

DOMINION BUREAU OF STATISTICS - CANADA

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Mining, Metallurgical and Chemical Branch

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X X

THE NICKEL-COPPER MINING, SMELTING AND REFINING INDUSTRY IN CANADA
1934.

According to figures published by the Mining, Metallurgical and Chemical Branch of the Dominion Bureau of Statistics, Ottawa, the Canadian Production of nickel in 1934 totalled 128,687,340 pounds, valued at \$32,139,452 as compared with an output of 83,264,658 pounds worth \$20,130,480 in 1933. The 1934 production of the metal comprised nickel in matte exported, electrolytic metal made at Port Colborne, Ontario, and nickel in oxides and salts produced in Canadian plants; the 1934 production of the metal was the greatest on record, surpassing 1929 the previous high year by 17 per cent. Of the total value of all metals produced in the Dominion, throughout 1934, the value of nickel comprised approximately 16.58 per cent, being surpassed only by that of gold.

Practically all of the nickel produced in Canada is derived from the copper nickel bearing deposits of the Sudbury district, Ontario. Two companies operate mines and metallurgical plants in this area. The International Nickel Company of Canada, Ltd., conducts smelting operations at Copper Cliff and Coniston, Ontario, while the Falconbridge Nickel Mines, Ltd., smelt their ores at the Falconbridge mine located a few miles east of the town of Sudbury. This last named company treat their matte in a refinery at Kristiansand, Norway. The relatively small amount of nickel oxide produced at Deloro, Ontario, is recovered from silver-cobalt-nickel-arsenic ores mined in Northern Ontario. Smelter matte made by the International Nickel Company is treated in plants located at Clydach, Wales; Huntington, West Virginia and at Port Colborne and Copper Cliff, Ontario.

Throughout 1934 ore was mined continuously by the International Nickel Company of Canada, Ltd., from the Frood and Creighton Mines, the total tonnage shipped amounting to 2,690,814 tons, of which the Frood Mine contributed 1,868,186 tons and the Creighton Mine 822,628 tons. At the Frood Mine exploration work was restricted to the lower levels and ordinary development work was regulated to conform with ore requirements. In order to mine efficiently the larger reserves of proven ore in the lower levels, a new shaft is being sunk at the Creighton Mine; it is estimated that this project will be completed early in 1937.

The concentrator of the Company was operated at a uniform rate throughout the year and treated 1,843,146 tons of ore, the greatest tonnage thus far handled; the available capacity in the grinding and flotation sections is 8,000 tons per day. This capacity can be readily increased to 11,000 tons per day should demand call for increased quantities of nickel. The Copper Cliff Smelter produced 92,174 tons of bessemer matte and 97,611 tons of blister Copper. Three reverberatory furnaces were in operation throughout the year. For the Orford separation process one blast furnace was used throughout the year and a second for seven months. At the Coniston Smelter three blast furnaces were in operation up to April 1st and four thereafter; during the year 840,980 tons of ore were smelted and 59,732 tons of bessemer matte produced.

At the Port Colborne refinery, six electrolytic circuits were in continuous operation during 1934 and a seventh was in use from April to August inclusive. The total output of nickel inclusive of nickel in oxide was 70,974,850 pounds. At Clydach, Wales (the Mond Nickel Co., Ltd.,) the output of nickel in various forms was 25,568,644 pounds compared with 20,760,117 pounds for 1933; the construction here of a small high-pressure carbonyl plant was started, this was expected to be in operation early in 1935. Because of increased nickel production at Port Colborne and Clydach, the Acton (London, England) plant, (Mond) refined more platinum metals than during any previous year. Henry Wiggin's Co., Ltd., (subsidiary of the Mond Nickel Co.) reported that the various departments of its plant in England enjoyed an increased volume of business and by December this Works was operating at an average of eighty per cent of present capacity. In the United States the Huntington Works of the International Nickel Co. Inc., was operated throughout the year at approximately 33 per cent of capacity, a rate considerably in excess of the previous year, while at the Bayonne (N.J.) plant total shipments were 41 per cent in excess of 1933, particularly noticeable were shipments of threaded fittings, coated welding wire, and casting block, each of which increased.

The total number of employees of the International Nickel and associated Companies at the year-end was 9,154 distributed as follows: Canada 5,474; Great Britain 2,507; United States 1,122; other Countries 51. Employees on December 31, 1933 numbered 8,297. The increase amounting to ten per cent, is due to the increased scale of operations. Capital expenditure scheduled for 1935, covering all properties calls for an estimated total of \$2,500,000. During 1934 the Mond Nickel Co., Ltd., entered into an agreement with the Government of Finland by which that Company has secured the sole rights, subject to the conditions contained in the agreement, to prospect for, mine, and treat nickel-bearing ore which may occur in a defined territory in Finland.

Sales by the Company of nickel in all forms, including nickel in alloys amounted to 91,459,554 pounds compared with 74,356,969 pounds in 1933, an increase of 23 per cent. Sales of nickel in products of the Port Colborne (Canada.) and Clydach (Wales) refineries amounted to 73,964,621 pounds compared with 61,353,495 pounds in 1933, an increase of 21 per cent. Sales of nickel in products of the Copper Cliff Smelter amounted to 1,357,008 pounds. Sales of nickel in products of the rolling mills at Birmingham, (England) Glasgow, (Scotland) and Huntington, (West Virginia) and of the foundry at Bayonne, (New Jersey) totalled 16,137,925 pounds compared with 13,003,474 pounds an increase of 24 per cent.

Copper sales, inclusive of copper in sulphate produced in Wales, increased from 113,682,312 pounds to 194,870,682 pounds or 71 per cent. Gold sales were 74,375 ounces compared with 21,355 ounces in 1933; silver sales were 1,006,808 ounces compared with 876,303 ounces and sales of the platinum metals were 124,424 ounces compared with 77,198. Sales of selenium were 73,516 pounds and sales of tellurium 1,110 pounds.

Proven ore reserves of the International Nickel Company on December 31st, 1934 were 204,399,463 tons. In the ordinary course of mining operations 2,720,779 tons were added to reserves.

Stoping of ore by Falconbridge Nickel Mines Ltd., during 1934 not only broke enough to satisfy the treatment plant requirements, but added 100,962 tons to the broken ore reserve, which stood at 509,742 tons at the end of the year. The tendency in stoping is to break wider than originally calculated, with the consequent increase in tonnage and lowering of grade. Justification for this is found in the fact that the cost of producing nickel in matte has progressively lowered in spite of lowered grade in ore according to the consulting engineer of the Company. By the end of the year the eastern orebody had been developed on the 500 ft. horizon over a length of 1,000 feet with ore still in the eastern face, on the 750 foot level, an advance of 610 feet west disclosed 575 feet of good ore. Preparations for sinking a five compartment shaft at a location

some 2,400 feet east from the present working shaft were made, this shaft is thirteen feet four inches by nineteen feet six inches, outside timber, and will be continued to a depth of 1,500 feet; sinking through 100 feet of overburden was commenced in June and bed rock entered in September. Data relating to the treatment plant are as follows:

	1934		1933	
	Nickel %	Copper %	Nickel %	Copper %
Grade of ore treated	2.050	.995	2.163	.986
Recovered in Matte	1.906	.898	2.006	.904
Metallurgical losses	.144	.097	.157	.082

From 317,646 tons of ore delivered to the crushing plant 44,116 tons or 13.9 per cent of waste was eliminated by sorting and discarded. The balance, 273,530 tons was transported over the aerial tramway to the treatment plant. The consequent production of matte for shipment to the refinery in Norway totalled 9,271.4 tons containing 10,405,200 pounds of nickel and 4,901,600 pounds of copper plus some precious metals. Refined metals produced in Norway during the period under review totalled 11,692,746 pounds of nickel and 6,241,125 pounds of copper. Of these 9,508,939 pounds nickel and 4,633,235 pounds copper were for account of Falconbridge, the balance being refined for a toll customer. In addition precious metals were recovered which sold for \$ 82,000; all for Falconbridge account. The plant for separation of precious metals was finished and the refinery operated very steadily throughout the year.

The copper-nickel property of Cuniptau Mines Ltd., located in Strathroy Twp., Northern Ontario, was active throughout 1934, both surface and underground operations were conducted and considerable diamond drilling completed; this Company erected a 50 ton smelter for the production of copper-nickel matte.

During 1934 approximately 130 men were employed by British Columbia Nickel Mines Ltd., the property of this Company is situated 15 miles by road North-West at Hope, British Columbia. Several hundred acres of the Company's claims were surveyed with a magnetometer of the Askania type and it is stated that this work indicated some sixty-eight areas of possible nickeliferous-pyrrhotite mineralization. On several of these indicated areas test-pits were sunk to bed-rock and in every case nickeliferous mineralization was reported found, where indicated. About 2,000 feet of diamond drilling was also completed in 1934, most of it being done from underground stations in the No. 1 tunnel which tunnel at an elevation of 3,527 feet was holed through in a length of 4,700 feet to the Emory Creek side of the mountain. No. 2 adit, the portal of which is approximately 2,200 feet west of No. 1 tunnel and at an elevation of 3,275 feet above sea level, was advanced to a total distance of 2,208 feet from the portal at the end of 1934.

An average of 1.02 per cent nickel and 0.45 per cent copper was obtained from 50 feet of core length, with 20 feet of core-length averaging 1.67 per cent nickel. This core came from horizontal hole No. 79 located 1,706 feet from the portal of No. 2 adit.

PRINCIPAL STATISTICS OF THE NICKEL-COPPER MINING, SMELTING AND REFINING INDUSTRY IN
CANADA, 1932 - 1934.

	1932	1933	1934
Number of firms	3	4	4
Number of mines	6	7	7
Number of smelters	3	3	3
Number of refineries	1	1	1
Capital employed	\$ 78,188,204	84,836,327	88,574,427
Number of employees - On salary	188	191	223
On wages	2,218	3,407	5,394
Total	2,406	3,598	5,617
Salaries and wages - Salaries	\$ 611,496	617,599	740,191
Wages	3,309,099	4,971,011	8,124,581
Total	3,920,595	5,588,610	8,864,772
Fuel and electricity used	\$ 1,371,985	2,592,216	4,202,810
Estimated value of matte exported and Refining products produced	\$ 14,003,637	31,191,527	68,445,844

WAGE-EARNERS EMPLOYED BY MONTHS, 1931, 1932, 1933 and 1934.

	1931	1932	1933	1934
January	4,726	3,014	1,822	4,811
February	4,656	3,019	1,957	4,878
March	4,641	3,039	2,036	5,048
April	4,620	2,577	1,976	5,139
May	4,597	2,379	2,034	5,409
June	4,422	2,434	3,001	5,622
July	4,324	2,235	3,957	5,688
August	4,262	1,672	4,523	5,566
September	3,657	1,628	4,775	5,500
October	3,068	1,580	5,050	5,722
November	3,195	1,490	4,968	5,707
December	3,094	1,551	4,762	5,309

FUEL AND ELECTRICITY USED FOR HEAT AND POWER, 1933 and 1934.

	1933		1934	
	Quantity	Cost at works \$	Quantity	Cost at works \$
Bituminous coal - Canadian, short ton	287	1,708	96	962
Imported, short ton	6,846	37,817	11,015	63,212
Anthracite coal, short ton	437	6,296	61	940
Sub-bituminous, short ton	842	7,279	793	7,551
Gasoline (exclusive of motor vehicles), Imp. gal.	11,777	2,638	14,483	3,415
Kerosene, Imp. gal.	3,815	763	5,394	1,153
Gas oil and diesel oil, Imp. gal.	178,295	9,187	117,024	11,077
Wood, cord	74	465	2,457	6,629
Gas - Natural, M cu. ft.	79	69	152	122
Other fuel .....	...	...	...	...
Electricity purchased, K.W.H.	183,600,029	633,946	253,556,257	788,705
TOTAL .....	...	700,166	...	884,264

FUEL AND ELECTRICITY USED FOR METALLURGICAL PURPOSES, 1933 and 1934.

	1933		1934	
	Quantity	Cost at works	Quantity	Cost at works
Bituminous coal - Canadian.. short ton	29,630	157,039	152,052	844,580
Imported.. short ton	89,466	467,571	21,295	133,030
Anthracite coal	short ton	...	...	...
Coke	short ton	101,862	176,340	1,688,038
Kerosene	Imp. gal.	...	214	46
Fuel oil and diesel oil ...	Imp. gal.	4,542,854	7,386,845	366,166
Wood	cord	2,834	2,354	16,338
Other fuel .....	...	22,079	...	30,898
Electricity purchased 1.... K.W.H.	36,697,360	125,938	70,961,897	239,450
TOTAL .....	...	1,882,050	...	3,318,546

OUTPUT FROM CANADIAN NICKEL-COPPER MINES AND SMELTERS, 1932 - 1934.

		1932	1933	1934
Ore and concentrates treated	tons	793,552	1,523,814	2,896,359
Refined nickel(x) produced in Ontario ..	tons	7,063	20,748	35,487
Blister copper produced in Ontario	tons	30,020	61,385	97,611
Matte exported	tons	21,778	43,315	46,755
Nickel content of matte	tons	8,068	20,811	28,771
Copper content of matte	tons	8,825	12,323	6,692

(x) Includes nickel in salts and oxides.

PRODUCTION IN CANADA, IMPORTS AND EXPORTS OF NICKEL, 1933 - 1934.

	1933		1934	
	Quantity	Value	Quantity	Value
	lb.	\$	lb.	\$
PRODUCTION				
Nickel in matte or residues exported(a); refined and electrolytic nickel produced; and nickel in oxides and salts sold	83,264,658	20,130,480	128,687,340	32,139,425
EXPORTS				
Nickel, fine; nickel contained in ore, matte or speiss and nickel contained in oxide	88,082,100	22,795,968	118,152,100	28,913,230
IMPORTS (specified)				
Nickel in bars or rods (not for anodes) and nickel in strips, sheets and plates	203,217	95,189	591,466	197,230
Nickel chromium in bars or rods (60+ per cent Ni) - 75 inch. diam. for electric resistance strip	50,841	46,210	48,413	45,114
Nickel, nickel silver and German silver in ingots or blocks, n.o.p.	686,777	193,229	2,646	771

(a) Nickel in matte exported valued at 18 cents per pound.

PRODUCTION OF NICKEL FROM CANADIAN ORES, 1925 - 1934.

Year	Pounds	Value	Year	Pounds	Value
		\$			\$
1925	73,857,114	15,946,672	1930	103,768,957	24,455,133
1926	65,714,294	14,374,163	1931	65,666,320	15,267,453
1927	66,798,717	15,262,171	1932	30,327,968	7,179,862
1928	96,755,578	22,318,907	1933	83,264,658	20,130,480
1929	110,275,912	27,115,461	1934	128,687,340	32,139,425

WORLD PRODUCTION OF NICKEL ORE, 1932 - 1934. (a)
(in terms of metal)

	1932	1933	1934
		short tons	
Canada (b)	15,164	41,632	64,344
New Caledonia (c)	3,200	4,900	5,500
Greece	1,053	1,344	
India (d)	1,042	1,090	1,500
Norway	1,042	1,096	
Russia .....	...	...	951

- (a) Production outside of these countries is very small.
 (b) Production in all forms from Canadian ores, as reported by Ontario Bureau of Mines.
 (c) Exports of matte; content, estimated at 75%.
 (d) Nickel content of speiss obtained as a by-product.

PURCHASES OF MINING, MILLING AND SMELTING EQUIPMENT AND GENERAL SUPPLIES AND INSURANCE,
 FREIGHT AND EXPRESS COSTS, IN THE CANADIAN NICKEL-COPPER MINING, SMELTING AND
 REFINING INDUSTRY, 1934.

	Value f.o.b. plant
1. Belting of all kinds, including elevator conveyor, transmission, etc., and fasteners for same	35,797
2. Bolts, nuts, rivets, studs, washers, coach, set and machine screws etc.	50,525
3. Castings: - unfinished iron and steel	106,099
4. Unfinished brass castings; brass and copper rods and sheets, babbitt and non-ferrous metals of all kinds	28,765
5. Cars and locomotives and mechanical parts of same	141,621
6. Track materials: - rails and fittings, switches, spikes, bolts etc.	134,848
7. Explosives: - powder, fuse and detonators	590,343
8. Rock drills and parts	163,052
9. Drill and tool steels	105,044
10. Pipe and fittings, plumbing supplies and valves	225,843
11. Iron and steel bars, sheets, plates and all structural steel	536,359
12. Wire rope and fittings	51,253
13. Diamonds and bort for drilling	1,230
14. Safety equipment and apparel: - safety hats, boots, gloves, goggles, respirators, etc.; miner's lamps and accessories and lamp rentals ...	60,500
15. Fuel: - coal, coke, charcoal and wood	3,020,258
16. Fuel oil, kerosene and gasoline	426,823

PURCHASES OF MINING, MILLING AND SMELTING EQUIPMENT AND GENERAL SUPPLIES AND
INSURANCE, FREIGHT AND EXPRESS COSTS, IN THE CANADIAN NICKEL-COPPER MINING
SMELTING AND REFINING INDUSTRY, 1934. -(concluded.)

	Value f.o.b. plant
	\$
17. Lubricants: - oil, grease and waste	67,497
18. Lumber and timber of all kinds	1,110,121
19. Building materials: - cement, brick, tile, roofing and building paper, insulating material, building hardware, glass, putty, paints, varnishes and brushes, wood screws, nails, screw hooks and eyes, sand, lime, and miscellaneous	231,592
20. Electrical equipment and supplies: - motors, batteries, wire and cable etc.	444,289
21. Crushing, grinding and screening machinery and parts: ball and tube mill liners, roll shells, etc.	136,328
22. Filter cloth, rotor covers and ore dressing blankets	63,534
23. Balls and rods for grinding	83,453
24. Machinery, mill, n.o.p. and parts	72,648
25. Machinery, mine, n.o.p. and parts: - steel shop equipment, hoists, mine pumps, etc.	195,405
26. Machinery, smelter, n.o.p. and parts	595,794
27. Machinery, miscellaneous, and parts: machine, blacksmith, carpenter shop and general surface equipment	203,590
28. Motor cars, trucks and accessories	23,837
29. Tools: - Brooms, picks, shovels, hammers, handles, saws, wrenches, machinists' tools, etc.	50,092
30. Welding and cutting equipment and accessories:- oxygen, acetylene welding, rods, tips, etc.	53,889
31. Rubber goods, suits, boots, hose and accessories, pump valves, launder linings, etc. (not including belts)	54,569
32. Flotation reagents	163,328
33. Cyanide and cyanide plant chemicals	164
34. Acids and chemicals, n.o.p.	77,465
35. Refractories: - brick, cement, fireclay, etc.	504,624
36. Smelter fluxes: - fluorspar, limestone, quartz, sand, etc.	1,255,986
37. Hospital equipment and medical supplies	11,879
38. Stationery, office equipment and supplies, survey and drafting equipment and supplies	33,885
39. Miscellaneous materials, n.o.p. Includes all materials NOT OTHER- WISE PROVIDED FOR in any other item	270,551
40. Power - electric	1,089,896
41. Freight (a) incoming - only amounts paid direct to Railway Company	3,347,908
(b) outgoing	137,718
42. Express (a) incoming - only amounts paid direct to Express Company	14,951
(b) outgoing	168
43. Insurance (a) Fire	42,527
(b) Sickness and accident .....	...
(c) Group .....	...
(d) Workmen's compensation	148,762
(e) Bullion	2,627
(f) Other	2,792
TOTAL	16,170,299

INDUSTRIAL NICKEL ALLOYS

(Supplied by International Nickel Co. of Canada, Ltd.)

Nickel is extensively used in combination with other metals in steels, irons and a large number of non-ferrous alloys, many of which are "key" materials of industry.

- Nickel steels ($\frac{1}{2}$ % to 7% nickel)
- Nickel steel castings (1% to 4% nickel)
- Corrosion resistant steels (7% to 35% nickel)
- Heat resistant steels (7% to 35% nickel)
- Heat resistant alloys (35% to 85% nickel)
- Electric resistance alloys (up to 85% nickel)
- Iron nickel alloys -
 - Non-magnetic (10% to 25% nickel)
 - Low expansion (32% to 45% nickel)
 - Highly magnetic (45% to 80% nickel)
- Nickel cast irons -
 - High quality cast iron ($\frac{1}{2}$ % to 5% nickel)
 - High strength cast iron (1% to 2 $\frac{1}{2}$ % nickel)
 - Chilled cast iron (4% to 6% nickel)
 - Corrosion resistant cast irons (14% to 30% nickel)
- Nickel wrought iron (3% nickel)
- Nickel-silvers (5% to 30% nickel, plus copper and zinc)
- Nickel bronzes ($\frac{1}{2}$ % to 8% nickel)
- Copper-nickel alloys (15% to 50% nickel)

The International Nickel Co. of Canada Ltd., states that the year 1934 witnessed a further increase in world nickel consumption, the deliveries in all forms being about 122,000,000 pounds compared with 96,000,000 pounds in 1933. As heretofore, the use of nickel was well distributed among different nickel-consuming countries as well as within various nickel-consuming industries. Although the increased pace of nickel consumption everywhere was well maintained, those industrial centres whose economic recovery has been most rapid have naturally registered the most prominent gains. The demand for nickel in the United Kingdom reached an all time peak in 1934; nickel deliveries were about equally divided between America (the United States and Canada) and the rest of the world. The automobile industry continued to be the largest single consumer of nickel, using about thirty per cent of the total in the United States and Canada; paralleling the general increase in steel and in foundry iron production, the use of nickel cast iron and of nickel steel increased substantially, one of the outstanding developments in the field of nickel alloy steel was the adoption of welded nickel steel for the pressure vessels and equipment used in the de-waxing processes for oil refining. Pure nickel as well as nickel-clad steel continued to be favoured for the construction of equipment for the manufacture of caustic soda. Ethiopia issued ten million coins of pure nickel, becoming the twenty-eighth nation to use pure nickel coinage. The amount of nickel going into light aluminum alloys registered an increase and the use of the metal in stainless steel continued to advance.

"Die Metallbörse" reported in 1934 that Russia was about to greatly extend its nickel production. The Orsk Works in the Urals are to be increased to produce 500 tons yearly - at present the Russian production amounts to about 1.4 per cent of the world production, but the programme laid down contemplates a yearly production of 5,000 tons. The U.S.S.R. Chamber of Commerce, Moscow, announced in July 1935 that a large nickel plant will commence production in the Orsk region in 1937.

DIRECTORY

Firms in the Nickel-Copper Mining and Smelting Industry in Canada, 1934.

<u>Name of Firm</u>	<u>Head Office Address</u>	<u>Location of Canadian plant</u>
<u>ONTARIO</u>		
Cuniptau Mines Development Co. Ltd., (x)	465 Bay St., Toronto	Strathy Twp.
Falconbridge Nickel Mines, Ltd.,	25 King St., W., Toronto	Falconbridge Twp.
International Nickel Co. of Canada, Ltd.	Copper Cliff	Copper Cliff, Coniston and Port Colborne, Ont.
<u>BRITISH COLUMBIA</u>		
B.C. Nickel Mines, Ltd. (x)	804 Standard Bank Building, Vancouver.	Choate

(x) Operating but not producing.

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