

# Canadian Reserves of Selected Major Metals, and Recent Production Decisions

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## RESERVES OF SELECTED MAJOR METALS

Canadian reserves of copper molybdenum, lead, zinc, silver and gold decreased significantly during 1998. Only nickel reserves were higher than in 1997 (Table 1).

Generally declining metal prices during 1998 caused many mining companies to make their ore reserve calculations at year-end based upon lower metal prices than they had used at the end of 1997. This resulted in reductions in ore reserves at most producing mines and a number of mine closures.

In Canada during 1998, there were only two announcements of new production decisions for the seven metals reviewed in this chapter. Given that metal prices continued to fall during 1999, it is probable that Canadian ore reserve levels for the major metals will continue to decline in the immediate future. The Voisey's Bay nickel-copper-cobalt deposit in Labrador is not presently included in Canadian reserves because there are several major issues to be resolved before production can begin. When a production decision is made, it will result in major increases in the reserves of nickel and copper.

### Reserves Policy

Canadian reserves are estimated from information contained in annual and other corporate reports, and from the responses of mining companies to the annual Federal-Provincial Survey of Mines and Concentrators.

Reserves reported here include only metal contained in material that is classified by companies as "proven" or "probable" (or their equivalents) at producing mines and in deposits that are firmly committed to production (Table 2). Metal contained in mineral resources classified by companies as "possible" (or its equivalents) is not included in national totals, nor is metal contained in deposits that have not advanced beyond the deposit appraisal phase (Figure 1). When available, only metal contained in mineable ore is included in Canadian totals to exclude losses inherent in the mining process. Every effort is made to achieve, from year to year, consistency in the reserves reported here; however, consistency ultimately depends on industry practice, which has evolved over the years. Imperial units reported by companies have been converted to metric units and the results have been rounded to the appropriate number of significant digits.

### Reserves by Commodity

#### Gold

There were 1415 t of gold contained in Canadian mine reserves in December 1998. This represents a decrease of 6% (95 t) compared to revised totals for December 1997. The major components of this decrease were the cancellation of production plans at the Aquarius mine (-40 t) of Echo Bay Mines Ltd. in Ontario and the depletion of reserves without replacement at many of the major gold mining operations. Notable increases in gold reserves were reported at the Red Lake mine (+55 t) of Goldcorp Inc. and the Dome mine (+8 t) of Placer Dome North America in Ontario, the Sigma mine (+11 t) of McWatters Mining Inc. and the Doyon mine (+11 t) of Barrick Gold Corporation in Quebec, and the Eskay Creek mine (+5 t) of Prime Resources Group in British Columbia.

#### Silver

There were 15 738 t of silver contained in Canadian mine reserves in December 1998. This represents a decrease of 6% (980 t) compared to revised totals for

Figure 1  
Generalized Model of the Mineral Development and Mining Process

PHASES	MINERAL RESOURCE ASSESSMENT	MINERAL EXPLORATION					MINERAL DEPOSIT APPRAISAL				MINE COMPLEX DEVELOPMENT	MINERAL PRODUCTION	ENVIRONMENTAL RESTORATION
	MRA	EX-1	EX-2	EX-3	EX-4	EX-5	DA-1	DA-2	DA-3	DA-4	MCD	MP	ER
STAGES	Surveys, research, synthesis.	Exploration planning.	Regional reconnaissance and surveys.	Prospecting and ground survey of anomalies.	Verification of anomalies and showings.	Discovery and delimitation.	Deposit definition.	Project engineering.	Project economics.	Feasibility study. Production decision.	Mine development. Infrastructure, plant, equipment.	Production, marketing, new development.	Mine closure. Site reclamation and restoration.
OBJECTIVES	Supply information and tools required to develop the mineral potential of the nation for economic benefit, in the perspective of sustained development.	Select target commodities. Establish exploration objectives and strategies. Select target areas.	Find regional and more localized anomalies. Select significant targets.	Acquire properties. Confirm presence, exact location and characteristics of anomalies.	Acquire additional properties as required. Investigate anomalies. Find mineral showings.	Discover, delimit a mineral deposit of potential economic interest. Appraise current technical and economic data to justify a deposit appraisal program.	Define the limits, internal grade distribution and controls, mineralogy and mineral processing character of the deposit. Acquire data for engineering planning.	Establish technical feasibility. Obtain realistic plans, schedules, investment costs and operating cost estimates for all aspects of the project.	Obtain all the parameters required and carry out economic, financial and social-political evaluation of the project.	Ensure the validity of project data, assumptions and evaluation results to achieve mine complex development and production objectives. Decide whether or not to undertake the project. Obtain the required permits.	Complete mine development and construction on schedule and within budget. Ensure efficient and timely mine and concentrator start-up according to schedule, forecasts and specifications.	Achieve planned rate and specifications of commercial production on schedule and within budget. Achieve mine profitability, company survival and sustained development.	Restore mine site to an environmentally acceptable condition.
EVALUATION METHODS	Geoscientific, mineral and economic surveys, research, compilations and synthesis by governments, research institutes and universities.	Metal and mineral market research. Review of geological and ore deposit information for various areas. Review of legal and political contexts.	Remote sensing aerial photography and airborne geophysics. Prospecting, geology and geochemistry. Appraisal, rating and selection of anomalies.	Ground-based geological, geochemical and geophysical prospecting and surveys. Review and selection of significant anomalies.	Geological mapping and other surveys. Trenching and sampling. Review of results and selection of targets.	Stripping, trenching, detailed mapping, sampling, drilling and down-hole geophysics. Preliminary deposit inventory and evaluation. Environmental characterization and site surveys.	Detailed mapping, sampling and drilling on surface or from underground. Systematic mineral processing tests. Detailed environmental and site surveys.	Pilot tests and engineering studies. Design, cost estimation for mining, mineral, metal processing, infrastructure, environmental protection and restoration.	Market, price, cost and other financial studies. Technical, environmental, economic, financial, social and political risk analysis.	Exhaustive due diligence review of the geological, engineering, environmental, economic, legal and site data. Evaluation of the profitability, risks and up-side factors.	Project and quality management methods. Training program for personnel and detailed start-up plan.	Production management using continuous quality improvement methods. Exploration, appraisal and development of new ore zones, both on the mine site and off-property.	Mine closure and decommissioning. Environmental restoration and monitoring.
RESULTS	Geoscientific, mineral and economic databases, maps and models.	Exploration projects.	Regional anomalies.	Local anomalies.	Mineral showings.	Mineral deposit.	Deposit appraisal project.			Mining project.	Mining Complex.	Mineral production.	Restored site.
FEASIBILITY STUDIES Expected margin of error of estimates at the 90% confidence level						Expected margin of error of estimates at the 90% confidence level:							
						± 100%	± 60%	± 40%	± 20%	± 10%	± 5%	Full compliance	
INVESTMENT RISK LEVEL	Low /moderate Moderate	Low but increasing investments. Very high, but decreasing risk of failure and financial loss.				Much larger and increasing investments. High, but decreasing risk of failure.				Large to very large industrial investment. Low to moderate industrial type risk.			
MINERAL INVENTORY	Undelimited mineral resources					Inferred	Delimited mineral resources				Ore reserves		
	Speculative	Hypothetical				Inferred	Indicated and measured				Proven and probable		

Sources: Modified by D.A. Cranstone, A. Lemieux and M. Vallée, February 25, 1994, from M. Vallée, 1992, *Guide to the Evaluation of Gold Deposits*, CIM Special Volume 45, p. 4, and *SOQUEM Annual Report*, 1976-77, pp. 4-5. Revised July 23, 1999.

December 1997. The major components of this decrease were the downward revision of reserves at the Brunswick No. 12 mine (-389 t) and the closure of the Caribou mine (-560 t) in New Brunswick. The only silver-producing mines to significantly increase their reserves during 1998 were the LaRonde mine (+931 t) in Quebec and the Kidd Creek No. 3 mine (+446 t) in Ontario.

### **Zinc**

During 1998, Canadian reserves of zinc decreased to about 10.2 Mt, down by about 4% (-429 000 t) compared to the previous year. The major components of this decrease were the downward revision of reserves at the Brunswick No. 12 mine (-468 000 t), and the closure of the Caribou mine (-426 000 t) in New Brunswick. The only zinc mines to significantly increase their ore reserves in 1998 were LaRonde (+637 000 t) in Quebec and the Kidd Creek No. 3 mine (+646 000 t) in Ontario.

### **Lead**

Canadian reserves of lead decreased by approximately 21% during 1998 to 1 845 000 t. This was largely as a result of the closure of the Caribou mine (-230 000 t) and the downward reassessment of reserves at the Brunswick No. 12 mine (-184 000 t) in New Brunswick.

### **Copper**

In December 1998, Canadian reserves of copper were estimated at about 8.4 Mt, or down by about 7% (-630 000 t) from a year earlier. Copper reserves were reduced as a result of the closure of the Gibraltar mine (-385 000 t) and the downward revision of reserves at the Highland Valley mine (-300 000 t) in British Columbia. Copper reserves were increased at the Inco Limited Ontario Division mines (+359 000 t), the Kidd Creek No. 3 mine (+154 000 t) in Ontario, and the new Konuto Lake mine (+45 000 t) of Hudson Bay Mining and Smelting Co. Limited (HBMS) in Saskatchewan.

### **Molybdenum**

Canadian reserves of molybdenum stood at 121 000 t in December 1998, or about 19% lower than in the previous year. This decrease was largely due to the closure of the Gibraltar mine in British Columbia.

### **Nickel**

In December 1998, there were some 5.7 Mt of nickel contained in Canadian mine reserves, up by approximately 11% from 1997 levels. This increase is due largely to successful exploration by Inco Limited in the vicinity of its operating mines in Ontario.

Inco had some 4.8 Mt of nickel in Canadian reserves at the end of 1998, or about 84% of the national total. It is expected that development of the copper-nickel-cobalt deposits at Voisey's Bay in Labrador will make major additions to Canada's mineable reserves of these metals in the near future.

## **Canadian Reserves by Province and Territory**

Four provinces (Ontario, British Columbia, New Brunswick and Quebec) held dominant positions in terms of Canada's proven and probable mineable reserves of major metals in December 1998 (Table 4).

Ontario had 72% of the nickel, 51% of the gold and 50% of the copper, plus 22% of the silver and 18% of the zinc.

British Columbia had 100% of the molybdenum, 35% of the copper and 32% of the silver, plus 14% of the lead, 9% of the zinc and 19% of the gold.

New Brunswick had 76% of the lead, 35% of the zinc and 25% of the silver, plus 2% of the copper and 2% of the gold.

Quebec had 26% of the zinc, 20% of the gold, 9% of the copper, 10% of the nickel and 18% of the silver.

Manitoba had 18% of the nickel, 6% of the zinc and 4% of the gold, plus 4% of the copper and 2% of the silver.

The Yukon Territory had less than 1% of the gold and the silver.

The Northwest Territories had 6% of the zinc, 6% of the lead and 3% of the gold.

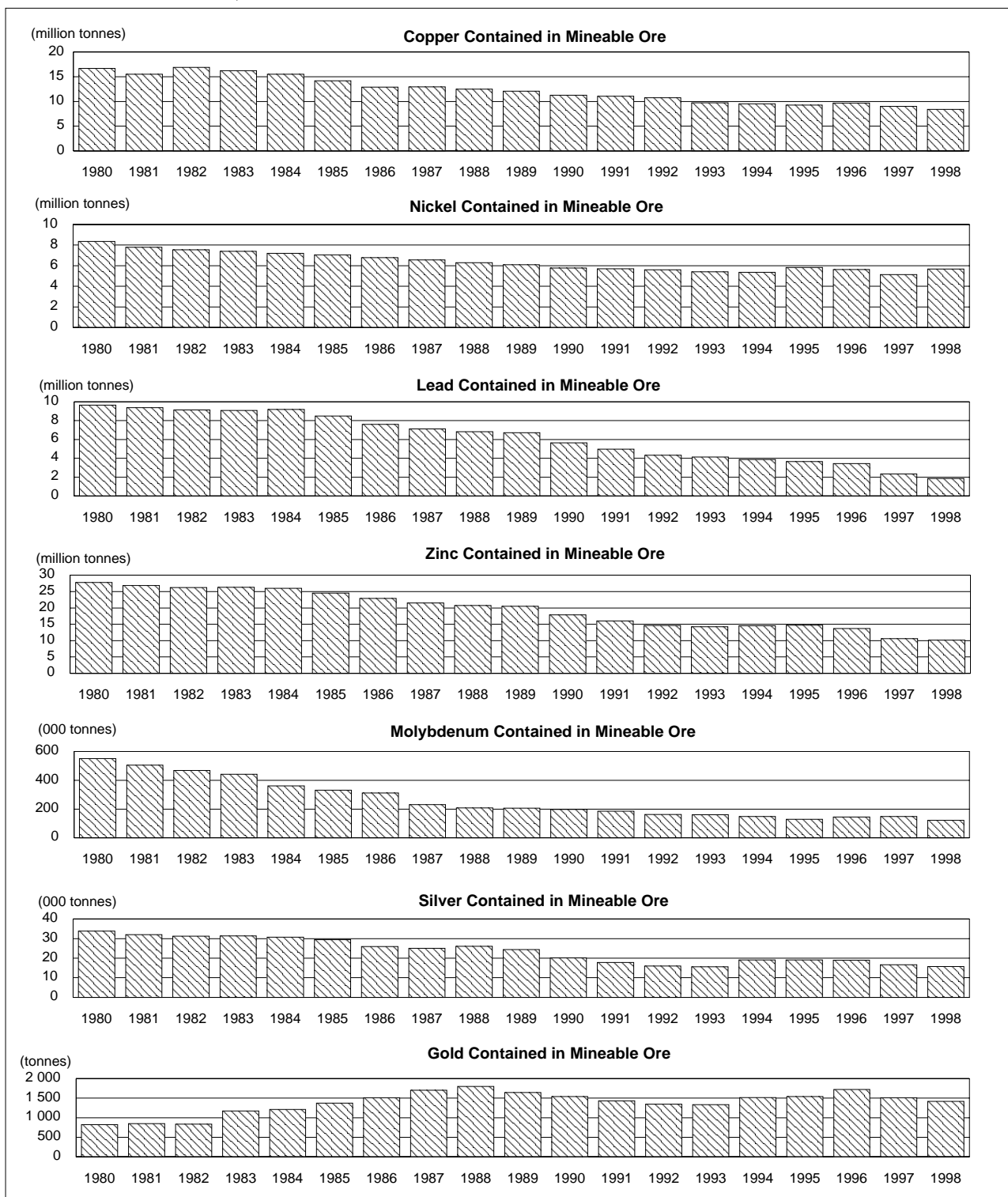
## **Canadian Reserves by Industry**

Canadian mines are, to a large extent, polymetallic, a complexity that the Standard Industrial Classification (SIC) tends to oversimplify (Table 5).

Current mine reserves of gold in Canada are distributed through the various SIC classes as follows: gold mines, 78%; copper and copper-zinc mines, 15%; nickel-copper mines, 5%; and zinc-lead-silver mines, 2%. Current mine reserves of silver in Canada are distributed through the various SIC classes as follows: gold mines, 34%; copper and copper-zinc mines, 29%; nickel-copper mines, 9%; and zinc-lead-silver mines, 28%.

Current mine reserves of copper in Canada are distributed through the various SIC classes as follows: gold mines, 1%; copper and copper-zinc mines, 52%; nickel-copper mines, 44%; and zinc-lead-silver mines,

**Figure 2**  
**Canadian Reserves of Selected Major Metals, 1980-98**  
 Metal Contained in Proven and Probable Mineable Ore in Operating Mines and Deposits Committed to Production, as at December 31 of Each Year



Source: Natural Resources Canada, based on company reports and the Federal-Provincial Survey of Mines and Concentrators.  
 Note: This series was revised during 1996.

2%. Current mine reserves of molybdenum in Canada are contained in the SIC classes as follows: copper and copper-zinc mines, 36%; and molybdenum mines, 64%.

Current mine reserves of nickel in Canada are contained entirely in the SIC class of nickel-copper mines.

Current mine reserves of lead in Canada are contained in the SIC classes as follows: copper and copper-zinc mines, 6%; and zinc-lead-silver mines, 94%. Current mine reserves of zinc in Canada are contained in the SIC classes as follows: gold mines, 10%; copper and copper-zinc mines, 42%; and zinc-lead-silver mines, 48%.

### Apparent Life of Canadian Reserves

The apparent life (life index) of mine reserves is usually calculated by dividing the total amount of metals remaining in mine reserves at the end of a given year by the corresponding amount of metals contained in the ores produced during that year. Similar calculations are often applied at the national level.

At the national level, life indices are but a very rough measure of the expected life of aggregate mine reserves, and they are often misleading unless abnormal situations are recognized. Life indices based on proven and probable reserves do not make allowances for inferred extensions to reserves at current mines, gross additions that will accrue to current reserves from the likely development, in the foreseeable future, of known orebodies for which a production decision has yet to be made, or expected changes in production rates. Furthermore, life indices tend to overstate the apparent life of reserves when, for example, annual production is abnormally low due to strikes, cutbacks or suspensions at large establishments, or when significant increases in capacity resulting from new production decisions will be coming on stream, but only several years hence.

The apparent life indices for the major metals in Canada at the end of 1998 were 22 years for nickel, 11 years for copper, 6 years for molybdenum, 10 years for silver, 7 years for lead, 8 years for zinc, and 7 years for gold.

### Reserve Trends

Figure 2 and Table 6 show how Canadian reserves of copper, nickel, lead, zinc, molybdenum and silver have declined steadily since the early 1980s. In contrast, gold reserves increased substantially until 1988, before starting a gradual decline. At the end of 1998, Canadian reserves of copper, lead, zinc and

molybdenum were lower than at any time since Natural Resources Canada began keeping records, and reserves of nickel, silver and gold were only slightly higher than the recent historic lows that occurred in 1993 and 1994.

The annual aggregate change in Canadian reserves is the net result of three main factors affecting individual mines (Figure 3): additions to reserves, deletions to reserves, and production. Additions to reserves are the result of new discoveries; of new geological, metallurgical, production or other information; of a decrease in production costs; or of a rise in commodity prices, all of which increase the quantity of mineral resources that are profitable to mine. Deletions to reserves are the result of new geological, metallurgical, production or other information; of increases in costs; or of decreases in commodity prices, all of which reduce the quantity of mineral resources previously counted in mine reserves that are now expected to be mined at a profit. Production is normally the main factor reducing the reserves at individual mines but, in 1998, declining metal prices were a significant factor in the reduction of ore reserves at producing mines.

## RECENT PRODUCTION DECISIONS

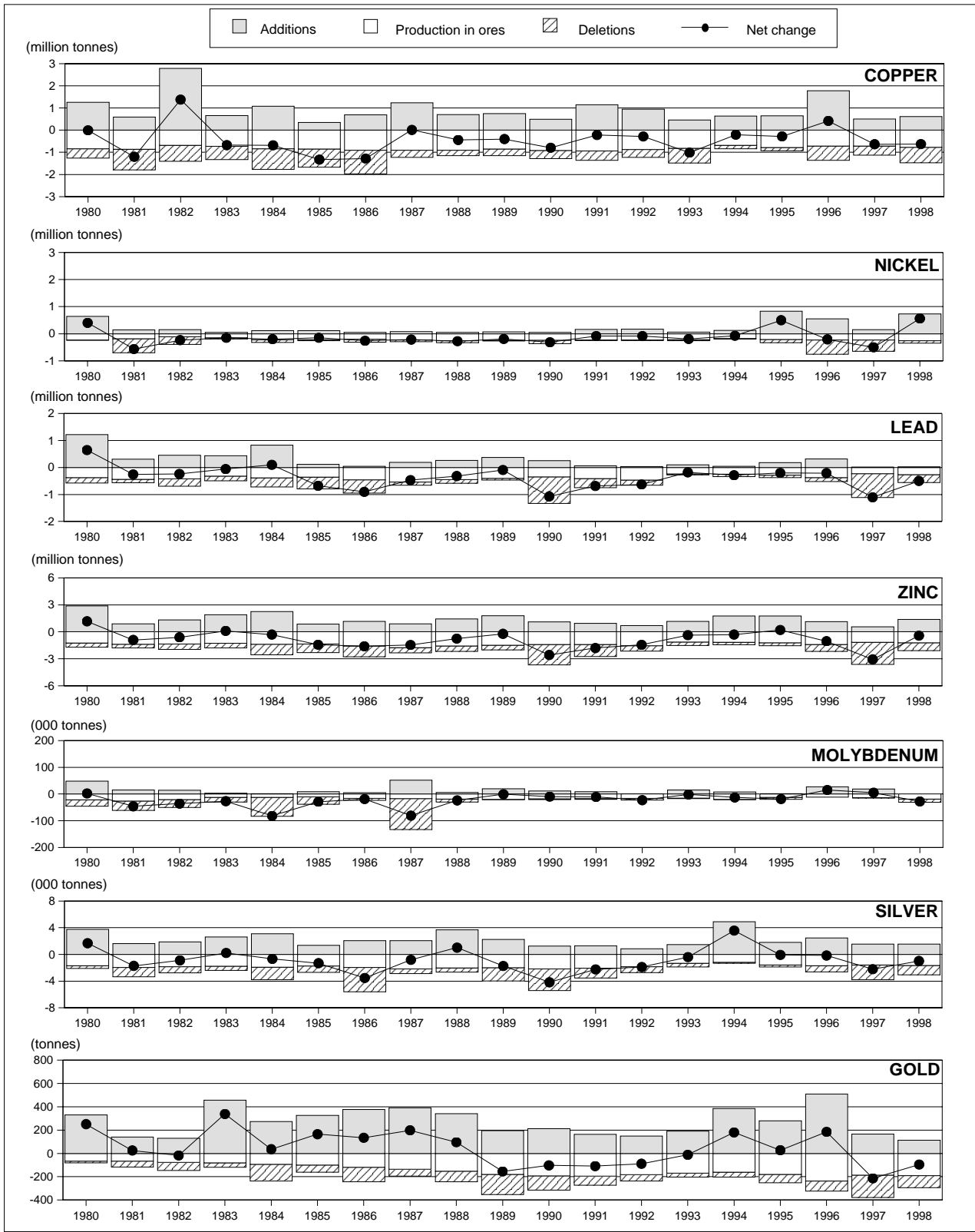
Several criteria need to be met for a project to be considered here to have reached the production decision stage. In general, there needs to have been a positive production feasibility study, all of the necessary permits must have been obtained, financing must have been arranged, and directors must have approved construction.

During 1998, production decisions were announced for the Konuto Lake mine at Creighton, Saskatchewan, and for the Black Dome mine near Clinton, British Columbia (Table 3).

During 1999, HBMS announced plans to bring the 777 deposit at Flin Flon, Manitoba, and the Chisel North deposit at Snow Lake, Manitoba, into production. The 777 deposit has reserves of 13.4 Mt containing 3.32% copper, 5.78% zinc, 2.7 g/t gold and 38 g/t silver. The Chisel North deposit has reserves of 2.4 Mt containing 10.8% zinc. Also during 1999, St. Andrew Goldfields Ltd. announced plans to begin production from a small open-pit mine on the Hislop West zone near Matheson, Ontario.

Inco Limited's Voisey's Bay deposit in Labrador is poised for a production decision, but it is not included as a 1999 production decision because not all of the necessary permits and agreements were in place at that time.

**Figure 3**  
**Main Components of Change in Canadian Reserves of Selected Major Metals, 1980-98**



Source: Natural Resources Canada.

## OUTLOOK

Given that metal prices continued to decline in 1999, it is highly probable that mine reserves of precious metals and base metals will fall further in 1999.

At the Voisey's Bay nickel-copper-cobalt deposit, Inco had established proven reserves of 32 Mt grading 2.83% nickel, 1.68% copper and 0.12% cobalt at the end of 1998. If these figures are confirmed, Voisey's Bay will increase Canada's nickel reserves by about 16% and its copper reserves by about 6%.

*Note: Information in this review was current as of February 11, 2000.*

### NOTE TO READERS

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**TABLE 1. MAIN COMPONENTS OF CHANGE DURING 1998 IN CANADIAN RESERVES OF SELECTED MAJOR METALS**

Metal	Units	Revised Opening Metal Balance, January 1998	Metal in Ore Mined During 1998	Metal Apparently Written Off During 1998	Metal in New Reserves Found During 1998	Net Change During 1998	Closing Metal Balance, December 1998	% Change During 1998
Copper	000 t	9 032	-777	-694	841	-630	8 402	-7
Nickel	000 t	5 122	-257	-90	909	562	5 683	11
Lead	000 t	2 344	-265	-290	56	-499	1 845	-21
Zinc	000 t	10 588	-1 221	-869	1 660	-429	10 159	-4
Molybdenum	000 t	149	-19	-12	3	-28	121	-19
Silver	t	16 697	-1 646	-405	2 073	-981	15 738	-6
Gold	t	1 510	-190	-103	198	-95	1 415	-6

Source: Natural Resources Canada, based on company reports and the Federal-Provincial Survey of Mines and Concentrators.

Note: May not balance due to rounding.

**TABLE 2. TONNAGES AND GRADES OF OPERATIONS INCLUDED IN CANADIAN RESERVES OF SELECTED MAJOR METALS, AS AT JANUARY 1, 1999**

Tonnages classified by companies as "possible" are not included where they are reported separately from proven and probable tonnages, nor are tonnages for deposits for which there is no firm production decision. Data reported in imperial units were converted to metric units and rounded to the corresponding number of significant digits. Confidential data have been suppressed from the details of this report.

	Tonnes	Grade						
		Cu	Ni	Pb	Zn	Mo	Ag	Au
		(%)	(%)	(%)	(%)	(%)	(g/t)	(g/t)
<b>NEWFOUNDLAND</b>								
Nugget Pond Richmont Mines Inc. Proven and probable	318 000							12
<b>NEW BRUNSWICK</b>								
Brunswick No. 12 Underground Noranda Inc. Proven	33 961 000	0.39		3.42	8.66		94	..
Probable	6 807 000	0.27		3.39	8.10		87	..
Heath Steele Noranda Inc. Proven	584 000	0.60		2.26	7.46		84	
Probable	184 000	0.20		3.09	10.41		118	
<b>QUEBEC</b>								
Beaufor Aurizon Mines Ltd. Louvem Mines Inc. Proven	295 000						..	7.7
Probable	602 000						..	8.2
Bell Allard Noranda Inc. Proven	983 000	1.06			11.79		34.5	0.81
Probable	2 552 000	1.57			14.46		44.2	0.75
Bouchard-Hébert (Mobrun 1100 Lens) Cambior inc. Proven and probable	6 308 000	0.75			4.37		38.5	1.3
Bousquet No. 2 Barrick Gold Corporation Proven and probable	2 937 000	..					..	7.1
Doyon Barrick Gold Corporation Cambior inc. Reserves	11 100 000						..	7.4
East Amphi McWatters Mining Inc. Proven and probable	131 000							5.96
Francoeur Richmont Mines Inc. Proven and probable	787 000						..	6.5
Gallen Noranda Metallurgy Inc. Probable	1 106 000	0.16			4.74		31.1	1.12
Joe Mann Campbell Resources Inc. Proven and probable	468 640	0.243					..	7.85
Joubi (Dubuisson) Western Quebec Mines Inc. Proven	33 190						..	4.85
Kiena McWatters Mining Inc. Proven and probable	3 385 000						..	4.43
Langlois (Grevet) Cambior inc. Proven and probable	6 117 000	0.51			8.99		40.7	0.1
LaRonde (Dumagami) Agnico-Eagle Mines Limited Probable	15 000 000	0.19			6.42		93.6	2





TABLE 2 (cont'd)

	Tonnes	Grade						
		Cu	Ni	Pb	Zn	Mo	Ag	Au
		(%)	(%)	(%)	(%)	(%)	(g/t)	(g/t)
<b>ONTARIO (cont'd)</b>								
Golden Giant								
Battle Mountain Gold Company								
Proven and probable	6 937 000						..	9.53
Holloway								
Battle Mountain Gold Company								
Teddy Bear Valley Mines, Limited								
Proven and probable	4 395 000						..	6.75
Holt-McDermott								
Barrick Gold Corporation								
Proven and probable	2 742 000						..	6.93
Hoyle Pond								
Kinross Gold Corporation								
Proven and probable	1 413 000						..	10.72
Inco Ontario Division <sup>1</sup>								
Inco Limited	..	..	..				..	..
Kidd Creek No. 12								
Falconbridge Limited								
Proven	6 913 000	..		..	..		..	
Kidd Creek No. 22								
Falconbridge Limited								
Proven	1 934 000	..		..	..		..	
Kidd Creek No. 32								
Falconbridge Limited	..	..		..	..		..	
Lac-des-Îles (palladium-platinum)								
North American Palladium Ltd.	..	..	..				..	..
Macassa								
Kinross Gold Corporation								
Proven and probable	877 000						..	12.38
Madsen Gold								
Claude Resources Inc.								
Proven and probable	315 217							9.34
Musselwhite								
Placer Dome North America								
TVX Gold Inc.								
Proven and probable	10 822 000							5.7
Red Lake (Arthur W. White)								
Goldcorp Inc.								
HGZ probable	1 317 736						..	47
Sulphide proven and probable	1 259 979						..	12
Royal Oak Ontario Division								
Royal Oak Mines Inc.								
Reserves	26 012 000						..	1.5
Williams								
Homestake Canada Inc.								
Teck Corporation								
Proven and probable	27 200 000						..	5.1
<b>MANITOBA</b>								
Bissett (San Antonio)								
Harmony Gold Mining Company Limited								
Proven	600 000						..	8.28
Probable	1 270 000						..	8.5
Callinan								
Hudson Bay Mining and Smelting Co., Limited								
..	..	..			..		..	..
Inco Manitoba Division <sup>1</sup>								
Inco Limited	..	..	..				..	..
Keystone								
Black Hawk Mining Inc.								
Reserves	493 700						..	3.7

TABLE 2 (cont'd)

	Tonnes	Grade						
		Cu	Ni	Pb	Zn	Mo	Ag	Au
		(%)	(%)	(%)	(%)	(%)	(g/t)	(g/t)
<b>MANITOBA (cont'd)</b>								
New Britannia (Nor-Acme/Snow Lake) High River Gold Mines Ltd. TVX Gold Inc. Reserves	3 602 000						..	5
Ruttan Hudson Bay Mining and Smelting Co., Limited Proven and probable	10 500 000	1.0			0.16		..	..
Trout Lake Hudson Bay Mining and Smelting Co., Limited Proven	2 743 199	1.60			4.69		18.3	1.6
Probable	3 031 672	1.77			4.03		15.6	1.3
<b>SASKATCHEWAN</b>								
Konuto Lake Hudson Bay Mining and Smelting Co., Limited ..	1 600 000	4.0			1.2		..	..
Seabee Claude Resources Inc. Proven and probable	559 808						..	8.97
<b>BRITISH COLUMBIA</b>								
Blackdome Claimstaker Resources Ltd. Jipangu Inc. Proven and probable	128 627						37	14
Endako Nissho Iwai Corporation Thompson Creek Mining Limited ..	..						..	..
Eskay Creek Prime Resources Group Inc. Reserves	1 500 000						2 490	58
Golden Bear North American Metals Corp. Stockpile	200 000							2.9
Ursa	519 400							6.9
Kodiak B	183 900							8.7
Highland Valley Cominco Ltd. Highmont Mining Company Rio Algom Limited Teck Corporation Proven and probable	417 000 000	0.42					..	..
Huckleberry Mitsubishi Corporation, Dowa Mining Co., Ltd., Furukawa Co. Ltd., Marubeni Corporation, and Imperial Metals Mining Corporation Proven and probable	74 745 100	0.509				0.014	2.82	0.062
Kemess South Royal Oak Mines Inc. Proven and probable	196 436 000	0.218						0.62
Mount Polley Imperial Metals Corporation Sumitomo Corp. Proven and probable	74 000 000	0.296						0.391
Myra Falls Westmin Resources Limited Proven and probable	6 785 000	1.5		0.4	7.7		35	1.4
Snip Prime Resources Group Inc. Reserves	100 000						..	22.7

**TABLE 2 (cont'd)**

	Tonnes	Grade						
		Cu	Ni	Pb	Zn	Mo	Ag	Au
		(%)	(%)	(%)	(%)	(%)	(g/t)	(g/t)
<b>BRITISH COLUMBIA (cont'd)</b>								
Sullivan Cominco Ltd. Proven and probable	6 100 000			3.7	6.6		20	
<b>YUKON TERRITORY</b>								
Brewery Creek (heap leach) Viceroy Resource Corporation Reserves	11 800 000						..	1.1
Mount Nansen B.Y.G. Natural Resources Inc. Proven	15 499						..	..
<b>NORTHWEST TERRITORIES</b>								
Con Miramar Mining Corporation Proven and probable	1 247 000						..	11.66
Giant Open Pit - Giant Underground Royal Oak Mines Inc. Proven	14 411						..	12.5
Probable	437 095						..	12.4
Lupin Echo Bay Mines Ltd. Proven and probable	1 831 000						..	9.22
Nanisivik Nanisivik Mines Ltd. Proven and probable	3 460 000			..	8.2		36	
Polaris Cominco Ltd. Pine Point Mines Limited Reserves	2 900 000			3.3	12.8			

Source: Natural Resources Canada, based on published company reports.

.. Not available in published reports or estimated by author.

<sup>1</sup> Inco Limited reports total Canadian ore reserves as 337 000 000 t grading 1.06% copper and 1.58% nickel. <sup>2</sup> Falconbridge Limited reports proven and probable ore reserves as 31 746 000 t grading 2.30% copper, 5.67% zinc, and 62 g/t silver.

Notes: One tonne (t) = 1.1023113 short tons. One gram per tonne (g/t) = 0.02916668 troy ounces per short ton.

**TABLE 3. PRODUCTION DECISIONS ADDED TO CANADIAN RESERVE TOTALS AS AT DECEMBER 31, 1998**

Project	Operators and Major Partners	Province	Metals
Blackdome	Claimstaker Resources Ltd. and Jipangu Inc.	British Columbia	Gold, silver
Konuto Lake	Hudson Bay Mining and Smelting Co., Limited	Saskatchewan	Copper, zinc

Source: Natural Resources Canada, based on company reports.

**TABLE 4. CANADIAN RESERVES OF SELECTED MAJOR METALS BY PROVINCE AND TERRITORY, AS AT DECEMBER 31, 1998**Metal Contained in Proven and Probable Mineable Ore<sup>1</sup> in Operating Mines<sup>2</sup> and Deposits Committed to Production

Metal	Units <sup>3</sup>	Nfld.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	B.C.	Yukon	N.W.T.	Canada <sup>5</sup>
Copper	000 t	–	–	152	744	4 218	314	45	2 929	–	–	8 402
Nickel	000 t	–	–	–	552	4 093	1 038	–	–	–	–	5 683
Lead	000 t	–	–	1 411	9	64	–	–	256	–	106	1 845
Zinc	000 t	–	–	3 555	2 649	1 800	561	14	925	–	655	10 159
Molybdenum	000 t	–	–	–	–	–	–	–	121	–	–	121
Silver	t	–	–	3 877	2 775	3 491	354	11	5 095	5	131	15 738
Gold <sup>4</sup>	t	4	–	25	277	726	59	7	266	13	37	1 415

Source: Natural Resources Canada, based on company reports and the Federal-Provincial Survey of Mines and Concentrators.

– Nil or less than one unit.

<sup>1</sup> No allowance is made for losses in milling, smelting and refining. Excludes material classified as "possible." Includes "geological reserves" for some mines that do not report mineable ore. <sup>2</sup> Includes metal in mines where production has been suspended temporarily. <sup>3</sup> One tonne (t) = 1.1023113 short tons = 32 150.746 troy ounces. <sup>4</sup> Excludes metal in placer deposits because reserves data are generally unavailable. <sup>5</sup> May not balance due to rounding at the provincial level.

**TABLE 5. CANADIAN RESERVES OF SELECTED MAJOR METALS BY INDUSTRY, AS AT DECEMBER 31, 1998**Metal Contained in Proven and Probable Mineable Ore<sup>1</sup> in Operating Mines<sup>2</sup> and Deposits Committed to Production

SIC no. <sup>5</sup>	(Units <sup>3</sup> )	Gold Mines	Copper, Copper-Zinc Mines	Nickel-Copper Mines	Zinc-Lead-Silver Mines	Molybdenum Mines	Miscellaneous Metal Mines	Canada <sup>6</sup>
		0611	0612	0613	0614	0615	0619	
Copper	000 t	92	4 400	3 708	199	–	2	8 402
Nickel	000 t	–	–	5 681	–	–	2	5 683
Lead	000 t	–	103	–	1 742	–	–	1 845
Zinc	000 t	990	4 280	–	4 889	–	–	10 159
Molybdenum	000 t	–	43	–	–	78	–	121
Silver	t	5 338	4 611	1 425	4 364	–	–	15 738
Gold <sup>4</sup>	t	1 099	212	70	33	–	1	1 415

Source: Natural Resources Canada, based on company reports and the Federal-Provincial Survey of Mines and Concentrators.

– Nil or less than one unit.

<sup>1</sup> No allowance is made for losses in milling, smelting and refining. Excludes material classified as "possible." Includes "geological reserves" for some mines that do not report mineable ore. <sup>2</sup> Includes metal in mines where production has been suspended temporarily. <sup>3</sup> One tonne (t) = 1.1023113 short tons = 32 150.746 troy ounces.

<sup>4</sup> Excludes metal in placer deposits because reserves data are generally unavailable. <sup>5</sup> SIC Standard Industrial Classification. <sup>6</sup> May not balance due to rounding at the SIC level.

**TABLE 6. CANADIAN RESERVES OF SELECTED MAJOR METALS AS AT DECEMBER 31 OF EACH YEAR, 1977-98**Metal Contained in Proven and Probable Mineable Ore<sup>1</sup> in Operating Mines<sup>2</sup> and Deposits Committed to Production

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold <sup>3</sup> (t)
1977	16 914	7 749	8 954	26 953	369	30 991	493
1978	16 184	7 843	8 930	26 721	464	30 995	505
1979	16 721	7 947	8 992	26 581	549	32 124	575
1980	16 714	8 348	9 637	27 742	551	33 804	826
1981	15 511	7 781	9 380	26 833	505	32 092	851
1982	16 889	7 546	9 139	26 216	469	31 204	833
1983	16 214	7 393	9 081	26 313	442	31 425	1 172
1984	15 530	7 191	9 180	26 000	361	30 757	1 208
1985	14 201	7 041	8 503	24 553	331	29 442	1 373
1986	12 918	6 780	7 599	22 936	312	25 914	1 507
1987	12 927	6 562	7 129	21 471	231	25 103	1 705
1988	12 485	6 286	6 811	20 710	208	26 122	1 801
1989	12 082	6 092	6 717	20 479	207	24 393	1 645
1990	11 261	5 776	5 643	17 847	198	20 102	1 542
1991	11 040	5 691	4 957	16 038	186	17 859	1 433
1992	10 755	5 605	4 328	14 584	163	15 974	1 345
1993	9 740	5 409	4 149	14 206	161	15 576	1 333
1994	9 533	5 334	3 861	14 514	148	19 146	1 513
1995	9 250	5 832	3 660	14 712	129	19 073	1 540
1996	9 667	5 623	3 450	13 660	144	18 911	1 724
1997	9 032	5 122	2 344	10 588	149	16 697	1 510
1998	8 402	5 683	1 845	10 159	121	15 738	1 415

Source: Natural Resources Canada, based on company reports and the Federal-Provincial Survey of Mines and Concentrators.

<sup>1</sup> No allowance is made for losses in milling, smelting and refining. Excludes material classified as "possible." Includes "geological reserves" for some mines that do not report mineable ore. <sup>2</sup> Includes metal in mines where production has been suspended temporarily. <sup>3</sup> Excludes metal in placer deposits because reserves data are generally unavailable.

Note: One tonne (t) = 1.1023113 short tons = 32 150.746 troy ounces.