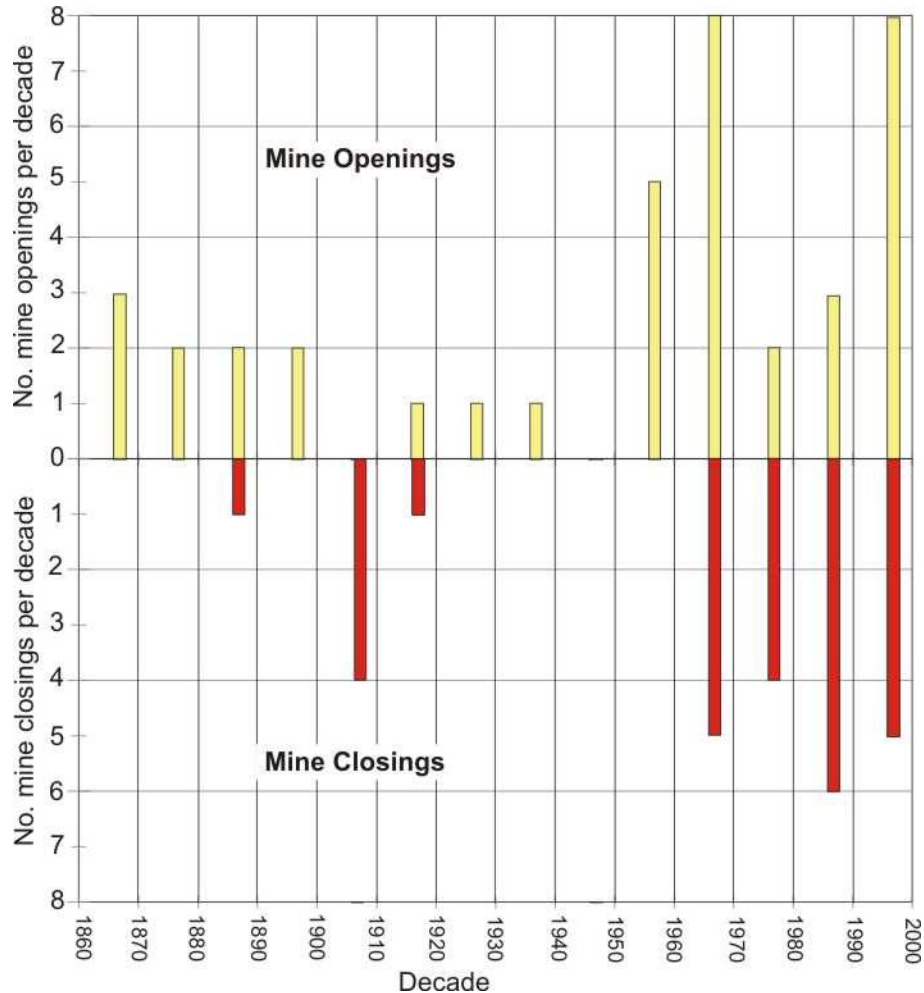


Figure 3. Summary of the number of mine openings and closings per decade (Source Appendix 4A).

The following interval 1910 to 1950 was a low in the mining cycle (Figure 4), punctuated only by the widely spaced development of the Aguathuna, Buchans and St. Lawrence deposits. The lack of activity during this period was probably due to the depression and the ensuing Second World War (Figure 4), both of which served to depress global trade in metals and minerals. The inactivity may also have been aided by the government policy of the time which perhaps did not provide sufficient focus on the mining potential of the Province (*see* section, The Development of Provincial Mineral Policy). The period of 1950-1970 that followed the Second World War introduced the second boom cycle and saw the mining industry in Newfoundland experience its greatest surge. This was undoubtedly driven primarily by post-war reconstruction and ensuing industrial expansion, and the rising metal prices that accompanied these forces. However, a determined effort by the fledgling Province to promote its opportunities to the international mining industry

may also have contributed strongly. This was the time of new base-metal, iron-ore and industrial mineral developments and the period when the number of mines in operation reached its peak (Figure 3). Without doubt the most significant developments of this period were those of the iron ore industry in western Labrador. This industry grew steadily in magnitude to a peak ca. 1980 and, despite the closure of the Schefferville operations and a subsequent decline in the overall level of production (*see* section, The Present-day Mining Industry in Newfoundland and Labrador), continues to dominate provincial mineral production. The boom in new mine openings was to some extent offset by a number of closings in the 1960-1970 period, testament to the short-lived nature of some of the operations of this period.

The following two decades of 1970 to 1990 saw the end of the boom and an acceleration in the number of mine closings as opposed to openings (Figure 3). The result was a

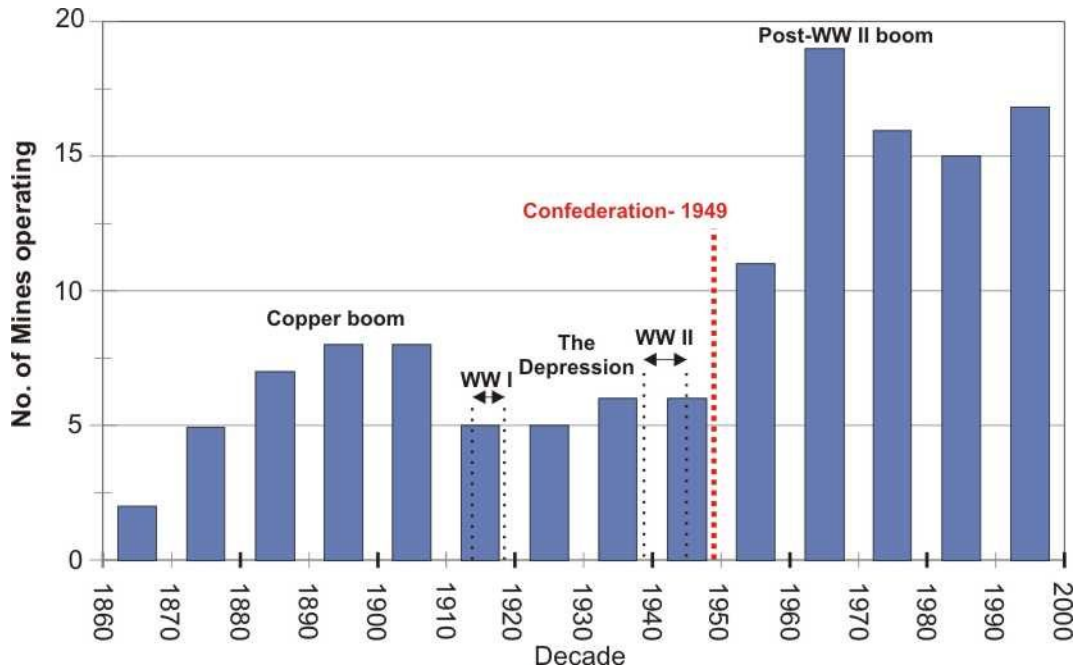


Figure 4. Number of mines in operation per decade in Newfoundland and Labrador (Source Appendix 4A). Note that some mines may only have operated for part of a decade.

steady decrease in the number of mines in operation (Figure 4), a trend that continues to the present day. This was the period of increased volatility during which many operations that had represented the heart of Newfoundland mining, e.g., Aguathuna, Buchans, Baie Verte, Rambler, Schefferville, St. Lawrence and Wabana, closed. The ensuing period 1991 to 2000 saw a partial resurgence in mine openings dominated by gold, industrial minerals and dimension stone (Figure 4), however, this only marginally exceeded the number of closings (Figure 3). Not apparent from Figures 2, 3 or 4, is the fact that in recent decades new “mines” (many of which are dimension-stone quarry operations) have been characterized by a trend toward smaller operations of lower overall production value – a trend that hopefully will be changed by development of the Voisey’s Bay project. These matters are more fully discussed later.

THE DEVELOPMENT OF PROVINCIAL MINERAL POLICY

The Pre-confederation Period, 1800 to 1949

Information on this period has been taken largely from Johnston (1973). The government was initially slow to recognize the potential for mining development, and early mineral rights generally involved special government grants that were usually given in perpetuity. It was not until the Newfoundland copper boom of the 1860s that systematic

efforts were made to produce a uniform code for the administration of mineral rights. Highlights of this period were:

- 1860 - The first mining law was proclaimed providing for granting of mineral title in Fee Simple for a period of 999 (*sic*) years and on condition of a 2.5% royalty to the Crown. The Fee Simple provision meant essentially that ownership of the mineral rights was vested in the holder of the property.
- 1864 - Prompted by a surge of mining activity, the Newfoundland Government inaugurated the Geological Survey of Newfoundland to commence geological studies of the Island and its mineral potential.
- 1880 - The first Crown Lands Act was proclaimed, followed by a revised version in 1884. This provided for staking of 40-acre claims, a size that remained more or less constant through subsequent legislative development. Claims could be converted to a fee-simple status after expenditure of \$6000.
- 1891 - Following widespread abuse and patronage in the awarding of mineral rights, the Newfoundland Government reformed the Crown Lands Act to enhance prospectors rights.

1893 - The Reid Newfoundland Company was granted all rights to minerals, water, timber and land in Fee Simple over 4100 square miles of land along the course of the Newfoundland railway.

1905 - The Anglo-Newfoundland Development Company was granted a 99-year lease to 2000 square miles of timber, minerals and land in central Newfoundland. Although timber was the prime initial interest, this lease led to the discovery in that year of the first of the Buchans base-metals deposits. The Pulp and Paper Act of that year also set a 5% net profits royalty on mineral revenue.

ca. 1910 - The Newfoundland Government passed a number of acts designed to preserve copper smelting in northeast Newfoundland – with little success. At the same time, a number of special acts were proclaimed providing exclusive access to minerals, including coal in western Newfoundland and, more importantly, a grant to the Dominion Steel and Coal company for rights to the Wabana iron deposits. This heralded a growing tendency over the coming years to award mineral rights by special acts of the legislature rather than through the Crown Lands Act.

1913 - The Geological Survey of Newfoundland was disbanded at a time when the copper boom was in decline and interest in mining was waning.

1934 - As a result of the Great Depression, a Commission of Government was established in response to the economic collapse of Newfoundland and its reversion to British rule. The Commission's rule was noted for its austerity, however, it did revive the Geological Survey of Newfoundland and begin a series of detailed geological investigations.

1936 - An Act Relating to Small Concessions for the Development of the Natural Resources of Labrador was passed that removed all Labrador lands from the Crown Lands Act and provided the basis for granting of mineral rights by special agreement – the basis of the so-called concession system that was to dominate Newfoundland's mineral tenure system for the next 40 years.

1938 - The Labrador Mining and Exploration Company obtained a seven-year concession to 22 000 square miles, including water and mineral rights, in western Labrador, acquired from an earlier option granted to Weaver Minerals of Montreal.

This led to the discovery of significant iron-ore resources that later formed the basis for the Knob Lake/Schefferville mining operation.

Mineral policy in the pre-confederation period was driven by the need to open up the interior of Newfoundland and provide economic development. During this time, Newfoundland was essentially a collection of isolated coastal communities linked primarily by sea and later in part by the trans-Newfoundland railway. The prime expectation of mining was that it would create jobs and provide infrastructure in remote regions. These expectations were not unique to Newfoundland; mining at this time being typically regarded as a means of frontier development throughout North America. Direct financial benefits to the Newfoundland Government through royalties were generally a secondary consideration. The initial methods of granting mineral rights were based on the claim-staking system then in use in most parts of North America, with the option of in some cases of converting these claims to fee-simple awards. Toward the end of the period, during the Commission of Government's rule, a growing tendency emerged to grant mineral rights by special agreement in the form of concessions – a tendency that was to accelerate in the coming years.

The Post-confederation Period, 1949 to 1972

Following the Second World War, the world entered a period of prolonged economic expansion that, as discussed in the previous section, dramatically increased the demand for mineral resources. Highlights of this period (Johnston, 1973) were:

1949 - Newfoundland joined Canada in confederation and regained responsibility for the administration and development of its mineral resources. This was followed by the granting of more concession agreements. The Geological Survey of Canada also took over the geological mapping of the new Province, the Geological Survey of Newfoundland being relegated to a minor role.

1951 - The Crown Lands (Mines and Quarries) Act, modeled after Québec legislation of the time, was proclaimed. Amongst other changes, this gave Government the right to negotiate exclusive mineral exploration agreements with individuals and corporations. In theory at least, the act also continued to permit the staking of claims either as individual claims or as blocks. In the same year, the Newfoundland and Labrador Corporation (NALCO) was formed as a crown entity responsible for exploration on concessions totaling 21 000 square miles.

Concessions were also granted to Frobisher Ltd. in Labrador, and to Falconbridge Ltd. for parts of Newfoundland.

1952 - The Undeveloped Mineral Areas Act was declared giving the provincial government the right to take over mineral properties deemed not to have been explored within the preceding 10 years.

1953 - The British Newfoundland Company Ltd. (BRINCO) was granted rights to water, minerals and land over 60 000 square miles in Newfoundland and Labrador. Although numerous mineral discoveries were made, the only producing mine to emerge from the concession was the short-lived Whalesback mine in the Notre Dame Bay area. The major benefit of the concession proved to be the rights to water in the Labrador part of the concession. These eventually led to the Churchill Falls Power development of the early 1970s.

1954-1973 - Numerous smaller concessions were granted under a series of special agreements that varied considerably in the nature of the rights granted and tenure. A trend in the later agreements was to require better reporting of exploration work and to restrict the rights to minerals, as opposed to all surface and subsurface resources. Many earlier concession agreements were renewed and extended during this period.

The 1949-1972 period was characterized by the overwhelming use of the concession system such that within four years of confederation, 77% of the total area of the Province and 99% of its best mineral lands lay under the control of eight major corporations. Most of the concession agreements were negotiated through the Premier's office, the Department of Mines being relegated largely to the role of observer. The role of the Department of Mines was further reduced by the assumption that the exploration companies were performing most of the basic geological mapping and technical work on the concession areas, and that the Geological Survey of Canada was performing the remaining regional work. To some extent this was correct, however, the quality and quantity of work performed by the exploration companies varied considerably and not all was reported to the Province. The Geological Survey of Canada also began to limit itself to regional mapping at the 1:250 000 scale thus leaving many areas of the Province unmapped at more detailed scales.

The successes and drawbacks of the concession system have been argued over the years with perhaps no clear con-

sensus. Clearly the system did result in significant resources being brought into production, e.g., the Buchans base-metal deposits, the Labrador iron-ore mines, the Baie Verte asbestos deposit, west coast gypsum, the reactivation of the Notre Dame Bay copper mines and the Manuels pyrophyllite mine. It was also argued that only large international companies had the resources to explore the vast inaccessible regions of the Provinces's interior, particularly Labrador, and that special rights and incentives were required to attract and reward them for doing this. In the early years this was probably a sensible argument, however, as time passed it became apparent that many concession owners were content to focus on the small parts of their properties where the potential for development was high, and to largely ignore the remainder. As a result, huge areas of land became fallow and exempt from competitive exploration. In contrast, during this period the remainder of Canada moved away from the concession system towards one of more universal access based on claim staking. The advantage of the claim system from the government-policy perspective was that it provided exploration companies with access to smaller areas of land for shorter periods of time and, through the use of escalating expenditure requirements, forced a periodic turnover of land. This allowed mineral properties to be acquired by successive owners each of whom might bring new capital and new ideas, thus increasing the chances of eventual economic discovery.

The Period 1972 to 1993

In 1972, the Newfoundland Government changed hands and a major re-thinking of minerals policy began. This sprang largely from misgivings concerning the concession system and a suspicion that the Province was falling behind the rest of Canada in its ability to attract mineral exploration and to benefit from its development. A number of major studies were launched, the most noteworthy being a Royal Commission on Mineral Revenue (Goundrey, 1974) and a report by the Study Group on Mining (McKillop *et al.*, 1973). A significant contribution to the Study Group on Mining report was a specific report on mineral land tenure by Johnston (1973). Collectively these studies recommended a complete overhaul of the Province's approach to mining and mineral exploration based upon the following conclusions:

- The concession system of mineral land tenure was outdated and should be replaced by a more competitive one based upon claim staking.
- In order to free land up so that it could be more effectively explored, some means of encouraging concession holders to surrender land was required.
- The previous fiscal policy, which had focused on mining principally as a method of opening the frontier and of

creating employment, should be overhauled in order to obtain fair market value for the Province's mineral products and to enhance government revenue. At the time it was estimated that Government collected only 1.13% of the gross value of mineral production. As an example, the two highest value producers, the Iron Ore Company of Canada and Asarco (Buchans) paid only a 5% profit-based tax. Other operations paid a 5% tax on net income. It was suggested that many of the more profitable operations could have afforded much higher taxes in the order of at least 10%.

- The Mines Department was grossly underfunded in comparison to other resource departments, particularly when the value of mining to the economy was considered. It was recommended that government increase the department's regulatory capacity and in particular its geoscience capacity. The latter was deemed necessary in order for the Province to catch up with other parts of Canada, which had benefitted from much higher levels of geoscience investment.

As a result, a number of reforms took place that dramatically revised the Province's mineral policies:

- 1971 - The first of a series of Federal-Provincial funding agreements was announced providing for increased levels of mineral commodity studies. These agreements were expanded in 1974 and 1976 to provide for a broad spectrum of geoscientific and commodity studies lasting until 1996, when the federal government curtailed its funding involvement in such programs.
- 1975 - A new Mining and Mineral Rights Tax Act was proclaimed that levied a profit-based 15% tax on mining companies and a 20% tax on any private royalties paid by these companies. However, the Act only applied to operations that came into production under the Mineral Act. Existing operations continued to be taxed under the terms of their original special acts. However, an important exception applied to private royalties, which, regardless of their antiquity, were taxed under the 20% provision of the new act.
- 1976 - A new Mineral Act was proclaimed. This used claim-staking as the basis for mineral land tenure and provided a system of escalating expenditure requirements designed to encourage companies to surrender ground once the initial exploration work had been done. The Act also provided for rigorous reporting of work done on mineral properties. The use of the Mining Lease as the preferred form of advanced title was continued from earlier acts.

1977 - The Quarry Materials Act was proclaimed giving separate treatment to quarry materials such as sand, gravel, aggregate, dimension stone and peat. These materials were previously included with minerals in the Crown Lands (Mines and Quarries) Act

1978 - The Minerals Holdings Impost Act was proclaimed requiring holders of mineral rights obtained prior to the declaration of the Mineral Act to either perform work on their lands or to pay an escalating per-hectare tax. The objective of the Act was to encourage the surrender of land so that it became available for claim-staking.

The proclamation of the Mineral Act, the Mineral Holdings Impost Act and the Mining and Mineral Rights Tax Act implemented most of the reforms advocated by the various studies of the early 1970s. It took time, though, for this legislation to take full effect. The new legislation was effective in promoting a rapid surrender of concession land. Whereas in 1970 only 10% of crown land was available for claim staking, by 1981, 87% had become available and at the present day 99.5% is available. The only concession lands that remain today are small parts of the Labrador Mining and Exploration Company concession in western Labrador, most of which persist as mining leases; several relicts of the Reid Newfoundland and Anglo-Newfoundland Development Company corporation lands in central Newfoundland; and some small fee-simple areas. However, many of the most prospective mineral areas were only slowly released; the concession holders preferring to explore these lands and thus offset the Mineral Holdings Impost Act tax rather than surrender them. For example, the old Anglo-Newfoundland Development Corporation lands in central Newfoundland – arguably some of the most valuable in the Province – were passed by a series of private agreements to a number of successor companies and were not fully surrendered until the late 1990s.

The recommendations to increase the budget of the Department of Mines and Energy were eventually implemented with the assistance of a number of federal-provincial funding agreements between 1971 and 1996. These allowed the Province to achieve detailed geoscientific coverage of most of its lands by the end of this funding period, although not to the levels existing in neighboring provinces.

Government was less successful in its intent to increase taxation revenue from mining. Although the new Mining and Mineral Rights Tax Act considerably increased the tax rate (to 15%), it did not override the previous special acts that governed most of the Province's mineral revenue at the time. Relatively few new mines have come into operation under the Act, thus a large part of the Province's mineral industry,

most of it consisting of the western Labrador iron-ore operations, has continued to be taxed under these original special agreements. The Mining and Mineral Rights Tax Act does, however, apply to private royalties paid by these companies and helps offset the lower taxation rates of the special acts. When the Voisey's Bay operation enters production in 2005, it will be the first large mining operation to come fully under the terms of the Act.

Recent Developments, 1993 to Present

Highlights of this period were:

- 1993 - The Federal Government, as part of fiscal restraint measures, announced its intent to wind-down minerals-funding agreements with the provinces. The result was a marked decrease in the level of geoscientific work carried out by the Newfoundland Geological Survey, particularly in Labrador.
- 1994 - The Mining and Minerals Rights Tax Act was revised to allow a 10-year corporate income tax credit (tax holiday) for new mines as an incentive to mineral development. This came at the time of an economic downturn and was prompted by the perceived need to encourage more mineral investment in the Province.
- 1994 - The Voisey's Bay nickel-copper-cobalt discovery initiated a surge of exploration activity in Labrador and prompted Government to re-examine its policy regarding taxation and primary processing
- 1998 - The Mineral Act was revised to reinforce conditions in the Act that required primary processing (such as smelting and refining) of minerals to take place in the Province unless it was demonstrably economically unfeasible to do so. Cabinet was given the authority to decide whether companies should be exempted from the these conditions of the Act.
- 1998 - A new Quarry Materials Act with increased enforcement provisions was declared. The Act also redefined quarry materials to exclude dimension stone, which instead came under the control of the Mineral Act. However, the new definition did not apply to Labrador where dimension stone continued to be treated as a quarry material.
- 1999 - A new Mining Act was proclaimed requiring that companies must submit development, annual operating, and rehabilitation and closure plans. The Act also required provision of financial assurance in order to allow government to rehabilitate the mine site in cases of bankruptcy or default by the owner.

1999 - An Agreement-in-Principle was reached with the Labrador Inuit Association regarding their claim to aboriginal rights and lands in northern Labrador. The agreement, when ratified in its final form (expected in 2004), will give the Labrador Inuit preferential rights over 28 000 square miles of land and ownership of 6100 square miles within that area. They will receive a share of revenues and benefits from mineral operations and will have approval rights over exploration on their lands.

2002 - A final agreement was reached between the Province and Inco Ltd. regarding the development of the Voisey's Bay mining project in mid 2002. This agreement committed Inco to primary processing of nickel concentrate in the Province, once it had evaluated the most suitable technology for doing so, and resolved a dispute that had delayed development since 1998. Inco also reached agreements with the Innu Nation and Labrador Inuit Association regarding provision of benefits to aboriginal communities. This was a new development for mining operations in the Province, which in the past had never been required to address aboriginal claims.

2002 - The Mining and Mineral Rights Tax Act was amended to cap the corporate income tax credit.

A prominent development of the 1990s was the increased focus on environmental and aboriginal land claims issues. Environmental pressures forced revisions to the Minerals Act requiring better conduct of exploration projects and were also instrumental in the development of the Mining Act as the means to deal with the problem of abandoned mines and their environmental legacy; notably through the requirement for filing of rehabilitation and closure plans. This was given impetus by concern over the abandoned Hope Brook mine and its potential for environmental damage. Aboriginal land claims have focused on mineral resources in Labrador, largely as a result of the Voisey's Bay discovery and the expectation of revenues from this development. The agreements of 2002 in relation to the Voisey's Bay project guaranteed the Labrador Inuit Association and the Innu Nation a share of the benefits from this project as well as a strong role in environmental monitoring of the project. A final and legally binding agreement on the Labrador Inuit land Claim is expected to be reached in 2004 and a similar agreement is being negotiated with the Innu Nation. These agreements in their final version will cede selected parts of Labrador as aboriginal-owned lands and will set out the means by which exploration and development will be conducted on these lands.

With respect to government activities, the withdrawal of federal funding from provincial geoscience in 1993 left the Province with a significant gap in its capacity to fund geoscience programs at previous levels. This, coupled with numerous reductions in the provincial budget, has led to a greatly diminished geoscience program that is funded at less than half of its mid-1980s levels.

THE PRESENT-DAY MINING INDUSTRY IN NEWFOUNDLAND AND LABRADOR

As of 2003, there were 12 producing operations in the Province, in addition to numerous seasonal sand and gravel operations. The producing operations are divided into metal, industrial mineral (including construction materials) and dimension-stone operations, and discussed in order of economic importance. Most of the material is taken from the periodic Department of Mines and Energy reviews of mining activity (Newfoundland and Labrador Department of Mines and Energy 2002 and updates). The location of the various operations is shown in Figure 5. Reserve and resource data are quoted where available, however, due to the historical nature of some of the information, they may not fully match the current National Instrument 43-101 standards for resource and reserve definition. It should also be noted that the production and reserve information becomes outdated very quickly. For updates see the Department of Mines and Energy web site at <http://www.gov.nl.ca/mines&en/>.

Producing Operations – Metals

1. Iron Ore Company of Canada (IOCC)

Annual production - 16.2 million tonnes of pellets and concentrate

Work force - 1450

Product - Iron oxide concentrate and pellets for shipment predominantly to US and European steel plants

This is by far the largest of the Province's mining operations and has been in production since 1962. It is based in Labrador City and is operated by IOCC on leases issued to the Labrador Mining and Exploration Company Ltd. The IOCC is owned by Rio Tinto Plc (59%), Mitsubishi Corporation (26%) and the Labrador Iron Ore Royalty Fund (15%). Mining is based upon two large open pits and feeds an on-site pellet plant. Concentrate and pellets are shipped via the 420-km Québec North Shore and Labrador (QNS&L) railway to the port of Sept-Île on the north shore of the St. Lawrence estuary. The mine has an overall annual production capacity of 35-38 million tonnes averaging 38% iron. Mill and concentrator capacity is 17.6 million tonnes of concentrate, of which 12.5 million tonnes can be pelletized.

The Iron Ore Company was originally developed as a wholly-owned subsidiary of a number of US and Canadian steel companies, however, in 1997 it was sold to North Company Ltd., which was in turn acquired by Rio Tinto plc in 2000. This company has indicated that it plans to continue with North's earlier \$1.1 billion capital investment program directed at expansion, growth and increased product diversity. Plans include; strategic replacement and upgrading of key assets, increased capacity, changes to processes, and an enhanced environmental program. As part of this investment program in 2000, IOCC continued with the construction of a new mine maintenance facility; a tailings management study; and the purchase of 15 new 255-tonne haulage trucks. Some of the additional concentrate was planned to be shipped to a reactivated pelletizer in Sept-Île, Québec, however, these plans were put on hold due to an unexpected downturn in markets during 2002.

Ore resources include 1.4 billion tonnes of proven and probable reserves, plus an additional 4.1 billion tonnes of indicated and inferred resources.

2. Wabush Mines (operated by Cleveland-Cliffs Incorporated, USA)

Annual production - 6.1 million tonnes of concentrate per year

Work force - 440

Product - Iron oxide concentrate for shipment to pelletizing plant

This is the second largest iron mining operation in the Province and began operations in 1965. It is based upon two open pits and a concentrating plant located near the townsite of Wabush (adjacent to Labrador City). The mine has an overall capacity of about 18 million tonnes of ore per year, from which up to 7 million tonnes of concentrate can be produced. The concentrate is shipped by the Québec North Shore and Labrador railway to a pelletizing plant and port at Pointe Noire on the north shore of the St. Lawrence estuary. The operation is managed by Cleveland-Cliffs, a major US iron-ore producer and part owner of the operation (26.8%). Other owners are Stelco Incorporated (44.6%) and Dofasco Incorporated (28.6%) of Canada. The operation mines ore at 36-38% iron, which is similar in grade to that at Labrador City but has the drawback of higher manganese levels. Plans have been considered for a manganese extraction plant, but are on hold. Ore reserves are reported to be in excess of 800 million tonnes but a detailed breakdown is not available.

3. Richmond Mines Incorporated

Annual production - 44 000 ounces

Work force - 85

Product - Gold bars

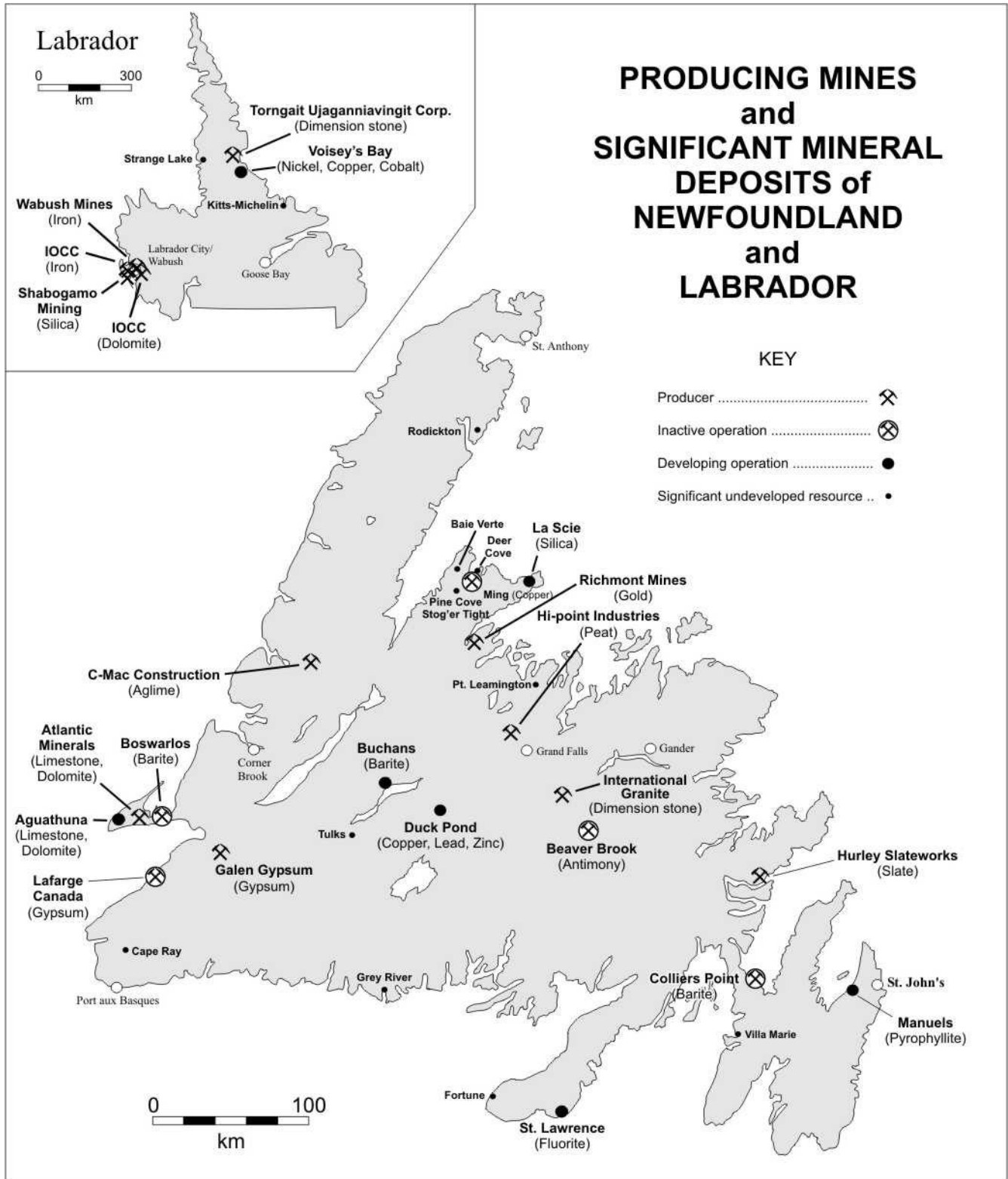


Figure 5. Location of current mining operations and significant mineral deposits in Newfoundland and Labrador.

Mining at Nugget Pond commenced in 1988 utilizing an underground operation. In 2001, the reserves at Nugget Pond were largely exhausted and production was shifted to the nearby Hammer Down deposit, which was exploited by initial open-pit mining and entered commercial underground production in 2001. At the present time this is the only remaining metal mining operation in the island part of the Province. As of November 2002, reserves at Hammer Down stood at 144 242 tonnes at a grade of 15.1 g/t. The ore is trucked to Nugget Pond mill for processing and should be sufficient to support operations until mid 2004.

Producing Operations – Industrial Minerals

4. Atlantic Minerals Limited

Annual production - 1.0 to 1.6 million tonnes

Work force - 95

Product - Crushed and sized limestone and dolomite for use in construction, iron ore pelletizing and steel-making

This is the largest industrial minerals operation in the Province and is located at Lower Cove on the Port au Port Peninsula, in western Newfoundland. Atlantic Minerals Ltd. acquired the property in 1995. The operation consists of three quarries, a 2-million-tonne per year processing plant and a deepwater ship-loading facility. Initial production by the original owner was of crushed limestone primarily for use as aggregate in construction, however, this has been largely switched to the production of high-purity limestone and dolomite for use in the iron and steel industry. The company continues, though, to export some limestone aggregate. A considerable amount of high-purity limestone is shipped to iron-ore companies in western Labrador and adjacent parts of Québec for use in the manufacture of fluxed pellets. Shipments for 2003 were forecast to be approximately 1.5 million tonnes. Remaining resources are estimated at one billion tonnes including 50 million tonnes of high-calcium limestone and 70 million tonnes of dolomite. The remainder is suitable for aggregate use.

5. Iron Ore Company of Canada

Annual production - about 300 000 tonnes

Work force - 17

Product - Dolomite for use in manufacture of iron-ore pellets

This operation is wholly owned by the Iron Ore Company of Canada, which uses it to supply dolomite for use in the manufacture of fluxed pellets at its Labrador City pelletizing plant. Production started in 1986 based on dolomite deposits on the east side of Wabush Lake. Current production comes from the Leila Wynne quarry.

6. C-Mac Construction Limited

Annual production - 4000 tonnes

Work force - 4 seasonal

Product - Agricultural lime

This small intermittent operation produces limestone for agricultural use (aglime) from a quarry located near Cormack in western Newfoundland. The product is currently supplied under a government aglime contract, however, the operation also supplies aglime and crushed rock to local markets.

7. Galen Gypsum Mines Limited

Annual production - about 70 000 tonnes

Work force - about 10, seasonal

Product - Gypsum for use in wallboard manufacturing

This small open-pit operation is located on the Coal Brook deposit near St George's Bay, western Newfoundland. The gypsum was initially used in cement manufacturing by North Star Cement Ltd. of Corner Brook, however, this ended with the closure of that operation in 2000. The operation currently supplies gypsum to Lafarge Canada for use in their wallboard manufacturing operation in Corner Brook. In 2002, the company supplied 60 000 tonnes to the plant and was forecast to do the same for 2003.

8. Hi-Point Peat Industries (1991) Limited

Annual production - Approximately \$1.0 million of products

Work force - 10 to 20

Product - Peat moss for horticultural and oil-absorbent use

There have been sporadic attempts to develop a peat mining industry in Newfoundland, the most successful of these being the current operation by Hi-Point Industries (1991) Ltd., which produces peat moss from bogs near Bishop's Falls in central Newfoundland. The project was originally conceived in the mid-1970s for fuel peat but evolved through several reorganizations to production of peat moss for horticultural and oil absorbency use. The oil-absorbent material is prepared on-site and marketed under the name Oclansorb. A new bog has been prepared for production near Gander. Total reserves are sufficient for at least 20 years.

9. Shabogamo Mining and Exploration Limited

Annual production - 60 000 to 80 000 tonnes

Work force - 15 - 20

Product - Lump silica for manufacture of silicon metal

This is a new open-pit operation in western Labrador that commenced production in 2000. The company mines high-purity quartzite near Labrador City and has shipped this via the QNS&L railway and Sept-Île port to Bécancour Inc. of Québec, which uses the material to manufacturer silicon metal. Shipments in 2003 are forecast to be worth \$1.8 million. The company has also made test shipments to Norwegian markets.

10. Miscellaneous companies

Annual production - 0.21 to 4.85 million tonnes
Work force - 280 to 350
Product - Sand, gravel and aggregate for construction use

Stone, including sand, gravel and aggregate, is produced either from surficial deposits or by crushing of bedrock from many quarries located throughout the Province. Most of this production is used within the Province for highway maintenance and for construction. Note that the above tonnage figure excludes limestone aggregate produced by the Lower Cove operation for construction use. Many of these quarrying operations are intermittent or seasonal in nature. Apart from Lower Cove, exports are limited.

Producing Operations – Dimension Stone

11. Torngait Ujaganniavingit Corp. (TUC)

Annual production - 2 200 m³ (forecast)
Work force - 35
Product - Large anorthosite blocks

TUC, a subsidiary of the Labrador Inuit Development Corporation (LIDC), commenced quarrying of anorthosite at its Ten Mile Bay quarry near Nain on the north Labrador coast in 1992. The anorthosite contains large labradorite crystals, with the striking blue iridescence that gives the rock its trademark name of “Labrador Blue-Eyes”. It is shipped as large blocks to Italy for further processing and resale. In 2001, a second quarry was opened at Igiak Bay, approximately 20 km south of Nain. The stone from this quarry contains larger, multi-coloured crystals and is marketed as “Arctic Rainbow”. A stone plant for processing smaller blocks has recently been set up at Ten Mile Bay and a similar plant at Hopedale, further south on the Labrador coast, is planned. These plants will process undersized material for various uses such as monuments, tile and tabletops.

12. International Granite Corporation

Annual production - 1150 m³
Work force - 20 to 30
Product - Gabbro dimension stone, primarily for monument use

This operation is based on quarries in the Mount Peyton (Jumpers Brook) area near Grand Falls, central Newfoundland. The operation, currently based on a quarry at Finger Pond, produces large blocks of gabbro (black granite) that are fed to a fabrication plant operated by Cabot Granite Fabricators Inc., which also imports some raw stone. The operation produces slabs, monument blanks, finished monuments, and architectural and landscaping products.

13. Hurley Slateworks Company

Annual production - 2000 to 4000 tonnes
Work force - 45
Product - Slate roofing tiles

This operation produces slate from a quarry at Nut Cove in eastern Newfoundland and uses the same rock formation that supported previous slate operations in this area as far back as 1860. Hurley Slateworks acquired the operation in 1999, following the bankruptcy of the previous owner and re-entered production, shipping 2400 tonnes of roofing slate to international markets before shutting down in August 2003. The company plans to resume slate production; purple and green slate is processed on site into roofing tile and exported to western European and US markets. Capacity is about 6000 tonnes per year.

Inactive Operations

Copper and accessory gold, were briefly produced by Ming Minerals between 1995 and 1996 from remaining material in the Ming West deposit of the old Rambler mining camp. This operation processed ore using the Rambler mill, which remains under care-and-maintenance for possible further use.

Barite has been produced intermittently in the Province, most recently by Phoenix Minerals in 1998-99, from small open-pit operations at Collier Point, Trinity Bay; and by Pennecon Ltd., who in 1999 produced 35 000 tonnes of barite and celestite from a quarry at Boswarlos in western Newfoundland. Barite has been produced mostly as a weighting agent for the drilling mud used in petroleum exploration.

Antimony was mined in 1997 by Roycefield Resources Ltd. from its underground Beaver Brook mine near Gander, central Newfoundland, and sold as concentrates through 1997-99. The operation eventually closed due to depressed antimony prices. In 2003, the operation was the subject of a purchase agreement – subject to financing – by VVC Exploration Corporation with the intention of resuming production in the first half of 2004. A total resource of 1.04 million tonnes was estimated to be present at a grade of 4.45%

antimony. A recent scoping study envisaged production of 150 000 tons per year to the mill and a mine-mill operation that could employ approximately 60 people.

Gypsum was produced briefly in 1996-1998 by Atlantic Gypsum Resources Incorporated and then by Lafarge Canada from the Fischells open-pit mine in western Newfoundland. The operation produced about 30 000 tonnes annually and employed about 10 persons at the mine site. Gypsum production has since been switched to the Galen Gypsum Mines Ltd. deposit at Coal Brook. Fischells reserves are estimated at 17 million tonnes at 93% gypsum.

Developing Operations

1. Voisey's Bay Deposit (Voisey's Bay Nickel Company Ltd.)

Est. annual production - approximately 2.2 to 7.3 million tonnes per year of ore

Est. work force - about 400, increasing to 800, if underground operations commence

Product - Nickel and copper concentrates for shipment to processing plants

Discovered in 1994, the Voisey's Bay nickel-copper-cobalt deposit of Labrador is by far the most valuable undeveloped deposit in the Province. It contains an estimated 150 million tonnes of inferred resources in the form of three deposits. One of these, the ovoid deposit, has proven reserves of 30 million tonnes of ore, at a grade of 2.85% Ni, 1.68% Cu and 0.14% Co that can be exploited by open-pit methods. The remaining deposits are lower in grade and, if proven to be economic, would require underground mining. Plans call for ore to be trucked to a mill-concentrator with a capacity of about 6000 tonnes per day. Concentrate will be stockpiled and shipped seasonally from a deep-water port at Anaktalak Bay. The mine would be run on a fly-in, fly-out basis and will not utilize a townsite. 54 million tonnes of indicated resources and 16 million tonnes of inferred resources are currently identified.

2. Duck Pond Deposit (Aur Resources Inc.)

Est. annual production - 540 000 tonnes per year

Est. work force - 166

Product - Zinc, lead and copper concentrates for shipment to smelters

This deposit is located in central Newfoundland, near the town of Grand Falls. A detailed feasibility study commissioned by the previous owners, Thundermin Resources Inc.

in 2001, outlined proven and probable reserves of 5.48 million tonnes grading 3.3% Cu, 5.8% Zn, 0.9% Pb, 59 g/t Ag and 0.8 g/t Au. The feasibility study envisaged the Duck Pond mine producing at a rate of 1500 tonnes/day (540 000 tonnes/year) and a mine life of 10.2 years with mining in the first year by open pit and thereafter by underground methods. Ore would be crushed and concentrated on site and then trucked to the port of Botwood for shipment to smelters.

3. Aguathuna Quarry (Port au Port Quarries)

Product - limestone and dolomite

This company has recently announced plans to establish a dolomite/limestone operation at Aguathuna on the Port au Port Peninsula. It will initially focus on dolomite for such end-users as the iron and steel industries and on construction aggregates. The results of a bulk sample extracted in 2002 were positive. The company plans to construct its processing and marine facilities when market conditions improve, possibly in 2004.

Other Deposits with Development Potential

Silica production has been investigated at the La Scie deposit in northeastern Newfoundland and at Mary's Harbour in southeast Labrador.

Fluorspar is being considered for production through a resumption of mining of the St. Lawrence deposits. The project could produce 180 000 tonnes per year of acid-grade fluorspar but has been stalled by financing difficulties and poor market conditions.

Pyrophyllite production may be resumed at the Manuels deposit in eastern Newfoundland. A new operating company, Newfoundland Pyrophyllite, is exploring opportunities for uses in the filler, extender and refractory markets and has shipped some material as test samples.

Barite production is being considered by Buchans Barite Company Ltd. using material recovered from the Buchans base metal tailings pile in Red Indian Lake, central Newfoundland. The deposit contains 1.5 million tonnes of recoverable material at 30% barite. The end use of the barite would be mostly as a weighting agent in the drilling mud used in petroleum exploration.

Undeveloped Resources

The Province has a number of deposits that for various reasons have not yet proved to be economic. Some of the more significant ones that may see future development are listed below (*see also* Figure 5). Note again that the quoted historical resources may not meet the current National

Instrument 43-101 standards for resource and reserve definition. In 43-101 terms, most would best be considered as inferred resources.

Rare Metals - The Strange Lake deposit of northern Labrador contains 52 million tonnes of rare metals (yttrium, zirconium, niobium and beryllium) and rare-earth-element mineralization and is a potential source of at least zirconium (2.93%) and yttrium (0.31%) production. The deposit was discovered in 1978 and taken to the advanced exploration stage. Although the deposit represents a major resource for these elements, a combination of remote location and uncertain markets have prevented development to date.

Uranium - Exploration in the 1950s - 1970s resulted in the discovery of the small Kitts (0.2 million tonnes 0.73% uranium oxide) and Michelin (6.2 million tonnes 0.13% uranium oxide) deposits near Postville in eastern Labrador. Although considered potentially economic in the late 1970s, a considerable price increase would be required to render these deposits economic under present-day market conditions.

Base Metals - A number of base-metal deposits exist in central Newfoundland, two of the more significant of which are the Point Leamington (18.8 million tonnes 0.48% Cu, 2.25% Zn) and Tulks Hill (0.7 million tonnes 1.3% Cu, 5.6% Zn and 2% Pb) deposits. Point Leamington has been considered too low grade and Tulks Hill too small for development to date. In the Rambler camp (Baie Verte), the Ming Footwall deposit contains a resource of 3 million tonnes at 1.6% Cu and the Ming West deposit contains 0.7 million tonnes at 3.6% Cu and 2 g/t Au.

Gold - Gold exploration in the 1980s discovered the Cape Ray gold deposit in western Newfoundland (455 000 tonnes at 8.3 g/t) and a number of gold deposits on the Baie Verte and Springdale peninsulas of northeastern Newfoundland, notably Pine Cove (1 865 000 tonnes at 3.19 g/t), Stog'er Tight (350 000 tonnes at 4.5 g/t), Deer Cove (94 093 tonnes at 6.0 g/t) and Orion (270 000 tonnes at 7.0g /t).

Talc - A small deposit of at least 3 million tonnes of 30% talc exists at Deer Cove on the Baie Verte Peninsula.

Marble - White marble deposits, with a resource potential of at least 3 million tonnes, exist near Roddickton on the Great Northern Peninsula and represent a potential source of high-purity, high-brightness material for use as filler in the paint, plastics and paper industries. Several bulk samples have been taken for testing but have not, as yet, resulted in development.

Magnesium - The tailings left over from asbestos mining at Baie Verte have been considered as a possible source of magnesium using hydro metallurgical extraction techniques. Several potential deposits of high-magnesium dolomite also exist along the Great Northern Peninsula.

Silica - Abundant silica resources, similar to those being exploited by Shabogamo Mining, exist in the western Labrador region. In Newfoundland, resources exist at Villa Marie (formerly the site of silica production for the Long Harbour phosphorous plant - 5.5 million tonnes at 94.7% silica), Fortune (8.8 million tonnes 98% silica) and Grey River (12 million tonnes 95.5% silica).

Dimension stone - Several marble deposits are known in western Newfoundland. There are also several sites in Newfoundland, such as those near Goobies, Terrenceville and the Mount Peyton area where granite and gabbro have been tested for production purposes. The Nain area of Labrador also contains abundant resources of anorthosite and other rocks that may form the basis for additional quarry operations.

THE ECONOMIC VALUE OF MINERAL PRODUCTION – PRESENT-DAY AND HISTORICAL PERSPECTIVES

This section analyzes the current and historical contribution of mining to the provincial economy. Mining contributes to the economy in four ways: through the direct return to the producing company and its shareholders, i.e., through the profit realized on a mining investment; through the revenues that accrue to various levels of government through taxes and royalties; through the spin-off benefits that come from mining investment and operations; and from employment, both in the mining industry and in its support sector. Analysis of some of these contributions is beyond the scope of this review. For example, information regarding the profitability of individual mining operations is often private or simply not available. Information on spin-off benefits is widely dispersed and would require a research effort well beyond the scope of this study. This section therefore focuses on the annual Gross Value of Mineral Production. This is a measure of the mineral production of the Province as realized in sales and is based on data collected through an annual census of mineral producers by Natural Resources Canada. The value, more correctly referred to as the Gross Value of Mineral Shipments, is a measure of the revenue that a particular mining operation is producing. Although not a measure of profitability, it is probably, in a general way, proportionate to profitability and provides some measure of the economic importance of a mining operation. Benefits from taxation and employment are examined in subsequent sections.

Key Statistics

Some key statistics with respect to the present-day mining industry in Newfoundland and Labrador are as follows:

- Mining in 2002 accounted for 8% of the Gross Domestic Product of the goods-producing sector (Newfoundland and Labrador Statistics Agency, 2003). As such, it lies behind oil and gas but ahead of other resource industries such as forestry, fishing and agriculture (Figure 6).
- Mining in 2002 accounted for 3% of the overall gross domestic product (Newfoundland and Labrador Statistics Agency, 2003) of the Province with all sectors of the economy included.
- Mining in the Province currently employs about 2500 persons at an average (1999) wage of \$66 000 (derived from aggregate wage data in Canadian Minerals Yearbook, 2001).
- The Province currently produces almost 6% of the total gross value of non-petroleum mineral shipments in Canada and as such ranks 6th in terms of jurisdictions behind Ontario, Québec, Saskatchewan, British Columbia and Manitoba (*see* Figure 7). When hydrocarbon fuels are included, the Province accounts for 4% of the gross value of production (Figure 8), behind Alberta, Saskatchewan, British Columbia, Ontario and Québec (Canadian Minerals Yearbook, 2001).
- Over the period 1989 - 2000, the Province has averaged 5% of the total gross value of non-petroleum mineral shipments in Canada and as such ranks 6th in terms of jurisdictions behind Ontario, Québec, Saskatchewan, British Columbia and Manitoba (*see* Figure 9).
- The Province is the leading producer of iron ore in Canada, accounting for 63% of Canadian iron ore production, and 2% of world production.
- When the Voisey's Bay nickel deposit enters production ca. 2005, the Province will (at projected levels) likely be the second largest supplier of nickel in Canada at around 30% of total production.

Present-Day Mineral Production

Table 1 illustrates the most recent breakdown of mineral production in the Province for 2002, based on preliminary

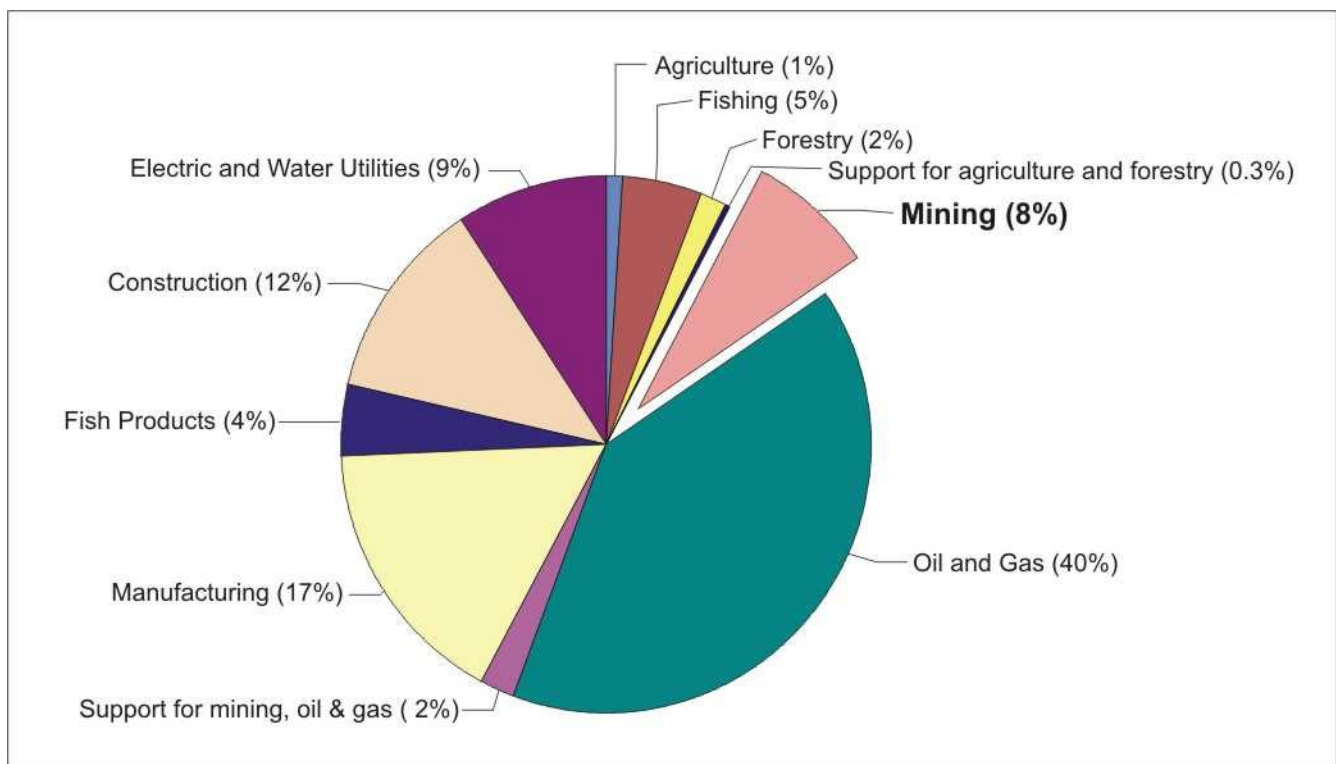


Figure 6. Relative share of real Gross Domestic Product (GDP) for the Goods Producing Industries, Newfoundland and Labrador, 2001 in 1997 Canadian dollars (Source Newfoundland Statistics Agency and Statistics Canada). Not shown is the GDP share for the pulp and paper sector, which is confidential.

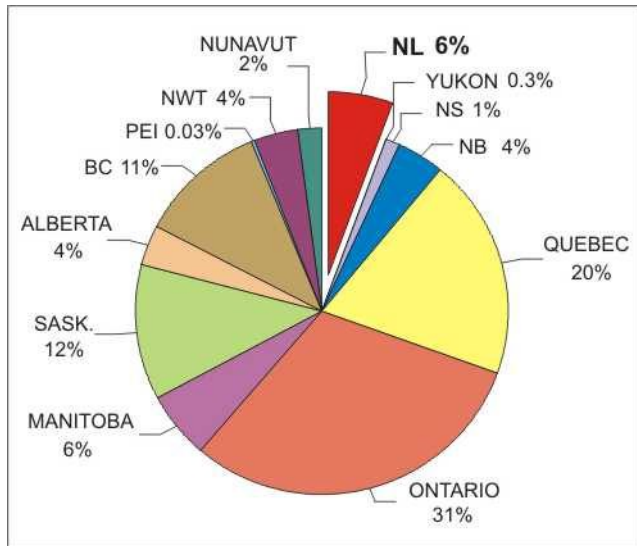


Figure 7. Value of Canadian minerals production (metals and non-metals), by province, 2000 (projected). (Source Natural Resources Canada data)

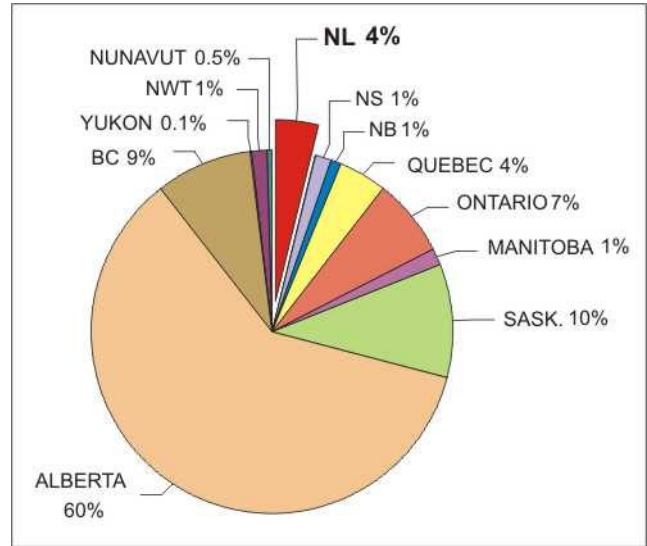


Figure 8. Value of Canadian minerals and fuels production, by province, 2000 (projected). (Source Natural Resources Canada data)

Table 1. Gross Value of Mineral Production for 2002, in decreasing order of value (estimated values). IOCC = Iron Ore Company of Canada; TUC = Torngat Ujaganniavingit Corporation.

COMMODITY	Gross value of production in \$ Canadian: 2002 (forecast)	Percentage of total value provincial production	Main production source
METALLIC			
Iron Ore	723 831 000	91.40%	IOCC & Wabush Mines
Gold	24 234 000	3.06%	Richmont Mines
Total Metallic	748 065 000	94.46%	
NON-METALLIC			
Dimension stone	4 838 000	0.61%	TUC, Int. Granite & Hurley Slateworks
Sand and gravel	11 133 000	1.41%	Multiple
Aggregate stone	11 020 000	1.39%	Multiple
Dolomite	9 010 000	1.14%	Atlantic Minerals
Limestone	4 217 000	0.53%	Atlantic Minerals
Silica	2 178 000	0.28%	Shabogamo Mining
Peat	860 000	0.11%	Hi-Point
Pyrophyllite	105 000	0.01%	Trinity Resources
Gypsum	540 000	0.07%	Galen/Lafarge Gypsum
Total Non-metallic	43 901 000	5.54%	
TOTAL MINERALS	791 966 000	100%	
Construction materials (sand, gravel and aggregate stone)	22 153 000	2.8% (of total minerals value) 50.46% (of total non-metals value)	

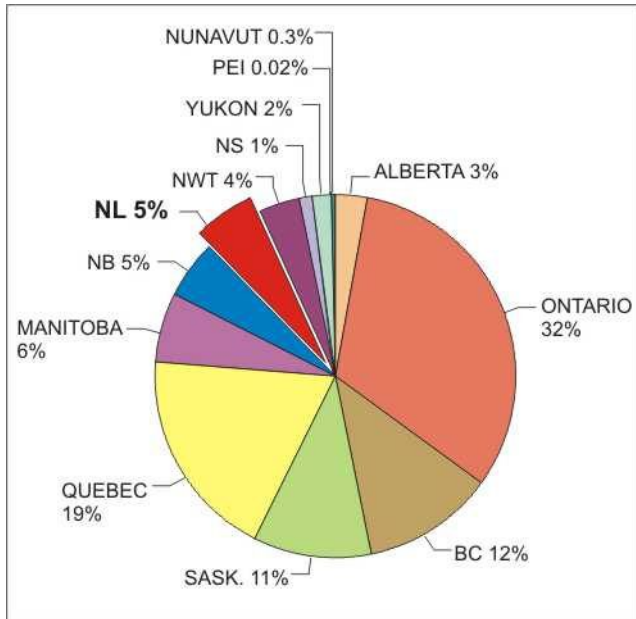


Figure 9. Value of Canadian minerals production (metals and non-metals), by province, 1989-2000 based on year-2000 dollars. (Source Natural Resources Canada data)

values, and the source of the production. The mineral commodities can be divided into metallic and non-metallic.

For 2002, and as for all preceding years, the value of shipments was dominated by metallic mineral commodities and in particular by iron ore, which at 91%, accounted for the bulk of the Province's mineral exports. Gold is the only other metallic commodity currently in production and accounts for 3% of the total value of production. Non-metals account for about 5.5% of production value. The leading non-metallic commodities were sand and gravel, crushed rock aggregate and dolomite. If sand, gravel and aggregate are grouped together as construction materials, they account for almost 3% of the overall mineral production value and 50% of the value of non-metallic production. Statistics (Newfoundland and Labrador Department of Mines and Energy, 2002) indicate that sand and gravel has consistently been the most valuable non-metallic commodity produced over the past decade. Crushed rock aggregate has shown the most growth of these commodities over the same decade and is currently the second most valuable item in this group. Dimension stone was showing promising growth until 2001, but fell in value in 2002.

Historical Value of Mineral Production

Historical data for the value of mineral production are available for the period 1865 to 2002 and are presented in

terms of current and constant (year-2000) Canadian dollars in Figure 10³. Current dollar values are the actual values for a particular year and have not been corrected for inflation. Constant dollar values have been adjusted for the effects of inflation. Constant dollars, with the year 2000 being used as the common reference base, have been used as the basis for most of the historical comparisons in this section. The calculation of constant dollars is explained in Appendix 3. As would be expected, the constant-dollar curve in Figure 10 shows higher historical values than the current dollar one because of the effects of inflation that have effectively reduced the purchasing power of the current-dollars over time. The constant-dollar curve shows a fairly flat profile until the late 1940s, when, stimulated by post-war reconstruction and industrial expansion, it rises steeply to a peak ca. 1980. After this point, the curve then declines in a cyclical fashion to its present-day level.

It should be noted that the constant-dollar curve in Figure 10 was generated using a deflator series based upon the Gross Domestic Product (GDP) index (see Appendix 3 for details), this being the only deflator series available that extends back to the 1860s. The results produced using this deflator series are similar in most respects to those using the Consumer Price Index (CPI, used elsewhere in this report), except for the peak inflationary years 1970-83, where the GDP results are slightly lower than those produced using the CPI deflator. For this reason, the peak value of about \$23 000 million dollars indicated for the year 1979 in Figure 10 is lower than that of \$2700 million shown in the figures used elsewhere in this section (e.g., see Figure 15), which use a CPI deflator series.

The value of production data is analyzed in more detail in the following sections, which divide the data into pre- and post-confederation periods, i.e., pre and post-1949.

The Pre-Confederation Period 1867-1949

Data on mineral production for this period have been compiled from the Newfoundland Government Customs Returns (see Appendix 2). The pre-confederation gross value of mineral production is plotted in terms of current dollars in Figure 11, and in year-2000 dollars in Figure 12. The data in each case are shown in terms of metallic versus non-metallic commodities. Major historical events are also shown to place these graphs in context. From both figures it is evident that the gross value of production was dominated by metallic minerals. Non-metallic minerals generally formed less than 10% of the total but rose to as high as 30% between 1880 - 1910 and during the 1940s.

³ Although 1865 is the earliest date for which production data are available, a deflation series is only available from 1867 – the starting point for Figure 10.

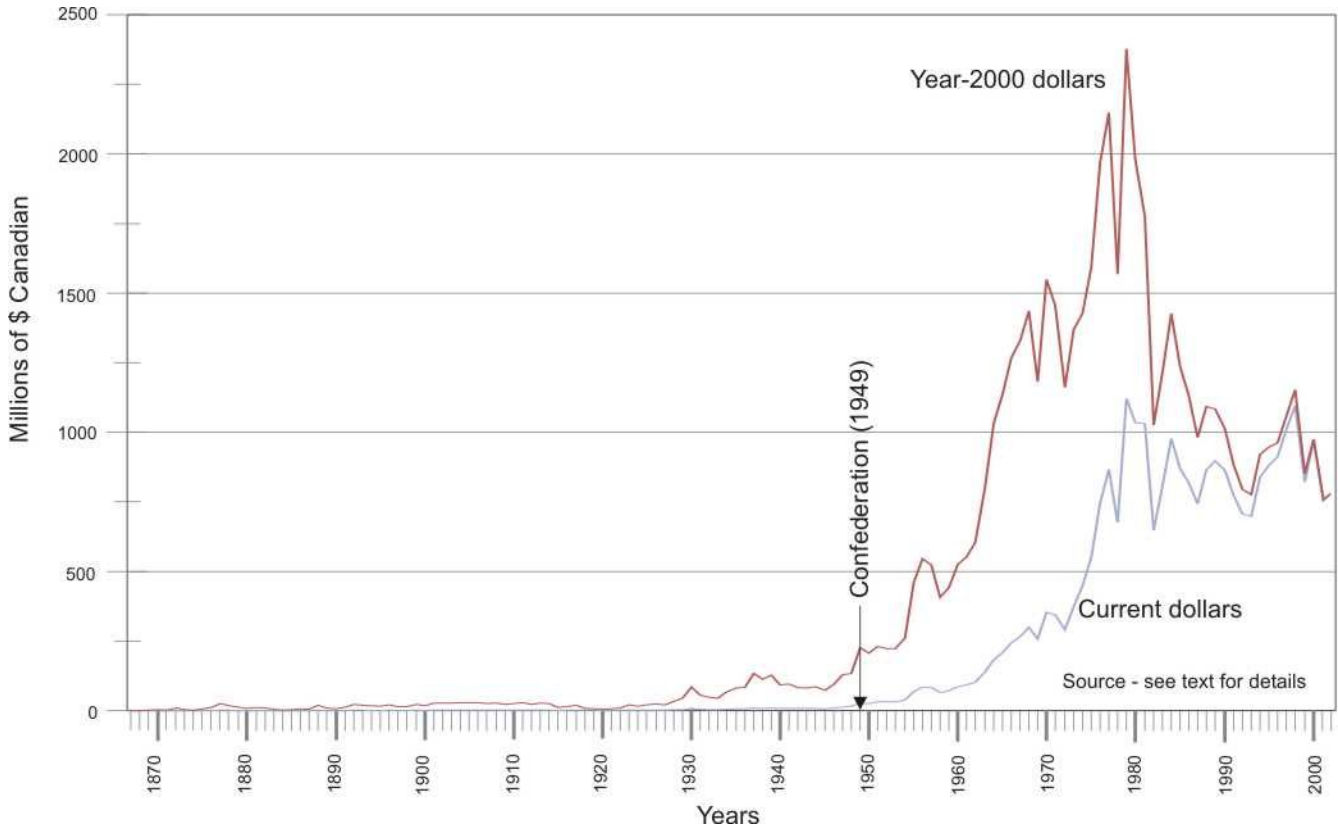


Figure 10. Total value of Newfoundland and Labrador mineral production, 1867 to 2002; in current and constant (year-2000) dollars. The constant dollar plot was produced using a Gross Domestic Product deflator series. (Source Appendix 4B)

Mineral production rose to an early peak ca. 1877, the time of the Notre Dame Bay copper boom, dipped in the late 1880s then attained a fairly even plateau in the period 1893-1914 during which production was dominated by Notre Dame Bay copper and (commencing ca. 1895), Wabana iron ore. The onset of World War I (1914-18) produced a dramatic fall in output, largely due to the wartime curtailment of North Atlantic shipping and loss of major European markets. The drop in production value persisted into the post-war years but then recovered in 1923 and rose rapidly to a peak in 1929, largely due to the onset of production from the Buchans operation. 1929 saw the crash in world stock markets and the start of the Great Depression, which lasted until around 1938. Not unexpectedly, Newfoundland's value of mineral production sustained a steep fall in the early part of the Depression but then recovered rapidly in the years 1935 to 1939. The outbreak of World War II in 1939 initiated another plunge in production, again due to the difficulties of wartime shipping and loss of European markets. Following the end of the war, production recovered rapidly and commenced a steep rise that was to last well into the 1980s. This boom in production was fueled by the demands of post-war reconstruction and the huge growth in the North American and European industrial economies that took place during this time.

The performance of the pre-confederation mineral economy is examined in more detail in Figure 13, which breaks the value of production down in terms of the major mineral producers. These were the Notre Dame Bay copper mines (chiefly Tilt Cove, Little Bay and Betts Cove), the Wabana iron-ore mines, the Aguathuna limestone operation, the St. Lawrence fluorspar mines and the Buchans base-metal mines. The production value for each of these operations is plotted separately in terms of constant dollars in Figure 13. From this it is evident that the early part of the period (1865 to ca. 1905) was dominated by copper production associated with the Notre Dame Bay copper boom. This in itself was highly cyclical as shown by the steep plunge in production in the mid-1880s associated with a crash in copper prices at that time. The Wabana mines began significant production ca. 1895 and then followed an erratic, deeply cyclical production path that was strongly influenced by World War I and the ensuing 1920s. At this time, and following the merger that resulted in the formation of BESCO, Wabana experienced repeated financial problems to the extent that management repeatedly pleaded for relief from royalty payments. The onset of the Depression greatly curtailed demand for iron ore and added to these woes by forcing closure of two of the four Wabana mines. However, growing demand from Germany in the late 1930s led to a rebound in demand (*see* Figure 13) and

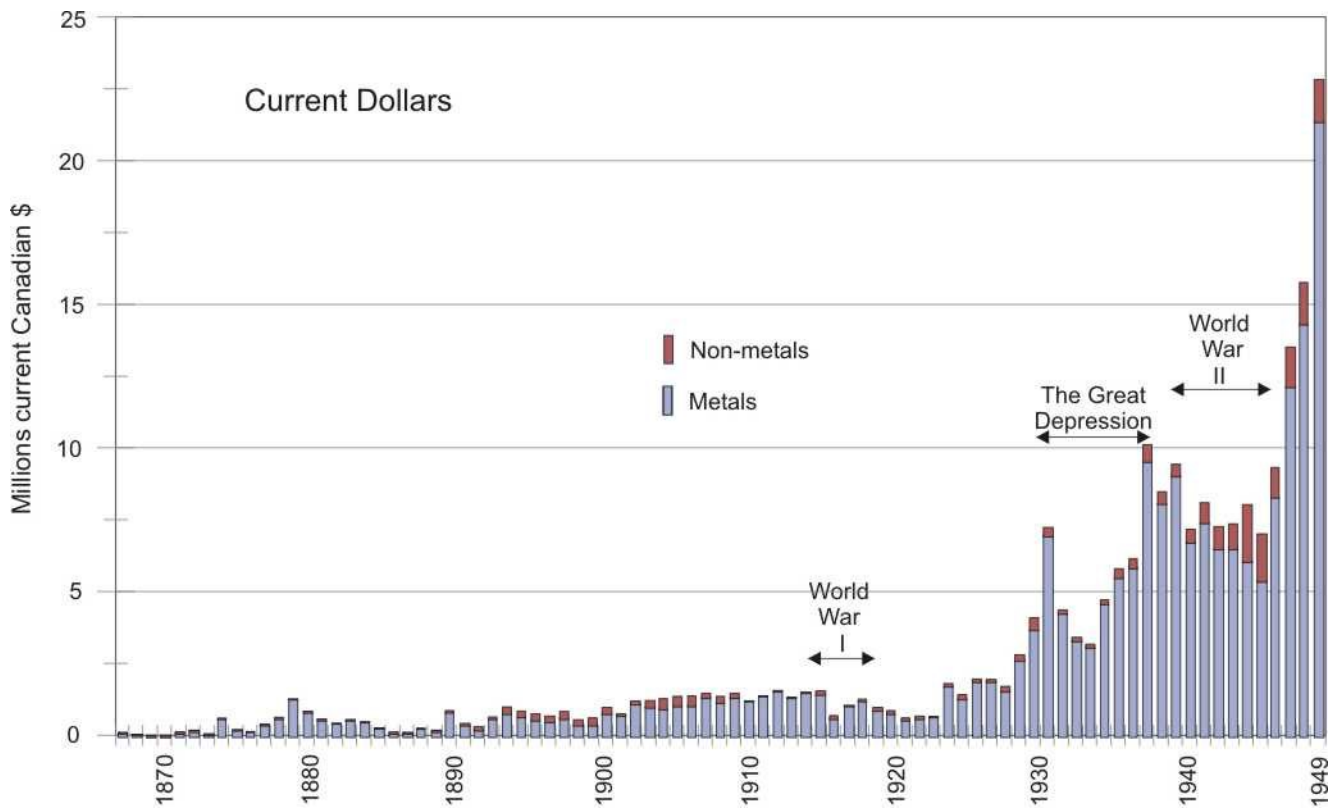


Figure 11. The Gross Value of Mineral Production during the pre-confederation period, in annual Canadian dollars – showing metals vs non-metals share. (Source Appendix 4C)

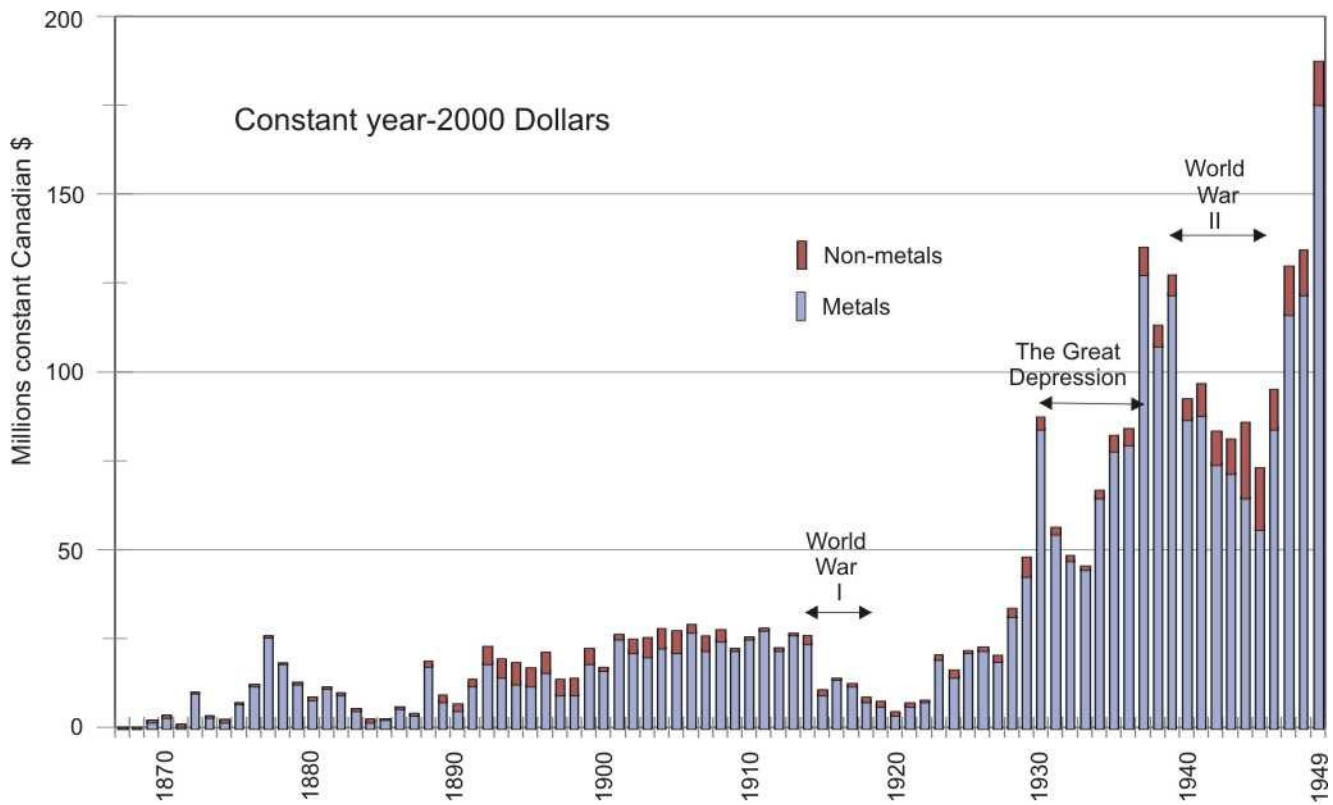


Figure 12. The Gross Value of Mineral Production during the pre-confederation period, in year-2000 Canadian dollars – showing metals vs non-metals share. (Source Appendix 4C)

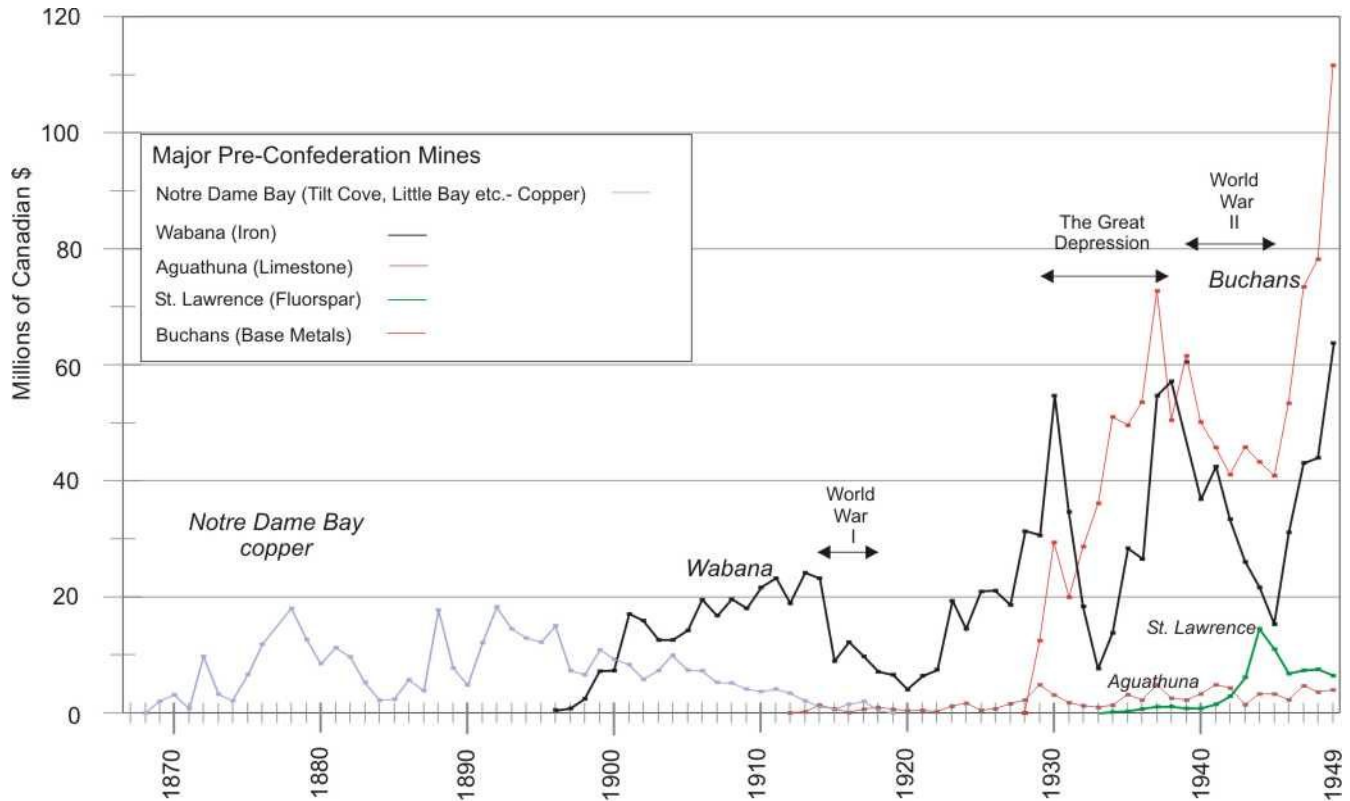


Figure 13. Value of major pre-confederation mine output, in year-2000 Canadian dollars. (Source Appendix 4C)

re-opening of the mines. Demand was curtailed again by the outbreak of World War II but was quickly re-established in the post-war period. Buchans, which opened in 1928, offers an interesting comparison to Wabana in that it saw a rapid rise in value of production that was largely unaffected by the Depression, but which was, however, temporarily reduced by the outbreak of World War II. In the post-war period it was Buchans that quickly established itself as Newfoundland's premier producer, enjoying a surge in growth that carried it well into the succeeding decades.

A notable feature of the pre-confederation Customs Returns, is the lack of any reported values for by-product precious metals. The Notre Dame Bay copper mines contained significant amounts of gold and silver (up to 2 oz of each per ton of copper metal according to Martin, 1983), though the presence of these elements was not recognized until the early 1890s. Similarly, the Buchans mines produced significant amounts of gold and silver throughout their history. In both cases, these precious metals were recovered at foreign smelters but the added production value was not credited back to the producing mine⁴, at least as reported in the Customs data. The pre-confederation data may, therefore, understate the real value of mineral production during that period.

The non-metals producers, Aguathuna and St. Lawrence, saw much lower overall growth in terms of value of production. St. Lawrence, however, did experience a rapid rise in value during World War II, due no doubt to the increased demands of war time (including increased demand for aluminium) and the fact that its main market was in North America and thus less affected by the wartime difficulties that curtailed markets for other Newfoundland mines.

The Post-Confederation Period, 1950-2002

Data for the post-confederation period are taken from the largely unpublished files of the Newfoundland Department of Mines and Energy. Most of these data are derived from the annual mineral production census data compiled by Natural Resources Canada and reported in summary format in the Canadian Minerals Yearbook.

The value of mineral production since 1949, subdivided into metals and non-metals, is plotted in both current- and constant-dollar terms in Figures 14 and 15. As for all inflation-corrected data, the constant-dollar plot of Figure 15 shows the higher historical values and is the more meaningful in terms of historical comparisons. The essential point of comparison between the two figures is that whilst the current

⁴ This manner of reporting remains to the present day; by-product metals usually being accredited to the country where smelting takes place.

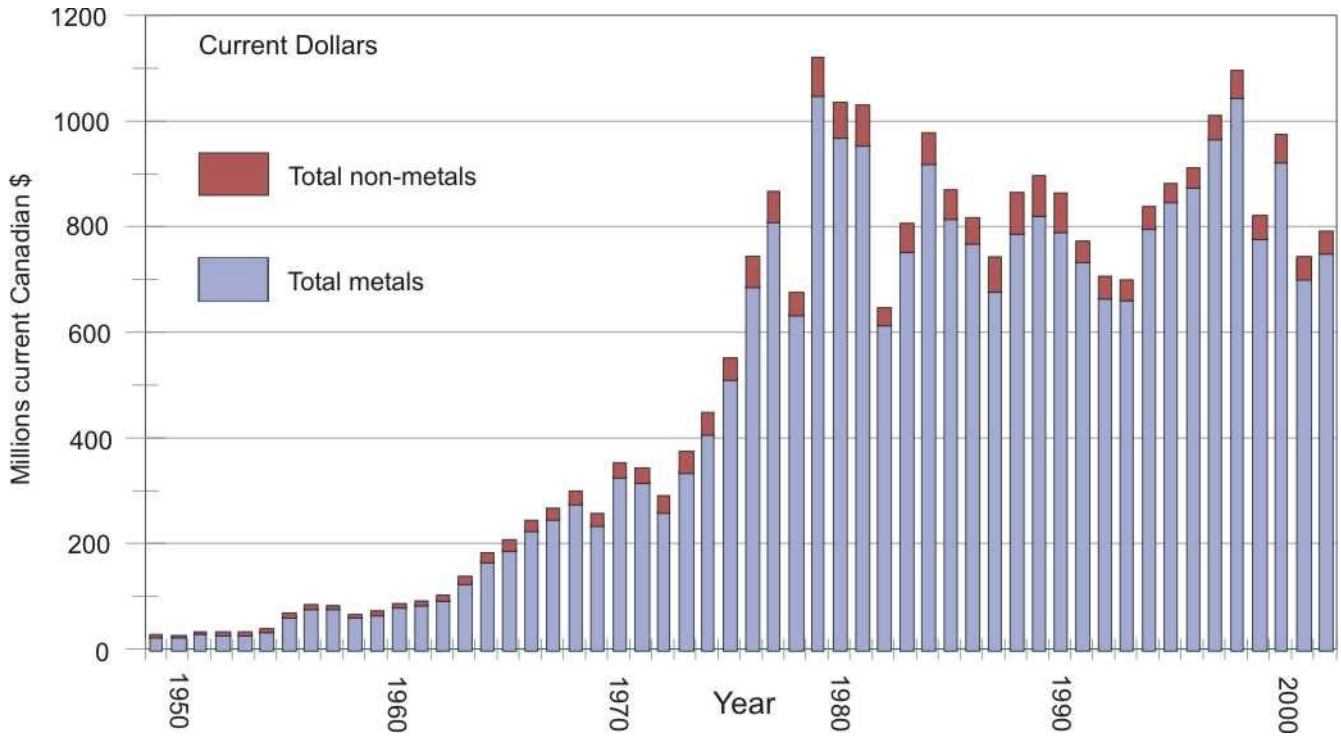


Figure 14. The Gross Value of Mineral Production, 1949 to 2002 in current Canadian dollars – showing metals vs non-metals share. (Source Appendix 4D)

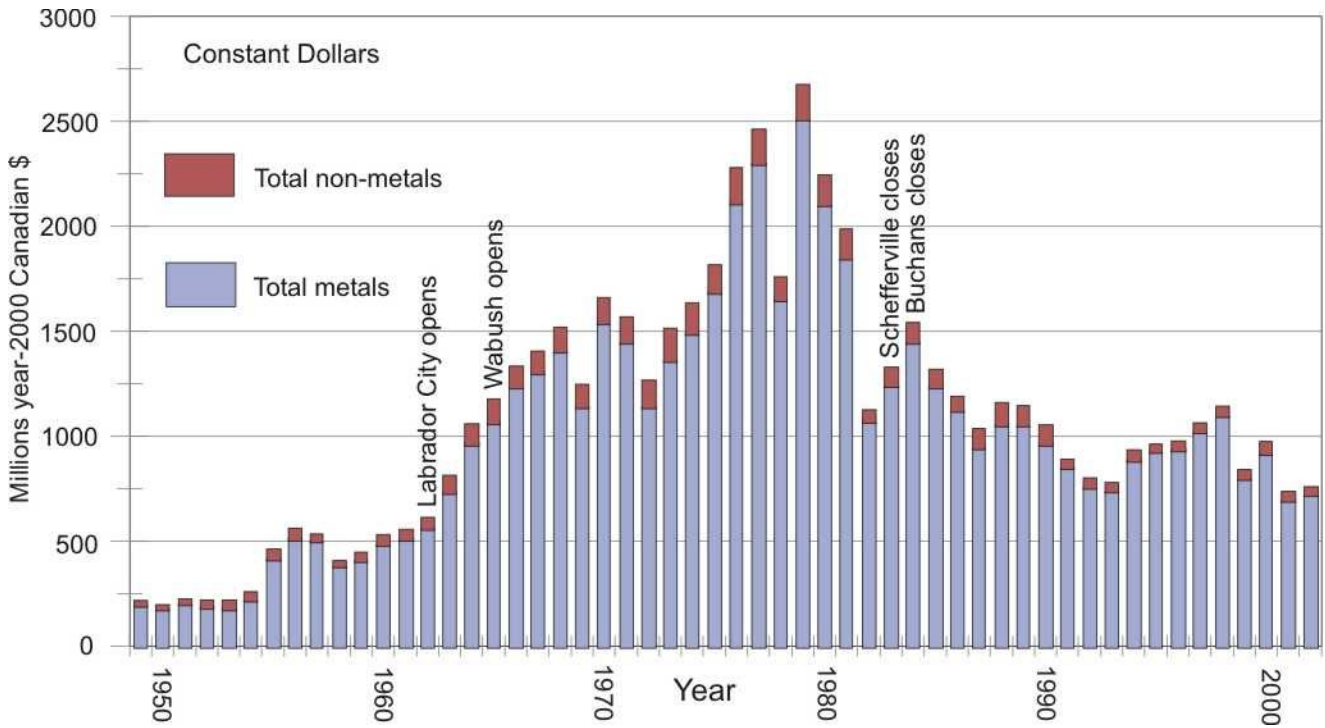


Figure 15. The Gross Value of Mineral Production, 1949 to 2002 in constant Canadian dollars – showing metals vs non-metals share. (Source Appendix 4D)

dollar plot (Figure 14) shows a steady rise in the value of production to ca. 1980, followed by an undulatory plateau of values, the constant dollar plot (Figure 15) shows a pronounced peak ca. 1979 of about \$2700 million, followed by a marked decline that only appears to have stabilized since 1993. It is the constant dollar plot of Figure 15, that is telling the real story in this case, namely that the provincial value of production has been in progressive decline since 1980. It can also be seen from these figures that non-metals form only a small part of the value of production. This has declined from about 10 to 18% for the years 1949-54 to around 8% to 1990 then to around 5% in subsequent years.

The historical value of production for metallic and non-metallic commodities is further broken down in Figures 16

and 17. These show the various commodities that comprise the two subdivisions as percentages of the total metallic and non-metallic production respectively. The metallic minerals chart in Figure 16 illustrates changes in the composition of metallic shipments. In 1949, these were dominated by base metals (copper, lead and zinc, mostly from Buchans) and iron ore (Wabana), however, in the years 1953 to 1969, the base-metal share fell and was progressively replaced by iron-ore shipments coming from the new mines in Labrador, such that by 1973 iron ore accounted for about 90% of shipments. Gold temporarily accounted for up to 5% of the value of shipments in the late 1980s and early 1990s due to production from Hope Brook. After this mine closed in 1997, iron ore increased its dominance up to a recent level of around 95%.

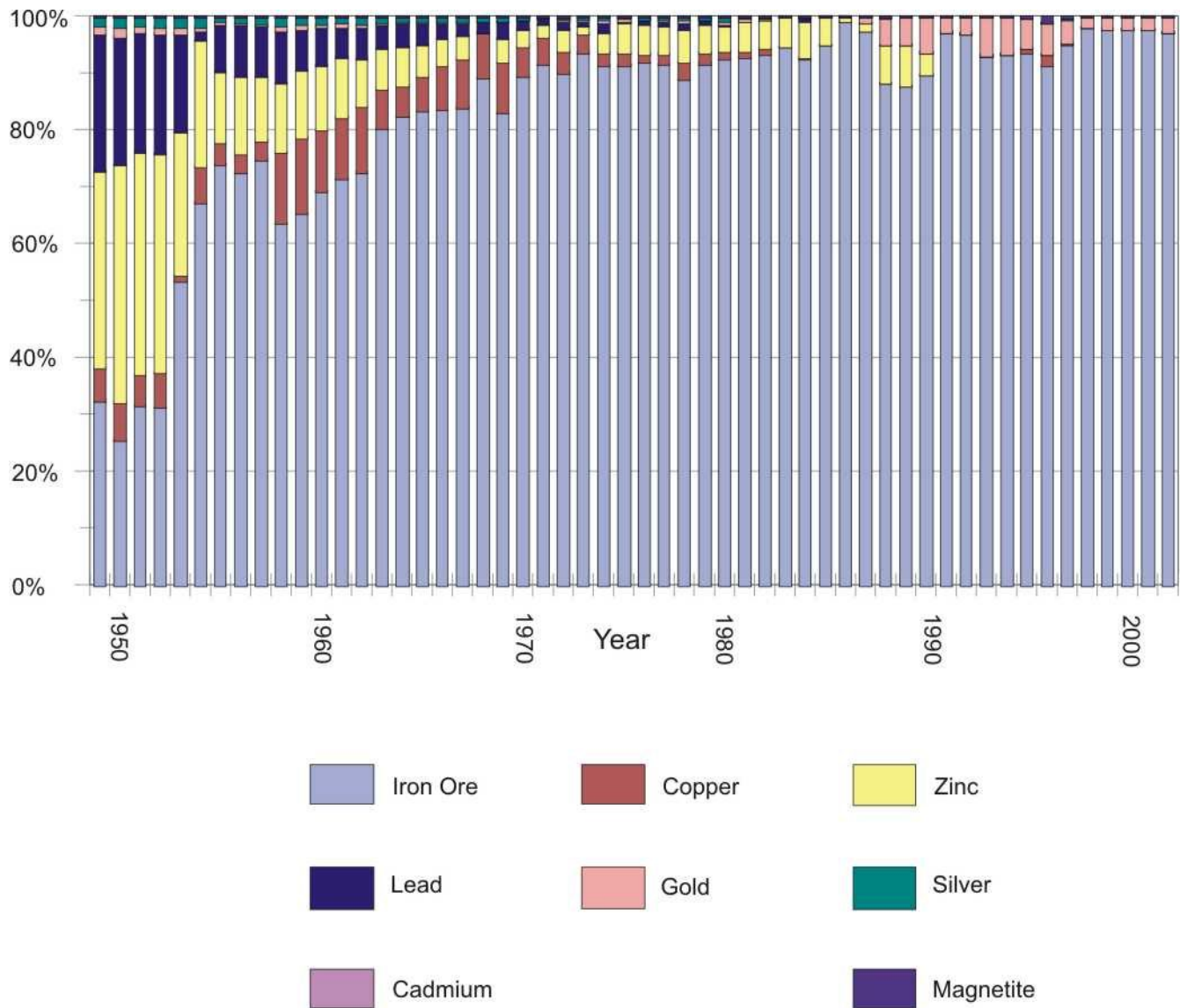


Figure 16. The share of individual metallic mineral commodities of the Gross Value of Mineral Production, 1949 to 2002. In year-2000 Canadian dollars. (Source Appendix 4D)

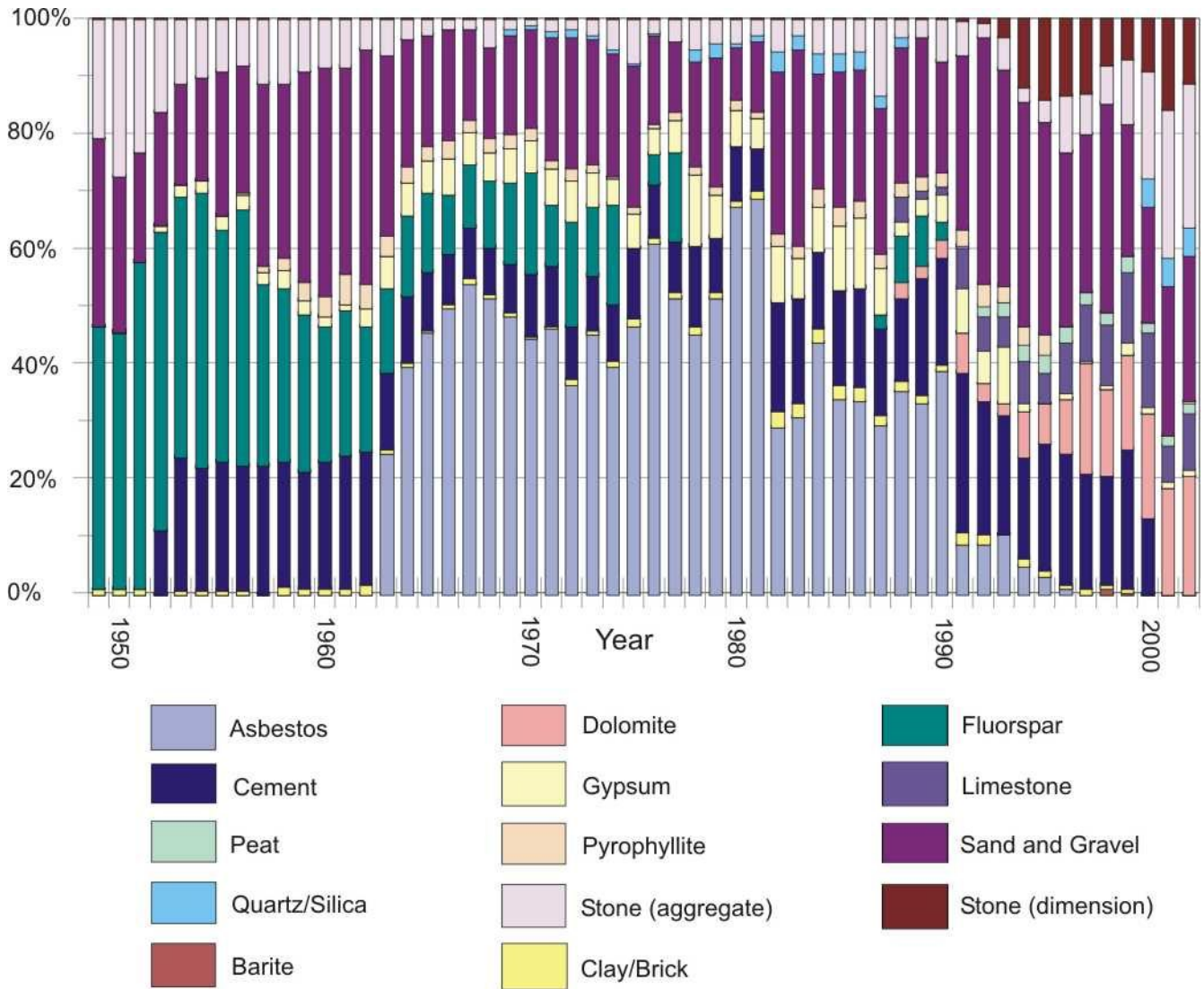


Figure 17. The share of individual non-metallic mineral commodities of the Gross Value of Mineral Production, 1949 to 2002. In year-2000 Canadian dollars. (Source Appendix 4D)

For non-metallic minerals, the corresponding breakdown is given in Figure 17. A significant feature is the dominance firstly of fluorspar from St. Lawrence and then asbestos from Baie Verte during the period leading to about 1980. After this time, a more diversified picture develops in which the construction materials (sand, gravel and crushed rock aggregate) in association with dimension stone, dolomite and limestone, form the dominant commodities. The construction materials have also consistently formed 30 to 50% of the value of non-metallic mineral production and have been the most stable part of this sector. Gypsum from Flat Bay was moderately significant in the period 1951-94, however, other commodities such as, silica, brick, pyrophyllite, barite and peat have formed only a small part of the overall value. Cement production was also a consistent feature of non-metal production until the demise of the Corner

Brook plant in 2000. Materials that have experienced prominent recent growth are:

Crushed rock aggregate - This commodity produced from a variety of sources has seen remarkable growth in the late 1990s to a present share of 25% of the non-metals value. Demand is thought to have been largely driven by recent highway upgrading and construction.

Dolomite - Since 1990, production of this mineral commodity (chiefly from Lower Cove) has seen significant growth to its present level where

it accounts for about 20% of the non-metals value.

Dimension stone -

This material (from various sources) saw rapid growth in the mid-1990s but after reaching a peak in 2000 appears to have stabilized at about 10% of the non-metallic value.

Trends in the Gross Value of Mineral Production – The Controlling Influence of Iron-Ore Prices?

What has controlled the strong surge and then decline in the provincial value of production in the years 1979 to present as shown in Figures 10 and 15? Obviously the industrial cycle and mine closures play a role (Figure 15). The early 1980s were a time of deep recession and reduced demand for metals. The closure of Schefferville in 1983 and of Buchans in 1984 also removed two very significant producers from the provincial scene and thus exacerbated the negative effect on the overall value of production. However, although the industrial cycle recovered from its recession in the mid to late 1980s, the provincial mineral output did not. As a result, 1979 remains as the watershed year for historical mineral production (see Figure 10). What then prevented a subsequent recovery?

Since 1980, iron ore has generally formed over 95% of the Province’s mineral production value (Figure 16) and it follows that a large part of the explanation for the marked decline in overall production value since this date might be sought in the behaviour of that commodity. This is shown in Figure 18, which compares post-1949 production of iron ore in terms of tonnage (vertical bars keyed to left vertical axis), vs the value of production in constant Canadian dollars (blue line keyed to right vertical axis). Not surprisingly, the profile for the value of iron-ore production is very similar to that for all mineral commodities depicted in Figure 15. For the pre-1979 period in Figure 18, there is a strong correlation between the value of iron-ore shipments and production, the steep growth in both production and value in this period being due to the growth of the Labrador iron ore sector, which more than offset the closure of Wabana in 1966 (noticeable only as a slight dip in production). However, after 1979 there was a pronounced decline in production that was at least in part due to the wind down and eventual closure of the Schefferville operation in 1983. Production recovered somewhat in subsequent years but never to the extent of completely replacing the lost production, which accounted for about one third of the province’s peak iron-ore production. Also apparent from Figure 18 is that ca. 1984 there began a pronounced de-coupling of value and production, during which the gross value of production declined markedly in comparison to the amount of production (which

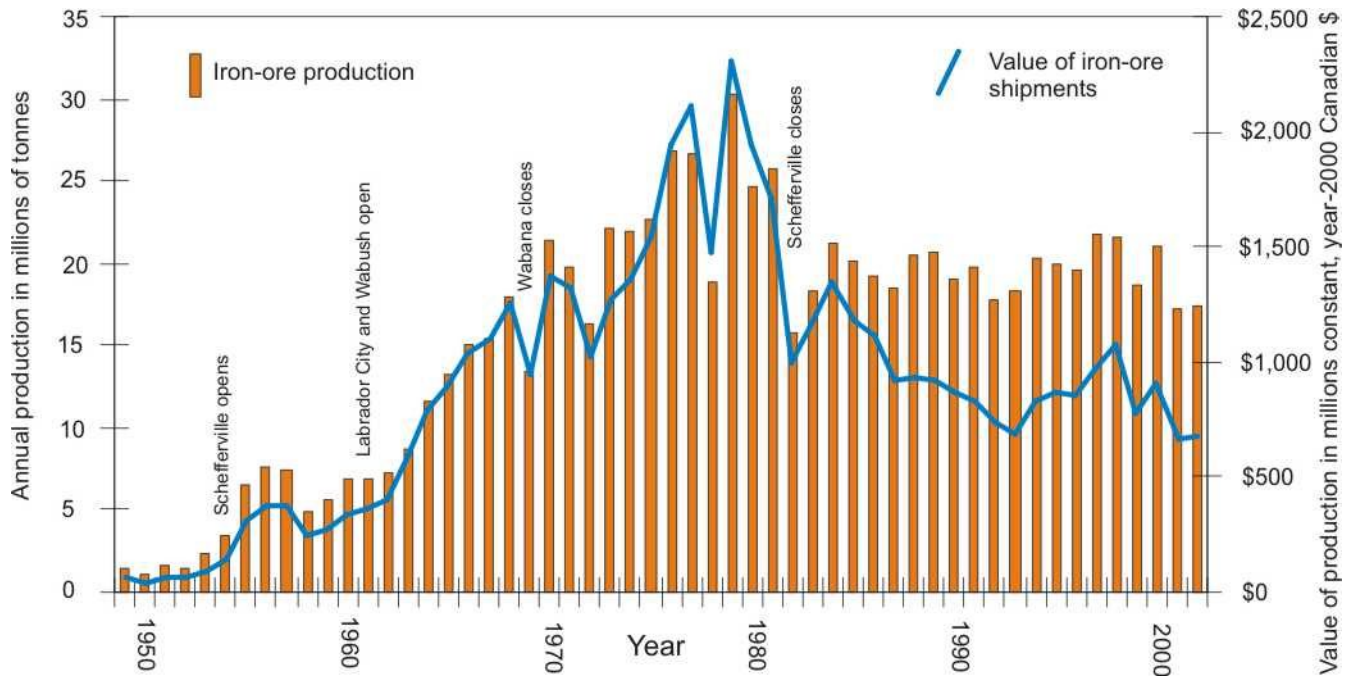


Figure 18. Provincial production of iron ore vs value of iron ore shipments in year-2000 Canadian dollars. (Source Appendix 4E)

remained relatively stable). This obviously indicates that real iron-ore prices (i.e., in constant dollars) fell after 1984, a matter that is examined further below.

The historical price trends for iron ore in both current and constant terms for Canadian and US dollars are depicted in Figure 19. The early part of this graph, from 1949 to 1980, shows a steady growth in both Canadian and US prices to a peak at about 1980. The slope of the price increase is considerably less than that of the value of overall Newfoundland and Labrador production (Figure 18) during this period, however, the time leading up to 1980 was a period during which the rise in prices coincided with the marked growth in provincial iron-ore production resulting from the developments in western Labrador. Commencing in 1980, there followed a steady decline in prices which, in terms of the US price continues to 2002. The Canadian price has apparently improved since a low in 1994, however, this is probably due in most part to the steep depreciation of the Canadian against the US dollar during this period.

The behaviour of gross Labrador iron production value closely follows that of global iron-ore production value as shown in Figure 20. This figure (after Kelly and Kirk, *in Kelly et al.*, 2001) compares the amount of production in tonnes (vertical bars keyed to the left vertical axis), with the value of world production (blue line keyed to the right axis). The value of world production reached a peak in 1979 and since then has declined along a path similar to that for the Newfoundland and Labrador value of production. The difference with the Newfoundland and Labrador situation (compare Figure 18) is that after prices started to fall in 1980, world production tonnage continued to rise along an almost straight-line trend despite the fall in value. Clearly,

Newfoundland and Labrador failed to benefit from this continued growth and must have lost market share.

What caused the iron-ore price peak ca. 1980 and why did Newfoundland and Labrador apparently lose market share after this date? With regard to prices, one explanation favoured by Kirk (2002) is that until ca. 1980 there were two international iron-ore price structures, one related to North America and the other to external market economies. The North American market was essentially a captive one due to the fact that steel producers owned more than three quarters of the iron-ore production capacity. Prices were therefore set on the basis of production cost plus royalty and management fees and were fairly stable, e.g., through the long-lived Lower Lakes pricing system. The Labrador iron-ore mines were owned by US and Canadian steel companies and thus largely controlled by events in the North American market. Demand during this period was also high and the iron-ore industry was continuing its post-World War II growth. However, in 1982, major structural changes occurred in the North American industry, one of which was the development of a spot market that led to price competition from offshore sources and the unwinding of the Lower Lakes pricing system. Exposure to international competition forced cuts in capacity and prices, re-negotiation of wage contracts and an overall increase in competitiveness. As a result, US mines cut costs by 30% and prices by 42% in a trend that continues to this day.

The period following 1981 also saw major increases in the supply of cheap, high-grade iron ore coming from new developments in Australia, Brazil and Venezuela. The result of this low-cost production was a steep decline in the global price of iron ore that in turn forced a decline in higher cost

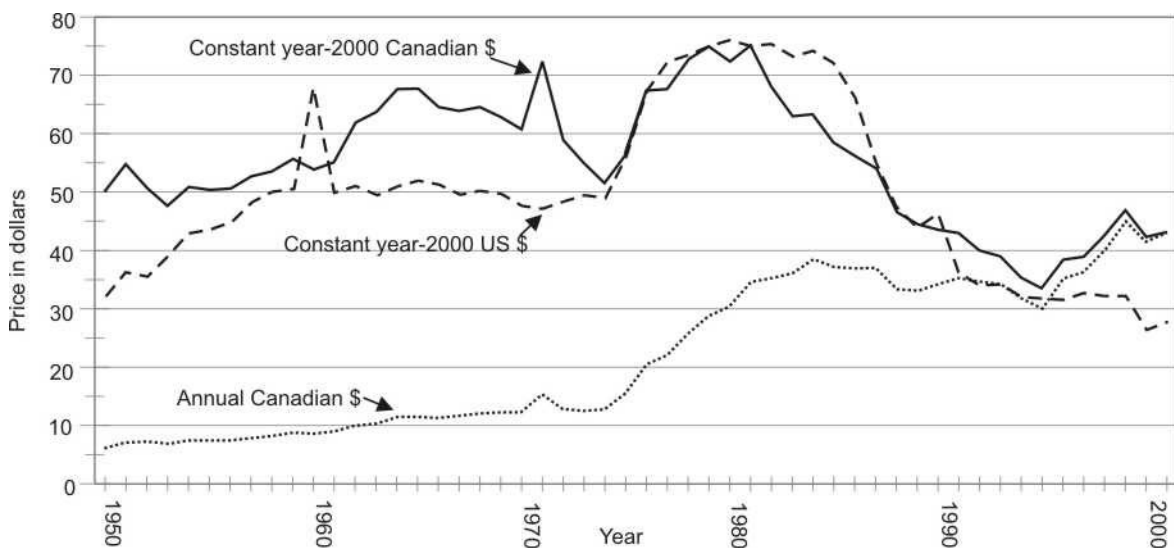


Figure 19. Price of iron ore 1949 to 2000 in current and year-2000 dollars. (Source Natural Resources Canada data)

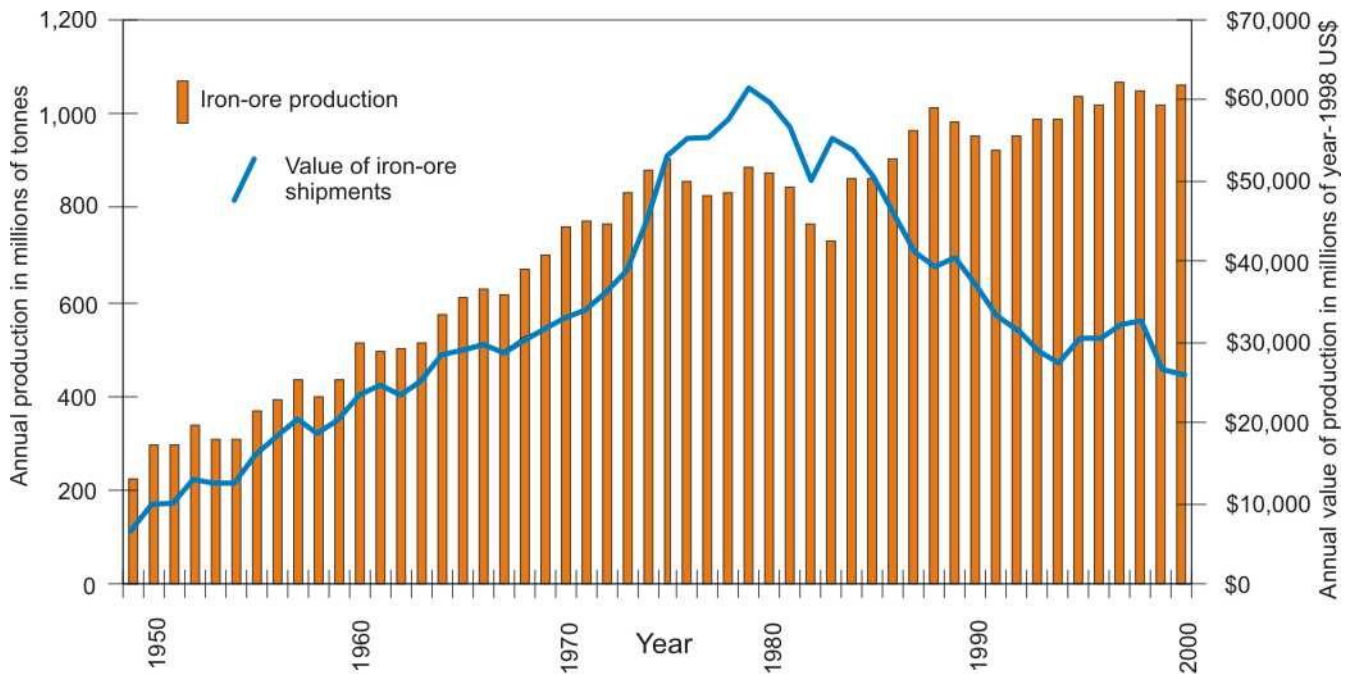


Figure 20. World production of iron ore vs world value of iron-ore production, in year-1998 US dollars. (Source United States Geological Survey; Kelley et al., 2001)

North American iron-ore production. Iron-ore prices rose again in the period 1994-97 but then fell victim to the Asian debt crisis and a recession in metal prices that continued to 2002. All of the iron mines in Labrador and adjacent parts of Québec were affected by these structural changes. According to Natural Resources Canada (Boyd and Perron, 1997), Brazil has been the most significant competitor for eastern Canadian (largely Québec and Labrador) iron ore and has made significant inroads into south-southeastern US and European markets. The only area where the Canadian producers have maintained a clear competitive advantage is in the north-northeastern US where they benefit from proximity to the market and cheaper transportation (Boyd and Perron, 1997). Globally, therefore, there is little doubt that since 1980 the Canadian producers, including Newfoundland and Labrador, have lost market share to cheaper iron ore from Brazil and other southern-hemisphere producers. The situation has stabilized somewhat since 1988, however, the fact remains that the value of shipments for Labrador iron ore today is only about half of its peak in 1979 and is more typical of the values of the late 1960s. From Figure 20 it is evident that world demand for iron ore is continuing to increase. Strong economic growth in China has prompted a resurgence in Asian market demand and a rise in prices. However, since transportation costs are a critical component of iron-ore prices, it is likely that this increased demand will benefit Australian and Brazilian producers to a greater extent than North American ones.

The post-1980 changes have severely impacted the Newfoundland and Labrador iron-ore producers. Both Wabush Mines and IOCC have experienced successive periods of downsizing, periodic shutdowns and ownership changes. In response, both companies have successfully implemented major cost-cutting programs and have achieved lower cost production. Both companies have also become more market-driven and have diversified their sales bases. For example, IOCC now exports roughly 40% of its production to the US, 40% to Europe and 20% to the Asia/Pacific region (Dempsey, 1999).

Effects of Other Metal Prices

Whilst the behaviour of iron ore prices may have been the controlling influence in Newfoundland and Labrador, there were apparently similar forces at work in other areas of the national mineral economy. This is shown by Figure 21, which compares the total value of mineral production for Canada (1886 to 2000) with that of Newfoundland and Labrador (as taken from Figure 10). The two sets of profiles are similar in that both show steep rises in the 1945-1980 period followed by steep declines. The Canadian profile differs, however, in that its post-1980 decline was less pronounced (a 30% decline vs the 50% decline shown by Newfoundland and Labrador) and shows signs of a recovering upward trend in recent years. It should be noted, though, that this recent upswing is due almost entirely to new dia-

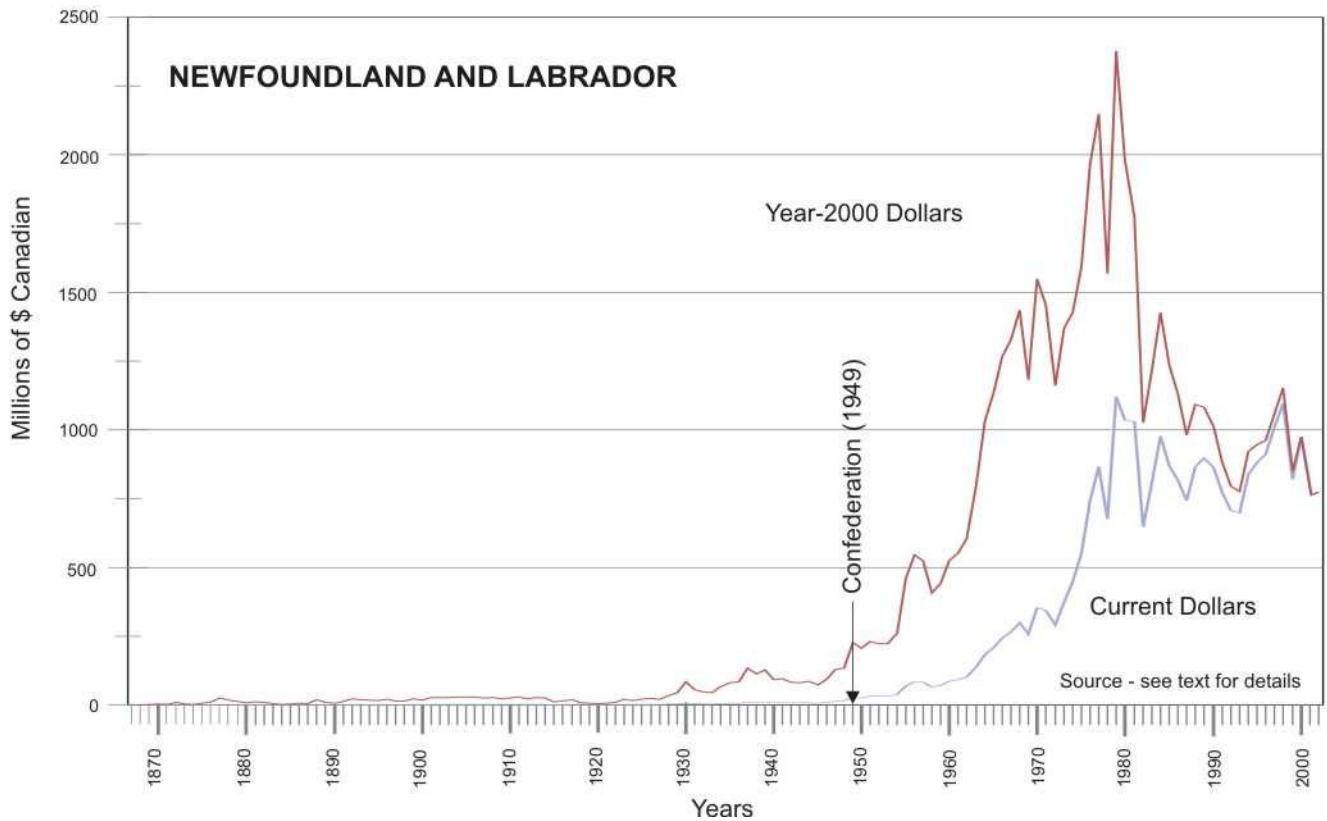
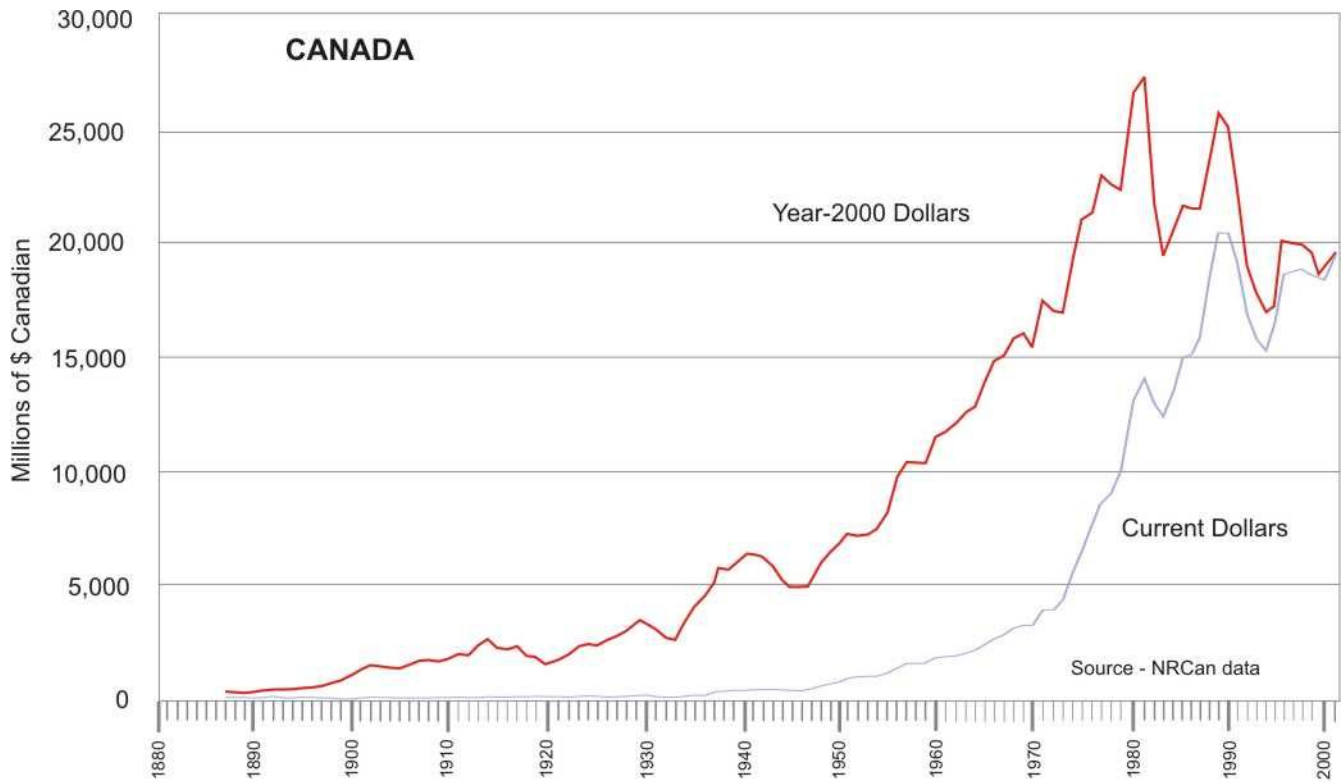


Figure 21. Comparison of Canadian vs Newfoundland and Labrador gross values of mineral production; in current and year-2000 Canadian dollars (Source Natural Resources Canada for Canadian data and Appendix 4B for provincial data). The year-2000 dollar plots were produced using a Gross Domestic Product deflator series. (Source Appendix 4B)

mond production from the Northwest Territories. If this were removed, the value of production trend would show a decline similar to that of Newfoundland and Labrador's production. Canadian mineral production is far more diverse than that of Newfoundland and Labrador and is not controlled by any single commodity, although base and precious metals exert a strong influence. This suggests that the post-1980 decline is a phenomenon that to a greater or lesser extent seems to have affected major mineral commodities other than just iron ore.

A recent review by Sullivan *et al.* (2000) using price indexes developed by the U.S. Geological Survey (USGS), has indicated that the long-term constant-dollar price of key US raw materials (based on five metal commodities – copper, gold, iron ore, lead and zinc – and seven industrial minerals) has declined since 1900. The behaviour of the metals group as a metals price index for the period 1950 to 1997 is shown in Figure 22 in terms of 1997 US dollars. The index is significant as it includes the chief metal commodities produced by Newfoundland and Labrador over this period. The regression line for the index over the 1900-2000 period is also shown for comparison. The index in Figure 22 shows a strong peak ca. 1980 followed by a steep but erratic price decline, a pattern similar to the behaviour of iron-ore prices described above. The behaviour of two significant components of the index; copper and gold, is broken out separately in Figure 23. From this it can be seen that 1980 marked a historic peak in gold prices. This followed the high inflation of the 1970s and in partnership with the iron-ore prices obviously contributed strongly to the peak in the metals index at this time (Figure 22). US copper prices (Figure 23) actually peaked ca. 1974 and then experienced a highly cyclical

behaviour with lows in the mid-1980s and early 1990s following major recessions. The latest decline since 1997 is attributable to the Asian economic crisis and a huge increase in global production capacity. A contributing factor to the overall decline in copper prices since the late 1970s has probably been technological innovations that have progressively brought the real cost of production down. Coupled with this, there has been an increased globalization of the copper market, as a result of which production has become increasingly influenced by South American and Asian producers. The general assumption is that the price decreases have been driven by increased supply (at times leading to oversupply, as has been the recent case for copper and zinc), increased technological efficiency that has resulted in lower production costs, and, in the case of iron ore at least, discovery of higher grade deposits. Taken together with the closure of major operations such as Buchans and Schefferville, these factors have contributed to a dramatic drop in the value of Newfoundland and Labrador's main metal ore exports in the post-1980 period.

The Gross Value of Mineral Production Broken Down by Mining Project

This section examines the historical contribution that each of the Province's mining operations has made to the total value of mineral production. The results of this analysis for the period 1864 to 2000 are summarized in Figure 24 and the following procedures were used to develop this figure:

1. The total amount of production, in metric tonnes, was determined for each of the Province's mineral

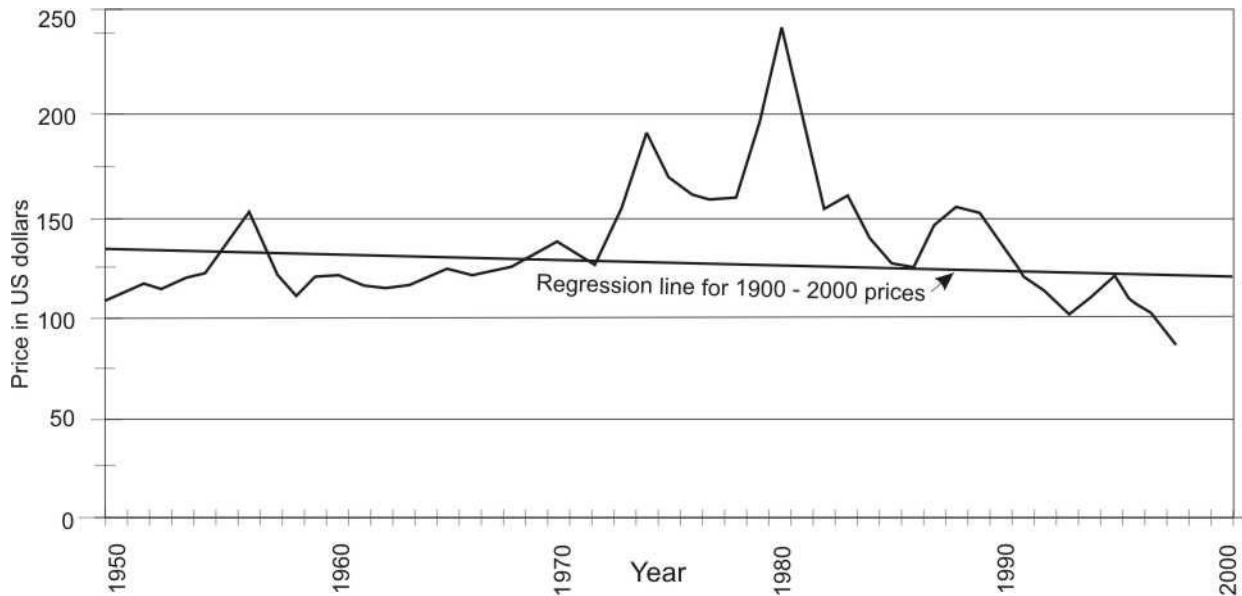


Figure 22. Metals price index in year-1997 US dollars (copper, gold, iron ore, lead and zinc). Source United States Geological Survey, Sullivan *et al.* (2000).

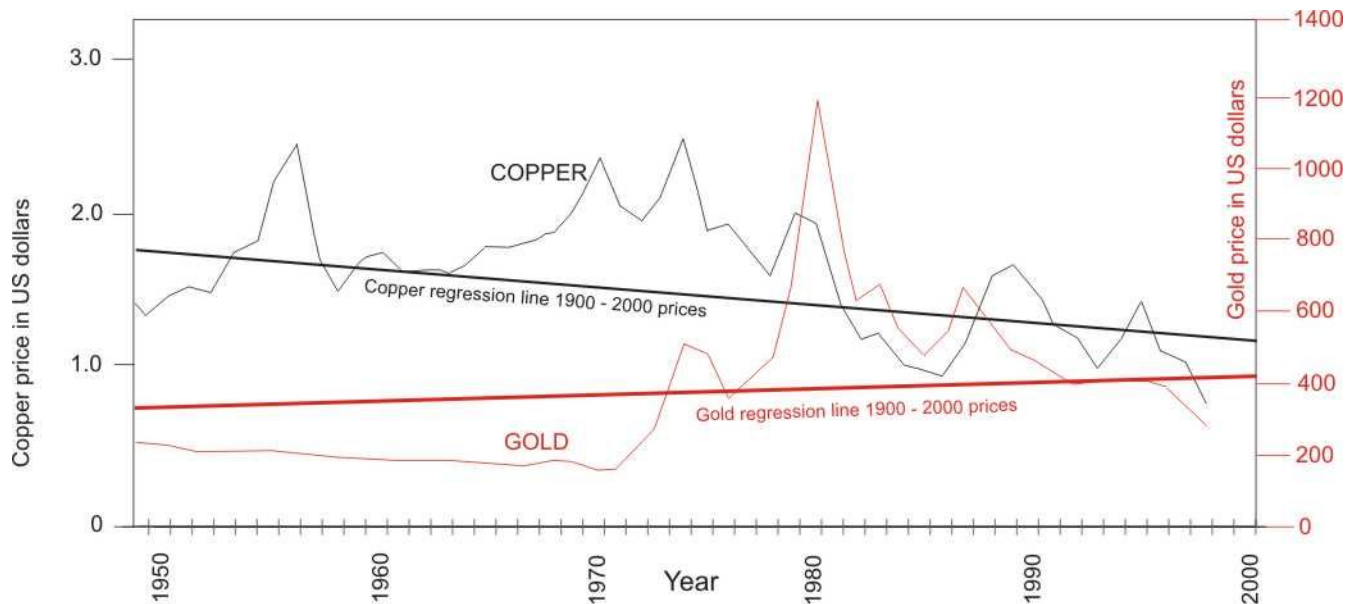


Figure 23. Copper and gold prices in year-1997 US dollars. Source United States Geological Survey, Sullivan et al. (2000).

operations, including metals and industrial minerals. These data were obtained principally from the Canadian Minerals Yearbook (Natural Resources Canada annual publication), supplemented by unpublished records of the Newfoundland and Labrador Department of Mines and Energy.

2. The annual historical price for each commodity produced was determined in US dollars, chiefly from the work of Kelly *et al.* (2002) for the United States Geological Survey. Some values not available in this list (e.g., dimension-stone prices) were determined from Natural Resources Canada and Newfoundland and Labrador Department of Mines and Energy records (Appendix 4H). The annual price was then converted to year-2000 constant US dollars using the US CPI (Appendix 4H; see Appendix 2 for method). An average, annual constant-dollar price for the life of the operation was then calculated.
3. The total tonnage produced per operation from step 1 was multiplied by the average, constant-dollar price calculated in step 2 to produce an adjusted gross value of mineral production in year-2000 US dollars. For the major iron operations of Labrador (Schefferville, Wabush and Labrador City), a more detailed method was used in which the annual value of production for each operation was calculated by multiplying the actual annual tonnage produced (taken from the Canadian Minerals Yearbook report for that year) by the year-2000 US dollar price

series (as calculated from the data of Kelley *et al.*, 2002) and then calculating a total gross value of production for each operation (Appendix 4G).

4. The adjusted gross values of mineral production calculated from step 3 are summarized in Table 2 (taken from Appendix 4F) and plotted against the year in which the operation commenced production in Figure 24.

Figure 24, therefore, shows the relative value of each of the province's mineral operations adjusted to a present day value in terms of year-2000 US dollars. However, some cautions apply:

1. The main one is that for all operations except Schefferville, Labrador City and Wabush, the calculation assumes a constant annual rate of production, which probably was not the case for most operations. If production was biased towards a particular period when historical metal prices were higher, or lower, than the average then this could distort the result – but probably not to the extent that it would change the major conclusions derived below. This caution does not apply to the Labrador iron-ore operations of Schefferville, Labrador City and Wabush, where as noted above, the value was determined on an annual basis and is thus more accurate.
2. The calculations use historical US prices, since comparable Canadian prices were not available for all mineral commodities. The US prices may not

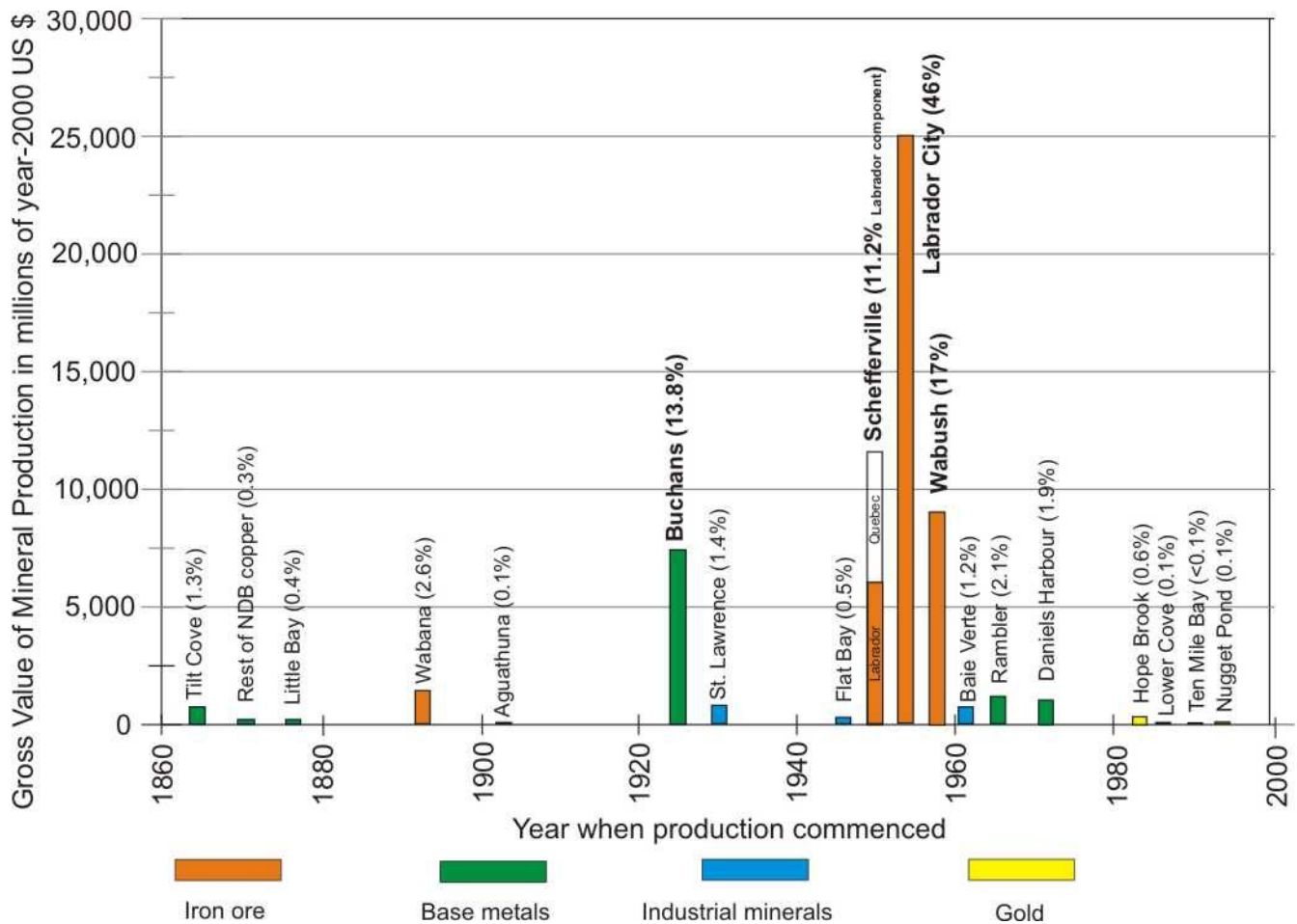


Figure 24. The comparative historical value of Newfoundland and Labrador mining operations in year-2000 US dollars. (Source Appendices 4F, 4G and 4H). Note: mineral production values are based upon total tonnage produced in metric tonnes multiplied by the average historical price adjusted to year-2000 US dollars. The percentages in brackets after the operation name are percentages of the total adjusted historical value of mineral production. The uncoloured part of the Schefferville bar indicates the Québec component of production value.

have matched the Canadian price at all times, particularly for industrial minerals where prices in earlier years were often determined locally rather than nationally or internationally. This also applies to iron ore that is usually traded under a series of long-term contracts and is thus not governed by a single price. The United States Geological Survey “price” that has been used is really an average unit value that has been determined by weight averaging the value of shipments and the value of imports (Kelley and Jorgenson in Kelley *et al.*, 2002). In the past 25 years or so this has been dominated by pellet production (including that from Labrador) and thus provides a good match for eastern Canadian production, much of which is pelletized. It may not, however, provide the best match for Wabana ore prices. The US price has historically been, and continues to be, higher than the world price for iron ore.

- Value estimates marked * in Table 2 are theoretical values based upon the tonnage produced multiplied by the mill head grade multiplied by price. This does not account for milling-concentrating losses and thus is an overestimate of the amount and value of a particular commodity that was actually shipped and sold.
- Finally, the historical price for some commodities such as copper and limestone was not known for the early parts of the production period and had to be based upon later years (*see* Appendix 4F for details).

For any or all of the above reasons, the values determined using the United States Geological Survey historical prices may not match precisely those actually realized by the producing companies. Nevertheless, they provide an inter-

Table 2. Historical Total Gross Values of Mineral Production for Newfoundland and Labrador mineral operations

Operation	Gross value of production in year 2000 US\$	% of total provincial value
Tilt Cove (Cu,Au)	\$715 000 000	1.3
Other Notre Dame Bay mines (Cu)	\$162 000 000	0.3
Little Bay (Cu,Au)	\$224 000 000	0.4
Wabana (Fe)	\$1 394 000 000	2.6
Aguathuna (limestone)	\$65 840 000	0.1
Buchans (Cu,Pb,Zn,Au)	*\$7 312 000 000	13.5
St. Lawrence (Fluorite)	*\$759 000 000	1.4
Flat Bay (Gypsum)	*\$266 000 000	0.5
Schefferville (Fe) - Labrador component only	\$6 070 000 000	11.2
Labrador City/Carol (Fe)	\$24 912 000 000	46.0
Wabush (Fe)	\$9 129 000 000	17.0
Baie Verte (asbestos)	\$675 000 000	1.2
Rambler (Cu,Pb,Zn,Au)	*\$1 136 000 000	2.1
Daniel's Harbour (Zn)	\$1 035,000 000	1.9
Lower Cove (limestone, dolomite)	\$42 000 000	0.1
Hope Brook (Au)	\$327 000 000	0.6
Ten Mile Bay (anorthosite)	\$12 000 000	0.02
Nugget Pond (Au)	\$60 000 000	0.1
Total provincial value	\$54 472 000 000	

See text for method of calculation (and cautions). Major operations in terms of value are highlighted in bold. For detailed calculations see Appendix 4F.

*Indicates that the value is based upon production tonnage *multiplied by* mill head grade rather than actual amount produced.

nally consistent data set as the basis for inter-operation comparisons.

Not surprisingly, the Labrador iron-ore operations of Schefferville⁵, Wabush and Labrador City stand head and shoulders above the rest of the field. The only other comparable operation in terms of its historical value was Buchans. Perhaps surprisingly, the historical copper operations of Notre Dame Bay (Tilt Cove, Little Bay and others) show a comparatively low overall value at ca. 2%, despite that fact that the value of recovered gold is probably overestimated in the calculation (see Appendix 4F). This is probably due to the fact that though historical copper prices were much higher in real terms than those of today, the overall production was low by modern standards. The same is true of Wabana, which

despite its longevity, has a comparatively low overall value at ca. 3% of the total. In this respect it should be noted that Wabana's annual production and grade of shipped product (ca. 48% iron) were much less than those of modern iron ore mines. Also of note is the overall low value of the industrial minerals operations in comparison to those producing metals. Table 2 and Figure 24 also show the percentage that each operation formed of the total historical value of mineral shipments, which amounts to \$54 billion in year-2000 US dollars. Three pertinent observations derived with respect to this are:

- Four mining operations (Labrador City, Schefferville⁶, Wabush and Buchans) contributed 89% of this total.
- One operation (Labrador City) contributed 46% of the total.
- Iron-ore operations (Wabana, Schefferville, Labrador City and Wabush) accounted for 75% of this total.

It should be remembered that the Buchans value, because it is based upon theoretical production values (Table 2) is probably overstated. However, even a 10% overvaluation would not significantly change either the above conclusions, or the standings in Table 2.

Estimated Effects of a Voisey's Bay Mining Operation on the Value of Mineral Production

Following the recent decision to proceed with the Voisey's Bay nickel-copper-cobalt project, it is interesting to analyze the projected gross *in-situ* value of this major discovery in comparison with past and existing operations. This is done in Figure 25, which adds estimated *in-situ* values for the major components of the Voisey's Bay deposit to the historical values for other deposits shown in Figure 24. The estimated Voisey's Bay values are founded simply upon the calculated value of the ore as derived from the published values in Table 3. Allowance has been made for milling losses (based upon published recovery figures for the Ovoid deposit, Voisey's Bay Mine and Mill Environmental Impact Statement 1997), but not for other potential losses such as incomplete mining of the resource. The value estimates are also subject to deviation of real prices from the assumed

⁵ Note that the Schefferville operation straddled the Québec-Labrador border with production divided roughly evenly between the two provinces. Figure 24 shows both the overall production and the Labrador component.

⁶ Schefferville production as used here includes only the Labrador component.

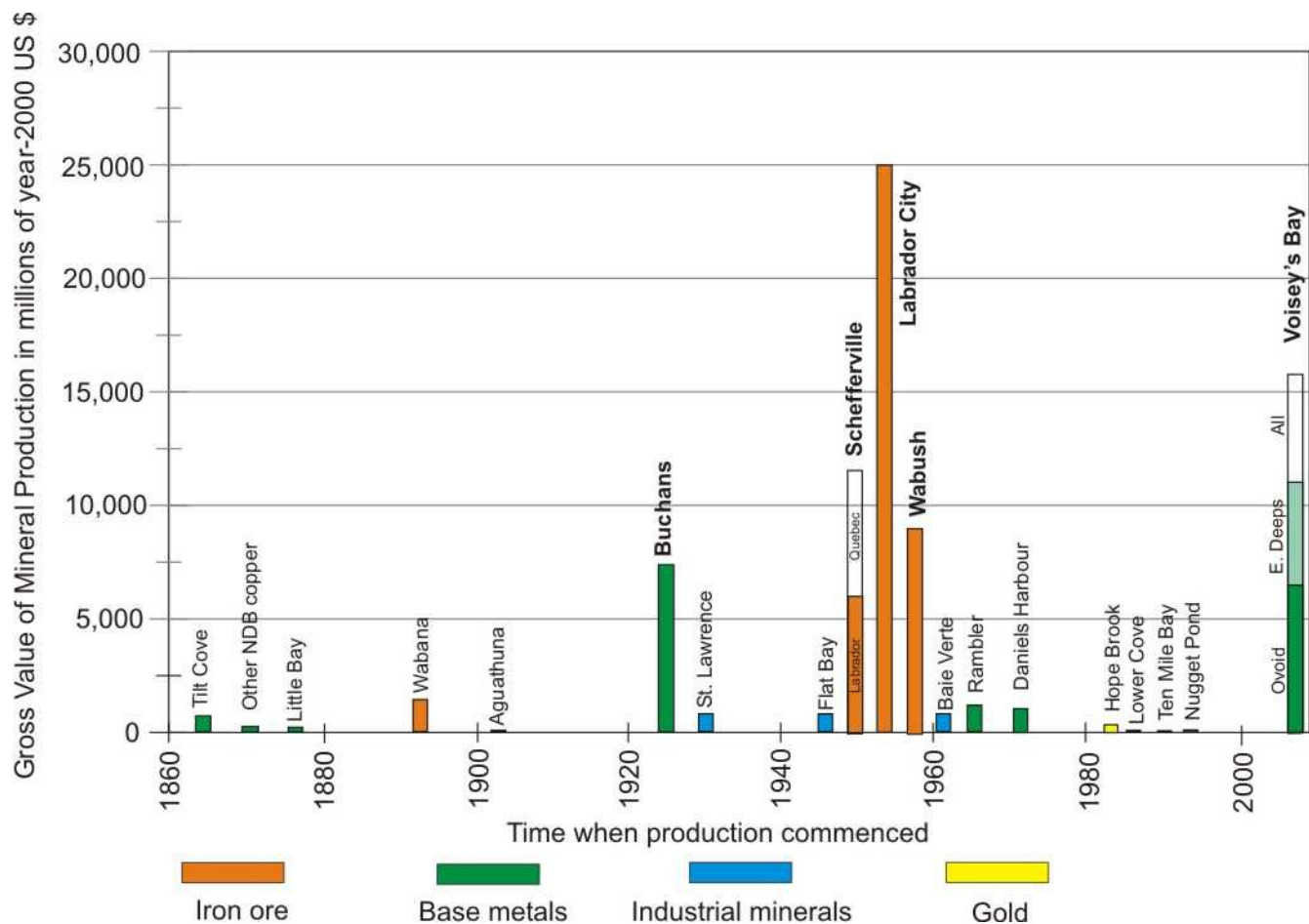


Figure 25. The comparative historical value of Newfoundland and Labrador mining operations in year-2000 US dollars, also showing estimated in-situ values for the Voisey's Bay deposit (Source Appendices 4F, 4G and 4H). Note: mineral production values are based upon total tonnage produced in metric tonnes multiplied by the average historical price adjusted to year-2000 US dollars. The value for Voisey's Bay is based upon the reserve tonnage, adjusted for processing losses multiplied by an assumed average long-term price in current US dollars.

Table 3. Estimated gross in-situ value of the Voisey's Bay deposits; the assumptions used in this table are discussed in the text

Deposit	Ore/Resources tonnes	Metal	Grade (%)	Tonnes of metal	Forecast Recovery (%)	Recovered tonnes	Assumed price US\$	Value US\$ million
Ovoid	31 700 000	Ni	2.85	903 450	82.1	741 732	\$6 614	\$4 906
		Cu	1.68	532 560	93.8	499 541	\$1 984	\$991
		Co	0.14	44 380	85	37 723	\$15 432	\$582
		Total						\$6 479
Eastern Deeps	47 000 000	Ni	1.39	653 300	82.1	536 359	\$6 614	\$3 548
		Cu	0.6	282 000	93.8	264 516	\$1 984	\$525
		Co	0.09	42 300	85	35 955	\$15 432	\$555
		Total						\$4 627
Total	137 000 000	Ni	1.6	2 192 000	82.1	1 799 632	\$6 614	\$11 903
		Cu	0.85	1 164 500	93.8	1 092 301	\$1 984	\$2 167
		Co	0.09	123 300	85	104 805	\$15 432	\$1 617
		Total						\$15 687

ones. In Figure 25 the deposit is divided into its major components (see also Table 3). The lower bar in Figure 25 is the Ovoid, which is the only part of the deposit to date that constitutes a proven reserve and for which definite mining plans exist. The second bar is the Eastern Deeps deposit, which depending upon further exploration results, may be the next mineable deposit, and the third bar represents all geological reserves discovered to date (137 million tonnes). The calculated values are heavily dependant on assumptions and are thus not directly comparable with the value of mineral production data for other operations. Nevertheless, they allow an order-of-magnitude comparison with existing and past operations. On this basis, the Ovoid seems to be roughly comparable to the Buchans operation, whereas the added value of the Eastern Deeps and other components would make the Voisey's Bay deposit more comparable to the value of the Schefferville and Wabush operations respectively, but still less than that of Labrador City.

Clearly the Voisey's Bay project will dramatically increase the annual gross value of the province's mineral production. The predicted average annual production and value from the Voisey's Bay Ovoid deposit has been published by Inco (2003) in current dollars as:

Nickel	– 110 000 000 lbs	= 49 896 t	= US\$330 012 144
Copper	– 85 000 000 lbs	= 38 556 t	= US\$ 76 495 104
Cobalt	– 5 000 000 lbs	= 2 268 t	= US\$ 34 999 776
Total			= US\$441 507 024

Total annual value of production in Canadian dollars
 (@0.66 US dollar exchange rate) = **CAN\$668 950 036**

This is based on the anticipated annual production rate of about 2.19 million tonnes (6000 tonnes per day). The predicted annual value of production will therefore be about CAN\$669 million Canadian (mid-2003 exchange rates), which represents an 85% increase over the overall gross value of provincial mineral production for the year 2002. This is shown graphically in Figure 26 where the annual gross value of Voisey's Bay production has been added to the adjusted constant-dollar graph for the value of mineral production of Figure 15. This would raise the gross value of mineral production to levels last seen in 1984. Obviously the gross value could change depending upon whether average metal prices exceed, or fall below, the assumptions in Table 3.

Comparison of Historical Mineral Production and Offshore Oil Project Values

In order to appreciate the significance of the historical production values discussed in the previous section, it is probably helpful to compare them to other non-renewable resource projects in the Province, particularly those involving offshore oil production. The Province's offshore oil production has grown greatly in recent years and is currently seen as one of the major revenue opportunities for future years. Figure 27 compares the historical production values

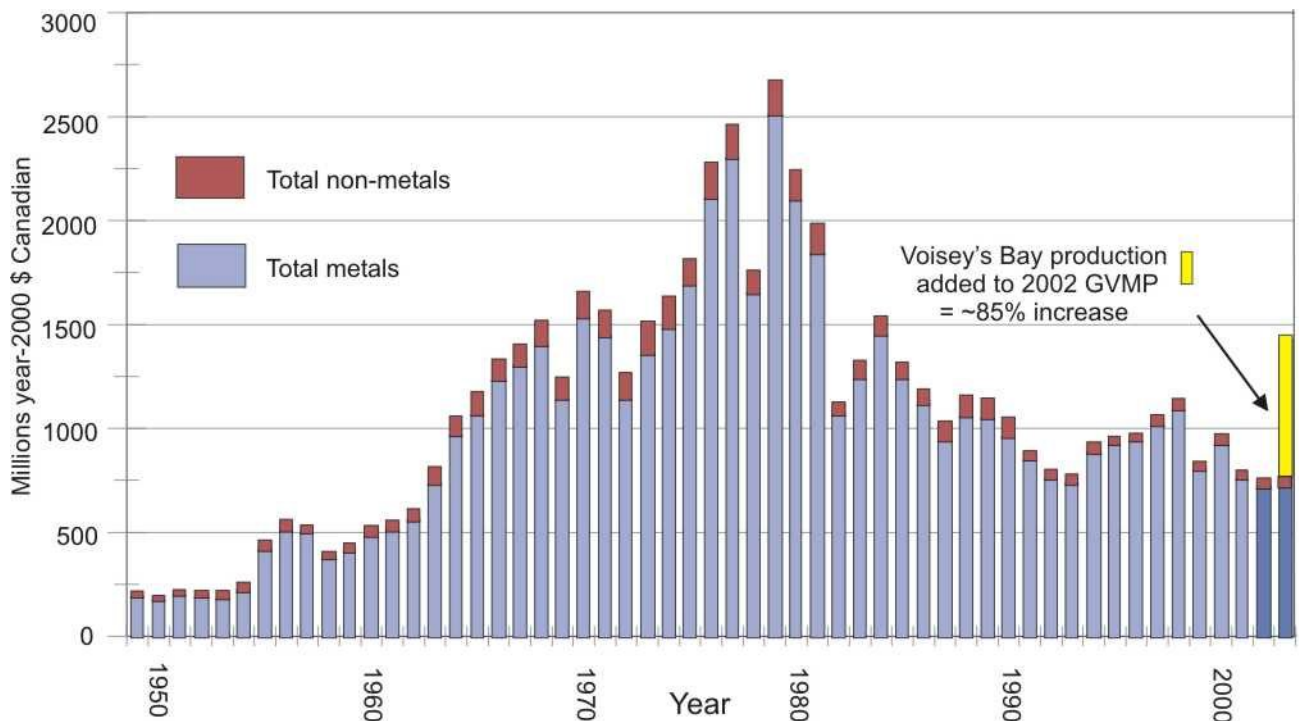


Figure 26. Gross Value of Mineral Production in constant Canadian dollars showing hypothetical effect of Voisey's Bay production added to year-2002 values. (Source Appendix 4B and Table 3)

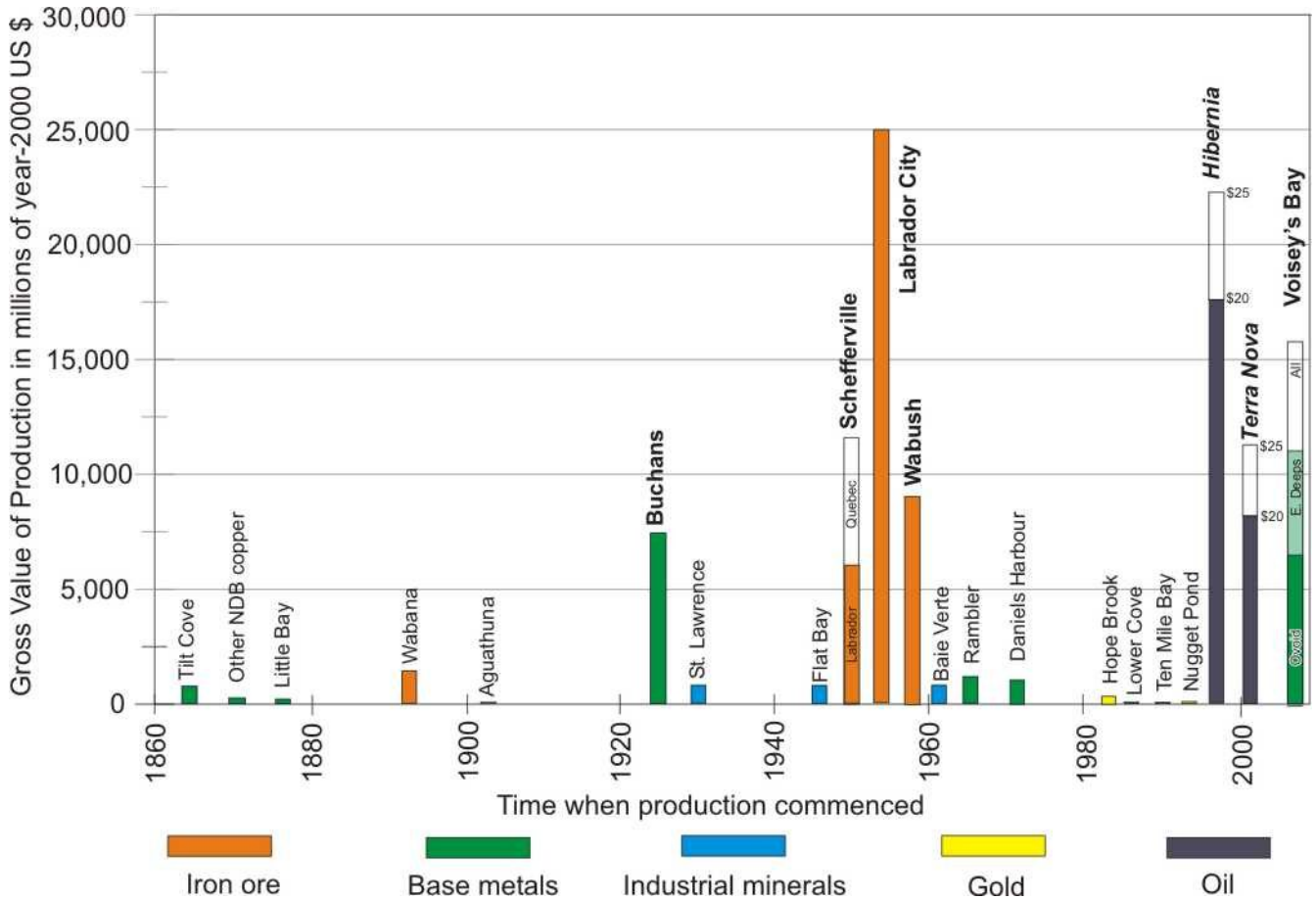


Figure 27 The comparative historical value of selected mining operations compared to estimated in-situ values for the Hibernia and Terra Nova oil fields, in year-2000 US dollars and using a long-term price of US\$20 per barrel. (Source for recoverable oil reserve data – Canada-Newfoundland Offshore Petroleum Board). The uncoloured part of the Hibernia and Terra Nova bars indicates the increase in value if a price of US\$25 per barrel is assumed. See Figure 25 for notes concerning historical mine valuations. The values for Hibernia and Terra Nova are based on total extractable reserves of oil multiplied by assumed long-term prices of \$US20 and \$25/barrel. Gas and near-gas liquids are excluded from the in-site value calculation.

from Figure 25 with the value of *in-situ* reserves for the Hibernia and Terra Nova offshore oil projects. This is based upon recoverable reserves of 884 and 406 million barrels of oil respectively for the Hibernia and Terra Nova projects (Canada-Newfoundland Offshore Petroleum Board 2003) and assumed long-term prices of US\$20 and US\$25 per barrel respectively. The value ranges derived from this are US\$17.7 to 22.1 billion for Hibernia and US\$8.1 to 10.2 billion for Terra Nova. Obviously these are predicted values that are subject to the same uncertainties regarding long-term price assumptions as those for the Voisey's Bay calculations. This aside, the interesting aspect that emerges from Figure 27 is that the Hibernia and Terra Nova projects fall within the same range in terms of overall *in-situ* value as the Province's major mining projects. Both, however, are exceeded by the gross value of production from the Labrador City operation. It is also interesting that the Terra Nova and Voisey's Bay

projects are broadly comparable in terms of *in-situ* value of the resource. This comparison does not take into account possible future gas production from these oil projects. It should also be noted that the current royalties from offshore oil greatly exceed those from mining, thus underlining the current value of offshore oil to the Province (*see* section, Taxation and Employment Benefits from Mining).

Summary

- Mining is the second most important resource industry in the Province in terms of gross domestic product.
- The Province accounts for 6% of the value of Canadian mineral production and ranks 6th highest in terms of other provinces and territories.

- Historically, the Province's mineral economy has moved from a diversified one prior to 1960, to one increasingly dominated by iron ore to the extent that in recent years this product has accounted for 91 to 94% of the value of mineral production. This is due as much to the closure of other operations as to increases in iron-ore production.
- The Province is currently the lead producer of iron ore in Canada at 63% and accounts for 2% of world production.
- Non-metals account for only 6% of mineral production and are dominated by construction materials (sand, gravel, and aggregate stone), dimension stone and dolomite. Aggregate stone, dolomite and dimension stone have all seen pronounced growth in the late 1990s.
- Historical trends in the value of mineral shipments, converted to constant dollars, show a steady increase to a peak ca. 1979, followed by a cyclical decline that has lasted to the present day. The present-day value of shipments, in constant-dollar terms, is comparable to that of the mid-1960s. This decline has been largely the result of lower iron-ore prices since 1979, combined with a decrease in production due to closures such as the Schefferville and Buchans operations.
- The decline in iron-ore prices (and other metal prices) since ca. 1980 has been driven largely by increased competition from low-cost foreign sources, chiefly in the iron-ore markets, and by technological improvements that have lowered production costs world wide.
- The provincial trend for value of mineral production is very similar to that for Canadian mineral production.
- Some pertinent facts concerning historical contributions to provincial mineral production are:
 - 89% of the value of mineral production has been provided by four operations (Labrador City, Schefferville, Wabush and Buchans).
 - One operation (Labrador City) has contributed 46% of the total value of production.
 - Iron-ore operations (Wabana, Schefferville, Labrador City and Wabush) have accounted for 75% of the total value of mineral production.
- The total historical gross value of mineral production is estimated at around US\$54 billion in year-2000 dollars.
- Production from the Voisey's Bay deposit could result in an increase of ca. 85% over the current value of mineral

production in the Province, but will only restore the gross value of mineral shipments to a ca. 1984 level value of production. The *in-situ* value of the Voisey's Bay deposit appears comparable in terms of value of total production to the Buchans, Wabush and Schefferville operations but is easily exceeded by the value of the IOCC Labrador City operation.

- The Province's major mining projects compare favourably in terms of their gross value of production with the predicted *in-situ* value of the Hibernia and Terra Nova offshore oil projects. The Labrador City iron-ore operation exceeds both in terms of its value of production to date.

TAXATION AND EMPLOYMENT BENEFITS FROM MINING

This section examines the benefits derived from mining through taxation, employment and wages.

Taxation Benefits

These⁷ are considered under the headings of *Mining Taxes and Royalties*, which are the revenues paid directly to government under various acts, and *Other Taxes*, which comprise more indirect sources of revenue.

Mining Taxes and Royalties

These accrue to the Province under the following acts:

1. *The Mining and Mineral Rights Act, 1975 as amended 1994, 2002.* This act governs all mining operations that have commenced since the introduction of the act in 1975. It imposes a royalty of 15% on taxable income and an additional levy of 20% on any private royalties paid to a third party. Major sources of revenue under this latter levy are the Labrador Iron Ore Royalty Income Fund, which on behalf of Labrador Mining and Exploration Company Ltd., is taxed on royalties that it receives from the Iron Ore Company of Canada; and Arbatax International Inc. (formerly Nalcap) and Knoll Lake Minerals, which are taxed on royalties that they receive from Wabush Mines.
2. *The Labrador Mining and Exploration Company Limited Act, 1938.* This governs the royalties paid by the Iron Ore Company of Canada from its Labrador City operations. Royalties are paid on the basis of 5% of profits as defined under the act.

⁷ This breakdown differs from that normally used in provincial tax accounting, where the mining/royalty, corporate, fuel, retail sales, payroll and sundry taxes are considered as direct, and municipal and other sundry taxes are considered as indirect.

3. *The NALCO-Javelin (Mineral Lands) Act, 1957.* This governs the royalties paid by Wabush Mines. The Province collects a basic royalty of \$0.22 per tonne of iron products shipped from Wabush Mines. Under the Government-Javelin Taxation (Confirmation of Agreement) Act of 1959, an escalation royalty is also collected from Arbatax in agreement with a formula established in the Act. This is based on the amount by which the value of iron products shipped exceeds the Lake Eyrie price of US\$11.70 for Old Range non-Bessemer ore analyzing 51.5% iron.

Figure 28 displays the existing Mining Tax and Royalties revenue for the period 1949 to present plotted against the gross value of production data, both data sets being shown in terms of year-2000 Canadian dollars (note, however, the radically different scales for the two data sets). From this figure it can be seen that revenue for the period 1949-73 increased steadily in overall correlation with the value of production until reaching a peak of ca. \$52 million in 1981, slightly postdating the peak of mineral production value in 1979. After this date, the revenue then declines in approximate correlation with the value of production, the exception being the years 1987-88 when revenue spiked to about \$45 million but in the absence of any corresponding increase in production value. The reasons for this revenue spike are as yet unclear. One of the more interesting aspects

of Figure 28 is the manner in which Mining Tax and Royalty revenue as a proportion of the value of production, increases with time. This is more clearly portrayed in Figure 29 which plots the revenue as a percentage of the value of production (the revenue percentage) against time. From this it is evident that ca. 1976, the revenue percentage began a fairly steep increase from a previous average level of about 1%, to an average of about 2.5% in the period 1984 onwards. Put another way, the revenue take increased from about \$10 million to an average of \$25 million over this period: an increase of 150%. What initiated this increase? The magnitude of the increase was such that it could only be accounted for by events impacting the iron-ore industry, which at this time was generating 85% of the gross value of mineral production. The explanation in this case is the application, starting in 1975, of the 20% tax provision in the Mining and Mineral Rights Tax Act to the private royalties paid out by Wabush Mines and later by IOCC. This is supported by the fact that at the present day, the tax derived from the private royalty revenues accounts for more than half of the direct tax take from the iron-ore companies. The Mining and Mineral Rights Tax Act, however, did not affect the primary royalty stream to government, which continued to be governed by the specific royalty agreements referred to above. Clearly, if all revenue from these operations (and others such as Buchans) had come under the Act since its proclamation in 1975, then the impact on provincial revenues would have

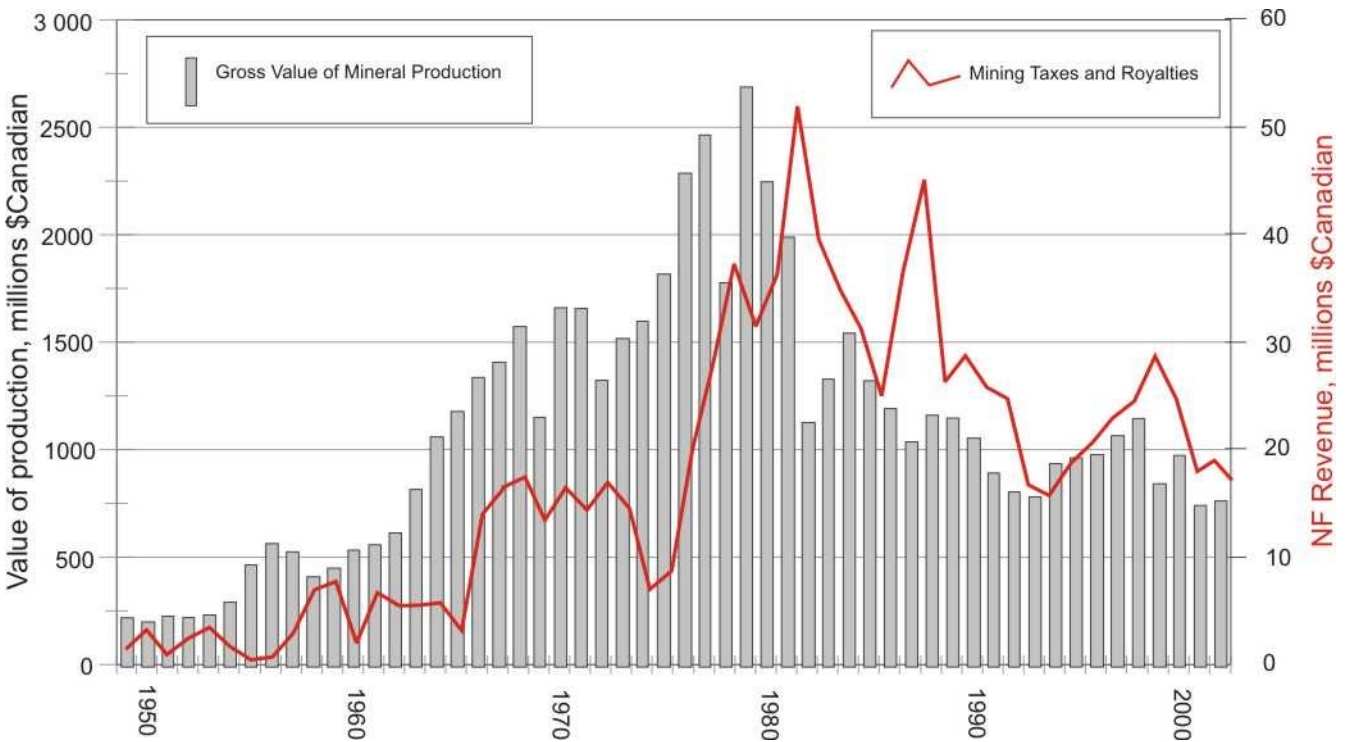


Figure 28. Direct Provincial Revenue (right axis) vs Gross Value of Mineral Production (left axis) in year-2000 Canadian dollars. (Source Appendix 4B)

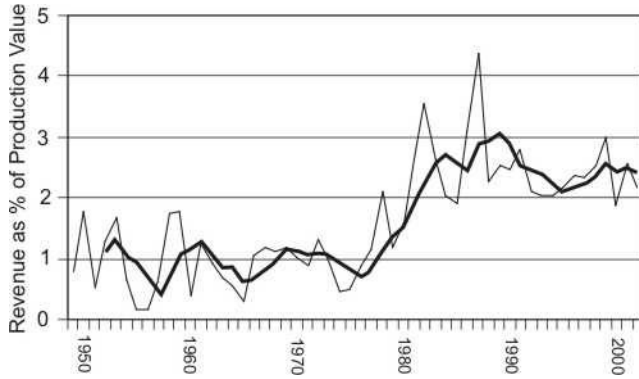


Figure 29. Direct Provincial Revenue as a percentage of the annual Gross Value of Mineral Production. Bold line is a moving-average trendline. (Source Appendix 4B)

been even greater. A subsidiary contribution to the increase in the revenue percentage was also the 1975 opening of the Daniel’s Harbour zinc mine, the first operation to be taxed completely under the new act. Mining tax from Daniel’s Harbour amounted to an average of \$1.7 million over the operating period and did not exceed an annual value of \$5 million (all in year-2000 dollars). Clearly, therefore, it was only a minor contributor to the rise in mineral revenues

Other Taxation Revenue

The Department of Mines and Energy records regarding other tax revenues since 1949 are very incomplete. The raw information probably exists in the form of the annual Natural Resources Canada census forms that each mining operation has to complete, however, many of these data have not been fully analyzed and thus were not available for use in this review.

Detailed revenue information is, however, available for the period 1990-98 (source: unpublished Newfoundland and Labrador Department of Mines and Energy statistics) and allows comparison with Mining Tax and Royalties revenue. Other tax revenue comprises corporate, fuel, retail sales, municipal and sundry taxes as derived from mining operations. The breakdown of these tax components, averaged over the 1990-1998 period, is shown graphically in Figure 30. The largest individual tax contribution, at about 40% (Figure 30), comes from sundry taxes, which comprise personal income, retail sales, gasoline, tobacco, alcohol and motor vehicle taxes as applied to mining workforces.

The comparison between Mining Tax and Royalties and other taxes for the 1990-1998 period is shown in Table 4.

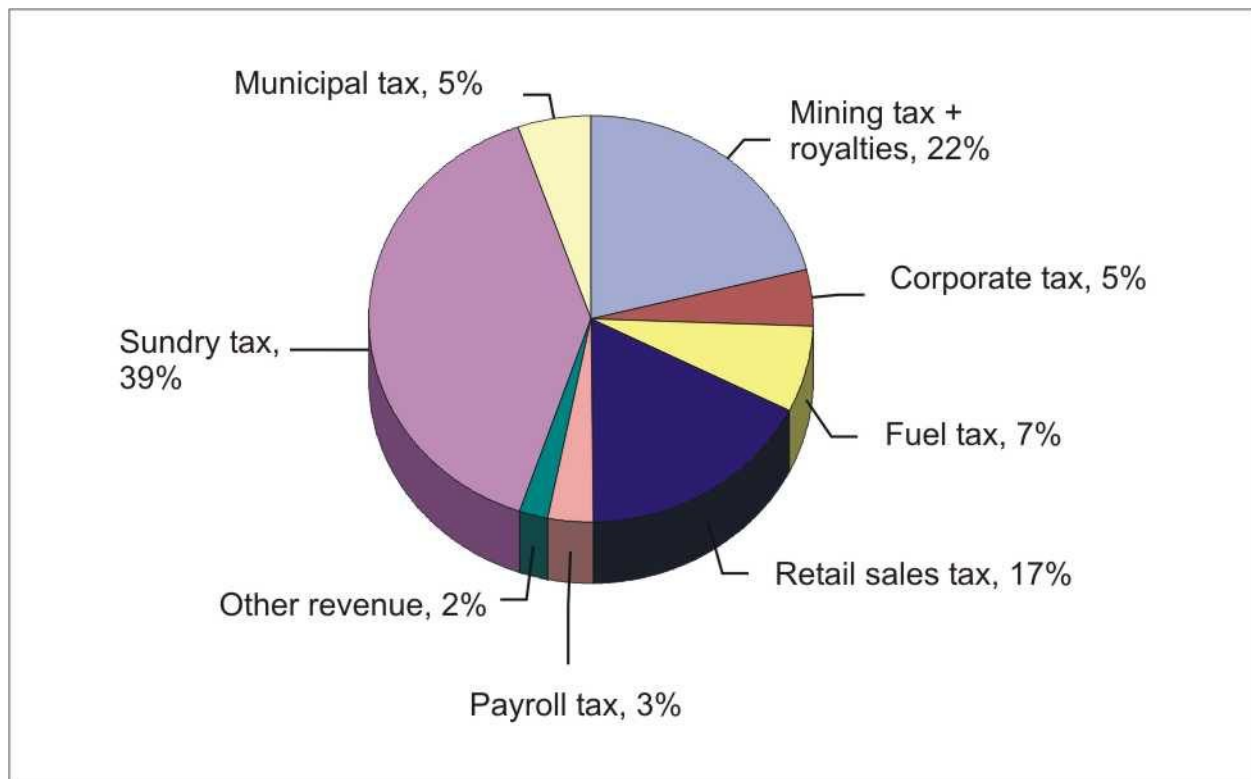


Figure 30. Breakdown of total Provincial Mineral Revenue averaged over the period 1990 to 1998. (Source Appendix 4I). In year-2000 Canadian dollars.

Table 4. Mining Tax & Royalties vs Other Taxes for the period 1990-1998, in millions of year-2000 Canadian dollars

Revenue type	1990	1991	1992	1993	1994	1995	1996	1997	1998
Mining Tax & Royalties (millions of \$)	26.0	25.0	17.0	15.9	18.9	21.0	23.3	24.9	29.1
Other Taxes (millions of \$)	74.4	85.5	76.3	68.3	78.0	93.5	104.2	82.2	88.8
Total (millions of \$)	100.4	110.5	93.2	84.2	97.0	114.4	127.4	107.1	117.9
Value of Mineral Production (millions of \$)	1054	892	803	781	935	962	978	1065	1144
Average Mining Tax & Royalties			= \$22.3 million			= 2.3% of AVMP			
Average Other Taxes			= \$83.5 million			= 8.7% of AVMP			
Total average revenue			= \$105.8 million			= 11% of AVMP			
Average Value of Mineral Production (AVMP)			= \$957 million						
Conversion to constant dollars was carried out using the CPI series (Table D-2)									

From this it is apparent that over this period, Other Tax Revenue exceeded that from Mining Tax and Royalties by a factor of about 4. Furthermore, when examined as a percentage of the gross value of mineral production, it is apparent that Mining Tax and Royalties only amounted to 2.3 % (historically this ranged between 1 and 2.5% - Figure 28) of this value during the period shown in Table 4, whereas Other Taxation Revenue accounted for 8.7%. The total taxation revenue accounted for 11%. It is not certain though whether the 11% value can be extrapolated over previous mineral production history.

Comparison of Mining and Oil Revenues

Following the comparison between the gross value of mineral and oil production (see Section on The Economic Value of Mineral Production - Present Day and Historical Perspectives, it is appropriate to briefly compare the revenues derived from these sectors. The figures below are taken from the Government of Newfoundland and Labrador Annual Statement of Public Accounts and deal only with

Year	Oil Royalty Revenues	Mining Tax and Royalties Revenues
1998	\$ 4 266	\$27 800
1999	\$ 3 295	\$24 465
2000	\$19 992	\$18 289
2001	\$39 481	\$19 364
2002	\$27 904	\$17 071
2003	\$72 287	\$17 360
	(in millions of current dollars)	

Mining Tax and Royalties vs oil revenues. As can be seen, the oil royalty revenues have surpassed those from mining in recent years, a comparison that is worsened by the decline in mining revenue during this period. Mining Revenues will likely increase substantially once Voisey's Bay has paid off its capital costs; however, oil revenues are projected to increase to levels of over \$100 million in coming years.

Employment and Wages

This section examines trends in mining workforce numbers and annual wages paid to the mining workforce. This does not include the supply or exploration sectors.

Wages paid to the mining workforce generate benefits to the mining communities and the Province through purchases of goods and services and also through the income and sales taxes described above. There are no data concerning the exact level of benefits derived from employment per operation, however, it is presumed that the benefits will be proportional to the average wage levels and the workforce employment numbers, common income multipliers being 1.32 to 1.36. Data for average wages and employment numbers are available but with numerous gaps. A meager amount of data for the pre-confederation period are available in annual reports by the Department of Agriculture and Mines and indicate levels of up to 2500 persons per year up to 1921. Data for the period 1949-73 come from Department of Mines and Energy annual reports, however, these are inconsistent and for some years the relevant information is lacking. For the post-1988 period more extensive data are available from unpublished Newfoundland and Labrador Department of

Mines and Energy statistics and for some years from the Canadian Minerals Yearbook.

Employment trends post-1949 are depicted in Figure 31, which plots the available employment data against the trends in the value of mineral production through to the present. From this it appears that employment increased from a level of about 3500 in 1949 to a peak of around 7000 in 1970 and has since declined significantly to a present level of about 2700. It should be noted that data are missing for the critical period of the late 1970s–early 1980s when mineral production peaked and when employment may have been even higher. This trend is broadly correlated with that of the value of mineral production, the post-1980 decline in mineral shipments being evidently matched by a proportional decline in employment. Current employment levels are the lowest in the Province’s post-confederation mining history.

The decline in employment is offset to some extent by the trends in average^s annual individual wages, shown in Figure 32. These are plotted (adjusted to year-2000 dollars) against the employment data referred to in Figure 31. For the period 1949-1970, average wages appear to have increased in proportion to employment, however, after 1988 there appears to have been a strong decoupling with average individual wages continuing to increase despite the decline in employment. The trend, therefore, has probably been driven by technological improvement and has resulted in fewer but

more highly paid and more productive workers. As with all aspects of the Province’s mining industry, these trends were probably driven overwhelmingly by the Labrador iron-ore operations (*see below*). This industry has undergone considerable downsizing over the past two decades whilst at the same time increasing its reliance on technology and automation in order to remain competitive. The recent trend of increasing individual wages in Figure 32 may, therefore, reflect the increasing skill-levels and consequent increasing wage levels in the industry as a result of these changes. Other effects may also be at work, for example contracting-out of some lower paid work to the supply sector. The most recent average annual wage for which information is available (1999) was about \$66 000 (derived by dividing the aggregate wage data for 1999 as provided in the Canadian Minerals Yearbook for 2001, by the total employment number posted by the Newfoundland and Labrador Department of Mines and Energy for that year). This was reputedly – and presumably still is – one of the highest paid in the provincial resource sector.

The breakdown of employment in the Province’s mining industry is considered further in Figures 33 and 34 for the period 1994-2002, based upon unpublished Department of Mines and Energy statistics. Figure 33 depicts the proportion of persons employed in iron-ore mining as opposed to overall employment in the industry. This has varied between 68 and 78% of the total employment and has averaged 74% over

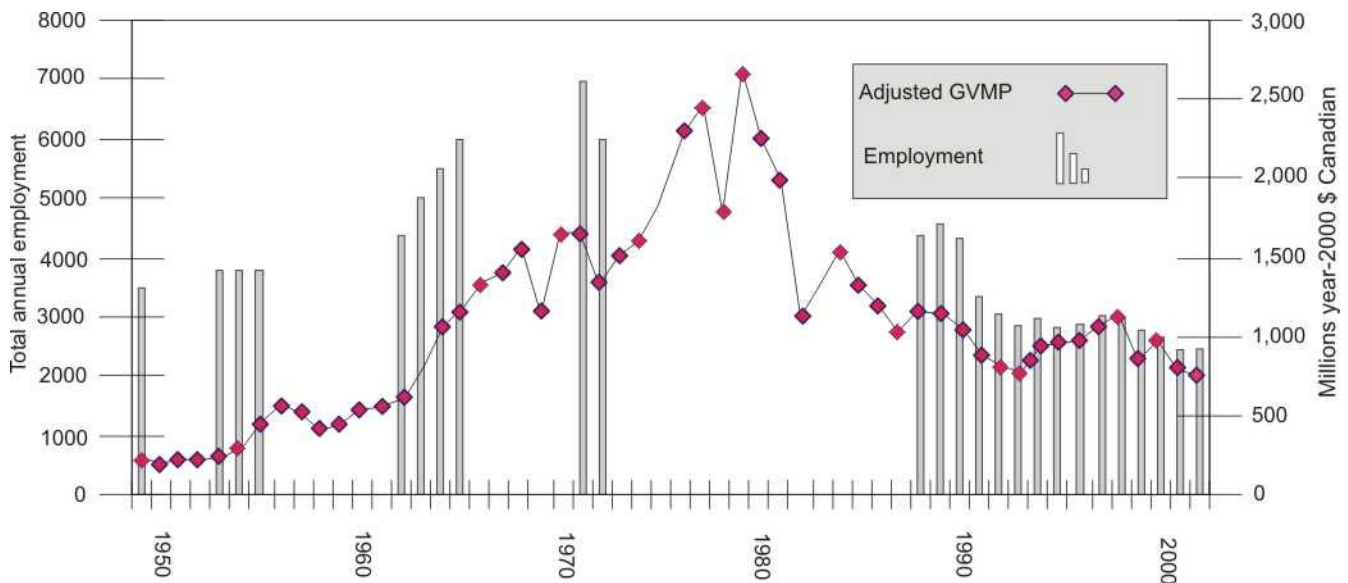


Figure 31. Total annual employment vs the Gross Value of Mineral Production (GVMP) in year-2000 Canadian dollars. (Source Appendices 4J and 4D)

^s Note that the annual wage data as derived from Natural Resources Canada sources may not include all seasonal work especially – that related to quarry operations, which by virtue of its lower wage levels would tend to lower the industry average.

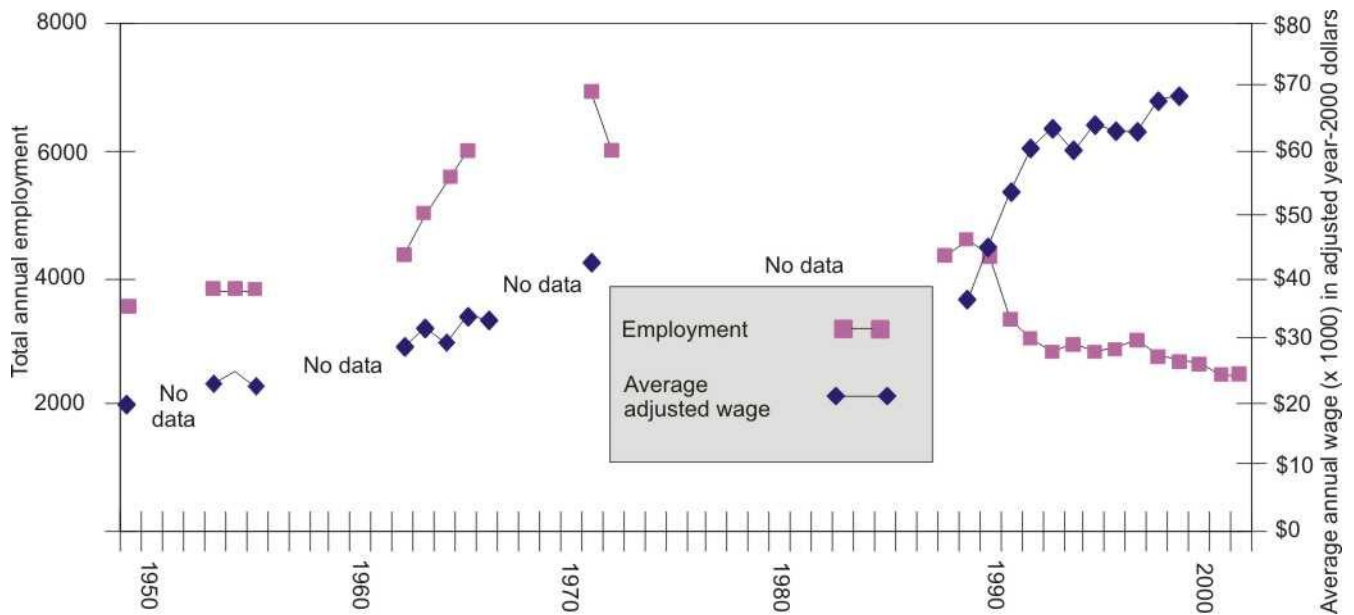


Figure 32. Total annual employment vs average wages for Newfoundland and Labrador mining in year-2000 Canadian dollars. (Source Appendix 4D)

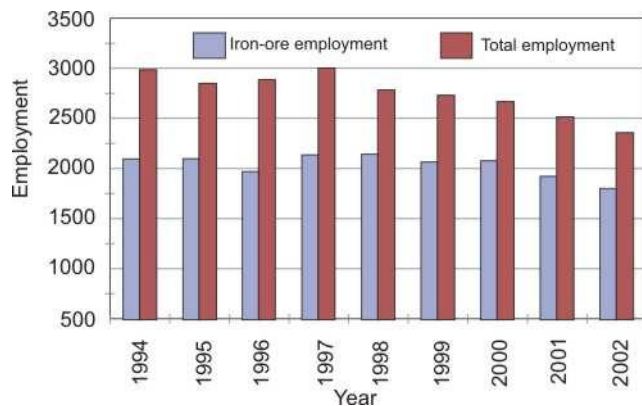


Figure 33. Employment in Newfoundland and Labrador mining; iron-ore mines vs all operations, 1994 to 2002. (Source – unpublished Newfoundland and Labrador Department of Mines and Energy statistics)

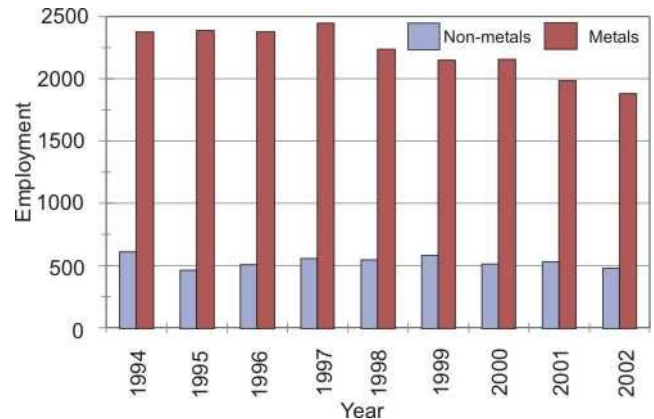


Figure 34. Employment in Newfoundland and Labrador mining; metallic vs non-metallic sectors, 1994 to 2002. (Source – unpublished Newfoundland and Labrador Department of Mines and Energy statistics)

this period. Employment in iron-ore mining thus dominates the industry but not to the extent that the gross value of iron-ore production (typically 95% plus, Table 1, Figure 16) dwarves other commodities.

Figure 34 compares employment in the metallic and non-metallic sectors. Mining of metallic commodities, chiefly iron ore, has employed an average of 81% of the mining workforce over the period 1994-2002.

Summary

- Revenue from Mining Tax and Royalties has increased from an average value of about 1% of the gross value of mineral production in the 1949-76 period, to an average level of 2.5% in 1985-2002 period; an increase of about 150%. This increase reflects the introduction of the Mining and Mineral Rights Tax Act in 1975.

- Other taxes from mining, data for which, are only available for the 1990-98 period, exceeded Mining Tax & Royalties revenue by a factor of four and averaged 8.7% of the gross value of mineral production during this period.
- Total revenue through taxation amounted to 11% of the gross value of mineral production during the 1990-98 period.
- The largest source of taxation revenue in recent years has been sundry tax, which includes personal income, retail sales, gasoline, tobacco, alcohol and motor vehicle taxes as applied to mining operation workforces.
- Direct mining revenues have been greatly exceeded by those from oil in recent years, however, a recovery in the iron-ore industry and future revenues from Voisey's Bay may well improve the mining vs oil comparison.
- Employment in the mining industry appears to be roughly correlated with the gross value of mineral production, and shows a steady increase to the late 1970s–mid 1980s, followed by a steady decline. Current employment levels are the lowest in the Province's mining history.
- Average individual wages have shown a consistent increase since 1949, even when adjusted to constant-dollar values. The 1999 average annual wage was around \$66 000 and one of the highest in the provincial resource sector.
- Metal mining (largely iron ore) has accounted for 81% of employment in the provincial mining industry over the past decade.
- Since the late 1980s, average individual wages have continued to increase strongly in the face of declining employment, probably as the result of increased technical specialization and higher skill requirements in the industry.

THE MINERAL EXPLORATION INDUSTRY

Introduction

Mineral exploration is the essential forerunner to mining development and is a vital component of a healthy and sustainable industry. The exploration industry is commonly divided into major and junior company sectors. The major sector comprises companies that produce minerals and metals and that are generally global in operational scope. The

junior sector is formed of smaller companies that rely on the promotion and sale of exploration properties, rather than production, for their income and are usually more local in scope.

Exploration for minerals may also be considered in terms of the stages that have to be covered in order to find a mineable deposit. The initial part of the search is generally referred to as the grassroots stage and involves prospecting, surface sampling, geophysical and geochemical surveys that cover fairly large areas of ground. This stage also involves acquisition of legal rights in the form of mineral exploration licenses or "claims". In Newfoundland and Labrador, claims are established by delineating the required areas on a map. The license holder then has the right to proceed to development, provided that other legal requirements are met. Once some evidence of promising mineralization has been found, the search moves to the intermediate exploration stage where the objective is to define the nature and size of the mineralization. This usually involves some combination of drilling, trenching and stripping, in conjunction with geological mapping and detailed geophysical and/or geochemical surveys. If the results of this work continue to be encouraging, the next (third) stage may be advanced exploration. This usually involves further diamond drilling, plus the taking of large bulk samples either by surface or underground means. The bulk samples are used to determine the type of mineral processing required and also to give a better picture of the ore grades. This would normally then be followed by pre- and final feasibility studies, financing arrangements and, hopefully, a production decision.

Exploration for industrial minerals, particularly non-metals, is typically rather different from that in the metals sector. There is a great deal of vertical integration amongst companies in this sector, consequently most of the exploration is done by producers, as opposed to a separate exploration sector, and is relatively small in scale compared to the metals sector. Grassroots exploration is generally minimal and initial work, usually consisting of sampling and drilling, can proceed fairly quickly to test mining or quarrying.

Historical Exploration Expenditures

A traditional measure of exploration activity is the amount that is spent annually on the search for mineral deposits in the Province. Records for the pre-confederation period do not seem to have been collected (or preserved), however, a reasonable amount of data are available for the post-confederation era (1949-2002). This is shown in current dollars in Figure 35 and year-2000 Canadian dollars in Figure 36 (taken from largely unpublished records of the Newfoundland and Labrador Department of Mines and Energy; and Swinden, 1993). Figure 36 also shows expenditure in relation to the opening of major metal mines in the

Province. It should be emphasized that exploration expenditures for the period 1949 to about 1980 may not be reliable. This is because of the fact that up to 1978, most exploration was carried out under the concession system, which generally required companies to spend a minimum amount on exploration but which did not necessarily require them to report all of their expenditures. The reporting requirements changed following the introduction of the Mineral Act of 1976, which

required companies to report all expenditures on lands held under that Act. The Mineral Holdings Impost Act in 1978, also gradually encouraged companies holding lands under the old concession agreements to surrender those lands and thus to make them available for acquisition under the Mineral Act. Since 1981, 87% or more of the mineral rights have been held under the Mineral Act and thus expenditure reporting can be considered reasonably reliable.

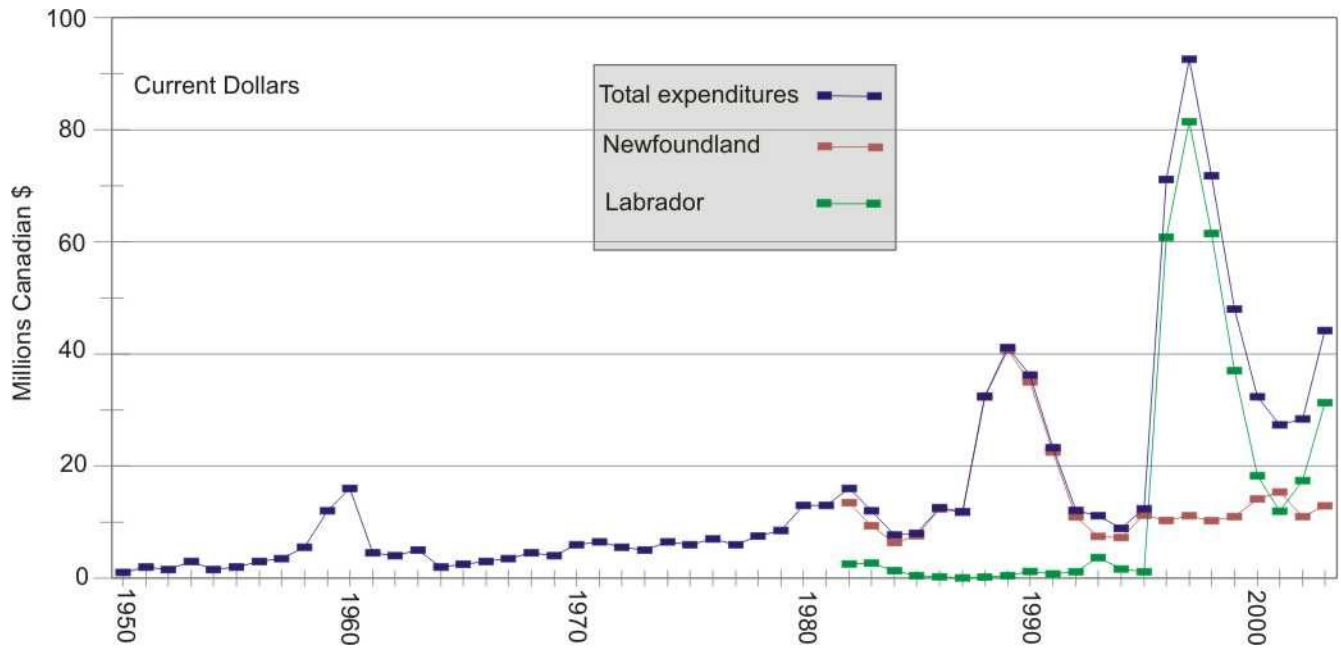


Figure 35. Historical exploration expenditures in current Canadian dollars. (Source Appendix 4K)

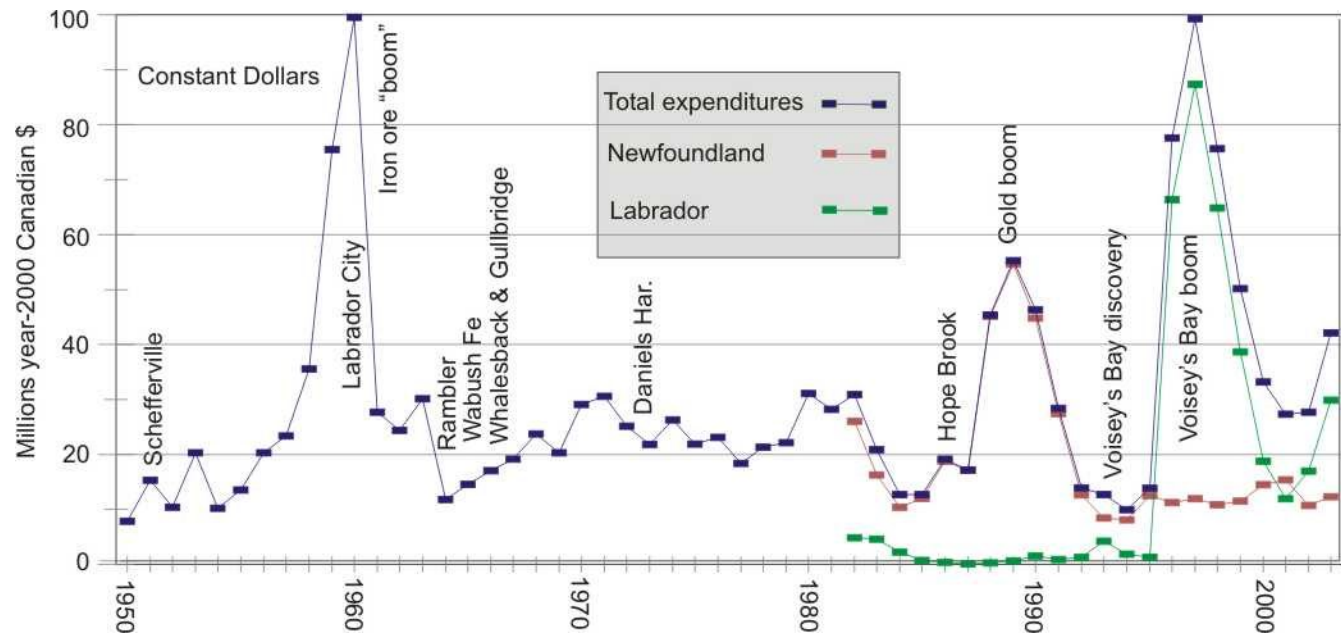


Figure 36. Historical exploration expenditures in year-2000 Canadian dollars. (Source Appendix 4K)

For the post-1980 period, the expenditure data in Figures 35 and 36 are further broken down into expenditures for insular Newfoundland versus Labrador. The expenditures in total are highly cyclical and reflect the fact that exploration is heavily dependant on profitability and therefore on metal prices. The cycles are also strongly influenced by new discoveries and the regional exploration surges that often follow them. The first boom cycle is evident for the years 1949 to 1960 when demand for steel was driving intensive exploration for iron ore in Labrador and expenditures reached a peak of about \$100 million (in year-2000 dollars, Figure 36) in 1960. Actual corporate expenditures were probably much higher since an equal amount of work was probably done in adjacent parts of Québec. Expenditures then declined markedly to a low in 1964 and then entered a relatively stable period lasting to ca. 1984 when a surge in gold prices initiated the boom of the late 1980s (Figure 36). This boom, which was largely restricted to Newfoundland expenditures, was also reinforced by the so-called “flow-through” era, when the federal government provided enhanced tax deductions for investments in Canadian junior mining companies. This phase of exploration resulted in the discovery and development of the Hope Brook deposit, and also a number of small deposits, two of which (Nugget Pond and Hammer Down) became mines in 1997-2001. The third boom occurred in the mid-1990s following the discovery of the Voisey’s Bay nickel–copper–cobalt deposit in Labrador. This resulted in a peak expenditure of \$100 million dollars in 1996 that was naturally focused largely in Labrador and which equaled the earlier peak in 1960. This boom was not, however, induced by a rise in metal prices (most were falling in real terms) but rather by the spectacular nature of the discovery and its revelation of Labrador as a grassroots nickel target. Newfoundland expenditures during this time stayed flat in response to the declining metal prices that characterized the late 1990s-2003 period. Expenditures in Labrador fell steeply in 1998 as the Voisey’s Bay boom waned and reached a trough in 2002. Total provincial expenditure began to recover in 2001-02 and seems to be continuing this trend in 2003. The current (2002) level of expenditure is \$44 million dollars; a figure that compares favourably with the average annual expenditure over the 1981-2002 period of \$35 million (in year-2000 dollars). Whilst the current upswing is encouraging, it should be noted that much of the expenditure in the last two years has been in Labrador where it has been associated with the assessment of the Voisey’s Bay deposit. Newfoundland expenditures have shown a more modest upswing, due mostly to renewed gold exploration.

Other Measures of Exploration Activity

Other exploration statistics collected by the Department of Mines and Energy on an annual basis include the number of claims staked, the number of claims that remain in good

standing, and the number of metres of diamond drilling undertaken. The number of claims staked and the number of those remaining in good standing are broad measures of the amount of exploration activity taking place in the Province but tend to be biased towards the early phases of exploration campaigns, when large amounts of ground are initially acquired. In contrast, the diamond-drilling statistics act more as a measure of the level of intermediate and advanced exploration that is taking place. The claims-staking and diamond-drilling records are given in Figures 37 and 38 respectively. As was the case for the exploration expenditures, the claims data for years prior to 1981 understate the activity taking place. Claim-staking did not become widespread until the introduction of the Mineral Act in 1976, and it was not until the 1980s that it came to represent the main form of mineral rights acquisition. The claims data in Figure 37 show a peak in the late 1980s related to the above mentioned boom in gold exploration, followed by a massive peak in 1995 related to the Voisey’s Bay discovery. This peak collapsed as quickly as it formed, due no doubt to the lack of immediate further discoveries in Labrador. Claim staking subsequently subsided to a low in 1999 but has recovered strongly to a current level of 33 000 claims in 2002. This is well above the historical 1981-2002 average of 25 000 claims per year (and much higher than the average of 14 258 claims if the anomalous peak of 1995 is excluded). Figure 37 does not distinguish between Newfoundland and Labrador data but analysis of the underlying Department of Mines and Energy statistics, indicates that converse to the expenditure situation, the recent increase has come largely from Newfoundland, where it has resulted from the recent resurgence in gold exploration.

Diamond drilling statistics (Figure 38) show similar peaks in activity related to the late 1980s gold boom and the mid to late 1990s Voisey’s Bay rush. Note again that activity prior to the introduction of the Mineral Act does not necessarily represent total drilling activity. The Mineral Act of 1976 did, however, require all companies to report drilling activity regardless of the form of land tenure, therefore, reporting after 1976 may be considered representative. Annual drilling between 1976 and 2001 averaged 77 000 metres per year, however, this was heavily influenced by the two exploration booms of the mid-late 1980s and mid-1990s. Activity for the past two years has averaged 57 000 metres per year; a level that is well below the historic average but which still compares favourably with levels outside of the two major booms (Figure 38). This also indicates that a reasonable amount of intermediate to advanced exploration is taking place.

Comparisons with other Canadian Jurisdictions

Figure 39 illustrates the performance of exploration expenditures for Newfoundland and Labrador against those

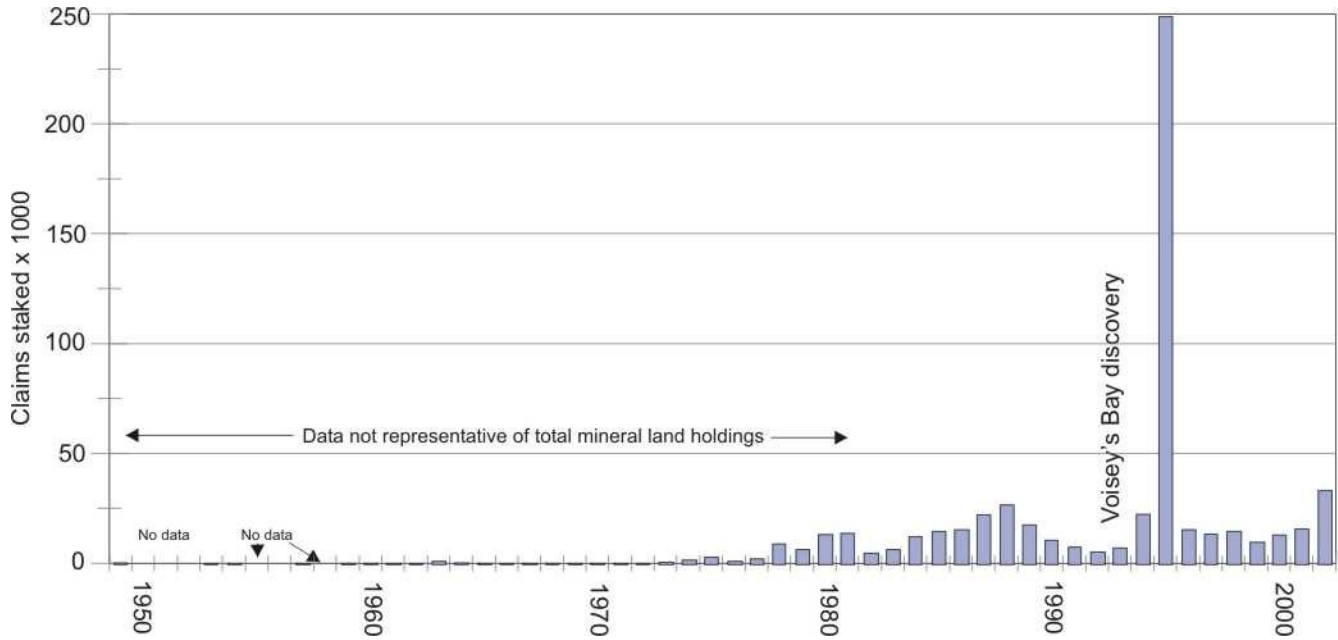


Figure 37. Number of claims staked per year. (Source Appendix 4K)

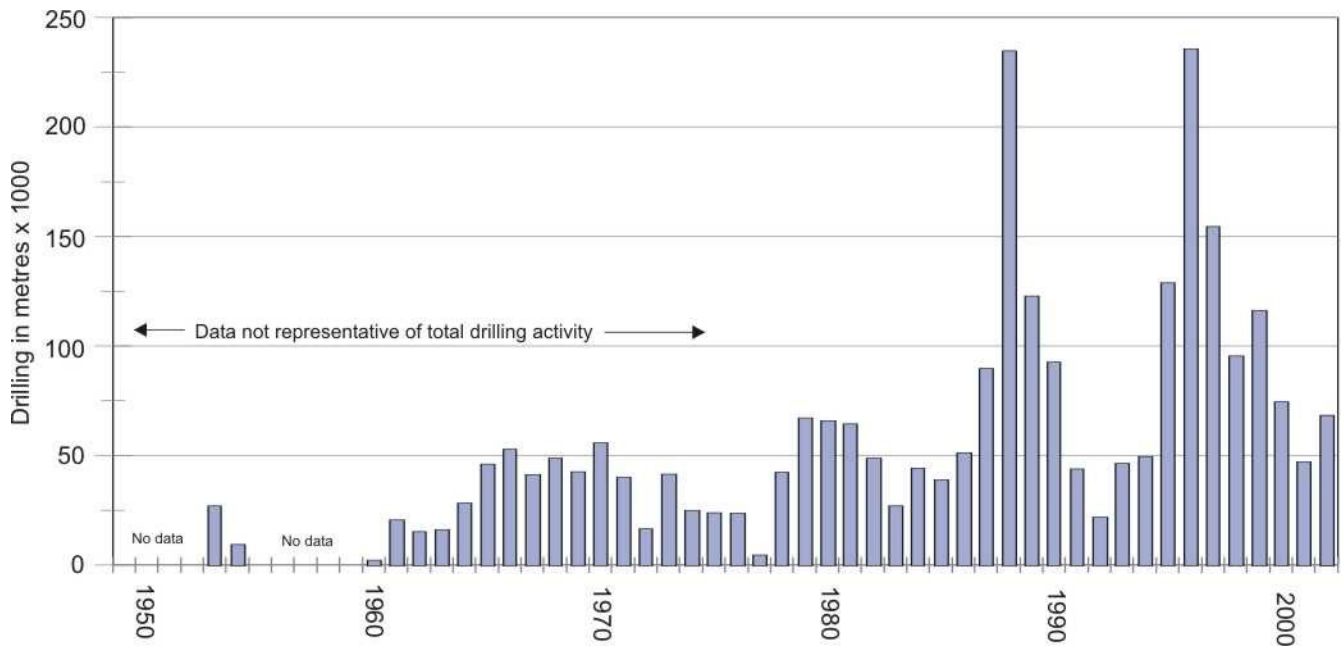


Figure 38. Number of metres of diamond drilling per year. (Source Appendix 4K)

for Canada as a whole for the period 1989-2001 (note the different scales used to portray this data). Total Canadian expenditures for this period (Natural Resources Canada, 2002), plotted in year-2000 dollars, show a strongly cyclical pattern that commences with a peak in the late 1980s, due largely to the gold exploration boom that occurred throughout Canada at this time. This was followed by a trough in the

early 1990s, coinciding with the recession of that time, followed by a strong peak in 1996 marking the ensuing recovery and increase in metal prices. This recovery in traditional precious- and base-metals exploration was also strongly augmented by the diamond exploration boom resulting from discoveries in the Northwest Territories. Expenditures started to decline again in 1997, due largely to the Asian economic cri-

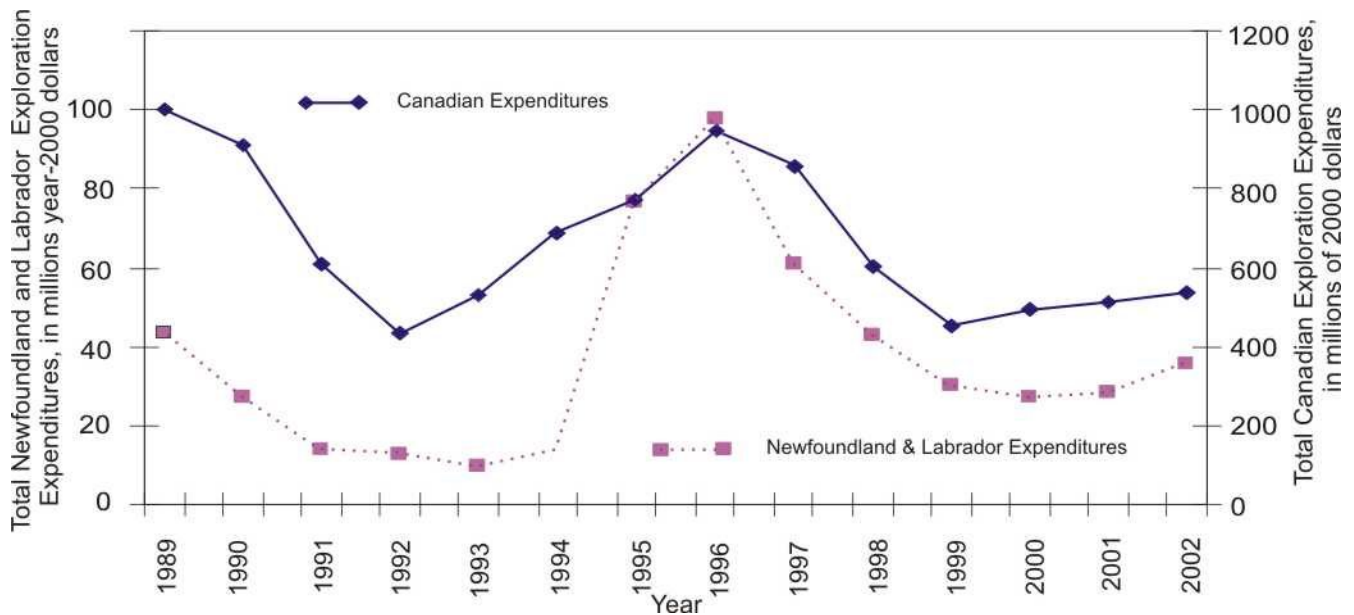


Figure 39. Canadian vs Newfoundland and Labrador exploration expenditures 1989 to 2002, in year-2000 dollars (Source Appendix 4L). Note that the figures used by Natural Resources Canada for Newfoundland and Labrador are somewhat lower than those calculated by the Province. (Source Appendix 4K)

sis and falling metal prices, and bottomed out in 1999, since which time they have been gradually recovering. The close relationship between metal prices and exploration expenditure is evident from the similarity in the profiles for exploration expenditures in Figure 39 and metal prices in Figures 22 and 23.

Newfoundland and Labrador expenditures are broadly correlated with the Canadian total, although obviously at a much lower dollar level. The peak in Newfoundland and Labrador expenditures in the late 1980s was due, as elsewhere in the country, to gold exploration, whereas that in 1995 was due almost entirely to the Voisey’s Bay discovery. The exploration rush following this discovery contributed about 10% of the overall Canadian expenditure at that time and reinforced the national boom resulting from increases in metal prices and diamond discoveries. Newfoundland and Labrador expenditures appear to have bottomed in 2000 and are now recovering in parallel with the Canadian expenditures.

Figure 40 compares Newfoundland and Labrador expenditures (in year-2000 dollars) with those of other Canadian provinces and territories for the 1989-2001 period (Natural Resources Canada, 2002). For most of this period, Newfoundland and Labrador placed in the lower part of the expenditure scale, however, it experienced a brief excursion into the middle rankings following the mid-1990s Voisey’s Bay discovery. This was also a time of boom exploration in Ontario, Québec, British Columbia and the Northwest

Territories. Since then, Newfoundland and Labrador has fallen back to its more traditional place in the lower part of the expenditure rankings. The Province’s ranking with respect to other jurisdictions is shown more clearly in Figure 41, which shows the average exploration expenditure for each province and territory over the 1989-2001 period as a percentage of the Canadian total. Again, this is based on year-2000 dollars. Newfoundland and Labrador averaged about 6% of the Canadian total during this period, the overall ranking, in ascending order, being:

Québec	21.1%
Ontario	20.5%
Northwest Territories	14.9%
British Columbia	15.4%
Saskatchewan	7.3%
Newfoundland and Labrador	5.5%
Manitoba	5.4%
Yukon	3.5%
New Brunswick	2.0%
Alberta	1.7%
Nunavut	1.6%
Nova Scotia	0.9%

Adequacy of Exploration Expenditures

The important question concerning exploration expenditures is whether they are adequate in the long term to replace, through new discoveries, the minerals that are being consumed through extraction. This question is difficult to answer

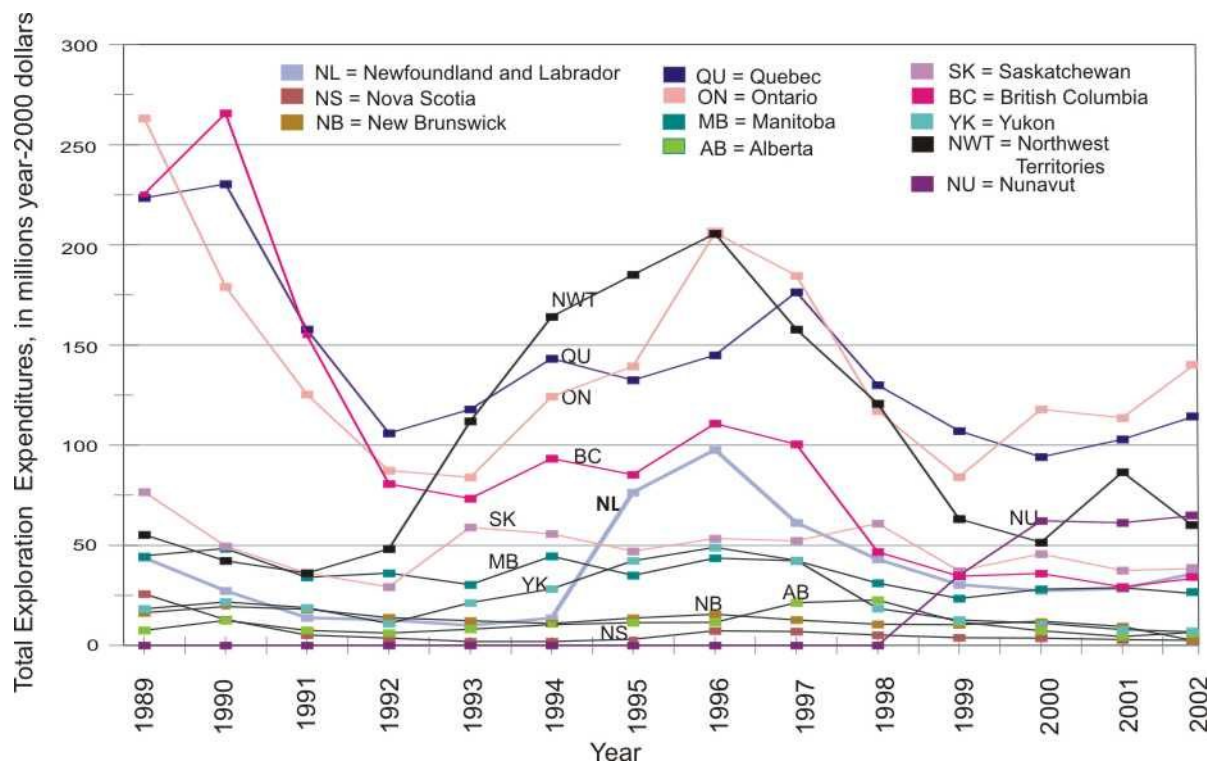


Figure 40. Exploration expenditures for Newfoundland and Labrador vs other provinces and territories 1989 to 2002, in year-2000 dollars (Source Appendix 4L). Note that the figures used by Natural Resources Canada for Newfoundland and Labrador are somewhat lower than those calculated by the Province. (Source Appendix 4K)

satisfactorily. Table 5 presents a summary of the approximate amount of metals that have been produced from the Province to date, versus the amount remaining in the various categories of reserves and resources that may eventually (assuming an optimistic perspective) be mineable. This, therefore, provides some indication of how successful exploration has been in maintaining the Province's inventory of mineral resources, though it is far from a complete answer to the question of how much exploration is enough.

From Table 5, reserves of iron ore in western Labrador would appear to be plentiful for the foreseeable future, assuming of course that existing ore grades and products continue to be economic. Consequently there has been little large-scale grassroots exploration, although IOCC has recently commenced a re-examination of the western Labrador iron-ore belt. Most exploration expenditures have instead been focused on base and precious metals. In the case of base metals, the discovery of the Voisey's Bay deposit has added major amounts of nickel and cobalt to the Province's inventory and has also more than replaced its copper inventory; the deposit containing more than double the Province's total historical copper production. Reserves of lead and zinc, however, remain depleted. Duck Pond remains the only likely source of new production for these metals but does not

contain enough reserves to replace previous levels of production from the Buchans, Rambler and Daniel's Harbour mines. With respect to precious metals, significant reserves of gold have been identified, however, much of these are contained in small deposits, not all of which may be mineable. Also, collectively these do not replace what has been mined to date. Remaining silver resources are also small in comparison to past production. Considerable resources of antimony (Beaver Brook) and zirconium-yttrium (Strange Lake) also exist but will probably require significant market improvements for development to commence.

The decline in provincial zinc, lead and precious-metal resources is very similar to that for Canada as a whole (Cranstone, 2003a, b), and is perhaps a sign that those commodities have matured as exploration targets (i.e., the likelihood of new discoveries is diminishing). Canadian reserves of nickel have been declining but the Voisey's Bay development, coupled with other recent discoveries, promises to reverse this trend (Natural Resources Canada, 2003). Copper from Voisey's Bay will add to diminishing Canadian reserves of this metal but not to the amount needed to reverse the continuing decline. The proportion of the world that is open for mineral development has expanded considerably over the past two decades and countries such as Canada face

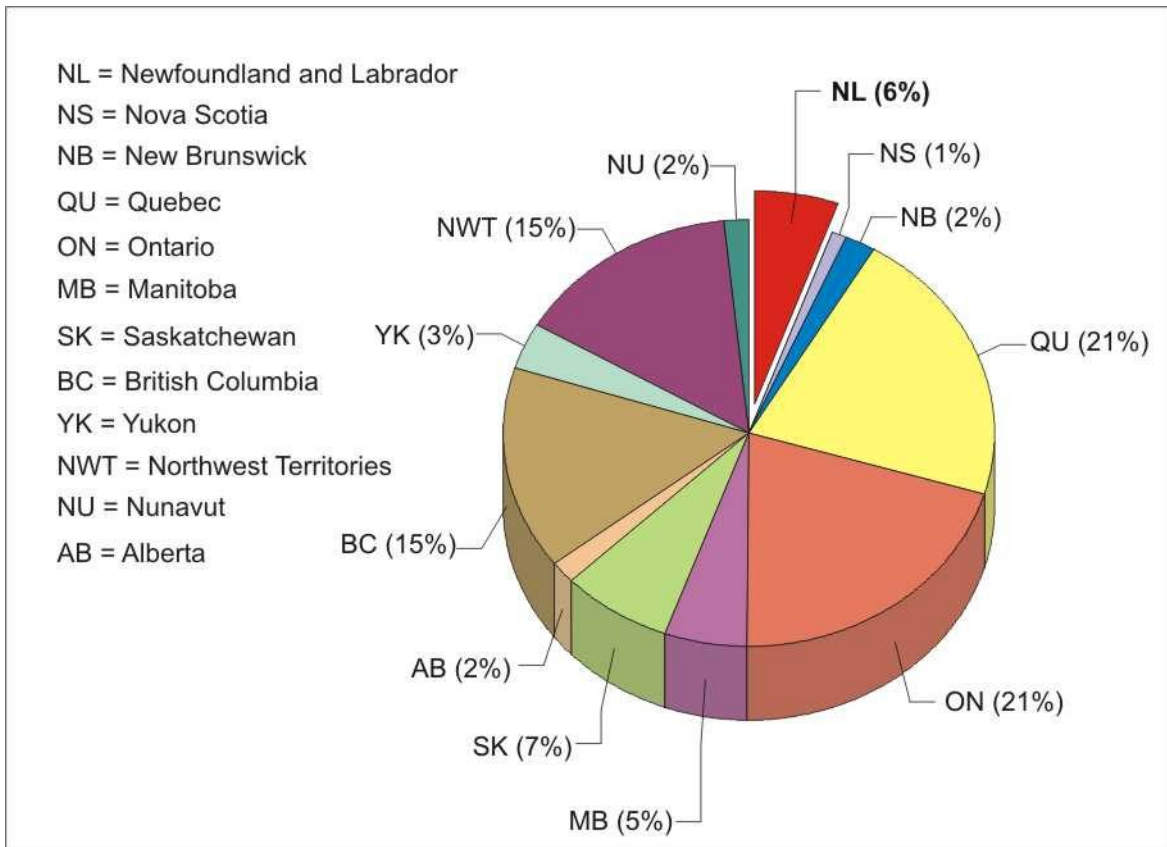


Figure 41. Average annual exploration expenditures 1989 to 2002 by Canadian provinces and territories as a percentage of the Canadian total. (Source Appendix 4L)

increased competition for exploration dollars, particularly for commodities such as base metals where they are perceived to be mature exploration targets.

As a final note, it is important to remember that exploration continues and that declines in resources can very quickly be reversed through new discoveries, or offset by discovery of new commodities (e.g., nickel and cobalt at Voisey's Bay).

Table 6 summarizes the total production versus the remaining reserve picture for the major non-metallic commodities. Existing operations based upon limestone, dolomite and gypsum appear to have sufficient reserves to allow current production to continue well into the future. Dimension stone and construction material reserves have not been shown in Table 6 due to lack of published data. As a general statement, however, it would appear that there are plentiful reserves of anorthosite, black granite and slate for the Province's three main producing operations at Nain, Jumpers Brook and Nut Cove.

Asbestos remains in small quantities at Baie Verte, but since the resource would require underground mining, and as

markets continue to diminish due to health and environmental concerns, it is doubtful if it will ever be mined. Fluorspar is still plentiful at St. Lawrence, however, it will take a significant price recovery or lower-cost mining method to allow production to resume. Considerable resources of gypsum, pyrophyllite and barite remain, however, recent production has been small-scale and sporadic. For many of the non-metallic minerals it is not the quantity or quality of the resource that is the problem, rather it is the distance from markets. Exploration for non-metals has therefore been a less pressing matter than for metals.

A further measure worth considering, is the relationship between a Province's exploration expenditure and its gross value of mineral production. This is summarized in Table 7 for the year 2000 (the most recent data available) and as an average for the period 1989-2000.

The higher values indicate jurisdictions that are attracting relatively large exploration expenditures in proportion to their value of production, and the lower numbers the converse. Clearly, the Northwest Territories and Nunavut lead the rankings for both the year 2000 and the historical period. This is by virtue of the recent overwhelming emphasis on

Table 5. Production to Date vs Remaining Resources – Metallic commodities

Commodity	Metal Produced to Date (million tonnes)	Source of Production	Remaining Resources* (million tonnes of contained metal)	Source of remaining Resources
Iron	840 Mt	Wabana, Wabush, Schefferville, Labrador City	+3000 plus Mt	Labrador City, Wabush
Copper	0.42 Mt	Notre Dame Bay mines, Rambler, Buchans	1.4 Mt	Voisey's Bay, Duck Pond, Rambler
Zinc	3.2 Mt	Rambler, Buchans, Daniel's Harbour	0.4 Mt	Duck Pond
Lead	1.22 Mt	Rambler, Buchans	.07 Mt	Duck Pond
Gold	65 tonnes	Hope Brook, Buchans, Rambler, Nugget Pond Hammer Down	41 tonnes	Cape Ray, Stog'er Tight, Pine Cove, Deer Cove, Duck Pond and other base metal deposits
Silver	2100 tonnes	Rambler, Buchans	414 tonnes	Duck Pond, Cape Ray
Nickel	minimal	Tilt Cove	2.2 Mt	Voisey's Bay
Cobalt	0		0.1Mt	Voisey's Bay
Antimony	1000 tonnes	Beaver Brook	0.08 Mt	Beaver Brook
Zirconium	0		1.5 Mt	Strange Lake
Yttrium	0		0.2 Mt	Strange Lake

*The term Resources includes all reserves and resources (including geological resources) that, from an optimistic present-day perspective, may at some future point be mineable.

+ Excludes Wabush reserves, which were unavailable at time of writing.

diamond exploration in Canada and the fact that these two territories are currently perceived to have the greatest geological potential for this mineral. Newfoundland and Labrador ranks fourth-highest in terms of the ratio for the year 2000, and fifth for the historical period. This says nothing about whether the amount of exploration expenditure in Newfoundland and Labrador is sufficient to sustain a healthy mining industry in the long term, however, it does indicate that at a national level, the Province is doing reasonably well in attracting a proportional share of exploration funds.

Following the recent announcement that the Voisey's Bay project is to proceed, it is to be expected that the pre-development and on-going underground exploration expenditures associated with this project will result in a further rise in provincial exploration expenditures. The recent recovery in gold prices will also continue to drive higher levels of exploration expenditure in insular Newfoundland.

Summary

- Exploration expenditures have been strongly cyclical showing peaks in late 1950s-early 1960s (iron), the late 1980s (gold) and mid 1990s (nickel). The most recent cycle has been a downturn that seems to have bottomed in 1999-2000. Expenditures are now increasing and the current level of \$44 million is above the historical average of \$35 million (in year-2000 dollars).
- Claim staking is also increasing following a low in 1999 and the current level of 33 000 claims is well above the historical average. Current diamond drilling at ca. 51 000 metres per year is below the historical average but appears to be increasing, along with other exploration indicators, into 2002.
- In comparison with total Canadian exploration expenditures, the Province has shown a similar expenditure pro-

Table 6. Production to Date vs Remaining Resources – Non-metallic minerals

Commodity	* Amount Produced to Date (million of tonnes)	Source of Production	Remaining Resources* (million of tonnes)	Source of remaining Resources
Asbestos	1.3 Mt mineral fibre	Baie Verte	~0.1 Mt mineral fibre	Baie Verte
Limestone	10 Mt rock	Aguathuna, Cobbs Arm, Lower Cove	1030 Mt chemical grade rock	Lower Cove, Aguathuna, Cobbs Arm, Port au Port, Coney Arm
			900 Mt aggregate rock	Lower Cove
Dolomite (NF only)	3 Mt rock	Lower Cove	590 Mt chemical- grade rock	Lower Cove, Port au Port Peninsula, Great Northern Peninsula deposits
Fluorspar	3 Mt mineral	St. Lawrence	3 Mt mineral	St. Lawrence
Gypsum	17 Mt mineral	Flat Bay, Fischells, Coal Brook	16 Mt+ mineral	Fischells, Coal Brook
Pyrophyllite	~0.3 Mt mineral	Manuels	1.7 Mt mineral	Manuels
Barite	0.02 Mt mineral	Colliers	0.5 Mt mineral	Buchans tailings

* Use of the term rock or mineral in these columns indicates whether the amount is for raw ore, or the contained mineral product (calculated from published grades).

The term Resources includes all reserves and resources that, from an optimistic present-day perspective, may at some future point be mineable.

Table 7. The ratio of exploration expenditures to the gross value of mineral production for each Canadian province and territory for the year 2000 and as an average for the period 1989-2000

Province/Territory	Exploration Expenditure x 1000/ Value of Production, for year 2000	Average Exploration Expenditure x 1000/ Average Value of Production, 1989-2000
Nunavut	10.8	10.4
Northwest Territories	5.7	13.4
Manitoba	2.3	2.8
Newfoundland and Labrador	1.9	3.2
Yukon	1.5	6.8
Québec	1.5	3.7
British Columbia	1.5	4.3
Saskatchewan	1.4	2.2
Ontario	1.4	2.0
Nova Scotia	1.3	2.7
New Brunswick	1.1	1.2
Alberta	0.9	1.9
Total Canadian	1.8	3.2

file with peaks in the late 1980s and mid 1990s. Both Canadian and provincial expenditures have declined since 1996 but are now emerging from a cyclical trough that reached its depth in 1999-2000.

- The Province's share of national exploration expenditures has remained fairly stable throughout the last decade or so and appears to have returned to normal levels following the distortion of the Voisey's Bay boom. The Province accounted for an average of 6% of total Canadian exploration expenditures over the 1989-2001 period and ranked 6th highest amongst other provinces and territories.
- With respect to status of remaining resources: reserves of iron ore are sufficient for the foreseeable future; significant new reserves and resources have been discovered for nickel, cobalt and copper; resources of zinc, lead, gold and silver are in significant decline.
- Resources of industrial minerals currently in production are adequate for the foreseeable future. Increased production will probably depend more on increased demand than additional discoveries.
- The Province's share of exploration expenditure is very similar to its share of the value of national mineral production. In terms of the ratio of exploration expenditure to value of production, the Province ranks 4th highest in Canada. Therefore, by national standards at least, the Province seems to be doing comparatively well at attracting exploration dollars in proportion to the size of its mining industry.
- The development of the Voisey's Bay project will result in a further rise in provincial exploration expenditures, as may the renewed gold exploration in insular Newfoundland.

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APPENDIX 1: AN ENCAPSULATED HISTORY OF MINING IN NEWFOUNDLAND AND LABRADOR

ca. 4000 BC	Maritime Archaic Indians mine chert from northern Labrador, followed by the Dorset Eskimo who quarry soapstone near Baie Verte on the Island of Newfoundland. Both cultures develop extensive coastal trading networks for these minerals.	1882	Limestone quarries are developed at Cobbs Arm, Notre Dame Bay, and provide a long-term source of lime for agricultural and industrial uses that last intermittently to 1966.
ca. 1000 AD	The Vikings settle in northeastern Newfoundland and mine some bog iron ore near their settlement of L'Anse aux Meadows.	1892	Just as the copper boom is waning, a new mining industry springs to life with the discovery of iron ore on Bell Island. Although this resource had been noted in the early 17th century, it is not until now that its full potential is realized. The discovery leads to the development, starting in 1894, of the Wabana mining operations by the Scotia and then Dominion companies. These companies later merge in 1921 as the British Empire Steel Corporation (BESCO), which in 1930 comes under the control of the Dominion Steel and Coal Company (DOSCO). Throughout their lives, these mines ship primarily to the Cape Breton steel plants but also periodically to European markets. The operation closes in 1966 following a prolonged period of decline when steel-making plants began to demand ore with a lower phosphorous content.
1500-1860	European settlers notice the potential mineral resources of Newfoundland but recorded mining does not occur until 1779, when the short-lived Shoal Bay Mine on the Avalon Peninsula starts. This is followed by a number of ventures between 1855 and 1860 around the Avalon Peninsula and Notre Dame Bay areas, none of which achieve success.		
1839-40	The first geological survey of Newfoundland is undertaken by J.B. Jukes.		
1857	Copper is discovered at Tilt Cove in Notre Dame bay leading to the Province's first commercially successful mine in 1864 and ushers in the Newfoundland copper boom. This peaks in the 1880s and finally expires ca. 1913. The period sees the development of several successful mines in the Notre Dame Bay area, notably Little Bay, Betts Cove and Pilley's Island and a host of smaller short-lived operations. During this time, Newfoundland is for a while the sixth largest producer of copper in the world.	1897	The construction of the Newfoundland railway by the Reid Newfoundland Company opens the interior of the Island to exploration. Initial interest is focused on the timber potential, however, this soon spread to minerals. Railway construction leads to interest in coal discovered in western Newfoundland, which is worked sporadically and with little success until 1929. The railway also requires the opening of a number of dimension-stone quarries across the Island that also become sources of building material for urban centres.
1860	The quarrying of roofing slate near Trinity starts an industry that is to last to 1910. Also in the Trinity area, brick making commences in 1866, starting a small industry that is to supply the domestic market intermittently until 1999.	1900-05	The Sops Arm (Browning) and then Goldenville mines, Newfoundland's first gold mines, are developed but close by 1906 due to lack of adequate capital.
1864	The Tilt Cove copper mine opens and runs until its closure in 1917.	1905	Copper, lead and zinc mineralization is discovered at what is to become the Buchans mine site. Metallurgical difficulties prevent further development at the time – <i>see below</i> .
1864	The first systematic geological investigations begin with the inauguration of the Geological Survey of Newfoundland under the directorship of Alexander Murray.	1913	The Dominion Company opens the Aguathuna quarry on the west coast of Newfoundland to supply limestone as a flux to the Cape Breton steel plants. This operation closes in 1967 due
1878	The Little Bay copper mine is opened and finally closes in 1904.		

	to the discovery of more proximal resources in Cape Breton.		
1913	The copper boom finally ends, a demise due partly to poor management – many mines being high-graded during market lows – but also to competition from new and cheaper sources of copper from large open-pit resources in Spain, the southwest USA and Chile. A plunge in copper prices following World War I provides the coup de grace.	1951	The Flat Bay gypsum mine opens, initially under Government control (Atlantic Gypsum Ltd.) but later under the ownership of Flintkote Canada, to supply material for wall-board construction. The operation is later sold to Domtar Limited in 1987 and is officially closed in the same year. However, the operation continued to operate intermittently until 1994.
1928	The Buchans mining operation is started by the American Smelting and Refining Company (ASARCO) following the development of new techniques for processing the complex ores. Discovery of new ore bodies provides the basis for a mining operation that lasts without interruption until the ore bodies are exhausted and the mines close in 1984.	1952	The North Star cement company opens quarries in the Corner Brook area. This is a government-sponsored venture that is later privatized and does not close until 2000 when changes in market demand render it uneconomic.
1933	Mining of fluorspar commences at St. Lawrence on the south coast of Newfoundland. This leads to the creation of two mining operations by the St. Lawrence Corporation and the American Newfoundland Fluorspar Corporation. The latter is later sold to the Aluminium Company of Canada (ALCAN), which eventually acquires the assets of both mining operations. The fluorspar ore is used mostly as a flux in aluminum smelting. The mines close in 1978 due to competition from cheaper Mexican ore. Despite a brief and unsuccessful attempt to resume mining in the mid 1980s, the deposits have remained inactive.	1954	Mining of the Knob Lake iron deposits commences under the control of the Iron Ore Company of Canada, a private company owned by a number of US and Canadian steel companies, including the M.A. Hanna corporation and operating on LME leases. By 1958, four mines are in production and numerous other potential deposits identified. Production lasts until 1983 when the operation closes due to changes in steelmaking techniques and market demand. Production from stockpiles continues for some time after closure.
1936	The Newfoundland Government grants a concession to the Labrador Mining and Exploration (LME) company to begin investigation of the iron deposits that had been reported by early explorers in western Labrador. LME is acquired in 1942 by Hollinger Consolidated Gold Mines Ltd with minority participation by the M.A. Hanna Company of Cleveland – a prominent US iron mining company. LME, together with its sister company in Québec – the Hollinger North Shore Exploration company – proceeds to explore the concession area and rapidly identifies the Knob Lake (now Schefferville) area as a major iron-ore resource.	1957	The Tilt Cove mine is reactivated using modern bulk mining techniques to extract previously uneconomic, low-grade ore. The operation closes in 1967.
		1957	A pyrophyllite mine is developed at Manuels on the Avalon Peninsula by Newfoundland Minerals, a division of Armstrong World Industries. The product is shipped to the United States for use in ceramic tiles. The mine closes in 1996.
		1961	Discoveries of iron ore by LME in southwest Labrador lead to the development of the Carol Project by the Iron Ore Company of Canada (IOCC) and the construction of the town of Labrador City.
1950	Development of the Knob Lake iron deposits in Labrador proceeds rapidly and sees the construction of the 588-km-long QNS&L railway from Sept-Île to Knob Lake (now Schefferville) on the Québec-Labrador border.	1961	The Little Bay copper mine in Notre Dame Bay is reactivated to exploit remaining bulk ore reserves. The mine closes in 1969.

1962	Production of iron ore by IOCC starts at Carol Lake in 1962. Ore is shipped to the port of Sept-Île using a rail spur to connect to the QNS&L railway. This operation has remained in production to the present day.		Limited who change the focus of production to high-purity limestone and dolomite, chiefly for use in the iron and steel industry. The operation is still in production.
1963	The Baie Verte asbestos mine opens in northeast Newfoundland. Operated initially by Advocate Mines Ltd. and then Baie Verte Mines Ltd. The mine falters in 1981 as asbestos markets diminish and finally closes in 1987 after several changes of ownership.	1992	The Nut Cove slate deposit of Trinity Bay, eastern Newfoundland is opened to produce roofing slate for European and US markets. The operation subsequently closes but resumes production in 2001 as the Hurley Slateworks Company.
1964	The Rambler copper–lead–zinc deposits are brought into production by Consolidated Rambler Mines Ltd. This operation lasts until 1982.	1993	The Ten Mile Bay quarry near Nain in northern Labrador is opened for the production of labradorescent anorthosite, primarily for export to Italy. The operation expands in 2001-02 and remains in production.
1965	The Canadian Javelin Company, operating on a concession granted to the Newfoundland and Labrador Company Ltd. (NALCO), develops the Wabush iron mining operation and townsite of Wabush (adjacent to Labrador City) in southwestern Labrador. This operation has remained in production to the present day.	1994	The Voisey’s Bay nickel–copper–cobalt deposit is discovered in 1994 by Archean Resources Ltd., generating a huge exploration boom in Labrador, which peaks in 1996, and results in record exploration expenditures. The deposit is later acquired by Inco Ltd. and is presently scheduled for production by 2005.
1965	The Whalesback copper mine is opened by the British Newfoundland Exploration Company (BRINEX) in the Notre Dame bay area. The mine lasts until 1972.	1996	The International Granite corporation begins producing black granite for use in the monument industry from its Jumpers Brook quarry in central Newfoundland. The operation remains in production.
1967	The Gullbridge (Gull Pond) copper mine opens, and closes in 1971.	1997	The Nugget Pond gold deposit in northeastern Newfoundland is brought into production by Richmond Mines Inc. The ore runs out in 2001 and production is shifted to the Hammer Down deposit (below).
1968	The Villa Marie silica mine, operated by the Dunville Mining Company, is opened to supply raw silica to the ERCO phosphorous plant at Long Harbour, southeast Newfoundland. The operation is phased out in 1988 following closure of the phosphorous plant.	2001	The Hammer Down gold deposit of northeast Newfoundland, owned by Richmond Mines Inc., enters production.
1975	The Daniel’s Harbour zinc deposit on the west coast of Newfoundland enters production under the control of Newfoundland Zinc Mines Limited. It closes in 1990.	2001	The Duck Pond copper–zinc–lead deposit of central Newfoundland, owned by Thundermin Resources Inc. passes final feasibility study and is sold to Aur Resources Inc. It currently awaits a development decision.
1987	The Hope Brook gold mine is opened by BP Minerals Ltd. The operation experiences temporary closure in 1991-92, and is later operated by Royal Oak Mines Ltd., prior to its exhaustion in 1997.	2001	Epoch Stone constructs a dimension-stone processing plant at Argentia on the Avalon Peninsula that begins production in 2002. The plant is designed primarily to handle large blocks of imported stone but may also serve local producers.
1990	A limestone aggregate operation is developed at Lower Cove in western Newfoundland. This is later taken over by Atlantic Minerals		

APPENDIX 2: SOURCES OF PRE-CONFEDERATION DATA

1865-1906. Taken from the compendium of Geological Survey of Newfoundland reports by Murray and Howley (1909). This includes two types of data table. One type, which is used as the basis for this report, gives the value of production reported by the mining operation. The second type (not used) lists the probable value of the mineral products when sold on the world market. For metals this would be the price for the finished product after smelting and refining. There are significant differences between the two datasets. A notable example concerns gold, which is not listed as one of the commodities produced in Newfoundland, but which was recovered from Notre Dame Bay copper ores and from the Buchans ores when smelted abroad.

1907-1949. From the Customs Returns. Until 1930, these reports were published in the appendices of the annual Journals of the (Newfoundland) House of Assembly (available at the Newfoundland and Labrador Legislative Library and the Provincial Archives of Newfoundland and Labrador), except for the years 1907-08 when the reports were published separately. For the years 1917 to 1930, mineral production data are also listed in reports by the Department of Mines and Agriculture, also incorporated into the Journal Appendices. There is, however, a remarkable variance between the two sets of reports. Whereas the Agriculture and Mines data seem to have been derived from direct reports from mining operations, the Customs Returns were based upon assessments of mineral exports. There is no systematic variation between the two datasets – each may exceed the other with a variance of as much as 130% in some years. Limestone in particular tends to be more consistently under-reported in the customs returns, sometimes by factors of up

to 12 times. The Customs Returns are also restricted to material exported from Newfoundland. This covered the main mineral producers such as the Notre Dame Bay mines, Wabana, Aguathuna, St. Lawrence and Buchans, but did not include materials such as stone, brick, sand and gravel and some amounts of limestone that were produced for domestic consumption. For the sake of their consistency and greater availability, the Customs Returns rather than the Department of Agriculture and Mines figures have been used in this report, however, the potential inaccuracies should be borne in mind. Howley, (page 387 in Murray and Howley, 1909) notes that Newfoundland was unusual at the time in not having legislation requiring the submission of mineral production data and caustically refers to the “inutility” (uselessness!) of the customs data. Nevertheless, these are all that is available for the greater part of this period. From 1930 onwards, the Customs Returns were published independently as annual reports. Data for the years 1935-38 are also available in summary form in the Annual Reports of the Commission of Government. Note that data for 1943 were only reported for nine months and for this report have been scaled up by 33% to give an assumed annual value of production.

A problem arises with precious metals values for the pre-confederation period. The Customs Returns data do not seem to include this, so Figure 10 may understate the real value of mineral production from Newfoundland at this time. However, the historical value calculations for individual operations, notably Tilt Cove, Little Bay and Buchans (Figures 24, 25 and 27; Appendix 4F) include estimates for gold and silver production.

APPENDIX 3: DEFINITION AND CALCULATION OF CONSTANT-DOLLAR VALUES

Constant dollars are those reported in terms of the value they had on a previous date. Constant dollars, therefore, have comparable purchasing power in different time periods. The adjustment from current dollars is done through use of a deflator series that removes the effect of inflation. There are two main types of deflator series used:

- The Consumer Price Index (CPI). This is an index maintained by the federal government that approximates the changes in average prices through measurement of the annual changes in the cost of a basket of common consumable goods and services. A similar price index is maintained by the US Government.
- The Gross Domestic Product (GDP). This measures changes in total domestic economic activity and reflects both growth in the economy and price changes (inflation). When used as a deflator, the GDP is a measure of changes in the price of inputs into the economy – essentially wages and profits. Its coverage is therefore wider than the CPI.

The CPI index has been used for most of the deflation corrections in this document. However, since the CPI only extends back as far as 1914, a GDP deflator was used for the full range of historical data. The GDP deflator series was made available courtesy of Donald Cranstone of Natural Resources Canada and is in part based upon earlier work by Dan Cavanagh, also of Natural Resources Canada. This index extends as far back as 1867, hence this date is used as the starting point for historical analysis (although actual production data are available from 1865). Test comparisons of

the CPI and GDP deflators on 1949-2000 Gross Value of Mineral Production data produced slightly different results on a year to year basis, the CPI generally yielding slightly higher values than the GDP, particularly in the high-inflation years between 1970 and 1983. However, over long periods of time there is little difference between the two sets of results.

Adjustment of a current-dollar value is made by the same calculation regardless of whether the CPI or GDP deflator is used, namely:

Adjusted value for *year x* = Current value for *year x* multiplied by (index *year y* / index *year x*)

Where *year x* refers to the year for which the comparisons are to be indexed, *year y* is the year to which the dollar comparison is to be made, and index is either the CPI or GDP. Thus, as an example, to adjust a value of \$100 in 1986 dollars to the equivalent in year-2000 dollars, the calculation would be:

Adjusted dollar value for 2000 = 100 1986 dollars multiplied by (index for year 2000/index for year 1986)

Using the CPI series in Appendix 4B:

$$= 100 (4.4505 / 3.1350)$$

$$= \$141.96$$

All adjustment in this report, except where noted otherwise, has been made in terms of year-2000 dollars.

APPENDIX 4: STATISTICAL INFORMATION

Appendix 4A. Duration of Newfoundland and Labrador mining operations to 2001. Note: Company name only refers to the major operators; Opening Date may vary in historical records depending on whether the commencement of mine development or the date of first commercial shipment is used, similarly Closure Date may vary according to whether cessation of mining or cessation of shipments from stockpiles is quoted. The notation '2' as in 'Tilt Cove 2' refers to a re-opened operation. Minor shut-downs or closures are not indicated. Bolded names are the major mining operations used in the historical analysis depicted in Figure 24. Source; unpublished records of the Newfoundland and Labrador Department of Mines and Energy.

Company Name	Location	Commodity	Opening Date	Closure Date	Duration (years)
Newfoundland Slate Company	Nut Cove, Random Sound; Trinity Bay	Slate	1860	1910	50
Tilt Cove Copper Co.	Tilt Cove	copper	1864	1917	53
Betts Cove Mining Co.		copper	1875	1883	8
Newfoundland Consolidated Copper Mining Co.	Little Bay	copper	1878	1904	26
Newfoundland Lime Manufacturing Co.	Cobbs Arm	limestone	1882	1966	84
Brick and Tile Manufacturing Co.	Trinity Bay	brick	1866	1999	133
Trinity Bay Brick Products					(intermittent)
Standard Pyrites Co.	Pilleys Island	pyrite	1886	1908	22
Scotia and Dominion Cos., Dominion Steel and Coal Co. (DOSCO)	Wabana (Bell Island)	iron ore	1894	1966	72
Reid Co.	various	granite	1898	1901	3
Dominion Steel and Coal Co. (DOSCO)	Aguathuna	limestone	1913	1967	54
American Smelting and Refining Co. Ltd. (ASARCO)	Buchans	base metals	1928	1984	56
St Lawrence Corp., Newfoundland Fluorspar, Aluminum Co. Of Canada (ALCAN)	St. Lawrence	fluorspar	1933	1978	45
Domtar Inc.	Flat Bay	gypsum	1951	1994	43
North Star Cement Ltd.	Corner Brook	shale, limestone	1952	2000	48
Iron Ore Company of Canada	Schefferville (Knob Lake)	iron ore	1954	1983	29
Atlantic Coast Copper Corp. Ltd.	Little Bay2	copper, gold	1961	1969	8
First Maritimes Mining Corp. Ltd.	Tilt Cove2	copper, gold	1957	1967	10
Armstrong World Industries Canada Ltd.	Manuels	pyrophyllite	1957	1996	39
Iron Ore Company of Canada	Labrador City	iron ore	1962	ongoing	39
Wabush Mines	Wabush	iron ore	1965	ongoing	36
Advocate Mines Ltd.	Baie Verte	asbestos	1963	1987	24
British Newfoundland Exploration Co. (BRINEX)	Whalesback (Springdale)	copper	1965	1972	8
Consolidated Rambler Mines	Rambler (Baie Verte)	base metals	1964	1982	18
Gullbridge Mines Ltd.	Gull Pond	copper	1967	1971	4
Dunville Mining Company Ltd.	Villa Marie	silica	1968	1988	20
Green Bay Mining Ltd.	Little Deer	copper	1974	1974	<1
Newfoundland Zinc Mines Ltd.	Daniel's Harbour	zinc	1975	1990	15
Newfoundland Resources and Mining Co. Ltd., Atlantic Minerals Ltd.	Lower Cove	limestone	1990	ongoing	11
Iron Ore Company of Canada	Leila Wynne (Wabush)	dolomite	1986	ongoing	15
Hope Brook Gold Inc., Royal Oak Mines Inc.	Hope Brook	gold, copper	1987	1997	10
Newfoundland Slate Inc., Hurley Slateworks	Nut Cove	slate	1992	2001	9
Torngait Ujaganniavingit Corp.	Ten Mile Bay (Nain)	anorthosite	1993	ongoing	8
International Granite	Jumpers Brook (Mt. Peyton)	gabbro	1996	ongoing	5
Hi-Point Industries (1991) Ltd.	Bishops Falls	peat	1982	ongoing	19
Richmont Mines Inc.	Nugget Pond	gold	1997	2001	4
Lafarge Gypsum Canada Ltd.	Fischells Brook	gypsum	1999	2001	2
Galen Gypsum Mines Ltd.	Coal Brook	gypsum	1999	ongoing	2
Shabogamo Mining & Exploration Inc.	Roy's Knob (Labrador City)	silica	1999	ongoing	2
Richmont Mines Inc.	Hammer Down	gold	2001	ongoing	<1

Appendix 4B. Gross Value of Newfoundland and Labrador Mineral Production (GVMP), plus Mining Tax and Royalties revenue, 1865 - 2002

Year	*GVMP in current \$	**GDP deflation index	**GVMP in year-2000 \$, using GDP deflator	***Mining Tax & Royalties in current \$	Mining Tax & Royalties in year-2000 \$, using GDP deflator	****Canadian Consumer Price Index (CPI) deflator	GVMP in year-2000 \$, using CPI deflator	Mining Tax and Royalties in year-2000 dollars using CPI deflator
1865	\$98,496							
1866	\$25,742							
1867	\$2,610	0.3236	\$48,609					
1868	\$8	0.3232	\$149					
1869	\$110,108	0.3256	\$2,038,059					
1870	\$176,352	0.3219	\$3,301,731					
1871	\$45,724	0.3285	\$838,863					
1872	\$591,120	0.3653	\$9,752,328					
1873	\$197,955	0.3665	\$3,255,178					
1874	\$125,952	0.3493	\$2,173,145					
1875	\$382,426	0.3354	\$6,871,739					
1876	\$622,060	0.3146	\$11,916,696					
1877	\$1,265,828	0.2982	\$25,582,876					
1878	\$823,998	0.2765	\$17,960,289					
1879	\$555,890	0.2667	\$12,561,692					
1880	\$411,680	0.2917	\$8,505,614					
1881	\$547,020	0.2941	\$11,209,610					
1882	\$468,576	0.2944	\$9,592,340					
1883	\$256,796	0.2955	\$5,237,368					
1884	\$104,817	0.2733	\$2,311,396					
1885	\$102,420	0.2581	\$2,391,548					
1886	\$246,150	0.2620	\$5,661,450					
1887	\$177,464	0.2674	\$4,000,039					
1888	\$854,226	0.2781	\$18,513,706					
1889	\$421,210	0.2781	\$9,128,917					
1890	\$306,247	0.2834	\$6,512,082					
1891	\$632,140	0.2834	\$13,441,920					
1892	\$984,027	0.2620	\$22,632,621					
1893	\$847,736	0.2674	\$19,107,969					
1894	\$743,596	0.2460	\$18,218,102					
1895	\$666,562	0.2406	\$16,693,675					
1896	\$824,440	0.2353	\$21,116,906					
1897	\$540,272	0.2406	\$13,530,812					
1898	\$609,630	0.2513	\$14,618,149					
1899	\$969,637	0.2567	\$22,766,269					
1900	\$742,491	0.2620	\$17,077,293					
1901	\$1,188,291	0.2620	\$27,330,693					
1902	\$1,217,686	0.2781	\$26,391,002					
1903	\$1,280,525	0.2834	\$27,229,277					
1904	\$1,352,619	0.2834	\$28,762,295					
1905	\$1,367,890	0.2941	\$28,029,310					
1906	\$1,458,017	0.2995	\$29,342,592					
1907	\$1,358,260	0.3209	\$25,512,650					
1908	\$1,458,067	0.3209	\$27,387,358					
1909	\$1,190,527	0.3262	\$21,995,474					
1910	\$1,369,828	0.3262	\$25,308,134					
1911	\$1,555,943	0.3369	\$27,834,091					
1912	\$1,319,389	0.3583	\$22,193,305					
1913	\$1,497,860	0.3422	\$26,376,378					
1914	\$1,551,782	0.3583	\$26,102,363					
1915	\$690,614	0.3797	\$10,962,281					
1916	\$1,034,831	0.4545	\$13,720,642					

Appendix 4B. Gross Value of Newfoundland and Labrador Mineral Production (GVMP), plus Mining Tax and Royalties revenue, 1865 - 2002

Year	*GVMP in current \$	**GDP deflation index	**GVMP in year-2000 \$, using GDP deflator	***Mining Tax & Royalties in current \$	Mining Tax & Royalties in year-2000 \$, using GDP deflator	****Canadian Consumer Price Index (CPI) deflator	GVMP in year-2000 \$, using CPI deflator	Mining Tax and Royalties in year-2000 dollars using CPI deflator
1917	\$1,921,925	0.6150	\$18,834,865					
1918	\$972,186	0.6845	\$8,559,794					
1919	\$833,910	0.7166	\$7,013,556					
1920	\$690,660	0.8342	\$4,989,576					
1921	\$662,843	0.5882	\$6,791,128					
1922	\$840,744	0.5241	\$9,668,556					
1923	\$1,806,642	0.5348	\$20,360,855					
1924	\$1,357,712	0.5348	\$15,301,414					
1925	\$1,958,036	0.5508	\$21,424,336					
1926	\$2,055,663	0.5187	\$23,883,837					
1927	\$1,699,596	0.5134	\$19,952,549					
1928	\$2,807,928	0.5080	\$33,310,893					
1929	\$3,879,561	0.5187	\$45,074,899					
1930	\$7,023,975	0.5027	\$84,212,977					
1931	\$4,371,278	0.4706	\$55,982,163					
1932	\$3,408,002	0.4278	\$48,010,228					
1933	\$3,167,722	0.4225	\$45,190,161					
1934	\$4,708,522	0.4278	\$66,331,304	\$62,603	\$881,920			
1935	\$5,793,610	0.4278	\$81,617,481	\$21,525	\$303,233			
1936	\$6,152,984	0.4439	\$83,547,144	\$20,952	\$284,493			
1937	\$10,125,806	0.4545	\$134,256,275	\$151,861	\$2,013,498			
1938	\$8,479,315	0.4545	\$112,425,741	\$159,729	\$2,117,819			
1939	\$9,426,036	0.4492	\$126,465,983	\$77,764	\$1,043,334			
1940	\$7,174,659	0.4706	\$91,884,553	\$117,150	\$1,500,319			
1941	\$8,099,386	0.5080	\$96,084,295	\$79,919	\$948,092			
1942	\$7,271,359	0.5294	\$82,775,976	\$63,341	\$721,064			
1943	\$7,368,225	0.5508	\$80,621,258	\$11,647	\$127,439			
1944	\$8,029,416	0.5668	\$85,369,357	\$57,024	\$606,283			
1945	\$7,016,286	0.5829	\$72,544,535	\$54,216	\$560,564			
1946	\$9,313,975	0.5936	\$94,566,215	\$85,906	\$872,217			
1947	\$13,505,511	0.6310	\$128,989,075	\$94,666	\$904,141			
1948	\$15,754,316	0.7112	\$133,497,099	\$167,337	\$1,417,961			
1949	\$27,561,155	0.7380	\$225,082,766	\$217,507	\$1,776,307	0.5800	\$217,067,855	\$1,713,055
1950	\$25,803,611	0.7540	\$206,245,884	\$454,636	\$3,633,864	0.5970	\$197,438,685	\$3,478,689
1951	\$32,392,960	0.8449	\$231,056,113	\$175,629	\$1,252,746	0.6600	\$224,198,547	\$1,215,566
1952	\$32,463,076	0.8770	\$223,084,675	\$415,723	\$2,856,828	0.6760	\$219,365,875	\$2,809,205
1953	\$32,326,884	0.8770	\$222,148,770	\$562,264	\$3,863,851	0.6700	\$220,401,800	\$3,833,466
1954	\$38,452,033	0.8877	\$261,056,875	\$282,476	\$1,917,774	0.6740	\$260,606,657	\$1,914,466
1955	\$68,396,343	0.8984	\$458,825,468	\$109,715	\$736,005	0.6750	\$462,865,918	\$742,486
1956	\$84,289,909	0.9305	\$545,946,709	\$140,124	\$907,585	0.6850	\$562,096,795	\$934,433
1957	\$82,655,713	0.9519	\$523,331,396	\$510,715	\$3,233,572	0.7070	\$534,047,096	\$3,299,782
1958	\$64,994,754	0.9626	\$406,939,376	\$1,135,832	\$7,111,570	0.7260	\$408,947,708	\$7,146,667
1959	\$72,156,996	0.9840	\$441,961,601	\$1,282,004	\$7,852,275	0.7340	\$449,064,248	\$7,978,466
1960	\$86,637,123	0.9947	\$524,946,439	\$347,845	\$2,107,641	0.7430	\$532,649,230	\$2,138,568
1961	\$91,618,709	1.0000	\$552,161,952	\$1,151,031	\$6,936,962	0.7500	\$558,019,017	\$7,010,546
1962	\$101,858,960	1.0160	\$604,184,463	\$934,745	\$5,544,514	0.7590	\$613,032,581	\$5,625,712
1963	\$137,796,907	1.0374	\$800,500,589	\$973,645	\$5,656,175	0.7720	\$815,357,864	\$5,761,153
1964	\$182,152,656	1.0642	\$1,031,588,157	\$1,031,381	\$5,841,037	0.7860	\$1,058,617,472	\$5,994,082
1965	\$207,557,627	1.1016	\$1,135,521,581	\$636,596	\$3,482,736	0.8050	\$1,177,792,845	\$3,612,386
1966	\$244,020,010	1.1604	\$1,267,329,729	\$2,582,878	\$13,414,302	0.8350	\$1,334,950,186	\$14,130,044
1967	\$266,317,101	1.2086	\$1,328,050,322	\$3,166,355	\$15,789,744	0.8650	\$1,406,400,598	\$16,721,283
1968	\$299,354,285	1.2567	\$1,435,626,720	\$3,509,890	\$16,832,536	0.9000	\$1,519,389,304	\$17,814,642

Appendix 4B. Gross Value of Newfoundland and Labrador Mineral Production (GVMP), plus Mining Tax and Royalties revenue, 1865 - 2002

Year	*GVMP in current \$	**GDP deflation index	**GVMP in year-2000 \$, using GDP deflator	***Mining Tax & Royalties in current \$	Mining Tax & Royalties in year-2000 \$, using GDP deflator	****Canadian Consumer Price Index (CPI) deflator	GVMP in year-2000 \$, using CPI deflator	Mining Tax and Royalties in year-2000 dollars using CPI deflator
1969	\$256,935,937	1.3102	\$1,181,905,310	\$2,824,897	\$12,994,526	0.9410	\$1,247,272,434	\$13,713,209
1970	\$353,204,018	1.3743	\$1,548,875,207	\$3,570,920	\$15,659,248	0.9720	\$1,659,913,533	\$16,781,854
1971	\$343,431,278	1.4225	\$1,455,064,099	\$3,219,426	\$13,640,200	1.0000	\$1,568,794,078	\$14,706,338
1972	\$290,659,060	1.5080	\$1,161,605,534	\$3,951,073	\$15,790,281	1.0470	\$1,268,128,544	\$17,238,301
1973	\$374,417,862	1.6471	\$1,370,028,995	\$3,664,933	\$13,410,323	1.1290	\$1,514,916,558	\$14,828,533
1974	\$448,102,101	1.8930	\$1,426,584,937	\$2,016,811	\$6,420,751	1.2510	\$1,636,235,330	\$7,364,343
1975	\$550,958,453	2.0856	\$1,592,128,658	\$2,725,154	\$7,874,996	1.3860	\$1,815,857,297	\$8,981,604
1976	\$743,492,023	2.2781	\$1,966,937,817	\$6,562,000	\$17,360,033	1.4890	\$2,280,907,697	\$20,131,105
1977	\$867,145,558	2.4332	\$2,147,852,844	\$10,044,000	\$24,878,215	1.6080	\$2,463,383,650	\$28,532,955
1978	\$675,095,984	2.5936	\$1,568,728,194	\$14,409,000	\$33,482,357	1.7520	\$1,760,181,767	\$37,568,671
1979	\$1,120,398,447	2.8396	\$2,377,945,480	\$13,278,000	\$28,181,367	1.9120	\$2,676,767,838	\$31,722,753
1980	\$1,035,653,000	3.1497	\$1,981,631,462	\$16,808,000	\$32,160,638	2.1070	\$2,245,307,501	\$36,439,935
1981	\$1,030,263,000	3.4973	\$1,775,392,050	\$27,093,000	\$46,687,784	2.3670	\$1,988,272,659	\$52,285,942
1982	\$646,702,000	3.7968	\$1,026,525,569	\$22,872,000	\$36,305,273	2.6240	\$1,125,813,543	\$39,816,805
1983	\$806,608,000	4.0000	\$1,215,303,765	\$21,290,000	\$32,077,313	2.7740	\$1,328,257,154	\$35,058,659
1984	\$978,032,000	4.1337	\$1,425,927,638	\$19,920,000	\$29,042,484	2.8970	\$1,542,164,369	\$31,409,928
1985	\$869,420,000	4.2353	\$1,237,167,096	\$16,696,000	\$23,758,071	3.0090	\$1,319,877,222	\$25,346,403
1986	\$817,159,000	4.3529	\$1,131,373,701	\$25,204,000	\$34,895,464	3.1350	\$1,190,680,163	\$36,724,680
1987	\$742,384,000	4.5615	\$980,852,014	\$32,474,000	\$42,905,273	3.2730	\$1,036,116,747	\$45,322,711
1988	\$864,766,000	4.7701	\$1,092,591,123	\$19,700,000	\$24,890,022	3.4040	\$1,160,473,293	\$26,436,428
1989	\$896,968,000	4.9893	\$1,083,475,816	\$22,600,000	\$27,299,250	3.5740	\$1,146,432,519	\$28,885,506
1990	\$864,263,000	5.1390	\$1,013,552,967	\$21,300,000	\$24,979,292	3.7460	\$1,053,911,742	\$25,973,946
1991	\$772,303,000	5.2781	\$881,849,525	\$21,657,975	\$24,730,028	3.9560	\$891,779,602	\$25,008,501
1992	\$705,877,000	5.3476	\$795,523,379	\$14,936,814	\$16,833,789	4.0160	\$802,899,934	\$16,989,882
1993	\$698,872,000	5.4278	\$775,988,910	\$14,247,979	\$15,820,170	4.0880	\$780,931,335	\$15,920,932
1994	\$838,325,000	5.4866	\$920,850,171	\$16,992,978	\$18,665,776	4.0970	\$934,700,659	\$18,946,528
1995	\$881,469,000	5.6096	\$947,011,976	\$19,238,459	\$20,668,964	4.1870	\$961,679,100	\$20,989,081
1996	\$911,331,000	5.7059	\$962,577,354	\$21,710,864	\$22,931,719	4.2580	\$977,679,664	\$23,291,505
1997	\$1,010,138,000	5.7594	\$1,057,033,915	\$23,580,257	\$24,674,976	4.3340	\$1,064,677,061	\$24,853,395
1998	\$1,095,795,000	5.7273	\$1,153,091,471	\$27,800,000	\$29,253,595	4.3740	\$1,144,396,790	\$29,033,013
1999	\$821,101,000	5.8182	\$850,533,848	\$24,465,000	\$25,341,962	4.4505	\$842,770,800	\$25,110,659
2000	\$975,255,000	6.0267	\$975,255,000	\$18,289,000	\$18,289,000	4.5680	\$975,255,000	\$18,289,000
2001	\$814,420,000	6.0428	\$812,257,823	\$19,364,000	\$19,312,591	4.6877	\$793,620,605	\$18,869,465
2002	\$791,260,000	6.0963	\$782,236,860	\$17,071,000	\$16,876,331	4.7923	\$754,232,697	\$16,272,156

Notes:

All currency in Canadian dollars

*The data for gross value of mineral production are taken from Geological Survey of Newfoundland reports for the period 1865 to 1906; from the Newfoundland Customs Returns for the period 1907 to 1949; and from unpublished files of the Newfoundland Department of Mines and Energy for the remaining years.

**Adjustment to constant dollars has been performed using a Gross Domestic product deflation index (courtesy D. Cranstone of NRCan in part based on an earlier index by D.A. Cavanagh; NRCan) recalculated to base year 1961.

***Mining Tax and Royalty revenue is that derived from taxation, under the Mineral Rights Tax Act, and Royalties, as recorded in the Annual Statement of Public Accounts

**** Source for Canadian Consumer Price Index data is Statistics Canada, base year 1971

Cells shaded in grey are assumed or interpolated values

Appendix 4C. Pre-confederation mineral production by quantity and value

Year	Copper ore or concentrate - tonnes	Copper value \$	Nickel ore - tonnes	Nickel value \$	Lead ore or concentrate - tonnes	Lead value \$	Zinc concentrate - tonnes	Zinc value \$	Pyrite - tonnes	Pyrite value \$	Brick (number)	Brick value \$	Building stone - tonnes	Building stone value \$	Chromite - tonnes	Chromite value \$	Coal - tonnes
1865	236	\$8,496			2250	\$90,000											
1866	284	\$10,206			314	\$15,036											
1867	79	\$2,370			5	\$240											
1868	0	\$0			4	\$8											
1869	3,422	\$109,504	2.5	\$600	2	\$4											
1870	5,226	\$167,232	38	\$9,120													
1871	1,407	\$45,024	7	\$700													
1872	4,955	\$588,560	8	\$2,560													
1873	5,553	\$194,355	120	\$3,600													
1874	5,052	\$121,248	98	\$4,704													
1875	10,018	\$370,666	17.5	\$5,520	130	\$6,240											
1876	25,134	\$614,700	28	\$2,800	95	\$4,560											
1877	47,454	\$1,264,004			38	\$1,824											
1878	35,823	\$822,606			10	\$1,392											
1879	28,405	\$555,790			2	\$100											
1880	22,042	\$411,680															
1881	27,351	\$547,020															
1882	19,004	\$468,576															
1883	11,989	\$256,724						10	\$72								
1884	4,079	\$97,217						950	\$7,600								
1885	4,401	\$102,420															
1886	235	\$246,150															
1887	7,492	\$168,864			10	\$400		410	\$8,200								
1888	3,322	\$816,386						1,850	\$37,000	120,000	\$840						
1889	2,306	\$356,370						7,530	\$64,000	120,000	\$840						
1890	400	\$226,792						8,670	\$72,315	820,000	\$7,140						
1891	7,060	\$565,850						19,150	\$57,900	820,000	\$7,140	0	\$0				0
1892	26,643	\$789,527						36,216	\$186,080	870,000	\$7,570	0	\$0				0
1893	45,431	\$639,401						39,953	\$199,765	870,000	\$7,570	0	\$0				0
1894	44,893	\$523,001						42,095	\$210,475	870,000	\$7,570	0	\$0				0
1895	45,951	\$483,698						34,330	\$171,650	870,000	\$7,570	0	\$0		32	\$640	0
1896	2,329	\$584,325						27,274	\$190,918	870,000	\$7,570	500	\$500	1,014	\$15,210		0
1897	69,878	\$289,961						32,790	\$163,950	870,000	\$7,570	500	\$500	3,033	\$42,462		0
1898	66,798	\$274,452						32,335	\$161,675	930,000	\$8,010	100	\$400	724	\$15,000		2,900
1899	86,957	\$460,524						25,954	\$129,770	772,000	\$8,464	500	\$500	706	\$10,399		5,000
1900	70,614	\$399,775						0	\$0	800,000	\$11,200	500	\$500	0	\$0		0
1901	75,348	\$360,094						7,532	\$14,128	1,305,000	\$13,050	5,000	\$5,000				
1902	74,608	\$265,810						26,000	\$117,000	1,625,000	\$18,950	5,000	\$6,000				
1903	87,790	\$343,050						42,000	\$210,000	1,550,000	\$14,120	4,000	\$4,000				
1904	107,839	\$466,739						60,200	\$210,700	1,236,000	\$11,432	3,100	\$4,650				
1905	78,720	\$358,880						50,720	\$229,530	1,335,500	\$9,690	1,000	\$1,500				
1906	75,989	\$360,345						28,132	\$84,396	906,000	\$8,100	500	\$750				
1907	55,890	\$278,950						29,805	\$184,140		\$0		\$0				
1908	54,667	\$275,960						20,451	\$135,186		\$0		\$0				
1909	40,279	\$220,895															
1910	37,036	\$197,709															
1911	42,131	\$231,693						5,448	\$26,290								
1912	32,057	\$200,595															
1913	17,800	\$120,650															
1914	13,797	\$66,707						1,335	\$13,430								
1915	3,250	\$39,000						4,139	\$18,625								

Appendix 4C. Pre-confederation mineral production by quantity and value

Year	Copper ore or concentrate - tonnes	Copper value \$	Nickel ore - tonnes	Nickel value \$	Lead ore or concentrate - tonnes	Lead value \$	Zinc concentrate - tonnes	Zinc value \$	Pyrite - tonnes	Pyrite value \$	Brick (number)	Brick value \$	Building stone - tonnes	Building stone value \$	Chromite - tonnes	Chromite value \$	Coal - tonnes
1916	9,450	\$111,440															
1917	16,066	\$204,307															
1918	5,087	\$58,768															
1919	56	\$673													80	\$2,900	
1920	0	\$0															
1921	0	\$0															
1922	0	\$0															
1923	0	\$0															
1924	0	\$0															
1925	0	\$0			230	\$18,406											
1926	8,450	\$67,600			20	\$1,200											
1927	0	\$0				\$260											
1928	0	\$0				\$0											
1929	0	\$0			10,501	\$509,300	18,168	\$556,816									
1930	1,000	\$51,976			23,451	\$1,194,665	55,213	\$1,189,670									
1931	0	\$0			29,229	\$1,038,026	45,783	\$508,885									
1932	0	\$0			41,240	\$1,060,517	88,847	\$960,651									
1933	0	\$0			43,088	\$1,016,971	129,900	\$1,499,646									
1934	826	21296			43,945	\$1,209,107	148,014	\$2,367,408									
1935	480	\$22,040			40,120	\$1,607,405	140,773	\$1,869,624									
1936	10,315	\$467,232			42,107	\$1,950,600	123,026	\$1,505,921									
1937	31,361	\$1,701,634			41,423	\$1,788,069	119,669	\$1,964,790									
1938	32,865	\$1,466,879			47,119	\$1,342,326	122,084	\$977,316									
1939	39,544	\$2,010,778			41,771	\$1,382,521	100,452	\$1,168,317									
1940	43,578	\$1,970,642			42,897	\$1,141,596	67,661	\$782,732									
1941	36,579	\$1,605,853			48,169	\$1,041,216	110,302	\$1,185,289									
1942	23,683	\$1,166,544			24,658	\$881,304	137,556	\$1,542,430									
**1943	19,675	\$891,427			54,647	\$2,164,498	93,553	\$1,110,357									
1944	20,498	\$927,621			42,561	\$1,414,535	261,299	\$1,701,777									
1945	24,251	\$1,033,316			32,352	\$1,290,331	75,096	\$1,611,404									
1946	17,944	\$893,077			39,151	\$1,711,890	102,746	\$2,626,656									
1947	17,631	\$1,426,143			36,518	\$3,512,139	93,580	\$2,709,742									
1948	16,604	\$1,521,570			35,525	\$5,149,339	69,360	\$2,503,554									
1949	14,580	\$1,534,336			37,137	\$7,336,566	76,175	\$4,721,077									

Appendix 4C. Pre-confederation mineral production by quantity and value

Year	Coal value \$	Stone - tonnes	Stone value \$	***Gold - troy ounces	***Gold value \$	Iron ore - tonnes	Iron ore value \$	***Silver - troy ounces	***Silver value \$	Gypsum - tonnes	Gypsum value \$	Limestone - tonnes	Limestone value \$	Barite - tonnes	Barite value \$	Sand & Gravel - tonnes	Sand & Gravel value \$
1865																	
1866													\$500				
1867																	
1868																	
1869																	
1870																	
1871																	
1872																	
1873																	
1874																	
1875																	
1876																	
1877																	
1878																	
1879																	
1880																	
1881																	
1882																	
1883																	
1884																	
1885																	
1886																	
1887																	
1888																	
1889																	
1890																	
1891	\$0									250	\$1,250						
1892	\$0									170	\$850						
1893	\$0										\$1,000						
1894	\$0	N/A	\$1,350								\$1,200						
1895	\$0	N/A	\$2,254			750	\$750										
1896	\$0	N/A	\$2,858			20,375	\$20,375	4,000	\$2,684								
1897	\$0	N/A	\$2,358			30,787	\$30,787	4,000	\$2,684								
1898	\$11,600	N/A	\$34,950			102,000	\$102,000	2,616	\$1,543								
1899	\$20,000	N/A	\$33,100			306,880	\$306,880	0	\$0								
1900	\$0	N/A	\$13,800			317,216	\$317,216	0	\$0								
1901		N/A	\$56,838			738,206	\$738,206					2,888	\$975				
1902		N/A	\$80,230			728,721	\$728,721					1,150	\$345	315	\$630		
1903		N/A	\$97,640	149	\$3,000	588,795	\$588,795					1,200	\$600	2,760	\$19,320		
1904		N/A	\$51,350	11	\$209	589,739	\$589,739							2,000	\$5,000	2,320	\$5,800
1905		N/A	\$51,700			689,970	\$689,970									1,048	\$2,620
1906		N/A	\$31,411	147	\$2,800	884,986	\$966,615					1,200	\$1,100			1,000	\$2,500
1907	\$0	N/A	\$0		\$0	809,700	\$890,670		\$0								
1908		N/A	\$0		\$0	943,460	\$1,037,806										
1909		N/A				880,120	\$968,132										
1910		N/A	\$652			1,059,880	\$1,165,867										
1911		N/A	\$5,258			1,175,185	\$1,292,702										
1912		N/A	\$172			1,016,930	\$1,118,622										
1913		N/A	\$740			1,243,200	\$1,367,520					17,900	\$8,950				
1914		N/A	\$21,720			1,245,797	\$1,370,375					155,100	\$79,550				
1915		N/A	\$25,600			511,990	\$563,189					88,400	\$44,200				

Appendix 4C. Pre-confederation mineral production by quantity and value

Year	Coal value \$	Stone - tonnes	Stone value \$	***Gold - troy ounces	***Gold value \$	Iron ore - tonnes	Iron ore value \$	***Silver - troy ounces	***Silver value \$	Gypsum - tonnes	Gypsum value \$	Limestone - tonnes	Limestone value \$	Barite - tonnes	Barite value \$	Sand & Gravel - tonnes	Sand & Gravel value \$
1916						834,310	\$917,741					11,360	\$5,650				
1917						902,380	\$992,618					118,600	\$59,300				
1918		N/A	\$3,780			731,080	\$804,188					210,900	\$105,450				
1919						709,338	\$780,271					155,100	\$77,550				
1920						510,600	\$561,660					85,600	\$42,800				
1921						514,203	\$621,576					93,401	\$46,705				
1922						484,322	\$643,687					24,000	\$12,000				
1923						1,004,138	\$1,706,017					201,250	\$100,625				
1924						744,075	\$1,281,929					144,000	\$144,000				
1925						1,117,429	\$1,899,630					40,000	\$40,000				
1926						1,063,973	\$1,808,750					60,000	\$60,000				
1927						929,159	\$1,579,636					131,500	\$131,525				
1928						1,542,292	\$2,623,944					182,900	\$182,900				
1929						1,334,148	\$2,621,610					414,700	\$414,700				
1930						1,644,708	\$4,539,391					256,600	\$256,600				
1931						974,223	\$2,688,764					135,603	\$135,603				
1932						470,404	\$1,299,035					87,799	\$87,799				
1933				594	\$45,719	194,252	\$536,127						\$69,259	?			
1934				659	28202	352,251	\$972,234					95,500	\$95,500				
1935						726,335	\$2,004,674					220,760	\$220,760				
1936						754,637	\$1,946,463					162,600	\$162,600				
1937						1,609,718	\$4,104,280					365,000	\$365,000				
1938						1,680,213	\$4,284,543					187,480	\$188,480				
1939						1,756,860	\$4,481,989					163,200	\$163,200				
1940						1,116,009	\$2,858,219					253,400	\$253,400				
1941						1,393,680	\$3,558,998					405,500	\$405,500				
1942						1,137,962	\$2,918,128					378,000	\$378,000				
**1943						927,566	\$2,364,693					130,340	\$130,340				
1944						791,688	\$2,019,695					306,150	\$306,150				
1945						578,263	\$1,474,346					313,250	\$313,250				
1946						999,868	\$3,051,630					224,500	\$224,500				
1947						1,245,852	\$4,486,187					326,320	\$485,666				
1948						1,259,742	\$5,163,799					276,259	\$427,415				
1949						1,704,628	\$7,767,731					333,053	\$486,855				

Appendix 4C. Pre-confederation mineral production by quantity and value

Year	Talc (pyrophyllite) - tonnes	Talc (pyrophyllite) value \$	Fluorspar - tonnes	Fluorspar value \$	Miscellaneous - tonnes	Miscellaneous value \$	Total value in current \$	*Total value in year-2000 \$
1865							\$98,496	
1866							\$25,742	
1867							\$2,610	\$48,609
1868							\$8	\$149
1869							\$110,108	\$2,038,059
1870							\$176,352	\$3,301,731
1871							\$45,724	\$838,863
1872							\$591,120	\$9,752,328
1873							\$197,955	\$3,255,178
1874							\$125,952	\$2,173,145
1875							\$382,426	\$6,871,739
1876							\$622,060	\$11,916,696
1877							\$1,265,828	\$25,582,876
1878							\$823,998	\$17,960,289
1879							\$555,890	\$12,561,692
1880							\$411,680	\$8,505,614
1881							\$547,020	\$11,209,610
1882							\$468,576	\$9,589,082
1883							\$256,796	\$5,237,368
1884							\$104,817	\$2,311,396
1885							\$102,420	\$2,391,548
1886							\$246,150	\$5,661,450
1887							\$177,464	\$4,000,039
1888							\$854,226	\$18,513,706
1889							\$421,210	\$9,128,917
1890							\$306,247	\$6,512,082
1891							\$632,140	\$13,441,920
1892							\$984,027	\$22,632,621
1893							\$847,736	\$19,107,969
1894							\$743,596	\$18,218,102
1895							\$666,562	\$16,693,675
1896							\$824,440	\$21,116,906
1897							\$540,272	\$13,530,812
1898							\$609,630	\$14,618,149
1899							\$969,637	\$22,766,269
1900							\$742,491	\$17,077,293
1901							\$1,188,291	\$27,330,693
1902							\$1,217,686	\$26,391,002
1903							\$1,280,525	\$27,229,277
1904	1,562	\$7,000					\$1,352,619	\$28,762,295
1905	6,000	\$24,000					\$1,367,890	\$28,029,310
1906							\$1,458,017	\$29,342,592
1907					30	\$4,500	\$1,358,260	\$0
1908						\$9,115	\$1,458,067	\$0
1909	1,300	\$1,500					\$1,190,527	\$21,995,474
1910	1,400	\$5,600					\$1,369,828	\$25,308,134
1911							\$1,555,943	\$27,834,091
1912							\$1,319,389	\$22,193,305
1913							\$1,497,860	\$26,376,378
1914							\$1,551,782	\$26,102,363
1915							\$690,614	\$10,962,281

Appendix 4C. Pre-confederation mineral production by quantity and value

Year	Talc (pyrophyllite) - tonnes	Talc (pyrophyllite) value \$	Fluorspar - tonnes	Fluorspar value \$	Miscellaneous - tonnes	Miscellaneous value \$	Total value in current \$	*Total value in year-2000 \$
1916							\$1,034,831	\$13,720,642
1917							\$1,256,225	\$18,834,865
1918							\$972,186	\$8,559,794
1919							\$861,394	\$7,013,556
1920							\$604,460	\$4,989,576
1921							\$668,281	\$6,791,128
1922							\$655,687	\$9,668,556
1923							\$1,806,642	\$20,360,855
1924							\$1,425,929	\$15,301,414
1925							\$1,958,036	\$21,424,336
1926							\$1,937,550	\$23,883,837
1927							\$1,711,421	\$19,952,549
1928	200	\$800					\$2,807,644	\$33,310,893
1929							\$4,102,426	\$45,074,899
1930							\$7,232,302	\$84,212,977
1931							\$4,371,278	\$0
1932							\$3,408,002	\$0
1933							\$3,167,722	\$0
1934			2,400	\$14,775			\$4,708,522	\$0
1935			3,077	\$18,462	441	\$50,645	\$5,793,610	\$81,617,481
1936			8,457	\$50,682	637	\$69,486	\$6,152,984	\$83,547,144
1937			11,228	\$78,596	571	\$123,437	\$10,125,806	\$134,256,275
1938	1,000	\$1,490	14,000	\$84,000	365	\$134,281	\$8,479,315	\$112,425,741
1939		\$0	8,605	\$60,235		\$158,996	\$9,426,036	\$0
1940			8,950	\$62,375	201	\$105,695	\$7,174,659	
1941	300	\$3,000	14,150	\$122,250	392	\$177,280	\$8,099,386	\$103,727,364
1942	229	\$3,400	16,390	\$251,825	197	\$129,728	\$7,271,359	\$86,261,280
**1943	922	\$22,945	30,038	\$561,519		\$122,446	\$7,368,225	\$63,066,692
1944	1,151	\$32,226	66,615	\$1,360,659	351	\$266,753	\$8,029,416	\$63,066,692
1945	354	\$7,908	42,870	\$1,059,384		\$226,347	\$7,016,286	\$74,597,682
1946	80	\$1,218	21,750	\$660,724	254	\$144,280	\$9,313,975	\$96,301,375
1947	261	\$6,775	27,932	\$765,634	296	\$113,225	\$13,505,511	\$137,123,522
1948	206	\$5,721	34,050	\$892,077	152	\$90,841	\$15,754,316	\$150,467,069
1949	0	\$0	32,102	\$782,908	260	\$181,590	\$22,811,063	\$193,293,744

Notes

All currency figures are in Canadian dollars.

Tonnage values for copper, nickel and lead prior to 1925 would be for hand-picked ore. Copper shipments prior to 1891 also excludes regulus and ingots.

A blank cell indicates that data were either not reported or have been lost.

Data prior to 1908 have been taken from the reports of The Newfoundland Geological Survey (Murray and Howley, 1909).

Data after 1909 have been taken from the Customs Returns (*see* Appendix 2). These do not include data for domestically consumed commodities, such as brick and building stone, that were reported earlier.

*Total value in year-2000 dollars has been calculated using the Gross Domestic Product deflator - *see* Appendix 4B.

**Tonnage and \$ values for 1943 are based on nine-month data that have been scaled up to 12 months.

***Prior to 1949, gold and silver were not reported as by-products of base metal mining.

Appendix 4D. Gross Value of Mineral Production 1949-2002, by product, in current and year-2000 Canadian dollars

A. In current Canadian dollars															
	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
*METALS															
Iron Ore	7,947,914	5,851,488	9,145,960	8,668,192	14,201,842	21,749,304	45,701,801	55,620,755	57,898,102	38,226,828	42,974,837	54,673,717	59,889,125	67,753,153	99,601,987
Copper	1,444,837	1,508,910	1,606,283	1,689,079	238,066	2,029,876	2,250,672	2,574,274	2,625,986	7,499,372	8,876,570	8,398,362	9,195,817	10,731,154	8,827,797
Zinc	8,454,091	9,558,647	11,330,799	10,656,475	6,698,029	7,188,595	7,817,635	10,293,055	8,631,847	7,370,102	7,753,838	9,133,517	8,722,020	7,874,869	8,814,473
Lead	5,880,191	5,178,320	6,051,427	5,847,571	4,576,214	493,054	5,135,085	7,068,813	6,843,665	5,448,339	4,765,328	5,131,091	4,485,938	5,025,529	5,146,264
Gold	333,684	352,115	313,778	294,551	263,451	222,409	218,753	282,938	327,280	454,686	450,207	458,834	511,652	522,468	465,004
Silver	434,382	465,138	505,388	533,295	544,712	617,867	618,840	858,350	1,045,307	1,099,950	987,622	1,130,158	1,079,376	1,376,620	1,357,711
Cadmium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Antimony	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Magnetite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total metals	\$24,495,099	\$22,914,618	\$28,953,635	\$27,689,163	\$26,522,314	\$32,301,105	\$61,742,786	\$76,698,185	\$77,372,187	\$60,099,277	\$65,808,402	\$78,925,679	\$83,883,928	\$93,283,793	\$124,213,236
*NON-METALS															
Asbestos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,320,064
Barite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clay/Brick	25,450	31,089	32,183	0	39,500	33,042	49,338	47,145	2,950	58,282	68,000	83,435	75,890	142,000	92,120
Cement	0	0	0	529,750	1,345,073	1,330,018	1,492,990	1,660,300	1,185,078	1,079,071	1,291,516	1,688,664	1,789,980	1,985,524	1,848,347
Dolomite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fluorspar	1,405,033	1,290,361	1,966,477	2,484,943	2,631,698	2,946,896	2,678,641	3,395,061	1,662,602	1,483,368	1,749,903	1,820,769	1,951,800	1,870,184	1,976,006
Gemstone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gypsum	0	0	0	54,881	117,208	124,385	175,829	186,727	121,800	144,510	148,617	141,668	101,696	284,564	766,298
Limestone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyrophyllite	0	0	0	0	0	230	120	12,077	47,328	109,551	200,275	262,925	404,059	343,210	476,745
Sand and Gravel	999,598	780,315	648,346	936,013	1,023,622	1,096,883	1,660,984	1,686,320	1,681,394	1,484,160	2,306,864	3,069,395	2,777,393	3,504,594	4,276,626
Quartz/Silica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stone (aggregate)	635,975	787,228	792,319	768,326	647,469	619,474	595,655	604,094	582,374	536,535	583,419	644,588	633,963	445,091	827,465
Stone (dimension)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total non-metals	\$3,066,056	\$2,888,993	\$3,439,325	\$4,773,913	\$5,804,570	\$6,150,928	\$6,653,557	\$7,591,724	\$5,283,526	\$4,895,477	\$6,348,594	\$7,711,444	\$7,734,781	\$8,575,167	\$13,583,671
TOTAL PRODUCTION VALUE	\$27,561,155	\$25,803,611	\$32,392,960	\$32,463,076	\$32,326,884	\$38,452,033	\$68,396,343	\$84,289,909	\$82,655,713	\$64,994,754	\$72,156,996	\$86,637,123	\$91,618,709	\$101,858,960	\$137,796,907

Appendix 4D. Gross Value of Mineral Production 1949-2002, by product, in current and year-2000 Canadian dollars

B. **In Constant (year-2000) Canadian dollars															
	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
METALS															
Iron Ore	62,596,674	44,773,195	63,301,129	58,574,410	96,826,887	147,404,778	309,282,707	370,913,298	374,085,615	240,523,623	267,451,029	336,136,661	364,764,697	407,768,647	589,354,762
Copper	11,379,337	11,545,563	11,117,425	11,413,776	1,623,113	13,757,379	15,231,214	17,166,837	16,966,767	47,186,131	55,242,741	51,633,536	56,008,656	64,584,864	52,234,944
Zinc	66,583,255	73,138,860	78,422,863	72,010,026	45,666,562	48,720,329	52,905,121	68,640,402	55,771,255	46,372,763	48,255,493	56,153,305	53,122,916	47,394,469	52,156,104
Lead	46,311,573	39,622,388	41,883,210	39,514,356	31,200,217	3,341,648	34,751,212	47,139,179	44,217,626	34,281,009	29,656,701	31,546,196	27,322,353	30,245,872	30,450,951
Gold	2,628,049	2,694,240	2,171,724	1,990,398	1,796,185	1,507,365	1,480,391	1,886,804	2,114,590	2,860,889	2,801,833	2,820,934	3,116,302	3,144,445	2,751,474
Silver	3,421,133	3,559,046	3,497,898	3,603,686	3,713,798	4,187,562	4,187,942	5,724,004	6,753,836	6,920,898	6,146,400	6,948,266	6,574,119	8,285,112	8,033,710
Cadmium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Antimony	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Magnetite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nickel															
Cobalt															
Total metals	\$192,920,021	\$175,333,291	\$200,394,250	\$187,106,652	\$180,826,762	\$218,919,062	\$417,838,587	\$511,470,524	\$499,909,689	\$378,145,313	\$409,554,197	\$485,238,899	\$510,909,044	\$561,423,408	\$734,981,946
NON-METALS															
Asbestos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,645,146
Barite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clay/Brick	200,441	237,880	222,745	0	269,307	223,940	333,890	314,392	19,060	366,711	423,193	512,962	462,221	854,619	545,083
Cement	0	0	0	3,579,731	9,170,587	9,014,128	10,103,672	11,071,898	7,656,911	6,789,527	8,037,664	10,381,988	10,902,172	11,949,768	10,936,851
Dolomite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fluorspar	11,065,846	9,873,315	13,610,404	16,791,745	17,942,681	19,972,435	18,127,455	22,640,348	10,742,243	9,333,368	10,890,405	11,194,176	11,887,763	11,255,600	11,692,222
Gemstone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gypsum	0	0	0	370,853	799,114	843,013	1,189,906	1,245,210	786,962	909,259	924,908	870,982	619,396	1,712,633	4,534,261
Limestone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyrophyllite	0	0	0	0	0	1,559	812	80,537	305,791	689,296	1,246,398	1,616,476	2,460,989	2,065,591	2,820,947
Sand and Gravel	7,872,696	5,970,651	4,487,340	6,325,011	6,978,963	7,434,068	11,240,555	11,245,416	10,863,660	9,338,351	14,356,614	18,870,789	16,916,175	21,092,207	25,305,217
Quartz/Silica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stone (aggregate)	5,008,851	6,023,547	5,483,808	5,191,883	4,414,386	4,198,453	4,031,040	4,028,469	3,762,779	3,375,884	3,630,869	3,962,958	3,861,257	2,678,756	4,896,192
Stone (dimension)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total non-metals	\$24,147,834	\$22,105,394	\$23,804,298	\$32,259,223	\$39,575,038	\$41,687,595	\$45,027,331	\$50,626,270	\$34,137,407	\$30,802,395	\$39,510,051	\$47,410,331	\$47,109,973	\$51,609,174	\$80,375,919
TOTAL PRODUCTION VALUE	\$217,067,855	\$197,438,685	\$224,198,547	\$219,365,875	\$220,401,800	\$260,606,657	\$462,865,918	\$562,096,795	\$534,047,096	\$408,947,708	\$449,064,248	\$532,649,230	\$558,019,017	\$613,032,581	\$815,357,864
***Canadian Consumer Price Index	0.58	0.60	0.66	0.68	0.67	0.67	0.68	0.69	0.71	0.73	0.73	0.74	0.75	0.76	0.77

Appendix 4D. Gross Value of Mineral Production 1949-2002, by product, in current and year-2000 Canadian dollars

A. In current Car														
*METALS	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	
Iron Ore	137,038,680	156,888,970	188,603,259	207,408,843	246,508,466	194,971,157	292,582,028	289,912,158	235,249,411	314,838,603	372,188,155	468,600,400	631,272,628	
Copper	9,095,013	11,147,108	17,415,394	20,897,555	22,413,551	21,049,062	17,639,532	14,762,654	9,689,977	11,031,913	9,664,523	10,541,388	11,197,883	
Zinc	11,047,407	10,928,579	10,316,464	10,099,901	10,357,709	10,022,171	9,530,344	6,970,621	10,138,934	4,199,158	14,689,531	26,619,174	35,251,008	
Lead	6,831,452	6,793,882	6,500,156	5,583,296	5,084,119	6,737,575	5,609,750	3,639,735	3,765,175	2,725,614	6,414,818	2,331,396	6,435,294	
Gold	631,067	892,555	967,903	1,028,989	294,251	338,532	249,010	259,460	810,487	1,397,375	1,802,489	2,127,843	170,494	
Silver	1,525,647	1,521,769	1,535,298	1,858,701	2,071,768	1,977,553	1,467,794	879,222	956,790	1,447,191	2,572,284	2,005,188	2,486,483	
Cadmium	0	0	0	0	0	0	0	0	401,764	191,093	22,573	37,041	311,320	
Antimony	0	0	0	0	0	0	0	0	0	0	0	0	0	
Magnetite	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total metals	\$166,169,266	\$188,172,863	\$225,338,474	\$246,877,285	\$276,372,155	\$235,096,050	\$327,078,458	\$316,423,850	\$261,012,538	\$335,830,947	\$407,354,373	\$512,262,430	\$687,125,110	
*NON-METALS														
Asbestos	6,355,578	8,825,182	9,301,204	10,499,143	11,844,605	10,588,875	11,669,402	12,497,626	10,841,820	17,529,667	16,111,107	18,139,165	34,445,154	
Barite	0	0	0	0	0	0	0	0	0	0	0	0	0	
Clay/Brick	99,038	72,717	172,700	199,570	152,200	120,280	37,304	79,605	256,814	260,000	436,000	536,149	568,842	
Cement	1,833,743	1,987,220	1,632,982	1,744,284	1,922,695	1,896,229	2,875,978	2,932,090	2,709,000	3,659,981	4,024,604	4,678,129	5,250,927	
Dolomite	0	0	0	0	0	0	0	0	0	0	0	0	0	
Fluorspar	2,254,060	2,677,443	1,890,768	2,097,391	2,602,230	3,036,931	4,595,522	2,819,091	5,432,151	4,620,382	7,119,090	0	2,934,995	
Gemstone	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gypsum	893,484	1,088,531	1,173,401	1,068,604	1,194,794	1,299,261	1,467,449	1,666,067	2,145,985	2,324,614	1,859,404	2,314,562	2,532,286	
Limestone	0	0	0	0	0	0	0	0	0	0	0	0	0	
Peat	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pyrophyllite	492,240	452,010	608,220	443,640	535,740	553,935	553,305	393,375	560,010	486,788	50,752	391,073	447,082	
Sand and Gravel	3,501,694	3,785,071	3,584,261	3,086,688	3,632,018	3,742,412	4,474,000	5,827,000	6,829,000	8,370,503	8,727,772	9,587,488	8,686,713	
Quartz/Silica	0	0	0	0	0	263,261	170,000	215,553	339,832	363,443	375,000	160,000	218,000	
Stone (aggregate)	553,553	496,590	318,000	300,496	1,097,848	338,703	282,600	577,021	531,910	971,537	2,043,999	2,889,457	1,282,914	
Stone (dimension)	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total non-metals	\$15,983,390	\$19,384,764	\$18,681,536	\$19,439,816	\$22,982,130	\$21,839,887	\$26,125,560	\$27,007,428	\$29,646,522	\$38,586,915	\$40,747,728	\$38,696,023	\$56,366,913	
TOTAL PRODUCTION VALUE	\$182,152,656	\$207,557,627	\$244,020,010	\$266,317,101	\$299,354,285	\$256,935,937	\$353,204,018	\$343,431,278	\$290,659,060	\$374,417,862	\$448,102,101	\$550,958,453	\$743,492,023	

Appendix 4D. Gross Value of Mineral Production 1949-2002, by product, in current and year-2000 Canadian dollars

B. **In Constant														
	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	
METALS														
Iron Ore	796,428,359	890,271,820	1,031,784,056	1,095,310,514	1,251,167,414	946,469,974	1,375,015,127	1,324,318,738	1,026,379,474	1,273,855,393	1,359,037,164	1,544,420,366	1,936,637,585	
Copper	52,857,531	63,254,645	95,273,676	110,358,418	113,761,223	102,180,781	82,898,541	67,435,803	42,276,805	44,635,765	35,289,801	34,742,468	34,353,210	
Zinc	64,204,269	62,014,595	56,437,853	53,336,818	52,571,127	48,651,729	44,788,695	31,841,797	44,235,578	16,990,039	53,638,511	87,731,881	108,144,127	
Lead	39,702,383	38,552,115	35,560,135	29,484,967	25,804,728	25,804,728	32,706,953	26,363,516	16,626,309	16,427,239	11,027,994	23,423,572	19,742,393	
Gold	3,667,575	5,064,834	5,295,067	5,434,014	1,493,487	1,643,373	1,170,245	1,185,213	3,536,108	5,653,861	6,581,750	7,012,978	523,047	
Silver	8,866,610	8,635,330	8,399,091	9,815,660	10,515,374	9,599,853	6,898,028	4,016,286	4,174,419	5,855,419	9,392,641	6,608,729	7,628,109	
Cadmium	0	0	0	0	0	0	0	0	1,752,873	773,173	82,425	122,080	955,077	
Antimony	0	0	0	0	0	0	0	0	0	0	0	0	0	
Magnetite	0	0	0	0	0	0	0	0	0	0	0	0	0	
Nickel														
Cobalt														
Total metals	\$965,726,727	\$1,067,793,339	\$1,232,749,879	\$1,303,740,391	\$1,455,313,354	\$1,141,252,664	\$1,537,134,152	\$1,445,424,147	\$1,138,782,496	\$1,358,791,644	\$1,487,445,864	\$1,688,322,352	\$2,107,983,548	
NON-METALS														
Asbestos	36,936,743	50,078,797	50,883,712	55,445,185	60,117,951	51,402,743	54,841,387	57,089,156	47,302,229	70,926,057	58,829,366	59,783,337	105,671,903	
Barite	0	0	0	0	0	0	0	0	0	0	0	0	0	
Clay/Brick	575,580	412,635	944,783	1,053,914	772,500	583,888	175,313	363,636	1,120,465	1,051,975	1,592,045	1,767,048	1,745,111	
Cement	10,657,173	11,276,548	8,933,487	9,211,433	9,758,745	9,205,073	13,515,913	13,393,787	11,819,209	14,808,497	14,695,756	15,418,249	16,108,955	
Dolomite	0	0	0	0	0	0	0	0	0	0	0	0	0	
Fluorspar	13,099,931	15,193,242	10,343,746	11,076,164	13,207,763	14,742,509	21,597,062	12,877,608	23,700,158	18,694,336	25,995,206	0	9,004,068	
Gemstone	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gypsum	5,192,665	6,176,906	6,419,276	5,643,217	6,064,243	6,307,146	6,896,406	7,610,594	9,362,808	9,405,524	6,789,574	7,628,369	7,768,625	
Limestone	0	0	0	0	0	0	0	0	0	0	0	0	0	
Peat	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pyrophyllite	2,860,754	2,564,946	3,327,364	2,342,830	2,719,178	2,689,028	2,600,306	1,796,937	2,443,291	1,969,573	185,320	1,288,904	1,371,572	
Sand and Gravel	20,350,812	21,478,515	19,608,269	16,300,567	18,434,509	18,167,203	21,025,959	26,617,736	29,794,529	33,867,544	31,869,275	31,598,590	26,649,365	
Quartz/Silica	0	0	0	0	0	1,277,977	798,930	984,646	1,482,667	1,470,512	1,369,305	527,330	668,787	
Stone (aggregate)	3,217,087	2,817,917	1,739,669	1,586,897	5,572,189	1,644,203	1,328,104	2,635,832	2,320,692	3,930,895	7,463,619	9,523,117	3,935,763	
Stone (dimension)	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total non-metals	\$92,890,745	\$109,999,506	\$102,200,307	\$102,660,208	\$116,647,078	\$106,019,770	\$122,779,381	\$123,369,931	\$129,346,048	\$156,124,914	\$148,789,466	\$127,534,944	\$172,924,149	
TOTAL PRODUCTION VALUE	\$1,058,617,472	\$1,177,792,845	\$1,334,950,186	\$1,406,400,598	\$1,571,960,432	\$1,247,272,434	\$1,659,913,533	\$1,568,794,078	\$1,268,128,544	\$1,514,916,558	\$1,636,235,330	\$1,815,857,297	\$2,280,907,697	
***Canadian Consumer Price Index	0.79	0.81	0.84	0.87	0.90	0.94	0.97	1.00	1.05	1.13	1.25	1.39	1.49	

Appendix 4D. Gross Value of Mineral Production 1949-2002, by product, in current and year-2000 Canadian dollars

A. In current Car													
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
*METALS													
Iron Ore	742,132,236	564,113,772	963,943,018	895,558,000	886,843,000	572,386,000	711,727,000	851,420,000	774,802,000	761,328,000	660,526,000	695,759,000	722,527,000
Copper	13,972,817	18,964,123	19,495,298	12,667,000	11,404,000	7,220,000	0	2,169,000	0	0	0	0	0
Zinc	40,660,642	36,561,788	50,546,842	42,801,000	47,797,000	30,194,000	40,637,000	59,967,000	41,043,000	6,940,000	9,737,000	52,594,000	58,882,000
Lead	7,702,122	7,214,909	9,265,343	4,729,000	2,699,000	855,000	0	3,580,000	0	0	0	0	0
Gold	2,261,453	3,888,420	457,857	5,381,000	3,707,000	2,108,000	0	527,000	0	0	7,092,000	38,621,000	39,792,000
Silver	2,833,029	3,249,513	5,942,561	7,185,000	2,899,000	928,000	0	2,502,000	0	0	0	49,000	31,000
Cadmium	524,708	411,972	497,652	218,000	78,000	30,000	6,000	0	0	0	0	1,388,000	1,035,000
Antimony	0	0	0	0	0	0	0	0	0	0	0	0	0
Magnetite	0	0	0	0	0	0	0	0	0	0	0	0	0
Total metals	\$810,087,007	\$634,404,497	\$1,050,148,571	\$968,539,000	\$955,427,000	\$613,721,000	\$752,370,000	\$920,165,000	\$815,845,000	\$768,268,000	\$677,355,000	\$788,411,000	\$822,267,000
*NON-METALS													
Asbestos	29,449,609	18,381,495	36,242,039	45,151,000	51,592,000	9,620,000	16,686,000	25,339,000	18,259,000	16,354,000	19,191,000	26,895,000	24,874,000
Barite	0	0	0	0	0	0	0	0	0	0	0	0	0
Clay/Brick	550,000	592,000	659,000	806,000	921,000	860,000	1,381,000	1,546,000	1,342,000	1,273,000	1,132,000	1,520,000	954,000
Cement	5,175,463	5,685,020	6,784,000	6,415,000	5,580,000	6,321,000	10,034,000	7,675,000	8,779,000	8,530,000	9,722,000	11,011,000	15,367,000
Dolomite	0	0	0	0	0	0	0	0	0	0	0	2,086,000	1,642,000
Fluorspar	8,685,119	68,119	0	0	0	0	0	0	0	0	1,656,000	6,258,000	6,422,000
Gemstone	0	0	0	0	0	0	0	0	0	0	0	34,000	160,000
Gypsum	3,213,601	4,942,700	5,198,250	4,312,000	3,824,000	3,284,000	3,731,000	4,549,000	6,096,000	6,038,000	5,338,000	1,949,000	1,981,000
Limestone	0	0	0	0	0	0	0	0	0	0	0	3,132,000	1,071,000
Peat	0	0	0	0	0	0	0	0	0	0	0	53,000	77,000
Pyrophyllite	756,104	663,916	1,024,879	1,040,000	1,003,000	603,000	1,141,000	1,654,000	1,734,000	1,346,000	1,655,000	1,702,000	1,832,000
Sand and Gravel	7,022,954	7,452,175	15,708,513	6,066,000	9,074,000	9,317,000	18,389,000	11,637,000	12,589,000	11,112,000	16,451,000	18,077,000	18,039,000
Quartz/Silica	0	742,502	1,710,233	636,000	768,000	1,213,000	1,445,000	2,138,000	1,584,000	1,526,000	1,349,000	1,371,000	0
Stone (aggregate)	2,205,701	2,163,560	2,922,962	2,688,000	2,074,000	1,763,000	1,431,000	3,329,000	3,192,000	2,712,000	8,535,000	2,267,000	2,282,000
Stone (dimension)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total non-metals	\$57,058,551	\$40,691,487	\$70,249,876	\$67,114,000	\$74,836,000	\$32,981,000	\$54,238,000	\$57,867,000	\$53,575,000	\$48,891,000	\$65,029,000	\$76,355,000	\$74,701,000
TOTAL PRODUCTION VALUE	\$867,145,558	\$675,095,984	\$1,120,398,447	\$1,035,653,000	\$1,030,263,000	\$646,702,000	\$806,608,000	\$978,032,000	\$869,420,000	\$817,159,000	\$742,384,000	\$864,766,000	\$896,968,000

Appendix 4D. Gross Value of Mineral Production 1949-2002, by product, in current and year-2000 Canadian dollars

B. **In Constant														
METALS	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	
Iron Ore	2,108,246,302	1,470,817,186	2,302,976,834	1,941,579,945	1,711,490,842	996,440,262	1,172,014,757	1,342,522,113	1,176,236,469	1,109,328,965	921,870,690	933,674,240	923,476,031	
Copper	39,693,923	49,445,270	46,576,632	27,462,200	22,008,226	12,568,963	0	3,420,087	0	0	0	0	0	
Zinc	115,508,590	95,327,767	120,762,539	92,793,056	92,241,950	52,563,335	66,917,742	94,556,181	62,307,884	10,112,255	13,589,556	70,578,552	75,258,247	
Lead	21,880,158	18,811,475	22,136,029	10,252,526	5,208,717	1,488,430	0	5,644,957	0	0	0	0	0	
Gold	6,424,327	10,138,301	1,093,876	11,666,069	7,154,025	3,669,720	0	830,975	0	0	9,898,031	51,827,476	50,858,941	
Silver	8,048,058	8,472,475	14,197,499	15,577,162	5,594,690	1,615,512	0	3,945,163	0	0	0	65,756	39,622	
Cadmium	1,490,588	1,074,137	1,188,951	472,626	150,530	52,226	9,880	0	0	0	0	1,862,627	1,322,854	
Antimony	0	0	0	0	0	0	0	0	0	0	0	0	0	
Magnetite	0	0	0	0	0	0	0	0	0	0	0	0	0	
Nickel														
Cobalt														
Total metals	\$2,301,291,945	\$1,654,086,611	\$2,508,932,360	\$2,099,803,584	\$1,843,848,980	\$1,068,398,448	\$1,238,942,379	\$1,450,919,475	\$1,238,544,354	\$1,119,441,220	\$945,358,277	\$1,058,008,651	\$1,050,955,696	
NON-METALS														
Asbestos	83,660,332	47,926,181	86,586,629	97,887,882	99,565,803	16,747,012	27,477,162	39,954,626	27,719,213	23,829,369	26,784,139	36,091,763	31,791,951	
Barite	0	0	0	0	0	0	0	0	0	0	0	0	0	
Clay/Brick	1,562,438	1,543,525	1,574,431	1,747,417	1,777,409	1,497,134	2,274,120	2,437,738	2,037,307	1,854,885	1,579,889	2,039,765	1,219,326	
Cement	14,702,435	14,822,586	16,207,799	13,907,793	10,768,669	11,003,936	16,523,184	12,101,968	13,327,508	12,429,040	13,568,621	14,776,219	19,640,866	
Dolomite	0	0	0	0	0	0	0	0	0	0	0	2,799,309	2,098,673	
Fluorspar	24,672,651	177,607	0	0	0	0	0	0	0	0	2,311,215	8,397,927	8,208,085	
Gemstone	0	0	0	0	0	0	0	0	0	0	0	45,626	204,499	
Gypsum	9,129,185	12,887,131	12,419,250	9,348,465	7,379,819	5,716,963	6,143,911	7,172,880	9,254,413	8,797,953	7,450,041	2,615,462	2,531,955	
Limestone	0	0	0	0	0	0	0	0	0	0	0	4,202,989	1,368,866	
Peat	0	0	0	0	0	0	0	0	0	0	0	71,123	98,415	
Pyrophyllite	2,147,937	1,731,032	2,448,560	2,254,732	1,935,659	1,049,735	1,878,907	2,608,033	2,632,407	1,961,253	2,309,820	2,284,000	2,341,515	
Sand and Gravel	19,950,780	19,430,100	37,529,544	13,151,157	17,511,632	16,219,534	30,281,526	18,349,263	19,111,516	16,191,265	22,960,027	24,258,442	23,056,002	
Quartz/Silica	0	1,935,930	4,085,954	1,378,855	1,482,139	2,111,655	2,379,510	3,371,206	2,404,690	2,223,530	1,882,747	1,839,814	0	
Stone (aggregate)	6,265,947	5,641,063	6,983,311	5,827,615	4,002,548	3,069,125	2,356,456	5,249,179	4,845,815	3,951,648	11,911,971	3,042,202	2,916,669	
Stone (dimension)	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total non-metals	\$162,091,705	\$106,095,156	\$167,835,478	\$145,503,916	\$144,423,679	\$57,415,095	\$89,314,774	\$91,244,893	\$81,332,868	\$71,238,944	\$90,758,470	\$102,464,642	\$95,476,824	
TOTAL PRODUCTION VALUE	\$2,463,383,650	\$1,760,181,767	\$2,676,767,838	\$2,245,307,501	\$1,988,272,659	\$1,125,813,543	\$1,328,257,154	\$1,542,164,369	\$1,319,877,222	\$1,190,680,163	\$1,036,116,747	\$1,160,473,293	\$1,146,432,519	
***Canadian Consumer Price Index	1.61	1.75	1.91	2.11	2.37	2.62	2.77	2.90	3.01	3.14	3.27	3.40	3.57	

Appendix 4D. Gross Value of Mineral Production 1949-2002, by product, in current and year-2000 Canadian dollars

A. In current Car													
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
*METALS													
Iron Ore	708,367,000	714,885,000	645,333,000	614,387,000	743,137,000	795,839,000	799,331,000	919,409,000	1,026,517,000	760,482,000	902,134,000	691,626,000	723,831,000
Copper	0	0	0	586,000	1,772,000	5,015,000	16,281,000	2,097,000	0	0	0	0	0
Zinc	31,724,000	0	0	0	0	0	0	0	0	0	0	0	0
Lead	0	0	0	0	0	0	0	0	0	0	0	0	0
Gold	49,197,000	19,499,000	19,431,000	45,119,000	51,953,000	45,516,000	47,827,000	42,121,000	19,388,000	16,633,000	19,678,000	17,958,000	24,234,000
Silver	40,000	13,000	3,000	8,000	25,000	38,000	325,000	107,000	159,000	138,000	137,000	75,000	60,000
Cadmium	332,000	0	0	0	0	0	0	0	0	0	0	0	0
Antimony	0	0	0	0	0	0	0	312,000	704,000	207,000	0	0	0
Magnetite	0	0	0	0	0	2,500,000	10,500,000	3,500,000	0	0	0	0	0
Total metals	\$789,660,000	\$734,397,000	\$664,767,000	\$660,100,000	\$796,887,000	\$848,908,000	\$874,264,000	\$967,546,000	\$1,046,768,000	\$777,460,000	\$921,949,000	\$709,659,000	\$748,125,000
*NON-METALS													
Asbestos	29,005,000	3,259,000	3,531,000	4,023,000	2,045,000	983,000	388,000	0	0	0	0	0	0
Barite	0	0	0	0	0	0	0	0	530,000	36,000	0	0	0
Clay/Brick	795,000	785,000	725,000	4,000	537,000	381,000	228,000	358,000	300,000	300,000	0	0	0
Cement	13,972,000	10,643,000	9,557,000	8,083,000	7,237,000	7,163,000	8,500,000	8,617,000	9,218,000	10,700,000	6,915,000	0	0
Dolomite	2,291,000	2,611,000	1,266,000	786,000	3,402,000	2,252,000	3,533,000	8,193,000	7,484,000	7,179,000	9,498,000	8,349,000	9,010,000
Fluorspar	2,300,000	0	0	0	0	0	0	0	0	0	0	0	0
Gemstone	0	0	0	0	0	0	0	0	0	0	0	0	0
Gypsum	3,571,000	2,930,000	2,409,000	3,797,000	500,000	0	273,000	207,000	264,000	948,000	558,000	464,000	540,000
Limestone	1,040,000	2,717,000	2,428,000	2,123,000	3,216,000	1,775,000	3,338,000	4,139,000	5,301,000	5,369,000	6,925,000	2,815,000	4,217,000
Peat	68,000	141,000	725,000	948,000	1,046,000	1,092,000	1,035,000	873,000	964,000	1,172,000	817,000	813,000	860,000
Pyrophyllite	1,748,000	1,027,000	1,590,000	1,139,000	1,340,000	1,103,000	4,000	0	0	45,000	5,000	0	105,000
Sand and Gravel	14,456,000	11,396,000	17,610,000	14,509,000	16,200,000	12,027,000	11,269,000	11,719,000	17,764,000	9,904,000	10,528,000	11,719,000	11,133,000
Quartz/Silica	0	0	0	0	0	0	0	0	0	0	2,640,000	2,178,000	2,178,000
Stone (aggregate)	5,357,000	2,362,000	1,064,000	2,148,000	1,006,000	1,300,000	3,654,000	3,064,000	3,250,000	4,931,000	9,683,000	11,600,000	11,020,000
Stone (dimension)	0	35,000	205,000	1,212,000	4,909,000	4,485,000	4,845,000	5,422,000	3,952,000	3,057,000	4,704,000	7,064,000	4,838,000
Total non-metals	\$74,603,000	\$37,906,000	\$41,110,000	\$38,772,000	\$41,438,000	\$32,561,000	\$37,067,000	\$42,592,000	\$49,027,000	\$43,641,000	\$52,273,000	\$45,002,000	\$43,901,000
TOTAL PRODUCTION VALUE	\$864,263,000	\$772,303,000	\$705,877,000	\$698,872,000	\$838,325,000	\$881,469,000	\$911,331,000	\$1,010,138,000	\$1,095,795,000	\$821,101,000	\$974,222,000	\$754,661,000	\$792,026,000

Appendix 4D. Gross Value of Mineral Production 1949-2002, by product, in current and year-2000 Canadian dollars

B. **In Constant													
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
METALS													
Iron Ore	863,806,849	825,478,938	734,034,149	686,526,374	828,569,640	868,257,118	857,525,601	969,049,449	1,072,046,103	780,559,887	902,134,000	673,965,392	689,952,634
Copper	0	0	0	654,806	1,975,713	5,471,345	17,466,324	2,210,221	0	0	0	0	0
Zinc	38,685,326	0	0	0	0	0	0	0	0	0	0	0	0
Lead	0	0	0	0	0	0	0	0	0	0	0	0	0
Gold	59,992,498	22,515,529	22,101,795	50,416,730	57,925,629	49,657,771	51,309,003	44,395,184	20,247,916	17,072,137	19,678,000	17,499,444	23,099,746
Silver	48,777	15,011	3,412	8,939	27,874	41,458	348,661	112,777	166,052	141,643	137,000	73,085	57,192
Cadmium	404,852	0	0	0	0	0	0	0	0	0	0	0	0
Antimony	0	0	0	0	0	0	0	328,845	735,225	212,465	0	0	0
Magnetite	0	0	0	0	0	2,727,490	11,264,443	3,688,971	0	0	0	0	0
Nickel													
Cobalt													
Total metals	\$962,938,302	\$848,009,478	\$756,139,357	\$737,606,849	\$888,498,857	\$926,155,181	\$937,914,033	\$1,019,785,447	\$1,093,195,296	\$797,986,132	\$921,949,000	\$691,537,921	\$713,109,572
NON-METALS													
Asbestos	35,369,685	3,763,173	4,016,337	4,495,368	2,280,098	1,072,449	416,248	0	0	0	0	0	0
Barite	0	0	0	0	0	0	0	0	553,507	36,950	0	0	0
Clay/Brick	969,450	906,441	824,651	4,470	598,735	415,669	244,599	377,329	313,306	307,920	0	0	0
Cement	17,037,933	12,289,490	10,870,612	9,032,080	8,068,981	7,814,804	9,118,835	9,082,246	9,626,846	10,982,496	6,915,000	0	0
Dolomite	2,793,723	3,014,926	1,440,012	878,290	3,793,101	2,456,923	3,790,217	8,635,354	7,815,938	7,368,537	9,498,000	8,135,809	8,588,294
Fluorspar	2,804,698	0	0	0	0	0	0	0	0	0	0	0	0
Gemstone	0	0	0	0	0	0	0	0	0	0	0	0	0
Gypsum	4,354,599	3,383,276	2,740,118	4,242,832	557,481	0	292,876	218,176	275,709	973,029	558,000	452,152	514,726
Limestone	1,268,211	3,137,325	2,761,729	2,372,276	3,585,718	1,936,518	3,581,020	4,362,472	5,536,115	5,510,750	6,925,000	2,743,119	4,019,626
Peat	82,922	162,813	824,651	1,059,311	1,166,250	1,191,368	1,110,352	920,135	1,006,756	1,202,943	817,000	792,240	819,748
Pyrophyllite	2,131,571	1,185,879	1,808,546	1,272,738	1,494,049	1,203,369	4,291	0	0	46,188	5,000	0	100,086
Sand and Gravel	17,628,139	13,158,981	20,030,498	16,212,601	18,062,387	13,121,408	12,089,430	12,351,729	18,551,887	10,165,481	10,528,000	11,419,756	10,611,928
Quartz/Silica	0	0	0	0	0	0	0	0	0	0	2,640,000	2,122,385	2,076,060
Stone (aggregate)	6,532,508	2,727,405	1,210,247	2,400,211	1,121,652	1,418,295	3,920,026	3,229,431	3,394,147	5,061,186	9,683,000	11,303,795	10,504,217
Stone (dimension)	0	40,415	233,177	1,354,309	5,473,349	4,893,117	5,197,736	5,714,743	4,127,283	3,137,709	4,704,000	6,883,621	4,611,561
Total non-metals	\$90,973,439	\$43,770,123	\$46,760,578	\$43,324,485	\$46,201,802	\$35,523,919	\$39,765,631	\$44,891,614	\$51,201,494	\$44,793,189	\$52,273,000	\$43,852,878	\$41,846,247
TOTAL PRODUCTION VALUE	\$1,053,911,742	\$891,779,602	\$802,899,934	\$780,931,335	\$934,700,659	\$961,679,100	\$977,679,664	\$1,064,677,061	\$1,144,396,790	\$842,779,321	\$974,222,000	\$735,390,799	\$754,955,818
***Canadian Consumer Price Index	3.75	3.96	4.02	4.09	4.10	4.19	4.26	4.33	4.37	4.45	4.57	4.69	4.79

Notes

*Mineral Production values (in current dollars) are taken from the Canadian Minerals Yearbook (NRCan) and unpublished files of the Newfoundland and Labrador Department of Mines and Energy.

**Deflation has been calculated using the Canadian Consumer Price Index.

***Canadian Consumer Price Index, base year 1971, from Statistics Canada.

Appendix 4E. Newfoundland and Labrador Iron-Ore Production;
Tonnage produced vs Value. (All values in Canadian dollars.)

Year	*Metric Tonnes produced	**Value of production in current dollars	***Value of production in year-2000 dollars
1949	1,504,011	\$7,947,914	\$62,596,674
1950	1,060,993	\$5,851,488	\$44,773,195
1951	1,564,886	\$9,145,960	\$63,301,129
1952	1,500,373	\$8,668,192	\$58,574,410
1953	2,437,135	\$14,201,842	\$96,826,887
1954	3,409,677	\$21,749,304	\$147,404,778
1955	6,537,974	\$45,701,801	\$309,282,707
1956	7,678,023	\$55,620,755	\$370,913,298
1957	7,416,035	\$57,898,102	\$374,085,615
1958	4,890,429	\$38,226,828	\$240,523,623
1959	5,539,106	\$42,974,837	\$267,451,029
1960	6,904,914	\$54,673,717	\$336,136,661
1961	6,904,891	\$59,889,125	\$364,764,697
1962	7,245,603	\$67,753,153	\$407,768,647
1963	8,784,273	\$99,601,987	\$589,354,762
1964	11,578,920	\$137,038,680	\$796,428,359
1965	13,154,628	\$156,888,970	\$890,271,820
1966	15,010,450	\$188,603,259	\$1,031,784,056
1967	15,405,418	\$207,408,843	\$1,095,310,514
1968	17,876,362	\$246,508,466	\$1,251,167,414
1969	13,350,325	\$194,971,157	\$946,469,974
1970	21,372,715	\$292,582,028	\$1,375,015,127
1971	19,846,442	\$289,912,158	\$1,324,318,738
1972	16,394,405	\$235,249,411	\$1,026,379,474
1973	22,133,101	\$314,838,603	\$1,273,855,393
1974	22,026,637	\$372,188,155	\$1,359,037,164
1975	22,585,445	\$468,600,400	\$1,544,420,366
1976	26,756,991	\$631,272,628	\$1,936,637,585
1977	26,658,063	\$742,132,236	\$2,108,246,302
1978	18,782,158	\$564,113,772	\$1,470,817,186
1979	30,220,000	\$963,943,018	\$2,302,976,834
1980	24,620,000	\$895,558,000	\$1,941,579,945
1981	25,686,000	\$886,843,000	\$1,711,490,842
1982	15,806,000	\$572,386,000	\$996,440,262
1983	18,405,000	\$711,727,000	\$1,172,014,757
1984	21,184,000	\$851,420,000	\$1,342,522,113
1985	20,192,000	\$774,802,000	\$1,176,236,469
1986	19,185,000	\$761,328,000	\$1,109,328,965
1987	18,423,000	\$660,526,000	\$921,870,690
1988	20,507,000	\$695,759,000	\$933,674,240
1989	20,662,000	\$722,527,000	\$923,476,031
1990	18,970,000	\$708,367,000	\$863,806,849
1991	19,799,000	\$714,885,000	\$825,478,938
1992	17,691,000	\$645,333,000	\$734,034,149
1993	18,238,000	\$614,387,000	\$686,526,374
1994	20,279,000	\$743,137,000	\$828,569,640
1995	19,969,000	\$795,839,000	\$868,257,118
1996	19,657,813	\$799,331,000	\$857,525,601
1997	21,747,537	\$919,409,000	\$969,049,449
1998	21,631,073	\$1,026,517,000	\$1,072,046,103
1999	18,742,573	\$760,482,000	\$779,421,534
2000	21,091,478	\$902,134,000	\$902,134,000
2001	17,310,000	\$691,626,000	\$673,965,392
2002	17,500,000	\$723,831,000	\$689,952,634

Notes

* Annual production tonnage and production value taken from the Canadian Minerals Yearbook, NRCan

** Deflation has been calculated using the Canadian Consumer Price Index (Statistics Canada) as per Appendix 4B

Appendix 4F. Historical values of selected Newfoundland and Labrador Mining Operations

Operation	Year of initial commercial production	Year closed	Duration	Commodities produced	Amount produced in metric tonnes	*Average historical price	Subtotals for multi-commodity operations in year-2000 \$US	***Total historical value of production in year-2000 \$US	Notes
Tilt Cove	1864	1917	53	copper	55,340	\$6,056	\$335,139,040		Price based on years 1886 to 1917
				^gold	3.4	\$11,179,408	\$38,009,987		Price based on years 1900 -1917
Tilt Cove	1957	1967	10	copper	83,278	\$4,005	\$333,566,577		
				gold	1.3	\$6,401,751	\$8,322,276		
Total Tilt Cove								\$715,037,880	
Other NDB copper	1864	1917	53	copper	24,045	\$6,056	\$145,616,520		Price based on years 1886 - 1917
				^gold	1.5	\$11,179,408	\$16,433,730		
Total other NDB								\$162,050,250	
Little Bay	1878	1904	26	copper	11,250	\$5,634	\$63,382,470		Price based on years 1886 - 1904
				^gold	0.7	\$12,100,938	\$8,349,647		Price based on years 1900-04
Little Bay	1961	1969	8	copper	36,008	\$4,198	\$151,152,756		
				gold	0.2	\$6,251,492	\$1,250,298		
Total Little Bay								\$224,135,172	
Wabana	1894	1966	72	iron ore	38,710,760	\$36		\$1,393,587,360	
***Aguathuna	1913	1967	54	limestone	4,702,795	\$14		\$65,839,130	Price based on years 1955-64
Buchans	1928	1984	56	copper	215,460	\$3,703	\$797,848,380		
				lead	1,224,720	\$1,617	\$1,980,372,240		
				zinc	2,350,620	\$1,684	\$3,958,444,080		
				gold	22	\$1,129,931	\$25,084,468		
				silver	2,041	\$269,629	\$550,312,789		
Buchans total								\$7,312,061,957	
St. Lawrence	1933	1978	45	fluorspar	3,010,761	\$252		\$758,711,772	Price based on years 1956-78
Flat Bay	1951	1994	43	gypsum	16,700,628	\$15.90		\$265,539,985	
**IOCC Schefferville (Labrador component only)	1954	1983	29	iron ore, concentrate and pellets	111,041,340	see note ** and Table D-7		\$6,069,719,158	
**IOCC Labrador City	1962	2001	39	iron ore, concentrate and pellets	503,698,692	see note ** and Table D-7		\$24,911,691,050	
**Wabush Mines	1965	2001	36	iron ore, concentrate and pellets	186,944,196	see note ** and Table D-7		\$9,128,557,282	
Baie Verte Mines	1963	1987	24	asbestos fibre	1,046,107	\$535	\$559,667,245		
				asbestos fibre	244,198	\$471	\$115,017,258		
Baie Verte Mines total				total fibre	1,290,305			\$674,684,503	
Rambler	1964	1982	18	copper	111,286	\$4,498	\$500,564,428		
				zinc	273,887	\$1,846	\$505,595,402		
				gold	8	\$13,621,628	\$103,388,157		
				silver	61	\$429,967	\$26,013,004		
Rambler total								\$1,135,560,990	
Daniels Harbour	1975	1990	15	zinc	546,000	\$1,896		\$1,035,216,000	
Lower Cove	1990	1995	5	limestone aggregate	2,267,827	\$3.00	\$6,803,481		Based on NDLM data

Appendix 4F. Historical values of selected Newfoundland and Labrador Mining Operations

Operation	Year of initial commercial production	Year closed	Duration	Commodities produced	Amount produced in metric tonnes	*Average historical price	Subtotals for multi-commodity operations in year-2000 \$US	***Total historical value of production in year-2000 \$US	Notes
Lower Cove	1995	2001	6	high-purity limestone and dolomite	6,163,056	\$5.65	\$34,821,266		Based on NDLME data
Lower Cove total								\$41,624,747	
Hope Brook	1987	1997	10	gold	19.4	\$16,445,000	\$319,033,000		
	1993	1997	4	copper	2,688	\$2,774	\$7,456,512		
Hope Brook total								\$326,489,512	
Ten Mile Bay	1993	2001	8	anorthosite	31,337	\$387		\$12,127,419	
Nugget Pond	1997	2001	4	gold	6.2	\$9,587,864	\$59,435,169		
			4	silver	2.4	\$162,824	\$390,777		
Total Nugget Pond								\$59,825,946	
						TOTAL =		\$54,292,460,114	

Notes

NDB = Notre Dame Bay

*The Average Historic Prices for all commodities except iron ore were calculated by first converting annual historic prices for the duration of production to year-2000 US\$ then averaging these over the period of mine production. Annual historic prices were taken in large part from the historical statistics of the United States Geological Survey (Kelly 2002 - see Appendix 4H). Some prices, e.g., dimension stone, limestone and anorthosite were taken from Natural Resources Canada and Newfoundland and Labrador Department of Mines and Energy data.

**The Total Historical Values of Production for the iron-ore mines of Schefferville (Labrador component only), Labrador City and Wabush are taken from Appendix 4G. These values were calculated directly by totaling the annual amounts of production multiplied by the annual US\$ price.

***Due to the above price assumptions, the Total Historic Value of Production as calculated here may not match the actual values received. It does, however, provide a consistent basis for inter-operation comparison.

****The historical prices for limestone production from Aguathuna in its early years were not available, and the price is based on that for the period 1955-67 (Natural Resources Canada).

^ Specific gold production amounts are only known for the period 1957 - 69. A crude estimate of earlier production has been made on the basis that the Tilt Cove ores averaged 2 ounces of gold per ton of copper (Snelgrove, 1935). Since gold was only recovered as a by-product from 1890 on, the amount calculated in this table for Little Bay and other Notre Dame Bay mines probably overstates the amount actually realized. Actual early recovery from Tilt Cove is based on the estimate conveyed by Snelgrove (1935) that the mine produced over 50,000 ounces of gold.

Historical prices for Lower Cove taken from Newfoundland and Labrador Department of Mines and Energy (NDLME) data in Appendix 4H.

Appendix 4G. Labrador Iron-Ore Production, by Operation

Year	PRODUCTION TONNAGE						VALUE OF PRODUCTION				
	Iron Ore Company of Canada					Wabush Mines	Total Labrador production	Value of Production in year-2000 US\$			
	Schefferville	Labrador City pellets	Labrador City concentrate	Labrador City total	Iron-ore price in year-2000 US\$			Schefferville	Labrador City total	Wabush	
1955	7,845,604					6,537,975	\$46.39	\$363,957,571			
1956	12,215,933					7,678,024	\$48.68	\$594,671,622			
1957	12,635,268					7,416,036	\$49.58	\$626,456,581			
1958	8,094,846					4,890,429	\$49.28	\$398,914,033			
1959	13,268,558					5,539,106	\$50.12	\$665,020,116			
1960	9,966,405					6,904,915	\$48.57	\$484,068,292			
1961	7,563,454					6,904,892	\$52.58	\$397,686,404			
1962	9,954,212	751,875		751,875		7,245,604	\$50.23	\$500,000,092	\$37,766,670		
1963	6,861,365	1,864,446	2,252,576	4,117,022		8,784,274	\$51.88	\$355,967,636	\$213,591,124		
1964	7,793,080	5,021,304	1,574,873	6,596,177		11,578,921	\$52.54	\$409,448,449	\$346,563,146		
1965	7,137,730	5,410,450	1,529,151	6,939,601	132,086	13,154,628	\$50.51	\$360,526,751	\$350,519,247	\$6,671,669	
1966	6,759,761	5,297,669	2,049,367	7,347,036	3,899,588	15,010,451	\$50.43	\$340,894,732	\$370,511,018	\$196,656,242	
1967	6,620,562	6,621,578	1,378,776	8,000,354	5,053,818	15,405,419	\$49.74	\$329,306,766	\$397,937,612	\$251,376,896	
1968	6,618,530	9,216,562	889,041	10,105,603	5,570,986	13,368,316	\$48.43	\$320,535,416	\$489,414,376	\$269,802,837	
1969	4,298,895	8,225,917	333,263	8,559,180	3,374,292	13,350,326	\$47.70	\$205,057,285	\$408,272,883	\$160,953,733	
1970	7,747,358	10,704,055	1,979,260	12,683,315	5,565,905	21,372,717	\$46.10	\$357,153,221	\$584,700,808	\$256,588,242	
1971	6,017,030	9,628,061	1,823,804	11,451,866	5,686,815	19,846,443	\$46.45	\$279,491,059	\$531,939,163	\$264,152,559	
1972	5,126,973	8,113,135	587,275	8,700,410	5,398,258	16,394,406	\$49.79	\$255,271,994	\$433,193,437	\$268,779,251	
1973	7,727,037	9,876,993	3,109,104	12,986,097	5,524,248	22,133,104	\$49.43	\$381,947,460	\$641,902,760	\$273,063,556	
1974	8,588,645	7,693,508	4,514,297	12,207,805	5,550,665	22,026,639	\$54.15	\$465,075,143	\$661,052,625	\$300,568,497	
1975	7,139,432	9,161,000	6,462,000	15,623,000	3,258,000	22,585,446	\$62.23	\$444,286,853	\$972,219,290	\$202,745,340	
1976	7,710,000	10,085,000	7,301,000	17,386,000	5,487,000	26,756,991	\$68.28	\$526,438,800	\$1,187,116,080	\$374,652,360	
1977	7,621,000	11,158,000	6,435,000	17,593,000	5,640,000	26,658,063	\$71.07	\$541,624,470	\$1,250,334,510	\$400,834,800	
1978	6,604,000	6,755,000	3,898,000	10,653,000	4,419,000	15,831,000	\$73.25	\$483,743,000	\$780,332,250	\$323,691,750	
1979	8,818,000	10,649,000	8,363,000	19,012,000	5,539,000	30,219,792	\$73.08	\$644,419,440	\$1,389,396,960	\$404,790,120	
1980	6,059,000	8,430,000	6,963,000	15,393,000	4,855,000	24,620,000	\$72.09	\$436,793,310	\$1,109,681,370	\$349,996,950	
1981	4,181,000	10,057,000	7,091,000	17,148,000	5,291,000	25,686,000	\$70.96	\$296,683,760	\$1,216,822,080	\$375,449,360	
1982	1,804,000	5,830,000	5,609,000	11,439,000	3,048,000	15,806,000	\$69.04	\$124,548,160	\$789,748,560	\$210,433,920	
1983	1,601,000	6,590,000	5,618,000	12,208,000	5,180,000	18,404,585	\$80.08	\$128,208,080	\$977,616,640	\$414,814,400	
1984	1,828,000	7,956,000	5,753,000	13,709,000	6,319,000	21,184,120	\$66.21	\$121,031,880	\$907,672,890	\$418,380,990	
1985	1,830,000	8,168,000	4,997,000	13,165,000	5,696,000	20,192,123	\$61.79	\$113,075,700	\$813,465,350	\$351,955,840	
1986	1,421,000	10,292,000	3,858,000	14,150,000	5,293,000	19,184,137	\$53.77	\$76,407,170	\$760,845,500	\$284,604,610	
1987	1,173,000	9,135,000	2,958,000	12,093,000	5,478,000	18,423,302	\$44.93	\$52,702,890	\$543,338,490	\$246,126,540	
1988	788,000	9,853,000	4,127,000	13,980,000	6,035,000	20,506,923	\$41.26	\$32,512,880	\$576,814,800	\$249,004,100	
1989	177,000	9,838,000	5,130,000	14,968,000	5,953,000	21,119,380	\$43.51	\$7,701,270	\$651,257,680	\$259,015,030	
1990	38,000	8,417,000	5,543,000	13,960,000	5,692,000	19,969,449	\$40.72	\$1,547,360	\$568,451,200	\$231,778,240	
1991	264,000	7,906,000	7,096,000	15,002,000	4,796,000	19,799,248	\$38.08	\$10,053,120	\$571,276,160	\$182,631,680	

Appendix 4G. Labrador Iron-Ore Production, by Operation

Year	PRODUCTION TONNAGE						VALUE OF PRODUCTION			
	Iron Ore Company of Canada					Wabush Mines	Total Labrador production	Value of Production in year-2000 US\$		
	Schefferville	Labrador City pellets	Labrador City concentrate	Labrador City total	Iron-ore price in year-2000 US\$			Schefferville	Labrador City total	Wabush
1992	120,000	7,831,000	4,818,000	12,649,000	5,176,000	17,691,747	\$35.09	\$4,210,800	\$443,853,410	\$181,625,840
1993	65,000	8,182,000	5,640,000	13,822,000	5,022,000	18,238,578	\$30.75	\$1,998,750	\$425,026,500	\$154,426,500
1994	0	10,031,000	5,475,000	15,506,000	5,076,000	20,278,926	\$29.24	\$0	\$453,395,440	\$148,422,240
1995	0	10,393,000	4,634,000	15,027,000	5,428,000	19,969,252	\$31.34	\$0	\$470,946,180	\$170,113,520
1996	0	10,674,000	4,038,000	14,712,000	5,337,000	19,957,813	\$31.74	\$0	\$466,958,880	\$169,396,380
1997	0	11,545,000	4,811,000	16,356,000	5,697,000	21,847,537	\$32.11	\$0	\$525,191,160	\$182,930,670
1998	0	10,982,637	5,031,162	16,013,799	5,617,274	23,265,706	\$32.93	\$0	\$527,334,401	\$184,976,833
1999	0	9,410,690	3,873,862	13,284,552	5,458,021	18,943,897	\$27.68	\$0	\$367,716,399	\$151,078,021
2000	0	11,500,000	3,900,000	15,400,000	5,897,240	21,091,517	\$25.81	\$0	\$397,474,000	\$152,207,764
2001	0	9,500,000	3,500,000	13,000,000	4,500,000	18,540,000	\$23.08	\$0	\$300,040,000	\$103,860,000
	222,082,681	338,754,881	164,943,811	503,698,692	186,944,196	812,314,159		\$12,139,438,316	\$24,911,691,050	\$9,128,557,282
								*\$6,069,719,158		

Notes:

Schefferville: Newfoundland and Labrador component of total Schefferville production was about 50%.

Commercial mine production was from 1955-1982; thereafter from stockpiles.

Production data from 1984 on includes some Labrador City concentrate and may therefore be overvalued.

Production consisted mostly of direct-shipping ore but from 1973 to 1984 also included pellet production from Sept Isle.

Labrador City: Commercial production commenced 1959; pellets and concentrate.

Wabush: Commercial production commenced 1959; mostly pellets.

All production data taken from Canadian Minerals Year Book, Natural Resources Canada annual publications.

US\$ price data was taken from United States Geological Survey historical statistics data Kelly (2002), updated for 2001 from Kirk (2002).

Appendix 4H. Historical Mineral Commodity Prices

Year	Cu unit value (\$/t)	Cu unit value (\$2000/t)	Iron ore unit value (\$/t)	Iron ore unit value (\$2000/t)	Lead unit value (\$/t)	Lead unit value (\$2000/t)	Zinc unit value (\$/t)	Zinc unit value (\$2000/t)	Gold unit value (\$/t)	Gold unit value (\$2000/t)	Silver unit value (\$/t)	Silver unit value (\$2000/t)	Limestone unit value (\$/t)NRRCAN	Limestone unit value (\$2000/t) NRRCAN	Limestone unit value (\$/t) NLDME	Limestone unit value (\$2000/t) NLDME
1886	\$243	\$4,644														
1887	\$248	\$4,740														
1888	\$368	\$7,033														
1889	\$303	\$5,791	\$2.26	\$43.19												
1890	\$347	\$6,632	\$2.25	\$43.00												
1891	\$284	\$5,428	\$2.25	\$43.00												
1892	\$255	\$4,873	\$2.01	\$38.41												
1893	\$237	\$4,529	\$1.64	\$31.34												
1894	\$211	\$4,188	\$1.12	\$22.23												
1895	\$237	\$4,892	\$1.12	\$23.12												
1896	\$240	\$4,954	\$1.40	\$28.90												
1897	\$249	\$5,139	\$1.06	\$21.88												
1898	\$265	\$5,470	\$1.12	\$23.12												
1899	\$388	\$8,008	\$1.40	\$28.90												
1900	\$357	\$7,368	\$2.35	\$48.50	100	\$2,064	\$97	\$2,002	\$609,000	\$12,569,760	\$20,000	\$412,800				
1901	\$355	\$7,327	\$1.68	\$34.68	97	\$2,002	\$90	\$1,858	\$610,000	\$12,590,400	\$19,000	\$392,160				
1902	\$256	\$5,081	\$1.82	\$37.35	90	\$1,786	\$106	\$2,104	\$609,000	\$12,086,308	\$17,000	\$337,385				
1903	\$291	\$5,561	\$1.88	\$35.93	93	\$1,777	\$119	\$2,274	\$609,000	\$11,638,667	\$17,000	\$324,889				
1904	\$282	\$5,389	\$1.55	\$29.62	95	\$1,816	\$112	\$2,140	\$608,000	\$11,619,556	\$19,000	\$363,111				
1905	\$344	\$6,574	\$1.75	\$33.44	99	\$1,892	\$130	\$2,484	\$607,000	\$11,600,444	\$20,000	\$382,222				
1906	\$425	\$8,122	\$2.09	\$39.94	126	\$2,408	\$135	\$2,580	\$608,000	\$11,619,556	\$22,000	\$420,444				
1907	\$441	\$8,127	\$2.53	\$46.62	119	\$2,193	\$128	\$2,359	\$609,000	\$11,223,000	\$21,000	\$387,000				
1908	\$291	\$5,561	\$2.25	\$43.00	93	\$1,777	\$101	\$1,930	\$609,000	\$11,638,667	\$17,000	\$324,889				
1909	\$289	\$5,523	\$2.13	\$40.71	95	\$1,816	\$119	\$2,274	\$609,000	\$11,638,667	\$17,000	\$324,889				
1910	\$284	\$5,234	\$2.46	\$45.33	97	\$1,788	\$119	\$2,193	\$608,000	\$11,204,571	\$17,000	\$313,286				
1911	\$277	\$5,105	\$1.98	\$36.49	97	\$1,788	\$126	\$2,322	\$608,000	\$11,204,571	\$17,000	\$313,286				
1912	\$363	\$6,459	\$1.95	\$34.70	99	\$1,762	\$152	\$2,705	\$609,000	\$10,836,000	\$20,000	\$355,862				
1913	\$342	\$5,942	\$2.12	\$36.83	97	\$1,685	\$123	\$2,137	\$608,000	\$10,563,232	\$19,600	\$340,525				
1914	\$293	\$5,023	\$1.76	\$30.17	86	\$1,474	\$112	\$1,920	\$610,000	\$10,457,143	\$18,000	\$308,571				
1915	\$385	\$6,535	\$1.83	\$31.06	104	\$1,765	\$313	\$5,313	\$616,000	\$10,455,789	\$16,400	\$278,368				
1916	\$627	\$9,894	\$2.40	\$37.87	152	\$2,399	\$300	\$4,734	\$623,000	\$9,830,826	\$21,500	\$339,266				
1917	\$644	\$8,654	\$3.12	\$41.93	190	\$2,553	\$196	\$2,634	\$629,000	\$8,452,188	\$27,000	\$362,813				
1918	\$544	\$625	\$3.46	\$39.59	157	\$1,796	\$176	\$2,014	\$635,000	\$7,265,188	\$31,500	\$360,399				
1919	\$401	\$3,995	\$3.20	\$31.88	128	\$1,275	\$154	\$1,534	\$641,000	\$6,385,251	\$36,000	\$358,610				
1920	\$386	\$3,320	\$4.14	\$35.60	181	\$1,557	\$172	\$1,479	\$660,000	\$5,676,000	\$32,800	\$282,080				
1921	\$279	\$2,686	\$3.00	\$28.88	104	\$1,001	\$104	\$1,001	\$662,000	\$6,372,985	\$20,300	\$195,425				
1922	\$299	\$3,073	\$3.32	\$35.29	126	\$1,295	\$126	\$1,295	\$667,000	\$6,856,016	\$21,900	\$225,108				
1923	\$325	\$3,282	\$3.44	\$34.74	163	\$1,646	\$148	\$1,494	\$664,000	\$6,704,971	\$20,900	\$211,045				
1924	\$293	\$2,953	\$2.83	\$28.52	183	\$1,844	\$139	\$1,401	\$665,000	\$6,701,953	\$21,500	\$216,680				
1925	\$315	\$3,096	\$2.57	\$25.26	201	\$1,976	\$169	\$1,661	\$664,000	\$6,526,171	\$22,200	\$218,194				
1926	\$310	\$3,018	\$2.52	\$24.53	186	\$1,811	\$163	\$1,587	\$663,000	\$6,454,868	\$19,900	\$193,743				
1927	\$288	\$2,858	\$2.50	\$24.81	150	\$1,488	\$138	\$1,369	\$664,000	\$6,588,923	\$18,300	\$181,592				
1928	\$327	\$3,289	\$2.45	\$24.64	139	\$1,398	\$133	\$1,338	\$665,000	\$6,688,889	\$18,600	\$187,088				
1929	\$405	\$4,074	\$2.65	\$26.65	151	\$1,519	\$143	\$1,438	\$663,000	\$6,668,772	\$17,000	\$170,994				
1930	\$292	\$3,013	\$2.47	\$25.49	122	\$1,259	\$101	\$1,042	\$662,000	\$6,831,840	\$12,200	\$125,904				
1931	\$185	\$2,093	\$2.36	\$26.71	94	\$1,064	\$80	\$905	\$723,000	\$8,181,316	\$9,320	\$105,463				
1932	\$128	\$1,615	\$1.41	\$17.79	70	\$883	\$64	\$807	\$665,000	\$8,389,731	\$9,000	\$113,545				
1933	\$160	\$2,128	\$3.52	\$46.81	85	\$1,130	\$89	\$1,184	\$847,000	\$11,264,227	\$11,300	\$150,278				
1934	\$191	\$2,458	\$2.64	\$33.97	85	\$1,094	\$92	\$1,184	\$1,120,000	\$14,411,970	\$15,400	\$198,165				
1935	\$196	\$2,461	\$2.66	\$33.40	90	\$1,130	\$96	\$1,205	\$1,120,000	\$14,061,314	\$20,600	\$258,628				
1936	\$214	\$2,661	\$2.64	\$32.83	104	\$1,293	\$108	\$1,343	\$1,120,000	\$13,925,783	\$14,500	\$180,289				

Appendix 4H. Historical Mineral Commodity Prices

Year	Cu unit value (\$/t)	Cu unit value (\$2000/t)	Iron ore unit value (\$/t)	Iron ore unit value (\$2000/t)	Lead unit value (\$/t)	Lead unit value (\$2000/t)	Zinc unit value (\$/t)	Zinc unit value (\$2000/t)	Gold unit value (\$/t)	Gold unit value (\$2000/t)	Silver unit value (\$/t)	Silver unit value (\$2000/t)	Limestone unit value (\$/t)NRCAN	Limestone unit value (\$2000/t) NRCAN	Limestone unit value (\$/t) NLDME	Limestone unit value (\$2000/t) NLDME
1937	\$295	\$3,540	\$2.82	\$33.84	132	\$1,584	\$144	\$1,728	\$1,120,000	\$13,440,000	\$14,500	\$174,000				
1938	\$225	\$2,751	\$2.56	\$31.30	104	\$1,272	\$102	\$1,247	\$1,120,000	\$13,694,787	\$13,800	\$168,739				
1939	\$247	\$3,064	\$2.99	\$37.09	111	\$1,377	\$113	\$1,402	\$1,110,000	\$13,768,269	\$12,500	\$155,048				
1940	\$254	\$3,121	\$2.52	\$30.96	114	\$1,401	\$140	\$1,720	\$1,090,000	\$13,391,429	\$11,300	\$138,829				
1941	\$265	\$3,101	\$2.65	\$31.01	128	\$1,498	\$165	\$1,931	\$1,090,000	\$12,753,741	\$11,300	\$132,218				
1942	\$265	\$2,802	\$2.61	\$27.60	143	\$1,512	\$182	\$1,924	\$1,090,000	\$11,525,410	\$12,200	\$129,000				
1943	\$265	\$2,640	\$2.62	\$26.10	143	\$1,424	\$182	\$1,813	\$1,090,000	\$10,857,915	\$14,500	\$144,440				
1944	\$265	\$2,595	\$2.69	\$26.34	143	\$1,400	\$182	\$1,782	\$1,090,000	\$10,672,486	\$14,500	\$141,973				
1945	\$265	\$2,537	\$2.72	\$26.04	143	\$1,369	\$182	\$1,742	\$1,120,000	\$10,722,078	\$16,700	\$159,874				
1946	\$310	\$2,734	\$3.01	\$26.55	179	\$1,579	\$192	\$1,694	\$1,120,000	\$9,878,974	\$25,700	\$226,687				
1947	\$469	\$3,617	\$3.44	\$26.53	323	\$2,491	\$232	\$1,789	\$1,120,000	\$8,638,565	\$23,100	\$178,170				
1948	\$492	\$3,521	\$3.88	\$27.77	398	\$2,848	\$299	\$2,140	\$1,120,000	\$8,015,534	\$23,800	\$170,330				
1949	\$430	\$3,108	\$4.46	\$32.23	339	\$2,450	\$268	\$1,937	\$1,020,000	\$7,371,429	\$23,100	\$166,941				
1950	\$476	\$3,407	\$4.92	\$35.21	293	\$2,097	\$306	\$2,190	\$1,120,000	\$8,015,534	\$23,800	\$170,330				
1951	\$540	\$3,581	\$5.40	\$35.81	386	\$2,560	\$397	\$2,633	\$1,120,000	\$7,428,278	\$28,600	\$189,686				
1952	\$540	\$3,505	\$6.21	\$40.31	363	\$2,356	\$357	\$2,317	\$1,110,000	\$7,204,528	\$27,300	\$177,192				
1953	\$640	\$4,123	\$6.81	\$43.87	297	\$1,913	\$239	\$1,540	\$1,120,000	\$7,214,981	\$27,300	\$175,865				
1954	\$660	\$4,231	\$6.76	\$43.33	310	\$1,987	\$236	\$1,513	\$1,130,000	\$7,243,230	\$27,300	\$174,991				
1955	\$827	\$5,321	\$7.21	\$46.39	334	\$2,149	\$271	\$1,744	\$1,130,000	\$7,270,324	\$28,600	\$184,010	1.95	\$12.54		
1956	\$926	\$5,870	\$7.68	\$48.68	353	\$2,238	\$297	\$1,883	\$1,130,000	\$7,163,145	\$29,300	\$185,735	1.98	\$12.56		
1957	\$665	\$4,070	\$8.10	\$49.58	323	\$1,977	\$251	\$1,536	\$1,120,000	\$6,855,516	\$29,300	\$179,345	1.87	\$11.42		
1958	\$580	\$3,456	\$8.27	\$49.28	267	\$1,591	\$227	\$1,353	\$1,130,000	\$6,733,025	\$28,600	\$170,411	2.00	\$11.90		
1959	\$683	\$4,037	\$8.48	\$50.12	269	\$1,590	\$253	\$1,495	\$1,130,000	\$6,679,038	\$29,300	\$173,182	1.85	\$10.96		
1960	\$713	\$4,148	\$8.35	\$48.57	263	\$1,530	\$286	\$1,664	\$1,130,000	\$6,573,619	\$29,300	\$170,449	1.86	\$10.84		
1961	\$668	\$3,847	\$9.13	\$52.58	240	\$1,382	\$255	\$1,469	\$1,130,000	\$6,507,589	\$29,600	\$170,464	2.07	\$11.92		
1962	\$683	\$3,890	\$8.82	\$50.23	212	\$1,207	\$256	\$1,458	\$1,130,000	\$6,435,762	\$35,000	\$199,338	1.97	\$11.23		
1963	\$683	\$3,843	\$9.22	\$51.88	246	\$1,384	\$265	\$1,491	\$1,130,000	\$6,358,561	\$41,200	\$231,834	1.96	\$11.04		
1964	\$713	\$3,960	\$9.46	\$52.54	300	\$1,666	\$299	\$1,661	\$1,130,000	\$6,276,426	\$41,500	\$230,506	1.86	\$10.31		
1965	\$780	\$4,259	\$9.25	\$50.51	353	\$1,927	\$320	\$1,747	\$1,130,000	\$6,170,159	\$41,500	\$226,603	7.62	\$41.62		
1966	\$794	\$4,215	\$9.50	\$50.43	333	\$1,768	\$320	\$1,699	\$1,130,000	\$5,998,765	\$41,500	\$220,309	4.08	\$21.64		
1967	\$840	\$4,334	\$9.64	\$49.74	309	\$1,594	\$305	\$1,574	\$1,130,000	\$5,830,800	\$49,800	\$256,968	1.08	\$5.57		
1968	\$908	\$4,496	\$9.78	\$48.43	291	\$1,441	\$298	\$1,476	\$1,290,000	\$6,388,100	\$68,800	\$340,699	1.25	\$6.18		
1969	\$1,050	\$4,934	\$10.15	\$47.70	329	\$1,546	\$323	\$1,518	\$1,340,000	\$6,297,268	\$57,550	\$270,454	1.51	\$7.08		
1970	\$1,280	\$5,679	\$10.39	\$46.10	346	\$1,535	\$338	\$1,500	\$1,170,000	\$5,191,058	\$56,910	\$252,498	1.02	\$4.51		
1971	\$1,150	\$4,892	\$10.92	\$46.45	306	\$1,302	\$356	\$1,514	\$1,330,000	\$5,657,708	\$49,830	\$211,973	1.98	\$8.42		
1972	\$1,130	\$4,653	\$12.09	\$49.79	331	\$1,363	\$391	\$1,610	\$1,880,000	\$7,742,059	\$54,010	\$222,419	2.84	\$11.71		
1973	\$1,310	\$5,079	\$12.75	\$49.43	359	\$1,392	\$456	\$1,768	\$3,150,000	\$12,211,871	\$82,310	\$319,098	2.69	\$10.42		
1974	\$1,700	\$5,939	\$15.50	\$54.15	496	\$1,733	\$793	\$2,770	\$5,140,000	\$17,956,940	\$151,400	\$528,926	3.03	\$10.60		
1975	\$1,410	\$4,513	\$19.44	\$62.23	474	\$1,517	\$859	\$2,750	\$5,190,000	\$16,613,151	\$142,100	\$454,861	2.87	\$9.17		
1976	\$1,530	\$4,630	\$22.56	\$68.28	509	\$1,540	\$816	\$2,470	\$4,030,000	\$12,196,364	\$139,900	\$423,392	3.41	\$10.33		
1977	\$1,470	\$4,179	\$25.00	\$71.07	677	\$1,925	\$758	\$2,155	\$4,770,000	\$13,560,992	\$148,500	\$422,182	2.79	\$7.92		
1978	\$1,450	\$3,829	\$27.74	\$73.25	743	\$1,962	\$683	\$1,804	\$6,220,000	\$16,425,384	\$173,600	\$458,432	2.64	\$6.97		
1979	\$2,030	\$4,818	\$30.79	\$73.08	1,160	\$2,753	\$822	\$1,951	\$9,890,000	\$23,473,965	\$356,600	\$846,392	1.77	\$4.20		
1980	\$2,230	\$4,662	\$34.48	\$72.09	937	\$1,959	\$825	\$1,725	\$19,700,000	\$41,188,006	\$663,300	\$1,386,802	2.25	\$4.70		
1981	\$1,860	\$3,523	\$37.46	\$70.96	805	\$1,525	\$983	\$1,862	\$14,800,000	\$28,035,242	\$338,200	\$640,643	3.02	\$5.72		
1982	\$1,600	\$2,856	\$38.68	\$69.04	562	\$1,003	\$848	\$1,514	\$12,100,000	\$21,596,679	\$255,600	\$456,208	3.94	\$7.03		
1983	\$1,690	\$2,922	\$46.31	\$80.08	478	\$827	\$913	\$1,579	\$13,600,000	\$23,517,426	\$367,800	\$636,008	3.34	\$5.78		
1984	\$1,470	\$2,438	\$39.92	\$66.21	564	\$935	\$1,070	\$1,775	\$11,600,000	\$19,240,116	\$261,700	\$434,064	4.68	\$7.76		
1985	\$1,480	\$2,370	\$38.58	\$61.79	421	\$674	\$890	\$1,425	\$10,200,000	\$16,335,196	\$197,400	\$316,134	5.04	\$8.07		
1986	\$1,460	\$2,294	\$34.22	\$53.77	485	\$762	\$838	\$1,317	\$11,800,000	\$18,540,804	\$175,900	\$276,384	4.15	\$6.52		
1987	\$1,820	\$2,759	\$29.64	\$44.93	791	\$1,199	\$924	\$1,401	\$15,400,000	\$23,344,301	\$225,400	\$341,676	8.88	\$13.46		

Appendix 4H. Historical Mineral Commodity Prices

Year	Cu unit value (\$/t)	Cu unit value (\$2000/t)	Iron ore unit value (\$/t)	Iron ore unit value (\$2000/t)	Lead unit value (\$/t)	Lead unit value (\$2000/t)	Zinc unit value (\$/t)	Zinc unit value (\$2000/t)	Gold unit value (\$/t)	Gold unit value (\$2000/t)	Silver unit value (\$/t)	Silver unit value (\$2000/t)	Limestone unit value (\$/t)NRCAN	Limestone unit value (\$2000/t) NRCAN	Limestone unit value (\$/t) NLDME	Limestone unit value (\$2000/t) NLDME
1988	\$2,660	\$3,874	\$28.33	\$41.26	818	\$1,191	\$1,330	\$1,937	\$14,100,000	\$20,535,140	\$209,900	\$305,697	5.52	\$8.05		
1989	\$2,890	\$4,016	\$31.31	\$43.51	869	\$1,208	\$1,810	\$2,515	\$12,300,000	\$17,093,455	\$176,800	\$245,701	5.55	\$7.71		
1990	\$2,710	\$3,573	\$30.89	\$40.72	1,010	\$1,332	\$1,640	\$2,162	\$12,400,000	\$16,347,471	\$155,000	\$204,343	4.92	\$6.48	\$3.29	\$4.34
1991	\$2,410	\$3,048	\$30.11	\$38.08	739	\$935	\$1,160	\$1,467	\$11,700,000	\$14,797,059	\$129,900	\$164,285	4.71	\$5.96	\$3.53	\$4.46
1992	\$2,370	\$2,910	\$28.58	\$35.09	774	\$950	\$1,290	\$1,584	\$11,100,000	\$13,627,409	\$126,700	\$155,549	3.56	\$4.38	\$2.15	\$2.64
1993	\$2,020	\$2,409	\$25.79	\$30.75	699	\$834	\$1,020	\$1,216	\$11,600,000	\$13,833,141	\$138,200	\$164,805	1.99	\$2.38	\$1.21	\$1.44
1994	\$2,450	\$2,847	\$25.16	\$29.24	820	\$953	\$1,090	\$1,267	\$12,400,000	\$14,410,811	\$170,100	\$197,684	4.09	\$4.76	\$1.92	\$2.23
1995	\$3,050	\$3,448	\$27.73	\$31.34	933	\$1,055	\$1,230	\$1,390	\$12,400,000	\$14,016,210	\$165,600	\$187,184	3.90	\$4.40	\$2.16	\$2.44
1996	\$2,400	\$2,635	\$28.90	\$31.74	1,080	\$1,186	\$1,130	\$1,241	\$12,500,000	\$13,726,325	\$166,900	\$183,274	4.78	\$5.25	\$5.51	\$6.05
1997	\$2,360	\$2,533	\$29.92	\$32.11	1,030	\$1,105	\$1,420	\$1,524	\$10,700,000	\$11,483,361	\$157,200	\$168,709	5.45	\$5.85	\$6.24	\$6.69
1998	\$1,730	\$1,828	\$31.16	\$32.93	992	\$1,048	\$1,130	\$1,194	\$9,490,000	\$10,028,343	\$164,000	\$173,303	5.03	\$5.32	\$5.80	\$6.13
1999	\$1,670	\$1,727	\$26.77	\$27.68	963	\$996	\$1,180	\$1,220	\$9,000,000	\$9,306,613	\$169,000	\$174,758	4.70	\$4.86	\$5.42	\$5.61
2000	\$1,940	\$1,940	\$25.81	\$25.81	962	\$962	\$1,230	\$1,230	\$9,000,000	\$9,000,000	\$161,000	\$161,000	0.00		\$5.39	\$5.39
2001	\$1,755	\$1,697	\$23.87	\$23.08	962	\$930	\$970	\$938	\$8,398,000	\$8,121,004	\$141,000	\$136,349			\$4.19	\$4.05
2002e	\$1,650	\$1,565	\$23.00	\$21.82	970	\$920	\$890	\$844	\$9,806,000	\$9,301,279	\$145,000	\$137,537				

Appendix 4H. Historical Mineral Commodity Prices

Year	Asbestos unit value (\$/t)	Asbestos unit value (\$2000/t)	Fluorspar unit value (\$/t)	Fluorspar unit value (\$2000/t)	Gypsum unit value (\$/t)	Gypsum unit value (\$2000/t)	Anorthosite unit value (\$/t)	Anorthosite unit value (\$2000/t)	US CPI	Canadian/US dollar exchange rates
1886									27	
1887									27	
1888									27	
1889									27	
1890									27	
1891									27	
1892									27	
1893									27	
1894									26	
1895									25	
1896									25	
1897									25	
1898									25	
1899									25	
1900	\$17	\$352							25	
1901	\$20	\$411							25	
1902	\$18	\$353							26	
1903	\$21	\$398							27	
1904	\$19	\$366							27	
1905	\$15	\$291							27	
1906	\$19	\$355							27	
1907	\$20	\$370							28	
1908	\$23	\$442							27	
1909	\$22	\$428							27	
1910	\$20	\$376							28	
1911	\$17	\$320							28	
1912	\$22	\$392							29	
1913	\$22	\$378							30	1
1914	\$17	\$287							30	0.9998
1915	\$24	\$404							30	1.01
1916	\$33	\$515							33	1.0081
1917	\$38	\$514							38	1.0094
1918	\$51	\$585							45	1.0244
1919	\$61	\$605							52	1.0525
1920	\$63	\$543							60	1.19
1921	\$48	\$464							54	1.1775
1922	\$38	\$388							50	1.0663
1923	\$39	\$389							51	1.03
1924	\$34	\$338							51	1.0359
1925	\$34	\$334							53	1.0047
1926	\$35	\$341							53	1.0063
1927	\$41	\$408							52	1.0019
1928	\$43	\$431							51	1.0044
1929	\$47	\$477							51	1.03
1930	\$38	\$389							50	1.0128
1931	\$41	\$464							46	1.2488
1932	\$33	\$416							41	1.195
1933	\$30	\$399							39	1.23
1934	\$34	\$438							40	1.0163
1935	\$36	\$452							41	1.0263
1936	\$31	\$385							42	1.0069

Appendix 4H. Historical Mineral Commodity Prices

Year	Asbestos unit value (\$/t)	Asbestos unit value (\$2000/t)	Fluorspar unit value (\$/t)	Fluorspar unit value (\$2000/t)	Gypsum unit value (\$/t)	Gypsum unit value (\$2000/t)	Anorthosite unit value (\$/t)	Anorthosite unit value (\$2000/t)	US CPI	Canadian/US dollar exchange rates
1937	\$31	\$372							43	1.0031
1938	\$26	\$318							42	1.035
1939	\$37	\$459							42	1.11
1940	\$37	\$455							42	1.11
1941	\$33	\$386							44	1.11
1942	\$36	\$381							49	1.11
1943	\$61	\$608							52	1.11
1944	\$63	\$617							53	1.11
1945	\$40	\$383							54	1.105
1946	\$40	\$353							59	1.005
1947	\$42	\$324							67	1.005
1948	\$54	\$386							72	1.005
1949	\$66	\$477							71	1.105
1950	\$76	\$544							72	1.105
1951	\$84	\$557							78	1.0731
1952	\$96	\$623			\$6.90	\$44.8			80	1.0113
1953	\$98	\$631			\$4.88	\$31.4			80	0.9978
1954	\$109	\$699			\$5.21	\$33.4			81	0.9875
1955	\$111	\$714			\$4.17	\$26.8			80	1.0006
1956	\$127	\$805	\$48	\$304	\$5.56	\$35.3			81	0.9997
1957	\$124	\$759	\$30	\$184	\$4.61	\$28.2			84	0.9863
1958	\$129	\$769	\$31	\$185	\$4.43	\$26.4			87	0.9916
1959	\$106	\$627	\$31	\$183	\$4.42	\$26.1			87	0.9819
1960	\$103	\$599	\$45	\$262	\$4.56	\$26.5			89	0.9981
1961	\$91	\$524	\$45	\$259	\$2.63	\$15.2			90	1.0438
1962	\$97	\$552	\$45	\$256	\$3.42	\$19.5			91	1.09
1963	\$85	\$478	\$41	\$231	\$3.35	\$18.9			92	1.0856
1964	\$86	\$478	\$41	\$228	\$2.74	\$15.2			93	1.0825
1965	\$95	\$519	\$41	\$224	\$2.50	\$13.6			95	1.085
1966	\$97	\$515	\$44	\$234	\$2.59	\$13.8			97	1.0841
1967	\$99	\$511	\$46	\$237	\$2.47	\$12.8			100	1.0834
1968	\$95	\$470	\$49	\$243	\$2.77	\$13.7			104	1.09
1969	\$93	\$437	\$52	\$244	\$2.82	\$13.2			110	1.0825
1970	\$94	\$417	\$64	\$284	\$3.04	\$13.5			116	1.0822
1971	\$103	\$438	\$71	\$302	\$3.19	\$13.6			121	1.0253
1972	\$112	\$461	\$72	\$297	\$3.19	\$13.1			125	1.0094
1973	\$120	\$465	\$72	\$279	\$3.13	\$12.1			133	1.0116
1974	\$139	\$486	\$72	\$252	\$3.71	\$12.9			148	0.9956
1975	\$159	\$509	\$95	\$304	\$3.82	\$12.2			161	1.04
1976	\$232	\$703	\$95	\$288	\$4.25	\$12.9			171	1.043
1977	\$260	\$739	\$95	\$270	\$4.78	\$13.6			182	1.1157
1978	\$273	\$721	\$103	\$272	\$5.35	\$14.1			195	1.141
1979	\$262	\$621	\$104	\$247	\$5.24	\$12.4			217	1.171
1980	\$283	\$591	\$106	\$222	\$5.82	\$12.2			247	1.169
1981	\$324	\$614			\$6.39	\$12.1			272	1.199
1982	\$285	\$508			\$6.51	\$11.6			289	1.234
1983	\$305	\$527			\$5.47	\$9.5			298	1.233
1984	\$313	\$518			\$6.62	\$11.0			311	1.295
1985	\$297	\$475			\$8.62	\$13.8			322	1.366
1986	\$246	\$386			\$8.82	\$13.9			328	1.39
1987	\$274	\$415			\$8.56	\$13.0			340	1.326

Appendix 4H. Historical Mineral Commodity Prices

Year	Asbestos unit value (\$/t)	Asbestos unit value (\$2000/t)	Fluorspar unit value (\$/t)	Fluorspar unit value (\$2000/t)	Gypsum unit value (\$/t)	Gypsum unit value (\$2000/t)	Anorthosite unit value (\$/t)	Anorthosite unit value (\$2000/t)	US CPI	Canadian/US dollar exchange rates
1988	\$252	\$367			\$7.47	\$10.9			354	1.231
1989	\$234	\$325			\$7.67	\$10.7			371	1.184
1990	\$261	\$344			\$7.57	\$10.0			391	1.167
1991	\$383	\$484			\$7.98	\$10.1			408	1.146
1992	\$394	\$484			\$8.73	\$10.7	\$321	\$394	420	1.209
1993	\$435	\$519			\$7.48	\$8.9	\$334	\$398	433	1.290
1994	\$506	\$588			\$7.26	\$8.4	\$334	\$388	444	1.366
1995	\$226	\$255			\$7.29	\$8.2	\$300	\$339	457	1.373
1996	\$222	\$244			\$7.54	\$8.3	\$353	\$388	470	1.363
1997	\$205	\$220			\$7.81	\$8.4	\$353	\$379	481	1.385
1998	\$200	\$211			\$7.12	\$7.5	\$394	\$416	488	1.484
1999		\$0			\$6.99	\$7.2	\$386	\$399	499	1.486
2000		\$0			\$7.00	\$7.0	\$409	\$409	516	1.486
2001							\$373	\$361	534	1.540
2002e									544	

Notes

All data is taken from United States Geological Survey (USGS) historical statistics (Kelley et al., 2002) locally updated for 2000 - 2002 from USGS mineral commodity statistics <http://minerals.usgs.gov/minerals/pubs/commodity/#C>, unless otherwise stated.

\$/t = Historical US\$/metric tonne value (i.e., in current dollars of the time)

\$2000/t = year-2000 US\$/metric tonne (i.e., deflated value)

e = estimated prices

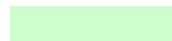
Grey cells = Statistics Canada data

NRCAN = Natural Resources Canada, Canadian Minerals Yearbook

NLDME = Newfoundland and Labrador Department of Mines and Energy, unpublished data



NRCAN prices for gypsum



NLDME prices for fluorspar



NLDME prices for high purity limestone and dolomite

Appendix 4I. Mining Tax Royalties and Other Taxation Revenue, 1990 to 1998

A. *Revenue breakdown In current Canadian dollars

Year	Mining Tax & Royalties	Other Taxation Revenue from Mining								Total Taxation Revenue (Mining & Royalties + Other)
		Corporate tax	Fuel tax	Retail sales tax	Payroll tax	Other revenue	Sundry tax	Municipal tax	Total Other Taxation Revenue	
1998	\$27,800,000	\$5,838,000	\$6,162,517	\$26,481,752	\$3,640,821	\$1,200,000	\$36,313,098	\$5,314,544	\$84,950,732	\$112,750,732
1997	\$23,580,257	\$5,160,000	\$8,537,076	\$6,049,078	\$3,820,819	\$1,650,000	\$47,231,976	\$5,485,741	\$77,934,690	\$101,514,947
1996	\$21,710,864	\$4,717,000	\$8,045,395	\$23,721,058	\$3,608,634	\$6,297,831	\$45,252,439	\$5,491,344	\$97,133,701	\$118,844,565
1995	\$19,238,459	\$3,981,000	\$7,313,048	\$17,537,448	\$3,520,923	\$1,961,962	\$46,447,395	\$4,961,724	\$85,723,500	\$104,961,959
1994	\$16,992,978	\$3,209,000	\$7,389,224	\$11,218,225	\$3,409,894	\$812,325	\$38,864,710	\$5,140,030	\$70,043,408	\$87,036,386
1993	\$14,247,979	\$2,907,000	\$7,349,339	\$11,723,978	\$3,225,485	\$1,296,666	\$29,591,920	\$5,059,533	\$61,153,921	\$75,401,900
1992	\$14,936,814	\$3,052,000	\$4,316,416	\$18,716,233	\$2,448,803	\$1,644,178	\$31,867,000	\$5,060,258	\$67,104,888	\$82,041,702
1991	\$21,657,975	\$5,250,000	\$8,227,884	\$20,588,748	\$2,182,600	\$1,650,000	\$31,779,100	\$4,455,658	\$74,133,990	\$95,791,965
1990	\$21,300,000	\$4,473,000	\$1,985,699	\$13,634,711	\$2,239,567	\$1,600,000	\$32,251,149	\$4,906,791	\$61,090,917	\$82,390,917
Averages	\$20,162,814	\$4,287,444	\$6,591,844	\$16,630,137	\$3,121,950	\$2,012,551	\$37,733,199	\$5,097,291	\$75,474,416	\$95,637,230
Average as a percentage of the total taxation value for 1990-1998 (\$95,637,230)	21.08	4.48	6.89	17.39	3.26	2.10	39.45	5.33		100.00

Italicized figures indicates Corporate Tax that has been estimated on basis that it is historically an average 21% of mining tax + royalties

B. **Direct and Indirect Provincial Revenue, 1990 to 1998, in constant year-2000 Canadian dollars

Year	***Canadian Consumer Price Index (CPI)	Total Taxation Revenue in constant year-2000 \$	Direct Revenue in constant year-2000 \$	Indirect Revenue in constant year-2000 \$
2000	4.57			
1999	4.45			
1998	4.37	\$117,859,346	\$29,059,588	\$88,799,758
1997	4.33	\$107,094,752	\$24,876,354	\$82,218,398
1996	4.26	\$127,437,083	\$23,280,570	\$104,156,513
1995	4.19	\$114,431,081	\$20,974,053	\$93,457,028
1994	4.1	\$96,971,271	\$18,932,664	\$78,038,607
1993	4.09	\$84,214,151	\$15,913,146	\$68,301,005
1992	4.02	\$93,225,496	\$16,972,977	\$76,252,519
1991	3.96	\$110,499,418	\$24,983,240	\$85,516,178
1990	3.75	\$100,363,122	\$25,946,240	\$74,416,882
Averages		\$105,788,414	\$22,326,537	\$83,461,877

Notes

*Revenue data is taken from unpublished files of the Newfoundland and Labrador Department of Mines and Energy

** Deflation has been calculated using the Canadian Consumer Price Index

*** Canadian Consumer price Index, base year 1971, from Statistics Canada

Appendix 4J. Employment and Annual Wages in the Newfoundland and Labrador Mining Industry

Year	*Employment	**Annual wages in current \$	Annual wages in year-2000 \$	Average individual annual wage in year-2000 \$	***CPI
1949	3507	\$8,416,000	\$66,283,255	\$18,900	0.58
1950					0.597
1951					0.66
1952					0.676
1953	3800	\$13,102,000	\$89,328,263	\$23,507	0.67
1954	3800	\$14,000,000	\$94,884,273	\$24,970	0.674
1955	3796	\$12,788,000	\$86,541,606	\$22,798	0.675
1956					0.685
1957					0.707
1958					0.726
1959					0.734
1960					0.743
1961					0.75
1962	4350	\$21,000,000	\$126,387,352	\$29,055	0.759
1963	5000	\$27,000,000	\$159,761,658	\$31,952	0.772
1964	5500	\$28,000,000	\$162,727,735	\$29,587	0.786
1965	6000	\$36,000,000	\$204,283,230	\$34,047	0.805
1966	6500	\$40,000,000	\$218,826,347	\$33,666	0.835
1967					0.865
1968					0.9
1969					0.941
1970					0.972
1971	6955	\$65,377,000	\$298,642,136	\$42,939	1
1972	6000				1.047
1973					1.129
1974					1.251
1975					1.386
1976					1.489
1977					1.608
1978					1.752
1979					1.912
1980					2.107
1981					2.367
1982					2.624
1983					2.774
1984					2.897
1985					3.009
1986		\$98,696,000	\$143,809,674		3.135
1987		\$102,525,000	\$143,090,192		3.273
1988	4361				3.404
1989	4580	\$130,439,000	\$166,716,663	\$36,401	3.574
1990	4342	\$161,747,000	\$197,239,801	\$45,426	3.746
1991	3357	\$154,944,000	\$178,914,103	\$53,296	3.956
1992	3053	\$163,098,000	\$185,515,853	\$60,765	4.016
1993	2832	\$160,553,000	\$179,404,624	\$63,349	4.088
1994	2985	\$160,370,000	\$178,806,483	\$59,902	4.097
1995	2850	\$168,223,000	\$183,530,610	\$64,397	4.187
1996	2887	\$170,078,000	\$182,460,381	\$63,201	4.258
1997	2996	\$178,382,000	\$188,013,146	\$62,755	4.334
1998	2788	\$181,834,000	\$189,898,882	\$68,113	4.374
1999	2732	\$183,443,000	\$188,286,175	\$68,919	4.451
2000	2661				4.568
2001e	2437				4.688
2002f	2438				4.792

Notes:

*Employment figures derived from Newfoundland Department of Mines and Energy (and predecessor departments) published and unpublished data (annual reports prior to 1973; unpublished data 1988 - 1993; web site data 1994 on).

** Annual wage data from Newfoundland Department of Mines and Energy (and predecessor departments) annual reports prior to 1973; and from Canadian Minerals Yearbook (Natural Resources Canada) from 1986 onward.

***CPI = Canadian Consumer Price Index, source Statistics Canada

All currency in Canadian dollars

Blank cells indicate missing or not reported information

e = estimated, as of 2001

f = forecast, as of 2001

Appendix 4K. Historical Exploration Statistics for Newfoundland and Labrador

Year	Exploration expenditures \$ (x000s)							Claims Staked				Diamond Drilling(m)				
	NF current \$	LB current \$	Total current \$	NF, year-2000 \$	LB, year-2000 \$	Total, year-2000 \$	*CPI	NF	LB	Total	Claims in good-standing	Production	Exploration	NF	LB	Total NF & LB
1949			1,000			\$7,876	0.58			271	258					
1950			2,000			\$15,303	0.60									
1951			1,500			\$10,382	0.66									
1952			3,000			\$20,272	0.68									
1953			1,500			\$10,227	0.67			0						26,895
1954			2,000			\$13,555	0.67			3						9,399
1955			3,000			\$20,302	0.68									
1956			3,500			\$23,340	0.69									
1957			5,500			\$35,536	0.71			0						
1958			12,000			\$75,504	0.73			0						
1959			16,000			\$99,575	0.73			40						
1960			4,500			\$27,666	0.74			42						2,197
1961			4,000			\$24,363	0.75			30						20,613
1962			5,000			\$30,092	0.76			0						15,181
1963			2,000			\$11,834	0.77			867						16,145
1964			2,500			\$14,529	0.79			105						28,204
1965			3,000			\$17,024	0.81			1						46,052
1966			3,500			\$19,147	0.84			73						52,795
1967			4,500			\$23,764	0.87			30						41,272
1968			4,000			\$20,302	0.90			40						48,769
1969			6,000			\$29,126	0.94			20						42,543
1970			6,500			\$30,547	0.97			9						55,791
1971			5,500			\$25,124	1.00			42						39,926
1972			5,000			\$21,815	1.05			35	542					16,456
1973			6,500			\$26,299	1.13			490	1,029					41,410
1974			6,000			\$21,909	1.25			1,456	2,304					25,011
1975			7,000			\$23,071	1.39			2,711	3,967					23,809
1976			6,000			\$18,407	1.49			891	2,856					23,701
1977			7,500			\$21,306	1.61			2,085	3,472					4,600
1978			8,500			\$22,162	1.75			8,876	11,990					42,313
1979			13,000			\$31,059	1.91			6,255	14,560					67,262
1980			13,000			\$28,184	2.11			13,099	20,772					65,882
1981	13,482	2,518	16,000	\$26,018	\$4,859	\$30,878	2.37	13,661	0	13,661	25,012	25,224	39,278	64,503	0	64,503
1982	9,360	2,640	12,000	\$16,294	\$4,596	\$20,890	2.62	4,670	0	4,670	18,517	24,810	23,961	39,429	9,342	48,771
1983	6,334	1,366	7,700	\$10,430	\$2,249	\$12,680	2.77	5,825	409	6,234	15,769	1,220	25,794	25,362	1,652	27,014
1984	7,596	444	8,040	\$11,977	\$700	\$12,678	2.90	11,021	1,057	12,078	21,246	19,533	24,613	43,941	205	44,146
1985	12,347	253	12,600	\$18,744	\$384	\$19,128	3.01	12,320	2,229	14,549	30,236	24,107	14,634	37,582	1,359	38,941
1986	11,738	62	11,800	\$17,103	\$90	\$17,194	3.14	12,413	2,861	15,274	34,256	21,373	29,772	48,035	3,110	51,145
1987	32,309	191	32,500	\$45,092	\$267	\$45,359	3.27	19,534	2,548	22,082	48,359	11,561	78,111	87,781	1,891	89,672
1988	40,706	453	41,159	\$54,625	\$608	\$55,233	3.40	25,763	843	26,606	68,667	17,449	217,382	234,313	518	234,831
1989	35,028	1,221	36,249	\$44,770	\$1,561	\$46,331	3.57	16,956	615	17,571	65,223	16,355	106,497	122,852	0	122,852
1990	22,520	754	23,274	\$27,462	\$919	\$28,381	3.75	8,968	1,453	10,421	45,427	8,884	84,462	91,346	1,350	92,696
1991	10,933	1,131	12,064	\$12,624	\$1,306	\$13,930	3.96	5,426	1,985	7,411	33,297	6,850	37,077	43,327	600	43,927

Appendix 4K. Historical Exploration Statistics for Newfoundland and Labrador

Year	Exploration expenditures \$ (x000s)							Claims Staked				Diamond Drilling(m)				
	NF current \$	LB current \$	Total current \$	NF, year-2000 \$	LB, year-2000 \$	Total, year-2000 \$	*CPI	NF	LB	Total	Claims in good-standing	Production	Exploration	NF	LB	Total NF & LB
1992	7,429	3,712	11,141	\$8,450	\$4,222	\$12,672	4.02	3,503	1,615	5,118	24,002	819	21,054	19,349	2,524	21,873
1993	7,251	1,654	8,905	\$8,102	\$1,848	\$9,951	4.09	5,177	1,778	6,955	22,910	16,982	29,528	38,310	8,200	46,510
1994	11,241	1,155	12,396	\$12,533	\$1,288	\$13,821	4.10	1,468	20,788	22,256	36,698	7,260	42,225	48,552	933	49,485
1995	10,295	60,818	71,113	\$11,232	\$66,352	\$77,584	4.19	17,864	230,842	248,706	280,750	8,107	120,803	56,660	72,250	128,910
1996	11,104	81,443	92,547	\$11,912	\$87,372	\$99,285	4.26	9,666	5,633	15,299	168,815	9,424	226,206	54,399	181,233	235,632
1997	10,266	61,486	71,752	\$10,820	\$64,806	\$75,626	4.33	8,620	4,743	13,363	126,766	13,318	141,320	49,145	105,493	154,638
1998	10,989	37,011	48,000	\$11,476	\$38,653	\$50,129	4.37	11,329	3,147	14,476	86,955	4,967	90,428	33,802	61,593	95,395
1999	14,096	18,257	32,353	\$14,468	\$18,739	\$33,207	4.45	9,470	173	9,643	57,431	4,168	112,095	62,857	53,406	116,263
2000	15,378	11,939	27,317	\$15,378	\$11,939	\$27,317	4.57	6,783	6,185	12,968	46,880	6,920	67,626	45,356	29,190	74,546
2001	11,010	17,432	28,442	\$10,729	\$16,987	\$27,716	4.69	9,885	5,780	15,665	47,425	N/A	N/A	32,700	14,476	47,176
2002	12,890	31,300	44,190	\$12,287	\$29,835	\$42,122	4.79	27,574	5,552	33,126	66,287	N/A	N/A	46,071	20,625	66,696

Notes:

Source for all data is Newfoundland and Labrador Department of Mines and Energy (or predecessor departments). Information prior to 1981 is taken from Swinden 1993; that for post-1981 is available on the Department web site.

Blank cells are missing or not reported data

NF = Newfoundland

LB = Labrador

*CPI = Canadian Consumer Price Index, source Statistics Canada

Appendix 4L. Canadian Exploration Expenditures, by Province and Territory 1989-2002, in year-2000 dollars

In millions of Canadian \$

Jurisdiction	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	*2002
Newfoundland and Labrador	\$43.7	\$27.3	\$13.8	\$12.6	\$9.9	\$13.6	\$76.4	\$97.7	\$61.2	\$42.9	\$30.4	\$27.3	\$28.4	\$35.7
Nova Scotia	\$25.8	\$12.9	\$5.1	\$3.7	\$2.0	\$1.9	\$3.1	\$7.3	\$7.0	\$5.1	\$3.8	\$3.6	\$2.8	\$3.4
New Brunswick	\$16.4	\$19.4	\$18.0	\$13.8	\$12.3	\$11.0	\$13.7	\$15.6	\$12.7	\$10.5	\$10.4	\$12.1	\$9.5	\$3.0
Quebec	\$223.5	\$230.3	\$157.7	\$106.0	\$117.8	\$143.1	\$132.5	\$144.9	\$176.4	\$130.0	\$107.1	\$94.1	\$102.9	\$114.3
Ontario	\$263.1	\$179.0	\$125.3	\$87.3	\$83.9	\$124.1	\$139.4	\$205.9	\$184.7	\$117.1	\$84.0	\$117.9	\$113.6	\$140.2
Manitoba	\$44.7	\$48.3	\$33.9	\$36.0	\$30.4	\$44.5	\$35.0	\$43.6	\$42.2	\$31.0	\$23.4	\$28.1	\$28.7	\$26.7
Saskatchewan	\$76.5	\$49.5	\$36.0	\$29.2	\$59.0	\$55.6	\$47.1	\$53.4	\$52.3	\$60.8	\$37.2	\$45.6	\$37.5	\$38.8
Alberta	\$7.5	\$12.5	\$7.5	\$6.1	\$8.1	\$10.3	\$11.4	\$11.5	\$21.4	\$22.7	\$11.8	\$7.2	\$4.5	\$5.8
British Columbia	\$225.4	\$265.6	\$154.9	\$80.7	\$73.3	\$93.3	\$85.3	\$110.7	\$100.3	\$46.6	\$34.6	\$35.9	\$29.1	\$34.1
Yukon	\$18.2	\$21.6	\$18.8	\$10.9	\$21.3	\$28.2	\$42.2	\$49.0	\$42.5	\$18.4	\$12.7	\$11.2	\$7.8	\$7.2
Northwest Territories	\$55.2	\$42.2	\$36.1	\$48.1	\$111.9	\$164.2	\$185.0	\$205.5	\$157.7	\$120.8	\$63.1	\$51.4	\$86.6	\$60.0
**Nunavut	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$35.0	\$62.1	\$61.3	\$64.9
Total Canada	\$1,000.0	\$908.6	\$607.1	\$434.4	\$529.9	\$689.8	\$771.1	\$945.1	\$858.4	\$605.9	\$453.5	\$496.5	\$512.7	\$534.1

Notes:

Source - Natural Resources Canada, Minerals and Metals sector; figures for Newfoundland and Labrador differ from the provincial estimates in Appendix 4K.

Expenditures include field and overhead expenses for exploration and deposit appraisal.

Type of deflator used by NRCan is unknown.

* Preliminary estimate

**Nunavut was not constituted until 1999