

CANADA
DEPARTMENT OF MINES
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PRELIMINARY REPORT

OF THE

MINERAL PRODUCTION OF
CANADA

DURING THE CALENDAR YEAR
1916

PREPARED BY
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EUGENE HAANEL, Ph. D.,
Director of Mines.

SIR,—I beg to submit herewith, the annual preliminary report on the mineral production of Canada in 1916.

The figures for production in 1916, while subject to revision, are based upon direct returns from mine and smelter operators and are fairly complete. Special acknowledgments are due to those operators who have promptly furnished reports of their operations during the year.

When complete returns shall have been received the usual annual report will be prepared containing in greater detail the final statistics as well as information relating to exploration, development, prices, markets, imports and exports, &c.

I am, sir, your obedient servant,

JOHN McLEISH.

Division of Mineral Resources and Statistics,
February 28, 1917.



PRELIMINARY REPORT ON THE MINERAL PRODUCTION OF CANADA

DURING THE CALENDAR YEAR 1916

The total value¹ of the metal and mineral production in 1916 as shown in the preliminary report presented herewith was \$177,357,454 which compared with a production in 1915 valued at \$137,109,171 shows an increase of \$40,248,283, or 29.3 per cent. The previous maximum production was \$145,634,812 in 1913.

The war has had a most pronounced effect not only in stimulating the production of those metals such as nickel, copper and zinc, iron and steel, molybdenum, etc., which are used so extensively for war purposes, but also in increasing the production of other products such as chromite and magnesite which can only now be obtained with difficulty if at all from sources previously available. The general industrial activity in metallurgical operations and in the manufacture generally of munitions of all kinds, including the freight movements required, have in turn increased the demand for fuel which has been met in Western Canada at least by large increases in coal production.

Increased production in quantity has in most instances been accompanied by large increases in prices, thus further enhancing the total value of the production.

Considerable progress has been made during the year in establishing and increasing smelting and refining capacities of which the installation of electrolytic zinc and copper refineries at Trail and the beginning of construction of a nickel refinery at Port Colborne, Ont., are conspicuous examples. In addition, mention should be made of the production of metallic magnesium at Shawinigan Falls, of ferro-molybdenum at Orillia and Belleville, of metallic arsenic at Thorold, and of stellite, the cobalt alloy for high speed tool metal, at Deloro, and of the increased capacity for the production of steel particularly the installation of electric furnaces.

The mining output has been restricted and the efficiency of its operation considerably reduced by the withdrawal for war service of such a large proportion of the more highly experienced labour and engineering supervision. Higher costs have tended to offset the advantages to be derived from higher prices of output and in the case of gold mining have been a distinct burden.

The mining and metallurgical industries include a great variety of products so that in dealing with the industry as a whole the total value presents the only means of comparison, nevertheless quantities of production and prices are at all times the items of essential importance.

The accompanying statistical tables show (1) the detailed production in 1916 (2) a comparison of the production of the more important products in 1916 with the production in 1915 (3) a record of the prices of metals during six years' and (4) the production by provinces.

It will be noted that there has been an increased production of nearly all metals with the exception of lead and silver. The total value of the metallic production in 1916 was \$107,040,035 as compared with \$75,814,841 in 1915, an increase of \$31,225,194 or 41.2 per cent.

¹ In presenting a total valuation of the mineral production as is here given, it should be explained that the production of the metals copper, gold, lead, nickel, silver, and zinc is given as far as possible on the basis of the quantities of metals recovered in smelters, and the total quantities in each case are valued at the average market price of the refined metal in a recognized market. There is thus included in some cases the values that have accrued in the smelting or refining of metals outside of Canada.

The Mineral Production of Canada in 1916

SUBJECT TO REVISION

Product.	Quantity.	Value.
METALLIC.		
Antimony ore (exports).....	*Tons. 794	\$ 48, 158
Cobalt metallic and contained in oxide, etc.....	Lbs. 841, 859	926, 045
Copper, value at 27.202 cents per pound.....	119, 770, 814	32, 580, 057
Gold.....	Ozs. 926, 963	19, 162, 025
Iron, pig from Canadian ore.....	Tons 115, 691	1, 328, 595
Iron, ore sold for export.....	" 140, 608	393, 689
Lead, value at 8.513 cents per pound.....	Lbs. 41, 593, 680	3, 540, 870
Molybdenite, MoS ₂ contents at \$1.00 per pound.....	" 159, 000	159, 000
Nickel, value at 35 cents per pound.....	" 82, 958, 564	29, 035, 497
Platinum.....	Ozs. 15	600
Silver, value at 65.661 cents per oz.....	25, 669, 172	16, 854, 635
Zinc, value at 12.804 cents per pound.....	Lbs. 23, 515, 030	3, 010, 864
Total.....		107, 040, 035
NON-METALLIC.		
Actinolite.....	Tons 250	2, 750
Arsenic, white.....	" 2, 186	262, 349
Asbestos.....	136, 016	5, 133, 332
Asbestic.....	" 18, 500	27, 147
Chromite, crude ore (a).....	" 27, 030	299, 753
Coal (b).....	14, 428, 278	38, 797, 437
Corundum.....	" 67	10, 307
Feldspar.....	" 19, 166	71, 357
Fluorspar.....	" 1, 284	10, 238
Graphite.....	" 3, 971	285, 362
Grindstones.....	" 3, 328	50, 982
Gypsum.....	" 341, 618	730, 831
Magnesite.....	" 55, 413	563, 829
Manganese.....	" 979	90, 791
Mica.....	" 914	122, 541
Mineral pigments—		
Barytes.....	" 1, 368	19, 393
Oxides.....	" 8, 811	58, 711
Mineral water.....		114, 587
Natural gas.....	M. cu. ft. 25, 238, 568	3, 924, 632
Peat.....	Tons 300	1, 500
Petroleum.....	Brls. 198, 123	392, 284
Phosphate.....	Tons 203	2, 514
Pyrites.....	" 309, 411	1, 084, 019
Quartz.....	" 135, 803	241, 806
Salt.....	" 124, 033	668, 627
Talc.....	" 10, 651	36, 475
Tripolite.....	" 620	12, 139
Total.....		53, 015, 693
STRUCTURAL MATERIALS AND CLAY PRODUCTS.		
Cement, Portland.....	Brls. 5, 359, 050	6, 529, 861
Clay products—		
Brick: common, pressed, paving.....		2, 358, 245
Sewerpipe.....		716, 287
Tile, pottery, refractories.....		1, 104, 901
Kaolin.....	Tons 1, 750	17, 500
Lime.....	Bush. 5, 482, 876	1, 089, 505
Sand and gravel (not complete) (c).....		1, 498, 009
Sand-lime brick.....	No. 13, 825, 307	113, 136
Slate.....	Sq. 1, 262	6, 223
Stone—		
Granite.....		1, 277, 019
Limestone.....		2, 326, 519
Marble.....		118, 810
Sandstone.....		145, 711
Total structural materials and clay products.....		17, 301, 726
All other non-metallic.....		53, 015, 693
Total value, metallic.....		107, 040, 035
Grand total, 1916.....		177, 357, 454

* Tons of 2,000 pounds.

(a) Ore and concentrates finally marketed estimated as 13,834 tons.

(b) Additional returns increase production to 14,461,678 tons, \$38,857,557.

(c) " " " value to \$1,734,183.

Increase or Decrease in Principal Products, 1916

Principal Products.	Increase (+) or Decrease (-) in Quantity.		Increase (+) or Decrease (-) in Value.	
		%		%
Copper..... Lbs.	+ 18,985,664	18.84	+ 15,169,422	87.13
Gold..... Ozs.	+ 8,907	0.97	+ 184,124	0.97
Pig iron from Canadian Ore (a)..... Tons.	- 42,904	27.05	- 387,279	22.57
Lead..... Lbs.	- 4,722,770	10.20	+ 947,149	36.52
Nickel.....	+ 14,649,907	21.45	+ 8,542,900	41.69
Silver..... Ozs.	- 956,768	3.59	+ 3,625,793	27.41
Total metallic.....			+ 31,225,194	41.19
Asbestos and Asbestic..... Tons.	+ 17,674	12.91	+ 1,585,494	44.35
Coal.....	+ 1,194,655	9.00	+ 6,746,375	21.01
Gypsum.....	+ 133,197	28.05	+ 124,098	14.52
Graphite.....	+ 1,336	50.70	+ 161,139	129.71
Magnesite.....	+ 40,634	274.94	+ 437,245	345.40
Natural gas..... M. ft.	+ 5,114,406	25.41	+ 216,997	5.86
Petroleum..... Brls.	+ 17,341	8.05	+ 91,712	30.51
Pyrites..... Tons.	+ 23,373	8.17	+ 98,829	10.03
Quartz.....	+ 8,695	6.84	+ 36,653	17.87
Salt.....	+ 4,133	3.45	+ 68,401	11.40
Cement..... Brls.	- 321,982	5.67	+ 447,163	6.41
Clay products.....			+ 282,445	7.22
Lime..... Bush.	+ 435,632	8.63	+ 73,803	7.28
Sand and Gravel.....			+ 126,758	7.80
Stone.....			- 376,938	8.88
Total non-metallic.....			+ 9,023,089	14.72
Grand total.....			+ 40,248,283	29.35

(a) The total production of pig iron shows an increase, see page 15.

Metal Prices.

(In cents per pound or ounce).

	1911.	1912.	1913.	1914.	1915.	1916.
Antimony (ordinaries).... Per pound.	7.540	7.760	7.520	8.763	30.280	25.370
Copper, New York.....	12.376	16.341	15.269	13.602	17.275	27.202
Lead.....	4.420	4.471	4.370	3.862	4.673	6.858
" London.....	3.035	3.895	4.072	4.146	4.979	6.715
" Montreal*.....	3.480	4.467	4.659	4.479	5.600	8.513
Nickel, New York.....	40.060	40.000	40.000	40.000	45.000	45.000
Silver, "..... Per ounce.	53.304	60.835	59.791	54.811	49.684	65.661
Spelter, "..... Per pound.	5.758	6.943	5.648	5.213	13.230	12.804
Tin, ".....	42.281	46.096	44.252	34.301	38.500	43.480

*Quotations furnished by Messrs. Thomas Robertson & Company, Montreal, Que.

Mineral Production by Provinces, 1915 and 1916.

	1915.		1916.		Increase (+) or Decrease (-).	
	Value of Production.	Per cent of total.	Value of Production.	Per cent of total.		
Nova Scotia.....	\$ 18,088,342	13.19	\$ 19,963,985	11.26	\$ + 1,875,643	10.37
New Brunswick.....	903,467	0.66	878,446	0.49	- 25,021	2.77
Quebec.....	11,619,275	8.48	14,397,909	8.12	+ 2,778,634	23.91
Ontario.....	61,071,287	44.54	80,379,352	45.32	+ 19,308,065	31.62
Manitoba.....	1,318,387	0.96	1,819,921	1.03	+ 501,534	38.04
Saskatchewan.....	451,933	0.33	583,708	0.33	+ 131,775	29.16
Alberta.....	9,909,347	7.23	13,336,702	7.52	+ 3,427,355	34.59
British Columbia.....	28,689,425	20.92	40,191,744	22.66	+ 11,502,319	40.09
Yukon.....	5,057,708	3.69	5,805,687	3.27	+ 747,979	14.79
Dominion.....	137,109,171	100.00	177,357,454	100.00	+ 40,248,283	29.35

The total value of the non-metallic production including clay and quarry products in 1916, was \$70,317,419, as compared with \$61,294,330 in 1915 showing an increase of \$9,023,089, or 14.7 per cent. The aggregate production of structural materials showed a slight decrease, the value in 1916 being \$17,301,726 as against \$17,920,759 in 1915. The total of all other non-metallics increased from \$43,373,571 to \$53,015,693 in 1916.

GOLD.

The total production of gold in placer and mill bullion and in smelter production in 1916 is estimated at 926,963 fine ounces valued at \$19,162,025 as compared with 918,056 fine ounces valued at \$18,977,901 in 1915, an increase of \$184,124, or about 1 per cent. It is the largest production since 1902. The highest production recorded was \$27,908,153 in 1900, and the lowest since then was \$8,382,780 in 1907.

Of the total production in 1916 \$4,957,663 or 26 per cent were derived from placer and alluvial mining; \$10,472,723, or 54 per cent in bullion and refined gold, and \$3,731,639, or 20 per cent contained in matte, blister copper, residues and ores exported.

The production in Nova Scotia was about \$103,359 a decrease of 24.4 per cent from that of 1915 and was due to the water shortage which interfered seriously with the operations of the hydro-electric plants.

The production in Quebec is derived from the pyrites ores of the Eastern Townships. The gold content of these ores is very low and is not paid for to the mine operators.

Ontario is, since 1914, the largest gold producing province in Canada. The production for 1916 was 489,679 fine ounces valued at \$10,122,563, being 52.8 per cent of the total production for Canada and an increase of 20.4 per cent over that of 1915, and 82 per cent over the production of 1914.

The Hollinger Consolidated mines contributed about 48 per cent of the output and the Dome about 21 per cent.

Apart from a very small recovery of alluvial gold in Alberta no production is recorded from this province nor from Manitoba, or Saskatchewan.

The production in British Columbia was \$4,520,868 as against \$5,651,184 in 1915, a decrease of 20 per cent; this total includes \$575,000 estimated by the provincial mineralogist as being the output of placer mining, and \$3,945,000 recovered from milling and smelting operations.

The production from the Yukon Territory amounted to \$4,391,669 as against \$4,750,450 in 1915, a decrease of 7.5 per cent and was derived from the alluvial deposits with the exception of about \$9,000 which was produced from the gold and copper ores of Whitehorse and the silver-lead ores of the Silver King mine near Mayo.

The exports of gold-bearing dust, nuggets, gold in ore, etc., in 1916 are reported by the Customs Department as \$18,382,903.

SILVER.

The production of silver in 1916 was 25,669,172 fine ounces valued at \$16,854,635 as against 26,625,960 fine ounces valued at \$13,228,842 in 1915, a decrease of 3.6 per cent in quantity, but an increase of 27 per cent in value.

The production in Ontario amounted to 21,975,942 ounces valued at \$14,429,623 or 85.6 per cent of the total production for Canada. The production from the ores of Cobalt and adjoining silver camps was 21,885,057

ounces including 18,418,392 ounces in bullion recovered in smelters and reduction plants in Canada and 3,466,665 ounces estimated as recovered from ores exported to the United States smelters, thus 84 per cent being recovered as bullion in Canada; of this bullion 9,665,516 ounces were recovered in Southern Ontario smelters and 8,752,876 ounces in the mills of Cobalt. The balance of the Ontario production—90,886 ounces—was the output of the gold and copper mines.

The production in Quebec was about 97,000 ounces valued at \$63,691 as against 63,450 ounces valued at \$31,524 in 1915 and is derived from the pyritic ores of the Eastern Townships and the zinc-lead ores of Notre Dame des Anges.

In British Columbia the production was 3,235,764 ounces valued at \$2,124,635 as against 3,565,852 ounces valued at \$1,771,658 in 1915, showing a decrease in quantity of about 9 per cent and an increase in value of about 20 per cent. This production includes refined silver, silver contained in smelter products and estimated recoveries from ores exported.

The Yukon production was 360,466 ounces valued at \$236,686 as against 248,049 ounces valued at \$123,241 in 1915, an increase in quantity of about 45 per cent and in value of about 92 per cent. The 1916 production includes 47,703 ounces derived from the placer operations, the balance being the product of the gold and copper mines of the Whitehorse district and the high grade gold-silver-lead mines of Mayo.

The exports of silver bullion and silver in ore, etc., as reported by the Customs Department were: 25,279,359 ounces valued at \$15,637,885, as against 27,672,481 ounces valued at \$13,812,038 in 1915.

The price of silver in New York which started in January with a minimum of 56½ cents, increased quite regularly throughout the year, reaching a maximum of 76¾ cents in December. The average for the year was 65.661 cents, as against 49.684 cents in 1915.

COPPER

The production of copper has shown large increases during the past three years. In 1916 the total copper contents of smelter products credited to Canadian ores and estimated recoveries from ores exported amounted to 119,770,814 pounds which would be worth \$32,580,057 at the average monthly price of refined copper in New York 27.202 cents per pound. The production in 1915 was 100,785,150 pounds, and at 17.275 cents per pound the average price for the year would be worth \$17,410,635. There was thus an increase in 1916 of 18,985,664 pounds, or 18.8 per cent in quantity and \$15,169,422 or 87.1 per cent in total value.

An electrolytic copper refinery which has been installed at Trail began active operations about November 1 and has a capacity of 10 tons of refined copper per day.

Of the total 1916 production 92,763,603 pounds were contained in blister copper and in matte, and 27,007,211 pounds estimated as recovered from ores exported.

In addition to the recoveries from domestic ores there was also recovered in British Columbia smelters 5,551,166 pounds of copper from imported ores.

The production in Quebec from pyrite ores was 5,707,200 pounds as against 4,197,482 pounds in 1915. These are the quantities reported as being paid for; the actual ore contents were much higher.

The Ontario production is derived chiefly from the nickel-copper ores of the Sudbury district and of the Alexo mine in Timiskaming supplemented by a small recovery from the Cobalt district silver ores and by shipments made from six copper properties under development.

The total production in 1916 was 44,997,035 pounds as against 39,361,464 pounds in 1915, an increase of 12.5 per cent.

The British Columbia production was somewhat less than early estimates seemed to indicate. The quantity reported being 65,086,119 pounds as compared with 56,692,988 pounds in 1915, an increase of 8,393,131 pounds, or 14.8 per cent. The 1916 production in this province included 47,904,282 pounds recovered in blister and matte and 17,181,837 pounds recovered from ores shipped to United States smelters. The Coast mines including the Britannia, Texada Island and Anyox mines together with the shipments from Hazelton are credited with 43,048,065 pounds and the Trail Creek and Boundary mines with 22,038,054 pounds. The increase in 1916 has been entirely from the Coast properties.

The high price of copper has stimulated production from the White Horse district of the Yukon. Complete returns have not yet been received but the ore shipments were approximately 49,000 tons with a recoverable copper content estimated at 3,980,640 pounds. In 1915 the production from this source was 533,216 pounds.

The New York price of electrolytic copper increased from a minimum of 22½ cents during the first week of the year to 29¼ cents in May, falling to 22½ cents again about the middle of July. From that the price increased steadily to 33½ cents during the first half of December closing the year at about 30 cents. The average monthly price was 27.202 cents as compared with an average of 17.275 cents in 1915, an increase of 9.927 cents or 57.5 per cent. Higher prices for copper have not been recorded since 1873 when the average for the year was 28 cents.

Exports of copper according to Customs records were: copper fine in ore, matte, regulus, etc., 124,942,400 pounds valued at \$20,776,536; copper in pigs, bars, sheets, etc., 2,430,400 pounds valued at \$581,268. There were also exports of old and scrap copper amounting to 5,846,600 pounds valued at \$1,284,895.

The total value of the imports of copper in 1916 are recorded as \$7,565,377 as against \$3,957,770 in 1915. The imports in 1916 included 25,584,087 pounds of copper in pigs, ingots and manufactures valued at \$7,565,377; other manufactures of copper values at \$234,437 and copper sulphate \$1,803,655 pounds valued at \$198,542. There was also a considerable import of copper contained in brass.

NICKEL.

The production of nickel in 1916 has as usual, been derived from the ores of the Sudbury district supplemented by the recovery of a small quantity of metallic nickel, nickel oxide and other nickel salts as by-products in the treatment of ores from the silver-cobalt-nickel ores of the Cobalt district.

The total production was 82,958,564 pounds which at 35 cents per pound would have a total value of \$29,035,497. The total production in 1915 was 68,308,657 pounds showing an increase in 1916 of 14,649,907 pounds, or 21.5 per cent.

The nickel-copper ore, derived from 9 separate mines in the Sudbury district supplemented by a small tonnage of similar ores from the Alexo

mine in Timiskaming, is reduced in smelters and converters at Copper Cliff and Coniston to a Bessemer matte containing from 77 to 82 per cent of the combined metals and shipped in that form to Great Britain and the United States for refining, the product of the Canadian Copper Company going to New Jersey and that of the Mond Nickel Company to Wales. A refinery is now under construction at Port Colborne, Ont., by the International Nickel Company, in which a portion of the matte produced by the Canadian Copper Company will be refined.

Although not shipping during the year the British America Nickel Corporation, Ltd., has been actively engaged in the development of its nickel properties in the Sudbury district and in the erection of a smelter.

The total production of matte in 1916 was 80,010 tons, containing 44,859,321 pounds of copper and 82,596,862 pounds of nickel. The tonnage of ore smelted (part being previously roasted) was 1,521,689 tons. The production in 1915 was 67,703 tons of matte containing 39,216,165 pounds of copper and 68,077,823 pounds of nickel.

Nickel was recovered as a by-product in smelters at Deloro Thorold and Welland, from the silver-cobalt-nickel ores of the Cobalt district, the total nickel contents of nickel oxide, nickel sulphate and metallic nickel produced being 361,701 pounds. The products recovered included 79,360 pounds of metallic nickel; 323,418 pounds of nickel oxide and 232,450 pounds of nickel sulphate having a total reported value of \$132,896. The recovery from these ores in 1914 was 231,634 pounds of nickel.

The exports of nickel in ore matte or other form are reported by the Customs Department as 80,441,700 pounds valued at \$8,622,179 or an average of 10.77 cents per pound of which about 83 per cent were exported to the United States.

The imports of nickel into the United States during 1916 which included small quantities from other sources as well as from Canada are recorded as 72,611,492 pounds contained in ore, matte, or other form valued at \$9,889,122 or an average of 13.62 cents per pound. The exports of nickel and nickel oxide, etc., were 33,404,011 pounds valued at \$12,952,493 or an average of 38.775 cents per pound of which about 50 per cent were consigned to Great Britain and 40 per cent to France, Italy and Russia in Europe. The United Kingdom, it will be observed, has continued to receive through United States refineries a much larger quantity of nickel than is exported directly from Canada to Great Britain. The published records do not show the details "To other countries" for 1916 but a large portion of the 2,906,665 pounds thus exported went to Russia in Asia with smaller quantities to Norway, Sweden and Spain, etc. The value of the exports in 1916 ranged from 37.128 cents to 45.211 cents per pound. The average values of the exports in 1915 to different countries ranged from 35.925 cents to 43.188 cents per pound, the total average being 38.338 cents per pound. The total average value in 1914 was 34.265 cents with a range of from 32.6 to 38.8 cents per pound.

The price of refined nickel in New York according to quotations published by the Engineering & Mining Journal remained throughout the year at from 45 to 50 cents per pound for ordinary forms with 5 cents more per pound asked for electrolytic nickel.

The following table shows the production of nickel by smelters in the Sudbury districts, the exports from Canada and United States records of imports and exports.

Production of Nickel in Canada.		1912.	1913.	1914.	1915.	1916.
	Tons.*	Tons.*	Tons.*	Tons.*	Tons.*	Tons.*
Ore mined.....	737,584	784,697	1,000,364	1,364,048	1,566,333	
Ore smelted.....	725,065	823,403	967,053	1,272,283	1,521,689	
Bessemer matte produced.....	41,925	47,150	46,396	67,703	80,010	
Copper content of matte.....	11,116	12,938	14,448	19,608	22,450	
Nickel " "	22,421	24,838	22,759	34,039	41,298	
Spot value of matte.....	\$6,303,102	\$7,076,945	\$7,189,031	\$10,352,344	.....	.....
	1912.	1913.	1914.	1915.	1916.	
Exports of Nickel from Canada.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Nickel contained in matte, etc.—						
Exported to Great Britain.....	5,072,867	5,164,512	10,291,979	13,748,000	11,136,900	
Exported to United States.....	39,148,993	44,224,119	36,015,642	52,662,400	69,304,600	
Exported to Other Countries.....	.....	70,386	220,706	.....	.....
	44,221,860	49,459,017	46,538,327	66,410,400	80,441,700	
Imports of Nickel into United States		1912.	1913.	1914.	1915.	1916.
Gross tons of ore and matte.....		33,101	37,623	29,564	45,798	59,741
Nickel contents..... Lbs.		42,168,769	47,194,101	35,006,700	56,352,582	72,611,492
Exports of Nickel from United States—						
To France..... Lbs.	5,083,947	3,631,858	3,457,157	3,018,354	2,823,132	
To Italy..... " "	.....	.....	.....	.....	2,715,521	
To Netherlands..... " "	7,387,447	6,622,811	855,168	129,557	516,331	
To Russia in Europe..... " "	.....	.....	.....	.....	7,767,875	
To United Kingdom..... " "	8,191,364	8,221,640	10,836,369	14,801,565	16,674,487	
To other Countries..... " "	5,152,258	10,096,779	12,446,458	8,469,074	2,906,665	
Total..... " "	25,815,016	29,173,088	27,595,152	26,418,550	33,404,011	

* In tons of 2,000 lbs.

LEAD.

Notwithstanding the demand and high prices, the actual recovery of lead as bullion and refined was less than during the previous year. The total production in 1916 of lead in bullion credited to Canadian mines and estimated as recoverable from ores exported was 41,593,680 pounds which at the average price of lead in Montreal 8.513 cents per pound, was valued at \$3,540,870. In 1915 the production was 46,316,450 pounds valued at \$2,593,721 (5.600 cents per pound). There was a decrease of over 10 per cent in quantity, but an increase of over 32 per cent in total value.

The 1916 production included 38,838,372 pounds of lead in bullion of which a large portion was electrolytically refined, and 2,755,308 pounds recoverable from ores exported. The lead bullion was produced chiefly at Trail with small contributions from smelters at Kingston and Galetta, Ontario. The lead ores exported were derived from Notre Dame des Anges, Quebec, Hollandia mine, Bannockburn, Ont., Surprise mine, Slocan, B.C., and the Silver King mine, Mayo, Yukon district.

Although the recoveries of lead were small in 1916, shipments of lead ores from mines appear to have been greater than in the previous year. Lead ore shipments in 1916 were approximately 82,000 tons, containing 51,083,000 pounds of lead, while zinc-lead ores shipped to Trail contained considerable quantities of lead which would be recoverable in large part after the extraction of the zinc. In 1915, the ore shipments were 73,752 tons containing 48,708,005 pounds of lead.

The exports of lead in 1916 included: lead in ore, etc., 9,048,400 pounds valued at \$558,180 and pig lead 112,100 pounds valued at \$7,710. Exports

in 1915 were: pig lead 2,066,929 pounds valued at \$79,067, and lead in ore, etc., 1,845,100 pounds valued at \$40,273.

The total value of the imports, as shown by the Customs records of lead and lead products in 1916 was \$2,077,986, as against a value of \$2,482,916 in 1915. The 1916 imports included old and scrap lead 19,865,800 pounds valued at \$1,258,284; bars, sheets, pipe, etc., 3,427,233 pounds valued at \$1,312,067; other manufactures valued at \$155,368, litherage 2,767,200 pounds valued at \$211,359 and lead pigments containing approximately 1,474,979 pounds of metallic lead valued at \$140,908. The total imports would thus exceed 13,629 tons by the quantity contained in "Other manufactures" which would probably not be greater than 500 or 600 tons. The imports in 1915 were about 25,000 tons.

The average monthly price of lead in Montreal varied between a minimum of 7·29 per pound in January and a maximum of 9·42 in December, averaging for the year 8·513 cents. This is the producer's price for lead in car lots as per quotations furnished by Messrs. Thomas Robertson and Company.

The average monthly price of lead in New York was 6·858 cents per pound and in London £30-19s-6d per gross ton equivalent to 6·715 cents per pound.

ZINC.

With the exception of a small production in experimental work, there was no recovery of zinc spelter, or refined zinc in Canada previous to 1916. Hitherto the production of zinc has been recorded in terms of the tonnage of ore shipped and metal contents thereof. The establishment of an electrolytic zinc refinery at Trail, and of zinc recovery plant at Shawinigan Falls, has placed the metallurgy of this metal in Canada on a similar basis to that of lead and copper and it will be in order to record the production accordingly.

In 1915 the shipments of zinc ores to United States smelters for reduction were 14,895 tons valued at \$554,938 and containing 12,231,439 pounds of zinc. Assuming a probable recovery of 80% of the metal the production of zinc may be recorded as 9,785,151 pounds which at the average price of zinc for the year 13·230 cents per pound in New York, would be worth \$1,294,575.

In 1916 the total zinc ore shipments from mines including the zinc-lead ores from the Sullivan mine, and ores exported were about 80,965 tons containing 47,243,575 pounds of zinc (partially estimated in the absence of complete returns). A portion of the ores shipped to Trail were not treated during the year and the percentage of zinc recovered at the Trail refinery in the early stages of operation was probably not as large as will be secured when primary difficulties have been eliminated. Adding to the actual recovery of refined zinc at Trail 80 per cent of the zinc contents of ores sent to the United States smelters, we have a zinc production of 23,515,030 pounds, which at the average price of zinc for the year 12·804 cents would be worth \$3,010,864. Of the total production thus recorded, 1,774,080 pounds is credited to the Notre Dame des Anges ores in Quebec, and 21,740,950 pounds to British Columbia.

The exports of zinc are not separately recorded by the Customs Department. The imports of zinc not including zinc contained in brass, were valued at \$3,690,577 in 1916, as against \$2,797,042 in 1915. The 1916 imports included: zinc in blocks or pigs 14,839,400 pounds valued at \$2,141,355; zinc white 14,171,673 pounds valued at \$1,314,629; zinc dust

691,704 pounds valued at \$162,186; sulphate and chloride of zinc 297,061 pounds valued at \$24,306; and manufactures of zinc valued at \$48,101. The total imports were equivalent to 13,465 tons of metallic zinc, as against 12,817 tons in 1915 and 11,022 tons in 1914. From 1,000 to 2,000 tons of zinc are probably imported in the form of brass.

The price of spelter in New York on the first of January was about 15½ cents and at the end of December about 9 cents. The highest and lowest prices quoted were respectively 20½ cents, about middle of February and 7¾ cents early in August. The average for the year being 12.804 cents per pound.

COBALT.

Cobalt is being recovered at the smelters at Deloro, Thorold and Welland, Ontario, in the form of metallic cobalt, cobalt oxide, cobalt sulphate and other salts and also stellite the cobalt alloy used for high speed tool metal, from silver-cobalt-nickel ores of the Cobalt district. Some cobalt residues from the Nipissing mill have also been shipped to Great Britain.

The total production of cobalt contained in smelter products recovered and in cobalt residues exported during 1916 is estimated at 841,859 pounds valued at \$926,045. In 1915 the production was equivalent to 504,212 pounds of cobalt valued at \$536,268.

The 1916 production included 215,215 pounds of metallic cobalt; 670,760 pounds of cobalt oxide together with smaller quantities of cobalt sulphate, cobalt carbonate, cobalt hydroxide, unseparated oxides, stellite and cobalt residues.

The 1915 production included 211,610 pounds of metallic cobalt and 423,717 pounds of cobalt oxide and cobalt sulphate.

The price of cobalt was quoted at various times during the year by the Engineering & Mining Journal of New York at from \$1.25 to \$1.50 per pound.

MOLYBDENUM.

The demand for molybdenite has resulted in considerable exploration of known occurrences and the development of several properties of considerable promise. Shipments were made during 1916 from at least 17 different localities in Quebec, Ontario and British Columbia of which that at Quyon operated by the Canadian Wood Molybdenite Company is probably the most important. Most of the ores produced were shipped for concentration to the International Molybdenum Company's mill at Renfrew, or the concentrating plant operated by the Mines Department at Ottawa. Some ores were also shipped by the Canadian Wood Molybdenite Company for concentration in Denver, this Company has also built a mill near the mine at Quyon and a second mill at Hull, Que. A concentrating mill has also been built by the Renfrew Molybdenum Mines Company at Mt. St. Patrick.

The total MoS₂ contents of concentrates produced and shipped during the year was about 159,000 pounds for which approximately \$1.00 per pound has been paid the official price being 105 shillings per unit of MoS₂ at Liverpool.

A portion of the concentrates have been used in the manufacture of molybdic acid, and ferro-molybdenum at Orillia, Ont. Ferro-molybdenum is also now being made at Belleville, Ont. The Imperial Munitions Board,

Ottawa, is an agent for the purchase in Canada of molybdenum for the British Government.

IRON ORE.

Mining operations have been confined to the Helen and Magpie mines of the Algoma Steel Corporation in the Michipicoten district of Ontario, together with a small production of ilmenite at Ivory-on-the-Lake, Quebec by the Manitou Iron Mining Company. There was also a shipment of concentrates from the concentrator at Trenton, Ont., produced in previous years' from ores derived from the Bessemer and Childs mines in Hastings county.

The total shipments in 1916 were 339,600 short tons valued at \$814,044 as compared with 398,112 tons valued at \$774,427 shipped in 1915. The 1916 shipment included 109,965 tons of Helen ore part of which was sent to Magpie for roasting, 210,522 tons of roasted siderite from Magpie, 15,904 tons of magnetite concentrates and 3,209 tons of ilmenite. The shipments in 1915 included 205,989 tons of hematite, 132,906 tons of roasted siderite and 59,217 tons of magnetite (including some ores with an admixture of hematite.)

In the Great Lakes area the ore prices for 1916 were Old Range Bessemer \$4.45 per gross ton; Messabi Bessemer \$4.20; Old Range Non-Bessemer \$3.70 and Messabi-Non-Bessemer \$3.55, an increase of 70 cents over 1915 prices. The 1917 quotations already fixed are \$1.50 in advance of those of 1916.

Mine operators reported 140,608 tons of ore exported to the United States and 198,992 tons shipped to Canadian furnaces.

According to the records of the Customs Department exports of iron ore amounted to 161,260 tons valued at \$541,779 and imports of iron ore to 2,339,667 tons valued at \$4,419,013.

Shipments of iron ore from Wabana mines, Newfoundland in 1916 by the two Canadian companies operating there were 1,012,060 short tons all of which was shipped to Cape Breton.

In 1915 the total shipments were 868,451 short tons of which 802,128 tons were shipped to Cape Breton and 66,323 tons to England.

PIG IRON.

The total production of pig iron in 1916, not including the output of ferro-alloys was according to complete returns now received, 1,169,257 short tons (1,043,979 long tons), valued at \$16,750,903 as compared with 913,775 short tons (815,870 long tons), valued at \$11,374,199 in 1915, showing an increase of 255,482 tons, or 27.9 per cent.

The 1916 production was greater than that of any previous year, the second largest production of pig iron having been 1,128,967 short tons in 1913.

The production in Nova Scotia in 1916 was 470,055 tons as against 420,275 tons in 1915, an increase of 49,780 tons or 11.8 per cent while the production in Ontario was 699,202 tons in 1916 compared with 493,500 tons in 1915, an increase of 205,702 tons, or 41.7 per cent.

Of the total output in 1916, 17,304 tons were made with charcoal as fuel as against 13,692 tons made with charcoal in 1915.

By grades the 1916 production included: Basic 953,627 tons; Bessemer 31,388 tons; Foundry and Malleable, etc., 184,242 tons. The 1915 pro-

duction included: Basic 739,613 tons; Bessemer 29,052; Foundry and Malleable, etc., 145,110 tons.

The blast furnace plants operated were the same as in the previous year, viz: the Dominion Iron & Steel Company at Sydney, N.S., the Nova Scotia Steel & Coal Company, at North Sydney; The Standard Iron Company at Deseronto, Ont., The Steel Company of Canada, at Hamilton, Ont., The Canadian Furnace Company, at Port Colborne, Ont., and the Algoma Steel Corporation at Sault Ste. Marie, Ont.

The production of ferro-alloys in Canada in 1916, chiefly ferro-silicon, but including also ferro-phosphorus and ferro-molybdenum, all made in electric furnaces was 28,628 tons valued at \$1,777,615, as compared with a production in 1915 of 10,794 tons valued at \$753,404.

The exports during 1916 of pig iron were 23,304 tons, valued at \$374,383 or an average per ton of \$16.07 and of ferro-silicon and ferro-compounds 22,802 tons valued at \$1,352,013, or an average of \$59.29 per ton.

The imports during 1916 included 57,337 tons of pig iron valued at \$1,128,557, or an average of \$19.68 per ton; 793 tons of charcoal pig valued at \$16,593, or an average of \$20.92, and 45,309 tons of ferro products valued at \$1,879,448, or an average of \$41.48 per ton, making a total import of pig iron and ferro-alloys of 103,439 tons valued at \$3,024,598.

STEEL INGOTS AND CASTINGS.

The estimated production of steel ingots and castings in 1916 as published at the end of December (complete returns have not yet been received) was 1,454,124 short tons (1,298,325 gross tons) of which 1,423,485 short tons were ingots and 30,639 tons direct steel castings. The total production in 1915 was 1,020,896 short tons, showing an increase in 1916 of 433,228 tons, or over 42 per cent. The 1916 production was greater than that of any previous year the second largest production having been 1,168,993 short tons in 1913.

Of the total production of steel ingots and castings in 1916, about 43,790 short tons (39,098 gross tons) were made in electric furnaces. In 1915 only 61 short tons were reported as having been made in electric furnaces.

ASBESTOS.

The Asbestos industry has been particularly active during 1916, the value of the production having been the highest on record though the quantity was slightly exceeded in 1913. Stocks on hand at the end of the year were reduced to a minimum. Production, as usual, has been confined to the asbestos district of Black Lake, Thetford, Robertsonville, Danville, and East Broughton, in the Eastern Townships, Province of Quebec.

The total output in 1916 was 118,246 tons which, compared with 106,559 tons in 1915, shows an increase of 11,687 tons or 11 per cent. The sales during 1916 were 136,016 tons valued at \$5,133,332 or an average of \$37.74 per ton, as against sales in 1915 of 111,142 tons valued at \$3,553,366 or an average of \$31.97 per ton, showing an increase of 24,874 tons or 22.4 per cent in quantity, and \$1,579,966 or 44.4 per cent in value. The 1916 sales included 5,893 tons of crude asbestos valued at \$1,867,064 or an average of \$316.82 per ton, and 130,123 tons of milled fibre valued at \$3,266,268 or an average of \$25.10 per ton. The 1915 sales included 5,370 tons of crude asbestos valued at \$1,076,297 or an average of \$200.43 per ton,

and 105,772 tons of milled fibre valued at \$2,476,869 or an average of \$23.42 per ton.

Stocks on hand at December 31st, 1916 were reported as only 6,081 tons, as compared with 24,345 tons on hand December 31st, 1915, and 31,171 tons on hand December 31st, 1914. Sales of asbestic in 1916 were 18,500 tons valued at \$27,147 an average of \$1.46 per ton, as compared with sales in 1915 of 21,031 tons valued at \$17,540 or an average of \$0.83 per ton.

The total quantity of asbestos rock sent to mills during the year was 1,822,461 tons from which was obtained 112,832 tons of fibre or an average recovery of 6.20%.

Output, Sales and Stocks of Asbestos 1915 and 1916.

	1915.			1916.		
	Crude.	Milled.	Total.	Crude.	Milled.	Total.
Output..... Tons.	3,987.2	102,572	106,559.2	5,414.34	112,832	118,246.34
Sold..... "	5,370.0	165,772	111,142	5,893.13	130,123	136,016.13
Value sales.....	\$1,076,297	\$2,476,869	\$3,553,166	\$1,867,064	\$3,266,268	\$5,133,332
Average per ton.....	\$200.43	\$23.42	\$31.97	\$316.82	\$25.10	\$37.74
Stocks, Dec. 31, 1916.. Tons	906.6	23,439	24,345.6	1,079	5,002	6,081

Exports of asbestos during the calendar year 1916 were 96,775 tons valued at \$3,872,463, or an average of \$40.01 per ton, as compared with exports in 1915 of 84,584 tons valued at \$2,734,695, or an average of \$32.45 per ton. There was also an export of asbestos sand and waste amounting to 33,564 tons, valued at \$241,272, or an average of \$7.18 per ton, and of manufactures of asbestos valued at \$4,741. The exports of sand and waste in 1915 were 25,103 tons, valued at \$157,410, or an average of \$6.27 per ton, and of manufactures of asbestos valued at \$125,003.

Imports of asbestos manufactures for the year were valued at \$136,670 as against a value of \$168,894 in 1915.

CHROMITE.

The total shipments of crude chromite ores in 1916 were 27,030 tons, valued at \$299,753. These ores contained a total of approximately 6,574 tons of Cr_2O_3 or an average of about 24 per cent. A considerable portion of the low grade ore and sand, however, amounting to 14,242 tons, was sent to concentrating mills for concentration before being marketed. The quantity thus concentrated was 10,992 tons from which were recovered 1,046 tons of concentrates, averaging from 42 per cent to over 50 per cent of Cr_2O_3 . The final shipments of ore and concentrates would approximate 13,834 tons.

The exports of chromite are reported by the Customs Department as 12,633 tons, valued at \$152,534.

Production in 1915 was reported as 12,341 tons, valued at \$179,540, with exports of 7,290, valued at \$81,838.

Practically the entire production has been obtained in the district tributary to Thetford and Black Lake, in the Eastern Townships, Quebec.

COAL AND COKE.

Coal. The total production of marketable coal during 1916, (comprising sales and shipments, colliery consumption, and coal used in making coke, or used otherwise by colliery operators), was 14,461,678 short tons, valued at \$38,857,557, as against 13,267,023 short tons, valued at \$32,111,182 in 1915, showing an increase of 1,194,655 tons or 9 per cent in quantity, and of \$6,746,375 or 21 per cent in total value.

Arbitrary values are assumed for Nova Scotia and British Columbia, viz.: \$3.00 per long ton for the former, and \$3.50 per long ton for the latter. In the other provinces values are as furnished by the operators.

Each of the coal producing provinces of the West shows not only an increase but also its maximum production. New Brunswick shows a slight increase, while Nova Scotia and the Yukon report decreases.

The Nova Scotia production was 6,894,728 short tons, a decrease of 568,642 tons or 7.6 per cent as compared with 1915; the Alberta production, 4,563,020 tons, shows an increase of 1,202,202 tons or 35.8 per cent over the previous year; the British Columbia production, 2,582,737 short tons, an excess of 517,124 tons or 25.1 per cent; the Saskatchewan production, 280,835 tons, shows an increase of 40,728 tons or about 17 per cent; the New Brunswick production, 137,058 tons, show an increase of 9,667 net tons or 7.6 per cent. The Yukon production is reported as 3,300 tons.

Production of Coal.

Province.	1914.		1915.		1916.	
	Tons	Value	Tons	Value	Tons	Value
Nova Scotia.....	7,370,924	\$16,452,955	7,463,370	\$16,659,308	6,894,728	\$18,468,021
Alberta.....	3,683,015	9,350,392	3,360,818	8,283,079	4,563,020	11,496,106
British Columbia.....	2,239,799	6,999,374	2,065,613	6,455,041	2,582,737	8,071,053
Saskatchewan.....	232,299	374,245	240,107	365,246	280,835	442,136
New Brunswick.....	98,049	241,075	127,391	309,612	137,058	367,041
Yukon Territory.....	13,443	53,760	9,724	38,896	3,300	13,200
	13,637,529	33,471,801	13,267,023	32,111,182	14,461,678	38,857,557

The exports of coal in 1916 were 2,135,359 tons, valued at \$7,099,387, as compared with exports of 1,766,543 tons in 1915, valued at \$5,406,058, showing an increase of 368,816 tons or 20.9 per cent.

The total imports of coal in 1916 were 17,580,603 tons, valued at \$38,289,666, made up as follows: bituminous, round and run of mine, 9,504,552 tons, valued at \$12,368,679 or an average of \$1.30 per ton; bituminous slack, 3,505,236 tons, valued at \$3,704,624, or an average of \$1.06 per ton; and anthracite, 4,570,815 tons, valued at \$22,216,363, or an average of \$4.86 per ton. There were thus increases in all three classes of coal, bituminous, round and run of mine increasing by 3,397,758 tons, or 55.6 per cent; bituminous slack by 1,218,320 tons or 53.3 per cent; anthracite by 498,623 tons or 12.2 per cent, or a total increase of 5,114,701 tons or over 41 per cent in quantity, while the total value shows an increase of \$9,944,061 or 35.1 per cent. Details of imports follow.

Imports of Coal.

	1915.			1916.		
	Tons	Value	Aver.	Tons	Value	Aver.
Bituminous, round and run of mine...	6,106,794	\$ 7,564,369	1.24	9,504,552	12,368,679	1.30
Bituminous, slack.....	2,228,916	2,027,256	0.89	3,505,236	3,704,624	1.06
Anthracite, coal and dust.....	4,071,192	18,753,980	4.61	4,570,815	22,216,363	4.86
Total.....	12,465,902	28,345,605	2.27	17,580,603	38,289,666	2.18

The apparent consumption of coal during 1916 was therefore 29,884,139 tons as against 23,906,692 tons in 1915. Canadian mines contributed 41 per cent of the domestic consumption and the balance was imported. The total Canadian production was equivalent to about 48.4 per cent of the consumption.

Coke. The total output of oven coke during 1916 was 1,448,782 short tons made from 2,134,911 tons of coal of which 1,501,835 tons were of domestic origin and 633,076 were imported. The total coke used or sold by the producers during the year was 1,469,741 tons, valued at \$6,045,412, or an average of \$4.19 per ton. In 1915 the output was 1,200,766 tons, and the quantity sold or used by the producers was 1,170,473 tons, valued at \$4,258,580, or an average of \$3.64 per ton. Returns in 1916 show a recovery of 67.9 per cent of the total coal charged, as compared with 64.7 per cent in 1915.

By provinces the output was: Nova Scotia, 653,836 tons, an increase of 68,843 tons; Ontario, 452,502 tons (all from imported coal), an increase of 136,291 tons; Alberta, 42,548 tons, an increase of 18,361 tons; and British Columbia, 299,896 tons, an increase of 24,521 tons. By-products from coke ovens included: 11,040 short tons of sulphate of ammonia; 9,012,202 gallons tar; 5,058,636 thousand cubic feet of gas; and were in excess of the previous year's production. Benzol, toluol, naphtha, and naphthalene were also produced in 1916. The ovens operated during the year were those at Sydney, and Sydney Mines, N.S., Sault Ste Marie, Ont., Coleman, Alta., and Fernie, Michel, and Union Bay, B.C.: all others were idle throughout the year. At the close of the year, 1,907 ovens were in operation. The imports of coke in 1916, the highest recorded, were 757,116 tons, valued at \$3,229,078, while the exports were 48,539 tons, valued at \$221,334.

FELDSPAR.

Feldspar was derived from the same districts as in previous years, viz.: Frontenac County, Ontario, and Hull and Villeneuve townships, Quebec. Shipments in 1916 which were the highest recorded amounted to a total of 19,166 tons, valued at \$71,357, or an average of \$3.72 per ton, and included 14,878 tons, valued at \$53,332 from Ontario and 4,288 tons, valued at \$18,025 from Quebec.

FLUORSPAR.

Shipments of fluorspar were made from Madoc, Ontario, during 1916 amounting to 1,284 tons, valued at \$10,238. This was practically the first commercial operation of these deposits.

Imports of fluorspar are not shown separately in the Customs records but there is an annual consumption in steel furnaces of from 10,000 to 15,000 tons.

GRAPHITE.

The total shipments of milled and refined graphite were 3,971 tons, valued at \$285,362, or an average of \$71.86 per ton, and included 495 tons, valued at \$35,776 from Quebec, and 3,476 tons, valued at \$249,586 from Ontario.

The production includes material varying in value from \$54 to \$270 per ton.

The production in 1915 was 2,635 tons, valued at \$124,223.

Exports of plumbago, crude and concentrates, were reported as 311 tons, valued at \$13,114, and of manufactures of plumbago to the value of \$304,919.

GYPSUM.

The total quantity of gypsum rock quarried in 1916, was 422,741 tons, of which 92,864 tons were calcined. The shipments of gypsum of all grades totalled 341,618 tons, valued at \$730,831, and included lump, 249,759 tons, crushed 15,680 tons, fine ground 6,057 tons, and calcined 70,122 tons.

In 1915 the quantity quarried was 505,989 tons, of which 84,763 tons were calcined. The shipments included: lump 346,947 tons, crushed 48,735 tons, fine ground 6,453 tons, and calcined 72,678 tons, or a total of 474,815 tons, valued at \$854,929.

Exports of crude gypsum were 221,234 tons, valued at \$252,476, while exports classed as gypsum or plaster, ground, rose to a value of \$154,630. The corresponding exports in 1915 were crude gypsum 292,234 tons, valued at \$336,380, and Gypsum or plaster, ground, valued at \$80,933.

MAGNESITE.

Magnesite was quarried and shipped chiefly from Grenville township, Argenteuil county, Quebec, supplemented by several hundred tons from Atlin district in British Columbia.

The total shipments in 1916 were 55,413 tons, valued at \$563,829, or an average of \$10.17 per ton.

In 1915 the shipments were 14,779 tons, valued at \$126,584, or an average of \$8.56 per ton, and in 1914, 358 tons, valued at \$2,240.

NATURAL GAS.

The total production of natural gas according to returns received, was 25,238,568 thousand cubic feet, valued at \$3,924,632, as compared with a production in 1915 of 20,124,162 thousand cubic feet, valued at \$3,706,035. The production by provinces was as follows: Ontario 17,838,318 thousand cubic feet, valued at \$2,730,653; New Brunswick 610,118 thousand cubic feet, valued at \$79,628, and Alberta 6,818,131 thousand cubic feet, valued at \$1,114,351.

PETROLEUM.

There has been comparatively little change in the production of petroleum during the past three years' although since 1907 there has been a distinct falling off. A bounty of $1\frac{1}{2}$ cents per gallon is paid on the marketed production of crude oil from Canadian oil fields through the Department of Trade and Commerce. From the bounty statistics it appears that the 1916 production in Ontario and New Brunswick was 198,123 barrels on which bounties amounting to \$104,014.13 were paid. The market value of the crude oil at \$1.97-11/12 per barrel amounted to \$392,284. In Alberta there was a small production of crude oil, but no bounty was paid on this as the specific gravity was below the standard set by the Petroleum Bounty Act and complete records have not as yet been received from the producers.

The total production of crude oil (exclusive of Alberta), in 1916 was therefore 198,123 barrels, valued at \$392,284 as compared with a production in 1915 of 215,464 barrels, valued at \$300,572, showing a decrease of about

8 per cent in quantity, but on account of the higher price an increase of over 30 per cent in total value.

The price of crude increased from \$1.73 at the beginning of the year to \$2.13 on March 16, declining to \$1.83 on August 14 and increasing again to \$1.98 at the end of the year, the average for the year being \$1.979.

The Ontario production in 1916 was according to the records of the Department of Trade and Commerce at Ottawa, 196,778 barrels. The production in barrels of the various fields as furnished by the Supervisor of Petroleum Bounties at Petrolia was as follows: Lambton 142,208 barrels, Bothwell 33,856 barrels, Dutton 2,851 barrels, Tilbury 16,296 barrels, Onondaga and Belle River 1,663 barrels, or a total of 196,894 barrels.

The production in New Brunswick was 1,345 barrels as against 1,020 barrels in 1915 and 1,725 barrels in 1914.

Exports of petroleum entered as crude mineral oil in 1916 were 137,647 gallons, valued at \$11,439, and of refined oil 446,595 gallons, valued at \$48,137. There was also an export of naphtha and gasoline of 54,806 gallons, valued at \$14,195.

The total value of the imports of petroleum and petroleum products in 1916 was \$14,701,521, as against a value of \$8,047,781 in 1915.

The total imports of petroleum oils, crude and refined in 1916 were 292,340,271 gallons, valued at \$14,600,674. These oil imports included: crude fuel and gas oils 253,007,420 gallons, valued at \$8,456,020; coal and kerosene and illuminating oils 8,080,107 gallons, valued at \$542,893; lubricating oils 5,466,076 gallons, valued at \$973,253; gasoline 18,321,891 gallons, valued at \$3,624,931 and other oils, products of petroleum 7,464,777 gallons, valued at \$1,003,577. The imports of petroleum products included 1,061,112 pounds of paraffin wax, valued at \$70,308 and paraffine wax candles 220,264 pounds, valued at \$30,539, or a total of \$100,847.

PYRITES.

The production of pyrites in 1916 was 309,411 tons, valued at \$1,084,019 and included 130,799 tons, valued at \$523,196 from Quebec, 177,552 tons, valued at \$555,523 from Ontario, and 1,060 tons, valued at \$5,300 from British Columbia. In 1915 the total production was 286,038 tons, valued at \$985,190, which included 142,735 tons, valued at \$570,940 from Quebec, and 143,303 tons, valued at \$414,250 from Ontario.

Exports of pyrites in 1916 were 156,722 tons, valued at \$557,024, or an average of \$3.55 per ton. Exports of sulphuric acid were 3,151,700 pounds valued at \$74,527.

SALT.

The Canadian salt production is obtained from southern Ontario. The total sales in 1916 were 124,033 tons, valued at \$668,627 (exclusive of the cost of packages). The 1915 sales were 119,900 tons, valued at \$600,226.

In addition to the production of salt, brine is pumped for use in chemical works at Sandwich, Ontario, where caustic soda and bleaching powder are manufactured by the Canadian Salt Co.

The exports of salt in 1916 were 305,900 pounds, valued at \$2,223. The total imports of salt were 151,208 tons, valued at \$694,835, and included 34,035 tons of fine salt in bulk, valued at \$111,130; 7,679 tons of salt in packages, valued at \$59,980, and 109,493 tons of salt imported from

Great Britain for the use of fisheries, valued at \$523,725. The total imports in 1915 were 137,486 tons, valued at \$517,526.

CEMENT.

The production of structural materials and clay products which showed a large falling off in both 1914 and 1915, show a further decrease in 1916. The total value of the production in 1916 was \$17,301,726, as against \$17,920,759 in 1915, and \$26,009,227 in 1914.

The total quantity of Portland cement including natural Portland, made in 1916 was 4,753,034 barrels of 350 pounds each, as compared with 5,153,767 barrels in 1915, a decrease of 400,733 barrels, or about 7·8 per cent.

The total quantity of Canadian Portland cement sold, or used during 1916 was 5,359,050 barrels, valued at \$6,529,861 or an average of \$1·218 per barrel, as compared with 5,681,032 barrels sold or used in 1915, valued at \$6,977,024, or an average of \$1.228, showing a decrease of 321,982 barrels, or about 5·7 per cent.

The total imports of cement in 1916 were 72,087 cwt., equivalent to 20,595 barrels of 350 pounds each, valued at \$31,621, or an average of \$1.54 per barrel, as compared with imports of 28,190 barrels, valued at \$40,426, or an average of \$1.43 per barrel in 1915.

The total consumption of cement, therefore, neglecting a small export was 5,379,645 barrels, as compared with a consumption of 5,709,222 barrels in 1915, showing a decrease of 329,577 barrels, or about 5·8 per cent.

The average price per barrel at the works in 1916 was \$1.218 as compared with \$1.228 in 1915, \$1.28 in 1914, \$1.27 in 1913, \$1.28 in 1912 and \$1.34 during 1911 and 1910.

The imports of cement in 1916 included 72,083 cwt., valued at \$31,616 from the United States, and 4 cwt., valued at \$5 from Great Britain.

Production and Sales of Portland Cement.

—	1913.	1914.	1915.	1916.
	Brls.	Brls.	Brls.	Brls.
Portland Cement sold or used.....	8,658,805	7,172,480	5,681,032	5,359,050
" manufactured.....	8,886,333	8,727,269	5,153,763	4,753,034
Stock on hand Jan. 1st.....	862,067	1,073,328	2,620,022	2,061,756
" Dec. 31st.....	1,089,595	2,628,117	2,062,961	1,444,876
Value of cement sold or used.....	\$11,019,418	\$ 9,187,924	\$ 6,977,024	\$ 6,529,861
Wages paid.....	\$ 3,466,451	\$ 2,271,096	\$ 1,184,459	\$ 1,307,222
Men employed.....	4,276	2,977	1,686	1,696

Consumption of Portland Cement.

Calendar Year.	Canadian.		Imported.		Total.
	Barrels.	Per cent.	Barrels.	Per cent.	Barrels.
1911.....	5,692,915	90·0	661,916	10·0	6,354,831
1912.....	7,132,732	83·3	1,434,413	16·7	8,567,145
1913.....	8,658,805	97·1	254,093	2·9	8,912,988
1914.....	7,172,480	98·7	98,022	1·3	7,270,502
1915.....	5,681,032	99·5	28,190	0·5	5,709,222
1916.....	5,359,050	99·6	20,595	0·4	5,379,645

Exports of Products of the Mine and Manufacture of Mine Products, Calendar Year, 1916.

Products.	Quantity.	Value.
Arsenic.....	Cwt. 39,505	\$ 197,458
Asbestos.....	Tons. 96,775	3,872,463
Asbestos sand and waste.....	" 33,564	241,272
Coal.....	" 2,135,359	7,099,387
Cobalt (nine months only).....	"	712,886
Chromite (Chromic Ore).....	" 12,633	152,534
Corundum.....	" 56	8,583
Felspar, Magnesite, Talc, etc.....	"	329,215
Gold-bearing quartz, dust, nuggets, etc.....	"	18,382,903
Gypsum or plaster, crude.....	Tons. 221,156	252,476
Metals, viz:—		
Copper, fine, contained in ore, matte, regulus, etc.....	Cwt. 1,249,424	20,776,536
Lead, metallic, contained in ore, etc.....	" 90,484	558,180
Nickel, fine, contained in ore, matte, or speiss.....	" 804,417	8,662,179
Platinum, contained in concentrates or other forms.....	Ozs. 532	41,945
Silver, metallic, contained in ore concentrates etc.....	25,279,359	15,637,885
Mica.....	Lbs. 1,308,793	379,720
Mineral pigments, iron oxides, ochres.....	Cwt. 33,917	25,312
Mineral Water, natural, not in bottles.....	Gals. 229	22
Mineral wax.....	Cwt. 80,987	201,653
Oil:—		
Mineral, coal and kerosene, crude.....	Gals. 137,647	11,439
Mineral, coal and kerosene, refined.....	" 446,595	48,137
Gasoline and naphtha.....	" 54,806	14,194
Ores:—		
Antimony.....	Tons. 794	48,158
Iron.....	" 161,260	541,779
Manganese.....	" 957	89,544
Other.....	" 69,331	1,348,540
Phosphates.....	Tons. 103	\$ 1,543
Plumbago, crude ore and concentrates.....	Cwt. 6,223	13,114
Pyrites.....	Tons. 156,722	557,024
Salt.....	Cwt. 3,059	2,223
Sand and Gravel.....	Tons. 1,114,913	388,309
Stone, ornamental, granite, marble, etc., unwrought.....	" 15,967	7,989
Stone, building, freestone, limestone, etc., unwrought.....	" 128,453	103,796
Stone, crushed.....	" 26,754	27,611
Stone, for manufacture of grindstones, rough.....	" 356	1,764
Other articles of the mine.....	"	17,694
Total mine products.....		80,817,792
MANUFACTURES.		
Agricultural implements and machines, viz:—		
Mowing machines.....	No. 6,672	\$ 233,024
Cultivators.....	" 4,219	142,028
Reapers.....	" 1,115	65,011
Drills.....	" 4,713	317,831
Harvesters and binders.....	" 7,495	814,517
Ploughs.....	" 17,700	483,650
Harrowes.....	" 6,691	97,214
Hay rakes.....	" 2,011	43,746
Seeders.....	" 2	128
Thrashing machines.....	" 1,522	465,209
All others.....	"	292,603
Parts.....	"	750,966
Asbestos, manufactures of.....	"	4,714
Bricks.....	M 1,746	13,942
Cement.....	"	2,424
Clay, manufactures of.....	"	58,550
Coke.....	Tons. 48,539	221,334
Cream separators.....	"	34,567
Drugs, chemicals and medicines, viz:		
Acetate of lime.....	Cwt. 73,589	216,397
Acid sulphuric.....	" 31,517	74,527
Calcium carbide.....	" 1,469,663	4,369,085
Phosphorus.....	Lbs. 834,950	122,323
Earthenware, and manufactures of.....	"	7,620
Fertilizers.....	"	3,338,413
Gasoline engines.....	No. 529	86,310
Grindstones, manufactured.....	"	43,178
Gypsum or plaster, ground.....	"	154,630
Iron and steel and manufactures of, viz:—		
Stoves of all kinds.....	"	29,956
Gas buoys and parts of.....	"	2,484
Castings, N.O.P.....	"	167,881
Ferro-silicon and ferro compounds.....	Tons. 22,802	1,352,013
Pig-iron.....	" 23,304	374,383
Linotype machines, and parts of.....	"	35,465
Machinery, N.O.P.....	"	1,206,863

Exports of Products of the Mine and manufactures of Mine Products, Calendar Year 1916—Continued.

Product.	Quantity.	Value.
Sewing machines, and parts of.....		\$ 82,032
Washing machines, domestic, and wringers.....		5,763
Typewriters.....	No. 3,597	246,761
Scrap iron or steel.....	Cwt. 2,285,991	1,357,018
Hardware, viz:—		
Tools, hand or machine.....		376,549
Wire, and wire nails.....	Cwt. 2,450,517	8,597,320
Hardware, N.O.P.....		515,613
All other N.O.P.....		38,974,154
Lead in pigs, etc.....	Cwt. 1,121	7,710
Lime.....		66,406
Metals:—		
Aluminium in bars, blocks, etc.....	Cwt. 184,253	5,201,066
Aluminium, manufactures of.....		26,780
Brass, old and scrap.....	Cwt. 375,037	6,064,779
Copper, in pigs, bars sheets, etc.....	" 24,304	581,268
Copper, old and scrap.....	" 58,466	1,284,895
Metallic shingles and laths and corrugated roofing.....		30,563
Plated ware, N.O.P.....		15,050
N.O.P.....		3,143,135
Mineral and aerated waters in bottles.....		1,576
Oil, N.O.P.....	Gals. 3,391,857	1,038,025
Plumbago, manufactures of.....		304,919
Stone of all kinds, dressed.....		4,592
Tar.....		50,352
Tin, manufactures of.....		16,284
Vehicles:—		
Automobiles.....	No. 12,579	6,078,668
" parts of.....		672,060
Bicycles.....	No. 580	50,894
" parts of.....		5,877
Total Manufactures.....		90,043,122
Grand Total.....		171,240,911

Mineral Production in Canada, 1915.

(Revised).

Product.	Quantity. (a).	Value. (b).
METALLIC.		
Antimony ore.....	Tons. 1,341	\$ 81,283
Antimony refined.....	Lbs. 59,440	11,888
Cobalt metallic and contained in oxide, etc.....	" 504,212	536,268
Copper, value at 17·275c per lb.....	" 100,765,150	17,410,635
Gold.....	Ozs. 918,056	18,977,901
Iron, pig, from Canadian ore (c).....	Tons. 158,595	1,715,874
Iron ore sold for export.....	" 89,730	161,381
Lead, value at 5·600c per lb.....	Lbs. 46,316,450	2,593,721
Molybdenite.....	" 29,210	28,450
Nickel, value at 30c per lb.....	" 68,308,657	20,492,597
Platinum.....	" 23	1,063
Silver, value at 49·684c per lb.....	Ozs. 26,625,960	13,228,842
Zinc ore.....	Tons. 14,895	554,938
Total.....		75,814,841
NON METALLICS.		
Actinolite.....	Tons. 220	2,420
Arsenious oxide.....	" 2,396	147,830
Asbestos.....	" 111,142	3,553,166
Asbestic.....	" 25,700	21,819
Chromite.....	" 12,341	179,543
Coal.....	" 13,267,023	32,111,182
Corundum.....	" 262	33,138
Feldspar.....	" 14,559	57,801
Graphite.....	" 2,635	124,223
Graphite (artificial).....	" 249	.....
Grindstones.....	" 2,580	35,768
Gypsum.....	" 474,815	854,929
Magnesite.....	" 14,779	126,584
Manganese.....	" 201	9,360
Mica.....		91,905

Mineral Production in Canada, 1915.—Concluded.

Product.	Quantity. (a)	Value. (b)
Mineral pigments:—		
Barytes.....Tons.	550	6,875
Oxides....."	6,248	48,353
Mineral water....."		115,274
Natural gas.....M. cu. ft.	20,124,162	3,706,035
Peat.....Tons.	300	1,050
Petroleum (d).....Bls.	215,464	300,572
Phosphate.....Tons.	217	2,502
Pyrites....."	286,038	985,190
Quartz....."	127,108	205,153
Salt....."	119,900	600,226
Talc....."	11,885	40,554
Tripolite....."	317	12,119
Total.....		43,373,571
Cement, Portland.....Bls.	5,681,032	\$ 6,977,024
Clay products:—		
Brick, common.....No.	234,732,882	1,755,187
Brick, pressed....."	49,817,160	492,774
Brick, paving....."	1,227,647	20,694
Brick, moulded and ornamental....."	1,008,567	49,097
Fireclay, and fireclay products....."		110,693
Fireproofing architectural terra-cotta....."		253,401
Kaolin.....Tons.	1,300	13,000
Pottery....."		64,900
Sewerpipe....."		799,446
Tile, drain.....No.		355,296
Lime.....Bus.	5,047,244	1,015,702
Sand-lime brick.....No.	17,960,802	141,742
Sand and gravel....."	6,445,717	1,624,767
Slate.....Squares.	397	2,039
Stone:—		
Granite....."		1,525,553
Limestone....."		2,312,081
Marble....."		158,027
Sandstone....."		249,336
Total.....		17,920,759
Grand Total.....		137,109,171

(a) Quantity of product sold or shipped. Tons of 2,000 pounds.

(b) The metals copper, lead and silver are for the purpose of these statistics valued at the prices of the metals as quoted in recognized markets. Nickel is valued at less than market price because a considerable portion of the output is marketed as monel metal and sold at a price less than that of nickel.

(c) The total production of pig iron in Canada in 1914 was 913,775 tons of which it is estimated 158,595 tons should be credited to Canadian ore and 755,180 tons to imported ore.

(d) Production based on claims made for bounty.

Annual Mineral Production in Canada Since 1886.

Year.	Value of production.	Value per capita.	Year.	Value of production.	Value per capita.
	\$	\$ cts.		\$	\$ cts.
1886.....	10,221,255	2 23	1902.....	63,231,036	11 36
1887.....	10,321,331	2 23	1903.....	61,740,513	10 83
1888.....	12,518,894	2 67	1904.....	60,082,771	10 27
1889.....	14,013,113	2 96	1905.....	69,078,999	11 49
1890.....	16,763,353	3 50	1906.....	79,286,697	12 81
1891.....	18,976,616	3 92	1907.....	86,865,202	13 75
1892.....	16,623,415	3 39	1908.....	85,557,101	13 16
1893.....	20,035,082	4 04	1909.....	91,831,441	13 70
1894.....	19,931,158	3 98	1910.....	106,823,623	14 93
1895.....	20,505,917	4 05	1911.....	103,220,994	14 42
1896.....	22,474,256	4 38	1912.....	135,048,296	18 27
1897.....	28,485,023	5 49	1913.....	145,634,812	18 77
1898.....	38,412,431	7 32	1914.....	128,863,075	15 96
1899.....	49,234,005	9 27	1915.....	137,109,171	.....
1900.....	64,420,877	12 04	1916.....	177,357,454	.....
1901.....	65,797,911	12 16			