

R082
8C214
Sept. '88
12

THE CANADIAN MINERAL INDUSTRY

MONTHLY REPORT

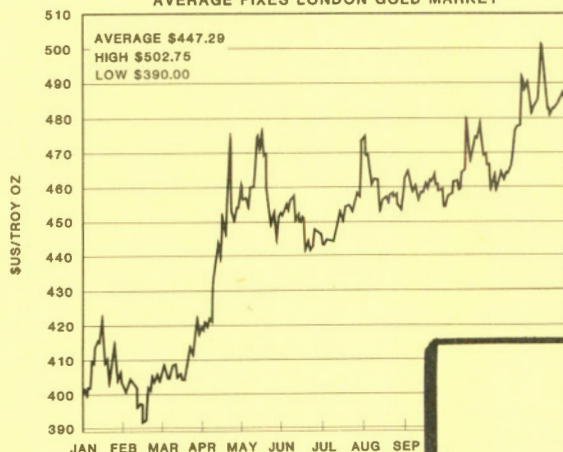
SEPTEMBER 1988

LIBRARY / BIBLIOTHÈQUE

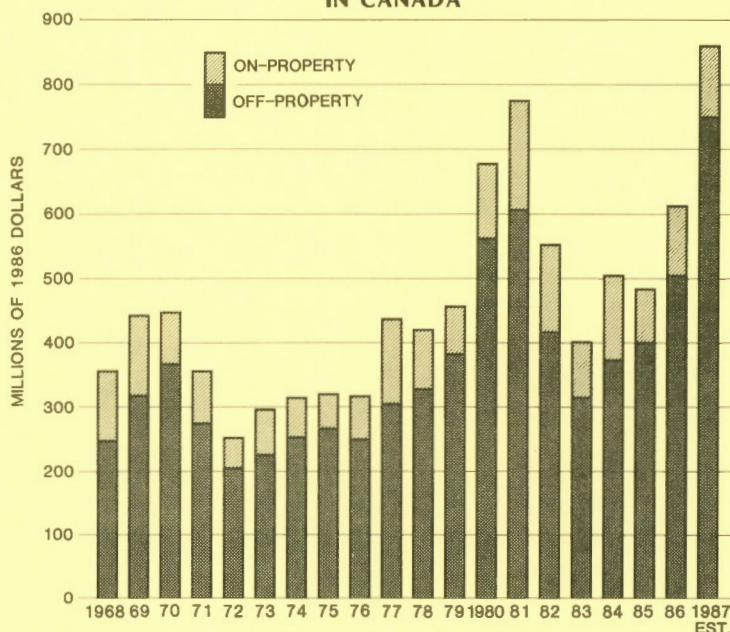
FEB 28 1989

GEOLOGICAL SURVEY
COMMISSION GEOLOGIQUE

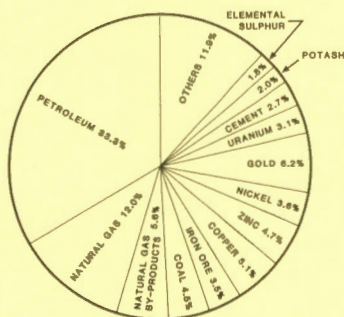
DAILY GOLD PRICES 1987
AVERAGE FIXES LONDON GOLD MARKET



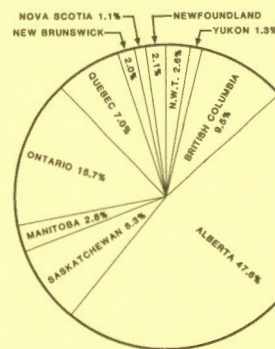
ANNUAL FIELD EXPENDITURES ON
OFF- AND ON-PROPERTY MINERAL EXPLORATION
IN CANADA



CANADA, MINERAL PRODUCTION, 1987



% OF TOTAL BY COMMODITY



% OF TOTAL BY PROVINCE

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

Énergie, Mines et
Ressources Canada

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
METALLIC MINERALS AND PRODUCTS	10
Copper	10
SPECIAL ITEM	12
Base Metals: Today's Exploration Challenge	12
NEW PUBLICATIONS	16
A Reference Guide to Mining Legislation in Canada	16
MR 219 - Bauxite and Alumina	16
MRI 88/1 - Canadian Iron Ore Industry Statistics, 1987	17

LIST OF TABLES

1. Canada, Production of Leading Minerals	3
2. Canada, Real Gross Domestic Product at Factor Cost by Industry in 1981 Prices, Monthly	4
3. Metal Prices, 1988	5
4. Canada, Industrial Fatalities per Thousand Workers by Industry Groups, 1985-87	6
5. Canada, Rate of Industrial Fatalities per Thousand Workers by Industry Groups, 1981-87	7
6. Canada, Industrial Fatalities by Occupational Injuries and Illnesses, 1985-87	7
7. Canada, Number of Strikes and Lockouts by Industries, 1985-87	8
8. Canada, Number of Strikes and Lockouts by Mining and Mineral Manufacturing Industries, 1985-87	9

THE CANADIAN MINERAL INDUSTRY FOR SEPTEMBER

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

HIGHLIGHTS

1. Copper prices averaged US\$110.0 ¢/lb. on the LME during the month of September, while the COMEX price averaged about US\$110.6 ¢/lb. Between August 26 and September 23, the combined LME and COMEX stocks decreased from 142 066 t to 121 975 t, reflecting continued strong demand.
2. Workers at the Ruttan mine voted to accept the offer of Hudson Bay Mining and Smelting Co., Limited, ending a three month strike.

ECONOMIC TRENDS

Table 1 provides a comparison of the volume of production of Canada's leading minerals for the months of June and July 1988 and the corresponding months last year, as well as the year-to-date totals. In the metals group, copper, gold, iron ore, silver, uranium and zinc showed gains in production during the first seven months of 1988 compared to last year. Lead, molybdenum and nickel experienced decreases in production. For the nonmetals group, asbestos, potash, lime and salt have experienced increases in production for the last seven months compared to last year, while clay products, gypsum and cement have shown decreases.

Table 2 provides information on Canada's Gross Domestic Product at factor cost by industry at 1981 prices. The data is also annualized and seasonally adjusted.

The annual rates shown for any given month is calculated by multiplying the figure for that month by twelve. It is important to note, however, that if a particular month has been influenced by special factors such as a strike, the annualized data will reflect this bias.

Factor cost refers to output which is valued exclusive of excise taxes and duties, and provincial and municipal sales tax. Factor cost does, however, include subsidies and other taxes which are not a function of the level of output or sale.

Seasonally adjusted data represent time-series data from which the effects of repetitive and clearly defined seasonal fluctuations have been removed. Such a practice permits the isolation of trends in the economy which might otherwise be obscured. Seasonal factors include such items as climate, trade practices and social institutions such as Christmas the Easter.

The GDP data are subject to ongoing revision.

GDP at Factor Cost at 1981 prices was unchanged in July following gains of 0.1% in June and 0.6% in May. In July, GDP stood 4.5% above the level of the corresponding month last year. Output of services producing industries advanced 0.3% while goods producing industries declined 0.4%.

Table 3 shows the prices of selected metals for June and July, 1988.

Tables 4, 5 and 6 deal with industrial fatality statistics by industry group.

Tables 7 and 8 provide data pertaining to the number of strikes and lockouts by industry group, and also, more specifically, for mining and mineral manufacturing.

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

			1987			1988			Percentage Changes		
			June	July	Total 7 Months	June	July	Total 7 Months	July 1988 July 1987	July 1988 June 1988	1st 7 months 1988 1987
Metals											
Copper			60.6	53.1 ^r	424.3	60.4	51.0	435.7	-4.0	-15.6	2.7
Gold	kg		9 946.3	9 596.7 ^r	61 836.9	11 002.4	10 008.2	71 456.1	4.3	-9.0	15.6
Iron ore			3 864.1	2 945.3 ^r	19 273.9	3 650.9	3 904.2	21 506.0	32.6	6.9	11.6
Lead			22.2	29.6	201.3	19.0	18.4	188.6	-37.8	-3.2	-6.3
Molybdenum	t		814.0	1 130.1 ^r	7 528.0	1 019.1	930.0	6 921.1	-17.7	-8.7	-8.1
Nickel			16.0	3.2	109.3	17.2	3.9	108.5	21.9	-77.3	-0.7
Silver	t		97.9	105.2 ^r	669.9	111.8	92.2	803.5	-12.4	-17.5	19.9
Uranium ¹	t		1 127.0	521.1	7 184.1	978.5	510.8	7 220.6	-2.0	-47.8	0.5
Zinc			64.3	95.2	659.3	88.4	94.3	676.4	-0.9	6.7	2.6
Nonmetals											
Asbestos			58.4	58.9	371.6	67.5	56.2	398.6	-4.6	-16.7	7.3
Clay products	\$000		20 591.0	22 048.4	120 359.5	19 177.6	18 277.4	104 128.2	-17.1	-4.7	-13.5
Gypsum			998.3	954.4	5 099.0	737.6	796.5	4 976.7	-16.5	8.0	-2.4
Potash K ₂ O			585.9	422.5	4 584.5	631.2	470.2	4 915.3	11.3	-25.5	7.2
Cement			1 438.5	1 423.3 ^r	6 804.6	1 389.5	1 294.3	6 733.4	-9.1	-6.9	-1.0
Lime			227.5	157.3	1 326.2	214.6	198.8	1 429.9	26.4	-7.4	7.8
Salt			734.5	742.1	5 302.3	894.1	762.3	5 780.6	2.7	-14.7	9.0
Fuels											
Coal			4 962.1	4 978.8	33 547.1	5 715.1	..	..	..	..	..
Natural gas	million m ³		6 229.0	6 475.0 ^r	54 841.0	6 831.0	..	..	..	..	..
Crude oil and equivalent	000 m ³		7 900.0	8 303.0 ^r	53 949.0	8 058.0	..	..	..	..	..

¹ Tonnes uranium (1 tonne U = 1.2999 short tons U₃O₈).

^r Revised; .. Not available.

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

Industry Sector	1987	1988			Percentage Change July 1988 July 1987
	July	May	June	July	
	(\$ million)				
Total Economy	378 468.7	394 915.1	395 325.3	395 404.2	4.5
Primary Industries					
Agriculture	11 276.5	10 177.4	9 987.9	9 925.2	-12.0
Forestry	2 784.9	2 943.8	2 616.3	2 784.9	0.0
Fishing and Trapping	676.7	723.5	690.7	655.7	-3.1
Mines, Quarries and Oil Wells	21 800.3	24 173.9	23 725.9	24 193.1	11.0
Mining Industries	7 951.4	8 483.7	8 308.2	8 554.6	7.6
Gold Mines	1 350.3	1 504.5	1 462.3	1 465.9	8.6
Iron Mines	611.6	753.4	606.8	734.2	20.0
Other Metal Mines	3 925.8	4 013.5	4 014.7	4 112.1	4.7
Nonmetal Mines	787.9	852.4	880.0	866.8	10.0
Asbestos Mines	216.3	162.2	156.3	158.7	-26.6
Mineral Fuels					
Coal Mines	945.5	1 081.3	1 064.5	1 106.5	17.0
Crude Petroleum and Natural Gas	12 318.3	13 533.6	13 474.8	13 754.4	11.7
Secondary Industries					
Manufacturing	72 934.4	78 035.0	78 415.2	77 403.3	6.1
Non-durable Manufacturing	32 699.9	33 408.8	33 300.0	33 405.3	2.1
Durable Manufacturing	40 234.5	44 626.2	45 115.2	43 998.0	9.4
Primary Metal Industries	5 722.6	6 436.1	6 733.2	6 177.8	8.0
Primary Steel Industries	2 428.1	2 538.3	2 603.0	2 423.3	-0.2
Steel, Pipe and Tube Industry	319.2	399.9	384.5	326.4	2.3
Iron Foundries	345.9	402.0	387.6	386.4	11.7
Smelting and Refining	1 945.6	2 342.7	2 624.2	2 300.6	18.2
Nonmetallic Mineral Products	2 353.6	2 342.5	2 427.7	2 426.5	3.1
Clay Products Industry	80.3	81.6	80.4	79.2	-1.4
Cement Industry	319.0	297.6	331.2	331.2	3.8
Ready-mix Concrete Industry	456.1	446.5	447.7	448.9	-1.6
Construction Industry	26 638.8	27 429.6	27 121.2	27 100.8	1.7
Transportation and Storage	16 934.0	18 472.8	18 391.2	18 552.0	9.6
Communications	11 024.1	11 666.4	12 028.8	12 024.0	9.1
Other Utilities	11 491.5	11 336.4	11 518.8	11 481.6	-0.1
Wholesale Trade	21 131.8	22 494.0	22 774.8	22 740.0	7.6
Retail Trade	24 571.7	25 422.9	25 485.4	25 634.5	4.3
Finance, Insurance and Real Estate	55 213.1	57 834.0	58 142.4	58 434.0	5.8
Community, Business and Personal Service	38 559.8	40 012.8	40 118.8	40 120.4	4.0

TABLE 3. METAL PRICES - 1988

	June	July
Copper		
Electrolytic, U.S. producer f.o.b. refinery, cents (U.S.)	112.875	103.448
Electrolytic, COMEX, 1st pos. plus 5¢, cents (C.)	138.745	125.288
Electrolytic, Standard, LME cash, cents (U.S.)	104.947	96.766
Lead		
New York, cents (U.S.)	36.000	36.000
Montreal, cents (C.)	44.500	44.500
LME cash, cents (U.S.)	30.678	28.057
Silver		
New York, cents (U.S.) per troy oz.	703.682	714.650
Toronto, cents (C.) per troy oz.	889.650	896.279
LME cash, cents (U.S.) per troy oz.	698.398	707.595
Zinc		
St. Louis, H.G., cents (U.S.)	62.550	65.644
Montreal, Electrolytic, cents (C.)	78.000	78.000
LME cash, cents (U.S.)	61.867	56.081
Tin		
New York, Straits, cents (U.S.)	330.886	335.500
Metals Week, composite, cents (U.S.)	439.836	446.110
Gold		
London, p.m., US\$ per troy oz.	451.280	437.629
Average, (Sharps Pixley) US\$ per troy oz.	451.494	437.540
High, (Sharps Pixley) US\$ per troy oz.	464.700	444.800
Low, (Sharps Pixley) US\$ per troy oz.	433.550	431.200
Mercury		
US\$ per flask	360.909	370.000
Nickel		
Major Producer Cathode, cents (C.)	-LPS-	-LPS-
Major Producer Cathode, cents (U.S.)	-LPS-	-LPS-
LME cash, US\$	7.071	6.618
Antimony		
New York, dealers, cents (U.S.)	96.773	97.000
Platinum		
New York, refined, US\$ per troy oz.	600.000	600.000
Cadmium		
New York, producers US\$	9.300	9.300
Aluminum		
LME cash, cents (C.)	197.571	141.399
LME cash, cents (U.S.)	162.289	117.120
Cobalt		
Shot/cathode/250 kg., US\$	7.500	7.500
U.S. spot cathode, US\$	6.950	6.975
Tungsten		
LMB ore, low, US\$/MTU	50.000	45.250
GSA domestic, US\$/MTU	-LPS-	-LPS-
Molybdenum		
M.W. dealer oxide, US\$	3.459	3.375
Uranium		
Nuexco, US\$ U ₃ O ₈	15.400	15.100

Average U.S. Exchange Rate for June = 1.2174, July = 1.2073

Note: Prices are per pound unless otherwise stated.

LPS List Price Suspended.

TABLE 4. CANADA, INDUSTRIAL FATALITIES PER THOUSAND WORKERS¹ BY INDUSTRY GROUPS, 1985-87

	Fatalities			Number of Workers			Rate per 1000 Workers		
	1985	1986	1987 ^p	1985	1986	1987 ^p	1985	1986	1987 ^p
	(number)			(000)					
Agriculture	20	9	12	168.0	172.0	179.0	0.12	0.05	0.07
Forestry	66	55	61	61.0 ^r	61.0	62.0	1.08 ^r	0.90	0.98
Fishing ²	26	14	24	12.0	14.0	15.0	2.17	1.00	1.60
Mining ³	131	108	108	189.0 ^r	183.0	181.0	0.69 ^r	0.59	0.60
Manufacturing ⁴	140 ^r	111	108	1 951.0 ^r	1 985.0	2 017.0	0.07	0.06	0.05
Construction	135 ^r	141	118	488.0 ^r	522.0	565.0	0.28 ^r	0.27	0.21
Transportation ⁵	132	122	107	834.0 ^r	842.0	848.0	0.16	0.14	0.13
Trade	79 ^r	59	40	1 797.0 ^r	1 881.0	1 928.0	0.04 ^r	0.03	0.02
Finance ⁶	5	6	4	599.0 ^r	628.0	661.0	0.01	0.01	0.01
Service ⁷	56 ^r	39	38	3 224.0 ^r	3 383.0	3 501.0	0.02	0.01	0.01
Public Administration ⁸	56	55	36	802.0 ^r	800.0	814.0	0.07 ^r	0.07	0.04
Unknown	18	3	9	..	..	..	..	..	..
Total	864 ^r	722	665	10 125.0 ^r	10 471.0	10 771.0	0.09	0.07	0.06

¹ Includes fatalities resulting from occupational chest illnesses such as silicosis, lung cancer, etc. Excludes the province of Quebec for which data is unavailable. ² Includes trapping and hunting. ³ Includes quarrying and oil wells. ⁴ Includes deaths of workers who were on pension for an earlier disabling injury. ⁵ Includes storage, communication, electric power and water utilities and highway maintenance. ⁶ Includes insurance and real estate. ⁷ Includes community, business and personal services. ⁸ Includes defence.
 .. Not available; ^p preliminary; ^r revised.

TABLE 5. CANADA, RATE OF INDUSTRIAL FATALITIES PER THOUSAND WORKERS BY INDUSTRY GROUPS,¹ 1981-87

	1981	1982	1983	1984	1985	1986	1987p2
Agriculture	0.14	0.13	0.13	0.13	0.12	0.05	0.07
Forestry	0.95	1.22	0.97 ^r	0.88 ^r	1.08 ^r	0.90	0.98
Fishing ³	1.47	1.58	1.07 ^r	1.93	2.17	1.00	1.60
Mining ⁴	0.76	0.96	0.63 ^r	0.57 ^r	0.69 ^r	0.59	0.60
Manufacturing ⁵	0.09	0.11	0.08	0.07 ^r	0.07	0.06	0.05
Construction	0.39	0.35	0.25 ^r	0.31 ^r	0.28 ^r	0.27	0.21
Transportation ⁶	0.25 ^r	0.22	0.17	0.15	0.16	0.14	0.13
Trade	0.04	0.04	0.03 ^r	0.03	0.04 ^r	0.03	0.02
Finance ⁷	0.02	0.01	0.01	0.01 ^r	0.01	0.01	0.01
Service ⁸	0.03	0.03	0.03	0.02	0.02	0.01	0.01
Public Administration ⁹	0.11	0.08	0.07 ^r	0.08 ^r	0.07 ^r	0.07	0.04
Total	0.11	0.11	0.08 ^r	0.08 ^r	0.09	0.07	0.06

¹ Includes fatalities resulting from occupational chest illnesses such as silicosis, lung cancer, etc. Excludes the province of Quebec for which data is unavailable. ² Prior to 1983, the rates may be understated because only 80 percent of workers in the Statistics Canada employment estimates are covered by workers' compensation, beginning 1983, the rates include 100 percent of workers. ³ Includes trapping and hunting. ⁴ Includes quarrying and oil wells. ⁵ Includes deaths of workers who were on pension for an earlier disabling injury. ⁶ Includes storage, communication, electric power and water utilities and highway maintenance. ⁷ Includes insurance and real estate. ⁸ Includes community, business and personal services. ⁹ Includes defence.

^p Preliminary; ^r Revised.

TABLE 6. CANADA, INDUSTRIAL FATALITIES BY OCCUPATIONAL INJURIES AND ILLNESSES,¹ 1985-87

	Occupational Injuries			Occupational Illnesses ²			Total		
	1985	1986	1987p	1985	1986	1987p	1985	1986	1987p
Agriculture	20 ^r	9	12	0	0	0	20 ^r	9	12
Forestry	65 ^r	55	61	1	0	0	66 ^r	55	61
Fishing ³	26 ^r	14	24	0	0	0	26 ^r	14	24
Mining ⁴	74 ^r	57	58	57 ^r	51	50	131 ^r	108	108
Manufacturing	105 ^r	87	69	35 ^r	24	39	140 ^r	111	108
Construction	109 ^r	113	100	26 ^r	28	18	135 ^r	141	118
Transportation ⁵	128 ^r	118	104	4	4	3	132 ^r	122	107
Trade	73 ^r	56	38	6 ^r	3	2	79 ^r	59	40
Finance ⁶	5 ^r	6	4	0	0	0	5 ^r	6	4
Service ⁷	53 ^r	37	38	3 ^r	2	0	56 ^r	39	38
Public Administration ⁸	52 ^r	50	29	4	5	7	56 ^r	55	36
Unknown	2	0	8	1	0	1	3	0	9
Total	712	602	545	137	117	120	849 ^r	719	665

¹ Includes fatalities resulting from occupational chest illness such as silicosis, lung cancer, etc. Excludes the province of Quebec for which data is unavailable. ² Includes trapping and hunting. ³ Includes quarrying and oil wells. ⁴ Includes deaths of workers who were on pension for an earlier disabling injury. ⁵ Includes storage, communication, electric power and water utilities and highway maintenance. ⁶ Includes insurance and real estate. ⁷ Includes community, business and personal services. ⁸ Includes defence.

^p Preliminary; ^r Revised.

TABLE 7. CANADA, NUMBER OF STRIKES AND LOCKOUTS BY INDUSTRIES, 1985-87

	1985			1986			1987 ^p		
	Strikes and Lockouts	Workers Involved	Duration in Person-days	Strikes and Lockouts	Workers Involved	Duration in Person-days	Strikes and Lockouts	Workers Involved	Duration in Person-days
Agriculture	1	16	290	0	0	0	1	18	3 800
Forestry	8 ^r	1 409 ^r	8 120 ^r	9	27 813	2 024 930	5	882	2 500
Fishing and trapping	0	0	0	0	0	0	0	0	0
Mines	12	6 309 ^r	90 180 ^r	14	8 796	351 870	14	8 902	228 440
Manufacturing	356 ^r	66 075 ^r	1 578 010 ^r	317	54 977	1 383 600	303	82 476	1 758 555
Construction	14	992	11 210	48	151 941	1 963 500	21	8 363	53 620
Transportation and utilities	96 ^r	38 763 ^r	478 900 ^r	59	23 859	305 450	64	125 408	700 890
Trade	129 ^r	23 196 ^r	467 880 ^r	109	8 443	234 940	95	8 427	326 250
Finance, insurance and real estate	18	1 137 ^r	106 920 ^r	13	885	32 570	13	622	29 930
Service	160 ^r	15 831 ^r	383 900 ^r	125	133 695	302 705	114	58 874	555 854
Public administration	31	5 999 ^r	55 300 ^r	41	73 206	506 860	28	288 707	326 920
Various industries	0	0	0	0	0	0	0	0	0
All industries	825 ^r	159 727 ^r	3 180 710 ^r	735	483 615	7 106 425	658	582 679	3 986 759

^p Preliminary; ^r Revised.

TABLE 8. CANADA, NUMBER OF STRIKES AND LOCKOUTS BY MINING AND MINERAL MANUFACTURING INDUSTRIES, 1985-87

	1985			1986			1987 ^p		
	Strikes and Lockouts	Workers Involved	Duration in Person-days	Strikes and Lockouts	Workers Involved	Duration in Person-days	Strikes and Lockouts	Workers Involved	Duration in Person-days
Mines	12	6 350	91 590	14	8 796	351 870	14	8 902	228 440
Metals	5	4 018	40 760	7	4 700	52 920	10	7 551	221 170
Mineral fuels	2	1 400	13 030	4	2 977	231 870	2	1 060	1 000
Nonmetals	3	876	37 260	3	1 119	67 080	1	272	6 210
Quarries	2	56	540	0	0	0	1	19	60
Mineral manufacturing	38	4 050	130 730	41	7 136	228 070	41	12 203	451 590
Primary metals	16	2 789	63 400	14	4 422	138 750	21	9 107	369 800
Nonmetallic mineral products	22	1 261	67 330	26	2 598	89 070	20	3 096	81 790
Petroleum and coal products	0	0	0	1	116	250	0	0	0

^p Preliminary.

METALLIC MINERALS AND PRODUCTS

Copper

W. McCutcheon (613) 992-4403

Metal Prices - US Cents/lb.

	London Metal Exchange (LME) Grade A Cash Settlement September 1-30	Commodities Exchange, Inc. (COMEX) 1st Position September 1-29
High	116.2	121.4
Low	105.2	101.8
Average	110.0	110.6

Between August 26 and September 23 the combined LME and COMEX stocks decreased from 142 066 t to 121 975 t, reflecting continued strong demand.

The LME decided to drop the standard copper contract. The last delivery date for standard copper will be January 4, 1989. In an attempt to increase the liquidity of the standard contract in January 1988 the LME had decided to list fire-refined high conductivity copper as good delivery against the standard contract effective April 1, 1988.

Workers at Ruttan mine voted to accept the offer of Hudson Bay Mining and Smelting Co., Limited (HBMS), ending a three month strike. Changes to the severance pay package were amongst the items negotiated. The workers will receive their first wage increases in four years: \$1.53/hr in the first year and 65 cents/hr in each of the next two years of the three year contract. HBMS hopes to produce about 80% of scheduled production from Ruttan, despite the strike. Throughout the strike, HBMS had kept its smelter operating with feed from its other mines, supplemented with supplies from alternative sources.

At Ok Tedi Mining Limited's operation in the Star Mountains of Papua New Guinea, workers struck on September 21 for the third time in 1988. Previously there was a brief strike in March and a 13-day strike in August. Unlike previous strikes, during the present strike widespread rioting took place. The government dispatched troops and riot police to restore calm while expatriate dependents were reportedly evacuated. Housing for unmarried workers and pay appear to be the main issues. The government called a conference between the workers union and the company to attempt to resolve differences and return to work. The government owns 20% of the operation.

Ok Tedi is not producing during the strike although equipment is being maintained. The production loss amounts to about 1 000 t/d of copper concentrate. The existing stockpile of 20 000 t of copper concentrate will be shipped by the first week of October. The company has not declared force majeure. Production of copper in concentrates in 1987 amounted to 39 500 t while production for the first six months of 1988 totalled 25 000 t.

Two major decisions affecting the Philippine copper industry are expected in 1989. Philippine Associated Smelting and Refining Corp. (PASAR) has prequalified seven contractors who

could provide funding through suppliers' credits. PASAR is considering expanding capacity from 138 000 to 172 500 t/y. Sourcing the concentrates for expanded operation could prove difficult if the Foreign Engineering and Construction Corp. of the People's Republic of China decides (in 1989) to invest about US\$300 million in the Philippine mining industry to obtain between 100 000 and 200 000 t/y of copper concentrates.

SPECIAL ITEM

Base Metals: Today's Exploration Challenge¹

Donald A. Cranstone (613) 992-4666

and

André Lemieux (613) 992-2709

Canadian reserves of gold in ores have quadrupled since 1979, an upward trend that seems likely to continue for some time. But since the early 1980s, preoccupation with gold exploration and general neglect of base-metal exploration have led to a significant decline in Canadian reserves of base metals. The decline of the inventory of mineable base-metal ores has seriously diminished the time available for finding and developing new ore to sustain Canadian mine production through the 1990s at current levels. Unless substantial new discoveries of copper, zinc and lead are made in Canada almost immediately, there will be a progressive decline in Canadian output of these metals beginning by the mid-1990s.

Discovery Requirements for Copper

To maintain current Canadian production, each mine approaching exhaustion must be replaced by a new operation, based on a discovery some six years earlier. Without some new discoveries very soon, Canadian copper production will begin to fall off sharply in about 5 years (Figure 1) because the reserves in many current mines will be exhausted.

The large inventory of mineable copper discoveries accumulated in Canada from the late 1950s to the early 1970s is running out.

The life of Canadian base-metal mines averages about 20 years. This means that, to make up for a given annual metal production shortfall, discoveries of that metal must amount to about 20 times that annual shortfall.

Consequently, to maintain a level output of copper from Canadian mines beyond the early 1990s, almost one million tonnes of copper contained in ore would have to be discovered on the average each year from now to the year 2000. This calculation takes into account i) the production required, over and above the likely copper output obtainable from deposits now known, to maintain the 1992 copper output level after that year, ii) overall recovery of 80%, iii) 20-year mine life, and iv) a 6-year lag between discovery and first production.

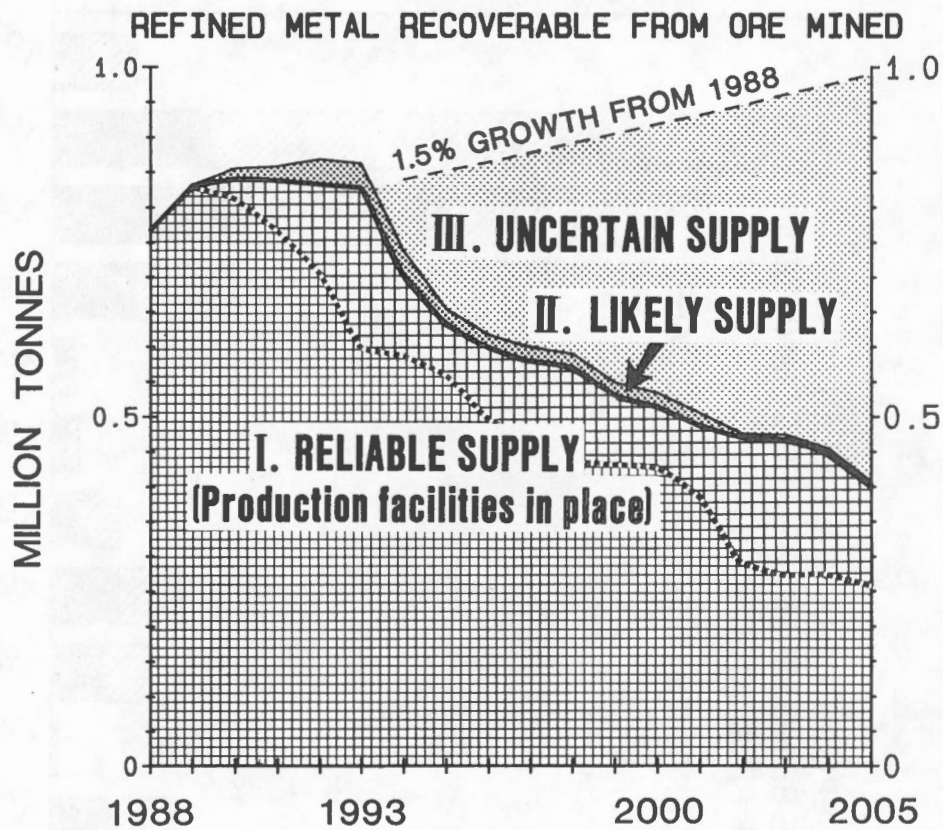
In the coming years, world copper consumption is expected to grow at a rate of 1% to 1.5% annually. To maintain its share of a growing world copper market, Canadian production will have to grow commensurately, and still more (or larger) discoveries will be needed. To keep up with 1.5% market growth, we would have to discover, from 1988 to the end of the century and beyond, about 1.3 Mt/y, on average, of mineable copper.

Is such a rate of discovery attainable? The historical record shows that it is only in the period 1956-75 that the rate of discovery exceeded an average of 1.3 Mt/y of mineable copper (Figure 2).

¹ Based on comments made by Pierre O. Perron, Associate Deputy Minister, EMR and a paper presented by Donald A. Cranstone and André Lemieux at "Congrès Annuel de l'Association des prospecteurs du Québec", Val-d'Or, Québec, Sept. 14-16, 1988. Copies of the complete paper are available from the authors upon request.

FIGURE 1

CANADIAN **COPPER** PRODUCTION TO THE YEAR 2005



UNCERTAIN SUPPLY



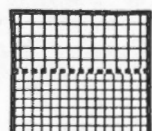
Supply from sources still undiscovered

LIKELY SUPPLY



Supply from known undeveloped deposits

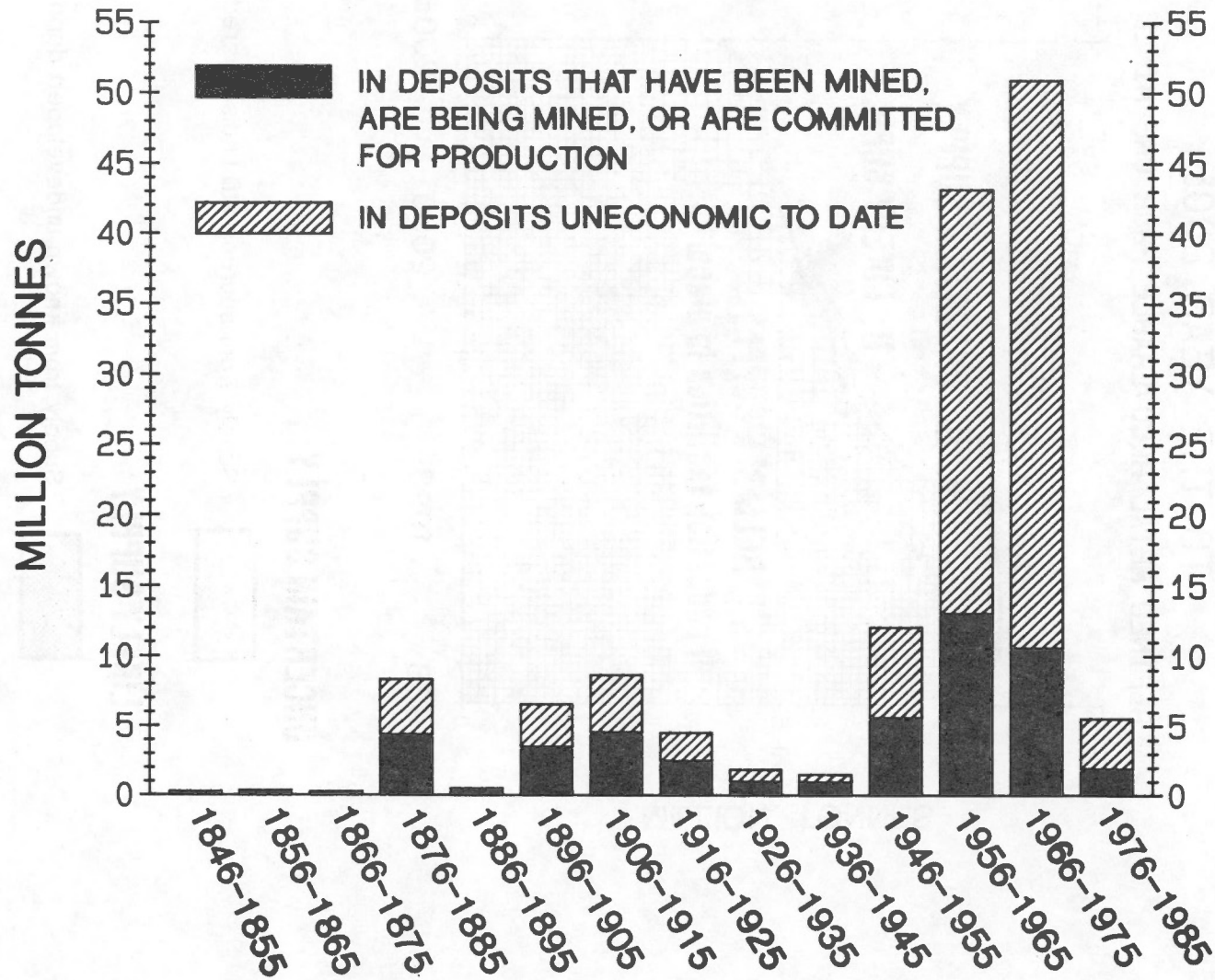
RELIABLE SUPPLY



Supply from inferred extensions

Supply from today's reserves

FIGURE 2
**COPPER DISCOVERED IN CANADA
BY 10-YEAR PERIODS**



The two most notable 10-year discovery periods in Figure 2, 1956-65 and 1966-75, encompass the discovery in British Columbia of at least 35, mostly large, porphyry-type copper deposits (a deposit type that was not recognized in Canada until the mid-50s), as well as lesser but still significant quantities of copper in many sulphide deposits associated with volcanic rocks, most notably the Kidd Creek mine near Timmins, Ontario.

During the exceptional 20-year period 1956-75, discovery of mineable copper in Canada averaged 1.3 Mt/y, but in the 12 years since 1975, the average was less than 0.2 Mt/y, a level that has shown no sign of rising in recent years with the overwhelming emphasis on gold exploration. On the contrary, only 18% of the copper discovered during 1976-85 was discovered in the second half of that period.

In view of this historical record, it is clear that a major upswing in exploration effort for copper will be required to equal the unusual success rate of the 1956-1975 period, a rate that would have to be reached again to maintain world market share in copper. Failure to do so will lead to a decline in national copper output -- and its contribution to our trade balance -- after 1993.

Discovery Requirements for Zinc and Lead

For zinc, the timely discovery of some 2.5 Mt/y on average required not to lose ground in the 1990s is attainable only if Canada's zinc exploration effort rises again to levels at least comparable to those of the 1960s and 1970s. Zinc exploration at such levels would likely provide sufficient lead in newly-discovered zinc-lead deposits to meet Canadian lead discovery requirements as well.

Discussion

For Canada to maintain its world market share of copper production in the 1990s, the discovery rate of copper in Canada would have to equal our best historical record, achieved in the 1956-75 period when numerous large porphyries were found. For zinc and lead, the challenge is less formidable, but exploration results will have to improve markedly over the rather dismal record of the 1980s.

One reason for Canada's singularly unsuccessful base-metal exploration record during the 1980s is that we have been spending progressively less on it since 1981. By 1986, it was only \$85 million, half (in 1986 dollars) of the average 10 years earlier. A decade ago, we spent 40% of all exploration funds on base metals. By 1986, it was only 14%.

Another reason for our poor finding record for base metals in the 1980s is that the discovery value per exploration dollar has dropped markedly relative to that of the preceding decades with their many porphyry discoveries. This means that, to find comparable amounts, we will have to spend more than we used to.

How much will we have to spend in Canada on base-metal exploration to keep our share of world base-metal production through the 1990s and beyond?

Over the last decade, we spent an annual average of \$750 million (in 1988 dollars) on mineral exploration, equivalent to 4% of mineral production. While gold exploration got from that what it needed, base metals will require at least an extra \$200 million per year, to bring base-metal exploration up to a total of about \$300 million per year.

NEW PUBLICATIONS

A Reference Guide to Mining Legislation in Canada
(Second Edition)
by Barry Barton, Barbara Roulston and Nancy Strantz

This publication is a guide to the legislation that governs the acquisition, content, maintenance and cancellation of legal interests in hard-rock minerals that are granted by the Crown. Mineral legislation differs from province to province and in the territories, although the basic principles are often similar. The purpose of the guide is to provide a ready means of finding how the different jurisdictions regulate mineral activity. It covers the rights required for the exploration, development and production of metallic minerals and industrial minerals such as asbestos; or structured materials. It concentrates on the most commonly acquired interests in minerals, such as claims and leases, and does not cover legislation dealing with incidental aspects of mining, such as taxation, environmental protection or incentive schemes. The law is stated as of May 31, 1988.

120 pages \$30.00
ISBN 0-919269-25-7

Publications are available from:

Canadian Institute of Resources Law
430 BioSciences Building
The University of Calgary
Calgary, Alberta Canada T2N 1N4

Please send a cheque or money order to *The University of Calgary*. Telephone (403) 220-3200.
Telex 03-821545. Facsimile (403) 282-7298.

The following publications were published by Energy, Mines and Resources Canada and copies can be obtained from:

Canadian Government Publishing Centre
Supply and Services Canada
Ottawa, Canada
K1A 0S9
Tel: (613) 997-2560

Mineral Bulletin

MR 219 - Bauxite and Alumina

This report on Bauxite-Alumina materials used in Canada to produce aluminum metal, looks at two of the relatively few raw materials for which Canada is currently totally dependent on imports.

Reference: Cat. No.: M38-2/219
ISBN: 0-660-54194-7

Micromedia Limited
Document Delivery
165 Hôtel de Ville
Place du Portage 2
Hull, Quebec
J8X 3X2

Tel: 1-800-567-9669 (Ont., Que., Maritimes)
1-819-770-9928 (other regions)

Internal Report

MRI 88/1 - Canadian Iron Ore Industry Statistics, 1987

This report is a continuation of the Canadian Iron Ore Industry Statistics series. The statistical data, when used in conjunction with the Iron Ore chapter of the Canadian Minerals Yearbook, presents a comprehensive review of the iron ore industry for 1987.

Reference: Cat. No. M35-2/88-1
ISBN: 0-662-56204-6

