

RD82
 .8C214
 Sept. '87

THE CANADIAN MINERAL INDUSTRY

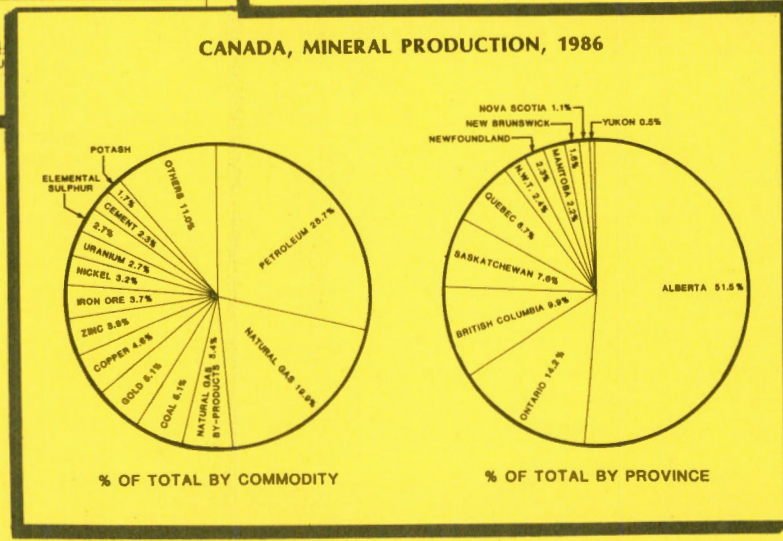
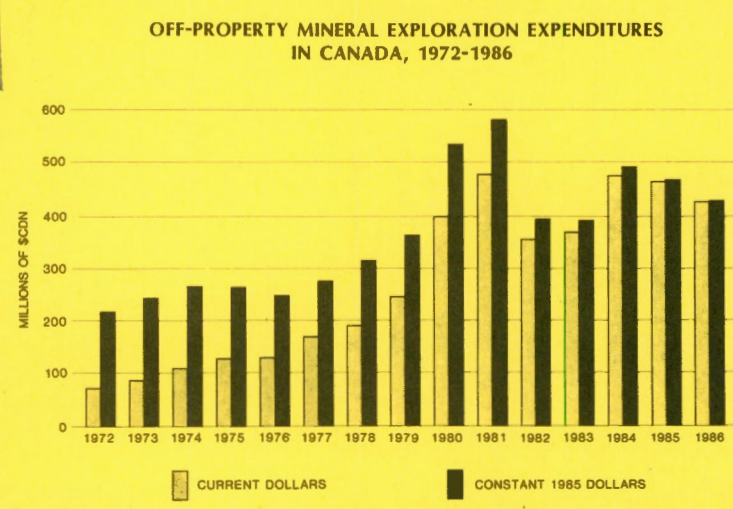
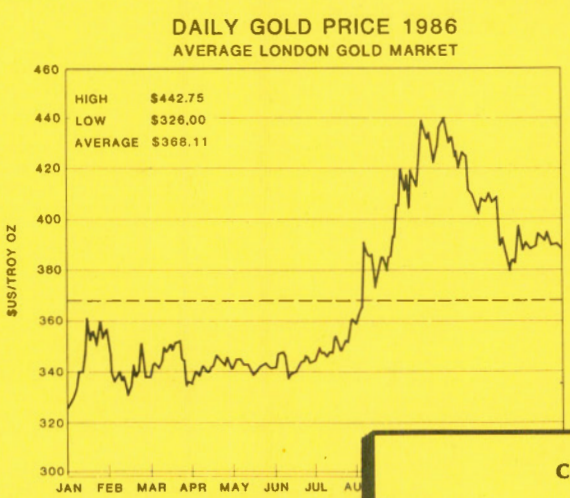
MONTHLY REPORT

SEPTEMBER 1987

Library / Bibliothèque

NOV 10 1987

Geological Survey
 Commission Géologique



This document was produced
by scanning the original publication.

Ce document est le produit d'une
numérisation par balayage
de la publication originale.

ISSN 0229-1908

THE CANADIAN MINERAL INDUSTRY

MONTHLY REPORT



Energy, Mines and
Resources Canada

Hon. Gerald S. Merrithew,
Minister of State
(Forestry and Mines)

Énergie, Mines et
Ressources Canada

L'Hon. Gerald S. Merrithew,
Ministre d'État
(Forêts et Mines)

A Proud Olympic Partner



Un fier partenaire olympique



PREFACE

This publication is prepared in the Mineral Policy Sector of the Department of Energy, Mines and Resources. It is compiled from many sources using the best information available to us. This report is intended to be a general review of the more important current developments that affect, or may affect the Canadian mineral industry. It should not be considered an authority for exact quotation or an expression of the official views of the Government of Canada.

Mineral Policy Sector
Department of Energy, Mines and Resources
580 Booth Street
Ottawa, Ontario K1A 0E4

CONTENTS

	Page
HIGHLIGHTS	1
ECONOMIC TRENDS	2
EMPLOYMENT TRENDS	9
METALLIC MINERALS AND PRODUCTS	16
Copper	16
Gold	16
Iron and Steel	17
Molybdenum	17
SPECIAL ITEM	19
Advanced Industrial Materials: Results of a Series of Canada-Wide Consultations	19
NEW PUBLICATIONS	23

LIST OF TABLES

1. Canada, Production of Leading Minerals	3
2. Canada, Real Gross Domestic Product at Factor Cost by Industry	4
3. Metal Prices, 1987	5
4. Canada, Census Value Added, Total Activity, Nonfuel Mining Industries, 1980-86	6
5. Canada, Principal Statistics of the Nonfuel Mining Industry, 1986	7
6. Canada, Principal Statistics of the Nonfuel Mining Industry by Region, 1986	8
7. Employment in the Mineral Industry, Stage I - Mining	9
8. Employment in the Nonfuel Mineral Industry, Stage I - Mining	10
9. Employment in the Mineral Industry, Stage II - Smelting and Refining	11
10. Employment in the Mineral Industry, Stage III - Semi-fabrication	12
11. Employment in the Mineral Industry, Stage III - Nonfuel Semi-fabrication	13
12. Employment in the Mineral Industry, Stage IV - Metallic Mineral Manufacturing	14
13. Employment for Services Incidental to Mines, Quarries and Oil Wells	15

THE CANADIAN MINERAL INDUSTRY FOR SEPTEMBER

The following constitutes a brief summary of the Canadian mineral industry based upon information that became available in September.

HIGHLIGHTS

1. Cia. Metalquimica do Maranhão (CMM) will proceed with detailed engineering studies for the construction of a 100 000 tpy copper smelter and refinery in São Luis, Carajás.
2. D'Or Val Mines Ltd. has opened its new mine on the Beacon property in northern Quebec. This project costs an estimated \$35 million.
3. There appears to be a downward trend in exports of steel to the United States. The quantity shipped in August 1987 was 237,045 tons, down from 296,873 tons in July of the same year.
4. Cyprus Minerals Company is petitioning the United States Trade Representative to suspend the General System of Preferences status for molybdenum oxide on the basis that imports of that commodity from Chile to the United States are depressing market prices. A decision should be reached in October.

ECONOMIC TRENDS

Table 1 provides information on the volume of production of Canada's leading minerals. Over the first seven months of 1987 relative to 1986, significant volume increases were noted for lead (55.4 per cent), uranium (17.9 per cent), zinc (25.8 per cent) and potash (17.0 per cent). These increases are very similar to those reported in the August issue of this report.

Table 2 provides information on Canada's Gross Domestic Product at factor cost by industry.

The value of GDP is shown in annualized seasonally adjusted constant 1981 dollars.

The annual rate for each month is calculated by multiplying the figure for that month by twelve. However, if a particular month has been influenced by special factors such as a strike, the annualized data may show significant variation from one month to another.

Seasonally adjusted data takes into account unusual seasonal factors, so that statistical series more accurately affect seasonal trends.

The GDP data shown in Table 2 is subject to ongoing revision. This process will also result in month to month variation.

Since January of this year, the GDP has gone up by 3.1 per cent, and in July stood 3.9 per cent above the corresponding month last year. Almost 80 per cent of the July GDP growth originated among the services producing industries. The remaining 20 per cent of the July GDP growth originated among the goods producing industries, principally construction, utilities and mining.

Table 3 shows the prices of selected minerals for June and July.

Table 4 provides information on Census Value Added for the Nonfuel Mining Industries for the years 1980 to 1986. The forecast for 1986 indicates that CVA showed some increase over the previous year but was still below the level recorded for 1984.

Tables 5 and 6 provide a forecast of the principal statistics of the Nonfuel Mining Industry by country and region. The principal statistics include such data as cost of fuel and electricity, materials and supplies used, and value of production. Data associated with value added, salaries and wages, and the number of employees are also included in these tables

TABLE 1. CANADA, PRODUCTION OF LEADING MINERALS ('000 TONNES EXCEPT WHERE NOTED)

		1986			1987			Percentage Changes		
		June	July	Total 7 months	June	July	Total 7 months	July 1987 July 1986	July 1987 June 1987	1st 7 months 1987 1986
Metals										
Copper		57.8	55.0 ^r	424.9	60.6	53.6	424.8	-2.5	-11.6	--
Gold	kg	9 678.9	8 973.0 ^r	59 361.0	9 971.2	9 298.2	61 558.7	+3.6	-6.7	+3.7
Iron ore		2 983.5	3 444.2 ^r	19 931.7	3 863.8	2 943.4	19 270.8	-14.5	-23.8	-3.3
Lead		19.4	14.1	127.5	22.1	29.6	198.1	+109.9	+33.9	+55.4
Molybdenum	t	977.3	877.3 ^r	7 214.2	1 116.4	1 297.4	7 605.1	+47.9	+16.2	+5.4
Nickel		9.6	4.5	99.3	16.0	3.3	109.3	-26.7	-79.4	+10.1
Silver	t	87.3	88.7 ^r	625.4	97.3	100.9	660.3	+13.8	+3.7	+5.6
Uranium ¹	t	979.4	845.2	6 093.3	1 127.0	521.1	7 184.1	-38.4	-53.8	+17.9
Zinc		71.0	88.1 ^r	521.8	64.3	95.2	656.4	+8.1	+48.1	+25.8
Nonmetals										
Asbestos		60.4	45.8	370.1	58.4	58.9	371.6	+28.6	+0.9	+0.4
Clay products	\$000	17,276.3	19,316.1 ^r	96,752.1	20,591.0	22,048.4	120,359.5	+14.1	+7.1	+24.4
Gypsum		907.9	945.8	5 224.8	972.6	913.0	4 903.2	-3.5	-6.1	-6.2
Potash K ₂ O		316.9	370.6	3 919.7	585.9	422.5	4 584.5	+14.0	-27.9	+17.0
Cement		1 052.7	1 181.3 ^r	5 647.0	1 389.3	1 403.4	6 654.7	+18.8	+1.0	+17.8
Lime		191.5	184.8	1 300.8	227.5	157.3	1 326.2	-14.9	-30.9	+2.0
Salt		778.5	718.8 ^r	6 132.5	734.5 ^r	750.6	5 310.8	+4.4	+2.2	-13.4
Fuels										
Coal		4 789.8	3 640.2 ^r	33 234.3	4 967.7	..	..	..	..	..
Natural gas	million m ³	6 084.0	6 116.0 ^r	52 631.0	6 154.0	..	..	..	..	..
Crude oil and equivalent	000 m ³	7 798.0	8 048.0 ^r	52 227.0	7 926.0	..	..	..	..	..

¹ Tonnes uranium (1 tonne U = 1.2999 short tons U₃O₈)... Not available; ^r Revised; -- Number too small to be expressed.

TABLE 2. CANADA, REAL GROSS DOMESTIC PRODUCT AT FACTOR COST BY INDUSTRY, IN 1981 PRICES, MONTHLY (SEASONALLY ADJUSTED AT ANNUAL RATES)

Industry Sector	1986	1987			Per cent Change
	July	May	June	July	July 1987 July 1986
		(\$ millions)			
Total Economy	365,189.7	375,653.9	377,883.4	379,352.9	+3.9
Primary Industries					
Agriculture	12,384.0	11,319.6	11,328.0	11,286.0	-8.9
Forestry	2,542.3	2,631.6	2,756.4	2,802.0	+10.2
Fishing and Trapping	613.6	452.4	735.6	664.8	+8.3
Mines, Quarries and Oil Wells	20,329.5	20,888.4	21,332.4	21,540.0	+6.0
Mining Industries	7,207.8	7,788.0	8,096.4	8,098.8	+12.4
Gold Mines	1,157.4	1,136.4	1,219.2	1,255.2	+8.5
Iron Mines	643.9	434.4	576.0	537.6	-16.5
Other Metal Mines	3,714.3	4,114.8	4,222.8	4,134.0	+11.3
Nonmetal Mines	607.5	841.2	831.6	811.2	+33.5
Asbestos Mines	141.5	166.8	151.2	189.6	+34.0
Mineral Fuels	-	-	-	-	-
Coal Mines	815.7	982.8	978.0	1,053.6	+29.2
Crude Petroleum and Natural Gas	11,896.1	11,932.8	11,810.4	11,949.6	+0.4
Secondary Industries					
Manufacturing	71,840.7	73,651.2	74,132.4	73,879.2	+2.8
Non-durable Manufacturing	32,606.0	32,826.0	32,930.4	33,034.8	+1.3
Durable Manufacturing	39,234.7	40,825.2	41,202.0	40,844.4	+4.1
Primary Metal Industries	5,383.2	5,803.2	5,886.0	5,834.4	+8.4
Primary Steel Industries	2,110.3	2,251.2	2,306.4	2,323.2	+10.1
Steel, Pipe and Tube Industry	311.5	316.8	300.0	333.6	+7.1
Iron Foundries	394.1	402.0	436.8	426.0	+8.1
Smelting and Refining	1,937.0	2,187.6	2,193.6	2,101.2	+8.5
Nonmetallic Mineral Products	2,243.0	2,367.6	2,379.6	2,424.0	+8.1
Clay Products Industry	104.0	102.0	91.2	109.2	+5.0
Cement Industry	263.6	340.8	331.2	339.6	+28.8
Ready-Mix Concrete Industry	363.1	448.8	446.4	446.4	+22.9
Construction Industry	24,945.1	27,338.4	27,590.4	27,838.8	+11.6
Transportation and Storage	16,166.0	16,677.6	16,550.4	16,531.2	+2.3
Communications	10,342.0	10,867.2	10,887.6	10,995.6	+6.3
Other Utilities	10,719.1	11,283.6	11,539.2	11,698.8	+9.1
Wholesale Trade	18,997.9	20,103.6	20,354.4	20,574.0	+8.3
Retail Trade	23,968.5	24,919.2	25,478.4	25,147.2	+4.9
Finance, Insurance and Real Estate	51,791.7	54,338.4	53,948.4	54,818.4	+5.8
Community, Business and Personal Service	38,121.0	38,102.3	38,119.0	38,381.3	+0.7

- Nil.

TABLE 3.

METAL PRICES - 1987

	June	July
Copper		
Electrolytic, U.S. producer f.o.b. refinery, cents (U.S.)	72.946	79.019
Electrolytic, Comex, 1st pos. plus 5¢, cents (Cdn.)	100.245	107.664
Electrolytic, Standard, LME cash, cents (U.S.)	69.852	76.677
Lead		
New York, cents (U.S.)	37.000	42.000
Montreal, cents (Cdn.)	49.700	55.750
LME cash, cents (U.S.)	28.509	30.065
Silver		
New York, cents (U.S.) per troy oz.	741.091	767.841
Toronto, cents (Cdn.) per troy oz.	1,024.977	1,054.086
LME cash, cents (U.S.) per troy oz.	741.717	763.487
Zinc		
St. Louis, H.G., cents (U.S.)	45.048	45.668
Montreal, Electrolytic, cents (Cdn.)	63.700	64.500
LME cash, cents (U.S.)	39.799	37.594
Tin		
New York, Straits, cents (U.S.)	313.568	302.630
Metals Week, composite, cents (U.S.)	414.488	403.092
Gold		
London, p.m., \$US per troy oz.	449.591	450.517
Average, (Sharps Pixley) \$US per troy oz.	449.436	450.424
High, (Sharps Pixley) \$US per troy oz.	457.000	462.500
Low, (Sharps Pixley) \$US per troy oz.	438.000	443.350
Mercury		
\$US per flask	307.273	295.652
Nickel		
Major Producer Cathode, cents (Cdn.)	428.336	424.260
Major Producer Cathode, cents (U.S.)	320.000	320.000
LME cash, \$US	2.012	2.156
Antimony		
New York, dealers, cents (U.S.)	117.045	108.913
Platinum		
New York, refined, \$US per troy oz.	600.000	600.000
Cadmium		
New York, producers, \$US	1.875	1.875
Aluminum		
LME cash, cents (Cdn.)	89.394	99.413
LME cash, cents (U.S.)	66.784	74.983
Cobalt		
Shot/cathode/250 kg., \$US	7.000	7.000
U.S. spot cathode, \$US	6.830	6.750
Tungsten		
LMB ore, low, \$US/MTU	48.000	48.000
GSA domestic, \$US/STU	31.350	31.350
Molybdenum		
M.W. dealer oxide, \$US	2.639	2.584
Uranium		
Nuexco, \$US U ₃ O ₈	17.000	16.925

Average U.S. Exchange Rate for June = 1.3385000, July = 1.32581364.

Note: Prices are per pound unless otherwise stated.

TABLE 4. CANADA, CENSUS VALUE ADDED, TOTAL ACTIVITY, NONFUEL MINING INDUSTRIES, 1980-86

	1980	1981	1982	1983	1984	1985	1986 ^f
	(\$ million)						
Metallic minerals							
Nickel-copper-zinc	2,992.2	2,007.9	1,144.9	1,567.3	2,008.1	1,868.5	1,755.9
Gold	588.8	519.0	566.2	693.6	660.8	635.3	1,022.8
Uranium	559.3	610.3	600.1	496.9	772.5	813.1	812.1
Iron	1,005.0	1,036.0	761.4	644.6	681.1	817.1	713.2
Silver-lead-zinc	513.6	380.3	351.1	294.2	465.7	275.3	408.0
Miscellaneous metal mines	243.3	150.2	73.7	33.2	72.1	65.4	66.1
Total	5,902.2	4,703.8	3,497.4	3,729.8	4,660.5	4,474.7	4,778.0
Industrial minerals							
Potash	900.4	889.7	488.5	455.4	717.1	428.8	405.3
Miscellaneous nonmetals	152.8	171.0	183.5	201.8	240.5	226.8	256.4
Stone	123.4	122.5	109.4	119.5	160.1	207.5	254.3
Sand and gravel	92.0	98.3	75.6	90.3	104.9	132.9	202.9
Asbestos	473.4	431.5	267.3	254.9	252.7	217.6	158.6
Peat	42.7	47.8	41.1	43.0	47.1	63.0	66.0
Gypsum	26.9	31.3	26.6	35.1	40.2	50.7	56.6
Total	1,811.6	1,791.9	1,192.1	1,200.0	1,562.5	1,327.2	1,400.2
Nonfuel mining industry	7,713.7	6,495.6	4,689.4	4,929.7	6,223.1	5,801.9	6,178.3

^f Forecast.

TABLE 5. CANADA, PRINCIPAL STATISTICS OF THE NONFUEL MINING INDUSTRY¹, 1986^f

	Mining Activity								Total Activity ²		
	Production and Related Workers				Costs				Salaries and Wages		
	Establish- ments (number)	Employees (number)	Person- hours Paid (000)	Wages (000)	Fuel and Electri- city (000)	Materials and Supplies (000)	Value of Production (000)	Value Added (000)	Employees (number)	Wages (000)	Value Added (000)
Metals											
Nickel-copper-zinc	25	15 918	30 412	533,029	208,186	1,478,707	3,417,436	1,730,543	21 445	739,548	1,755,861
Gold	47	6 689	14 106	252,579	71,984	306,038	1,396,401	1,018,379	8 657	328,872	1,022,846
Uranium	5	4 542	9 679	190,115	60,170	168,753	1,045,448	816,525	5 575	236,598	812,059
Iron	8	4 574	9 847	179,335	180,345	390,320	1,287,738	717,073	6 379	258,111	713,171
Silver-lead-zinc	13	2 994	6 353	110,698	61,323	493,586	976,518	421,609	4 079	159,923	408,049
Misc. metal mines	7	838	1 795	30,197	12,576	36,194	121,601	67,496	1 171	42,294	66,062
Total	105	35 555	72 192	1,295,953	594,584	2,873,599	8,239,807	4,771,624	47 306	1,765,346	4,778,049
Industrials											
Potash	11	3 014	6 367	95,291	104,708	96,072	608,166	407,387	4 272	146,263	405,317
Misc. nonmetals	49	1 998	4 171	61,962	33,659	56,426	344,216	254,131	2 518	82,369	256,443
Stone	121	1 982	4 509	57,945	30,057	84,475	363,512	248,980	2 544	74,994	254,342
Sand and gravel	112	1 295	2 973	38,231	23,169	62,576	264,070	178,326	2 132	61,938	202,910
Asbestos	5	2 500	5 057	76,275	39,914	50,444	251,213	160,855	3 227	105,486	158,614
Peat	62	1 155	2 494	20,586	3,984	17,441	84,772	63,348	1 412	27,353	65,986
Gypsum	10	601	1 479	14,754	6,912	20,335	84,249	57,001	869	23,800	56,606
Total	370	12 545	27 051	365,044	242,403	387,768	2,000,198	1,370,027	16 974	522,204	1,400,216
Total nonfuel mining industry	475	48 100	99 243	1,660,997	837,987	3,261,367	10,240,007	6,141,651	64 280	2,287,550	6,178,265

¹ Cement manufacturing, lime manufacturers, clay and clay products (domestic clays) are included in the mineral manufacturing industry.² Total activity includes sales and head offices.^f Forecast.

TABLE 6. CANADA, PRINCIPAL STATISTICS OF THE NONFUEL MINING INDUSTRY¹ BY REGION, 1986^f

	Mines, Quarries and Oil Well Activity								Total Activity ²		
	Production and Related Workers				Costs						
	Establish- ments (number)	Employees (number)	Person- hours Paid	Wages	Fuel and Electri- city	Materials and Supplies	Value of Production	Value Added	Employees (number)	Salaries and Wages	Value Added
			(000)	(\$000)	(\$000)	(\$000)	(\$000)	(\$000)		(\$000)	(\$000)
Atlantic	60	5 324	11 620	174,397	120,625	491,661	1,211,117	598,831	6 659	228,611	599,273
Quebec	184	10 634	22 324	356,853	186,524	483,280	1,697,419	1,027,614	14 360	497,510	1,045,898
Ontario	118	17 910	37 725	643,999	208,128	1,194,900	3,825,483	2,422,456	24 173	879,694	2,449,682
Prairies	60	6 822	14 403	227,127	144,917	352,353	1,613,382	1,116,111	9 382	325,793	1,116,513
British Columbia	41	5 617	9 263	176,429	121,150	494,848	1,159,635	543,638	7 087	236,868	535,913
Yukon and Northwest Territories	12	1 793	3 908	82,191	55,644	244,324	732,969	433,002	2 619	119,073	430,992
Canada	475	48 100	99 243	1,660,997	837,987	3,261,367	10,240,007	6,141,651	64 280	2,287,550	6,178,265

¹ Cement manufacturing, lime manufacturing, clay and clay products are included in the mineral manufacturing industry. ² Total activity includes sales and head offices.

^f Forecast.

EMPLOYMENT TRENDS

Tables 7 through 13 provide employment data for the mineral industry from 1961 to 1987. It should be noted that each employment number shown may be an average derived from monthly data.

Some readers may find it useful to know that historical data for Stage 1 (back to and including 1961) is available on CANSIM matrices 7951 to 7966.

The employment data provided is disaggregated into four stages as follows: Stage 1, Mining; Stage 2, Smelting and Refining; Stage 3, Semi-manufacturing; and Stage 4, Manufacturing.

TABLE 7.
EMPLOYMENT¹ IN THE MINERAL INDUSTRY
STAGE I - MINING
(total activity)

SIC#	Metal Mines 061	Nonmetal Mines 062	Structural Materials 081,082	Nonfuel Mining 061,062 081,082 (number)	Coal 063	Crude Oil and Natural Gas 071	Total Nonfuel and Fuel
1961	58 591	11 003	5 235	74 829	10 302	11 184	96 315
1962	58 243	11 408	5 514	75 165	9 897	11 232	96 294
1963	57 119	11 661	5 686	74 466	9 828	11 237	95 531
1964	57 648	11 727	6 044	75 419	9 796	11 242	96 457
1965	60 942	12 116	6 248	79 306	9 697	11 817	100 820
1966	61 670	12 422	6 312	80 404	9 281	12 378	102 063
1967	61 728	13 077	5 779	80 584	8 981	13 113	102 678
1968	63 369	13 673	5 836	82 878	8 427	13 611	104 916
1969	60 550	14 322	5 692	80 564	7 371	14 153	102 088
1970	66 590	15 150	5 510	87 250	7 874	14 970	110 094
1971	66 012	15 105	5 328	86 445	8 069	15 896	110 410
1972	61 994	14 866	5 154	82 014	8 704	16 604	107 322
1973	66 134	15 391	5 276	86 801	7 856	16 786	111 443
1974	70 038	16 198	6 197	92 433	8 142	18 155	118 730
1975	69 161	13 703	6 382	89 246	8 416	18 053	115 715
1976	68 269	15 649	5 685	89 603	8 995	19 096	117 694
1977	67 242	16 608	5 190	89 040	9 781	20 240	119 061
1978	56 447	16 035	4 847	77 329	10 574	22 045	109 948
1979	58 960	16 770	4 692	80 422	10 269	24 554	115 245
1980	66 118	16 979	4 461	87 558	11 416	27 448	126 422
1981	68 712	16 391	4 183	89 286	11 182	28 783	129 251
1982	61 503	13 680	3 491	78 674	13 113	31 699	123 486
1983	52 194	13 170	3 403	68 767	11 646	33 418	113 831
1984	52 683	13 698	3 560	69 941	11 905	33 944	115 790
1985	48 672	12 974	3 941	65 587	11 860	34 108	111 555
1986 ^P	47 306	12 298	4 676	64 280	11 150	32 700	108 130
1987 ^f	46 400	12 100	6 000	64 500	11 250	32 000	107 750

Source: Annual Census of Mines.

SIC: 1980 Standard Industrial Classification.

¹ Number shown for any given year may be an average derived from monthly data for full-time employees.

P Preliminary; ^f Forecast.

TABLE 8.
EMPLOYMENT IN THE NONFUEL MINERAL INDUSTRY
STAGE I - MINING
(total activity)

SIC#	Gold 0611	Uranium 0616	Iron 0617	Nickel, Copper, Zinc 0612,0613	Silver, Lead, Zinc 0614	Other Nonferrous 0615,0619	Asbestos 0621 (number)	Peat 0622	Gypsum 0623	Potash 0624	Other Nonmetal 0625,0629	Stone Quarries 081	Sand and Gravel 082	Total Nonfuel Mining
1961	15 994	(1)	8 446	23 351	4 524	6 276	6 773	1 207	599	(2)	2 424	3 173	2 062	74 829
1962	15 425	(1)	9 181	23 383	4 669	5 585	6 936	1 220	594	(2)	2 658	3 221	2 293	75 165
1963	14 639	(1)	9 608	22 703	5 163	5 006	6 828	1 303	677	(2)	2 853	3 477	2 209	74 466
1964	14 012	(1)	9 544	23 848	5 898	4 346	6 544	1 290	710	(2)	3 183	3 718	2 326	75 419
1965	13 155	(1)	11 739	25 892	6 121	4 035	6 536	1 201	646	1 050	2 683	3 511	2 737	79 306
1966	11 656	(1)	11 464	27 651	6 356	4 543	6 736	1 254	585	1 195	2 652	3 701	2 611	80 404
1967	10 355	(1)	10 899	29 288	6 030	5 156	6 931	1 261	505	1 724	2 656	3 381	2 398	80 584
1968	9 001	(1)	11 342	30 557	6 320	6 149	7 213	1 306	489	2 086	2 579	3 340	2 496	82 878
1969	8 221	(1)	10 490	28 679	6 467	6 693	7 242	1 156	657	2 713	2 554	3 252	2 440	80 564
1970	7 185	(1)	11 336	36 253	7 103	4 713	7 664	1 195	671	2 837	2 783	3 023	2 487	87 250
1971	6 148	(1)	11 524	37 713	6 506	4 121	8 101	1 269	603	2 519	2 613	2 832	2 496	86 445
1972	5 579	(1)	10 842	36 012	6 057	3 504	7 843	1 114	670	2 440	2 799	2 803	2 351	82 014
1973	5 603	(1)	13 395	37 602	6 112	3 422	8 027	1 236	676	2 684	2 768	3 097	2 179	86 801
1974	5 665	(1)	15 019	38 876	6 722	3 756	8 131	1 288	671	3 224	2 884	3 458	2 739	92 433
1975	5 798	(1)	16 155	35 538	7 362	4 308	6 042	1 303	576	3 351	2 431	3 544	2 838	89 246
1976	5 051	3 430	16 765	34 049	7 351	1 623	7 900	1 168	591	3 270	2 720	3 217	2 468	89 603
1977	4 643	4 140	15 550	33 703	7 512	1 694	8 302	1 244	652	3 628	2 782	3 004	2 186	89 040
1978	4 943	4 965	12 103	25 610	7 073	1 753	7 752	1 295	683	3 708	2 597	2 876	1 971	77 329
1979	5 013	5 858	14 563	25 116	7 081	1 329	8 067	1 372	738	3 905	2 688	2 860	1 832	80 422
1980	5 839	6 304	13 753	31 063	7 349	1 810	8 055	1 308	715	4 160	2 741	2 660	1 801	87 558
1981	6 809	6 869	12 397	33 246	7 740	1 651	6 829	1 441	711	4 661	2 749	2 418	1 765	89 286
1982	7 350	6 035	10 676	28 851	6 837	1 754	4 973	1 323	614	4 076	2 694	2 028	1 463	78 674
1983	7 956	5 390	8 236	24 953	5 073	586	4 617	1 301	682	3 696	2 874	1 980	1 423	68 767
1984	8 450	6 249	7 843	24 000	5 165	976	4 177	1 369	770	4 508	2 874	2 256	1 304	69 941
1985	7 862	5 989	7 077	22 073	4 724	947	3 569	1 363	753	4 488	2 801	2 340	1 601	65 587
1986 ^P	8 657	5 575	6 379	21 445	4 079	1 171	3 227	1 412	869	4 272	2 518	2 544	2 132	64 280
1987 ^f	8 900	5 600	5 500	21 200	4 100	1 100	2 800	1 425	875	4 400	2 600	3 100	2 900	64 500

Source: Annual Census of Mines.

SIC: 1980 Standard Industrial Classification.

(1) Included in other nonferrous. (2) Included in other nonmetal.

P Preliminary; f Forecast.

TABLE 9.
EMPLOYMENT IN THE MINERAL INDUSTRY
STAGE II - SMELTING AND REFINING
(total activity)

SIC#	Smelting/ Refining 295	Iron & Steel Mills 291	Total Primary Metal 291,295 (number)	Petroleum Refineries 3,611	Total Smelting & Refining
1961	29 938	34 749	64 687	10 660	75 347
1962	29 693	36 593	66 286	10 184	76 470
1963	28 516	38 196	66 712	9 734	76 446
1964	30 153	41 505	71 658	9 547	81 205
1965	31 835	44 274	76 109	8 976	85 085
1966	34 237	45 999	80 236	8 996	89 232
1967	34 764	44 203	78 967	9 147	88 114
1968	34 710	44 634	79 344	9 091	88 435
1969	33 376	42 954	76 330	8 765	85 095
1970	37 298	49 169	86 467	14 725	101 192
1971	36 445	49 601	86 046	14 506	100 552
1972	33 829	49 758	83 587	14 376	97 963
1973	32 396	53 008	85 404	14 843	100 247
1974	35 249	54 253	89 502	15 967	105 469
1975	35 577	54 003	89 580	15 624	105 204
1976	34 246	51 978	86 224	15 105	101 329
1977	35 647	52 709	88 356	16 464	104 820
1978	32 652	56 669	89 321	18 958	108 279
1979	32 869	59 167	92 036	18 037	110 073
1980	36 137	61 238	97 375	18 743	116 118
1981	38 011	56 543	94 554	21 325	115 879
1982	33 215	52 330	85 545	20 155	105 700
1983	31 788	47 693	79 481	17 557	97 038
1984	31 752	48 899	80 651	15 847	96 498
1985	30 567	47 685	78 252	15 326	93 578
1986 ^P	28 750	47 000	75 750	15 500	91 250
1987 ^f	28 900	44 225	73 125	15 975	89 100

Source: Annual Census of Manufactures.
SIC: 1980 Standard Industrial Classification.
P Preliminary; ^f Forecast.

TABLE 10.
EMPLOYMENT IN THE MINERAL INDUSTRY¹
STAGE III - SEMI-FABRICATION
(total activity)

SIC#	Total Nonfuel Semi-Fabrication	Miscellaneous Petroleum and Coal Products	Lubricating Oil and Greases	Total Semi-Fabrication
		369	3 612	
		(number)		
1961	64 836	581	331	65 748
1962	67 561	608	352	68 521
1963	68 677	635	354	69 666
1964	72 993	726	373	74 092
1965	77 813	531	408	78 752
1966	82 211	585	424	83 220
1967	79 973	546	407	80 926
1968	80 293	518	397	81 208
1969	82 424	532	438	83 394
1970	79 546	499	423	80 468
1971	79 559	561	450	80 570
1972	83 458	555	478	84 491
1973	87 007	757	487	88 251
1974	90 283	954	514	91 751
1975	86 682	984	656	88 322
1976	85 838	982	602	87 422
1977	83 371	716	669	84 756
1978	88 411	683	712	89 806
1979	91 466	461	695	92 622
1980	87 373	532	798	88 703
1981	85 883	584	729	87 196
1982	75 619	571	792	76 982
1983	73 321	503	857	74 681
1984	77 198	521	896	78 615
1985	79 153	513	900	80 566
1986 ^P	79 175	615	900	80 690
1987 ^f	80 700	700	1 200	82 600

Source: Annual Census of Manufactures.

SIC: 1980 Standard Industrial Classification.

¹ 1970 SIC for years 1961-82.

^P Preliminary; ^f Forecast.

TABLE 11.
EMPLOYMENT IN THE MINERAL INDUSTRY¹
STAGE III - NONFUEL SEMI-FABRICATION
(total activity)

SIC#	Steel Pipe and Tube 292	Iron Foundries 294	Aluminum Rolling, Casting Extruding 296	Copper Rolling, Casting Extruding 297	Other Rolling, Casting Extruding 299	Clay and Clay Products 351	Cement 352 (number)	Concrete Products 354	Ready-mix Concrete 355	Glass and Glass Products ² 356	Abrasives 357	Lime 358	Other Non- metallic Products 359	Total Nonfuel Semi- fabrication
1961	3 407	8 178	5 095	3 482	2 731	5 327	3 590	8 503	4 232	9 802	2 481	847	7 161	64 836
1962	3 676	8 546	5 118	3 492	2 770	5 468	3 679	9 156	4 886	10 042	2 577	949	7 202	67 561
1963	3 840	8 216	5 164	3 651	3 038	5 376	3 566	9 317	5 411	10 346	2 464	886	7 402	68 677
1964	4 437	9 620	4 834	3 849	3 382	5 582	3 592	10 225	6 171	10 362	2 580	815	7 544	72 993
1965	4 799	11 714	4 654	3 620	3 736	5 675	3 837	10 988	6 559	10 873	2 821	800	7 737	77 813
1966	4 795	13 027	4 943	4 199	4 103	5 876	4 053	11 090	7 349	11 248	3 044	785	7 699	82 211
1967	5 012	11 970	5 468	4 027	4 287	5 559	3 972	10 321	7 137	11 388	2 734	724	7 374	79 973
1968	5 441	11 131	5 491	3 947	4 585	5 515	3 747	10 166	7 440	11 992	2 617	662	7 559	80 293
1969	5 146	11 582	6 028	3 922	4 856	5 383	3 778	11 011	7 509	12 031	2 697	707	7 774	82 424
1970	5 314	10 663	6 297	3 744	4 060	4 938	3 887	9 562	7 340	11 654	2 559	660	8 868	79 546
1971	5 306	9 897	5 612	3 608	3 845	4 682	3 954	10 719	7 997	11 672	2 310	670	9 287	79 559
1972	6 268	9 948	6 200	3 740	4 215	4 695	4 732	10 817	8 240	12 045	2 367	651	9 540	83 458
1973	5 288	10 965	6 206	3 736	4 863	5 001	4 871	10 790	9 233	12 840	2 555	724	9 935	87 007
1974	5 845	12 054	6 162	3 779	4 877	5 289	4 666	11 602	9 219	12 915	2 676	840	10 359	90 283
1975	5 785	11 480	5 672	3 240	4 573	5 042	4 577	11 201	9 541	11 779	2 318	790	10 684	86 682
1976	5 546	10 365	6 255	3 297	5 354	4 791	4 517	10 773	9 128	11 836	2 535	804	10 637	85 838
1977	5 634	10 459	6 884	3 183	4 703	4 553	4 265	10 001	8 521	11 204	2 557	828	10 579	83 371
1978	6 289	10 472	7 060	3 586	5 268	4 366	4 520	10 486	9 520	11 595	2 678	784	11 787	88 411
1979	6 480	10 520	7 698	3 728	6 292	4 947	4 828	9 766	9 332	11 835	2 660	925	12 455	91 466
1980	6 514	9 245	6 627	3 230	5 749	4 875	4 791	9 280	9 348	11 967	2 628	1 003	12 116	87 373
1981	7 531	8 358	6 512	3 031	5 182	4 145	4 726	9 121	10 053	12 003	2 571	968	11 682	85 883
1982	6 017	8 163	6 255	2 541	4 694	3 004	4 317	8 245	8 034	11 016	2 170	895	10 268	75 619
1983	4 521	7 364	6 415	2 744	4 827	3 008	4 057	7 286	8 390	11 896	1 852	862	10 099	73 321
1984	5 482	7 911	6 661	2 971	5 274	3 070	3 771	7 657	8 807	12 754	1 949	876	10 015	77 198
1985	5 978	7 750	6 196	3 012	5 620	2 727	3 533	8 336	9 210	12 872	1 895	783	11 241	79 153
1986P	5 250	7 675	6 200	3 025	5 275	2 600	3 600	8 700	9 350	13 500	1 800	900	11 300	79 175
1987f	5 675	8 050	6 000	2 850	5 725	2 800	3 400	8 100	9 400	14 900	1 550	950	11 300	80 700

Source: Annual Census of Manufactures.

SIC: 1980 Standard Industrial Classification.

¹ 1970 SIC for years 1961-82. ² Includes sealed window manufacturers until 1969; thereafter these are included in Stage IV - Ornamental Metal Products.

P Preliminary; f Forecast.

TABLE 12.
EMPLOYMENT IN THE MINERAL INDUSTRY¹
STAGE IV - METALLIC MINERAL MANUFACTURING
(total activity)

SIC#	Boilers 301	Structural Metal Products 302	Ornamental Metal Products 303	Stamped, Pressed and Coated Products 304	Wire and Wire Products 305 (Number)	Hardware Tool and Cutlery 306	Heating Equipment 307	Machine Parts 308	Other Metal Fabricating 309	Total Mineral Manu- facturing
1961	4 709	14 231	10 641	21 156	12 227	9 135	5 137	7 756	15 249	100 241
1962	4 886	14 802	11 640	23 606	13 045	10 223	5 349	8 603	16 283	108 437
1963	5 350	14 212	12 459	24 024	13 743	11 112	5 586	9 179	16 627	112 292
1964	5 429	14 602	12 808	25 192	14 850	13 110	5 673	10 137	18 088	119 889
1965	6 496	18 072	13 439	27 925	16 099	13 570	5 711	11 618	20 017	132 947
1966	7 239	21 038	13 488	29 577	16 391	14 326	5 464	13 235	21 431	142 189
1967	6 622	18 547	12 994	29 830	16 060	14 056	5 461	13 810	21 007	138 387
1968	7 962	17 150	12 664	29 560	16 082	14 166	4 930	13 501	20 825	136 840
1969	7 494	18 203	12 784	30 463	17 014	14 401	5 059	14 517	20 895	140 830
1970	7 661	19 104	12 417	29 709	16 598	15 241	4 670	14 221	20 543	140 164
1971	7 847	17 556	12 614	28 710	16 272	14 920	4 749	13 097	20 755	136 520
1972	8 136	17 113	13 611	27 939	17 651	16 386	4 238	11 731	21 504	138 309
1973	8 013	18 164	13 937	30 026	18 877	18 819	4 453	10 138	22 494	144 921
1974	8 681	20 020	14 470	31 276	19 535	20 234	4 930	10 936	23 663	153 745
1975	10 211	19 101	15 241	30 273	17 614	18 990	4 717	10 922	23 810	150 879
1976	10 704	18 056	15 541	31 487	17 573	19 316	4 977	10 764	23 704	152 122
1977	9 660	17 209	14 800	30 888	17 886	17 867	4 538	10 762	23 298	146 908
1978	9 124	16 759	16 753	34 181	18 823	18 856	5 086	12 029	24 904	156 515
1979	9 477	18 676	18 018	33 548	19 765	21 090	5 818	13 081	23 705	163 178
1980	10 374	17 700	17 890	32 266	18 529	20 830	5 993	13 449	24 217	161 248
1981	11 215	18 445	17 603	32 459	17 309	19 575	5 806	14 297	22 123	158 832
1982	10 965	17 021	15 228	29 865	14 575	17 342	5 317	13 083	18 167	141 563
1983	5 413	18 437	13 537	27 947	13 493	16 609	5 032	12 881	16 044	129 393
1984	4 548	17 162	13 538	27 760	19 521	17 308	4 220	14 200	16 256	134 513
1985	4 455	18 083	15 598	31 021	15 354	19 209	5 607	15 356	14 927	139 610
1986 ^P	5 050	17 175	16 550	35 500	16 000	24 000	5 950	14 750	15 750	150 725
1987 ^f	5 275	19 400	15 900	33 900	15 700	23 400	7 000	16 400	14 900	151 875

Source: Annual Census of Manufactures.

SIC: 1980 Standard Industrial Classification.

¹ 1970 SIC for years 1961-82.

P Preliminary; ^f Forecast.

TABLE 13.
EMPLOYMENT FOR SERVICES INCIDENTAL TO MINES, QUARRIES AND OIL WELLS

	Petroleum and Natural Gas Contract Drilling ¹	Mining Diamond Drilling ²	Other Services Incidental to Mines, Quarries and Oil Wells ³	Total ⁴
1961	4 144	2 025	1 409	7 578
1962	3 800	1 926	1 720	7 446
1963	4 179	2 201	1 491	7 871
1964	4 158	2 401	2 077	8 636
1965	4 648	2 776	3 137	10 561
1966	4 428	2 887	4 317	11 632
1967	4 249	2 669	5 425	12 343
1968	4 434	2 985	6 350	13 769
1969	4 821	3 109	6 967	14 897
1970	4 267	3 207	7 894	15 368
1971	4 093	2 514	7 710	14 317
1972	4 817	2 083	6 139	13 039
1973	5 680	2 123	5 193	12 996
1974	5 054	2 317	5 017	12 388
1975	5 096	1 899	4 139	11 134
1976	5 486	1 548	5 043	12 077
1977	6 054	1 682	5 723	13 459
1978	7 419	1 681	7 492	16 592
1979	9 076	2 420	8 436	19 932
1980	11 097	2 959	9 327	23 383
1981	8 448	2 721	9 856	21 025
1982	6 882	1 880	7 752	16 514
1983	12 032	1 575	12 254	25 861
1984	13 803	1 684	12 698	28 185
1985	18 178	1 576	15 781	35 535
1986 ^P	15 600	1 650	19 750	37 000
1987 ^f	14 000	1 700	24 650	40 350

¹ Statistics Canada Annual Census to 1976, Labour Force Survey or estimate thereafter. ² Energy, Mines and Resources' Annual Census. ³ Statistics Canada's Labour Force Survey, predominantly servicing the Energy Sector, estimates by EMR from 1983 onwards. ⁴ Statistics Canada's Labour Force Survey, estimated by EMR from 1983 onwards.

P Preliminary; f Forecast.

METALLIC MINERALS AND PRODUCTS

Copper

Metal Prices cents (U.S.)/lb.		
	London Metal Exchange (LME) Grade A Cash Settlement Sept. 1-29	Commodities Exchange, Inc. (Comex) 1st Position Sept. 1-28
High	85.5	84.2
Low	76.6	77.1
Average	82.0	81.0
Year to Date Average	70.8	68.8
Year to Date Average Cents Cdn	94.2	91.6

The backwardation of three-month copper with respect to cash copper that started in early March continued through September, ranging from 0.95 to 1.80 cents (U.S.)/lb. The LME cash settlement price averaged 0.626 Special Drawing Rights/lb (SDR/lb) for the period Sept. 1-29, up from 0.606 SDR/lb in July and 0.626 in August.

Between August 28 and September 25, the combined LME and Comex stocks increased from 177 795 tonnes to 188 081 t. In mid-July, combined exchange stocks were as low as 155 919 t (July 17).

Progress continued with the drilling of the Ansil deposit in Quebec, owned by Minnova Inc. (formerly Corporation Falconbridge Copper). A shaft has been sunk to 1 400 metres and drilling has taken place from three levels. The reserves are expected to be defined by the end of October.

Agreement in principle has been reached whereby Teck Corporation's Highmont mill will be incorporated into the Highland Valley Copper partnership. The partnership will change so that Cominco Ltd. will reduce its share from 55 per cent to 50 per cent, Lornex Mining Corporation Ltd. will retain its 45 per cent share and Highmont Mining Corporation will have a 5 per cent share. Cominco will be paid \$16.7 million for the restructuring. Highmont is owned 50 per cent by Teck.

Cia. Metalquimica do Maranhão (CMM) will proceed with detailed engineering studies for construction of its planned 100 000 tpy copper smelter and refinery at São Luis, Carajás. Construction could start in mid-1988 on the \$US 200 million project. Likely startup is seen in early 1990 with the plant being brought up to capacity by the next year. Brazil's existing copper smelter and refinery, owned by Caraiiba Metais S.A., is expanding its operation from 150 000 to 200 000 tpy of metal.

Gold

The average price of gold on the London Gold Market remained relatively unchanged at \$US 460.17 compared to \$460.89 for the previous month. For the first three quarters of the year, gold prices have averaged \$US 437 compared with \$355 during 1986.

Cambior inc. and Sullivan Mines Inc. have announced a merger agreement. Cambior will purchase all outstanding shares of Sullivan, increasing its interest from the current 35 per cent to 100 per cent. Sullivan's major asset is its 34 per cent interest in the Arthur White gold mine in northern Ontario which produced 2 100 kg in 1986. Cambior has a 50 per cent interest in the Doyon gold mine in northern Quebec, which produced 6 600 kg last year. The merger is to be finalized at the October 15th shareholders meeting. Annual gold production for the company will increase to over 7 800 kg.

D'Or Val Mines Ltd. has officially opened its new mine on the Beacon property in northern Quebec. The project, including a 750 tpd mill, cost an estimated \$35 million. The mine shaft has been sunk to 500 m and could be extended to 1 000 m should reserves be proved up. Current reserves are 750 000 t grading an average 4.4 g/t.

Last month's strike by about 300 000 black mine workers in South Africa led to a sharp drop in the country's gold output to 44 345 kg in August, down from 53 023 kg in July and 53 845 kg in August 1986. The three-week strike, the largest industrial dispute in the country's history, was mainly over higher wages.

Iron and Steel

The Canadian steel industry operated at 71.8 per cent (preliminary) of capacity in August compared to the 69.99 per cent rate of July. The July figure has been revised from 64.9 per cent.

The August report of the Canadian "Steel Export Monitoring Program" indicates a continuation of the downward trend in exports to the United States. The figures are June, 296,873 tons; July, 281,189 tons; August, 237,045 tons. Of the amount shipped to the United States, in August, 1,191 tons were declared to be of other than Canadian origin.

The Algoma Steel Corporation, Limited and Huron Steel Products (Windsor) Ltd. have formed a limited partnership to be known as Huron Steel Products. A similar arrangement is planned for Mohawk Metal Products Limited, an affiliate of Huron Steel. Huron and Mohawk are involved in the manufacture and maintenance of tools, dies, jigs, fixtures in the automotive and related industry. The joint venture will provide Huron and Mohawk with financing for future ventures and Algoma with participation in the secondary steel product market, as well as a captive market for Algoma's steel products.

Algoma announced the sale of 20 000 tonnes of steel tubular product to the U.S.S.R., worth about \$19 million.

Sidbec-Dosco Inc. has announced a profit of \$5.4 million in the first six months of 1987. This is an improvement over 1986 when the company had made a \$6.5 million profit for the full year. The first profitable year in over a decade was 1986.

Molybdenum

The United States Trade Representative (USTR) held hearings on September 2 on a petition by Cyprus Minerals Company to suspend GSP (General System of Preferences) status for molybdenum oxide. Representatives from Cyprus Minerals, AMAX Inc., Corporacion Nacional del Cobre de Chile (CODELCO-CHILE) and the American Iron and Steel Institute (AISI) all made presentations at the hearing. Cyprus Minerals claimed that molybdenum imports from Chile depressed market prices, and the increase in the Chilean imports at the expense of the U.S. producers has been detrimental to the domestic molybdenum industry. Chile was initially granted the GSP status in 1986, extended for another year in 1987.

Siding with Cyprus Minerals, AMAX claimed that the Chilean exports to the United States increased significantly in the first five months of 1987, and that allowing special status for CODELCO of Chile, currently the world's largest molybdenum producer, contradicts the good intent of the GSP program. The program was designed to provide a special benefit to certain developing countries that could not otherwise compete in world markets.

CODELCO argued at the hearing that both Cyprus Minerals and AMAX have artificially inflated molybdenum prices in the United States and that removing molybdenum from GSP would limit domestic competition. In addition, CODELCO asked that the Trade Policy Staff Committee investigate concentrate purchases of both U.S. companies to determine whether they were used to strengthen the producers' dominance in the U.S. market.

The American Iron and Steel Institute argued that the GSP renders U.S. steels more competitive, and supports the President's steel program. The Institute also stressed that the removal of the GSP status would not cure the problems of the U.S. primary molybdenum industry.

The USTR is expected to receive a report on the domestic molybdenum industry from the U.S. International Trade Commission on October 1, and to reach a decision as early as the end of October.

In British Columbia, Lornex Mining Corporation Ltd., Cominco Ltd., and Highmont Mining Corporation reached an agreement to include Highmont in the Highland Valley Copper joint venture. Under the agreement, Cominco will have 50 per cent of Highland Valley cash flow, Lornex will take 45 per cent and Highmont 5 per cent. Lornex will provide Highland Valley with \$16.7 million in cash to retain its 45 per cent equity. Highmont was closed in 1984 after three years of operation due to the poor market for copper and molybdenum.

In 1986, Cominco and Lornex formed the Highland Valley Copper joint venture to manage their combined assets in the Highland Valley. Under the agreement, mining is to be gradually shifted from the Lornex pit to the Cominco pit, while milling will continue at the Lornex and Bethlehem mills. The takeover of Cominco by Teck Corporation in late 1986 has facilitated the negotiation for adding Highmont to the Joint Venture. Highmont is owned 50 per cent by Teck Corporation.

SPECIAL ITEM

ADVANCED INDUSTRIAL MATERIALS

Results of a Series of Canada-Wide Consultations¹

Introduction

In October 1986, the Ministry of State for Science and Technology (MOSST) released a consultation document, "Advanced Materials Technologies: Underpinnings of Industrial Competitiveness -- A Working Paper", developed by the Interdepartmental Working Group on Advanced Industrial Materials, chaired by MOSST, on which EMR was represented by members of the Mineral Policy Sector and the Research and Technology Sector. The Working Paper was designed to raise issues and to elicit comments and suggestions, and was aimed at decision makers and planners in the private, academic and public sectors.

The Working Group chose to consult with Chief Executive Officers of a representative sample of companies across Canada, deans of research of a few universities known to be active in materials R&D, presidents or directors of a sample of trade associations, and with all provincial and territorial governments and provincial research organizations. Discussions were also held with professional societies, consultants and individuals.

The objectives of the consultation process were: to develop an accurate perception of the Canadian situation in advanced industrial materials use and R&D; to identify related problems and opportunities; and to elicit suggestions for a coordinated strategy to promote excellence in materials, involving the private, academic and public sectors.

The formal consultations, initiated in December 1986, involved correspondence between the Secretary of MOSST and approximately 100 organizations, and follow-up meetings and discussions coordinated by MOSST. Prior to and during this period of formal consultations, however, all members of the Working Group were involved in extensive informal discussions, as well as more formal discussions through other mechanisms such as committees and advisory boards; the results of these discussions have been put to use in planning, interpreting and augmenting the formal consultations.

The Findings

The written replies and discussions were wide-ranging and of course different according to the interests and experience of each organization.

The Emerging Consensus

There is a clear consensus that new materials technologies are and will be critically important to the Canadian economy. The importance to individual companies varies according to the nature of their business. There is also wide variation in the extent to which companies are aware of these new technologies and their impacts.

¹ As reported by Messrs. Alain Lévesque and Graham Taylor, Ministry of State for Science and Technology, Ottawa.

Frequently it was noted that Canada lacks a major driving force such as the U.S. military and space programs, U.S. automotive industry spending, or Japan's chronic shortage of raw materials. The lack of targeted national programs accounts for some of the dispersion and fragmentation of the Canadian R&D efforts in new materials. Various suggestions concerning the establishment of national projects were made; most often, these related to the establishment of national goals for materials performance in critical applications, or to the need to develop and disseminate data on properties and performance.

It was widely agreed that Canada's economy is too small and widely dispersed to allow Canada to compete across the board with major industrial nations. Compounding this limitation is the fact that in general, according to most respondents, Canada lags well behind the United States, Japan, and to a lesser extent Europe in the development and application of new materials.

The logical conclusion is that Canada should pursue a "niching" strategy -- seeking those product areas in which Canada is in a good position to excel in export markets. Several examples were cited of companies that have successfully taken this route. Most companies commented that the job of picking and pursuing these niches must be left to industry. The government's role should be primarily to create the right climate, and to build the flexible capability and infrastructure that will be needed to pursue emerging markets five years hence and beyond. Some organizations, including several companies, did, however, suggest that industry, government and the R&D community, working together, should undertake the job of selecting niches and setting appropriate R&D priorities.

Perhaps the most prominent of the items of consensus -- expressed in different ways -- was the need for greater cooperation, linkages (domestic and international) and networking. These mechanisms are recommended to overcome the problems of dispersion and fragmentation (and create "critical mass" of researchers), to improve information flows, to share the risks and costs of R&D, especially at the pre-competitive stage, and to accelerate technology development and application. Various mechanisms are available, including industrial R&D consortia, formal networks, and joint industry/university/government projects.

Few if any suggestions were raised for the creation of new institutes or programs. Instead, virtually all those consulted emphasized the need to build on strengths, fortify existing bodies of expertise, fill in gaps, re-orient activities where necessary, and draw in new participants. It was generally recognized that this will not happen overnight, and that capability will have to be built over a number of years. Nonetheless, many respondents conveyed a sense of urgency, and added that the shorter-term needs of the private sector must not be overlooked.

For many companies and research organizations, especially the smaller ones, information needs are paramount. Information is required on new technologies and their applications, and on markets. The general impression gleaned from the responses is that many Canadian companies and organizations are poorly informed on such matters. The most commonly cited category of technical information relates to materials characterization, properties, performance and standards.

Finally, there is an apparent consensus that the universities must be strengthened -- in two respects. They must be able to meet industry's requirements for expert personnel, and they must provide the technical and industrial knowledge base needed for productive partnerships with industry in R&D. The strategic grants and university-industry programs of NSERC were cited for their positive contribution to meeting those needs.

Special Considerations

Extensive discussions were held with the **minerals and metals industries**. Their capability in advanced materials technologies varies from non-existent to world-class. Generally, the need for diversification, for adding value to products, and for investing in product R&D is well recognized. Historically, however, the orientation of companies in these industries has been toward

mining and primary processing and toward volume production of commodities. For many companies, advanced materials represent high market risk, and unfamiliar lines of business. Given this situation, the government might be expected to share the risks of investing in product R&D. The industries are generally adamant, however, that they are not "sunset industries", and that any ventures into new materials would be logical extensions of current business, building wherever possible on their considerable experience in working with materials.

In the **manufacturing sector**, interest in advanced materials is building rapidly, and some firms have established a solid market position. In general, however, the capability to incorporate these new technologies into products remains weak. The principal needs are for information on technology and markets, access to markets, and for domestic and international linkages. Government policy, say most respondents, must be market-oriented.

User-supplier linkages are considered very important in the development and application of new materials technologies. To date, such linkages have not been well developed in Canada. The increasing role of product engineers and designers in specifying materials requirements, and the broadening range of materials available, is forcing materials suppliers to get closer to the market.

The **universities** are concerned about the needs for "critical mass" of researchers, and for stable, industrial support for longer-term work. The problem of qualified materials scientists leaving the country to occupy better positions in the United States was cited on several occasions. The government was cautioned against eroding the basic support for fundamental research (i.e., NSERC Operating Grants). In general, the university researchers interviewed believe that Strategic Grants and the new Matching Fund Policy are creating stronger university-industry links, but they would like the source of funds to become more stable and they believe that longer financial commitments or short-term commitments to long-term R&D are essential to attract industrial partners and hold teams of researchers together.

Technical Priorities

Advanced materials is an extremely broad field. Many companies and researchers have yet to determine priorities for their own activities. The level of awareness and knowledge of the relevant technologies varies considerably. At this stage, it would be extremely difficult to draw conclusions as to which specific technologies are the most important. It was, however, suggested by several organizations that this is a necessary task that may have to be undertaken cooperatively by industry and the R&D community. The basic approach should be to match strengths with opportunities.

Three areas of technology were, however, recognized by virtually all respondents as being of fundamental importance:

- non-destructive evaluation;
- methods and data on materials characterization, properties and performance; and
- advanced design and processing methods with the aid of computers.

The Role of Government

There seems to be a general appeal for government leadership in advanced industrial materials, but views differ on what form that leadership should take. If there is a consensus, it could perhaps be best characterized as a vision of the government leading by example -- that is to say, committing funds and human resources to the advanced materials field. There definitely is a consensus that a major commitment from government would positively influence the climate for private commitment.

It was generally agreed that the role of government was one of facilitator, helping to create linkages, both domestic and international; helping industry to identify emerging technologies of economic importance; providing certain facilities that are too costly for most companies to establish; helping to secure access to markets; and sharing the risks and costs of R&D, particularly at the pre-competitive stage.

According to a majority of those consulted, government should play a major role in supporting R&D in industries and universities and in coordinating R&D in government laboratories with the work performed in industrial and university laboratories to avoid duplication.

In general, the private sector does not advocate an expansion of government laboratory activities, but there is a wide variation of opinion on the role of government laboratories. Views seem to be based largely on personal or corporate experience. Two areas of activity do, however, seem to have the support of most respondents; the provision of common-use facilities (such as aircraft testing facilities); and the identification and preliminary investigation of emerging technologies for which the industrial base is not yet established.

Government procurement is seen to be an instrument that could be more effectively used to develop industrial capability in designing and working with new materials. Many examples of the use of procurement by the U.S. military were given.

The government is also seen to have a legitimate role in providing information, sharing the costs of its provision by the private sector, or facilitating its acquisition. Of particular interest is information sourced outside of Canada.

Government-wide discussions continue to be held on various aspects of Canadian policy towards advanced industrial materials. Of particular interest are:

1. the need for mechanisms to overcome dispersion and fragmentation of effort, to improve information flows and communication, and to pool expertise and resources;
2. the need for reliable information on:
 - "technical intelligence", pioneering investigations, and assessments of emerging technologies that are likely to be economically important,
 - data on materials standards, characterization, properties and performance, and
 - world markets.
3. the question of how to strengthen the universities in their roles of contributors to the industrial technology base and developers of expert personnel.

NEW PUBLICATIONS

The following publications were recently published by Energy, Mines and Resources Canada. Copies may be obtained from the indicated distribution centres.

Mineral Bulletin

MR 215 - Canadian Mines: Perspective from 1986

Catalogue No.: M38-2/215

ISBN: 0-660-53839-3

Price: \$7.95

Canadian Government Publishing Centre
Supply and Services Canada
Ottawa, Ontario
K1A 0S9

Internal Report

MRI 87/7 - Peat Producers in Canada

Catalogue No.: M35-2/87-7

ISBN: 0-662-55443-4

Micromedia Limited
165 Hôtel de Ville
Place du Portage
Hull, Quebec
J8X 3X2

