THE YUKON MINING INDUSTRY

A Background Paper

Mineral Resources Branch
Department of Economic Development
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PREFACE

During development of the Yukon Mineral Strategy, the Department of Economic Development compiled information on various aspects of the Yukon mining industry. This information includes mineral production, supply, demand, exploration, taxation, economic impacts, and the role of the Yukon Geology Program in helping develop Yukon's mining industry. Most of the information focuses on various aspects of the economics of the mining industry and, in particular, the importance of the industry to the economic well-being of the Yukon.

This paper on the Yukon mineral industry is a compilation of technical and statistical information on the past and present state of Yukon's mining industry. The data contained in this report is current as of June, 1999. The first part of the paper provides an overview of the global mining industry from a supply and demand perspective. Subsequent chapters examine the mining industry at a national and then territorial level. The last part of the paper details various aspects of Yukon's mining industry including the role of the Yukon Geology program, taxation, mining trends and Yukon Government programs to support the mining sector.

The information in this document is from various sources – some from existing sources, some generated by the department. The Department of Economic Development cannot take responsibility for the accuracy of the data provided, but we would certainly like to know of any errors or omissions.

For additional information on the Yukon Mineral Strategy or other aspects of the Yukon mining industry, please contact:

Jesse Duke
Mining Facilitator
Department of Economic Development
Government of the Yukon
Phone (867) 667-3422
Fax (867) 667-8601
email: jesse.duke@gov.yk.ca

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INTRODUCTION

The process of exploring for, mining, processing and exporting mineral wealth has generated economic wealth for many civilizations throughout history. The exchange of valuable metals or sought-after minerals like gemstones for foreign currencies has helped finance exploration and infrastructure and established rudimentary economic foundations for emerging nations. Presently, there are more than 7,000 producing mines in the world, providing the raw materials needed for global manufacturing, construction, chemical industries and energy industries.

On a national scale, mining (including mineral exploration, production, metal processing) is a moderately sized, high investment and high-producing sector whose Gross Domestic Product (GDP) contribution to the Canadian economy has remained relatively constant since 1980. The mining and mineral processing sector employed over 350,000 Canadians and contributed $26.5 billion to the Canadian economy in 1998. With about 200 operating open pit and underground mines, Canada remains one of the world's largest mineral exporters. In addition, there is an inventory of over 30,000 known mineral deposits and mineral occurrences, and a large contingent of over 100 potential mines that are awaiting development and production decisions. Less than 10 percent of Canada's vast landmass has been intensively explored for minerals and there is great potential in remote areas like the Yukon for new, large, near-surface deposits.

Ore deposits are not scattered randomly throughout the earth's crust; geology and geography dictate their location. The Yukon is underlain by a tremendous variety of rock types resulting in a complex geology ideal for hosting many types of ore deposits. The business of finding, evaluating and mining these deposits has played a leading role in the development of the Yukon Territory.

The economy of the Yukon is closely tied to the fortunes of the mining industry and is therefore vulnerable to drastic upswings and downcycles. In addition, for almost 30 years, the giant lead-zinc mine at Faro has dominated the Yukon economy, accounting for a substantial portion of the Yukon's mineral production and private sector employment. With the closure of the mine in 1998, the Yukon is adjusting to a post-Faro economy, agitated by a multi-year global downturn in exploration and mining investment.

Low metal prices over the past couple of years due to the "Asian crisis" and other factors have globally generated decreased profits, mine closures, layoffs, asset write-downs and corporate take-overs. On a territorial level, this has translated into low employment rates in the Yukon and decreased revenue for those in the mining or mining supply sectors. On a national scale, domestic exploration is below threshold levels for maintaining current production, base metal reserves are in decline and mine closures have been outpacing operations. At the same time Canada is facing unprecedented competition for mining investment dollars from a number of developing countries.

This paper presents an economic overview of the Yukon mineral industry in a global and national context by compiling technical and statistical information on mineral supply, demand, production, exploration, economic impact and taxation, and examining the role of the Yukon Geology Program in the development of Yukon's mineral industry.

OVERVIEW OF GLOBAL MINERAL SUPPLY AND DEMAND

The following chapter provides a brief economic overview of mining, from a supply and demand perspective, focusing on the Yukon's five major metals: gold, silver, lead, zinc, and copper.

MINERAL SUPPLY

With over 7,000 mines in operation around the world, the production of metals is a highly competitive global activity. The mining sector includes many producers, each vying for position and profit in the global marketplace. Factors that contribute to a production decision include:

- capital and operating costs,
- metal prices,
- technology,
- labour,
- government involvement,
- market structure, and
- metal uses.

MINERAL CONSUMPTION (DEMAND)

Metals are demanded because they are required as inputs in other products. Metals possess certain qualities or attributes that make them valuable, such as strength, conductivity, and resistance to corrosion or ductility. Some of the uses for the five metals important to the Yukon economy are listed in Appendix 1. As is the case with supply, there are several factors that influence the demand for a particular commodity. These include:

- income,
- price,
- price of substitutes and complements,
- technology,
- consumer preferences,
- government activities,
- production rates, and
- marketing.

Table 1
Average annual prices for lead, zinc, gold, silver, copper, 1993-1998

Year	Lead $US/kg	Lead $US/lb	Zinc $US/kg	Zinc $US/lb	Gold $US/oz	Silver $US/oz	Copper $US/kg	Copper $US/lb
1993	0.404	0.183	0.959	0.435	364.10	4.40	1.89	0.857
1994	0.555	0.252	1.001	0.454	384.68	5.30	2.35	1.066
1995	0.637	0.289	1.028	0.466	384.27	5.20	2.92	1.324
1996	0.769	0.349	1.030	0.467	386.45	5.16	2.30	1.043
1997	0.630	0.286	1.310	0.594	329.65	5.00	2.25	1.021
1998	0.530	0.240	1.030	0.467	294.87	5.50	1.67	0.757
6-year average	**0.588**	**0.267**	**1.060**	**0.481**	**357.34**	**5.09**	**2.23**	**1.012**

Source: The Northern Miner/Yukon Bureau of Statistics

METAL PRICES

World markets determine metal prices. Historically, there are two basic approaches to pricing in the mining industry, producer price and commodity exchanges[1]. Producer prices are set by the major producing firms in an industry. These prices change at discrete intervals and have small variances. Commodity exchanges, known for hedging[2] and speculating[3], allow the prices to be set by market forces. Copper, lead and zinc are traded on the London Metal Exchange (LME).

Prices are determined daily through auctions where dealers make bids and offers, resulting in the issue of contracts. The commodity exchange is generally believed to be a much more productive mechanism. Average annual metal prices for lead, zinc, gold, silver and copper are given in Table 1.

Metal prices are a major determining factor of mining production. Producers have the incentive to increase their output up to the point where the costs of producing one additional unit equals the revenue received for selling that unit. Theoretically speaking, a rise in the price of a metal will increase its production, while a fall in price will decrease production.

In the real world, however, production changes are not this immediate. The production response to a change in price is constrained, in the short term, by existing capacity. On average, it takes five to seven years to respond fully to a price increase. By the time a mine expands capacity, metal prices will likely have changed again. It often takes even longer to respond to a price decrease. As mining is a capital-intensive activity with a long production life, companies will often continue to produce through price decreases as long as costs are still met. The end result is that mining companies actually determine production levels, or targets, at the feasibility stage, before production begins. Changes in production targets are difficult and unlikely.

The following figures show annual prices for the Yukon's five major metals over the last 40 years in real[4] and nominal terms. "Real" prices have been adjusted for the effects of inflation, relative to 1996.

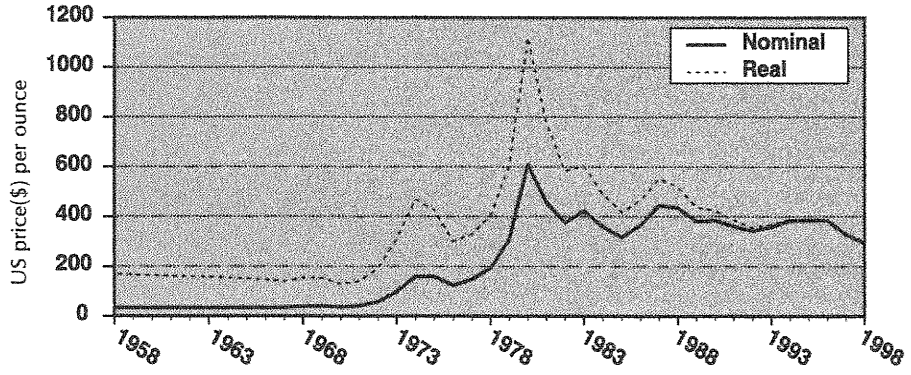
GOLD PRICE

Gold has been the backbone of the Yukon's mineral industry. Currently, the only operating hardrock mine in the Yukon is a gold mine, Brewery Creek. In addition, there are an estimated 161 placer gold mines.[5]

The average price for gold in 1998 was US $295 per ounce.

Global gold production is increasing due to reduction in production costs, and higher output due to expansions, greater efficiencies and higher grades.

Figure 1
Gold prices, 1958–1998



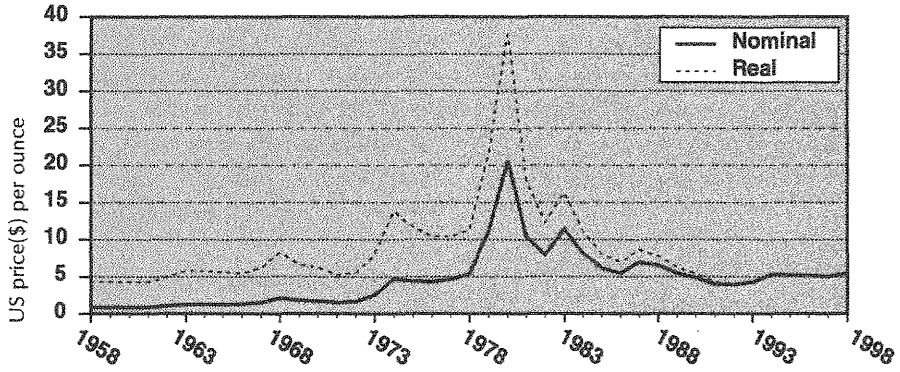
Source: Natural Resources Canada

SILVER PRICE

Silver has been a significant commodity in the Yukon's history. The primary mining of silver took place at the United Keno Hill mine, which shut down in 1989 due to low silver prices. More often, silver is produced as a secondary commodity from base metal mines. For example, silver was produced at the Faro mine.

Silver experienced price spikes in the late 1970s and early 1980s. The average price for silver in 1998 was US $5.50 per ounce (Figure 2).

Figure 2
Silver prices, 1958-1998



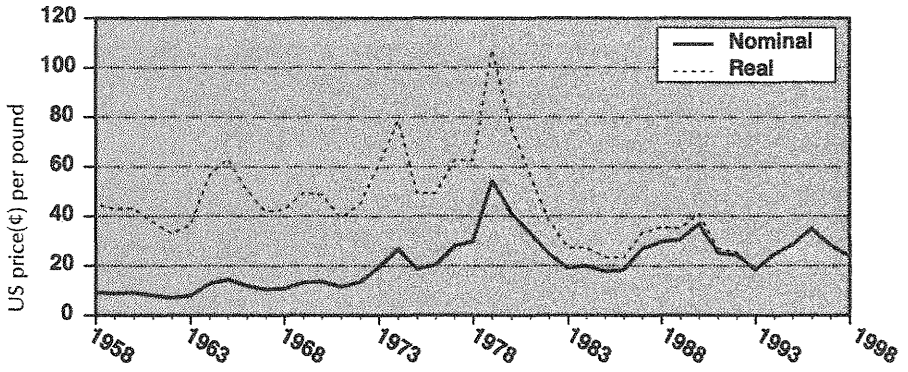
Source: Natural Resources Canada

LEAD PRICE

Lead has been a primary commodity of the Faro mine and the Sa Dena Hes mine. It is a secondary commodity of silver mines such as United Keno Hill. Lead is a bulk commodity and therefore requires expensive shipping to smelters.

The average price for lead in 1998 was US $0.24 per pound (Figure 3).

Figure 3
Lead prices, 1958-1998



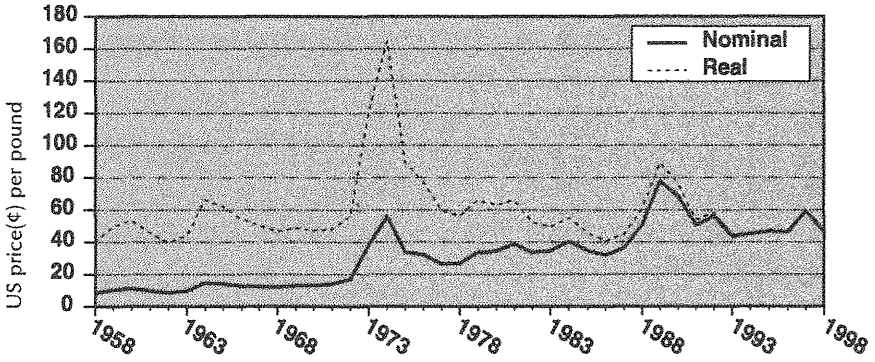
Source: Natural Resources Canada

ZINC PRICE

For most of the past 30 years, zinc has been the most important Yukon mineral in terms of value of mineral production. The major commodity produced at the Faro mine was zinc.

The average price of zinc in 1998 was US $0.47 per pound (Figure 4).

Figure 4
Zinc prices, 1958-1998



Source: Natural Resources Canada

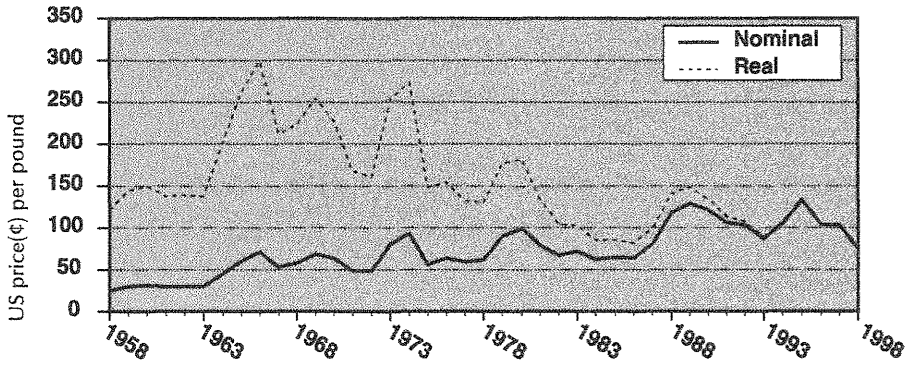
COPPER PRICE

Historically, copper has been a very significant Yukon commodity. The Whitehorse Copper mine was a world class deposit and produced from the late 1800s to 1982. There has been no copper mining in the Yukon since the closure of the Whitehorse Copper mine, however several copper projects are currently in the environmental permitting and advanced exploration stages.

Although world demand for copper has been steadily increasing, the technology used to mine copper has made mining increasingly lower grade deposits viable. This technological improvement has lowered production costs, subsequently resulting in the lowering of copper prices. Recent advances in smelting technology may further reduce copper prices.

The average price of copper in 1998 was US $0.75 per pound (Figure 5).

Figure 5
Copper prices, 1958-1998



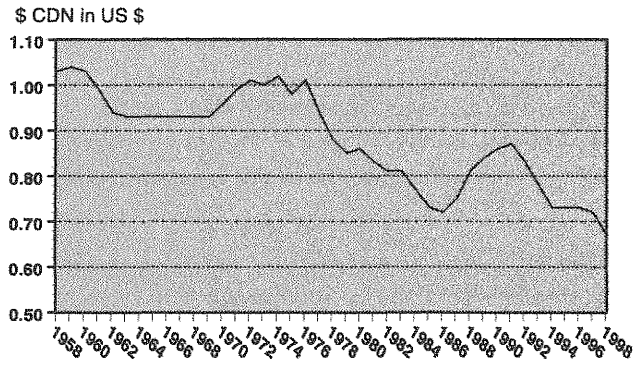
Source: Natural Resources Canada

EXCHANGE RATES

Since metals important to the Yukon are traded in the global economy, exchange rates have a significant impact on the viability of Yukon mines. Canadian producers benefit from the low exchange rate for the Canadian dollar because they sell their output in US dollars but their production costs are paid in lower Canadian dollars. At the same time, a lower dollar will raise the cost of importing equipment and machinery, a necessary feature in an ever changing, highly competitive and technologically based industry.

Alternatively, any upward trend in the exchange rate will have a reverse effect on the level of exports. The following figure gives Canadian exchange rates relative to the US dollar for the period 1958 to 1998.

Figure 6
Exchange rates



Source: Statistics Canada

OUTLOOK FOR METAL PRICES

Overall, the downturn in metal prices which began in 1997 continued through to May, 1999. A general decrease in demand for metals, brought about by the Asian economic slump, is operating in conjunction with an increase in the global supply of many metals to keep prices low. By the summer of 1999, signs of a recovery are showing in terms of metal prices and improvements in the Southeast Asian economy.

Gold

- The world demand for gold is increasing.
- The price trend into next century is partly dependent on continued central bank sales of gold.
- The severe cuts to exploration and development budgets mean reserves are not being replaced.

Silver

- The demand for silver continues to exceed supply.
- The price may be affected by speculative buying.

Lead

- As the Asian economies recover, growth in demand should be exceeded by rising production and net exports from Eastern countries.

Zinc

- Upcoming large increases in mine and smelter capacity will lead to a weakening zinc price in the first few years of the next century followed by a gradual rise through to 2005. Prices are forecast to range between US $0.49 and US $0.57 per ounce.

Copper

- The combination of the Asian crisis and major increases in copper mine production and smelting capacity should exert downward pressure on world prices.

Sources of information:
Canadian Metals Yearbook 1997
Engineering and Mining Journal, April, 1999
Mining Journal Annual Review for Metals, May, 1999

THE CANADIAN MINING SECTOR

Canada's mining history has played a fundamental role in the development of the nation. Iron mines in Quebec in the 1700s generated raw materials for the forging of cooking pots and other "value-added" items. The search for metals in the Canadian frontier was the driving force behind many historic expeditions.

Today, Canada is a world leader in the exploration and mining industry. The mining industry in Canada showed tremendous growth starting in the early 1950s, and concurrent with a growing world economy, over the following 40 years.

The Canadian mining industry is increasingly knowledge-based and technology-intensive, using sophisticated and innovative technology to reduce the inherent risks in exploration, to improve the productivity and competitiveness of mining and processing methods, and to enhance environmental protection.

CANADA'S MINERAL PRODUCTION

The output and value of Canadian mineral production is tracked by the Natural Resources Canada (NRCan) Minerals and Mining Statistics Division. Much of the information in this section on Canada's mineral production is from publications released by NRCan[6]. The following information (Table 2) on Canada's mineral production is taken from NRC statistical information, available at www.nrcan.gc.ca/mms/efab/mmsd, and from the publication *Mining in Canada 1998, Facts and Figures,* Mining Association of Canada.

Metals ..... gold, silver, lead, zinc, copper, other metals

Non-metals ..... potash, salt, peat, asbestos, gypsum, sulphur, diamonds

Structural materials ..... cement, sand and gravel, stone, lime, clay products

Fuels ..... crude oil and equivalent, natural gas, coal

Table 2
Canada mineral production. Value of production, 1996-1998

	1996	1997	1998	Change (1997-1998)
Metals (billions)	$11,697.5	$11,549.2	$10,318.9	-10.7%
Ontario (millions)	4,113,101	3,841,788	3,272,001	-14.8%
Quebec (millions)	2,223,269	2,288,106	2,192,194	-4.2%
British Columbia (millions)	1,534,248	1,495,315	1,463,590	-2.1%
Newfoundland (millions)	871,217	966,218	962,414	-0.4%
Manitoba (millions)	825,385	940,926	825,630	-12.3%
Saskatchewan (millions)	627,834	614,847	538,566	-12.4%
New Brunswick (millions)	586,294	657,533	602,521	-8.4%
Northwest Territories (millions)	510,369	543,682	348,531	-35.9%
Yukon (millions)	402,446	200,587	113,463	-43.4%
Alberta (millions)	304	176	–	–
Nova Scotia (millions)	–	–	–	–
Prince Edward Island (millions)	–	–	–	–
Non-metals (billions)	2,757.5	3,027.0	3,277.2	8.3%
Structural materials (billions)	2,641.9	2,885.4	2,948.8	2.2%
Fuels (billions)	32,581.3	33,076.7	27,770.2	-16.0%
Total (billions)	**$49,678.2**	**$50,538.3**	**$44,315.1**	**-12.3%**

Source: Preliminary estimate of the mineral production of Canada, by province
NRCAN Minerals and Metals Sector - various years, www.nrcan.gc.ca/mms

The overall value of Canada's mineral production (Table 2) increased only slightly in 1997 to $50.5 billion and dropped significantly by 12.3 percent to $44.3 billion in 1998. The decrease in this sector was the first for the Canadian minerals industry since 1991 and is largely due to the decline in world prices for major minerals and metals.

As a subgroup, the value of metal production fell by more than 10.7 percent in 1998 to $10.3 billion. Copper production in Canada alone dropped by 17.5 percent in value in 1998 despite an increase of 6.3 percent in production. With gold prices remaining soft, Canadian gold production fell by 3.1 percent in 1998 and its associated value decreased by 8.1 percent or $200 million.

The value of non-metals increased from $3.0 billion in 1997 to $3.3 billion in 1998. The increase is due to the first diamond production in Canadian history, valued at $53.4 million (278,000 carats).

The top non-fuel commodities produced in Canada in 1998 were:

gold ..... $2.3 billion
copper ..... $1.7 billion
potash ..... $1.7 billion
iron ore ..... $1.6 billion
zinc ..... $1.5 billion
nickel ..... $1.4 billion

CANADA'S CONTRIBUTION TO GLOBAL MINERAL PRODUCTION

For a small economy, Canada is a significant contributor to world metal production. Table 3 lists mineral production for gold, silver, lead, zinc and copper on global, national and territorial levels. Figure 7, from Natural Resources Canada, summarizes world production share and ranking of selected commodities produced in Canada, 1997.

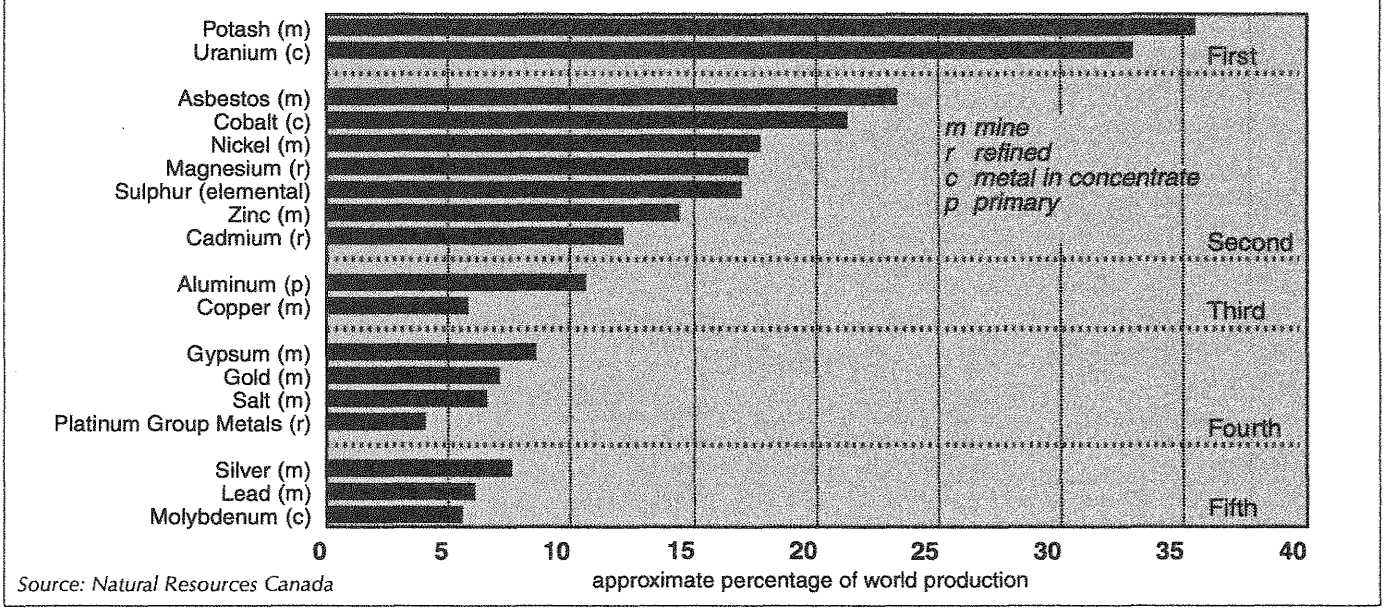
Canada's global percent share of gold and silver mineral production has remained relatively constant, but Canada's share of global lead, zinc and copper production is gradually decreasing. This is partly due to intermittent production and the subsequent closure of the Faro mine during the 1990s and the opening of enormous, low cost copper mines in South America and Indonesia.

The following information on Canadian production of gold, silver, lead, zinc and copper is taken from *Natural Resources Canada, Minerals Yearbook – 1997*. The figures presented may vary slightly from the production figures in Table 3.

Canadian gold production

Canada is currently the world's fourth largest gold producer behind South Africa, the United States and Australia. Although Canadian gold output increased by 2.6 percent to 169 tonnes in 1997, the total value of Canadian gold shipments decreased by 3.6 percent to

Figure 7
World production share and ranking of selected commodities produced in Canada, 1997



Source: Natural Resources Canada

Table 3
Global, Canada and Yukon mineral production of gold, silver, lead, zinc and copper

GOLD (tonnes)	1980	1990	1991	1992	1993	1994	1995	1996	1997	1998
World mine production	n/a	2,149.3	2,122.0	2,227.8	2,244.6	2,237.8	2,181.2	2,277.8	2,398.3	n/a
Canada mine production	50.6	160.3	175.3	160.3	153.1	146.4	150.9	164.7	171.5	164.0
Yukon mine production	2.6	5.0	4.0	4.0	4.0	3.0	5.0	5.0	7.0	6.0
Canada % of world mine production		7.5%	8.3%	7.2%	6.8%	6.5%	6.9%	7.2%	7.1%	
Yukon % of Canada mine production	5.1%	3.1%	2.3%	2.5%	2.6%	2.0%	3.3%	3.0%	4.1%	3.7%
Yukon % of World mine production		0.2%	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.3%	
SILVER (tonnes)	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
World mine production	n/a	14,971.7	14,591.3	14,654.7	13,951.9	13,706.4	14,498.2	15,077.1	16,112.9	n/a
Canada mine production	1,070.0	1,381.4	1,261.3	1,168.9	879.4	740.4	1,244.7	1,242.8	1,194.0	1,125.4
Yukon mine production	147.0	84.0	87.0	124.0	30.0	1.0	35.0	113.0	38.0	15.0
Canada % of world mine production		9.2%	8.6%	8.0%	6.3%	5.4%	8.6%	8.2%	7.4%	
Yukon % of Canada mine production	13.7%	6.1%	6.9%	10.6%	3.4%	0.1%	2.8%	9.1%	3.2%	1.3%
Yukon % of World mine production		0.6%	0.6%	0.8%	0.2%	0.0%	0.2%	0.7%	0.2%	
LEAD ('000 tonnes)	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
World mine production	n/a	3,187.4	3,147.9	3,043.2	2,713.3	2,766.3	2,789.9	3,053.4	3,052.9	n/a
Canada mine production	251.6	233.4	248.1	339.7	183.0	167.6	204.0	241.6	171.0	150.7
Yukon mine production	65.8	104.2	93.9	135.7	27.9	0.0	27.1	90.7	26.6	9.4
Canada % of world mine production		7.3%	7.9%	11.2%	6.7%	6.1%	7.3%	7.9%	5.6%	
Yukon % of Canada mine production	26.2%	44.6%	37.8%	39.9%	15.2%	0.0%	13.3%	37.5%	15.6%	6.2%
Yukon % of World mine production		3.3%	3.0%	4.5%	1.0%	0.0%	1.0%	3.0%	0.9%	
ZINC ('000 tonnes)	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
World mine production	n/a	7,055.0	7,210.7	7,192.9	6,754.6	6,853.9	7,030.7	7,356.9	7,418.9	n/a
Canada mine production	883.7	1,179.4	1,083.0	1,195.7	990.6	976.4	1,094.9	1,162.8	1,026.8	991.2
Yukon mine production	90.9	168.8	149.5	202.3	35.2	0.0	42.3	146.2	38.1	15.0
Canada % of world mine production		16.7%	15.0%	16.6%	14.7%	14.2%	15.6%	15.8%	13.8%	
Yukon % of Canada mine production	10.3%	14.3%	13.8%	16.9%	3.6%	0.0%	3.9%	12.6%	3.7%	1.5%
Yukon % of World mine production		2.4%	2.1%	2.8%	0.5%	0.0%	0.6%	2.0%	0.5%	
COPPER ('000 tonnes)	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
World mine production	n/a	9,016.4	9,135.3	9,579.7	9,568.5	9,556.9	10,058.1	11,062.8	11,448.6	n/a
Canada mine production	716.4	791.1	780.4	761.6	711.2	591.0	700.9	652.5	647.9	687.7
Yukon mine production	10.4	–	–	–	–	–	–	–	–	–
Canada % of world mine production		8.8%	8.5%	8.0%	7.4%	6.2%	7.0%	5.9%	5.7%	–
Yukon % of Canada mine production	0.0%	–	–	–	–	–	–	–	–	–
Yukon % of World mine production	0.0%	–	–	–	–	–	–	–	–	–

Sources:
1) Yukon/Canada Production: Yukon Annual Statistical Review. Various issues and Yukon statistical profile
2) Natural Resources Canada. World non-ferrous mineral statistics online

Note: Percentage calculations are based on different data sources and are subject to rounding errors and should be treated as estimates only.

$2.5 billion. In Canada, in 1997, three gold mines opened, 11 gold mines closed, with 42 primary gold mines in operation.

Source of gold production in Canada–1997

Primary gold mines (42 mines) ..... 90.4 percent of gold production

Base-metal mines ..... 7.2 percent of gold production as a by-product from base metal mining.

Placer operations ..... 2.1 percent of total Canadian gold production

Gold production is expected to decline to below 150 tonnes/year by the year 2000. Canadian gold fabrication demand in 1997 consisted of 33 tonnes, which mainly went into gold coin production, jewellery, electronics and dentistry. Since 1979, the Maple Leaf coin program at the Royal Canadian Mint has consumed 527 tonnes of gold, or 23.3 percent of total Canadian gold production.

Canadian silver production

In 1997, a total of 14,593.2 tonnes of silver was produced from mines operating worldwide in over 50 countries. Of this, Canada produced 1,218 tonnes.

In 1997, there were no primary silver mines operating in Canada. All silver was mined as a by-product of base-metal or gold mining. Ore reserve depletion and production cutbacks or closures in response to weak base metal prices contributed to a six-year decline in Canadian silver production which reached a 46-year low in 1994.

Canadian lead production

World mine production of lead decreased in 1997 by 2.3 percent to 2.9 million tonnes. In Canada, lead mine production decreased from 257,000 tonnes in 1996 to 184,000 tonnes in 1997. In 1996, Canada was the third largest mine producer of lead, but dropped to fourth in 1997.

One of the largest lead-zinc mines in the world, the Faro mine in the Yukon, closed in 1998. It had an annual capacity of 98,000 tonnes of lead in concentrate at full production.

Canadian zinc production

Canada's mine production of zinc in 1997 totalled 1,060,000 tonnes. This 13 percent decrease from 1996 was due to the closure of the Faro mine in the Yukon for most of the year. The world's mine production of zinc totalled 7,168,000 tonnes in 1997, a decrease of 2 percent from 1996. In 1997, Canada ranked second for zinc mine production. The global decline in world zinc production due to the closure of Faro was partially offset by production increases in Ireland, Spain and Peru.

Canadian copper production

In 1997, Canadian copper mine production (recoverable copper in concentrate plus SX-EW output) decreased to 657,500 tonnes from 688,400 tonnes in 1996. World mine production of copper was estimated at about 11.35 million tonnes in 1997, compared to 11.0 million tonnes in 1996. In 1997, Canada ranked third in copper production.

THE ECONOMY

The Canadian mineral industry is a moderately sized sector whose contribution to the Canadian economy has remained relatively constant since 1980. Mining is a high investment and high producing sector creating important foreign earnings for the Canadian economy. The high level of productivity in the mining sector is generated by the high level of investment in Canada by mining companies, very efficient mining technologies developed and used in Canada, and Canada's abundant mineral resources.

MINING AND THE GROSS DOMESTIC PRODUCT

The total Canadian Gross Domestic Product (GDP) reached $718 billion in 1998. The minerals and metals industry contributed $26.5 billion, or 3.7 percent of the total Canadian GDP, rising from $25.7 billion in 1997. The minerals and metals industry includes mining and concentrating, smelting and refining, and the manufacture of semi-fabricated and fabricated products.

MINING AND CANADIAN EMPLOYMENT

Mining is the primary source of employment in over 128 Canadian communities, mostly in rural and remote areas of Canada. In 1997, the minerals sector directly employed 367,232 Canadians. This figure includes all four stages of mining, as listed below. The breakdown of employees for 1998 (forecast)[7] is as follows:

Stage I ..... primary mineral production: 55,746

Stage II ..... metal production (smelting and refining): 59,588

Stage III ..... minerals and metals-based semi-fabricated industries: 94,134

Stage IV ..... metals fabricating industries: 157,764

Mining supply and service industries (oil wells, diamond drilling) 11,000

Employment in Stage I jobs (mining) dropped by 4.8 percent (2,664 jobs) in 1998, from 58,410 employees in 1997. This represents the lowest level of mining employment dating back to 1990[8].

Output of metal mines has increased by 28 percent since 1988[8], which has affected total mine employment. Technological advancement has enabled the mining and processing of previously uneconomic deposits by lowering production costs, using highly skilled workers and making use of robotics.

Average weekly earnings in the Canadian metal mining sector are $1165, one of the highest levels of any industry in Canada (Table 4).

MINING AND CANADIAN EXPORTS

Canada exports approximately 60 different mineral commodities to over 100 countries. Of Canada's total mineral production in 1998, 80 percent, valued at $45.17 billion, is destined for the export market. Overall, Canada's minerals and metals exports represent 14.5 percent of domestic exports and 6.5 percent of Canada's 1998 trade surplus.

The reduced demand for metals in 1998 resulted in an oversupply of metals, increased inventories and much lower prices.

The Canadian mining industry benefited from a low Canadian dollar in 1998, averaging US $0.67.

The United States is Canada's largest minerals and metals products trading partner, accounting for 75.1 percent of domestic mineral exports.

The top minerals and metals exports by value for 1998 were as follows:[9]

iron and steel ..... 21.3 percent
aluminium ..... 15.8 percent
gold ..... 7.5 percent
copper ..... 5.3 percent
coal and coke ..... 5.6 percent
nickel ..... 4.2 percent
potash and potassium ..... 4.4 percent
zinc ..... 3.4 percent
iron ore ..... 2.9 percent

Table 4
Average weekly earnings* (including overtime), logging, forestry, mining, oil wells and quarrying industries

	1994	1995	1996	1997	1998
ALL INDUSTRIES**	$568.27	$573.75	$586.06	$598.26	$606.32
LOGGING AND FORESTRY	733.88	735.30	768.63	793.12	767.91
Logging	766.01	767.38	792.45	804.07	776.98
Forestry services	657.15	655.86	707.66	763.72	745.89
MINING, OIL WELLS AND QUARRYING	960.83	991.43	1,039.08	1,057.61	1,111.82
Mining	972.67	1,013.75	1,051.24	1,036.86	1,101.80
Metal mines	1,018.75	1,067.15	1,109.27	1,084.60	1,165.36
Non-metal mines (except coal)	830.51	845.53	871.52	910.50	920.56
Coal mines	956.98	990.84	1,105.54	994.15	1,071.30
Crude petroleum and natural gas	1,165.58	1,202.52	1,243.35	1,252.89	1,297.23
Quarries and sand pits	669.64	724.13	746.72	781.99	845.45
Stone quarries	680.10	789.13	778.35	778.99	799.16
Sand and gravel pits	664.73	697.95	733.75	783.11	867.31
Services related to mineral extraction	833.42	825.26	894.44	973.83	1,022.65

*Excludes owners or partners of unincorporated business and professional practices, the self-employed, unpaid family workers, persons working outside of Canada, military personnel and casual workers for whom a T4 is not required.

**Excludes agriculture, fishing and trapping, private household services, religious organizations and the military.

Source: Statistics Canada, CANSIM, Matrix 4288

MINING AND CANADIAN BUSINESS

Minerals and mineral products accounted for 69 percent of the total volume handled at Canadian ports in 1997, and 55 percent of total rail revenues that freight generated for the Canadian railway system[10]. More than 600 domestic consulting services and equipment companies earn in excess of 30 percent of their revenues by supplying Canadian mining companies in more than 100 countries.

In 1997, Canadian metal mining companies spent $94 million on research and development. The total spending on research and development by the mineral and metal products sector was $346 million in 1997.

The indirect contribution of the mining sector to the Canadian GDP has been estimated at $615 million in goods and services for every $1 billion in output created by the mining, smelting and refining sectors[11]. The $615 million in indirect spending is a result of the multiplier effect.

Canada is the world leader when it comes to raising financing for mining projects. In 1997-1998, mining companies listed on Canadian stock exchanges raised over $8.8 billion in equity financing[12]. Many exploration companies may have no substantial revenues from mineral production and they rely entirely on the stock market to finance their exploration programs. Canadian expertise at raising risk capital from investors in Canada, US, Europe, Asia and elsewhere has facilitated the penetration by Canadian companies into more than 100 foreign jurisdictions. Investment and exploration by Canadian mining companies in foreign jurisdictions generates new opportunities for domestic equipment and technology manufacturers, as well as engineering, geological and environmental service industries.

MINERAL EXPLORATION SECTOR

Mineral exploration is a multi-stage process that usually proceeds over a relatively long period of time as information is gathered from geological mapping, geophysical and geochemical surveys, diamond drilling and so on. Exploration and development provide the means to sustain the industry's production capabilities. Remote sensing, satellite imagery and other advanced exploration techniques can indicate the existence of ore deposits, but the grade and extent of those deposits can only be determined by drilling and underground sampling. Exploration and new discoveries often lead to a much better understanding of how the ore deposit formed. A better understanding of ore deposit formation may ultimately lead to additional discoveries that were not considered remotely likely even a few years ago.

The mineral exploration industry as a whole is characterised by low success rates; anecdotal evidence suggests that only one out of every 1,000 mineral showings results in the discovery of economic grade mineralization. Once discovered, the mineralized zone has a 1-2 percent chance of developing into an economic deposit.[13]

The global mineral exploration industry has been affected by several factors, including:

- collapse of the price of gold and decline of other metal prices;
- financial crisis in Asia;
- strong lingering effect of Bre-X and other corporate mining scandals;
- investments based on unrealistic expectations of profit during the mid-1990s.

CANADA'S GLOBAL SHARE OF MINERAL EXPLORATION

The global nature of the mining industry has placed Canadian mining companies as leaders in exploration for minerals, both in Canada and internationally.

Canada's reported share of global exploration expenditures differs based on the source of statistical information. Natural Resources Canada uses official statistics for Canada, Australia and the best available data from other jurisdictions in order to calculate Canada's share of the global exploration market.

Canada was ranked first as a destination for mineral investment from worldwide sources by NRCan from 1981 to 1991. Since 1992, NRCan has ranked Canada second behind Australia in terms of exploration investment.

In 1998, exploration spending in Canada dropped drastically by $220 million to approximately $601 million or 26.7 percent from the 1997 level of $820 million.

The Metals Economics Group (MEG) of Halifax, Nova Scotia conducts a proprietary annual survey of worldwide mineral exploration expenditures. This estimate of worldwide mineral exploration expenditures is based on a survey of companies planning to spend more than US $2.9 million[14]. In 1998, it was estimated by MEG that these 182 companies accounted for 81 percent of the worldwide expenditures. MEG's estimate for exploration spending in 1998 totals US $3.5 billion, down from US $5.1 billion in 1997, and US $4.6 billion in 1996. The breakdown for 1998, by region, is as follows:

Latin America ..... 28.8 percent
Australia ..... 17.5 percent
Africa ..... 17.4 percent
Canada ..... 10.9 percent
Pacific/South East Asia ..... 9.4 percent
United States ..... 8.6 percent
Rest of the world ..... 7.4 percent

By country, the MEG survey shows Canada ranks second, after Australia, as a target for mineral exploration.

Australia ..... US $495 million
Canada ..... US $308 million
United States ..... US $242 million
Chile ..... US $177 million
Indonesia ..... US $136 million
Peru ..... US $136 million
Mexico ..... US $127 million
Brazil ..... US $122 million
Argentina ..... US $76 million
PNG ..... US $60 million
Tanzania ..... US $58 million
Ghana ..... US $49 million
Zambia ..... US $46 million
South Africa ..... US $45 million
Russia ..... US $29 million

Up until the 1990s, large senior mining companies dominated exploration spending worldwide. Starting in 1991, Canadian junior companies started the exodus out of Canada to work in Latin America, South America, Southeast Asia and Africa. Although the total actual exploration dollars spent by the Canadian junior mining sector has increased five-fold from 1991 (US $100 million in 59 countries) to 1997 (US $500 million in 95 countries), the percentage spent in Canada has declined from 60 percent in 1991 to 28 percent in 1997 (MEG data).

Natural Resources Canada also reports on this trend and notes that the budgets for the world's larger domestic-based and foreign-based companies allocated to exploration in Canada were down by about $45 million in 1997 compared to 1996.[15] Although the budgets of these companies for Canada have risen almost every year since 1991, the proportion of worldwide budgets allocated to Canada has fallen gradually from 18 percent in 1992 to 11 percent in 1997.

THE YUKON MINERAL INDUSTRY

The Yukon is underlain by a tremendous variety of rock types, resulting in a complex geology ideal for hosting many types of ore deposits.

Indeed, mining has been the single most significant industry in the Yukon since the discovery of gold in the Klondike in 1896. For most of the Yukon's short recorded history, the production of metals, from the copper nugget cartel ruled by the "Copper King" in pre-gold rush days, to the new heap leach Brewery Creek mine, has driven the Yukon economy.

A major factor in the growth of the Yukon mineral industry has been the proximity of an ice-free, deep water port at Skagway, Alaska. In addition, there is a well-developed network of over 4,700 kilometres of roads, and an airport at Whitehorse which handles daily jet traffic from Vancouver. Yukon infrastructure, including the location of the electrical power grid, is shown in Appendix 2.

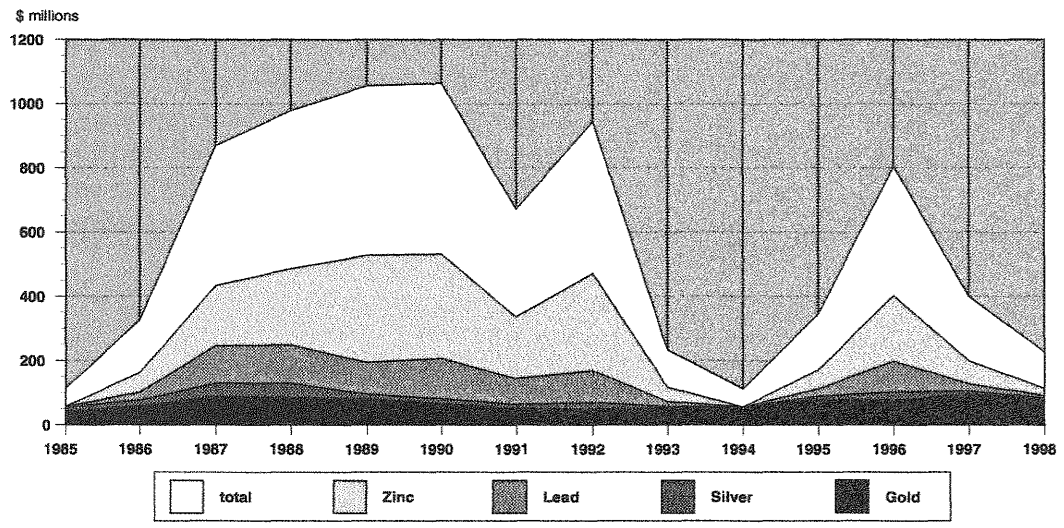
There are 2,535 known mineral occurrences in the Yukon[16]. Yukon mineral properties currently being mined, or in the stages of advanced exploration are shown in Appendix 3. Of the 2,535 known mineral occurrences, a total of 54 have been in production, ranging from two or three-person jade and hand-mined silver producers to larger, underground or open-pit mines. Since 1960, there have been 12 significant hardrock mines, involving mill and mine infrastructure construction in the Yukon (Table 5).

Table 5
Significant Yukon mines since 1960

Name	Opening, closing	Main commodity
Brewery Creek	1996-ongoing	gold
Cantung*	1962-1986	tungsten
Clinton Creek	1967-1978	asbestos
Faro	1969-1982 1986-1993 1995-1996 1997-1998	zinc, lead, silver
Ketza River	1988-1990	gold
Mt. Nansen	1967-1969 1975-1976 1997-1999	gold, silver
Mt. Skukum	1986-1988	gold, silver
Sa Dena Hes	1991-1992	zinc, lead
United Keno Hill	1921-1982 1983-1989	silver, lead, zinc
Venus	1906-1911 1970-1971 1980-1982	gold, silver
Wellgreen	1972-1973	nickel, copper
Whitehorse Copper	1967-1982	copper, silver, gold

* Cantung is in NWT, but was supplied from Yukon communities.

Figure 8
Value of mineral production in the Yukon, by metal



Source: Yukon Bureau of Statistics

As of June 1999, there is one hardrock mine operation in the Yukon, the Brewery Creek Gold Mine owned by Viceroy Resource Corporation. In addition, there are an estimated 161 placer mines and one industrial barite mineral mine near Ross River. Descriptions of these operations are given in *Yukon Exploration and Geology 1998,* available through Exploration and Geological Services, Department of Indian and Northern Development and *Mineral Property Update,* Mineral Resources Branch, Department of Economic Development.

YUKON MINERAL PRODUCTION, EXPLORATION AND MINE DEVELOPMENT

The amount and value of Yukon's mineral production is shown in Table 6. Figure 8 shows mineral production in the Yukon by metal. Table 3 lists the Yukon's share of world mine production of gold, silver, lead and zinc.

The lead-zinc mine at Faro, Yukon has been both the largest mineral producer and the largest single private sector employer for almost all of the 30 years since the

Table 6
Yukon mining facts

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Yukon mineral production OUTPUT											
Gold (thousands of kg -000s)	5	6	5	4	4	4	3	5	5	7	6
Silver (thousands of kg -000s)	159	71	84	87	124	30	1	35	113	38	15
Lead (thousands of kg -000s)	117,058	94,529	104,181	93,912	135,688	27,857	0	27,068	90,709	26,625	9,413
Zinc (thousands of kg -000s)	143,939	154,709	168,846	149,487	202,304	35,204	0	42,293	146,190	38,057	14,984
Yukon mineral production VALUE											
Gold (thousands of $ -000s)	87,386	82,070	66,731	51,573	49,898	52,795	56,406	81,239	76,791	98,150	79,767
Silver (thousands of $ -000s)	42,593	14,851	15,177	12,890	19,014	5,334	194	8,033	25,699	8,270	3,807
Lead (thousands of $ -000s)	118,696	98,310	12,704	79,825	99,595	14,597	0	23,414	95,516	23,004	7,323
Zinc (thousands of $ -000s)	237,932	332,934	325,366	191,194	303,051	43,688	0	59,844	204,374	71,163	22,566
Other (thousands of $ -000s)	225	31	3	4	0	1	0	0	66	0	0
Total (thousands of $ -000s)	486,607	528,165	419,978	335,482	471,558	116,414	56,600	172,530	402,380	200,587	113,463
Yukon mining industry share of total real Yukon gross domestic product (includes mining, quarrying and oil wells)	26%	22%	24%	21%	28%	10%	6%	11%	19%	12%	n/a
Mineral exploration expenditures ($millions)											
DIAND ($millions)	50	18	13	16	10	20	26	40	55	35	15
Natural Resources Canada	38.6	15.1	18.4	16.5	9.7	19.2	25.7	39.3	46.4	40.6	15.5
Yukon share of Canadian mineral exploration	3.3%	1.8%	2.4%	3.1%	2.5%	4.0%	4.1%	5.5%	5.2%	5.0%	2.6%
Mine development expenditures ($millions)	–	–	not available		–	–	11	57	54	23	6
Total crude ounces of placer gold	162,492	165,571	132,658	111,972	101,062	108,950	114,479	127,335	109,478	116,383	90,288
Placer gold production ($millions)	$69	$58	$46	$37	$34	$42	$48	$53	$46	$42	$31
Number of placer claims staked	2,355	2,022	1,440	1,163	868	1,037	1,357	1,126	908	709	781
Total placer claims in good standing			17,915	17,801	17,155	17,338	17,464	17,935	17,702	17,537	16,988
Number of quartz claims staked	10,290	4,642	6,122	4,766	4,147	5,032	10,378	14,275	22,685	9,692	5,148
Total quartz claims in good standing	52,977	48,342	45,240	42,989	43,756	40,973	45,030	56,969	71,504	72,723	66,287

mine opened in 1969. Most recently, the mine was operated by Anvil Range Mining Corporation, but declining metal prices pushed the mine into receivership in early 1998.

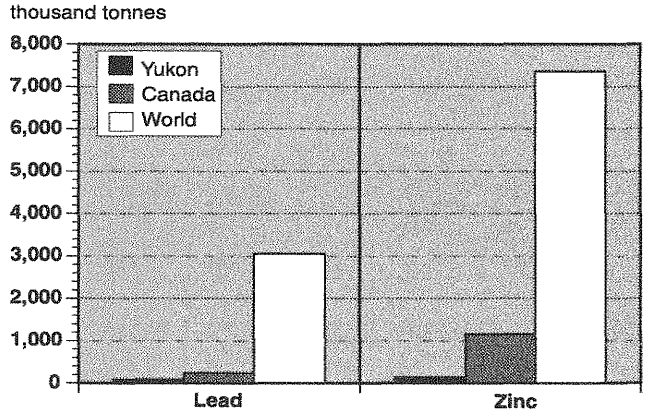
Faro mine facts

- One of the largest capacity lead-zinc operations in the world.
- Accounted for 2.1 percent of global zinc and 3.2 percent of global lead production in 1996 (according to International Lead and Zinc Study Group).
- The mine at Faro has historically accounted for 70 to 85 percent of the total annual value of the Yukon's mineral production.
- Direct contribution to the Yukon GDP, when at full capacity, is 12 to 15 percent.
- When at full capacity, the mine employs 600 workers.
- An additional 120 workers are employed in hauling the lead and zinc concentrate to the port in Skagway.
- An estimated 140 spin-off jobs are attributable to the Faro operation.

Although, since 1969 the Faro mine has been the largest mineral producer in the Yukon, Figure 8 shows that placer gold and hardrock gold mines have remained the foundation of Yukon's mineral production, consistently producing an estimated 3,000 to 7,000 kilograms of gold annually.

Total mineral production in the Yukon for 1998 generated a value of $113.5 million, down from production in 1997 which totalled $200.6 million.

Figure 9
Lead and zinc production, world, Canada and Yukon



Source: International Lead and Zinc Study Group

EXPLORATION AND MINE DEVELOPMENT

Exploration expenditures in the Yukon are monitored by Natural Resources Canada and by Exploration and Geological Services Division, Department of Indian Affairs and Northern Development (DIAND). The Natural Resources Canada figures are based on surveys sent to mining companies and include overhead costs (Table 6). The DIAND estimate is based on field visits and discussions with mining industry contacts.

According to Natural Resources Canada, Canada's total exploration in 1998 was $601 million, a 27 percent drop from 1997. Exploration spending is forecast at a six year low of $489 million for 1999, which represents a national drop of 19 percent from 1998.

The Yukon's share of Canadian exploration expenditures is estimated at 2.6 percent for 1998, a decrease from its 5.0 percent share in 1997. The Yukon's forecast share of Canadian exploration expenditures in 1999 is also estimated at 2.6 percent.

Quebec, Ontario and the Northwest Territories attracted the highest levels of exploration spending in 1998. Alberta was the only jurisdiction to experience an increase in spending in 1998. All other jurisdictions experienced a drop in exploration expenditures ranging from 2 percent in Saskatchewan to 62 percent in the Yukon.

Natural Resources Canada forecasts a further drop of 19 percent from 1998 to 1999 for Canadian exploration expenditures. The Yukon's percentage decrease for 1998-1999 is forecast at 19 percent, compared to the forecast drops for the Northwest Territories of 24 percent, 42 percent in Saskatchewan, 20 percent in Quebec and 28 percent in Newfoundland. Expenditures in Alberta are expected to drop 11 percent between 1998 and 1999. The only jurisdiction forecast to experience an increase in exploration spending in 1999 is British Columbia, forecast to increase by 2.4 percent.

The exploration spending data provided by Natural Resources Canada can be linked to major discoveries during the 1990s. The discovery of diamonds in the Northwest Territories in the early 1990s resulted in a spending peak of $195 million for exploration in that jurisdiction in 1996. Diamond exploration expenditures have declined in the Northwest Territories, but increased dramatically in Alberta in the mid and late 1990s due to diamond exploration.

The discovery of the massive Voisey's Bay nickel find in Newfoundland in 1995 had an effect not only on

Table 7
Mineral exploration expenditures in Canada and Alaska – 1993-1998 (Canadian $ millions)

	1993	1994	1995	1996	1997	1998	(forecast) 1999
Yukon (DIAND)	20.0	26.0	40.0	55.0	35.0	15.0	8.9
Yukon	19.2	25.7	39.3	46.4	40.6	15.5	12.6
Northwest Territories	100.7	149.5	172.1	194.5	150.7	112.9	86.3
British Columbia	66.0	85.0	79.4	104.9	95.8	49.4	50.6
Alberta	7.3	9.4	10.6	10.8	20.5	24.8	22.0
Saskatchewan	53.1	50.6	43.8	50.6	49.9	48.9	28.7
Manitoba	27.4	40.5	32.6	41.2	40.3	30.0	28.3
Ontario	75.6	113.0	129.7	194.9	176.5	124.3	105.4
Quebec	106.1	130.3	123.3	137.2	168.6	131.6	105.7
New Brunswick	11.1	10.0	12.7	14.8	12.2	8.6	7.4
Nova Scotia	1.8	1.7	3.0	6.9	6.7	5.7	5.5
Newfoundland	8.9	12.4	71.1	92.5	58.4	49.7	36.1
Canada	**477.3**	**628.1**	**717.6**	**894.8**	**820.2**	**601.1**	**488.6**
Alaska ($US)	30.3	31.1	34.3	44.6	57.8	56.4	

Source: Natural Resources Canada and Exploration and Geological Services, DIAND, Yukon

Table 8
Percentage by jurisdiction of total Canadian exploration – 1993-1998

	1993	1994	1995	1996	1997	1998	(forecast) 1999
Yukon	4.0%	4.1%	5.5%	5.2%	5.0%	2.6%	2.6%
Northwest Territories	21.1%	23.8%	24.0%	21.7%	18.4%	18.8%	17.7%
British Columbia	13.8%	13.5%	11.1%	11.7%	11.7%	8.2%	10.4%
Alberta	1.5%	1.5%	1.5%	1.2%	2.5%	4.1%	4.5%
Saskatchewan	11.1%	8.1%	6.1%	5.7%	6.1%	8.1%	5.9%
Manitoba	5.7%	6.4%	4.5%	4.6%	4.9%	5.0%	5.8%
Ontario	15.8%	18.0%	18.1%	21.8%	21.5%	20.7%	21.6%
Quebec	22.2%	20.7%	17.2%	15.3%	20.6%	21.9%	21.6%
New Brunswick	2.3%	1.6%	1.8%	1.7%	1.5%	1.4%	1.5%
Nova Scotia	0.4%	0.3%	0.4%	0.8%	0.8%	0.9%	1.1%
Newfoundland	1.9%	2.0%	9.9%	10.3%	7.1%	8.3%	7.4%

Source: Natural Resources Canada and Exploration and Geological Services, DIAND, Yukon

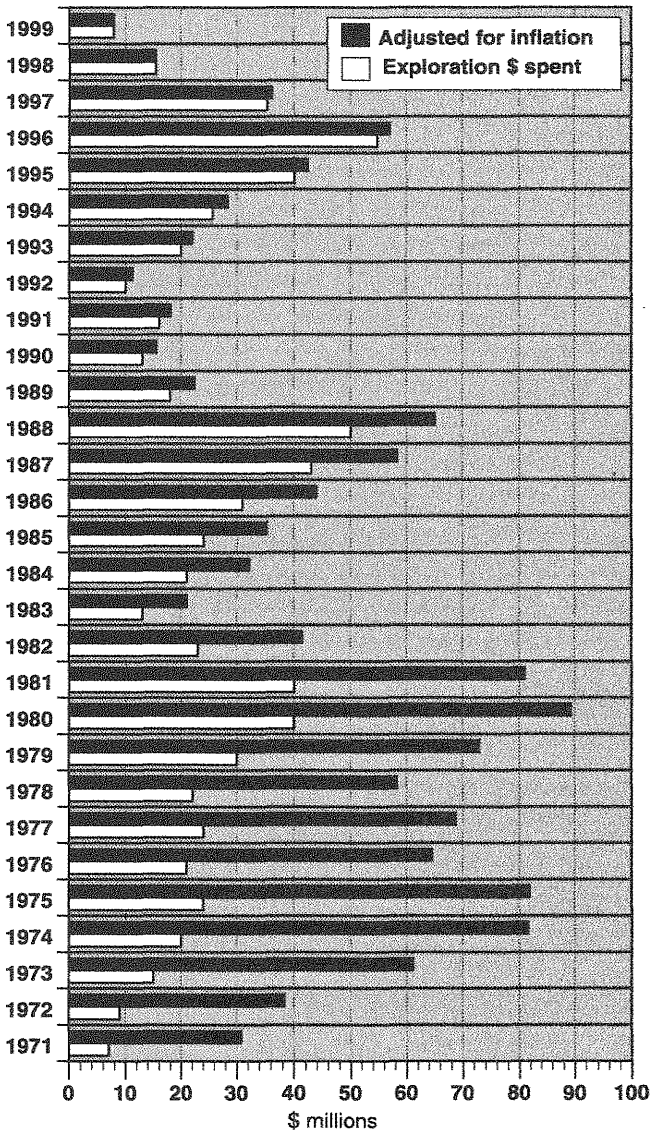
Table 9
Yearly percentage change in exploration expenditures by jurisdiction

	1993-94	1994-95	1995-96	1996-97	1997-98	(forecast) 1998-99
Yukon	33.9%	52.9%	18.1%	-12.5%	-61.8%	-18.7%
Northwest Territories	48.5%	15.1%	13.0%	-22.5%	-25.1%	-23.6%
British Columbia	28.8%	-6.6%	32.1%	-8.7%	-48.4%	2.4%
Alberta	28.8%	12.8%	1.9%	89.8%	21.0%	-11.3%
Saskatchewan	-4.7%	-13.4%	15.5%	-1.4%	-0.2%	-41.3%
Manitoba	47.8%	-19.5%	26.4%	-2.2%	-25.6%	-5.7%
Ontario	49.5%	14.8%	50.3%	-9.4%	-29.6%	-15.2%
Quebec	22.8%	-5.4%	11.3%	22.9%	-21.9%	-19.7%
New Brunswick	-9.9%	27.0%	16.5%	-17.6%	-29.5%	-14.0%
Nova Scotia	-5.6%	76.5%	130.0%	-2.9%	-14.9%	-3.5%
Newfoundland	39.3%	473.4%	30.1%	-36.9%	-14.9%	-27.4%
Canada	**31.6%**	**14.2%**	**24.7%**	**-8.3%**	**-26.7%**	**-18.7%**
Alaska ($US)	2.6%	10.3%	30.0%	29.6%	-2.4%	

Source: Natural Resources Canada and Exploration and Geological Services, DIAND, Yukon

expenditures in Newfoundland, but also in Ontario and Quebec, since spending in those provinces decreased while companies either explored for diamonds or participated in the Voisey's Bay exploration play. To some extent, the Yukon was insulated from the effects of diamond exploration and Voisey's Bay by the discovery of the lead-zinc-copper massive sulphide camp in the Finlayson Lake area. Record staking and subsequent exploration helped Yukon attract exploration capital during the mid 1990s.

Figure 10
Yukon exploration expenditures, 1971 to 1999



Source: DIAND, Exploration and Geological Services Division, except for 1999 forecast of $7.9 million (includes both exploration and development expenditures) is from the Yukon Chamber of Mines Survey of 1999 exploration spending.

Exploration expenditures in the Yukon for the period 1971 to 1999, as reported by DIAND, are shown in Figure 10.

Until 1994, senior mining companies accounted for most of the exploration dollars spent in the Yukon. By 1996, expenditures from junior companies doubled compared to senior companies. Junior mining companies, most based out of Vancouver, now account for over half of the exploration dollars spent in the Yukon.

Exploration expenditures in the Yukon for 1999 are forecast at $7.9 million, according to a survey carried out by the Yukon Chamber of Mines[17]. The figure represents a decrease in expenditures of approximately 49 percent from the 1998 actual expenditures of $15.4 million, as estimated by DIAND, and is considered to be an estimate only. The mining survey results indicate that approximately 95 percent of the estimated expenditures will be spent on exploration for precious metals.

MINES AND MINE DEVELOPMENT

There are currently a number of properties either in the environmental permitting process, awaiting an improvement in metal prices or in the advanced stages of mineral exploration. These properties are summarized in Appendix 4.

Mine development expenditures in the Yukon, listed in Table 6, have declined the last few years, with the completion of infrastructure at the Brewery Creek and Mount Nansen operations. Mine development expenditures totalling $6 million[18] in 1998 were incurred at Brewery Creek, Mount Nansen and in the development of the Minto copper-gold-silver project.

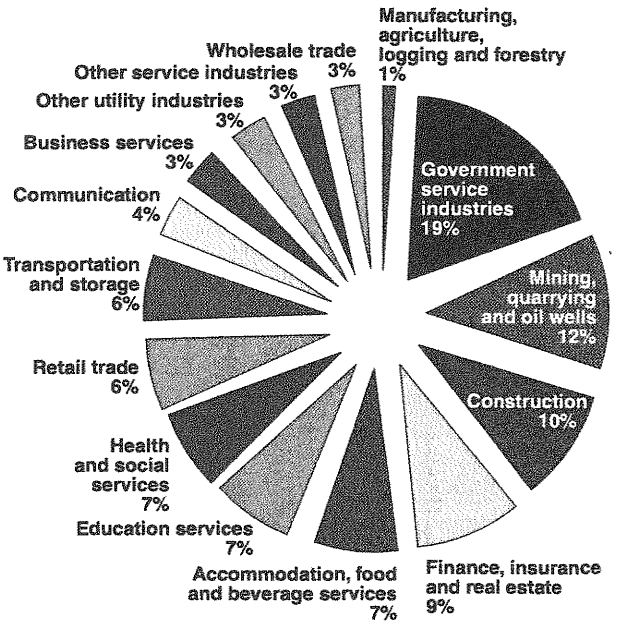
Diamond drilling and claim staking activity was down in 1998 from 1997 levels and is expected to decline further in 1999. In 1998, diamond drilling was down 80 percent from 1997 totals to approximately 20,000 metres. The number of quartz and placer claims staked, as shown in Table 6, decreased from 1997.

IMPORTANCE OF MINING TO THE YUKON ECONOMY

GROSS DOMESTIC PRODUCT

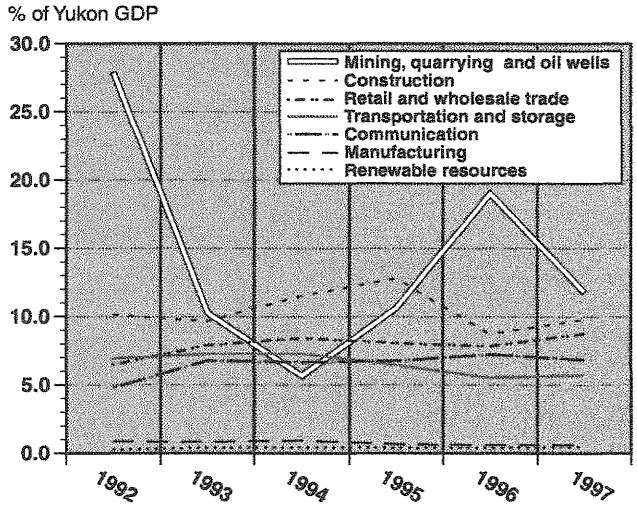
On a national scale, the Yukon has relatively little influence on the Canadian economy. The Yukon Gross Domestic Product (GDP) accounts for less than two-tenths of one percent of Canadian GDP.

Figure 11
Yukon Gross Domestic Product, by industry – 1997



Source: Yukon Bureau of Statistics

Figure 12
Business sector contributions to Yukon GDP – 1992-1997



Source: Statistics Canada, Cat. No. 15-203

The Yukon remains a small and specialized economy which is strongly dependent on mining. As a result, the Yukon's GDP is volatile and can fluctuate wildly depending on changes affecting the mining industry.

The chart in Figure 11 shows the significant influence of mining activity. Although there has been an increase in the size of government and increased economic diversification, mining activity remains the most important economic business sector.

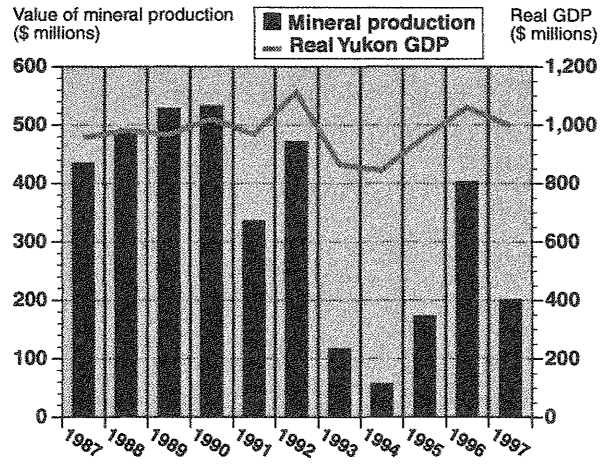
Total GDP of the Yukon

1999 (forecast) ..... $1,064 million
1998 (estimate) ..... $1,086 million
1997 ..... $1,131 million

The recent decrease in GDP is primarily a result of low mineral prices and the closure of the Faro mine, which resulted in an overall decrease in economic activity, as well as a decrease in the Yukon's population. When operating, the Faro mine was a major contributor to Yukon economic output, directly accounting for 12-15 percent of the GDP[19]. The effects of the Faro mine closure to the Yukon economy are substantial. The Faro mine closed in January, 1998, with resulting Yukon unemployment figures as high as 17.5 percent in April, 1998. In addition, an estimated 2,000 people have left the territory since the mine closure, pushing down house prices and increasing the vacancy rate.

Figure 13 shows the close relationship between mineral production and the Yukon GDP.

Figure 13
Yukon GDP and mineral production



Source: Yukon Bureau of Statistics

EMPLOYMENT IN THE YUKON MINING INDUSTRY

There are two sources of information regarding the number of people employed by the mining industry in the Yukon.

Census data from 1986, 1991 and 1996 includes information on the number of people employed in mining (Table 10). The data shows that 940 people indicated that they were employed in the mining industry in 1996. A total of 215 people indicated that they were employed in 1996 in service industries incidental to mineral extraction.

Occupational Health and Safety, Yukon Workers' Compensation Health and Safety Board prepares an annual summary of employment, production and accident statistics. The information is based solely on information compiled from workers' compensation forms and other, less quantitative survey methods and does not capture the full spectrum of direct mining industry employment (Table 11 and Figure 14). The data illustrates the effect of the Faro mine on employment, but also shows the employment benefit of having several smaller mines operating at the same time as Faro.

WAGES IN THE YUKON MINING INDUSTRY

The book, *Rock Solid,* (Dungan, 1996) presents statistical information on average wages for Canadian workers in the mining industry. On average, workers in the Canadian mining industry make 1.7 times the business sector average.

The report, "The Mining Industry in British Columbia – 1998," by PricewaterhouseCoopers, states that employees of the mining companies surveyed receive the following average salary and benefits per employee:

Average salary per employee	$65,100
Average benefits per employee	$12,700
Total salary and benefits per employee	$77,800

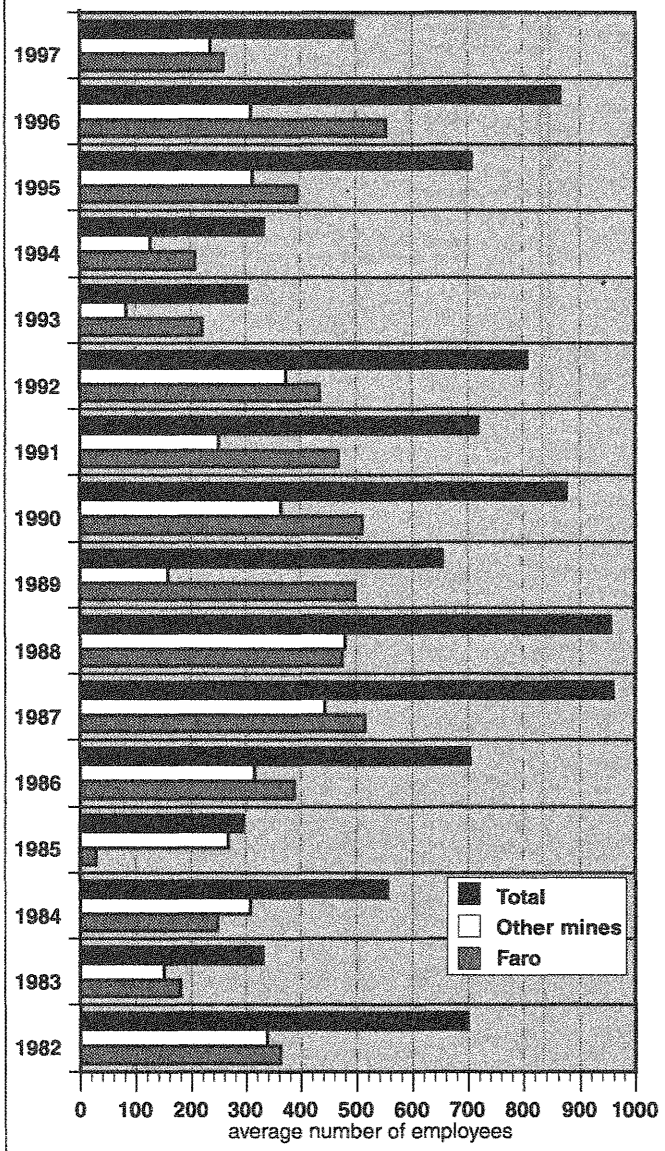
Benefits may include medical, dental and life insurance, company pension plan, holiday and vacation pay, Workers' Compensation, Canada Pension Plan, and unemployment insurance.

Table 10
Yukon employment in mining – Census

Mining (including milling), quarrying and oil well industries	1996	1991	1986
Total employment	1,180	990	915
Mining industries	940	805	730
Crude petroleum and natural gas industries	0	20	25
Quarry and sand pit industries	20	20	0
Service industries incidental to mineral extraction	215	140	155

Source: Statistics Canada, Labour Force 15 years and over by industry division and major groups for 1996, 1991 and 1986 censuses, 20 percent sample data

Figure 14
Employment in the mining industry at hardrock mines



Source: Occupational Health and Safety, Yukon Workers' Compensation, Health and Safety Board

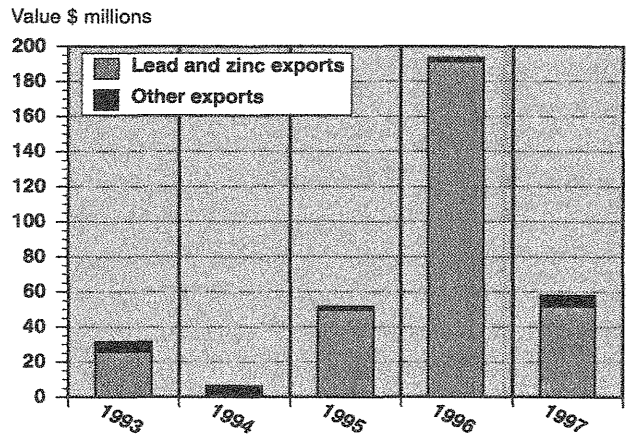
According to census data collected by Statistics Canada, the average employment income in the Yukon for all mining, quarrying and oil well workers was $33,395 in 1995. The average full-time and full-year worker wage in 1995 for workers in the Yukon mining, quarrying and oil well industries was $47,229.

YUKON WORLD EXPORTS

With the exception of 1994, when the Faro mine was closed, zinc and lead accounted for at least 80 percent of all Yukon exports during the period 1993-1997. Data for 1996 shows zinc and lead comprising 99 percent of all internationally exported products from the Yukon, with a combined value of $191 million. Figure 15 shows the value of Yukon lead and zinc exports from 1993 to 1997. The next closest export in 1996 was petroleum and natural gas with a total export value of $194,000.

After 1997, with the partial closure of the Faro mine, the value of the Yukon's top two world exports, lead and zinc ores, dropped dramatically, thus leading to a huge decrease in the total value of goods exported from the territory to other countries. The combined value of lead and zinc international exports dropped by 73 percent in 1997.

Figure 15
Yukon lead and zinc exports, 1993-1997



Source: Industry Canada, Trade Data On-line (http://strategis.ie.gc.ea)

While the value of exported lead and zinc plummeted after the mine closure, the value of other exports has increased due to a redistribution of resources such as capital, labour and time that would otherwise have

Table 11
Employment in the Yukon mining industry

	HARDROCK					PLACER			TOTAL	
	FARO number employed	OTHER MINES number employed	Total number employed	Total number hours	Total number person years	Total number employed	Total number hours	Total number person years	Total number hours	Total number person years
1982	361	337	698	1,321,945	635.6	650	975,000	468.8	2,296,945	1,104.3
1983	180	150	330	588,546	283.0	769	1,153,500	554.6	1,742,046	837.5
1984	247	307	554	871,900	419.2	707	1,060,500	509.9	1,932,400	929.0
1985	28	267	295	528,000	253.8	700	1,050,000	504.8	1,578,000	758.7
1986	388	315	703	1,591,700	765.2	722	1,083,000	520.7	2,674,700	1,285.9
1987	515	443	958	2,108,840	1,013.9	744	1,116,000	536.5	3,224,840	1,550.4
1988	475	480	955	1,938,500	932.0	725	1,087,500	522.8	3,026,000	1,454.8
1989	497	157	654	1,447,460	695.9	725	1,087,500	522.8	2,534,960	1,218.7
1990	510	365	875	1,677,710	806.6	675	1,012,500	486.8	2,690,210	1,293.4
1991	468	250	718	1,635,730	786.4	675	1,012,500	486.8	2,648,230	1,273.2
1992	434	374	808	1,729,520	831.5	650	975,000	468.8	2,704,520	1,300.3
1993	220	82	302	304,230	146.3	650	975,000	468.8	1,279,230	615.0
1994	207	126	333	224,270	107.8	675	1,012,000	486.5	1,236,270	594.4
1995	394	312	706	1,412,170	678.9	700	1,050,000	504.8	2,462,170	1,183.7
1996*	553	310	863	1,895,910	911,5	333	466,730	224.4	2,362,640	1,135.9
1997*	259	235	494	1,016,640	488.8	324	465,410	223.8	1,482,050	712.5

**Note: 1996-1997 saw a change in methodology in the measurement of placer mining employment. The current system is now based on computerized WCB numbers which do not include workers who do not pay premiums to the corporation – namely self-employed miners.*

Source: Yukon Mining Industry. Summary of Employment, Production, and Accident Statistics 1982-1997: INAC

become unused or idle. Table 12 lists the top 20 Yukon exports from 1994-1998.

With the shutdown of the Faro mine in early 1998 and lack of lead and zinc exports, barium sulphate is now the top Yukon world export. Natural barium sulphate, known as barite, is mined in the Ross River area by H. Coyne & Sons Limited and exported into Alaska as a drilling mud. This Yukon export's closest competitor is in Nevada, making transportation costs a competitive advantage.

It should be noted that gold is not listed as an export because Yukon gold is a domestic, rather than an international, export sent to other Canadian provinces before being exported internationally.

INDIRECT BENEFITS

There is little up-to-date statistical information regarding spin-off benefits, such as indirect spending and employment generated by the Yukon mining industry.

Reliable data on which to base estimates of the indirect impact of mining has not been collected since 1990. However, Statistics Canada is planning to release 1996 input-output data by the end of 1999.

Yukon Mining Incentives Program information

Since 1986, the Yukon Mining Incentives Program (YMIP), funded through Department of Economic Development, Yukon government, has helped provide some of the risk capital for prospecting and initial target evaluation exploration projects.

Prior to 1993, there were two separate programs, Prospectors Assistance Program (PAP) and Exploration Incentives Program (EIP). In 1993, they were combined into YMIP. Clients receiving funding under YMIP spend a total of 80 percent of their exploration budgets on Yukon-based goods and services.

Table 12
Yukon top 20 world exports, 1993-1998, percentage of total value

Good	1994	1995	1996	1997	1998
Lead ores and concentrates	–	42.97%	44.15%	45.74%	–
Zinc ores and concentrates	–	53.58%	54.75%	43.25%	–
Natural barium sulphate	–	–	–	0.88%	47.42%
Lumber (>6mm)	1.73%	0.20%	0.08%	2.58%	21.29%
Animal parts (not fit for human consumption)	–	0.20%	0.08%	0.15%	3.56%
Liquefied petroleum or hydrocarbon gases	3.25%	0.40%	0.10%	0.24%	3.15%
Cases, boxes and crates	–	0.01%	–	–	2.58%
Doors, windows and frames	5.65%	0.47%	0.07%	0.25%	2.15%
Low value transactions and confidential com.	1.27%	0.11%	0.05%	0.13%	2.08%
Original sculptures	0.05%	0.01%	0.00%	0.01%	1.87%
Non-monetary gold	–	0.00%	0.02%	0.19%	1.68%
Scientific collectors pieces	0.42%	0.23%	0.05%	0.10%	1.39%
Lifting and handling machinery	–	–	–	–	1.29%
Oxygen	–	–	–	0.00%	1.14%
Transmission and reception apparatus	–	–	0.05%	–	0.93%
Motor vehicles (>3000cc)	0.32%	–	–	–	0.91%
Prefabricated buildings	0.47%	–	–	0.03%	0.89%
Survey or geophysical equipment and like	0.03%	–	–	–	0.67%
Laminated beams % prefab partitions (wood)	0.19%	0.05%	0.02%	0.05%	0.57%
Printed books, brochures and booklets	–	0.01%	–	0.02%	0.56%
Phosphates	–	–	–	–	0.42%
Beer	–	–	–	0.01%	0.38%
Derivatives of acyclic hydrocarbons	–	–	–	–	0.37%

Yukon Mining Incentive Program facts[20]

Total amount of YMIP funding, 1993-1998	$2,878,560
Total amount spent on exploration by YMIP clients, 1993-1998	$6,572,648
Total amount of YMIP exploration budget spent on local goods and services, 1993-1998	$5,230,129
Percentage of YMIP exploration budget spent on local goods and services, 1993-1998	79.6 percent
Total number of mineral claims staked under the YMIP program	4,334 claims
Precious metal properties found or re-evaluated under YMIP	Wayne, Sprague/Sun, Horn, Drag, May, Nug, Poker Creek, Killerman Lake, Seattle Creek
Base metal properties found or re-evaluated under YMIP	Maui, Bigtop, Taiga, Monster, Mars, Java, AZ
Gemstone properties found or re-evaluated under the YMIP	Arctic Jade

In 1994, the Department of Economic Development, together with the Dawson City Chamber of Commerce and the Klondike Placer Miners Association developed an Economic Profile for the Dawson City area in order to gain an understanding of the relative contribution of the key sectors to the local economy[21]. The modern economy of Dawson City revolves around seasonal placer mining and tourism activities. The study showed, on a local scale, the importance of placer mining to the economy of Dawson City.

- The incomes earned by miners are much higher than those earned by service sector employees.
- Mining is a capital intensive industry that uses more expensive inputs to production than are used in service based or government activities.
- Placer mining payroll and the amount of purchases made from within the community are well in excess of those made in any other sector, since it is uneconomic for mining operations to go outside the Dawson City area for purchases of fuel, parts and equipment servicing.
- Placer mining provides the most employment in the Dawson City area.

MINING TRENDS IN THE YUKON

Mining, as with most industries, is dynamic and changes with social and economic trends. These changes affect the way actual physical mining is conducted, the support infrastructure around the mine and the feasibility and economics of mining certain deposits. In the last 30 years, there has been a move to mechanized and large scale mining, the introduction of heap leach and solvent extraction technologies and a departure from construction of mine townsites.

POTENTIAL FOR NEW DISCOVERIES

The Yukon still has potential for the discovery of near-surface world class mineral deposits (MacKenzie, 1988). The recent success at Kudz Ze Kayah and subsequent successes in the Finlayson Lake camp confirm this; however, in recent years, overall new discoveries are on the decline.

The relationship between exploration expenditures and discoveries is shown in Figure 16. Between 1960 and 1985, there is a broad correlation between dollars spent and discoveries of mineral showings. The large expenditure peak in the early 1980s can be attributed to very high world metal prices at this time.

From 1984 to 1990, a federal tax incentive program to increase the flow-through share allowance caused large amounts of money to be spent in the Yukon. Although the program helped generate mineral exploration expenditures, the design of the program was such that it put constraints on the expenditure of funds to support exploration programs. This resulted in exploration work which was not always planned in advance and the ability for follow-up was at times restricted.

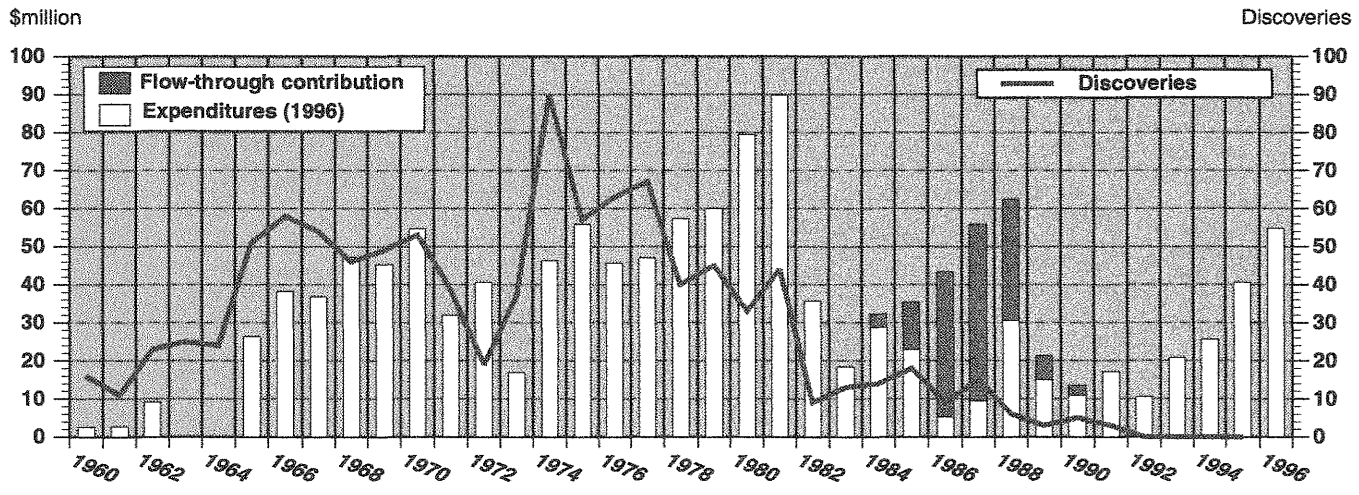
MINING TECHNOLOGY

Mining has become increasingly efficient, and new technologies have made lower grade deposits economically viable. General process efficiency and streamlining have made large volume mining viable in short time periods. These trends are reflected in the commodity prices; the prices in general show consistent downward trends. This is not due to reduction in value, but reflects the competitive nature of mining commodities at consistently lower prices.

BULK MINING

This type of mining refers to the processing of large tonnage of ore, typically using large ore trucks in combination with shovels or loaders. In the Yukon, a specific example of this technology is the development of low grade, high tonnage heap leach operations at Brewery Creek. In this case, very large scale bulk mining

Figure 16
Yukon mineral exploration expenditures and mineral discoveries



Source: Discovery rate complied from Abbot 1993, unpublished
Exploration expenditures compiled from Yukon Exploration and Geology 1960 to 1996, EGSD

is required to make the low grade deposit viable. After the first year of heap leach operation, Brewery Creek has proven this technology to be successful in the Yukon.

CYANIDE HEAP LEACH AND SOLVENT EXTRACTION

A significant technological development is cyanide heap leach and solvent extraction technologies. These two processes are different, but both basically consist of the application of an acidic fluid to large volumes of mined rock to extract metal.

This process reduces capital costs significantly and reduces operating costs and results in making mining of low grade deposits economically feasible. This technology has lower power requirements since only primary crushing is required, as opposed to a full scale crushing, grinding and extraction circuit. For example, the Brewery Creek project requires only 3 MW of power where if mined by conventional methods would require at least 11 MW. At the Dublin Gulch property, using waste heat from an on-site diesel electric plant or from an auxiliary fuelled furnace to heat the solution is possible.

As demonstrated at Brewery Creek, this technology works very well when combined with bulk mining methods, as large volumes of rock can be mined and processed, at a marginal cost.

The solvent extraction method used for extraction of copper has somewhat higher power demands since copper is liberated from the pregnant solution by electrowinning. Yet, this power demand is still lower than that of conventional milling. For example, a feasibility study for the Carmacks copper deposit, using solvent extraction, calls for an electrical demand of 7.2 MW where conventional milling of this deposit would require power on the order of 13 MW.

MINE INFRASTRUCTURE

The most significant change in mine infrastructure is the abandonment of the mine town. Mine operations have almost totally switched to the use of on-site camps, with workers staying at the camp during work rotations, and then returning to their home towns for the furlough rotation.

All modern mines in the Yukon and Alaska have used this model. The construction of a complete town site now is too high a cost and liability, especially in light of shorter mine project lives.

Compliance with Impact and Benefits Agreements, Local Hire, and First Nation hiring policies, makes it more likely that mine workers will be increasingly staying in the neighbouring community.

MINING AND THE ENVIRONMENT

Many mining companies have changed their operations because of increased environmental awareness and improved technology. At the exploration stage, improvements include larger helicopters and smaller diamond drilling equipment, negating the creation of new access roads into properties. Mining development operations include plans that respect habitat and migration requirements of wildlife and technology that encourages energy efficiency and reduction of releases to air and water. Ideally, mine closures are captured within well-developed reclamation plans designed to return mine sites to viable and, wherever practicable, self-sustaining ecosystems.

MINING TAXATION

Canada has a long tradition of providing special income tax rules to foster investment in mineral exploration and development. However, these federal rules have become less generous, especially after the tax reforms of 1972 and 1987.

Canadian provinces have the right to control and manage mineral resources, and impose taxes or royalties for minerals extracted. Provincial and territorial governments use fiscal measures, through their income tax or mining tax regimes, to assist the mineral industry in manners that meets their particular goals.

There is a "three-tier" system in place to tax Canadian mining operations.

1. Federal income tax: based on taxable income. Taxable income is the total income of the taxpayer less allowable deductions and exemptions.
2. Provincial/territorial income tax: based on the same taxable income as the federal tax.
2. Provincial/territorial mining taxes, royalties or duties: levied against production profits or revenues.

Specific taxes and royalties for the mining sector are under the jurisdiction of the federal government. The Yukon government levies its own corporate income tax, which applies to all companies.

FEDERAL INCOME TAX

The federal government imposes a federal corporate income tax on mining operations. The net federal corporate income tax rate is 29.12 percent.

Taxpayers involved in mining exploration and development are eligible to claim federal taxation provisions. These federal provisions are provided in Appendix 5 and include Resource Allowance, Canadian Exploration Expenses (CEE), Canadian Development Expenses (CDE), Flow-Through Shares, Foreign Exploration and Development Expense (FEDE), Capital Cost Allowance (CCA), Accelerated Capital Cost Allowance and deductions for Mine Reclamation Funds.

YUKON INCOME TAX

The Yukon Territory levies its own corporate income tax rate which generally applies to mining operations. The Yukon's corporate tax rate is 15 percent for large businesses and 6 percent for small business. The tax is levied against the portion of taxable income of a corporation allocated to the Yukon.

YUKON MINING ROYALTIES

Mining royalties for Yukon mining operations are under the jurisdiction of the federal government. A mine operator in the Yukon is required to pay a mining royalty to the Government of Canada since the Yukon does not have administrative or constitutional authority in the area of mineral resources.

Table 13
Federal and provincial/territorial corporate income tax rates

1992		1998	
Federal corporate net tax rate	**28%**	**Federal corporate net tax rate**	**29.12%**
Provincial/territorial corporate income tax rate		**Provincial/territorial corporate income tax rate**	
Quebec	8.9%	Quebec	8.9%
Yukon	10.0%	Ontario	13.5%
Northwest Territories	12.0%	Northwest Territories, Newfoundland	14%
Ontario	14.5%	Yukon	15%
Nova Scotia	15.0%	Alberta	15.5%
Alberta	15.5%	Nova Scotia	16%
British Columbia, New Brunswick	16.0%	British Columbia	16.5%
Newfoundland, Saskatchewan, Manitoba	17.0%	New Brunswick, Saskatchewan, Manitoba	17.0%

Yukon metal mine operators with mine output valued at more than $10,000 in a calendar year pay a graduated rate of tax on "net profit." The annual royalty is computed as follows:

1. The tax rate applied to the annual net profit in excess of $10,000 and up to $1 million is 3 percent;
2. On the excess above $1 million and up to $5 million, the tax rate is 5 percent;
3. On the excess above $5 million and up to $10, the tax rate is 6 percent; and
4. On the excess above $10 million, a proportional increase in the tax rate for each additional $5 million is applied.

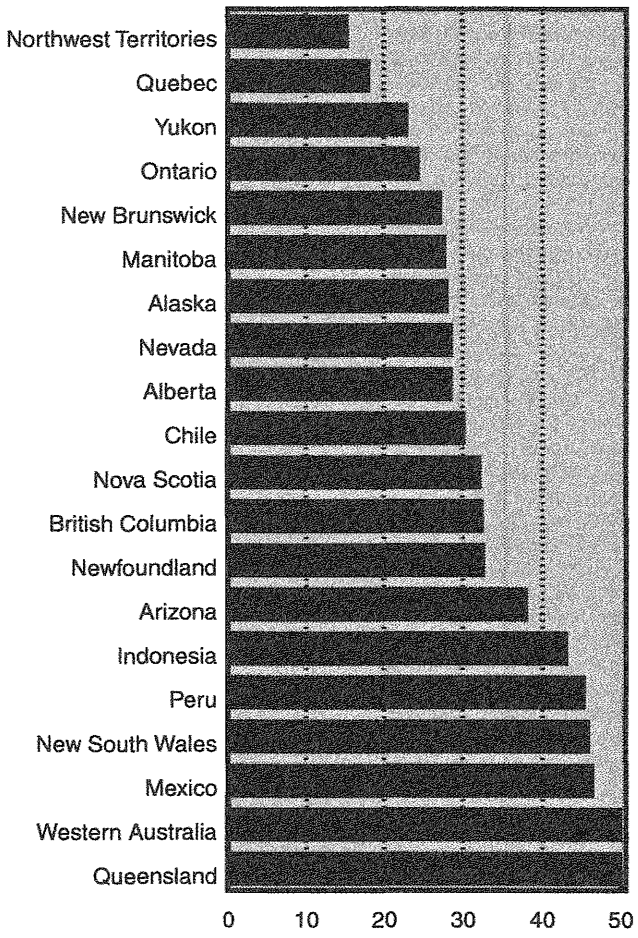
Table 14
Provincial and territorial metal mining taxation or royalty rates

Province/territory	Mining tax rate
Yukon, Northwest Territories	No royalty under $10,000 $10K to $1M – 3% $1M to $5M – 5% $5M to $10M – 6% Each additional $5M, 1% up to maximum of 12%
British Columbia	2% on net current proceeds, plus 13% on cumulative net revenue
Alberta	Greater of 1% of mine mouth revenue or 12% of net profits after full cost recovery
Saskatchewan	12.5%
Manitoba	20%
Ontario	20%
Quebec	12%
New Brunswick	2% on net revenue plus 16% on net profit in excess of $100,000
Nova Scotia	Greater of 2% net smelter return or 15% of net income
Newfoundland	Mine profit is subject to 15% tax. Additional deductions are available.

Gold royalty

Yukon placer gold producers are required to pay a royalty on all gold exported from the territory. Similar to the mining royalty, the gold royalty is paid to the federal government. The royalty is computed at the rate of 2.5 percent of the value of the gold as fixed by the Governor in Council. The value of gold has been fixed at $15 per ounce since early this century. As a result, the current gold royalty is $0.375 per ounce of exported gold.

Figure 17
Average effective tax rates for base-metal operations (10 percent internal rate of return)



Note: Natural Resources Canada uses a model that calculates tax payments that would be incurred by a typical mine during its entire life. This model includes federal and provincial corporate income taxes, the large corporations tax, as well as mining taxes and royalties.

Source: 1997 data provided by Natural Resources Canada. Brewer, Bergevin and Arseneau (1997). Brewer, Bergevin and Kitts (1993). From Mintz Report on Business Taxation

COMPARISON OF MINING TAXATION REGIMES

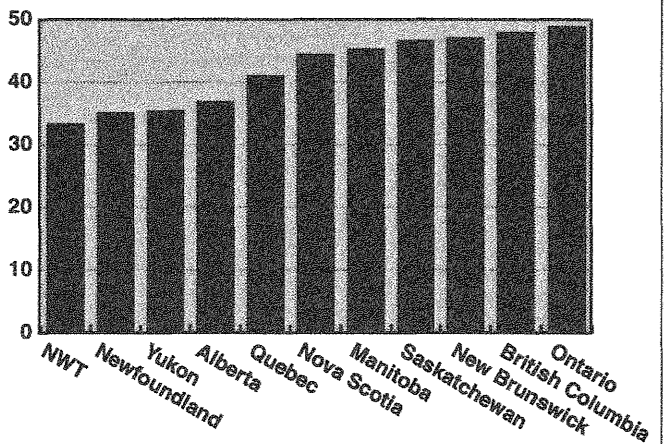
Provincial and territorial mining tax and royalty regimes vary wildly. It is difficult to compare between jurisdictions the effects of special provisions such as accelerated write-offs, deferred tax payments, tax holidays, super write-offs and other incentives.

One way to compare the effectiveness of a jurisdiction's mining taxation regime is to create a hypothetical mine, and then compare, across jurisdictions, the taxation burden on the hypothetical mining operation for a set period of time. The average effective tax rate for base metal operations with a 10 percent pre-tax inflation-adjusted internal rate of return on capital in various jurisdictions was studied by Natural Resources Canada and presented in the Mintz Report on Business Taxation (Figure 17).

Figure 18 shows the calculated total effect of federal and provincial income tax, capital tax and mining tax burden for a hypothetical Canadian gold mining operation. This figure is based on a model presented in the book, *Canadian Mining Taxation*, and takes into account recent changes to provincial and territorial mining taxation regimes.

The results show that the Yukon rates as third lowest in Canada for mining taxation burden on a hypothetical gold mining operation (Figure 18). When the mine model takes into account tax regime changes and the effects of the Yukon Mineral Exploration Tax Credit, the Yukon is second lowest[22].

Figure 18
Ranking of tax burden by jurisdiction on hypothetical gold mining operation



Source: Modified from Canadian Mining Taxation, by Price Waterhouse 1997

THE YUKON GEOLOGY PROGRAM AND THE MINING INDUSTRY

Geoscience knowledge is the foundation upon which the mineral industry plans and conducts its exploration activities. It is a key advantage in attracting investment in the increasingly competitive global mineral exploration market.

Geoscience knowledge is developed over many years through a partnership among government, industry and universities. Government geological surveys provide objective geoscience information in the form of data, maps and reports. They maintain a resident pool of knowledge gained by an expert staff over many years of work. The mining industry contributes exploration data from its drilling, mapping, geophysical and laboratory activities.

The Yukon government supports the Yukon Geology Program in partnership with the geoscience staff at Department of Indian and Northern Affairs (DIAND).

The mandate of the Yukon Geology Program is to promote sustainable mineral resource development and management in the Yukon Territory through the development of a modern geoscience database.

The staff of the Yukon Geology Program carry out regional bedrock mapping projects, mineral deposit studies, placer deposit studies, mineral assessments, and geochemical, geophysical and environmental studies. The program is assisted by other government agencies, including the Geological Survey of Canada, Canadian universities and industry partners.

IMPORTANCE OF GEOLOGICAL MAPS

Geological maps are the primary geoscience information source for nearly all land-based investigations. Geoscience information portrayed on such maps is vital in the search for new mineral resources. It is instrumental in rationalizing new mineral exploration programs and in selecting and narrowing potential exploration targets.

These maps also play an important role as a basis of decision making in other areas such as land evaluation and planning, hazard awareness and local tourism.

PRESENT GEOLOGICAL MAP COVERAGE OF THE YUKON

Geological mapping must strike a balance between the degree of detail versus the aerial extent of map coverage desired. Coverage of larger areas (regional or 1:250,000 scale mapping) allows resolution of broad scale geologic problems and establishes regional continuity of geologic entities. Industry uses regional scale maps and data in the initial phases of an exploration program to select broad target areas.

Mapping of a smaller area in relative detail (detailed or 1:50,000 scale mapping) serves to resolve more specific geologic problems and to more narrowly and precisely define geologic units. This more detailed information is required by industry as it focuses its investigations on smaller and smaller areas.

To maintain and upgrade the geoscience information base at a timely rate both scales of investigation are critical.

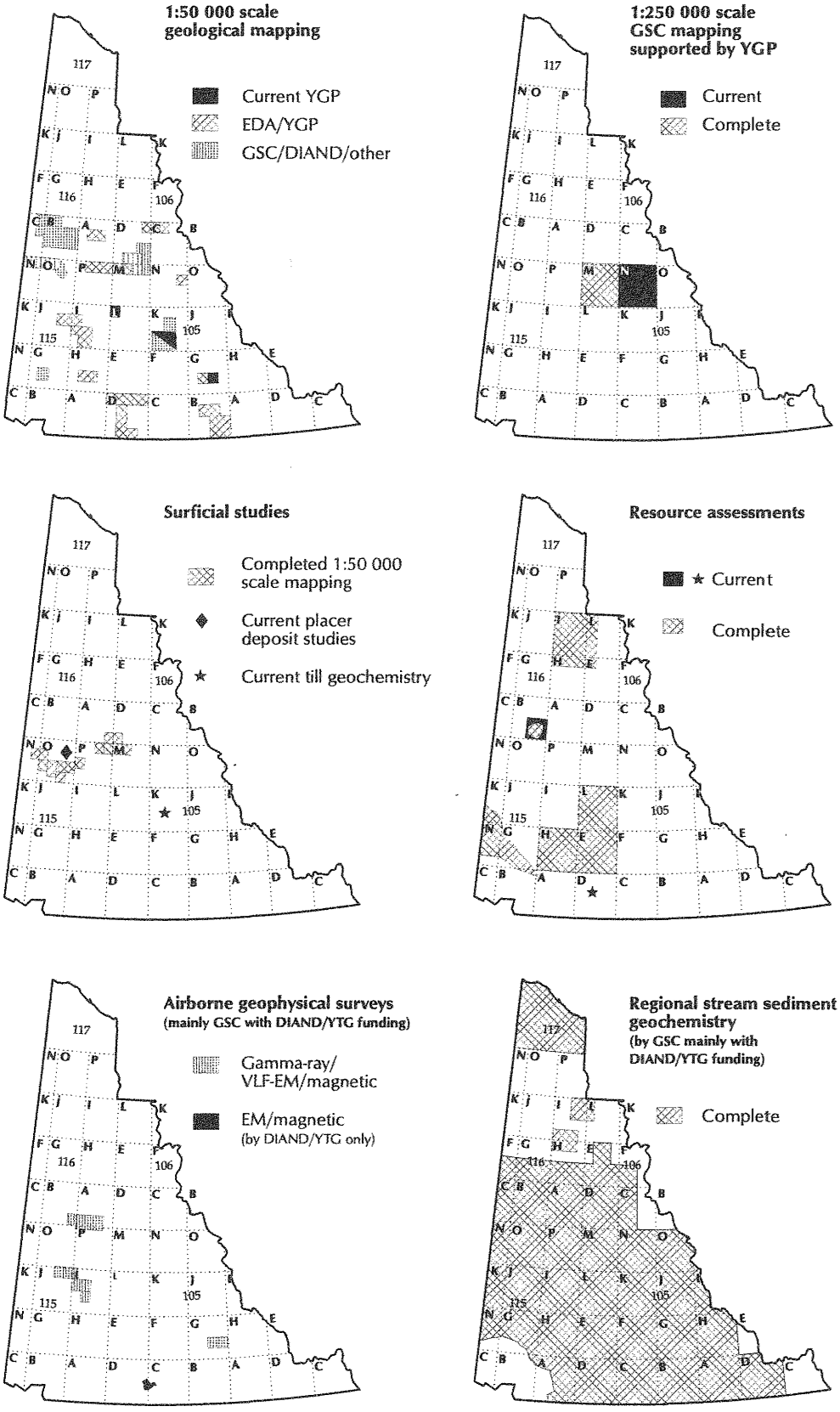
Regional or 1:250,000 scale mapping

All of the Yukon has been mapped at 1:250,000 scale by the Geological Survey of Canada (GSC). Figure 19 illustrates the extent of regional scale mapping in the Yukon. A geologic map has a life of 20 to 30 years. Using an average 25 year map life, 26 percent of the Yukon's regional maps are currently out of date.

Detailed or 1:50,000 scale mapping

In contrast to regional scale mapping coverage, only 11 percent of the Yukon has been mapped at 1:50,000 scale (78 of 712 maps). Figure 19 shows the extent of 1:50,000 scale mapping in Yukon.

Figure 19
Extent of regional scale mapping in the Yukon



Source: Yukon Geology Program

SURFICIAL GEOLOGY MAPPING

Surficial geology mapping has been carried out in the Yukon for as long as geological subsurface mapping. Placer geological mapping carried out by R.G. McConnell at the time of the goldrush has been invaluable to gold miners in the Klondike region. Subsequent work on glaciation by H.S. Bostock established four events of glacial deposition throughout Yukon. Reconstruction of ice limits and paleo ice-flow directions were compiled for Yukon in the 1960s.

Surficial geology mapping is tied into economic demands; for instance, the proposed Alaska Highway gas pipeline stimulated reconnaissance coverage of eight 1:250,000 map sheets. Surficial geology studies in the northern Yukon were carried out at a slower pace and are therefore of generally higher quality.

Surficial geology studies include regional terrain inventories, placer potential mapping, and till geochemistry.

- Terrain inventory mapping is essential for evaluating impact and determining the least hazardous routes for pipeline roads and structure locations.
- Placer potential mapping is a new type of multidisciplinary investigation aimed at evaluation of placer potential in frontier placer districts. Surficial geology is often regarded as a supporting activity to aid prospecting and development in remote areas (e.g. aggregate for road building and identifying permafrost and landslide hazards). Figure 19 shows the extent of surficial geology studies in the Yukon.

REGIONAL GEOCHEMISTRY AND GEOPHYSICS

Regional geochemical and geophysical surveys are recognized as fundamental geoscientific tools which:

- provide relatively inexpensive baseline data over large areas, for a wide range of end users (mappers, explorationists, environmentalists, planners, policy-makers);
- assist exploration by identification of geochemical and geophysical anomalies;
- improve 1:250,000 and 1:50,000 scale geological mapping;
- identify large (crustal scale) geological features;
- map cryptic lithological features not easily recognizable by geological mapping; and
- yield regionally coherent, quantitative digital databases with very long shelf lives.

Coverage of regional stream sediment geochemistry and airborne geophysical surveys is shown on Figure A. Most of the Yukon has been covered by regional geochemical surveys. Re-analysis of existing samples for elements like bismuth or tin is being carried out locally.

Most of the Yukon has been covered by aeromagnetic surveys; other, more focused surveys have taken place over mineralized districts. Figure A shows coverage of the more detailed geophysical surveys.

MINERAL DEPOSIT STUDIES

Mineral deposit studies, broad metallogenic studies and comparative studies are useful in areas of emerging interest to the mining industry and established mineralized districts.

The Yukon Geology Program offers, in addition to geological mapping, deposit studies, placer potential projects, surficial geological mapping and geochemical and geophysical studies, the following programs to help the mining industry:

Industry liaison and support

Yukon Geology Program staff monitor Yukon hardrock and placer exploration and mining, visit properties and maintain assessment library.

Yukon Minfile

The Yukon's inventory of mineral occurrences, Yukon Minfile, is maintained by the Yukon Geology Program.

Yukon Geoprocess File

An inventory of information on geological process and terrain hazards.

H.S. Bostock Core Library

This facility contains 128,000 m of diamond drill core from about 200 mineral occurrences. Rock saws and rock preparation equipment is available.

Mineral Resource Assessments

The Yukon Geology Program provides input on geological and metallurgical information to assist in resolution of land use issues and conflicts.

YUKON GOVERNMENT SUPPORT FOR THE MINING INDUSTRY

Compared with other Canadian jurisdictions, the Yukon government spends the most per capita, $89.24 (1998), on direct financial exploration incentives for the mining industry (Figure 20). The Yukon's percentage of its total budget committed to direct exploration incentives is also the highest in Canada at 0.61 percent (Figure 21). These figures reflect the value of mineral production to the Yukon's economy.

The Yukon provides high direct exploration incentives in terms of tax credits or contributions for exploration programs. Table 15 compares the size of direct exploration incentives across jurisdictions to companies for exploration programs of $50,000 to $2 million.

GOVERNMENT PROGRAMS AND INCENTIVES

The Yukon government provides support for the mining industry by providing the following programs, incentives and services:

- Yukon Geology Program,
- Yukon Mineral Exploration Tax Credit,
- Yukon Mining Incentives Program,
- Yukon Energy Infrastructure Loans for Resource Development Program,
- Yukon Industrial Support Policy, and
- Yukon Mining Environment Research Group.

Table 15
Comparison of direct mining incentives – Canadian jurisdictions
(government grant programs for mineral exploration and refundable tax credits for mineral exploration)
- assume all exploration expenditures are eligible, and all projects qualify for grant programs
- using September 1998 data

		$50,000 program	$100,000 program	$500,000 program	$1 million program	$2 million program
Yukon	**Yukon Mining Incentives Contribution Program** (up to 50% of eligible expenses to a maximum of $20,000 available for exploration programs of $100,000 or less)	$20,000	$20,000	–	–	–
	Yukon Mineral Exploration Tax Credit (refundable tax credit of 22% on grassroots exploration expenditures in Yukon available to eligible companies) * calculated on balance after grant deduction	$6,600	$17,600	$110,000	$220,000	$440,000
	Total Yukon Mining Incentives	$26,600	$37,600	$110,000	$220,000	$440,000
British Columbia	**Mineral Exploration Tax Credit** (refundable tax credit of 20% on grassroots exploration expenditures in B.C., no cap)	$10,000	$20,000	$100,000	$200,000	$400,000
Manitoba	**Mining Exploration Assistance Grant Program (MEAP)**					
	Central Manitoba Program (25% grant on eligible expenditures, cap of $300,000 per recipient per fiscal year)	$12,500	$25,000	$125,000	$250,000	$300,000
	Northern Superior Program (35% grant on eligible expenditures, cap of $400,000 per recipient per fiscal year)	$17,500	$35,000	$175,000	$350,000	$400,00
Quebec	**Quebec Assistance Program for Mining Exploration** (grants of up to 50% of costs up to max of $50,000)	$25,000	$50,000	$50,000	$50,000	$50,000
	Near North Mineral Exploration Program (grants of up to 50% of costs up to a max of $100,000)	$25,000	$50,000	$100,000	$100,000	$100,000
New Brunswick	**New Brunswick Exploration Assistance Program** (grants of up to 50% of costs up to max of $40,000)	$25,000	$40,000	$40,000	$40,000	$40,000
Ontario	Prospectors Assistance Program only					
Nova Scotia	Prospectors Assistance Program only					
Newfoundland	Prospectors Assistance Program only					
Northwest Territories	Prospectors Assistance Program only					
Alberta	No direct mining incentives					
Saskatchewan	No direct mining incentives					
Prince Edward Island	No direct mining incentives					

Yukon Mineral Exploration Tax Credit

The Yukon Mineral Exploration Tax Credit provides for a refundable tax credit equal to 22 percent of eligible mineral exploration expenses incurred by qualified individuals and companies conducting mineral exploration in the Yukon. The credit applies to qualifying expenditures incurred between April 1, 1999 and March 31, 2001. Taxpayers file for the credit when they complete their individual or corporate income tax forms.

Yukon Mining Incentives Program

The Yukon Mining Incentives Program is designed to promote and enhance mineral prospecting, exploration and development activities in the Yukon. The program's function is to provide a portion of the risk capital required to locate and explore mineral deposits. The program consists of three modules:

1) Grassroots — prospecting

Qualified prospectors may apply for up to $10,000 per year to cover basic operating expenses while searching for new mineral occurrences in the Yukon. One hundred percent of approved expenses are reimbursed.

2) Grassroots — grubstake

Companies or individuals providing prospectors with a grubstake (basic operating expenses while searching for new mineral discoveries in the Yukon) may apply for a contribution of up to $10,000 per prospector, per year. A total of 75 percent of approved expenses are reimbursed.

3) Target evaluation

Individuals, partnerships or junior companies undertaking basic exploration work directed at appraising the potential of an unevaluated occurrence or target may apply for reimbursement of 50 percent of approved expenses up to a maximum of $20,000.

The intent of this funding is to allow prospectors to evaluate new occurrences following discovery and to prepare them for option or sale. Projects must have budgets of less than $100,000.

Yukon Industrial Support Policy (YISP)

The Yukon government recognizes the need for infrastructure in many regions of the territory. This policy supports the development of an infrastructure base that encourages private sector investment in the Yukon.

The Yukon government may enter into an agreement with the developer for projects that require road improvement or construction, energy supply, grid connections or related training programs for Yukon residents.

Energy Infrastructure Loans for Resource Development Program

This program assists the resource development sector in the Yukon by helping defer the capital cost of building energy infrastructure. The program provides loans to companies to help them create infrastructure to meet their energy needs.

Figure 20
Direct exploration incentive funding, per capita

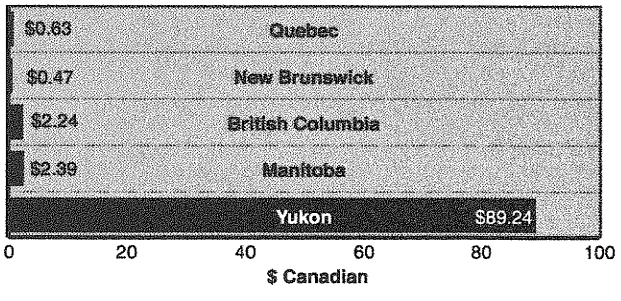
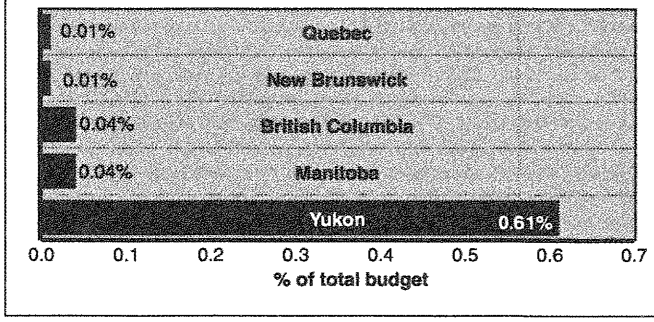


Figure 21
Direct exploration incentive funding, as a percentage of total budget



FOOTNOTES

1 There are arguments for and against each of these two options. For further reading see Margaret E. Slade, *Pricing of Metals*, 1988.

2 Hedging occurs when an investor, attempting to eliminate the risk of price movements, sells a quantity of commodity not yet needed in the forward market. If, in the following period, the price of the commodity drops, the investor has offset some of the loss as the commodity has already been sold (to a speculator). If the price rises, the investor has gained a profit offset by the amount needed to honour the forward contract.

3 Speculators make hedging possible. A speculator purchases commodities from investors to be sold at a later date for a profit. Speculators take the risk that normal investors will not and gamble that prices will increase enough times to enable them to make a profit.

4 Real prices are derived from current-day, or nominal, prices by accounting for the effects of inflation. The result is data relative to some base year that makes comparison between years more meaningful.

5 Yukon Exploration and Geology – 1998, pg. 31.

6 See Natural Resources Canada website at www.nrcan.gc.ca/mms/efab/mmsd.

7 *Natural Resources Canada*

8,9 *Mining in Canada 1998, Facts and Figures,* Mining Association of Canada

10 Centre for Study of Living Standards, 1998 report. Also quoted in *Mining in Canada 1998, Facts and Figures*

11 Dungan, 1996, *Rock Solid*

12 *Mining in Canada 1998, Facts and Figures,* Mining Association of Canada

13 Supplement to Mining Journal, February 19, 1999, pg. 12

14 Mining Journal, vol. 332, no. 8519, 1999

15 Overview of Trends in Canadian Mineral Exploration, p. 107

16 Yukon Minfile, 1996

17 Yukon Chamber of Mines, Press Release, May 3, 1999

18 Yukon Exploration and Geology, 1998

19 Yukon Short-term Economic Outlook, 1999, Department of Economic Development

20 Yukon Mining Incentives Program data provided by Ken Galambos, Mineral Development Geologist, Yukon Geology Program

21 Dawson City Economic Profile, 1994, Department of Economic Development

22 Mine modelling report for Department of Economic Development by Pricewaterhouse Coopers, 1999

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APPENDIX 1: USES OF METALS

GOLD

Gold is a bright, shiny yellow metal known for its great density, extreme ductility, high resistance to corrosion, beauty and its scarcity. As it is the least chemically active of all metals, gold usually occurs in the free or un-combined state. Although most often found in veins or dispersed in bedrock, gold is also found as "placer" deposits in the sand or gravel along streams and is sometimes recovered as a by-product of base-metal mining. The value of this precious commodity is measured in carats, with 24-carat representing pure gold.

The most common use of gold, comprising 80 percent of the total world supply, is in jewellery, coins and ornamentation. Another 10 percent is used in other sectors such as electronics and dentistry while the remainder is purchased by investors.

Canada is the world's leading user of gold for coins, as is evidenced in the Maple Leaf bullion coin series. Gold is also known internationally for its use by governments as a monetary reserve.

SILVER

Silver, also a scarce precious commodity, is a brilliant grey-white metal which takes a fine finish, is soft and malleable and is also resistant to corrosion. It is known for being the best conductor of electricity among metals.

The greatest user of silver is the photographic industry which uses over 40 percent of total industrial consumption. Silver is also used for ornamentation or jewellery, and is often combined with copper to make it harder and stronger. Silver compounds are found on both photographic film and paper.

Nearly 25 percent of total silver use occurs within the electrical industry. Silver is used in electrical components like contacts and conductors in equipment that demands dependability such as satellites, spacecraft and guidance systems.

As an alloy with cadmium or zinc, silver is used in the high performance batteries of aircraft and spacecraft. Other uses include glass coating, dentistry and medicine. Finally, silver plating, the process of coating other metals with a thin layer of silver, is popular for decorative purposes.

LEAD

Lead is a dense, malleable, bluish-white metal known for its corrosion resistance. It is found in both mined ore and in recycled scrap materials.

Lead is most commonly used in lead-acid storage batteries found in automobiles, forklifts and baggage carts. Battery production consumes around 65 percent of total lead production in the Western World. The average car battery contains about 10 kg of lead.

Lead is also commonly used as a pigment in paint, adding toughness and flexibility to the paint coating. Lead is found in chemicals, including lead-based stabilizers in PVC products and lead oxides in ceramics and high quality crystal and glass.

As an alloy with tin, lead is used in soldering for plumbing and electronic applications. The construction industry has historically made use of lead for roofing, piping and caulking. These uses have declined in recent years, although lead is often used as a sound barrier in office buildings, schools and multiple unit dwellings. Lead provides an effective shield in X-ray equipment and a protective sheath in underground and underwater cables.

ZINC

Known as "The Protector," zinc is a bluish-grey metal used around the world for such divergent purposes as galvanizing, die-casting and brass manufacturing.

The galvanizing process, accounting for over 40 percent of annual world consumption, uses zinc as a cost-effective coating for iron and steel, forming a protective layer against rust and corrosion. The greatest consumer of galvanized steel is the automobile industry, using anywhere from 11 to 17 kilograms of zinc per automobile. Galvanized steel is also commonly used in the construction industry for roofing and siding, as well as in heating and ventilation ducts.

With a relatively low melting point and significant fluidity, zinc is useful in die-casting that requires rapid, assembly line shaping of small and intricate objects.

Brass, an alloy of copper and zinc, is used in plumbing, heat exchange equipment and decorative hardware. Zinc also forms a component of dry-cell batteries, manufactured rubber, white paint, agricultural products, cosmetics and medicinal products.

COPPER

Copper has a long history of use because of its easy workability, softness, resistance to corrosion and attractive colour and texture. In the modern era, copper use has increased even further due to its high conductivity of heat and electricity, its good tensile strength and mechanical properties and its non-magnetic attributes.

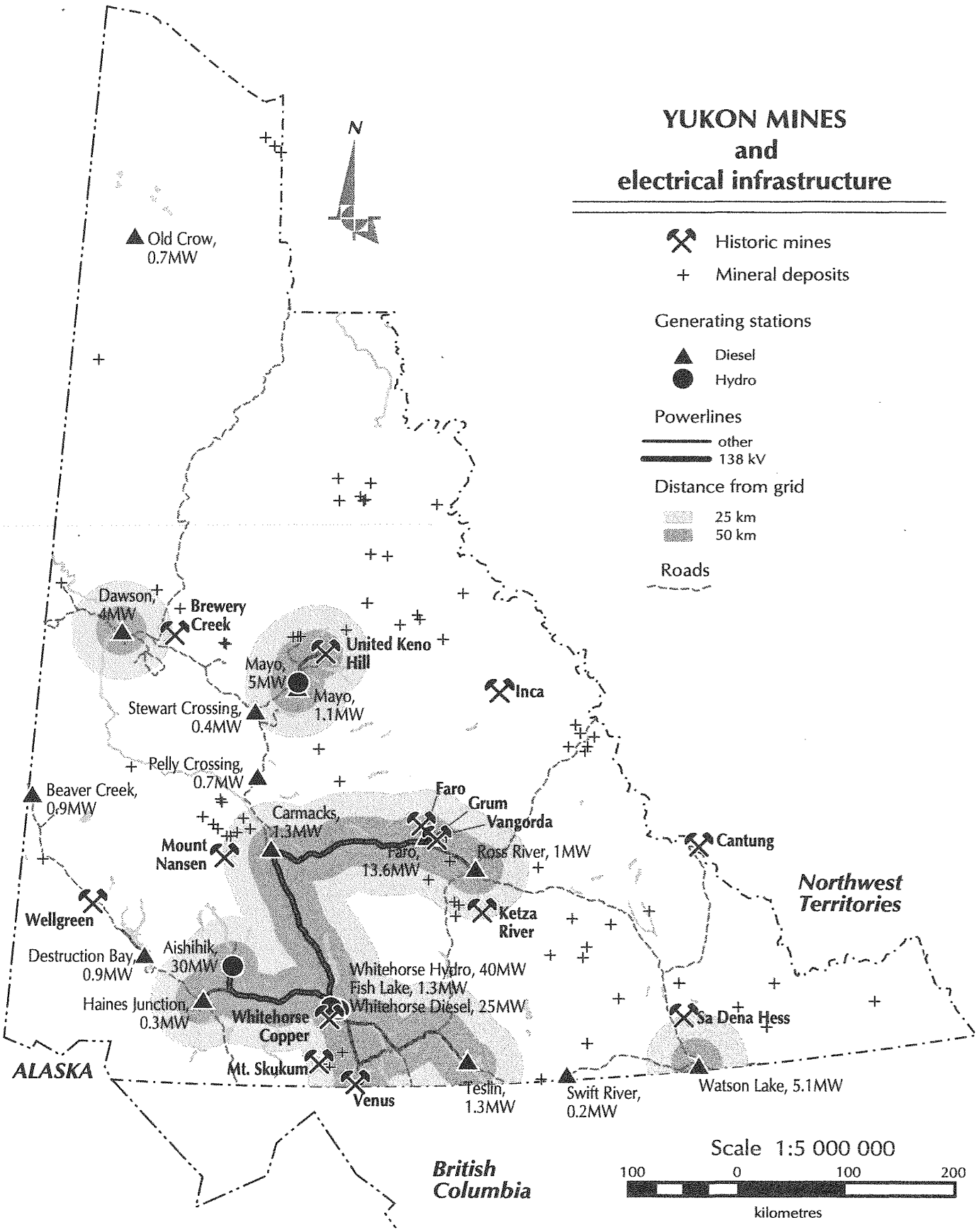
With the advent of many alloys, the use of copper has increased substantially. In addition to being alloyed with zinc to form brass and with tin to form "true" bronze, copper is also commonly combined with aluminum, silicon, nickel and many other metals in small quantities. The various purposes of alloying include improving hardness, resistance to corrosion or ease of manufacture.

The most common use of copper is for electrical applications. More than half of Canada's consumption of copper is found in copper wire. The brass mill industry, the second largest user of copper, manufactures pipe, plate, sheet and strip, rods, bars and shapes which may be used directly or become part of further manufacturing. Other uses of copper include shipbuilding, architecture, chemical and food-processing industries, house construction and agriculture.

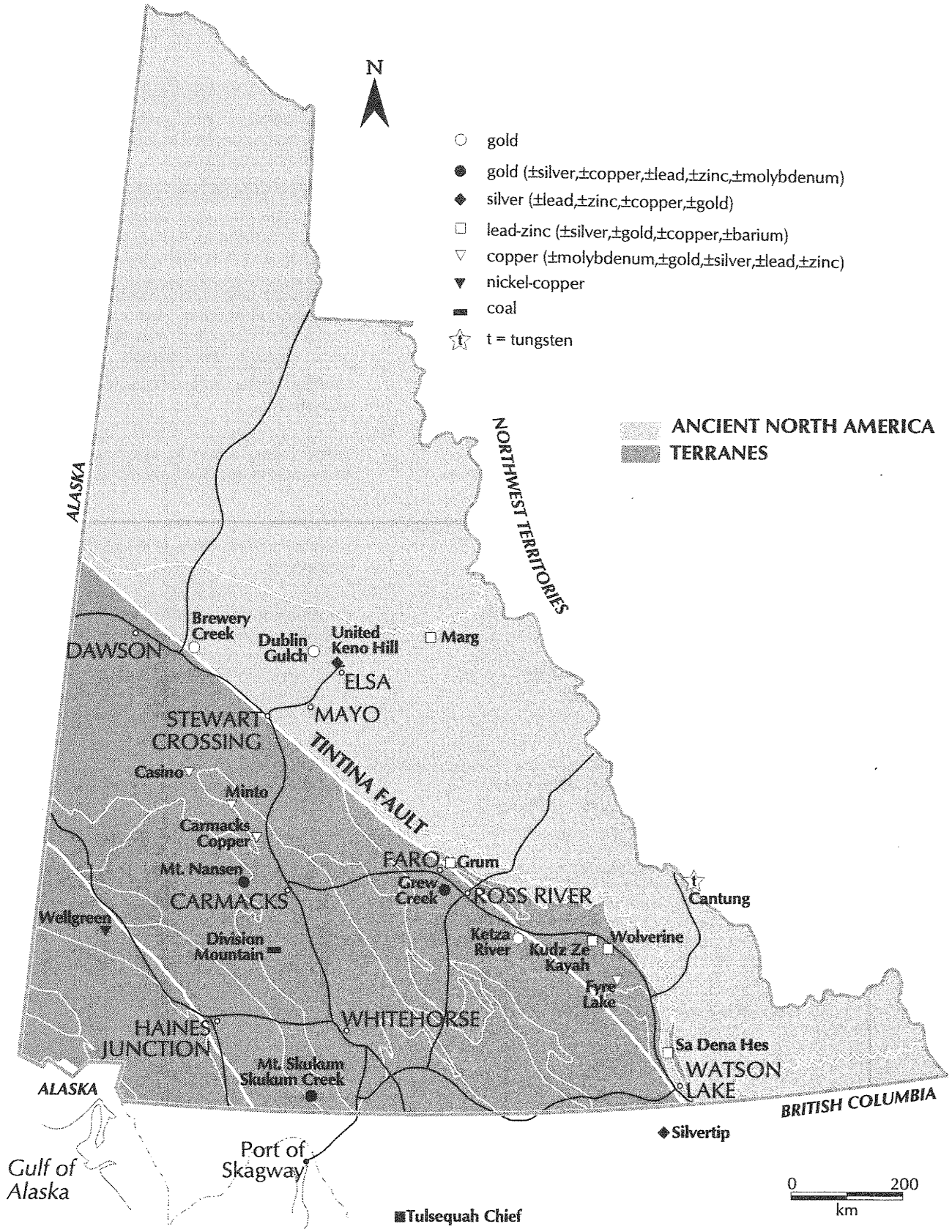
Sources of information

- *Canadian Minerals Yearbook, 1997, Natural Resources Canada*
- *International Lead and Zinc Study Group*

APPENDIX 2: INFRASTRUCTURE MAP



APPENDIX 3: MINES, MINE DEVELOPMENT AND ADVANCED EXPLORATION PROJECTS



APPENDIX 4: YUKON MINES AND MINE DEVELOPMENT PROJECTS 1999

Property	Reserves	Status
OPERATING MINES		
Brewery Creek Viceroy Resource Corporation	**Mineable reserve:** 11.8 million tonnes 1.13 grams/tonne gold	79,396 ounces of gold produced in 1998. Aggressive exploration to increase reserves. Requires mining license.
UNDER CONSTRUCTION		
Minto Asarco Inc./Minto Explorations Ltd.	**Mineable reserve:** 7,200,000 tonnes 2.13% copper, 7.54 grams/tonne silver 0.51 grams/tonne gold	Water license is signed. Initial construction has been completed. Production planned for late 2000. Requires mining license.
DEVELOPMENT PROJECTS		
Keno Hill United Keno Hill Mines Ltd.	**Geological resource:** 838,758 tonnes 4.58% lead, 3.76% zinc 1,022.06 grams/tonne silver	Reopening planned for 1999 pending availability of financing. New water license in place. Requires mining license.
Dublin Gulch New Millennium Mining Ltd.	**Mineable reserve:** 50.4 million tonnes 0.93 grams/tonne gold	Undergoing final stages of environmental assessment.
Kudz Ze Kayah Cominco Ltd.	**Mineable reserve:** 11.3 million tonnes 0.93 percent copper, 1.52% lead, 5.89% zinc 133.0 grams/tonne silver 1.34 grams/tonne gold	Environmental screening report complete. Water license should be signed in 1999.
Carmacks Copper Western Copper Holdings Ltd.	**Mineable reserve:** 14,109,800 tonnes 1.01% copper, 0.51 grams/tonne gold	Undergoing final stages of environmental assessment.
Division Mountain Coal Cash Resources	**Geological resource:** 52.9 million tonnes 2.42% residual moisture 28.45% ash, 25.79% volatiles 43.18% fixed carbon, 0.43% sulphur 5,216 kCal/kg (9,328 BTU/lb)	Additional reserve development, scoping and feasibility studies underway towards developing an export market and local power generation. Environmental assessment to begin next year. Washability tests indicate an export quality product can be produced.
Wolverine Atna Resources Expatriate Resources	**Geological resource:** 6,237,000 tonnes 12.66% zinc, 1.33% copper, 1.55% lead 370.9 grams/tonne silver 1.76 grams/tonne gold	On hold. Metallurgical work planned.
EXPLORATION PROJECTS		
Wolf Atna Resources/ YGC Resources	Zn-Pb-Ag volcanogenic massive sulphide target Inferred resource of 4.1 million tonnes grading 6.2% zinc, 1.8% lead and 84 grams/tonne silver	1998 delineation drill program complete (6,625 m, 30 holes). Deposit strike length 600 m, down-dip length 450 m, good continuity of sulphide mineralization, deposit is open. 1999 program planned.
Mt. Skukum/ Skukum Creek Goddell Omni Resources	**Mineable reserve:** *Rainbow Zone:* 956,949 tonnes @ 6.3 grams/tonne gold, 193.5 grams/tonne silver *Kuhn Zone:* 148,781 tonnes @ 8.78 grams/tonne gold, 167.70 grams/tonne silver *Goddell Zone:* 900,000 tonnes @ 7.0 grams/tonne	On hold.
Fyre Lake Pacific Ridge Exploration	**Preliminary resource**: 15.4 million tonnes within which 8.2 million tonnes grade 2.1% copper, 0.11% cobalt, 0.73 grams/tonne gold	Preliminary reserve estimate based on wide-spaced drill holes.

APPENDIX 5: FEDERAL MINING TAXATION PROVISIONS

Resource Allowance

Instead of being able to deduct provincial/territorial mining taxes or royalties a taxpayer can deduct, as a resource allowance, 25 percent of resource profits.

Canadian Exploration Expenses (CEE)

Canadian exploration expenses are expenses related to prospecting, geological, geochemical and geophysical surveying, drilling, trenching and feasibility studies for the purpose of determining the location, extent or quality of a mineral resource.

A taxpayer may deduct 100 percent of the CEE. Any unused balance may be carried forward indefinitely in a cumulative tax pool claimed in a later year.

Canadian Development Expenses (CDE)

Canadian development expenses are expenses incurred after a mine is in production to sink or excavate a mine shaft, main haulageway or similar underground work. The cost of any Canadian mineral property also qualifies as a CDE.

CDE are accumulated in a pool called the Cumulative Canadian Development Expenses (CCDE). The taxpayer may deduct up to 30 percent of the unclaimed balance in that pool at the end of each year and carry forward unclaimed balances indefinitely.

Flow-Through Shares

Flow-through shares are a mechanism by which a company can raise financing for expenditures on exploration and development. Junior mining companies, for example, have no revenue against which to expense their CEE. The company can renounce the expenses and let them flow-through to the purchaser of shares in the company.

Investors in flow-through shares get an immediate 100 percent tax deduction for the amount of money invested in the shares. There is always the added possibility that the exploration venture will be a successful one and the value of the shares will go up.

From 1983 to 1989, an additional 33 ⅓ percent tax benefit (on top of the 100 percent CEE write-off) was introduced which made investment more attractive. In 1989, the additional 33 ⅓ percent depletion was terminated. A grant system, Canadian Exploration Incentive Program (CEIP) was designed to replace it but was never introduced. CEIP would have provided cash grants to investors, in the order of 30 percent of qualifying exploration expenditures financed with flow-through shares.

Foreign Exploration and Development Expense (FEDE)

Canadian firms involved in foreign resource activities are allowed to build up a balance or pool of foreign exploration and development expenses. Each year they are entitled to deduct from this balance an amount up to their foreign resource income. If they have little or no foreign income they can still deduct up to 10 percent of the balance and apply this amount against Canadian-source income of the firm.

Capital Cost Allowance (CCA)

Most capital assets acquired by mining and oil and gas companies are included in Class 41, which allow a depreciation rate of 25 percent on a declining balance basis.

Accelerated Capital Cost Allowance

In addition to the normal 25 percent rate of depreciation accorded to Class 41 assets, the accelerated capital cost allowance (ACCA) can provide for an additional depreciation allowance of up to 100 percent of asset cost.

The ACCA allows for the full write-off of capital costs before a mine starts to pay income tax.

Mine Reclamation Funds

Reclamation fund payments are deductible by the taxpayer in the year that the contribution is made. Payments received from the trust are included in the taxpayer's income in the year that they are received. Income earned by the trust is taxable each year at corporate income tax rates.

Provincial/territorial mining taxation

Alberta

A deduction in computing taxable income is available in Alberta to corporations that pay Crown royalties if the non-deductible Crown royalties exceed the federal resource allowance.

British Columbia

A calculation is made which determines the amount of the British Columbia income tax otherwise payable which exceeds the tax that would be payable if the 25 percent resource allowance deduction was not claimed in computing taxable income. This calculation can result in either the income tax rate being reduced or increased.

Ontario

A one-time deduction of 30 percent of the cost of the purchase over the CCA is available for any piece of new pollution control equipment purchased for use in Ontario.

Corporations may qualify for a direct deduction from income of 125 percent (more in certain circumstances) of current and capital expenditures on scientific research and experimental development incurred in Ontario.

Mining companies are entitled to a 100 percent deduction for development expenses incurred in Ontario.

Quebec

For Quebec income tax purposes, a development corporation may deduct 100 percent of its cumulative Canadian development expenses in computing its income for a taxation year.

To stimulate mineral exploration in Quebec, an extra allowance of 25 percent of eligible exploration expenditures incurred in Quebec can be claimed by flow-through investors. A further 50 percent deduction for certain surface mining exploration expenses can be claimed by individuals and flow-through share investors.

Saskatchewan

A tax credit mechanism applies when non-deductible Crown royalties exceed the federal resource allowance, then the taxpayer is entitled to a tax credit.

Provincial and territorial mining taxation provisions on mining taxes and royalties

Yukon

- A refundable, 22 percent mineral exploration tax credit.

British Columbia

- Investment Allowance applied to the average CEA balance of the mine for the year.
- A new mines allowance adds 33 ⅓ percent of the capital costs and pre-production development, before the commencement of commercial production, to the CEA of the new, reopened or major expansion.
- A refundable, 20 percent mineral exploration tax credit.

Manitoba

- New Mine Investment Tax Credit: New mine capital assets benefit from a 7 percent provincial investment tax credit that can be applied to reduce Manitoba mining taxes, up to a maximum of 30 percent of mining tax otherwise payable.
- Off-Site Super Exploration Allowance: To encourage additional exploration for potential new mines, an operator can deduct 150 percent of off-site exploration expenses incurred in Manitoba in excess of a three-year moving average of such expenses. Exploration must be in search of new ore bodies and excludes the cost of acquiring mineral properties or capital assets.
- New Mine Holiday: A new mine commencing production after 1992 is exempt from Manitoba mining tax until its profit, prior to deduction for depreciation, exceeds the total cost of capital assets acquired prior to the commencement of commercial production.

New Brunswick

- Super Exploration Allowance: The exploration expenditure allowance is a deduction equal to 150 percent of eligible exploration expenditures that are defined as expenditures incurred during the year on exploration for new mineral occurrences in New Brunswick, but excluding expenditures to purchase mineral rights or an option in respect thereof.

Ontario

- The profit generated by a new mine, or a major expansion of an existing mine, is exempt from tax for the first three years of production.
- If the company also operates a smelter and refinery in Ontario, it is entitled to a processing allowance equal to 20 percent of the cost of all concentrating, smelting and refining assets.

Quebec

- An operator can claim a refund for losses incurred in mining operations in lieu of allowing any carry-forward of losses.
- In Quebec's northern region, mines situated north of 55 degrees are entitled to an incentive deduction in computing annual profit for the first ten years of production. The deduction is the lesser of annual profit from all mines otherwise determined, or 166 2/3 percent of the capital cost of processing assets used at the northern mine (net of prior year's northern mine allowances).

Nova Scotia

- Equity Investment Tax Credit: A tax credit is issued to investors who form companies where at least 25 percent of the wages are paid in Nova Scotia. The credit is non-refundable and may be carried forward or back. It is for 30 percent of the investment up to a maximum annual credit of $9,000 on a $30,000 investment.
- Prospectus Tax Credit: This tax credit of 35 percent is to assist with the audit, legal and printing costs associated with taking a company public. A corporation must pay Nova Scotia income tax to claim the credit, which has a maximum eligible expenditure limit of $100,000.